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Hall of Fame
**From
Graceland
to Cleveland**

The sculptural house that rock built

Elvis gave his first concert north of the Mason-Dixon line in Cleveland. Now it's the home of the Rock and Roll Hall of Fame.



In Cleveland in the 50s, disc jockey Alan Freed coined the phrase rock 'n' roll. Back in Cleveland 40 years later, steelworkers hoisted a steel beam autographed by 25,000 fans to the top of the Rock and Roll Hall of Fame and Museum. A 50-ft-tall inflatable *Honky Tonk Woman* decorated the scene and—who else?—Jerry Lee Lewis pounded out *Great Balls of Fire* for the celebration.

The offbeat topping out last August was just one measure of the unusual rhythm driving the 150,000-sq-ft building under construction on the Cleveland harbor front. The Eagles, Motley Crüe, Crosby Stills & Nash and Billy Joel have stopped by for site visits. Pink Floyd had a few (very good!) suggestions for the owner. Even the geotechnical engineer is in sync: "I got James Brown's autograph and framed it for my office."

Celebrities aside, there is plenty to note about the design and construction. Besides the curves and sharp an-

gles of the concrete, steel and glass structure, one section of the building is actually founded in Lake Erie. A 162-ft-tall hall of fame tower is supported by a 60x60-ft pile cap in the lake, and a 44-ft-dia cylindrical exhibit space is perched on a single column supported by a 35x35-ft pile cap. A 125-seat theater cantilevers 65 ft out from the tower over the water. And a sloping glass wall, supported by bowstring pipe trusses, rises at a 45° angle from the entrance at plaza level to the top of the tower.

Just getting the project under way took years of work, says Peter E. Arendt, director of design and construction for the owner. The project was funded by a public-private partnership of the State of Ohio, the City of Cleveland, Cuyahoga County, the Cleveland-Cuyahoga County Port Authority and Cleveland area and music industry corporations and foundations.

The partnership brought close attention to budget. "The construction

team came on board early as a consultant to value engineer while we were in design development," with New York City-based architect Pei Cobb Freed & Partners, Arendt says. The construction management team of the Cleveland office of Turner Construction Co. in association with local firms Colejon Corp., Choice Construction Co. Inc. and Bradley Construction Co. Inc. won the job over 17 other teams with its \$46-million guaranteed maximum price bid. The overall cost, adding land, fees and exhibits, will be \$84 million.

The design by I.M. Pei is an expression in "architectural language of the excitement of rock and roll," says Michael D. Flynn, the technology partner in the firm. "The result is sculptural and, because of the lakeside site, you always see it against the sky."

Flynn's expertise in sloped glazing came into play on the dominant element of the building—what designers dubbed the "tent" above the entrance. "We used a prefabricated, preglazed



Twist and shout: Architect I.M. Pei (right) got an enthusiastic greeting from *Rolling Stone* magazine publisher Jann Wenner at the spirited topping off celebration for the building in August (top right). Construction challenges on the project include a 125-seat theater that cantilevers 65 ft out over Lake Erie (top, center) and a sloping wall over the entrance (center and left). Dubbed a "tent" by the designers, the wall rises at a 45° angle from the plaza to the top of the hall of fame tower. A waffle slab creates an outdoor plaza and covers the main exhibit hall (above). The interactive exhibits will be "more than just things in a case," says the owner's director of design and construction.



Connections involved three and four pipes.



Bowstring trusses are perpendicular to the sloped surface.

unit system of sloped glazing" that was customized for the project, Flynn says.

Beneath the glass, there will be ticket areas, shops and a restaurant. Visitors will take escalators down into the

grid of 16 bowstring trusses of different lengths. Vertical glass curtain walls enclose the two other sides of the tent.

The bowstrings curve from as much as 6½ ft deep in the center down to

zero at the edges. The longest is 162 ft. Saw-Teen See, partner-in-charge for project structural engineer Leslie E. Robertson Associates, New York City, explains, "Instead of being in the vertical plane, the bowstrings are perpendicular to the sloped surface." Robertson adds: "We got the idea by imagining the shape of a membrane over the surface with a uniform pressure on it. The trusses create an in-fill between the surface and the deflected shape. It's quite efficient because of that."

Wet work. Construction started with the installation of two different foundation systems. Robert A. Celli, project manager

for Turner, says the work proceeded simultaneously using a 90-ton crawler crane on a floating pontoon assembly and another crawler crane on land.

In the harbor, H piles were driven to bedrock and on land, auger cast-in-place concrete piles were installed. "During drilling near the lake, we encountered natural gas in areas of the bedrock formation," says Vijay Khosla,

weeks at a time, pushing the job behind schedule, Arendt says.

Steven J. Crawford, project manager for Baker Concrete Construction Inc., Monroe, Ohio, describes it as "bitter, bitter weather" for building the 80,000-sq-ft slab and for installing the pile caps in the lake. "It didn't shut us down, but it slowed us down," he says.

Forms for the pile caps were installed using divers, who also set the bottom rebar mat. Baker then tremied in the first pour of concrete and after it hardened, pumped the water out, so the forms became a cofferdam. Top steel and the balance of the concrete could be placed in the dry. The top of the first pour was held under mean lake level so the joint would not be seen, and the cap was clad with panels with an architectural finish.

The smaller pile cap for the cylindrical exhibit space was built using the same basic technique except that the entire cap was left below lake level. The column was built on the pile cap, and the finished effect is a column disappearing into the lake. This work was done at one of the most severe periods of the winter. "We could walk out to the pile cap on ice 12 inches thick," says Crawford.

For the mass concrete, Baker used a mix design that had a low heat of hydration to minimize cracks. "We used 70% ground granulated blast furnace slag as a substitute for regular cement, and it did everything we wanted at the same time," Crawford says. It provided low heat of hydration, low permeability against the lake water and also the soft white color required by the architect.

Baker's greatest challenge, Crawford



Forms for pile caps create a cofferdam to place concrete in lake.

main exhibition space below the outdoor plaza or up into the tower, the theater and other exhibit space.

The tent has a main triangular section connected to an offset parallelogram in a different plane. Two edge trusses bring the main triangle to a peak and one supports the other side of the parallelogram. The sloping glass wall is supported by an intersecting

adds, was meeting the exacting standards required for the curving architectural concrete walls around the side of the large exhibit hall. The building has a regular 4.5-ft grid, but the forms along the curve do not have even dimensions. "We were measuring down to $\frac{1}{32}$ nds of an inch and using sines and cosines to calculate the curves of the forms," Crawford says. "It was more like building furniture than formwork."

To make up time lost during the severe winter, the steel erection schedule was expedited by starting the tent structure earlier than originally planned, says T.W. Owens, district manager for steel erector American Bridge Co., Pittsburgh. Structural steel was re-sequenced and parts of the two main pipe trusses were erected early and shored.

Kilroy Structural Steel Co., Cleveland, fabricated roughly 1,900 tons of steel for the job with "a lot of tubes and exposed steel shapes," says Project Manager Robert Krejci. "The most complicated connections, where three and four pieces of pipe intersect, were shop welded," he adds. Field welds were almost all straight joints.

Steel erection started using the pontoon-mounted crane, which erected the tower steel and then the cantilevered box girders on the cylindrical exhibit hall. While these girders were being welded, the water crane moved around and erected the cantilevered theater trusses. Temporary tiebacks were used until the truss connections were made.

The land crane was primarily used for the tent steel. But a 100-ton truss "was shipped to the site in two pieces, spliced together on the ground and then erected using both the land and water rigs," Owens says. Some trusses were too long to erect in one piece, so falsework was set and the trusses erected in pieces. "The splices were fit up and welded in the air," he says.

One of the toughest jobs is still ahead. "Mullion tube steel on the roof requires alignment to near-perfect tolerances to establish a plane for the glass framing to fit," adds Owens.

When construction crews move out in June, installation of exhibits, designed by the Burdick Group, will continue in earnest. Arendt describes the exhibits as "highly interactive" and says they will include an "anti-rock barrage, Little Richard's tour of fashion (how rock has influenced dress) and a video wall." And it was no coincidence that the *Honky Tonk Woman* appeared at the topping off ceremony. The Rolling Stones have donated items from their Steel Wheels Tour set. ■

By Janice L. Tuchman in Cleveland

Crafting a catalyst for creativity



Stainless steel sail at new home of Inventors Hall of Fame in Akron creates an uplifting spirit.

Just a half-hour drive from Cleveland, another less-heralded museum is rapidly taking shape on a tight site in downtown Akron. But the \$38-million Invention Place, future home of the National Inventors Hall of Fame, is not taking a backseat to anything. The public-private project boasts its own high-end design, unusual exhibits, precise detailing and site challenges.

The new quarters will be a T-shaped, 77,000-sq-ft, cast-in-place concrete building that features 29,000 sq ft of interactive exhibit space. The main entrance is draped by a 50-ft-tall sloping "sail" of stainless steel panels and glass. Framed on exposed steel arcs, the shimmering skin vaults over the main hall's interior plaza and thin five-story wall of famed inventors. The great hall is backed by a four-story service wing for offices and classrooms.

"There's definitely an uplifting quality to it but no single reading to the symbol of the sail," says Don Weinreich, project architect with James Stewart Polshek & Partners, New York City. Polshek's design, engineered by the New York City office of Ove Arup & Partners, relies on "the geometry of three," he adds, using basic shapes—a plane, a curve and a rectangle—to form an image of progress and possibility.

"The detailing on this required a lot of brainstorming to build what the architect wanted," claims Donzell Taylor, vice president of Welty Building Corp., Akron, construction manager for the job's \$22.4 million in contracts. "It inspired a lot of creativity, especially in designing scaffolding to install the steel panels."

Inspiring creativity is the stated goal of

owner Invention Place, a nonprofit group dedicated to promoting invention and innovation through educational outreach. The group formed in 1987 to support the Hall of Fame's announced relocation to Akron from the crammed lobby of the U.S. Patent and Trademark Office in Arlington, Va., where the museum had been housed since its creation in 1973.

Below the new plaza is a 33-ft-high open area for workshops, where visitors of all ages will be encouraged to "discover the inventor within" with the help of a wide variety of tools and equipment, ranging from children's toys to a lathe and a drill press. Exhibits will be installed next year by the design-build contractor Hands On! Inc., St. Petersburg, Fla.

The museum's unusual mission has not been lost on the construction team. Invention Place President Dick Nichols orients every

new group of workers. "I want them to know that this is not just another building in Akron—it's a national monument," says Nichols. Taylor believes the sessions "improved our work ethic and resulted in better craftsmanship." He also credits Welty's good relationship with Akron-born Polshek.

Now on schedule for completion next spring, work has moved past early delays on architectural concrete. Local concrete contractor W.G. Lockhart Construction Co. had little experience with such detailed formwork so time was lost in training and pouring test panels. Crews worked extra shifts for five weeks to make up the difference. "Lockhart really rose to the occasion," says Taylor.

By Rob McManamy



Main hall includes wall of inventors. Exhibits are interactive.