3.0 Evaluation Objectives and Performance Measures

The goals and objectives of conducting the evaluation of ramp meter effectiveness in the Twin Cities Metropolitan Region were designed to meet the mandate of the legislature's bill. Three evaluation goals for the Ramp Meter Study were identified, including:

- Evaluate whether the benefits of ramp metering outweigh the impacts and associated costs;
- Identify other ramp metering impacts on surface streets and transit operations; and
- Identify how the Twin Cities' ramp metering system compares and contrasts with other national and international ramp meter systems in other areas.

For each of the broad evaluation goals, several detailed evaluation objectives were identified. These evaluation objectives provide the framework for conducting the evaluation. Table 3.1 presents the evaluation objectives as they relate to each of the evaluation goals.

For each of the evaluation objectives, one or more measures of effectiveness were identified to provide an assessment of the objective. Where possible, these evaluation measures were expressed in quantitative terms; however, many of the measures are more appropriately expressed in qualitative terms. Appropriate data were collected relating to each of these measures to provide the opportunity for assessment against the evaluation objectives and goals.

The evaluation measures selected for each evaluation objective are presented in Table 3.2. The measures of effectiveness are focused on the incremental change observed between the two evaluation scenarios – "with ramp meters" and "without ramp meters." By focusing on the change occurring between the two scenarios, the evaluation team was better able to isolate the particular benefit/impact. The measures of effectiveness are not mutually exclusive and, in some cases, the same measure was used to test several objectives. The evaluation measures were also designed to be "neutral" and not pre-suppose any outcome of the ramp meter test. In all cases, the outcome of the particular measure could be either positive or negative, depending on the impacts observed during the two scenarios. Outcomes could also be *both* positive and negative, in that results could vary geographically across the selected corridors, market segments, or timeframes.

Table 3.1 Evaluation Goals and Objectives

Evaluation Goal	Evaluation Objective
Evaluate whether the benefits of ramp metering outweigh the impacts and associated costs.	• Quantify ramp metering safety impacts (positive and negative) for selected corridors. Extrapolate ramp metering safety impacts to the entire system. • Quantify ramp metering traffic flow impacts (positive and negative) for selected corridors. Extrapolate ramp metering traffic flow impacts for the entire system. • Estimate ramp metering impacts (positive and negative) on energy consumption and the environment. • Compare the systemwide ramp metering benefits with the associated impacts and costs. • Identify (both quantitatively and qualitatively) public attitudes toward ramp metering for both the selected corridors and the region as a whole.
Identify other ramp metering impacts on surface streets and transit operations.	• Identify ramp metering impacts on local streets. • Identify ramp metering impacts on transit operations. • Document additional ramp metering benefits/impacts observed during the study.
Identify how the Twin Cities' ramp metering system compares and contrasts with ramp meter systems in other areas.	• Identify similarities and differences between the Twin Cities' ramp metering system and other metropolitan areas in terms of ramp meter operation strategy employed, and ramp configuration strategy. • Identify national and international trends regarding the use of ramp metering as a traffic management strategy. • Identify benefits/impacts of ramp metering systems documented in other national and international studies.

Table 3.2 Evaluation Measures

Evaluation Objective	Measures of Effectiveness
1. Quantify ramp metering safety impacts for selected corridors and the entire system.	• Change in the number and severity of crashes occurring in selected corridors and the entire system. • Estimated change in the regional crash rate for different facility types. • Change in the number of traffic conflicts (non-crashes) occurring at specific corridor locations (ramp merge and adjacent intersections). • Change in HOV lane violations. • Perceived change in safety of travel in selected corridors and the entire system.
2. Quantify ramp metering traffic flow and travel time impacts for selected corridors.	• Change in travel time for primary and alternative travel routes in selected corridors. • Change in travel speed for primary and alternative travel routes in selected corridors. • Change in traffic volume for primary and alternative travel routes in selected corridors. • Change in travel time reliability for selected corridors. • Change in traffic volume, travel time, travel speed, and travel time reliability for on-ramps in selected corridors. • Perceived change in travel time and travel time reliability for selected corridors.
3. Identify ramp metering impacts on local streets.	• Change in traffic volumes on local streets in selected corridors. • Change in the length and severity of ramp queue spillover onto adjacent intersections in selected corridors.
4. Extrapolate ramp metering traffic flow and travel time impacts (positive and negative) for the entire system.	• Estimated regional change in travel time, travel time reliability, travel speed, vehicle miles traveled for different facility types. • Perceived regional change in travel time. • Perceived regional change in travel time reliability.
5. Estimate ramp metering impacts (positive and negative) on energy consumption and the environment.	• Estimated regional change in emissions by pollutant and by facility type. • Estimated regional change in fuel consumption by facility type.

Table 3.2 Evaluation Measures (continued)

Evaluation Objective	Measures of Effectiveness
6. Compare the systemwide ramp metering benefits with the associated impacts and costs.	• Change in the number and severity of crashes occurring systemwide. • Change in systemwide travel times. • Change in the total number of trips. • Change in travel time reliability. • Change in fuel use and other user paid costs. • Change in vehicle emissions levels. • Estimated change in DOT operating costs. • Estimated change in operating costs of other agencies (e.g., State Patrol, transit agencies, local jurisdictions, etc.) • Capital and operating costs of ramp metering system.
7. Identify ramp metering impacts on transit operations.	• Change in transit travel times for selected corridors. • Change in transit ridership levels for selected corridors. • Estimated change in operating costs for transit providers.
9. Document additional ramp metering benefits/impacts observed during the study.	• Documentation only.
10. Identify similarities and differences between the Twin Cities' ramp metering system and other metropolitan areas in terms of ramp meter operation strategy employed, and ramp configuration strategy.	• Documentation only.
11. Identify national and international trends regarding the use of ramp metering as a traffic management strategy.	• Documentation only.
12. Identify benefits/impacts of ramp metering systems documented in other national and international studies.	• Documentation only.