



Central Square Retrofit

Transforming the Mass Ave. corridor into a pedestrian centered live-work environment

Apoorv Goyal, Thomas Sherman, Zachary Shore, Saurabh Shrestha, Arta Yazdanseta

Central Square, Cambridge | Retrofit

Boston

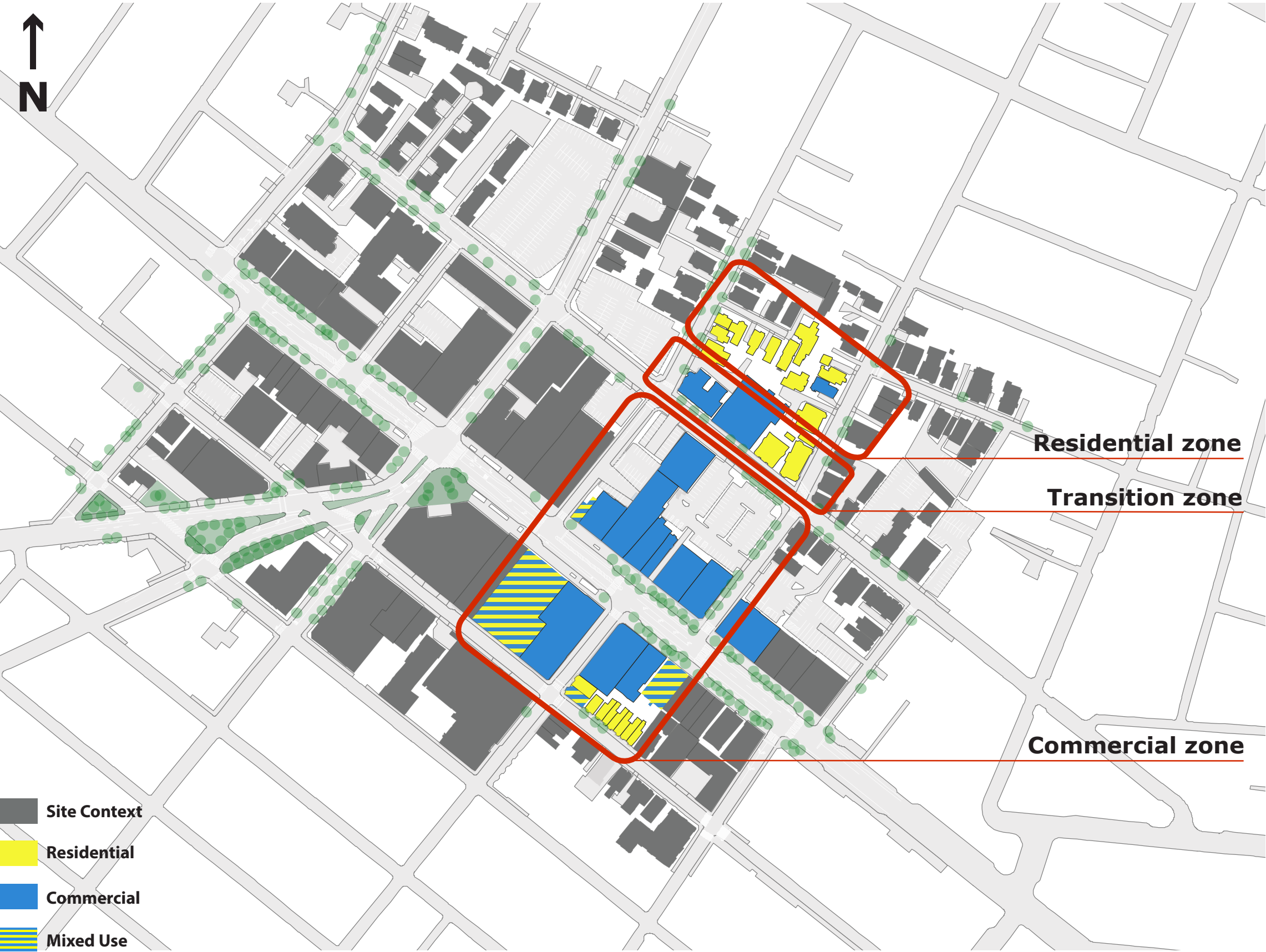


Central Square, Cambridge | Retrofit



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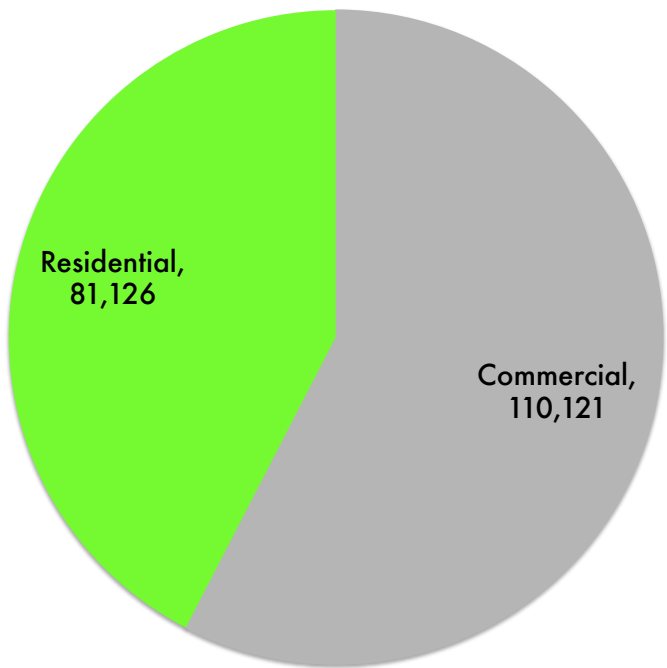
Land Use Map_Existing



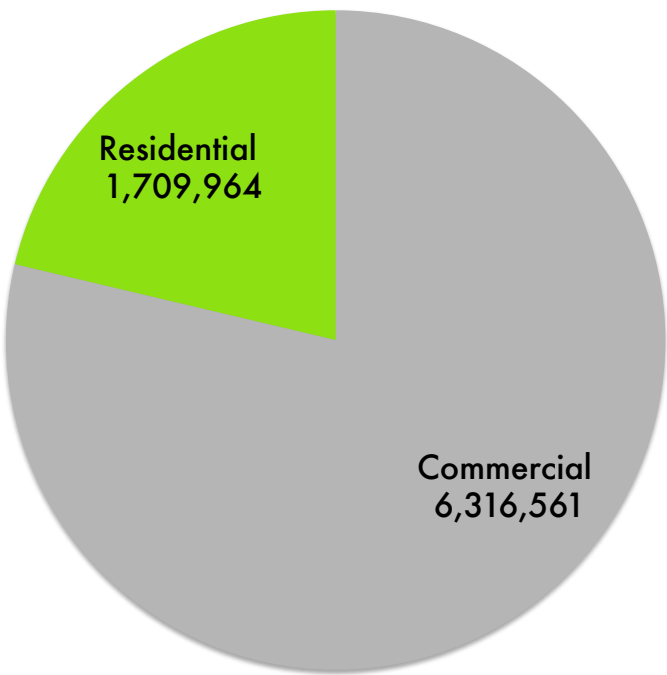
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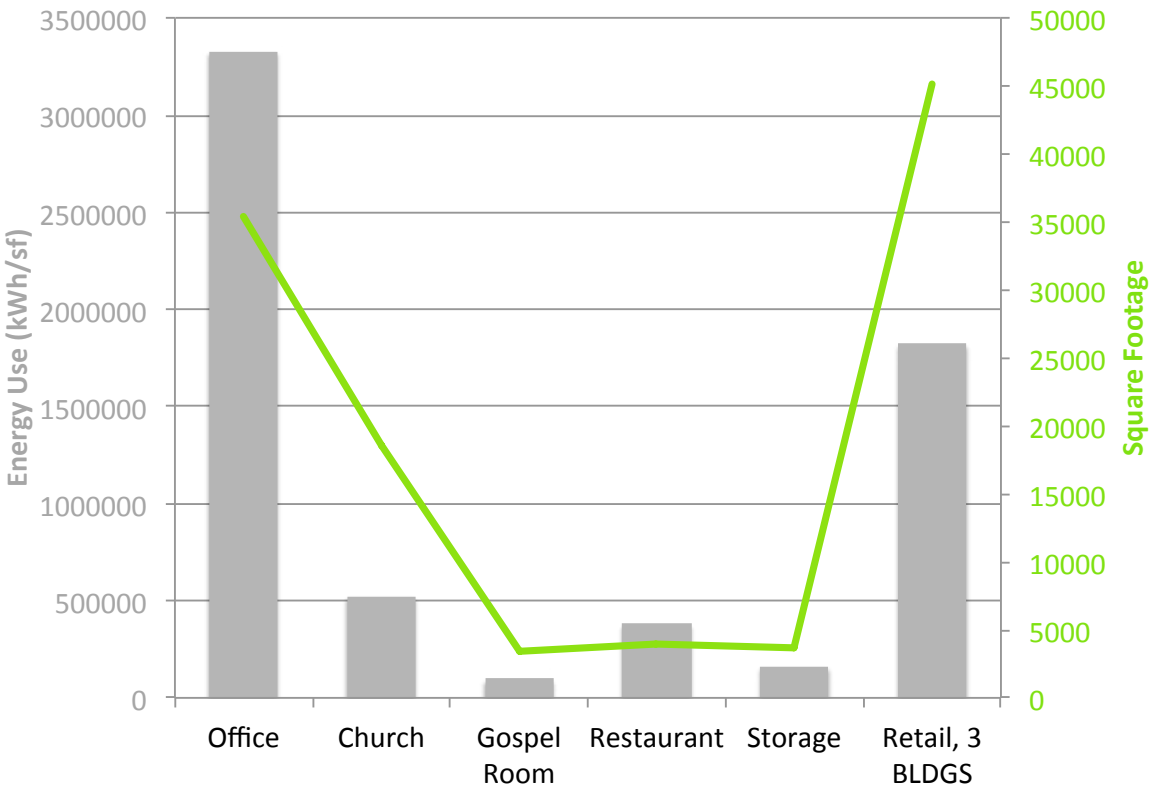
Commercial vs Residential Square Footage



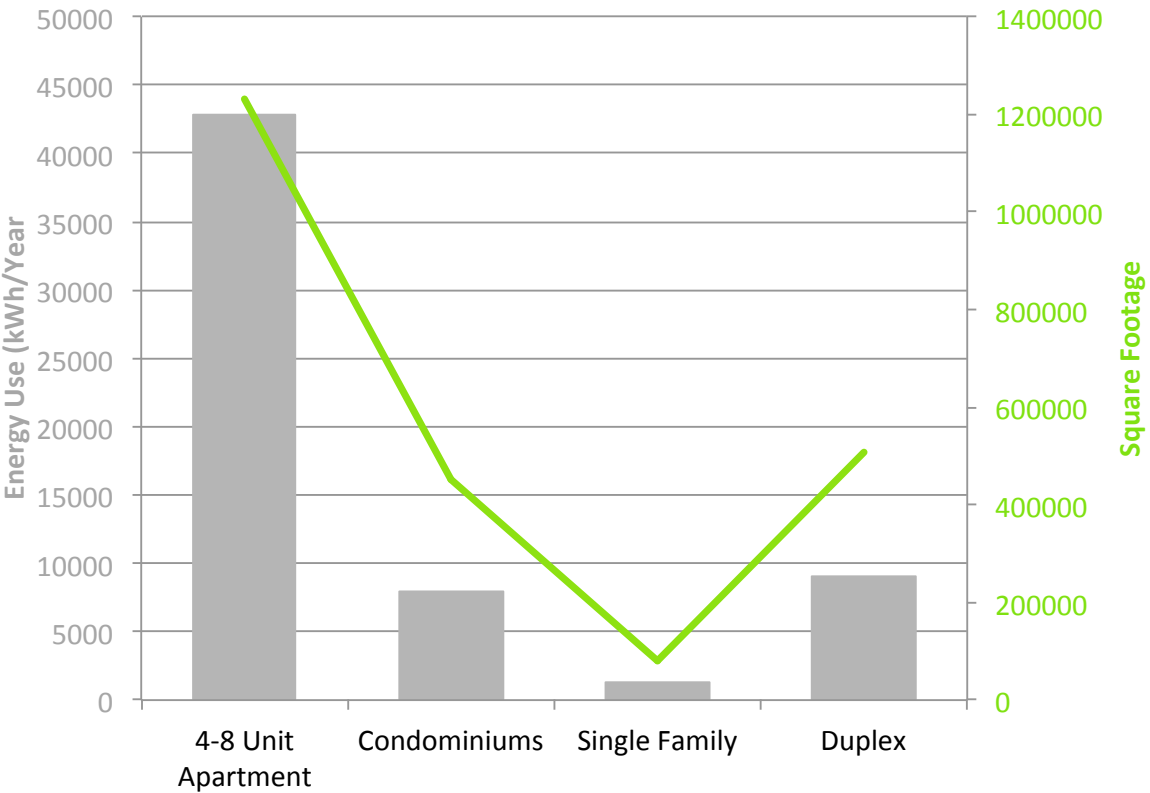
Total Site Energy Use (kWh/Year)



Commercial Energy Use and Square Footage



Residential Energy Use and Square Footage

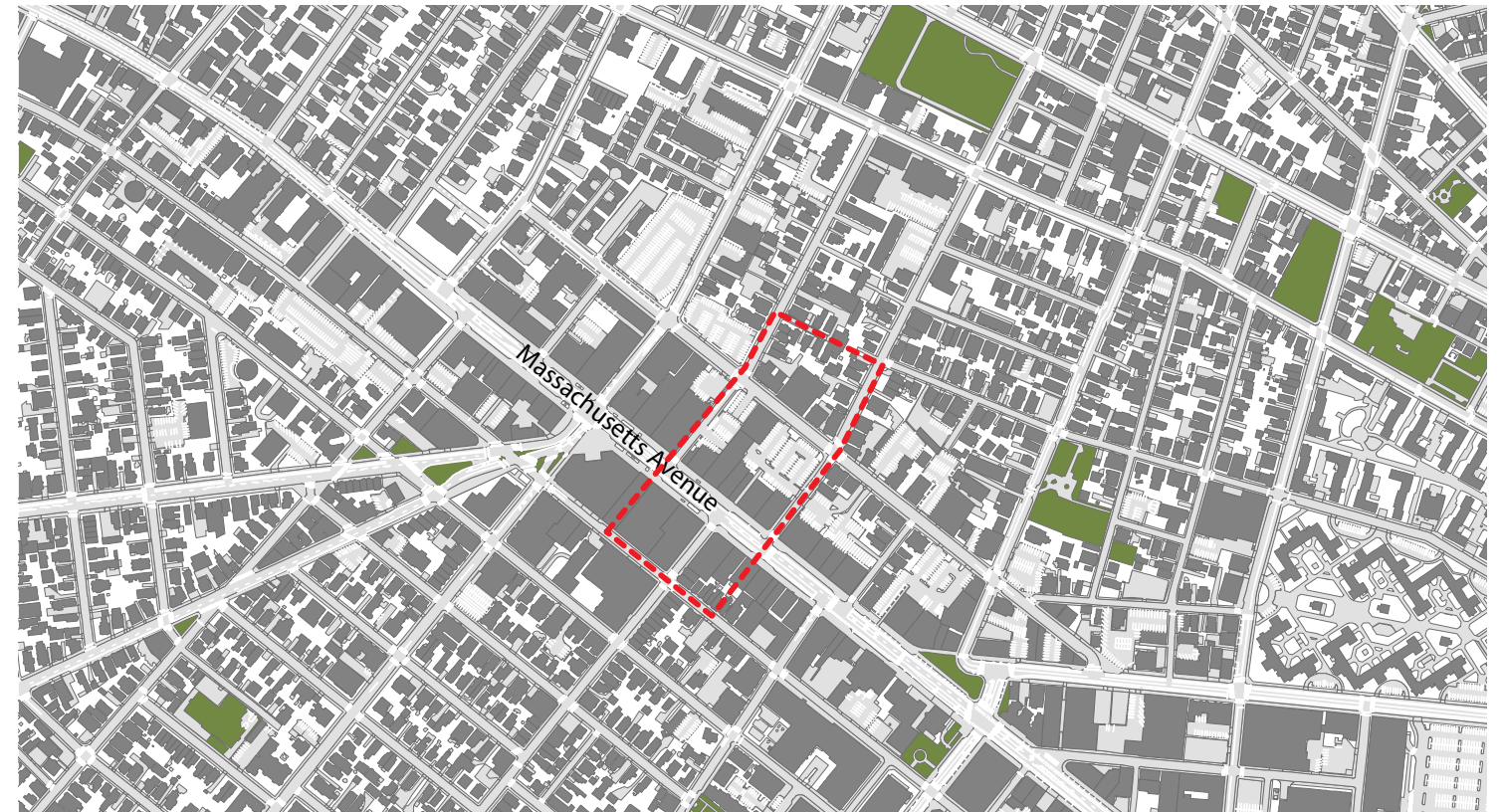


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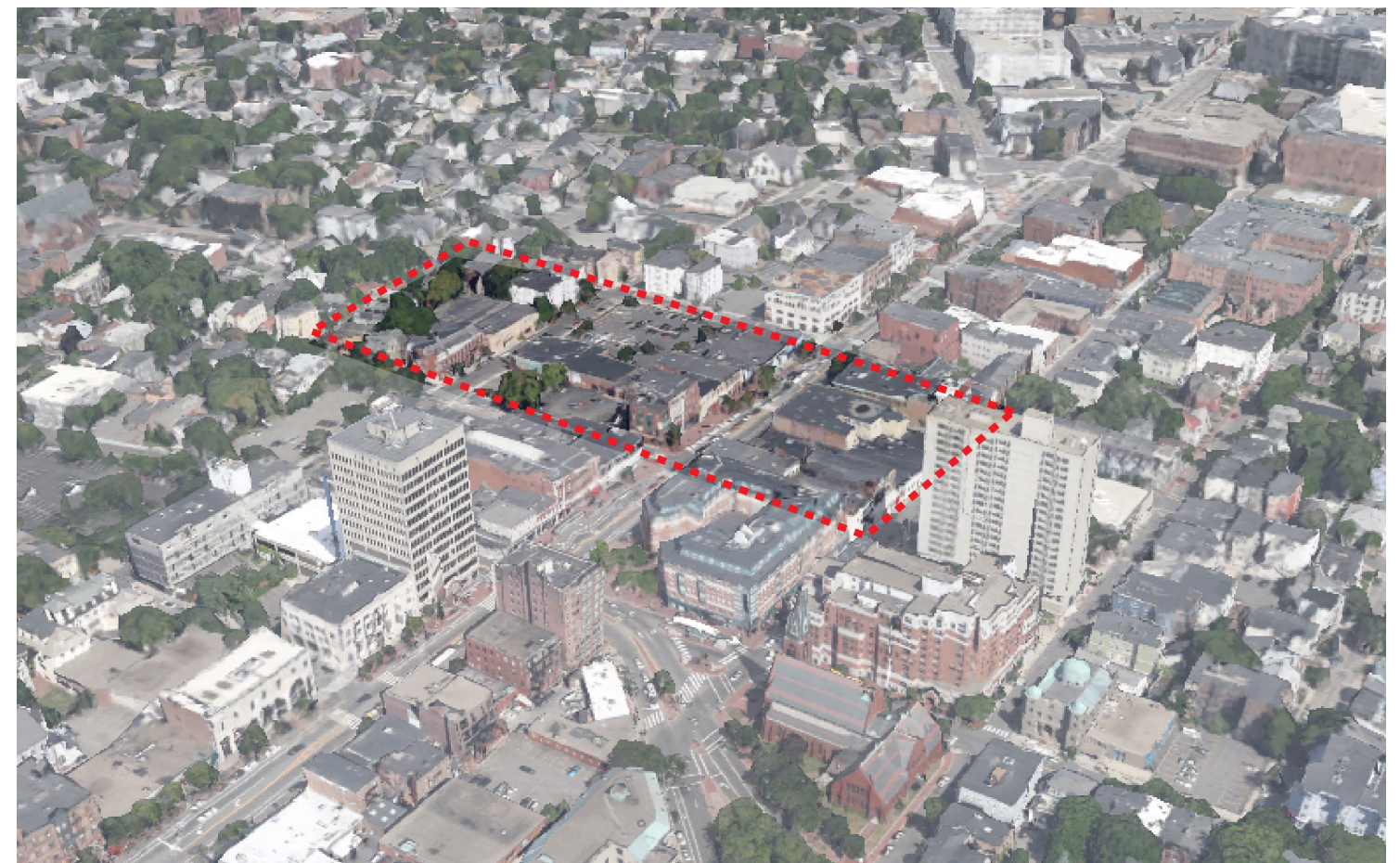


Constraints

- Lack of open space and public parks.
- Lack of mixed use buildings and a live/work environment
- Deep floor plate buildings along the Mass Ave corridor lack natural daylight.
- Unpleasant wind conditions along Mass Ave, and a lack of trees or other wind blocking system.
- Abundant parking lots generate minimal revenue, and cause a division between the residential and commercial districts.
- Excessive impermeable areas cause urban heat island effect, and hamper water drainage.
- No permanent community gathering space like a farmersmarket or outdoor venue.
- Lack of pedestrian throughway connections between Mass Ave corridor and residential neighborhoods.



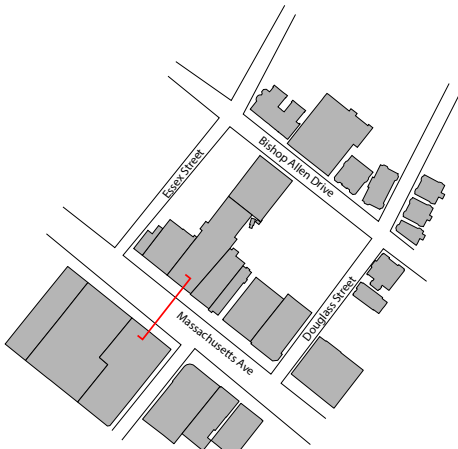
Open Space GIS Layer - Central Square



Aerial Image of Central Square

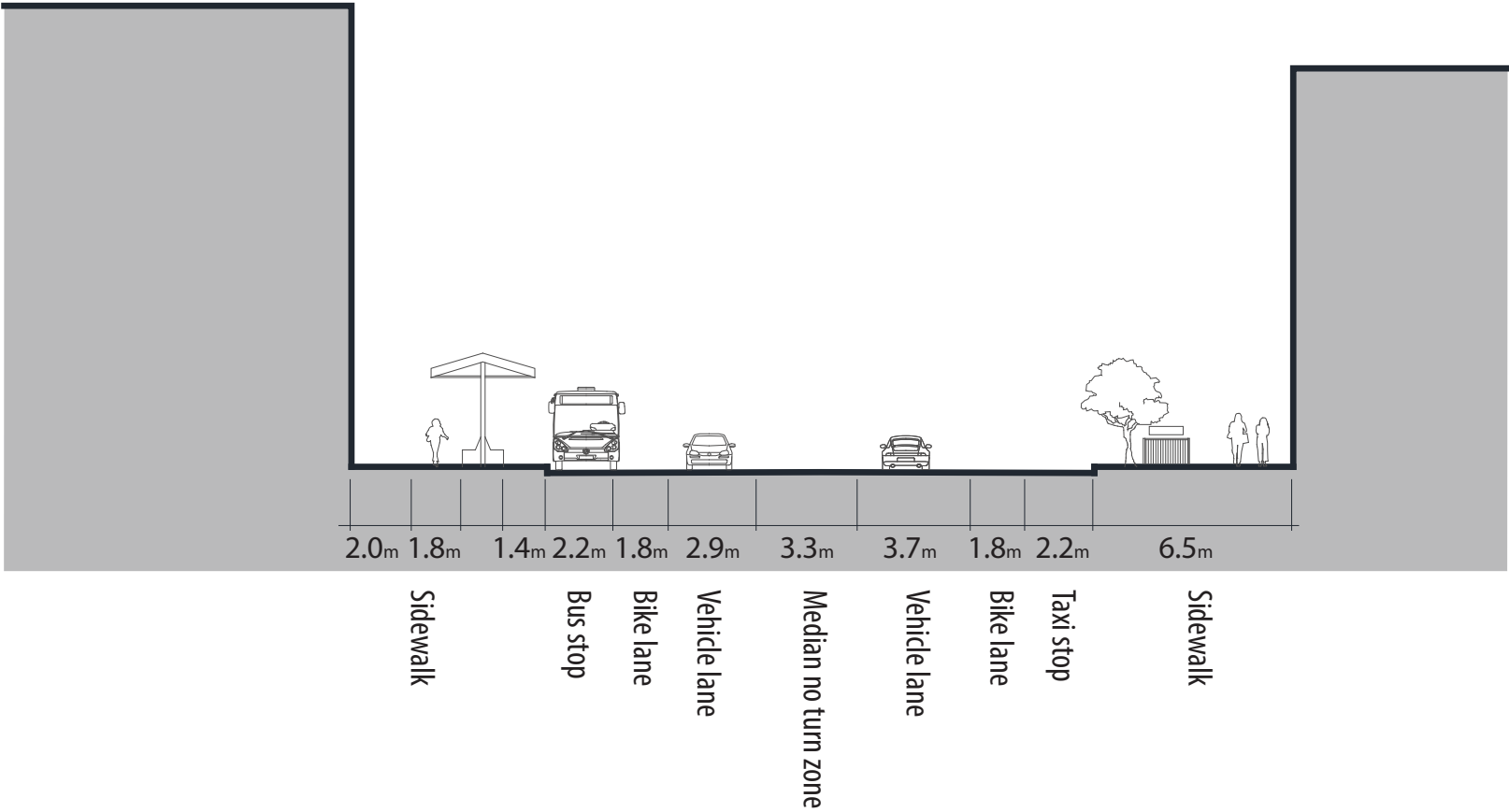
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Sections



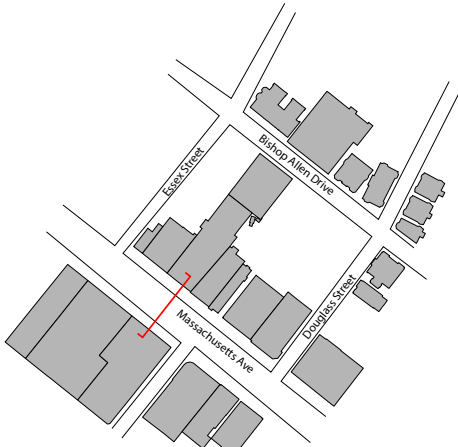
Key Plan

Mass Ave_Existing

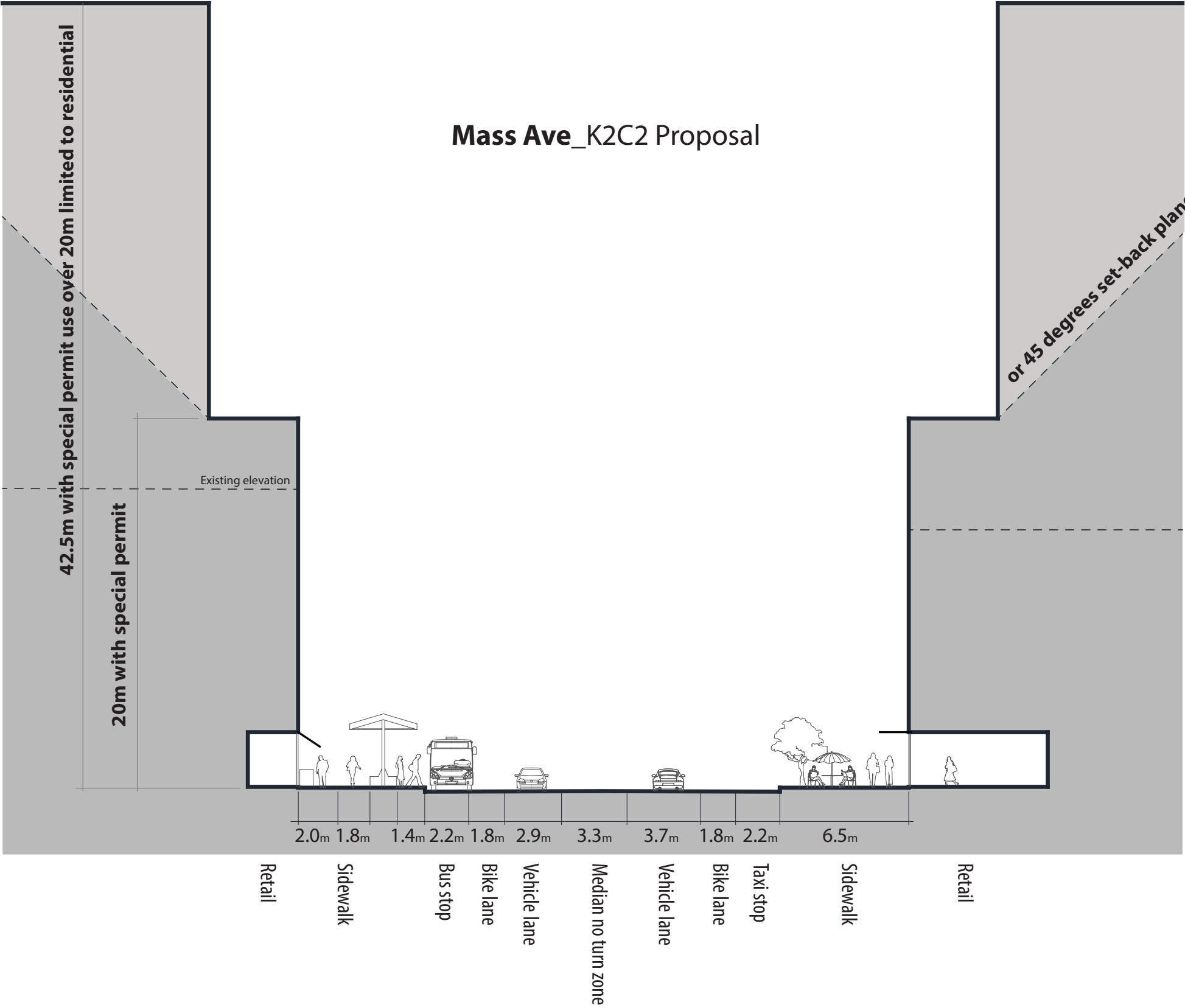


Central Square, Cambridge | Retrofit

Sections

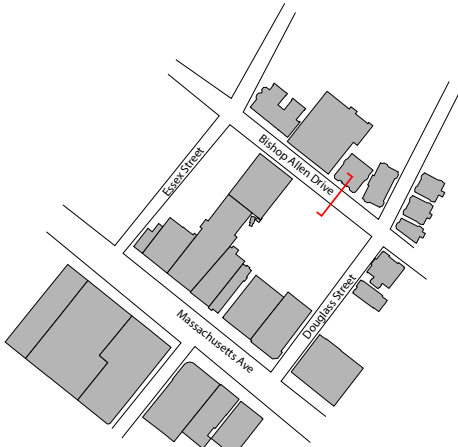


Key Plan



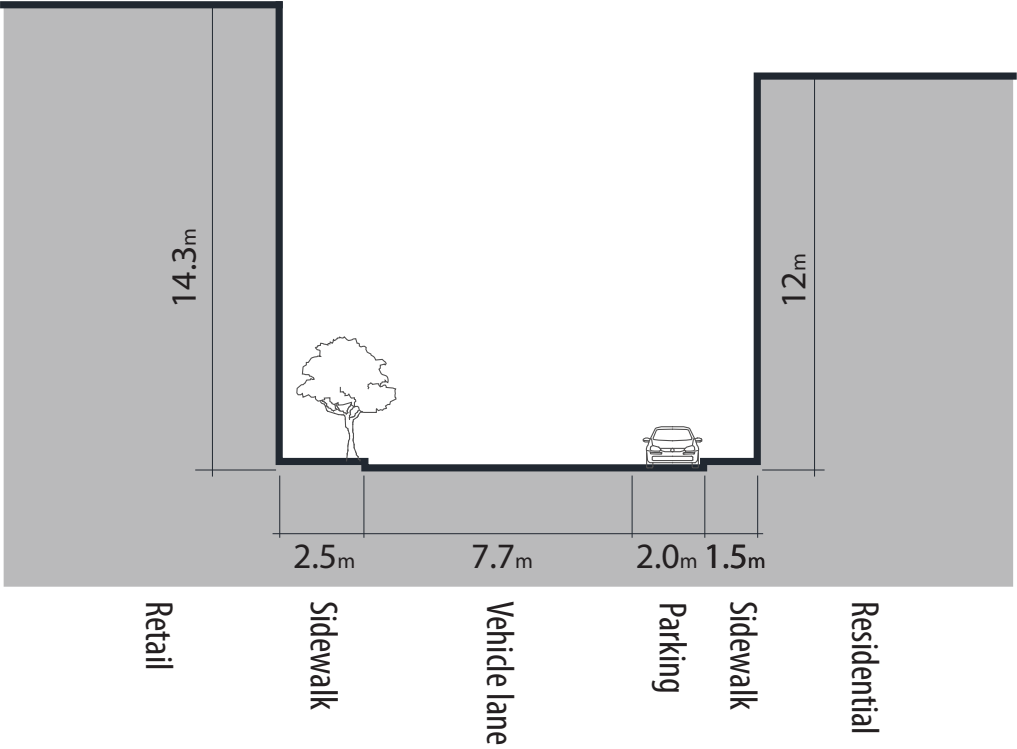
Central Square, Cambridge | Retrofit

Sections



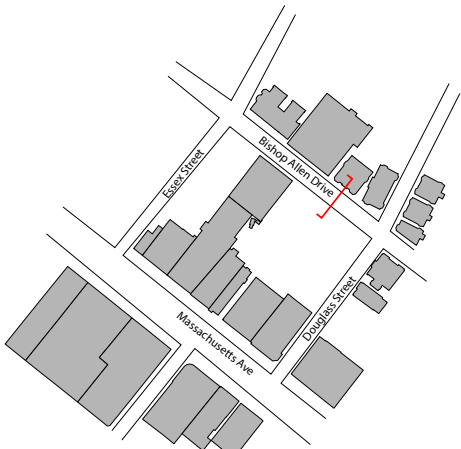
Key Plan

Bishop Allen Dr_Existing

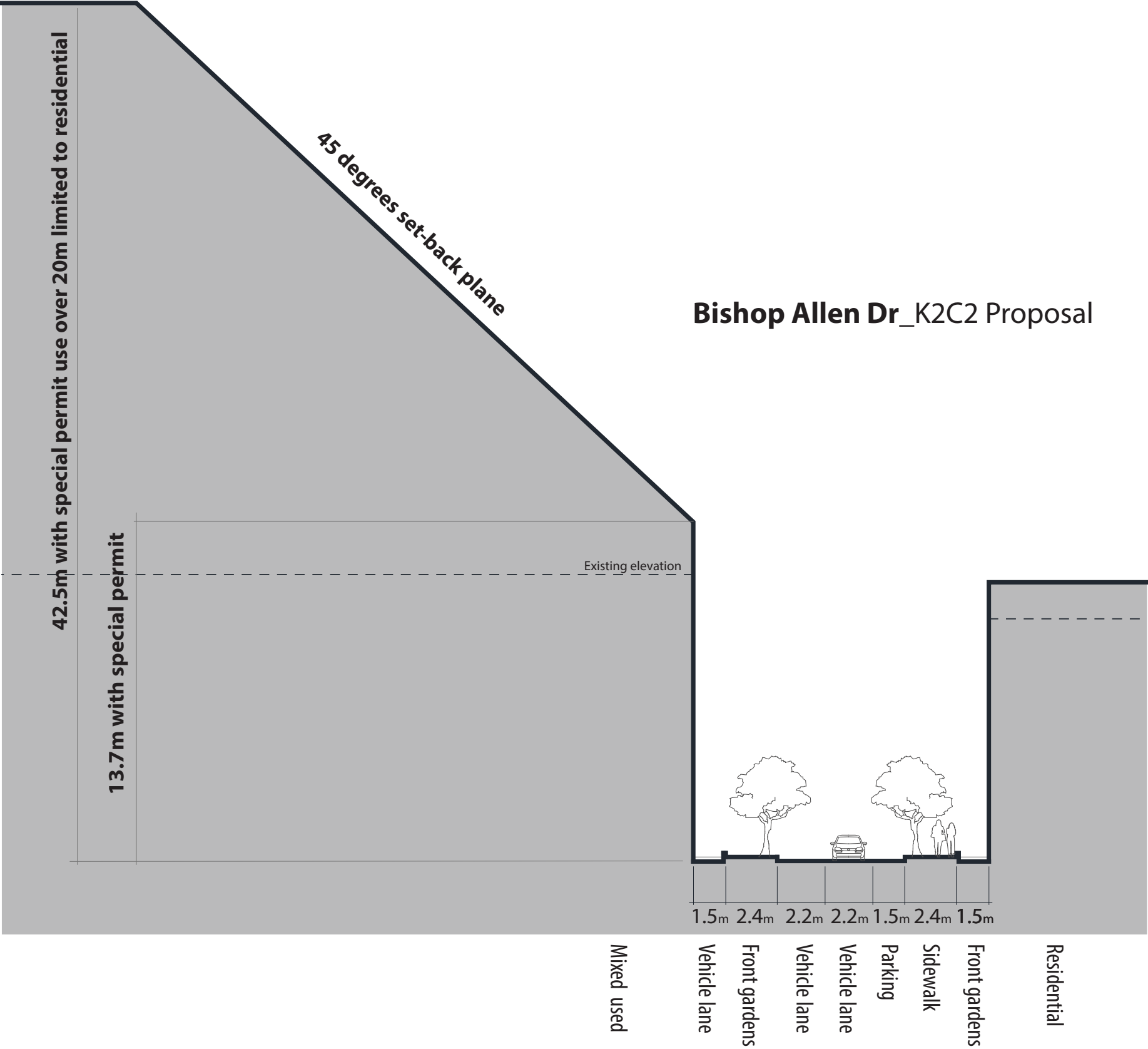


Central Square, Cambridge | Retrofit

Sections



Key Plan

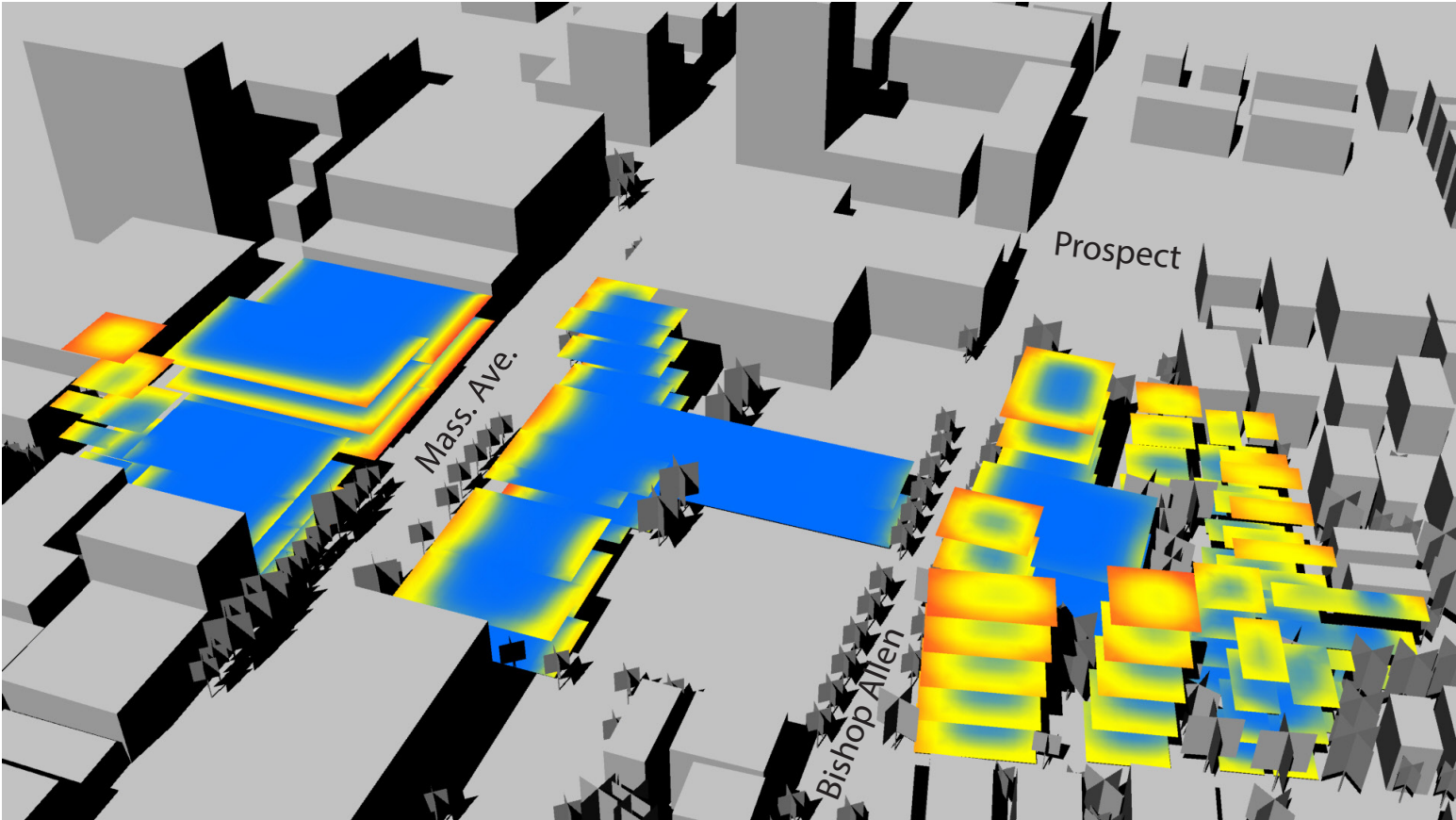


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Continuous Daylight Autonomy

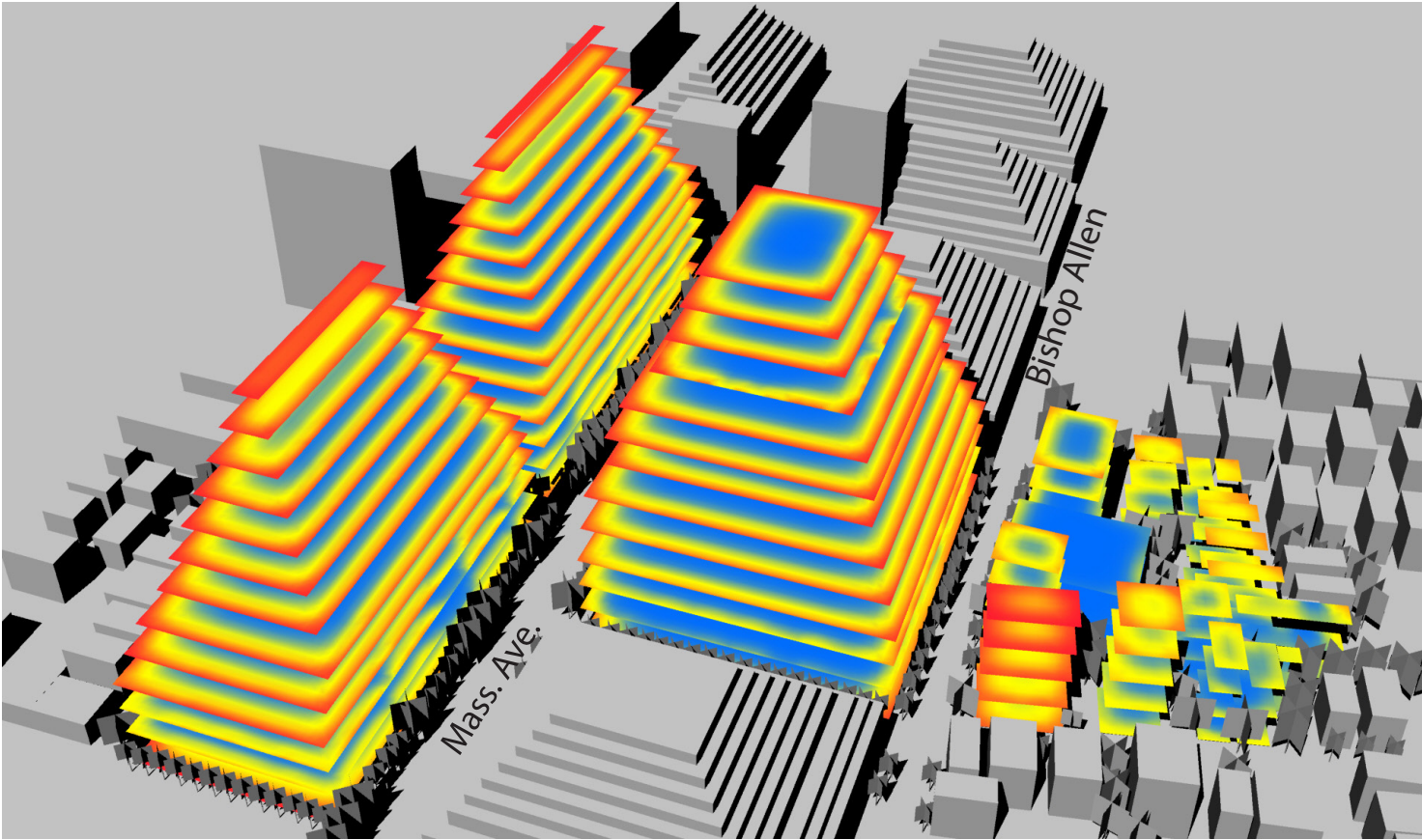


29% Daylit






Existing

33% Daylit

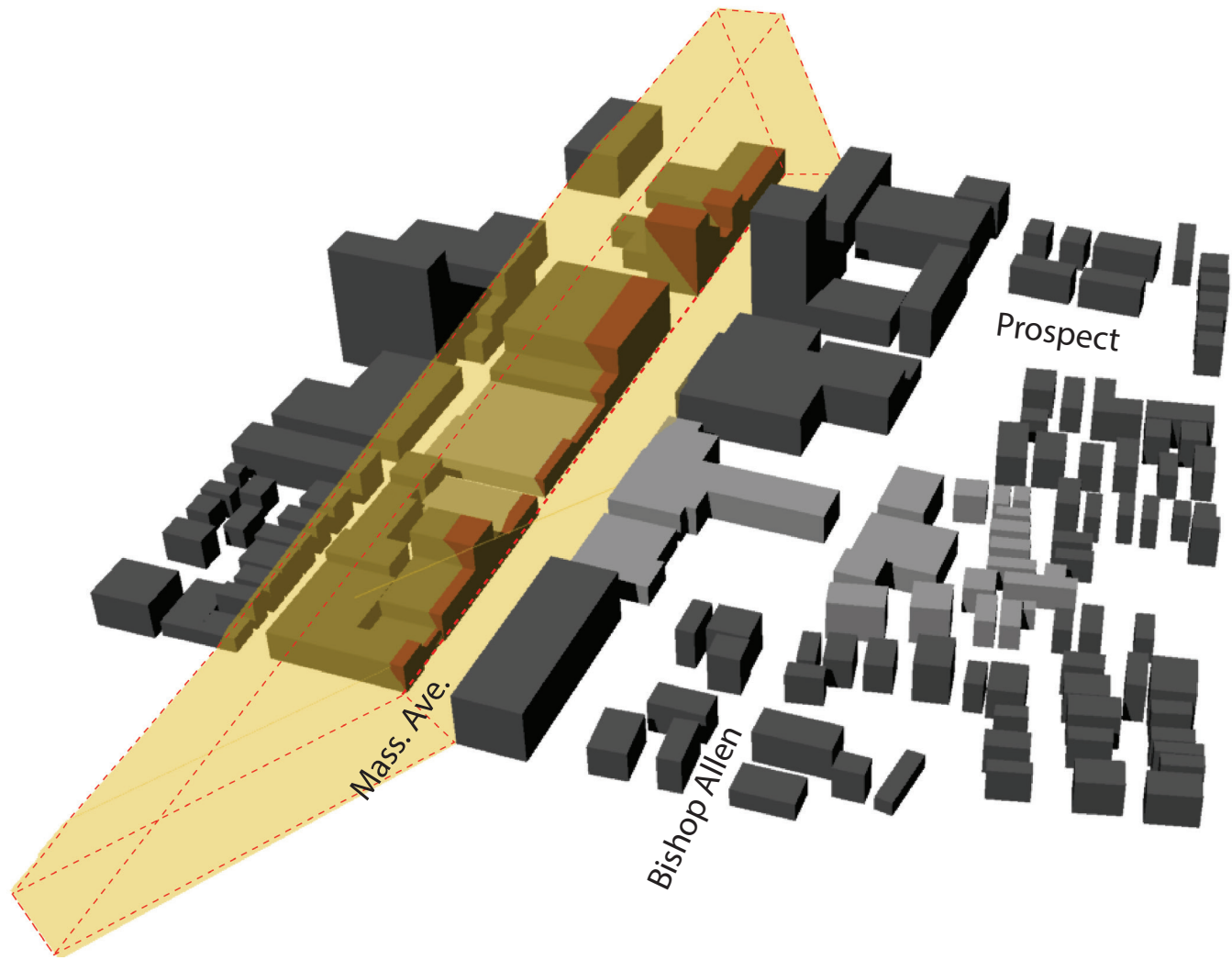


K2C2 Proposal

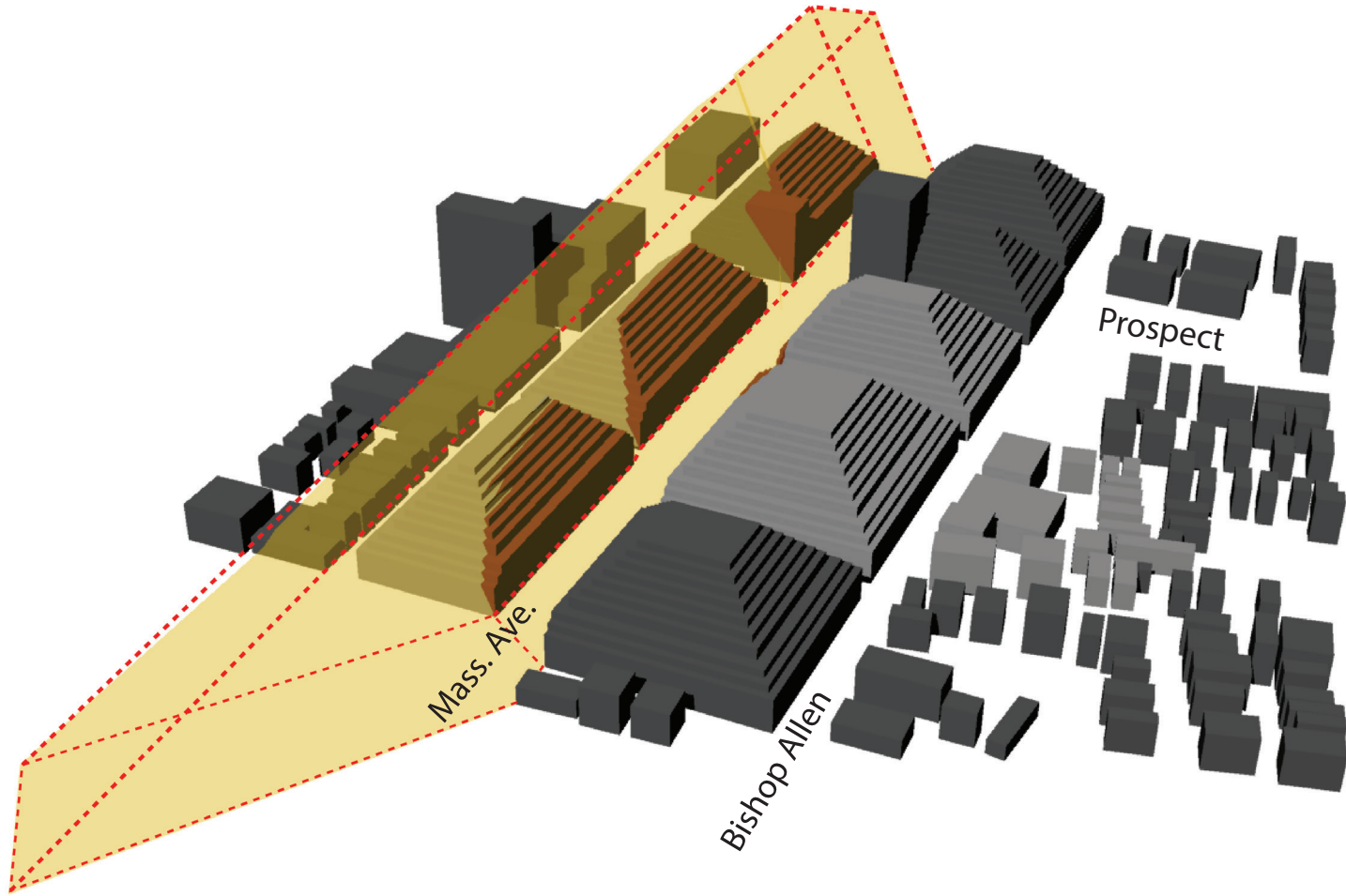
-  Best-Daylight Areas
-  Well-Daylight Areas
-  Non-Daylight Areas
Below 300 lux
Less than 50% of occupied hours

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Solar Fan_Mass Ave



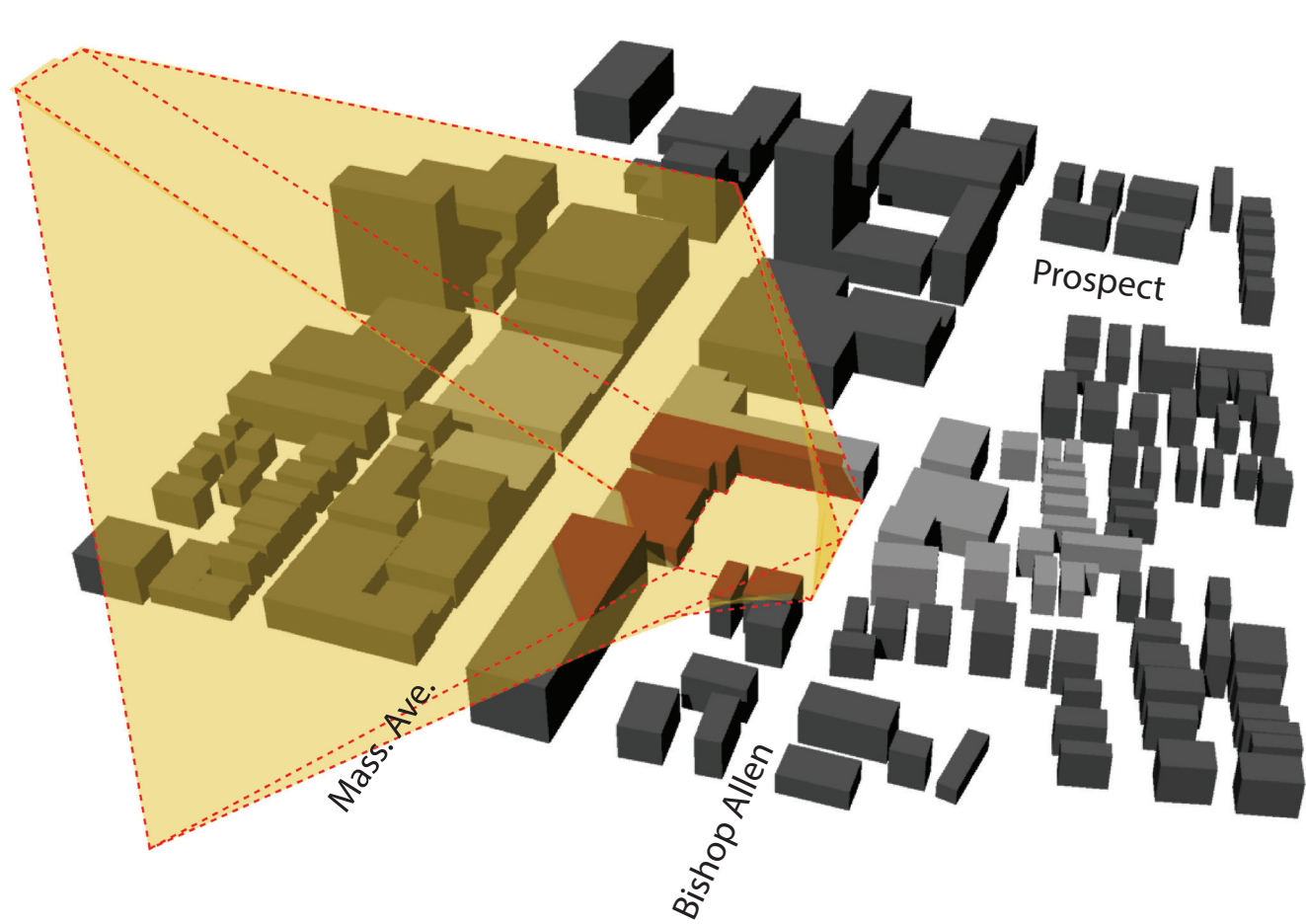
Existing



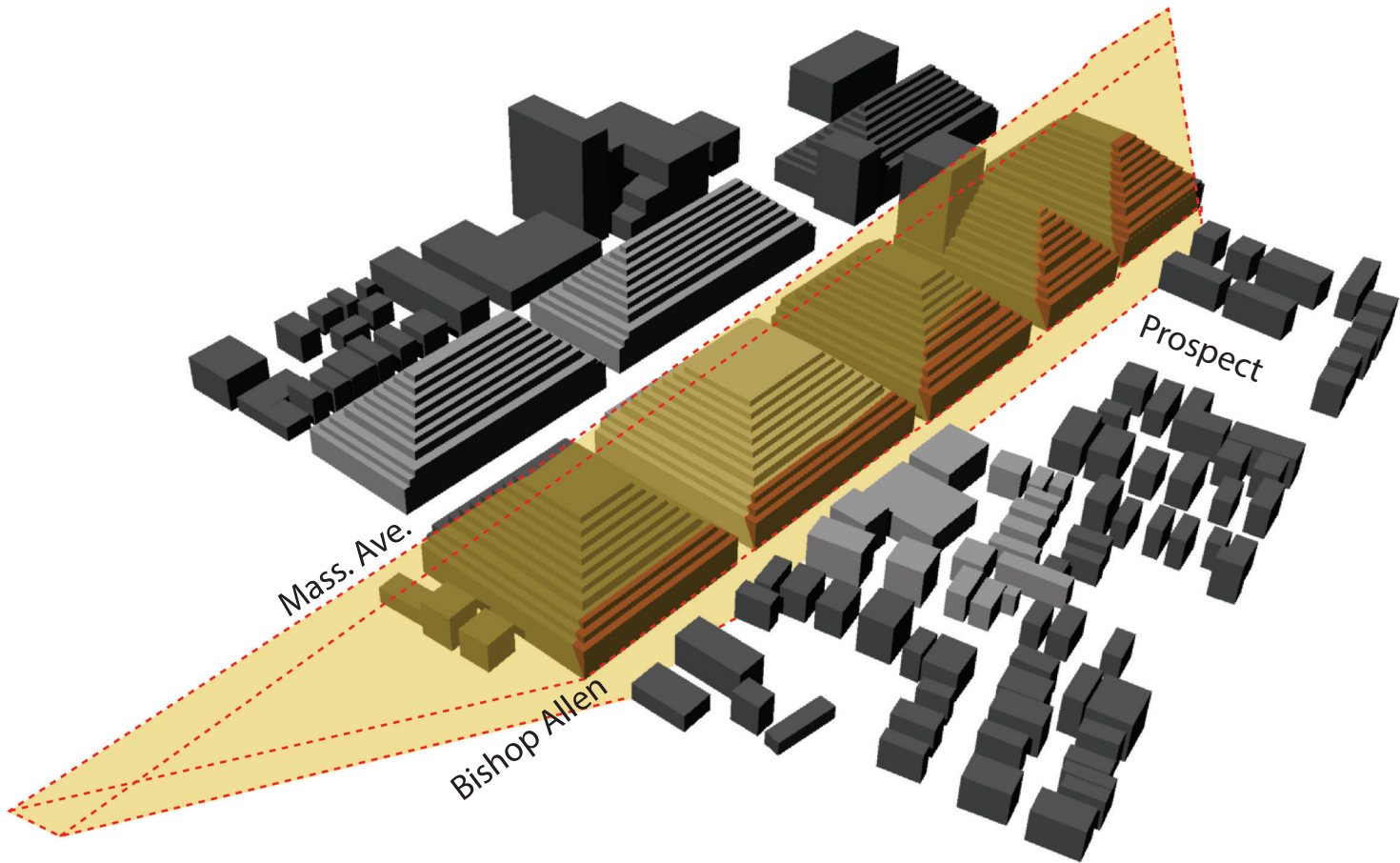
K2C2 Proposal

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Solar Fan_Parking Lot



Existing



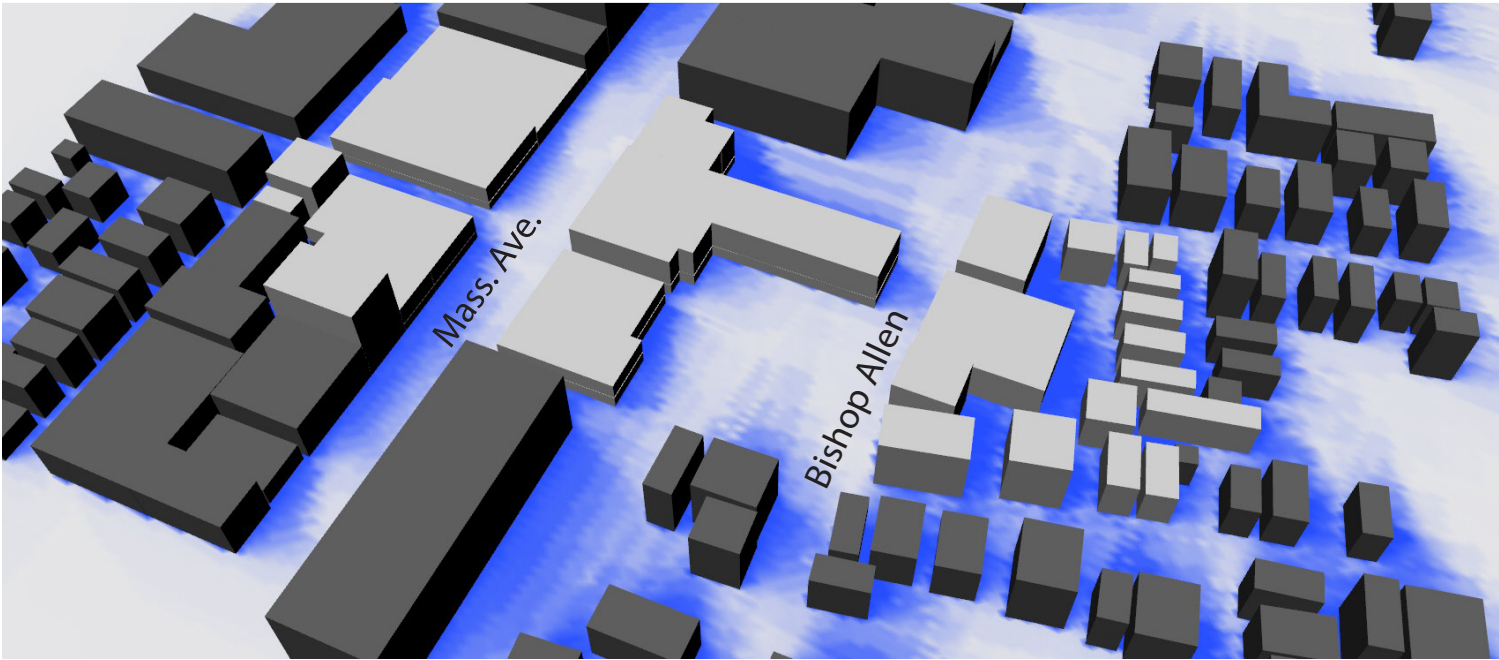
K2C2 Proposal

Central Square, Cambridge | Retrofit

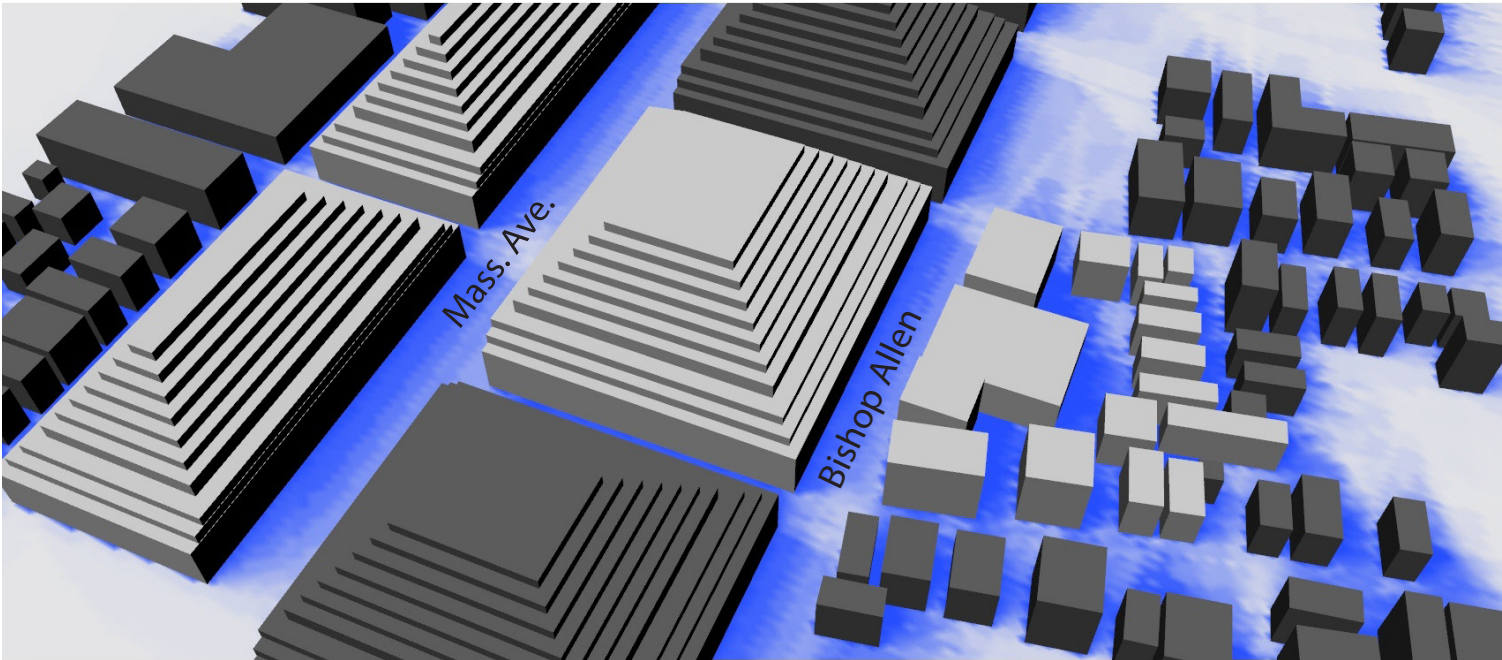
Outdoor Comfort_Winter



Uncomfortable (Cold)
Below 5 C and no direct sunlight
January - February - March



Existing



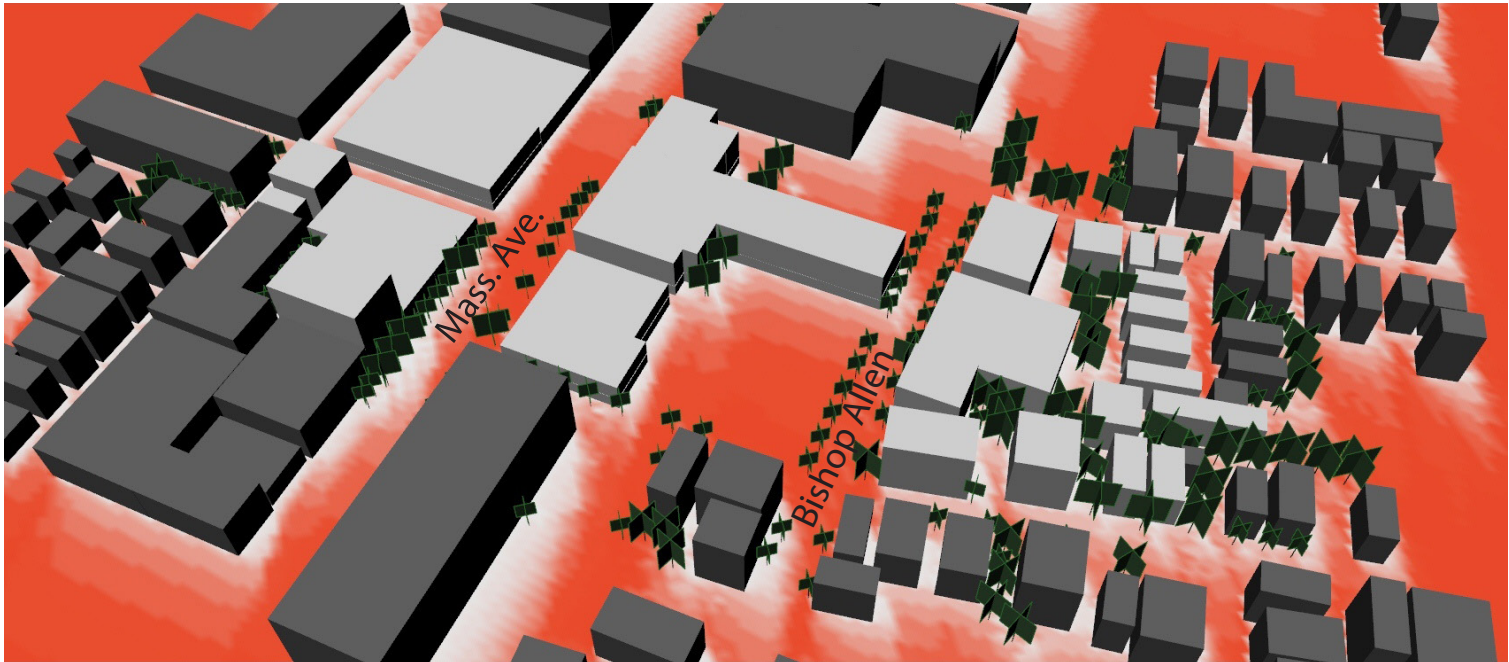
K2C2 Proposal

Central Square, Cambridge | Retrofit

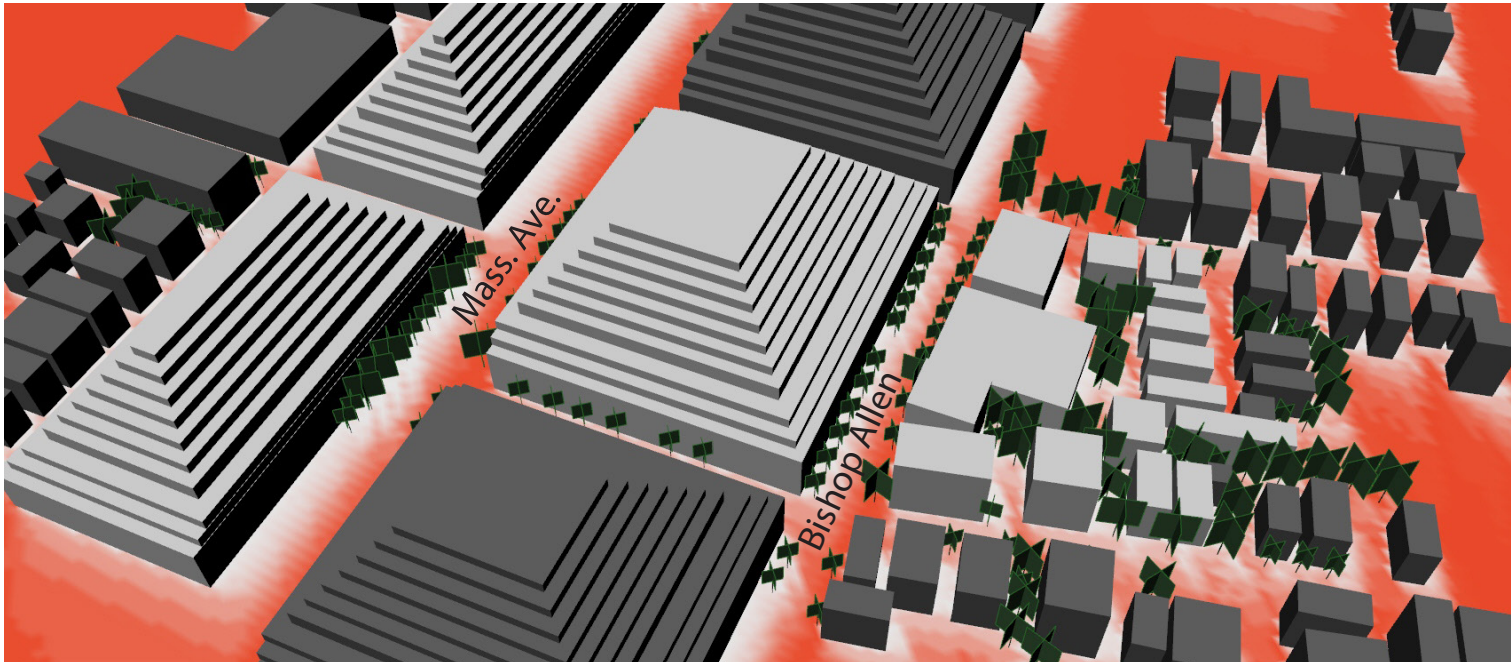
Outdoor Comfort_Summer



Uncomfortable (Hot)
Above 28 C and direct sunlight
June - July - August



Existing

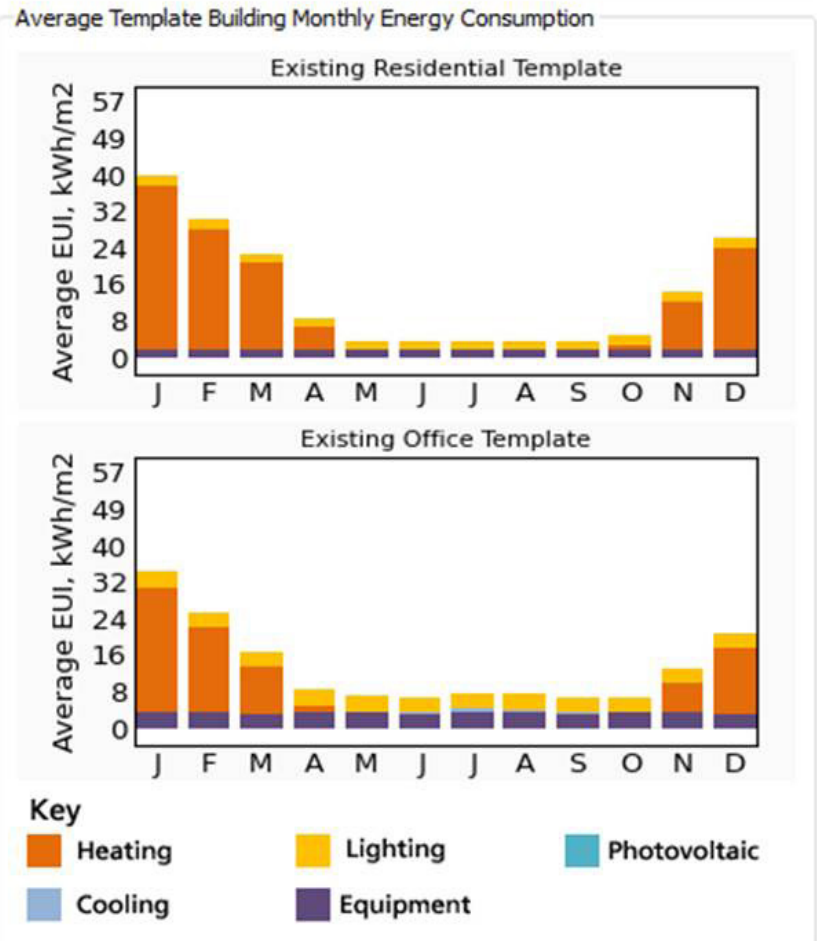
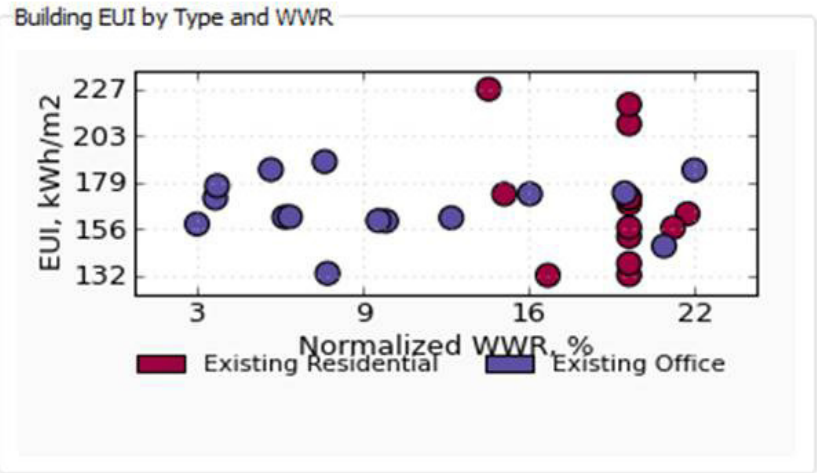
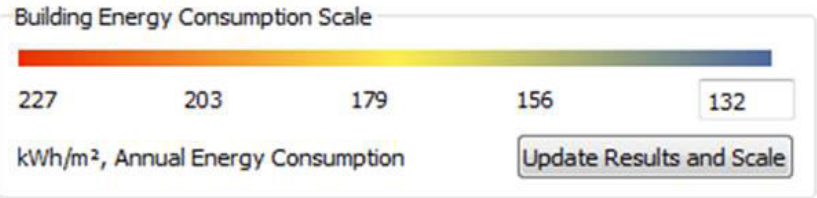
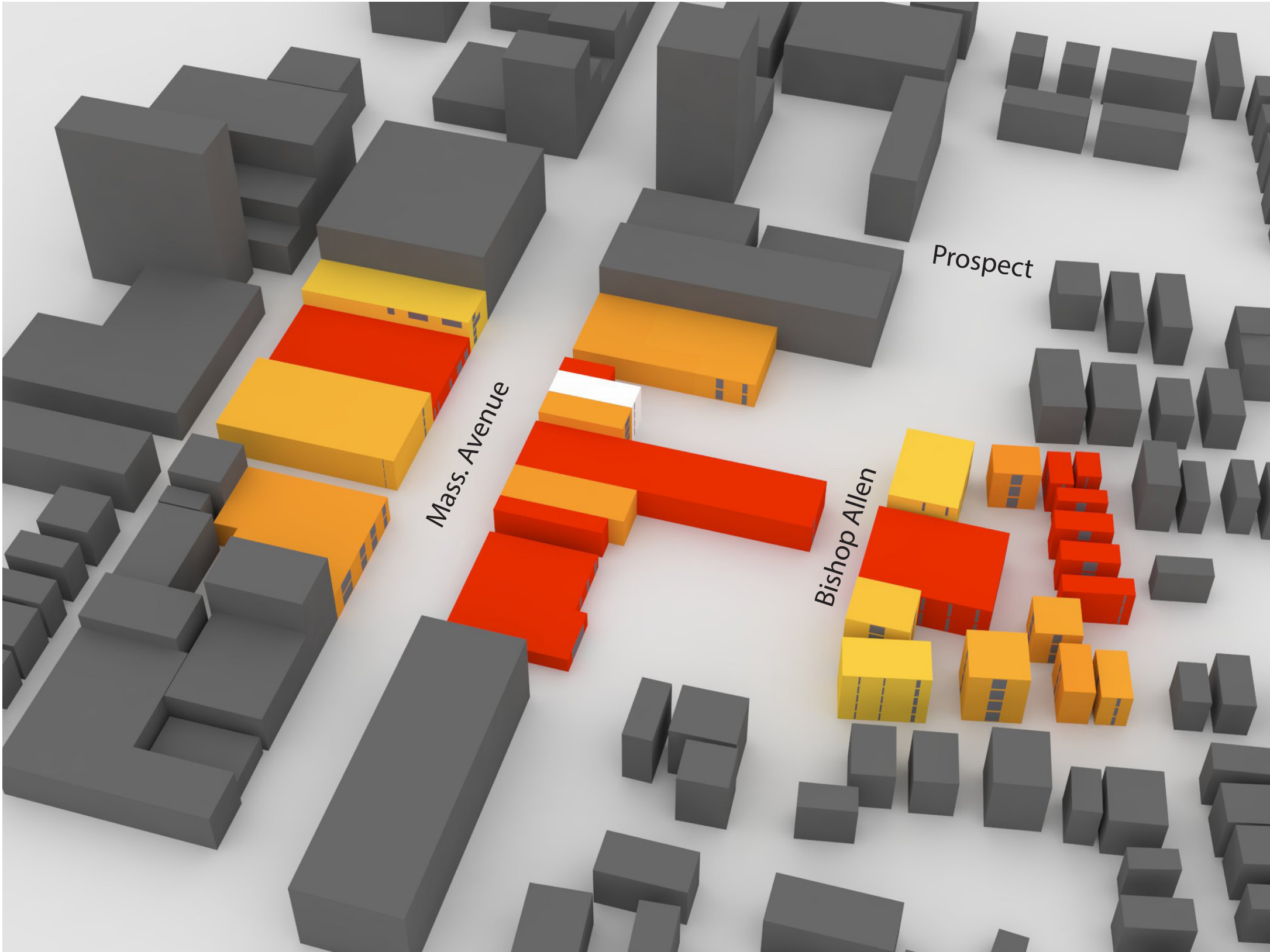


K2C2 Proposal

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UMI_Existing

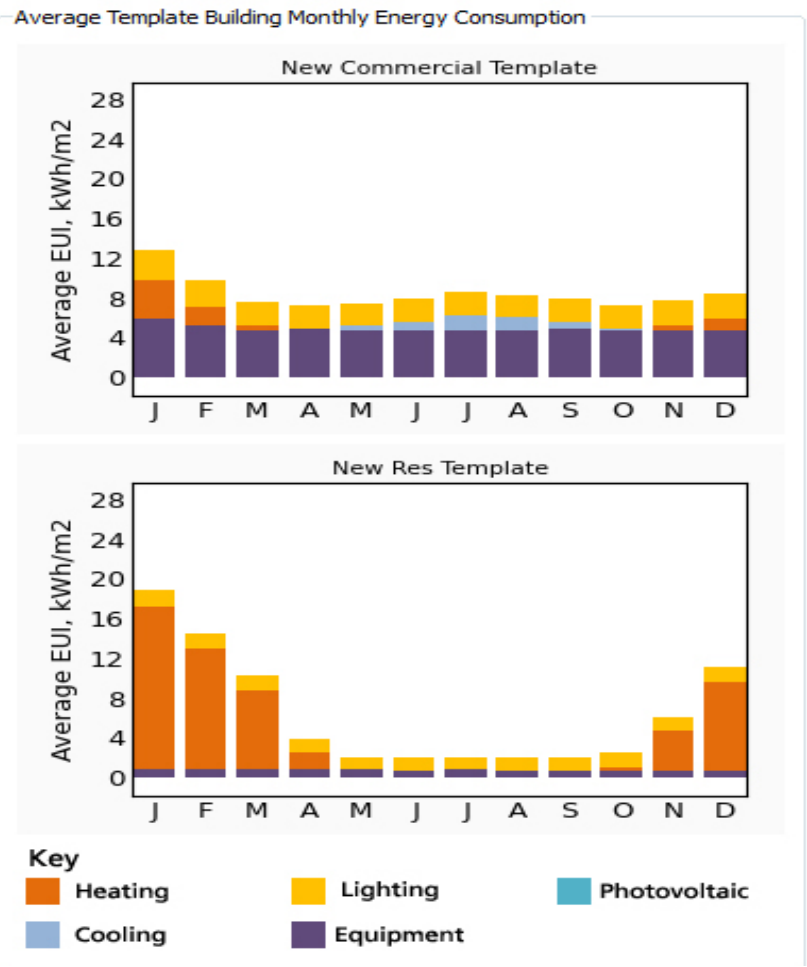
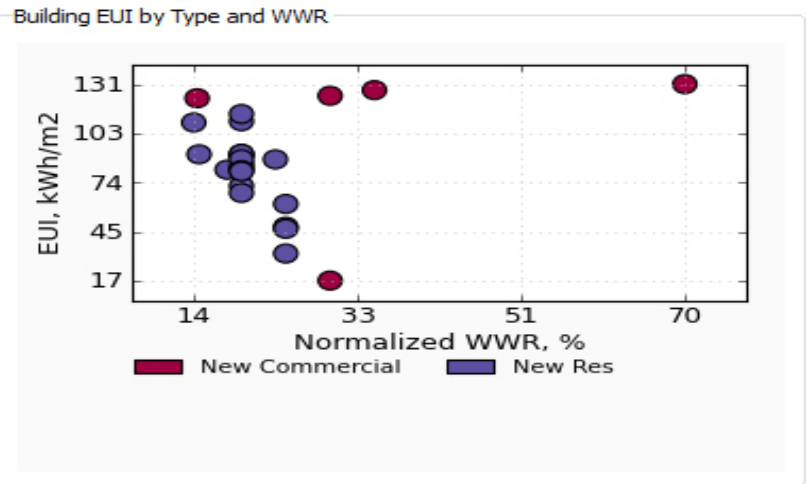
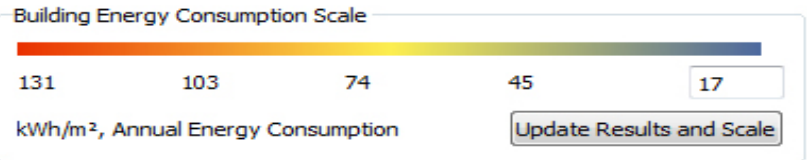
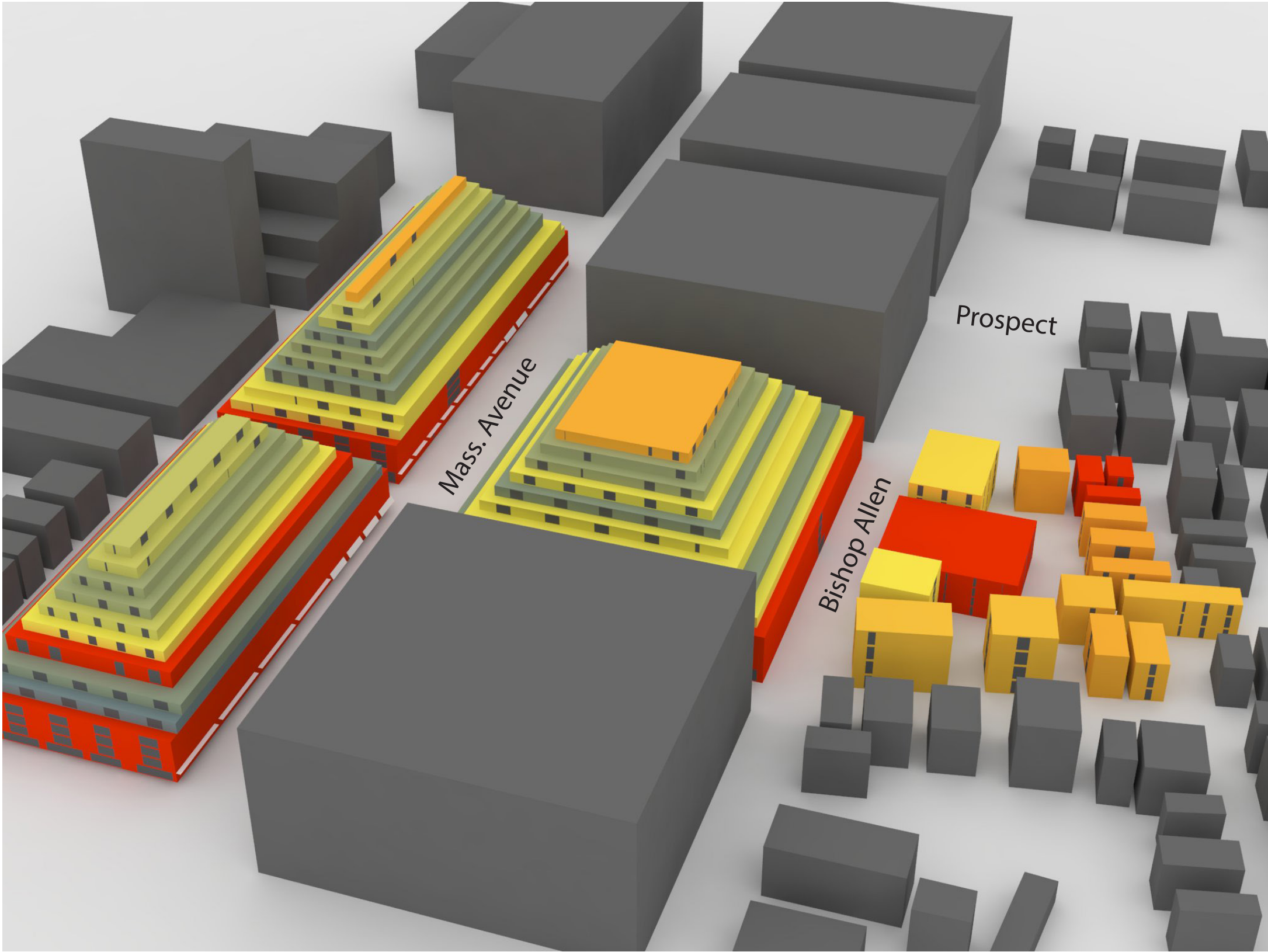
Urban EUI : 158 kWh/m²



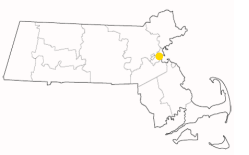
Central Square, Cambridge | Retrofit

UMI_K2C2 Proposal

Urban EUI : 133 kWh/m²

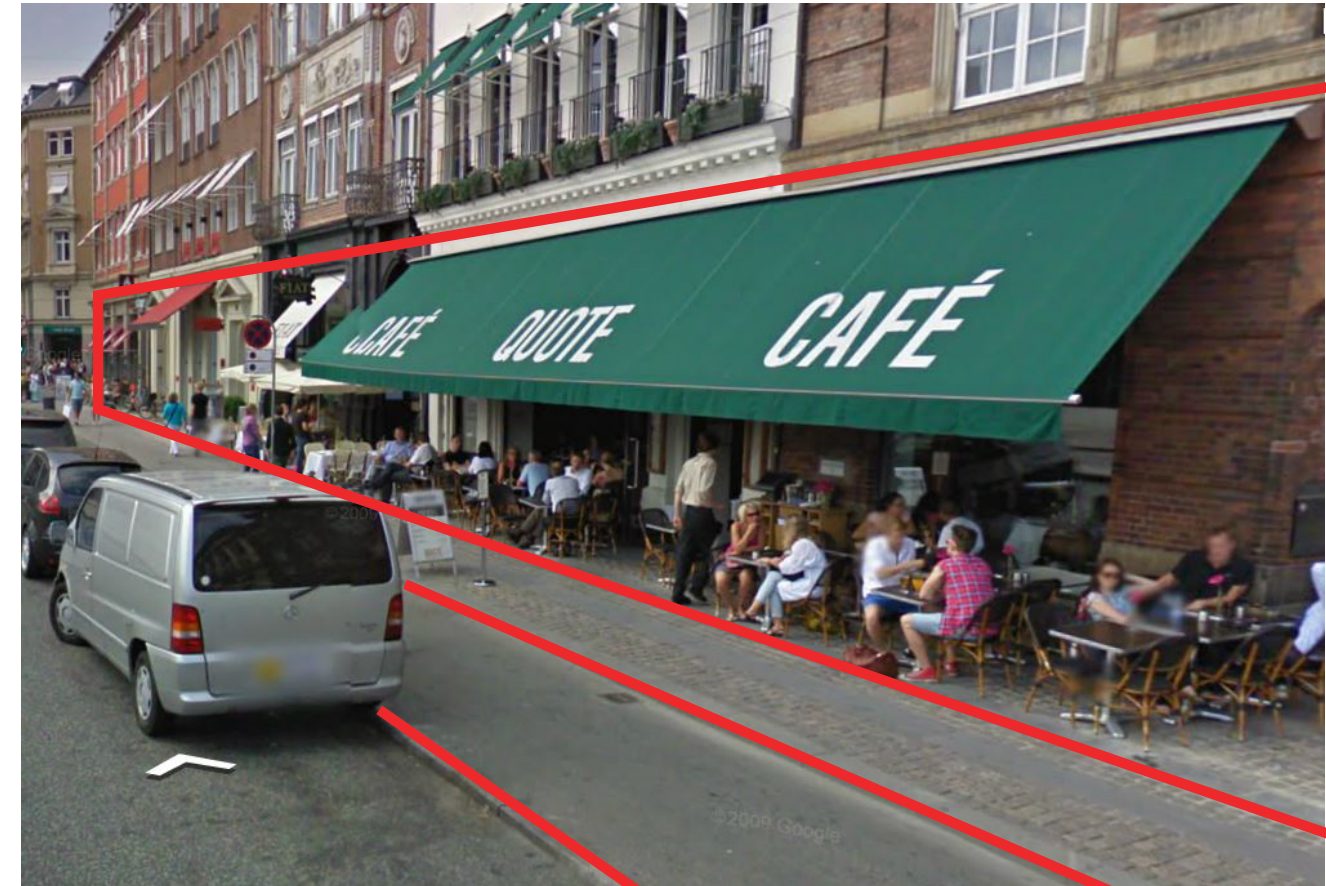


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Transit:

- Integrate defined and separated bikepaths for safer cycling. This would alleviate the current conflict between cyclists and buses.
- Improve the pedestrian experience by allowing cafes to add outdoor seating to sidewalk areas at their facades. Encourage mobile food vendors for increased activity along Mass Ave. corridor.
- Build additional bus stops outside of bikelanes with improved rain and wind protection. Integrate timers and other technology to display bus schedules and arrival times.



Restaurants with outdoor sitting

Off-street Bikepath

Side Walk

Streetscapes/Greenspace:

- Plan for more deciduous street trees along sidewalks to improve shading for homes and sidewalks in summer.
- Compare options of replacing parking lots with open space VS mixed use development. Pocket parks and pedestrian only streets can reactivate underutilized spaces.
- Integrate green roofs into commercial and residential buildings to counteract the urban heat island effect, lower the urban EUI, and provide additional open spaces for added density.



parking

Off-street Bikepath

Bike

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Massing:

- Tactfully add density to the Mass Ave corridor without causing excessive shading to facades or sidewalks.
- Divide deep floor plate commercial buildings to open up the blocks for optimized daylighting. Improve the quality of the office environment.
- Utilize micro-units and other residential types to add diversity to housing options in the Central Square area. Compact footprint residential towers allow for better access to daylight and natural ventilation.

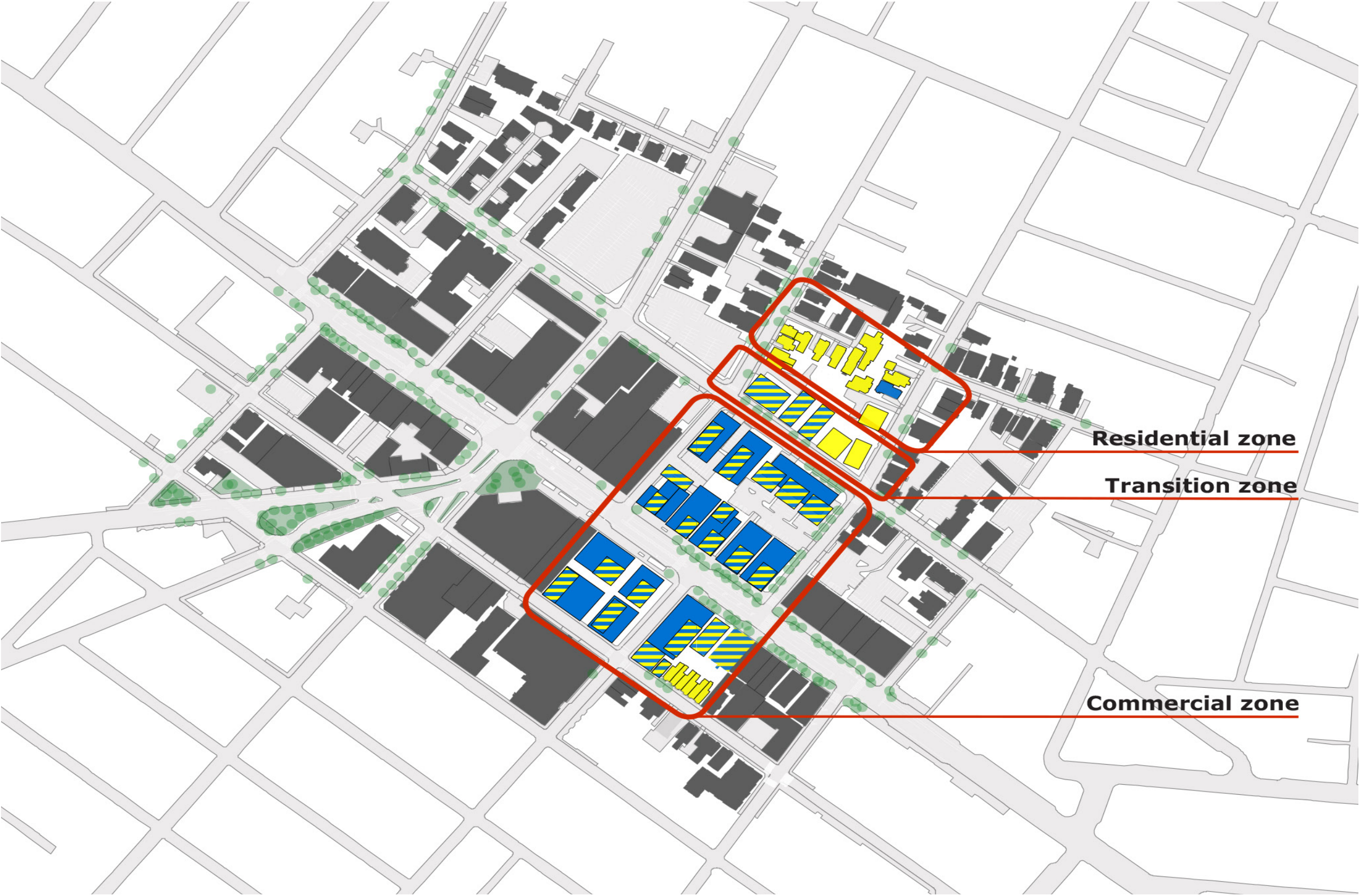
Facades:

- Measure the impact of proposed high window to wall ratios and transparency for the commercial facades. Utilize urban daylighting tool to compare massing and WWR options.
- Measure the impact of sidewalk awnings and shading devices on commercial/residential facades.
- Cater facade design and transparency Measure the impact of sidewalk awnings and shading devices on commercial/residential facades.



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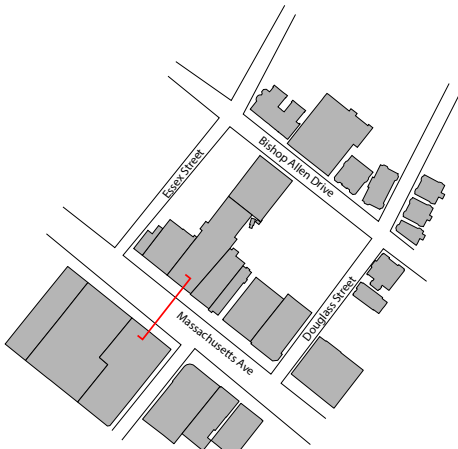
Land Use Map_Final Proposal



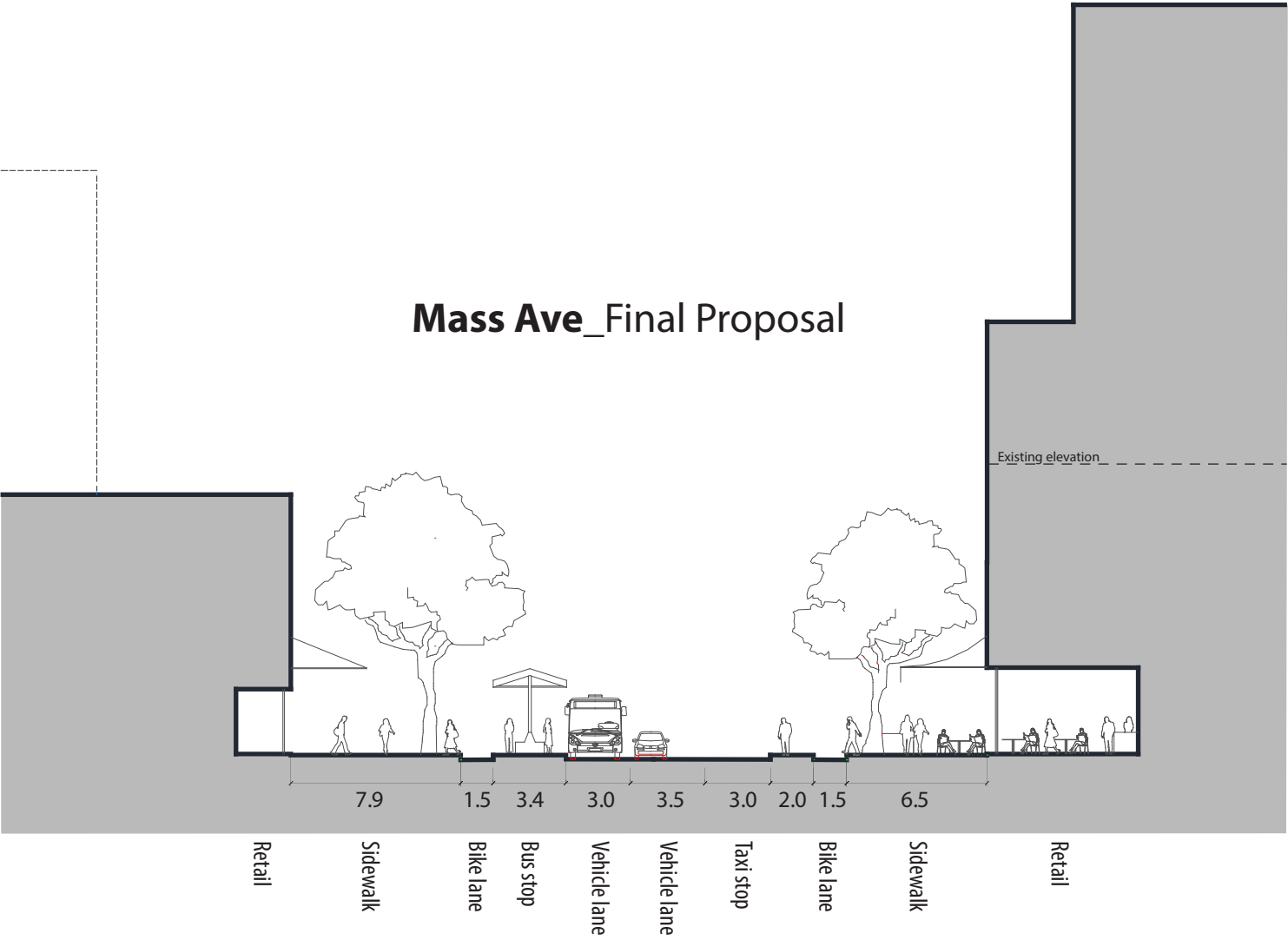
- Site Context
- Residential
- Commercial
- Mixed Use

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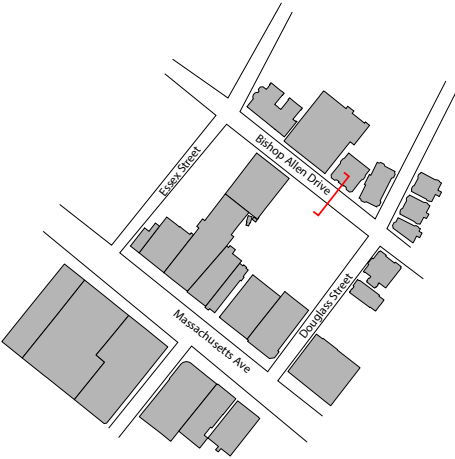
Section



Key Plan

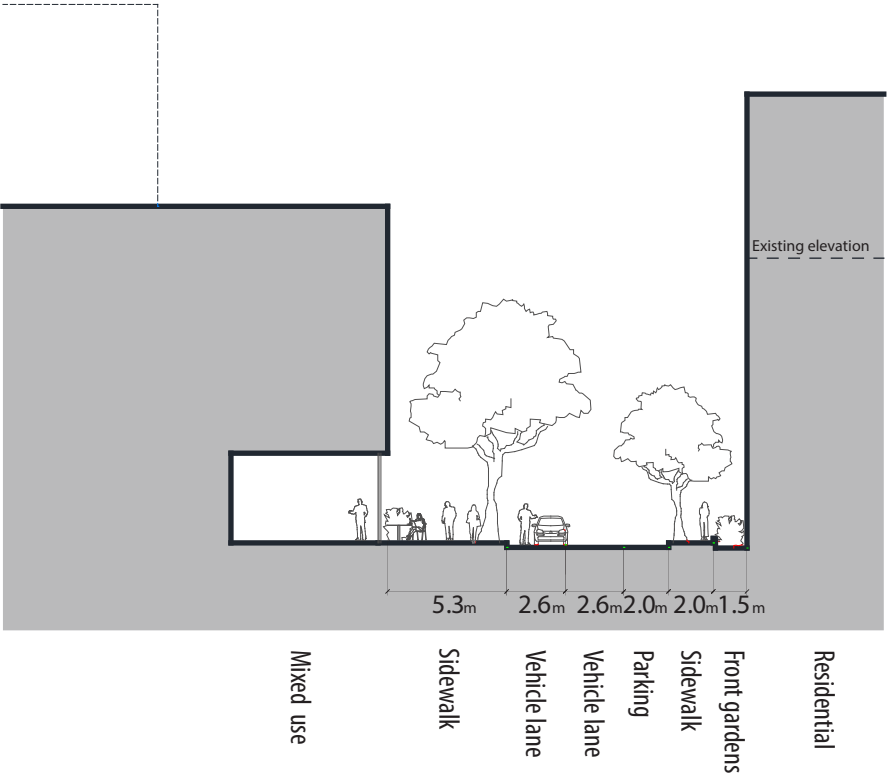


Central Square, Cambridge | Retrofit Section



Key Plan

Bishop Allen Drive_Final Proposal



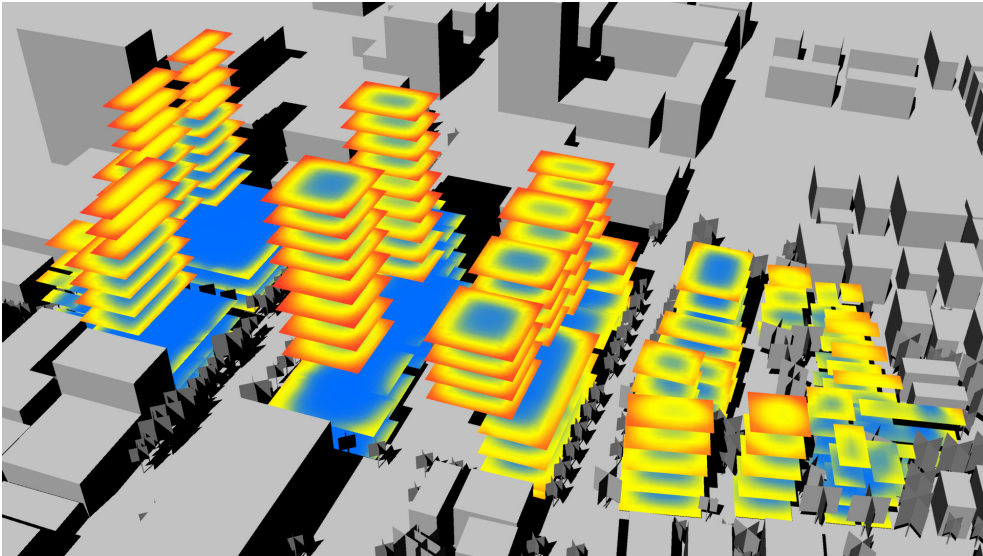
Central Square, Cambridge | Retrofit

Birds Eye View_Final Proposal

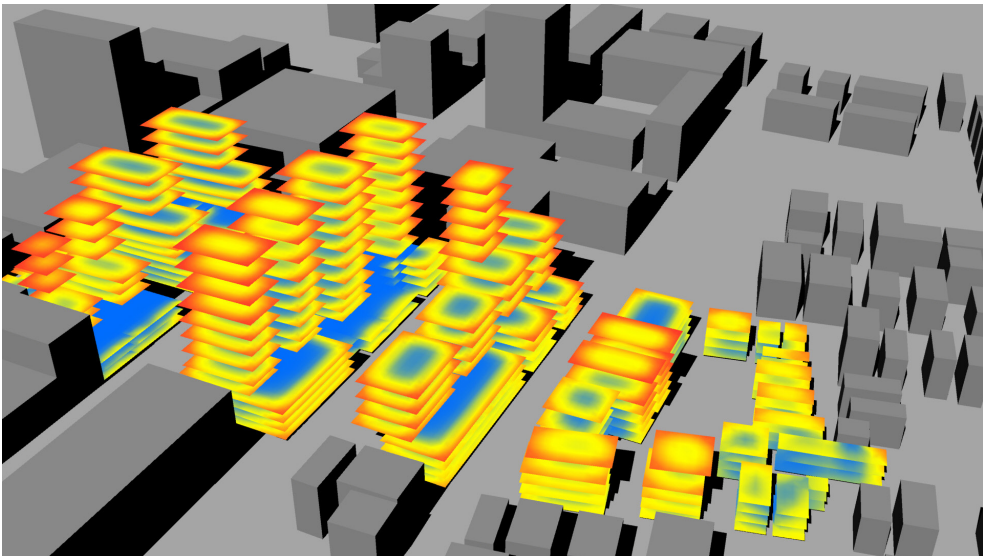


- Proposed Massing
- Context
- Existing Protoblock

Central Square, Cambridge | Retrofit Continuous Daylight Autonomy



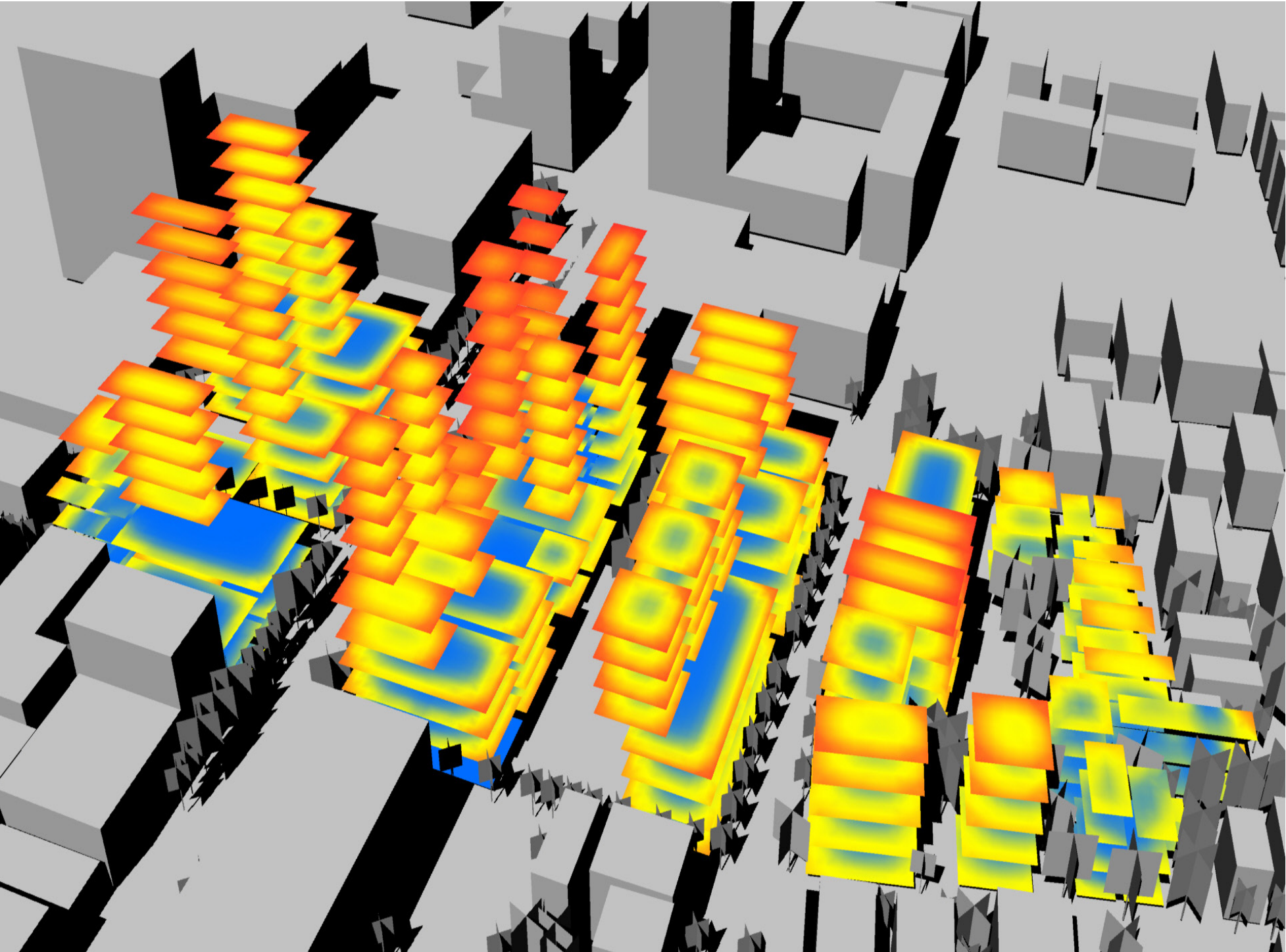
Proposal 1



Proposal 2

- Best-Daylight Areas
- Well-Daylight Areas
- Non-Daylight Areas
Below 300 lux
Less than 50% of occupied hours

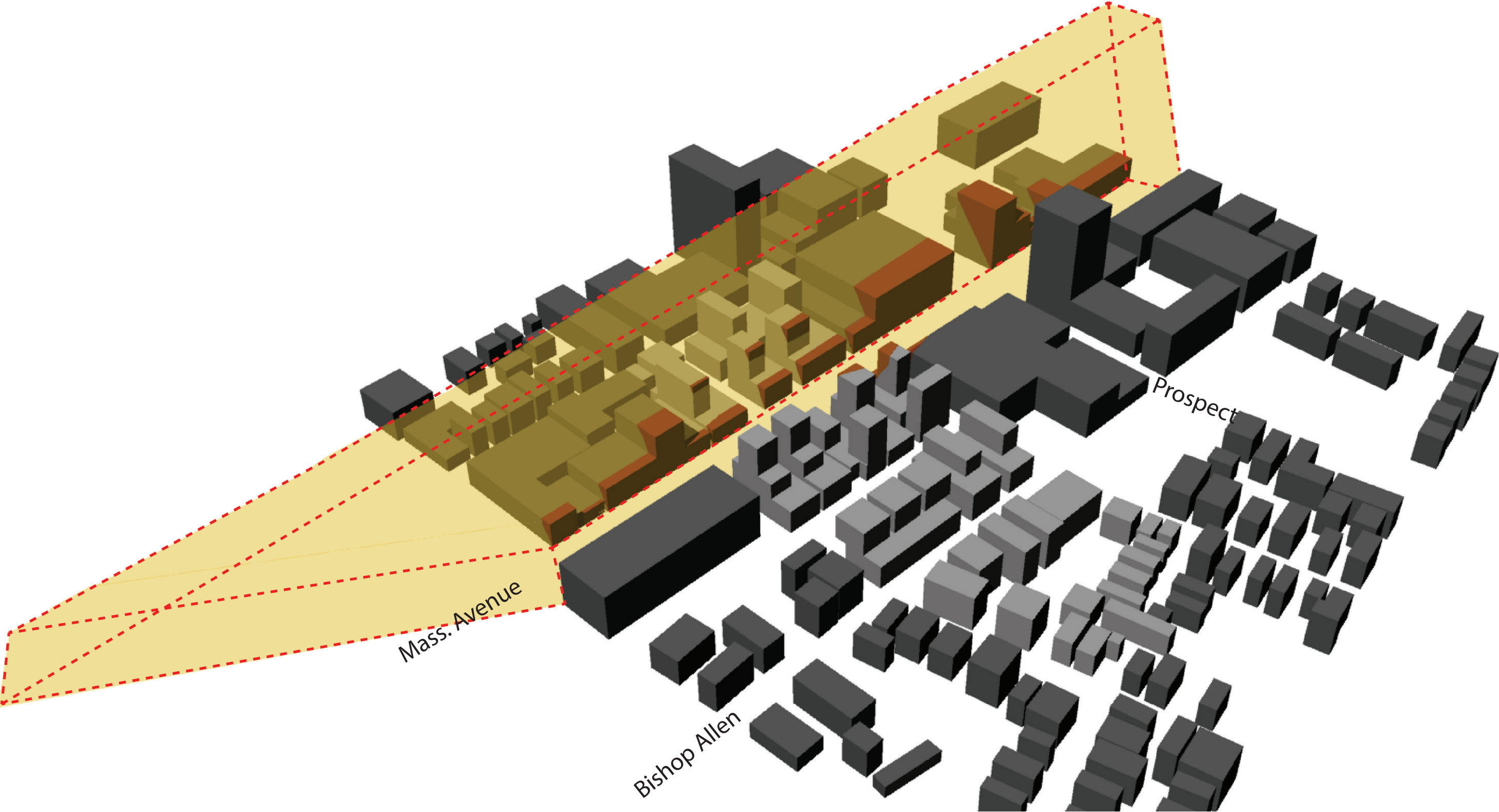
39 % Daylit



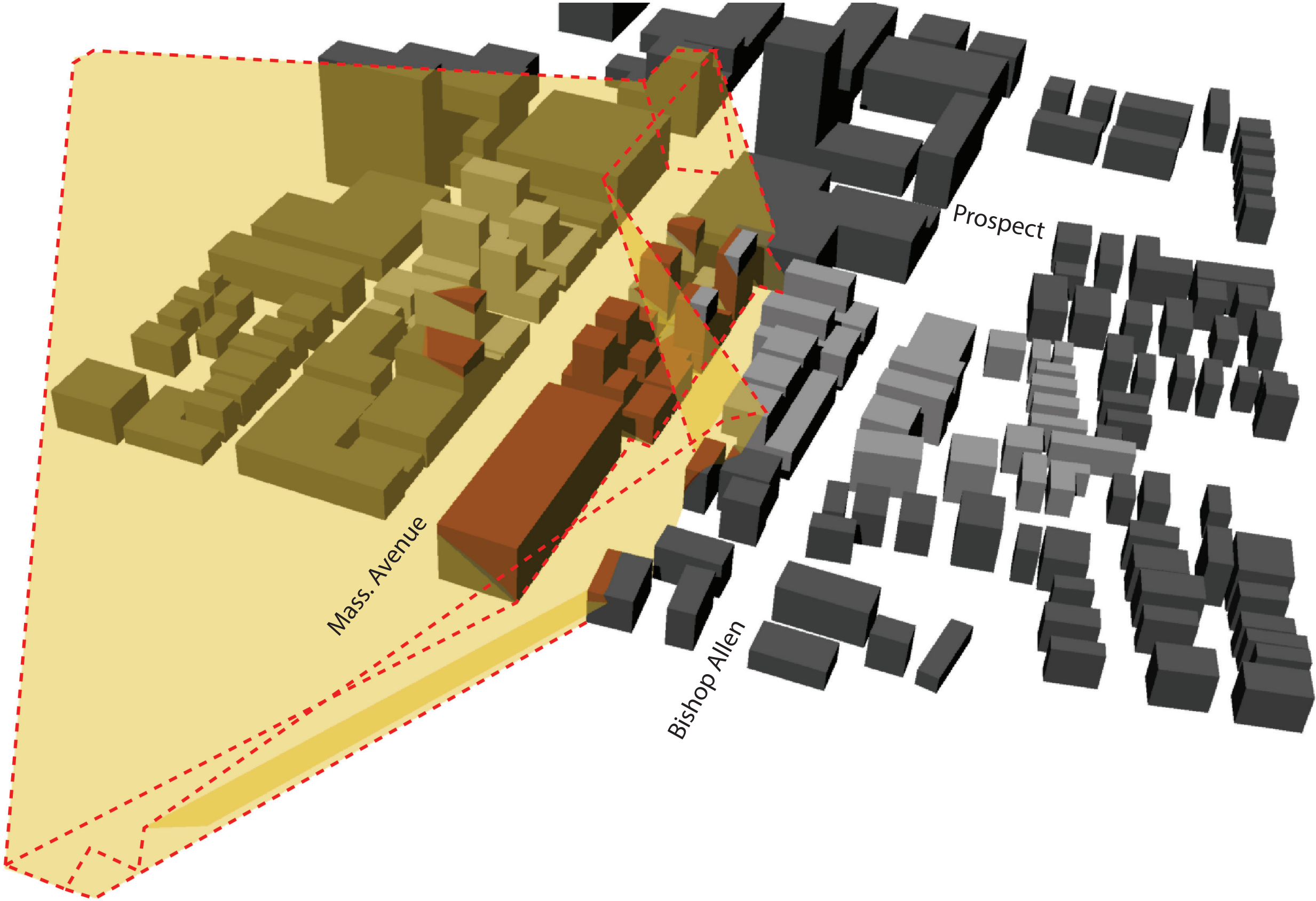
Final Proposal

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Solar Fan_ Final Proposal Mass Ave



Central Square, Cambridge | Retrofit
Solar Fan_Final Proposal Pedestrian street

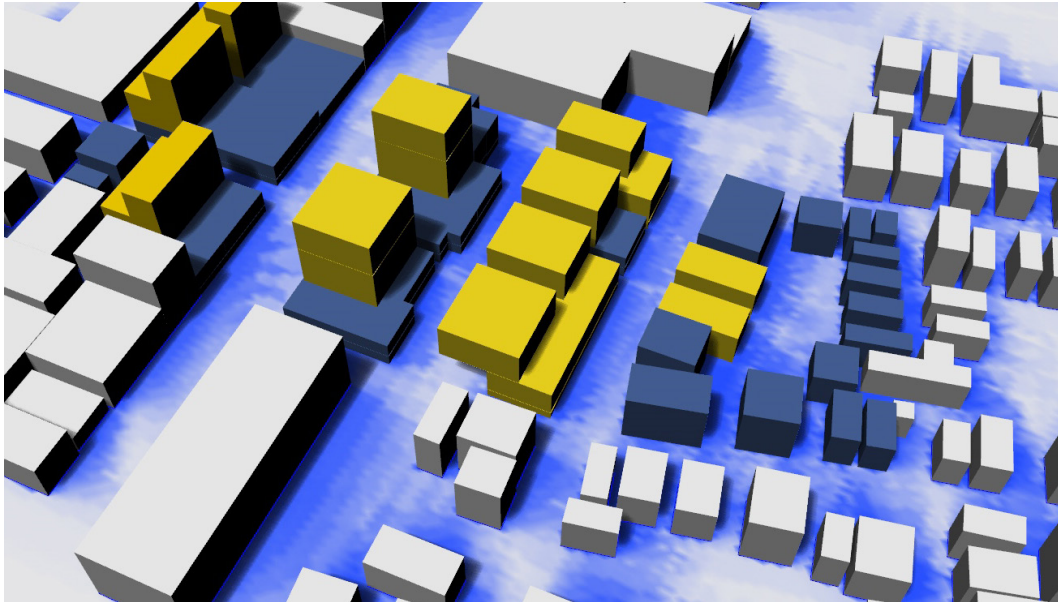


Central Square, Cambridge | Retrofit

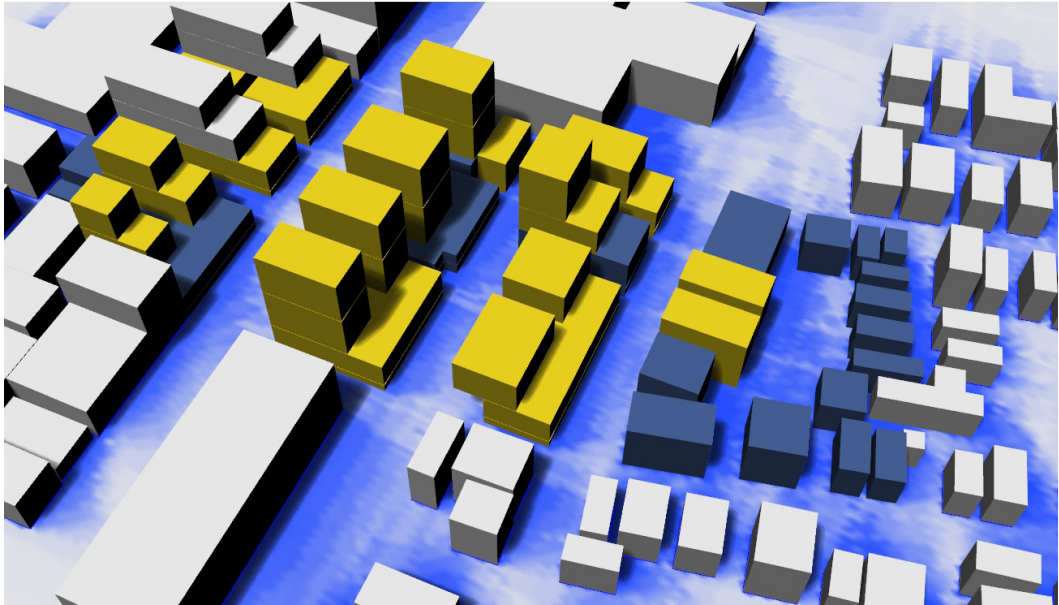
Outdoor Comfort_Proposals 1,2, & Final



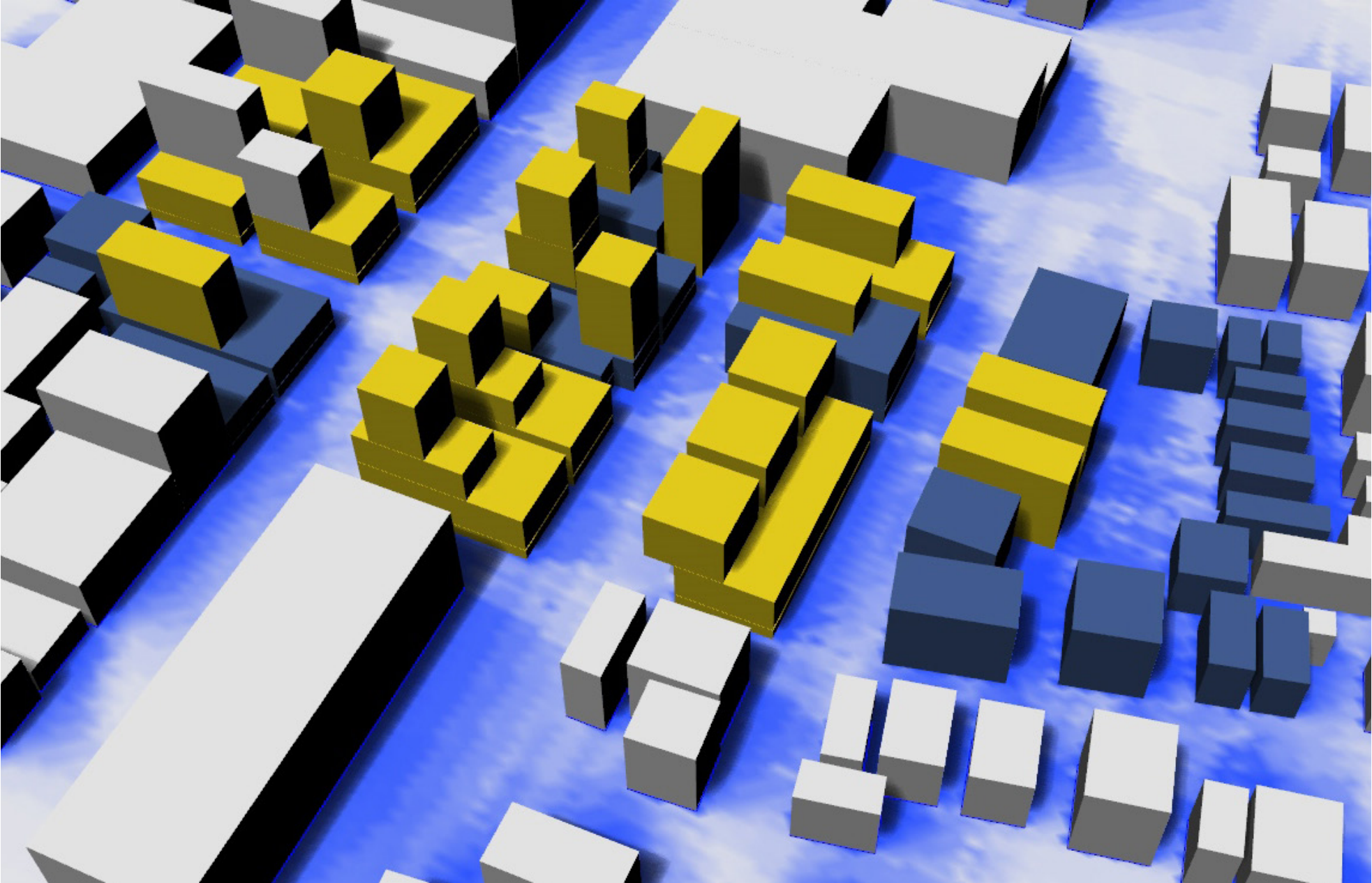
Uncomfortable (Cold)
Below 5 C and no direct sunlight
January - February - March



Proposal 1



Proposal 2



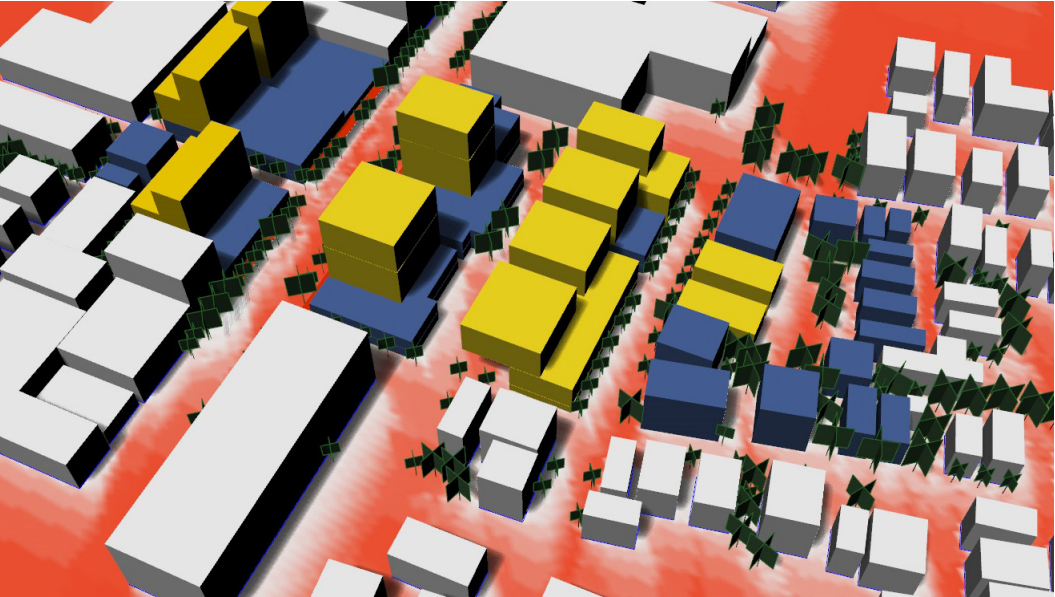
Final Proposal

Central Square, Cambridge | Retrofit

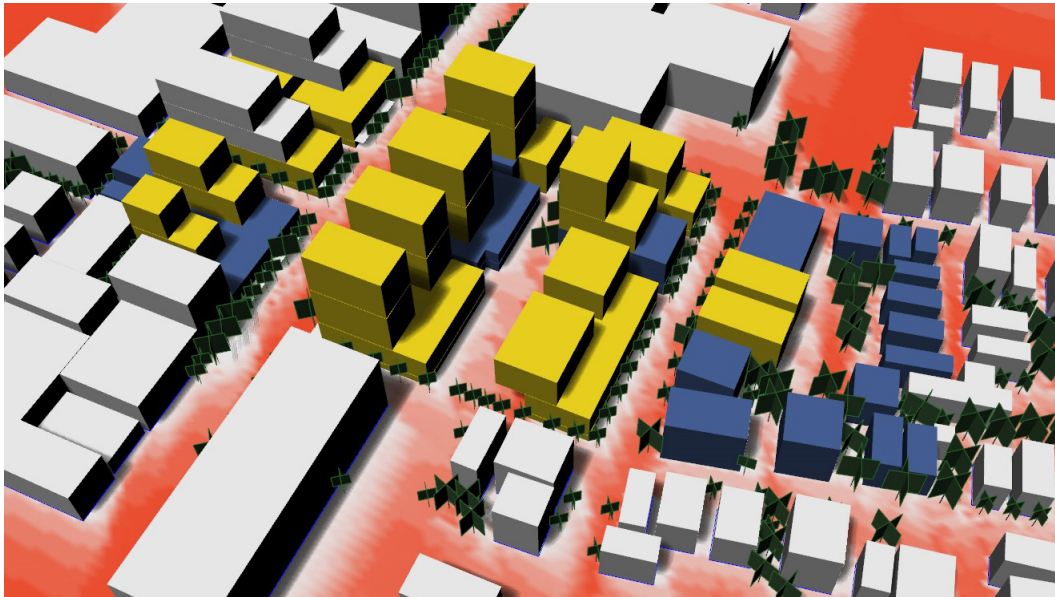
Outdoor Comfort_Proposals 1,2, & Final



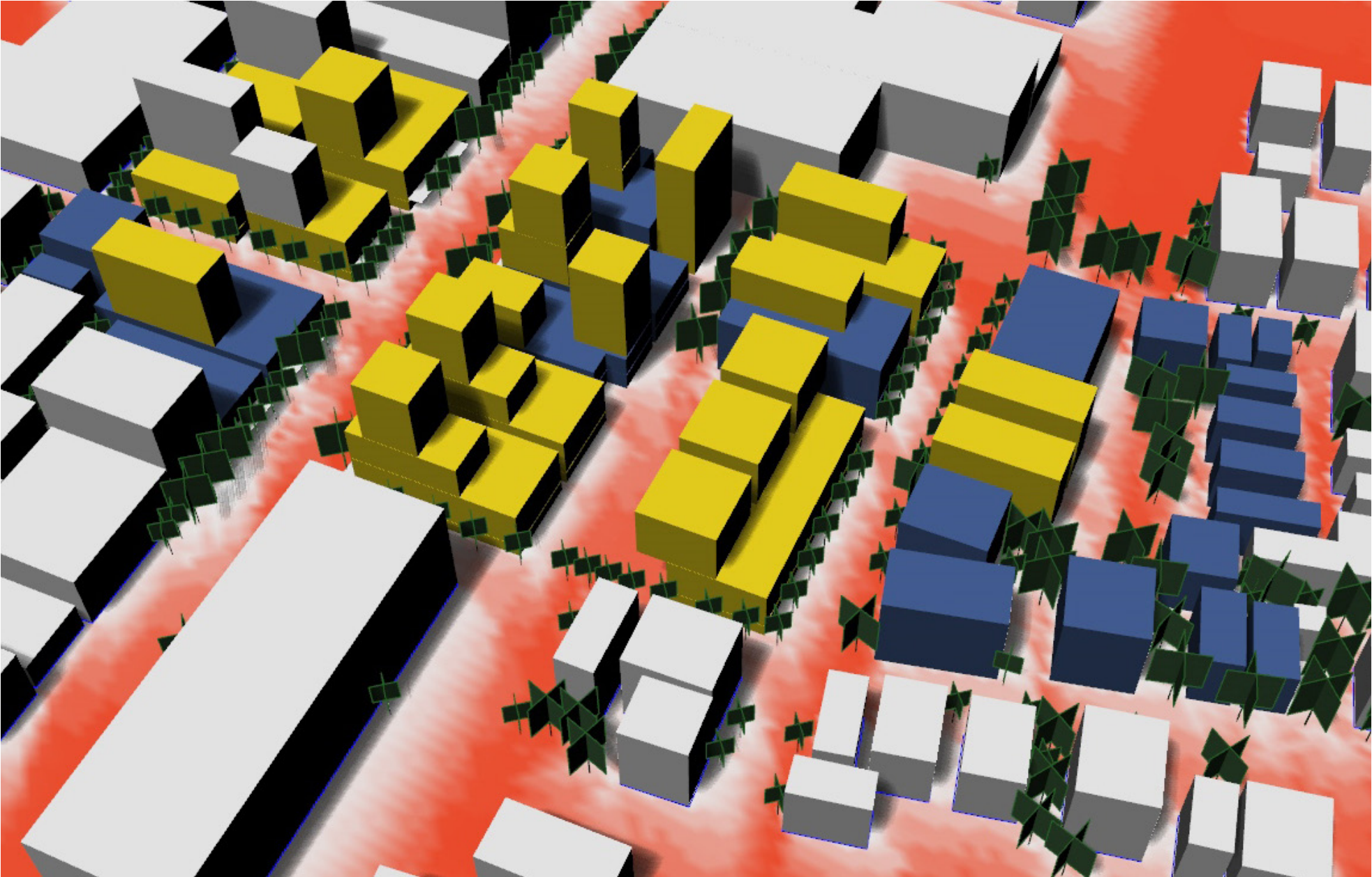
Uncomfortable (Hot)
Above 28 C and direct sunlight
June - July - August



Proposal 1



Proposal 2

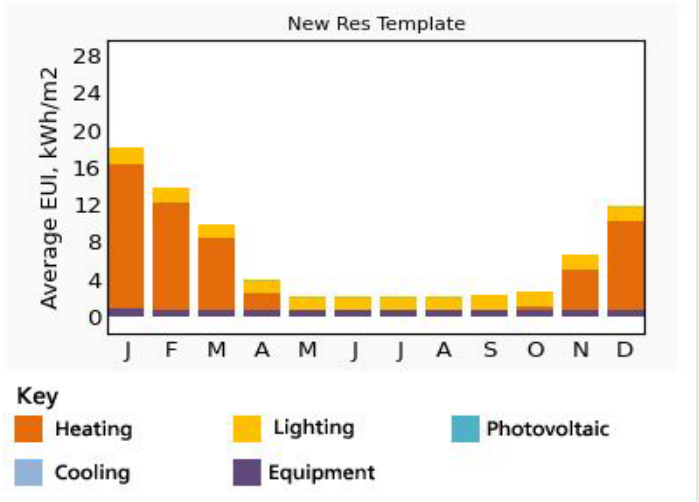
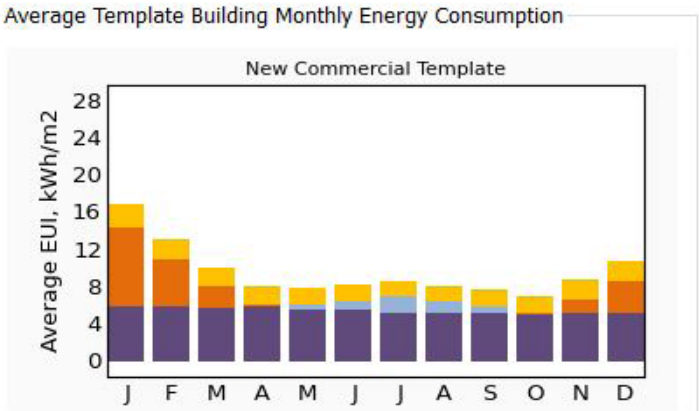
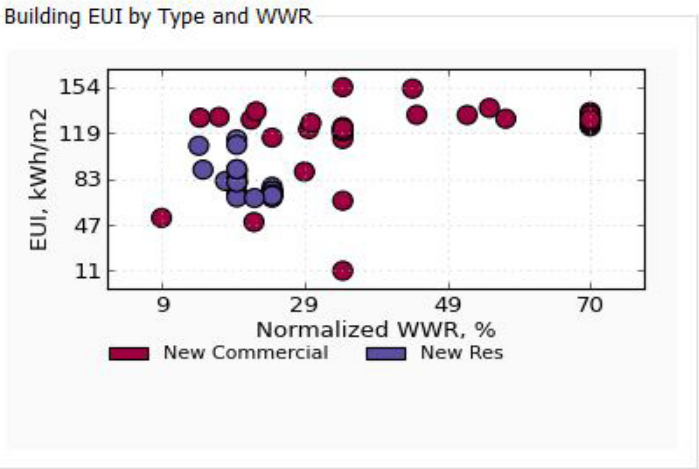
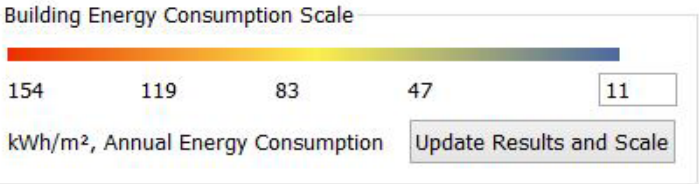
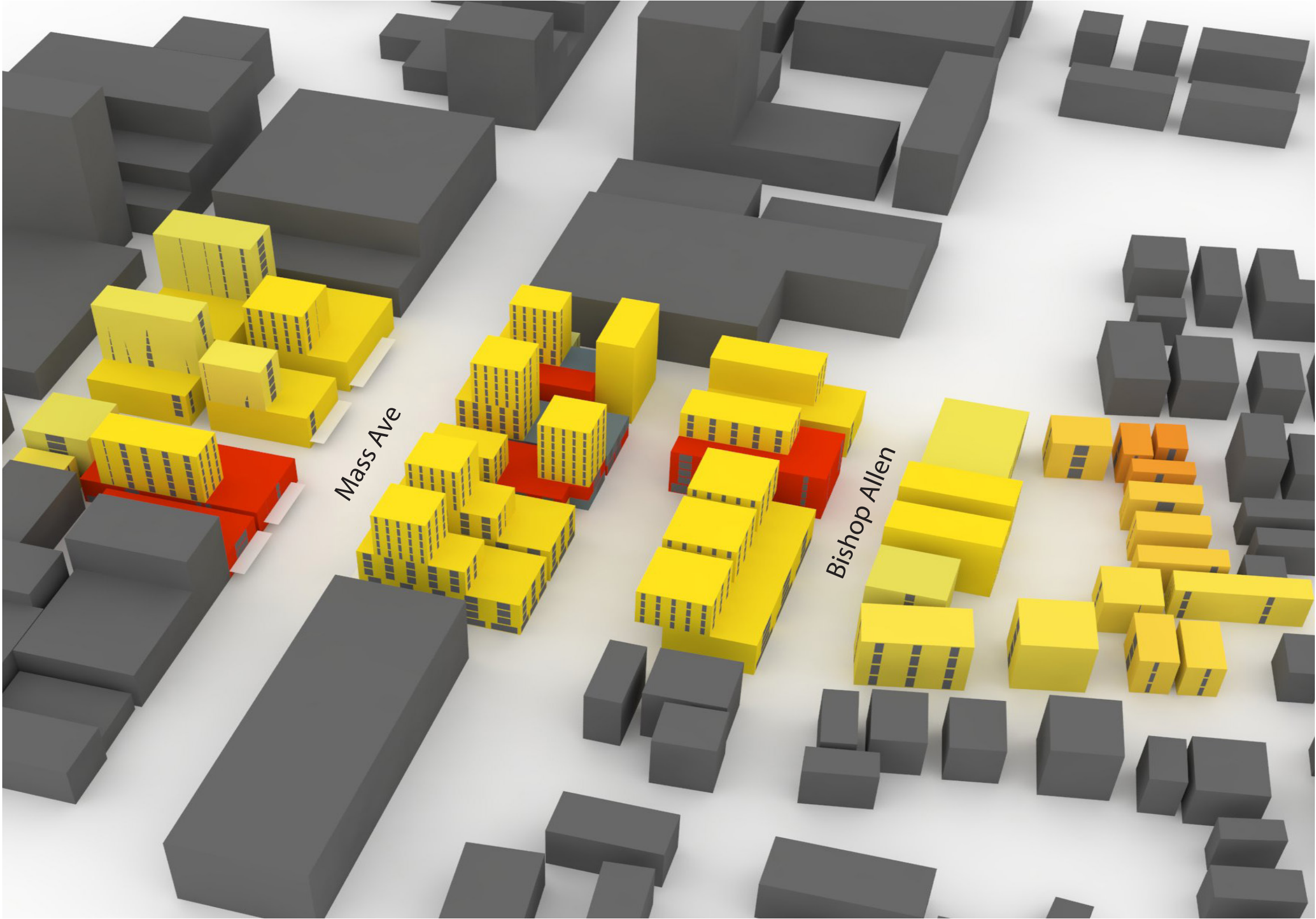


Final Proposal

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UMI_Final Proposal

Urban EUI : 101.1 kWh/m²

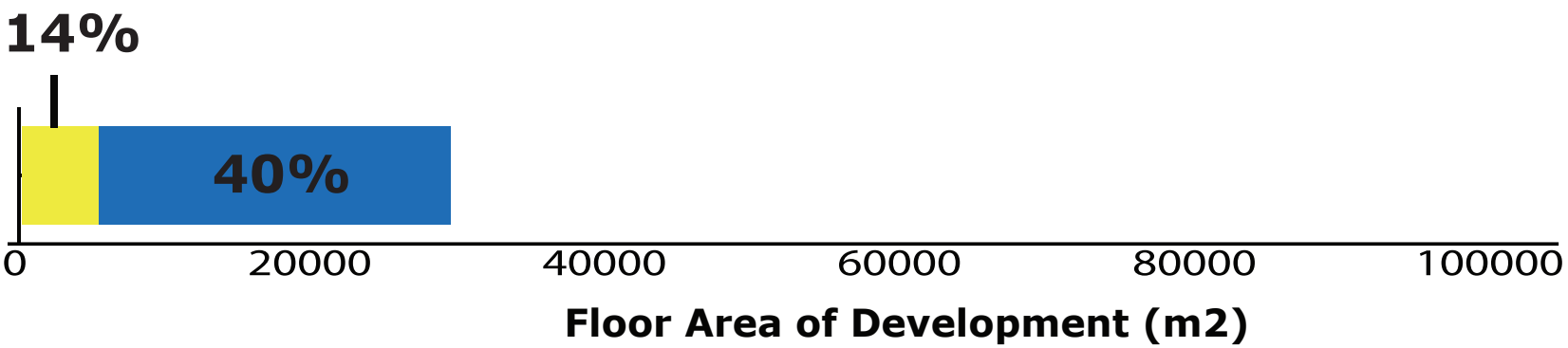


Central Square, Cambridge | Retrofit

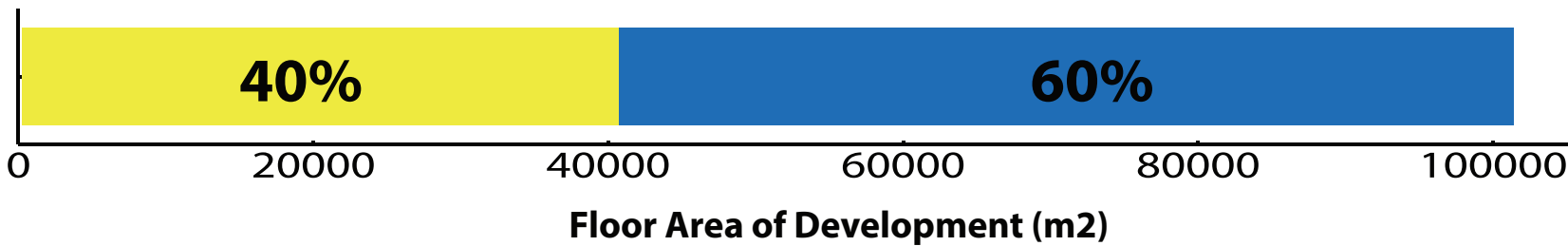
Floor Area Breakdown



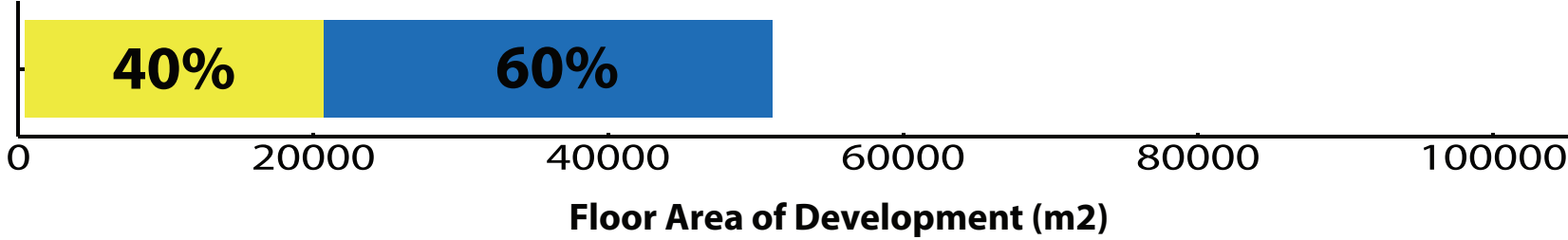
EXISTING



K2C2



PROPOSAL



 Residential  Commercial

Central Square, Cambridge | Retrofit

Summary of Metrics



EXISTING

K2C2

PROPOSAL



1.5

Density[FAR]

5.2

Density[FAR]

2.8

Density[FAR]



3.5

Finance IRR[%]

6.4

Finance IRR[%]

7.4

Finance IRR[%]



158

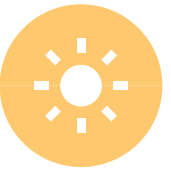
Energy[kWh/m2 a]

133

Energy[kWh/m2 a]

101

Energy[kWh/m2 a]



29

Daylit Area[%]

33

Daylit Area[%]

39

Daylit Area[%]



90

Accessibility[%]

98

Accessibility[%]

99

Accessibility[%]



0.11

Carbon Emissions[t/m2]

0.09

Carbon Emissions[t/m2]

0.07

Carbon Emissions[t/m2]

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