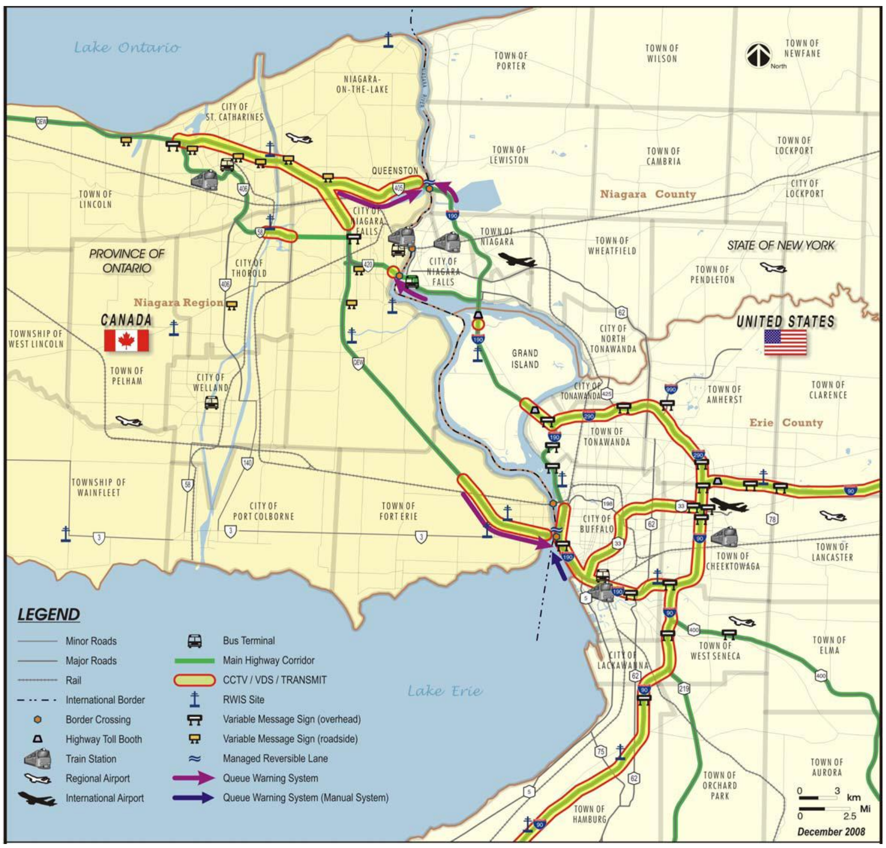
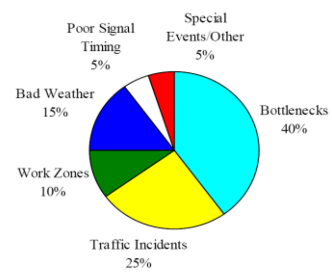
GBNRTC

Congestion Management Process





GREATER BUFFALO-NIAGARA
REGIONAL TRANSPORTATION COUNCIL

Congestion Management Process Document Contents/Outline

Congestion Management Process

Intent

The Congestion Management Process (CMP) is a planning tool used by Greater Buffalo-Niagara Regional Transportation Council (GBNRTC) to analyze the transportation system and plan and implement travel demand reduction and operational management strategies to reduce or minimize congestion. The purpose of the CMP is to:

- Manage or reduce the existing congestion
- Efficiently utilize existing transportation facilities
- Maximize the mobility of persons and goods
- Keep future congestion problems from occurring.

The Institutional Context of the CMP in the GBNRTC Region

The federally designated Metropolitan Planning Organization (MPO) for the region is the GBNRTC. A Policy Committee of senior elected officials and agency representatives provides overall decision making capacity for transportation plans and projects in the region. A Planning and Coordinating Committee (PCC) provides technical analysis and recommendation to the Policy Committee. Subcommittees of the PCC are engaged in coordination of specific subject areas including Long Range Planning, Transportation Projects, and Management and Operations, where the CMP engagement resides.

Federal Requirement

Congestion has been defined by the federal regulations as: ***"The level at which the transportation system performance is no longer acceptable due to traffic interference. The level of acceptable system performance deemed acceptable by State and local officials may vary by type of transportation facility, geographic location (metropolitan area, sub-area or rural area) and/or time of day."*** Since that time federal transportation legislation has required the assessment and management of a region's transportation system prior to the implementation of additional highway capacity.

The Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) requires that metropolitan transportation planning processes include a CMP. The CMP is intended to place an emphasis on the planning process and environmental review process, while maintaining and developing effective management and operation strategies. Federal regulations state that Metropolitan transportation planning areas with a population of 200,000 or more, designated as a Transportation Management Area (TMA), are required to have a CMP, and that long-range transportation plans developed after July 1, 2007 must contain a CMP component. Also, in metropolitan planning areas classified as non-attainment for ozone and Carbon Monoxide (CO) under the Clean Air Act, no single occupant vehicle (SOV) capacity expanding project can receive federal funds unless it shows that the CMP has been considered.

The CMP is intended to operate within or in conjunction with the planning process, which is the focal point for consideration of other factors, such as Clean Air Act requirements, transit, funding, land use scenarios, and non-motorized alternatives. The planning process also leads to decisions on which projects are programmed and implemented. The CMP will provide better information for project prioritization.

This report defines the CMP process and status. This report documents the region's recent CMP activities. The concept of addressing congestion and meeting regional goals will continue to be an integral part of the metropolitan planning process. This report also describes the procedures that the GBNRTC uses to evaluate the impact of the Long Range Transportation Plan (LRTP) on congestion at the regional level. It also discusses the steps that are taken to develop strategies for managing congestion for inclusion in the Unified Planning Work Program (UPWP) and the Transportation Improvement Program (TIP). The LRTP is a document used to guide the investment of transportation dollars and looks 20+ years into the future to predict the transportation needs of the region and structures a safe, efficient, balanced, and environmentally sound transportation system for the movement of people, goods, and services. The TIP is multi-modal program of transportation projects and funding sources that covers the first three to five year period of the LRTP. It is updated every two years and amended as necessary. The UPWP is developed on a biannual basis and describes the planning activities of the MPO that are to be undertaken in support of the vision, goals, objectives, and policies identified in the LRTP.

Definition and Components

A Congestion Management Process (CMP) is a systematic process for managing congestion that provides information on transportation system performance and on alternative strategies for alleviating congestion and enhancing the mobility of persons and goods to levels that meet State and local needs.

The CMP represents one component of the larger regional transportation planning process; it does not operate independently nor does it account for all aspects of planning. Congestion is not the only variable to be considered when determining transportation priorities. The role of the CMP is to provide public agencies and decision-makers with a tool to examine congestion in greater detail.

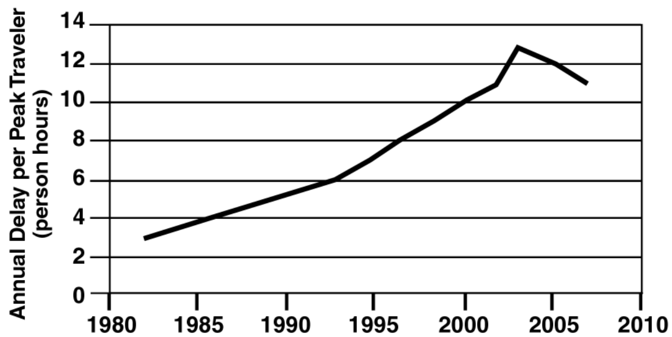
Additional federal requirements regarding the CMP are necessary in Erie and Niagara Counties, since the region is classified as a non-attainment TMA for ozone. The requirements are that:

- All reasonable, multi-modal Transportation Demand Management (TDM)/Operations and Supply Management (OSM) strategies must be analyzed in corridors where capacity increase is proposed.
- If the analysis demonstrates that the TDM/OSM strategies cannot satisfy the need for additional capacity, the CMS shall identify all reasonable strategies for managing the single occupancy vehicle (SOV) facility effectively.
- All identified strategies shall be incorporated into SOV or committed to by the State and the MPO.
- Federal funds may not be programmed in a non-attainment TMA for any highway or SOV project unless based on approved CMP.

Congestion in Buffalo-Niagara

The Buffalo-Niagara metropolitan region is known for having a relatively quick and easy commute, due in part to its low levels of congestion. According to the Texas Institute of Transportation 2009 Urban Mobility report, Buffalo-Niagara commuters rank 79 out of the 90 largest metro areas in terms of annual delay per peak traveler. Drivers in Buffalo-Niagara added 11 hours in 2007 due to traffic, whereas the average **delay** in metropolitan areas across the country was 41 hours. The report also indicates the rate of increase in congestion (for Buffalo) is at a much slower rate from 1982 to 2007, compared with the rate of some of the other urban areas during the same period.

Despite these numbers there is sufficient cause for concern. Average annual delay in Buffalo-Niagara has quadrupled in the last twenty years.



This section provides a summary of the methodology used by GBNRTC to identify and quantify congestion. It also discusses performance measures that are applied to monitor levels of congestion and establish goals for improvement, and the toolbox from which potential mitigation measures can be chosen.

Congestion Management Process Approach

The CMP for GBNRTC was developed to address congestion 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. It has been developed to meet the requirements stated in the federal planning rule sec. 450.320. This technical memorandum documents GBNRTC CMP.

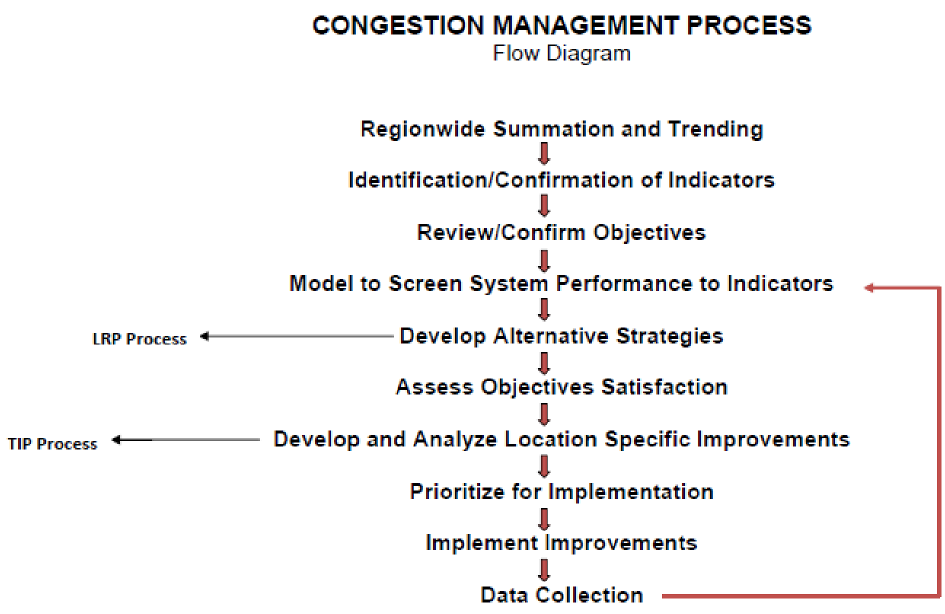
The CMP includes emphasis on regional coordination and on integration with other planning efforts. The role of CMP is to identify and evaluate congestion, then identify and evaluate potential congestion solutions. The CMP is used to prioritize projects for funding. SAFETEA-LU specifically states, “The development of a congestion management process should result in multimodal strategies that can be reflected in the metropolitan transportation plan and the Transportation Improvement Program (TIP).”

The process of congestion management is reasonably mature in the GBNRTC region, as the MPO specifically allocates resources in the LRTP for congestion management projects, and as a demonstration project, an advanced regional **simulation framework** program is being developed to tier down from the regional four step travel model, through **mesoscopic** analysis, all the way to microsimulation. This integrated approach will provide consistent and focused congestion management opportunities and operational analyses. Further, a comprehensive regional operations agency, the Niagara International Transportation Technology Coalition (NITTEC), has been in place and actively functioning to coordinate systems operation. This group includes all GBNRTC members as well as Canadian partners in a regional approach to systems operations efficiency. NTTEC is currently completing a Regional Concept of Transportation Operations (RCTO) document, which is fully embodied in the CMP, and an Integrated Corridor Management (ICM) demonstration to cooperatively put operations management practices in place in a major binational corridor. Since many aspects of the CMP involve management and operations activities and maximizing the efficiency of the existing system, the Management and Operations (M&O) subcommittee of the GBNRTC PCC serves as the CMP management focus.

CMP STEPS

The primary focus areas of the CMP are summarized in the following steps, with a flowchart graphic following:

- Identify Performance Measures: Performance measures are determined through a cooperative effort and consistent with the NITTEC RCTO and ICM.
- Collect Data: A coordinated data collection program is in place, using existing data sources when possible as well as emerging newer technologies.
- Evaluation of Alternatives: Expected benefits of the congestion management strategies are identified and evaluated based on the established performance measures.
- Selection of Projects: Appropriate improvement strategies are selected. Consideration is given to demand management, traffic operational improvements, public transportation improvements, Intelligent Transportation Systems (ITS) improvements, and where necessary, additional system capacity. Implementation schedules and responsibilities are identified.
- Monitor Improvements: Compare before and after conditions using performance measures. Learn from the results and apply the appropriate findings to subsequent projects. Consistent with the distinction as a process rather than a plan or a system, the CMP steps include a feedback loop. The CMP will continually be revised based on findings from the monitoring process and from other planning efforts.



Evaluation of System Performance

Congestion occurs when the number of users on a roadway system is greater than the peak capacity it was designed to handle. This is a result of the fact that users traveling to work, school, or recreation often operate on a similar schedule that is consistent from day-to-day. Transportation systems are intentionally not designed to accommodate this amount of volume since doing so would be excessive during off-peak hours. This level of peak period congestion – while predictable – places added strain on the system. It results in deterioration of the level of service as vehicle density increases and vehicle speeds decline. Consequently, delay, defined as the additional travel time required to make a trip due to congestion, will increase with increased congestion.

Travel system users are readily familiar with the concept of congestion and can easily recognize it. However, it is important to define consistent measures and metrics to analyze congestion issues. Congestion itself is defined as state where the performance of a transportation system is unacceptable due to traffic interference, and can be directly measured as the ratio of the traffic volume utilizing a given facility to the capacity of that facility.

Both the cause and direct effects of congestion are of interest to planning agencies, as well as the general public. When summed up over an entire region, the total **delay**, whether measured in **vehicle-hours or person-hours**, provides a measure of the total societal cost of congestion.

Delay is not the only measurement of interest to travelers. Reliability, which is a measure of the consistency of the transportation system from day to day, also impacts the perception of level of service. It measures the variation in travel times for the same trip. A system with poor reliability forces users to schedule longer-than-average trips, especially for those trips where arrival time is critical, such as trips to the airport.

These phenomena are interrelated such that low reliability adds congestion by forcing drivers to plan for longer trips, while congestion contributes to low reliability. There is a cause and effect relationship between recurring and **non-recurring** congestion; the former increasing the frequency of the latter. As the roadway system becomes highly congested due to **recurring** traffic, the system becomes less stable and is more likely to break down when confronted with unanticipated events such as traffic accidents or unusual weather. Not surprisingly, then, reducing congestion has the added benefit of increasing the reliability of the transportation system.

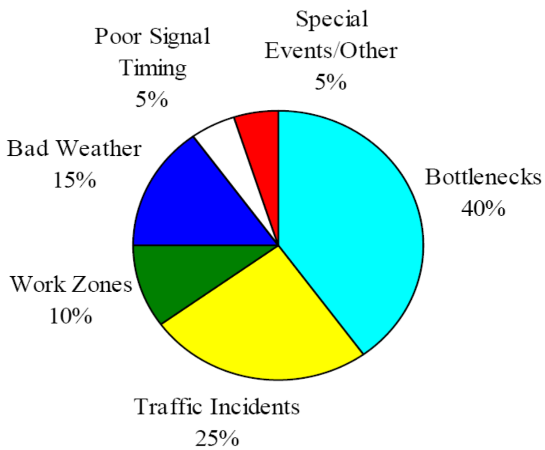
Recurring vs. Non-recurring Congestion

Congestion is typically divided into two categories; recurring and non-recurring congestion.

Recurring congestion is congestion that is predictable and regular. It is created by the combination of normal peak traffic volumes with insufficient capacity at particular locations. This type of congestion typically occurs during weekday mornings and evenings, and is generally caused by large numbers of commuters traveling between their workplaces and their homes. Recurring congestion can also occur on weekends, particularly where significant retail or recreational activity creates such demand. In addition, some recurring congestion is seasonal in nature, especially when related to holidays and recreation destinations.

Non-recurring congestion is caused by atypical events such as highway accidents, sudden lane or road closures, weather conditions, or sudden traffic demand increases induced by special events such as a football game. Non-recurring congestion can occur at any time, including midday, overnight, and also during peak periods, in addition to recurring traffic.

<u>The FHWA identified the common causes of congestion</u> – as well as their relative proportions – in the chart below.



Bottlenecks and poor signal timing are causes of recurring congestion, while traffic incidents, bad weather, work zones, and special events are considered causes of non-recurring congestion. Although non-recurring congestion is estimated to account for as much as 50% of delay experienced by the public, its unpredictable, random nature makes modeling and analysis difficult. Therefore, for this status report, analysis of congestion will be limited to weekday recurring congestion.

<u>Intensity and Duration of Congestion</u>
Both the intensity and duration of congestion contribute to its delay. In other words, very intense, albeit brief congestion can cause as much delay as less intense congestion that lasts longer.

Intensity is a measure of the severity of congestion during its peak hour. It is typically measured by factors including peak hour level of service, peak hour volume-demand-to-capacity (V/C) ratio, and peak hour speed.

Duration is a measure of the span of time during which a roadway segment is considered congested. This is generally not directly measured and reported but is embedded in such overall congestion metrics as **vehicle hours of delay** and **person hours of delay**.

<u>Volume, Capacity, and Volume-Demand/Capacity Ratio</u>
The volume on a roadway is the total number of vehicles, including passenger vehicles, trucks, and busses, using that facility during a particular time period. These are tracked by traffic counts done by GBNRTC, the New York State Department of Transportation (NYSDOT), and the New York State Thruway Authority.

The capacity of a roadway represents the theoretical maximum volume that a roadway segment can accommodate during a specific time period, typically one hour. Capacity is determined by number of lanes, lane widths, signalization, parking characteristics, geometric characteristics, terrain, and other factors.

When such capacities are approached and roadway conditions become saturated, volumes do not present useful information about the level of congestion. As density increases, speed decreases, which provides inaccurate flow rate information. Since such conditions deter travelers, volumes do not necessarily represent the demand for the roadway. For these reasons, Volume-Demand (based on trip generation and assignment) to Capacity ratio is used to define congestion. This allows estimation of congestion based on trip demand.

By definition, a roadway where the volume demand is at or near capacity is considered to be congested. Typically, a volume-demand-to-capacity (V/C) ratio of 0.8 can be considered the start of moderate congestion. As the V/C ratio approaches 1.0, the segment will experience severe congestion conditions, resulting in high delays.

Methods and Tools to Monitor Congestion

Regional Travel Model

To estimate and report the performance measures described above a software system travel demand model was developed for use by the GBNRTC. The model is a TransCAD network based simulation model encompassing Erie and Niagara Counties. It is a set of journey-based travel demand forecasting models utilizing GIS based highway and transit networks. The network contains approximately 11,000 highway links consisting of all minor arterial and above facilities. The transit network consists of all public bus and light rail routes serving the region. The study area is divided into approximately 550 Traffic Analysis Zones with a base year of 2008.

The model generates a total number of journeys that begin and terminate in each zone based on a zones socioeconomic characteristics and employment opportunities. These trip tables then are processed through the destination/mode choice subroutine to develop mode of travel, trip purpose, and time of day for each origin-destination pair. A trip assignment module then assigns each trip (car or transit) to a specific path over its associated network system based upon quickest time after incorporating link level delays. These delays are identified by a comparison of forecasted travel flows with capacity levels. These link level delays are used to adjust travel times reflecting congestion.

Urban Simulation Framework

An urban simulation project is nearing completion that will provide dynamic simulation capabilities in the Buffalo-Niagara region with initial focus in the Buffalo area. The simulation capabilities will interface with **mesoscopic** level aggregation and perform as subtier to the Regional Travel Model, to redistribute trips in the simulation area based on congestion and travel times. The simulation tool will be available in Transmodeler format. A description of the approach includes:

- The criteria for the definition of a major corridor were developed. The criteria were then applied to determine the major corridors within the region.

- Matrices were developed to prioritize the corridors that will be included in the regional simulation model. Corridors with the highest priority are included in the demonstration networks. The model was developed with the flexibility to include corridors at a future date.

- This effort utilizes data that has already been collected by GBNRTC and exists either in the Travel Demand Model or the databases developed and maintained by the GBNRTC.

- Advanced computer programming and GIS techniques were employed to migrate the data from the planning model to the simulation model. Regional demand table OD matrices represent demand which can exceed the capacity of the transportation system. When directly imported into simulation models any demands that exceeds capacity will result in grid-lock within the model. In real life these demands would seek alternative routes, modes and/or shift time periods. Therefore, the OD tables were reconciled against current capacity and ground counts.

- After the existing conditions model was calibrated, the future year mesoscopic simulation models are developed using the current GBNRTC planning horizon year. This will be useful for the GBNRTC to conduct enhanced analysis of future year needs in its Long Range

Planning efforts. For the identification of future bottlenecks in the regional system, the simulation provides the benefit of an operational analysis of the future needs and allows projects to be developed that specifically address the cause of the bottlenecks, unlike Travel Demand Models where the location of future bottlenecks cannot be identified.

<u>TRANSMIT Network</u>

NITTEC has established a comprehensive network of speed monitoring devices (TRANSMIT) and the freeway system throughout much of the region, initially in Erie County. The speed information is displayed at their website (<u>www.NITTEC.org</u>). This data will be compiled for analysis, providing a basis for travel time reliability and periods of **recurring** congestion. Data incorporation procedures between NITTEC and GBNRTC are currently in development.

TRANSMIT is a system that uses E-ZPass electronic tolling transponders to measure travel times between selected points on the road network. TRANSMIT was developed by the Transportation Operations Coordinating Committee (TRANSCOM), a coalition of 16 transportation and public safety agencies in the New York, New Jersey, Connecticut metropolitan region. TRANSMIT is comprised of devices capable of reading E-ZPass transponders located at strategic locations throughout the road network. As a vehicle equipped with a transponder passes a reader, the tag ID and time it passed is read and communicated to the server. As the vehicle passes another reader at a different point within the road network, the new IDs are matched and the time differential is calculated. The result is the travel time between two points on the road network. Post processing and averaging of numerous vehicles provides a near real time measure of travel times for the various road segments of the network monitored. Currently, TRANSMIT monitors portions of routes I-90, I-290 and 33 in the Buffalo area as shown below.

TRANSIMS Activity Based Approach

TRANSIMS models create a virtual metropolitan region with a complete representation of the region's individuals, their activities, and the transportation infrastructure. Trips are planned to satisfy the individuals' activity patterns. TRANSIMS then simulates the movement of individuals across the transportation network, including their use of vehicles such as cars or buses, on a second-by-second basis. This virtual world of travelers mimics the traveling and driving behavior of real people in the region. The interactions of individual vehicles produce realistic traffic dynamics from which analysts using TRANSIMS can estimate vehicle emissions and judge the overall performance of the transportation system.

The modules developed for TRANSIMS contain many significant advances beyond the four-step models:

- *Disaggregate Models*. TRANSIMS tracks individuals, households, and vehicles, not zonal aggregation of households and employment. TRANSIMS also estimates travel second-by-second throughout the entire day rather than total travel for various periods.
- *Simulation*. The regional microsimulation uses vehicle interactions to produce operating speeds, intersection operations, and vehicle operating conditions for each vehicle in the system instead of deterministic equations.
- *Integrated System.* Underlying the development of the TRANSIMS modules has been the effort to tightly couple the functions and data flow among the four modules. While it is currently possible to add a microsimulation or an air quality emission calculation into current forecasting models, such capabilities require considerable postprocessing. Feedback and the careful scrutiny of policy or infrastructure actions are currently difficult to achieve. By integrating all these capabilities in one model, TRANSIMS overcomes many of the limitations that transportation professionals currently experience.
- *Highly Detailed Vehicle Emission Estimates.* Current emission models use average speed estimates from the current models. The resulting emission estimates are insensitive to traffic conditions and lack precision. In contrast, the TRANSIMS emission estimates are based on the operation of individual vehicles as they interact in roadway traffic.
- *Operational Tools*. The microsimulation module permits very detailed analyses of traffic operations on the transportation network. This capability could be used to evaluate improvements such as traffic signal plans and ramp metering

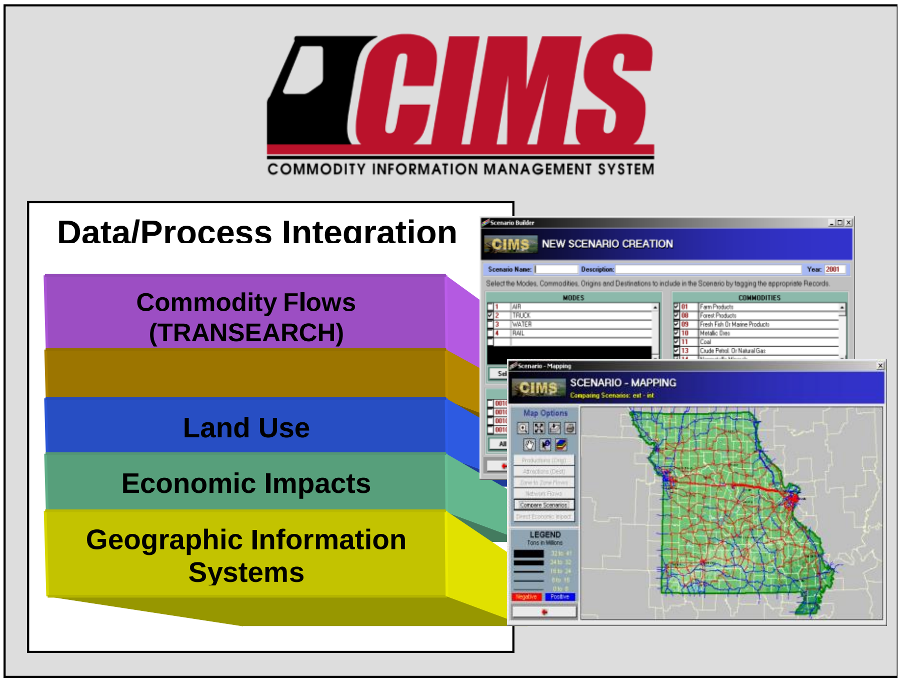
A demonstration TRANSIMS application has been completed for the Buffalo-Niagara region using existing regional travel data. Congestion related test deployments have been completed and the tool will be available for selected use in the CMP.

Freight Analysis

As part of the Niagara Frontier Urban Area Freight Study, a customized version of the Commodity Information Management System (CIMS) is being developed. Attributes of this system include:

Commodity Flow Data – CIMS was built to use information from the TRANSEARCH database. Query tools allow the user to select specific information from the TRANSEARCH database, use the selected information as inputs to other component model and retrieve model outputs so that the results can be viewed in standard report or map form. In addition to TRANSEARCH data, CIMS can also include access to any other spatial information including socioeconomic, demographic and special freight generator information. Since CIMS helps manage and display information on all transportation modes, it is useful in identifying modal deficiencies and opportunities for intermodal connections.

Travel Demand Modeling - The CIMS is being built to seamlessly interact with the MPO's existing travel demand model. This interface will allow the MPO to very quickly model regional freight movements and summarize those movements in the form of standard reports and maps. Tools will be included to compare different scenarios to more quickly identify areas where growth potential future bottlenecks.



Geographic Information Systems – The mapping within CIMS is compatible with the Environment Systems Research Institute (ESRI) standards and is thus information is easily transmitted to and from the ArcGIS software. This allows users to very quickly move output from CIMS into the MPO's GIS environment for additional study and analysis.

Use in the Monitoring Process

These tools and the data collected provide the basis for a multi level screening process. Initial, overall regional indicators are monitored to determine trends and relative severity of the congestion problem. Subsequently, the regional model and analytical tools are employed to identify locations, duration, and temporal distribution of congestion. Finally, the simulation capabilities permit localized analysis to offer specific solutions and test proposals for congestion management. This tiered approach will facilitate a more integrated approach to project development and deployment as the impacts of various proposals can be examined in a system wide context, allowing the majority of the CMP resources to be focused on the most problematic areas.

Definition of Objectives & Performance Measures

The GBNRTC has integrated some of the RCTO goals, objectives and performance measures into its CMP. The RCTO was cooperatively developed through the member agencies of the Niagara International Transportation Technology Coalition (NITTEC), a comprehensive regional operations agency. The purpose of the RCTO is to provide a framework for regional agencies to improve regional transportation system performance by continuous collaboration. It aims to answer 2 basic questions:

- What do stakeholders want to achieve?
- How are they going to achieve it?

The overall vision of the RCTO; "to establish a basis for safe, reliable, efficient, and seamless transportation system"; identifies goals that rely on managing congestion in the Greater Buffalo Niagara region. Coalition member agencies recognize that deliberate and sustained efforts by operators, planners and other key stakeholders are necessary to establish direction and agree on ways to move toward these goals. Nineteen operational objectives were developed to facilitate implementation of the RCTO and help identify where progress is needed. These objectives are grouped into five categories, or target areas: agency coordination, policy and procedures, traveler information, mobility, and incident management. Three of these operational target areas are common to both the RCTO and the CMP. Specific objectives for them are shown in the following table.

RCTO/CMP OPERATIONAL TARGET AREA OJECTIVES		
I	**Agency Coordination**	
	OBJECTIVE	*Improve inter-agency and cross jurisdictional coordination and collaboration during highway incidents*
II	**Traveler Information**	
	OBJECTIVE	*Increase accuracy of congestion information (travel time)*
III	**Mobility**	
	OBJECTIVES	*Minimize travel delay* *Enhanced transit operations* *Reduce travel time uncertainty* *Balance traffic loads on border crossing corridors*

Mobility objectives generally strive to limit the percent increase in average travel time to less than the percent increase in traffic volume. While the mobility and incident management target areas appear to have the most direct impact on identifying, measuring, and addressing recurring and non-recurring congestion, each target area can contribute to proactive congestion management.

How efficiently the regional transportation system functions largely part depends on multi-**agency coordination**. Communication and collaboration between agencies provides the basis for **regional traveler information** sharing, incident and emergency management, and signal coordination between jurisdictions. Choices of travel times, modes, and routes are increasingly affected by the availability of real-time traveler information enabled by ITS deployment and operations. **Policy and procedure** provide guidance to stakeholder agencies, facilitates coordination across jurisdictions, and can institutionalize integration. Progress toward meeting the identified objectives for each target area is assessed by periodically monitoring and evaluating the performance measurements contained in the following tables.

PERFORMANCE MEASURES FOR DEFINED RCTO/CMP OBJECTIVES

TARGET AREA I: Agency Coordination

OBJECTIVE Improve inter-agency and cross jurisdictional coordination and collaboration during highway incidents

PERFORMANCE MEASURES

a) *Evaluate the use of established center-to-center communication links*
  - *# of agencies*
  - *Monthly activity*
  - *Monthly down-time*

b) *Yearly survey of agencies*

c) *Quarterly use of procedures are in place*

TARGET AREA II: Traveler Information

OBJECTIVE Increase accuracy of congestion information (travel time)

PERFORMANCE MEASURE

Compare reader time vs. actual travel time for selected periods and links

TARGET AREA III: Mobility

OBJECTIVE Minimize travel delay

PERFORMANCE MEASURE

Compare non-delayed travel times with delayed travel times for selected time periods and links

OBJECTIVE Enhanced transit operations

PERFORMANCE MEASURES

a) *Percentage of time running on or close to schedule*

b) *Number of passengers*

c) *Identification of high quality transit corridors*

d) *Number of routes*

e) *Frequency of routes*

OBJECTIVE Reduce travel time uncertainty

PERFORMANCE MEASURE

Compare monthly & yearly travel times on selected links during selected time periods

OBJECTIVE Balance traffic loads on border crossing corridors

PERFORMANCE MEASURE

Monthly percentage of border crossing traffic on each facility

Based on stakeholder input the region is also pursuing ICM concepts and initiatives parallel to the RCTO which could be integrated in its CMP. These look towards incorporating the management of multiple networks, and network connections, along corridors under certain operating scenarios once an ICM program is implemented and stakeholder roles and responsibilities are identified. The following operating scenarios have been cooperatively selected for inclusion in the region's ICM concept:

1. Daily operations (recurring congestion)
2. Incident operations
   - Highway – major (arterials, freeway)
   - Transit
   - Border crossing
   - Weather
3. Work Zone operations
4. Planned Special Event operations
5. Evacuation operations

Operational coordination between modes and jurisdictions to continuously provide better mobility along select corridors, i.e. through signal coordination, not only contributes to achieving overall regional mobility; it promotes additional stakeholder involvement by supplying demonstrable benefits. Practical implementation of individual, limited scale, ICM initiatives could be also serve as test cases which provide effectiveness information that may be applicable to different parts of the region and different portions of the transportation network.

While all RCTO objectives and performance measures directly or indirectly support the regional ICM strategy, twelve objectives with corresponding performance measures specific to integrated corridor management have been developed. Ten relate to the operational target areas common to both the RCTO and the CMP (agency coordination, traveler information, mobility) and two relate to incident management. The table below includes ten objectives and performance measures that specifically relate to managed corridor operations and are used by the CMP to evaluate the effectiveness in meeting ICM objectives.

ICM Objectives & Performance Measures	**RTCO** *Target Area*
ICM OBJECTIVE 1: Improve center-to-center communications	**I**
ICM OBJECTIVE 2: Improve accuracy of congestion (travel time) information reliability **PERFORMANCE MEASURES** a) *Posted travel times (speed limits) vs. measured travel times for selected times and links* b) *Monthly system up-time/down-time*	**II**
ICM OBJECTIVE 3: Enable intermodal choices through improved traveler information **PERFORMANCE MEASURES** *Number of static/dynamic traveler information sources in place*	**II, III**

ICM OBJECTIVE 4: Improve integration of weather information/data for traveler information & maintenance operations **PERFORMANCE MEASURES** *Number of relationships with weather information/data sources*	**II**
ICM OBJECTIVE 5: Improve integrated operations based on real-time data **PERFORMANCE MEASURES** b) *Monthly up-time* c) *Frequency of system element updates*	**II, III**
ICM OBJECTIVE 6: Maximize the free flow of traffic & reduce congestion **PERFORMANCE MEASURES** a) *Percentage of coordinated corridors* b) *Percentage of ICM corridors operated by a central source* c) *Number of key signals re-timed every three years*	**III**
ICM OBJECTIVE 7: Provide transit alternative & park-and-ride facilities **PERFORMANCE MEASURES** *Number of park and ride facilities*	**III**
ICM OBJECTIVE 8: Enhance border crossing clearance **PERFORMANCE MEASURES** *Monthly total border delay time during selected times & periods*	**III**
ICM OBJECTIVE 9: Facilitate ITS & operational improvements that will facilitate ICM mobility **PERFORMANCE MEASURES** a) *Number of VMS, Travel Time readers & CCTV deployed per year* b) *HAR system coverage in the ICM corridor*	**I, II**
ICM OBJECTIVE 10: Enhance alternative route management capabilities **PERFORMANCE MEASURES** a) *Number of signal systems integrated* b) *Number of corridors operating as a system* c) *Number of arterials instrumented* d) *Number of parallel arterials instrumented*	**I, III**

The CMP will use the RCTO as a sustaining foundation for developing strategies and implementation plans to address congestion identified in the region (within and outside of integrated corridors). It integrates new or expanded operations objectives and performance measures that evolve in the RCTO from a cooperative forum via –

- collaborative partnership and formal coordination
- improved monitoring capabilities afforded by deployment of existing and emerging technologies (i.e. TRANSMIT network data, travel modeling and simulation tools).

Although priorities vary between agencies there is much common ground to first advance policies, procedures, and practices related to the RTCO, and in turn the CMP, as they are formally established. Improvements regarding information flow are needed; particularly related to disseminating information about unplanned incidents, formal partnership and connectivity with the media, and integration of US-Canadian data, i.e.., center-to-center communication links, incident management coordination, VMS standards. Similarly, considerable work is required to upgrade arterial signal systems for ICM strategies to integrate priority corridors with the expressway systems.

Coordinated Data Collection & Performance Monitoring

The available data on the RCTO/ICM performance measures will be collected on a continuous basis to periodically track and summarize changes in performance, and compare performance information to that of previous years. To help gauge the extent to which identified objectives are being met this data will be supplemented by performance measure data traditionally used to identify the extent and duration of congestion at highway locations and transit routes:

- Level of Service
- Vehicle / Person Hours of Delay
- Transit Load Factors

Thus, CMP relies on both internal and external data sources of data. Regional highway travel is monitored primarily through the GBNRTC continuous regional traffic monitoring program. On a yearly basis this program provides 24-hour traffic volume count data for approximately 500 federal aid-eligible highway segments according to New York State Traffic Monitoring Standards. A three-year cycle is necessary for complete coverage of the state and local federal aid system. Vehicle classification and speed data are also being generated by the current automatic traffic recorder (ATR) hardware and software configurations. This provides the quantity of single-combination trailer trucks, multiple-trailer combination trucks, two-axle four tire vehicles, and buses operating on an average weekday. Travel time speed and delay studies have been conducted on various arterials during peak and off-peak time periods to calibrate speed estimates in the travel demand model. System-wide, approximately 85 miles of roadway in the region have been identified as major travel corridors for speed/delay data collection. These data segments enable more thorough estimation of congestion on highways and transit routes. The GBNRTC has incorporated continuous speed and delay monitoring into a program similar to the traffic count program to enable travel demand model calibration on a regular basis. Approximately 100 manual intersection turning movement counts are also collected annually to assess congestion level at selected roadway intersection locations.

External data sources must also be leveraged for continued CMP development, namely from MPO member agencies as well as the NITTEC and its member agencies. Data from key stakeholders which have established the direction and priorities for managing congestion and operational objectives will be a vital addition to the large bank of travel data that provides information on regional travel patterns and transportation networks. The region's transit operator, Niagara Frontier Transportation Authority (NFTA), provides transit data necessary to calibrate the travel demand model; specifically ridership, transfer, origin/destination, frequency of usage, and fare payment data collected on a route by route basis from its on-board surveys; and mode of access on a segment by segment basis for input into multi-modal planning analysis. Base data from on-board surveys are updated using the automated passenger count (APC) machine fare collection procedure. Light rail ridership statistics are collected via manual count by NFTA personnel. Data on load factors and capacity rates for individual routes could be calculated from data available through the NFTA to provide service standard information.

Data collected by new technologies as they relate to the cooperatively developed operational objectives and performance measures will also need to be considered for integration into the CMP. Technological advances continually improve the data collection process and offer real-time system performance monitoring and operation. This makes the NITTEC regional Traffic Operations Center (TOC) and coalition another primary external source of system congestion and performance measure data. A bulk of the RTCO and ICM performance measure data provided by deployed ITS technologies could be leveraged through agency coordination and formally established administrative policy and procedures. Coupled with modeling tools and traditional congestion data within the MPO these data could provide an accurate representation of the location, extent, and duration of congestion pre - and post- project implementation for strategy assessment, and for determining the extent to which objectives are being met.

The RCTO being the basis for developing congestion management strategies and planning, any revisions to data collection processes and data sources that occur as a result of either improved capabilities; or changes to strategic direction/priorities or operational objectives set in the RCTO by stakeholders, will be included in documents that report how congestion in the region is managed.

Identification of Strategies, Responsibilities, and Funding

Several strategies have been introduced in the Buffalo-Niagara metropolitan area that will contribute to the more effective use and improved safety of existing and future transportation systems. The following description of strategies includes current status, future expectations, responsibilities and funding for each.

Demand management measures, including growth management and congestion pricing:

Demand management/SOV Alternatives:
The Greater Buffalo-Niagara Regional Transportation Council has created a new way for travelers and other ride-seekers to find transportation alternatives, named as GoodGoing. This secure, easy-to-use and free website provides information on smarter travel options - including carpooling, taking the bus/rail, and bicycling. The main feature of the website is a carpool-matching program which allows the user to find ridesharing opportunities in the Erie and Niagara Counties area and beyond. Good Going lets you enjoy the advantages of sharing ride costs and the benefits of less stressful travel, while also reducing traffic congestion and pollution in the region.

Good Going further offers information on other travel choices - transit (Metro bus/rail), the location of park-and-ride lots, and bicycling. The interactive website provides users assistance in finding their personalized best alternatives. Users can also find carpool partners for special events that take place around the region, throughout the year.

An employer module has been added to allow companies to evaluate the commute options their employees use and assess what travel reduction programs will work best for their employees. GoodGoing allows the appropriate representative to download daily, weekly or monthly reports that will indicate how many employees participate from the company, their commute choice and their trip and emission reductions. The company representative is also able to post commute notices and personalize GoodGoing to fit their company's needs.

GoodGoing provides comprehensive reports for compressed workweeks, flexible schedules, telecommuting and bus or vanpool use. The benefits of offering such programs can attract and retain skilled employees, reducing the need for costly training of new employees, or they may even expand the labor pool. Companies also benefit from:

- tax and cost savings,
- reduced parking challenges and/or costs,
- an improved company image,
- recognition for clean air programs.

The program is currently being operated by GBNRTC with contract support from Ecology and Environment, and is funded through the Metropolitan Planning Program and well as with CMAQ funds.

<u>Related Initiatives for SOV Reduction</u>
Two additional initiatives are in place and functioning as indicated below. Each offers pooled transportation resources, the first is a car share program and the second a bike share program

<u>Buffalo Car Share</u>

Car sharing is a service that offers an automobile without the up-front costs, hassles, or environmental impacts associated with private vehicle ownership. Members reserve vehicles on an hourly basis for errands or occasional trips, while relying on other modes of transportation (such as walking, biking, using public transit, or carpooling) for their daily commute.

When a reservation comes up, the registered member goes out to the car, uses an electronic key fob to access it, and then drives the car as if they owned it. The car tracks the time out, time returned, and miles traveled. The car is then returned to the same spot it was taken from and is available to the member with the next reservation.

Anyone 18 or older with a relatively clean driving record can become a member, and will be insured for use of any cars in the Buffalo CarShare fleet. Membership is most convenient for those that live or work within a 1/2 mile of vehicle hubs, but membership is open to anyone interested, and accessing the vehicles from the Metro Bus or Metro Rail is easy.

<u>Buffalo Blue Bicycle</u>

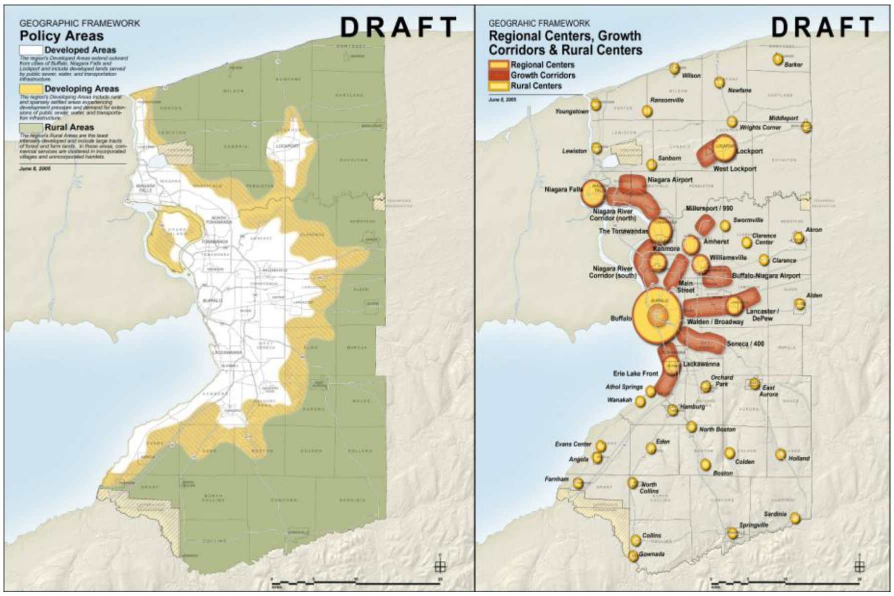
Buffalo Blue Bicycle is an innovative community bicycle-lending program committed to making a healthy, environmentally sustainable and community friendly form of transportation accessible to all City of Buffalo residents. Blue Bicycle members have access to a fleet of metallic blue bicycles located at a number of conveniently located hubs across the city and can use them for a couple of hours or up to two days.

Buffalo Blue Bicycle members are able to check out any one of a wide array of bicycles. All bicycles and hubs are connected by an online database, which allows members to use any of the hubs for pick-up or drop-off.

Growth Management
Recognition of the need to engage local decision makers in collaborative growth management led to creation of the Framework for Regional Growth. Acknowledging an opportunity to better manage the land use and transportation interface, the Framework offers benefits in ability to reduce trip lengths and VMT, congestion, infrastructure costs, and emissions and energy consumption. The Framework's core policies and strategies offer guidance regarding the type

and pattern of development for three broad geographic areas—developed, developing and rural—as well as more specific direction for the future of sub areas—centers and corridors and conservation overlays. For each geographic area, the Framework offers:

- High level policy direction for regional decision-makers;
- Direction to municipal officials and community stakeholder regarding regional preferences for future development and conservation; and
- A baseline to compare future conditions with existing conditions and Framework growth targets.



To advance the vision and ideas expressed in the principles, the Framework establishes broad targets for future development, which result in increased rates of reinvestment in older communities, significant savings for the region's localities and tax payers, and substantially lower rates of land consumption for new development in rural areas. Framework recommendations are designed around a broad vision for a region with strong urban and rural centers; safe, sustainable neighborhoods; compact forms of new development; and conserved rural landscapes and natural systems. To achieve this vision, the Framework calls for a significant shift in the region's development trends. Rather than have most new households locate outside existing developed areas, as has been the case during the past 30 years, the Framework calls for most new housing to occur in the developed area with only modest increases in households in the developing and rural areas. Specifically, the Framework target for the distribution of new households calls for 70% to locate in the developed area, 15% in the developing area, and 15% in the rural area.

The growth targets were based on an assessment of three alternative concepts for the regional distribution of households—a trend concept, a strategic investment concept, and a reinvestment concept. The three alternative concepts were prepared as part of the Framework planning process to reflect different assumptions regarding the distribution and density of development among the planning policy areas. As the basis for the concepts, the team has used GBNRTC's forecasts of population and households. These forecasts, developed and refined in collaboration with county and local officials, have served as the foundation for a range of local and regional planning studies, including the MPO Long Range Transportation Plan and many local government comprehensive plans. GBNRTC's forecasts call for the region to add 58,553 households by 2025, an increase of 12% over the year 2000 or an average annual increase of 0.50%. According to the rationale provided in the MPO Long Range Plan, the increase in households is based on projections that the region will reverse job and population losses experienced during the 1980s and 1990s and average household sizes will continue to modestly decline from 2.41 persons per household in 2000 to 2.34 in 2025.

The table below shows the preferred distribution of new households in the region and the effect on the overall regional distribution of households.

Density Assignments & Land Area Requirements for the 2025 Concepts

	Trend Concept			**Strategic Investment Concept**			**Reinvestment Concept**		
	New Households 2000-2025	Density Factor (HH/acre)	Land Need (acres)	New Households 2000-2025	Density Factor (HH/acre)	Land Need (acres)	New Households 2000-2025	Density Factor (HH/acre)	Land Need (acres)
Developed Area									
Erie County	12,235	4.00	3,059	21,106	6.00	3,518	37,155	6.00	6,193
Niagara County	2,203	4.00	551	7,035	6.00	1,173	4,690	6.00	782
Subtotal	**14,439**		**3,610**	**28,142**		**4,690**	**41,845**		**6,974**
Developing Area									
Erie County	14,057	2.00	7,029	11,733	4.00	2,933	4,965	4.00	1,241
Niagara County	9,006	2.00	0	3,911	4.00	978	3,259	4.00	815
Subtotal	**23,063**		**7,029**	**15,644**		**3,911**	**8,224**		**2,056**
Rural Area									
Erie County	13,914	0.50	103,987	11,076	1.00	11,076	6,307	2.00	3,154
Niagara County	7,137	0.50	52,538	3,692	1.00	3,692	2,177	2.00	1,088
Subtotal	**21,051**		**156,525**	**14,768**		**14,768**	**8,484**		**4,242**
TOTAL	**58,553**		**181,846**	**58,553**		**23,369**	**58,553**		**13,272**

Framework Implementation

A consortium of public agencies and private partners is currently working to fully implement the Framework. Affected Counties have endorsed the document and directed agencies to follow the principles. A strategy in the document called for the two counties and the MPO to jointly meet and provide regional interface and transportation influence to further the implementation of the Framework.

Congestion Pricing
The MPO is hosting a USDOT Value Pricing Demonstration to provide information for national level policy consideration, and as a possible demonstration project in the region in congestion pricing. The project will design a truck-based VMT fee that will meet multiple objectives:

- Reduce congestion
- Save energy
- Reduce costs to collect truck fees
- Provide a long-term base for transportation finance
- Support a regional system and then a national system of congestion-based fees

While not the focus of this project, the data generated by this project has other potential benefits:

- Help improve freight mobility based on data about the precise time, location, and cost of truck delays and in support of the regional freight initiative
- Help monitor and possibly manage Greenhouse Gas (GHG) emissions, measuring the carbon footprints for trucks and track changes based on policies and investments

This planning phase will use actual truck fleet data for New York State with an emphasis on Buffalo. Working in conjunction with the MPO and the CMP initiative, the project will:

Define congestion conditions, extent and severity of congested conditions on key freight corridors. This is being categorized using traditional level of service categories. This will provide an input to development of the congestion portion of a VMT fee, including estimates of when and where the higher congestion-based rates will be charged.

Develop alternative fee structures, estimating a revenue neutral VMT fee that would generate the same level of revenue as the current tax code. This is an important starting point for a VMT fee, as it will maintain tax revenues from the participating fleets while potentially reducing the administrative burden (for New York State and the motor carriers) associated with collecting the tax.

Develop alternative congestion-based fees that will vary by time of day and location based on the level of traffic congestion. Each alternative congestion fee will be associated with a different base VMT fee for periods of low or zero congestion.

Develop and apply analytic models including three major aspects: 1) the development of a map-set which includes tax policy attributes; 2) the development of vehicle activity processes based on actual data; and, 3) the development of vehicle activity processes for theoretical extensions of data.

This project is being hosted by the MPO and funded by USDOT Value Pricing Demonstration Program.

Traffic operational improvements

Signal Systems Upgrade and Coordination

The GBNRTC Long Range Plan includes an overall initiative to upgrade signalization regionwide. Toward that end a comprehensive scope and estimate was assembled for a 2009 TIGER grant application. This project is a comprehensive approach to congestion management, energy efficiency and emissions reduction in the Buffalo-Niagara region. Immediate actions are to retime traffic signals in several identified corridors, upgrade signal equipment throughout the region, and provide interconnect in priority corridors to safely and efficiently move autos and transit vehicles. The traffic control system in the Buffalo-Niagara region includes approximately 1800 signals in the two county area. A comprehensive survey done by the MPO indicated age of the equipment, need for retiming and lack of substantial interconnect capabilities as significant in diminished capability to move traffic safely and effectively, ensure predictable transit travel times and ridership stabilization, reduce emissions and energy consumption, and balance travel demand among routes with available capacity. Estimation of emissions and user savings indicates:

Overall Benefit Cost Ratio

Benefits Directly Attributable to Project:	$M/year
Maintenance savings to municipalities	.511
User savings delay reduction	116.070
User fuel savings	23.019
Accident savings	22.530
Total	162.130
Ten Year Cumulative Savings:	$1,621.300 M
Project Implementation Costs:	$ 38.734 M
Benefit/Cost ratio:	41.86

	BUFFALO									EXTENDED METRO
	VMT Daily	2007 Emission Rate		Emission grams daily	2 Emission Rate		Emission grams daily	Reduction Grams Daily	Reduction Kilograms Yearly	Reduction Kilograms yearly
		current 23mph			optimal 28mph					
	713674	Class 16	Class 17		Class 16	Class 17				
CO		18.24	18.15	12985298	17.6	17.6	12610620	374679	136758	358311
Nox		1.03	0.95	706537	0.9	0.9	677990	28547	10420	27300
VOC		0.95	0.94	674422	0.8	0.8	617328	57094	20839	54600

User Savings

	VMT	Factor	current conditions	future conditions	Savings between	saved/ unit	savings/ day	Savings/ year
Buffalo			current 23mph	optimal 28mph				
time	713.674	vehicle hrs. travel (vht)	31029 vht	25488 vht	5541 vht	$21.88	$121,237	$44,251,534
gas	713.674	gallons/ 1000 mls.	74.2 52954 gallons	63 44961 gallons	7993 gallons	$3.00	$23979	$8,752,335
accidents	713.674	accidents/ million vehicle mls. (amvm)	2.19 amvm 570 accidents	1.77 amvm 462 accidents	108 accidents	$79,400		$8,606,563
Total								$61,610,432
Extended Metro								$162,035,436

Calculation Assumptions (including from Upstate New York Signal Analysis Study, Bergmann Associates for NYSERDA):

Vehicle hours traveled were calculated based upon an estimated vehicle miles traveled within the city divided by an estimated travel speed. That speed was selected giving consideration to the current number of signals updated and coordinated. The same vehicle miles traveled was divided by 28mph assuming optimal performance within a City. Time saved is the difference between these two numbers.

The time cost savings was calculated assuming a $21.88 rate per hour of productivity based on the average hourly wage in New York State.

Fuel savings were based on the estimated number of vehicle miles traveled multiplied by speed based fuel use factors based on speeds. A cost of $3.00per gallon of fuel was assumed. Fuel use at current estimated speeds and optimal speeds were calculated. The difference between these two numbers is the fuel savings produced by optimizing signal timings and coordination.

It is estimated that by upgrading and retiming signals and improving coordination by enhancing the quality of progression, accidents can be reduced by 19% (NYSDOT accident reduction factors upgrading a red/yellow/green signal). On average, there are 2.19 accidents per million vehicle miles, according to the NYSDOT accident rates. The amount of accidents reduced by retiming city signals was calculated using these numbers and assuming a cost of $79,400 per accident, the average of all types of accidents.

Emissions were also estimated using the vehicle miles traveled and estimated speeds before and after signal retiming and coordination. Grams of CO, NOx, and VOX produced were calculated. All of the above variables were used to calculate costs and savings.

City of Buffalo estimates were extrapolated metrowide by MPO based on proportion of signals in each.

Buffalo Niagara Regional Arterial Management System:

The Buffalo Niagara Regional Arterial Management System BNRAMS Plan helps build out the regional upgrade program. This NYSDOT initiative is a multi-agency plan to address the current and future needs for improved efficiency along priority arterials and adjacent freeways in the Buffalo Niagara Region. The scope of this plan is to install electronic infrastructure on the regional priority arterial network and at the Regional Transportation Management Center (RTMC) to affect real time and planned management of traffic during weather and traffic related incidents, planned events, and reoccurring peak traffic volume periods from the RTMC and agency facilities. The plan incorporates closed loop traffic signal control, closed caption television (CCTV) cameras, Vehicle Detection Stations (VDS), Highway Advisory Radio (HAR), and Dynamic Message Signs (DMS) related communications infrastructure, and other various mediums for data collection, public notification, and integration with the existing Freeway Management System (FMS). This plan is intended to be a living document to be administered by each agency which incorporates infrastructure into the BNRAMS. This effort is administered by NYSDOT and funded through State Planning and Research program.

Traffic Signal Optimization Program:

Another signal initiative is in place to provide planning information and development/implementation of corridor-wide signal control system. The goals and objectives are compatible with the initiatives set forth in New York Statewide Transportation Master Plan to provide:

- Mobility and Reliability
- Improve Air Quality
- Environmental Improvement
- Economic Sustainability and Competitiveness
- Improve Safety
- Maximize existing roadway capacity without costly capital investments

The project is developing traffic signal coordination timing plans (i.e. cycle length, offsets, phasings, split lengths and time-space diagrams) for the identified corridors, and three coordination timings for each of the systems.

The resulting traffic models developed for the various Corridors will include an extensive amount of network documentation. The models can be used to manage and maintain the traffic network and provide a database for volumes, lane geometry, signal timing and phasing, and system coordination and offsets. Additionally, corridor network models will include simulations allowing for visual presentation of the network wide traffic system for both analysis and public presentation. This project is being administered by the MPO and funded through the CMAQ process.

Corridors and times currently planned to be retimed in this initiative include:

Corridor	Limits	# of Signals	Owner	Peak Traffic Periods
Main	Goodell to Humboldt	19	City of Buffalo	AM, noon, PM
Clinton	Michigan to City Line	25	City of Buffalo	AM, noon, PM
Elmwood	Tupper to City Line	39	City of Buffalo	AM, noon, PM
Hertel	Delaware to Main	11	City of Buffalo	AM, noon, PM
Jefferson	Clinton to Main	20	City of Buffalo	AM, noon, PM
Ridge	Rte 219 to Seneca	6	NYSDOT	AM, noon, PM
Sheridan	Grand Island Blvd to N. Forest	25	NYSDOT	AM, noon, PM
Niagara Falls Blvd	Eggert to Niagara Co. Line	14	NYSDOT	AM, noon, SAT
Main	Bailey to I-290	15	NYSDOT	AM, noon, PM
Delaware	Nottingham to I-290	15	NYSDOT	AM, noon, PM
Walden	I-90 to Union	5	NYSDOT	AM, noon, SAT

Other Signal Projects in the Buffalo-Niagara Region:

<u>Closed Loop Signal System, Phase 1:</u>
Deployment of closed loop signal system installation along portions of Walden Avenue and Delaware Avenue with communications to NITTEC through central signal software.
Fund Source: NYSDOT
Construction Estimate: $0.6M
Project Completion Date: Fall 2009
Agencies Involved: NYSDOT, NITTEC

<u>Closed Loop Signal System, Phase 2A:</u>
Deployment of closed loop signal system installation along portions of Sheridan Drive and Niagara Falls Boulevard with communications to NITTEC through central signal software.
Fund Source: NYSDOT
Construction Estimate: $2.0M
Letting Date: June 2013
Agencies Involved: NYSDOT

<u>Closed Loop Signal System, Phase 2B:</u>
Deployment of closed loop signal system installation along portions of Sheridan Drive with communications to NITTEC through central signal software.
Fund Source: NYSDOT
Construction Estimate: $2.0M
Letting Date: June 2014
Agencies Involved: NYSDOT

City of Buffalo Signal Project:
The City of Buffalo is undergoing a $2.5M project to install new signal controllers that allow interconnection along designated traffic corridors and evacuation routes with centralized control. The project is nearing completion of the installation of equipment for the identified corridors. Fiber has been installed between City Hall and NITTEC via the Erie County Public Safety Campus. The City of Buffalo has purchased the Quixote Signal Software package to run their signal system. The server at NITTEC has been installed and configured. The workstations for the City and NITTEC have been installed and configured

Public transportation improvements

A regional strategy for public transportation is being developed by NFTA, in collaboration with the Greater Buffalo Niagara Regional Transportation Council. The purpose of the study is to develop a short-term (3 year) and long-term (12 year) plan for providing and financing effective and efficient NFTA Metro transit service to meet the varied and evolving mobility needs of the region.

Key areas of focus include:

Identifying key mobility markets where transit is competitive today and can be tomorrow, for both transit dependent and those with other travel options available

Planning for continuing changes in the needs of existing and potential transit customers, including the transit dependent and disadvantaged populations, particularly addressing the "spatial mismatch" between suburban jobs and urban workers

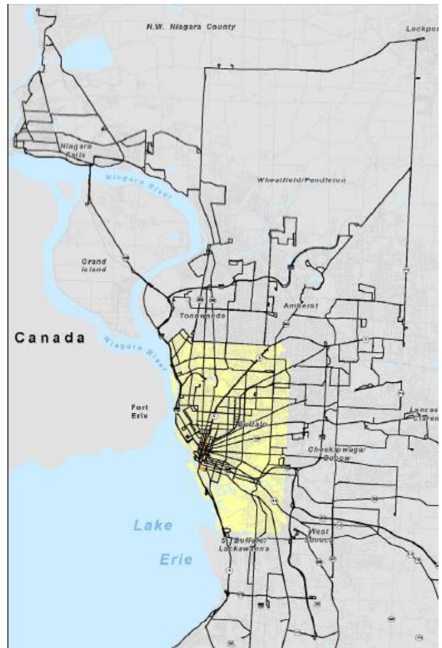
Identifying strong emerging transit market opportunities beyond the transit dependent, with particular focus on economic growth engines such as the education and medical research sectors, and the structural mobility corridors of the region

Through development of a more efficient and sustainable public transportation system a strengthened opportunity to reduce congestion by modal shift will improve the overall transportation system. Some redefined approaches for Erie County are shown by the following figures:

Erie County Service Area

Urban Core

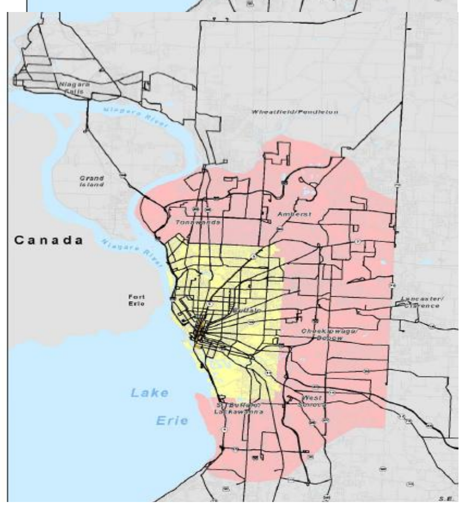
- City of Buffalo has a dense transit-oriented population, which supports a robust network of bus and rail transit.
- Key desired outcomes include:
  - Faster operation.
  - Spontaneous use frequencies.
  - Better linkages with Suburban Ring.
  - Make transit a primary travel mode in the urban core.



Erie County Service Area

Suburban Ring

- Ring city and town populations are less densely developed and more automobile-centric.
- Key desired outcomes include:
  - Better connections for Buffalo residents to suburban ring jobs.
  - Make commuter transit more competitive with other modes.
  - Focus service on major suburban destinations (UB, Galleria, Airports) and major corridors.



Service Options

Major Corridors	Local Corridors	Community
• Enhanced Bus • BRT • LRT • Commuter Express	• Local Bus • Inter-Urban Bus	• Circulators • Employer Shuttles • Flexible Service • Vanpools

ITS technologies as related to the regional ITS architecture

GBNRTC has endorsed the ITS Regional Architecture and it is used to guide project development. The Buffalo-Niagara Bi-National Regional ITS Architecture is a roadmap for transportation systems integration for the metropolitan area of Buffalo, Niagara Falls, and the surrounding municipalities in New York as well as Region Niagara in Ontario, Canada over the next 15 years. The Buffalo-Niagara Bi-National Regional ITS Architecture has been developed through a cooperative effort by the region's transportation agencies, covering all surface transportation modes and all roads in the region.

The Buffalo-Niagara Bi-National Regional ITS Architecture represents a shared vision of how each agencies systems will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the region.

The architecture is an important tool that is used by:

- Planning agencies/organizations to better reflect integration opportunities and operational needs into the transportation planning process.
- Operating and implementing agencies to recognize and plan for transportation integration opportunities in the region.
- Other organizations and individuals that use the transportation system in the region.

The architecture provides an overarching framework that spans all of these organizations and individual transportation projects. Using the architecture, each transportation project can be viewed as an element of the overall transportation system, providing visibility into the relationship between individual transportation projects and ways to cost-effectively build an integrated transportation system over time.

The MPO works closely with the Niagara International Transportation Technology Coalition (NITTEC) to integrate planning and operations in the region. NITTEC is completing a Regional Concept of Transportation Operations (RCTO) and also an Integrated Corridor Management (ICM) to further guide development of projects and operational strategies.

The RCTO is a management tool to assist in planning and implementing management and operations strategies in a collaborative and sustained manner. The RCTO focuses partners on specific operations objectives and strategies within one or more management and operations functions of regional significance, such as traveler information, road weather management, or traffic incident management. The ICM initiative consists of the operational coordination of multiple transportation networks and cross-network connections comprising a corridor, and the coordination of
institutions responsible for corridor mobility. The goal of ICM is to improve mobility, safety, and other transportation objectives for travelers and goods.

Five overall strategies were surfaced for use in the project:

Information Sharing/Distribution
Improved Operational Efficiency of Network Junctions and Interfaces
Accommodation/Promotion Cross-Network Route and Modal Shifts
Management of Capacity/Demand Relationships within the Corridor on a "Realtime"/Short-term basis

Manage Capacity/Demand Relationships within the Corridor on a "Realtime"/Long-term basis

Specific objectives attributable to these strategies include:

Information Sharing/Distribution
Center-to-center (C2C) communications is functioning among agencies
Increase in traveler information services (web, 511, TV, radio)
Increase in traveler information usage
Reduce travel time variation
Integration of weather information into traveler information services
Integration of RWIS between the region and the province
Increase number of VMS, travel time readers, and CCTV deployed
Integrate transit information into the highway information network
Improve Operational Efficiency of Network Junctions and Interfaces
Facilitate ITS and operational improvements
Reduce system and system element down-time
Improve integrated operations based on real-time data
Integrate new technology
Develop uniform incident classifications and severity guidelines
Decrease detection, arrival, clearance and recovery times
Hold coordination meetings among agencies
Implement uniform incident measures
Conduct responder training
Utilize ICM approach for events
Accommodate / Promote Cross-Network Route & Modal Shifts
Enable intermodal choices through improved traveler information
Provide travelers with various modal and route options
Increase transit reliability
Increase transit ridership
Increase the number of park-and ride facilities
Manage Capacity/Demand Relationship – "Real-time"/ Short -Term
Increase transit capacity
Increase corridor traffic signal coordination
Retiming of key signals in the corridor
Provide additional instrumentation on primary arterials
Manage Capacity/Demand Relationship – "Real-time"/ Long-Term
Enhance alternative route management capabilities
Appointment of a central source to manage and operate corridors in the ICM
Decrease total border delay time
Operate signals and freeways as a system

A traceability matrix that outlines responsibilities and correlation between the goals and strategies and identifies which strategies directly and indirectly support the identified goals of the ICM follows:

Agency/Service	*Responsibilities*	*ICM Aligned Staff*
NITTEC Traffic Operations Center	• Corridor coordinated operations • Corridor administration activities • Corridor performance monitoring • Corridor technical management and development • VMS • ITS device management (VMS, HAR, CCTV, etc.) • Enact/implement response plans	• Executive Director • Engineering Manager • TOC Manager • Staff support from other agencies/services to support coordinated operations and technical development
Bridge agencies – **Buffalo and Fort Erie Public Bridge Authority** – **Niagara Falls Bridge Commission (NFBC)**	• Daily corridor operations • Monitoring bridge traffic flow • Bridge surveillance • Enact response plans • Maintenance	• Agency/Service Officer • Corridor operations, administration, and technical support staff
Ministry of Transportation, Ontario (MTO)	• Daily corridor operations • Freeway management • Signal systems • ITS device management (VMS, CCTV, etc.) • Enact/implement response plans • Maintenance	• Agency/Service Officer • Corridor operations, administration, and technical support staff
New York State Department of Transportation (NYSDOT)	• Daily corridor operations • Freeway management • Signal systems • Maintenance	• Agency/Service Officer • Corridor operations, administration, and technical support staff
New York State Thruway Authority (NYSTA)	• Daily corridor operations • Freeway management • Maintenance	• Agency/Service Officer • Corridor operations, administration, and technical support staff
Niagara Frontier Transportation Authority (NFTA)	• Daily operations • Monitor bus on-time levels • Monitor train schedules • Monitor parking conditions • Enact response plans	• Agency/Service Officer • Corridor operations, administration, and technical support staff

ICM Strategy

Agency/Service	*Responsibilities*	*ICM Aligned Staff*
Local municipalities within: – Erie County, New York – Niagara County, New York – Niagara Region, Ontario	• Daily Operations • Arterial surveillance • VMS on arterials • Enact response plans	• Agency/Service Officer • Corridor operations, administration, and technical support staff
Local municipalities that maintain traffic signals	• Daily Operations • Signal systems	• Agency/Service Officer • Corridor operations, administration, and technical support staff
Border agencies – Canada Border Services Agency (CBSA) – United States Customs and Border Protection (CBP)	• Daily operations • Border patrol • Border traffic management	• Agency/Service Officer • Corridor operations, administration, and technical support staff
Emergency agencies – Erie County Emergency Services – New York State Police (NYSP) – Niagara Falls Fire Department – Niagara Parks Police – Ontario Provincial Police (OPP) – NITTEC Incident Management Committee Members WNY & Ontario	• Emergency management • Coordination of law enforcement activities • Coordination of emergency services activities • Incident response management • Integration of Computer Aided Dispatch (CAD)	• Agency/Service Officer • Corridor operations, administration, and technical support staff • Local law enforcement staff • Emergency responder staff

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Directly Supports

Additional ITS Capital Projects including responsibility and funding:

Design of Intelligent Transportation Systems Project in the Buffalo / Niagara Falls/ Southern Ontario Region

This project is the installation of an Intelligent Transportation System on Various Highways (parts of NY Route 5, NY Route 33, Interstate 90, Interstate 290, and US Route 219). The System will include CCTV, HAR Signs, VMS, TRANSMIT, Permanent Loop Detection Stations, and fiber optic communications.

Fund Source: ITS Funds (28%), Federal Demo (30%), NHS (17%), SDF (21 %) and Local (3%) & CMAQ (80%), SDF (11%) and NYSTA (9%)

Construction Estimate: $1.339M & $6.623 M

Project Completion Date: September 30, 2009

Agencies Involved: NYSTA and NYSDOT. NYSTA is administering the Contract.

Installation of a TRANSMIT System in Niagara Region

This project will install TRANSMIT electronic toll-collection tag readers at seven locations in the Niagara Region expanding the existing base of reader sites in New York State. It will provide motorists with advance warning of travel-time / average speed information for better route selection crossing the international border to and from Canada and within the Niagara Region on both sides of the border.

Fund Source: MTO
Construction Estimate: $1.5 M
Project Completion Date: Fall 2009
Agencies Involved: MTO

ITS Phase 4A:

Deployment of ITS equipment and communications system along the I-190 and I-90.
Fund Source: CMAQ, NYSTA
Construction Estimate: $11M
Project Completion Date: July 2011
Agencies Involved: NYSTA

Action Plan for Deploying Intelligent Transportation Systems at Ontario's Borders

The purpose of this study is to develop an Action Plan to deploy Intelligent Transportation Systems (ITS) at border crossings for the Ontario, Canada-U.S. border.
Agencies Involved: MTO, Transport Canada

Equipment and Communications:

Deployment of ITS equipment and communications system along the I-990, Route 219, Route 5, Route 400 and Route 198.
Fund Source: CMAQ, STP-Flex, NYSDOT
Construction Estimate: $6.0M & $3.0M
Letting Date: June 2011
Agencies Involved: NYSDOT, NITTEC

Additional system capacity:

There is consensus that congestion in the WNY area is not as serious a problem when compared to other areas; however, there is a need to resolve existing spot congestion problems. The current GBNRTC Long Range Plan 2030 contains funds for continuous infrastructure upgrade, and also allocates funds for specifically identified projects. Implementation will serve to focus congestion relief on those projects that would impact major travel corridors within the region and maintain good travel flow on intercity routes and major freight corridors.

Projects identified in the LRP include

I-90/I-290 Interchange improvement
I-90 Widening between Exit 50 and Exit 53
Exit 50 Toll Barrier relocation
I-90 Youngs Rd. interchange
Lackawanna Toll Relocation
Amherst Corridor High Quality/High Capacity Transit service

Tonawanda Corridor High Quality/High Capacity Transit service
Buffalo/Niagara Falls Commuter Rail Service
Regionwide Express Bus Service
LRRT Infrastructure improvements
Southtowns Access/Redevelopment project
Improved Waterfront Access
South Grand Island Bridge
Area-wide Signalization upgrade
ITS Implementation
Robert Moses Parkway enhancements
Scajaquada Expressway enhancements
Intersection Improvements
Economic Development Projects
Safety Projects
Bike-Pedestrian Master Plan Implementation

Some of the identified projects have been previously discussed specific to the congestion management process. Other projects are areawide in nature and will provide for a continuous response to identified needs over the timeframe of the Plan. The CMP will provide an opportunity to regularly examine congestion measures using tools such as the regional simulation framework. This will be useful for the GBNRTC to conduct enhanced analysis of future year needs in their Long Range Planning efforts and the CMP. For identification of future bottlenecks in the regional system, the simulation provides the benefit of an operational analysis of the future needs and allows projects to be developed that specifically address the cause of the bottlenecks.

Process for Periodic assessment of Implemented Strategies

GBNRTC plans to work closely with coalition and member agencies to coordinate data needs to the assess costs and benefits of implemented projects. As these needs, as well as an overall pre- and post-congestion monitoring system for the region, become more refined progress reports that summarize and track congestion mitigation strategies will be produced. These documents will enumerate projects within the CMP strategy categories listed below. This list of strategies is not meant to be all inclusive, particularly when a package of improvements is combined to address a specific congestion problem that has been identified, or, when more than one category applies to the components of a single project.

CMP Strategies
Transportation Demand Management
Traffic Operational Improvements
Parking Management Actions
Promote High Occupancy Vehicle Use
Promotion of Car and Van Pool Actions
Transit Capital and Operational Improvements
Advanced Public Transportation System Applications
Bicycle and Pedestrian Facility Alternatives
Growth Management and Congestion Pricing Applications
Land Use Management Activities
Access Management Techniques
Incident Management Techniques
Intelligent Transportation System (ITS) Applications

Progressively more tracking of quantifiable congestion indicators and performance measures will be used in future versions of the regional progress report. Where multi-year data is available GBNRTC plans to include some form of before-and after analysis as a means to further gauge project effectiveness. The GBNRTC is also considering incorporating a safety element into its CMP. As regional crash data screenings and other safety analyses become more reliable and accessible, such information could be examined for areas with recurring congestion, or to identify locations characterized with non-recurring congestion due to incidents. Improving these types of reports to better analyze specific projects and evaluate their effectiveness on relieving congestion also provides the rationale for the projects included in the LRTP and the TIP project development/selection processes.