San Francisco County Transportation Authority

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Motor Vehicle Circulation Survey

Purpose

This memorandum summarizes the methodology and results of a motor vehicle circulation survey conducted for Market Street. The intent of the survey was to provide information that can be used to support decisions about whether or not to recommend automobile restrictions as a part of the Market Street Study. Based on results from the survey, several automobile turning restrictions were tested to determine the resulting potential traffic impacts.

Methodology

The following steps were undertaken to develop a reliable vehicle trip origin-destination matrix for Market Street between Van Ness and Steuart Street:

1. The City's 1999 weekday p.m. peak hour Synchro traffic operations model contains intersection turning movement counts for each study intersection along Market Street. Some of the outbound traffic counts from one intersection did not balance with inbound counts to the next intersection due to counts taken on different days, varying one-hour peak periods at adjacent intersections, and other factors. Where appropriate, the turning volumes were manually adjusted to provide a more balanced traffic flow model. In general, when adjustments were made, volumes at lower-volume intersections were increased to balance with adjacent higher-volume intersections. This created a conservatively high estimate of p.m. peak hour traffic volumes along Market Street.
2. Using MUNI bus route and schedule information from published route maps and timetables, the p.m. peak hour bus volumes and turning movements along Market Street were estimated. These volumes and movements were then discounted from the balanced traffic volume Synchro model.
3. Vehicle movements that do not travel on Market Street, but only across Market Street, were then removed from the Synchro model. At this stage, the Synchro model consisted of balanced non-MUNI traffic that travels along one or more blocks of Market Street between Van Ness and Steuart Street.
4. An initial origin-destination matrix was then created that estimated trip origins and destinations via Market Street intersections. This initial matrix was created by first proportionally assigning trips to intersection turning movement volumes, and then by balancing resulting volumes on the segments between intersections. The VISUM travel assignment tool was used as a visual aid to distribute traffic volumes.
5. Next, a vehicle license plate survey was conducted at nine locations along Market Street. The surveys were conducted on Thursday, September 4, 2003 between 3:00 and 6:00 p.m. and did not include MUNI vehicles. Surveyors noted license plate numbers and vehicle colors. The nine locations yielded data for 16 trip pairs.

6. In 1998, the Department of Parking and Traffic conducted a vehicle license plate survey along Market Street. This survey captured different locations than the September 2003 survey. DPT's survey yielded data for an additional 10 trip pairs.
7. The results of both license plate surveys were used to calibrate the travel assignments for the Market Street intersections. As shown in Table 1, the calibrated trip table is generally within three percent of the observed survey results for each of the 25 license plate locations. For example, September 2003 survey results showed that 43 percent of the Market Street traffic traveling inbound through Van Ness Avenue also traveled through 8th Street. The estimated origin-destination table predicted 45 percent. (Note: "Original-straight percentage" origin-destination results are shown in the table. These were the results of the fourth step described above, prior to the model's calibration using actual license plate survey data.)

The weekday p.m. peak hour origin-destination model tracks non-MUNI travel demands along Market Street between Van Ness and Steuart Street. The model consists of an origin-destination matrix, as well as VISUM's graphical interface, which illustrates traffic origins or destinations from or to selected roadway links or movements.

As previously mentioned, the intent of the origin-destination survey and model is to provide information that can be used to support decisions about whether or not to recommend automobile restrictions as a part of the Market Street Study. Restricting specific automobile movements are being considered as a tool to achieve several study goals along a key segment of Market Street (particularly between 1st and 5th Streets), including decreasing transit travel time and improving transit reliability, improving pedestrian circulation and safety, and creating a more inviting street for bicycle travel. Automobile restrictions, which would likely occur during peak traffic periods, could be relatively simple to implement through the use of signing and other techniques.

Automobile restrictions could occur at several locations. For purposes of analysis, the following three potential restricted automobile movements were tested based upon automobile travel patterns and roadway network connectivity and considering Market Street's intersection configurations:

- Requiring eastbound Market Street automobiles approaching 8th Street to turn right,
- Requiring eastbound Market Street automobiles approaching 4th Street to turn right, and
- Requiring southbound Montgomery Street motorists wishing to turn right onto Market Street to proceed straight instead.

The following steps were undertaken to assess the potential traffic impacts associated with these three automobile restriction measures:

1. Based on a preliminary assessment, it was determined that the three intersections that would be the most affected by the turning prohibitions, i.e., their traffic volumes would increase the greatest, are Mission Street at 3rd, 5th, and 8th Streets.
2. To conduct a conservative analysis, no traffic diversion upstream of a turning prohibition was assumed, with the exception of the Montgomery Street scenario. For example, under the scenario where eastbound Market Street automobiles would be required to turn right onto 8th Street, all automobiles currently traveling eastbound along Market Street and traveling through

the 8th Street intersection were assumed to turn right at 8th Street. In other words, it was assumed that motorists would not turn off of Market upstream of 8th Street or use an alternative route. For the Montgomery Street scenario, it was assumed that only 15 percent of the southbound Montgomery Street traffic approaching Market Street (and currently taking a right turn) would divert onto streets north of Market Street. This was also a conservative assumption since it is likely that most of the motorists currently turning right are eventually destined to locations north of Market Street.

3. Redirected traffic was reassigned to the study intersections assuming that 50 percent of the traffic would divert to Mission Street and 50 percent would divert to the Harrison/Folsom Street one-way couplet.

The potential impacts to the study intersections were determined using the Synchro traffic operations model. The model was adjusted to account for downtown-type conditions. For example, lane capacities were reduced to consider such things as narrower streets, smaller turning radii, and general inefficiencies of intersections in central business districts. In addition, high pedestrian volumes were considered for each of the study intersections.

The resulting traffic impacts associated with the identified automobile turning restrictions are discussed in the next section.

Results

The motor vehicle origin-destination model developed for Market Street can be used for a number of purposes. It can estimate the origins and destinations, via Market Street intersections, of vehicles on specific roadway links or movements. Sample output is provided in the three attached figures.

For example, the first figure illustrates the destinations of p.m. peak hour traffic turning right onto Market Street from Montgomery Street. Of the 278 vehicles turning right, 68 vehicles (24%) travel outbound on Market past 8th Street, and 45 vehicles (16%) travel eastbound past Van Ness Avenue.

The second figure shows the origins and destinations of vehicles traveling inbound on Market Street between 8th and 7th Streets. Of the 548 vehicles observed, 266 vehicles (49%) traveled from west of Van Ness Avenue and 87 vehicles (16%) turned right from 9th Street. Most of the inbound traffic between 8th and 7th Street "dissipates" to the east, with most of the traffic turning right at 6th, 5th, and 4th Streets, and only 54 vehicles (10%) traveling to Main Street.

The last figure illustrates inbound traffic between 4th Street and O'Farrell Street. Interestingly, almost one-quarter of the 366 vehicles that travel this segment turn right onto Market Street from 5th Street (88 vehicles, or 24%). The 366 vehicles are then relatively distributed among New Montgomery Street, 2nd Street, 1st Street, Beale Street, and Spear Street.

The auto circulation survey model was used to test various combinations of the following potential automobile turning prohibitions: 1) requiring eastbound Market Street automobiles approaching 8th Street to turn right, 2) requiring eastbound Market Street automobiles approaching 4th Street to turn right, 3) requiring southbound Montgomery Street motorists wishing to turn right onto Market Street to proceed straight instead. The model provided the following results:

- Forcing right-turns at 8th Street would reduce eastbound Market Street traffic volumes between 5th and 4th Streets by 33 percent.
- Requiring right-turns at 4th Street would reduce eastbound Market Street traffic volumes between New Montgomery and 2nd Streets by 30 percent.
- Prohibiting southbound right-turns from Montgomery Street would reduce westbound Market Street traffic volumes by 27 percent between O'Farrell and Stockton Streets.

Using the vehicle trip distribution procedure previously described for the various turning prohibitions studied, p.m. peak hour intersection level-of-service was estimated for the three study intersections. As shown in Table 2, the only study intersection that would degrade to an unacceptable service level is Mission Street and 8th Street. This intersection, which currently operates at LOS C, would worsen to LOS E under the Market Street/8th Street forced right-turn option, but would operate at LOS D or better under both of the other turn prohibition scenarios. However, the Mission Street/8th Street intersection could be improved by adjusting its traffic signal timing (Mission Street currently receives 35 seconds of the 60-second cycle and 8th Street receives the remaining 25 seconds; providing 30 second splits for both phases would result in LOS C operations). Alternatively, removal of parking to create an additional left-turn lane serving eastbound Mission Street could alleviate unacceptable level-of-service conditions.

Table 1. Origin-Destination Survey and Trip Table Results

Inbound Market St. Percentage of Vehicles Observed "From" Survey Locations "To" Survey Locations

Origin	Destination	Survey	Original - Straight Percentages	Calibrated Trip Table
September 2003 Surveys				
Market Thru at Van Ness	Market Thru at 8th	43	46	45
Market Thru at Van Ness	Market Thru at 4th	18	15	21
Market Thru at Van Ness	Market Right at 4th	6	9	5
Market Thru at Van Ness	Market Thru at 1st	9	4	10
Market Thru at Van Ness	Market Right at 1st	5	3	5
Market Thru at 8th	Market Thru at 4th	34	33	33
Market Thru at 8th	Market Right at 4th	16	20	14
Market Thru at 8th	Market Thru at 1st	16	9	17
Market Thru at 8th	Market Right at 1st	8	6	7
5th Street Right onto Market	Market Thru at 4th	45	62	45
5th Street Right onto Market	Market Right at 4th	55	38	52
5th Street Right onto Market	Market Thru at 1st	20	16	20
5th Street Right onto Market	Market Right at 1st	16	11	16
Market Thru at 4th	Market Thru at 1st	36	27	41
Market Thru at 4th	Market Right at 1st	19	17	22
NB Main Street Left onto Market	Market Right at Sutter/Sansome	50	29	50
DPT 1998 Surveys				
O'Farrell Left onto Market	Market Thru at 1st	20	27	20
O'Farrell Left onto Market	Market Right at 1st	18	17	18
O'Farrell Left onto Market	Market Right at 2nd	27	27	27
O'Farrell Left onto Market	Market Right at New Montgomery	35	30	36
Montgomery/Post Left onto Market	Market Thru at 1st	28	38	28
Montgomery/Post Left onto Market	Market Right at 1st	20	25	20
3rd Street Right onto Market	Market Thru at 1st	21	27	20
3rd Street Right onto Market	Market Right at 1st	14	17	15
3rd Street Right onto Market	Market Right at 2nd	29	27	29
3rd Street Right onto Market	Market Right at New Montgomery	36	29	37

Inbound Market St. Percentage of Vehicles Observed "To" Survey Locations "From" Survey Locations

Origin	Destination	Survey	Original - Straight Percentages	Calibrated Trip Table
September 2003 Surveys				
Market Thru at Van Ness	Market Thru at 8th	57	56	55
Market Thru at Van Ness	Market Thru at 4th	27	24	32
Market Thru at Van Ness	Market Right at 4th	14	24	13
Market Thru at Van Ness	Market Thru at 1st	13	5	13
Market Thru at Van Ness	Market Right at 1st	12	5	10
Market Thru at 8th	Market Thru at 4th	38	42	42
Market Thru at 8th	Market Right at 4th	28	42	30
Market Thru at 8th	Market Thru at 1st	19	9	17
Market Thru at 8th	Market Right at 1st	15	9	12
5th Street Right onto Market	Market Thru at 4th	23	32	23
5th Street Right onto Market	Market Right at 4th	42	32	43
5th Street Right onto Market	Market Thru at 1st	10	7	8
5th Street Right onto Market	Market Right at 1st	13	7	10
Market Thru at 4th	Market Thru at 1st	38	22	33
Market Thru at 4th	Market Right at 1st	31	22	28
NB Main Street Left onto Market	Market Right at Sutter/Sansome	45	26	45

Note: Survey percentages that did not total 100% due to rounding or other causes were adjusted in this spreadsheet for comparison

Number of Vehicles Driving on Market Street During PM Peak Hour	5794
Number of Vehicles Crossing Market Street SB During PM Peak Hour	9664
Number of Vehicles Crossing Market Street NB During PM Peak Hour	11286
Total Number of Vehicles Crossing Market Street	20950
Total Number of Vehicles Using (Crossing and Driving on) Market Street	26744
Percentage of "Users" who Drive on Market	22%

Table 2. Vehicle Trip Diversion Results

Intersection	Existing		4th St. RT Only		8th St. RT Only		4th & 8th St. RT		Montgomery no SB RT		All 3 Diversions	
	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS
8th / Mission	34.4	C	35.5	D	68.1	E	69.2	E	34.5	C	68.9	E
8th / Mission (Mitigated)	N/A	N/A	N/A	N/A	23.8	C	24.2	C	N/A	N/A	24.2	C
5th / Mission	47.2	D	44.4	D	37.8	D	34.8	C	53.6	D	40.0	D
3rd / Mission	27.2	C	27.6	C	27.7	C	27.9	C	34.3	C	35.3	D
EB Mission Avg. Travel Speed	9.8	D	9.3	D	9.5	D	9.2	D	9.8	D	9.1	D
WB Mission Avg. Travel Speed	9.5	D	9.7	D	9.5	D	9.5	D	9.2	D	9.2	D

VISUM 8.03 PTV AG	Operator: Fehr & Peers	MarketPM
Date: 10/27/03	OD Distribution for All Traffic Turning Right onto WB Market from SB Montgomery	1 : 1082

VISUM 8.03 PTV AG	Operator: Fehr & Peers	MarketPM
Date: 10/27/03	OD Distribution for All Traffic Using EB Market St. Between 8th & 7th Streets	1 : 1082

VISUM 8.03 PTV AG	Operator: Fehr & Peers	MarketPM
Date: 10/27/03	OD Distribution for All Traffic Using EB Market St. Between 4th & O'Farrell	1 : 1082