NAVY YARD

CPLN 660 - FUNDAMENTALS OF URBAN DESIGN

STUART WEITZMAN SCHOOL OF DESIGN
UNIVERSITY OF PENNSYLVANIA

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Image Source: phillymag.com

THE BIG PICTURE

THE BIG PICTURE: Innovation + Philadelphia

CONNECTING AUTONOMOUS INNOVATION WITH PHILADELPHIA

INNOVATION

HEALTHY CITY

WALKABILITY

ACTIVATION

Photo Source: Unsplash; https://www.bcg.com/publications/2017/automotive-making-autonomous-vehicles-a-reality; https://www.cooperhewitt.org/2018/12/03/who-owns-the-city-of-the-future/

INSPIRATIONS

SOURCES OF INSPIRATION

Image Source: https://pressroom.toyota.com/

Toyota Woven City

- 3 Street typologies woven together
- Use of sustainable materials
- Use of AI and automated systems

Image Source: https://www.insidehook.com/

Waymo

- Fully autonomous ride hail service
- Add-on to existing car models
- Currently in use in Phoenix and San Fransisco

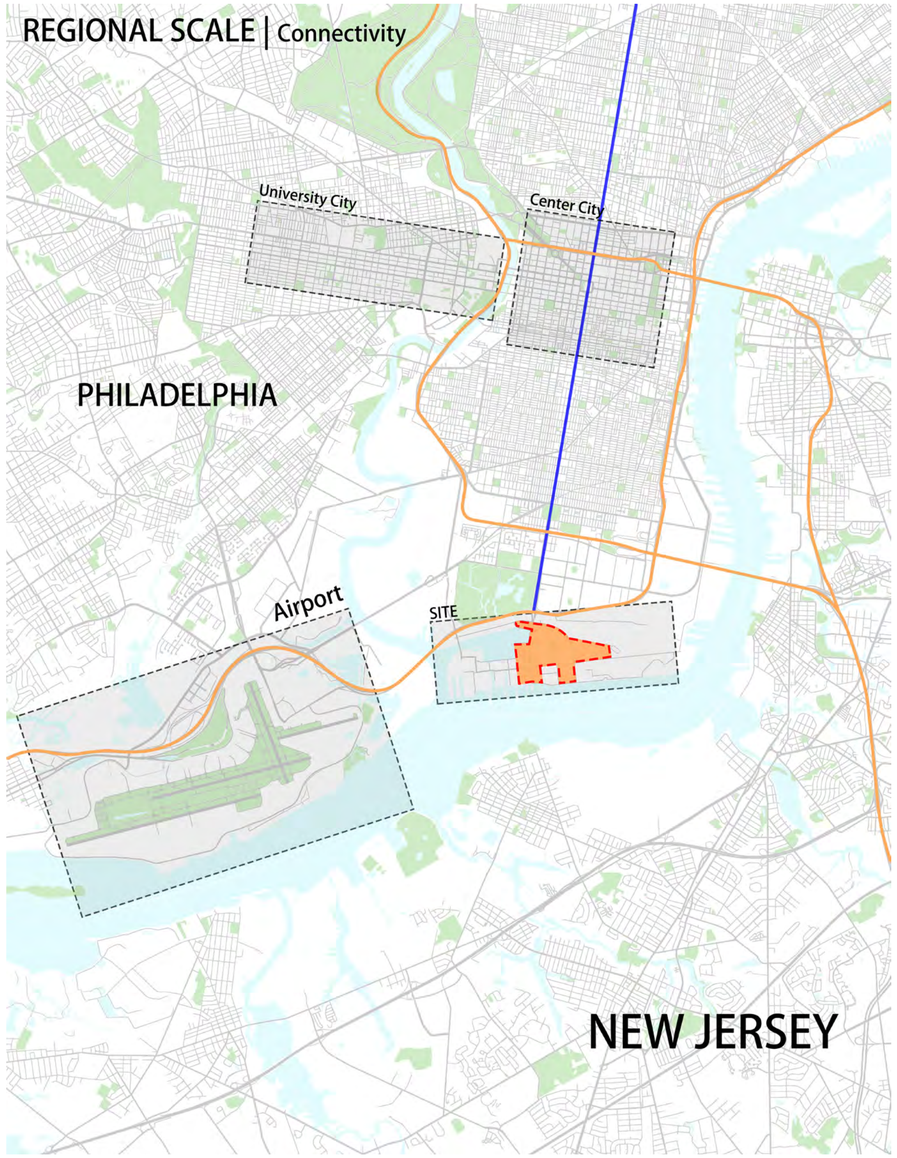
https://metropolismag.com

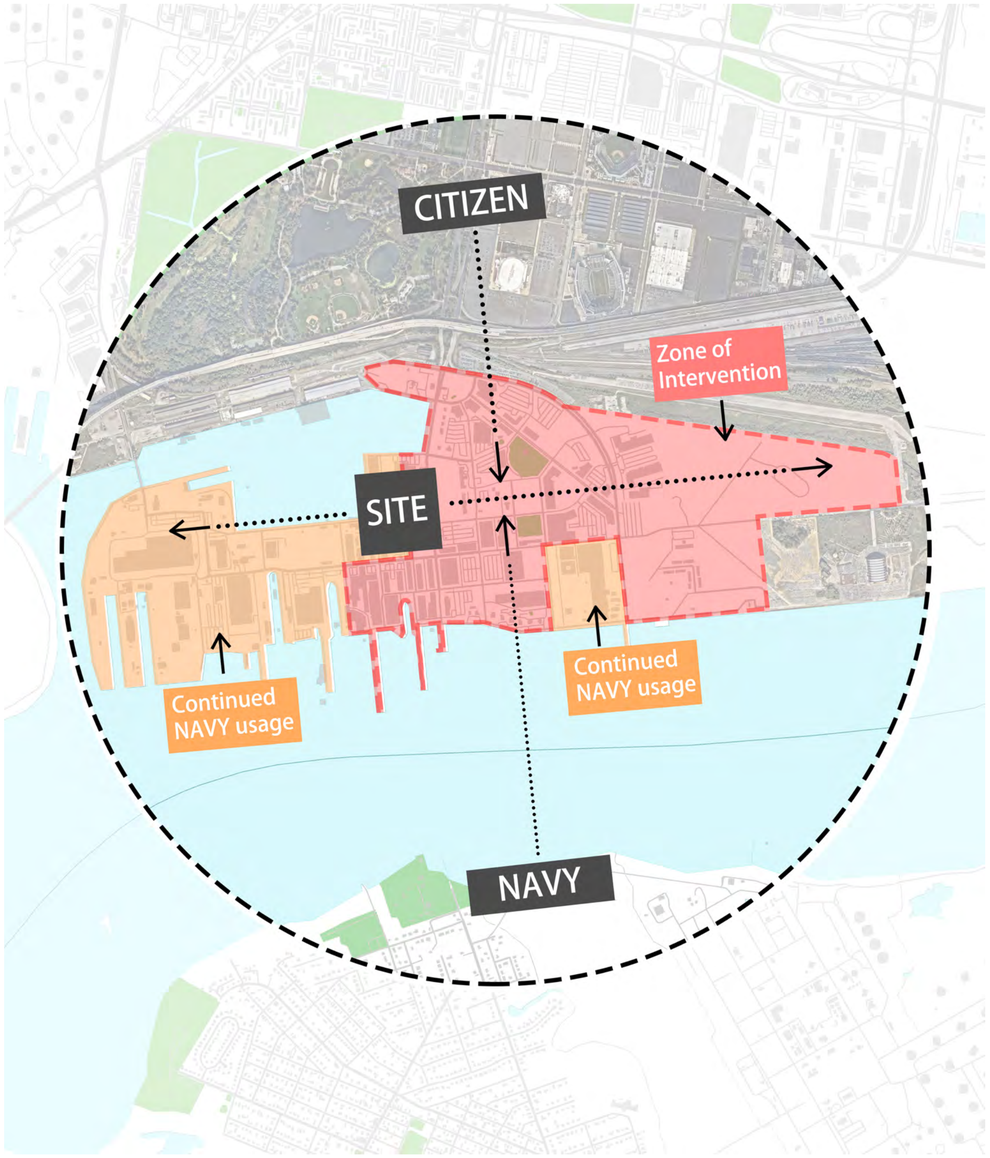
Sidewalk Labs Quayside Toronto

- Similar spatial condition (waterfront)
- Use of data to problem solve and cater experiences
- Lack of transparency with data collections

ENVISIONING THE NAVY YARD

SITE ANALYSIS





TIMELINE

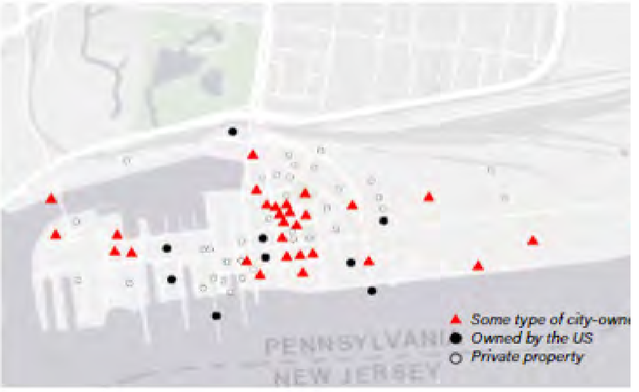
Philadelphia's original navy yard, begun in 1776 on Front Street and Federal Street in what is now the Pennsport section of the city, was the first naval shipyard of the United States.

The shipyard's greatest period came in World War II, when the yard employed 40,000 people who built 53 ships and repaired 574.

After the war, the workforce dropped to 12,000,

The yard's closure was originally recommended in 1991 by the Base Realignment and Closure Commission, as a result of foreign competition and reduced needs due to the end of the Cold War.

in 2000, the Philadelphia Industrial Development Corporation, on behalf of the city of Philadelphia, acquired and began to redevelop the land.

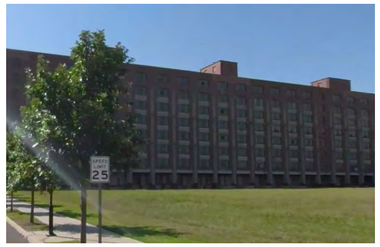
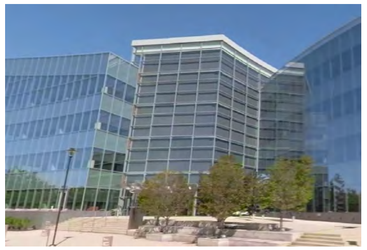


DEVELOPMENT OF NAVY YARD: PIDC

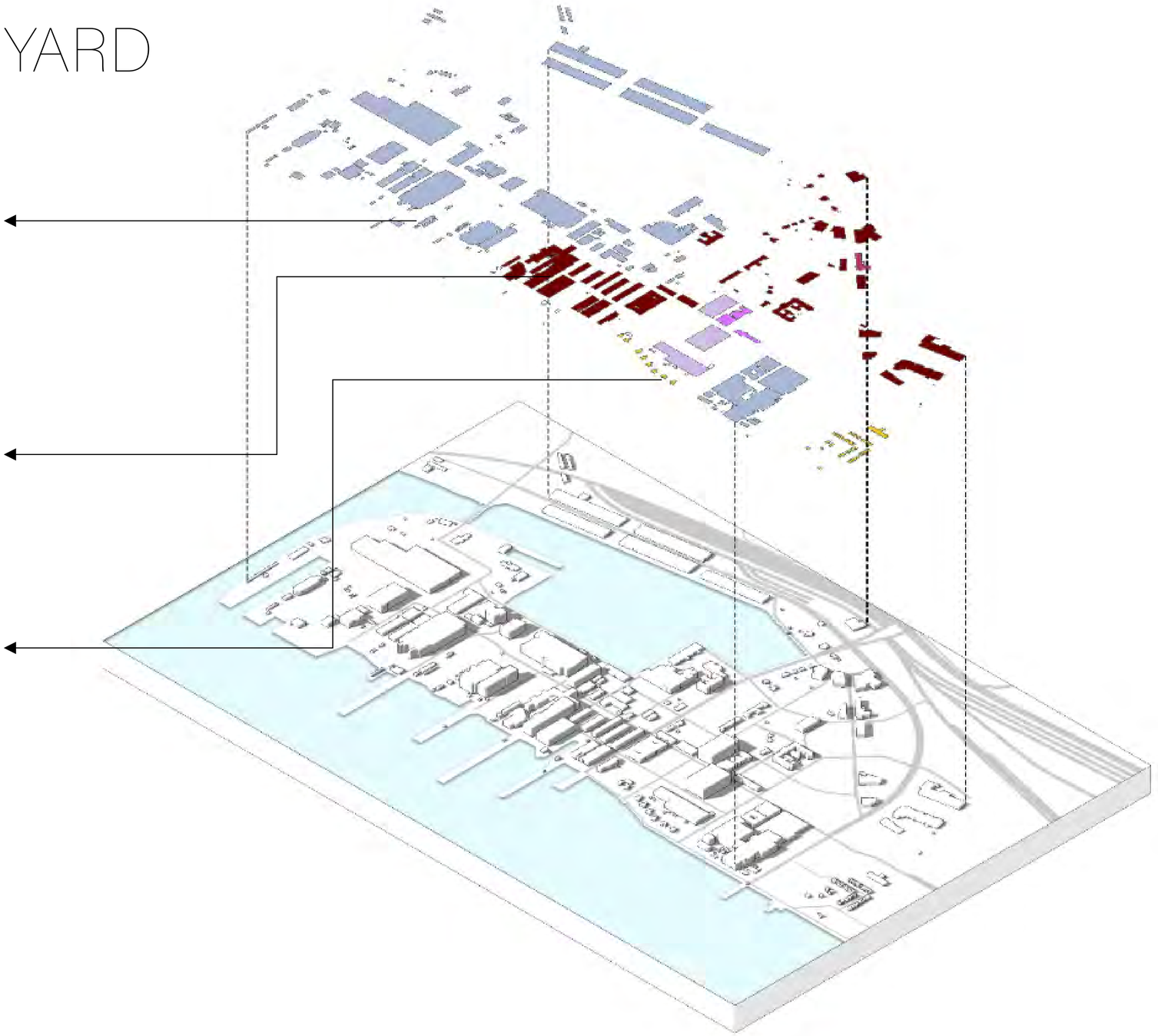
- PIDC: Philadelphia's non-profit, *public-private* economic development corporation.
- Real estate activities supporting the next wave of industrial and commercial growth.
- Offering a wide range of loans, tax-exempt financing, and technical assistance to businesses, developers, and non-profits.
- Involved in the development of most properties in the Navy Yard.

LAND USE OF THE NAVY YARD




Industrial
Commerical
Office
Residential
Education
Unused

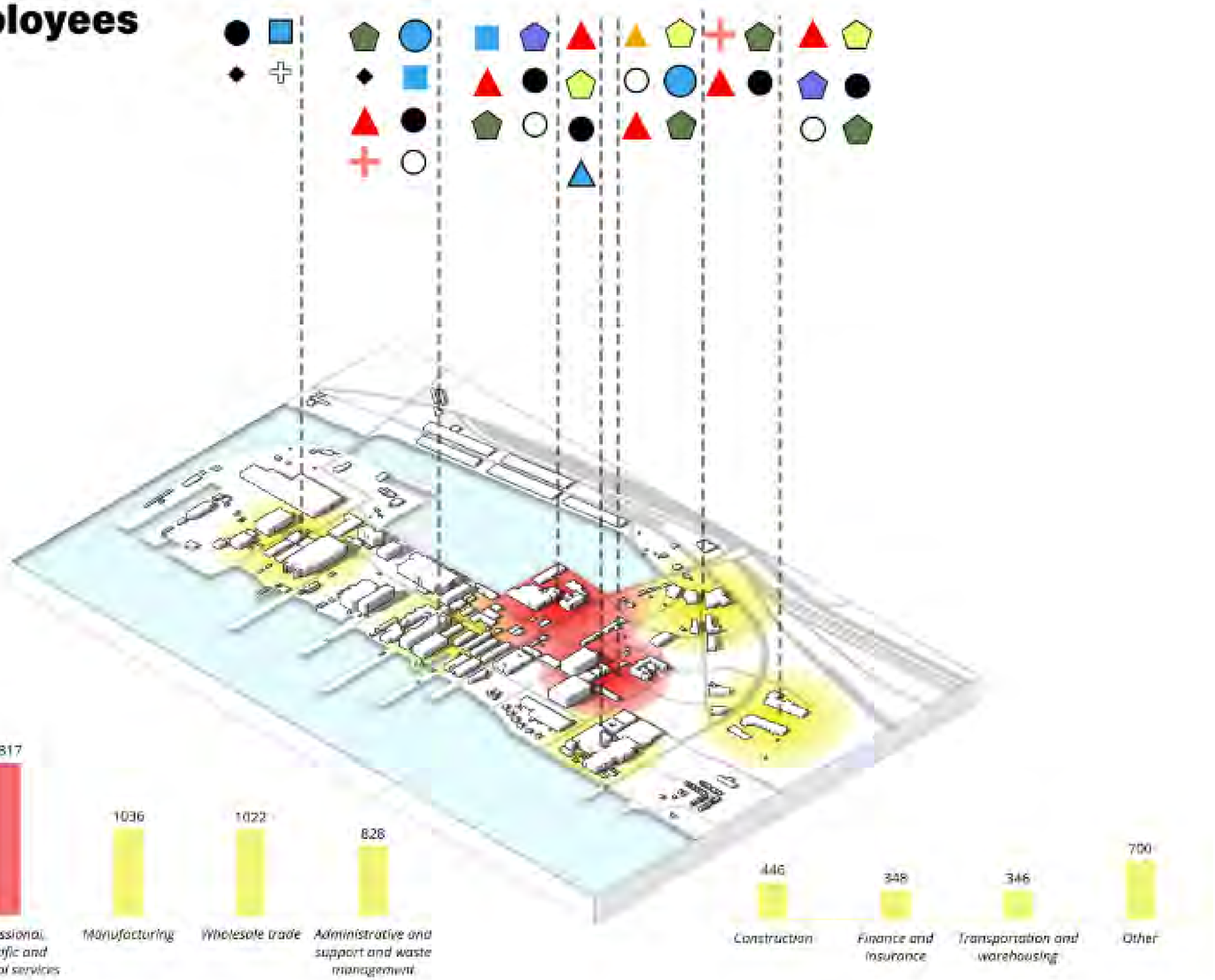


CURRENT BUSINESS ANALYSIS

150 companies

- **Technical, IT/other manufacture related service**
- **Business, management, other business service**
- *Logistics*
- *Construction*
- *Marine service*
- *Manufacture: ship building & related*
- *Manufacture: other technical/enginnering*
- *Manufacture: pharmaceutical*
- *Pharmaceutical research*
- *Finance/insurance*
- *Real estate*
- *Government/military/other autorities*
- *Health service*
- *Other service*

8617 employees



POPULATION PROJECTIONS

COMMUTERS

EXISTING

~9,000 Employees

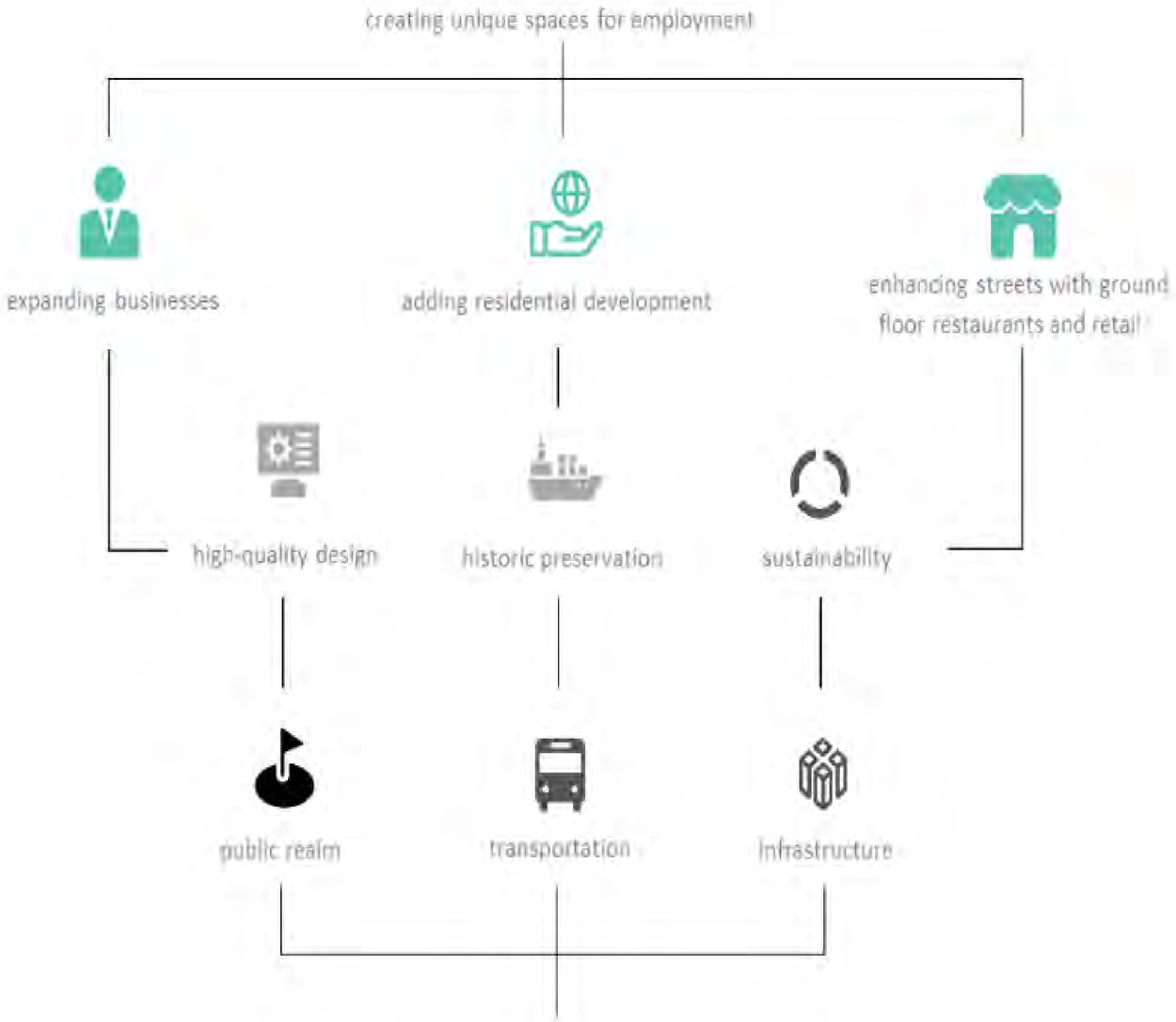
PROPOSED (2035 AND BEYOND)

25,500 Employees by 2035
21,000 Commuters by 2035

- Projected 750 new employees per year
- 4,000 employees are residents
- 12,500 parking spots needed

COMMUTER TYPE BREAKDOWN

- Residents: 15%
- Public Transit: 35%
- Conventional Cars: 10%
- Private AVs: 10%
- Ride-Hail AVs: 30%



15.8 million square feet of development
25,500 people

PROPOSED PROGRAM AREA CALCULATIONS

	EXISTING SQUARE FOOTAGE	PROPOSED SQUARE FOOTAGE
BUSINESS / INDUSTRY	2,120,000 SF (Building Footprint)	+1,920,00 SF (Building Footprint)
RETAIL / SERVICES	36,000 SF (Building Footprint)	+780,000 SF (Building Footprint)
RESIDENTIAL	42 Housing Units ~100 Residents	+2,580,000 SF +2,500 Housing Units +5,000 Residents
GREEN SPACE	800,000 SF	+2,700,000 SF

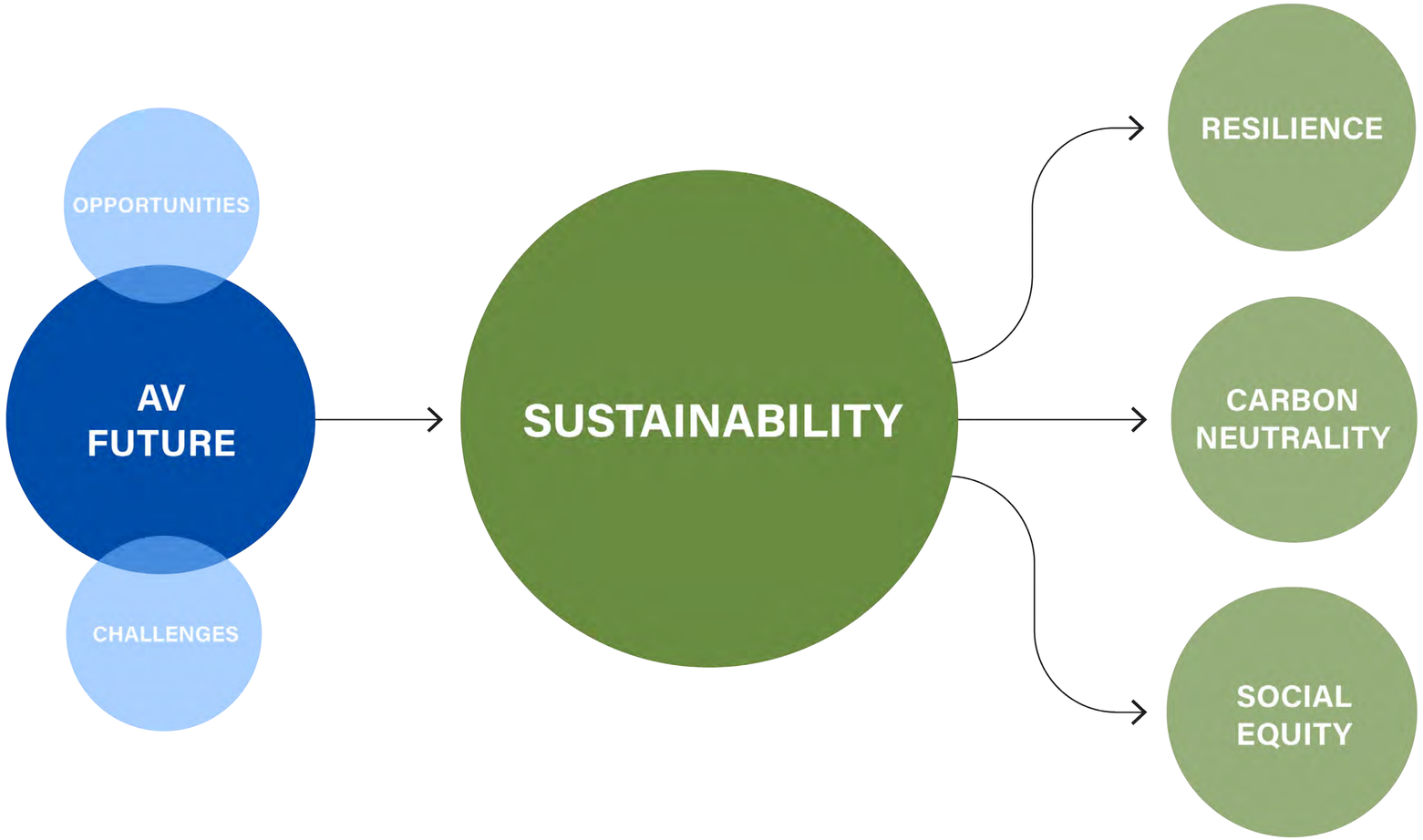
SUSTAINABILITY VISION

SUSTAINING OUR VISION

AVs AND SUSTAINABILITY

Sustainability is directly tied to systems of autonomy and technology

AVs rely on sustainability for maximum efficacy in the built environment

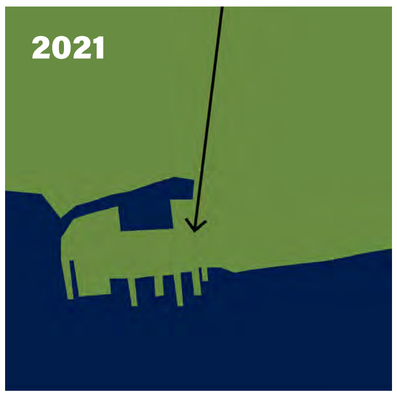


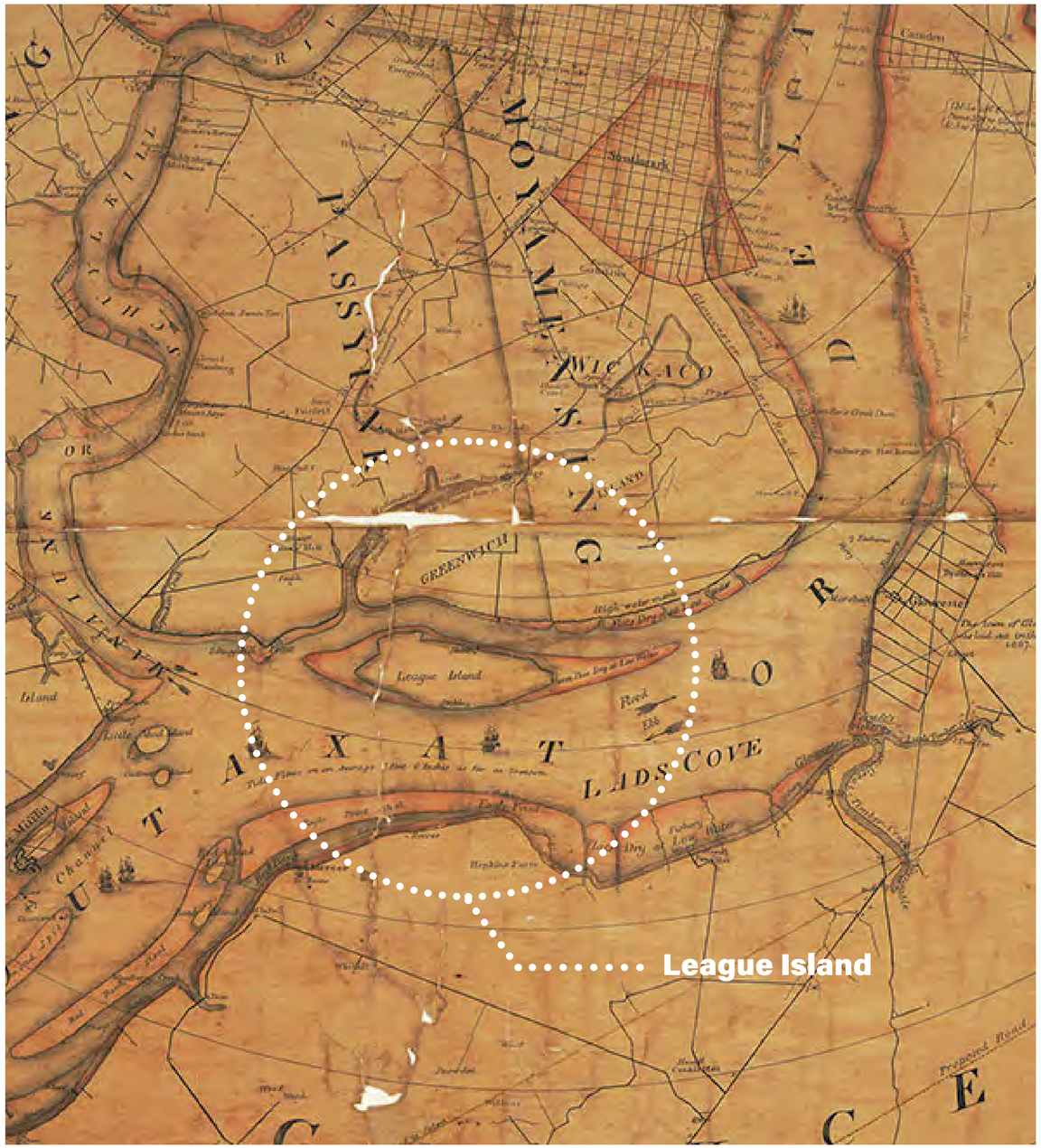
RESILIENCE

NAVY YARD AND THE DELAWARE RIVER

Philadelphia and the Delaware River are two inseparable entities that shape the development of our Navy Yard site

- 1840s - Broad Street Causeway
- 1871 - Philadelphia Naval Shipyard
- 1926 - Mustin Airfield
- 2000 - The Navy Yard

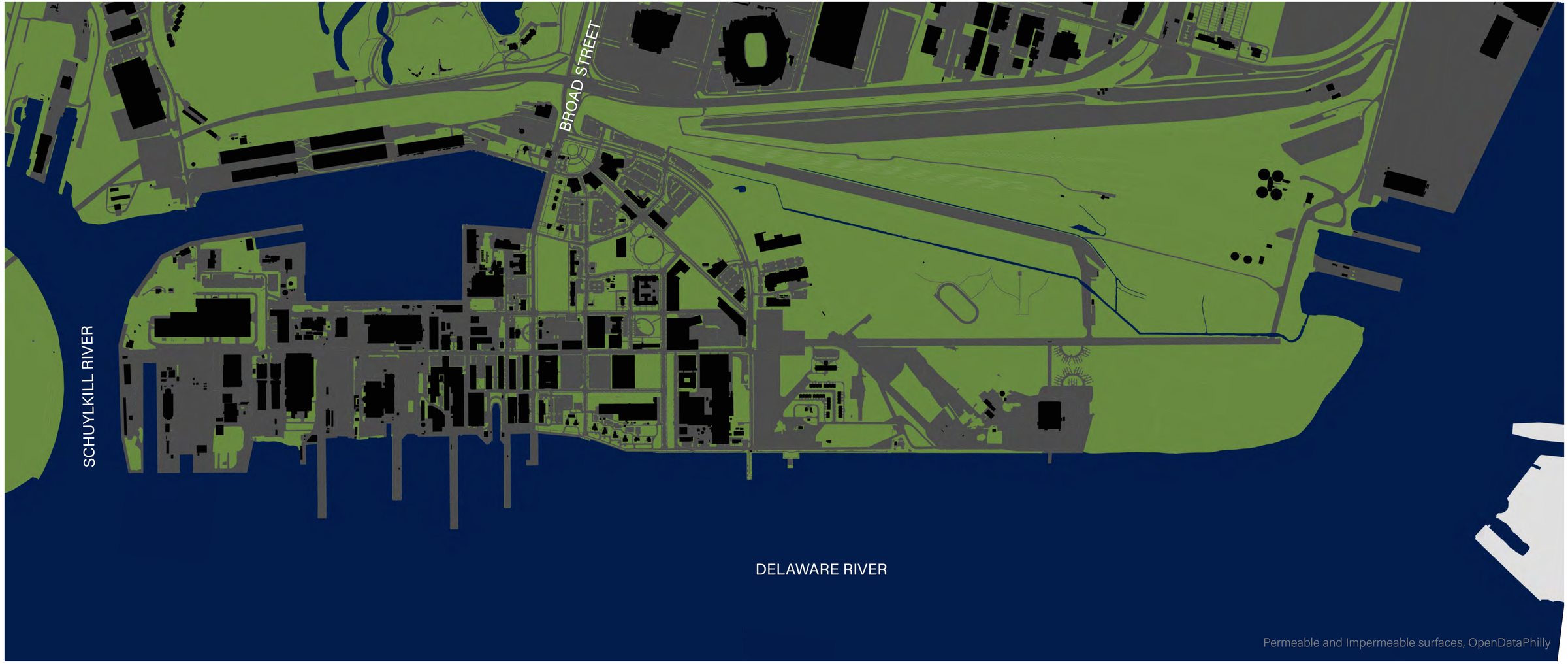




1809 Map of Philadelphia - Free Library of Philadelphia

RESILIENCE

IMPERVIOUS SURFACES



Rivers

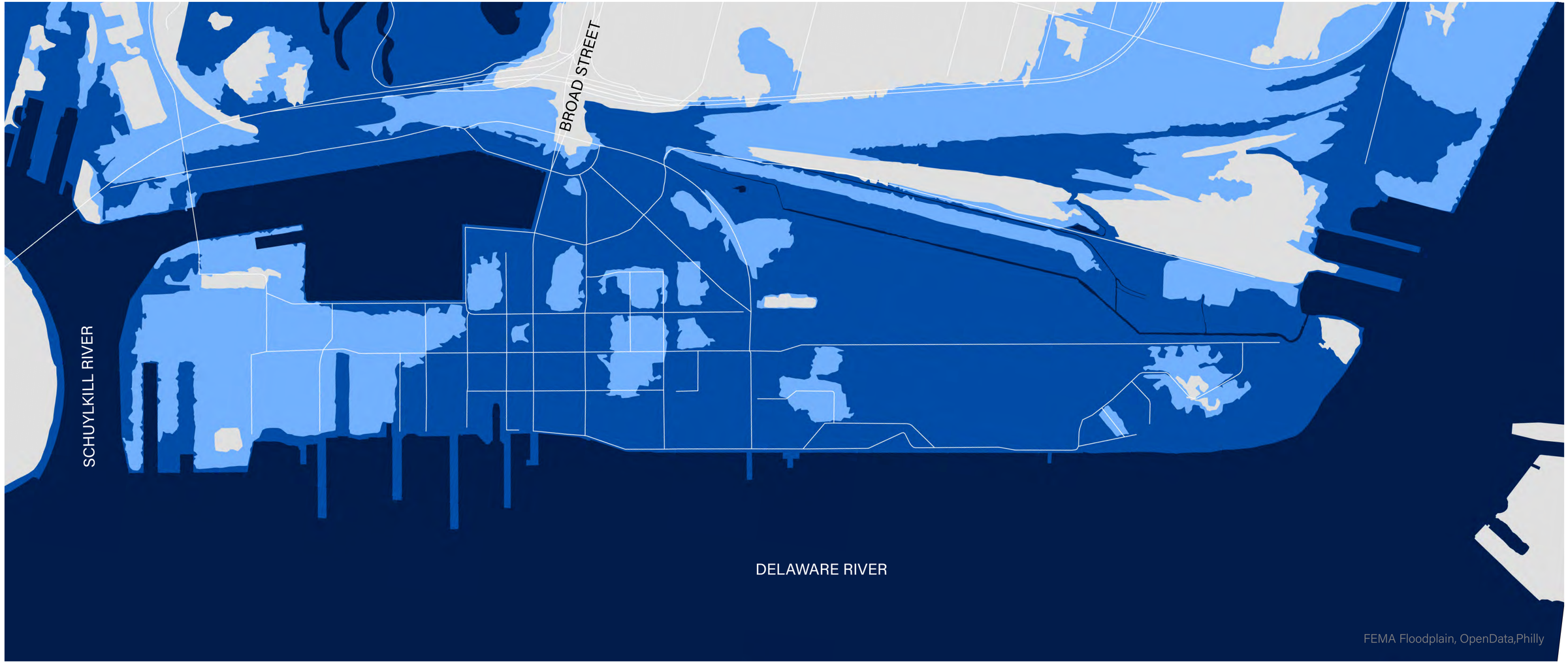
Buildings

Impermeable Surfaces

Permeable Surfaces

RESILIENCE

FLOOD RISK



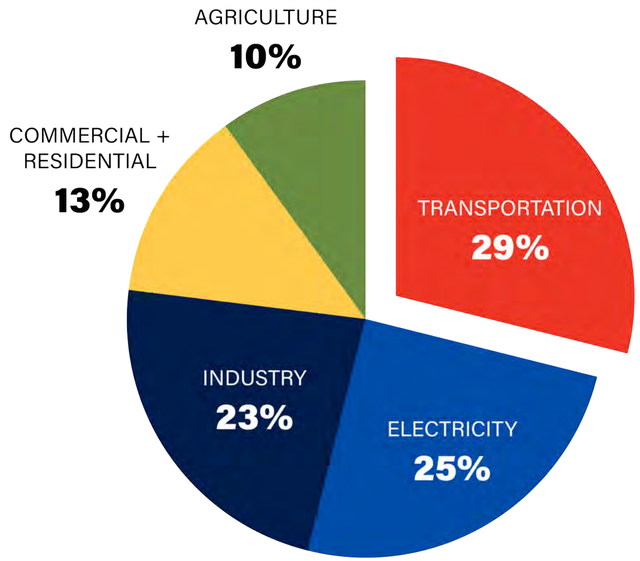
CARBON NEUTRALITY

PREPARING FOR AV SYSTEMS

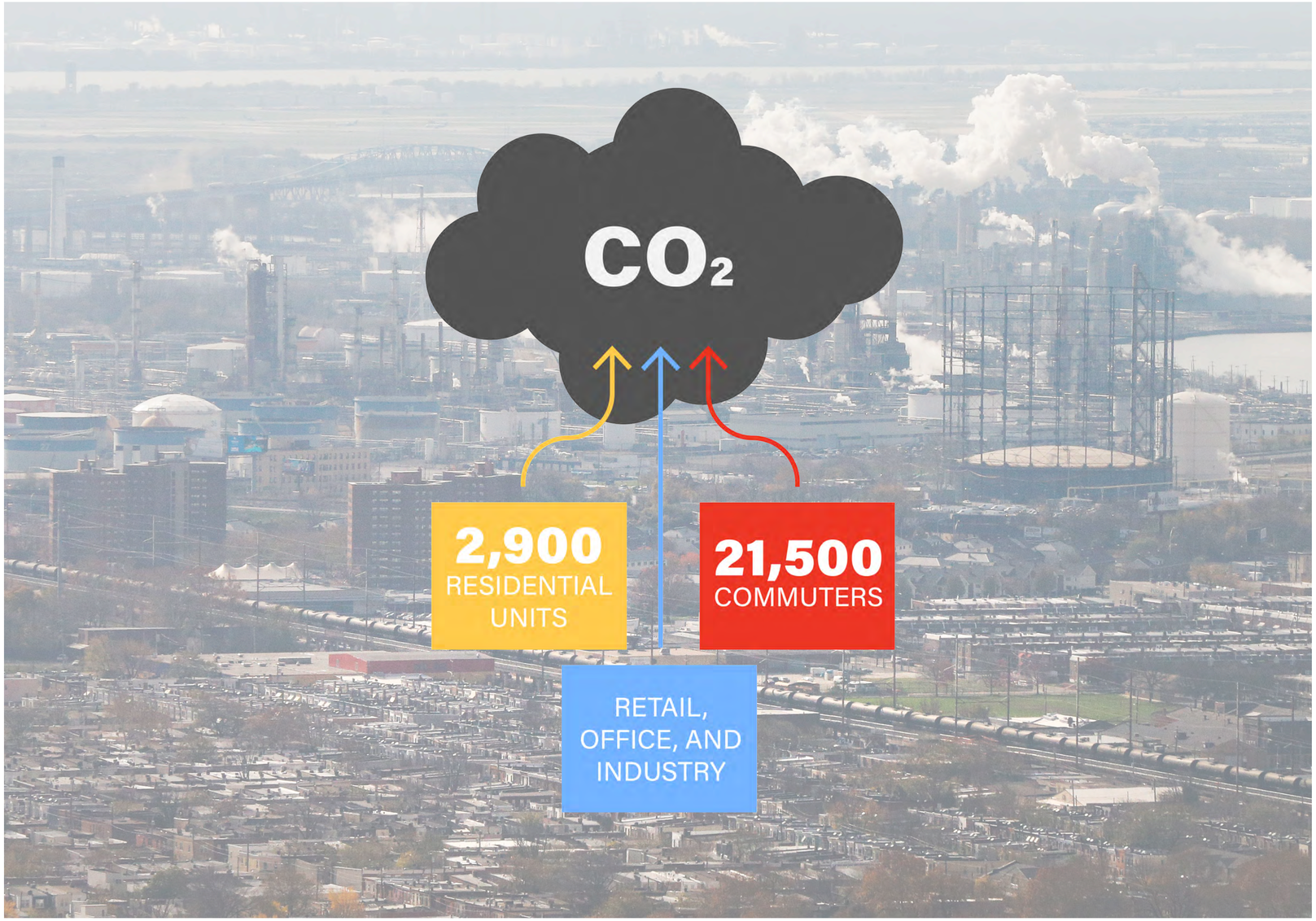
Technology should advance sustainability

An AV future is dependent on resources and energy that we have to conserve

NATIONAL GHG EMISSIONS BY SECTOR



https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions



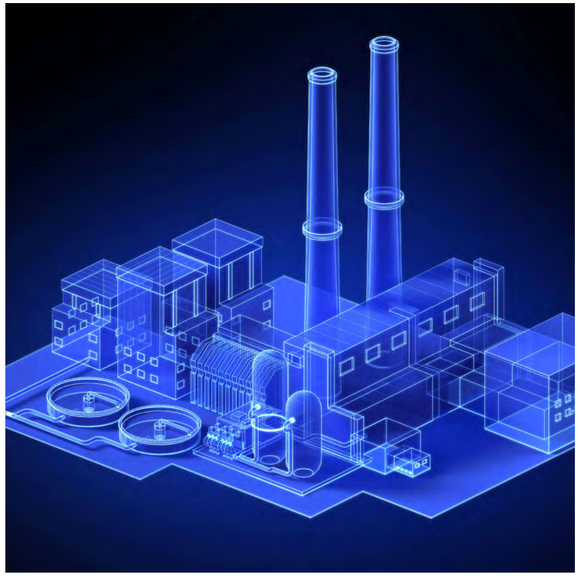
https://stateimpact.npr.org/pennsylvania/2017/04/11/dep-fines-delco-refinery-for-air-pollution-violations/

CARBON NEUTRALITY

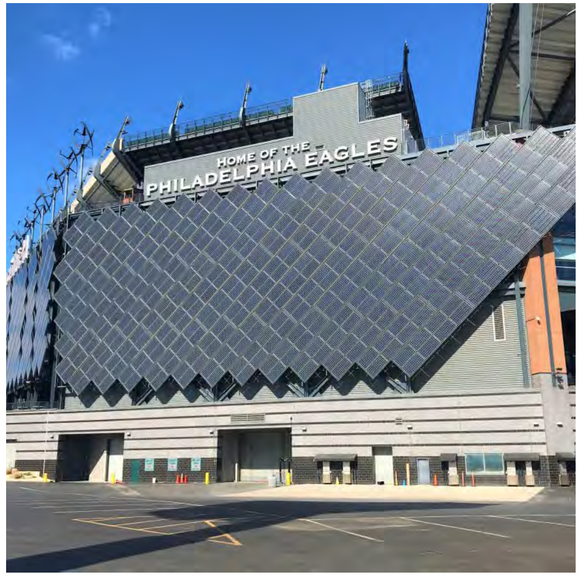
STRATEGIES FOR INNOVATION

- LEED or International Green Building designations
- Improve system efficiency
- Utilize digital twin for adaptability
- Create clean energy onsite
- Sequester carbon where possible

https://www.marriott.com/hotels/hotel-photos/phlcs-courtyard-philadelphia-south-at-the-navy-yard/



https://blog.bosch-si.com/bosch-iot-suite/a-primer-on-digital-twins-in-the-iot/virtual-factory/



https://www.greenbiz.com/article/professional-sports-needs-new-type-agent

http://www.mayorsfundphila.org/initiatives/urban-forest/

SOCIAL EQUITY

ACCESS

Sustaining people sustains the community and urban systems

- HEALTHY FOOD
- HEALTH CARE FACILITIES
- COMMUNITY BUILDING
- EDUCATION
- CHILDCARE
- NATURE
- MOBILITY
- DIVERSE JOB OPPORTUNITIES
- ARTS AND LEISURE

SOCIAL EQUITY

ENVIRONMENTAL JUSTICE

THE SUSTAINABILITY FRAMEWORK

RESILIENCE

Navy Yard is vulnerable to flooding

Increase permeability

Development erased League Island

Reclaim riparian edges

AVs will change the built environment

Create new spaces for stewardship

CARBON NEUTRALITY

AV driven development needs energy

Create clean energy onsite

Human resource demand must be met

Increase efficiency of buildings and infrastructure

Complete neutrality is difficult in industry

Sequester excess

SOCIAL EQUITY

AVs promote mobility

Ensure access to services and resources

New innovation has externalities

Mitigate environmental hazards

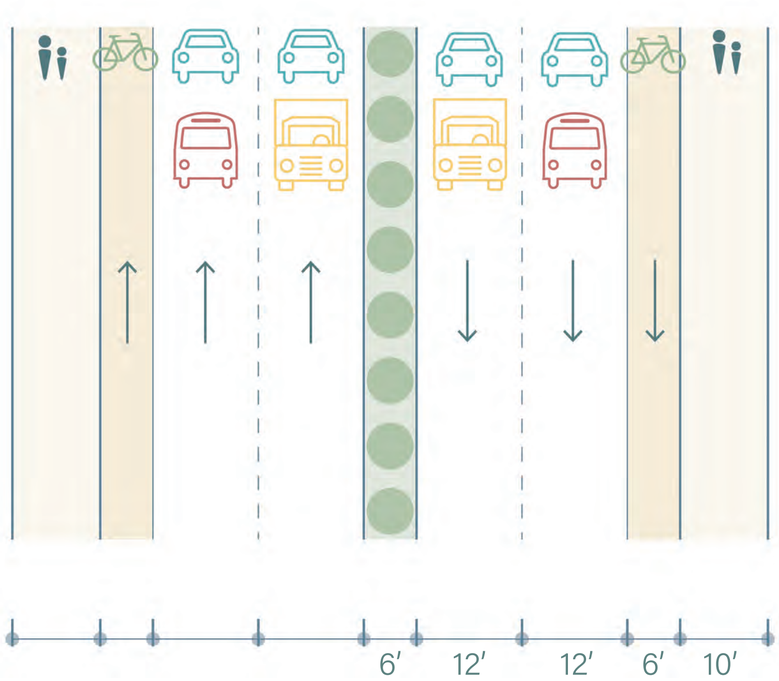
AVs are a cost prohibitive technology

Protect affordability

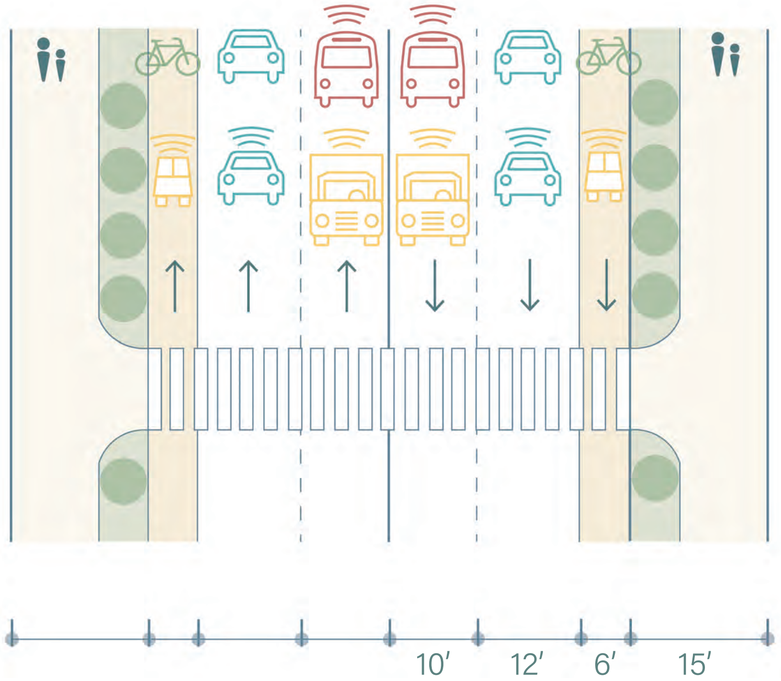
THE MOBILITY PLAN

FUTURE ROAD MAP

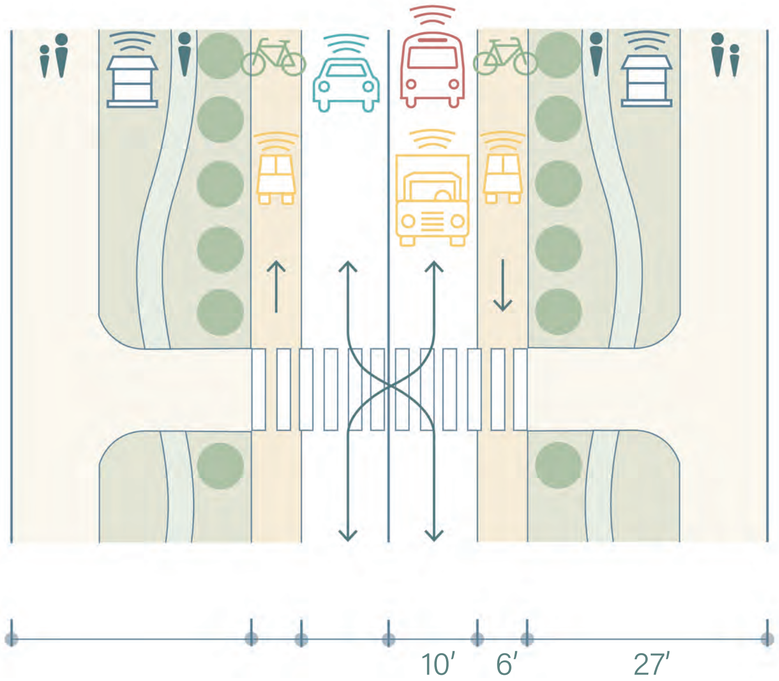
THREE TIME PERIODS OF THE AV+ DEVELOPMENT



2017-2022
Now



2023-2027
Short Term Future



2027-2040
Long Term Future

Private Vehicle

Auto Private Vehicle

Shuttle Bus

Autonomous Shuttle Bus

Truck

Autonomous Truck

Autonomous Delivery Vehicle

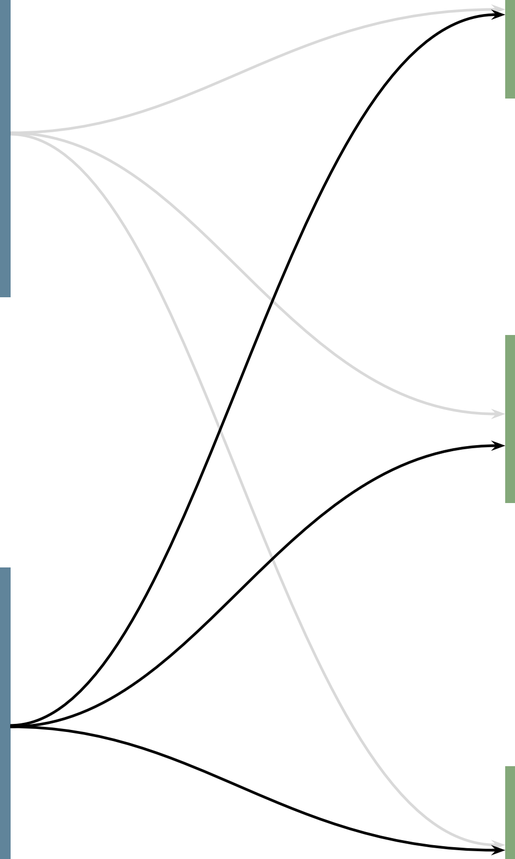
Bikes

Pedestrian

PLANNING SCENARIOS

Scenario 1: Private AV Driven Development
Promote AV+ to improve the private travel mode, and public transportation is the auxiliary mode

Scenario 2: Integrated Mobility Driven Planning
The system develops automatic public transportation and reduces private vehicles



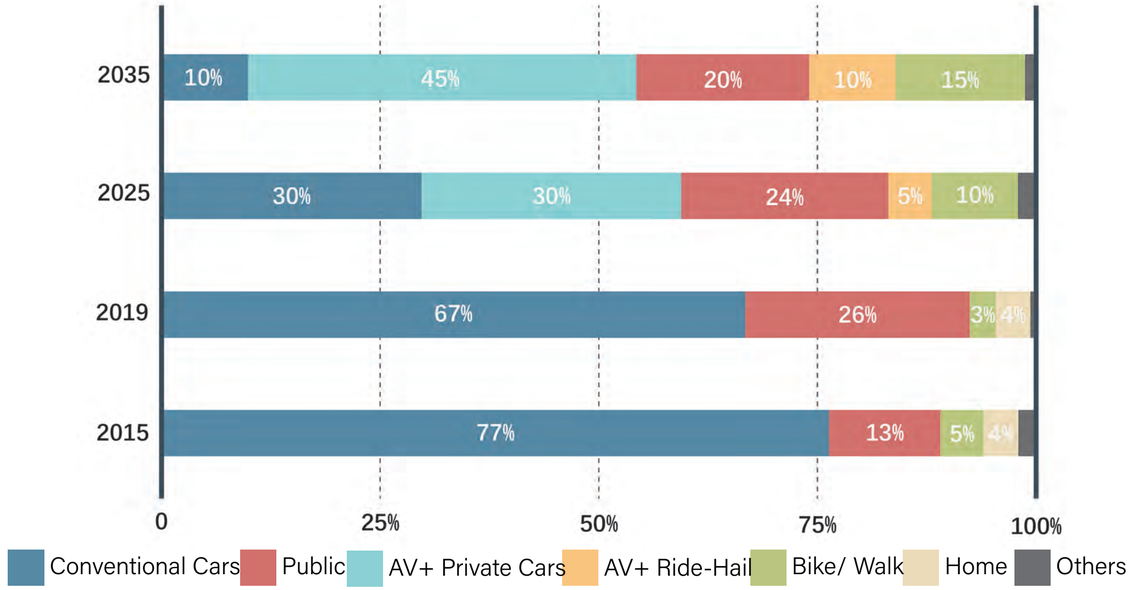
Transportation
(Commuting Efficiency; Congestion; Long term Development...)

Urban Pattern
(Street Design; Parking Space; Architecture Footprints...)

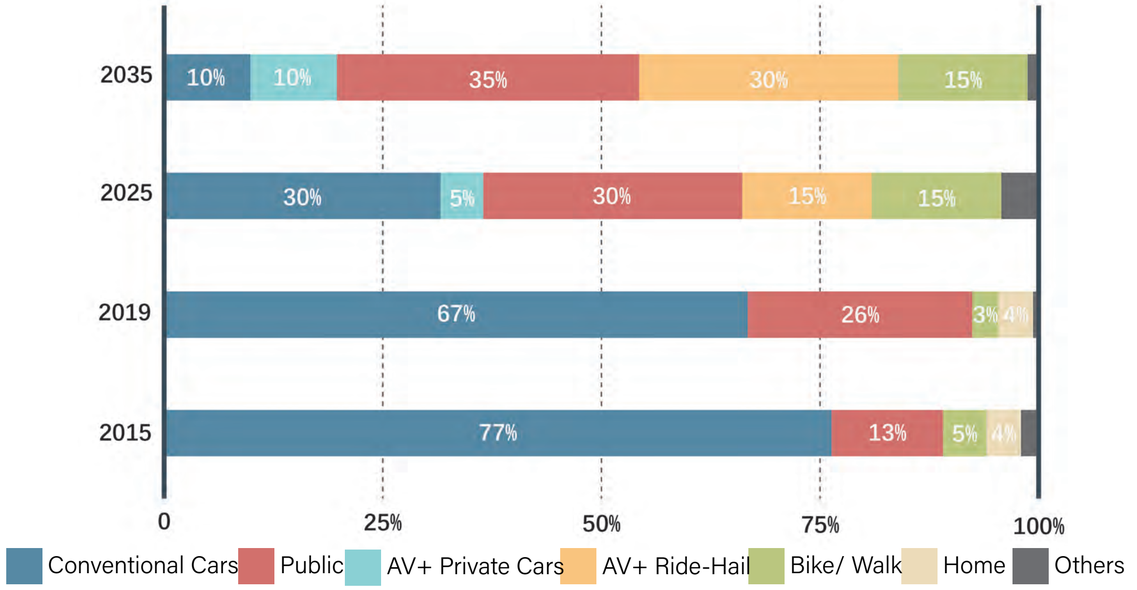
Energy Consumption
(Fuel Saving; Trip Cost...)

TRANSPORTATION

Scenario 1: AV+ Private Vehicle



Scenario 2: AV+ Public Transportation



Commuting Time Comparison from Italian Market to Navy Yard Gateway:

	Free Flow (4AM)	Congested (9AM)	Increase
Car Commute Time (min)	10	20	100%
Bus Commute Time (min)	12	31	158%
Mode Differential	2	13	550%

Benefits of Public Transportation:

1. Improves Road Congestion;
2.Improves Community Mobility;
3. Provides an Equitable Transportation System

URBAN PATTERN

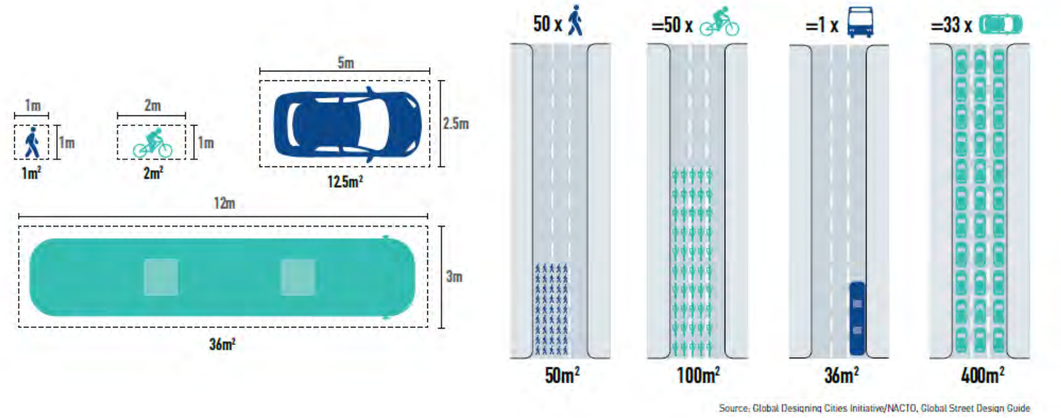
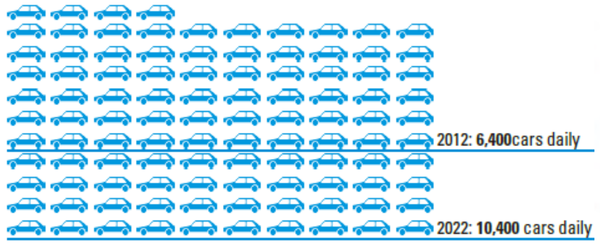
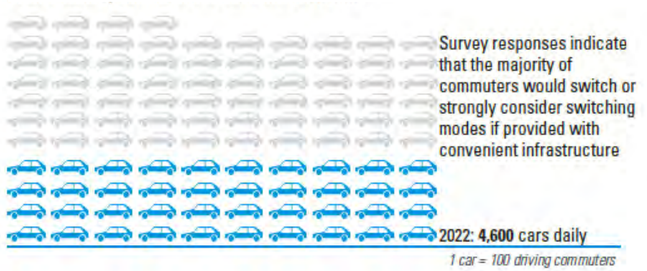


Image Source: Center City Reports: KEEP PHILADELPHIA MOVING

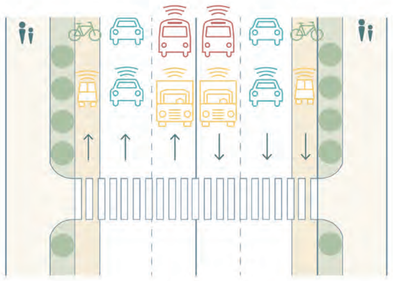
Without Alternative Transportation Investments



Develop Public Transportation and Bicycle System



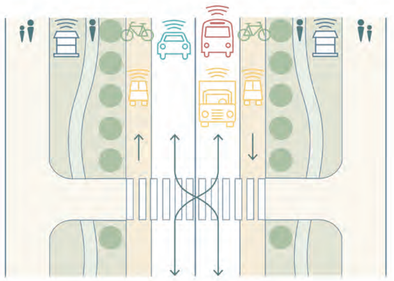
Scenario 1: AV+ Private Vehicle



Streets need more motorized lanes, squeezing pedestrian and bicycle space

The site needs to provide more parking lots for private AVs, squeezing the open green space in the site.

Scenario 2: AV+ Public Transportation



Streets release about 63,000 sqft. of extra space per mile for the pedestrians.

Saved more than 4,000 parking spots, equivalent to the area of two large parking lots. Create more open green spaces for tourists.

ENERGY CONSUMPTION

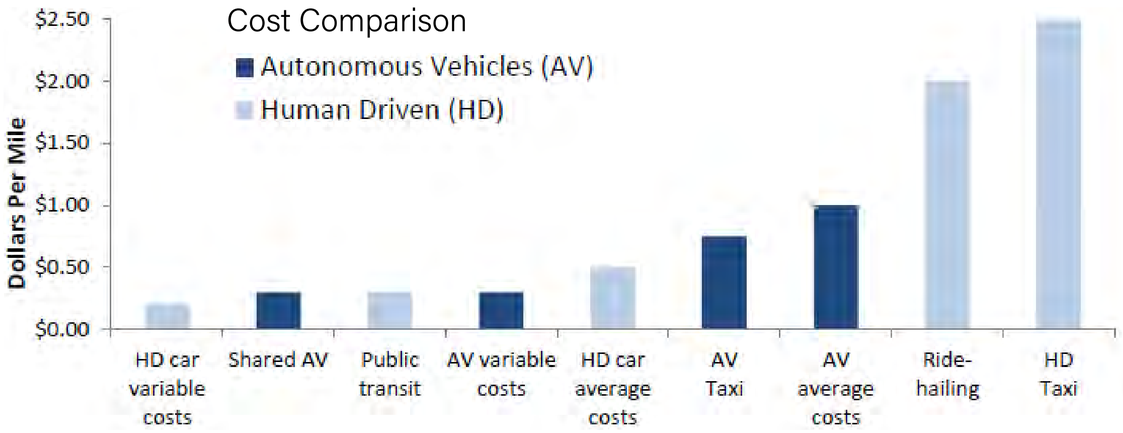
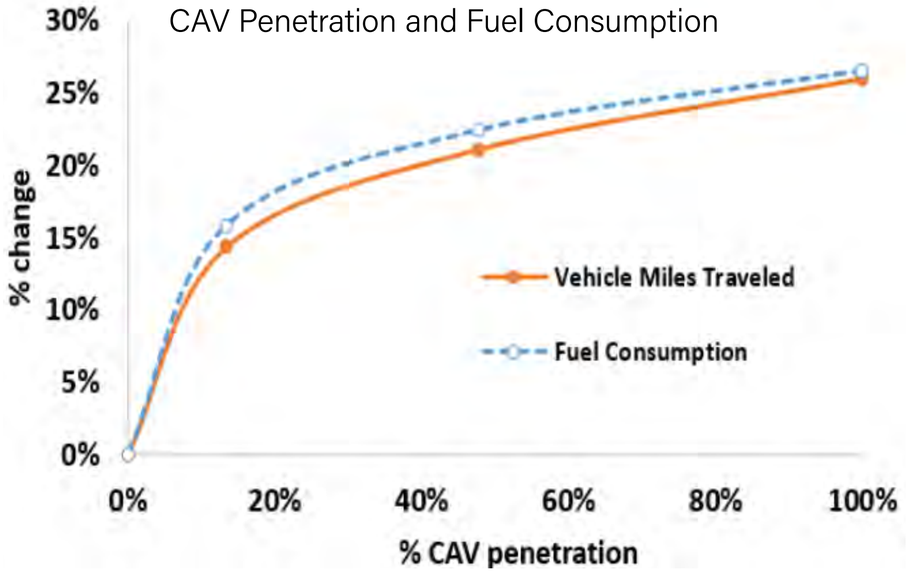


Image Source: Autonomous Vehicle Implementation Predictions Implications for Transport Planning
Vehicle Electrification Impacts on Energy Consumption for Different Connected- Autonomous Vehicle Scenario Runs



Scenario 1: AV+ Private Vehicle

With 100% CAV penetration, the average fuel consumption decreases by 1.5%.

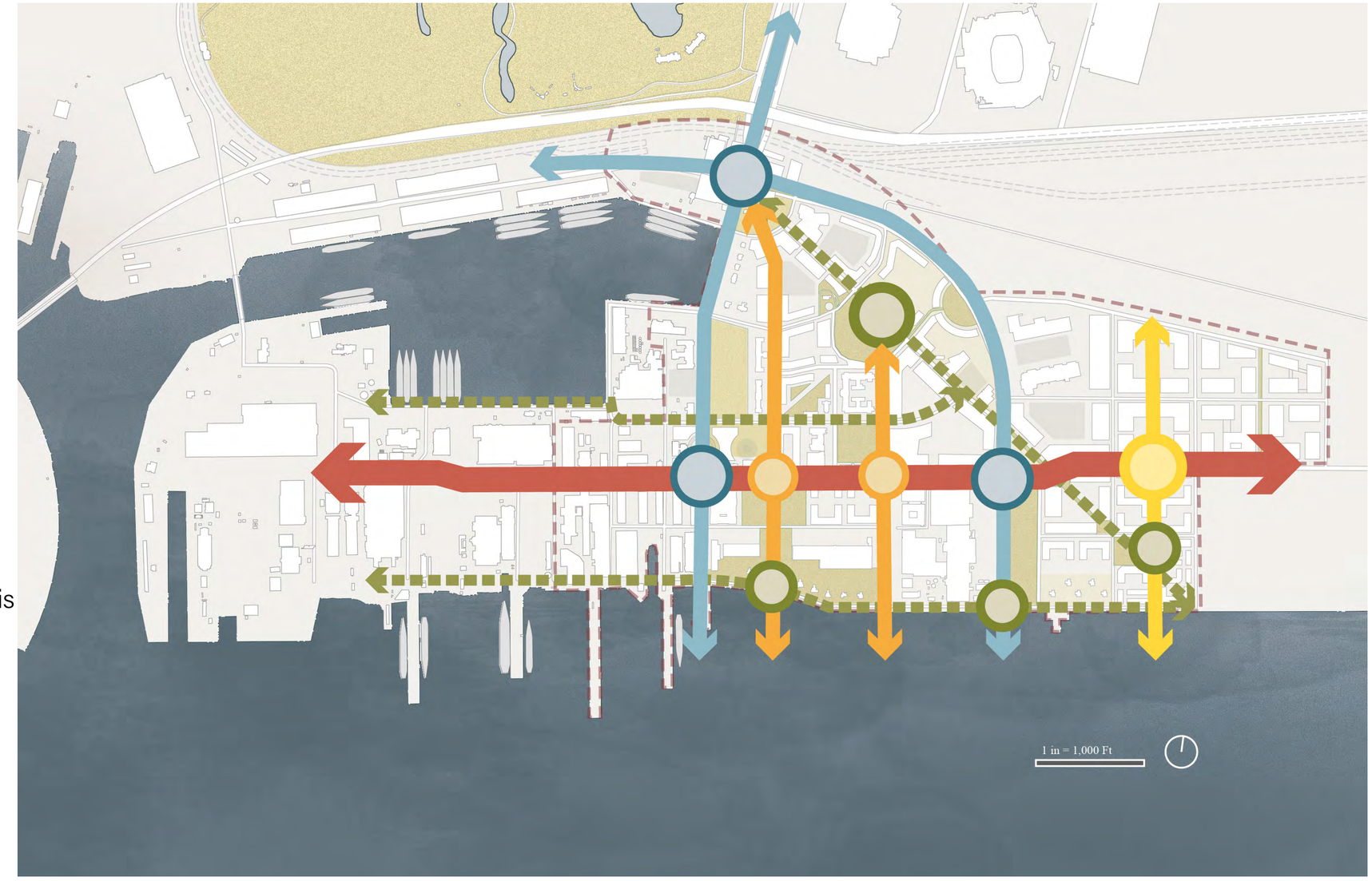
Scenario 2: AV+ Public Transportation

Although the one-way energy consumption is greater, the efficiency of the public transportation system is **11** times that of private AVs on average during the peak commuting period and carrying the same number of people.

CIRCULATION SYSTEM

AXIS PLAN

- One main east-west axis and several multifunctional north-south axis.
- We combine transportation systems according to different axes to determine various transportation system paths and important stations, as well as station capacity.



Potential Nodes

Transportation/Logistics Axis

Transportation Axis

Green Axis

Cultural/Historical Axis

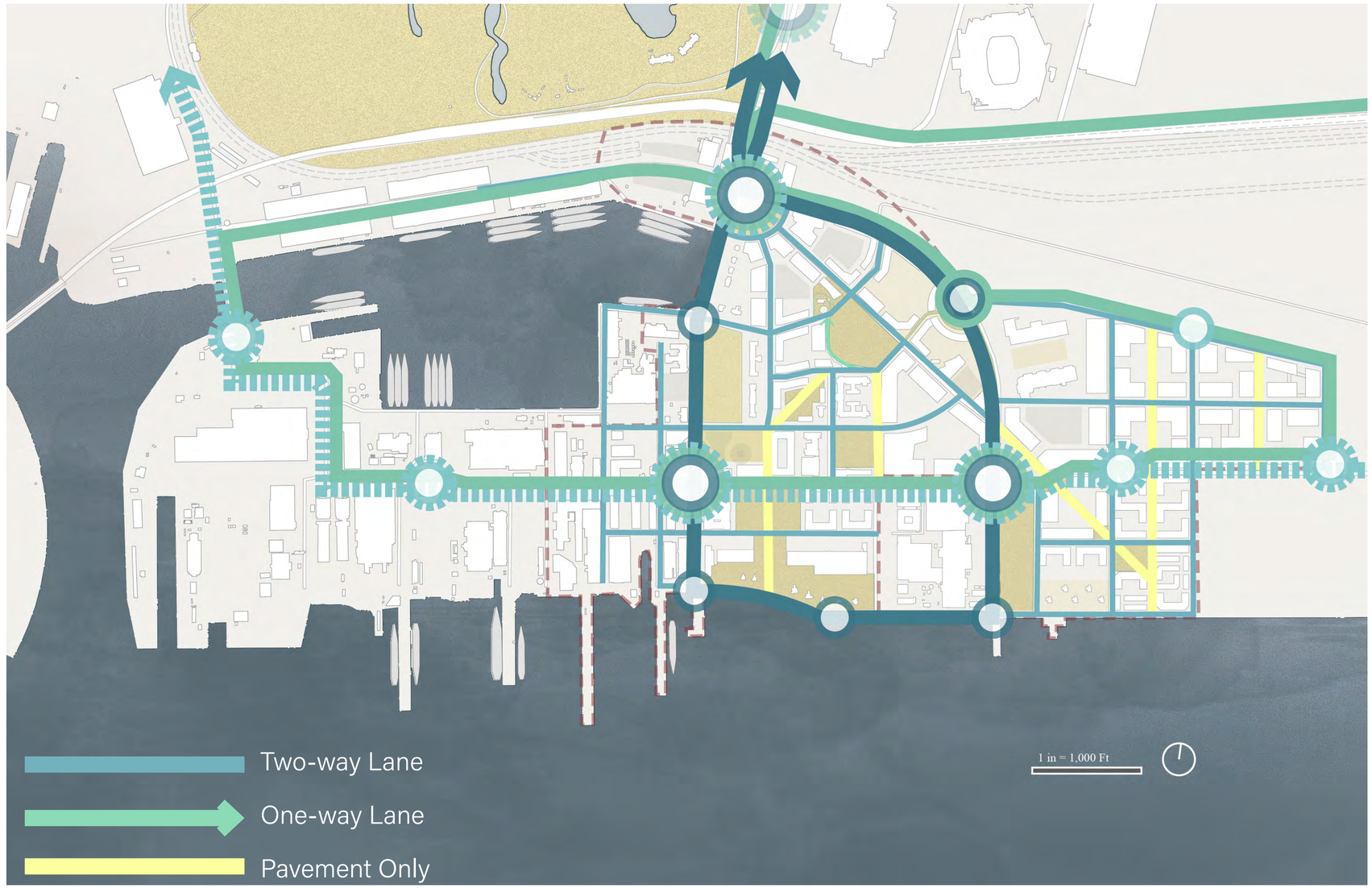
Business/Industrial Axis

CIRCULATION SYSTEM

PRIVATE VEHICLE TRANSPORTATION SYSTEM

Image source: https://waymo.com/waymo-driver/

Image source: https://www.forbes.com/sites/alanohnsman/2021/01/29/self-driving-tech-goes-to-transit-with-new-flyers-autonomous-electric-bus/

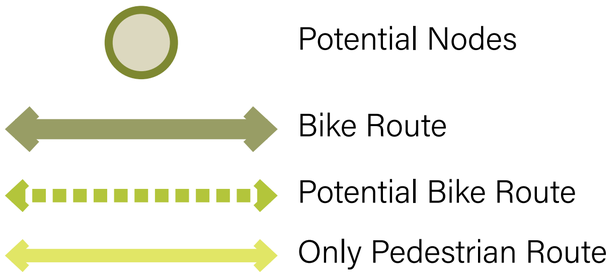


CIRCULATION SYSTEM

BIKE/ WALKING SYSTEM

Image source: https://www.forbes.com/sites/alanohnsman/2021/01/29/self-driving-tech-goes-to-transit-with-new-flyers-autonomous-electric-bus/

The shared bicycle node map is mainly based on a sustainable design map, combined with the green corridors we designed in advance to create a scenic and environmentally friendly travel route.



CIRCULATION SYSTEM

LOGISTIC/ MANAGEMENT SYSTEM

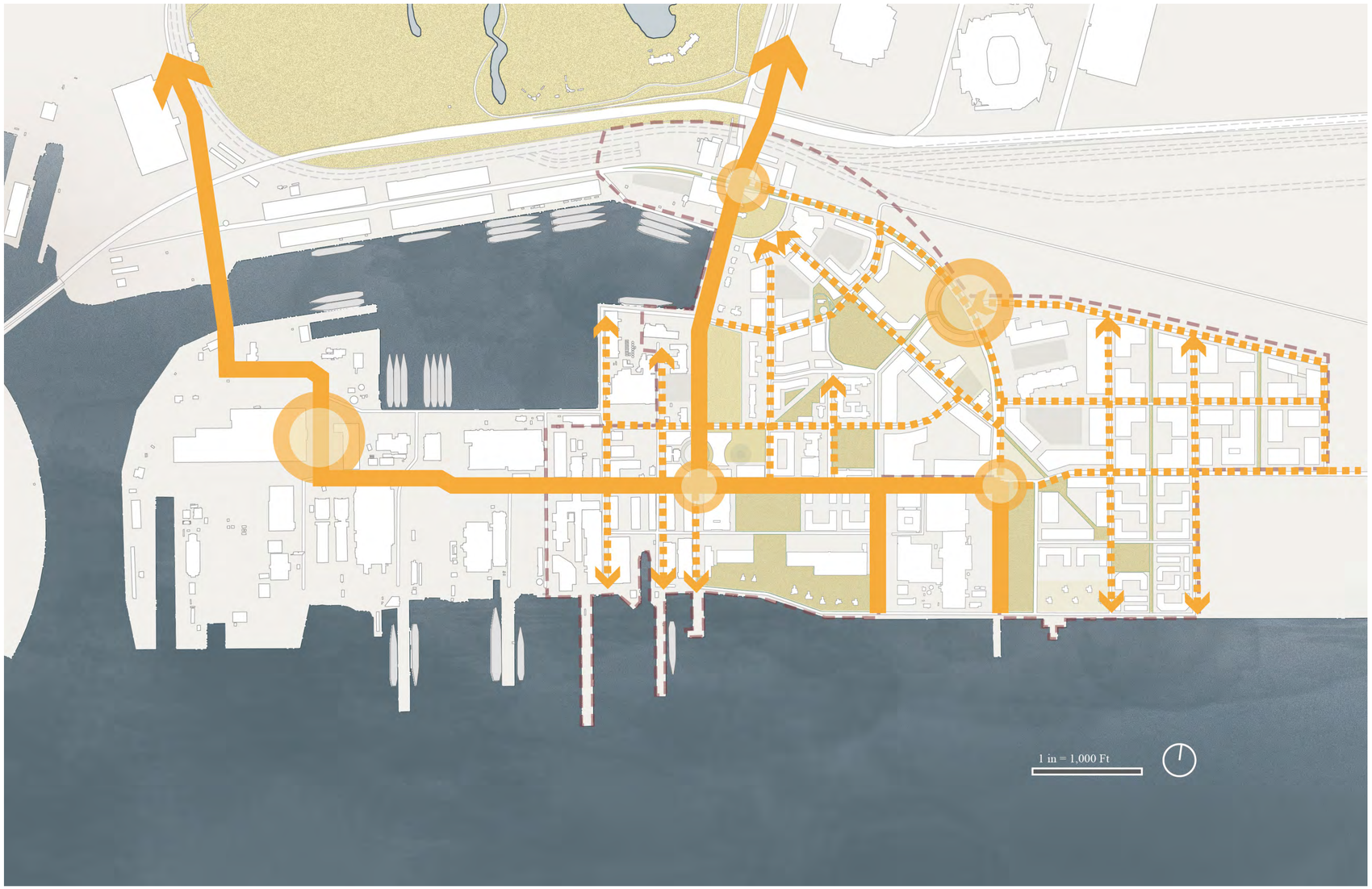
Image source: https://www.bbc.com/news/business-56332388

Image source: https://www.therobotreport.com/nuro-r2-autonomous-delivery-vehicle-gets-green-light/

Potential Nodes

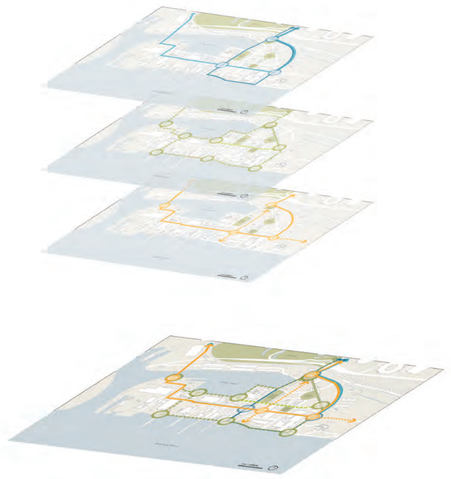
AV+ Delivery Truck Route

Delivery AV+ Route



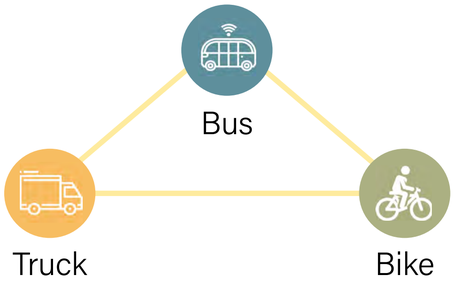
CIRCULATION SYSTEM

OVERLAY ALL SYSTEM/ FILTER NODES



Combining all the above fixed route transportation systems, use the following theory to filter nodes:

- Walkability Range;
- Commuting Time Truck

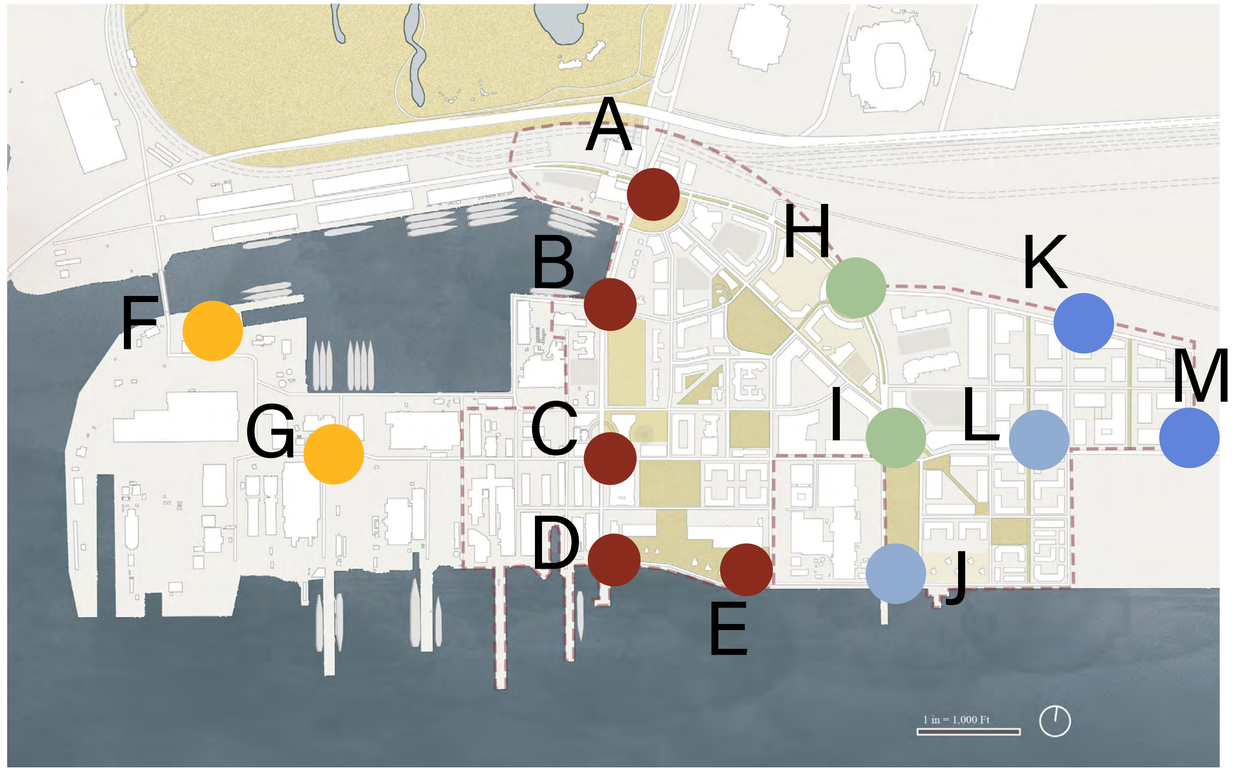


CIRCULATION SYSTEM

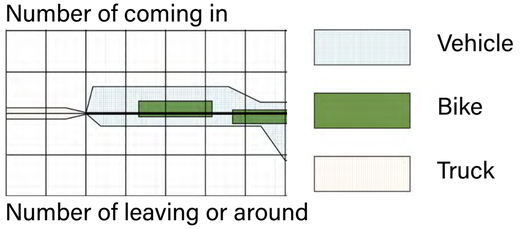
WALKABILITY RANGE: BIKING SYSTEM

"It appears that no matter how station-spacing increases, 50 percent of the people will not walk more than 6 minutes or 0.3 miles to an unattractive place.
"An average walk is about 13,200 feet per hour or 220 feet per minute. On this basis, a 5-minute walk would be 1,100 feet and a 10-minute walk would be 2,200 feet."

COMMUTING TIME TRUCK



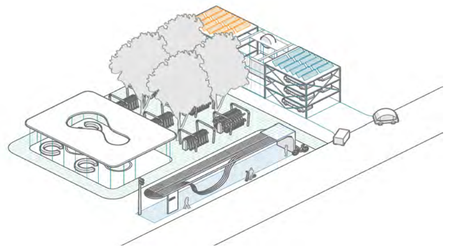
- Frequently Used Station
- Commonly Used Station
- Moderate frequency Station
- Less Commonly Used Station
- Seldom Busy Station



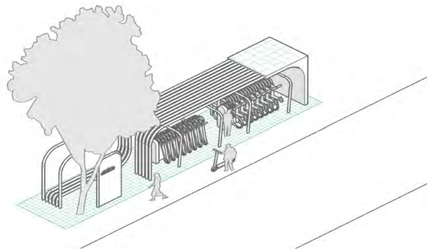
CIRCULATION SYSTEM

FINAL CIRCULATION MAP

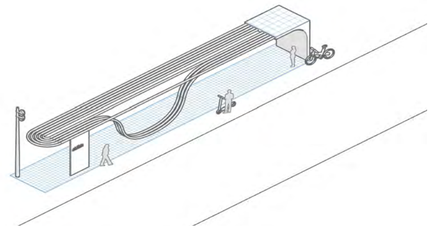
Station Level 1: mixed-use transit hub

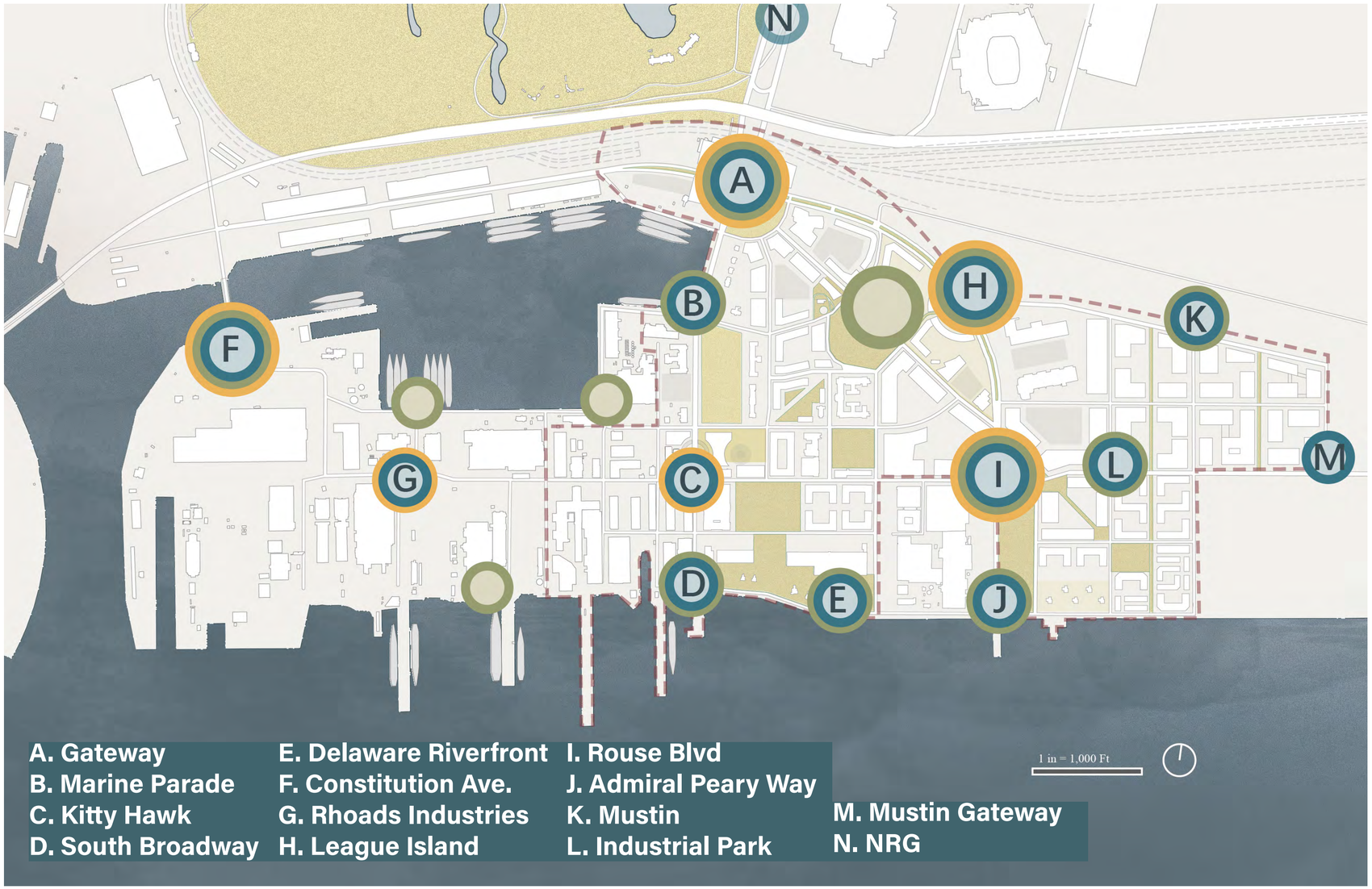


Station Level 2: mixed-use station

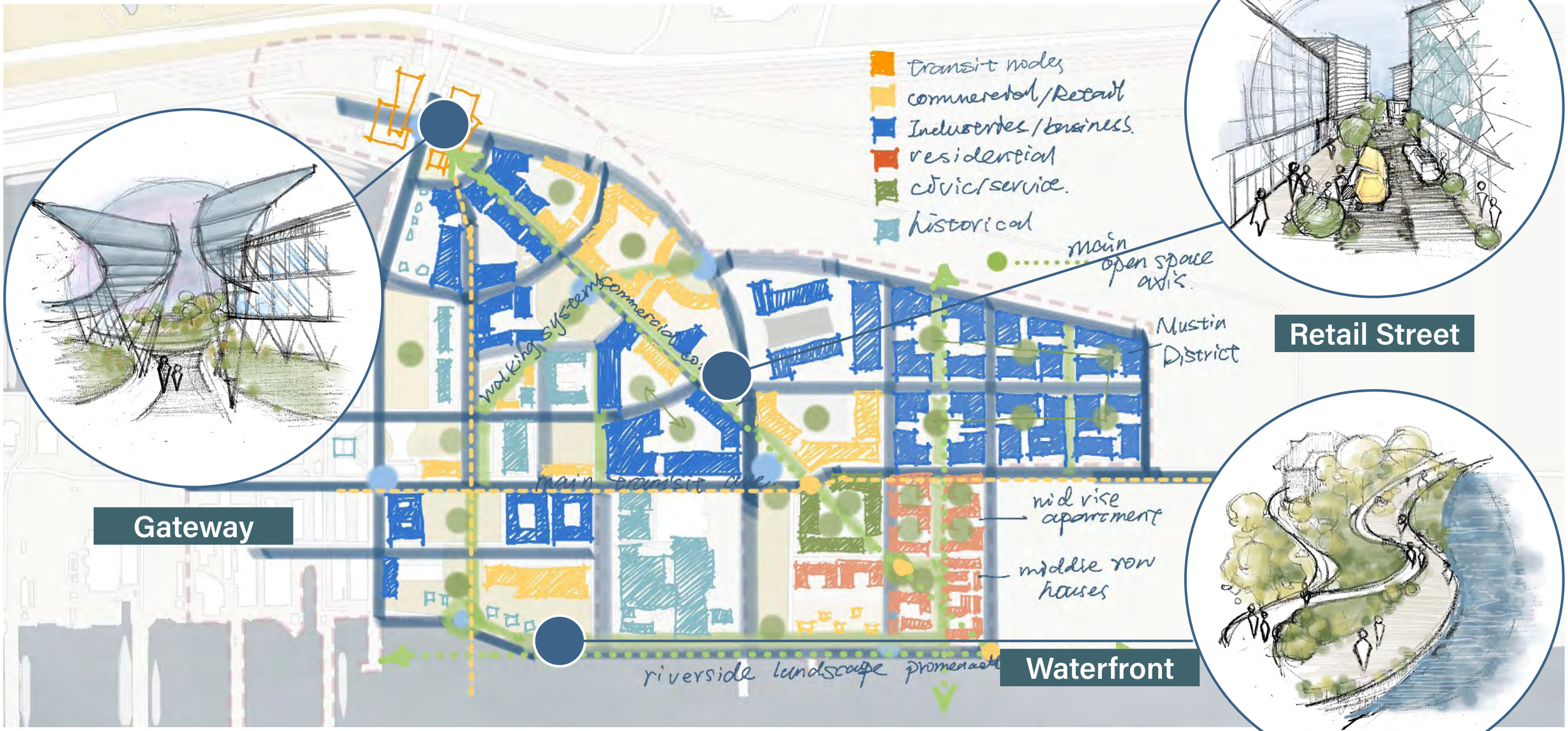


Station Level 3: bus stop

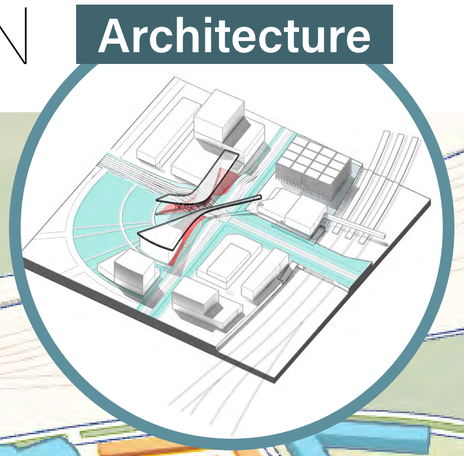


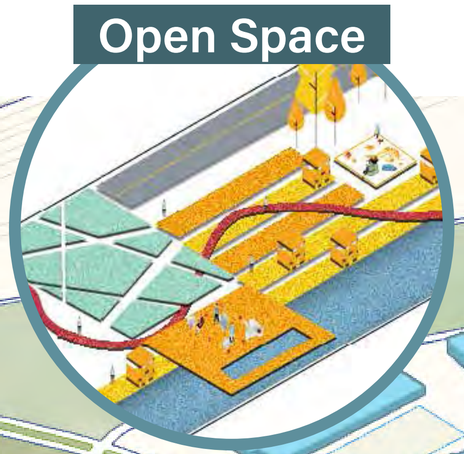


MASTER PLAN CONCEPT



MASTER PLAN


Architecture


Open Space

Industrial
Residential
Commercial/ Retail
Mix-use
Civic/ Service

Parking

Streets

1

STREETS

PARKING

ARCHITECTURE

PUBLIC SPACE

DIGITAL INFRASTRUCTURE

SUSTAINABILITY IMPLEMENTATION

STREETS

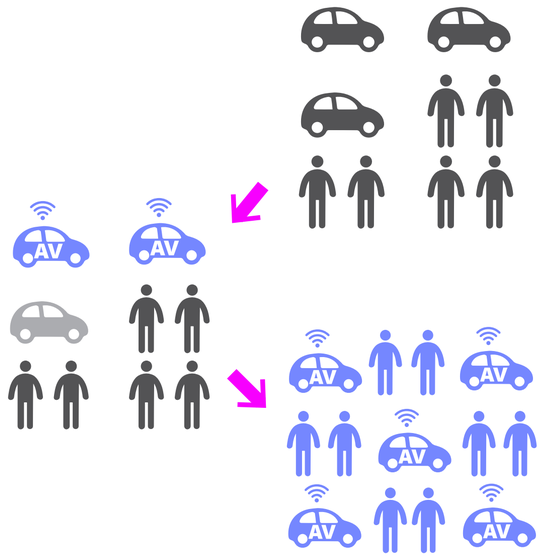
DESIGNING FOR THE PEDESTRIAN EXPERIENCE

Transferring ownership of steets back to pedestrians.

- Shared streets
- Curbless streets
- Narrower road footprint

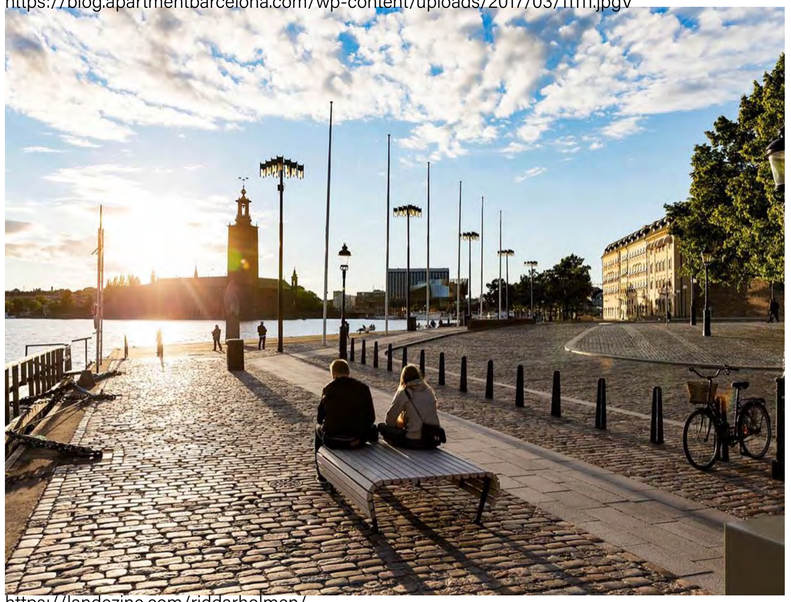
Introducing Autonomous Circulation to streets

- AV only streets
- AV Drop-off areas
- Ride hail stations



https://blog.apartmentbarcelona.com/wp-content/uploads/2017/03/11111.jpgV

Image source: The Landscape Tree Company

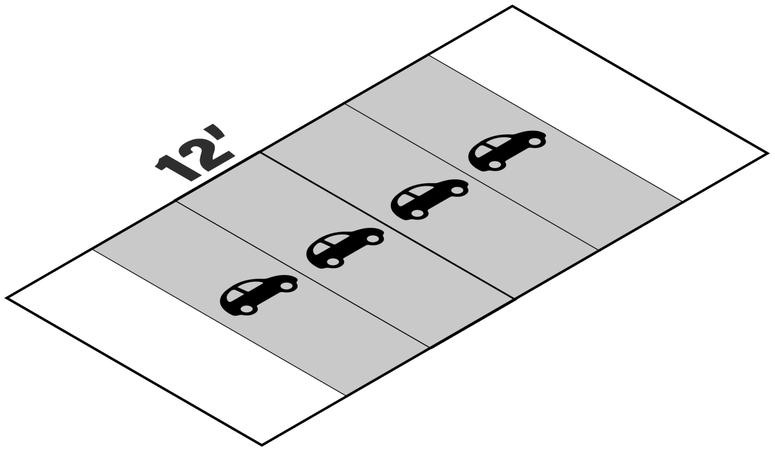


https://landezine.com/riddarholmen/

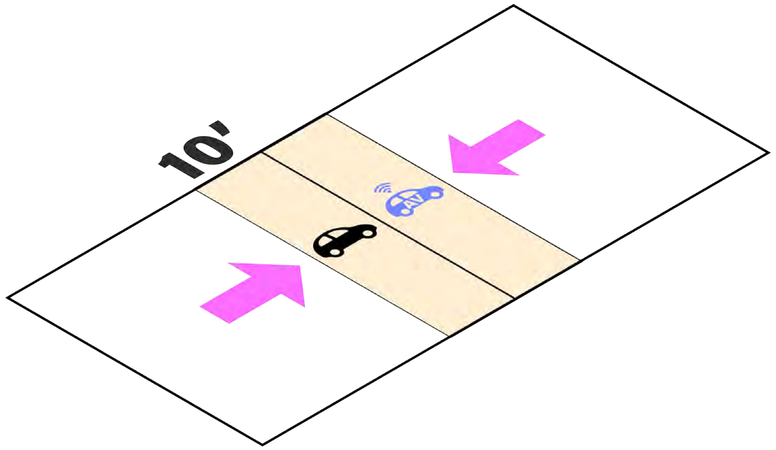
Image source: https://landezine.com/bus-rapid-transit-brt-place-thorel-by-espace-libre/

STREET TYPOLOGY DIAGRAM

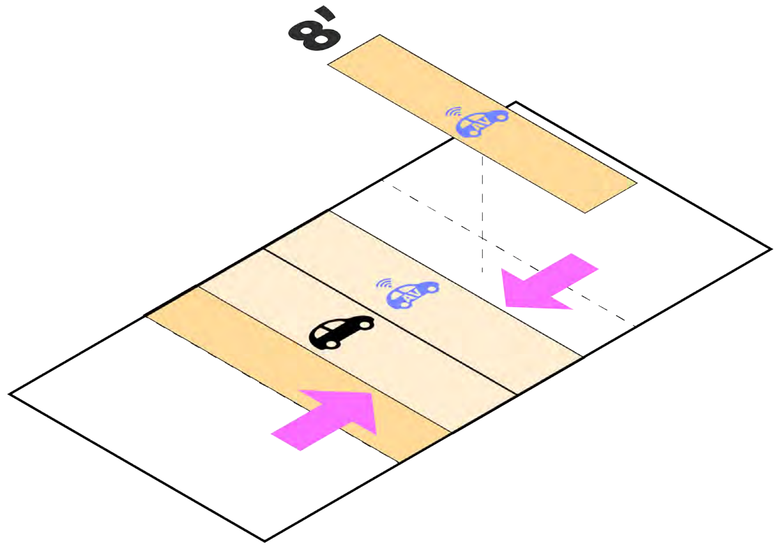
CONVENTIONAL STREET



ROAD WIDTH REDUCTION

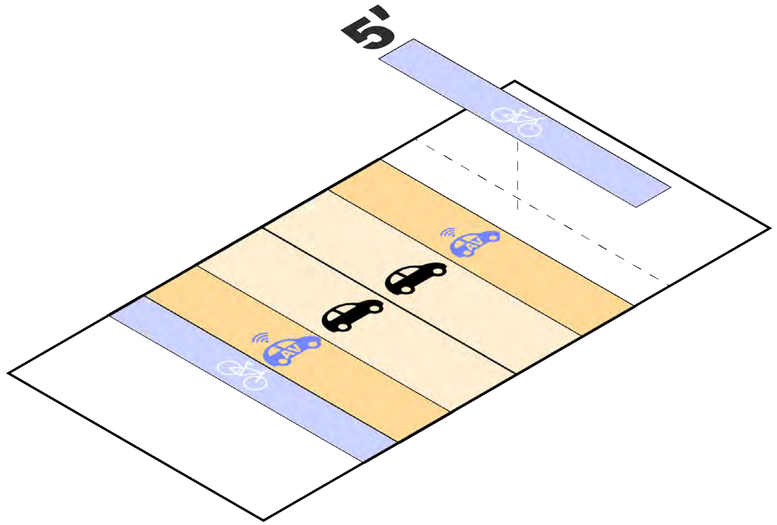


FURTHER REDUCTION & AV ONLY LANE

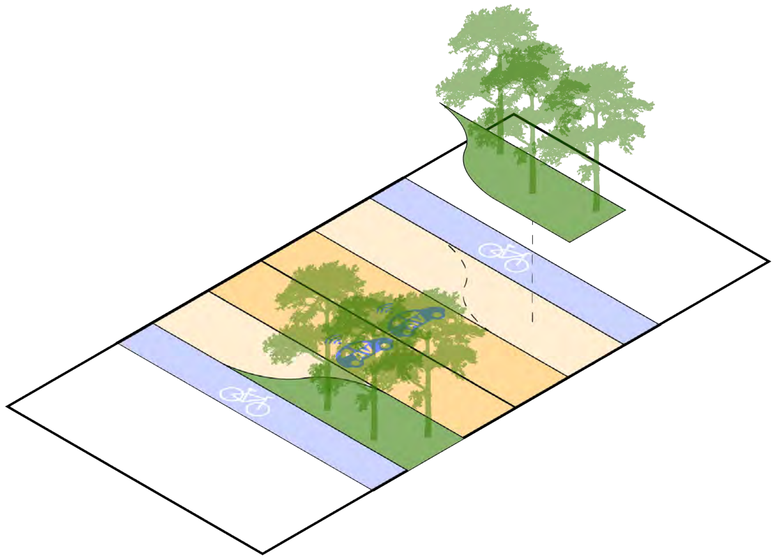


STREET TYPOLOGY DIAGRAM

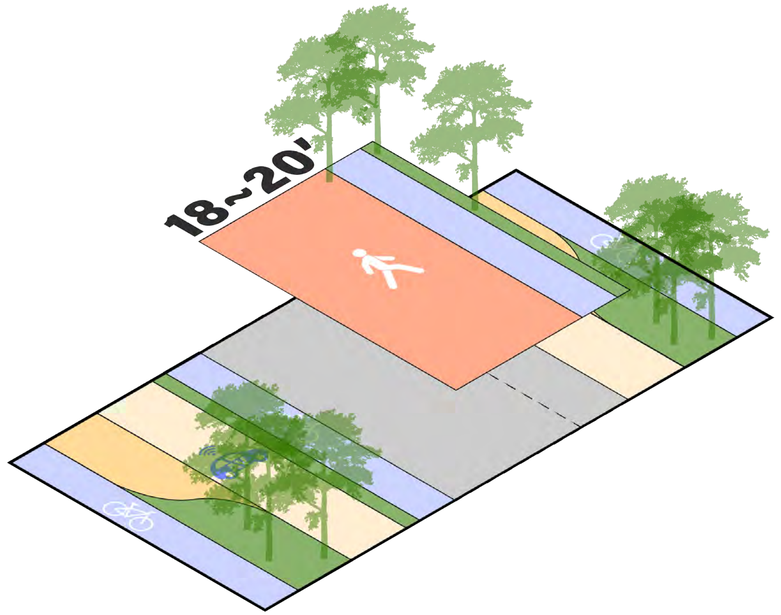
ADDITION OF BIKE PATHS



ADDITION OF SUSTAINABLE FEATURES



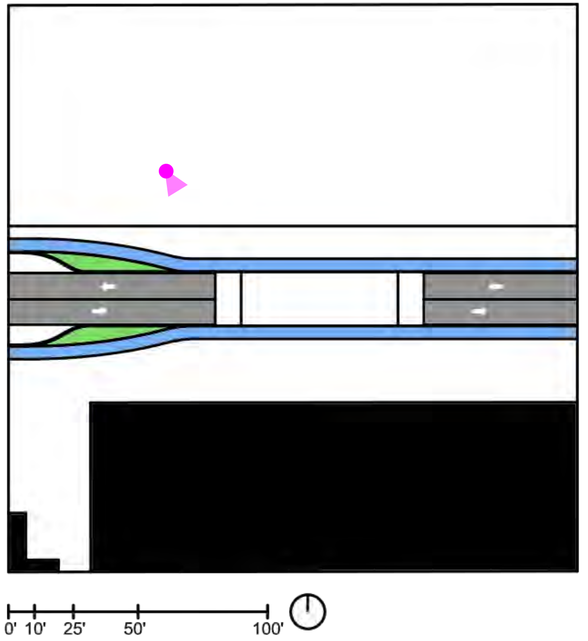
ROADWAY REDESIGN FOR PEDESTRIANS



TYPOLOGY: TWO WAY STREET

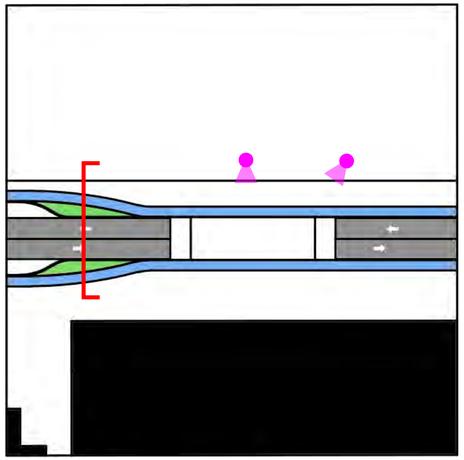
KITTY HAWK AVENUE

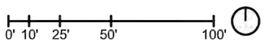
The two-way street typology applies road width reductions to allow for all vehicle types, with eventual switch to all AV in the future.



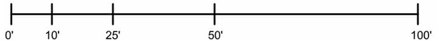
TYPOLOGY: TWO WAY STREET

KITTY HAWK AVENUE





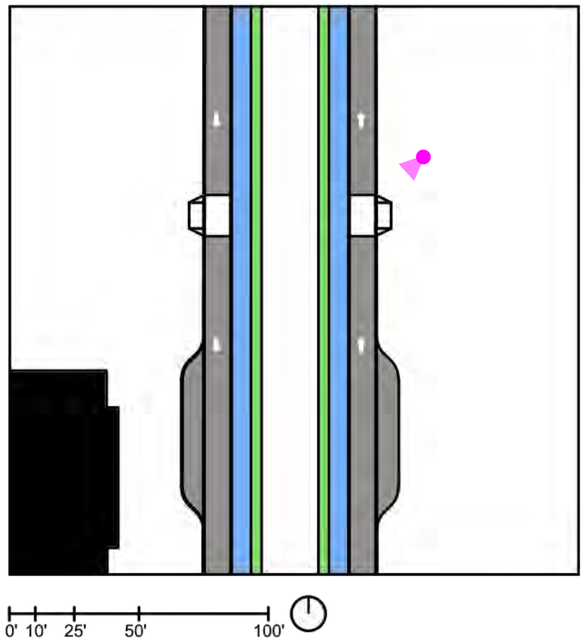
- Elevated crosswalks, bioswales, and limited road width allows for slower vehicle speed and pedestrian safety.

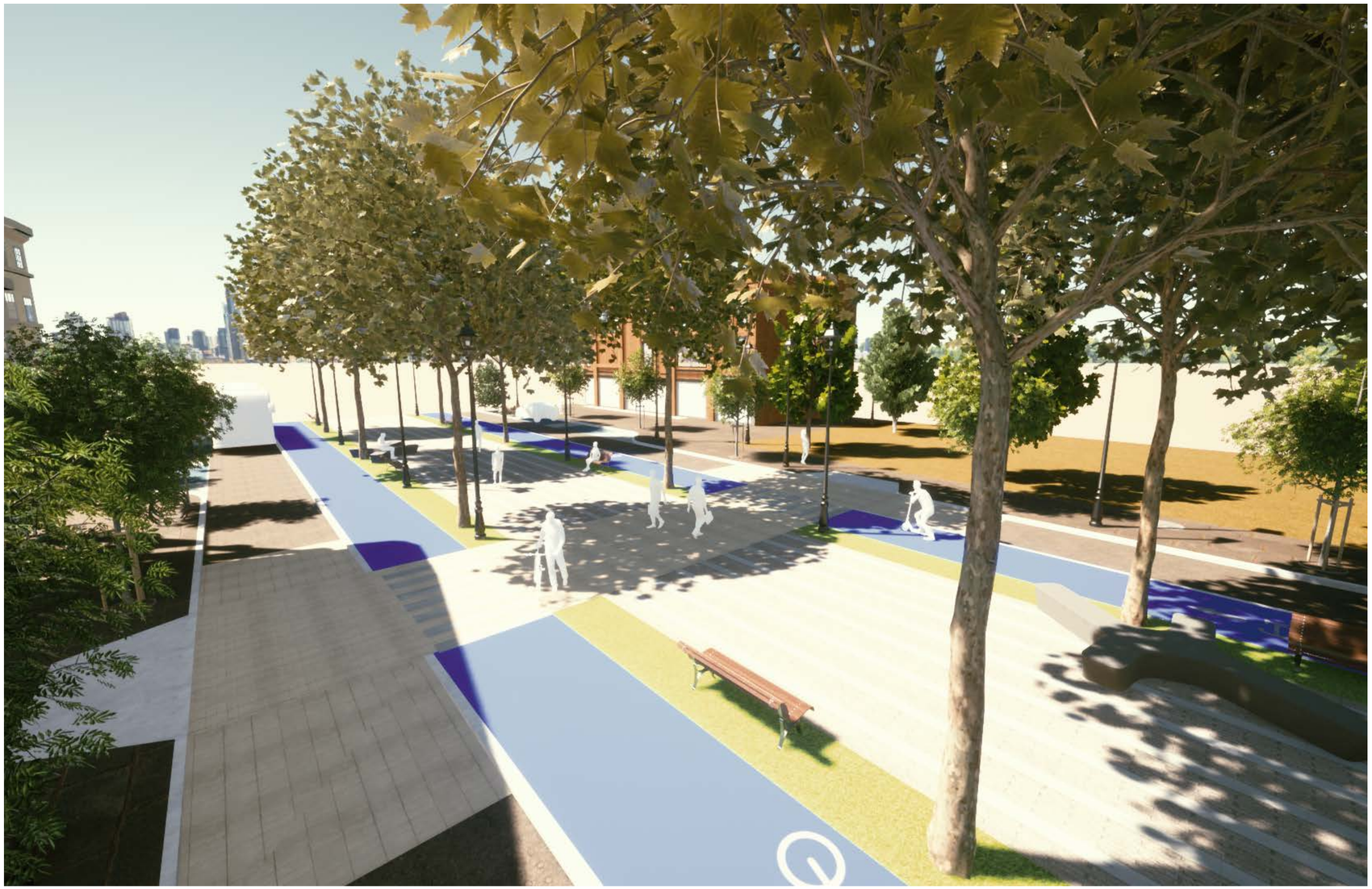


TYPOLOGY: STREET PROMENADE

BROAD STREET

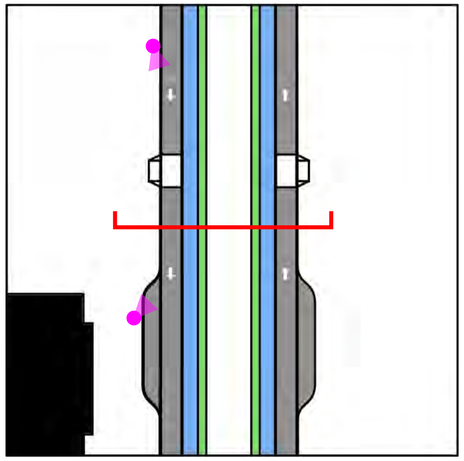
Reclamation of road footprint into a central pedestrian promenade. Roadways are pushed off to the side to maximize pedestrian walking space.

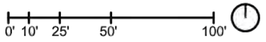




TYPOLOGY: STREET PROMENADE

BROAD STREET



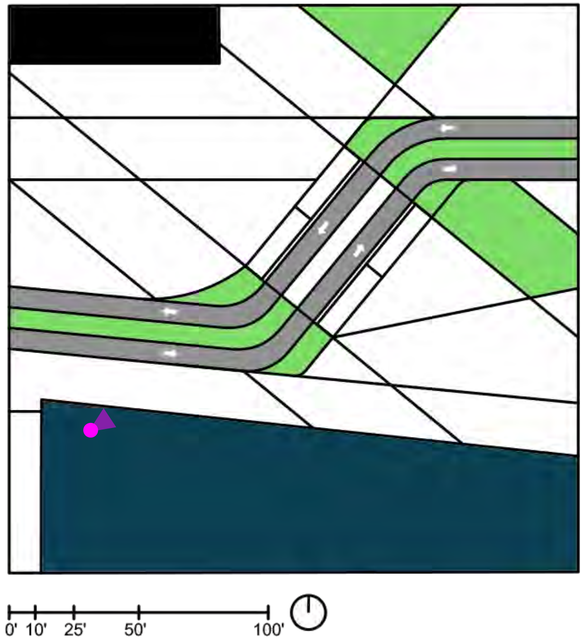


- Planted trees enhance the walking experience.
- Use of permeable paving to reduce sheet flow of stormwater on site.

TYPOLOGY: WATERFRONT

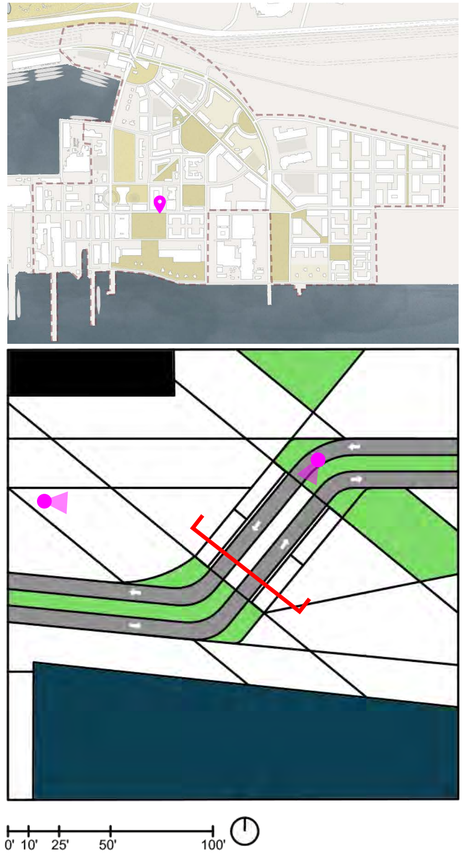
PROMENADE & TRANSIT HUB

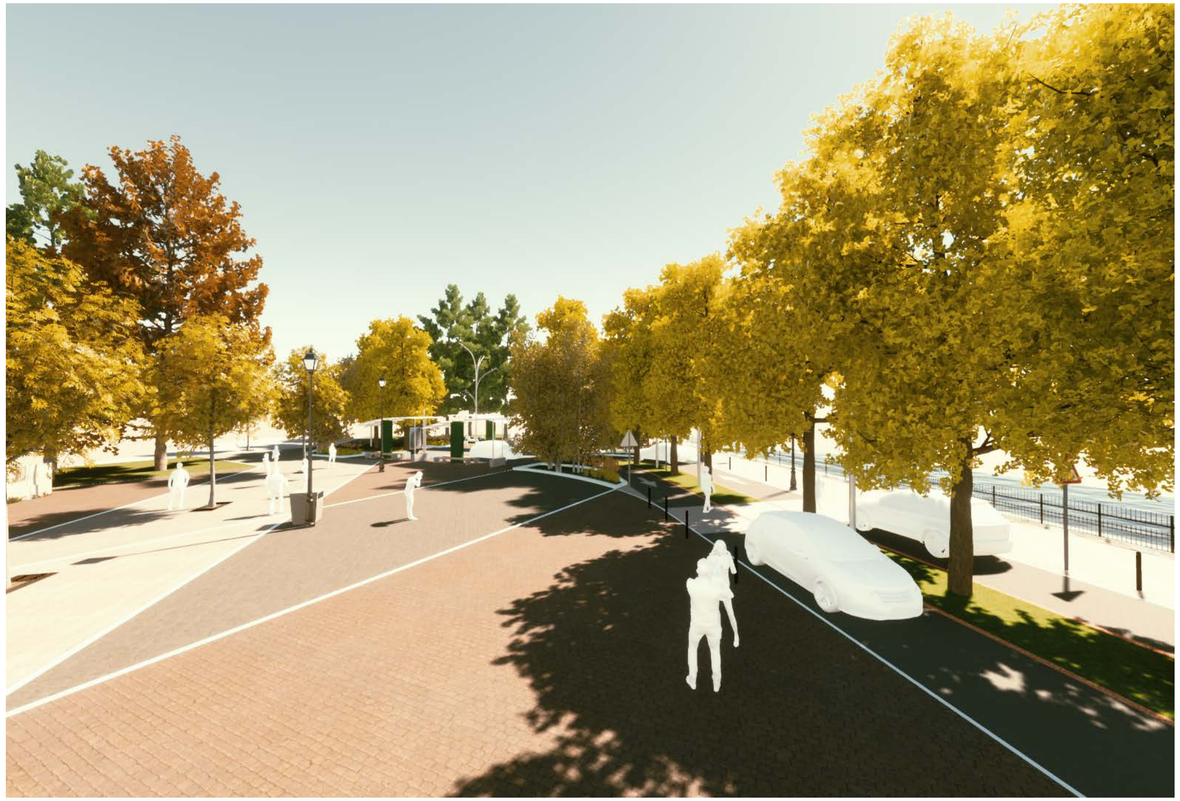
The use of curbless streets allows for lower vehicular traffic throughout this mainly pedestrian zone.



TYPOLOGY: WATERFRONT

PROMENADE & TRANSIT HUB



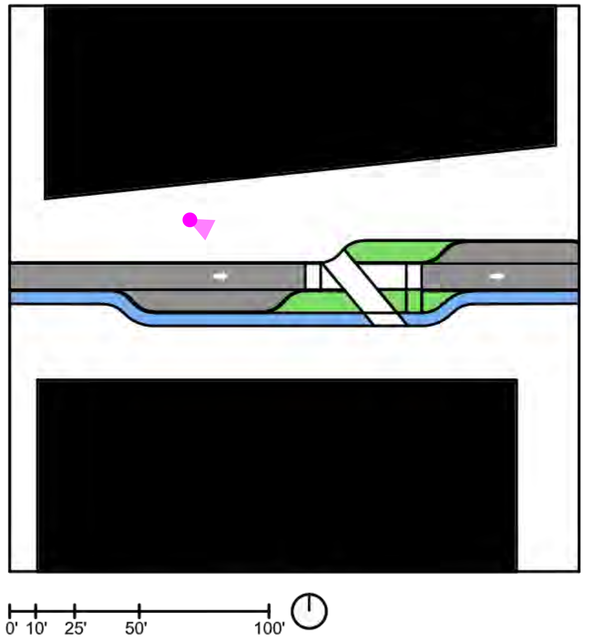


- Roadways are limited to AV only roads.
- Waterfront promenades and shade tree plantings expand the street into a plaza-like space.

TYPOLOGY: COMMERCIAL CORRIDOR

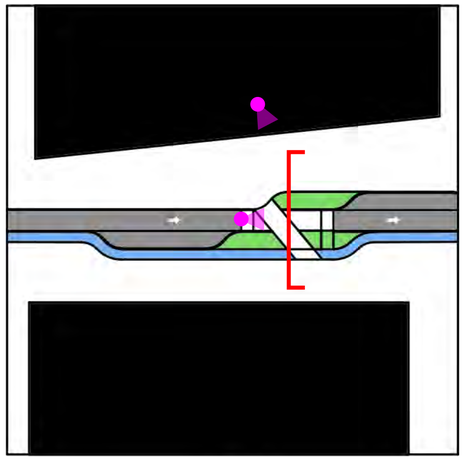
COMMERCIAL ONE WAY STREET

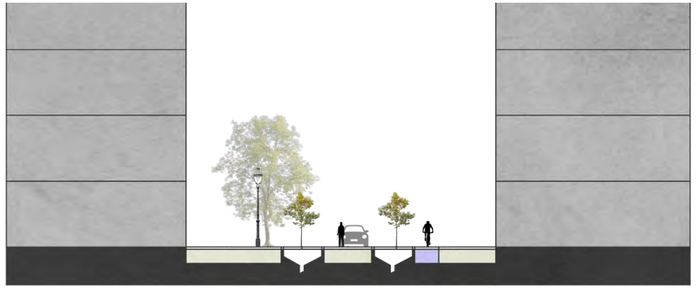
Street typology for limited footprints and streets between business/industrial/ commercial buildings.



TYPOLOGY: COMMERCIAL CORRIDOR

COMMERCIAL ONE WAY STREET





- Use of bioswales and permeable paving allow for sustainable collection of stormwater
- Narrow road widths discourage speeding.

2

STREETS

PARKING

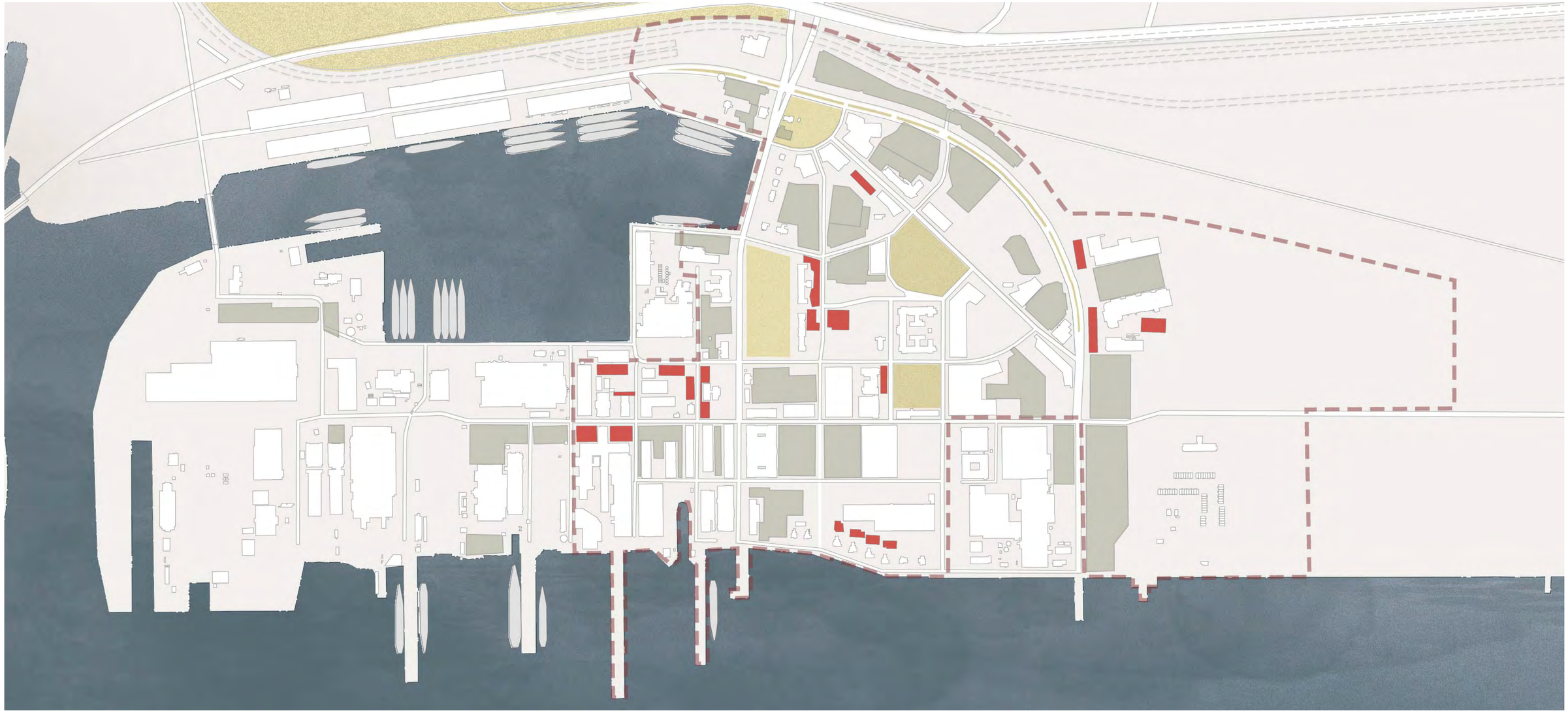
ARCHITECTURE

PUBLIC SPACE

DIGITAL INFRASTRUCTURE

SUSTAINABILITY IMPLEMENTATION

EXISTING & SHORT-TERM PARKING



EXISTING PARKING LOT

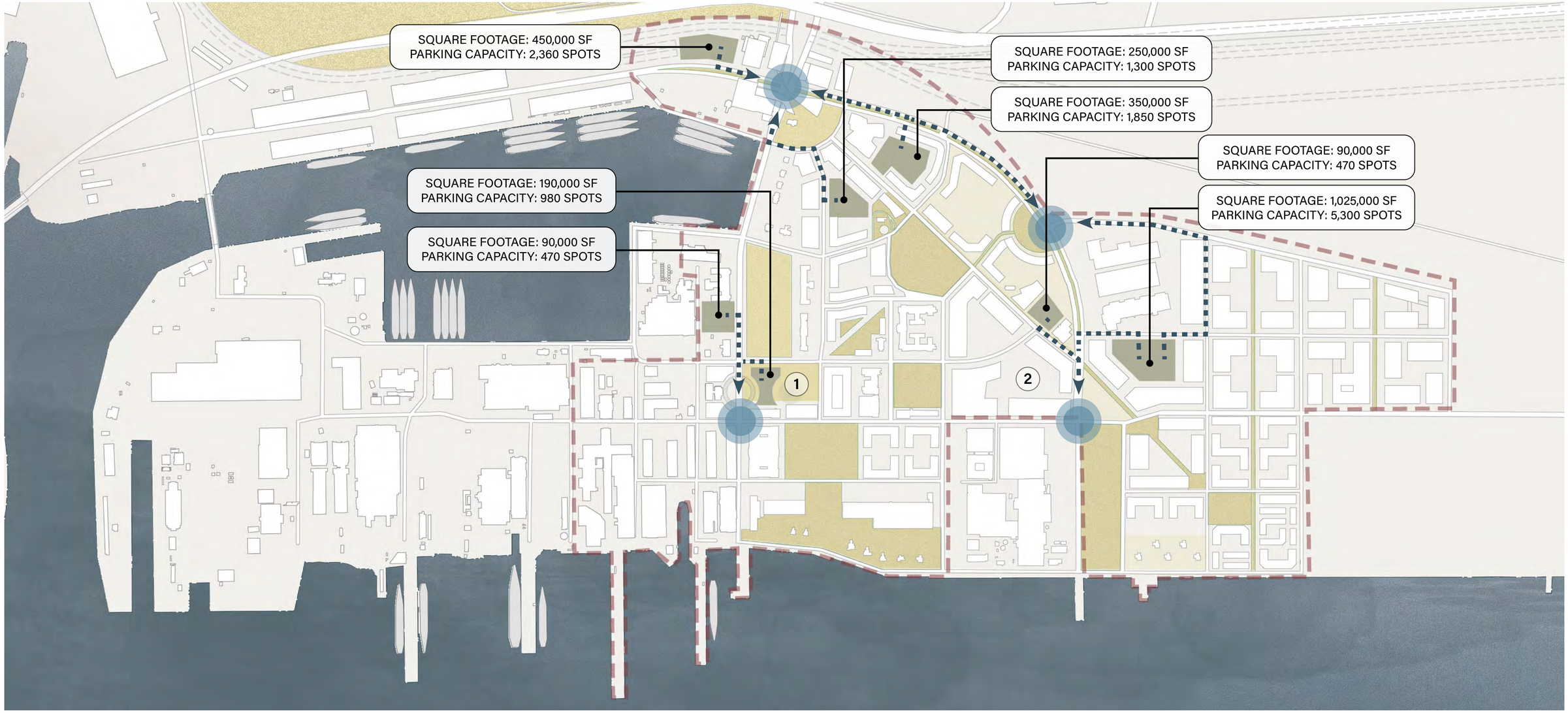
PARKING LOT TO BE REMOVED

0 250 500 1000ft

PARKING PROJECTIONS

	EXISTING	PROPOSED (2035 AND BEYOND)
COMMUTERS	**~9,000** COMMUTERS	**21,500** COMMUTERS BY 2035 ▪ **12,500** PARKING SPOTS NEEDED
SURFACE AREA	**3,615,000** SF	**730,000** SF (80% REDUCTION)
TOTAL PARKING	**3,680,000** SF	**2,445,000** SF
PARKING SPOTS	**9,200** SPOTS ▪ ASSUMES **45%** OF PARKING AREA IS DEDICATED TO PARKING SPOTS ▪ AVERAGE SPOT SIZE: **180 SF**	**12,730** SPOTS ▪ ASSUMES **75%** OF PARKING AREA IS DEDICATED TO PARKING SPOTS ▪ AVERAGE SPOT SIZE: **145 SF**

PROPOSED PARKING

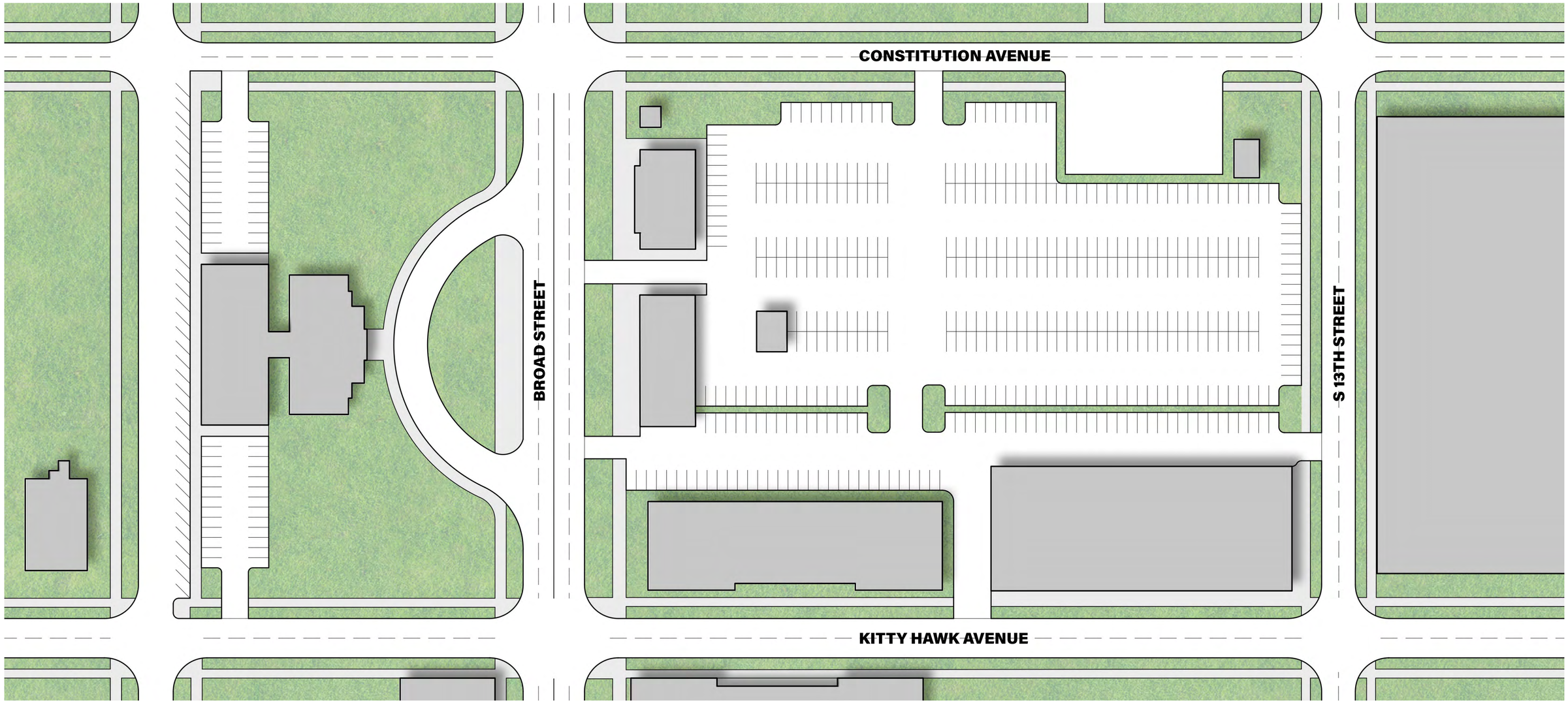


NEW PARKING GARAGE

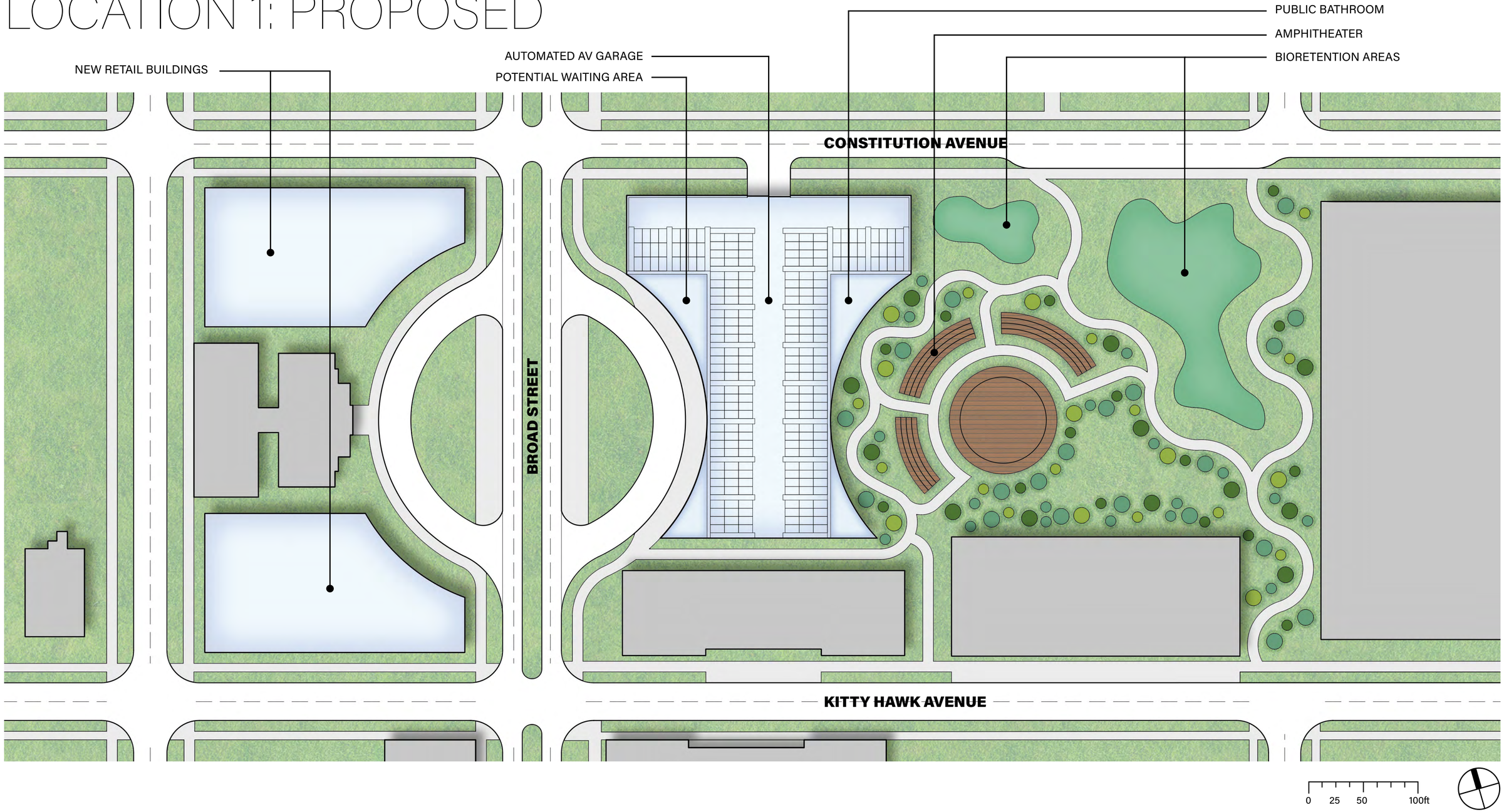
TRANSIT NODE

0 250 500 1000ft

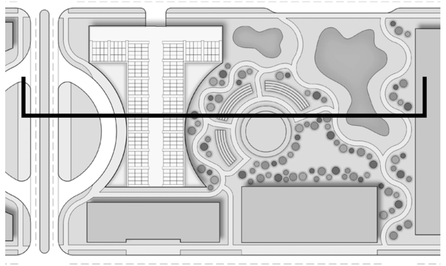
LOCATION 1: EXISTING



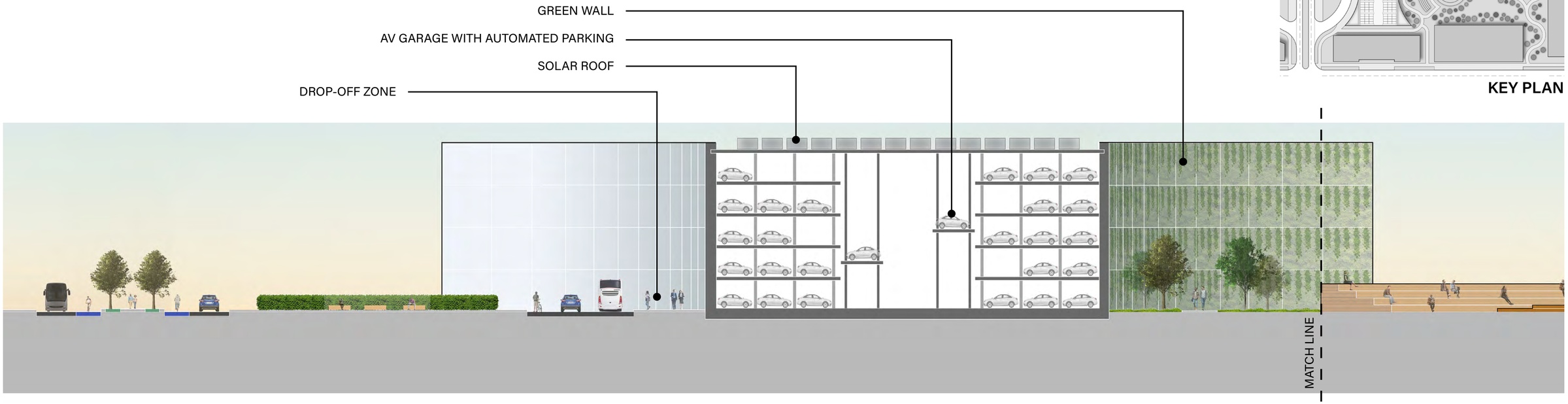
LOCATION 1: PROPOSED



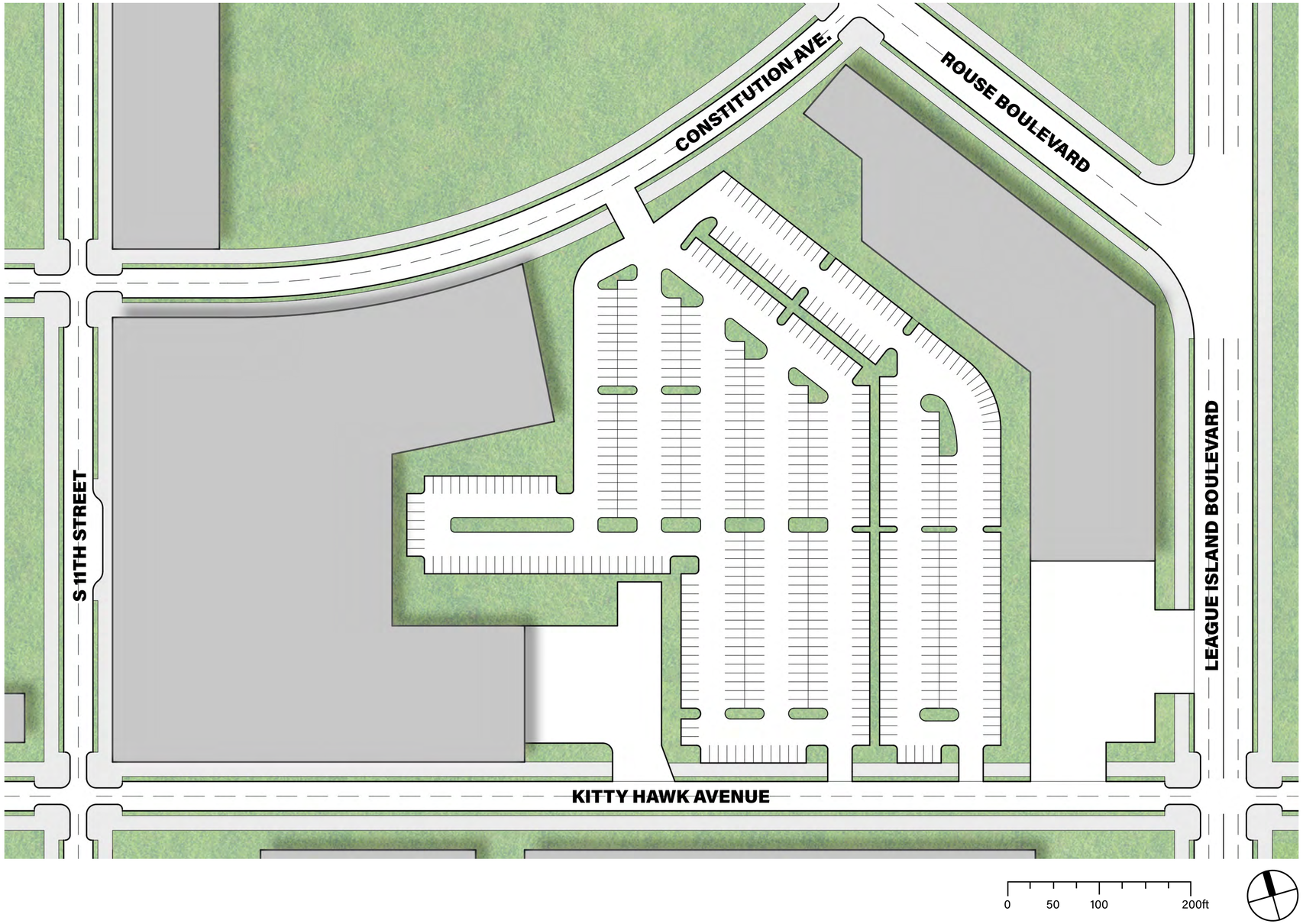
LOCATION 1: SECTION



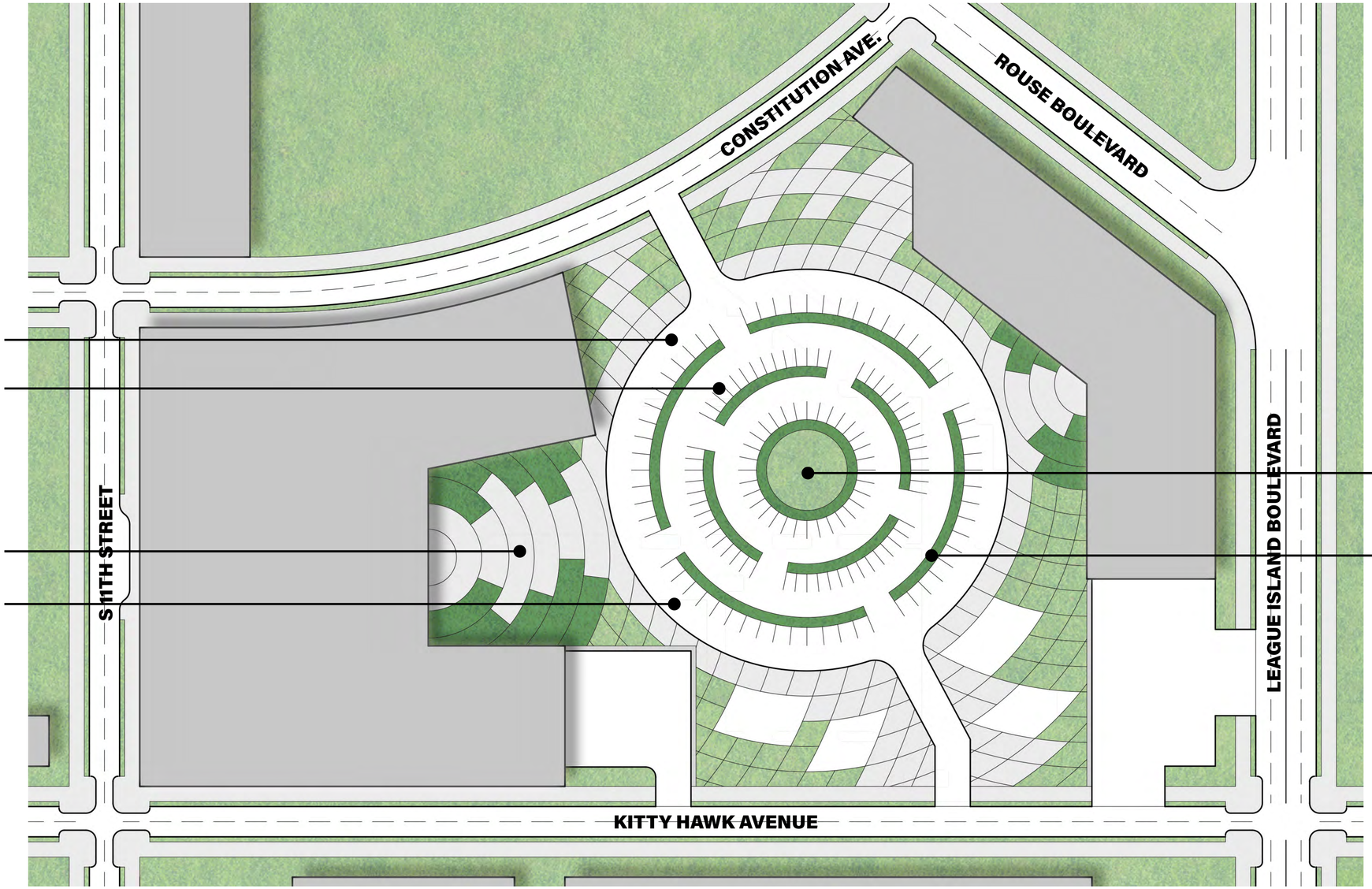
KEY PLAN



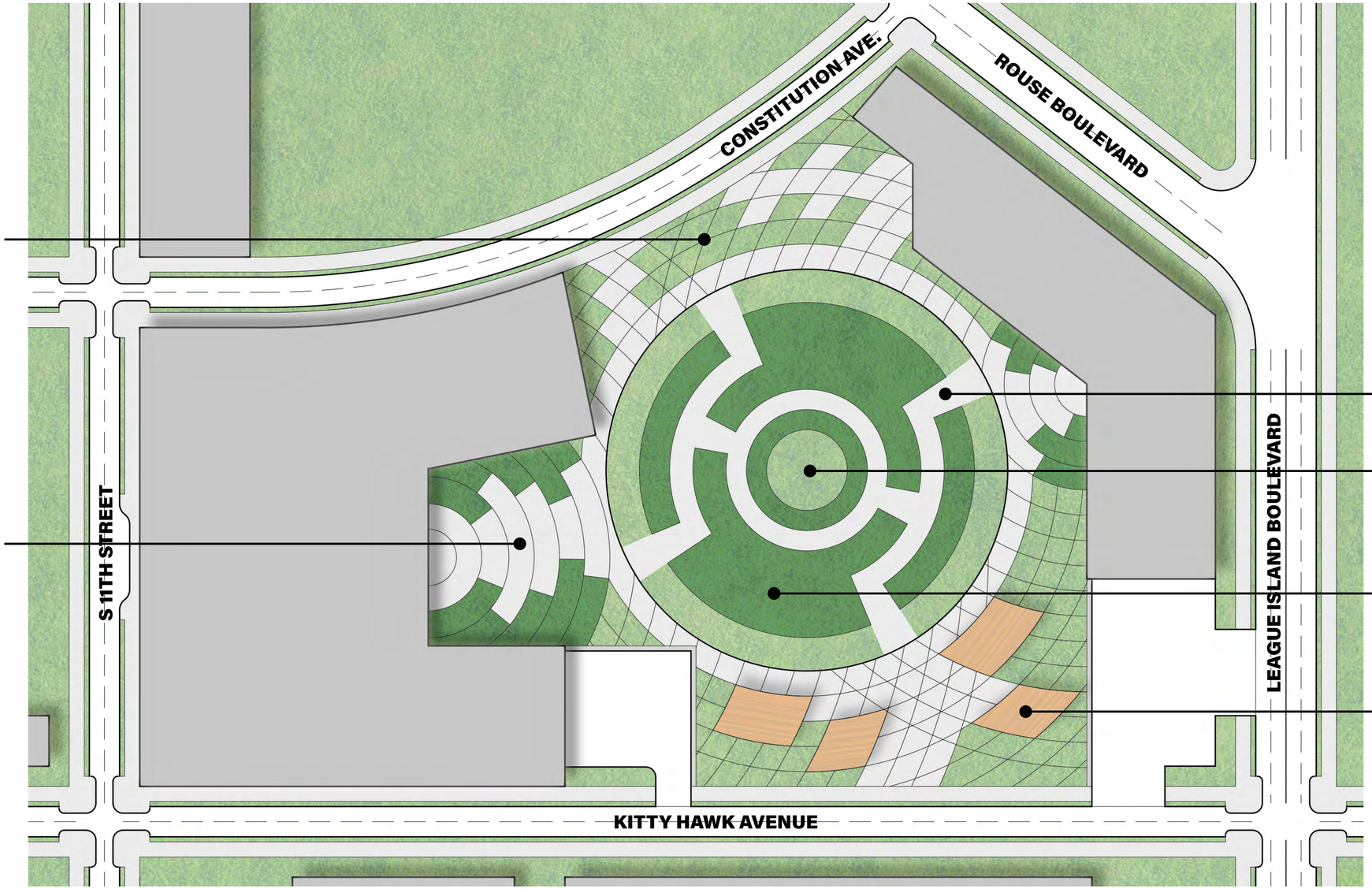
LOCATION 2: EXISTING



LOCATION 2: SHORT-TERM



LOCATION 2: LONG-TERM



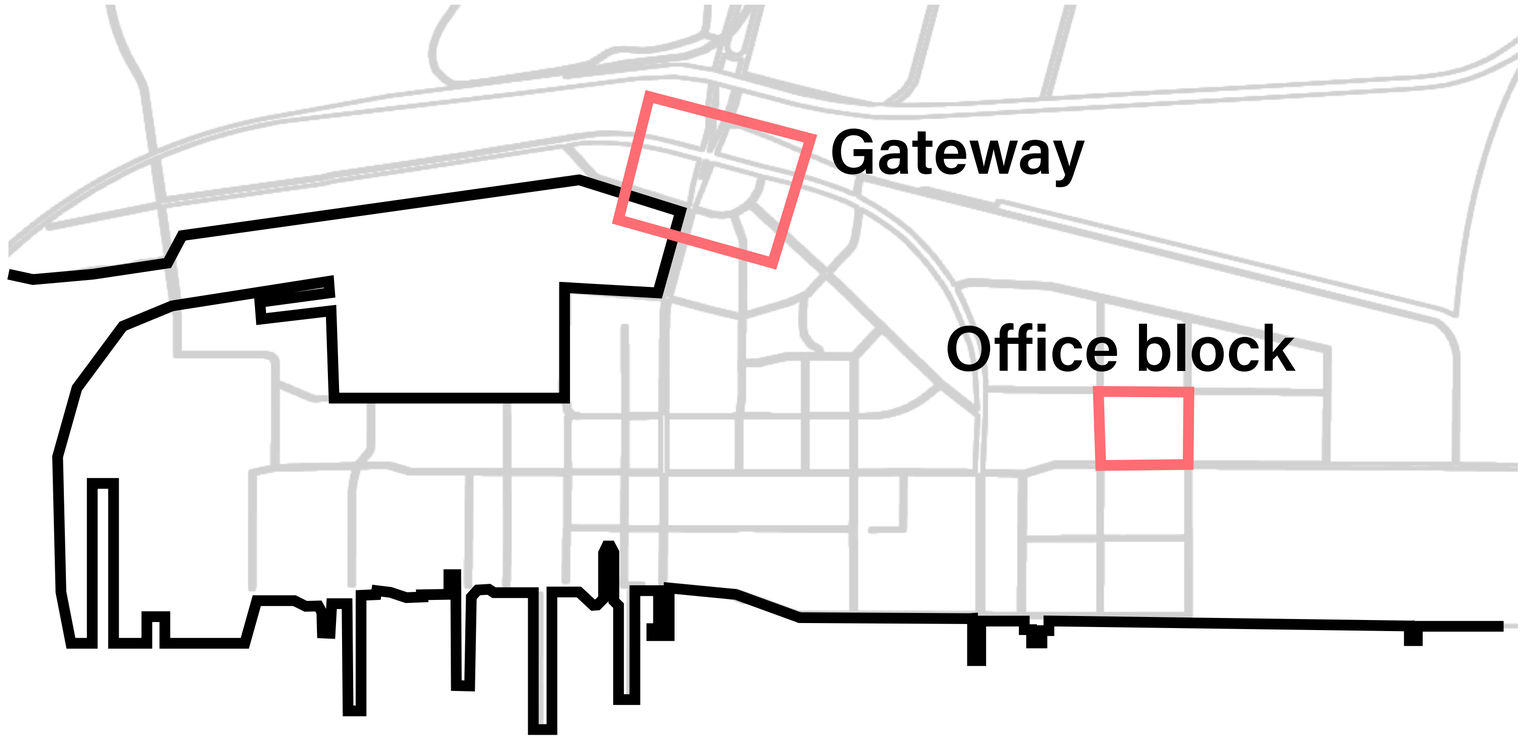
LOCATION 2: SHORT-TERM

LOCATION 2: LONG-TERM

3

STREETS
PARKING
ARCHITECTURE
PUBLIC SPACE
DIGITAL INFRASTRUCTURE
SUSTAINABILITY IMPLEMENTATION

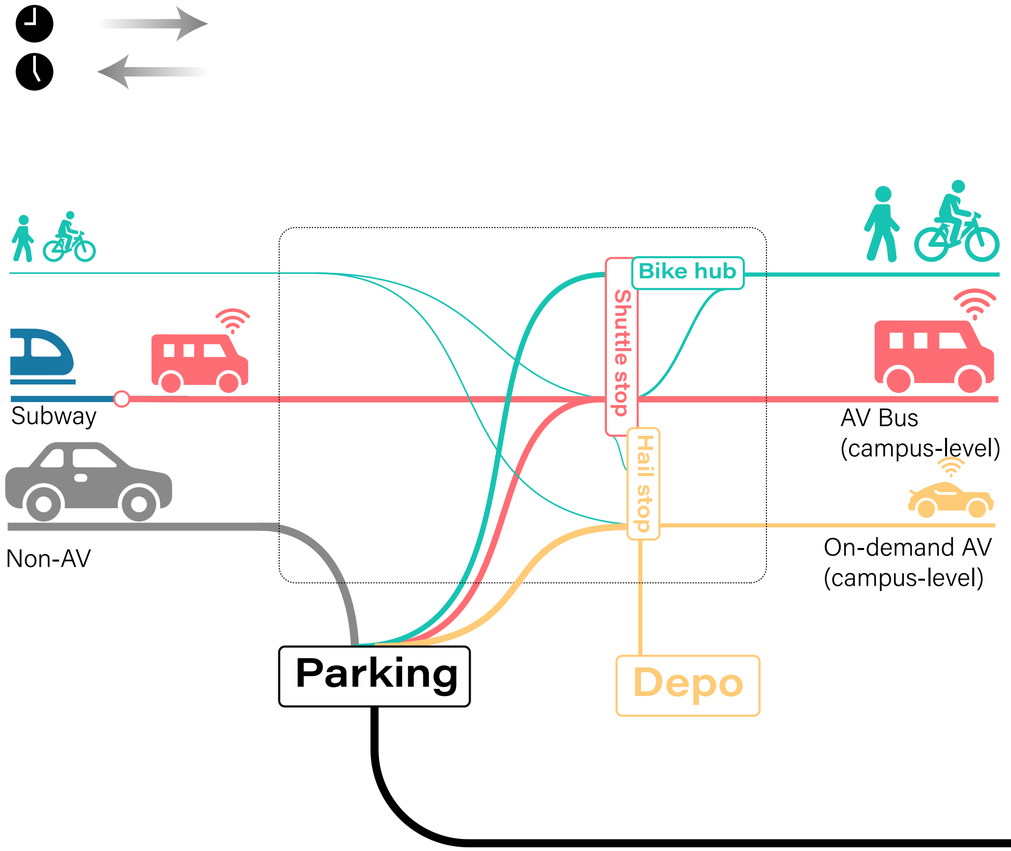
ARCHITECTURE IN THE AGE OF AV'S



GATEWAY MOBILITY

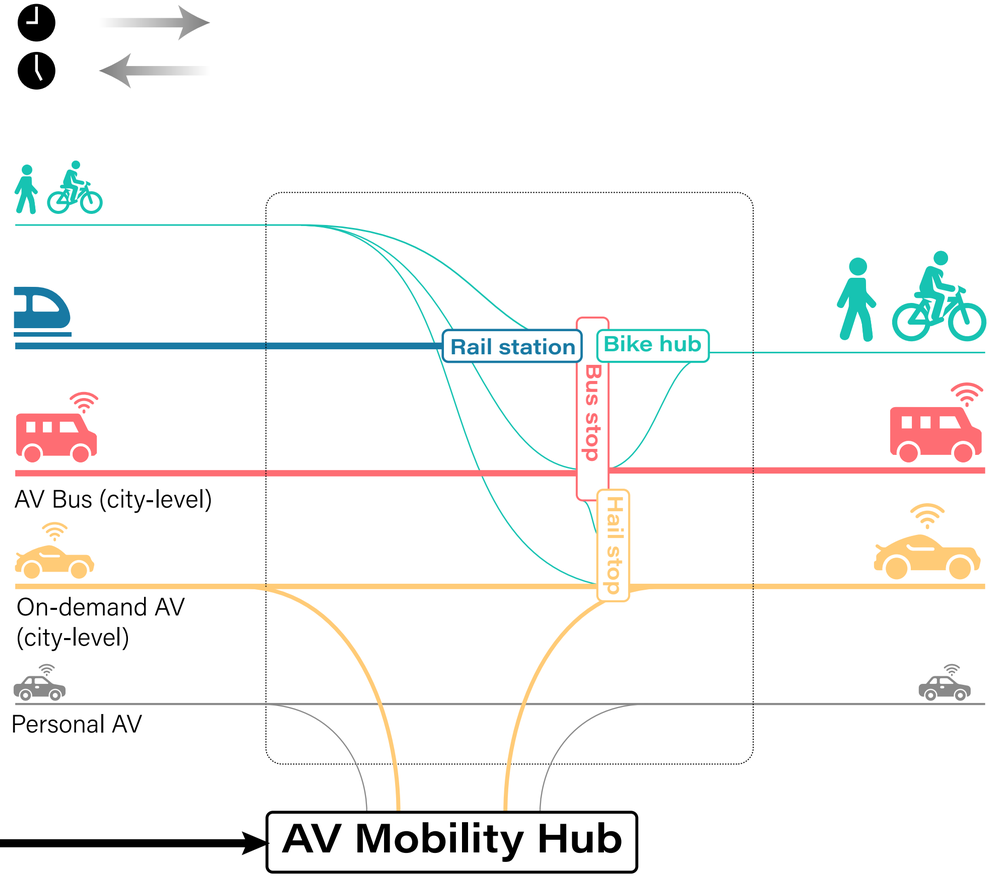
Short-term

Modal change transit hub

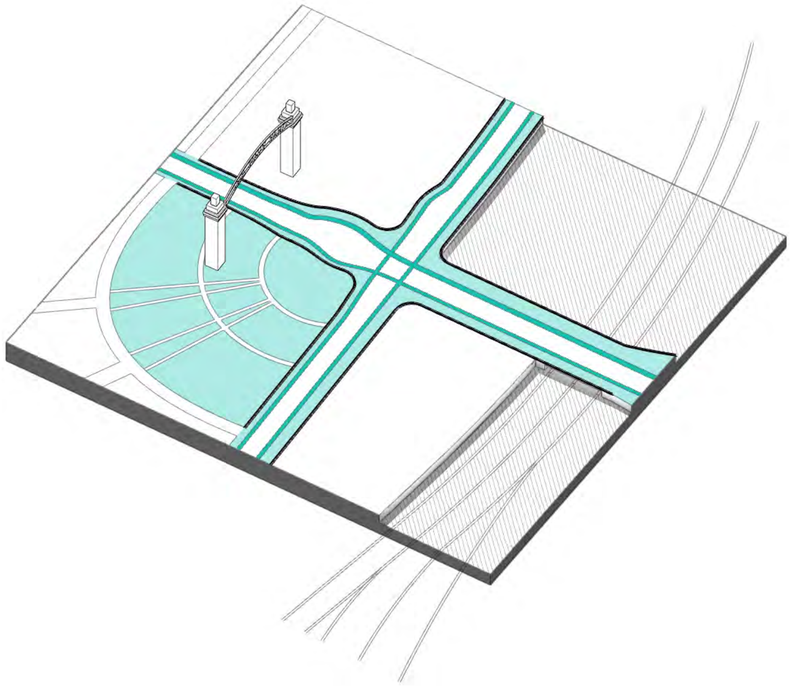


Long-term

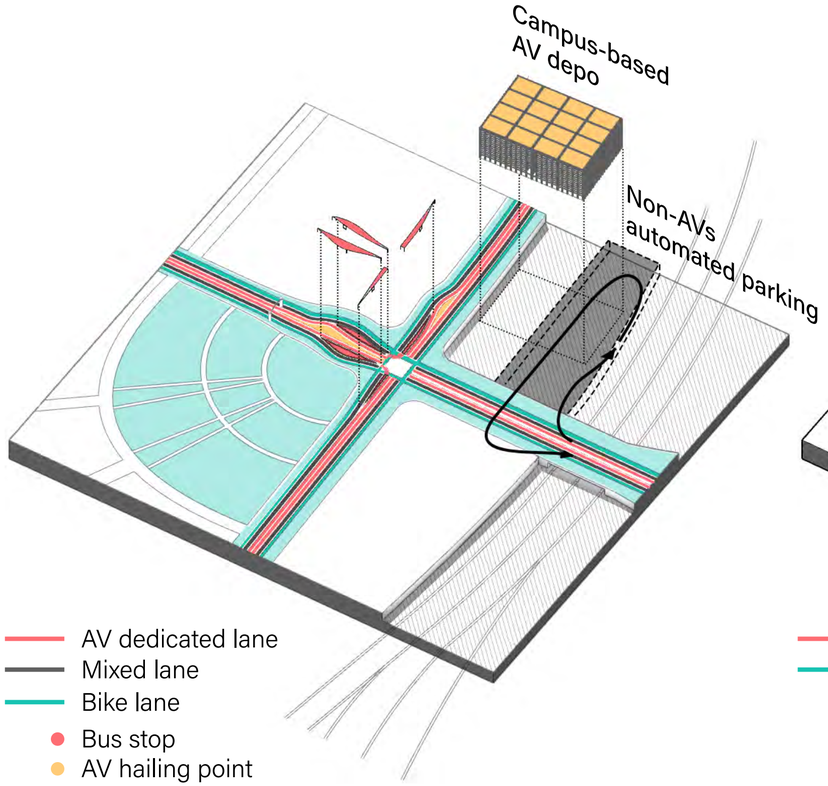
Less of modal change,
More of public space & symbolism



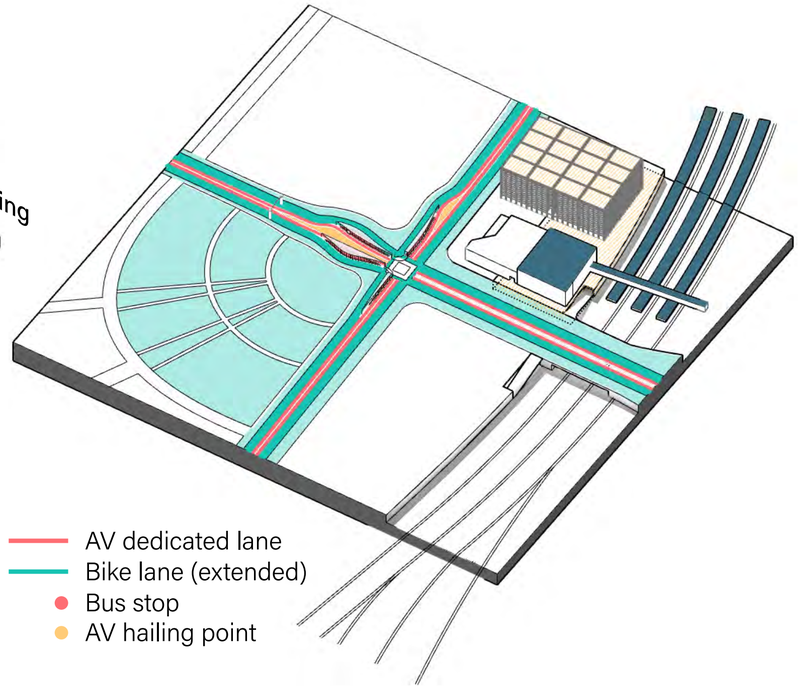
DESIGNING GATEWAY



Street reduction

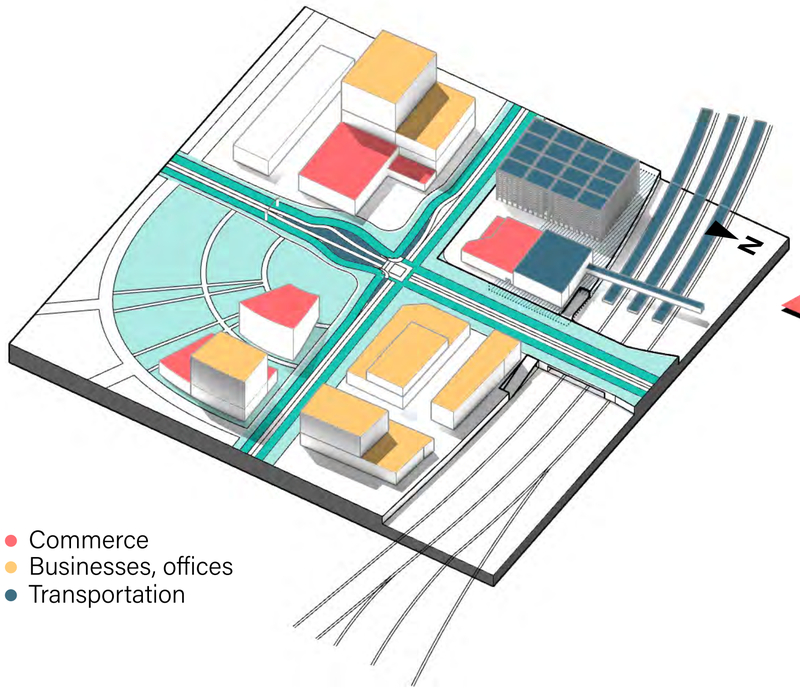


Street-based traffic
(short-term)

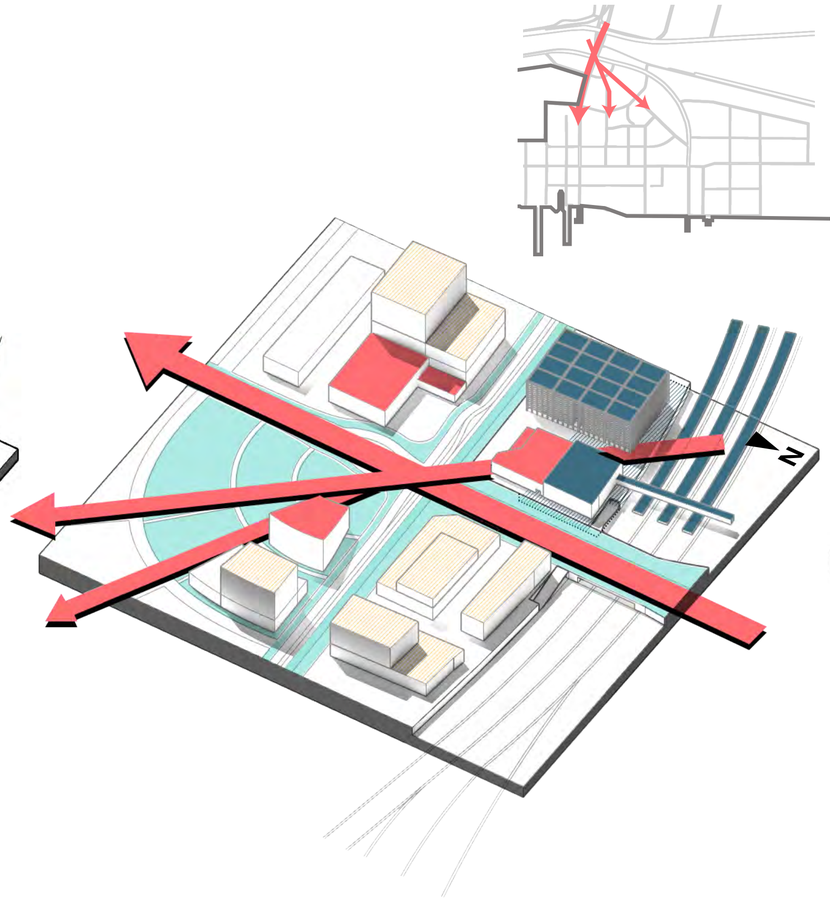


Street-based traffic
(long-term)

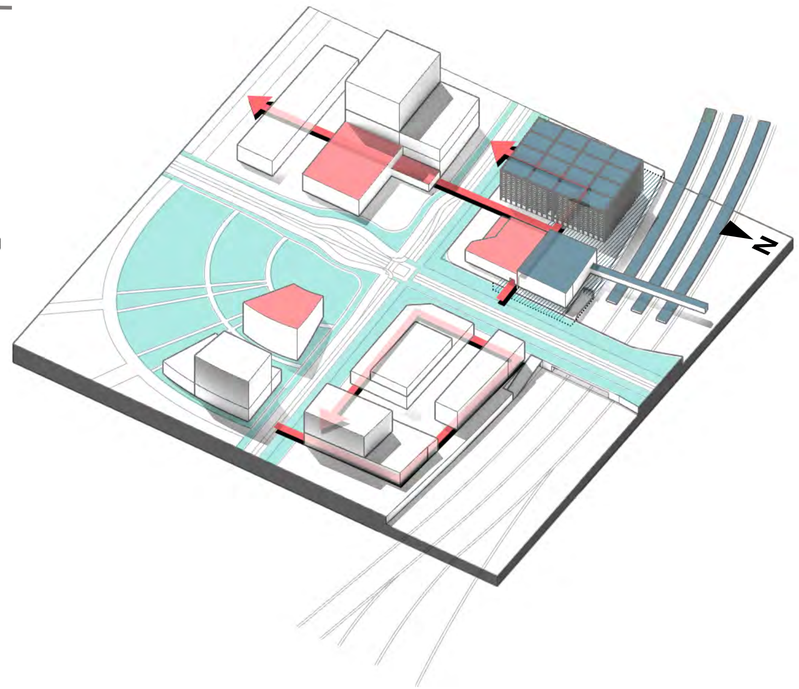
DESIGNING GATEWAY



Gateway attraction
('TOD')

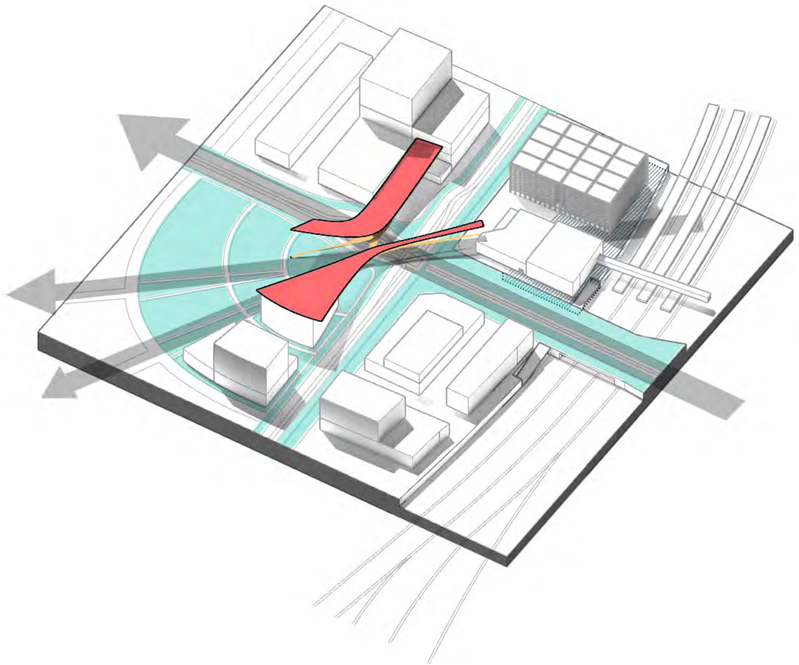


Desired connection



Alternative circulation
(delivery robots)

DESIGNING GATEWAY



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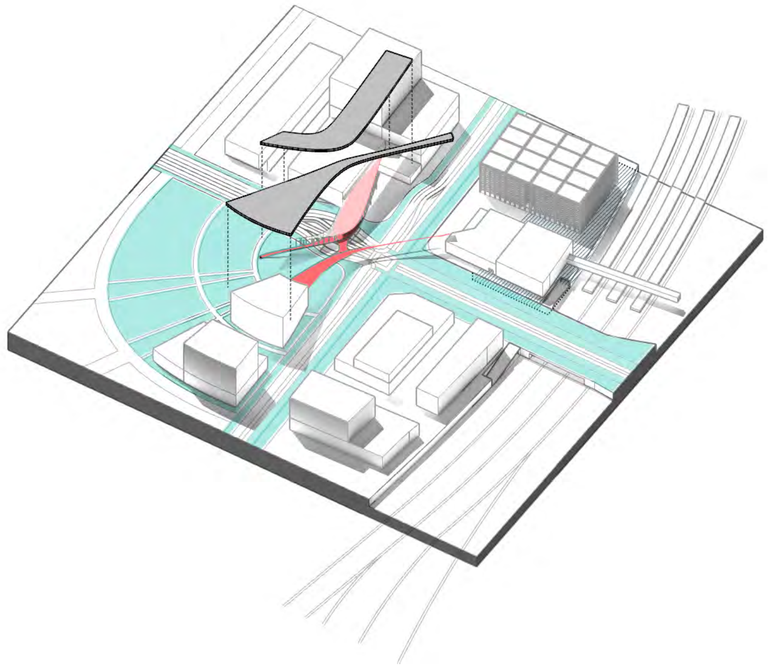
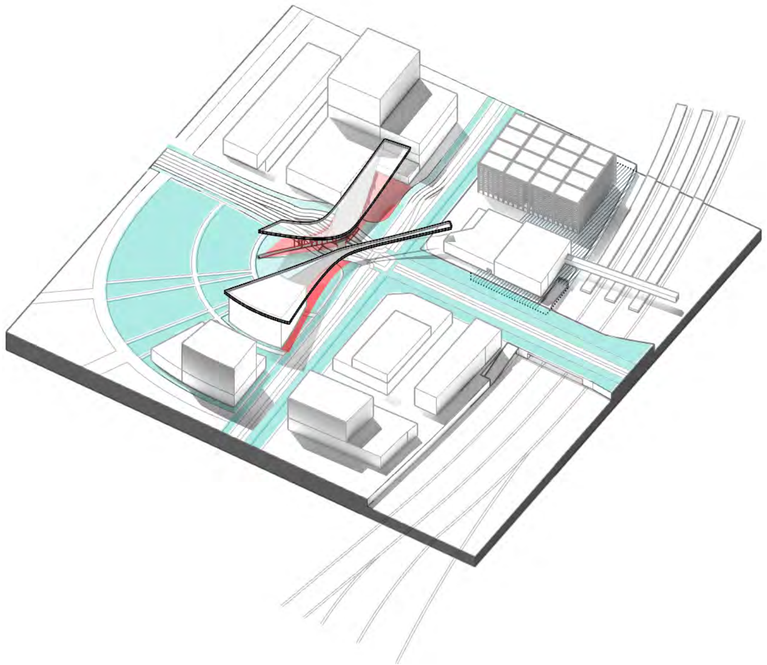
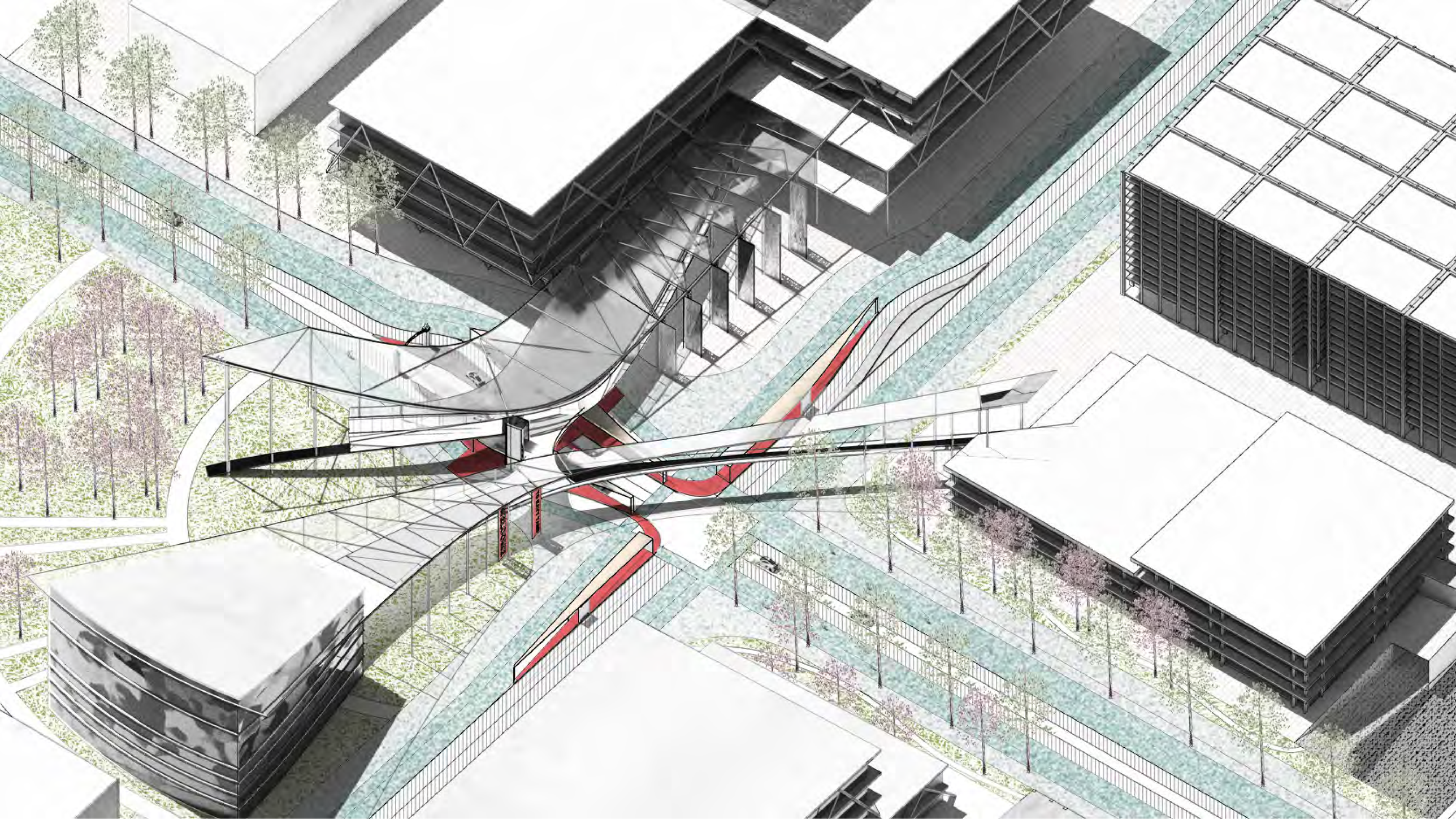
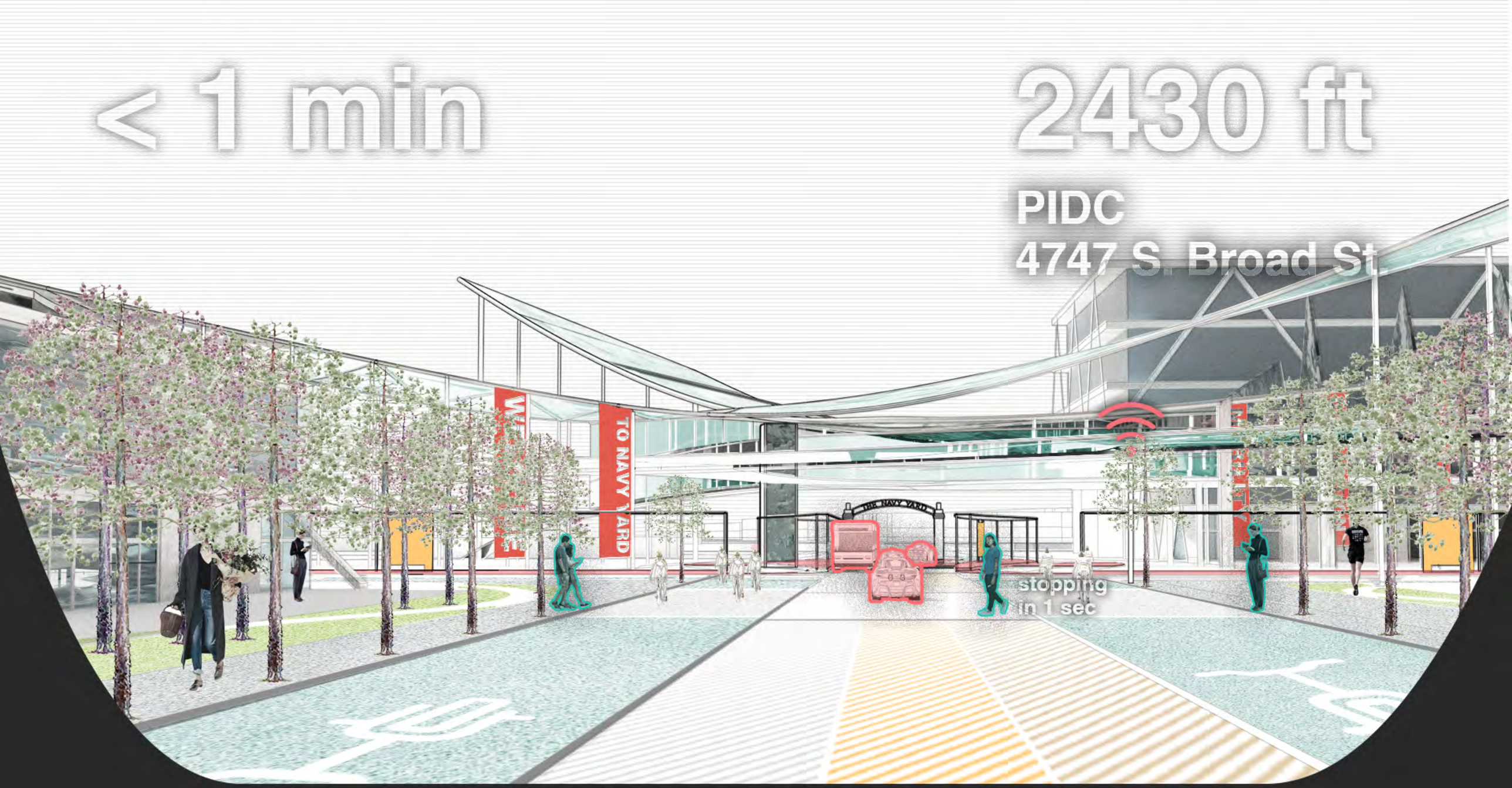


Bridge

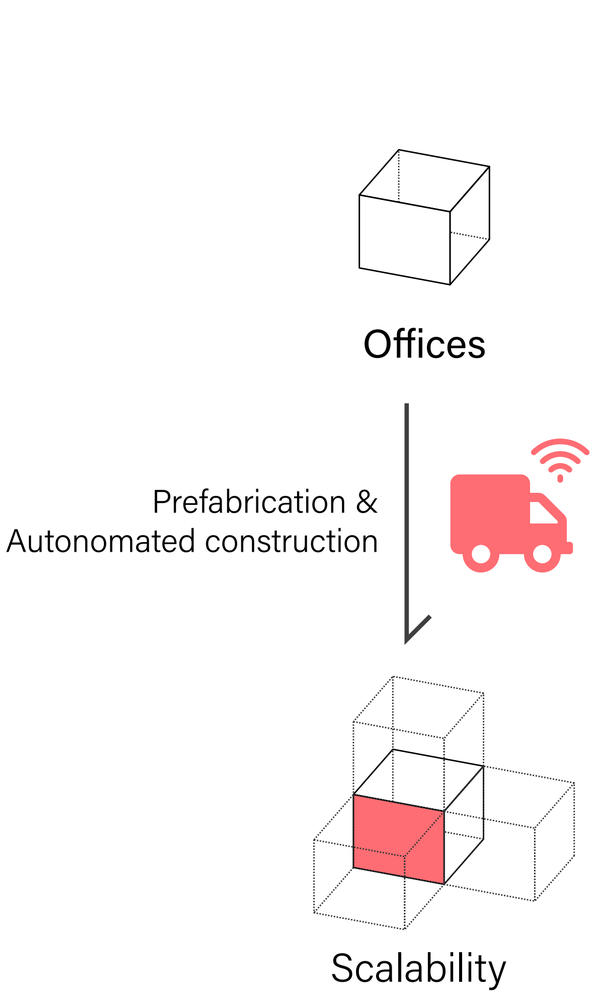


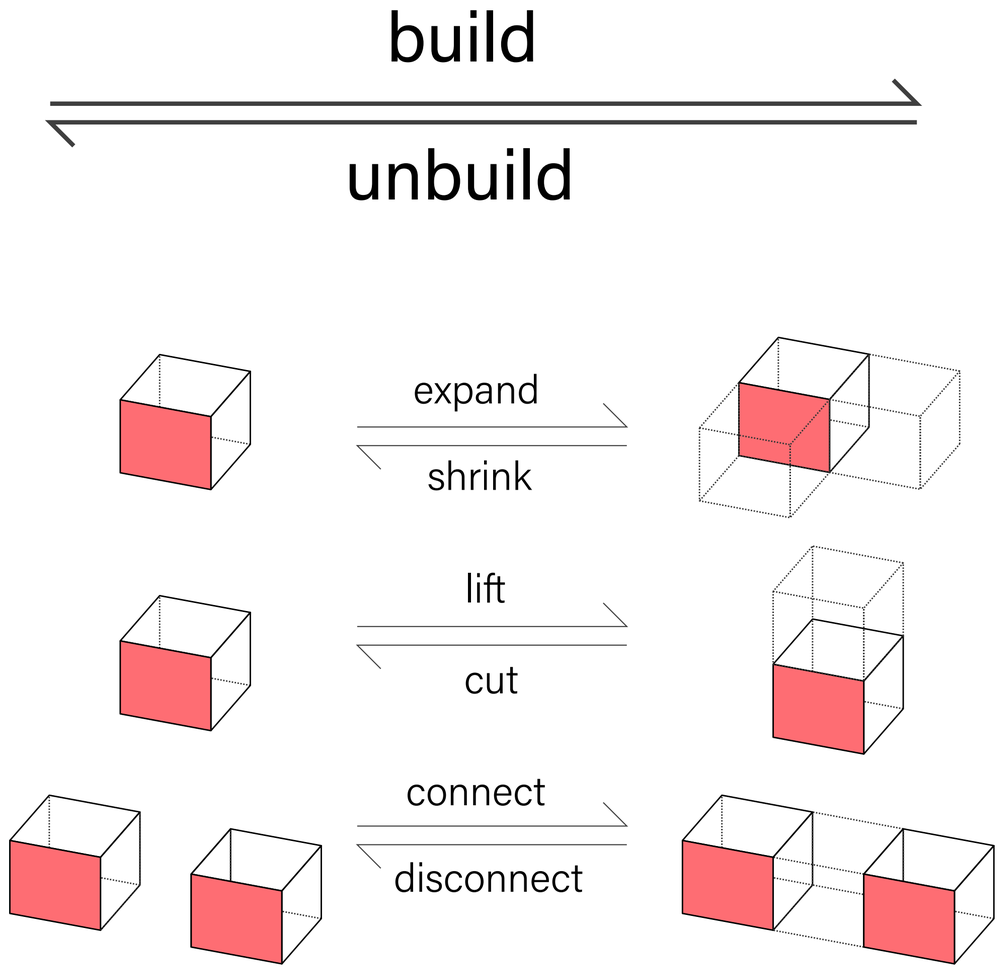
Manipulatable gray area



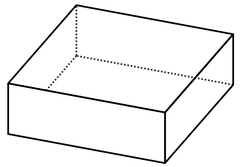

< 1 min
2430 ft
PIDC
4747 S. Broad St.
TO NAVY YARD
THE NAVY YARD
stopping
in 1 sec

OFFICES IN THE AGE OF AV'S



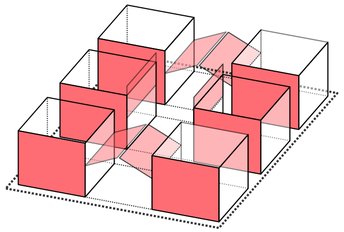


OFFICES IN THE AGE OF AV'S



Conventions, exhibitions, recreation

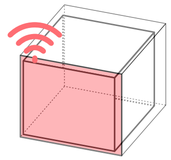
Smart control systems &
moveable building parts



Convertibility

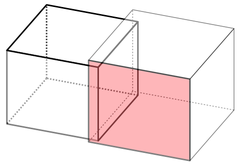
stretch

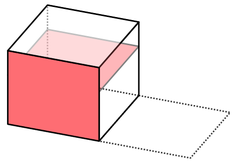
retract



pull

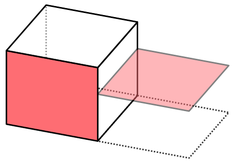
push

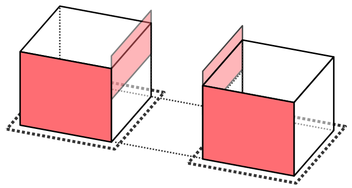




cover

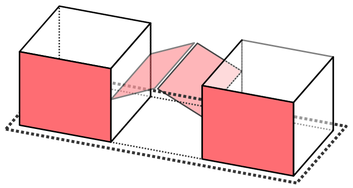
uncover



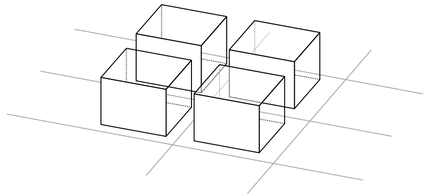


join

disjoin

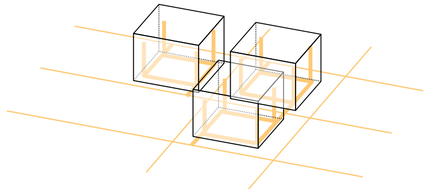


OFFICES IN THE AGE OF AV'S



Industrial linkages

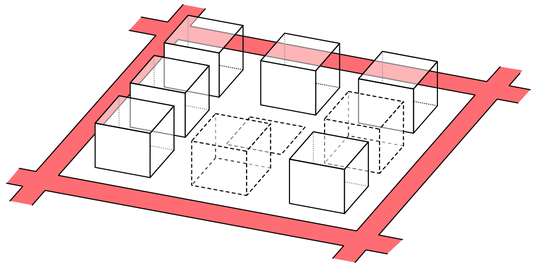
Small AV delivery robots &
accommodating building structures



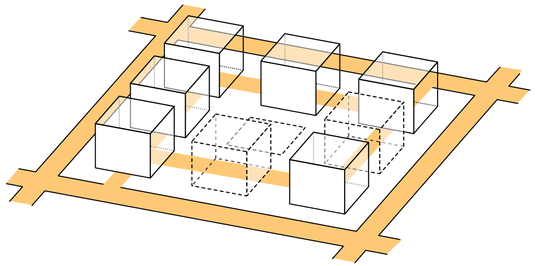
Right by side

alternative circulation

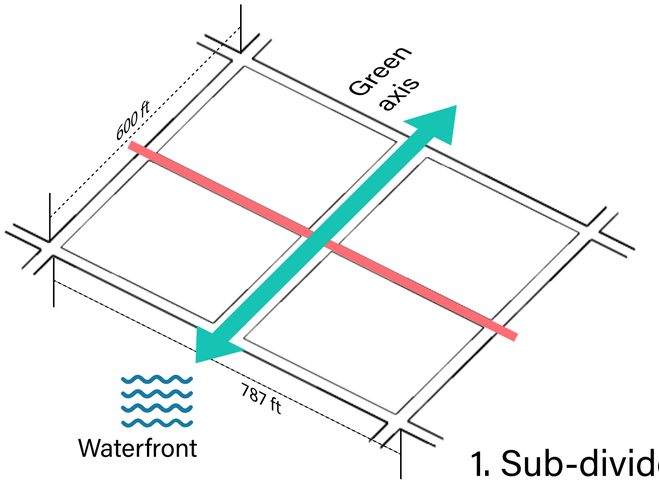
people-net



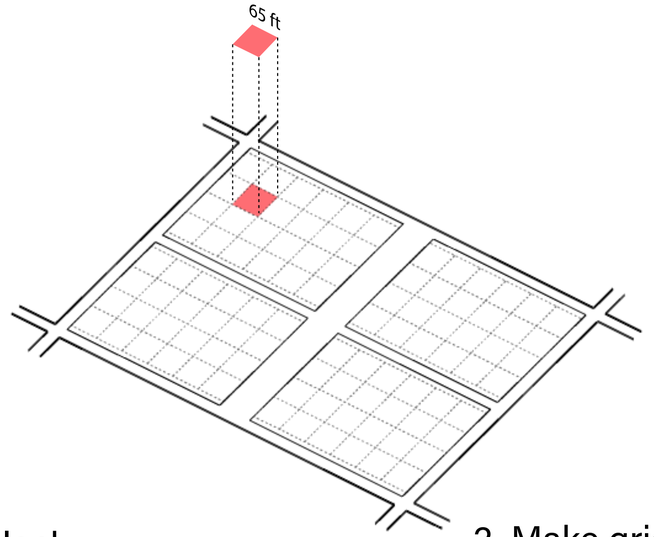
thing-ternet



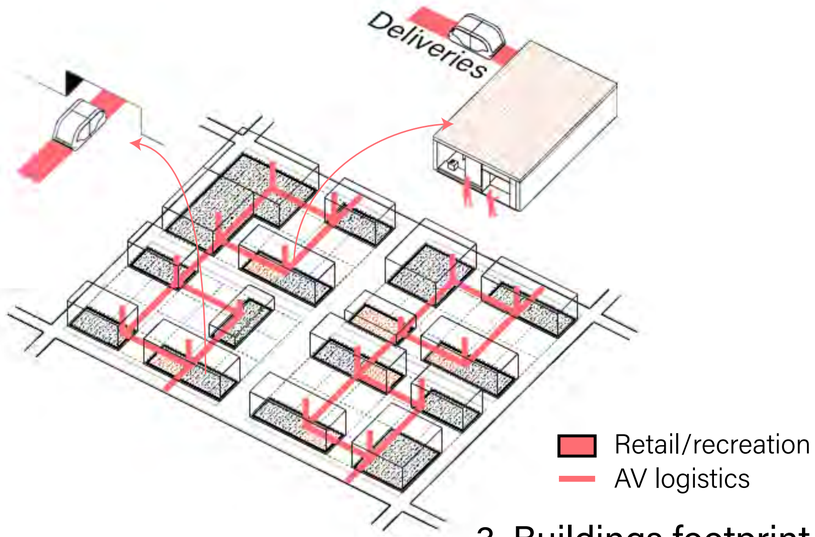
PROTOTPYE BLOCK



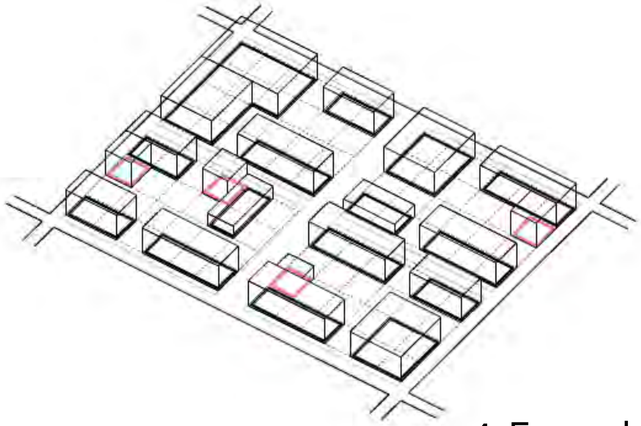
1. Sub-divide block; central greenway



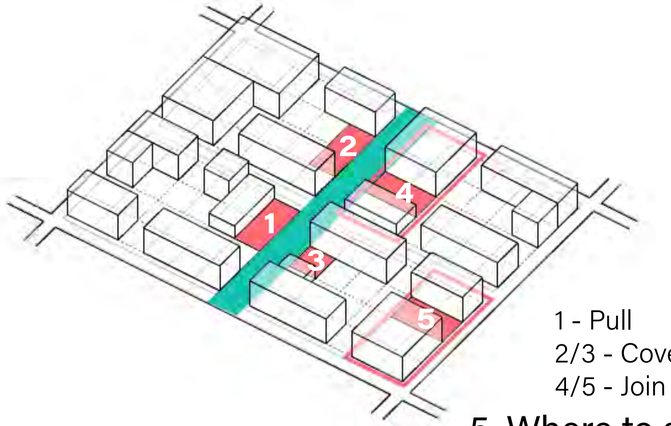
2. Make grids



3. Buildings footprint & logistics (example)

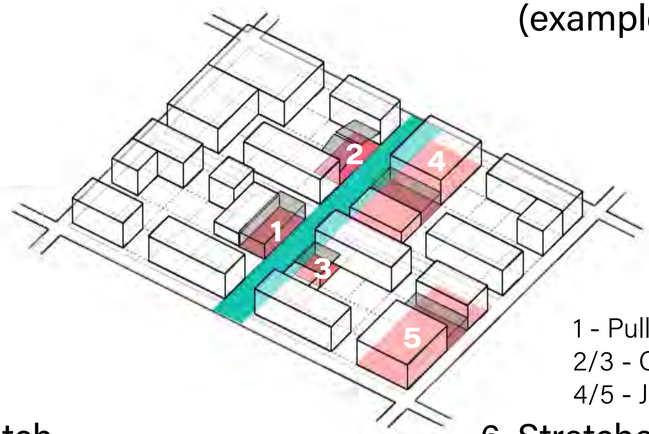


4. Expand (example)



1 - Pull
2/3 - Cover
4/5 - Join

5. Where to stretch



1 - Pull
2/3 - Cover
4/5 - Join

6. Stretched

4

STREETS
PARKING
ARCHITECTURE
PUBLIC SPACE
DIGITAL INFRASTRUCTURE
SUSTAINABILITY IMPLEMENTATION

PUBLIC SPACE in AV ERA

TRANSFORMATION FROM CONVENTIONAL PUBLIC SPACE TO SMART OPEN SPACE

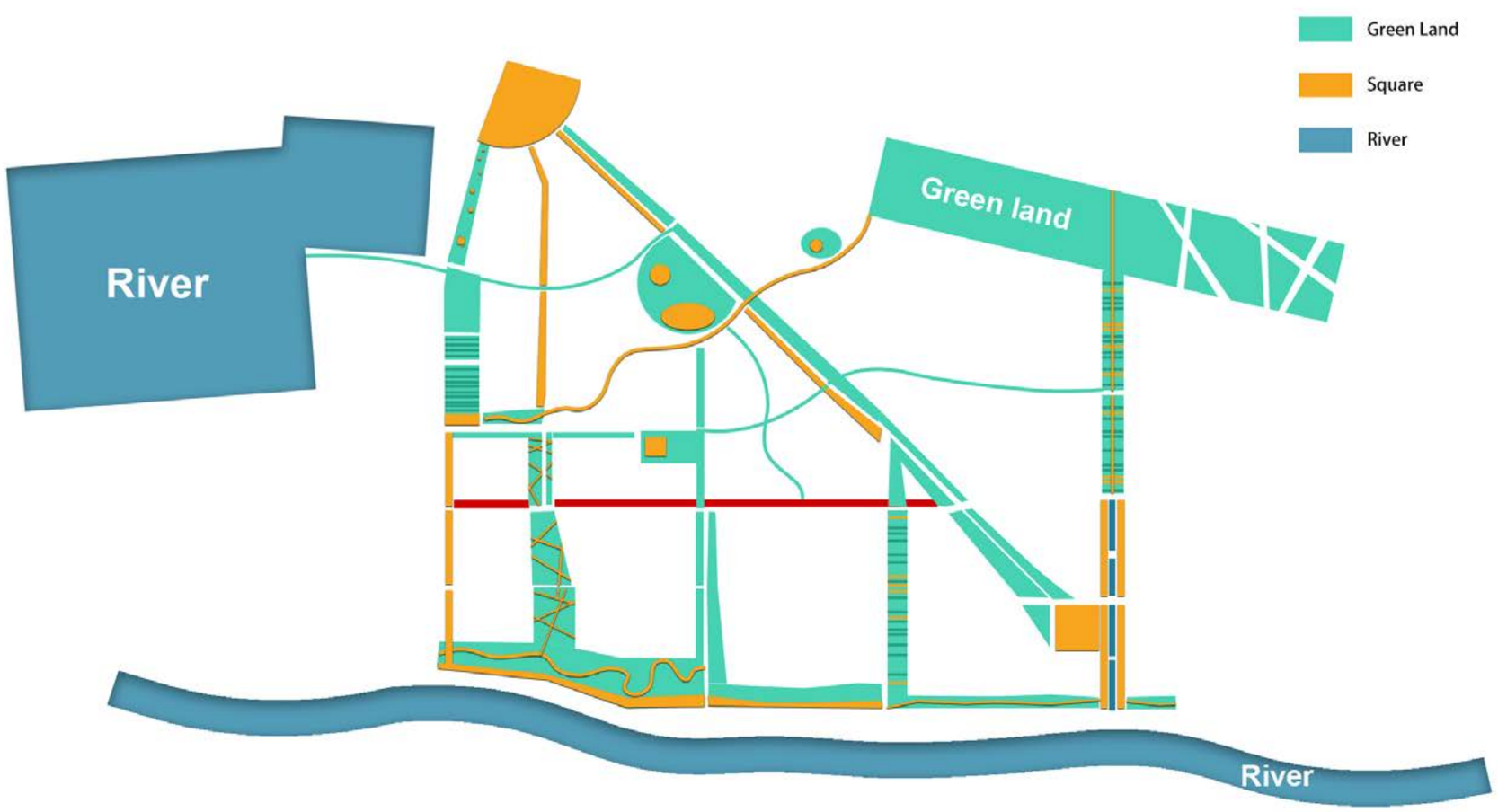
Main characters of conventional public space
- Constantness
- Space relevance

Main characters of public space in AV era
- ADAPTABILITY
- INTERACTION

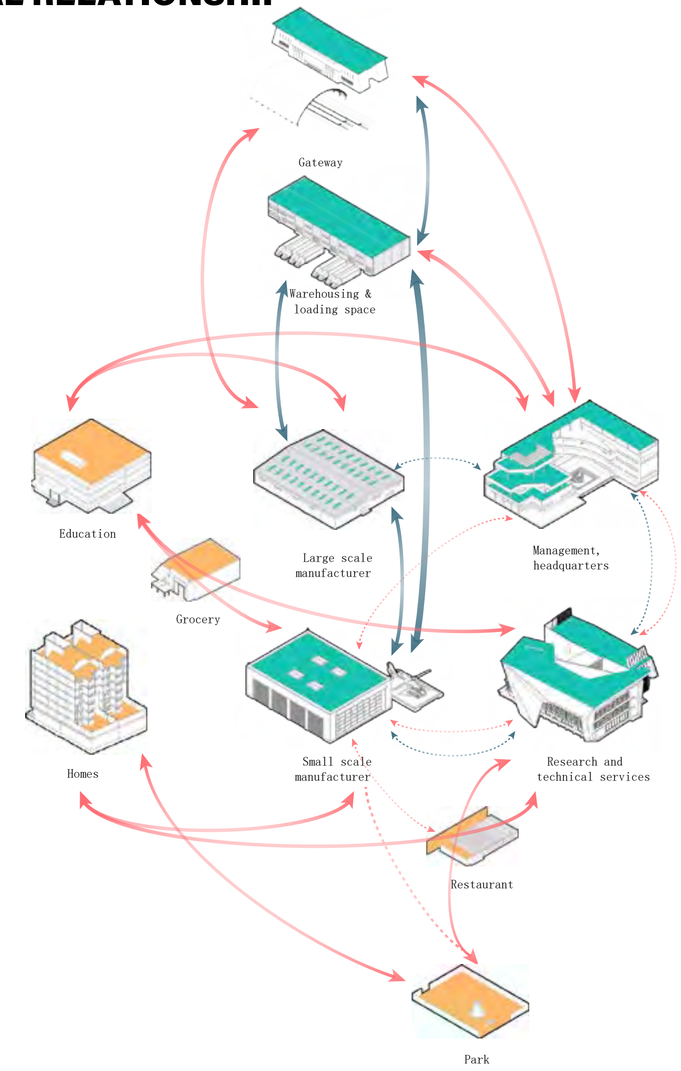
Image Source: https://www.behance.net/gallery/55573929/Be-Street-Smart-Glendale

PUBLIC SPACE SYSTEM

MACRO SPATIAL RELATIONSHIP



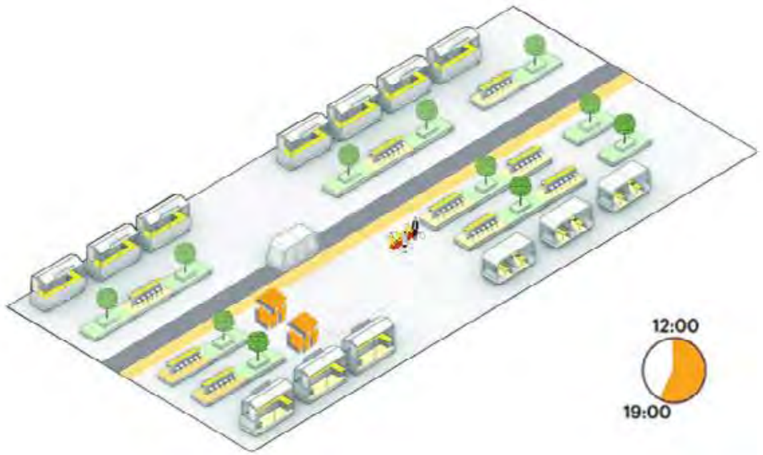
MICRO SPATIAL RELATIONSHIP

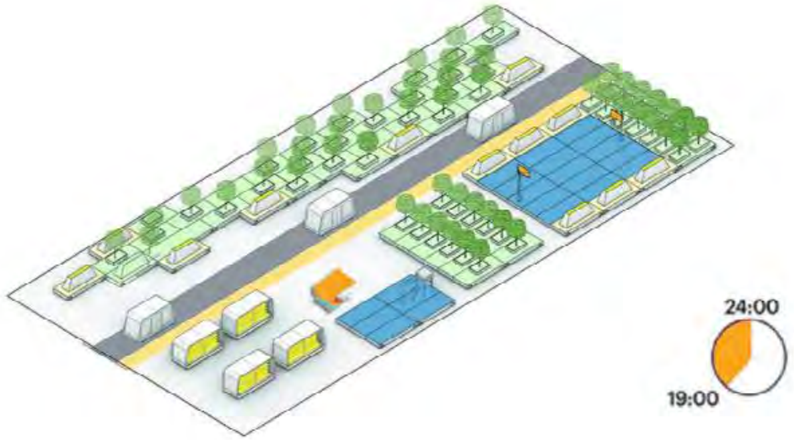


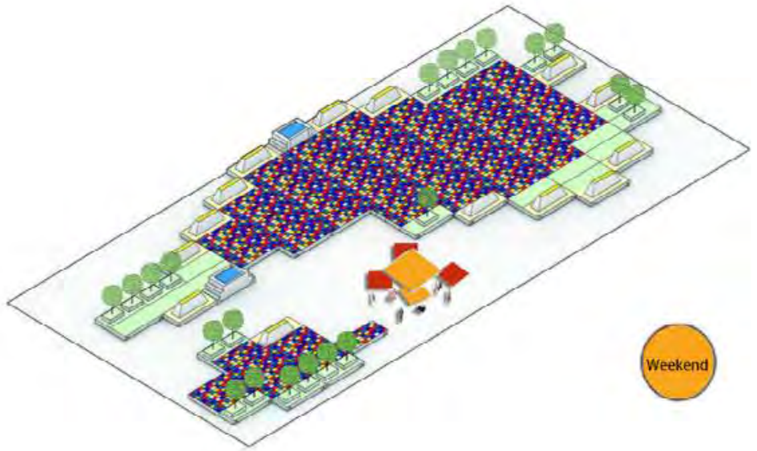
PUBLIC SPACE with STREET

PUBLIC SPACE IN AV ERA

- Spatial Elasticity
- Space Adaptability
- Data Based Design





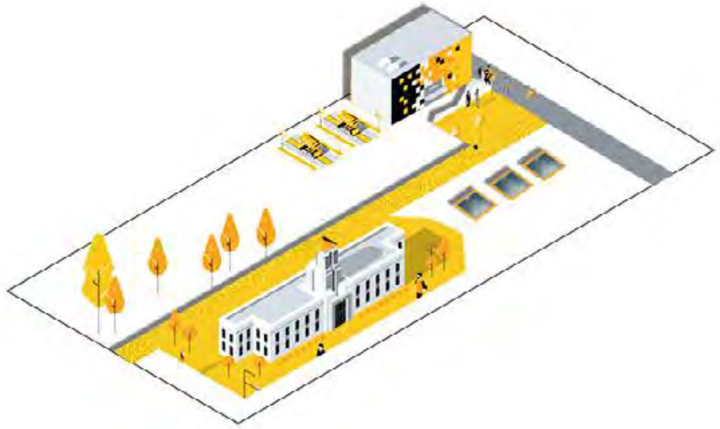


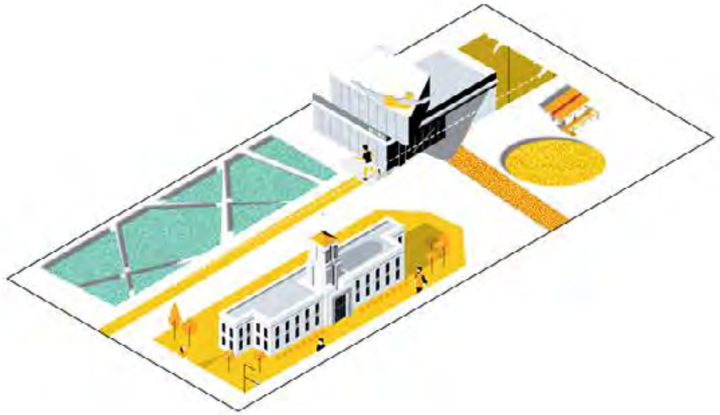
The landscape, pavement, and activity could be changed due to different time periods to adapt for different spatial needs in various conditions.

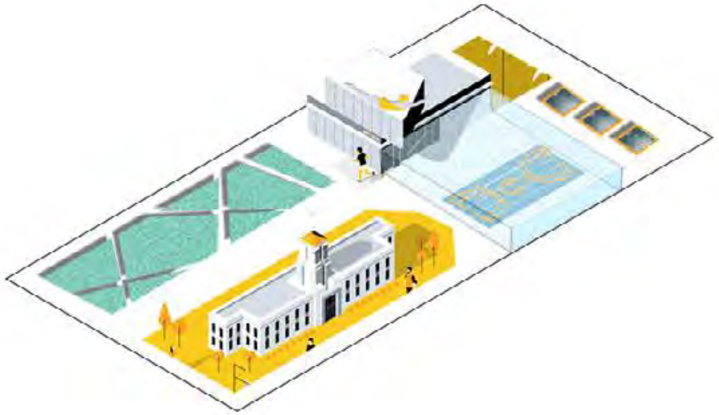
PUBLIC SPACE with BUILDING

PUBLIC SPACE IN AV ERA

- Prefabricated Modular Building
- Transition in Exterior and Interior Space
- Combination and Split





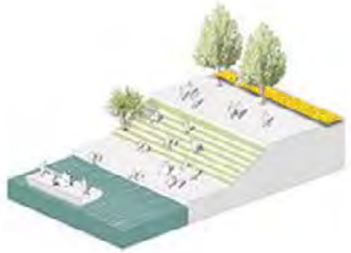


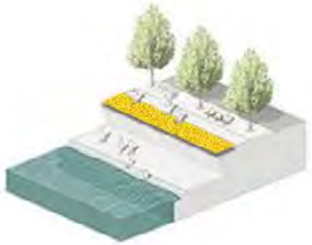
The building could also be changed through the slidable walls, assembled modular units and prefabricated structure of the building.

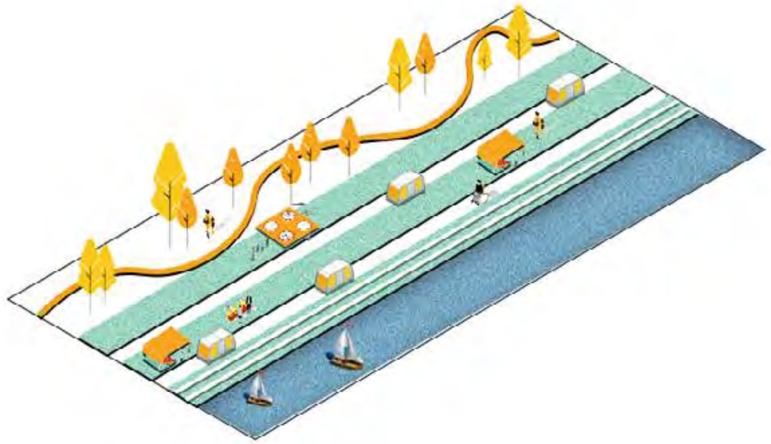
PUBLIC SPACE with WATERFRONT

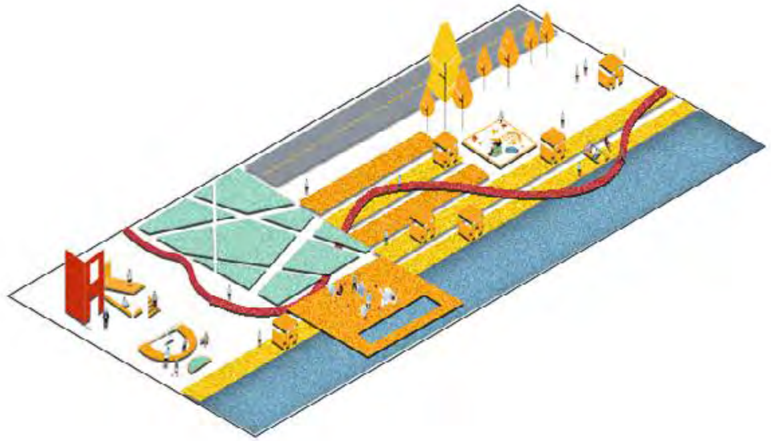
PUBLIC SPACE IN AV ERA

- AV Tech Combine with the Landscape
- Space Flexibility
- Resilient City



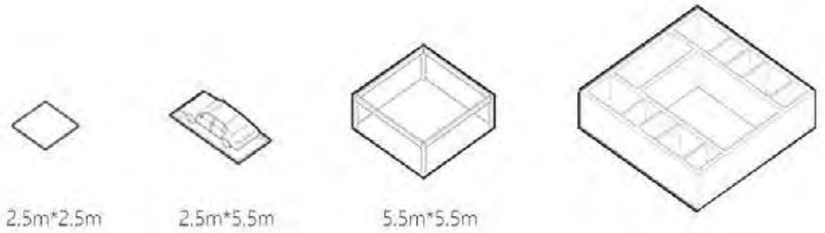


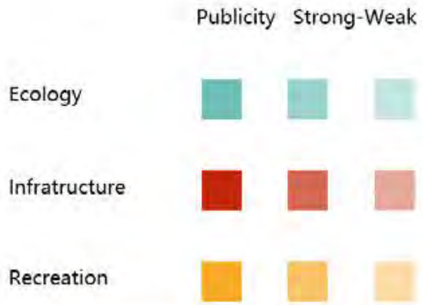




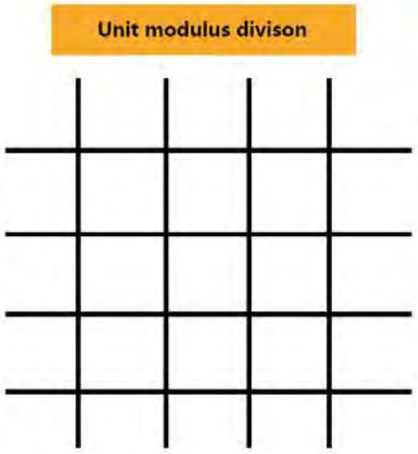
Different scenarios show the methods for coordinating the prevention of the flood and build ecological, human-scale and accessible landscape

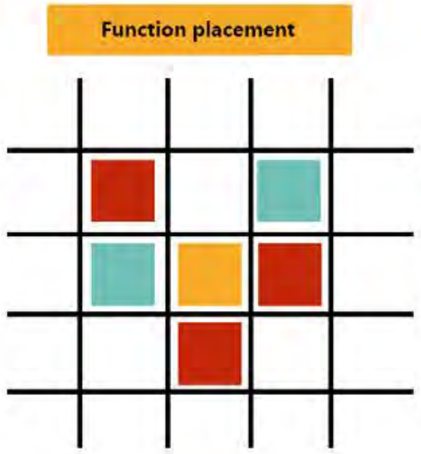
MODULAR SYSTEM / PUBLIC SPACE on DEMAND

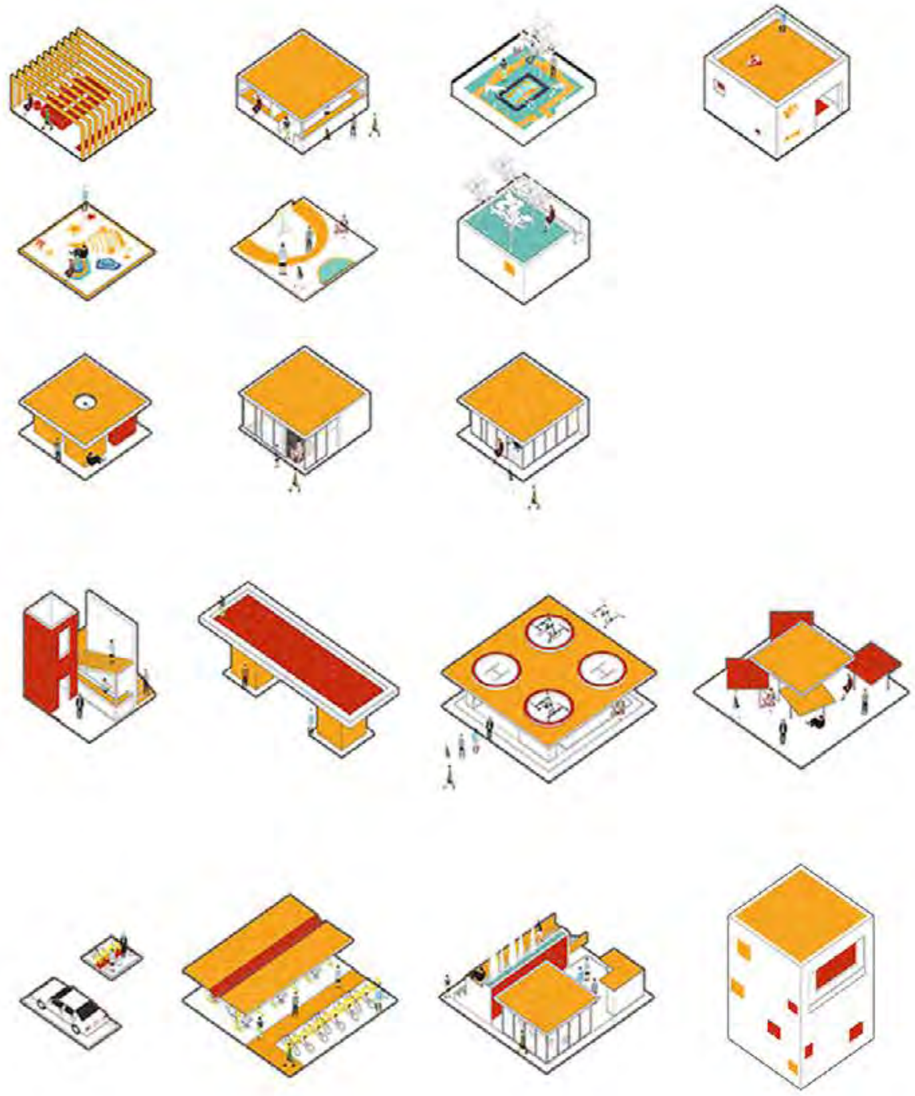




周期性
更灵活的改变方式informal
instant city eg. community festival

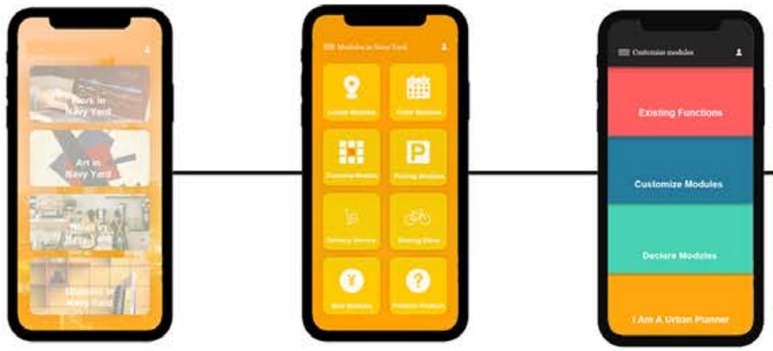






CUSTOM SYSTEM for PREFABRICATED MODULES

CUSTOM PROCESS



Digital Platform APP Smart Phone

Informal open space

Changable open space

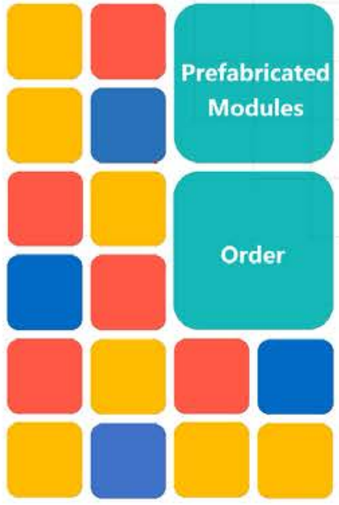
Flexible open space

Public participation

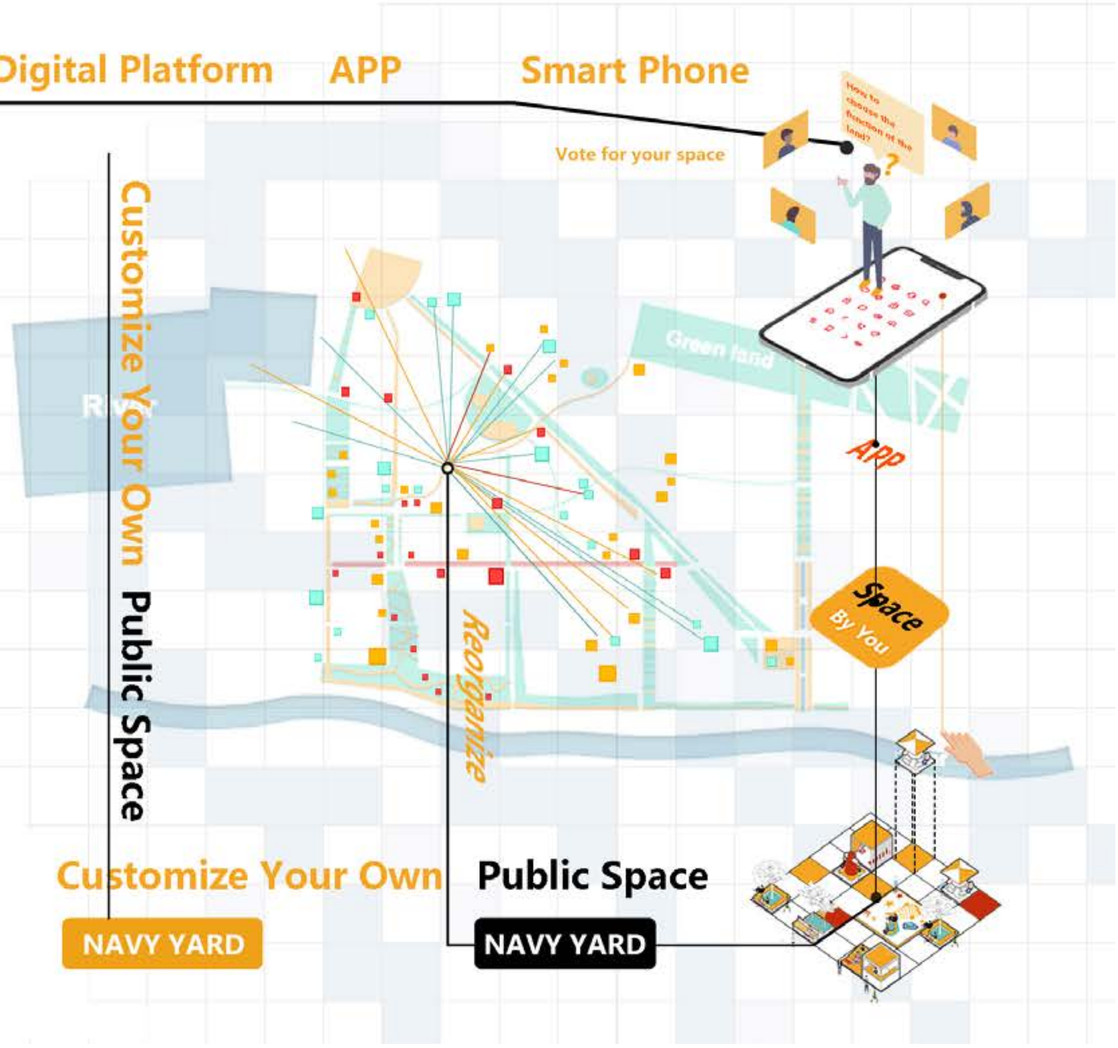
Order modules online

Customize by your own

Custom the modules for your own open space



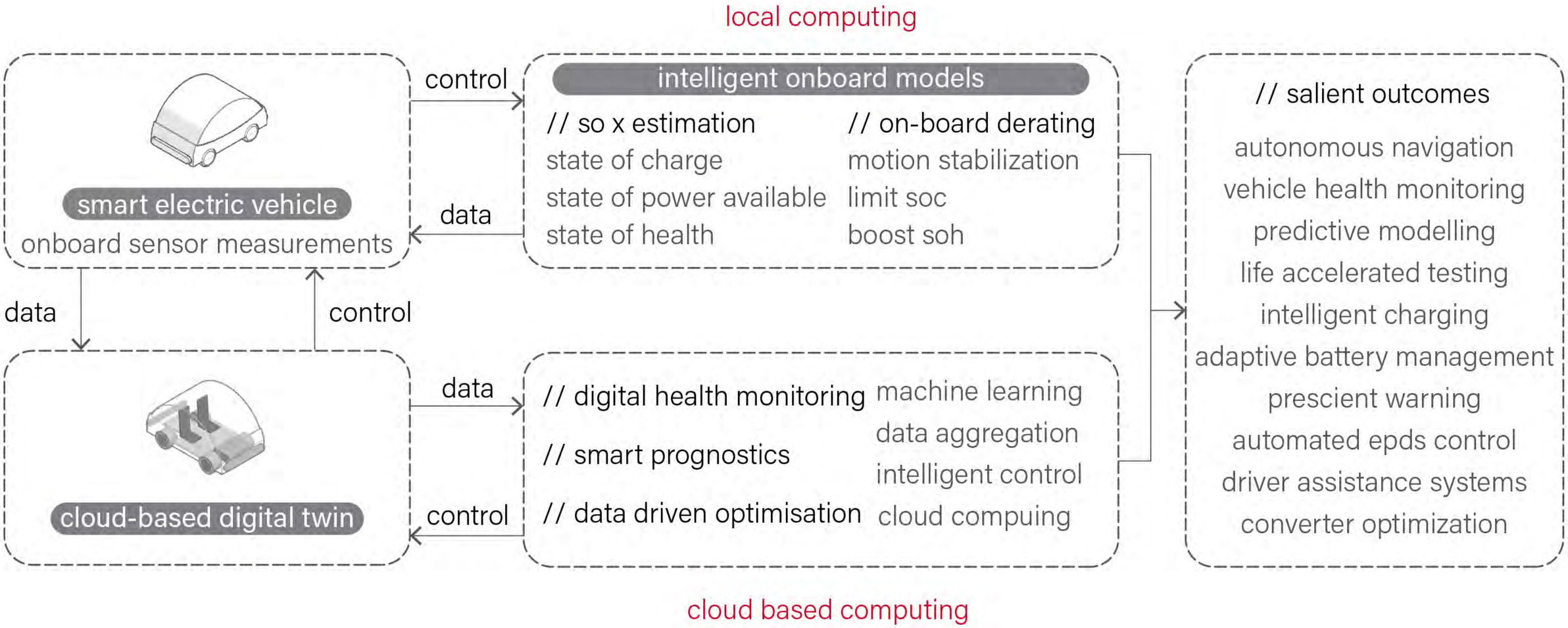
VIDEO



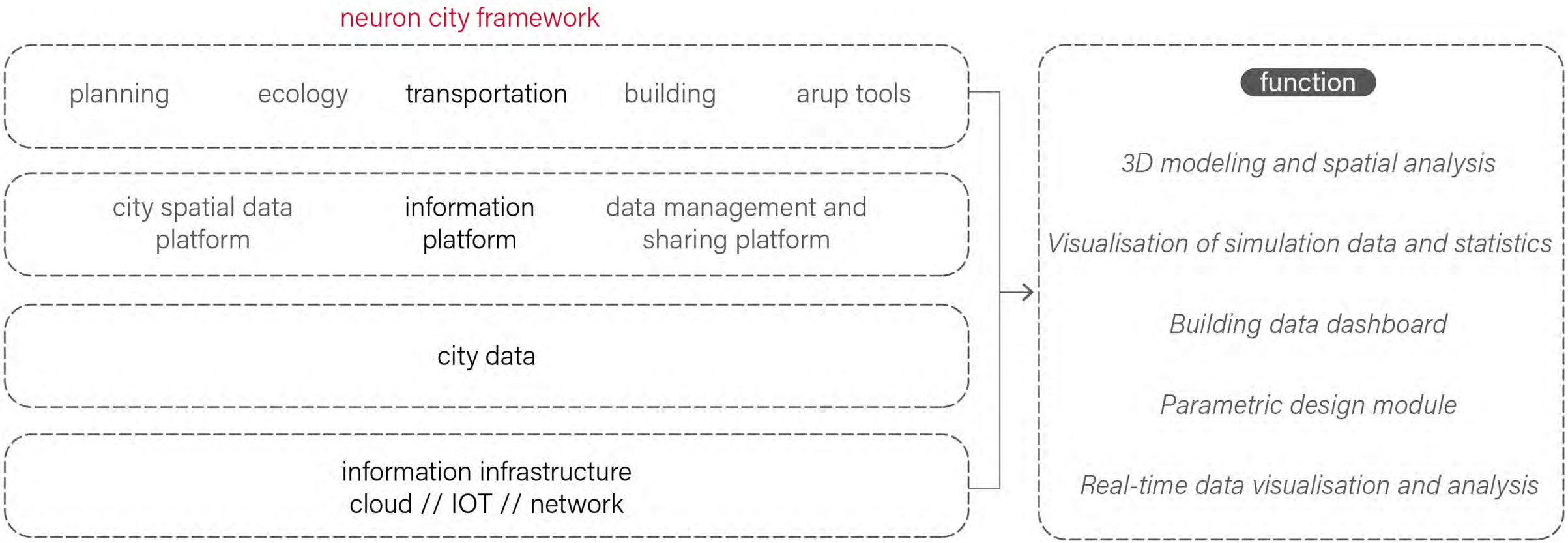
5

STREETS
PARKING
ARCHITECTURE
PUBLIC SPACE
DIGITAL INFRASTRUCTURE
SUSTAINABILITY IMPLEMENTATION

DIGITAL TWIN OF ELECTRIC VEHICLE

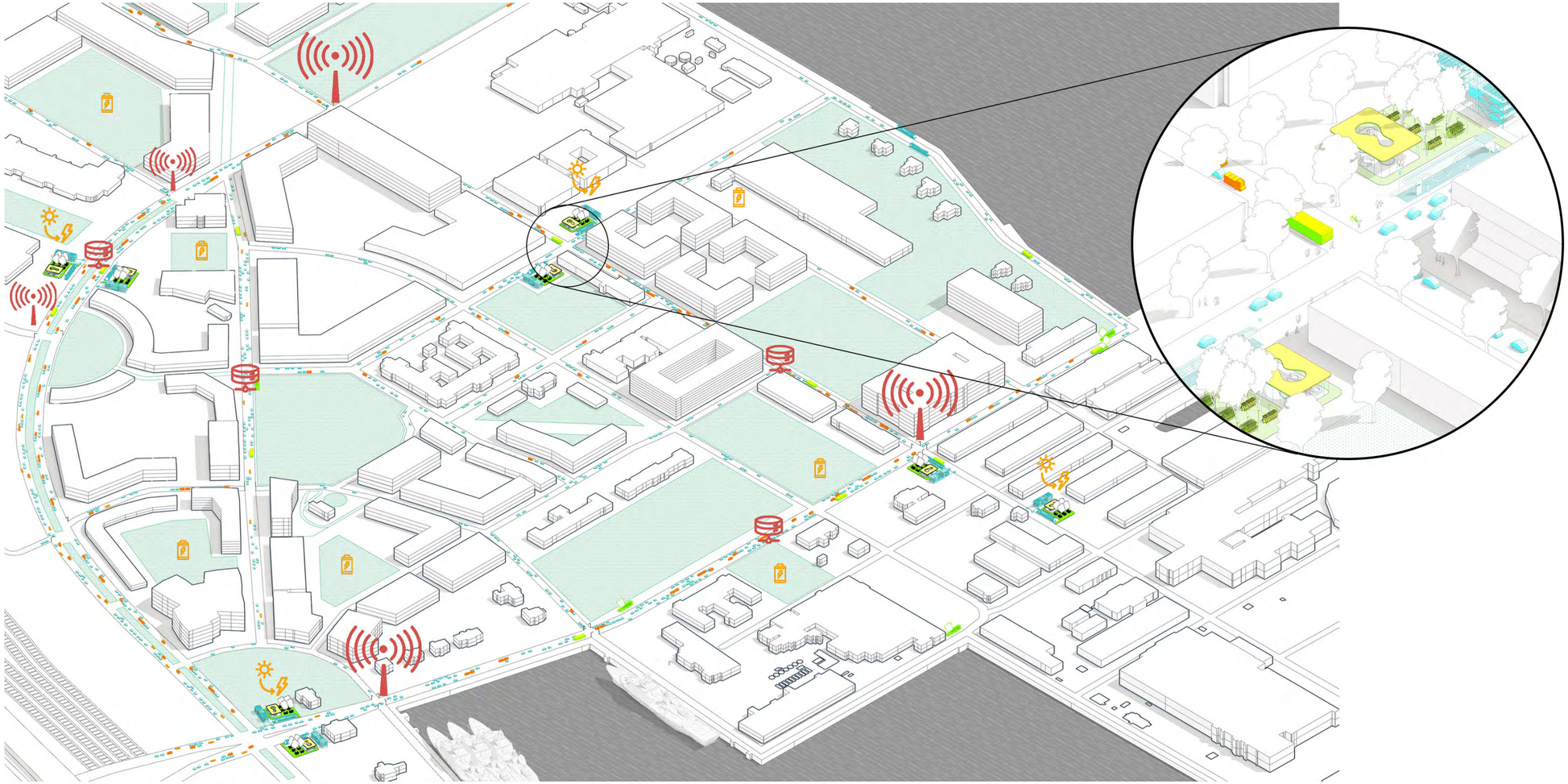


THE NEURON CITY PROTOTYPE



Digital twins of cities map space, people, and activities in the physical city to a virtual city. By building closed-loop city-level data into the virtual city, monitoring, prediction and control of the physical city can be achieved, in order to solve complex problems of the urban lifecycle.

DIGITAL TWIN IN NAVY YARD



Semaphore Sensors

AV Bus

AV Vehicle

AV Shuttle

Traffic Flow Upload

Solar Energy

Parking Charging

Delivery Vehicle

AV +

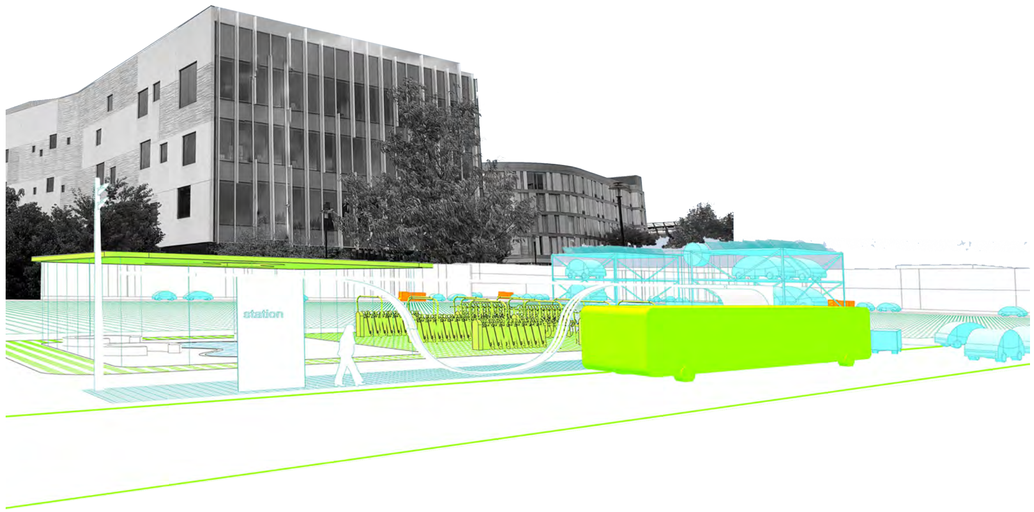
DAILY COMMUTE TO WORK WITH AV-SHARE VEHICLE

SHIPMENT TRAIL

TRACKING COMPANY DELIVERY VEHICLES

PUBLIC TRANSIT +

AV TRANSIT STOP



SCAVENGING EXCURSION

USING A SPECIALLY PRICED X-ZONE TRANSIT SHUTTLE

FUTURE GOALS

Digital twin will provide data support for seamless and personalized travel

Establish more partnerships with on-demand service and ride-sharing service providers to expand corresponding transportation services

Navy Yard will be a world-leading adopter of connected and automated vehicles

Test the integration of autonomous ride services and systems of corresponding transportation services

Test the integration of vehicles sensors and infrastructure

Rapid transition to EV will help Navy yard to reach net zero emissions by 2030

Navy Yard's more efficient public transportation solution will provide data for vehicle automation in other cities

More efficient freight through technology

Obtain and share data to take a more comprehensive view of the supply chain

Automated and sustainable last mile freight vehicles will be trialled and rolled out

Sensors and intelligent systems will create smart transport networks

Smart sensors will be deployed across the network for richer customer information, service performance, and incident response

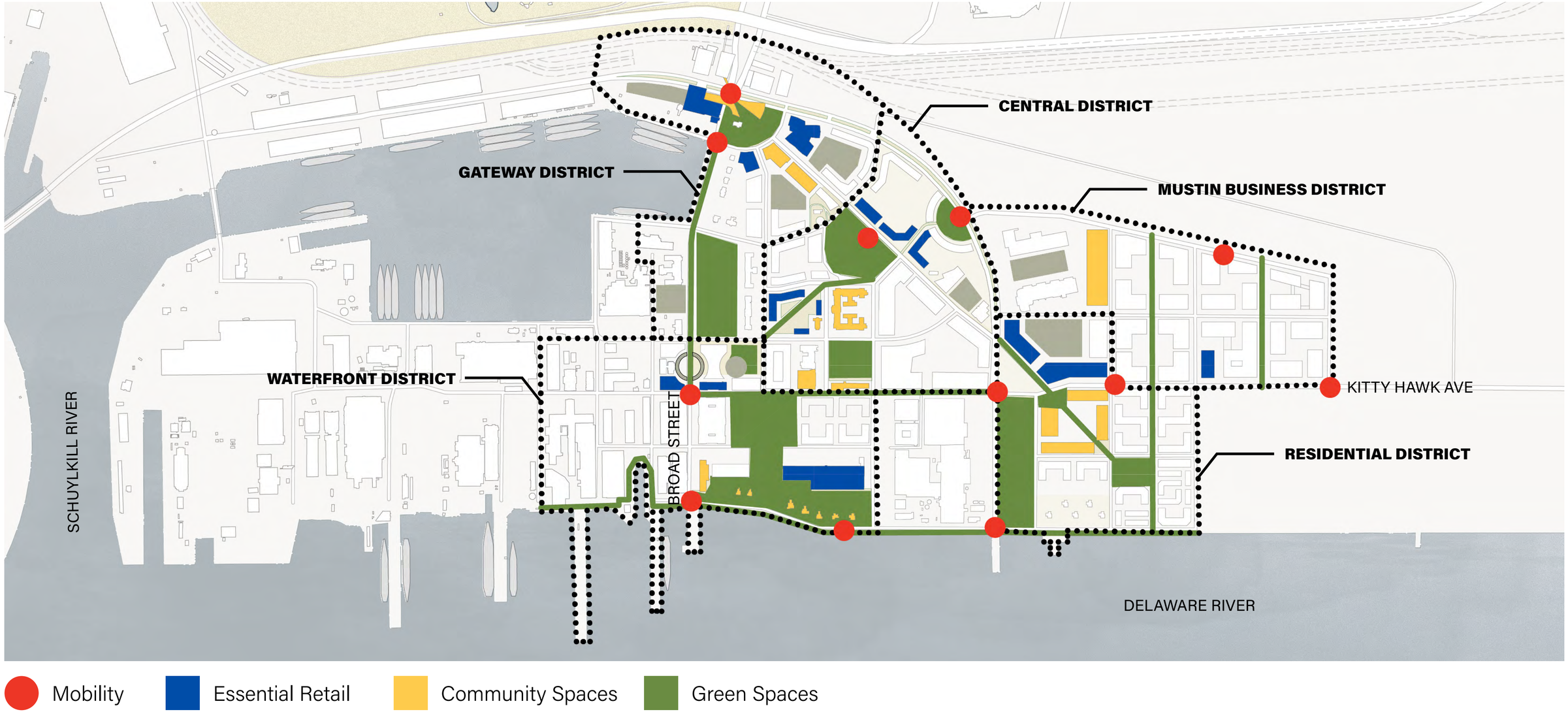
Intelligent systems powered by AI will dynamically optimize network and predict events

6

STREETS
PARKING
ARCHITECTURE
PUBLIC SPACE
DIGITAL INFRASTRUCTURE
SUSTAINABILITY IMPLEMENTATION

SUSTAINABLE DISTRICT PLAN

ACCESS IN THE AGE OF AVs



METRICS OF SUCCESS

	SHORT TERM (2027)	LONG TERM (2035+)
RESILIENCE	40% REDUCTION IN IMPERVIOUS SURFACES	80% REDUCTION IN IMPERVIOUS SURFACES
	15% OVERALL TREE CANOPY	30% OVERALL TREE CANOPY
CARBON NEUTRALITY	SOLAR ON RESIDENTIAL BUILDINGS	CLEAN ENERGY FOR ALL BUILDINGS AND VEHICLES
	20% REDUCTION IN ENERGY USE	50%+ REDUCTION IN ENERGY USE*
SOCIAL EQUITY	AV RIDERSHIP AT 30% OF ALL COMMUTERS	AV RIDERSHIP AT 75% OF ALL COMMUTERS
	ALL AMENITIES WITHIN 5 MINUTE DRIVE	ALL AMENITIES WITHIN 5 MINUTE WALK

*Requires a more thorough calculation of Navy Yard energy use


Clean Energy
AV+Architecture
Mobility
Access
Natural Connections
AV+Parking
Digital Twin
AV+Open Space
AV+Streets

THANK YOU!

We welcome your feedback and discussion of our project