Freeway Traffic Management Strategies

ICM Functional Area / Tactic	ICM Category	ICM High-Level Benefits								
		Safety / Response	Mobility / Accessibility	Demand Reduction / Shift	Travel choice / Decision Making	Return on / Use of Existing Investment	Efficiency / Productivity	Institutional Cooperation	Environmental Impact	Customer Experience / DOT Perception
Freeway Management										
Traffic Data Collection and Processing	Foundational		•	•	•			•		
Traveler Information Dissemination	Foundational	•	•	•	•			•		•
Network Monitoring / Surveillance	Foundational	•	•	•	•			•		•
TMC Enhancement / Expanded Operations	Foundational	•	•	•	•	•	•	•	•	•
Ramp Terminal Treatments	Fundamental	•	•			•		•		
Ramp Closure	Fundamental	•	•	•				•		
Special Use Ramps	Fundamental		•	•	•	•		•		•
Ramp Metering	Fundamental	•	•	•		•	•	•	•	
Adaptive Ramp Metering	Active and Advanced	•	•	•		•	•	•	•	
Dynamic Junction Control	Active and Advanced	•	•			•			•	
Dynamic Shoulder Lanes / Part-time Shoulder Use	Active and Advanced		•			•			•	•
Dynamic Truck Restrictions	Active and Advanced	•	•	•					•	

Traffic Data Collection and Processing

	Traffic Data Collection and Processing
Description	This component stores information that is created through operations performed by a Traffic Management Center. Data collected by the center can be used directly by operations personnel or it can be made available to other data users and archives. Center-based data collection and processing supports other fundamental, advanced and emerging strategies by providing the raw data needed to initiate appropriate response and assess performance. The Institute for Transportation has been active in this area in several capacities, including: • Establishing the Iowa DOT's open traffic data service which allows vendors and agencies to provide near real-time, proactive alerts to commercial drivers regarding traffic conditions along their routes. • Deep learning applied to wrong way driving. More specifically taking image data from TMC elements as closed circuit television cameras to detect high-risk locations and eventually automating wrong-way detection systems.
ICM Category	• Foundational strategy
Anticipated Benefits	• Improved accessibility and mobility • Reduced or shifted demand • Enhanced traveler choice and decision making (e.g., enhances transportation planning and real-time decision making) • Improved institutional cooperation
Provided Functionality	• Enhances decision making
Prerequisite Functionality Required	• Communications
Complementary and/or Supported Strategies	• Supports or enhances most ICM strategies outside of system modifications.
Examples	• Widely adopted

Network Monitoring/Surveillance

	Network Monitoring/Surveillance
Description	This strategy uses information collected from a variety of sources including detectors and sensors, operational data feeds from centers, probe data (often from third-party private providers) and eventually connected vehicles to monitor network conditions on a near real-time or real-time basis. The information may be used to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data. Additional data are collected including crash data, road condition data, road closures and other operational decisions to provide context for measured transportation performance and additional safety and mobility-related measures. More complex performance measures may be derived from the collected data The data derived from these sources can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Center). The data generated by this strategy enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect data for traffic strategy development and long range planning. The Institute for Transportation has been active in conducting research that aims to maximize the potential benefits of network monitoring/surveillance systems to initiate timely alerting and to access the performance of the transportation system.
ICM Category	• Foundational strategy
Anticipated Benefits	• Improved safety and emergency response (e.g., incident detection, verification and response) • Improved accessibility and mobility • Reduced or shifted demand • Enhanced traveler choice and decision making • Improved institutional cooperation (e.g., sharing of information between agencies) • Improved customer experience and perception
Provided Functionality	• Enhances roadway situational awareness
Prerequisite Functionality Required	• Communications
Complementary and/or Supported Strategies	• Supports or enhances most ICM strategies outside of system modifications.
Examples	• Widely adopted

Traveler Information Dissemination

	Traveler Information Dissemination
Description	This fundamental strategy provides traveler information using roadway equipment such as dynamic message signs and highway advisory radio and/or commercially available data via mobile devices. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, travel time estimate, emergency alerts and driver advisories. Traveler information can be provided to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information.
ICM Category	• Foundational strategy
Anticipated Benefits	• Improved safety and emergency response • Improved accessibility and mobility • Reduced or shifted demand • Enhanced traveler choice and decision making • Improved institutional cooperation • Improved customer experience and perception
Provided Functionality	• Enhances traveler decision making
Prerequisite Functionality Required	• Communications
Complementary and/or Supported Strategies	• Supports or enhances most ICM strategies outside of system modifications.
Examples	• Widely adopted

TMC Enhancement / Expanded Operations

	TMC Enhancement / Expanded Operations
Description	This strategy expands the resources and operations of Iowa DOT's existing TMC to enhance current operations and coverage (geographic and times-of-day). It will also enhance institutional relationships through improved monitoring of arterial networks that connect with freeway or state-owned roadways. Expanded functions could include expanding services to include arterials presently not actively monitored so that freeways and arterials can be managed in a more integrated manner.
ICM Category	• Fundamental strategy
Anticipated Benefits	• Improved safety and emergency response • Improved accessibility and mobility • Reduced or shifted demand • Enhanced traveler choice and decision making (e.g., enhances transportation planning and real-time decision making) • Increased return on and use of existing investment • Improved transportation efficiency and productivity • Improved institutional cooperation • Reduced environmental impact • Improved customer experience and perception
Provided Functionality	• Improved transportation operations including enhanced traffic monitoring, data collection and information provision along both freeways and connecting arterials.
Prerequisite Functionality Required	• Communications • Traffic data collection and processing • Network monitoring and surveillance • Traveler information dissemination
Complementary and/or Supported Strategies	• This strategy, while focusing on expanding services provided by the TMC will support most ICM strategies (outside of system modifications).
Examples	• City of Austin, TX • Las Vegas, NV

Ramp Terminal Treatments

	Ramp Terminal Treatments
Description	Ramp terminal treatments focus on solving problems at the ramp/arterial intersection, on the freeway (e.g., exit ramp traffic queuing onto the freeway mainline), or on freeway ramps. Treatments include signal timing improvements, ramp widening, additional storage or new turn lanes on arterials, and improved signing, and pavement markings on or adjacent to ramps. These treatments are geared to improving localized problems at either entrance or exit ramp terminals. At exit ramp terminals, the strategies are aimed at reducing queue spillback onto the freeway, but may also be aimed at improved arterial flow by limiting the amount of freeway traffic that can access certain areas in the arterial network. At entrance ramps, treatments can better coordinate timing of ramp signals and arterial traffic signals and/or provide additional storage space on the arterial to prevent ramp queues from extending into the adjacent arterial intersection.
ICM Category	• Fundamental strategy
Anticipated Benefits	• Improved safety and emergency response • Improved accessibility and mobility (e.g., reduced delay, queuing impacts, and upstream arterial impacts) • Increased return on and use of existing investment • Improved institutional cooperation
Provided Functionality	• Improves safety and traffic flow at freeway entrance and exit ramps and their connections to the arterial roadway network.
Prerequisite Functionality Required	• None
Complementary and/or Supported Strategies	• Ramp metering • Traffic signal system improvements • Adaptive traffic signal control • Access control
Examples	• University Parkway – adding additional lanes to an off-ramp (Sarasota, FL)

Ramp Closure

	Ramp Closure
Description	Ramp closure involves the closing of an entrance or exit ramp to all traffic, or to specific vehicle classes on a temporary, intermittent, or permanent and is generally considered to improve safety at locations with severe geometric limitations. Ramp closure is an extreme strategy that should only be considered when other ramp treatments are not suitable. Besides locations with severe geometric deficiencies, ramp closure may also be a viable option for managing special event traffic or controlling traffic in or around work zones.
ICM Category	• Fundamental strategy
Anticipated Benefits	• Improved safety and emergency response (e.g. reduced rear-end and sideswipe crashes at problematic freeway entrance ramps) • Improved accessibility and mobility (e.g., improved freeway traffic flow) • Reduced or shifted demand (also improves neighborhood impacts) • Improved institutional cooperation
Provided Functionality	• Improves safety and traffic flow at freeway entrance and exit ramps and their connections to the arterial roadway network.
Prerequisite Functionality Required	• None
Complementary and/or Supported Strategies	• Access control
Examples	• Honolulu, HI • I-43 (Milwaukee, WI)

Special Use Ramps

	Special Use Ramps
Description	Special use ramps provide preferential treatment to a specific class or classes of vehicles and can be applied to either entrance or exit ramps. Special use treatments include exclusive access to ramps for a class of vehicle (e.g., high occupancy vehicle (HOV), emergency, freight, or construction) or special lanes on a ramp for the exclusive use by these vehicle classes. Special use treatments are best undertaken in a coordinated effort with other special use treatments and programs. For example, transit management programs may identify candidate ramps where transit vehicle priority considerations may be deployed.
ICM Category	• Fundamental strategy
Anticipated Benefits	• Improved accessibility and mobility • Reduced or shifted demand • Enhanced traveler choice and decision making • Increased return on and use of existing investment • Improved institutional cooperation • Improved customer experience and perception
Provided Functionality	• Provide preferential treatment to high occupant and/or special classes of vehicles
Prerequisite Functionality Required	• None
Complementary and/or Supported Strategies	• Ramp metering • Access control
Examples	• Southern California Association of Governments – truck only ramps • I-710 truck lanes (Los Angeles, CA)

Ramp Metering

	Ramp Metering
Description	Comprised of traffic signals installed on freeway on-ramps to control the frequency at which vehicles enter the flow of traffic on the freeway. Ramp metering reduces overall freeway congestion by managing the amount of traffic entering the freeway and by breaking up platoons that make it difficult to merge onto the freeway. Traditional ramp metering involves the use of pre-timed signals that operate with a constant cycle in accordance with a metering rate prescribed for the control period. Adaptive ramp metering or traffic responsive ramp metering relies on vehicle detection systems to select metering rates. Benefits of effective ramp metering include traffic speed increase, travel time reduction, collision reduction, and emissions reduction.
ICM Category	• Fundamental strategy
Anticipated Benefits	• Improved safety and emergency response (e.g., reduced speed differentials) • Improved accessibility and mobility (e.g. improved freeway vehicle speeds and throughput) • Reduced or shifted demand • Increased return on and use of existing investment • Improved transportation efficiency and productivity • Improved institutional cooperation • Reduced environmental impact
Provided Functionality	• Harmonizes the flow of traffic entering a freeway.
Prerequisite Functionality Required	• Network surveillance
Complementary and/or Supported Strategies	• Ramp terminal treatments
Examples	• Minneapolis, MN • Seattle, WA • Denver, CO • Detroit, MI • Portland, OR • Milwaukee, WI • Chicago, IL

Adaptive Ramp Metering

	Adaptive Ramp Metering
Description	Adaptive ramp metering is like ramp metering but is more sophisticated in its metering approach. Like ramp metering, adaptive ramp metering reduces overall freeway congestion by managing the amount of traffic entering the freeway and by breaking up platoons that make it difficult to merge onto the freeway. However, instead of pre-timed signals adaptive ramp metering or traffic responsive ramp metering relies on vehicle detection systems to select the most appropriate metering rates based on observed traffic. Benefits of effective ramp metering include traffic speed increase, travel time reduction, collision reduction, and emissions reduction.
ICM Category	• Active and advanced strategy
Anticipated Benefits	• Improved safety and emergency response • Improved accessibility and mobility • Reduced or shifted demand • Increased return on and use of existing investment • Improved transportation efficiency and productivity • Improved institutional cooperation • Reduced environmental impact
Provided Functionality	• Harmonizes the flow of traffic entering a freeway.
Prerequisite Functionality Required	• Network Surveillance • Traffic signal control/software
Complementary and/or Supported Strategies	• Ramp terminal treatments
Examples	• I-680 (Caltrans) • I-210 (Caltrans) • I-45 (Houston, TX) • Portland, OR • WSDOT • Caltrans District 7 • MnDOT • VDOT • VicRoads

Dynamic Junction Control

	Dynamic Junction Control (DJC)
Description	Junction control is the dynamic provision of lane access based on highway traffic present and merging/diverging traffic to give priority to the facility with higher volume to minimize the impact of the merging/diverging movement. Using signs, mainline lanes can be closed or become an exit, shoulders can be opened, and so forth to accommodate entering or exiting traffic. A strategy variation is dynamic turn restrictions on arterials. DJC is applicable to interchanges and on/off ramps. Some potential benefits of DJC include reduced travel time, reduced travel delay, reduced ramp delay, and increased travel speeds.
ICM Category	• Active and advanced strategy
Anticipated Benefits	• Improved safety and emergency response • Improved accessibility and mobility (e.g., improved vehicle speeds and reduce delay) • Increased return on and use of existing investment • Reduced environmental impact
Provided Functionality	• Reduces impact of vehicles entering and exiting the freeway at high volume locations.
Prerequisite Functionality Required	• Network surveillance • Traffic information dissemination
Complementary and/or Supported Strategies	• Bus on-shoulder • Dynamic shoulder lanes / part-time shoulder use
Examples	• Dynamic Lanes on SR 110 (Pasadena Freeway, Los Angeles)

Dynamic Shoulder Lanes / Part-time Shoulder Use

	Dynamic Shoulder Lanes / Part-time Shoulder Use
Description	The dynamic opening of a shoulder lane to traffic or dynamic closure of travel lanes on a temporary basis in response to increasing congestion or incidents. This strategy provides additional capacity when it is needed such as during peak travel periods. The temporary addition of a shoulder lane allows congested roadways to have higher throughput—even if the speeds are reduced. Adding an additional lane in the form of temporary shoulder use delays the onset of congestion and breakdown and increases the facility's overall throughput. By increasing capacity and encouraging more uniform speeds, the traffic flows more smoothly and efficiently, which can improve travel time reliability.
ICM Category	• Active and advanced strategy
Anticipated Benefits	• Improved safety and emergency response • Improved accessibility and mobility (i.e., vehicle throughput and travel time reliability) • Increased return on and use of existing investment • Reduced environmental impact
Provided Functionality	• Provides temporary increase in roadway capacity.
Prerequisite Functionality Required	• Roadway basic surveillance • Roadway traffic information dissemination
Complementary and/or Supported Strategies	• Traffic incident management • Variable speed limits • Dynamic roadway warning
Examples	• I-66 ATM (Virginia) • I-35W Priced Dynamic Shoulder Lane (Minneapolis, MN) • Seattle, WA

Dynamic Truck Restrictions

	Dynamic Truck Restrictions
Description	This strategy requires all truck traffic to use designated lanes in a dynamic manner during peak periods. The intent is to increase the homogeneity of speed on each lane and to minimize the disruption in traffic flow caused by heavy vehicles. The dynamic nature of the treatment allows for more flexibility in application as opposed to static restrictions. The activation of the signs indicating the presence of restrictions is usually automated and is triggered by real-time traffic volumes. The signs should be placed on overhead gantries for visibility.
ICM Category	• Active and advanced strategy
Anticipated Benefits	• Improved safety and emergency response • Improved accessibility and mobility (e.g., traffic flow and speed uniformity) • Reduced or shifted demand • Reduced environmental impact
Provided Functionality	• Reduces truck-related disruptions to traffic flow and safety at specific times of day or problematic locations.
Prerequisite Functionality Required	• Network surveillance • Traffic information dissemination • Connected and automated vehicles
Complementary and/or Supported Strategies	• Weather traffic responsive management • Work zone management
Examples	• Netherlands

Event Management Strategies