Reimaging the Boston Row House Neighborhood

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Modeling Urban Energy Flows

VISION

Row houses are a popular **typology** in many of **Boston's** vibrant, historic neighborhoods.

Is it possible to use this typology to create a **sustainable, 21st century** Boston **neighborhood?**

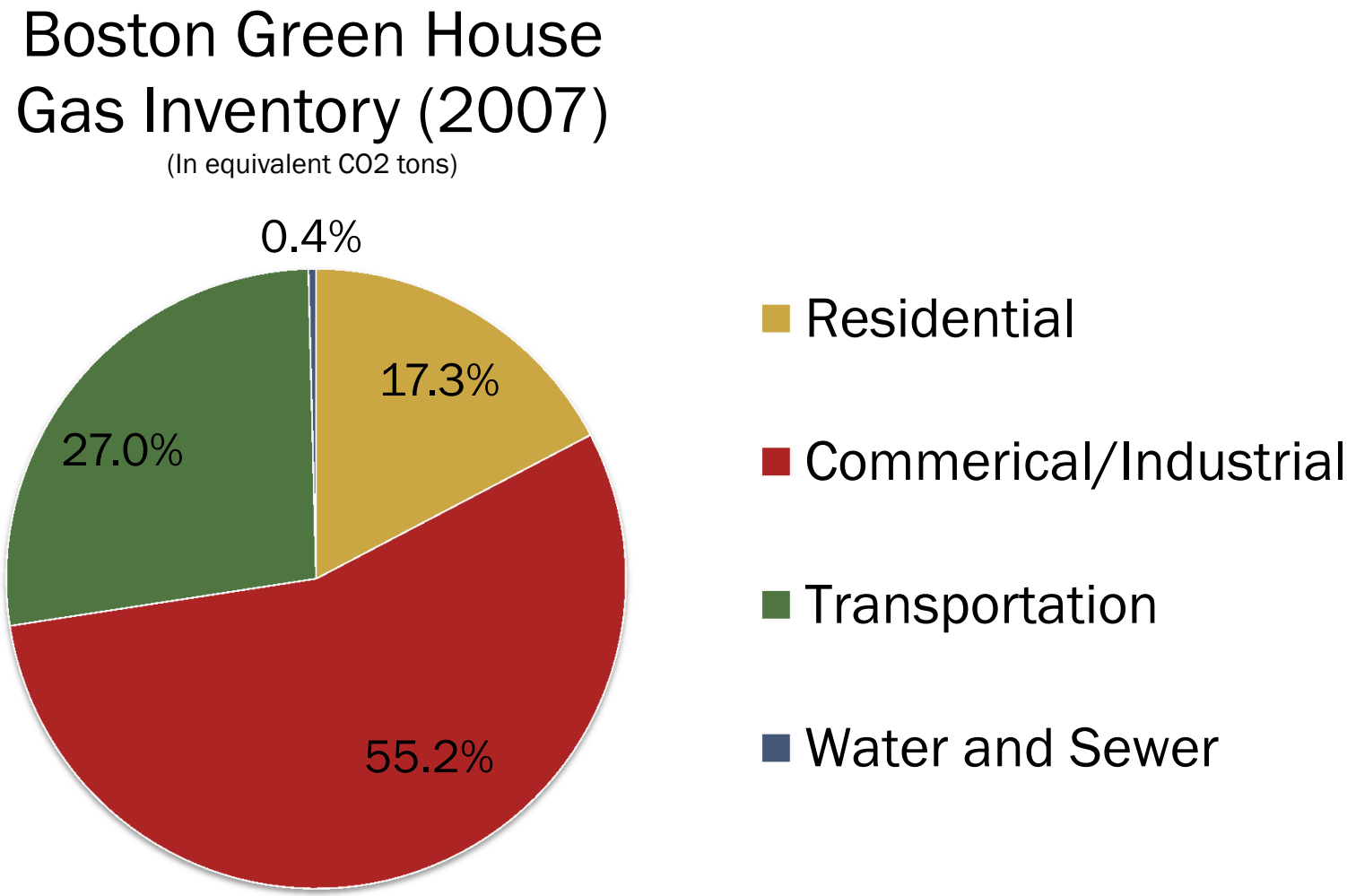

Beacon Hill


Back Bay


South End

North End

URBAN ENERGY FLOWS



OUR SUSTAINABILITY FOCUS AREAS

Metrics:

- All electricity, heating and cooling energy is generated from renewable energy (net-zero).
  - Energy efficient
  - Renewable resources
- Enable a car free lifestyle
  - Transient oriented
  - Walkable and vibrant
- Flexible and responsive to the future functions and conditions

INSPIRATION

NETPOSITIVE

Constructed:
2000-2005

Passivhaus
Heat requirement: 11-14 kWh/m² and year
Solar panels

wide, attractive walkways
bike routes
connections to public transportation

Solar Settlement in Vauban: Freiburg, Germany

100% Locally Renewable Energy System

Constructed: 2001

District Heating and Cooling Plant:
Heat Pump: 1.1 MW Heat, 0.7 MW Cooling
Chillers

Aquifer
Solar panels
Wind power: *2 MW*
Seawater: 0.8 MW

Malmö, Sweden

White Flint, Maryland

"A mix of interest groups not normally keen on major development-senior citizens, environmentalists, social equity advocates-saw the benefits of a more walkable, cyclable, affordable White Flint."

(Michael Smith, executive for developer LCOR Inc.)

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SITE: Bayside Expo Center, Boston, Ma

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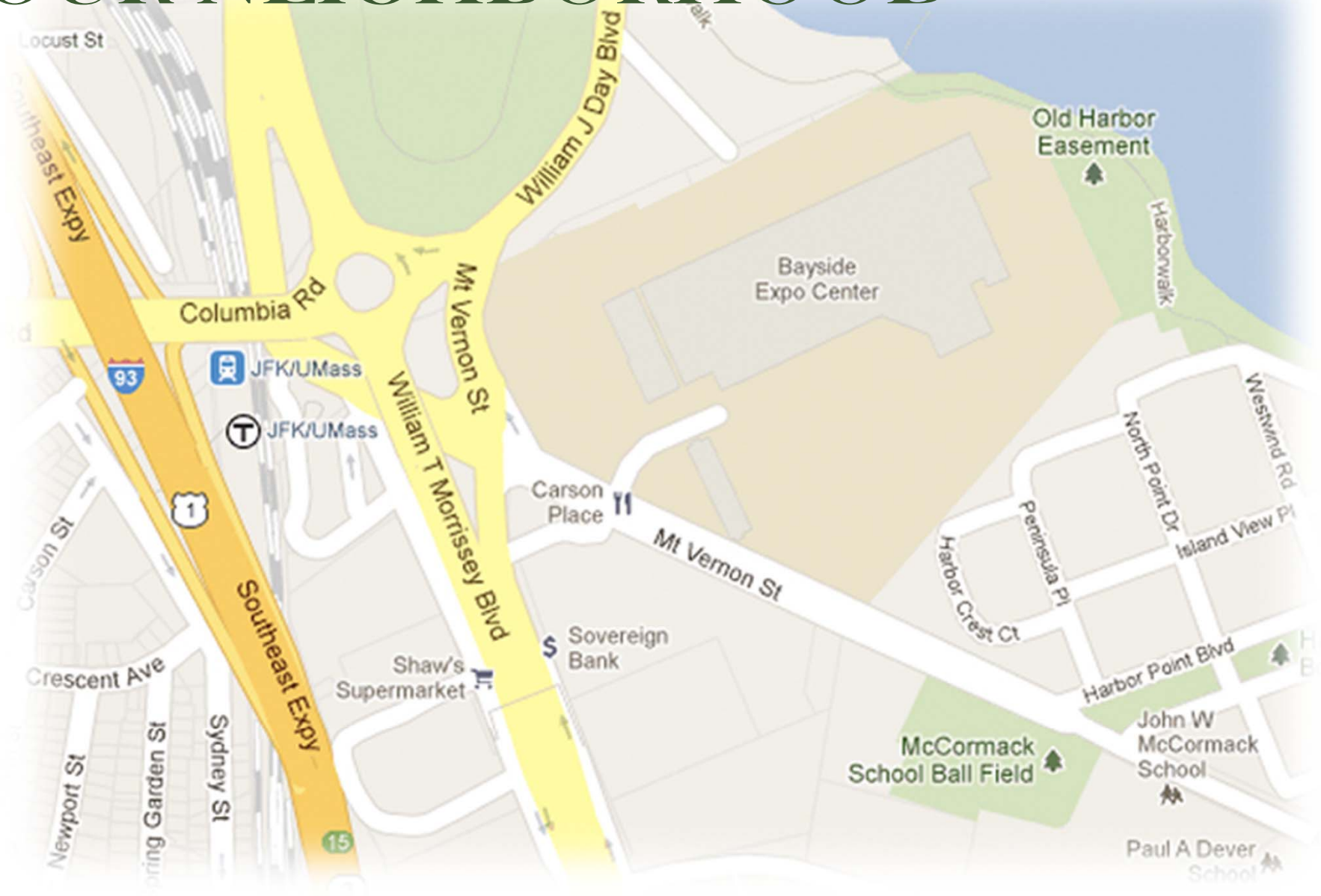
OUR NEIGHBORHOOD



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OUR NEIGHBORHOOD

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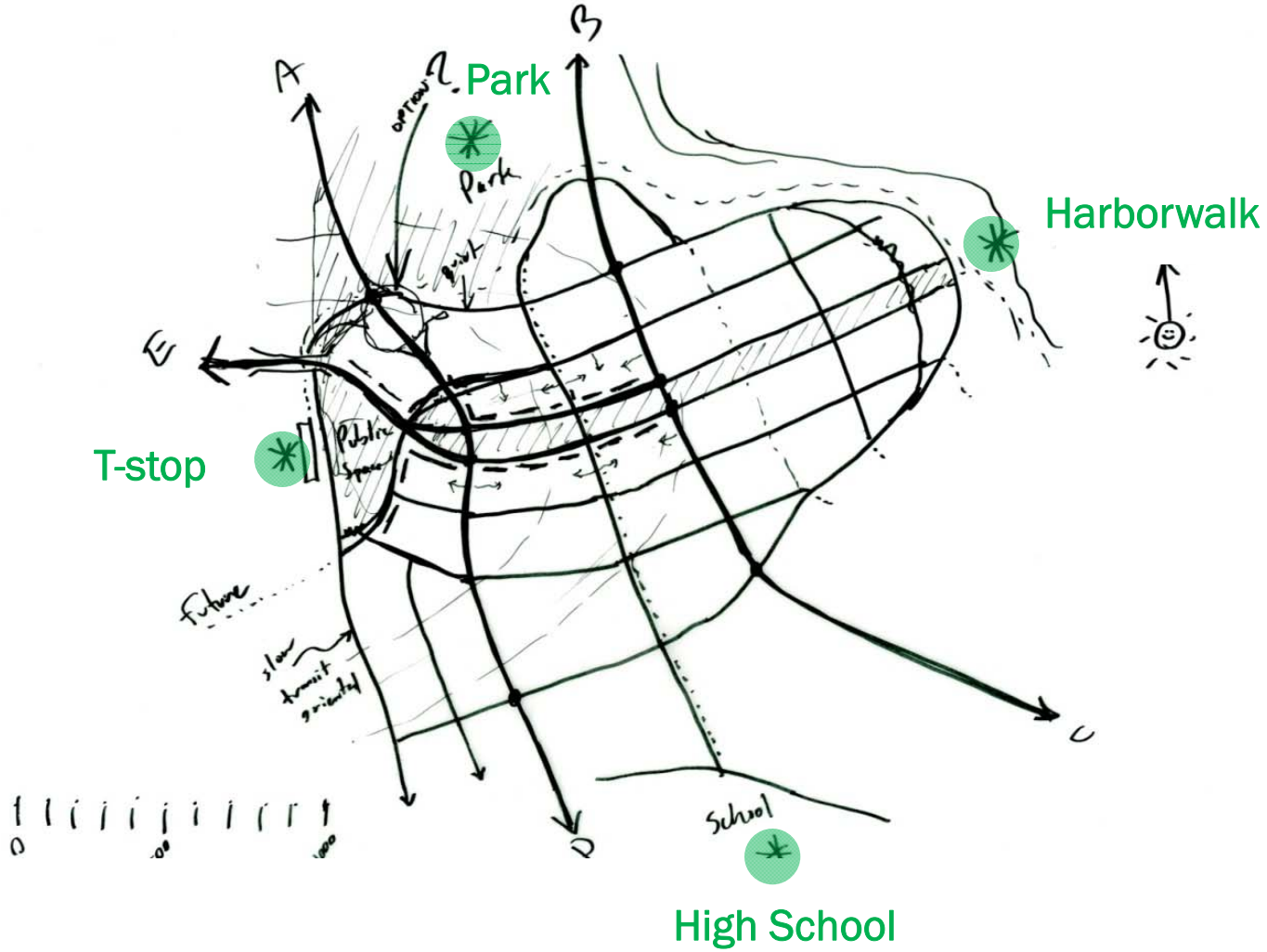
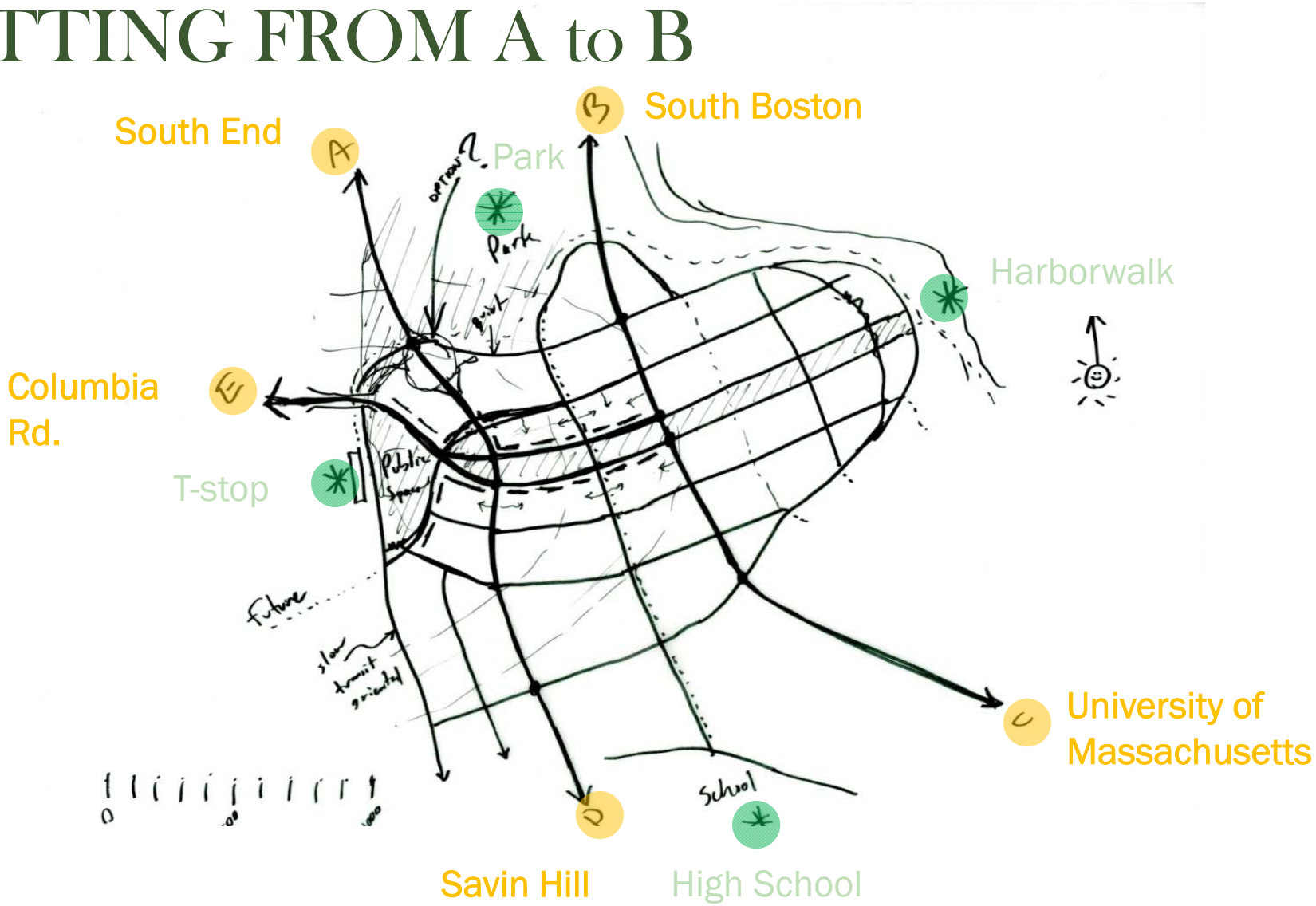
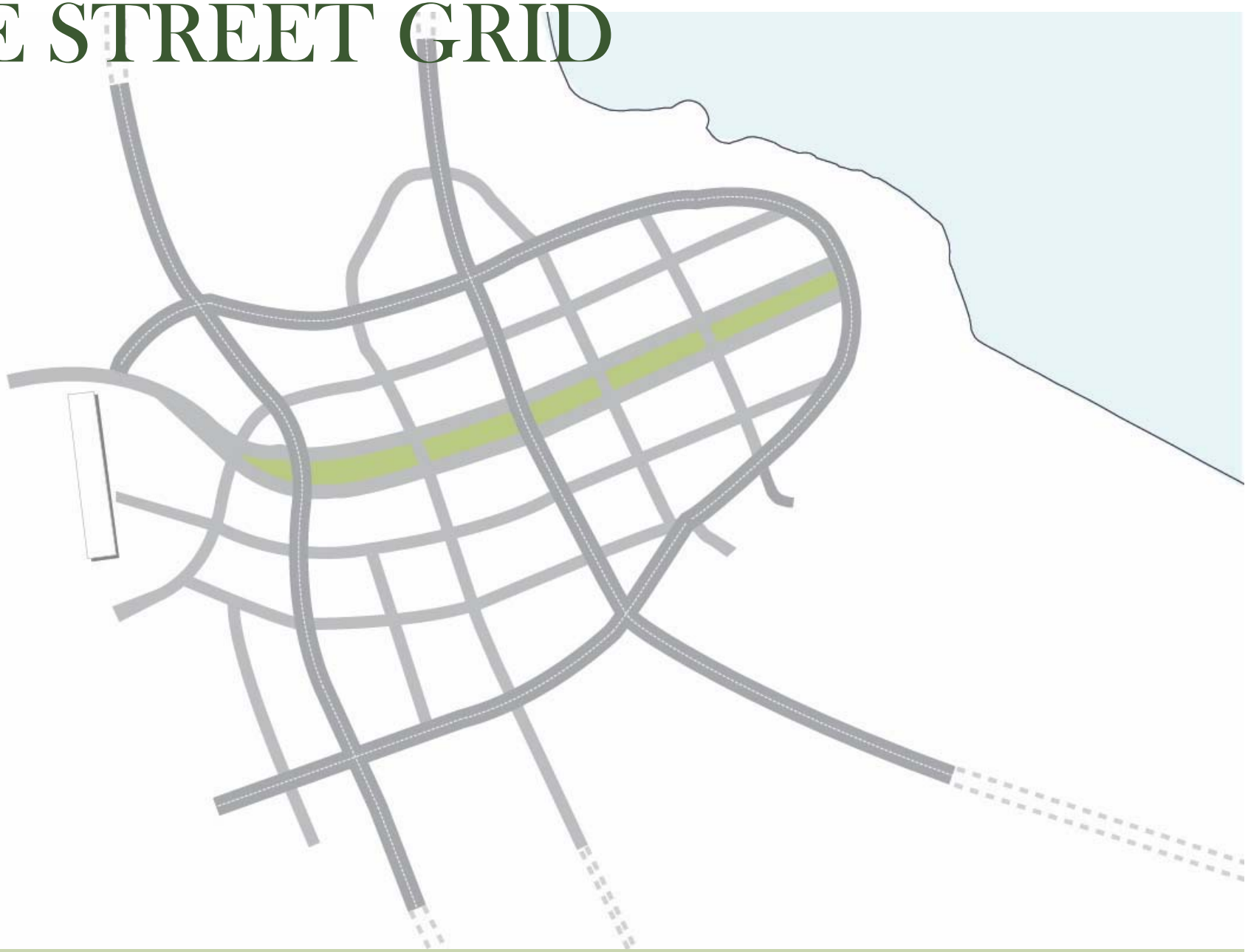
CREATE RELATIONSHIPS



STEET NETWORK: GETTING FROM A to B



THE STREET GRID



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THE PEDESTRIAN & BIKE PATHS

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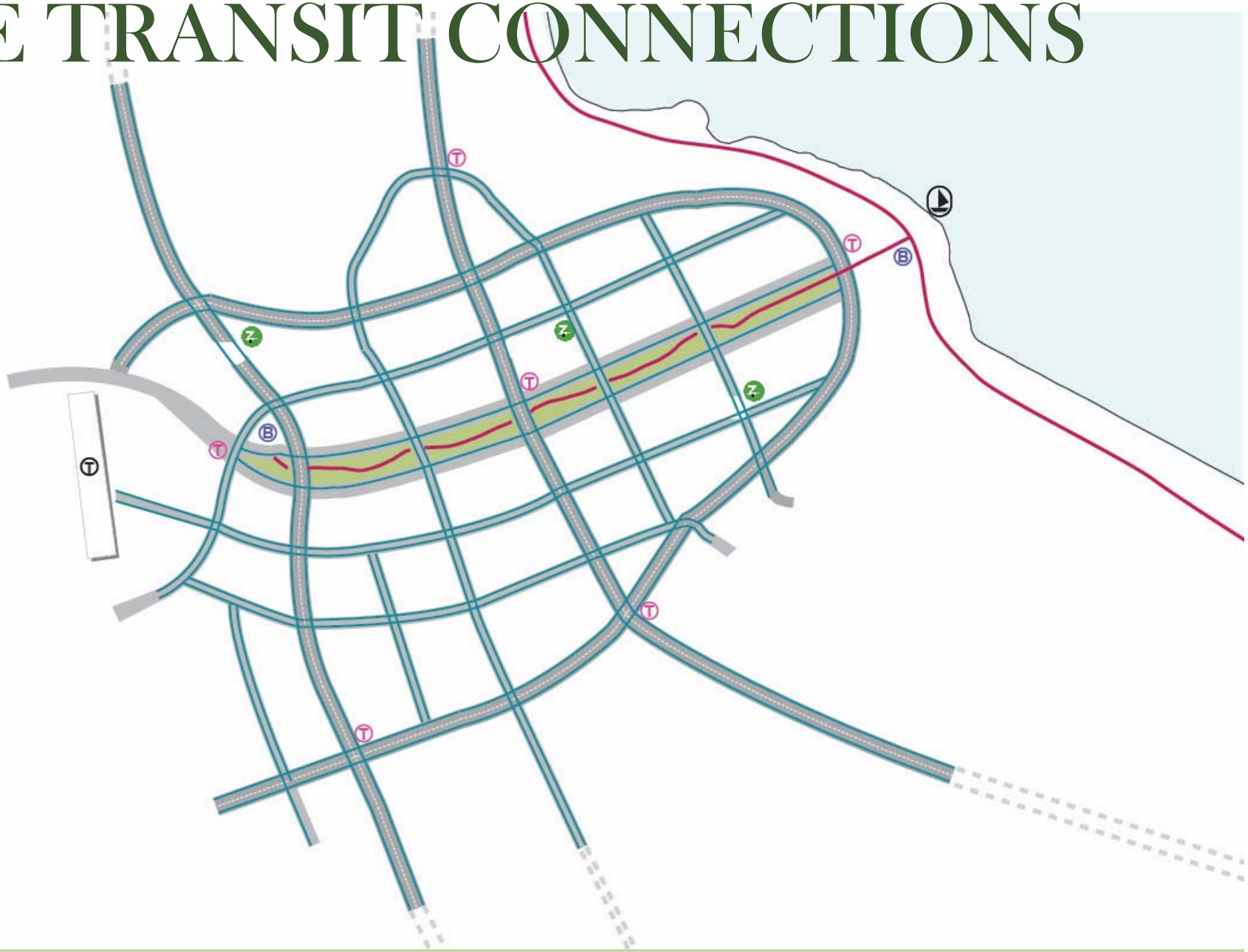
THE TRANSIT CONNECTIONS



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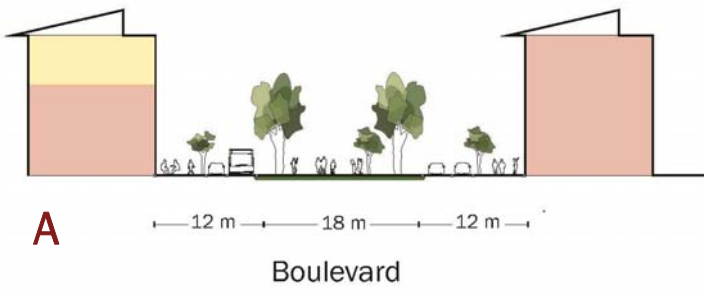
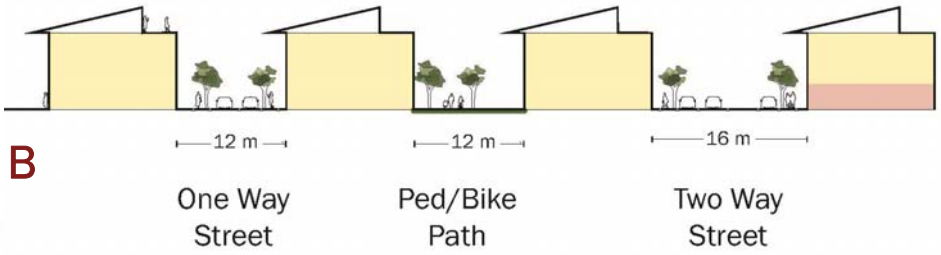
STREET TYPOLOGIES





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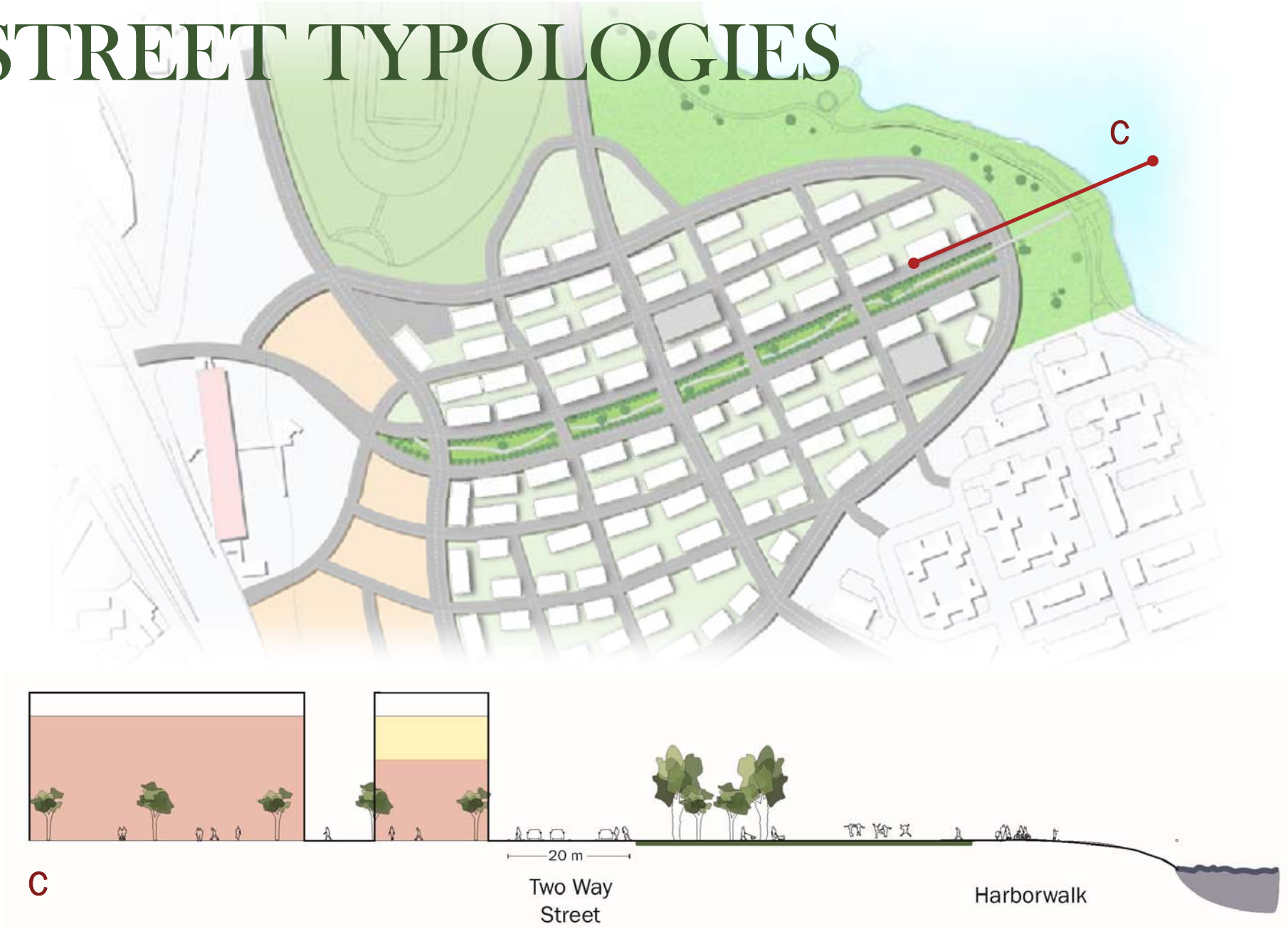

THE BUILDINGS ?

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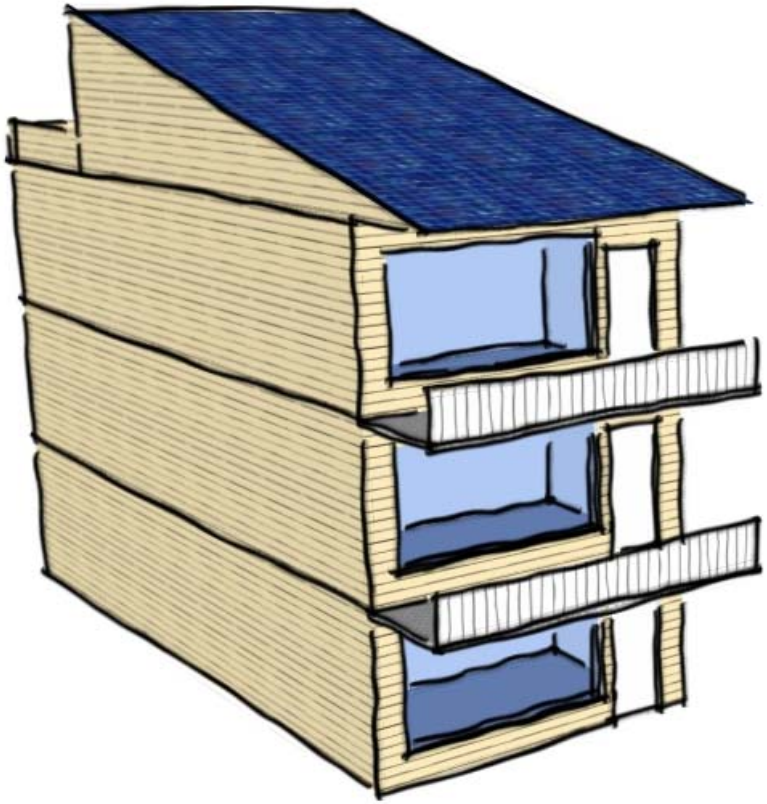
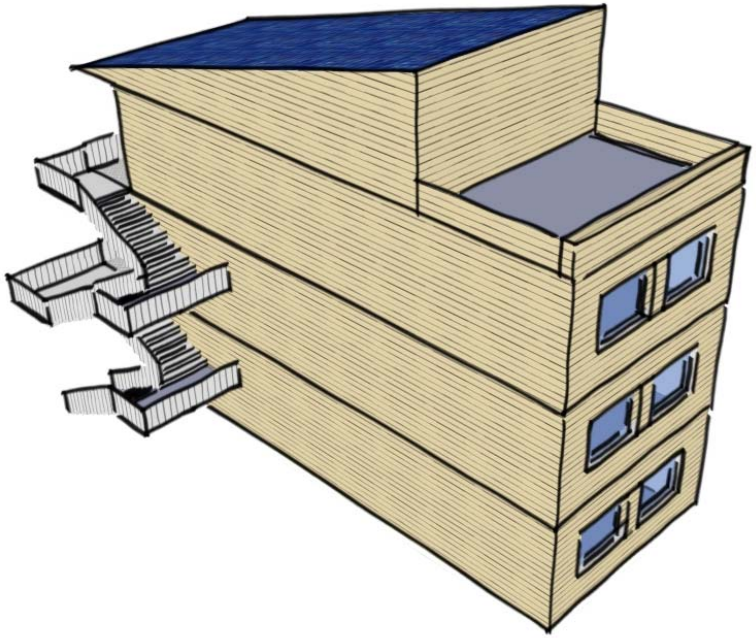
THE BUILDINGS: RESIDENTIAL

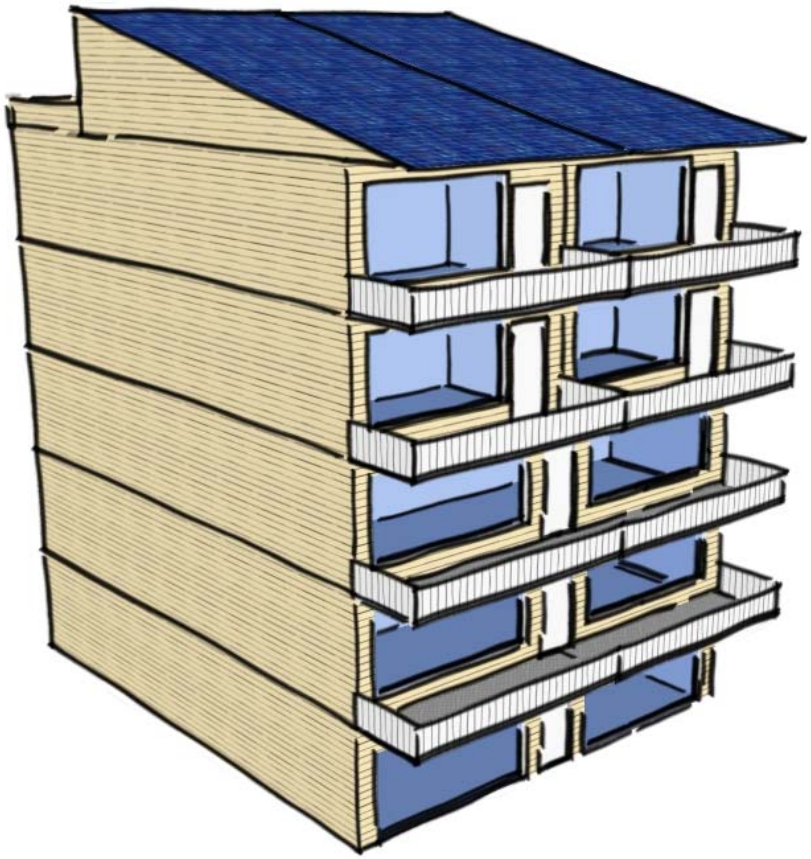




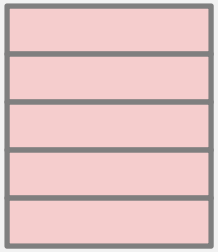
90m^2 & 2.5 people/unit
EUI: **55 kWh/m2**
PV Energy Production: **57 kWh/m2**
Heat Recovery Ventilation & Natural Ventilation in summer

PassivHaus
Super-insulated Timber Frame
U<0.2 W/m^{2}K
30% Glazing
Triple Pane, Low E
U<0.8 W/m^{2}K

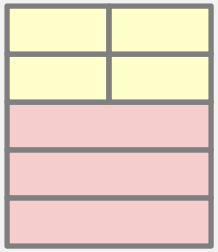
THE BUILDINGS: COMMERCIAL



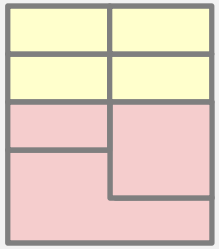
Flexibility of the units



office on all levels



office on lower floors and residential on the higher floors



various floor plans

900m^2, 85 people
EUI: **76 kWh/m2**
PV Energy Production: **34 kWh/m2**
Mechanical Ventilation & Cooling,
Natural Ventilation in summer

HOW DO THEY FIT TOGETHER?

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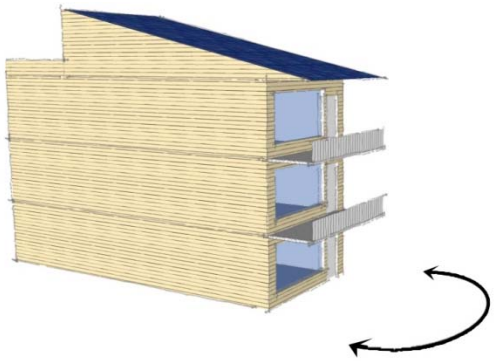
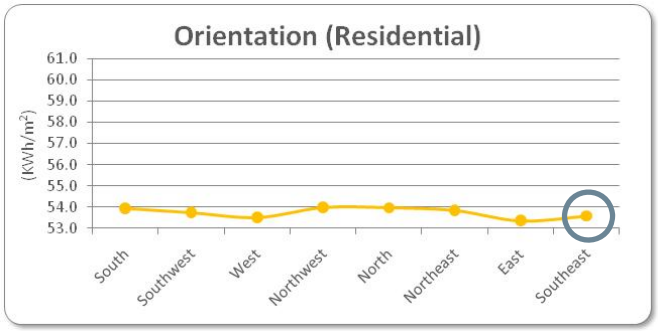
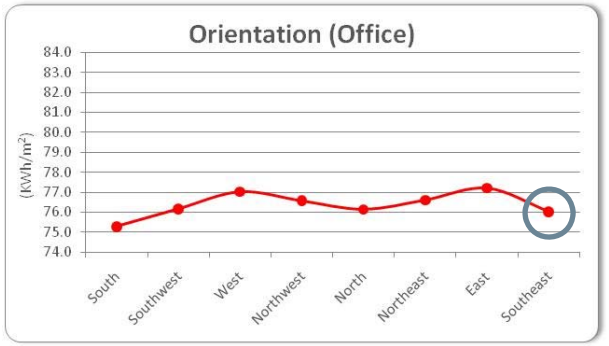
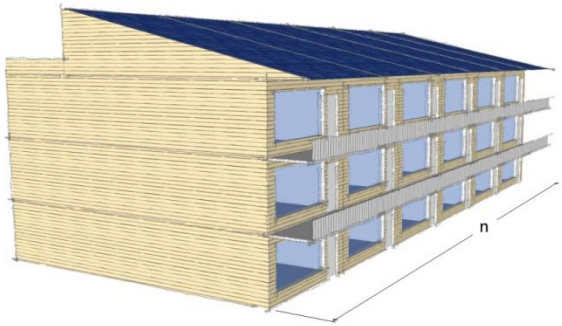
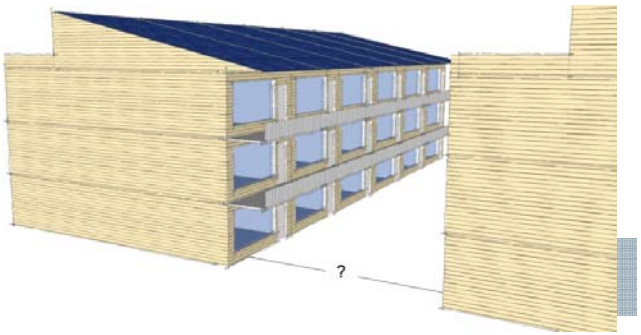
BLOCK ANALYSIS

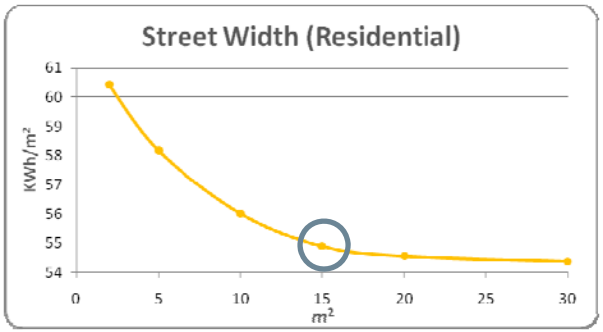












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OUR PROGRAM

1,000 residential units

700,000 square feet of commercial (63,500 m^2)

200,000 square feet of retail (18,600 m^2)

500,000 square feet of office (44,900 m^2)

SCENARIO 1

2300 Parking Spaces (29% on-street, 63% garage, 8% surface)

SCENARIO 2

670 Parking Spaces (100% on-street)

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HOW MUCH PARKING IS REASONABLE?

General Parking Requirements	For Our Site
0.7 per 1,000 sf of Office (Portland)	338
1.0 per 1,000 sf of Retail (Portland)	200
0.5 per Residential Unit	500
Total	1038

We can expect some complementary usage (i.e., office worker uses a parking space during the day and a resident uses it at night)

Some portion of our spaces will be dedicated towards car share programs.

Our estimate matches the BRA's proposal for 1,000 spaces on the site.

SCENARIO 3

Cost Savings: **$22.7 million** compared to Scenario 1

1000 Parking Spaces (64% on-street, 31% garage, 5% surface)

WALKABILITY

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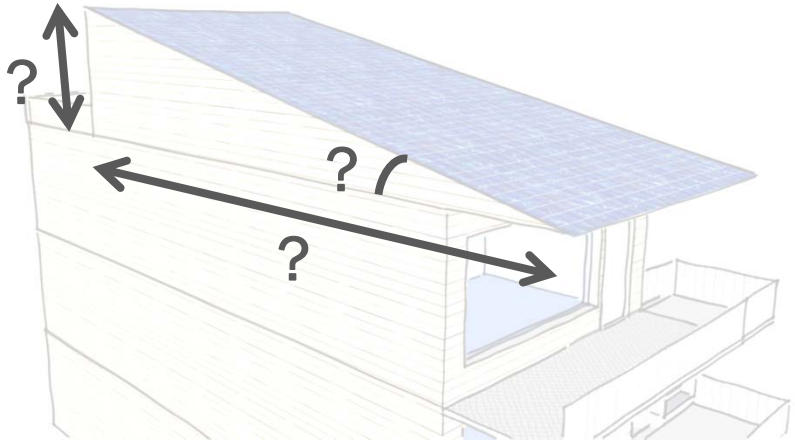
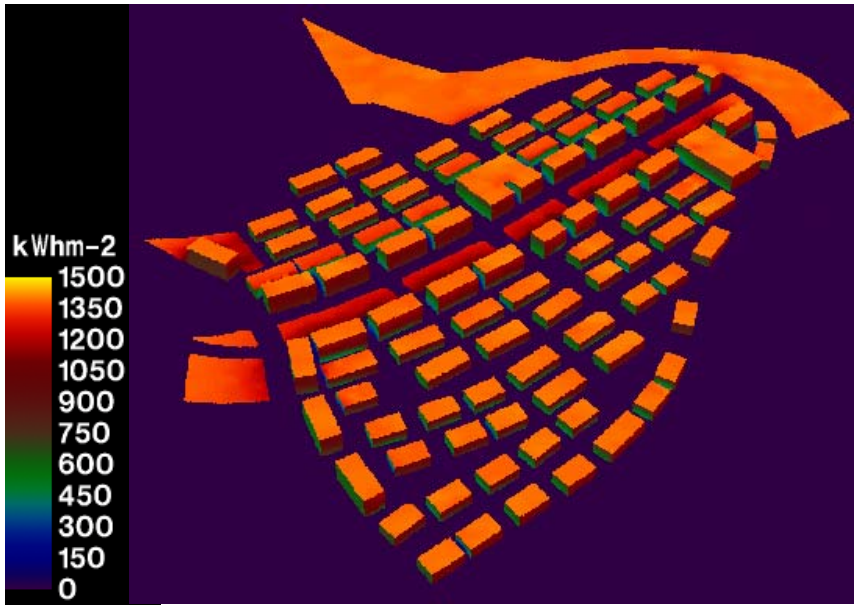
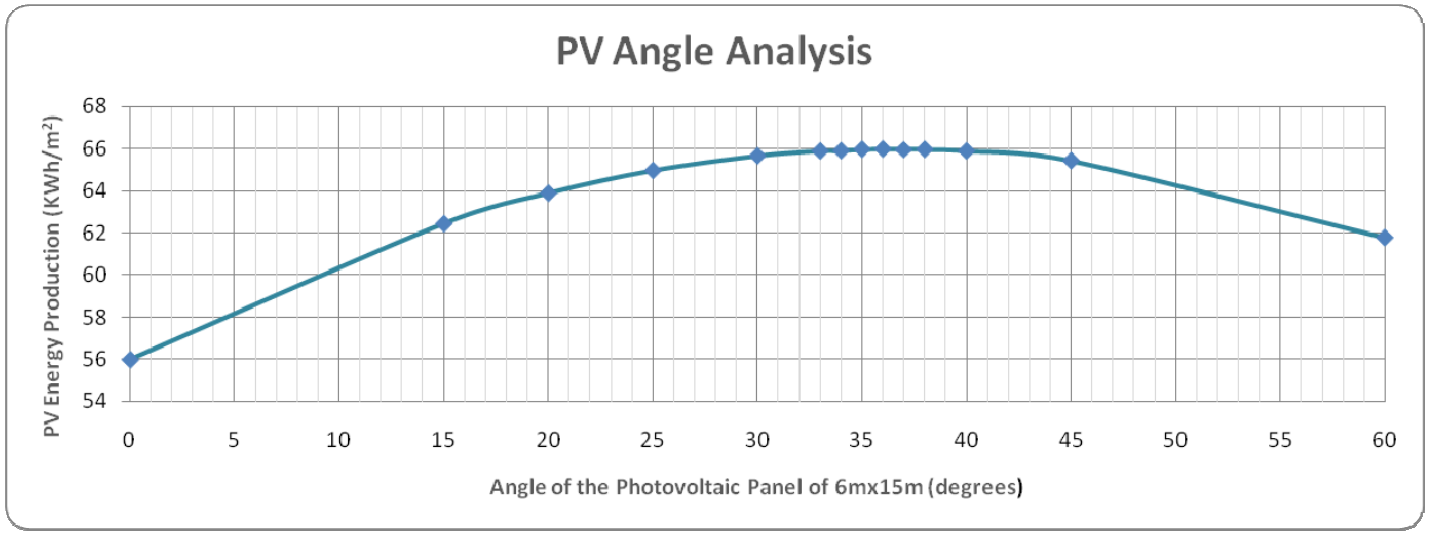
ENERGY INFRASTRUCTURE: HEATING & COOLING

ENERGY INFRASTRUCTURE: ELECTRICITY







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ENERGY INFRASTRUCTURE: SUMMARY

No. of Buildings
Residential- 332 (900,000 m^2)
Commercial- 71 (62,500 m^2)

Electricity

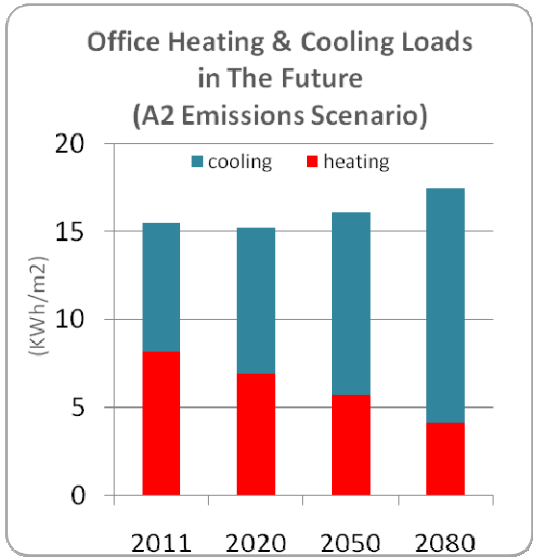
	Annual Electricity Consumption (KWh)	**Annual PV Potential** (KWh)	**Percentage of Energy Generated**
Residential	2,913,300	5,127,208.80	139%
Commercial	3,680,100	2,177,519.40	33%
Total	**6593 MWh**	**7304 MWh**	**111%**

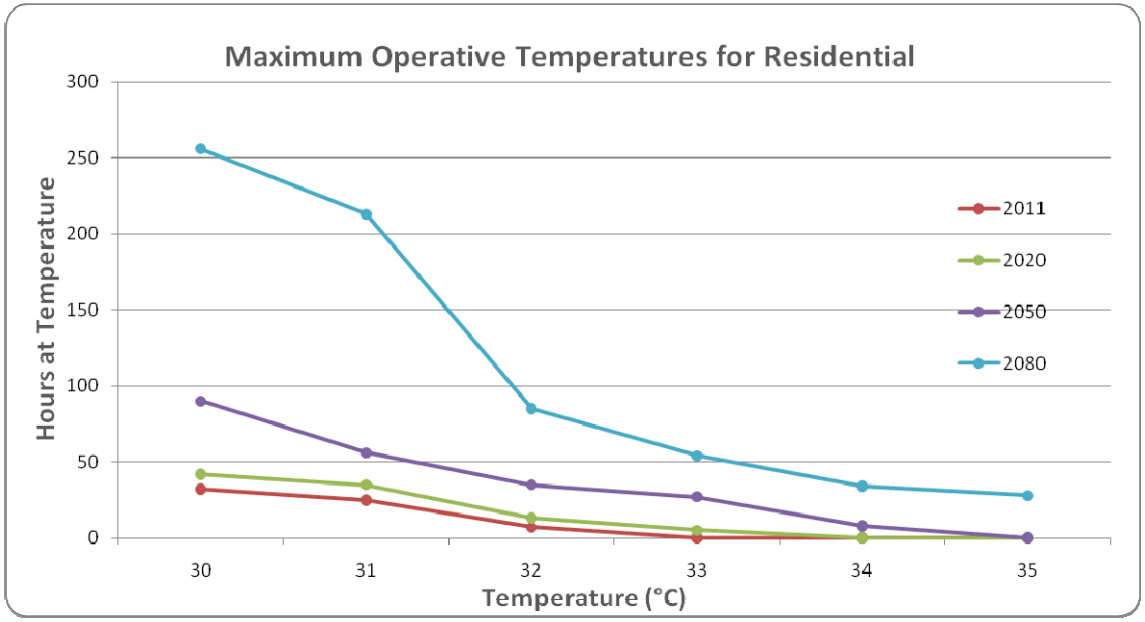
Heating | Cooling

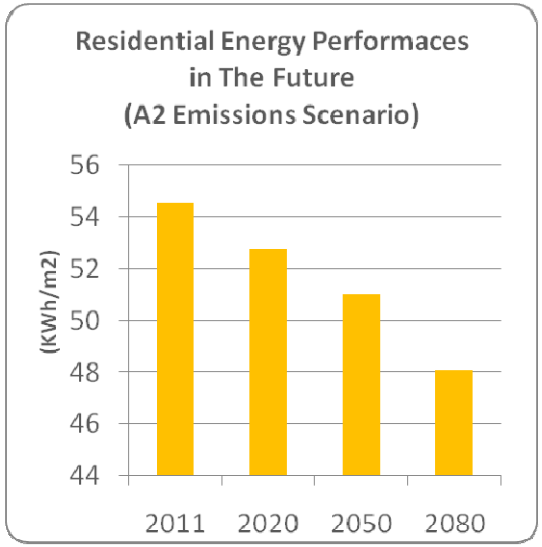
	Peak Heating Demand (December, 13:00)	**Peak Cooling Demand** (July, 15:00)
Residential	4482	0
Commercial	418.77	2411.1
Total	**4.9 MW**	**2.4MW**

NEIGHBORHOOD FUTURE

Increased temperature extremes
Sea level rise
Shift to Urban
Higher energy prices







NEIGHBORHOOD EVALUATION

Metrics:

- All electricity, heating and cooling energy is generated from renewable energy (net-zero).
  - Energy efficient
  - Renewable resources
- Enable a car free lifestyle
  - Transient oriented
  - Walkable and vibrant
- Flexible and responsive to the future functions and conditions

CONCLUDING THOUGHTS

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