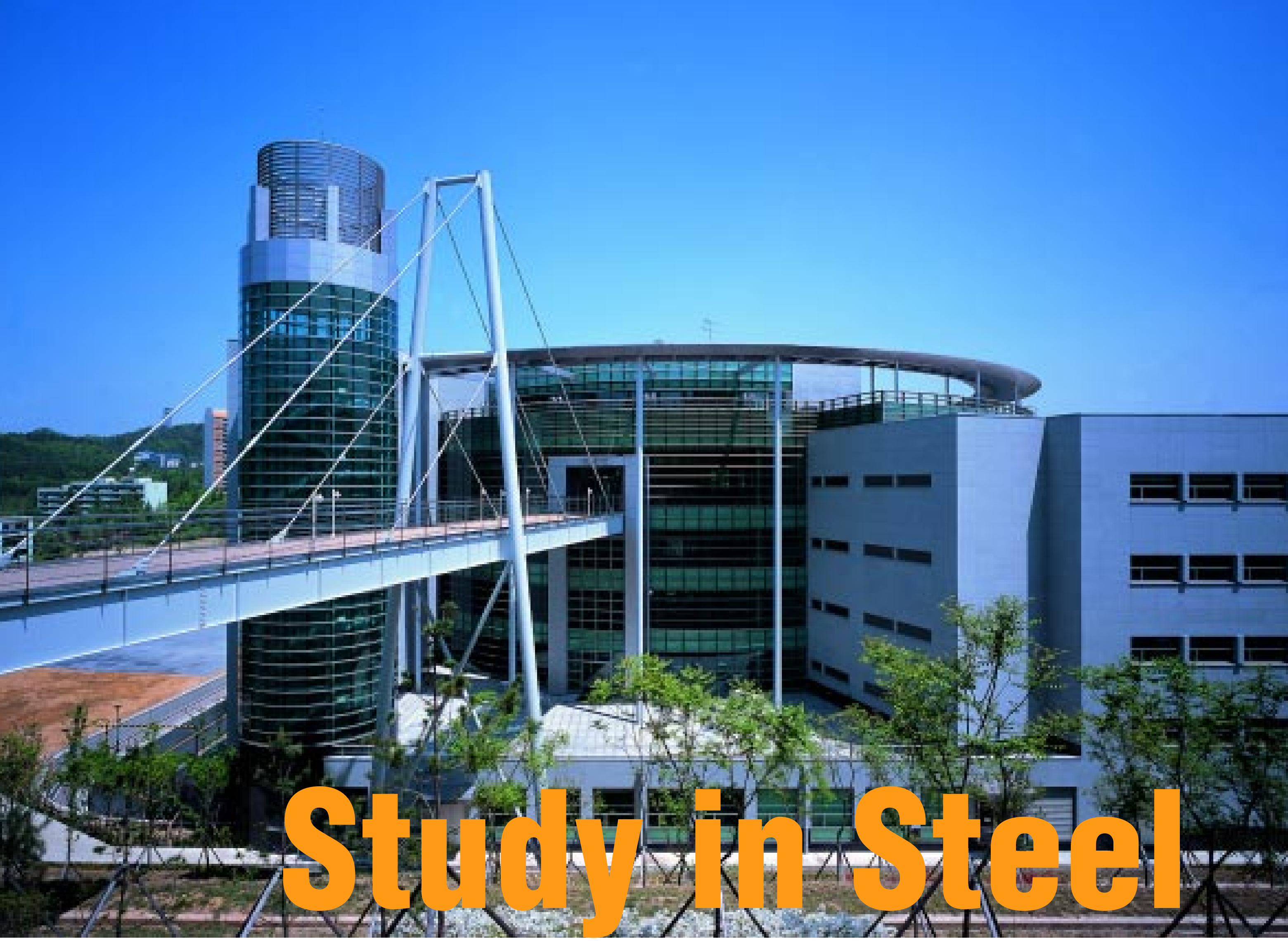
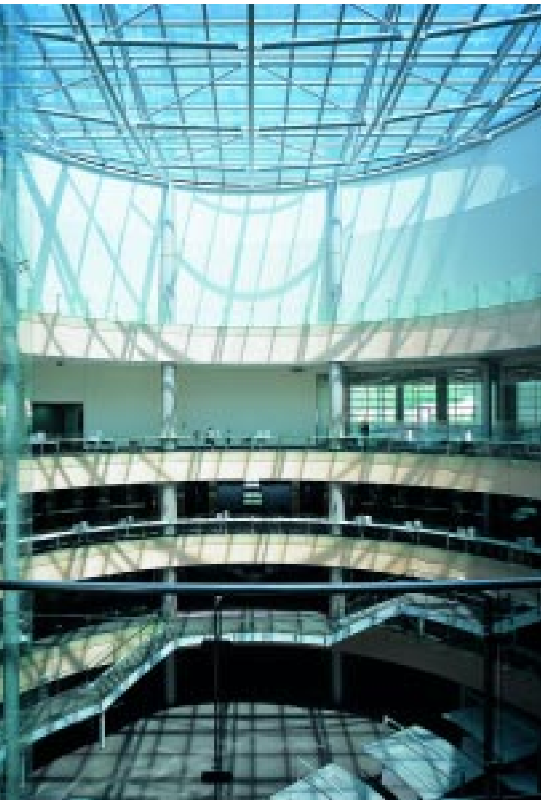


Study in Steel



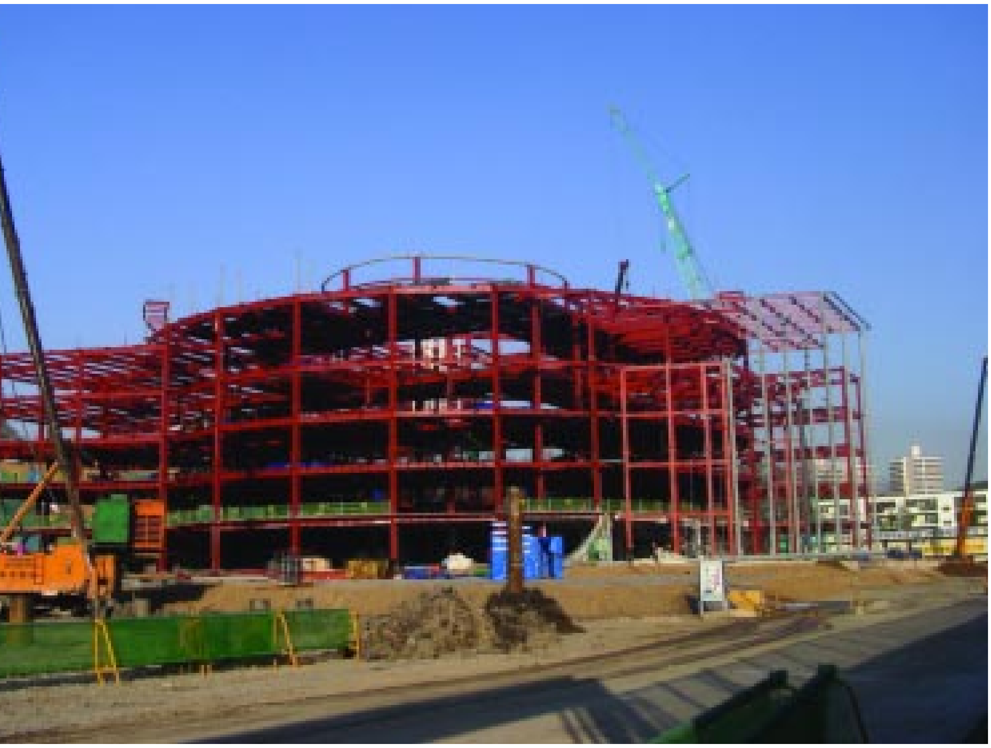
Heather Hammatt

A high-tech architectural design in steel and glass symbolizes the cutting-edge technology inside this Korean university's library and computer center.

One of the fastest growing and most technologically advanced universities in Korea, Pohang University of Science and Technology (Postech) is known as the "MIT of Asia." At the heart of campus, the new Tae-Joon Park Digital Library, constructed with 2,230 tons (21.5 lb per sq. ft) of structural steel, straddles a steep hillside on the Postech campus, providing a visual focal point for both the upper and lower campus levels.

The site presents a challenging drop of 25 m (82′), necessitating a variety of bridges and vertical connections both inside and outside of the building. "We wanted the space to be fluid and interconnecting," said SmithGroup Architect Michael Kang, AIA, project designer for the library. "This dictated going with steel, to give us the flexibility to shape and build circulation and connection elements."

The building expresses its tectonic structure with a circular atrium encased in a skin of metal and glass, uniting the library vertically, and creating a dramatic openness that encourages interaction and communication. "The connections are very powerful," Kang said. "You can feel the whole building structure as a skele-



The library is constructed with 3,646 pieces of structural steel, which cost approximately $2.8 million, including erection.

ton, the bones of the building expressed within a transparent skin."

The lateral systems are constructed with a moment-resisting frame, and the gravity systems are constructed using a combination of a moment-resisting frame, composite beams, and composite metal decking. The steel frame and reinforced concrete structure also incorporates an imported deck-slab system, Ace-Deck Plate, which is a combination slab with high section performance. The 3,646 pieces of steel frame cost approximately $2.8 million, including erection. Designed in typical 9 m-by-9 m bays, the beams are wide-flange sections, equal or less than 650 mm in depth with 3 m spacing. Connection types vary, and are chosen to maintain the building's transparency. Columns are connected to a system of girders by moment connections with total compression bolts. Beams are then fastened to the girders using a shear connection.

ATRIUM

The library's five-story, circular atrium invites visitors into the interactive combination of public and private space. The transparent structure provides high ceilings and a clear view from the ground up to the fifth floor.

"We were able to span long distances with thin elements, keeping the structure light and dynamic," Kang said. "In this case, form follows structure. With steel you are able to express transparency through glass, not only vertically with the curtain wall, but also horizontally, as in the skylight."

The ground-floor entrance is situated in an expansive, glass wall. "Using steel, we were able to express monumental scale at the main entrance with slender columns and a clear expanse of glass," Kang said.

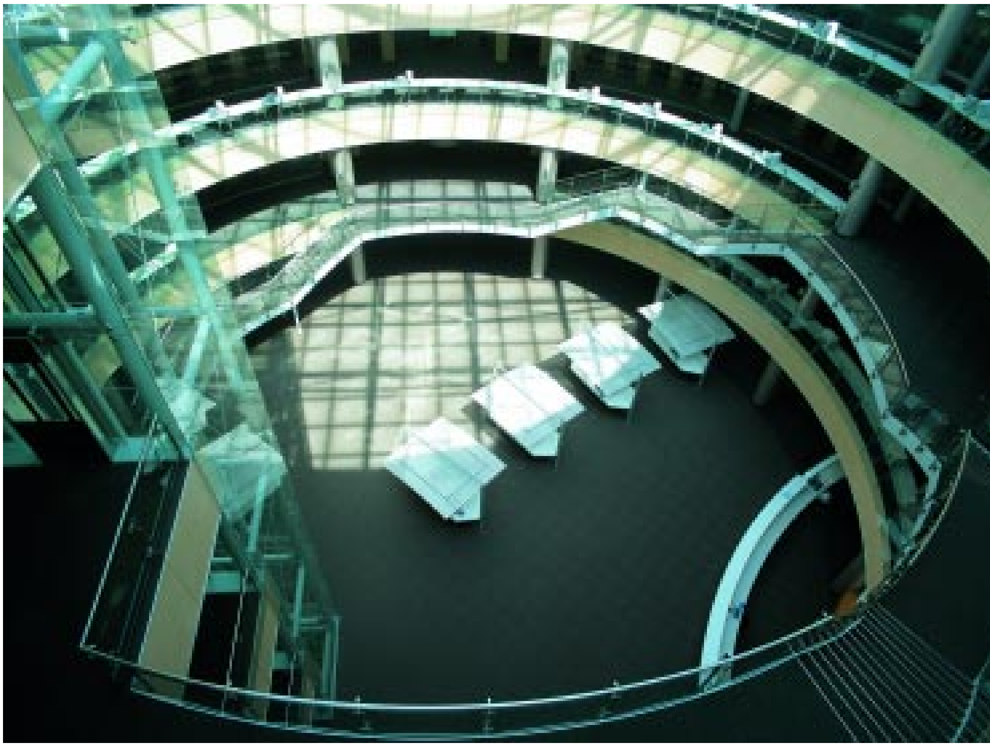
Also at the main entrance, steel columns 406 mm (16" inches) in diameter support a portico along with the stainless-steel, tension-rod system supporting the 27 m-wide (88′), five-story glass system. The columns are made of SM 490 steel (F_y = 3,300 kg/cm^2, or 47 ksi).

The design of the atrium's skylight uses a regular 9 m-by-9 m (29′-by-29′) modular, structural grid. The modular grid is very rigid, presenting a challenge to accommodate the round building footprint. A focal point of the atrium's design, the skylight, was originally envisioned as a cable dome. However, that proved cost-prohibitive, and instead the skylight was carved out of the modular layout and supported with a pin-connection truss system. The skylight's king-post trusses were assembled off site, eliminating on-site welding during the final assembly process. In addition to providing support, the steel grid gives shape and shadow to the experience of natural sunlight in the atrium space.

ARCHITECTURAL ADVENTURE

Two rectangular buildings of imported stone from China flank the glass-and-metal curtain wall and anchor it to the earth. The glass is an energy-efficient, low-E type, shaded from direct sunlight by horizontal aluminum sunshades.

Within the building, a sweeping, glass and stainless-steel staircase provides access from the second through fifth floors and connects the upper and lower campus. Visitors from the upper campus enter via the fifth floor and cross a post-tension-rod steel bridge. The bridge is supported by a 32 m (105′)-tall structural-steel arch that



The glass-roofed central atrium is five stories high. Stainless steel and glass are combined to create a monumental stair connecting all levels of the digital library.

spans between a hillside slope of 25 m (82′) and the library building.

Visitors enter to expansive views of the center atrium and the front entrance below, with immediate access to a series of multi-media labs and faculty and student study areas. The bridge also functions as the all-night entrance for the 24-hour cyber café on the sixth floor.

Typical 9 m-by-9 m steel bays are designed to carry live loads (700 kg/m^2 or 100 psf) with an 800 mm (31″) structural depth, including the composite deck slab. If the building had been constructed of reinforced concrete, it would have been a much heavier structural system. Using steel sped construction, because it allowed the steel-fabrication process to overlap with site preparation. The lightweight steel structure provided for fast erection, and the project was completed on time and in budget.

Some of the challenges of working on foreign soil came in the form of communication and presentation. SmithGroup, with the help of the structural engineers at Cagley and Associates in Rockville, MD, shepherded the design through schematics and development. Then their counterparts at POS-A.C. Co. Ltd., in Seoul, Korea took over and produced construction documents. "It was not as simple as working on our own," Kang said. "But they were able to make some of the details more appropriate to local construction methods and processes."

Kang says cultural differences meant careful preparation. "It was critical that we were prepared and that we kept open lines of communication with our counterparts in Korea throughout the design process." Presentation of the design took place over a series of six visits and a span of 26 weeks.

The design and documentation of the project began in August 2000, and construction started in July 2001. The entire project was complete by May 2003.

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