

## **Measure 2: General Purpose Traffic Operations**

### **Monitoring Objectives**

The City of Seattle measured downtown traffic conditions before and during tunnel closure and after tunnel re-opening to assess the impacts of tunnel closure on general purpose traffic operations. Where problems were observed, data was used to help identify corrective actions.

Traffic data were collected in January 2005 (before tunnel closure), October 2005 and May 2006 (during tunnel closure), and October/November 2007 (after tunnel re-opening). This chapter highlights key observations on general purpose traffic operations and summarizes the data collected.

### **Methodology**

The City of Seattle collected three sets of data to evaluate the effect of tunnel closure on downtown traffic operations:

1. **Travel time studies:** The City of Seattle conducted studies to assess changes in travel time for general traffic on key downtown corridor segments on First Avenue, Second Avenue, Fourth Avenue, Fifth Avenue, Stewart Street, Olive Way, Pike Street, Spring Street and Cherry Street. The City used a “floating car” travel time method, in which a probe car is driven along each route and the driver records the time it takes to traverse the route moving within the flow of general traffic. Data was collected during the AM peak period (7-9 AM), mid-day or off-peak period (1-3 PM), and PM peak period (4-6 PM). In most cases, the reported travel times are the average of 5-10 travel time “runs” by a single car during each time period on a single day and may reflect unique traffic conditions.
2. **Traffic volume (“tube”) counts:** The City of Seattle collected traffic volume data at selected locations through downtown using pneumatic tubes. These automated counting machines typically count all vehicles at each location for a full week, and data are summarized to provide hourly and daily directional volumes. Key measures reported in this chapter are Average Weekday Daily Traffic based on 5 weekdays (AWDT) and AWDT PM Peak Hour volume based on the highest volume weekday PM hour at each location. During the 2007 data collection, pneumatic tubes were damaged at the following locations, and no data are available for this report: Second/Pike, Second/Pine, Sixth/University, Spring/Third, and University/Third.
3. **Turning movement counts:** The City of Seattle counted turning movements at 23 intersections. Data gatherers directly observe and record traffic and turning movement activity for one hour during the AM peak period, mid-day or off-peak period, and PM peak period. As with the travel time studies, these data are typically collected on a single day and may reflect unique traffic conditions. Turning movement counts are usually used to troubleshoot and resolve traffic problems observed in the field (rather than to identify traffic problems).

### **Key Observations**

Traffic operations data collected before, during, and after tunnel closure are summarized at the end of this chapter. Key observations are summarized below.

#### Downtown Travel Times

During the AM peak period:

- Travel times on northbound and southbound First Avenue and eastbound Spring Street increased after tunnel re-opening, but are less than pre-tunnel closure travel times.

- Travel times on eastbound Olive Way, which decreased substantially after tunnel closure, continued to increase and are now approaching pre-tunnel closure levels.
- Travel times decreased after tunnel re-opening on northbound Fourth Avenue, southbound Fifth Avenue, westbound Stewart Street, and eastbound Cherry Street.

During the mid-day or off-peak period:

- Travel times increased on northbound Fourth Avenue and southbound Fifth Avenue.
- Travel times on most other corridors have decreased or have remained at or near pre-tunnel closure levels.

During the PM peak period:

- Travel times increased substantially on northbound Fourth Avenue between Royal Brougham Way and South Washington Street, and between James Street and Olive Way. On the day that travel times were collected on this corridor, travel times were significantly higher after 5:15 PM; travel times earlier in the PM peak were closer to earlier studies. This increase may be a function of the specific days the survey was conducted.
- Travel times increased substantially on eastbound Spring Street. The City recently adjusted parking restrictions on Spring Street that may have contributed to this congestion.
- Travel times on southbound Second Avenue remained well below pre-tunnel closure levels, and travel times decreased substantially on eastbound Cherry Street.

#### Traffic Volumes and Turning Movements

- PM peak and daily traffic volumes on northbound and southbound Third Avenue decreased at all locations from pre-tunnel closure levels due to peak period traffic restrictions on Third.
- Decreased traffic volumes on Third Avenue were not clearly reflected as increased traffic volumes on other corridors. In fact, PM peak volumes decreased by more than 100 vehicles per hour on southbound Second Avenue and northbound Fourth Avenue.
- Increased PM peak volumes of more than 100 vehicles per hour were observed at only a few locations: on northbound Sixth Avenue and westbound Stewart Street.
- Turning movement counts showed significant increases in volume for the following intersection movements:
  - First/Columbia westbound through, southbound through, northbound left, and northbound through in the AM and PM peaks.
  - First/Spring northbound through in the AM peak.
  - Second/University southbound left and southbound through in the AM, mid-day, and PM peak periods.

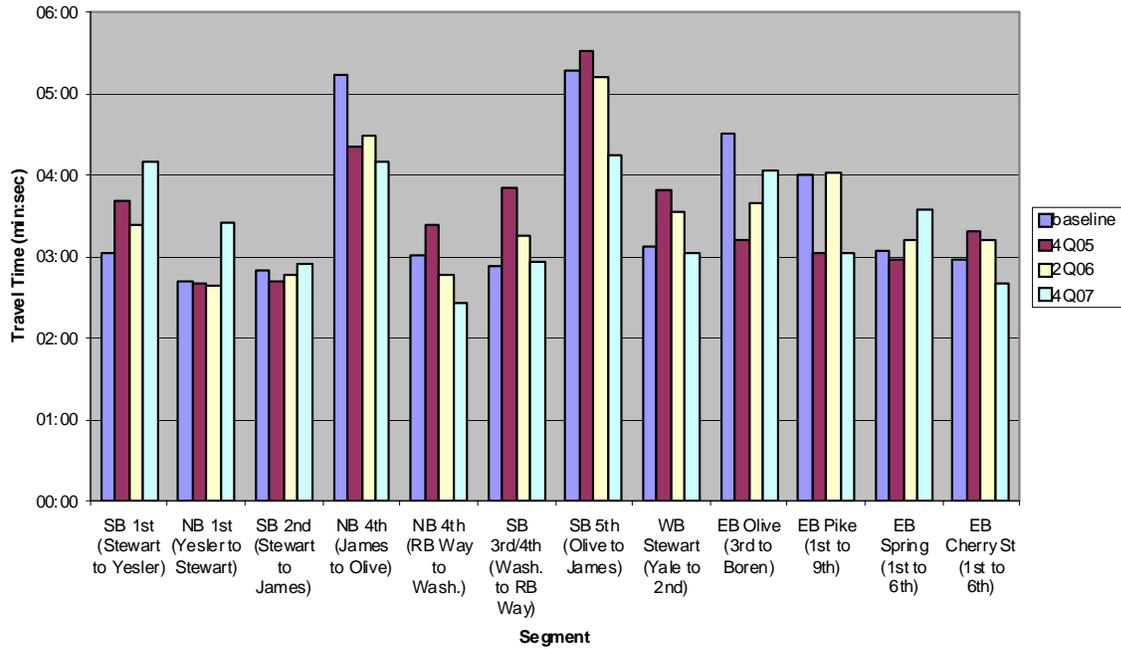
#### **Summary of Data Collected**

Figure 7A (AM peak), Figure 7B (mid-day), and Figure 7C (PM peak) summarize travel times on downtown corridors before and during tunnel closure, and after tunnel re-opening.

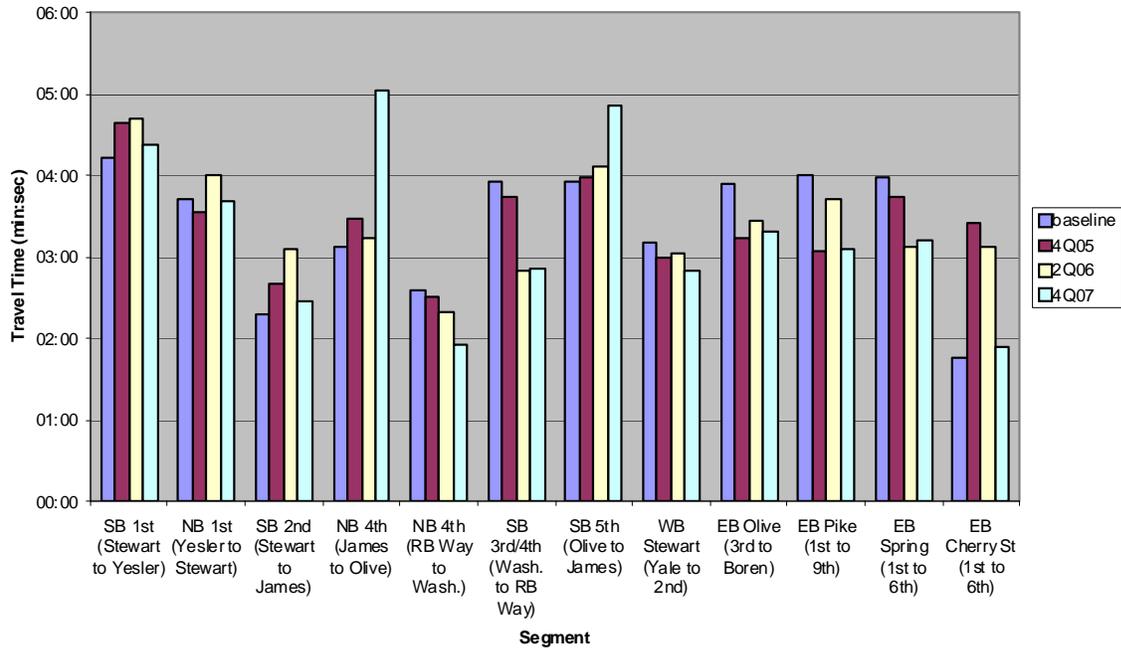
Figure 8A summarizes traffic volume counts at selected downtown locations before and during tunnel closure, and after tunnel re-opening. Figure 8B summarizes the changes in traffic volumes between before tunnel closure counts, and counts conducting during tunnel closure and after tunnel re-opening.

Tables summarizing turning movement counts at 23 downtown intersections before and during tunnel closure, and after tunnel re-opening are not printed in this report, but are available upon request.

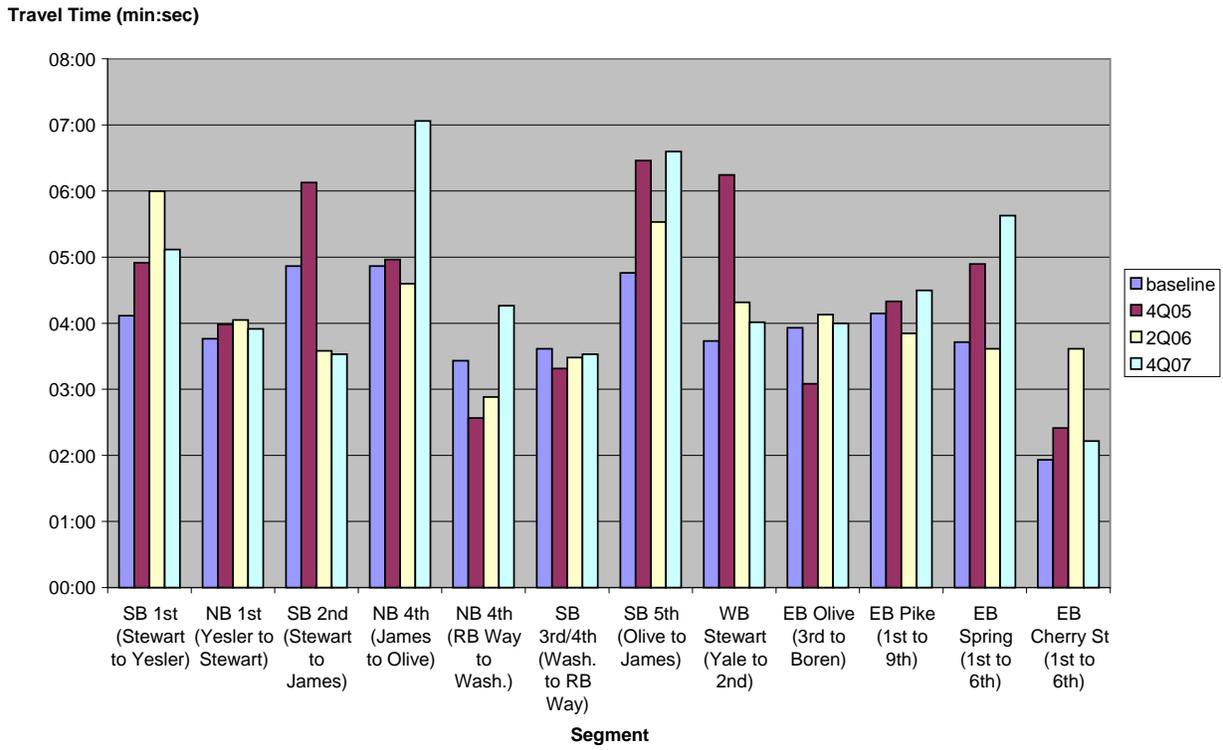
**Figure 7A. General Purpose Travel Time AM Peak (7-9 AM)**



**Figure 7B. General Purpose Travel Time Off Peak (1-3 PM)**



**Figure 7C. General Purpose Travel Time PM Peak (4 - 6 PM)**



**Figure 8A. Average Daily and PM Peak Traffic Volumes**

Location	Direction of Flow	Jan-05		Oct-05		May-06		Oct-07	
		PM Peak Hour	AWDT*						
1ST AVE, NW/O CHERRY ST	South	610	6,645	436	6,467	652	6,502	674	6,700
1ST AVE, NW/O SPRING ST	South	797	10,211	790	10,123	814	10,122	747	10,004
2ND AVE, NW/O PIKE ST	South	1,339	16,831	1,232	15,333	1,394	17,536	na	na
2ND AVE, NW/O PINE ST	South	1,174	14,441	1,381	17,569	1,349	16,427	na	na
2ND AVE, NW/O VIRGINIA ST	South	1,038	12,429	990	13,013	753	12,021	907	12,743
3RD AVE, NW/O LENORA ST	South	316	3,749	228	3,131	262	3,421	258	3,460
3RD AVE, NW/O PINE ST	South	447	4,684	296	3,612	287	3,630	303	3,963
3RD AVE, NW/O STEWART ST	South	356	4,095	260	3,331	276	3,388	284	3,808
3RD AVE, NW/O VIRGINIA ST	South	376	4,450	259	3,473	279	3,409	319	4,031
3RD AVE, SE/O JAMES ST	South	459	4,286	260	3,132	261	3,194	235	2,907
3RD AVE, SE/O UNION ST	South	478	6,297	358	4,282	335	4,062	326	4,299
5TH AVE S, N/O S JACKSON ST	South	600	5,626	640	6,497	588	6,387	474	5,316
5TH AVE S, N/O S MAIN ST	South	561	5,590	572	6,171	583	6,413	447	5,225
5TH AVE S, S/O S WELLER ST	South	611	5,094	583	5,670	554	5,610	440	4,688
WESTERN AVE, NW/O YESLER WAY	South	262	2,301	256	2,304	277	2,473	246	2,328
1ST AVE, SE/O COLUMBIA ST	North	550	7,430	593	7,968	587	8,115	551	8,065
1ST AVE, SE/O SENECA ST	North	677	7,661	775	8,403	728	8,291	758	8,717
3RD AVE, SE/O BLANCHARD ST	North	630	5,358	338	4,091	325	3,984	336	4,043
3RD AVE, SE/O JAMES ST	North	405	4,871	341	4,275	333	4,270	303	4,025
3RD AVE, SE/O LENORA ST	North	692	6,189	391	4,829	406	5,022	386	4,891
3RD AVE, SE/O STEWART ST	North	692	6,667	396	5,550	381	5,174	102	1,417
3RD AVE, SE/O UNION ST	North	515	6,164	359	4,690	355	4,508	366	4,329
3RD AVE, SE/O VIRGINIA ST	North	655	5,901	335	4,751	337	4,611	302	4,153
4TH AVE S, S/O S JACKSON ST	North	1,218	13,926	1,041	12,068	1,093	12,379	983	12,172
4TH AVE, SE/O CHERRY ST	North	1,784	18,833	1,820	19,000	1,718	18,863	1,608	17,588
4TH AVE, SE/O JAMES ST	North	1,523	15,698	1,554	16,456	1,461	15,715	1,525	16,447
4TH AVE, SE/O UNION ST	North	1,808	19,236	1,900	20,383	1,827	19,446	1,799	19,316
5TH AVE S, S/O S WELLER ST	North	86	1,144	155	1,814	128	1,590	119	1,490
6TH AVE, SE/O OLIVE WAY	North	1,055	12,618	1,254	14,644	1,111	13,196	1,160	14,155
6TH AVE, SE/O UNIVERSITY ST	North	1,026	15,102	1,194	16,332	1,151	16,237	1,150	16,659
WESTERN AVE, SE/O COLUMBIA ST	North	208	1,587	211	1,637	201	1,662	206	1,710
CHERRY ST, SW/O 3RD AVE	East	548	5,100	547	5,255	728	8,490	516	4,991
JAMES ST, SW/O 3RD AVE	East	313	2,759	363	3,115	360	3,005	322	2,827
SPRING ST, SW/O 3RD AVE	East	747	7,885	721	7,814	587	5,481	700	8,600
UNIVERSITY ST, SW/O 3RD AVE	East	445	5,626	507	6,508	484	6,369	500	6,648
JAMES ST, NE/O 2ND AVE	West	282	4,049	290	4,002	291	4,055	269	3,901
LENORA ST, NE/O 2ND AVE	West	440	4,463	404	4,620	419	4,558	410	4,571
PINE ST, NE/O 2ND AVE	West	424	5,330	410	5,602	494	6,203	417	5,863
STEWART ST, NE/O 2ND AVE	West	626	7,191	723	8,379	652	7,871	773	8,907
STEWART ST, NE/O 4TH AVE	West	785	10,869	819	11,756	772	11,302	715	10,196

\* AWDT = Average Weekday Daily Traffic (based on 5 weekdays)

**Figure 8B. Changes in Average Daily and PM Peak Traffic Volumes**

Location	Direction of Flow	Oct-05 to Jan-05				Oct-05 to May-06				Oct-05 to Oct-07			
		PM Peak Hour		AWDT*		PM Peak Hour		AWDT*		PM Peak Hour		AWDT*	
		Total Change	% Change	Total Change	% Change	Total Change	% Change	Total Change	% Change	Total Change	% Change	Total Change	% Change
1ST AVE, NW/O CHERRY ST	South	-174	-29%	-178	-3%	42	7%	-143	-2%	64	10%	55	1%
1ST AVE, NW/O SPRING ST	South	-7	-1%	-88	-1%	17	2%	-89	-1%	-50	-6%	-207	-2%
2ND AVE, NW/O PIKE ST	South	-107	-8%	-1,498	-9%	55	4%	705	4%	na	na	na	na
2ND AVE, NW/O PINE ST	South	207	18%	3,128	22%	175	15%	1,986	14%	na	na	na	na
2ND AVE, NW/O VIRGINIA ST	South	-48	-5%	584	5%	-285	-27%	-408	-3%	-131	-13%	314	3%
3RD AVE, NW/O LENORA ST	South	-88	-28%	-618	-16%	-54	-17%	-328	-9%	-58	-18%	-289	-8%
3RD AVE, NW/O PINE ST	South	-151	-34%	-1,072	-23%	-160	-36%	-1,054	-23%	-144	-32%	-721	-15%
3RD AVE, NW/O STEWART ST	South	-96	-27%	-764	-19%	-80	-22%	-707	-17%	-72	-20%	-287	-7%
3RD AVE, NW/O VIRGINIA ST	South	-117	-31%	-977	-22%	-97	-26%	-1,041	-23%	-57	-15%	-419	-9%
3RD AVE, SE/O JAMES ST	South	-199	-43%	-1,154	-27%	-198	-43%	-1,092	-25%	-224	-49%	-1,379	-32%
3RD AVE, SE/O UNION ST	South	-120	-25%	-2,015	-32%	-143	-30%	-2,235	-35%	-152	-32%	-1,998	-32%
5TH AVE S, N/O S JACKSON ST	South	40	7%	871	15%	-12	-2%	761	14%	-126	-21%	-310	-6%
5TH AVE S, N/O S MAIN ST	South	11	2%	581	10%	22	4%	823	15%	-114	-20%	-365	-7%
5TH AVE S, S/O S WELLS ST	South	-28	-5%	576	11%	-57	-9%	516	10%	-171	-28%	-406	-8%
WESTERN AVE, NW/O YESLER WAY	South	-6	-2%	3	0%	15	6%	172	7%	-16	-6%	27	1%
1ST AVE, SE/O COLUMBIA ST	North	43	8%	538	7%	37	7%	685	9%	1	0%	635	9%
1ST AVE, SE/O SENECA ST	North	98	14%	742	10%	51	8%	630	8%	81	12%	1,056	14%
3RD AVE, SE/O BLANCHARD ST	North	-292	-46%	-1,267	-24%	-305	-48%	-1,374	-26%	-294	-47%	-1,315	-25%
3RD AVE, SE/O JAMES ST	North	-64	-16%	-596	-12%	-72	-18%	-601	-12%	-102	-25%	-846	-17%
3RD AVE, SE/O LENORA ST	North	-301	-44%	-1,360	-22%	-286	-41%	-1,167	-19%	-306	-44%	-1,298	-21%
3RD AVE, SE/O STEWART ST	North	-296	-43%	-1,117	-17%	-311	-45%	-1,493	-22%	-590	-85%	-5,250	-79%
3RD AVE, SE/O UNION ST	North	-156	-30%	-1,474	-24%	-160	-31%	-1,656	-27%	-149	-29%	-1,835	-30%
3RD AVE, SE/O VIRGINIA ST	North	-320	-49%	-1,150	-19%	-318	-49%	-1,290	-22%	-353	-54%	-1,748	-30%
4TH AVE S, S/O S JACKSON ST	North	-177	-15%	-1,858	-13%	-125	-10%	-1,547	-11%	-235	-19%	-1,754	-13%
4TH AVE, SE/O CHERRY ST	North	36	2%	167	1%	-66	-4%	30	0%	-176	-10%	-1,245	-7%
4TH AVE, SE/O JAMES ST	North	31	2%	758	5%	-62	-4%	17	0%	2	0%	749	5%
4TH AVE, SE/O UNION ST	North	92	5%	1,147	6%	19	1%	210	1%	-9	0%	80	0%
5TH AVE S, S/O S WELLS ST	North	69	81%	670	59%	42	49%	446	39%	33	38%	346	30%
6TH AVE, SE/O OLIVE WAY	North	199	19%	2,026	16%	56	5%	578	5%	105	10%	1,537	12%
6TH AVE, SE/O UNIVERSITY ST	North	168	16%	1,230	8%	125	12%	1,135	8%	124	12%	1,557	10%
WESTERN AVE, SE/O COLUMBIA ST	North	3	1%	50	3%	-7	-3%	75	5%	-2	-1%	123	8%
CHERRY ST, SW/O 3RD AVE	East	-1	0%	155	3%	180	33%	3,390	66%	-32	-6%	-109	-2%
JAMES ST, SW/O 3RD AVE	East	50	16%	356	13%	47	15%	246	9%	9	3%	68	2%
SPRING ST, SW/O 3RD AVE	East	-26	-3%	-71	-1%	-160	-21%	-2,404	-30%	-47	-6%	715	9%
UNIVERSITY ST, SW/O 3RD AVE	East	62	14%	882	16%	39	9%	743	13%	55	12%	1,022	18%
JAMES ST, NE/O 2ND AVE	West	8	3%	-47	-1%	9	3%	6	0%	-13	-5%	-148	-4%
LENORA ST, NE/O 2ND AVE	West	-36	-8%	157	4%	-21	-5%	95	2%	-30	-7%	108	2%
PINE ST, NE/O 2ND AVE	West	-14	-3%	272	5%	70	17%	873	16%	-7	-2%	533	10%
STEWART ST, NE/O 2ND AVE	West	97	16%	1,188	17%	26	4%	680	9%	147	23%	1,716	24%
STEWART ST, NE/O 4TH AVE	West	34	4%	887	8%	-13	-2%	433	4%	-70	-9%	-673	-6%

\* AWDT = Average Weekday Daily Traffic (based on 5 weekdays)