THE ARCHITECT'S NEWSPAPER

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Left: A model and rendering show 100 11th's multifaceted facade, which features a seven-story street wall that creates a semienclosed atrium around the building.
Above: A performance mock-up of the curtain wall's megapanels.
Below: Each glass panel sits in aluminum cassettes that are welded to the steel extrusions of the megapanel frame.

ATELIERS JEAN NOUVEL WITH BEYER BLINDER BELLE AND FRONT (CURTAIN WALL CONSULTANT)

Frank Gehry's IAC building has about 16 months before it faces a competitor for the most-jaw-dropping-facade-on-Manhattan's-West-Side crown. Literally faces it, that is—from across the street. French architect Jean Nouvel's 100 11th Residences, a 21-story luxury condominium now rising on the corner of 19th Street and 11th Avenue, may have a mostly rectilinear profile, but it will feature a faceted facade, pixelated with glass panes of varying shapes and materialities, tilted in multiple angles on multiple axes within an inscrutable wiry frame. Not only has the design drawn comparison to the Borg spaceship (obviously a potent and revered influence upon the engineering community), it has also given rise to plenty of head-scratching over how such an unusual building envelope could be built.

To make sure that the adventurous design could feasibly be constructed, Alf Naman (who is developing 100 11th along with Craig Wood and Keith Bashaw), brought in facade consultant Front, Inc. to work with Nouvel and executive architect Beyer Blinder Belle. "Nouvel's idea for the facade was to have a single composition, as opposed to a traditional curtain wall with discernable panels," said Marc Simmons of Front. "Our challenge was to introduce a regulating order to give a suppressed but present logic to the face, and resolve it into a system that makes sense in terms of good construction practices."

Front used the two 3D modeling software packages CATIA and Digital Project to design the wall system, starting by locating vision panels and operable windows based upon the condo's interior program. "The team designed the envelope from the inside out and outside in," said Simmons. "Once you do that it yields specific constraints that allow for the continued articulation of the complete pattern." To make sure things didn't get too regular, Front organized groups of glass panes into megapanels. The megapanels' overall dimensions conform to the rooms they cover, defining picture frames designed specifically for each interior space and ranging in size from 11 by 18 feet to 20 by 37 feet, depending on the width and floor-to-ceiling height of the individual spaces. There are 192 megapanels, 87 of which are unique. Seven megapanels wrap each floor (the facade will cover only the two street faces—the other sides of the building are black brick with normal punched windows), and the entire edifice features 1,351 individual glass panes, composed of four different material variations, each pane tilted on one of four axes by two, three, four, or five degrees.

Once the individual units of glass had been located in megapanels, Front turned to the job of framing each panel. Because there are no linear load paths within the megapanels, a traditional moment-connected aluminum mullion system, with its large fasteners and bolts, would have been too bulky to meet the slim profiles Nouvel wanted. Front decided instead on a frame of welded 3-inch-wide steel mullions, which carry the required loads even when formed into the design's irregular patterns. But the design's variation presented further challenges: The steel extrusions of the mullion system had to vary in depth from 3 to 6 inches to support the various tilts of the glass panes. A system of aluminum cassettes, welded to the extrusions and sanded smooth, was devised to hold the individual glass units and provide a thermal and acoustical break.

When planning the connection of a megapanel system to a reinforced concrete structure, managing deflection between the two systems can become a significant problem. Since multiple connections rest on an uneven slab, deflection can twist the system out of shape and compromise both the envelope's aesthetic and its weather seal. To manage the deflection, Front introduced a 4-by-10-inch steel spreader beam to hang the wall off of the building structure. Each megapanel has multiple connection points to the beam, but the beam only has two connection points to the structure. The resulting system minimizes deflection to ¼ inch.

It all sounds simple enough, but finding someone to fabricate the steel and aluminum wall system proved challenging. "We bid the job to seven contractors," said Simmons, "and got back six no bids and one yes." The yes came from Seele, a German fabricator, but even that firm couldn't meet the feasibility requirements. So Front took matters into its own hands. "If you're going to design something difficult," continued Simmons, "you have to take responsibility to see if it can be built." Front formed its own contracting company, CCA Facade Technologies, which assembled a fabrication and erection team composed of KGE, one of China's largest fabricators, and Island Industries, a local union company that erects large panel systems. The approach worked, cutting costs by 25 percent and saving the ambitious design from falling into the shadow land of unbuilt works. **AARON SEWARD**