NASHUA REGIONAL PLANNING COMMISSION

CONGESTION MANAGEMENT PROCESS

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INTRODUCTION

Traffic congestion can be a daily frustration for many travelers in the Nashua region, having negative impacts on the economic vitality of the area, the quality of life of its residents and the environment. The Congestion Management Process (CMP) is a planning and project programming tool that aids in the effective management of the transportation system through development and implementation of operational and travel demand management strategies. It also provides system performance information to decision-makers to assess the effectiveness of implemented strategies as well as identify system investment priorities. This Nashua Regional Planning Commission (NRPC) CMP includes the following:

1. The identified congestion management objectives for the region.
2. The established geographic area for which the CMP will apply.
3. A defined transportation system.
4. An established set of performance measures to evaluate the existing system and the outcomes of future improvements.
5. A Performance Monitoring Plan.
6. A set of potential strategies to utilize in the region to mitigate congestion.

The Need for a Congestion Management Process

As the region continues to grow, managing congestion will remain an important goal for the NRPC's Long Range Transportation Plan (LRTP), especially given limited financial resources and the inherent difficulties in expanding the roadway network. As demand and operational management strategies are implemented to address congestion problems, it becomes increasingly important to document these strategies in a structured process to ensure the effectiveness if the investments in the transportation system. The CMP is the tool for documenting this process and connecting the Long Range planning goals of the region to short range project implementation. The benefits of an ongoing CMP include:

- Efficient use of limited federal transportation funds to help the region increase system efficiency, reduce congestion, and improve air quality.
- Improving the effectiveness of each mode of transportation and strengthening the transportation, land use, economic development, and environmental planning connections.
- Encouraging participation and coordination between a wide range of stakeholders to improve data collection and system monitoring, and prioritize CMP projects in the LRTP and Transportation Improvement Program (TIP).
- Regular monitoring and evaluation of system performance.
- Monitoring the effectiveness of strategies to address congestion in the region.

Congestion Management Process Background and Requirements

Congestion Management Systems (CMS) were first mandated in 1991 as part of the Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA required state departments of transportation and Metropolitan Planning Organizations to implement a CMS with five other management systems (intermodal, public transportation, safety, pavement, and bridge). In 1995, the National Highway System Designation Act made all of the management systems optional at the state level. However, the metropolitan planning provisions of ISTEA continued to require that all Transportation Management Areas (TMAs) with a population in excess of 200,000 maintain a CMS as part of their planning process. This stipulation continued in the subsequent Transportation Equity Act for the 21st Century (TEA-21) adopted in 1998.

The current surface transportation law, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), enacted August 10, 2005, requires that metropolitan transportation planning processes include a Congestion Management Process (CMP), similar to the CMS requirements under the previous federal transportation bills. As laid out in federal regulations, SAFETEA-LU requirements under Subsection C - Metropolitan Transportation Planning and Programming state:

> "The transportation planning process in a TMA shall address congestion management through a process that provides for safe and effective integrated management and operation of the multimodal transportation system, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities eligible for funding under title 23 U.S.C. and title 49 U.S.C. Chapter 53 through the use of travel demand reduction and operational management strategies."[23 CFR § 450.320(a)]

Aside from the change in name from a "System" to a "Process", the requirements have not changed substantially under SAFETEA-LU, which intends the CMP as an integrated process that augments the overall metropolitan planning process. The goal is a systematic, transparent way for transportation planning agencies to identify and manage congestion, and utilize performance measures to direct funding toward projects and strategies that are most effective for addressing congestion.

The NRPC Long Range Transportation Plan must consider the results of the Congestion Management Process including the identification of single occupancy vehicle (SOV) projects because there are portions of two NRPC member communities, Pelham and Hudson, that are part of the larger Boston MA-NH-RI Urbanized Area. In addition, these communities are within the Southeast New Hampshire 8-hour Ozone Nonattainment Area. Consideration needs to be given to strategies that manage demand, reduce SOV travel, and improve transportation system management and operations. The Congestion Management Process should result in multimodal system performance measures and strategies that can be utilized in the development of the metropolitan transportation plan and reflected in the Transportation Improvement Program.

According to the provisions in SAFETEA-LU, this Congestion Management Process should include:

- Methods to monitor and evaluate the performance of the multimodal transportation system, identify the causes of recurring and non-recurring congestion, identify and evaluate alternative strategies, provide information supporting the implementation of actions, and evaluate the effectiveness of implemented actions.
- Definitions of congestion management objectives and appropriate performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods. Performance measures should be established cooperatively by State, Metropolitan Planning Organization (MPO) and local officials - in consultation with operators of major modes of transportation.
- Establishment of a coordinated program for data collection and system performance monitoring to define the extent and duration of congestion. This data collection program should be coordinated with existing data sources like a Transportation Management Center (TMC).
- Identification and evaluation of the anticipated performance and expected benefits.
- Development of an implementation schedule, along with information on implementation responsibility and possible funding sources for each strategy.

- Implementation of a process for periodic assessment of the effectiveness of implemented strategies. The results of this assessment should be provided to decision makers and the public to provide guidance for future strategy selection.

Goals and Objectives of the Congestion Management Process

The overarching goal of the NRPC Congestion Management Process is to identify and measure current and expected transportation system congestion through data collection, travel demand modeling, and capacity analysis, and to utilize that information to aid decision-making regarding project priorities for the region. This is consistent with the transportation goals specified in the Long Range Transportation Plan, which has direct application to the content and intent of the Congestion Management Process:

Long Range Transportation Plan Goals and Objectives

1. New highways and new road connections should establish shorter routes to cross natural boundaries, **relieve traffic congestion**, and create a logical progression in increasing the connectivity of the existing road network. The road network should provide for the **most efficient circulation of vehicles**. Response time for fire apparatus and emergency vehicles at the local and regional level should be reduced through improvements in the road network. The expansion of the road network should be achieved in ways that limit impacts to neighborhood cohesiveness, conserve open space (including woodlands and wetlands), and **encourage pedestrian and bicycle travel**. Consideration should be given to lessen the impact of secondary growth due to new highways, which in turn can lead to the re-emergence of traffic congestion.
2. Promote transportation demand management practices and the development of a transportation management association to **relieve traffic congestion and increase circulation and efficiency in the existing highway network**.
3. Encourage the use of access management techniques in commercial highway corridors to **preserve capacity**, increase safety, and improve the aesthetic environment. Support and encourage the redesign of areas and highway corridors that have experienced strip mall development so that they can **better accommodate bicycle, pedestrian, and transit use.**
4. Encourage transportation improvements in urban centers and town centers away from the urban fringe to **improve transportation efficiency**. **Improve convenience and service, and therefore the ridership, of the transit syst**em through the targeting of segments of the market that are not currently part of Citybus patronage. Promote the **extension of transit service** to urbanized areas in the towns and the **expansion of sidewalk and pedestrian facilities** in town centers.
5. Encourage multi-modal use and the integration of alternative modes, coordinated with land use and zoning practices **that reduce dependency on the automobile** and **encourage pedestrian oriented and transit oriented development**.
6. Encourage local planning that supports an efficient and cost effective transportation system including the development of site review regulations that encourage access management techniques and the **inter-connection between sites and the accommodation of cars, bicycles, and pedestrians**.
7. Establish inter-city transit connections including **passenger rail service**.
8. Promote access to transportation for the under-served and include plans and projects that **ensure that the needs of transit users, bicyclists, and pedestrians are met**. Promote plans and projects that link the jobless with jobs on a regional level. Improve the safety and quality of life in low-income areas and minority

neighborhoods by **reducing traffic congestion and implementing traffic calming techniques**.

9. Encourage public/private sector partnerships and private sector participation in the financing of transportation projects and services. Establish a transportation system that provides for orderly economic growth while preserving the environmental and cultural resources of the region.

These goals provide guidance in the development of the objectives, performance measures, and strategies that form a link between the LRTP and the CMP.

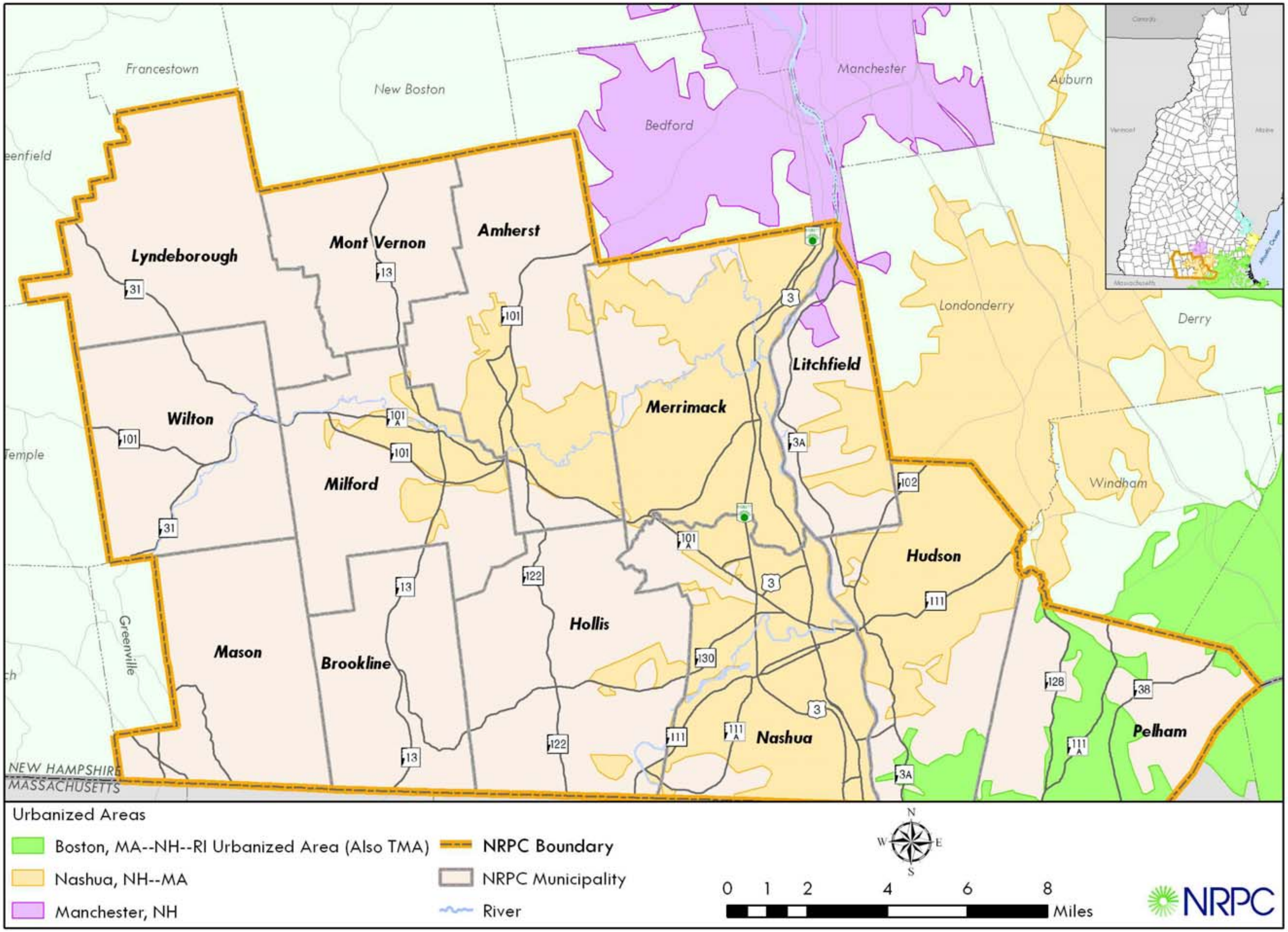
For the purposes of the CMP, the goals in the Long Range Plan must be modified to be more specific and detailed to track progress in meeting them over different timeframes (daily, annual), different scales (regional, corridor), by various modes (highway, freight, transit), as well as from both the facility perspective (volume to capacity ratio and level of service) and the user experience perspective (travel time, delay, and reliability). As this is the first work on a CMP for the NRPC region (and in New Hampshire), the current set of objectives is primarily focused on the establishment of the data collection and monitoring program and coordination with other MPO and statewide processes. The objectives of the CMP are:

- **Objective 1: A robust data collection process:** Develop and annually update travel time data and traffic volumes for each of the corridors included in the CMP for at least one peak period.
- **Objective 2: Coordinated data collection**: Integrate CMP data collection efforts with the efforts of New Hampshire Department of Transportation (NH DOT) and other NH MPOs by 2015.
- **Objective 3: Comprehensive analysis, monitoring and reporting:** Produce biennial CMP report that details data collection and analysis efforts, performance of CMP corridors and the details of any projects for all modes.
- **Objective 4: Implement congestion mitigation recommendations:** Integrate the CMP into the project development and prioritization process of the MPO for the 2012 LRTP and TIP updates.

GEOGRAPHIC COVERAGE AREA

Technically, the NRPC Congestion Management Process could include just Hudson and Pelham, which are the only NRPC communities within the Boston, MA-NH-RI Urbanized Area (see Figure 1). It is expected that the results of the 2010 Census will expand the Boston, MA-NH-RI Urbanized Area to include additional NRPC communities and potentially merge with neighboring urbanized areas. For that reason, NRPC has developed a CMP framework and toolbox that can be applied to all 13 communities within the Nashua Regional Planning Commission MPO planning area.

Figure 1: Geographic Coverage Area



SYSTEM DEFINITION

Interstate Highways, the Turnpike System, and other Principal Arterials form the backbone of transportation routes that carry the majority of long distance travel within the region as well as to and from adjacent regions. These routes carry the highest volumes of people and goods between the communities and the regional employment and other activity centers. These roadways in the NRPC are:

- ***F.E.. Everett Turnpike/US 3*** is a toll facility that bisects the region running north-south between Massachusetts and points north. The route serves as a major commuter transport corridor in the region, as well as handling year round tourist traffic between southern and northern New England. Because of the tourist traffic, volumes on the roadway vary significantly by time of year.

- ***NH 101*** is the primary east-west highway for the communities in the western half of the NRPC region. The eastern third of the corridor through the town of Amherst is primarily a two lane arterial that carries commuter traffic to Manchester and the FE Everett Turnpike. The middle third of the corridor is known as the NH 101 Bypass. This upgraded section of the corridor is a limited access highway. The Bypass begins at NH 101A in Milford and carries east west traffic around Downtown Milford. The Bypass was constructed to address safety and congestion in the Milford Downtown area. The western third of the corridor transitions back to a two lane arterial with limited development through Wilton to the Temple line.

- ***NH 101A*** is a principal east-west arterial connecting Nashua and the FE Everett Turnpike with points west and north. It serves as the primary commuter route for residents living in Amherst, Milford, Wilton, Mont Vernon and Lyndeborough. The eastern two thirds of the corridor has succumbed to extreme development pressure and as such, experiences high volumes of traffic due to multiple retail and commercial destinations located along the corridor. The western third of the corridor runs through Downtown Milford and includes the Milford Oval which introduces conflicting traffic flow. NH 101A is scheduled to be improved between Celina Avenue and Somerset Parkway in Nashua by widening the corridor to a consistent 3 lane cross section and completing a series of intersection improvements. Additional improvements to intersections and road segments in Merrimack, Amherst and Milford are also anticipated.

- ***NH 3A*** is a north-south arterial that parallels the Merrimack River and carries traffic from Massachusetts through Hudson and Litchfield where it exits the NRPC region. The roadway intersects with NH 111 and NH 102 in the center of Hudson. Except for short four lane sections in Hudson near the Sagamore Bridge it is primarily a two lane roadway. This roadway is unique in that it collects virtually all westbound traffic originating east of the Merrimack River destined for the FE Everett Turnpike or Downtown Nashua. This results in high traffic volumes along segments of the corridor that intersect with the two river crossings, the Sagamore Bridge and Taylor Falls Bridge. A portion of the NH 3A corridor in Hudson is located within the Boston TMA.

- ***US 3/Daniel Webster Highway.*** The southern portion of US 3 from the Massachusetts border to Exit 7 is part of the FE Everett Turnpike system. At Exit 7, US 3 deviates from the Turnpike, following the Henry Burque Highway where it eventually intersects with and becomes the Daniel Webster Highway in North Nashua. The DW Highway is a moderately developed two to four lane roadway for most of its length that provides north-south travel parallel to the FE Everett Turnpike. It provides local connections to the town of Merrimack; connections to the FE Everett Turnpike at Exits 10, 11 and 12; and will provide access to the Manchester Airport via the planned access road scheduled to open in 2012 just north of the Merrimack town line in Bedford, NH.

- ***NH 13*** is a north-south arterial running the entire length of the region from the Brookline town line in the south through Milford and Mont Vernon to the north. It provides a connection to NH 101 and NH 101A, the primary east-west corridors in the region.

- ***NH 122*** is a north south arterial running from the Massachusetts border in Hollis north to NH 101 in Amherst. It intersect NH 130 in Hollis forming the for corners intersection near the Hollis Town Center.

- ***NH 130*** is an east west arterial running from the center of Brookline to through Hollis where it intersects with NH 122 forming the four corners intersection. Continuing east, NH 130 provides a connection to the FEE Turnpike at Exit 6 in Nashua.

- ***NH 102*** provides a connection between Hudson where it intersects with NH 111 and NH 3A near the center of town and I-93 in Derry. It serves commuters seeking to access intercity bus facilities located at Exit 4 of I-93 in Londonderry. It also serves commuters from portions of Hudson and Litchfield seeking to access the FEE Turnpike and Downtown Nashua.

- ***NH 128*** serves as a commuter route for residents of Pelham and Hudson destined for Lowell MA. It also intersects with NH111 just outside of the region in Windham, NH providing connection to I-93. A portion of the NH 128 Corridor is located within the Boston TMA

- ***NH 38*** is a two lane roadway that runs between the Massachusetts border in Pelham and Salem, NH, where it serves commuters, commercial traffic, and provides a connection to I-93.

- ***NH 111*** provides an additional east-west route through the NRPC region that connects the southwestern section of the region to Downtown Nashua, and continues east through Hudson to the NH Seacoast. This facility interconnects NH 102, NH 3A US 3/FEE Turnpike. The roadway has three distinct regions of heavy activity located around NH 102 and NH3A in Hudson, and Downtown Nashua and FEE Turnpike in Nashua.

IDENTIFYING AND DEFINING TRAFFIC CONGESTION

The U.S. Department of Transportation defines congestion as "*the level at which transportation system performance is no longer acceptable due to traffic interference*" and the Transportation Research Board defines congestion as "*travel time or delay in excess of that normally incurred under light or free-flow travel conditions*." However, determining exactly at what point delay becomes excessive or performance is "no longer acceptable", is dependent upon geographic location, type of transportation facility, and even time of day. On a basic level, congestion is easy to distinguish and define as you can observe stop and go traffic on the roadways, crowded sidewalks, and packed buses. For the purposes of the Congestion Management Process however, more explicit definitions are needed to delineate those locations with excessive congestion, track trends, and identify locations expected to become congested in the future. Previous experience and research has shown that congestion is the result of seven root causes[1], often interacting with one another:

- ***Physical Bottlenecks ("Capacity") –*** Capacity is the maximum amount of traffic capable of being handled by a given highway section. Capacity is determined by a number of factors: the number and width of lanes and shoulders; merge areas at interchanges; and roadway alignment (grades and curves).

- ***Traffic Incidents –*** Are events that disrupt the normal flow of traffic, usually by physical impedance in the travel lanes. Events such as vehicular crashes, breakdowns, and debris in travel lanes are the most common form of incidents.

- ***Work Zones –*** Are construction activities on the roadway that result in physical changes to the highway environment. These changes may include a reduction in the number or width of travel lanes, lane "shifts," lane diversions, reduction, or elimination of shoulders, and even temporary roadway closures.

[1] From "White Paper: The Congestion Management Process for State and Metropolitan Transportation Planning", Erin Flanigan, P.E., AASHTO, November, 2008. http://www.statewideplanning.org/_resources/242_NCHRP-08-36-76b.pdf

- ***Weather* –** Environmental conditions can lead to changes in driver behavior that affect traffic flow, such as slower traveling speeds and greater spacing of vehicles.
- ***Traffic Control Device* –** Intermittent disruption of traffic flow by control devices such as railroad grade crossings and poorly timed signals also contribute to congestion and travel time variability.
- ***Special Events* –** Are a special case of demand fluctuations whereby traffic flow in the vicinity of the event will be radically different from "typical" patterns. Special events occasionally cause "surges" in traffic demand that overwhelm the system.
- ***Fluctuations in Normal Traffic* –** Day-to-day variability in demand leads to some days with higher traffic volumes than others. Varying demand volumes superimposed on a system with fixed capacity also results in variable (i.e., unreliable) travel times.

Based on this information, a number of ways to define congestion related to automobile and transit travel in the region are offered. For the purposes of the Congestion Management Process these definitions are focused in three areas: Capacity Utilization, Recurring Congestion (daily peak period travel), and Non-Recurring Congestion (impacts of accidents and other unpredictable events).

Facility Type	Definition of Congestion
Roadway Segments	• Links with a Level of Service of E or F (Freeways) • Links with a Level of Service of E or F (Non-freeways) • Segments with travel times 1.5 times (or greater) than the free-flow travel time • Segments with high crash frequencies during peak periods that are greater than the regional average
Intersections	• Overall composite LOS of E or F • Intersections with crash frequencies during peak periods that are greater than the regional average
Transit	• Trips with 80% or more bus capacity utilized • Transit travel times 1.5 times (or greater) than free-flow transit travel time

APPLICABLE PERFORMANCE MEASURES

Performance measures are a qualitative or quantitative characteristic describing the quality of service provided by a transportation facility or service primarily from the user's point of view. Development of performance measures is important in the CMP as there needs to be consistency between the evaluation criteria and the associated data collection and analytical procedures that are selected to support them. In addition, for a measure to be useful supporting data must be readily available or easy to collect given limited resources. The CMP will be utilizing a limited set of performance measures that addresses how much capacity is being used, how much day-to-day congestion is experienced, and that provides insight into the impacts of non-recurring congestion from traffic accidents and other incidents. The following measures of transportation system performance are typical of those that may be utilized in the CMP for the NRPC Region.

Capacity Utilization Measures

- ***Vehicle Miles of Travel (VMT):*** This measure estimates what percentage of the capacity of a roadway is being utilized by traffic. It is calculated by multiplying the amount of vehicle travel on a designated roadway by the total mileage of that roadway.
- ***Roadway Volume to Capacity Ratio and Level of Service:*** The volume to capacity (v/c) ratio is a number between 0 and 2.00 that is derived by dividing the traffic volume on a road by the capacity of that roadway. In a standard engineering capacity analysis, a v/c ratio of 1.00 represents a road where the volume matches the capacity. As the number surpasses 1.00 and approaches 2.00, more congestion is indicated. The NRPC Regional Travel Demand Model has a slightly different scale where failure condition is indicated by a v/c ratio of 1.35 or greater as shown in the table below. Level of Service (LOS) applies an A to F "grade" to ranges of v/c ratios and equates them to vehicles moving along the roadway. LOS A is the equivalent to free flowing traffic while F indicates a breakdown in flow.
- ***Transit Level of Service:*** Transit Level of Service (LOS) is a performance measure which identifies the congestion level based on the passengers per seat ratio on a route during peak periods. Transit LOS is also represented by the letters A through F, with an A representing no passenger needing to sit next to another and an F representing the maximum number of passengers that can be accommodated on a transit vehicle. Listed below is the determination of respective LOS based on the passenger per seat ratio for buses.

Measures of Congestion for each Level of Service

Level of Service	Signalized Intersection Stopped Delay per Vehicle (seconds)*	Unsignalized Intersection Stopped Delay per Vehicle (seconds)	Equivalent Volume to Capacity Ratio (v/c)*	Equivalent Travel Demand Model v/c Ratio	Density Range (passenger cars per mile per lane)*	Transit Volume to Capacity Ratio (v/c) [Bus Passengers]
A	≤ 10.0	≤ 10.0	≤ 0.50	< 0.60	0 – 11	0 to .50
B	10.1 to 20.0	10.1 to 15.0	0.60 to 0.69	0.60 to 0.80	> 11 – 18	51 to .75
C	20.1 to 35.0	15.1 to 25.0	0.70 to 0.79	0.80 to 1.00	> 18 – 26	.76 to 1.0
D	35.1 to 55.0	25.1 to 35.0	0.80 to 0.89	1.00 to 1.20	> 26 – 35	1.01 to 1.25
E	55.1 to 80.0	35.1 to 50.0	0.90 to 0.99	1.20 to 1.35	> 35 – 45	1.26 to 1.50
F	> 80.0	> 50.0	≥ 1.00	> 1.35	> 45	> 1.5

* Source: 2000 Highway Capacity Manual, FHWA

Measures of Recurring Delay

Level of Service	Posted Speed			
	45-55 MPH	35-40 MPH	30 MPH	25-30 MPH
	Model-generated Average Travel Speed (MPH)*			
A	> 42	> 35	> 30	> 25
B	34 – 42	28 – 35	24 – 30	19 – 25
C	27 – 34	22 – 28	18 – 24	13 – 19
D	21 – 27	17 – 22	14 – 18	9 – 13
E	16 – 21	13 – 17	10 – 14	7 – 9
F	≤ 16	≤ 13	≤ 10	≤ 7

* Source: 2000 Highway Capacity Manual, FHWA

- ***Congested Speed:*** The estimated speed at which traffic would be moving based on modeled congestion. The congested speed is taken directly from the travel model on the segment of the road with the slowest congested speed.
- ***Delay:*** Indicates the number of hours the traffic stream is delayed, measured in vehicle-hours.
- ***Vehicle Delay***: A measure of actual delay per vehicle (in seconds) on the road.
- ***Transit Travel Time***: A measure of how long a transit vehicle takes to travel a route or a corridor, including the time necessary to stop and disembark or take-on passengers.
- ***Travel Time Index:*** The Travel Time Index (TTI) is the ratio of peak period travel time to free flow travel time. The TTI expresses the average amount of extra time it takes to travel in the peak relative to free-flow travel. A TTI of 1.3, for example, indicates a 20-minute free-flow trip will take 26 minutes during the peak travel time periods, a 6-minute (30 percent) travel time penalty.

Measures of Non-Recurring Delay

- ***Crash Rate:*** The crash rate for a corridor is the number of accidents per million miles of travel. Combined with other measures, this can provide insight into the causes of congestion on some corridors as accidents can have dramatic impacts on the capacity of the roadway for short periods of time.
- ***Crash Frequency:*** The frequency at which accidents occur on a roadway, especially during peak periods of travel, impacts the travel time reliability of a roadway. While a corridor may have a relatively low accident rate overall, even a few peak hour accidents can create lasting disruptions. Examining the frequency at which accidents are happening on CMP corridors can provide insight into the amount of disruption that travelers face on roadways and the resulting variability in travel times.
- ***Work Zone and Special Event Identification:*** The identification of work zones and special events that impact traffic along CMP corridors can aid in the understanding of non-recurring congestion in the region. NH DOT is utilizing "Smart Work Zones" for several major construction projects in the state, and speed sensors provide information on delay related to those projects, which can help to estimate the delays caused by future projects. In addition, understanding what special event or construction is occurring during other data collection activities such as travel time studies provide important context to changes in travel time or travel speeds over time.

The intent of this initial CMP is to establish a limited set of performance measures that enhance the analytical capability of the staff and transportation decision-makers. It is expected that these will evolve and change over time as new needs arise, different data becomes available, or as resources permit.

Equations Utilized to Calculate Mobility Measures

Individual Measures	
Delay per Traveler	$\text{Delay per Traveler (annual hours)} = \dfrac{\left[\text{Actual Travel Time (minutes)} - \text{FFS or PSL Travel Time (minutes)}\right] \times \text{Vehicle Volume (vehicles)} \times \text{Vehicle Occupancy (persons/vehicles)} \times \dfrac{250\text{ weekdays}}{\text{year}} \times \dfrac{\text{hour}}{60\text{ minutes}}}{\text{Vehicle Volume (vehicles)} \times \text{Vehicle Occupancy (persons/vehicles)}}$
Travel Time	$\text{Travel Time (person – minutes)} = \text{Actual Travel Rate (minutes per mile)} \times \text{Length (miles)} \times \text{Vehicle Volume (vehicles)} \times \text{Vehicle Occupancy (persons/vehicles)}$
Travel Time Index or Travel Rate Index	$\text{Travel Time Index or Travel Rate Index} = \dfrac{\text{Actual Travel Rate (minutes per mile)}}{\text{FFS or PSL Travel Rate (minutes per mile)}}$
Buffer Index	$\text{Buffer Index (\%)} = \left[\dfrac{\text{95th Percentile Travel Time (minutes)} - \text{Average Travel Time (minutes)}}{\text{Average Travel Time (minutes)}}\right] \times 100\%$
Planning Time Index	$\text{Planning Time Index (no units)} = \dfrac{\text{95th Percentile Travel Time (minutes)}}{\text{FFS or PSL Travel Time (minutes)}}$
Area Mobility Measures	
Total Delay	$\text{Total Segment Delay (person - minutes)} = \left[\text{Actual Travel Time (minutes)} - \text{FFS or PSL Travel Time (minutes)}\right] \times \text{Vehicle Volume (vehicles)} \times \text{Vehicle Occupancy (persons/vehicles)}$
Congested Travel	$\text{Congested Travel (vehicle - miles)} = \sum \left[\text{Congested Segment Length (miles)} \times \text{Vehicle Volume (vehicles)}\right]$
Percent of Congested Travel	$\text{Percent of Congested Travel} = \left[\dfrac{\sum_{i=1}^{n} \left[\left[\text{Actual Travel Time}_i - \text{FFS or PSL Travel Time}_i \text{ (minutes)}\right] \times \left[\text{Vehicle Volume}_i \text{ (vehicles)} \times \text{Vehicle Occupancy}_i \text{ (persons/vehicles)}\right]\right]_{\text{Each congested segment}}}{\sum_{j=1}^{m} \left[\text{Actual Travel Rate}_j \text{ (minutes per mile)} \times \text{Length}_j \text{ (miles)} \times \text{Vehicle Volume}_j \text{ (vehicles)} \times \text{Vehicle Occupancy}_j \text{ (persons/vehicles)}\right]_{\text{All segments}}}\right] \times 100$
Congested Roadway	$\text{Congested Roadway (miles)} = \sum \text{Congested Segment Length (miles)}$
Accessibility	$\text{Accessibility (opportunities)} = \sum \text{Objective Fulfillment Opportunities (e.g., jobs) Where Travel Time} \leq \text{Target Travel Time}$

Equations from Texas Transportation Institute "Guidebook for Mobility Monitoring In Small to Medium-Sized Communities"

PERFORMANCE MONITORING PLAN

Currently, the primary traffic data collection effort of the MPO and NH DOT is a three component annual program of traffic counting in the region. The first component consists of permanent counters embedded in the roadways that capture data 24 hours a day, every day of the year. These permanent counters are operated and maintained by NH DOT. The second component consists of weekly automatic directional traffic volume counts conducted with the exact number and location of counts determined by NH DOT, and coordinated with community requests and project needs where possible. Through this component, the NRPC conducts up to 130 Average Daily Traffic (ADT) counts and 5 Manual Classification counts each season. The third and final component consists of Manual Turning Movement counts conducted at up to 10 intersections during the peak-hour (unless otherwise specified) at locations coordinated with the NH DOT. *For a fully functioning Congestion Management Process, resources will need to be identified to expand data collection efforts*. Additional data collection needs are described below.

Annual Volume and Classification Counts

The number of classification counts will need to be increased to better track truck volumes on the CMP corridors in the region. It also may be necessary to perform more counts than currently completed, or shift some current count locations to places more advantageous for the monitoring of congestion on the CMP corridors. In some cases, traffic volumes may require the use of equipment designed to capture volumes and vehicle classification on heavily travelled roadways, such as radar based systems. Data collected from this aspect includes snapshots of traffic volumes, vehicle classification information, point travel speeds and direction of travel.

Travel Time Studies

GPS-based travel time runs will be conducted to measure a variety of quantitative data that is important to identify and evaluate congested locations. Such data will accommodate performance measures that account for travel time, delay, speeds, and stops during one or more peak travel periods. The busiest peak travel periods in the NRPC region typically occur during weekday morning (approximately 7:00-9:00 AM) and afternoon (approximately 4:00-6:00 PM) commuter and school travel periods. There are also significant seasonal weekend peak periods related to retail centers. Travel time data collection efforts will expand upon the peak periods to include adjacent non-peak times (7:00-10:00 AM and 3:00-7:00 PM, for example) to provide off-peak travel times for comparison purposes. Primary measures for comparing or prioritizing multiple corridors will include total delay and delay rate, measured travel time and delay, delay ratio, average speed, number of stops, and stop rate. Travel time data may also be supplemented with commercially available data depending on availability and cost.

Transit Use and Travel Data

- Nashua Transit System, Boston Express, and other ridership data
- Transit travel time studies

Permanent Traffic Counters

It may be desirable to increase the number of permanent traffic volume counters to ensure that there is at least one counter on each end of the National Highway System (NHS) roadways in the region, as well as at least one on the other CMP corridors. Data collected from the permanent counters includes directional traffic volumes for each day of the year (barring technical issues). In some cases vehicle classification or other data may be available as well.

Implementation and Monitoring Plan

The initial development of the CMP requires a certain amount of data collection and analysis to identify the appropriate corridors to include in the Process, the relevant performance measures, and the potential data collection efforts required. In that sense, the NRPC has already begun implementing the CMP through efforts to establish baseline information on the corridors expected to be included, and will continue to do so with the initiation of travel time studies in summer 2011. Tracking congestion will require annual efforts by NRPC staff and the establishment of scheduled data collection, analysis, and summarization through the following steps:

1. ***CMP Corridor Definition:*** NRPC will use its Travel Demand Model to define potential CMP corridors. NRPC staff will then field check the corridors identified in the model to refine the limits of data collection. Once defined, a corridor must be separated into logical segments and nodes to provide a finer level of detail, as well as to facilitate data collection and reporting. Node locations should include all signalized intersections and major route junctions, as well as political boundaries. The limits of the corridor will be evaluated over time for new congested areas.
2. ***Corridor Data Collection:*** Basic information regarding each corridor should be collected through available data sources and through a field review of each roadway. Information collected should include roadway classification, adjacent land uses, multimodal uses, traffic volume and classification data, and accident statistics. In addition photos of the corridor may be collected to document special uses areas of concern. This is supplemented by annual data collection efforts over time to gather travel time and delay information along with vehicle volumes and classification.
3. ***Corridor Performance Summary:*** A summary report will be produced for each corridor in the CMP to compile all data collected in the steps above. The report will consist of a map of the corridor, relevant traffic information and a summary narrative identifying changes or trends on the corridor. The report will be updated on a biennial basis and will also identify Congestion Management Toolbox strategies applicable to each segment or intersection proposed to be addressed with mitigation efforts.
4. ***CMP Performance Summary:*** The individual corridor reports and data collected will be compiled into a regional summary on a biennial basis. In addition to including the individual corridor summaries, this report will identify regional trends and impacts from changes. This document will assist decision-makers in project considerations for funding, as well as provide background project development information for proposals from NH DOT and the communities.

Update Process

The Congestion Management Process is an ongoing effort that will require consistent management and updating as new information is collected over time. The NRPC will maintain responsibility for updating and revising the Congestion Management Process, conducting data collection efforts, preparing and distributing reports, as well as coordination with regional partners in these efforts. The update schedule for the CMP is the following:

- Annually collect data
- Biennially update Corridor Performance Summaries
- Biennially produce CMP Performance Summary
- Biennially review and update the CMP data collection efforts, and modify as necessary. At this time new areas to be considered for addition to the CMP should be monitored and listed for consideration to be added at the next update.
- Every 4 years review and update all aspects of the CMP as necessary. This should include a review and assessment of the utility of the biennial reports as well as an evaluation of the effectiveness of any congestion management strategies that have been implemented, and a

review of alignment with goals, objectives and projects identified in the long-range transportation plan.

Integration into the Planning Process

The final step in implementing and maintaining the CMP is fully integrating the process into the transportation planning efforts of the MPO. The data will be made available to the decision-makers in the region through the corridor summaries and regional report.

- Use the CMP data to identify congestion management strategies for all monitored corridors.
- Apply the CMP information to project selection process for use by the MPO and other agencies.
- Use the potential strategies identified and other CMP data to aid in the project prioritization process for including projects in the MPO Long Range Transportation Plan, State Ten Year Plan, and the TIP.
- Use the CMP to convey information to the general public through the biennial corridor summaries as well as through the regional summary.
- Utilize reviews of the CMP to assess the effectiveness of any implemented strategies in the region.

Next Steps

Once the Congestion Management Process has been approved and adopted by the NRPC, it becomes a formal component of the Metropolitan Planning process. As resources permit work will begin in FY 2011 on data collection, analysis, and identification of corridors and on the development of the summary reports.

CONGESTION MANAGEMENT PROCESS

STRATEGIES TOOLBOX

CONGESTION MANAGEMENT PROCESS TOOLBOX

One of the components of the Congestion Management Process for the region is a toolbox of potential congestion reduction and mobility strategies. The idea behind this toolbox is to identify and encourage ways to deal with congestion and mobility problems beyond traditional roadway widening projects. As the CMP is implemented, the toolbox will be utilized as the starting point for evaluating alternative solutions and will act as a checklist to consider each potential solution and determine whether it had a reasonable potential for providing benefit to the congested area. If a particular strategy could potentially work it would then be evaluated in detail, while those not likely to be successful would include a brief explanation of why it is not appropriate. The strategies included in this toolbox essentially fit into the categories of supply management, demand management, and land use management.

For each of the strategies described in the toolbox, the potential for congestion reduction, implementation cost and schedule, and an analysis method have been estimated. The congestion reduction impacts are defined by indicators such as the potential reduction of single occupant vehicles (SOV), improved travel times, and reduced delay.

The implementation costs and schedules consider design and maintenance costs, inter- jurisdictional agreements, and implementation timing over short-term (one to five years), medium-term (five to 10 years), and long-term (over 10 years). The implementation costs and schedules presented in each section are based on information prepared by the Institute of Transportation Engineers (ITE) and Cambridge Systematics for other projects, and therefore will vary for specific implementation in the region. The strategies are presented using the following categories:

Highway Projects

Table 1 presents the potential highway infrastructure projects that may be applicable for the region. The regional travel model and Highway Capacity Manual based intersection/segment analysis will be the primary tools to assess the transportation impacts. The travel demand management (TDM) Evaluation Model and Intelligent Transportation System (ITS) Deployment Analysis System (IDAS) can also be applied to evaluate high occupancy vehicle (HOV) lanes.

Transit Projects

Transit services and infrastructure projects have traditionally been implemented in regions to provide an alternative to automobile travel potentially reducing peak-period congestion and improving mobility and accessibility for commuters. Table 2 presents the transit projects that may be applicable for the region. These projects tend to reduce system-wide VMT in relatively small increments but do improve corridor and system-wide accessibility, improve roadway travel times, and decrease congestion on the roadway system.

Bicycle and Pedestrian Projects

Non-motorized modes of transportation, such as biking and walking, are often overlooked by transportation professionals. Investments in these modes can increase safety and mobility in a cost-efficient manner, while providing a zero-emission alternative to motorized modes. The strategies listed in Table 3 can be implemented in the area with relatively little cost, but tend to have local rather than system wide impacts. The effectiveness of an investment in non-motorized travel depends heavily on coordination with local land use policies and connections with other modes, such as transit, for longer- distance travel. Safety and aesthetics should also be emphasized in the design of bicycle and pedestrian facilities in order to increase their attractiveness.

TDM Strategies

Transportation demand management (TDM) strategies are used to reduce travel during the peak, commute period. They are also used to help agencies meet air quality conformity standards, and are intended to provide ways to provide congestion relief/mobility improvements without high cost infrastructure projects. Table 4 presents the TDM strategies that may be applicable for the region.

ITS and TSM Strategies

Intelligent transportation system (ITS) and transportation system management (TSM) strategies have traditionally focused on improving the operation of the transportation system without major capital investment and cost. While ITS strategies may be costly compared to more traditional TSM strategies, their relative congestion-reduction impacts can be significant. Table 5 presents the ITS and TSM strategies that may be applicable for the region. The strategies identified in Table 5 build upon the Regional and State ITS Architectures.

Access Management Strategies

Access management is a broad concept that can include everything from curb cut restrictions on local arterials to minimum interchange spacing on freeways. Restricting turning movements on local arterials can reduce accidents and prevent turning vehicles from impeding traffic flow. Similarly, eliminating merge points and weaving sections at freeway interchanges increases the capacity of the facility. The access management strategies listed in Table 6 are applicable to the region, and can be used in either the modification or original design of a facility.

Land Development Strategies

Land development strategies have been used in some areas to manage transportation demand on the system, and to help agencies meet air quality conformity standards. Land development strategies can include limits on the amount and location of development until certain service standards are met, or policies that encourage development patterns better served by public transportation and non-motorized modes. Table 7 presents the land development strategies that may be applicable for the region.

Parking Management Strategies

Parking management is most often used to decrease automobile trips for both work and non-work purposes, although in the context of enforcement it may also be used to improve traffic flow. Often, policies implemented by local governments and directed towards the private sector must be accompanied by incentives in order to ensure their effectiveness. Several strategies applicable to the region are presented in Table 8.

Table 1. Potential Highway Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
1a. Increasing Number of Lanes without Highway Widening This takes advantage of "excess" width in the highway cross section used for break- down lanes or median.	• Increase capacity	• Construction and engineering • Maintenance	• Short-term: 1 to 5 years (includes planning, engineering, and implementation)	• Regional Travel Model • HCM • IDAS
1b. Geometric Design Improvements This includes widening to provide shoulders, additional turn lanes at intersections, improved sight lines, auxiliary lanes to improve merging and diverging.	• Increase mobility • Reduce congestion by improving bottlenecks • Increase traffic flow and improve safety	• Costs vary by type of design	• Short-term: 1 to 5 years	• Regional Travel Model • HCM
1c. 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	• HOV, separate ROW costs • HOV, barrier separated costs • HOV, contra-flow 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 Model • IDAS
1d. Super Street Arterials This involves converting existing major arterials with signalized intersections into "super streets" that feature grade-separated intersections.	• Increase capacity • Improve mobility	• 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
1e. 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 o congestion depend on local conditions	• 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

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

Table 2. Potential Transit Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
2a. Reducing Transit Fares This encourages additional transit use, to the extent that high fares are a real barrier to transit.	• Reduce daily VMT • Reduce congestion • Increase ridership	• Lost in revenue per rider • Capital costs per passenger trip • Operating costs per passenger trip • Operating subsidies needed to replace lost fare revenue • Alternative financial arrangements need to be negotiated with donor agencies	• Short-term: • Less than one year	• Regional Travel Model • TDM Evaluation Model
2b. Increasing Bus Route Coverage or frequencies This provides better accessibility to transit to a greater share of the population. Increasing frequency makes transit more attractive to use.	• Increase transit ridership • Decrease travel time • Reduce daily VMT	• Capital costs per passenger trip • Operating costs per trip • New bus purchases likely	• Short-term: • 1 to 5 years (includes planning, engineering, and construction)	• TDM Evaluation Model • Regional Travel Model
2c. Implementing Park-and-Ride Lots 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	• Structure costs for transit stations	• Medium-term: • 5 to 10 years (includes planning, engineering, and construction)	• TDM Evaluation Model • Regional Travel Model
2d. Implementing Rail Transit This best serves dense urban centers where travelers can walk to their destinations. Rail transit from suburban areas can sometimes be enhanced by providing park- and-ride lots.	• Reduce daily VMT	• Capital costs per passenger • New systems require large up- front capital outlays and ongoing sources of operating subsi- dies, in addition to funds that may be obtained from fed- eral sources, under increasingly tight competition.	• Long-term: • 10 or more years (includes planning, engineering, and construction)	• Regional Travel Model

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

Table 3. Potential Bicycle and Pedestrian Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
3a. 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.	• Increase mobility and access • Increase non-motorized mode shares • Separate slow-moving bicycles from motorized vehicles • Reduce incidents	• 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 Model
3b. 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 pro- vide further incentives for using bicycles.	• Increase bicycle mode share • Reduce motorized vehicle congestion on access routes	• Capital and maintenance costs for bicycle racks and lockers, locker rooms	• Short-term: 1 to 5 years (includes planning, engineering, and construction)	• TDM Evaluation Model
3c. Design Guidelines for Pedestrian-Oriented Development. Maximum block lengths, building setback restrictions, and streetscape enhancements are examples of design guide- lines that can be codified in zoning ordinances to encourage pedestrian activity.	• Increase pedestrian mode share • Discourage motor vehicle use for short trips • Reduce VMT, emissions	• 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 Model • Regional Travel Model
3d. 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 non-motorized mode share • Reduce incidents	• Increased monitoring and maintenance costs • Capital costs of sidewalk improvements and additional traffic control devices	• Short-term: 1 to 5 years	• TDM Evaluation Model • Regional Travel Model
3e. 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 non-motorized mode shares • Reduce congestion on nearby roads • Separate slow-moving bicycles from motorized vehicles • Reduce incidents	• ROW Costs • Construction and • Engineering Costs • Maintenance Costs	• Medium-term: 5 to 10 years (includes planning, engneering, and construction)	• TDM Evaluation Model • Regional Travel Model

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

Table 4. Potential TDM Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
4a. 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	• Reduce peak-period VMT • Improve travel time among participants	• No capital costs • Agency costs for outreach and publicity • Employer costs associated with accommodating alternative work schedules	• Employer-based • Short-term: 1 to 5 years	• TDM Evaluation Model • Regional Travel Model
4b. 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.	• Reduce VMT • Reduce SOV trips	• First-year implementation costs for private-sector (per employee for equipment) • Second-year costs tend to decline	• Employer-based • Short-term: 1 to 5 years	• TDM Evaluation Model • Regional Travel Model
4c. Ridesharing This is typically arranged/ encouraged through employers or transportation management agencies (TMA), which pro- vides ride-matching services.	• Reduce work VMT • Reduce SOV trips	• Savings per carpool and vanpool riders • Costs per year per free parking space provided • Administrative costs	• Employer-based • Short-term: 1 to 5 years	• TDM Evaluation Model • Regional Travel Model

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

Table 5. Potential ITS and TSM Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
5a. Traffic Signal Coordination This improves traffic flow and reduces emissions by minimizing stops on arterial streets.	• Improve travel time • Reduce the number of stops • Reduce VMT by vehicle miles per day, depending on program	• O&M costs per signal • Signalized intersections per mile costs variable	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model
5b. Reversible Traffic Lanes These are appropriate where traffic flow is highly directional.	• Increase peak direction capacity • Reduce peak travel times • Improve mobility	• Barrier separated costs per mile • Operation costs per mile • Maintenance costs variable	• Short-term: 1 to 5 years	• IDAS • Regional Travel Model
5c. Freeway 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.	• Reduce accident delay • Reduce travel time	• Capital costs variable and substantial • Annual operating and maintenance costs	• Medium- to Long-term: likely 10 years or more	• IDAS • Regional Travel Model
5d. Ramp Metering This allows freeways to operate at their optimal flow rates, thereby speeding travel and reducing collisions.	• Decrease travel time • Decrease accidents • Improve traffic flow on major facilities	• O&M costs • Significant costs associated with enhancements to centralized control system • Capital costs	• Medium-term: 5 to 10 years	• IDAS • Regional Travel Model
5e. Highway Information Systems These systems provide travelers with real-time information that can be used to make trip and route choice decisions.	• Reduce travel times and delay • Some peak-period travel shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium-term: 5 to 10 years	• IDAS • Regional Travel Model
5f. 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, and transit vehicle schedule progress.	• Reduce travel times and delay • Some peak-period travel and mode shift	• Design and implementation costs variable • Operating and maintenance costs variable	• Medium-term: 5 to 10 years	• IDAS • Regional Travel Model

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

Table 6. Potential Access Management Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
6a. Left Turn Restrictions; Curb Cut and Driveway Restrictions Turning vehicles can impede traffic flow and are more likely to be involved in crashes.	• Increased capacity, efficiency on arterials • Improved mobility on facility • Improved travel times and reduced delay for through traffic • Fewer incidents	• 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)	• Localized Analysis
6b. Turn lanes and New or Relocated Driveways and Exit Ramps In some situations, increasing or modifying access to a property can be more beneficial than reducing access.	• Increased capacity, efficiency • Improved mobility and safety on facility • Improved travel times and reduced delay for all traffic	• Additional right-of- way costs • Design, construction, and maintenance costs	• Short-term: 1 to 5 years (includes planning, engineering, and implementation)	• Localized Analysis
6c. Interchange Modifications Conversion of a full cloverleaf interchange to a partial cloverleaf, for example, reduces weaving sections on a freeway	• Increased capacity, efficiency • Improved mobility on facility • Improved travel times and reduced delay for through traffic • Fewer incidents due to fewer conflict points	• Design and construction costs	• Short-term:1 to 5 years (includes planning, engineering, and implementation)	• IDAS • Regional Travel Model • Would need to code ramps
6d. Minimum Intersection/ Interchange Spacing. Reduces number of conflict points and merging areas, which in turn reduces incidents and delays.	• Increased capacity, efficiency • Improved mobility on facility • Improved travel times and reduced delay for through traffic • Fewer incidents	• Part of design costs for new facilities and reconstruction projects	• Medium-term: 5 to 10 years (includes planning, engineering, and implementation)	• Local
6e. Frontage Roads and Collector-Distributor Roads Frontage roads can be used to direct local traffic to major intersections on both super arterials and freeways. Collector-distributor roads are used to separate exiting, merging, and weaving traffic from through traffic at closely-spaced interchanges.	• Increased capacity, efficiency • Improved mobility on facility • Improved travel times and reduced delay for through traffic •	• Additional right-of- way costs • Design, construction, and maintenance costs	• Medium-term: 5 to 10 years (includes planning, engineering, and implementation)	• IDAS • Regional Travel Model • Would need more network detail

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

Table 7. Potential Land Use Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
7a. 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	• 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 Model
7b. Infill and Densification This takes advantage of infra-structure that already exists, rather than building new infra-structure 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	• 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 Model
7c. 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	• 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 Model

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

Table 8. Potential Parking Management Strategies for the CMP Toolbox

Strategies/Projects	Congestion and Mobility Benefits	Implementation Costs and Other Impacts	Implementation Timeframe	Analysis Method
8a. On-Street Parking and Standing Restrictions Enforcement of existing regulations can substantially improve traffic flow in urban areas. Peak-period parking prohibitions can free up extra general purpose travel lanes or special bus or HOV "diamond"lanes.	• Increase peak- period capacity • Reduce travel time and congestion on arterials • Increase HOV and bus mode shares	• Design, construction, and maintenance costs for signage and striping. • Rigid enforcement of parking restrictions.	• Short-term: 1 to 5 years (includes planning, engineering, and implementation)	• IDAS • Regional Travel Model
8b. Employer/Landlord Parking Agreements Employers can negotiate leases so that they pay only for the number of spaces used by employees. In turn, employers can pass along parking savings by purchasing transit passes or reimbursing non-driving employees with the cash equivalent of a parking space.	• Reduce work VMT • Increase non-auto mode shares	• Economic incentives used to encourage employer and landlord buy-in	• Metropolitan and Employer-based • Short-term: 1 to 5 years	• TDM Evaluation Model
8c. Preferential or Free Parking for HOVs This provides an incentive for workers to carpool.	• Reduce work VMT • Increase vehicle occupancy	• Relatively low costs, primarily borne by the private sector, include signing, striping, and administrative costs	• Metropolitan and Employer-based • Short-term: 1 to 5 years	• TDM Evaluation Model
8d. Location-Specific Parking Ordinances Parking requirements can be adjusted for factors such as availability of transit, a mix of land uses, or pedestrian-oriented development that may reduce the need for on-site parking. This encourages transit-oriented and mixed- use development.	• Reduce work VMT • Increase transit and non-motorized mode share	• Economic incentives used to encourage developer buy-in	• Long-term: 10 or more years	• Regional Travel Model • TDM Evaluation Model

Source: Cambridge Systematics, Inc. and ITE, A Toolbox for Alleviating Traffic Congestion.

#300ZZ-235

APPENDIX A

PUBLIC PARTICIPATION

MEMORANDUM

TO: Transportation Stakeholders

SUBJECT: **CONGESTION MANAGEMENT PROCESS MEETING ANNOUNCEMENT**

DATE: August 26, 2010

Congestion Management Process Stakeholder Meeting
Wednesday September 8, 2010
11:00AM

Nashua Regional Planning Commission
9 Executive Park Drive (Suite 201)
Merrimack, NH

The Nashua Regional Planning Commission (NRPC) has developed the attached Draft Congestion Management Process (CMP) for the Nashua Region. NRPC will be holding a Congestion Management Process (CMP) Stakeholder Meeting to provide information to interested parties on the development of the draft CMP Plan. This meeting will be combined with a regularly scheduled **Transportation Technical Advisory Committee meeting and will begin at 11:00 AM on Wednesday September 8** at the NRPC offices, located at 9 Executive Park Drive (Suite 201) in Merrimack, NH. A summary of the CMP process and plan is provided below.

Congestion Management Process Summary:

A CMP contains of a set of actions that provide for effective management and operation of the transportation system. It is used to identify congested locations and determine their cause, evaluate and develop alternative congestion mitigation strategies, track and assess previously implemented congestion management strategies, and prioritize projects for the Long Range Transportation Plan and State Ten Year Plan/Transportation Improvement Program. At its core, the NRPC CMP includes a robust and coordinated data collection and monitoring system, a range of strategies for addressing congestion, performance measures for identifying when action is needed, and steps for keeping the CMP current and fully integrating it into the other planning efforts of the MPO.

A CMP is required in metropolitan areas with population exceeding 200,000, known as Transportation Management Areas (TMAs). Federal requirements also state that in all TMAs, a CMP shall be developed and implemented as part of the metropolitan planning process. Portions of the towns of Hudson and Pelham lie within the Boston TMA, and therefore, a CMP is required for those areas. In addition, these communities are designated ozone non-attainment areas; Federal guidelines prohibit the spending of federal dollars on projects that increase capacity for single occupant vehicles unless the project comes from a CMP. Initially, the Draft CMP will be applied to corridors in TMA (Pelham and Hudson). However, the process has been developed such that it can apply to any corridor in the region. It is anticipated that the 2010 Census likely to expand TMA boundaries to include more of the NRPC region.

The NRPC invites you to review the Draft CMP and share your thoughts on the document at a **Stakeholder Meeting on Wednesday, September 8, 2010 at 11:00 am** at the NRPC offices, located at 9 Executive Park Drive (Suite 201) in Merrimack, NH. In addition to reviewing the CMP, please consider any opportunities for your community or agency may have to share data collection efforts and information with the NRPC as part of this effort.

Nashua Regional Planning Commission
Transportation Technical Advisory Committee
And
Congestion Management Process Stakeholder Meeting

Wednesday, September 8, 2010 11:00 AM
NRPC Office Main Conference Room
9 Executive Park Drive, Suite 201
Merrimack, New Hampshire

Agenda

1. Congestion Management Process Stakeholder Meeting (11:00 AM)

2. TTAC Call to Order and Introductions (Approximately 12:00 PM)

3. Approval of Minutes from the August 11, 2010 Meeting (Attachment 1)

4. Draft Congestion Management Process (Action Item)
   - Draft document emailed last week with TTAC meeting announcement
   - Seeking motion to recommend approval by the NRPC

5. Plan Updates (Action Item)
   - Draft documents available on the web:
     - 2011 – 2014 Transportation Improvement Program
     - 2011 – 2035 Air Quality Conformity Analysis
     - 2011 – 2035 Long Range Transportation Plan
     - Summary of Changes to the LRTP
   - Seeking motion to recommend approval by the NRPC

6. Staff and Project Updates

7. Other Business

Lunch will be provided

JC/kmb
#300ZZ-230

Congestion Management Process (CMP) Meeting

NRPC Office – 9 Executive Park Drive – Merrimack, NH

Sign-in-Sheet

Wednesday, September 8, 2010 ~ 11:00 Noon

NAME	ORGANIZATION	EMAIL
Julie Chizmas	NRPC	julie@nashuarpc.org
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Nick Alexander	NHDOT	
Leigh Levine	FHWA	
Kerrie Diers	NRPC	
Kyle Fox	Town of Merrimack	kfox@merrimacknh.gov
Tim Roach		

ATTACHMENT 1

DRAFT MINUTES
NRPC TRANSPORTATION TECHNICAL ADVISORY COMMITTEE MEETING
08/11/10

Members Present:

John Cashell, Town of Hudson
Jean Marie Kennamer (A) - City of Nashua
Bill Parker - Town of Milford
Jeff Gowan, Town of Pelham
Jeff Babel - Town of Hollis

Staff Present

Tim Roache, Assistant Director
Matt Waitkins, NRPC
Steve Wagner, Regional Planner
Julie Chizmas, Transportation Planner
Karen M. Baker, Administrative Assistant

Others Present

Mark Dixon, FHWA
Leigh Levine, FHWA
William Rose, NHDOT
Gary Webster, Town of Hudson
Chris Skoglund, NHDES
Eric Abrams, NHDES
Roger Houston, City of Nashua

CALL TO ORDER AND INTRODUCTIONS

Tim Roache opened the meeting at 12:10 with introductions

APPROVAL OF THE MINUTES FROM THE FEBRUARY 10TH 2010 MEETING

Roache referred to the minutes of July 14, 2010 included in the agenda packet as Attachment 1 and asked for a motion to approve. Gowan moved to approve the July 14th, 2010 minutes with a second from Kennamer. All were in favor and the motion passed.

DRAFT CONGESTION MANAGEMENT PLAN

Roache and Chizmas provided a Point Presentation to the group summarizing the purpose of the Congestion Management Process. Chizmas explained that the Congestion Management Process (CMP) is a planning and project programming tool that aids in the effective management of the transportation system through development and implementation of operational and travel demand management strategies. Listed below are some of the important elements:

What is a CMP?

- A set of actions designed to manage the operation of the transportation system

How was it developed?

- Cooperative effort with RPC and SNHPC with shared portions of the Boston TMA, using similar goals, objectives, definitions

What are the objectives of the CMP?

- A robust data collection process
- Coordinated data collection
- Comprehensive analysis, monitoring and reporting
- Implementation of congestion mitigation recommendations

What is the Geographic Coverage Area?

- Corridors in TMA (Pelham and Hudson)

How do you define Congestion?

- Indentify the 7 root causes (bottlenecks, traffic incidents, work zones, weather, traffic control devices, special events, fluctuations in normal traffic)
- Determine a specific location
- Identify segment of roadways and/or intersections

What are the steps to the process?

- Define congestion and identify corridors
- Collect and analyze data
- Develop Corridor Performance regional CMP Performance Summary report
- Recommend and implement mitigation measures through the TIP/Ten Year Plan/LRTP Process

How will this process be maintained?

- Through a Performance Monitoring Plan to include annual volume and classification counts and travel time studies

What are the deadlines to complete this?

- FHWA requiring CMP by October, 2010
- TTAC accept draft CMP - August 11th, 2010
- Stakeholder meeting – Late August/Early September
- TTAC recommend approval of CMP - September 8th, 2010
- Commission approve CMP - September 15th, 2010
- Begin implementation in the shared TMA areas (Hudson and Pelham)
- Expansion of scope and process as appropriate or necessary

Cashell wanted to know if there was a meeting date set with Hudson. Roache said not yet, but DOT, TTAC, Hudson and Pelham would be invited. Levine wanted to know what the deadline for comments was. Roache said beginning of September.

PLAN UPDATES - LONG RANGE TRANSPORTATION PLAN (LRTP), TRANSPORTATION IMPROVEMENT PROGRAM (TIP), AND AIR QUALITY CONFORMITY ANALYSIS

Roache informed the group of the draft updates that NRPC had completed on the LRTP, TIP and Air Quality Conformity Analysis.

LRTP

Roache explained that this was a minor update with not much change to the text. Changes were primarily with fiscal constraint, updating the project list, and project recommendations. Roache provided an onscreen view of the LRTP outer year's project list and reviewed it with the group, also pointing out that the list was sent to the affected communities for comments and/or changes. Milford had commented and this would be addressed in the next version update. There were some questions from Levine on projects listed and their effect on air quality which Roache addressed. He added that when it goes out for public comment, it would be available in the larger Libraries, at the NRPC office and electronically on the NRPC website.

TIP

Chizmas reviewed the project list included in the TIP indicating that there were no significant projects added to the Ten Year Plan and that the list was pretty much the same list of projects as in the previous TIP. She pointed out that the projects were now separated out by category and the project financials numbers had either been changed or updated, adding that the Broad Street Parkway numbers had just changed on Monday. Other changes were in the Fiscal Constraint summary on page 5. Roache informed the group that he was still waiting on air quality information from DOT, who was waiting for the numbers from a couple of the other MPOs, and that the public comment period would open once he had this information.

Air Quality Conformity Analysis

Chizmas reviewed the Air Quality Conformity Analysis with the group, specifically the exempt and non-exempt project lists. She pointed out that there were 2 projects that were not technically in the NRPC region but would impact traffic in our region. Listed below are the projects which Chizmas informed the group of that had been moved from the non-exempt list to exempt list.

- Hollis Four Corners
- Merrimack Intersections Improvements
- NH 130
- Broad Street Project
- East Hollis Street Project
- 101 Improvements (safety) currently in the TIP

Roache said the 30 day public comment period would open before the end of the week and eventually he would be requesting motion from TTAC to recommend to the full Commission for approval.

Skoglund referred to page 2 of the Air Quality Conformity Analysis questioning the interpellations for 2035 and whether the model was run for all analyses years (2011 & 2017). Chizmas said it was run for all the years. Skoglund felt this should be clarified. Roache added that the numbers would be submitted to NHDOT and NHDES with the hopes of staying below the budget. He concluded that NRPC was working on consistency from year to year for the LRTP, TIP, and Air Quality Analysis. Levine suggested that a summary cover sheet with the changes be included with the documents. Roache said that would be done.

STAFF AND PROJECT UPDATES

Roache asked the group if they had anything to share.

Parker informed the group that the construction phase of a Milford project was moved to spring.

Gowan said the new Fire Station would be on the ballot again and that they were in negotiations regarding the roundabout with the BOS.

Roache informed the group of the (non-voting) CMAQ meeting being held Thursday (August 12) regarding the process of scoring and ranking the projects at the state level. He added that all 9 MPO's would have representation and that the DOT defined regional and state scores would be factored in with an end result to be that the top scoring projects be the top projects in the region and be funded. Roache said that communities in the end need to know how that process is going to run.

Skoglund said that DES would be at the CMAQ meeting and would do a presentation on CMAQ projects and the air quality benefits.

Cashell questioned the scoring on CMAQ projects and elaborated on the intersection and congestion problems with Hudson project.

Houston motioned to adjourn with a second from Babel. The meeting adjourned at **1:05pm.**