



Optimization of Electric Vehicle charge Locations

A case study in San Francisco, CA

Sitao Li, Yirui Hu, Kanisha Patel

May 2, 2024

In the contemporary era, the field of new energy science has reached a promising stage, leading to the global recognition and rapid proliferation of electric vehicles (EVs) across diverse nations. However, this exponential growth in EV adoption has posed a myriad of challenges, including an inadequate number of charging stations, uneven distribution, and high costs, which are progressively exacerbating



Choosing San Francisco as our research focus is driven by these compelling factors. Situated in California, USA, San Francisco serves as a prime example of the challenges faced in the realm of EV infrastructure development. With 1246 public charging station ports (comprising Level 2 and Level 3

chargers) within a 15km radius, the city boasts a considerable charging infrastructure. However, despite this extensive network, 87% of the ports are Level 2 chargers, and only 37% offer free charging services, underscoring potential disparities in accessibility and affordability.

Powered by Esri

Existing EV charger location.

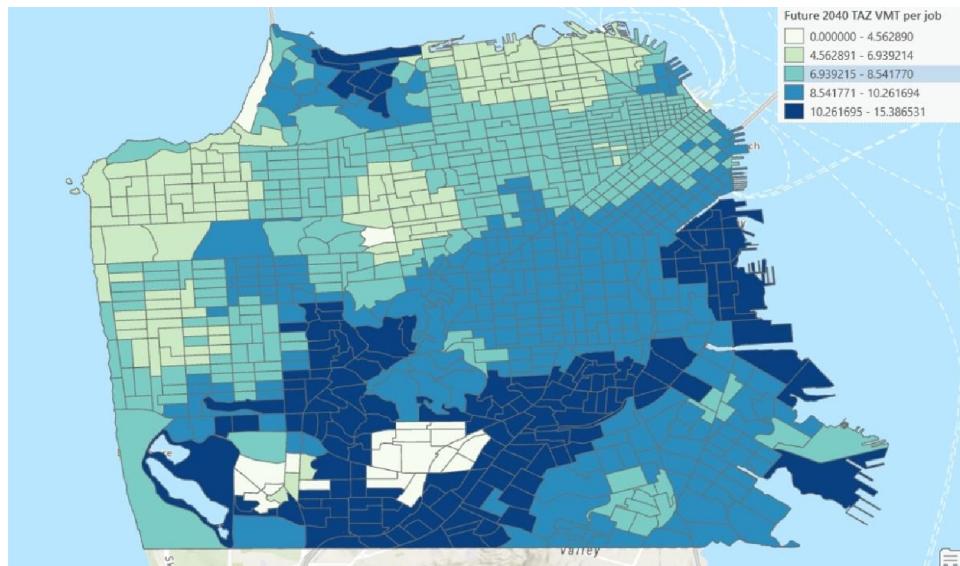


Powered by Esri

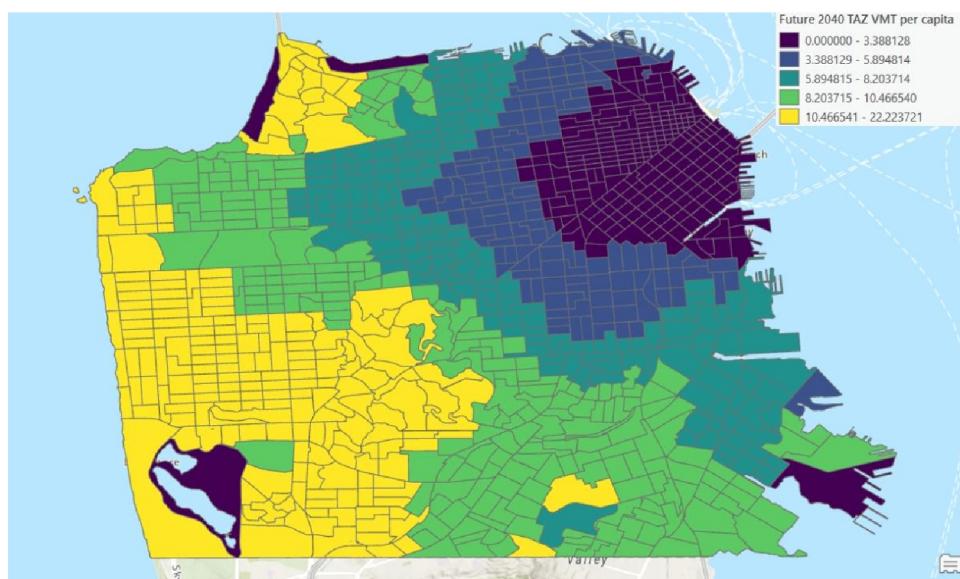
Population Density of 2021 in SF, CA

Powered by Esri

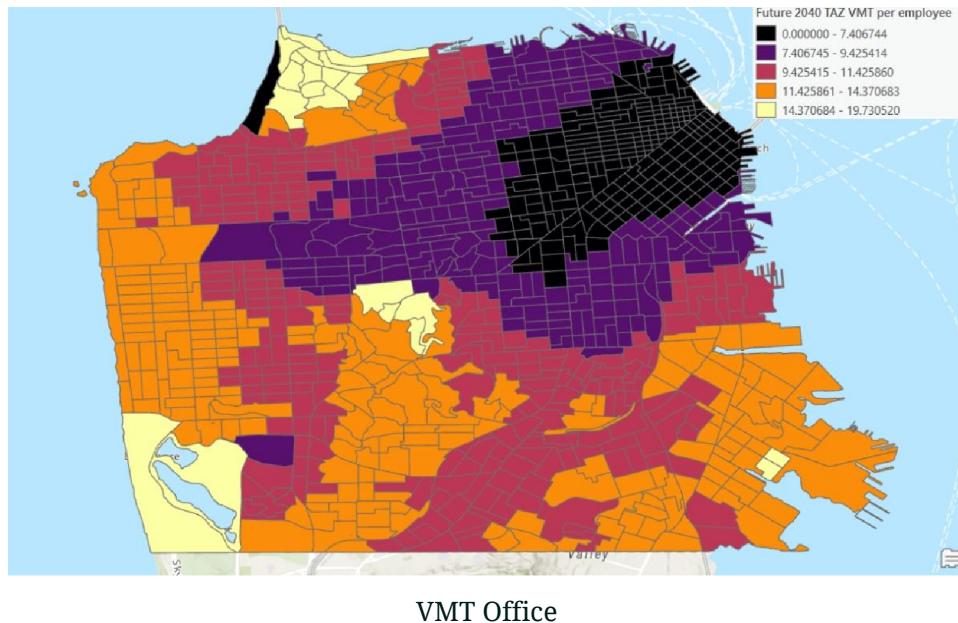




VMT TAZ Retail



VMT Residential

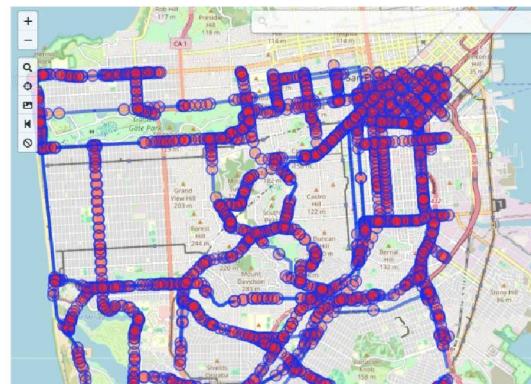


Service Area Calculation:

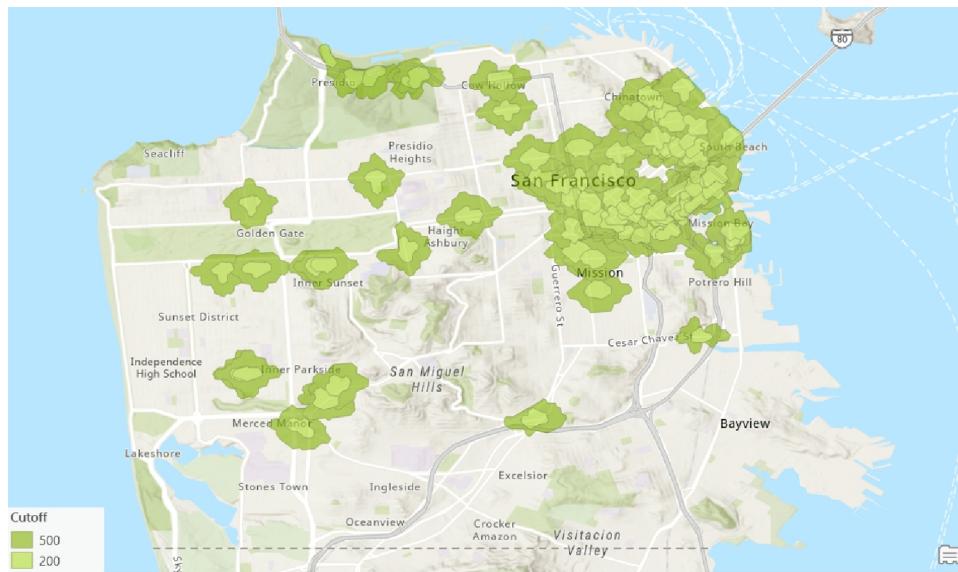
For each POI, we calculate service areas using a dual-radius approach to define their influence. The primary service area extends up to 500 meters, ideal for pedestrians and short-range accessibility. The secondary service area reaches up to 1 kilometer, accommodating broader service coverage, including vehicular access.

```

1  /* This has been generated by the overpass-turbo wizard.
2   * The original search was:
3   * "(highway=primary or highway=secondary) and type:way"
4   */
5   (osm:json){timeout:25};
6   // gather results
7   (
8     way["highway"="primary"]((bbox));
9     way["highway"="secondary"]((bbox));
10   );
11   // print results
12   out geo;
13 
```



Data Collection: Overturbo



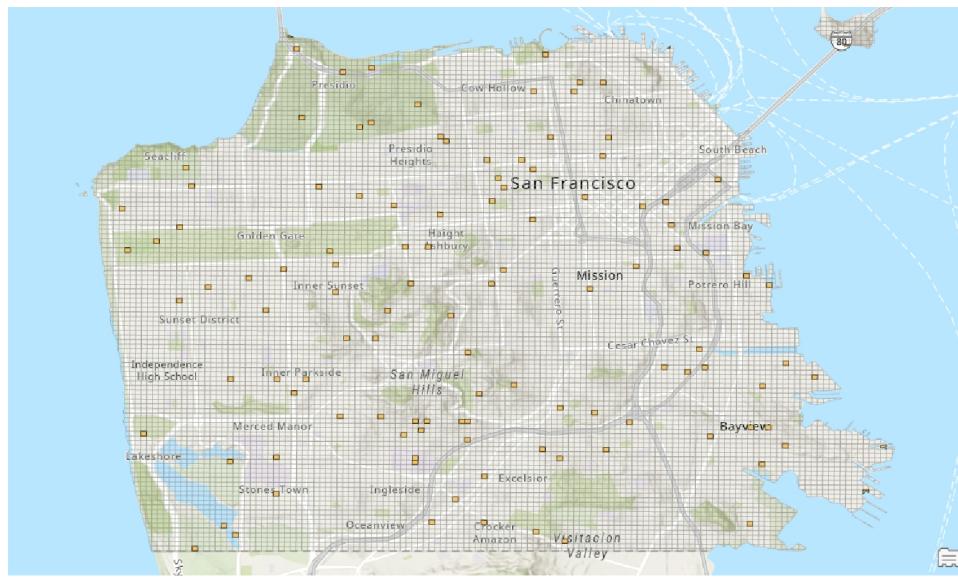
Service Area of Residential Area



Service Area of Office Area

Grid Overlay and POI Identification:

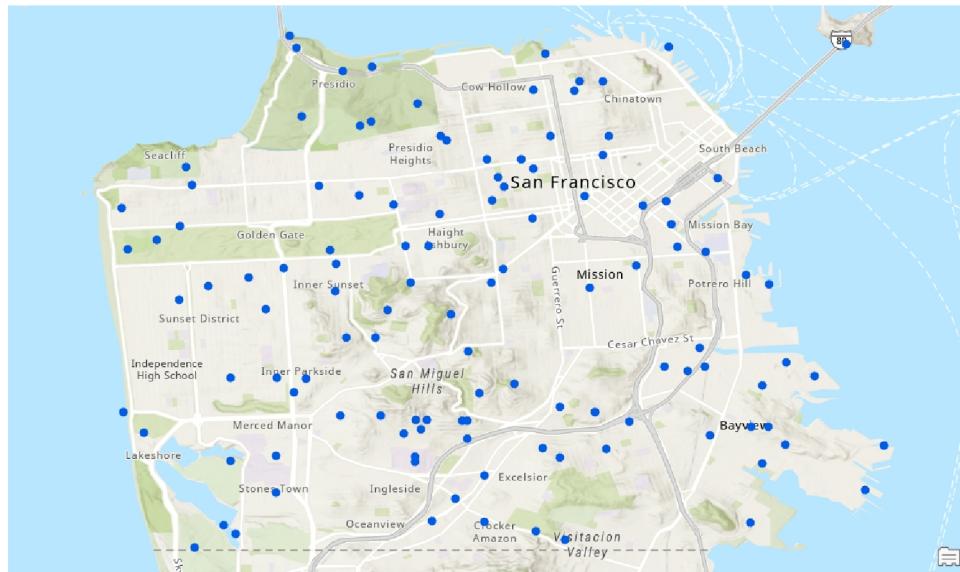
We start by overlaying a structured grid on a map of San Francisco. Each cell in the grid represents a potential area for service development based on proximity to existing POIs, such as public transport stations, parks, or commercial centers.



Selection of the Grid Cell

Selection of Strategic Points:

Through the grid, we identify new strategic points that coverage for these service areas. These points are selected based on their potential to serve the maximum number of users, considering both the 500-meter and 1-kilometer radii around each POI.



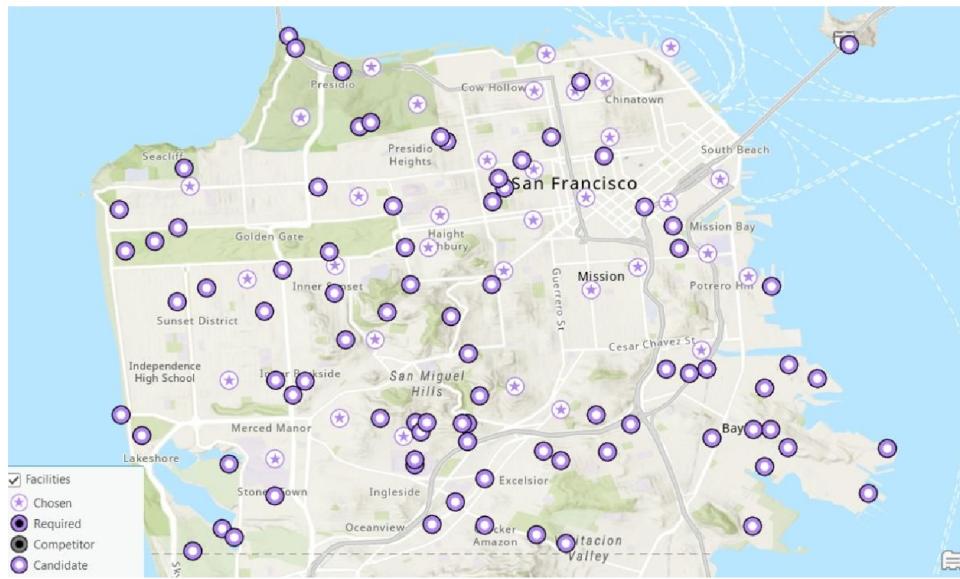
New selected points



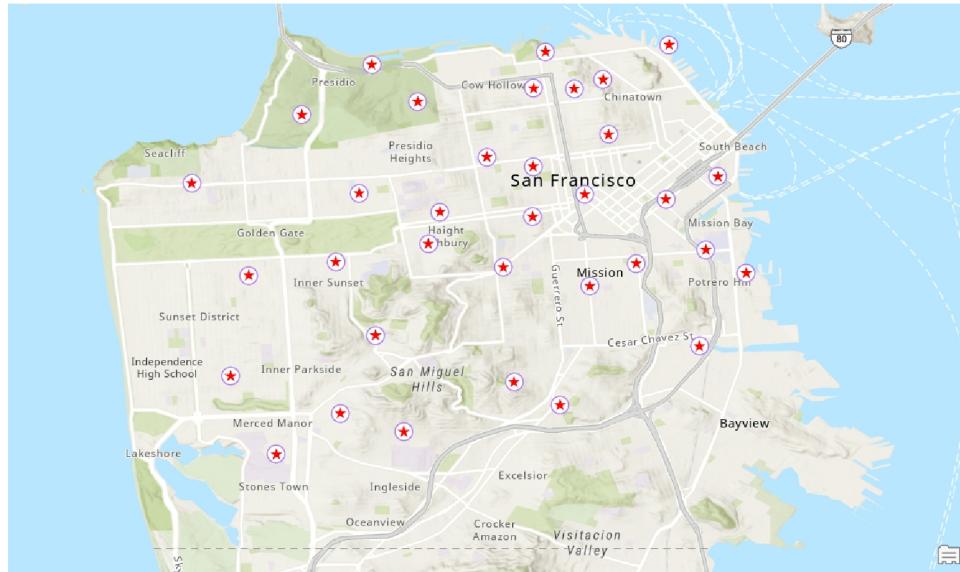
Location Allocation Analysis:

Utilizing location-allocation techniques, we determine the most effective locations for new services or facilities from the

strategic points identified. This method helps in minimizing travel time for the majority of users and ensures that services are placed where they are most needed.



Location Allocation



Optimized Location

Powered by Esri

