

Boston City Budget - F

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Project Overview

Boston, a city of profound economic and demographic diversity, presents a unique landscape for budget analysis. Renowned for its high economic mobility across various racial and gender groups, highlighting the need for inclusive budgeting that addresses diverse community needs is crucial for Boston. Boston has a dynamic economic environment, further enriched by its robust healthcare sector and significant contributions from world-class universities. (footnote: <https://www.britannica.com/place/Boston/Economy>) Understanding Boston's socio-economic fabric is essential in analyzing how the city allocates its budget, ensuring that it effectively supports and reflects the needs of its diverse population and vibrant economy.

The overall goal of this project is to analyze the budget of the City of Boston. In the analysis, we will try and understand how the budget is spread across various categories like departments and geography and showcase how it has changed over time.

This project is important because it has the potential to have an impact on the lives of millions of people. This data-driven approach not only ensures efficient use of public funds but also engages citizens in the budgetary process, fostering trust in government and promoting informed governance practices.

This is what motivated our team to opt for this project. It will provide transparency and help demand accountability from the budget planners. By analyzing spending patterns across departments, budget categories, geography, and programs, we can make informed decisions, identify disparities, and evaluate program effectiveness.

Base Analysis

- Showcase how Boston city budget is distributed across Cabinets, Departments and Geography
- Portray how it has changed over time
- Evaluate city's financial management
- Providing valuable insights that can help the stakeholders make decisions
- Suggest ideas which can help distribute budget in a way which empowers and helps more boston residents

Why These Questions

- Answering these questions will have the potential to impact the lives of millions of Boston residents
- It will help bring transparency and bring accountability to the budgeting process promoting informed governance practices
- Data driven approach can highlight areas of focus and increase efficiency in use of public funds
- Can help engage citizens in the budgeting process

For the base project, we focused on the following datasets

Dataset Descriptions

Dataset 1: FY24 RECOMMENDED CAPITAL BUDGET PLAN

The provided dataset details Boston's FY24 Recommended Capital Budget Plan, outlining various infrastructure projects, their statuses, scopes, and budget allocations. Key columns include the department responsible, project name, scope of work, current status, and budget details, such as authorizations, grants, and total budget. For instance, the dataset includes projects like BCYF Security and Technology Upgrades with a total budget of \$2,000,000, and BCYF North End Community Center with an \$88,000,000 budget, indicating the city's diverse investment in infrastructure developments.

Brief descriptions of the columns:

1. Department: Indicates the city department managing the project.
2. Project Name: The title or name of the specific infrastructure project.
3. Scope Of Work: A brief outline of the project's objectives and tasks.
4. PM Department: Department overseeing project management.
5. Project Status: The current status or phase of the project.
6. Neighborhood: The city area or neighborhood where the project is located.
7. Authorization Existing/FY/Future: Funds allocated currently, in the fiscal year, and anticipated in the future.
8. Grant Existing/FY/Future: Grant funds allocated currently, in the fiscal year, and anticipated future grants.
9. GO Expended: The amount of Government Obligation funds already spent.
10. Capital Year 0/1/25: Projected capital expenditures for the current, next, and 25 years ahead.
11. Grant Year 0/1/25: Projected grant expenditures for the current, next, and 25 years ahead.
12. External Funds: Funding from non-city budget sources.
13. Total Project Budget: The combined total of all funding sources for the project.

Dataset 2: FY24 RECOMMENDED OPERATING BUDGET

The dataset outlines the FY24 Recommended Operating Budget for the city of Boston, totaling \$4.28 billion, a 6.8% increase from FY23. It contains detailed records of projected expenses for various city departments and programs, derived from the City's General Fund, for the fiscal year starting July 1, 2023, and ending June 30, 2024. Each row represents a unique combination of department, program, and expense category, showcasing a clear breakdown of where and how

funds are allocated and spent. The data allows for a detailed analysis of the financial planning and allocations across different city departments and services.

Brief descriptions of each column in the dataset:

- Cabinet: The top-level organizational unit, often associated with city governance.
- Dept: The specific department within the cabinet responsible for a program or service.
- Program: Individual programs or initiatives managed by the department.
- Expense Category: The type of expense, such as personnel services, contractual services, etc.
- FY21 Actual Expense: The actual expenses incurred during Fiscal Year 2021.
- FY22 Actual Expense: The actual expenses incurred during Fiscal Year 2022.
- FY23 Appropriation: The budget allocated for expenses in Fiscal Year 2023.
- FY24 Recommended: The proposed budget for expenses in Fiscal Year 2024.

Dataset 3: FY24 ADOPTED REVENUE BUDGET

This dataset provides information on the budget adopted for FY24 by a city and how it compares to the budget and actual revenues of previous fiscal years (FY21, FY22, FY23). It includes details of both recurring and non-recurring revenues and breaks them down into different categories and accounts.

A brief description of each column in the dataset:

- Revenue Category: Describes the type of revenue, such as Property Tax Levy.
- Account: Specifies the particular account under each revenue category, like Real Estate Taxes, Personal Property Tax, etc.
- Cabinet: Indicates the higher-level organizational entity or section of the city government overseeing the revenue accounts, in this case, Finance.
- Department: The specific department within the cabinet that is responsible for the account, such as the Assessing Department.
- FY21 Actual: The actual revenue collected under each account during Fiscal Year 2021.
- FY22 Actual: - The actual revenue collected under each account during Fiscal Year 2022.
- FY23 Appropriation: The anticipated or budgeted revenue for each account for Fiscal Year 23; it may not be the actual collected amount.
- FY24 Adopted: The adopted or finalized budget for each account for Fiscal Year 24, indicating planned or expected revenues.

Each row in the dataset provides detailed information for a specific account, including the actual revenues from past fiscal years, the appropriated budget for FY23, and the adopted budget for FY24, organized by the responsible cabinet and department.

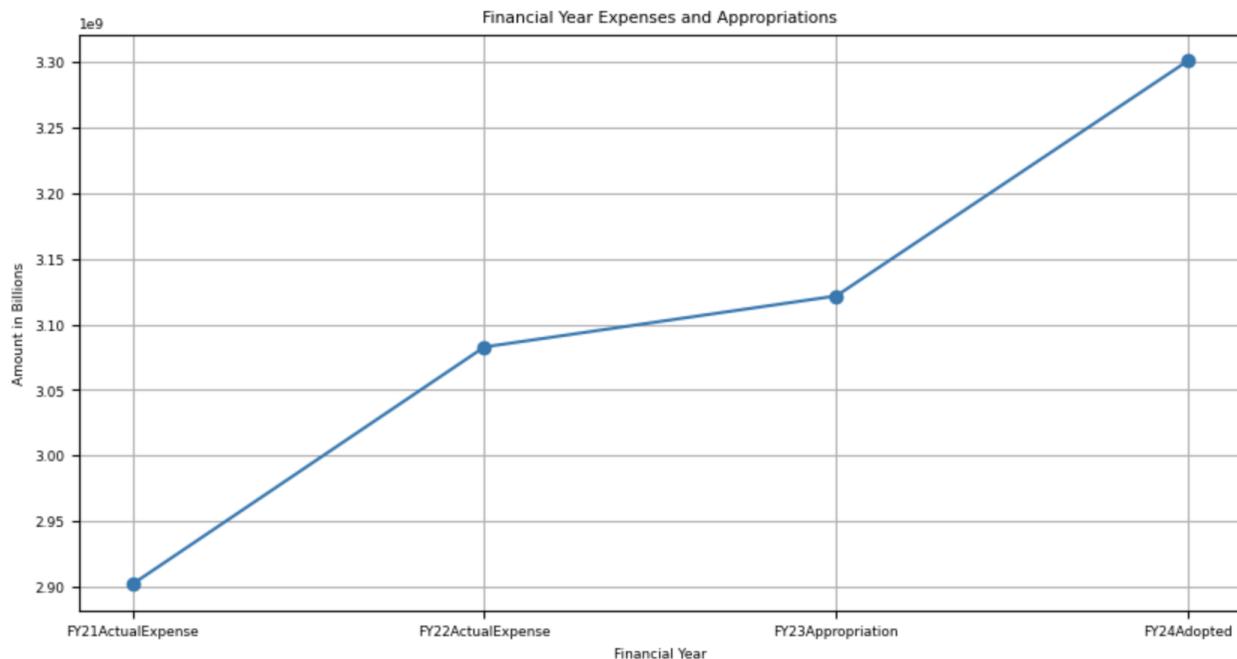
DATA CLEANING

We have removed rows which had even 1 column value that was missing or erroneous.

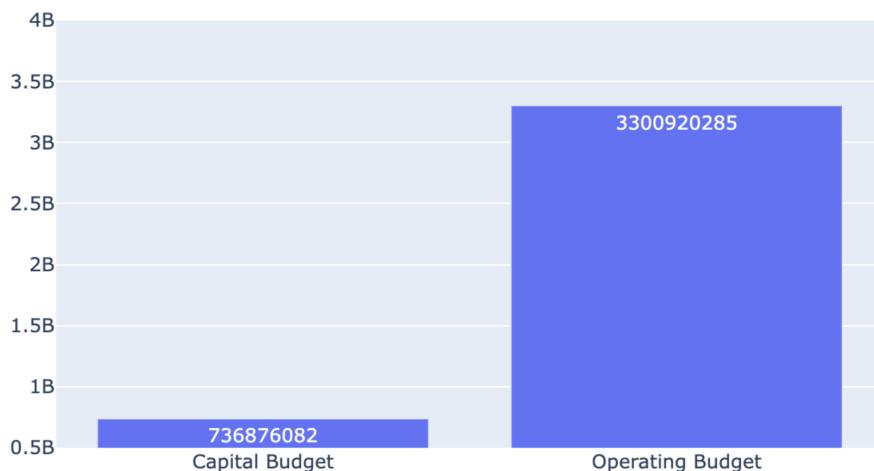
1. Changed column names - remove spaces
2. Remove extra spaces from values
3. Replace #missing with Nulls

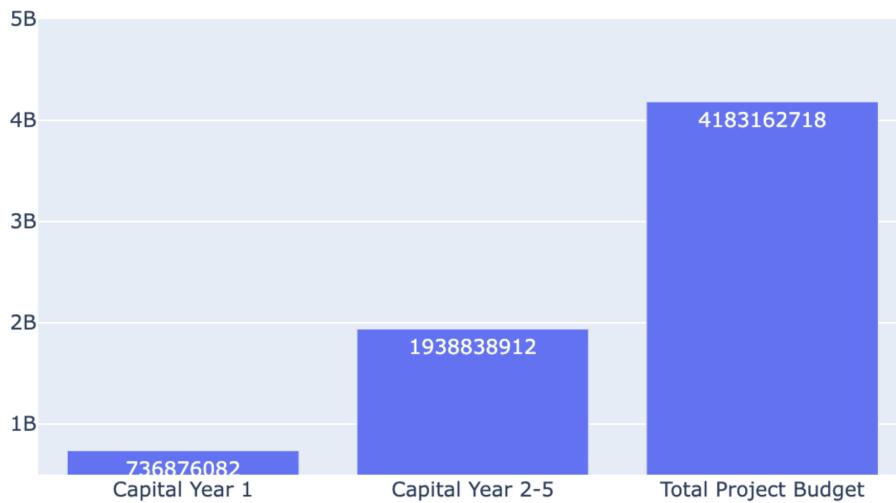
The following figure shows the total Operating budget over the years. There has been a 7.5% increment from 2021 to 2023.

The Capital Budget data has the budget allocation for a project for the first year (2024), the combined budget for the next 4 years as well as the total budget approved for the project.



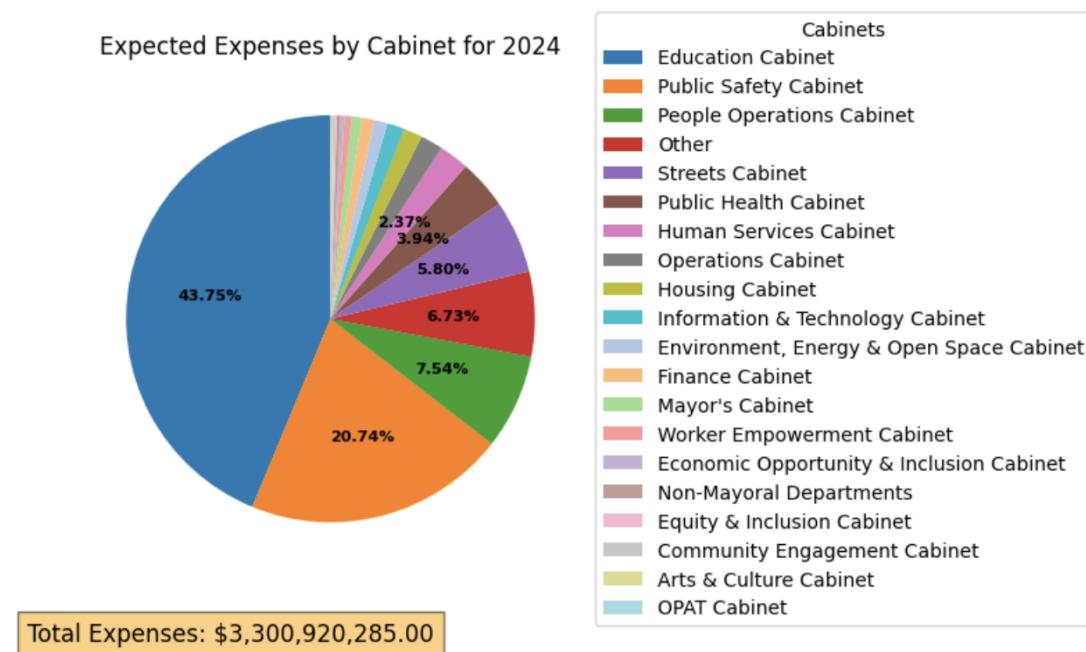
Comparison of the Operating and Capital Budget for 2024 shows that Capital budget is a very small portion (~18% of the overall city budget)

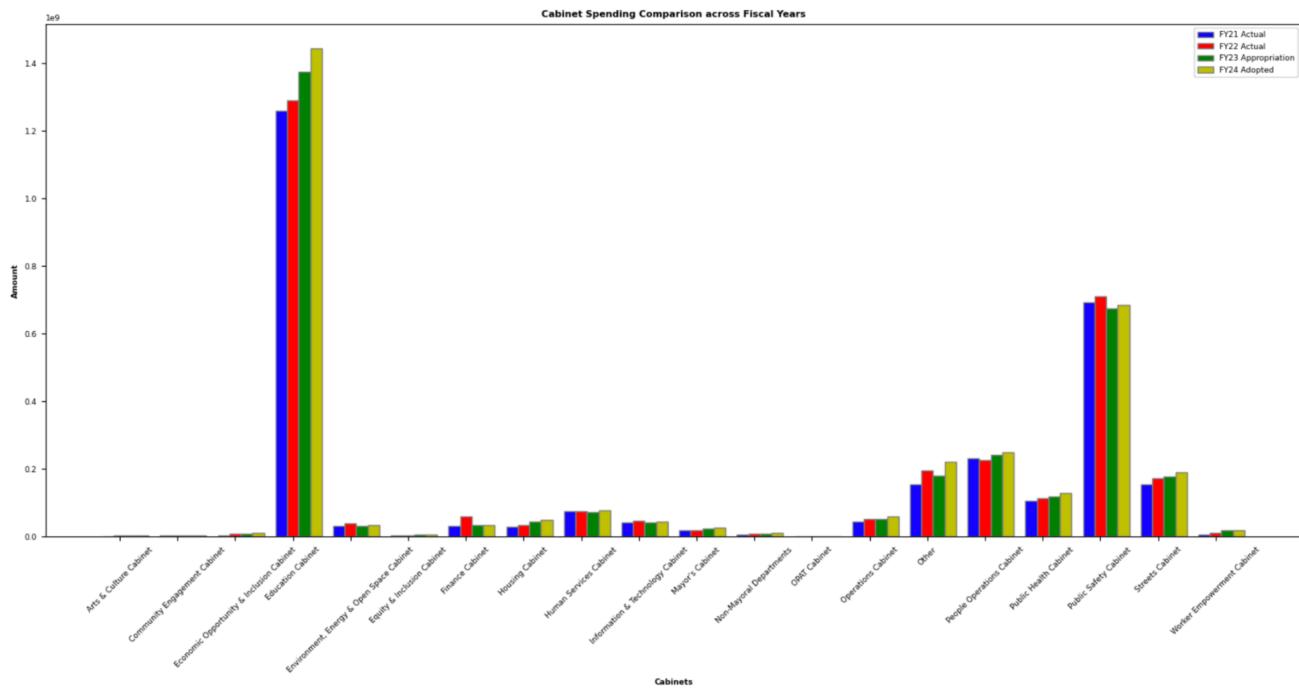




The following figure shows the Operating Budget distribution by cabinet.

- The total expenses increased from approximately \$2.9 billion in 2021 to \$3.3 billion in 2024. The proportions allocated to most cabinets seem relatively stable over the years, with minor fluctuations.
- 'Non-Mayoral Departments' and 'Worker Empowerment Cabinet' appear in the 2022 chart onward





- The most significant spending is observed in the Public Safety Cabinet and the Education Cabinet across all fiscal years. This indicates a consistent priority given to these areas by the city.
- The trend from FY21 Actual to FY24 Adopted shows an increase for most cabinets, which might be due to inflation, expansion of services, or new initiatives that require additional funding

FY24-FY28 Capital Plan

Overview

The FY24-FY28 Capital Plan is a comprehensive, forward-looking strategy for enhancing and expanding the city's infrastructure and public services. With a total budget of \$4.2 billion, the plan encompasses a broad range of initiatives aimed at developing and revitalizing the city's physical assets. Over the next five years, a total of 433 projects are slated to be either initiated or brought to completion, reflecting the city's commitment to continuous improvement and sustainable development.

Nature of the Capital Plan

The Capital Plan is a multi-year blueprint designed for the acquisition and enhancement of the city's physical assets. Its scope is diverse and dynamic, encapsulating a variety of projects:

Construction and Renovation: This includes building new schools and libraries, as well as refurbishing existing recreational centers, bridges, and other public facilities.

Diverse Project Types: The plan covers a wide array of projects, ensuring that various needs and aspects of urban infrastructure are addressed.

Funding

The implementation of the Capital Plan is supported through a mix of financing sources:

- Bonds: The city raises a significant portion of the required funds through the sale of bonds.
- City Funds: Allocations from the city's budget also contribute to financing the projects.
- Grants: External sources, including state, federal, and private grants, play a crucial role in supplementing the funding.

Project Development Pipeline

The development of projects under the Capital Plan follows a structured pipeline, ensuring systematic progression from conception to completion:

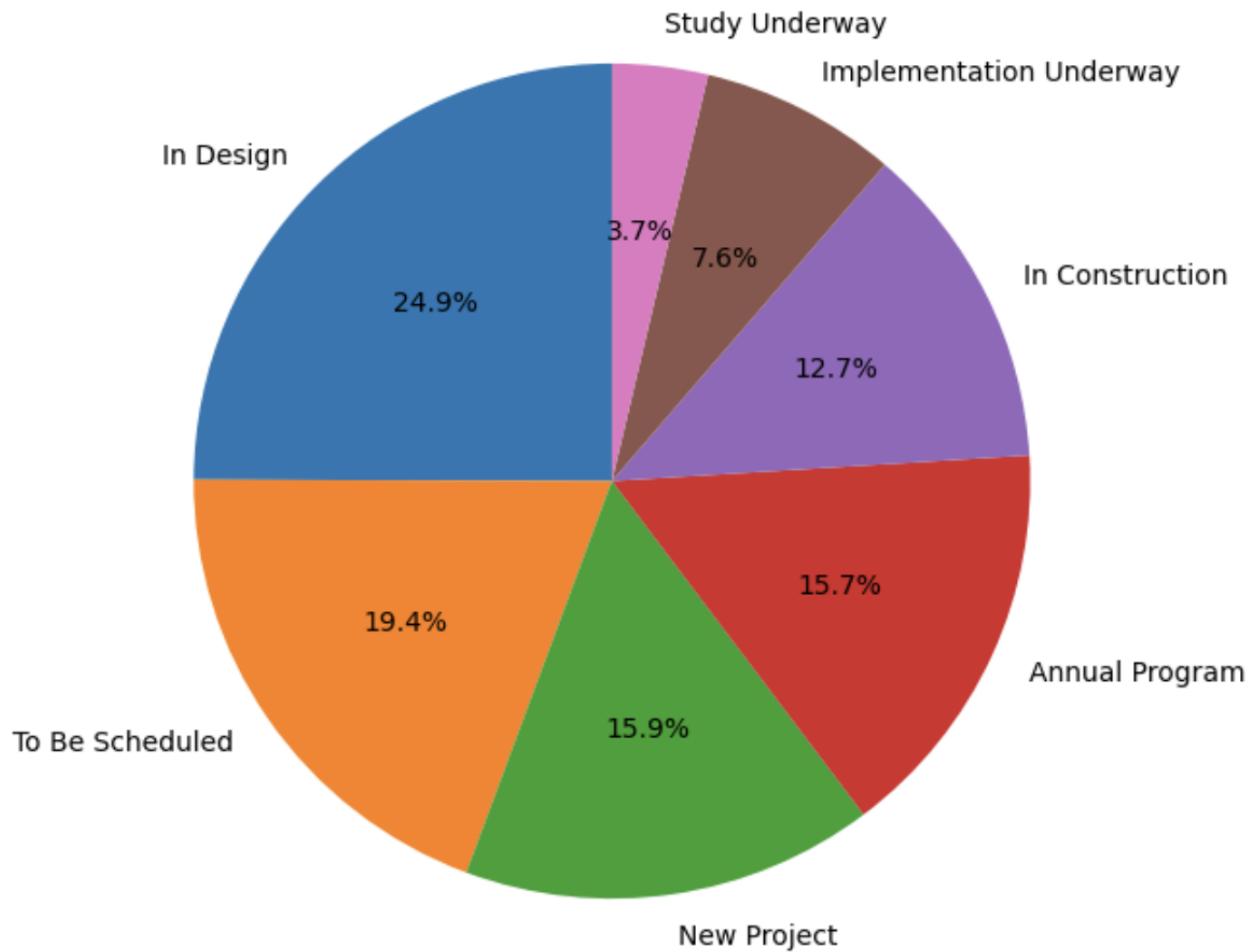
Phase in the Project Pipeline	Description
1	New Project
2	Study Underway
3	To Be Scheduled
4	In Design
5	Annual Program
6	Implementation Underway
7	In Construction

Answering Key Questions

Project Development

The provided pie chart offers a visual breakdown of the various stages of project development within the FY24-FY28 Capital Plan.

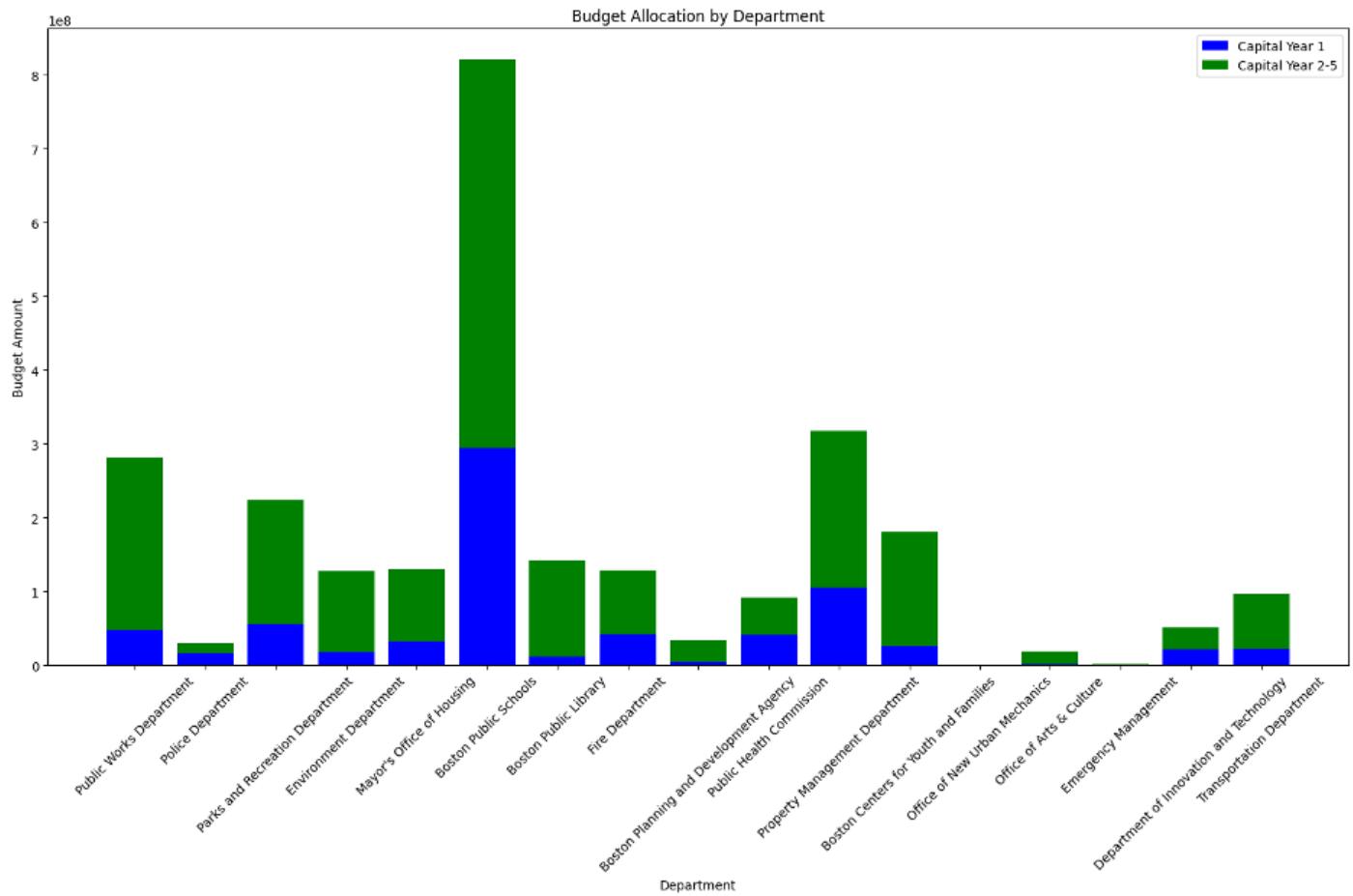
Project Status Distribution



The concentration of projects in the design phase can be seen as a sign of progress and growth. It implies that the city is continually initiating new projects and investing in future development. This can be a positive indicator for the city's commitment to infrastructure improvement, community development, or other capital project areas.

Budget Allocation by Department

The bar chart illustrates the distribution of the capital budget among various city departments, differentiating between the allocations for the immediate fiscal year (Capital Year 1) and the subsequent four-year period (Capital Years 2-5).



Implications:

- Forward Planning: The allocations across the departments suggest that the city is not only addressing immediate needs but also planning for the future, which is evident from the budgets assigned for Capital Years 2-5.
- Balanced Development: The spread of the budget indicates a balanced approach to development, ensuring that different sectors such as education, infrastructure, community services, and emergency services are all receiving attention.
- Sustainable Investments: The focus on long-term investments in the Public Works and Parks and Recreation departments reflects a commitment to sustainability and the creation of a robust infrastructure for the future.

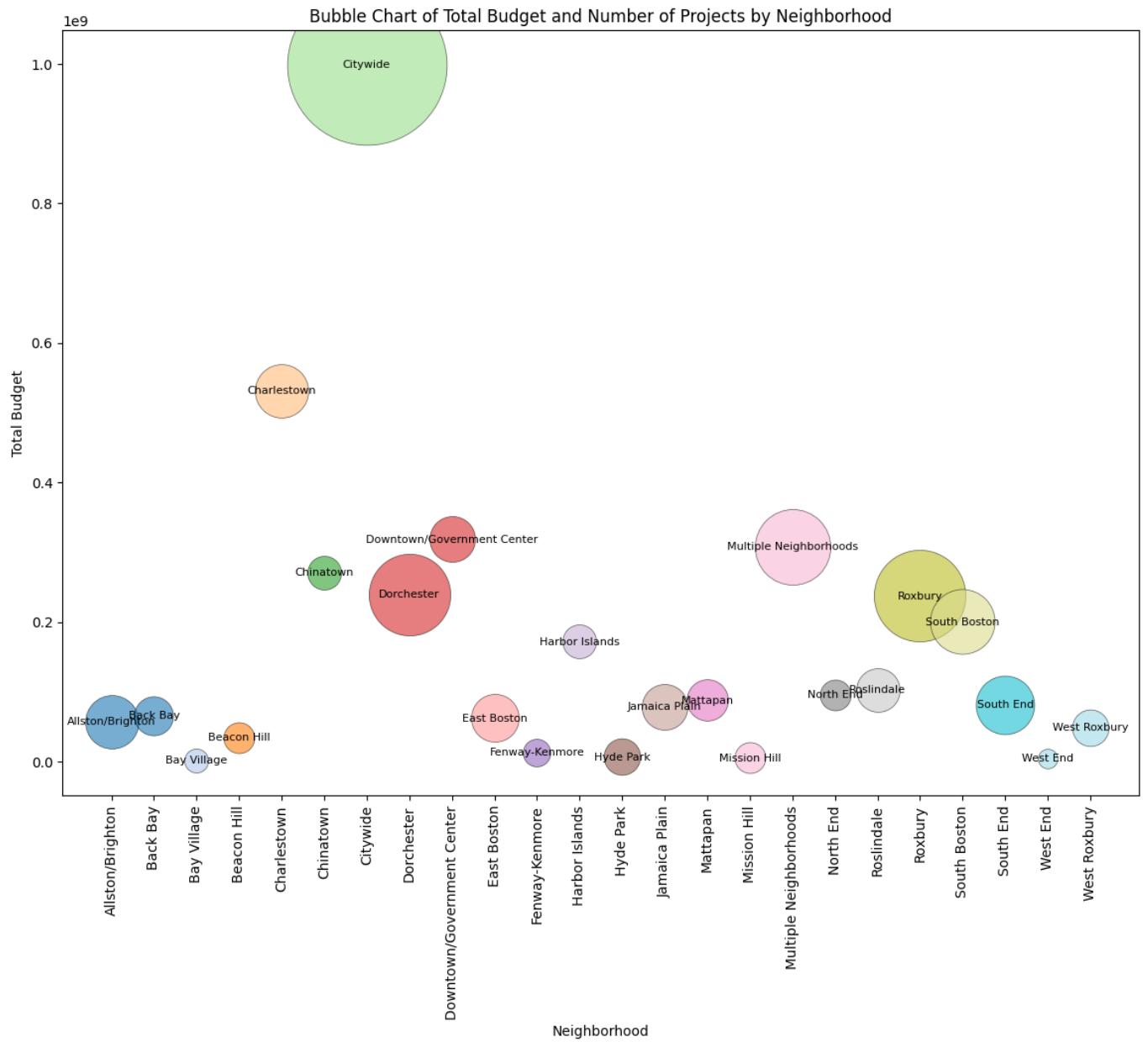
I have added the following table to provide a detailed breakdown of capital budget allocations, showing both the absolute and relative financial commitments for each department in both the short term (Capital Year 1) and medium term (Capital Year 2-5). It highlights the city's priorities and areas of focus in terms of capital investments.

	Department	Capital Year 1	Capital Year 1 %	Capital Year 2-5	Capital Year 2-5 %
0	Boston Centers for Youth and Families	1840000	0.790916	154902125	7.989427
1	Boston Planning and Development Agency	170000	0.073074	29354783	1.514039
2	Boston Public Library	8010000	3.443064	130758203	6.744150
3	Boston Public Schools	71249815	30.626429	527733636	27.219055
4	Department of Innovation and Technology	7353000	3.160656	29985140	1.546551
5	Emergency Management	0	0.000000	1500000	0.077366
6	Environment Department	13625000	5.856648	110400474	5.694154
7	Fire Department	12855000	5.525667	86467628	4.459763
8	Mayor's Office of Housing	25750000	11.068528	97178179	5.012184
9	Office of Arts & Culture	825000	0.354623	16664650	0.859517
10	Office of New Urban Mechanics	0	0.000000	150000	0.007737
11	Parks and Recreation Department	20893645	8.981044	168399600	8.685590
12	Police Department	4490000	1.930007	12735000	0.656836
13	Property Management Department	11859489	5.097751	212755793	10.973361
14	Public Health Commission	9075000	3.900850	49860610	2.571674
15	Public Works Department	35240574	15.148010	235091668	12.125384
16	Transportation Department	9405079	4.042733	74901423	3.863210

Spending by Geography (Neighborhood)

The following bubble and bar chart show the distribution of the total project budget across different neighborhoods in Boston.

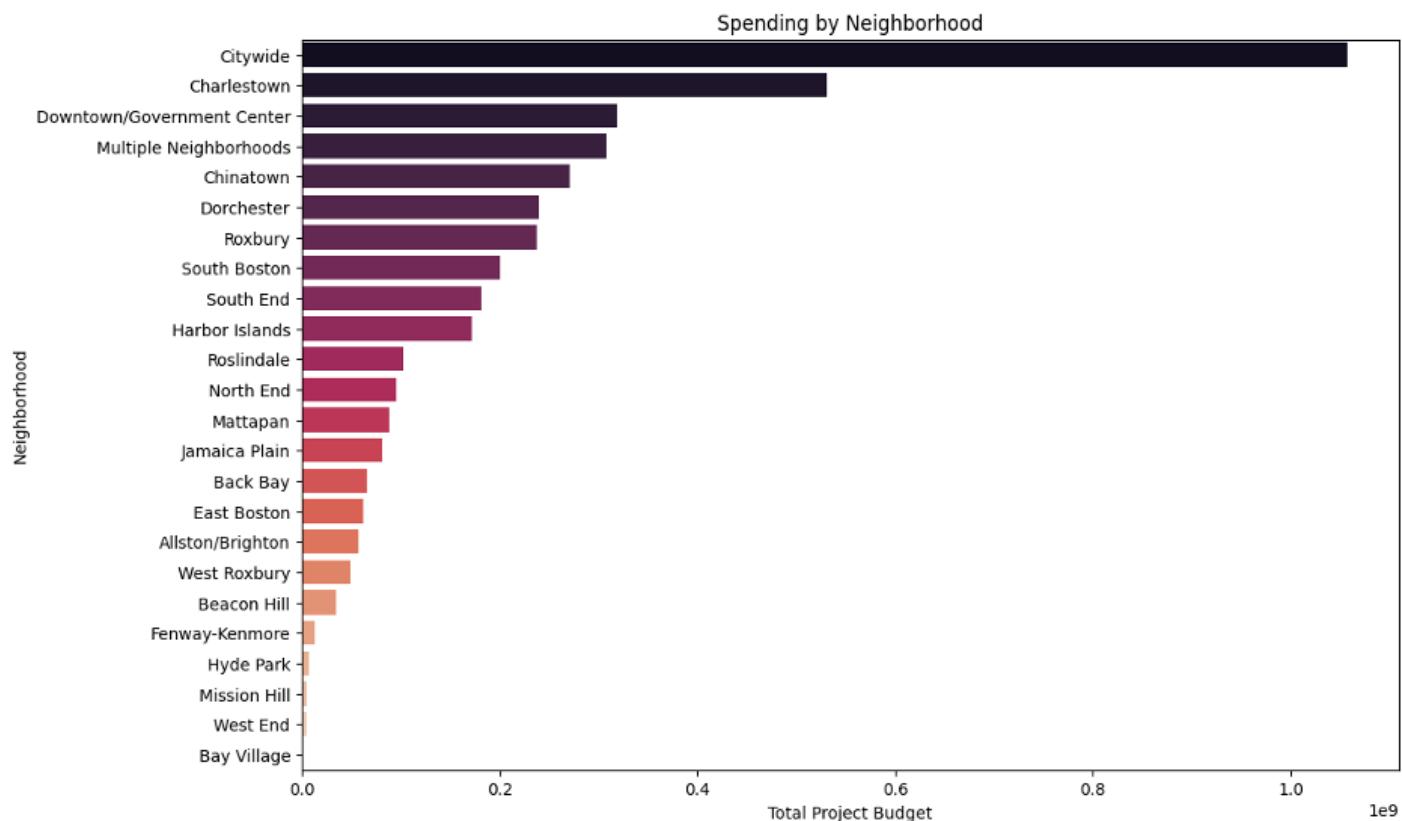
- Potential for Growth: Neighborhoods with medium to large bubbles, but lower on the y-axis (indicating a smaller total budget), might represent areas with many smaller-scale projects. These could be neighborhoods with potential for growth or regions that are receiving incremental improvements over time.
- Neighborhood-Specific Allocations: The chart shows that certain neighborhoods, like Charlestown, Downtown/Government Center, and Dorchester, have notably larger budgets. This could indicate the presence of major projects in these areas, which might be related to either substantial infrastructural developments or a high number of cumulative projects.



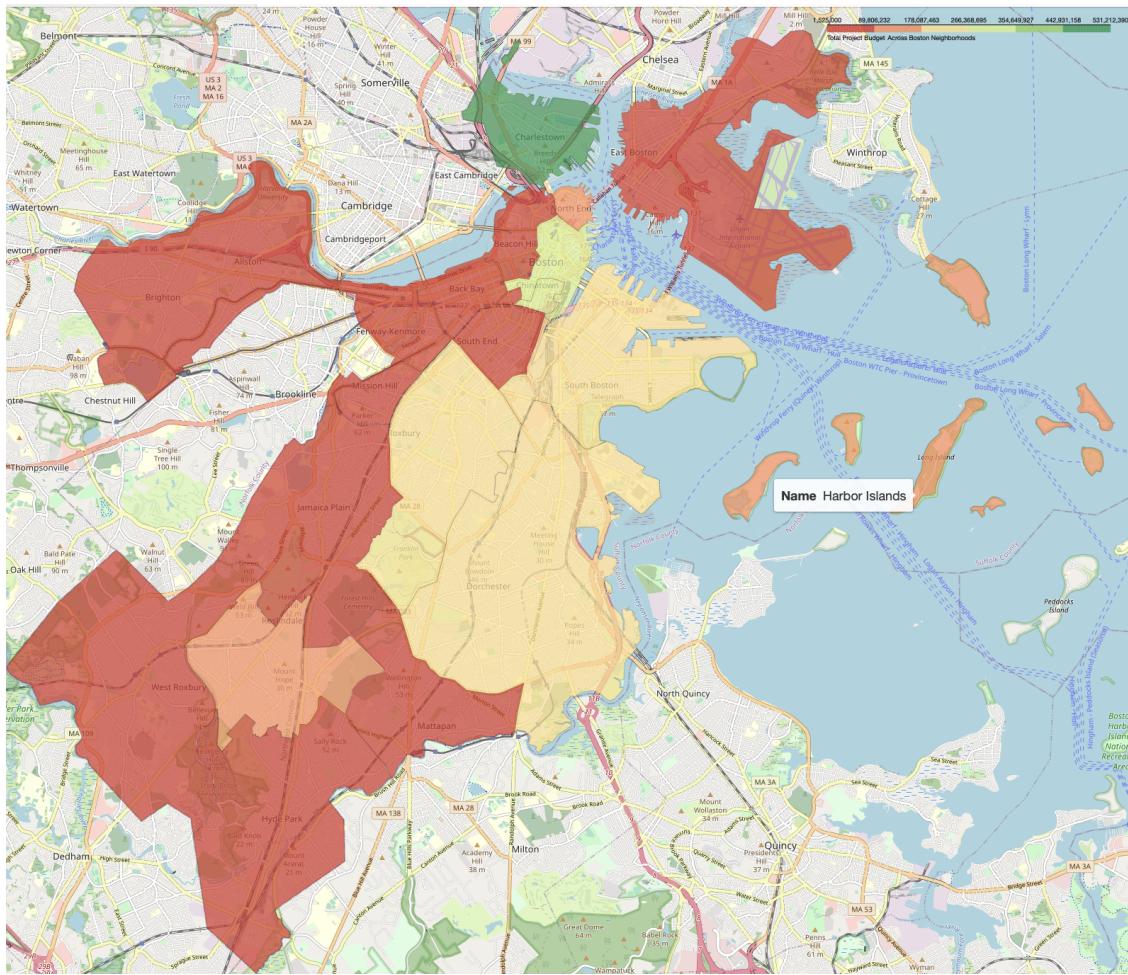
In the following bar chart, the neighborhoods with the highest spending are at the top, indicating a larger allocation of funds. This could be due to larger or more numerous projects, or a focus on specific development needs in those areas. Analyzing spending by neighborhood helps in understanding which areas of the city are receiving more attention in terms of capital investments, potentially highlighting regions with greater infrastructural or community needs.

- **Citywide Initiatives:** A substantial budget designated as 'Citywide' implies investment in projects that benefit the entire city, indicating a focus on broad impact.
- **Targeted Investments:** Notable allocations in Charlestown, Downtown/Government Center, and multiple neighborhoods suggest targeted initiatives, possibly due to unique developmental needs or large-scale projects.

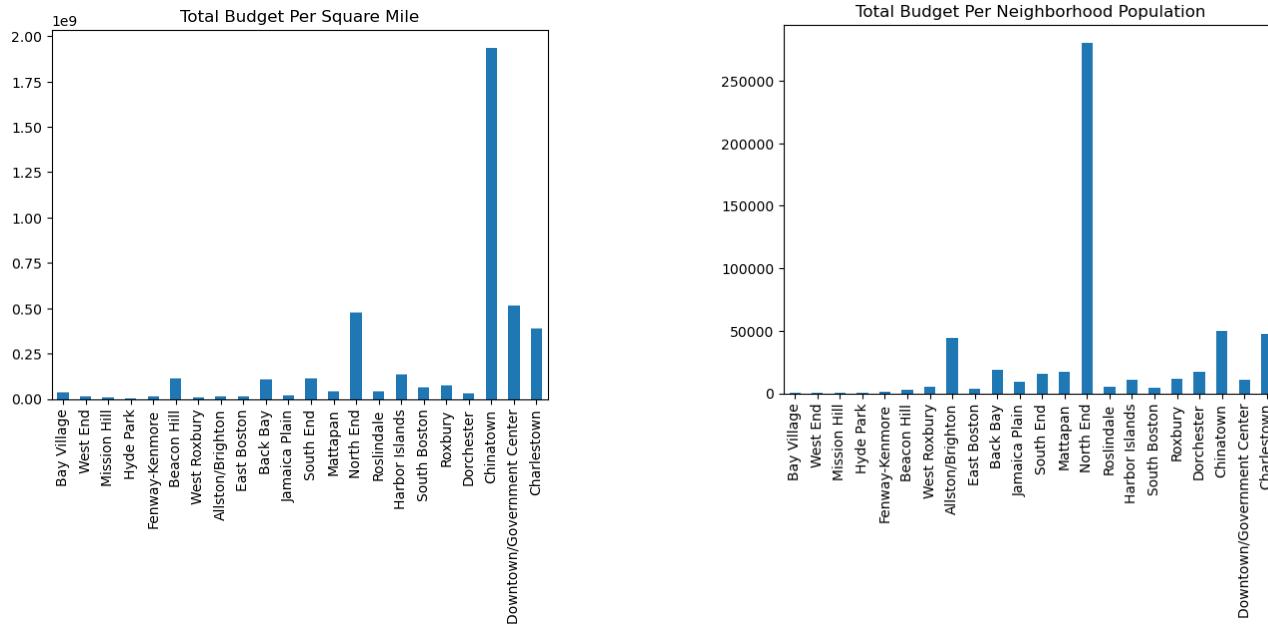
- **Equity in Distribution:** The chart also prompts consideration of the equity of investments across neighborhoods, highlighting the city's approach to addressing diverse infrastructural and community needs



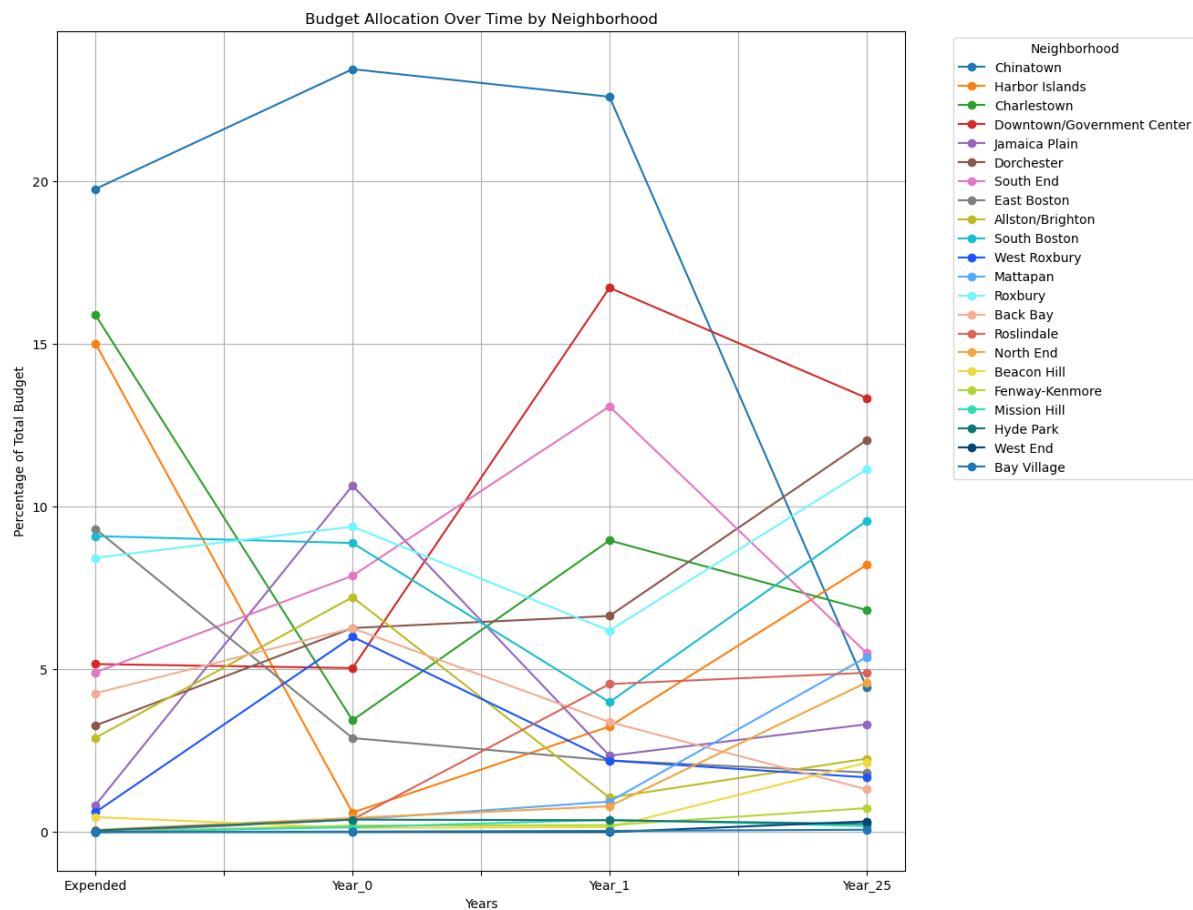
There is a wide range of total budgets for projects in each neighborhood, from Charlestown (\$531,212,390.00) to Bay Village (\$1,525,000.00). This is mostly due to the disparity in the amount of projects per neighborhood—ranging from 44 (Roxbury) to 2 (West End)—and the scale of each project—ranging from \$223,591,467.00 (Chinatown) to \$575,000.00 (Bay Village).



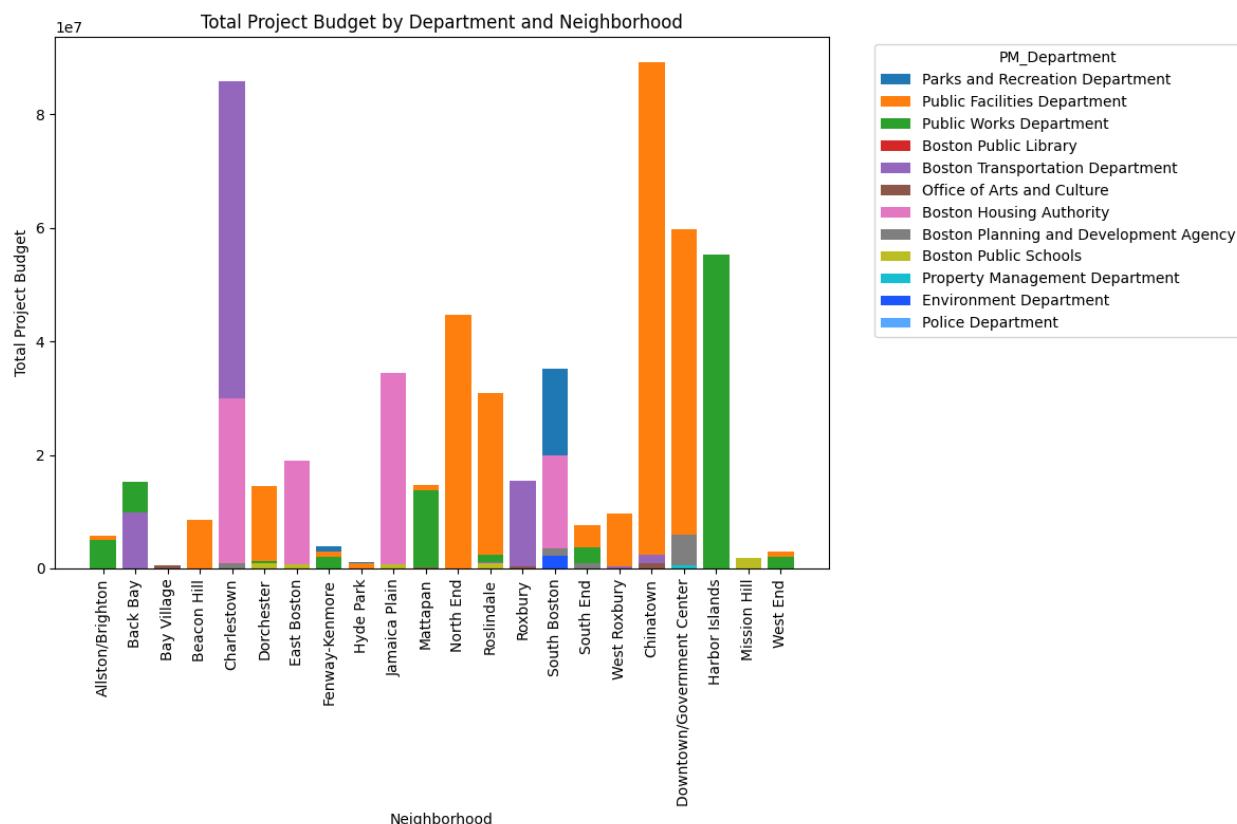
Chinatown stands out with the highest budget per square mile, followed by Downtown/Government Center and North End with \$4.77 hundred million per square mile. Which means that some of the neighborhoods with the smallest areas are getting a lot of budgets for projects in comparison to larger ones such as Allston/Brighton. This disparity in budget allocation could be due to the population density of the areas involved. There are some neighborhoods like Allston/Brighton, Dorchester, and North End, where the budget per neighborhood population is higher than the one of other neighborhoods in comparison to the budget per area. There are still some disparities that are not necessarily explained by area or population, which could be due to the infrastructure qualities and needs of various neighborhoods.



The trends of changes in the distribution of the total budget over the years of the Capital Plan is better condensed by the following line chart.



This could indicate that the projects will have the most investment during year 1, so it is likely that most projects for Chinatown are related to infrastructure or short-term projects. Harbor Islands, Charlestown, and Downtown/Government Center also show substantial changes in budget percentages, suggesting considerable variability in their budget allocations as well. Bay Village, West End, and Hyde Park have the smallest maximum changes, indicating that their budget allocations will be relatively stable over the years of the capital plan. For neighborhoods such as Downtown/Government Center, Harbor Islands, and Charlestown their budget percentages increase significantly from Year 0 to Years 2-5, while others like Back Bay and South Boston have seen their budget percentages decrease throughout these years of the plan. This could be related to the timing of the projects in each neighborhood. Chinatown has the highest expended percentage, suggesting that it uses most of its allocated budget before years 2-5 of the plan. On the other hand, neighborhoods like Fenway-Kenmore, Mission Hill, West End, and Bay Village have expended percentages close to zero, indicating that they have used very little of their allocated budgets before the plan begins.

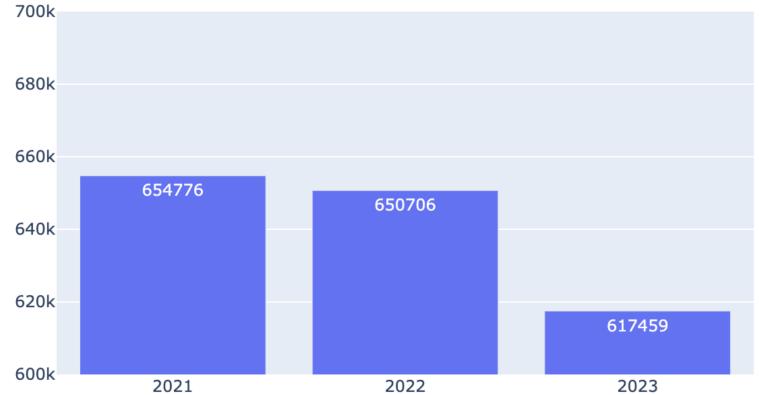


Here one can observe that some of the departments with most budget per neighborhood across all neighborhoods on the capital plan are the Public Facilities Department, Public Works Department, and the Boston Housing Authority. This might be because the plan includes several improvements to traffic infrastructure, government-owned buildings, and new housing projects.

2024 Projected Revenue vs Expenditure

The revenue is higher than the total expenditure therefore, Boston City can afford the planned Capital Budget and Operating Budget for 2024

BOSTON CITY BUDGET PER CAPITA = 6540



Extension Project

Overview

We propose three extension ideas to deepen our understanding of Boston's city budget allocation and its impacts. These ideas will provide a multifaceted analysis, considering revenue generation, demographic influences, and comparative budgeting practices with another major city.

All data is taken directly from City budget documents. These budget documents can be found [here](#).

Impact of Revenue Analysis:

Objective: To analyze how the revenue generated by a specific Cabinet or Department influences its budget allocation. This project will explore whether increased investment in certain areas leads to proportionately higher revenue generation, which in turn could be utilized for the broader benefit of Boston's residents.

Demographic Budget Analysis:

Objective: To scrutinize Boston's budget allocation along demographic lines, focusing on race, poverty rates, and household income. This analysis aims to uncover any latent inefficiencies or biases, enabling the identification of areas where budgetary adjustments could lead to more equitable and effective resource distribution.

Budget Comparative Analysis with Philadelphia:

Objective: To compare Boston's budget distribution with Philadelphia's, identifying both similarities and differences. This comparison will offer insights into alternative budgeting strategies and highlight potential areas for improvement in Boston's budgeting approach.

Rationale

- Impact of Revenue: Understanding the relationship between revenue generation and budget allocation is crucial. If higher capital allocations to certain departments significantly boost revenue, this strategy could unlock additional resources to enhance city services and resident welfare.
- Demographic Analysis: An optimal budget distribution should reflect the city's diverse demographic needs. By analyzing budget allocations against demographic data, we can identify potential disparities and propose changes for a more equitable distribution of resources.
- Comparative City Analysis: Studying Philadelphia's budgeting practices provides an opportunity to learn from a similar urban context. This comparison can reveal best practices and help Boston avoid common budgeting pitfalls, akin to the principles of zero-based budgeting.

Questions for Analysis

- Revenue Generation and Allocation: Which Cabinets or Revenue categories are the most productive in terms of revenue generation, and how does this relate to their budget allocations?
- Budget and Demographics: How do factors like household income, poverty rates, and racial demographics of neighborhoods influence budget allocations in Boston?
- Budget Comparison Insights: What modifications can Boston implement in its budget division based on the budget distribution strategies of Philadelphia?

The datasets can be found [here](#)

Impact of Revenue Analysis

In order to better understand what contributes the most to City of Boston's revenue and how that affects the city's spending. We first look at how the Finance Cabinet and Property Tax Levy compares with its spendings in the operating budget.



The graph presented is a stacked bar chart titled "Comparison of Property Tax Levy and Finance with Top 3 Operating Spending Cabinets". It compares the property tax levy (the main source of revenue from its Finance Cabinet) and the budget allocation across top three different categories—Education Cabinet, Public Safety Cabinet, and People Operations Cabinet—over four fiscal years. It appears that there is a trend of increasing revenue in Property Tax Levy and also an increase in investment in the top three cabinets of operating budgets.

Philadelphia's Spending Dataset

Introduction: This dataset provides a granular view of Philadelphia's budgetary allocations across various categories and departments from 2020 to 2025. It includes data on proposed and revised spending across major classes such as 'Advances & Misc.', 'Contrib./Indemnities', 'Debt Service', 'Materials/Equip.', and 'Payments to Other Funds', along with detailed spending by the City Council under 'Legislative & Elections'.

Utility for Extension Projects: This spending dataset is invaluable for our "Impact of Revenue" analysis. It allows us to trace how budget allocations are adjusted over time. This data will also aid in our comparative analysis with Boston, highlighting how two major cities manage their finances under similar economic pressures.

Philadelphia's Revenue Dataset

Introduction: This dataset focuses on Philadelphia's revenue streams, outlining proposed and revised figures for various revenue sources like 'Wage and Earnings Tax', 'PICA City Account', 'Real Estate Tax', and 'Business Income & Receipts Tax' from 2020 to 2025. It provides a comprehensive overview of the city's income, crucial for understanding its fiscal health and priorities.

Utility for Extension Projects: This revenue dataset is key to our analysis of how different revenue sources impact overall budget decisions. It will help us in correlating revenue generation with budget allocation decisions, crucial for the "Impact of Revenue" project. Additionally, it will serve as a benchmark for our demographic analysis project, helping us understand if and how revenue sources are influenced by demographic factors.

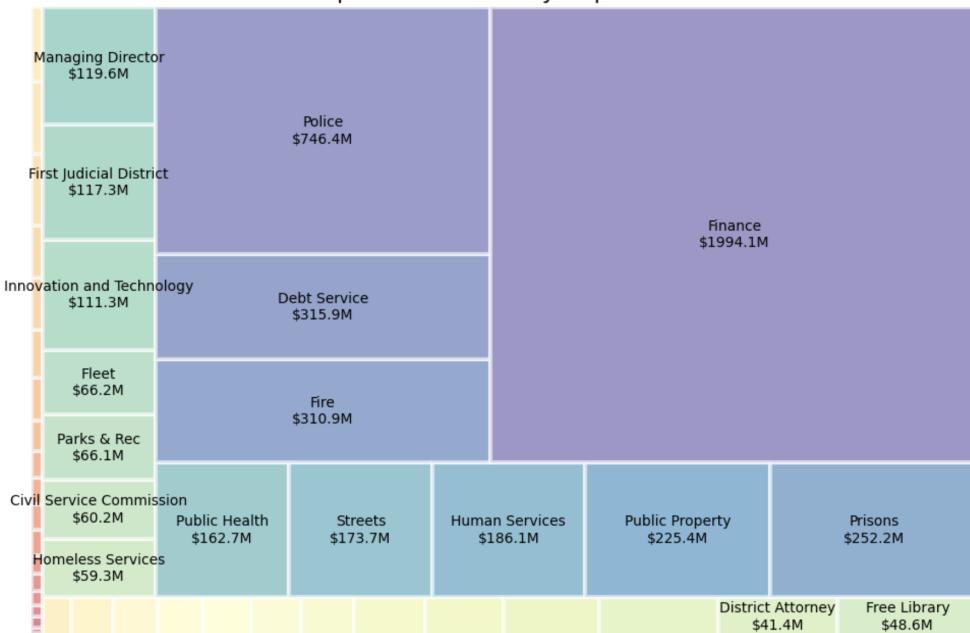
Comparative Analysis with Boston

Both datasets are instrumental for the comparative analysis with Boston's budget. By examining similar datasets from Boston, we can draw parallels and contrasts in budgetary priorities, adjustments in response to economic challenges, and the overall fiscal strategies of two major cities. This comparison will help us in identifying best practices, potential areas for improvement, and innovative approaches to budgeting that can be beneficial in times of economic uncertainty. Overall, these datasets from Philadelphia provide a robust foundation for our extension projects, offering the data necessary to conduct in-depth, comparative, and demographic analyses. They will enable us to answer critical questions about budget allocation, revenue generation, and fiscal management in the context of challenging economic conditions.

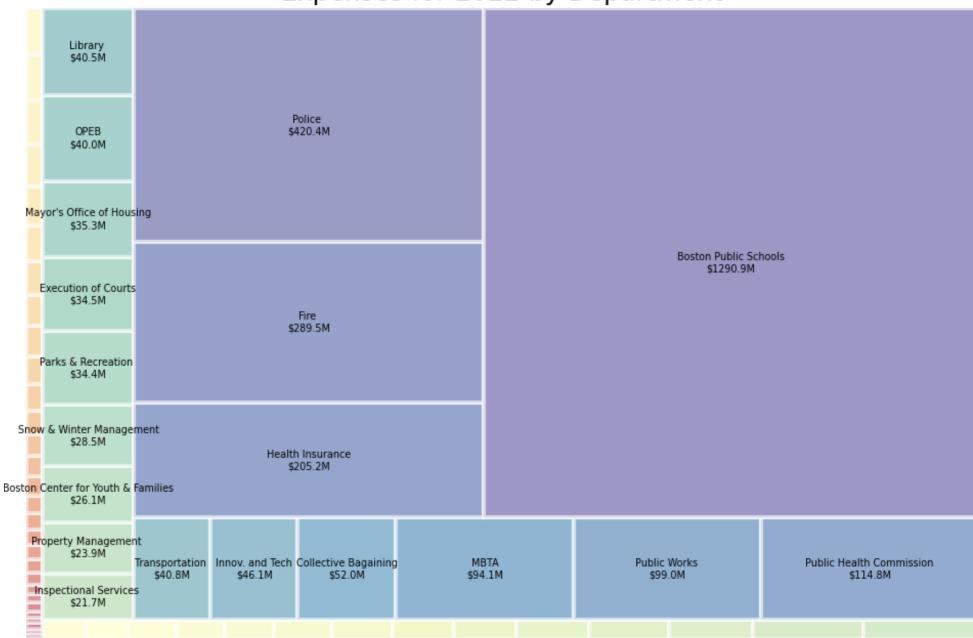
Why Philadelphia?:

- When looking for a city to compare to Boston it was important to find a city that was comparable in terms of location and identity.
- There aren't a lot of major cities on the east coast that were good options as New York City is way too big and Miami is really different in terms of culture and location
- As a result we decided on Philadelphia despite it have a larger population than Boston

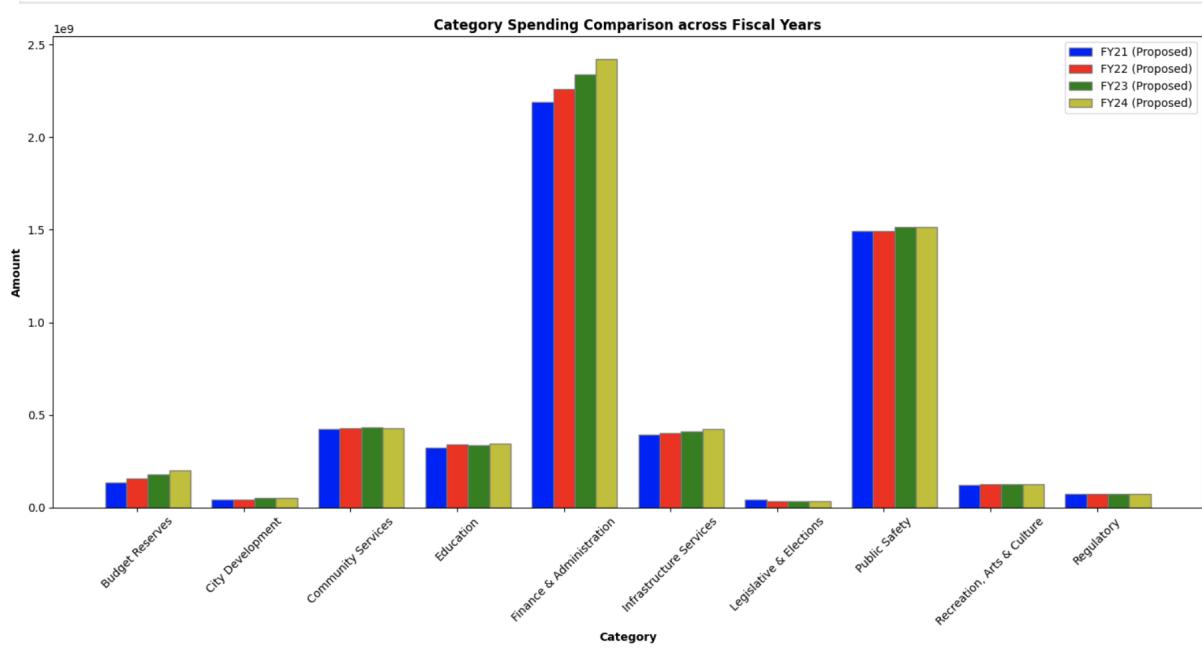
Expenses for 2022 by Department



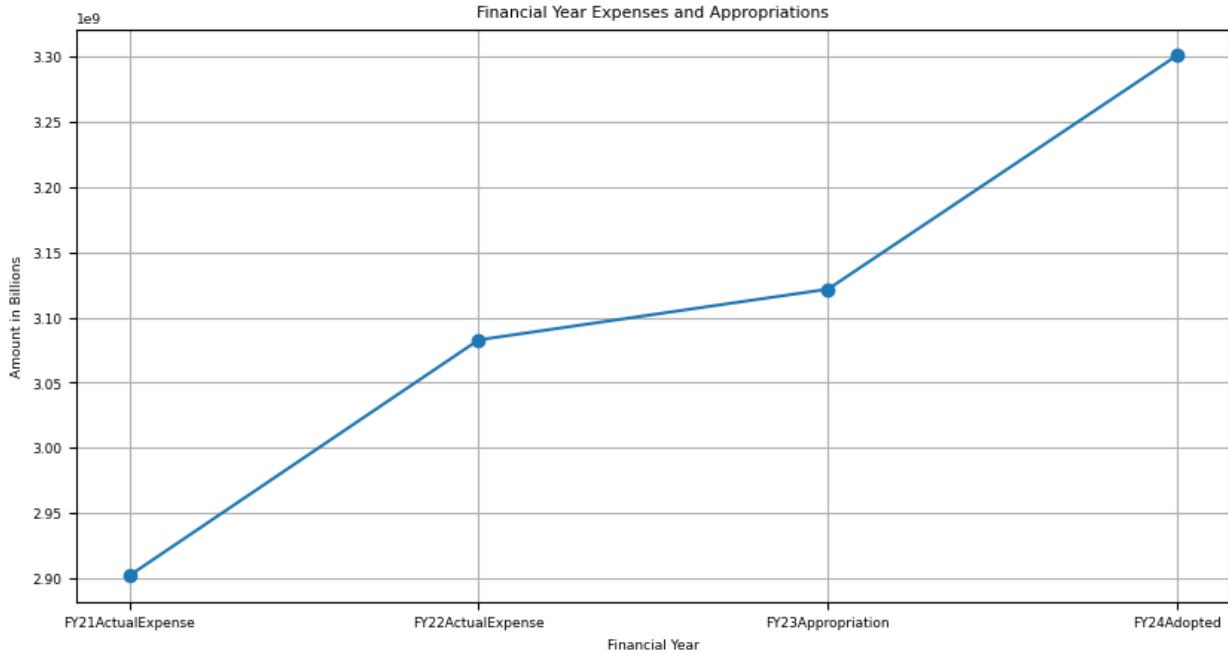
Expenses for 2022 by Department



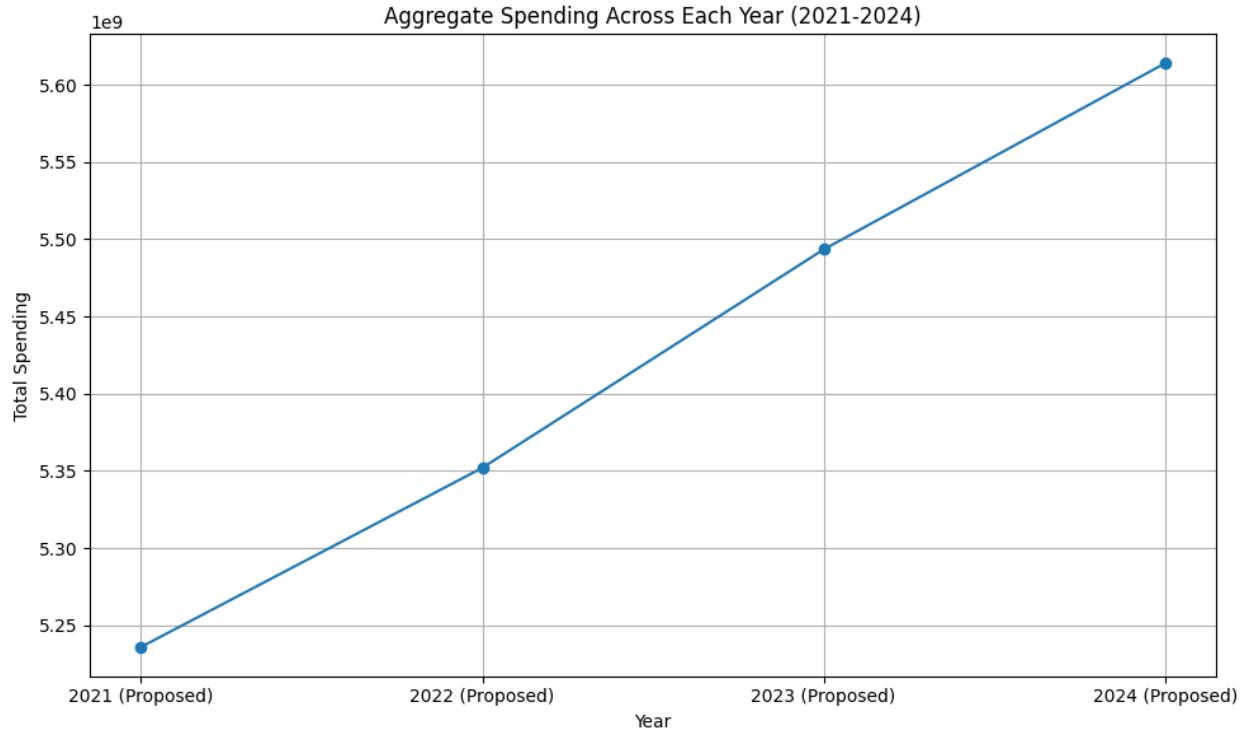
2022 Boston vs Philadelphia comparison of Departments. Police and Fire are two of the biggest expenses across both cities. Biggest difference is spending in Philadelphia on Finance compared to Boston's spending on 'Boston Public Schools'. This trend applied to all the years analyzed 2021-2024.



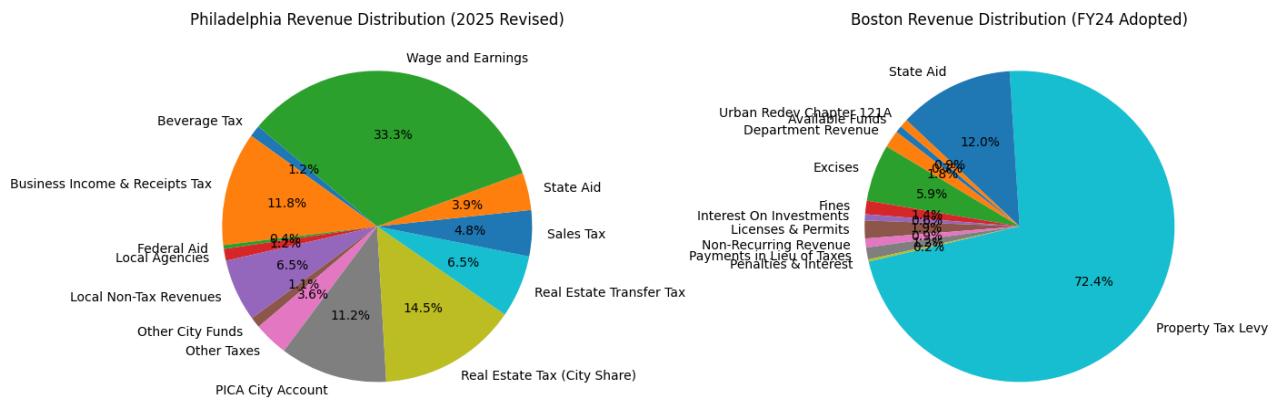
It appears that the trend for each category is for either flat spending or a small increase in spending with 'Finance and Administration' being the largest increase across each year.



Boston total spending is increasing every year with the biggest increases in 22' and 24'.



Compared to Boston Spending, Philadelphia's spending is more linear with similar changes each year. Something to keep in mind is that the data we have access to in Philadelphia is proposed spending and not actual spending.



The visualizations offer a clear comparison of the revenue distributions for Philadelphia and Boston.

Philadelphia: The largest revenue source is the Wage and Earnings Tax, which makes up a significant portion of the revenue at 33.3%. Business Income & Receipts Tax and Real Estate Tax are also significant contributors.

Boston: The Property Tax Levy is the dominant source of revenue at 72.4%, which is quite substantial compared to Philadelphia's distribution. State Aid and Excises form the next significant sources, but they are much smaller in proportion than the Property Tax Levy.

From this comparison, we can draw these conclusions:

- Diversification of Revenue: Philadelphia has a more diversified revenue portfolio compared to Boston, which relies heavily on property taxes. Boston may benefit from exploring alternative revenue sources to reduce over-reliance on property taxes and mitigate risks associated with property value fluctuations.
- Taxation Focus: The heavy reliance on Wage and Earnings Tax in Philadelphia suggests a focus on income-based revenue. In contrast, Boston's reliance on property taxes may indicate a different approach to taxation that could be influenced by property values and the real estate market's stability.

Spending Budget Analysis of the two cities

To draw further comparisons between Philadelphia and Boston, I used their spending budgets. Our goal was to compare how they spent their money in different departments, but the two datasets had different department names. To perform grouping, I mapped each of the departments in the dataset into 7 big categories:

1. Health & Human Services: This category includes departments and programs related to public health, social services, and human welfare.
2. Community & Economic Development: this includes departments that are involved in community development, economic growth, and related initiatives to improve the city's well-being.
3. Culture & Recreation: Departments in this category deal with cultural affairs, recreational activities, and events that enrich the city's cultural life.
4. General Government & Administration: This category contains departments for administrative functions and government operations.
5. Infrastructure and Public Works: Departments under this category handle city infrastructure, public works, and maintenance, including services related to transportation, utilities, and facilities.
6. Public Safety: Departments related to law enforcement, fire services, and emergency management fall under this category, ensuring the safety and security of the city's residents.
7. Education: This category includes departments and programs associated with educational institutions and initiatives, focusing on the city's educational development.

Here is a snippet of the mapping performed. The following two figures contain the mapping for Philadelphia and Boston's departments' respectively.

```
▶ philly_mappings = {
    'City Council': 'General Government & Administration',
    'Labor': 'General Government & Administration',
    'Innovation and Technology': 'Education',
    'Mayor': 'General Government & Administration',
    'Community Empowerment': 'Community & Economic Development',
    'Managing Director': 'General Government & Administration',
    'Police': 'Public Safety',
    'Streets': 'Infrastructure & Public Works',
    'Fire': 'Public Safety',
    'Public Health': 'Health & Human Services',
    'Behavioral Health': 'Health & Human Services',
    'Parks & Rec': 'Culture & Recreation',
    'Atwater Kent': 'Culture & Recreation',
    'Public Property': 'Infrastructure & Public Works',
    'Human Services': 'Health & Human Services',
    'Prisons': 'Public Safety',
    'Homeless Services': 'Health & Human Services',
    'Fleet': 'Infrastructure & Public Works',
    'Lenses & Inspections': 'Infrastructure & Public Works',
    'Board of Review': 'General Government & Administration',
    'Board of Bldg. Stds.': 'General Government & Administration',
    'Records': 'General Government & Administration',
    'Art Museum': 'Culture & Recreation',
    'Finance': 'General Government & Administration',
    'Revenue': 'General Government & Administration',
    'Debt Service': 'General Government & Administration',
    'Procurement': 'General Government & Administration',
    'City Treasurer': 'General Government & Administration',
    'City Rep': 'General Government & Administration',
    'Commerce': 'Community & Economic Development',
    'Law': 'General Government & Administration',
    'Board of Ethics': 'General Government & Administration',
    'Inspector General': 'General Government & Administration',
    'Sustainability': 'General Government & Administration',
    'Mural Arts': 'Culture & Recreation',
    'Free Library': 'Education',
    'Human Relations ': 'General Government & Administration',
    'Civil Service Commission': 'General Government & Administration',
    'Human Resources': 'General Government & Administration',
    'Arts & Culture': 'Culture & Recreation',
    'Property Assessment': 'General Government & Administration',
    'City Controller': 'General Government & Administration',
    'Revision of Taxes': 'General Government & Administration',
    'Chief Admin. Officer': 'General Government & Administration',
```

```

boston_category_mapping = [
    'Boston Centers for Youth and Families': 'Health & Human Services',
    'Boston Planning and Development Agency': 'Community & Economic Development',
    'Boston Public Library': 'Culture & Recreation',
    'Boston Public Schools': 'Education',
    'Department of Innovation and Technology': 'General Government & Administration',
    'Emergency Management': 'Public Safety',
    'Environment Department': 'Infrastructure & Public Works',
    'Fire Department': 'Public Safety',
    "Mayor's Office of Housing": 'Community & Economic Development',
    'Office of Arts & Culture': 'Culture & Recreation',
    'Office of New Urban Mechanics': 'General Government & Administration',
    'Parks and Recreation Department': 'Infrastructure & Public Works',
    'Police Department': 'Public Safety',
    'Property Management Department': 'Infrastructure & Public Works',
    'Public Health Commission': 'Health & Human Services',
    'Public Works Department': 'Infrastructure & Public Works',
    'Transportation Department': 'Infrastructure & Public Works',
    #more mappings for operating budget departments
    "Mayor's Office": 'General Government & Administration',
    'Election Department': 'General Government & Administration',
    'Intergovernmental Relations': 'General Government & Administration',
    'Law Department': 'General Government & Administration',
    'Office of Equity': 'General Government & Administration',
    'Office of Diversity': 'General Government & Administration',
    'Office of Resiliency & Racial Equity': 'General Government & Administration',
    'Office of Language & Communications Access': 'General Government & Administration',
    'Human Right Commission': 'General Government & Administration',
    'Office for Immigrant Advancement': 'General Government & Administration',
    "Women's Advancement": 'General Government & Administration',
    'Black Male Advancement': 'General Government & Administration',
    'Fair Housing & Equity': 'General Government & Administration',
    'LGBTQ+ Advancement': 'General Government & Administration',
    'Commission for Persons with Disabilities': 'General Government & Administration',
    'Office of Police Accountability & Transparency': 'Public Safety',
    'Inspectional Services Department': 'Infrastructure & Public Works',
    'Neighborhood Services': 'Community & Economic Development',
    'Consumer Affairs & Licensing': 'General Government & Administration',
    'Supplier Diversity': 'General Government & Administration',
    'Office of Tourism': 'Culture & Recreation',
    'Labor Compliance and Worker Protection': 'General Government & Administration',
    'Youth Employment and Opportunity': 'Health & Human Services',
    'Office of Historic Preservation': 'Culture & Recreation',
    'Office of Food Justice': 'Health & Human Services',
    'Office of Finance': 'General Government & Administration',
    'Assessing Department': 'General Government & Administration',
]

```

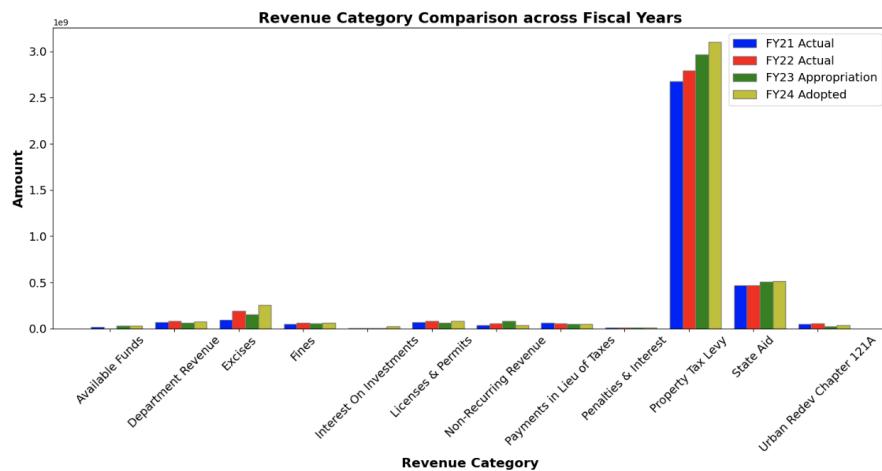
In this budget comparison between Philadelphia and Boston, we can observe the following key points:

- General Government & Administration: Philadelphia's spending in this category is significantly higher than Boston's, indicating that Philadelphia allocates a substantial portion of its budget to administrative functions. This could be due to its larger population and administrative needs.
- Public Safety: Both cities allocate a considerable budget to public safety, with Philadelphia slightly higher than Boston. This suggests a commitment to maintaining safety and security in both cities.
- Infrastructure and Public Works: Boston outspends Philadelphia by a significant margin in this category. This could be attributed to Boston's historical significance and the need to maintain and upgrade its infrastructure, including roads, bridges, and public transportation.

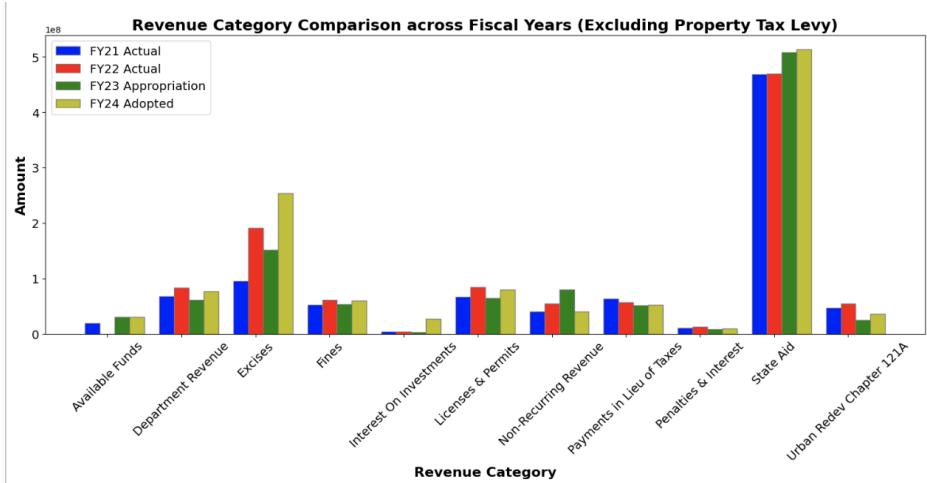
- Health & Human Services: Philadelphia allocates a substantial budget to health and human services, reflecting its commitment to addressing the well-being of its residents. Boston also invests significantly but at a lower level than Philadelphia.
- Education: Boston's education spending is notably higher than Philadelphia's, indicating a strong emphasis on educational initiatives and institutions in the city.
- Culture & Recreation: Both cities invest in culture and recreation, but the budgets in this category are relatively smaller compared to other areas. Philadelphia's spending slightly surpasses Boston's.
- Community & Economic Development: Philadelphia and Boston allocate budgetary resources to community and economic development. While the figures are relatively modest, they reflect efforts to support local communities and stimulate economic growth.

Overall, the budget analysis shows that each city prioritizes different aspects of governance and services based on its unique needs and circumstances. Philadelphia tends to focus more on administration and public health, while Boston places a significant emphasis on education and infrastructure development.

Revenue distribution by Expense Category

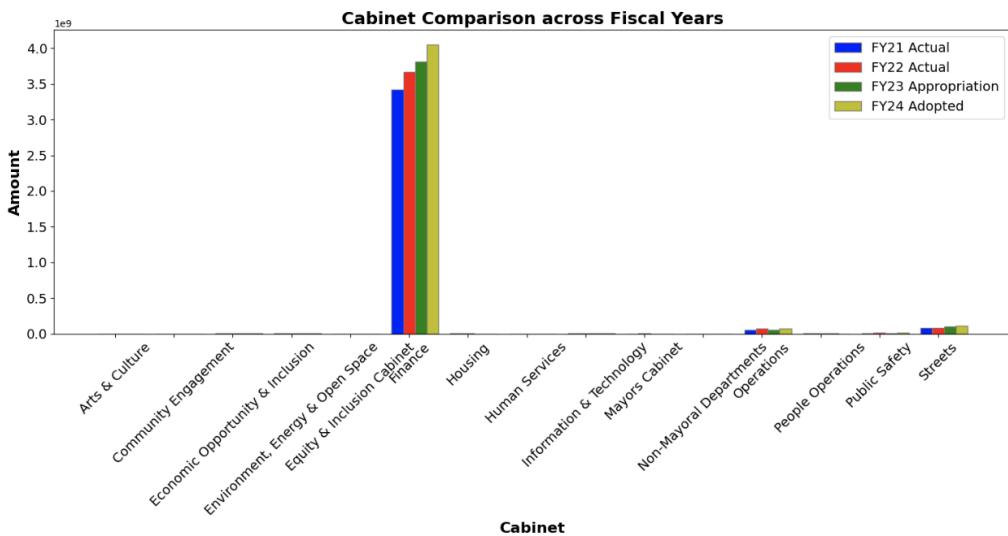


The "Property Tax Levy" stands out significantly, indicating its dominant role in revenue generation. Therefore, we exclude this category and graph again to see changes in other categories more clearly.

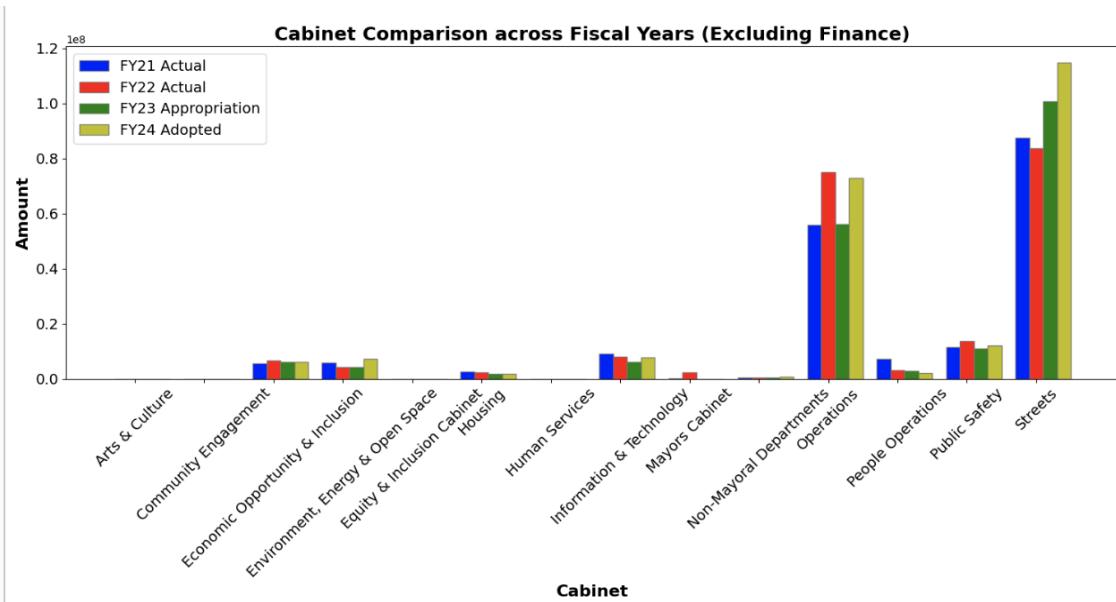


The majority of other revenue categories exhibit consistent trends across the years with slight fluctuations. Some categories, such as "Interest on Investment" and "Penalties & Interest," have minimal values throughout.

Revenue distribution by Cabinet

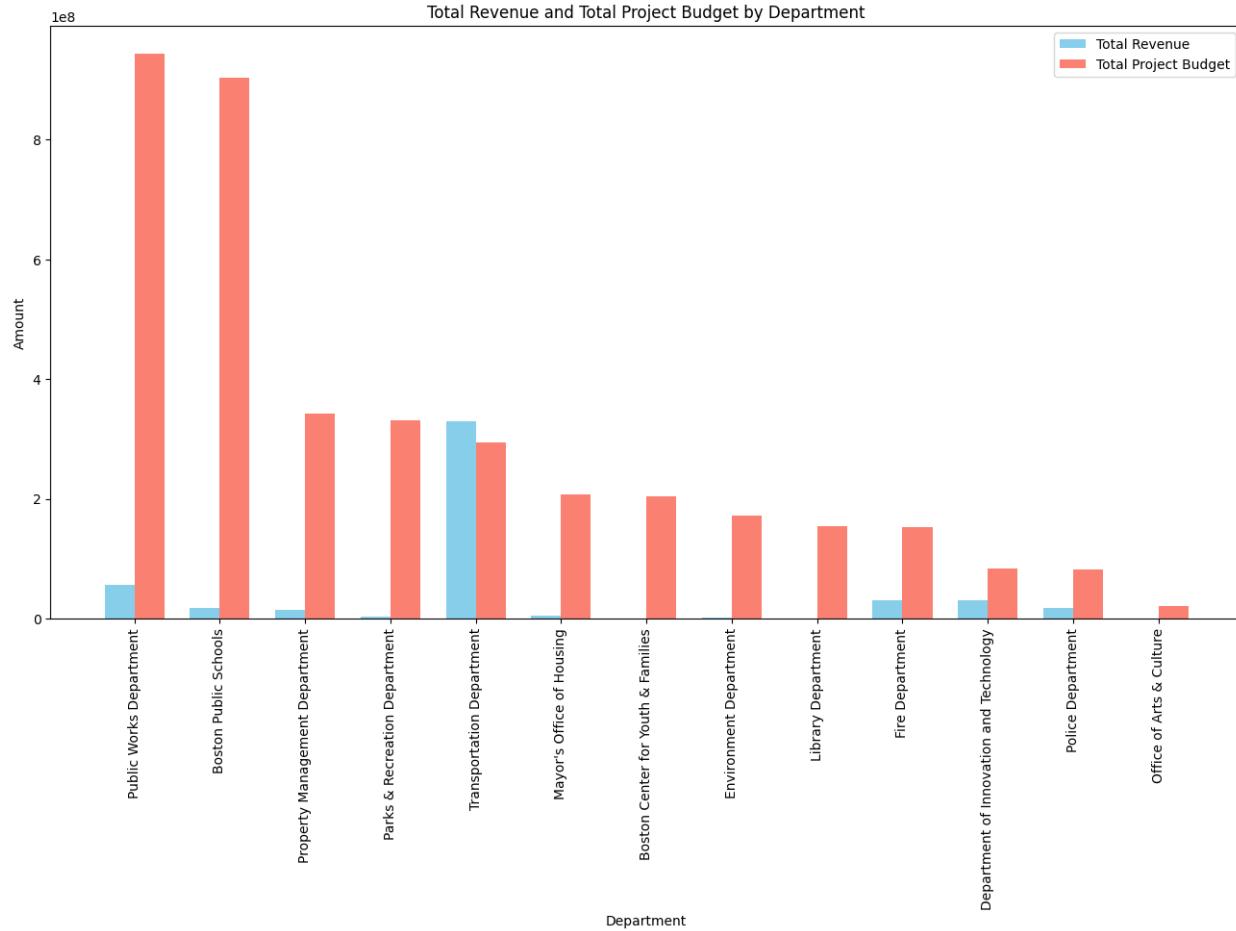


The "Finance" cabinet significantly dominates in terms of revenue across all years, overshadowing other cabinets. This is consistent with the prior graph where 'Property Tax Levy' dominates the revenue in terms of Revenue Category because the Finance Cabinet is responsible for collecting property tax.

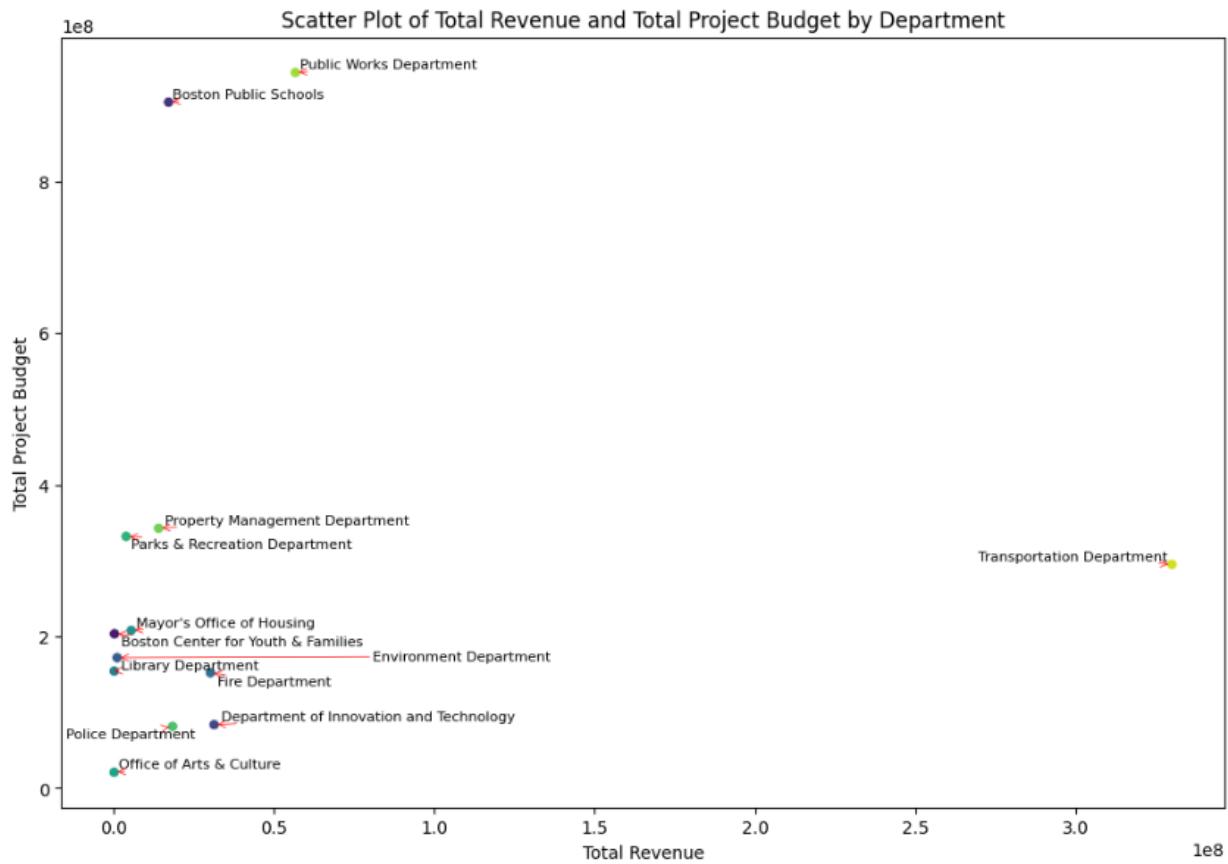


While cabinets like 'Arts & Culture', 'Environment, Energy & Open Space', and 'Human Services' have no contribution to revenues, the majority of cabinets see consistent funding patterns across the years.

Revenue vs. Capital Budget

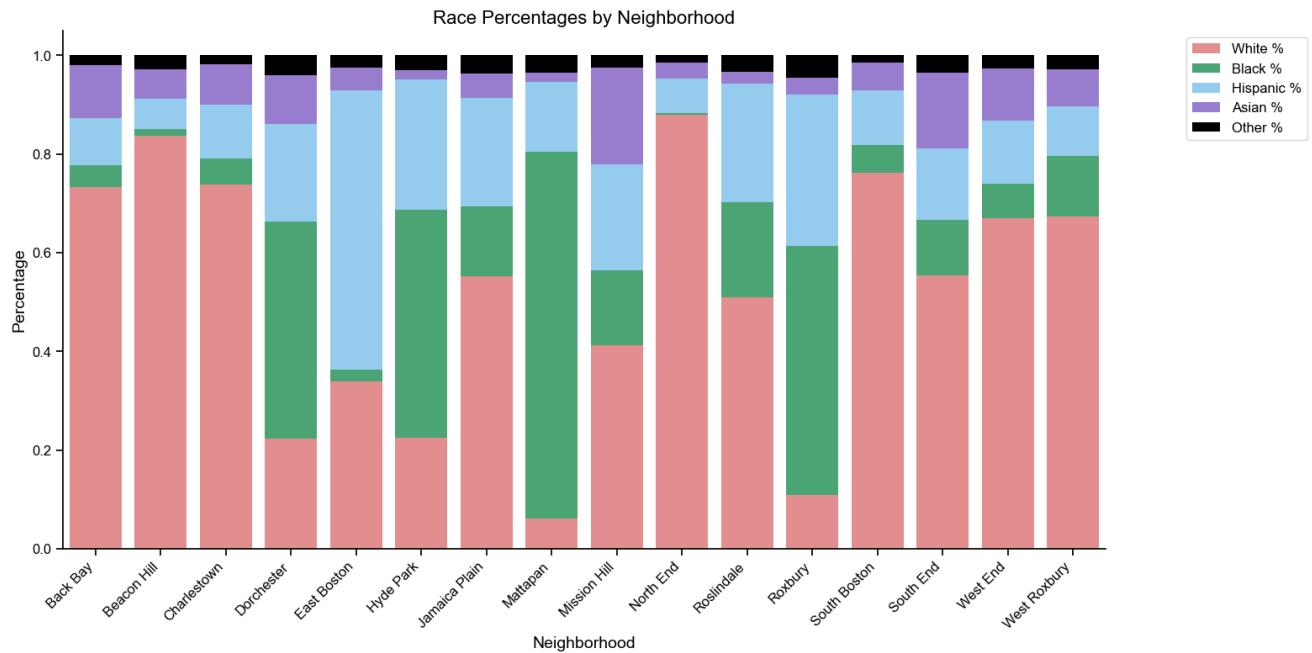


Among the departments shared in the Capital and Revenue datasets, we can see that there isn't much of a trend when it comes to total project budget and revenue generated. While the graphs may not show a trend, it should be noted that the majority of departments that generated revenue didn't have a corresponding department in the Capital Budget dataset.



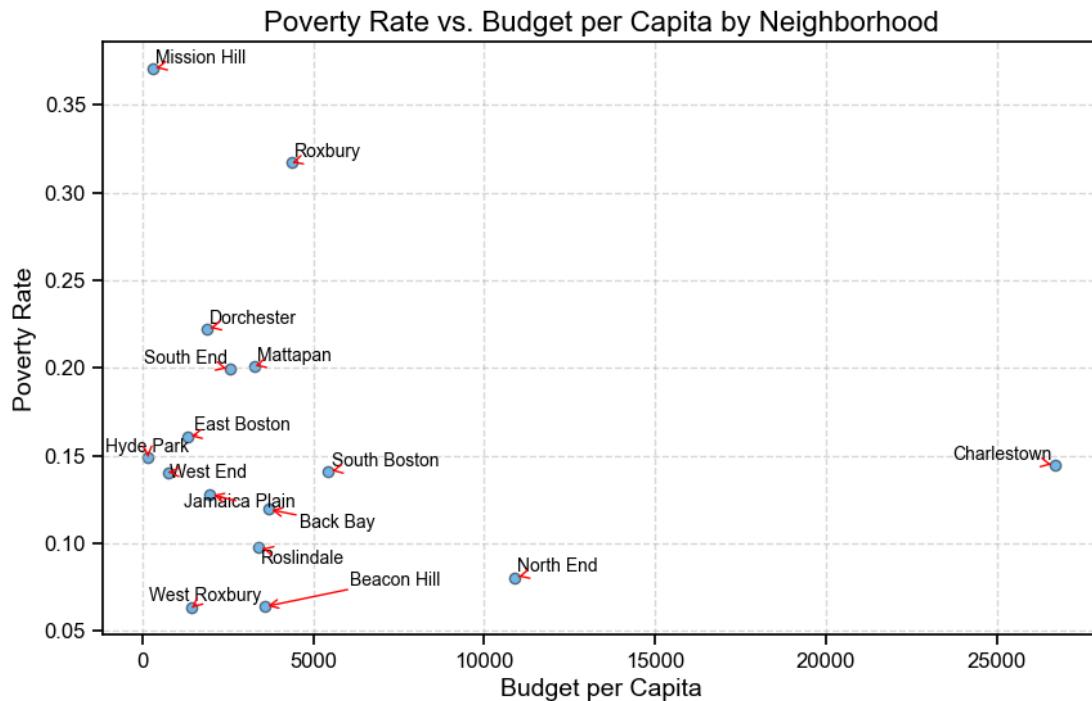
This scatterplot also explores the relationship between Total Revenue and Total Project Budget by department. Here we can see that the Transportation Department is an outlier, with it generating a substantial amount of revenue compared to the other departments, but not receiving a lot of budget.

Socio-economic Analysis

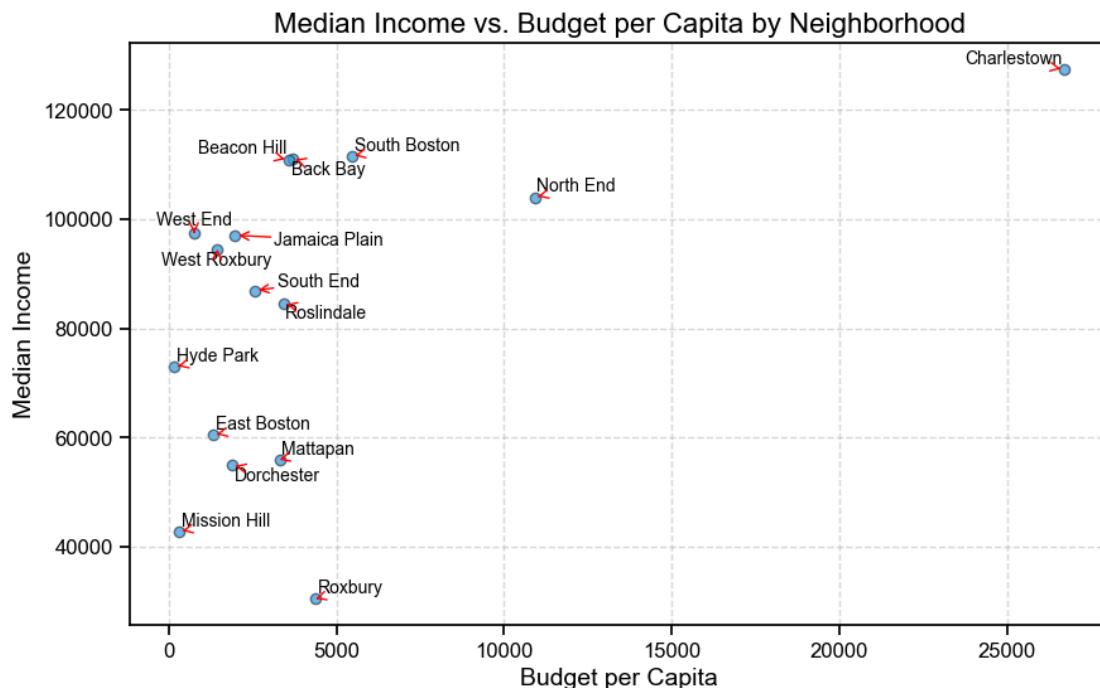


The stacked bar chart illustrates that the majority of neighborhoods are predominantly white. However, Dorchester, Hyde Park, Mattapan, and Roxbury are predominantly Black/African American, while East Boston is majority Hispanic. Mission Hill stands out with a more even distribution of races, possibly due to its proximity to nearby universities.

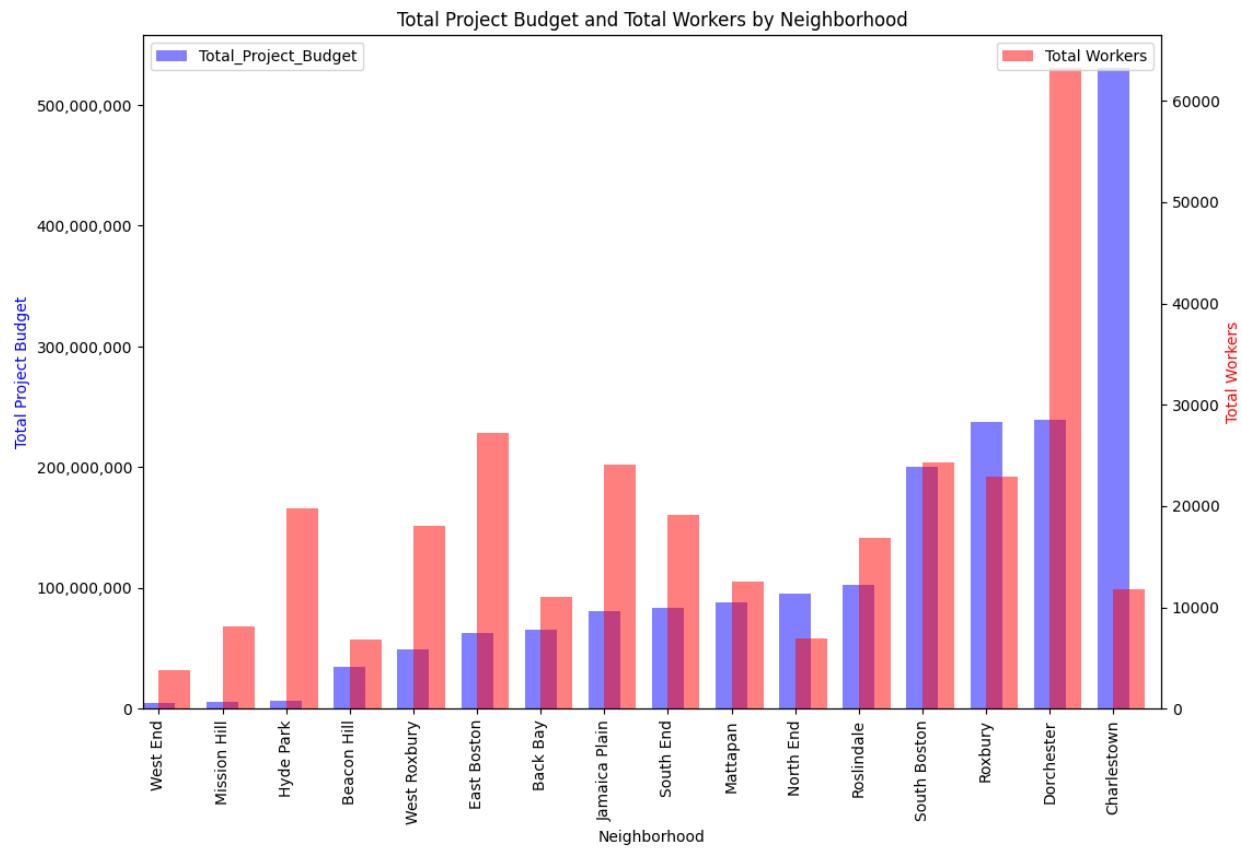
The average for majority white neighborhoods is 5174.46, and the average for majority non-white is 2434.12. Removing Charlestown gives 3216.91 and 2434.12 respectively. Excluding Charlestown, predominantly white neighborhoods exhibit an almost \$1000 higher budget per person compared to majority non-white neighborhoods. This aligns with subsequent graphs indicating that these non predominantly white neighborhoods also have a higher poverty rate than other areas.



The graph suggests a slight trend of higher budget per capita for neighborhoods with lower poverty rates.



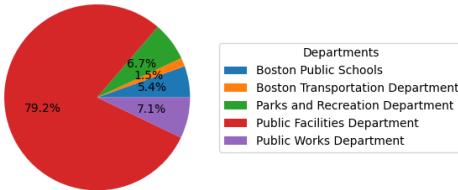
Similar to the last graph, this one suggests a very slight trend of higher budget per capita for neighborhoods with higher median income.



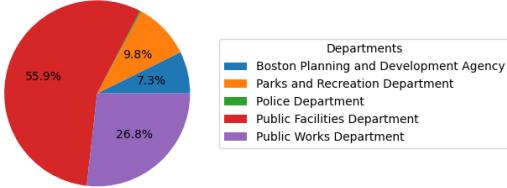
Some neighborhoods such as Charlestown, North End, and Roxbury have high total project budgets per worker, indicating a substantial investment in each worker. On the other hand, Mission Hill and Hyde Park, have a low total project budget per worker. The graphs below have the distribution by department of the total project budget by neighborhood of the ones with the most, median, and least number of workers. The most prominent department in all of these is the Public Facilities Department followed by the Public Works Department.

Distribution of budget on the neighborhoods with the most, median, and least number of workers

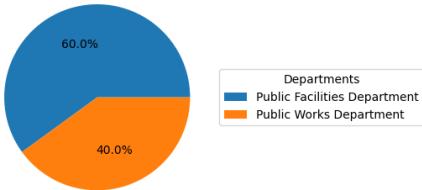
Dorchester



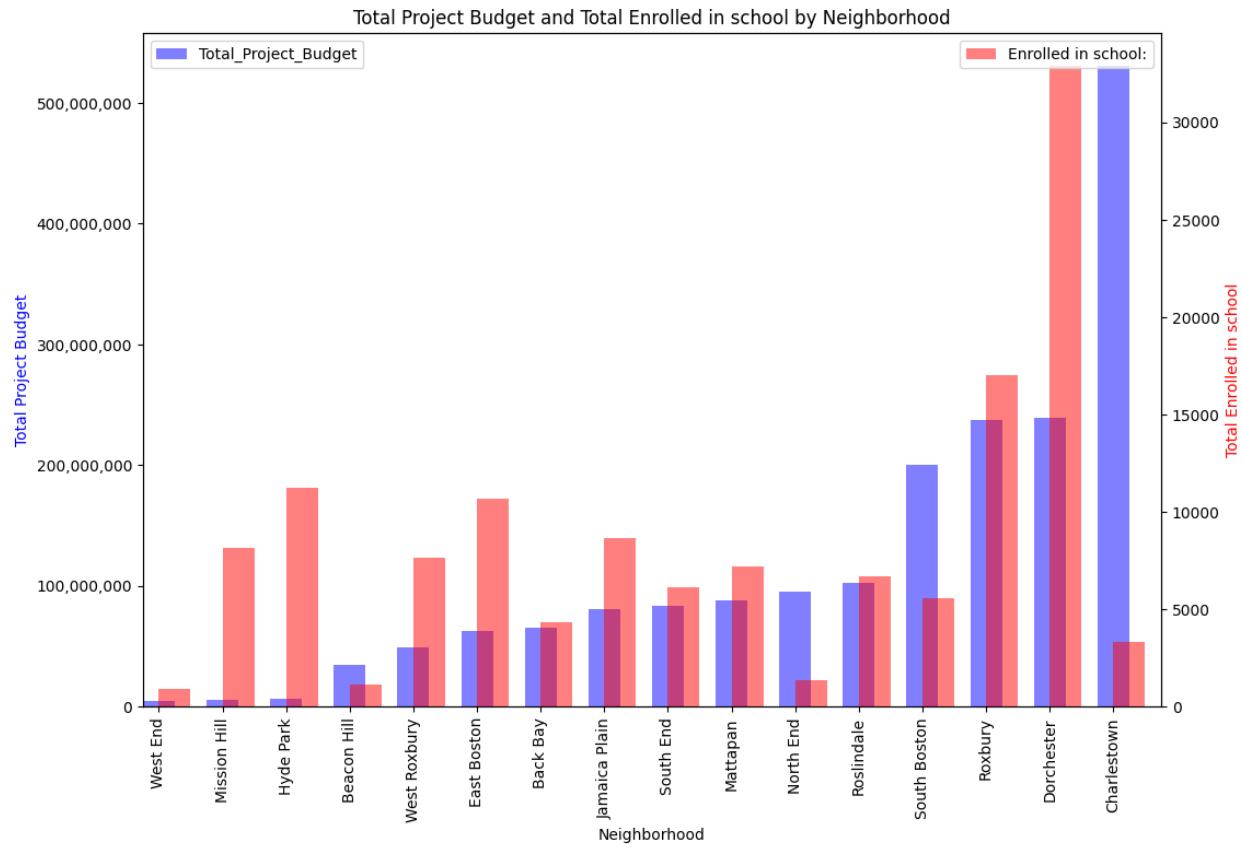
South End



West End

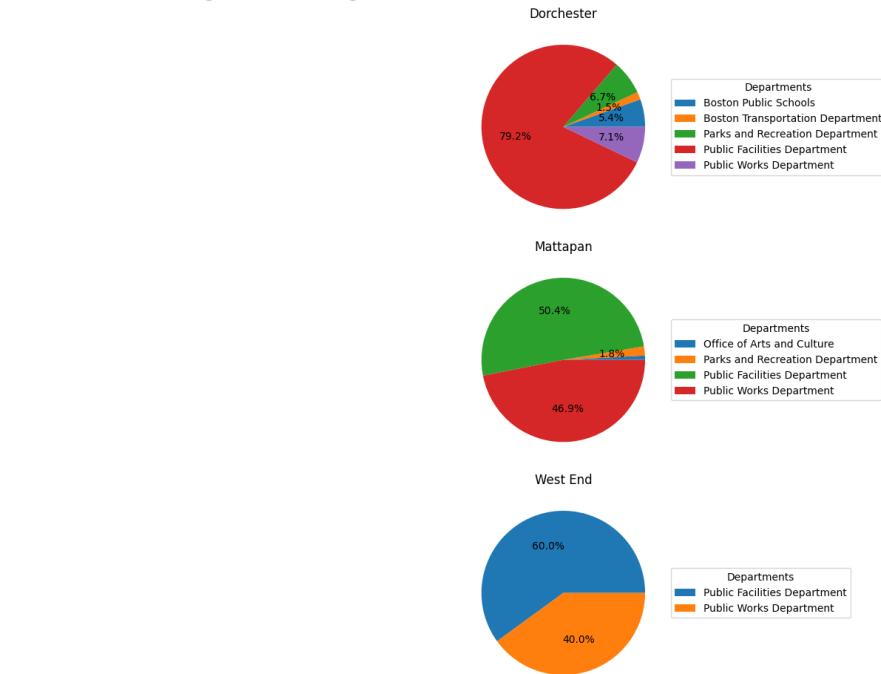


There are similar trends in the budget in relation to school enrollment numbers per neighborhood.

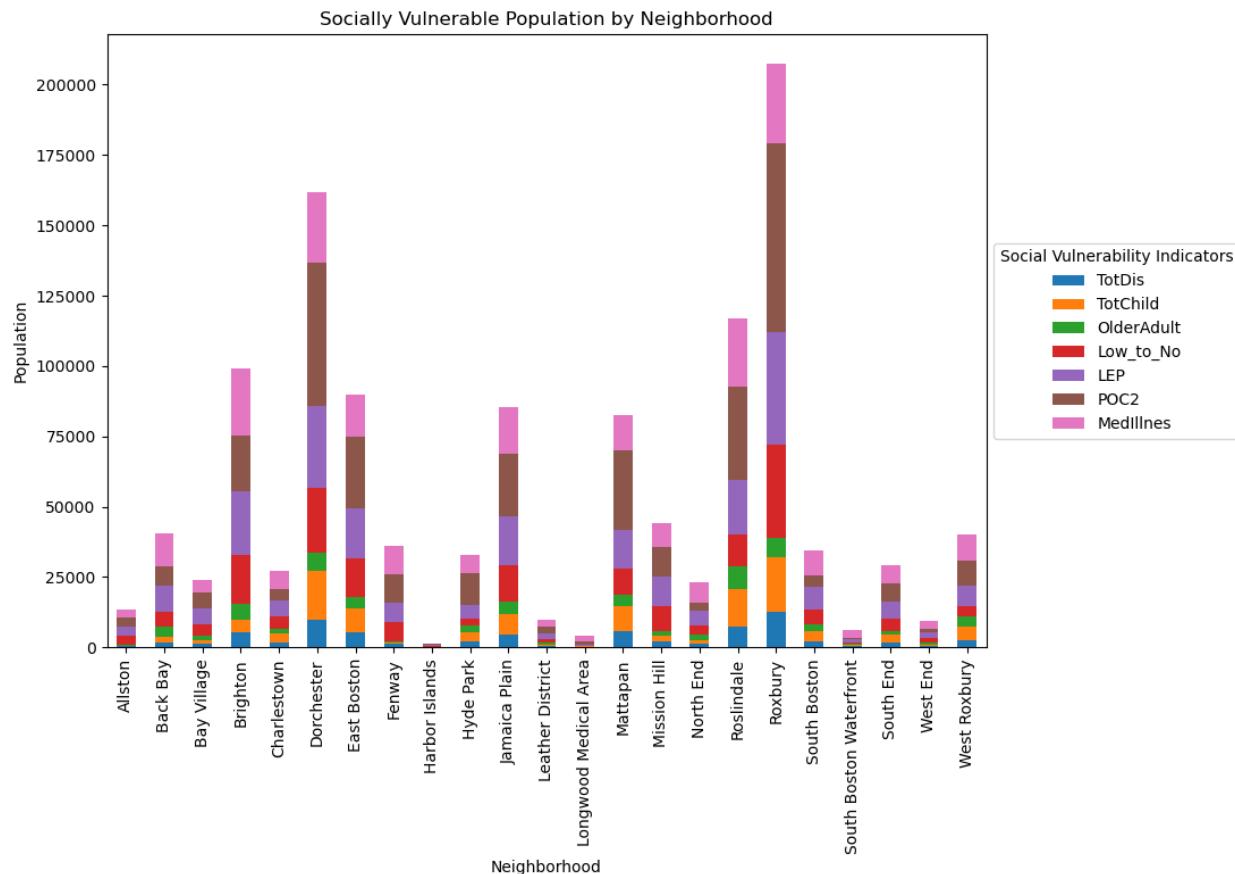


North End, South Boston, and Charlestown have a high rate of total project budget per number of people enrolled in any type of schooling in the dataset. On the other hand, Hyde Park, Mission Hill and West End, have a low total budget per number of people enrolled in school. The next graphs include the distribution of budget by department of the neighborhoods with the most, median, and least number of people enrolled in school.

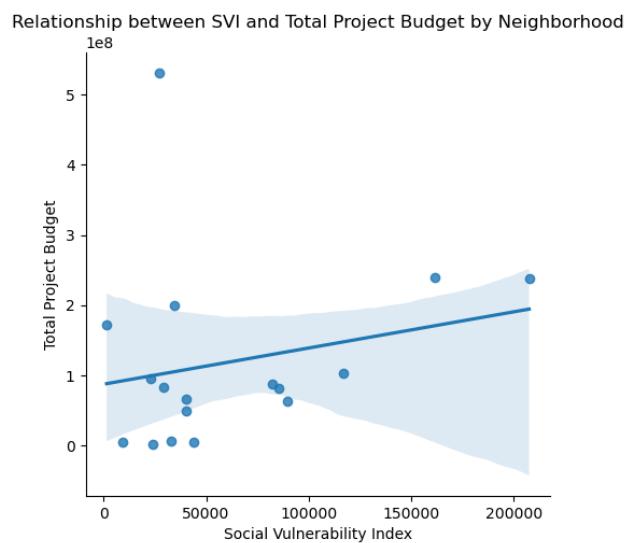
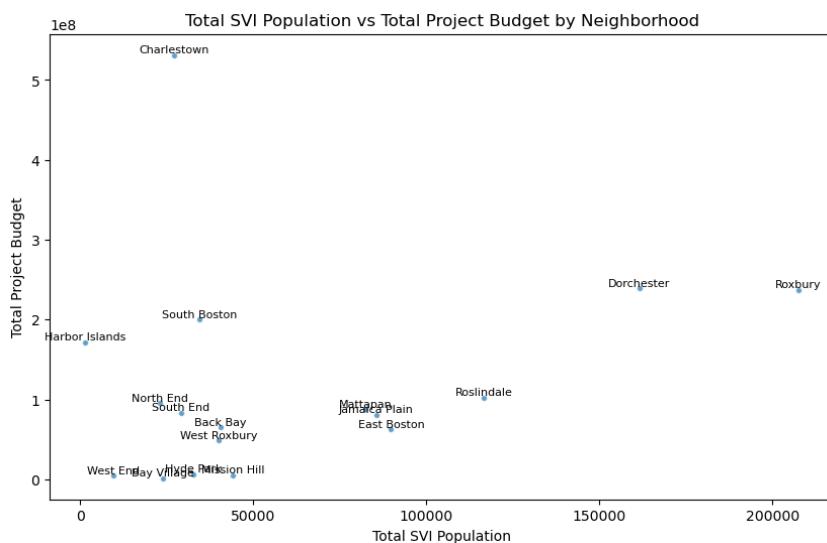
Distribution of budget on the neighborhoods with the most, median, and least number of enrolled in school



The following is a graph of the distribution of socially vulnerable populations per neighborhood. It includes the total population on each neighborhood with disabilities, children, older adults, people with low English proficiency (LEP), people of color, and people with medical illness.



Lastly, there is the relationship between the total socially vulnerable population and the total project budget per neighborhood. There is a seemingly linear relationship between them, except for a few outliers such as Charlestown. This means that the city is investing more in neighborhoods where there is a higher number of socially vulnerable people.



Challenges and Limitations

- The datasets exhibited inconsistencies, with variations between the 'Department' and 'PM_Department' fields. Assistance from clients is required to gain a clearer understanding of these disparities.
- Categories used in budget reporting did not align perfectly between the two cities, making it necessary to manually map and group similar categories, which introduced subjectivity.
- Variances in population size and demographics between cities (Boston and Philadelphia) might have influenced budget priorities and spending.
- Boston's spending data consists of both operating and capital spending, making it hard to directly compare with Philadelphia's spending data sets.
- The two cities use different names for their department and cabinets, making it difficult for comparison.
- Departments in Revenue and Capital Budget datasets didn't line up completely. A lot of the departments listed in the Revenue dataset didn't have a corresponding department in the Capital Budget dataset.
- The neighborhoods of boston were divided in different ways across some of the datasets.

Conclusion

Our comprehensive analysis of the City of Boston's budget, enriched by the extension projects and comparative study with Philadelphia, has provided valuable insights into municipal financial management during challenging times. The datasets from both cities allowed us to delve deeply into how budget allocations and revenue generation strategies adapt in response to economic fluctuations. Our investigation into the impact of revenue on budget allocations revealed a complex relationship between departmental revenue generation and budget adjustments. This understanding is crucial for future fiscal planning, ensuring that investment in city departments is both effective and efficient. The demographic analysis of the budget highlighted the importance of equitable resource distribution, ensuring that all communities within Boston are adequately served. This aspect of our study is particularly significant in promoting fair and inclusive governance.

Comparing Boston's financial strategies with those of Philadelphia has been instrumental in uncovering best practices and potential improvement areas. This comparative approach provided a broader perspective on urban financial management, offering insights that could be beneficial for both cities in refining their budgeting processes.

The lessons learned from this analysis can guide future budgeting decisions, promoting the efficient use of public funds and the well-being of city residents. The insights gleaned from this project should be seen as a stepping stone towards more informed, responsive, and responsible urban fiscal policies.

Individual Contributions

Naima Abrar

1. Compiled this report
2. Cleaned Boston's Capital Budget dataset
3. Made visualizations to illustrate the current stages of each project within the project pipeline.
4. Created charts for budget allocation per department
5. Created bubble charts for total budget and projects per neighborhood
6. Visualized how funds are allocated to various sectors such as infrastructure, technology, education, etc in Boston
7. Visualized the top 10 programs in terms of budget allocation
8. Made pie charts for revenue distribution for both Philadelphia and Boston
9. Compared revenue data for the two cities
10. Created bar charts for budget comparisons between Boston and Philadelphia
11. Analyzed yearly budget trend for Boston and Philadelphia
12. Used "Philadelphia Spending", "Boston's Capital Budget", "Boston's Operating budget" and "Boston's Revenue" to draw comparisons between the two cities and also analyzed why those differences might exist
13. Manually went through the departments in Boston and Philly's dataset and grouped them into 7 broader categories
14. Made bar charts to analyze spending by each category for both the cities

Maria S. Mercado Arevalo

1. Performed data cleaning for Revenue dataset.
2. Preprocessed geographical Boston data to plot Total Budget by Neighborhood map.
3. Created bar charts for Total Budget Per Neighborhood Population and per Square Mile.
4. Created pie charts for Total Budget Distribution by neighborhood for all years, and for each individual year of the Capital Plan. Additionally, a line chart to capture these distribution trends.
5. Analyzed Total Budget distribution by department for all neighborhoods (stacked bar chart and pie charts in appendix for more detail).
6. Socioeconomic analysis of the distribution of the Capital Plan based on working population and population enrolled in school (grouped bar plots for each, pie charts for more in depth distribution of the budget for the neighborhoods with the most, median, and least amount of these populations).
7. Analyzed the relationship between socially vulnerable populations and the total project budget by neighborhood.
8. Merged team branches and organized GitHub repo folder to have all of our work and its history submitted.

Alex Baptista

1. Created bar charts for Capital Budget distribution : by department, by neighborhood

2. Cleaned and Preprocessed Multiple Pages of the Socio Economic Excel Dataset.
3. Combined socio-economic data with capital budget data.
4. Explored Socio-Economic Data and created charts Budget per capita vs Median Income and Poverty Rates, Racial distribution per neighborhood
5. Analyzed spending in top and bottom 3 neighborhoods based on income, minority percentage, and poverty rate by creating pie charts.
6. Generated word clouds for top-funded departmental projects for each neighborhood.
7. Combined revenue and capital budget datasets for easier analysis
8. Created scatter plots and histograms to visualize trends between revenue generated by department and total project budget per department
9. Contributed to the final report as well as other reports/deliverables.

Gauravdeep Singh Bindra

1. Conducted Exploratory Data Analysis (EDA) on Boston's operating and capital budget datasets and cleaned the data.
2. Developed charts to analyze Boston City's per-capita budget and financial condition and how this has trended over the years.
3. Performed comparison of the above results with those of Philadelphia.
4. Created presentations for all deliverables.
5. Prepared the proposal for the 3 extension projects we went ahead with.
6. Established project goals, allocated work among team members, held regular meetings, and provided assistance to team members as needed. Also conducted follow-ups to ensure all our deliverable commitments were met.
7. Prepared the poster for the Spark! Demo Day.

Jason Kwan

1. Converted Philly data into CSV files from PDFs
2. Cleaned Philly Spending dataset
3. Created pie charts for cabinet budget for Boston and Philly
4. Created tree graphs by expense category for Boston and Philly
5. Created tree graphs by department for Boston and Philly
6. Created line graph for total spending by year for Boston and Philly
7. Created bar chart for cabinet spending across 21'-24' for Boston and Philly
8. Cleaned up code to make it reusable in other datasets
9. Provided analysis for relevant graphs
10. Contributed to final report as well as other reports/ deliverables

Haokun Wu

1. Conducted EDA on Revenue data sets
2. Created graphs for visualizations on the Boston and Philadelphia revenue budget data sets by revenue category, department, and cabinet; provided analysis for the graphs; wrote analysis for the graphs
3. Consolidated the code that are used for data cleaning and data visualization of budget, operating, and revenue data sets; turned all code into functions for easier reuse

4. Attempted to merge Boston spending data sets and Philadelphia spending data sets for comparison in the extension project
5. Created graphs and wrote analysis for the extension project: Impact of Revenue Analysis
6. Participated in the poster show on Spark! Demo day and presented our findings to the audience

Appendix

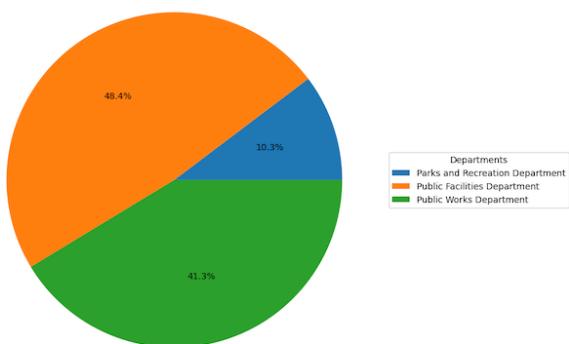
DATA SOURCE FOR PHILADELPHIA BUDGET DISTRIBUTION

[Deliverable 2 Slides](#)

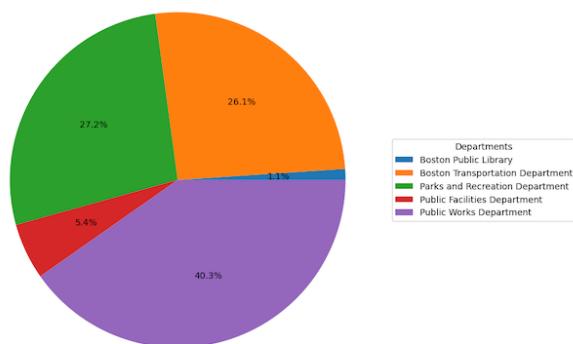
[Deliverable 3 Slides](#)

In Depth Distribution of Budget by Department for all Neighborhoods (in the following pages)

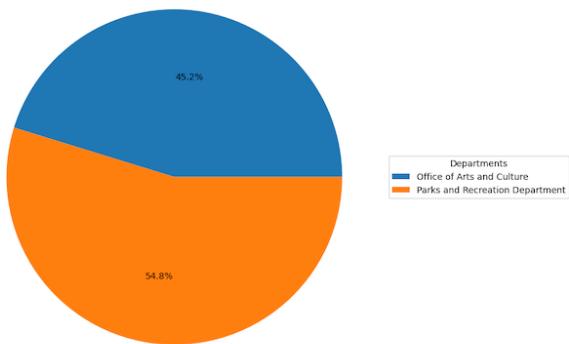
Allston/Brighton



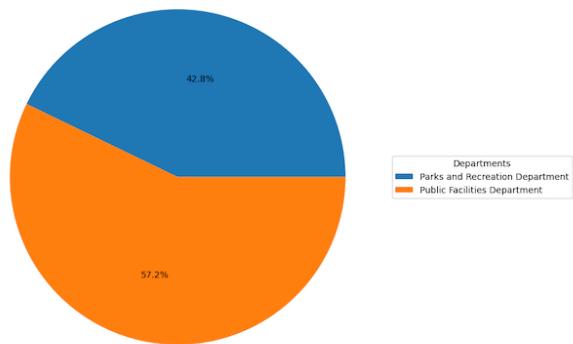
Back Bay



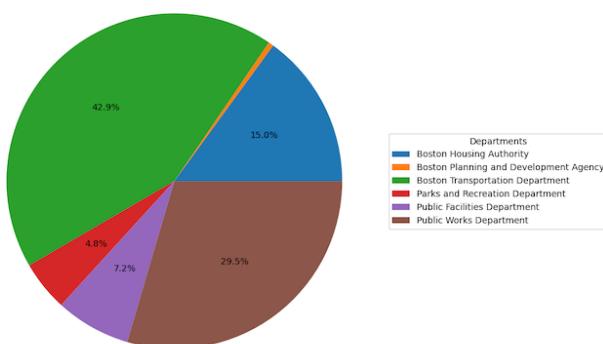
Bay Village



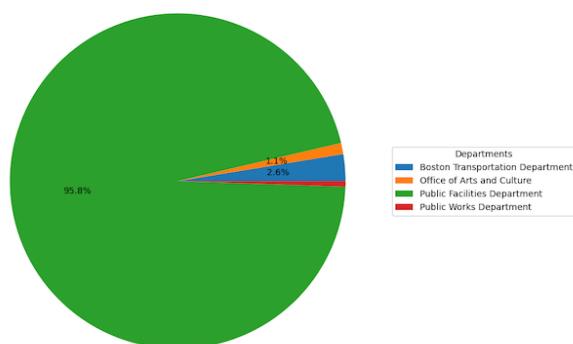
Beacon Hill



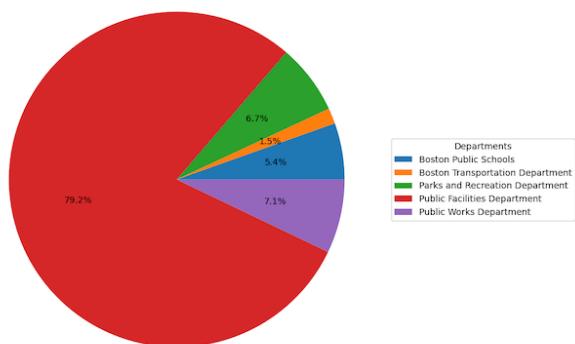
Charlestown



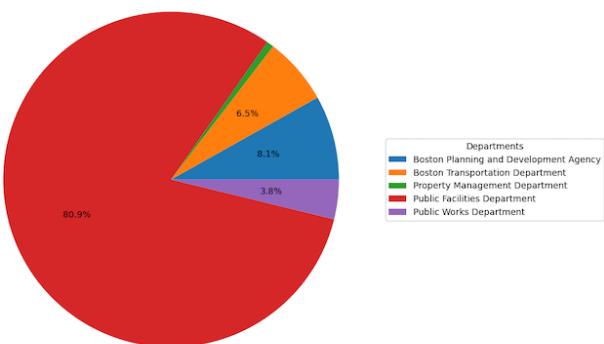
Chinatown



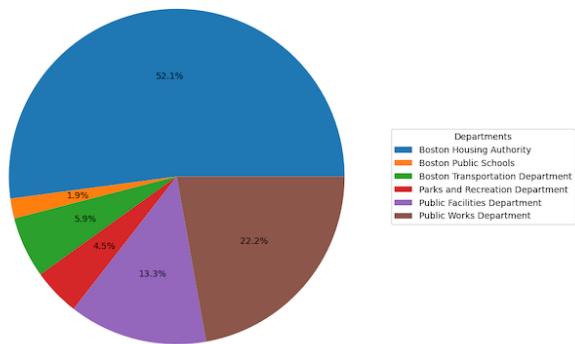
Dorchester



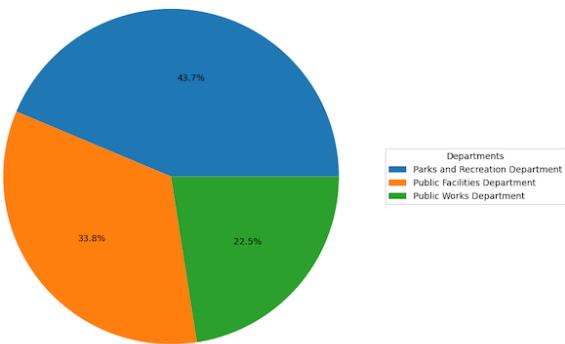
Downtown/Government Center



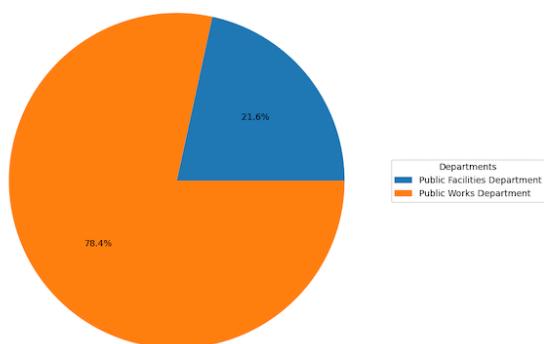
East Boston



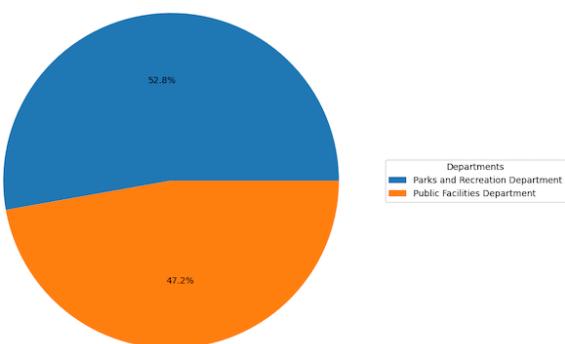
Fenway-Kenmore



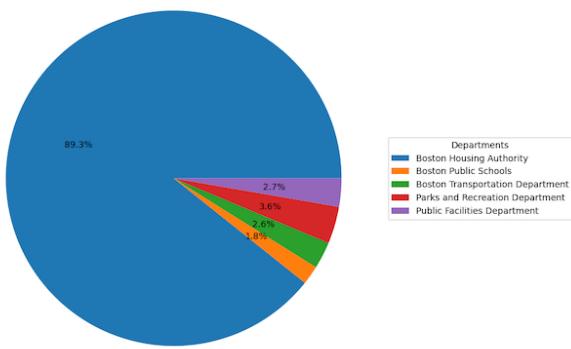
Harbor Islands



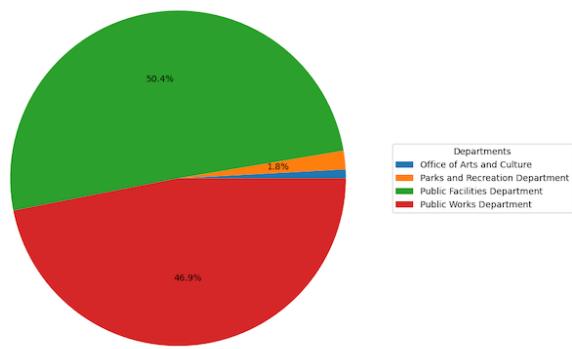
Hyde Park



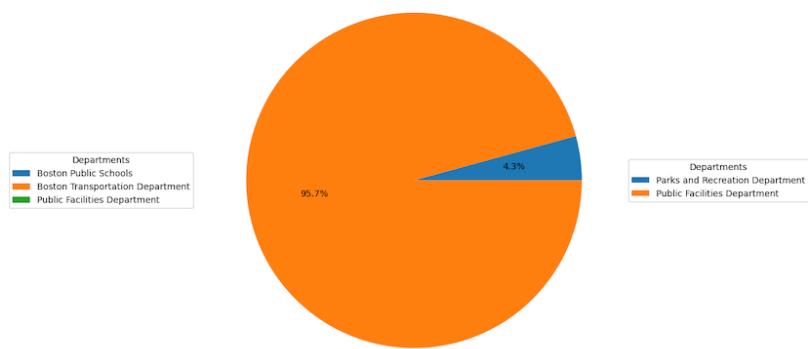
Jamaica Plain



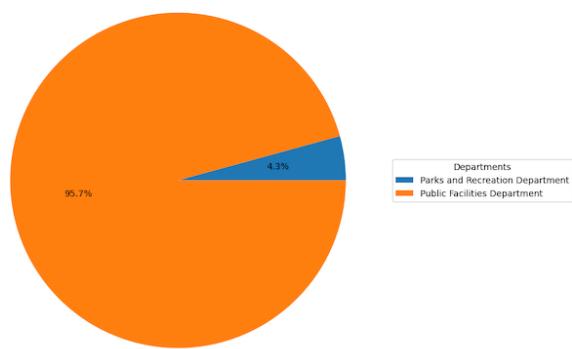
Mattapan



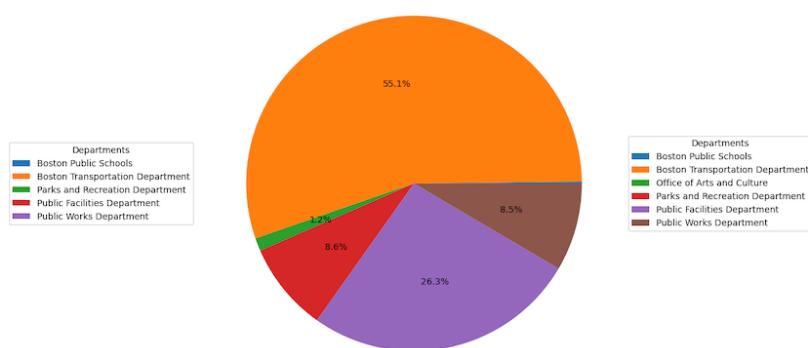
Mission Hill



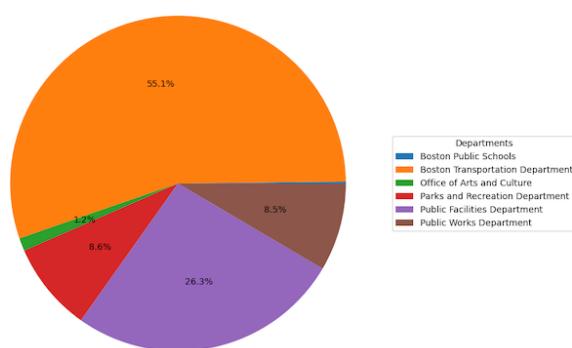
North End



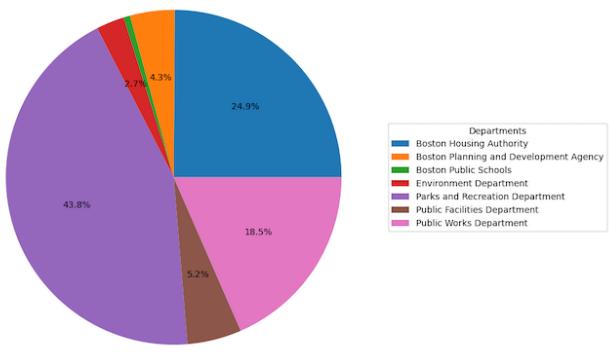
Roslindale



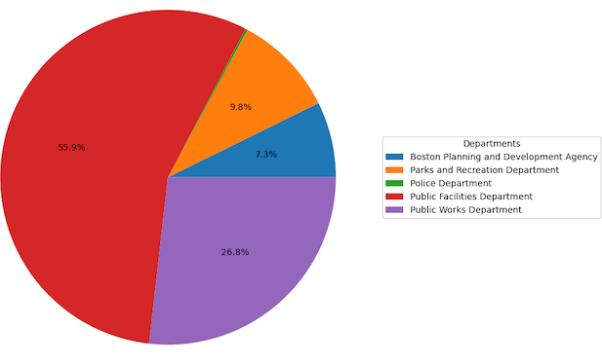
Roxbury



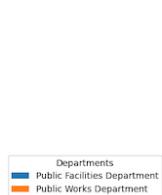
South Boston



South End



West End



West Roxbury

