City of Boston: Remodeling and Unit Loss - Team C Mid Semester Report

04/05/24

AGENDA

- How many units on average are lost to renovation per year?
  - First an analysis of the Land Usage
  - Then bedrooms/living area analysis

- Which communities are losing/gaining units?
  - A heatmap based on which units have lost/gained
  - Where are housing remodels and renovations happening?

- Which neighborhoods have the most building permits?
  - What is the value going into these communities?

- Next steps!

How many units on average are lost to renovation per year?

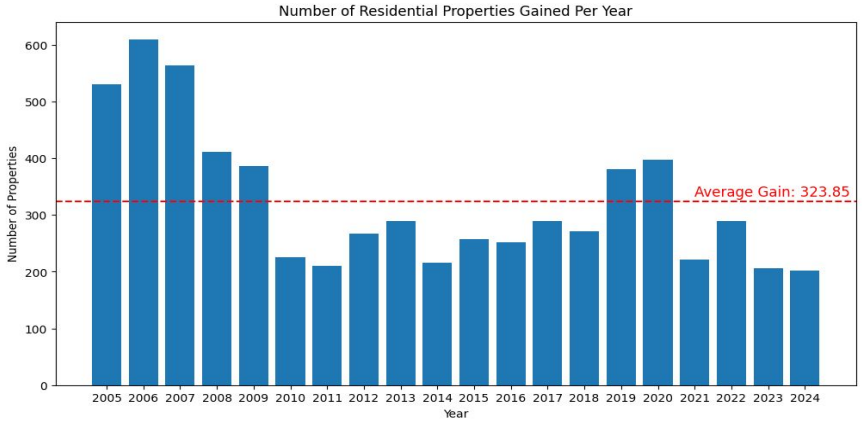
Analysis of the Land Usage

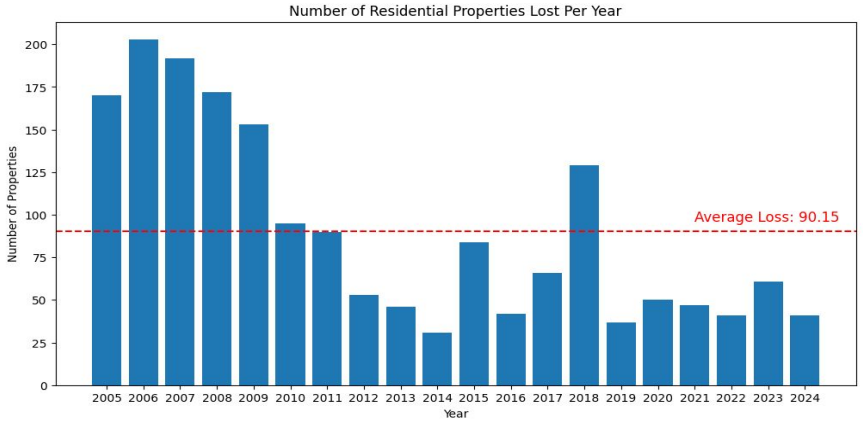
Brief Overview of the Data

- Starting from the earliest data we have, 2004, we look at the land usage codes for particular properties per year
- If the land usage code is one of the residential ones, R1, R2, R3, R4, RC, A, or CM, we count it as a residential property for that year
- We can then compare a property's land usage over the 20 years of data
  - Which properties are still considered residential?
  - Which properties are no longer residential or are no longer in the data?
  - Which properties have become residential or have been added to the data?

Code	Type
A	Residental (7 or more Units)
AH	Agricultural/Horticultural
C	Commercial
CC	Commercial Condominium
CD	Residental Condominium Unit
CL	Commercial Land
CM	Condominium Building (excluding units)
CP	Condominium Parking
E	Tax Exempt
EA	Tax Exempt (121A)
I	Industrial
R1	Residental One-Family Home
R2	Residental Two-Family Home
R3	Residental Three-Family Home
R4	Residental Four-Family Home
RC	Mixed Use (Residental and Commercial)

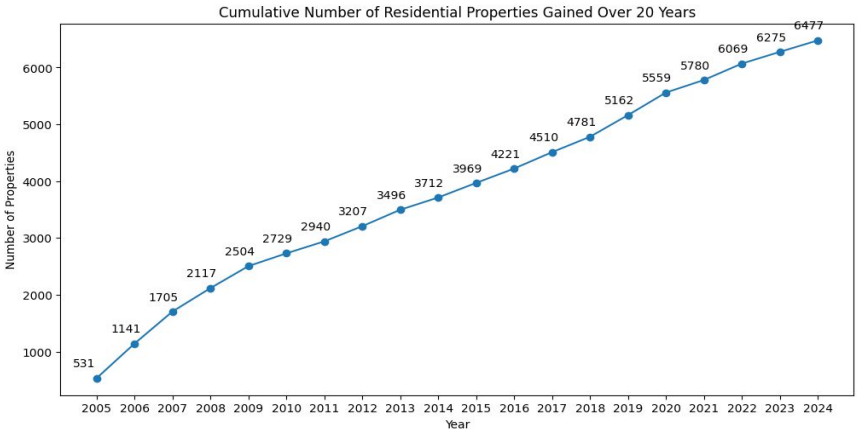
Average Number of Residential Properties Gained and Lost Per Year over the Last 20 Years

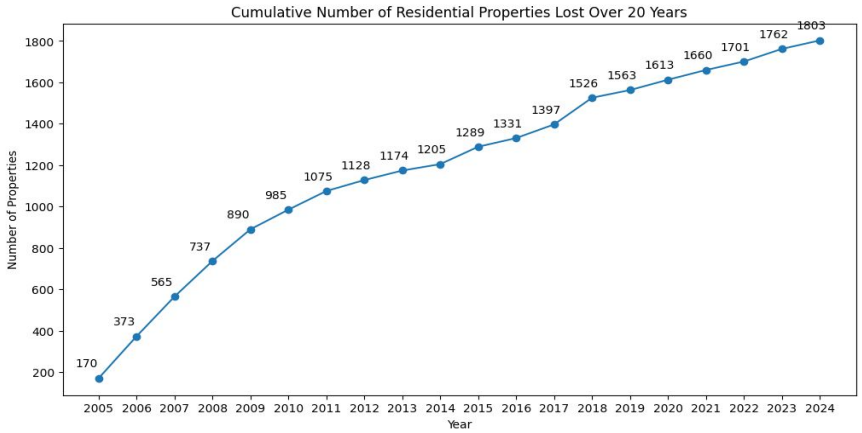




- On average, we gain 323.85 residential properties per year
- On average, we lose 90.15 residential properties per year

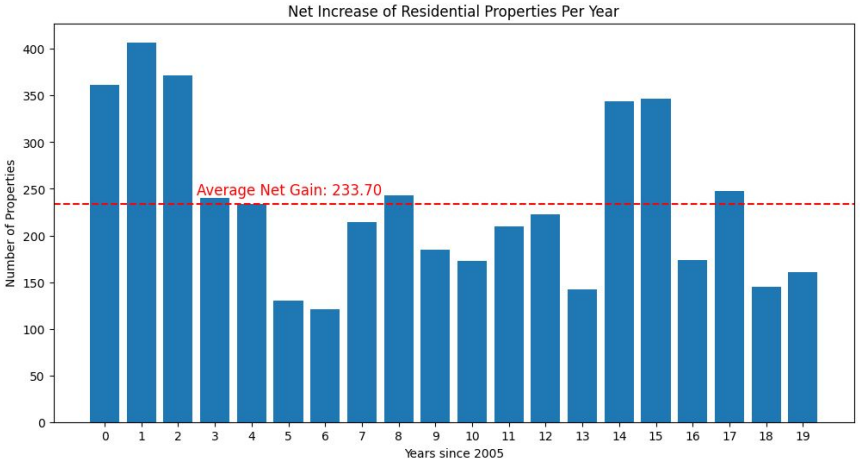
Cumulative Number of Residential Properties Gained and Lost over the Last 20 Years

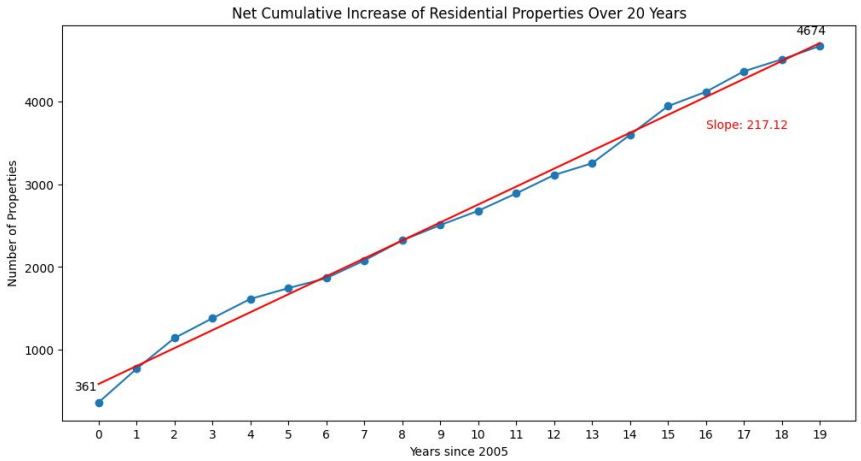




- From 2004 to 2024, we gained 6477 residential properties
- From 2004, to 2024, we lost 1803 residential properties

Net Increase in Residential Properties over the Last 20 Years





- On average, we have a net gain of 233.70 residential properties per year
- From 2004, to 2024, we had a net gain of 4674 residential properties

How Many of the Lost Residential Properties are Due to Remodels?

- We have data on the year of the most recent remodel for a given property
- If a remodel year falls between 2004 and 2024, we can check the land usage code the year before and the year after and see if it has changed
  - Did the property go from residential to non residential?
  - Did the property go from non residential to residential?
  - Did the property start as residential and remain residential?

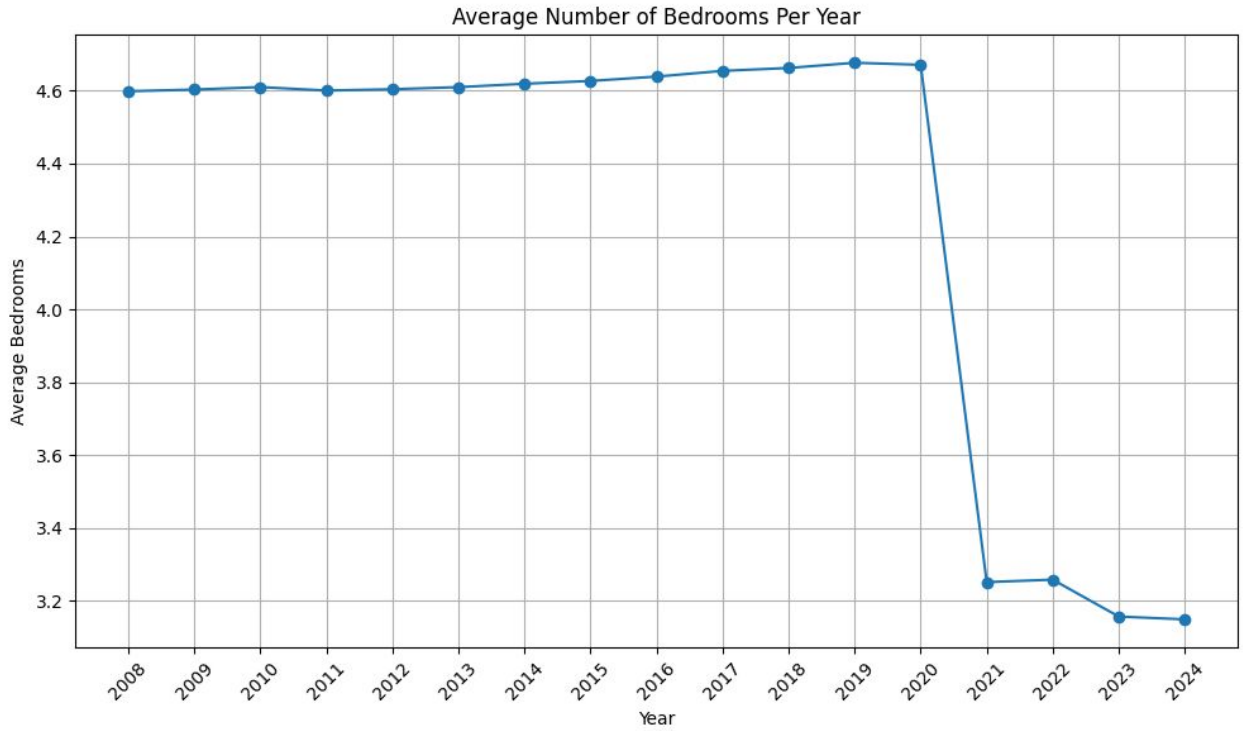
How Many of the Lost Residential Properties are Due to Remodels?

Number of Residential Properties Involved in Remodels	Number of Properties that Lost Residential Status After a Remodel	Number of Properties that Gained Residential Status After a Remodel	Number of Residential Properties Remained Residential after a Remodel
113,944	252	1,068	112,624

- Of all residential properties involved in remodels:
  - 0.22% of properties lost residential status
  - 0.94% of properties gained residential status
  - 98.84% of properties retained residential status

Analysis of Bedrooms/Living Area

Plot of Average Bedrooms from 2008 - 2024



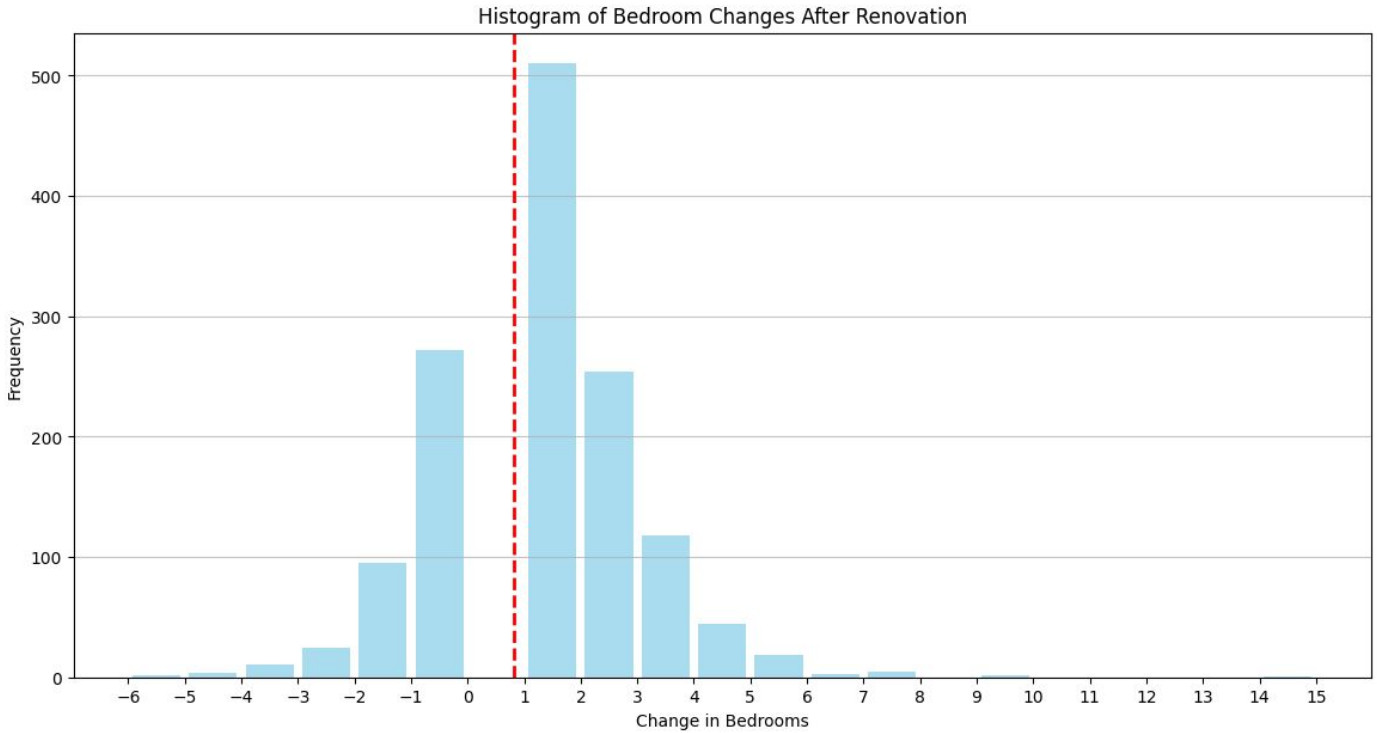
- Sharp Decline 2021 onwards.
- Is this because of renovations?
- Created a new dataset with a before and after snapshot for each renovated property

Property Change Statistics

	Gained	Lost	No Change	Average Changes (Excluding No Change)
Bedrooms	956	409	4402	+ 0.82 Bedrooms
Living Area	1839	1028	2900	+ 142.1 ft

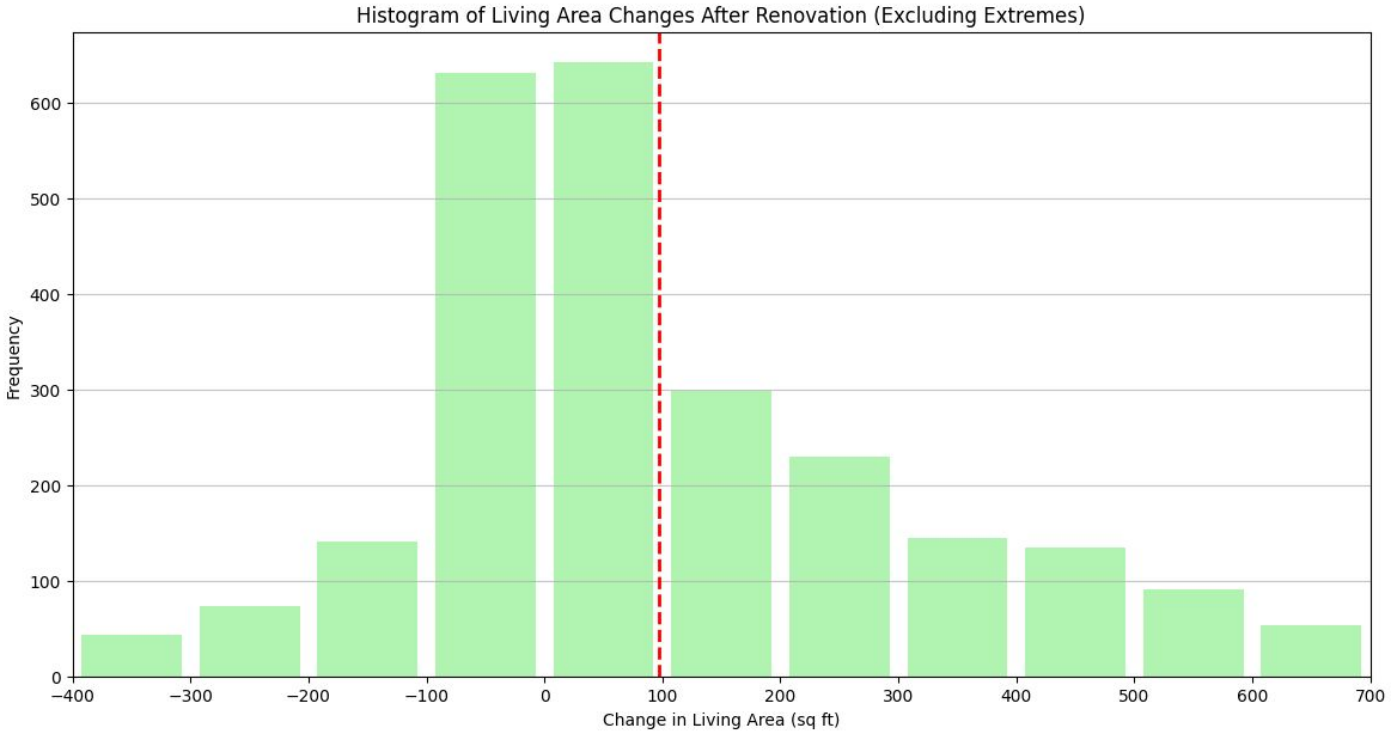
- Seems to be an overall net gain in bedrooms/living area
- When something was renovated, more often than not there was no change.
- Let's look at the distributions for a complete picture

Distribution of bedroom changes



- Modal class at around 1 bedroom (excluding no change)
- It seems on average when there is a remodelling there is gain of 1 bedroom

Distribution of living area changes



- Seems to be bi-modal, with most properties either gaining around 100ft or losing 100 ft

Conclusion

- It seems that when a property undergoes renovations/remodeling the majority of the time it has no loss in bedrooms and living area

- Net averages Show gains

- We have created three datasets, one that shows properties that have gained, one that shows properties that have lost, and one that shows properties with no change.

- Their links are below:
  - Properties where the number of bedrooms decreased: https://drive.google.com/file/d/1cYpj9TwjelMAKjfHuf0dMx01aZX7pTny/view?usp=drive_link
  - Properties where the number of bedrooms increased: https://drive.google.com/file/d/1pQakhixIUoykG9gzUb3MM37eOXKdi83K/view?usp=drive_link
  - Properties where the number of bedrooms remained unchanged: https://drive.google.com/file/d/1avOsv_SshwBi5dHB9oUUtAkbx_K38IbN/view?usp=drive_link

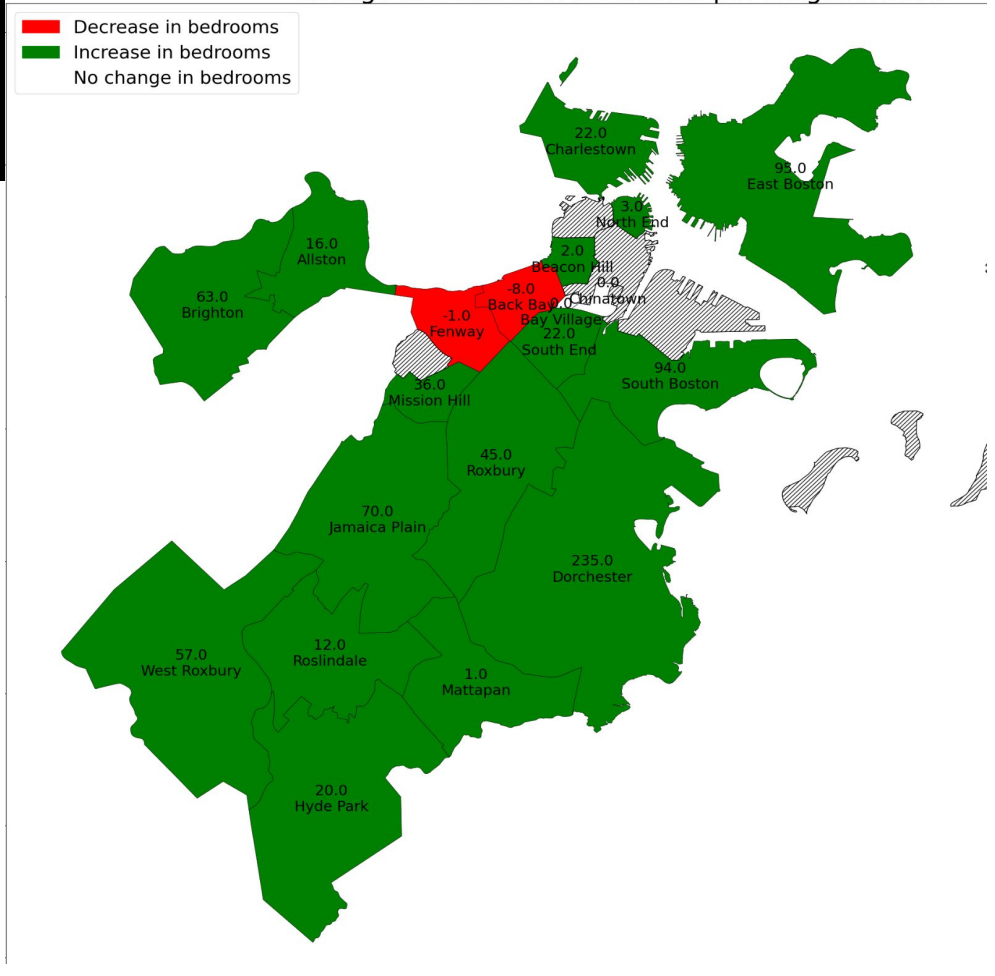
Which communities are losing/gaining units?

Where are housing remodels and renovations happening? Visualized with a heatmap

Heatmap of Neighborhood Renovations by Bedrooms

Key Findings:

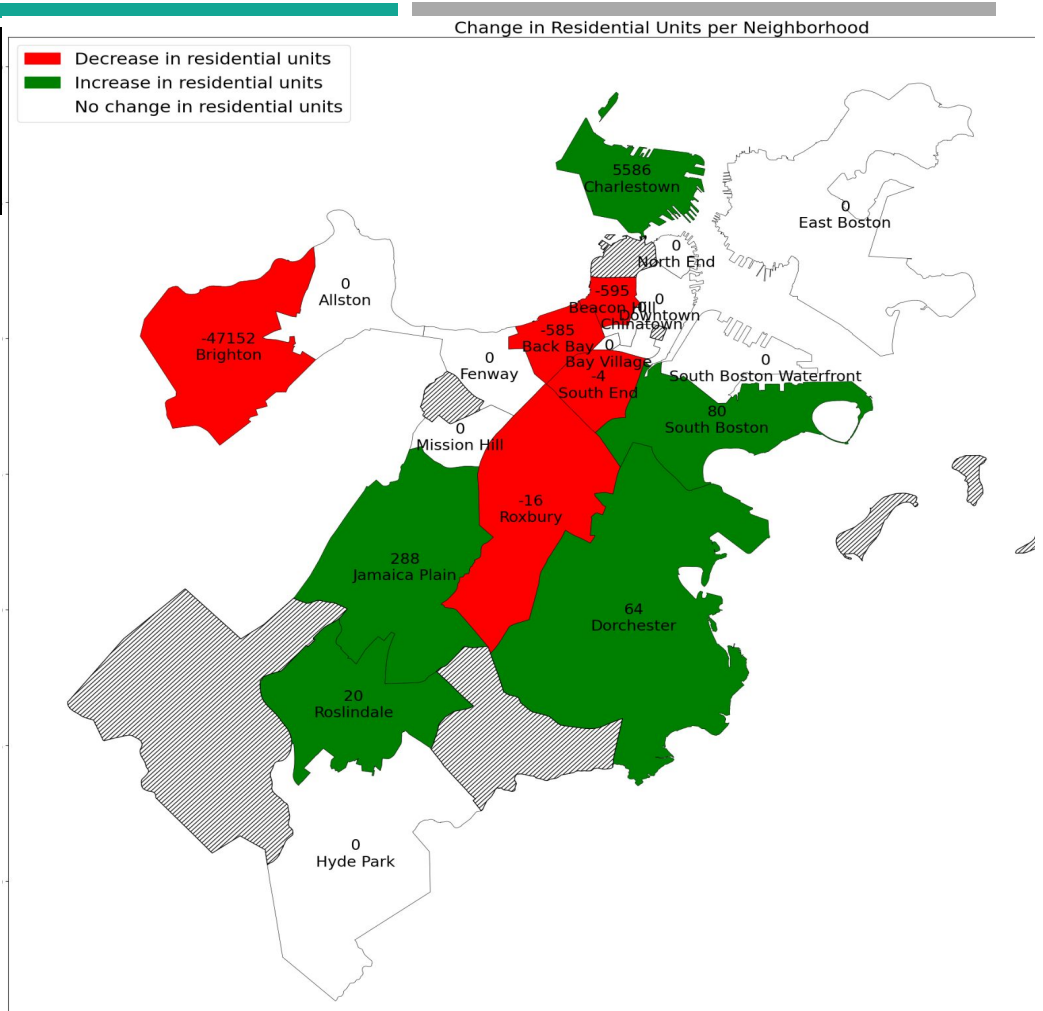
- Neighborhoods Fenway and Backbay slightly decreased in the number of bedrooms.
- Neighborhoods Chinatown and Bay village number of bedrooms remain unchanged.
- Most other neighborhoods significantly increase in the number of bedrooms.
    - Especially Dorchester which increased 235 bedrooms.



Heatmap of Neighborhood Renovations by Units

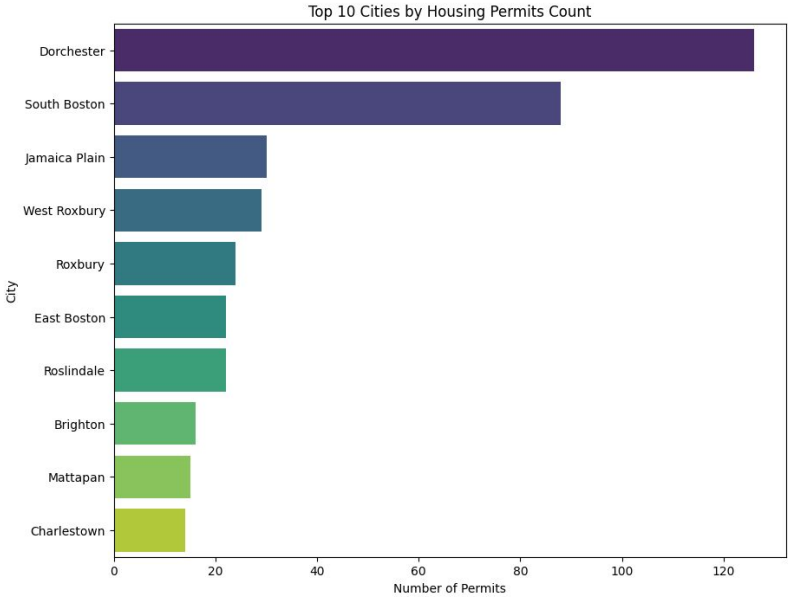
Key Findings:

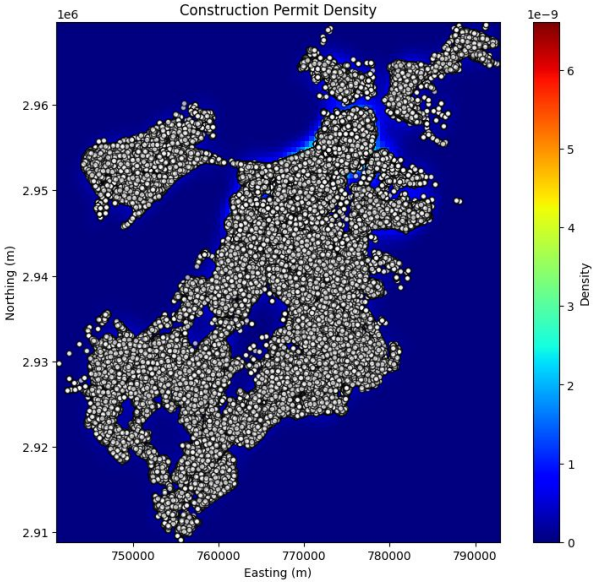
- Notable decrease in the number of units lost in Brighton compared to other neighborhood losses.
- A significant number of neighborhoods had no changes in the number of units like Allston, Fenway, North End, and Mission Hill.
- Neighborhoods that increased in the number of units did not increase significantly except for Charlestown that increased by 5586 units.



Which neighborhoods have the most building permits?

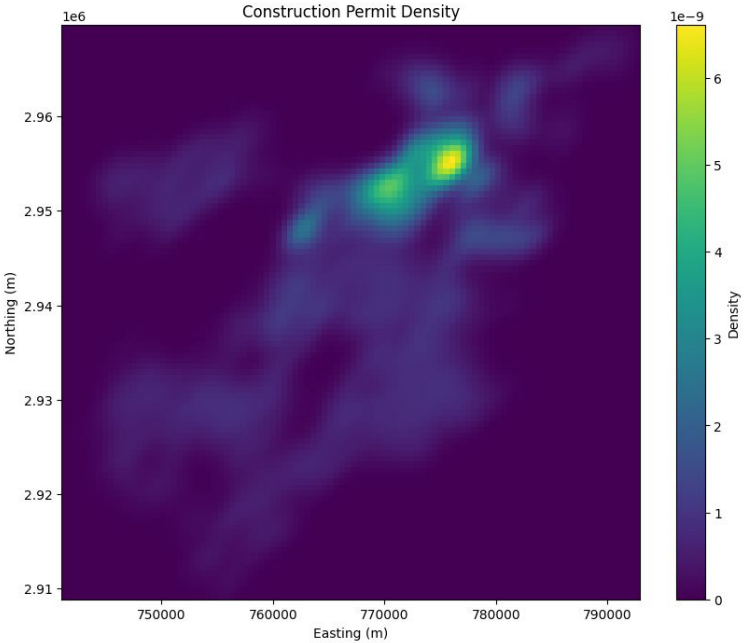
Top 10 Cities with Housing Permits

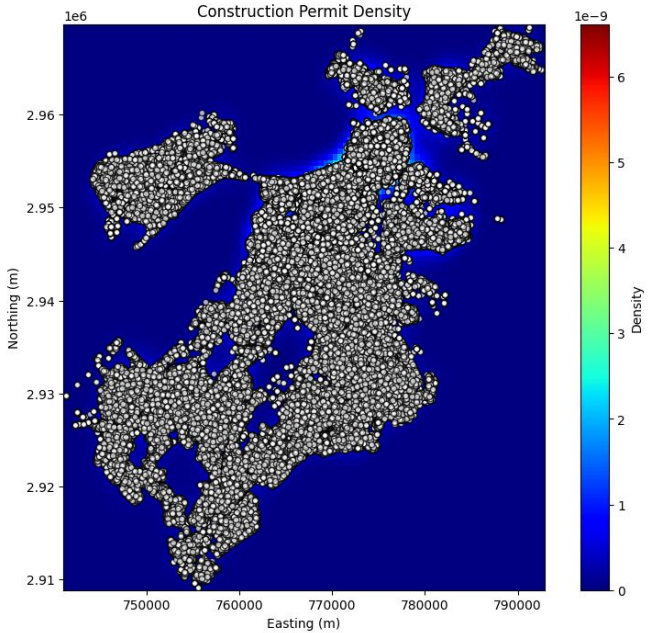




Dorchester being the highest area with highest housing permits followed by South boston. By taking the Y_COORD and X_COORD we can see which area has the highest density.

Top 10 Cities with Housing Permits

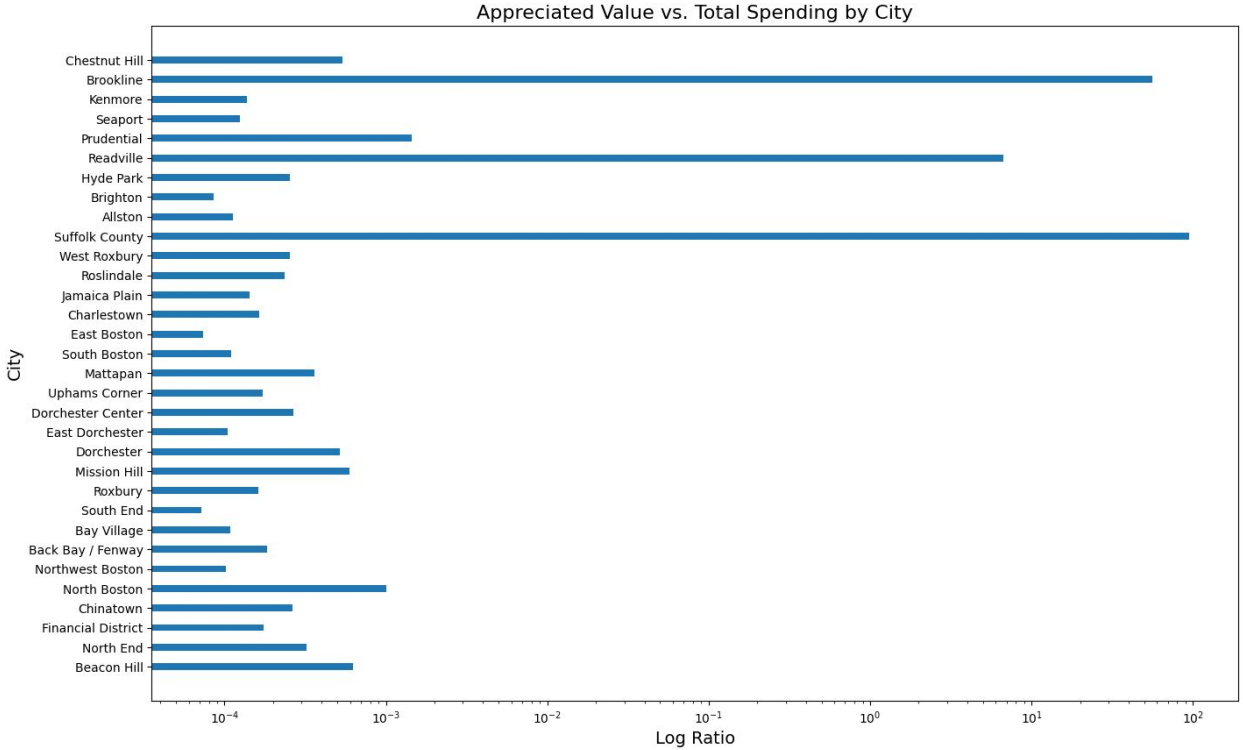




Visualization on Dorchester having the highest density in the number of permits.

What is the value going into these communities?

Building Appreciation vs. Spending by City



Key findings:

- None of the high values (Ratio > 1) were in “top 10 cities with housing permits”
- Brookline and Readville are high values most likely due to increased demand
- Suffolk county is high potentially due to high values in zip code 02114 (close to renovations)

Possible Next Steps

POSSIBLE NEXT STEPS

- Further analysis on the heat map overlaid with neighborhood demographics may correlate with areas that might be being gentrified.
- If renovations isn't causing loss in bedrooms, what is? We could look into ML models that can help us find out what predictors are associated with loss.
- What are the loss in residential units being replaced with? Are residential areas being converted to something else?
- Look into the comments/complaints in Dorchester and South Boston and see if they differ to areas that are losing housing.
- Finding the greatest correlates and predictors of price appreciation
- How are condominium buildings affected by renovation? When renovated do they lose or gain units?