Transit Optimisation under Ride Hailing Competition and Traffic Congestion (by Naman Goel)

Approach 1:

Introduction

In the subject of transportation planning, the Transit Network Design Problem (TNDP) has been extensively studied. It is a nonlinear optimization problem that deals with the construction of optimum public transportation networks and systems. Within the framework of a transportation network, attempts are made to balance the tradeoffs between utility maximization and cost reduction given specific resource limits.

Mainly the two types of problems are faced:

1. Increased ride hailing competition which is a direct result of improper transit network of public transportation which has led to the decrease in its ridership.
2. Increased cost of transportation operations as the decrease in ridership of public transit has resulted in less revenue whereas the operation cost lies the same.

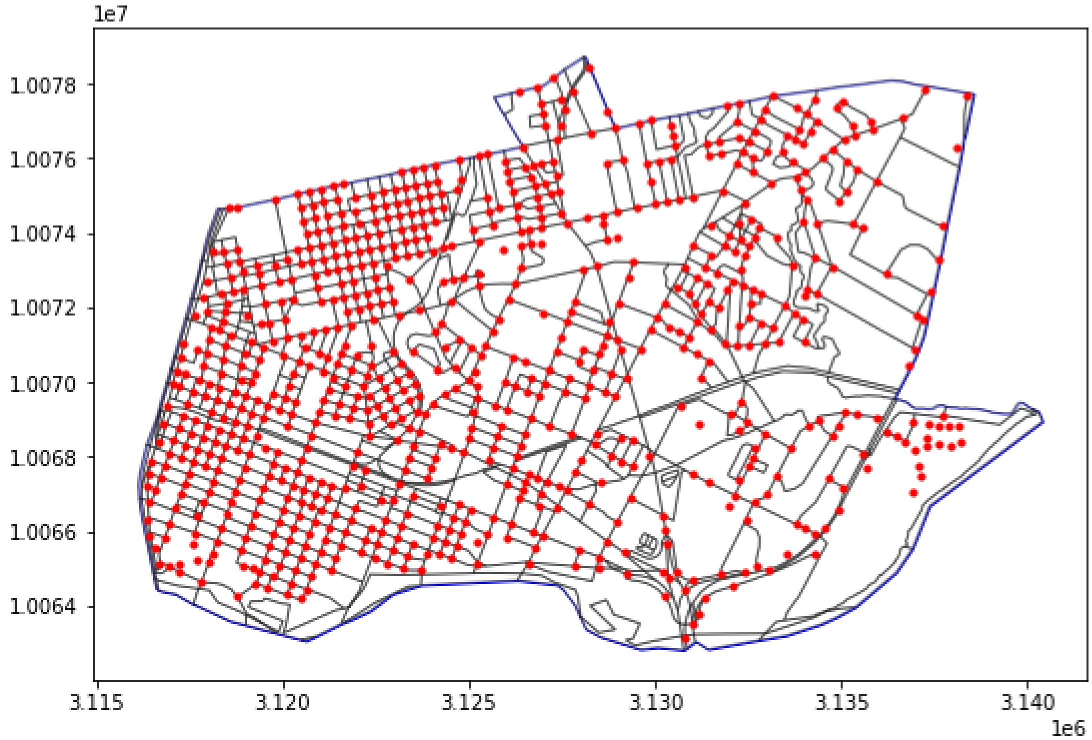
Solution:

The argument is that the present transit network is inconvenient and ineffective for a huge section of the population. The objective is to reduce travel time and increase network coverage. The optimal location of transit stops is the first difficulty to tackle.

A new set of transit stops are initialized using block-level population data from the 2010 census by assigning weights to each intersection according to the population in its surrounding blocks. A suitable metric is defined to assign weights to each intersection by summing up the population of their surrounding blocks. After assigning weights to all the intersections, the transit stop locations are determined by finding out their reach within a suitable buffer zone.

After finding out the optimal locations of the stops (proposed), we find the location of the current stops using the shape files of the city. The population served by the current and proposed stops are then compared.

After that the shortest path between two stops is calculated to reduce the travel time and operation costs.

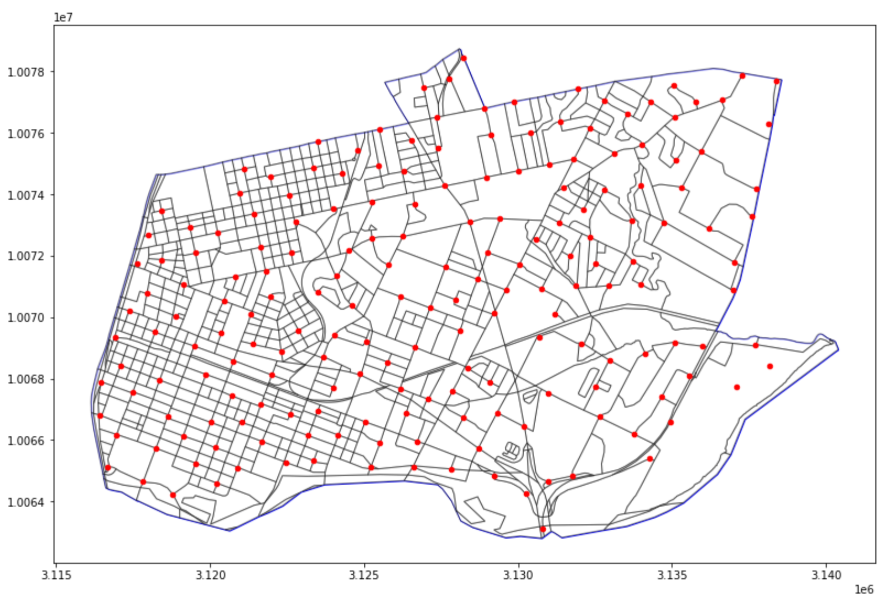


Intersections of the routes in the city

Results:

It was observed that the proposed stops will serve approximately 45% population within 400 meters (or ¼ mile) whereas the current stops only served approximately 37% population within 400 meters (or ¼ mile).

Current Network of the transit stops which only served about 37% of the population.



Proposed Network of the transit stops which serves about 45% of the population.

Conclusion:

Creating a rapid and well-connected network will encourage daily commuters to choose public transportation instead of various ride hailing options available upto some extent. Further, a well connected network will greatly reduce the operational costs that go to waste because of the decreased ridership.

Also, **increased ridership of the public transit system** can greatly reduce the traffic congestion in the city as the competition of various ride hailing companies will be reduced significantly. Choosing public transit options over ride hailing options also leads to **cost optimisation** for the public.

Approach 2:

Introduction

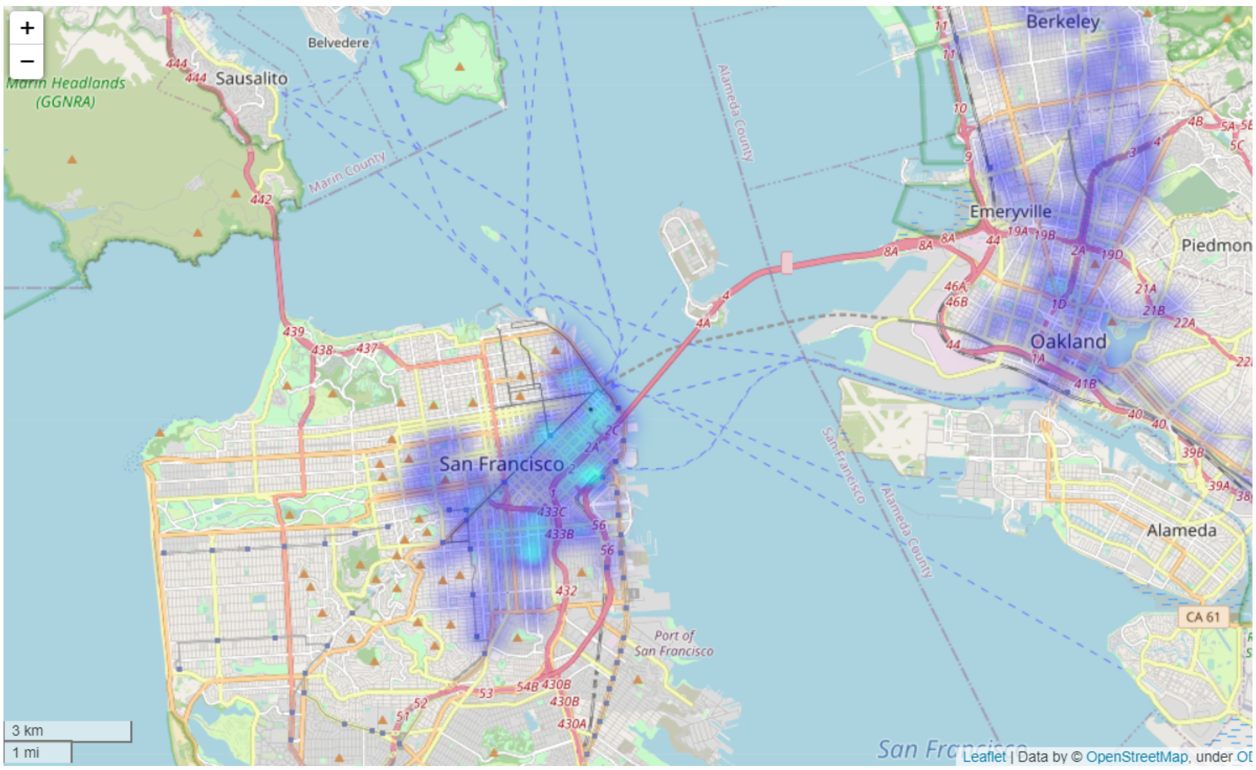
The unstructured method to manage road traffic, which is mostly made up of everyday commuters, is an issue that any expanding city and metropolitan encounters. One of the issue factors is the clustering of cabs at specific places that travel specific routes, causing these geographic areas to become overcrowded. As a result, the traffic speed on main roads linking these hotspots of passenger pickup and drop-off slows.

Solution:

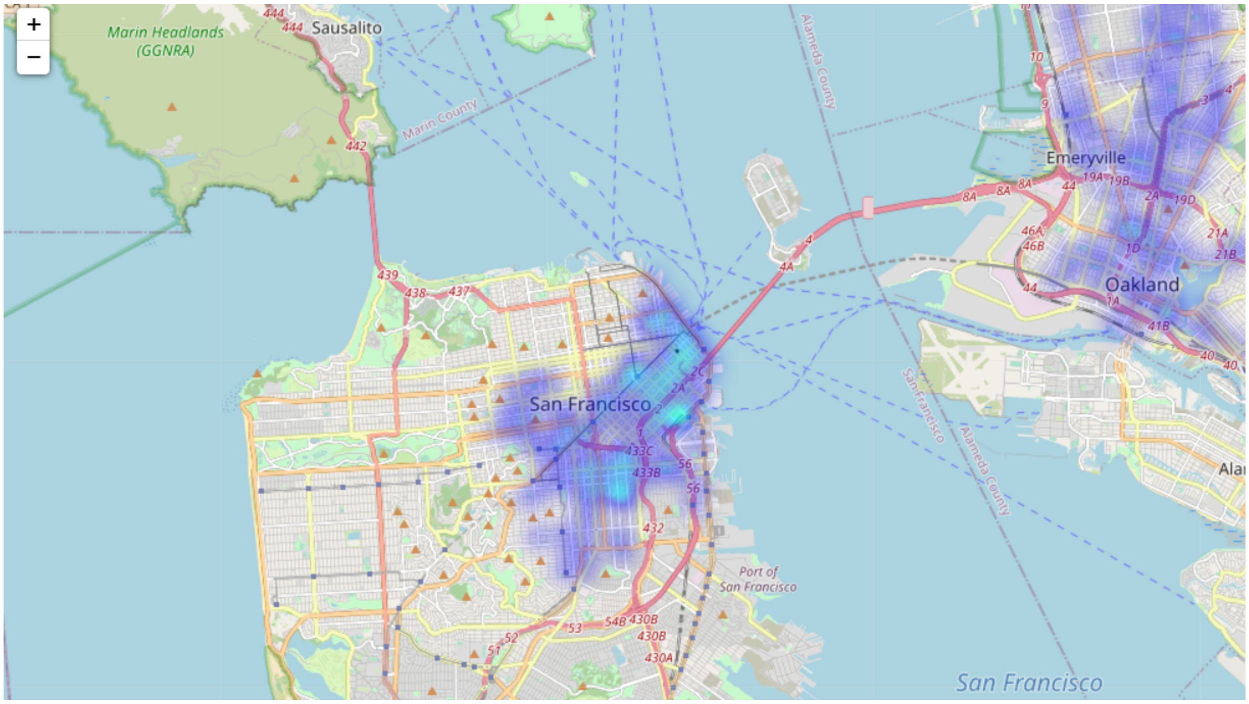
The first step in the process is to identify the hotspots that trigger cab clustering. After we've investigated these hotspots in a demographic region, we'll have a good sense of where major traffic originates and ends within a specific time window. Now here's the crux of our issue: these hotspots have more cabs than any other area, and at the same time, there's a drop point that will have more taxis than any other location. When we have a dataset that contains data for pair-wise pickup and drop sites, the picture becomes clearer.

Result:

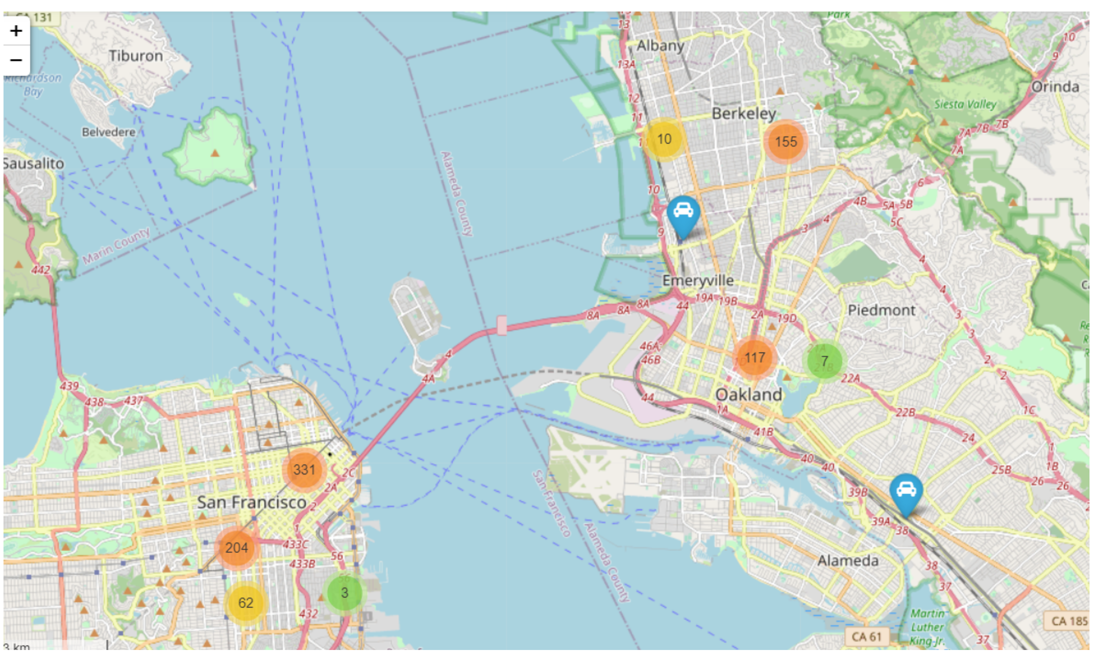
During certain hours, the roads linking these two sites will see the most traffic. The number of taxis on these routes accounts for the majority of traffic congestion.



Hotspots zones during 12 a.m. to 4 a.m.



Hotspots zone during 4 to 8 am



Clusters of cabs at various locations during 12 a.m. to 4 a.m.

Conclusion:

The apparent answer to this problem is to reduce the number of taxis on the road in order to boost traffic speed and free up these routes by replacing them with adequate alternatives. Depending on the dataset and the party of interest, these alternatives might cover a large range.

Whoever the implementer, one thing is certain: identifying and replacing these extra traffic-generating elements would have a significant impact on the environment, primarily in terms of reduced pollution, **cost-effectiveness of daily and inevitable commutes**, and the time spent on them, resulting in **increased productivity of both the consumer and the implementer**, as they would spend less time stuck in traffic and more time on activities requiring more attention.

These service providers might be anybody, such as cab firms looking for more environmentally friendly and cost-effective ways to give service to their consumers, or the government, which could focus its public transportation on routes that demand more attention than others.