Design/Build PROVES EFFICIENT in Steel Parking Structure for Winthrop University Hospital

David Monroe and Ed Baum, P.E.

(Top photo)Precast concrete panels are used in combination with the steel elements to frame the interior ramp system of the structure. Note the post tensioning anchors where the deck is tensioned into the panels.

Carl Walker Inc. (CWI) and Carl Walker Construction Group, Inc. (CWCG), working in conjunction with architect, Sydney Bowne and Son, and Axis Construction, the Construction Manager, recommended the design/build process for the Winthrop University Hospital parking structure because the faster schedule appealed to the hospital's growing need for additional parking.

The Winthrop University Hospital parking structure, a three story parking structure for 630 cars located in Mineola, NY (Long Island), consists of a steel frame with a nominal 6" composite, post tensioned, cast-in-place concrete deck. Ten feet between floor heights is typical with a minimum clearance of 7' 2". Architectural precast concrete panels are used as a façade treatment for the structure. The panels feature a thin set brick inlay at certain locations to enhance the aesthetic appearance of the structure. At other less visible locations, the panels have a sandblasted finish with some rustication to achieve some cost savings. The structure fills a large city block with overall dimensions of 180' x 400'. There is 145,000 sq. ft. of supported area.

The design/build process, in combination with the selected steel framed structural system, offered the client some clear advantages in accelerating the schedule for the project. The project began as a conceptual design with a budget price

prepared by CWI (Design) and CWCG (Build). After the client reviewed the proposal and revised it to accommodate a better understanding of their requirements, the process quickly moved to the point where CWCG could confirm a Guaranteed Maximum Price (GMP) for the client. Once selected as the Design/Builder, CWI and CWCG worked together identifying critical path items and focused first on fully developing the details for the long lead items and initial site requirements. Eliminating the need to develop complete bid documents and getting rid of the formal bid process saved both time and money. Once the GMP was agreed upon, the owner could make further adjustments to the project requirements with full knowledge of what the real cost and schedule impact would be.

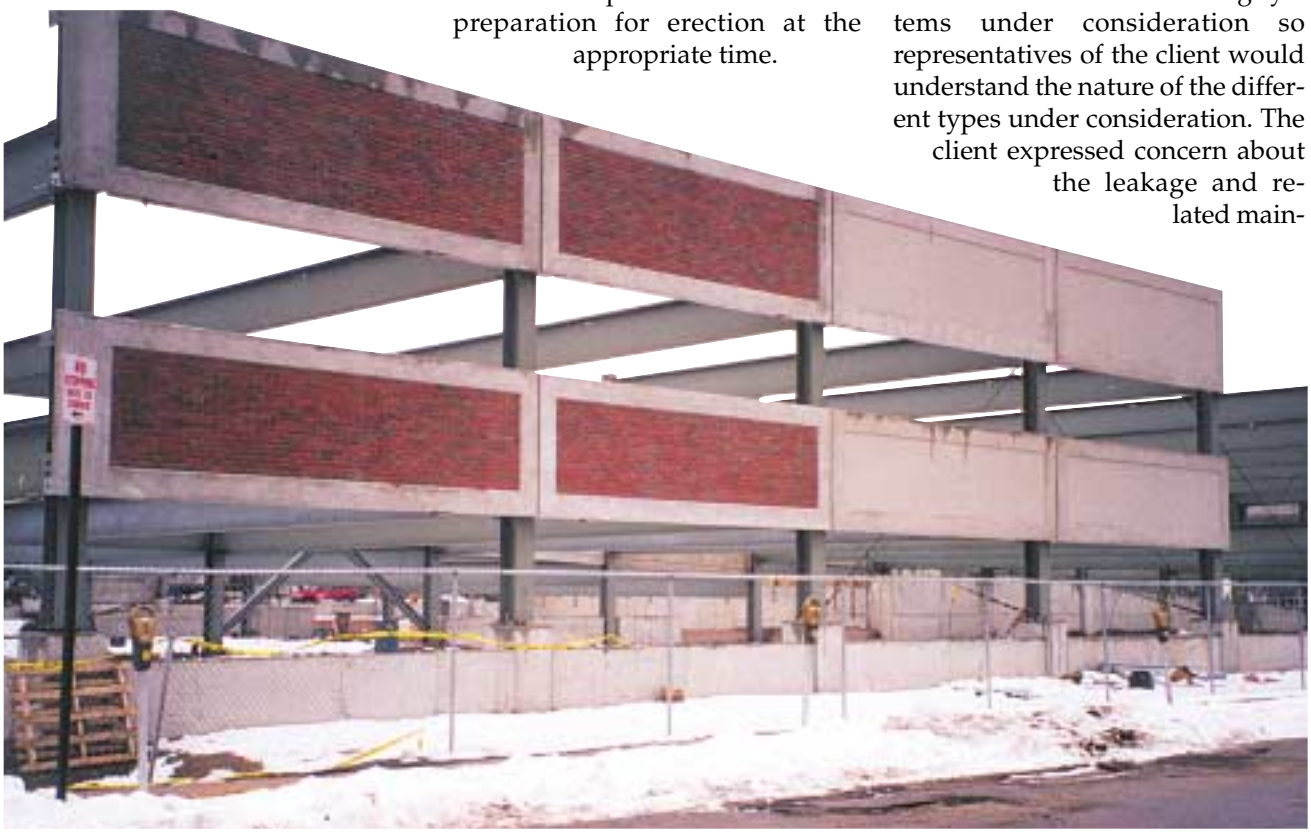
At the beginning of the project, CWI focused on the foundation requirements while CWCG got the steel ordered, the fabrication process started and an erector selected. The steel fabrication process proceeded off site concurrently with the site work required to get the foundations ready for erection.

During this time, the design for the precast concrete panels was also finalized and the order placed so that the panel production could also proceed off site in preparation for erection at the appropriate time.

A view of the partially erected steel frame with the P/C concrete panels placed at the exterior for a façade treatment. Note the composite studs affixed to the top of the beams to tie in the concrete deck.

Advantages Of The Steel Framed System

Prior to selecting a structural framing system for the project, CWCG and CWI evaluated alternative systems, including precast concrete, cast-in-place post-tensioned concrete and the steel framed system ultimately selected. Field visits were conducted to existing structures with the various framing systems under consideration so representatives of the client would understand the nature of the different types under consideration. The client expressed concern about the leakage and related main-



The partially erected structure showing both the brick faced and plane P/C panels used as a façade treatment.

Close up of the P/T anchors showing how the deck, the P/C panels and the steel columns work in a composite manner

tenance experienced with a precast concrete deck they currently owned. The client was very impressed with the lack of joints and large expanses of crack free, joint free concrete decks associated with the post tensioned concrete deck systems, in addition to appreciating the openness and excellent light distribution characteristics provided by the steel framing system. When considering the comparative costs, the client found that the steel framed system was competitive with precast and less expensive than a cast-in-place structure. Availability of the steel was also better than the precast alternative. Based on all of these considerations, the steel framed system won the day.

Steel Framed Structure: The Preferred Structural System

The structure utilizes 750 tons of structural steel consisting primarily of columns, beams and girders. The typical member is a 30″ deep I beam spanning 60′ across the parking bays and drive lanes.

The structural design proved efficient when running the steel in a single plane (across drive aisles and parking stalls) and using the composite post-tensioned concrete deck and the precast concrete façade panels to stabilize the structure in the other direction. By utilizing this method, steel weight was reduced to about 9 lbs. per sq. ft. The precast concrete façade panels, erected at the same time as the steel frame, facilitated the schedule and added stability to the structure at the perimeter during erection.

Anti-Corrosion And Durability Features

The structure utilizes bolted connections to expedite the erection and incorporate some savings when compared to field welded connections. Hot dip galvanizing all the connection plates and fasteners provided anti-corrosion protection for the connections. A field applied epoxy coating is also provided for additional durability.

Once the steel frame was erected, the open space in between the beams was formed up, composite studs were fastened to the top flanges, and the concrete decks were placed, finished and water cured for seven days. The post tensioning of the slabs occurred within 48 hours of concrete placement. The forms were then removed, making the structure permanently stable and ready for use.

Long-term durability was a key consideration for the design elements of the project. Numerous provisions were made to minimize the long-term effects of corrosion related deterioration and reduce future maintenance and repair costs.

In order to enhance the durability of the steel frame, a special protective epoxy coating system was used to provide long-term anti-corrosion protection. The beams were prepared by shot blasting to bare metal in the shop (SSPC 6) and applying 3 mils of an organic epoxy/zinc based primer. The preparation and primer were all accomplished in the shop prior to shipment to the job site. A 4 to 6 mil epoxy topcoat applied in the field completed the protective coating system. A light, off white, color enhanced light distribution within the structure and reduce fading over time. The protective coating system has a life expectancy of about 15 years. The long life of the protective steel coating system was an important consideration for the owner's decision to opt for a steel framed structure.

The cast-in-place, post-tensioned (CIP/PT), concrete deck was the perfect complement for the steel frame. CIP/PT concrete offers the opportunity to provide large expanses of concrete deck area without intermediate joints or cracks. This minimizes the probability of leakage and/or chloride contamination of the slab, which in turn reduces maintenance and future repair expense.

By utilizing post tensioning, the amount of steel required to reinforce the slab was reduced, which also reduced the exposure to future chloride related deterioration. The post tensioning system conforms with the durability recommendations of the Post Tensioning Institute (PTI), which emphasizes a

An interior view shows the openness created by the steel framing system. Also note the large deck area free of joints and cracks.

number of measures designed to reduce the probability of future corrosion of the system.

A 40 % solids penetrating silane sealer applied to the finished concrete deck surface acted as additional protection against moisture and chloride absorption.

A proprietary joint sealing system sealed the expansion joints. These specially designed seals resist the snowplow traffic anticipated at the top level, as well as the wheel traffic at other conditions. The system consisted of a cellular rubber seal element that was compressed when inserted into the joint providing a minimum area of top exposure. The seal was embedded into a special polymer nosing material, which holds the seal in place as well as providing reinforcement and tolerance control for the concrete joint edge.

Carl Walker Inc. (CWI) is a nationally known parking consulting firm based in Kalamazoo, MI with seven regional offices located at various locations around the country. The design is being performed out of their Cherry Hill, NJ, office under the direction of Ed Baum. Construction of the project was the primary responsibility of Carl Walker Construction Group, Inc. (CWCG), based in Pittsburgh, PA. CWCG specializes in the construction of new parking structures, as well as the repair and restoration of existing parking structures. CWCG and CWI, affiliated with each other by name and experience, are separately owned. Len Tsupros was the project manager for CWCG.

The Hospital retained Axis Construction of Deer Park, NY, to act as a Construction Manager and represent its interests and coordinate this and other projects currently undertaken.

Sydney Bowne and Son, retained directly by Winthrop University Hospital, provides direction for the conceptual design and architectural features of the project. Roger Coche was the project architect.

David Monroe is President of Carl Walker Construction Group in Pittsburgh, PA. Ed Baum, P.E., is regional manager for Carl Walker in Cherry Hill, NJ.

ENGINEER:
Carl Walker, Inc., Cherry Hill, NJ

ARCHITECT:
Sydney Bowne and Son

CONSTRUCTION MANAGER:
Axis Construction, Deer Park, NY

SOFTWARE:
Design Data (SDS/2)