EVALUATION OF PROPOSED CHANGES TO QUICKRIDE
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This report examines three potential improvements to the QuickRide system in Houston. The first analysis determines the optimum time of day to close the HOV lane to reverse its direction. Then, the possibility of moving and/or expanding the current QuickRide times is examined. Additionally, the possibility of adding QuickRide to US 290 in the afternoon is investigated. Finally, an analysis is performed to determine the optimum time of day for allowing single occupant vehicles (SOVs) onto the HOV lane (if any).

Determination of Optimum Reversal Time

The HOV lanes on the Katy and Northwest freeways in Houston are single-lane and barrier separated. At some point in the day, the HOV lane must be closed and cleared out to reverse the direction of flow. Currently, the HOV lanes are closed from 11:00 a.m. to 2:00 p.m. each day. However, the researchers have been informed by METRO officials that the reversal time can be shortened to two hours. Therefore, the base case scenario for the analysis was that the reversal time occurred between 11:00 a.m. and 1:00 p.m.

A number of possible reversal times were examined using 2002 average speed data for the freeway main lanes (see Appendix A). Each of the possible reversal times was compared against the base case scenario. For each reversal time, the HOV time savings gained was compared to the HOV time savings that was lost by changing the reversal time. For instance, suppose the reversal time were to be moved back 30 minutes so that it began at 10:30. The HOV lane would then be closed from 10:30 to 11:00, a time which it had previously been open. Conversely, the HOV lane would now be open from 12:30 to 1:00, a time which it had previously been closed. To evaluate this new scenario, the travel time savings of using the HOV lane from 10:30 to 11:00 was compared to the time savings of using the HOV lane from 12:30 to 1:00. If the savings of the gained time was greater than the time savings of the lost time, then a positive change was calculated, indicating an increase in overall benefit. A negative change would indicate a decrease in overall benefit.

The travel time savings for each scenario was calculated as follows:

$$\Delta TTS = \frac{D}{S_{gained}} - \frac{D}{S_{lost}}$$

where:

ΔTTS = change in travel time savings
D = the length of the HOV lane
S_{gained} = the speed on the main lanes during the gained HOV lane time
S_{lost} = the speed on the main lanes during the lost HOV lane time

The net change in travel time savings (in seconds per vehicle) is shown in Tables 1 and 2. The tables indicate that the best reversal time is from 10:30 AM to 12:30 PM on the Katy Freeway and from 11:30 AM to 1:30 PM on the Northwest Freeway. However, the change in travel time savings may not necessarily be large enough to warrant changing the reversal time. Additionally, the two lanes should be closed for reversal at the same time to reduce public confusion. Therefore 11:00 AM to 1:00 PM is the recommended reversal time.

Table 1. Reversal Time Analysis Results for the Katy Freeway

Proposed Reversal Time	Change in Travel Time Savings (sec/veh)
9:00-11:00	-329
9:30-11:30	-92
10:00-12:00	45
10:30-12:30	**58**
11:00-1:00	0
11:30-1:30	-6
12:00-2:00	12
12:30-2:30	6
1:00-3:00	-37

Table 2. Reversal Time Analysis Results for the Northwest Freeway

Proposed Reversal Time	Change in Travel Time Savings (sec/veh)
9:00-11:00	-537
9:30-11:30	-244
10:00-12:00	-79
10:30-12:30	-13
11:00-1:00	0
11:30-1:30	**5**
12:00-2:00	1
12:30-2:30	-34
1:00-3:00	-112

Examination of Possible Expansion of QuickRide Hours

An analysis was performed to determine if it would be beneficial to expand the QuickRide hours beyond their current operating times. Currently, the QuickRide program operates from 6:45 AM to 8:00 AM in the morning peak on the Katy and Northwest Freeways, and it operates from 5:00 PM to 6:00 PM in the evening peak on the Katy Freeway. In order to determine whether an expansion of QuickRide hours was warranted, travel speeds and volumes on the HOV lane were examined (see Appendices A & C). The volume on the HOV lane, the average speed of the HOV lane and the time of day were analyzed. A spreadsheet was created to examine three factors: HOV lane volume, HOV lane speed, and the time of day. Fifteen-minute time periods were analyzed using 2002 average volume and speed data.

For each 15-minute time period, HOV lane volume is compared to a minimum requirement. If the volume is greater than the minimum, then that time period may qualify for conversion to QuickRide. A similar comparison was performed for average speed. Additionally, the spreadsheet also checks if the time period is located outside the current QuickRide hours. If a positive response is returned for all three tests, then that time period deserves careful consideration to be converted to QuickRide. Figures 1-4 are examples of the spreadsheets. Table 3 shows the results obtained from the analysis.

Table 3. Results of Expansion Analysis

Direction	Times Qualifying for Expansion
Katy Freeway AM	6:30, 8:15
Katy Freeway PM	4:45, 6:00
Northwest Freeway AM	6:30
Northwest Freeway PM	5:15, 5:30, 5:45, 6:00

Time	Current HOV Volume Greater than 1200 vph	Current HOV Speed Lower than 55 mph	Outside of QuickRide Period?	All Criteria Met?
5:00	NO	NO	**YES**	NO
5:15	NO	NO	**YES**	NO
5:30	NO	NO	**YES**	NO
5:45	NO	NO	**YES**	NO
6:00	NO	NO	**YES**	NO
6:15	NO	NO	**YES**	NO
6:30	**YES**	**YES**	**YES**	**YES**
6:45	**YES**	**YES**	NO	NO
7:00	**YES**	NO	NO	NO
7:15	NO	NO	NO	NO
7:30	NO	NO	NO	NO
7:45	NO	NO	NO	NO
8:00	NO	NO	**YES**	NO
8:15	**YES**	**YES**	**YES**	**YES**
8:30	NO	NO	**YES**	NO
8:45	NO	NO	**YES**	NO
9:00	NO	NO	**YES**	NO
9:15	NO	NO	**YES**	NO
9:30	NO	NO	**YES**	NO
9:45	NO	NO	**YES**	NO
10:00	NO	NO	**YES**	NO
10:15	NO	NO	**YES**	NO
10:30	NO	NO	**YES**	NO
10:45	NO	NO	**YES**	NO

Figure 1. Example of QuickRide Expansion Spreadsheet – Katy Freeway AM

Time	Current HOV Volume Greater than 1200 vph	Current HOV Speed Lower than 55 mph	Outside of QuickRide Period?	All Criteria Met?
14:00	NO	NO	**YES**	NO
14:15	NO	NO	**YES**	NO
14:30	NO	NO	**YES**	NO
14:45	NO	NO	**YES**	NO
15:00	NO	NO	**YES**	NO
15:15	NO	NO	**YES**	NO
15:30	NO	NO	**YES**	NO
15:45	NO	NO	**YES**	NO
16:00	NO	NO	**YES**	NO
16:15	**YES**	NO	**YES**	NO
16:30	**YES**	NO	**YES**	NO
16:45	**YES**	**YES**	**YES**	**YES**
17:00	NO	**YES**	NO	NO
17:15	NO	NO	NO	NO
17:30	NO	NO	NO	NO
17:45	NO	**YES**	NO	NO
18:00	**YES**	**YES**	**YES**	**YES**
18:15	NO	**YES**	**YES**	NO
18:30	NO	**YES**	**YES**	NO
18:45	NO	NO	**YES**	NO
19:00	NO	NO	**YES**	NO
19:15	NO	NO	**YES**	NO
19:30	NO	NO	**YES**	NO
19:45	NO	NO	**YES**	NO
20:00	NO	NO	**YES**	NO

Figure 2. Example of QuickRide Expansion Spreadsheet – Katy Freeway PM

Time	Current HOV Volume Greater than 1200 vph	Current HOV Speed Lower than 55 mph	Outside of QuickRide Period?	All Criteria Met?
5:00	NO	NO	**YES**	NO
5:15	NO	NO	**YES**	NO
5:30	NO	NO	**YES**	NO
5:45	NO	NO	**YES**	NO
6:00	NO	NO	**YES**	NO
6:15	NO	NO	**YES**	NO
6:30	**YES**	**YES**	**YES**	**YES**
6:45	**YES**	**YES**	NO	NO
7:00	**YES**	NO	NO	NO
7:15	NO	NO	NO	NO
7:30	NO	NO	NO	NO
7:45	NO	NO	NO	NO
8:00	NO	NO	**YES**	NO
8:15	**YES**	NO	**YES**	NO
8:30	NO	NO	**YES**	NO
8:45	NO	NO	**YES**	NO
9:00	NO	NO	**YES**	NO
9:15	NO	NO	**YES**	NO
9:30	NO	NO	**YES**	NO
9:45	NO	NO	**YES**	NO
10:00	NO	NO	**YES**	NO
10:15	NO	NO	**YES**	NO
10:30	NO	NO	**YES**	NO
10:45	NO	NO	**YES**	NO

Figure 3. Example of QuickRide Expansion Spreadsheet – Northwest Freeway AM

Time	Current HOV Volume Greater than 1200 vph	Current HOV Speed Lower than 55 mph	Outside of QuickRide Period?	All Criteria Met?
14:00	NO	NO	**YES**	NO
14:15	NO	NO	**YES**	NO
14:30	NO	NO	**YES**	NO
14:45	NO	NO	**YES**	NO
15:00	NO	NO	**YES**	NO
15:15	NO	NO	**YES**	NO
15:30	NO	NO	**YES**	NO
15:45	NO	NO	**YES**	NO
16:00	NO	NO	**YES**	NO
16:15	NO	NO	**YES**	NO
16:30	NO	NO	**YES**	NO
16:45	**YES**	NO	**YES**	NO
17:00	**YES**	NO	**YES**	NO
17:15	**YES**	**YES**	**YES**	**YES**
17:30	**YES**	**YES**	**YES**	**YES**
17:45	**YES**	**YES**	**YES**	**YES**
18:00	**YES**	**YES**	**YES**	**YES**
18:15	NO	NO	**YES**	NO
18:30	NO	NO	**YES**	NO
18:45	NO	NO	**YES**	NO
19:00	NO	NO	**YES**	NO
19:15	NO	NO	**YES**	NO
19:30	NO	NO	**YES**	NO
19:45	NO	NO	**YES**	NO
20:00	NO	NO	**YES**	NO

Figure 4. Example of QuickRide Expansion Spreadsheet – Northwest Freeway PM

Examination of Possible Allowance of SOVs on the HOV Lane

The possibility of allowing single occupant vehicles (SOVs) on the HOV lane was also examined. A spreadsheet similar that used for the expansion analysis was created to examine three factors: travel time savings, available capacity, and the time of day. First the travel time savings of using the HOV lane were calculated (see Appendix B). If the time savings was above a set minimum, then the spreadsheet returns a positive response. Next, the available capacity of the lane is measured by subtracting the volume of the lane from its capacity. If the available capacity is above a set minimum, the spreadsheet returns a positive response. Next, the time of day is checked to determine if it is outside the QuickRide period. It was decided that SOVs would only be allowed on the HOV lane during non-QuickRide hours. If the time period is outside of QuickRide hours, the spreadsheet returns a positive response. If a positive response is returned in all three cases, then the time period qualifies for SOV allowance. Figures 5-8 are examples of the spreadsheets. Table 4 shows the results obtained from the analysis.

Table 4. Results of SOV Analysis

Direction	Times Qualifying for SOV Allowance
Katy Freeway AM	8:45, 9:00, 9:15, 9:30, 9:45, 10:00
Katy Freeway PM	2:00, 2:15, 2:30, 2:45, 3:00, 3:15, 3:30, 3:45, 6:30, 6:45, 7:00
Northwest Freeway AM	6:15, 8:45, 9:00
Northwest Freeway PM	3:45, 4:00, 4:15, 6:15, 6:30

Time	Travel Time Savings Greater than 5 Minutes	Available Capacity Greater Than 500 vph	Outside of QuickRide Period?	All Criteria Met?
5:00	NO	YES	YES	NO
5:15	NO	YES	YES	NO
5:30	NO	YES	YES	NO
5:45	NO	YES	YES	NO
6:00	NO	YES	YES	NO
6:15	NO	YES	YES	NO
6:30	YES	NO	YES	NO
6:45	YES	NO	NO	NO
7:00	YES	NO	NO	NO
7:15	YES	NO	NO	NO
7:30	YES	NO	NO	NO
7:45	YES	YES	NO	NO
8:00	YES	NO	YES	NO
8:15	YES	NO	YES	NO
8:30	YES	NO	YES	NO
8:45	YES	YES	YES	YES
9:00	YES	YES	YES	YES
9:15	YES	YES	YES	YES
9:30	YES	YES	YES	YES
9:45	YES	YES	YES	YES
10:00	YES	YES	YES	YES
10:15	NO	YES	YES	NO
10:30	NO	YES	YES	NO
10:45	NO	YES	YES	NO

Figure 5. Example of SOV Allowance Spreadsheet – Katy Freeway AM

Time	Travel Time Savings Greater than 5 Minutes	Available Capacity Greater Than 500 vph	Outside of QuickRide Period?	All Criteria Met?
14:00	YES	YES	YES	YES
14:15	YES	YES	YES	YES
14:30	YES	YES	YES	YES
14:45	YES	YES	YES	YES
15:00	YES	YES	YES	YES
15:15	YES	YES	YES	YES
15:30	YES	YES	YES	YES
15:45	YES	YES	YES	YES
16:00	YES	NO	YES	NO
16:15	YES	NO	YES	NO
16:30	YES	NO	YES	NO
16:45	YES	NO	YES	NO
17:00	YES	NO	NO	NO
17:15	YES	NO	NO	NO
17:30	YES	YES	NO	NO
17:45	YES	NO	NO	NO
18:00	YES	NO	YES	NO
18:15	YES	NO	YES	NO
18:30	YES	YES	YES	YES
18:45	YES	YES	YES	YES
19:00	YES	YES	YES	YES
19:15	NO	YES	YES	NO
19:30	NO	YES	YES	NO
19:45	NO	YES	YES	NO
20:00	NO	YES	YES	NO

Figure 6. Example of SOV Allowance Spreadsheet – Katy Freeway PM

Time	Travel Time Savings Greater than 5 Minutes	Available Capacity Greater Than 500 vph	Outside of QuickRide Period?	All Criteria Met?
5:00	NO	YES	YES	NO
5:15	NO	YES	YES	NO
5:30	NO	YES	YES	NO
5:45	NO	YES	YES	NO
6:00	NO	YES	YES	NO
6:15	YES	YES	YES	YES
6:30	YES	NO	YES	NO
6:45	YES	NO	NO	NO
7:00	YES	NO	NO	NO
7:15	YES	YES	NO	NO
7:30	YES	NO	NO	NO
7:45	YES	NO	NO	NO
8:00	YES	NO	YES	NO
8:15	YES	NO	YES	NO
8:30	YES	NO	YES	NO
8:45	YES	YES	YES	YES
9:00	YES	YES	YES	YES
9:15	NO	YES	YES	NO
9:30	NO	YES	YES	NO
9:45	NO	YES	YES	NO
10:00	NO	YES	YES	NO
10:15	NO	YES	YES	NO
10:30	NO	YES	YES	NO
10:45	NO	YES	YES	NO

Figure 7. Example of SOV Allowance Spreadsheet – Northwest Freeway AM

Time	Travel Time Savings Greater than 5 Minutes	Available Capacity Greater Than 500 vph	Outside of QuickRide Period?	All Criteria Met?
14:00	NO	**YES**	**YES**	NO
14:15	NO	**YES**	**YES**	NO
14:30	NO	**YES**	**YES**	NO
14:45	NO	**YES**	**YES**	NO
15:00	NO	**YES**	**YES**	NO
15:15	NO	**YES**	**YES**	NO
15:30	NO	**YES**	**YES**	NO
15:45	**YES**	**YES**	**YES**	**YES**
16:00	**YES**	**YES**	**YES**	**YES**
16:15	**YES**	**YES**	**YES**	**YES**
16:30	**YES**	NO	**YES**	NO
16:45	**YES**	NO	**YES**	NO
17:00	**YES**	NO	**YES**	NO
17:15	**YES**	NO	**YES**	NO
17:30	**YES**	NO	**YES**	NO
17:45	**YES**	NO	**YES**	NO
18:00	**YES**	NO	**YES**	NO
18:15	**YES**	**YES**	**YES**	**YES**
18:30	**YES**	**YES**	**YES**	**YES**
18:45	NO	**YES**	**YES**	NO
19:00	NO	**YES**	**YES**	NO
19:15	NO	**YES**	**YES**	NO
19:30	NO	**YES**	**YES**	NO
19:45	NO	**YES**	**YES**	NO
20:00	NO	**YES**	**YES**	NO

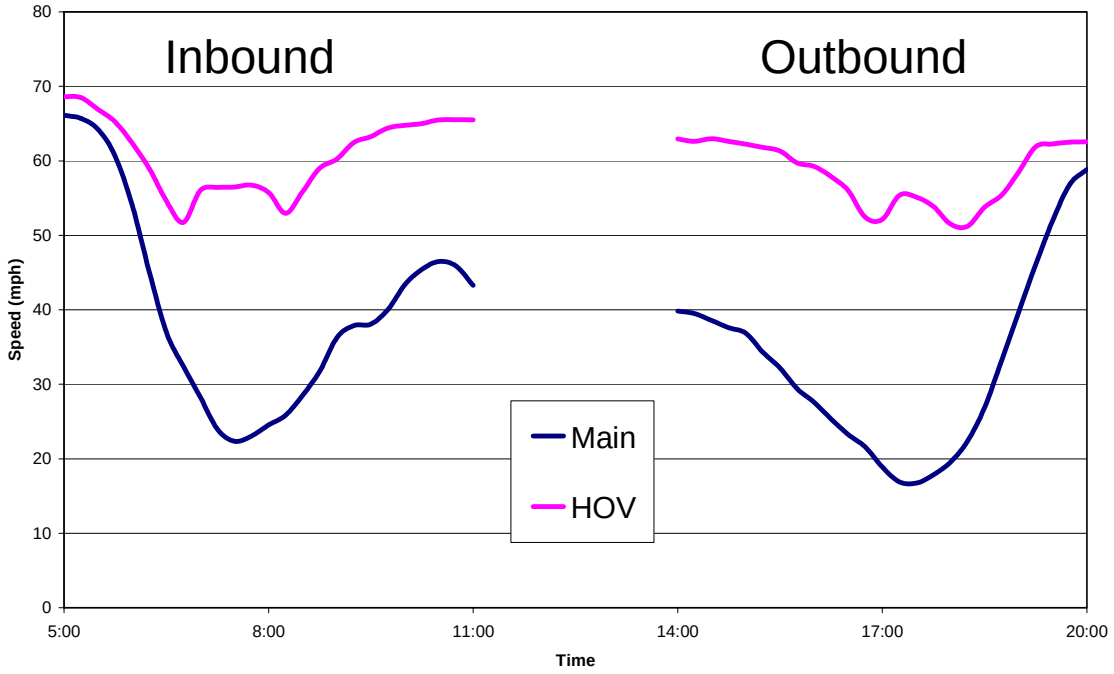
Figure 8. Example of SOV Allowance Spreadsheet – Northwest Freeway PM

RESULTS

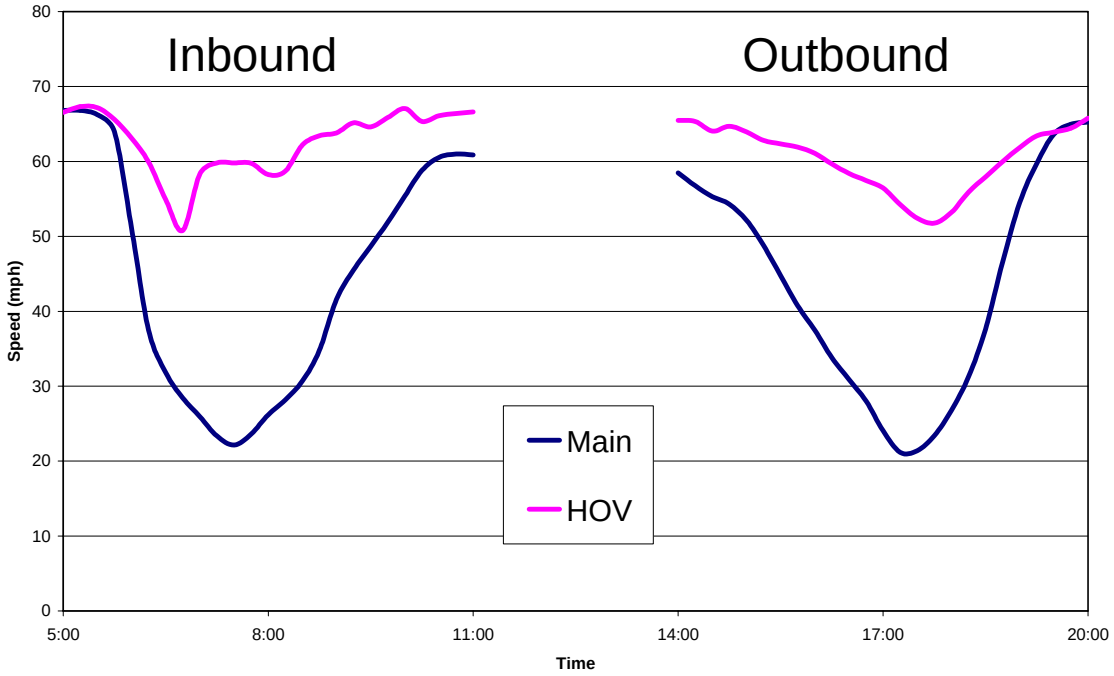
The purpose of this analysis was not to obtain results but rather to develop a method for determining whether proposed changes to QuickRide may be implemented. The input values used in the analysis are not definitive. The spreadsheet allows them to be changed, thus allowing the parameters of the analysis to be altered. Therefore, the results obtained in this analysis are not the "right answer," but rather an example of the type of analysis that was performed. However, a few conclusions can be made based on the data that was analyzed. First, there appear to be portions of the day when it would likely be beneficial to allow SOVs on the HOV lane for a toll. The data shows an excess capacity during the off-peak hours of the day. Additionally, the data shows that the volumes on the HOV lane are very close to, if not above, capacity during the shoulder periods outside of QuickRide hours. This would suggest that expansion of QuickRide hours may be necessary.

APPENDIX A: SPEED DATA

Space Mean Speed - Katy Freeway - 2002

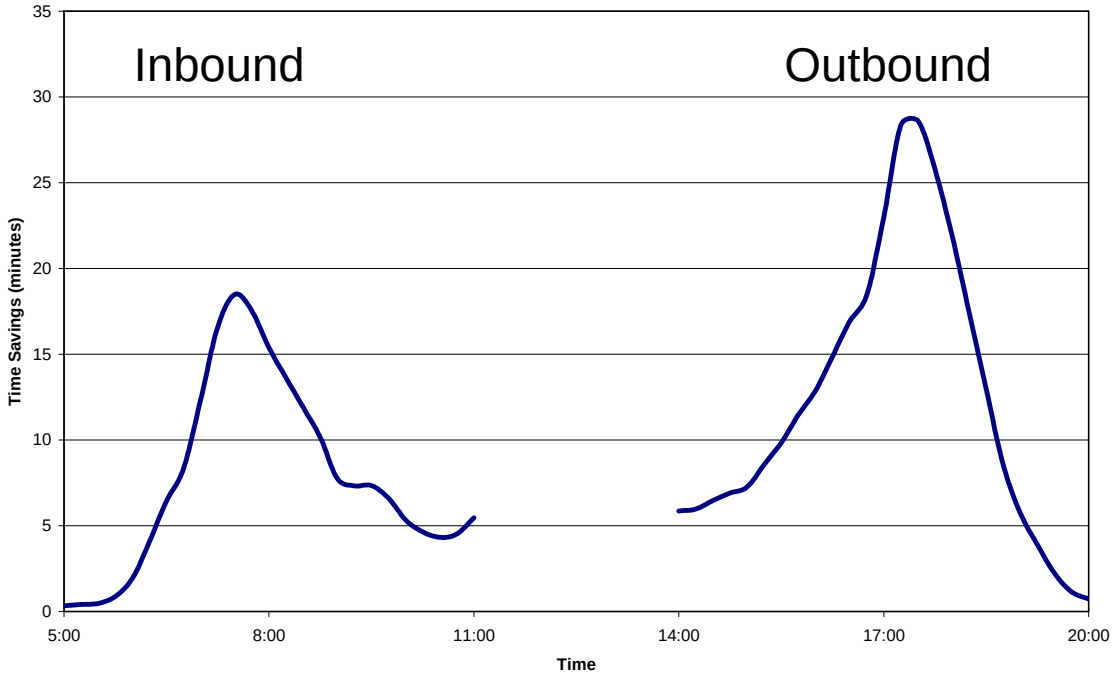


Space Mean Speed - Northwest Freeway - 2002

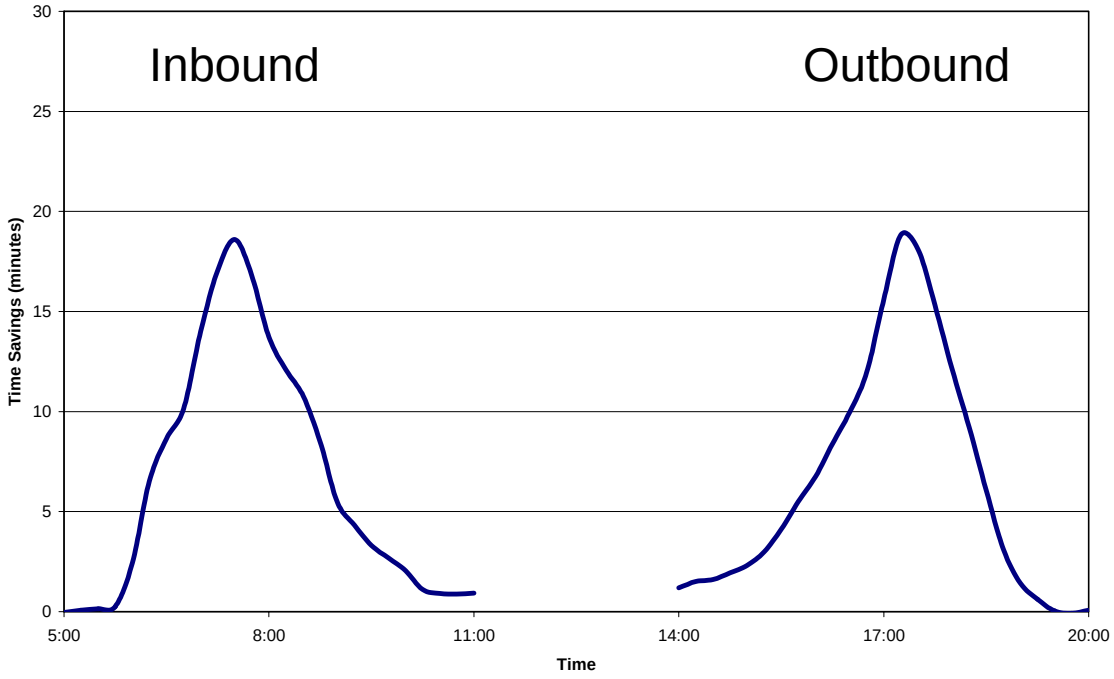


APPENDIX B: TRAVEL TIME SAVINGS

Travel Time Savings - Katy Freeway - 2002

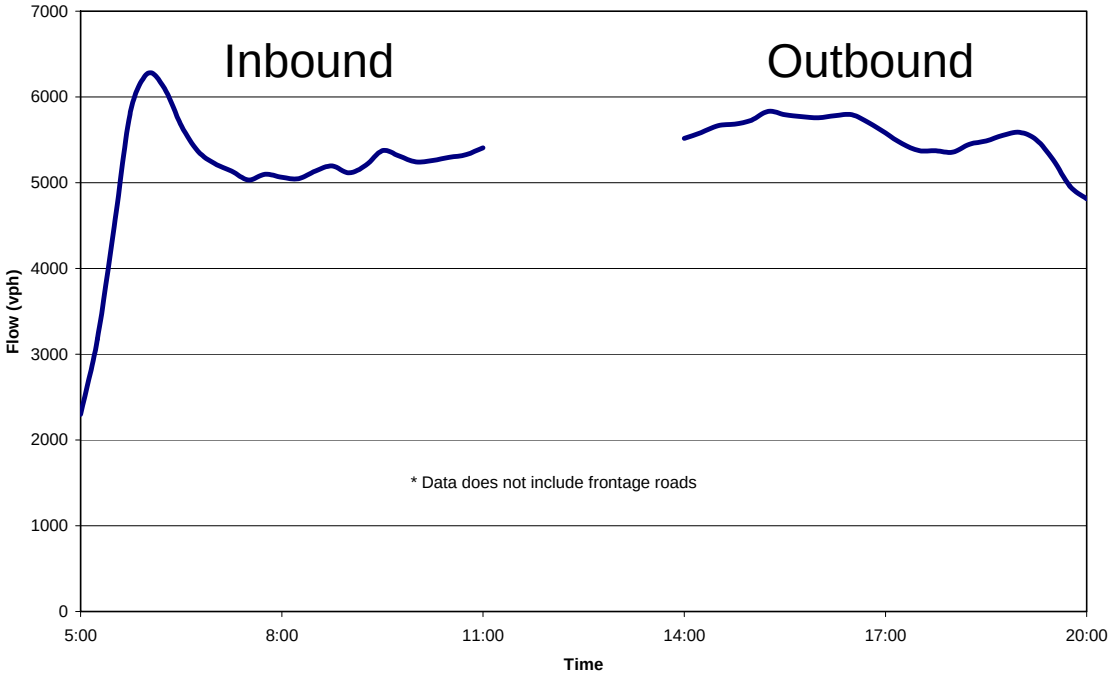


Travel Time Savings - Northwest Freeway - 2002

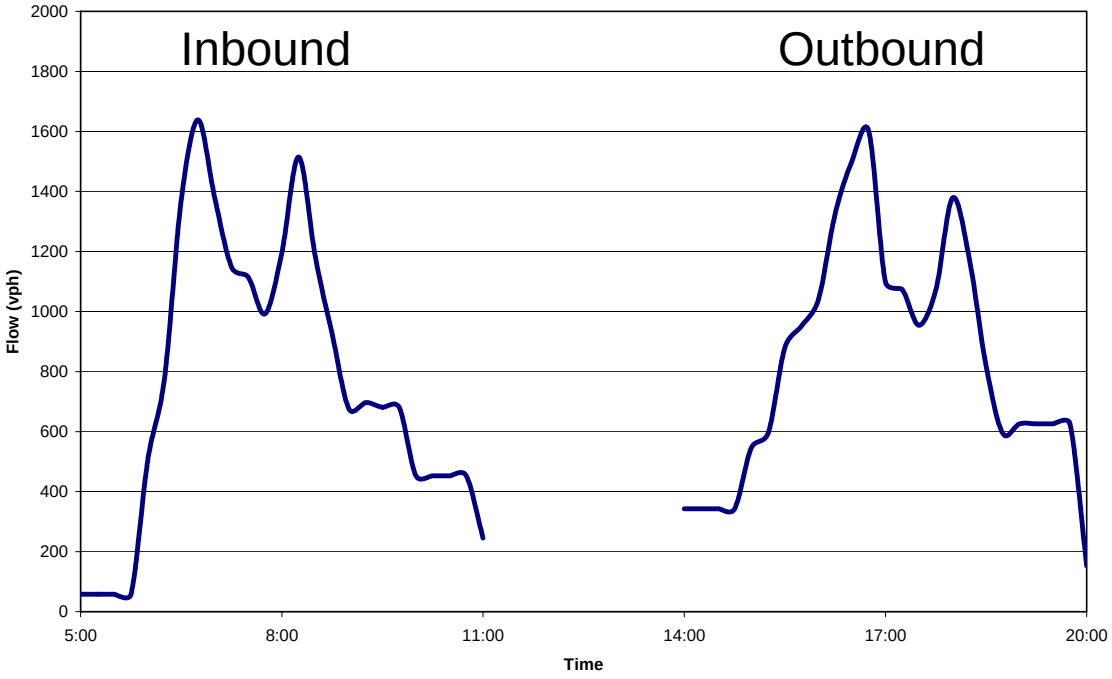


APPENDIX C: FLOW DATA

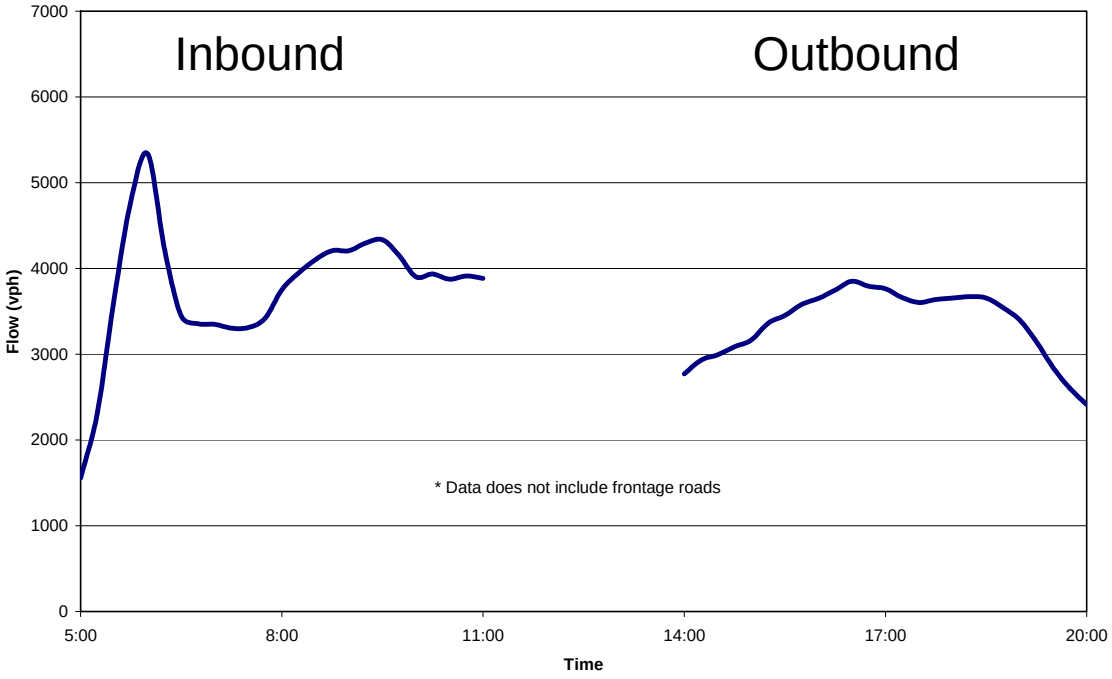
Flow - Katy Freeway Mainlanes - 2002



Flow - Katy Freeway HOV - 2002



Flow - Northwest Freeway Mainlanes - 2002



Flow - Northwest Freeway HOV - 2002