

Odeh Engineers

Customer Success Story

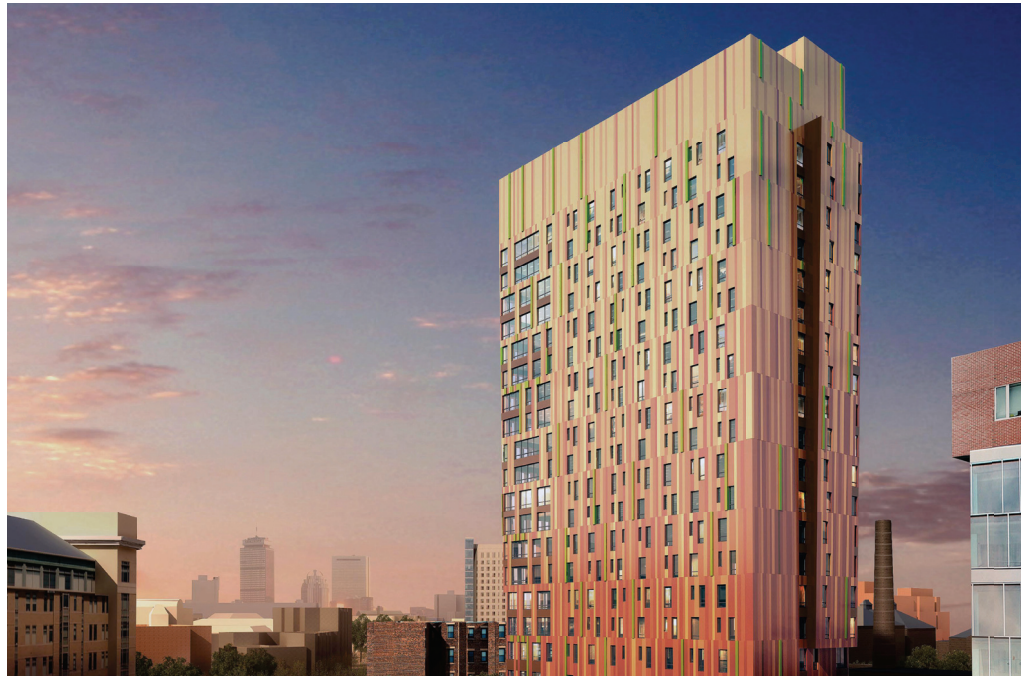
Autodesk® Revit® Structure  
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Our firm relies on Autodesk BIM solutions to help us deliver the highest level of service to our clients.

—David J. Odeh, PE, SECB  
Principal  
Odeh Engineers, Inc.

# Rising to the top.

Odeh Engineers uses Autodesk Revit Structure for the efficient design of a new high rise residence hall.



Rendering of the residence hall. Image courtesy of ADD, Inc.

## The Firm

Odeh Engineers, Inc. is a full-service structural engineering consulting firm specializing in the design, analysis, and evaluation of commercial, industrial, and institutional building structures. Based in Rhode Island, the company's projects include the design of new buildings as well as renovations, additions, and historical preservation.

Since its founding in 1982, Odeh Engineers has never used drafting boards—relying exclusively on digital design representations. In 2006, the firm adopted Building Information Modeling (BIM) supported by Autodesk® Revit® Structure software. “BIM and the Revit Structure software is at the heart of our design approach,” explains David J. Odeh, principal of Odeh Engineers. “We have 26 engineers on our staff and we all use Revit Structure for all of our projects.” Odeh Engineers has completed over 250 projects using the software. The firm also uses Autodesk® 3ds Max® Design software and Autodesk® Robot™ Structural Analysis software.

## The Challenge

One of the firm's latest BIM projects is a new 21-story steel frame residence hall for the Massachusetts College of Art and Design (MassArt) located in downtown Boston, Massachusetts. When it opens in 2012, the 493-bed residence hall will also include a café, student lounges, artist work rooms, an art gallery, laundry and kitchen facilities and a health service office. The build-

ing is being built by the Massachusetts State College Building Authority (MSCBA), which plans, designs, finances, and constructs housing and student activity facilities for the nice university campuses.

With Boston's premiere art museums just blocks away, the building's urban setting is well suited for MassArt's students, but poses significant challenges for new construction. The site contains a large network of underground culverts that carry waste to a Massachusetts Water Resource Authority (MWRA) wastewater treatment plant. MWRA has an easement over the State of Massachusetts owned property, such that the building had to be constructed away from the culvert and running adjacent to their sewage line. The MWRA must have the ability to dig them out for future repair or replacement and required a 30-foot minimum clearance above the culvert for access.

As a result, the architectural design is a tall, slender building that curves around and cantilevers over the MWRA easement. “Our structural design had to ensure that MWRA could construct a 25-foot deep excavation to those pipes without impacting the building or its foundation,” says Odeh. “Furthermore, the shape of the building itself posed structural challenges, requiring a deep pile foundation and specialized lateral bracing for wind and seismic loads, as well as the careful coordination of all that additional structural framing with the building systems.”

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# More accurately visualize the project and understand the spatial relationships between designs from different disciplines.

## The Solution

Odeh Engineers used Revit Structure software to model the existing culverts and design rows of protective soldier piles on both sides of sewage lines. The team then used those model elements to design the building foundation, strategically locating the building piles to carry the load of the building without impacting the culverts.

The project's architect, ADD Inc., and the mechanical, electrical, and plumbing (MEP) engineer, WSP Flack+Kurtz, also used Revit software products, enabling multidiscipline design collaboration and coordination. "By sharing our Revit design models, we could more accurately visualize the project and understand the spatial relationships between the structural framing, the architectural elements, and the building systems," says Daniel Batt, structural engineer at Odeh Engineers.

## Coordinate Existing Infrastructure

"We work on a lot of renovation projects, and typically start those projects by using Revit Structure software to help create a detailed model of existing conditions," remarks Odeh. "This enables our engineers—and our clients—to better understand the issues relating to an existing structure and the feasibility of various design concepts." Although the MassArt project is new construction, the team still had to work around existing conditions in the form of adjacent buildings, and most importantly, the MWRA easement.

Detailed coordination between the location of the sewer pipes, the soldier piles, and the building support piles was essential. So the team used Revit Structure to model the culverts based on existing MWRA drawings, and then design the soldier piles and building support piles. "We could not have designed and coordinated this project as efficiently as we did without the Revit Structure software and a model that more accurately reflected existing site conditions," says Jason Bacon, structural engineer at Odeh Engineers. "If the MWRA ever needs to excavate those culverts, the soldier piles will protect their sewage lines as well as the building foundation and the area around it."

## Improve Design Efficiency

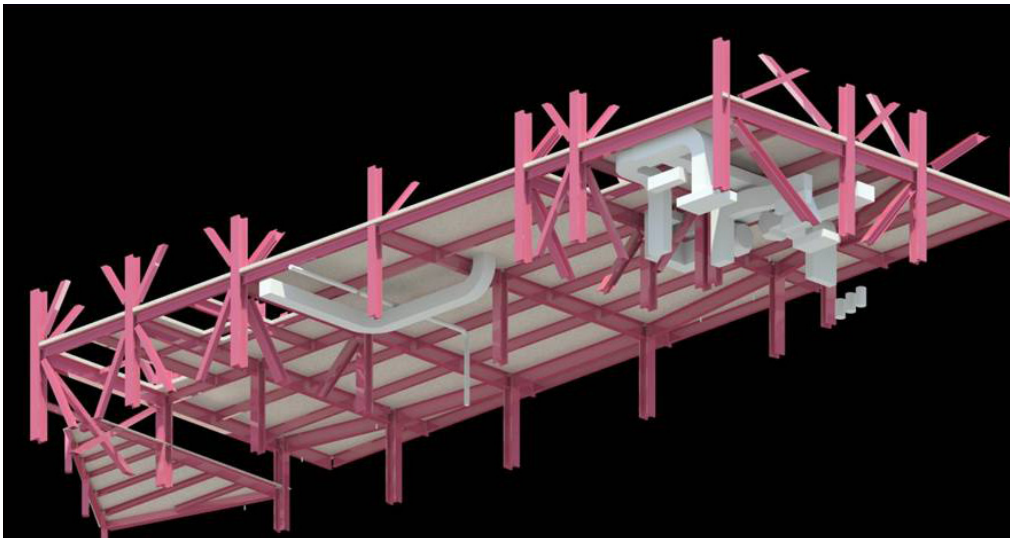
The 21-story residence hall sits on a relatively small footprint—only 121 x 52 feet. The height of the narrow structure and its cantilevered form necessitated unusually deep building piles and additional bracing. "Our structural design includes intricate links between the building frame and the foundation piles, along with a great deal of steel bracing for building support," says Batt. "And all the building systems—the duct work, the sprinkler systems, the plumbing and waste lines—had to be woven through this complex structure."

Odeh Engineers used Revit Structure to visualize, analyze, and refine the building's foundation and steel framing—helping to design a structure that could bear its own weight, weather the winds whipping off the Atlantic Ocean, and withstand any

Transparency and collaboration were critical for the success of this project and BIM enabled both.

—Daniel Batt  
Structural Engineer  
Odeh Engineers, Inc.

future excavation of the nearby sewer culverts. To promote a more streamlined design process, the team imported the Revit Architecture and Revit MEP models into their Revit Structure model to facilitate cross-discipline design coordination and proactive clash avoidance.



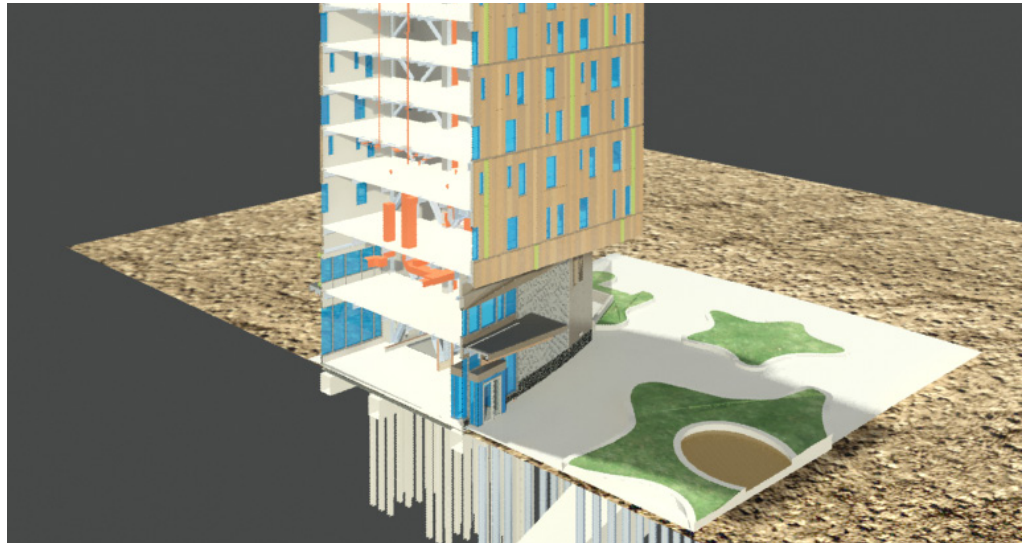
Structural framing. Image courtesy of Odeh Engineers.

### Integrate the Project

In fact the extended design team and the contractor, Suffolk Construction Company, worked together as a team from the onset of the project. “Transparency and collaboration were critical for the success of this project and BIM enabled both,” remarks Batt. “In addition to sharing our respective design models for design coordination, we used Revit software to bring all the models together for formal clash detection.” The extended project team attended regular online coordination review meetings and used this combined Revit model to help identify and examine cross-discipline clashes and facilitate quick resolutions.

Suffolk also used the combined Revit models for early quantity takeoffs, as well as preconstruction estimating, planning, and scheduling. “For example, the building support piles are particularly expensive so the team needed an early count for budgeting,” explains Bacon. “Using our preliminary Revit Structure model, we worked with Suffolk to study different options for the pile systems and generate a more accurate cost estimate for the building support piles.”

Suffolk is now using Autodesk® Navisworks® Manage software to help with construction coordination, a process that Revit software helped to streamline during design. “The building was extremely well coordinated during the design process, which is making the contractor’s coordination effort much easier,” says Batt. “And because Suffolk is using the original design files of all of the major



Foundation and bottom floors. Image courtesy of Odeh Engineers.

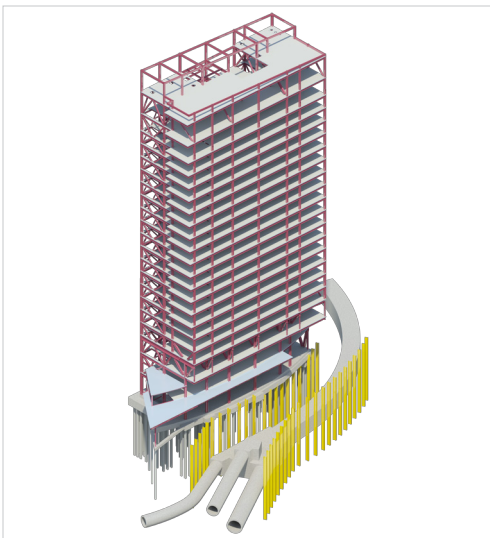
building disciplines they didn’t have to waste time recreating models.” Instead the design teams just exported a Navisworks file using their respective Revit software and Suffolk then combined those files using Navisworks software. As construction proceeds, Suffolk will continue to use Navisworks software to aggregate the various fabrication models for coordination and clash detection.

### Communicate Your Design

Revit Structure not only helped the Odeh Engineers visualize and evaluate the project, it was essential for more clearly communicating its design to the extended team and project stakeholders. Like many new construction projects in an urban area, there was a lengthy approval process for this dormitory. In addition, the MWRA needed to sign off on the project due to their easement. “The use of BIM

helped the entire team to visualize the complexity of the design and provided a workflow for interdisciplinary coordination” says Ed Adelman, the Executive Director of the Massachusetts State College Building Authority (MSCBA)

The team used their Revit Structure design model and both Revit Structure and 3ds Max software to help create a range of design visualizations—sections, cutaways, renderings, and even animations—that helped everyone gain a better understanding of the structure and expedite the approval process. “These visualizations were particularly useful during the MWRA review cycle,” says Odeh. “We were able to demonstrate to them that the building could be built safely while protecting their easement.”



Culvert, soldier piles, and deep pile foundation. Image courtesy of Odeh Engineers.

# Minimize RFIs and help streamline fabrication by leveraging Revit Structure design models.

## Streamline Fabrication

To improve model fidelity between structural design and fabrication and to minimize the number of requests for information (RFIs), Odeh Engineers shared its Revit Structure design model with the steel fabricator. The firm exported the Revit Structure design to CIS/2 format using Revit Extensions for Autodesk Revit Structure and sent the files to the steel fabricator for use in the steel detailing process.

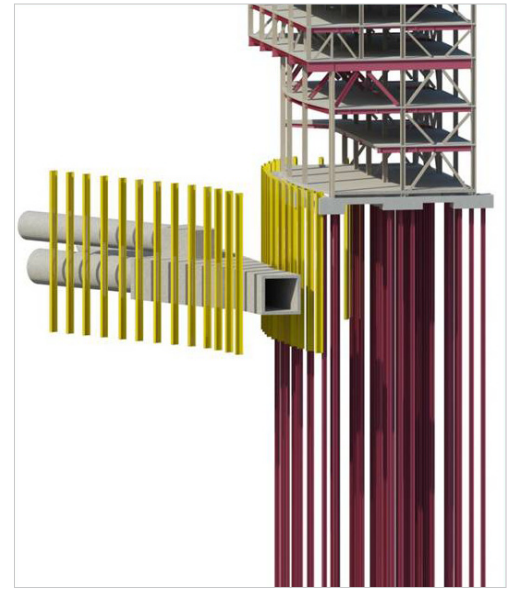
“We’re not subject to the fabricator’s interpretation of our drawings,” explains Bacon. “We know that they’re using the most accurate information for their steel detailing and they better understand our design intent. As a result, even though there are thousands of shop drawings on this job, there’s been a minimal number of RFIs and the project has gone extremely smoothly.”

“The team’s rigorous coordination during the design phase really paid off during the steel fabrication process,” adds Odeh. “All the shop drawings were approved on the first pass and the steel fabricator stated that this was the best steel shop drawing process they have ever experienced.”

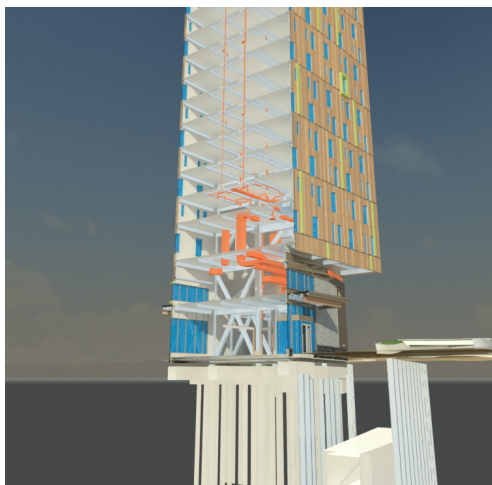
## The Results

MassArt’s new \$61 million residence hall is under construction and will be ready for students in the fall of 2012. Odeh Engineers used Revit Structure software to efficiently design, analyze, and document the building’s structural design. “Our firm relies on Autodesk BIM solutions to help us deliver the highest level of service to our clients,” says Odeh. “BIM leads to better coordination, improved visualization, and higher quality construction documentation.”

For more information about Autodesk BIM solutions, visit [www.autodesk.com/BIM](http://www.autodesk.com/BIM).



Culvert, soldier piles, and deep pile foundation. Image courtesy of Odeh Engineers.



Foundation and bottom floors. Image courtesy of Odeh Engineers.

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