

The Wall Journal™ 13

The International Journal of Transportation-Related Environmental Issues

May/June
1994



First, I have to get on the front page to make certain that all of our readers are aware that The Wall Journal has moved to Florida. The only notice of that was in Issue No. 12, tucked into the Editor's Corner which is the last item to be placed before printing, and probably is the one least read. Therefore, please take notice of our new vital statistics at right.

Second, I wish to apologize to all of those who could not locate me during the sudden move to Florida. The Post Office did a pretty good job of forwarding mail, but the phone company let us down on advising callers of new number. If I ever do this again, I will have to designate Domenick Billera as my agent to keep the public advised of my whereabouts, since he did such a good job this time. Thanks, Domenick.

CHANGE OF ADDRESS

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In This Issue:

p. 10 The First **12** Issues

A retrospective of the first two years in the life of The Journal. A compilation of all the important articles, stories and papers which were printed in those first 12 issues. All of it sorted for content and alphabetized for your reference convenience, with an index for the various segments on page 10

p. 6 A General Contractor Holds Open House on Noise Barriers

Advocate of Design/Build Contracts Invites Virginia DOT Officials to his Manufacturing Facility to View Noise Barriers and Discuss Speeding the Product Approval Process

p. 8 Parametric Amplification of Sound

Another look at the Kilo Wall, which is being developed using certain design aspects of a 1,000 year old Mayan temple in the Yucatan Peninsula

Also In This Issue:

3 Editor's Corner

4 The Career Connection

5 Letters to the Editor

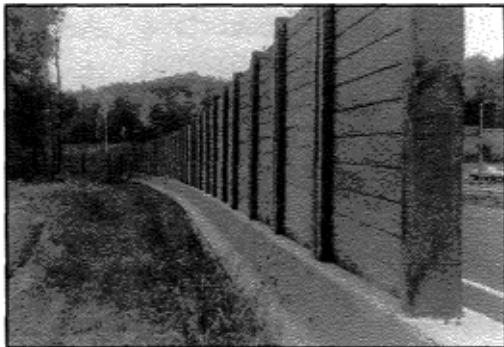
19 A1F04 Committee

24 Reader Registration and Subscriptions

26 Index of Advertisers

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The Wall Journal

The International Journal of Transportation-Related Environmental Issues

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May/June, 1994

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Subscription and advertising information are shown on page 24 and the back cover page.

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EDITOR'S CORNER

by El Angove

I hate to borrow from a fellow writer, but the time comes when you find that someone else has said it much better than you ever could. That always makes me want to go back to selling used cars. But, I resist and borrow anyway. Therefore:

"The time has come, the walrus said, to talk of many things".

That was Wally Orenstein (in case you didn't know) in the bar at the Downstairs at the Upstairs in Chicago, many years ago. Wally was calling his raggedy and semi-literate supporters about him, to inform them of the way that things were going to have to be to assure that they would be able to survive in the cruel years to come. Some of Ina Ray Hutton's lady musicians wandered in (they had a gig down at the Palmer House a block or so away), looked at Wally and said, "You fool. You know a walrus can't talk. You're crazy, man". (Most of you were just kids or unborn in those days).

But Wally just smiled and said to her, "Doll, the walrus talks. You just don't hear him", to which his idiot followers guffawed and clapped their hands and rolled on the floor. The chicks split, but Wally just kept smiling his secret smile. He **knew**.

Now, I know that's a dumb story (albeit true), but it bears the same message as it did in Wonderland. The walrus (played by me) waddles onto the stage, looks around at all the 2,000 or so readers, and says, "Look, guys. I have spent my own money to create this fantastic medium for all of you guys to communicate with one another for the further enrichment of your personal career, the advancement of the state-of-the-art, and to make the world a better place in which to live".

So what happens? A handful of the A1F04 Committee guys jump right in to help spread the word. The Journal gets a little bigger every issue, a lot of people say nice things about it, the advertisers start to get on board, the printer loves it, I keep investing my own bucks, and most of you just sit out there and wait for something to happen. Good as they are, that handful of people is not enough.

Get **involved**, guys. This is **your** communication medium. And (if you're government) you get it **free**! What we're trying to do here is to put together a compendium of the knowledge of the acoustical impact of transportation on the environment and the ways in which we can ameliorate that impact. You are the prime actors in this play; this is what you do every day. But, Bill or Sally over in West Overshoe don't have your experience, although they face the same environmental problems you work with (and sometimes solve) every day.

The Walrus says: "Is there a community of people out there which will embrace, support and make a contribution of experience and knowledge? If so, it is time to stand up and be heard". **Your** work and experience are important to all of us. Get it published. Right here and now. You **must** have a project that has **something** about it that bears telling. Let **us** in on it. I wish all of you could attend some of our A1F04 Committee meetings. **Everybody** has something to say there. The stories fly thick and fast. What we are trying to do with The Journal is to provide that kind of access to information and experience, which you can use in your career. But we can't do it without your help. **We need more input**.

Now, why don't you sit down right now and call the old Walrus and find out how we can get you published. I'm at 813 369-0178. I'll leave the light on. ■



In Coming Issues:

The Fundamentals of Sound — Part IV: The Receiver

A Report on Papers Presented at the Summer Meeting

of the TRB A1F04 Committee in Philadelphia

And More ...

THE CAREER CONNECTION

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Willing to relocate. Please mark all responses "CH5" and send to:

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POSITION WANTED

Engineer with 12 years experience as a consultant in acoustics and vibration seeks a challenging, leadership position with an acoustics, environmental, or engineering consulting firm. I would also consider an opportunity with a progressive state DOT or educational institution.

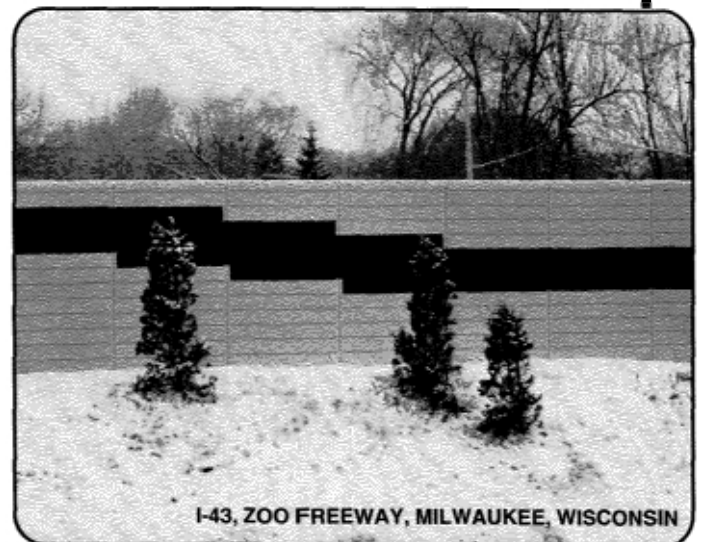
Experience includes conducting environmental sound and vibration studies for transportation, industrial, military, mining, and land development projects using acoustics and vibration instrumentation, computer models and analytical methods. Have practical experience preparing noise analyses pursuant to the requirements on California Environmental Quality Act and the National EPA for large state and federally funded projects, and also in business development, proposal preparation and project management. Member of INCE, registered professional engineer, willing to relocate. Please mark responses "CH9" and send to:

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LETTERS TO THE EDITOR

Dear El:

This is an acceptance speech of sorts. I was both surprised and honored when I read about my nomination for the first AcousticAce of the Month, in Issue No. 12 of The Wall Journal. I want to take this opportunity to thank you for the award.

My connection with the Transportation Research Board (TRB), first as an associate and later as a full member of the A1F04 Committee, has landed me many special friends and acceptance in the international acoustical fraternity. Unfortunately, because of budgetary restrictions, I am not always able to attend the TRB functions. At times, this is very frustrating.

The Wall Journal, however, has been very helpful in bringing us all together. It serves as a gathering place where we can formally and informally exchange information, ideas, and also have some fun. We're coming to this watering hole from many directions, lapping at common shores, in an effort to quench our perpetual thirst for acoustical knowledge.

I can't help thinking that we are all benefitting. Thanks, El!

Rudy Hendricks
Caltrans Division of New Technology, Materials and Research

Thanks, Rudy. I wasn't sure how you would take to this award, but I did want to start some form of recognition of merit for our authors. Your response is just what I had hoped. Now I want a squadron of Aces, but you will always be the first.
Regards. — El

Dear El:

The letter from Gene Miller in the last issue of The Journal prompted me to grab a pen and write this letter to you and Gene. It hadn't occurred to me that we all could keep in touch in the pages of The Wall Journal.

As many of you know, for a number of years, I was a construction manager for highway noise barriers. In those days, Maryland's State Highway Administration had a very large noise barrier program, and I spent many days along Maryland highways installing noise barriers.

I will always remember Gene for the attention he paid to the jobs in progress, and for his big smile, his ability to resolve problems, and his general good spirit. I even miss old friend Charlie Adams.

As you know, my life has been influenced by walls ever since I was born (Germany, 1936). My hometown of Ahrweiler has been surrounded by a wall since 1248. On the outskirts of town, a convent which houses an

exclusive college for girls from all over the world, is surrounded by a wall. And of course, there is (was) the Berlin Wall.

But the crowning as a "wall warrior" for me occurred during my years with you, building Fanwall and Durisol walls, which involved having to work with Charlie Adams and Harvey Knauer (Gene had to work with only one of these gentlemen).

I enjoy the Wall Journal tremendously for its technical information format, to read about old friends, and as positive proof you are still alive.

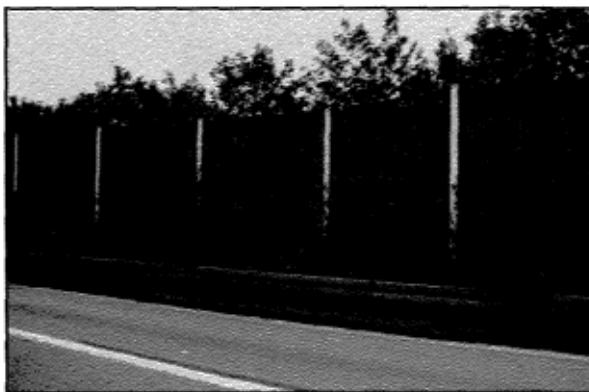
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Virginia Wall Builder Holds Two-Day 'Invitational' on Soundwall Products and Construction Methods

By Jennifer O'Brien

When contractor Tom Elmore, president of JTE, Inc. in Lorton, Virginia determined that he and his staff were expending a lot of time and effort in securing go-ahead approvals on soundwall construction from some state highway agencies, he decided it was time to change the playing field.

Instead of trying to visit with all of the people involved in the approval process in the highway departments (carrying samples, slides, brochures, plans, etc.), Elmore figured it would be a lot more efficient and time-saving procedure to invite all of those people to his offices, where they could all see and hear the presentations at the same time, handle and examine the wall products of various manufacturers, and witness full-scale construction methods and techniques. In addition, all of the engineering disciplines (structures, soils, meteorology, acoustics, materials, maintenance) could be discussed in an interactive environment.

Since JTE INC's home state of Virginia has a large highway noise program in process, it was logical to have a tryout with the Virginia Department of Transportation. Accordingly, invitations were extended to members of VDOT's Sound Wall Committee: Cary Adkins (environmental), J.T. Broach (location and design), Larry Parker (structure and bridges), Bob Hatcher (materials), and Welford King (construction). Also invited was Bob McCarty of the Richmond office of Federal Highway Administration, as were Paul Schubring and Ralph Lundgren of Carsonite International.

Carsonite had been invited to demonstrate their wall system much as was done for the Maryland State Highway Administration (see article in *The Wall Journal*, Issue No. 11, page 12). In this Virginia demonstration, however, the site was in a contractor's yard rather than at the DOT.

The JTE, Inc. staff are in the process of developing a 150-foot long display



Above: Demonstration of wall panels being lowered by crane between flanges of steel posts.

At right: Tom Elmore (white shirt) describes construction methods to (left to right) Paul Schubring, Cary Adkins and Joe Broach.



area on their property for the express purpose of display and demonstration of the types of sound walls they have installed or on which they have contracts. It is anticipated that this will display 10 to 15 manufacturers when it is completed later this year. This noise barrier 'park' will be available to state highway agencies and their consultants for comparative analysis or for determining approvals, in addition to general information on the state of the art of noise abatement by the use of soundwalls.

This particular 'Invitational' began with a presentation by Carsonite Inter-

national, an innovative supplier of sound barrier and highway safety products. Their presentation stressed their environmentally friendly noise barrier that utilizes difficult-to-recycle items such as scrap tires and some post consumer scrap plastics. Other advantages of the Carsonite wall which were discussed included its anti-graffiti properties, resistance to snow plow damage, fire and vandalism, as well its compliance with VDOT's weight and sound transmission loss specifications. Also discussed was the suitability of the Carsonite wall as a bridge and structure-mounted product.

The presentation was followed by a demonstration of the erection of a full-scale Carsonite test wall at JTE Inc.' display facility. The addition of the Carsonite test wall to JTE Inc.'s three other full scale test soundwall structures made the comparison of the different products very convenient. The demonstration was intended to accelerate the development and detail design procedure for alternate ground- and structure-mounted noise barrier systems to provide the highway departments with viable options of appearance, design, structure, maintenance, cost and other considerations.

One participant noted that "This unique combination of suppliers, contractors and both state and federal officials is innately helpful in accelerating the process of getting new and better materials and processes to the actual projects'.

The demonstration continued with an exposition of the evolution of JTE Inc.'s recently developed Smart Wall System that is Rapidly Removable, Raisable and Relocatable. This new system has been accepted by the North Carolina DOT as a standard, and also has been used successfully in VDOT's ever widening and continuously growing highway program. The Smart Wall System incorporates a wedge post-to-panel connection system. This feature eliminates the need for costly fabrication of steel posts to accommodate varying panel thicknesses, and caulking.

The Smart Wall system was designed as a direct result of Virginia DOT's contractor design and build program. This innovative program places the design responsibility on the Contractor, and has provided VDOT with cutting edge soundwall technology that is designed site-specific to individual projects. Tom Elmore stated that "because of this design/build program and their soundwall committee, VDOT gets more bang for their buck than any other owner constructing soundwalls."

According to JTE, Inc.: "Relocatable sound walls are the wave of the future and the only economical way to proceed, if we are to fully address the life cycle cost of sound walls as well as many other structures built along right of ways which are included in future widening plans. A relocatable sound



During the two-day Invitational open house, a three-hour session was held to introduce the Virginia DOT Committee on Noise Barrier Evaluation (chaired by Cary Adkins) to the products and representatives of Carsonite International. This session was concluded with a full-scale panel installation in the noise wall display area of the JTE, Inc. facility at Lorton, Virginia.

wall gives the owner extreme design flexibility at no additional cost."

The 'Invitational' successfully brought together the entire noise wall building team and was a unique opportunity for the clients, contractors and suppliers to discuss concerns as well as new ideas and technologies. The unique forum provided opportunities for all involved

to participate actively in a process that will ultimately lead to new and cost effective technology reaching the consumer on a considerably more efficient time scale. ■

(For further information on the JTE Inc. 'Invitational', telephone Tom Elmore at 703 550-0600 or fax 703 550-0601).



During the session on the erection of the Carsonite test wall, this group gathered in front of the Carsonite display for a photo op. Left to right: Ralph Lundgren and Paul Schubring (Carsonite Int'l.); Robert Glasgow (JTE, Inc.); Bob Hatcher, Welford King, Cary Adkins, Joe Broach and Larry Parker (all VDOT officials); Tom Elmore (JTE, Inc.); Bob McCarthy (FHWA).

Parametric Amplification of Sound —

Ancient Mayan Wall Provides Example for Design of Modern Acoustical Surfaces

By Frank Hodgson

This article is a follow-on discussion of details presented in my article in the January/February 1994 issue of *The Wall Journal*. In that article, a new type of wall surface was introduced which was based on my personal observations of a Mayan temple at Chichén Itzá in the Yucatan Peninsula. The sloping walls of that temple appear to have the unusual property of reflecting and transforming sound into higher frequencies than that which is directed at the wall. I have described that effect as "parametric amplification of sound," based on the analogous effect found in electrical engineering applications. Such walls and surfaces have been collectively named by me as having "Kilo Surfaces."

The purpose of this presentation is to propose some options available in the creation of new surfaces of this type, and to propose nomenclature for the various configurations. This should facilitate communications and help in creating beneficial products for control and modification of indoor and outdoor noise.

Standard nomenclature for the description of the special surfaces

which demonstrate frequency shifting characteristics should be of assistance in their study and characterization. In Fig. 1 below, a basic wall pattern is shown. It is a modified form of the Mayan wall, and for such a Kilo surface the following terms are used:

Gap Depth & Width: The average dimensions of the depth and width of a typical gap.

Span and Reach: The respective width and height of a standard rectangular block face on a wall.

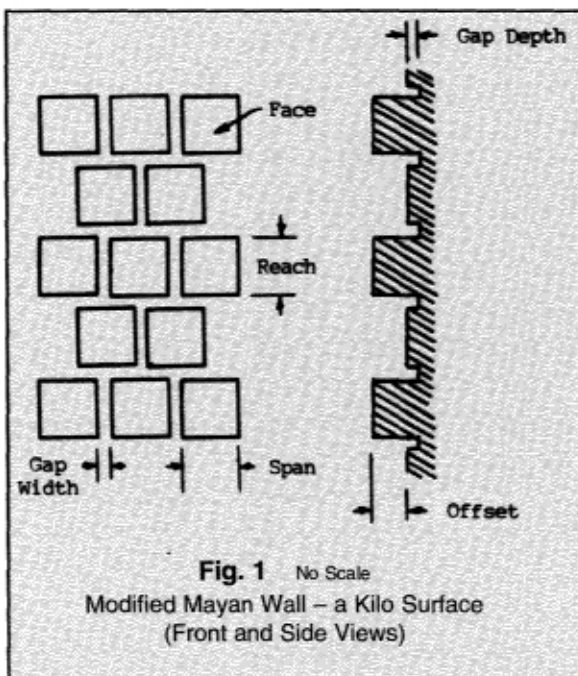
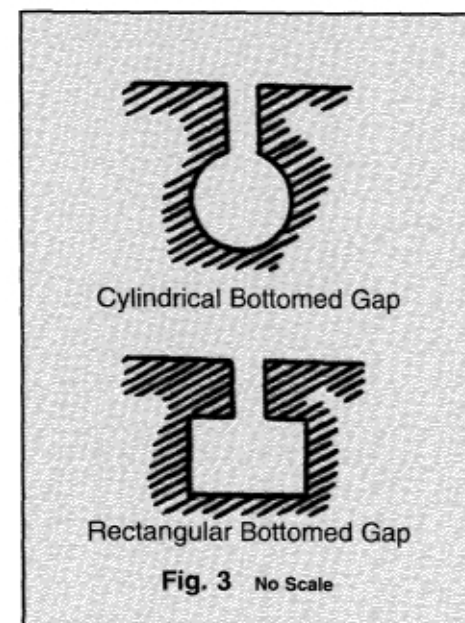
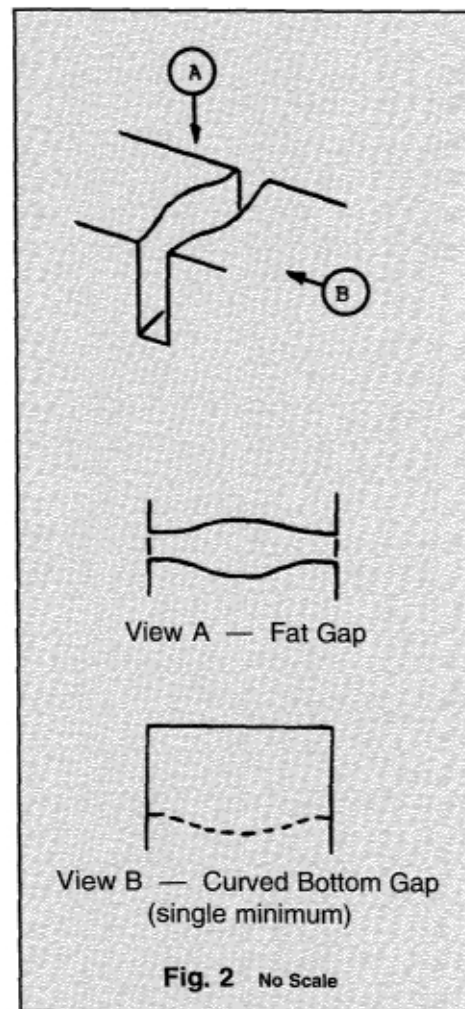
Offset: The average displacement, if any, by which rows or individual blocks are raised from the average or innermost blocks.

When gradual variations are created in the widths of gaps (i.e., centered along single blocks), these variations are termed "fat gaps." These types of gaps together with curved bottoms may help avoid cancellation of the even harmonics which can result from the conversion. Thus, the steady state which results should be more pleasant sounding. See Fig. 2.

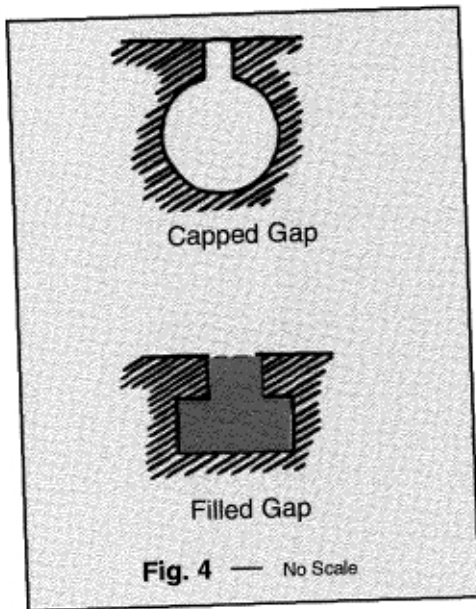
When the bottom of the gap has a more complex configuration, the gap can be called "chambered" or "chambered bottom." The cylindrical and rectangular shaped bottoms of gaps shown in Fig. 3 are chambered and should have important applications (see below).

The structure of Kilo surfaces, may be made to be largely insensitive to the orientation of the surface so that a listener (or a measurement device) perceives little variation when the surface is rotated in its own plane (assuming that it is flat). This characteristic is termed to constitute a "nondirectional" surface.

When the gaps are filled with a substance which is less dense than the basic structure forming the gaps, the gaps can be termed "filled" or if membrane-covered, "capped" slots or gaps. Such configurations may be useful in offering pro-



tection against contamination of the gaps with dirt or other foreign objects which would reduce or eliminate their effectiveness. See Fig. 4, next page.



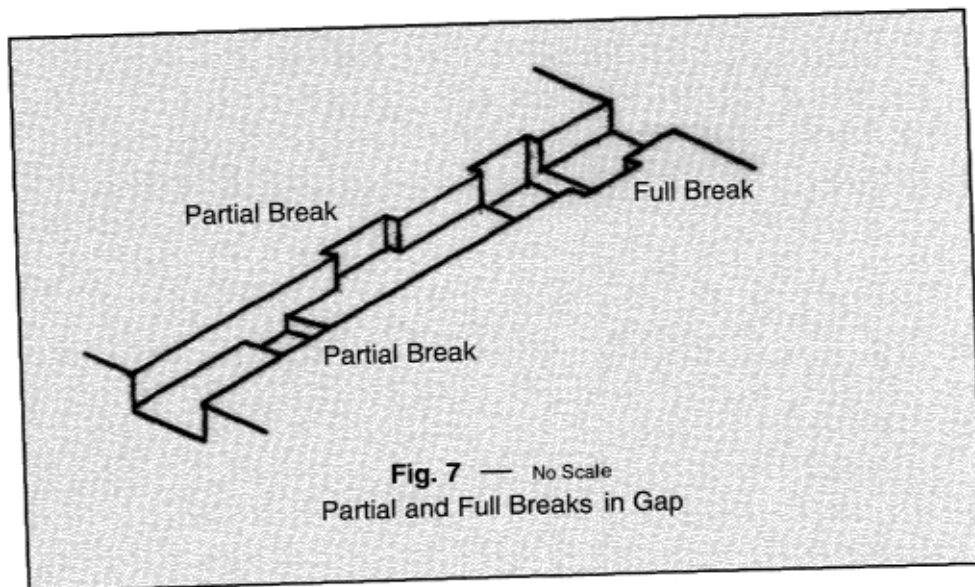
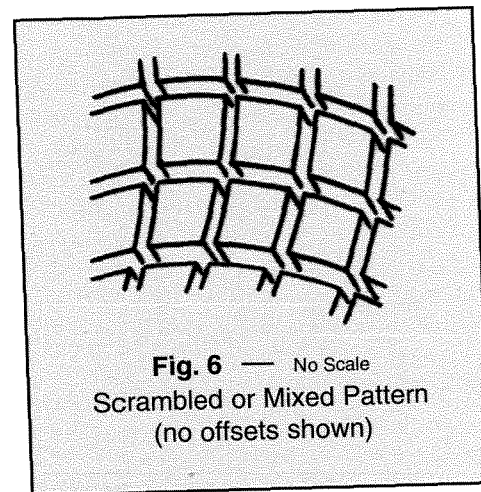
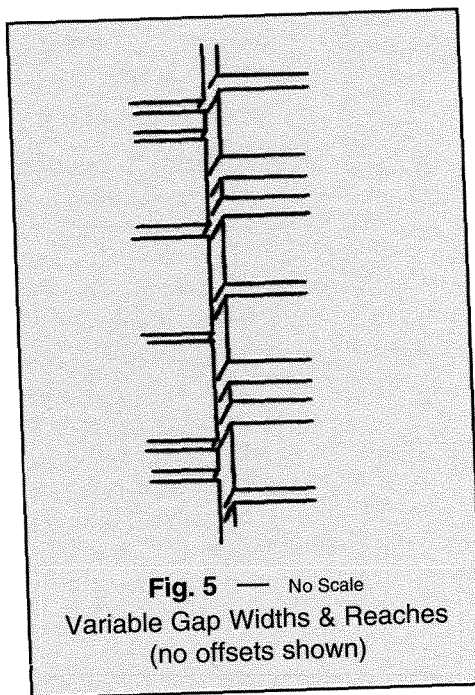
Gap configurations can also be characterized as variable (Fig. 5) or as scrambled or mixed (Fig. 6). The patterns can be non-linear and/or discontinuous. Combinations involving breaks (Fig. 7), variable gap widths, offsets and/or spans can be considered. Note that special gaps may be tapered by width and/or depth.

The performance of a surface should change when the media facing or touching the surface changes. Thus a water or gel media should give rise to a different result than an air media. To obtain comparable results, some rescaling of the dimensions will probably be needed. This conversion is designated as the media constant or alpha constant.

Kilo surfaces should be highly interactive and spatial resonances should be possible. Indeed, these interactive resonances may constitute a serious problem in evaluating the proper types of surfaces to be used when combinations are required (e.g., on walls on opposite sides of a freeway). These spatial resonances are given the term "unconditional" if they are largely independent of the frequencies of the original sound source(s) and "conditional" if affected by such frequencies (or any other factor such as humidity in an air medium).

When a surface varies in a progressive manner (e.g., a wall that has gaps that vary in size or spacing from top to bottom), then the surface can be termed to be a "progressive" gap surface.

A Kilo surface itself could be made of



flexible material for special applications. They also could be made with perforations through the surface itself, or with baffles on the front and/or back of the surface. In addition, "micro" gaps should in theory be possible; i.e., it should be possible to put very small gaps on the sides and/or bottoms of regular gaps.

Gap intersections would seem to pose special problems. Currently, the basic options are to have sharp or round corners. Such choices and the possible use of "macro" gap breaks may be of concern when larger scale variations are introduced into the gap structure.

See Fig. 7 for "full" and "partial" breaks in gaps, that is, macro gap breaks, which represent some of the possible variations.

The analysis of the frequency shifting characteristics of these surfaces in strict mathematical terms will probably be easiest through the use of finite analysis techniques. There is however a practical limit to the need for such work as it is difficult and requires considerable care. Bessel functions, used to describe edge and corner boundary conditions, are probably fully adequate to describe the wave effects at any specific point

(Continued on page 13)

The First 12

A Backward Look at the First Twelve Issues of The Wall Journal. With Recaps and Listings of Articles, Paper Summaries, New Product Notices, Construction Forecasts, Project Reports and More...

The Wall Journal got its start when I brought a mocked-up copy of a proposed first issue to the '92 Summer Meeting of the TRB A1F04 Committee in Colorado Springs. The response from those at the meeting was very encouraging and I went back home and mailed out 2,000 copies in August. And so the die was cast. There would be some troubled times ahead, but no turning back.

In the early issues, we experimented with monthly issues 10 times a year with combined issues in July/August and November/December. We soon discovered that we could not keep up such a pace as the issues became larger. Accordingly, in mid-1993 we switched to bi-monthly publication, six times a year, and that was working well until last Christmas when I got my triple by-pass and in April when I moved lock, stock and barrel to Florida.

I believe we are coming into a period where everything gets back on track, where The Journal gets out on a regular schedule, and where the quality of the magazine continues to grow.

I appreciate your staying with us, and I particularly appreciate the response of our full-time, annual advertisers, most of whom have just signed up for another year. That also indicates that people are reading The Journal and are sending inquiries to the advertisers. The Wall Journal is a one-of-a-kind periodical in a niche market, published by the private sector to report on mainly public works, distributed freely to the public sector, and funded entirely by the private sector. ■

Issue	Size	Date	Pages
1	Tabloid	Jul/Aug '92	4
2	"	Sep '92	8
3	"	Oct '92	8
4	Magazine	Dec/Jan '93	12
5	"	Feb '93	12
6	"	Mar '93	12
7	"	May/Jun '93	16
8	"	Jul/Aug '93	20
9	"	Sep/Oct '93	24
10	"	Nov/Dec '93	24
11	"	Jan/Feb '94	28
12	"	Mar/Apr '94	28

We have selected 128 items from the past issues of The Wall Journal. All of these are in one way or another directly concerned with one of the transportation-related environmental considerations. These 128 items have been sorted into 11 different categories, which appear in the table below. In each category, the number of the issue of The Wall Journal in which the item was printed, appears in parentheses following the title of the item or the author(s) name.

All of the sorting was done alphabetically with the first word in item's title (or author's name in the Paper Summaries). Note that a single paper which has more than one author will be listed alphabetically for each author's name.

Many of our readers are collecting and saving full sets of The Journal. For your filing retrieval convenience, we shall provide this information on an annual basis (every six issues). We hope that you find this worthwhile.

INDEX OF CATEGORIES



**PROTECTING THE ENVIRONMENT
THE MASTER LIST: ALL CATEGORIES**
PAGES 11 AND 12



AIRCRAFT NOISE
PAGE 15



HIGHWAY TRAFFIC NOISE:
PAGE 16



LIGHT RAIL & RAILROAD NOISE
PAGE 18

BARRIER DESIGN PAGE 17

NOISE ANALYSIS PAGE 21

SOUND-ABSORPTIVE BARRIERS PAGE 20

PARALLEL BARRIERS PAGE 20

ACTIVE NOISE CONTROL PAGE 20

RECYCLED MATERIALS PAGE 20

WETLANDS PAGE 20

SUMMARIES OF

PROFESSIONAL PAPERS PAGES 22,23

THE FIRST 12 ISSUES — THE MASTER LIST: ALL CATEGORIES

\$15 Million VDOT Abatement Project (1)	Cary B. Adkins	Highway Noise
A Comprehensive Software Library of Highway Noise Analysis (4)	Drs. Al Harris & Louis Cohn	Noise Analysis
A General Comparison of Airport Noise Contours with Actual Noise Measurement (5)	Rich Letty	Aircraft Noise
A Review of Current Building Codes Instituting Sound Insulation Requirements (7)	Dana Houglund	Aircraft Noise
A Summary of Measured Seismic Wave Attenuation Coefficients for Soils (9)	J. C.Ortega & H. Khosrovani	Noise Analysis
Acoustic Characteristics of Porous Road Surface (2)	Dr. Jean-Francois Hamet	Highway Noise
Active Noise & Vibration Technologies Research & Development Programme (3)	Dr. Alan Curtis	Noise Control
Active Noise Control (7)	Bela Schmidt	Active Control
Aircraft Noise Recognition with Intelligent Noise Monitoring Terminals (5)	Robert Krug	Aircraft Noise
Along Noisy Interstates, a Hue and Cry for a Wall (7)	Stephen C. Fehr, Wash. Post	Highway Noise
Analysis of Railroad Environmental Vibration in China (7)	Ma Jun	Rail Noise
Analysis of Vibration and Acoustics Using VAPEPS (9)	Albert Lee & Vance Anderson	Noise Analysis
Background-Noise-Corrected Sound Level Measurements (6)	Mike Staiano	Noise Analysis
Before and After Study of F3 Project North of Sydney (10)	George Glazier	Highway Noise
Boston Rail Transit Noise Analysis (2)	David E. Coate	Rail Noise
California Noise Barriers Task Force Report - A Summary (4)		Highway Noise
Caltrans Builds \$6 Billion HOV Program (10)	Russell Snyder	Highway Noise
Caltrans' Arroyo Simi Wetlands Replacement (12)	Russell Snyder	Wetlands
Caltrans' Contra Costa County Freeway I-680 (9)	Dianne Steinhauser	Highway Noise
Canada Develops National Noise Barrier Standard (1)	Soren Pedersen	Highway Noise
Carsonite Int'l One of First to Use MDSHA Soundwall Display (11)		Highway Noise
Colorado DOT Hosts A1F04 Summer(1992) Meeting (1)		A1F04
Comparison of INM and NOISEMAP Results (9)	Areg Gharabegian	Aircraft Noise
Computer Models for the Analysis of Vehicle/Guideway Vibration Problems (9)	John F. Leary	Rail Noise
Conference Calendar (3)		Conf Calendar
Conference Calendar (5)		Conf Calendar
Construction Noise Control Program of a Transit Tunnel (9)	Stephen Wolf	Rail Noise
Could Mayan Temple Walls Provide Model for Today's Soundwalls? (11)	Frank Hodgson	Noise Analysis
Country-Wide Noise Mapping Terminals	Robert Krug	Noise Analysis
Criteria for the Design of Sound Insulation in Homes Around Commercial Airports (7)	Eric Stusnick	Aircraft Noise
Determination of the Leq of a Vehicle from Its Acoustic Signature (10)	Dr. Jean-Francois Hamet	Barrier Design
Determination of Noise Barrier Effectiveness: An Evaluation of Noise on I-440 (3)	Herman, Bowlby& Brisson	Absorptive Barr.
Effectiveness of Sound Barriers Along I-270 in Montgomery County, Maryland (3)	Kenneth D. Polcak	Highway Noise
Electronic Noise Control on California Freeways (12)	George Hartwell	Active Control
Elevated Highways and Sound Level Limits (10)	Alexander Segal	Barrier Design
Evaluation of Performance of Experimental Highway Noise Barriers (10)	G. Fleming & E. J. Rickley	Parallel Barriers
Examination of a Structural Sandwich of Reclaimed Tire Rubber as a Noise Barrier (10)	Dr. Indu B. Mishra	Recycled Mat'l.
FDOT Noise Barrier Design, Construction & Maintenance Workshop (2)	Win Lindeman	Barrier Design
FHWA Mobile Noise Lab Is Available for Use (4)	Gregg Fleming & E.J. Rickley	Noise Analysis
FHWA Update (1), (2), (3), (4), (5), (10), (11), (12)	Bob Armstrong	FHWA
From the Sunshine State (12)	Win Lindeman	Highway Noise
Gore Hill Freeway, Sydney, Australia (8)	Karl Mezgailis	Highway Noise
Happy Ending to a Noisy Nightmare (2)	Cary B. Adkins	Highway Noise
Highway Traffic Noise in Denmark;; Noise Barrier Design Considerations (4)	Hans Bendtsen	Highway Noise
Hong Kong Government Puts a Lid on Noisy Highways (6)	Raymond CHAN	Highway Noise
Identification, Analysis and Prediction of Noise Radiated from a Light Rail Vehicle (9)	James B. Steedman	Rail Noise
In Situ Evaluation of Parallel Barrier Effectiveness (3)	G. Fleming & E. J. Rickley	Parallel Barrier
Internal Consistency and Stability of Measurements of Community Reaction to Noise	Dr. R.F. Soames Job	Highway Noise
LaGuardia Airport Ground-Noise Abatement Study (9)	D. E. Barrett & C. W. Menge	Aircraft Noise
Land Development Issues Resulting from "All Stage 3" Airline Fleets (2)	Neal Phillips	Aircraft Noise
Letters to the Editor (3), (5), (10), (12)		Letters
Long Range Sound Propagation in a Suburban Environment Under an Inversion (9)	Pablo A. Daroux	Highway Noise
Managing the Flood of Data in Airport Noise Monitoring Systems (9)	D. Ingold & M. Karmelich	Aircraft Noise
Maryland Minutes (5), (10)	Ken Polcak	Barrier Design
Measuring Excess Attenuation of Traffic Noise Due to Ground Effects (10)	Rudy Hendriks	Noise Analysis
Memorial for Dr. Simon Slutsky (6)		Memorial
National Council of Acoustical Consultants (11)		Press Releases
New FHWA Model and Software - Part 1 (9)	Anderson, Fleming, et al	Noise Analysis
New FHWA Model and Software - Part 2 (10)	Anderson, Fleming, et al	Noise Analysis
New FHWA Model and Software - Part 3 (12)	Anderson, Fleming, et al	Noise Analysis
New Product - The Impressor (9)		Barrier Design
New Products (5)		Highway Noise

(continued on page 12)

The First 12 Issues — The Master List: All Categories *(continued from page 11)*

Noise Analysis for Air Force Base Disposal and Refuse Program (2)	R. Nugent & S. Lind	Aircraft Noise
Noise Analysis for Proposed Helistop - Shadyside Hospital (PA) (4)	David Coate	Aircraft Noise
Noise and Vibration, BART-A and B-Cars (9)	Jason Micklewright	Rail Noise
Noise Barrier Construction Forecast —Three Parts (9), (10), (11)		Const Forecast
Noise Barrier Construction in a High Water Table Environment (2)	Win Lindeman	Highway Noise
Noise Barriers for the New Jersey Turnpike (3)	Bela Schmidt	Highway Noise
Noise Control, O'Hare International Airport (5)	Mary Rose Loney	Aircraft Noise
Noise from Virginia (6)	Cary B. Adkins	Highway Noise
Noise Source Identification and Database Control for Unattended Noise Monitors (5)	Chris Menge	Aircraft Noise
Noise Wall Construction Continues on I-95 in Florida (9)	Win Lindeman	Highway Noise
Noise Walls: \$2 million/mile and worth it (12)	Comm. Thomas M. Downs	Highway Noise
Oldcastle Precast Group Press Release (11)		Press Releases
On the Florida Front (6)	Win Lindeman	Highway Noise
On the Florida Front (7)	Win Lindeman	Highway Noise
On Traffic Noise (7)	Paul Wang	Highway Noise
Parallel Barrier Effectiveness, Dulles Airport Noise Barrier Project (7)	B. Armstrong & G. Fleming	Parallel Barriers
Parallel Barriers: A Ray-Tracing Program, RAYverb (3)	G. Anderson & C. Bajdek	Noise Analysis
PennDOT's I-95 Intermodal Mobility Project (2)	Harvey Knauer	Highway Noise
Prediction of Rail Transit Groundborne Noise and Vibration: A Case Study (9)	Steven L. Wolfe	Rail Noise
Protecting Vibration-Sensitive Facilities from Transportation Vibrations (2)	R. Nugent & H. Amick	Rail Noise
Psychoacoustic Effects of Rapid Shift in Frequency and Intensity (6)	David Still	Noise Analysis
Psychoacoustic Effects of Rapid Shift in Frequency and Intensity (7)	David Still	Noise Analysis
Railroad Track Noise and Vibration, Impact Study and Soundwall Design(9)	Bui, Amick, Yazdaniyaz	Rail Noise
Recent Research and Advancements in Sound Insulation Capabilities of Windows (7)	Dana Houglund	Aircraft Noise
Recycled Paint(5)	S. M. Greenberg	Recycled Mat'l.
Recycling Reports (5)	Soren Pedersen	Barrier Design
Reducing the Ambiguity of Vehicle Noise Evaluations for Permit Applications (2)	Stuart D. McGregor	Highway Noise
Reference Energy Mean Emission Levels; Florida Experience (3)	Wayson, Lindeman & Ogle	Noise Analysis
Reflective and Absorptive Noise Barrier Test (7)	Lloyd Herman	Absorptive Barr.
Road Covers on Elevated Structures (7)	C. L. Wong	Highway Noise
Road/Tire Contact Noise Research in Europe (7)	Claude Lamure	Highway Noise
Roadway Noise Model Observations (7)	Emery W. Tuttle	Highway Noise
Some Recent UK Examples of Building Isolation from Railway Vibration and Noise (9)	Richard Cowell	Rail Noise
Sound Fundamentals - Part 1 (8)	Dr. Roger Wayson	Noise Analysis
Sound Fundamentals - Part 2 (9)	Dr. Roger Wayson	Noise Analysis
Sound Fundamentals - Part 3 (11)	Dr. Roger Wayson	Noise Analysis
Sound Power Levels of Road Vehicles Measured by Square-Integrating Technique (7)	Koichi Yoshihisa	Noise Analysis
Specifying Water-Based Acrylic Stains for Concrete Sound Walls (6)	Luis Calvo & Steve Geiger	Barrier Design
STAMINA Improvements: Ground Effects and Multiple Diffraction (6)	Chris Blaney	Noise Analysis
Strategic Three-Dimensional Aviation Noise Planning (2)	Dr. Clifford R. Bragdon	Aircraft Noise
Test Track Center Research Program (2)	Don K. Waldo	Rail Noise
Testing an Electronic Noise Control System (12)	Rudy Hendriks	Active Control
Texas DOT Noise Program Research Proposal (2)	Cynthia R. Wilson	Highway Noise
The Bulletin Board (3), (5)		Bulletin Board
The Challenge for the Future (1)	William Bowlby	Editorial
The Effects of Road Surface Texture on Traffic & Vehicular Noise (7)	George S. J. Glazier	Highway Noise
The Making of PennDOT's Blue Route, I-476 (8)	Harvey Knauer	Highway Noise
The Product Approval Process - Part 1 (3)	Soren Pedersen	Barrier Design
The Product Approval Process - Part 2 (4)	Soren Pedersen	Barrier Design
The Pros & Cons of Various Techniques for financing Noise Remedy Programs (7)	Ronald Tulis	Aircraft Noise
The Stapleton Noise Insulation Program: A Case History (2)	Dana Houglund	Aircraft Noise
The Stapleton Noise Mitigation Program (2)	Bryan Ryks	Aircraft Noise
The Use of a Sound Exposure Level Metric for Design of Sound Insulation in Homes (6)	Eric Stusnick	Aircraft Noise
The Winning Entries in Caltrans' Student Noise Design Competition (10)	George Hartwell	Barrier Design
Tornado Kills Three Near Petersburg (12)		Barrier Design
Traffic Noise Attenuation Across Open Terrain for a Rural State Highway (10)	Jack E. Randorff	Highway Noise
Traffic Noise Attenuation Costs Based on Varying Noise Level Criteria (7)	Karl Mezgailis	Highway Noise
Transportation Noise in the Nineties (2)	Louis F. Cohn	Editorial
TRB A1F04 Committee (All Issues — #1 thru #12)	Domenick Billera	A1F04
Update of Traffic Noise Research Needs (7)	Ken Polcak	Noise Analysis
USAF, NOISEMAP 6.0	Robert Lee (6)	Aircraft Noise
Utilizing Radar Data to Identify Aircraft Noise Events (5)	Steve Alverson	Aircraft Noise
Wanted: Sound Design (5)	Caltrans	Barrier Design
Wisconsin DOT's Entry Into the World of Parallel Noise Barriers (11)	John Jaeckel	Parallel Barriers
Wisconsin Notice to Suppliers (7)	WIDOT	Barrier Design
Wood Noise Walls Completed Near MN/ND Border (12)	Don Jaenicke	Highway Noise

(Parametric Amplification of Sound, from page 9)

on a surface. However, this information is probably of limited value when evaluating an entire surface, given the difficulty and expense of such calculations.

Although it may be instructive to examine microwave applications to seek analogs for these surfaces, caution should be exercised as the fundamental characteristics of microwave devices derive from the electric current skin effect which is unique to such electromagnetic wave devices. Nevertheless, the similarities which are heavily dependent upon physical shape, are worthy of consideration. There is a direct similarity for example between the cylindrical bottomed gap surface shown in Fig. 3 and 4 and the active segments of the cavity magnetron which is commonly used in regular household microwave ovens. By extrapolation therefore, using the cavity magnetron as a model, it is proposed that one of the most useful surfaces will be cylindrical bottomed gap surfaces, as they seem to be the most likely candidates for realizing uniform conversions (i.e., shifting an entire spectrum without distortion).

Special Kilo surfaces could be designed for incorporation into the surfaces (interior or exterior) of motors, generators and pumps. Such applications would change their fundamental sound. The design of new musical instruments is a particularly attractive avenue of study. The pragmatic approach of utilizing a variety of configurations as inherent parts of such instruments (e.g., surfaces which are nondirectional fractal gap patterns) should help in understanding the functional details of specific families of surfaces. Applications which utilize active energy sources such as motors or musical instruments are of interest as the work done in understanding these devices should gracefully compliment the work needed to understand the purely passive surface transformations.

Thin sandwiched sections which contain a liquid or gel and which have special Kilo surfaces on the interior surfaces should be capable of transforming sound to much higher frequen-

cies. Therefore, they should have the capability of being excellent sound barriers for use in soundproofing in the construction of walls in houses and buildings.

The creation of accurate Kilo surfaces probably will require new molding techniques. The advanced etching techniques used in semiconductor production applications may be of value in creating some of these surfaces.

It is fortunate that there exists at least one wall which functions well as a parametric converter of sound. It is over 1,000 years old and is located on the face of the main temple in the Mayan ruins of Chichén Itzá near Merido, Mexico. The Maya have provided a durable monument from which a new and valuable technology can be formulated. A wide variety of applications can be foreseen to be derivable from this unique wall.

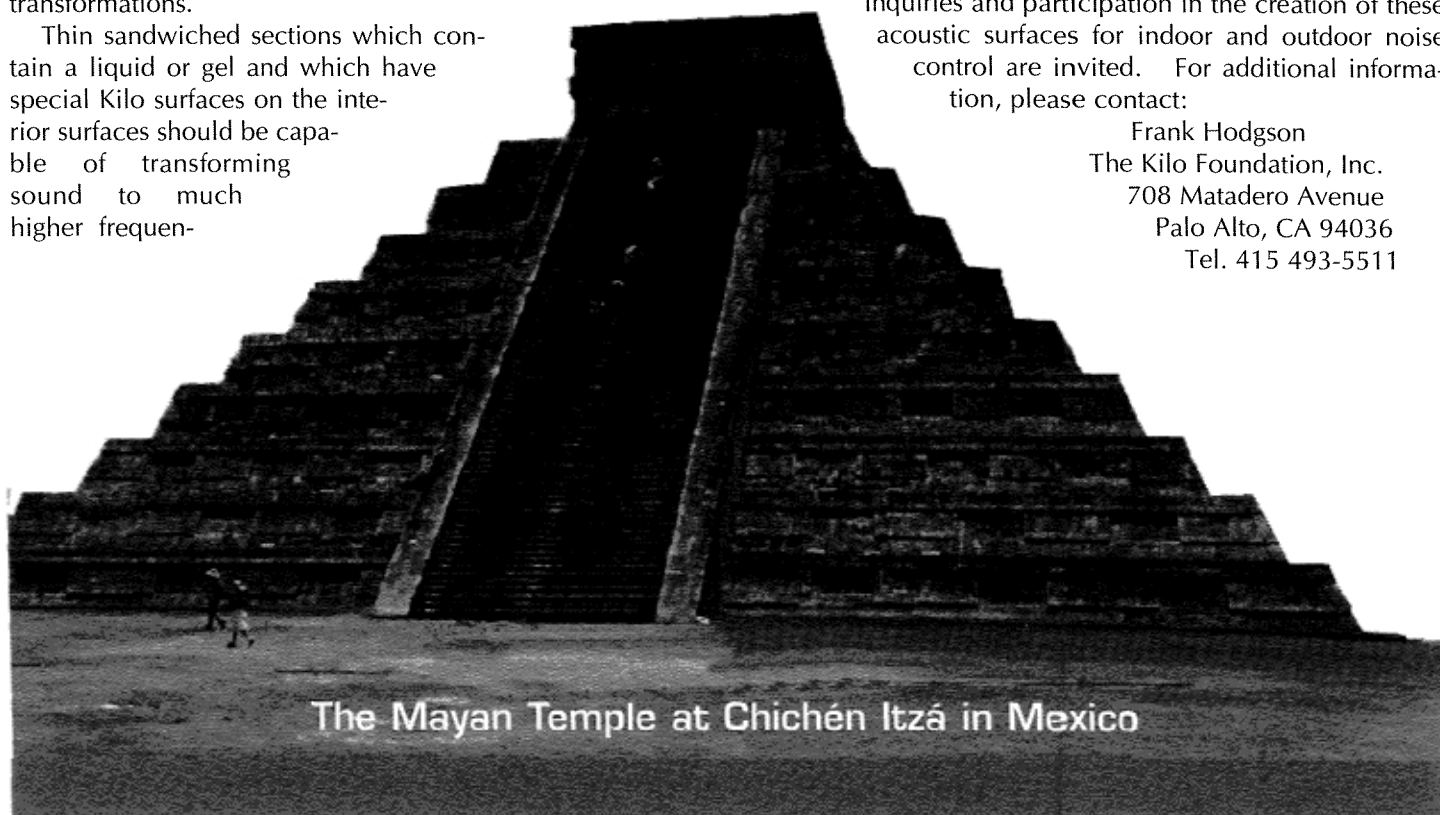
The Mayan wall shown in modified form in Fig. 1 utilizes square bottomed slots with the result that its echos are very harsh. This is probably the result of the elimination of even harmonics during the conversion process. The structures set out in Fig. 2 represent an attempt to reduce or eliminate this harsh effect. When such curved features are used, more of the even harmonics may be produced. The curves used to form the fat gaps and the curved bottoms are sinusoids. Double curved bottoms (i.e., two minimums along each side of block face) can also be considered.

With diligence and care the complexities of these surfaces can be understood and the analytic relationships refined. The Kilo Foundation believe that there is much to be learned from the construction of the temple wall at Chichén Itzá.

Kilo surfaces represent a new technology which should permit varied and unusual approaches to the control and modification of sound.

Inquiries and participation in the creation of these acoustic surfaces for indoor and outdoor noise control are invited. For additional information, please contact:

Frank Hodgson
The Kilo Foundation, Inc.
708 Matadero Avenue
Palo Alto, CA 94036
Tel. 415 493-5511



The Mayan Temple at Chichén Itzá in Mexico

PRESS RELEASE

Louisville, KY — Two University of Louisville civil engineering professors who are longtime consultants on transportation noise abatement will conduct a seminar on highway noise analysis October 17-21.

Drs. Louis Cohn and Al Harris bring a combined 37 years of highway noise analysis expertise to the 15th semiannual short course for professionals. The two have worked with federal and state highway agencies and have been on the Transportation Research Board's Committee on Transportation-Related Noise and Vibration.

The workshop at U of L's Shelby Campus will feature recent advances in noise prediction software, barrier design and noise analysis. Participants will have the opportunity to do computer modeling exercises, in addition to attending lectures and workshops and reviewing case studies.

The \$895 registration fee includes a 500-page workbook, materials and the course software library and user's manual for noise analysis programs. Continuing education credits and low-cost campus housing are available.

To register, call the University Center for Continuing and Professional Education, (502) 852-6456. For more information, call Lou Cohn or Al Harris at U of L's Speed Scientific School, (502) 852-6276.

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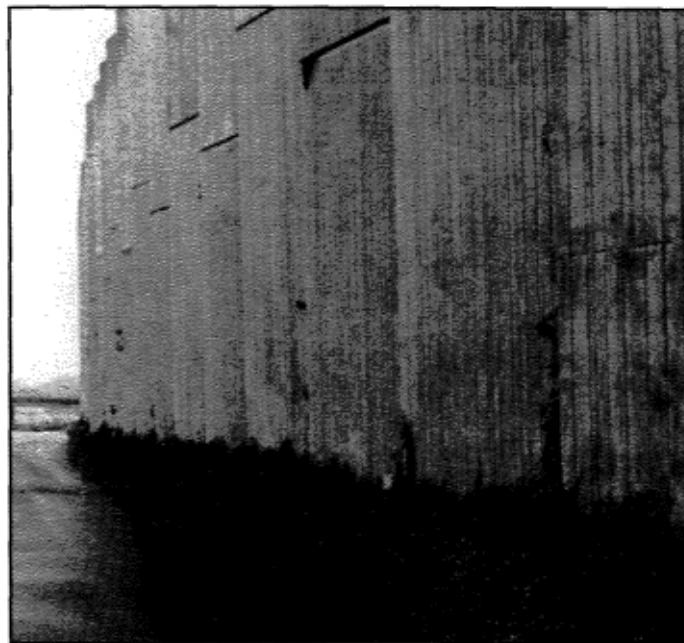
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The First 12 AIRCRAFT NOISE



A General Comparison of Airport Noise Contours with Actual Noise Measurement (5)
 A Review of Current Building Codes Instituting Sound Insulation Requirements for Structures (7)
 Aircraft Noise Recognition with Intelligent Noise Monitoring Terminals (5)
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 Criteria for the Design of Sound Insulation in Homes Around Commercial Airports (7)
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 Noise Control, O'Hare International Airport (5)
 Noise Source Identification and Database Control for Unattended Noise Monitors (5)
 Recent Research and Advancements in Sound Insulation Capabilities of Glazing and Windows (7)
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The First 12 HIGHWAY NOISE



The following are articles, professional papers and reports which have been arranged in alphabetical order. The number in parentheses following the item title designates the issue in which the item was printed.

\$15 Million VDOT Abatement Project (1)	Cary B. Adkins
Acoustic Characteristics of Porous Road Surface (2)	Dr. Jean-Francois Hamet
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Long Range Sound Propagation in a Suburban Environment Under an Inversion (9)	Pablo A. Daroux
Maryland Minutes (5)	Ken Polcak
New Products (5)	
Noise Barrier Construction in a High Water Table Environment; Alternative Method (2)	Win Lindeman
Noise Barriers for the New Jersey Turnpike (3)	Bela Schmidt
Noise from Virginia (6)	Cary B. Adkins
Noise Wall Construction Continues on I-95 in Florida (9)	Win Lindeman
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On the Florida Front (6)	Win Lindeman
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PennDOT's I-95 Intermodal Mobility Project (2)	Harvey Knauer
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Traffic Noise Attenuation Across Open Terrain for a Rural State Highway (10)	Jack E. Randorff
Traffic Noise Attenuation Costs Based on Varying Noise Level Criteria for a Freeway (7)	Karl Mezgailis
Wood Noise Walls Completed Near MN/ND Border (12)	Don Jaenicke

The First 12: BARRIER DESIGN

Elevated Highways and Sound Level Limits (10)
 FDOT Noise Barrier Design, Construction & Maintenance Workshop (2)
 Maryland Minutes (10)
 New Product - The Impressor (9)
 Recycling Reports (5)
 Specifying Water-Based Acrylic Stains for Concrete Sound Walls (6)
 The Product Approval Process - Part 1 (3)
 The Product Approval Process - Part 2 (4)
 The Winning Entries in Caltrans' Student Noise Design Competition (10)
 Tornado Kills Three Near Petersburg, VA: Minor Damage to 32'-high Soundwall (12)
 Wanted: Sound Design (5)
 Wisconsin Notice to Suppliers (7)

Alexander Segal
 Win Lindeman
 Ken Polcak

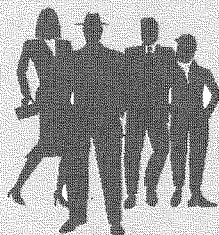
 Soren Pedersen
 Luis Calvo & Steve Geiger
 Soren Pedersen
 Soren Pedersen
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Radiated from a Light Rail Vehicle (9)

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Noise and Vibration, BART-A and B-Cars (9)

Jason Micklewright

Prediction of Rail Transit Groundborne Noise and Vibration:

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Some Recent UK Examples of Building Isolation from

Railway Vibration and Structureborne Noise (9)

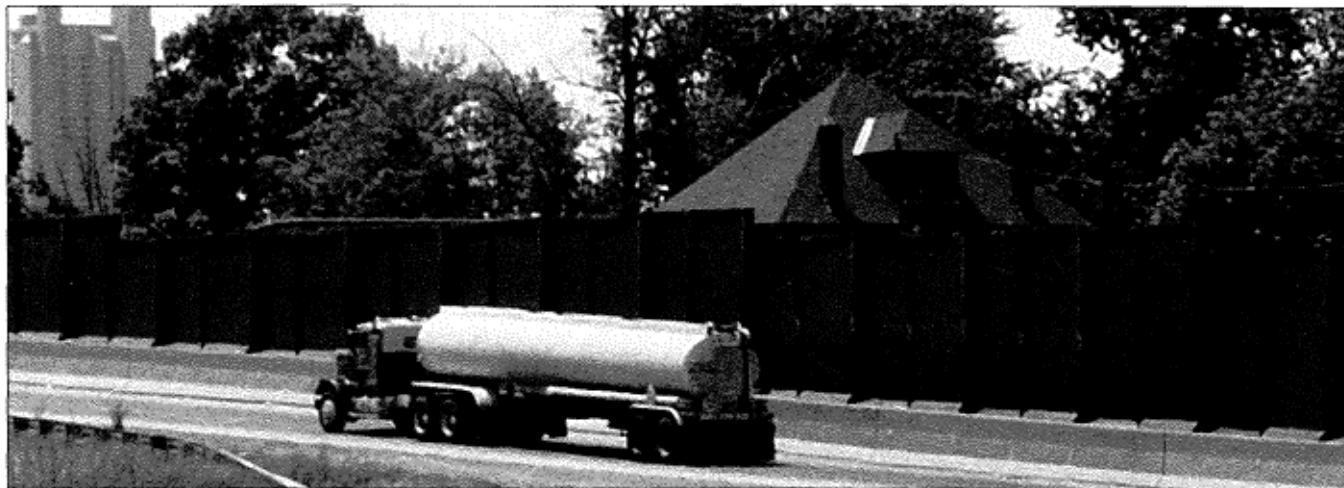
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By Domenick Billera, Chairman



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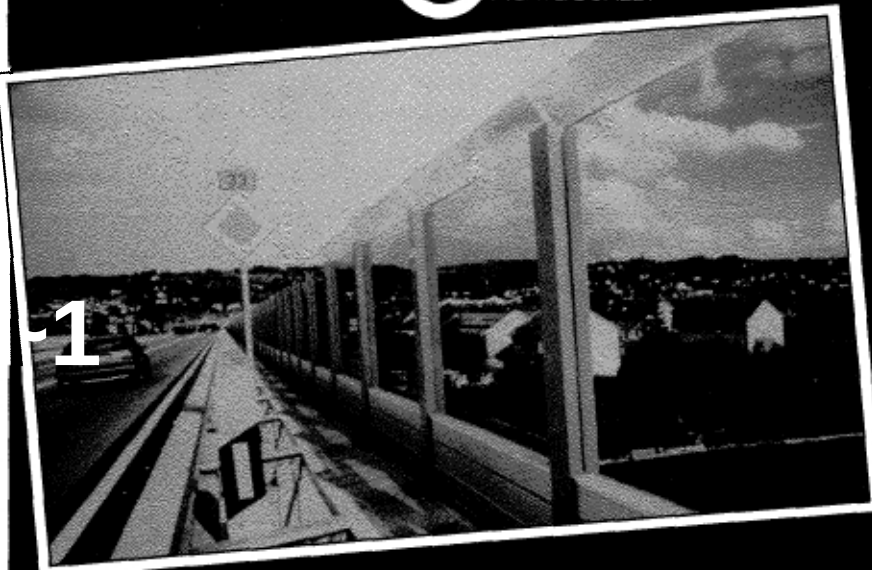
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On page 4 of this issue, you will find a new department, which we call "The Career Connection". We have had some success for our readers in previous notices about careers, and decided that we should now formalize that service, since it seems to be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

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The First 12

MISCELLANEOUS TOPICS

PARALLEL BARRIERS

Evaluation of Performance of Experimental Highway Noise Barriers (10)
 In Situ Evaluation of Parallel Barrier Effectiveness (3)
 Parallel Barrier Effectiveness, Dulles Airport Noise Barrier Project (7)
 Wisconsin DOT's Entry Into the World of Parallel Noise Barriers (11)

Gregg G. Fleming & E. J. Rickley
 Gregg G. Fleming & Edward J. Rickley
 Bob Armstrong & Gregg Fleming
 John Jaeckel

SOUND-ABSORPTIVE BARRIERS

Determination of Traffic Noise Barrier Effectiveness: An Evaluation of
 Noise Abatement Measures on I-440
 Reflective and Absorptive Noise Barrier Test

L. Herman, W. Bowlby & R. Brisson
 Lloyd Herman

ACTIVE NOISE CONTROL

Active Noise & Vibration Technologies Research & Development Program
 Active Noise Control (7)
 Electronic Noise Control on California Freeways (12)
 Testing an Electronic Noise Control System (12)

Dr. Alan Curtis
 Bela Schmidt
 George Hartwell
 Rudy Hendriks

RECYCLED MATERIALS

Examination of a Structural Sandwich Made of Reclaimed
 Tire Rubber as a Noise Barrier (10)
 Recycled Paint (5)
 Recycled Tires (5)

Dr. Indu B. Mishra
 Steven M. Greenberg
 Soren Pedersen

WETLANDS REPLACEMENT & CONSERVATION

Caltrans' Arroyo Simi Wetlands Replacement (12)

Russell Snyder

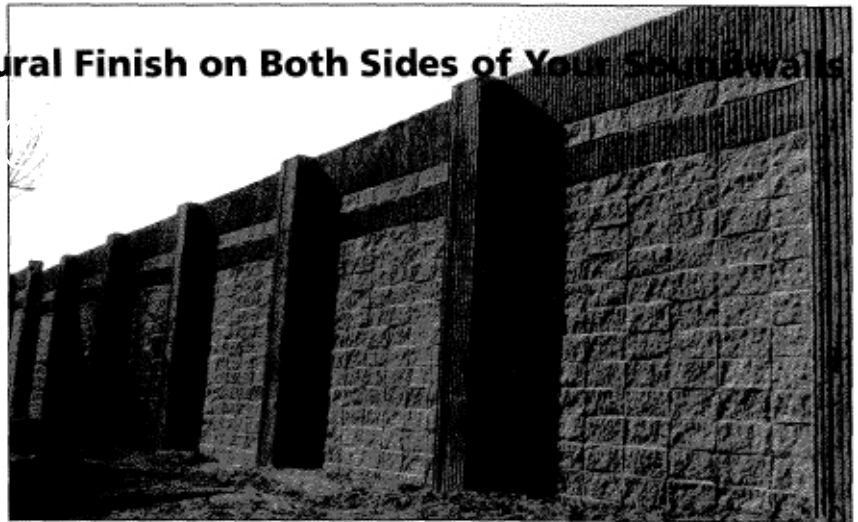
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The First 12: NOISE ANALYSIS

A Comprehensive Software Library of Highway Noise Analysis (4)
 A Summary of Measured Seismic Wave Attenuation Coefficients for Soils (9)
 Analysis of Vibration and Acoustics Using VAPEPS (9)
 Background-Noise-Corrected Sound Level Measurements (6)
 Could Mayan Temple Walls Provide Model for Today's Soundwalls (11)
 Country-Wide Noise Mapping Terminals (4)
 FHWA Mobile Noise Lab Is Available for Use (4)
 Measuring Excess Attenuation of Traffic Noise Due to Ground Effects (10)
 New FHWA Model and Software - Part1 (9)
 New FHWA Model and Software - Part2 (10)
 New FHWA Model and Software - Part 3 (12)
 Parallel Barriers: A Ray-Tracing Program, RAYverb, for General Cross Sections (6)
 Psychoacoustic Effects of Rapid Shift in Frequency and Intensity (6)
 Psychoacoustic Effects of Rapid Shift in Frequency and Intensity (7)
 Reference Energy Mean Emission Levels; The Florida Experience (3)
 Sound Fundamentals - Part 1 (8)
 Sound Fundamentals - Part 2 (9)
 Sound Fundamentals - Part 2 (11)
 Sound Power Levels of Road Vehicles Measured by Square-Integrating Technique (7)
 STAMINA Improvements: Ground Effects and Multiple Diffraction (6)
 Update of Traffic Noise Research Needs (7)

Drs. Al Harris & Louis Cohn
 Jose C. Ortega & Dr. Hooshang Khosrovani
 Albert Lee & Vance Anderson
 Mike Staiano
 Frank Hodgson
 Robert Krug
 Gregg G. Fleming & Edward J. Rickley
 Rudy Hendriks
 Grant Anderson, Gregg Fleming, et al
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PRESENTED AT THE TRB A1F04 COMMITTEE MEETINGS

Author(s)	Organization	Issue No.	Title of Paper
Al Harris & Louis Cohn	University of Louisville	4	A Comprehensive Software Library of Highway Noise Analysis
Alan Curtis	Active Noise & Vibration Technologies	3	Active Noise & Vibration Technologies Research & Development Programme
Albert Lee & Vance Anderson	Lockheed Missiles & Space Co., Inc.	9	Analysis of Vibration and Acoustics Using VAPEPS
Alexander Segal	County of San Diego	10	Elevated Highways and Sound Level Limits
Yazdanniyaz, Bui & Amick	Arup Acoustics & Acentech Inc.	9	Railroad Track Noise and Vibration, Impact Study and Soundwall Design
Areg Gharabegian	Engineering-Science, Inc.	9	Comparison of INM and NOISEMAP Results
Bela Schmidt	Louis Berger & Associates Inc.	7	Active Noise Control
Bela Schmidt	Louis Berger & Associates Inc.	3	Noise Barriers for the New Jersey Turnpike
Bryan Ryks	Stapleton International Airport	2	The Stapleton Noise Mitigation Program
C. L. Wong	Hong Kong Government	7	Road Covers on Elevated Structures
Chris Blaney	Ontario Ministry of Transportation	6	STAMINA Improvements: Ground Effects and Multiple Diffraction
C. J. Bajdek & G. S. Anderson	Harris Miller Miller & Hanson Inc.	6	Parallel Barriers: A Ray-Tracing Program, RAYverb, for General Cross Sections
Christopher W. Menge	Harris Miller Miller & Hanson Inc.	5	Noise Source Identification and Database Control for Unattended Noise Monitors
C. W. Menge & D. E. Barrett	Harris Miller Miller & Hanson Inc.	9	LaGuardia Airport Ground-Noise Abatement Study
Claude Lamure	INRETS (France)	7	Road/Tire Contact Noise Research in Europe
Clifford R. Bragdon	Georgia Institute of Technology	2	Strategic Three-Dimensional Aviation Noise Planning
Cynthia R. Wilson	Texas Dept. of Transportation	2	Texas DOT Noise Program Research Proposal
Ingold, Karmelich & Dunholter	The Flood Group & Mestre Greve Assoc.	9	Managing the Flood of Data in Airport Noise Monitoring Systems
Dana Houglund	David L. Adams Associates, Inc.	7	Review of Current Building Codes: Sound Insulation Requirements for Structures
Dana Houglund	David L. Adams Associates, Inc.	7	Recent Research and Advancements in Sound Insulation Capabilities of Windows
Dana Houglund	David L. Adams Associates, Inc.	2	The Stapleton Noise Insulation Program: A Case History
David E. Coate	Acentech Incorporated	4	Noise Analysis for Proposed Helistop - Shadyside Hospital (PA)
David E. Coate	Acentech Incorporated	2	Boston Rail Transit Noise Analysis
David Still	Gannett Fleming, Inc.	6	Psychoacoustic Effects of Rapid Shift in Frequency and Intensity
David Still	Gannett Fleming, Inc.	7	Psychoacoustic Effects of Rapid Shift in Frequency and Intensity
Don K. Waldo	AAR Transportation Test Center	2	Test Track Center Research Program
D. E. Barrett & C. W. Menge	Harris Miller Miller & Hanson Inc.	9	LaGuardia Airport Ground-Noise Abatement Study
E. J. Rickley & G. G. Fleming	Volpe Nat'l. Transp. Systems Center	3	In Situ Evaluation of Parallel Barrier Effectiveness
E. J. Rickley & G. G. Fleming	Volpe Nat'l. Transp. Systems Center	10	Evaluation of Performance of Experimental Highway Noise Barriers
Emery W. Tuttle	Engineering-Sciences, Inc.	7	Roadway Noise Model Observations
Eric Stusnick	Wyle Laboratories	7	Criteria for the Design of Sound Insulation in Homes Around Airports
Eric Stusnick	Wyle Laboratories	6	The Use of a Sound Exposure Level Metric for Design of Sound Insulation in Homes
George S. J. Glazier	Wilkinson Murray Pty Ltd. (Australia)	10	Before and After Study of F3 Project North of Sydney
George S. J. Glazier	Wilkinson Murray Pty Ltd. (Australia)	7	The Effects of Road Surface Texture on Traffic & Vehicular Noise
G. Anderson & C. J. Bajdek	Harris Miller Miller & Hanson Inc.	6	Parallel Barriers: A Ray-Tracing Program, RAYverb, for General Cross Sections
G. G. Fleming & E. J. Rickley	Volpe Nat'l. Transp. Systems Center	10	Evaluation of Performance of Experimental Highway Noise Barriers
G. G. Fleming & E. J. Rickley	Volpe Nat'l. Transp. Systems Center	3	In Situ Evaluation of Parallel Barrier Effectiveness
G. Fleming & Robert Armstrong	Volpe Nat'l. Transp. Sys. Ctr. & FHWA	7	Parallel Barrier Effectiveness, Dulles Airport Noise Barrier Project
Hal Amick & Ramon Nugent	Acentech Incorporated	2	Protecting Vibration-Sensitive Facilities from Transportation Vibrations
Amick, Bui & Yazdanniyaz	Acentech Inc. & Arup Acoustics	9	Railroad Track Noise and Vibration, Impact Study and Soundwall Design
H. Khosrovani & J.C. Ortega	Paul S. Veneklasen & Associates	9	A Summary of Measured Seismic Wave Attenuation Coefficients for Soils
Indu B. Mishra	Kanan Associates, Inc.	10	Examination of a Structural Sandwich Made of Reclaimed Tire Rubber as a Noise Barrier
Jack E. Randorff	Randorff & Associates, Inc.	10	Traffic Noise Attenuation Across Open Terrain for a Rural State Highway
J. Steedman & W. Halvorsen	Navcon Engrg. & Halvorsen Assoc.	9	Identification, Analysis and Prediction of Noise Radiated from a Light Rail Vehicle
Jason Micklewright	PGH Wong Engineering	9	Noise and Vibration, BART-A and B-Cars
Jean-Francois Hamet	INRETS (France)	2	Acoustic Characteristics of Porous Road Surface
Jean-Francois Hamet	INRETS (France)	10	Determination of the Leq of a Vehicle from Its Acoustic Signature
John F. Leary & Magdy El-Sibaie	Association of American Railroads	9	Computer Models for the Analysis of Vehicle/Guideway Vibration Problems
J. C. Ortega & H. Khosrovani	Paul S. Veneklasen & Associates	9	A Summary of Measured Seismic Wave Attenuation Coefficients for Soils
Karl Mezgailis	Roads & Traffic Authority (Australia)	7	Noise Attenuation Costs Based on Varying Noise Level Criteria for Major Freeway
Kenneth D. Polcak	Maryland State Highway Administration	7	Update of Traffic Noise Research Needs
Kenneth D. Polcak	Maryland State Highway Administration	3	Effectiveness of Sound Barriers Along I-270 in Montgomery County, Maryland
Koichi Yoshihisa	Meijo University (Japan)	7	Sound Power Levels of Road Vehicles Measured by Square-Integrating Technique
Lloyd Herman	Vanderbilt University	7	Reflective and Absorptive Noise Barrier Test
Herman, Bowlby & Brisson	Vanderbilt Univ. & Tennessee DOT	3	Determination of Traffic Noise Barrier Effectiveness: An Evaluation of I-440
Louis Cohn & Al Harris	University of Louisville	4	A Comprehensive Software Library of Highway Noise Analysis
Ma Jun	Ministry of China	7	Analysis of Railroad Environmental Vibration in China
Magdy El-Sibaie & John F. Leary	Association of American Railroads	9	Computer Models for the Analysis of Vehicle/Guideway Vibration Problems
Karmelich, Ingold & Dunholter	The Flood Group & Mestre Greve Assoc.	9	Managing the Flood of Data in Airport Noise Monitoring Systems
Mary Rose Loney	Chicago Department of Aviation	5	Noise Control, O'Hare International Airport
Mike Staiano	Staiano Engineering, Inc.	6	Background-Noise-Corrected Sound Level Measurements

(continued on next page)

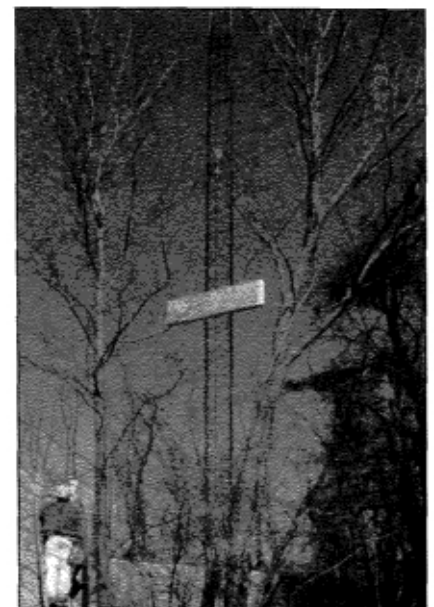
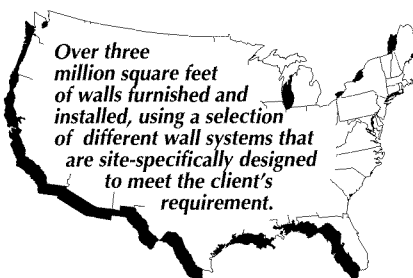
SUMMARIES OF PROFESSIONAL PAPERS — [continued]

Author(s)	Organization	Issue No.	Title of Paper
Neal Phillips	Metropolitan Wash. Airports Authority	2	Land Development Issues Resulting from "All Stage 3" Airline Fleets
Pablo A. Daroux	Wilson, Ihrig & Associates, Inc.	9	Long Range Sound Propagation in a Suburban Environment Under an Inversion
Dunholter, Karmelich & Ingold	Mestre Greve Assoc & The Flood Group	9	Managing the Flood of Data in Airport Noise Monitoring Systems
Paul Wang	County of Orange, California	7	On Traffic Noise
R.F. Soames Job	University of Sydney (Australia)	7	Internal Consistency and Stability of Measurements of Community Reaction to Noise
Ramon Nugent & Hal Amick	Acentech Incorporated	2	Protecting Vibration-Sensitive Facilities from Transportation Vibrations
Ramon Nugent & Stephen Lind	Acentech Incorporated	2	Noise Analysis for Air Force Base Disposal and Refuse Program
Brisson, Herman & Bowlby	Tennessee DOT & Vanderbilt Univ.	3	Determination of Traffic Noise Barrier Effectiveness: An Evaluation of I-440
Rich Letty	Acentech Incorporated	5	A General Comparison of Airport Noise Contours with Actual Noise Measurement
Richard Cowell	Arup Acoustics (London)	9	Recent UK Examples of Building Isolation from Railway Vibration and Noise
Bob Armstrong & Gregg Fleming	FHWA & Volpe Nat'l. Trans. Sys. Ctr.	7	Parallel Barrier Effectiveness, Dulles Airport Noise Barrier Project
Robert Krug	Cirrus Research, Inc.	5	Aircraft Noise Recognition with Intelligent Noise Monitoring Terminals
Robert Krug	Cirrus Research, Inc.	4	Country-Wide Noise Mapping Terminals
Robert Lee	Wright Patterson Air Force Base	6	USAF, NOISEMAP 6.0
Wayson, Ogle & Lindeman	U. of Central Florida & Florida DOT	3	Reference Energy Mean Emission Levels; The Florida Experience
Ronald Tulis	KPMG Peat Marwick	7	The Pros & Cons of Various Techniques for financing Noise Remedy Programs
Rudy Hendriks	Caltrans Lab	10	Measuring Excess Attenuation of Traffic Noise Due to Ground Effects
Bui, Amick, & Yazdanniyaz	Acentech Inc. & Arup Acoustics	9	Railroad Track Noise and Vibration, Impact Study and Soundwall Design
Stephen Lind & Ramon Nugent	Acentech Incorporated	2	Noise Analysis for Air Force Base Disposal and Refuse Program
Stephen Wolf	Parsons Brinckerhoff Quade & Douglas	9	Construction Noise Control Program of a Transit Tunnel
Steve Alverson	Harris Miller Miller & Hanson Inc.	5	Utilizing Radar Data to Identify Aircraft Noise Events
Steven L. Wolfe	Wilson, Ihrig & Associates, Inc.	9	Prediction of Rail Transit Groundborne Noise and Vibration: A Case Study
Stuart D. McGregor	Engineering Dynamics	2	Reducing the Ambiguity of Vehicle Noise Evaluations for Permit Applications
Ogle, Wayson & Lindeman	U. of Central Florida & Florida DOT	3	Reference Energy Mean Emission Levels; The Florida Experience
Vance Anderson & Albert Lee	Lockheed Missiles & Space Company	9	Analysis of Vibration and Acoustics Using VAPEPS
Bowlby, Herman & Brisson	Vanderbilt Univ. & Tennessee DOT	3	Determination of Noise Barrier Effectiveness: An Evaluation of Noise Abatement on I-440
W. Halvorsen & J. Steedman	Halvorsen Assoc. & Navcon Engrg.	9	Identification, Analysis and Prediction of Noise Radiated from a Light Rail Vehicle
Win Lindeman	Florida Department of Transportation	2	Noise Barrier Construction in a High Water Table Environment; An Alternative Method
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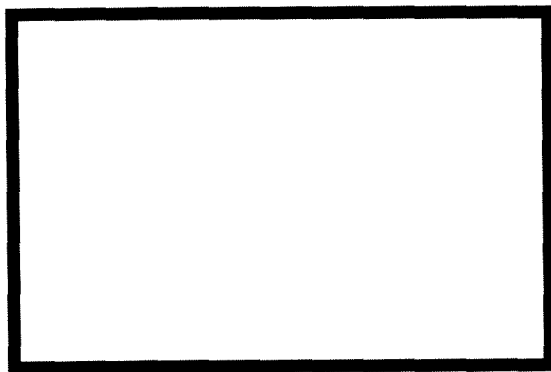
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(See Ed. Corner, p. 3)

Press Release

April 5, 1994, Lorton, Va.

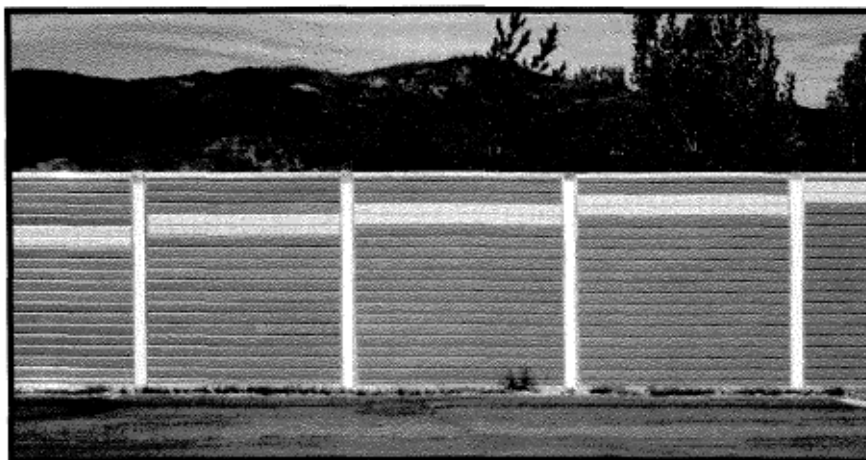
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INDEX OF ADVERTISERS

Bowlby & Associates, Inc. Nashville, Tennessee	28
Carsonite International Carson City, Nevada	25
Concrete Impressions, Inc. Denver, Colorado	20
CYRO INDUSTRIES Mt. Arlington, New Jersey	19
DURISOL International Corp. Hamilton, Ontario, Canada	26
Faddis Concrete Products Downington, Pennsylvania	24
Fosroc Inc. Georgetown, Kentucky	27
Hoover Treated Wood Prod., Inc. Thomson, Georgia	2
Industrial Acoustics Co., Inc. Bronx, New York	4
JTE INC Lorton, Virginia	23
Mi-Jack Products Hazel Crest, Illinois	18
Pickett Wall Systems, Inc. Hollywood, Florida	26
The Reinforced Earth Co. Vienna, Virginia	15
SCANTEK Inc. Silver Spring, Maryland	14, 19
The Scott System Denver, Colorado	21
Soundtrap. Austin, Texas	14
Timbatech Limited Milwaukee, Wisconsin	5
University of Louisville Louisville, Kentucky	17

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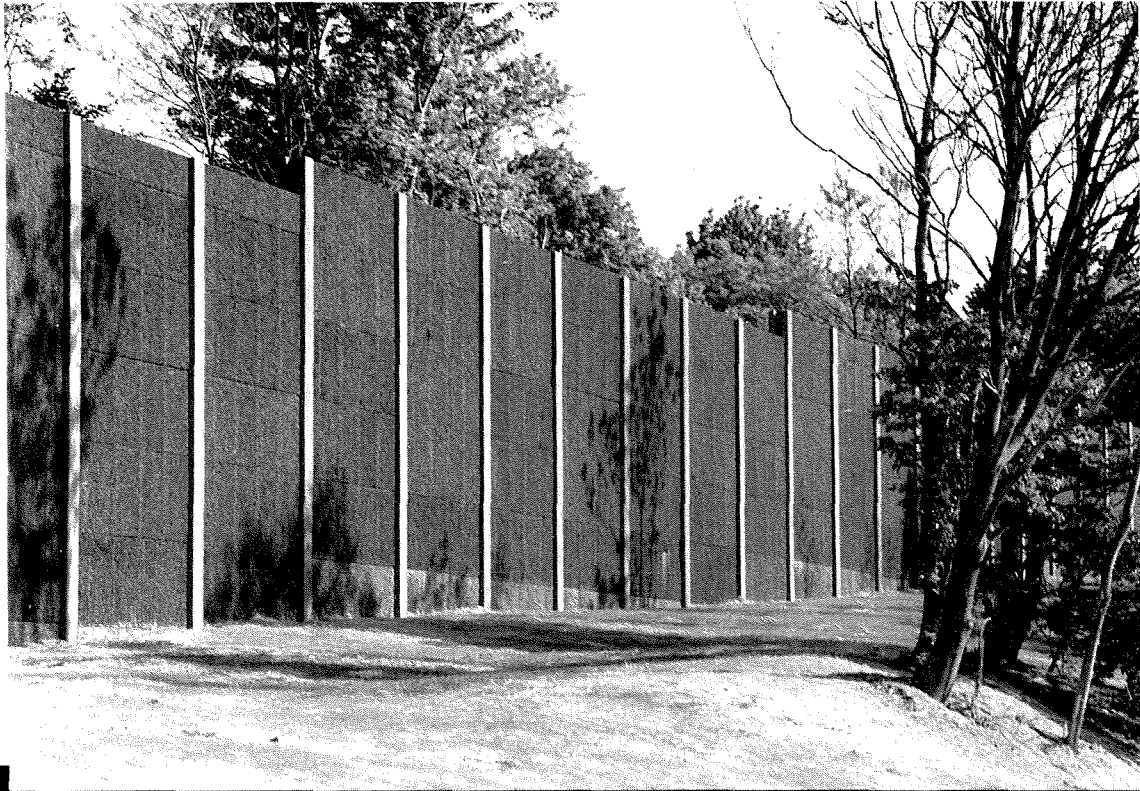
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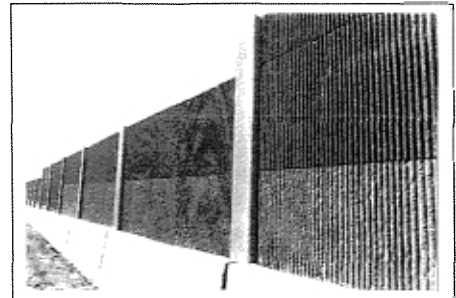
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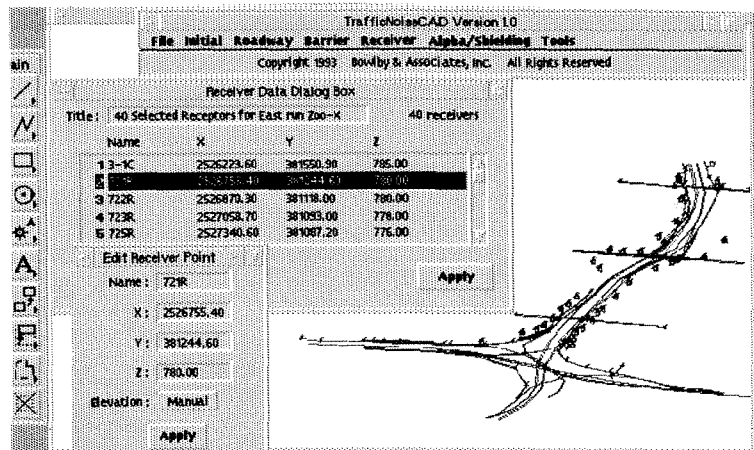
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