6.0 Phase II Traveler Surveys

6.0 Phase II Traveler Surveys

Travelers' perceptions of the ramp meter strategies implemented were quantified through a set of Phase II telephone surveys among travelers in the Minneapolis/St. Paul metropolitan area. An important element in the evaluation of the ramp meter strategy evaluation was the measurement of travelers' attitudes toward different ramp metering strategies. The Fall 2001 surveys consisted of a random survey of Twin Cities residents. The following sections highlight the survey efforts.

6.1 Fall 2001 Traveler Survey Methodology

The objective of the fall 2001 wave of surveys was to assess travelers' views of the ramp meter operations during the first nine months in 2001. Respondents were asked about their opinions on a range of different ramp metering strategies that are under consideration for implementation. The random sampling was developed by means of random digit dialing, and included all travelers (potentially including transit riders) who traveled during the peak periods. This sample allowed comparisons at an area-wide level, but it did not allow for comparisons at a corridor level with a high degree of statistical confidence.

The survey was similar to the sample surveys fielded during Phase I of the evaluation, and included the following groups of questions:

1. A set of screener questions to identify respondents traveling in the peak direction between 6:00 and 9:00 a.m. and/or between 3:00 and 6:00 p.m. Interviews with respondents working for Mn/DOT, planning agencies, media outlets, and city/county public works departments were discontinued.
2. Characteristics of their last peak-period trip that included:
   - Trip purpose, place of trip origin, and date and time of trip;
   - Origin and destination (at town/suburb level and in detail);
   - Total travel time and percentage of time traveled on freeway;
   - Rating of freeway congestion; and
   - Wait time at entrance meter and at other freeway-freeway meter(s).

3. Experience with a "typical" freeway trip, including the frequency of using the freeway, the percentage of time the respondents experienced longer wait times at ramps, and the corresponding longer total travel time.

4. A battery of attitudinal statements regarding the respondent's travel experiences in general and ramp meters in particular. Ramp-related questions consisted of travelers' attitudes toward ramp wait times, safety considerations, predictability of travel, and the usefulness of ramp by-pass lanes.

5. Travelers' preferences for a set of ramp metering strategies, including a queue management policy to cap wait times at ramps, the re-definition of time windows when ramp meters are in operation, the testing of a freeway-freeway ramp metering policy, and a policy of ad-hoc ramp metering to respond to incident congestion.

6. Demographic information to control for differences among respondents.

The statistical analysis aimed to identify important differences by focusing on differences that are statistically significant at a 95 percent confidence level.

Tasks and deliverables in this effort included:

1. Design of the survey instrument for a random sample traveler survey. Mn/DOT participated in giving input and approval.

2. Programming of the random sample survey into a computer-aided telephone interview program to accommodate any changes to the original survey design.

3. Administration of the telephone survey for the random sample.

4. Data processing of the survey with two books of cross-tabulations (32 banner points).

5. A comparative statistical analysis of traveler perceptions and travel behavior with the previous two surveys and across traveler market segments.

6. Presentations to Mn/DOT of the survey analysis findings.

■ 6.2 Fall 2001 Market Research Results

During the Fall 2001 study period, the traveler survey was conducted by telephone and was based on a random sample of 500 travelers in the seven-county metropolitan study area. This section details the results of the market research analysis. The analysis focused on a comparative statistical analysis of traveler perceptions and travel behavior with the previous two waves of "With metering" and "Without metering" surveys conducted in the Fall of 2000, as well as across different segments of the traveler market. The statistical analysis identified important differences by focusing on those differences that were statistically significant at least at the 95 percent confidence level.

6.2.1 Socioeconomic Profile

There are great similarities in the socioeconomic characteristics of respondents who participated in each of the three random sample surveys. The respondents' profile was constructed based on their gender, age, automobile ownership, income, education, and household size. As can be seen in Table 6.1 through Table 6.6, the distributions of gender, age, automobile ownership, income, education, or household size are very similar across surveys ensuring that the randomly drawn samples are effectively the same and representative of the seven-county area population.

Table 6.1 Gender Distribution for Random Samples

	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Male	126	49.8%	126	50.0%	253	50.0%
Female	127	50.2%	126	50.0%	253	50.0%
Total	**253**	**100.0%**	**252**	**100.0%**	**506**	**100.0%**

Table 6.2 Age Distribution for Random Samples

	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
18 to 29 years	42	16.7%	45	18.0%	80	16.0%
30 to 39 years	61	24.2%	57	22.8%	117	23.4%
40 to 49 years	70	27.8%	73	29.2%	137	27.3%
50 to 59 years	42	16.7%	39	15.6%	89	17.8%
60 to 69 years	25	9.9%	22	8.8%	40	8.0%
70 or more years	12	4.8%	14	5.6%	38	7.6%
Total	**252**	**100.0%**	**250**	**100.0%**	**501**	**100.0%**

Table 6.3 Car Ownership for Random Samples

	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
None	0	0.0%	0	0.0%	6	1.2%
1 vehicle	52	20.7%	38	15.1%	99	19.8%
2 vehicles	120	47.8%	145	57.5%	266	53.3%
3 vehicles	47	18.7%	44	17.5%	80	16.0%
4 or more vehicles	32	12.7%	25	9.9%	54	10.8%
Total	**251**	**100.0%**	**252**	**100.0%**	**499**	**100.0%**

Table 6.4 Income Distribution for Random Samples

	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Under $20,000	6	2.6%	8	3.9%	26	5.8%
$20,000 to $34,000	39	17.2%	19	9.3%	41	9.1%
$35,000 to $49,000	36	15.9%	25	12.2%	83	18.4%
$50,000 to $64,000	42	18.5%	47	22.9%	79	17.5%
$65,000 to $79,000	37	16.3%	45	22.0%	81	18.0%
$80,000 to $99,000	22	9.7%	27	13.2%	67	14.9%
$100,000 to $149,000	34	15.0%	24	11.7%	52	11.5%
$150,000 or more	11	4.8%	10	4.9%	22	4.9%
Total	**227**	**100.0%**	**205**	**100.0%**	**451**	**100.0%**

Table 6.5 Education Levels for Random Samples

	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
High School or less	43	17.0%	44	17.5%	97	19.2%
Technical/vocational school	29	11.5%	23	9.1%	71	14.1%
Some college	59	23.3%	59	23.4%	107	21.2%
College graduate	75	29.6%	75	29.8%	132	26.2%
Post-graduate studies	47	18.6%	51	20.2%	97	19.2%
Total	**253**	**100.0%**	**252**	**100.0%**	**504**	**100.0%**

Table 6.6 Household Size for Random Samples

	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
One-person household	44	17.4%	31	12.3%	76	15.0%
Two-person household	91	36.0%	100	39.7%	183	36.2%
Three-person household	49	19.4%	47	18.7%	95	18.8%
Four-person household	51	20.2%	49	19.4%	100	19.8%
Five + person household	18	7.1%	25	9.9%	51	10.1%
Total	**253**	**100.0%**	**252**	**100.0%**	**505**	**100.0%**

The hypothesis of identical survey samples was tested using the statistical analysis technique known as "analysis of variance" (ANOVA). This technique was used to test whether any differences in the distribution of socioeconomic characteristics were statistically significant. In every case, there were no statistically significant differences at the 95 percent confidence level. As a result, the similarities in the respondent profile over the three survey waves strongly suggest that the three independently drawn samples are indistinguishable in terms of their socioeconomic composition.

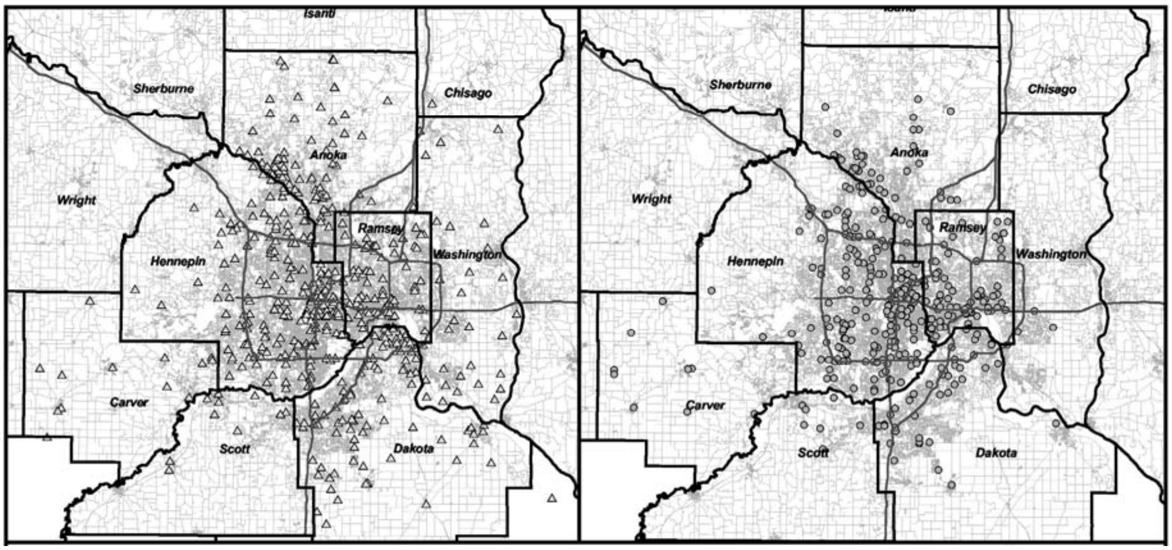
6.2.2 Geographic Representativeness

Subsequently, the survey data were examined and described geographically through maps that show respondents' origins and destinations. The objective of developing these maps was to ensure that respondents were spread out within the study area and were, therefore, not concentrated in specific sections potentially biasing the survey results.

Each of the 506 surveys contained geographic data describing the detailed origins and destinations of the respondents' trips and their home zip code. These data were geocoded using a Geographic Information System (GIS). These maps were developed in ArcView using the *Lawrence Group (TLG) Street Centerline Data* to match respondents' origin and destination addresses. Where matching was not feasible due to missing information, the respondent's home zip code was used to randomly assign each individual within the zip code boundaries.

The results of this geocoding effort are illustrated in Figure 6.1. The two maps showing respondents' origins and destinations clearly reflect a widespread distribution of respondents within the study area. These findings provide further support to the representativeness of the randomly drawn survey sample.

Figure 6.1 Fall 2001 Survey Geocoding Results



6.2.3 Travel Patterns

A key piece of information used to summarize potential differences in travel patterns within the Twin Cities metropolitan area was the average origin-destination travel time reported for peak-period trips. Tables 6.7 and 6.8 show the distribution of reported total travel times and the reported freeway travel times in each of the three survey waves.

Table 6.7 Total Travel Time for Random Samples

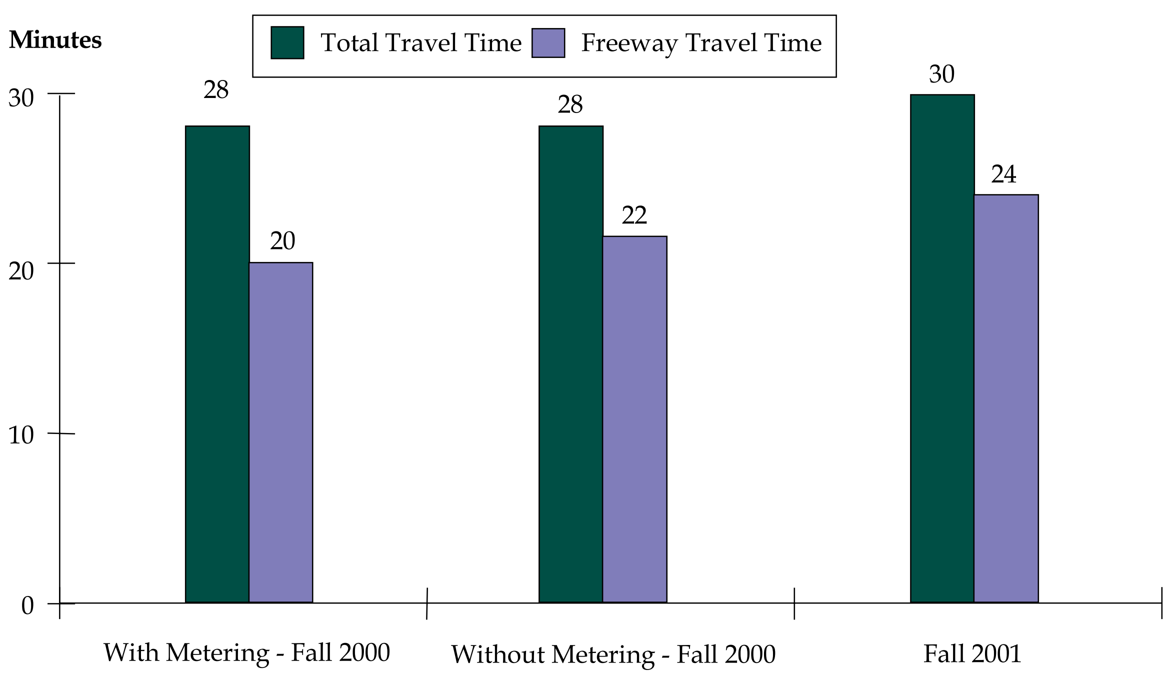
	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less than 15 minutes	38	15.0%	38	15.1%	88	17.4%
15 to 19 minutes	43	17.0%	26	10.3%	66	13.0%
20 to 24 minutes	44	17.4%	46	18.3%	76	15.0%
25 to 29 minutes	24	9.5%	43	17.1%	54	10.7%
30 to 34 minutes	36	14.2%	30	11.9%	67	13.2%
35 to 44 minutes	27	10.7%	27	10.7%	53	10.5%
45 to 59 minutes	25	9.9%	24	9.5%	59	11.7%
1 to 1.5 hours	12	4.7%	17	6.7%	36	7.1%
More than 1.5 hours	4	1.6%	1	0.4%	7	1.4%
Total	**253**	**100.0%**	**252**	**100.0%**	**506**	**100.0%**

Table 6.8 Freeway Travel Time for Random Samples

	"With Metering" – Fall 2000		"Without Metering" – Fall 2000		Fall 2001	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Less than 15 minutes	64	25.3%	75	29.8%	107	21.1%
15 to 19 minutes	26	10.3%	45	17.9%	53	10.5%
20 to 24 minutes	27	10.7%	31	12.3%	52	10.3%
25 to 29 minutes	11	4.3%	19	7.5%	33	6.5%
30 to 34 minutes	23	9.1%	16	6.3%	41	8.1%
35 to 44 minutes	14	5.5%	16	6.3%	28	5.5%
45 to 59 minutes	4	1.6%	13	5.2%	20	4.0%
More than 1 hour	5	2.0%	7	2.8%	15	3.0%
Total	**174**	**68.8%**	**222**	**88.1%**	**349**	**69.0%**

There was a modest increase in the average value for total origin-destination travel times with a 30-minute time travel time reported under the Fall 2001 study period (Figure 6.2). This estimate is comparable to the almost identical "With metering" and "Without metering" total travel time estimates of 28 minutes in 2000. The comparisons between these three values suggest that there were no statistically significant differences in total travel times across the three survey waves.

Figure 6.2 Average Travel Times



Q3I – How much time did this trip take from the time you started until you reached your destination?

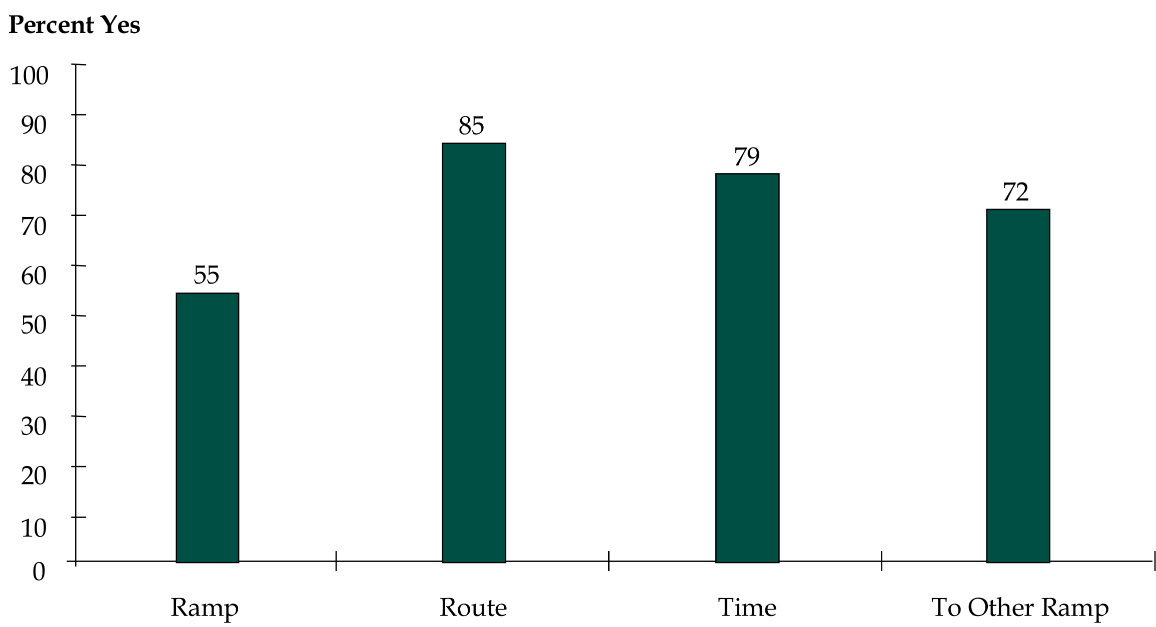
Q3K2 – How many minutes of this travel time did you spend on any freeways?

On the other hand, the average peak period travel times spent on a freeway showed a gradual modest increase in travel time from each wave of data collection to the next. This results in a Fall 2001 freeway travel time of almost 24 minutes compared to a low of a 20-minute freeway travel time under the "With Metering – Fall 2000" conditions.

This difference corresponds to ***a statistically significant increase in the average travel time spent on freeways*** by survey respondents in the random sample. This finding suggests that, despite an overall similar total travel time, respondents believe that the time they spent on the freeways during the peak periods increased following the implementation of the reduced ramp metering strategy. This finding is consistent with the findings of an increase in actual travel times and decrease in speed measurements along the freeway corridors of interest to the study.

Finally, the stated diversion patterns in response to congestion are illustrated in Figure 6.3. It should be noted that respondents gave a higher-stated probability of changing their departure times (85 percent) and diverting to an alternate route (79 percent), rather than using another ramp. This pattern again confirms the underlying changes in ramp meter operations that have changed the focus of travelers' attention from the ramp meter delays to traffic conditions on the freeways.

Figure 6.3 Diversion Pattern Under Current Conditions



Q11B – Do you sometimes use alternate routes to
B-1 Avoid waiting at ramp meters?
B-2 Avoid traveling on congested freeways?

Q11C – Do you sometimes leave earlier or later to avoid traffic congestion?

Q11D – Do you sometimes avoid a ramp that is backed up and use a different ramp?

6.2.4 Attitudes Toward Aspects of Travel

The battery of attitudinal questions examined travelers' attitudes toward their overall travel in the area, as well as specific attributes of their travel experience that were affected by ramp meter operations. Respondents rated the statements on a scale of zero to 10, with a rating of one meaning that respondents strongly disagreed with a statement and a rating of 10 suggesting that they strongly agreed. The wording of the attitudinal statements was intentionally mixed with both positively and negatively worded statements to control for any wording biases. The order of the statements was also randomized to avoid any ordering biases.

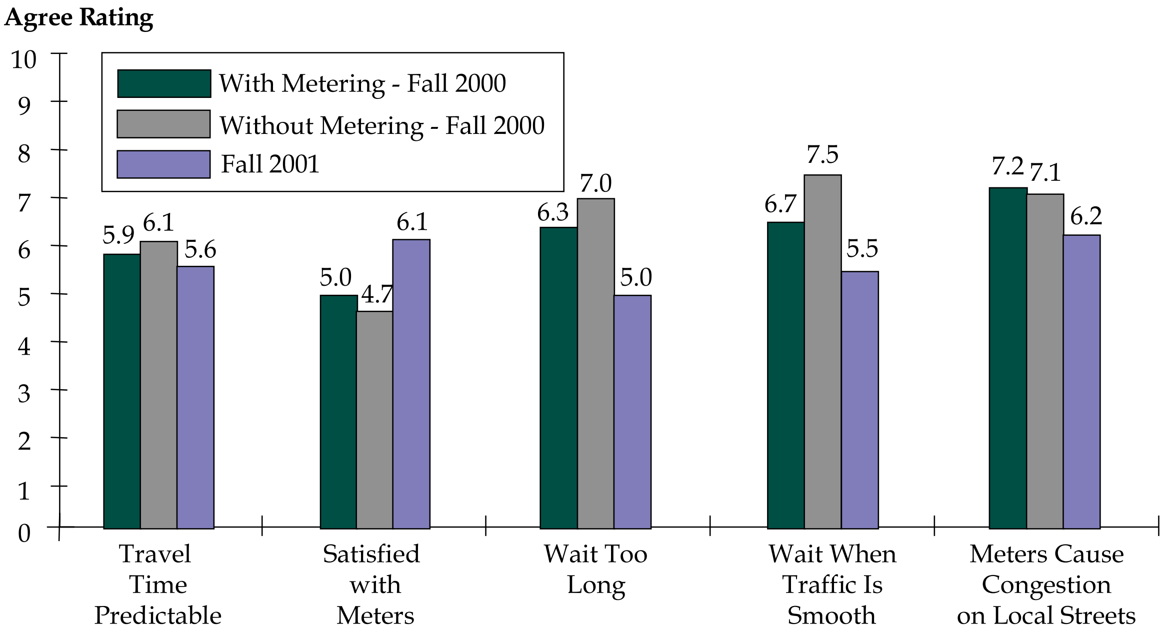
Respondents were asked to rate the same battery of attitudinal statements in each of the three survey waves with consistent wording of each question. Table 6.9 illustrates respondents' ratings for all of the original (Fall 2000) statements, plus the two new statements that were added in the Fall 2001 survey. The most important patterns and interesting findings have been summarized in Figure 6.4 and include the following:

Table 6.9 Comparison in Respondents' Ratings Across Waves of Random Samples

	Average Rating		
	"With Metering" – Fall 2000	**"Without Metering" – Fall 2000**	**Fall 2001**
Feel safe from crashes on freeways	5.64	6.10	5.61
Special lane for buses/carpools	4.64	5.23	5.00
Good freeway network	5.43	5.16	5.03
Travel time predictable during peak	***5.86***	***6.09***	***5.59***
Overall satisfied with ramp meters	***4.99***	***4.72***	***6.13***
Wait time at meters is too long	***6.28***	***6.98***	***5.04***
Never know how long wait time will be	***6.89***	***6.91***	***5.94***
Safe when leaving ramp meter to merge	5.81	6.15	6.18
Ramp meters improve overall traffic	5.41	5.32	5.63
Cost of ramp meters is good value	4.63	4.14	4.74
Ramp meters shorten travel time	4.37	4.37	4.54
Ramp meters reduce car crashes	5.38	5.27	5.38
Ramp by-pass lanes benefit to me	4.33	4.26	4.24
Some meters may not be necessary	6.38	7.88	6.89
Buses/carpools should have ramp by-pass lanes	7.52	7.39	7.33
Sometimes need to wait even with smooth traffic	***6.72***	***7.52***	***5.50***
More alternative routes to avoid ramp meters	6.49	6.22	5.89
Ramp meters cause congestion on local streets	***7.16***	***7.13***	***6.20***
Electronic sign stating wait time	5.85	5.13	
Do not feel safe when going through a meter			4.17
Length of time drivers wait at meters is too short			3.62
Tolerance for congestion	5.27	4.54	5.29
Amount of traffic congestion	5.82	5.45	5.67

Italics = Statistically significant differences.

Figure 6.4 Ramp Metering Attributes



Q10 – Use a scale of 1 to 10 to tell me how much you agree with the statement
D – Travel time is predictable
E – Overall satisfied with ramp meters
F – Length of time waiting at meters is too long
P – Wait at meters when traffic is moving well
Q – Meters cause congestion on local streets

- The ***predictability of travel times*** during the peak period in the Fall 2001 survey was given the lowest rating among the three survey waves. This finding is consistent with the observed traffic patterns along the freeways of interest to the study as illustrated by the increased variability in travel times during the most recent wave of data collection.

- Respondents' ***overall satisfaction with ramp meters*** was considerably higher under the Fall 2001 survey. This finding is consistent with the change in ramp metering operations that has reduced the waiting times at the meters.

- The same pattern was reflected in respondents' ratings of ***wait time at the meters***. Their higher level of agreement reflected the lower wait times under the Fall 2001 conditions. Similarly, respondents in the Fall 2001 survey disagreed more strongly that they ***had to wait too long at the meters even when traffic was proceeding smoothly,*** again reflecting the perceived improvement in ramp metering operations.

- Furthermore, respondents in the Fall 2000 survey disagreed more strongly about the statement that ramp meter operations cause a spillover of ***congestion on local streets***.

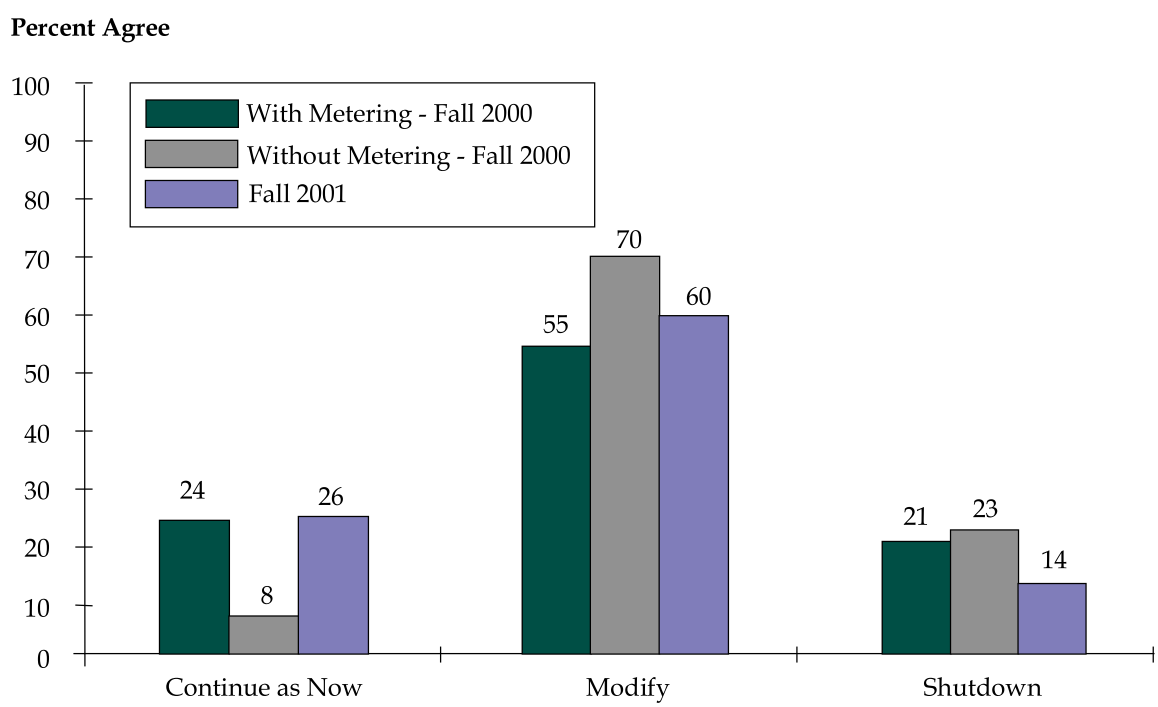
The lack of such localized congestion was again confirmed by the lack of any ramp queues as observed during the traffic data collection effort.

- Finally, there did not seem to be any particular safety concerns reflected either in the original safety-related statements or in the new statements that were added for the Fall 2001 wave of data collection.

6.2.5 Traveler Opinions About the Future of Ramp Metering

The future of ramp metering was assessed with the same "polling" question across the three waves of data collection. Figure 6.5 illustrates the continuing very strong support for experimenting with ramp metering efforts trying to fine-tune the metering operations. Although the support for further ramp metering modifications has dropped a little compared to the "Without metering" survey, the support for completely shutting off the ramp meters was at its lowest level among the three survey waves.

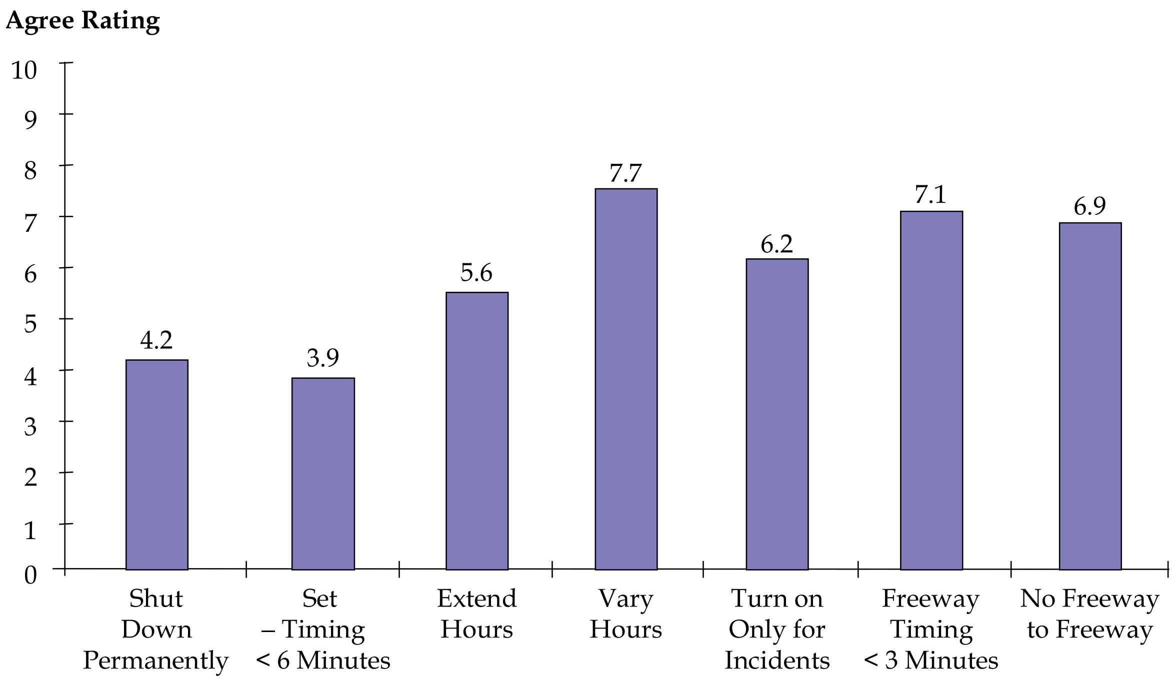
Figure 6.5 Results of the Polling Questions



Q13-A Do you think the ramp meter system should be continued as now, modified, or shutdown?

In the Fall 2001 survey, respondents were also asked a follow-up question to examine the appeal of different proposed modifications in ramp metering operations. Figure 6.6 summarizes respondents' level of agreement with the different ramp metering strategies. The option that received the greatest support among respondents was that *"The hours that ramp meters operate would vary in different locations depending on the traffic congestion"* (average rating of 7.7). Strong agreement was also provided *for "When using a ramp that takes you from one freeway to another, set the timing on the ramp meter so that vehicles would never wait more than two or three minutes"* and *"When using a ramp that takes you from one freeway to another, you should not have to wait at a ramp meter to enter the next freeway"* with average ratings of 7.1 and 6.9, respectively.

Figure 6.6 Policy Options for Metering Modification



Q11-J There are a number of ways meters could be operated.
Tell me how much you agree with each option

- Shut down
- Set timing so you might have to wait longer than you do now but never more than 6 minutes
- Extend hours if traffic is heavy
- Vary hours depending on congestion
- Turn on only in response to incidents
- When using a freeway-to-freeway ramp, set timing so wait is never more than 2-3 minutes
- When using freeway-to-freeway ramp, you should not have to wait at a meter

The option that received the lowest level of support was stated, *"Set the timing so you might have to wait longer than you do now, but never more than six minutes"* (average rating of 3.9) and was also followed at a very low level of support by *"Shut down all ramp meters permanently"* (average rating of 4.2). It should be noted that lack of support for a maximum wait time of six minutes does not necessarily mean lack of support for lesser wait times, which would still represent an increase from Fall 2001 negligible wait times if this resulted in an overall improvement in traffic operations and travel times.

Finally, Table 6.10 provides yet another way of examining these statements in addition to focusing on the average ratings. An examination of the distribution of "Agree" versus "Disagree" responses is provided by grouping ratings of 1-3 (strongly disagree), 4-7 (neither agree nor disagree), and 8-10 (strongly agree).

Table 6.10 Grouping of Responses for Metering Policy Options

		Strongly Disagree	Neither Agree Nor Disagree	Strongly Agree
	Average Rating	Rating Between 1 and 3	Rating Between 4 and 7	Rating Between 8 and 10
Shut down all ramp meters permanently	4.2	51%	27%	22%
Set the timing so you might have to wait longer than you do now, but never more than 6 minutes	3.9	56%	27%	17%
Extend the hours that ramp meters are operating if traffic continues to be heavy	5.6	29%	39%	32%
Turn the ramp meters on only when there are specific incidents that cause traffic congestion such as road construction or car crashes	6.2	24%	33%	43%
When using a ramp that takes you from one freeway to another, set the timing on the ramp meter so that vehicles would never wait more than 2 or 3 minutes	7.1	14%	32%	55%
The hours that ramp meters operate would vary in different locations depending on the traffic congestion	7.7	7%	28%	65%
When using a ramp that takes you from one freeway to another you should not have to wait at a ramp meter to enter the next freeway	6.9	19%	29%	52%

The distribution of ratings suggests that two out of three respondents strongly agreed with the ramp metering strategy that states: *"The hours that ramp meters operate would vary in different locations depending on the traffic congestion."* At the opposite end of the spectrum, more than half of the respondents strongly disagreed with the ramp metering strategy proposing to *"Set the timing so you might have to wait longer than you do now, but never more than six minutes."*

6.2.6 Summary and Conclusions

The results of this market research supported the findings of the traffic analysis which indicate that freeway operations continued to be degraded under the Fall 2001 (representing the reduced metering capacity) study period relative to the "With metering" scenario in the fall of 2000. Support for continued modification of the system remained high, while support for a permanent shutdown was at its lowest level during the course of these evaluations.