

ENGINEERING NEWS-RECORD

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CONTENTS ON PAGE 41

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A special report on the new Pittsburgh . . .



Fitting Cities to the Future 

Structural steel work

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ERECTED FOR
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PENN-LINCOLN
PARKWAY

Much of this project was fabricated for erection six months ahead of schedule, despite a severe steel shortage at the time. This reflects Fort Pitt Bridge's modern facilities, skilled personnel and 60-year reputation for prompt handling of urgent requirements.

*When planning your next steel structure,
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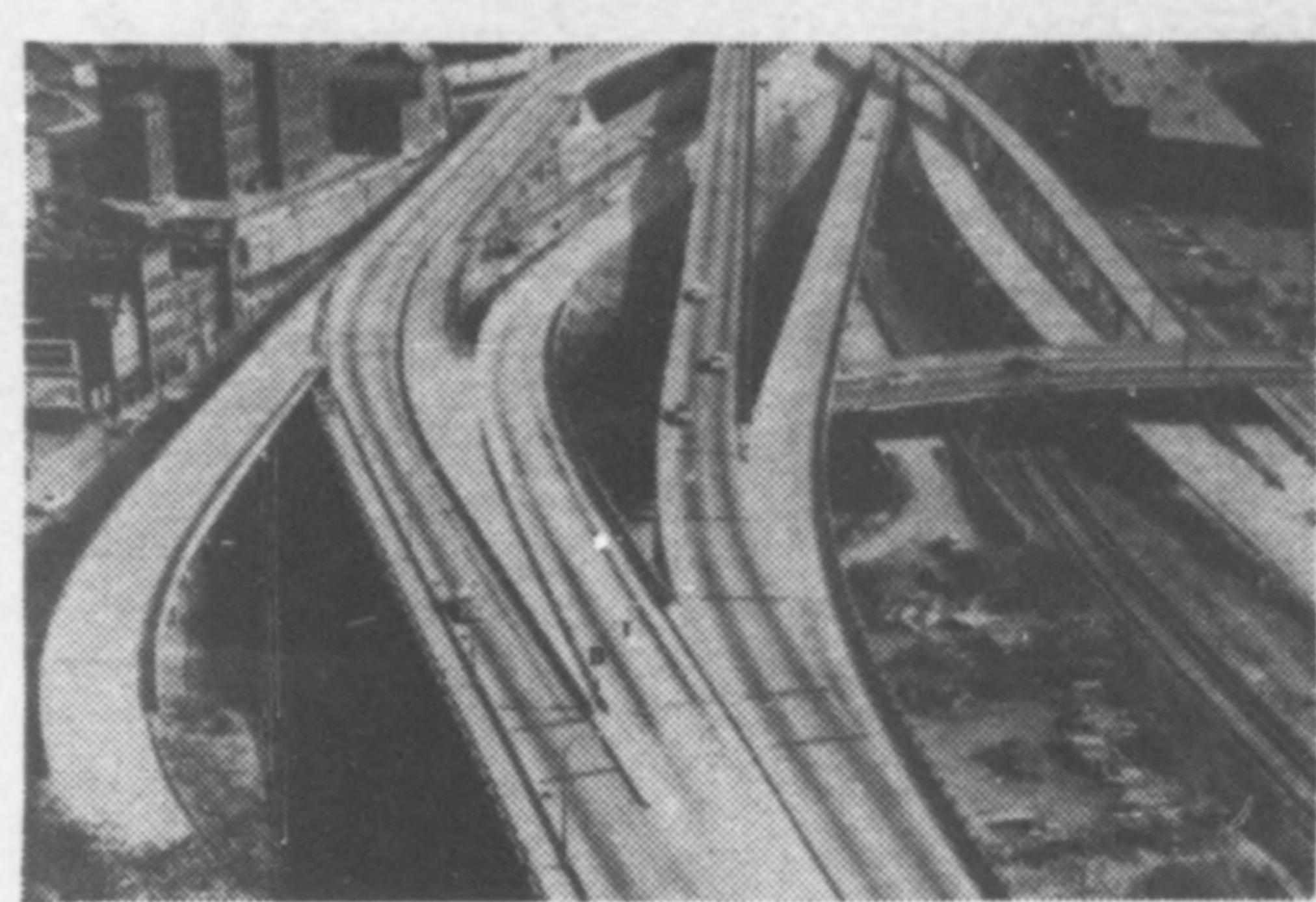


FORT PITT BRIDGE WORKS

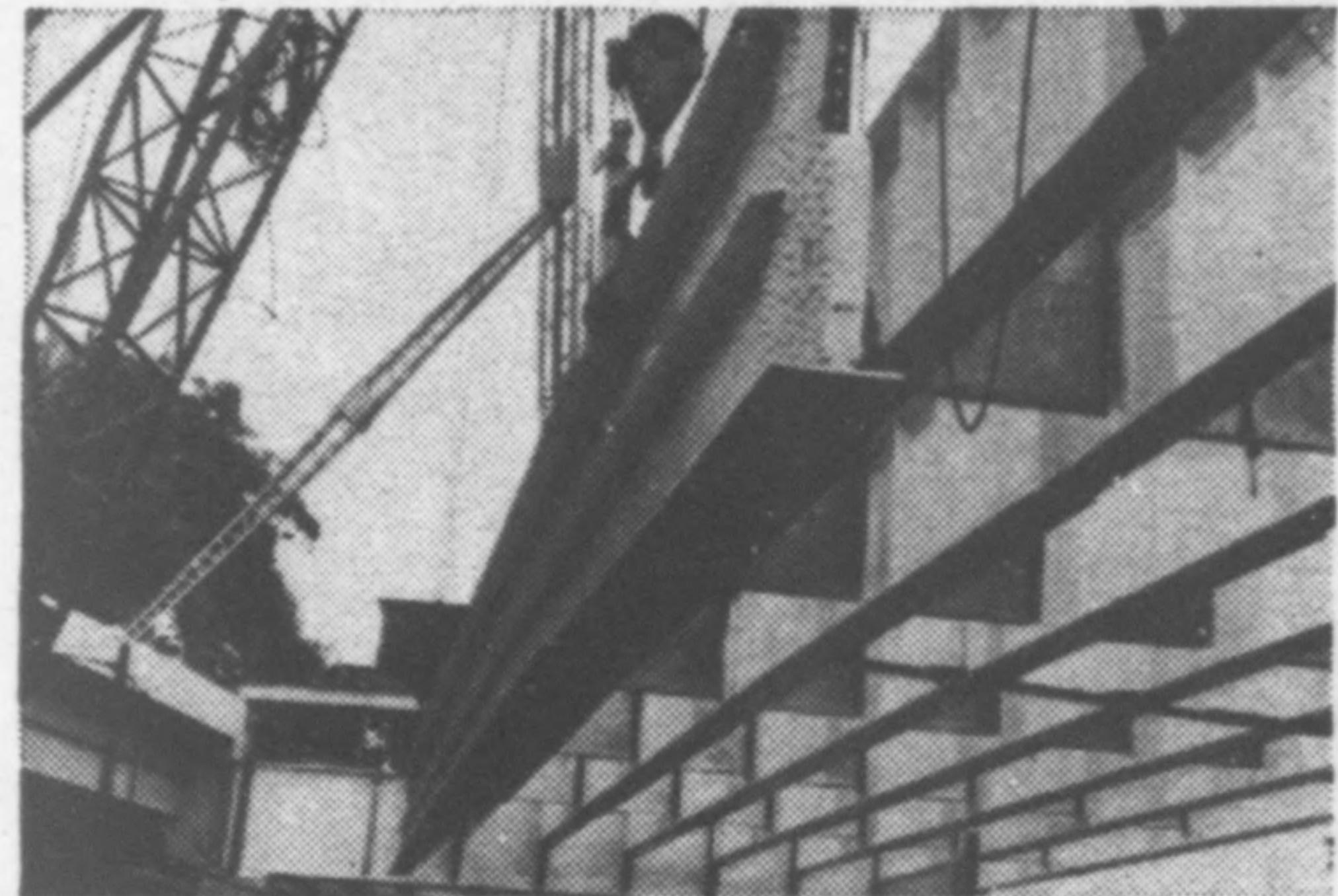
General Offices: 212 Wood Street • Pittsburgh, Pa.

Plants at Canonsburg, Pa.

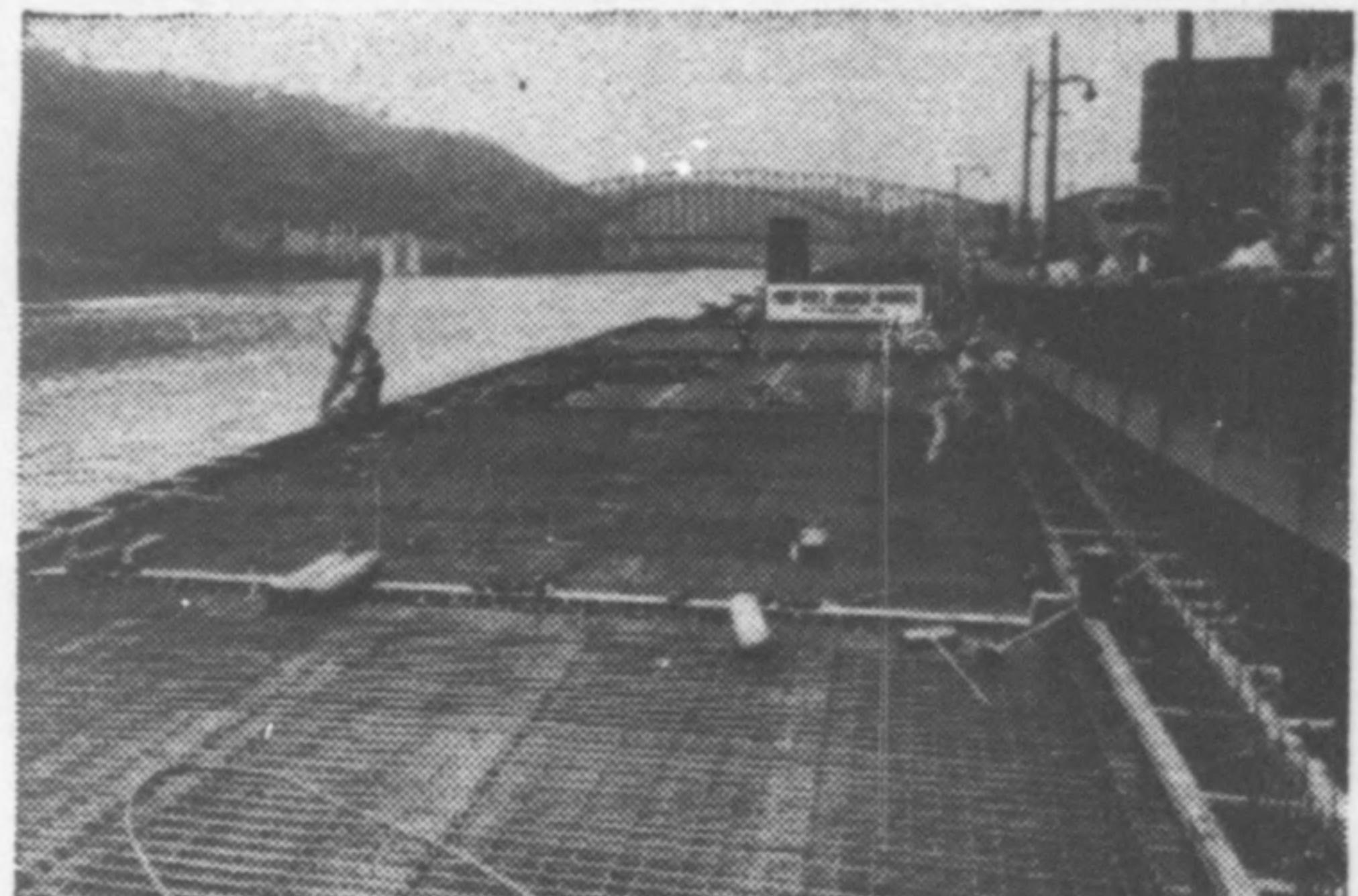
"There is no substitute for structural steel!"



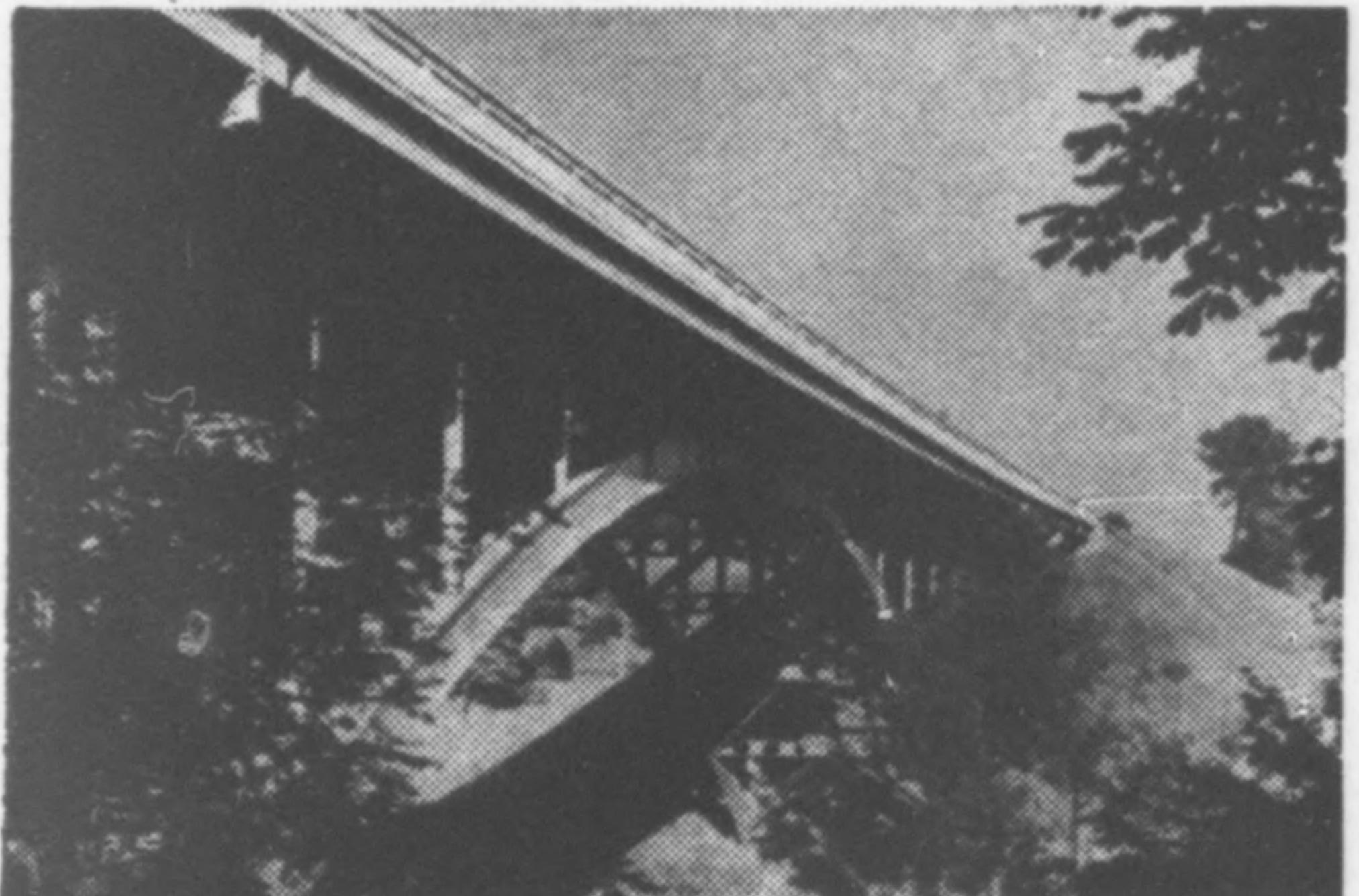
Interchange at 22nd Street Bridge.



Precision erection of 130-foot long girders.



Concrete reinforcing bars by Electric Welding Company, a Fort Pitt Bridge subsidiary.



Bridge crossing Campbell's Run Road on Parkway ten miles west of Pittsburgh.

A special report by the editors of ENR

Focus: Pittsburgh. Application: Anywhere

Fitting Cities to the Future

OUR RAPID ECONOMIC and population growth has outpaced the development of our cities. What is worse, procrastination has too often blocked progress in meeting the problem.

The resulting pattern is familiar: People and businesses move out of the central city to the suburbs; tax income goes down; public utilities are neglected; slums widen; office and industrial buildings deteriorate; traffic congests inadequate streets. Finally, the whole municipal mechanism becomes inadequate and inefficient.

Too many of our cities have allowed this pattern to develop.

By 1975 more than three-quarters of the people in the United States will be living in an urban environment. Plainly, unless urban redevelopment is quickly taken in hand, the hope for a rising standard of living will become a mirage, business efficiency will suffer further and economic growth will be arrested.

Fitting cities for the future, therefore,

ranks high, perhaps first, on the nation's list of problems to be solved in the years immediately ahead. To make this problem real and to prove it can be solved is the purpose of this special report. It is focused on Pittsburgh. Reason: More than any other U.S. city, Pittsburgh has demonstrated how a community on the downgrade can arrest its slide, reverse the trend and build anew.

Pittsburgh is a shining example of what engineering planning, political leadership and business support can do to initiate and carry out a program of reconstruction and development. Moreover, since few cities are in a worse state than Pittsburgh was, and no city has any more difficult or varied terrain into which to fit new developments, the example that Pittsburgh provides can cover almost any set of circumstances.

If Pittsburgh can fit itself for a bright future, any city can do the same. It is on this premise that the following account of Pittsburgh's renaissance has been prepared and is presented.

Special Features

1. **Pittsburgh sets a precedent by bold planning, building** p. 55
2. **To move the traffic: New bridges replace old ones** p. 64
3. **Pacesetting buildings bring new ideas for thin walls** p. 68
4. **How imagination created a unique sewage works** p. 72
5. **Spectacular auditorium goes up under separate contracts** p. 76



1946 Pittsburgh's Point was 60 acres of rundown buildings, narrow streets and freight yards.

Pittsburgh Sets a Precedent by

- In a single decade of reconstruction Pittsburgh has replaced gloomy prospects with glowing possibilities.
- Here's how the city organized for the future . . .

Except for a few war-devastated cities in Europe, probably no city in the world during the past decade has altered its physical pattern and appearance as much as Pittsburgh.

The wrecked European cities had no choice. They had to rebuild. But Pittsburgh was the master of its own fate. It could choose to do nothing, and let its central business district continue to deteriorate and its slum areas spread. Or it could choose to arrest the decay by bold planning and purposeful action.

Pittsburgh chose to plan boldly, and to take purposeful, quick action to translate the plans into reality.

The city of Pittsburgh owes its beginning to geography and its growth to geology. Two navigable rivers—the Allegheny and the Monongahela—come together to form the Ohio and enclose a point of land that was ideal for a frontier fort and its contiguous settlement.

This favorable geography might have spawned only a thriving river town if it had not been for equally favorable geology. Out of the ground came coal, oil and gas for fuel and energy, limestone and iron ore for making steel, and sand and clay for fashioning glass and pottery. With these ingredients for an industrial economy, Pittsburgh quickly became a large city, then a bigger one and ultimately the center of a vast industrially oriented region.

But growth had its penalties. Industry and homes spilled out of the triangle between the rivers, up and over the steep hills to the rear and onto the far banks. Streets and roads became more difficult and expensive to build. Water supply and sewage disposal posed new and troublesome problems.

The city grew bigger and more prosperous, but it also became dirtier and less attractive as a place to work and

live. The amount of solid matter in its smoke-laden air was unbelievable and almost unbearable. Pride in the city's future all but disappeared. Worn out factories, homes and utilities could be replaced only with difficulty.

It was against this background that Pittsburgh inaugurated its rebuilding effort. The results so far:

- A city clear of smoke, full of pride that it can paint its houses white if it wants to.
- A city free from the threat of devastating floods.
- A city you can leave and enter without inching through traffic-clogged streets.
- A city where parks and modern office developments stand on what was a downtown slum.
- A city with a future—and more big plans.

These results could never have been

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NOW The Point has new skyscrapers fronting on spacious park. Old bridges are being replaced.

Bold Planning, Major Building

achieved had there not been people in Pittsburgh who were concerned about its future. As far back as the early 1900's, in fact, a reform administration made a survey, financed by the then-new Russell Sage Foundation, which uncovered vice, corruption and inhuman working and living conditions. Its six volumes of published results and recommendations aroused a latent civic consciousness and led to the organization of the Pittsburgh Civic Commission. The commission studied and reported on transportation, streets, water supply, schools, sewage treatment, smoke prevention and housing. It is said that, with only a few exceptions, there has been no improvement in Pittsburgh in the last half century that was not proposed originally in these commission reports.

(Lesson to Note—In many another city similar old but good reports are tucked away somewhere. Dug out and dusted off, they might prove to be as forward looking as Pittsburgh's.)

But the improvements came slowly, if at all, and invariably too late. Pittsburgh barely coped with the present,

let alone the future. World War II and its huge industrial demands provided a reprieve, but as the war drew to a close, concern over the city's future grew.

Associations and committees, existing and newly formed, set out to "save Pittsburgh." Each of the groups was sincere, but limited in outlook and working at cross-purposes.

Fortunately, there was one exception, the Regional Planning Association. It had the necessary broad outlook, but was always short of funds and lacked sufficient business and political support to initiate action.

(Other cities with good planning agencies hamstring them like Pittsburgh did. Like Pittsburgh, they could stop this tragic waste of effort if they would.)

The planning association's executive director, Wallace Richards, sensed that the "save Pittsburgh" campaign was vital, but that the diverse pressure groups promoting it were only creating confusion.

He decided that an over-all organization was needed to establish order and assure cooperation. Also that it should

be made up of business men and civic and political leaders who would work hard on nonpartisan committees dedicated to the over-all development of the Pittsburgh region.

And he set down the objectives of such an organization.

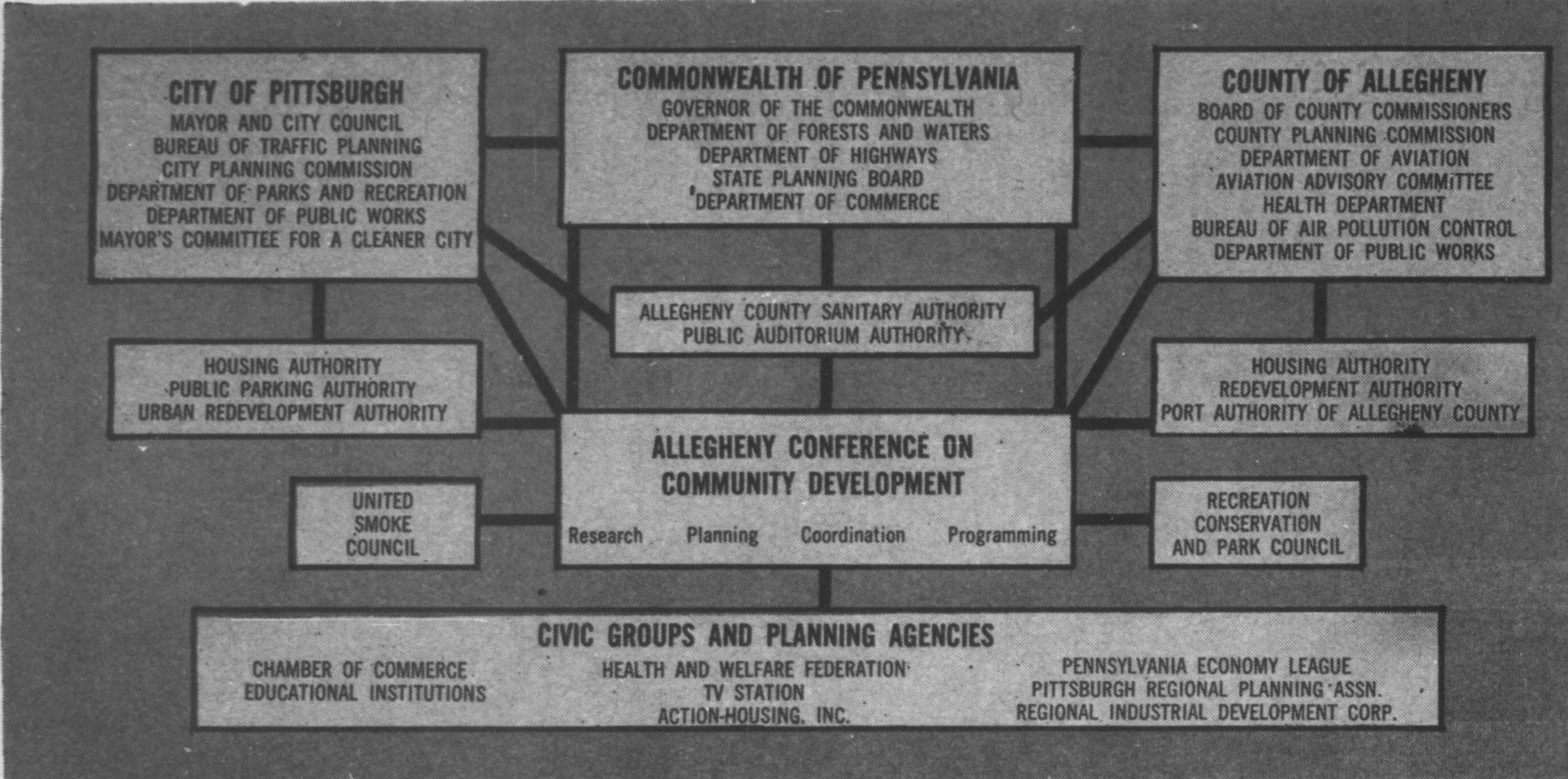
- To develop and advance a comprehensive unified plan and program for the region as a whole.

- To see that various parts of the program were systematically carried out — by government departments where possible, otherwise by the creation of new special purpose agencies.

The basic ingredient for success of such a plan was the unqualified and active support of the top business leaders of the city. This concept had the effective backing of Richard K. Mellon, banker, industrialist and the city's most influential citizen.

(Other cities can enlist business leadership too, even though their economic power may be less concentrated than in Pittsburgh.)

The Allegheny Conference on Community Development came into being in 1943, after six months of meetings by a half dozen industrial leaders and



GUIDING REDEVELOPMENT is the Allegheny Conference on Community Development. It is the focal point for the efforts

educators, including Mr. Mellon. This group laid the groundwork for a Citizens Sponsoring Committee and won over a much larger number of civic leaders to serve on it. This sponsoring committee, now numbering about 125, is today the Allegheny Conference on Community Development, which has been the guiding hand in Pittsburgh's rebuilding. Serving on it are representatives from industry, commerce, finance, labor, education, public administration and civic affairs.

The Conference was chartered by the state in 1944 as a nonpartisan, non-profit and privately financed organization. In 1945 it hired as executive director Park H. Martin, a civil engineer who had been Allegheny County Planning Director, and went to work. Soon a technical staff had research projects under way, and citizen committees were evaluating the findings, making recommendations and selling their proposals to government agencies and the public.

The Conference soon became a powerful force, with the backing of Mayor David L. Lawrence, now Pennsylvania governor, and the Allegheny County Board of Commissioners.

Here's how the Conference works: It elects officers and an executive committee from its membership. The executive director reports to the committee and is responsible for administration. There are two assistant directors; one in charge of engineering and one for public relations. An office manager and two secretaries bring the full-time staff to six. Consultants are hired as required for special jobs.

The Conference conducts its studies and surveys through citizen's working committees concerned with the following fields: cultural development, eco-

nomic problems; health, welfare and recreation; highways; housing and neighborhood development; land use and zoning; parks; mass transportation; parking; refuse disposal; research coordination; smoke abatement; stream pollution abatement; and water supply. Reports and recommendations of these committees and their consultants are made public only after approval by the executive committee.

Funds for the conference's regular operating budget (about \$125,000) and for specific projects and programs come from corporations, foundations and individuals.

Why does it work? The city's success in redevelopment stems directly from the efforts of the Allegheny Conference. The reasons for the success of the Conference itself are well worth examination:

The Conference was created as a truly over-all civic organization. It did not try to supersede any of the existing organizations, but rather sought to coordinate the special talents of each and focus them collectively on the comprehensive development program.

(Pittsburgh's precedent suggests to other cities seeking planning coordination: Keep the agency small, let special citizens committees do the work.)

Actually, most of the members of the Conference are also members of one or more of the earlier civic organizations. It is significant that the Conference used the existing Pittsburgh Regional Planning Association as its technical planning arm. In its study and research activities, it relies heavily, too, on such other organizations as the Pennsylvania

of all other groups—public and private. It conducts studies and surveys through citizens' committees.

Economy League, a privately financed governmental research organization; Action-Housing, Inc., the Regional Industrial Development Corporation and the Health and Welfare Federation.

And it operates in close partnership with both the city and the county planning commissions as well as the quasi-public agencies created for certain phases of the renaissance program.

How the Conference fits in as the focal point in the pattern of civic organizations and government departments is shown in the chart above.

• It looks to the elected public officials for all actions relating to public policy, legislation and appropriations. It offers aid, ideas and pledges of support, but it leaves the political arena to

... How the

First things had to come first in Pittsburgh's renaissance. And the smoke control ordinance that became effective in 1946 literally permitted the city to see what it was doing—and what it had to do.

The cleaner atmosphere revealed the shoddy appearance of the city in a new light. Psychologically, no rebuilding incentive could have been more effective.

But Pittsburgh had another basic fault—flood threats—to overcome before rebuilding was a worthwhile gamble. Until it could be freed from the possibility of devastating floods, any proposals for major changes in the downtown area between the two rivers were doomed to fail.

Pittsburgh's greatest flood of record

others. Again the guiding philosophy is one of support and cooperation.

• Much of the great strength of the Conference stems from the top business leadership that it can muster in support of its plan and programs. The certainty of this support arises from the way the Conference operates—first, studies and research; then a refining of the results into definite programs by citizens working committees; next, discussion with government departments to secure their acceptance; and finally, approval by the executive committee of the Conference. By the time this procedure is complete and the program made public, effective business support has already been won.

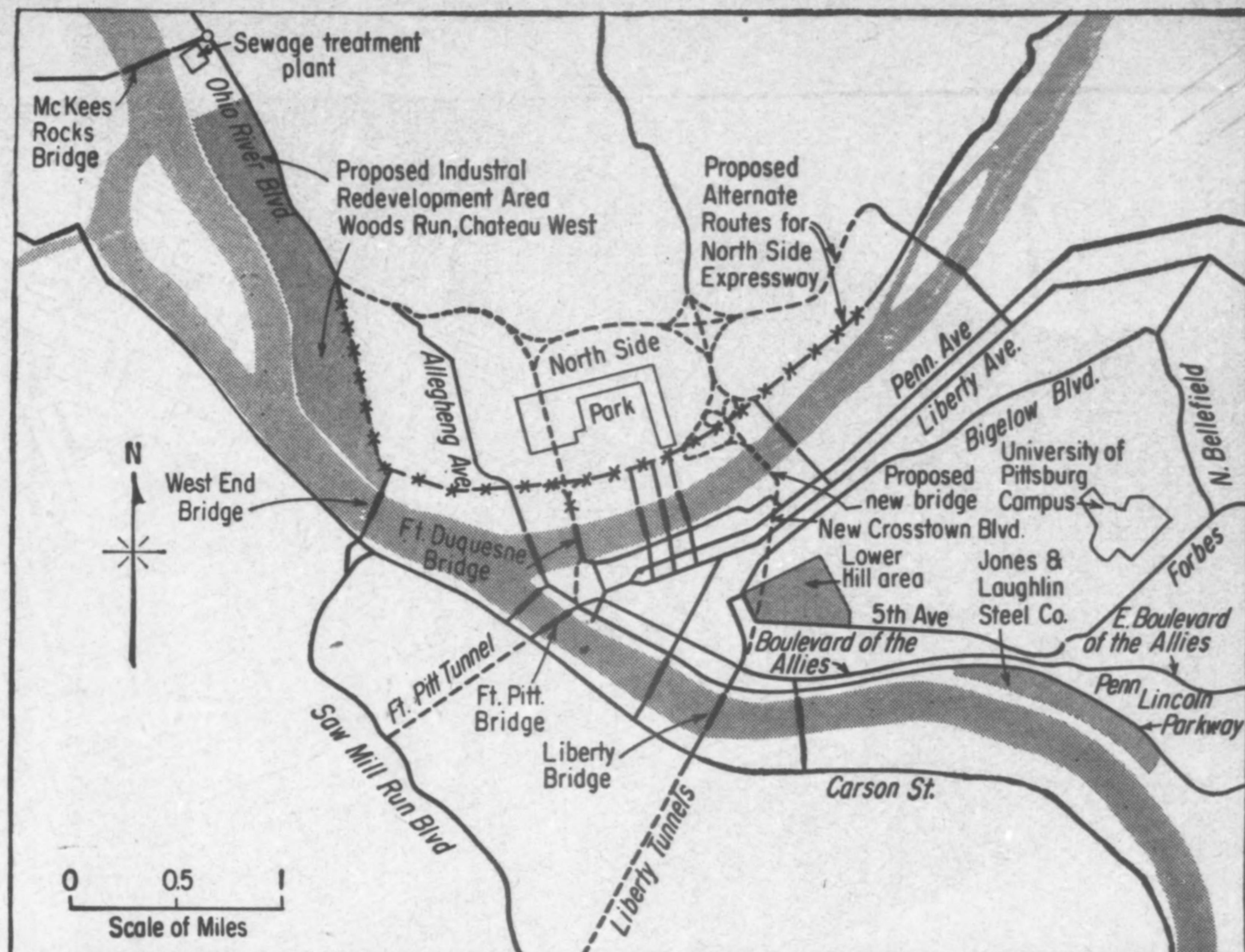
The Conference got off to a quick start with accomplishments that won public favor, choosing three projects that had wide appeal. There was a backlog of projects to start on whose need was widely recognized.

(Getting results from planning is a matter of letting elected officials do the political chores, backing them up with facts and figures, and putting popular projects first on the agenda. Success breeds success.)

The first three projects were a state park at the Point to replace part of a commercial slum, the Penn-Lincoln Highway along the Monongahela River in downtown Pittsburgh, and enforcement of a smoke abatement ordinance.

The committee rallied the coordinated support of civic organizations and local governments, and won state authorization of money for the park and the highway. The Conference was appointed the official agency for the park.

On smoke control, the Conference supported the mayor and city council in enforcing the provisions of an existing ordinance applying to industry and



KEY PROJECTS, many completed, others just beginning, will change the map of the city, make it a better place to live, work and raise a family.

households within the city limits. And it entered the campaign to extend the benefits of smoke control to all of Allegheny County. These activities greatly enhanced the standing of the conference. Slums, clogged highways and heavy smoke were things most residents cared about.

The Conference was now firmly established as a group that could achieve coordination of efforts in getting projects started.

Next it turned to its role of study and research. The result was a series of proposals for needed state legislation, eight of which were enacted into laws.

The laws authorized creation of a City Parking Authority, a County Transit

and Traffic Commission to study mass transit, and the right to establish a county-wide refuse disposal system. They permitted creation of a City Department of Parks and Recreation, and allowed local governments to broaden their taxing powers. The new laws also removed the exemption of the railroads from the county smoke control ordinance, relieved the city of damages in connection with construction of limited-access highways and gave the County Planning Commission approval-control over subdivision of lots.

These measures removed many long-standing obstacles to progress. And Pittsburgh was ready for more achievements (see below).

Face of Pittsburgh Is Changing

occurred in March, 1936, reaching 21 ft above flood level at the Point and putting a number of the main downtown streets under as much as 8 ft of water. Later that year Congress passed the act that made flood control a federal responsibility for the first time, and set off a huge nationwide dam building program. Pittsburgh benefited greatly from this activity.

By 1946 its flood problem was largely solved. In the next decade, eight dams were built above Pittsburgh on the tributaries of the Allegheny and Monongahela rivers. They included such well known dams as Tygart, Youghiogheny, Conemaugh, Tionesta and Mahoning. They provided insurance that 10 ft would be cut off the crest of any major flood, and that most floods would

flow harmlessly past the city. With other dams still in the offing, Pittsburgh no longer considers floods an obstacle to its redevelopment.

Freedom from floods made the city's first true expressway, the Penn-Lincoln Parkway, practicable enough to justify its expense. It is 25 miles long and for two miles it runs along the bank of the Monongahela River as it skirts the city's business district.

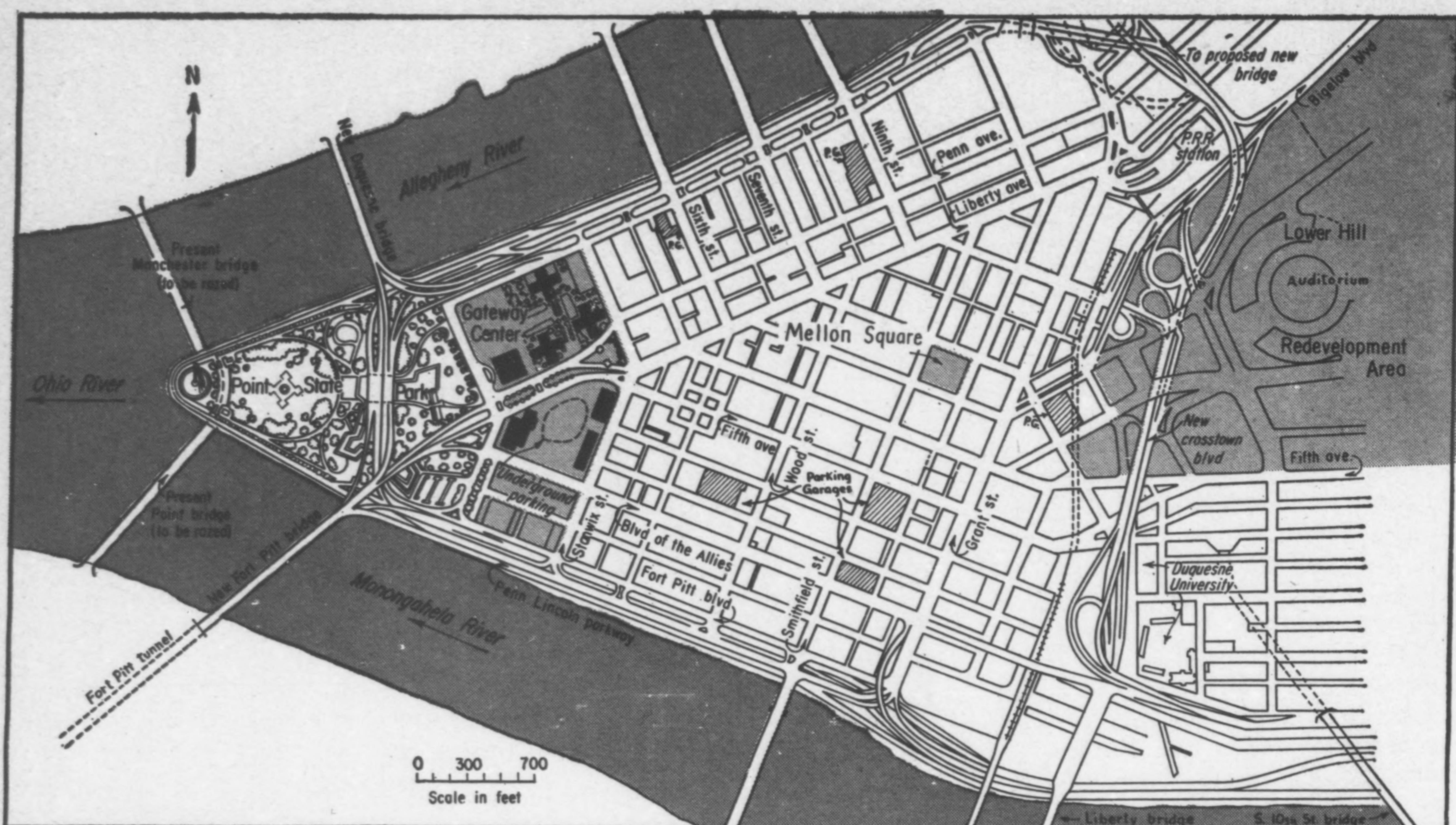
This great parkway rates as one of the country's most difficult and expensive highway projects. On its eastern leg—which extends 15 miles to the Pennsylvania Turnpike—it passes under a residential area, through the 4,225-ft Squirrel Hill tunnel. Along the river end at the Point, it is on an elevated structure. It crosses the river on the

double deck tied arch Fort Pitt Bridge (see p. 64) and passes under adjacent Mt. Washington in the twin-tube 3,600-ft Fort Pitt tunnel, which will be completed next year. This western leg extends another 10 miles with a branch to Greater Pittsburgh Airport.

For the bulk of these facilities the cost was about \$6 million a mile. But now a motorist can traverse the whole parkway in 30 minutes instead of encountering the long delays that were common on the tortuous and traffic-filled route that the parkway replaced.

Of the \$135 million initially put into the Penn-Lincoln Parkway, about \$57 million came from the state, \$5 million from the county and \$1 million from the city. The U. S. supplied the rest.

(Turn the page)



GOLDEN TRIANGLE is being modernized to bring parks to Pittsburgh's business district, relieve traffic congestion, provide

The most critical present need is for federal aid on the Crosstown Boulevard between the rivers at the base of the triangle. Nevertheless, the state highway department, with help from the city and county, is going ahead on its own. The first mile from the Liberty Bridge-Penn Lincoln Parkway intersection (see map) is under construction while plans are being made for the second mile, which will extend the route to Fort Duquesne Boulevard along the Allegheny River.

The ultimate plan also includes a new bridge across the Allegheny River. This will connect with the proposed Allegheny River Expressway, which will extend 10 miles along the north bank of the river to an intersection with the Pennsylvania Turnpike.

A southward extension of this same expressway would also provide a connection with the new Fort Duquesne Bridge, now under construction across the Allegheny at the Point (see p. 64) as well as with an expressway route westward. Just where this highway on Pittsburgh's North Side would be placed—along the river or farther back on the hillside—is still undecided. Each of the two routes has its special proponents.

With these projects and others farther from the city in some active stage, from planning to actual construction, Pittsburgh and Allegheny County are rapidly arranging their major traffic arteries into a pattern that will greatly enhance transportation efficiency.

modern housing nearby. Another change involves construction of a spectacular municipal auditorium.

Nearly all of these major expressways originate in the Point, emphasizing the key position this pie-shaped piece of land plays in the Pittsburgh picture. Pittsburgh refers to its entire downtown business section of about 330 acres as the Golden Triangle. Its sides are the two rivers and its base is about at the location of the new Crosstown Boulevard. At the apex of the triangle is the 50-acre area called the Point.

The Point is Pittsburgh's front yard, and no city ever had a more littered one. It was covered with railroad yards, rundown commercial structures and streets leading to obsolete bridges across each of the rivers. The area was plainly marked for renovation.

It was here that Pittsburgh began its rebuilding program in 1945, urged on by the mounting traffic congestion at bridge approaches and disappearing tax income from Point properties.

The state agreed to develop 36 acres into a state park because of the Point's historic national significance as the location of early frontier forts—first France's Fort Duquesne and then the British Fort Pitt. The move also provided space for the traffic interchange facility required between new bridges to be built across the rivers upstream from the old converging structures. Spurred by this beginning, plans were laid for the development of the area.

At that time there was no federally aided urban redevelopment program, and events proved it wasn't needed in this case. The Point Development Com-

mittee of the Allegheny Conference recommended that the 23 acres bordering the park be redeveloped by private enterprise, and found an interested participant in the Equitable Life Assurance Society of the U.S.

With this much of a start the city council created the Pittsburgh Urban Redevelopment Authority, which negotiated a contract with Equitable Life and agreed to assemble the land and transfer it at acquisition cost, subject to land-use controls.

The authority was one of the first of its kind in the country and had to be subjected to legal tests. Its final approval by the U.S. Supreme Court paved the way for the present urban renewal setup in which federal aid plays a prominent part.

More than 90 old buildings were demolished to clear the site. Equitable called it Gateway Center and planned a group of tall office buildings in a park-like setting. A 24-story and two 20-story buildings were built between 1951 and 1954. Another, Gateway No. 4, is presently under construction. The first three buildings were pioneers in the use of stainless steel cladding for the exterior walls of tall buildings. They are also notable for their cross-shaped plan, which puts the elevators and utilities at the intersection of the legs, reserving the legs themselves to office space with maximum light and air. The latest building is T-shaped, with the utilities in the leg. Its walls are also largely glass (see p. 68).

Three other new buildings have also been erected on Gateway Center land purchased from Equitable—a 16-story state office building, a 12-story office building of the Bell Telephone Co. of Pennsylvania and the Pittsburgh-Hilton Hotel, just completed (see p. 68).

Prior to development, the assessed valuation of the Gateway Center area was only about \$7 million. It is now in excess of \$44 million, assuring that taxes will repay the city many times for the investment it made in preparing the site for redevelopment.

Point Park and Gateway Center provided downtown Pittsburgh with its first park-like open space. A second major park project, Mellon Square, was literally carved out of an acre of commercial slums surrounded by some of the city's most imposing old buildings as well as its newest skyscrapers. It's located almost at the geographical center of the Golden Triangle.

It consists of a park on top of a six-story 1,000-car underground parking garage. The park, raised about a story above the surrounding streets, offers large expanses of terrazzo walks for strollers and granite benches for sitters, all in surroundings of fountains, reflecting pools and flower gardens.

The land and the park itself were financed with a gift to the city by the Mellon family—\$3.75 million for land acquisition and demolition of old buildings and \$665,000 for constructing the park. The Allegheny Conference was the contracting and disbursing agent for the park. For the underground garage, private financing was arranged by the city's Public Parking Authority. In return for operating rights for 38 years, the Morrison-Knudsen Co. and its subsidiary, H. K. Ferguson Co., built and paid for the \$3.5-million facility.

Mellon Square, like Gateway Center, gave Pittsburgh something to be proud of. Together, they provided prominent proof of what the redevelopment effort was accomplishing and promoted support for the program.

One of the early accomplishments of the Allegheny Conference was to recommend and guide the creation of the Pittsburgh Public Parking Authority, so that garages could be provided by revenue bond financing.

Off-street parking was necessary because of the traffic problem, but it could not be provided from tax income.

Since its creation in 1947, the Public Parking Authority of Pittsburgh has built six multistory open-deck garages financed through revenue bonds. And it represented the city in the arrangements for the Mellon Square Garage, which was built with private funds.

All of these garages are in the downtown Triangle. They provide 5,150 parking spaces. There are also two paved, metered parking lots in outlying areas. Concurrent with these indus-



MELLON SQUARE replaced a square block of dilapidated commercial structures with a park in the heart of the Golden Triangle. Under the park: a parking garage.

business areas. All of these facilities are leased to private operators, with the authority retaining control over rates and operating policy.

In Pittsburgh's slum clearance work, the Gateway Center development was the forerunner of today's accepted procedure for large-scale programs, as noted earlier. In this, the government acquires the land, clears slums and then sells the land to private interests for redevelopment. This system was used several times by the Pittsburgh Urban Redevelopment Authority before the federal government came into the picture in 1954 with the now-familiar Title I procedure.

Without federal or even state aid, the Authority assembled slum housing properties adjacent to the Jones & Laughlin Steel Corp. plant (two miles up the Monongahela River from the business district) and sold it to J&L for a \$70-million expansion of its facilities. Across the river the Authority repeated the operation with 85 acres of blighted area; J&L was again the developer. Concurrent with these indus-

trial renewal operations, the Authority acquired 10 acres of substandard property and transferred it to the University of Pittsburgh for its new Graduate School of Public Health, and a major addition to the Children's Hospital. Another 31 acres was obtained to expand University athletic facilities.

These activities were well under way when the federal government passed the Housing Act of 1954, bringing substantial funds to bear on the nation's urban renewal problem. With the experience it had gained, Pittsburgh's Urban Redevelopment Authority made a Title I project out of one of its greatest redevelopment dreams—conversion of the so-called Lower Hill slum area into a great city asset.

The Lower Hill redevelopment project will replace 95 acres of the worst residential slums in the city. It's located right at the base of the Golden Triangle, within a stone's throw of the downtown skyscrapers. The site is now clear of old structures, and major reconstruction is under way.

The reconstruction is most notice-



PARKING GARAGES now dot the Golden Triangle, providing space for more than 5,000 cars. They're financed by revenue bonds.

Garages are leased to private operators, but the Parking Authority retains control of rates and policy.

able in a new six-lane Avenue and in the new Civic Auditorium, a novel circular structure with a retractable stainless steel roof (see p. 76). The auditorium is now being built by the Public Auditorium Authority at a cost of about \$20 million.

It is in the center of a 20-acre plot to be devoted to gardens and recreational uses. It will be surrounded with tall, widely spaced apartment houses covering 14 acres. These, in turn, will be surrounded by 19 acres devoted to commercial buildings. The Urban Redevelopment Authority has accepted a proposal from Webb & Knapp to develop one group of these apartment houses. Other proposals are pending.

The 32 acres remaining of the 95-acre area will accommodate the new Crosstown Boulevard, which will run north and south across the western end of the plot.

The Lower Hill project is a key phase of Pittsburgh's redevelopment program. It will provide living quarters near downtown for about 1,000 middle-income families; a new cultural and recreational center; a site for modern small business expansion; and park-like open spaces to supplement those of Gateway Center and Mellon Square.

It is also the beginning of an even more ambitious program of other projects. One of these involves 60 acres of slums immediately adjacent to the Lower Hill project—they may be cleared as a location for new buildings of Duquesne University. This plan is now under study as a possible Title I un-

dertaking by the Urban Redevelopment Authority.

The availability of Title I money has also caused the Redevelopment Authority to begin focusing on ever-larger slum clearance areas. One of the plans covers a 268-acre area in the East Liberty district, about five miles east of Lower Hill. Modern housing accommodations and a revitalized commercial and light industrial district would be provided.

By far the biggest scheme is rehabilitation of a good deal of the near North Side district of the city. This would eventually call for dozens of separate projects. Here deteriorating residential and business areas exist adjacent to the cramped and congested industrial area that borders the north bank of the Ohio River from the vicinity of the old Manchester Bridge at the Point westward to the McKees Rocks Bridge (see map). Through this area, also, will cut the new expressway leading from the new Fort Duquesne Bridge across the Allegheny to a connection with the existing Ohio River Boulevard. The slum clearance required by the expressway is just a starter to what is envisioned as needed for the North Side.

There is also a plan that includes two notable projects for the area directly across from the Point. This plan was initially prepared by the City Planning Commission and the Pittsburgh Regional Planning Association.

One project would replace 74 acres of rundown business buildings with modern apartments and a shopping

center. The buildings are now surrounded on three sides by one of the city's fine old parks.

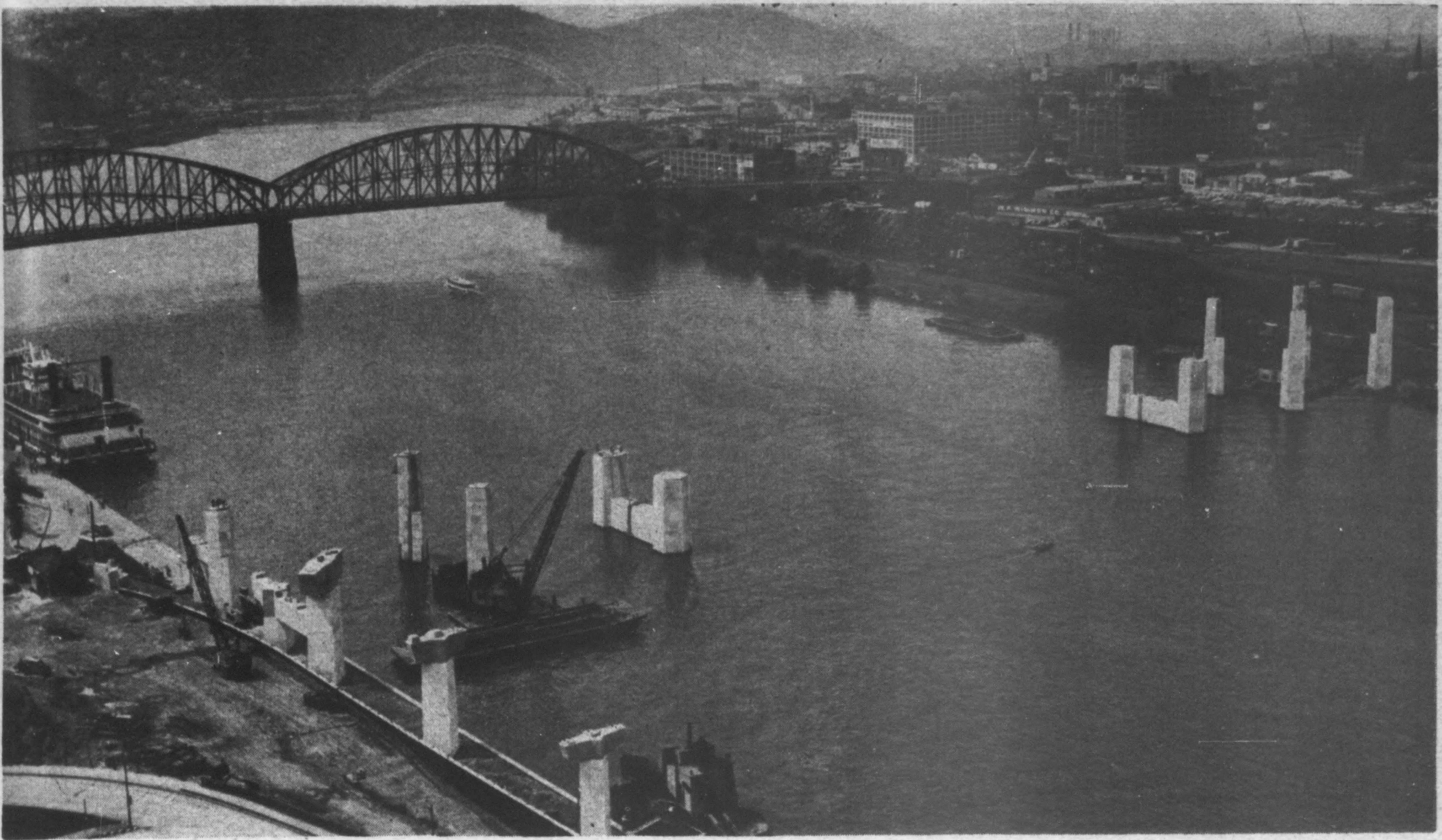
The other project involves a 90-acre area known as Monument Hill; it's adjacent to the first area. The hill would be cut down to provide a level area for a 50,000-seat municipal stadium with a 10,000-car parking field.

But outdistancing both of these in size, in economic impact, and urgency is the industrial redevelopment the planners have in mind for the North Side. The Urban Redevelopment Authority has received Title I planning money for a 165-acre project encompassing the west half of the industrial strip along the Ohio River, known as Lower Manchester Chateau West.

Most significant, the newest of Pittsburgh's planning bodies, the Regional Industrial Development Corporation, has chosen this entire industrial strip as its first project for study, analysis and recommendation.

RIDC was set up in 1955 as a private, non-profit organization to do the same kind of a job for industry that other agencies are doing for housing, highways and business generally. It resembles the Allegheny Conference, on a smaller base. Many of the same top industrial leaders serve on its board of directors. It works closely with all other development agencies and with local governments, serving as a middleman and spokesman for industry with them.

RIDC is concerned with the whole of industrialized Western Pennsylvania. Its objectives: Stimulating expansion of



INDUSTRIAL REDEVELOPMENT is next step for Pittsburgh. Involved are 325 acres (beyond steel truss bridge), along Ohio

existing industry and attracting new companies to the region. The report and recommendations it has made for Pittsburgh's North Side takes both of these objectives into account, but stresses the needs of existing industry. The emphasis now is on rehabilitation, since industries now there need room for expansion and relief from traffic congestion more than anything else.

RIDC would like to see the 165-acre Chateau West planning area of the Urban Redevelopment Authority expanded westward to include the 160-acre Woods Run district. Already, 70 acres at the west end, near the McKees Rock Bridge, has been developed in connection with the new sewage treatment works of the Allegheny County Sanitary Authority (see p. 72). Conditions in both Chateau West and Woods Run are identical: narrow streets, serious traffic tieups, extreme building congestion, no off-street parking, and industry without room for expansion. RIDC's report details what can be done to correct these conditions to Pittsburgh's advantage.

More efficient mass transit, everyone seems to agree, is what Pittsburgh must have before it can go much further with redevelopment. Few cities have a public transportation system as bad as Pittsburgh's. About 50 trolley and bus companies operated under franchise in Allegheny County, with no coordination, no transfer privileges and a minimum of connections between communities. The beginning to a solution is seen in a county-wide Transit Authority.

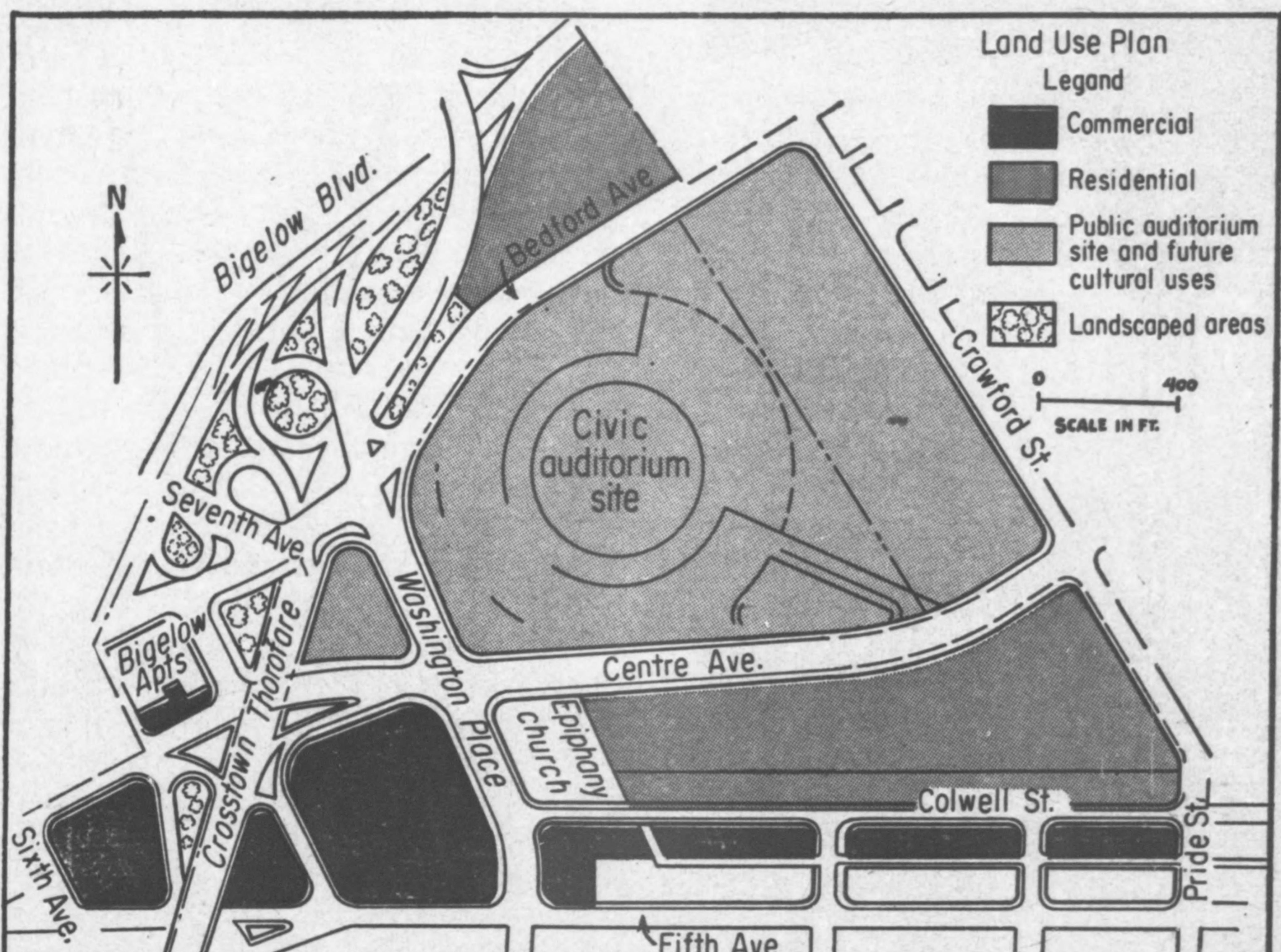
River. Area is now covered by manufacturing plants that need expansion room. Piers in foreground are for Fort Duquesne Bridge.

An enabling act to authorize one is now before the state legislature.

On two previous occasions, similar legislation has been defeated, so Pittsburgh's future is again in jeopardy. Failure to take this needed step toward more efficient mass transit will be disastrous, says the Allegheny Conference.

Assuming a favorable solution of the mass transit problem, however, Pittsburgh's future is as full of glowing possibilities as ever.

The city already has one of the few jet age airports in the country, the only operating commercial atomic power plant and a health center at the University of Pittsburgh that rates with the largest and best in the nation. Add to these the other redevelopment projects in housing, highways, office buildings, parks, and sewage treatment, and Pittsburgh's precedent for fitting itself for its future is one that every city can study with profit.

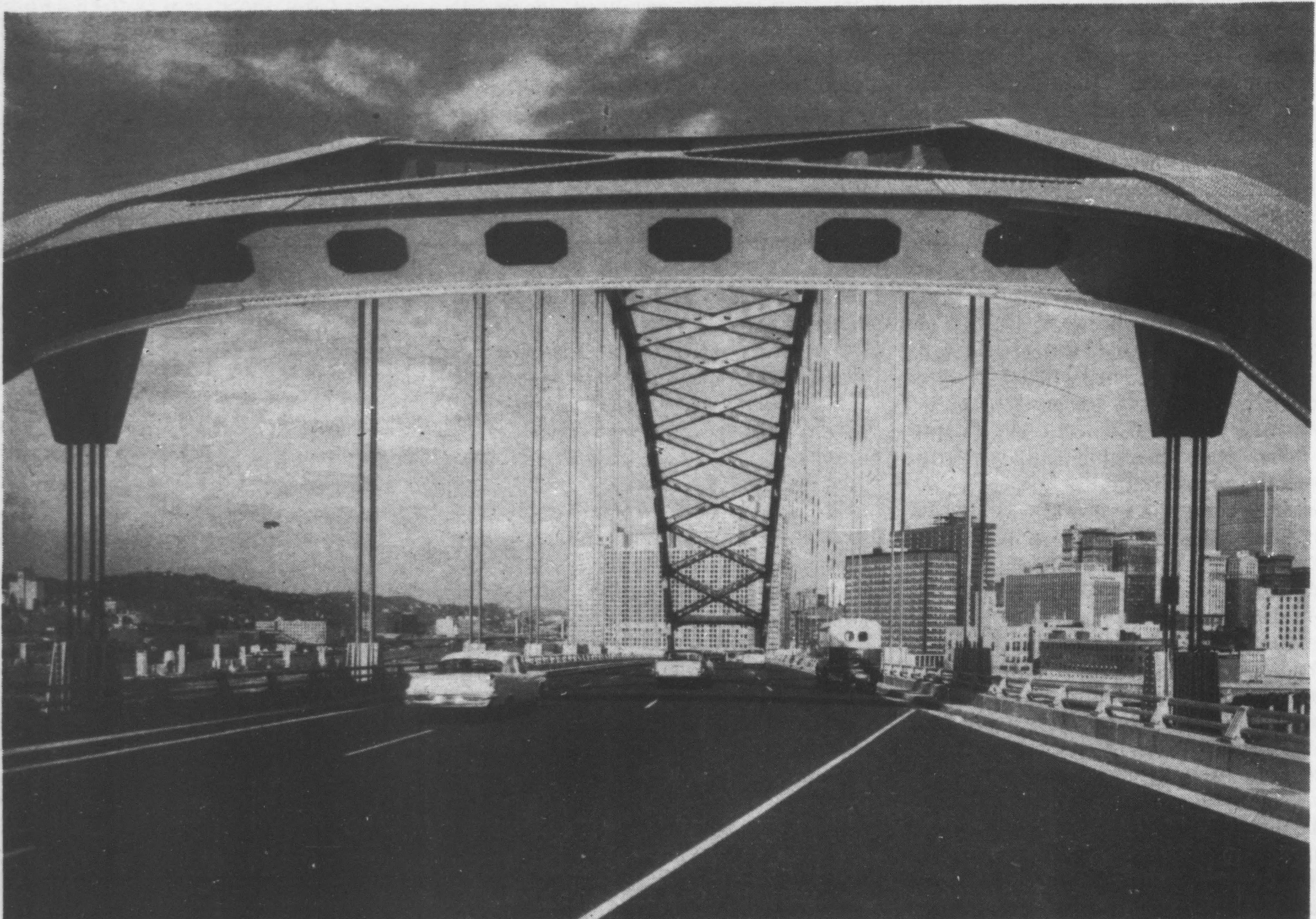


CIVIC AUDITORIUM will be surrounded by parks and shopping facilities. It is at the center of Lower Hill area, now cleared of slums.



New Fort Pitt Bridge will be connected to the Fort Duquesne Bridge, which will be built on the

To Move the Traffic: Novel New



Open appearance of Fort Pitt Bridge comes from widely spaced suspenders and diamond-shaped sway bracing.

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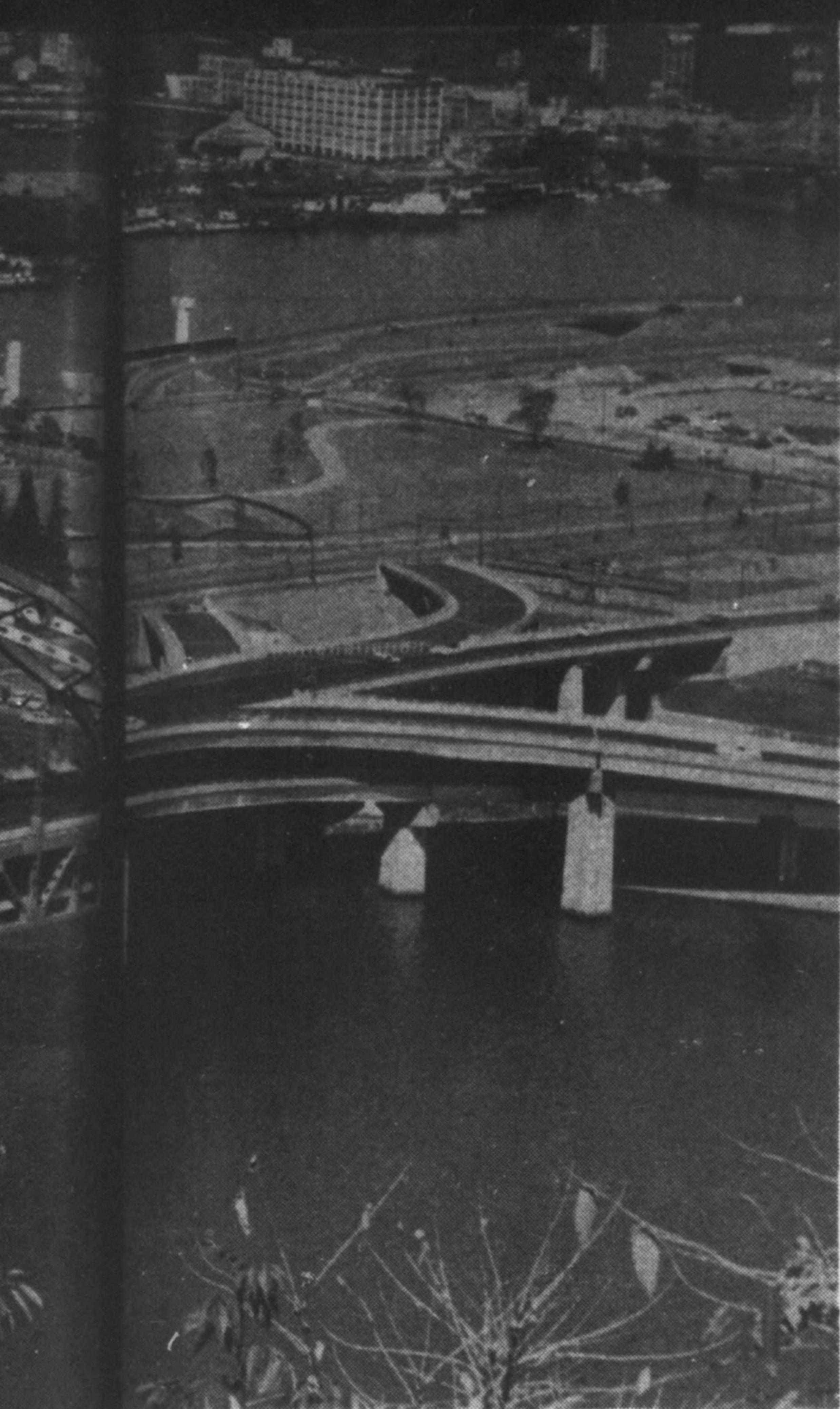
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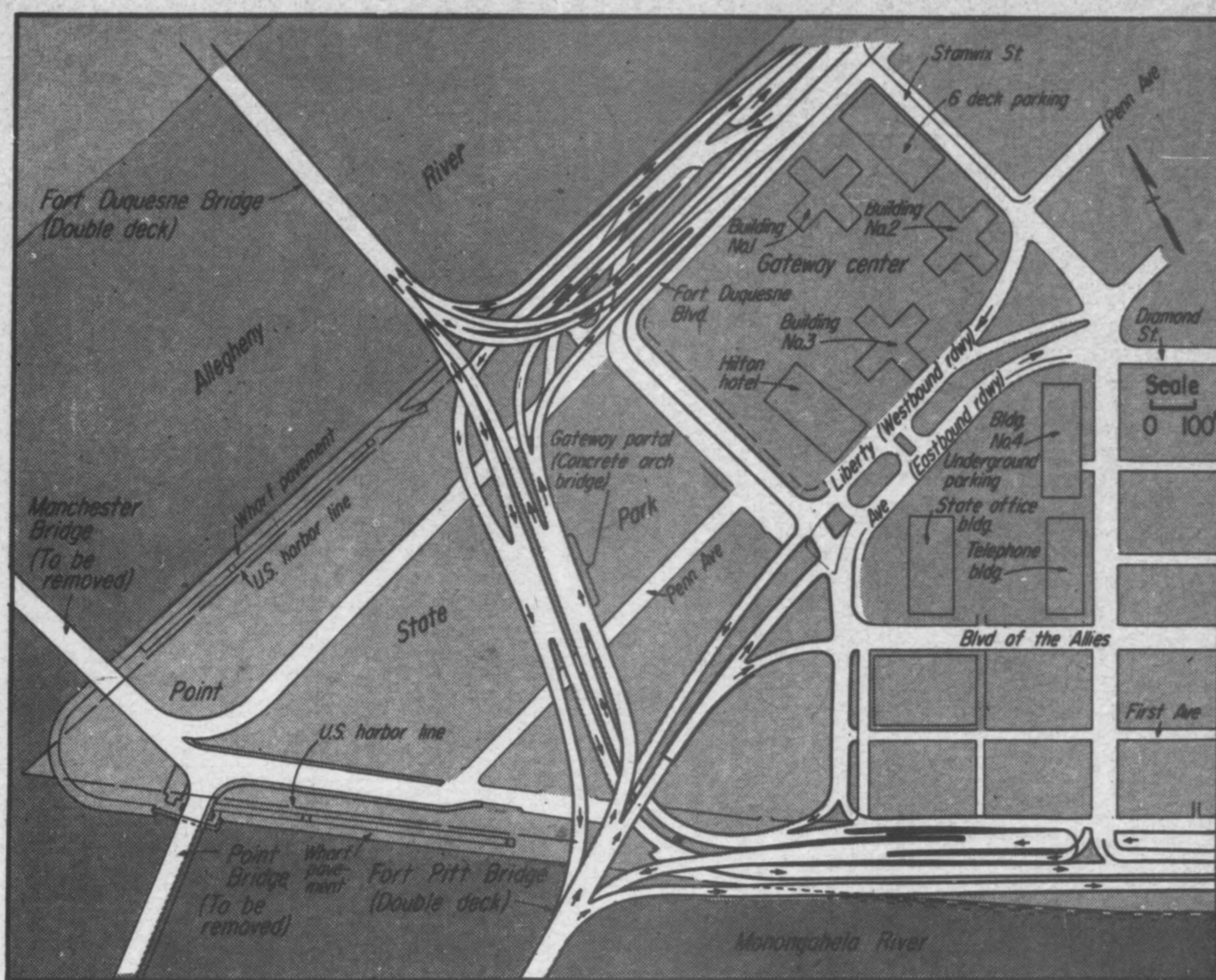
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concrete piers in background.



Traffic will flow on this criss-cross network of elevated roadways.

Bridges at the Point

Pittsburgh has traditionally been a leader in introducing bridges of new type or improved design. So it is not unexpected to find the city pioneering again in its current program of reconstruction.

Largest and most notable among the numerous bridges required to modernize the city's traffic arteries will be a trio at the Point where the Monongahela and Allegheny rivers converge. Efficient traffic handling here is a do-or-die proposition. Unless motor vehicles can get into, out of or through this restricted orifice with reasonable ease, every other city activity will suffer.

This trio of bridges consists of new crossings of the Allegheny and the Monongahela and an allied interchange structure to be located in the new Point State Park. They were designed by Richardson Gordon & Associates, of Pittsburgh, for the Pennsylvania Department of Highways.

The river bridges are tied steel arches and, for this type of structure, are unique in combining three unusual features: They are double deck, and they utilize box sections for the arch ribs and trusses for the ties.

The interchange structure, with a deck almost as wide as its span is long, will be a low-rise three-hinged reinforced concrete arch tied with prestressed members between abutments. The structure will also be unusual in

that its four arch ribs will be joined transversely in pairs by arched slabs, which will actually hide the ribs from view.

The result: From beneath, the bridge will suggest a series of narrow barrel arches side by side, or even a single wide barrel arch with a fluted surface. This unique architectural treatment is a joint effort, of the offices of Skidmore, Owings & Merrill of New York and Charles M. and Edward Stotz of Pittsburgh. It was planned to add a spectacular and pleasing note to a utilitarian highway structure, which will also be an arched gateway for pedestrians going from one side of the park to the other. Its official name is the Point Park Portal.

The two tied arch bridges are required to replace inadequate truss spans over the rivers. These old bridges practically converge at the Point, leaving no room under modern traffic conditions for a workable interchange. The new bridges, therefore, will be about 1,000 ft upstream from the structures they are replacing.

Both new bridges are of the same design, but the Fort Pitt Bridge over the Monongahela is considerably larger, having a span of 750 ft. It replaces the present Point Bridge built in 1926. The Fort Pitt Bridge has been in service since July.


Steel erection is just about to start

on the Fort Duquesne Bridge over the Allegheny. Foundations were completed this summer by the Dravo Corp. of Pittsburgh. It will have a span of only 423 ft but, like the Fort Pitt Bridge, it will provide for four lanes of traffic on each of two decks. It will replace the old Manchester Bridge, which dates back to 1914.

The Fort Pitt Bridge was made a tied arch instead of a truss largely for economy and better appearance. The choice, however, added greatly to the design complications, and might not have been possible, or at least **economically practicable**, before the days of electronic computers.

The work was carried out in two steps. First the structure was analyzed as indeterminate in the first degree by assuming that the arch rib would take no bending moment. But then, for the final design, analysis was based on the true condition—a structure indeterminate to the 15th degree, the unknowns being the arch thrust and the stresses in the fourteen suspenders. It was here that the electronic computer proved its value.

A few days' time was required for one man to prepare input data on cards for the fourteen sets of fifteen simultaneous equations that had to be solved. But after that the mechanical solution by computer was reached in two hours. Many other calculations were also car-



HUGE MEMBERS are required at ends of the Fort Pitt Bridge, where the arch ribs join the tie truss. End post of the truss is only about 30 ft long, but it weighs 118 tons.

ried out or checked on the computer in the course of the design.

The use of a tied arch of the type chosen aided materially in developing an efficient double deck arrangement, since the tie truss was deep enough to accommodate the floorbeams of both roadways and still provide a 14-ft 5-in. vertical clearance between. The trusses of the Fort Pitt Bridge are 25 ft deep center to center of chords, and they are hung 62 ft 6 in. apart on suspenders, each consisting of four 3 1/2-in.-dia wire ropes. The tie trusses also

serve effectively as a stiffening member of the arch bridge, since they distribute live loads almost evenly among the suspenders.

The floorbeams spanning between the trusses are 6-ft-deep plate girders and carry 52-ft-wide roadways made up of a 6 1/2-in. concrete slab and a 3-in. bituminous wearing surface. The upper deck roadway accommodates four lanes of inbound traffic, while four lanes of outbound traffic use the lower deck. (On the Fort Duquesne Bridge these locations of inbound and outbound

lanes will be reversed so that all traffic movements through the interchange can follow direct and natural paths.)

Since a tied arch is inherently light and open in appearance—a condition accentuated in this case by the use of a truss as the tie member—a basic tenet of the designers was to make all other elements of the bridge as light and open as possible. Thus suspenders are spaced 50 ft apart, instead of at every 25-ft panel point. Also, the upper lateral bracing system is so proportioned that no cross struts had to be used.

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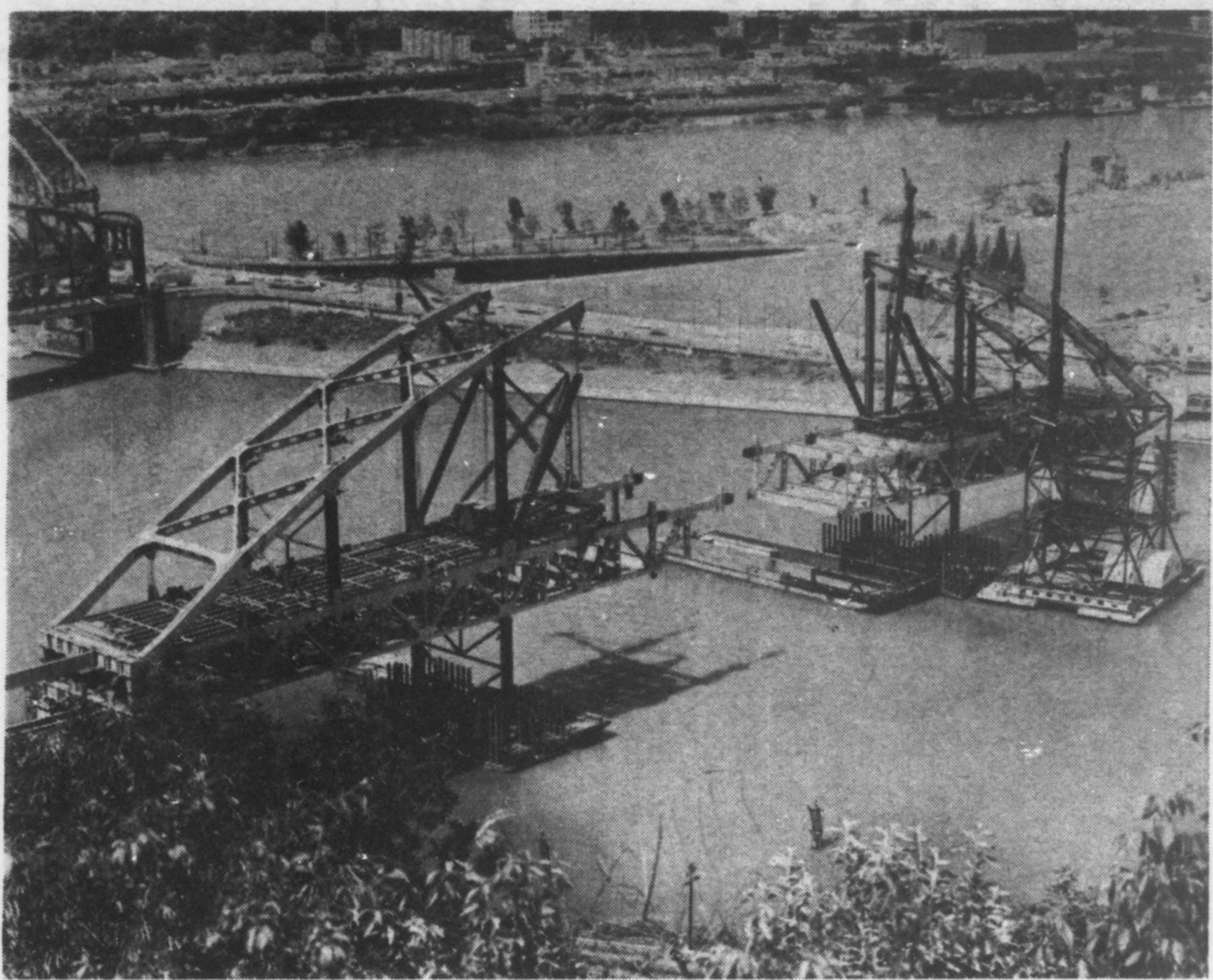
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IN ERECTING Fort Pitt Bridge, tie trusses and arch ribs are cantilevered together. For Fort Duquesne Bridge, trusses will be completed first, then arch ribs.

The result is a diamond shaped pattern.

In the interest of lightness, too, all main members of the bridge—arch ribs, truss chords and about half of the diagonals and verticals in the trusses—were fabricated in high strength structural steel.

In the original design, the engineers had also used high strength rivets, but these were changed to carbon steel at the request of the then chief engineer of the Pennsylvania highway department. This change, theoretically, increased the number of stress-carrying rivets nearly 50%, and actually required substantial increases in the size of many of the gusset plates. The result is that the bridge is some 300 tons heavier than it otherwise would have been. As built, the Fort Pitt Bridge contains 8,000 tons of steel—high strength, carbon and cast.

Some of the sections required for the main members of the Fort Pitt Bridge are of substantial size and unusual makeup (see drawings). That's because of the long span and the large live load (eight lanes of traffic).

The end panels of the arch ribs, for example, which are proportioned for a design load of 6,000 tons, require a sectional area of 746.5 sq in. The largest member in the bridge is the vertical end post of the truss. It weighs 118 tons. It has an area of almost 1,000 sq in. Its size is governed by the vertical reaction of the arch rib and the lateral wind forces, which must be carried by portal action to the piers.

Other elements of the bridge notable for size are the 22-in.-dia forged alloy steel pins that connect the arch ribs

to the truss tie, and the truss shoes on the piers. A steel casting 8 x 10 ft in plan and 4 ft 6 in. high is used to carry the 10-in.-dia pin of the shoe at the fixed end, while the expansion shoe includes a steel forging 8 x 10 x 2 ft 10 in. high set on top of its segmental rollers.

Several unusual design features characterize the Fort Pitt Bridge. One of these was the use of a modified H-20 S-16 live loading. Load concentrations and impact were ignored except for individual members in the floor system and for those vertical truss members governed by localized loads. Another design feature was to camber (shorten) the suspenders for a dead load stress 25 kips greater than that calculated. This induced stresses in the top and bottom chords of the truss of opposite sign to the stresses due to dead load moment carried by the truss. This made the indeterminate analysis of the structure converge quickly.

Because of the uniqueness of this bridge, a 1:100 steel model was built and tested before final design. The rib and truss sections of the model were made to conform to the sections determined in a preliminary design. An exact theoretical analysis of the model was then computed and compared with the experiment results. Very good correlation resulted. Another useful purpose of the model study was to confirm the existence of a sharp node on the otherwise curved influence lines for the wire rope suspenders.

The contracts for erecting both the Fort Pitt and the Fort Duquesne bridges were obtained by the American Bridge Division of the U.S. Steel Corp., and

it has elected to use a different method for each.

On the Fort Pitt Bridge, the entire structure of trusses and arch ribs was erected in one operation, working simultaneously from each end. Six falsework bents were required, three for each half, 50 ft, 100 ft and 200 ft out from the piers.

For the Fort Duquesne Bridge, the trusses will first be erected entirely across the river, advancing from one end only. They will also be erected in pre-assembled, four-panel sections, whereas the Fort Pitt trusses were assembled in place, member by member. Then in a second operation, the arch ribs will be built out from each end to a closure in the center. Only two falsework bents will be required on the Fort Duquesne Bridge, the first 94 ft out and the second 235 ft out from the pier where truss erection begins.

There is one other basic difference in the erection methods on the two bridges. For the Fort Pitt Bridge, the first 100 ft of bridge from each pier was erected by a floating derrick, after which deck travelers were installed to complete the erection (see photo). On the Fort Duquesne, the floating derrick will erect the entire bridge.

At the stage of Fort Pitt erection shown in the accompanying photo, the arch ribs being extended out from either end are supported by temporary columns at truss panel points 4 and 8. Note also that a diagonal member is being extended outward from the base of the column at panel point 8. When an additional section was added to this member it extended to the mid-point between panel points 10 and 12. Here it supported the next rib section directly and permitted cantilevering the following rib section, which adjoined the closing member of the arch. When it was time to install this latter member, the two deck travelers, which had erected the bridge from either end, picked it up together and lowered it into place from above.

Following this, the closing top chord members were placed, and closure effected by jacking the south half of the span horizontally (about 3 in.) with the aid of jacks at the south pier.

Jacks in the falsework bents (one of 1,250 tons capacity at each leg) were then lowered to permit the closing arch rib member to be connected. The jacks were then lowered further to free all the temporary members supporting the arch rib. After a further lowering of these jacks to release the falsework bents, erection was complete with the exception of the closing member at the center of the bottom chord of the truss. This closure was effected by jacking the two halves apart to permit inserting the member, and then releasing the jacks to make connections.

Pittsburgh Sprouts

At the tip of Pittsburgh's Golden Triangle there is now a glint of gold. You see it almost immediately when you enter the city from the airport. It's the new Hilton Hotel, one of many extraordinary buildings sparking the renaissance of the city's business center.

The hotel, just opened, is enclosed in spectacular panels of gold-anodized aluminum. Protruding slightly outward, they house the windows like picture frames, and the changing angle of the sun produces a variety of intriguing light and shadow effects on the angular surfaces.

When you can turn your eyes away, you soon become aware of other unusual buildings. For when Pittsburgh, as part of its redevelopment program, replaced obsolete, dilapidated or uneconomic structures in its business district, it did so with buildings that incorporate the latest concepts in architecture and structural, mechanical and electrical engineering.

Across the street from the Hilton is another startling structure. It's being enclosed with stainless steel and glass panels. This is the fourth and newest structure in Gateway Center, which is an office-building development sponsored by the Equitable Life Assurance Society of the United States.

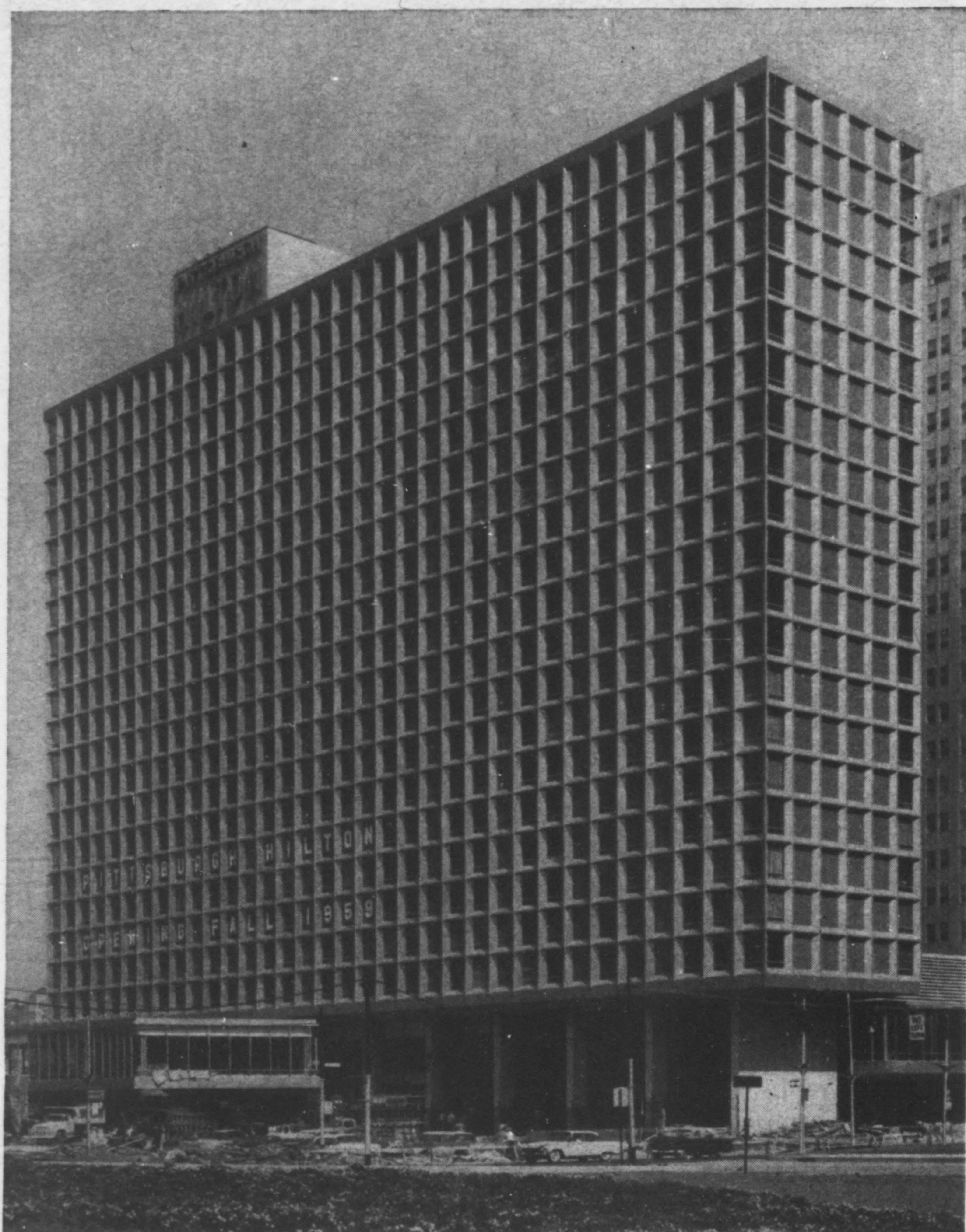
Nearby, a bright blue building draws your attention. It's the two-year-old, 16-story State Office Building—sheathed in blue anodized aluminum (ENR Feb. 21, 1957, p. 109). It is separated from Four Gateway Center by a park over a huge underground parking garage.

Behind it is the new 12-story Bell Telephone Building, with a facade of metal and glass. And then you will note the three other, cross-shaped, stainless-steel-paneled Gateway Center buildings.

Continuing deeper into the business center, you pass many older structures, not yet ready for the wrecker. Interspersed among them are new multi-story, ramp-type parking garages.

Finally you come to Mellon Square, which might be considered the center of gravity of the Golden Triangle. (The square itself is a park over another parking garage.) Towering above this oasis in the midst of skyscrapers are two striking buildings that also played a major role in Pittsburgh's renaissance—the U. S. Steel-Mellon Bank Building, the original Gateway Center buildings and the Alcoa Building in 1951 and 1952.

These buildings, though important in Pittsburgh's redevelopment, probably are at least equally significant worldwide because of their effect on archi-



Hilton Hotel—its gold color adds glamor to Pittsburgh's Point.

tecture and engineering. They bolstered the postwar trend to thin walls for tall buildings and to air conditioning. And you find in them the latest concepts in structural engineering, in electrical distribution and in lighting for skyscrapers.

The trend to thin walls appears to have received its greatest impetus from the erection of the U. S. Steel-Mellon Bank Building, the original Gateway Center buildings and the Alcoa Building in 1951 and 1952.

The 41-story U. S. Steel-Mellon Bank Building hardly classifies as a thin-wall structure, since its walls have a thick backup. Nevertheless, its metal exterior attracted worldwide attention and aroused interest in this type of construction. The facade consists of stainless steel panels placed in vertical strips between narrow limestone-faced piers extending the full height of the building. Behind these panels are an air

space and an 8-in. brick backup. Each story-high panel incorporates both a window and a spandrel (ENR Feb. 22, 1951, p. 40). Earlier metal facades had independent spandrels.

For the first three office buildings, in Gateway Center, a stainless steel facing and precast lightweight-concrete backup were preassembled for installation as a complete wall unit (ENR April 24, 1952, p. 67). This project established the practicability of combining facing and backup for a tall building into a single, prefabricated unit. Total thickness of some panels is only 4½ in., compared with the 10 to 13 in. previously used for masonry walls.

The 30-story Alcoa Building was enclosed with story-high panels made of ½-in.-thick stamped aluminum sheets, each incorporating a 4-ft-high window (ENR April 3, 1952, p. 67). Behind the facade is a 1½-in. air space and a

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New Ideas In Thin-Wall Buildings



Four Gateway Center—more offices in stainless steel and glass.

backup of perlite concrete only 4 in. thick. Total weight of this wall is 40 psf, about one-third that of conventional masonry walls of that time. It probably was the lightest ever used for a tall building until then.

The vertically pivoted windows were an innovation. They are double glazed for insulation, and a rubber gasket around each is inflated to 22 psi to make them watertight.

After the construction of these buildings, thin, light-wall skyscrapers were erected in many cities.

Gold-Colored Hotel

The brand new Hilton Hotel continues the trend to thin-wall buildings. The backup used behind its story-high, gold-anodized aluminum walls is only 1½ in. of insulation and 1 in. of plaster.

The \$15-million building is com-

prised of a 22-story tower and a three-story base 200 x 275 ft. The base incorporates a 120x50-ft dining room with curved exterior, as well as the lobby and usual main-floor hotel facilities. The tower is long and narrow—283x51 ft—and contains 812 rooms.

Near one end is a projecting service core with five passenger elevators, three service elevators and one automobile lift to the ballroom level (second floor). Unlike the rest of the tower, this portion is enclosed in light-colored brick and concrete.

The building is of flat-plate concrete construction, except around the 160x120-ft ballroom. There, steel plate girders span 120 ft across the room at 25-ft intervals between steel columns.

Floors in the 51-ft-wide tower are supported on only two rows of reinforced concrete tied columns. The rows are about 28 ft apart, and the

spacing of the columns in each row is 25 ft.

Floors and roof cantilever 11 ft 8 in. past the columns on the long sides of the building and 16 ft beyond at the ends. The floors are 9 in. thick, except for the 16-ft cantilevers, which are 9½ in. thick.

Columns are thin and wide, so as not to take too much space from the rooms. They range in thickness (parallel to the long axis of the building) from 14 in. at the top of the tower to 30 in. at the bottom. Width is 52 in. up to the seventh floor, 48 in. above. To take wind loads, transverse shear walls were built between the pair of columns at each end of the tower.

Within this arrangement of structural members, the architect placed a central corridor along the long axis of the tower. On either side of the corridor he generally laid out two rooms in the 25-ft space between columns. And he set the bathrooms for adjacent rooms back to back so the plumbing shares a common space.

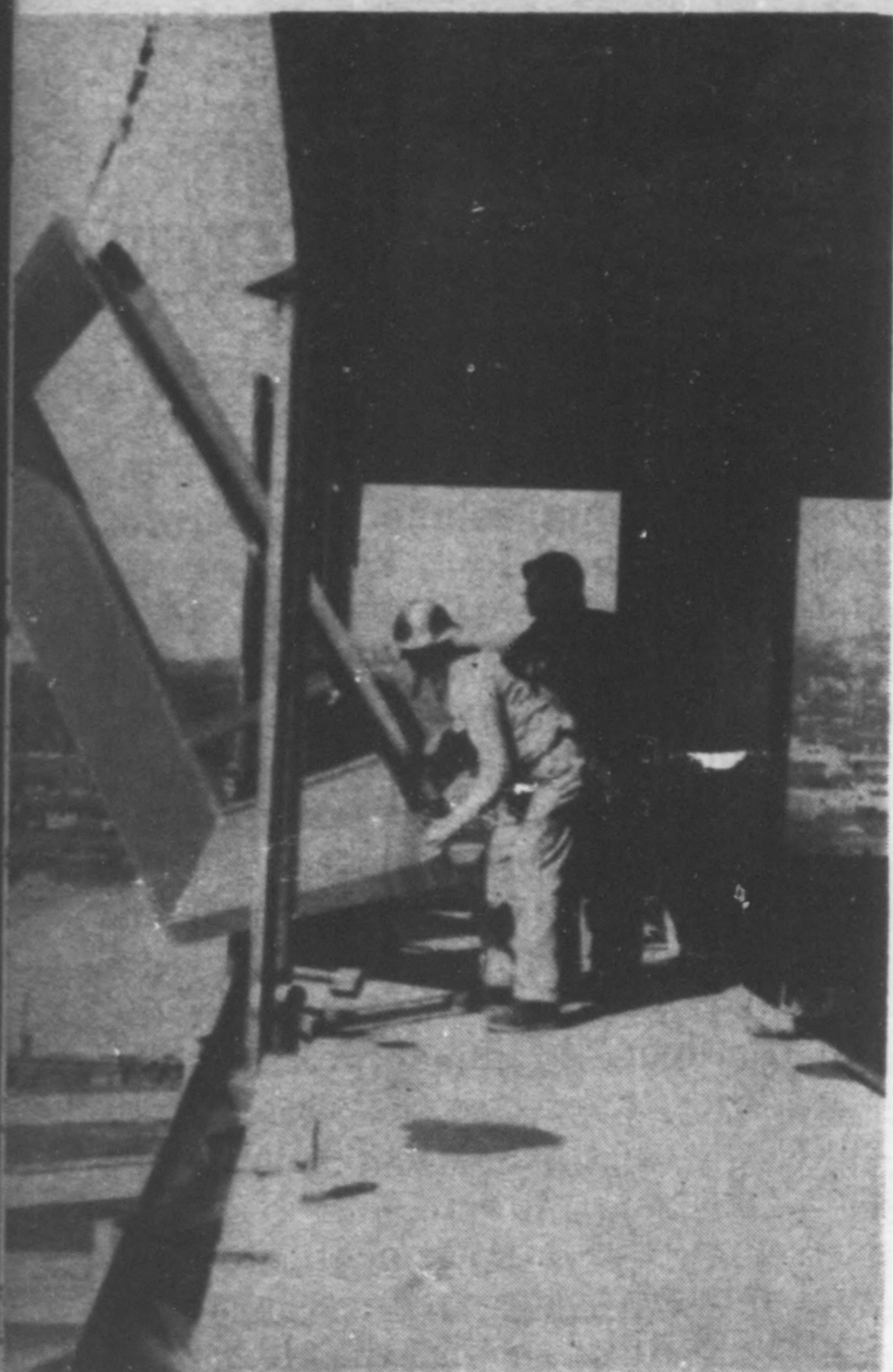
(One minor, though noteworthy innovation: Soapdish tiles are not recessed. Reason: to avoid leakage that sometimes occurs with recessed tiles.)

The floors of the 22-story tower are almost all alike, so the contractor was able to standardize his operations to speed the work and re-use his forms several times. He averaged about one floor per week. Best speed was a floor every three days while good weather prevailed.

To eliminate the forest of shores normally used to support forms in this type of construction, the contractor carried them on expandable-length beams at 4-ft intervals. He needed only 4x4-in. timber shores about 25 ft apart to support these beams. The beams, in turn, carried 3x4-in. wood joists, 2 ft c-c, atop which were the ½-in. plywood forms.

The flat-plate floors are made of 3,000-psi lightweight concrete with expanded-clay aggregate. Columns up to the 13th floor are 3,750-psi stone-aggregate concrete; those above, 3,000-psi concrete. Shear and core walls are 3,750-psi concrete. The underside of each floor was ground smooth mechanically, sprayed with a bonding agent and plastered.

Some unusual concrete work was required for the floor of the dining room. The 120-ft-long slab of this curved wing, which is at the level of the second floor of the tower, is supported on only two concrete columns, 70 ft apart. A reinforced concrete girder, 10 ft wide and 5 ft deep, spans between these columns



Gold-colored panel of aluminum has inward-sloping sides, gives picture-frame effect to hotel windows.

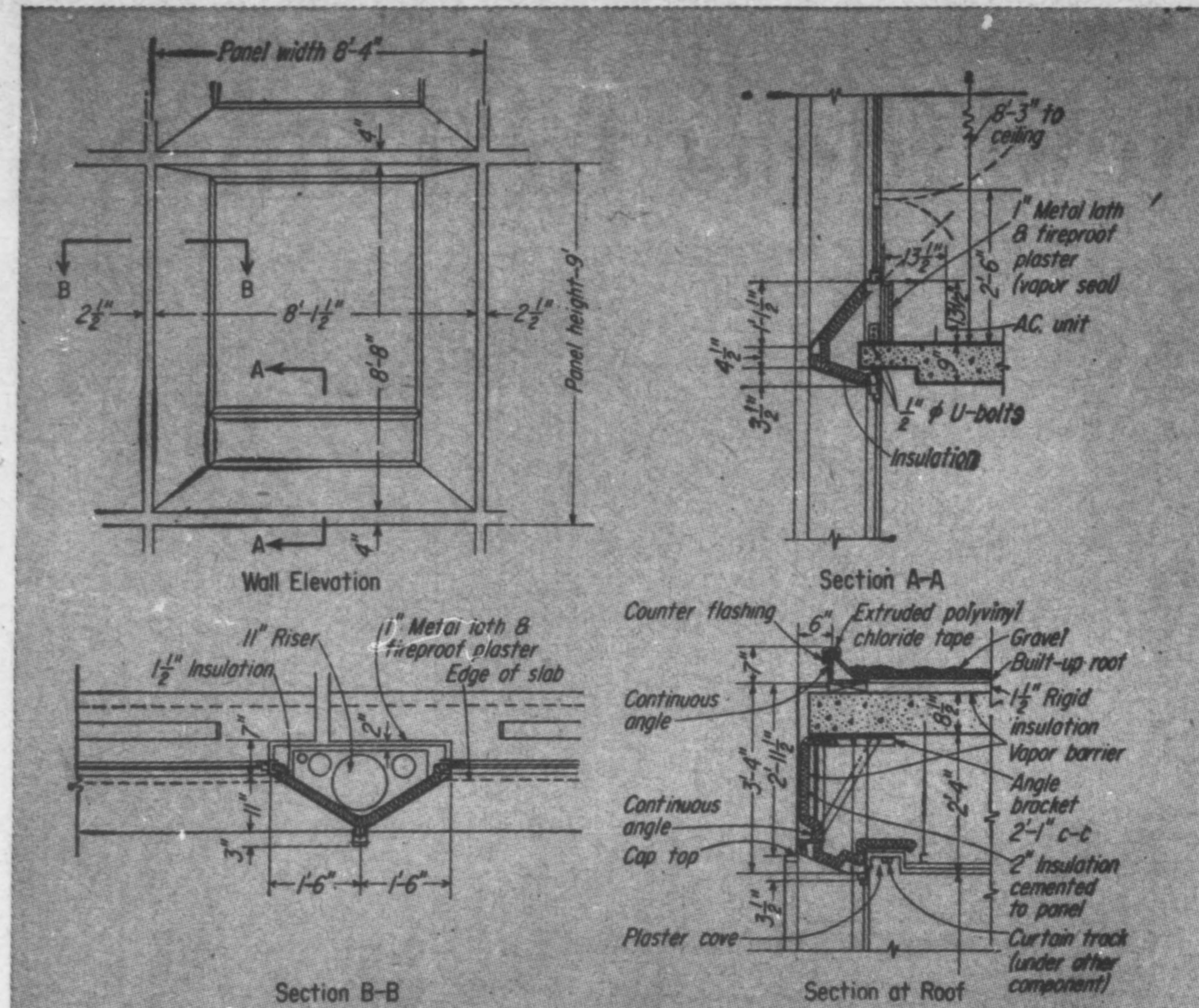
and cantilevers 25 ft beyond at both ends. (Cantilever reinforcing: 40 No. 11 bars in two layers.) The girder supports beams transverse to it that carry the concrete floor. These beams, spaced 20 ft c-c, cantilever 25 ft from both sides of the girder.

In preparation for receiving the panels on the tower exterior, U-shaped steel plates were placed at intervals along the perimeter of the floors and roof. These plates fit around the floor edge and were anchored in the concrete with U-bolts. Their locations were determined by measurements from column grid lines at each level. Threaded studs were shot with a powder-actuated tool into the steel plates at top and bottom of the slab for bolting on panels.

The story-high panels were lifted directly from a delivery truck and hoisted to the various floors for stockpiling near the point of installation. The panels are 9 ft high by 8 ft 4 in. wide, three being used per bay. Two out of three incorporate the frame for a floor-to-ceiling window within the inward sloping aluminum sides that create the picture-window effect. (Provision was made behind it for a 13-in.-high heating-cooling unit on the floor.)

Every third window on the long sides is opaque. Located at partitions, these windows hold a pane of gray ceramic enameled glass, and are backed up with $1\frac{1}{2}$ in. of glass-fiber insulation and 1 in. of plaster on metal lath. In this way, the architect was able to have a uniform facade and yet provide wall space in each room.

The panels were set in place by men working from the inside of the tower



They were aided by a small manually operated hoist on a floor above. Mullions, which were bolted to the floor plates, had been fastened to the back of the panels in the factory.

The panels had a lap fit at top and bottom. Vertical edges later were covered with a U-shaped metal sheet, with a neoprene gasket for watertightness.

The sloping vertical sides of the panels provide a prismatic space that is put to good use. Air supply, steam lines and chilled-water pipes for heating and cooling are fitted into these triangular pockets between panels and feed the under-window units from there. Also in these spaces are plastic pipes about 1 in. in diameter that carry condensate to a drain in the basement.

William B. Tabler is the architect, with David P. Dann in charge of the project and John Bungen as field engineer. Seelye, Stevenson, Value & Knecht are the consulting structural engineers, and Jaros, Baum and Bolles, the consulting mechanical engineers.

Turner Construction Co. is the general contractor with H. V. Debo as project manager and Paul Starr as project superintendent. All are New York City firms. Flour City Ornamental Iron Co., Minneapolis, fabricated the 1,496 gold-anodized panels.

Gray Office Building

The newest Gateway Center building, also follows the trend to thin-wall buildings, though its facade differs from those of the other metal-covered Pittsburgh buildings.

Its tower is enclosed with glass, the

panes set in slender stainless steel framing. The windowless service core, however, is completely faced with stainless steel.

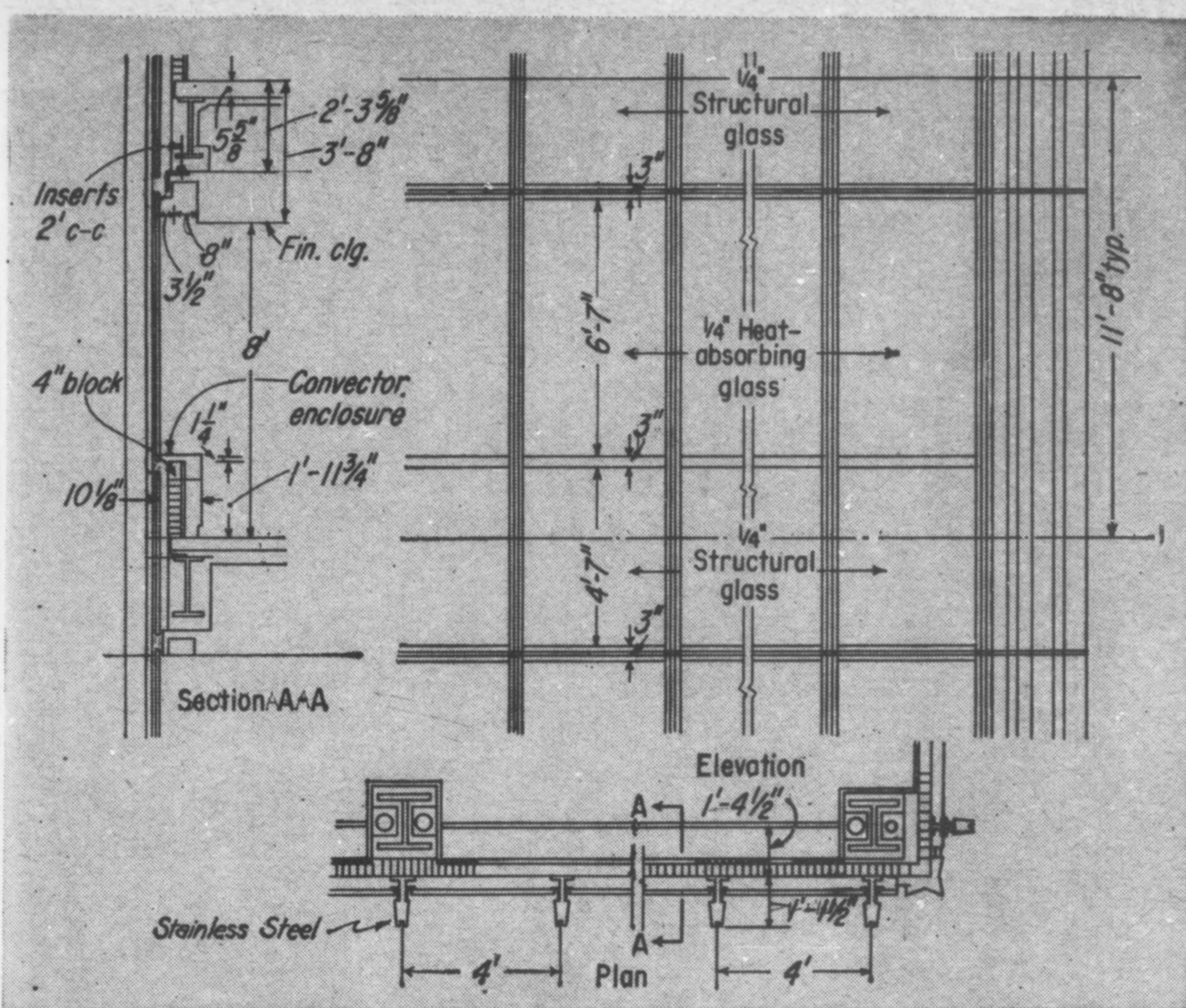
Four Gateway Center contains 400,000 sq ft of floor area. The \$16-million structure is 22 stories high, plus two mechanical penthouses. Its tower is 267x63 ft in plan, and the service core, projecting out near the center of the tower, is irregularly shaped, roughly 74x35 ft. It contains twelve elevators, six high-rise (12th floor up) and six low-rise (up to 12th floor) and a stairway.

There is another stairway in the tower and an electric stairway between basement and first floor. The basement has a connection to the three-level garage under the adjoining park.

The building has a structural steel frame with bolted connections, the narrow tower being supported by three rows of columns. Columns in each row are spaced 24 ft, and the rows 24 and 36 ft apart. Girders are mostly 24 WF, and beams, spaced 8 ft c-c, usually 16WF. Floors are cellular steel decking topped with $2\frac{1}{2}$ in. of stone aggregate concrete, for a total thickness of $5\frac{1}{2}$ in. Floor-to-floor height is 11 ft 8 in.

Another departure from its steel-framed predecessors is the use of sprayed-on fireproofing on the under side of floor deck and on beams and girders. Later, an acoustic ceiling with recessed fixtures was suspended below, 8 ft above the floor.

The first step in this fireproofing operation was to spray the metal with a latex-type adhesive, to insure proper bond of fireproofing material to the



Stainless steel mullions, fastened to zinc-coated steel framing, accent vertical in Gateway building.

steel. This was done with a conventional paint sprayer.

Then, with special equipment, the men sprayed over the metal a mill-mixed formulation of asbestos and mineral fibers and organic binders. (A thickness of $\frac{1}{8}$ in. on cellular deck has been given a three-hour fire rating; of $1\frac{1}{8}$ in. on steel beams, a three-hour rating; and of $2\frac{1}{8}$ in. on steel girders, a four-hour rating.)

Finally, the fireproofing was tamped by hand to desired thickness and density (about $\frac{1}{2}$ lb per cu ft) and a sealer coat was sprayed on with a conventional paint sprayer. The object of the overspray is to improve internal and surface bonding characteristics and eliminate dusting.

Adhesive and fiber was sprayed from staging by a four-man crew; the sealer was applied from the floor. Four crews, each with their own spraying machines, were used for this building. With two machines per floor, they covered one complete level in $4\frac{1}{2}$ to 5 days.

Columns were fireproofed with concrete. Chases were left in the exterior columns for the water risers of the air-conditioning units around the periphery of the building.

Air lines are located along the edges of the building at about the middle of each bay. They feed under-window units of the induction type. Mechanical rooms are located in the basement and penthouses.

Chilled water for air conditioning is piped in from a central plant across the street in Three Gateway Center. Domestic water is also supplied from tanks atop that building. Steam for heating

is purchased from Allegheny Steam Corp.

To hold the glass facade to the structural frame of the tower, 9-ga galvanized steel verticals, painted with zinc chromate for additional corrosion protection, were bolted to the exterior at 4-ft intervals. Then, stainless steel mullions and muntins were mounted on these supports with galvanized clips and stainless steel bolts. The mullions project $8\frac{1}{2}$ in. in front of the muntins to give the facade a vertical accent.

Structural glass panels, 4 ft 7 in. high and $\frac{1}{2}$ in. thick, were installed as spandrels. They are charcoal gray with a tint of green, to give them the same color in daylight as the windows. The windows, 6 ft 7 in. high, are $\frac{1}{2}$ -in.-thick heat-absorbing, glare-reducing glass.

Behind the spandrel panels is a 2-ft-high backup wall made of 4-in. thick concrete block. Under-window heating and cooling units are set against this wall.

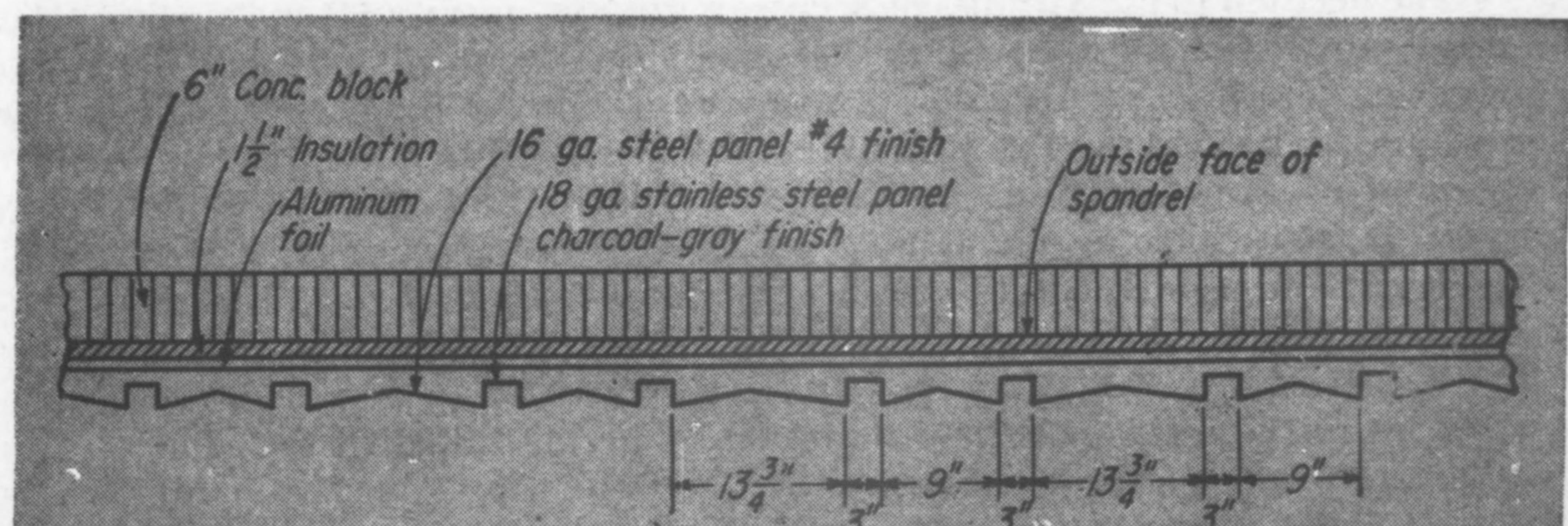
The stainless steel panels that face the service core also accent the vertical. Made of 16-ga metal and installed in

story-height lengths, the panels are fluted and of different widths. Wide portions have the natural color of stainless steel, but 3-in.-wide vertical recesses at frequent intervals were colored charcoal gray by the Stoner Mudge process. The panels are bolted to continuous, galvanized steel hat sections bracketed on 3-ft centers to the steel spandrel beams.

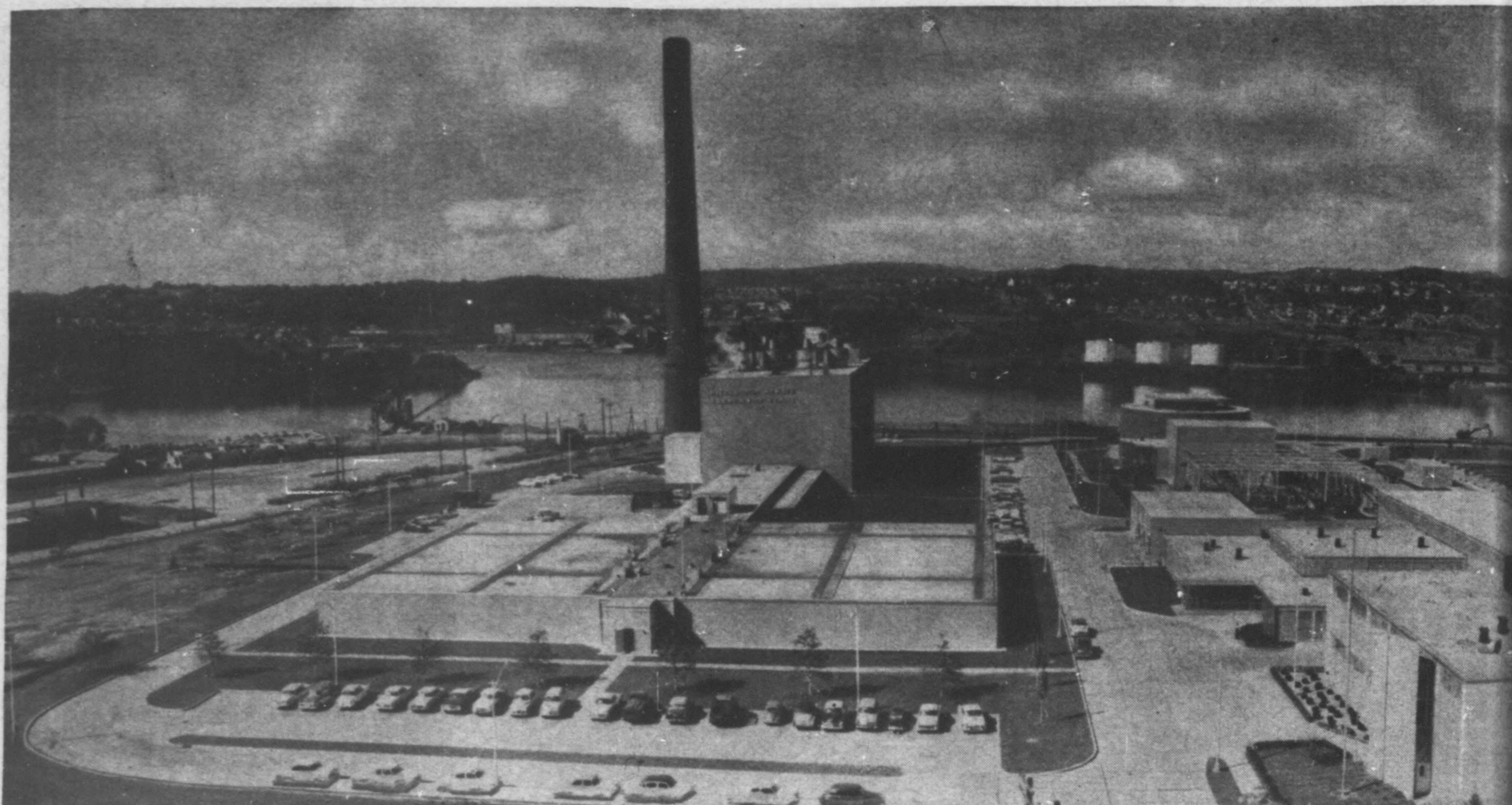
Behind the metal facade are $1\frac{1}{2}$ in. of foil-faced glass-fiber (6-lb density) and a 6-in.-thick concrete-block backup.

Harrison & Abramovitz are the architects, with J. A. Kingsland in charge. Edwards & Hjorth are the structural engineers, and Meyer, Strong and Jones, the mechanical and electrical engineers. All are New York City firms.

George A. Fuller Co., New York City, is the general contractor, the work being carried out under R. J. Nolan, Pittsburgh manager, and Douglas A. Pyle, project manager. Columbia Acoustics and Fireproofing Co. applied the sprayed-on fireproofing. The stainless steel curtain wall was fabricated and erected by Limbach Co., Pittsburgh.



Service-core facade also is colored to emphasize verticality.



It's not only the nation's newest of its size. This plant is the only one of its type.

How Imagination Created Unique

The same sort of bold thinking that brought about Pittsburgh's renaissance produced for the city and its environs a sewage disposal system that is unique.

Combined imaginations of the Allegheny County Sanitary Authority's engineers, its consulting firm and its architects have evolved financing, a design, construction techniques and a finished plant that are all without parallel.

The result is a radically new and architecturally colorful treatment works at the end of a 70-mile interceptor system. It serves 69 communities and Pittsburgh.

Research and development were the essentials to bridge the often unclosed gap between imaginative thinking and finished project. Applied research and development of process and products preceded design and construction to bring many novel features at a net saving in total costs. Among them:

- The decision to use 33 miles of deep tunnels—instead of added length of shallower lines—in the interceptor system presented unknowns in the hydraulics of dropping sewage vertically as much as 170 ft from collector to interceptor. Studies at Carnegie Institute of Technology established shaft inlet characteristics best suited to the task.

- The decision to concentrate sludge by flotation sufficiently to incinerate it raw—rather than digest it first—came only after extensive laboratory work

and pilot plant operation to check out the untried Laboon process.

- The decision to line tunnels with reinforced concrete pressure pipe, instead of cast-in-place concrete, followed accelerated erosion tests to prove that 7,000-psi concrete might afford the pipe a 100-year life as sewer lining.

Research also played an important part in other developments:

- The treatment plant's outstanding structure—a circular pumping plant in which five (eventually six) 60-mgd pumps are spaced in an annular ring outside a 40-ft ID wet well, 120 ft deep.

- Selection of glazed brick in four bright, matched colors for the architectural treatment of plant structure exteriors, which was handled by architects Celli-Flynn, of McKeesport, Pa.

- Installation of a telemetering system by which flows at 10 strategic points along the interceptors are reported to operators continuously. This enables them to anticipate arrival of storm flows at the plant and draw down the wet well to accommodate them.

- Establishment of ordinances to protect the finished system from troublesome waste discharges and to establish charges to assure the revenues needed to pay off a \$100-million bond issue.

The big thinking, the kind of thinking that has sparked the public's imagination and thus assured the public's support in all of Pittsburgh's efforts to

rebuild itself, began for Pittsburgh in this area of water pollution control over a decade ago with the Allegheny County Sanitary Authority and the naming of John F. Laboon (see ENR Oct. 1, p. 67) as its chairman.

As with the entire Pittsburgh renaissance, the first big effort was public relations. From a public educated to the needs came support; with public support came official cooperation; and with official acceptance came financing.

It wasn't easy, of course. Convincing 70 separate communities to participate in the project was a tough job. Only a long, hard selling job by the authority, backed to the fullest by enthusiastic Pittsburgh and county administrations, brought surrounding communities to join with the city in the project. The surrounding communities did not have to put up any funds—Pittsburgh loaned the authority \$2 million to get started. There was a \$505,000 grant-in-aid made by the state, which pioneered state aid to municipalities for sewage works planning.

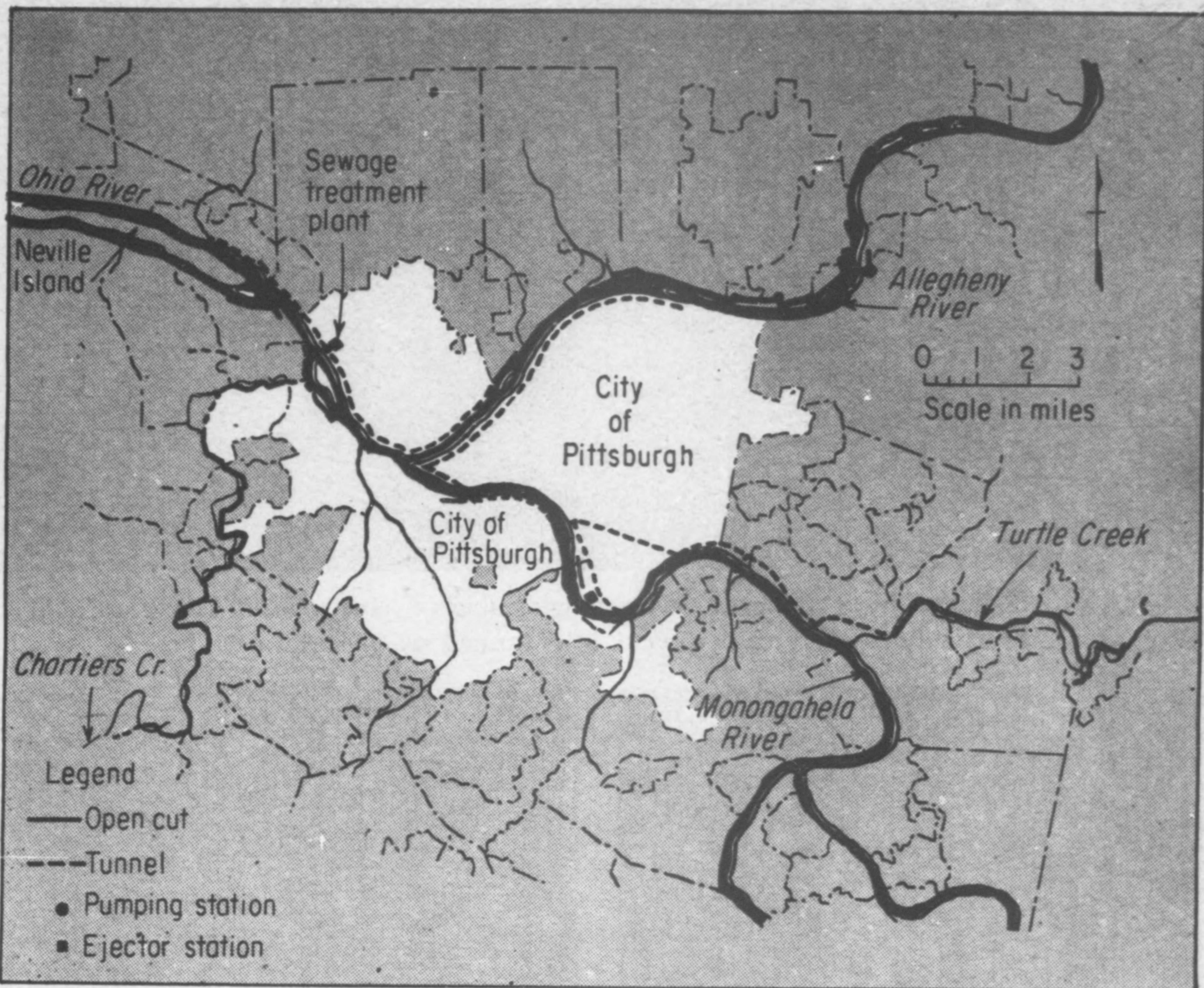
In October 1955, the authority finally got its construction money, and in a big way—an unprecedented \$100-million bank loan from a group of 25 banks headed by Pittsburgh's Mellon National Bank & Trust Co. Terms: 2½% for secured funds (invested in federal government securities) and 2¾% for unsecured funds for a maximum of

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But research some Pro negie 165 sh have interc the i Mode flow b inlet flow strong 1953,

ENGIN



It drains rugged terrain in Pittsburgh, 69 other communities.

Sewage Works for Pittsburgh

four years during which the authority could decide when to sell the revenue bonds that would provide the long-term financing. The loan made it possible for the authority to advertise construction contracts worth \$80 million (\$20 million was earmarked for interest charges, repayment of loans, engineering and administration, legal fees, and rights-of-way). Meanwhile, the borrowed money was reinvested in short-term government securities with a matching and generally better interest rate, earning money for the authority while idle.

The money wasn't idle long. Thirty-three contracts totaling \$79.6 million were awarded to 20 contractors in January 1956, and in May the first \$25 million worth of revenue bonds were sold (at 3.35%) to finance the first construction.

But before construction came the research and development. Here's how some of it was done.

Prof. L. M. Laushey, then at Carnegie Tech in Pittsburgh, studied the 165 shafts through which sewage would have to drop vertically to the deep interceptors in tunnels and cuts beneath the industrial city and its suburbs. Model studies showed sewage would flow best down the shafts from circular inlet tanks into which sewer lateral flow entered tangentially to form a strong, smooth vortex (ENR Mar. 5, 1953, p. 38). Precise shaft-to-tank re-

lationships and tank entrance dimensions were then recommended to the designers.

Model studies were also used to check design of the system's 250 diversion structures that connect the ends of intercepted sewers with the top of downshafts. These structures were built along the river banks throughout the project's 205-sq-mi area. They now divert all dry weather flow and storm flow up to 250% of dry weather flow down the shafts and into the deep interceptor sewers. When storm flows exceed 250% of dry weather flow, the excess is discharged to the rivers through tide gates designed to open under pressure from within.

The authority's greatest research project of all, of course, was Chief Engineer John Laboon's untiring efforts to prove out his sludge concentration theories—to come up with a process short of digestion to dispose of the sludge from a 150-mgd primary treatment plant.

It amounted to years of investigation. Mr. Laboon noted how heated sludge, starting to digest, would float into quite a compact mass on a relatively clear fluid, which he calls a subnatant, after about five days in a tank. Why go on with the digestion process and tie up that tank for 30 days or more, he asked. Why not drain the subnatant from under the floating sludge and send the

concentrated remainder to an incinerator to be burned along with pulverized coal?

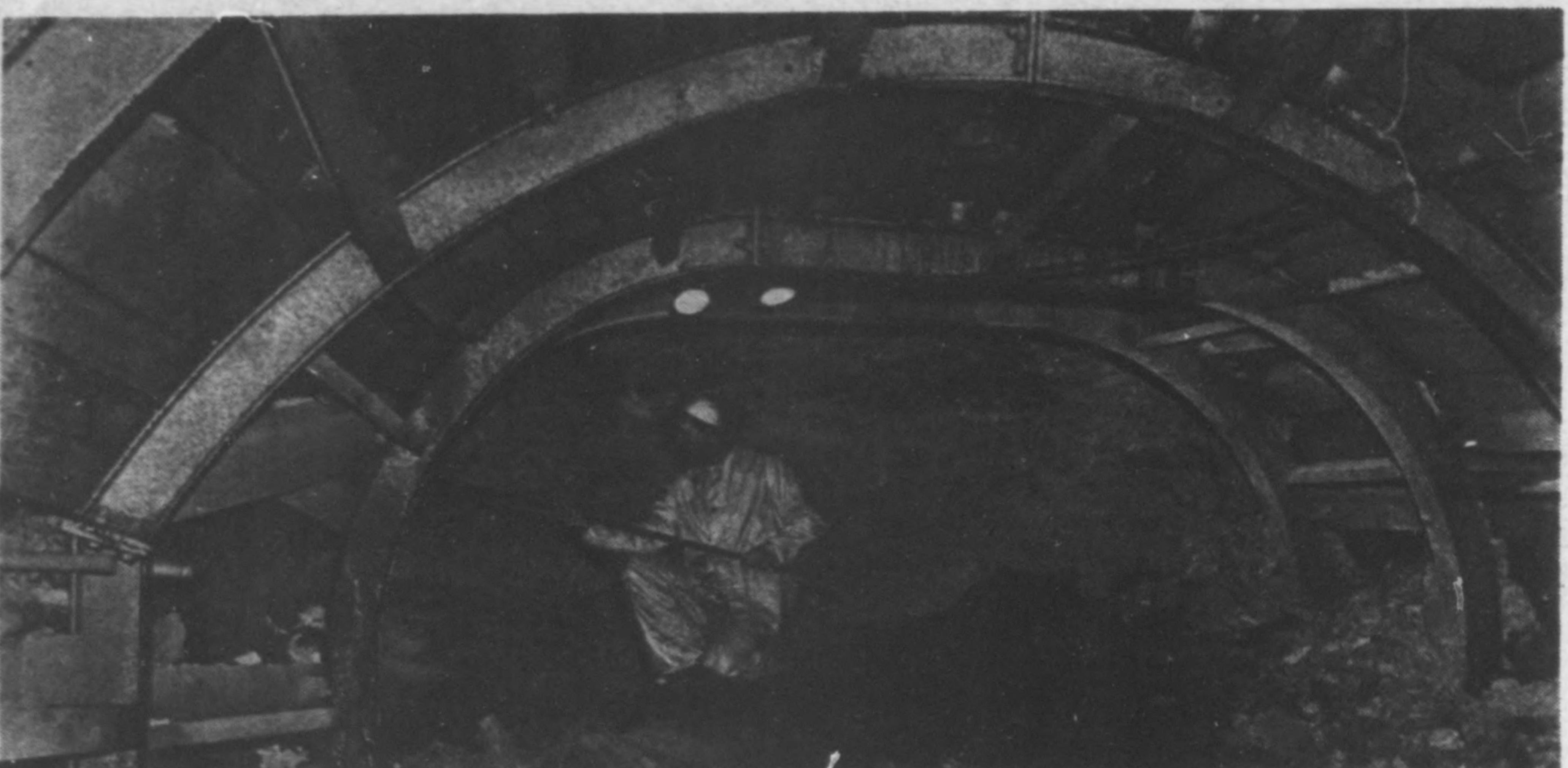
First, he had to see what concentration the sludge flotation would produce; next, how to move sludge of that concentration to an incinerator.

Laboratory work was done first at test-tube scale, and redone to the satisfaction of the authority's research staff. Then John Laboon took over a small frame building within U. S. Steel's nearby Homestead works and set up a crude, but adequate, pilot plant for primary treatment and aeration. Taking sewage from a sewer that discharged Homestead's sewage across the steel mill's property, he set up tall, slim tanks of a practical (13 ft) depth and kept them heated to 95 F while watching primary sludge concentrate in them through transparent plastic walls (ENR Oct. 11, 1951, p. 30).

It worked well. The sludge concentrated readily to 20% solids. Virtually all the solids were floated to a relatively compact 2- to 3-ft thickness on top of a clear subnatant within five days.

How to move it? Screw conveyors would work; conventional pumps would not. A progressing cavity pump (Moyno, by name) was tried, and it worked. In this type pump a helical rotor turns within the double-helical interior of a cylindrical stator. It's

From rugged construction . . .



SEWAGE TUNNELS included some very rough going in hard rock, in coal and in filled ground. High strength concrete pipe went into tunnels as precast liner.



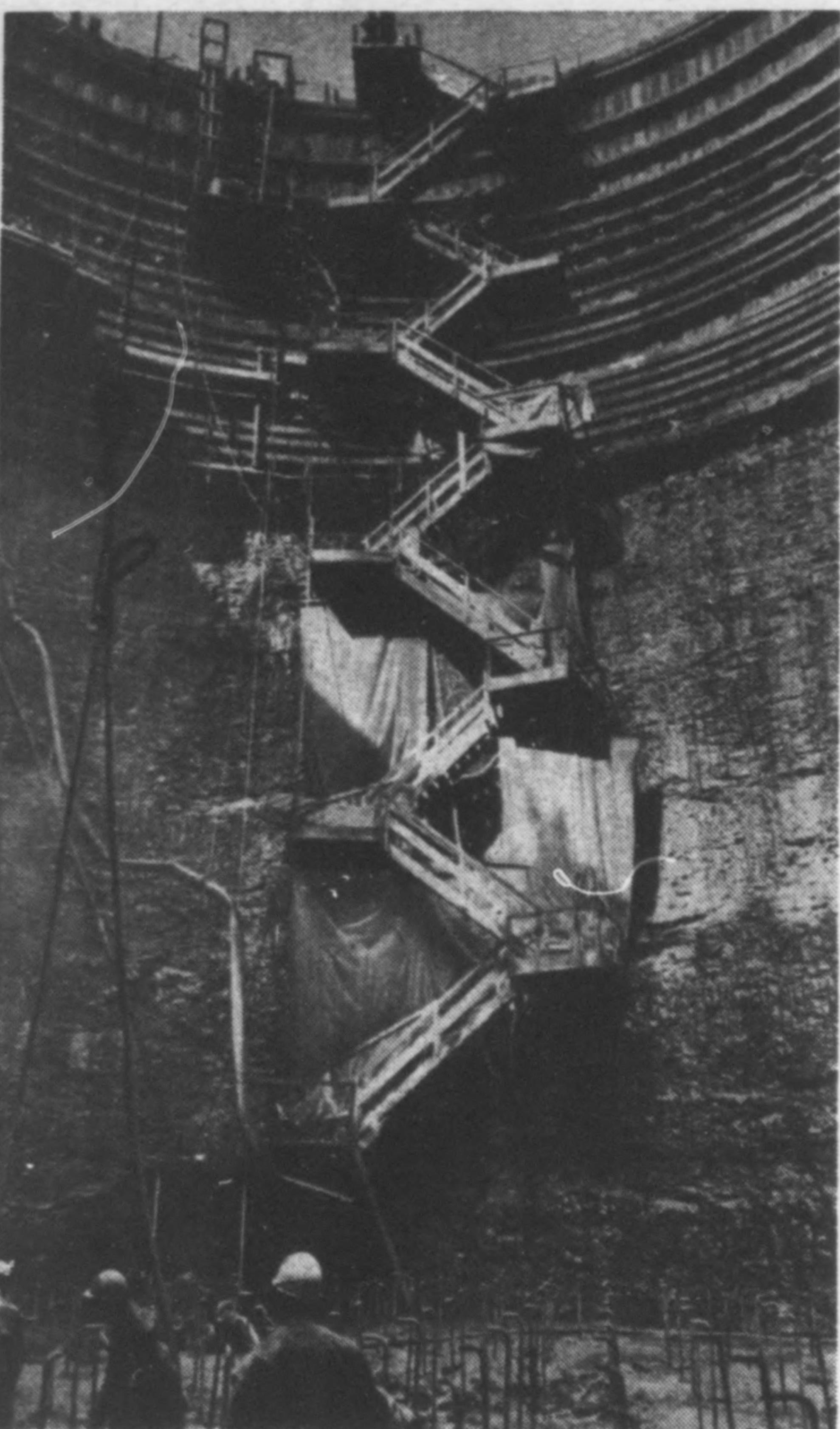
OPEN CUTS were sometimes in streambeds as lines cut through developed areas.

a self-priming, positive displacement device that will move all sorts of dense fluids or plastic solids. As its rotor turns, it moves the material along between rotor and stator. It tends to homogenize the material it moves.

John Laboon was assured through his pilot plant that he could concentrate primary sludge in deep tanks to 20% solids; that he could pump this relatively solid material; and he figured he could burn it. His research gave him a whole year's records on the concentrations and volatiles achievable.

This put the problem of designing a full-scale plant squarely up to the authority's consultants, Metcalf & Eddy. And the Boston firm was every bit up to the challenge.

The late Frank Flood, M&E partner, set wholeheartedly about the task and



END OF LINE was excavation for novel circular pumping plant at the sewage works.

by late 1953 designs for the structures and the hydraulics of the Laboon process—plant scale—were ready.

What came off the drawing boards was new—like nothing Metcalf & Eddy had ever done before. Alongside a conventional primary treatment plant, they had designed a closed system for sludge handling—heating, concentration and burning—based on concentration to an average of 18% solids.

The dollar saving over construction of sludge digesters and filters for dewatering digested sludge has been estimated by the authority at close to \$2.5 million, and annual savings are figured at \$150,000.

Briefly, the sludge handling begins in a heater building where raw sludge passed through heat exchangers is warmed to 95 F. Then it goes to fill one

of 10 rectangular concentration tanks, where it stays five days. The tank is 105 x 30 ft in plan, about 15 ft deep, completely enclosed and insulated. (For further details, see ENR Oct. 1, 1953, p. 30.)

In 24 hours the solids float; the supernatant is withdrawn after five days and the solids drop to a saw-toothed bottom in the tank where screw conveyors in V-notches move it to one end. At that end, suction of a 100 gpm Moyno pump pulls it from the tank and sends it along to the incinerator building. Ventilators in the concentration tank blow its foul air to the furnaces. There both the sludge and its odors are to be burned along with pulverized coal.

Thus was the design fashioned after findings of the R&D.

And with the R&D on the sludge disposal process done and its results designed into working plans, construction could be started. But even as construction began there remained some significant research into materials of construction. Principally, there was the test program on pressure pipe to be used as sewer tunnel lining.

Accelerated erosion tests were made with a sand blasting machine on sections of concrete pipe made with various aggregates and by various processes (ENR Oct. 2, 1958, p. 30). Concrete strength and closeness of a good, hard aggregate to the surface of the pipe proved to be the significant factors of erosion resistance. A 7,000-psi concrete was chosen for pipe with 7-in. wall thickness at 72-in. dia (as opposed to the 6-in. thickness ASTM sets for the same size pipe in 4,500-psi concrete). Steel end rings and rubber gaskets were adopted as standard for all concrete pipe of 24-in. dia and larger.

Lock Joint Pipe Co. and Allegheny Concrete Pipe Associates set up plants to produce the project's 24- to 126-in. tunnel lining pipe. The authority kept inspectors checking for infiltration, absorption, density and strength as the pipe was cast and steam cured. Strength and density checks were run on 0.5% of all pipe. Infiltration tests were made on 1% (no visible infiltration permissible after 24 hours under 100-ft head). Absorption was not allowed to exceed 6%.

While cast-iron pipe and asbestos-cement pipe were laid in open-cut sewer work and in certain river crossings along the system, the 7,000-psi reinforced concrete pressure pipe went into all the tunnels and all open-cut sewer work 24 in. and larger. Placed, aligned and jointed, it was backed up with 3,000-psi concrete pumped or dropped down the system's downshafts and placed (about 1.2 cu yd per linear foot of tunnel) between the pipe and the faces of the tunnel.

In the construction of this project,

tunneling was unquestionably the toughest part. It varied from easy, to difficult, to miserable as it went from hard rock, to coal, to mixed face.

Always along the river fronts, the tunnelers were plagued with water. Last April, floods trapped five miners in an air lock while John Laboon rushed emergency use of one of his sewage plant's still untried pumps to drain the tunnels and get them out safely (ENR Apr. 30, p. 27).

Sometimes in coal, the tunnels had to be checked constantly for gases, and despite checking and ventilation explosions occurred—none fatal.

Often in bad rock, soft ground or mixed face, the tunnel headings in many places had to be held by closely spaced steel roof supports, liner plates and spiling. Progress was often no more than 2 or 3 ft per day, and necessary air pressures in places ranged 10 to 17 psi.

In the 39 miles of open-cut pipe-laying, stream beds were often used as right-of-way to avoid the densely developed lands along shore. Pipe laid under streambeds was placed and jointed with utmost care to avoid infiltration.

At the plant itself, on the shore of the Ohio, the neatest construction trick was excavation of the 120-ft-deep, 100-ft-dia hole for the circular pumping station. This imposing excavation went about half way down through water-bearing soil with sheetpiling held by sectionalized steel rings. For the rest of the way, excavation was in rock.

A 5-ft-thick slab went on the bottom of this cylindrical hole, 3-ft-thick walls were concreted around it, then the inner wall to separate annular pump from central wet well went up.

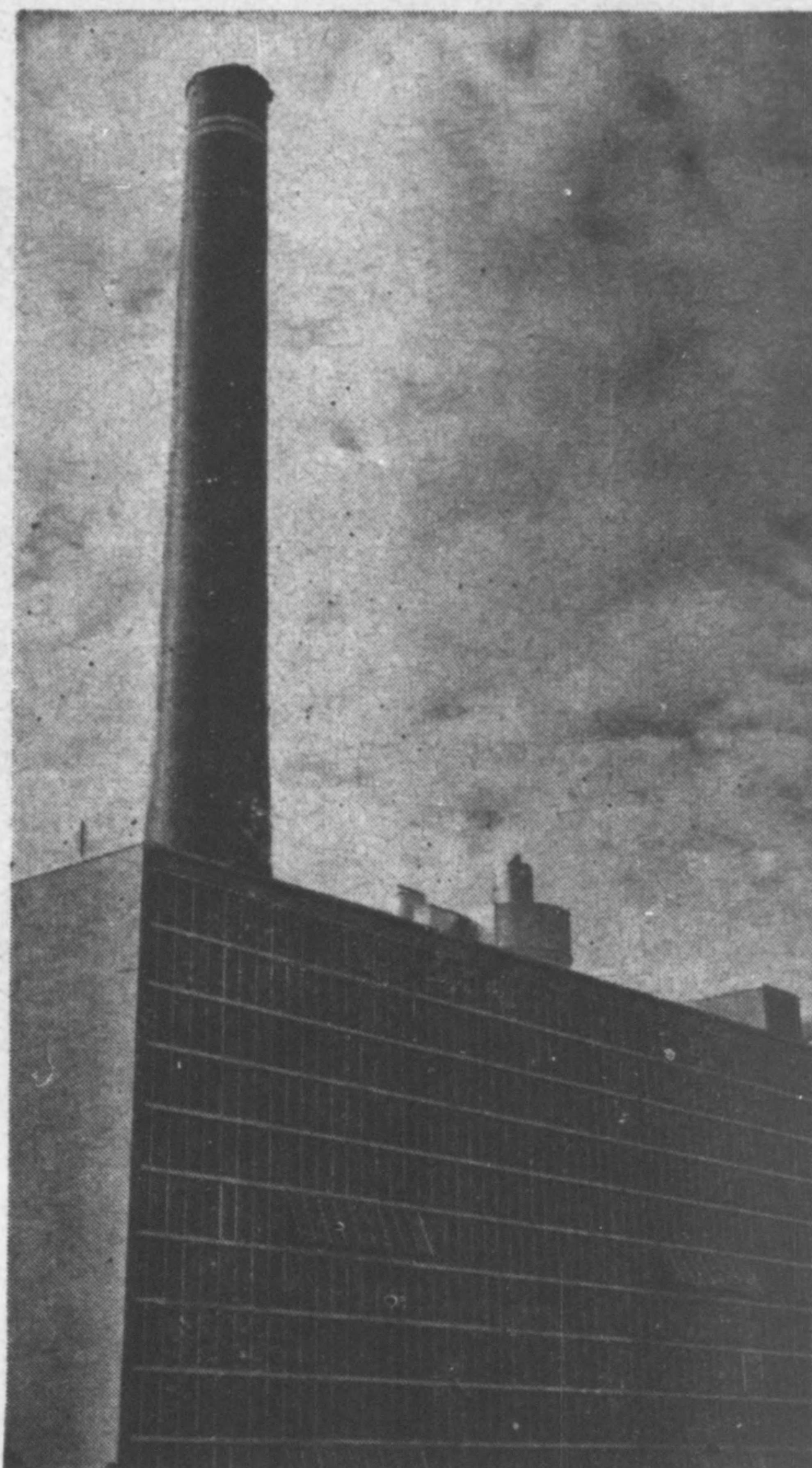
The remainder of plant-site construction was not unusual. A granulated slag fill was rolled to form a base for the settling tanks of primary treatment and the sludge concentration tanks of the Laboon process. The site did present that fairly common problem of excavating old concrete and brick wall foundations of demolished industrial plants.

Now the problem is getting it all to work smoothly. And this is no small problem. There are always bugs to be worked out of a new sewage treatment plant. And this one is not only new, but different—totally unconventional in its collection system as well as its sludge-disposal process.

The downshafts are working in complete accord with model-test findings.

The sludge is concentrating to the 18% adopted as the design figure, and the Moyno pumps are moving it successfully to the incinerators. Only the incinerator has been causing serious trouble, and this trouble is due to be surmounted. The problem is to get all four furnaces in the incinerator burning the sludge at above 1,300 F—to

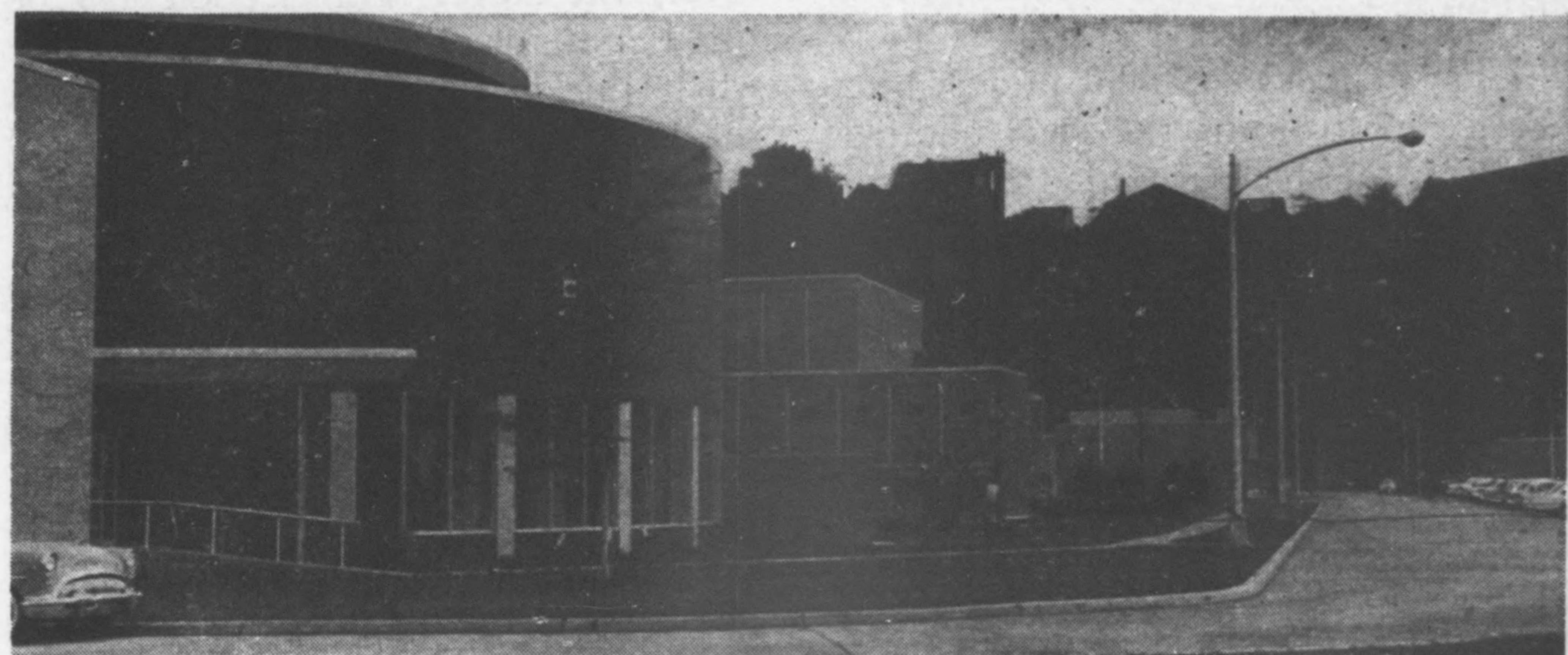
. . . To finished product



INCINERATOR is the end of the process and last remaining step to be ironed out.



ADMINISTRATION BUILDING houses department where charges are collected.



PLANT STRUCTURES are architecturally pleasing. Glazed brick and paints chosen are gayly colored, and the spacious site is well landscaped.

burn it completely and emit no badly objectionable stack odors.

As the many difficult problems of start-up have been narrowed down to the critical problem of stack odors, the Pittsburgh Sewage Treatment Plant has come to do the job for which it was planned, designed and built. The difficult selling job that launched the project and all the R&D that made it something truly different among sewerage projects should soon pay off in 50% removal of biochemical oxygen demand (BOD) to assure the Ohio a satisfactory dissolved oxygen content below the plant. Removal of settleable solids will improve quality of the river's water. And chlorination is killing the bacteria of Pittsburgh's sewage.

It was an extremely difficult job from all aspects.

From the financial aspect, it was one only inspired communities would tackle—and Pittsburgh's officialdom provided the inspiration.

From the design point of view, a courageous consulting firm staked its considerable prestige on results of R&D in an unusual sludge-disposal process.

From the construction point of view, there were some of the worst imaginable tunneling conditions.

And now from the operations point of view there are the difficulties of ironing out roughness of a new and different plant.

This project had all the drama that politics, strikes, floods and explosions can give a job. A difficult job, pushed through, the gayly colored plant stands in attractive relief against a drab industrial river front.



Huge steel cantilever will support crown of movable dome roof for Pittsburgh's new auditorium.

Constructing a Unique Auditorium

High on a hill overlooking Pittsburgh's Golden Triangle, the city's \$20-million Public Auditorium sits roofless, waiting for steel.

This key redevelopment project progressed rapidly until the steel shortage struck. And steel is needed for its big movable dome roof and the huge cantilever that supports it.

Building such an unusual structure would have been tough even under ordinary conditions. Pennsylvania law prevents the Public Auditorium Authority, owner of the structure, from placing responsibility for construction in the hands of one general contractor.

The law requires at least four separate contracts to be let. The authority found it necessary to award eight major contracts, none of which exceeds 40% of the total construction cost.

Chaos would have resulted if the work of the different trades had not been successfully coordinated. For this project calls for unprecedented structural work and complex mechanical and electrical controls.

The auditorium is part of a cultural center being constructed in the redevelopment of Pittsburgh's Lower Hill area. It will be used as an open-air amphitheater and sports arena, convention hall and exhibit center. It will have 9,280 permanent seats, but will accommodate nearly 14,000 for some events, such as boxing and political rallies. It will be air conditioned. The auditorium, its mall and its parking area for 1,700 cars will occupy about 20 acres.

The seating arrangement is unusual: One section of 2,100 permanent seats covers the stage. This section can be tilted out of the way hydraulically when the 119x64-ft stage is used for theatrical productions. The seats will be needed for basketball, hockey and ice shows.

Even more unusual is the movable dome roof. Nearly circular in plan, it spans 403 ft across the seating area in one direction, 413 ft in the other, and has a rise of 116 ft (ENR Jan. 30, 1958, p. 30). The dome will be supported at the crown by a 260-ft-long, curved, steel cantilever anchored outside the auditorium.

The dome is comprised of eight sections—six movable, two fixed. The fixed sections are located next to the huge cantilever, which carries two pivots, 10 ft apart (accounting for the 10-ft difference in the diameters of the auditorium). Each pivot is used by three movable leaves on opposite sides of the auditorium.

At the push of a button, the movable leaves will roll on rails anchored atop a 20-ft-wide concrete ring girder that encircles the auditorium. When the roof is closed, the small gaps between overlapping parts will be sealed by the automatic tensioning of cables that will pull neoprene gaskets into bearing against stops on adjoining components.

The leaves are framed with structural steel. Each has seven main ribs—30-in. wide-flange beams. They support 8- and 10-in.-deep purlins.

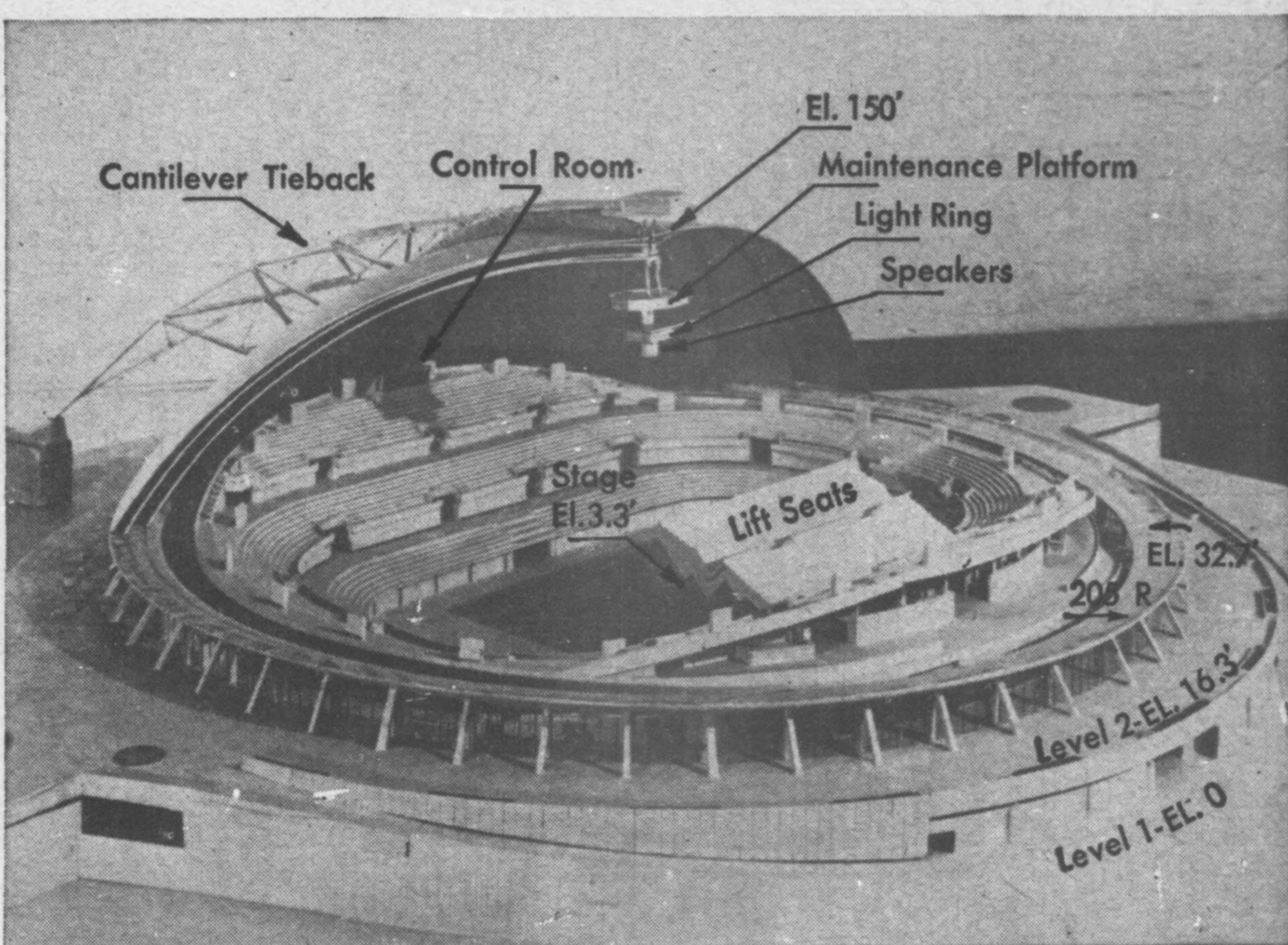
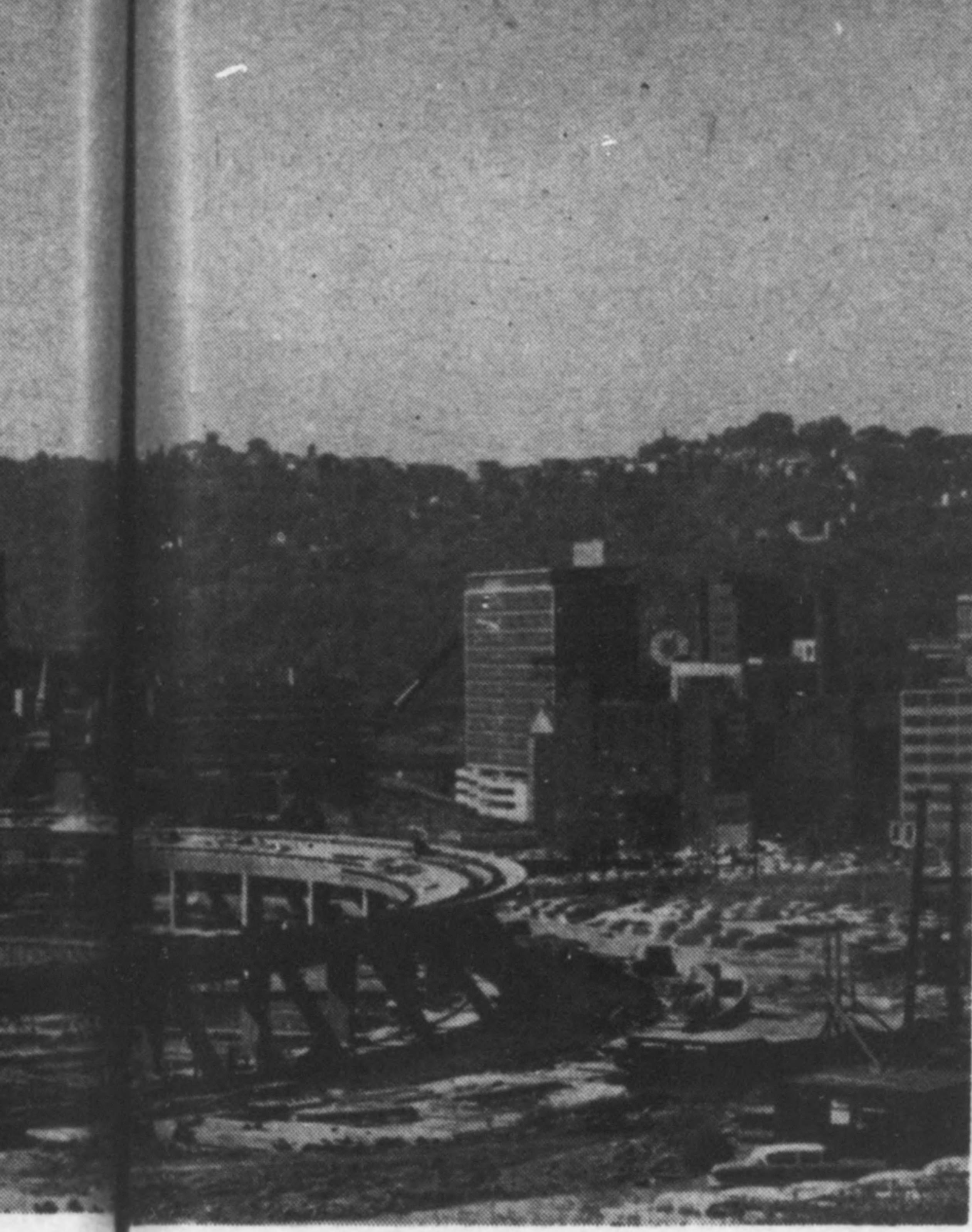
Acoustical metal panels will be attached to the under side of the ribs. The roof will be metal deck. On top of the deck will be a vapor barrier, two 1-in. layers of rigid insulation, roofing felt and an exterior facing of Type 302 stainless steel.

Principal component of the curved steel cantilever about which the movable leaves pivot is a box girder about 8 ft wide and 17½ ft deep. It rises more than 110 ft above its abutment and projects 205 ft into the auditorium. The box girder carries in its interior electrical wiring for control and operation of the roof, and for the lighting and sound systems. Trussed tiebacks, also steel box sections, extend from near the top of the girder to an anchorage 110 ft beyond the girder's abutment. The cantilever contains 1,400 tons of steel.

The auditorium will have three working floors in addition to the concrete stands. Entrances are provided at grade to both the first and second levels, which have a 16-ft difference in elevation. The designers accomplished this by taking advantage of the natural slope of the site.

At the first level will be the arena, exhibit areas, locker and dressing rooms, the main mechanical room and storage space. The main entrance, promenade deck, offices and meeting rooms will be on the second level. At the third level (at about the height of the ring girder, 16½ ft above the second level) will be the control booth and access to stands.

Until the steel strike, construction



Seating, including lift section, will accommodate 14,000.

Under Eight Separate Contracts

on this complex project proceeded smoothly, despite the absence of a general contractor. Edward Fraher, executive director of the Public Auditorium Authority, had the foresight to set up an organization for coordinating all the contract work.

Mr. Fraher brought in H. Rey Helvenston as superintendent of construction. This title carries many more responsibilities and duties on this project than it does on ordinary projects. Mr. Helvenston is an engineer with broad construction experience and once was the head of a contracting company. He takes over to a great extent the co-ordinating role of the missing general contractor. He also doubles as resident engineer for the owner, architect and consulting engineers.

It is Mr. Helvenston's job to deal with field problems—to work them out with the contractors in an orderly sequence, eliminating ambiguity, overlapping tasks and interferences.

As far as possible, operations are planned in advance to avoid delays and unnecessary extra costs. For one thing, combined drawings are made that show all the contractors' work. This enables them to discover and eliminate in advance any interferences between the installations and operations of different trades.

Models are used wherever the need is indicated.

Field inspection is handled along functional lines. The inspection staff, in general, has been trained by Mr. Helvenston, who prefers older men who

have done the type of work they are assigned to inspect, rather than career inspectors.

The eight prime contractors were notified to start work in April, 1958. First job was removal of $\frac{1}{2}$ million cu yd of clay, shale and old foundations.

A wet summer and cold winter slowed only slightly the extensive underground work that followed. Included were sewers, concrete retaining walls, column footings and 1,500 lin ft of tunnels. The tunnels will distribute fresh air, accommodate plumbing, house steam and chilled-water piping for heating and air conditioning, and carry electrical conduits. Little work on the rest of the auditorium could proceed until this underground construction was completed.

Concreting of the second-level promenade deck, which encircles the auditorium, had to be carried out in cold weather, when many cycles of freezing and thawing could be expected. Heat was required to prevent the concrete from freezing early in the morning and just before nightfall. The contractor used high-early-strength cement when low temperatures or rainstorms that might cause settlement of soil under the shores were anticipated. Under ordinary circumstances, the extra expense was avoided.

Forms for the 50-ft-wide promenade slab were made of plywood. They were supported on 2x4's spanning between adjustable-length steel beams. The relatively large span of these beams reduced appreciably the number of 4x4 shores

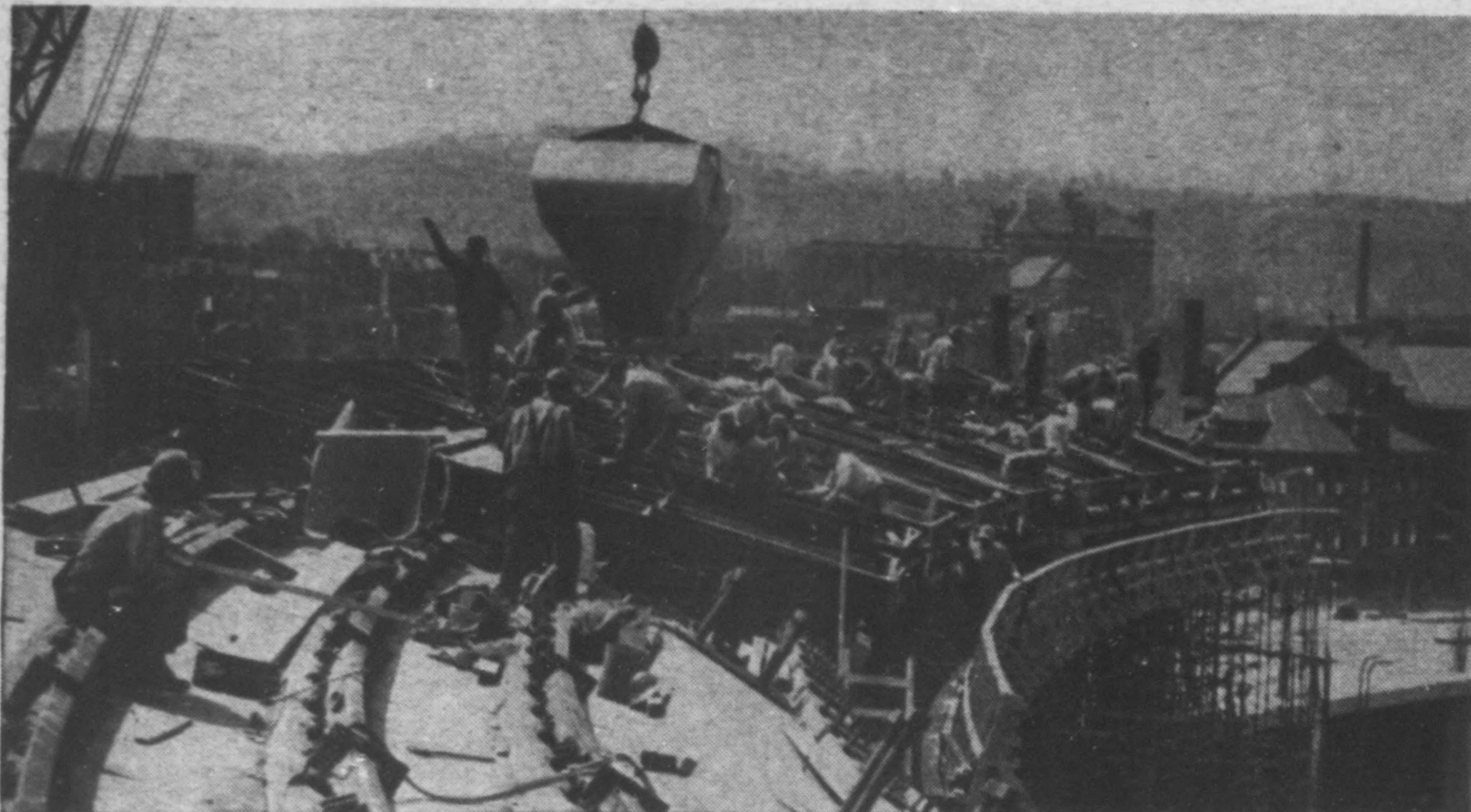
needed. This arrangement eliminated a forest of lumber and avoided a great deal of the tedious work of installing shoring sills to prevent washouts in heavy rain.

To keep the fresh concrete warm in cold weather, oil-burning salamanders were inserted under the formwork inside an enclosure formed by hanging tarpaulins around the outside. Insulation covered with tarpaulins protected the top surface of the concrete.

When the concrete had gained sufficient strength, the forms and shores were removed for re-use elsewhere. The contractor then re-shored the promenade slab with steel-pipe scaffolding so that he could support the falsework for the concrete ring girder on the second-level deck. The superimposed load was estimated at 7 tons per lin ft of girder.

The ring girder was designed to be continuous over four 26-ft spans. It is supported on 48 concrete A-frames and banked at a 13-deg angle to resist the thrust of the dome. (Estimated force normal to rails from each of the 12 or 13 wheels per moving roof leaf is 30 kips when the roof is closed.) Expansion joints were provided between the continuous sections, and double columns located at the junction. It was logical, therefore, to concrete the girder in four-bay lengths.

Two complete sets of forms were built, intended for seven uses. Since the 20-ft-wide banked girder is irregularly shaped in cross section, with a maximum depth of about 5 ft, the plywood forms consisted of several skew planes—



RING GIRDER, on which roof rolls, is concreted in four-bay lengths. Steel templets insure accuracy of rail haunches and bolts.



WELDER anchors rail clip to base plates. Neoprene gaskets at bottom of movable roof will be pressed against a pipe-top plate (right) to seal out weather.

inner and outer fascia and two bottom slopes. They were supported at 16-in. intervals on radial wood joists. Wood trusses transmitted the load from these joists to 2x8 laminated wood beams along the curve. Shores were steel-pipe scaffolding.

The inclined and vertical legs of the A-frames were formed at the same time as the girder.

All forms had to be set accurately to the required elevation and alignment. Where the shores could not be supported on the promenade deck, granulated slag was spread on the ground, which was roughly graded, to level up under the shore sills.

The slope of the top surface of the girder was flat enough to be shaped without forms. However, the plans called for four banked annular haunches atop the ring girder to carry the rails for the movable roof. (The fourth rail, at the inner edge of the girder, is not for a roof leaf but for two rolling work scaffolds for electricians and ceiling installers—and for maintenance work later. Wedge-shaped and curved, these steel-truss scaffolds, like the roof sec-

tions, will pivot about the tip of the steel cantilever. Each is 260 ft long and 55 ft wide at the ring girder. At the termination of the job, one will be scrapped, the other dismantled and saved for maintenance work.) The raised portion of the ring girder required forms.

To insure uniform setting of the 5,000 sloping bolts for the rails and the haunches, the steel contractor furnished eight templet frames. These were supported on the radial joists with unequal-length angle posts to obtain the desired slope. Curved wood forms for the haunches and templets for the bolts were attached to the bottom of steel channels extending below the frames. The bolt templets consisted of paper sleeves set inside pipe spacers welded to steel plates, which, in turn, were welded to the channels.

Drains will carry roof rainwater through the ring girder, conducting the water along the vertical columns of the A-frame to an underground sewer.

Typical stadium construction was used for the concrete risers and treads of the stands. Forms were metal pans.

The concourse slab connecting with the second-level promenade was constructed with hollows to obtain greater thickness without great increase in weight. The hollows were formed with paper tubes.

Preplanning paid off here too. Electrical conduit had to fit into the spaces between the tubes. In the preplanning studies, the conduit was laid out to allow curves that would not make wire pulling difficult. Tubes were shortened, in a few cases. This increased the volume of concrete slightly, but permitted easier conduit turns.

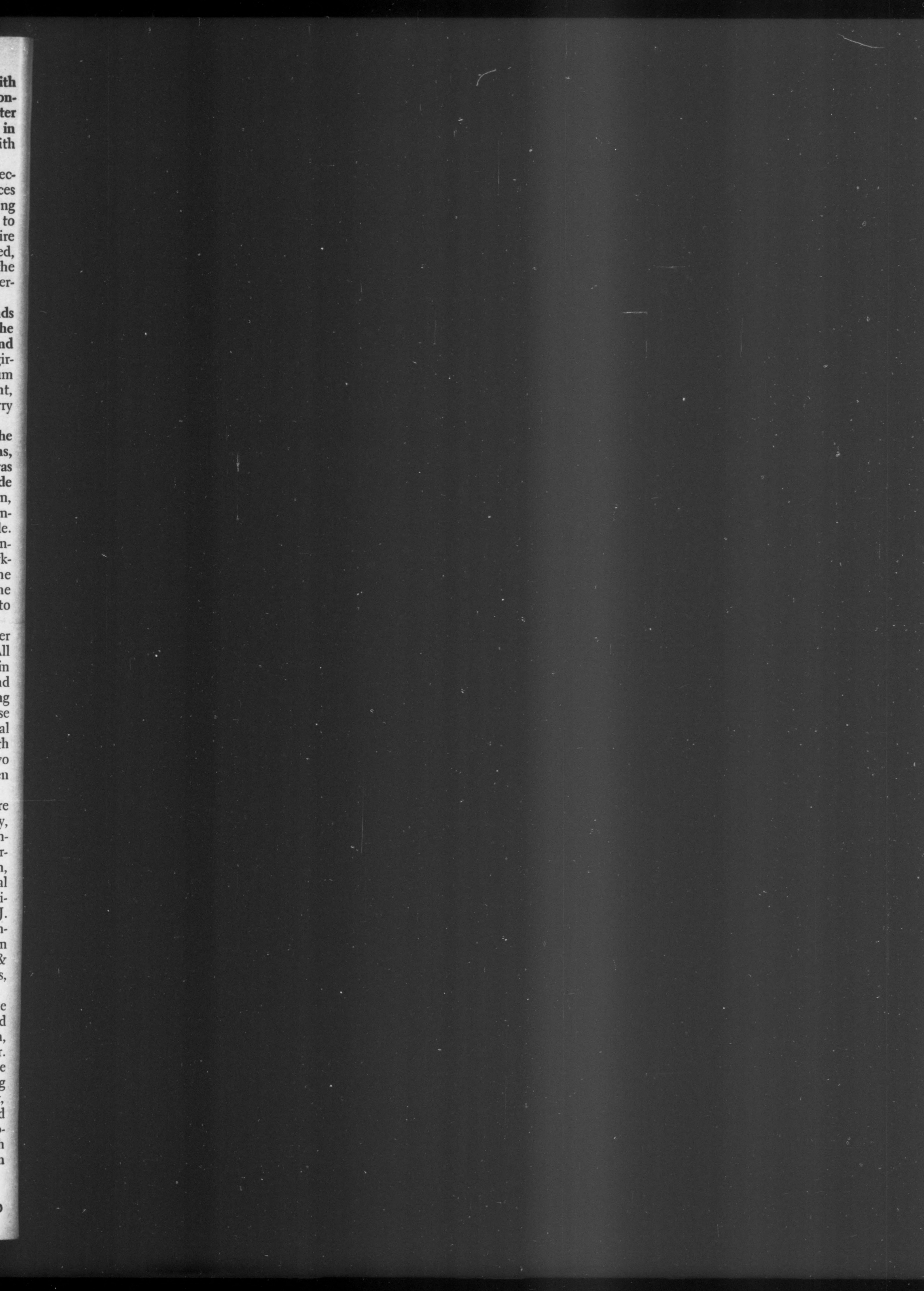
While the ring girder and stands were being concreted, erection of the 260-ft-long steel cantilever girder and its tiebacks was started. The steel girder is expected to transmit a maximum thrust of 7,210 kips to its abutment, and each of the two tiebacks may carry as much as 3,850 kips in tension.

To transfer the huge thrust from the box girder to the concrete foundations, a dense system of reinforcing bars was incorporated in the abutment, inside and outside the girder cells. In addition, 24 five-inch aluminum electrical conduits had to be accommodated inside. The congestion made it difficult to concrete the abutment. Nevertheless, workmen managed to crawl or stand in the tight space, spading and vibrating the concrete into place as it was fed to them from a 1-ft-dia hose.

The huge box sections for the girder and tiebacks were shop welded. All welds were stress relieved by heating in an oven, then machined, subdrilled and retested for soundness. Field welding was done with nickel-alloy rod. These welds were peened to relieve residual welding stresses. About half the length of girder, tiebacks and ribs of the two fixed roof leaves had been erected when the steel supply gave out.

Mitchell & Ritchey, Pittsburgh, are the architects. Ammann & Whitney, New York City, are the consulting engineers on the movable roof, ring girder and podium. Robert A. Zern, Pittsburgh, is the consulting structural engineer on the portion of the auditorium inside the ring girder. Carl J. Long, Pittsburgh, is the consulting engineer for electrical work other than that for the roof, and Dzubay & Bedsole and John Mullin & Associates, Pittsburgh, the mechanical engineers.

Dick Corp., Large, Pa., holds the general contract covering concrete and earth work. American Bridge Division, U. S. Steel Corp., is the steel contractor. Limbach Co., Pittsburgh, is doing the heating and ventilating and installing the stainless steel roof. E. C. Ernst, Inc., is the electrical contractor, and Wayne-Crouse, Inc., is handling plumbing and drainage; both are Pittsburgh firms. Seating contractor is American Seating Co.



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**SPECIAL
REPORT**

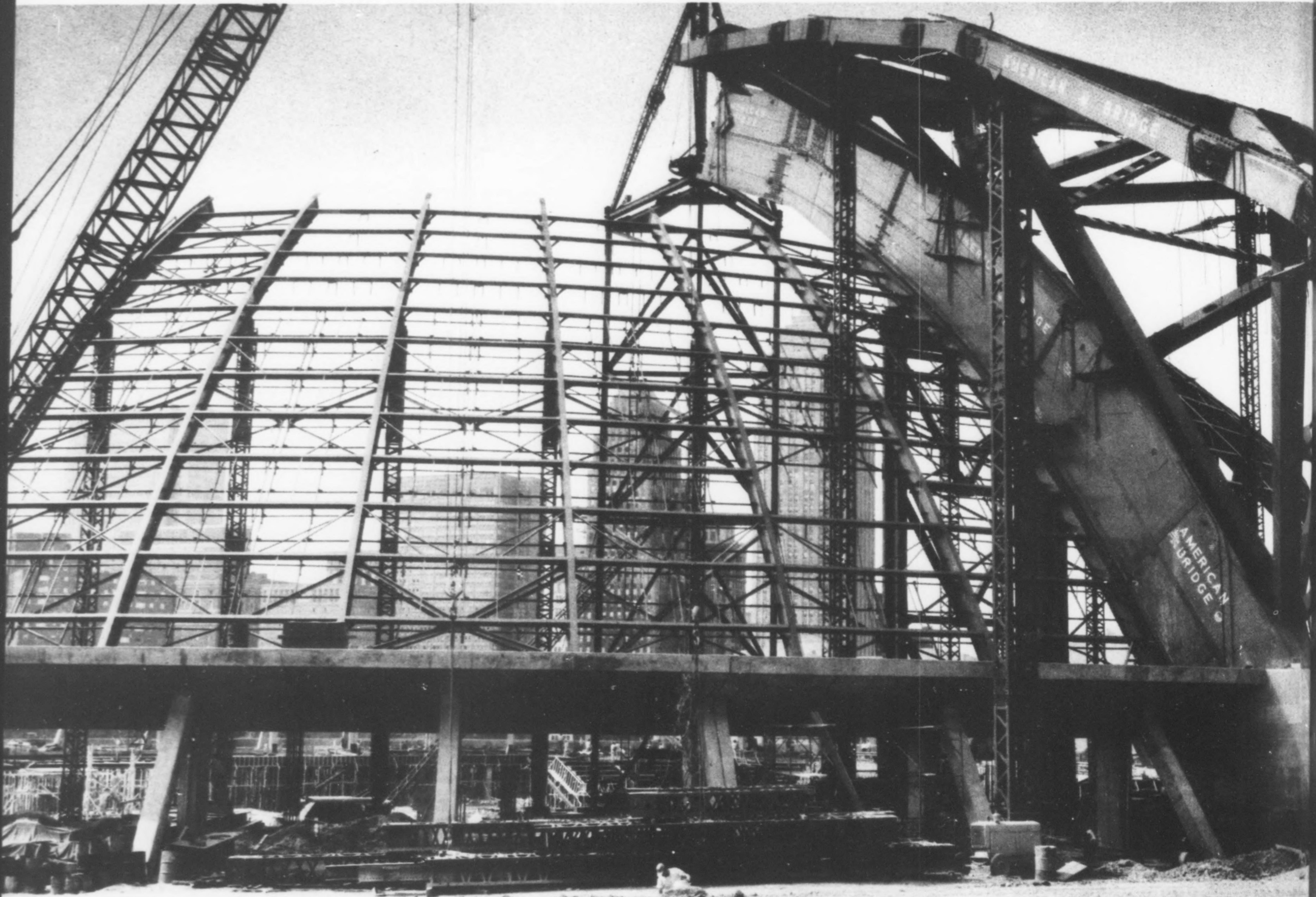


Pittsburgh rebuilds in steel

See the following 11 pages



11 Pittsburgh buildings—2 new bridges fabricated and



Unique Public Auditorium—Can be used as a convention hall, an open air amphitheater, a sports arena, and an exhibit center. American Bridge is now erecting the structural steel which was difficult to fabricate because of the circular design and cantilever construction which supports the movable stainless steel dome.

No hemming and hawing on this job—Four Gateway Center, newest of the Gateway buildings. American Bridge put up the structural framework in three months and 17 days—fast and on schedule. And once the steel was in place, there was no hum-drum period of waiting . . . for steel not only goes up faster, but it provides immediate full strength, permitting other trades to proceed rapidly.

(Credit list for all projects in this report on last page.)



ed and erected by American Bridge

Judged by its population, Pittsburgh and Allegheny County have built more new skyscrapers, bridges, highways and public works in the last few years than any similar area in the country.

Starting with the Mellon-U.S. Steel Building, Pittsburgh's redevelopment program swung into action. Soon the riveters and welders were erecting steel for three Gateway Center Buildings, the Alcoa Building and Mellon Square Parking Garage. These were followed by the State Office Building, Bell Telephone Building and the Porter Building.

Still under construction are the fourth Gateway Center Building and the huge new Public Auditorium with Stainless Steel dome.

Two new bridges complete the list. The double-deck Fort Pitt Bridge over the Monongahela is already in use and the Fort Duquesne Bridge across the Allegheny is under construction.

United States Steel, through its various divisions, supplied much of the basic steel and many of the finished steel products used in these structures. The American Bridge Division fabricated and erected the structural steel in each building mentioned and in both bridges.

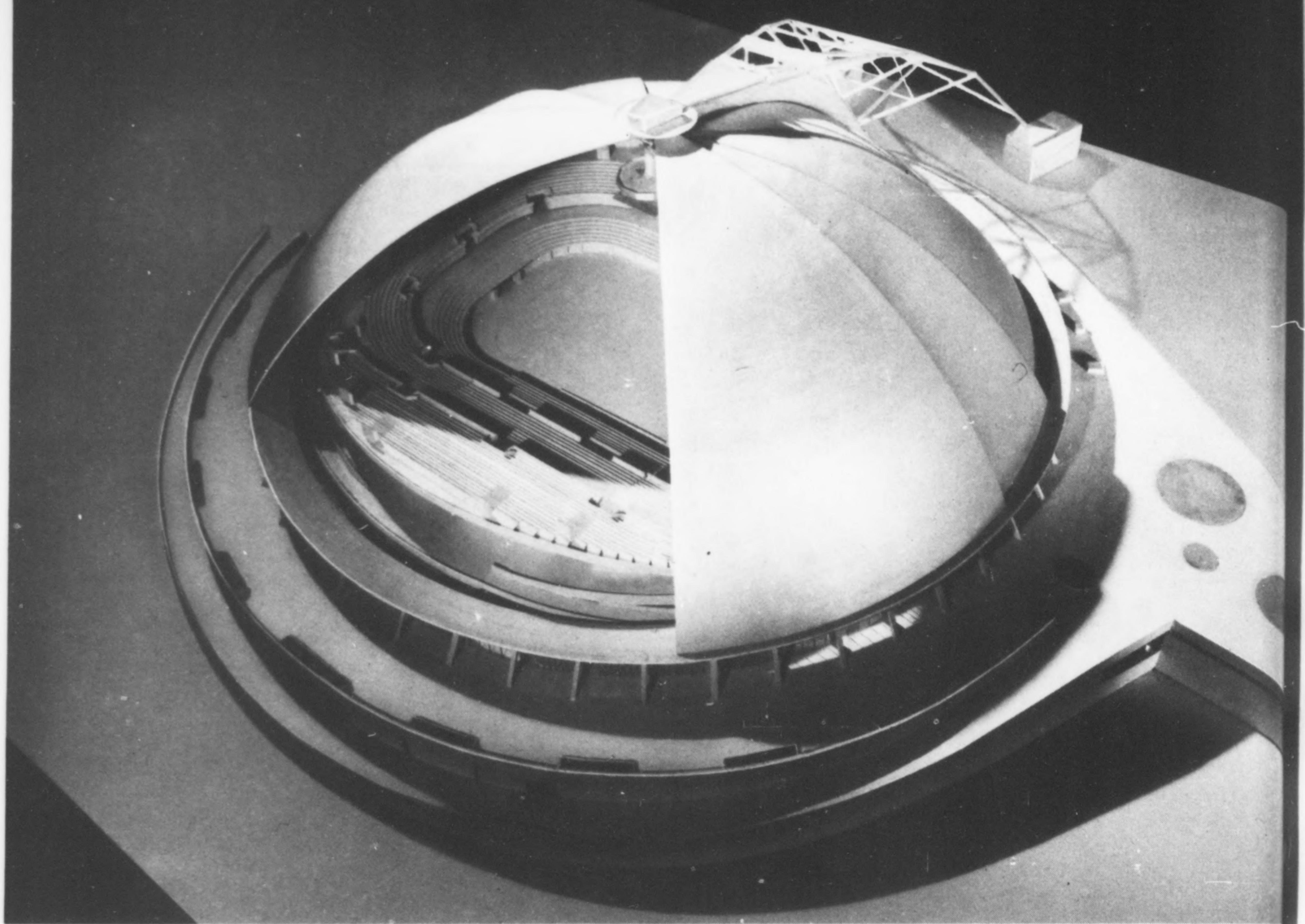
Other divisions such as American Steel & Wire and Universal Atlas Cement supplied products for the many new highways and the sewage disposal system.



New Gateway to the West—Fort Pitt Bridge carries the Lincoln and Wm. Penn highways across the Monongahela River at the Point. It is an 8-lane, double-deck structure with a tied-arch span 752 feet long. Erected by American Bridge Division. The Fort Duquesne Bridge, of similar design, is under construction over the Allegheny River.



**American Bridge
Division of
United States Steel**



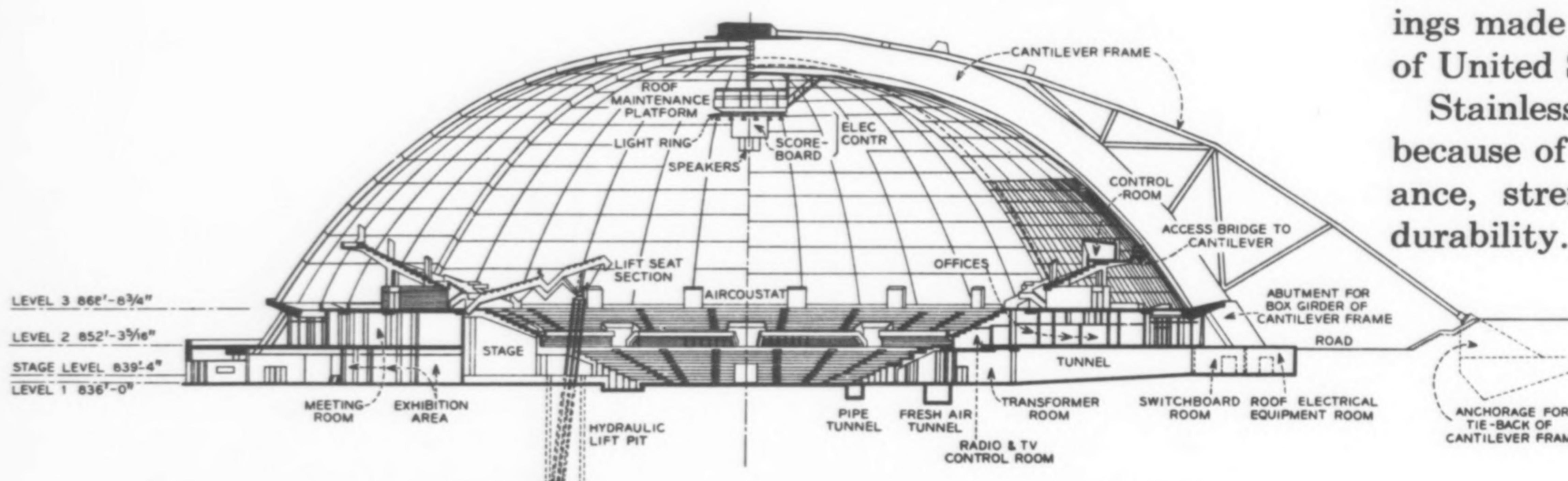
Stainless steel retractable dome highlights the new Pittsburgh public auditorium

The unusual and exciting Public Auditorium for Pittsburgh and Allegheny County will accommodate up to 13,600 spectators. The unique feature of the auditorium is its gleaming retractable Stainless Steel dome—the first of its kind ever built. The mammoth movable roof, some 415 feet in diameter and 136 feet

high makes possible a spectacular open air stadium that can be converted to a weather-proof auditorium in 2½ minutes.

The dome is divided into eight sections. Two of these are stationary and six are movable. About 166,000 square feet of Stainless Steel sheets will be used to make the roof. Each of the movable segments will swivel on long-wearing Stainless Steel bearings made by the American Bridge Division of United States Steel.

Stainless Steel was selected for the dome because of its lasting beauty, weather resistance, strength, ease of maintenance, and durability.



Structural Steel supports the dome—The cantilever frame which is the main support for the leaves is composed of a curved box girder about 8 feet wide and 17½ feet deep, with a system of tie-back members extending from the anchorage point near the ground line up to near the top of the box girder. The dome will have no interior supports. Rather, the leaves will rest on rails laid on a ring girder. The structural steel cantilever box girder arm and tie truss weigh about 1,400 tons.

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

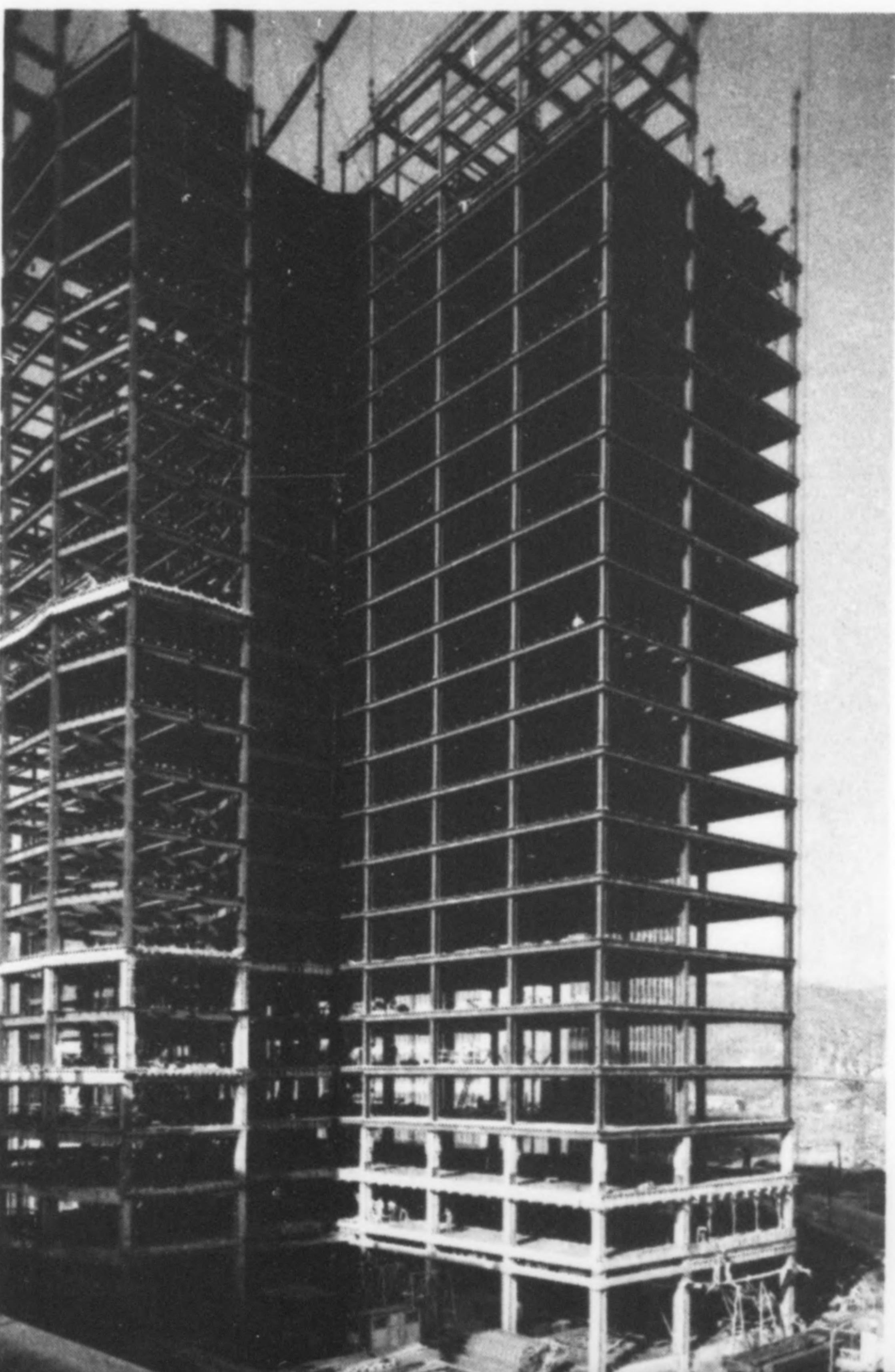


United States Steel

Structural steel goes up fast in Pittsburgh's newest buildings

Stainless Steel provides the glamour for many of Pittsburgh's new buildings but the backbone and ribs are structural steel. Thousands of tons of USS Structural Shapes and Plates form the strong framework for 11 new buildings, two new bridges and numerous other redevelopment projects.

Pittsburgh pioneered the steel building with curtain walls of stainless steel or porcelain enamel on steel sheet panels. This type of structure is economical. It goes up in a hurry and provides more usable floor space per dollar spent for construction. Other cities followed suit until today a building looks its best when it's made of steel. For information, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



USS Structural Steel framework for the new Pittsburgh Auditorium. 3,425 tons are being used including USS TRI-TEN High-Strength, Low-Alloy Steel for members where extra strength is needed.

(AT LEFT)

Three months and 17 days was the time it took to erect the 6,400-ton structural steel framework of the Four Gateway Center Building. When a structure is built of steel, everything moves fast.



United States Steel Corporation - Pittsburgh
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Tennessee Coal & Iron - Fairfield, Alabama
United States Steel Supply - Steel Service Centers
United States Steel Export Company

United States Steel

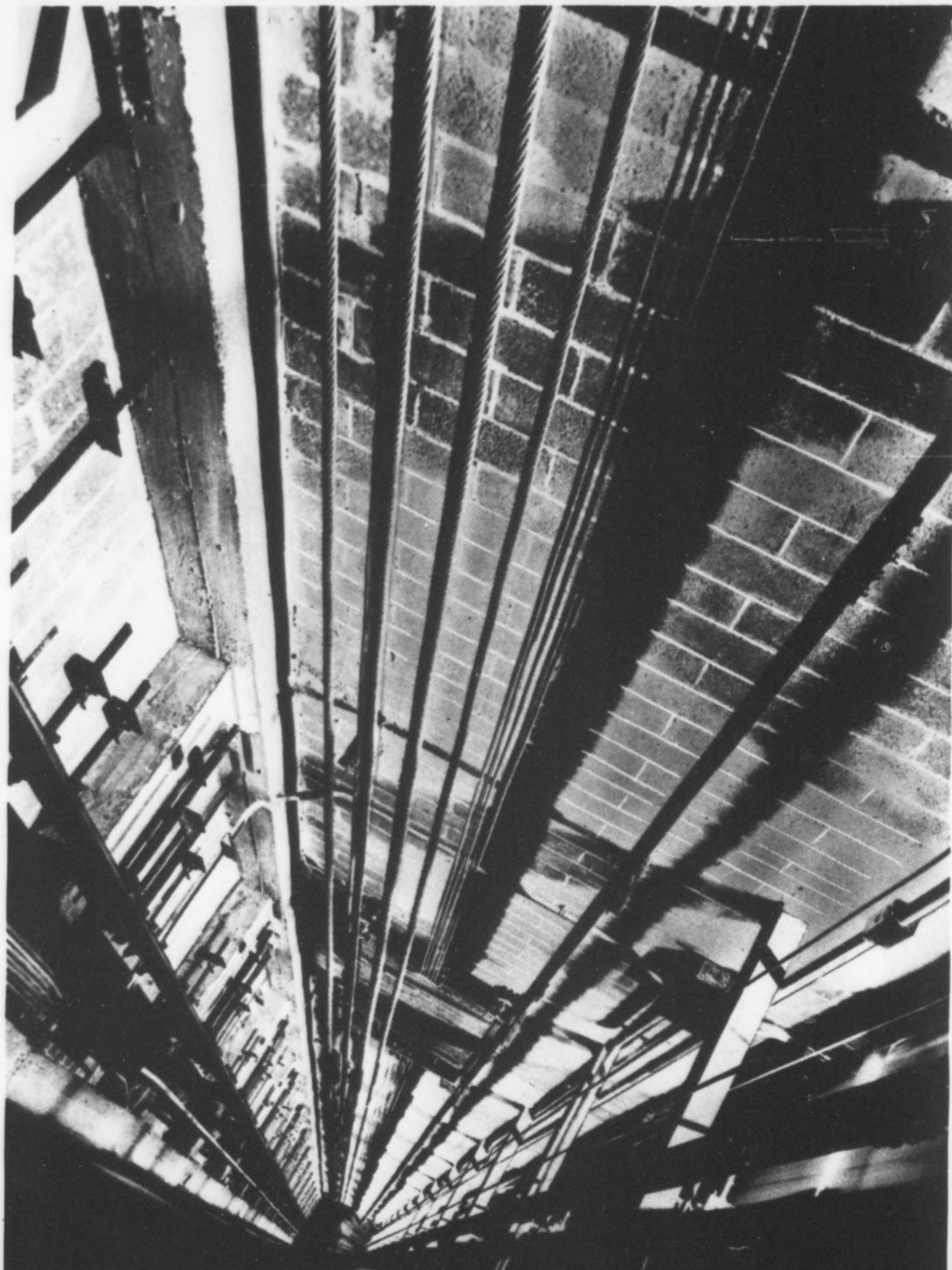
Muscles of steel for Pittsburgh's jet-plane runway, bridges and buildings



Concrete culvert pipe for the jet-plane runway is reinforced with heavy-duty USS AMERICAN Welded Wire Fabric. Triple cages of reinforcing provide extra strength for supporting a 90-foot fill. Concrete pipe reinforced with steel means long life, great strength and durability, plus low maintenance cost.

The new Allegheny County sewage disposal system contains over 30 miles of reinforced concrete pipe. All this concrete pipe, ranging in sizes from 24 to 126 inches, was reinforced with USS AMERICAN Welded Wire Fabric.

Over 17 miles of USS TIGER BRAND Elevator Rope speed tenants up and down in Pittsburgh's first Gateway Center Buildings. Operating speeds are as high as 800 feet per minute, so the elevator ropes must be strong, flexible, and durable. Tough TIGER BRAND Elevator Ropes meet these requirements and give long, long service in the bargain.



The
Mt. V
desig
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The new double-deck Fort Pitt Bridge spans the Monongahela River and connects the Golden Triangle with a double-deck tunnel through Mt. Washington. Traffic will soon be able to cross Pittsburgh in half an hour without stopping for traffic lights. The new bridge is unique in design. It is a double-deck, tied-arch span, 752 feet long. Two 4-lane roadways are supported by 112 prestressed USS TIGER BRAND suspender ropes, each 3½ inches in diameter. A total of 8,960 feet of suspender ropes were used in the bridge.



American Steel & Wire
Division of
United States Steel

High-strength Steel saves weight and money in Pittsburgh bridges and highways



Pittsburgh's Fort Pitt Bridge was built with a steel with a reputation—USS MAN-TEN Brand High-Strength Steel. About 5,800 tons of MAN-TEN Steel were used in the 750-foot span. This steel is about 50% stronger than structural carbon steel and saves weight and money.

The bridge is regarded by engineers as the most unusual structure in the entire Penn-Lincoln Parkway System. It is a double-deck, tied-arch design and will carry four lanes of one-way traffic on each level.

For the heavily stressed members, high-strength steel answered the problem of get-

ting higher allowable stress per dollar by avoiding unnecessary weight, USS MAN-TEN Steel was used in all chords, most diagonals and verticals, and all portal members including end floor beams.

Other Pittsburgh projects using USS MAN-TEN High-Strength Steel include the soon-to-be-erected Fort Duquesne Bridge involving 3,220 tons, sections of the Penn-Lincoln Parkway involving 4,250 tons, and the Crosstown Parkway, 1,554 tons.

USS TRI-TEN High-Strength, Low-Alloy Steel is being used for highly stressed members of the Public Auditorium.

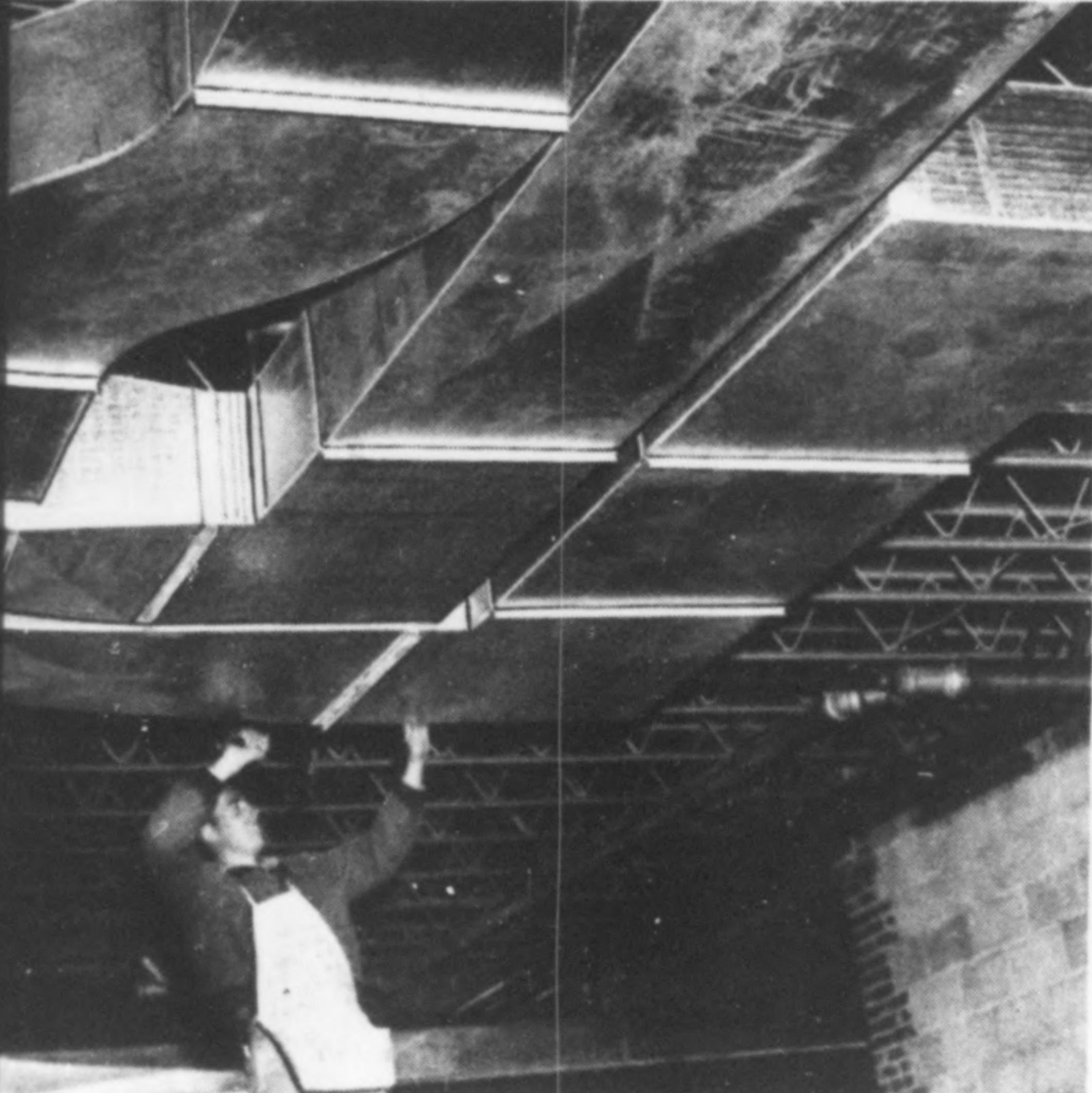
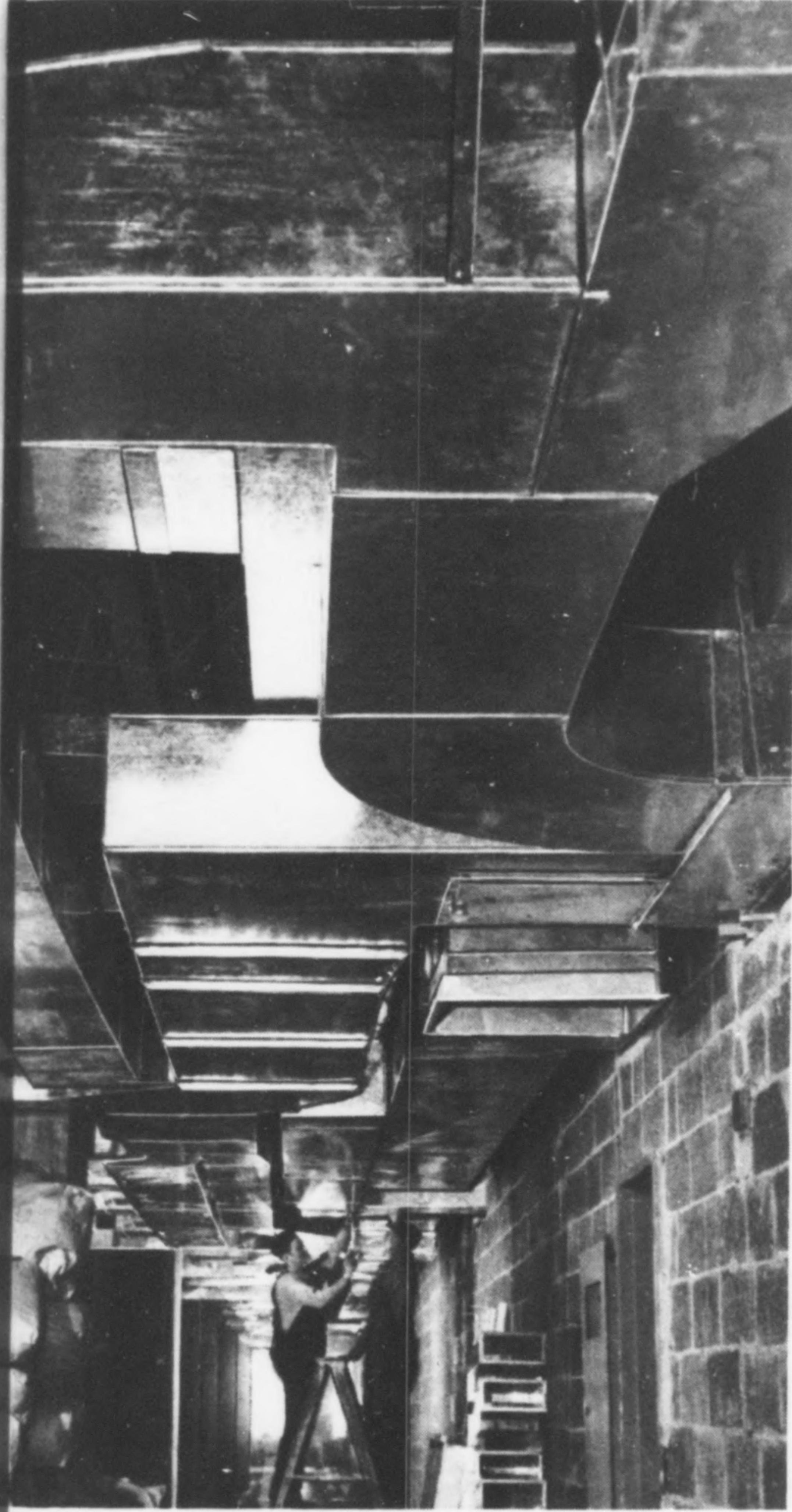


United States Steel Corporation—Pittsburgh
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United States Steel



Steels are doing the difficult, unglamorous jobs, too



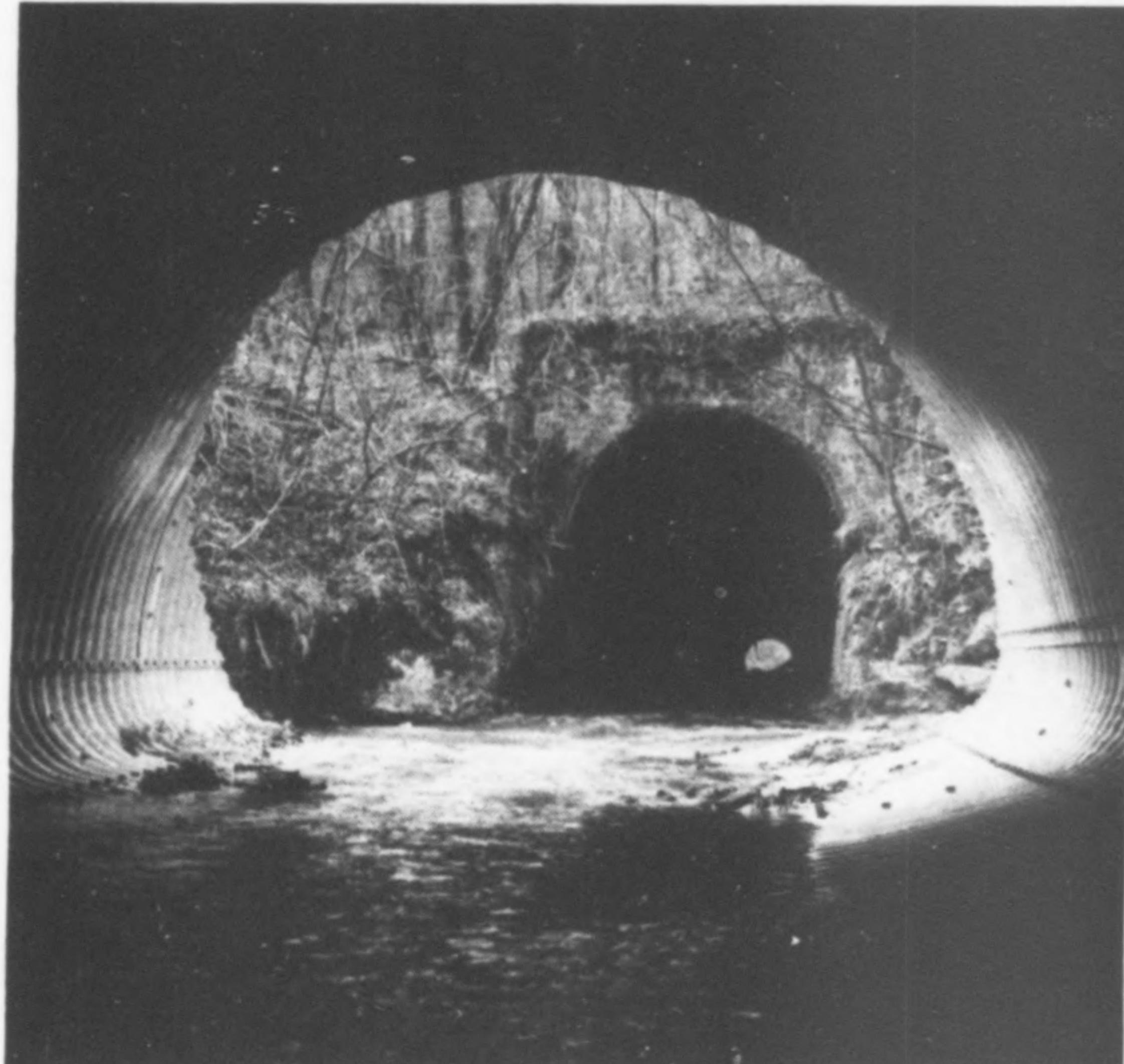
Not all parts of the Pittsburgh rebuilding fall in the class of "tourist attraction," of course. Even the most spectacular structures have unseen parts which make them work. The ductwork in the monumental buildings, for example, will never be seen by anyone but the heating engineers. But here, too, the finest steel products are at work—USS Galvanized Steel Sheets. They provide strength and economy; their consistently high quality of galvanizing makes them easy to work with, provides long life with little maintenance.

USS Galvanized Steel Sheets also do a dependable job in the drainage products throughout the vast network of super roads in the Pittsburgh area. Corrugated steel culverts and sectional arches provide drainage with the strongest possible support under everything from small access roads to six-lane Interstate highways.

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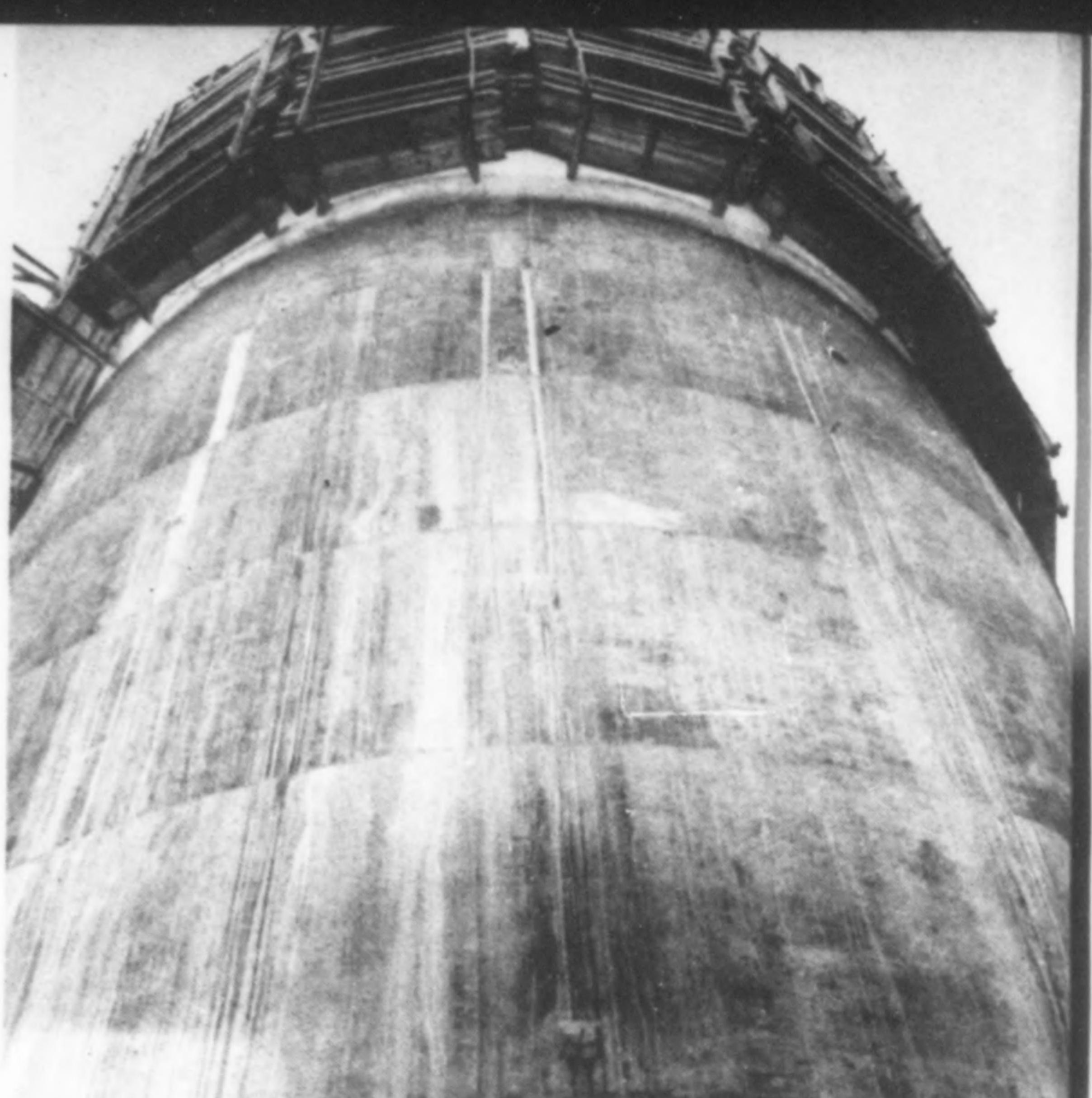


United States Steel





Penn-Lincoln Parkway contains five miles of non-skid slag concrete pavement, requiring 125,000 tons of slag aggregate. Another 143,000 tons were used for the sub-base to stabilize pavement.



New Pittsburgh sewage treatment plant of the Allegheny County Sanitary Authority. Practically all structural concrete was made with USS Blast Furnace Slag aggregate which provided high ultimate strength.



Mellon Square Park and a six-floor underground parking garage. Built with reinforced concrete in which all the coarse aggregate was USS Blast Furnace Slag.



Greater Pittsburgh Airport. Almost 1,000,000 square yards of concrete and bituminous paving included air-cooled blast furnace slag as the coarse aggregate where concrete failure could not be tolerated.



Mountains of Blast Furnace Slag help build a beautiful Pittsburgh

One of the most spectacular sights you can see coming into Pittsburgh at night is a cascade of molten slag being dumped down a high bank. It looks like lava from a volcano.

A slag pile, once considered as a monstrous heap of waste, was discovered to be a wonderful source of construction material.

Produced in various sizes, air-cooled blast furnace slag can be used as aggregate in modern highways, in concrete structures and as railroad ballast.

An expanded form of slag is used in making

lightweight concrete blocks. Three of these blocks weigh no more than two of the conventional variety. They're easier to handle and they save construction dollars.

Granulated slag, formed by a water bath process, is widely used in making portland cement and for building stable highway bases.

To get the complete story on USS Blast Furnace Slag, and how it reduces construction costs, write to United States Steel, Room 2820, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



Fort Pitt Restoration at the historic point where the Monongahela and Allegheny Rivers merge to form the Ohio. 10,000 tons of USS Granulated Blast Furnace Slag were used as permanent fill in the flag bastion to a depth of 20 feet.



United States Steel

More power to Pittsburgh

The redevelopment of Pittsburgh's downtown district brought the need for more power in this area. The Duquesne Light Company solved the problem by installing a new substation downtown and supplying it by two 69 KV feeders from two existing power sources to assure reliable operation.

The transmission system chosen to handle 100,000 KVA was a high-pressure oil pipe-type cable. Basically, this system consists of seamless steel pipe, joined by welding, functioning as a conduit through which are drawn three solid-type paper-insulated oil-impreg-

nated cables. The remaining space within the pipe is filled with insulating oil kept at a pressure of 200 psi. The pipe-type cable system has a lower failure rate than any other high-voltage cable system in use today.

USS NATIONAL Seamless Pipe was used throughout this extensive installation which included three river crossings and many miles of pipe through difficult areas. Jobs like this call for exceptionally strong, flexible pipe to resist internal and external stresses. NATIONAL Seamless Pipe is doing its work well in bringing more power to Pittsburgh.



Preparing to weld pipe for Ohio River crossing. Pipe has a heavier wall to provide additional margin for burning in case of a line-to-ground fault in a river section.



**National Tube
Division of
United States Steel**

AMONG THE ORGANIZATIONS RESPONSIBLE FOR PROJECTS MENTIONED IN THIS ADVERTISEMENT ARE:

ALLEGHENY COUNTY SANITARY AUTHORITY—Owner: Allegheny County Sanitary Authority. Architect: Selli and Flynn, McKeesport. Consulting Engineers: Metcalf and Eddy, Boston, Mass. Gen. Contractor: James McHugh Construction Co., Allegheny Contracting Industries, Johnson-Drake and Piper, Inc. **POINT PARK**—Owner: State of Pennsylvania, Dept. of Forests and Waters. Landscaping Architect: John A. Renner, Pittsburgh. **MELLON SQUARE**—Owners: City of Pittsburgh; The Public Parking Authority of Pittsburgh. Architect: Stiles and Robert Clements and Associates, Los Angeles, Cal. (garage). Mitchell and Ritchey, Pittsburgh (park). Landscaping Architect: Simonds and Simonds, Pittsburgh. Gen. Contractor: The H. F. Ferguson Co., Cleveland, Ohio. **AIRPORT RUNWAY**—Owner: Allegheny County, State of Pennsylvania. Designer: E. G. Messner, Chief Engineer. Gen. Contractor: Harrison Construction Co., Pittsburgh. **FOUR GATEWAY CENTER BUILDING**—Owner: Equitable Life Assurance Society. Gen. Contractor: George A. Fuller Co. Architect: Harrison & Abramovitz. Structural Steel Fabricator and Erector: American Bridge Division. Stainless Steel Fabricator and Erector: Limbach Company. Structural Engineers: Edwards & Hjorth. **FORT PITT BRIDGE**—Owner: Pennsylvania Department of Highways. Bridge Designer and Consultant: George S. Richardson of Richardson, Gordon & Assoc. Steel Fabricator and Erector: American Bridge Division. **THE AUDITORIUM**—Owner: Public Auditorium Authority of Pittsburgh and Allegheny County. Architect: Mitchell and Ritchey. Roof Designer and Consulting Engineer: Ammann & Whitney. Structural Fabricator and Erector: American Bridge Division. Roof Fabricator and Erector: Limbach Company.