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Title: **Case Study: Tree House Residence Hall, Boston**

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Subjects: Architectural/Design
Building Case Study

Keywords: BIM
Design Process
Interior Design
Landscape
Sustainability

Publication Date: 2014

Original Publication: CTBUH Journal, 2014 Issue I

Paper Type:

1. Book chapter/Part chapter
2. **Journal paper**
3. Conference proceeding
4. Unpublished conference paper
5. Magazine article
6. Unpublished

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CTBUH Journal

International Journal on Tall Buildings and Urban Habitat

Tall buildings: design, construction, and operation | 2014 Issue I

Tree House Residence Hall, Boston

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Case Study: Tree House Residence Hall, Boston

A Coat of Many Colors



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B. K. leads projects with a passion for design excellence and sustainability. As the Director of ADD Inc's Academic Practice, he creates inspiring environments in which to live and learn. His recent work includes residence halls for Westfield State University, UMass Lowell, the Massachusetts College of Art and Design, and Worcester Polytechnic Institute. He has also led the design of many of ADD Inc's most innovative residential projects including 315 on A, Pier 4, and Parcel 24. B. K. received his Bachelor of Architecture from Carnegie Mellon University and his Master of Architecture and Urban Design from the Berlage Institute.

Tamara Roy

Tamara is an architect and urban designer working at the forefront of innovative housing. Tamara's recent academic projects include the Tree House Residence Hall at the Massachusetts College of Art and Design, described as the "most interesting high-rise in Boston," as well as new housing at UMass Lowell and Worcester Polytechnic Institute. Tamara received her Bachelor of Architecture from Carnegie Mellon University and her Master of Architecture and Urban Design from the Berlage Institute. Tamara was the recipient of the BSA Women in Design Award of Excellence in 2012.

The Tree House, a 20-story residential tower for 493 freshmen, is inspired by Gustav Klimt's painting, *The Tree of Life*. It is clad in more than 5,000 composite aluminum panels of various widths and depths, resulting in an organic, colorful expression along Boston's Huntington Avenue, also known as the Avenue of the Arts. Opened in 2012, the new residence hall includes a ground floor café and living room, a second-floor health center, third-floor "pajama programs" consisting of communal spaces, and 17 floors of suites with lounges and studio workrooms.

The Massachusetts College of Art and Design

Opening in 1873 as the United States' first independent public college of art and design – and the first art school to grant a degree – Massachusetts College of Art and Design (MassArt)'s mission is to educate tomorrow's fine artists, designers, and art educators in the creative process. In 2007, the school found itself woefully short of student residence halls, and hoped to achieve the housing of 50% of its student body through the construction of a new building.

The MassArt campus sits along the Avenue of the Arts (Huntington Avenue), near Symphony Hall, the Museum of Fine Arts, and the Isabella Stewart Gardner Museum. Housed in a series of brick buildings punctuated by a 1960s 11-story black glass tower, the school was ready for a new image. After doing an extensive economic feasibility study for two potential locations for the residence hall, it was determined that a 21-story tower of narrow footprint, snug to the rear of an existing faculty parking lot and visible from Huntington Avenue, was the best choice.

Good Timing for Funding

When the request for proposals went out to qualified architect/contractor teams in 2007, the US economy teetered on the brink of the largest recession of the last 50 years. The Massachusetts State College Building Authority (MSCBA) develops residence halls and other revenue-generating facilities for the nine state university campuses; these projects are funded through revenue bonds whose debt service is offset by the student

rent and fees. The Commonwealth of Massachusetts neither funds these projects nor guarantees these bonds.

At the time, the Strategic Plan for MassArt included the need for several hundred additional beds to meet its recruitment and retention goals. This was a significant opportunity to build required residence hall capacity at a time of low-interest bond financing, competitive bidding, and tighter pricing, which would provide better value for the students who would live in the future building. The available land for this project was limited, and the only way to construct an affordable residence hall on the very small buildable footprint was to design a tall building. "Given the financial constraints of the project and the physical constraints of the site, the Tree House Residence Hall provided the campus with a cost-effective and energy-efficient building that is a



Figure 1. Mirrored artwork at the café. © Lucy Chen

dynamic addition to the skyline, as well,” according to Edward Adelman, Executive Director of the MSCBA.

A Hyper-Collaborative Design Process

The rapid schedule and highly competitive economic climate demanded an integrated approach to decision-making – a way of working together through pre-construction pricing, planning, design, and construction that involved weekly fluid sharing of computer models between architects, engineers, and sub-contractors, rarely seen outside the design/build industry in projects of this size. The project opened three months ahead of schedule and came in under budget. Much of this can be attributed to efficient information management.

The design of the new residence hall is the result of an interactive and flexible process. The architects sought a vision that could harmonize the aspirations of college professors, administrators, students, trustees, alumni, and the building’s owner. The team conducted in-depth benchmarking and hosted focus groups with students, residence assistants (RAs), and facilities managers. The stakeholder involvement culminated in an 85-person design charrette that focused on four areas: open space, exterior design, common space, and typical floors/units.

Out of the exterior design group arose the idea of realizing the building as an artistic landmark.

In September 2012, the incoming student residents voted to nickname the building “The Tree House.”

Many of the participant comments were woven into the final planning and design:

- The open space should be primarily a place for sitting, in variously sized groups, clearly identified as MassArt’s public plaza.
- The green design approach should not be accomplished through “gadgetry,” but



Figure 2. Windows configured in response to the passive daylighting techniques. © Chuck Choi

“MassArt wanted the building to stand out in the Boston skyline and meaningfully identify them as an art college... It was the students’ idea that the building look like a painting and that it be just as colorful and vibrant as they are.”



Figure 3. Main entrance. © Chuck Choi

through time-tested approaches to proper solar orientation, reduction in glass façade area, highly insulated façades, etc.

- The students should be able to express individual artistic statements along the corridors.
- Common spaces should be co-located to allow for synergy, including the common kitchen, lounge, game room, laundry, fitness, and vending machines
- The shared foyers for each semi-suite should not have sinks in them – which would turn these spaces into bathrooms – instead, the sinks should be in a separate alcove beside the foyer

The collaboration did not end there, however. The owner funded specific art installations throughout the building, chosen through a competition open to MassArt alumni. The final commissions fulfill MassArt’s mission to promote art that fundamentally changes and enhances the experience of space. A 30.5-meter-long painted glass work fills the lobby with reflections of students and light. An interactive composition of round mirrors jiggles when one sits on the café banquette (see Figure 1). A colorful mobile depicts the history of MassArt, enlivening a two-story space leading up to the university health center. A backlit photo of a cruise ship brightens the third-floor common spaces.

To better understand the space, the architects built a full-scale foam-core mock-up unit for students and staff to experience and critique. Complete with mock beds, desk and bureau alternatives, closets, and electrical outlets, the demonstration room generated invaluable

feedback. Making sure that the size and proportion of the room was adequate was foremost in the designers’ minds. Requests for larger desks, stacking bureaus, deep closet shelves for portfolio storage, and a wall of homasote for pinning up photos and art projects all

represent the importance of designers reaching out to future occupants.

Lastly, MassArt’s architecture and interior design students helped shape the design and functioning of the ground floor café. Students wanted it to serve primarily as a nightspot for those too young to go to clubs or lounges. In addition, the café is open to the public. They also suggested a central communal table that glows like a fire on cold winter evenings to help draw students in and create opportunities for conversations between Wentworth Institute of Technology, Massachusetts College of Pharmacy, and MassArt students (the three institutions share dining and health center facilities). Students from MassArt’s graphic design studio named the café “Spoon” and developed the logo.

Massing and Program

The curved base – the proverbial trunk of the tree – was designed to accommodate an underground tunnel that swerves through the site, requiring the efficient rectangular building to cantilever above (see Figure 3). The ground floor contains the security desk, café, mail room, and lobbies (see Figure 4). It is an extension of the landscaped plaza. The second floor is dedicated to a student health center, and the third floor – called the “pajama floor” because the students use it in their pajamas – has all the common spaces of kitchen, lounge, laundry, and group study spaces. Above this are 17 floors of four- and five-person semi-suites with independent sink, shower, and toilet facilities, but without

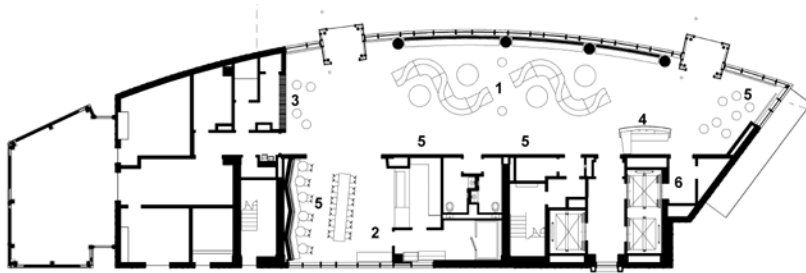
kitchens (see Figure 5). Each typical floor has two lounges at either end of a corridor to let in natural light, and beside each suite entrance is a marker board wall for student artwork.

Structure

The site contains a large network of underground culverts that carry waste to a Massachusetts Water Resource Authority (MWRA) wastewater treatment plant, which serves a large percentage of downtown Boston buildings. The MWRA has a large easement through the site and, consequently, the tall, slender building curves around and cantilevers over the easement. The structural design had to ensure that the MWRA could construct a 7.6-meter-deep excavation to those pipes without impacting the building or its foundation. Furthermore, the width and height of the building itself posed structural challenges, requiring a deep pile foundation and specialized bracing for support, as well as the careful coordination of the resultant additional structural framing with other building systems.

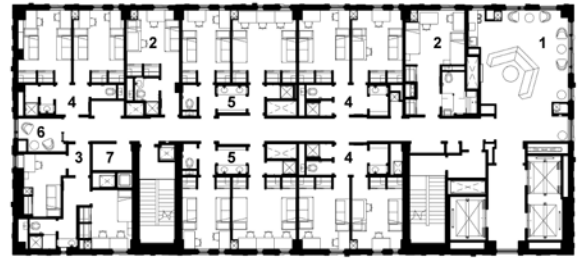
The engineers modeled the existing culverts and designed rows of protective soldier piles on both sides of the sewage lines. The team then used those model elements to design the building foundation, strategically locating the building piles to carry the load of the building without impacting the culverts. If the MWRA ever needs to excavate the culverts in the future, the soldier piles will protect its sewage lines as well as the building foundation and the surrounding.

The team used the Revit Structural design and 3DS Max software to create a range of design visualizations – sections, cutaways, renderings, and even animations – that helped everyone gain a better understanding of the structure and ultimately expedite the final approval process. These visualizations were particularly useful during the sewer-easement review cycle. The team was able to demonstrate to MWRA that the building could be built safely while protecting its easement.



- 1. Lobby
- 2. Café
- 3. Mailboxes
- 4. Security
- 5. Art Installation
- 6. Health Clinic Entrance

Figure 4. Ground floor plan. © ADD Inc



- 1. TV Lounge & Snack Kitchen
- 2. 2 Person Semi-Suite
- 3. 3 Person Ra-Suite
- 4. 4 Person Semi Suite
- 5. 5 Person Semi-Suite
- 6. Cell Phone Lounge
- 7. Trash & Recycling

Figure 5. Typical floor plan. © ADD Inc

An Artful Landscape

The new landscaped open space was an exciting opportunity for MassArt to re-craft its public identity, create a new center of outdoor student life, and reflect the expressive design qualities of the college.

Fronting onto the Avenue of the Arts, the landscape capitalizes on the public life of the street and college and serves as a prominent landmark for the school. This being an art college, the seat-walls go a bit mad, extending beyond the archetype, undulating both in plan and in section to create seating for individuals, small groups, and class gatherings. Custom wood benches inset with glowing colored polycarbonate lights complement the curves of the seat-walls (see Figure 6).

Highly visible from the residence hall above, the paving pattern shadows the expressive form of the planters. Cleverly hidden

between the planters are the three sewer manholes that need to be serviced twice a year by large vacuum trucks. The planting is primarily native, with swaths of evergreen groundcovers and flowering perennials beneath a canopy of Amelanchier trees.

Digitally Expressive Skin

One of the reasons the architects chose Klimt as an inspiration was the artist's technique of placing slightly contrasting colors beside one another, creating richness in his paintings that resembled tapestries with gold and brown hues. Each of the 5,500 metal panels that comprise the façade was considered as a singular brush-stroke that could help build a strong background (see Figure 7).

To reinforce the "Tree of Life" concept, a total of 16,236 square meters of 4-millimeter-thick metal panels were ordered in seven custom colors, which were

further differentiated with five gloss levels to create a shimmering composition. An extensive color study resulted in the browns, greens, and golds of a tree in autumn, which were then organized from dark to light as they ascend toward the sky.

The variety of panel depths and widths allows the building skin to resemble the bark of a tree. These dimensional patterns repeat every two floors to create budget-friendly fabrication and installation efficiency, but are combined with an overlay of varying panel colors to prevent the repetition from being easily recognized.

The double-insulated metal panels are made of aluminum-composite material. The wall assembly is a pressure-equalized rainscreen system that meets the NFPA 285 multistory fire test and the Massachusetts State Energy Code. The building's façade includes areas of curtain wall and low-e windows that have a solar tint to reduce heat gain.



Figure 6. External landscaping. © Chuck Choi



Figure 7. Multi-colored façade panels. © Chuck Choi

Building Information Modeling (BIM)

The constrained footprint mandated that every square inch of space had to be utilized effectively in order to meet the program goals and requirements within the constraints of the site. BIM modeling of all components and systems enabled real-time visualization and coordination by all team members, allowing the team to recognize conflicts early in the design phase. Full modeling of major MEP and fire protection systems provided assurance to the design team, contractor, and owner that early design decisions were workable, reducing the risk as the project design progressed.

BIM facilitated the high level of coordination that was required to integrate the building architecture and mechanical systems with the structural system, and produce the comprehensive and complete set of construction documents required for a public bid process. All major design team members (architecture, structural, and MEP engineers) used the Revit design platform to enable more accurate and faster cross-disciplinary design coordination and proactive clash avoidance.

To improve model fidelity between structural design and fabrication, the structural engineer shared the Revit Structure design models with the steel fabricator, which imported them into its steel detailing software. This resulted in zero revise-and-resubmit requests during the steel shop drawing process – a factor unheard-of in a high-rise structure.

During construction administration, the design teams exported their Revit files, and the contractor combined those files using Navisworks software. Each sub-contractor was required to generate 3D shop drawings, which were integrated into the federated Navisworks model for use by MassArt facilities personnel post-construction.

Lean Construction Means “Teamwork”

MassArt’s new residence hall has become the first example of the use of “lean construction” techniques in New England. Begun on the West Coast, this method of planning breaks the job down into efficient, repeatable batches that benefit from using the same small group of laborers from each sub-contractor, who follow each other in a logical order, then move on to the next batch.

After a difficult winter construction season, the lead contractor invited the interior sub-contractors to attend an in-house workshop that included a Lego team-building exercise. Each team competed to build Lego airplanes: at first, without a clear strategy, teams only built three planes. But after developing a clear sequence of responsibility, they could build up to 30 planes within the same time limit. It was a telling indicator of how each team member (whether responsible for studs, plumbing, drywall, paint, etc.) could move quickly through the task if preceding members fulfilled their responsibilities in the right order.

This method involved all the sub-contractors in the creation of a “pull schedule,” in which

foremen contributed their expertise to planning the work sequence and established buy-in for the time allotted to each task. This schedule provided better communication on the job site, since every sub-contractor and installer knew the work plan, which was posted in the trailer and reviewed daily. The result of implementing the work plan was that construction finished two months ahead of schedule, with fewer interruptions, a cleaner job site, and improved safety.

Organic Sustainability

The owner had clear sustainability goals for energy and water efficiency, as well as a desire to create healthful environmental air quality in all of its buildings. The MassArt building is designed to a minimum LEED Silver certification from the US Green Building Council, and its energy usage is 22% more efficient than code mandates. In keeping with the simple organic nature of the project concept, the team focused on passive solar and daylighting techniques, rather than high-tech triple-skin façades and active approaches. The team chose to explore a super-insulated skin with smaller punched windows, reserving the use of large glazing panels for the studios and workrooms that faced north, away from the direct sun (see Figure 2). Windows were positioned at the ends of corridors and in stairwells, so the use of electric light could be reduced. Windows in the bedrooms were placed closer to the north wall of the room, rather than centered, so natural light would bounce off the wall, making the room brighter, instead of getting lost on the floor.



Figure 8. Typical lounge with view to the Boston skyline. © Lucy Chen



Figure 9. Main lobby. © Lucy Chen

Other green features include low-e glass engineered to solar orientation, double-insulated metal panels, closed-cell spray insulation in the cavity wall to reduce infiltration, and low-flow plumbing fixtures that reduce the amount of potable water usage by 33%. More than 50% of the material used in the residential hall has recycled content, 20% from local sources, and 70% of the wood is certified by the Forest Stewardship Council.

Clear windows on the tower's north façade provide light favorable to artists' work and a view to the Boston skyline (see Figure 8), while the south side's fewer windows are solar-tinted to help reduce heat gain. The windows are operable, and a green signal lamp tied into the building management system and located near the elevators, lets students know when it's advisable to open the windows.

Interior Design – Wood and Color

On the ground floor, a ceiling of variegated wood slats hovers over a swirling yellow sofa, capturing the whimsy of the Klimt painting at the base of his tree (see Figure 9). At the third-floor common areas, light wood paneling with bright paint reveals provides a backdrop of warmth and richness to the graphic film used elsewhere in the project (see Figure 10), such as the purple bubbles in the laundry room.



Figure 10. Third-floor common area. © Lucy Chen

On every floor, a charcoal carpet with threads of gold, orange, and green provides a neutral backdrop for brightly colored walls and corridors. The architect's interiors team used a palette that ranged from deep blues to bright orange, green, and yellow, making every two floors appear different, and giving art students a reason to travel to other levels of the building.

This is especially apparent at the typical floor lounges, which are the first areas visible to those emerging from the elevator lobby. With color-coordinated sofas, swivel chairs, and ottomans, each lounge color gives a unique identity to the community of students and residential assistants living there. Each lounge is an essay in how color affects the perception of space; every student has a favorite color floor, and each is distinct and special.

Within the semi-suites, color is used sparingly to allow the students to personalize their

own spaces. Yet even in the mundane spaces of shower rooms and toilets, a vertical strip of colored tile is added as if to say, "Don't forget – this is an art school."

Expressive Urbanism

Art urges us to think, reflect, and speak. MassArt has trained generations of artists to speak out and engage others, but their physical campus, inherited from the Boston Normal School, has lacked an ability to represent the place of MassArt in the culture of urban planning and architectural design. The Tree House, now open for almost a year, has allowed the school and the students to announce their position along the Avenue of the Arts and to articulate their belief that Art matters, that Architecture matters, and that city building and expression is everyone's business and responsibility. ■

Project Data

Completion Date: June 2012
Height: 85 meters
Stories: 21
Area: 13,519 square meters
Use: Residential
Owner: Massachusetts State College Building Authority
Architect: ADD Inc
Structural Engineer: Odeh Engineers, Inc.
MEP Engineer: WSP Flack + Kurtz
Main Contractor: Suffolk Construction
Other Consultants: Ground Inc. (landscape); Lerch Bates (vertical transportation); Nitsch Engineering (civil); SGH (façade); C3 (code)

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