

Building San Francisco: Analyzing & Forecasting Coming Permit Growth

By: Shu Teng, Max Valladolid, Schadrack Karekezi & Jessica Gallardo

San Francisco, known for its iconic landmarks, diverse culture, and technological innovation, is a vibrant city on the northern California coast. With a rich history shaped by the Gold Rush, waves of immigration, and the rise of Silicon Valley, it remains a hub for finance, technology, and tourism. The city's unique geography, steep hills, and the scenic San Francisco Bay contribute to its distinct character. However, pressing factors such as high living costs, complex infrastructure, environmental conservation efforts, historic preservation regulations, strict zoning laws, and a demanding permit approval process shape the city's ongoing growth.

Our driving question is, "How can building permit trends help us forecast urban growth in San Francisco overall?" To investigate this, we analyzed a dataset of approximately 200,000 building permits in San Francisco, focusing on data from 2013 to 2017. San Francisco is the second most densely populated city nationwide that also sits on a major fault line, requiring adherence to stringent seismic retrofit standards, all of which influence the building permit process.

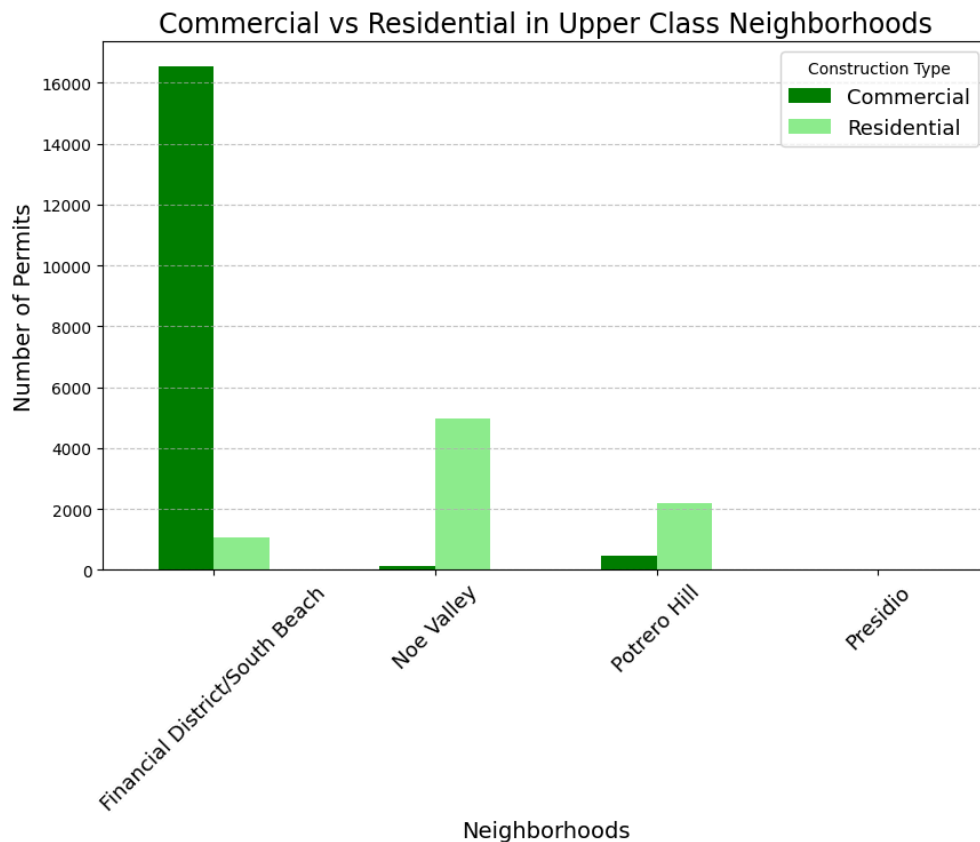
Context

A building permit is a government approval to begin construction or renovation, overseen by the San Francisco Department of Building Inspection (DBI). Permits are categorized into minor projects requiring an over-the-counter review, such as reroofing or home renovation, or complex projects requiring an in-house review, such as construction of an apartment complex or building demolition. Construction projects that require a permit include wood framing, structural work, demolitions, and signage installation, as well as reparations like home remodeling and interior store installations. Small projects, such as bathroom renovations, reroofing, and window replacement, also require approval. As the number of permits steadily increase over time, city planners and urban developers can use this data to predict future urban growth, identifying trends that inform strategic development and address the city's ongoing needs. However for the sake of simplicity, our project specifically addresses building construction permits.

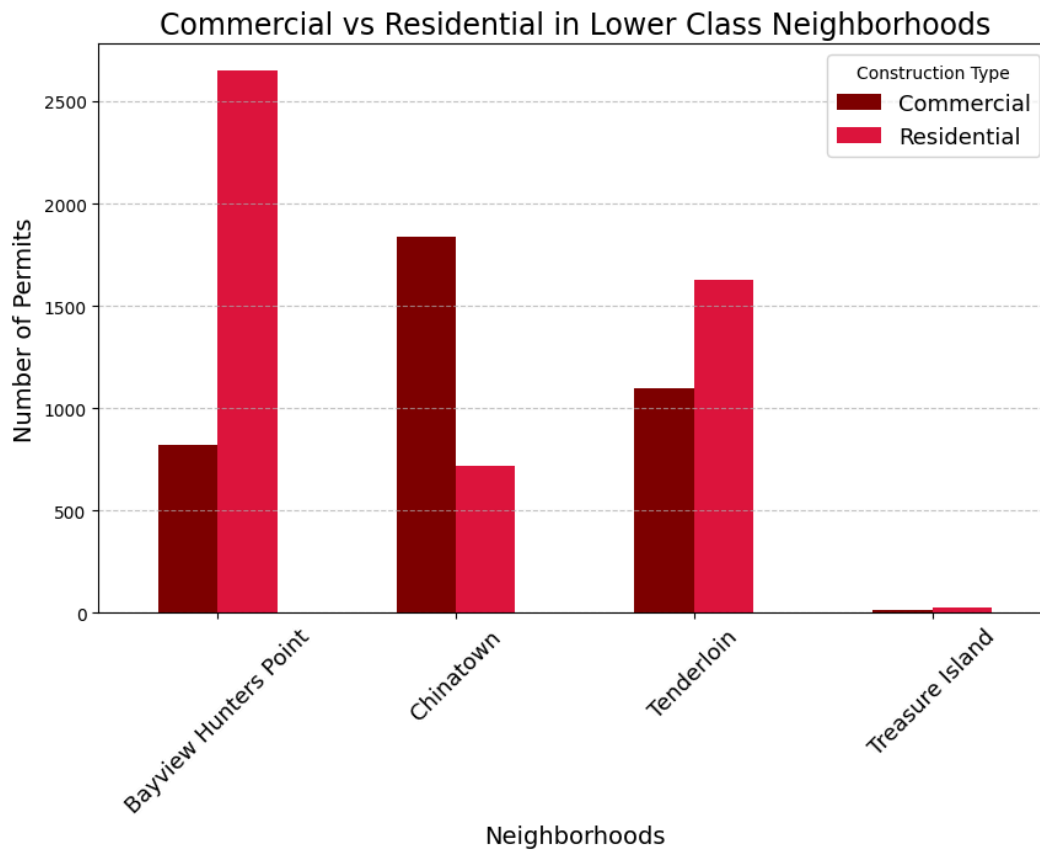
Analyzing Building Permits by Socioeconomic Class

For our project, we focused on comparing the economic disparity between San Francisco's wealthiest and poorest neighborhoods. We selected the top 4 wealthiest neighborhoods—Presidio, Financial District/South Beach, Potrero Hill, and Noe Valley— and the bottom 4 poorest neighborhoods—Chinatown, Tenderloin, Treasure Island, and Bayview Hunters Point. To better understand the economic contrast, the upper class makes up 7.5% percent of the

San Francisco population and has the highest percentages of households with income above \$200k, with 57.3% in Presidio, 49.7% in Potrero Hill, 49.5% in Financial District/South Beach, and 48.4% in Noe Valley. Meanwhile, the lower class comprises 11% of the city's population, with 1 in 5 households living below the national poverty line: Chinatown (32.9%), Tenderloin (26.5%), Treasure Island (22.9%), and Bayview Hunters Point (18.8%) (The San Francisco Standard, 2022). **Despite having a smaller population, the upper class requests 3 times more permits than the lower class.**



In upper-class neighborhoods, the distribution of residential and commercial building permits varies based on each area's development focus. **Financial District/South Beach**, also known as the "Wall Street of the West," **has the highest number of commercial building permits overall**, given its role as a business hub. However it has fewer residential permits, likely due to the prevalence of apartment complexes rather than single-family housing developments. In contrast, **Noe Valley and Potrero Hill have a significantly higher number of residential building permits**, reflecting their character as **primarily residential neighborhoods** with a focus on single-family homes and small multi-unit housing developments. Meanwhile, **Presidio has almost no building permits**, likely **due to** its status as a **protected natural and historic area**, restricting large-scale construction.

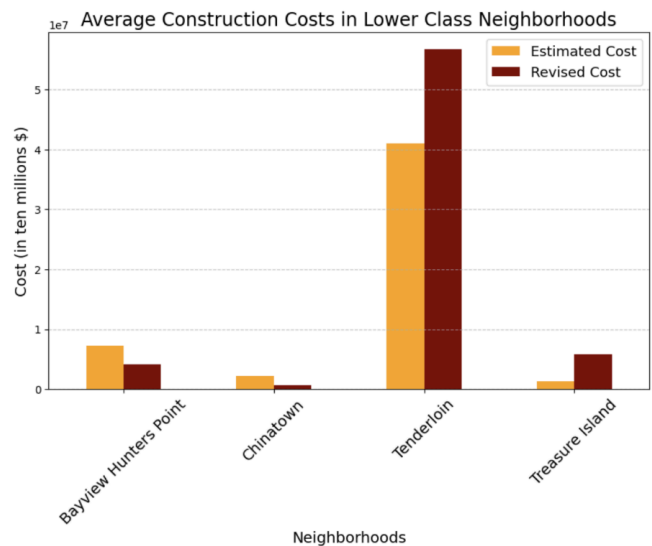
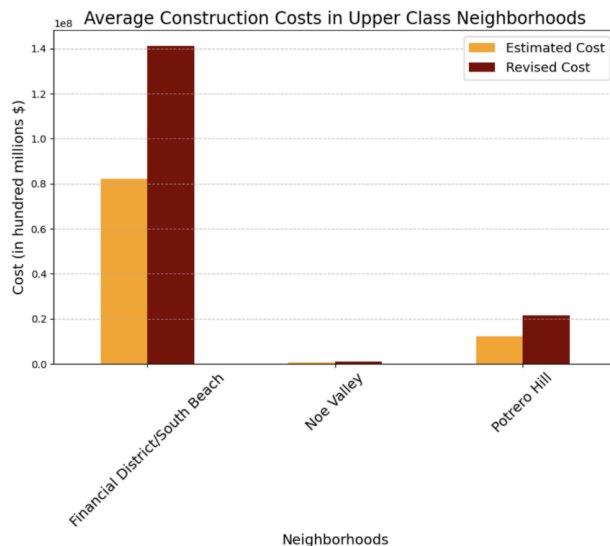


In lower-class neighborhoods, the distribution of building permits also reflect the areas' development patterns. **Chinatown has more commercial building permits than residential**, likely **due to its dense commercial activity with numerous small businesses and retail establishments** being the main suburb attraction. On the other hand, **Bayview Hunters Point and Tenderloin have more residential building permits than commercial**, indicating a **focus on housing development** in these areas. **Treasure Island**, however, **has very few building permits overall**, which may be **due to its isolated location, ongoing redevelopment plans, or zoning restrictions limiting construction**.

Building Costs

Permit Category	Lower Class: Permit Share	Upper Class: Permit Share	Lower Class: Total Cost %	Upper Class: Total Cost %
Demolition	0.7%	0.3%	0.6%	0.1%
Building Construction	1.9%	0.5%	50.6%	49.5%
Reparations	8.4%	6.4%	26.9%	12.9%
Small Projects	86%	90.4%	21.9%	37.5%
Signs	2.9%	2.4%	0.1%	0.1%

When analyzing permit categories across lower- and upper- class neighborhoods, we found that **Building Construction permits (wood framing and construction) make up only 2% of all lower-class permits and 0.5% of all upper-class permits. Despite their small share in total permit count, these permits account for a significant portion of the total spending. In both socioeconomic classes, building construction permits represent approximately 50% of the total cost spent on all permit types. This highlights the high cost associated with large-scale construction projects, even though they are relatively rare compared to minor renovations and repairs.**



With that being said, let's dive into the Estimated and Revised Costs for Building Construction based on neighborhood class. Interestingly enough, though the upper class neighborhoods had a lower amount of permits in comparison to the lower class neighborhoods, the cost of construction in the upper class is significantly higher.

Looking deeper at the **upper-class neighborhoods**, we can directly distinguish that the **Financial District/South Beach has a higher overall cost due to its more elaborate and sustainable construction projects**. For instance, **available land in the area is already quite limited**. For instance, there is a very tight space to work within the area. By virtue of this limitation, **office buildings are typically constructed upwards to optimize space, yet they remain vulnerable to earthquakes**. Taking this into consideration, developers must adjust their plans accordingly to ensure construction can withstand. **In contrast, Noe Valley and Potrero Hill have lower construction costs since they focus more on single-family homes or low-rise residential buildings** rather than high-density developments, **although they do exceed the original estimated cost that these permits initially proposed**, we noticed Noe Valley and Potrero Hill follow this pattern.

However, when it comes to neighborhoods with a more historical lower socioeconomic status, we notice a few key trends. For example, **Bayview Hunters Point and Chinatown tend to overestimate** how much they will be **spending on an average building construction project**. On the other hand, **Treasure Island does the complete opposite - they end up spending more than they initially proposed** on their permit proposal. Lastly, **Tenderloin follows suit to Treasure Island however on a greater scale**; It came as a surprise to see that Tenderloin tends to overspend a few tens of millions more than what they initially estimated in their original permit proposal.

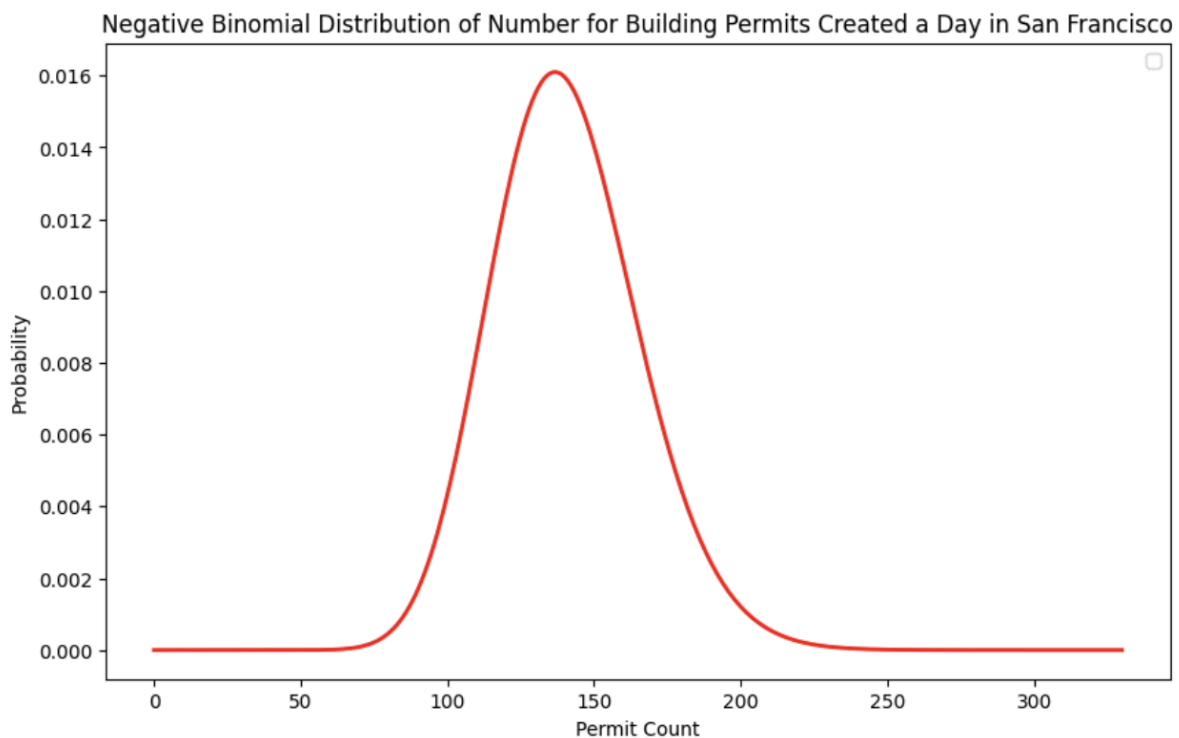
Construction Type	Presidio	Financial District/South Beach	Noe Valley	Potrero Hill
Residential	-	\$151.88M	\$0.97M	\$19.92M
Commerical	-	\$135.4M	-	\$50.14M

Construction Type	Tenderloin	Chinatown	Treasure Island	Bayview Hunters Point
Residential	\$50.48M	-	\$2M	\$3.97M
Commerical	-	-	-	\$4.32M

The above table displays the average construction cost associated with our respective “test” neighborhoods. Starting off with **the upper class we notice higher construction costs**,

especially in Financial District/South Beach, **where residential projects average \$151.88 million and commercial projects average about \$135.4 million**, likely due to large-scale, high-rise developments with strict seismic regulations. On that note **Noe Valley and Potrero Hill have lower residential construction costs, reflecting smaller scale housing projects**. Lastly, Presidio is missing an average cost due to it being a preserved area with highly-strict regulations and protection efforts issued by the local government.

Meanwhile, **lower income neighborhoods focus on residential development**, which is the reason why **Tenderloin leads with \$50.48 million**, likely **due to their affordability**. **Bayview Hunters Point is the only lower-income area with commercial construction, fostering a space for potentially growing business investment and stimulating the local economy**. **Chinatown**, mainly **focuses on small projects** such as home remodeling and renovations.



Finally, to address our original research question, we ask how building permit trends can help **forecast future urban growth in San Francisco**. **On average, about 141 permits are issued daily**. However **this estimation was found with a high variance of 627**, indicating significant unpredictability. Due to the large variation in permit counts and types, **we leveraged a negative binomial distribution to model our data**. **The model accounts for greater fluctuations than a simple Poisson model**, which typically does not. **Our probability distribution graph** tells us we can **expect around 100-200 permits created a day in the entire city**. This model is highly adaptable to individual neighborhoods, offering a valuable tool for estimating future trends and helping city planners anticipate urban development patterns.

Conclusion

Some key takeaways include upper-income neighborhoods having **more** building permits overall, with **commercial projects in the Financial District and Chinatown**. In contrast, **residential projects are more common in Noe Valley, Potrero Hill, Bayview Hunters Point, and Tenderloin**. **Presidio has minimal construction due to its protected status** by the city, and **Treasure Island has minimal construction** activity due to its secluded location. Residential construction surpasses commercial projects in all neighborhoods. The **Financial District has the highest average construction costs in upper-income areas**, likely due to large-scale, high-rise developments. On the other side of the socioeconomic spectrum, **Tenderloin has the highest average construction costs in lower-income areas**, driven by its affordability in housing and urban renewal projects. **These trends highlight how economic disparities influence urban development**, shaping neighborhood growth and investment patterns across San Francisco. Understanding building permit patterns helps city planners forecast future development and allocate resources effectively. Given the city's ongoing challenges, analyzing permit data offers critical insights into evolving neighborhoods and guides strategic development efforts.