Hudson River Crossing Study

Final Report

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Prepared for:

Capital District
Transportation Committee

New York State
Department of Transportation

Bergmann associates

smart mobility

alta PLANNING + DESIGN

HOWARD/STEIN-HUDSON. ASSOCIATES

ARCH STREET COMMUNICATIONS

Baker

Acknowledgements

Study Advisory Committee

Capital District Regional Planning Commission	Rocco Ferraro
Capital District Transportation Authority	Kristina Younger
City of Albany	Deirdre Rudolph
City of Rensselaer	Marybeth Pettit
City of Troy	Judy Breselor
County of Albany	Michael Franchini
Hudson Valley Greenway	Mary Mangione
NYS Department of State	Bonnie Devine
NYS Senate Task Force on High Speed Rail	Jim Cartin
NYS Thruway Authority	Jill Ross Phil Serafino
Port of Albany	Frank Commisso
Rensselaer County	Linda Von der Heide
Town of East Greenbush	James Moore
Town of North Greenbush	Mark Evers

Stakeholders

A Regional Initiative Supporting Empowerment	Andreas Kriefall
Adirondack Trailways	Marc Boungard Anne Noonan
Albany Convention and Visitors Bureau	Michelle Vennard
American Automobile Association	Michelle Vanepps
Amtrak	Thomas Connolly
Center for Economic Growth	David Rooney
Center for Independence	Tim Maxwell
Chamber of Commerce (Albany)	Lyn Taylor
Chamber of Commerce (Rensselaer County)	Linda Hillman
City of Cohoes	John T. McDonald III
Council of Albany Neighborhood Association	Howard Stoller
CSX Transportation	John Cassalini
Greyhound	Mike Fleichhauer Deanna Simsek William Sliger
Hudson River Greenway	Mary Mangione
Hudson Valley Community College	Stephen Cowan
I Love NY	Marketing Dept.
New York Planning Federation	David Kay
NYS Bike Coalition	Joshua Poppel
NYS Department of Environmental Conservation	Jeff Sama
NYS Office of General Services	Bruce Trobridge
NYS Parks and Historic Preservation	Kurt Kress
Peter Pan Bus Lines	
Scenic Hudson	Ned Sullivan
Schodack Island State Park	Rob Taylor
Town of Bethlehem	John Cunningham
Town of Colonie	Mary Brizzell
Town of East Greenbush	Rick McCabe
Town of North Greenbush	Mark A. Evers
Town of Schodack	Beth Knauf Secor
US Army Corps of Engineers	James Cannon
Village of Castleton-On-Hudson	Nancy Perry
Village of Menands	Bill Smith
Watervliet Arsenal	Lawrence Schaefer

Executive Summary

In a cooperative partnership, the Capital District Transportation Committee (CDTC) and the New York State Department of Transportation (NYSDOT) initiated the Hudson River Crossing Study (HRCS) to take a broad, initial look at transportation and multi-modal mobility issues related to the Patroon Island Bridge and adjacent Hudson River crossings. Together these crossings accommodate approximately 244,000 vehicle trips each day. The study includes an examination of the entire system of crossings under several possible future growth scenarios as defined in CDTC's New Visions 2030 document. NYSDOT will use the mobility and traffic findings from this study to help frame the scope of its upcoming major rehabilitation/replacement study of the Patroon Island Bridge.

In regard to congestion management, the traffic analysis indicates that widening of the Patroon Island Bridge is not necessary to provide reasonable traffic operation for the foreseeable future. The amount of delay that would be reduced by widening the Patroon Island Bridge does not warrant the considerable cost for additional lanes. Traffic congestion currently being experienced in the westbound I-90 morning peak hour is not because of the geometric capacity of the bridge, as many commuters believe; instead, it occurs "upstream" in the merge and weave area between Exit 7 and 8. The merge and weave area between Exit 7 and 8 should be analyzed under the scope of the upcoming major rehabilitation/replacement study, with ramp metering being studied as a possible method to reduce the delays.

The potential of diverting traffic from the Patroon Island Bridge to the NYS Thruway Authority's (NYSTA's) Castleton-On-Hudson Bridge was also considered as a way to reduce demand on the Patroon Island Bridge. It was determined that the number of trips that could be diverted to the Thruway would not significantly change the traffic conditions on the Patroon Island Bridge. Nevertheless, signage, re-designation of free I-90, and toll restructuring should be studied to reduce confusion and better manage traffic passing through the Capital District on the Thruway rather than using free I-90.

The CDTC's New Visions Plan supports and encourages concentrated development patterns in the Capital District for the significant benefits to the transportation system and for regional quality of life. The study's findings indicate that the traffic demand of the high-density infill growth described in the New Vision 2030 plan can be accommodated by the existing Hudson River crossings. The application of the New Vision 2030 principles can reduce future vehicle-miles traveled and future costs for road improvements. Creating more opportunities to access arterials will expand regional capacity using infrastructure already in place. An interconnected road network gives users multiple route choices to get to their destination.

In regard to transit, the study found that improving the regional bus network can help reduce future peak hour volumes at the Hudson River crossings. However, to be effective, transit investments should be coordinated with opportunities for pedestrian and transit-oriented development. (The development of the new waterfront at Rensselaer, and the Albany Convention Center, create opportunities to explore ways to enhance transit usage and intermodal access.) In addition to bus services, opportunities for water taxis (bicycle/pedestrian) and ferry service across the Hudson River should also be considered as part of the overall regional plan for accessibility.

The Capital Region currently offers numerous Intelligent Transportation Systems (ITS) services, including traffic cameras, variable message signs, and traffic counters. Traffic operations in the Capital Region are monitored at the NYSDOT Transportation Management Center and the NYSTA Statewide Operations Center. To date the primary focus of these agencies, has been on I-90, I-787, and I-87. Little ITS service is found east of the Hudson River. As the ITS System expands in the Region it is recommended that emphasis be given to the addition of Arterial Management Systems, and real time traffic information in and around Rensselaer. As recommended in the Federal Highway Administration, "Integrated Corridor Management" program, total integration with arterials on nearby priority corridors such as Routes 9 and 20 and the

intersection of Routes 4 and 43, could help reduce congestion on both the Patroon Island Bridge and local street networks. Regional Travel Demand Management programs that encourage telecommuting, condensed work weeks, and varying work day times for employers, particularly at large employment centers, can reduce peak hour volumes and the need for expensive mitigation.

The capital program needs of the bridges were also reviewed. The review focused on the Patroon Island Bridge and its immediate neighbors: Dunn Memorial, Livingston Avenue and the Troy-Menands. These four bridges were reviewed in a systems context perspective that included traffic and existing and potential mulit-modal opportunities. The study found that all bridges within the study limits have ample vehicular capacity, although bicycle/pedestrian (bike/ped) improvements on all bridges were warranted – and there was very strong support among stakeholders for these improvements.

The Troy-Menands Bridge may need major rehabilitation or replacement within the next 15 years. The bridge's highway approach network has capacity and delay issues that should be addressed in a regional context before major work is undertaken.

Access and connectivity to the local street and rail network for transit, bicyclists and pedestrians should be studied closely and programmed accordingly before any major capital program work is initiated on the Livingston Avenue and Dunn Memorial Bridges. The re-establishment of bicycle and pedestrian access on the Livingston Avenue Bridge should be considered an "early win" and given the highest priority for implementing an improved bike/ped crossing over the Hudson River. It would provide the most useful and desirable connection between Rensselaer and Albany. Using public/private funding partnerships, the walkway could be established in the near term.

To the south, the NYSTA has identified $50 million in repairs needed for the Castleton-On-Hudson Bridge in the next 10 years, framed by an on-going substructure repair contract, and a deck replacement at the end of the 10 year period. To the north, the Collar City, Troy-Green Island, and Troy-Watervliet Bridges are all in relatively good condition with only minor repairs needed.

Through collaboration that included a Study Advisory Committee and key stakeholders, CDTC and NYSDOT's Hudson River Crossing Study has resulted in key findings that will facilitate the critical task of managing multiple capital priorities. The findings that the Patroon Island Bridge does not need widening, and that all the river crossings between Albany and Rensselaer counties have ample capacity for the foreseeable future, are positive steps. Implementing some of the recommendations within the study regarding multi-modal transportation, interchange capacity, ITS and land use are the next steps to improving existing and future traffic flow in this area.

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Introduction

Background and Purpose of Study

The Capital District Transportation Committee (CDTC) and the New York State Department of Transportation (NYSDOT), in their effort to address long-term regional transportation capacity needs, initiated a six-month appraisal, titled the Hudson River Crossing Study (HRCS). Structural issues provide a compelling justification for an upcoming study of the rehabilitation or replacement of the Patroon Island Bridge. They also created an opportunity to first take a broader look at transportation and mobility issues related to the bridge and other Hudson River crossings in the area through a unique collaboration between CDTC and NYSDOT; one that both agencies have identified as a model for future major transportation projects. A consultant team led by Bergmann Associates was selected to support this broader study.

The intent of the Study was to examine traffic volumes and patterns, with specific consideration for the I-90 Patroon Island Bridge and seven other Hudson River crossings in the Capital District, which together accommodate approximately 244,000 vehicle trips each day. The Patroon Island Bridge carries 82,000 vehicles per day, making it an important link in the regional transportation network, and creating the ideal catalyst for an assessment of the whole question of regional mobility along with specific consideration for replacing or rehabilitating the bridge.

The study included an examination of the entire system of bridges within the region under several possible future growth scenarios - as defined in CDTC's *New Visions 2030* document - in order to project multi-modal transportation needs and regional development opportunities. The team studied the bridge system's relationship to regional mobility from a multi-modal perspective, including highway, transit, bicycle and pedestrian river-crossing needs and reviewed traffic volumes and patterns on the Patroon, as well as other nearby crossings, in order to provide a view into the function of the whole system of bridges within the region and into their impacts on regional mobility.

The results provide both short and long-term recommendations:

- The results provide a traffic-based statistical foundation for the projected rehabilitation or replacement of the Patroon Island Bridge, along with an analytical foundation for capacity enhancements (such as additional lanes and bottleneck eliminations) as well as alternative mobility investments.
- By taking a view into the entire bridge network, the region's transportation system can be developed to address the long-term infrastructure and mobility needs and be designed to integrate with the quality of life in the Capital District, linking the economic, employment and residential centers throughout the larger region.

Assessment of the short term major capital programmatic needs of the Patroon Island Bridge - major rehabilitation or replacement - provided the agencies with a unique opportunity to join with key stakeholders in the region to take a broad look at transportation and mobility issues related to the bridge and to the adjacent Hudson River Crossings. The collaborative study offered an opportunity to maximize existing transportation infrastructure, concurrent with addressing technical issues related to the Patroon Island Bridge. Findings and recommendations are highlighted throughout the report and are summarized in Tables 5 and 6 starting on page 54.

While broad-based public outreach will be the function of a larger Patroon Island Bridge study at a future date, interagency input, involvement and coordination was a priority, essential to the success of this first phase of the project. The Study Team developed an outreach plan with a committee structure designed to

forge new alliances with agencies and stakeholders in order to solicit and incorporate their input on the issues and topics under consideration.

Study Area

The study area includes eight Hudson River crossings connecting Albany and Rensselaer Counties. The Bridges, in order from north to south: Collar City Bridge, Troy-Green Island Bridge, Troy-Watervliet Bridge, Troy-Menands Bridge, Patroon Island Bridge, Livingston Avenue Bridge, Dunn Memorial Bridge, and the Castleton-on-Hudson Bridge. It should be noted that a ninth bridge, the CSX Castleton Bridge, also spans the Hudson River between Albany and Rensselaer Counties, but was not included in the Study. The NYS Thruway Authority's Castleton-on-Hudson Bridge was included because of the interrelationship with "free I-90" carried by the Patroon Island Bridge.

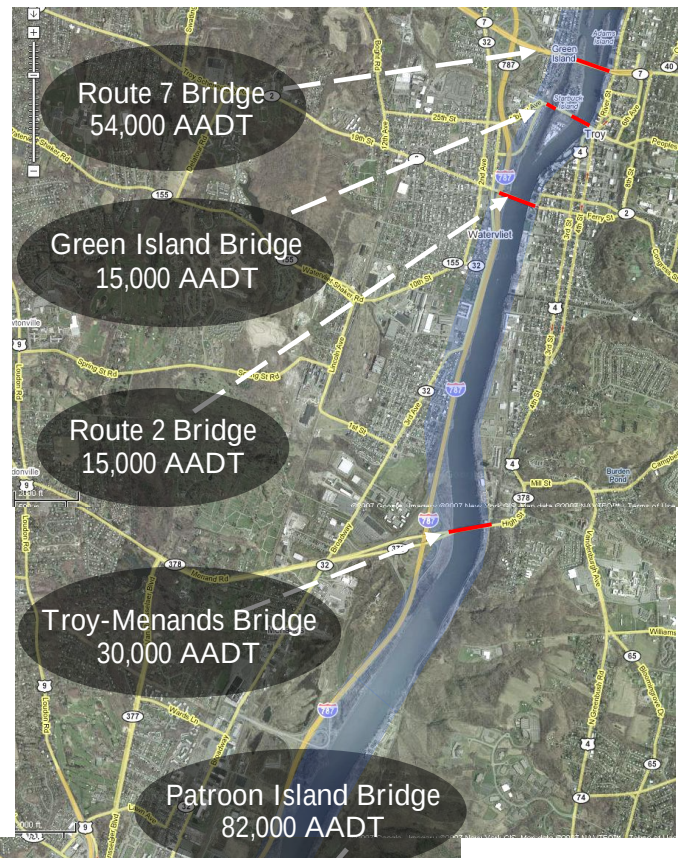
While eight bridges were included in the study limits, the focus of the Study revolved around the Patroon Island Bridge as well as the first vehicular bridges to the north and south, the Troy-Menands and Dunn Memorial Bridges. The Livingston Avenue RR Bridge, located between the Patroon Island and the Dunn Memorial Bridges, became one of the focal points as the study progressed due to its multi-modal possibilities.

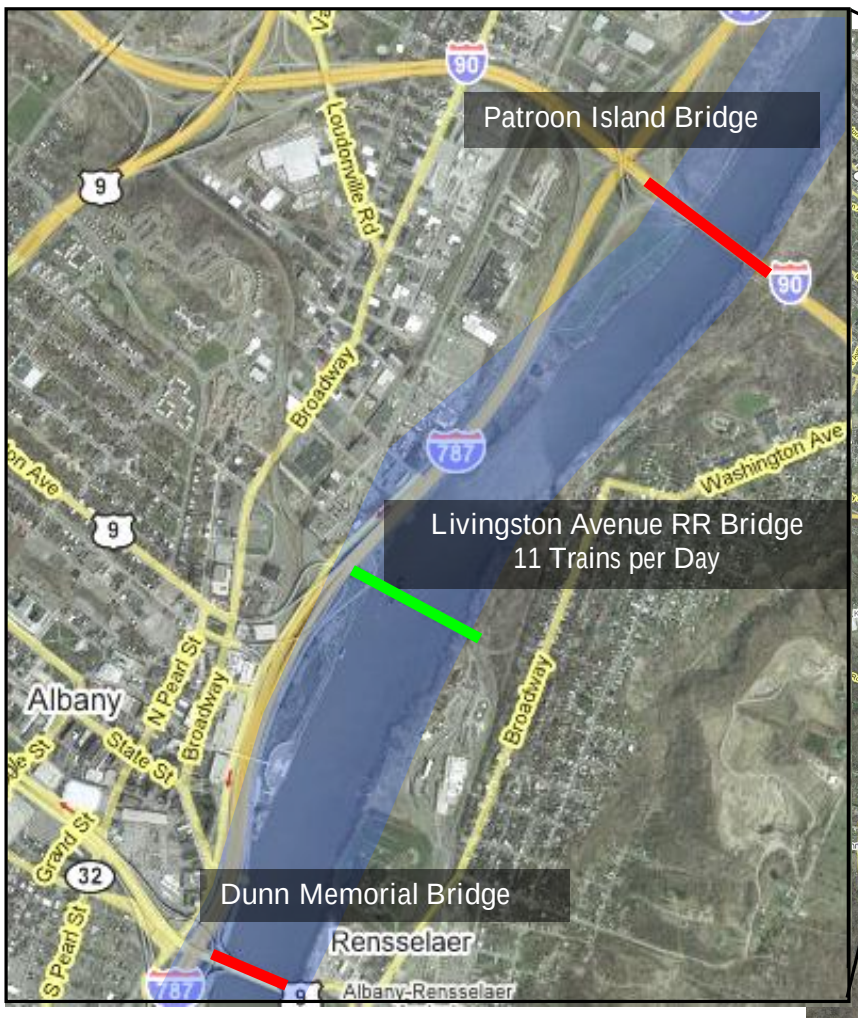
Facilitation & Communication

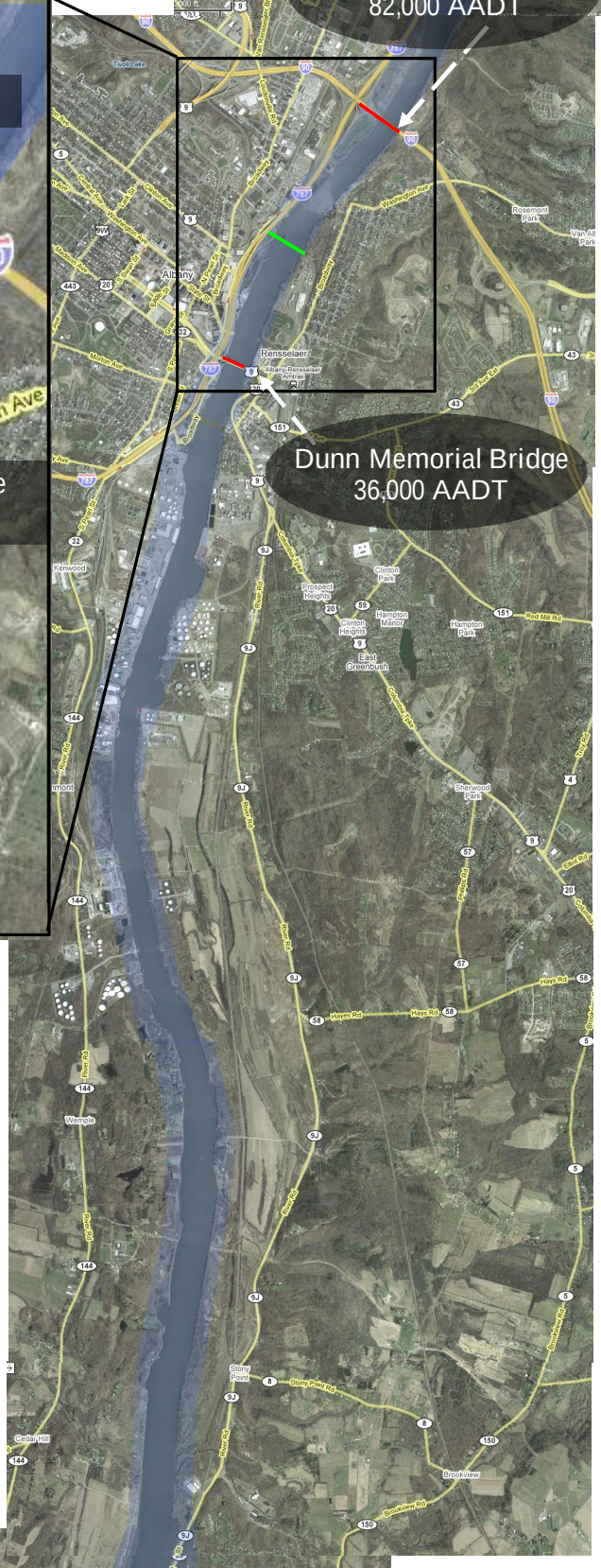
Interagency input, involvement and coordination were essential to the success of the study. A study structure of committees was established to solicit appropriate input and to generate a collaborative approach to discussing issues related to the Patroon Island Bridge and the nearby Hudson River Crossings. The following committees and groups were formed and served to facilitate the sharing of data, information and ideas:

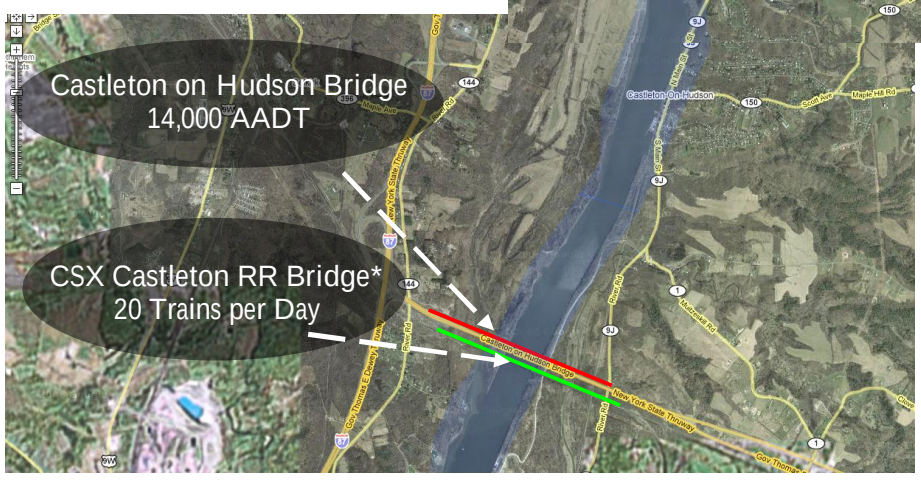
- Steering Committee: This committee included representatives of both CDTC and NYSDOT, and directed the Study.
- Study Advisory Committee (SAC): This committee is composed of government agencies that served as a conduit for sharing information on local issues that the Study should consider. The SAC members were responsible for outreach to constituents within their jurisdiction in order to advise them of the Study; solicit their input on local plans, needs and concerns for consideration, and apprise them of the Study's progress. In addition, meetings were scheduled with individual SAC members to discuss specific topics or issues as needed, such as tolling and transit.
- Stakeholders Group: This group was comprised of elected officials and private organizations that should be kept informed about the progress of the Study. A newsletter was distributed three times during the course of the Study to keep the Stakeholders Group informed. The Stakeholders Group was also invited to the final presentation conducted by the Study Team at the conclusion of the Study.
- Technical Resource Group: This group, composed of in-house experts, provided counsel to the Study Team on an as needed basis. The Technical Resource Group included primarily NYSDOT technical staff and was used as a resource for environmental analysis, strategy, and structures.

Figure 1: Project Location Map & Study Area









* Not included in the Study

Congestion Management Process

Introduction

The Metropolitan Congestion Management Process (CMP) is a required component of the Federally-mandated metropolitan planning process in urbanized areas over 200,000 in population. The Federal Highway Administration (FHWA) defines CMP (formerly called *Congestion Management System*) as: "a systematic process for defining what levels of congestion are acceptable to the community; developing performance measures for congestion; identifying alternative solutions to manage congestion; prioritizing funding for those strategies and assessing the effectiveness of those actions."[1]

The CDTC has ten Congestion Management Principles:

1) Management of demand is preferable to accommodation of single-occupant vehicle demand growth.
2) Cost-effective operational actions are preferable to physical highway capacity expansion.
3) Land use management is critical to the protection of transportation system investment.
4) Capital projects designed to provide significant physical highway capacity expansion are appropriate congestion management actions only under certain conditions.
5) Significant physical highway capacity additions carried out in the context of major infrastructure renewal are appropriate only under certain conditions.
6) Incident management is essential to effective congestion management.
7) Corridor protection and official street mapping are necessary to preserve options.
8) Any major highway expansion considered by CDTC will include a management approach.
9) In project development and design, other performance measures, such as pedestrian, bicycle and transit access, community quality of life, and safety will be considered along with congestion measures.
10) The NYSDOT guidelines for roundabouts will be used for all CDTC federal aid projects that involve intersection improvements.

The Hudson River Crossing Study Request for Qualifications highlighted how the CDTC CMP applies to this Study, calling for:

a) Incremental costs and benefits of designs which add capacity to accommodate future traffic, relative to less-accommodating designs;
b) The projected amount of time that will lapse before a given design with greater capacity would be expected to have annual benefits sufficient to return an incremental benefit/cost ratio comparable to other *capacity* projects included in the CDTC Transportation Improvement Plan (TIP);

[1] Federal Highway Administration Publication No.: FHWA-RC-BAL-04-0015, "Congestion Management Systems."

c) The additional expense involved in providing the incremental capacity at that later date, rather than during the initial project;

d) The degree of uncertainty present regarding future demand forecasts; and,

e) The compatibility of the additional capacity with regional, county and local land use plans.

The time costs of congestion are measured in terms of "delay" where delay is the additional travel time under congested conditions relative to uncongested conditions. Delay includes both daily *recurring delay* that is routinely present due to high traffic volumes relative to roadway capacity and *non-recurring delay* that results from incidents, weather, or high traffic volumes associated with extraordinary events. The Texas Transportation Institute estimates that 44 percent of the delay in the greater Albany area in 2005 was from recurring delay and that 56 percent of the delay was from non-recurring delay.[2]

Although there is a fairly even split between the different types of delay, the pattern within each is quite different. In general, recurring delay is in the form of relatively short delays affecting large numbers of people, and the non-recurring delay is in the form of longer delays that affect a smaller group of people (on an average day).

Management Information System for Transportation (MIST) data on I-90 westbound approaching the Patroon Island Bridge in the weekday morning peak hour was reviewed. On an annual basis, the average observed speeds for the three travel lanes are 58 mph for the left lane, 54 mph for the middle lane and 48 mph for the right lane for an average of 53 mph. This represents a fairly small amount of recurring delay. Except for the summer, there are 5-6 days per month on which the average speeds are lower – e.g. 40 mph, 30 mph and 25 mph across the three lanes. This non-recurring delay is much greater per day, but it reflects only a small percentage of the total days in the year. It is also likely that on many of these days, the non-recurring delays are related to weather and/or incidents.

Increasing roadway capacity is a common strategy for addressing recurring delay. However, increased roadway capacity generally is ineffective in addressing non-recurring delay. The strategies emphasized in the CMP for addressing non-recurring delay include "rapid clearing of incidents, information for travelers to avoid incidents."[3]

CDTC has completed innovative modeling and analysis that illustrates the potential pitfalls of widening freeways as a means of mitigating traffic delays. In analyses of adding capacity to the Northway (I-87 from Albany north), two important conclusions were reached that must be considered in any discussion of additional freeway capacity. First, additional capacity will likely result in higher traffic volume, which make it impossible to attain a targeted level of service.

> One of the conclusions of this analysis is that there is no capital improvement such as highway widening that can eliminate daily recurring congestion in the peak periods. Adding

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[2] Texas Transportation Institute. *Urban Mobility Study*, complete_data07.xls, 2007.

[3] Capital District Transportation Committee. *New Visions 2030: The Plan for a Quality Region Summary Document*, p. 12, August 2007.

capacity to the Northway can be expected to result in higher traffic volumes and could generally be expected to result in conditions similar to those which exist today. In addition, widening would not prevent delays that result from incidents such as bad weather conditions, traffic accidents and vehicle breakdowns. (*New Visions Working Group B Report: Expressway System Options*, April 2007 p. 60)

Second, relieving congestion at one bottleneck location may worsen traffic at other bottlenecks. These other bottlenecks may include other freeway locations, but also non-freeway arterial roadways. No trip begins or ends on a limited access roadway. Increasing freeway flows generally worsens local traffic congestion in the vicinity of interchanges, which are often some of the most congested points on the local street system.

Finding 1: Relieving congestion at one bottleneck location may worsen traffic at other bottlenecks.

Analysis of the MIST (Management Information System for Transportation) data leads to additional preliminary conclusions about potential results of adding capacity to the Northway. For example, in the AM peak period, significant delay is experienced by southbound commuters approaching the Twin Bridges. However, south of the Twin Bridges, delays are significantly less because the congestion at the bridges "meters" the traffic further to the south; that is, since only a smaller amount of traffic is currently allowed to get past the bottleneck at the bridges, the traffic that does get through the bottleneck is less than the capacity provided and flows at much higher quality after clearing the bottleneck. Adding lanes to the Northway could remove this effect and possibly introduce new morning peak congestion dynamics in the area south of the current bottleneck. Also, the additional traffic that would be diverted by widening could add more delay to I-90 eastbound in the morning, which is also capacity constrained. (*New Visions Working Group B Report: Expressway System Options*, April 2007 p. 58)

This Study, therefore, focused on a systems approach considering the need or desirability for increasing freeway capacity, an essential approach for determining whether or not a freeway increase will simply create new problems downstream. Figures 2, 3, and 4 depict the existing Annual Average Daily Traffic (AADT) on the roadway segments on and near the Patroon Island Bridge. Similar figures comparing volumes on these segments during both the AM and PM peak hours are located in Appendix A.

Figure 2: Patroon Island Bridge AADT

Figure 3: I-90 & I-787 Stack AADT

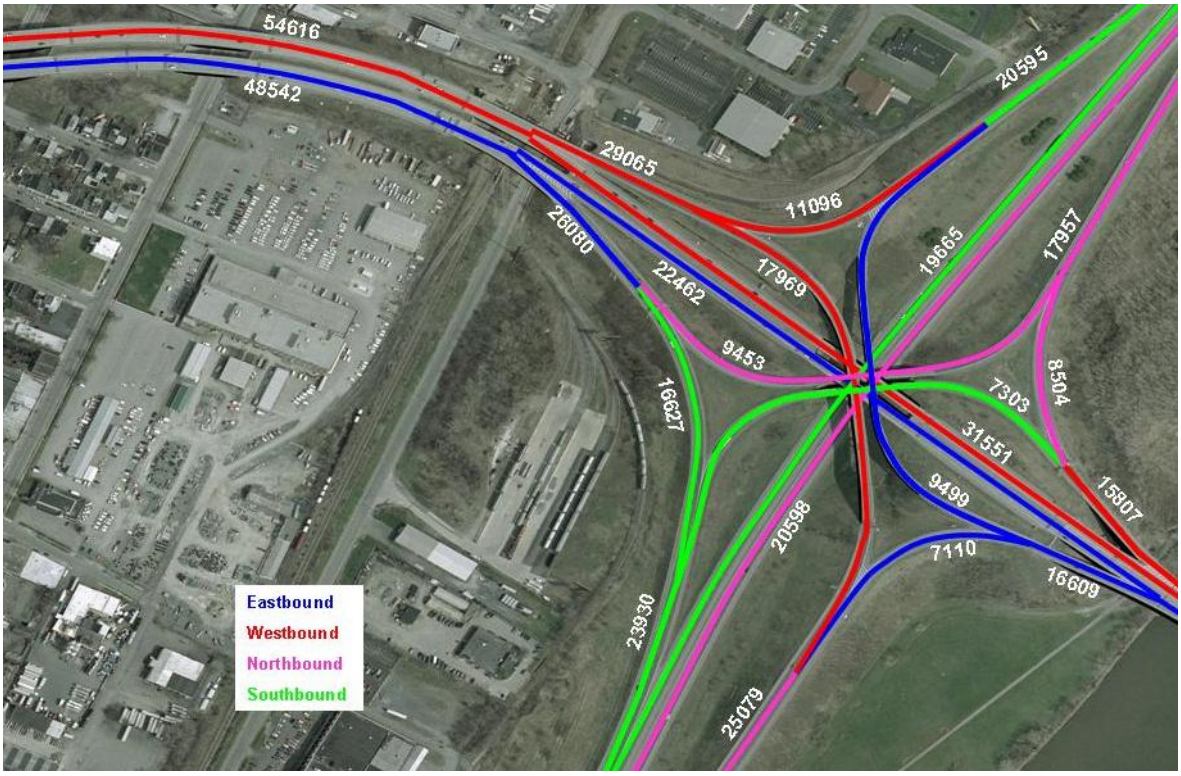
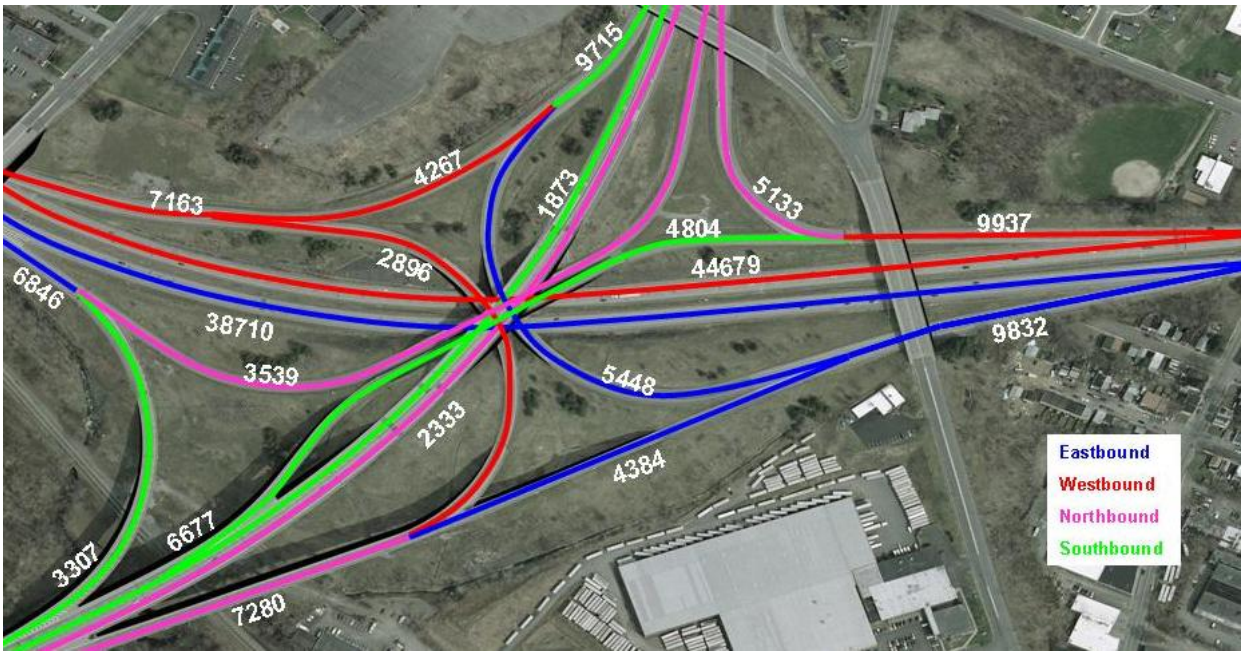


Figure 4: I-90 & Rt. 9 (Exit 6) Stack AADT



Future Population and Employment Scenarios

Traffic congestion on the Hudson River crossings is largely limited to the weekday morning and afternoon peak hours in the peak direction –westbound in the morning and eastbound in the afternoon. During these time periods, the great majority of the crossings are made within the Capital District. The peak direction traffic is comprised largely of Rensselaer County residents traveling to Albany and other destinations west of the Hudson River. Therefore, future Rensselaer County population and employment will be important determinants of future Hudson River crossing traffic volume. In general, higher Rensselaer County population will result in more crossings. On the other hand, higher Rensselaer County employment will tend to reduce peak hour/peak direction crossings as more Rensselaer County residents would work, shop, and use services in Rensselaer County.

Over the period 1980 to 2000, Rensselaer County's population increased by 0.4 percent (*New Visions Working Group A, Effects of Alternative Development Scenarios Draft*, September 1, 2005, p. 10). Looking beyond 2030, it is expected that population growth in Rensselaer County will continue to be modest, although there is considerable uncertainty relative to both the total level of regional growth and also in the type of growth.

The technology industry has been identified as a primary source of potential economic growth in the region, and specific initiatives have been implemented to encourage the expansion of the industry in the Capital Region. Among them, is the redevelopment of the Harriman Research and Technology Park. International Sematach, a global consortium of nanoelectronics manufacturers, recently agreed to a major expansion of its research facilities at the University of Albany. The expanded presence of International Sematech is expected to lead to other new technology jobs in the region. When the Sematech announcement was made, the Times Union (May 10, 2007) reported on the rapid growth in the Austin region related to the semiconductor industry, and stated that: "Some officials in the Capital Region predict the same will happen here."

The type of growth may be shifting as well. The Sematech and Harriman sites are infill sites. Although they are designed for auto-oriented commuting, there are plans to develop these sites to have improved pedestrian and transit service, as well as better connectivity to the local street system.

There is also movement in the region toward increasing density in older urban areas, especially along the Hudson River. Current local plans include development of the Albany Convention Center, as well as a major expansion effort that includes commercial and residential development on the waterfront in Rensselaer, with each project offering unique and significant opportunities for economic development with regional opportunities for job growth and commercial expansion. Both the Albany Convention Center and Rensselaer waterfront initiatives envision higher density, pedestrian-friendly environments along the river with multimodal transportation. The private sector is investing heavily in riverfront development in the region:

> Builders plan to invest billions of dollars in waterside redevelopment, including high-rise apartment and hotel buildings in Rensselaer; a promenade to accompany a hotel and office and residential buildings in Troy; and condominiums, a marina and more on an abandoned industrial site in Schenectady. (Times Union, "Rethinking the Waterfront", October 28, 2007)

Unlike the development patterns over the past 30 years, a renewed emphasis on the Hudson River would focus development in and near older urban centers.

Scenario planning is an excellent tool for planning under uncertainty, and also for working toward future scenarios that result in preferred outcomes. CDTC has been using scenario planning to test alternative futures for several years. Based on local and regional plans, CDTC has developed four scenarios for the year 2030 and 2040:

1. Status Quo Trend- This is the Capital District Regional Planning Commission (CDRPC) baseline forecast (9 percent growth in population, 15 percent growth in households by 2030, current development patterns continuing); this is the official Plan forecast, and can be considered the most likely based on past trends;
2. Concentrated Growth- This scenario assumes the baseline growth rate, but with more concentrated development patterns resulting from urban reinvestment and suburban planning;
3. Trend Hyper-Growth- This scenario assumes "hyper-growth" (29 percent population growth and 35 percent household growth by 2030), with trend patterns of dispersed development; the rate of growth mirrors the national average of one percent per year;
4. Concentrated Hyper-Growth- This scenario assumes hyper-growth occurring in a concentrated pattern resulting from more urban reinvestment and suburban planning.[4]

The contrast is strongest between the two hyper-growth scenarios as illustrated in Figures 7 and 8.

[4] Capital District Transportation Committee. *New Vision s 2030: The Plan for a Quality Region Summary Document*, p. 14, August 2007.

Figure 5: Scenario 1 2030 Population Trend

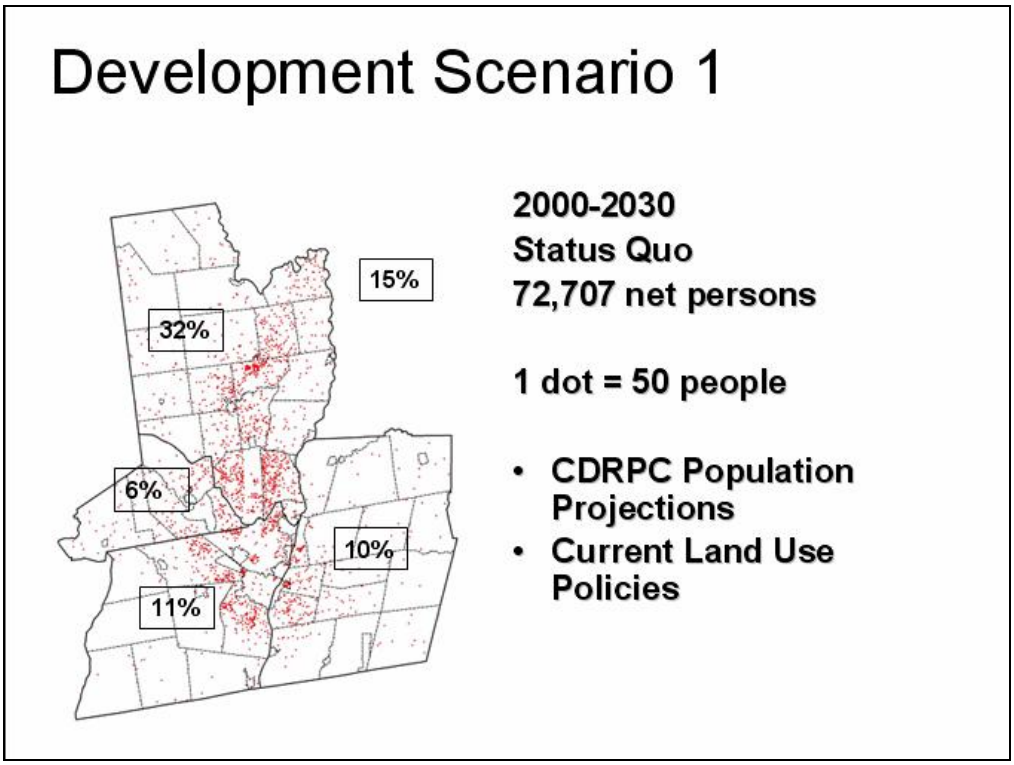


Figure 6: Scenario 2 2030 Population Trend

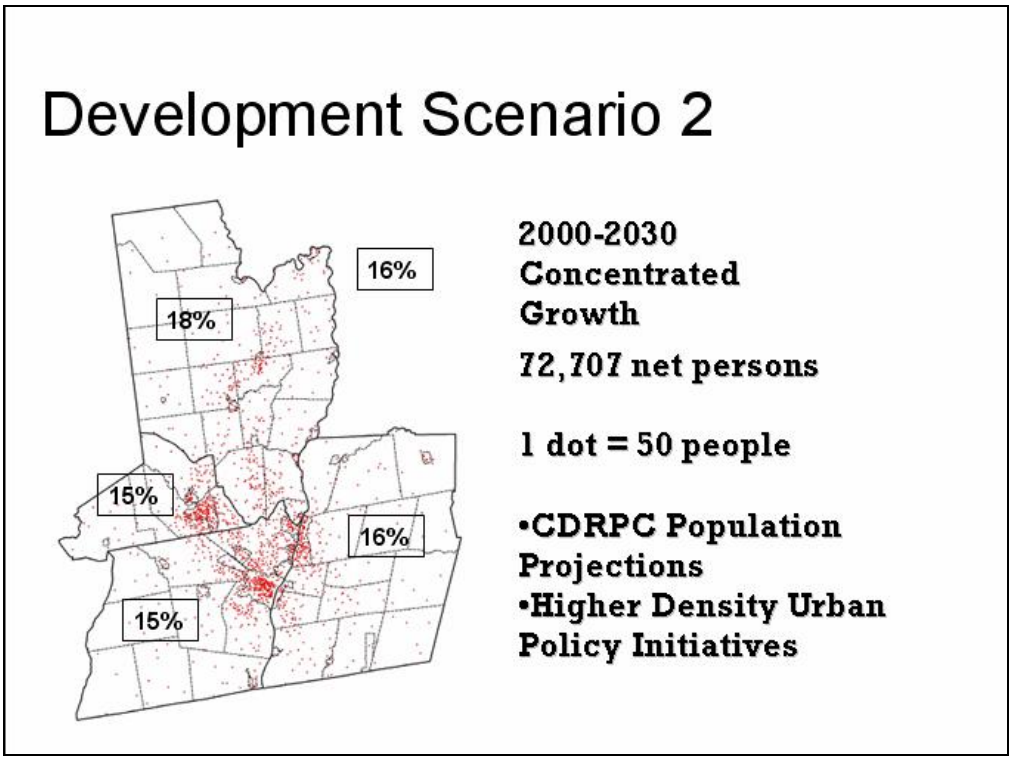


Figure 7: Scenario 3 2030 Population Trend

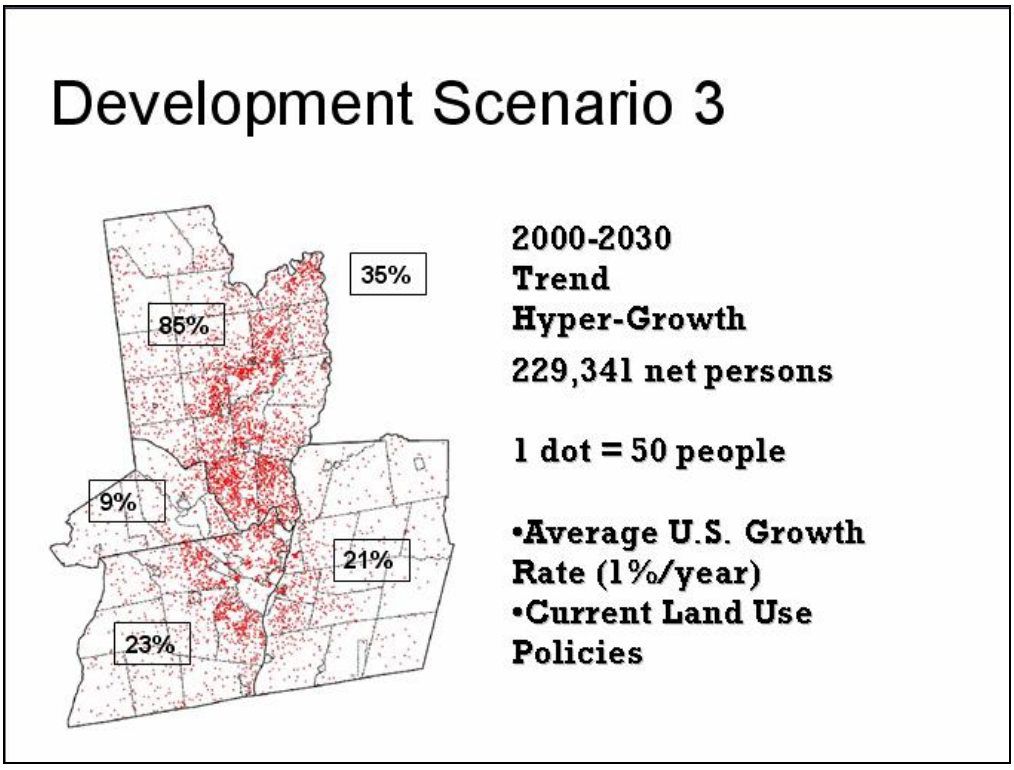
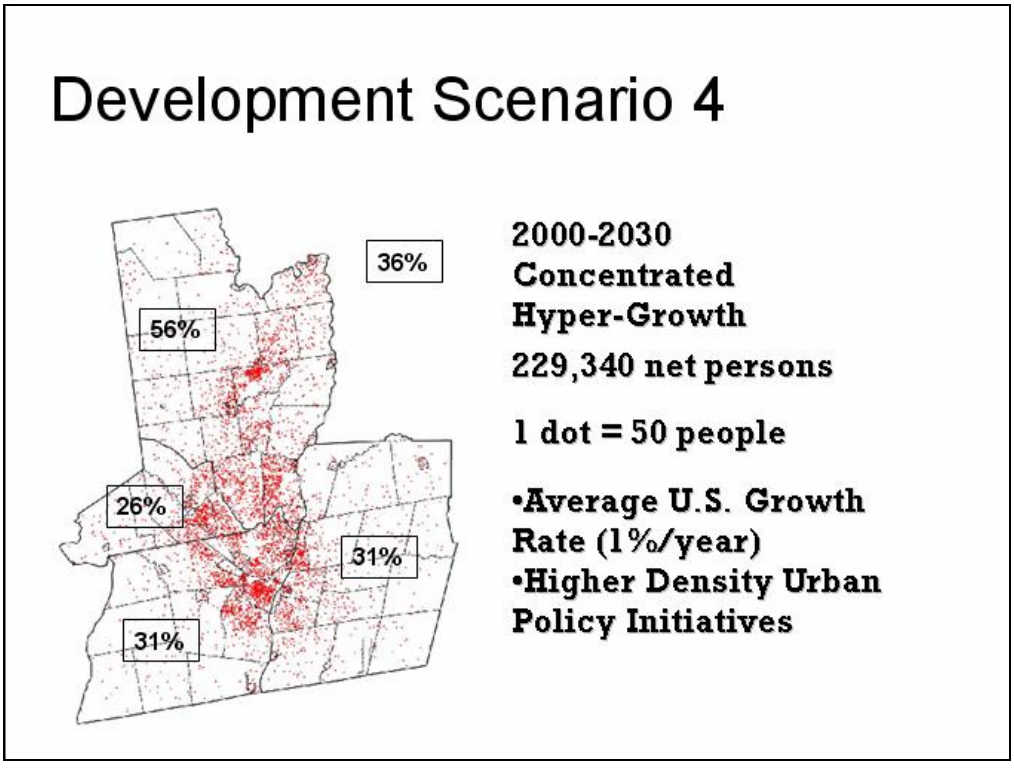


Figure 8: Scenario 4 2030 Population Trend



The county totals for 2005, 2030 and 2040 for employment, population and households are shown in Table 1.

Table 1: 2040 Employment, Population and Households by County and Scenario

	Scenario 1: Status Quo	Scenario 2: Concentrated	Scenario 3: High Growth Dispersed	Scenario 4: High Growth Concentrated
Employment				
Albany County	268,734	275,581	328,906	350,661
Rensselaer County	60,185	63,047	72,755	76,195
Saratoga County	93,762	81,237	156,706	124,888
Schenectady County	71,798	74,612	81,731	88,354
Capital District Total	494,479	494,477	640,098	640,098
Population				
Albany County	316,197	328,140	368,674	394,331
Rensselaer County	161,379	169,933	181,072	201,258
Saratoga County	258,305	223,493	400,175	322,141
Schenectady County	148,950	163,265	153,562	185,753
Capital District Total	884,831	884,831	1,103,483	1,103,483
Households				
Albany County	136,282	142,978	158,149	171,093
Rensselaer County	67,979	72,134	76,290	85,240
Saratoga County	109,547	95,080	168,118	136,625
Schenectady County	64,343	70,764	66,284	80,245
Capital District Total	378,151	380,956	468,841	473,203

*Source: CDTC

The hyper-growth scenarios would result in more future river crossing traffic than the status quo growth scenarios; however, the impact of the type of growth will have a small effect on future river crossings. There are cities and inner suburbs on both sides of the Hudson River. The concentrated development scenarios will result in significant growth in jobs in the cities of Albany, Watervliet, Cohoes, Troy, and Rensselaer, as well as at the Rensselaer Polytechnic Institute (RPI) Tech Park. This growth will generate nearly as much cross-river traffic as the dispersed scenarios.

Scenario Modeling Results

The modeling process for the four scenarios used two transportation models. First, CDTC applied their regional STEP model to assign traffic to all roadways during the 2045 weekday morning and afternoon peak hour volumes (based on extrapolation of the 2040 population and employment projections). CDTC extracted traffic volumes for I-90 and the consultant team analyzed these future traffic volumes in the VISSIM Microsimulation model. (The VISSIM model is described in detail in a separate *Technical Memorandum: 2007 VISSIM Microsimulation I-90 Exits 6, 6A and 7*.)

Four Development Scenarios

- **Status Quo – current growth rate and development patterns**
- **Base Concentrated (current growth rate, Concentrated development from urban reinvestment and suburban planning)**
- **High Growth Dispersed (higher growth rate, dispersed development)**
- **High Growth Concentrated (higher growth rate, Concentrated development from urban reinvestment and suburban planning)**

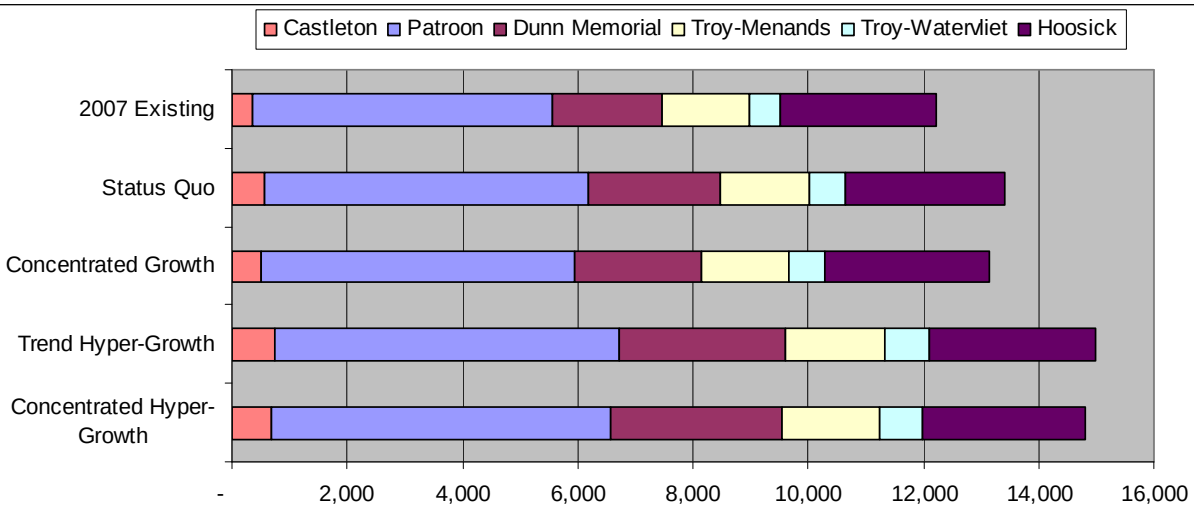
Modeling is focused on weekday morning and afternoon peak hour conditions. The peak direction traffic was determined for each peak hour, i.e. westbound in the morning peak hour and eastbound in the afternoon peak hour. These are the critical design conditions. Approximately 10 percent of the daily traffic is traveling in each of these two peak hours, and about 2/3 of peak hour traffic is traveling in the peak direction for the Hudson River crossings. Therefore, only about 13 percent of daily traffic travels is in either the morning or afternoon peak hour in the peak travel direction. The other 87 percent of the traffic experiences less congestion. This includes most truck freight traffic and long distance travel. The availability of reverse commute roadway capacity also can encourage more balanced jobs and housing on both sides of the river.

Both the STEP and VISSIM models were tested with existing I-90 geometries as well as a widened Patroon Island Bridge to assess the impacts of widening on demand and traffic operations. About 40 percent of morning peak hour traffic at this point today is exiting onto I-787 and a fourth eastbound lane would allow two exit lanes. In addition to supporting higher ramp volumes, it also would likely result in fewer crashes. Although there is less traffic congestion eastbound in the afternoon at the bridge today, the traffic counts show the volume entering from I-787 to be almost as large as the I-90 through volume (47 percent of the total). An additional eastbound lane on the bridge would support higher ramp volumes and improve safety at this merge area. Currently, two ramp lanes merge to a single ramp lane just before I-90.

Figures 9 and 10 show Hudson River Bridge crossings (total of both directions for the weekday morning and afternoon peak hours, respectively, for 2007 and for the four *New Visions* scenarios. All bridges from the Collar City Bridge to the Dunn Memorial Bridge are included. The regional modeling shows only limited traffic growth in the morning and afternoon peak hours between 2007 and 2045 across all of the bridges – ranging across scenarios from 6.4 percent to 20.1 percent for the morning peak hour, and from 6.1 percent to 19.5 percent for the afternoon peak hour. The lowest growth is with the base concentrated scenario, and the highest growth is with the high growth dispersed scenario.

Finding 2: Regional modeling shows only limited traffic growth in the morning and afternoon peak hours between 2007 and 2045 across all of the bridges.

Figure 9: Weekday Morning Peak Hour Crossings for 2007 and Four 2045 Scenarios



	Concentrated Hyper-Growth	Trend Hyper-Growth	Concentrated Growth	Status Quo	2007 Existing
Hoosick	2,814	2,872	2,852	2,741	2,706
Troy-Watervliet	743	767	614	625	525
Troy-Menands	1,689	1,728	1,529	1,560	1,514
Dunn Memorial	2,978	2,877	2,187	2,284	1,908
Patroon	5,891	5,993	5,434	5,624	5,199
Castleton	685	740	518	567	366

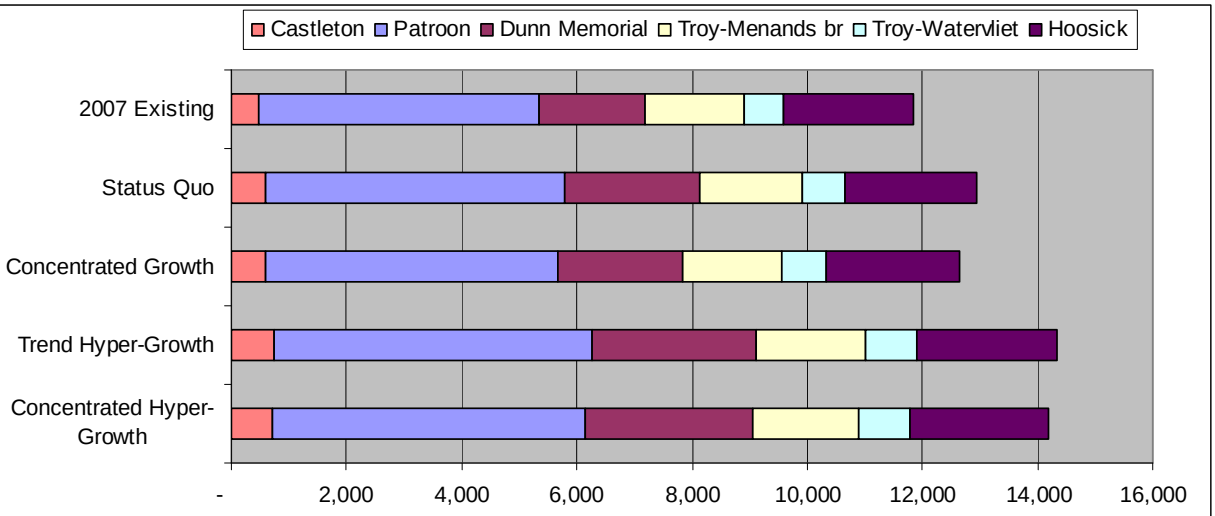
The modeled traffic growth on the Patroon Island Bridge between 2007 and 2045 is even less —between 4.5 percent and 15.3 percent for the weekday morning peak hour, and between 3.8 percent and 13.2 percent for the weekday afternoon peak hour —across the four scenarios. In the concentrated growth scenarios, the percent traffic growth is greatest for the Dunn Memorial Bridge because of assumed growth near that bridge on both sides of the Hudson River.

Finding 3:

The modeled traffic growth on the Patroon Island Bridge between 2007 and 2045 is less than the other Hudson River bridges.

Percent traffic growth is greatest for the Dunn Memorial Bridge in concentrated growth scenarios.

Figure 10: Weekday Afternoon Peak Hour Crossings for 2007 and Four 2045 Scenarios



	Concentrated Hyper-Growth	Trend Hyper-Growth	Concentrated Growth	Status Quo	2007 Existing
Hoosick	2,419	2,429	2,323	2,310	2,257
Troy-Watervliet	874	890	767	744	657
Troy-Menands br	1,842	1,878	1,736	1,769	1,729
Dunn Memorial	2,925	2,867	2,176	2,352	1,848
Patroon	5,437	5,517	5,058	5,183	4,872
Castleton	705	743	600	599	469

In some scenario planning applications, different scenarios can lead to very different conclusions. In this case, however; future Patroon Island Bridge traffic volumes are similar for a wide range of scenarios, and a high growth rate for this roadway segment is unlikely. The consistency of results across all of the four scenarios indicates a low level of risk.

Regional modeling also was done with a widened Patroon Island Bridge (four lanes in each direction). As shown in Figures 11 and 12 total crossings in both directions for the morning and afternoon peak hours, results in greater Patroon Island Bridge traffic volumes and also somewhat higher total Hudson River crossing volumes. There is some traffic diversion from other bridges and also some new or "induced" river crossings. For example, in the 2045 weekday morning peak hour for the High Growth Concentrated scenario, the traffic volume for the Patroon Island Bridge is 473 vehicles greater with widening than without. A little more than half of these vehicles, 451, are diverted from other bridges; 222 are new or induced crossings.

Figure 11: Weekday 2045 Morning Peak Hour Crossings for Four Scenarios without and with Widened Patroon Island Bridge

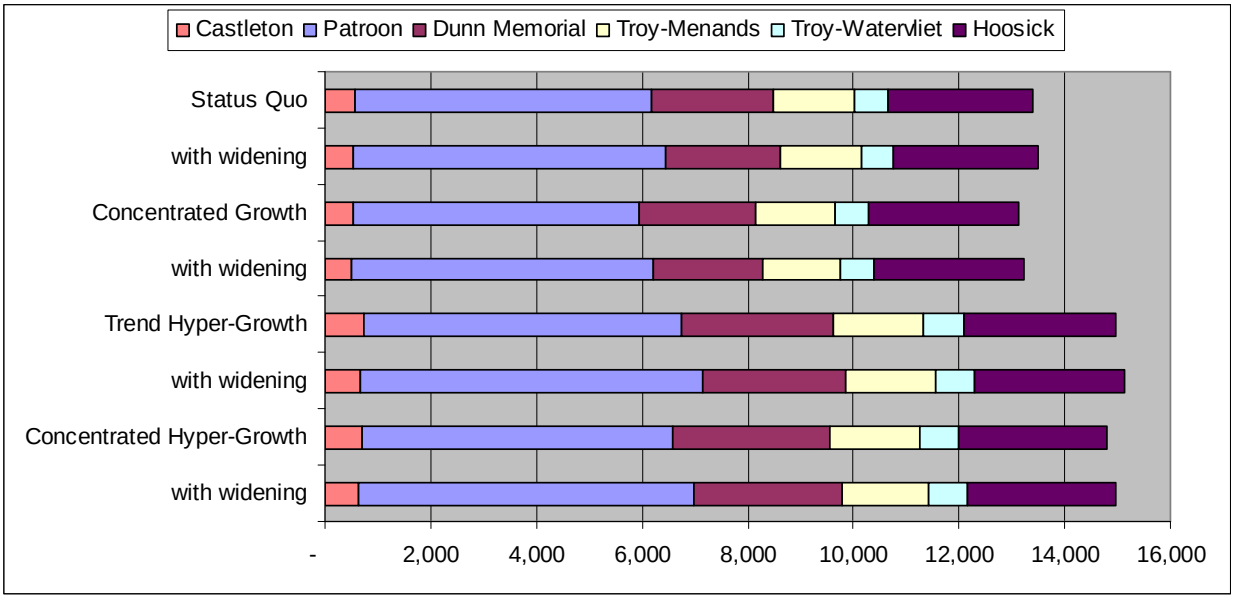
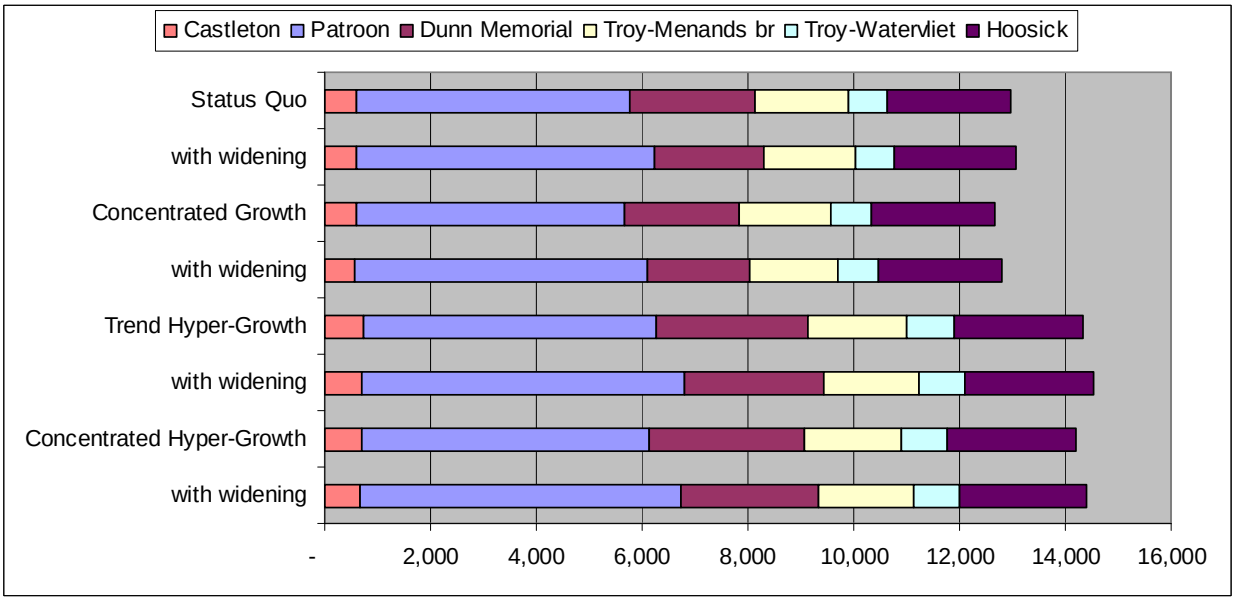
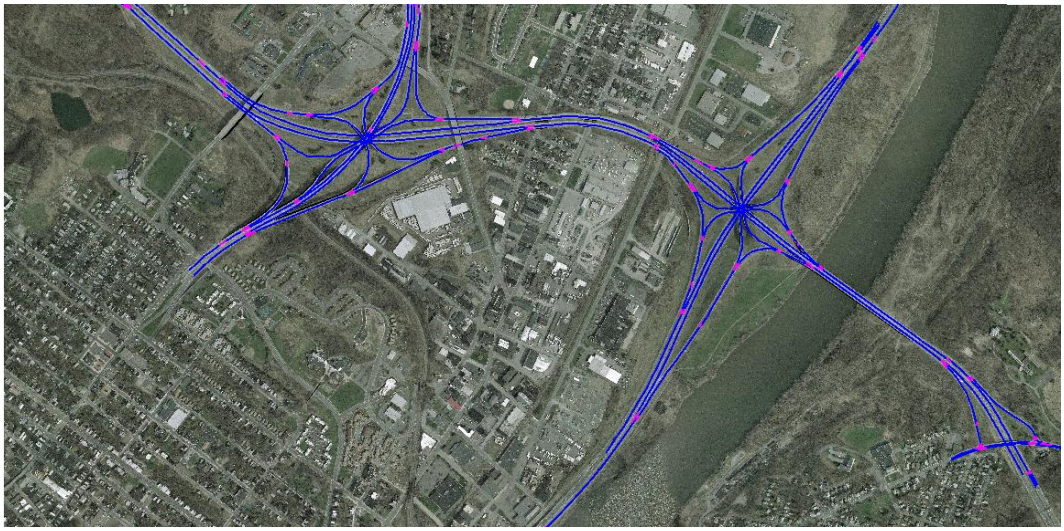


Figure 12: Weekday 2045 Afternoon Peak Hour Crossings for Four Scenarios without and with Widened Patroon Island Bridge



The second model used in the CMP Risk Analysis was a VISSIM microsimulation model that was developed for morning and afternoon peak hour conditions for the I-90 Patroon Island Bridge over the Hudson River plus Exits 6 (Route 9), 6A (I-787) and 7 (Washington Avenue).

Figure 13: VISSIM Model Network on Base Map



The VISSIM model was based on June 2007 traffic counts and was calibrated to observed conditions captured on video. A detailed description of the VISSIM model development and base year calibration is included in *Technical Memorandum: 2007 VISSIM Microsimulation I-90 Exits 6, 6A and 7*. This report identified several traffic operations and safety issues:

1) The modeled system operates at close to capacity during both the morning and afternoon peak hours. There is congestion in the weekday morning peak hour for the westbound approach to the I-787 interchange. There is some congestion in the weekday afternoon peak hour for the I-787 exit to I-90 eastbound. There is some congestion between the two stack interchanges (Exit 6 and I-787).

2) The VISSIM bottlenecks observed make sense given the traffic volumes and the roadway geometry. Even for the 2007 average weekday, in the morning peak hour, there are 2107 vehicles from I-90 westbound exiting onto I-787 onto a single lane (that soon splits into two lanes). As the *Highway Capacity Manual* gives 2200 as the hourly capacity for a freeway lane, there is little room for growth here. The weave with the Washington Avenue ramp traffic also creates turbulence in the traffic flow. The ramps for the two stack interchanges (I-787 and Route 9) are separated by only 1600-1700 feet, which is less than the minimum standard for major weaving movements.

3) About 40 percent of morning peak hour traffic at this point is exiting onto I-787 and a fourth eastbound lane would allow two exit lanes. In addition to supporting higher ramp volumes, it also would likely result in fewer crashes. Although there is less traffic congestion eastbound in the afternoon at the bridge today, the traffic counts show the volume entering from I-787 to be almost as large as the I-90 through volume (47 percent of the total). An additional eastbound lane on the bridge would support higher ramp volumes and better safety at this merge area. Currently, two ramp lanes merge to a single ramp lane just before I-90.

Detailed analysis of the morning westbound commuting traffic, including field observations, revealed that much of the existing traffic congestion upstream of the I-787 interchange results not from the interchange or the bridge itself, but from weaving movements farther upstream, particularly weaving between Exits 7 and 8. This congestion does not occur through the full morning rush but typically, only for the peak half hour. Delays occur between Exits 7 and 8 while the queue dissipates once reaching the east end of the bridge. Pictures of the congestions both east and west of the Washington Street Bridge are included in Figures 14 and 15. This roadway section is outside the boundary of the scope, so detailed modeling analysis was not done. The detailed VISSIM microsimulation model should be expanded to include Exit 8. Ramp metering could be considered to address congestion there, particularly if congestion were to increase. Ramp metering has the potential to improve traffic flow for all vehicles, including entering vehicles, by reducing the need for vehicles to change speed – thus improving traffic flow. Traffic on I-90 westbound, during the morning peak hour, tends to be grouped, leaving gaps for entering vehicles, so ramp metering could be of particular use in this instance.

Recommendation 1:

the microsimulation model should be expanded to include exits 7 and 8. Ramp metering should be considered to address congestion at this location.

Figure 14 – I-90 Westbound AM Peak Hour (looking east from Washington St. Bridge)

Figure 15 – I-90 Westbound AM Peak Hour (looking west from Washington St. Bridge)

The *Highway Capacity Manual* uses qualitative letter grades –*A, B, C, D, E, and F* –to define *Level of Service* (LOS). Freeway LOS are defined as a function of vehicle density (vehicles per lane per hour). Level of Service F represents a failing condition where stop-and-go traffic is likely. Otherwise, average freeway traffic speeds are fairly high, even at the lower service grades. At LOS D, average speeds are generally 55 mph or higher; at LOS E, average speeds are generally 50 mph or higher.[5]

The primary performance measure from the VISSIM model is traffic speed for different roadway segments. Based on the volumes and speeds, vehicle densities are calculated and converted to LOS. Tables 2 and 3 present Levels of Service for the weekday morning and afternoon peak hours, respectively, for 2007 and for the 2045 scenarios[6] More modeling detail, including –traffic volumes, speeds, and densities –are included in Appendix B.

Table 2: Weekday Morning Peak Hour Levels of Service for 2007 and 2045 Scenarios

	2007	Status Quo	Base Conc.	High Growth Disp.	High Growth Conc.	Status Quo with widening	High Growth Conc. with widening
Patroon westbound	D	D	D	E	E	D	D
Patroon eastbound	C	C	C	C	C	B	B
I-90 at I-787 westbound	D	D	D	D	D	D	D
I-90 at I-787 eastbound	C	C	C	C	C	C	C
I-90 between Exit 6 and I-787 wb	D	D	D	D	D	D	D
I-90 between Exit 6 and I-787 eb	C	C	C	C	C	C	C
I-90 to I-787 ramp merge	C	C	C	C	C	C	C

Table 3: Weekday Afternoon Peak Hour Levels of Service for 2007 and 2045 Scenarios

	2007	Status Quo	Base Conc.	High Growth Disp.	High Growth Conc.	Status Quo with widening	High Growth Conc. with widening
Patroon westbound	B	B	B	B	B	B	B
Patroon eastbound	D	D	D	D	D	C	C
I-90 at I-787 westbound	B	B	B	B	B	B	B
I-90 at I-787 eastbound	C	C	C	C	C	B	C
I-90 between Exit 6 and I-787 wb	C	C	C	C	C	C	C
I-90 between Exit 6 and I-787 eb	C	C	C	D	D	C	D
I-90 to I-787 ramp merge	B	B	B	B	B	B	B

As shown in Tables 2 and 3, the small changes in future traffic volumes produce corresponding changes in future LOS in the VISSIM model. The key Patroon River Bridge morning westbound movement declines

[5] Transportation Research Board, *Highway Capacity Manual 2000*, Exhibit 23-3, p, 23-5.

[6] Only two of the widening scenarios have been modeled with VISSIM.

from LOS D to LOS E, but only in the high-growth scenarios. As this represents high growth in the year 2045, there is no intermediate term problem, even at this location. All of the other LOS are D or better. With widening, the westbound morning peak period with high growth is restored to D and there are no negative consequences observed in the VISSIM model. However, the geographic area covered by the VISSIM model is limited. It is possible that higher traffic volumes could intensify bottlenecks downstream of the modeled area, e.g. on I-787 or in downtown Albany. In this case, it may be better to meter the traffic on the Patroon Island Bridge rather than supporting a larger traffic flow into Albany.

Finding 4:
Widening of the Patroon Island Bridge is not necessary to provide reasonable traffic operation.

Interaction with Thruway

Introduction

The I-90 Patroon Island Bridge carries much more traffic than the New York State Thruway Authority (NYSTA) Castleton-on-Hudson Bridge. This difference is especially pronounced during the weekday peak hours in the peak travel directions (westbound in the morning peak hour and eastbound in the afternoon peak hour). Based on recent traffic counts, the westbound morning peak hour volume for the Patroon Island Bridge was 5,200 or about 15 times the 340 vehicles counted on the Castleton-on-Hudson Bridge. The eastbound afternoon peak hour volume of 4,900 on the Patroon Island Bridge was about 9 times the 530 vehicles on the Castleton-on-Hudson Bridge.

Two interrelated questions have arisen: 1) is through traffic being diverted from the Thruway to I-90 due to I-90 signage and/or toll avoidance? and 2) is it possible to divert traffic from I-90 to the Thruway to improve I-90 operations?

Diversion

There are Thruway interchanges with I-90 at Interchange 24, west of the Hudson River and at Interchange B-1 (Berkshire Spur), east of the Hudson River. The travel distance between these two points is 2 miles shorter using I-90 than the Thruway route (20 miles vs. 22 miles). Travel between these two points was also about 2 minutes faster during both the morning and afternoon peak hours on I-90, as when driven on an October weekday. It is possible that the Thruway could be faster on any particular day; however, it is likely that any travel time savings are small. The Thruway's tolling exits can create delays at the tollbooths, in addition to the monetary cost. Therefore, it is reasonable not to expect diversion of I-90 traffic onto the Thruway.

Any diverted traffic must enter and exit the Berkshire Spur at Interchange B-1. In November 2001, a survey was conducted of traffic entering and exiting at Interchange B-1 as part of a study done by Vollmer Associates.[7] The survey included postcard surveys for cash customers and mail surveys of E-ZPass customers. Based on the survey results, of the traffic entering the Thruway east of the Hudson River at Interchange B-1, 15 percent of the eastbound traffic is diverted from the Thruway west of Interchange 24 and without planned Albany stops. Approximately 19 percent of the westbound traffic exiting at Interchange B-1 is similarly diverted. In 2001, this equaled 1200 daily vehicles eastbound and 1450 daily vehicles westbound.

At the Castleton-on-Hudson Bridge, 5 percent of weekday westbound traffic is during the morning peak hour, and 8 percent of weekday eastbound traffic is during the afternoon peak hour (as measured in recent traffic counts). If these percentages are applied to the daily estimates of diverted traffic, the result is estimates of 70 diverted westbound peak hour vehicles and 100 diverted eastbound peak hour vehicles. These represent approximately 1.4 and 2.0 percent of morning peak hour/peak direction and afternoon peak hour/peak direction Patroon Island Bridge traffic, respectively.

These estimates are approximate, and there are several sources of possible error. First, the survey response rates were low, as is typical in these types of surveys. Second, the estimates are based on 2001 data. Traffic volumes have not increased at the Castleton-on-Hudson Bridge, but diversion rates may have increased. Third, the distribution of Interchange B-1 entering and exiting traffic by time of day may be different than at the Castleton-on-

Only a small percentage of peak hour/peak direction traffic on the Patroon Island Bridge is traffic that is diverted from the Thruway.

[7] Vollmer Associates. New York State Thruway Authority Berkshire Section Toll Modification Options, March 8, 2002.

Hudson Bridge. Fourth, diversion rates may be different for the peak direction in the peak hour than across the entire day. This factor may be especially important. It is likely that there is less diversion during at times of peak congestion for reasons discussed in the following section. Despite these possible sources of error, it is clear that only a small percentage of peak hour/peak direction traffic on the Patroon Island Bridge is traffic that is diverted from the Thruway.

User Economics

A traveler's choice between a free route and a tolled route has become a critical transportation modeling issue, particularly as the issue of choice may influence construction plans for additional express toll lanes. The general analytical framework applied to this problem is based on the economics concept of the "value of time."

The U.S. Department of Transportation recommends that 50 percent of the prevailing wage rate be used for the value of time in transportation planning studies.[8] The U.S. Bureau of Labor Statistics reports that for 2006, the median wage rate in the Albany-Schenectady-Troy Metropolitan Statistical Area was $16.13 per hour.[9] Adding in a year's inflation increases this to $16.64 an hour. Therefore, an appropriate average value of time for the region is $8.32 per hour. A value of time of $8.32 per hour is equal to about $.14 per minute.

The Thruway toll between the two I-90 interchanges (24 and B-1) is $1.35 cash/$1.22 E-ZPass for cars. The $1.22 E-ZPass toll is equivalent to 8.8 minutes. The simple model suggests that an economically rational median wage earner should choose the free route over the tolled route unless it takes more than 8.8 minutes longer. Instead, travel on the free route for one weekday in October was actually 2 minutes shorter. It is likely that there are times when I-90 is congested and takes longer to traverse than the Thruway. However, it appears that the economically rational median wage earner should choose I-90 throughout the day and throughout the week.

However, such simple models often fail to match observed conditions. The deficiencies in the simple model result primarily by lumping everyone together. In reality, there are some drivers who are much more likely to accept the tolls than are others. These include higher income drivers, drivers traveling on business (with business reimbursement for toll payments), drivers with a strong need or desire to complete their current trip as soon as possible, drivers that especially dislike congestion, and drivers that don't think about the potential savings or about toll payment in general. These factors can overlap and further increase the likelihood of choosing the tolled route. On the other hand, there are drivers who are adverse to paying tolls, or who may not have the cash on hand to pay tolls. The combination of all these factors often requires model adjustments in order to match observed splits between free and toll routes. Lacking detailed data and a more sophisticated model, the conclusion that can be drawn now is that the diversion rate should be lower during peak congestion periods than at other times.

Potential for Shifting Traffic from Patroon Island Bridge to Castleton-on-Hudson Bridge

Recommendation 2,3,4:
Shifting some traffic to the Thruway
1) Signage
2) Re-designation

Three concepts have been discussed for shifting traffic from the Patroon Island Bridge: 1) signage, 2) re-designation, and 3) toll structure. These could be applied separately or as a package.

[8] Kruesi, Frank E, Assistant Secretary for Transportation Policy, U.S. Department of Transportation. Memorandum re "Departmental Guidance of Valuation of Travel Time in Economic Analyses", April 9, 1997.

[9] http://www.bls.gov/oes/current/oes_10580.htm#b00-0000

The first two concepts are directed toward the diverted traffic discussed above – traffic that would otherwise be on the Thruway without stopping between Interchanges 24 and B-1. As discussed above, it is estimated that only 1.4 - 2.0 percent of peak hour/peak direction traffic on the Patroon Island Bridge fits this definition, limiting the potential benefits of these approaches, at least during peak traffic conditions. Additional rationale for doing this is to increase toll revenues and better safety at Patroon Island Bridge during rush hour from fewer trucks.

I-90 is generally on the Thruway except for the section between Interchange 24 and Interchange B-1. In 1999, there was a meeting of NYSDOT, FHWA and NYSTA to discuss the possibility of designating the Thruway's Berkshire Spur as I-90. The primary result of this meeting was an initiative to modify signage. Signage was added in 2001 for eastbound Thruway travelers approaching Interchange 24 to stay on the Thruway for the Mass Pike and Boston. The Vollmer report describes how this change in signage balanced diversion by direction. Previously there was more eastbound diversion than westbound diversion. Re-designation remains a possibility, although there are several issues that would need to be resolved. One promising idea is to re-designate existing free I-90 between Interchanges 24 and B-1 as I-88, with I-90 and I-88 overlapping between Schenectady and Interchange 24. The current and proposed re-designations are show in Figure 16.

The third factor – toll structure – could include reducing Thruway tolls and/or adding I-90 tolls. Depending on how much the toll structure was changed, this could have some potential to not only reduce diversion from the Thruway, but also shift some intra-regional traffic to the Castleton-on-Hudson Bridge. For example, someone traveling from Nassau to Albany could use either bridge. However, they also could use the Dunn Memorial Bridge, which is in between, so diversion analyses would need to include at least these three bridges.

These concepts all have some merit. However, no combination of these factors is likely to shift enough traffic from the Patroon Island Bridge to dramatically effect I-90 operations.

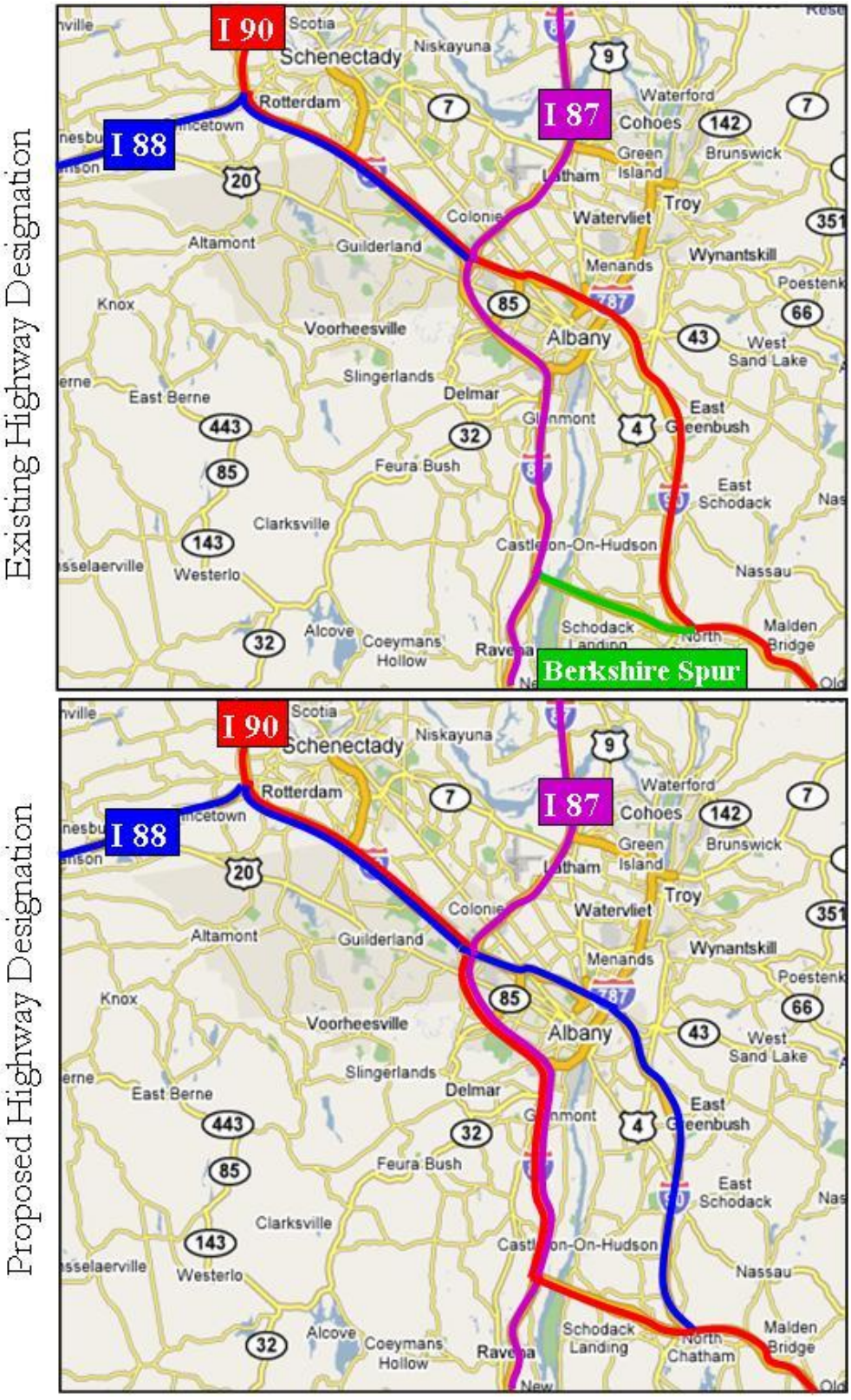
Function of the Thruway in the Hudson River Crossings System

Even though the Castleton-on-Hudson Bridge carries much less traffic than the Patroon Island Bridge, it is a critical Hudson River crossing. In May 2007, the bridge carried 14,500 vehicles per day, with 24 percent of these being trucks of greater than 40 feet in length.

Microsimulation of the Patroon Island Bridge and adjacent I-90 has shown that weaving operations are very sensitive to the number of trucks. Each truck – due to a combination of length and less maneuverability – has a much greater effect on weaving capacity than a single car. Therefore, the Thruway has a critical role in moving freight through the region, and reducing congestion on the Patroon Island Bridge.

The peak annual period for the Berkshire Spur is Thanksgiving weekend. The Castleton-on-Hudson Bridge serves a critical function of carrying traffic during this period and other high seasonal traffic periods.

Figure 16: Interstate Re-designation



Other CMP Risk Assessment Issues

Changing Transportation Investment Patterns

The Patroon Island Bridge is a major bridge located in the core of the region that provides excellent access both to I-90 and to I-787. Therefore, it will always be an important roadway, but its importance relative to other bridges is heightened even further due to the historic emphasis in the Capital District on auto freeway travel relative to other modes and roadways. A shift in emphasis toward arterial roadways and other travel modes could result in some shifts in vehicular travel away from the Patroon Island Bridge to other bridges. As discussed previously, the regional modeling of the concentrated growth scenarios shows more growth in traffic for other bridges than for the Patroon Island Bridge. This result is from land use changes alone. If concentrated growth occurs in conjunction with related changes in transportation investments, the shifts could be even greater.

Past Emphasis on Freeways

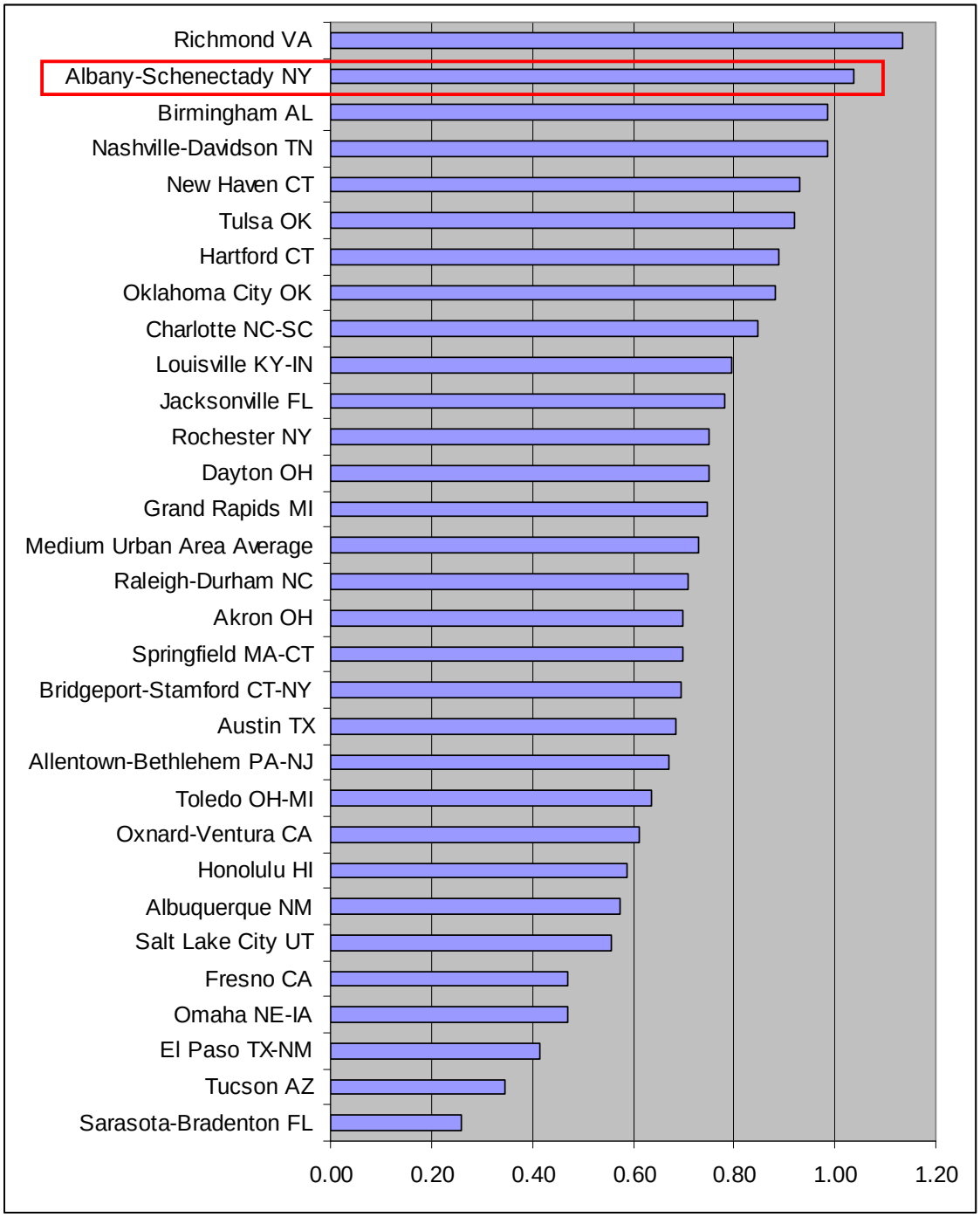
During the critical times for congestion, most of the traffic is internal to the Capital District.

The Patroon Island Bridge is on I-90, an interstate highway, which suggests long distance traffic. However, during the critical times for congestion – the weekday morning and afternoon peak hours in the peak directions – most of the traffic is internal to the Capital District. Of westbound morning peak hour traffic on the Patroon Island Bridge, 41 percent exits onto I-787 and another 13 percent exits at Exit 6, so that less than half (46 percent) continues on I-90 west of Exit 6. There are not sufficient data available to estimate destinations west of Exit 6, but there are several large job concentrations that certainly attract large numbers of trips including the State University of New York (SUNY) Albany Campus and Wolf Road, and that little of the Patroon Bridge traffic during weekday peak hours leaves the region. In the weekday afternoon peak hour even less of the traffic is through-traffic on I-90, with 47 percent of the eastbound Patroon Island Bridge traffic entering from I-787, 13 percent entering at Exit 6, and only 40 percent coming from I-90 west of Exit 6.[10]

In the Capital District today, freeways carry a large share of daily trips. The Interstate system, including I-90, I-87 and I-787, are most important, but the region also has a number of freeway sections on other roadways. This can be seen by comparing freeway lane-miles per capita across regions. (A freeway lane-mile is a single lane of freeway for a single mile.) Compared to other similar regions, the Capital District has more freeway lane-miles per capita. In its *Urban Mobility Study*, the Texas Transportation Institute has published data for all U.S. regions, including 30 regions in the size class that includes the Capital District – half a million to a million population. Of these 30 regions, Albany has the second highest number of freeway lane-miles per person, after only Richmond (See Figure 17). Freeway lane-miles per person in the Capital District are 42 percent higher than the average of the 30 comparable regions.

[10] These percentages are estimated from traffic counts as described in Technical Memorandum: 2007 VISSIM Microsimulation I-90 Exits 6, 6A and 7, Revised: September 28, 2007.

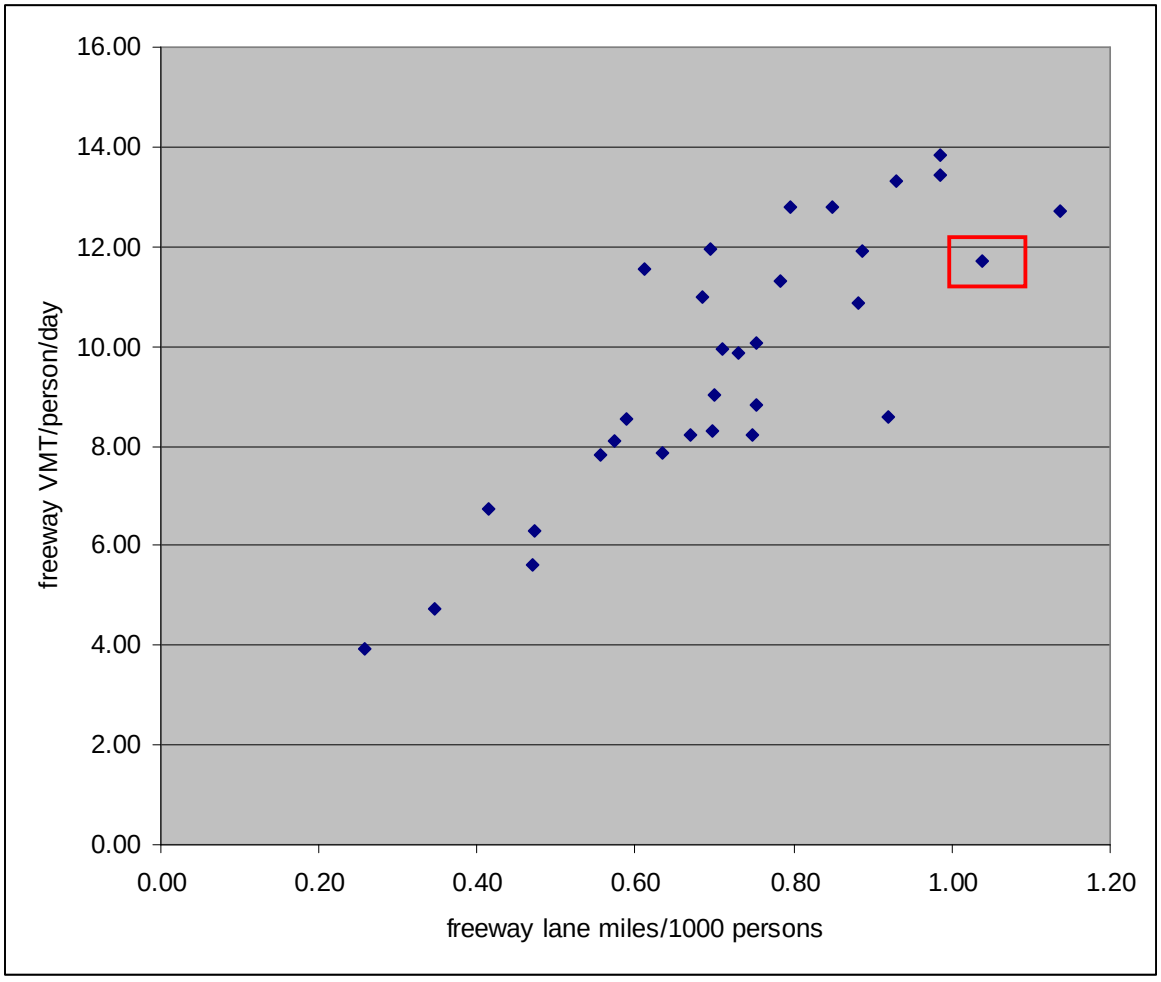
Figure 17: Freeway Lane Miles per 1000 Population – U.S. Regions of 500,000 to 1,000,000 Population



Data Source: Texas Transportation Institute *Urban Mobility Study*, 2007 (data for 2005).

In general, more freeway lane- miles per person results in more freeway vehicle miles traveled (VMT) per person, but there is variation. Figure 18 shows freeway vehicle miles traveled (VMT) per person per day by freeway lane miles for the same group of 30 U.S. metropolitan areas. Although the Capital District has the second highest number of lane miles per person, it has only the ninth highest freeway VMT per person.

Figure 18: Freeway VMT per capita versus Freeway Lane Miles per Capita (Albany-Schenectady in blue box)



Data Source: Texas Transportation Institute *Urban Mobility Study*, 2007 (data for 2005).

This combination of high lane miles (capacity) and only moderate use means the Capital District has a low average utilization rate for freeways. The Capital Region's average of 11,300 VMT per lane mile is the fourth lowest of 30 regions, and is 16 percent lower than the average across the 30 regions.

This is an average rate, and some freeways are congested while others are underutilized. The underutilized freeways represent under-performing capital assets that are expensive to maintain, and that will be prohibitively expensive to rehabilitate or replace. Decisions will be made concerning most of these during the modeling time horizon of 2007-2045. They are candidates for downsizing by replacing with lower-cost, lower-speed arterial roadways. In addition to cost savings, there are strong planning reasons to consider downsizing that are discussed in the following section.

New Planning Directions

The Capital District Transportation Committee has a clearly defined vision in their *New Visions Plan* that includes reducing the growth of traffic by implementing land use plans and patterns that generate lower amounts of vehicle travel. These patterns of growth are generally described as *Smart Growth* or *New Urbanism*, and include more compact, mixed use neighborhoods, infill development or redevelopment in areas near

existing infrastructure, activity and services; and creating more walkable, bikeable, "transit-ready" communities.

Reduce the growth of traffic by implementing land use plans and patterns that generate lower amounts of vehicle travel.

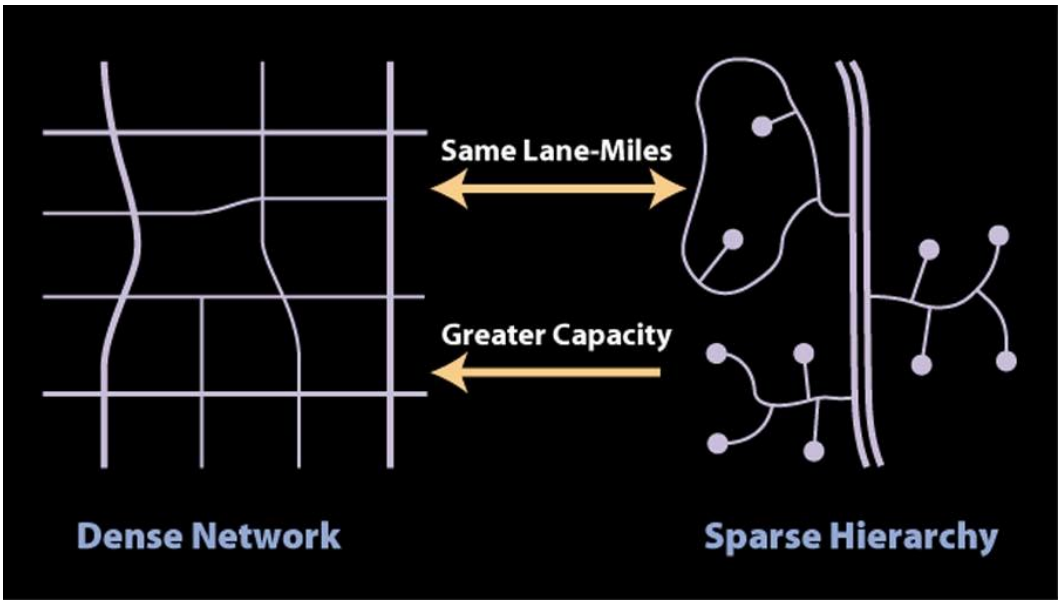
To be effective, these policies must be applied at all levels of planning and government: regional, corridor and street block. At the regional level, land use and growth patterns are primary determinants of how much vehicle travel is generated and where it goes. Through the implementation of more compact, mixed use development, the need for vehicle travel is reduced by the close proximity between residences and services. As discussed above, there is an ongoing shift toward these types of development both in public planning and by private sector developers. These forms of development are also more amenable to walking and transit use, which further reduces vehicle travel.

At the corridor level, smart growth encourages the development of redundant street networks, and of distribution of traffic through the network rather than concentration onto a highway facility. Figure 19, below, illustrates the advantage of a highly connected network of streets rather than the more typical branching pattern of suburban development on arterials. On the left, there is a variety of routes through the network, and traffic congestion can be avoided by choosing a different route. On the right, a more conventional suburban street network results in all traffic, through and local, using the arterial route – in the Capital District this is often a limited access freeway. The resulting traffic congestion cannot be avoided, as there are no alternate routes.

Recommendation 5:

Traffic congestion can not be avoided, if there are no alternative routes.

Figure 19: Dense Network vs. Sparse Hierarchy



The sparse network generally increases travel distances for all modes. It is almost impossible to serve efficiently with transit because of the "last half-mile problem" of getting into the cul-de-sac areas which are difficult to service efficiently with transit. In the sparse network, walk and bike trips are longer and must pass through high-volume roadways. This is unpleasant, potentially dangerous, and in some cases, not even

allowed. In the Capital District, there are several efforts to improve street connectivity, which should have corresponding benefits for other modes of transportation. For example, the Harriman Campus area has been the focus of a CDTC Linkage Study, which has recommended greatly improved connectivity with the local street network. The campus as originally designed had very good access to I-90, but was somewhat isolated from the surrounding street network. These changes will allow more multi-modal access to the campus.

Recommendation 6:

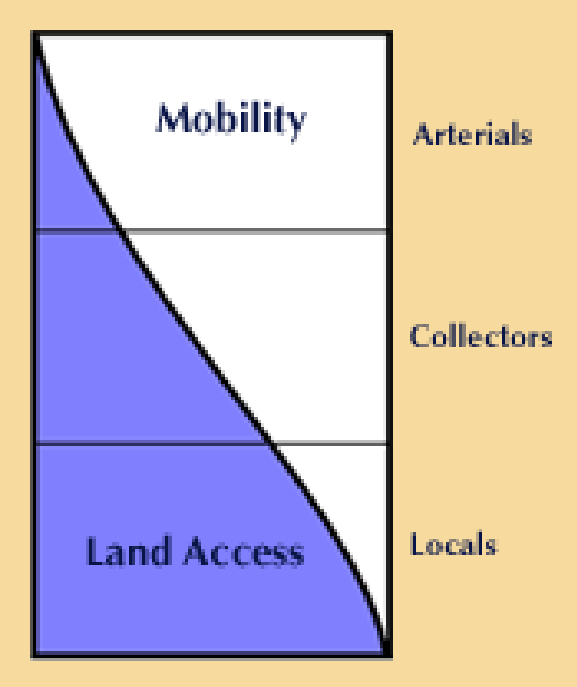
Improve street connectivity especially near potential infill and redevelopment sites.

Auto trips are also lengthened in the sparse network. One case that is particularly relevant to the Hudson River Crossings Study is that some trips with Rensselaer County origins and destinations make two bridge crossings in order to use the high speed I-787. These trips have been reported anecdotally and also occur in the regional modeling. They are particularly important because each one way trip includes two bridge crossings.

Access vs. Mobility / Access and Mobility

As shown in Figure 20, the sparse network is premised on the idea that land access is provided primarily with local roadways and that little access is provided by arterial roadways.

Figure 20: Mobility vs. Land Access in the Sparse Network Hierarchy



Finding 5:

Common Desires:

- Improved waterfront access
- Increased connections to isolated areas
- Separation between industrial and residential land uses

This design paradigm has led directly to some of the most intractable problems transportation planners are addressing today in the Capital Region. The following list of issues and themes appear frequently in transportation planning studies:

- Neighborhoods near the Hudson River desire an improved connection to waterfront for pedestrians, and perceive that connection as essential to neighborhood revitalization (I-787 often a barrier).

- Many areas have poor access due to a broken street network that is hampering redevelopment. Many locations are isolated from the street network by limited access highways and railroads. New connector roads are often proposed as the solution, which often require expensive interchanges with limited access routes.
- Many neighborhoods have concerns about truck traffic on neighborhood streets. Industrial areas often have indirect, circuitous routes to access freeways, requiring passing through residential areas on local streets.
- Some locations desire a direct connection to I-787 (generally infeasible due to cost and/or design issues).

Recommendation 7:

Minimize use of cul-de-sacs and increase levels of access along major urban arterials.

The Smart Growth/New Urbanism paradigm rejects the premise that arterial roadways should not provide local access, and emphasizes building streets and boulevards that can move large amounts of traffic, provide local access, and serve all travel modes. These ideas are moving beyond New Urbanism into the transportation planning mainstream. Many of these ideas are captured in at Institute of Transportation Engineers (ITE) Proposed Recommended Practice on *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*.

Challenges with Infill Development in the Capital District Related to the Highway Network

One of the principles of Smart Growth is to encourage building in or near existing services, rather than expanding the footprint of urban and suburban areas onto undeveloped "green fields". The compact growth scenarios under consideration in the Capital District will also require more intense use of developable properties in or near the core of the region. Numerous planning studies have been conducted in the Capital District that describe potential development areas that are near the center of the region, but due to poor access, or other challenges, are not able to fulfill their potential for infill development.

One of the most typical barriers for better use of these urban infill sites is poor access. While they are surrounded by limited access highways, there is a gap in the network that does not provide the local connectivity that is needed. For example, a site has been selected for the Albany Convention Center on an infill site at the core of the city. The site is surrounded by limited access highways, and the local street grid is interrupted. Large urban facilities such as this are best served by multiple access routes in a redundant street network. However, the urban street network adjacent to the region's freeway facilities is often interrupted and not complete, hindering access to important sites. These concerns also apply to the South End, the South Troy Brownfield site, Menands, and the north Waterfront.

The Harriman site is an example of a location that was planned completely around automobile access, with its own direct connection to the interstate system, and high speed ramp-like facilities surrounding the core of the Campus. This system is not serving the new planning directions which call for improved connectivity to the local streets, and better access for pedestrians and transit users. As changes or rehabilitations are contemplated for the region's freeways and arterials, the needs of other modes, and the type of access to sites that is most appropriate to support *New Visions 2030*, should be considered.

In addition, many studies call for improving the pedestrian environment of their older commercial centers, to help keep them vital, and to provide local, walkable services to urban neighborhoods. There are neighborhoods in or near the core of the Capital District that suffer from high volumes of truck traffic, which result from the circuitous routings that these trucks need to follow to gain access to the region's highway system.

Many of the efforts to promote infill development in or near the region's core could be aided by more flexible highway access policies. While the conventional planning paradigm is that high through-put roads require access control, that is really only true for areas that are highly auto-dependent. Urban streets can provide pedestrian-oriented access and mobility, and there are examples of facilities that successfully combine these roles throughout the country.

Planning Considerations for the Future Transportation Network

While the Capital District is pursuing new directions in regional planning toward Smart Growth and New Urbanism with an emphasis on multimodal streets with local access, there are still several active proposals for high-speed, limited access connector roads. Improved connectivity is important, but as further planning is done on these potential new connectors, consideration should be given to designs that can provide the vehicular throughput needed, but with lower-speed designs with local access for pedestrian-oriented development in appropriate locations.

Recommendation 8: One candidate for downsizing close to the Patroon Island Bridge is the I-90 Exit 6 interchange with Route 9 and I-90.

The Capital District's transportation system will evolve over time as infrastructure requires rehabilitation or replacement and in response to planning and development opportunities. One candidate for consideration for future downsizing that is close to the Patroon Island Bridge is the I-90 Exit 6 interchange with Route 9 and I-90, just west of the I-90/I-787 interchange. This interchange has a very high capacity relative to the volume using it, and consumes a great deal of space with its high-speed stack design. In addition, its close proximity to the I-90/I-787 interchange creates weaving conflicts, which would be alleviated by a smaller interchange design. Replacing this interchange with a more compact design (e.g. a diamond interchange) in conjunction with a lower speed Route 9 would improve access to adjacent land. Improving access by replacing this interchange could have the added benefit of encouraging economic development in the immediate area.

Other infrastructure where downsizing may be warranted— and where such action could also lead to economic development--includes the interchanges at both ends of the Dunn Memorial Bridge, the interchange with Route 378 and Broadway in Menands, and parts of I-787. Many potential infill development sites are hampered because they are surrounded by limited access facilities. The re-designation of some of these roadway facilities, allowing them to provide direct access, should be considered. In addition, adjusting the road's design speed downward may also be appropriate.

If transportation investments are targeted at developing a highly connected network of multimodal streets over the coming years, this will gradually change the spatial geography of trip making in the Capital District. Where today it might be more attractive for someone to use the freeway to travel to a local supermarket; in 2020, it might be more attractive to shop at a closer location that does not require freeway travel. By the year 2045, it is possible that some sections of I-787 will have been converted from a freeway to a boulevard, which will provide the connectivity to the transportation and to the waterfront that is desired by many residents. In the context of this CMP risk assessment there is little risk that freeways, including the Patroon Island Bridge, will be more important in the future. Instead, there is a strong possibility that they will become less important over time.

Bicycle/Pedestrian Opportunities on 4 Bridges

Introduction

Collectively, as a group, the Hudson River crossings within the Capital District are in good condition, safe, and carry adequate capacity for the demand of vehicles wishing to cross them on a daily basis. However, major components (i.e. bridge decks) on several of the bridges are at or near the end of their design life and will require reconstruction or replacement in the near future. In fact, almost $200 million has already been programmed or identified as needed for five of the bridges in the next 5-10 years. With approximately one billion dollars in collective value among the eight bridges, an important ongoing task for NYSDOT and others is to balance multiple priorities with finite funding, and to look for ways to optimize expenditures and the resulting benefits. For example, providing multi-modal opportunities such as bicycle/pedestrian (bike/ped) access during a major rehabilitation or replacement. The study focused on the four bridges with the greatest potential for bike/ped improvements and the resulting benefits: Dunn Memorial, Livingston Avenue, Patroon Island, and Troy-Menands.

Ped/Bike facilities help:

- Economic development
- Waterfront revitalization
- Recreation
- Tourism
- Quality of life
- Transportation

The CDTC *New Visions 2030 Plan* strongly supports improved bicycle and pedestrian access in the Capital Region. CDTC's *Bicycle and Pedestrian Game Plan and Toolbox* states that, *"While moving towards a regional bicycle and pedestrian system, increasing capacity for cyclists and pedestrians at the limited number of river crossings should be a priority."* This vision is supported in CDTC's regional Greenways Concept Plan, which shows the potential for creating a connected system of shared use paths on both sides of the Hudson River. CDTC has also supported several studies that will create improved trail connections along the River, including the South Troy Waterfront Trail, the I-90 Patroon Greenway, and the Rensselaer County Trail plan. Urban waterfront access is essential for economic development in communities along the River, and bike/ped access is an important part of local waterfront revitalization efforts. Improved bicyclist and pedestrian access is important for recreation, tourism, and quality of life, and provides for commuter and utilitarian travel choices that are a key to developing a sustainable transportation system.

The challenge to achieving this vision will be in balancing the need for improved bike/ped access with the costs, benefits, opportunities and constraints associated with the Hudson River Bridges. The Patroon Island, Dunn Memorial, Troy-Menands and Livingston Avenue Bridges are valuable assets for the Capital Region, but existing access across these bridges is very limited for people walking and bicycling. The Dunn Memorial Bridge is the only one of these four facilities that provides a continuous pedestrian path, but that path is of limited use for bicyclists, does not meet ADA compliance, and is posted for bicyclists to walk across the more than one mile crossing due to design and operational conditions. Both the Dunn and Patroon Island Bridges cross the river at elevations far above the developing waterfront trail systems and key destinations for pedestrian and bicycle traffic. The Livingston Avenue Railroad Bridge has an existing timber deck walkway on its south side, but pedestrians and bicyclists are currently prohibited from using the bridge. Capital District Transportation Authority (CDTA) transit provides bike-on-bus service as an alternative means of access across the river, and it is possible that future water taxi service could improve access for pedestrians and bicyclists. The maps on the following pages show the four bridges in the study area in relation to the existing regional bike/ped trail system.

In considering the alternatives for renovation or replacement of the Patroon Island Bridge, it is important to evaluate the potential for walking and bicycling both across and under the span. The Patroon Island Bridge offers a potentially spectacular view of the Hudson River Valley (if an overlook were to be provided), and the structure can offer access to trails on both sides of the river. If the bridge is going to be replaced by a new span, a bike/ped crossing could be included in the early phases of design. If the bridge is only being rehabilitated, then it is unlikely that a new bike/ped crossing would be cost effective. Due to its height above the waterfront and the need to address more immediate needs on the other bridges in the study area, a pedestrian and bicycle facility across the Patroon Island Bridge may not be the most strategic location for short-term improvements to bike/ped access, but that bike/ped access to be included into longer term planning for Patroon reconstruction or replacement and that bike/ped access be provided at multiple crossings in order to improve safety, access and mobility issues.

Recommendation 9: Invest in improving bicycle / pedestrian needs at multiple locations to improve safety, access and mobility issues.

Troy-Menands Bridge

The Troy-Menands Bridge has two eastbound and two westbound lanes carrying an estimated 30,000 vehicles per day. The deck was replaced in 1995. Additional repairs valued at approximately $6 million are programmed on the TIP. It appears that this bridge, a non-redundant structure, may warrant replacement in the future. There are large traffic delays that occur during the PM peak hour due to the large volume of vehicles exiting I-787 and merging with Route 378, traveling toward Route 4 and Hudson Valley Community College (HVCC). There are points at which the right lane is stopped on most of the bridge. There is enough capacity and little delay during all other times of the day. The delays during the evening should be considered more closely before any major capital work on the Troy-Menands Bridge is initiated.

Recommendation 10: Address capacity and delay issues before any capital work projects are initiated.

The Troy-Menands (Route 378) Bridge has existing sidewalks which are currently posted as "closed." The bridge connects to South Troy near HVCC on the east side of the River. The existing sidewalks transition to road shoulders on the west side, and there is no access between the bridge and the existing trail. Improved connections are recommended as part of the South Troy Pedestrian and Bicycle Trail. The trail is listed on the TIP as project R223 for $2.3 million beginning in 2007.

Existing Bike/Ped Path: Concrete sidewalks on both sides of bridge, currently closed. The width of sidewalks and shoulders on approach roads varies. Note pier cofferdams that could support a platform from the bike trail.

Path Width: Six-foot sidewalks are available on both sides with paved shoulders on west approaches

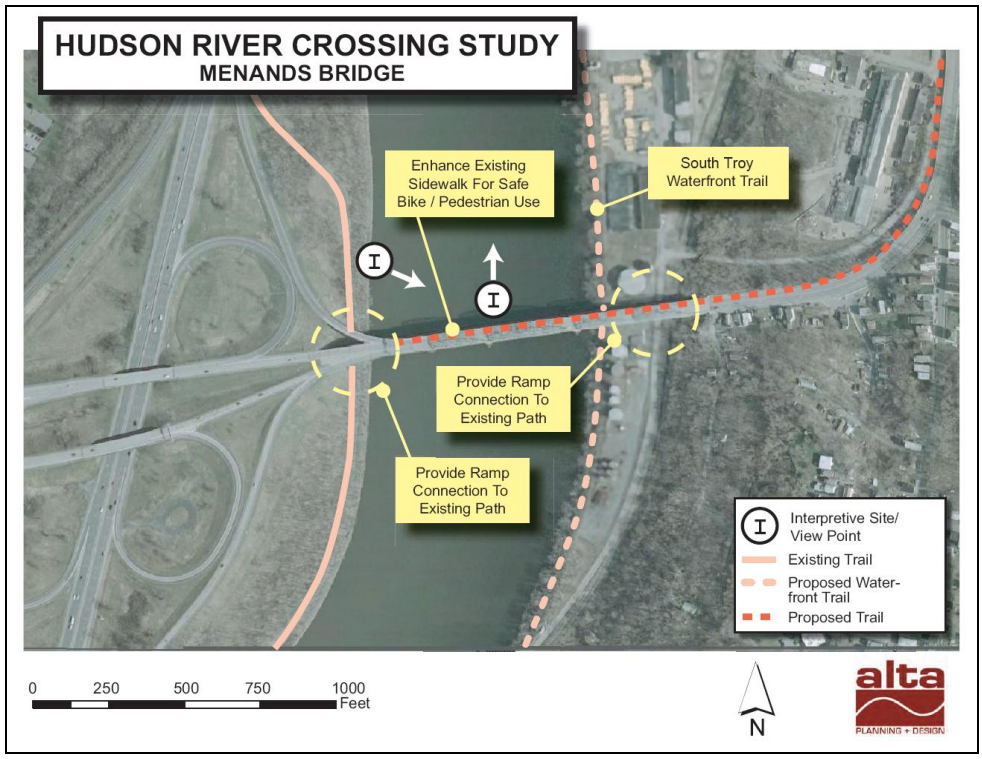
Access from Hudson River Trail: No access is currently available, although there is a potential to ramp down to existing trail

using improved sidewalks and shoulders. Ramps should be ADA compliant. A river viewing/fishing access platform could be created by connecting the pier cofferdams on the west shore with direct access from the existing trail.

Key Issues: The bridge is currently listed on the TIP as project R178, with $500 thousand in bike/ped access improvements programmed beginning in 2008. Potential improvements are shown on the graphic below.

Recommendation 11: Connect sidewalks

Figure 21: Menands Bridge Bike/Ped Improvements



Patroon Island Bridge

The Patroon Island Bridge consists of three lanes in either direction carrying approximately 82,000 vehicles per day. The bridge has been experiencing cracking in the floor beam/truss connection since 1994. NYSDOT has been proactively monitoring and repairing the cracks. NYSDOT is currently field evaluating an innovative crack repair technique that could extend the life of the floorbeam connections to coincide with the replacement of the 40 year old concrete bridge deck.. The bridge has received additional public attention recently due to its design similarities to the failed I-35W Mississippi River bridge in Minnesota.

The I-90 Patroon Island Bridge is elevated more than 100 feet above the water, and does not provide access from either side of the river to the proposed paths along the shoreline. Opportunities include a viewing platform/walkway at the existing bridge deck level, an emergency/maintenance access path at existing deck level, a bike/ped path located below existing deck level at the bottom chord of the truss structure, improved river access at the bridge pier locations, and the potential adaptive re-use of the existing steel trusses for a pedestrian span at another location (if the existing bridge is replaced by a new span). The bridge is listed on the TIP as

Elevation is limiting

project R268, where $110 million has been allocated for bridge replacement.

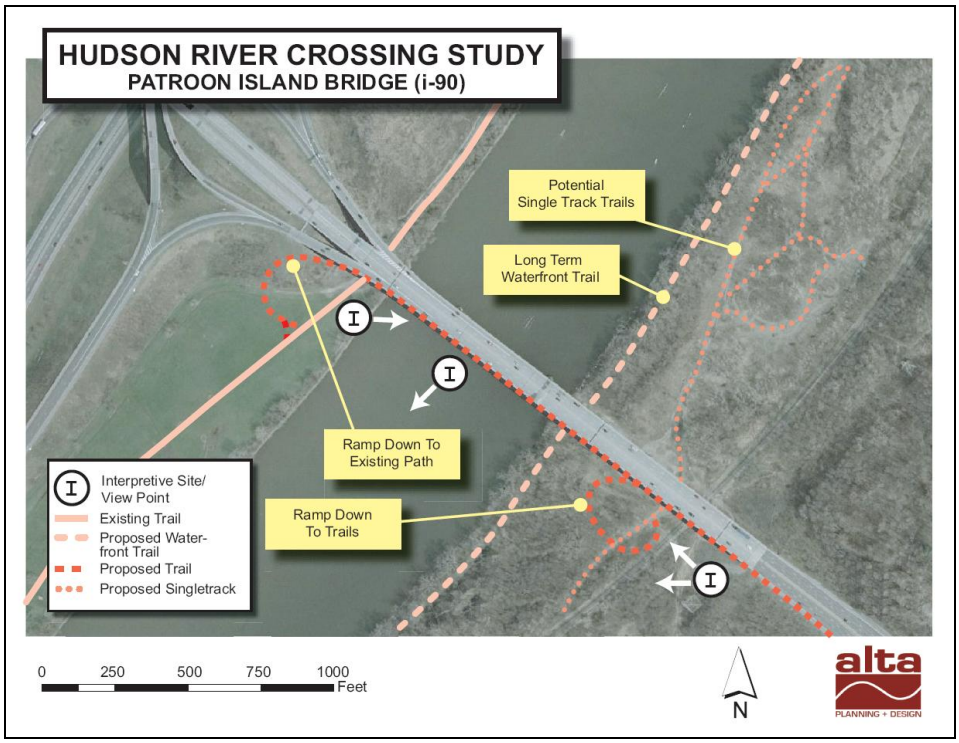
Existing Bike/Ped Path: No path is currently available.

Path Width: Not Applicable.

Access from Hudson River Trail: There is no access currently; the bridge deck elevation is above the navigation channel and would require a substantial ramp from west side; east side access could connect to trails leading to the proposed Rensselaer Waterfront Trail.

Key Issues: Limited access to existing pedestrian/bicyclist generators is available on either side of the structure. If the recommended alternative is a new 'signature 'span, a bike/ped path on the bridge could provide tourism, recreation and emergency/maintenance access benefits. Potential improvements are shown on the graphic below.

Figure 22: Patroon Island Bridge Bike/Ped Improvements



Livingston Avenue Bridge

The Livingston Avenue Bridge provides a unique opportunity for an "early win" in the effort to improve bike/ped mobility between the shores of the Hudson River. It is the shortest of all

the study area bridges. The bridge is a "swing" bridge that pivots to allow ships to pass.

- Close to the water
- Perfect trail link between Rensselaer and Albany
- Commuter possibilities

The existing Livingston Avenue Railroad Bridge provides Amtrak and CSX freight railroad service across the Hudson. The bridge currently carries approximately 17 freight trains per week and 8 Amtrak trains per day. The new Rensselaer/Albany train station is located just south of the bridge on the east side of the river. New major redevelopment projects are proposed on either side of the bridge (Albany Warehouse property and Rensselaer Waterfront), and the bridge deck is the closest to water level of the four bridges included in the site visit. The bridge is currently owned by CSX Railroad. Liability, operations, safety and security issues related to the active rail use would have to be resolved before a path can be considered on the Livingston Avenue Bridge.

Existing Bike/Ped Path: A timber deck maintenance walkway exists on the south side. Access is prohibited.

Path Width: The path is approximately seven-feet wide.

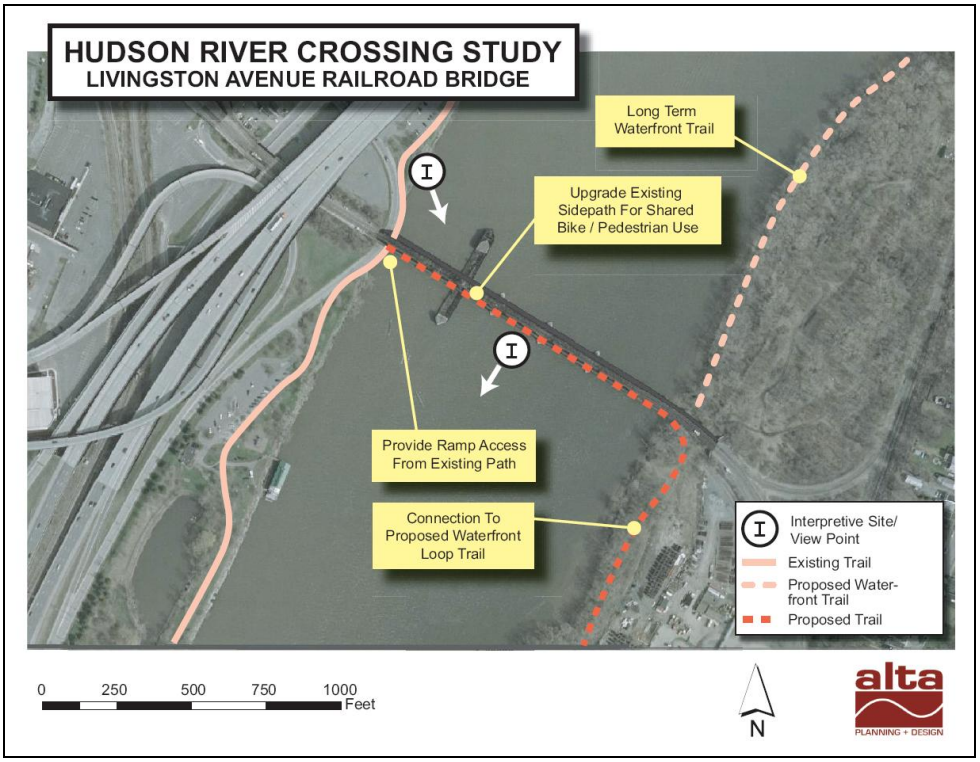
Access from Hudson River Trail: No access is currently available, with the exception of a narrow steel staircase located adjacent to the bridge abutments above the trail on the south west corner. Using the walkway is currently prohibited by CSX Railroad.

Key Issues: The bridge rotates at center pivot for river traffic. The structure is scheduled for renovation. The bridge is the key element in a proposed loop trail linking Rensselaer and Albany. Improvements can include a standard width walkway with ramps on either side for ADA compliance. Potential improvements are shown on the graphic below. The bridge was previously listed on TIP as project A394. Potential funding may become available through the efforts of the NYS High Speed Rail Task Force initiative. The Task Force estimates complete rehabilitation of the bridge to allow for dual train operation, signalization upgrades, etc, at $20 million. However, the cost to just restore the walkway for pedestrian and bicyclists could be done for approximately 1/10th the cost using public/private partnerships, and should be actively pursued.

Recommendation 12:

Immediately implement a functional bike/ped crossing over Livingston Avenue Bridge.

Figure 23: Livingston Avenue Bridge Bike/Ped Improvements



Dunn Memorial Bridge

The Dunn Memorial Bridge carries 36,000 vehicles per day with four lanes in either direction. The bridge is operating well with extra capacity. Repair work on one of the I787 approach ramps was recently completed when there was a failure in one of the supports causing a partial collapse onto the pier supporting it. The structure is in need of short term rehabilitation work which is currently programmed in the TIP.

The Dunn Memorial Bridge is the only crossing providing access for pedestrians and bicyclists between Albany and Rensselaer. The bridge connects the Rensselaer Amtrak Station with the State Capitol. It is a long, high-level crossing above the navigation channel. There is significant road noise and wind. A guide rail is mounted at the top of the curb, and the path has existing light stanchions. There is no existing way finding signage, and the path is bordered with industrial chain link fencing. Winter maintenance appears to be limited. The path is located on the north side of the bridge with views of the River, Troy, and the mountains beyond. The path provides maintenance access for bridge-mounted navigation lights. An historical marker honoring Private Dunn (a Medal of Honor recipient) is located at the top of the western ramp. Roadway sign structures on the bridge could provide support for an overlook at the top of the span for views of the River. The bridge is listed on the TIP, project R269 general repairs for approximately $6.9 million.

Bicyclists must walk their bikes on the only available crossing

Existing Bike/Ped Path: The existing path is a concrete sidewalk

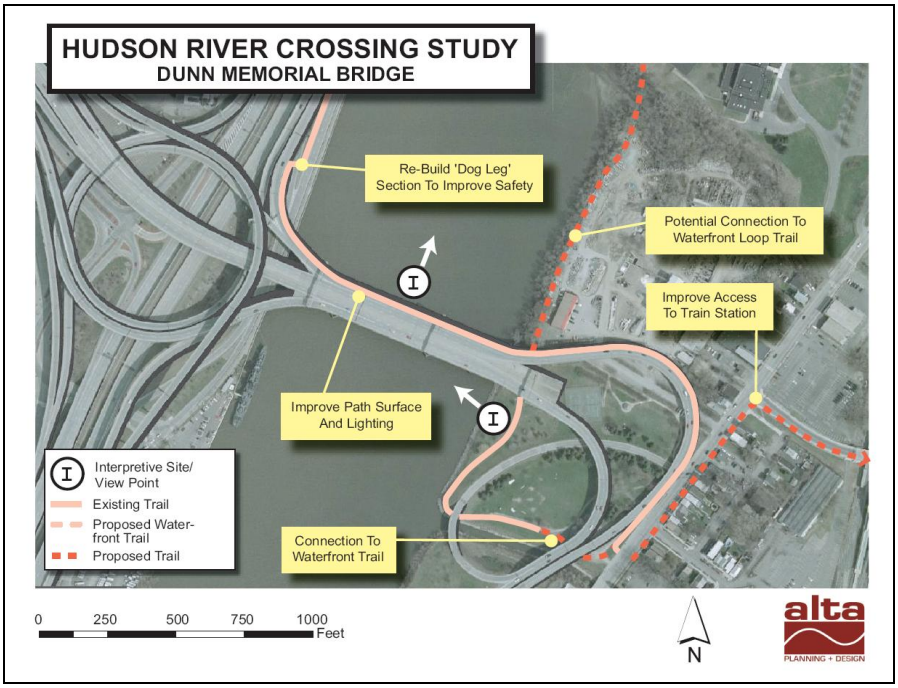
Path Width: Approximately 8 feet.

Access from Hudson River Trail: Signalized crossing is provided at the I-787 ramp. The sidewalk continues down along the bridge to the east side, meeting the street grid approximately 1000 feet inland from the shoreline. The bridge is part of State Bicycle Route 5.

Key Issues: The existing ramp on the west side has steep grades and a double 90 degree turn. The path narrows on the approach above the top of the ramp. Signs are posted for bicyclists to walk their bikes on the bridge ramp. The path is part of New York State Bike Route 9. Potential improvements are shown on the graphic below.

Recommendation 13:
Improve the existing bike/ped accommodations on Dunn Memorial Bridge and its approaches.

Figure 24: Dunn Memorial Bridge Bike/Ped Improvements



In reviewing the four bridges for bicycle and pedestrian access, there are specific issues at each location that would need to be addressed in order to realize the potential benefit of these facilities for recreation, tourism, accessibility to vistas of the Hudson Valley, interpretive opportunities for the history of the region and its transportation infrastructure and enhanced waterfront access, in addition to the bridges 'utilitarian purposes. Crossing the Hudson River without a motor vehicle is currently very difficult in the study area. The conditions of the four bridges from a bicyclist and pedestrian perspective are summarized in the table below:

Table 4: Bridge Bike/Ped Matrix

Bridge	Attributes							
	Existing Path	Restrictions	Path Width	Elevation*	Access to Trails	Bike Access	Ped. Access	Notes
Dunn Memorial	•	"Walk Bikes"	8 '	109 ft.	•	•	•	Key Link to Amtrak
Livingston	•	Access Prohibited	7 '	30 ft.	•		•	Timber deck
Patroon Island	N/A	N/A	N/A	95 ft.				No access
Troy-Menands	•	"Closed "	6 ¹-4 "	54 ft.	•		•	Sidewalk

* GPS estimated field elevation above sea level. Bridge clearance must meet U.S. Coast Guard standards.

Improvements to the Dunn Memorial should be made to increase safety and operation.

Of the four bridges reviewed in this Study, the I-90 Patroon Island Bridge offers the least short-term effectiveness in promoting the bicycle and pedestrian system in the Capital Region's Hudson River corridor. While a pathway on the existing bridge could benefit tourism, maintenance and emergency use, it is of lower priority as a transportation and recreation connection than other bridges in the study area. There is limited bicycle and pedestrian access on either side of the bridge since the highway is part of the interstate system. Linking to the existing Mohawk-Hudson Bike Trail on the west side and the proposed waterfront trail on the east side would require a significant investment. If short term bicycle and pedestrian improvements can be made to the other Hudson River Bridges, then the Patroon Island Bridge should be considered as a long term solution.

Bike/Ped additions to the Patroon Island Bridge should be considered as a long term solution.

The Dunn Memorial Bridge provides the best existing access for bicyclists and pedestrians crossing the river but is hindered by a number of problems. The west side ramp is very steep and includes a double 90 degree turn halfway down the ramp. Bicyclists are required to walk their bikes –even though the bridge is part of NY State Bike Route 9 and is the primary bike/ped connection between downtown Albany and the Rensselaer Amtrak station. There are also significant safety and operational issues. The narrow path is not wide enough to be shared by bicyclists and pedestrians and there is minimal separation between the path and adjacent high-speed traffic. The total crossing distance, limited winter maintenance, lack of lighting and long grades make this crossing a challenge for many potential users. Upgrades to this bridge are important for connectivity, safety and accessibility.

The Troy-Menands Bridge is a valuable connection to the communities on both sides of the river. The bridge connects directly to the sidewalk infrastructure in South Troy and passes directly above the Mohawk Hudson Bike-Hike Path. Construction of a ramp on the west side would give the existing sidewalks a destination and provide a much needed connection across the river north of Albany, especially for people traveling to Hudson Valley Community College and South Troy. This bridge is a key connection for the proposed South Troy Waterfront Trail and the Rensselaer Waterfront Trail.

Adding a ramp on the west side of the Troy-Menands Bridge would give the existing sidewalks a destination.

Of the four bridges, the Livingston Avenue Railroad Bridge offers a distinct advantage when compared to the others in the suitability matrix. The existing pathway is separated from railroad traffic and the lower elevation of the deck increases accessibility and the user's appreciation of the river. The Pathway is located next to the existing Mohawk Hudson Bike-Hike Trail and could easily be connected to the waterfront trail planned for the east side of the river. Two additional factors favor the Livingston Avenue Bridge are its proximity to Albany's downtown business district and its connection with the proposed Waterfront Loop Trail. This would be a prime connection for the train station, the new Rensselaer waterfront development and downtown Albany and the proposed Albany Convention Center If the conditions required for a "rail with trail" solution can be met, the railroad bridge could be an "early win" for improved access across the Hudson River in the study area.

Livingston Avenue Bridge offers a distinct accessibility advantage.

The View Forward: Transit and Travel Demand Management in the Capital Region

Two Bridges Form Key Links in Regional Transit System

The inadequacy of bike/ped facilities on bridges within the Capital District makes CDTA buses themselves the preferred method for bicyclists and pedestrians to gain access between Albany and Rensselaer. However, only two bridges, the Dunn Memorial Bridge and the Troy-Watervliet Bridge, currently have regular bus service, carrying numerous routes.

Only two bridges carry regular bus routes.

Limited service

The Collar City Bridge, and the Patroon Island Bridge provide limited service. These buses run during limited times during the day and usually operate between more distant points. These bus routes are designed primarily for commuters, not for leisure riders.

No transit service

The Castleton-on-Hudson, Troy-Menands, Troy-Green Island, and Livingston Avenue Bridges currently do not carry any transit systems. The Livingston Avenue Bridge does provide a river crossing for Amtrak, however this service is not meant for commuters.

The Opportunities for Transit

Transit incentives can be used to encourage transit-oriented development, such as retail centers with bus stops and high density residential to increase rider-ship per stop. Additional transit hubs throughout the Capital District, particularly on either side of the Hudson could enhance transit as a mode of choice.

Recommendation 14: Use transit incentives to encourage transit-oriented development.

CDTA currently operates a Corporate Swiper program with approximately 100 Capital Region businesses participating; however, support for additional and expanded commuter /employer programs can be used to encourage higher occupancy vehicles and increased transit use. By increasing transit service and use, traffic volumes can be reduced, providing better service for riders and other vehicles.

More focus should be placed on increasing system efficiency and exploring new modes such as bus rapid transit, light rail, ferries, and water taxis.

Recommendation 15:
Support increased efficiency in current transit system.

The Benefits for Transit

There are many benefits to increased transit service and ridership. Congestion mitigation is a primary reason for transit implementation. Transit also increases safety and mobility on roadways. The availability of transit is important for job access for those that can not or choose not to own a vehicle. Transit service can also help to spark economic growth. There are also numerous environmental benefits to transit service such as improved air quality, and reduced emissions.

Benefits:
- traffic
- safety
- mobility
- economy
- environment

The Path Forward for Transit

The Capital District is already taking steps forward to increase transit service and use. CDTA will begin the launch of modified Bus Rapid Transit (BRT) service along the NY Route 5 corridor next year. CDTA is also

considering the potential for expanding BRT to include up to 100 miles of route service over the next two decades.

High Speed Rail is another transit alternative that is being considered to link the Capital Region with other major economic centers, such as New York City. While the potential rewards of High Speed Rail are compelling, both in terms of accessibility and the potential for significant economic growth, High Speed Rail can be realized only over the long term. A Light Rail System (LRS) would be focused more on travel within the Capital Region, and may provide a shorter-term alternative than High Speed Rail, if the market exists to support the development of such infrastructure. A study is currently being conducted to consider the potential of LRS and BRT within the Capital Region.

New Possibilities for Transit

The Patroon Island Bridge is not currently a viable option for adding BRT or LRS alternatives. Current capacity limits these possibilities and adding structure would be expensive; however, these transit services can be revisited when the existing structure is replaced.

The Livingston Avenue Bridge is currently a key link in Amtrak Empire Corridor intrastate service. The bridge connects Albany and Rensselaer and could hold opportunities for BRT, LRS, and bike/ped access. The development of the Rensselaer waterfront could enhance usage of such a facility and other additional transit services between the train station, Rensselaer and Albany.

Recommendation 16:

Patroon Island Bridge: Future BRT or LRS with replacement

Livingston Avenue Bridge: BRT, LRS, or bike/ped

New Possibilities for Travel Demand Management

Travel Demand Management (TDM) techniques are steps undertaken by the public and private sector to reduce the peak demands on the transportation network. These can be techniques, like those discussed above, that try to shift private vehicle users into transit (as well as into ridesharing modes). In addition, and with special relevance to the Patroon Island Bridge, TDM can also include a host of concepts where commuters are urged to shift the times in which they travel from the "peak of the peak" to so-called "shoulder periods" on either side of the peak. Such techniques that should be considered here include the encouragement of New York State employees (working with their agency employers) to shift work hours, to work condensed work weeks, and telecommute. TDM measures are often cost-effective and can be achieved through collaboration and policy rather than construction and new infrastructure investments.

Recommendation 17:

Implement travel demand management (TDM) techniques.

TDM measures reduce the amount of time people sit in traffic, which in turn has impacts on productivity and health/stress levels, as well as the amount of time vehicles spend idling, which has significant environmental benefit,s including reduced emissions and improved energy independence.

The United States Department of Transportation (USDOT) has found that information availability has positively influenced travel demand. Informed travelers make better choices about how, when, on which routes, and whether to travel to their destinations. Delivery of this information is supported by Intelligent Transportation Systems (ITS) and other techniques. The USDOT furthermore found that time-savings and financial incentives were the most effective at changing behavior, including HOV lanes and road pricing.

Seattle and the Washington State Department of Transportation (WSDOT) provide live travel information to travelers through a variety of media. Available information includes camera images, estimated travel times, construction information, and live closure and accident alerts. The Seattle area conducted a survey which showed that a significant number of travelers— around 36 percent— altered their behavior because of travel information, including 13 percent who changed the time they left. Forty-three percent felt as if the information reduced their trip times, and others cited less stress, better predictability, and improved safety. By providing travelers with accurate information, users of the transportation network are able to make better decisions, reduce travel time, and avoid worsening existing points of congestion.

Intelligent Transportation Systems (ITS)

Background on ITS

For the past several decades the demands on our nation's transportation system have grown significantly faster than system capacity. Population growth, population dispersion from urban cores to suburban and exurban locations, and increasing household automobile ownership have all contributed to dramatic increases in person vehicle miles traveled. Economic trends, such as increased trade and just-in-time delivery, have also contributed to significant increases in traffic congestion and delays across the country. Concurrent with these changes, it has become increasingly difficult to expand system capacity by adding lanes or new facilities. In response, transportation agencies have turned to Intelligent Transportation Systems (ITS) to help manage congestion and delays.

Better management and operation of existing transportation systems.

ITS is an umbrella term covering a range of specific sensor, communication, and computing technologies and their applications. The goal of ITS is to help ease traffic congestion, reduce travel times, provide safer and more convenient travel, allow more efficient and secure freight movements, and allow agencies to quickly and effectively respond to crises through better management and operation of existing transportation systems.

Examples of the type of services provided by ITS include:

- Arterial management systems
- Emergency management
- Special event coordination
- Traffic incident management
- Traveler information systems
- Traffic detection & surveillance
- Work zone management systems
- Electronic toll and fare collection
- Automated traffic enforcement
- Road weather management
- Commercial vehicle operations
- Freight management

Some specific examples of ITS components include:

- E-ZPass
- In-car navigation systems
- Traffic signal control, priority, and preemption systems
- Variable message signs
- Highway Advisory Radio (HAR)
- Traffic cameras and Closed Circuit Television (CCTV) systems

At the Federal level several ITS initiatives are underway that will play a major role in ITS in the coming years.

- Integrated Corridor Management (ICM) aims to coordinate and integrate transportation management systems between individual networks, such as highway and transit that comprise a travel corridor.
- Vehicle Infrastructure Integration (VII) will help support two-way communication between vehicles and the transportation infrastructure via short range radio transceivers offering the potential for significant improvement in operations, safety, and mobility.
- Emergency Transportation Operations (ETO) will help ensure that operational policies, protocols, procedures, practices, and improvements are put into place to facilitate emergency transportation operations during such events as major incidents, severe weather conditions, natural disasters, and security-related emergencies.
- Traveler Information / 511 would provide travelers and would-be travelers accurate, relevant and timely information about travel conditions to allow the traveler to make informed decisions about whether to travel or not, their route, their time of travel, or their mode of travel. This information could be delivered via electronic message signs, highway advisory radio, in-vehicle devices, personal digital assistants and cell phone text messages, via email and Web pages, and through the 511 telephone number.
- Comprehensive Weather Monitoring and Forecasting Program will collect surface transportation related observations to feed into traveler information systems and weather-related alerts.

Within New York state there has been extensive deployment of ITS technology among the various agencies that operate the State's transportation infrastructure including:

- ITS device deployment on freeways.
- Transportation Management Centers in many of the NYSDOT Regions.
- Emergency Transportation Operations program and plans for a Statewide Transportation Information and Coordination Center (STICC).
- Interagency Motor Carrier Task Force which is responsible for the movement of commercial vehicles within the state.
- Information Exchange Network to facilitate information sharing between transportation agencies.
- Variable Message Signs (VMS) that provide traffic conditions or other important information to motorists.
- Highway Advisory Radio (HAR).
- TRANSalert from the New York State Thruway Authority that provides a Web site, phone number, email and text alerts about traffic conditions on the Thruway.
- Highway Emergency Local Patrol (HELP) to provide free emergency road service during rush hour travel periods for disabled vehicles.
- EZ-Pass electronic toll collection.
- Road Weather Information (e.g., air temperature, pavement temperature, and wind speed and direction, etc) to increase safety, improve traffic flow, and allow transportation operators to implement weather related strategies.
- Highway Data Services which has deployed ITS loop sites in Regions 1 and 6 to continuously collect data regarding traffic volume, speed and occupancy along roadways in these regions

Capital Region ITS Program

(NYSDOT Region 1; counties of Albany, Columbia, Essex, Greene, Rensselaer, Saratoga, Schenectady, Warren and Washington)

The Capital Region Transportation Management Center (TMC) is staffed full-time (24/7) by both the Department and the NY State Police. It is co-located in the NY State Police Headquarters on the State Office Campus in Albany. It controls 27 detector stations, 30 CCTV television cameras, more than 60 portable and permanent variable message signs and two highway advisory radio stations.

Local ITS:
- Transportation Management Center
- HELP Program
- Surveillance
- Variable Message Signs
- Highway Advisory Radio
- E-Z Pass
- *MIST (partially implemented)*
- *511 (under development)*

The Region operates a Highway Emergency Local Patrol (HELP) Program to assist motorists, utilizing the jointly-operated DOT / State Police Computer-Aided Dispatch functions.

In the immediate area surrounding I-90 and the Patroon Island Bridge the NYSDOT has a series of CCTV, VMS and traffic system sensors as shown on Figure 25.

East of the bridge on I-90 there are three system sensor sites on I-90 in Rensselaer County; one at Exit 7, one Exit 8-9 and one Exit 9-10. There is also currently a permanent VMS WB west of Exit 8 and a portable VMS EB between Exits 7 and 8. There are no immediate plans to install additional devices on this corridor.

Region 1 is currently installing the MIST[11] center-center module to interface with TRANSMIT[12], which will allow them to work with the travel time information. The NYSDOT is working with TRANSCOM[13] to insure compatibility with the TRANSMIT system. The MIST system uses the system sensors to collect volume, occupancy and speeds on the expressway system. The TRANSMIT system uses EZ pass collection tags as probes coupled with field transmitters to track travel time through a system of highways. Through an integrated system of communication devices the travel information is sent back to the Traffic Operations Center and processed and monitored. These systems linked together help to provide real time travel information. This information is then sent to the motorists via Variable Message Signs (VMS), Highway Advisory Radio (HAR) and a soon to be implemented 511 system for travel information.

Currently there are no immediate plans for arterial ITS implementation (CCTV/VMS/HAR) in Rensselaer County area east of the Patroon Island Bridge. West of the bridge, the City of Albany (Police Department) has a CCTV network in place and NYSDOT hopes to partner with them in the future to share video.

The New York State Thruway Authority highway system in the Capital District area is an integral part of the network. Figure 25 shows the existing ITS devices on the Thruway system.

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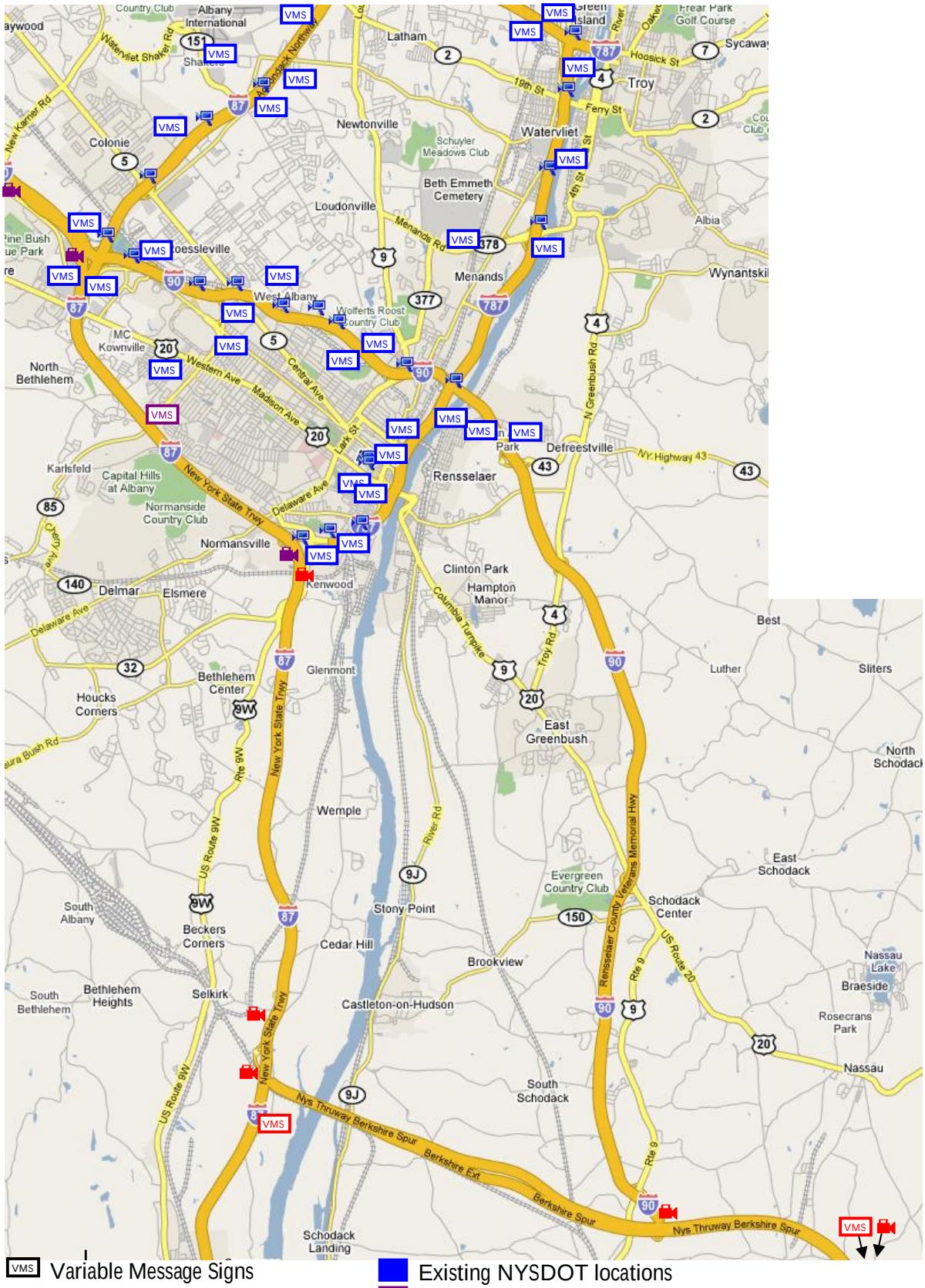
[11] Management Information System for Transportation

[12] TRANSMIT (*TRANSCOM*'s System for Managing Incidents & Traffic)

[13] *TRANSCOM* is a coalition of 16 transportation and public safety agencies in the New York - New Jersey - Connecticut metropolitan region. It was created in 1986 to provide a cooperative, coordinated approach to regional transportation management.

Figure 25: NYSDOT and NYSTA Cameras and Variable Message Signs



VMS Variable Message Signs
NYSDOT Cameras
NYSTA Cameras

Existing NYSDOT locations
Existing NYSTA locations
Future NYSTA locations

The Authority has plans to install additional ITS devices in the Albany Division. All of these devices will be integrated into the Authority's Advanced Traffic Management System, operated centrally from the Thruway Statewide Operation Center (TSOC). It is unclear at this time if the devices included in the list below will all be let in the next ITS construction project, sometime in 2009.

Additional CCTV cameras will be installed at the following locations: I-87 Exit 21A, 21B, 22, and 23. I-90 the Berkshire Connector: Exit B2, B3, and at the Canaan Barrier. Additional permanent VMS will be installed between the Massachusetts State Line and Canaan, and I-87 Northbound prior to I-90 the Berkshire Connector. There are not any additional TRANSMIT sites planned for this section of the Thruway. The Authority will be integrating the TRANSMIT system with the ATMS in 2008.

NYSITS Strategic Plan

The NYSDOT is currently developing an ITS Strategic Plan that will act as a road map for the future of ITS planning and operations within the State. The plan focuses "on the management and operations of the transportation infrastructure, with a specific emphasis on ITS technologies and the associated operational strategies. The Plan will provide a structured, integrated, multimodal and effective perspective regarding the "what" and "how" ITS opportunities should be considered from a statewide perspective."

Though developed for NYSDOT, "the information and recommendations in the plan address all modes and their related operations; and they will likely impact all agencies... that manage transportation facilities and/or provide transportation –related services within the New York State."

Benefits of ITS in the Capital Region and Patroon Island Bridge

Traffic flow on I-90 across the Patroon Island Bridge currently operates at capacity conditions during the morning and evening peak periods. A key component of this traffic flow is traffic entering and exiting I-90 east and west of the bridge. ITS devices displaying "real time" traffic information to motorist can help to better manage these existing and future peak and off peak traffic flow conditions.

Use of the TRANSMIT program currently being implemented in the Capital Region will help to facilitate getting this information out to the travelers.

Recent studies in Houston, Texas found that 85 percent of respondents to an internet survey changed their route after viewing real time travel time information on the freeway dynamic message signs.[14] While the Capital Region may not see that high a diversion, similar type systems coupled with arterial systems on the roadway network surrounding the Patroon Island Bridge have the potential for diverting trips and balancing traffic flow under capacity conditions. Currently the Dunn Memorial Bridge located 1.8 miles south of the Patroon Island Bridge is operating during peak hours with available capacity. Traffic diversion from I-90 to this bridge will help to balance traffic in the area.

Recommendation 18, 19, 20, 21:
Facilitate mobility on local networks

- ITS arterial management system on Routes 9 & 20
- ITS improvements at Route 4 and Route 43
- Consider ramp metering technology and applications at I-90 interchanges 7 and 8

Installation of ITS Arterial systems along the Rt. 9 and 20 corridor between I-90 and the Dunn Memorial Bridge to accomplish real time signal timing and coordination, traffic surveillance and monitoring, with the associated operation and management support, should be

[14] www.itsbenefits.its.dot.gov

evaluated. Another corridor that can benefit from installation of ITS devices with real time traveler information is the I-90 Exit 8 interchange with Route 43 and the associated traffic movements with Route 4. Diversion of traffic during peak hours can help to reduce traffic capacity demands on the Patroon Island Bridge. It is recommended that this corridor be evaluated further. In addition, ramp metering should be considered as vehicles enter I-90 at both Interchanges 7 and 8. Ramp metering has been used often around the nation by agencies dealing with bottleneck situations as a way of smoothing traffic flows along the main roadway.

Transit ridership and operation can also benefit from the availability of real time travel information. Transit vehicles can serve as probes in the traffic mix and provide useful travel time information.

Recommendation 22, 23: Increase availability of real time transit information.

The real time motorist information system in the Capital Region should also include the New York State Thruway System from I-88 through the Capital Region and the Berkshire Section.

The combination of these ITS systems in the Capital Region will help the operating agencies manage traffic flow and allow the users of the highway and transit network the flexibility to alter travel patterns based on up to-date information.

Recommendations

Congestion Management Process Risk Assessment

The future operations of the Patroon Island Bridge were evaluated using two models – the CDTC regional STEP model and a microsimulation VISSIM model focused on the bridge and adjacent sections of I-90. The VISSIM model was developed specifically for this project.

The CDTC New Visions planning process considers four possible future growth scenarios that can be used to inform regional transportation planning decisions. These scenarios were applied to this Study and served as the basis for evaluating the Patroon Island Bridge and the surrounding freeway network. The four 2045 scenarios are:

- Status Quo (current growth rate and development patterns)
- Base Concentrated (current growth rate, concentrated development from urban reinvestment and suburban planning)
- High Growth Dispersed (higher growth rate, dispersed development)
- High Growth Concentrated (higher growth rate, concentrated development from urban reinvestment and suburban planning)

The modeled traffic growth on the Patroon Island Bridge between 2007 and 2045 was consistent across the four scenarios, and reflects a rate of growth between 4.5 percent and 15.3 percent for the weekday morning peak hour, and between 3.8 percent and 13.2 percent for the weekday afternoon peak hour. These percentages indicate average annual growth rates of 0.1 to 0.4 percent.

Existing and future congestion on the Patroon Island Bridge caused by upstream movements, not a bottleneck created at the bridge. The westbound delays in the morning are caused by merging and weaving movements between Exits 7 and 8. These movements should be studied further and added to the VISSIM microsimulation. Ramp metering should be looked into as a short term solution to the problem.

In the concentrated growth scenarios, the percent traffic growth is greatest for the Dunn Memorial Bridge because of assumed growth near that bridge on both sides of the Hudson River. This traffic growth is not attributable to a diversion of traffic to the Dunn Memorial Bridge; instead it is a result of the Dunn Memorial Bridge providing better access to the concentrated growth areas than the Patroon Island Bridge. In particular, the Dunn Memorial Bridge links growth areas on both sides of the Hudson River.

Levels of Service (LOS)

Levels of Service, and projected changes in service, were measured using the VISSIM model. The *Highway Capacity Manual* uses qualitative letter grades – A, B, C, D, E, and F – to define Level of Service.

The changes in future traffic volumes produce corresponding changes in future LOS in the VISSIM model. The key Patroon Island Bridge morning westbound movement declines from LOS D to LOS E in the high-growth scenarios. As this represents high growth in the year 2045, there is no intermediate term (i.e. 20 years) problem, even at this location. All of the other movements indicate a LOS of D or better.

This Study considered the role of each of the Hudson River Crossings in the Capital District, and looked particularly toward the future for the potential range of land use forecasts. The Castleton-on-Hudson Bridge is particularly underutilized, which encouraged an investigation into the possibility of diverting traffic to this

facility. A review of the facility and the alternative, I-90, however showed travel time to generally be slightly faster using I-90 over the Thruway. A slightly longer travel time, combined with a toll payment, eliminated the Thruway as a preferred choice of diversion of traffic. Changing signage along the Thruway, re-designation, or toll restructuring could better position the Thruway as a choice for traffic diversion.

The Capital District's economic centers are located on both shores of the Hudson River. Many river crossings are relatively short trips between these centers that can be accommodated with lower speed non-freeway facilities. The Capital District relies more heavily today on freeways than most other regions. There is potential for "downsizing" some of the less utilized interchanges and freeways in order to save money and also to support the region's Smart Growth agenda as articulated in the New Visions 2030 plan. If freeways become less important to Capital District transportation in the future, this may reduce total bridge crossings and also could shift travel from the Patroon Island Bridge to other bridges and other travel modes.

CMP

- The traffic analysis indicates that widening of the Patroon Island Bridge is not necessary to provide reasonable traffic operation. Because all of the scenarios evaluated in this study resulted in this same conclusion, the risk of not providing sufficient capacity is very low.
- The amount of delay that would be reduced by widening the bridge does not warrant the costly improvement of additional lanes.
- Widening of the Patroon Island Bridge could induce traffic that will create new bottlenecks elsewhere in the system, particularly at interchanges, which could be challenging to address.
- Merge and weaving areas between Exits 7 and 8 should be considered in the VISSIM microsimulation. Ramp metering should be studied as a solution to the delays during the westbound morning peak hour.

Thruway Diversion

- Based on current volumes and estimated origin-destinations, the number of trips that can be diverted to the Thruway would not noticeably change the traffic conditions on the Patroon Island Bridge.
- Signage, re-designation, and toll restructuring would help divert some commuter traffic and keep Thruway patrons passing through the Capital District on the Thruway rather than using I-90.

Smart Growth

- The study's findings support the high-density infill growth described in the *New Visions 2030* plan, which can reduce future vehicle-miles traveled and future costs for road improvements.
- Numerous local planning studies have been completed that evaluate infill sites for redevelopment. Many of these sites are challenged by lack of access to the urban street network, and would benefit from greater local connectivity and accessibility by pedestrians and transit.
- Creating more access opportunities to arterials rather than cul-de-sacs will utilize the capacity we already have, encouraging residents to use a wider variety of routes to get to their destination. In addition, the downsizing of some limited access facilities to urban arterials would significantly help many infill opportunities.

Bridge Assets

The capital program needs of the bridges were reviewed. The review focused on the Patroon Island Bridge and its immediate neighbors: Dunn Memorial, Livingston Avenue and the Troy-Menands. These four bridges

were reviewed in a systems context perspective that include traffic and existing and potential mulit-modal opportunities. Toward the end of this study, the NYSDOT initiated an innovative approach to address floorbeam cracking issues on the Patroon Island Bridge; should they prove successful, they will serve to extend the functional life of the bridge for approximately 10 years when the concrete deck will be 50 years old and require replacement. NYSDOT will be using the mobility and traffic findings from this study to help frame the scope of its upcoming major rehabilitation/replacement study of the bridge. NYSDOT has programmed $110 million for a possible replacement.

The Troy-Menands Bridge has approximately $6 million budgeted for repairs in the next 5 years. However, the bridge may need major rehabilitation or replacement within the next 15 years. This bridge has capacity and delay issues that should be addressed in a regional context before major work is undertaken. The Livingston Avenue and the Dunn Memorial have $20 million and $6.9 million in repair work identified, with the Dunn Memorial budgeted on the TIP. For the Livingston Avenue and Dunn Memorial Bridges, access and connectivity to the local street and rail network for transit, bicyclists and pedestrians should be studied closely and programmed accordingly before any major capital program work is initiated.

To the south, the NYSTA has identified $50 million in repairs needed for the Castleton-On-Hudson Bridge in the next 10 years, framed by an on-going substructure repair contract, and a deck replacement at the end of the 10 year window. To the north, the Collar City, Troy-Green Island, and Troy-Watervliet Bridges are all in good condition with only minor repairs needed. All four of these bridges operate with excess capacity.

Bicycle and Pedestrian Accommodations

This Study explored the accessibility of the facilities to bicyclists and pedestrians, and produced short and long-term recommendations for bike/ped accommodations.

Currently, bike/ped Hudson River crossing is provided primarily by the CDTA bus transit system. All of the buses in the CDTA regular route system can accommodate bicycles. Between Albany and Rensselaer Counties, only the Dunn Memorial Bridge has some pedestrian accommodations; however, the connecting path is not Americans with Disabilities Act (ADA) compliant. In addition, cyclists must walk their bicycles over one mile to cross. The Troy-Menands Bridge has sidewalks, but they do not connect with a trail or sidewalk network. The Livingston Avenue Bridge has a timber decked walkway, but pedestrians are prohibited from using the bridge.

Short term improvement should include connecting the sidewalks on the Troy-Menands Bridge to the Mohawk-Hudson Trailway on the west and current sidewalk networks on the east, as well as making improvements to the existing bike/ped accommodations on the Dunn Memorial Bridge. The Livingston Avenue Bridge should be explored for its potential to be rehabilitated to accommodate bicyclists and pedestrians. This facility would be an ideal connector between the east and west trail networks, and Albany and Rensselaer.

Long term improvements would include a bike/ped facility on the Patroon Island Bridge. Access could be provided to the sidewalk network on Washington Street and the trail networks on the east and west side of the Hudson River. The addition of this service to the bridge would be expensive, but costs could be reduced by including bike/ped accommodations when the bridge is replaced.

Bike/Ped

- The Livingston Avenue should be considered an "early win" and given the highest priority for implementing an improved bike/ped crossing over the Hudson River. It would provide the most useful and desirable connection between Rensselaer and Albany. Rehabilitating and reopening the walkway could possibly be done independently of other improvements to the bridge and signal system. Using public/private funding partnerships, the walkway could be restored within a couple of years..
- The existing ramps on the Dunn Memorial should be improved for ADA compliance and bike safety, particularly since it is currently the only Hudson River Crossing with pedestrian accommodations.
- The Troy-Menands Bridge sidewalks should be linked to the Hudson-Mohawk trail and the existing sidewalk network in South Troy.
- Any bike/ped accommodations on the Patroon Island Bridge should be considered in long term planning such as a major rehabilitation or replacement of the entire structure.

Transit in the Capital Region

The CDTA bus system is currently the primary transit service in the Capital Region. It carried more than 12.7 million people in 2007, and currently provides the only real Hudson River crossing for bicyclists and pedestrians. All CDTA buses are now "bikeable" and are equipped to carry two bicycles to facilitate this mode.

Two bridges in the region form the key links in the regional transit system: the Dunn Memorial and the Troy-Watervliet Bridges, with limited service available on the Collar City, Castleton and Troy-Menands Bridges and no transit service on the remaining bridges in the Capital Region. Several important initiatives and studies in the Capital Region have the potential to impact the development of a more comprehensive transit system with a diversity of options designed to encourage both the transit-dependent and choice rider to use these modes over single occupancy vehicles.

- CDTA will shortly launch the first phase of a modified Bus Rapid Transit (BRT) route along with Route 5 corridor in order to increase mobility on the route and to improve it as a regional and community corridor. The influence of BRT may also encourage transit-oriented development and cooperation among corridor business improvement districts, potentially expanding the regional benefit of this new mode. CDTA is, in addition, examining next steps for BRT expansion beyond the NY5 corridor in order to increase service, thereby reducing traffic volumes. Consideration for a potential 100 miles of BRT service area is under discussion, potentially making use of the now transit-less Hudson River crossings. Neither the Patroon Island or the Livingston Avenue Bridges are currently viable for BRT operations however, a decision to expand or replace the Patroon Island Bridge, or a comprehensive rehabilitation of the Livingston Avenue Bridge opens the door to the possibility of implementing BRT on those crossings.
- A new Assessment of Capital Region North/South Corridors will begin shortly by the NYS Senate Task Force on High Speed Rail that will include consideration of a Light Rail System within the Capital Region. The new study will examine Northway Corridor improvements to current express bus services, as well as the future role of existing rail corridors and a long-range evaluation of rail, including LRT and commuter rail, and Bus Rapid Transit. Decisions pertaining to the Patroon

Island Bridge and the Livingston Avenue Bridge, along with the other crossings included in this study, may have important bearing on the potential for long-term transit investment in the corridor.

- The development of the new waterfront at Rensselaer, and the Convention Center, create opportunities to explore ways to enhance transit usage and intermodal access. In addition to bus, light rail, commuter rail and BRT services, opportunities for water taxis (bike/ped) and ferry service across the Hudson River should also be considered as part of the overall regional plan for accessibility.

The examination of the whole system of bridges that is at the basis of the Hudson River Crossing Study, affords the region several opportunities in the area of transit, not only to reduce congestion and potential traffic delays and to increase accessibility for bicycles and pedestrians, but also to meet underserved travel markets along major corridor employment centers and the developing suburbs, and to improve connectivity among the region's key economic centers.

Transit

- Improving the regional bus network can help reduce future peak hour volumes at the Hudson River Crossings. However, to be effective, transit investments should be coordinated with opportunities for pedestrian- and transit-oriented development.
- North-South transit needs and opportunities to establish BRT or LRT service, will be the subject of an upcoming study, and may provide further options for future Hudson River Crossing travel demand.

Intelligent Transportation Systems (ITS)

The Capital Region currently offers numerous ITS services, including traffic cameras, variable message signs, MIST stations, and HELP trucks. Traffic operations in the Capital Region are monitored at the NYSDOT Transportation Management Center and the NYSTA Statewide Operations Center. To date the primary focus of these agencies, through the ITS devices in the Albany area, has been on I-90, I-787, and I-87. Little ITS service is found east of the Hudson River. As the ITS System expands in the Region it is recommended that emphasis be given to the addition of Arterial Management Systems, and real time traffic information in and around Rensselaer. As recommended in the Federal Highway Administration "Integrated Corridor Management" program, total integration with arterials on priority corridors such as Routes 9 and 20 and the intersection of Routes 4 and 43, could help reduce congestion on both the Patroon Island Bridge and local street networks. ITS could also help facilitate a better balance in bridge capacity utilization.

ITS

- Implementing an Arterial Management System on Routes 9 & 20 will facilitate better traffic mobility.
- A large volume of commuter traffic travels through the intersection of Routes 43 & 4, both on Route 4 & Route 43 to I-90. Adding variable message signs and updating signal timings will increase traffic mobility at this intersection.
- Further study should be done on the possible benefits of ramp metering at Exits 7 and 8 westbound on-ramps. Westbound AM congestion for those in the right lane exiting to I-787 could be reduced.

- Regional Travel Demand Management programs, such as encourage telecommuting, condensed work weeks, and varying work day times for employers, particularly at the state offices, can reduce peak hour volumes and the need for expensive mitigation.

Table 5: Findings and Recommendations sorted by bridge

Bridge	Number	Term	Recommendation/Observation	Benefit	Reference
Troy-Menands Bridge	Rec. 11	Short	Link Troy-Menands Bridge sidewalks to the Hudson-Mohawk trail and the existing sidewalk network in South Troy.	Connectivity of trails.	Page 33
Troy-Menands Bridge	Rec. 10	Long	Address capacity and delay issues of Troy-Menands Bridge before any major capital work on the bridge is initiated.	The bridge may need major rehabilitation or replacement within the next 15 years.	Page 32
Patroon Island Bridge	Rec. 1	Short	Traffic congestion occurs westbound upstream of the Patroon Island Bridge, between Exits 7 and 8. The microsimulation should be expanded to this section of I-90. Ramp metering should be studied in	Ramp metering could improve operations and safety sooner and more cost effectively than increasing capacity.	Page 17
Patroon Island Bridge	Rec. 21	Short	Further study the possible benefits of ramp metering at Exits 7 and 8 westbound on-ramps.	Westbound AM congestion for those in the right lane exiting to I-787 could be reduced.	Page 47, 48
Patroon Island Bridge	Rec. 3	Short	Free I-90 should be changed to I-88 and I-90 should continue on the Thruway through the Berkshire Spur.	Divert some commuter traffic from Patroon Island Bridge and keep Thruway users on the Thruway, rather than I-90.	Page 22
Patroon Island Bridge	Rec. 20	Short	Adding variable message signs and updating signal timings at the intersection of Routes 43 & 4.	Will increase traffic mobility at this intersection.	Page 47, 48
Patroon Island Bridge	Rec. 23	Long	Integrate NYSTA System travel time data and NYSDOT data.	Provides uniform travel time information in Region and corridor.	Page 47, 48
Patroon Island Bridge	Rec. 4	Long	Consider toll restructuring, including reducing Thruway tolls and/or adding I-90 tolls	Divert some commuter traffic from Patroon Island Bridge and keep Thruway users on the Thruway, rather than I-90.	Page 22
Patroon Island Bridge	Rec. 9	Long	Consider bike/ped access in long term planning of Patroon Island Bridge.	Additional pedestrian crossing of the Hudson River.	Page 32
Patroon Island Bridge	Fnd. 1		Widening the Patroon Island Bridge could induce traffic that will create new bottlenecks elsewhere in the system.	Not widening eliminates chance of indirect negative impacts	Page 5
Patroon Island Bridge	Fnd. 3		The modeled traffic growth on the Patroon Island Bridge between 2007 and 2040 is less than the other Hudson River bridges.	Opportunity to maximize the existing infrastructure (36 lanes across the Hudson River), instead of adding more to maintain.	Page 13
Patroon Island Bridge	Fnd. 4		is not necessary to provide reasonable traffic operation based on microsimulation analyses of 2040	Capital program monetary savings that can be used on other infrastructure needs.	Page 19

Table 5 Cont.: Findings and Recommendations sorted by bridge

Bridge	Number	Term	Recommendation/Observation	Benefit	Reference
Livingston Avenue Bridge	Rec. 12	Short	Immediately implement a functional bike/ped crossing over Livingston Avenue Bridge.	It would provide the most useful and desirable connection between Rensselaer and Albany counties.	Page 35
Livingston Avenue Bridge	Rec. 12, 13	Short	Budgeted Livingston Avenue and Dunn Memorial Bridges repair work.	Structural improvement.	Pages 35, 37
Livingston Avenue Bridge	Rec. 12, 13	Long	Address improved access and connectivity to the Albany and Rensselaer waterfronts for Livingston and Dunn Memorial Bridges before budgeted repairs are completed.	Improved access for transit, bicyclists and pedestrians.	Pages 35, 37
Dunn Memorial Bridge	Rec. 13	Short	Improve the existing bike/ped accomodations on Dunn Memorial Bridge and its approaches.	ADA compliance and bike safety. Encourage use. Vista opportunities.	Page 37
Dunn Memorial Bridge	Rec. 12, 13	Short	Budgeted Livingston Avenue and Dunn Memorial Bridges repair work.	Structural improvement.	Pages 35, 37
Dunn Memorial Bridge	Rec. 19	Long	Implement an Arterial Management System on Routes 9 & 20.	Will facilitate better traffic mobility in the corridor.	Page 47, 48
Dunn Memorial Bridge	Rec. 12, 13	Long	Address improved access and connectivity to the Albany and Rensselaer waterfronts for Livingston and Dunn Memorial Bridges before budgeted repairs are completed.	Improved access for transit, bicyclists and pedestrians.	Pages 35, 37
Dunn Memorial Bridge	Rec. 23	Long	Integrate NYSTA System travel time data and NYSDOT data.	Provides uniform travel time information in Region and corridor.	Page 47, 48
Castleton-on-Hudson Bridge	Rec. 2	Short	Increase signage along the Thruway.	Divert some commuter traffic from Patroon Island Bridge and keep Thruway users on the Thruway, rather than I-90.	Page 22
Castleton-on-Hudson Bridge	Rec. 3	Short	Free I-90 should be changed to I-88 and I-90 should continue on the Thruway through the Berkshire Spur.	Divert some commuter traffic from Patroon Island Bridge and keep Thruway users on the Thruway, rather than I-90.	Page 22
Castleton-on-Hudson Bridge	Rec. 23	Long	Integrate NYSTA System travel time data and NYSDOT data.	Provides uniform travel time information in Region and corridor.	Page 47, 48
Castleton-on-Hudson Bridge	Rec. 4	Long	Consider toll restructuring, including reducing Thruway tolls and/or adding I-90 tolls	Divert some commuter traffic from Patroon Island Bridge and keep Thruway users on the Thruway, rather than I-90.	Page 22
I-90 Exit 6 Interchange Bridges	Rec. 8	Long	Consider downsizing of selected facilities where current volumes warrant, and where slower speed/higher access facilities would better serve infill development	Encourages infill development with improved access; environmental and safety benefits from lower speed facilities.	Page 30

Table 5 Cont.: Findings and Recommendations sorted by bridge

Bridge	Number	Term	Recommendation/Observation	Benefit	Reference
General	Rec. 15	Short	Support increased efficiency in current transit system	Provides congestion mitigation, increased safety and mobility, improved job access, economic growth, improved air quality, and reduced emissions	Page 40
General	Rec. 16	Short	Continue to study and pursue bike/ped Hudson River crossings		Page 41
General	Rec. 17	Short	Implement travel demand management (TDM) techniques		Page 41
General	Rec. 14	Short	Use transit incentives to encourage transit-oriented development		Page 40
General	Rec. 15	Long	Explore new transit modes such as bus rapid transit, light rail, ferries, and water taxis		Page 40
General	Rec. 18	Short	Continue to implement the TRANSMIT System	Will provide real time travel information to users	Page 47
General	Rec. 22	Long	Use real-time information on Transit	Provides travel information to users and transit vehicles serve as probes in the system	Page 47, 48
General	Rec. 6	Short	Improve street connectivity especially near potential infill and redevelopment sites, such as Harriman Campus.	Shifts some traffic off of highway system, and provides more direct connections for transit users, bicyclists, and pedestrians.	Page 28
General	Rec. 5	Long	Develop a more redundant network of arterials and streets in the region.	Reduces reliance on freeways, which are expensive to expand and maintain.	Page 27
General	Rec. 7	Long	Minimize use of cul-de-sacs and increase levels of access along major urban arterials in areas where infill development is desired.	Create more access opportunities to arterials, and utilize the existing capacity, encouraging use of a variety of routes.	Page 29
General	Fnd. 2		Regional modeling shows only limited traffic growth in the morning and afternoon peak hours between 2007 and 2040 across all of the bridges.	Opportunity to maximize the existing infrastructure (36 lanes across the Hudson River), instead of adding more to maintain.	Page 12
General	Fnd. 5		Common desires in the studies reviewed were improved waterfront access, increased connections to isolated areas, and seperation between industrial and residential land uses.	Potential new economic development, improved mobility for residents, improved access for businesses, and reduced in truck traffic in residential areas.	Page 28

Table 6: Findings and Recommendations sorted by subject

Bridge	Number	Term	Recommendation	Benefit	Reference
Congestion Management Process					
Patroon Island Bridge	Rec. 1	Short	Traffic congestion occurs westbound upstream of the Patroon Island Bridge, between Exits 7 and 8. The microsimulation should be expanded to this section of I-90. Ramp metering should be studied in these locations as a solution to delays in the westbound morning peak hour.	Ramp metering could improve operations and safety sooner and more cost effectively than increasing capacity.	Page 17
Patroon Island Bridge	Fnd. 4		Widening of the Patroon Island Bridge is not necessary to provide reasonable traffic operation based on microsimulation analyses of 2040 scenarios.	Capital program monetary savings that can be used on other infrastructure needs.	Page 19
Patroon Island Bridge	Fnd. 1		Widening the Patroon Island Bridge could induce traffic that will create new bottlenecks elsewhere in the system.	Not widening eliminates chance of indirect negative impacts	Page 5
Patroon Island Bridge	Fnd. 3		The modeled traffic growth on the Patroon Island Bridge between 2007 and 2040 is less than the other Hudson River bridges.	Opportunity to maximize the existing infrastructure (36 lanes across the Hudson River), instead of adding more to maintain.	Page 13
General	Fnd. 2		Regional modeling shows only limited traffic growth in the morning and afternoon peak hours between 2007 and 2040 across all of the bridges.	Opportunity to maximize the existing infrastructure (36 lanes across the Hudson River), instead of adding more to maintain.	Page 12
Thruway Diversion					
Patroon Island Bridge Castleton-on-Hudson Bridge	Rec. 3	Short	Free I-90 should be changed to I-88 and I-90 should continue on the Thruway through the Berkshire Spur.	Divert some commuter traffic from Patroon Island Bridge and keep Thruway users on the Thruway, rather than I-90.	Page 22
Castleton-on-Hudson Bridge	Rec. 2	Short	Increase signage along the Thruway.		Page 22
Patroon Island Bridge Castleton-on-Hudson Bridge	Rec. 4	Long	Consider toll restructuring, including reducing Thruway tolls and/or adding I-90 tolls		Page 22
Smart Growth					
General	Rec. 6	Short	Improve street connectivity especially near potential infill and redevelopment sites, such as Harriman Campus.	Shifts some traffic off of highway system, and provides more direct connections for transit users, bicyclists, and pedestrians.	Page 28
General	Rec. 5	Long	Develop a more redundant network of arterials and streets in the region.	Reduces reliance on freeways, which are expensive to expand and maintain.	Page 27
General	Rec. 7	Long	Minimize use of cul-de-sacs and increase levels of access along major urban arterials in areas where infill development is desired.	Create more access opportunities to arterials, and utilize the existing capacity, encouraging use of a variety of routes.	Page 29

Table 6 Cont: Findings and Recommendations sorted by subject

Bridge	Number	Term	Recommendation	Benefit	Reference
Smart Growth					
I-90 Exit 6 Interchange Bridges	Rec. 8	Long	Consider downsizing of selected facilities where current volumes warrant, and where slower speed/higher access facilities would better serve infill development	Encourages infill development with improved access; environmental and safety benefits from lower speed facilities.	Page 29
General	Fnd. 5		Common desires in the studies reviewed were improved waterfront access, increased connections to isolated areas, and seperation between industrial and residential land uses.	Potential new economic development, improved mobility for residents, improved access for businesses, and reduced in truck traffic in residential areas.	Page 27
Bridge Assets					
Livingston Avenue Bridge Dunn Memorial Bridge	Rec. 12, 13	Short	Budgeted Livingston Avenue and Dunn Memorial Bridges repair work.	Structural improvement.	Pages 34, 36
Livingston Avenue Bridge Dunn Memorial Bridge	Rec. 12, 13	Long	Address improved access and connectivity to the Albany and Rensselaer waterfronts for Livingston and Dunn Memorial Bridges before budgeted repairs are completed.	Improved access for transit, bicyclists and pedestrians.	Pages 34, 36
Troy-Menands Bridge	Rec. 10	Long	Address capacity and delay issues of Troy-Menands Bridge before any major capital work on the bridge is initiated.	The bridge may need major rehabilitation or replacement within the next 15 years.	Page 31
Bicycle and Pedestrian Accommodations					
Livingston Avenue Bridge	Rec. 12	Short	Immediately implement a functional bike/ped crossing over Livingston Avenue Bridge.	It would provide the most useful and desirable connection between Rensselaer and Albany counties.	Page 34
Dunn Memorial Bridge	Rec. 13	Short	Improve the existing bike/ped accomodations on Dunn Memorial Bridge and its approaches.	ADA compliance and bike safety. Encourage use. Vista opportunities.	Page 36
Troy-Menands Bridge	Rec. 11	Short	Link Troy-Menands Bridge sidewalks to the Hudson-Mohawk trail and the existing sidewalk network in South Troy.	Connectivity of trails.	Page 33
Patroon Island Bridge	Rec. 9	Long	Consider bike/ped access in long term planning of Patroon Island Bridge.	Additional pedestrian crossing of the Hudson River.	Page 32
Transit in the Capital Region					
General	Rec. 15	Short	Support increased efficiency in current transit system	Provides congestion mitigation, increased safety and mobility, improved job access, economic growth, improved air quality, and reduced emissions	Page 40
General	Rec. 16	Short	Continue to study and pursue bike/ped Hudson River crossings		Page 41
General	Rec. 17	Short	Implement travel demand management (TDM) techniques		Page 41
General	Rec. 14	Short	Use transit incentives to encourage transit-oriented development		Page 40
General	Rec. 15	Long	Explore new transit modes such as bus rapid transit, light rail, ferries, and water taxis		Page 40

Table 6 Cont: Findings and Recommendations sorted by subject

Bridge	Number	Term	Recommendation	Benefit	Reference
Intelligent Transportation Systems (ITS)					
General	Rec. 18	Short	Continue to implement the TRANSMIT System	Will provide real time travel information to users	Page 47
Dunn Memorial Bridge	Rec. 19	Long	Implement an Arterial Management System on Routes 9 & 20.	Will facilitate better traffic mobility in the corridor	Page 47, 48
Patroon Island Bridge	Rec. 20	Short	Adding variable message signs and updating signal timings at the intersection of Routes 43 & 4.	Will increase traffic mobility at this intersection.	Page 47, 48
Patroon Island Bridge Castleton-on-Hudson Bridge	Rec. 23	Long	Integrate NYSTA System travel time data and NYSDOT data.	Provides uniform travel time information in Region and corridor.	Page 47, 48
Patroon Island Bridge	Rec. 21	Short	Further study the possible benefits of ramp metering at Exits 7 and 8 westbound on-ramps.	Westbound AM congestion for those in the right lane exiting to I-787 could be reduced.	Page 47, 48
General	Rec. 22	Long	Use real-time information on Transit	Provides travel information to users and transit vehicles serve as probes in the system	Page 47, 48