Measure 1: Transit Travel Time

Monitoring Objectives

The purpose of monitoring transit travel times is to answer the following questions regarding transit travel times in the Seattle downtown core before and after tunnel closure:

- How long are the transit travel times in the Seattle downtown core?
- How consistent are the transit travel times in the Seattle downtown core?
- Where are slowdowns occurring and are there mitigation measures that might address these slowdowns?

Methodology

Transit travel times on surface streets were measured using roadside bus detection equipment at 16 locations in the Seattle downtown core. The locations of these detection points are identified in Figure 2. A description of the equipment and technology can be found in the Methodology section of the baseline tunnel closure report.

The collection of transit travel times began in summer 2005 and will be continuously collected throughout the tunnel closure period. Two levels of data are included in the regular performance reports issued by the Monitor and Maintain Committee:

Level 1: Seattle downtown core summary statistics will be the highest level summary. They consist of aggregated travel times through the study area to define an average transit operating time in the Seattle downtown core on surface streets for the AM peak and the PM peak. This measure will show the amount of time a bus takes on average to traverse the downtown area. Considered over time, this measure will give an overall trend of the increase or decrease in delay on surface streets caused by tunnel closure.

Level 2: Transit Corridor Travel Time summary will track travel time along a discrete set of transit corridors on surface streets in the central business district. The transit corridors included in the monitoring are identified in Figure 2. The data will be categorized by corridor and by time of day (AM Peak and PM Peak). Variability of the data will also be reported to show the consistency of transit travel times.

Figure 2. Transit Travel Time Summary Analysis Corridors and Detection Point Locations

Transit Travel Time Comparison

Data for transit travel time in the Seattle downtown core post tunnel closure is collected continuously. For this report, weekday travel times between February 13, 2006 and February 24, 2006 were used. This period was used to coincide with the spring 2006 service change that went into effect Saturday, February 11. Time of day periods, monitoring locations and analysis tiers, as described in the previous section, are the same as the baseline report except where noted.

In general, transit travel time averages on surface streets for this period were faster than the initial post-closure period results. On Third Avenue, conditions for transit improved slightly, maintaining the noticeable improvement over the pre-closure baseline. East-West conditions on Stewart Street and Virginia Street were notably improved over the initial post-closure results. Unsatisfactory performance was identified soon after tunnel closure and additional mitigation actions were taken. The additional mitigation had a significant, positive impact on these two corridors.

Seattle downtown core Travel Time Summary (Level 1):

The first level of analysis for downtown transit travel time is a composite measurement of average time spent in the study area. This value is obtained by identifying the first and last observation of a bus trip in the downtown core, regardless of the corridor. Averaging this figure for all trips results in a single value of time spent in the downtown core for all observed trips.

This value is used as an index, not a measure. This figure includes layover time as well as through-routed trips under one measurement. It will also include many different paths through the downtown core with different lengths and travel conditions. The measure becomes meaningful when compared to the same measurement in the future to compare the ease of travel for transit through the downtown core.

The data used for this reporting period includes only the first two weeks in February, 2006 immediately following the February service change. This is the first data set that was available to evaluate all of the post tunnel closure adjustments that are the primary reason for this report.

The baseline Travel Time Index is **100**, representing the value before tunnel closure. The average travel time value was determined to be 21:59, based on bus trips between 4 - 6 p.m. on weekdays during the month of July. The Travel Time index for this reporting period is **78**. This represents a **22%** decrease in time spent in the downtown core over the baseline, and a 33% decrease over the previous index measured in November 2005. The dramatic improvement is due to the implementation of additional mitigation measures on Stewart and Virginia Streets, as well further adjustments to bus schedules to reflect improved downtown core operating conditions, particularly along Third Avenue.

There may also be other factors contributing to the improvement in the Travel Time Index. First, the February data that was used does not include the impacts of seasonal holidays. There were no major sporting events or other major public events in downtown Seattle in this two week period that would negatively impact this index. There is also no updated information available on traffic volumes so it is not possible to determine if overall congestion levels in downtown Seattle have been reduced due to lower traffic volumes. Finally there may be some inherent seasonal variations impacting the comparison of baseline travel time value that was derived from data collected in the July 2005 with the travel time value reported for February 2006 in Volume 3. With the next report, Volume 4, it will be possible to see if the current level of street operation can be maintained based on a more complete data set, which will also capture the traffic impacts of a number of sporting events in this time period.

Transit Corridor Travel Time Summaries (Level 2)

The four charts in Figure 3 show the average travel times for transit after tunnel closure. The data was collected in February 2006 using the monitoring system. The data used is from weekdays only. Each chart shows the average travel time for the direction of travel and time of day indicated. The AM charts include buses observed between 7 – 9 a.m. at the first reader on the corridor being measured. The PM charts cover the time period from 4 – 6 p.m.

The average corridor travel times in this report are compared to the comparable statistics for both pre-tunnel closure baseline conditions and for the first post tunnel closure data reported in Volume 2. Corridor travel times should not be compared to each other. Readers were placed to ensure route coverage. Readers were also sited to facilitate communications and insure access to power. As a result, the measured corridors differ in length, number of stops and number of signals, all of which affect travel time but are not related to congestion.

The reader locations that define the boundaries of each of the transit corridors are described below along with a table for each corridor that summarizes the Average Travel Time by time period along with the standard deviation (SD) of the observations in minutes. As a statistical measure, approximately 69% of all observations are within one standard deviation of the average. The SD can be interpreted as approximating the range (+/- SD) of the typical travel time that a majority of bus riders will experience on the corridor. There are currently three data points; pre-tunnel baseline; Volume 2 date post-tunnel closure observations; and Volume 3 post tunnel closure observations.

Figure 3. Transit Corridor Travel Time after Tunnel Closure, February 2006

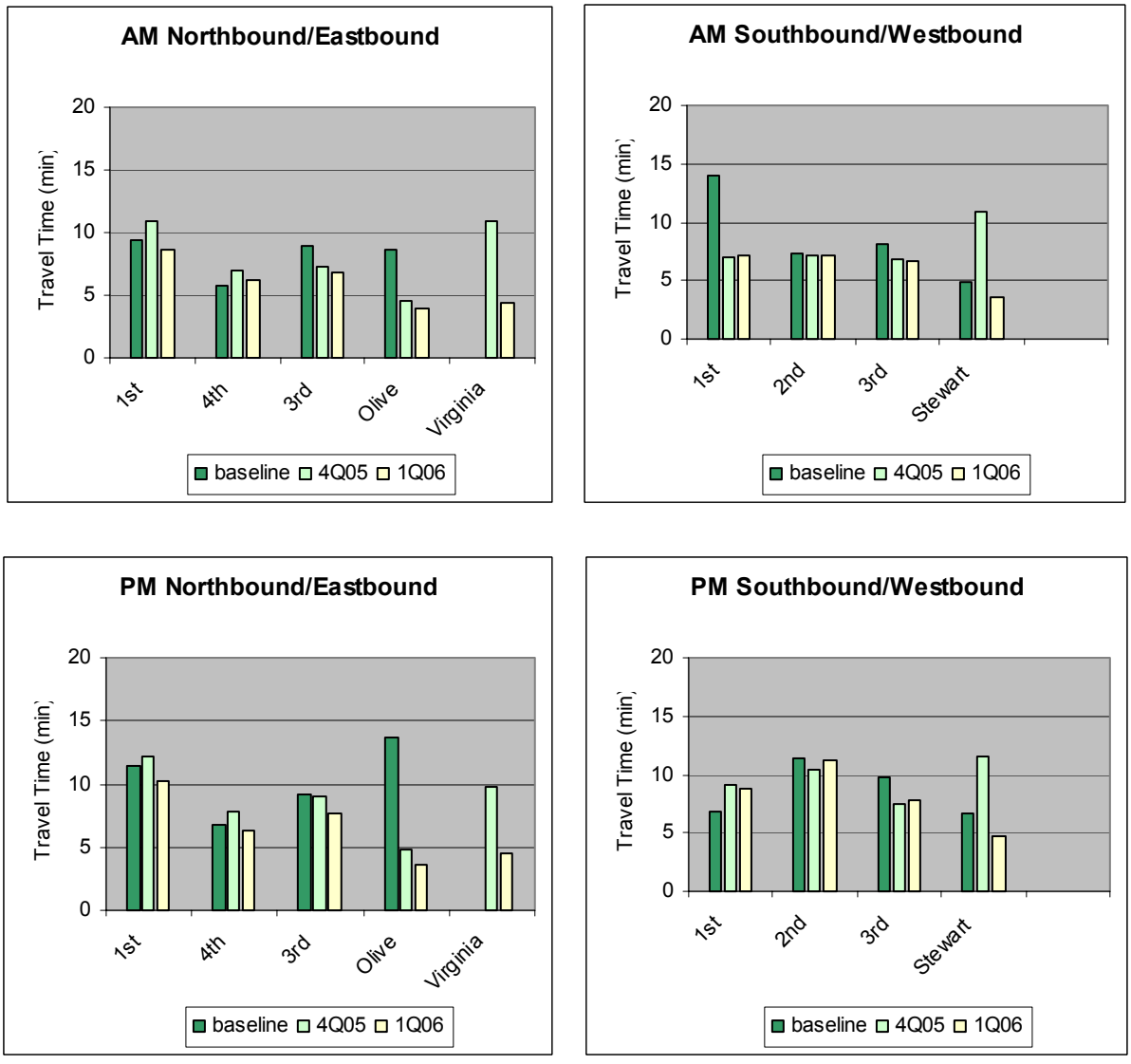

Figure 4A. First Avenue Transit Travel Time and Variation

First Avenue	AM Peak (7 – 9 a.m.)	PM Peak (4 – 6 p.m.)
Northbound, Royal Brougham to Seneca Street	Travel time: Baseline – 9 min 22 sec *(SD: 4.8 min)* Volume 2 – 10 min 54 sec *(SD: 5.8 min)* Volume 3 – 8 min 36 sec *(SD:1.8 min)* *Change : -2min 18sec*	Travel Time: Baseline – 11 min 24 sec *(SD: 5.3 min)* Volume 2 – 12 min 12 sec *(SD:6.0 min)* Volume 3 – 10 min 18 sec *(SD:3 min)* *Change : -1min 54sec*
Southbound, Seneca Street to Royal Brougham*	Travel time: Baseline – 14 min *(SD: 8.8 min)* Volume 2 – 7 min *(SD: 5.4 min)* Volume 3 – 7 min 8 sec *(SD:1 min)* *Change : +8sec*	Travel time: Baseline – 6 min 51 sec *(SD: 3.9 min)* Volume 2 – 9 min 6 sec *(SD: 6 min)* Volume 3 – 8 min 49 sec *(SD:1.4 min)* *Change : -17sec*

First Avenue (Northbound and Southbound) reader locations are Royal Brougham to the south and Stewart Street to the north, with a midpoint at Seneca Street. However, the baseline travel time measurements were taken for the segment between Seneca Street and Royal Brougham because the Stewart reader was not available for the initial survey. For consistency, future data measures will use the same start and end points as the baseline report.

Figure 4B. Second Avenue Transit Travel Time and Variation

Second Avenue	AM Peak (7 – 9 a.m.)	PM Peak (4 – 6 p.m.)
Southbound, Pike Street to S Jackson Street	Travel time: Baseline – 7 min 20 sec *(SD: 1.9 min)* Volume 2 – 7 min 13 sec *(SD: 2.6 min)* Volume 3 – 7 min 11 sec *(SD:1.45 min)* *Change : - 2sec*	Travel time: Baseline – 11 min 26 sec *(SD: 4.3 min)* Volume 2 – 10 min 26 sec *(SD: 3.5 min)* Volume 3 – 11 min 10 sec *(SD:2.4 min)* *Change : +44sec*

Second Avenue (Southbound only) reader locations are Pike Street and S Jackson Street with a midpoint at Seneca Street. Second Avenue maintained the same average travel time with slightly less variation in the AM Peak. In the PM Peak, average travel times degraded by 44 seconds, but remained better than the baseline and improved an additional one minute in and variation. Over three study periods, the variation in average travel time is less than the standard deviations suggesting the conditions on Second Avenue have been consistent.

Figure 4C. Third Avenue Transit Travel Time and Variation

Third Avenue	AM Peak (7 – 9 a.m.)	PM Peak (4 – 6 p.m.)
Northbound, Yesler Way to Stewart Street	Travel time: Baseline – 9 min *(SD: 4.6 min)* Volume 2 – 7 min 20 sec *(SD: 3.1 min)* Volume 3 – 6 min 53 sec *(SD:1.3 min)* *Change : -27 sec*	Travel Time: Baseline – 9 min 6 sec *(SD: n/a)* Volume 2 – 8 min 57 sec *(SD: 3.6 min)* Volume 3 – 7 min 41 sec *(SD:1.3 min)* *Change : -1min 16sec*
Southbound, Stewart Street to Yesler Way	Travel time: Baseline – 8 min 5 sec *(SD: 1.3 min)* Volume 2 – 6 min 52 sec *(SD: 2.8 min)* Volume 3 – 6 min 36 sec *(SD:1.6 min)* *Change : -16sec*	Travel time: Baseline – 9 min 45 sec *(SD: 2.5 min)* Volume 2 – 7 min 27 sec *(SD: 2.9 min)* Volume 3 – 7 min 51 sec *(SD:1.5 min)* *Change : +24sec*

Third Avenue (Northbound and Southbound) reader locations are Stewart Street to the north and Yesler Way to the south, with a midpoint at Seneca Street. Average travel times improved in both directions and in both peak periods compared to before tunnel closure due to traffic restrictions and transit lanes implemented on the corridor. Average travel times were improved over the previous reporting period in all cases except the PM Peak southbound. In all cases the standard deviation was reduced indicating more consistent travel times.

In the previous reporting period, traffic restrictions were removed after 6:30 p.m**.** with no negative effect noted. The increase in average travel time in the southbound PM Peak is not due to this change. Travel times in the southbound direction on Third Avenue between 6:30 and 7 p.m. averaged seven minutes, 31

seconds. The changes in average travel times the southbound direction in both the AM and PM periods are less than the standard deviation suggesting conditions in the southbound direction have been consistent. Northbound reduction in average travel times are more significant, and probably related to improvements on Virginia Street.

Figure 4D. Fourth Avenue Transit Travel Time and Variation

Fourth Avenue	**AM Peak (7 – 9a.m.)**	**PM Peak (4 – 6 p.m.)**
Northbound, S Jackson Street to Seneca Street	Travel time: Baseline – 5 min 48 sec *(SD: 1.2 min)* Volume 2 – 6 min 58 sec *(SD: 2.8 min)* Volume 3 – 6 min 14 sec *(SD:1.35 min)* *Change : -44 sec*	Travel Time: Baseline – 6 min 46 sec *(SD: 1.1 min)* Volume 2 – 7 min 50 sec *(SD: 4 min)* Volume 3 – 6 min 15 sec *(SD:2 min)* *Change : -1min 35sec*

Fourth Avenue (Northbound only) reader locations are Seneca Street to the north and S Jackson Street to the south. Average travel times decreased by one minute during both the morning and evening peak periods, with notably less variation. Average travel times are near or below the pre-closure baseline with similar variation. The increased travel times in the previous period appear to have been related to a group of trips experiencing longer travel times while other trips maintained pre-closure travel times. In this period, there was more consistency in travel times.

Figure 4E. Virginia, Olive Way and Howell Transit Travel Time and Variation

	AM Peak (7 – 9a.m.)	**PM Peak (4 – 6 p.m.)**
Eastbound Virginia, Third Avenue to Ninth Ave	Travel time: Volume 2 – 10 min 39 sec *(SD: 5.1 min)* Volume 3 – 4 min 23 sec *(SD : .9 min)* *Change : -6min 16sec*	Travel Time: Volume 2 – 9 min 50 sec *(SD: 4.9 min)* Volume 3 – 4 min 28 sec *(SD:1 min)* *Change : -5min 22sec*
Eastbound Olive Way, Third Avenue to Eighth Ave	Travel time: Baseline – 8 min 42 sec *(SD: 9.1 min)* Volume 2 – 4 min 34 sec *(SD: 2.4 min)* Volume 3– 3 min 54 sec *(SD :1 min)* *Change : - 40sec*	Travel Time: Baseline – 13 min 43 sec *(SD: 9.7 min)* Volume 2 – 4 min 51 sec *(SD: 2.5 min)* Volume 3 – 3 min 41 sec *(SD : .9 min)* *Change : -1min 10sec*
Eastbound Howell, Eighth Ave to Yale Street	Travel time: Baseline – 2 min 6 sec *(SD: 1.4 min)* Volume 2 – 3 min 53 sec *(SD: 2.4 min)* Volume 3 – 3 min 23 sec *(SD :1.6 min)* *Change : -30sec*	Travel Time: Baseline – 5 min 25 sec *(SD: 3.1 min)* Volume 2 – 5 min 37 sec *(SD: 3.3 min)* Volume 3 – 4 min 50 sec *(SD:2.3 min)* *Change : -47sec*

Virginia Street (Eastbound only) reader locations are Third Avenue at Stewart to the west and Ninth Avenue at Stewart to the east. Virginia Street was not a transit routing before the tunnel closure, so there is no baseline data. Average travel times were reduced by over five minutes with the implementation of additional mitigation measures.

Olive Way (Eastbound only) reader locations are Third Avenue to the west and Eighth Avenue to the east. Average travel times improved to less than four minutes on Olive Way between Third and Eighth Avenues. Travel time variation improved as well.

Howell (Eastbound only): Transit on Howell east of Eighth Avenue improved slightly, with variation decreasing by about one minute in both the AM and PM peak periods.

Figure 4F. Stewart Street Transit Travel Time and Variation

	AM Peak (7 – 9a.m.)	**PM Peak (4 – 6 p.m.)**
Westbound, Ninth Avenue to Third Avenue	Travel time: Baseline – 4 min 50 sec *(SD: 1.9 min)* Volume 2 – 10 min 52 sec *(SD: 5.2 min)* Volume 3 – 3 min 31 sec *(SD:1 min)* *Change : -7min 21 sec*	Travel Time: Baseline – 6 min 42 sec *(SD: 1.5 min)* Volume 2 – 11 min 36 sec *(SD: 4.9 min)* Volume 3 – 4 min 42 sec *(SD: 2 min)* *Change : -6min 54 sec*

Stewart Street (Westbound only) reader locations are Third Avenue to the west and Ninth Avenue to the east. Average travel time on Stewart Street decreased by more than seven minutes with the implementation of additional mitigation measures. The current average travel times are now one to two minutes faster than the pre-closure baseline. Variation also decreased dramatically.