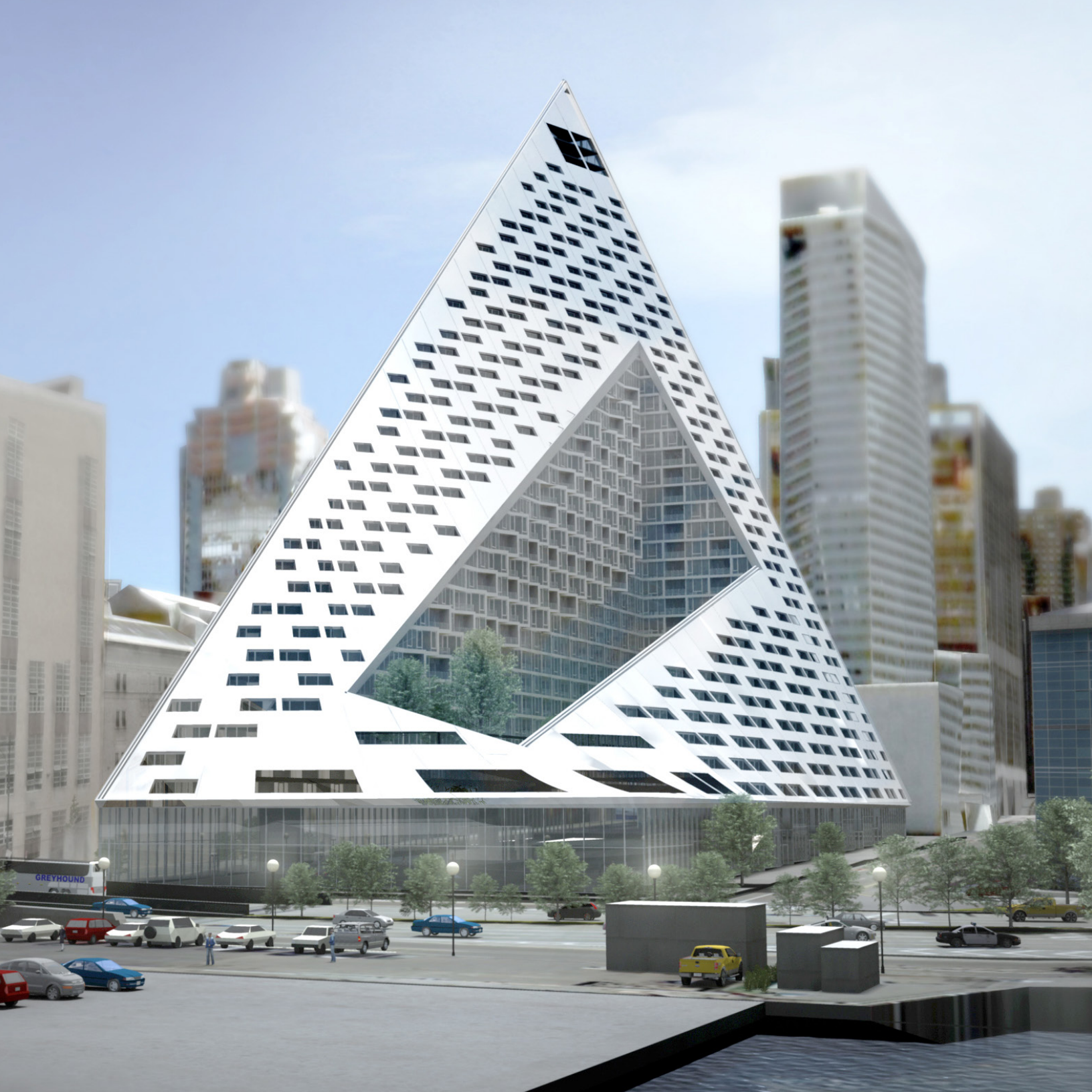




LOOKING BEYOND THE SCREEN: EXPLORING THE PATH FROM DIGITAL TO PHYSICAL

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During the design process of a complex building facade, the utilization of cutting edge computer technology can help in communicating solutions for real world applications. Integrating multiple technologies within 3D platforms from a once 2D environment can be overwhelming, but it can also be extremely beneficial. In an effort to execute designs with the most complex conditions, 3D software has become a successful time saver for generating 3D models to be documented, analyzed, and later sent to fabrication for installation. Translating the client's design language to a technological platform ensures the fluidity of dialog between architects and curtainwall designers.

BRIEF HISTORY

Not too long ago, computers were a luxury in the design industry. Computer-aided design (CAD) and drafting software was nonexistent, and architectural drawings were completed by draftsmen. Although these drawings were efficient, this time-consuming process required an unprecedented level of skill. Due to the influx of shorter project deadlines, AutoCAD quickly became an essential tool for drawing in a 2D environment. Recently, the pace of drawing production has exceedingly increased, but it is still prudent to make sure the process of creating and reevaluating is instilled. With the addition of these new technologies, the process of design has evolved and inputting ideas into a computer program has become a standard practice.

COMMUNICATION

For a curtainwall company to be successful, communication is key. Whether internal or external, having the ability to communicate design solutions is essential in a competitive market. With the addition of a wide variety of 3D design software, the Studios can now develop 3D computer models and rendered images of facade components, 3D printed prototypes of complex conditions, and animations for logistics planning. These additions have helped to bridge the gap between owners, architects and facade designers.

Prior to this, a submission consisted of a 2D drawing set composed of elevations, plans, sections and details. Since 2D drawings were limited in visual information, the current use of 3D views accompanying 2D drawings helps explain and answer areas in question. In addition to discussing drawings on paper, detailed system information can now be viewed as a 3D computer model on screen, allowing us to rotate, hide and explode parts, and show material properties in real time. Exploded 3D view's help explain part make-up and sequencing of sub-assemblies but also assists with logistics planning, especially when 3D animations of installation stages are needed. Taking one step further, when dealing with complex conditions, a plastic 3D printed section of a detail can now be produced, bringing a tactile element to meetings as a valuable resource for discussion. By combining these methods of communication the Studios are able to accurately explain our design process

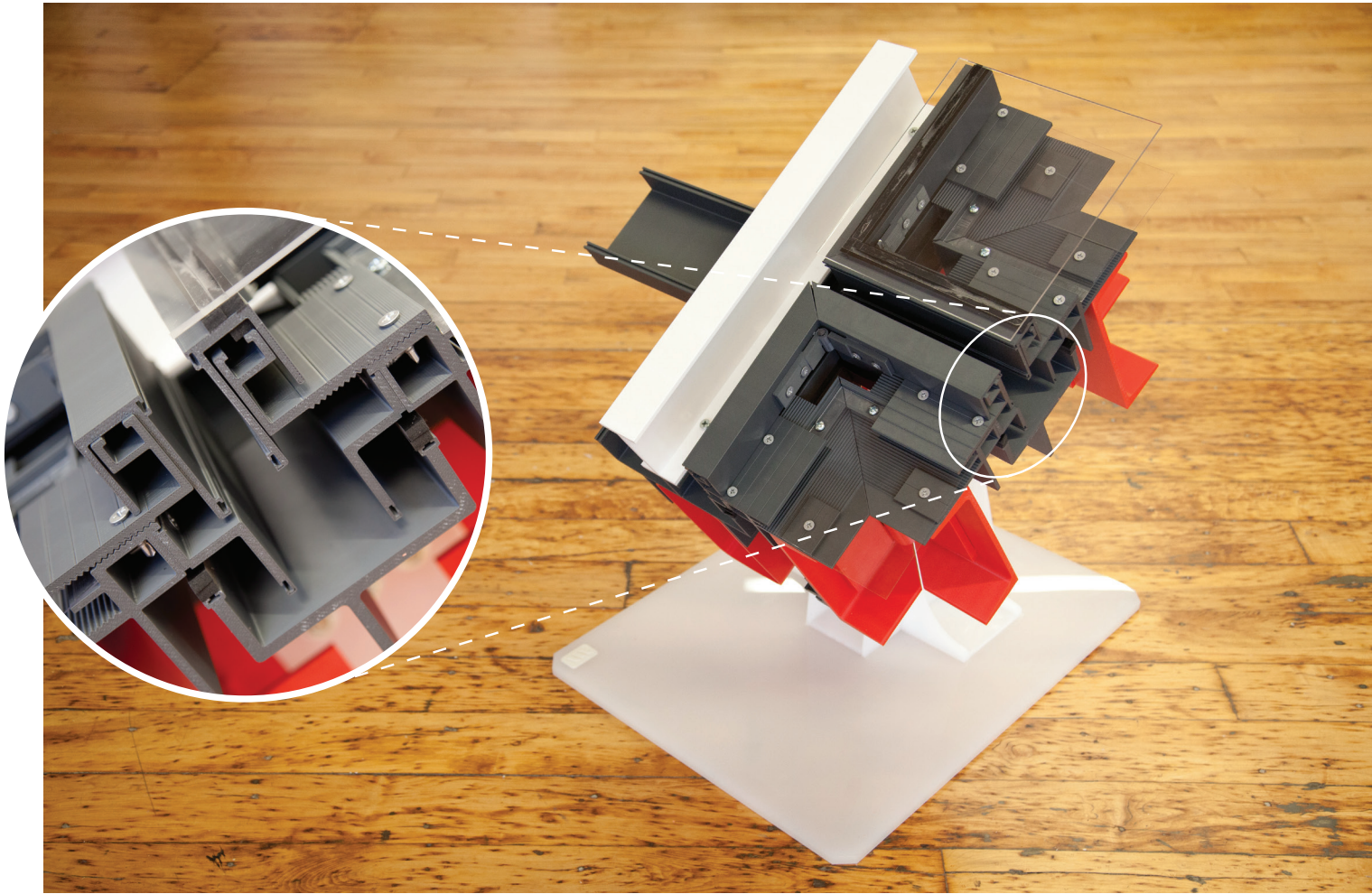
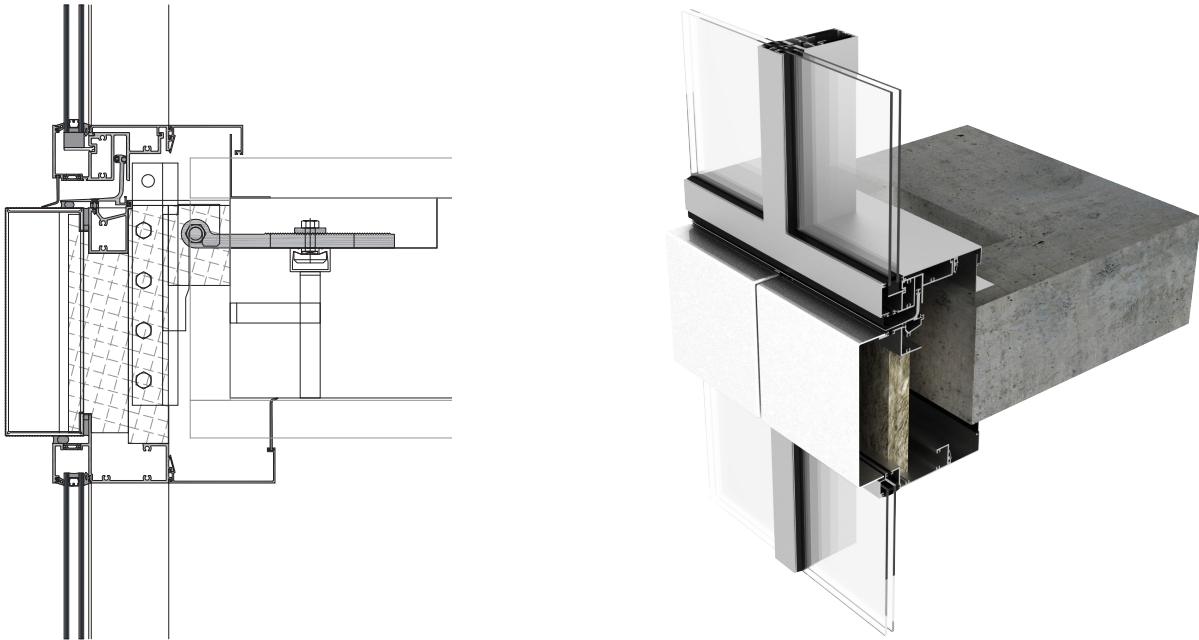
and plan of action in a dialog our clientele can understand.

DELIVERY PROCESS

Conventional design thinking is now entering a digital world, and 3D parametric technology is beginning to reconstruct the design phase. Starting with a simple design question on how horizontal and vertical extrusions connect can help discover collisions on the computer screen before finding them during installation. In various projects, the Studios have done the work on the front end and provided the client with a finalized version of the job prior to fabrication. By assisting in analyses and presentations of physical processes with a variety of computer simulations, we can address various aspects of the building's facade prior to mock-up and installation. Recently, the Studios have made progress in efficiency by assisting in various

aspects of the facade performance requirements for the 625 West 57th Street residential project, such as thermal expansion and contraction, building movement, water diversion, and acoustical analysis.

The sloped wall of the 625 West 57th Street facade is unique because its surface contains multiple radii formed from an ashlar pattern to differentiate singular panel geometry. Without the use of Rhinoceros and Grasshopper simultaneously, we would not have been able to correctly calculate the rationalization of the building's skin to optimize the surface area. In order to engineer the finished sloped surface, multiple Rhino models were generated to document and analyze details, pull data extraction, and facilitate production efforts. When visualizing 2D drawings, Rhino has been an instrumental tool because it gives us the ability to model a detail and display it in a 3D axonometric view



to discover any possible unforeseen extrusion collisions or holes in the facade system. A good example would be the anchor design for the 625 West 57th Street project. Since the design parameters for the slope wall and slab anchors were complex, the design had to be revisited multiple times in 2D and 3D modeling to finalize all components involved. Once the slab anchor angles were optimized, Rhino's ability to convert geometry to closed polygon

mesh objects allowed us to rapid-prototype a scaled 3D-printed model to ensure accurate movement of all parts in real time. Within a few days, the model was printed and assembled to verify that each individual component would allow for accurate adjustability to accommodate various set radial locations. Printing 3D models, especially of 1:1 scale of four corner intersections, allows us to closely study the connection details prior to fabrication. These models have

FIGURE 1
A 2D detail drawing paired with a 3D rendering helps explain and answer all areas in question.

FIGURE 2
A 3D printed model with zoom view of the four corner intersection on the sloped wall from 625 West 57th Street.

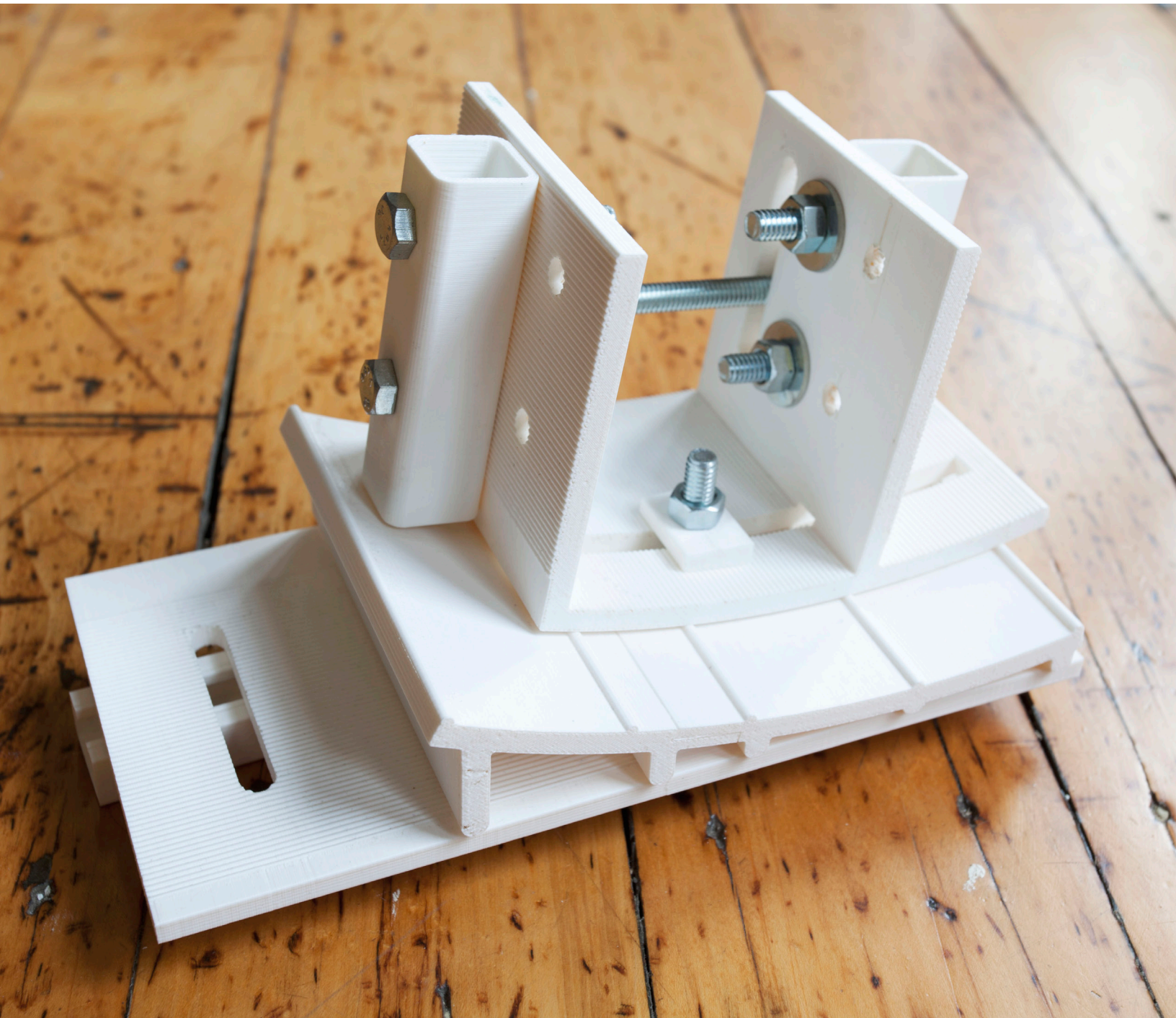


FIGURE 3
A 3D printed model of an early anchor concept for the sloped wall of 625 West 57th Street.

also been helpful in our means and methods by producing conversations regarding possible installation and shop-applied processes.

The use of Grasshopper as a Rhino plug-in has now become standard practice. As a parametric-based scripting program, multiple routines and definitions were developed to calculate thousands of surfaces at a single time. This ensured accurate line projections for splitting panels and rationalizing the window washing rail locations. Since the building went through multiple revisions, the logic developed in certain scripts made it possible to enable the input of various editions without physically remodeling the surface. It also allowed us to pull correct square footage calculations to assist in estimating material usage and production details. Whether the curtainwall contains glazing, suspended cable net systems, or steel triangular truss canopies, coordinating 3D processes allows us to transition digital models into physical production for facade construction.

CONCLUSION

The integration of 3D software directly into physical componentry of the building facade was unprecedented just a few years ago. Without the use of these resources, the 625 West 57th Street project's complex geometry would not have been properly addressed. Various 3D software programs may soon become overwhelming in their availability, but they should be filtered for relevant content. The indicator that will separate the many from the few will be the programs that are adaptable in multiple platforms, offer opportunities to manipulate physical properties, and allow advances in fabrication tolerances. In order to stay ahead of the competitive construction market, the Studios must continue to explore digital technologies that will allow us to apply their advances to the built environment.

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gc
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Israel Berger & Associates

facade
Enclos

completion
2016