

4.0. POLICY GUIDANCE FOR RAMP METERING

4.1. Background and Current Experience

Ramp metering is the use of traffic signals (posted either above or alongside freeway on-ramps) to control the flow of traffic entering a freeway. Ramp metering can be an effective tool to address congestion and safety issues that either occur at a specific point or along a stretch of freeway. The application of ramp metering, however, must be consistent with overall agency and regional transportation policies, goals, and objectives. Ramp meters should not be deployed until metering goals and objectives are integrated into a larger transportation management program and policies that support ramp meter implementation exist.

The recent implementation of ramp meters has resulted in the need to define policies regarding the implementation, operation and maintenance of these systems. The policies outlined in this section help practitioners identify when ramp meters should be used, and how they should be operated to maintain a consistent approach statewide.

4.2. Program and Policy Understanding

The policies presented in this draft represents “a beginning” – a first attempt at assembling guidelines related to ramp metering. The document is deliberately general. As new transportation facilities are opened in Nevada, experience may highlight changing conditions or deficiencies in particular policies that will necessitate further study and refinement before a definitive policy can be developed for some topic areas.

This policy is intended to provide the framework to ensure consistency statewide for all aspects of ramp metering implementation, operation and maintenance. However, recognizing the imminent nature of ramp metering in the Las Vegas area, and acknowledging that northern Nevada cities are probably many years away from seriously considering ramp metering projects, the focus of this initial draft policy statement is on southern Nevada.

4.2.1. Goals and Objectives

The following goals and objectives were identified for ramp metering in the State of Nevada.

Safety

Goal #1: Improve overall safety and decrease crashes

- ❖ The primary intent of this goal is to decrease collisions in the vicinity of the freeway/ramp merge/weave area.

- ❖ This goal seeks to improve the flow and improved rate that vehicles enter freeways from ramps to reduce conflicts as vehicles merge.

Mobility

Goal #2: Improve overall travel speeds

- ❖ The primary intent of this goal is to increase vehicles speeds to levels that are considered desirable by the traveling public. Typically, speeds in excess of 40 mph are considered to be desirable; however, the actual “desired speed” should be defined by local decision makers.

Goal #3: Increase freeway throughput

- ❖ The primary intent of this goal is to reduce congestion, and improve the overall freeway level of service.

Goal #4: Increase ramp throughput and avoid queuing

- ❖ The primary intent of this goal is to maintain queue lengths and queue times at acceptable levels.
- ❖ This goal also ensures that vehicle queues that form at the ramp meter do not spill back onto and affect operations on adjacent arterials.

Neighborhood Impacts

Goal #5: Avoid cut through traffic in neighborhoods

- ❖ The primary intent of this goal is monitor and adjust wait times at ramp meters to reduce the occurrence of traffic diverting from freeways to adjacent surface streets. Ramp meter release rates should not be overly restrictive such that motorists tend to favor traveling via surface streets versus waiting at ramp meters and traveling via the freeway.

Reduce Environmental Impacts

Goal #6: Support Regional Air Quality

- ❖ The primary intent of this goal is to reduce overall vehicle delay through the use of ramp meters to reduce the amount of emissions released into the environment.

Transit/Carpool/Vanpool

Goal #7: Promote bus and carpool benefits at ramp meter sites

- ❖ The primary intent of this goal is to promote the use of transit/carpooling/vanpooling by implementing an HOV-Bypass lane where it is possible to do so.

4.2.2. Organizational Structure –Roles and Responsibilities

The primary partners in ramp metering projects mirror HOV/managed lanes and include NDOT, FHWA, and other local implementation, operation and enforcement agencies. The role each serves is distinct and related to the specific implementation, operation, enforcement and monitoring activities of individual projects and the regional system as a whole.

Coordination is an essential aspect of any successful transportation program. NDOT will coordinate ramp metering efforts with appropriate agencies, including regional and local transportation engineering departments, public transit and private transportation service providers, law enforcement, upper management, and government officials and decision makers throughout the planning, design, construction, and operation phases. When operational changes are to occur to the ramp metering program, it will be the responsibility of NDOT to coordinate such changes with the agencies and jurisdictions specifically affected by the change.

Planning

- ❖ System planning, corridor screening and concept development: NDOT
- ❖ Regional forecasting: RTC with NDOT concurrence
- ❖ Partnering agencies: FHWA, Local agencies

Project Development

- ❖ Environmental Approval, Design and Construction: NDOT
- ❖ Partnering Agencies: FHWA, local implementing and enforcement agencies

Operation

- ❖ Operation Policy and Regulations: NDOT in consultation with local operation agencies (i.e., RTC in southern Nevada and Washoe RTC in northern Nevada)
- ❖ Enforcement: Local and state police
- ❖ Transit Service: Local provider
- ❖ Partnering Agencies: FHWA, City, County

Marketing

- ❖ Outreach: RTC, NDOT
- ❖ Communication: RTC
- ❖ Partnering Agencies: NDOT, City, County

Performance Monitoring

- ❖ Data collection: NDOT, FAST, RTC and other agencies as appropriate
- ❖ Documentation and dissemination: NDOT

The functional roles outlined serves as a means of establishing working relationships on projects or regional

system task force. Specific roles may be assigned on a project-by-project basis. In each case the lead agency is charged with the responsibility of coordinating and communicating with partnering agencies and addressing issues of common interest and concern. The overall goal of the HOV/Managed Lane organizational structure will be to foster development of lane treatments and associated facilities that can best meet regional and corridor-specific congestion management needs by promoting more efficient travel, primarily for higher occupancy vehicles and trucks.

4.3. Program Policies

This section outlines policy points that address ramp metering goals and objectives as outlined above. Program policies help provide the framework for ramp metering technical guidance found in the Implementation and Design Manuals. These policies should be revisited from time to time as projects are implemented and operated.

4.3.1. Implementation

Policies are needed to ensure that ramp metering equipment is not only implemented in a manner that is beneficial but one that is also achievable and practical. Implementing ramp meters for the mere objective of trying to improve existing conditions may not be the best or most cost-effective approach. Alternatively, taking a holistic approach that considers all the variables will almost always be more successful. The policies below serve as a starting point, or minimum set of recommended actions tied to implementation that must be completed to ensure successful implementation of ramp metering equipment.

Justification for Ramp Meter Deployment

- ❖ A system level assessment shall be conducted for any area considering ramp metering that will determine the need for, and impacts of ramp meters. The initial region for this assessment is the Las Vegas area.
- ❖ Corridors with routine congestion shall be considered for ramp metering.
- ❖ Ramp meters shall be considered for deployment on ramps where a safety problem exists either on the ramp or at a location on the freeway facility at or near the ramp/freeway merge point.

Justification of Geographic Extent

- ❖ Ramp meters shall be considered for deployment on a corridor basis, if ramp related problems are observed at multiple locations on a specific corridor, and no such problems are observed on any other corridor.
- ❖ Ramp meters shall be considered for deployment at an isolated location (i.e., without considering metering other nearby ramps) if a ramp related problem is observed at that location and similar problems are not observed at ramps immediately upstream or downstream of the ramp in question.

Demand Thresholds

- ❖ Pre-metering demand on the ramp shall be used to determine the appropriate ramp metering flow control (refer to the Implementation Manual).

Adjacent Facility Operations

- ❖ When planning ramp meter projects, the impacts to adjacent arterial traffic will be considered.
- ❖ Ramp meters will be considered for deployment only if there is sufficient storage room on the ramp to hold vehicles that must wait at the ramp meter. If existing storage room is deemed inadequate for times of day when the ramp meter is operational, ramp meter implementation may be allowable if sufficient, additional storage can be created by widening the ramp, or by other means (e.g., re-striping lanes).

Implementation Phasing

- ❖ Phasing of ramp meters for any introductory or “first” projects in a region will attempt to maximize benefits and minimize impacts to the greatest extent possible, since this will be the basis for how future projects will be perceived.
- ❖ Ramp meters will be installed and operational at least one week before they are turned on for public use for the first time to allow sufficient time to fully test the operation of each meter.
- ❖ Ramp meters will be phased in a logical sequence with the communications provided to the TMC prior to deployment.

4.3.2. Operations

Policies are needed to ensure that deployed ramp metering equipment is operated correctly and in a consistent manner. The primary responsibility for ramp meter operations lies with NDOT. In the Las Vegas area, the operation of ramp meters is through an agreement with RTC.

Staff Readiness

- ❖ Ramp meter policies and procedures shall be consolidated into a single operations manual and either given directly to operations staff or housed in a location where staff can easily access it if needed.

Hours of Operation

- ❖ Ramp meters shall be turned on/off at the same time everyday during the initial period of operation, unless otherwise indicated by the supervisor in charge of ramp metering operations. The initial period will depend on several factors, including the degree to which motorists have adjusted to metering and the experience of the operators.
- ❖ Ramp meters shall be operated only during the peak-periods during the initial period of operation to reduce motorists’ confusion and to make the system predictable.

- ❖ Ramp meters will be considered for operation when emergencies occur or in unique situations where their use will benefit existing conditions.
- ❖ Ramp meters will be turned on/off outside their normal hours of operation only by trained operators that are familiar with typical traffic patterns and problems.

Day-to-Day Activities

- ❖ Ramp meters will be operated on a consistent basis for the entire region.
- ❖ If CCTV is present near metered ramps, meters will be individually monitored on a periodic basis to confirm that they are working correctly, and to adjust parameters when appropriate.
- ❖ If CCTV is not present near metered ramps, operators will schedule routine field visits to observe if meters are working correctly, and to adjust parameters when appropriate.

4.3.3. Maintenance

Policies are needed to ensure the continual use and effectiveness of ramp meter equipment. Policies in this section ensure that equipment is maintained on a routine and as-needed basis. The primary responsibility for ramp meter maintenance is NDOT.

Day-to-Day Activities

- ❖ Ramp metering equipment shall be maintained according to vendor requirements.
- ❖ Operators shall develop and update a check list of activities for maintaining ramp metering equipment.
- ❖ Operators shall develop and update an inventory of ramp meter hardware, software and other equipment, that detail:
 - Date equipment was installed
 - Location of equipment
 - Equipment vendor
 - Vendor contact information
 - Equipment model or version and serial numbers

Responsive Maintenance

- ❖ Ramp metering equipment shall be maintained on an as-needed basis when system malfunctions occur.
- ❖ Responsive maintenance needs shall have a higher priority than preventative maintenance needs when sufficient staff are not immediately available to address every maintenance need.

Preventative Maintenance

- ❖ Ramp metering equipment shall be maintained on a regular/scheduled basis, according to vendor recommendations.

4.3.4. Enforcement

Policies are needed to enforce ramp meter operations.

Outreach

- ❖ NDOT shall be responsible for coordinating with local, regional, and state law enforcement agencies to maximize public compliance. This role is continuing to emerge as legislation is enacted.

Initial Operations

- ❖ Ramp meters shall be actively enforced during the initial month of operation.
- ❖ After the initial month of operation, ramp meters should be enforced on a routine, spot check basis.
- ❖ Operators shall report meters with high violation rates to enforcement agencies.
- ❖ Ramp meter locations shall include enforcement areas that provide a safe observation point for officers and an area to pull violators off the traveled lane so enforcement actions will have minimal effect on traffic conditions.

4.3.5. Performance Monitoring, Evaluation and Reporting

Policies are needed to monitor, evaluate and report the performance of ramp meters. Performance monitoring, evaluation and reporting conveys the benefits of ramp meters to decision makers and creates the foundation from which this ramp metering program can become publicly accepted in Nevada. Performance measurement policies serve as a means to improve operations and to allocate resources to programs that are most effective in satisfying stated goals and objectives.

Monitoring

- ❖ Ramp meters shall be monitored on an on-going basis throughout their entire life-cycle.
- ❖ Ramp meters shall be monitored either remotely (using CCTV), or manually in the field, to determine their impacts and effectiveness in accomplishing stated goals and objectives. Refer to the Ramp Metering Monitoring Plan for more information.

Evaluation

- ❖ Ramp meters shall be evaluated on a routine basis to assess whether or not anticipated outcomes are being produced and if improvements need to be made.
- ❖ Measures of effectiveness for ramp meter system evaluation shall be selected that reflect overall transportation system goals and objectives.
- ❖ Ramp meters shall be evaluated several times during the first year of operation and annually thereafter.

Reporting

- ❖ Ramp meter effectiveness should be monitored by NDOT and be reported to upper management, staff, outside agencies, the media and public in a manner that each of these groups can easily understand.

- ❖ Operators shall record and compare the results of ramp meter evaluations with the results of past and future evaluations so conclusions regarding ramp metering effectiveness can be made.

4.3.6. Marketing and Outreach

- ❖ The benefits of ramp meters and the reasoning for their implementation will be conveyed to upper management, traffic managers, traffic engineering departments, law enforcement agencies, transit agencies, the media, or any other individual or agency affected by ramp meter implementation and operation.

4.4. Ramp Metering System Needs

Policies are needed to ensure that ramp metering programs obtain the necessary resources that are needed for successful system implementation, operation and maintenance.

4.4.1. Funding (Operations and Maintenance)

Funding is the backbone for any project. It is necessary to identify funding sources well in advance of when ramp meters are proposed to be installed, so they can be implemented in a timely and effective fashion, operated correctly and consistently and routinely maintained. Since NDOT is leading the effort to deploy ramp meters, funding will be the responsibility of NDOT. In terms of funding, the following policies shall be followed:

- ❖ Ramp meters shall be considered for deployment only if funding is available to support their operation and maintenance throughout their designed operational life cycles.
- ❖ Funding sources shall be identified well in advanced of when meters are planned to be deployed.
- ❖ Funding shall be secured for the entire life-cycles of ramp metering equipment, including that which is needed for planning, design, implementation, operation, maintenance, and performance evaluation.
- ❖ Resources shall be secured to properly train staff.
- ❖ Resources shall be secured to allow staff to do their jobs effectively.
- ❖ New and innovate ways to fund ramp meter life-cycle activities shall be investigated, including possibilities to "piggyback" with other projects.

4.4.2. Staffing (Operations and Maintenance)

Staff are needed to operate and maintain ramp metering equipment. Ramp meters shall not be implemented if staff are not available to perform these tasks. In addition, ramp meters will not be operated if staff have not be trained on its proper operation.

4.4.2.1. Staff Skills

- ❖ The skills of staff responsible for ramp metering operations and maintenance shall be evaluated before ramp metering equipment is installed.
- ❖ Staff skills shall be evaluated to determine the feasibility of ramp meter operations, and to assess additional training needs.
- ❖ Ramp metering equipment should not be installed until NDOT and RTC agree that staff skills are adequate.

4.4.2.2. Staff Training

- ❖ The training needs of staff that operate or maintain ramp metering equipment shall be evaluated during the planning phase, before ramp meters are deployed.
- ❖ Staff who operate ramp meters shall be trained on the policies and procedures for effective ramp meter operation.
- ❖ Staff training shall be conducted on an on-going basis to keep staff up-to-date and to train new staff members.
- ❖ Staff who operate or maintain ramp metering equipment shall be trained on how to perform these activities correctly and in a timely fashion before ramp meters are initially operated.
- ❖ Staff training shall include a technical and operational component.
- ❖ Staff who operate or maintain ramp metering equipment shall be each given a training manual or be made aware of the location where one is kept.
- ❖ Training manuals shall include, at a minimum, the types of information outlined in Section 3.3.3 of the Implementation Plan.

4.4.2.3. Staff Levels: In-house, Out-sourced

- ❖ The levels of staff responsible for ramp metering operations shall be evaluated before ramp metering equipment is installed.
- ❖ Ramp metering equipment shall not be installed until NDOT and RTC agree that staff levels are adequate.

4.4.3. Equipment and Hardware

- ❖ Ramp metering equipment and hardware shall be upgraded periodically in order to assure that they can be maintained. As a minimum, equipment needs to be upgraded before spare parts and vendor support are no longer available.
- ❖ Ramp metering equipment and hardware shall be inventoried.
- ❖ Ramp metering equipment and hardware inventories shall be updated every time a equipment or hardware is added, removed, or modified.

4.4.4. Software

- ❖ Ramp metering software shall be upgraded periodically. A software and system upgrade plan shall be developed to provide a plan for updating software that indicates when the entire computer system (including software) should be replaced.
- ❖ Ramp metering software shall be inventoried.

References:

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3. Guide for the Design of High Occupancy Vehicle Facilities," American Association of State Highway and Transportation Officials, Washington, D.C., November 2004.
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5. High-Occupancy (HOT) Lane Manual, Federal Highway Administration, Washington, D.C., 2003.
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