lead

LEAD INDUSTRIES ASSOCIATION, INC.

292 MADISON AVENUE, NEW YORK, N. Y. 10017

LIA26645

# THE VOICE OF AN INDUSTRY

We think there is a moral for all of us in the following story:

Recent failures of electrical cables in the New York City area were discussed on the evening television newscasts of both NBC and CBS. A piece of lead sheathed cable was displayed by the science editor and lead was blamed for the power failure. It was allegedly produced by corrosion effected by salt used for snow control.

One of our staff dug into the story and this is what he discovered. The utility reported the cables in question were 30 to 40 years old. Their record of service was so admirable that replacement cable will be similarly lead sheathed.

Negatives make news. The amateur pottery maker's defective ceramics; slum-connected child poisoning—these reinforce the negative associations of lead.

That is why this magazine is dedicated to accentuating the positive: improved environment created by noise suppression, enhanced industrial personnel relations brought about by lead batteries, highway safety abetted by chrome yellow.

It's an uphill fight. But worth making. Your comments and suggestions are welcomed by the editorial staff of LEAD.

D. Broward Craig

*D. Broward Craig,*
*President*
*Lead Industries Association*

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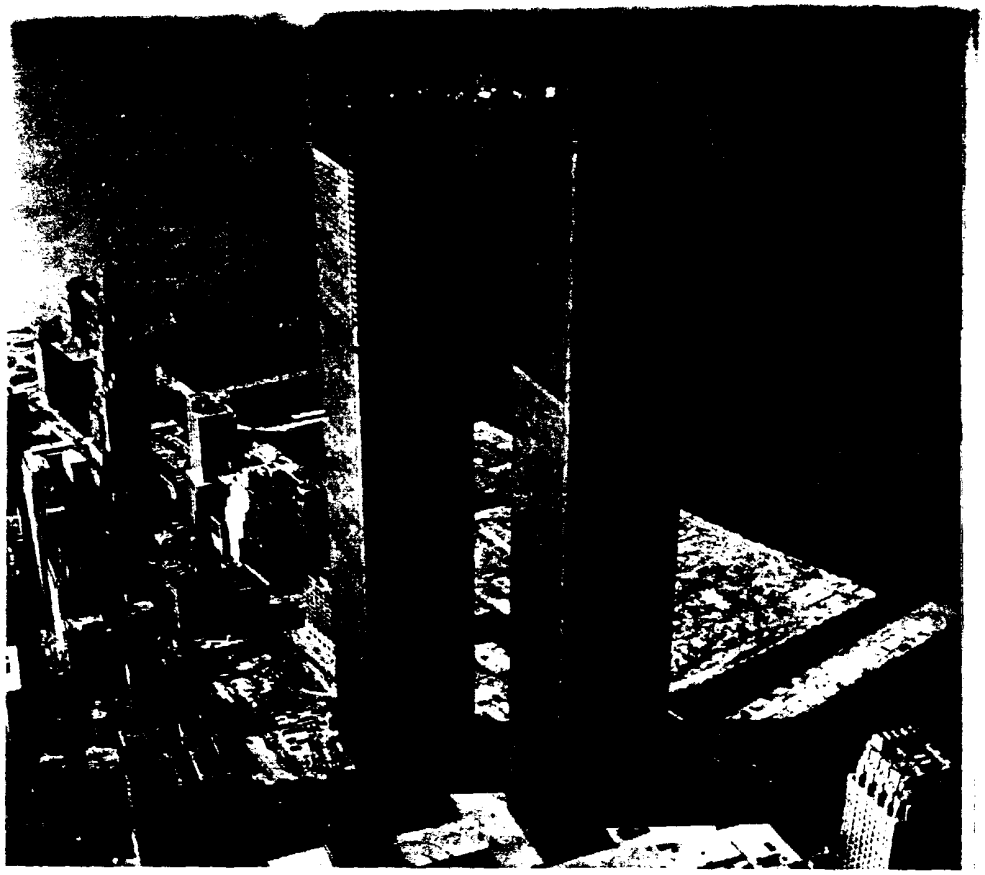
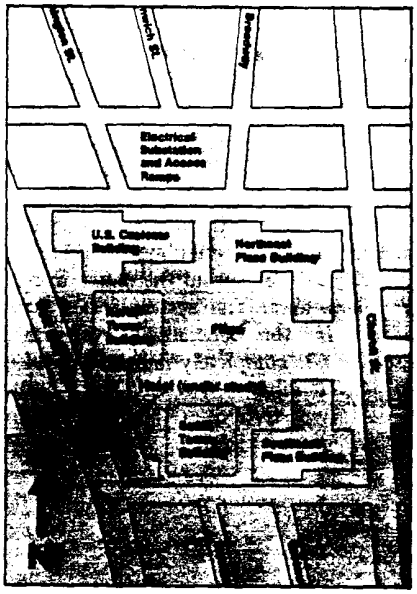
# WORLD TRADE CENTER SETS RECORDS IN SPECIFICATION OF LEAD



The World Trade Center, located on a five-acre site near the tip of Manhattan overlooking the Hudson River, has changed the profile of New York's world-famous skyscraper skyline. The Center, which is designed by Minoru Yamasaki and Associates of Troy, Mich.; and Emery Roth and Sons of New York City, is dominated by the world's tallest buildings. They are the 1,350 feet high twin towers that soar 110 stories into the sky and they are rapidly becoming as well known as the Empire State Building, which they exceed in height by 100 feet.

Opened for business in December, 1970, the Center is designed to expand the flow of international trade by bringing together business and government agencies involved in the marketing and processing of such trade. Housed within the five commercial buildings at the Center—the twin towers, the Southeast and Northeast Plaza Buildings and the United States Customs Building—will be all the financing, transportation, communications and trade education facilities required to carry on international trade as efficiently as possible.

When the Center is completed in 1974, it will contain 9 million square feet of office space and have a daily population of about 50,000 workers and approximately 80,000 visitors. A hotel, the first to be built in lower Manhattan, is scheduled to be constructed at the Center.




Built by The Port Authority of New York and New Jersey at a cost of about $700 million, the World Trade Center is on such a gigantic scale that its construction is resulting in an impressive list of record-breaking achievements.

## FOUR RECORD USES OF LEAD

For example, by the time the Center is completed, nearly a million pounds of sheet lead will have been installed. While the nearly one million pounds of lead is a record for this type of construction, three other record uses of lead also are expected to result by the time the Center is completed. They include:

- The most lead used to line landscaping planters . . . about 780,000 lbs.
- The most lead used to waterproof a water fountain . . . about 60,000 lbs.
- The most lead used to flash the base of buildings . . . about 54,000 lbs.

Most of the lead is being installed in and around the World Trade Center Plaza, an enormous five-acre elevated platform that will surround the six buildings at the Center.

For example, 20 huge lead-lined landscaping planters are being installed around, adjacent to, and between the six buildings facing the elevated plaza. Also being installed is the lead flashing around the base of buildings facing the Plaza as is the lead waterproofing for the water fountain, an enormous installation located in the Plaza's gigantic 369′ by 375′ Center Court.

Installation is yet to begin for two additional lead applications that will be added to those now being installed: lining for 30 large sidewalk-level landscap-

ing planters, and waterproofing for exterior stairways leading from the street levels (the Center is surrounded by Church, Liberty, Vesey and West Streets) to the Plaza and from the Plaza to the Center's Concourse Level, located immediately below the Plaza.

Installation of the lead waterproofing for the plaza-level landscaping planters, the water fountain and flashing for the perimeter of buildings facing the Plaza has been underway since early this year. The lead is being installed through a joint venture sub-contract shared by John F. Abernethy & Co., Inc., Brooklyn, N.Y.; and Allied Lead, Inc., Chicago.

Lead for the three jobs is being supplied in increments depending on construction schedules of other sub-contractors working on the World Trade Center construction project. Both 6 lb. psf (3/32" thick) and 8 lb. pounds per square foot (1/8" thick) lead is being used. The lead contains not less than 3¾ percent nor more than 4¼ percent antimony and an arsenic content of 0.10 percent to provide for increased corrosion resistance and to decrease thermal expansion. Sheet sizes as large as practicable are being utilized in order to keep joints to a minimum and thereby help insure the watertight integrity of the lead.

Lead's corrosion resistance, freedom from maintenance, and the fact that it provides for a trouble-free waterproofing membrance are the primary reasons it was selected for the various moisture protection applications at the World Trade Center. Lead's traditional durability—it will invariably outlast other building materials when properly installed—was another important selection factor.

All sheet lead to be in contact with concrete, fill, mortar or grout is protected first with a cold-applied bituminous brush coating of 12 to 14 mil thickness, a normal precaution against potential corrosive attack from free lime found in all materials containing cement. To insure that the lead membrane is protected from possible damage by sharp-edged stones and other inclusions in the cement, a 30 lb. asphalt-impregnated felt covering was applied over the bituminous coating before the sheet lead was installed.

## PLAZA-LEVEL PLANTERS

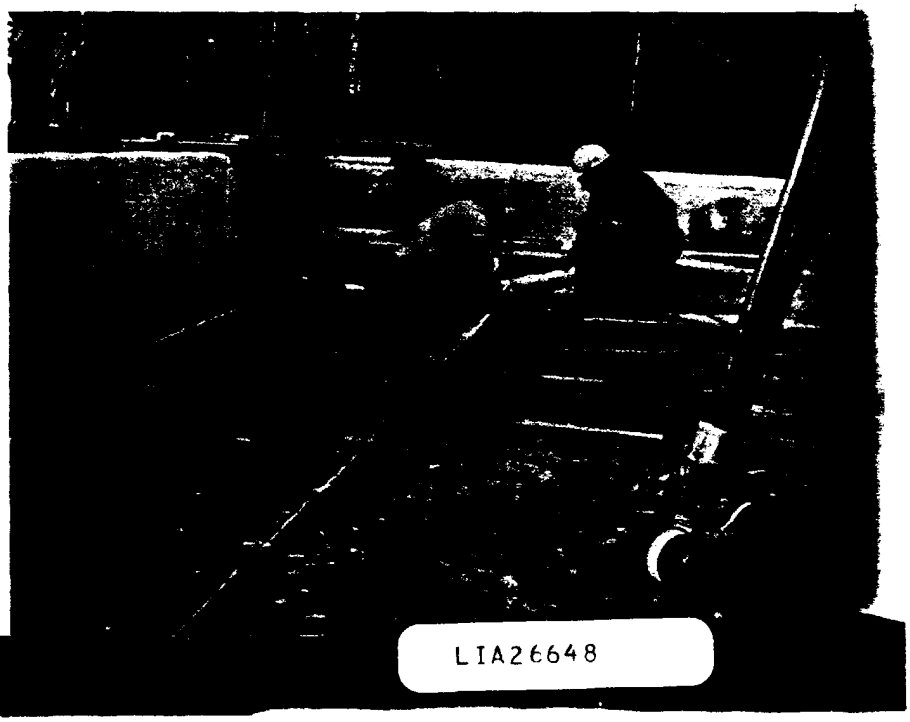
Typical of the critical role lead is playing in constructing the Center is its use to line the 20 plaza-level landscaping planters. Simply stated, the lead lining for the planters is an extension of, and is incorporated with, the multi-membrane moisture protection system that is being used to waterproof the entire five-acre Plaza area. The system serves as the roof for the Concourse Level and must be made completely moisture-proof in order to insure that various facilities therein . . . shops, restaurants, etc. . . . are not damaged by water leaking through the roof.

The landscaping planters will be one of the major highlights of the Plaza area. In addition to their landscaping function, they will help break up the distance between buildings and the Plaza area, separate building sides from street areas, and serve as dividers between buildings and the Plaza's Center Court. Some of the planters will be as big as 106′ long and 40′ wide while others are nearly a block long and about 6′ wide.

The large landscaping planters will contain 6 London plane trees, each with an approximate 12′ branch diameter; about 7 flowing crab apple trees; and more than 1,400 evergreens. About 1,190 plantings of Baltic ivy will be used to fill in the outer edges of the planters. The tallest trees will be planted atop a series of "hills", some as high as six feet, which will be created within the planters.

## SIDEWALK PLANTERS

The lead lining for the 30 street-level landscaping planters, like the lining for the 20 huge plaza-level planters, also plays a vitally important moisture pro-




*Typical landscaping planter lining being installed.*

*Overall view of Center Court water fountain under construction.*

section role. Each 10′ in diameter and between 5′ and 6′ deep, the planters will be buried in sidewalks running along the entire block fronting on Church Street and partly along Vesey and Liberty Streets. Part of the Center's Concourse Level as well as subway station facilities are located below the sidewalks and therefore the planters must be thoroughly waterproofed. London plane trees also will be planted in the sidewalk planters.

### WATERPROOFING PLAZA-LEVEL BUILDING PERIMETER

In designing the moisture protection system for the World Trade Center's five-acre Plaza area, particular attention was paid to insuring that a watertight seal was installed around the plaza-level exterior perimeter of the Center's five commercial buildings and the proposed hotel. The reason: all the buildings will extend through and above the Plaza in much the same manner as gigantic thru-roof penetrations and a failure anywhere along the seal will likely result in water leaking into the scores of international shops, restaurants, between-building passageways and other facilities in the Concourse level.

### SHEET LEAD USED TO FLASH BASE OF PLAZA-LEVEL BUILDINGS

Waterproofing around the perimeter of the buildings is being accomplished with sheet lead and, like the sheet lead membrane used to waterproof the plaza-level landscaping planters, it is being joined to the plaza's moisture protection system in order to insure that the entire five-acre area is waterproof.

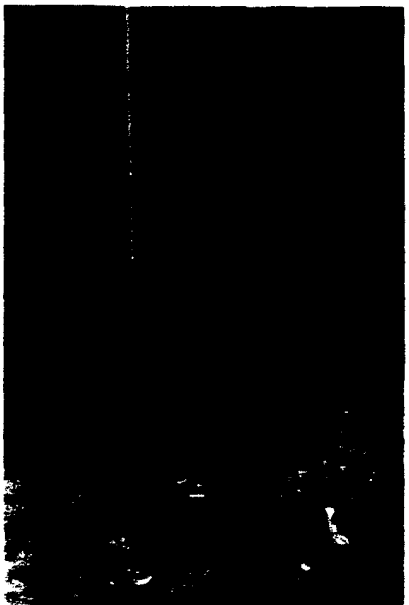
Nearly everything at the World Trade Center is on a gigantic scale and installation of the waterproofing around the plaza-level perimeter of the buildings is no exception. For example, more than half a mile of 3′ wide sheet lead has already been installed around the perimeter of three buildings at the Center. Included in the total are 840 lineal feet of sheet lead for the perimeter of each of the twin towers and approximately 1,109 linear feet of sheet lead for the perimeter of the Northeast Plaza Building.

### 17-TON ROTATING CENTER COURT FOUNTAIN TO BE SET ON HUGE PLATFORM

Among the many dramatic sights at the World Trade Center will be the water fountain in the Plaza's center court. The fountain is believed to be the biggest of its kind ever built.

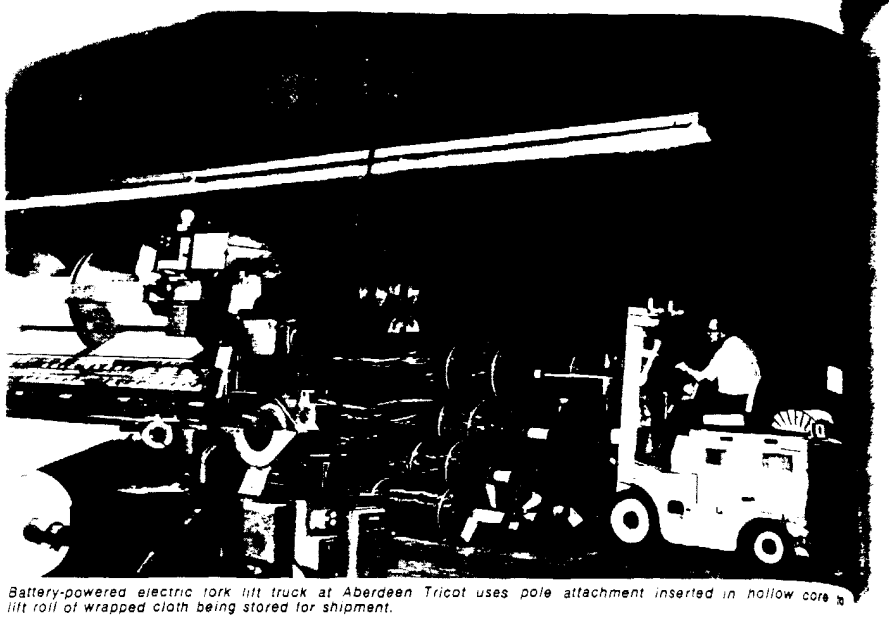
A 24′ high, 17-ton cast bronze sculpture, to be set on a 13′ diameter rotating turntable, will be installed in the center of the fountain. A circular platform with an outside diameter of 82′ 4″ will surround the large rotating turntable on which the sculpture will be set. Rising from a 4′ base, the platform, which has been completed, gradually slopes upward to the point where it adjoins the circular turntable. Water flowing from the rotating sculpture at a flow rate of 7,600 gpm. will cascade over the surface of the circular platform that surrounds it, be collected in a gutter at the platform base, and then be recirculated through the sculpture by a large charge chamber located in a well below the fountain. Approximately 76,000 square feet of sheet lead was used to waterproof the fountain and the 30 sq. ft. charge chamber well below the fountain. Six lb. psf sheet lead was used to waterproof the top of the rotating turntable and the platform surrounding it while 8lb. psf sheet lead was used to waterproof the charge chamber well. A total of nearly 30 tons of sheet lead was required to waterproof the fountain which, like other plaza-level installations, is located above the Concourse level.

The 13′ diameter rotating turntable and the 82′ 4″ diameter platform surrounding it will be covered in black granite. Until this is accomplished, the lead membrane covering the turntable and platform has been painted white to reflect radiant heat from the sun and thus avoid possible damage from excessive thermal expansion. The huge size of the fountain is architecturally scaled to compensate for the gigantic proportions of the 369′ x 375′ center court.



*Flashing installed at base of North Twin Tower.*

# BATTERY POWERED LIFT TRUCK CLEARS



*Battery-powered electric fork lift truck at Aberdeen Tricot uses pole attachment inserted in hollow core to lift roll of wrapped cloth being stored for shipment.*

The substitution of a lead acid battery-powered lift truck for one powered by a propane fueled internal combustion engine has solved a number of perplexing corrosion and environmental problems at Aberdeen Tricot, Inc., a knitting company in Aberdeen, N.C.

Company president, Glenn Fogleman, reports that the following facts became evident soon after his plant began operating:

- Knitting needles, machinery parts and other plant equipment were rusting.
- Expensive maintenance and parts replacements were required to keep the plant operating.
- A few employees were suffering from minor nausea and minor eye irritations.
- Production and sales were decreasing due to equipment downtime and a loss in productive manhours.

The solution to the problems, all of which were found to be related to the use of a propane-fueled lift truck, is an interesting case history of a search for the source and effects of pollutants that can develop under certain conditions in the controlled atmosphere of an industrial plant.

Closely controlled temperature and humidity conditions are critical requirements for the production of quality tricot fabric. At Aberdeen Tricot, the temperature is kept at 78 to 80° F. Humidifiers automatically maintain a relative humidity of 58 percent.

The temperature and humidity, combined with exhaust fumes from a propane-fueled fork lift truck, were first thought to be causing the corrosion, eye irritation and nausea problems since they were most evident in the production area of the plant where the truck operated. Steps were therefore taken to replace the truck's carburetor, tune the engine, and change the fuel tanks, thinking that some foreign elements may have been placed in the tanks.

These preventive measures produced no effect and the problems continued to worsen. The corrosive conditions, evident in formations on door latches and other plant equipment, became critical when they developed on the hundreds of delicate knitting needles attached to the 14-foot long needle bars of about half of the 14 knitting machines in the plant. The corrosive attacks were particularly aggressive when the machines were stopped to change a knitting pattern. The needles became corroded before the knitting operation could begin again. Corroded needles prevent yarn from traveling through the knitting zone.

An estimated $5,000 was spent to replace rusting needles during a two month period. In addition, production time was also lost due to machinery downtime required to change the needles.

With these combined factors becoming more and more detrimental to plant production and sales volume, as well as employee health and morale, the company president searched for other solutions to the problems.

For example, he thought the plant's electric duct heaters, used during winter months to heat incoming air to keep the plant interior at a constant temperature, might be the cause of the problem. His conclusion was arrived at after a number of related circumstances were considered.

The knitting machines in the plant also are kept at a constant temperature. To accomplish this, a coolant oil is circulated at the base of each knitting machine. A small amount of this oil is vaporized and the resulting vapor condenses on the cooler overhead structure including the air conditioning and heating ducts. The heating elements were investigated and, since visible traces of the condensed oil were found, it was presumed that some of the particles were being burned when they came in contact with the energized heating elements. This was thought to result in fumes that were causing the corrosion and environmental health problems and this theory was strengthened by the fact that the company president detected what he thought was smoke coming from the air vent in his office during those times when the heating elements were energized.

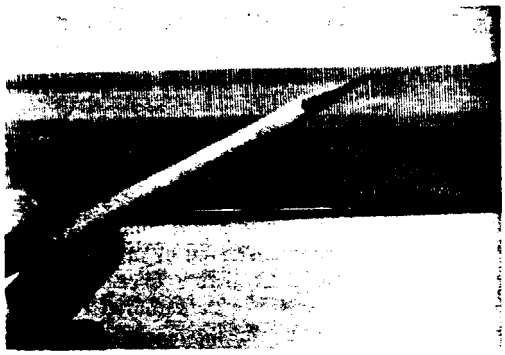
As the result of this theory, Aberdeen Tricot president Fogleman requested assistance from Carolina Power & Light Co. to solve what was thought to be a problem with the plant's electrical heating system. Their representatives made a careful study of the plant's air handling equipment, determined it was working efficiently, and believed it was not causing the corrosion and environmental health problems.

Since the problem only existed in the

# IN-PLANT PRODUCTION PROBLEM

Close-up of knitting machines at Aberdeen Tricot.

Pencil indicates small size of delicate knitting needles seen in section of 14' long needle bar used on knitting machines.



production area and not in the adjoining plant office. Carolina Power & Light representatives turned their attention to what was first believed to be the source of the problems: the propane-fueled lift truck. They speculated that fumes emitted from the truck operating in the closed environment of the plant produced an abnormally high concentration of nitrogen in the atmosphere. When the nitrogen was mixed with the water vapor continuously circulated by the humidifiers, and then combined with the heated air during winter months, the nitrogen caused a chemical reaction that resulted in the formation of nitric acid mist which is highly corrosive to most metals.

The utility company representatives also concluded that the nitric acid mist also was the pollutant that ultimately caused the nausea and eye irritation. They felt that these two environmental problems were caused by the two nitric acid-based poisonous gases: nitric oxide, which is formed when nitric acid combines with metal; and nitrogen dioxide, which is formed when nitric oxide combines with oxygen. The situation at Aberdeen Tricot was unique because the nitrogen dioxide was reacting with the presence of moisture in the atmosphere to form more nitric acid, thus generating a continuous cycle of highly corrosive and toxic conditions as long as the heating season lasted. Carolina Power & Light representatives therefore recommended that an electric fork lift truck replace the propane fueled vehicle.

Wishing to prove their theories and to insure Aberdeen Tricot that their opinions were unbiased (the electric company promotes the use of battery-powered electrics in industrial plants because they are normally recharged during off-peak hours), the Carolina Power & Light representatives assisted Aberdeen Tricot in studying the corrosion and environmental problems.

Samples of the oily mist and rust from the plant equipment were taken to be chemically analyzed by an outside chemical laboratory. The tests showed that about 9.5 ppm nitric acid was present in the air in the knitting room.

Meanwhile, the corrosion rate of the knitting needles was being observed. In this phase of the test, needles attached to tapes were placed on knitting machines throughout the plant. Needles placed near where the fork lift truck operated rusted in three hours while those at the rear of the building, and some distance from where the truck operated, rusted in 18 hours. While this also tended to prove the propane fuel fork lift truck theory, it was felt that the test was inconclusive because of the difference in conditions at the front and rear of the plant.

The problem was also discussed with a staff member of the North Carolina State Industrial Extension Service and it was learned that propane can contain sulfur which can be oxidized in the truck engine and result in sulfuric acid fumes being emitted into the air of the knitting room. They were therefore assured that the presence of sulfuric acid fumes, plus nitric acid fumes, could promote the high rate of machinery rusting.

Based on this combined evidence, Aberdeen Tricot president Fogleman ordered a lead acid battery-powered fork lift truck as a replacement for the propane-fueled vehicle. During the 18 months the lead acid battery-powered fork lift truck has been in operation, the plant has experienced no noticeable corrosion action and there have been no further incidents of nausea or eye irritation.

The electric truck used at Aberdeen Tricot has a 4000-lb. capacity. It is fitted with a long pole when used to move wrapped circular rolls of cloth onto trucks at the loading dock or to unload bundles of hollow cores which are used to wrap the rolls of cloth. To move the circular rolls of cloth or bundles of cores, the pole is inserted in a core and is used to lift the material to be transported. When huge spools of yarn, called beams, are to be moved into the plant or to and from the knitting machines, the long pole is replaced with two forks.

Based on the successful use of the electric truck at the Aberdeen plant, another one was ordered for a new 38,000 sq. ft. plant that Mr. Fogleman manages just across the street.

Glenn Fogleman, Aberdeen Tricot President (left) and J. David Smith (right), Industrial Power Engineer, Carolina Power & Light Co., discuss operation of knitting machines.

# CHROME YELLOW TO PLAY EXPAND

Lead chromate paint will play a major role in two highway pavement marking programs that are key elements of a proposed nationwide, Federally-funded highway safety project. The two programs were developed to help decrease the staggering 16.1 million vehicular traffic accidents that resulted in 55 thousand deaths, 2 million disabling injuries and more than $13 billion in property damage in the United States during each of the past two years.

The nationwide highway safety project would result from the Highway Safety Act of 1973, which is expected to be passed early in the next Congress. The two highway pavement marking programs, which will cost a combined $250 million, are considered of priority from among the more than a dozen highway safety programs to be authorized by the Act. Two thirds of the more than $1 billion annual cost of the highway safety program would come from the Highway Trust Fund, which is financed by Federal taxes on the sale of oil, gasoline and truck highway uses and can now only be used for new Federal-aid highway construction.

The first project authorized by the Act would be a special pavement marking program. It will meet the critical need to provide, for the first time, sufficient initial funds to thoroughly mark those rural two-lane roads where two-thirds of the nation's highway fatalities presently occur. A total of $200 million, to be allocated during a two-year period beginning with the fiscal year ending June 30, 1974, would be authorized for the program.

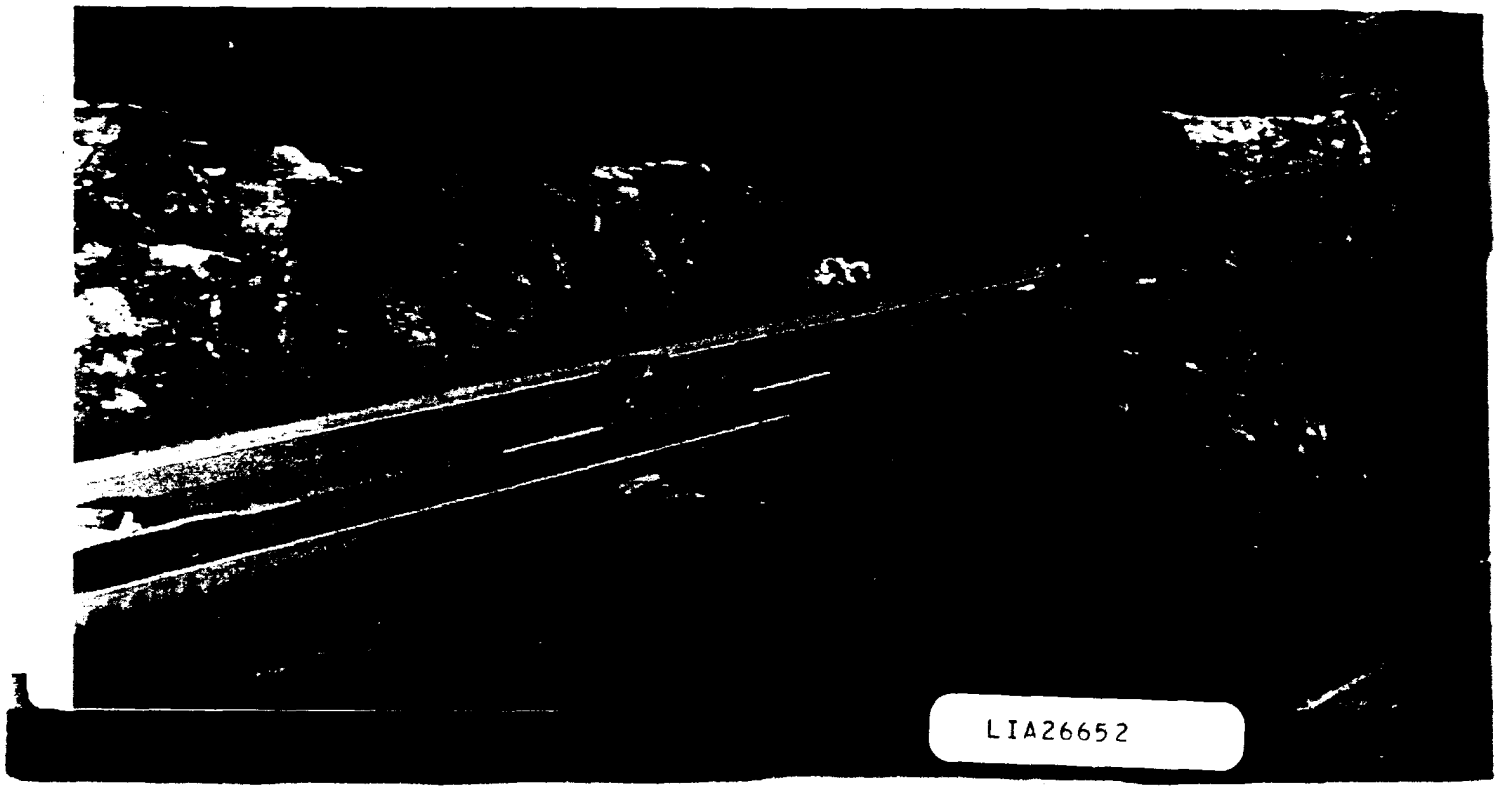
The second project authorized by the Act would be a pavement-marking research and demonstration program to determine the effectiveness of various types of pavement markings under inclement weather and nighttime conditions. A total of $50 million would be authorized for this phase. Funding for the program also would be available during the two-year period beginning with the end of the 1974 fiscal year.

Such traffic control devices can prevent thousands of accidents and subsequent deaths, injuries and property damage annually. It is estimated that the pavement marking programs can save from 3,000 to 5,000 lives and avoid from 63,000 to 105,000 injuries each year in the United States. It also is estimated that such pavement markings will save $2.5 to $4 for each dollar it will cost to apply the pavement markings. The difference in numerical and dollar figures is due to the fact that Federal, State, urban and rural roads each have different highway accident rates: Rural roads, for example, accounted for a whopping 68% of the highway traffic deaths during the 1971 period. It is for this reason that the special pavement marking program authorized by the Act gives priority for installing pavement markings on rural roads.

Solid, broken and dotted single and double center line markings are the most frequently used to prevent highway traffic accidents. They indicate "passing", "no passing" and "passing-with-caution" zones and, even though they are known as center lane markings, they are not always in the geographic center of pavements. Solid line pavement markings also are used to mark the pavement edge of streets and highways where there is inadequate clear space to the left of the line even for disabled vehicles or for making emergency stops.

These types of pavement markings and others such as curb markings and transverse lines to indicate highway obstructions are painted "highway yellow", a special color standard that has been specified for all cautionary highway traffic control devices including signs. The yellow paint pigment that most readily meets this standard color requirement as well as cost requirements is lead chromate, or "chrome yellow" paint. Yellow is the most visible color to the human eye from among all those in the color spectrum.

In addition to meeting the color standard for highway yellow, chrome yellow paint possesses many other important qualities which make it the most versatile, low-cost pigment available for traffic control devices. Chrome yellow paint also has good resistance to degradation by light and it resists chemicals used to remove snow and ice from pavements. It is for these reasons that chrome yellow paint will play a major role in any nationwide highway pavement marking



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# D DLE IN DECREASING TRAFFIC ACCIDENITS

program. In most cases, reflectorized chrome yellow paint will be used for the pavement markings since it is important that they be highly visible at night.

The $200 million the Act will allocate for the nationwide highway pavement marking program cannot be fully appreciated until one is aware of the critical need for such a program. Simply stated, it will provide, for the first time, funding to mark in accordance with the 1971 Manual on Uniform Traffic Control Devices for Street and Highways (known as the UTCD) those roads which are included in the Federal-aid primary and secondary highway system as well as those roads which are not.

A revised, updated and expanded version of the 1961 UTCD it supersedes, the 1971 edition is published by the U.S. Department of Transportation, Federal Highway Administration, and was developed with the cooperation of the National Joint Committee of Uniform Traffic Control Devices. The end result of efforts that began in 1927 to develop uniform standards for traffic control devices, the 1971 Manual is intended to serve as the regulatory directive for all streets and highways in the United States.

There is, however, a major problem in implementing and complying with the new manual on a nationwide basis until the new law is passed. To understand the problem, it is necessary to have a basic understanding of the United States highway system, how it was built, and how it is being maintained.

Of the nearly 4,000,000 miles of paved streets and highways in the United States, only 900,000 miles of Interstate, State and county and municipal primary and secondary roads are built with Federal aid funds.

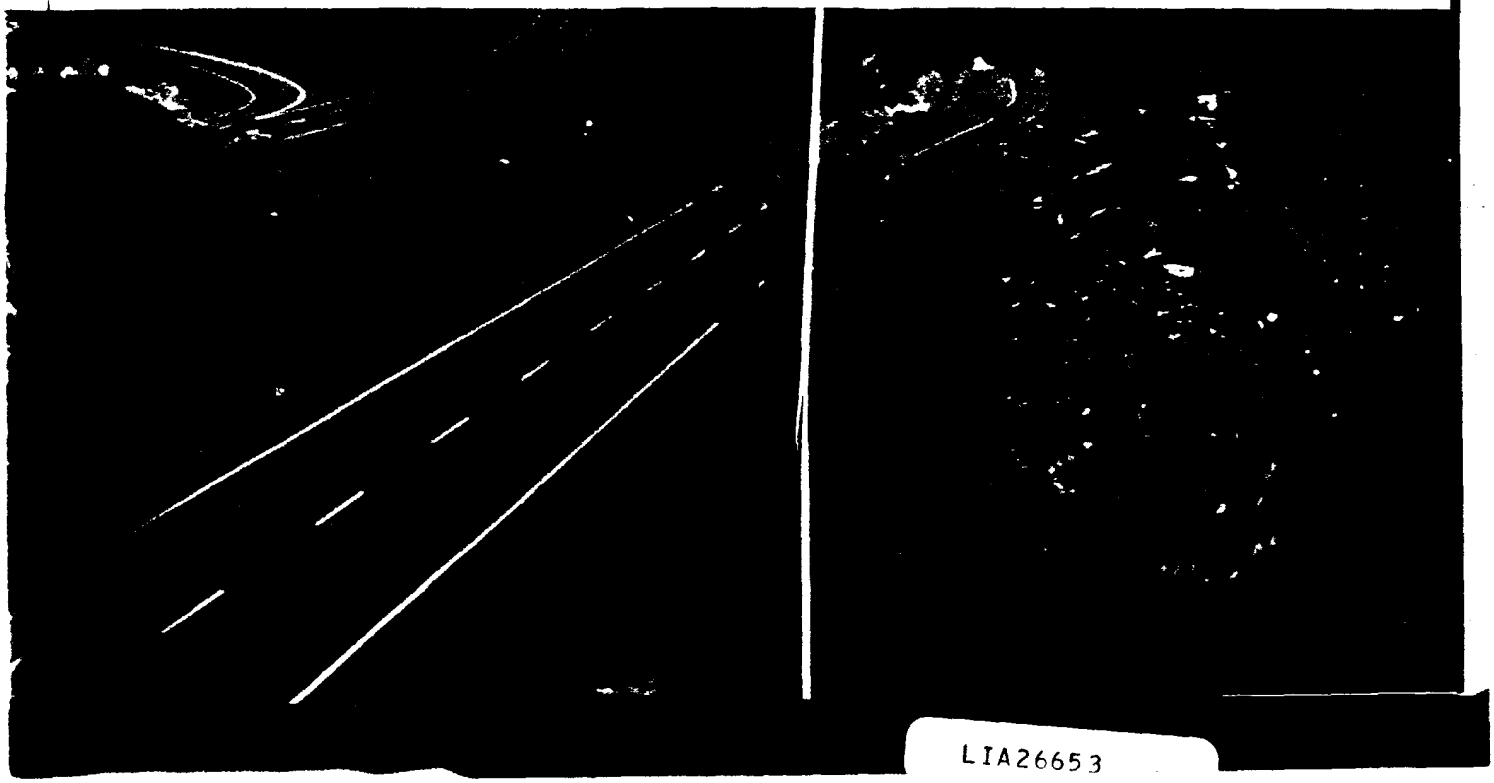
In qualifying for such highways built with Federal-aid funds, individual States were committed to maintaining them after they were built. They had to do so in accordance with instructions and regulations established by the UTCD Manual. Hard pressed for funds needed to comply even with the 1961 edition of the Manual, the States found it virtually impossible to comply with the greatly expanded requirements for the increased use of traffic control devices outlined in the 1971 Manual. In particular, they lacked the funds to provide the paint, men and equipment needed to comply with the new requirements.

For example, the New York State Highway Department expects to use about 308,000 gallons of highway yellow paint this fiscal year when it begins implementing the provision of the new Manual. The Department estimates it will require an additional 1352,000 gallons of highway yellow paint to fully comply with the new Manual during the 1973 fiscal year. It takes about 17 gallons of paint to paint one mile of 4" to 6" wide normal width pavement marking; the State expects to have to paint approximately 20,000 miles of additional yellow pavement marking to comply with the new Manual.

Many municipal and county officials, responsible for maintaining the nearly 3,000,000 miles of paved rural and urban primary and secondary highways that were not built with Federal aid funds, find it difficult if not impossible to comply with the guidelines published in the new Manual. They have far less funds to allocate for such purposes than do States, and, as a result, only 27% of such highways have been marked in accordance with the Manual.

With the $200 million likely to be allocated by the Highway Act of 1973, it is expected that States and counties in the United States will have sufficient money to provide the paint, men and equipment required to mark the principal highways under their respective jurisdictions. In addition, the funding will permit surveys to determine where pavement markings are needed in order to comply with the 1971 UTCD Manual.

In carrying out the program, it is estimated that 300,000 miles of two-lane roads will receive yellow centerline markings and the approximate cost will be $40 million. It is expected that $25 million will be spent in applying "no passing" pavement markings, and approximately 500,000 miles of edgelines will be placed on primary and secondary county and township routes at a cost of $135 million.



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# LEAD CLAD STEEL FOR ARCHITECTURAL USE

A new composite material that combines lead's outstanding corrosion resistance, aesthetic appeal and sound barrier properties with the strength of steel has been successfully introduced in Great Britain.

Called lead clad steel, the new composite material was developed by the British Non-Ferrous Metals Research Association. It is produced by pressure bonding lead to steel sheets which have been pre-coated with lead alloy. The lead clad steel has been subjected to extensive mechanical and thermal testing without bond failure. It is easy to fabricate and has already been successfully used for commercial and industrial building construction application in Great Britain.

American lead producers have expressed an interest in producing the new lead clad steel for the domestic market because the composite material offers an excellent potential for increasing the lead market in the United States.

### LEAD PRODUCT APPLICATIONS EXPANDED

Lead clad steel has made it possible to specify the material at prices that are competitive with other quality metal products used in the construction market, an existing important domestic lead market. Some examples include such uses as fascias and wall coverings, applications that have already been developed in England, and for applications such as roof coverings, ventilating ducts and equipment, gutters, rainwater pipes (downspouts) and parapet coverings. Heretofore, it was sometimes not practical to use lead for such applications because it normally requires structural support which, in this case, the steel cladding supplies.

However, an even bigger market is believed to exist for commercial and industrial applications of lead clad steel and such applications are now being explored by British producers. These applications include panels and small, deep-drawn containers from sheet as well as flanged duct sections and spirally wrapped tubing formed from strips. The development of lead clad steel for tank panels is of particular importance since sheet lead already is being used to line a variety of chemical and pollution control vessels. The availability of a material that can easily be fabricated to form an economical lead-lined vessel is therefore expected to result in expanded lead uses for such applications.

Because lead coated steel combines lead's outstanding advantages as a sound barrier material with the strength of steel, it is ideally suited to meet the increasing demands for quieter commercial, industrial and consumer products. Typical potential applications include enclosures for home appliance equipment such as dishwashers, waste food disposals and laundry equipment; ductwork for air, liquid and semi-solid handling systems; industrial machinery and equipment enclosures; and a variety of automotive transportation equipment uses. In particular, the use of lead clad steel can assist the producers of commercial and industrial machinery and equipment in complying with Occupational Safety and Health Act (OSHA) regulations.

### BOTH SINGLE AND DOUBLE SIDE CLADDING AVAILABLE

Lead clad steel is currently being produced in sheet form in the United Kingdom. Both single (one side) and double (both sides) cladding are available. Single cladding is immediately available while double cladding is produced on a special order basis.

Single side cladding is being produced with lead coatings that range from .020-in. to .040-in. applied to steel that ranges in thickness from 14 to 16 gage. The standard *nominal* coating for building applications ranges from .020-in. to .030-in. thickness of lead bonded to 20 gage steel. Thicker lead coatings on steel are being explored for chemical applications.

### FABRICATING LEAD CLAD STEEL

Standard roll-forming, brake-pressing, lock-forming and deep-drawing metal-working techniques can be used to fabricate lead clad steel. However, as is the case with most new materials, some minor initial tooling modification may be required to accommodate the forming characteristics of the composite material. Standard hand and machine tools also can be used to fabricate lead clad steel and, in addition, drilling, punching and cutting operations can be easily performed. Lead clad steel can be bent through 180° without loss of adhesion and, although some thinning of the lead occurs where it forms the outer surface of the bend, the local reduction in thickness is normally acceptable.

Most types of fasteners can be used to mechanically join lead coated steel. When decorative architectural panels are secured to timber battens or other structural members, lead capping pieces can be incorporated to provide a continuous lead surface. The use of lead capping pieces also helps to waterproof the fastener and retain the pleasing appearance of lead throughout.

With certain limitations, lead burning and soldering can be performed on lead clad steel almost as easily as when using sheet lead. Welding the steel section of the composite material will destroy the lead coating in the heat affected zone of the weld and therefore requires special care. However, stud and projection welding can be used to produce satisfactory joints; similarly mechanical fasteners can be attached by these methods without detriment to the lead coating.

A strippable, self-adhesive paper coating is applied over the lead cladding to protect it during fabricating, shipping and installation. After installation, any exposed edges of lead clad steel can be sealed from corrosion attack by painting with quick-drying primer followed by a coat of finish paint. Alternatively exposed edges of lead clad steel can be protected by tinning, a method that is particularly suitable for double clad sheet.

### ROOF FASCIA IS FIRST LEAD CLAD STEEL APPLICATION

The first application in England for lead coated steel was the roof fascia of

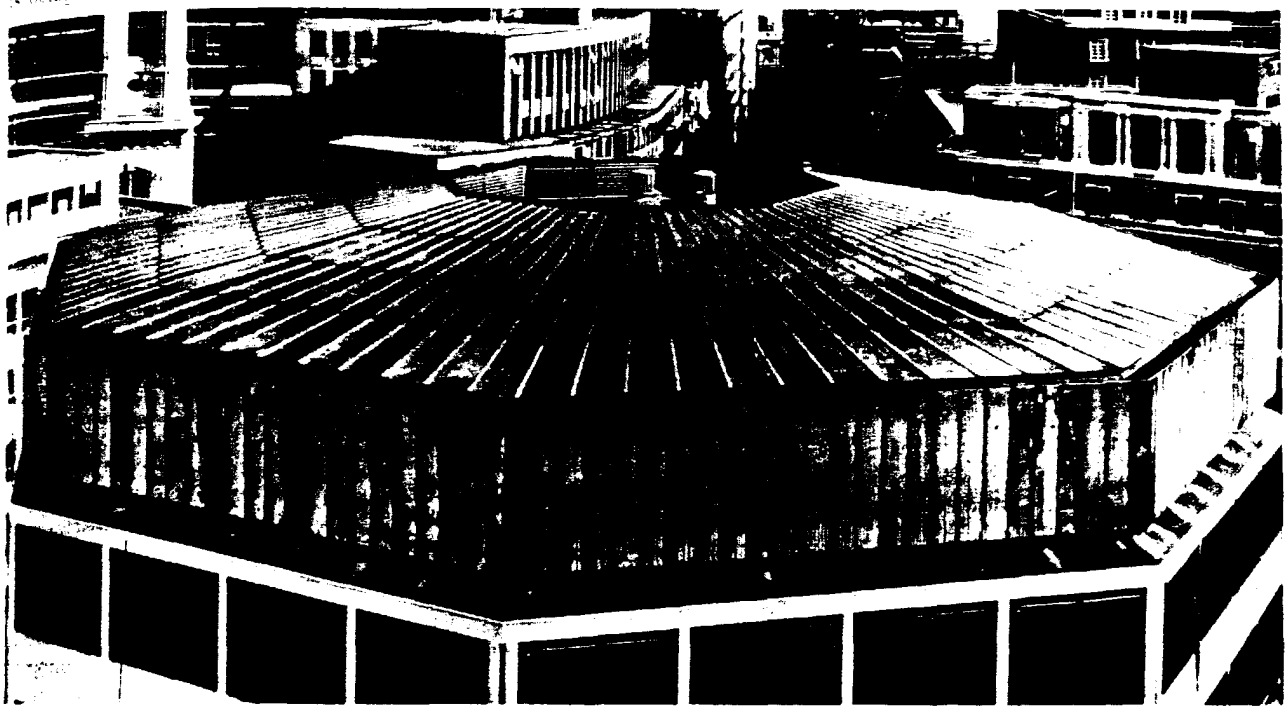
the new octagon-shaped National Mutual Life Association of Australasia Ltd. office building designed by Gotch & Partners. Located in the City of London within the precinct of St. Paul's Cathedral, the new office building, like the world-famous cathedral, has a lead roof.

The fascia of the roof of the six-story office building is in the form of an open screen comprised of 200 panels. Each 9' high and 11½' wide, the panels are installed vertically around the fascia of the roof which, like the building itself, is octagonal in shape. A small gap separates each of the panels and they are hung with stainless steel bolts. Because the backs of the panels are partially exposed to the weather, lead cladding was applied to both sides of the panels. They were fabricated from 20 gage terne-plate steel with a coating of about 1½ pounds per sq. ft. (.0234" thick) on each side.

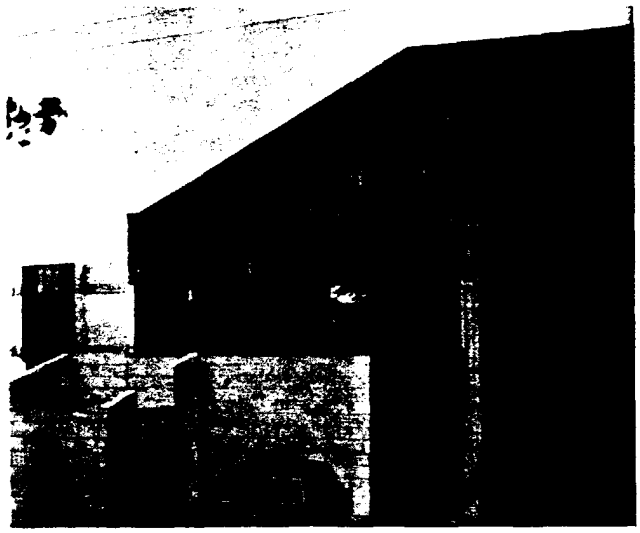
## OTHER LEAD CLAD STEEL APPLICATIONS

Architects Newman, Levison and Partners also used the newly developed lead clad steel for the new buildings they designed for the Road Transport Industry Training Center Board's Multioccupational Training and Educational Center (MOTEC), located at Livingston New Town, West Lothian. They used the lead steel composite material for the facia of the MOTEC Conference Hall and for several applications on the boiler house that provides heat for the facility.

In addition, the lead clad steel was used for various other applications at the MOTEC facility. The applications included window fascia for dormitory buildings and siding and roof fascia for a restaurant.



*Close-up view of new National Mutual Life Association of Australasia Ltd. building in London, England, shows how lead clad steel was used for 200 vertical panels that make up fascia for roof of building.*



*View at left shows how lead clad steel panels were used for window fascia of a residential building at the MOTEC facility located at Livingston New Town. View at right shows how panels also were used for window fascia of another residential building (seen at far left) and the siding and roof fascia of an adjoining restaurant seen in close-up at center right).*

## APARTMENT COMPLEX FINDS SOUNDPROOFING PROFITABLE

Suppose you spent considerable time, effort and money to build a group of architecturally impressive townhouse apartments, installed a fireplace in each apartment and furnished it in excellent taste; landscaped the surrounding grounds in keeping with the quiet, country-like setting of the area, and then discovered that you couldn't keep the apartments occupied because tenants complained of excessive noise.

Sidney Rolfe, a successful Manhattan economist, faced this problem when he built the first of three apartment buildings he owns in the popular resort area of East Hampton, Long Island. Known as Hampton Mews, the buildings each contained a row of eight connected two-story units. Each unit contains two apartments—a floor-through apartment at ground level; and a second-story duplex apartment that is reached via an outside stairway between each apartment.

The noise problems were encountered when tenants began occupying the first apartment building at Hampton Mews. They were being caused by a number of factors, none of which were thought to result in sound attenuation deficiencies when the first unit was built.

The wood structural system used to construct the apartment building and the materials used for the floor of the second-story duplex apartments resulted in the creation of a drumhead that stretched across the entire second floor area of the 16 apartments in the building. The drumhead effect magnified the slightest sound. Normal conversation and the sounds of radio and television were clearly audible between the ground floor and second-story apartments. Walking across the living room of a second-story duplex apartment in the building while wearing high-heel shoes was compared to the sound of blows from a hammer and even the normally barely audible sound of a small plastic ball being rolled across the second floor by a playful cat sounded like hurling a ball down a bowling alley. The building owner reports that primarily due to such noise problems, five of the first 16 tenants in the apartment building moved during the first year it was occupied.

To correct the sound attenuation problems, the owner retained the services of M. J. Kodaras & Associates, an Elmhurst, N.Y., firm specializing in acoustical consulting.

*Partial view of first unit of apartments built at Hampton Mews.*

*Carpet folded back in bedroom to show sheet lead sound barrier.*

*View of living room in typical duplex apartment where carpet covers sheet lead sound barrier.*

As the first step in solving the sound attenuation problems, the acoustical specialists tested the noise level transmission of second-story flooring in the apartments. It consisted of one layer $1^{11}/_{32}$" thick dense fiberboard with plywood underlayment on 2" x 8" joists with a 4" thick glass fiber blanket between joists and a $5/_8$" thick gypsum board finished ceiling below.

Results of the tests showed that the floor construction had a Sound Transmission Class (STC) of 34, a level at which loud speech is clearly audible.

In order to increase the STC to an acceptable level, consideration was given to applying various combinations of materials to the ceiling side of the flooring, but this would have been expensive and time consuming. According to Steven Wolf, the M. J. Kodaras & Associates acoustics engineer who supervised the materials study, it became evident that the required acoustical improvements could be achieved most quickly and economically by installing 3 lbs. psf (3/64" thick) sheet lead over the entire second-story floor side of each apartment except for kitchen and bathroom areas.

Installation of the sheet lead sound barrier was so simple that it was accomplished by a member of the Hampton Mews maintenance staff. The only equipment required was a hoist, which was used to lift some of the lead rolls to the second floor, and a cutting tool.

After the lead sheet barrier was installed, the flooring achieved a Sound Transmission Class of 39, a five decibel increase in sound transmission loss. According to M. J. Kodaras & Associates, this is considered to be a substantial improvement in sound loss. At this level, loud noise is barely audible.

Speaking of the effectiveness of the sheet lead sound barrier, owner-builder Rolfe stated: "Lead literally saved the building. Lead was the most economical and quickest solution to the problem and there have been no noise complaints from any apartment in the building." He also said that the cost of installing the lead was quickly amortized by the fully rented apartments in the building.

## GAS COMPRESSION STATION PRACTICES GOOD NEIGHBOR POLICY

The high-pitched whine of turbine compressors—comparable in sound to a jet airplane—are necessary to keep gas flowing through cross-country pipelines, but they are hardly endearing when such installations must be located near residential areas. This was the problem faced by two Canadian natural gas companies when they each needed to build such a gas compressor station.

Wishing to be good neighbors, the two utilities were determined to find a way of decreasing the 115 decibel (db) sound of the turbines to an acceptable level that would not disturb residents of the communities where the gas compressor stations were to be constructed.

The two companies concerned with the noise problems were the Ontario Division of Northern and Central Gas Corporation Ltd., and the Union Gas Company of Canada Ltd. Northern and Central planned construction of a compressor station powered by two 1,100 H.P. turbines at Hagar, near the city of Sudbury in northern Ontario. Union Gas planned a slightly larger installation at Lobo, near London, Ontario, that would be powered by a 12,500 H.P. turbine.

Rather than be concerned with the noise problems after the two compressor stations were built, the two companies joined forces to solve them as the stations were being designed. It developed that it was not only possible to decrease the sound of the turbines to acceptable levels, but a new composite acoustical building was created to accomplish the job.

The gas companies selected International Pipeline Engineering, Ltd. (IPEL), a subsidiary of Trans Canada Pipelines Ltd., to act as consultants in designing the stations. Included in the agreement was a requirement to solve the noise problems.

Aware of similar noise levels encountered at other compressor stations built adjacent to residential areas, IPEL drew up rigid specifications for the new compressor stations. The requirements called for noise controls to be built into the turbine equipment as well as the structures that would house them.

Pro-Eng Buildings Ltd., Streetsville, Ont., was awarded the contract to build the compressor stations. To meet the sound specifications, Pro-Eng developed an acoustical building panel to enclose the compressor stations.

The panels consist of the following components and materials:

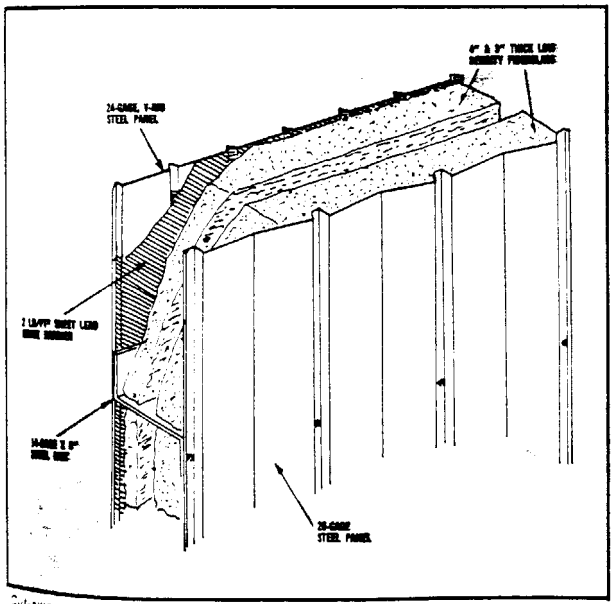
- Inside face—2 lbs. psf (.0312" thick) sheet lead bonded to the back side of 24 gage (.0239" thick) V-rib galvanized steel sheet.
- Center core—one 4" and one 3" thick low density fiberglass layer with vinyl backing.
- Exterior face—26 gage (.0179" thick) galvanized steel sheet with a baked enamel finish.

The building panel girts (stiffeners) were cold rolled from steel Z-sections.

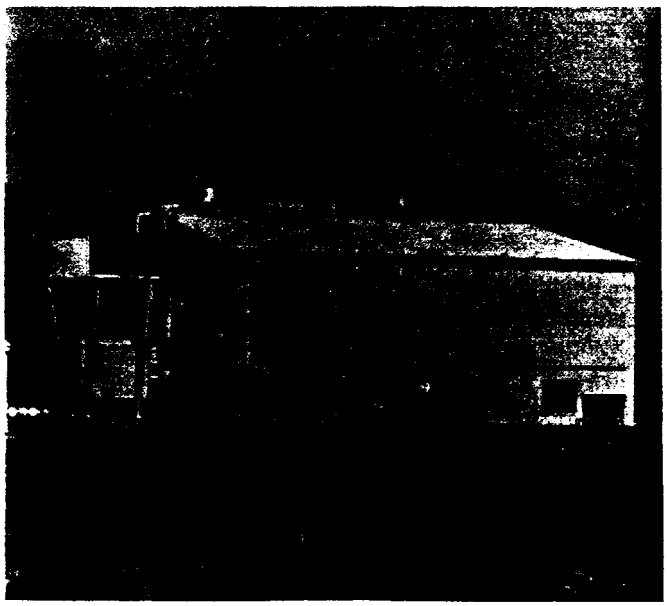
The building panel, when tested for noise barrier quality, received a Sound Transmission Class (STC) rating in excess of 40 decibels. An STC rating is a measurement of the relative efficiency of acoustical sound barriers established by ASTM specifications E90-66T.

The steel/lead/fiberglass acoustical building panel was used for both roofing and siding at the two installations. The two 1,100 H.P. turbine compressors at the Northern and Central compressor station at Hagar are housed in a 30' x 50' x 14' structure while the single 12,500 H.P. unit at Union Gas Corporation's Lobo installation is housed in a somewhat larger 43' x 57' x 22' building.

According to both pipeline operators and IPEL, there have been no complaints of noise from either of the installations. It is therefore expected that additional applications for the new lead/fiberglass/steel composite material building panel will include its use in constructing future cross-country oil and gas pipeline compressor stations. The panels also can be used to enclose a variety of other industrial machinery buildings and equipment where noise is a problem.




Cut-away view of new acoustical building panel shows position of 2 lbs. psf (1/32" thick) sheet lead that is bonded to back face of panel.



Building housing 12,500 HP turbine compressor at Union Gas Co. of Canada Ltd. station located at Lobo, Ontario.

# BUCKET TRUCK GETS A LIFT OUT OF LEAD

The nation's first truck-mounted aerial lift bucket with a hydraulic lift mechanism that can be powered by lead acid batteries is now in production. Use of the batteries replaces the truck engine as the power source for the hydraulic lift mechanism.

Called Power Pack, the newly developed lead acid battery power system provides four major advantages that result in dramatic cost savings: (1) elimination of the need to run the truck engine to supply power for the hydraulic lift system, (2) longer engine life, (3) decreased truck operation costs, and (4) decrease engine maintenance costs.

Trucks with aerial lift devices, commonly called bucket trucks, sometimes are known as cherry pickers or lift baskets. The basket of such vehicles, attached to a hinged boom, is used to hoist workmen as high as 34 feet while performing a variety of above-ground jobs. Municipalities use bucket trucks to install and maintain street and traffic lights and signs; they are also used to trim trees and for a wide variety of other tasks. Telephone and electric companies use fleets of bucket trucks to install, maintain and repair telephone and electrical equipment.

According to the manufacturer, Tel-E-Lect Corp., elimination of the requirement for an engine power take-off (PTO) unit on a bucket truck will be particularly meaningful for those who operate fleets of such vehicles. For example, use of the batteries to supply power for the bucket's hydraulic lift mechanism will save 20,000 engine miles per year. Added to this would be a corresponding saving in gasoline and oil as well as decreased maintenance and repair, engine wear and truck downtime.

Other advantages of the battery-powered hydraulic lift unit include: quieter operation of the unit through elimination of loud truck noise, virtually pollution-free operation since truck engine emissions are eliminated, and improved voice communication between the bucket operator and personnel on the ground who will not have to shout above the noise of the truck engine.

Production of the bucket truck follows a successful six-month test of a prototype vehicle. Designed and developed in cooperation with Arkansas Power & Light Co., the prototype has been undergoing tests in Hot Springs, Ark., where the utility's personnel have been using it to perform a variety of maintenance and installation work.

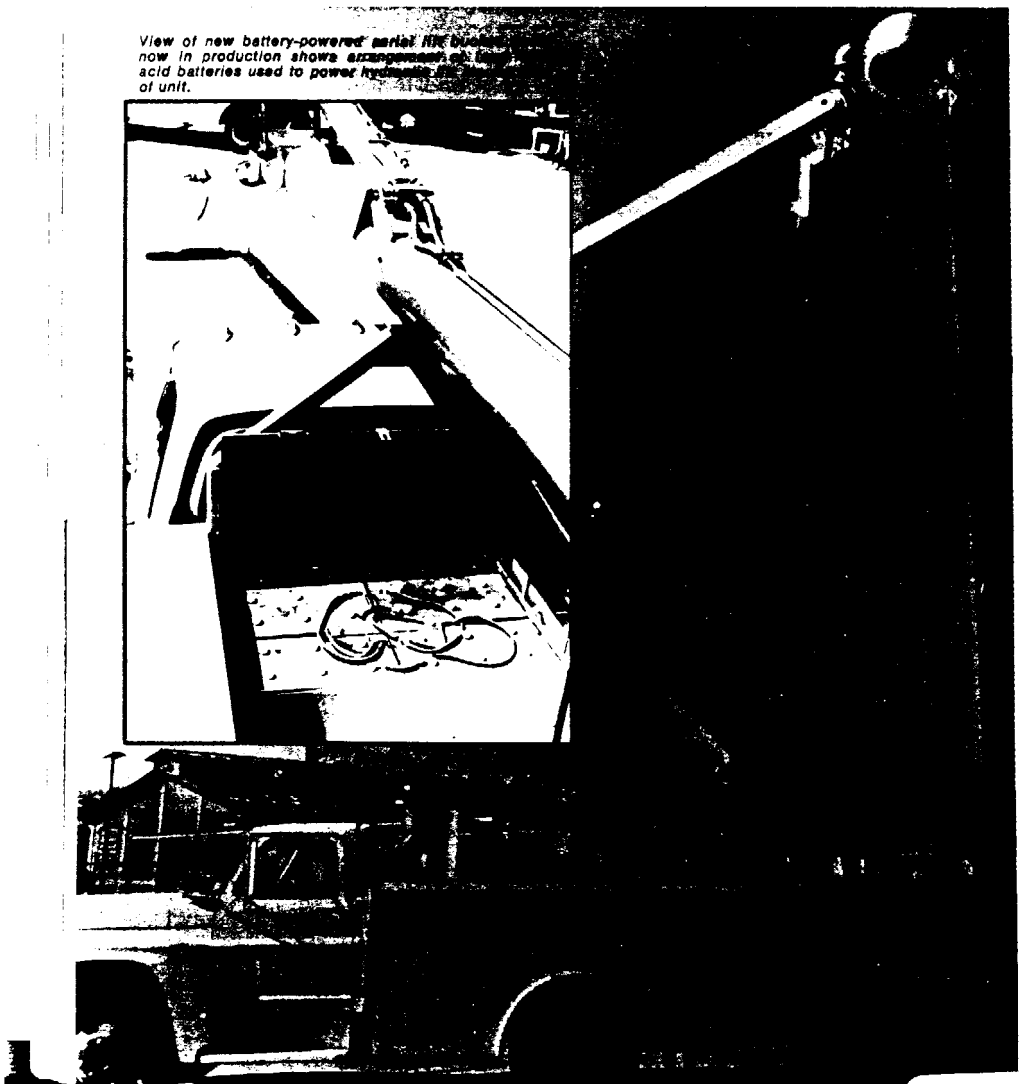
Based on the outstanding success of the prototype, the utility has announced it has ordered an additional battery-powered bucket truck for delivery this year.

Speaking of the reasons for his interest in battery-powered aerial lift bucket trucks, one utility spokesman said, "Through 15 years of using hydraulic equipment, our company has found that the hydraulic lift system for the baskets consistently outlasts our truck engines. I felt sure that if the truck engine did not have to run continuously to supply power for the hydraulic lift system, then the truck life would be extended and therefore become more compatible with the life of the hydraulic lift mechanism."

He also felt that the major cost savings could be achieved due to decreased requirements for gasoline, oil and engine maintenance and repair. The fact that a battery-powered unit would be quiet and virtually pollution free and could be more easily transferred to another chassis because there would be no PTO connections to make were other important considerations.

Mounted on the chassis of a Ford F-500 1½ ton truck, the standard vehicle used by the utility for bucket truck service, the hydraulic lift system for the prototype vehicle appears at first glance to be no different from the more than 100 vehicles the utility uses for bucket truck service. However, a special box directly behind the cab houses four 200

*Prototype battery-powered aerial lift bucket truck is being used here for street light maintenance.*



*View of new battery-powered aerial lift bucket now in production shows arrangement of lead acid batteries used to power hydraulic lift of unit.*

LIA26658

AH, 6-volt batteries used to power the prototype's hydraulic lift system.

**EXTENSIVE TESTING**

The prototype truck was driven 7,650 miles during the test. Meters installed on the engine PTO unit and the batteries provided positive evidence that operating the hydraulic lift system off the PTO unit dramatically increases engine running time.

The hydraulic lift system operated from electricity supplied by the batteries for 64 hours during the test period. The batteries were recharged by a separate, engine-powered alternator as the truck was driven between job sites. To achieve 64 hours of operating time using the PTO unit to power the truck's hydraulic lift mechanism, it is estimated that the truck engine would have to run approximately 512 hours, or at least 10,000 miles.

These figures are based on the fact that the truck engine must be continuously run at an average speed of 20 mph during the time the bucket is in operation. Converted to annual estimates, about 20,000 miles would be added to the approximately 15,300 miles an average bucket truck is driven in a year. Therefore, about 200,000 engine miles can be saved during the average 10-year life of a truck.

Equally impressive are savings that are expected to be achieved through decreased maintenance costs and truck downtime as well as eliminating the cost of gasoline and oil required to operate a truck for 200,000 miles in 10 years. For example, it is estimated that the additional cost of the combination PTO and battery-powered bucket truck now being produced can be amortized in about three years based solely on the approximately $500 per year in savings achieved by decreasing maintenance costs.

## ELECTRIC VEHICLES GET PRODUCTION GO-AHEAD

A new stimulus to electric vehicle production has been provided by a group of 55 electric utilities. Funding a $1 million research program, the utilities have ordered 100 on-the-road vehicles for practical testing.

The program is being sponsored by the Electric Vehicle Council (EVC), an operation of the Electric Energy Assoc., New York. Battronic Corp., division of Boyerton Auto Body Works, Boyerton, Pa., will build the trucks.

Electric road vehicles will begin to appear in the US in noticeable numbers about 1980 according to EVC officials, in describing the 100-vehicle project, a program designed to help utilities understand use patterns of electrical vehicles and the special requirements such vehicles may place on future power supply systems.

The 55 utility companies plan to operate the vehicles as general purpose, multi-stop work vehicles. Production will begin early in 1973 with first deliveries scheduled for March. Each vehicle will be instrumented and careful records kept of its operations. These data should provide guidelines for the utilities in anticipating load demands and operation requirements of the 1980's.

*Final design of the multi-purpose electric battery-powered work vehicle being built for the Electric Vehicle Council.*

Unlike many earlier electrics, the Battronic is being designed from the wheels up and is not a converted passenger car. According to Paul Hafer, Battronic president, the vehicle is designed as a walk-in, van-type multistop which will be used for repair work, meter reading, product distribution and personnel transportation. It will carry a 1000 lb. payload in a 140 cu. ft. cargo space. It will weigh 6000 lb. and will have cargo area access from side doors and a rear door. General Electric Co. will provide the powerplant and a matched solid state controller.

# lead

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## NEW LISTINGS

### Lead in glazes

Reprint from American Ceramic Society Bulletin. Six papers on subject of lead release testing on ceramic dinnerware glazes. Charts and tables. Twelve pages. B-10

### Lead a major factor in new machinery noise suppression systems

Description of techniques used to lower machinery noise levels with lead and lead composites. Lists machines that normally exceed noise level allowed by Walsh-Healey Public Contracts Act. Two pages. J-9

### Lift profits electrically

Provides performance data on electric battery powered vehicles for industrial use. Cost calculators are designed to help buyer estimate depreciation, operating and maintenance costs. Sixteen pages. L-14

### Sheet lead plenum barriers

Detailed description of acoustical plenum barriers and how to install them. Materials and installation procedures described and illustrated. Eight pages. J-10

### Techniques for reducing machinery noise

Reprint from Pollution Engineering details materials and solutions for reducing machinery noise to acceptable levels. Specifics given for several machine types in common usage. Illustrated. Four pages. J-11

### Controlling sound with lead

Reprint cites three installations where lead is being used as a noise and vibration barrier: John Hancock Building; Baldwin-Wallace College; and New England Medical Center, Boston. Four pages. J-12

### Lead and zinc: Free world supply and demand 1972-5

Reprint of papers delivered at joint Lead and Zinc Associations Annual Meeting, April 1972. Statistical analysis, with charts, of factors influencing supply and demand of these metals through 1975. Twenty-five pages. M-10

### Ecology in the new lead belt

Reprint describes cooperation of industry and environmentalists in developing southern Missouri lead mines. Four pages. M-23

## ARCHITECTURAL

### Waterproofing with sheet lead

A description of the use of lead as a membrane waterproofing material for lining pools, planters, fountains, shower stalls and floors where positive waterproofing is required. Architectural details and specifications are included. Eight pages. A-2

### Lead roofing and flashing

Detailed instructions on the simplest and most usual methods for forming or joining lead for roofing and flashing applications. Complete specifications. Diagrammatic drawings. Sixteen pages. A-5

## PAINTS

### Follow the safety line with chrome yellow

Formulations and suggested applications for chrome yellow safety paints. Illustrated. Eight pages. F-5

### Red lead based paint systems

Provides details on general properties and suggested uses of recommended paints. Instructions on surface preparation for a variety of applications. Listing of LIA recommended formulations. Thirty-two pages. F-1

## PLUMBING

### Lead plumbing catalog and specifications

Specifications and details for the use of lead in plumbing. Waste connections, shower and safe pans and chemical laboratory drains are covered. Four pages. D-2

## CHEMICAL CONSTRUCTION & CORROSION PROTECTION

### Corrosion resistance of lead in chemical applications

A chart presentation of the corrosion resistance of lead and its alloys against 188 chemicals from 0° to 3000°F. Six pages. M-3

### Lead in modern chemical construction

Reprint from *Encyclopedia of Chemical Process Equipment*. Describes installation, properties, design applications, and testing of lead linings. Twelve pages, illustrated. M-1

## BATTERIES

### A primer on the lead-acid battery

A condensed story of the principles of the lead-acid battery and its chemistry, including some of the fundamentals and definitions of direct-current electric energy. Two pages. L-6

### Electric trucks are the choice

Reprint from *Electrified Industry*. Operational and maintenance experience of a major company with battery powered in-plant vehicles. Four pages. L-10

## CERAMICS

### Facts about lead glazes for art potters and hobbyists

Detailed information on the proper formulation, firing techniques, handling, etc. of lead fluxed glazes used by art potters and hobby ceramists. Illustrated. Sixteen pages. B-11

## SOUND BARRIERS

### Directory of acoustic specialties

Summary of available materials for sound insulation by barrier, damping and absorption methods. Sixteen page list of materials by brand name and manufacturer. Eighteen pages. J-4

## ANTI-VIBRATION PADS

### Ways to reduce press vibration

Two installations of lead asbestos pads to reduce heavy machinery vibrations. Sectional drawings and loadings are given. Two pages, illustrated. G-1

### Lead asbestos anti-vibration pads

Specifics on lead anti-vibration pads including design and sizing, specifications for the sub-contractor, and list of pad manufacturers. Three pages. G-3

## CABLE SHEATHING

### Lead-covered underground cable use increasing

Reprint outlining a major utility's recent experience with lead sheathed underground cable. Details on where this type cable is desirable. Graphs. Four pages. C-2

## GENERAL

### Lead Welding

Reprint from *American Welding Handbook*, covers methods of lead, joint design, torch manipulation and welding speeds. Other sections on safety promotions and common applications. Bibliography. Fourteen pages.

### The U.S. Lead Industry—1971

An annual review of activity within the industry that contains a general summary for the year and a series of charts and tables giving current statistics on production and consumption. M-14

### Primary lead production areas in the U.S.

For schools, libraries. 11"x14" map showing locations in U.S. of most lead mines and refineries, and lead mines. M-11

### Lead—A modern design material

Summary of properties and applications forms of lead for radiation shielding, sound/vibration control, electrical sources, soldering and ceramics. Six pages. M-15

### The new lead belt

Reprint of article details operations in the new lead belt in Missouri. Book describes activities at four mines, two concentrators and three smelters. Six pages. M-16.

### Use of lead in the automobile

Reprint of article from *Metals* discussing in detail the various applications of lead in the automobile. Six pages. M-17

### Lead—The "Clydesdale" workhorse in space

Reprint from *Space World* details applications of lead in space exploration. Illustrated. Four pages. M-19.

## FILMS

### Lead Matrix

A 26-min., 16mm color film. Demonstrates that lead is one of the basic elements in the matrix that binds our organization together. To order, specify alternate show date and one alternate date. No charge to borrow; viewer pays return postage. N-1

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