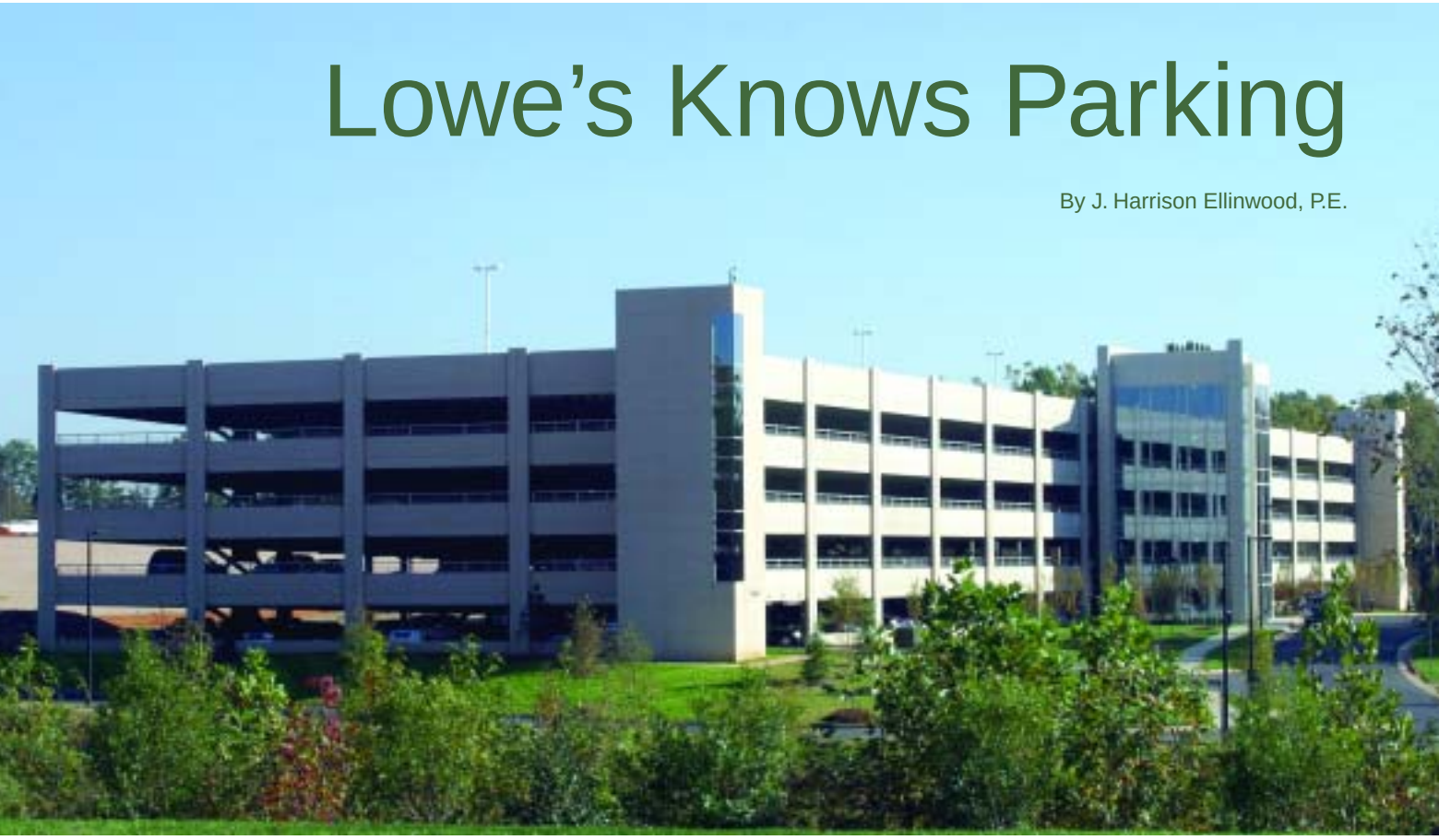
Lowe's Knows Parking

By J. Harrison Ellinwood, P.E.



Steel-framed parking decks saved more than $300,000—while also meeting the stringent aesthetic requirements for Lowe's new corporate headquarters in Mooresville, NC.

The exterior design of the new five-story parking deck for Lowe's Companies, Inc., was designed to unobtrusively blend in with its natural surroundings.

When a pre-cast concrete design proved too expensive, the designers of three parking decks with more than 1,500 parking spaces turned to structural steel—with very fortuitous results.

The master plan for the new corporate headquarters for home improvement giant Lowe's Companies, Inc., in Mooresville, NC, called for campus buildings that would blend with the natural beauty of the surrounding landscape. Buildings would feature natural, rustic materials including sandstone, limestone, wood, and brick as the primary building materials to complement the area.

The first phase of the project, which was completed in September 2003, included a 400,000-sq.-ft. main building, one five-story parking deck with 925 spaces, two two-story parking decks with 300 spaces each, and extensive site work to the 164-acre campus located in a wooded valley.

Calloway Johnson Moore & West, P.A. (CJMW)—a full service architecture, engineering, and interior design firm headquartered in Winston-Salem, NC—provided architectural and structural services, as well as mechanical, electrical, and interior design services for the campus, which is located about 30 miles from Charlotte, NC.

Because of the emphasis on wood and stone, a precast concrete design was initially chosen for the parking structures. However, the preliminary design proved too costly and a steel-framed variant was presented to Lowe's as a value-engineering option and solution. The initial cost savings of steel-frame versus pre-cast convinced Lowe's to allow CJMW to further investigate this option.

Designer's Challenge

The first task included an inspection of various steel-framed parking deck designs. The team wanted to judge the aesthetic appeal of the different designs, as well as evaluate the designs' durability and long-term maintenance costs. After Lowe's executives and members of the design team traveled to Atlanta, GA to examine steel-framed parking decks of various ages and designs, the potential cost savings and the aesthetic attractiveness of these decks convinced the team that a steel-framed structure was the solution.

To investigate different corrosion protection systems for the steel framing, CJMW compared a zinc galvanized finish to various paint protection options. Hot-dip galvanized steel design—a corrosion protection method proposed by Galvan Industries, Inc. in Harrisburg, NC—ranked highest.

Hot-dip galvanizing provided not only a competitive initial cost, but also a much lower life cycle-cost estimate compared to other paint systems. One of the main convincing factors for the team was the minimal long-term maintenance cost for the hot-dip galvanized steel frame design over its estimated service life.

Timing is Everything

In order to maintain the original project construction schedule—with construction starting in 2002 and wrapping up in the fall of 2003—the team completed the re-design of the structural system on a fast-track schedule. This schedule required intensive collaboration among the structural engineer, steel fabricators, and contractor.

1. Cellular beams, such as SMI Steel Products' SmartBeams, are manufactured by cutting a steel beam and then off-setting and welding the resultant pieces (visit **www.smisteelproducts.com** for more information).

2. Corrosion protection for the steel members was provided through hot-dip galvanizing. Because of the size of the members, they were double-dipped—galvinizing one side first and then the other.

3. One of the advantages of a steel-framed parking structure, especially one framed with cellular beams, is the bright, open look.

One key to the speed of the project was that instead of mailing design drawings back-and-forth, team members—including the project designer and the steel fabricator—would scan the drawings, electronically transmit them, print them out, mark their changes, re-scan the drawings, and resubmit them electronically. This limited use of Electronic Data Interchange (EDI) facilitated collaboration among team members by allowing a quick transfer of information. As a result, final drawings for the five-story deck were completed less than one month after receiving the owner's verbal authorization to proceed. EDI also helped speed up the shop drawing submittal process. Further, thanks to the efforts of the team and the use of EDI, the entire process—re-design to final steel erection—took only six months.

A Perfect Fit

The basic frame system used for each of the three decks consisted of conventional steel framing for the columns, girders, and perimeter beams. Castellated beams spanning 60′ and spaced at 10′ o.c. were used to support the elevated decks. A typical bay consisted of W24x55 girders spanning 30′ and LB30x50/62 SmartBeams™ from SMI Steel Products. LB30 indicates a 30″-deep castellated beam with round holes. The "50/62" designation indicates that the top half of the beam was cut from a W21x50 and the bottom half from a W21x62. Both the girders and the castellated beams were cambered to meet deflection requirements.

The composite concrete slab consisted of 3″ of 4000-psi normal weight concrete on 3″, 20 ga., galvanized composite steel floor deck. Wide-flange, chevron-braced frames provided lateral stability, and bolted connections eliminated the need to touch up the galvanized paint surface. Expansion joints in the parking deck structure also helped to accommodate differential thermal changes of the steel frame.

In order to maintain the galvanized finish on the entire steel beam-framing surface, shear studs were shot through the galvanized composite floor deck onto the galvanized top flange of the beam framing. A tension pull test performed on the shear studs prior to the shear stud installation determined the proper weld settings and adequacy of the shear stud capacity to adhere to the galvanized surface.

The elevated concrete slabs were reinforced to mitigate shrinkage cracking, with additional rebar placed in areas of negative bending in the slab. In order to help prevent water infiltration into the concrete slab that could lead to corrosion of the slab reinforcement, the top of the concrete slabs were treated with a protective waterproofing sealant, and any joints or slab penetrations were sealed with an elastomeric sealant to bridge any minor surface cracking. These protective measures were utilized to enhance the durability of the concrete parking deck slabs.

Construction of the phase one parking decks required a total of approximately 1,700 tons of hot-dip galvanized structural columns, girders, castellated beams, and miscellaneous steel.

Sealing the Deal

Selecting a steel-framed parking deck structure provided numerous positive attributes to the project. The galvanized steel frame with castellated beams not only provided a visually appealing structure but also allowed for a more open interior design layout for the parking deck. It also allowed designers to maintain the pre-cast exterior cladding on the structure, thus maintaining the aesthetic continuity with the building materials chosen for the rest of the campus.

In addition, the reduced design dead loads afforded by the steel structure resulted in significantly lower foundation loads than those required by the pre-cast structure, consequently reducing footing sizes. The ease of erection for steel framing provided an initial cost benefit, as did the ability to use the steel erector already on-site for the construction of the adjacent main office building. These advantages supplemented the estimated $300,000 initial cost savings and the lower life cycle maintenance costs.

Due to the success of the first phase of construction and the serviceability of the steel-framed parking decks, a phase two addition to the five-story parking deck is currently under construction. The design for phase one was so successful that only minor tweaking of some details was necessary for the new structure. This addition will add a five-story mirror image bay to the parking deck. The new bay will include another approximately 1,100 tons of hot-dip galvanized steel.

Achieving the success of these new parking structures is a direct result of the advantages offered by utilizing steel construction, as well as by developing an organized team approach between all parties involved in the project. And as a final note, the project won a "Most Distinguished Project" award from the American Galvanizers Association in 2004.

Lateral stability for the five-story parking deck was provided by chevron-braced frames. Shown above is a close-up of the connection for the lateral framing system.

For more information on galvanizing, please visit **www.galvanizeit.org**. For more information on designing steel-framed parking structures, visit **www.aisc.org/parking** or call the AISC Steel Solutions Center at 866.ASK.AISC.

J. Harrison Ellinwood, P.E. is an associate of Calloway Johnson Moore & West P.A.

Owner
Lowe's Companies, Inc.,
Mooresville, NC

Engineer/Architect
Calloway Johnson Moore & West, P.A.,
Winston-Salem, NC

Engineering Software
RAM Structural System
RISA 3D

Detailing Software
X-Steel

Steel Fabricators
SteelFab, Charlotte, NC (main structural steel and detailing) (AISC member)
SMI Steel Products, Hope, AR (castellated beams) (AISC member)

Steel Erector
Contract Erectors, Randleman, NC (SEAA member)

Contractor
Skanska USA Building, Inc.