Prescription for Parking

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SmartBeams® were the smart solution for this steel parking structure in Vancouver, WA.

The Legacy Salmon Creek Hospital campus includes two four-story medical office buildings, a 1,500-car parking garage, a new hospital, and interconnecting bridges. Construction began in May 2003. With the hospital scheduled to open for patients in summer of 2005, this required overlapping schedules for each element of the campus. To make it work with site constraints and a peak employment of over 500 craftspeople, it was essential to fast-track the 450,000 sq. ft, seven-story parking structure to allow for parking for the duration of the project's construction.

Schedules and costs for the parking structure, designed to be primarily above-grade, were compared between a traditional steel frame, with long-span girders and beams spanning 30', and various concrete systems. The scheduling advantage of erecting steel, especially during the winter months, was a deciding factor in favor of a steel frame.

Design-build steel contractor R.F. Stearns, Inc. worked with Skanska USA and KPFF Consulting Engineers to propose an alternate steel design using SmartBeam cellular beams, produced by SMI Steel Products. Stearns' history using SmartBeams in long-span projects had shown the product's excellent application for multi-level parking structures. In this case, the three-bay-wide structure required spans of 61'-6" to 61'-9", with floor-to-floor heights of 10'-3". A 3" vented metal floor deck with 3.5" normal weight concrete cover provided the composite wear surface.

The owner and design team chose the SmartBeams option because of the system's positive attributes, including column-free space, lighter structure weight and the corresponding decrease in lateral and foundation loads, fewer erection pieces, and the reduction in overall project costs.

Exposed Steel Design Challenges

The resulting steel system made use of the established economic and schedule advantages of SmartBeams for the long spans and wide-flange braced-frames for the lateral resistance system. KPFF was especially attuned to the exposed nature of the garage and effectively applied the structural design elements.

According to KPFF, special concentric braced frames in a two-story "X" configuration were a natural choice for the exposed steel project. The need to have unobstructed views inside the garage, both for driving sightlines and occupant safety, guided the choice to place longitudinal frames along each side of the middle ramp bay. At the contractor's suggestion, frames at the low end of each ramp level were sloped with the ramp girders in order to eliminate difficult beam connections for the adjacent level floor framing. Transverse braced frames for the garage were placed at each exterior face of the structure, with narrow bay widths used to create optimum bracing geometry. The size and geometry of connecting gusset plates were minimized to enhance the visual appearance of these exposed frames.

With long-span SmartBeams having been chosen for the floor plate, the architects wanted to express the same cellular look for the exposed perimeter girders. The challenge for the structural team was maintaining constant hole spacing in the cellular girders while ensuring that floor beams connected directly to web posts. The use of SmartBeam girders resulted in a cost-effective and steel weight-savings option that eliminated the need for expensive fascia treatments.

High Performance Coating Systems

One of the many challenges with an exposed steel project is the selection of the coating system. The overall durability and final appearance of the project was important to the owner and architect. In order to meet these performance requirements, the design team and Stearns worked together closely to select the

The parking structure features glass and steel exterior cladding that required tight tolerances for the steel frame.

proper coating system. While several options were available and evaluated based on an initial specification, the decision was ultimately made to prepare the steel with an SSPC-SP10 (near white blast) surface preparation, a shop applied zinc-rich primer (Sherwin-Williams Zinc Clad II), and a field-applied epoxy topcoat (Sherwin-Williams Macropoxy). This system was chosen due to its superior performance characteristics, ability to endure the Pacific Northwest weather conditions, and the assurance of a consistent final appearance.

Glass and Steel Tolerances

The incorporation of glass and steel components was another challenge that had to be addressed. Glass block and curtain wall components had to attach directly to the architecturally exposed steel framework. As a result, the allowable tolerances for the frames had to be significantly restricted to match the requirements of the glass components. This resulted in extensive use of tightly controlled shop-built frames to minimize the need for field locating the glass support pieces.

It also included close coordination between Stearns, Skanska USA, and the glass subcontractor to ensure that the resulting steel framework would be within acceptable tolerance for glass placement, specifically at the areas of glass blocks. The blocks were attached directly to steel framing that consisted of WT sections and C-shaped bent plate sections to form the various reveals. The resulting placement of the approximately 80′ tower was within ½″ in overall plumb and squareness. Early recognition of these issues and close coordination between the parties resulted in a successful completion of this challenging feature.

Architectural Components

Several unique architectural features were incorporated into the design that blended well with the exposed structural steel components. These items included landscaping panels, headlight screens, and a vehicle barrier system.

The landscape panels were custom-made grids for the incorporation of climbing vegetation. Panels were supported off the main building members around the perimeter of the building. In order to provide protection from direct exposure to the elements, the panels received a powder-coated finish and were field-bolted to the structure with stainless steel fasteners.

Due to the proximity of the hospital and the surrounding neighborhood, the owner was concerned about screening vehicle headlights. Placement of horizontal and vertical steel channel sections above the slab level and incorporation of perforated aluminum panels at the north and south sides of the building constituted this screening.

The vehicle barrier restraint system consisted of 11-line, ½″ diameter high-strength galvanized cables. KPFF designed the anchorage of these cables into the steel structure. The resulting cable lengths allowed for a minimum number of anchorages per floor and a less intrusive exterior appearance for the barrier system.

Site Conditions and Schedule

Site work and three separate buildings were under construction concurrently at the hospital campus, with all subcontractors sharing common access for equipment and deliveries. The resulting site logistics, coupled with a tight schedule, were challenging for each of the parties involved in the project. One of the main issues involved the proper sequencing of over 150 loads of structural steel and metal decking for the garage alone. This required daily coordination between Stearns, Skanska USA, and the trucking companies. The steel erector faced the challenge of having to perform multiple activities simultaneously to achieve the aggressive concrete-on-metal deck placement schedule.

The use of steel for parking structures continues to increase, with long-span systems, high-performance coatings, reduced foundation loads, and aesthetics among the main considerations for that choice. The Legacy Salmon Creek Hospital parking structure exemplifies all of these attributes by combining unique and pleasing architecture with the latest in steel technology. ★

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