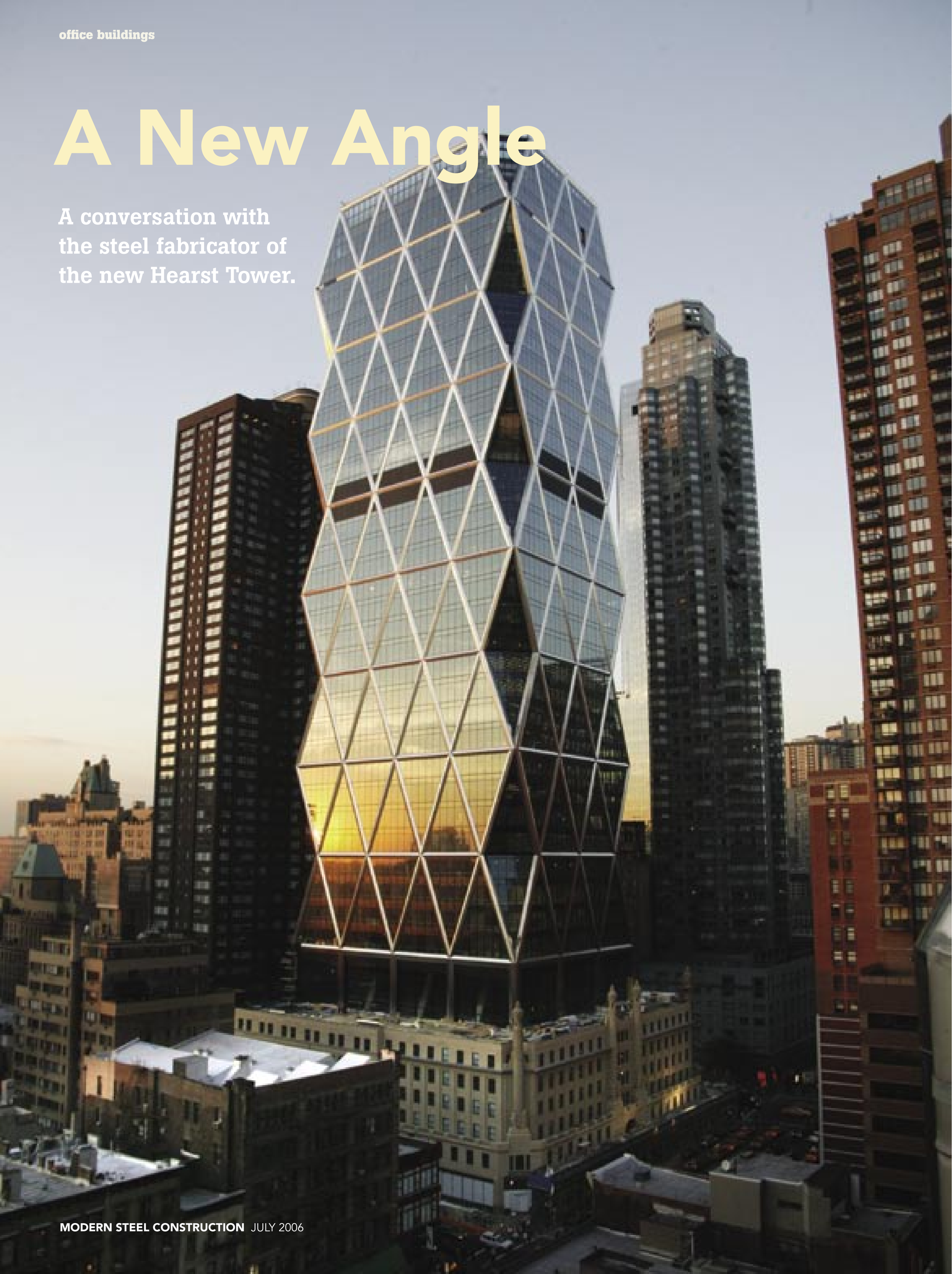
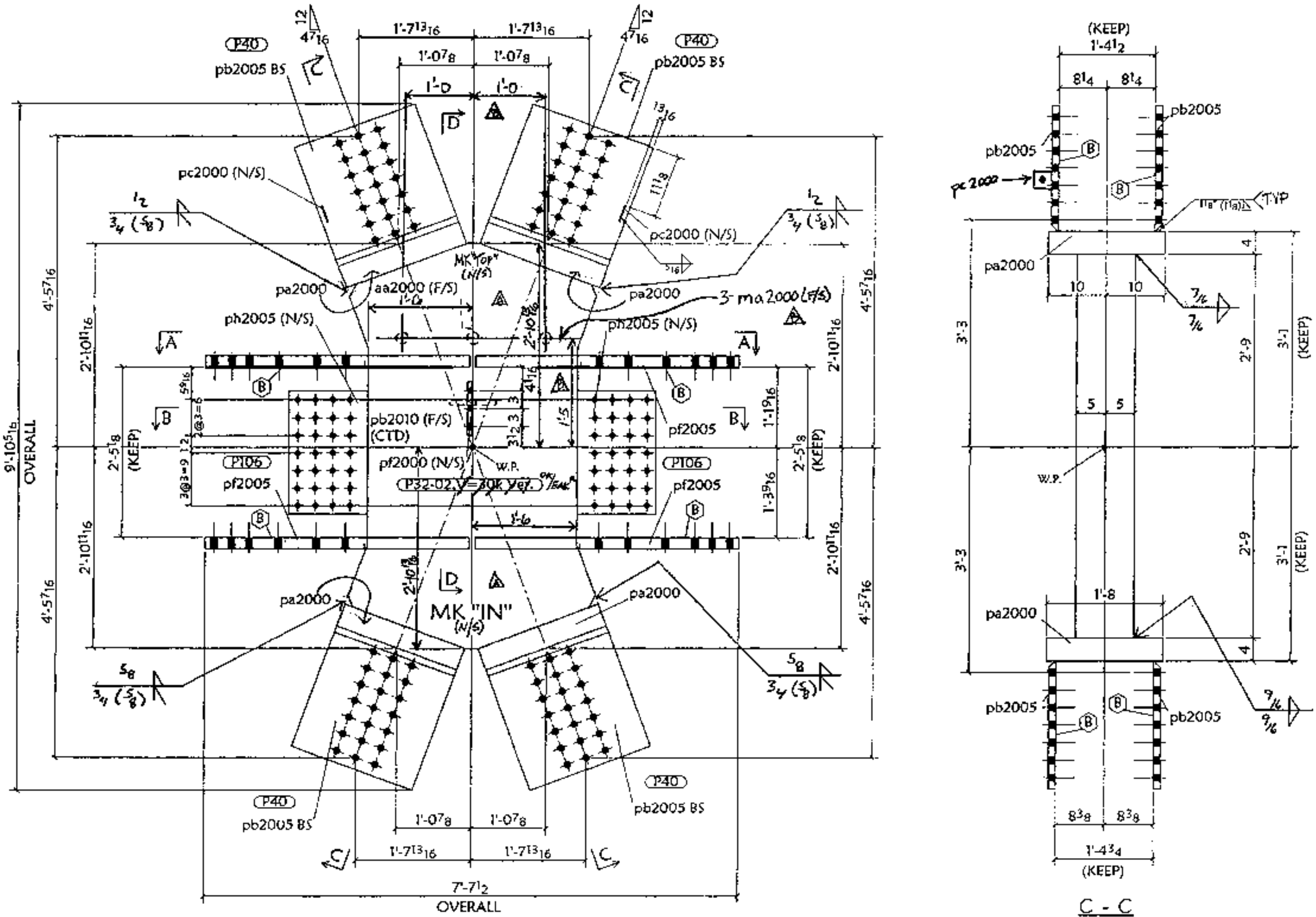
A New Angle

A conversation with the steel fabricator of the new Hearst Tower.





This detail shows a typical node for the building. Eighty-four similar pieces were fabricated from 10"-thick machined steel plates.

Courtesy Hearst Corporation

THE 46-STORY HEARST TOWER, RECENTLY COMPLETED IN MANHATTAN, COMBINES 40 STORIES OF NEW CONSTRUCTION WITH THE HEARST CORPORATION'S ORIGINAL SIX-STORY HEADQUARTERS. The 1920s-era stone façade of the original structure now serves as the shell of the headquarters' lobby and provides the architectural base for a 40-story exterior steel diagonal grid (diagrid) system, designed by Foster and Partners architects and engineered by WSP Cantor Seinuk.

Cives Steel Company, an AISC member, performed the project's connection design and fabricated its 11,500 tons of structural steel. Fabrication began in early 2004 and steel erection, performed by AISC member subcontractors Cornell and Company of Woodbury, N.J., was completed by the end of 2005.

Kurt Gustafson, S.E., P.E., AISC's Director of Technical Assistance, and Ron Tuttle, Senior Project Manager for Cives Steel Fabricators in Governeur, N.Y., recently discussed the challenges in fabricating the tower's structural steel.

Kurt Gustafson: Did Cives do the connection design on the project, or did the engineer [WSP Cantor Seinuk] do it?

Ron Tuttle: We did the connection design out of our office in Atlanta, and we also did some of the design out of the office

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All photos this page: Cives Steel Co.

here [in New York] with our in-house designers.

Gustafson: What did you find difficult about the project? I know it's an unusual project with the geogrid framing system on the perimeter. Did that present any problems as to erection tolerances?

Tuttle: That was the single biggest issue—the tolerances and the drift of the building, trying to maintain the building to where it was supposed to be. With the diagrid node system, we basically machined each one of the nodes to make sure we maintained the proper dimensions, and then we milled each of the columns bearing onto those. Periodically up through the building, we would hold a certain tier of columns and do a field check, and then adjust the columns as needed to try to keep the building where it was supposed to be.

Gustafson: Were they all bolted splices?

Tuttle: Yes. There was a big 10" node plate system and then the columns were bearing on the nodes. We had paddle plates coming off the nodes, bolting through plates that welded onto the toes of the column. So it was a bolted column to the node, yes.

Gustafson: And the beams also bolted into the same node?

Tuttle: Yes. There was a shear tab connection coming into the nodes. Actually, the beams come more into the center of these nodes. It's like an upside down V and a right-side up V in a given node system, and you have four columns coming into that. The 10" plate kept the columns away from the centroid of the nodes a fair amount and allowed room to connect the beams into the center of the nodes.

Gustafson: Did you use standard holes or did you need oversized holes for erection?

Tuttle: We used a combination of both, but we used quite a lot of oversized holes to allow a little bit of fit-up tolerance in the field.

Gustafson: Were these all slip-critical connections?

Tuttle: A large share of them were, yes.

Gustafson: Did you find problems in the field as you were erecting the building? You said you had to make adjustments as you went up.

Tuttle: We really didn't adjust too much going up through the building. Actually, everything fit pretty well. We struggled with one or two points in trying to make all the bolts fit because there were so many bolts coming into some of the corner nodes [also called the "bird's mouth" nodes], but all in all it fit very well. The New York City Erectors Local No. 40 sent a letter saying it was some of the best fabricated steel they'd ever seen for this complex a structure.

Gustafson: Was the steel clad with a covering?

Tuttle: Yes. There was a stainless steel cladding system that covered the diagrid columns. Between the columns, a glass mullion-type system was used.

Gustafson: Was Cives involved in the cladding at all?

Tuttle: We shared models back and forth with the curtain wall supplier. We took his information and downloaded it into our computer model. We checked for clearances and any clashes between their connections and our connections, but we weren't really involved in fabricating the cladding. We had connections on our steel to support their materials, so we did fabricate the connections for them.

Gustafson: Did you use interoperability with the design engineer?

Tuttle: We created the model on our system—we did the three-dimensional model and incorporated the information. We didn't download their model into our system.

Gustafson: So you created the model. Was the review process done by the engineer? Did they do it from your model, or did you just submit regular shop drawings?

Tuttle: We actually submitted both. We submitted the drawings for the engineer and architect to review, and then the model was used by the curtain wall contractor, Permasteelisa, on the exterior of the building. Permasteelisa used Catia and we used two systems: SDS/2 in the lower part of the building and Xsteel on the upper part of the building. With the schedule we had on the project, there were two different detailers and we broke the building out into six phases. We did the detailing for the first ten floors in house, and then we had an outside detailer [AISC member Mountain Enterprises of Sharpsburg, Md.] for the eleventh floor up through the top of the building.

The lower phase included the work involved from the basement level up to the tenth floor, which got us up and out of the existing structure. Then we had [Mountain Enterprises] pick up the work from there up the building. The work from there involved quite a lot of repetition with the shapes of the diagrids and the node system. With an outside detailer working on that, it helped us expedite the work to keep up with the schedule.

We had two of our plants working to fabricate the job, too, and we alternated phases. [The New York plant] did the exterior skeleton of the building from the ground up, as well as all of phase one. Then we had our other shop in Virginia alternate phases with us. Because of the schedule, we felt it was a safer way to keep up with the erector.

Gustafson: Where did the steel actually start in relation to the height? Was up above the existing building, or did you go down inside the old?

Tuttle: They kept the old stonework of the landmark façade around the perimeter of the building. They also kept the very first bay of steel intact. Then they gutted the interior of the building right down below grade and put in foundations. We put the new steel inside the existing façade steel, some of which was reused and some was taken out.

Gustafson: So you actually started at grade or below grade?

Tuttle: The columns extended one level below grade.

Gustafson: Was it all A992 steel? Or did you require anything else?

Tuttle: There were some Grade 65 columns on the diagrid system. There's a horizontal truss system on the third floor of the building and we used Grade 65 steel for some of that, too. Pretty much the third floor main horizontal framing was Grade 65, and then the diagrid columns on the perimeter of the building were Grade 65, with the balance being A992.

Gustafson: It sounds like it was a very interesting project.

Tuttle: Yes, it was a very complex system of weldments and very tight tolerances. And it was the first time we'd ever used this diagrid column and big heavy plate node system.

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The engineer had actually designed the plates with four pieces of 5" plates welded together to build these bird's mouth nodes, but we ended up coming up with a design to use two 10"-thick plates. There were 84 of the internal 10" nodes and 16 of the bird's mouth nodes.

Gustafson: Were the bird's mouth nodes fabricated out of one piece?

Tuttle: No, actually two pieces.

Gustafson: And then you welded them together to the 10" thickness?

Tuttle: Not the full thickness. There were partial penetration welds welding the plates together.

Gustafson: Were they all under compressive stresses?

Tuttle: The engineer provided us with the shear load transfer forces, which created long partial penetration welds that were quite heavy, but they weren't the full thickness of the plate.

Gustafson: So I presume from two sides.

Tuttle: Yes. Then at the third floor, there were what they called Y joints, which weighed about 24 tons apiece. They were a big heavy plate weldment, and they picked up what they called the megadiagonals. The megadiagonals went up from the third floor and supported the steel up on the tenth floor, and then they framed into these big 44" square megacolumns built out of plates.

Gustafson: What kind of steel were the plates for the megacolumns?

Tuttle: They were A572 Grade 50 plates. Some of them had big stiffeners into the internals of the big 44" square columns to support the truss system at the third floor. MSC