



San Francisco
Municipal Railway

**PLAN
TO ACCOMPLISH PROPOSED OBJECTIVES OF 85%
ON LRV LINES**

SAN FRANCISCO, APRIL 2006

Plan to Accomplish Prop E Objectives of 85%

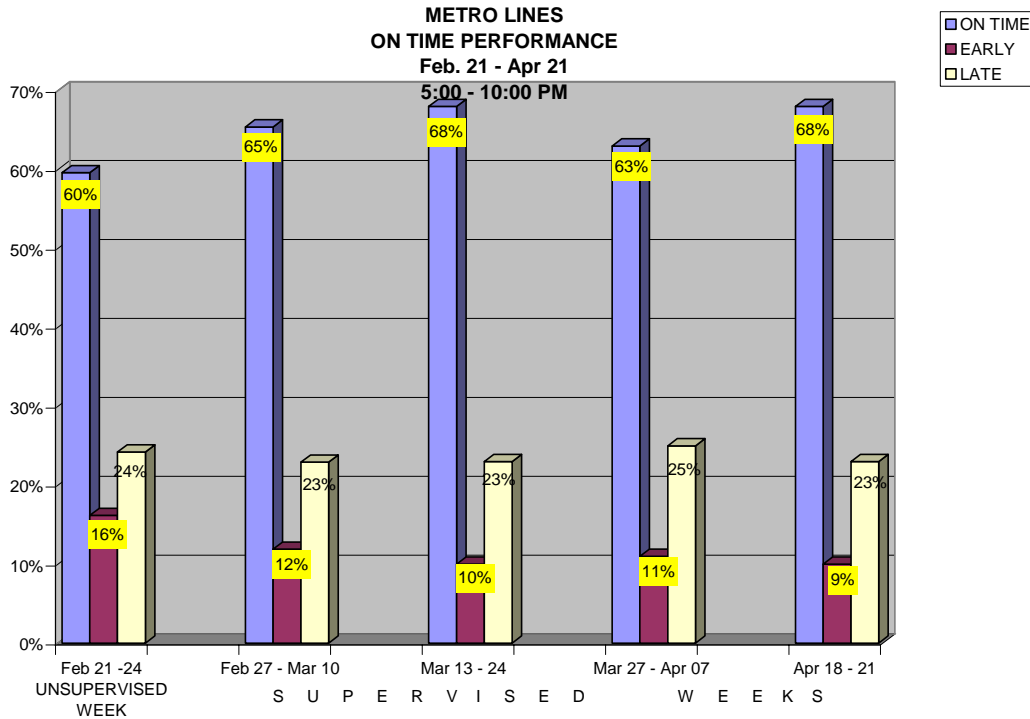
Purpose:

The purpose of this study is to evaluate traffic and schedule impediments that prevent MTA from achieving the Proposition E on time goal of 85%.

I. Prop E Objective is 85%.

System-wide Muni's on-time performance has been averaging 70%. To investigate how to best improve on-time performance, staff decided to focus on a smaller segment of the system and chose to study the light rail lines. We chose the LRV lines because the automatic vehicle location software program known as NextBus provides us with data regarding on-time performance. LRV on-time performance is averaging 68% on time, 09% early and 23% late during the service hours of 5 p.m. to 10 p.m. weekdays. The rationale is to identify and implement actions required to improve performance on this segment of the service and subsequently expand these actions to a larger portion of the system. To that end we began closely monitoring LRV p.m. performance and:

- 1) To address the matter of early arrivals we consistently placed supervision at the terminals (Balboa Park for the J, K and M, Zoo Loop for the L line and La Playa loop for the N line) to ensure that operators left on time.
- 2) Yard supervisors and supervisors at the terminals and at entry portals synchronized their watches. Operators were also asked to ensure that their timepieces matched the Supervisors time.
- 3) Careful notations were made of why trains were early or late. Using the Prop E five minute window we tracked performance utilizing NextBus data and it was as follows:



Time Period	On Time	Early	Late
Feb 21 -24 UNSUPERVISED WEEK	60%	16%	24%
Feb 27 - Mar 10	65%	12%	23%
Mar 13 - 24	68%	10%	23%
Mar 27 - Apr 07	63%	11%	25%
Apr 18 - 21	68%	9%	23%

Overall performance improved by 8% from measurements taken before the added supervision. The following problems and proposed solutions were noted for each line:

Proposed or Active Solutions:

For all lines to achieve 85% on-time performance, it will be necessary to fill all runs and ensure that lines that run with two car trains (L, M and N) are not running with single cars.

It is also necessary to continue the additional supervision at the terminals to make the necessary adjustments to service and also to ensure on time departures.

Adding standby trains at Church and Duboce and also at Metro will help fill gaps in service when a delay occurs. This will allow supervisors to make the necessary adjustments to service without impacting our customers.

Also we will explore various methods of run cutting to remove the extra car from a train during off peak and late evening service. This will reduce mileage and increase car count during the critical A.M. and P.M. rush periods.

J Church:

The J line runs approximately 3 miles between Balboa Park and Church and Duboce. The majority of this line is operated in mixed traffic conditions. From Balboa Park to Highway 280 traffic is relatively light with only two signalized intersections, the train then enters the right of way to Randall where the train again is in mixed flow. During the time frame measured (5:00 P.M. to 10:00 P.M.) we noted that LRV traffic was delayed as a result of traffic backup for the left turn onto 30th. The line can further be delayed by the number of stop signs along Church Street. As the trains approach Market Street they also experience heavy traffic that may result in the LRV missing one traffic signal cycle.

Short Term Solutions:

Schedules Dept. will add 3 min. of running time inbound between Metro and Church and Duboce. This will not impact the current headways. It will be implemented in the next sign up in June, 2006.

Investigate the possibility of re-timing the signal at 30th and Dolores to allow more time for the left turn.

Consider signalizing the six all way stops on Church Street.

Move the LRV stop at 30th to a far side stop. This would minimize the instances when LRV's get trapped at the intersection.

Long Term Solutions:

Installation of pre-empt LRV detectors to assist with the left turn at 30th.

Install similar pre-empt detectors at Market Street.

Signalize the six stop signs at 20th, 25th, Clipper, 26th, Cesar Chavez and 27th.

K Ingleside:

The K line runs approximately 2.5 miles from Balboa Park to West Portal Station. The trains operate in mixed traffic from West Portal Station to St. Francis Circle where the LRV's enter an exclusive right of way along Junipero Serra Boulevard to Ocean Ave. The LRV's re-enter mixed flow conditions on Ocean Avenue to the terminal at Balboa Park.

Vehicular traffic can be heavy along West Portal Avenue in both directions from the station to St. Francis Circle. Traffic along Ocean Avenue varies from moderate to heavy. The heaviest areas are between Victoria Avenue and highway 280 and at the approach to Junipero Serra Boulevard.

Stop signs in the commercial district are causing congestion. During peak periods, traffic can back up as far as three blocks.

Double parking is also a concern along the commercial area.

Short Term Solutions:

No schedule adjustments are required.

Improve traffic flow on Ocean Ave by increased enforcement of double parking in the commercial area.

Enforce the "No Left Turn" signs at Harold and at Lee Avenues.

Increase the green light for the left turn from Northbound Junipero Serra to Westbound Sloat. This would encourage drivers heading toward the Sunset District to use Sloat and 19th instead of using West Portal and then turning onto 14th or 15th.

Long Term Solutions:

Upgrade stop sign controlled intersections to signalized intersections.

Install pre-empt detectors that would extend the green turn arrow at Phelan when the LRV is detected. This would clear the turn lane and allow the LRV to proceed through the intersection.

L Taraval:

The L line runs approximately 3 miles from West Portal Station to the terminal at 46th and Wawona. The line runs generally through residential areas with the exception of a commercial area between 15th and 35th.

Traffic can be moderate to heavy at peak times as this street provides a direct connection to the West side of the city via Dewey Boulevard/Woodside Ave and 7th/Lincoln Way. Once past Sunset, traffic diminishes significantly.

The vast majority of intersections are controlled by 4 way stop signs; signals are installed at Sunset and also at 19th Ave.

Short Term Solutions:

The Schedules Department will add 2 mins. to the running time inbound between 46th and West Portal Station. This will be implemented in the next sign up in June 2006.

Long Term Solutions:

The Department of Public Works plans to resurface Taraval Street within the next five years. The MTA will take advantage of this to look at stop spacing.

Upgrading 4 way stops to signalized intersections.

Install LRV pre-empt detectors at 19th and Sunset.

M Oceanview:

From West Portal Station the M line proceeds Southwest along West Portal Ave crosses St. Francis Circle and enters an exclusive right of way. It then stops at Ocean Ave, a commercial area near 19th Ave. The train continues to the next stop at Eucalyptus Drive. This is a major passenger stop for Lowell High School, Lakeshore Elementary, Mercy High School. The next stops on the right of way in the middle of 19th Ave are Stonestown and San Francisco State. The train continues along the right of way until it re-enters mixed flow traffic at Junipero Serra and then proceeds through a mostly residential neighborhood along Randolph and Broad streets to San Jose Ave, where it terminates at the Metro Geneva Terminal.

Short Term Solutions:

Add an additional 8 mins. in running time round trip. To maintain the current headway, it may be necessary to add one additional run to the schedule.

Increase enforcement of "Keep Clear" areas on 19th Ave that block LRV's from entering the right of way.

Consider changing stops at Eucalyptus and Ocean to far side stops.

Long Term Solutions:

Consider MUNI-actuated train crossing signals at Eucalyptus and Ocean stops, and installing stop signs for cross traffic.

LRV pre-empt detector at St Francis Circle.

N Judah:

From Church and Duboce, the N line runs approximately 4 miles to La Playa Loop. The train enters Sunset Tunnel for approximately 1 mile where it re-enters mixed flow traffic at Carl and Cole Streets and continues in mixed flow until Judah and 9th to 19th Ave. where there is a raised track bed for LRV traffic.

Short Term Solutions:

Increase stop spacing where appropriate.

Add two minutes of running time inbound to the schedule.

DPT to adjust pre-empt detectors at 6th Ave.

Move stops at 40th, 31st and 22nd inbound to near side stops. Currently LRVs stop at the stop sign and then stop at the far side for passenger loading/unloading.

Long Term Solutions:

Add signal priority at 7th and Irving and at Carl and Stanyan.

Signalization of selected intersections that are currently four way stops. Examples include 4th, 10th, Funston, 25th 34th.

Next Steps:

The benefits of the recent reorganization which merged Muni Operations and Maintenance will assist in improved service delivery for both bus and rail.

Combining Street Operations, Central Control and Dispatch into one unit will improve the dynamic management of service delivery.

Continue to improve the relationship between Muni and DPT staff.

Hire four summer interns to measure and conceive new service models.

Improve schedules line by line after we have simulated the effects of the changes.

Improve schedules starting with the poorest performers and on lines with long headways.

Develop an On Time Performance Task Force who will solicit input from diverse units throughout the Agency, as well as stakeholders and interested community groups.

MEMORANDUM

To: Fred Stephens
General Manager, MUNI

From: Bond M. Yee
Acting Executive Director, DPT

Re: Light Rail On-Time Performance Studies

Date: April 14, 2006

In conjunction with your on-going operational studies of on-time performance for the J, K, L, M, and N Lines, my staff has for the past four weeks conducted extensive observations along each route between the Metro tunnel entrances and their terminals. Our goal was to identify any traffic and/or parking conditions that would impede the progress of the trains or result in variations in on-time performance other than the normal day-to-day variances. With our attached report we've included both short term and longer term recommendations for improvements, and included order-of-magnitude costs for the longer term improvements where possible.

Participants in the study were:

J Line—Manito Velasco
K Line—Philip Louie
L Line—Bond Yee
M Line—Sam Fielding
N Line—Dan Provence

Our observations and analysis included numerous ride-alongs on the trains, driving observations, and interviews with train operators. One common, recurring theme that runs across all five lines is the reliability of the doors. Malfunctioning doors resulted in quite a few delays or trains being pulled out of service. We would suggest that a more vigorous preventive maintenance program to give this area some special attention.

We are pleased to be able to participate in this joint MTA effort to improve MUNI Light Rail service, and stand ready to implement the short term changes as soon as possible. We would be glad to sit down with your staff and go over our results as well as the short and longer term recommendations.

On Time Performance Study J-Church Line

Purpose

The purpose of this study is to examine and evaluate the traffic and parking conditions along the J-Church line, between the Balboa Park Station and the Duboce Avenue and Church Street entrance to determine if these are factors impinging on the travel time and reliability of this line. If so, specific short and longer term improvements are recommended to mitigate these impacts.

Setting

The J-Line runs about three miles between the two station points. Although it operates for the most part in mixed flow traffic on City streets, there are a few short segments where it is on exclusive right of way.

From the Balboa Park Station, it travels in the center lane of San Jose Avenue from Ocean Avenue to Tingley Streets. In this first mile of track, there are only two signalized intersections at Ocean Avenue and at Santa Rosa Avenue. There are no STOP signs stopping San Jose Avenue along this segment which makes for a relatively smooth journey. These favorable traffic control conditions along San Jose Avenue are also the same reasons we have received a number of STOP sign requests in the past to slow traffic down. We have been able to recommend against additional STOP signs to date.

Just north of Tingley Street, it enters the exclusive right-of-way along the San Jose Avenue Bernal Cut section until the intersection at Randall Street. There is a transit pre-emption feature at the Randall Street and at the downstream 30th Street intersection to enable the streetcar to move ahead of the northbound San Jose Avenue vehicular movement to its right. At the 30th Street intersection it turns left, continues across Dolores Street and makes a right turn again on Church Street.

Church Street is of mixed commercial and residential use in this area. Between 22nd and 18th Streets, the streetcar leaves the City street grid and enters exclusive right-of-way in between residential lots. There are all-way STOPs at the intersections with the cross streets along the way. North of 18th Street are the signalized intersections of 17th, 16th, 15th and 14th/Market Streets, before the Church/Duboce entry into the subway. There are transit pre-emption features at 18th, 17th and 15th Streets, all working well as designed. The 14th, Church and Market Street intersection is the obvious bottleneck, as it has been for the last several years.

Observations:

1. For the most part, the J line travels smoothly with the exception of a couple of locations mentioned below.
2. The streetcar ends up waiting close to two minutes at SJ and Randall before getting its green signal
3. The streetcar sometimes gets stuck at SJ and 30th either because it missed its green signal or the traffic on westbound 30th hasn't cleared yet.
4. There are 5 intersections in a row on lower Church Street where there are 4-way STOPS on consecutive short blocks (25th, Clipper, 26th, Cesar Chavez and 27th)
5. Right of way at 20th and Church Streets can be improved by replacing the all-way STOP with a signal with transit preemption
6. Illegal parking around clearance zones, particularly at 30th and Church Streets, can impede streetcars even momentarily

Possible Improvements

Short Term:

1. Implement a more aggressive pre-emption scheme for northbound streetcars at SJ and Randall, within the limitations of the existing LMD40 signal controller. The Signal Shop believes this change would be relatively difficult, but not impossible, to undertake. A new controller would be desirable (see long term improvement).
2. Retime the signal at 30th/Dolores to give more green time to 30th Street (J-line).
3. Move streetcar stop on 30th/Dolores farside to allow the streetcar to continue across the intersection and minimize instances of getting stuck within the intersection

Long Term:

1. Upgrade the signal controller at SJ and Randall to allow for more sophisticated and efficient pre-emption schemes (\$20,000)
2. Install a switch/presence detector to help the streetcar turn left onto 30th, if it somehow missed its green (\$15,000)
3. Consider signalizing the six all-way STOPS on Church Street namely 20th, 25th, Clipper, 26th, Cesar Chavez and 27th intersections (six signals at \$150,000 each or \$900,000)
4. Consider constructing sidewalk bulb-outs at the 2-way STOP control intersections on lower Church Street and on San Jose Avenue to improve pedestrian crossings and visibility for traffic from the side streets. This should also help pre-empt requests for additional STOP signs. (ten bulb-outs at \$50,000 each or \$500,000)
5. Build out the sidewalk at the NE corner of 30th and Church Street to encompass the striped clearance area for the streetcar and prevent people from stopping there illegally (\$50,000)

On Time Performance Study K-Ingleside Line

Purpose

The purpose of this study is to examine and evaluate the traffic and parking conditions along the K-Ingleside Line, between the West Portal Station and the terminal at Balboa Park Station, to determine if these are factors impinging on the travel time and reliability of this line. If so, specific short and longer term improvements are recommended to mitigate these impacts.

Setting

From West Portal Station, the K Line runs about 2-3 miles south on West Portal Avenue, then south on Junipero Serra Boulevard and finally east onto Ocean Avenue to its terminal at Balboa Park Station. These streets have a combination of residential and commercial areas along with tree-lined arterial streets. The residential sections run on Ocean Avenue between Paloma Avenue and Manor Drive and between Phelan Avenue and Howth Street. The commercial sections are split up in 3 sections: West Portal Avenue between Ulloa Street and Saint Francis Circle, Ocean Avenue between Junipero Serra Boulevard and Paloma Avenue, and Ocean Avenue between Manor Drive and Phelan Avenue.

All-way STOP controlled intersections are located on West Portal Avenue at 14th and 15th Avenues, and on Ocean Avenue at Ashton and Capitol Avenues. Traffic signals are located at West Portal Avenue at Vicente Street, at Saint Francis Circle, at Junipero Serra Boulevard and Ocean Avenue, and finally on Ocean Avenue at San Fernando Way, San Leandro Way, Aptos Avenue, West Gate/Cerritos Avenue, Victoria Street, Jules Street/Dorado Terrace, Faxon Avenue, Miramar Avenue, Plymouth Avenue, Brighton Avenue, Lee Avenue, Phelan/Geneva Avenue, Howth Street and the northbound Interstate 280 freeway on-ramp/Balboa Park MUNI LRV entrance/exit. Light rail stops are generally every 2-4 blocks; however, many of the blocks are quite short or offset between the north and south legs. The stops generally coincide with the signal locations and all-way STOPs and are on the nearside. Muni has several "key stop" locations where regular loading platforms and high level platforms for disabled access have been constructed. They are located at Saint Francis Circle, Junipero Serra Boulevard at Ocean Avenue, Ocean Avenue at Jules Avenue/Dorado Terrace, Ocean Avenue at Lee Avenue and the City College Station.

Vehicular traffic on Ocean and West Portal Avenues is moderate with heavier spurts during peak hours. Ocean Avenue provides a crosstown connection route between the west side of the city (via Sloat/Junipero Serra Boulevard) and the east side of the city via (Geneva Avenue), and Downtown San Francisco and the

East Bay and Peninsula communities (via Interstate 280). The heaviest areas on Ocean Avenue are between Victoria Avenue and Interstate 280, and at the approach to Junipero Serra Boulevard. The K line has an exclusive right of way along Junipero Serra Boulevard, so vehicular traffic does not affect the performance here. West Portal Avenue vehicular traffic can get busy with drivers turning left onto 14th and 15th Avenues. This is another route for drivers coming from the east and south sides of the city to reach the Sunset District.

Ocean Avenue was reconstructed in 2000-2002 as part of the trackway replacement project. The street was beautified and improved for all traffic modes with the installation of sidewalk bulb-outs, improved traffic signals, improved street lighting and major reconstruction of the sidewalks and pavement.

Observations

1. A delay occurs at the West Portal entrance to the Twin Peaks Tunnel when the K, L and M lines all meet at the same time to enter the subway.
2. LRV doors sometimes do not close properly. Like the N-Line, this causes delays as the drivers try multiple times to close the doors or they give up and disable the broken door. Also, one or two drivers like to start accelerating the train before the doors completely close. This may or may not contribute to the door problem.
3. Bunching of K line LRVs seem to happen occasionally.
4. STOP signs on Ocean Avenue in the commercial district are causing congestion that can lead to backups to 2 to 3 blocks. This is aggravated by people double parking in the right travel lane. Sometimes, double parkers will park half on the sidewalk bulb-outs and half on the street. This creates an uncomfortable situation and delays where the LRV and cars in both lanes have to decide if they can squeeze side-by-side or one after the other.
5. Dialysis Center double parking continues to be a problem. When the paratransit vehicles block the entire roadway, drivers get stuck and can't get out due to the platform and sidewalk. Drivers have tried backing out of the trapped area which startles drivers and forces other drivers to the track lane where they queue up and force LRVs to make sudden stops, or they must queue up behind the line of cars. Combined with the double parking in the commercial area and the STOP sign at Capitol Avenue results in congestion that backs up for blocks.
6. A signal preemption scheme at the Phelan/Geneva intersection could help during peak times.
7. Drivers make illegal left turns at Lee and Harold Avenues to bypass the left turn at Brighton Avenue which can back up.
8. LRVs must stop twice on Junipero Serra Boulevard because of the two track switches in one block.
9. Left turning vehicles sometimes causes delays at several locations where the left lane shares the right of way with LRV vehicles. Westbound

Ocean Avenue at Brighton and Plymouth Avenues are spots where there are a number of left turning vehicles. Sometimes, when many drivers are making a left turn at Brighton Avenue, other drivers waiting behind them will pass them and instead, make the left turn at Plymouth Avenue where the 29-Sunset line also makes a left turn. Another intersection where this happens is on West Portal Avenue at 14th and 15th Avenues. A line of cars on northbound West Portal Avenue waiting to make a left turn onto northbound 14th and 15th Avenues causes LRVs to be delayed as each car must take their turn at this all-way STOP. Drivers use this as a shortcut instead of turning left from northbound Junipero Serra Boulevard to westbound Sloat Boulevard to get to the Sunset District.

10. The short platform at Cerritos Avenue confuses LRV drivers where to stop.
11. Drivers encroach onto the LRV right of way on the westbound approach of Ocean Avenue to Junipero Serra Boulevard. This may be due to sloppy driving by drivers who don't want to stay in the center of the lane.

Possible Improvements

Short Term:

4. Better coordination between trains so that they don't bunch up at the West Portal subway entrance or elsewhere.
5. More preventative maintenance should improve the delays caused by door malfunctions.
6. Enforcement of double parking and various short-term parking zones in the commercial area and in front of the Dialysis Center where cars become trapped.
7. Explore additional blue zones near the Dialysis Center. There was one on the north side of Ocean Avenue west of Dorado Terrace that was not restored after the track reconstruction project. See if restoring this will help the Dialysis Center double parking situation.
8. Enforce illegal left turns at Lee and Harold Avenues. No physical barriers can be installed here as there are buses and fire trucks making turns at both of these intersections.
9. Increase green time for the left turn movement from northbound Junipero Serra Boulevard to westbound Sloat Boulevard. This would encourage drivers heading toward the Sunset District to use Sloat Boulevard and 19th Avenue instead of using West Portal Avenue and then turning left onto 14th and 15th Avenues. When drivers use West Portal Avenue instead of Sloat Boulevard, they take over the track lane which causes delays for both the K and M lines.
10. Restripe to narrow the lanes down on the westbound approach of Ocean Avenue to Junipero Serra Boulevard to discourage sloppy drivers from encroaching onto the LRV right of way.

Long Term:

1. Upgrade STOP controlled intersections with signals. This will reduce delays caused by cars stopping for nothing, and alleviate some of the delays caused by double parking (\$300,000 for two intersections).
2. Shorten handicap boarding platform at Faxon so that drivers don't get trapped. This, along with removing STOP signs, will make drivers more predictable in their movements to avoid the double parked cars. This would reduce the sudden stops by vehicles cutting into the track lane at the last minute.
3. Create a pre-emption scheme that will allow westbound LRVs to go through the westbound Geneva spur intersection first before other vehicles. Extend the green arrow at Phelan when an LRV is detected so that the left turn pocket is flushed out faster .
4. Remove the temporary track switch on Junipero Serra Boulevard near St Francis Circle. It's not needed anymore. LRVs can switch at the new permanent track switch near Ocean Avenue.
5. Continue monitoring left turn movements at Brighton Avenue and Dorado Terrace. They have not met warrants recently, but have a history of large left turn movements. The signals should be modified when warrants are satisfied.
6. LRV drivers do not know where to stop at Cerritos Avenue as the platform does not extend to the crosswalk. Extend the platform so that it reaches the crosswalk. This will give the LRV drivers a clear point to stop. Currently, they sometimes stop and then creep up to the platform.
7. Consider signaling the intersection of 15th and West Portal Avenues. This may not help the situation as it may attract more vehicles to this turn movement. It may be better to increase the green time and actuate the left turn from northbound Junipero Serra Boulevard to westbound Sloat Boulevard to attract drivers to stay on the arterials than on transit preferential and residential streets. The green time should be extended until the left turn pocket clears. To offset the potential increase in LRV delay with this green extension, the pre-emption should be improved so that it can be activated after whatever phase the signal is in (if possible).

On Time Performance Study L-Taraval Line

Purpose

The purpose of this study is to examine and evaluate the traffic and parking conditions along the L-Taraval Line, between the West Portal Station and the terminal at 46th Avenue and Wawona Street, to determine if these are factors impinging on the travel time and reliability of this line. If so, specific short and longer term improvements are recommended to mitigate these impacts.

Setting

West of Twin Peaks Tunnel the L Line runs about three miles through generally residential streets between West Portal Station and the terminal at 46th Avenue and Wawona Street. There is a section of commercial activity on Taraval between 15th and 35th Avenues.

All-way STOP controlled intersections are located on Ulloa at West Portal, 14th, and 15th; on Taraval at 15th, 17th, 22nd, 24th, 26th, 28th, 30th, 32nd, 35th, 40th, 42nd, 46th; and on Vicente at 46th and 47th. Traffic signals are located on Taraval and 19th Avenue, and Taraval and Sunset Boulevard. Light rail stops are generally every two blocks, coinciding with the signal locations and all-way STOPs and on the nearside. Muni has two “key stop” locations, on Taraval at 22nd Avenue and at Sunset Boulevard where regular loading platforms and high level platforms for disabled access have been constructed. Regular loading platforms at these two locations are nearside, with the exception of the eastbound platform at 22nd Avenue, which is on the farside.

Vehicular traffic on Taraval is moderate, since it provides a direct connection to the west side of the city via Dewey Boulevard/Woodside Avenue and 7th Avenue/Lincoln Way, both crosstown routes. Traffic diminishes gradually as one heads west. Past Sunset Boulevard, the street takes on the characteristics of a neighborhood residential street.

On the north and south sides of Ulloa west of West Portal Avenue, we have previously intalled tow-away no stopping 7-10 am and 3-7 pm Monday through Friday. This is to allow the #48 buses and L streetcars to get through by preventing double parking on the short block between West Portal and Lenox. Even though cars start to park at the curb during the tail ends of the tow-away times, there is little or no double parking taking place, so the regulation is serving its intended purpose.

Observations

1. There does not appear to be any traffic controls along this corridor that result in significant day-to-day fluctuations in transit travel times. These controls have been in place for some time, and scheduling should realistically reflect their existence.
2. The car stop spacing appears optimum. They are located generally every two blocks and on the nearsides of all-way STOPS. There is some discussion that as part of the Transit Efficiency Project, the stop spacing will be re-evaluated, and perhaps lengthened to every three blocks. Such a move may be counterproductive. The relocated stops would probably necessitate new all-way STOP control. Existing all-way STOPS that no longer serve car stops would not likely to be removed due to safety and liability concerns. They were originally installed due to the significant presence of pedestrians in this corridor.
3. Transit priority for the two signals does not appear feasible. At Sunset Boulevard, the car stops are part of a systemwide "key stop." Low level platforms are located on the nearside. Taraval traffic already currently gets about 40% of the signal green time. Any priority here would mean holding the green for Taraval until the light rail vehicle passes. This would result in a significant interruption of Sunset Boulevard flow, which carries the #29 bus line. The same applies to 19th Avenue, to an even greater degree. The flag stops are nearside, and providing transit priority would pose serious operational concerns. Moving the stops to the farside would pose safety problems, as motorists may be approaching, on a green light, a stopped light rail vehicle picking up and discharging passengers on the farside. Transit priority here would also seriously impact flow on 19th Avenue, a convention State highway that carries over 80,000 vehicles a day (over four times more than Taraval but gets only two-thirds of the green signal time) as well as the heavily used #28 and 28L bus line.
4. Signalizing Taraval and 22nd to reduce potential transit delay may not be desirable. This is currently a "key stop" with all-way STOP control, and is located among several large generators of foot traffic (eg, park, library, Walgreens, fastfood outlet.) The inbound low level platform island on the farside has been struck repeatedly since it was constructed, in spite of striping and delineation improvements. We have recently installed a flashing red beacon facing this direction of traffic to better delineate the edge of the island and railing. A new signal here under these circumstances may not improve safety, as half the time drivers on Taraval will be passing through on a green light. In the hierarchy of traffic controls, an all-way STOP is the most positive form of control, as everyone is required to come to a complete stop first before proceeding.
5. At the West Portal station approach, the delays are due to scheduling and convergence and queueing of L, K, and M vehicles. The peak period tow-

away zones on Ulloa between West Portal and Lenox serve their purpose of minimizing double parking and allowing the L vehicles to pass through.

6. There are very few instances of double parking observed along the commercial sections, so additional loading zones or enforcement does not appear to be a priority.

Short Term Recommendations

1. Repaint the car clearance red curbs where the L vehicles turn, on Ulloa at 15th and on Taraval at 15th. Install new clearance red curbs where the inbound L turns on 46th at Taraval and where the outbound L turns on 46th at Vicente. This would minimize the possibility of a parked vehicle blocking the progress of a light rail vehicle.

Longer Term Recommendations

1. DPW plans to resurface Taraval Street as part of its five-year plan. Other entities will be upgrading their infrastructure taking advantage of the window of opportunity for coordination. The MTA's Livable Streets group also has plans to develop traffic plans for this arterial street corridor within the five-year horizon. Perhaps intersection corner bulbs and safety loading islands at selected car stops can be added to the mix of potential improvements. These changes would certainly have a beneficial impact on traffic and pedestrian safety, and may also result in some ancillary benefits in transit operational performance.
2. In the 1970s a package of transit improvements including an exclusive right-of-way portion east of 19th Avenue and "Left Lane for Transit and Left Turns Only" for west of 19th Avenue was proposed for both Judah and Taraval Streets. Judah improvements received consensus support by residents and businesses and were thus implemented. The proposed changes on Taraval were not supported. With the Transit Efficiency Project, these improvements should be revisited. These changes would improve reliability and travel times.

On Time Performance Study M-Ocean View Line

Purpose

The purpose of this study is to examine and evaluate the traffic and parking conditions along the M-Ocean View Line, between West Portal Station and the terminal at Balboa Park Station, to determine if these are factors impinging on the travel time and reliability of this line. If so, specific short and longer term improvements are recommended to mitigate these impacts.

Setting

West of the Twin Peaks Tunnel, the M-Line proceeds southwest along West Portal Avenue, a moderately dense commercial street with angled parking and a mixture of commercial businesses including restaurants, banks, movies theater, book store, etc. The line then crosses the St. Francis Circle intersection and enters an exclusive right-of-way. It then stops at Ocean Avenue, a commercial cross-street, near 19th Avenue. The next stop is at Eucalyptus Drive which is a drop off point for many school students heading to Lowell High School, Lakeshore Elementary School, Saint Stephens Elementary and Mercy High School. The next stops are Stonestown Mall and San Francisco State University. After these stops the M-Line follows 19th Ave until it leaves the exclusive right-of-way at Junipero Serra Boulevard. The route through the Oceanside neighborhood streets from Randolph to Broad Streets to San Jose Ave until the end of the line at Balboa Station is mostly residential with light traffic volumes.

All-way STOP controlled intersections are located on West Portal at Ulloa, 14th Avenue, 15th Avenue, Ocean Avenue, Eucalyptus Street; on Randolph Street at Arch, Ramsell and Victoria Streets; on Broad Street at Capitol, Plymouth and Farragut Avenues; and on San Jose Avenue at Niagara Street

Traffic signals are located on West Portal Avenue at Vicente Street, St. Francis Circle, Rossmoor Drive; on 19th Avenue at Winston Drive, Holloway Avenue, Crespi Drive and Junipero Serra Boulevard

Observations

1. There does not appear to be any traffic controls along this corridor that result in significant day-to-day fluctuations in transit travel time. Some delay occurs to the complex signal timing and traffic patterns that the 5-legged intersection of St. Francis Circle. MUNI plans on making major improvements to this intersection including adding a central boarding

- island on West Portal, new ADA curb ramps, repainting crosswalks for shorter crossing distances and installing pedestrian signals.
2. The car stop spacing appears satisfactory. They are located generally every two blocks and on the nearsides of all-way STOPS.
 3. Comments from an interview with an M-Line operator were that there was very little on surface delay due to traffic conditions. Most delays, according to the operator were due to delays in the Market Street underground system, broken train doors and other car equipment problems.

Short Term Recommendations

1. Upgrade the train crossing where MUNI crosses over 19th Avenue between Stonestown stop and Eucalyptus at Rossmoor (Investigate providing train pre-emptive feature and using TPS funds for the upgrade). Consider more enforcement of KEEP CLEAR areas on 19th Avenue, as cars often do block the trains from crossing onto the 19th Avenue median causing delays. Also, pursue the abandonment of the mid block signal and pedestrian crossing at Mercy High School and installing median fencing.
2. M-Line Stops at Eucalyptus and Ocean: two options
 - A. Consider changing M-Line stops at Eucalyptus Drive and Ocean Avenue from near side to far side stops. This will allow the M-Line to clear the STOP signs before letting off passengers and decrease delay from cars crossing and/or queuing in front of the trains on Eucalyptus Drive.
 - B. Consider installing MUNI actuated train crossing signals at Eucalyptus and Ocean where M-Line tracks cross. Consider using flashing red-solid red signals.
2. Evaluate all STOP sign controls along the M-Line route, especially between St. Francis Circle and West Portal tunnel. Consider converting the existing STOP controls to actuated flashing red-solid red signals. This should reduce congestion and queuing that hold up MUNI trains and should improve MUNI on-time performance.
3. Evaluate whether installing a signal at the intersection of West Portal and Ulloa would improve the function of the intersection for traffic and pedestrians and improve on-time performance for MUNI. It is possible MUNI Metro delays at this intersection are more related to underground MUNI operations and a signal would not provide any benefit.

4. Invest in new LRV's and replacement parts to reduce delays caused by doors that do not shut or other equipment maintenance problems on MUNI Metro that cause delays.

Long-Term Recommendations

1. Add more LRV's to the M-Line, 3 to 4 cars versus the existing 2 car configuration. An interview with an M-Line operator revealed that he believed that most delays are caused by in tunnel delays/congestion, car passenger overcrowding, broken doors, NOT surface delay. The Market Street MUNI Metro corridor is often overloaded during peak morning and evening commute hours, (8:00-9:00AM and 5:00-6:00PM) primarily between Castro station and downtown stations. These delays occur as passengers hold doors open trying to squeeze in more passengers into overcrowded cars. This is particularly a problem with the M and K lines. MUNI needs to invest in more MUNI cars to increase passenger capacity in this corridor. MUNI should add more Castro Shuttles (downtown to Castro station) and add a third or fourth car to both the M and K lines. The N and L lines are also sometimes crowded during peak hours but less than the M and K lines.

On Time Performance Study N-Judah Line

Purpose

The purpose of this study is to examine and evaluate the traffic and parking conditions along the N-Judah Line, between the tunnel at Church Street and Duboce Avenue and the terminal at Lower Great Highway and Judah Street, to determine if there are factors impinging on the travel time and reliability of this line. If so, specific short and longer term improvements are recommended to mitigate these impacts.

Setting

West of the Market Street Subway, the N Line runs about four miles to Ocean Beach. It runs through a tunnel for about a mile and through City streets of mixed residential and commercial activities for the remaining 3 miles. On the City streets, the N shares the roadway with automobiles except for a section of Judah between 9th and 19th Avenues, where there is a raised track specifically for the N.

All-way STOP controlled intersections are located on Judah Street at 48th, 46th, 43rd, 41st, 40th, 34th, 31st, 30th, 28th, 25th, 23rd, 22nd, 18th, Funston, 12th, 10th, 4th, 2nd Avenues; on Carl and Cole Streets; and on Duboce Avenue at Steiner and Church Streets. Traffic signals are located on Judah Street and Sunset Boulevard, Judah Street and 19th Avenue, and Judah Street and 9th Avenue; on Irving Street at 9th, 7th, and 6th Avenues; on Carl and Stanyan Streets. Light rail stops are spaced between one and four blocks, and are a mixture of near and far side stops. There are key stop locations, on Judah Street at the Great Highway, Sunset Boulevard, 19th Avenue, 9th Avenue; on Irving Street at 2nd Avenue; on Carl at Cole Street; and on Duboce Avenue at Noe Street where regular loading platforms and high level platforms for disabled access have been constructed. Regular loading platforms at these two locations are near side, with the exception of the eastbound platform at 9th Avenue, and both platforms at 2nd Avenue, which are on the far side.

Vehicular traffic on Judah is low to moderate. Traffic diminishes gradually as one heads west. Past Sunset Boulevard, the street takes on the characteristics of a neighborhood residential street.

Observations

7. The most regular delay on the N line is at the Duboce/Church tunnel entrance, especially in the morning. This problem arises when vehicles

- from the J and N lines merge with vehicles from the K, L and M lines in the subway.
8. Several times the LRV doors do not close properly. The driver often has to try closing the door several times before it will close. Sometimes the driver has to exit the train to attempt a quick repair. When this does not work, passengers must wait for a repair crew to show up. A few times they have been unable to repair the LRV and it must be taken out of service.
 9. The car stop spacing is another source of delay for the N. In one instance, there is only about 310 feet between stops (12th Avenue and Funston). Since a stop is requested only some of the time in this stretch, it is difficult to schedule.
 10. The signal preemption at 6th Avenue seems to be working well. Improvements to the signal at 9th/Irving and 9th/Judah are in progress. There are often delays at 7th/Irving and Stanyan/Carl when a street car stops during a green light and then must wait through an entire red phase.
 11. A few locations have STOP signs followed by far side stops, leading to two stoppages in a very short period (inbound at 40th, 31st, 22nd Aves.).
 12. There are very few instances of double parking observed along the commercial sections, so additional loading zones or enforcement does not appear to be a priority.
 13. If a street car is running behind, a larger number of riders congregate and board the street car, often filling it to capacity. These full street cars continue to make each stop on the line. Boarding becomes slower as people fight their way in and there are increased problems with door blockages. Delays are increased and a trailing car can close the gap between the two street cars. This is mainly an issue in the AM peak, when a majority of riders are going downtown.

Short Term Recommendations

2. More preventative maintenance should improve the delays caused by door malfunctions.
3. The back up at the tunnel entrance could be solved by joining the LRVs in the subway area. The subway platforms are all long enough to accommodate at least four LRVs and the frequency of the morning trains would mean that those boarding in the subway would not have to wait much longer for an LRV. Joining LRVs in the subway should create significant reductions in delays.

4. If a car is full and another is close behind, operators should skip all non-subway stops until a stop is requested.

Longer Term Recommendations

5. Remove some of the transit stops. The bullets below show one possible scenario that removes five stops. This scenario takes into account intersecting Muni routes and existing “key” stops. The longest proposed distance between stops is just over a quarter mile.
 - Combine the stops at 43rd and 40th Avenue to one at 41st Avenue
 - Consolidate the stops at 34th, 31st, 28th, 25th, 23rd (outbound) 22nd (inbound) Avenues to near side stops at 32nd, 28th, and 23rd Avenues.
 - Remove the stop at Funston Avenue
 - Combine the stops at 7th and 4th to one at 5th Avenue.
6. If the above recommendations are considered, further benefit could be found by improving the flow at all-way STOPS that do not have transit stops. These locations include 4th, 10th, Funston, 18th, 22nd, 25th, 30th, 31st, 34th, 40th, and 43rd Avenues. One possibility is installing signals with transit priority (\$150,000 per intersection).
7. Add transit signal priority to signals at 7th/Irving and Carl/Stanyan, converting near side stops to far side stops where possible.
8. Discuss possible durability improvements with the door mechanism manufacturer so there is a better design.
9. Improve boarding time by installing more pre-boarding payment machines at transit stops.