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# Tall Buildings as Extensions Of Urban Infrastructure and Vitality

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**Elie Gamburg** is a director at KPF. He has designed projects in US, Asia, Europe, and the Middle East, across a variety of programs, including academic, mixed-use, office, residential, retail, and many more. Gamburg is a graduate of Harvard's Graduate School of Design, where he was awarded the Kevin V. Kieran Prize for highest academic performance.

This paper reviews the 2014 ***Network 3D High-Rise Design Studio,*** which was undertaken by the College of Architecture and Urban Planning (CAUP), Tongji University, with assistance from the CTBUH and Kohn Pedersen Fox Associates (KPF). The project site is located in Manhattan, New York City, one of the densest urban areas in the world. The studio was intended to explore what the three-dimensionality of cities means for tall buildings and their ability to locate extremely dense development atop major urban infrastructure, while also providing quality public space.

## Introduction

As part of its mission, CTBUH connects numerous higher-education institutions around the world with professional expertise in the tall building field. In this case, KPF kindly funded the studio through its "Gold + Design Research Sponsorship Package" at the CTBUH Shanghai 2014 International Conference. Specifically, the studio that took place in the 2014–2015 academic year included a week-long visit by Tongji University students and professors to New York City, which included design workshops at KPF's headquarters, site studies, tall building tours, etc. This collaborative design studio was intended to explore what the three-dimensionality of cities means for tall buildings and their ability to locate extremely dense development atop major urban infrastructure, while also providing quality public space.

## The 3D City in New York

Manhattan is dense in both population and infrastructure (Koolhaas 1997). Density, programmatic variety, and verticality have long been the unspoken manifesto behind New York City's urban form. At an average density of 26,717 people per square kilometer in 2010 (US Census Bureau 2012, 133), the borough of Manhattan in New York City has long been one of the world's densest city centers. In terms of its mix of programs, social groups/uses, cultures, and building types/sizes the city has also long been one of the most varied.

**CTBUH 2014 Student Design Research Project Sponsor:**

KPF

Figure 1. View from Midtown Manhattan looking south. © Anthony Quintano

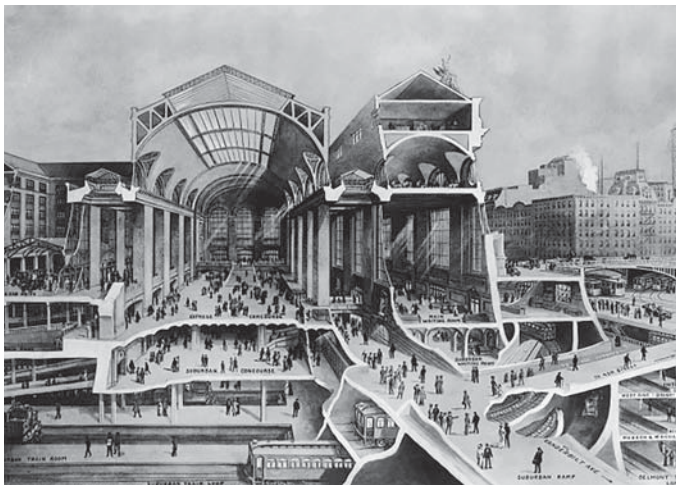

Figure 2. Section rendering of Grand Central Terminal (GCT).
Source: Scientific American, 1912.

> "The students were asked to develop a skyscraper that pushes the boundaries of what it means to build a truly 'three-dimensional city' – mixing programs, encouraging high density, and introducing meaningful public space strategically throughout the building."

Throughout the borough, offices, residences, and hubs of health, education, entertainment, and leisure are connected laterally by one of the world's oldest mass-transit systems, and vertically within some of architecture's earliest experiments in stacked, mixed-use buildings.

Important urban projects such as Rockefeller Center (at a major subway junction), the George Washington Bridge Transport Terminal + Residential Towers (at a bus and subway station), and both the new and original World Trade Center (at the terminus of a rail tunnel to New Jersey). All of these projects consist of a dense, mixed-use program comprising groups of towers atop major transit hubs.

Contemporary projects, such as the Hudson Yards redevelopment (see Case Study on page 12), the largest private development project in American history, Atlantic Yards/ Pacific Park and the AOL-Time Warner Center have continued this paradigm of relating high density, the provision of public space, and a mix of uses to transit hubs.

The objective of the Network 3D Studio was to explore the theme of tall, multifunctional urban projects connected to transit hubs, in order to find alternative design approaches for tall buildings; to create high-rise buildings that are inspired by the cultural, physical, and environmental aspects of place.

## The Studio Project

### The site

Grand Central Terminal (GCT) is a commuter railroad terminal at 42nd Street and Park Avenue in Midtown Manhattan in New York City. It is the hub of a vast network of connections, funneling 500,000 people per day directly up into a number of New York's grandest skyscrapers, down to a major subway hub, and out to the surrounding streets, which lead to some of the city's most important spaces and structures. At the heart of this network is Grand Central's "Great Hall" – a light-filled central gathering space. Through the skillful manipulation of section and the introduction of natural light through large apertures, the Great Hall appears to lie on street level, with direct connections to the streets beyond – but in reality is located more than a story below grade, directly on the upper track level (see Figure 2).

Recently, New York's Department of City Planning proposed a rezoning of East Midtown, including 73 blocks surrounding GCT. This re-zoning proposal offers an incredible opportunity to address the issues that have existed in GCT and its surrounding neighborhood for decades, such as: overcrowded pedestrian traffic and limited public/green space.

### The project

The design studio's project was based on a real ongoing project, One Vanderbilt Place, designed by KPF in 2013 and expected to be completed in 2020.[1] One Vanderbilt Place is located at the corner of 42nd Street and Vanderbilt Avenue (see Figure 3). Located at the heart of Midtown Manhattan next to one of the most diverse and crucial networks of public space and transit in the city, One Vanderbilt offers a unique opportunity to truly push vertical urbanism into the third dimension, by introducing meaningful public space into its section, while adapting to the unique challenges of building vertically in an already dense, confined, and historically sensitive site.

The students were asked to develop a skyscraper that pushes the boundaries of what


Figure 3. One Vanderbilt Place, New York – location plan.
© Kohn Pedersen Fox Associates

[1] When completed in 2020, One Vanderbilt Place is expected to be a 64-floor (above ground), 158,000-square-meter GFA office skyscraper. The tower will be 461.5 meters high, making it the city's third-tallest building, after One World Trade Center (541.3 meters) and Central Park Tower (541 meters). Source: CTBUH Skyscraper Center.

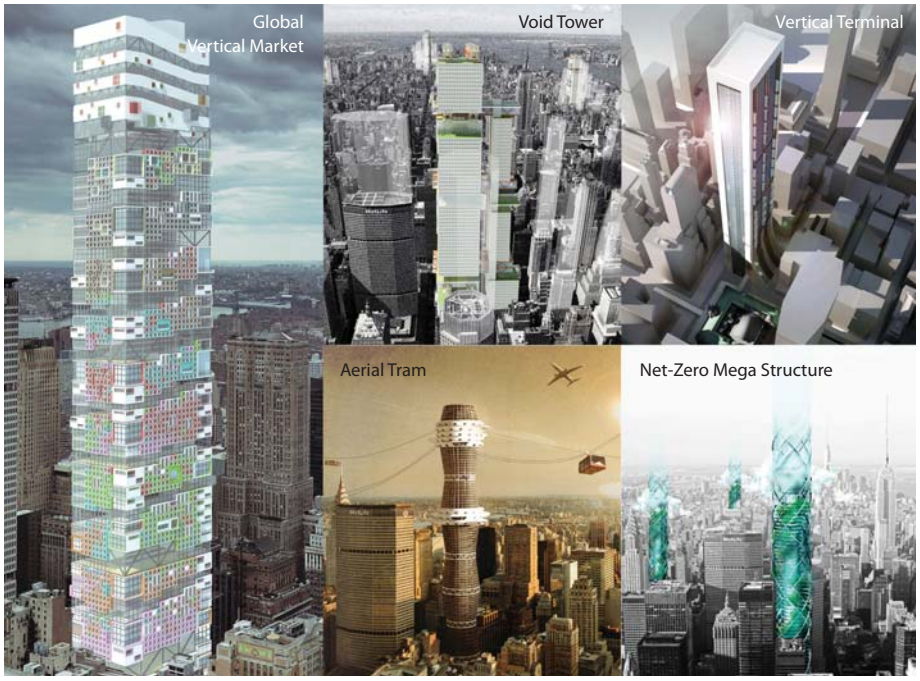


Figure 4. Renderings of the five towers, designed by groups of Tongji University architecture students.

it means to build a truly "three-dimensional city" – mixing programs, encouraging high density, and introducing meaningful public space strategically throughout the building.

### The program

As a result of the proposed re-zoning laws, the area immediately surrounding GCT would be given the tallest zoning allowances. The site of One Vanderbilt will thus be zoned FAR 30, per the current zoning strategy for the area around Grand Central. This will result in an estimated zoning floor area (gross area minus the area of shafts) of 120,760 square meters. The site sits atop the terminal for East Side Access, a new rail service to Long Island, and will form the western gateway to Grand Central – both the regional train station and its subway station. Thus, a transit hub with train hall and connections to other transit facilities will be a required part of any program. Also, as a critical part of a nexus through which 700,000 people (more than the entire population of Boston) will travel daily, there is an opportunity for additional public programs, ranging from more prosaic restaurants and retail to museums, observation decks, concert halls, schools, and beyond.

Students were asked to pick two or three major programs, fulfill all requirements of the transit center, and add auxiliary public programs that could take advantage of the synergies of site, program, tower form, infrastructure, and New York's unique urban context.

### Design studio sequence

The studio process included two major steps. In the first step, studio advisors provided the students with 10 keywords, which were relevant to the theme of this design studio. The keywords were: Context, Building Profile, Diversity, Program, Compositionality, Topography, Urbanity, Culture of Congestion, Ecology, and Mega Structure. Each group was required to choose two keywords, and conduct in-depth research on the relevant urban and architectural history/theory and design approach behind the chosen keywords. In the second step, based on the outcomes of the research conducted in the first step, each group was required to develop a unique design strategy to deal with specific challenges in the project.

The design studio officially kicked off at KPF headquarters when Tongji University students took a week-long visit to New York City in November 2014, which included design workshops, site studies, and tall building tours. In the Day One workshop at KPF, studio advisors from CTBUH, KPF, and Tongji University delivered presentations covering topics from global tall building development and urbanization to the specific urban morphology of tall buildings in New York City, and from overall tall building design principles to detailed technical design strategies for tall buildings. After the Day One workshop, the students performed physical, historical, cultural, and environmental studies of the project site and the city, and continued to work on their projects based on the feedback from the Day One workshop. In the Day Two workshop, students presented their research findings and design concepts by group, and received critiques from the advisors. The students then made their way to Chicago to explore the tall building typology and visit the CTBUH headquarters.

After returning to China, Tongji students continued working on their design proposals for the project, developing five different themes (see Figure 4). The final review was conducted at the KPF office in Shanghai in January, 2015. Following the final review, work from the studio was further developed and submitted to the Fourth Annual CTBUH International Student Tall Building Design Competition. Ultimately, the results will be published as a book and distributed internationally.

"Following the final review, work from the studio was further developed and submitted to the Fourth Annual CTBUH International Student Tall Building Design Competition. Ultimately, the results will be published as a book and distributed internationally."

## Void Tower

*Yang Zhou, Beisen Li, Chaohao Wei & Yidan Chen*

This design starts with the proposition that zoning regulations should be revised based on the design of real 3D urban spaces, particularly integrated public spaces. With this as the first assumption, the Void Tower will appear as a node to create vertical grids and interact with the whole area three-dimensionally (see Figure 5). The Void Tower brings all the previously separate and disparate pockets of public space into the center and rearranges them into a "vertical central park," with programs such as a monorail station, theater, and stadium all suspended hundreds of meters above the ground. Further, the Void Tower provides sites that offer public spaces and financial support, such as incentives for common and private programs, which could be treated as the method to balance the increasing intensity with public spaces of high quality. The rezoning would not stop there. In the future, more Void Towers, connected by monorails and sky pedestrian bridges, could act as active nodes for urban life in the air and form a starting point for 3D urban self-organization.


Figure 5. Void Tower.

## Global Vertical Market

*Si Cheng, Yizhe Li, Pu Zhang & Yindian Zhao*

This group noticed an opportunity to contribute life and vitality to the facility and surrounding neighborhood in the form of a vertical market, which can also stimulate a new possibility for the typology of high-rise buildings. The vertical market would be as multi-cultural, mixed-use, populist and accessible as traditional streets. People from different cultural backgrounds would intersect while shopping for their necessities here. The design integrates the underground space of the station with proposed facilities assembled vertically along the building, which are chained together by a spiral pedestrian market running from the bottom to the top. The system of facilities is calculated to optimize cross-pollination: a food court at the bottom is shared by the station; a cultural center on the top pulls up pedestrians from ground level. An organic food market, a set of public classrooms, a medical center, a fashion market, sport clubs, a theater center, and indoor parks are scattered among these functions. Their accessibility and efficiency are ensured by a "bus elevator" system, which runs automatically on schedule and stops every 54 meters, where each of the major facilities resides. Small, flexible spaces in the interstices are left for leasing and for spontaneous temporary use. Flexible live/work spaces are also provided to appeal to the entrepreneur. Due to the small scale, rent is kept affordable, allowing for a greater diversity of uses and cultural intersections.

Figure 6. Global Vertical Market.

Figure 7. Vertical Terminal.

## Vertical Terminal

*Ao Li, Xiaoyu Liu, Yiyun Lu & Zhiyun Yang*

As one of the busiest metropolitan areas in the world, New York City enjoys the reputation of a highly efficient transportation system. However, intermodal connections, such as between the center city and airports, is still wanting, and requires more intensive and efficient transportation infrastructure to be built. The extreme density makes it almost impossible to build new or expand existing infrastructure horizontally. The peninsula of Manhattan lies on a layer of hard rock, which makes it much more economical and efficient to build the infrastructure upwards rather than downwards. In order to satisfy the huge future demand of commuting and enhance the connectivity among the airports, subway, and long distance commuting, the group proposed a vertical terminal (see Figure 7). This terminal integrates airport transport, railway, and ground public transport into one system. For commuters, the primary issue is efficiency. In the Vertical Terminal, passengers can transfer between multiple lines by walking for less than one minute to the diagonal side of the building on the same level. Various transportation systems of different levels draw people up into this infrastructure building. Vertical Terminal is, in a real sense, a full-time functional skyscraper. From the underground connection with GCT, to the city plaza; from the revolving driveway for city buses and taxis, to the three-dimensional parking of rental cars; from transfer floors for airport arrivals and subways, to departure floors; these systems together comprise a new high-rise building archetype.

## Aerial Tram

*Pan Zheng, Xiaoyu Cheng, Nasha Mou & Menghao Wu*

Though there is plenty of three-dimensional space in New York City, there is not much 3D life. The vitality of the city is at ground level. Further, New Yorkers spend an average of 48 minutes each weekday commuting in each direction, well above the national average. To instill in the skyline the vitality of the ground and to resolve the transportation issues, the team reimagined skyscrapers to serve as a major part of the urban transportation system. The group proposed a new transportation system of aerial tramways (see Figure 8). In order to further the integration of the tops of tall buildings with city life, beyond the role of observation decks or skyline icons, a new dimension in the sky was proposed. Unlike the street grid, an aerial tramway system has the advantage of being able to follow routes on the diagonal or "as the crow flies," thus shrinking transportation time between key tall building communities, while adding vitality to those communities. Starting as an expansion of the existing Roosevelt Island Tramway, this new network could also keep growing across the whole city/region, connected by proposed skyscrapers. The value of this verticality is further supplemented by arranging high-intensity uses in buildings between the tram terminals and the existing surface and underground transport links.


Figure 8. Aerial Tram.

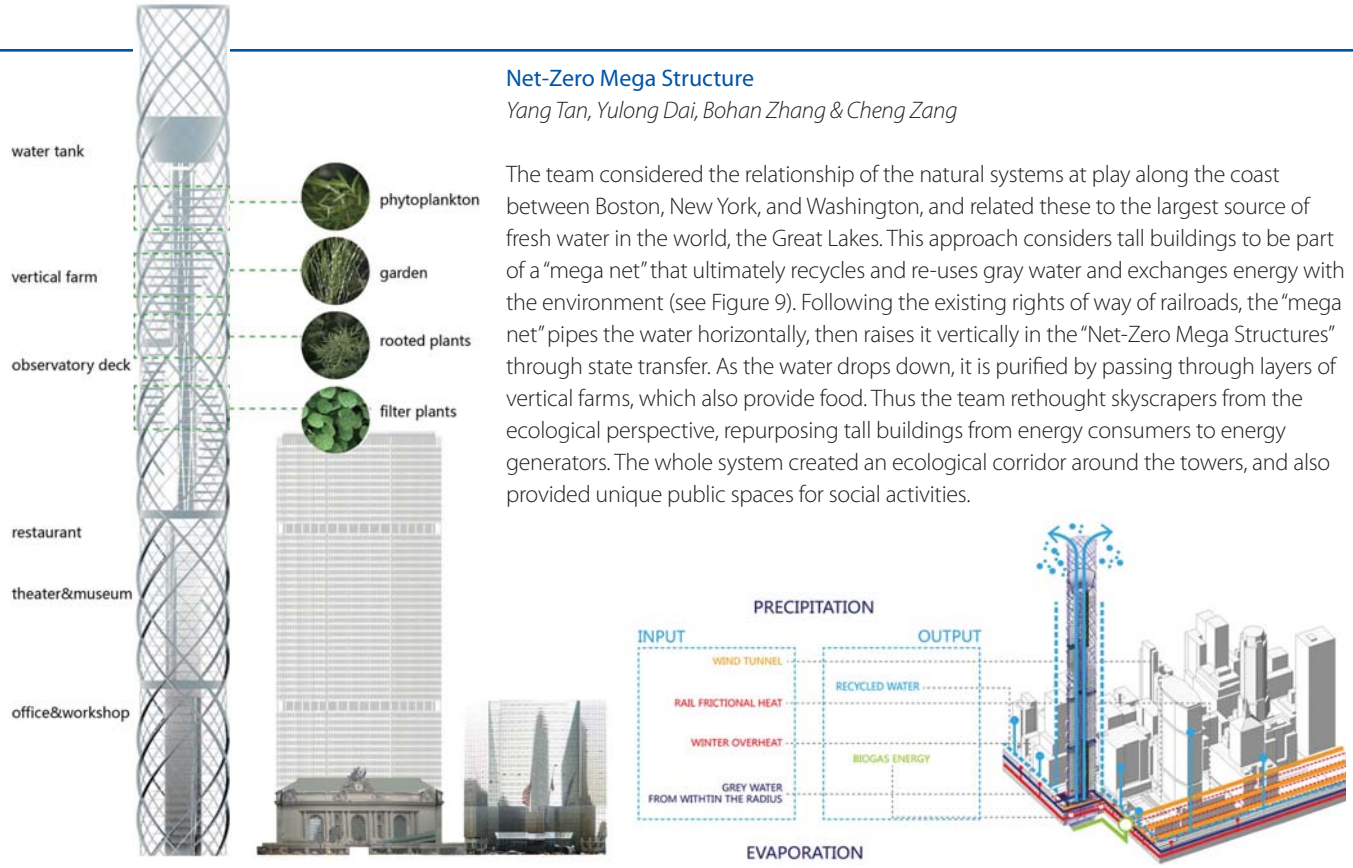


Figure 9. Net-Zero Mega Structure

### Net-Zero Mega Structure

*Yang Tan, Yulong Dai, Bohan Zhang & Cheng Zang*

The team considered the relationship of the natural systems at play along the coast between Boston, New York, and Washington, and related these to the largest source of fresh water in the world, the Great Lakes. This approach considers tall buildings to be part of a "mega net" that ultimately recycles and re-uses gray water and exchanges energy with the environment (see Figure 9). Following the existing rights of way of railroads, the "mega net" pipes the water horizontally, then raises it vertically in the "Net-Zero Mega Structures" through state transfer. As the water drops down, it is purified by passing through layers of vertical farms, which also provide food. Thus the team rethought skyscrapers from the ecological perspective, repurposing tall buildings from energy consumers to energy generators. The whole system created an ecological corridor around the towers, and also provided unique public spaces for social activities.

## Conclusion

Following the theme *Tall Buildings as Extensions of Urban Infrastructure and Vitality,* this design studio mainly aimed to explore and resolve the synergistic relationship of placing a tall building in a complex and unique urban context, and also to explore how that tall building, as an extension of urban infrastructure and vitality, can be inspired by the cultural, physical, and environmental aspects of site.

Moreover, this New York studio explored an innovative form for an international student design studio, which was undertaken by one academic institute with great support from the world's leading tall building industry organizations and practices. It provided the students with valuable learning experiences. ■

*Unless otherwise noted, all image credits in this paper are to the College of Architecture and Urban Planning (CAUP), Tongji University, Shanghai.*

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