First Transit Contra Flow Lane in Downtown San Francisco

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Introduction

Traffic congestion places a tremendous burden on transit vehicles in cities worldwide. San Francisco, located in the heart of the Bay Area region with a high influx of daily work population, is no exception to this dilemma.

In 1973, the City and County of San Francisco established the Transit Preferential Streets (TPS) program to expedite transit service and to encourage greater use of public transit, which in turn reduces traffic congestion and air pollution. As part of the TPS program San Francisco has implemented a variety of traffic measures including transit signal priority, bus lanes, bus bulbs and boarding islands to reduce transit delay. Our latest attempt to improve transit operations in the downtown area is the introduction of a transit contra flow lane.

The City and County of San Francisco

The current population of the City and County of San Francisco is about 755,000, with a downtown employment of about 280,000. San Francisco has been relatively successful in having a large percentage of its workforce commute by public transit. In 1984, it was estimated that about 55% of the downtown workforce commuted by public transportation. However, the City still has a large number of automobile commuters who congest downtown streets. The 1989 Loma Prieta earthquake further compounded this congestion. This earthquake removed the City's Embarcadero Freeway and the Terminal Separation Structure from service, adding approximately 110,000 vehicles to downtown streets.

Congestion can sometimes act as a motivator for people to use public transportation, but when the congestion begins to affect the mobility of public transportation, that incentive can be neutralized. San Francisco was seeing this deterioration of public transportation service on its downtown streets with increasing automobile congestion. This led to the inception of the City's Sansome Street Contra-flow project.

This project was a joint venture between the City's transit planners in the Department of Parking and Traffic (DPT) and transit planners in the City's transit agency, the Municipal Railway (MUNI). This project cost $120,000.00 and was funded by the San Francisco City and County Transportation Authority through proposition B sales tax funds.

Problem Statement

Traffic congestion was seriously affecting the reliability of three transit routes through San Francisco's downtown. These routes (#12, #15, and #42 lines) were operating on two southbound one-way streets, Montgomery and Battery Streets, and getting caught in recurrent congestion (see Figure 1 for a vicinity map). Delays of up to 50 minutes on weekday afternoons were common.

Figure 1. Project vicinity in downtown San Francisco

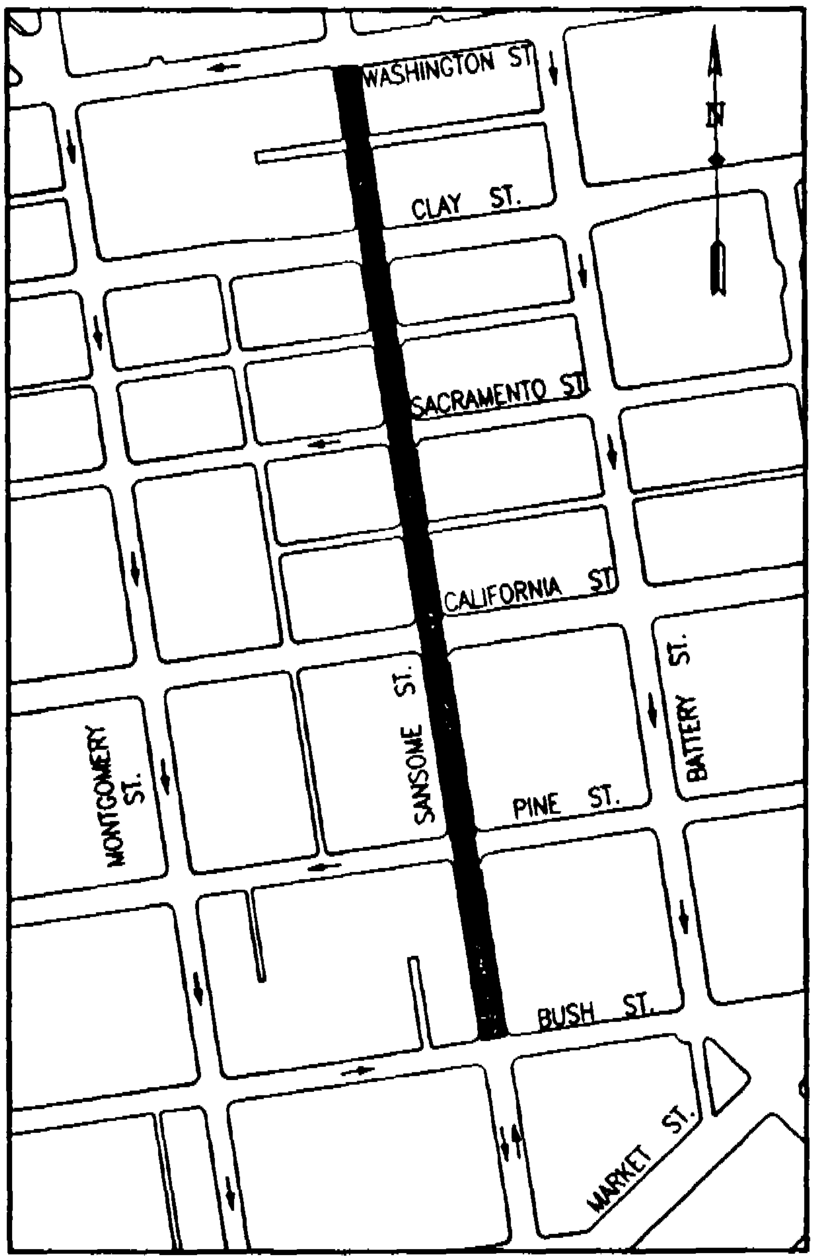
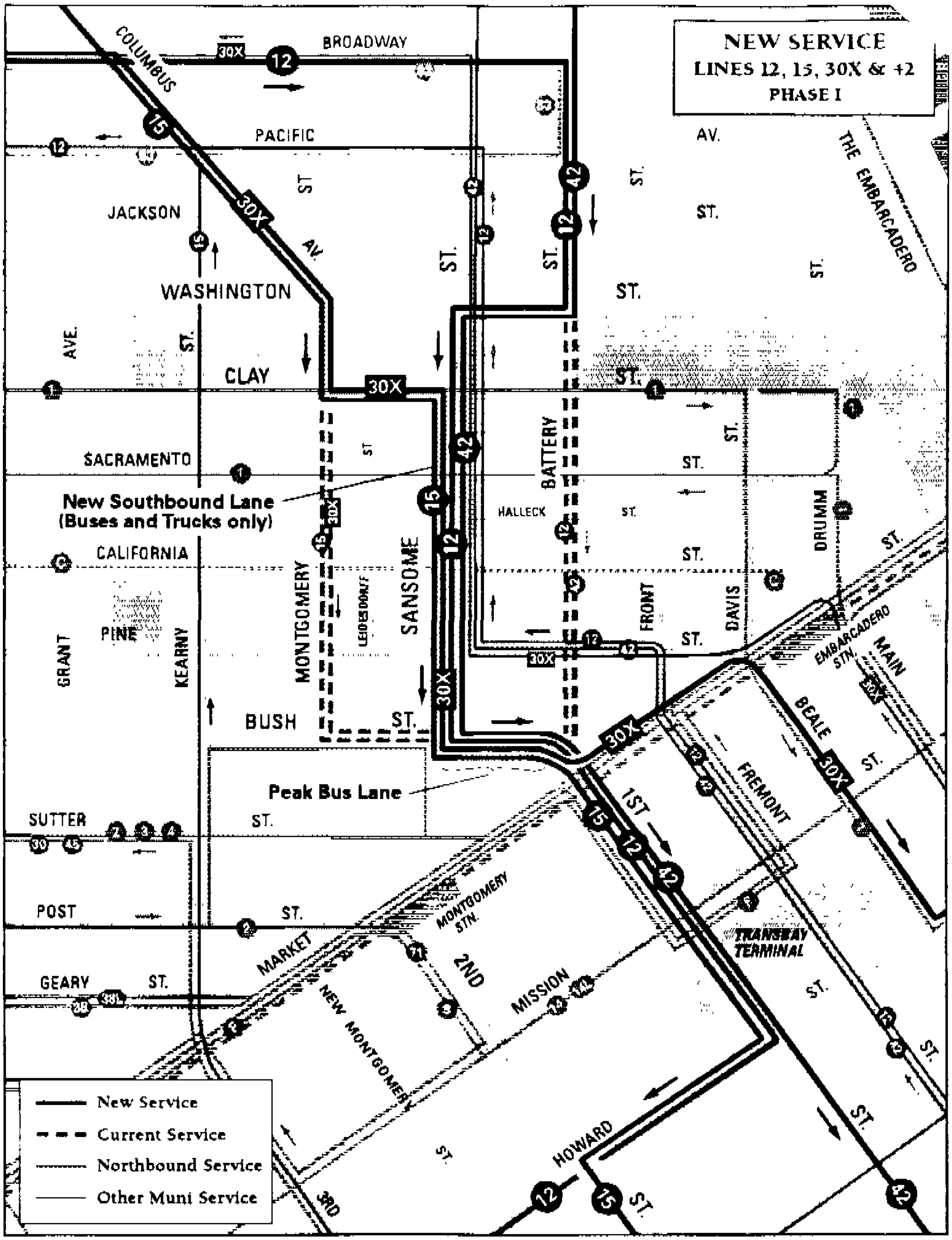


Figure 2. Existing and proposed Routes for Bus Line 12, 15 &42



Muni Service Planning - Sept 1997

Solution

To reduce this delay, the City and County of San Francisco looked at a number of potential alternatives. These included such options as installing standard bus-only lanes on Battery and Montgomery Streets. This option was ruled out for several reasons. In order to make a significant improvement the diamond lane had to be in effect at least from 7 AM to 7 PM Monday through Friday. Such a diamond lane had to be in the curb lane, which required removing all loading zones on the right side of the street. The second problem was cars making right or left turns from the diamond lane which would reduce the efficiency of the diamond lane especially in the peak hours. The third problem was that assigning the curb lane as a diamond lane would only exacerbate existing congestion by eliminating a lane for mixed traffic during peak hours. The fourth problem was driver compliance when such a highly needed traffic lane is removed. Because of these problems it was decided that other options had to be considered.

The City then began to consider a more radical option: change a parallel northbound one-way street into a two-way street for southbound transit use. The candidate street was Sansome Street, which runs parallel to and is located between Montgomery and Battery Streets. At this time, Sansome Street was one-way northbound with three traffic lanes and metered parking (only loading zones) on both sides. The City conducted an extensive traffic study collecting turning movement counts, analyzing level of service and surveying parking along Sansome Street. The study demonstrated that it would be technically feasible to convert one of the northbound lanes to a southbound bus lane, along the section between Washington and Bush Streets. The only problem was how to deal with the highly needed loading zones on the west side of Sansome Street. Two options were available. The first option was to eliminate all loading zones on the west side and establish an exclusive bus contra-flow lane. This option was rejected because of the high demand for loading zones in the downtown area. The second option was to make a compromise on the bus contra-flow lane and allow commercial vehicles to use it as well. This option would allow us to maintain all loading zones as is. An analysis of the bus/commercial vehicle contra-flow lane indicated that mix use of the lane by commercial vehicles would have minimal impact on the bus operation. This alternative would allow buses to bypass most of the congestion on Montgomery and Battery Streets, and would retain freight loading access for all businesses on both sides of Sansome Street. The concept was simple, but selling the idea to the public, especially the merchants, was not so simple (see Figure 2 for existing and proposed bus line routes).

Implementing the Solution

Our approach to this project was twofold, the outreach or public participation aspect and the technical aspect.

Public Participation Aspect

Our public participation strategy for the Sansome Street project was simple: first, make sure the public understands the purpose of the project and second, be sensitive and responsive to their concerns. Rather than launch directly into having a departmental public hearing, the City decided to engage in an outreach campaign first. The idea behind this was to identify and solve most problems before having them expressed at a public hearing. By doing this, even if the City could not solve all the problems, it would at least know what they were and be prepared to respond in a professional and reasonable manner.

To begin, the City issued a one-page joint project memo/fact sheet from DPT and MUNI. The memo included a map of the proposed project on one side and a project description with the public hearing date and DPT/MUNI contact phone numbers on the other side. This memo was mailed to all major businesses, building owners and managers along Sansome Street and business associations in the downtown area. The memo was also hand delivered to every business and building manager or owner along Sansome Street with a brief verbal description of the project to make sure the scope and impacts of the project were well understood. Follow-up presentations were scheduled with downtown merchant associations to address their concerns and get their support. They also agreed to inform their members through their newsletters. Other follow-up meetings were also held to discuss specific concerns, such as parking loss or bus stop relocations in front of someone's business.

By the time of the departmental public hearing, not only was there no major opposition to the project, DPT also had support from major downtown merchant associations and businesses speaking in favor of the change. By this time the project was publicized in major San Francisco newspapers. The Parking and Traffic Commission which oversees DPT and the Board of Supervisors readily approved the project without any problems. Another key to the project's success was the emphasis made about its public benefits. The project was designed to benefit public transportation, which everyone could agree upon as a worthwhile goal.

Despite the ease of approval, the City has had enough experience with controversial projects to know that the public will oftentimes not get involved until a project is actually being implemented. To counter potential problems of this sort, DPT started a second public information campaign one month before the actual opening of the southbound bus contra-flow lane. DPT installed 3' x 3' warning signs on Sansome Street facing northbound traffic, informing motorists about the new southbound lane, which would be restricted to buses and commercial vehicles and the actual date of the opening. DPT also installed small 8.5" x 11" cardboard signs with a brief description of the project, its implementation date, and a contact name and phone number on each meter post. These warned motorists that the west side parking spaces would eventually only be accessible by commercial vehicles. A joint press release with a map of the area was issued by DPT and MUNI on Wednesday to inform the public about the opening day which was set for the following Monday. The local newspaper, the *San Francisco Chronicle* published an article about the change. The City also informed major package carriers, such as UPS and Fed EX, about the change and asked them to issue a memo to their drivers.

The striping changes were made on Saturday night and Sunday Morning. On Monday morning, Traffic Control Officers were assigned to be on site, just in case, for any possible traffic problems. When the street was finally opened, traffic moved smoothly, in both the northbound and southbound directions, and there were no major problems. The new two-way operation continues to be a public relations success.

Technical Aspect

The technical aspect of the project was also twofold. The first was changing the street from one-way northbound to two-way to include the southbound contra-flow lane. This change included signal modifications from a one-way to a two-way street at five intersection, re-striping the street, installing new signs restricting southbound traffic except buses and commercial vehicles in the southbound contra-flow lane, and parking meter relocation on the west side of the street. All these tasks were designed and implemented in-house by DPT which helped to expedite the project. Secondly, a joint before and after study by DPT and MUNI was also conducted to evaluate the effectiveness of the project.

Methodology

We planned a before and after study to evaluate the effectiveness of the project. The before and after study was conducted at four signalized intersections along the subject bus routes #12,15, and 42 which overlapped on both existing and the proposed routes. The intersection of Washington and Battery Streets (A) and the intersection of First and Market Streets (B) were chosen for bus line 12 and 42 and the intersections of Clay and Montgomery Streets (A) and 2nd and Howard Streets (B) were chosen for bus line 15. The days of the study were Monday through Friday, during various time periods of the day, 8 a.m. to 11 a.m., 10 a.m. to 1 p.m. and 4 p.m. to 7 p.m. over a period of one month during the months of July and August.

A total of 20 employees from DPT and MUNI participated in the before and after study data collection. Two persons with synchronized watches recorded the bus number, bus line number, and the time when the bus passed points A and B.

Before and after study

Travel time for each bus was calculated by comparing their arrival times at points A and B. The minimum, maximum, mean, and standard deviation of travel times for each time period were also calculated. The study indicated that standard deviations of travel time, which is indicative of service reliability, were reduced for all bus lines during all time periods.

The changes in mean, maximum and standard deviations of travel time were most significant during the p.m. peak period. The maximum travel time for bus line 15 was reduced from 41 minutes and 53 seconds to 15 minutes and 10 seconds and the standard deviation was reduced from 7 minutes and 46 seconds to 1 minutes and 39 seconds. The travel time difference for bus line 12 and 42 was even more significant despite the fact that travel distance for bus line 12 and 42 were increased by 550 feet (34%) and the buses were going through two more signalized intersections. The maximum travel time for bus line 12 and 42 during the p.m. peak was reduced from 56 minutes and 23 seconds to 17 minutes and 3 seconds. The standard deviation of the travel time was also reduced from 11 minutes and 9 seconds to 2 minutes and 28 seconds.

The average travel time for bus lines 12 and 42 during mid-day was slightly increased due to the increase in travel distance by 34%. However, the standard deviation for bus lines 12 and 42 was reduced despite the increase in the travel distance. Service reliability had improved for all lines during all time periods as reflected by decreased standard deviations. (see Table 1).

Table 1. Before and After Travel Time Data

Bus Line #	Time Period	Statistical Measure	Before Study	After Study	Difference
Line #15	10 a.m.- 12 p.m.	Min.	06:38	07.30	
		Max	13:24	14:06	
		Mean	10:19	09:16	01:03
		Stdev	01:34	01:18	
	1 p.m.- 3 p.m.	Min.	08:25	07:17	
		Max	21:23	21:15	
		Mean	12:08	10:56	01:12
		Stdev	03:08	02:27	
	4 p.m.- 7 p.m.	Min.	07:14	06:31	
		Max	41:53	15:10	
		Mean	16:11	10:20	05:51
		Stdev	07:46	01:39	
Line #12, 42	10 a.m.- 12 p.m.	Min.	02:09	03:20	
		Max	11:19	07:54	
		Mean	04:25	05:20	-00:55
		Stdev	01:43	00:46	
	1 p.m.- 3 p.m.	Min.	01:58	04:24	
		Max	08:55	12:08	
		Mean	04:54	06:31	-01:37
		Stdev	01:26	01:20	
	4 p.m.- 7 p.m.	Min.	02:02	02:41	
		Max	56:23	17:03	
		Mean	14:45	06:53	07:52
		Stdev	11:09	02:48	

Operational Adjustments

After we implemented the system we found out that the turning radius that we used for MUNI buses was different from the turning radius for Golden Gate Transit (GGT) buses. The GGT buses had a wider wheelbase requiring a wider turning radius. Physically we were not able to provide a wider turning radius because the geometry of the intersection was fixed. However, we were able to resolve this problem by installing advance stop bars, 20 feet before the crosswalks, to solve this problem. We also installed "KEEP CLEAR" messages between the crosswalks and the stop bars to make sure the space is clear for wide turnings of GGT buses. We also had to relocate a MUNI nearside bus stop on Pine Street at Sansome Street to accommodate a wider turn for Muni buses making right turns from Pine to Sansome Street.

Follow-up projects

This project is part of a larger comprehensive program to improve transit service in this corridor. While it resolved the traffic congestion delays to bus lines #12, 15, and 42 along 1,612 feet of Battery and Montgomery Street in the San Francisco downtown area, before they get to their final destination they had to go through a few more streets and intersections, which required different treatments. Three other transit related projects were designed to help move these buses through downtown to their final destinations. Each one of these projects deals with a specific problem and solution along these routes. These projects were scheduled to be implemented after Sansome Street contra-flow lane project.

The first project already implemented is the rerouting of bus line #15 from First Street to Second Street due to heavy traffic volumes on First Street. This project required signal modifications at the intersection of Market/Sansome and Sutter Streets. As part of this project we also converted a short section of Sutter Street from one-way to two-way to allow buses to make a left turn from southbound Sansome Street to eastbound Sutter Street and then an immediate right turn from Sutter Street to westbound Market Street. This project has improved bus line #15 travel time even more significantly.

The Second project, which is scheduled for construction in the summer of 1999, is a boarding island on the north side of Bush Street at Battery Street. This boarding island will resolve bus problems passing through the intersection of Battery and Bush Streets. Buses now have to fight their way from the existing diamond lane on the south side of Bush Street over three traffic lanes to get to the diamond lane on the east side of First Street. As part of this project we will relocate the existing diamond lane from the south side of Bush Street to the north side so that the buses can use the diamond lane to get to the boarding island. We will also relocate and combine two bus stops from Bush and First Streets to this new boarding island.

The third project, which is in the test process, is a "queue jump" project at the intersection of First and Howard Streets. We are testing a video detection technology to detect the buses and then provide them with a queue jump phase, which would allow them to make right turns from the left most lane. This project would allow buses, which make right turns from First Street to cross streets, to use the existing diamond lane, which is on the left side of First Street. First Street is a one-way southbound street leading to the Bay Bridge On Ramp.

Conclusion

The City and County of San Francisco took what may at first seem a backward step in traffic engineering by changing a downtown street from a one-way to a two-way street. This was done to facilitate public transportation through a congested downtown. By involving the public at an early stage, the City was able to successfully implement the project.

Reducing traffic congestion delay to transit vehicles and shortening the travel time is very important for transit riders, but what is more important than a short travel time is the reliability of that travel time. Transit riders would like to know how long it would take them to get from point A to point B, so that they can plan and rely on it. A short and unreliable travel time is in some ways worse than a longer but reliable travel time. This study indicated that bus contra-flow lanes can be used under especial conditions in the downtown area to not only reduce congestion delay to transit vehicles but also to improve the transit service reliability.

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