Arterial Speed Management with Control Measures:
The Case of San Francisco

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Introduction

Studies show that the risk of pedestrian injury and death as the result of a collision increases exponentially as vehicle speeds increase. High vehicle speeds are strongly associated with both a greater likelihood of crash occurrence and more serious pedestrian injury.

There are several speed management strategies for urban streets, such as roundabouts and vertical or horizontal deflections. However, most of the design treatments are appropriate for low volume roads and are not applicable on multilane arterial streets with high traffic volumes and pedestrian interactions, typical in large metropolitan cities.

Background

One of the design parameters for signal coordination is the progression speed, i.e., the speed used to set the signal offsets at the successive intersections along the arterial so vehicles can proceed without stopping. Adjusting the progression speed may result in lower or higher travel speeds along the arterial, as drivers try to adjust their travel speeds to arrive during the green phase at each intersection.

Scope of Project

This study evaluates the effectiveness of traffic signal progression as a speed management tool in three arterial corridors in the city of San Francisco:

- Turk Street between Gough and Baker Streets
- Guerrero Street between 15th and 25th Streets
- 16th Street between Bryant and Market Streets

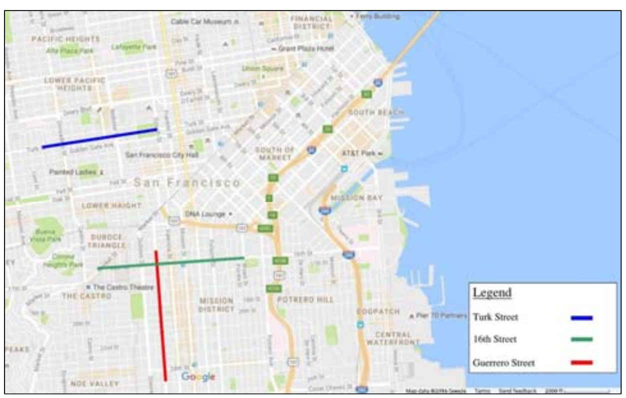

Figure 1. Location of Test Corridors, San Francisco, CA

Methodology

Data Collection

Transit data: Average speeds from city buses travelling on 16th St., excluding door open times and pullout dwell times. Data collected in October 2013 and October 2015.

INRIX data: Historical and real-time speed and travel time data for main arterials. Data is collected from private mobile phones and fleet vehicles (such as delivery vans and trucks) equipped with GPS locator devices. Data collection periods were set on typical weekdays in November 2014 and November 2015.

ATR data: 24-hour traffic volumes were collected at two locations along each of the three corridors in November 2014 and November 2015.

Field data: Speed profiles in addition to longitude/latitude and elevation were collected with GPS loggers via the mobile phone-based app, *myTracks*. Travel runs were completed in May 2016 along the three corridors.

Findings

Table 1. Average Travel Speeds – Guerrero Street

Operating Conditions	Travel Direction	Speeds (mph)		
		AM PEAK	OFF-PEAK	PM PEAK
Before	NB	14.8	14.5	14.0
After		13.5	13.1	11.0
% change		-8.8%	-9.8%	-21.8%
Before	SB	13.5	15.2	14.1
After		12.1	13.7	12.5
% change		-10.4%	-9.9%	-10.9%

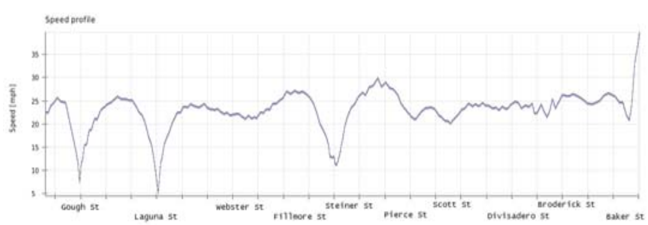

Figure 2. Speed Profiles – Turk Street

The implementation of new signal timings resulted in decrease of average travel speeds in all corridors.

Findings

Turk and Guerrero experienced an increase in average daily traffic (ADT) since the progression results in a smother drive and attracts drivers.16th street experienced a decrease in ADT since it exhibits a high number of stops at the traffic signal which could deter drivers.

Table 2. Average Daily Traffic

Study Corridor	14-Nov	15-Nov	Change (%)
Turk	**10,523**	**12,378**	**17.60%**
16th St-EB	*6,933*	*5,529*	-20.30%
16th St-WB	*5,515*	*5,168*	-6.30%
16th St	**12,448**	**10,697**	**-14.10%**
Guerrero - NB	*10,446*	*12,625*	20.90%
Guerrero - SB	*10,339*	*11,820*	14.30%
Guerrero	**20,785**	**24,445**	**17.60%**

Net environmental emissions also decreased due to the improved progression and the lower accelerating/decelerating frequency.

Table 3. Annual Reductions in Air Pollutant Emissions (tons)

Air Pollutant	16th	Guerrero	Turk
1. ROG Emissions	0.0031	0.0447	0.0188
2. NOx Emissions	0.0031	0.0242	0.0125
3. PM Emissions	0.0015	0.0188	0.011
4. CO2 Emissions	8.354	94.91	56.04

Conclusions

Findings show that signal progression is an effective low-cost method to reduce the average speed in urban arterials. An induced demand shift was presented, depending on the comfort level of the drive along its corresponding corridor. The revised signal timings also resulted in emissions reduction and safer driving behavior.

Next steps in improving the operations and safety on a city's arterial corridors focus on the application of emerging technologies for control and management

Acknowledgments

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