An Investigation of the Operation of the Metering System at the San Francisco-Oakland Bay Bridge (SFOBB)

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Background

The San Francisco-Oakland Bay Bridge (SFOBB) is part of Interstate 80 connecting San Francisco and Oakland.



The 4.5 mile bridge crosses San Francisco Bay in two spans. The SFOBB is one of the region's most heavily travelled corridors, with over 280,000 vehicles and 500,000 people per day, and among the ten most congested freeway facilities in the nation.

Site Layout

At the east or Oakland end of the bridge in the westbound direction, a 20-lane toll plaza collects tolls from westbound drivers. Of the 20 tollbooth lanes, four are dedicated to buses and High Occupancy Vehicle Vehicles (HOVs) in the morning peak 5:00 AM-10:00 AM.



Nine lanes (3-6, 12-16) are open to vehicles with cash paying drivers, and the remaining seven lanes (7-11, 17-18) are reserved for vehicles equipped with Fastrak tags. A metering system located approximately 0.18 miles downstream of the toll plaza and right before the merge area (with 12 Lanes) is used to control the flow at or below entering the bridge and to facilitate the merging of vehicles from 20 into five lanes.



Objective

The objective of this project is to perform a systematic empirical analysis of the traffic on the SFOBB during the morning peak hour based on data from multiple sources and to use the analysis to propose strategies to improve performance.

Data Collection

- Loop detector data: Dual loop detectors are installed on each lane of the bridge starting at the beginning of the five-lane section after the merge area past the metering lights. There are 11 loop detector stations on the westbound span of the SFOBB.
- Video data: The SFOBB study section is equipped with 13 analog video surveillance cameras that provide good coverage of this section.
- Tollbooth counts data: We obtained from Caltrans the tollbooth counts data that gives the exact time, lane, and type of each vehicle crossing the tollbooths.
- Metering lights exit rate: The Caltrans SFOBB metering operator manually logs the metering rate (in vehicles/min) for the time periods during which ramp metering is operational.

Detectors Data Analysis and Findings

We collected data for the whole month of May 2015. Sample results are shown for, Monday, May 18, 2015.

According to our analysis:

- There is an active bottleneck between 9 and 10 AM that originates west of the Yerba Buena Island with congestion extending more than two miles upstream to the base of the bridge.
- There is a bottleneck early in the morning at the base of the bridge, even when there is no sign of congestion on the bridge. This is likely due to lane changes and the large difference in flows in the middle and outer lanes among vehicle types.
- We observed the same results for every workday.



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peed at May 18th time (from 5AM to noon)

Flow at May 18th

Counter maps over 6-hour interval



Tollbooth counts for each category



Future Work

- We will develop new traffic responsive algorithms for the metering lights on the bridge. The goal is to develop an efficient control system that adapts to the traffic condition of the bridge and increases the throughput while preventing congestion in the merging area.
- We will investigate ways to avoid underutilization of the HOV lanes while preserving the priority of HOV vehicles and improving the operating performance of the entire traffic stream.



References

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