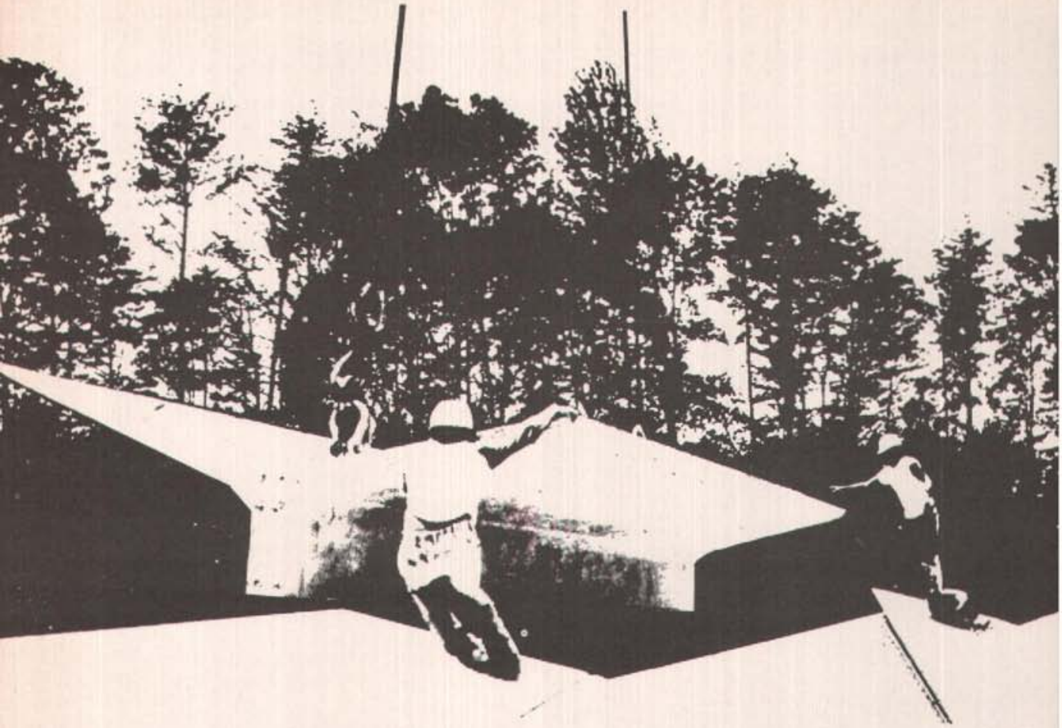


Giant Battery Plant Framed With Precast Components

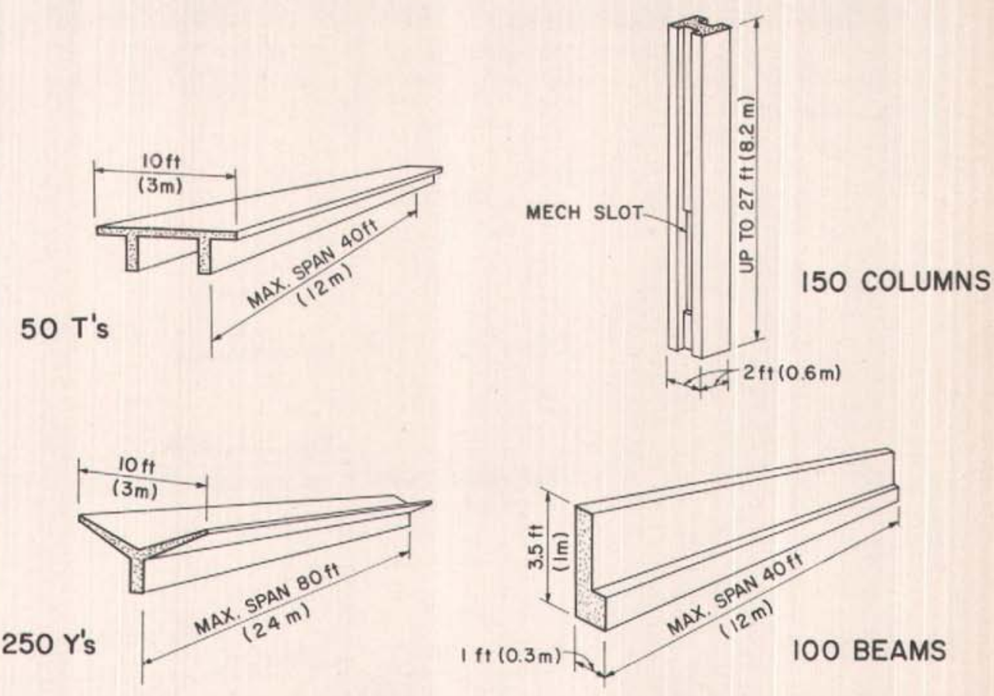
Precast prestressed concrete was chosen as the major structural element for this 200,000 sq ft (18,580 m^2) lead-acid storage battery manufacturing plant in order to minimize construction and material costs, and to help reach the energy conservation goals set by the architect and client.

The 550 precast elements provided a striking architectural statement as well as satisfying the following design conditions: allowing natural lighting, ventilation, and cooling, and providing integration of mechanical systems, minimal necessary maintenance, fire resistant structure, and effective noise dispersion. Some difficult building joints were also eliminated; and the building system will facilitate future expansions.

In response to a growing awareness of the nation's energy and ecological situation, a new generation of industrial buildings is evolving. A greater understanding of the basic laws of physics and nature is being integrated with structural design to provide a healthier work environment and minimize the energy requirements of the building system.

The building is placed on a ridge. The sloping site allows the railroad receiving area to be on a mezzanine level, with a gravity feed system to the assembly lines below. In addition, the roof of every successive bay area is raised, moving up the

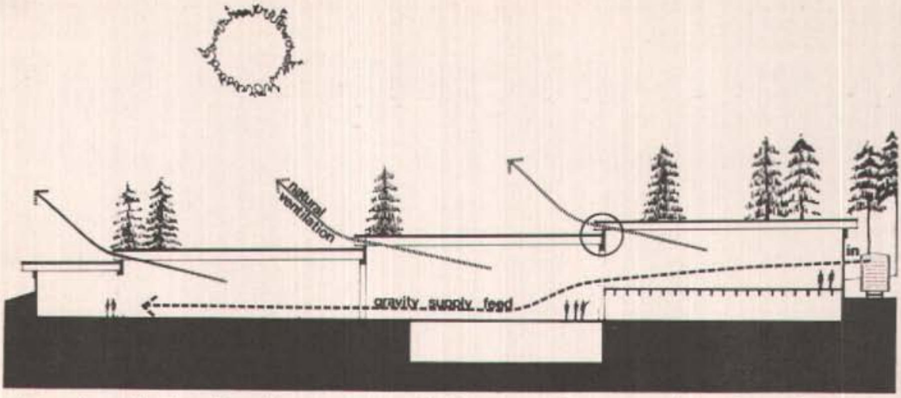
A total of 550 precast prestressed concrete elements, comprising double-tees, Y-beams, spandrel beams, and columns were used effectively to frame a battery manufacturing plant in Winston-Salem, North Carolina.



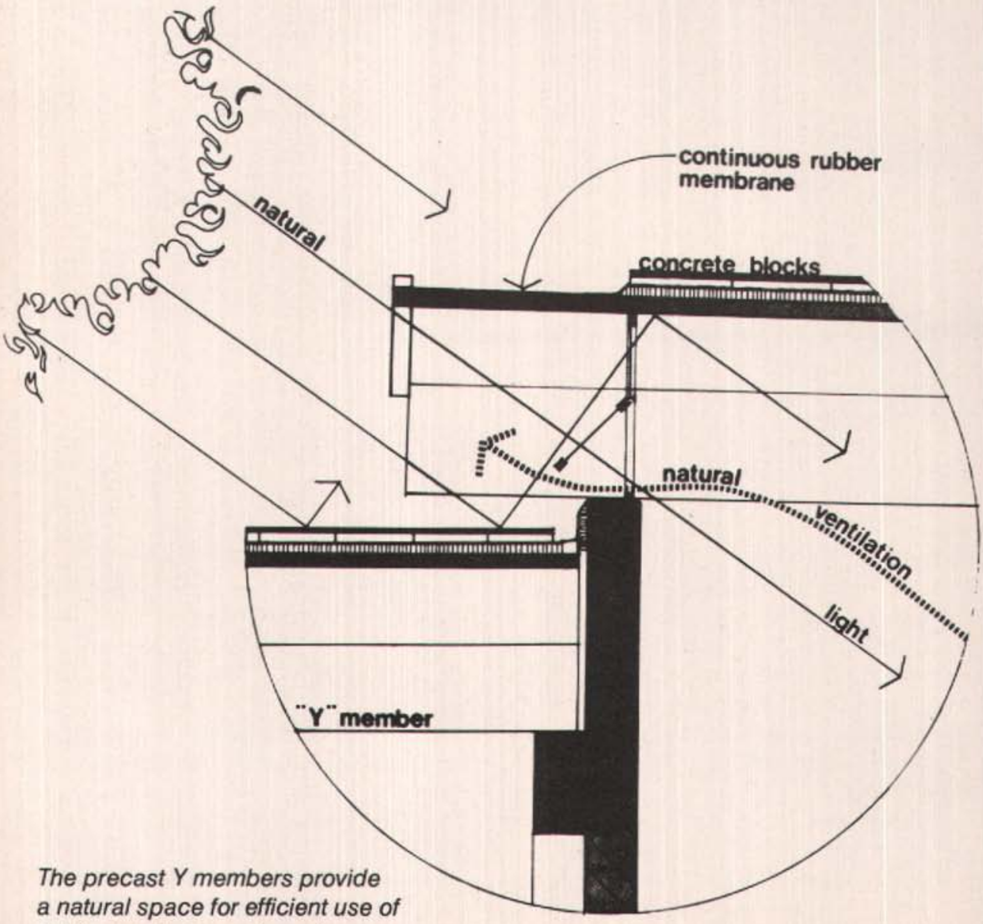
hill, to provide clerestory natural lighting and venting as well as manufacturing exhaust. This roof system also made it easier to avoid roof leaks and bad joints. A large roof overhang in front of the building's office area shades those windows from the south and west sun in the summer.

The roof is provided with expansion joints every 10 ft (3.1 m), at the high points of the Y-beams which support the roof. The continuous rubber roofing membrane is anchored at the edges, and weighted by hollow concrete blocks. The hollow cores provide natural venting and cooling for the roof, and should provide the equivalent of 60 tons of air conditioning.

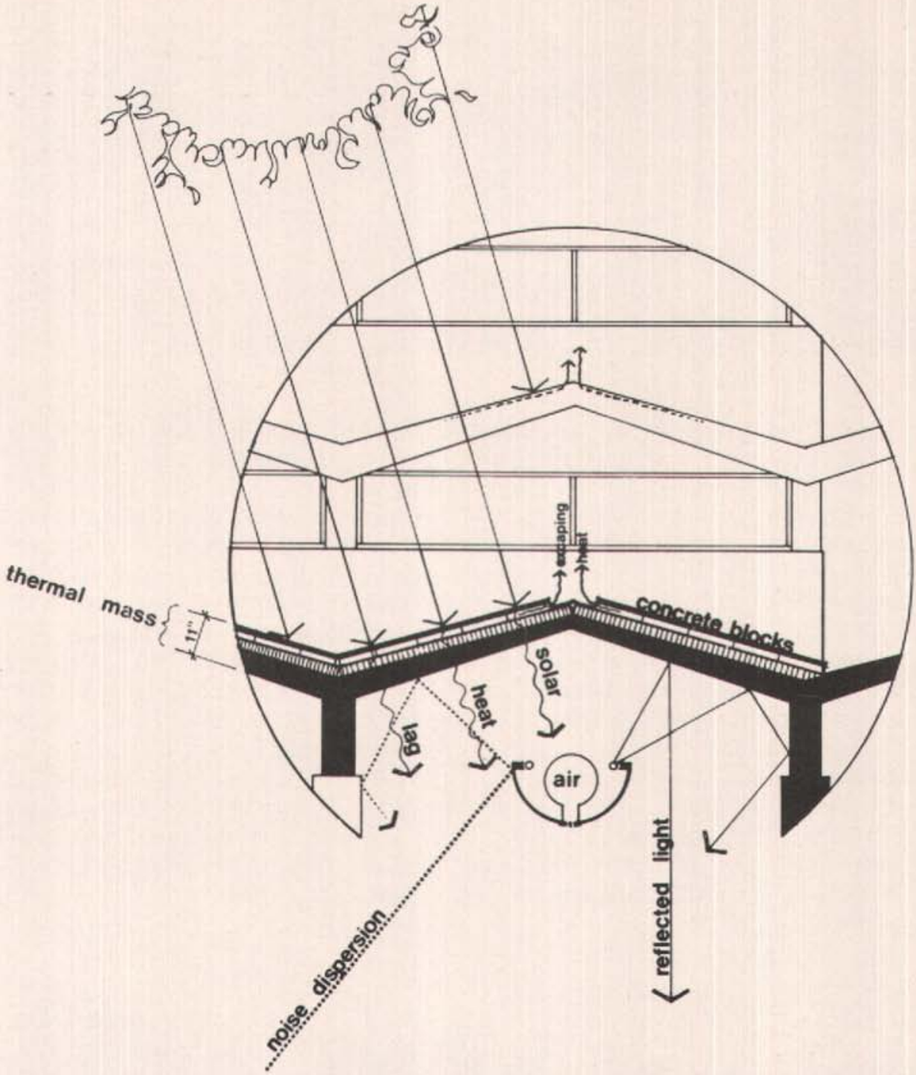
The mass of the concrete roof structure also helps regulate internal temperatures, by creating a 12-hour heat lag. Thus, the heat gain during a summer day does not fully reach the inside until the evening shifts. Similarly, the day's heat from the production process is retained into the evening shift in the winter.



Natural ventilation–Good summer ventilation as well as manufacturing exhaust are controlled by the clerestory windows which are made possible by the successive raising of bay areas.



The precast Y members provide a natural space for efficient use of lighting and air supply systems.

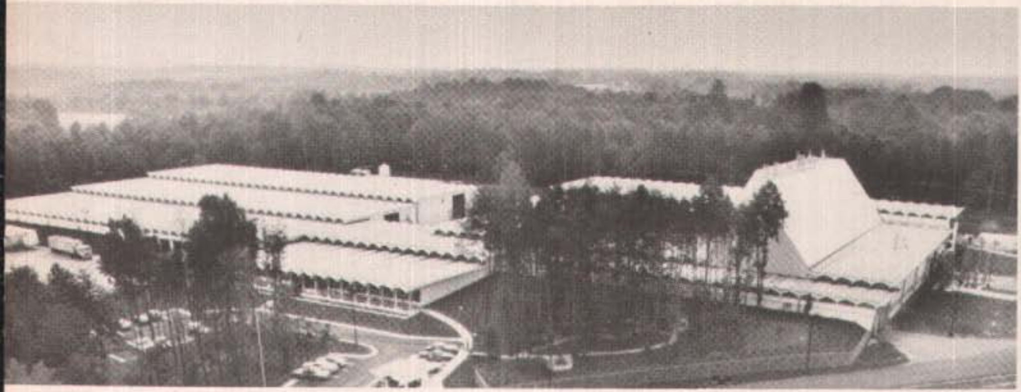


12-hour heat lag–The mass of the precast concrete roof structure provides a time lag in heat loss and heat gain. Thus, the heat gain of a summer day is delayed to act on the inside during the evening. Similarly, the cold winter night is delayed into the first shift when the production process provides excess heat.

Natural cooling of roof–The precast Y members, in conjunction with a rubber type roof, provide expansion movement every 10 ft (3.05 m) at the high points of the roof.

Integration of mechanical systems–The precast beams provide space for routing mechanical and sprinkler piping thereby setting up a discipline of mechanical service lines.

Acoustical considerations–The angular shape of the precast Y members help to diffuse the high noise levels within the plant.



The precast Y members provide a natural space for efficient lighting and air supply systems. Other precast beams provide ample space for routing mechanical and sprinkler systems, for a disciplined organization of mechanical service lines.

The manufacturing process requires a penthouse for the lead oxide ball mill and a tower for oxide mixing. Although normally separate, they were combined and extended over the grid casting room at the architect's suggestion, producing a natural chimney effect to remove excess heat from the process areas without the usual mechanical methods. The penthouse area is used for heat recovery to provide all the heat necessary while the building is occupied. These systems are adaptable to solar energy as well, if the process is changed to produce less heat.

The entire production layout was designed to bring similar manufacturing conditions to common locations. This allowed centralization of pollution controls and heat recovery, thus allowing maximum energy conservation. The giant Y beams, by providing a clear, uncluttered ceiling, greatly facilitated pollution control because they are easy to clean having no dirt catching surfaces, an important consideration where toxic lead oxide is a major part of the production process.

The building system also provides two other advantages: the shape of the Y beams helps diffuse noise in the plant, and the extensive use of precast concrete provides a fire-resistant plant structure.

In summation, the precast Y's, columns and beams allowed for a minimum number of parts with maximum duplication resulting in optimum cost economy. The use of precast concrete allowed construction to be completed within a fast track schedule.

The project was completed in April 1979 and since then the building has been functioning with total satisfaction.

Credits

Architect: Charles H. Harper, AIA, Harper, Van Lanen, Kinnich, Milwaukee, Wisconsin.

Owner: Johnson Controls, Inc./Globe Union Battery Division, Milwaukee, Wisconsin.

Structural Engineering Consultant: Brust Engineering, Wauwatosa, Wisconsin.

Precast Concrete Manufacturer: Arnold Stone Company, Greensboro, North Carolina.

General Contractor: Frank L. Blum Construction Co., Winston-Salem, North Carolina.