

MIT i²

idea incubator

by Suk Lee

Bachelor of Arts in Architectural Studies, University of Washington
June 2008

Submitted to the Department of Architecture in Partial Fulfillment
of the Requirements for the Degree of Master of Architecture at the
Massachusetts Institute of Technology
February 2015

© 2015 Massachusetts Institute of Technology. All rights reserved.
The author hereby grants to MIT permission to reproduce and to
distribute publicly paper and electronic copies of this thesis document
in whole or in part in any medium now known or hereafter created.

Signature of Author :

Department of Architecture
January 15, 2015

Certified by :

Antón García-Abril, PhD
Professor of Architecture
Thesis Supervisor

Accepted by :

Terry Knight, PhD
Professor of Design and Computation
Chair of the Department Committee on Graduate Students

Acknowledgements

Professor Antón García-Abril, My growth in architecture has been really led by your ambition in architecture from both academic and practical realms. I truly appreciate all that we shared at both MIT and Ensamble Studio

Professor John A. Ochsendorf, participation in the Guastavino Project really opened up my vision in design. The experience was very valuable that not anybody can have such opportunity. Thank you for all the passion you shared with me on this thesis project.

Professor Simon Frommenwiler, it was a great opportunity for me to have you in my thesis committee while you were visiting MIT. Your passion in architecture provoked me to push my project to the limit. Thank you for all of your harsh and warm comments on the project.

I also want to note the fact how much I appreciate the infinite support from my parents and family.

Thesis Committee

Thesis Supervisor Antón García-Abril, PhD
Professor of Architecture

Thesis Reader John A. Ochsendorf, PhD
Professor of Building Technology

Thesis Reader Simon Frommenwiler
Associate Professor of Architecture
ENSA Strasbourg, France

MIT i²

idea incubator

by Suk Lee

Submitted to the Department of Architecture on January 15, 2015 in Partial Fulfillment of the requirements for the degree of Master of Architecture.

Abstract:

This thesis propose a flexible public space for both the MIT community and the city of Boston in response to the unknown future of the university campus, questioned by the rapid growth of online learning.

Despite the various opinions on the future campus, the value of physical social interaction remains the primary method of incubating ideas. MIT i² is an architectural solution to this issue, and is situated on the Charles River along the Harvard Bridge, the point of greatest pedestrian activity compared to the other parts of the waterfront.

This project ultimately changes the Charles River from a barrier to a new urban destination where various social and intellectual activities can occur. Two radical interventions address completely different relationships with the water: spaces above and below the water.

These typologies create different spatial experiences for different programs, but remain flexible for the unknown.

Thesis Supervisor: Antón García-Abril, PhD

Title: Professor of Architecture

Table of Contents

Introduction.....	09
I. City Growing as an Intellectual Hub.....	10-17
II. Redefining the Boundary for Education.....	18-29
III. Electracy: Social Machines in the Information Age.....	30-37
IV. Learning from the History of MIT Campus.....	38-43
V. Redefining Traditional Academic Space of MIT.....	44-49
VI. Design Proposal: MIT i ² - idea incubator.....	50-101
Bibliography.....	102-103

Introduction

Influenced by the technological development of our society, universities have experienced considerable institutional and spatial transformation over the past centuries. Based on its 1916 radical campus plan, Massachusetts Institute of Technology in Cambridge has been able to provide a physical environment for interdepartmental pedagogies and collaborations with neighboring industries. However, we must now think critically about whether this educational infrastructure is successfully responding to the emerging digital and information technologies of today.

This thesis investigates the paradigm of the digital apparatus today and analyzes how emerging communication technologies such as the internet are influencing human behavior. Further analysis, based on Luhmann's systems theory, will address the technological and cultural changes that we are witnessing today and investigate whether or not universities, as agents existing between individuals and the society, are responding to these social changes.

Where, when, why and how we interact, what we share, and with whom we engage will become profound criteria when we rethink our future cities. This is especially true with regard to universities. Learning from the history of higher education, thoughts and theories about technology and society, and the analysis of the current institutional system of MIT, this thesis finally proposes a flexible public space for both the MIT community and the city of Boston in response to the unknown future of the university campus, questioned by the rapid growth of online learning.

This project ultimately changes the Charles River from a barrier to a new urban destination where various social and intellectual activities can occur. Two radical interventions address completely different relationships with the water: spaces above and below the water. These typologies create different spatial experiences for different programs, but remain flexible for the unknown.

I. City Growing as an Intellectual Hub

Located in the northeastern territory of the United States as one of the principal cities, Boston, a city known as the fourth high-dense city in the United States, is constantly experiencing population growth. According to the demographic data investigated by Ben Oldenburg from America 2050, 17 million more residents are expected to be added to this territory.¹

Noting this increasing population, this thesis attempts to envision public life shared by millions of people living in the Greater Boston area, which has more than 60 colleges and universities. How should high-level education institutes, such as Harvard University and Massachusetts Institute of Technology (MIT), take a leading role to develop a city of education for the increasing residents?

MIT is an interesting education infrastructure that has already opened its institutional boundary to the rest of Cambridge. A number of institutes, business, and laboratories moved to MIT campus or adjacent areas such as Kendall Square, forming a technological hub. According to 2013 business report by Antonio Regalado from MIT Technology Review, this innovation cluster around MIT is achieving the second highest venture capital in the world.² This accomplishment was possible because of flexible physical environment that MIT provided for the collaboration with other institutions.

1. Ben Oldenburg, 2008
2. Antonio Regalado, 2013



Figure 1.0 | Territorial Analysis Focus Area: Greater Boston



Figure 2.1 | Population Growth in the Northeastern U.S.
Source | Regional Plan Association, 2014

Principal Cities: Boston, New York
Philadelphia, Baltimore, Washington D.C.

Population 2010: 52.3 million
Population 2025: 58.4 million
Population 2050: 70.8 million
Projected Growth: 35.2%

North East will add

17 million new residents



Figure 2.2 | High-level Education in the Greater Boston Territory

Territorial Focus: Greater Boston
Boston, Cambridge, Worcester
Providence, Lowell, Quincy

Population: 4,684,299
10th U.S. Metropolitan Statistical Areas
Colleges and Universities: +60
Students for Residential Education: 249,556

Educational Metropolis

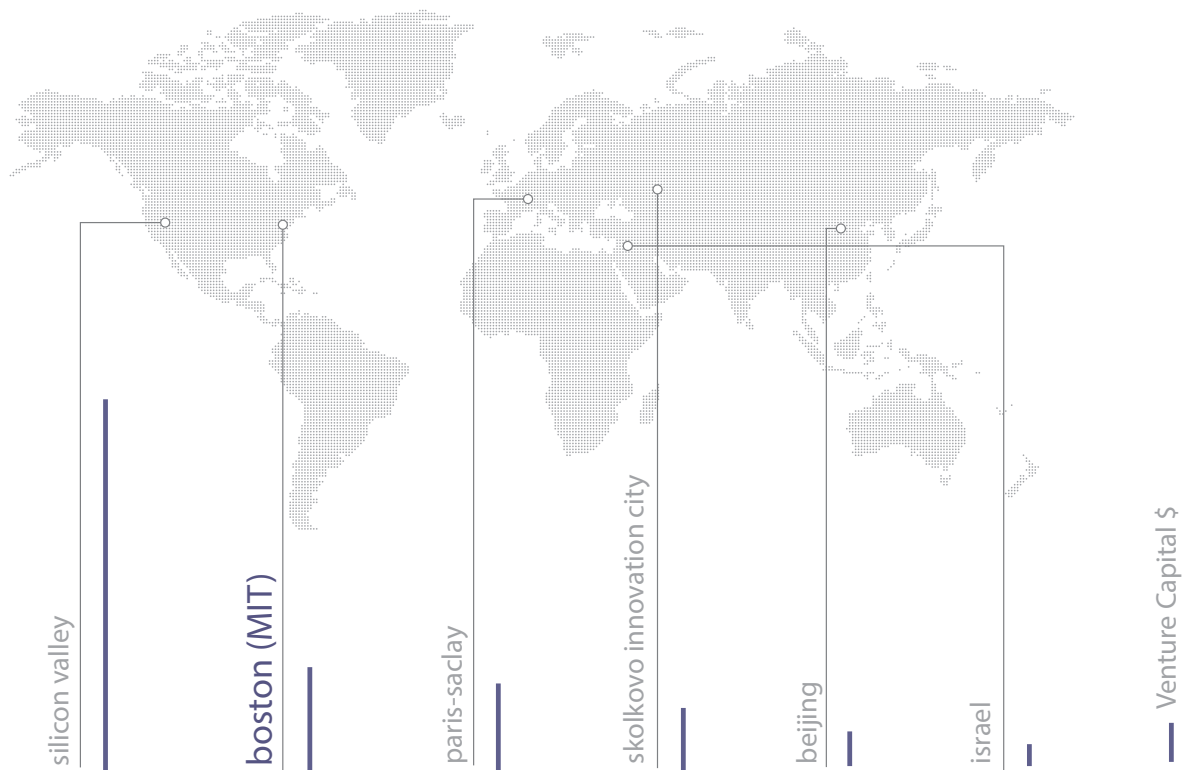


Figure 2.3 | Boston's Rapid Growth as a Technological Hub
 Source | MIT Technology Review, 2013

MIT - Acheiving 2nd Highest Venture Capital

The region around MIT is changing
 the city of Boston into a world-wide

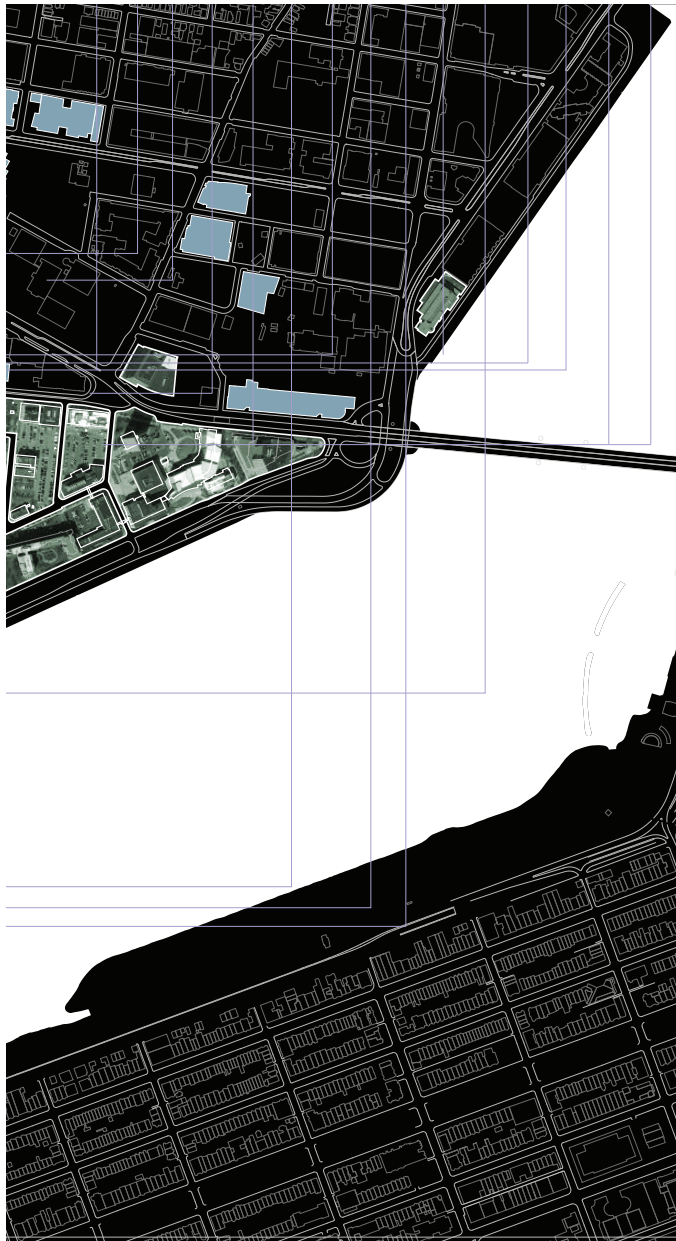
Technological Hub

Agios
 Ariad
 Ragon Institute
 GlaxoSmithKline
 Schlumberger
 Metabolix
 Momenta Pharmaceuticals
 Aveo pharmaceuticals
 Takeda Pharmaceuticals, USA
 Akamai
 Amgen
 EMC
 Ethanol Boosting Systems
 Partners Healthcare
 Whitehead Institute
 Draper Laboratory
 Akcell
 Cambridge Innovation Center
 Acceleron
 Novartis Institute for Biomedical Research
 Broad Institute
 Twitter
 Yahoo!
 Ironwood
 Vertex
 Highland Capital
 Etex
 Charles River Ventures
 Genomics Collaborative
 Google
 Facebook



Figure 3.0 | Map of the Connectivity Between MIT and Surrounding Industries and Institutes

Apple
 Biogen
 Genzyme
 Amazon
 Microsoft
 Epizyme
 Eisai
 Boston Biomedical
 Sanofi
 Pfizer
 Aileron
 Lab | Central
 VMWare
 Flagship Ventures
 Intersystems



Inter-departmental pedagogy of MIT has successfully attracted various laboratories, institutes and industries to neighborhood, Kendall Square and Central Square.

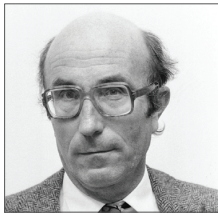
These neighborhood and MIT campus have created a biotechnology hub of the United States and also invited energy, IT/data, and venture capital to this field of intellectual collaboration.

II. Redefining the Boundary for Education

By 2050, there will be seven billion people living in cities and two billion of this population will be over the age of 60 and have different eyes of experience and wisdom. In his interview on Critical Thought | TV, Mark Wigley, an architectural theorist and author at Columbia University, points out that the spectrum of learners in the future will no longer be segregated in different age groups like today, but significantly widened from children below 10 to elders above 65. “How can we really incubate fully real-time collaborative ecology of creative design around the questions of city?” Wigley emphasizes that ideas are fundamentally social and they live in the interconnections of all of various brains of different age groups and these ideas are incubated and evolve in cities.¹

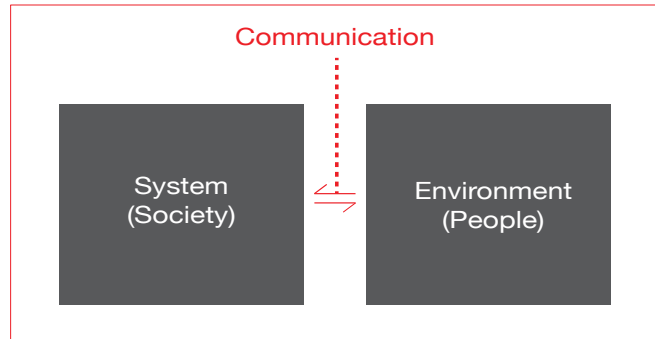
This ecological system of looking at the city as an idea of incubator is related to systems theory by Niklas Luhmann, German theorist, from the late 20th century. In his book, *Social Systems*, Luhmann described society as an autopoietic system. The system (society) self-references and reproduces itself through communication with its environment (people).² MIT, as an intellectual community, has been a system that develop itself by communicating with members of its community by means of its pedagogy. This thesis transform the role of MIT from system to a communicative agency between the larger system (City) and its environment (learners from both institution and the rest of the city).

1. Mark Wigley, 2014
2. Niklas Luhmann, 1996



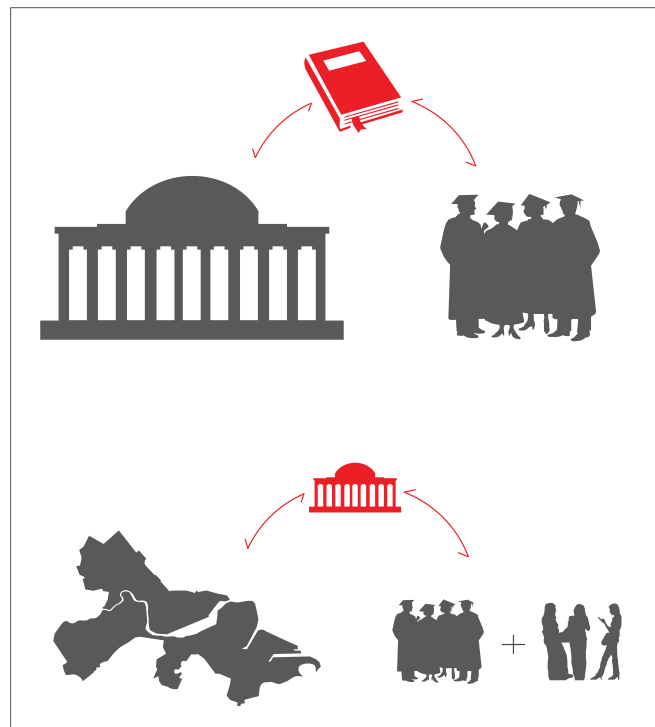
“Humans cannot communicate; not even their brains can communicate; not even their conscious minds can communicate. Only communication can communicate.”

-Niklas Luhmann



Cultural Feedback Loop

University (system) evolve through communication with scholars (environment) by means of its pedagogy (communication).



City (system) evolves through communication with both scholars and public (environment) by means of shared institution (communication).

Figure 4.0 | Application of Social System Theory on the Education System

Wigley addresses that social and cultural interactions between each individual from different age groups in our urban life have a potential to become enormous assets as these cities grow denser.¹ As intellectual hubs of cities, how can universities communicate better with each individual of the institutions and public around them, and subsequently incubate ideas from them? Are universities providing appropriate institutional and spatial environments where people can more efficiently collaborate with each other and generate ideas to enrich the ecological system of our society?

To answer this question, this thesis performs the regional analysis on the vicinity of MIT and Charles River in order to understand geographic factors that affect the public life. Considering the significant number of individuals from both the technological district around MIT and the rest of city, the urban life on the Harvard Bridge and Charles River alludes to the great potential of this bridge becoming a shared place for both MIT and the city, creating a new type of local and global intellectual hub.

1. Mark Wigley, 2014

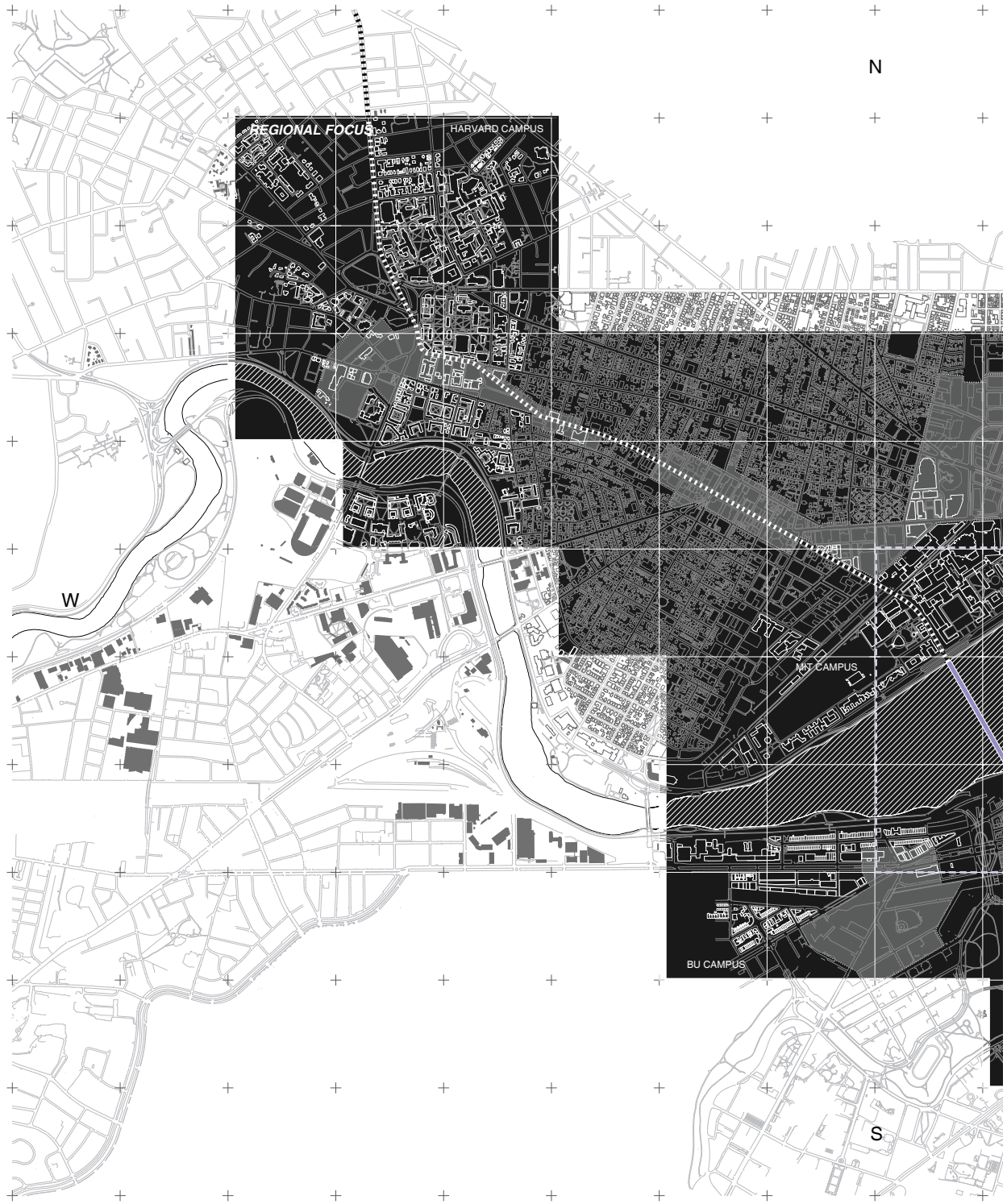
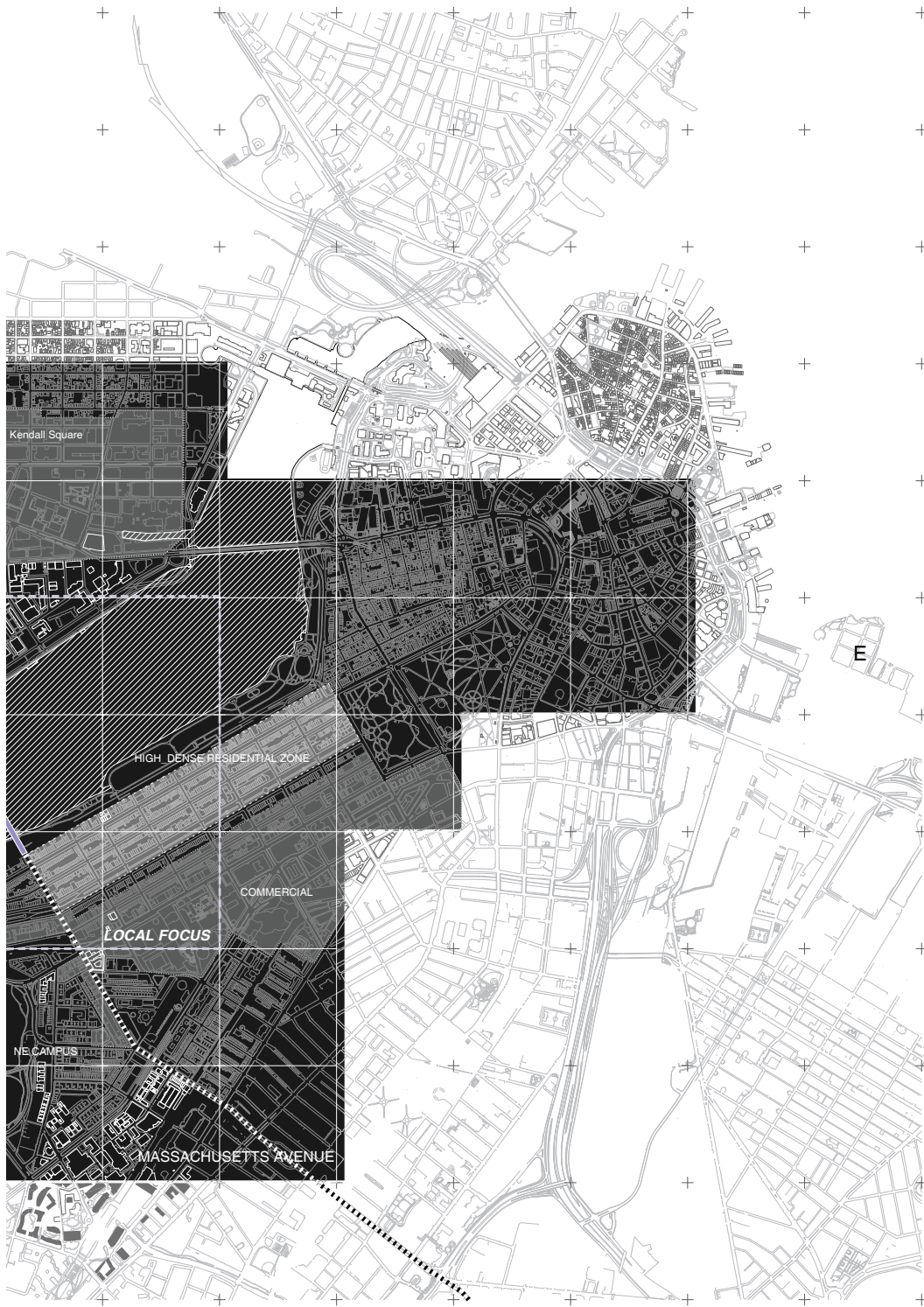


Figure 5.0 | Map of the Regional Focus Area



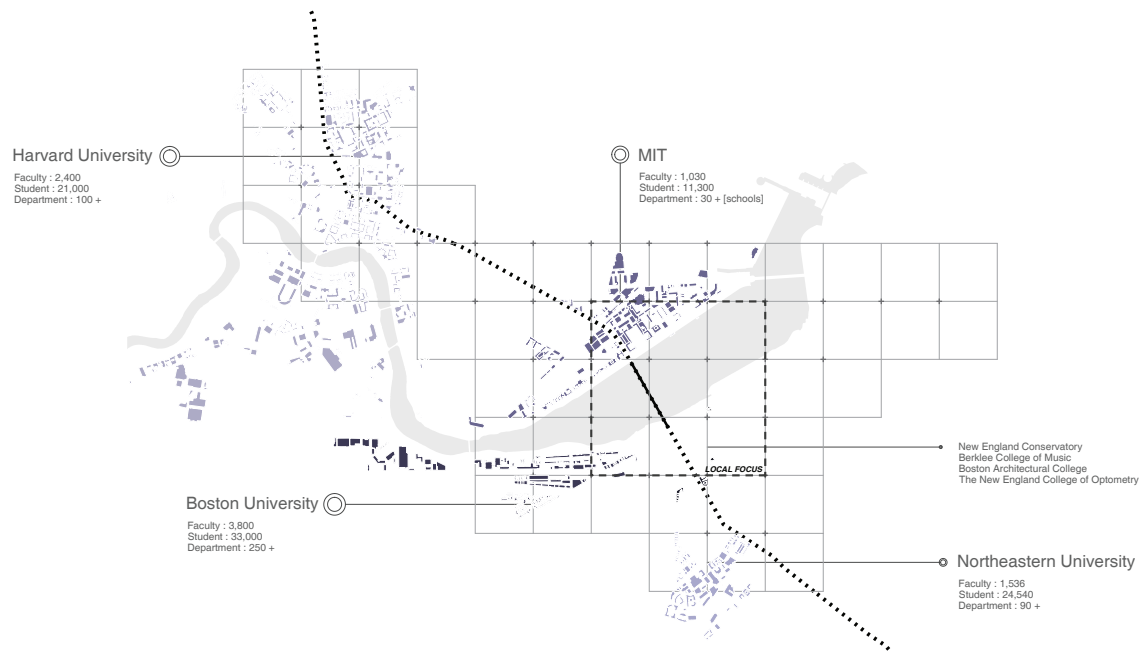


Figure 6.1 | Regional Analysis: Education Infrastructure Statistics

There are four major institutions for high-level education within this regional focus vicinity. Harvard University and Massachusetts Institute of Technology are located on the northern side of the Charles River and Boston University, Northeastern University and other smaller colleges are located on the other side of the river. Boston is truly the city of education.

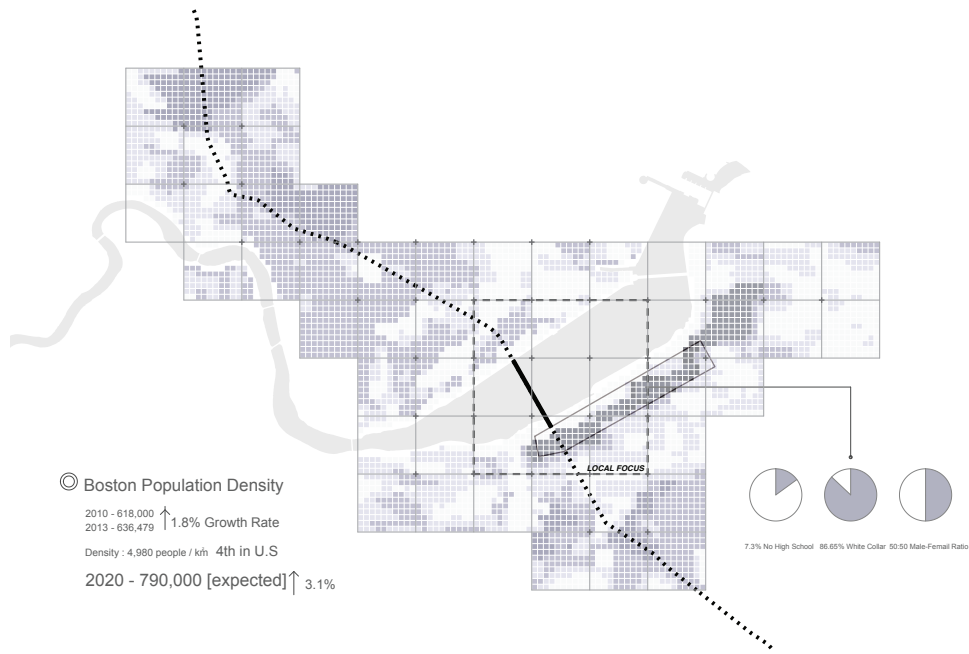


Figure 6.2 | Regional Analysis: Boston Demographic Data
 Source | World Population Review, 2014

The population of Boston has grown in 1.8% growth rate, reaching 4th population density in the United States. According to Boston Population Review, the growth rate is expected to rise to 3.1%, reaching 790,000 people by 2020. Another interesting statistics can be found at the Back Bay area (Local Focus) that over 86% of the entire population is white collar workers.¹

1. World Population Review, 2014

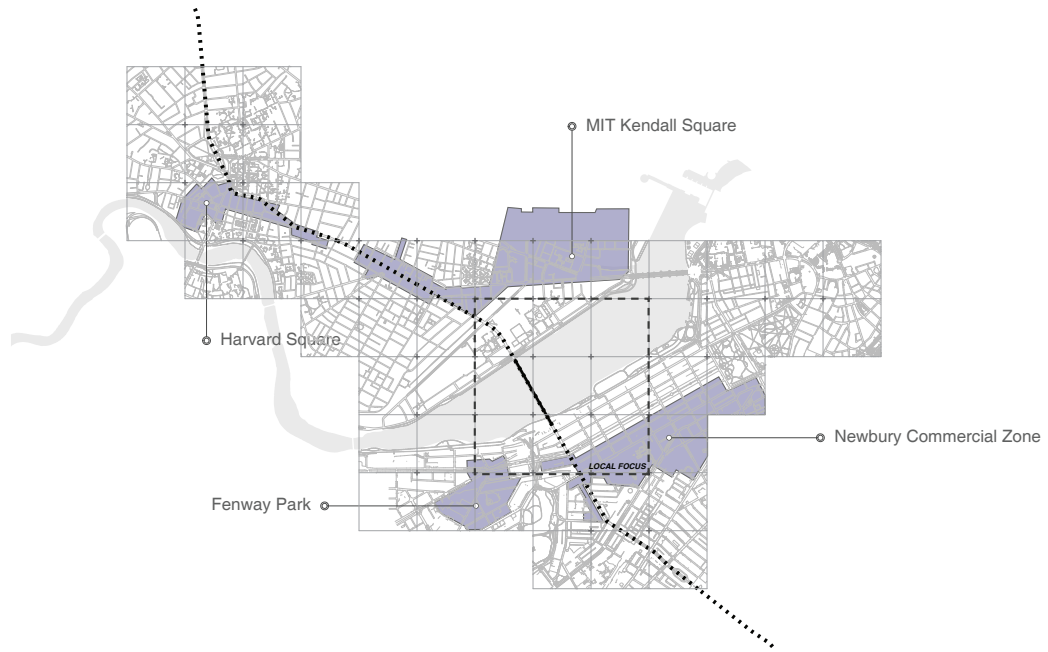


Figure 6.3 | Regional Analysis: Places for Public Activities

In order to create a new urban platform for public education, understanding the existing public places within this focusing vicinity is important. These public places on the map above either run parallel to the Charles River or along the Massachusetts Avenue that runs orthogonal to the river.

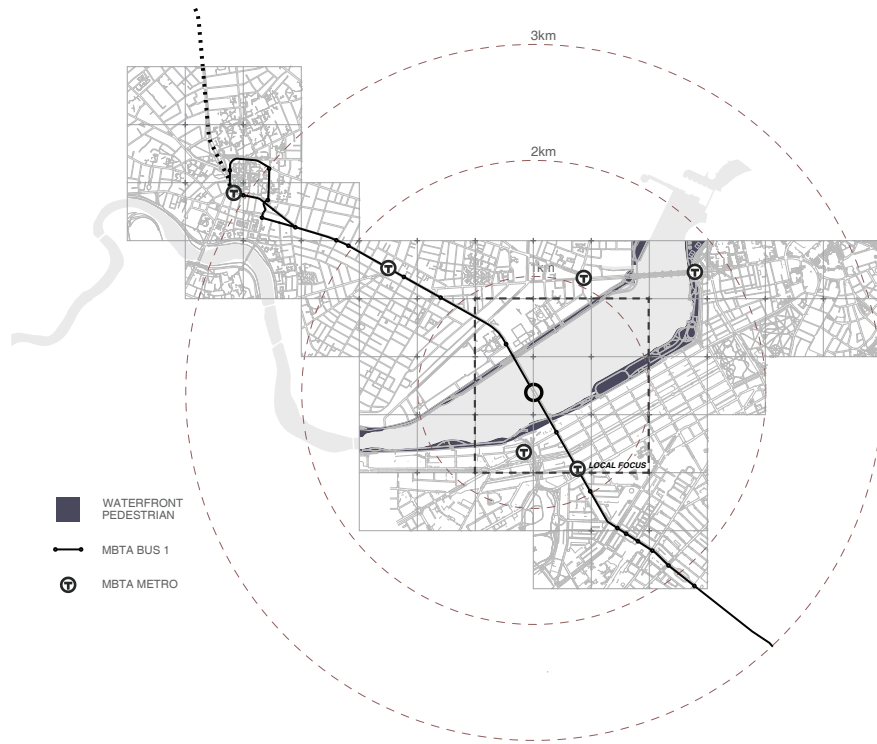


Figure 6.4 | Regional Analysis: Public Transportation and Access

Considering the center of the map, center of the Harvard Bridge, as a focal point, there are multiple public transportation access within 3km radius vicinity.

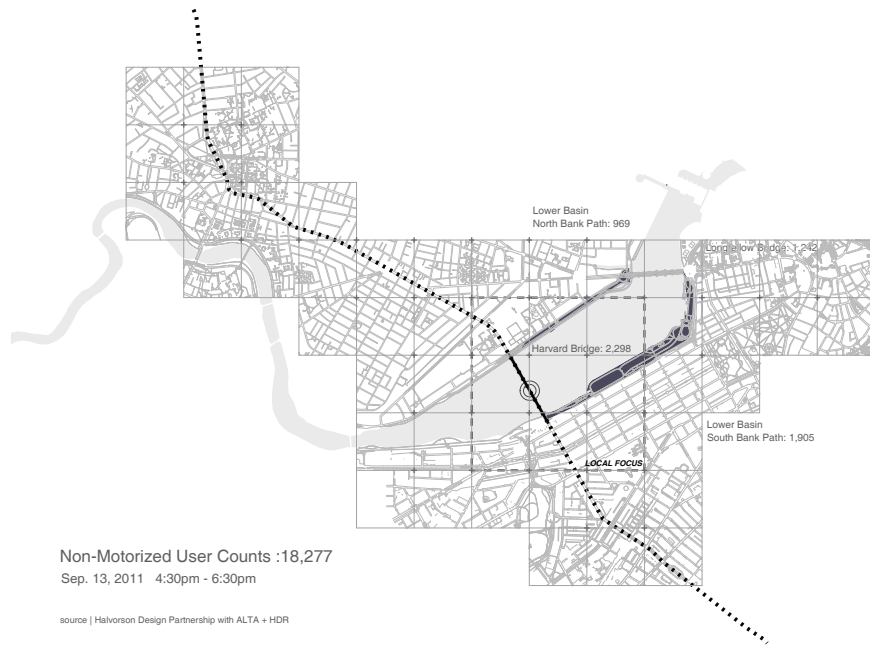


Figure 6.5 | Regional Analysis: Pedestrian Circulation Along the Charles River

Pedestrians are the main target of this new public education platform. Halvarson Design Partnership investigated the number of pedestrians along the Charles River, indicating that the Harvard Bridge is the most crowded spot for pedestrians.

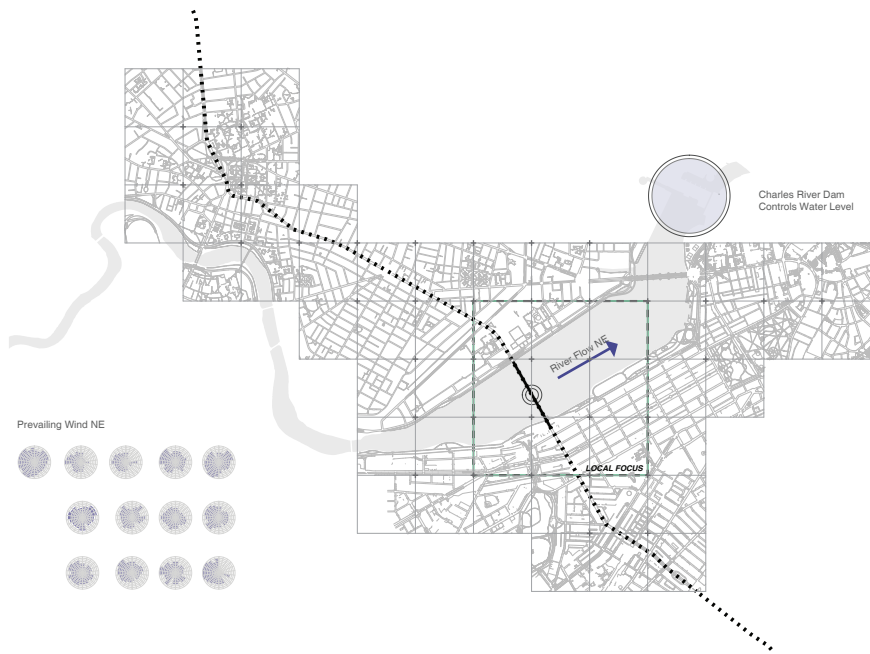


Figure 6.6 | Regional Analysis: Local Climate and Water Analysis

Previous regional analysis reveals the importance of the Harvard Bridge and the Charles River for the public places. The river flows northeast direction as well as the direction of the prevailing wind. The water level is controlled by the Charles River Dam, limiting water level difference under two feet. The water becomes a very important design criteria.

III. Electracy: Social Machines in the Information Age

Through the rapid growth of these technologies and their impact on the global society, our dependency on the internet and information technologies is exponentially increasing in our everyday lives. The idea of the technical term ‘feedback loop’ explains the communicative relationships between individuals through the lens of digital technologies.

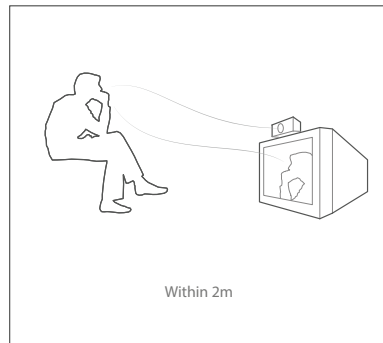
Concerned about this major paradigm shift, from the apparatus of literacy to the new apparatus, that our society is undergoing today, Gregory Ulmer, a professor in the Department of English at the University of Florida, introduced “electracy” as a new emerging apparatus in his book, *Teletheory*, in which he addresses the importance of its impact on the pedagogy of higher education. According to Ulmer, electracy is a theory that describes the necessity of discovering the full potential of emerging media or information technologies as new social communicative tools or skills.¹ In her 2003 article, Lisa Gye, a lecturer in media and communications at Swinburne University of Technology in Australia, writes:

The transition from a predominantly literate culture to an electronic culture is already engendering changes in the ways in which we think, write and exchange ideas. Ulmer has been concerned with the kinds of changes that take place as a result of this transition and his primary concern has been a pedagogical one—that is, he is interested in how learning is transformed by the shift from the apparatus of literacy to the apparatus of what he comes to term ‘electracy’.²

1. Gregory L. Ulmer, 2003

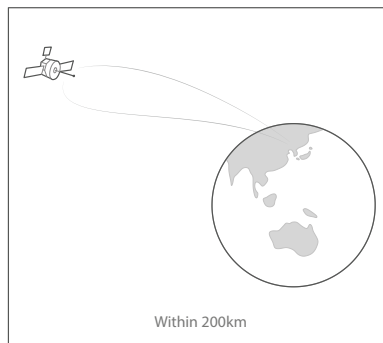
2. Lisa Gye, 2003

Human visually transcending
himself/herself via camera



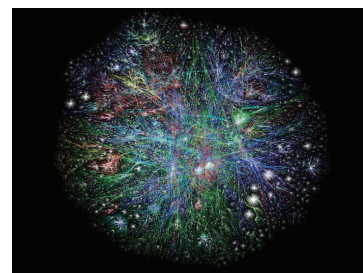
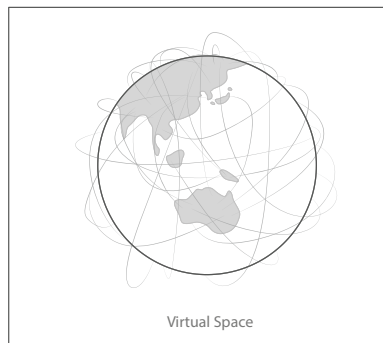
Nam June Paik, TV Buddha, 1974(2002).
Collection of the Nam June Paik Art Center
© Nam June Paik Estate

Human visually transcending
himself/herself astronomical
distance via satellite



Astronaut photograph AS17-148-22727 courtesy
NASA Johnson Space Center Gateway to Astronaut
Photography of Earth. Apollo - 70mm Camera

Human visually transcending
himself/herself to a virtually
shared place via internet



The combination of physical infrastructure and
wireless technologies. Image source by Flickr user
© Symplio

Figure 7.0 | Feedback Loop and the Development of Technology

Thus, how can we employ these technologies and propose a new successful educational infrastructure for the future? The future is uncertain, but we can learn from how commercial sectors digested the potential of electracy.

Quickly responding to the rising notion of the global interconnectivity, MIT and Harvard University founded EdX, a massive open online course (MOOC), in May of 2012, and has since provided free online courses for a worldwide audience. The internet has changed the sense of time and place in learning, subsequently providing an opportunity for individuals to learn at their own pace and on their own path. The role of the professor therefore must change. In his 2013 article, Thomas L. Friedman, the NY Times columnist, stated that the job of a professor will no longer be about teaching in a class for students to acquire knowledge, but that it will be about guiding students who have already acquired knowledge online and helping them master what they have learned.¹

1. Thomas L. Friedman, 2013

Introduction to Computer Science The Ancient Greek Hero Ancient History of China Integrated Health M
of Electric Circuits Intermediate Chinese Grammar The Study of Folklore Introduction to Theoretical Co
Improving Global Health: Focusing on Quality and Safety Unlocking the Immunity to Change: A New A
English Networks and Crowds English for Doing Business in Asia English Grammar and Style Paradigms o
to Packets Composite Materials Overview for Engineers A Global History of Architecture Future Cities W
From Data Découvrir la science politique Introduction to Philosophy: God, Knowledge and Conscious
Logistics Fundamentals The Art of Poetry AnatomyX: Musculoskeletal Cases International Politics in
Underactuated Robotics Shakespeare: On the Page and in Performance Fundamentals of Programming I
in Action Globalization's Winners and Losers: Challenges for Developed and Developing Countries Desig
World Creating Modern China: The Birth of a Nation Introduction à l'astrophysique Medicinal Chemistry:
Comedy: Dante's Journey to Freedom Fundamentals of Immunology American Capitalism: A History T
America: Nature and Nation, 1700-1850 Introduction to Game Design Blue is the New Green Introduction
Science of Exoplanet Discovery and Characterization Technology for Biobased Products Delft Design App
Light, Spike, and Sight: The Neuroscience of Vision Communist Liberations Solving Complex Problems R
Trials in Health Care An Introduction to Global Health Greater China Today: The People's Republic, Taiwan
Sewage Electronic Interfaces: Bridging the Physical and Digital Worlds The Divine Comedy: Dante's
DOCUMENTARY! New Trends, New Formats Educación para una sociedad del conocimiento Pricing Option
1400 to 1800 Descubriendo la pintura europea de 1400 a 1800 The Beauty and Joy of Computing Nat
Pre-University Calculus Tangible Things: Discovering History through Artworks, Artifacts, Scientific Specim
Mathematics Poetry in America: The Poetry of Early New England Explore Statistics with R Behavioral Mec
Education Invasions, Rebellions, and the End of Imperial China Introduction to Solid State Chemistry
Introduction to Global Sociology Anthropology of Current World Issues Solar Energy Age of Globalizati
Introduction to Water and Climate Introduction to Aeronautical Engineering Fundamentals of Immunol
Secret of Life Quantitative Biology Workshop Positive Behavior Support for Young Children Engineerir
Structures Introduction to Statistics: Inference Introduction to Baseball Analytics Mechanics ReView Vocal
Physics Cyber-Physical Systems Becoming a Resilient Person - The Science of Stress Management Copy
Universe Introduction to Bioethics An Introduction to Credit Risk Management Introduction to Statistics:
Genomics United States Health Policy Introduction to Biomedical Imaging Innovating in Health Care G
customer? Flight Vehicle Aerodynamics The Analytics Edge Financial Analysis and Decision Making Meca
Crowds and Markets The Science of Everyday Thinking Historical Relic Treasures and Cultural China Globa
Introduction to Statistics: Descriptive Statistics Global Warming Science Effective Thinking Through Ma
Ressources naturelles et développement durable The Challenges of Global Poverty Introduction to Probal
and Legacies of History's Greatest Warrior Relativity and Astrophysics Linear Algebra - Foundations to Frc
Magnetism Principles of Economics with Calculus Introduction to Public Speaking Early Christianity: The L
Dynamics - Computational Neuroscience of Single Neurons Fundamentals of Clinical Trials Science & Coc
of American National Security, Strategy and the Press: An Introduction Introduction to Human Evolution
Medicine - The Impact of Drug Development Classical Mechanics Quantum Mechanics and Quantum
...

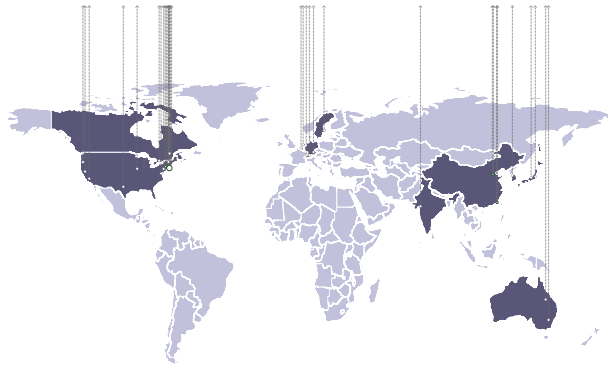


Figure 8.1 | Over 400 Faculty Members and Staffs from Over 36 EdX Chapters Providing More Than 200 Courses

Management Strategies for Menopause Data Structures and Algorithms Chemistry and Society Principles
 Computer Science Nutrition Around You International Criminal Law Data Structures **Effective Field Theory**
 Approach to Personal Improvement **The Civil War and Reconstruction - 1850 -1861** Principles of Written
 Computer Programming Epidemics **Electrotechnique** A System View of Communications: From Signals
 for the Greater Middle East Next Generation Infrastructures History of Chinese Architecture Learning
 The Fascinating World of Robots and Robotics Computing: Art, Magic, Science **Supply Chain and**
 the Korean Peninsula **Food for Thought** Terrorism and Counterterrorism **Evaluating Social Programs**
 Representations of HIV/AIDS Foundations of Computer Graphics **Waves & Optics** Behavioural Economics
 and Development of Educational Technology Sense, Control, Act: Measure the Universe, Transform the
 The Molecular Basis of Drug Discovery Foundations of Chinese Thought The Violent Universe The Divine
 The Psychology of Criminal Justice Introduction to Computational Thinking and Data Science **Poetry in**
 to Drinking Water Treatment Entrepreneurship and Healthcare in Emerging Economies Alien Worlds: The
 Approach Introduction to Functional Programming Foundations of Data Analysis Visualizing Postwar Tokyo
 Responsible Innovation The Civil War and Reconstruction - 1861-1865 Pragmatic Randomized Controlled
 and Hong Kong **U.Lab: Transforming Business, Society, and Self** Introduction to the Treatment of Urban
 Journey to Freedom **Mastering Quantum Mechanics** The Civil War and Reconstruction - 1865-1890
 ns with Mathematical Models Caer o No caer. El secreto de las estructuras. Explaining European Paintings,
ural Disasters Humanity and Nature in Chinese Thought The Search for Vernacular Architecture of Asia
 ens, and the Stuff around You **Discovery Precalculus: A Creative and Connected Approach** Combinatorial
icine: A Key to Better Health The Science of Happiness **Saving Schools: History, Politics, and Policy in U.S.**
Visualizing Japan (1850s-1930s): Westernization, Protest, Modernity Mechanical Behavior of Materials
 ion Ideas of the Twentieth Century Introduction to Computer Science and Programming Using Python
ogy Leaders of Learning Exoplanets Introduction to Computing with Java Introduction to Biology - The
 ng Software as a Service Robot Mechanics and Control **Genomic Medicine Gets Personal** Elements of
 Recording Technology Introduction to the Music Business **The Manchus and the Qing** **Big Data and Social**
right Engaging India **Tropical Coastal Ecosystems** From Global Empire to Global Economy The Evolving
Probability Justice **Street-Fighting Math** Hypersonics – from Shock Waves to Scramjets **Data Analysis for**
 reatest Unsolved Mysteries of the Universe **A New National Culture** **Entrepreneurship 101: Who is your**
nique des Fluides Wiretaps to Big Data: Privacy and Surveillance in the Age of Interconnection Networks,
il Health: Case Studies from a Biosocial Perspective Principles and Practice of Computer Aided Translation
thematics International Human Rights **Discrete Time Signals and Systems** Autonomous Mobile Robots
bility -The Science of Uncertainty Building Mobile Experiences Was Alexander Great? The Life, Leadership,
ntiers Embedded Systems - Shape The World **Jazz Appreciation** **Poetry in America: Whitman** **Electricity &**
eters of Paul Health and Society **Fundamentals of Neuroscience** **Our Energetic Earth Dynamics** Neuronal
aking: From Haute Cuisine to Soft Matter Science Foundations of Computer Graphics **Central Challenges**
Music in the 20th Century Cultural Geography of the World **Innovation and Commercialization** Take Your
Computation **Human Health and Global Environmental Change** **Artificial Intelligence** **Electricity and**

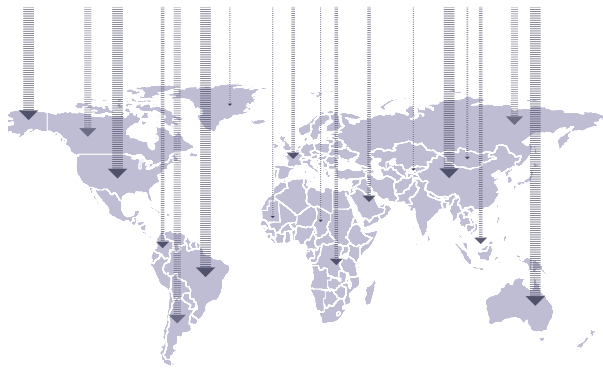


Figure 8.2 | More Than 2.5 Million Users Registered in EdX and 100,000+ Certificates Earned by Students As of Today

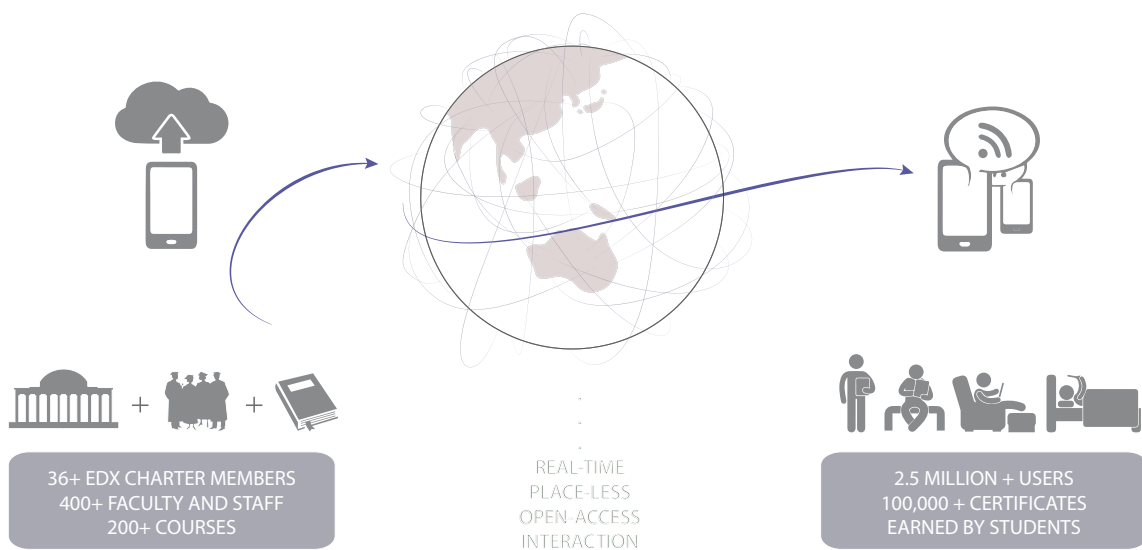


Figure 9.0 | World-Wide, Real-Time, Place-Less, Open-Access Education

I think that not only are we ready (for the Internet) but adoption is occurring at a faster rate than we had thought... The rise of online learning carries with it an unprecedented opportunity to transform the schooling system into a **student-centric** one that can affordably **customize** for different student needs by allowing all students to learn at their appropriate pace and path, thereby allowing each student to realize his or her **fullest potential**

Clayton Christensen, Harvard Business School Professor
in his interview with Courtney Boyd Myers from The Next Web

I think it will not be long before people will see that those who took their **education online** will have learned it better than people who got it in the classroom, and that is exciting.



Illustration by Joel kimmel

Interview by Courtney Boyd Myers, Copyright © 2001-2015, The Next Web, Inc

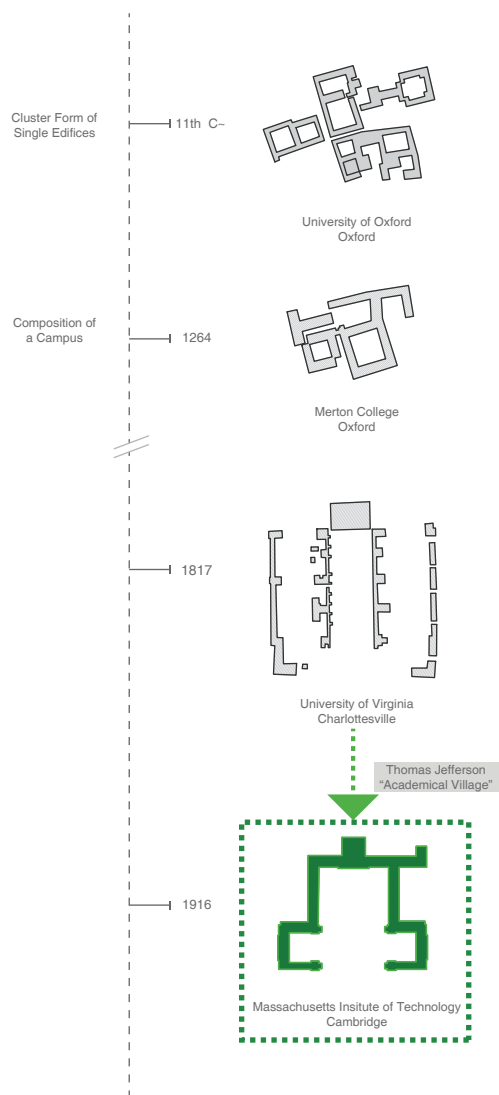


Figure 10.1 | Influenced by Thomas Jefferson's "Academic Village"

IV. Learning from the History of MIT Campus

Shifting from orality to literacy thousands of years ago, human began to capture information and knowledge and define them with terms. In order to internalize this new potential institutionally, Plato established his school of philosophy in 385 BC as the first academy of higher education. The change of the apparatus, from orality to literacy, significantly influenced the education system in the west, in which experiments were conducted, leading to alphabetical inventions.

The University of Bologna was established in 1088 as the first university, and Merton College at Oxford, founded in 1264, was the first built institution in the form of an enclosed quadrangle edifice with an internal courtyard. In his book, *Campus: An American Planning Tradition*, Paul Turner, an architectural historian, explains that the building typology was to reflect the strict disciplinary routine of the pedagogical system. These units grew by forming clusters in order to accommodate the growing number of students.¹ In 1447, the Gutenberg Bible was first printed in the west using movable type. This printing press technology resulted in a pedagogical shift from dictating original knowledge to reinterpreting given printed books, leading to the subsequent development of research-oriented pedagogy.

In the United States, Thomas Jefferson designed the University of Virginia in Charlottesville in 1817. Compared to European typologies, the plans for American universities were spatially more open and dispersed, which is the composition of a campus today. According to Turner, the “campus sums up the distinctive physical qualities of the American college, but also its integrity as a self-contained community and its architectural expression of educational and social ideals.”

1. Paul V. Turner, 1987

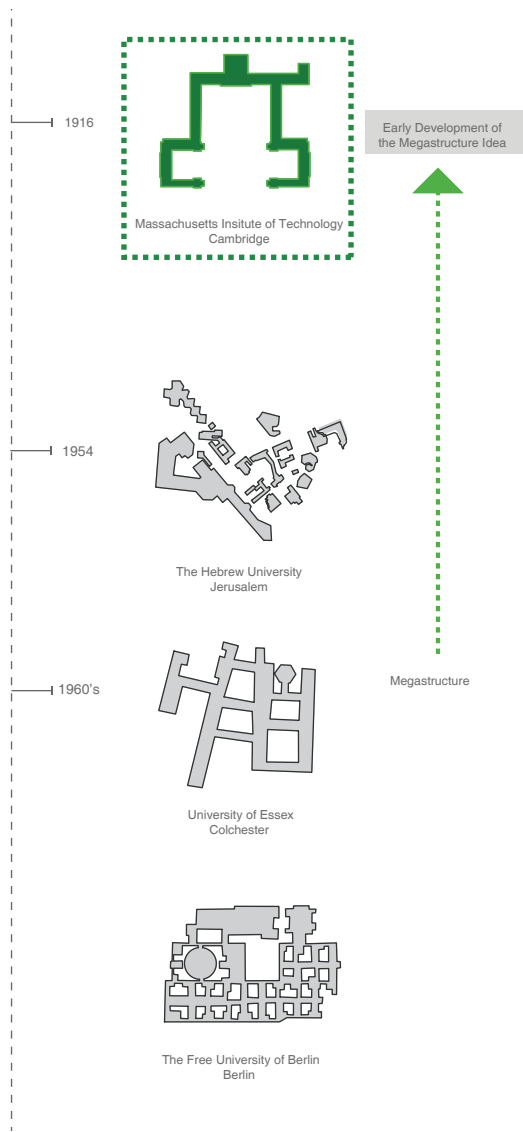


Figure 10.2 | Early Development of the Megastructure Idea

During World War I, universities began to open their boundaries and collaborate with industries in order to develop applied research to meet new social demands. Since World War II, the demand for people with high-level education has increased dramatically and has led to the uncontrollable expansion of the campus. An alternative, mega-structure typology, embodied by concepts such as the Free University of Berlin in 1964, was introduced but quickly abandoned due to its lack of flexibility and its incongruity with the existing urban context.

The university has been an isolated community of highly educated people and has performed almost as a city within a city, creating a strict disciplinary boundary between scholars and the public. In contrast, institutions and industries have formed a symbiotic relationship, and the demand for this collaborative development is increasing today. For example, a number of private laboratories and industries moved to be in close proximity to the Massachusetts Institute of Technology (MIT) campus area, producing enormous intellectual outcomes and eventually developing a national technological hub.

Ironically, these notions of interdisciplinary relationships and collaborations between institutions and industries were already established at MIT by the early 20th century. Retaining the 1912 proposal for the MIT campus by John Ripley Freeman, the architect William Welles Bosworth completed a radical campus plan in 1916, which was fifty years before the introduction of mega-structure institutions in Europe. The proposal was to build a single educational infrastructure that connected different departments in order to encourage cross-disciplinary collaboration and to provide flexibility of use over time. This radical infrastructure successfully developed not only the MIT institution but also surrounding neighborhoods, such as Kendall Square and Central Square, as an interconnected hub of technology and engineering. This early radical establishment from the 20th century is now admired as the role model of other universities today as they expand their campuses.

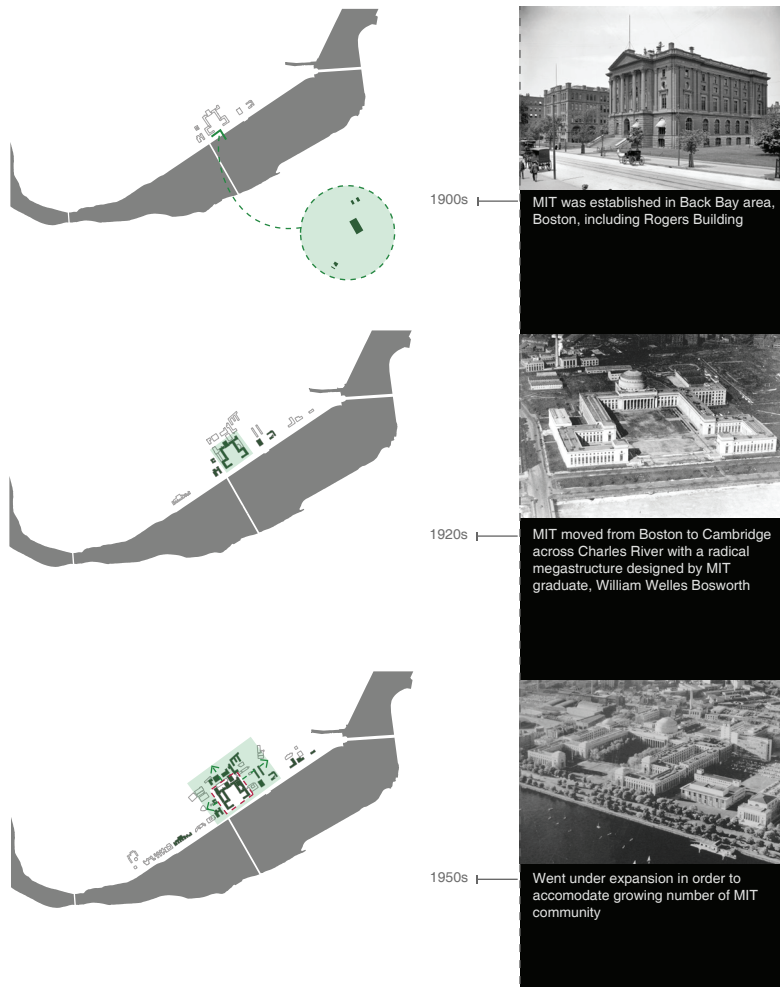


Figure 11.1 | Graphic History of MIT Campus from 1900-1950

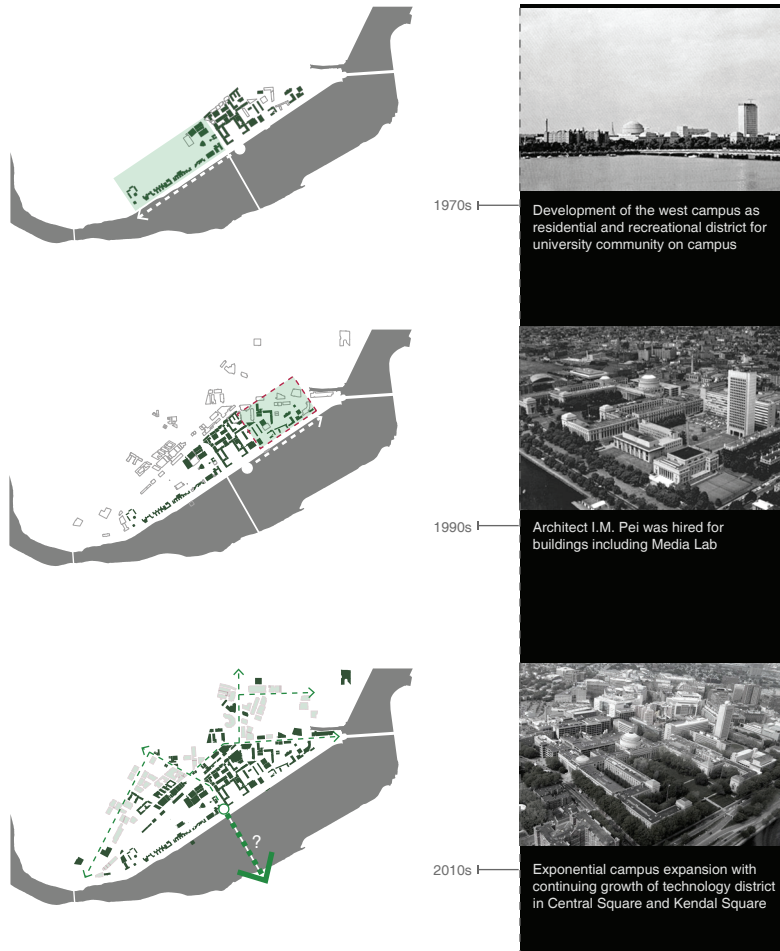


Figure 11.2 | Graphic History of MIT Campus from 1950 - Present

V. Redefining Traditional Academic Space of MIT

Between the 1970s and 1980s, the commercial sector began to apply information technologies to its business models, but its performance remained the same and did not show a positive effect. The main reason behind this was that the effort focused on improving traditional business models by simply gaining efficiency from new technologies. In the late 1980s, however, American Airlines discovered the potential of these new technologies by focusing on not only their internal efficiency but also the external relationship between the company and its customers. Shifting from mass production to mass customization and from mass marketing to one-to-one marketing, the commercial sector made profound changes by reestablishing its relationship with customers and reorganizing its internal structure.

Institutions for higher education are experiencing an issue similar to that commerce had in the late 20th century. As Ulmer noted, institutions need to employ these information technologies in their pedagogical systems as commercial organizations did in their business structure.¹ Although the value of communication and information technologies is remarkable, institutions will not be able to experience a positive effect until they change the fundamental nature of their own internal structure and their external relationship with the society.

1. Gregory L. Ulmer, 2003

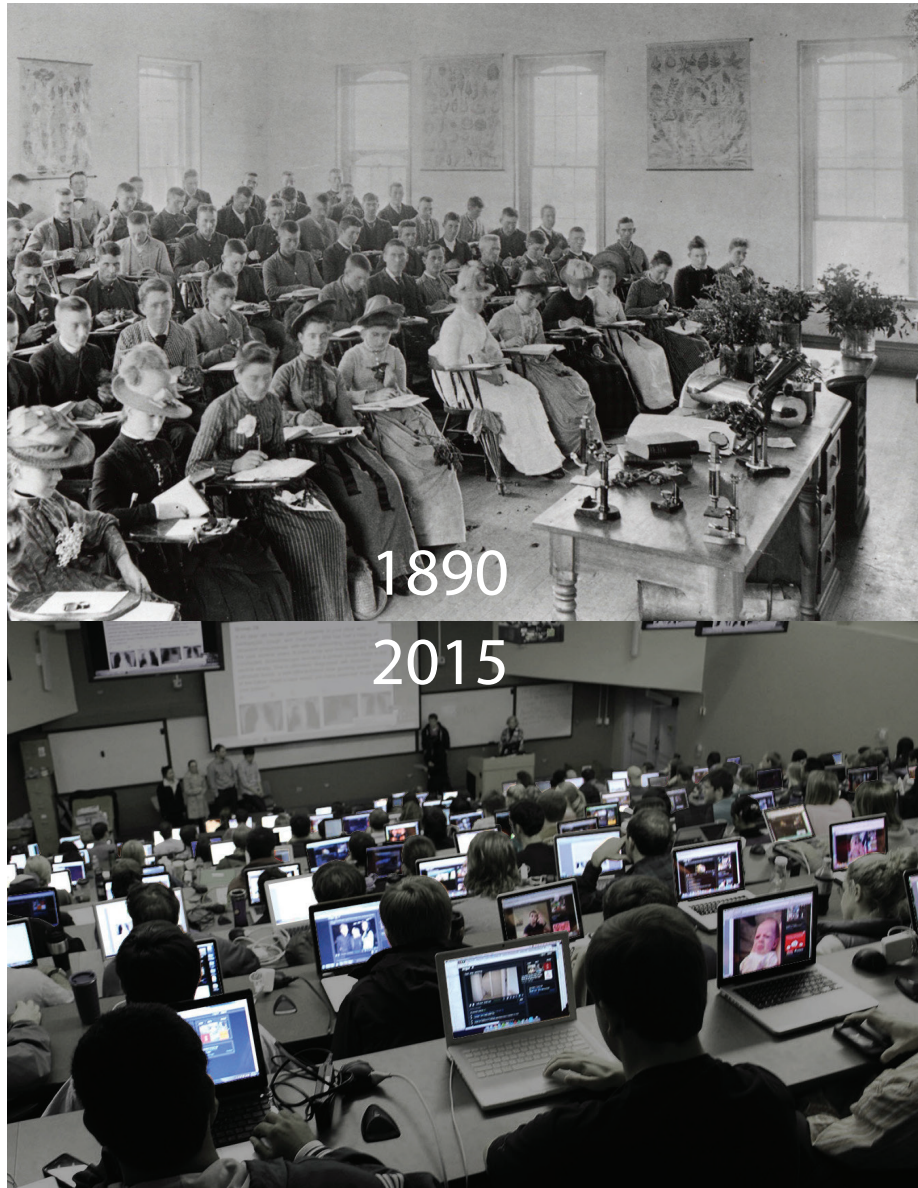


Figure 12.0 | Influence of Internet Infrastructure on the Typical Classroom
Source | Iowa State University of Science and Technology, 2007

The value of the online learning experience with the global community needs to be blended with the residential college experience. As discussed earlier, technological advancements are rapidly shifting our public domain from physical spaces to the virtual space, especially when people share knowledge or information. People are now able to transcend even themselves via their personal electronic devices, such as laptops and smartphones, from anywhere in the world to reach the shared virtual space. How can universities be transformed in the future by taking advantage of the use of these digital technologies and the ability of distant communication? Institutional intervention, experimenting with these phenomena in the paradigm of electracy, will significantly reduce the necessity of physical spaces for traditional pedagogy, such as classrooms, lecture halls, seminar rooms, conference rooms, and even certain aspects of libraries, which have thus far developed in the paradigm of literacy.

With the emergence of online education, the relationship between students and the institution needs to be redefined, meaning that the means of teaching and learning should not remain traditional. For example, access to infinite information and knowledge in the internet environment will lead us to question the roles of teachers in classrooms or lecture halls.



Figure 13.0 | Category of Different Types of Spaces at Massachusetts Institute of Technology

According to the data collected from the MIT Department of Facility, approximately 71 percent of the entire institutional building area is programmed to allow flexible spatial modification. Within these areas, 54 percent of the programs, including classrooms and offices, are expected to be removed from the institution when they adopt the online learning experience.

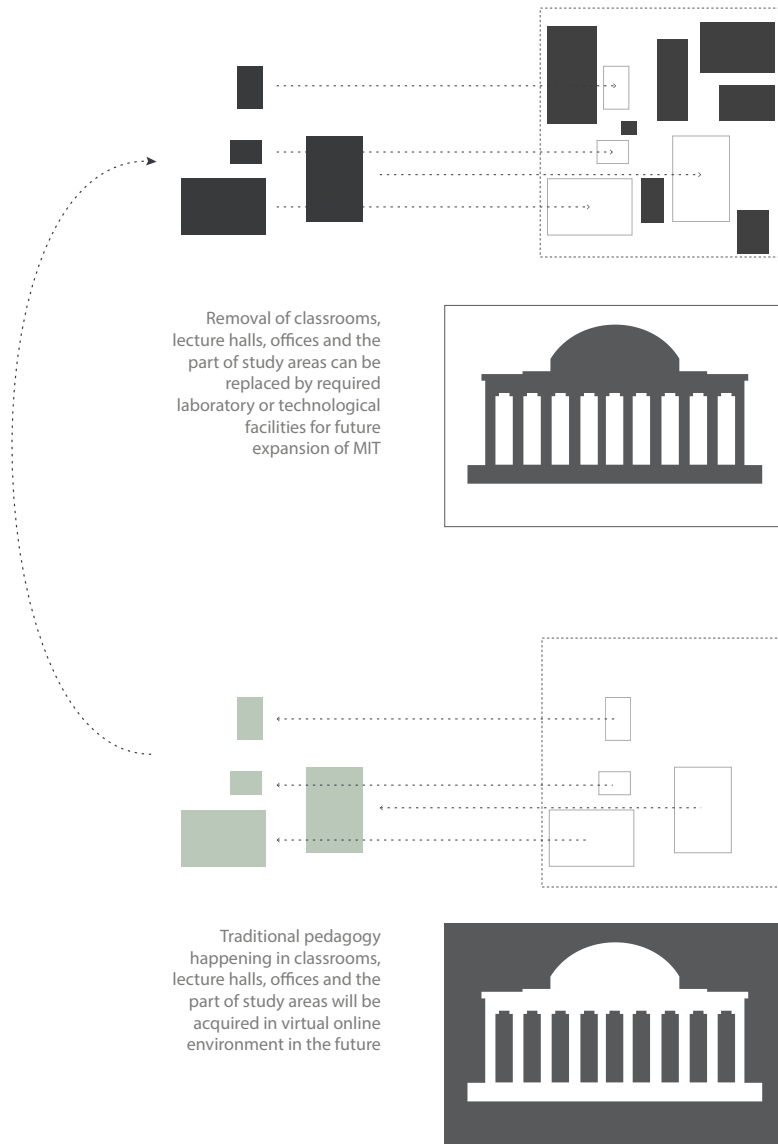


Figure 14.0 | Reprogramming the Existing Infrastructure

The removal process will generate flexible spaces for the future spatial expansion of MIT. In the high-density circumstances of future cities, this renovation strategy will be an ideal solution over new construction.

VI. Design Proposal: MIT i² - idea incubator

Learning from the previous analysis on various topics, including geographic, demographic and technological issues, this thesis propose a new educational infrastructure in which, individuals from both the MIT community and the city of Boston naturally come together and incubate ideas.

Despite the various opinions on the future campus, the value of physical social interaction remains the primary method of incubating ideas. MIT i² is an architectural solution to this issue, and is situated on the Charles River along the Harvard Bridge, the point of greatest pedestrian activity compared to the other parts of the waterfront. Instead of inviting public to an enclosed environment, MIT i² transforms the existing physical condition where a number of pedestrians naturally pass by.

The number of vehicle lanes are reduced from four to three in order to provide spaces for the anticipated users of MIT i², and different types of architecture are located along the bridge, on which the users access from. The project is composed of two different zones and each zone has a dock for water transportation, such as boats and canoes.

This project ultimately changes the Charles River from a barrier to a new urban destination where various social and intellectual activities can occur. Two radical interventions address completely different relationships with the water: spaces above and below the water.

These typologies create different spatial experiences for different programs, but remain flexible for the unknown.

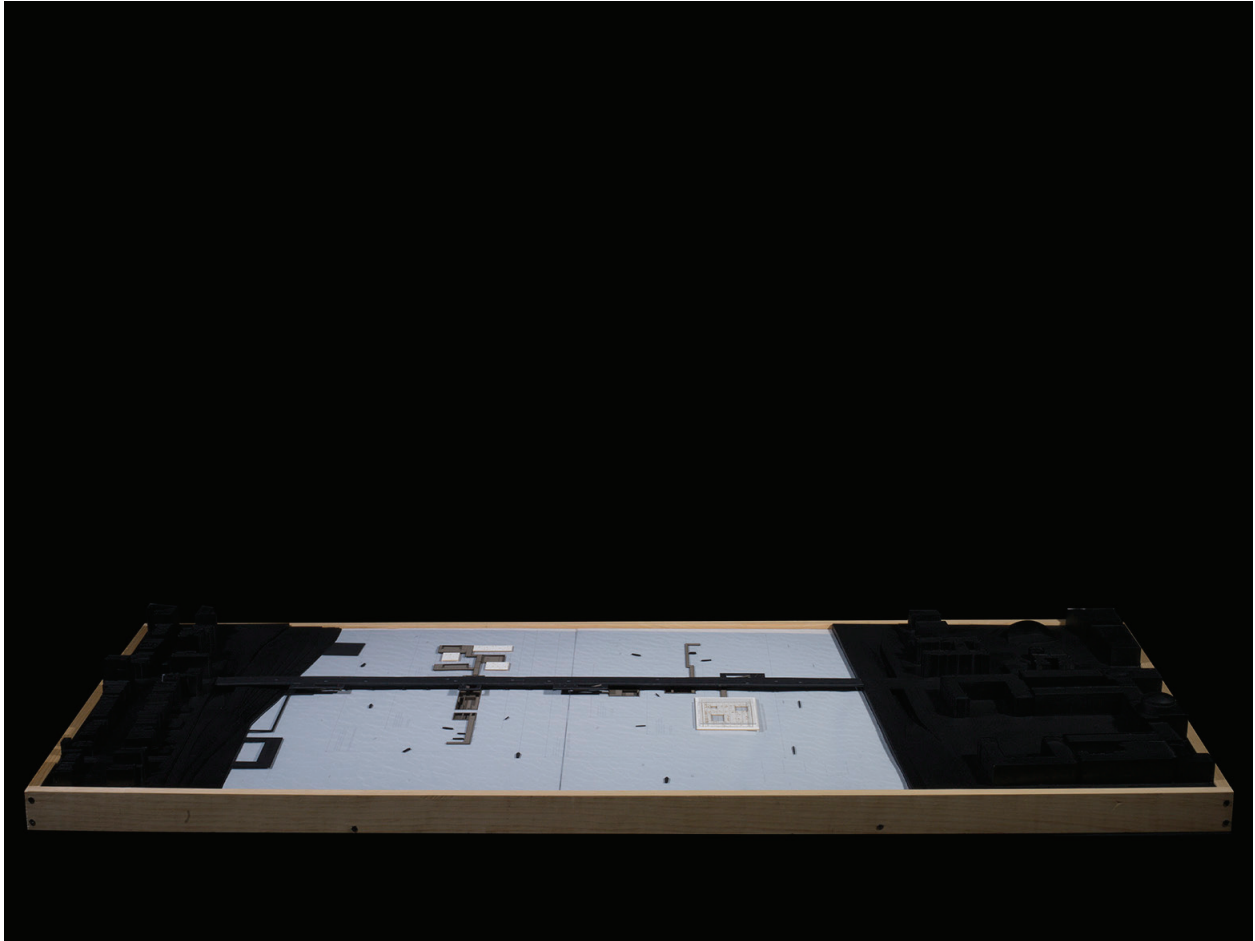


Figure 15.0 | 1:700 Overall Physical Model of the Design Proposal



Figure 16.0 | 1:700 Overall Physical Model: View from Boston

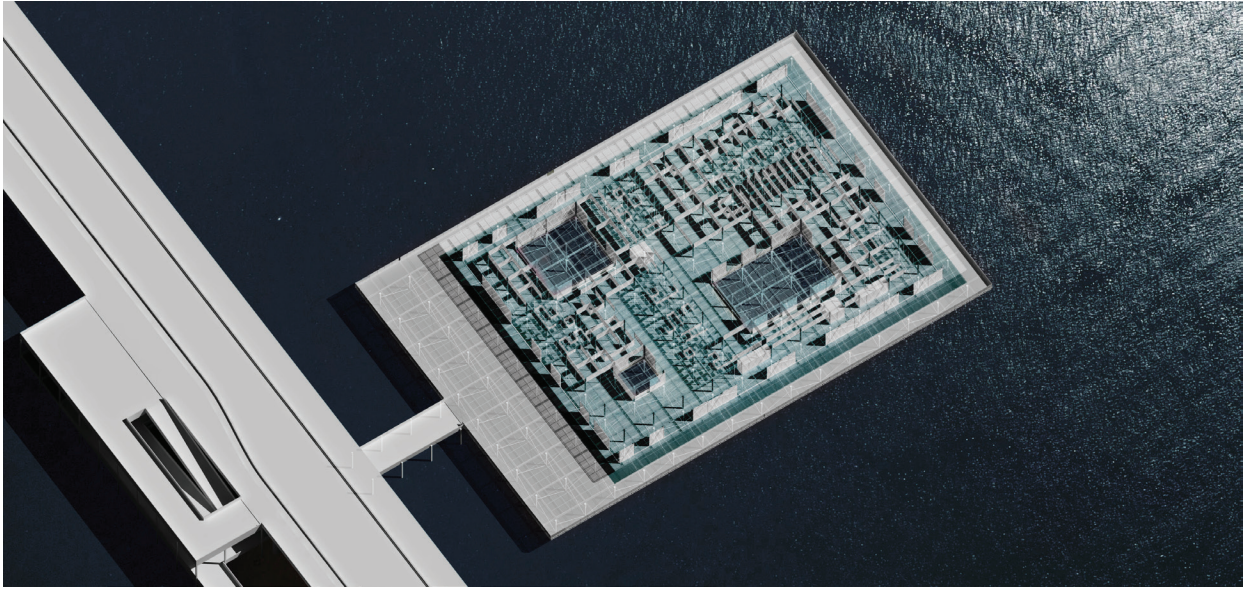


Figure 17.1 | Floating Typology - Pavilion



Figure 17.2 | Floating Typology - Island

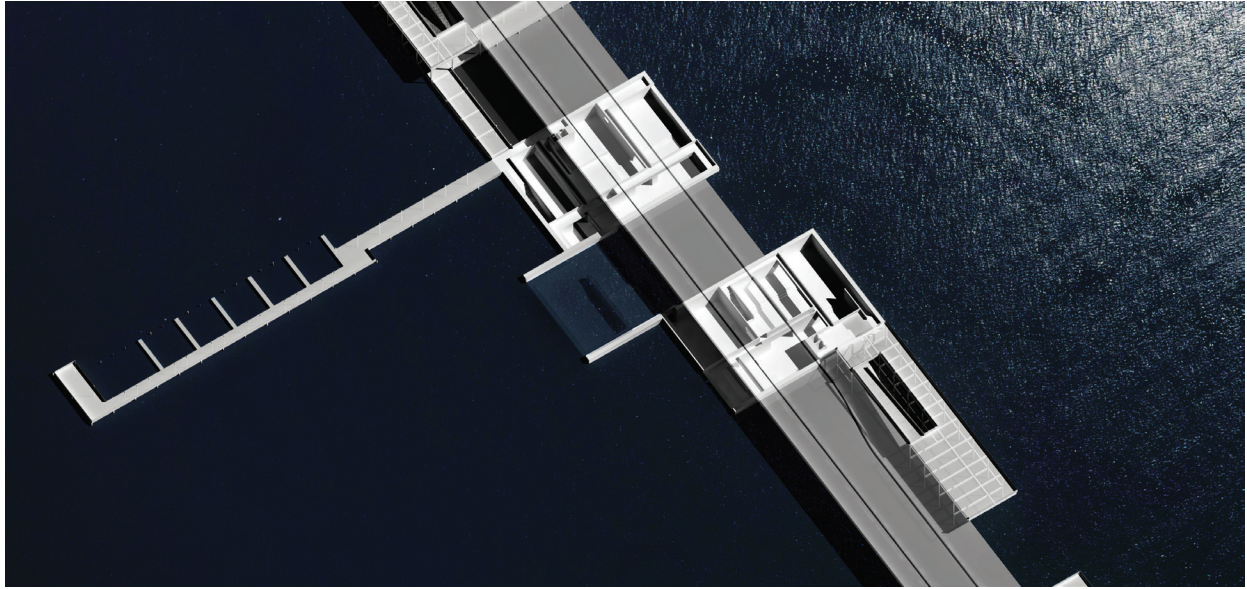


Figure 17.3 | Sunken Typology - Under the Bridge

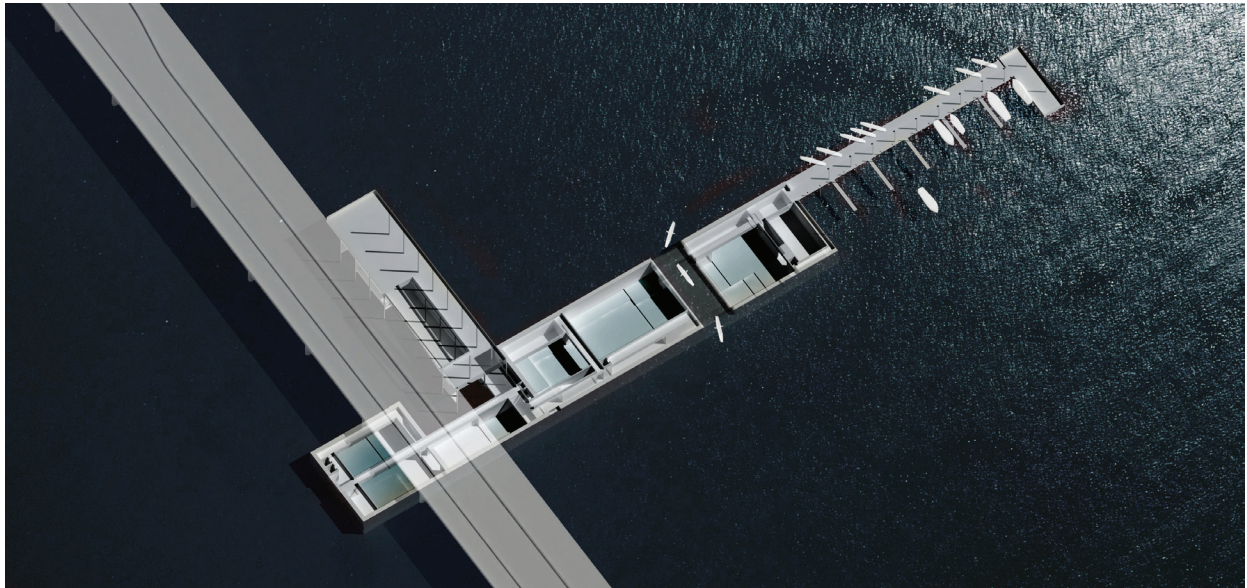


Figure 17.4 | Sunken Typology - Projection from the Bridge

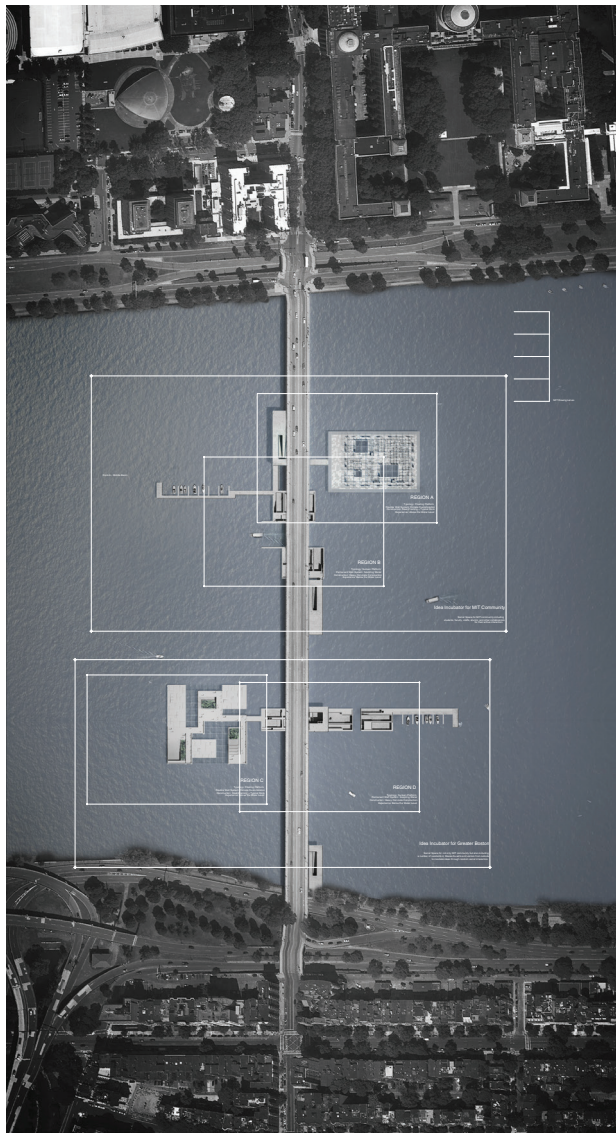


Figure 18.0 | Top View: MIT i² Design Proposal



Figure 19.0 | Aerial View of MIT i²

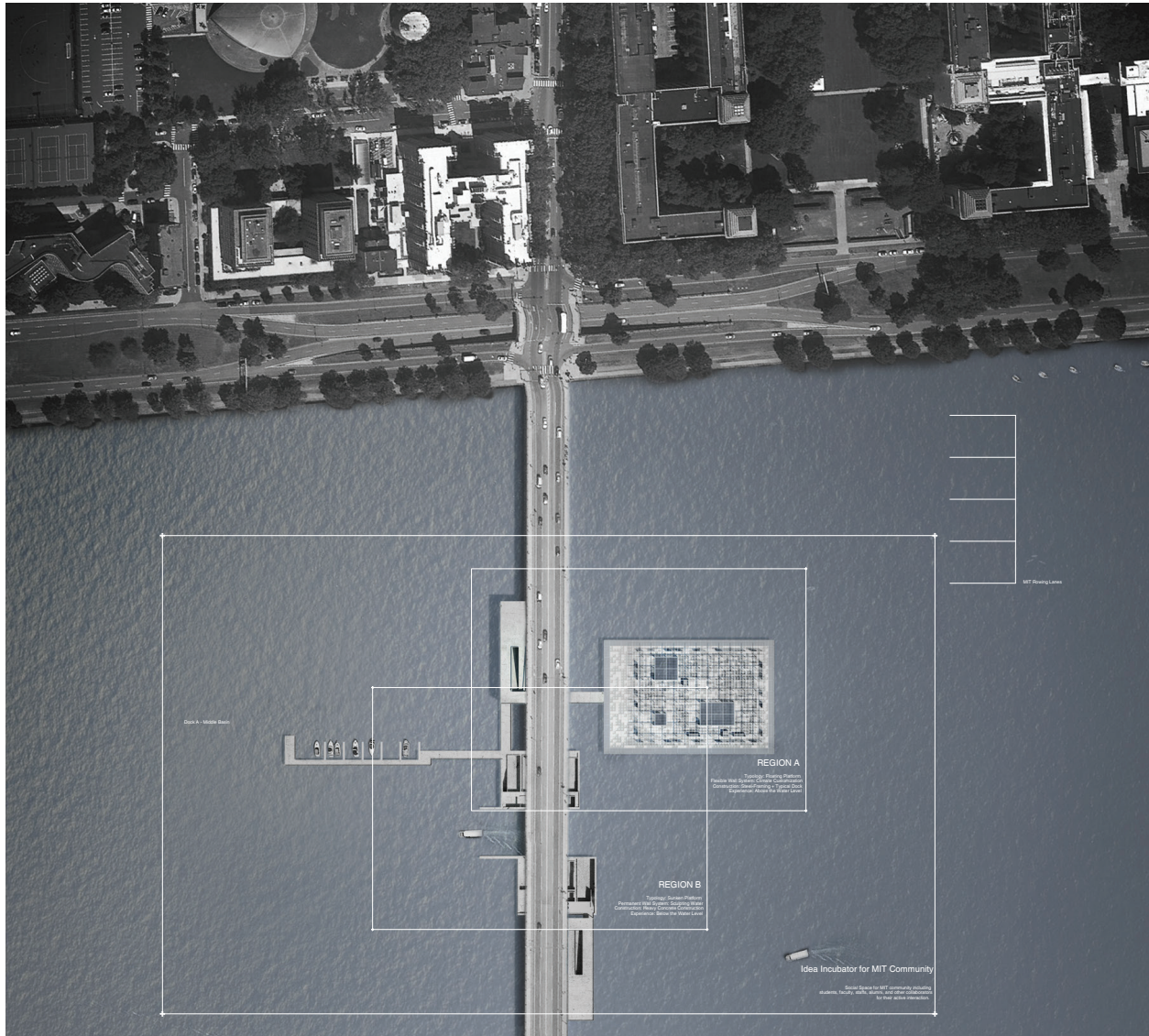


Figure 20.0 | Zone A: idea incubator for MIT Community



Figure 21.0 | View on the Floating Pavilion

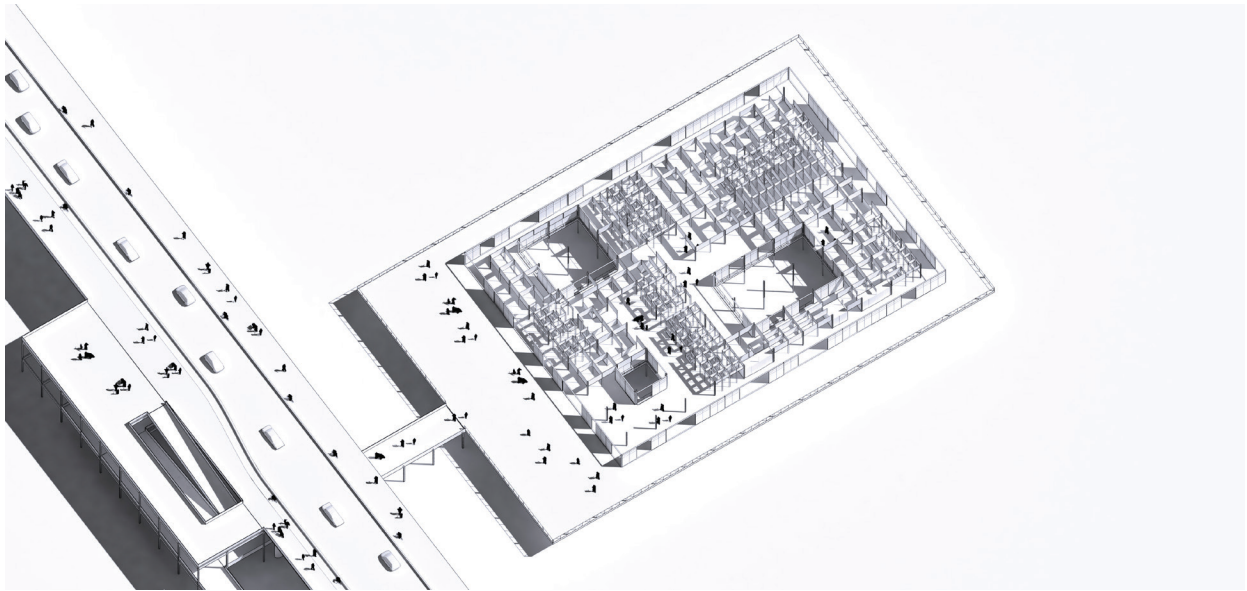


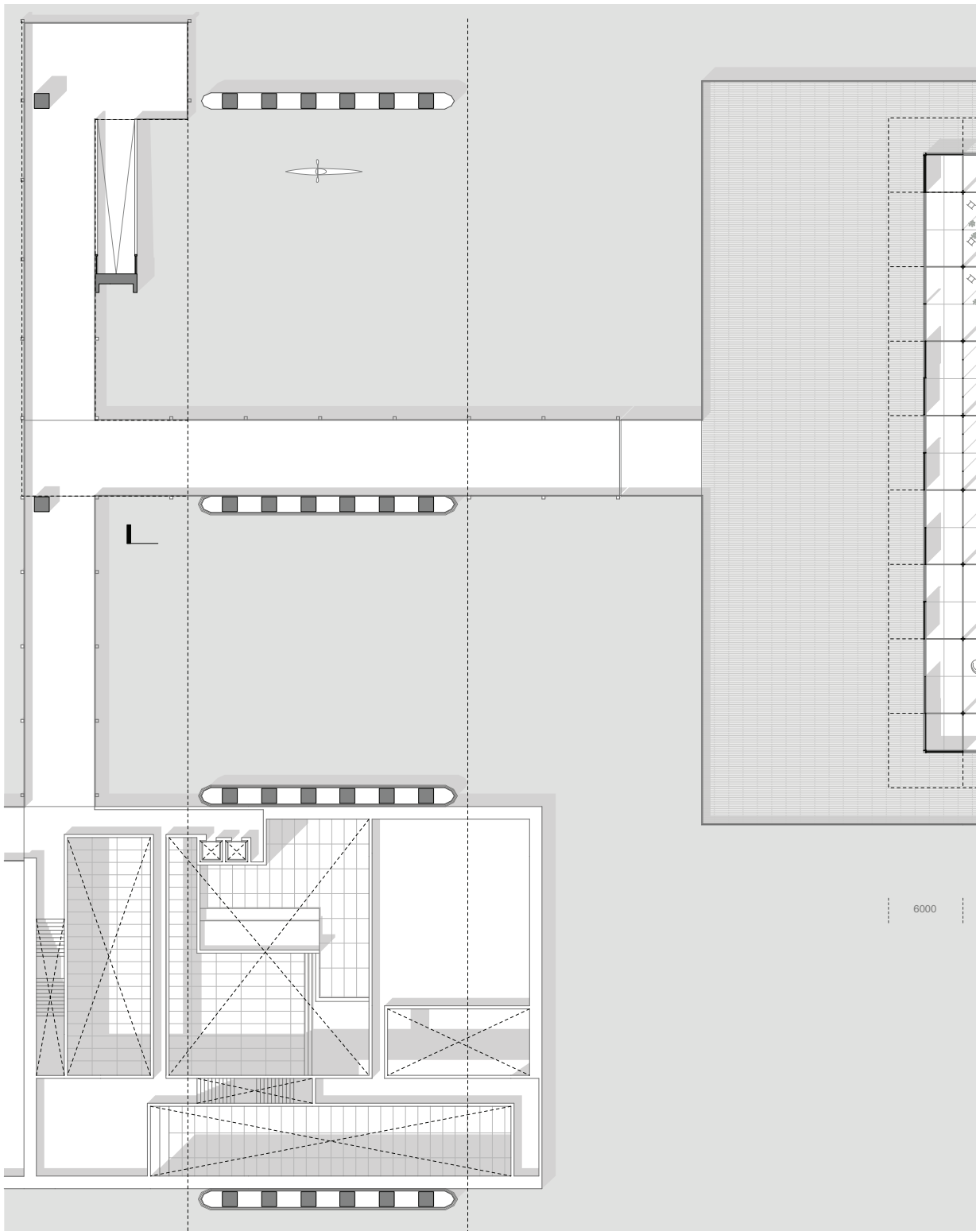
Figure 22.1 | Public Access to the Floating Pavilion

Floating Pavilion

Floating Pavilion has a typical dock structure, which allows two feet vertical movement in consideration of the water level fluctuation. More detail structures are designed in order to prevent future damages that could occur when the ice on the river starts to melt.

The structure above is designed with light steel frames on top of EPS foam floor structure not only to minimize the dead load, but also to maximize the transparency.

Cross-shape columns act for compression force, while square-shape columns resist tension force caused by the wind load. Between each columns, vertical movable partition walls are placed for occupants to control their local climate and the level of privacy. The structure can be divided into individual cells or function as a completely open pavilion for large gathering event by simply controlling the interior walls.



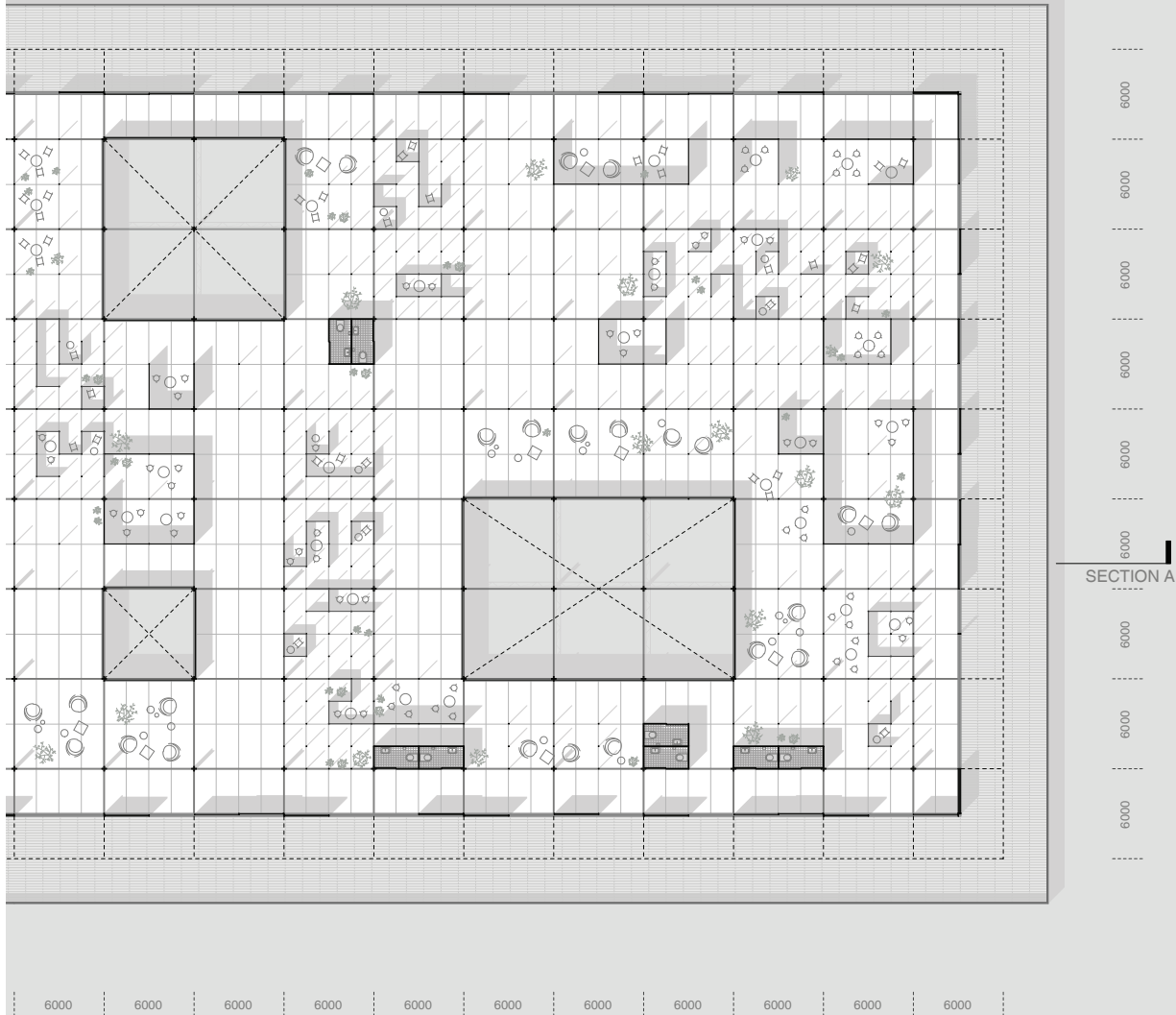
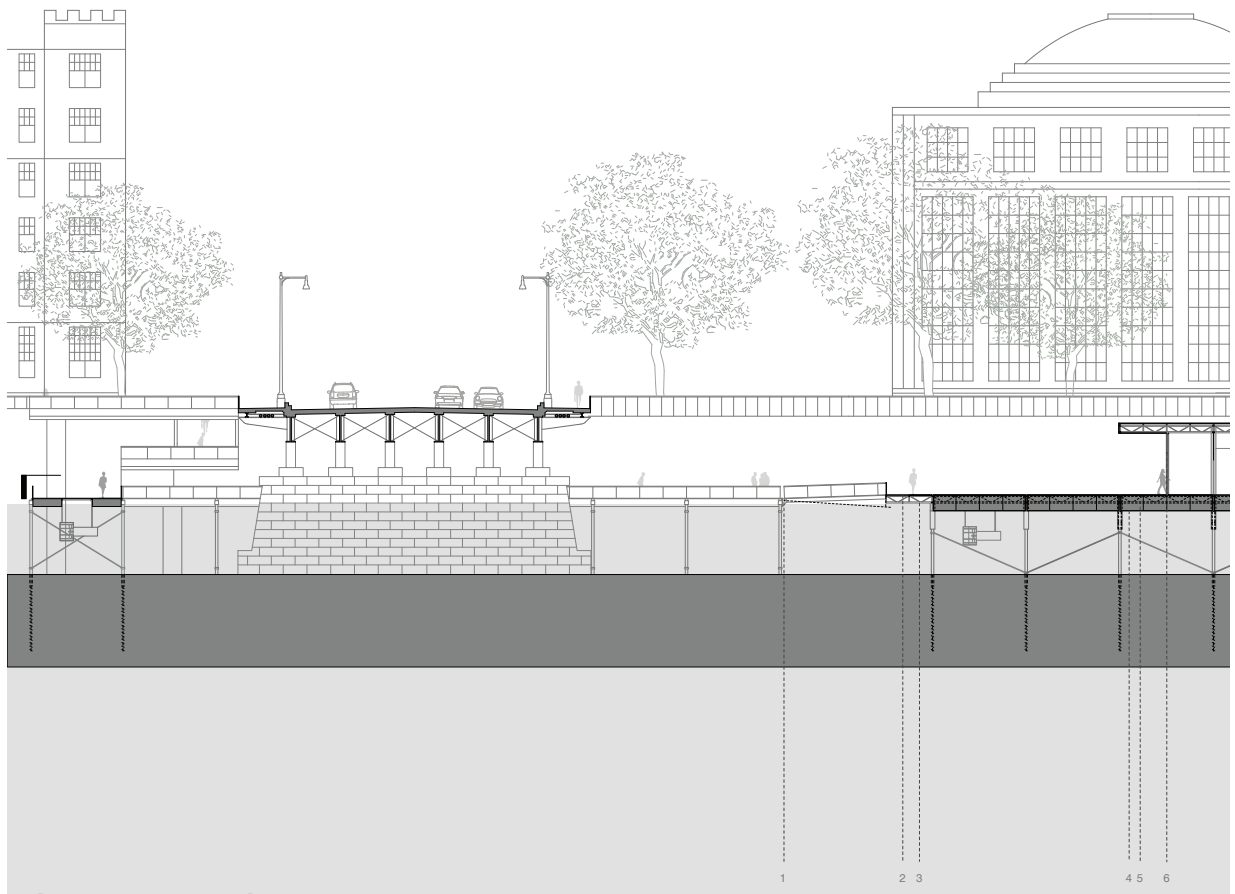


Figure 22.2 | Plan of the Floating Pavilion +1.85m



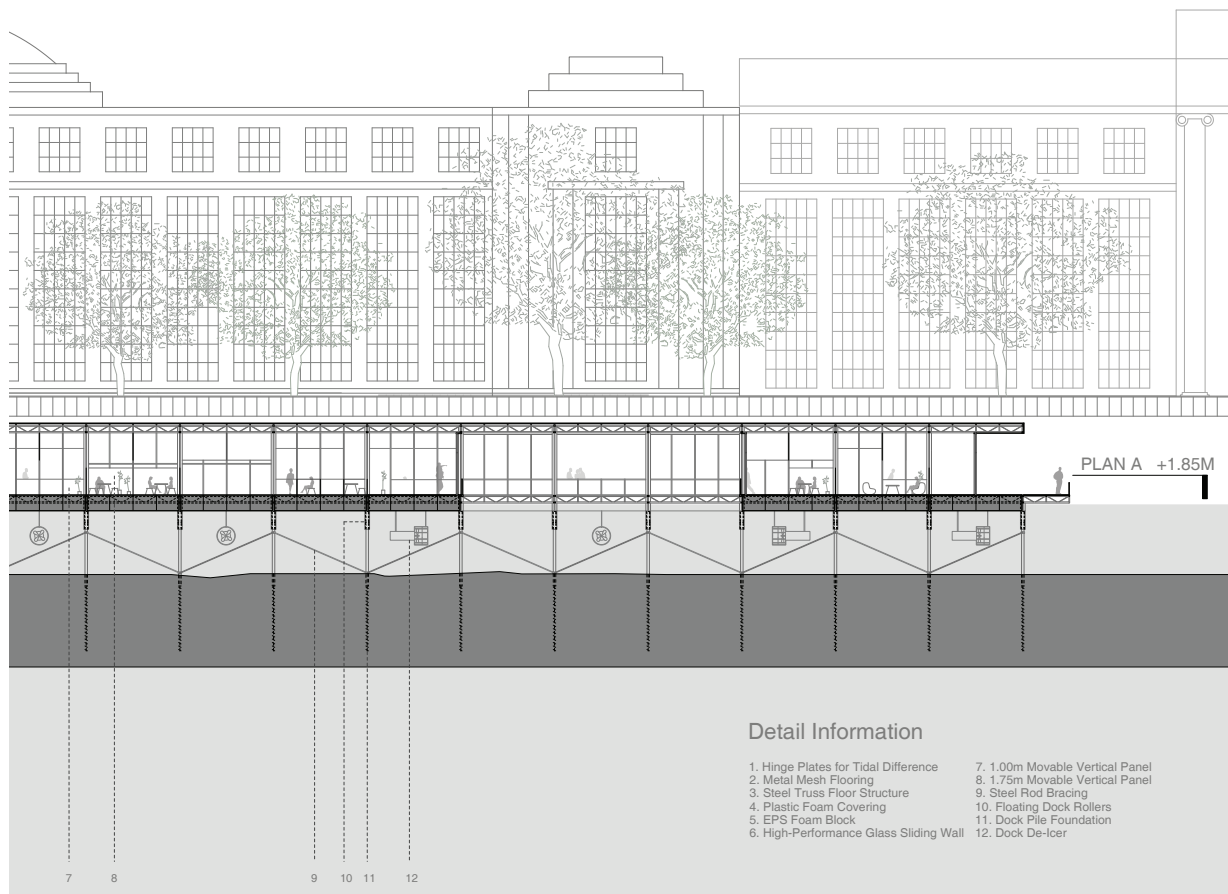


Figure 22.3 | Section of the Floating Pavilion





Figure 22.4 | 1:150 Physical Model of the Floating Pavilion



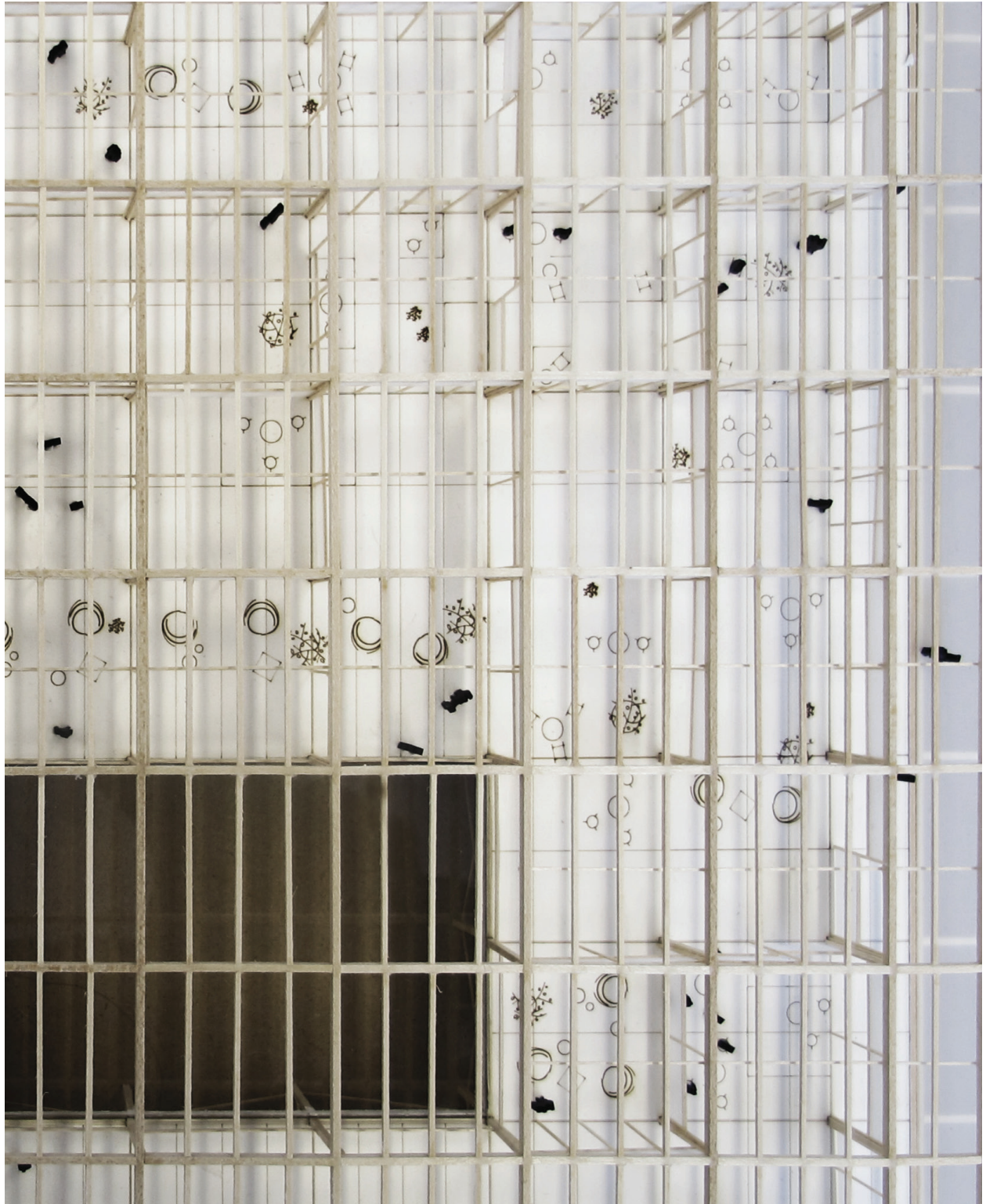


Figure 22.5 | 1:150 Physical Model of the Floating Pavilion

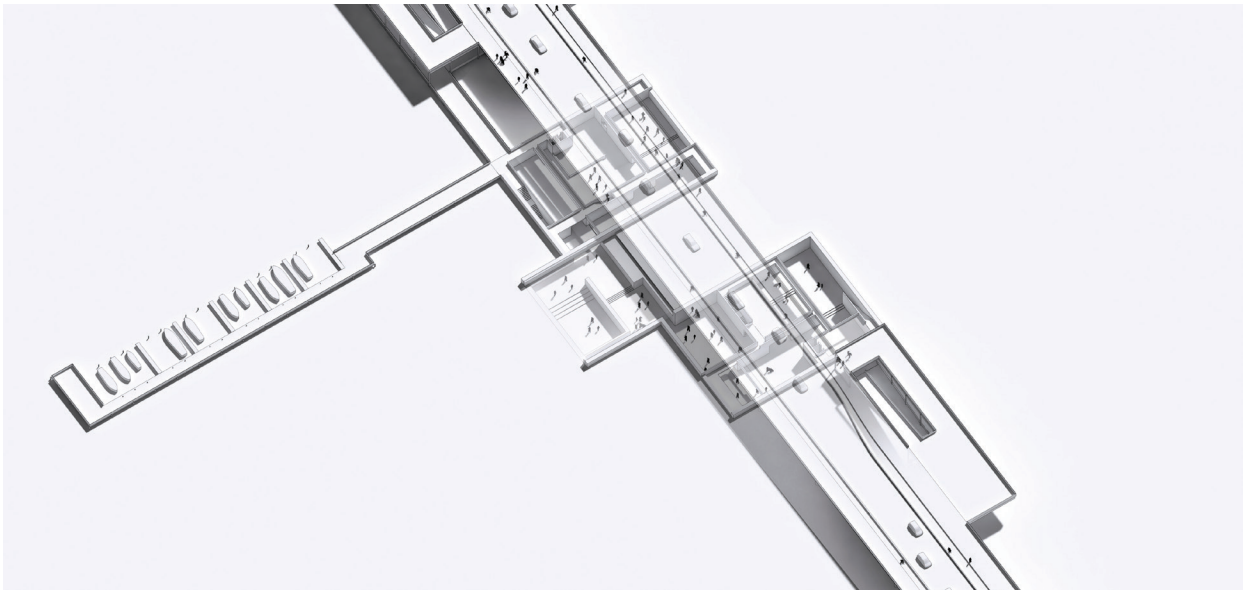


Figure 23.1 | Public Access to the Sunken Platform Under the Bridge

Sunken Platform Under the Bridge

Sunken Platform Under the Bridge is an intervention that is located below the Harvard Bridge. The dark environment provides an underwater public platform, on which multimedia related programs and events could occur.

This intervention consists of three different massings with each fits into the foundation structures of the bridge. The middle part is shifted off from the bridge, but provide the darkest environment by having a mega-bathtub structure above, on which water transportation continues.

In contrast to the floating typologies, mega-scale concrete structures are chosen for the design process to architecturally express the meaning of carving out the water. The structure contains necessary infrastructure while providing large spaces between each part for flexible spatial operations.



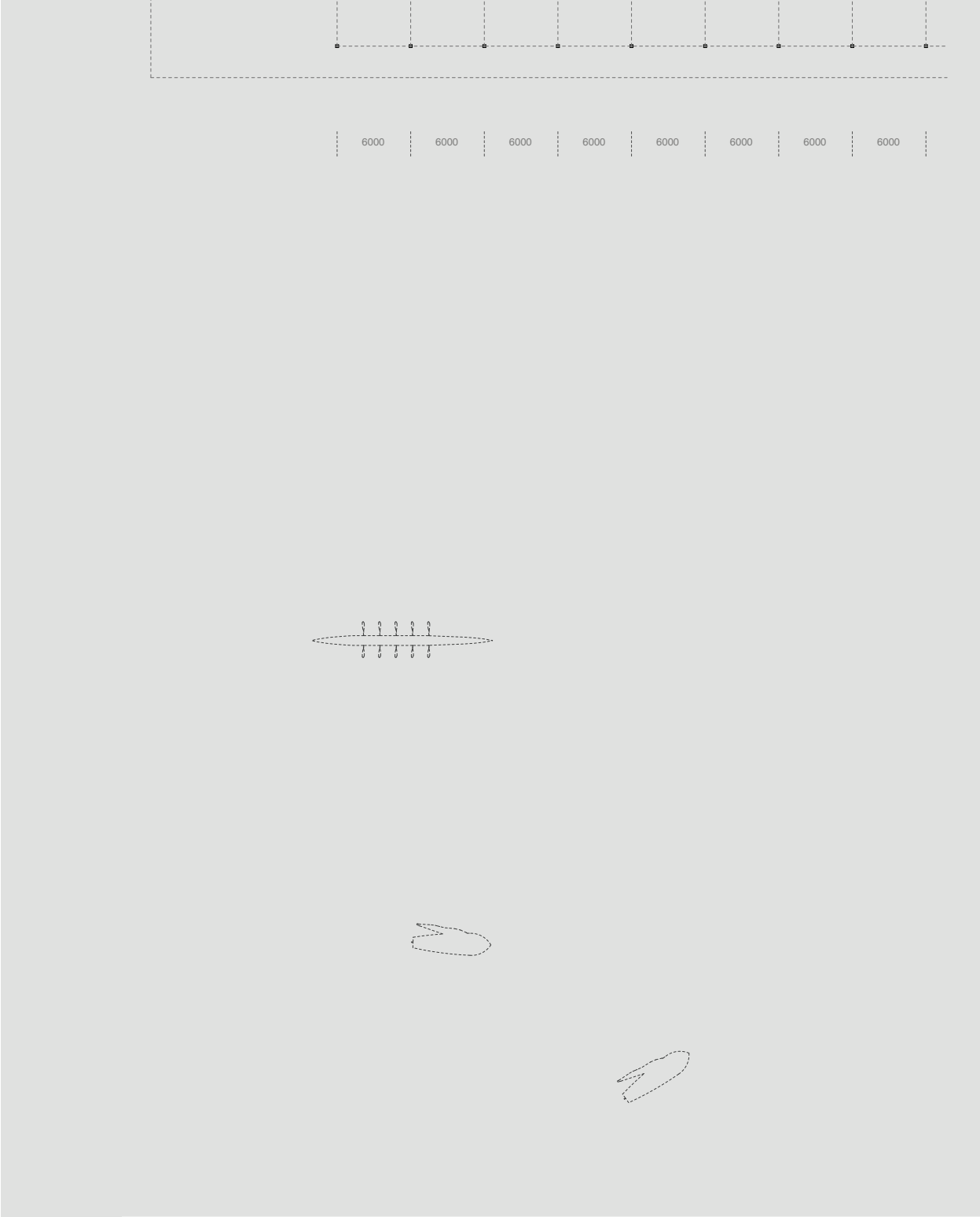
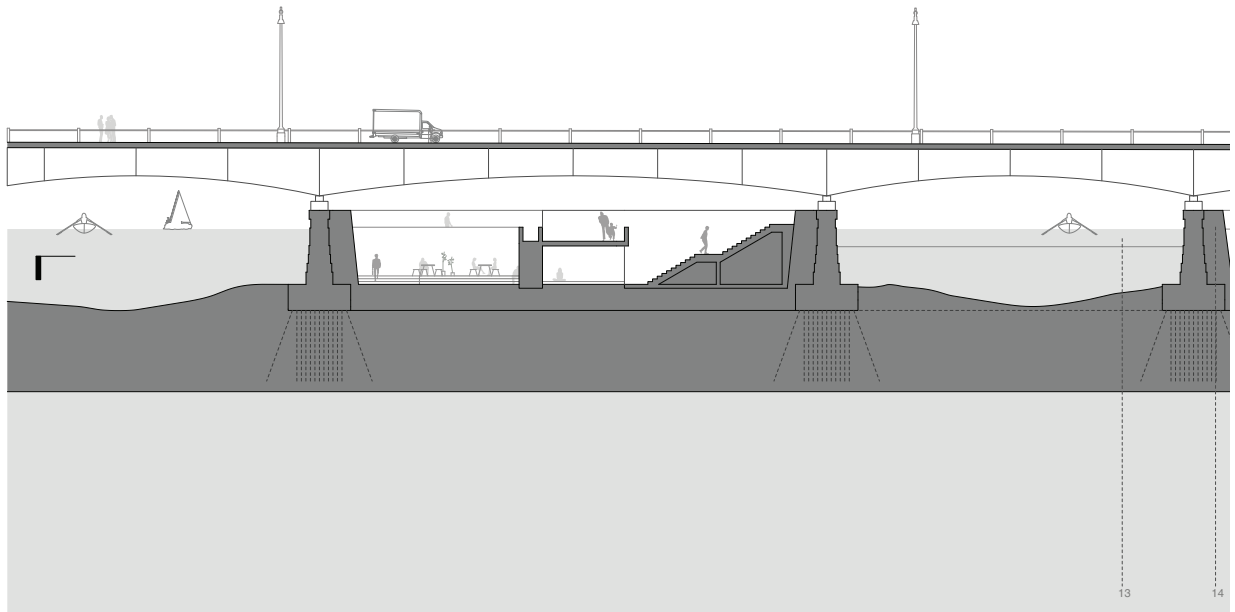


Figure 23.2 | Plan of the Sunken Platform Under the Bridge -1.75m



13

14

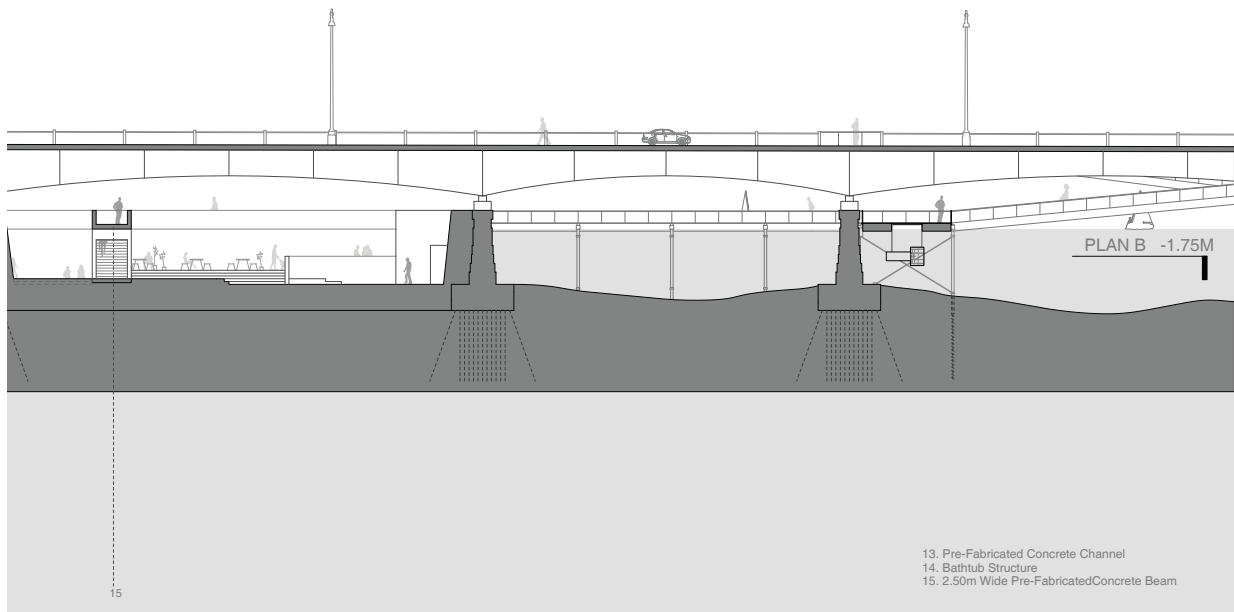


Figure 23.3 | Section of the Sunken Platform Under the Bridge



Figure 24.0 | Zone B: idea incubator for the City



Figure 25.0 | View of the Sunken Platform Projected from the Bridge

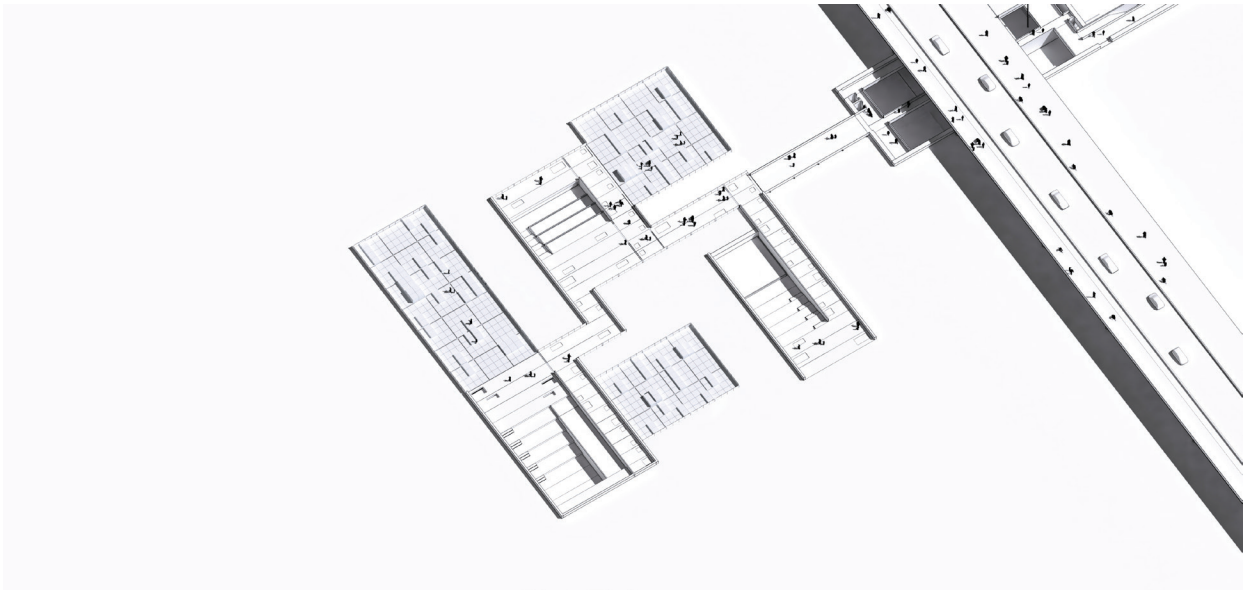


Figure 26.1 | Public Access to the Floating Island

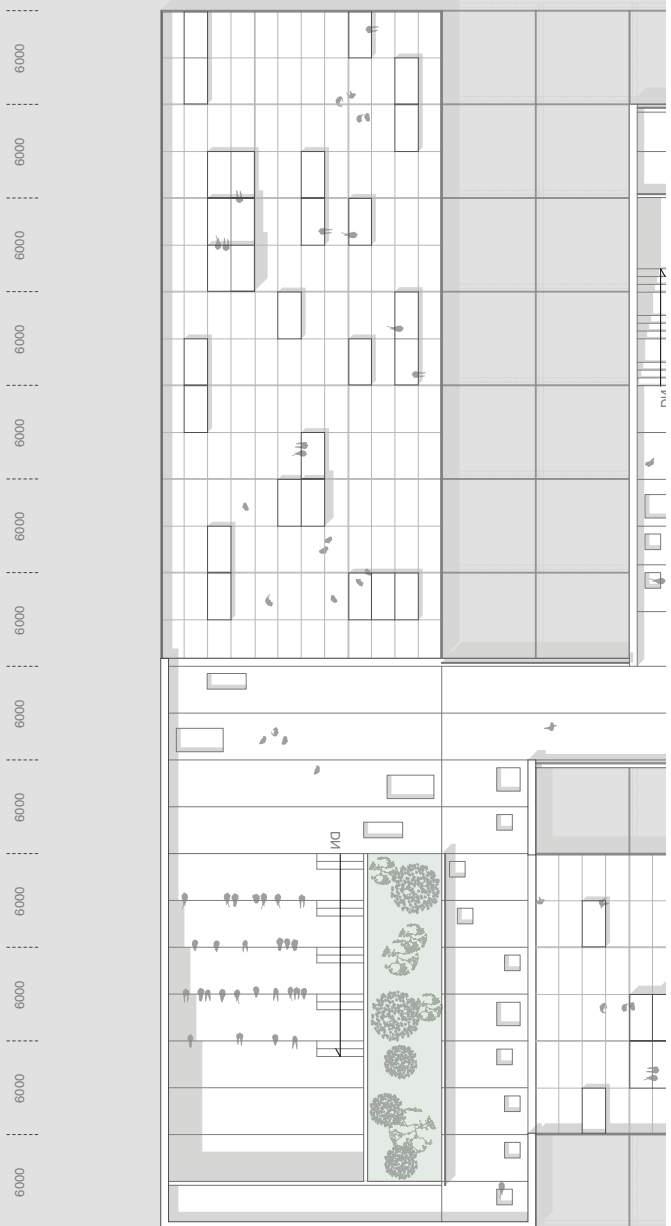
Floating Island

Smaller floating structures are placed adjacent to partially sunken structures to create different atmosphere without any roofing elements in order to create an open-to-the-air island.

Similar to the Floating Pavilion, each small floating structures allow two feet vertical movements for the extreme weather condition and the rest of structures are minimum two feet above the average water level.

The spaces become ideal for various outdoor social programs for the public in any age groups. Various size of the EPS foam blocks and prefabricated concrete beams provide seatings on the island.

SECTION C



6000 6000 6000 6000 6000 6000 6000

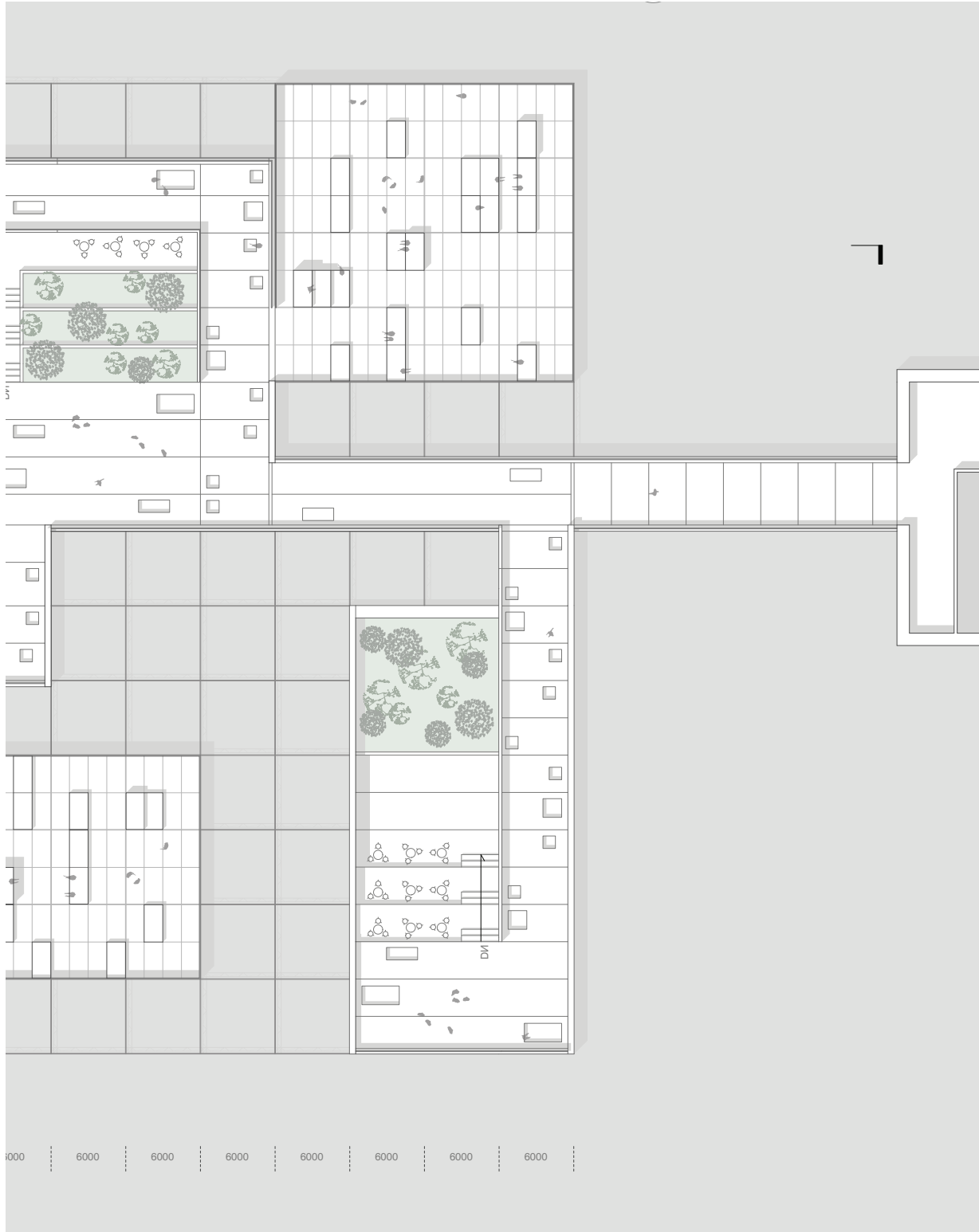
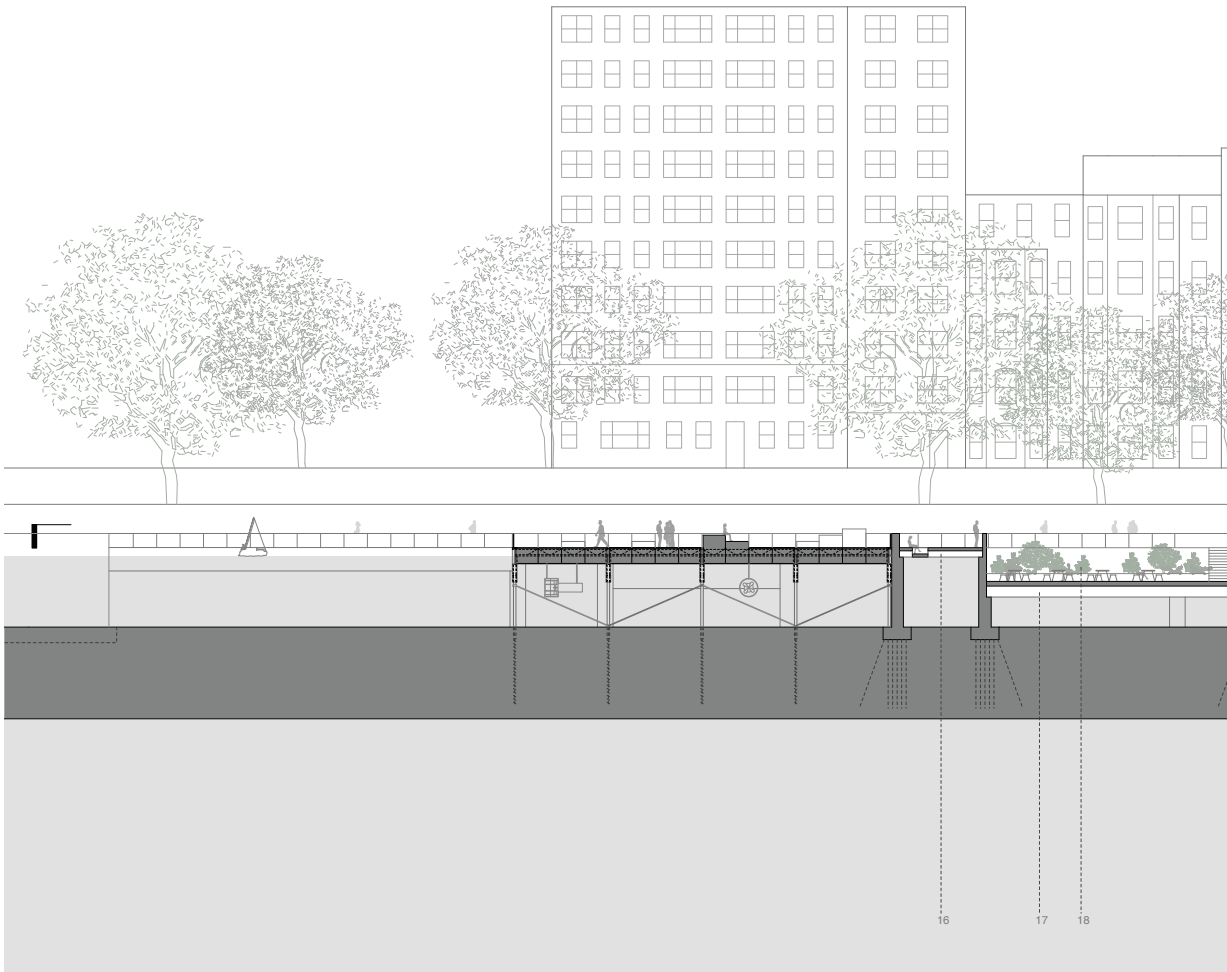


Figure 26.2 | Plan of the Floating Island +1.85m



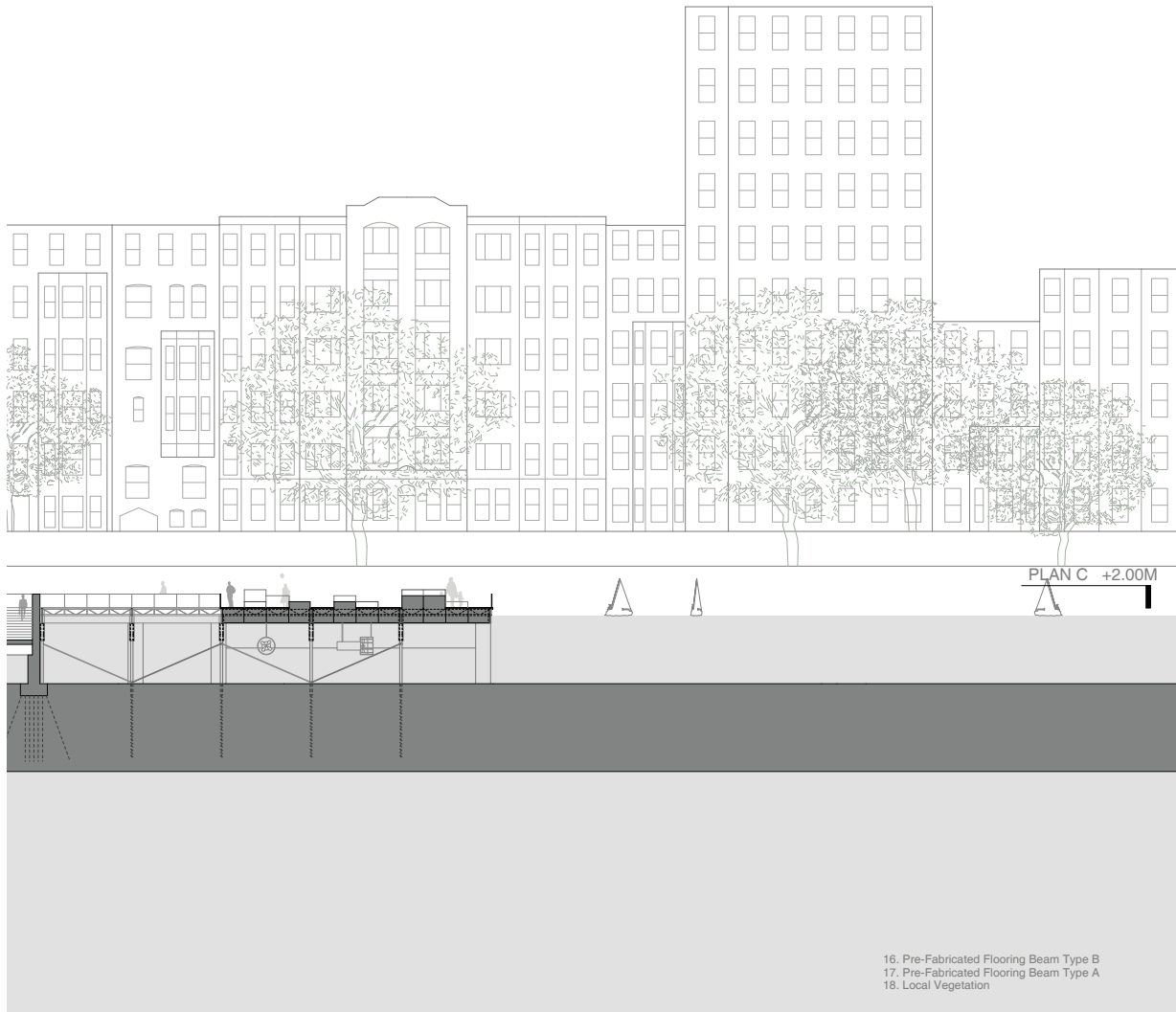


Figure 26.3 | Section of the Floating Island

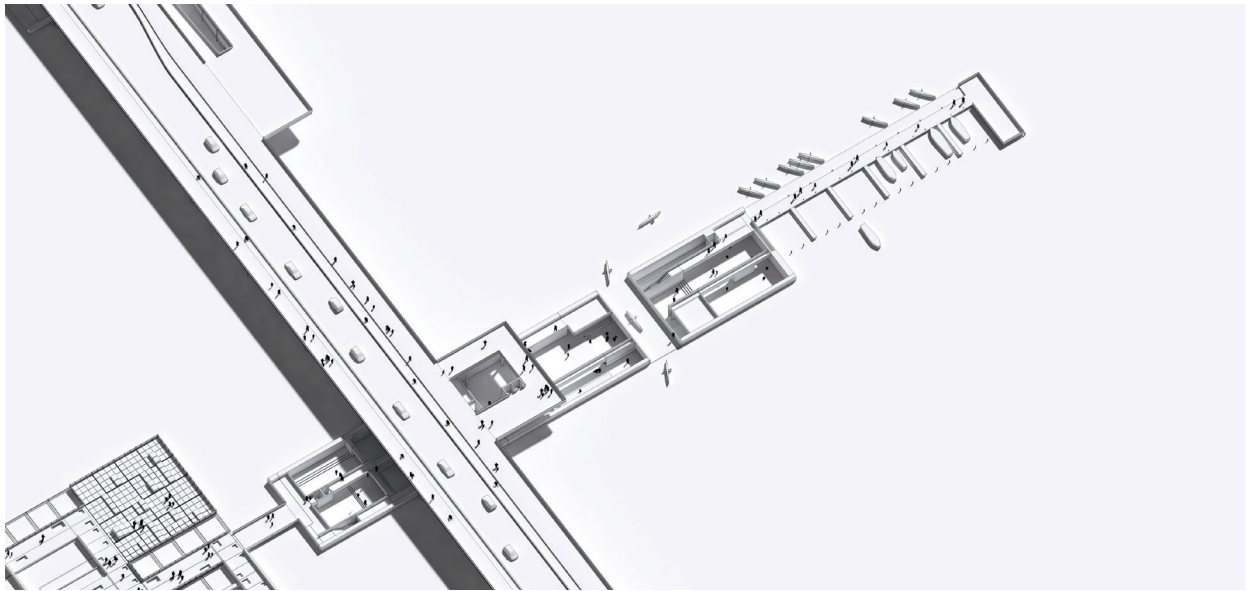


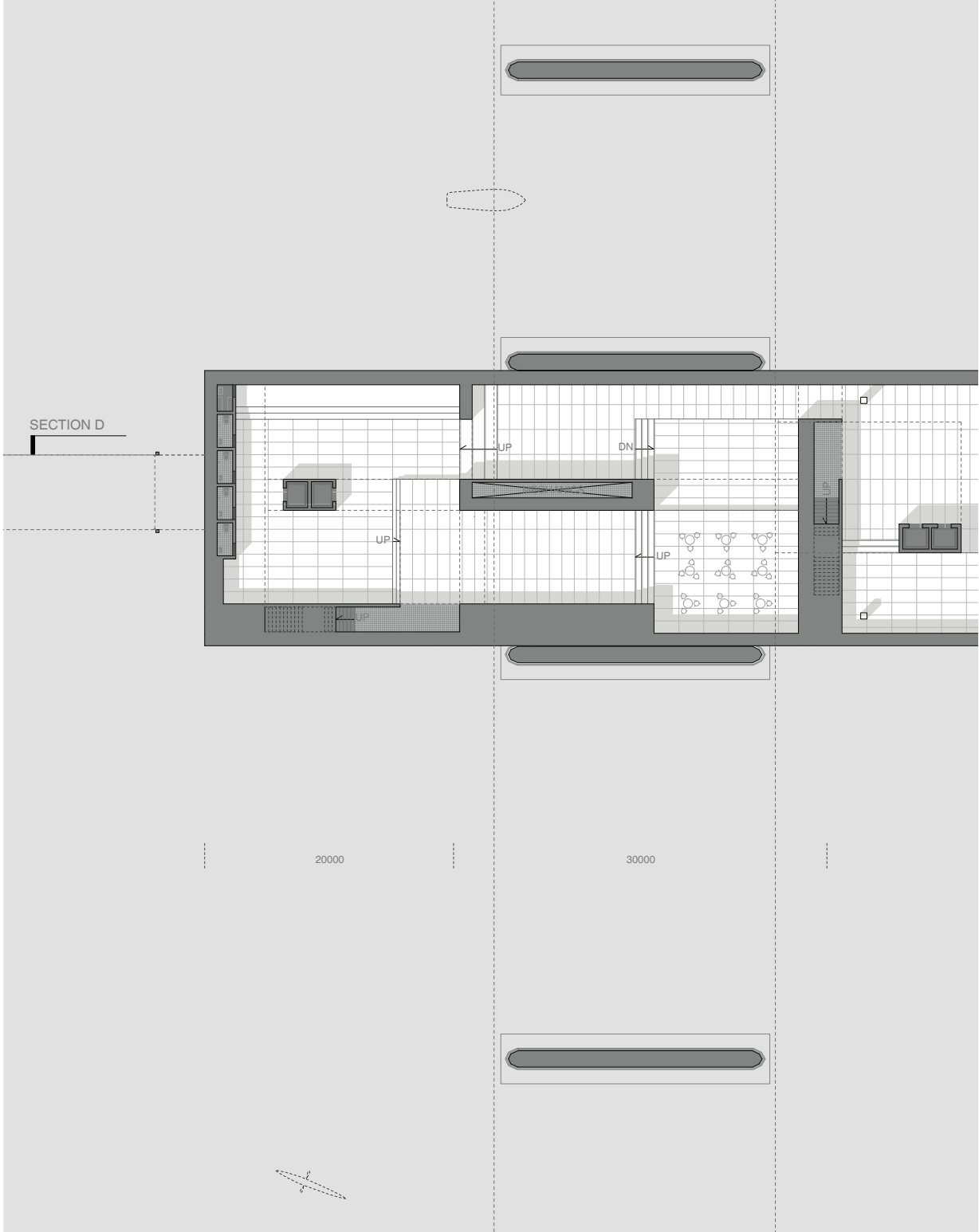
Figure 27.1 | Public Access to the Sunken Platform Projected from the Bridge

Sunken Platform Projected from the Bridge

Different from the Sunken Platform Under the Bridge, this type has a strong orthogonal relationship to the Harvard Bridge, emphasizing the direction of the river flow. A linear progression creates various spaces with different level of exposure to the air and light.

The dimension of the platform is constrained by the span of the existing foundation structure of the bridge in respect to the scale of given site condition.

Different kinds of multi media social programs are considered to be programmed in this typology.



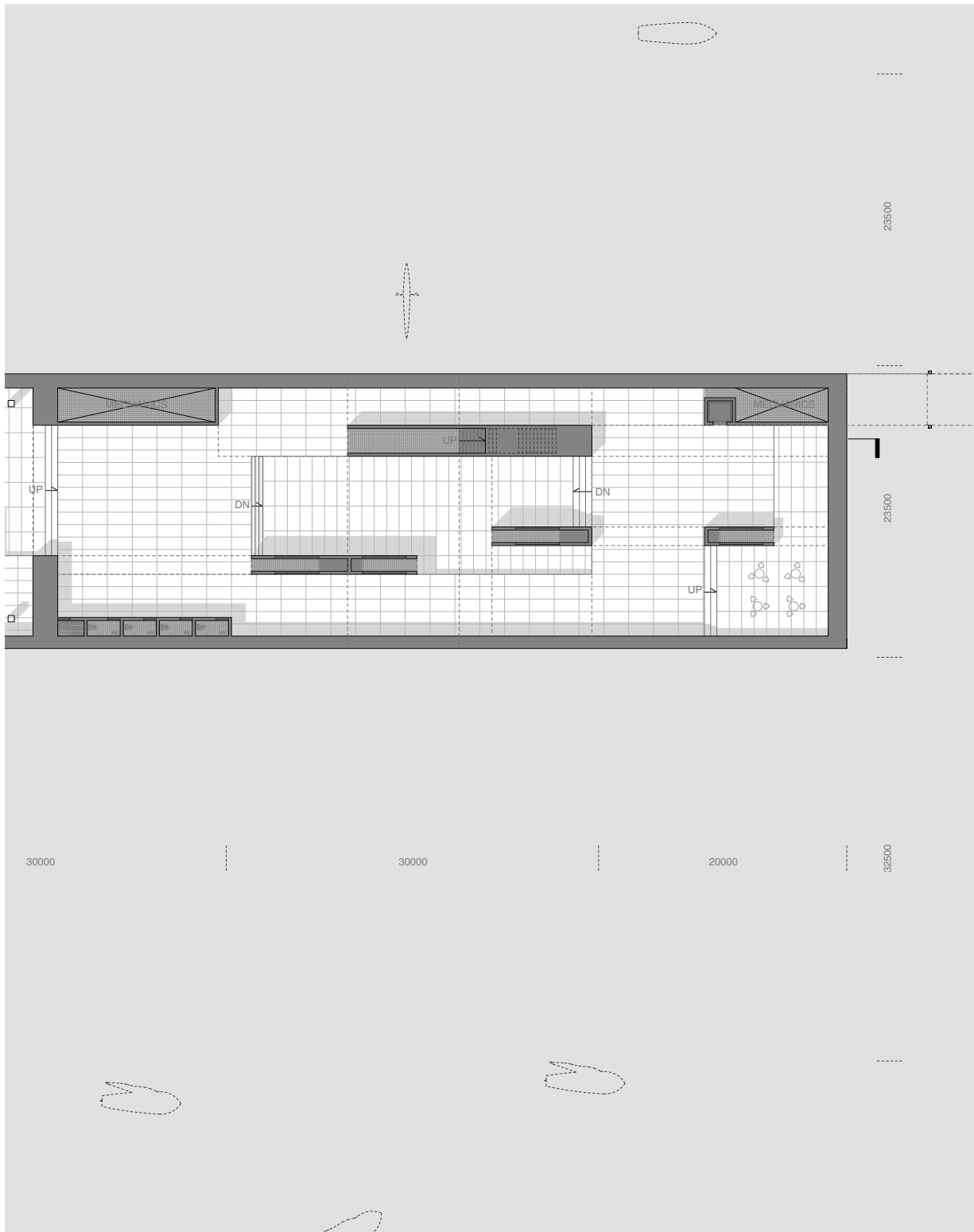
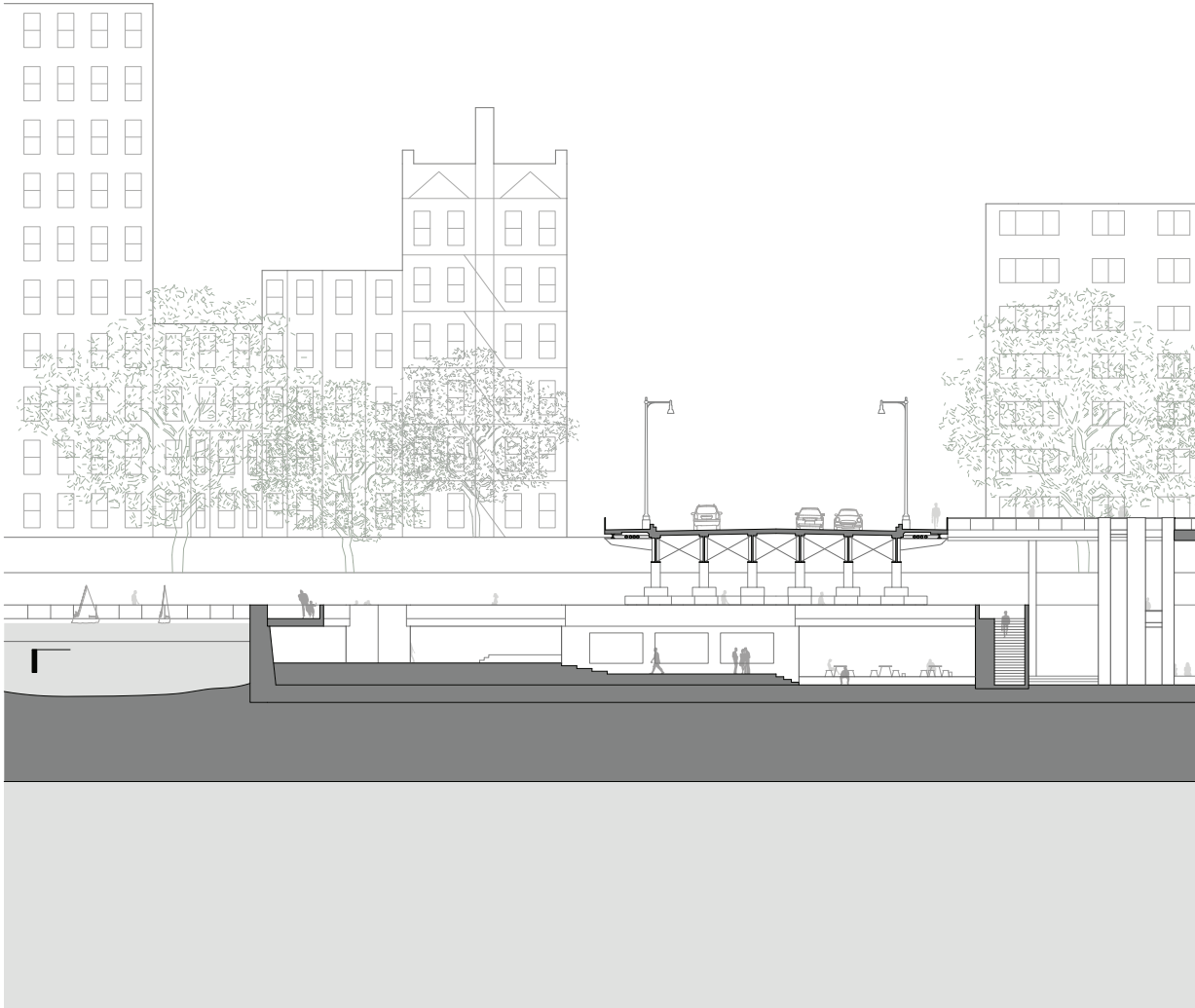


Figure 27.2 | Plan of the Sunken Platform Projected from the Bridge -1.75m



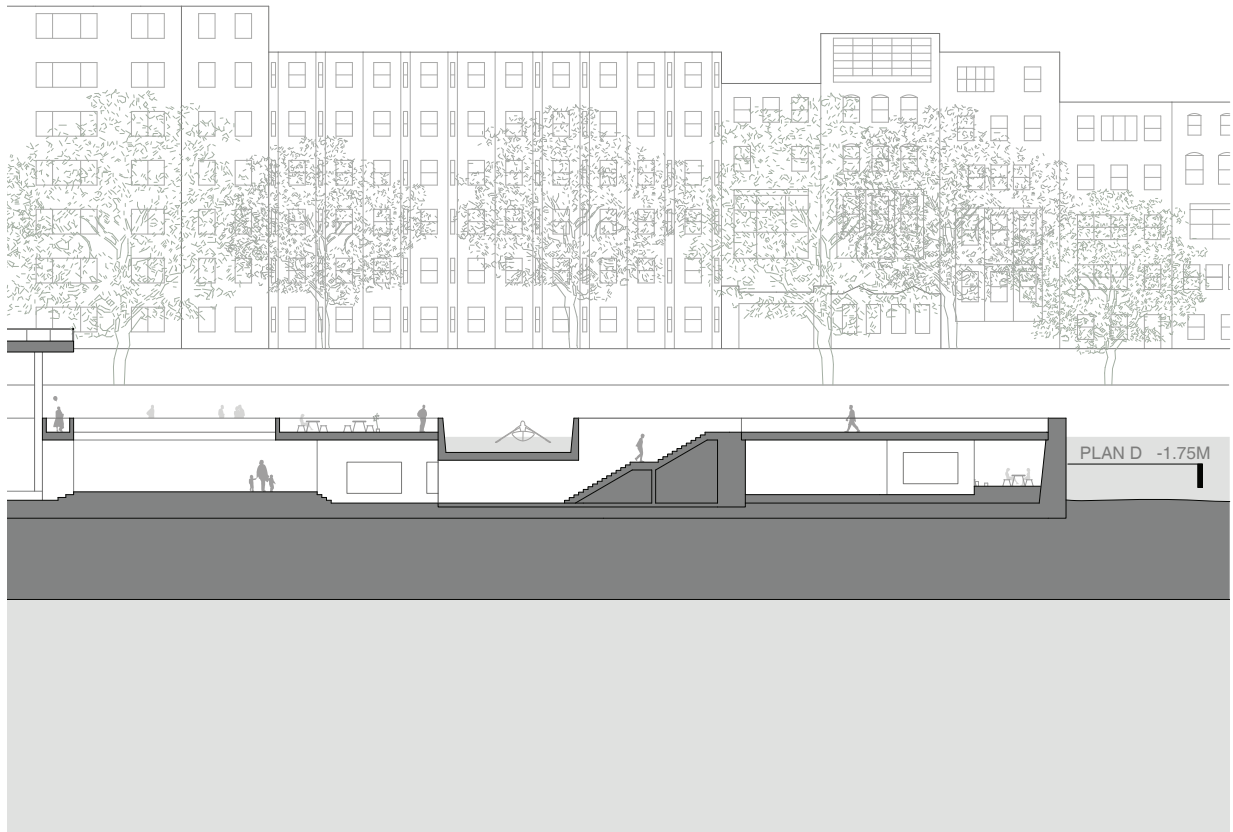


Figure 27.3 | Section of the Sunken Platform Projected from the Bridge





Figure 27.4 | 1:150 Physical Model of the Sunken Platform Projected from the Bridge





Figure 27.5 | 1:150 Physical Model of the Sunken Platform Projected from the Bridge



Copyright © 2014, Photography by Andy Ryan



Figure 28.1 | 1:150 Physical Model of the Floating Pavilion

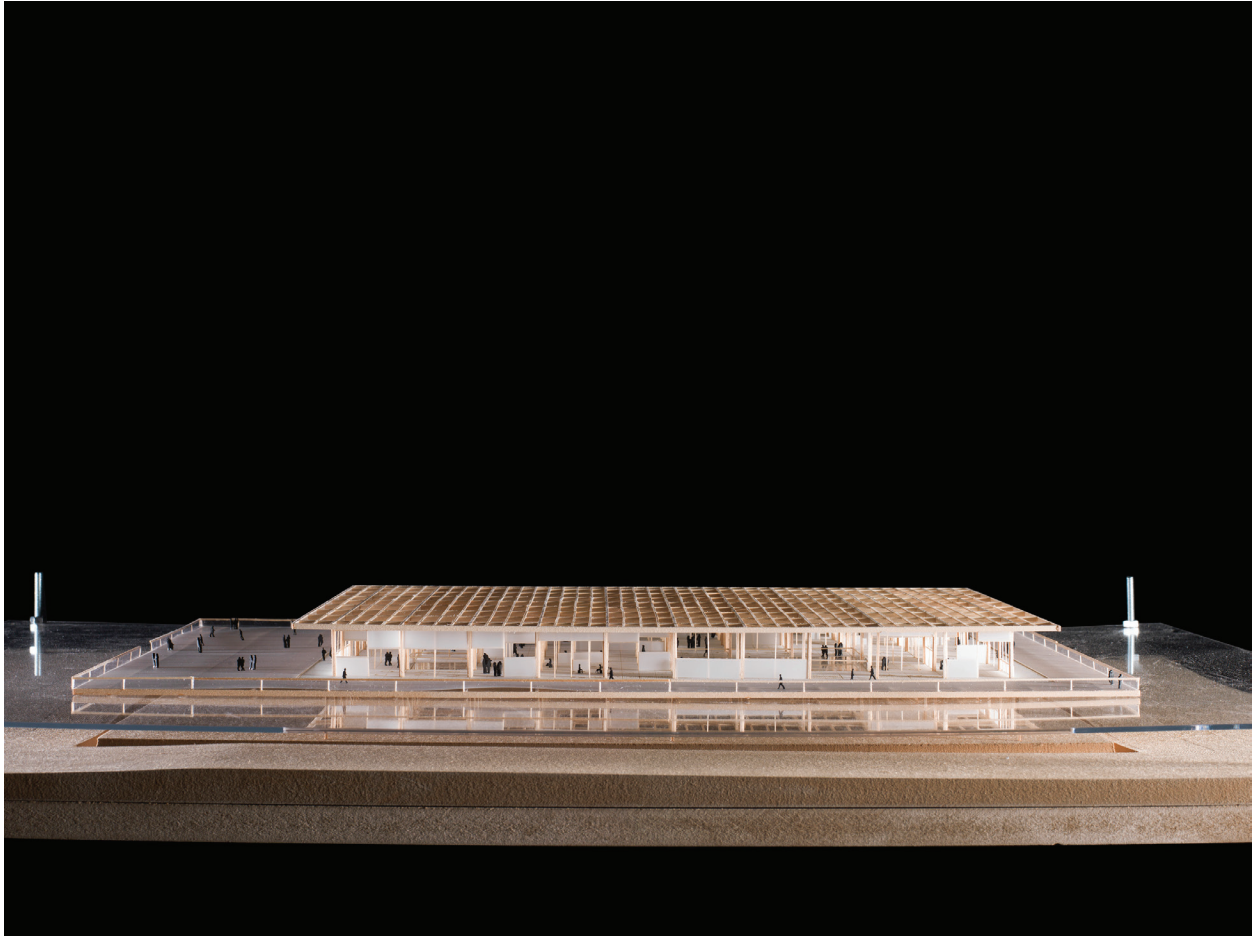


Figure 28.2 | 1:150 Physical Model of the Floating Pavilion

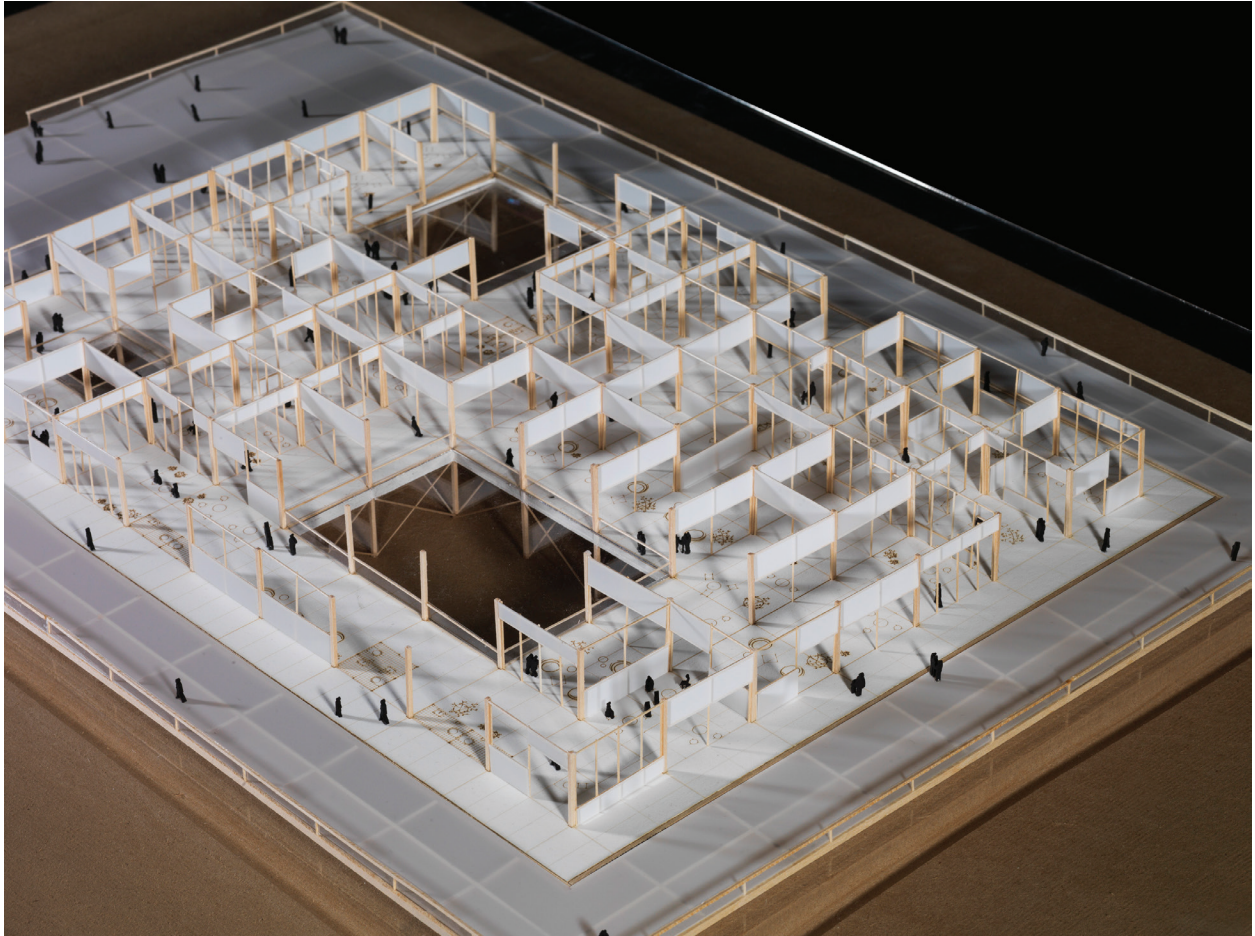
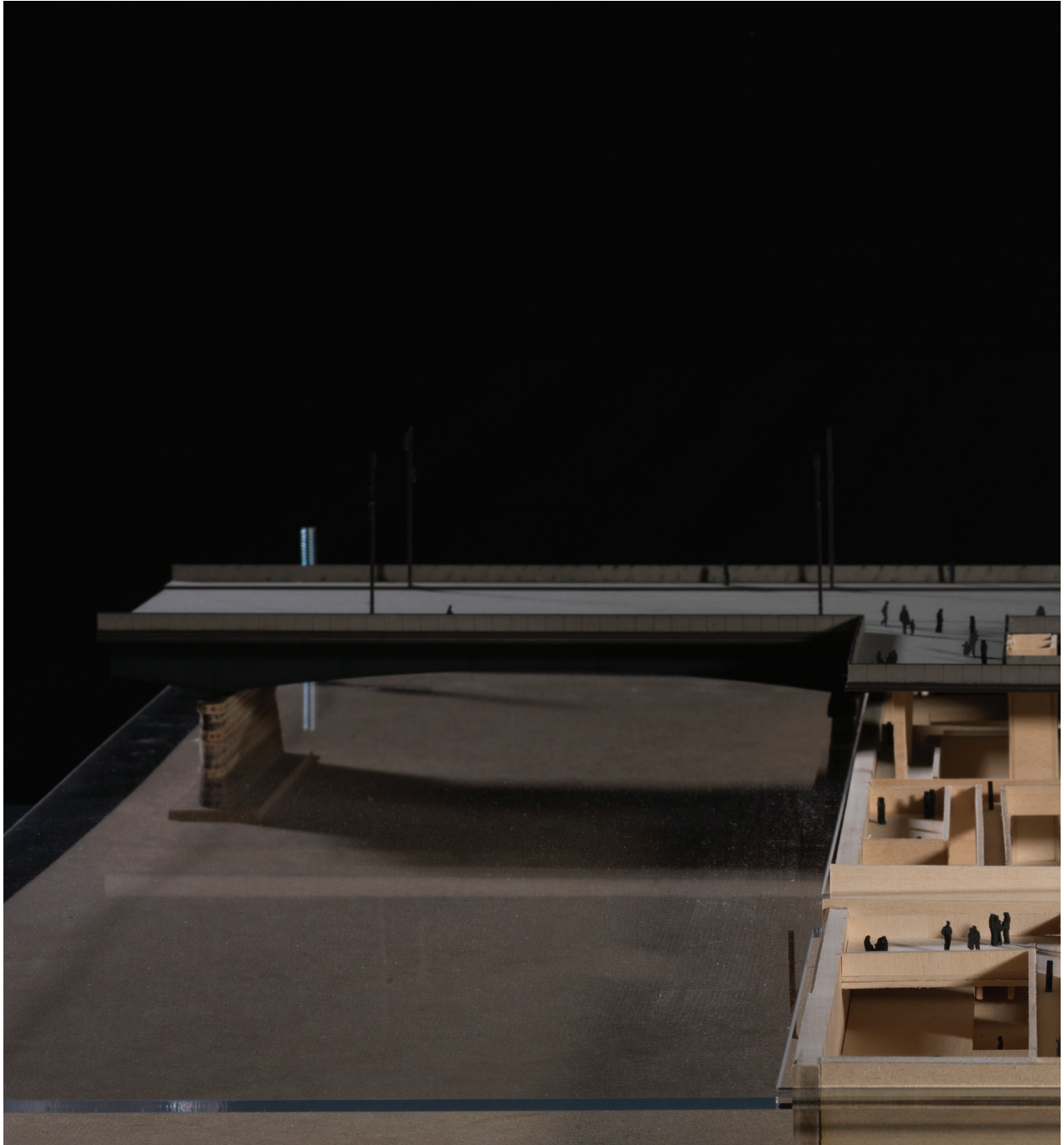


Figure 28.3 | 1:150 Physical Model of the Floating Pavilion



Copyright © 2014, Photography by Andy Ryan

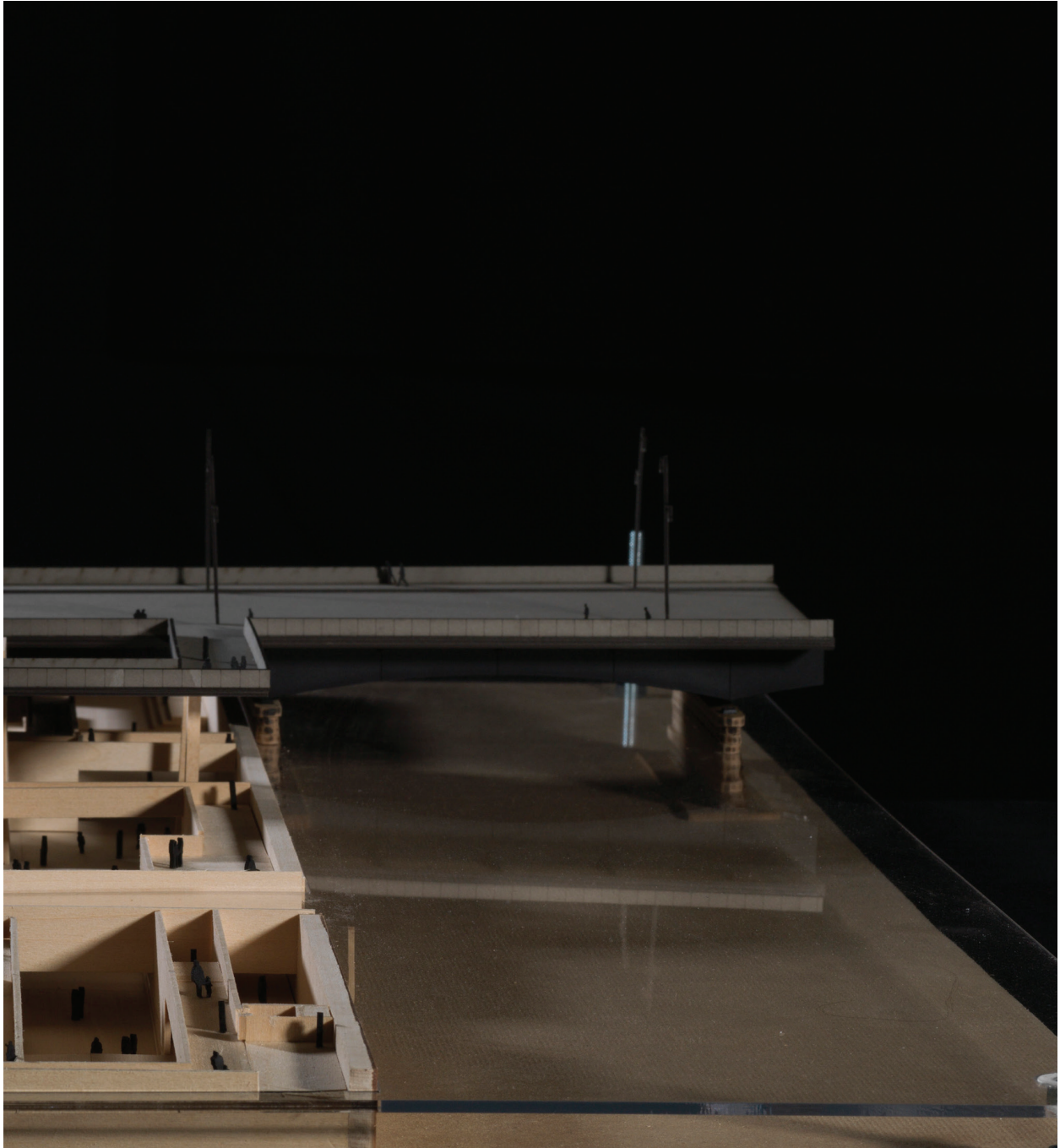


Figure 29.1 | 1:150 Physical Model of the Sunken Platform Projected from the Bridge

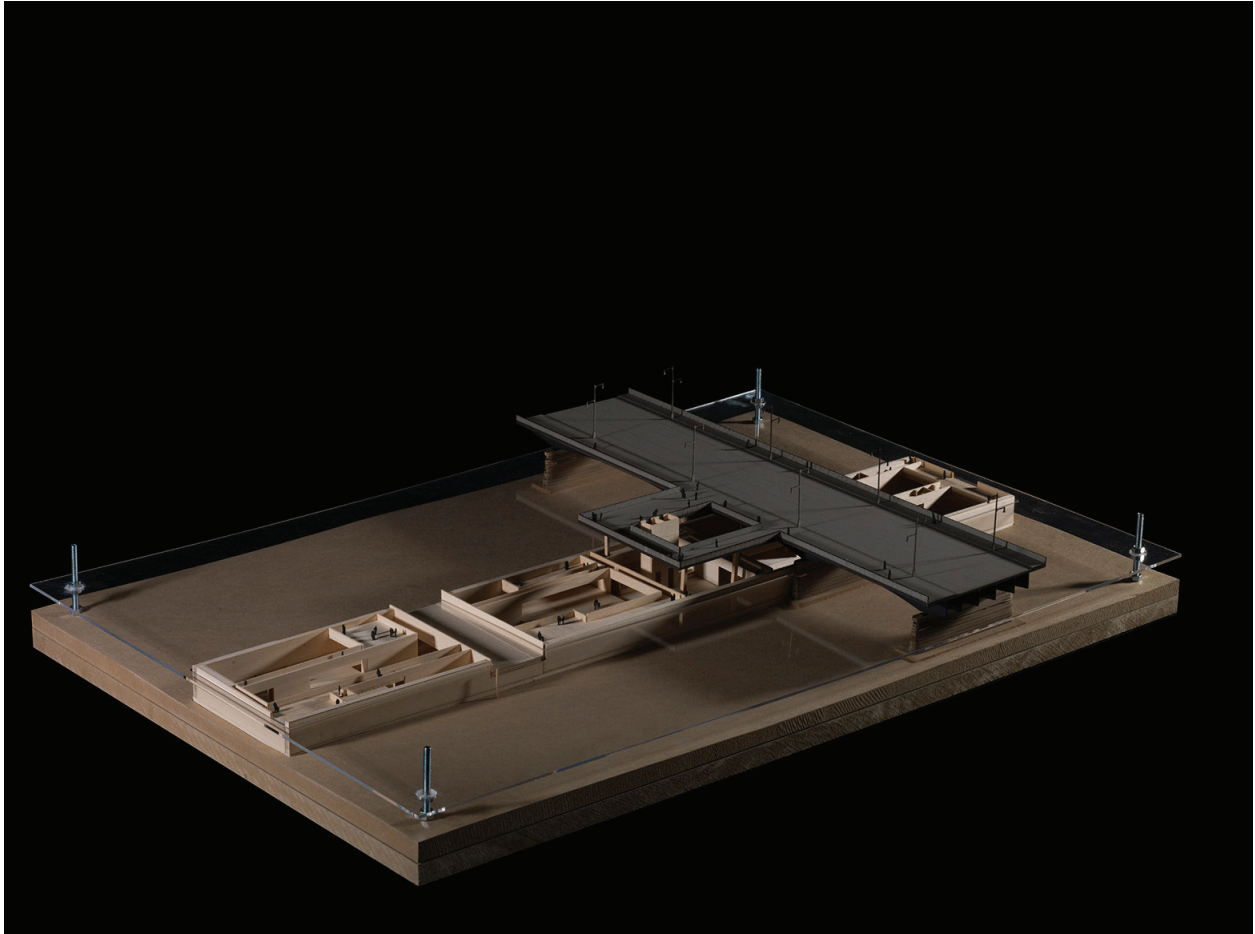


Figure 29.2 | 1:150 Physical Model of the Sunken Platform Projected from the Bridge

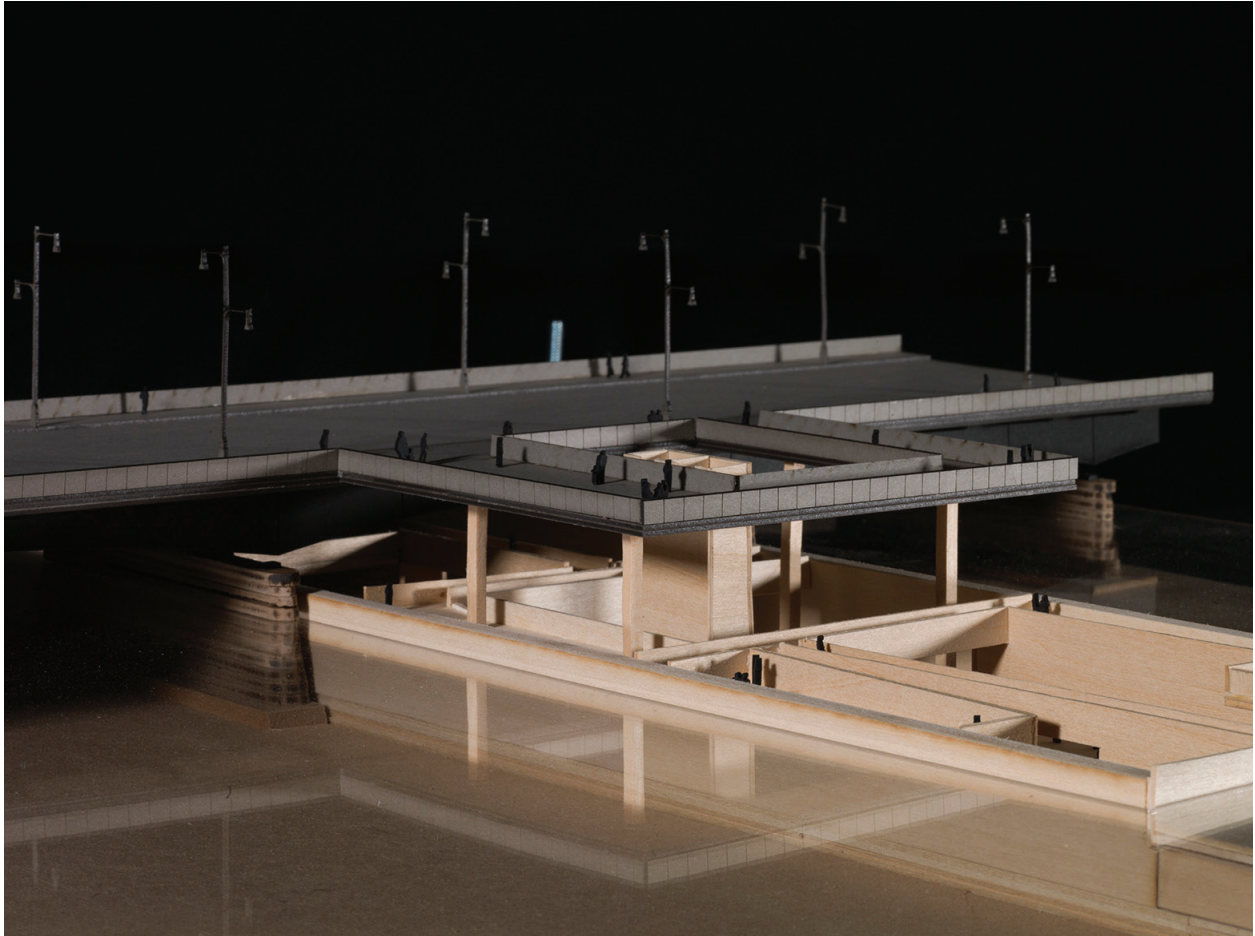


Figure 29.3 | 1:150 Physical Model of the Sunken Platform Projected from the Bridge

Bibliography

- Appadurai, Arjun. *Modernity at Large: cultural dimensions of globalization*. Minneapolis: University of Minnesota Press, 1996.
- Friedman, Thomas L. "The Professors' Big Stage." *New York Times*, March 5, 2013. Accessed May 8, 2014. <http://www.nytimes.com/2013/03/06/opinion/friedman-the-professors-big-stage.html>.
- Gye, Lisa. "Halives, A Mystory: Writing Hypertext to Learn." *The Fibreculture Journal* 2 (2003). Accessed April 15, 2014.
- Luhmann, Niklas. *Social Systems (Writing Science)*. Redwood City: Stanford University Press, 1996.
- Mitchell, William J. *City of Bits: Space, Place, and the Infobahn*. Cambridge: MIT Press, 1995.
- Oldenburg, Ben. "Northeast." *America 2050*, October 6, 2008. Accessed July 5 2014. <http://www.america2050.org/megaregions/northeast.html>.
- Regalado, Antonio. "The Next Silicon Valley: In Innovation Quest, Regions Seek Critical Mass." *MIT Technology Review*, July 1, 2013. Accessed July 5, 2014. <http://www.technologyreview.com/news/516501/in-innovation-quest-regions-seek-critical-mass>.
- Turner, Paul V. *Campus: An American Planning Tradition*. Cambridge: MIT Press, 1987.
- Ulmer, Gregory L. *Teletheory*. New York: Atropos Press, 2003.
- Wigley, Mark. "Architectural Theory: The Future of Cities." *Critical Thought TV video*, 11:58. June 8, 2012. <http://www.criticalthought.com/critical-thought-tv/critical-thought-tv-mark-wigley>.

MIT i²
idea incubator

by Suk Lee

© 2015 Massachusetts Institute of Technology. All rights reserved.