Adding gems to garden's treasure

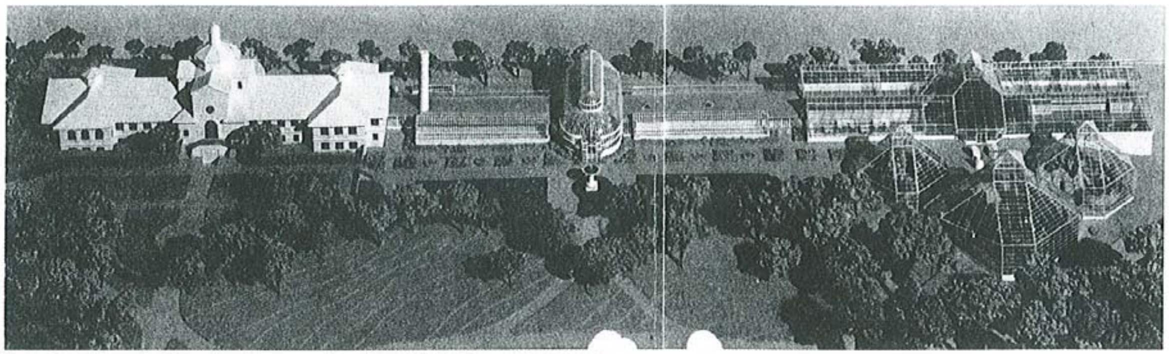
Challenging steel and concrete work expands Brooklyn setting

he rose garden blooming at the Brooklyn Botanic Garden currently marks the end of the peak season at the 70-year-old, New York City horticultural treasure. But when new greenhouses and indoor pavilions open their doors next year—after the first phase of a $25-million construction program—garden officials expect the year-round attractions to push attendance to a million visitors a year.

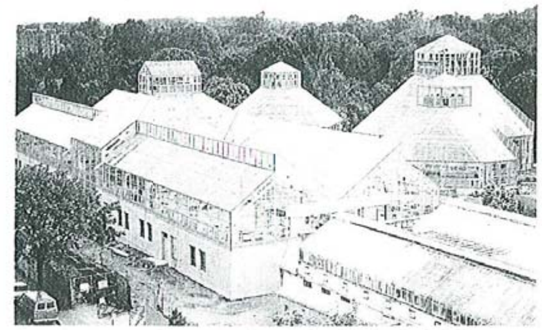
The additions are the result of a "one-of-a-kind" construction program that was an "exceptional challenge," says Thomas F. Giles, project manager for The DeMatteis Organization, Elmont, N.Y., the project's general contractor. The steel superstructures are complex and difficult to weld—as many as eight members frame into some of the joints. Changes in grade across the site required retaining walls of continually varying heights, and the octagonal plan of the pavilions caused a "never-ending series of crooks and corners in the concrete foundation," says structural engineer Joseph D. Goldreich, president of Goldreich, Page & Thropp, New York City.

The project gives the dominant impression of steel and glass from the exterior, but it actually has more concrete than steel—about 5,500 cu yd placed by ACME-ACE Foundations Inc., New York City, and Rokmin Concrete Corp., East Northport, N.Y. Concrete in spread footings, massive piers, retaining walls, aquatic growing pools, waterfalls and monumental stairs will be the backdrop for a fern garden, a renowned bonsai collection, an aquatic garden and separate pavilions for plants from tropical, desert and temperate climates.

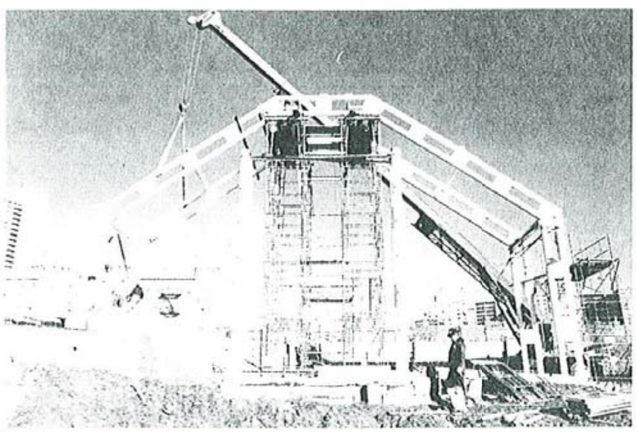
Picturesque. The Brooklyn Botanic Garden was designed in the early part of the century by the office of Olmsted Brothers, New York City, which also laid out Central Park in Manhattan. With buildings designed by McKim, Mead and White, the garden combines classical Beaux Arts architectural symmetry and picturesque English landscaping traditions. In recent years, however, the existing conservatories deteriorated and became too small for the garden's needs.



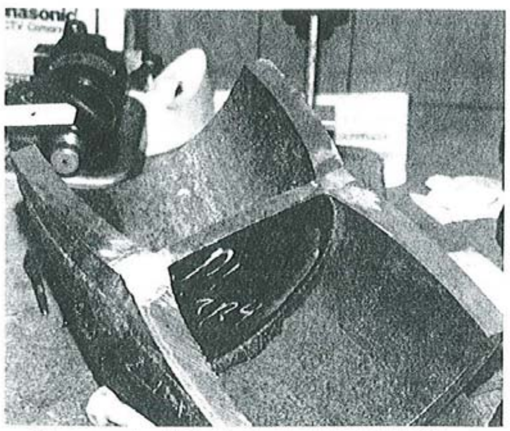
Expansion adds new buildings along the same axis as the old. First-phase work is at far righ.



Greenhouses and pavilions are nearly ready for artificial rockwork inside.



Bent trusses were erected in sections on top of a temporary tower.



Full-size samples of joints helped prepare for easier inspection.

In designing the 90,000-sq-ft expansion, New York C based architect Davis Brody & Associates "tried to impin the least degree possible on the landscape and to respect the existing architectural context," says Gerald B. Olanoff, the project architect. Studies of potential siting led them back to Olmsted's original master plan, which showed future buildings along an avenue on one side of the garden. Davis Brody added the new buildings mainly along that axis.

The existing administration building is slated for restora-n in a later phase of the project, and the possibility of storing the existing Palm House was investigated. But the old wood superstructure was found to be so deteriorated that it will have to be torn down and replaced with a replica. That building and buildings flanking it for classrooms and administration space will be built in a second phase.

Artificial rock. The structural work now nearing completion includes the bonsai, fern and aquatic greenhouses and the three climatic pavilions. The Larson Co., Tucson, will move in next and spend about six months creating artificial rockwork for features such as a trail-of-evolution exhibit, tracing the origins of plant life from five billion years ago.

muel M. Brody, the architect's partner in charge of the ject, wanted the appearance of very light structures that would have the feel of greenhouses—but at the same time the expansion had to meet modern standards for public assembly buildings. Goldreich accommodated by developing a structural frame based on round steel tubes that could be painted white to give the feeling of lightness. To keep the members from getting large and heavy, he designed the bent frame as a double line of 10¾-in.-dia tubes connected by ½-in.-thick rectangular steel plates to produce Vierendeel trusses. The pipe joints are a through-plate type designed to transmit axial and bending stresses.

The frames of the octagonal pavilions are composed of two pairs of these bent trusses that intersect. "The design was complicated by the sloping site, which dictated that the base elevation of each side of each truss would be different," Goldreich adds. The design is based on continuity of the framing through support points, joints and connections. "The entire stability of the structure is predicated on rigid joints," Goldreich says. "If we had allowed normal deflection for members of that size it could have cracked the glass."

The ¾-in. thickness of the pipe walls, the stiffener plates and the number of different angles of pipe framing into a single joint made the welding a challenge. In its Albany shop, Quickway Metal Fabricators Inc. laid as many as nine passes of metal to produce the full-penetration welds at the joints. Full-size samples of many joints were produced to determine what "land dimension" (the extent of the projection of the joint plates into the pipe wall) would produce welds that could be readily inspected. Goldreich required X rays of all full-penetration welds and dye-penetrant inspection of the fillet welds on the intermediate plates between the two lines of pipe.

Bonus. The structural requirement for welding offered the bonus of extra corrosion protection. Rust-inhibitive coatings were specified for all steel because of the humid environment of the greenhouses and pavilions. But the welding also hermetically sealed the pipes against internal deterioration.

Car-Mar Construction Corp., Baldwin, N.Y., erected the bent trusses in three sections by field-welding them on top of a temporary tower. In the field, when no welds were rejected after the first 10 full-penetration welds were X-rayed, the inspection rate was reduced to 50% of the welds at random.

The garden has received $11.6 million in funding for the project from New York City's Dept. of General Services. The job is one of a select group of city construction projects whose management has been turned over to nonprofit groups to by-pass cumbersome city procedures (ENR 12/11/86 p. 10). Says Peter M. Casler, director of capital planning and construction for the garden, "I think it's a good process. It has proven to be successful here." ■

By Janice L. Tuchman