Parking Spaces

Alan Pillinger and Stephen Govier

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While steel parking structures are still unusual in the United States, they have long been recognized in the United Kingdom for their lightweight construction and long-term durability. One of the leading designers of parking structures in the United Kingdom is Bourne Parking, headquartered in Dorset, UK. During the past 25 years, they have completed numerous steel-framed parking structures ranging from a 60-space single-deck construction to 1,500-space multi-story developments.

In the drive to reduce construction times and offer a fast and flexible construction solution, Bourne Parking has developed Montex, a modular assembly system that enables a steel-framed parking structure to be completed in just a few weeks. The system not only maximizes the benefits of steel construction—including the creation of light, airy and spacious parking environments—but also creates a low-cost, durable design that capitalizes on the efficiencies of the design-build methodology.

Most recently, Bourne Parking worked with engineers Ove Arup & Partners and architects RTKL to design and build a new parking facility for the European headquarters of a major American client, Computer Sciences Corporation.

ENVIRONMENTALLY SENSITIVE LOCATION

When Computer Sciences Corporation opened their European headquarters at Aldershot, Hampshire (UK), they requested a flexible, cost-effective design that could maximize the potential of a complex, steeply sloped site located within a protected area of natural beauty.

The designers first considered a cast-in-place concrete design, but the client was concerned about the systems high cost and potential maintenance problems. Instead, the Montex system

The Montex framing system provides a clear headroom of 2.2 m (7.2') and a floor construction depth of just 570mm (22.5").

Steel framing creates a light, airy structure.

was chosen as a cost-effective design—both in terms of initial capital costs and maintenance/life-cycle costs. The resulting design combined a traditional flat plate layout with a split level arrangement, allowing the parking structure's tiered multi-story design to follow the steep line of the sloping site to achieve optimum use of the available area.

In addition, the long clear spans possible with the Montex system allowed for more efficient floor layouts and ramp configurations, as well as providing a brighter internal environment and a less "massive" building in such an environmentally sensitive location.

Finally, the Montex system offered a very attractive construction schedule with completion in just 45 weeks.

HOW THE SYSTEM WORKS

The Aldershot project comprises seven levels, each with a clear headroom of 2.2 m (7.2') and a floor construction depth of just 570 mm (22.5"). The final seven-story building was just 24 m (79') tall, substantially less than with the concrete alternative. A traditional concrete scheme would have had floor depths of around 850 mm (33.5"), while the Montex system has floor depths of 570 mm (22.5").

For durability, the 1,270 metric tons (1,400 tons) of steel were galvanized to a minimum of 85 microns. The structure's main superstructure has a 15-minute fire resistance, while stairways are designed with a one-hour fire rating.

With a structural grid of 16 m × 2.4 m (52.5' × 7.9'), the long-span, pre-cambered 460 mm (18.1") steel beams of the frame support 8 m × 2.4 m × 110 mm (30' × 7.9' × 4.3") high-strength concrete floor slabs, each with a design strength of 50 N/mm^2 (7,250 psi). These slabs comply with the specifications of BS 8110 to ensure optimum resistance to road salts. Cast-in conduits in the ramp slabs also allow heating elements to be retrofitted (or replaced) without removing any of the floor finishes.

Galvanized steel framing provides durability.

Columns are placed on a "clear span" grid of 16 m (52.5′) to provide column-free parking bays. Columns on the perimeter are spaced at 2.4 m (7.9′) centers to spread the load of the structure and make best use of the ground conditions. The 2.4 m (7.9′) grid also provides regular support from which to hang the facade/elevational finishes (and saves the cost of secondary steel support members). Column sizes are 203 mm × 203 mm (8″ × 8″), which provides the required 15 minute fire resistance. Structurally, they could be smaller sections, but to comply with UK Building Codes, the 203 mm (8″) size was needed.

During construction, each of the 3.5-ton slabs was lifted into position using a vacuum lifting machine. This avoided the use of cast-in lifting sockets, which would have needed to be filled in on-site.

With the Montex system, composite action is achieved between the steel beams and precast units through the use of shear connectors and galvanized loop reinforcements. The resultant joint is then filled on-site with high-strength, non-shrink concrete grout. There is no need for a structural screed either, thereby resulting in a fast, reliable, and proven construction system that is less susceptible to poor whether conditions.

Ultimately, the clear-span frame layout, column-free bays, and efficiency of the ramp configuration meant that the total floor area of 19,449m^2 (209,347sq. ft.) provides 1,177 parking bays.

ARCHITECTURAL FEATURES

Aesthetic considerations on this project included the use of mesh fascia panels throughout and silver PVF2-coated composite steel cladding to the stair towers—each of which also houses a dry riser for fire suppression.

Within the stair towers, the white architectural concrete spiral staircase incorporates cast-in heating elements in the threads to prevent the build-up of ice during inclement weather—a feature required by UK Building Regulations in open staircases of this size and height.

A pedestrian walkway clad with terra cotta tiles provides covered access from the office development into the main stair core and lift shaft where two 11-person elevators provide access to all levels.

From the start, the parking structures shape was adapted to help preserve an existing group of trees on the site. The architectural design of the project, in turn, utilized these trees to provide landscaping and help soften the visual impact of the structure.

As this project demonstrates, steel is an innovative design option for contemporary parking structures. The project was delivered on-time at a cost—including design fees—of just £4,400,000 (approximately $6.5 million).

Stephen Govier, Managing Director, and Alan Pillinger, Technical Director, both work with Bourne Parking in Dorset, United Kingdom.

STRUCTURAL ENGINEER

Bourne Parking, Dorset, United Kingdom

ARCHITECT

RTKL Architects, London