Congestion Management Process Update

Anchorage Bowl & Chugiak-Eagle River

Congestion Management Process Report

prepared for

Municipality of Anchorage

prepared by

Cambridge Systematics, Inc.

with

Solstice Alaska Consulting, Inc.
Parsons Brinckerhoff

February, 2016

Congestion Management Process Update

Anchorage Bowl & Chugiak-Eagle River

prepared for

Municipality of Anchorage

prepared by

Cambridge Systematics, Inc.
100 CambridgePark Drive, Suite 400
Cambridge, MA 02140

with

Solstice Alaska Consulting, Inc.
Parsons Brinckerhoff

date

February, 2016

Table of Contents

List of Tables

List of Figures

1.0 Congestion Management Process Objectives

This technical report presents the congestion management objectives of the AMATS Congestion Management Process (CMP) Update. The outlined objectives are designed to:

- Meet the Federal requirements for congestion management planning under the Moving Ahead for Progress in the 21st Century Act (MAP-21);
- Provide the technical foundation for the development of the CMP Update;
- Integrate the CMP with the region's 2035 Metropolitan Transportation Plan (MTP) and upcoming 2040 MTP update;
- Inform the Status of the System Report, and
- Consider agency stakeholder's goals for congestion management as defined through the CMP Public Involvement Plan components.

Section 2 of this report outlines federal requirements for congestion management planning, including proposed performance measures and target setting guidance currently published under MAP-21. Section 3 presents proposed objectives for the CMP Update. Section 4 presents the data management plan, identifying data sources to obtain the desired performance measures that describe congestion levels in the region. Section 5 presents an analysis of congestion levels in the region and identifies potential projects to consider for the CMP. Section 6 provides a description of strategies that could help reduce congestion in the region. Section 7 provides a description of how does the CMP integrates with AMATS activities. Section 8 provides a description on how to evaluate implemented strategies. Finally, section 9 presents key work tasks considerations for a successful CMP implementation.

1.1 Federal CMP Requirements

The Congestion Management System (CMS) was first introduced as part of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and was outlined as a systematic process for state departments of transportation (DOTs) and metropolitan planning organizations (MPOs) to provide information on transportation system performance and alternative strategies to alleviate congestion and enhance mobility of people and goods.[1] The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA LU) did little to change requirements, but changed the name of the CMS to the Congestion Management Process (CMP). While the CMS was often used as a stand-alone data

[1] Framework of the Capital Region Transportation Planning Agency (CRTPA) Congestion Management Process Report.

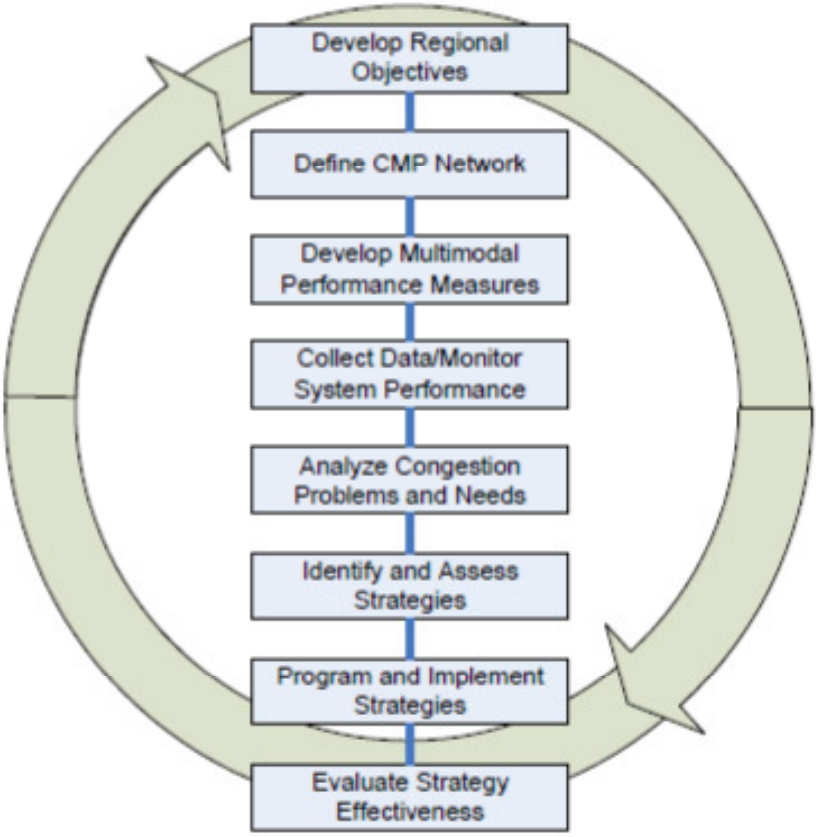
analysis/planning exercise, the CMP was intended to be an ongoing process, fully integrated into the overall transportation planning process of both states and regions.[2]

Federal regulations are provided in the 23 Code of Federal Regulations (CFR) Section 450.32 – congestion management process in transportation management areas. As shown in Figure 1.1, elements of the CMP include:

- Performance monitoring and evaluation, identification of causes of recurring and nonrecurring congestion, and strategy identification and effectiveness;
- Definition of congestion management objectives and performance measures;
- Coordinated data collection and system performance monitoring efforts;
- Identification of anticipated performance and benefits of congestion management strategies;
- Implementation schedule, responsibilities, and potential funding for strategies; and
- Implementation of a process for assessment of strategies, in terms of established performance measures.

[2] Federal Highway Administration (FHWA) CMP Guidebook.

Figure 1.1 Elements of the Congestion Management Process



Source: FHWA, Congestion Management Process: A Guidebook.

Federal requirements also explicitly outlined the CMP implementation and development process to be part of an overall metropolitan transportation planning process that involves coordination with transportation system management and operations activities. The CMP does not have an update cycle established by Federal regulations, though the four-year certification review cycle and the four- or five-year Metropolitan Transportation Plan (MTP) update cycle for each TMA provide a baseline for a reevaluation/update cycle in the absence of an identified requirement.

- MAP 21 preserves the existing law related to CMPs, with an increased focus on a performance-based approach to decision-making and the development of transportation plans. Enhanced monitoring and reporting of congestion and reliability are also focus areas.

- MAP 21 established a series of performance requirements focusing on national goals, increased accountability, and improved transparency. Of the seven national goals outlined in MAP 21, the following are directly or indirectly related to congestion management:

1. Safety – To achieve a significant reduction in traffic fatalities and serious injuries on all public roads;

2. Infrastructure Condition - To maintain the highway infrastructure asset system in a state of good repair

3. Congestion Reduction – To achieve a significant reduction in congestion on the National Highway System;

4. System Reliability – To improve the efficiency of the surface transportation system;

5. Freight Movement and Economic Vitality - To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development; and

- The U.S. DOT is implementing the new requirements through a number of rulemakings. One of these focuses on congestion and system performance. This process will involve[3]:

- Defining performance of the interstate system, non-interstate National Highway System, and freight movement on the interstate system;

- Finalizing interpretation of scope of Congestion Mitigation and Air Quality Improvement (CMAQ) performance requirements, including congestion and on-road mobile source emissions; and

- Summarizing MAP 21 highway performance measure rules.

- In addition, a number of rules are expected for transit performance, including a requirement that transit providers embark on target setting and progress reporting. Additionally, modifications in Sections 5303 and 5304 related to Metropolitan and Statewide Planning require that MPOs serving Transportation Management Areas (TMAs) include transit agency officials in their governing structure and establishment of performance targets.

- Lastly, MAP 21 established the National Highway Performance Program, which provides support for the condition of the National Highway System (NHS), with more than one-half of highway funding going to this program devoted to preserving and improving the most important highways both in states and regions. The NHPP will require MPOs to coordinate with States in selecting targets to ensure consistency. In addition, MPOs will be required to report on metropolitan system performance as part of its transportation plan every 4 or 5 years. Reporting requirements include:

- Evaluating the condition and performance of transportation system;

- Documenting progress achieved in meeting performance targets in comparison with the performance in previous reports;

[3] MAP-21: Putting Performance into Action, http://www.fhwa.dot.gov/tpm/about/action.pdf#page=2

- Evaluating how the preferred scenario has improved conditions and performance, where applicable; and
- Evaluating how local policies and investments have impacted costs necessary to achieve performance targets, where applicable.

Table 1.1 summarizes the MAP-21 national goals related to congestion management, and provides an overview of the current status of proposed rulemaking, including proposed performance measures and guidance on target setting. It is anticipated that final rulemaking for all national goal areas will be complete in 2015.

Table 1.1 MAP-21 National Goals Related to Congestion Management

MAP-21 National Goals Related to Congestion Management	Notice of Proposed Rulemaking Date	Proposed Performance Measures	Target Setting Guidance
Safety - To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.	March 2014[1]	5-year rolling average on all public roads: • Number of fatalities • Number of serious injuries • Fatality rate per 100M VMT • Serious injury rate per 100M VMT	MPOs would set targets for any or all of the measures (consistent with State) for all public roads in the MPO (regardless of ownership or functional class) within 180 days after the State sets each target. The targets would be set in coordination with the State to the maximum extent practicable. The MPO could either agree to support the State DOT target or set a numerical target specific to the MPO planning area. Significant progress toward achieving targets is proposed as the actual measure outcome at or below a 70% prediction interval based on a historical trend line determined from the 5-year rolling averages of historical data.[2]
Infrastructure Condition - To maintain the highway infrastructure asset system in a state of good repair	Anticipated Q4 2014[3]	Percent of Interstate pavement in good, fair, and poor condition based on IRI Percent of non-Interstate NHS pavement in good, fair, and poor condition based on IRI Pavement Structural Health Index Percent of deck area on structurally deficient bridges NHS bridges in good, fair, and poor condition based on deck area[4]	TBD

MAP-21 National Goals Related to Congestion Management	Notice of Proposed Rulemaking Date	Proposed Performance Measures	Target Setting Guidance
Congestion Reduction - To achieve a significant reduction in congestion on the National Highway System	Anticipated Q1 2015[3]	Annual Vehicle-Hours of Delay on Interstate and NHS Corridors[4]	TBD
System Reliability - To improve the efficiency of the surface transportation system	Anticipated Q1 2015[3]	Reliability Index – threshold of 80th percentile travel time to agency-determined threshold travel time[4]	TBD
Freight Movement and Economic Vitality - To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.	Anticipated Q1 2015[3]	Annual Hours of Truck Delay on the Interstate Highway System[4] Truck Reliability Index[4]	TBD

Source: [1] Safety Performance Measures NPRM, https://www.federalregister.gov/articles/2014/03/11/2014-05152/national-performance-management-measures-highway-safety-improvement-program#h-39 [2] Safety Fact Sheet, http://www.fhwa.dot.gov/tpm/rule/safetyfactsheet.pdf [3] MAP-21: Putting Performance into Action, http://www.fhwa.dot.gov/tpm/about/action.pdf#page=2 [4] AASHTO Standing Committee on Performance Management (SCOPM) Task Force Findings on MAP-21 Performance Measure Target-Setting, http://scopm.transportation.org/Documents/SCOPM%20Task%20Force%20Findings%20on%20Performance%20Measure%20Target-Setting%20FINAL%20v2%20%283-25-2013%29.pdf.

1.2 Proposed CMP Objectives

The regional objectives for congestion management are tied directly to the goals and congestion-related objectives defined in the region's 2035 MTP. These, while subject to change based on the ongoing development of the 2040 MTP, included:

- Goal 1: Ensure development of a balanced transportation network that provides an acceptable level of service, maximizes safety, minimizes environmental impacts, provides a variety of transportation choices, and supports planned land use patterns
- Goal 2: Provide a transportation system that moves people and goods safety and securely through the community
- Goal 3: Develop an attractive and efficient transportation network that considers the cost of building, operating, and maintaining the system; the equity of all users; public health impacts; community values; and social justice
- Goal 4: Develop a transportation system that supports a thriving, sustainable, broad-based economy by locating and using transportation infrastructure and facilities to enhance community development
- Goal 5: Establish community connectivity with safe, convenient, year-round automobile and non-automobile travel routes within and between neighborhoods, commercial centers, and public facilities
- Goal 6: Improve access to goods, jobs, services, housing, and other destinations while providing mobility for people and goods in a safe, affordable, efficient, and convenient manner
- Goal 7: Provide a transportation system that provides viable transportation choices among various modes
- Goal 8: Design and maintain a transportation system that respects the integrity of the community's natural and built environment and protects scenic vistas

The draft CMP objectives defined in this technical report also follow the Federal Highway Administration's (FHWA) concept of **SMART** characteristics. As defined in the FHWA CMP Guidance, objectives should be **S**pecific enough to guide the development of the CMP process; **M**easurable enough to identify and track plan success; **A**greed upon by regional and local agency stakeholders; **R**ealistic and supported by available tools, data, and overall agency resources; and **T**ime-bound or achievable in a specific timeframe (e.g., 2035 MTP time horizon). As AMATS establishes performance targets in accordance with MAP-21, the objectives should be revisited and defined to be more specific, measurable, and time-bound based on growth trends and established targets (e.g., reduce passenger hours traveled (VHT) per capita by "X" percent by Year "YYYY"). An analysis of growth trends based on past Status

of the System reports will be conducted as part of future subtasks to formulate recommendations for potential targets.

Table 1.2 summarizes the draft objectives for the CMP Update and includes the following information:

- **Goal Area.** As described above, the 2035 MTP Goals serve as a basis for establishing regional objectives for performance management. This column identifies goal areas based on 2035 MTP goals and the national goals for MAP-21. As a note, current MTP goals and objectives do address all of the congestion management-related MAP-21 national goals, so it is not necessary to revise the MTP goals and objectives to address the MAP-21 national goals for congestion.

- **2035 MTP Objectives Related to Congestion Management.** The 2035 MTP establishes objectives that provide direction on how to accomplish the goals. Only MTP objectives related to congestion management in the region are shown in the table.

- **Proposed CMP Objectives.** The 2035 MTP goals and objectives were used to define objectives for congestion management. In some cases, the 2035 MTP and CMP objectives are the same, and in all cases, both are similar to one another.

- **Related Performance Measures from 2010 Status of the System Report.** The final column shows the performance measures from the 2010 Status of the System Report that relate to the MTP goals/objectives and proposed CMP objectives.

- **Gaps in Performance Measures.** In some cases, there are clear gaps in performance measures between the proposed CMP objectives and the measures in the 2010 Status of the System Report. It should be noted that this is a first look; these performance measures and gaps in performance measures will be further explored and evaluated for applicability to the CMP as part of Subtask 3.1.3, "Develop Multimodal Performance Measures." It is anticipated that new data collection efforts may be required to support these measures; these needs will be explored in a later subtask to develop a Data Management Plan for the CMP Update.

- **Recommended Target Setting Method.** Guidance on target setting is provided based on the MAP-21 Notice of Proposed Rulemaking for safety, AASHTO Standing Committee on Performance Management (SCOPM) Task Force Findings on MAP-21 Performance Measure Target Setting, and the FHWA CMP Guidebook. Placeholders are provided for specific targets and dates.

Table 1.2 CMP Objectives Aligned with the 2035 Metropolitan Transportation Plan

Goal Area (*and related 2035 MTP and MAP-21 Goals*)	2035 MTP Objectives Related to Congestion Management	Proposed CMP Objectives	Related Performance Measures from 2010 Status of the System Report	Gaps in Performance Measures	Recommended Target Setting Method
Goal 1: Efficiency & Reliability *MTP Goal 1: Ensure development of a balanced transportation network that provides an acceptable level of service, maximizes safety, minimizes environmental impacts, provides a variety of transportation choices, and supports planned land use patterns* *MAP-21 National Goals: Congestion Reduction – To achieve a significant reduction in congestion on the National Highway System* *System Reliability – To improve the efficiency of the surface transportation system*	• Decrease travel time through an increase in transportation efficiency during peak-hour periods • Minimize cut-through traffic in residential neighborhoods • Improve, as necessary, expressway, arterial, and collector roads to safety and efficiently handle projected traffic	• Reduce delay and improve travel times during peak-hour periods • Improve year-round reliability of travel times • Reduce non-recurring delay during peak-hour periods caused by traffic incidents, special events, work zones	Freeway Segment Level of Service Intersection Level of Service Driver Hours of Delay at Intersections Travel Time Ratio (Morning/ Afternoon Peak vs Midday Travel Times) Duration of Congestion Travel Time by Corridor Total Annual Delay (TTI urban mobility report)	Person or vehicle hours of delay by mode Percent of lane miles severely congested 80th percentile travel time index Cost of delay Person or vehicle hours of non-recurring delay (i.e., due to incidents, special events, work zones)	Establish targets for delay / reliability based on past trends or adopt ADOT&PF targets (e.g., reduce vehicle hours of delay by X% by year 20YY).
Goal 2: Safety & Incident Management *MTP Goal 2: Provide a transportation system that*	• Reduce vehicle, pedestrian, and bicyclist crashes • Decrease emergency	• Reduce the number and rate of fatality and serious injury crashes	Vehicle Crashes (Number) by Severity Number of Pedestrian-Vehicle Crashes by	Fatality and serious injury crash rate per 100M VMT Number of commercial	Set evidence-based target based on trend analysis of 5-year rolling averages of historical crash data

Goal Area (*and related 2035 MTP and MAP-21 Goals*)	2035 MTP Objectives Related to Congestion Management	Proposed CMP Objectives	Related Performance Measures from 2010 Status of the System Report	Gaps in Performance Measures	Recommended Target Setting Method
moves people and goods safety and securely through the community *MAP-21 National Goal: Safety – To achieve a significant reduction in traffic fatalities and serious injuries on all public roads*	response time and reduce risk to the community from natural hazards and disasters • Promote a walkable community with safe winter walking conditions • Minimize conflicts between freight and passenger vehicles and non-motorized travelers	• Reduce number of commercial motor vehicle (CMV) and non-motorized traveler involved crashes • Decrease response and/or incident clearance times on major highways/ arterials	Severity Number of Bicycle-Vehicle Crashes by Severity	motor vehicle involved crashes Response and/or incident clearance time	(e.g., reduce number of fatalities and injuries by x% by year 20YY based on the 5-year average) Establish incident clearance time goals (e.g., decrease incident clearance times on major highways/arterials by X% by year 20YY)
Goal 3: Travel Options *MTP Goal 3: Develop an attractive and efficient transportation network that considers the cost of building, operating, and maintaining the system; the equity of all users; public health impacts; community values; and social justice* *MTP Goal 7: Provide a transportation system that provides viable transportation choices*	• Optimize the travel choices within the transportation system to maximize the associated benefits for all users while minimizing the costs to taxpayers • Improve opportunities for active transportation (non-motorized) as part of daily system use • Preserve and improve air quality to maintain	• Increase promotion of and participation in Ride Share program • Increase alternative (non-SOV) mode share for commuter trips • Reduce CO emissions through congestion management • Improve extent and quality of pedestrian and bicycle facilities • Reduce delay and	Ride Share Participation Commuter Vehicle Occupancy Estimated CO Emissions by Source[1] 8-hour CO Concentration[1] Number of walking trips Number of Miles of Sidewalks Number of bicycling trips	Alternative (non-SO) mode share for commuter trips Transit on-time performance Transfer wait times Peak transit vehicle loading	Establish targets based on regional policies/program goals (e.g., increase participation in Ride Share program by X% by year 20YY, etc.)

Goal Area (*and related 2035 MTP and MAP-21 Goals*)	2035 MTP Objectives Related to Congestion Management	Proposed CMP Objectives	Related Performance Measures from 2010 Status of the System Report	Gaps in Performance Measures	Recommended Target Setting Method
among various modes	the health and welfare of citizens • Promote the development of a safe network of trails and sidewalks that provide reasonable access to work, schools, parks, services, shopping, and the natural environment, with priority given to trail and sidewalk projects expected to have the highest use • Optimize the year-round accessibility and convenience of travel choices and, in particular, improve the year-round reliability and travel time of transit through the implementation of programs such as transit signal priority	improve travel time on facilities used for transit service	Number of Miles of Bicycle Paths/Lanes Transit Ridership Frequency of Bus Service Daily Bus Service Hours Bus Service Productivity (number of passenger boardings per hour of bus service) Transit Mode Share (commuter) Bus Travel Time vs. Auto Travel Time Transit Rider Transfers		
Goal 4: Freight *MTP Goal 4: Develop a transportation system that supports a thriving,*	• Optimize the transportation system to meet the needs of the Port of Anchorage,	• Reduce delay and improve truck reliability on corridors that serve major	TSAIA Passenger and Cargo Volumes Port of Anchorage	Vehicle hours of delay on freight corridors or annual hours of truck delay	Monitor Pavement and Bridge Performance Measure Rule and System

Goal Area (*and related 2035 MTP and MAP-21 Goals*)	2035 MTP Objectives Related to Congestion Management	Proposed CMP Objectives	Related Performance Measures from 2010 Status of the System Report	Gaps in Performance Measures	Recommended Target Setting Method
sustainable, broad-based economy by locating and using transportation infrastructure and facilities to enhance community development *MAP-21 National Goals: Infrastructure Condition - To maintain the highway infrastructure asset system in a state of good repair* *Freight Movement and Economic Vitality - To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.*	Ted Stevens Anchorage International Airport, the Alaska Railroad, the military bases, employment centers, and industrial and commercial areas	freight centers or economic hubs • Maintain adequate bridge/ pavement condition ratings on freight corridors	Tonnage Alaska Railroad Freight Tonnage Daily Truck Volumes Daily Traffic Volume Across AMATS Boundaries	Truck reliability index Bridge/pavement condition ratings on freight corridors	Performance Measure Rule for final performance measures and guidance on target setting. Adopt ADOT&PF targets for annual hours of truck delay and bridge/ pavement condition (e.g., maintain X% of bridges/ pavements on freight corridors in good condition)
Goal 5: System Connectivity *MTP Goal 5: Establish community connectivity with safe, convenient, year-round automobile and non-automobile travel*	• Ensure an adequate system of arterial and collector roads is identified • Promote the even distribution of traffic loads between streets	• Develop and maintain a functional roadway hierarchy for new projects • Improve motorized and non-motorized	N/A	Connectivity index for pedestrian and bikeway system Grid completeness or connectivity index for roadways	Assess whether a specific target is desired

Goal Area (*and related 2035 MTP and MAP-21 Goals*)	2035 MTP Objectives Related to Congestion Management	Proposed CMP Objectives	Related Performance Measures from 2010 Status of the System Report	Gaps in Performance Measures	Recommended Target Setting Method
routes within and between neighborhoods, commercial centers, and public facilities	by enhancing the existing grid pattern of streets • Enhance the physical connectivity between neighborhoods by increasing the number of roadway, pedestrian, bicycle, and transit connections • Improve safe and convenient connectivity from schools to neighborhoods, parks, and other recreational and commercial areas by use of multi-use trails, bicycle lanes, sidewalks, and transit	system connectivity			
Goal 6: Access & Mobility *MTP Goal 6: Improve access to goods, jobs, services, housing, and other destinations while providing mobility for people and goods in a safe, affordable, efficient,*	• Reduce the passenger vehicle miles traveled (VMT) and passenger vehicle hours traveled (VHT) per capita • Increase opportunities for multi-purpose trips in planned mixed-use	• Reduce person miles traveled (PMT) and passenger hours traveled (PHT) per capita • Promote transportation system management (TSM), transportation	Vehicle Miles Traveled (VMT) per Capita Vehicle Hours of Travel	Person miles of travel (PMT) Passenger hours traveled (PHT) per capita Number of traveler information tools or enhancements to	Establish targets based on regional policies and goals (e.g., reduce person miles of travel per capita by X% by year 20YY)

Goal Area (*and related 2035 MTP and MAP-21 Goals*)	2035 MTP Objectives Related to Congestion Management	Proposed CMP Objectives	Related Performance Measures from 2010 Status of the System Report	Gaps in Performance Measures	Recommended Target Setting Method
and convenient manner	centers • Promote the development of an effective roadway network through improvements in intersection and efficient roadway capacity • Improve the existing transportation system through the implementation of effective and innovative transportation system management (TSM), transportation demand management (TDM), and Intelligent Transportation System (ITS) strategies	demand management (TDM), and Intelligent Transportation System (ITS) strategies		existing traveler information tools available for travelers (e.g., bike/ped component, web based trip planner requests)	
Goal 7: Transit-Oriented Development *MTP Goal 8: Design and maintain a transportation system that respects the integrity of the community's natural and built environment and*	• Use context-sensitive design strategies especially to support the development of mixed-use centers and transit-supportive corridors with more pedestrian-, bicycle-	• Promote the development of mixed-use centers and transit-supportive corridors • Promote transit-friendly residential and commercial	N/A	Percent of population and jobs with access to transit (within one-quarter mile) SF of mixed-use centers/transit-oriented development	Assess whether a specific target is desired

Goal Area (*and related 2035 MTP and MAP-21 Goals*)	2035 MTP Objectives Related to Congestion Management	Proposed CMP Objectives	Related Performance Measures from 2010 Status of the System Report	Gaps in Performance Measures	Recommended Target Setting Method
protects scenic vistas	and transit-oriented street environments while recognizing the need to move freight into and throughout the community. • Reinforce the link between transit and land use by establishing as a priority the building of transit-friendly residential and commercial development in Downtown Anchorage and Downtown Eagle River	development in Downtown Anchorage and Downtown Eagle River			

Source: MTP 2035, Cambridge Systematics.

2.0 CMP Area and Network

The Congestion Management Process Update requires stakeholders to identify the area and network of influence. During this process, the network developed for the AMATS Travel Demand Model was revised and utilized as the area and network of influence. A detailed description, along with several maps of the network, were prepared and submitted previously to AMATS. For formatting convenience, these maps and tables are not included in this report, but are available for AMATS to consider in electronic versions.

3.0 Performance Measures

This section presents a summary and recommendations on performance measures to support the AMATS Congestion Management Process (CMP) Update. It is intended that these measures will be applied to understand congestion problems, assess potential solutions, and evaluate implemented strategies. Performance measures were identified using the following methodology:

- Compiled a comprehensive list of performance measures based on adopted measures used by AMATS in various efforts, including past Status of the System Reports and the 2035 Metropolitan Transportation Plan;
- Building on the gap analysis conducted in Technical Report 1: CMP Objectives, identified additional performance measures, such as reliability, that addresses operations and ITS strategies and assesses the variability in congestion due to nonrecurring events, as well as other congestion reducing strategies such as improving accessibility;
- Assessed potential measures for their applicability using the following criteria: easily understood, supported with available data and models, consistent with other AMATS planning processes, provide an adequate measure and comparison of congestion, and ability to track trends over time; and
- Identified a recommended, short list of measures for the CMP Update based on the assessment results, keeping the total number of measures to a small, yet meaningful set of indicators.

The comprehensive list of performance measures is provided in Section 2/Appendix A, and the short list of recommended measures is provided in Section 3.

3.1 Comprehensive List of Performance Measures

A comprehensive list of performance measures was developed by building on the current 2010 AMATS Status of the System and 2035 Metropolitan Transportation Plan performance measures. Additional measures were identified based on proposed MAP-21 performance measures, as well as the analysis to identify gaps in performance measures between the proposed CMP objectives and current AMATS measures as documented in Technical Report 1: CMP Objectives.

An assessment was conducted to evaluate potential use of measures for the CMP based on the following criteria:

- **Easily understood.** The measure is simple, understandable, logical, and repeatable;
- **Supported by available data and models.** The measure can be calculated using available data, models, and tools;

- **Consistent with other planning processes.** The measure is consistent with AMATS MTP measures and planning processes;

- **Adequate measure of congestion.** The measure is accepted by the transportation community and provides a recognizable and adequate indicator of the change in congestion associated with CMP improvement strategies; and

- **Ability to track trends over time.** The measure provides quantitative results and allows for meaningful trend analysis to support target setting.

The assessment identifies whether the measure meets the criteria (●), somewhat meets the criteria (⦿), or does not meet the criteria (○).

A comprehensive list of performance measures organized by mode (e.g., road system, public transportation, Ride Share participation, bicycle and pedestrian elements, intermodal goods movement and regional connections, and air quality) was analyzed. The list included the performance measures, source of the measures (e.g., 2010 Status of the System Report, 2035 MTP, proposed MAP-21 performance measure as documented in the current rulemaking and AASHTO Standing Committee on Performance Management (SCOPM) Task Force Findings on MAP-21 Performance Measure Target-Setting, or gap analysis), data requirements, comments regarding the potential applicability of the measure for the CMP Update, and assessment results for each criteria.

3.2 Recommended Performance Measures

Table 3.1 presents recommended performance measures for the AMATS CMP Update. The measures are organized by mode and tiers that categorize priority for implementation.

- **Tier 1 Performance Measures.** Congestion-oriented measures to provide detailed analysis of congestion management strategies/projects and that are supported by current data/models maintained and used by AMATS. It is envisioned that these measures could be used to assess the congestion impacts of MTP projects and strategies.

- **Tier 2 Performance Measures.** Additional measures for potential future use by AMATS, if required by MAP-21 and/or available to be supported by AMATS data/models in a relatively short time frame. These measures are envisioned to provide AMATS with a potential future set of measures for more detailed congestion management analysis upon the collection of new data in the region and the development of new planning tools.

Table 3.1 CMP Performance Measures

Assessment Key: ●- Meets Criteria ◉-somewhat meets criteria ○-does not meet criteria

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
Vehicle Hours of Travel	●		●	●			Average number of vehicle-hours of travel. Total VHT and VHT by roadway class (collector/local, arterial, freeway/expressway) are reported in 2010 Status of System report. Provides a measure of congestion duration.	Estimate of traffic volume, travel time by roadway segment.	AMATS travel demand model or collected traffic counts/travel time data	●	●	●	●	●
Total System VMT	●		●	●			VMT is the average number of vehicle-miles traveled per day, calculated as AADT multiplied by the length of the roadway segment.	Volume by roadway segment, length of roadway segment and annualization factor.	AMATS travel demand model estimate of traffic volume by roadway segment or Highway Performance Monitoring System	●	●	●	●	●

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
Travel Time by Corridor	●		●	●			Average corridor travel times on Anchorage corridors during the AM, midday, and PM peak periods. Provides a measure of congestion intensity.	Travel time runs to collect travel time and speed. Use list of 9 corridors included in the 2010 Status of the System report along with additional corridors selected by AMATS using TransCAD. Measure should include both winter/non-winter travel times.	Expand/modify pilot travel time data collection program or use probe vehicle data sources (e.g., FHWA National Performance Management Research Data Set (NPMRDS), Inrix, ITS, Bluetooth, O-D studies, etc.).	●	⦿	●	⦿	⦿
Travel Time Ratio		●	●				Ratio of AM/PM peak period to midday travel times. Provides a measure of congestion intensity.	Travel time runs to collect travel time and speed. Measure should include both winter/non-winter travel times.	Expand/modify pilot travel time data collection program or use probe vehicle data sources (e.g., NPMRDS, Inrix, ITS, Bluetooth, O-D studies, etc.).	●	⦿	●	⦿	⦿

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
Annual vehicle-hours of delay[a]	●		●				Annual number of hours of travel delay on Interstate and NHS corridors and selected principal arterials. Delay is based on travel speeds operating below established congestion threshold speed. Provides a measure of congestion intensity.	Corridor segments (O-D pairs on Interstate and NHS), VMT, speed or TT, determination of congestion threshold (e.g., LOS F, V/C > 1,0, speed < 45 mph).	HPMS and NPMRDS are potential data sources.	●	⦿	●	⦿	○
80th percentile travel time index[a]		●			●	●	80th percentile travel time divided by free-flow travel time. Provides a measure of congestion variability.	Travel time distribution, free-flow travel time.	NPMRDS is a potential data source.	⦿	⦿	○	⦿	●
Vehicle Crashes (Number) by Severity[a]	●		●	●	●	●	5-year rolling averages for number of fatality and serious injury crashes for all public roads.	Number of crashes, crash severity. 2010 Status of the System report includes detailed breakdown for Glenn Highway crashes between Airport Heights Drive and Parks Highway Interchange.	MOA Traffic Department annual crash reports, ADOT&PF crash data.	●	●	●	●	●

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
Road System (continued)														
Fatality and serious injury crash rate per 100 million VMT[a]	●				●	●	5-year rolling averages for fatality and serious injury rates per 100 million VMT.	Number of crashes, segment length/ traffic volume or VMT on segment.	MOA Traffic Department annual crash reports, ADOT&PF crash data.	●	●	○	●	●
Incident response time	●					●	Time between when a responder is dispatched and when that responder arrives at the incident scene.	Time of dispatch, time of arrival.	Anchorage PD	●	○	○	○	●
Incident clearance time		●				●	Time between initial notification time and the time the last responder leaves the scene. Consistent with national TIM definition.	Time of initial incident notification, time that the last responder has left the scene.	Anchorage PD	●	○	○	●	●

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
Public Transportation														
Transit Ridership	●		●	●			Average weekday riders on People Mover	Ridership data.	MOA Public Transportation Department	●	●	●	○	○
Transit on-time performance	●					●	Percent of time in which transit vehicles arrive at their scheduled destination no more than 5 minutes early or late.	Transit routes, number of early/late departures.	MOA Public Transportation Department	●	●	○	○	●
Public transportation /automobile travel-time ratio to/from selected locations		●		●			Ratio of public transportation to automobile travel time for specific origin and destination locations	Sample of automobile travel time runs and measurement of transit travel along the same route at the same time	MOA Public Transportation Department Expand/modify pilot travel time data collection program or use probe vehicle data sources (e.g., FHWA National Performance Management Research Data Set (NPMRDS), Inrix, ITS, Bluetooth, O-D studies, etc.).	●	○	○	●	○

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
SF of mixed-use centers/transit-oriented development		●				●	Square footage of commercial development classified as mixed-use or transit-oriented development within ¼ mile of transit stop in transit supportive corridors.	Square footage of commercial development, square footage of development designated as mixed-use or transit-oriented development, location of transit supportive corridors	MOA	●	●	○	○	●
Ride Share Participation														
Ride Share/ Vanpool Participation	●		●	●			Number of registered applicants participating in the Ride Share/Vanpool Program, number of active carpools, active carpoolers, active vanpools, and active vanpoolers	Number of registered applicants participating in the Ride Share/Vanpool Program, number of active carpools, carpoolers, vanpools, and vanpoolers	MOA Public Transportation Department	●	●	●	●	●

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
Pedestrian and Bicycle Elements														
Number of Pedestrian-Vehicle and Bicycle-Vehicle Crashes by Severity	●		●				Number of pedestrian-vehicle crashes by severity (accidents, fatalities).	Number of bike/ped accidents and fatalities.	MOA Traffic Engineering Department, ADOT&PF crash data.	●	●	●	⦿	●
Connectivity index for pedestrian and bikeway system	●					●	Measurement of the density of pedestrian and bikeway connections in the road network and directness of links.	Location of pedestrian/ bicycle facilities, bicycle and pedestrian trip origin/destination, number of street links, number of nodes.	MOA Public Works	●	●	○	⦿	●
Number of bicycle trips		●	●	●			Total number of bicycle trips on an average weekday.	Total number of bicycle trips on an average weekday.	Anchorage Household Travel Survey	●	⦿	●	⦿	●
Number of pedestrian trips		●	●	●			Total number of pedestrian trips of minimum length and/or duration on an average weekday.	Total number of pedestrian trips on an average weekday. Trips should be defined as having minimum length and/or time.	Anchorage Household Travel Survey	●	⦿	●	⦿	●

Performance Measure	Tier 1	Tier 2	Source: Status of System	Source: 2035 MTP	Source: Prop. MAP-21	Source: Gap Analysis	Definition	Data Required to Calculate the Measure	Potential Data Source	Assessment: Easily Understood	Assessment: Supported by Available Data & Models	Assessment: Consistent with Planning Processes	Assessment: Adequate Measure of Congestion	Assessment: Ability to track trends over time
Intermodal Goods Movement and Regional Connections														
Annual hours of truck delay[a]	●				●		Travel time above the congestion threshold in units of vehicle-hours for Trucks on the Interstate Highway System.	Corridor segments (O-D pairs), freight VMT (corridor length, truck volume), Truck speed or TT, determination of congestion threshold (e.g., speed < 35 mph, 85% of FFS, etc.).	NPMRDS, AMATS classification counts/travel time data.	●	⦿	○	●	●
Truck reliability index (RI_{80})[a]		●			●		Ratio of the total truck travel time needed to ensure on-time arrival to the agency-determined threshold travel time (e.g., observed travel time or preferred travel time).	Corridor segments (O-D pairs), truck speed or TT, agency-determined threshold truck travel time (Note – recommend using same speed threshold as for annual hours of truck delay).	NPMRDS, AMATS classification counts/travel time data.	⦿	⦿	○	⦿	●
Daily Truck Volumes by Location		●			●		Average daily volume of single-unit and truck/ tractor units at selected roadway locations around the Anchorage metropolitan area.	Daily traffic volumes for single-unit trucks and truck/tractor units.	ADOTP&F classification counts, AMATS classification counts/HPMS.	●	●	●	○	⦿

Source: Cambridge Systematics.

THIS PAGE INTENTIONALLY LEFT BLANK

4.0 Data Management Plan

This section presents a list of data types and sources identified to develop the desired performance measures described in Section 3, as well as recommendation guidelines for AMATS to consider for the CMP Update.

The first part of this section presents an introduction to Data Management Plan objectives and structure. The second part of this section provides a detailed description of the data needed to obtain the desired performance measures, as well as needs identified in other plans closely related to the CMP. The third part of this section identifies and describes current and new data sources. The fourth and final part of this section presents a description of recommended data types and sources, to allow a smooth integration with prior data collection protocols and other regional planning processes, such as the Metropolitan Transportation Plan (MTP) and the Transportation Improvement Program (TIP).

4.1 Data Requirements

A comprehensive list of performance measures was presented in Section 3 to support the AMATS Congestion Management Process (CMP) Update. It is intended that these measures will provide sufficient information to understand congestion problems, assess potential solutions, and evaluate implementation strategies. Table 4.1 shows performance measures which were initially agreed upon by the AMATS Technical Advisory Committee:

Table 4.1 Performance Measures involved in CMP Update

Tier 1	Tier 2
Total Vehicle Hours Traveled	Travel time (via probe or bluetooth technology)
Total System VMT	Travel Time Ratio
Travel Time by Corridor	80th Percentile Travel Time Index
Annual Vehicle Hours of Delay	Public Transportation/automobile Travel Time Ratio To/From Selected Locations
Vehicle Crashes by Severity, location and mode	Square Feet of Mixed Use Centers/Transit Oriented Development
Fatality and Serious Injury Crash Rate per 100 Million VMT	Number of Bicycle Trips
Incident Response Time	Number of Pedestrian Trips
Transit Ridership per revenue hour of service	Truck Reliability Index
Transit On-time Performance	Daily Truck Volumes by Location
Transit ridership within ¼ mile of a fixed transit route	Incident Clearance Time

Ride Share/Vanpool Participation	
Number of Pedestrian-Vehicle and Bicycle-Vehicle Crashes by Severity	
Annual Hours of Truck Delay	
Connectivity Index for Pedestrian and Bikeway System	

Source: Cambridge Systematics.

To obtain these performance measures, field data is required. In addition to data required to update the CMP, other planning efforts require similar type of data. For this reason, the Data Management Plan takes in consideration synergy among two important documents for which the Municipality of Anchorage Transportation Planning group is responsible: the Intelligent Transportation Systems (ITS) Update, and the Metropolitan Transportation Plan (MTP). The following data was identified as necessary to obtain the desired performance measures, and are commonly required for different transportation-related analyses:

- Volume: Volume data is required for all roadway segments that are included in the CMP Update, which will include minor arterials and above. It is anticipated that Average Annual Daily Traffic (AADT) will be used. This data element is necessary to capture aggregate measures of vehicle-miles traveled as well as delay and reliability measures. Since all roads are not physically counted, estimates are needed for many roadways; these are available from either the Travel Demand Model or the HPMS. Since the HPMS derives volume estimates from actual counts and is more readily available it appears to be the most reliable source for volume estimates.

- Travel times: Travel times are available for specific corridors from speed and delay runs conducted by AMATS. ADOTP&F has detectors on the Seward and Glenn Highways which can provide continuous travel time data on those facilities. Travel time measures can be applied for specific key corridors in the region so a full set of travel time data is not required, at least for Tier 1 measures. It should be noted that continuous travel time data can be obtained from the National Performance Management Research Data Set (NPMRDS) through FHWA or from private vendors for a fee. This information is currently limited in the Anchorage region, but this could change in the future.

- Physical characteristics of the network – Networks have been defined for the CMP Update, which include all roads classified as minor arterial and above, the People Mover transit system, bicycle and pedestrian networks and major truck routes. For roadways, posted speeds and number of lanes will be required for the deficiency analysis to be conducted in the Status of the System report and benefit/cost analysis for proposed improvements in the CMP Update.

- Crash data – Aggregate regional crash data, broken down by severity, time, and location are needed for the two crash-related measures proposed. This will be summarized on an annual basis.

- Incident response data – Incident response data available from the Anchorage Police Department include the time from receipt of the call to dispatch and time from the dispatch to officer's arrival on the scene. These can be aggregated to estimate response time. It should be noted that roadway calls need to be separated from all other calls, and that police are not dispatched to roadway crashes when there are no injuries involved.
- Transit data – MOA Public Transportation has the data items required to address the proposed measures; ridership by route, revenue-hours of service, on-time performance and ridership on active registered carpool/vanpool services.
- Pedestrian data – Pedestrian data are limited to household survey information on pedestrian use for various trip purposes, and possibly some pedestrian counts.
- Bicycle data – Bicycle data are limited to household survey information on bicycle use for various trip purposes, and possibly some on key bicycle facilities and routes.
- Goods movement data – Truck classification counts from either ADOTP&F or MOA will be used to identify major routes and measure volumes.
- Land use data – Census and land use data from MOA planning will be used to estimate population within ¼ mile of a transit route and square footage of transit oriented development. In addition, connectivity indexes will be obtained from private source "Walk Score."

4.2 Data Sources

There are a number of stakeholders involved in the data collection efforts and act as sources for this type of data. Table 4.2 presents a summary of the data required, its use, and current and possible data sources.

Table 4.2 Data needed for performance measures from current and potential sources

Data type (desired level of detail)	Related performance measures	Tier 1	Tier 2	Current data source	Potential data source	Evaluation
Traffic volume. (AADT by road section)	Total VHT, total system VMT.	●	●	MOA – Traffic Engineering	HPMS, AMATS TDM	Combination of TE counts and HPMS will provide full set of volumes. Adjustments will be needed to establish common base year.
Truck volume (truck volume by type and by road section)	Daily truck volumes by location.		●	MOA – Traffic Engineering	HPMS, AMATS TDM	TE counts on key truck routes will be primary source, supplemented with HPMS data where needed. Adjustments will be needed to establish common base year.
Average vehicular travel time for desired routes (AM, midday, and PM periods, as well as winter and non-winter times)	Travel Time by corridor, travel time ratio, annual vehicle-hours of delay, 80th percentile travel time index.	●	●	AMATS[4], ADOTP&F[5]	NPMRDS, Private vendors, AMATS TDM	AMATS travel time data supplemented with ADOTP&F Wavetronix data on Glenn and Seward Highways. Limited sample of AMATS travel time runs makes comparison difficult over time. NPMRDS and private vendor data can help to supplement corridor samples.
Average truck travel time for desired routes (AM, midday, and PM periods)	Annual hours of truck delay, truck reliability index.	●	●	ADOT&PF[6]	NPMRDS,AMATS TDM, Private vendors	Will use same data as above for major truck routes. NPMRDS provides truck only travel time data but it has reliability problems due to small sample size.
Road length (by road section)	VHT, total system VMT.	●		MOA -	HPMS	Available from both HPMS or

[4] *Current data source for travel times refers to data collected for the 2010 "AMATS 2035 Metropolitan Transportation Plan", as shown in Figure 4-12 (see references). Information might be available from other private sources.*

[5] *ADOT&PF collect speed and is testing speed results through Wavetronix devices and Permanent Traffic Recorders (PTR's) in certain Areas.*

[6] *While there is no specific truck travel time data being collected, the spot PTR's can be used as a surrogate indicator for truck travel time.*

Data type (desired level of detail)	Related performance measures	Tier 1	Tier 2	Current data source	Potential data source	Evaluation
				Transportation Planning		MOA GIS files. Segments will need to be aggregated for corridor travel times and reliability measures.
Speed limits (by road section and type of vehicle)	Annual vehicle hours of delay, travel time ratio, 80th percentile travel time index.	●	●	MOA - Transportation Planning /ADOT&PF	HPMS	Available from MOA, HPMS or travel demand model.
Crashes (by location, mode, and severity)	Vehicle crashes by severity, fatality and serious injury crash rate per 100 million VMT, Number of Pedestrian-Vehicle and Bicycle-Vehicle Crashes by Severity.	●	●	Primary: MOA – Traffic Engineering Secondary: ADOT&PF – HQ Planning/Central Region Traffic		Crash data available from MOA.
Incident response data (from incident reports)	Incident response time, incident clearance time.	●	●	Anchorage Police Department		APD provides call to dispatch and dispatch to arrival times for accidents with injuries. Officers are not dispatched if there are no injuries. Clearance times are not considered reliable at this point.
Transit ridership (by type of service)	Transit ridership.	●		MOA – Transportation Planning/Public Transportation	NTD[7]	Available from MOA-PT.
Transit schedules (with late dispatch availability)	Transit on-time performance, Public transportation/ automobile travel-time ratio to/from selected locations.	●	●	MOA – Public Transportation		MOA-PT available to develop comparison between scheduled and actual run times. Same data can be used for transit/auto travel time ratio.
Population data	Population within ¼ mile of a fixed transit route as	●		MOA – Public Transportation,MOA		MOA – PT route map, MOA Planning Census data.

[7] *NTD data might be redundant with the information provided by MOA – Transportation Planning/Public Transportation*

Data type (desired level of detail)	Related performance measures	Tier 1	Tier 2	Current data source	Potential data source	Evaluation
	determined by Census Block.			Planning Census data.		
Rideshare number of person-trips	Rideshare/Vanpool participation.	●		MOA – Public Transportation	VRide and Rideamigos	Available from MOA-PT.
Walkscore	Connectivity index for pedestrian and bikeway system.	●		Walkscore		Walkscore.com is a private website.
S.F. of TOD development (by type of development)	S.F. of mixed-use centers/ transit-oriented development.		●	MOA – Planning & Public Works		Permit data from MOA. Some judgment is involved as to what is a TOD.
Bicycle trips (on average weekday, on winter and non-winter)	Number of bicycle trips.		●	Anchorage Household Travel Survey	AMATS TDM	Low mode split and small sample in HH survey make it difficult to compare over time, MOA bicycle counts on non-motorized facilities may be used as well.
Pedestrian trips (on average weekday, on winter and non-winter)	Number of pedestrian trips.		●	Anchorage Household Travel Survey	AMATS TDM	Low mode split and small sample in HH survey make it difficult to compare over time, MOA pedestrian counts on non-motorized facilities may be used as well.

Source: Cambridge Systematics.

4.3 Potential Data Sources Description

4.3.1 AMATS Regional Travel Demand Model

The AMATS travel demand model is a regional model encompassing the Municipality of Anchorage and the Mat-Su Borough. The model was a tool created by AMATS to develop the 2035 Metropolitan Transportation Plan. This tool was developed in 2012, using the modeling software TransCAD. However, AMATS recently launched a project to update the model. The information used to update the model, as well as the model's projections, may be a useful data source to obtain some of the desired performance measures.

Pros:

- The data is already being collected for the model update project. The AMATS model update might benefit from the synergy involved with the CMP project.

Cons:

- If the data is not updated regularly, and the model's projections are used instead, there may be a greater range of unpredictability with the projections.

4.3.2 Highway Performance Monitoring System (HPMS)

The HPMS is a data source managed by the Federal DOT, to measure the performance of the highway system. "The HPMS is a national program that includes inventory information for all of the Nation's public road mileage as certified by the States' Governors on an annual basis. All roads open to public travel are reported in HPMS regardless of ownership, including Federal, State, county, city, and privately owned roads such as toll facilities. Each State is required to annually furnish all data per the reporting requirements specified in this HPMS Field Manual."[8] Access to the HPMS is granted through the User Profile Access Control System (UPACS), granting access to State Departments of Transportations (DOT), as well as Metropolitan Planning Offices (MPO).

Pros:

- It has been widely used and recognized in various projects across the country.
- Rich database for regional analysis, includes: inventory information (such as type, lanes, special lanes, etc.), AADT, AADT for Trucks and buses (only in some sections), length, among many other characteristics.
- Available in GPS format.

[8] Highway Performance Monitoring System: http://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/index.cfm

Cons:

- Shapefiles are inconsistent and often require time to clean and process.
- Does not have truck information and speed limits in all sections surveyed.

4.3.3 National Performance Management Research Data Set (NPMRDS)

As with the HPMS, this dataset is available to State DOTs as well as MPOs. This dataset consists of nation-wide travel times, obtained from numerous sources like mobile phones, probe vehicles, and portable navigation devices. Freight data is obtained from American Transportation Research Institute leveraging embedded fleet systems.

Pros:

- Robust travel time dataset, as it is continuously updated.
- Information obtained directly from the field.
- Reliable, as it is currently being used and validated by different project across the United States.
- Available in GIS format.

Cons:

- Relies on penetration rate of probe vehicles, so it must be used with confidence intervals.
- Heavy data, can require time to process adequately.

4.3.4 Private vendors

Other sources of travel time information are private vendors. Given the high-penetration rate of some GPS-Navigation service providers, these companies are often a very useful source of information. The main companies that provide this type of services are Inrix, HERE, and Tom Tom.

Pros:

- Datasets tailor-made to customers.
- Real-time data available.

Cons:

- Price subject to negotiation and thus can be expensive.
- Believed to be limited coverage in the Anchorage region.

4.3.5 National Transit Database (NTD)

The National Transit Database is a database collected from over 660 transit providers across the U.S., recipients or beneficiaries of Section 5307 or 5311 formula grants from the Federal Transit Administration. The source of this information is the service provider. The data provided monthly includes passenger trips, revenue miles traveled, revenue hours, vehicle(s) operating in maximum service, safety and security data.

Pros:

- Passenger data, at monthly level of detail, by provider.
- Crash data at a yearly basis, disaggregated by mode of transportation, severity and subject (operator, passenger, etc).

Cons:

- Information is redundant, as it is already collected by the MOA Transportation Planning Department.

4.4 Data Framework

The benefits of having an updated and reliable transportation dataset that is accessible from a single point is not something exclusively useful for the CMP Update project, but would be helpful to other transportation planning products and processes as well. The benefits of obtaining performance measures over the regional transportation system can be shared across different stakeholders. However, these benefits rely largely on the ease of data transfer among the different stakeholders.

It is common to find different agencies and entities collecting similar types of data for their operations. Although there may be data sharing and file transferring protocols among different entities, a single framework that provides one point of access for the data could be useful for all the stakeholders involved.

A data management framework can be designed to provide a clean and reliable repository of information for many of the data sources used in the CMP Update. The tool could be based on a software-based portal, where stakeholders could navigate to search for the desired information, query the information, and download it. This tool could provide valuable benefits and reduce costs significantly across departments, promoting a more efficient and transparent data transfer framework. It is important to note that the portal concept does not necessarily involve modifications to the data itself, or moving the data from one place to another. The portal provides a single on-line site where data sources can be identified and easily accessed. This approached was used by the Wisconsin DOT and the University of Wisconsin to provide access to different data sources within the DOT. Some of the sources still require password access from the Division housing the data.

https://transportal.cee.wisc.edu/

For a successful data framework development, an implementation plan needs to be agreed upon, examining available resources, maintenances protocols, and cost considerations. Furthermore, the plan needs to consider two important factors. The first one is defining a data manager. The data manager may actually compile and store the data, or as in the WisDOT example, simply make the data available from a single point while the data owners continue to collect, store and process their own data. An important role of the data manager is to control access to the data and ensure privacy issue over the information handled. If data is identified as sensitive or confidential, the manager should make sure this data set is handled appropriately. There have been successful cases were the data manager assigned is a university or non-governmental organization. The second consideration is to determine the roles of different stakeholders acting as a data source. The framework needs to be accompanied by agreements on who will provide the data, the format, and the time frame for data updates. Through these agreements the data framework can provide metadata information to historic data users, which will help them identify which sources they need and more easily download and use the data.

Once a data framework is designed and implemented, the benefits of data accessibility can be shared across different stakeholders, providing reliable and updated information to be used across the different transportation planning activities in the region.

5.0 Congestion Problems and Needs

The objective of this section is to present the results of the analysis made to describe congestion in the Anchorage region. This analysis consisted of a highway-level analysis, through corridor travel times and Level of Service; and an intersection-level analysis through intersection Level of Service and Level of Mobility. The results of these analysis are then summarized to characterize congestion levels in the Anchorage Region and define corridors that could benefit from congestion management projects.

After presenting traffic conditions, it is possible to identify a list of projects to incorporate in the Congestion Management Process Update. For this purpose, the list of projects identified in the Metropolitan Transportation Plan (MTP) 2035 was revised. A subset of the projects considered in the MTP are then selected, according to their proximity and possible benefit to the previously defined congested corridors.

5.1 Highway Level Analysis

This section analyzes and evaluates congestion on roadways with continuous flows, such as freeways and highways. This analysis focuses on two parameters: travel times and level of service.

5.1.1 Travel Times

Travel time is a metric which shows the average time taken to go from a certain origin or intersection to a relevant destination, along a defined corridor, freeway or highway. This metric is applicable across different modes, including automobiles, transit vehicles, or bicycles. To determine the performance of the road system, travel times and speeds for automobiles were collected during the fall of 2013, on the following 9 different Anchorage corridors[9]:

- Seward Highway (from 5th St to Old Seward Highway)
- Glenn Highway (from C St to North Birchwood)
- Minnesota Drive (from 5th St to Seward Highway)
- Northern Lights Boulevard (from Minnesota Drive to Muldoon Rd)
- Tudor Rd (from Minnesota Drive to Glenn Highway)
- Lake Otis Parkway (from 15th Ave to O'Malley Rd)

[9] The corridors selected correspond to the corridors included in the Status of the System Report 2010, and currently being used for the Status of the System Report Update, included in this CMP Update Project.

- C St (from O'Malley Rd to Ocean Dock Rd)
- DeBarr Rd (from I St to Muldoon Rd)
- Dimond Blvd (from Jewel Lake Otis Pkwy)

Drivers in instrumented vehicles made multiple trips during the months of September, October, and early November 2013 on each corridor from 7 to 9 a.m. (AM peak period), between 11 a.m. and 1 p.m. (Midday peak period), and from 4 to 6 p.m. (PM peak period). They drove at the same speed as other motorists and recorded their locations and clock times at major intersections along the way. Travel time measurement runs were recorded on each direction of travel for each corridor. Table 5.1 lists the average corridor travel minutes by time of day and direction for each corridor. The overall corridor speeds for the morning and afternoon peak periods also are shown for each direction of travel.

Table 5.1 Automobile Travel Time Summary

			Average Travel Time (minutes)			Average Speed (mph)	
Corridor	**Direction**	**Length (miles)**	**AM peak period**	**Midday peak period**	**PM peak period**	**AM peak period**	**PM peak period**
Seward Highway	north	9.2	11.5	11.2	11.5	42.4	44.3
	south	9.2	11.4	12.8	12.5	43.3	40.5
Glenn Highway*	north/east	14	22.6	21.7	25.6	48.2	42.8
	south/west	14	25.4	22.5	22.9	42.3	46.4
Minnesota Drive	north	8.2	12.8	12.0	13.2	35.2	36.7
	south	8.2	13.0	13.3	17.9	36.7	32.7
Northern Lights Boulevard	east	6.2	14.4	11.2	16.5	28.7	25.2
	west	6.2	13.7	11.5	14.5	28.9	28.5
Tudor Rd	north/east	8.8	15.6	16.1	20.8	36.8	32.8
	south/west	8.8	16.3	17.1	20.6	36.3	29.1
Lake Otis Parkway**	north	5.9	17.9	16.0	17.1	30.3	28.7
	south	5.9	17.2	15.0	22.4	28.0	27.9
C St	north	7.3	15.6	15.1	14.9	28.8	28.7
	south	7.3	15.0	16.4	17.0	28.0	25.1
DeBarr Road/15th Avenue	east	5.6	14.3	13.9	18.4	26.7	25.5
	west	5.6	12.8	10.9	12.4	26.9	28.8

Corridor	Direction	Length (miles)	Average Travel Time (minutes)			Average Speed (mph)	
			AM peak period	Midday peak period	PM peak period	AM peak period	PM peak period
Dimond Blvd/Abbott Road	east	5.3	9.9	10.6	12.4	34.2	32.6
	west	5.3	9.8	11.3	12.1	34.1	29.3

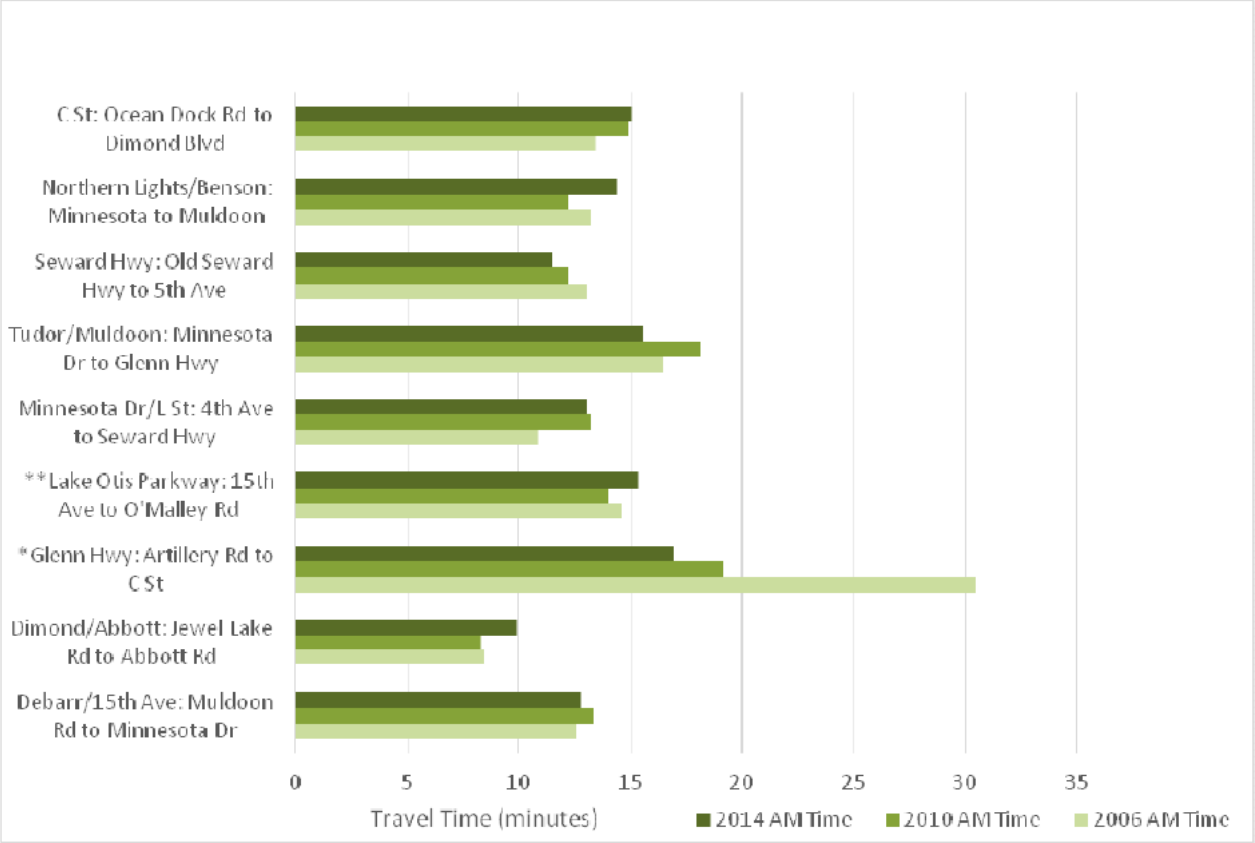
Source: Cambridge Systematics.

*Note: These travel times refer to the corridor from C St to Birchwood, which differs from data collection efforts done previously.

**Note: These travel times refer to the corridor from 15th Ave to Huffman, which differs from data collection efforts done previously.

The information shown on Table 5.1 can be compared with data collected in previous years. This comparison allows us to see if there are any corridors with a reduction or increase in travel times. Figures 5.1 and 5.2 show this comparison for the AM and PM peak periods, respectively. See Appendix D for additional information.

Figure 5.1 AM Peak Period Travel Times



Source: Municipality of Anchorage Traffic Department Travel Time Reports, Status of the System Report 2010.

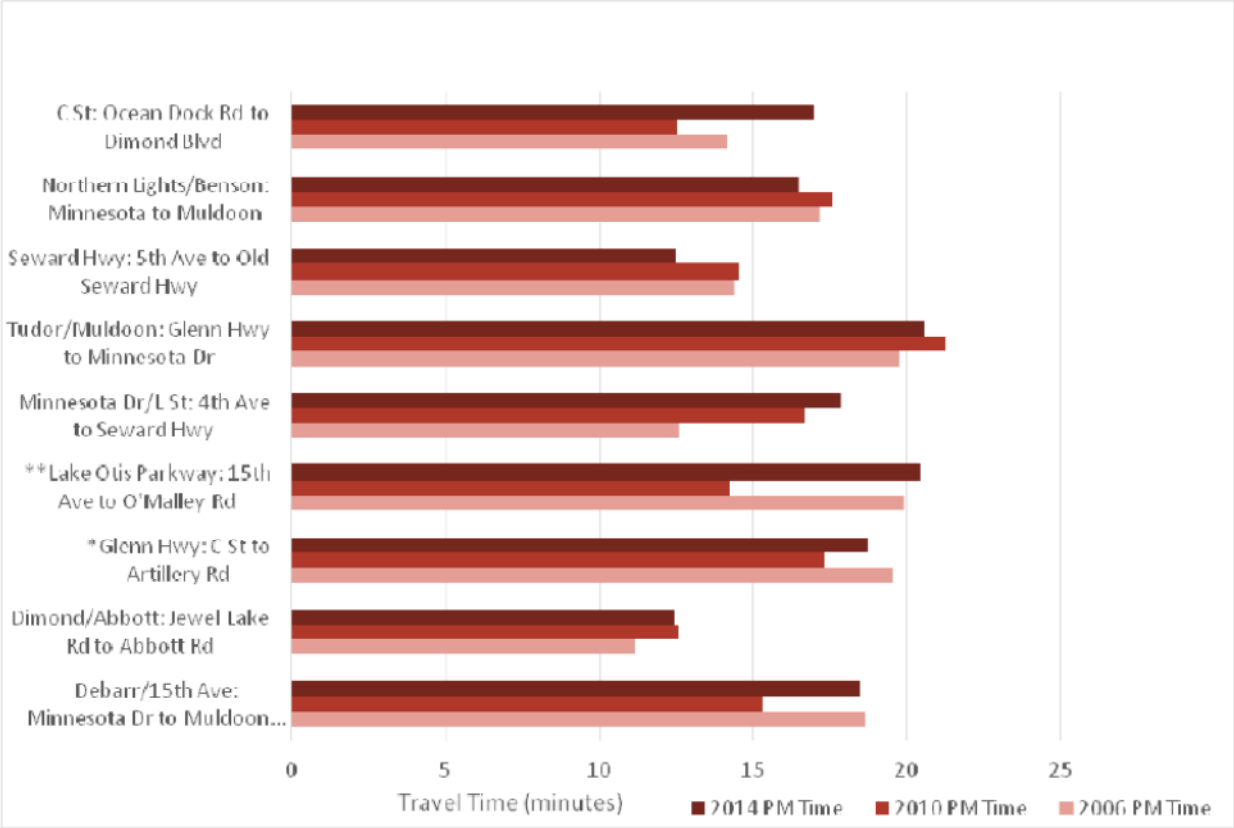
Note: *This graph shows the travel times from Artillery Rd to C St, a shorter corridor from the one data was collected from. This is presented for comparison purposes with previous years.

Note: ** This graph shows the travel times from 15th Ave to O'Malley Rd, a shorter corridor from the one data was collected from. This is presented for comparison purposes with previous years. Furthermore, the intersection of 40th and Lake Otis Parkway had improvements done between these years. Data is not fully comparable.

Note: Additional data can be found in Appendix D.

We can observe in Figure 5.1 that travel times remain similar to previously reported travel times, except for Glenn Highway and Lake Otis Parkway (see note). Other corridors do not present significant changes.

Figure 5.2 PM Peak Period Travel Times



Source: Municipality of Anchorage Traffic Department Travel Time Reports, Status of the System Report 2010.

Note: * This graph shows the travel times from C St to Artillery Rd, a shorter corridor from the one data was collected from. This is presented for comparison purposes with previous years.

Note: ** This graph shows the travel times from 15th Ave to O'Malley Rd, a shorter corridor from the one data was collected from. This is presented for comparison purposes with previous years. Furthermore, the intersection of 40th and Lake Otis Parkway had improvements done between these years. Data is not fully comparable.

Note: Additional data can be found in Appendix D.

Figure 5.2 shows how travel times have in general increase in the PM peak period across the different corridors. Aside from the travel time increases presented on Glenn Highway and Lake Otis Parkway (see notes), other corridors experiencing increased travel times from previous years are C St, Minnesota Dr, and DeBarr/15th Ave.

5.1.2 Level of Service

The Highway Segment Level of Service (LOS) seeks to represent traffic conditions in roadways where flow is continuous, like in freeways and highways. The highway LOS is a metric that reflects congestion levels on road sections, according to the available roadway capacity, speed, and delay experienced. The LOS output is a relative parameter, varying from 'A' to 'F', 'A' being uncongested, and 'F' saturated conditions. In general, an LOS of 'C' or better is considered to be an acceptable level of service and an LOS of 'D' is approaching the capacity of the roadway or intersection. An LOS of 'E' or worse represents operating conditions that are at or above capacity.

The LOS for access-controlled highways is determined from the traffic density (passenger cars per mile per lane), using procedures presented in the *Highway Capacity Manual*[10]. Density is calculated by considering the freeway geometry and peak 15-minute traffic volume. Once the road's density is determined, Table 5.2 allows us to determine the LOS per segment analyzed.

Table 5.2 Highway Capacity Manual LOS Criteria for Highway Segments

Level of Service	Density (passenger cars per hour per lane)	Speed (mph)	Traffic Volume (passenger cars per hour per lane)
A	0-11	65	0-410
B	11-18	65	710-1170
C	18-26	65	1170-1680
D	26-35	60-65	1680-2090
E	35-45	52-60	2090-2350
F	>45	<52	>2350

Source: Highway Capacity Manual, 2000.

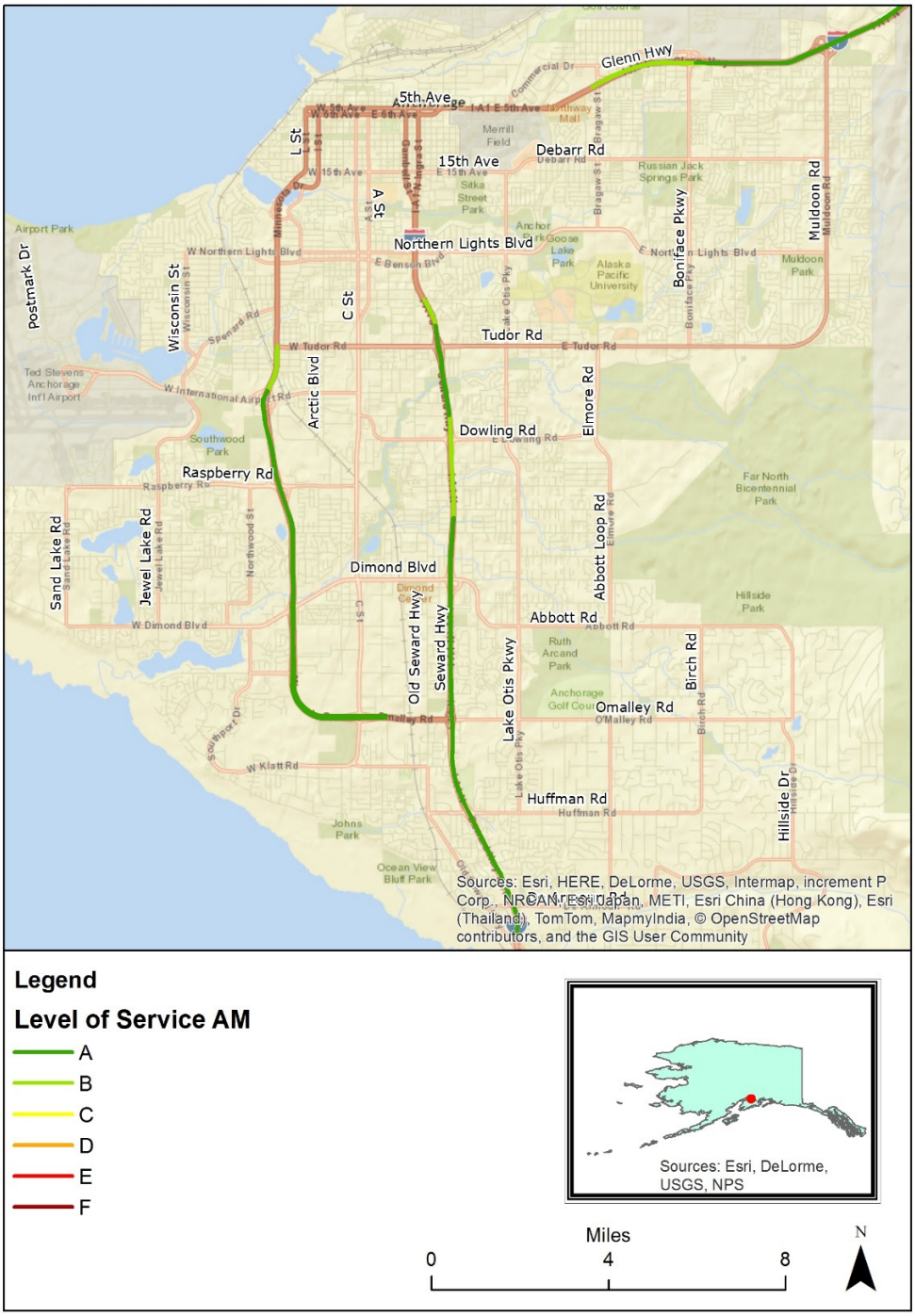
To determine the Highway LOS, the Average Annual Daily Traffic (AADT) was obtained for 2013, from the "Central Region Annual Traffic Volume Report 2011-2013" report. The report presents AADT by highway segment. To determine the vehicle per hour per lane, the percentages of hourly traffic were used. In this case this data was obtained from the Glenn Highway – West of Bragaw permanent traffic counter, the Seward Highway – South of 76th Ave permanent traffic counter, and Minnesota Drive – South of International Airport Road permanent traffic counter, to represent hourly volumes across the selected corridors.

Figures 5.3 and 5.4 show the results of the highway LOS analysis. We can observe that in the AM peak period (from 7 AM to 9 AM), conditions on the main highways in Anchorage are above

[10] Transportation Research Board, National Research Council, Highway Capacity Manual, 2000

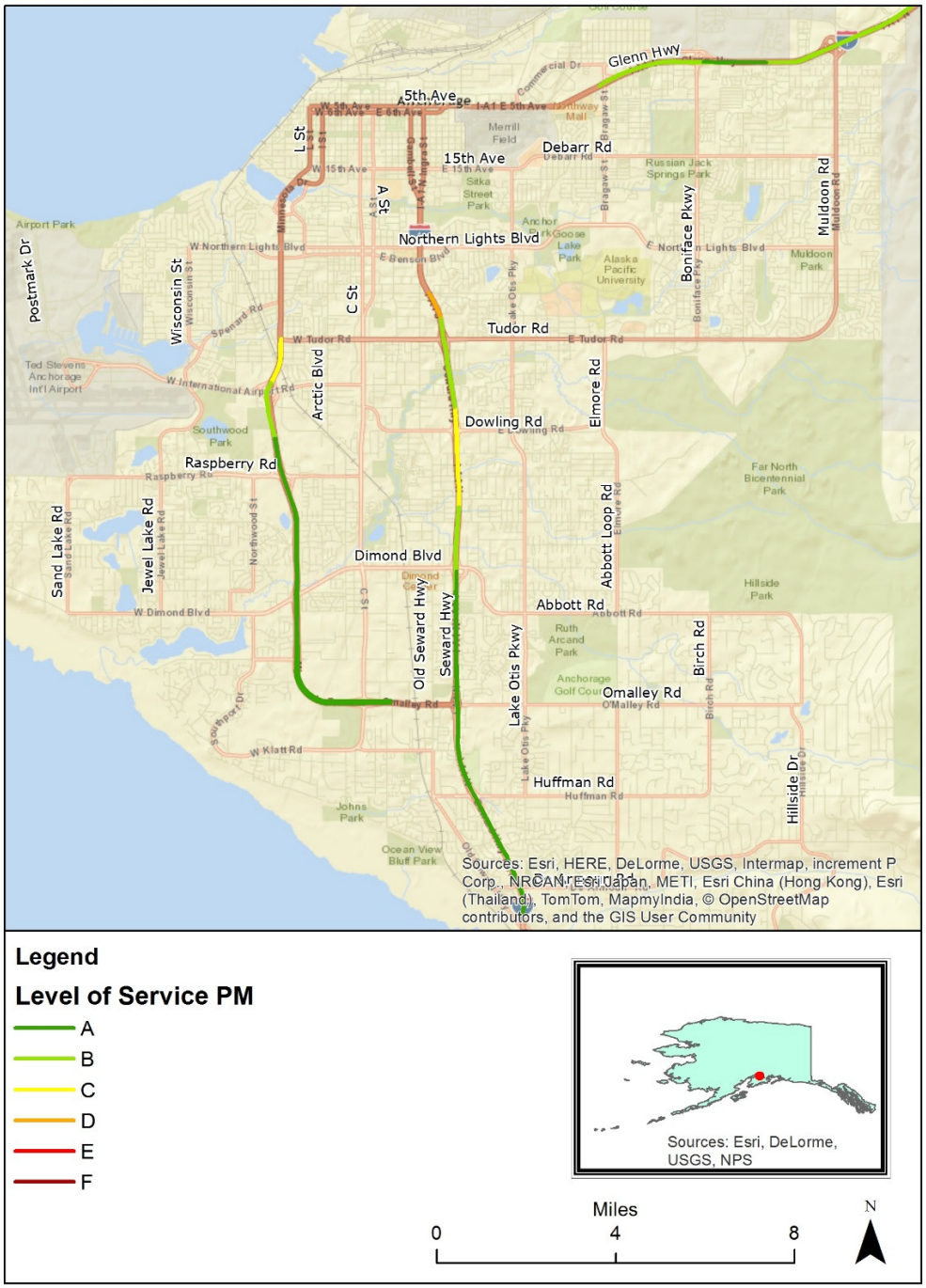
the LOS 'C'. For the PM peak period, Seward Highway and Minnesota Drive present congested LOS, with the highest congestion being present on Seward Highway, between 36th Ave and Tudor Rd.

Figure 5.3 Freeway LOS, Average AM Peak Hour, 2013



Source: Municipality of Anchorage Traffic Department Travel Time Reports, Volumes from DOT & PF Annual Traffic Volume Reports

Figure 5.4 Freeway LOS, Average PM Peak Hour, 2013



Source: Municipality of Anchorage Traffic Department Travel Time Reports, Volumes from DOT & PF Annual Traffic Volume Reports

5.2 Intersection Level Analysis

Intersections are often the main source of congestion in urban areas. Traffic signals, traffic movement conflicts, multi-modal interactions, among other intersection's characteristics are directly correlated to congestion levels in urban areas. In order to adequately characterize congestion in Anchorage, an analysis at the intersection level is presented. This section presents two analysis made to determine the congestion level across different key intersections in the region: Level of Service, and Level of Mobility.

5.2.1 Level of Service

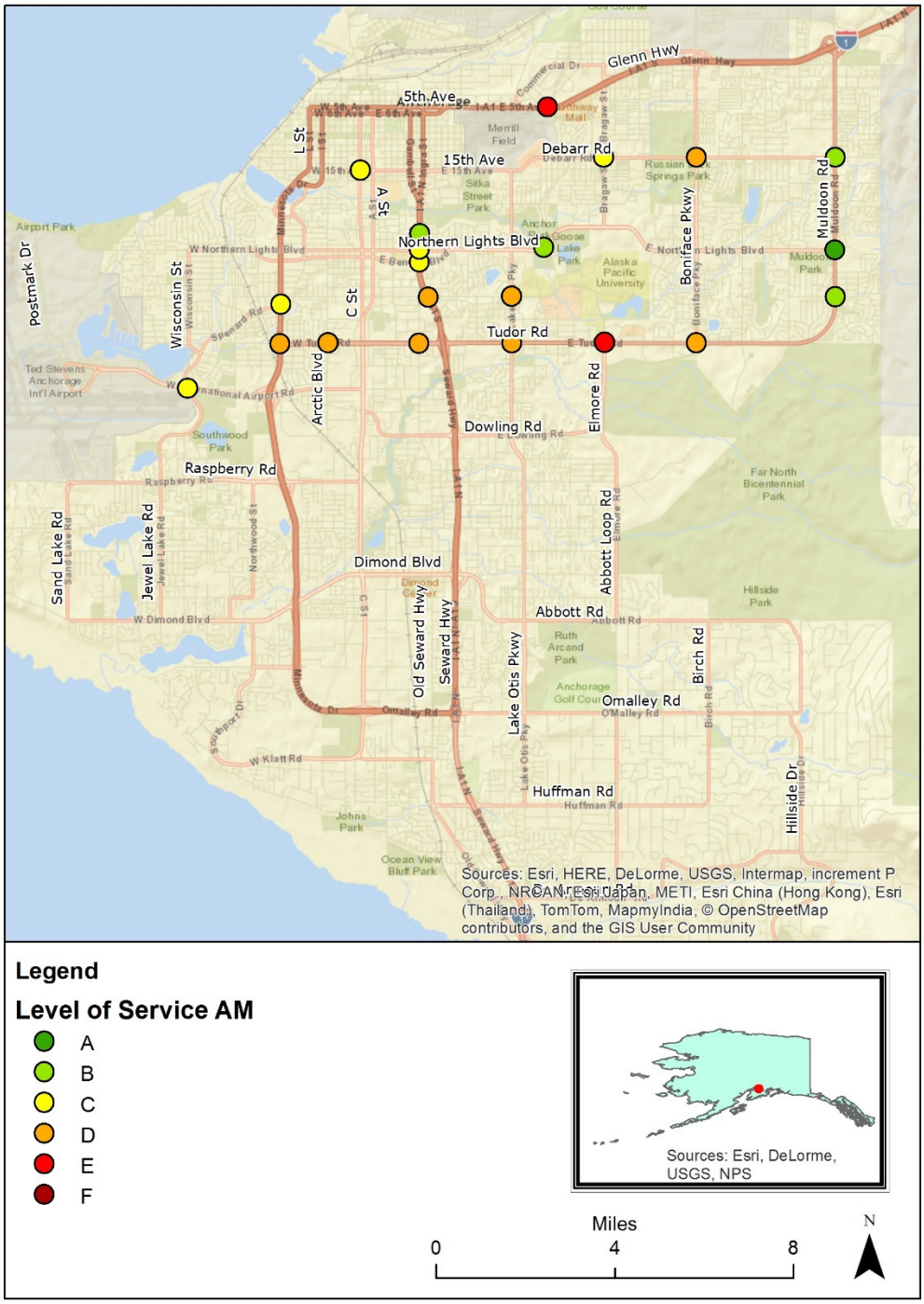
The Intersection Level of Service (LOS) is a parameter which describes traffic conditions on roadways on which traffic is interrupted by intersection control systems, such as stop signs or traffic signals. Similar to the highway LOS, this metric reflects congestion levels on intersections, according to the available roadway capacity, speed, or delay experienced. The LOS output is a relative parameter, varying from 'A' to 'F', 'A' being uncongested, and 'F' saturated conditions. In general, an LOS of 'C' or better is considered to be an acceptable level of service and an LOS of 'D' is approaching the capacity of the roadway or intersection. An LOS of 'E' or worse represents operating conditions that are at or above capacity. To determine the Intersection LOS, traffic counts, traffic signal timings, and roadway geometric characteristics were analyzed using the traffic software Synchro. The source of the traffic volumes and traffic signal timings was the Municipality of Anchorage, corresponding to 2013 traffic conditions.

It is important to notice that the LOS metric is a parameter of delay, which is correlated with congestion, but is not collinear. Thus, the LOS is a helpful metric to identify undesirable levels of delay, but not necessarily heavy congestion. Long delays could be caused by poorly timed traffic signals, multi-modal traffic, or particular operational conditions. Furthermore, causes for congestion are poorly identified through LOS parameters, especially if there is no data on all intersections. In this study, delay is used to identify intersections with high levels of delay, and this study assumes that congestion is present on highly-delayed intersections. To identify heavily congested intersections, including causalities, more detailed data is required.

Figure 5.5 shows the results of the Intersection LOS evaluation during the AM peak hour. We can observe that the intersection with the lowest LOS is Glenn Highway & Airport Heights Dr and Tudor Rd & Elmore Rd, with a LOS of 'E'. A corridor that can be observed with low LOS levels is Tudor Rd, which has a LOS of 'D' across the corridor. It is important to observe that Seward Highway also has a LOS level of 'D' once it enters the urban core at 36th St.

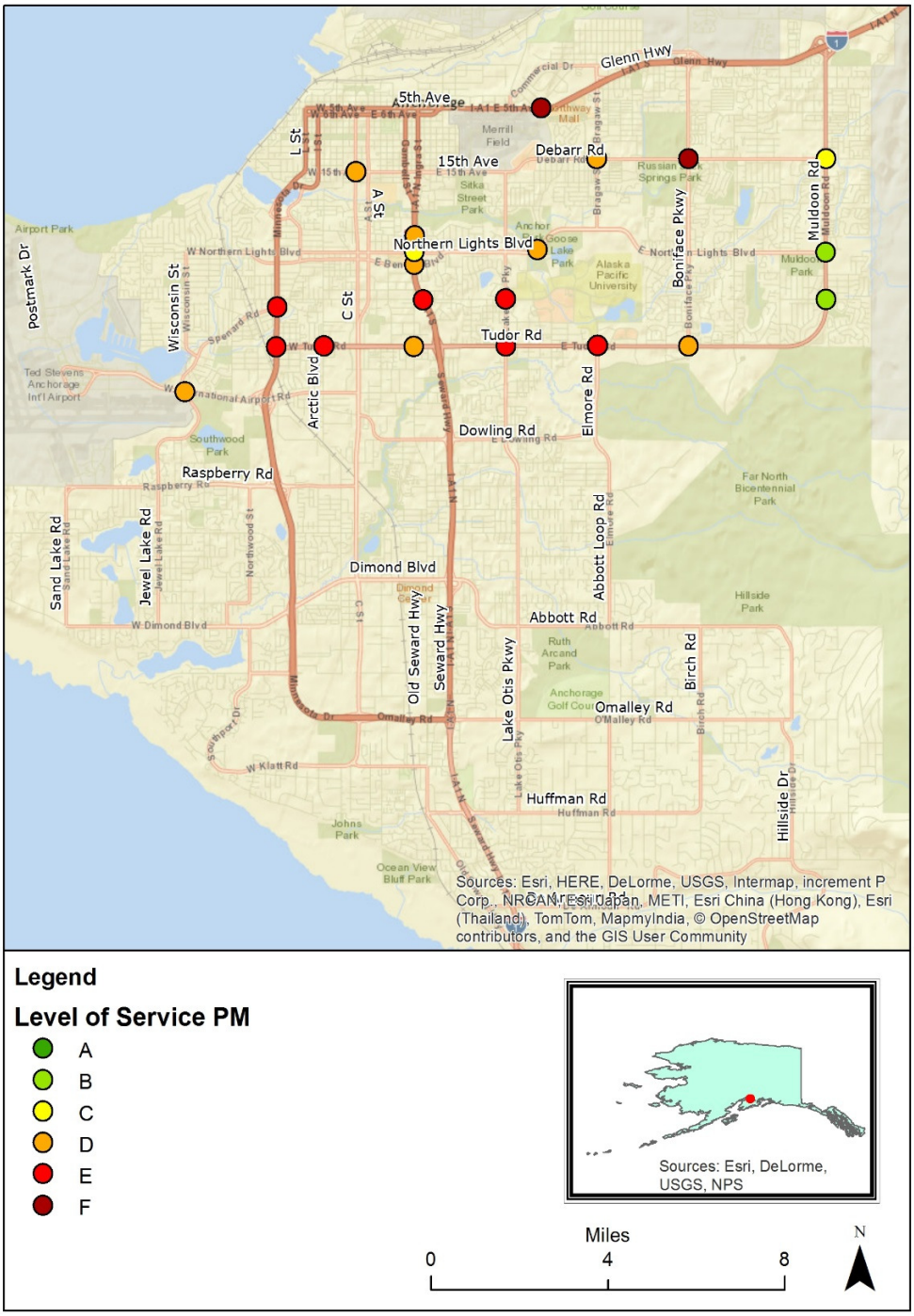
Figure 5.6 shows the results of the Intersection LOS evaluation during the PM peak hour. We can observe that in general, there are higher congestion levels than during the morning peak period. As with the AM peak period, Glenn Highway presents a low LOS of 'F' in the afternoon. The intersection of Boniface Parkway and DeBarr Rd also present an LOS of 'F'. Tudor Rd, also presents low LOS levels of 'E' across the corridor. Finally, Seward Highway also presents a lower LOS level than in the morning, showing saturated condition with an 'E' LOS.

Figure 5.5 Intersection LOS, AM Peak Period, 2013



Source: Municipality of Anchorage, Traffic Data Management System Report.

Figure 5.6 Intersection LOS, PM Peak Period, 2013



Source: Municipality of Anchorage, Traffic Data Management System Report.

5.2.2 Level of Mobility

Another useful measure to characterize congestion levels is Level of Mobility (LOM). LOM helps determine the State of Congestion within the region, classifying congestion in four categories, which include Tolerable, Moderate, Serious, and Severe. The classification relies on the intersection's volume/capacity ratio, which determines the amount of space available at an intersection, given the volume of vehicles in it.

The classification of LOM used is based on the Federal Highway Administration Guidelines to analyze signalized intersections[11]. These guidelines presents a four-level category classification based on different thresholds of volume/capacity ratio. To better understand such categories, the following labels were given to each level of mobility: tolerable, moderate, serious, and severe. Table 5.3 shows a summary of the criteria used to determine the LOM levels.

Table 5.3 FHWA LOM Criteria for Signalized Intersections

Volume/Capacity Ratio	Category	Assessment
<0.85	Tolerable	Intersection is operating under capacity. Excessive delays are not experienced.
0.85 – 0.95	Moderate	Intersection is operating near its capacity. Higher delays may be expected, but continuously increasing queues should not occur.
0.95 – 1.0	Serious	Unstable flow results in a wide range of delay. Intersection improvements will be required soon to avoid excessive delays.
>1.0	Severe	The demand exceeds the available capacity of the intersection. Excessive delays and queuing are anticipated.

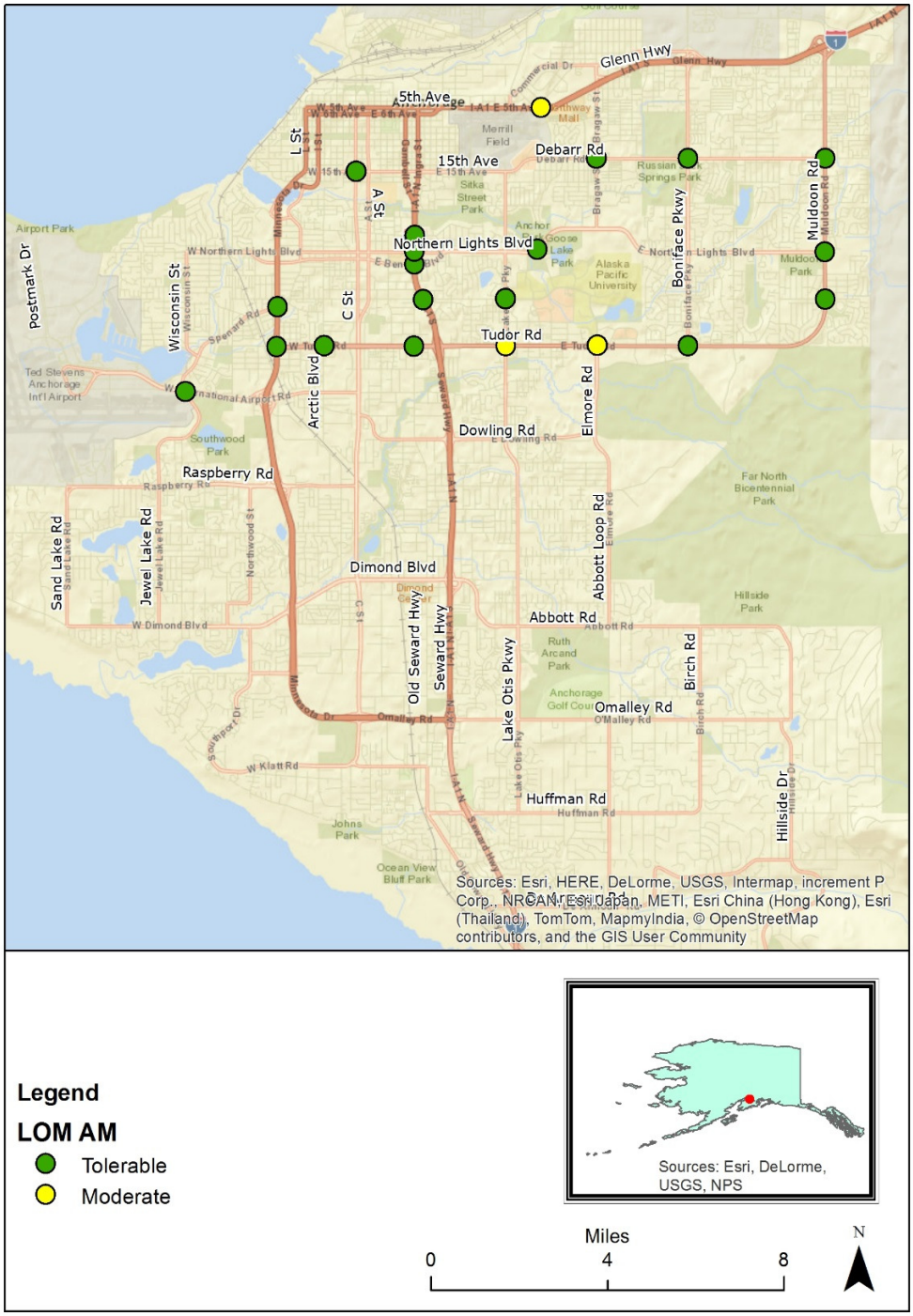
Source: Federal Highway Administration Research and Technology. Signalized Intersections. Informational Guide.

As with LOS, the proposed Level of Mobility is used in this study to identify intersections were congestion might be present. However, more detailed data is required to clearly identify congestion in the road network.

Figures 5.7 and 5.8 show the LOM obtained for each intersection evaluated, for the AM and PM peak periods. We can observe in these figures similar results to the LOS analysis. Intersections with severe congestion are only present during the PM peak period, on the intersections of Glenn Highway and Airport Height Dr, Minnesota Dr and Tudor Rd, and Boniface Pkwy and DeBarr St.

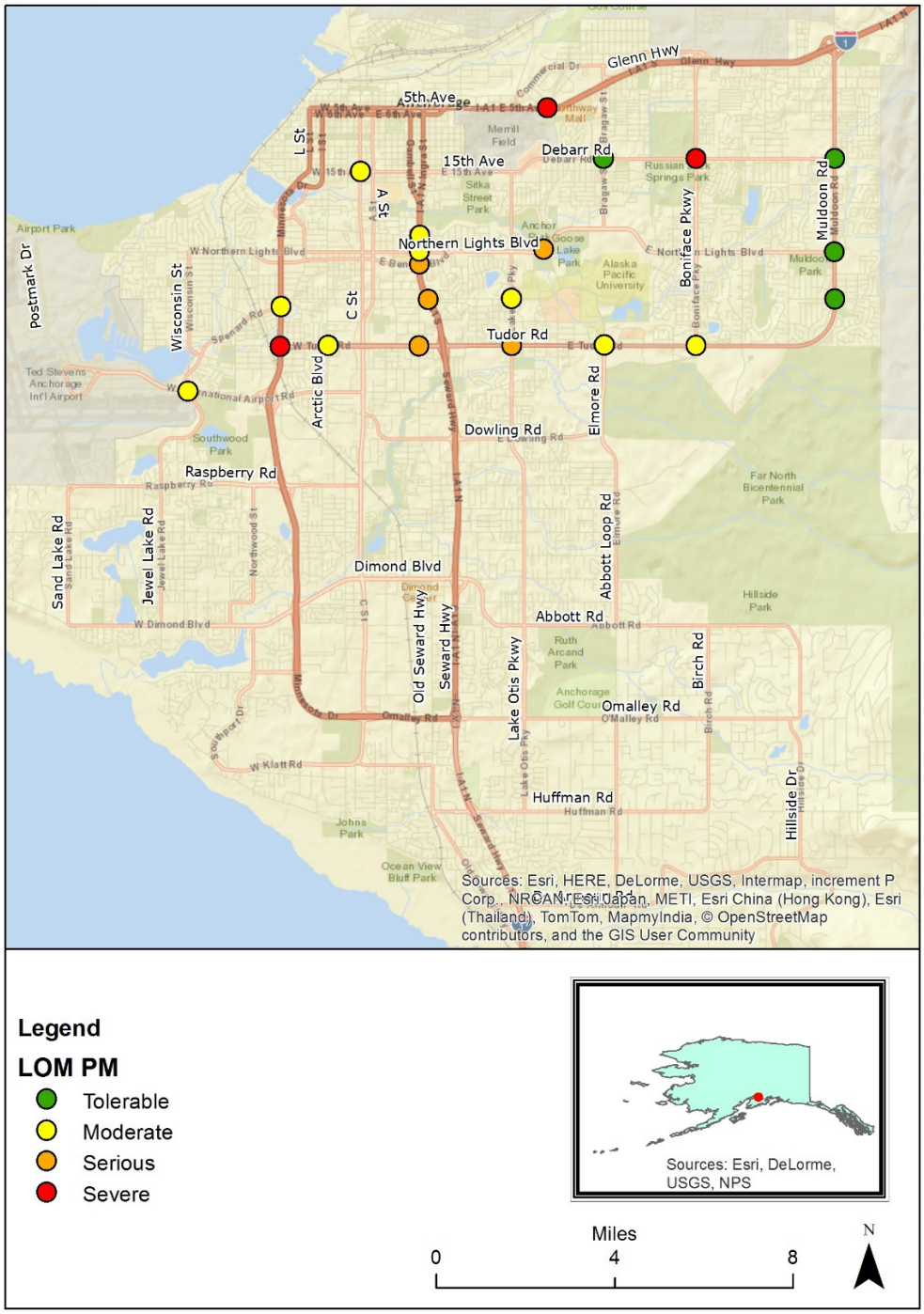
[11] For complete access to the source, follow this link: http://www.fhwa.dot.gov/publications/research/safety/04091/07.cfm

Figure 5.7 Intersection LOM, AM Peak Period, 2013



Source: Municipality of Anchorage, Traffic Data Management System Report.

Figure 5.8 Intersection LOM, PM Peak Period, 2013



Source: Municipality of Anchorage, Traffic Data Management System Report.

5.3 Congestion Problems and Needs

Based on the analysis' results, the following conclusions can be drawn:

- We can observe that the PM peak period presents a roadway network with higher level of congestion than the AM peak period.
- The highway system is currently operating on a desirable level of congestion, given that the LOS levels in the highway segments analyzed were mostly below the acceptable level of service "C". However, in the afternoon in particular, the system is operating at levels below acceptable, particularly on Glenn Highway and Seward Highway on the immediate sections to the urban core.
- The evaluation of travel times across different corridors in Anchorage show similar results to the ones obtained in the LOS analysis. Although data is not fully comparable with previous Status of the System reports on Glenn Highway and Lake Otis Parkway, these corridors presented the highest increase in travel times. In the PM peak period, C St, Minnesota Drive, and DeBarr Rd also presented an increase in travel times.
- The LOS at the intersection level shows that there are several intersections below acceptable levels of service. In the AM peak period, the intersection that requires more attention is Glenn Highway with Airport Heights Drive. In the afternoon peak period, this intersection presents the same characteristics. The intersection of Glenn Highway with Airports Heights Drive presents a LOS of 'F', as well as the intersection of Boniface Parkway and DeBarr Rd.
- Other conclusions that can be drawn from the LOS analysis at the intersection level are the traffic conditions along Tudor Road. The LOS at the intersections on Tudor Rd are all below the acceptable level of 'C'.
- The LOS analysis presents similar results to the LOM analysis. This metric can be easier to relate to and describes congestion levels in a way that can be easier to understand.

Based on these conclusions, the following corridors and streets have been identified for consideration in the Congestion Management Process:

- Glenn Highway
- Lake Otis Parkway
- Tudor Road
- Boniface Parkway
- Minnesota Drive
- C Street

Note: The intension of this analysis is to present a suggested list of corridors to consider for project implementation. This analysis would supplement current efforts to determine gaps and needs for transportation project consideration. Corridors not presented in this list should not be excluded from being considered for improvement projects.

5.4 Congestion Management Projects Selection

Having characterized traffic conditions in the region, it is possible to identify a subset of projects that could improve conditions in the intersections and highway segments with high levels of congestion.[12]

5.4.1 MTP Projects

To consider possible future transportation projects, the Metropolitan Transportation Plan (MTP) 2035 was revised. The MTP provides a framework for the Anchorage region's transportation system by identifying the goals, strategies, and priorities for meeting the region's transportation needs through the year 2035. The MTP is a multimodal plan that identifies all regionally-significant projects and programs planned for the region regardless of the likely funding source.

The MTP Chapter 5, "Metropolitan Area Transportation in 2035", provides the list of projects considered for this report. These projects are classified in three categories: road projects, public transportation projects, and non-motorized projects[13]. The list of road projects include 82 projects, considering construction, reconstruction, rehabilitation, access management, and planning projects. The list of public transportation projects include 26 projects, considering service expansion, new bus routes and new Bus Rapid Transit services. Finally, the list of non-motorized projects include 118 projects, considering sidewalk construction, pathways improvement, and bicycle projects, the Midtown Transportation Plan among others. In addition to these projects, the MTP was consulted to define ITS related projects which would have direct impacts on congestion in Anchorage.

5.4.2 CMP Projects Selection

Having identified intersections and highway sections with unacceptable levels of congestion, and identifying possible solutions, it is possible to suggest a subset of the projects considered to address current congestion issues in Anchorage. Through this analysis, the following projects are proposed to be considered for the CMP process:

---

[12] Note: The intension of this analysis is to present a suggested list of projects to consider for implementation. To determine the projects that consider for consideration, further data collection efforts need to be conducted, and other data sources need to be included in the analysis. This list is only a suggested list to address congestion issues on Anchorage, but projects that are not included should not be excluded from consideration without further analysis.

[13] For more information on the projects selected refer to the 2035 MTP Chapter 5 Report: http://www.muni.org/Departments/OCPD/Planning/AMATS/Pages/1_MTP.aspx

Road projects

Table 5.4 shows a subset of projects that are directly related to the congested corridors previously identified.

Table 5.4 Road Projects Considered for CMP[14]

MTP ID Number	Project Name	Project Type	Project Location
101	Seward Highway	Reconstruction	Dimond Blvd to Dowling Road
104	36th Ave/Seward Highway	Add new facility	Tudor Rd to 33th Ave
105	Glenn Highway	Reconstruction	Hiland Rd to Old Glenn Highway
114	Seward Highway Improvements(Midtown Congestion Relief: Seward Hwy/ Glenn Hwy Connection Ph II)	Reconstruction	33rd Ave to Tudor Rd
137	Glenn Highway Operation Analysis	Reconstruction	Muldoon Rd to Eklutna
201, A, B, & C	Seward Hwy/Glenn Hwy Connection	Reconstruction/Add New Facility	Chester Creek to Airport Heights Dr.
209	A-C St Couplet Restripe	Rehabilitation	Tudor Rd to 9th Ave
301	Tudor Road Access Management	Access Management	Seward Hwy to Arctic Blvd
302	Tudor Road Access Management	Access Management	Seward Hwy to Patterson St
316	Minnesota Dr Rehabilitation	Rehabilitation	26th Ave to 15th Ave

Source: MTP 2035.

Public Transportation Projects

Table 5.5 shows a subset of projects that are directly related to the congested corridors previously identified.

[14] Note: Some projects may already be under construction or in process. This list only presents a list of projects that could be considered for CMP purposes, but it not a final and exclusive list of projects, new projects can be considered, or current projects can be disregarded.

Table 5.5 Public Transportation Projects Considered for CMP[15]

MTP ID Number	Project Name	Project Description
820	Service Expansion – 15-minute headways on Routes 7, 9, & 15	An additional 10 buses will be needed to increase the frequency of service to 15 minutes on these three routes. No replacement buses will be needed.
821	Service Expansion - Mat-Su and Anchorage Express Bus Service	Express bus service between Mat-Su Valley and Anchorage will provide a 30 minute frequency of service during the AM and PM peak periods.
823	Bus Rapid Transit - Downtown, Midtown, & University-Medical District core service	The initial phase of BRT implementation will connect Downtown, Midtown, and UMED District and eight new buses will be needed. Characteristics of service will include frequent headways, well-spaced enhanced stops, and improved travel times.
824	South Anchorage to Downtown Express Route	The South Anchorage BRT Route will be preceded by an Express Bus Route that will connect the Huffman Town Center with Downtown Anchorage. Possible Park-and-Ride to be developed to supplement this route.

Source: MTP 2035.

Non-motorized Projects

Table 5.6 shows a subset of projects that are directly related to the congested corridors previously identified.

Table 5.6 Non-motorized Projects Considered for CMP[16]

MTP ID Number	Project Name	Project Location	Project Description
508	Lake Otis Pkwy	Huffman Rd to Chester Creek	Study feasibility of bicycle lane
509	Lake Otis Pkwy	DeArmoun Rd to DeBarr Rd	Bicycle lane (pending results from 508)

[15] Note: Some projects may already be under construction or in process. This list only presents a list of projects that could be considered for CMP purposes, but it not a final and exclusive list of projects, new projects can be considered, or current projects can be disregarded. Furthermore, routes are projects specifics are presented as reported on the MTP 2035 report, these can also change in the near future.

[16] Note: Some projects may already be under construction or in process. This list only presents a list of projects that could be considered for CMP purposes, but it not a final and exclusive list of projects, new projects can be considered, or current projects can be disregarded.

515	C St	O'Malley Rd to 10th Ave	Bicycle lanes
520	Lake Otis Pkwy	Abbott Rd to DeArmoun Rd	Upgrade sweeps at intersection of separated pathway and intersections
541	Ingra-Gambell Couplet	Reconnaissance Study	Investigate pedestrian safety study
565	Seward Hwy	Tudor Rd to 36th Ave	Separated pathway
566	Tudor Rd	Campbell Airstrip Rd to Pioneer Dr	Separated pathway
573	Boniface Pkwy	Glenn Highway south to Northern Lights Blvd	Construction of missing sidewalk
602	Tudor Rd	Elmore Rd to Minnesota Dr	Upgrade separated pathway
624	Tudor Rd	Minnesota Dr to Old Seward Hwy	Paved shoulder bikeway
703	Lake Otis Pkwy	68th Ave to Abbott Rd	Sidewalk upgrade

Source: 2035 AMATS MTP.

ITS Projects

The following ITS projects are all recommended for the short term, within the next 5 years, and include the following.

Near-Term (0-3 Years):

- Archive Data Services
- Data Archive Investigation
- Common Geographic Information System (GIS)
- Shared Traffic Database
- Integration with DOT&PF Traffic and Roadway Conditions Entry System (511)
- Arterial Management
- Traffic Operations Center
- Closed Circuit Television (CCTV)
- Traffic Signal Controller
- Transit Signal Priority
- WiFi/Bluetooth Detection for Travel Time
- Bicycle Detection and Warnings
- Traveler Information
- Highway-Rail Intersection (HRI) Warning Systems
- Traveler Information Website
- Roadway Maintenance and Construction
- Signal Priority for Maintenance Vehicles
- RWID Data Sharing
- Transit Operations
- Transit Technology Refresh
- Multi-modal Trip Planner
- Transit Signal Priority
- Fare Payment

Medium-Term (3-5 Years)

- Archive Data Services
- Data Archive Implementation
- Traveler Information

- Parking Management
- Advanced Highway-Rail Intersection (HRI) Warning Systems
- Transit Operations

Intelligent Transit Stops

Table 5.7 shows a subset of projects that are directly related to the congested corridors previously identified.[17]

Table 5.7 ITS Projects Considered for CMP[18]

Project Type	Project Description
Archive Data Services	Collect transportation data from various sources and archive them for future use. Types of archive data could include traffic data, weather, emergency, transit, and etc. Geographic Information System (GIS) data is also an integral component of this service area as the Archive Data Services element would be communicating with a GIS data update provider.
Shared Traffic Database	Within the overall data archive, traffic data shared and easily retrieved traffic data was noted by many agencies as a need.. A initial focus of a regional data archive should be on implementing a shared database for traffic data.
Integration with ADOT&PF Traffic and Roadway Conditions Entry System	The existing condition entry system that ADOT&PF has connects directly to their 511 system and the information potentially could be shared among a variety of agencies. Authorized personnel in the MOA such as police, fire, and traffic operators, can input and retrieve traffic information and roadway conditions directly into the statewide database. Personnel could enter and retrieve data through use of mobile devices as well.

[17] Note: The projects presented are mentioned and described in the Anchorage Regional ITS Architecture Report (ARIA)..

[18] Note: There was no specific ITS list of projects considered in the MTP 2035 report. This list was developed from the overall description of projects provided in the ARIA report. This list of projects could be modified if there is more information on ITS projects considered in the near future.

Arterial Management	Support arterial traffic management and focus on the communication processes amongst center and field systems involved in arterial operations. This includes data flow amongst systems such as traffic cameras, traffic signal controllers, traffic signal preemption and priority systems, transit vehicular on-board systems, traffic detectors and other elements. Projects included in arterial management are as follows: Traffic Operations Center ; Closed Circuit Television (CCTV) ; Traffic Signal Controller Upgrade ; Transit Signal Priority ; WiFi/Bluetooth Detection for Travel Time ;and Bicycle Detection and Warnings.
Traveler Information	Provide two key functions – public traveler information and internal agency traveler information. Enable stakeholders to provide automated real-time or static public information regarding traffic conditions, events, emergencies, or construction via the internet and phone. Projects include: Highway-Rail Intersection (HRI) Warning Systems; Traveler Information Website, Parking Management , and Advanced Highway-Rail Intersection (HRI) Warning Systems. ,
Roadway Maintenance & Construction	Distribute of maintenance and construction data in support of operations. Weather, work zone, environmental conditions, and traffic images are some of the potential data flows that may be exchanged among agencies. Projects include: Signal Priority for Maintenance Vehicles and Road Weather Information Systems(RWIS) Data Sharing.
Transit Operations	Provide external flows connecting to and from internal transit operations along with internal transit operations amongst transit management centers, transit vehicles, field support, and demand response services. Projects include: Transit Technology Refresh (software upgrades); Multi-modal Trip Planner; Transit Signal Priority; Fare Payment, Intelligent Transit Stops.

Source: Anchorage Regional ITS Architecture Update (ARIA) Implementation Plan, 2014.

As noted earlier, the CMP is used at various levels of planning and operational analysis from the MTP to the TIP to the development of individual projects. A CMP that is integrated into the metropolitan transportation planning process and also the regional ITS architecture can provide comprehensive information on the performance of the transportation system so citizens, elected officials, and partner agencies will have up-to-date information regarding congestion levels and implemented strategies. In order to identify and prioritize key CMP projects and to facilitate effective integration with other projects in the region, AMATS will develop a mid-term CMP strategic implementation plan as identified in the recent UPWP. It is

anticipated that the mid-term strategic plan will offer a program of specific projects, system integration strategies and institutional activities related to CMP and performance measures. The level of detail in such a plan would be greater than the list of strategies included in this document.

6.0 Congestion Management Strategies

Congestion management strategies include a variety of projects, actions and programs, and strategies that will best mitigate congestion in the Anchorage region. This section of the CMP Report presents a set of strategies that could be implemented in the Anchorage region to reduce or mitigate congestion.

The first part of this section seeks to identify strategies that fit the Anchorage region's gaps and needs. The strategies were identified based on the goals and objectives identified in the Technical Report 1, which defines strategies for the CMP based on AMATS' Metropolitan Transportation Plan and MAP-21 requirements. This part focuses on strategies that appear to best meet the unique characteristics and needs of the Anchorage region's transportation land use and system, and that can be achieved and implemented in a relatively short time frame.

The second part of this section provides a framework for evaluating congestion management strategies. This part presents a general toolbox of potential CMP strategies for application, and describes potential evaluation methods, the expected effectiveness, and impact of the strategies.

6.1 Identifying Strategies

One of the key components of the CMP is to identify a set of recommended solutions to effectively manage congestion and achieve regional congestion management goals and objectives. Federal guidance recommends that identification of strategies be based on their ability to support regional congestion management objectives, meet local context and relevance, contribute to other regional goals and objectives, and consider the coordination and collaboration that will be needed to assign jurisdictional responsibility for implementing the strategies.

An agency must also have an understanding of the nature of the need and current operating characteristics of the system/corridor/project location. Congestion management strategies may vary depending on:

1. The specific issue or dimension of congestion that needs to be addressed (see Figure 6.1)
2. The objectives to be accomplished through the strategy
3. Whether the strategy is to be implemented on new capacity or an existing facility
4. The availability of right-of-way
5. Current operational characteristics of the system/corridor/ project location, and
6. Environmental and societal concerns.

Figure 6.1 Different Dimensions of Congestion

Spatial

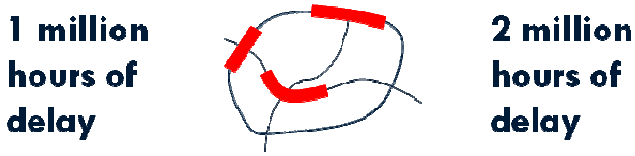
How much of the system is congested? The image presents an example of a metropolitan highway network with 20 percent of all miles congested.

Temporal

How long does congestion last? The image presents an example of a metropolitan highway network with congestion from 6:00 a.m. through 10:00 a.m.

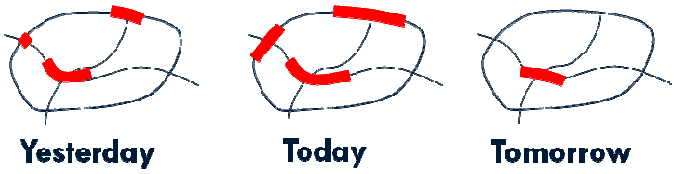
Severity

How much delay is there or how low are travel speeds? The image shows that for the same percentage of miles congested, the number of vehicles and total hours of vehicular delay can be different.



Variability

How does congestion change from day to day? The image shows how the severity and location of congestion can change from day to day. More variation in travel time indicates less reliable travel. A reliable system would have consistent levels of congestion from hour to hour and day to day.



Source: Cambridge Systematics.

The CMP goals and objectives identified in the first section of this report provide context for identifying appropriate strategies to resolve specific congestion issues. For example, if incidents prove to cause unreliable travel on a project corridor, the analyst might consider operations/intelligent transportation system (ITS) strategies such as incident detection and management. Table 6.1 identifies potential actions and strategies based on CMP objectives.

This table also identifies performance measures that can be used to evaluate potential congestion management strategies. Important criteria for selecting these measures include:

1. Ability to support CMP goals and objectives.

2. Ability to evaluate progress in meeting these goals and objectives through the defined performance measures.

3. Ability to be calculated with existing data. As a result, only Tier 1 performance measures are included.

Table 6.1 Strategy Identification

Strategic goal	CMP Goals & Objectives	CMP Actions & Strategies	CMP Performance Measures
Goal 1 – Efficiency & Reliability: Improve the efficiency and reliability of the surface transportation system, seeking to reduce congestion in the region, minimizing environmental impacts, and ensuring adequate system resilience.	• Reduce delay and improve travel times during peak hour. • Improve year-round reliability of travel times. • Reduce non-recurrent delay during peak hour periods caused by traffic incidents, special events, work zones.	Develop tools and processes to better manage transportation system congestion into the future by implementing a comprehensive set of TDM, TSM, operations/ITS, transit, and pedestrian/bicycle strategies. Link transit operational strategies with MOA Public Transportation's future projects for evaluation within the CMP.	• Total system VMT. • Total vehicle hours traveled. • Travel time by corridor. • Annual vehicle hours of delay. • Travel Time Ratio • 80th Percentile Travel Time Index
Goal 2 – Safety and Incident Management: Achieve a significant reduction in traffic fatalities and serious injuries in public roads, by providing a system that moves people and goods safely and securely.	• Reduce the number and rate of fatalities and serious injury crashes. • Reduce the number of commercial motor vehicle and non-motorized traveler involved crashes. • Decrease response and/or incident clearance times on major highways.	Assess the safety benefits of TDM, TSM, operations/ITS, transit, and roadway strategies, projects, and programs. Implement operations/ITS strategies that enhance the region's traffic incident management program.	• Vehicle crashes by severity, location, and mode. • Fatality and serious injury crash rate per 100 Million VMT. • Incident response time. • Number of pedestrian-vehicle and bicycle-vehicle crashes by severity and location. • Incident Clearance Time
Goal 3 – Travel Options: Provide a transportation system with viable and attractive choices across transportation modes.	• Increase promotion and participation in Ride-sharing programs. • Increase alternative (non-SOV) mode shares for commuting trips. • Reduce CO emissions through congestion management. • Improve extent and quality of pedestrian and bicycle facilities. • Reduce delay and improve travel time on facilities used for transit service.	Identify/link transit strategies, programs, and projects from MOA Public Transportation to CMP. Promote the use of ride-sharing programs by using ITS technologies to make them more attractive and convenient.	• Transit ridership per revenue hour of service. • Transit on-time performance. • Rideshare/Vanpool participation. • Number of Bicycle Trips. • Number of Pedestrian Trips.

Strategic goal	CMP Goals & Objectives	CMP Actions & Strategies	CMP Performance Measures
Goal 4 – Freight: Improve the freight network to promote economic development, while maintaining the system in state of good repair.	• Reduce delay and improve truck reliability on commercial corridors. • Maintain adequate bridge/pavement condition on freight corridors.	Emphasize reliability/operational efficiency on major freight corridors in the region by establishing priority for ITS deployments and services.	• Annual hours of truck delay. • Truck Reliability Index • Daily Truck Volumes by Location
Goal 5 – System connectivity: Establish community connectivity with safe, convenient, year-round automobile and non-automobile travel routes between neighborhoods, commercial centers, and public facilities.	• Develop and maintain a functional roadway hierarchy for new projects. • Improve motorized and non-motorized system connectivity.	Implement a comprehensive set of TDM, TSM, operations/ITS, transit, and pedestrian/bicycle strategies. Physical improvements to close critical gaps in bicycle/pedestrian network.	• Connectivity index for pedestrian and bikeway systems.
Goal 6 – Access & mobility: Improve access to goods, jobs, services, housing, and other destinations while providing mobility for people and goods in a safe, affordable, efficient, and convenient manner.	• Reduce PMT and PHT per capita. • Promote TSM, TDM, and ITS strategies.	Emphasize TDM strategies to better manage congestion across the transportation system. Emphasize projects that increase accessibility and mobility measures across the region.	• Population within ¼ mile of a fixed transit route. • Public Transportation/automobile Travel Time Ratio To/From Selected Locations
Goal 7 – Transit-Oriented Development: Promote the development of TODs in the region.	• Promote the development of mixed-use centers and transit-supportive corridors. • Promote transit-friendly residential and commercial development in Downtown Anchorage and Downtown Eagle River.	Promote TOD developments by emphasizing projects that would make transit services more attractive on desired corridors.	• Square Feet of Mixed-Use Center/Transit Oriented Development

Source: Source text here.

6.2 Congestion Management Toolbox

Guiding principles for Anchorage's CMP suggest that preference be given to demand management strategies that eliminate or reduce travel, while leaving high-cost capacity serving single occupant vehicle travel as a last resort. The following is a list of congestion management strategies, sorted in hierarchical order:

1. Transportation demand management (TDM) strategies that eliminate or reduce the need to make trips by single occupancy vehicle.

2. Land use strategies that promote mixed-use and transit-oriented development and allow for reduced use of motor vehicles for some discretionary trips.

3. Strategies that expand public transportation and promote the use of higher occupancy modes.

4. Operational improvements and Intelligent Transportation Systems (ITS) that make the best use of existing capacity.

5. Pricing strategies that reduce vehicle demand.

6. Bicycle and pedestrian strategies that shift trips to bicycling and walking modes.

7. Roadway/mobility (non-ITS) strategies that are designed to help improve operations and relieve bottlenecks on existing facilities through non-capacity adding improvements.

8. Roadway capacity expansion strategies such as adding additional capacity to existing roadway facilities or constructing new roadway facilities that serve newer developed or rapidly developing areas, or where gaps exist in the existing freeway or arterial network.

Each strategy type is described in greater detail below. Table 6.2 provides a congestion management toolbox that identifies strategies within each of the hierarchical categories. Some of the strategies are more regional or system wide in applications, while others are corridor or project specific. For each of the projects and strategies, the potential for congestion reduction benefits is indicated, along with a recommended analysis method to help with location-specific assessment and prioritization. Order-of-magnitude cost estimates are also provided based on national cost data built into IDAS and the TOPS-BC software. Finally, the toolbox indicates strategies that are complementary, and in what situations they are best used together.

6.2.1 Transportation Demand Management (TDM)

Ten different TDM categories are identified including alternative work hours, ridesharing, telecommuting, road pricing, and toll roads. The costs of these strategies tend to be low to moderate and have benefits such as reducing peak period travel and reducing single-occupant

VMT. These, in turn can provide a number of environmental benefits including improved air quality and reduced greenhouse gas emissions. TDM strategies can be grouped effectively with various public transportation services as well as land use and bicycle/pedestrian strategies.

6.2.2 Land Use and the Built Environment

Five strategies related to land use and the built environment are identified including infill development, transit-oriented development (TOD), and densification efforts. Effective land use strategies decrease SOV trips, increase walk trips as well as transit mode share, and provide air quality benefits to the region. Most practices in this category are important components to transit friendly and transit oriented developments.

In addition to the strategies outlined above, Transportation Management Associations may be established within the central business district and the UMED district. These are nonprofit, member-controlled organizations that provide transportation services in a particular area, such as a commercial district, mall, medical center, or industrial park. They are generally public-private partnerships consisting primarily of area businesses with local government support.

Generally, land use strategies have low to moderate costs and tend to involve the establishment of ordinances and the potential need for economic incentives that will encourage developer buy-in.

6.2.3 Public Transportation

Nineteen different public transportation strategies are identified including increasing route coverage and frequency, employer incentive programs, signal priority, intelligent transit stops, and other technological improvements.

These strategies range in cost but unless new right-of-way is being proposed are generally low-to-medium. Predominant benefits include shifting mode share, increasing transit ridership, reducing VMT, and improving air quality. Transit strategies may work well alongside bicycle and pedestrian strategies and densifying land use strategies that aim to further shift mode share away from SOVs.

6.2.4 ITS and Operations

Fourteen ITS and transportation system management (TSM) strategies are identified including signal coordination, traveler information systems, incident management, and service patrols.

Costs of these strategies vary but tend to be low to moderate. Large scale ITS and operations strategies that involve the construction of new infrastructure and devices tend to be higher in cost than other projects. Benefits include improved travel option awareness, reduced travel time, reduced stops, reduced delays, and improved safety. Installation of vehicle detection systems may help ramp metering. Active management will help avoid queues extending to arterial streets.

6.2.5 Pricing

Pricing strategies are regulatory in nature but may also relate to parking systems. Carbon pricing, VMT fees, pay as you drive insurance, and auto and truck restriction zones are all regulations that can be instituted to help alleviate congestion and generate revenue for additional strategies, although most of these are probably not applicable in the Anchorage area at this point in time.

Beyond this, a number of parking pricing strategies can help to reduce congestion. These include preferential or free parking for HOVs and local regional excise taxes. This provides an incentive for workers to carpool. Strategies could include dynamic pricing, fees on free parking lots, and parking permits. Additionally, a local flat fee per space on parking spaces provided by businesses can discourage automobile-dependent development.

Pricing strategies may result in a reduction in VMT and increased vehicle capacity. They also generate revenue to maintain the strategy and system and promote transit, biking, and walking as other forms of travel. These are generally low cost strategies although methods of implementation and exceptions can increase administrative costs. They may work well with a number of land use and built environment strategies as well as strategies promoting public transportation, and walking and bicycling.

6.2.6 Bicycle and Pedestrians

Seven bicycle and pedestrian strategies are identified. These tend to be low to moderate in cost. Strategies include wayfinding, secure bike storage, new sidewalks and bicycle lanes, improved facilities near transit stations, bike sharing, and exclusive non-motorized rights of way. Abandoned rail rights-of-way and existing parkland can be used for medium to long distance bike trails improving safety and reducing travel times. Bicycle and pedestrian policies may work well when grouped with other strategies such as implementation of a complete streets policy, land use and environmental strategies that promote densification, and improved safety strategies.

Benefits of bicycle and pedestrian strategies include decreasing auto mode share, which in turn reduces VMT and improves regional air quality. Costs of bicycle and pedestrian strategies tend to be low to moderate.

6.2.7 Roadway/Mobility Strategies (Non-ITS)

Eight roadway/mobility strategies (non-ITS) are identified. These strategies are designed to help improve operations and relieve bottlenecks on existing facilities through non-capacity adding improvements. Strategies include access management improvements; turn restrictions at key intersections; converting streets to one-way operations; geometric design improvements to roadways, interchanges, and intersections; non-added capacity grade separations; addition of acceleration or deceleration lanes; and adoption of a Complete Streets policy.

These strategies range in cost low to high based on the type and complexity of strategy implemented. Also, these strategies may be grouped with improved signage and ITS/operations strategies for additional benefits.

6.2.8 Roadway Capacity Expansion

Highway strategies to add roadway capacity include the construction of a new roadway or bypass, major or minor road widening to add additional through lanes on an existing highway, major roadway reconstruction, adding capacity to a corridor by improving many related intersections, new interchange, adding capacity to an existing interchange, or grade separation of existing intersections (that add capacity). Adding is the strategy of last resort due to issues related to sprawl, land preservation, promotion of alternative transportation modes, and cost considerations.

These strategies range in cost from moderate to high based on the type of strategy implemented, with new right-of-way resulting in higher costs than design improvements. Predominant benefits of these strategies include increased capacity as well as improved mobility and traffic flow. For those transportation management areas (TMAs) that are either non-attainment or a maintenance area for ozone or carbon monoxide federal regulations, the CMP must provide an analysis of how capacity expansion projects will reduce congestion.

These types of roadway projects and strategies may be coupled with improved signage and real time information messages for additional benefits to travelers.

Figure 6.2 Summary of Congestion Management Strategies in Toolbox

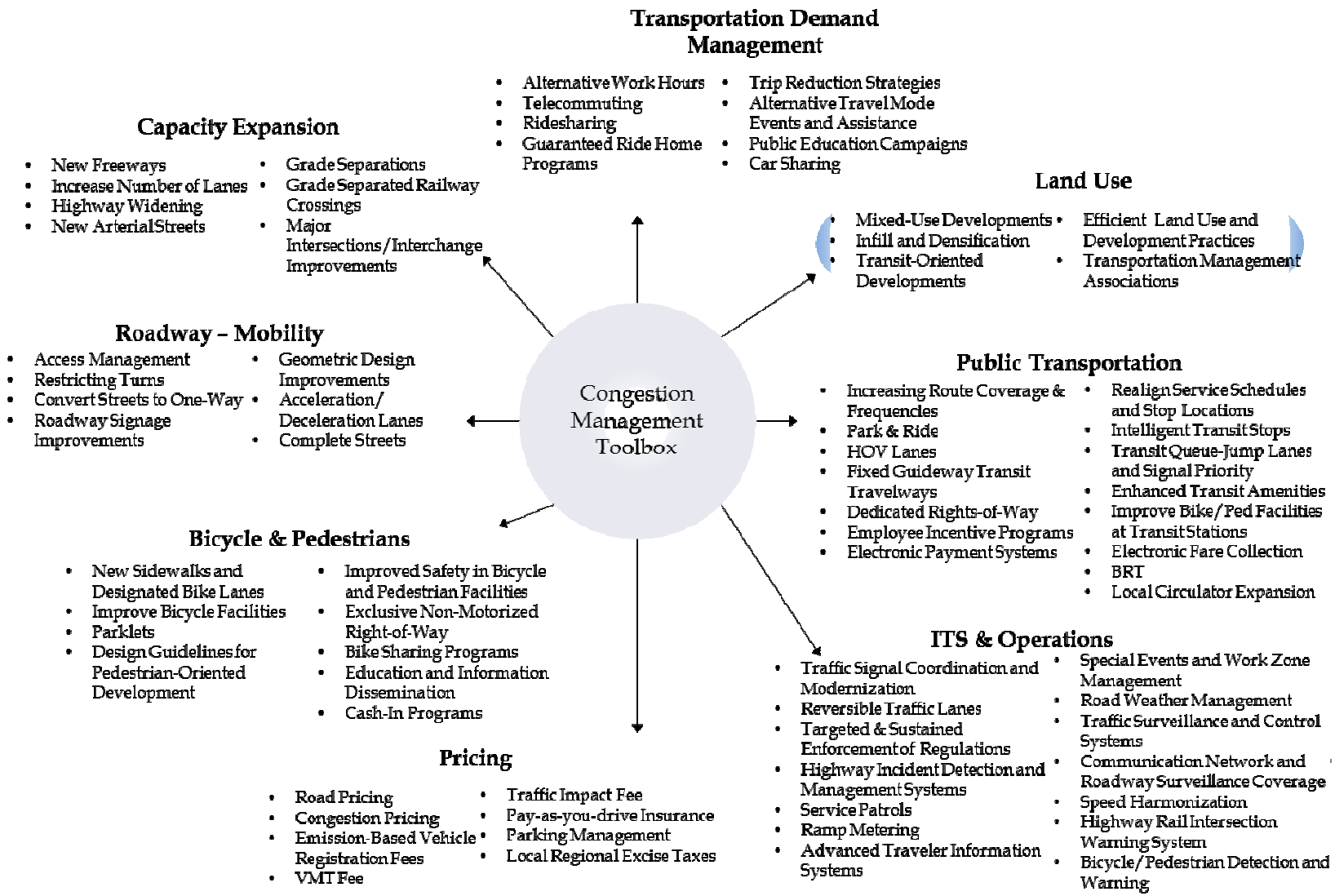


Table 6.2 Congestion Management Toolbox

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
1. Transportation Demand Management Strategies							
Alternative Work Hours – This allows workers to arrive and leave work outside of the traditional commute period. It can be on a scheduled basis or a true flex-time arrangement. Can also include a compressed work week.	• Reduce peak-period VMT • Improve travel time among participants. • Reduction in peak period SOV trips.	• Region	• Agency costs for outreach and publicity • Employer costs associated with accommodating alternative work schedules.	• Short-term: 1 to 5 years • Employer-based	• TDM Evaluation Models • Vehicle Emissions Model • Regional Travel Model		• Part of TO Report & RA
Telecommuting – This involves employees to work at home or regional telecommute center instead of going into the office. They might do this all the time, or only one or more days per week. Also include teleconferencing and videoconferencing - The live exchange of information among several persons and machines linked by telecommunications.	• Reduce peak period VMT. • Reduce peak period SOV trips. • Fewer drivers during morning and afternoon rush hours. • Increased employee productivity, improved employee retention and recruitment, reduced overhead costs and lower demand for physical office and parking space. • Decreased commuting time (VHT) and expenses for employees.		• First-year implementation costs for private-sector (per employee for equipment). • Second-year costs tend to decline.	• Short-term: 1 to 5 years • Employer-based	• TDM Evaluation Models • Vehicle Emissions Model • Regional Travel Model	• Telework participants may also be interested in alternative travel mode services on days.	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Ridesharing – This is typically arranged/encouraged through employers or transportation management agencies (TMA) that provide ride-matching services programs to promote carpooling and vanpooling, including ride-matching services and policies that give ridesharing vehicles priority in traffic and parking.	• Reduce commuter-based VMT. • Reduce peak period SOV trips. • Lower commuting costs. • Reduce parking congestion. • Promote transit, biking and walking.	• Region	• Low to Moderate. • Savings per carpool and vanpool riders. • Costs per year per free parking space provided. • Administrative costs.	• Short-term: 1 to 5 years • Employer-based	• TDM Evaluation Models • Vehicle Emissions Model • Regional Travel Model	• Cross-promotion of complementary transit services can result in greater overall benefits. • Programs to encourage carpooling to transit stations may have merit. • Employer-based "trip reduction managers" can operate programs geared toward their employees. This could be represented by a more robust program of the current Employee Transportation Coordinators (ETC) program.	• Part of TO Report & RA
Guaranteed Ride Home Programs – Provides a guaranteed ride home at no cost to the employee in the event an employee or a member of their immediate family becomes ill or injured, requiring the employee to leave work.	• Decrease work VMT • Decrease SOV trips	• Region • Project	• Requires administrative support from employers. • Potential to be costly.	• Short-term: 1 to 5 years • Employer-based	• TDM Evaluation Models • Vehicle Emissions Model	• Employee incentives • Carpool and vanpool programs. • Telecommuting • Transit riders (102 and/or Connect).	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Trip Reduction Strategies – Plans, policies, and regulations instituted to reduce the use of SOVs for commuting; often linked to air quality planning.	• Reduce VMT • Reduce SOV trips • Increase alternative modes share • Increase transit mode share	• Region	• First-year implementation costs for private-sector (per employee equipment). • Second-year costs tend to decline. • Requires interagency and private sector coordination.	• Short-term: 1 to 5 years • Employer-based	• Vehicle Emissions Model • TDM Evaluation Models	• Travel demand management strategies	• Part of TO Report & RA
Alternative Travel Mode Events and Assistance – Variety of events that promote, encourage and educate people about alternative travel modes (e.g. Bike to Work Day and employer transportation fairs). Programs that provide free or low-cost transit services (e.g. free service to elder riders or users with disabilities) or other incentives.	• Fewer single-occupant vehicles on the road and less overall traffic congestion. • Lower commuting costs.	• Region	• Low • Cost can be relatively low, depending on the level of participation from employers and sponsors.	• Short-term: 1 to 5 years		• Cross-promotion of complementary transit services can result in greater overall benefits. • Provision of additional transit or vanpool service and construction of bicycling facilities offers further encouragement. • Complementary facilities such as high-occupancy vehicle (HOV) lanes that offer carpools a less-congested roadway.	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Public Education Campaigns – E.g. driving habits, trip chaining, idle reduction, hard acceleration (i.e., jackrabbit starts) Currently MOA DHHS has an iniciative to promote campaigns to reduce cold starts and emissions.	• Air Quality Benefit Medium • Positive user impacts	• Region	• Agency costs for outreach and publicity	• Short-term: 1 to 5 years		• Improved safety (auto, transit, bicycle and pedestrians).	• Part of TO Report & RA
Car Sharing – Program in which automobile rental services are used to substitute private vehicle use and ownership. Peer to peer car sharing, also known as Personal Vehicle Car-Sharing (PVCS) enables private car owners to make their vehicle available on a temporary basis to a private carsharing company for rental. When not rented, the vehicle owner can continue to use their car as before, this service is available in Anchorage through RelayRides. Commercial Car Sharing, run by private firms such as Hertz 24/7, maintain a fleet of vehicles that are deployed regionally (neighborhoods) for rental and use.	• Provide cost savings to users. • Reduce parking congestion. • Promote transit, biking, and walking. • Increase public health through physical activity and walkability.	• Region		• Currently implemented • Expansion could take place within 1 to 2 years or between 3 to 10 years depending on the level of service changes and magnitude of project.t	• Analyze current utilization reports, and determine benefits of current programs expansion.n	• Other Transportation Demand Management • Public Transportation • Land Use and Built Environment • Bicycle and Pedestrian	• Currently available • Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
2. Land Use Strategies							
Mixed-Use Development – This allows many trips to be made without automobiles. People can walk to restaurants and services rather than use their vehicles.	• Increase walk trips • Decrease SOV trips • Decrease in VMT • Decrease vehicle hours of travel	• Region	• Public costs to set up and monitor appropriate ordinances. • Economic incentives used to encourage developer buy-in.	• Long-term: 10 or more years	• Regional Travel Model • TDM Evaluation Models		
Infill and Densification – This takes advantage of infrastructure that already exists, rather than building new infrastructure on the fringes of the urban area.	• Decrease SOV • Increase transit, walk, and bicycle. • Doubling density decreases VMT per household. • Medium/high vehicle trip reductions. • Air quality benefit to densification.	• Region	• Public costs to set up and monitor appropriate ordinances. • Economic incentives used to encourage developer buy-in.	• Long-term: 10 or more years	• Regional Travel Model • TDM Evaluation Models		
Transit-Oriented Development – This clusters housing units and/or businesses near transit stations in walkable communities.	• Decrease SOV share. • Shift carpool to transit • Increase transit trips. • Decrease VMT. • Decrease in vehicle trips. • Increase transit mode share.	• Region	• Public costs to set up and monitor appropriate ordinances. • Economic incentives used to encourage developer buy-in.	• Long-term: 10 or more years	• Regional Travel Model • TDM Evaluation Models		

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Efficient Land Use and Development Practices – Areawide policies and strategies that result in a more transportation-efficient regional development pattern (e.g. urban growth boundary). Localized planning, zoning, ordinances and site approval strategies that result in more transportation-efficient developments (e.g. mixed-land-uses, higher density, urban centers, well connected transit, pedestrian and bicycling facilities).	• Less motor vehicle use through greater bicycling, walking and transit use. • Related health benefits and economic savings via less infrastructure needs. • Reduce VMT. • Reduce SOV trips. • Increase alternative modes share.	• Region	• Low to moderate • Costs can vary widely and are difficult to calculate, as they will be shared by local governments, developers, home buyers, businesses and customers.	• Short- to long-term • Small-scale retrofit practices, re-zonings or comprehensive plan amendments can be done in a short to moderate timeframe. • Regional-scale policy changes may take a long time to adopt and result in development changes on the ground and integration with transportation systems.	• Regional Travel Model	• Transit-oriented development (TOD)	
Transportation Management Associations – Nonprofit, member-controlled organizations that provide transportation services in a particular area, such as a commercial district, mall, medical center, or industrial park. They are generally public-private partnerships consisting primarily of area businesses with local government support.	• Reduce VMT • Reduce SOV trips • Increase alternative modes share • Increase transit mode share.	• Region	• First-year implementation costs for private-sector (per employee equipment). • Second-year costs tend to decline. • Requires interagency and private sector coordination.	• Employer-based • Short-term: 1 to 5 years	• Vehicle Emissions Model	• Travel demand management strategies	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
3. Public Transportation Strategies							
Increasing Route Coverage and Frequencies – This provides better accessibility to transit to a greater share of the population. Increasing frequency makes transit more attractive to use. May require investment in new buses which would create a capital cost per passenger trip. May also include new routes or extensions to existing routes.	• Increase transit ridership. • Decrease travel time. • Reduce daily VMT. • Improved convenience and travel reliability. • Reduced traffic congestion due to trips switched from driving alone to transit.	• Region	• Capital costs per passenger trip. • Operating costs per trip. • New bus purchases likely.	• Short-term: 1 to 5 years (includes planning, engineering, and construction).	• Regional Travel Model • TDM Evaluation Models • Vehicle Emissions Model	• Transit queue jump lanes • Use of automated vehicle location (AVL) technology enables provision of real-time traveler information. This technology is currently being used. • Developments designed with transit friendly features and connections to and from transit stops make bus travel more convenient.	
Park-and- Ride – These can be used in conjunction with HOV lanes and/or express bus services. They are particularly helpful for encouraging HOV use for longer distance commute trips.	• Reduce regional VMT (up to 0.1 percent). • Increase mobility and transit efficiency. • Reduce SOV trips • Increased transit boardings and mode share. • Decrease congestion by increasing vehicle occupancy rate.	• Corridor • Project	• Structure costs for transit stations. • Land acquisition costs.	• Medium-term: 5 to 10 years (includes planning, engineering, and construction).	• TDM Evaluation Models • Regional Travel Model	• Increased transit service and coverage and other transit. related congestion strategies. • Enhanced bicycle and pedestrian facilities.	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
HOV Lanes – This increases corridor capacity while at the same time provides an incentive for single-occupant drivers to shift to ridesharing. These lanes are most effective as part of a comprehensive effort to encourage HOVs, including publicity, outreach, park-and-ride lots, and rideshare matching services.	• Reduce regional VMT. • Reduce regional trips. • Increase vehicle occupancy. • Improve travel times. • Increase transit use and improve bus travel times.	• Corridor	• HOV, separate ROW costs. • HOV, barrier separated costs. • HOV, contraflow costs. • Annual operations and enforcement. • Can create environmental and community impacts.	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• Regional Travel Model • TDM Evaluation Models • IDAS	• Non-traditional toll roads. • Enhanced bus service, bus rapid transit, and TDM programs will increase the number of persons using the facility. • Electronic toll collection methods are commonly used with non-traditional toll roads.	• Part of TO Report & RA
Fixed Guideway Transit Travelways – Exclusive guideways (e.g. light rail, heavy/commuter rail) and street travelways (e.g. bus rapid transit (BRT)) devoted to increasing the person-carrying capacity within a travel corridor	• More consistent and sometimes faster travel times for transit passengers versus driving. • Increased person throughput capacity within a corridor due to people switching from single occupant motor vehicles to transit. • Stimulation of efficient mixed-use or higher-density development.	• Corridor	• Moderate to high • Implementation cost will vary, but cost usually high due to acquisition of rights-of-way, materials and infrastructure.	• Long-term – 20 years • Development and implementation of a rail project is a major undertaking that can take 10 or more years from initial planning. phases through NEPA studies to an opening day. • On-street conversion of travel lanes to BRT may not take quite as long.	• Regional Travel Model	• Transit-oriented developments (TODs) stimulate additional use of rail and bus services. • Parking management, fare collection and other technological transit applications. • Transportation demand management services/incentive s encourage transit use.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Dedicated Rights-of-Way for Transit – Reserved travel lanes or rights-of-way for transit operations, including use of shoulders during peak periods.	• Increase transit ridership. • Decrease travel time.	• Corridor	• Costs vary by type of design	• Medium-term: 5 to 10 years (includes planning, engineering, and construction.)	• Regional Travel Model	• Transit signal priority • Paved shoulders	
Employer Incentive Programs – Encourages additional transit use through transit subsidies of mass transit fares provided by employers.	• Increase transit ridership. • Decrease travel time. • Decrease daily VMT.	• Region	• Cost of incentives to employers offering employee benefits for transit use.	• Short-term: 1 to 5 years	• Vehicle Emissions Model	• Increasing transit/bus route coverage and frequency • Carpool, vanpool, and rideshare programs	• Part of TO Report & RA
Electronic Payment Systems and Universal Fare Cards – Interchangeable smartcard payment system (including RFID) that can be used as a fare payment method for multiple modes of transportation throughout the region. This project would complement current smart farebox technology.	• Increase transit ridership. • Decrease travel time.	• Region	• Currently high, but expected to decrease. • Implementation costs vary based on system design and functionality.	• Short-term: 1 to 5 years		• Increasing transit/bus route coverage and frequency. • Intelligent transit stops. • Enhance transit amenities.	• State transit is looking at this currently
Realigned Transit Service Schedules and Stop Locations – Service adjustments to better align transit service with ridership markets.	• Increase transit ridership. • Decrease daily VMT.	• Region	• Operating costs per trip	• Short-term: 1 to 5 years		• Increasing transit/bus route coverage and frequency. • Intelligent transit stops. • Enhance transit amenities.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Intelligent Transit Stops – Ranges from kiosks, which show static transit schedules, to real-time information on schedules, locations of transit vehicles, arrival time of the vehicle, and alternative routes and modes.	• Decrease daily VMT. • Decrease congestion. • Increase ridership.	• Region • Corridor • Project	• Capital costs per passenger. • On-going maintenance costs.	• Medium-term: 5 to 10 years (includes planning, engineering, and construction).	• Sketch planning and /or spreadsheet models	• Increasing transit/bus route coverage and frequency. • Electronic payment systems and universal farecards. • Enhance transit amenities. • Integration of transit information into advanced traveler information systems.	• Part of TO Report & RA
Transit Intersection Queue Jump Lanes and Signal Priority – Additional travel lane at a signalized intersection that allows buses to proceed via their own "green-time" before other vehicles. Done by restriping within existing road footprint or this may require construction.	• Reduced bus travel delays due to traffic signals and traffic congestion. • Improved operational efficiency of transit service within a corridor. • Increased ridership and reduced congestion due to time savings. • Safer driving conditions for all vehicles due to fewer severe and sudden lane changes by buses.	• Corridor • Project	• Low to moderate • Installation and operation cost of queue jump lane and signal equipment is low. • Constructing a new designated transit lane has a higher cost Implementation costs vary based on system design and functionality and type of equipment.	• Short-term: 1 to 5 years • All phases–planning, engineering and implementing–a queue-jump lane can be reasonably completed in less than one year. • Longer time is needed if new lane must be constructed.	• TOPS B-C • IDAS	• Newly constructed queue-jump lanes are costly if right-of-way must be obtained. Efforts should be made to incorporate the lane into the existing roadway. • Enforcement at transit queue-jump locations is important to ensure safety and proper operation. • If the queue-jump lane replaces on-street parking meter spots, cities may receive less	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
						parking revenue.	
Enhanced Transit Amenities – Includes vehicle replacement/upgrade, which furthers the benefits of increased transit use.	• Decrease daily VM.T • Decrease congestion. • Increase ridership.	• Region • Corridor • Project	• Capital costs • Addition of clean fuel bus fleets may be incorporated as part of regular vehicle replacement programs.	• Short-term: 1 to 5 years (includes planning, engineering, and construction).	• TOPS B-C	• Increasing transit/bus route coverage and frequency. • Intelligent transit stops. • Enhance transit amenities. • Paved shoulders.	
Improved Bicycle and Pedestrian Facilities at Transit Stations – Includes improvements to facilities that provide access to transit stops as well as provisions for bicycles on transit vehicles and at transit stops (bicycle racks and lockers).	• Increase bicycle mode share. • Decrease motorized vehicle congestion on access routes.	• Region • Corridor • Project	• Capital and maintenance costs for bicycle racks and lockers.	• Short-term: 1 to 5 years (includes planning, engineering, and construction).	• TOPS B-C	• Intelligent transit stops. • Enhance bicycle and pedestrian connectivity. • Complete Streets policy.	• Part of TO Report & RA
Electronic Fare Collection – Equipment that allows riders to electronically pay a transit fare by using credit, debit and magnetic fare cards.	• Improved service efficiency, passenger convenience and passenger loading time. • Increase ridership. • Better quality ridership data. • Improved analysis and forecasting of trip ridership patterns and fare structure impact. • Reduced overall operating cost of fare collection and	• Region	• Moderate to high • The cost to purchase and implement. electronic fare collection equipment can be high depending on the technology used. • Maintenance and repair of electronic fare equipment can be expected due to the need for highly	• Medium-term: 5 to 10 years.	• TOPS B-C	• Future technology and equipment may allow fare payment media to be used as general-purpose debit cards for other types of purchases.	• Currently being considered

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
	processing.		trained personnel.				
BRT – High-capacity, highly efficient bus service designed to upgrade bus transit services to mass-transit levels.	• Reduce VMT. • Reduce SOV trip.s • Increase transit ridership & mode share.	• Corridor	• Capital costs per passenger trip. • New & expanded systems require large up-front capital outlays and ongoing sources of operating subsidies, in addition to funds that may be obtained from federal sources, under increasingly tight competition.	• Long-term: 10 or more years (includes planning, engineering, and construction).	• Regional Travel Model • Vehicle Emissions Model	• This improvement increases feasibility of TOD developments.	
Express Bus Service Expansion – Bus service with high-speed operations, usually between two commuter points.	• Reduce VMT. • Reduce SOV trips. • Increase transit ridership & mode share.	• Region • Corridor	• Capital costs per passenger trip. • Operating costs per trip. • New bus purchases.	• Short-term: 1 to 5 years (includes planning, engineering, and construction).	• Regional Travel Model • Vehicle Emissions Model	• Developments designed with transit-friendly features and connections to and from transit stops make bus travel more convenient.	
Local Circulator Expansion – Fixed-route service within an activity area, such as a CBD or campus, designed to reduce short trips by car.	• Reduce VMT. • Reduce SOV trips. • Increase transit ridership & boardings.	• Region • Corridor • Project	• Capital costs per passenger trip. • Operating costs per trip. • New bus purchases.	• Short-term: 1 to 5 years (includes planning, engineering, and construction.)	• Regional Travel Model • Vehicle Emissions Model	• Transit intersection queue-jump lanes save time. • Developments designed with transit-friendly features and connections to and from transit stops make bus travel more	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
						convenient.	
4. ITS and Operations Strategies							
Traffic Signal Coordination and Modernization – This improves traffic flow and reduces emissions by minimizing stops on arterial streets. Enhancements to timing/coordination plans and equipment to improve traffic flow and decrease the number of vehicle stops. May include: • Modern technology that provides for real-time traffic and transit management • Equipment that may permit immediate knowledge of malfunctions. • Responsive control that allows traffic signals to alter timing in response to immediate traffic flow conditions, rather than at predetermined times. • Transit signal priority system that can extend "green-time" a few seconds to allow buses to progress through an intersection.	• Improve travel time. • Reduce the number of stops. • Reduce VMT by vehicle miles per day, depending on program. • Reduce VHT and PHT. • Reduced air pollution, fuel consumption and travel time. • Increase "capacity" of an intersection to handle vehicles, reduced number of vehicle strategies.	• Region • Corridor • Project	• Low to moderate (Costs include initial investment of equipment, software, and communication network and connections. Varies depending on required equipment.) • O&M costs per signal. • Signalized intersections per mile costs variable.	• Short-term: 1 to 5 years (includes planning, engineering, and implementation).	• IDAS • Regional Travel Model • TOPS B-C • Simulation Model	• In some cases, existing traffic signals on lower-volume streets could be replaced by stop signs. • Intersections with low volume late-night traffic could change to flashing operation. • New timing coordination plans should be implemented along with modernized equipment. • In some cases, bus routes or transit stops may be modified to increase ridership along with transit signal priority system. • Appropriate communications infrastructure must be in place for both traffic signal and transit systems.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Reversible Traffic Lanes – These are appropriate where traffic flow is highly directional.	• Increase peak direction capacity. • Reduce peak travel times. • Improve mobility.	• Corridor	• Barrier separated costs per mile. • Operation costs per mile. • Maintenance costs variable.	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model • Simulation Model		
Targeted and Sustained Enforcement of Regulations – Improves traffic flow by reducing violations that cause delays; Includes automated enforcement (e.g., red light cameras).	• Improve travel time. • Decrease the number of stops.	• Region • Corridor • Project	• Increased labor costs per officer.	• Short-term: 1 to 5 years			
Highway Incident Detection and Management Systems – This is an effective way to alleviate non-recurring congestion. Systems typically include video monitoring, dispatch systems, and sometimes roving service patrol vehicles. This systems could be applied to Glenn Highway or Seward Highway, for example.	• Reduce travel delay due to incidents. • Reduce the risks of secondary accidents to motorists. • Improved emergency response time and information distribution. • Reduce travel time. • Decrease VHT and PHT.	• Region • Corridor	• Capital costs variable and substantial. • Annual operating and maintenance costs.	• Medium- to Long-term: likely 10 years or more.	• IDAS • TOPS-BC • Regional Travel Model	• Service patrols. • Traffic signal timing and coordination plans along predetermined arterial street diversion/detour routes. • Variable message signs and other traveler information devices to alert oncoming traffic. • Traffic Surveillance and Control Systems.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Service Patrols – Service vehicles patrol heavily traveled segments and congested sections of the freeways that are prone to incidents to provide faster and anticipatory responses to traffic incidents and disabled vehicles.	• Reduce travel delay due to incidents. • Reduce incident duration time. • Restore full freeway capacity. • Reduce the risks of secondary accidents to motorists.	• Region • Corridor	• Costs vary based on the number of vehicles used by the patrol, number of routes that the patrol operates, and the population of the area in which the program operates.	• Short-term: 1 to 5 years	• IDAS • TOPS-BC • Freeway Service Patrol Evaluation (FSPE). • FHWA Benefit/Cost Tool for Safety Service Patrols.	• Highway Incident Detection and Management Systems. • Advanced Traveler Information Systems.	
Ramp Metering – This allows freeways to operate at their optimal flow rates, thereby speeding travel and reducing collisions. May include bus or high-occupancy vehicle bypass lanes. May require ramp widening to avoid extensive vehicle queuing.	• Decrease travel time. • Decrease accidents. • Improve traffic flow on major facilities. • Improved speed on freeway. • Decreased crash rate on freeway.	• Corridor • Project	• O&M costs • Significant costs associated with enhancements to centralized control system. • Capital costs	• Medium-term: 5 to 10 years	• IDAS • TOPS-BC • Regional Travel Model • Simulation Model	• Installation of a vehicle detector at the top of the ramp and active management will help avoid queues extending to the arterial street..	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Advanced Traveler Information Systems – This provides an extensive amount of data to travelers, such as real time speed estimates on the web or over wireless devices, transit vehicle schedule progress, and parking conditions in urban areas. Provides real-time information to make trip and route choice decisions. Information accessible on the web, dynamic message signs, 511 systems, Highway Advisory Radio (HAR), or handheld wireless devices.	• Reduce travel times and delay. • Some peak-period travel and mode shift.	• Region • Corridor • Project	• Design and implementation costs variable. • Operating and maintenance costs variable.	• Medium-term: 5 to 10 years	• IDAS • TOPS-BC • Regional Travel Model		• Part of TO Report & RA
Special Events and Work Zone Management – Includes a suite of strategies including temporary traffic control, public awareness and motorist information, and traffic operations.	• Minimize traffic delays. • Improve mobility. • Maintain access for businesses and residents.	• Region • Corridor • Project	• Design and implementation costs variable.	• Short-term: 1 to 5 years	• IDAS • TOPS-BC		• Part of TO Report & RA
Road Weather Management – Identifying weather and road surface problems and rapidly targeting responses including advisory information, control measures, and treatment strategies.	• Improve safety due to reduced crash risk. • Increased mobility due to restored capacity, delay reductions, and more uniform traffic flow.	• Region • Corridor • Project	• Design and implementation costs variable. • Operating and maintenance costs variable.	• Short-term: 1 to 5 years			

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Traffic Surveillance and Control Systems – Often housed within a Traffic Management Center (TMC), monitors volume and flow of traffic by a system of sensors, and further analyzes traffic conditions to flag developing problems, and implement adjustments to traffic signal timing sequences, in order to optimize traffic flow estimating traffic parameters in real-time. Currently, the dominant technology traffic surveillance is that of magnetic loop detectors, which are buried underneath roadways and count automobiles passing over them. Video monitoring systems for traffic surveillance may provide vehicle classifications, travel times, lane changes, rapid accelerations or decelerations, and length queues at urban intersections, in addition to vehicle counts and speeds.	• Decrease travel times and delay. • Some peak-period travel and mode shift.	• Region • Corridor • Project	• Range of TMC costs can vary greatly ranging from staffed building to virtual system that enhaces coordination among existing agencies. • Installation of video surveillance cameras may be less expensive than magnetic loop detectors, which require disruption and digging of the road surface.	• Medium-term: 5 to 10 years	• IDAS • TOPS-BC		

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Communications networks and roadway surveillance coverage – Base infrastructure (fiber, cameras, etc.) required to support all operational activities. Communications networks that allow remote roadway surveillance and system control from a TMC and provision of data for immediate management of transportation operations and distribution of information.	• Increased capability for regional-level coordination of operations and traveler information.	• Region • Corridor • Project	• Moderate • Communication networks are not low-cost or high-profile items, but needed to get the most efficiency and capacity out of the existing transportation system. • Cost can be reduced when done in conjunction with a larger scale construction project.	• Medium to long-term: 10 to 15 years • Small-scale items and opportunistic expansion can be done quickly. Larger-scale regional network components require more time for planning and funding.	• IDAS • TOPS-BC	• Supplementing fiber optics communications with wireless technologies may prove beneficial. • Most active management strategies require the support of roadway surveillance and communications infrastructure.	
Transit Vehicle Travel Information – Communications infrastructure, GPS technology, vehicle detection/monitoring devices and signs/media/Internet sites for providing information to the public such as the arrival times of the next vehicles. These technologies are currently available; however, updates are constantly required.	• More satisfied customers and increased ridership due to enhanced and reliable information sources. • Improved operations and management of transit service.	• Region	• Moderate • Costs are dependent upon communication networks, changing technologies and the number of fleet vehicles to be equipped.	• Medium: 5 to 10 years • Time is required for detailed planning, design and funding procurement.	• IDAS	• Integration of transit information with that provided to motorists (e.g. via web sites) provides a more comprehensive base of materials for travelers. • New or expanded transit service can be marketed in conjunction with new information outlets.	• This technology is currently available. Upgrades may be required.

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Speed Harmonization – Changes traffic speed limits on links that approach areas of congestion, bottlenecks, incidents, special events, and other conditions that affect traffic flow.	• Reduced delay. • Reduced emissions. • Improved safety.	• Region • Corridor • Project	• Signing requirements can run into significant expense, especially if overhead signs are needed. • Increase enforcement.		• IDAS • TOPS- BC • Simulation Model		
Highway Rail Intersection Warning System- ITS technologies to provide improved control of highway and train traffic to avoid or decrease the severity of collisions between trains and vehicles at HRIs. The implementation can alert users about long blockages at crossings. The Warning Systems can be advanced (makes use of positive train control) and regular (makes use of other types of detection).	• Improved safety. • Reduced delay.	• Project	• Moderate	• Short-term: 1 to 5 years	• IDAS • TOPS- BC	• Advanced Traveler Information systems	
Bicycle/Pedestrian Detection and Warning - detect bicycles and pedestrians and interact with traffic signal controller, providing warnings to drivers of motorized vehicles of their presence through means of dynamic message signs, or flashing warning signs.	• Increase mode shift.	• Corridor • Region	• Low to moderate (Costs varies depending on required equipment). • O&M costs per signal.	• Short-term: 1 to 5 years	• IDAS • TOPS- BC	• Dynamic Message Signs • Beacons	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
5. Pricing Strategies							
Road Pricing – Involves pricing facilities to encourage off-peak or HOV travel, and includes time-variable congestions pricing and cordon (area) tolls, high occupancy/ toll (HOT) lanes, and vehicle-use fees.	• Decrease peak period VMT. • Decrease SOV trips.	• Region • Corridor	• First-year implementation costs for public – sector.	• Short-term: 1 to 5 years	• TDM Evaluation Models • Vehicle Emissions Model • Regional Travel Model	• Telework. • Flexible work hours. • Cordon area congestion fees. • Electronic toll collections. • Electronic sign messaging.	
Congestion Pricing – Controls peak-period use of transportation facilities by charging more for peak-period use than for off-peak. Congestion pricing fees are charged to drivers using congested roadways during specific times of the day. This strategy is evaluated in order to maintain a specific level of service on a given road or all roads (areawide systems) in a region.	• Decrease peak period VMT. • Decrease SOV trips. • Increase transit and nonmotorized mode shares.	• Region • Corridor	• Implementation and maintenance costs vary.	• Medium-term: 5 to 10 years	• TDM Evaluation Models • Vehicle Emissions Mode • Regional Travel Model	• Land Use and Built Environment (e.g., Mixed use developments). • Operations and ITS (e.g., traveler information). • Public Transportation. • Transportation Demand Management.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Emissions-Based Vehicle Registration Fees – Fees are levied based on the carbon dioxide emission levels of a car while it is operating.	• Generate revenue to maintain its system and to address transportation improvements regionwide. • Reduce congestion in corridors and systems. • Provide incentive to use transit, bike, or walk. • Provide incentive to purchase and use efficient vehicles.	• Region		• Medium-term: 5 to 10 years • Implementation should take between 3 to 10 years.		• Land Use and Built Environment (e.g., Mixed use developments). • Transportation Demand Management Operations and ITS (e.g., traveler information). • Public Transportation.	•
VMT Fee – A VMT Fee is charged based on how many miles a car is driven. Odometer readings determine the exact fee charged. VMT fees can be layered to be higher or lower based on the fuel economy of cars and also layered based on urban and rural usage . Specific VMT fees of 2 to 5 cents per mile have been tested. VMT Fees consider distance-traveled charges levied to users based on the amount a vehicle uses a road system, while Congestion Pricing/Road User fees are levied to system users during congested periods of the day.	• Generate revenue to maintain its system and to address transportation improvements regionwide. • Reduce congestion in corridors and systems. • Incentive to use transit, biking, and walking. • Provide incentive to purchase and use efficient vehicles.	• Region		• Mid-Term • Implementation should take between 3 to 10 years.	• TDM Evaluation Models • Vehicle Emissions Mode	• Land Use and Built Environment (e.g., Mixed use developments). • Transportation Demand Management Operations and ITS (e.g., traveler information). • Public Transportation	•

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Traffic Impact Fee – A charge on new development to cover the full cost of the additional transportation capacity, including transit, required to serve the development. While fee strategies may vary, in most cases, only those new developments that result in an increase in vehicle trips would be charged. Traffic impact fees can be structured as a single fee for the entire region, multiple fees for individual geographic areas, or multiple fees for specific corridors. Traffic impact fees vary based on the expected new development impact on the transportation system and are often structured with lower fees for developments that promote mixed use development, reduce single occupant vehicle use, and encourage transit and non-motorized travel use.	• Generate revenue to maintain its system and to address transportation improvements regionwide. • Provide Incentive to purchase and use efficient vehicles.	• Region			• TDM Evaluation Models • Vehicle Emissions Mode	• Land Use and Built Environment (e.g., Mixed use developments). • Transportation Demand Management. • Operations and ITS (e.g., traveler information). • Public Transportation. • Bicycle and Pedestrian (e.g., pedestrian and bicycle improvements).	•

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Pay-As-You-Drive (PAYD) Insurance (state level) – PAYD insurance considers charging drivers insurance premium costs based in part on annual vehicle miles travelled. Other insurance rating factors would still apply to insurance rates, so high risk drivers would pay more than lower risk drivers. All drivers would have the opportunity to save money (reduced insurance fees) by driving fewer miles. The state could require insurance companies to offer PAYD insurance at lower rates and require companies to offer higher rates to encourage fewer vehicle miles travelled.	• Reduce congestion in corridors and systems. • Promote transit, biking and walking.	• Region		• Long-Term • While implemented in near-term, travel behavior changes unclear and associated GHG benefits will be realized after implementation (11+ years).			
Parking Management – Strategies include reducing the availability of free parking spaces, particularly in congested areas, or providing preferential or free parking for HOVs. This provides an incentive for workers to carpool. Strategies include dynamic pricing, redefining pricing policies, parking lots, and parking permits.	• Reduce work VMT • Increase vehicle occupancy.	• Corridor • Project	• Relatively low costs, primarily borne by the private sector, include signing, striping, and administrative costs.	• Short-term: 1 to 5 years • Metropolitan and Employer-based	• TDM Evaluation Models • Vehicle Emissions Model	• Land Use and Built Environment (e.g., Combined land use and transportation strategies). • Transportation Demand Management and ITS (e.g., traveler information). • Public Transportation .	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Local and Regional Excise Taxes – A flat fee-per-space on parking spaces provided by businesses designed to discourage automobile-dependent development, encourage more efficient land use, and - to the extent the fees are passed on to parkers - encourage non-motorized and transit choices. The revenue generated by such a tax (on parking spaces, not their use) could be used for transit and other transportation investments not eligible for highway dollars.	• Generate revenue to maintain its system and to address transportation improvements regionwide. • Reduce congestion in corridors and systems. • Promote transit, biking, and walking. • Increase access to and increase use of alternative modes.	• Region		• Mid term: 3 - 10 years for implementation and long-term for strategy to become effective (regarding GHG benefits).		• Land Use and Built Environment (e.g., Combined land use and transportation strategies). • Transportation Demand Management Operations and ITS (e.g., traveler information). • Bicycle and Pedestrian (e.g., pedestrian and bicycle improvements). • Public Transportation.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
6. Bicycle and Pedestrian Strategies							
New Sidewalks and Designated Bicycle Lanes on Local Streets – Enhancing the visibility of bicycle and pedestrian facilities increases the perception of safety. In many cases, bike lanes can be added to existing roadways through restriping. Use of bicycling and walking is often discouraged by a fragmentary, incomplete network of sidewalks and shared use facilities. Constructing new facilities, such as bike lanes on arterials and/or connecting existing facilities, will encourage greater use of walking and bicycling. This strategy is in line with proposed networks on the bicycle and pedestrian plans.	• Increase mobility and access. • Increase nonmotorized mode shares. • Separate slow moving bicycles from motorized vehicles. • Reduce bicycle- and pedestrian-involved incidents. • Lower commuting costs.	• Region • Corridor • Project	• Design and construction costs for paving, striping, signals, and signing. • ROW costs if widening necessary. • Bicycle lanes may require improvements to roadway shoulders to ensure acceptable pavement quality.	• Short-term: 1 to 5 years (includes planning, engineering, and construction).	• TDM Evaluation Models	• Complete Streets Policy. • Road construction projects on local streets should consider new sidewalks and designated bicycle lanes. • Interaction with connecting off-street bike trails should be considered. • Bicycling promotion events can encourage use of facilities.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Improved Bicycle Facilities at Transit Stations and Other Trip Destinations – Bicycle racks and bike lockers at transit stations and other trip destinations increase security. Additional amenities such as locker rooms with showers at workplaces provide further incentives for using bicycles. This could be a measure for developers to adopt, for future projects.	• Increase bicycle mode share. • Reduce motorized vehicle congestion on access routes.	• Corridor • Project	• Capital and maintenance costs for bicycle racks and lockers, locker rooms.	• Short-term: 1 to 5 years (includes planning, engineering, and construction.)	• TDM Evaluation Models		• Part of TO Report & RA
Parklets – Parklets are sidewalk extensions using parking spaces. Parklets typically extend out from the sidewalk at the level of the sidewalk to the width of the adjacent parking space. A parklet may accommodate bicycle parking within it, or bicycle parking may be associated with it.	• Increase nonmotorized mode shares. • Reduce bicycle- and pedestrian-involved incidents. • Discourage motor vehicle use for short trips.	• Project	• Capital and maintenance costs for sidewalk extension, and amenities offered.	• Short-term: 1 to 5 years (includes planning, engineering, and construction).	• TOPS-BC	• Traffic calming measure to reduce speeds in congested areas and incidents related. • Provides value to local commercial areas, inviting pedestrian activities.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Design Guidelines for Pedestrian-Oriented Development – Maximum block lengths, building setback restrictions, and streetscape enhancements are examples of design guidelines that can be codified in zoning ordinances to encourage pedestrian activity.	• Increase pedestrian mode share. • Discourage motor vehicle use for short trips. • Reduce VMT. • Reduce emissions.	• Region • Corridor	• Capital costs largely borne by private sector; developer incentives may be necessary. • Public sector may be responsible for some capital and/or maintenance costs associated with right-of-way improvements. • Ordinance development and enforcement costs.	• Short-term: 1 to 5 years	• TDM Evaluation Models • Regional Travel Model		
Improved Safety of Existing Bicycle and Pedestrian Facilities – Maintaining lighting, signage, striping, traffic control devices, and pavement quality, and installing curb cuts, curb extensions, median refuges, and raised crosswalks can increase bicycle and pedestrian safety.	• Increase nonmotorized mode share. • Reduce bicycle- and pedestrian-involved incidents. • Increase monitoring and maintenance costs.	• Region • Corridor • Project	• Increased monitoring and maintenance costs. • Capital costs of sidewalk improvements and additional traffic control devices.	• Short-term: 1 to 5 years	• TDM Evaluation Models • Regional Travel Model		

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Exclusive Non-Motorized Rights-of-Way – Abandoned rail rights-of-way and existing parkland can be used for medium- to long distance bike trails, improving safety and reducing travel times.	• Increase mobility. • Increase nonmotorized mode shares. • Reduce congestion on nearby roads. • Separate slow-moving bicycles from motorized vehicles. • Reduce bicycle- and pedestrian-involved incidents.	• Region • Corridor	• ROW Costs • Construction and Engineering Costs • Maintenance Costs	• Medium-term: 5 to 10 years (includes planning, engineering, and construction)	• TDM Evaluation Models • Regional Travel Model	• Complete Streets Policy. • Road construction projects should consider interaction with off-street bike trails. • Access management practices that reduce the number of driveways across trails parallel to roadways reduce the risk for bicycle-vehicle crashes. • Bicycling promotion events can encourage use of facilities.	
Bike Sharing Programs – Short-term bicycle rental program supported by a network of automated rental stations.	• Increase non-motorized mode share. • Discourage motor vehicle use for short trips. • Decrease VMT.	• Region • Corridor • Project	• Capital and maintenance costs. for bicycles and rental stations.	• Short-term: 1 to 5 years		• Complete Streets Policy. • New Sidewalks and designated bicycle lanes. • Improved bicycle facilities at transit stations.	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Promote Bicycle and Pedestrian Use Through Education and Information Dissemination – Bicycle and pedestrian use can be promoted through educational programs and through distribution of maps of bicycle facility/ multi-use path maps.	• Shift trips into non-SOV modes such as walking, bicycling, transit. • Increase bicycle/pedestrian mode share.	• Region • Corridor	• First-year implementation costs for private-sector. • Second-year costs tend to decline. • Requires interagency and private sector coordination. • Requires public agency support & coordination.	• Employer-based • Short-term: 1 to 5 years	• Vehicle Emissions Model	• Complete Streets Policy. • New Sidewalks and designated bicycle lanes. • Improved bicycle facilities at transit stations • Improved safety. • Improved pedestrian facilities.	• Part of TO Report & RA
Cash-In Programs – Promote shifting your commute trips from vehicular to bicycle and pedestrian by giving money back to the users that do it. Other examples have seen the possibility of offering discount at local stores, to promote mode-shift and local economies**.** Stanford's Capri program is an example of this type of incentive.	• Shift trips into non-SOV modes such as walking, bicycling, transit. • Increase bicycle/pedestrian mode share.	• Region • Project	• First-year implementation costs for private-sector. • Second-year costs tend to decline. • Requires interagency and private sector coordination. • Requires public agency support & coordination.	• Employer-based • Short-term: 1 to 5 years	• Vehicle Emissions Model		• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
7. Roadway/Mobility (Non-ITS) Strategies							
Access Management – Planning and design practices that identify existing and future land use and arterial access points to maximize traffic safety and mobility. Strategies include medians, turn lanes, side/rear access points between businesses, shared access, and local land use ordinances to control access.	• Reduction in crashes along a roadway. • Improved roadway capacity; greater vehicle throughput. • Decreased corridor delay.	• Region • Corridor • Project	• Low to high (Costs and complexity of strategies can vary widely and may depend on whether access controls are implemented before development occurs or as a retrofit).	• Short- to medium-term • Some access management strategies can be implemented quickly if there are cooperating property owners. Major access management plans require a greater amount of time for planning, negotiation and ultimate benefits related to the full anticipated future development. Capital construction efforts (e.g. medians) take a moderate amount of time.	• Simulation Model	• Access management is enhanced by parking lot/building site designs that incorporate adequate exit/entrance capacity, side or rear access points and walking and transit features. • Growth management plans should incorporate access management. • Traffic signal coordination.	
Restricting Turns at Key Intersections – Limits turning vehicles, which can impede traffic flow and are more likely to be involved in crashes.	• Increase capacity, efficiency on arterials. • Improve mobility on facility. • Improve travel times and decrease delay for through traffic • Decrease incidents.	• Corridor • Project	• Implementation and maintenance costs vary; range from new signage and striping to more costly permanent median barriers and curbs.	• Short-term: 1 to 5 years (includes planning, engineering, and implementation).	• Simulation Model		

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Converting Streets to One-Way Operations – Establishes pairs of one-way streets in place of two-way operations. Most effective in downtown or very heavily congested areas.	• Increase traffic flow.	• Corridor • Project	• Conversion costs include adjustments to traffic signals, striping, signing and parking meters. • May create some confusion, especially for non-local residents.	• Short-term: 1 to 5 years (includes planning, engineering, and implementation).	• Simulation Model		
Roadway Signage Improvements – Adequate or additional signage that facilitates route-finding and the decision-making ability of roadway users. Signs with clearer/larger lettering that can be read from a greater distance.	• Reduced level of driver uncertainty and fewer erratic driving maneuvers. • Reduced delay for upstream approaching vehicles. • Psychological encouragement to unsure motorists. • Less chance of crashes caused by sudden lane changes, extremely slow-moving vehicles or sudden stops.	• Region • Corridor • Project	• Low	• Short-term • Production of signs and installation can occur shortly after site visits and design of new signing plans. Design should follow the guidance of the Manual on Uniform Traffic Control Devices (MUTCD).		• Variable message signs and other ITS applications can provide real-time or temporary information to travelers. • Emerging in-vehicle technologies that provide real-time traveler information and route-finding capabilities.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Geometric Design Improvements – This includes bottleneck improvements such as roadway widening to provide shoulders, improved sight lines, auxiliary lanes to improve merging and diverging. Interchange modifications to decrease weaving sections on a freeway, paved shoulders and realignment of intersecting streets. Intersection modifications such as adding turning lanes at an intersection, realignment of intersection streets, intersection channelization, or modifying intersection geometrics to improve overall efficiency and operation.	• Increase mobility. • Reduce congestion by improving bottlenecks. • Increase traffic flow and improve safety. • Decrease incidents due to fewer conflict points.	• Corridor • Project	• Costs vary by type • Design, implementation, operations and maintenance (O&M) costs vary by type of design.	• Short-term: 1 to 5 years (includes planning, engineering, and implementation).	• Regional Travel Model • Simulation Model		
Grade Separations (Non-Added Capacity) – Also called Super Street Arterials, this involves converting existing major arterials with signalized intersections into "super streets" that feature grade-separated intersections and overpasses (non-added capacity).	• Improve mobility. • Reduce congestion by improving bottlenecks at intersections.	• Corridor	• Construction and engineering substantial for grade separation. • Maintenance variable based on area.	• Medium-term: 5 to 10 years (includes planning, engineering, and implementation).	• Regional Travel Model • Simulation Model		

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Acceleration/Deceleration lanes – Deceleration lane provided on a freeway just before an exit off-ramp allowing vehicles to reduce speed outside the through-lanes. Acceleration lane provided as an extension of a freeway on-ramp or an arterial street turn-lane for vehicles to increase speed and merge more smoothly into the through-lane.	• Slower-moving turning or exiting vehicles are removed from through lanes resulting in fewer delays for upstream traffic. • Accelerating vehicles are provided more distance to reach the speed of through traffic, resulting in fewer delays caused by merging and weaving vehicles. • In certain situations, can greatly reduce delays (caused by braking) for upstream vehicles during peak traffic flow periods.	• Corridor • Project	• Low to moderate • Cost is relatively low if right-of-way or bridge widening is not required.	• Medium-term • Right-of-way is an important factor in the time required for implementation and construction.	• Simulation Model	• Signs to alert drivers to the availability of acceleration or deceleration lanes can greatly increase the proper use of these lanes.	

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Complete Streets – Policy that takes into account all users of streets rather than just autos, with a goal of completing the streets with adequate facilities for all users. A "Complete Street" is one designed and operated to enable safe access for all users including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities.	• Increase safety by improving the overall (pedestrian and bicycle) transportation system environment. • Reduce congestion in corridors and systems. • Provide cost savings by reducing longer distance travel, increasing shorter distance travel, and use by non-motorized modes. • Provide travel time savings to users of the system. • Increase access to and use of alternative modes. • Protect natural environment through sound land use and transportation sustainability policies. • Increase community involvement and activity in developing policy and promoting projects. • Promote incentive to use transit, bike, or walk.	• Region • Corridor		• Short term (1-2 years)		• Pricing. • Land Use and Built Environment. • Transportation Demand Management. • Operations and ITS • Public Transportation	• Part of TO Report & RA

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
8. Roadway Capacity Expansion Strategies							
New Freeways – Construction of new, access-controlled, high-capacity roadways in areas previously not served by freeways.	• Reduce arterial street network congestion. • Reduce travel times & delay. • Increased capacity to serve developing areas. • Reduced traffic and congestion on parallel streets due to vehicles diverted to the new road.	• Corridor	• High • Costs vary by type of highway constructed; cost depends on amount of right-of-way needed and the scale of construction impediments; in dense urban areas can be very expensive. • Can create environmental and community impacts.	• Medium- to long-term (includes planning, engineering, and construction). • Completion of a new roadway project can take from five to 25 years, including planning, engineering, environmental analysis and construction phases.	• Regional Travel Model • Simulation Model	• Active roadway management strategies and newer technology to monitor/control traffic conditions. • Transit service can be provided to reduce the demand for vehicle travel on the new road. • Land use practices that manage the amount of new development in the area to a level that the roadway system can adequately handle should be enacted.	
Increasing Number of Lanes without Highway Widening – This takes advantage of "excess" width in the highway cross section used for breakdown lanes or median.	• Increase capacity • Reduce congestion by improving bottlenecks.	• Corridor • Project	• Construction and engineering • Maintenance	• Short-term: 1 to 5 years (includes planning, engineering, and implementation).	• Regional Travel Model • IDAS • Simulation Model		

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
Highway Widening by Adding Lanes – This is the traditional way to deal with congestion.	• Increase capacity, reducing congestion in the short term. • Long-term effects on congestion depend on local conditions. • Reduced traffic and congestion on parallel streets.	• Corridor	• Costs vary by type of highway constructed; in dense urban areas can be very expensive. • Can create environmental and community impacts.	• Long-term: 10 or more years (includes planning, engineering, and construction.)	• Regional Travel Model • Simulation Model	• Active roadway management strategies and newer technology to monitor/control traffic conditions should be implemented during construction. • TDM strategies could provide significant benefits during construction and they could carry over following project completion. • Incident management programs and service patrols for quick clearance of incidents during construction.	
New Arterial Streets – Construction of new, higher-capacity roads designed to carry large volumes of traffic between areas in urban settings.	• Provide connectivity. • Carry traffic from local & collector. streets to other areas.	• Corridor	• Can create environmental and community impacts • Construction and engineering costs substantial (grade separate, other design features). • Maintenance	• Medium-term: 5 to 10 years (includes planning, engineering, and construction.	• Regional Travel Model • Simulation Model		

Project/Mode Type	Congestion Impacts	Application Scale	Implementation Costs	Implementation Timeframe	Analysis Tools	Grouping	Currently Considered
			variable based on urban region.				
Grade separations (Added capacity) – This involves converting existing major arterials with signalized intersections into "super streets" that feature grade-separated intersections and overpasses with added capacity.	• Increase capacity. • Improve mobility.	• Corridor	• Construction and engineering substantial for grade separation. • Maintenance variable based on area.	• Medium-term: 5 to 10 years (includes planning, engineering, and implementation).	• Regional Travel Model • Simulation Model		
Grade separated railroad crossings – Roadway underpass or overpass of a railroad line.	• Significant reduction in travel delays at high volume locations. • Likely elimination of car-train crashes. • Decreased noise from train horns/whistles.	• Corridor • Project	• High - Cost is very high to provide either a roadway or railroad bridge or tunnel.	• Medium- to long-term • Implementation requires significant negotiation with railroads and local communities.	• Simulation Model	• Grade separations should be planned for in conjunction with new roadways that are built. • The capability to provide real-time information on message signs regarding location and time of train crossings.	
Major Intersection/Interchange Improvements – This includes major intersection/interchange improvements or adding through lanes to provide additional capacity.	• Increase mobility. • Reduce congestion by improving bottlenecks. • Increase traffic flow and improve safety.	• Corridor • Project	• Costs vary by type • Design, implementation, operations and maintenance (O&M) costs vary by type of design.	• Medium-term: 5 to 10 years (includes planning, engineering, and implementation).	• Regional Travel Model • Simulation Model		

Source: Cambridge Systematics.

6.3 Using the Toolbox

The toolbox can be used by project sponsors to identify alternative strategies for addressing local congestion issues on the CMP network and select the most appropriate strategy (or package of strategies) that have a reasonable potential for providing benefit to the corridor or study area being evaluated. If a strategy shows promise, it can be evaluated in detail using the regional travel demand model and/or applicable analysis tools suggested in the toolbox.

For larger projects (particularly high cost, capacity-adding projects), the toolbox could be used to identify CMP strategies that should be incorporated into these projects as part of the project development process. In terms of benefits, CMP strategies typically will not result in the large capacity gains typical of capacity expansion projects; however, demand management and operational strategies could be incorporated into the capacity improvement project to potentially extend the number of productive years of the facility before additional capacity is needed.

In many cases, there would be no need to do an independent analysis to fulfill CMP requirements, since data collection and analysis using the regional travel model, simulation models, or other tools would take place regardless as part of the project development process. These analysis results could be translated into CMP performance measures (e.g., reduction in crash rate, increase in vehicle throughput, reduction in traveler delay, benefit-cost ratio based on value of travel time savings, fuel consumption, and emissions reduction, etc.) to support congestion management efforts.

6.4 Evaluating Strategies

As shown in the toolbox, a variety of analysis tools are available to AMATS and its local agency partners to help evaluate the effectiveness (or potential effectiveness) of congestion management strategies. These tools are designed to assess the congestion reduction potential of the projects and strategies carried forward for analysis and screening in AMATS' congestion management process. These tools, and in some cases combinations of these tools, can be used to identify the impacts of the different strategy types identified in the toolbox (e.g., transportation demand management land use, public transportation, ITS and operations, etc.). A summary of each analysis tool category is presented below.

6.4.1 Travel Demand Model

AMATS' Travel Demand Model is used to support a variety of analytical needs such as preparation of various system and subarea analyses, including transit projects, ongoing evaluations of the region's air quality conformity analysis, and other technical analysis. In some cases, the results from the Travel Demand Model will be used to assess the impacts of alternative strategies, specifically the additional system capacity (freeway, arterial roadway, and new roadway facility construction) projects.

Travel demand model outputs (VMT, VHT, and other measures) can be used to illustrate the location, duration, and extent of congestion for the region at baseline conditions. The travel

demand model can then be used to forecast congested conditions assuming currently programmed TIP projects. These model outputs can in turn be used as inputs into the ITS Deployment Analysis System (IDAS), the Tool for Operations Benefit/Cost (TOPS-BC), and/or other tools to calculate a variety of performance measures, to evaluate the impacts of many of the types of strategies in the Toolbox, and to help allocate benefits to subregions. These data can include changes in travel time, speed, mode share, or trip reduction, for example, that can either directly measure or indirectly measure the CMP performance measures for the no-build and build conditions.

6.4.2 Simulation Model

Simulation models are designed to assess the travel impacts of multimodal and roadway specific projects. The use of simulation models requires that the analysis area be relatively constrained to a small subarea of the regional network, usually a corridor or specific project area. Expansion of the analysis to a broader region would require significantly more resources. These models are effective in evaluating the buildup, dissipation, and duration of traffic congestion, and model outputs can be used to calculate measures of effectiveness such as vehicle/person miles traveled, vehicle/person hours of travel, travel time/queue length, throughput/delay, emissions, and fuel consumption. Simulation results can be used to conduct a benefit valuation of individual strategies or set of strategies. Information on calculation of various measures of effectiveness using simulation outputs is available in FHWA's Traffic Analysis Toolbox[19]. Emerging methods for using simulation model outputs to calculate travel time reliability impacts are detailed in SHRP 2 projects L04, L05 (Technical Reference), and L08.

6.4.3 Intelligent Transportation System Deployment Analysis System (IDAS)

The Intelligent Transportation System Deployment Analysis System (IDAS) is an operations and ITS sketch-planning analysis tool that interfaces with planning data prepared from existing regional travel demand models. IDAS was first developed in 1998 for the Federal Highway Administration (FHWA). IDAS provides a comprehensive analysis tool for determining the system, subarea, corridor-specific impacts, benefits, and costs of the full spectrum of operations and ITS deployments and strategies. IDAS was designed to meet the needs of MPOs by offering the capability for a systematic assessment of operations and ITS with one analysis tool, with the overall goal of assisting these agencies in integrating ITS into their ongoing transportation planning process. Although IDAS has not been used by AMATS in the past, it could be linked with the Travel Demand Model to assess the impacts of various operations, ITS, and roadway capacity projects as defined in the CMP Toolbox. It should be noted though that recently-developed TOPS-BC, which is described in Section 5.4, can be used for many of the same analyses as IDAS. TOPS-BC is significantly easier to use and requires less data than IDAS.

[19] http://ops.fhwa.dot.gov/trafficanalysistools/

6.4.4 Tool for Operations Benefit/Cost (TOPS B-C)

TOPS-BC is one of several benefit/cost tools that can be used to evaluate operational and ITS improvements. An early generation of spreadsheet tools was developed by FHWA and state and local agencies for targeted analysis, including SCRITS and CAL-B/C[20]. Following these initial efforts, FHWA developed the ITS Deployment Analysis System (IDAS), which included a network-based model able to incorporate regional and statewide travel demand models. The major benefit of IDAS is that by using existing travel demand models, it incorporates the same set of assumptions used for other regional planning activities. As a network model, however, IDAS has a steeper learning curve than spreadsheet tools and may require a level of effort beyond what is feasible for a relatively limited improvement.

TOPS-BC essentially reflects the incorporation of IDAS into a spreadsheet format, which is accessible to a wider range of users and provides relatively quick assessments of ITS and operational projects with limited data. The tool is supported by the U.S. DOT's benefit[21] and cost[22] databases, allowing users to access and incorporate national experience in impact measurement. The TOPS-BC User's Manual[23] provides more instructions on how to use the tool, along with some case studies.

Due to the characteristics described above, TOPS-BC is recommended as a key congestion management toolbox component for AMATS and its planning partners, as it provides the following features:

- The ability to investigate the expected range of impacts associated with previous deployments and analyze many transportation system management and operational strategies;
- A screening mechanism to help identify appropriate tools and methodologies for conducting a benefit-cost analysis based on analysis needs;
- A framework and default cost data to estimate the life-cycle costs (including capital, replacement, and continuing operating and maintenance costs) of various transportation system management and operational strategies; and
- A framework and suggested impact values for conducting simple sketch planning level benefit-cost analysis for selected transportation system management and operational strategies.

[20] http://www.dot.ca.gov/hq/tpp/offices/eab/LCBC_Analysis_Model.html

[21] http://www.itsbenefits.its.dot.gov/

[22] http://www.itscosts.its.dot.gov/

[23] http://ops.fhwa.dot.gov/publications/fhwahop12028/index.htm

6.4.5 Vehicle Emissions Modeling Software

The U.S. Environmental Protection Agency (EPA) has developed several spreadsheet-based analysis models to evaluate the potential travel and emissions impacts of TDM strategies, including land use, demand management, and transit-based transportation projects. These models are designed to assist an agency in identifying the impacts of these programs at a systemwide, as well as at the corridor, subarea, and employer-specific level. The MOBILE6 vehicle emission factor model, initially developed in 1978 and last updated in 2004, calculates emissions of hydrocarbons (HC), oxides of nitrogen (NOx), and carbon monoxide (CO) from passenger cars, motorcycles, light- and heavy-duty trucks. In 2010, the MOBILE series of models was replaced by the Motor Vehicle Emission Simulator (MOVES) model as EPA's official model for estimating emissions from cars, trucks, and motorcycles. The full modeling system and documentation are available from the U.S. EPA Modeling and Inventories link, http://www.epa.gov/otaq/models/moves/index.htm.

6.4.6 Transportation Demand Management (TDM) Evaluation Models

Vehicle emissions models are often used in conjunction with the Travel Demand Model (for regionally significant programs) or other tools such as the Center for Urban Transportation Research Trip Reduction Impacts of Mobility Management Strategies (TRIMMS) tool[24] or TDM Effectiveness Evaluation Model[25] (for non-regionally significant strategies) to estimate the number of commuters who would change their mode of travel or trip-making behavior through participation in the program and calculate the resultant changes in vehicle activity (e.g., reduction in VMT). This information can then be used with the emissions model to estimate the emissions that the commuter program would reduce. Additional guidance can be found in the EPA publication, *Commuter Programs: Quantifying and Using Their Emission Benefits in SIPs and Conformity*[26].

[24] http://trimms.com/

[25] http://mctrans.ce.ufl.edu/store/description.asp?itemID=149

[26] http://www.epa.gov/otaq/stateresources/policy/transp/commuter/420b14004.pdf

7.0 Implementation Plan

This section documents the programming and implementation process for the CMP. It describes how CMP projects are programmed and implemented through inclusion of CMP strategies in various components of the metropolitan transportation planning process, including the Metropolitan Transportation Plan (MTP), Transportation Improvement Program (TIP), and the Regional ITS Architecture. It also presents a process for conducting a CMP analysis for various transportation investment types.

7.1 Integration with the Metropolitan Transportation Planning Process

This section describes how the CMP coordinates with other regional plans, including the Metropolitan Transportation Plan (MTP), Transportation Improvement Program (TIP), and the Regional ITS Architecture. The CMP both informs and receives information from these elements of the metropolitan transportation planning process.

7.1.1 Relationship with the Metropolitan Transportation Plan (MTP)

The MTP provides a framework for the Anchorage region's transportation system by identifying the goals, strategies, and priorities for meeting the region's transportation needs through the year 2035. The MTP is a multimodal plan that identifies all regionally significant projects and programs planned for the region regardless of the likely funding source. Once a project is included in the MTP, it proceeds through the project development process, including environmental review, preliminary engineering, and right-of-way acquisition. The CMP is an integral part of the long-range planning process and relates to the MTP in the following ways:

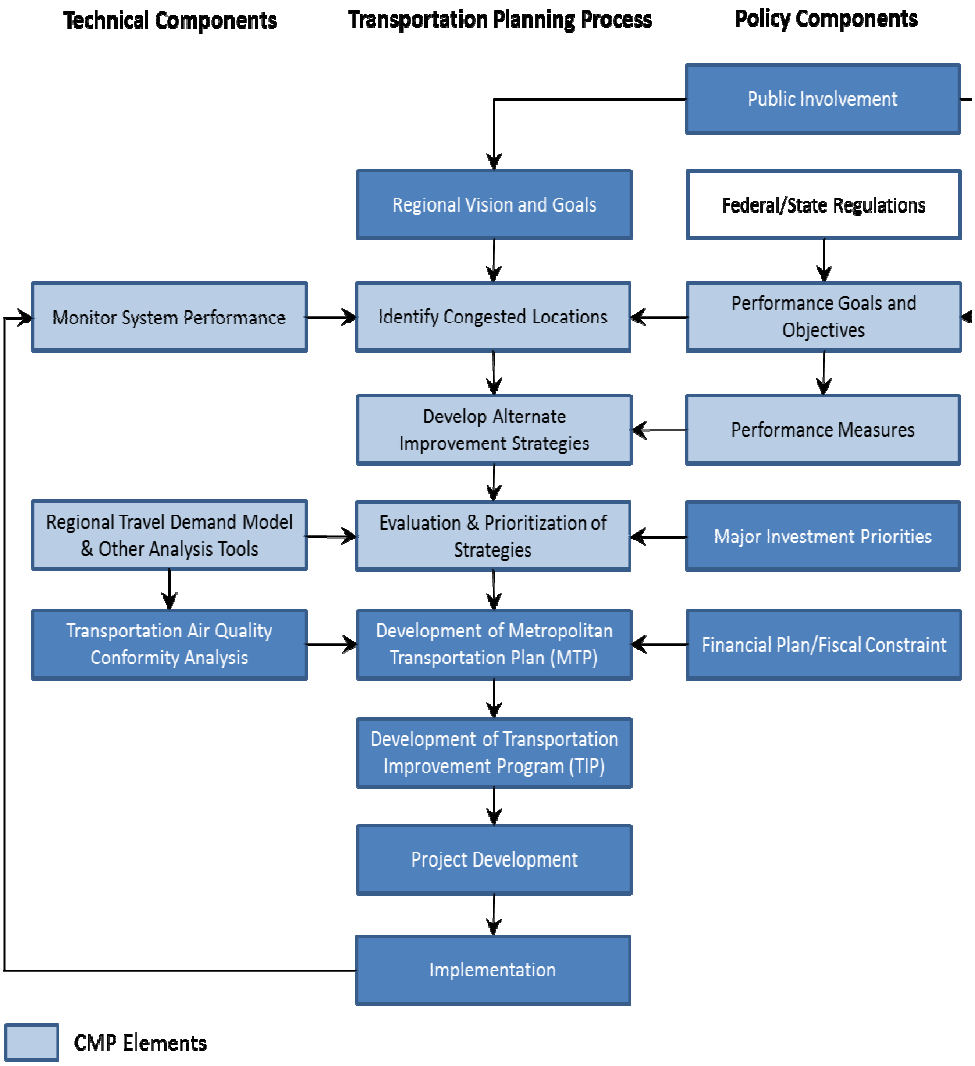
- The MTP's vision statement and goals provide a foundation for the development of congestion management objectives and performance measures that are applied through the CMP.
- The CMP provides information on congestion in the region, which can be used by AMATS to identify congested corridors or segments in need of detailed analysis as part of Corridor or Major Investment Studies.
- The CMP Toolbox provides a framework for developing and evaluating transportation projects and strategies that maintain or reduce recurring and non-recurring congestion. The suggested analysis tools are intended to be used in concert with existing tools such as travel demand modeling, corridor analysis, and traffic simulation to assess how congestion mitigation strategies contribute to achieving regional goals and objectives related to congestion management.
- The CMP defines a process for programming and implementing the most cost-effective strategies by introducing them into the MTP process and subsequently for programming into the TIP. The CMP does not directly obligate funds, but rather it presents a toolbox of

congestion mitigation strategies that can be implemented independently or as part of larger projects and programmed in future MTPs and TIPs.

- Once projects are implemented, the CMP provides a mechanism for ongoing system monitoring, both to assess the performance of the system and to evaluate the effectiveness of the congestion management strategies that have been implemented.

Figure 7.1 shows how the CMP is integrated into various technical and policy components of the transportation planning process.

Figure 7.1 Integration of the Congestion Management Process in the Transportation Planning Process



Source: Adapted from *The Transportation Planning Process: Key Issues - A Briefing Book for Transportation Decision makers, Officials, and Staff*, Updated September 2007, Publication No. FHWA-HEP-07-039, http://www.planning.dot.gov/documents/BriefingBook/BBook.htm

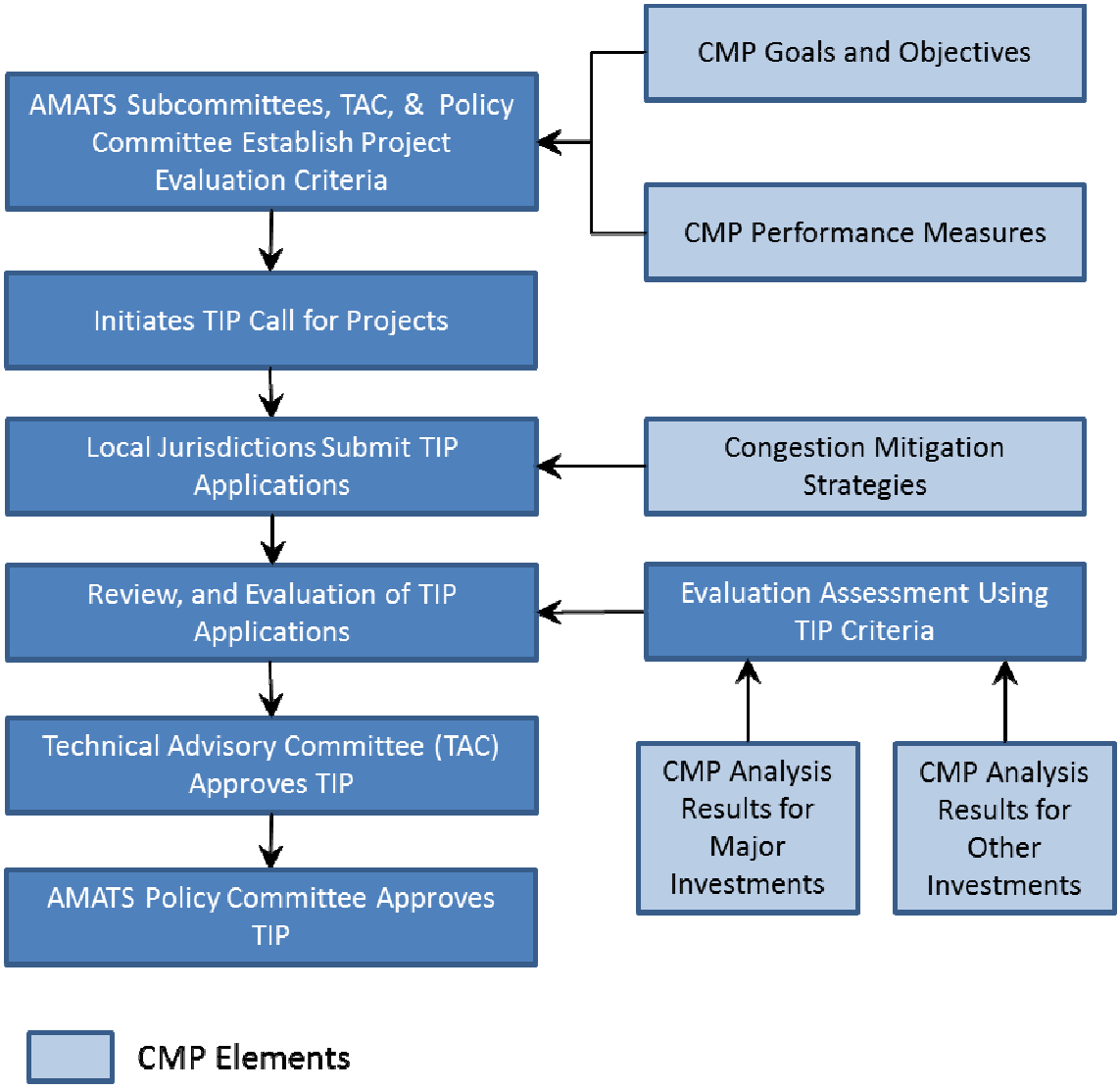
7.1.2 Relationship to the Transportation Improvement Program (TIP)

The TIP is a short-range program that identifies the highest priority projects and programs to be funded and implemented in the Anchorage region over the next 4 years. The program identifies federal, state, and local funding for transportation projects that will be implemented within the TIP's three-year timeframe. Updated every four years, the TIP is the implementation plan for projects in the MTP. AMATS has a defined and established framework for project application, programming schedule, project evaluation, and project selection processes in place for the TIP. AMATS staff and the TIP Subcommittee evaluate and prioritize Major Investment and Other Investment projects based on criteria approved by the AMATS Policy Committee. Figure 7.2 identifies how the CMP can be integrated into existing TIP processes. The CMP relates to the TIP in the following ways:

- The CMP provides system performance information for use by AMATS in evaluating projects nominated for inclusion in the TIP.
- The CMP provides system performance information for project sponsors, which may influence their project applications for incorporation in the TIP.
- The CMP Toolbox identifies alternative congestion management strategies that can be used to advance transportation projects through the selection process.
- The CMP Toolbox identifies potential analysis tools for evaluating project effectiveness in terms of their contribution to a reduction in congestion levels in the region. The suggested analysis tools are not intended to supplant existing analysis techniques or decision making processes, but rather to complement the approaches currently used.

The next TIP update should incorporate the CMP objectives and measures into the application scoring process used to select and prioritize projects in the TIP. The CMP is intended to supplement, not replace, the existing TIP project selection process used by AMATS. It serves as an additional tool for decision-making by the TIP Subcommittees by providing additional information and insights for the committee's use.

Figure 7.2 Integration of the Congestion Management Process in the Transportation Improvement Program (TIP)



Source: Cambridge Systematics

7.1.3 Relationship to the Project Development/NEPA Process

The CMP supports the link between planning and project development by providing information to support project development activities, including corridor alternatives analysis and environmental analyses conducted under the National Environmental Policy Act (NEPA). The CMP relates to these processes in the following ways:

- The CMP provides system performance information that can be used by AMATS to identify corridors or segments in need of detailed analysis through corridor and NEPA studies.
- Documentation of the need for capacity enhancement (based on the analysis of alternative strategies) should be included in the NEPA project purpose and need statement.

- The CMP Toolbox provides a starting point for identifying alternative congestion mitigation strategies for consideration in corridor and NEPA studies. This does not preclude the corridor/NEPA study from considering other strategies that may not be in the CMP Toolbox, nor does it require that the study select a strategy from the CMP Toolbox as the preferred alternative. However, corridor/NEPA document should include a discussion of how the CMP Toolbox strategies were addressed.

- The CMP Toolbox identifies potential analysis tools for evaluating project alternatives. Simulation or other appropriate analysis tools from the CMP Toolbox can be used to conduct an evaluation of the actions to assess their impacts in the corridor. The extent to which these actions can alleviate travel demand and congestion in the corridor compared to the baseline condition are documented as part of the study.

- Monitoring the effectiveness of implemented improvement projects provides data that supports use of congestion management strategies in future projects.

7.1.4 Relationship to the Regional Intelligent Transportation Systems (ITS) Architecture

The CMP relates to the Regional Intelligent Transportation System (ITS) Architecture in the following ways:

- The Regional ITS Architecture is an important resource for identifying sources of data in the region that can support monitoring and reporting of congestion using CMP performance measures.

- The Regional ITS Architecture can provide technology-related solutions to some of the needs and deficiencies identified in the CMP. Furthermore, the Architecture's framework, including stakeholder and service packages involved, can provide a strategy for smooth deployment of ITS related projects.

- All ITS strategies implemented from the CMP Toolbox should be consistent with the Regional ITS Architecture. The Regional ITS Architecture and the CMP Toolbox should be reviewed for consistency and reconciled as necessary when either is updated.

The integration of Regional ITS Architecture to different planning products can be defined as a separate process. Given that this report focuses on the CMP process, a more detailed description of such integration can be found as an Appendix to this document (see Appendix A – ITS/MTP/CMP Strategic Integration for more information.)

7.2 CMP Analysis Process

This section presents a proposed CMP analysis process for assessing the congestion reduction potential of CMP strategies in terms of established congestion management objectives and performance measures. A CMP analysis process is defined for each of the following types of transportation investments:

- **Major Investments**. These are Federal and State assisted regionally significant added capacity projects located on the CMP network. Significant added capacity projects tend to have a substantial cost and significantly impact regional or corridor travel patterns. Project descriptions typically include a new roadway or bypass, major or minor road widening to add additional through lanes on an existing highway, major roadway reconstruction, adding capacity to a corridor by improving many related intersections, new interchange, adding capacity to an existing interchange, grade separation of existing intersections (that add capacity), etc.

- **Other Investment Types**. These are Federal and State assisted projects that encompass the following improvement types: Transportation Demand Management (TDM), land use, public transportation, bicycle/pedestrian, Intelligent Transportation Systems (ITS) and operations, roadway/mobility (Non-ITS), or added capacity projects located off the CMP Network.

- **Accelerated Projects**. These are projects that are introduced late in the Metropolitan Transportation Plan (MTP) planning cycle due to accelerated growth or congestion relief, connection with an existing project, or new funding opportunities. As a result, the implementation of the projects does not correspond with the typical evaluation process and timeline required for projects already documented in the MTP.

- **Exempted Projects**. Projects should be exempt from a CMP analysis if the proposed project solves a safety or bottleneck problem. The criteria for determining whether a project is categorized as a safety or bottleneck project is described at the end of this section.

The CMP analysis process involves conducting either a quantitative or qualitative assessment of the extent to which congestion mitigation strategies can alleviate travel demand and congestion in the corridor. The level of analysis varies depending on the type of transportation investment:

- **Major Investments**. The CMP analysis process for major investments consists of conducting a quantitative analysis of corridor alternatives to assess the extent to which congestion mitigation strategies can alleviate travel demand and congestion in the corridor. Congestion mitigation strategies should be considered as an alternative to capacity. Project sponsors should report on the specific strategies that will be implemented as part of the project, as well as quantitatively document the benefits of the project's ability to relieve congestion, improve trip reliability, and/or to define how it meets one or more of the CMP goals and objectives.

- **Other Investment Types**. The proposed CMP analysis process for other investment types is less rigorous compared to that for major investments and consists of a qualitative assessment of the congestion reduction impacts of the project in terms of CMP objectives and performance measures. Most CMP projects are likely to fall under this category.

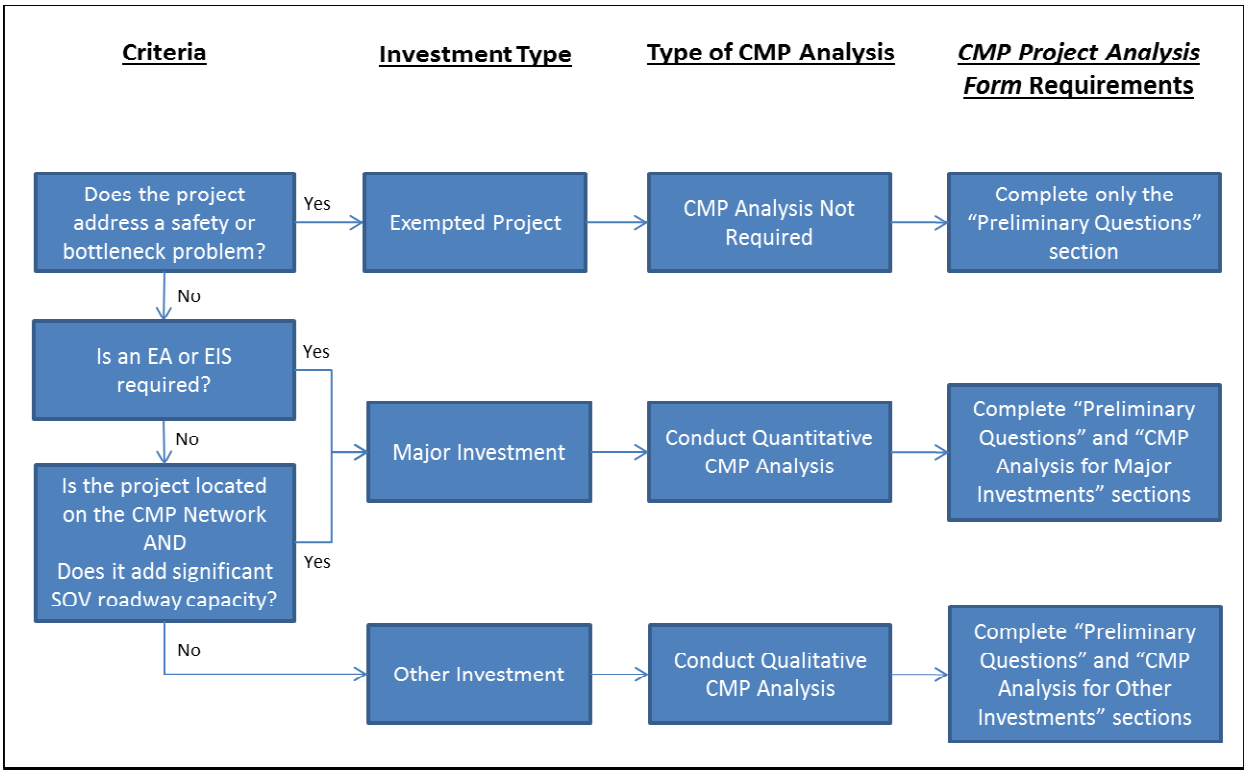
- **Accelerated Projects**. The CMP analysis process for accelerated projects may be quantitative or qualitative, depending on whether the project is categorized as a major investment or other investment type.

- **Exempted Projects**. Safety and bottleneck projects should be exempt and should not require a CMP analysis to be conducted.

It is proposed that project sponsors complete the *CMP Project Analysis Form* (provided as an appendix to this document, see Appendix B – CMP Project Analysis Form) and submit it to AMATS. The "Preliminary Questions" section of the form must be completed for all projects, regardless of investment type. For major investments, the "CMP Analysis for Major Investments" section of the form should be completed. For other investment types, the "CMP Analysis for Other Investment Types" section of the form should be completed. Instructions for completing the form are provided as and appendix to this document (see Appendix C - Instructions to fill CMP Project Analysis Form). AMATS staff would review and approve the forms and, if necessary, contact the submitting agency regarding any questions.

An overview of the CMP analysis process for each investment type is summarized in Figure 7.3 and Table 7.1. The table identifies the criteria used to define each investment type (i.e., major investments, other investment types, accelerated projects, exempted projects), an overview of the CMP analysis process for the investment type, CMP Project Analysis Form Requirements, and the timing of the CMP analysis within the overall project development process. The figure graphically depicts the criteria for determining investment type, type of CMP analysis, and CMP Project Analysis form requirements.

Figure 7.3 CMP Analysis Process



Source: Cambridge Systematics

Having identified the type of investment and the CMP Project Analysis Forms required to fill, it is important to highlight the process that each project should go through for the CMP approval. Table 7.1 shows an overview of the CMP process according to the different type of projects. The first row shows the criteria used to identify each project. The second row shows the activities involved in the CMP process according to the project type. The third row describes the form that project managers should fill, according to the project type. Finally, the fourth row provides a broad description of the timing requirements that projects could expect for the CMP approval process.

Table 7.1 CMP Analysis Process

	Investment Type			
	Major Investments	**Other Investments**	**Accelerated Projects**	**Exempted Projects**
Criteria for Defining Investment Type	– Environmental Assessment (EA) or Environmental Impact Statement (EIS) required, OR – Project located on CMP Network AND adds significant SOV capacity.	– Project not on CMP Network, OR – Project does not add significant SOV capacity. NOTE: Other investment type could include capacity-adding projects not on the CMP Network.	– The same criteria as Major Investments or Other Investment Types applies.	– Project solves a safety or bottleneck problem.
CMP Analysis Process	– CMP serves as warrant for justifying additional SOV capacity. – Quantitative CMP analysis – Use CMP Report to identify deficiencies on project corridor. – Use CMP Toolbox to identify congestion mitigation strategies and/or suggested analysis tools for inclusion in the corridor alternatives analysis and/or NEPA documentation. Consider CMP strategies as an alternative to capacity, and/or bundle CMP strategies into the added capacity project. – Quantitatively document congestion reduction impacts in terms of CMP objectives and	– Other investment projects are subject to less rigorous congestion analysis. – Qualitative CMP analysis. – Use CMP Toolbox to identify congestion mitigation strategies and/or suggested analysis tools. – Conduct qualitative analysis of congestion impacts based on planning factors. – Qualitatively document congestion reduction impacts of the project in terms of CMP	– The same CMP analysis process as Major Investments or Other Investment Types applies. – AMATS reviews the CMP analysis process results. – AMATS conducts a scoping meeting with the consultant/project sponsor to discuss alternatives analysis and incorporate CMP strategies into the preferred project alternative.	– Project does not require a CMP analysis.

	Investment Type			
	Major Investments	**Other Investments**	**Accelerated Projects**	**Exempted Projects**
	measures. – Justify reasons for not implementing congestion mitigation strategies.	objectives and measures.		
CMP Project Analysis Form Requirements	– Project sponsors complete both the "Preliminary Questions" and "CMP Analysis for Major Investments" sections of the *CMP Project Analysis Form.*	– Project sponsors complete both the "Preliminary Questions" and "CMP Analysis for Other Investments" sections of the *CMP Project Analysis Form.*	– Project sponsors complete the "Preliminary Questions" and either the "CMP Analysis for Major Investments" OR the "CMP Analysis for Other Investments" sections of the *CMP Project Analysis Form* (depending on investment type).	– Project sponsors complete only the "Preliminary Questions" section of the *CMP Project Analysis Form.*
Timing of CMP Analysis	– Conduct CMP analysis as part of corridor alternatives analysis or NEPA document preparation. – Pre-requisite for TIP project application.	– Conduct CMP analysis as part of mobility study, traffic operations analysis, or local/regional study. – Pre-requisite for TIP project application.	– The same timing of CMP analysis as Major Investments or Other Investment Types applies (depending on investment type).	– CMP analysis not required. – Submit *CMP Project Analysis Form* to AMATS as part of TIP project application.

Source: Cambridge Systematics

7.2.1 CMP Analysis for Major Investments

Projects that result in a significant increase in carrying capacity for single-occupant vehicles (SOV) should seek to include CMP options in order to be considered for inclusion in the TIP. Therefore, a CMP analysis is recommended for all Federal and State assisted regionally significant added capacity projects located on the CMP network.

The CMP analysis process for major investments consists of conducting a quantitative analysis of corridor alternatives to assess the extent to which congestion mitigation strategies can alleviate travel demand and congestion in the corridor. First, the baseline condition is assessed to determine whether the problem/deficiency can be addressed without building more road capacity. Next, congestion mitigation strategies are evaluated as an alternative to the added capacity improvement. The CMP Toolbox provides a starting point for identifying alternative congestion mitigation strategies, while simulation or other appropriate analysis tools from the CMP Toolbox are used to conduct an evaluation of the actions to assess their impacts in the corridor. If the CMP analysis indicates that congestion mitigation strategies are insufficient to meet the travel demand needs in the corridor and additional SOV capacity is warranted, then the analysis must identify supplemental congestion mitigation strategies to improve the long-term effectiveness of the capacity improvement. The extent to which these actions can alleviate travel demand and congestion in the corridor compared to the baseline condition are documented as part of the CMP analysis. Project sponsors would be required to report on the specific strategies that will be implemented as part of the project, as well as quantitatively document the benefits of the project's ability to relieve congestion, improve trip reliability, and/or to define how it meets one or more of the CMP goals and objectives. If congestion mitigation strategies are not feasible or warranted as part of the project, an explanation must be provided as part of the CMP analysis.

Project sponsors would be required to complete both the "Preliminary Questions" and "CMP Analysis for Major Investments" sections of the CMP Project Analysis Form and submit it to AMATS. Ideally, a CMP analysis is performed by the project sponsor during the four to ten year short-range planning period in the MTP, prior to submittal of the TIP project application. The CMP analysis could be conducted as part of corridor alternatives analysis or NEPA document preparation, or it could be conducted as a separate analysis. Completing the CMP analysis should be a pre-requisite for consideration under AMATS' TIP project application process.

Because major investment projects are often implemented by other local agencies, project sponsors should contact AMATS staff at the start of a study or project that will likely add SOV road capacity to the CMP network. AMATS staff will work with the consultant/project sponsor to discuss the alternatives analysis and incorporate congestion mitigation strategies into the preferred project alternative

7.2.2 CMP Analysis for Other Investments

The CMP analysis process for other investment types is less rigorous compared to that for major investments and consists of a qualitative assessment of the congestion reduction impacts of the project in terms of CMP objectives and performance measures. Completing the

CMP analysis for other investments will assist AMATS in assessing the project's expected impact on overall congestion goals and objectives for the region.

The CMP Toolbox can be used to identify congestion mitigation strategies to solve a specific problem, or to identify an appropriate analysis tool for evaluating the benefits of a specific strategy type. The congestion reduction impacts of the project are assessed in terms of various qualitative criteria depending on the type of strategy, as shown in Table 7.2. The assessment criteria should be similar to those established for the Transportation Improvement Program. The process also includes qualitatively documenting the benefits of the project's ability to relieve congestion, improve trip reliability, and/or to define how it meets one or more of the CMP goals and objectives.

Project sponsors are required to complete both the "Preliminary Questions" and "CMP Analysis for Other Investment Types" sections of the *CMP Project Analysis Form*. The CMP analysis can be conducted as part of a mobility study, traffic operations analysis, or other local/regional study, and it is a pre-requisite for consideration under AMATS' TIP project application process.

Table 7.2 Qualitative Assessment for Other Investment Types

Strategy Type	Qualitative Criteria
Transportation Demand Management Strategies	– Does the project strongly support or enhance travel demand management programs that are already in place and that have regional significance? If yes, please explain. – Will the project reduce traffic congestion by reducing vehicle trips or VMT? If yes, please explain. – Will the project reduce vehicle emissions? If yes, please explain. – Does the project include marketing, education and incentive programs that encourage shift to alternative modes? If yes, please explain.
Land Use Improvements	– Does the project provide or demonstrate the potential for a transit connection? If yes, please explain. – Does the project provide an accessible pedestrian/bicyclist environment for Bicycle and Pedestrian Accommodation? If yes, please explain.
Public Transportation Improvements	– Does the project provide connection to other transit services? If yes, please explain. – Does the project include pedestrian and bicycle accommodations? If yes, please explain. – Is the project an intrinsic part or demonstrate the potential for Transit Oriented Development? If yes, please explain. – Does the project provide access to job opportunities, unmet or enhanced needs? If yes, please explain. – Does the project use Intelligent Transportation Systems and other operation/ service enhancing technologies? If yes, please explain. – Does the project address a need for expanded transit service capacity? If yes, please explain.

Strategy Type	Qualitative Criteria
Bicycle/ Pedestrian Improvements	– Does the proposed facility meet or exceed local policies for Bicycle and Pedestrian Accommodation and AASHTO design guidelines for pedestrian and/or bicycle facilities? If yes, please explain. – Does the proposed facility provide safe and convenient routes across barriers, such as freeways, railroads, and waterways, or does it close a gap in the existing bicycle network? If yes, please explain. – Does the proposed facility provide or demonstrate the potential for a transit connection? If yes, please explain. – Does the proposed facility provide connections to regional destinations? If yes, please explain.
Intelligent Transportation Systems (ITS) and Operations Strategies	– Will the project contribute to a reduction in incident clearance time? If yes, please explain. – – Does the project improve accuracy, timeliness, and availability of real-time information to the public? If yes, please explain. – Does the project improve automated traffic data collection and archiving ability? If yes, please explain. – Will the project give priority to emergency vehicles, transit, or high-occupancy vehicles? If yes, please explain. – Is the project consistent with the Regional ITS Architecture? If yes, please explain.
Roadway/ Mobility Improvements (Non-ITS)	– Will the project improve operational efficiency/reliability on a designated freight corridor? If yes, please explain. – Will the project improve a roadway on which fixed route transit service is being provided or otherwise used by other transit services outside of a fixed route service area? If yes, please explain. – Does the project incorporate access management principles such as raised medians, turn lanes, sharing/combining access points between businesses, or innovative intersections to reduce conflict points (e.g., roundabout, diverging diamond, single point urban interchange, etc.)? If yes, please explain. – Does the project include pedestrian/bicycle accommodations that meet or exceed local policies for Bicycle and Pedestrian Accommodation and AASHTO design guidelines? If yes, please explain. – Does the project integrate complete streets design principles? If yes, please explain.
Roadway Capacity Expansion (off the CMP Network)	– Does the project include segments of high congestion, and will the project help to mitigate this congestion? If yes, please explain. – Does the project provide access to existing and/or future business and job activity centers, shopping, educational, cultural, and recreational opportunities? If yes, please explain. – Will the project accommodate or create significant benefits to at least two additional modes of travel, or complete a link to intermodal or freight facilities of regional importance? If yes, please explain.

Strategy Type	Qualitative Criteria
	– Does the project impact a network-level change in congestion? If yes, please explain.

Source: Cambridge Systematics

7.2.3 CMP Analysis for Accelerated Projects

Some projects or strategies may get introduced late in the planning process due to one of the following factors:

- Accelerated growth or congestion relief;
- Connection with an existing project; or
- Additional/new funding opportunities.

The implementation of these projects does not correspond with the typical evaluation process and timeline required for projects already documented in the MTP. The following approach is recommended for this current CMP/MTP Update cycle.

The CMP analysis process for accelerated projects is dependent on whether the project is categorized as a major investment, other investment type, or exempted project, using the same criteria defined previously in Table 7.1. The process includes the following steps:

- Project sponsors complete the "Preliminary Questions" and either the "CMP Analysis for Major Investments" or the "CMP Analysis for Other Investments" sections of the *CMP Project Analysis Form*, depending on the investment type;
- AMATS reviews the CMP analysis process results; and
- AMATS conducts a scoping meeting with the consultant/project sponsor to discuss alternatives analysis and incorporate congestion mitigation strategies into the preferred project alternative.

The CMP analysis should be completed before start of the environmental assessment process and potential incorporation in the TIP. The congestion mitigation strategies identified to be most beneficial are required to be incorporated into each of these projects. The process also includes documenting the benefits of the project's ability to relieve congestion, improve trip reliability, and/or to define how it meets one or more of the CMP goals and objectives.

AMATS should meet with other relevant agencies to periodically review projects, determine where they are in the process, identify which elements/documents need to be completed, and identify the agency/jurisdiction responsible for performing the work.

7.3 CMP Analysis Exemptions

Projects are exempt from a CMP analysis if the predominant improvement type solves a safety or bottleneck problem. Table 7.3 identifies site characteristics and typical strategies used to distinguish safety and bottleneck improvement projects. Project sponsors must work with AMATS staff to confirm that a safety or bottleneck issue exists.

No CMP analysis is required to be conducted for safety and bottleneck projects. Project sponsors complete only the "Preliminary Questions" section of the *CMP Project Analysis Form* and submit it to AMATS as part of the TIP project application.

Table 7.3 Project Types Exempt from CMP Analysis

Project Type	Site Characteristics	Typical Strategies
Safety Projects	– The predominant improvement type addresses an immediate safety need along a corridor or intersection as documented in a regional/local traffic or safety study.	Safety improvements do not include adding capacity and can be accommodated within existing right-of-way. Safety exempt project types include[27]: – Railroad/highway crossing. – Projects that correct, improve, or eliminate a hazardous location or feature. – Safer non-Federal-aid system roads. – Shoulder improvements. – Increasing sight distance. – Highway Safety Improvement Program (HSIP) implementation projects. – Traffic control devices and operating assistance other than signalization projects. – Railroad/highway crossing warning devices. – Guardrails, median barriers, crash cushions. – Pavement resurfacing and/or rehabilitation. – Pavement marking. – Emergency relief (23 USC 125). – Fencing.

[27] Safety exempt project types are the same as those defined in federal regulation (40 CFR 92.126) to be exempt from conformity requirements

Project Type	Site Characteristics	Typical Strategies
		– Skid treatments. – Safety roadside rest areas. – Adding medians. – Truck climbing lanes outside the urbanized area. – Lighting improvements. – Widening narrow pavements or reconstructing bridges (no additional travel lanes). – Emergency truck pullovers.
Bottleneck Projects	Typical bottleneck locations include lane drops, weaving areas, freeway on-ramps, freeway exit ramps, freeway-to-freeway interchanges, changes in highway alignment, tunnels/underpasses, narrow lanes/lack of shoulders, or at traffic control devices. The following conditions exist or help to identify a recurring bottleneck condition[28]: – A traffic queue exists upstream of the bottleneck, wherein speeds are lower, while free-flow conditions exist elsewhere on the facility. – A beginning point for a queue. There should be a definable point that separates upstream and downstream conditions. The geometry of that point is often coincidently the root cause of the operational deficiency. – Free flow traffic conditions downstream of the bottleneck that have returned to nominal or design conditions. – As it pertains to an operational deficiency, a predictable recurring cause that is theoretically "correctable" by design. – Traffic volumes that exceed the capability of the confluence to process traffic. Note: this applies to recurring events more so than nonrecurring.	Bottleneck improvements are low cost, less than 1 mile in length, and typically include the following strategy types: – Low cost capacity improvements (e.g., auxiliary lanes, shoulder conversions.) – Minor intersection/interchange modifications (restriping to change lane configuration, merge/diverge areas, or weaving areas, ramp modifications.) – Traffic control device improvements (e.g., ramp metering, signal timing, etc.).

[28] Source: FHWA Guidance on Localized Bottlenecks, http://ops.fhwa.dot.gov/bn/lbr.htm#g9

8.0 Strategy Effectiveness

This section documents the process for quantitative evaluation of Congestion Management Process Implementation Strategies. The purpose of this final task is to determine the effectiveness of congestion management strategies implemented, to keep track of congestion levels on Anchorage, and consider future strategies to address congestion in the region.

This section identifies two approaches: the system-level performance evaluation, and the strategy effectiveness evaluation. The first approach seeks to develop a regional analysis to determine improvement or degradation of congestion levels in the region as a whole. The second approach seeks to identify the effect of specific congestion mitigation projects or programs, through a before and after analysis.

As a final product of this section, two proposed projects are presented and evaluated, as examples of strategy effectiveness evaluations, for future congestion management strategies implemented in Anchorage.

8.1 Strategy Effectiveness Progress

Evaluating the effectiveness of implemented congestion mitigation strategies is an essential step in the CMP process. The purpose of this evaluation is to ensure that implemented strategies are having the desired effect on congestion, and to modify the CMP Toolbox accordingly to inform the selection and prioritization of future strategies. This could include modifying the expected congestion impacts of strategies, or eliminating a strategy from future consideration if it is ineffective in addressing congestion.

Two strategies are proposed for these evaluations:

- **System-Level Performance Evaluation** - A regional analysis of historical trends to identify improvement or degradation in system performance in the region as a whole, in terms of the region's established performance measures. This can be done prior to implementation of a program with use of the regional travel demand model, or after using empirical data. Task 3 identified a preferred set of system wide performance measures for the AMATS region and Task 4 provided a data management plan for collection, storage and processing of this information.

- **Strategy Effectiveness Evaluation** – An analysis of before and after conditions for a specific congestion mitigation project or programs implemented in the region, in terms of the region's established performance measures.

System level monitoring will provide feedback on the system wide effectiveness of congestion mitigation strategies and projects that have been implemented in the region. By collecting, presenting, and comparing data for the performance measures defined, AMATS will be able to determine the overall effectiveness of the transportation projects implemented through the Congestion Management Process.

The Strategy Effectiveness Evaluation should be conducted through an analysis of before and after conditions for specific congestion mitigation projects and programs implemented in the region. For major investments, a follow-up evaluation should be conducted 3 years after project completion, and results should be reported in terms of the region's established performance measures. For other investment types, before and after analysis should be conducted on an as-needed basis, or as funding and resources allow. To demonstrate the concept, two examples of strategy effectiveness evaluation using the TOPS-BC analysis tool are provided next.

8.1.1 Example 1: Major Arterial Traffic Signal Coordination Project

This example seeks to provide the information needed to demonstrate how to evaluate a project for the Strategy Effectiveness Evaluation. The following proposed project aims to evaluate a congestion management project on an uncoordinated major arterial in the region. The purpose of this example is to determine the benefits of implementing optimal preset timing traffic signals on the corridor described (assuming that current traffic signals are uncoordinated).

The proposed analysis tool for this tool is the Tool for Operations Benefit/Cost (TOPS-BC) developed by FHWA Operations Office to provide benefit and cost estimates for a variety of ITS and operational alternatives. TOPS-BC was developed as a follow-up tool to the ITS Deployment Analysis System (IDAS), which is a network model that evaluated ITS and operational options based on the regional travel demand model. IDAS is now over 15 years old and is no longer supported by FHWA. TOPS-BC operates in a spreadsheet format, is easy to learn and highly-transparent. It provides the ability to conduct numerous "what-if" analyses of different assumptions related to both benefits and costs. The program contains a range of default values for both benefits and costs and provides documentation of various studies used to derive those values. In addition, this also includes the ability to take advanced level training.

TOPS-BC requires certain inputs to provide cost and benefits estimates. For this purpose, the following assumptions were made for this example project:

Cost assumptions:

- Installation of Linked Signal System LAN
- Installation of system across 5 intersections

Benefit assumptions:

- Corridor length: 1.7 miles
- Number of lanes: 4 lanes
- Analysis Period: 1 Peak Hour
- Number of analysis periods per year: 500 (two peak periods for 250 days)

- Link Volume: 2,400 veh/hr (PM peak average)
- Change in capacity: 8%
- Reduction in Crash Rate: 2%
- Reduction in Fuel Use: 5%

Figures 8.1 and 8.2 below illustrate the process of populating the TOPS-BC spreadsheets. Figure 8.1 shows the basic assumptions considered to obtain the project cost. For this project in particular, it shows the unit cost per item considered. Once the total cost is estimated, it is annualized by the project life span, to obtain the annual average cost, which is then compared with benefit values. Figure 8.2 shows the main assumptions considered to quantify the projects benefits. As with costs, TOPS-BC seeks to estimate the changes and improvements of specific projects, to quantify how users have benefitted from them.

Figure 8.1 Major Arterial Main Cost Assumptions

FHWA Tool for Operations Benefit/Cost (TOPS-BC): Version 1.1

PURPOSE: Estimate Lifecycle Costs of TSM&O Strategies

WORK AREA 1 - ESTIMATE AVERAGE ANNUAL COST

Traffic Signal Coordination Systems: Preset Timing

Equipment	Useful Life	Capital / Replacement Costs (Total)	O&M Costs (Annual)	Annualized Costs
Basic Infrastructure Equipment				
Linked Signal System LAN	10	$ 55,000	$ 1,100	$ 6,600
TOTAL Infrastructure Cost		$ 55,000	$ 1,100	$ 6,600
Incremental Deployment Equipment (per Intersection)				
Signal Controller	15	$ 6,250	$ 350	$ 767
Communication Line	20	$ 750	$ 6,600	$ 6,638
TOTAL Incremental Cost		$ 7,000	$ 8,050	$ 7,404
INPUT Enter Number of Infrastructure Deployments	1			$ 6,600
INPUT Enter Number of Incremental Deployments	5			$ 37,021
INPUT Enter Year of Deployment	2016			
Average Annual Cost				**$ 43,621**

Source: FHWA Tool for Operations Benefit Cost Analysis (TOPS-BC)

Figure 8.2 Major Arterial Main Benefit Assumptions

Length of Analysis Period (Hours)	1
Signal Timing Type	Preset Timing

Cost Information

Facility Characteristics

Link Facility Type	Principal Arte		Baseline Override	Baseline	Improvement Override	Improvement	Change
Link Length (Miles)	1.7						
Total Number of Lanes	4			4		4	0
Link Capacity (All Lanes - per Period)		7200		7200		7776	576
Free Flow Speed (MPH)	40	45					

Facility Performance

Link Volume (during the time period of analysis)	2400	Baseline Override	Baseline	Improvement Override	Improvement	Change
Congested Speed		26	39.258	29.6	39.339	3.600
Vehicles Miles Traveled (VMT)			4080.0000		4080.0000	0.0000
V/C			0.3333		0.3086	-0.0247
Vehicle Hours of Travel			156.9231		137.8378	-19.0852
Incident Related Delay (hours) per vehicle per mile			3.1059E-06		2.98291E-06	-1.22994E-07
Number of **Fatality** Crashes			7.22160E-07		7.07717E-07	-1.44432E-08
Number of **Injury** Crashes			6.93192E-05		6.79328E-05	-1.38638E-06
Number of **Property Damage Only** Crashes			1.00923E-04		9.89044E-05	-2.01846E-06
Fuel consumption (Gallons)			192.0541		182.4514	-9.6027

Source: FHWA Tool for Operations Benefit Cost Analysis (TOPS-BC)

Based on these assumptions, the total average annual cost of this project would add up to $43,621, and the total annual expected benefits would be $346,401. Considering these assumptions, the project net benefit is $302,780, with a benefit-cost ratio of 7.94. This result shows that this project would provide a positive output for congestion measures.

8.1.2 Example 2: Incident Management System on a Selected Highway

Similar to the traffic signal coordination project, a second example is proposed, consisting of the implementation of an Incident System Management on a selected Highway. A Traffic Incident Management system consists of basic infrastructure equipment, like surveillance, incident response hardware and software, and emergency response labor. This option assumes that two trucks equipped to remove breakdowns and crashes where there are no injuries would be stationed along the Highway during weekday peak hours. Additional surveillance and detection equipment would be installed and part of an operator's time dedicated to monitoring the roadway. With this equipment and labor, the emergency response team is able to identify traffic incidents more quickly and respond accordingly. Benefits derive primarily from faster removal of incidents and reduction in the secondary crashes that occur when cars queue behind the initial crash. Incident Management System and TMC education along with training is also highly recommended.

To evaluate the impact of this project, the TOPS-BC tool is used. For this project in particular, the following assumptions were made:

Cost assumptions:

- Labor for TMC operations: $50,000

- Response vehicles (2): $170,000
- Vehicle operator (2 at peak hours only): $100,000

Benefit assumptions:

- Link length: 11.5 miles
- Total number of lanes: 6 lanes
- Length Analysis Period: 3 hours
- Number of analysis periods per year: 250
- Volume per period: 13,600 vehicles (from permanent traffic count station report)
- Change in speed: 2%
- Reduction in non-fatality crash rates: 10%
- Reduction in crash duration: 40%
- Reduction in fatality crash rate: 1%

Similar to the previous example project, Figures 8.3 and 8.4 show the main cost and benefit assumptions that were added as inputs for the evaluation.

Figure 8.3 Highway Main Cost Assumptions

FHWA Tool for Operations Benefit/Cost (TOPS-BC): Version 1.1

PURPOSE: Estimate Lifecycle Costs of TSM&O Strategies

WORK AREA 1 - ESTIMATE AVERAGE ANNUAL COST

Other Freeway Systems: Traffic Incident Management

Equipment	Useful Life	Capital / Replacement Costs (Total)	O&M Costs (Annual)	Annualized Costs
Basic Infrastructure Equipment				
Video Monitors/Wall for Incident Detection	5	$ 3,000	$ 150	$ 750
TMC Incident Response Hardware	5	$ 3,000	$ 150	$ 750
TMC System Integration	10	$ 60,000	$ -	$ 6,000
TMC Incident Response Software	5	$ 10,000	$ 750	$ 2,750
TMC Labor		$ -	$ 50,000	$ 50,000
Emergency Management Center Hardware	10	$ 5,000	$ 450	$ 950
Emergency Management Center Software	10	$ 10,000	$ 2,000	$ 3,000
Emergency Response Labor		$ -	$ -	$ -
Communication Line	20	$ 750	$ 900	$ 938
TOTAL Infrastructure Cost		$ 91,750	$ 54,400	$ 65,138
Incremental Deployment Equipment (per FSP Vehicle)				
Incident Response Vehicle	7	$ 85,000	$ 15,000	$ 27,143
Incident Response Labor			$ 50,000	$ 50,000
Communication Line	25	$ 750	$ 250	$ 280

Source: FHWA Tool for Operations Benefit Cost Analysis (TOPS-BC)

Figure 8.4 Highway Main Benefit Assumptions

Strategy: Traffic Incident Management

Length of Analysis Period (Hours)	3

Cost Information

Facility Characteristics

			Baseline Override	Baseline	Improvement Override	Improvement	Change
Link Facility Type	Urban Freew						
Link Length (Miles)	11.5						
Total Number of Lanes	6			6		6	0
Link Capacity (All Lanes - Per Period)	36000	39600		36000		36000	0
Free Flow Speed (MPH)	55	55					

Facility Performance

		Baseline Override	Baseline	Improvement Override	Improvement	Change
Link Volume (Per Period)	13600					
Congested Speed			53.133		54.196	1.063
Vehicles Miles Traveled (VMT)			156400.0000		156400.0000	0.0000
V/C			0.3778		0.3778	0.0000
Vehicle Hours of Travel			2943.5356		2885.8193	-57.7164
Incident Related Delay (hours) per vehicle per mile			6.87702E-09		3.34223E-09	-3.53479E-09
Number of **Fatality** Crashes			1.03224E-05		9.29016E-06	-1.03224E-06
Number of **Injury** Crashes			7.44933E-04		6.70440E-04	-7.44933E-05
Number of **Property Damage Only** Crashes			9.65144E-04		8.68630E-04	-9.65144E-05
Fuel consumption (Gallons)			7362.0721		7362.0721	0.0000

Source: FHWA Tool for Operations Benefit Cost Analysis (TOPS-BC)

Based on the stated assumptions, the total average annual cost of the project would accumulate to $219,983. The total average annual benefits would add up to $497,685. With these results, the net benefit of this project would be $277,702, with a benefit cost ratio of 2.26. This implies that the project evaluated would have a modest improvement on the Highway congestion measures.

8.1.3 Strategy Evaluation Summary

An important part of the CMP process is to evaluate strategies implemented, determining their effect on the performance measures defined in the CMP process. There are two evaluation strategies suggested in this study:

- System-Level Performance Evaluation
- Strategy Effectiveness Evaluation

The first strategy requires continuous collection of system-wide data, to develop the performance measures mentioned on Task 3 of this report. Task 4 of this report provided a data management plan that can be used to help collect, store and process the data required to develop these systemwide performance measures. By implementing this process, AMATS will be able to measure and visualize traffic performance in the metropolitan area, and evaluate whether the transportation system is evolving towards a desired direction.

The second strategy consists of evaluating the performance of specific projects. This report presents two examples of this evaluation process. The projects are evaluated through the use of the Tool for Operations Benefit Cost Analysis (TOPS-BC) tool. This tool is useful because it provides a structured analysis, through transparent calculations, that can be used to estimate project performance and evaluate whether the investment has a positive benefit/cost ratio. The life cycle cost capabilities of TOPS-BC are a unique feature that allows costs to be annualized based on their expected life. There are other tools that can be used for this end. A complete list of tools for evaluation processes is presented in CMP Toolbox section of this report. With these tools, AMATS will be able to determine specific project impacts, and steer Anchorage's transportation system evolution toward an efficient and sustainable future.

9.0 System Performance and Data Management Plan

This report is part of the Congestion Management Process (CMP) Update. This final section of the CMP Update project seeks to clearly define subtasks related to the Congestion Management Process that are important to consider for a successful implementation. This report highlights three important tasks for AMATS' consideration during the application of the CMP Update process. The first task is data management. Highlights from the Data Management Plan are presented to identify clear tasks that require further consideration for the implementation of the CMP process. The second task is the CMP implementation process, highlighting important tasks for AMATS to consider during the CMP implementation. Finally, tasks from the CMP Strategy Effectiveness are highlighted to describe a path for ongoing maintenance and successful execution of the CMP implementation process.

Following the process described throughout the 9 technical reports presented for the purposes of this study, it is possible to define the main work elements necessary to guarantee a meaningful Congestion Management Process implementation in the region. For this purpose, this section presents three main work tasks that require further consideration from AMATS and stakeholders involved, to guarantee a successful implementation of the Congestion Management Process:

- Data Management Plan Considerations
- CMP Implementation Tasks
- CMP Strategy Effectiveness Tasks

9.1 Data Management Plan Considerations

In the third Technical Memorandum, CMP Performance Measures, a list of performance measures was defined to support the Congestion Management Process Update. An important aspect of the Congestion Management Process defined is continued support of the data collection efforts that are currently in place for various modes of transportation and geographic areas. By supporting these efforts, AMATS will be able to continue analyzing the congestion conditions in the region, and proactively respond to them. If these efforts are strengthened, AMATS and the stakeholders involved in transportation in the region will have better resources that allow them to be proactive, and steer the transportation-related plans towards a sustainable and prosperous horizon.

In the Data Management Plan of this report, a proposal to structure a data management framework is presented. The benefits of having an updated and reliable transportation dataset that is accessible from a single point is not something exclusively useful for the CMP Update project, but would be helpful to other transportation planning products and processes as well. Once a data framework is designed and implemented, the benefits of data accessibility can be shared across different stakeholders, providing reliable and updated information to be used

across the different transportation planning activities in the region. Further consideration of this proposal could be beneficial for the defined Congestion Management Processes described, as well as many other planning endeavors in the region.

9.2 CMP Implementation Tasks

In the seventh Technical Report, the CMP Implementation Plan, a detailed process is described to incorporate Congestion Management Processes into near and long term transportation projects in the region. By following this process, AMATS will be able to consider strategies that will have an impact on congestion and the reduction of its externalities at the right time. It is considered important to evaluate new projects following the implementation procedure described, and to identify the correct strategies for each project. The process proposed will promote the incorporation of operational, ITS and transit and non-motorized elements into large capital roadway projects where appropriate, thus creating a more balanced system.

Furthermore, the coordination with other planning efforts, such as the MTP, ITS Architecture, and TIP process is described in detail. By following the implementation plan, these activities could benefit by having further information on upcoming projects, and ease the development of these products.

9.3 CMP Strategy Effectiveness Tasks

Finally, in the eighth Technical Report, the Strategy Effectiveness section, a framework for following up on the implementation of strategies is presented. By following this strategy, AMATS will be able to quantify and value strategies and their impact on congestion. This report presents examples using one evaluation tool, FHWA's Tool for Operations Benefit Cost Analysis (TOPS-BC), however, other tools are described in this report, and their use will be beneficial for the Congestion Management Process. Tools like the regional travel demand model, simulation tools, vehicle emissions modeling software, and other evaluation model provide particular output that can be used to define strategies' effectiveness. With these tools, supported by the data management plan described in Task 4 and Section 2.1 above, AMATS will be able to better evaluate project impacts and build a database that can be used for future planning efforts including CMP updates. Like the other strategies described in the memo, this effort does not create a duplicate maintenance program for the CMP but strives to integrate the CMP with other planning activities and datasets.

Appendix A. ITS/MTP/CMP Strategic Integration

The web site for National ITS Architecture 7.0 provides a good initial framework for integrating ITS Architecture into the Planning process, specifically that of congestion management. (http://www.iteris.com/itsarch/html/archuse/planning.htm). A similar process can be applied to achieve integration with the Metropolitan Transportation Plan (MTP) process as well. Some goals, objectives, and measures will be shared by the two processes, while others will only be relevant to one or the other. A structured approach to integration will promote consistency between the various processes and make sure that relevant projects are incorporated into the ITS architecture.

A.1 Introduction

The focus of this memorandum is to provide a framework and process for integrating the ITS Architecture with the AMATS Congestion Management Process (CMP) and Metropolitan Transportation Plan (MTP). A framework for the Congestion Management Process Update currently is underway and the next major update of the Metropolitan Transportation Plan is anticipated to begin third quarter 2015. The scope of this task includes the following:

- Review of current CMP and MTP processes – Current processes followed have been documented in the most recent CMP and MTP efforts. The purpose of this effort is to identify key points in each process where coordination with the ITS Architecture should occur. All three products identified are updated periodically. One of the key challenges is to make sure that needed changes generated by one product are available to be incorporated into the others at the proper time.

- Review and assessment of existing data sources for use in evaluating ITS and operations projects – ITS Architecture provides documentation of regional ITS systems, including deployment types, location and data generated. More detailed information on data flows also is included in the Architecture and can be used to identify inputs for the alternatives evaluation required in both the MTP and the CMP.

- Recommendation of existing data sources for use in evaluating ITS and operations projects – Work already is underway in the CMP Update to identify existing sources of data that can be used to evaluate ITS and Operations projects. An important goal of this effort is to identify "baseline" or "benchmark" conditions that will allow: 1) comparison of alternative impacts with current conditions and 2) use of ITS data for ongoing performance measure development and system monitoring.

- Guidelines for project description and evaluation – A format is provided for moving information between the ITS Architecture and the CMP and MTP evaluation processes.

- Approach to benefit-cost analysis – Benefit-cost analysis can be an effective tool for evaluating potential ITS and Operations projects. A variety of tools exist which can be used to assess the costs and benefits of these projects which are described in more detail in Section 3:

  - Regional Travel Demand Model;
  - Simulation tools;
  - ITS Deployment Analysis System (IDAS); and
  - TOPS-BC.

- Tables and written descriptions showing links between ITS architecture and the CMP and MTP – Several flowcharts developed by FHWA for Operations planning activity are shown in the document.

A.1.1 1.1 Overview of ITS Architecture Project

Intelligent Transportation Systems (ITS) include advanced sensor, computer, electronic, and communication technologies integrated with the built transportation infrastructure, and deployed to improve overall transportation system operations and safety. Some examples of ITS already in place within the MOA include:

- Computerized traffic signals, including those that can be managed from a central computer platform;
- Traffic detectors and traffic cameras that provide real-time information to support operations;
- Public information web sites such as the MOA's site showing the status of snow plow-out by subarea; and
- Transit bus location and dispatch systems.

The term 'architecture', when applied to computerized systems and technology, is a model or framework used to describe these inherently complex systems. For ITS, architectures are focused on identifying the data flows between systems that may be owned and operated by different agencies or departments in support of transportation operations improvements. ITS Architectures include:

- The requirements for defining the connections;
- Documenting the connections; and
- Documenting any supporting resources, such as interagency agreements, that will enable the architecture to be implemented as planned.

When ITS was first broadly funded by the Federal Highway Administration (FHWA) in the 1990s, many of the systems that were implemented were not designed to enable access to the data that was used within them. When agencies wanted to use the source or processed data for other purposes, they were not able to do so without either replacing the system, or making a large investment to modify their existing system. Computerized systems and software were new ground for many agencies, and the project development processes in place were not

designed to support planning for technologies that might be called upon in the future to provide functions not needed in the original core system.

FHWA responded to this issue by recommending that systems engineering processes, developed for computerized technologies, be applied to plan for potential future integration and data connections. Systems engineering processes include the development of systems architectures.

Because these processes provide such long-term added value, the U.S. DOT further instituted the National ITS Architecture conformity rule (23 CRF Part 940) (and the FTA National ITS Architecture Policy on Transit Projects) requiring that ITS Architectures be completed for certain 'regionally significant' ITS projects, if the projects are to be eligible for Federal transportation funding. Today, developing, documenting and using an ITS Architecture is considered a best practice in the transportation/ITS industry.

The timeframe for the MOA's ITS Architecture Update is approximately 10 years, with an emphasis on the first 5 years. This timeframe allows the stakeholders to consider ITS systems and connections that may not be feasible today, but are not so far beyond today's capabilities and needs to be considered "stretch" goals. In addition, the rapid change of technology capabilities limits any organization's ability to plan technology for the very long-term beyond planning to meet functional needs. The Anchorage Regional ITS Architecture (ARIA) was originally developed in 2003, and approved in 2004. The focus of the current ITS update is to:

- Improve the ability to access and understand the ITS Architecture.
- Modify the ARIA to reflect any updates to systems deployed, and the regional partner's vision and goals for ITS over the 10-year timeframe of this update.
- Make the ARIA easier to maintain by converting it to a Turbo Architecture file.

This memo addresses one of the additional objectives for the ARIA update, which is to integrate with regional planning processes, including the Anchorage Metropolitan Area Transportation Solutions (AMATS) Metropolitan Transportation Plan (MTP), and the AMATS Congestion Management Process (CMP). AMATS is a Federally recognized Metropolitan Planning Organization (MPO). AMATS works to plan, fund, and coordinate the transportation system in the Anchorage and Chugiak-Eagle River areas when Federal funds are used. During the course of this project, meetings were held with the AMATS committee responsible for the regional plan to solicit input.

A Congestion Management Process (CMP) provides guidance for the application of strategies to improve transportation system performance and reliability by reducing adverse impacts of congestion on the movement of people and freight. The CMP identifies congestion management objectives, multimodal performance measures, causes of congestion and management strategies, and the effectiveness of management strategies. The original Congestion Management Program (CMP) for MOA was first published in 1994. Currently, the Congestion Management Process is being updated. There is generally no set timetable for a CMP update but its focus is primarily on short-term bottleneck relief projects and operational

strategies. AMATS currently is identifying a set of performance measures for the CMP, that reflect Federally required reporting and the increasing emphasis on using performance measures to guide operational strategies and future investments in the transportation system.

A.1.2 Benefits of Integration

Integration of ITS Architecture with the MTP and CMP has a number of specific benefits for the region, including:

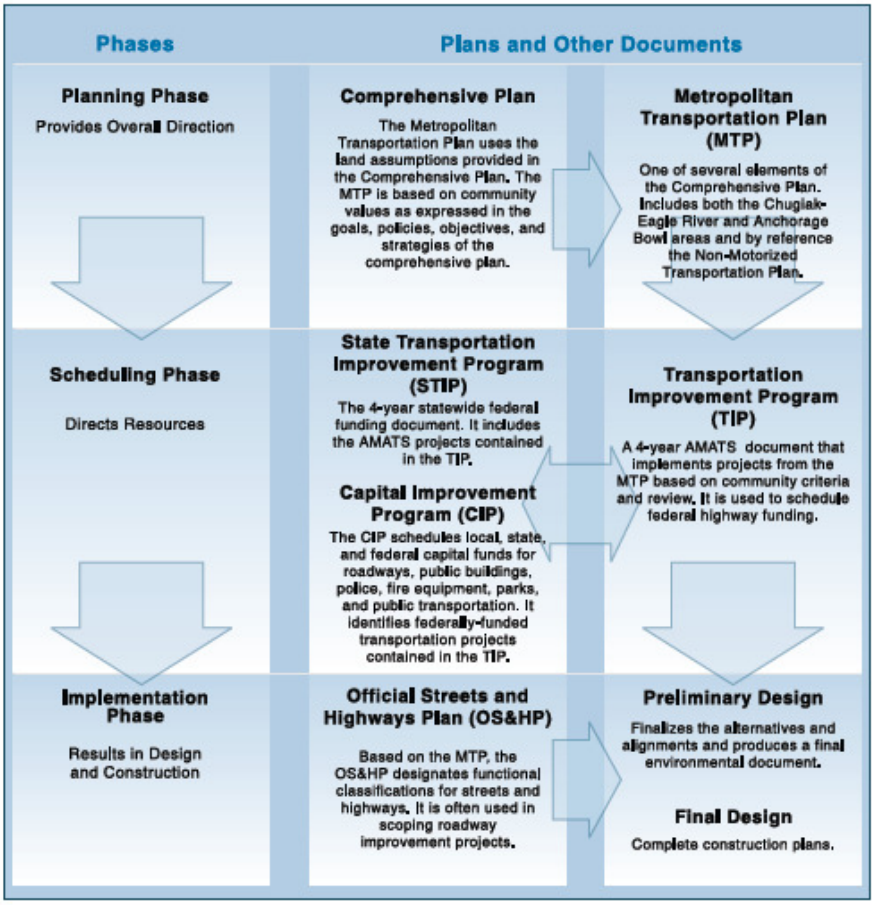
- It will assure that ITS projects are incorporated into other plans/programs of the region and are consistent with the goals and objectives of those programs.
- It will prevent duplication of planning and design efforts and encourage efficiency by combining ITS and capital projects where feasible. For example, the architecture may define desired ITS deployments and communications links that can be incorporated into a roadway reconstruction or widening project.
- ITS projects provide a potential source of data for evaluation of proposed MTP and CMP projects. Emerging sources of information such as probe-based travel-time data can be used to assess the feasibility of proposed projects and track their impacts over time. Models used for forecasting can be improved in both level of accuracy and detail with these new sources of information. Coordination with the ITS architecture can help to assure that data are provided in usable format and are archived for use in planning activities.
- A review of past AMATS planning efforts shows that different performance measures have been used over time. With greater focus on performance measurement the importance of using consistent data sources over time has increased. Coordination with ITS architecture is helpful in achieving this consistency.
- As noted above, incorporation into the architecture keeps proposed Operations and ITS projects eligible for Federal funding.

A.2 Summary of Current MTP and CMP Process

A.2.1 MTP Background

The current AMATS 2035 MTP was approved in 2012 and documents $4 billion in multimodal transportation investment between 2012 and 2035. The MTP was developed under the last round of Federal transportation legislation (SAFETEA-LU) and is driven by the eight Federal planning factors which can be found on the AMATS MTP web site in Chapter 1 (http://www.muni.org/Departments/OCPD/Planning/AMATS/Pages/2035MTP.aspx) and the specific goals and objectives of the Anchorage region, which can be found in Chapter 3 at the same link above. The MTP involves a wide range of stakeholders and is coordinated in a structured manner with a number of other planning products as documented in the flow chart in Figure A1. The diagram does not show linkages to either the ITS architecture or the Congestion Management Plan, both of which need to be established.

Figure A.1 AMATS MTP Planning Process Linkages



Source: AMATS 2035 Metropolitan Transportation Plan, page 1-6.

A.2.2 CMP Background

Congestion Management System (CMS) was first introduced as part of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and was outlined as a systematic process for state departments of transportation (DOTs) and metropolitan planning organizations (MPOs) to provide information on transportation system performance and alternative strategies to alleviate congestion and enhance mobility of people and goods[29]. The Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA LU) did little to change requirements, but changed the name of the CMS to the Congestion Management Process (CMP). While the CMS was often used as a stand-alone data analysis/planning exercise, the CMP was intended to be an ongoing process, fully integrated into the overall transportation planning process of both states and regions[30].

[29] Framework of the Capital Region Transportation Planning Agency (CRTPA) Congestion Management Process Report.

[30] Federal Highway Administration (FHWA) CMP Guidebook.

Federal regulations are provided in the 23 Code of Federal Regulations (CFR) Section 450.32 – congestion management process in transportation management areas. Elements of the CMP include:

- Performance monitoring and evaluation, identification of causes of recurring and nonrecurring congestion, and strategy identification and effectiveness;
- Definition of congestion management objectives and performance measures;
- Coordinated data collection and system performance monitoring efforts;
- Identification of anticipated performance and benefits of congestion management strategies;
- Implementation schedule, responsibilities, and potential funding for strategies; and
- Implementation of a process for assessment of strategies, in terms of established performance measures.

Federal requirements also explicitly outlined the CMP implementation and development process to be part of an overall metropolitan transportation planning process that involves coordination with transportation system management and operations activities. The CMP does not have an update cycle established by Federal regulations, though the four-year certification review cycle and the four- or five-year Metropolitan Transportation Plan (MTP) update cycle for each TMA provide a baseline for a reevaluation/update cycle in the absence of an identified requirement.

MAP 21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), preserves the existing law related to CMPs, with an increased focus on a performance-based approach to decision-making and the development of transportation plans. Enhanced monitoring and reporting of congestion and reliability also are focus areas, which encourages coordination with ITS and Operations planning, and particularly the ITS Architecture Update.

Seven goals and 23 objectives were adopted in December 2014 as part of the ongoing AMATS CMP process. These are documented in Technical Memorandum #1 of the CMP Update project. CMP documents will be posted to the following Web page as they are finalized: http://www.muni.org/Departments/OCPD/Planning/AMATS/Pages/congestionmanagementprocess.aspx

A.3 Review of Data Sources

The integration of ITS Architecture with the CMP and MTP processes will focus primarily on proposed projects and the availability of data that they generate. Some existing data sources were identified in the Draft ITS Architecture Update document developed by Parsons Brinckerhoff for AMATS. They are represented in this document in several places, including:

- Roles and Responsibilities
- Data Definitions

- Architecture Flows

A large number of planned data sources are identified in the document. These also need to be reviewed when planning ITS and Operations projects. Key categories of data sources are described briefly below:

- **Permanent Sources and Locations** – Permanent stations provide a continuing stream of data. These include roadway detection systems that provide information on traffic volumes, speeds, and vehicle classification. ADOT&PF has recent deployments of permanent detection on the Glenn and Seward Highways. Some traffic signal systems may be able to provide traffic volume data from their detectors as well, although in many cases the controllers are not configured to capture or provide this information. If the controllers are able to provide the information, it currently is not saved or archived. More investigation is required with signal system operators before data from signals can be included. Passenger counting and vehicle location systems used on public transportation and maintenance vehicles could also fall into this category.

- **Temporary Sources and Locations** – Temporary sources include mobile automated counting and classification stations as well as data from speed and delay runs that are conducted on a regular basis by AMATS. Household travel surveys, roadside surveys and transit passenger surveys also can be considered as temporary sources since they are a snapshot of conditions at a point in time.

- **Models and other Estimation Tools** – Much of the project evaluation process is conducted using Travel Demand or simulation models. More recently there has been great interest in benefit-cost tools. Some type of model is generally needed for forecasting future conditions although simple growth factors can often be applied to short-term forecasts. Categories of tools are described below:

  - **Regional Travel Demand Model** – The regional Travel Demand Model can be used to estimate impacts of capacity changes that impact significant parts of the network; for example major signal coordination in a regionally significant arterial corridor. Travel-time benefits can be monetized and compared to project cost. For smaller projects, or projects that address non-recurring congestion such as incidents or work zones, Travel Demand models are generally not effective. The AMATS model currently is being updated and when operational can be used by staff to identify system changes for certain operational alternatives. The learning curve for travel demand models is steep and processing time for the purpose of benefit-cost analysis can be significant.

  - **Simulation tools** – Microscopic and mesoscopic models can be used to generate data for benefit-cost analysis and are most effective in evaluation of operational changes over a small area; such as an arterial corridor or an activity center. Tools can be used to help evaluate alternatives that address both recurring and non-recurring congestion. Simulation models can provide relatively detailed outputs that address operation of individual lanes and intersection approaches.

- **ITS Deployment Analysis System (IDAS)** – IDAS was developed for FHWA (http://ops.fhwa.dot.gov/trafficanalysistools/idas.htm) to specifically assess ITS and operational improvements. It is based on a regional travel demand model but provides benefit parameters for a wide range of ITS and operational deployments. It also includes a cost module that provides capital, operations, maintenance, and overall life cycle cost. Benefit-cost information is generated by the software based on the FHWA national database of costs and benefits. Default benefit and cost parameters are provided that can be overridden by the user. Since IDAS requires that the travel demand model be incorporated, it takes significant resources and is therefore most appropriate for regional ITS plans and large deployments.

- **TOPS-BC** is a recently developed FHWA tool that takes the ITS parameters and places them in a spreadsheet format that is menu-driven and relatively user-friendly (http://plan4operations.dot.gov/topsbctool/index.htm). Like IDAS it evaluates a wide range of ITS and operations projects and includes default parameters, opportunity for user override of the parameters and automated generation of benefit-cost numbers. It works on a segment-by-segment basis and is thus suitable for spot or corridor analysis. Unlike IDAS, TOPS-BC cannot identify traffic shifts that may occur as a result of corridor signal upgrades or ramp meter installations. Overall, however, TOPS-BC provides project-level benefit-cost estimates with limited resources and in a transparent manner.

- Emerging Data Sources – Emerging data sources include private sector-based probe data, which is obtained from mobile communications devices such as cell phones and in-vehicle navigation systems. A number of private vendors are in the market and have been supplying data to Federal, state and regional transportation agencies. They focus on travel time and can provide a much richer dataset than can be obtained by traditional data collection methods. Given Alaska's location and unique geography there has been limited interest from vendors to date in serving the Anchorage area, but this is likely to change in the future. It also should be noted that there are now mobile sensor arrays that can be transported from one location to another. Many agencies are using these to monitor the impacts of construction zones or to obtain more detailed information on congested locations.

A.3.1 Process for Coordinating Planning Products and ITS Architecture

The starting point for coordination and integration with the ITS Architecture is similar for both the CMP and MTP. FHWA provides the following guidance:

"The development of the regional ITS architecture is not meant to compete with the formal transportation planning process. They must work together to provide the best "plan" for the region. Key ITS projects and initiatives are targeted early in the planning process in order to facilitate more effective integration with other projects in the region.

The architecture can support and help define the goals and objectives of (the MTP and CMP) since it provides a vision of ITS in the future as seen by the stakeholders. Operational concepts, service packages, and agency/subsystem interfaces can all provide more clarity to

the Plan components for better scoping and allocating costs." (http://www.ops.fhwa.dot.gov/its_arch_imp/faq.htm)

The AMATS region currently does not have a specific ITS/Operations Plan so the primary coordination required for planning products is with the ITS Architecture. The Service Areas identified in the ITS Architecture can be used as the starting point for coordination, with categories of specific projects included. The Network Surveillance service package category has been added to the Service Areas from the statewide Alaska Iways Architecture; while this is primarily a state function it needs to be included in both the CMP and MTP. The Network Surveillance Service Area is included in the current Alaska statewide ITS architecture. The mapping of project categories and projects to Service Areas is shown below in Table A.1. This table can help planners in determining where their potential projects are reflected in the architecture. Service Areas in the statewide architecture are denoted with "(AKIA)."

Table A.1 Mapping of ITS/Operational Projects to Architecture Service Areas

Project Categories	Potential Projects	Service Area
Traveler Information Systems	• Detector systems • Probe data systems • Dynamic message sign • Highway advisory radio • 511, web site mobile services	• Archived data service • Network surveillance (AKIA) • Arterial management • Traveler information • Roadway maintenance and construction • Transit operations
Signal Improvements	• Intersection upgrades • Corridor upgrades • Retiming • Central control • Emergency preemption	• Archived data service • Arterial management • Traveler information
Transit Signal Priority	• Intersection priority • Corridor priority	• Arterial management • Traveler information • Transit operations
Transit ITS Operations	• AVL deployment • Automated passenger count system • Fare collection upgrade • Bus safety and collision avoidance systems	• Transit operations • Traveler information • Archived data services
Carpooling and Vanpooling Systems	• Dynamic ride matching • HOV lanes	• Archived data service • Network surveillance (AKIA) • Arterial management • Traveler information

Project Categories	Potential Projects	Service Area
Non Motorized ITS and Operations	• Safety warning systems • Bikeshare system	• Archived data service • Arterial management
Freeway Management	• Detection and Surveillance System • Traffic Management Center • Ramp Metering • Active Traffic Management	• Archived Data Service • Network Surveillance (AKIA) • Traveler Information • Roadway Maintenance and Construction
Emergency Management, Incident Management	• Service patrol • Emergency signal preemption • Emergency center – transportation center links	• Traffic incident management (AKIA)regional traffic management (AKIA) • Arterial management • Traveler information • Roadway maintenance and construction • Transit operations
Road Weather Management	• Road weather information systems • Mobile sensors • Winter maintenance decision support	• Archived data service • Road weather data collection (AKIA)weather information and processing and distribution (AKIA) • Arterial management • Traveler information • Roadway maintenance and construction • Transit operations
Construction and Workzones	• Work zone monitoring systems • Active traffic management	• Archived data service • Arterial management • Traveler information • Roadway maintenance and construction

Both the CMP and MTP go through a series of planning steps that are documented in Table A.2 below along with the proposed touch points with ITS Architecture (shown in bold). This table summarizes the points where direct coordination is required as well as specific outputs that utilize or impact ITS architecture:

Table A.2 Documentation of CMP/MTP – ITS Architecture Coordination Process

CMP or MTP Planning Step	Coordination with ITS Architecture	Output
1. Goals and Objectives	• Identify key ITS Architecture stakeholders associated with each goal area (safety, mobility, etc.)	List and contact information for ITS stakeholders for each goal area

CMP or MTP Planning Step	Coordination with ITS Architecture	Output
2. Identification of Needs and Deficiencies (using performance measures)	• Categorize those needs and deficiencies which could be addressed all or in part with ITS solutions	List needs and deficiencies that may have ITS solutions
3. Development of Alternatives	• Use output list identified in steps 1 and 2 to identify potential ITS and operational solutions. • Review ITS architecture to determine whether proposed solutions are included • For those solutions included identify key stakeholders	List of potential ITS solutions, whether or not they currently are in architecture and associated key stakeholders (if included)
4. Refinement of Potential ITS Solutions	• Define ITS alternatives, including geographic scope and technology • Determine whether project is stand-alone or should be incorporated into capital project • Review ITS architecture for project refinement – identify linkages, data flows and stakeholders • Refine project definition as needed	List of refined ITS solutions to be evaluated
5. Evaluation of Alternatives	• Conduct evaluation of ITS alternatives identified in step 4 Output.	Evaluation Report of Potential ITS Solutions identified in step 4.
6. Project Selection and Prioritization	• Develop project ranking / selection criteria. • Rank ITS projects and develop prioritized list, applying ranking/selection criteria developed in step 1. • Reprioritize projects based on financial constraints • Identify needed changes and/or additions to ITS architecture based on selected project list	Final list of prioritized ITS projects, based on fiscal constraints Update the ITS Architecture to reflect changes based on final list of prioritized ITS projects. For projects not in ITS define full architecture inputs, including stakeholders, service packages and data flows

As noted above the Anchorage region does not currently have an Operations/ITS Plan. An Operations/ITS Plan is closely related to the ITS Architecture but provides a program of specific deployments, system integration strategies and institutional activities related to Operations and ITS. The plan will identify specific corridors proposed for new or upgraded instrumentation, along with details on operating and maintenance responsibilities. A summary of costs and benefits is generally included which helps identify priorities for funding. Other key elements will include a summary of potential funding sources and institutional agreements and MOUs that may be needed. While such a plan is not a Federal or State requirement, many regional agencies have found such an effort to provide a number of benefits:

- Much like the ITS Architecture it helps bring a range of stakeholders together to discuss Operations/ITS issues. Law enforcement, emergency management and health care organizations are among the parties that may not ordinarily be active in transportation planning activities.

- It provides a forum and potential mechanism for coordination of Operations/ITS strategies between the DOTP&F and the Municipality. This includes both deployment of equipment and operating strategies.

- It provides a separate needs analysis related to Operations and ITS and in particular can help identify strategies that may be used to defer the need for higher-cost capital projects.

- Operations and ITS do not usually have high visibility with decision makers or the public. The Operations/ITS Plan can provide quantitative estimates of benefit and cost that can be used to educate the public and decision makers about Operations and ITS.

It is important that the Operations/ITS plan be coordinated closely with the MTP, CMP and other planning activities, in a manner similar to that described in this document. Please note that the Operations/ITS Plan would embody the step in Figures A.1 through A.3 labeled "Systematic process to develop and select M&O strategies to meet objectives". Such plans are usually relatively modest in cost but do require a strong stakeholder outreach program in order to be effective.

Also key are institutional arrangements to assure that the proposed coordinating activities take place. These include:

- Establishing clear ownership and responsibility for making changes to the ITS Architecture

- Establishing contact personnel for each key stakeholder organization and making sure that this position continues to be filled through personnel changes

- Identification of the ITS owner at the beginning of the CMP and MTP process and continued contact to make sure that individual or designate participates in key planning activities

- Availability of updated ITS Architecture documents on shared system

- Inclusion of ITS Architecture coordination in the scope and work plans for the CMP and MTP with adequate budget attached

- Availability of ITS and Operations tools and expertise in their use with TOPS-BC capability as a minimum
- To the extent possible, standard form that can be used to submit changes to ITS Architecture owner, including:
  - Project description
  - Proposed technology
  - Geographic scope
  - Key stakeholders and their roles
  - Sources and receivers of system data
  - Linkages to other systems

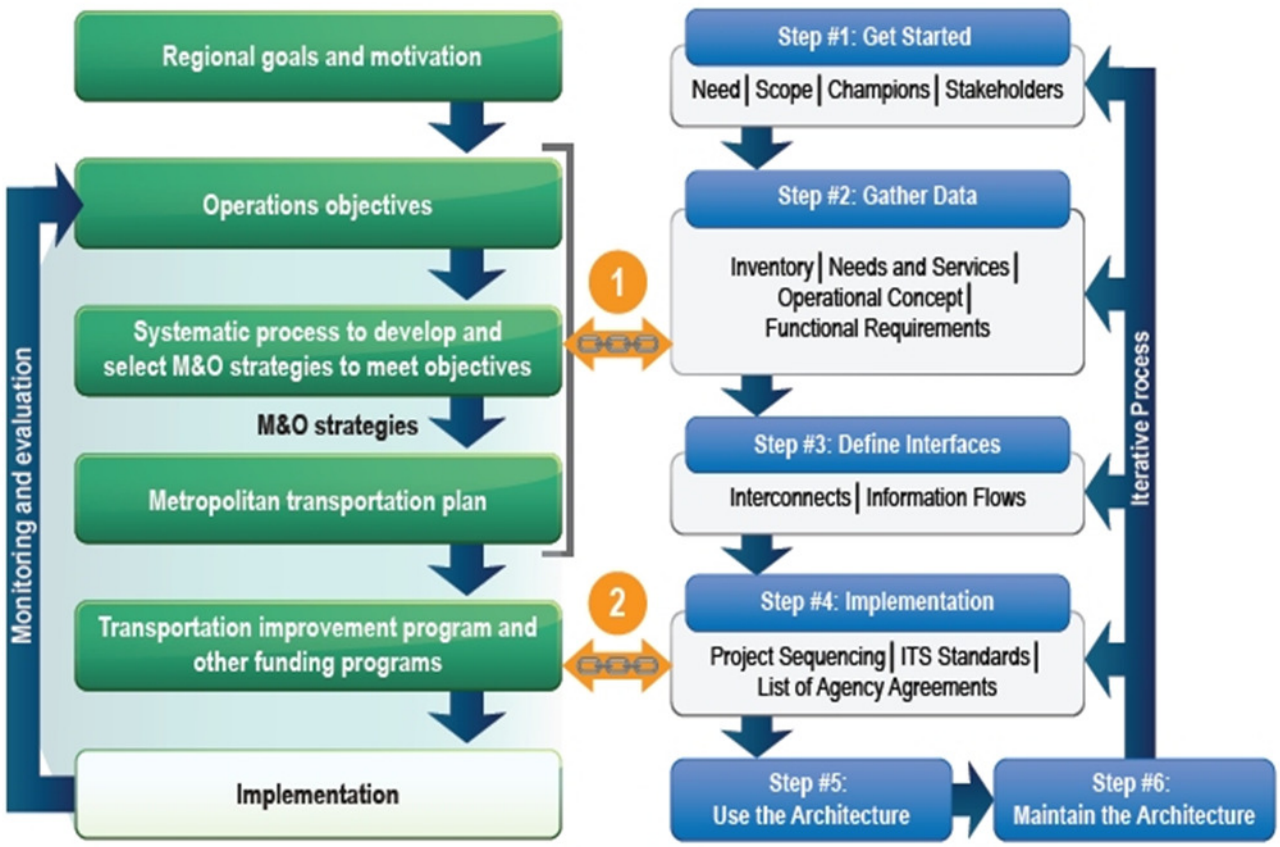
It should be noted that all changes do not have to be made dynamically but can be part of periodic updates.

A.4 Flow Charts

Several flow charts are included below that document the linkages between planning and ITS architecture as presented by FHWA.

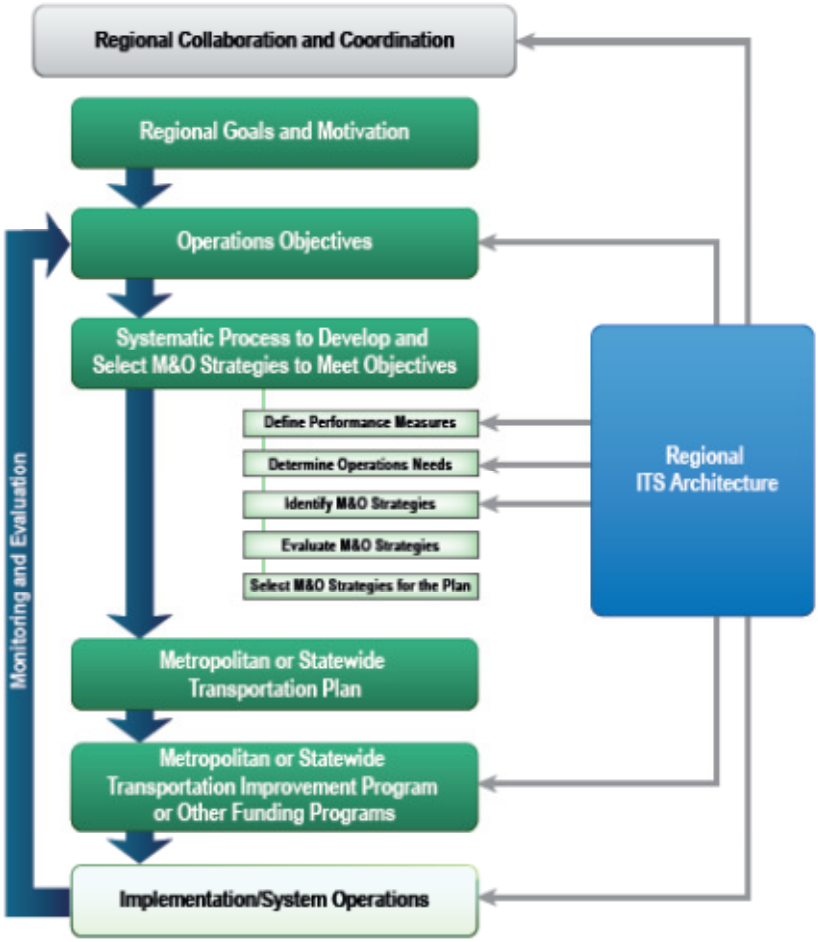
Figure A.2 shows parallel tracks of ITS Architecture development alongside the development process for a Metropolitan Transportation Plan. Figure A.3 shows FHWA's intent on how the ITS architecture can link to both Operations Planning and Regional Planning efforts. Figure A.4 documents the Congestion Management Process and while it does note directly include ITS Architecture, the M&O process on the right side of the diagram can be considered to include it. As noted above, the Operations/ITS Plan could embody the step in Figures A.2 through A.4 labeled "Systematic process to develop and select M&O strategies to meet objectives".

Figure A.2 MTP and ITS Architecture Process



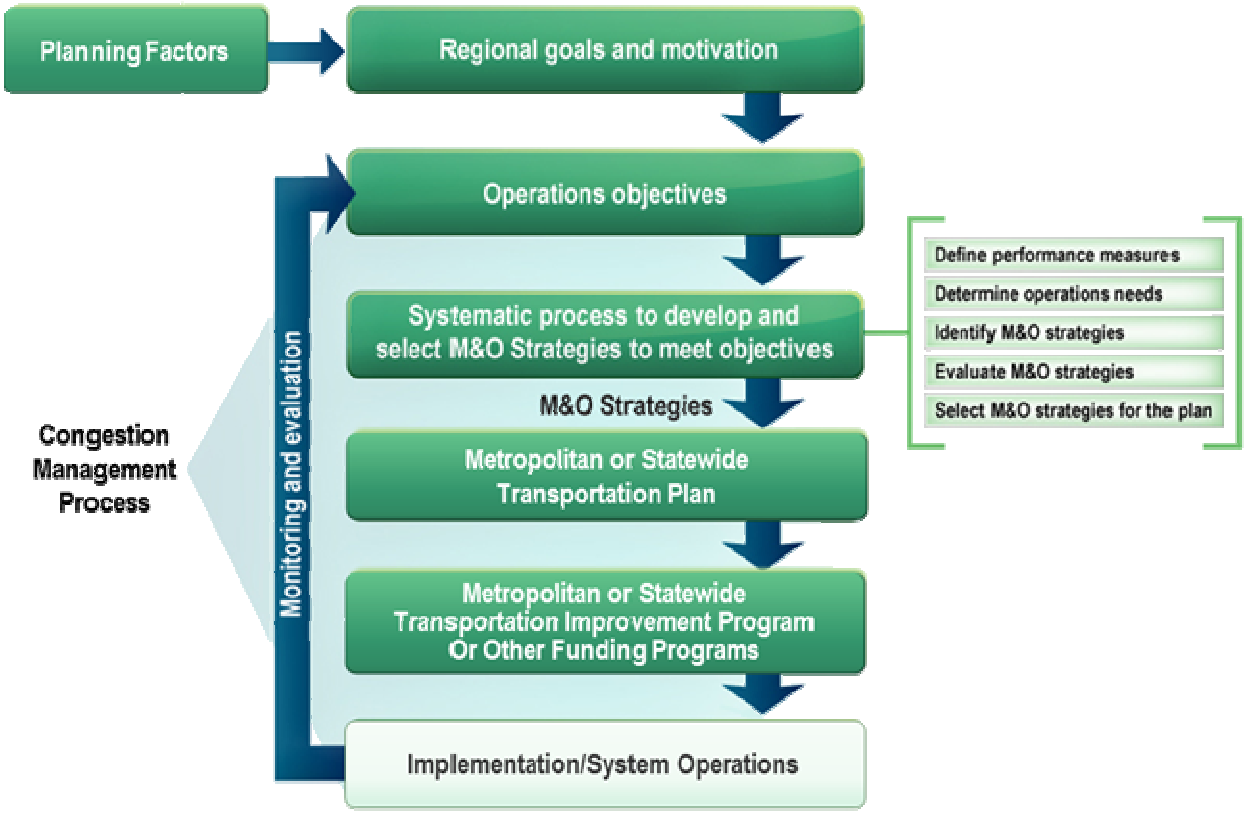
Source: FHWA Planning for Operations Manual.

Figure A.3 Use of Regional ITS Architecture in Planning for Operations



Source: Turbo Architecture web site.

Figure A.4 Congestion Management Process



Source: FHWA Planning for Operations.

Appendix B. CMP Project Analysis Form

Applicant Information

Agency Name: Click here to enter text.

Agency Address: Click here to enter text.

Person Submitting Form: Click here to enter text.

Email: Click here to enter text.

Telephone Number: Click here to enter text.

Date: Click here to enter a date.

Preliminary Questions

This section is REQUIRED to be completed for ALL projects.

1. Describe the proposed improvement (Facility, Limits, Project Description).

Click here to enter text.

2. Does the project address a safety or bottleneck problem?

☐ Yes ☐ No

If yes, please explain. Click here to enter text.

If "yes", the project is exempt from further CMP analysis; stop and submit form to AMATS. If "no", continue to next question.

3. **Is an Environmental Assessment (EA) or Environmental Impact Statement (EIS) required for the project?**

☐ Yes ☐ No

If "yes", complete the CMP Analysis for Major Investments section (Questions 6-12). If "no", continue to the next question.

4. **Is the project located on the CMP Network?**

☐ Yes ☐ No

If "yes", continue to the next question. If "no", complete *CMP Analysis for Other Investments* section (Questions 13-15).

5. **Does the project add significant single occupancy vehicle (SOV) roadway capacity?**

☐ Yes ☐ No

If yes, please explain. Click here to enter text.

If "yes", complete CMP Analysis for Major Investments section (Questions 6-12). If "no", complete CMP Analysis for Other Investments section (Questions 13-15).

CMP Analysis for Major Investments

This section is to be completed for projects requiring an EA/EIS, or for significant SOV capacity-adding projects located on the CMP Network.

6. Are there other congestion mitigation projects (e.g., transportation demand management, land use, public transportation, ITS and operations, pricing, bicycle and pedestrian, and bottleneck relief) within the project corridor that are programmed into the current TIP?

☐ Yes ☐ No

If yes, identify the project name(s), and TIP project identification number.

Project Name	Click here to enter text.	TIP Project #	Click here to enter text.
Project Name	Click here to enter text.	MPO Project #	Click here to enter text.
Project Name	Click here to enter text.	MPO Project #	Click here to enter text.

7. Using the CMP and Status of the System Reports, is the corridor identified as congested?

☐ Yes ☐ No

If yes, please explain the project's interaction with the corridor?

Click here to enter text.

8. **Can the problem/deficiency be addressed without building more road capacity?**

Click here to enter text.

9. **Describe any congestion mitigation alternatives to the proposed improvement that have been considered or will be evaluated to correct the**

deficiencies and manage the facility effectively (or facilitate its management in the future).

Click here to enter text.

10. **Specify congestion mitigation strategies that will be implemented as part of the project.**

    Click here to enter text.

11. **How will the implemented strategies reduce specific congestion impacts?**

    Click here to enter text.

12. **If not implementing a congestion mitigation strategy, please explain reason.**

    Click here to enter text.

Stop and submit completed form to AMATS.

CMP Analysis for Other Investments

This section is to be completed for other investment types, or for capacity-adding projects that are not located on the CMP Network.

13. What type(s) of congestion management strategy(ies) is encompassed by the project/program according to the following strategy types:

- ☐ Transportation Demand Management Improvements
- ☐ Land Use Improvements
- ☐ Public Transportation Improvements
- ☐ Bicycle/Pedestrian Improvements
- ☐ Intelligent Transportation Systems (ITS) and Operations Strategies
- ☐ Roadway/Mobility (Non-ITS) Improvements
- ☐ Roadway Capacity Expansion (Off the CMP Network)

14. Complete the following qualitative criteria for the strategy type(s) encompassed by the project/program:

Transportation Demand Management Strategies

- Does the project strongly support or enhance travel demand management programs that are already in place and that have regional significance?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Will the project reduce traffic congestion by reducing vehicle trips or VMT?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Will the project reduce vehicle emissions? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project include marketing, education and incentive programs that encourage shift to alternative modes? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

Land Use Improvements

- Does the project provide or demonstrate the potential for a transit connection? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project provide an accessible pedestrian/bicyclist environment that meets or exceeds local policies for Bicycle and Pedestrian Accommodation?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

Public Transportation Improvements

- Does the project provide connection to other transit services?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project include pedestrian and bicycle accommodations?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Is the project an intrinsic part or demonstrate the potential for Transit Oriented Development? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project provide access to job opportunities, unmet or enhanced needs? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project use intelligent transportation systems and other operation/ service enhancing technologies? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project address a need for expanded transit service capacity?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

Bicycle/Pedestrian Improvements

- Does the proposed facility meet or exceed local policies for Bicycle and Pedestrian Accommodation and AASHTO design guidelines for pedestrian and/or bicycle facilities? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the proposed facility provide safe and convenient routes across barriers, such as freeways, railroads, and waterways, or does it close a gap in the existing bicycle network? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the proposed facility provide or demonstrate the potential for a transit connection? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the proposed facility provide connections to regional destinations?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

Intelligent Transportation Systems (ITS) and Operations Strategies

- Will the project contribute to a reduction in incident clearance time? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project coordinate traffic signal systems and improve progression?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project improve accuracy, timeliness, and availability of real-time information to the public? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project improve automated traffic data collection and archiving ability? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Will the project give priority to emergency vehicles, transit, or high-occupancy vehicles? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Is the project consistent with the Regional ITS Architecture?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

Roadway/Mobility Improvements (Non-ITS)

- Will the project improve operational efficiency/reliability on a designated freight corridor? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Will the project improve a roadway on which fixed route transit service is being provided or otherwise used by other transit services outside of a fixed route service area? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project incorporate access management principles such as raised medians, turn lanes, sharing/combining access points between businesses, or innovative intersections to reduce conflict points (e.g., roundabout, diverging diamond, single point urban interchange, etc.)? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project include pedestrian/bicycle accommodations that meet or exceed local policies for Bicycle and Pedestrian Accommodation and AASHTO design guidelines? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project integrate complete streets design principles?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

Roadway Capacity Expansion (Capacity-adding projects that are not located on the CMP Network)

- Does the project include segments of high congestion, and will the project help to mitigate this congestion? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project provide access to existing and/or future business and job activity centers, shopping, educational, cultural, and recreational opportunities? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Will the project complete a link to intermodal or freight facilities of regional importance? ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

- Does the project impact a network-level change in congestion?
  ☐ Yes ☐ No
  If yes, please explain. Click here to enter text.

15. **What are the specific congestion reduction impacts of the implemented strategies?**

    Click here to enter text.

Stop and submit completed form to AMATS.

Appendix C. Instructions to Fill CMP Project Analysis Form

Applicant Information

Provide agency name, address, and contact information for person submitting the CMP Project Analysis Form.

Preliminary Questions

This section is REQUIRED to be completed for ALL projects.

1. **Describe the proposed improvement (Facility, Limits, Project Description).**

   Specify the location of the proposed project, project limits, and description of the proposed improvement.

2. **Does the project address a safety or bottleneck problem? If yes, please explain.**

   Project sponsors must confirm with AMATS staff that a safety or bottleneck issue exists. If "yes", the project is exempt from further CMP analysis. If "no", continue to next question.

3. **Is an Environmental Assessment (EA) or Environmental Impact Statement (EIS) required for the project?**

   Determine whether an Environment Assessment (EA) or Environmental Impact Statement (EIS) is required for the project. If "yes", complete the *CMP Analysis for Major Investments* section. If "no", continue to the next question.

4. **Is the project located on the CMP Network? If yes, please explain.**

   Check the CMP Network maps and segment list in the CMP Report. If "yes" continue to the next question. If "no", complete *CMP Analysis for Other Investments* section.

5. **Does the project add significant Single Occupancy Vehicle (SOV) roadway capacity? If yes, please explain.**

   Significant SOV capacity-adding projects impact regional or corridor travel patterns. Project descriptions typically include a new roadway or bypass, major or minor road widening to add additional through lanes on an existing highway, major roadway reconstruction, adding capacity to a corridor by improving many related intersections, new interchange, adding capacity to an existing interchange, grade separation of existing intersections (that add capacity), etc. If "yes", provide a brief explanation and complete *CMP Analysis for Major Investments* section. If "no", complete *CMP Analysis for Other Investments* section.

CMP Analysis for Major Investments

This section is to be completed for projects requiring an EA/EIS, or for significant SOV capacity-adding projects located on the CMP Network.

6. Are there other congestion mitigation projects (e.g., transportation demand management, land use, public transportation, ITS and operations, pricing, bicycle and pedestrian, and bottleneck relief) within the project corridor that are programmed into the current TIP?

Check project list in AMATS current TIP to identify committed projects. If "yes", identify the project name(s), description of improvement, and TIP project number.

7. Using the CMP and Status of the System Reports, is the corridor identified as congested? If so, which performance areas?

See congestion analysis section of the CMP and Status of the System Reports to identify performance areas of deficiency or in need of improvement.

8. Can the problem/deficiency be addressed without building more road capacity?

Using simulation or other appropriate analysis tool from the CMP Toolbox, conduct an alternatives analysis to determine whether the problem/deficiency can be addressed without building more road capacity.

9. Describe any congestion mitigation alternatives to the proposed improvement that have been considered or will be evaluated to correct the deficiencies and manage the facility effectively (or facilitate its management in the future).

Using the CMP Toolbox or other available resources, identify corridor-level congestion mitigation strategies that will be evaluated to address the problems and deficiencies in the corridor. Consider strategies as an alternative to the added capacity project, and/or bundle congestion mitigation strategies into the added capacity project. Using simulation or other appropriate analysis tool from the CMP Toolbox, conduct an evaluation of the actions to assess the extent to which these actions can alleviate travel demand and congestion in the corridor compared to the baseline condition.

10. Specify congestion mitigation strategies that will be implemented as part of the project.

Identify which congestion mitigation strategies will be implemented as part of the project.

11. How will the implemented strategies reduce specific congestion impacts?

Based on the results of the CMP analysis, quantitatively document the benefits of the project's ability to relieve congestion, improve trip reliability, and/or how it meets one or more of the CMP goals and objectives. Benefits should be documented in terms of specific CMP performance measures when possible.

12. If not implementing a congestion mitigation strategy, please explain reason.

Include an explanation that highlights the reason why no congestion mitigation strategies are feasible or warranted as part of the project.

CMP Analysis for Other Investments

This section is to be completed for other investment types, or for capacity-adding projects that are not located on the CMP Network.

13. What type(s) of congestion management strategy(ies) is encompassed by the project/program according to the following strategy types:

Identify the type of congestion management strategy(ies) encompassed by the project/Program according to the following types: Transportation Demand Management, Land Use, Public Transportation, Bicycle/Pedestrian, Intelligent Transportation Systems (ITS) and Operations, Roadway/Mobility (Non-ITS), or Roadway Capacity Expansion (off the CMP Network).

14. Complete the following qualitative criteria for the strategy type(s) encompassed by the project/program:

Answer the questions for the strategy type(s) identified above.

Transportation Demand Management Strategies

- Does the project strongly support or enhance travel demand management programs that are already in place and that have regional significance? If yes, please explain.
- Will the project reduce traffic congestion by reducing vehicle trips or VMT? If yes, please explain.
- Will the project reduce vehicle emissions? If yes, please explain.
- Does the project include marketing, education and incentive programs that encourage shift to alternative modes? If yes, please explain.

Land Use Improvements

- Does the project provide or demonstrate the potential for a transit connection? If yes, please explain.

- Does the project provide an accessible pedestrian/bicyclist environment that meets or exceeds local policies for Bicycle and Pedestrian Accommodation (revise with AMATS which policies could apply)? If yes, please explain.

Public Transportation Improvements

- Does the project provide connection to other transit services? If yes, please explain.
- Does the project include pedestrian and bicycle accommodations? If yes, please explain.
- Is the project an intrinsic part or demonstrate the potential for Transit Oriented Development? If yes, please explain.
- Does the project provide access to job opportunities, unmet or enhanced needs? If yes, please explain.
- Does the project use intelligent transportation systems and other operation/ service enhancing technologies? If yes, please explain.
- Does the project address a need for expanded transit service capacity? If yes, please explain.

Bicycle/Pedestrian Improvements

- Does the proposed facility meet or exceed local policies for Bicycle and Pedestrian Accommodation (revise with AMATS which policies could apply) and AASHTO design guidelines for pedestrian and/or bicycle facilities? If yes, please explain.
- Does the proposed facility provide safe and convenient routes across barriers, such as freeways, railroads, and waterways, or does it close a gap in the existing bicycle network? If yes, please explain.
- Does the proposed facility provide or demonstrate the potential for a transit connection? If yes, please explain.
- Does the proposed facility provide connections to regional destinations? If yes, please explain.

Intelligent Transportation Systems (ITS) and Operations Strategies

- Will the project contribute to a reduction in incident clearance time? If yes, please explain.
- Does the project coordinate traffic signal systems and improve progression? If yes, please explain.

- Does the project improve accuracy, timeliness, and availability of real-time information to the public? If yes, please explain.
- Does the project improve automated traffic data collection and archiving ability? If yes, please explain.
- Will the project give priority to emergency vehicles, transit, or high-occupancy vehicles? If yes, please explain.
- Is the project consistent with the Regional ITS Architecture? If yes, please explain.

Roadway/Mobility Improvements (Non-ITS)

- Will the project improve operational efficiency/reliability on a designated freight corridor? If yes, please explain.
- Will the project improve a roadway on which fixed route transit service is being provided or otherwise used by other transit services outside of a fixed route service area? If yes, please explain.
- Does the project incorporate access management principles such as raised medians, turn lanes, sharing/combining access points between businesses, or innovative intersections to reduce conflict points (e.g., roundabout, diverging diamond, single point urban interchange, etc.)? If yes, please explain.
- Does the project include pedestrian/bicycle accommodations that meet or exceed local policies for Bicycle and Pedestrian Accommodation (revise with AMATS which policies could apply) and AASHTO design guidelines? If yes, please explain.
- Does the project integrate complete streets design principles? If yes, please explain.

Roadway Capacity Expansion (Capacity-adding projects that are not located on the CMP Network)

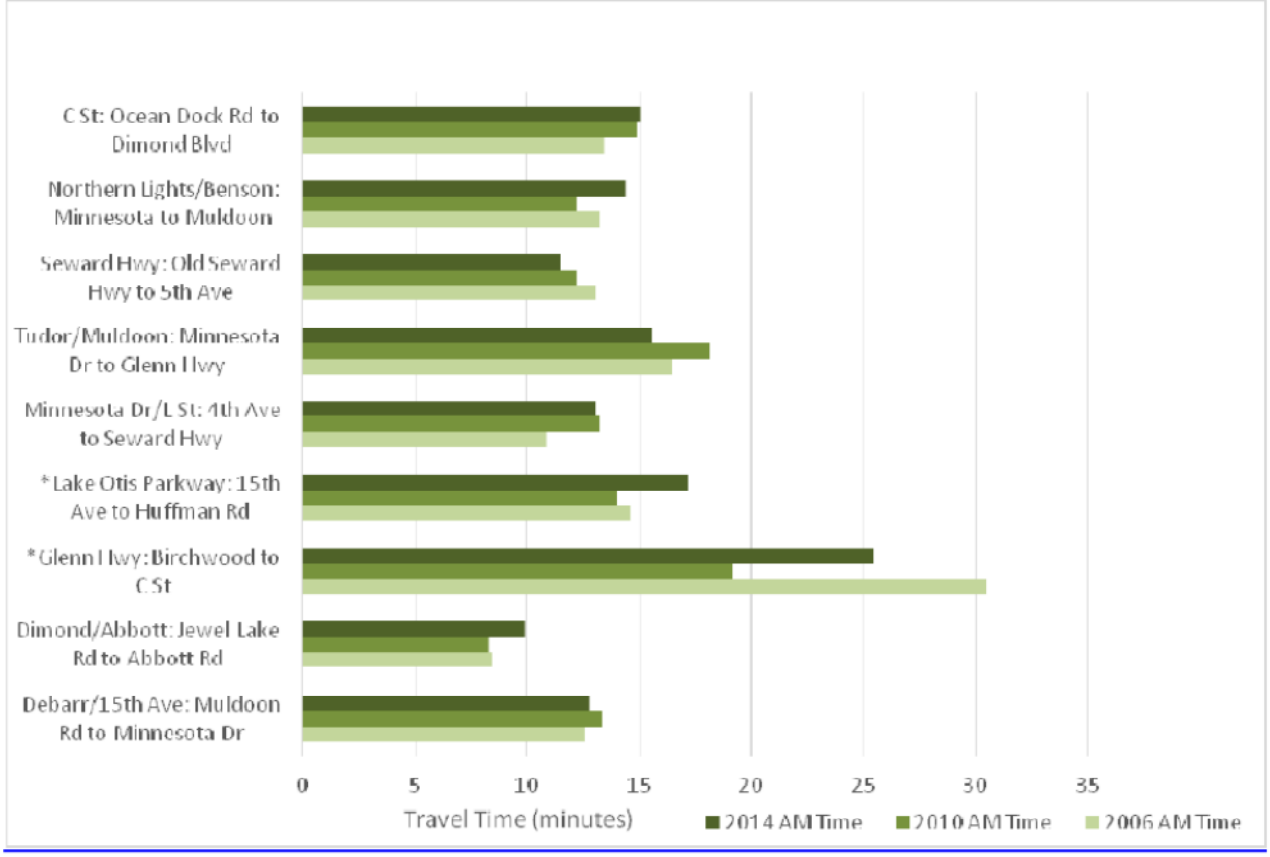
- Does the project include segments of high congestion, and will the project help to mitigate this congestion? If yes, please explain.
- Does the project provide access to existing and/or future business and job activity centers, shopping, educational, cultural, and recreational opportunities? If yes, please explain.
- Will the project complete a link to intermodal or freight facilities of regional importance? If yes, please explain.
- Does the project impact a network-level change in congestion? If yes, please explain.

15. What are the general congestion reduction impacts of the implemented strategies?

Qualitatively document the benefits of the project's ability to relieve congestion, improve trip reliability, and/or how it meets one or more of the CMP goals and objectives. Specific CMP performance measures should be used for documenting benefits when possible. Quantitative impacts may also be reported if desired (i.e., using analysis tools from the CMP Toolbox or other methods as appropriate to conduct an evaluation of project benefits).

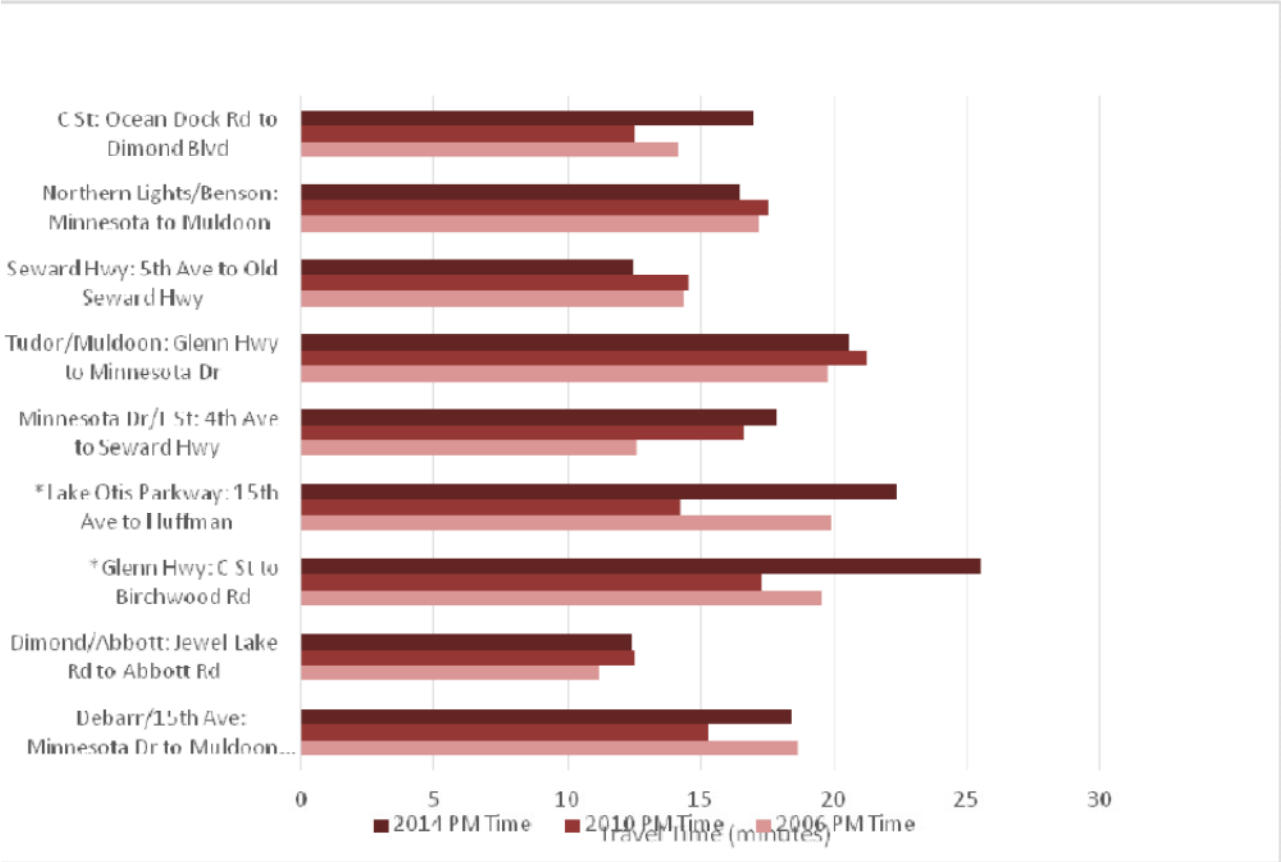
Appendix D. Travel Times for Complete Corridors

Figure D.1 AM Peak Period Travel Times: 2006, 2009, 2013



*Note: This graph shows a larger corridor than the one used in previous Status of the System reports. For future corridor comparisons, this data should be compared.

Figure D.2 PM Peak Period Travel Times: 2006, 2009, 2013



*Note: This graph shows a larger corridor than the one used in previous Status of the System reports. For future corridor comparisons, this data should be compared.