L.E.A.P. TO A SMART FUTURE
INTRODUCTION

This report synthesizes background analysis and smart city design concepts for the Chelsea site.

We propose L.E.A.P., which was formulated from our vision that cities are “smart” only if technology is utilized to improve the urban experience, mitigate impact to nature, and provide new opportunities for civic engagement and human interaction.

L.E.A.P. is committed to connecting the top and the bottom, providing communities with both platforms to tap into collective intelligence and comprehensive systems and infrastructure of support.

We invite all to L.E.A.P to the future with us, with tech-based design driven by the philosophies of Livability, Empowerment, Accessibility, and Play.

CONTENTS

| 03 | Research: Overview |
| 04 | Land-Use & Zoning |
| 06 | Socioeconomics |
| 07 | Natural Systems |
| 08 | Mobility & Access |
| 10 | Smart City Trends |
| 11 | Design Philosophy |
| 12 | Conceptual Map 1 |
| 14 | Livability |
| 15 | Empowerment |
| 16 | Conceptual Map 2 |
| 18 | Accessibility |
| 19 | Play |
| 20 | Team & Citations |
Since the redevelopment of the High Line in 2005, West Chelsea has garnered intensive growth and demand in residential and commercial uses. Defined by the High Line that dissects the space and surrounded by warehouse-turned-galleries, burgeoning boutiques, historic residences, and major attractions, the Project Site is a unique transition zone among the varying uses and built forms in the neighborhood.

**NEIGHBORHOOD CONTEXT: 0.5 MILE BUFFER**

- Chelsea Piers
- Chelsea Market
- Gansevoort Market
- Whitney Museum
- Chelsea-Elliot Houses
- Fulton Houses
- Art Galleries
- Project Site
- Major Attractions
- Historic Landmarks
- Parks/Open Spaces

**CURRENT ZONING & SPECIAL DISTRICT DESIGNATIONS**

- Residential
- Mixed w/Residential
- Commercial
- Industrial
- Transport/Utility
- Misc/Vacant
- Project Site
- Special West Chelsea Zoning District

**NEIGHBORHOOD TRAITS**

Formerly known for residences and light manufacturing industries, the West Chelsea neighborhood has in recent years emerged as an arts and entertainment district full of galleries, shops, and restaurants converted from warehouses and factories. Not only is the High Line itself a major public facility and attraction, but it also provides direct connections to the bustling Meatpacking District to the south and the rapidly developing Hudson Yards to the north.

**MAJOR LAND-USES**

The site is in close proximity to the Gansevoort Market, Chelsea Market, and the Chelsea Piers Sports & Entertainment Complex, which are major tourist attractions. It is also walkable distance to the Whitney Museum and the gallery district. Notably, the area is home to two major public housing projects, which denotes a need to consider a diverse population utilizing the site and the area.

**CURRENT ZONING & SPECIAL DISTRICT DESIGNATIONS**

Due to the special relationship between the site and the High Line, which crosses over from 10th Ave to dissect the space, the site is subject to special regulations to preserve views, air, and light on the High Line. The major requirements are: 1) at-grade public plaza east of the High Line 2) setbacks and height restrictions to ensure that building frontage do not exceed the height of the High Line 3) Minimum 20% of adjacent lot area dedicated to green space.

*Source: NYC Planning, 2005, West Chelsea Zoning Proposal*
1.2 SOCIOECONOMICS

West Chelsea has experienced significant socioeconomic shifts in the past 10 years with the rapid growth of the young creative class and Asian populations.

GROWTH

West Chelsea has experienced robust population growth and rapid increase in housing rent since 2005 with the reuse of the High Line.

DEMOGRAPHY

Asians have contributed the most growth share. In stark contrast, the population share of Black/African Americans is in rapid decline. Overall, however, the area remains a majority white neighborhood.

Compared to Manhattan, there are more newcomers from various origins.

CREATIVE CLASS

The majority of current residents work in financial and professional services (60%). They have higher educational attainment and are younger, as the median age dropped from 37.8 (2005-2009) to 32.5 (2011-2015).

Further, median household income showed 11.6% growth in the past 10 years.

10-YEAR POPULATION GROWTH

10-YEAR RENT INCREASE

<table>
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<th>Manhattan</th>
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<td>1%</td>
<td>233%</td>
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<td>2008-2012</td>
<td></td>
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<tr>
<td>2011-2015</td>
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GRAPHS & CHARTS ON PAGE

2. 10-Year Median Gross Rent Growth Rate (2005-2015)
4. Place of Origin Compared to 1 Year Ago in Manhattan & Chelsea (2015)

1.3 NATURAL SYSTEMS

Considering natural conditions and the disaster landscape, development at the site should address storm surges, sea level rise, and the natural habitat of native species.

NATURAL CONDITIONS

The West Chelsea neighborhood is located adjacent to the Hudson River Coast, which is a Hardened Sheltered Bay Plain. This designation means that the area is protected against most erosion and wave force, but there are potential risks from storm surge and sea level rise. Additionally, the area has an Estuarine Wetland, which is important to migratory routes for birds.

FLOOD ZONES

Most of West Chelsea is in Flood Zone A, a FEMA 100 year flood area. Flood mitigation strategies should be implemented to current and future development in the region to ensure resiliency of infrastructure and that the combined sewage overflows (CSO) that occur in storm events do not harm the balance of the Hudson River estuarine system. The Hudson River system is relatively adaptive and CSO should not significantly alter environments, but storm water management methods for the neighborhood should be a priority.

FLOOD MANAGEMENT

NYC Planning requires Dry Flood Proofing to protect commercial structures against floods. This involves building flood shields on the ground level floors up to the Base Flood Elevation Level (BFE), and preferably up to the Design Flood Elevation (DFE; usually 4-8 feet around the site) in case of future sea level rise.

CURRENT INITIATIVES

Recently, NYC Planning has been involved in waterfront revitalization in West Chelsea, renovating Pier 57 and others and creating more open space with natural buffers to improve the resiliency of the neighborhood. This plan would mitigate hazards associated with sea level rise and storm surges.

The West Chelsea neighborhood is also subject to the Hudson River Park Act, which created a system of parks as a sanctuary for environmental research, education, preservation, recreation and more.

Providing additional connections to this plan in the neighborhood would work towards collaborative goals of connecting people to nature in the urban environment as well as improving neighborhood resiliency.
1.4 MOBILITY & ACCESS

The proximity to the High Line and the Hudson River Greenway, ground-level retail presence on 10th Ave, and relative distance to subway stations indicate the prominence of pedestrian and bicycle activities near the site.

TRANSPORTATION CONTEXT: SITE SCALE

11TH AVE
Two-way arterial with seven traffic lanes. This road has heavy and fast traffic, and is also a freight truck route.

HUDSON RIVER GREENWAY
Major trail running along the Hudson River, to the west of 11th Ave.

10TH AVE
One-way road with six lanes going northeast. On-street parking is somewhat permitted. Traffic speed is moderate, but there have been higher crash instances involving pedestrians/bicycles at intersections

17TH & 18TH AVE
Both are single lane one-way streets. On-street parking is permitted on both streets. There is a bike lane on 18th, but 11th Ave presents an obstacle to direct connection with the Hudson River Greenway

HIGH LINE ACCESS
There is an access stairway to the High Line on 18th St. Because of the wider dimensions and the observation deck on 10th Ave, the portions of the High Line near the site are some of the most popular and crowded.

3 BUS ROUTES BUT NO SUBWAY STATION
Three bus routes pass by the site - 11, 12, 14D. 14D comes every 5 minutes (Peak Hour) and operates 24 hours, connecting between West and East Manhattan. However, there is no subway station near the site. The closest metro stations are 23rd and 14th Stations (A C E lines), which are 10~15 min walking distance from the site.

11TH AVE: HEAVY TRAFFIC ON MAJOR ARTERIAL
11th Ave, also known as NY State Route 9A, provides access to at least 5 Interstate Highways. From the site, this arterial allows connections to Northern Manhattan and the FDR Drive, completing a loop of the Manhattan Island. Accordingly, there is heavy traffic and fast travel speeds along 11th Ave.

CRASHES WITH BIKE OR PEDESTRIAN INJURIES
NYC Traffic Crash Data from 2009-2016 indicate higher number of crashes involving bikes or pedestrians at 18th St & 10th Ave and 17th St & 11th Ave than at other places around the site. Designs can be implemented to improve the safety at these intersections to benefit the high concentration of pedestrians and bicyclists.

CHARACTERISTICS OF HIGH LINE VISITORS AT A GLANCE

To highlight some of the key findings shared by the Friends of the High Line (2017), there has been an increase in racial/ethnic diversity and NYC resident visitors in recent years. Notably, 19% of visitors enter the Highline through the 16th & 18th St access points near the site and most people spend their time walking.

Considering the popularity of the High Line, prominence of ground-level retail, and bicycle connections, focus on pedestrian- and bike-friendly design is highly recommended.
SMART CITY TRENDS

“The use of Smart City technologies results in cost efficiencies, resilient infrastructure, and an improved urban experience.” (APA, 2015)

WHAT MAKES A CITY SMART?

Smart City, as defined in APA (2015), uses information-communication technology “to engage citizens, to deliver city services, and to enhance urban systems” (p.6). Though the core is utilizing urban informatics and technology, we found that “Smart City” is a dynamic concept that has evolved over time. We identified the prevailing current themes cities around the world as engaging in place-based solutions, bottom-up innovation, and public-private partnerships.

1. PLACE-BASED SOLUTIONS

Place-based solutions recognize the local context and its unique social, economic, cultural, and institutional features. Most of the successful Smart City best practices in Europe, Asia, and in the US adopt policies that integrate multiple stakeholders in creating Smart City districts that address the local urban environment.

2. PARTNERSHIPS

With the popularization of Smart City applications in cities, public-private partnerships have become essential to producing appropriate tools and resources and matching them with demand. In most cases, the private sector’s strong technological background meets the public sector’s demand for solving public issues.

3. BOTTOM-UP INNOVATION

Though early Smart Cities like Barcelona and Seoul featured top-down approaches with systems of sensors and central control centers, cities are increasingly realizing the importance of facilitating innovations and changes from the bottom up (President’s Council of Advisors on Science and Technology, 2016). More practices suggest that citizens are not just “consumers” of the applications but also “producers” (Townsend, 2013).

WHAT SHOULD SMART TECHNOLOGY RESULT IN?

Cost-Efficiency
Smart technologies should resolve the inefficiency of an urban system due to the unbalanced distribution of resources.

Better Urban Experience
Since the actual users of urban systems are people, smart technology should promote users’ experiences in their daily life.

Resiliency
In anticipation of climate change, smart technology should provide solutions to make an urban system resilient.

DESIGN

This section describes design concepts and smart city technology applications for the project site. Recognizing both challenges and opportunities posed by the heterogeneous land-use and built character, multi-modal transportation systems, diverse demography, and natural resources and hazard landscape, we defined four visions to guide our design.

LIVABILITY
Blending low-impact development and hazard mitigation with environmental sensing, sustainable energy systems, and resilient infrastructure.

PLAY
Offering resources for greater freedom in shaping interactions with each other and the built environment, because what makes urban experience truly dynamic is often spontaneous, not pre-programmed.

ACCESSIBILITY
Utilizing responsive networks and infrastructure to improve the safety, efficiency, and equity of transportation systems, regardless of mode of travel or physical ability.
Smart Cities should be sustainable and resilient. Mimicking the natural system's storm water management increases the ability of the site to survive hazards.

Creating energy on site reduces the costs for business owners and costs on the environment.

If a planner designs a smart city, but does not educate its community, how smart is it? Businesses are given the opportunity to engage with the public who enter and live in the neighborhood. They are utilizing the interactions to benefit their business as well as their community.
2.1.2 

LIVABILITY

Creating a resilient, sustainable space for people to enjoy for generations to come.

L1. KINETIC ENERGY

Kinetic Footpath System
Pavegen® generates power from the kinetic movements from people stepping on the tiles.

The amount of energy from 250,000 steps would generate enough power to charge 10,000 cell phones.

Low-energy LED on the panel’s light up for instant gratification only using 5% of the energy generated

L3. FLOOD MITIGATION

The buildings are dry flood proofed, using sturdy glass materials to maintain the neighborhood’s transparency requirements. The walls are water sealed and doors will be sealed in case of flooding. This method is for the first level up to the 8 foot tall recommended DFE. Flood sensors detect water level conditions to keep retail owners updated in major storm events, so extra reinforcements can be added to the ground

Providing swales and a natural storm water system is essential for the resiliency of the site against flooding. It also reduces costs of infrastructure needed.

This system also allows for more control of water flow across the site. The stream, which receives water from rain and runoff from the green roofs, runs to the waterfall to provide hydroelectric power to site. The amount of energy generated and used is monitored to make sure the system is running efficiently.

L2. SOLAR/GREEN ROOFING

Roof space used “Green Roofing” techniques, planting native species and grass, with a water filtration system that funnels the excess water to the stream system below.

Solar Panels are on the West Building roofs to generate energy for the offices and retail spaces on site.

L4. GREEN INFRASTRUCTURE

Since the site has an estuarine wetland to the right of the High Line, this area was left as public open space to preserve migratory routes, and more.

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E1. FREE PUBLIC WIFI/POWER

Access to free public wifi and charging stations creates an environment where everyone can interact with the smart technology of the site.

E2. INTERACTIVE DASHBOARD*

An open data source that tracks utilities such as energy usage, waste, water and air quality, and electricity usage.

Users of the dashboard can provide feedback about their urban experiences on the site. Management can respond to these needs expressed on the site.

E3. EDUCATIONAL WORKSHOPS

Having a city with smart technology is not useful unless people know how to utilize it. With a partnership of community members and professionals, workshops will be held to teach people how to use technology. Holding these workshops encourages all people in the community to come to the space and use the amenities, while promoting the local businesses.

E4. INTERACTIVE DESIGN

Citizens submit ideas for projects they want to see in their communities to a dashboard. Local designers and specialists suggest how to implement the designs. The designs can be implemented in public spaces.

E5. FLEXIBLE WORK SPACES

Having some office space for rent that is more flexible can benefit smaller businesses and communities. Using movable walls creates customizable spaces for organizations, communities and more to rent to meet their specific and unique

E6. SMART INTERIOR

Many businesses are defined by the tone of their spaces. Creating smart work environments can enhance the office space and improve the experience for users. This can be changing the color or brightness of lighting, using built in speakers to play music or white noise, and altering the tint of windows in spaces for various needs.

*Dashboard QR Code
2.3.1 ACCESSIBILITY

A2 INTERACTIVE CROSSWALK
1. Sensors count the number of pedestrians waiting in line.
2. Hologram over the road shows "STOP" sign at red traffic light.
3. If there is too many pedestrians, traffic management system extends the crossing time.

A1 INTERACTIVE ROAD SYSTEM
1. Traffic management system receives the real-time traffic information of neighborhood.
2. Interactive road system shows traffic information on the road.
3. Drivers choose alternative routes.

A7 PEDESTRIAN BRIDGE
1. Pedestrian bridge over the 11th Ave. directly connects the High Line-level walkway to the Hudson Greenway.

P5 INTERACTIVE WATERFALL
1. People send text messages or photos to the website.
2. The messages and photos are projected on the waterfall.

P4 INTERACTIVE STREET WALL
1. People can draw pictures or messages on the LED walls.

A3 INDOOR WAYFINDING
1. Indoor sensors interact with visitors’ smart phone.
2. Sensors provide location information.
3. Like real-time GPS map, visitors can query route information.

P2 RESPONSIVE PUBLIC SPACE
1. Sensors detect pedestrian volume at the public space.
2. Considering the time of the day and the volume of pedestrian, it plays proper mood of music and changes the level of light.

A6 DEVICE-FREE SMART BIS
1. Users require routes for traveling.
2. Kiosk shows multiple real-time several fastest-route options.
3. The Kiosk prints paper itinerary.
4. Users can take the paper.

A4 SMART GUIDE FOR THE BLIND
1. Smart Stick for the blind interacts with street sensors
2. Sensors provide walkway information to the Smart Stick.
3. Smart Stick informs the blind.

P3 MOBILE LEGO® BRICKS
1. LEGO® bricks bring more people to generate energy on the tiles.
2. Buildable into sitting areas or sculptures, they encourage design.

A5 SMART SNOW REMOVAL
1. Sensor detects severe snowfall.
2. Building Management System orders removal to the UV.
3. Snow removal UV moves and plows snow on the walkway.

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Offering resources for greater freedom in shaping interactions with each other and the built environment, because what makes urban experience truly dynamic is often spontaneous, not pre-programmed.

Accessibility analysis finds that even though walking and biking are primary modes of travel at the site, there are certain barriers to their safe accessibility and connectivity. By using various smart transportation technology such as interactive road or traffic volume detecting sensors, accessibility and safety for people will be further promoted.
2.3.2 ACCESSIBILITY

Smart city utilizes responsive networks and infrastructure to improve the safety, efficiency, and equity of transportation systems.

A1. INTERACTIVE ROAD

Interactive Road System communicates with drivers via either LED panel or hologram.

LED panel directly connects to the server receiving real-time traffic information and displays it. Unlike the concrete and asphalt road, this LED panel road can display information at any point of the road.

Further, instead of using LED on the road, the information can be projected as an Hologram.

A2. INTERACTIVE CROSSWALK

Smart sensors detect the pedestrian volume waiting at the crossing.

Either infrared sensor or Vision-based camera sensor can be used to detect the volume.

A3. INDOOR WAYFINDING

Aruba Beacons/Sensor® provides indoor-positioning system using Bluetooth network.

A4. SMART GUIDE FOR THE BLIND

Eye Stick® helps the blind interact with walkway using Bluetooth network. It can receive real-time information (i.e. crosswalk, construction) on route.

A5. SMART SNOW REMOVAL

KOBI® is an autonomous KOBI® machine to plow snow after receiving info from the sensors. To provide comfort and safe walkway, this machine removes operate especially at the night.

A6. DEVICE-FREE SMART BIS

There are still lots of people who do not have smart phones to enjoy the smart technology. To support them, printed-itinerary is provided at the transit station.

A7. PEDESTRIAN BRIDGE

This elevated bridge promotes connectivity between the High Line and Hudson Greenway.

P1. DANCING CROSSWALK

To motivate fun experience for crosswalking as well as encouraging safe street crossings, the “man” in the traffic light shows off people’s dance moves.

P3. INTERACTIVE WATERFALL

Unlike typical street wall which is made by brick or concrete, the interactive street wall is covered by interactive LCD touch screen.

People go inside the “life size” box and dance. The motion detecting sensors capture the body’s movement. The movement of dancer transmits the messages and photos can be projected on the waterfall at the public space.

P5. PLAYING LEGO® BRICKS

LEGO® bricks bring people to the public space promoting active, creative life styles, which also generates more electricity from the increased activity.

DESIGN PROPOSAL FOR PUBLIC SPACE

Dancing Crosswalk Light

Playing LEGO® Bricks

By using pedestrian detecting sensors and light detecting sensors, the public space can provides street lights and music for community events.
Team Collaboration

- Architecture
- Engineering
- Smart City
- Economics
- Environmental Science
- Urban Studies

We are team of planners with diverse expertise and former experiences: architecture, urban studies, economics, engineering, and environmental science. Recognizing the need to consider both questions of technological innovation and practical application to benefit society, we each contributed to the design process with knowledge from our backgrounds to combine technical construction and implementation of technology with social context analysis.

During the past 3 months, we were busy debating, drafting, experimenting, and envisioning, all 5 of us chiming in with insights and discoveries to articulate our shared vision, push our limits of creative thinking, and manifest the products of our collaboration in our designs.

Between weekly idea meetings and numerous late-night work sessions, we consumed 5 gallons of coffee, created 40 sketches, and exchanged 200 messages.

References


Holographic traffic signals are the signs of the future. Retrieved February 02, 2017, from http://www.wikitrend.org/holographic-traffic-signals-are-signs-future


