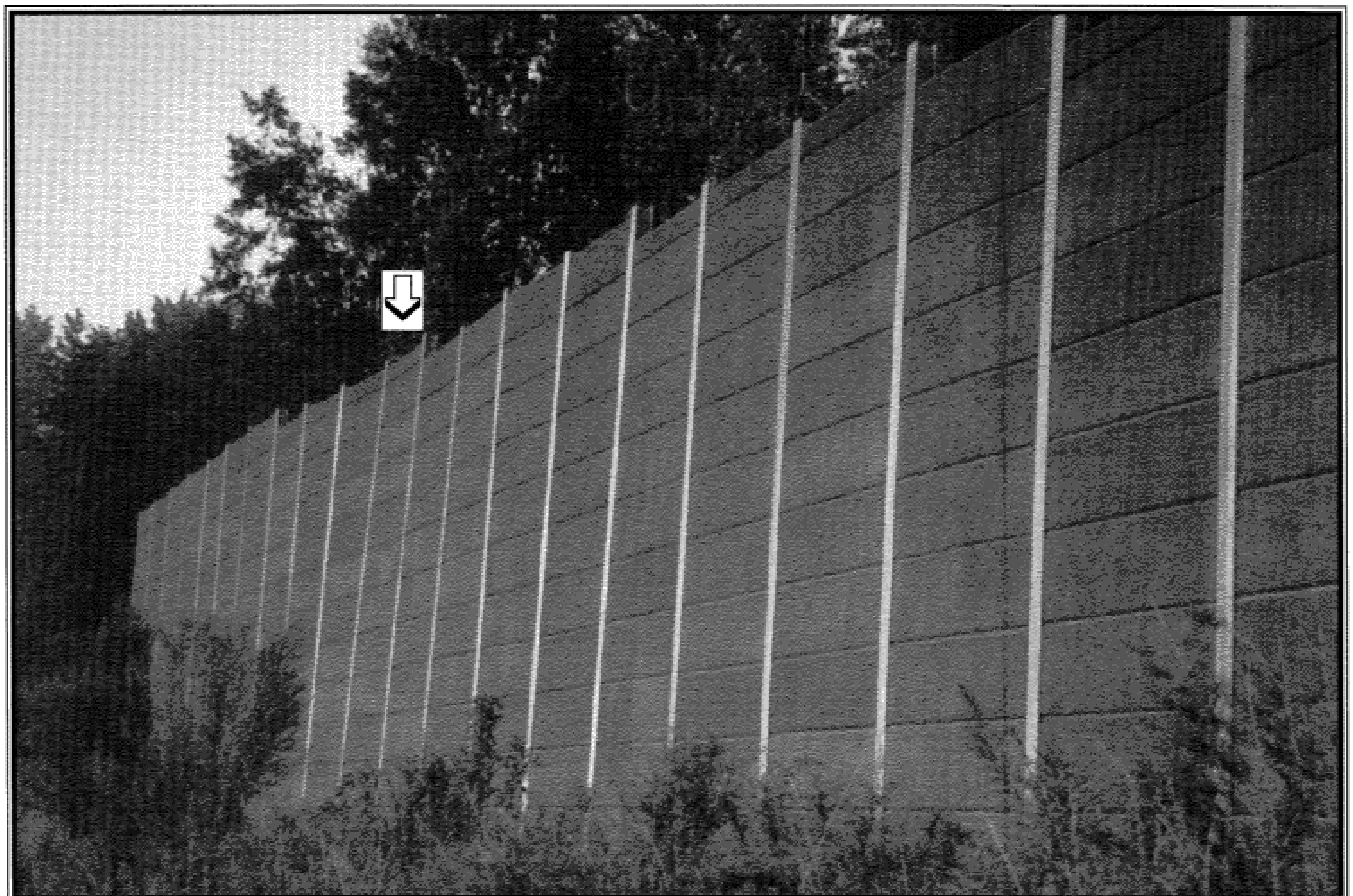
The Wall Journal™ 12

The International Journal of Transportation-Related Environmental Issues

March/April 1994

Killer Tornado Slams Into Virginia Soundwall

A Report on page 6



32-foot high soundwall on I-295 in Hopewell, Virginia impacted by winds of 113-157 mph in outbreak of tornadoes. The only damage sustained was a slight bending of the steel post designated by the arrow in the photo above.

Also In This Issue:

THE SOUND SOLUTION

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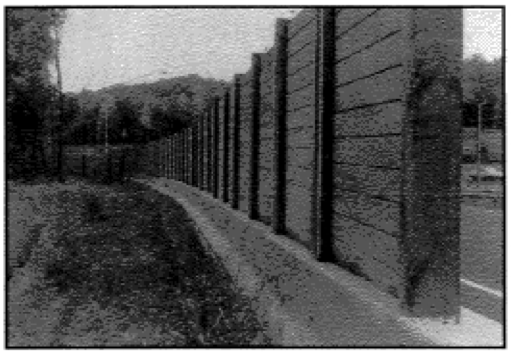

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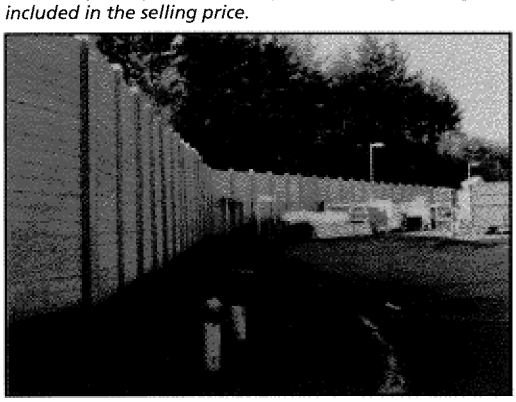

This bottling plant had received noise complaints from nearby homes. The complaints stopped after installation of this 15-foot high PLYWALL barrier.

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The Wall Journal

The International Journal of Transportation-Related Environmental Issues

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March/April, 1994

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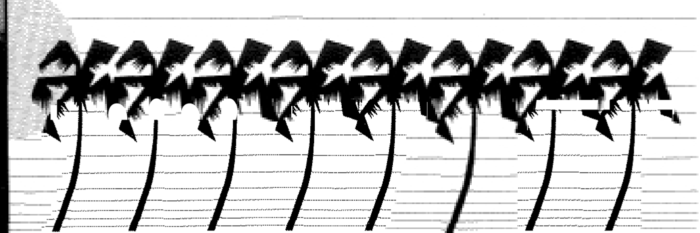
EDITOR'S CORNER

by El Angove



Well, here I am in sunny, sub-tropical Florida, just where I promised to be. Our new office is located in the Fort Myers area, eight miles from the new Southwestern Florida International Airport, surrounded by palm trees and bathed in the warm sunshine and fanned by gentle breezes from the Gulf of Mexico. Some may call this "God's waiting room", and it is true that this is close to heaven.

I regret that we were unable to confirm our new fax number at the time this issue was printed; it will be printed here in the next issue. In the meantime, if you wish to call us, dial (813) 369-0178.

I am trying to make up the time lost in getting Issue No. 11 to you, due to my unexpected hospital visit. This has been further impacted by our move to Florida, but we will catch up soon and get back on schedule.

Dr. Wayson also experienced some scheduling problems with his classroom load, and was unable to give us his "Fundamentals of Sound — Part IV" for this issue. We hope to have that instalment in our next issue (Dr. Wayson's complete 'course' consists of six instalments).

We had anticipated receiving a Caltrans report on damage to three noise barriers (all of masonry construction) in the Los Angeles earthquakes in 1994 for this issue, but Caltrans wishes to complete their investigation of cause and effect. Hopefully, that will soon become available.

Again, we invite our advertisers and other suppliers to send us technical articles and stories concerning projects they have completed. Our readers have great interest in your field experiences with your projects. Be sure to include good photographs.

It's time for me to take a swim in the Gulf, come back and make a pitcher of mai tais, and recline under my palm trees. Life is hell. ■

In Coming Issues:

The Fundamentals of Sound — Part IV

A General Contractor Demonstrates His Action Plan for Obtaining Noise Barrier Approvals

A Recap of Technical Articles and Paper Abstracts from the Past 12 Issues of The Wall Journal

And More ...

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Qualified applicants should submit resumé and college transcript to:

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Jefferson City, MO 65102

Sam Donaldson – Investigative Reporter?

On Thursday, March 17, 1994 Mr. Donaldson hosted his "PrimeTime Live" television series, as usual. However, the subject of one of his feature stories entitled "Hush Money" has distressed a number of our readers, who feel a response is due. It is our duty to facilitate those readers.

The theme of "Hush Money" was that certain public officials involved in the abatement of highway traffic noise had allegedly overstepped their authority by providing noise barriers in certain areas of five states where (Mr. Donaldson believes) it is doubtful that they were indeed required.

Mr. Donaldson said to his viewers: "Surely, though, you've seen them – high walls lining the interstate highways, to cut down the traffic noise for people nearby. But did you realize that you are paying for those walls, and that in many cases your money is being wasted? No? Well, let us show you."

If you had watched "PrimeTime Live" that night, you may have formed an opinion. If not, we will be happy to tell you how you may obtain a copy of the transcript of that show (which is available to the general public).

If you professionals in the highway traffic noise abatement endeavor wish to make your thoughts known, we will be happy to print all that you send us. Your name will not be printed unless you agree in writing. Simply address:

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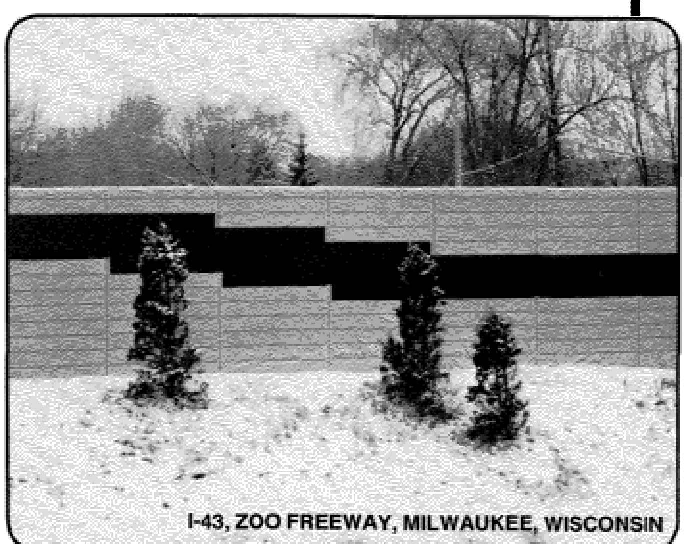
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Letters to the Editor

HONG KONG INSTITUTE OF ACOUSTICS

G.P.O. BOX 7261 HONG KONG

17 February 1994

The Wall Journal

Dear Sir,

I am writing to inform your readers that the Hong Kong Institute of Acoustics (HKIOA), a local institution of acoustics professionals, has recently been formed here in Hong Kong.

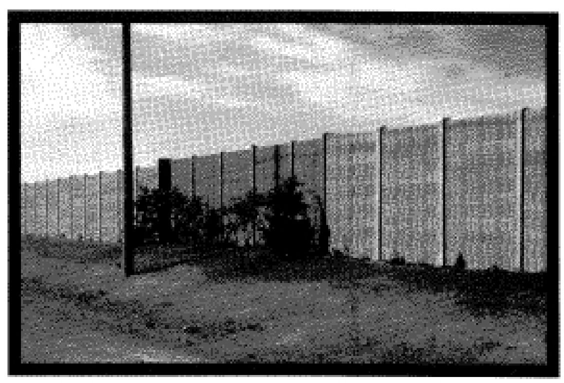
We have now 54 founding members of the Institute all of whom are either members of UK's Institute of Acoustics (IOA), Acoustical Society of America (ASA) and/or Institute of Noise Control Engineering (INCE). We also represent a wide spectrum of services including consultancy, contracting, academic and government.

We are committed to the long-term advancement of our profession in Hong Kong as well as in this dynamic region. We welcome contacts with professionals from other places and will be pleased to arrange and facilitate such interactions. Please direct any enquiry to the above address or to :

Mr. Raymond CHAN, Hon Secretary HKIOA Acting Assistant Director of
Environmental Protection Department
27/F., Southern Centre, 130 Hennessy Road, Wanchai, Hong Kong
Tel : 852(Area Code)-835-1964 Fax : 852(Area Code)-591-0558

Thank you for your attention.

Raymond CHAN
Hon. Secretary
HKIOA



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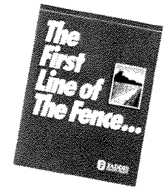

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"Tornado Kills Three Near Petersburg, Va.

Department Store Collapses; 100 Injured"

So read the headline in The Washington Post on Saturday, August 7, 1993. The accompanying story by Staff Writers D'Vera Cohn and Donald P. Baker opened as follows:

"A large tornado tore through a tri-city area about 20 miles south of Richmond yesterday afternoon, killing at least three people when a suburban Wal-Mart collapsed and injuring more than 100.

The storm smashed into a shopping mall in Colonial Heights, leveled much of downtown Petersburg's historic district and blasted the roofs off apartment complexes in Hopewell. Interstate 95 was littered with overturned tractor-trailer trucks as a series of storm-related accidents caused miles-long traffic backups.

Virginia Gov. L. Douglas Wilder called out the National Guard to help local authorities overwhelmed by the storm, toured the stricken area by helicopter and promised to seek federal disaster aid to help repair damage estimated at tens of millions of dollars."

We all have empathy for the victims of this disaster, and much was written in the newspapers and reported on television of their personal grief and loss of property. That is the province of the news media, and they performed a thorough and sensitive coverage of the widespread disaster.

However, the province of The Wall Journal is principally the reporting of highway traffic noise abatement, and those activities and methods which make it possible. Arguably, the use of a soundwall is the most efficient and generally the most widely-used.

Therefore, this piece will now turn into a story of one particular soundwall and how it fared when it was battered by one of nature's most destructive and erratic energy outbursts — the tornado.

We begin with a report written by Gary Figallo of The Reinforced Earth Company (manufacturer of the noise barrier involved) to the Virginia Department of Transportation in Richmond., to the attention of Cary B. Adkins, Chairman, Sound Barrier Review Committee, which follows:

January 21, 1994

Gentlemen:

The afternoon of August 6, 1993 brought several tornadoes to the Colonial Heights, Petersburg and Hopewell areas. One of the tornadoes crashed through the Wal-Mart store in Colonial Heights, wrecked the historical section of Petersburg, and destroyed trees and property in the Hopewell area.

That tornado struck our No. 4 DURISOL sound barrier in Hopewell. One W10 x 54 galvanized steel post was bent. No damage occurred to the DURISOL panels.

The tornado, estimated by the National Weather Service to be a category F-2 on the Fujita scale with gust wind velocities between 113 and 157 miles per hour, passed across I-295 and directly through the DURISOL sound barrier, which is 32 feet exposed height above ground at that point.

The Durisol wall is comprised of steel posts mounted in drilled concrete caissons. Posts and caissons are spaced twelve feet on centers. The caissons and steel posts are designed for an 80 mph wind velocity in accordance with the requirements of the AASHTO Guide Specification for the Structural Design of Sound Barriers.

Durisol panels have a composite section, comprised of two layers of Durisol material with a 1 3/4"-thick reinforced concrete core. They are designed using actual panel bending tests for proof of lateral load capacity.

The estimated wind velocities (113-157 mph) are consistent with the damage observed for a category F-2 tornado. The observed tornado damage in the immediate vicinity of the wall was snapped-off trees and roof damage. A tree with a measured circumference of 65 inches (24 inch diameter) was snapped off at an elevation of five feet above the ground, at a distance of 21 feet from the residential (leeward) side of the wall. The National Weather Service also estimates that the tornado was an F-2 category tornado as it passed across I-295 at the wall site.

The DURISOL wall has been inspected by members of the Virginia DOT Sound Barrier Committee. No damage to the panels is apparent, and the deflection of the wall is not noticeable from vehicles traveling along I-295, nor from the residential house near the wall. The Virginia Department of Transportation decided that no repair or corrective action to the wall is necessary. The Reinforced Earth Company engineers have also inspected the wall and confirm that no damage to the panels occurred, and that the wall safely withstood the force of the tornado.

The material which accompanies this letter was compiled to document the incident which caused the deflection of the wall.

Very truly yours,
Gary S. Figallo
Durisol Product Manager
The Reinforced Earth Company

Following are excerpts from the official report of the National Oceanic and Atmospheric Administration, National Weather Service, Weather Forecast Office:

August 6, 1993 Southeast Virginia Tornado Outbreak

By Barbara McNaught, Warning Coordination Meteorologist, NWS Washington, D.C. Forecast Office, and

Laura Cook, Meteorologist-in-Charge, NWS Norfolk Weather Office, and

Central Wills, Officer-in-Charge, NWS Richmond Weather Office.

"Tornadoes are not considered a common event in Virginia and many of the Commonwealth's people will tell you that they do not even consider tornadoes a threat. August 6, 1993 broke that myth and shocked many with the reality of destruction that tornadoes bring. Prior to 1993, Virginia averaged six tornadoes a year. Records kept since 1950 showed 263 total tornadoes reported in the state, 21 fatalities, and 192 injuries. There have been 56 fatalities since 1916. The most active year for tornadoes was 1975 with 22, and the most active day was October 13, 1983 with 10 tornadoes.

These statistics should help place in context the August 6, 1993 outbreak.

Many records were broken. Eighteen tornadoes occurred on that day, smashing the old record of ten. This brought the total record for the year to 25, breaking the old record of 22 only eight months into the year. The Petersburg tornado was rated an F-4 on the Fujita Damage Scale (see Table 1) with estimated winds peaking near 210 mph. This is the strongest recorded tornado in Virginia since 1950. It was the costliest tornado, with an estimated 47 million dollars in damages. The total estimated damage from the outbreak was 52.5 million dollars. Twenty-one Virginia jurisdictions were affected by tornado impacts".

Ed. Following is a recap of parts of the NWS report describing the paths of two of the tornadoes, their estimated strengths, and the damage caused:

Tornado 1. First touchdown of the day occurred near the town of Kenbridge at 12:43 pm. Roofs were blown off a briquet plant and a furniture company. The tornado began as an F-0 on the Fujita scale with a path width of 100 yards. Estimated damage was $300,000.

In Nottoway County, the tornado strengthened to an F-1 as it leveled a barn, trees and outbuildings near the west edge of Fort Pickett reservation. The tornado width was 100 yards. Estimated damage: #100,000

The tornado crossed Route 643 near the northeast corner of Fort Pickett and continued to the town of Ford. By this point, it had strengthened to an F-2. The second level of a house was sheared off, windows on the first level were blasted out, and a wooden shed, telephone pole and large trees were leveled. The tornado tracked northeast to near the Chesterfield County line. It lifted near Route 611 and 623. Average width was 150-175 yards. Total damage was $320,500.

About 5 miles to the northeast in Chesterfield County, the tornado touched down again with damage along Routes 628, 534 and 692 for about 3.5 miles. The damage is rated F-0. Total path length through the four counties was about 38 miles. Total damage is estimated at $720,500.

Fig. 1 — Fujita Scale (F-Scale) on Tornado Winds and Damage

F Number	Winds (mph)	Damage
0 (Very Weak)	40-72	Light damage. Tree branches snapped; rotten trees down; TV antennas and signs damaged
1 (Weak)	72-112	Moderate damage. Roofs peeled off; windows broken; trees snapped; trailers moved or overturned
2 (Strong)	113-157	Considerable damage. Roofs torn off; weak structures and trailers demolished; trees uprooted; cars blown off road
3 (Severe)	158-206	Roofs and some walls torn off well-constructed houses; some rural buildings demolished; cars lifted and tumbled
4 (Devastating)	207-260	Houses leveled leaving piles of debris; cars thrown some distance
5 (Incredible)	261-318	Well-built houses lifted clear off foundation and carried a considerable distance and disintegrated

Total life of the tornado on the ground was about 40 minutes.

Tornado 2. The most devastating tornado of the day touched down in the city of Petersburg at approximately 1:30 pm. The tornado grew rapidly in size and strength as it moved two miles northeast into the commercial historic district of Petersburg, known as Old Towne. Here, damage showed a path width of 250 yards. Much of this damage was of an F-2 magnitude, however, within this path were smaller paths about 30 yards wide of more concentrated F-4 damage (winds estimated near 210 mph). Because of this pattern, the tornado has been designated an F-4 multi-vortex tornado. The vortex of a large tornado can sometimes break down into smaller tornadoes which rotate around a central core. This is called a multi-vortex tornado.

Amazingly, no one was killed in Petersburg, although 58 buildings were badly damaged or destroyed. F-4 tornado winds were determined based on the construction, design and damage to these buildings.

From Old Towne, the tornado moved across to the historic black neighborhood of Pocohontas Island at about 1:35 pm. Here it destroyed or heavily damaged 47 of the 57 homes on the island, most of which were wood frame, and demolished a 200 year old church. Damage was rated as an F-3 with a path width of 250 yards. Total damage to Petersburg and Pocohontas Island was estimated at 15 million dollars, but there were no deaths.

From Pocohontas Island, the tornado crossed the river entering Colonial Heights and crossing I-95 to the Southpark shopping area (amazingly, no vehicles were struck on this normally very busy interstate highway).Here, it went on to damage several large stores including a K-Mart, a strip mall (Southgate Square) and then the Wal-Mart. The tornado had narrowed to about 200 yards by this point (as described by eyewitnesses) and was weakening, but it still retained its multi-vortex characteristics when it struck the Wal-Mart.

The tornado was as wide as the Wal-Mart was long. It moved across the length of the store. A small vortex within the length of the tornado struck the front of the store, slicing a 20-yard wide path through the cinder block wall and the store roof (this was from a vector direction of 230 degrees converging into the main path of the tornado). The vortex gives the storm a rating at the lower end of an F-3 with winds up to 175 mph. Damage outside the small vortex was F-2.

Three people were killed near the store front and another 198 injured. In the parking lot between the Wal-Mart and Southgate Square, 500 cars were

(continued next page)

*(**Tornado**, from page 7)*

removed, all with windows blown out and many completely totalled having been tossed about and flipped over. Of the 185 people brought to area hospitals, only 23 had to be admitted (this is a typical percentage for disasters). Total damage in Colonial Heights was estimated at 29.5 million dollars.

From the Wal-Mart, the tornado crossed the Appomattox River again, this time entering Prince George County. About a mile from the Wal-Mart at about 1:40 pm, it struck Tarmac Virginia, Inc., a sand and gravel pit company. The second floor of the cinder block building collapsed, killing one man who was crushed between the cinder blocks and a large electrical panel that fell. Cars, trucks and large conveyor belts were overturned. The tornado path width was 125 yards. It was a strong F-2 with winds estimated near 150 mph. Damage at the Tarmac site was estimated at $750,000.

The tornado then crossed I-295, damaging a tall sound barrier wall and headed for the independent city of Hopewell. *(Ed. Note: The "sound barrier" is shown in the cover photo and photos on this page).* Here it sliced through the northern section. The hardest hit was the Riverside Park Apartment Complex where it took off several roofs. The tornado destroyed two homes, caused major damage to 13, and minor damage to 49. It struck Hopewell around 1:45 pm. The tornado was rated an F-1 with a width of 75 to 100 yards. Damages were estimated at 2.2 million dollars. Eight people were injured.

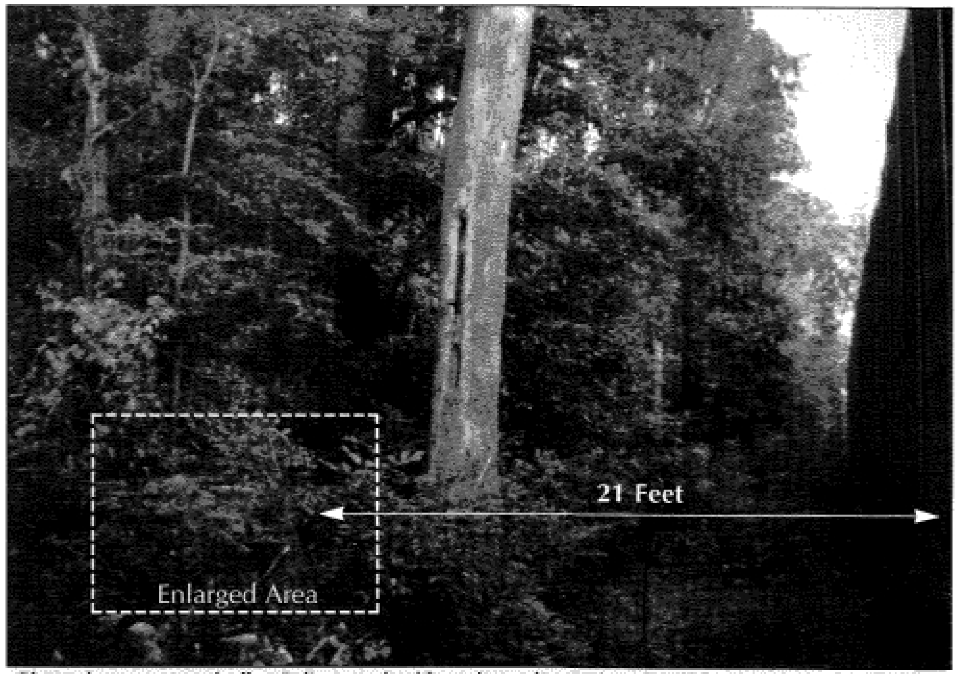

Photo shows snapped-off 24"-diameter healthy oak tree located 21 feet behind the soundwall in the area where the steel post was bent by the force of the tornado. The arrow on the cover photo shows the location of the bent post in the wall.

Close-up of snapped tree — the break occurred five feet above the ground level at that point. The tornado path is from right to left in the photo.The Interstate 275 is approximately 60 feet away on the other side of the wall.

The tornado weakened to an F-0 as it crossed Route 10 near the bridge and moved out over the confluence of the Appomattox and James Rivers. It dissipated before entering Charles County. Total path length through three independent cities and one county was about 12 miles. Total damages were estimated at 47.5 million dollars. Total life time of the tornado on the ground was 15 to 20 minutes.

Ed. Note: The National Weather Service report continues:

"This was not the deadliest tornado outbreak for Virginia. That occurred May 2, 1929 when five tornadoes killed 21 people and injured 70. In 1929, it was a relatively unpopulated state and there may have been more tornadoes that day which went unreported. By comparison, the August 6 tornadoes killed four and injured 259 people. The tornado that struck Petersburg injured as many people as all the tornadoes combined for the past 40 years in Virginia. While not the deadliest, it was the worst tornado as far as total citizens in the commonwealth affected. We can thank the rapid response of emergency services and medical personnel for saving lives and minimizing the potential death toll from this disaster.

After the Petersburg tornado, some people talked about how unusual it was for a tornado to strike that area of Virginia. While it was an unusual event, it was not a first. Petersburg was struck by an F-2 tornado on June 21, 1970 and an F-3 tornado on May 8, 1984. While no deaths or injuries occurred, there was significant damage. Nearby counties such as Chesterfield, Dinwiddie, Prince George and Charles City have recorded nine, four, four and five tornadoes respectively since 1950. Chesterfield has been one of the hotter tornado spots in Virginia's history. ■

(Ed. Note: Following is further general information on tornadoes, as excerpted from "Recommendations for Wind Design Parameters," prepared for a noise barrier manufacturer by Technology Frontiers of Bethesda, MD, and co-authored by Dr. Michael P. Gaus of Technology Frontiers and Dr. Kishor Mehta of Texas Tech University).

Tornadoes

On the average, 800-1000 tornadoes occur each year in the contiguous United States. Tornadoes are short-lived, randomly occurring, localized storms. It has not been possible to place instrumentation inside the storm to measure intensity of the storm and associated wind speeds. Damage and photogrammetric analyses have been used to estimate wind speeds; however, detailed analysis of this nature is feasible only in isolated cases.

The most commonly used method for assessing the intensity of a tornado is the F-scale (Fujita, 1971). This method assigns a numerical value of F-scale to each tornado, based on the appearance of damage. Since the assignments of F-scale are accomplished often by laypersons, they are not expected to be precise.

Dr. Fujita has designated a wind speed range to each F-scale damage. It should be noted that the designation of wind speeds to F-scale are not based on engineering analysis, but are based on good subjective judgment. Hence, accuracy of wind speed estimates using F-scale rating are not expected to be high.

Notwithstanding the inaccuracies in assignments of F-scale, wind speed estimates based on F-scale rating is the only method available that considers almost all the reported tornadoes. From a statistical point of view, it is essential that a large sample of tornadoes be considered to determine the tornado hazard probability at a given location.

A review of F-scale rating data of all tornadoes that occurred in a 63-year period reveals interesting results. The review shows that almost 86 percent of tornadoes are assigned to the scale of F-2 or smaller. The maximum designated wind speed for F-2 is 157 mph. Thus, according to these data, 86 percent of tornadoes contained gust wind speeds of 157 mph or less (Dr. Fujita used gust wind speeds in designating ranges for each F-scale). ■

(Ed. Note: This is the most detailed and thorough investigation of high wind speeds impacting a tall noise barrier that we have seen. It demonstrates the difference between gust winds and prevailing winds and speaks well for properly designed barrier systems). ■

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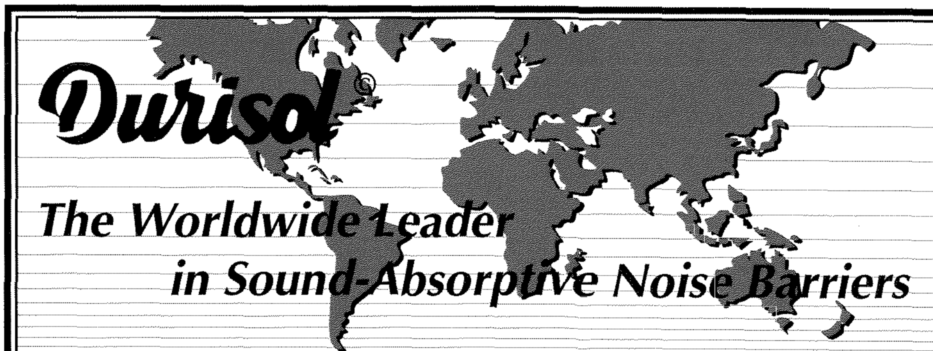

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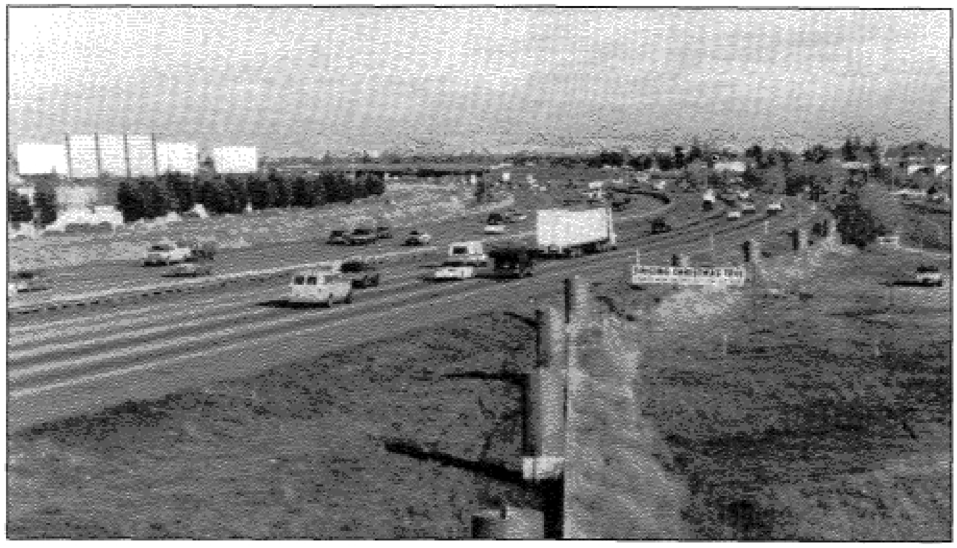
Electronic Noise Control on California Freeways — A Special Report to The Wall Journal

by George Hartwell of the Caltrans Office at Los Angeles

> *"It took Edison a long time to come up with the first filament for his light bulb."*
> — Rudy Hendriks, acoustical engineer, California Department of Transportation at Sacramento

(Sacramento, CA) "The failure was in the equipment, not the theory," insisted inventor Stanley Marquiss, explaining why his futuristic electronic sound wall didn't work in its first full scale test on a California freeway.

Marquiss, president of Marquiss Geddreaux, Inc. of Plymouth, California, an acoustical engineering and research firm, proposed to demonstrate how an electronically-driven "active noise mitigation" system could reduce transportation system noise adjacent to the state's highways. In theory, the system would provide a less expensive alternative to masonry noise barriers, of which California has built more than 325 miles at a cost of a million dollars per mile.



According to Marquiss, some of the ultra high-tech equipment designed for the test was damaged in transit, and wet, freezing weather warped critical components rendering the system ineffective. Marquiss, however, was undeterred. "I wasn't put off by the fact that the weather was extreme," he noted. "I knew the system would have to function in unspeakable weather. We just got the unspeakable weather first." New weather-resistant materials will be used to construct another demonstration system Marquiss hopes will be ready for evaluation in spring, 1994.

Allen Wrenn, Caltrans' noise abatement program manager, confirmed that equipment damage contributed to the system's difficulties. He indicated Caltrans still has high hopes the system will function effectively. "We're still very excited about the possibility of discovering another way to reduce transportation generated noise that is less expensive and intrusive to the landscape than traditional masonry walls," Wrenn said. "We are looking forward to continuing our work with Marquiss Geddreaux, Inc."

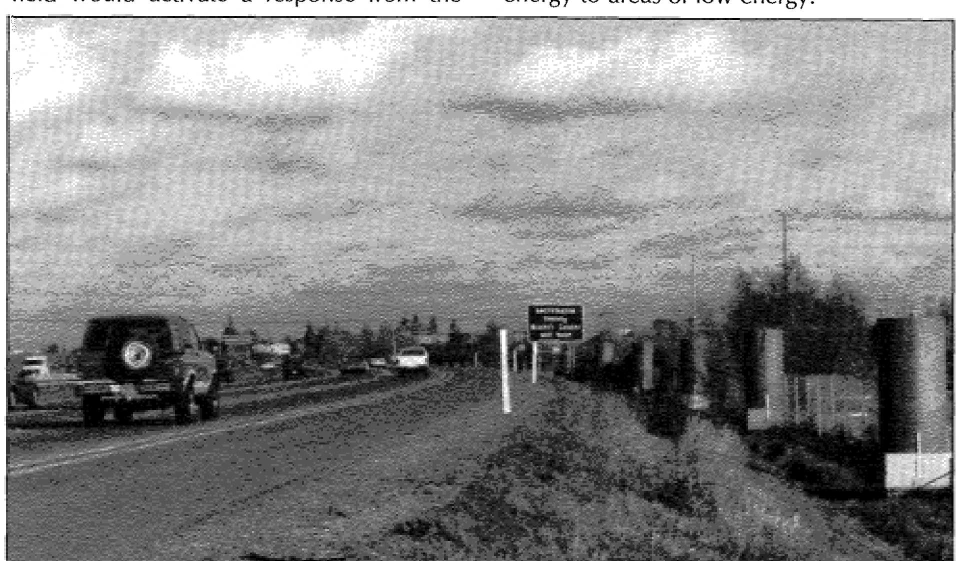
Development costs related to the electronic sound wall project are underwritten by Marquiss Geddreaux, Wrenn said. The only costs incurred by Caltrans are staff expenses for analysis and verification of system performance, he noted.

Marquiss' system consisted of 13 nine and one-half-foot-high cylindrical transducers spaced at 100-foot intervals along a section of the south side of Highway 50 in Sacramento.

It does not match the scientific stereotype of previously explored active noise control systems, according to Wrenn. "We know this system is not what is commonly referred to as 'active noise control'," Wrenn noted. "When Stanley Marquiss came to us he could not share details of his invention because he had not completed the patent process and he wanted to protect his proprietary interests in the method and design of the system. He advised us that it was something like active noise control, and the name just stuck for a while."

According to Marquiss, highway noise received at various points within the test field would activate a response from the transducers. Sound pressure waves generated from the transducers, according to Marquiss' theory, would reduce in-coming noise without increasing noise on the opposite side of the highway.

Marquiss explained that most freeway sound is inaudible to the human ear. Most highway noise occurs in a very low frequency range in the form of an energy carrier; a pressure wave that functions similarly to a weather system. You have a large-scale acoustical phenomenon," he said. "In a weather system energy moves from areas of high pressure to low pressure. On the freeway system sound moves from areas of high energy to areas of low energy."



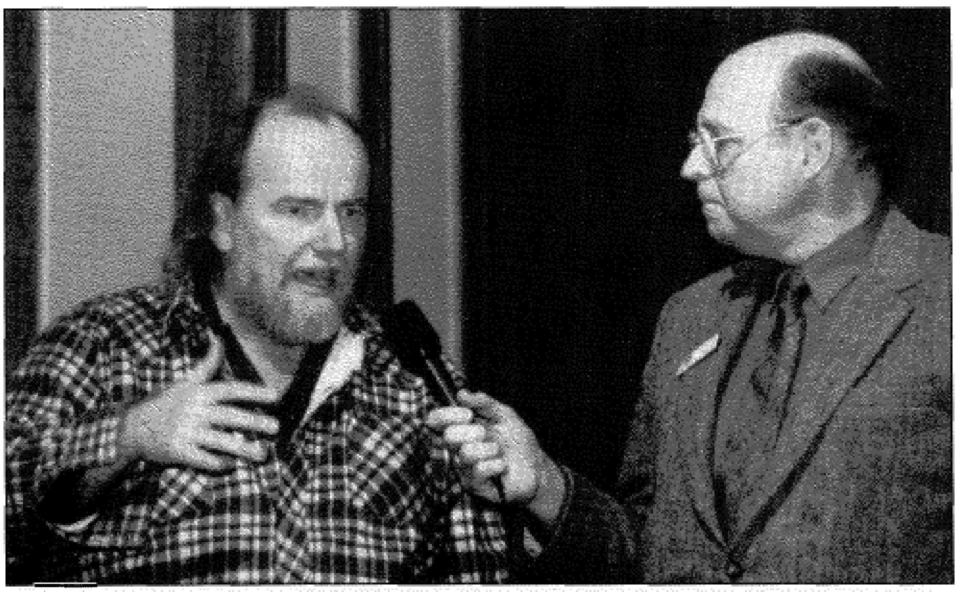
He described the freeway environment as a chaotic energy field. "It's a huge, pressure-driven source and the consequences of that source is unwanted noise," Marquiss commented.

"The active (noise control) system generates a series of low frequency pulses. They move back and forth between adjacent transducers to create an area of local high pressure," he explained. "The transducer is just an extremely capable air mover," Marquiss added.

The key instrument that produces a harmonic, well-orchestrated noise field instead of cacophony is a computer program that controls the transducer. "The program is the music, so to speak," he said.

Critics asked, why not just use a fan?

"Fans don't have a high degree of controllability," Marquiss argued. "They just don't have a high degree of potential directivity."



Inventor Stanley Marquiss answers a question from the audience of media and public who gathered to hear the results of the test. At the right is Allen Wrenn, Caltrans' noise abatement program manager.

The simplicity of Marquiss' transducer is remarkable. "The device consists of vertical, parallel diaphragms that open and close," he said. He described the panels as "diverging or converging surfaces that are connected at the apex of a triangle." Sort of like clapping hands, hinged at their palms. "You're creating an over pressure," he noted.

"Air is amazingly easy to move," he said. "It takes little energy. The mechanical resistance of air is very, very low."

Caltrans' evaluation of the system proved exacting. Engineer Rudy Hendriks was asked to test the system. "When Stan Marquiss approached us, he asked, 'What would it take to impress us as far as noise reduction is concerned.'" Hendriks said. "We told him that if he could reduce the noise level (adjacent to a freeway) by six decibels we would be impressed. We would have a basis to start thinking about active noise control systems."

According to Hendriks, a reduction in highway noise of three decibels is barely perceptible to the human ear. A five decibel reduction is clearly noticeable, and a ten decibel reduction is perceived by people as cutting the noise in half.

"The average (masonry) noise barrier attenuates noise by eight to ten decibels, depending upon the height of the barrier, its length, and so on," Hendriks said.

Hendriks used a four-fold approach to system analysis. Three types of noise measurements were conducted within the test field. One method measured noise at 30 fixed sites in the test area. Another measured noise at varying heights. A third method used was to roam the test area randomly with a sound level meter to measure noise changes corresponding with on and off system cycles.

Hendriks also measured noise levels on the north side of the freeway, opposite the active noise control system site.

"Inside the test area we also measured meteorology," Hendriks noted. "Meteorology will create variability in noise measurement. We tested wind speed, wind direction, temperature and humidity." Traffic volume was documented by videotape from a nearby overcrossing. We measured the speed of the traffic since freeway noise is highly dependent on the speed of the traffic.

The system was put to a test of 15 cycles, Hendriks explained. "Each cycle consisted of 20 minutes; 15 minutes of active on and off measurements in one minute intervals and a five minute break to move the instruments to a different location."

In spite of Marquiss' near 'round-the-clock efforts to design, manufacture and demonstrate his device with which to control the acoustical-meteorological environment, nature's own interference scuttled the test. Dense fog shrouded the cylinders in the nights preceding the demonstration and temperatures dropped below freezing.

The cellular foam diaphragms used in the transducers acted like sponges. "The foam would wick-up the water and at night it froze," Marquiss said. "The face of the half inch thick diaphragms expanded and pulled the diaphragms into an arc. That pulled the actuators out of a magnetic gap and had the effect of reducing their air moving capacity by about 75 percent."

Hendriks illustrated the test results with a graph. A thin, horizontal median line depicted the point from which variation would be registered. "The 'ons' and the 'offs' fell within the band of insignificance," he declared.

Program manager Wrenn remarked, "You've heard the expression, 'Everyone should have a Plan B." Then he held high a plastic bag of cotton balls. "It's labeled 'Plan B,"' he joked.

"Really, our 'Plan B' is, where do we go from here?" Wrenn said. "Caltrans plans to continue its work with Marquiss Geddreaux. We want to see what they can do. After we go through another series of testing, if the equipment can reduce sound significantly we would consider [an in depth development and analysis project]."

Marquiss stands ready to accept the challenge. "We have redesigned the diaphragm with a surface skin membrane that is impermeable to water," he said. "We also redesigned the electromagnetic actuator.

"We are going to do it again," he promised. Marquiss also reports he has transferred European patent rights to the system's technology to a consortium of Austrian investors and expects his research to benefit from an infusion of new capital.

"This is a first experiment," Hendriks observed. "As far as I know this has never been tried anywhere else in the world. It took Edison a long time to come up with the first filament for his light bulb. We need to begin thinking about new technologies and preparing for the 21st Century. There are many ways of [reducing highway noise]. I think all of them should be explored." ■

(For further information, contact Allen Wrenn, Chief, Community Noise Abatement Branch, Caltrans, 1120 N Street, P.O. Box 942873, Sacramento, CA 94273-0001, Tel. 916 654-6680)

FOR DETAILS OF THE TEST METHOD, SEE THE PAGES FOLLOWING

Testing an Electronic Noise Control System Along a California Freeway

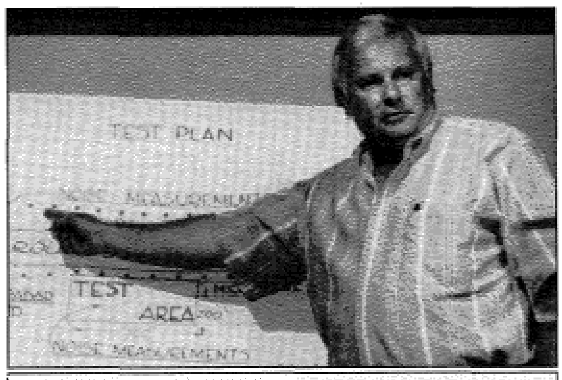
By Rudy Hendriks

Ordinarily, a reduction of 6 dBA is not exactly an ambitious goal to strive for in mitigating freeway noise, especially not when a freeway is nearly at-grade, the surrounding terrain is flat, and there is sufficient right-of-way to allow optimum placement of a noise barrier. After all, the average noise reduction provided by California noise barriers at first tier homes is probably close to 10 dBA. Why then did some of us in Caltrans become excited at a proposal to lower noise levels from a freeway in an adjacent empty field by 6 dBA? The answer lies not in the amount of the suggested noise reduction, but rather in the method proposed to achieve it.

In the spring of 1993, Mr. Stanley Marquiss, president of Marquiss Geddreaux, Inc. (MGx) of Plymouth, California, proposed to install and test a prototype of an electronic noise control (ENC) system along Route 50 freeway in Sacramento. The proposed system, invented by Mr. Marquiss, consisted of 13 gigantic, cylindrical transducers (speakers), approximately 3 m (9.5 ft) tall and 1.2 m (4 ft) in diameter. These speakers would be spaced 30.5 m (100 ft) apart (on center), within the freeway right-of-way (R/W), on a line roughly parallel to the freeway. The speakers, driven by a signal generator and amplifiers, were designed to emit sound pressure waves that would interfere with the sound pressure waves emanating from vehicles on the freeway. Mr. Marquiss was in the process of applying for a patent on the system and would, understandably, not reveal his theory and the workings of the system until after the test. He proposed to manufacture and install the system, and allow Caltrans to test his system for effectiveness in reducing noise. The costs of manufacturing and installation would be borne by MGx, while Caltrans would fund the noise reduction tests.

Caltrans and the inventor agreed on a test area of about 150 m (500 ft) parallel to the freeway along the R/W boundary x 60 m (200 ft) perpendicular to the freeway, outside the R/W. The latter dimension was chosen to represent a region in which most freeway noise impacts normally occur. The criterion for a successful test would be an average noise reduction of 6 dBA inside the test area, without increasing the noise at any location(s) inside or outside the test area.

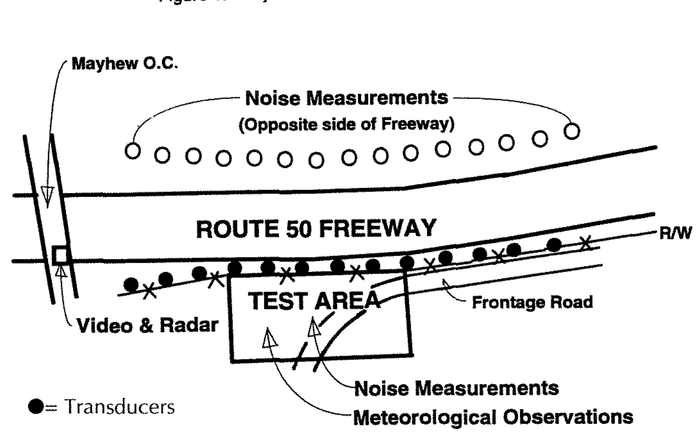
A test site was selected on the south side of Route 50 at Capital Christian Center, 1.2 km (3/4 mi) west of Bradshaw Road, on a level field, free of obstructions. Preliminary noise measurements were made at the site to determine existing noise characteristics. This information was used to select the appropriate noise descriptors and averaging times, and to determine the number of noise samples needed to measure changes in noise levels attributable to the ENC system.



Rudy Hendriks explains the test protocol to the media and public who gathered to hear the results of the test.

The Caltrans Division of New Technology, Materials and Research (DNTM&R) developed an elaborate test plan that included noise measurements inside and outside the test area, meteorological observations, video taping of traffic, and trafffic speed measurements by radar. Figure 1 shows a general layout of the project area, including the test area and other measurement locations. Although most of the noise measurements would be concentrated within the test area, measurements would also be taken at 15 sites on the opposite (north) side of the freeway to guard against any undetected noise increases caused by the ENC system.

Figure 1. Project Area and Test Locations



An enlarged, detailed view of the test area is shown in Figure 2. Thirty noise measurement sites were laid out in a skewed grid. The dimensions and shape of the grid were selected to create a wide variety of positional relationships between the transducers and the measurement sites. The thirty sites would be occupied two at a time, by two sound level meters (SLM). One of these SLM would be connected to a tape recorder allowing more detailed analysis at a later date, if the ENC system proved to be successful. The SLM microphones (mic's) were positioned at a height of 1.5 m (5 ft). One additional site was selected to measure noise at various heights above the ground. At this site mic's would be placed at 1.5 m (5 ft), 3 m (10 ft), 4.5 m (15 ft), 6 m (20 ft), and 7 m (23 ft), respectively. In addition to the predetermined, flxed sites, "sweeps" with an SLM and graphic level recorder (GLR) were planned at random locations in the test area. Instantaneous noise traces of level vs time would be graphically displayed from about 30 seconds before to 30 seconds after the ENC system was turned on or off. If the system achieved a noise reduction, the traces would show a "jump" down or up corresponding with the ENC system "on" and "off" cycles.

The previously mentioned preliminary noise measurements were made in the test site during freeflowing traffic conditions. The results repeatedly showed that standard deviations of seven one minute average [(Leq(l min)] samples were small enough to determine the actual average within 1 dBA, at a 95% confidence level. The same noise measurements also consistently found, in absence of the ENC system, no statistiscally significant difference between the average of eight odd numbered samples and seven even numbered samples during a 15 minute period. This information demonstrated that the trafflc noise on Route 50 did not fluctuate signiflcantly in volume, speed and vehicle mix, and that therefore the ENC system could be tested in 15 minute cycles, by alternately switching the system on and off

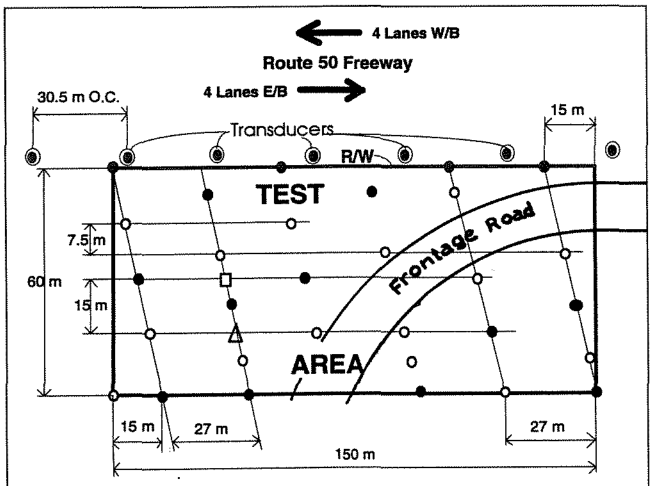


Fig. 2. DETAIL OF TEST AREA

● = SLM (linear, Leq 1 min.) + Tape Recording (linear) 1.5 m high
○ = SLM Only (A-weighted, Leq i min.),1.5m high
❑ = SLM Only (A-weighted, Leq 1 min.) 1.5m, 3m, 4.5m 6 and7m
Δ = Meteorological Station and ControlPanel

at 1 minute intervals. The resulting eight 1 minute "on" period noise levels, and seven 1 minute "off" period noise levels could then be tested statistically with the Student "t"-test, at a level of signiflcance of 0.05 . This procedure tests the hypothesis that the mean noise level of the "on" period equals the mean of the "off" period. If the hypothesis were rejected, it would mean that the noise level change (either up or down) would be statistically signiflcant and attributed to the ENC system.

From these flndings, a rigid schedule was developed for testing the ENC system. The system would be tested between the hours of 0900 and 1500, when trafflc on Route 50 is normally freeflowing. Total testing time would be five hours, from 0900 - 1200 and 1300 - 1500. The five hours were divided into fifteen test cycles, or three per hour. Thus, each test cycle lasted 20 minutes, during which the ENC system would be switched on and off at 1 minute intervals for 15 minutes. Noise, meteorology and traffic would be measured simultaneously. The remaining 5 minutes would be devoted to moving the SLM to the next sites. With two SLM, each of the thirty fixed sites would be covered within the five hour testing period. A third SLM would be needed to measure the single variable height site. The random pattern "sweeps" would require a fourth SLM. A fifth SLM would cover the fifteen sites on the opposite side of the freeway.

An encroachment permit was granted by Caltrans to Mr. Marquiss, and the system was installed and ready for testing on December 15, 1993. A Caltrans employee was assigned to switch the ENC system on and off according to the schedule. To insure rigid compliance with the testing schedules, all SLM operators wore watches synchronized to the nearest second. Every minute during the test cycles, the SLM readings were recorded and reset for the next minute's measurement. This resetting process was virtually instantaneous. The traffflc video tapes, radar speed measurements, and meteorological observations were also time correlated.

Early into the testing cycles it became apparent that the ENC system did not reduce noise perceptibly. The measured data also confirmed what appeared to be no significant differences between the system on and system off noise levels. During the course of the first day, the amplitude of the signal to speakers was increased several times and adjustments were made to the vertical diaphragms of the speakers, to no avail.

A second day of testing (actually only half a day) yielded basically the same results and further testing was called off. Later, all the noise data, except for the tape recorded data were statistically analyzed using the Student "t"-test. At all sites, including those on the opposite side of the freeway, the noise levels during the system on and off periods showed no significant differences, using a level of significance of 0.05 (two-tailed).

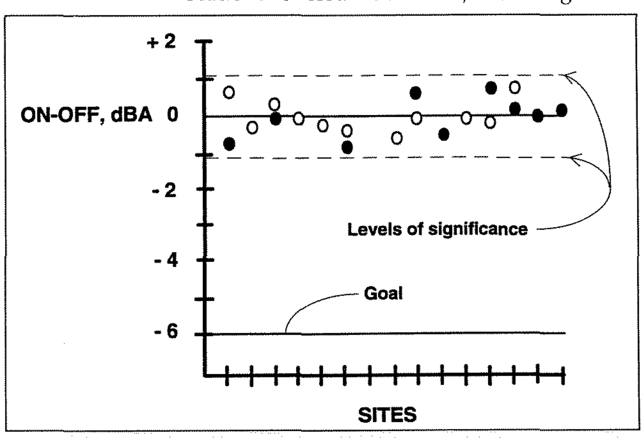


Fig. 3. ENC System "On Minus Off" Differences at 15 Sites in the Test Area.
○ = First Day ● = Second Day

Figure 3 shows a plot of the mean A-weighted "on minus off" differences at 15 sites in the test area. The remaining 15 sites in the test area were recorded linearly, and the mean linear noise level differences between "on minus off' showed similar plots. The variable height site also showed no significant differences at the five different heights.

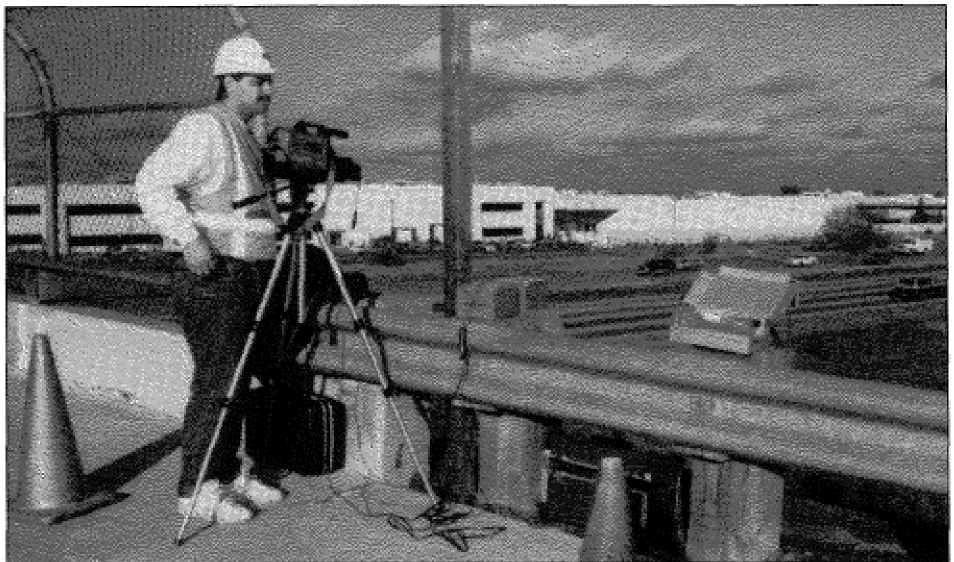
Sound level meters occupied 30 test sites for measuring the effects of the electronic devices being turned on and off

On December 21, Mr. Marquiss disclosed his theory and the workings of his system. The transducers were directional parallel to the freeway. In the "on" mode they emitted 9 Hz pressure waves in down stream, near lane traffic direction. The transducers were driven by a signal generator coupled with amplifiers to the transducers. The infrasonic pressure waves were generated by two vertical diaphragms, connected by a single vertical shaft, inside each transducer. The diaphragms were oriented approximately 90 degrees with respect to each other, at 45 degrees either side of the axis of directionality, and moved several inches back and forth towards open and closed positions. The transducers were spaced at approximately one wave length apart, and the inventor hoped to create a local pressure gradient parallel to the freeway, with a strong upward component. According to the inventor's theory, the pressure gradient would refract sound pressure waves from the freeway upwards, thereby creating a noise shadow on the receiver side of the gradient.

Mr. Marquiss is convinced that the transducers did not perform as hoped because of warping of the diaphragms due to moisture from fog and rain. He is manufacturing a new improved system and says that he will

(continued on page 14)

(*CALTRANS*, continued from page 13)



Traffic flow and speed for the test was documented by videotape and radar speed readings from the adjacent overpass.

be ready for further testing in March 1994. At that time, Caltrans will once again do the noise monitoring. We plan, however, a simple screening test first. If the ENC system passes the screening test, a more detailed measurement program will be initiated. ■

(For further information on the test method for this demonstration, contact:
Rudy Hendriks,
CALTRANS LAB,
P.O. Box 19128, Sacramento, CA 95819-0128.
Tel. 916 227-7269, fax 916 227-7075)

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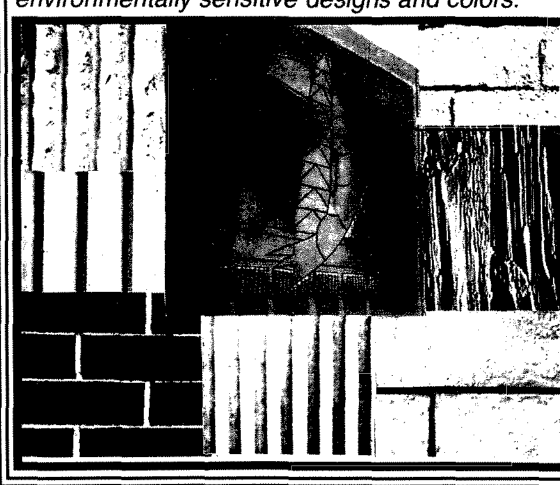

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New FHWA Model and Software - Part III — A Continuing Series

By: Grant S. Anderson (HMMH Inc.), Gregg G. Fleming (US DOT), Robert E. Armstrong and Steven A. Ronning (FHWA)

This is the third in a series of articles to appear in *The Wall Journal* about the continuing development of the Federal Highway Administration's (FHWA) next-generation highway noise prediction model and implementing computer software (model/software). It presents the developmental status of the new model/software, the status of its database measurements, and the status of its emission-level design from the user's point of view.

Harris Miller Miller and Hanson Inc. (HMMH), under the direction and guidance of FHWA, the Volpe National Transportation Systems Center (Volpe Center), and a review panel of eight noise specialists from state highway agencies, is currently designing and developing the new model/software. Foliage Software Systems, Inc. (FSS) has recently been added to the technical development team, under the supervision of HMMH, as the new software's Program Designer. FSS is primarily responsible for implementing the software's graphical user interface (GUI), as suggested by HMMH, and for incorporating the acoustical algorithms being developed by HMMH. On May 9-10, 1994, a software Screen Design/User Interaction Conference will be conducted by HMMH and FSS in Bedford, MA. The purpose of the conference is to review and evaluate the preliminary GUI design. All members of the model/software technical review panel should be attending.

The Volpe Center, in support of the FHWA and 21 state transportation agencies, is in the process of developing the database for the new model/software. Thanks to the contributing states and the work of Howard Jongedyk of FHWA, funding for this effort is at approximately 90 percent of the $300K goal. Specific data to be measured for the database consist of (1) multiple-barrier diffraction data, (2) Reference Energy Mean Emission Level (REMEL) data for both constant-flow and interrupted-flow traffic, on level grade and upgrade roadways, and (3) third-octave subsource height data.

Several sites for multiple-barrier diffraction measurements have been identified to date. Additional sites are required, however. If you have candidate measurement sites for multiple-barrier diffraction measurements, please call Gregg Fleming at (617) 494-2876.

REMEL measurements were conducted at six sites in northern California between February 28 and March 5, 1994. Rudy Hendriks of CALTRANS and Ken Polcak of Maryland State Highway Administration provided invaluable assistance to the Volpe Center during these measurements. Additional REMEL sites have been identified and measurements have been scheduled for Spring, 1994, in southern California, Florida and Texas. REMEL measurements will also take place in Maryland, Michigan and Massachusetts later in the year. With the assistance of the University of Central Florida and Vanderbilt University, tentative sites for interrupted-flow measurements have been identified in Florida and Kentucky.

Measurement and analysis of third-octave subsource height data are currently being performed by Florida Atlantic University under the guidance of the Florida Department of Transportation (FLDOT), FHWA, the Volpe Center, and HMMH. These measurements are being jointly funded by FLDOT and the Volpe Center, via the 21-State Pooled-Fund Study.

The REMEL measurements and the third-octave subsource measurements will be combined into the new model/software's emission-level database. From the user's point of view, the increased complexity of this database, compared to that of STAMINA, should be mostly concealed. The user will not be required to input information about third-octave noise emissions at specific subsource heights, for example. These portions of the database serve to improve the new model's accuracy compared to STAMINA, once the software combines them with its third-octave propagation algorithms.

Even for user-defined vehicles, third octaves and subsource heights will not be required by the user. As presently planned, to define a special vehicle type the user will need to enter only its A-weighted REMEL as a function of speed, in a special dialogue box on the screen, and then give the vehicle type a name. From this information, the software will estimate the third-octave and subsource components, based upon its built-in database, and then will remember that vehicle type for later use, as well. Within STAMINA, the REMEL speed function depends upon only two parameters. For the new model/software, perhaps four or five parameters will be required for better accuracy. In any case, the User's Manual will describe how to analyze REMEL field data to obtain these parameters for user-defined vehicles.

The new model/software may have the ability to account for optional vehicle types as follows: medium buses, heavy buses, motor homes and motorcycles. Also, the new model/software may allow the user to input state-specific emission levels, in addition to national-average emissions.

As presently planned, traffic input by the user will consist of the following:

- During setup, the user's choice of emission levels: national average or a specific state.
- Also during setup, four or five constants for each user-defined vehicle (if the user desires them).
- Hourly volume and speed for each vehicle type: automobiles, medium trucks and heavy trucks — plus medium buses, heavy buses, motor homes, motorcycles and user-defined vehicles (if the user wishes).
- For interrupted-flow roadway segments, the type of control device, e.g., stop sign, traffic signal, or toll barrier, and its location.

The software will automatically compute all upgrade adjustments to emission levels and will also automatically perform the interrupted-flow computations now in NCHRP Report 311 (W. Bowlby, R. L. Wayson and R. E. Stammer, Jr. *Predicting Stop-and-Go Traffic Noise Levels.* NCHRP Report 311. Washington DC : Transportation Research Board, November 1989).

Future articles in *The Wall Journal* will adhere to a format similar to this article, focusing on different components and/or capabilities of the new model/software. Progress on the software's GUI will appear in the next issue. At that time, the GUI will have had input from attendees at both the past Brainstorming Conference on User Interaction and the upcoming Screen Design/User Interaction Conference in early May. ■

Noise Walls: $2.4 million per mile and worth it —

by Thomas M. Downs, New Jersey State Transportation Commissioner

The following is a public statement printed in the Bergen (NJ) Daily Record to clarify the New Jersey Department of Transportation's policy on noise barrier construction.

In the September 7 Daily Record, a reader asked several questions about construction of Highway noise walls.

This issue is one that more and more residents are interested in and I would like to explain our policies and procedures and share the comments we have been receiving both for and against noise wall construction. The growing awareness that noise from vehicles affects nearby homeowners led the federal government in 1970 to authorize the use of highway money for noise abatement measures.

Among the environmental issues to be considered when building a new highway or widening an existing highway is the noise impact on those living near the highway. When noise thresholds are met, mitigation measures are required as part of the highway project.

On Route 80 in Morris County, the state Department of Transportation is widening the existing highway. When this project was planned, acoustic studies were done in the residential areas nearby and it was determined that a noise wall would reduce the noise from traffic by the guidelines set by the federal government. The noise wall under construction will provide relief to more than 800 homes.

The DOT in recent years has received an increasing number of requests from individual residents and from communities requesting that noise walls be built along existing highways.

In these cases, acoustic studies also are performed to determine if a wall will reduce noise in compliance with federal standards. We also determine if noise walls, which cost $2 million to $4 million per mile, meet the federal standard of costing less than $40,000 per house.

There are 17 existing highway corridors that we plan to study for noise walls. Additionally, DOT has received requests for similar studies from more than 40 communities with additional requests coming in at a steady flow. The letters seeking noise relief are among the most impassioned and personal we receive, and they underscore the fact that highway noise intrusion is a quality of life issue.

We also hear from residents who are opposed to noise wall construction. We are aware of aesthetic concerns and we do try to minimize the visual impact of noise walls by using trees and plants. However, the walls must be tall to block the noise from high tractor-trailer exhaust stacks.

As to sound reduction measures other than noise walls, we have found that trees are only effective when they cover an area of at least 300 feet deep between houses and highway. With New Jersey's density and development, this amount of open land is seldom available alongside our highways.

Likewise, earth berms can offer some sound relief. Again, I must stress that berms are not as effective as sound walls given the high exhaust stacks on trucks.

Some argue that houses should not have been built so close to highways in the first place. Appropriate land use law and procedures on the local level can prevent future residential development alongside highways. Likewise, developers can be required to incorporate berms and/or tree buffer zones into their proposed projects so noise relief is in place when the first residents move in.

Even so, we are faced with highway noise intrusion in neighborhoods throughout New Jersey. The Department of Transportation is committed to responding to our neighborhoods, but we are also sensitive to the objections to the walls.

It is our goal to try to balance both concerns in order to provide the best service to New Jerseyans. ■

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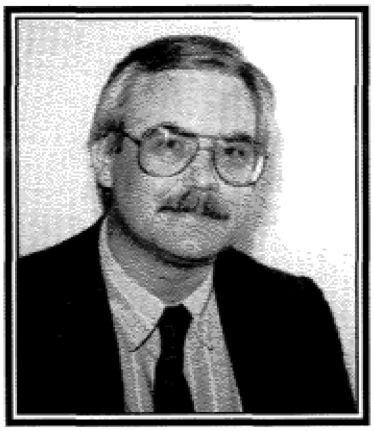

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FROM THE SUNSHINE STATE

By Win Lindeman, Florida Department of Transportation

Ed. Note: We don't hear from Win often enough. However, now that he and I are fellow Floridians, perhaps I can coax him out of an article on Florida's noise and wetlands projects.

Library Material Review

Wetlands and Highway: A Natural Approach." FHWA Publication No. FHWA-PD-94-004; HEP-40/11-93 (30M) E; 1993; 38 pp.

This booklet gives a great non-technical explanation of the problems associated with wetland loss resulting from highway expansion and offers some solutions. The solutions discussed include mitigation and mitigation banking, and the booklet looks beyond mitigation activities as well. Full of color photos and information, this is a great publication to have on your library shelf. Contact FHWA's Office of Environment and Planning at 202 366-2069 to find out how you can obtain a copy of your own.

Noise Barrier Status Report

The updated 1994 Noise Barrier Status Report is now available from the Florida Department of Transportation's Environmental Management Office in Tallahassee. This report contains everything you wanted to know about FDOT constructed noise barriers and more. If you want to receive your own personal copy, contact Rudy Maloy at FDOT, 605 Suwannee St., M.S. 37, Tallahassee, FL 32399-0450 or call him at 904 933-7203 or fax him at 904 922-7292.

Environmental Research Notebook

The latest copy of the FDOT Environmental Research Notebook is now available from the Environmental Management Office in Tallahassee. This report contains detailed information about all of the environmental research conducted by and for FDOT over all the past 20 years. If you want to receive your own personal copy, contact Rudy Maloy at FDOT, 605 Suwannee St., M.S. 37, Tallahassee, FL 32399-0450 or call him at 904 933-7203 or fax him at 904 922-7292.

Better Roads Article Questions Noise Barriers

An article by Ruth Stidger, Editor-in-Chief of the Better Roads magazine questioned the economic value of highway noise barriers. If you would like to know more, look at their February 1994 issue. ■

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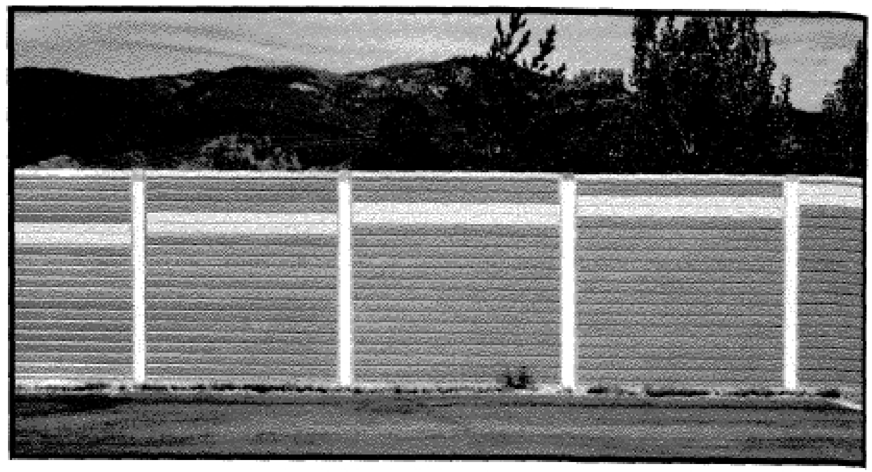

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TRB Committee A1F04

By Domenick Billera, Chairman

The topic of my column for this issue is the Transportation Research Board (TRB) membership. February was the time of year for turnover of TRB Committee members. Although the official roster of committee members is limited to 26 people, the committees are allowed to have an unlimited number of "subcommittee" members.

With our three subcommittees covering the areas of Aircraft, Highway and Guided Transit (Rail) noise, we feel that we have something to offer to anyone interested in transportation-related noise and vibration.

As chairman, my goal is to encourage a wide cross section of subcommittee members whose interests cover all aspects of our field. A1F04 provides an excellent meeting ground for discussion where all sides of an issue can be heard. A pleasant consequence of our meetings has been the many friendships that have been forged.

A1F04 is a dynamic committee. We hold our annual meetings in January at the Annual Transportation Research Board meeting in Washington, D.C. But we also have yearly summer meetings, which are hosted by rotating state agencies and involved consultants. The summer meetings have grown steadily in attendance, and combine hard work with a host of social activities. Our next summer meeting will be in Pennsylvania (see notice on page 25 of this issue).

Become a part of this group and interact with your fellow professionals. If you register now, you will be welcomed in Pennsylvania and you will be very happy and better informed if you join us.

Contact the subcommittee chairman of your choice at the earliest:

Aircraft Subcommittee:
Eric Stusnick, 703 415-4550
Highway Subcommittee:
Ken Polcak, 410 333-8072
Guided Transit Subcommittee:
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Caltrans' Arroyo Simi Wetlands Replacement Exceeds Expectations of its Designers

The unique wetlands-replacement program undertaken as part of the 118-23 freeway connector in Moorpark, California has quickly surpassed the high expectations of its Caltrans designers. "So far, we can say this is a really successful project, reported Caltrans biologist Monica Einn. "When we first began planting, we weren't quite sure what to expect. But everything went well. We're really happy with the project."

The construction of the $33 million freeway displaced six acres of Arroyo Simi wetlands, so Caltrans agreed to create a 17-acre wetlands at another site nearby. The project represented the first time Caltrans had undertaken a wetlands-replacement of this size in District 7.

More than 5,000 native trees and shrubs were planted as part of the $863,000 project. A stream was diverted through the area to provide a natural source of water for the flora and fauna. For the record, the wetlands is called a riparian woodland, which means it consists mostly of shrubs, including mulefat, elderberry, and wild rose.

The trees planted on the site include willows, cottonwoods, sycamores and oaks. Wetlands are considered a vital part of the environment because they support a variety of plant and animal life, and serve as a filter to help clean out impurities from the water supply.

In California, more than 90 percent of the native wetlands have been destroyed by development, magnifying the importance of the few that remain. Einn, Caltrans landscape architect Haiching Pan and Project Engineer Eddie Chow plunged into the task, turning a relatively empty pasture into a wetlands teeming with life and activity.

Frank Latham, Haiching Pan and Monica Finn (left to right) examine aerial photographs of the area to determine the best locations for additional planting.

Pan said Caltrans' chief concern was making sure the plants established themselves in the new site, which was a condition of the permit. What they are looking for is plant survival," Pan said. "The plants are doing well and tapping onto the groundwater system, which is the key to their long-term survival. We designed it with special attention to that.

"That's what distinguishes our project from others," Pan said. "The goal was to create a self-sufficient system so that after the first year, no maintenance will be necessary. The plants have continued to flourish since we stopped watering. This indicates the plants

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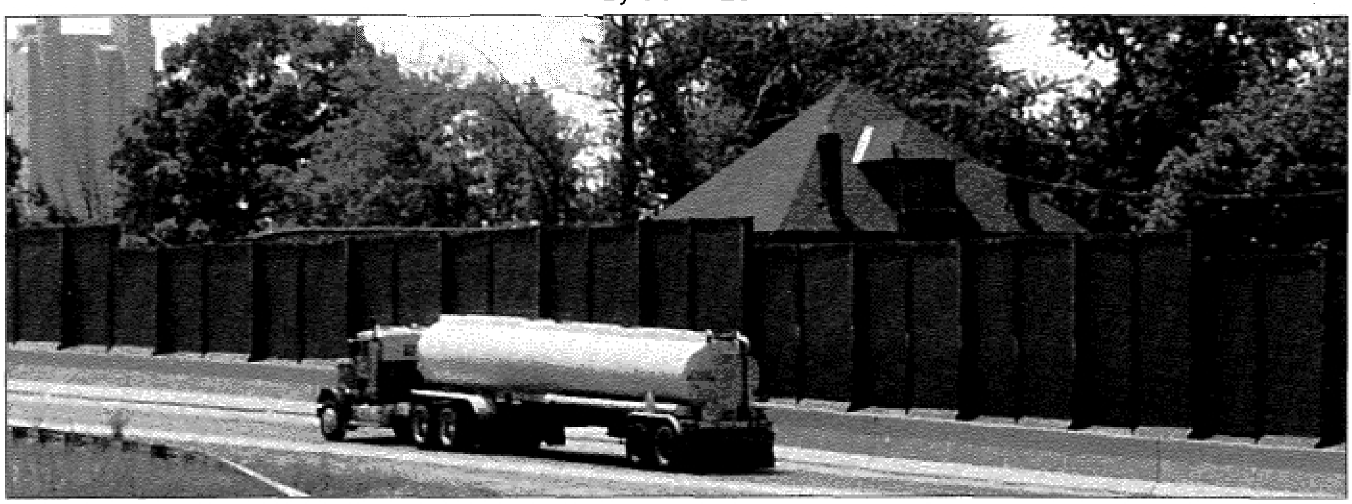

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are established."

Finn and Pan said representatives from other government agencies, including the state Department of Fish and Game and the U.S. Fish and Wildlife Service, have visited the site and are pleased with the results. "They use it as an example of a successful wetlands-replacement project," Einn said. Cathy Brown, a biologist in the Ventura, California office of the U.S. Fish and Wildlife Service, recently praised the project, saying, "They did an excellent job."

Evidence such as track marls and droppings indicate that several types of wildlife are enjoying Caltrans' handiwork. The animals include bobcats, coyotes, raccoons, amphibians and rodents. "There are many species that rely on the wetlands for their existence," Finn says.

But perhaps the most pleasant surprise has been how quickly the man bird species have taken to the habitat. A bird study is underway to determine which birds are using the wetlands, and so far the data have proved promising. There are about 75 different types of birds living in the habitat adjacent to the wetlands. In just two visits, biologists have recorded 23 different specie of birds using the wetlands. Some of those birds include the Cooper's hawk, the red-tailed hawk, Downey woodpecker, American egret, great blue heron, black-headed grosbeak and five different types of warblers. In addition, biologists have spotted the state bird, the California quail. In the future, biologists hope the wetlands become a safe haven to some endangered or sensitive birds, including the least Bell's vireo, the yellow- breasted chat and the blue grosbeak. Already, biologists and landscape architects have learned a great deal from the experience.

For example. they found cuttings from indigenous plants are preferable to purchasing stock plants from nurseries. "Cuttings are the best material to use because they are already adapted to the area," Finn said. "When you buy plants, you don't know where they came from."

Biologists also learned that size isn't everything when it comes to plant establishment. "Some publications have suggested that the larger the plant, the better," said Pan, "but that wasn't true." She said this project used cuttings about one inch in diameter and less than 24 inches in length. The plants took root quickly and grew 10 to 15 feet in six months.

The educational value of the wetlands has not been lost on nearby Moorpark College. Officials there also are enthusiastic about the project, and plans are in the works to use the site as a training ground to teach future biologists. A Memorandum of Understanding to eventually turn over the wetlands to the college is awaiting final approval.

Meanwhile, accolades for the project continue to pour in. It was honored with a prestigious "Tranny" award by the California Transportation Foundation in the environmental category. The project also earned the Caltrans Excellence in Transportation Facilities Award. In addition, District 7 was recently awarded a $200,000 state grant, called the Environmental Enhancement Mitigation Grant, to improve the wetlands project. Finn says the funds are going to be used to create a "buffer zone" between the wetlands and the surrounding area.

Finn and Pan stressed that the wet- lands-replacement program is a team effort, and much credit goes to the construction engineers who are building the 118-23 interchange. Specifically, they said Resident Engineer Frank Latham and Jim Lytle were very helpful. "We couldn't have done it without them," said Finn, a sentiment that was later echoed by Pan.

There is still plenty of work ahead monitoring the progress of the fledgling woodland, but its creators are optimistic of its long-term success because it was designed to be the closest thing to the genuine article. "The work is artificial, but we are trying to make it a natural system," Pan said. Agreed Finn, "We didn't want to plant trees and have a glorified orchard." ■

(If you wish further information, contact Russell Snyder, Caltrans Public Information Officer for Caltrans District 7 by phone at 213 897-0849 or fax 213 897-3674).

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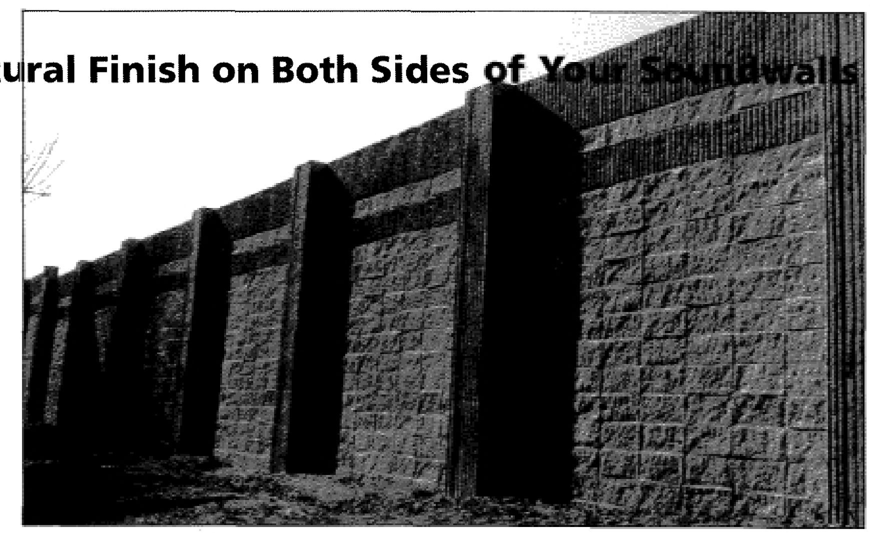

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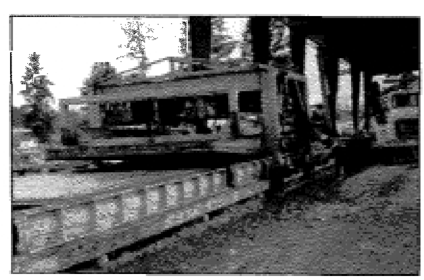

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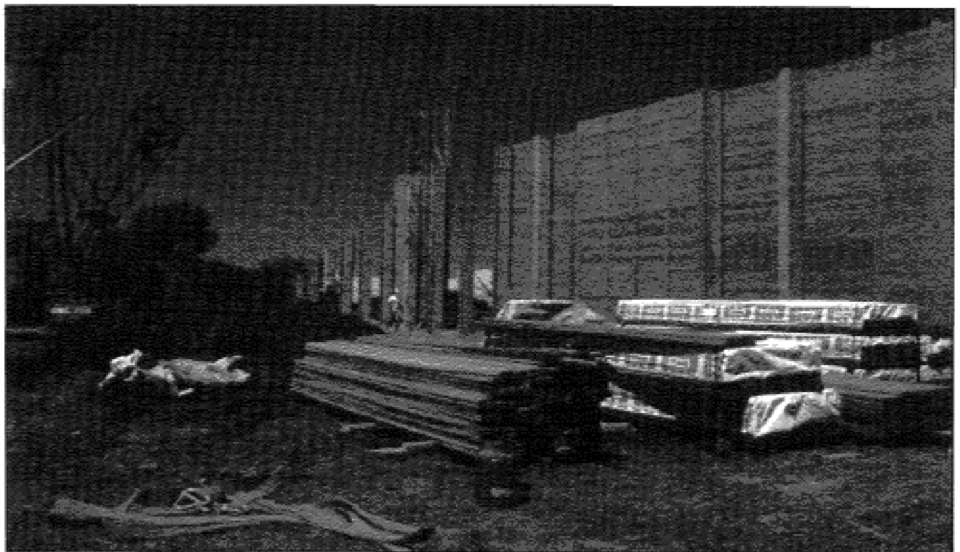
Wood Noise Walls Completed Near Minnesota/North Dakota Border

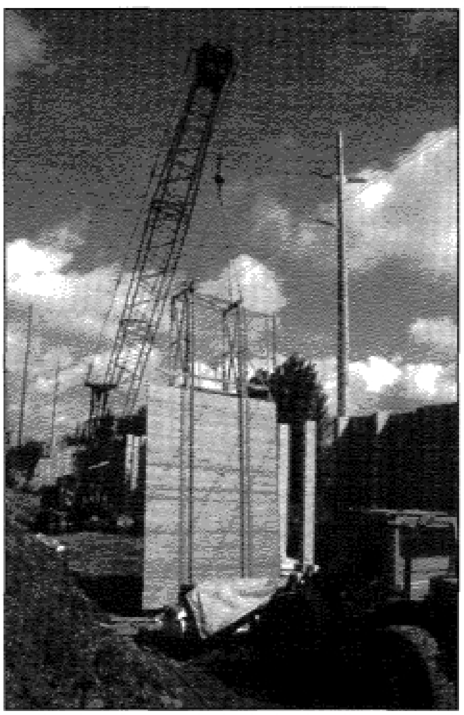
By Don Jaenicke



Minnesota has long been a leader in the design and installation of wood noise barriers. The Minnesota Department of Transportation has recently completed another major section of wood barriers on highway I-94 near the North Dakota line.

The walls are made of solid pressure-treated Southern Pine lumber (kiln-dried after treatment). They were panelized into sections on the ground before being lifted into place. This avoided the need for scaffolding, which would have been required if the lumber was installed one piece at a time.

Southern Pine 2x6 tongue-and-groove boards were used for the panels, which are about 16 feet wide and up to 24 feet high. The contractor was able to place six to eight sections of the walls per day.



The wall sections are secured on alternate sides to concrete posts that are set eight feet apart. Total cost of the project was about $1 million for 0.6 miles, or approximately $15.50 per square foot. The material and labor for the wood noise walls cost about $3.00 per square foot. The contractor was D.H. Blattner and Sons of Avon, MN.

Mark Waisanen, resident engineer for Minnesota DOT said that surveys of nearby homeowners indicated a preference for wood walls because of their natural appearance and compatibility with the surrounding area. The highway is used by about 30,000 vehicles per day between Fargo and Moorhead.

For more information, contact Don Jaenicke at 206 575-8745, or write to Southern Forest Products Association, P.O. Box 641700, Kenner, LA 70065. ■

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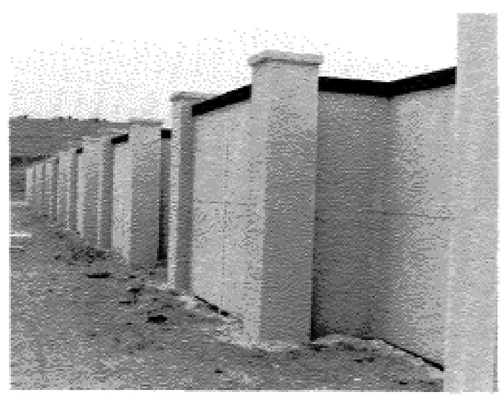

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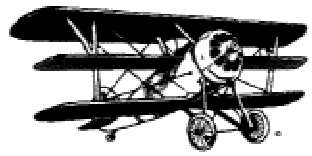
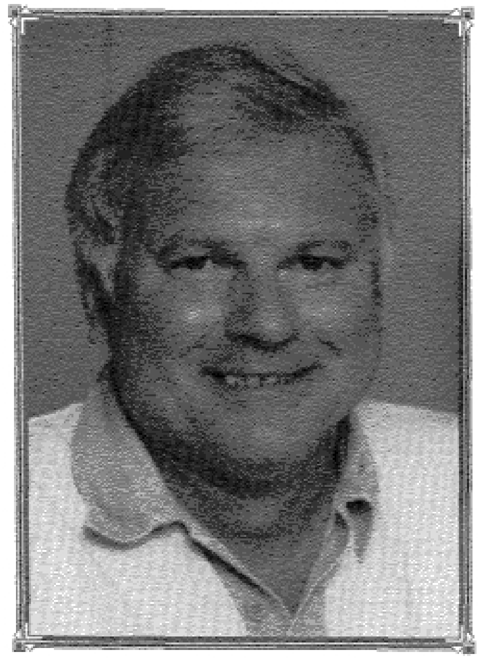


In this issue, we introduce a new personal recognition department, in which we honor outstanding performances and contributions from our readers.

It is with great pleasure that the awards committee has selected Rudy Hendriks for the first honorarium. Rudy is very well known and respected by a great number of the acoustical fraternity, in particular those members and associates of the TRB A1F04 Committee on Transportation Related Noise and Vibration.

Our first award goes to Rudy for his work in developing an elaborate test plan for an on-site field test of an electronic noise control system, and for his report on the test itself (see story on page 12 of this issue).

Congratulations, Rudy.



Rudy Hendriks

(If you wish to extend your personal congratulations to Rudy, his telephone and address are at the end of his story).

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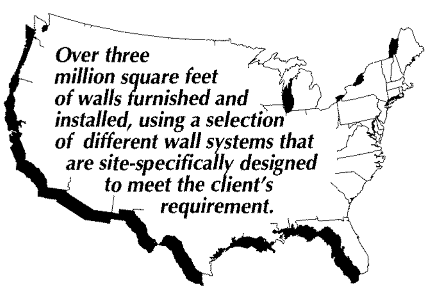

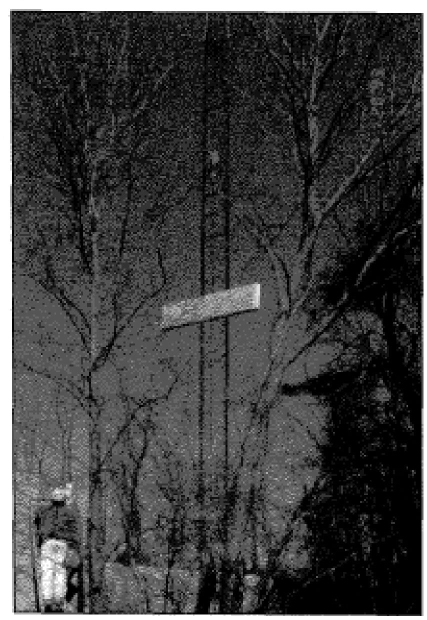

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Not Just Another Letter to the Editor

(Ed. Note: I particularly like this one, because in addition to plaudits, it will bring welcome news to the many friends and professional associates of the writer of the letter).

Dear El:

I was happy to receive the latest issue of The Wall Journal and find you are on the mend and back on the job. JoAnne and I send our best wishes for your continued and complete recovery.

If you haven't heard already, I'm no longer in the noise abatement arena (at least for the next couple of years). A special assignment has me coordinating the complete renovation of the State Highway Administration headquarters complex. Since I volunteered for this position, people are questioning my sanity. When I explain that the noise program has already driven me crazy, they seem to understand a little better.

Actually, this is an excellent opportunity for me to develop skills for the future career I have been planning. Although my main interest is in church space renovation and construction, people are people and all have needs and fears when change is anticipated. My task is to listen carefully and provide liaison between State Highway Administration personnel and our space planning consultant and architects.This first month has been every bit exciting as I'd imagined.

My only regret is losing contact with those I've worked with for the last decade or so. The memories acquired during this time are something that will remain with me as I continue life's journey. Your friendship has been an important component of this process.

Finally, I applaud your intent to move to the "Sunshine State." After this winter, I was ready to do it myself.

Again, may the future be kind to you and provide peace and satisfaction in all your endeavors. Keep up the good work and don't take me off your mailing list.

Sincerely,

Gene Miller, Maryland State Highway Administration

*(Ed. Note: Gene Miller is widely known for his tireless work in handling citizen noise complaints and in furthering the cause and methodology of highway traffic noise abatement in his beautiful state. No wonder he was so successful in placating irate citizens; he writes fabulous letters. Many thanks and best wishes for **your** future, Gene).*

For those of you who may wish to call or send a note to Gene, here are the particulars;
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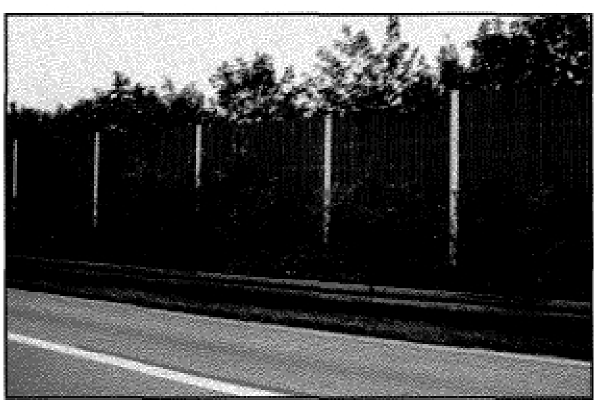

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TRB Committee A1F04 Summer Meeting

Announcement

The TRB A1F04 Committee on Transportation-Related Noise and Vibration will hold its Annual Summer Meeting on July 10-13 1994 at the Holiday Inn Center City in Philadelphia, Pennsylvania.

If you wish to attend, present a professional paper, or would like to exhibit your product, please contact either of the following:

Mr. Roy Osborne
Environmental Scientist
Bureau of Environmental Quality
Pennsylvania Department of Transportation
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Transportation and Safety Building
Harrisburg, Pennsylvania 17120
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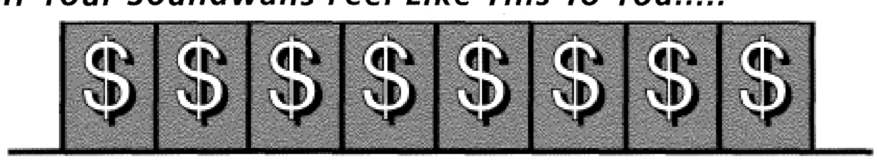

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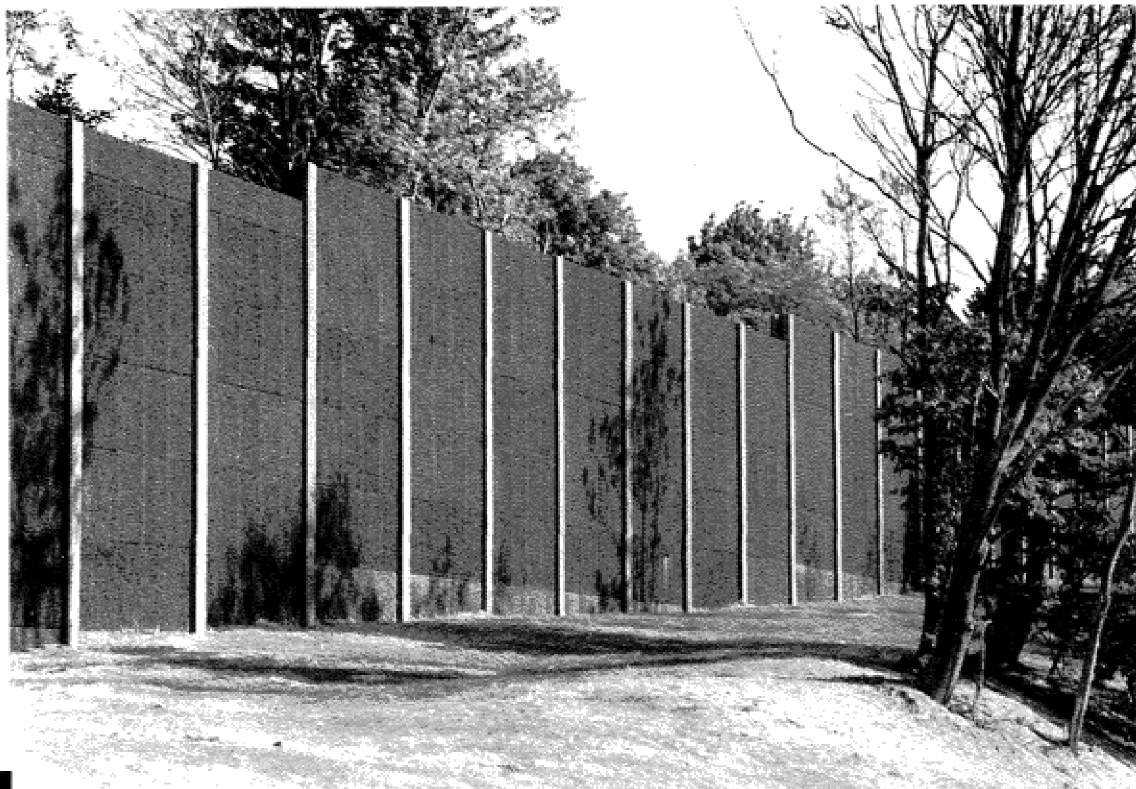

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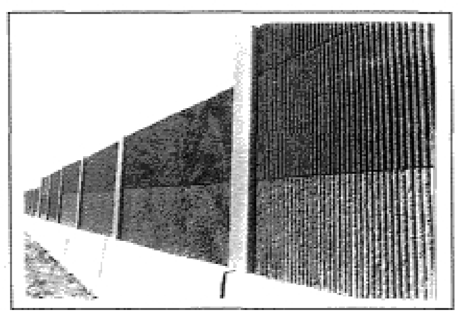

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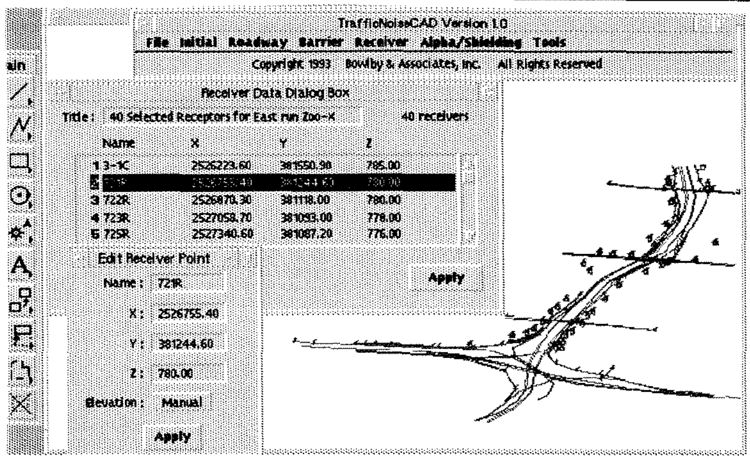

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