

Long Range Transportation Plan for the Genesee-Finger Lakes Region 2007-2027 Update



APPENDICES

Appendix A

Summaries of Public Comments Received

Summaries of Public Comments Received

This appendix provides summaries of the public comments received during the development of the LRTP Update. Individual written comments received during the public review periods are available for review by contacting GTC.

Opportunities and Issues

Summary of Public Comments

Four public meetings were held throughout the Genesee-Finger Lakes Region between March 15 and March 22, 2007 to introduce the LRTP Update and gather input on the opportunities and issues facing the region.

The following represents a summary of the comments received from the participants at the four public meetings and others who provided written statements by April 6, 2007. The comments are categorized into seven topic areas.

The unique identifier (e.g., PT-2) assigned to each opportunity/issue is used for reference purposes only. No priority has been assigned to any individual opportunity/issue.

Public Transportation

- PT-1. Suggested development of light rail transit system using abandoned railroad rights-of-way in region
- PT-2. Suggested additional funding be allocated to the Renaissance Square project
- PT-3. Expressed need for additional investment in public transportation with the following reasons cited:
 - a. Need for expanded bus fleet
 - b. Need for more frequent service
 - c. Need for lower fares
- PT-4. Expressed need for improved informational signage at bus stops
- PT-5. Expressed concern regarding elimination of Lift Line service in western suburbs
- PT-6. Suggested that paratransit service be improved across the region

Bicycle & Pedestrian

- BP-1. Expressed concern about the unsafe condition of on-street bicycle facilities
- BP-2. Suggested that all roadway construction projects be required to enhance green space and include pedestrian amenities
- BP-3. Suggested that multi-use trails in the region be better connected
- BP-4. Suggested that local bicycling and trails groups be better promoted
- BP-5. Expressed need for bicycle lockers at the Greater Rochester International Airport for employees and travelers

Interregional Travel

- IR-1. Expressed the need for a reconstructed Rochester Amtrak Station
- IR-2. Expressed need for construction of an Amtrak Station in Lyons
- IR-3. Expressed concern regarding accessibility at interregional travel facilities

Goods Movement

- GM-1. Suggested development of an intermodal freight facility in Rochester
- GM-2. Suggested that waterborne freight facilities be developed in the region

Safety

- S-1. Expressed concern regarding the safety of railroads in the region
- S-2. Expressed need for guardrails on I-590 near Edgewood Ave overpass
- S-3. Expressed concern regarding unsafe conditions on the Erie Canalway Trail between Long Pond Road and the Greater Rochester International Airport
- S-4. Expressed concern about the unsafe condition of on-street bicycle facilities

Air Quality and Energy Efficiency

- AQ-1. Encouraged RGRTA to use funding to purchase alternative fuel buses rather than diesel
- AQ-2. Suggested that funding be given to electrify truck stops to improve air quality
- AQ-3. Suggested that additional incentives be developed to encourage carpooling in the area
- AQ-4. Encouraged RGRTA to work with employers to provide incentives for employees to use transit

Other

- OTH-1. Opposed to funding renovations to the Inner Loop
- OTH-2. Suggested removal of the abandoned Hojack Railroad Swing Bridge at the Port of Rochester
- OTH-3. Suggested removal of the abandoned Hojack Railroad bridge over Lake Road in the Town of Webster
- OTH-4. Suggested reconstruction of the Irondequoit Bay Outlet Swing Bridge for year-round vehicular use
- OTH-5. Expressed support for a planning study on Route 104 in the Town of Ontario
- OTH-6. Suggested that intersection improvements be made at congested locations in the region
- OTH-7. Expressed concern regarding NYSDOT's lack of responsiveness to inquiries by local municipalities

OTH-8. Suggested that non-air environmental considerations include the built environment/ historic resources

Recommendations

Summary of Public Comments

Three public meetings were held throughout the Genesee-Finger Lakes Region between May 1 and May 8, 2007 to seek input on the draft recommendations (policies and actions) developed by GTC for inclusion in the LRTP Update.

The following represents a summary of the comments received from the participants at the three public meetings and others who provided written statements by May 18, 2007. The comments are organized by the categories (i.e., Preservation & Maintenance, Operations & Management, Expansion, Land Use.) which comprise the Recommendations section of the LRTP Update.

The unique identifier (e.g., OM.3.) assigned to each comment is used for reference purposes only. The comments are presented in order of quantity received (number in parentheses); no priority has been assigned to any individual comment.

Preservation & Maintenance

- PM.1. Expressed support for preserving and maintaining bicycle and pedestrian facilities, specifically sidewalks and shoulders, to ensure accessibility for the disabled. (1)
- PM.2. Suggested incorporating the preservation of rights-of-way into a Preservation & Maintenance Policy. (1)
- PM.3. An aspect of lighting is energy usage; support implementing a "dark skies program" to decrease light pollution and energy use. (1)
- PM.4. Expressed concern about the maintenance of public transportation vehicles (both fixed route and paratransit), particularly wheelchair lifts and ramps. (1)
- PM.5. Expressed the need for improved education and increased enforcement of traffic laws relating to automobiles and non-motorized transportation. (1)
- PM.6. Suggested that the findings of the Pedestrian Facilities Inventory be made available to the public upon completion. (1)

Operations & Management

- OM.1. Suggested that the transportation system must support the ability to commute to work or school by bicycle. (1)
- OM.2. Expressed support for the continued use of roundabouts as part of intersection improvements to improve safety and keep traffic moving. (1)
- OM.3. Suggested that, with respect to the unprecedented increases in materials costs used in transportation projects, light rail transit does not have as much follow-on

- maintenance costs as roads and bridges. A light rail transit system may operate at a loss; however, the long-term savings on maintenance may offset that. (1)
- OM.4. Encouraged agencies to lower capacity on area roadways to increase demand for public transportation and decrease maintenance costs. (1)
 - OM.5. Expressed the need to pay close attention to CO₂ emissions as it may become a federal requirement in the future. (1)
 - OM.6. Suggested that our region's recent clean air could be the result of cyclical weather patterns and that poor air quality could return as soon as this year. (1)
 - OM.7. Suggested that community review boards be put in place to provide input on public transportation service in rural areas. (1)
 - OM.8. Suggested that the Greater Rochester International Airport become more accessible to the hearing impaired, including electronic message boards. (1)
 - OM.9. Expressed the need for the re-establishment of paratransit service in southwestern Monroe County. (1)

Expansion

- E.1. Expressed support for establishing light rail transit service in the Rochester area. (2)
- E.2. Suggested that new traffic lanes should be the last resort; increasing roadway capacity leads to development of existing farmland which negatively impacts the agriculture industry (1)
- E.3. Suggested that designs for the reconstruction of the Rochester Amtrak Station and construction of the new Lyons Amtrak Station incorporate full accessibility. (1)

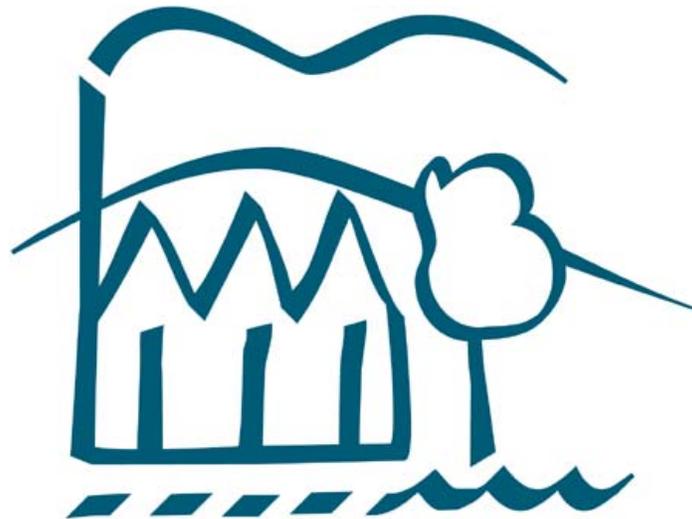
Land Use

- LU.1. Expressed support for preserving railroad rights-of-way (active and abandoned) for future transportation use. (2)

Appendix B

Long Range Transportation Plan Non-Air Environmental Issues Scan

Long Range Transportation Plan Non-Air Environmental Issue Scan



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Regional Planning Council

Commissioned by the Genesee Transportation Council

February 2007

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Long Range Transportation Plan Non-Air Environmental Issue Scan

Commissioned by the Genesee Transportation Council

February 2007



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GENESEE/FINGER LAKES
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Mission Statement

The Genesee/Finger Lakes Regional Planning Council (G/FLRPC) will identify, define, and inform its member counties of issues and opportunities critical to the physical, economic, and social health of the region. G/FLRPC provides forums for discussion, debate, and consensus building, and develops and implements a focused action plan with clearly defined outcomes, which include programs, personnel, and funding.

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Appendix A: Acronyms Used in Report

Report Overview

The following report lists each primary non-air environmental issue category and any applicable sub-categories. For each category and sub-category, an Issue Description is included in order to provide the reader with a clear understanding of the issue's definition and context as it relates to this project. Along with issue descriptions, each category includes lists of the following items:

- Applicable *Federal and state legislative mandates*;
- Key *partners for consultation*, split by Federal, state and independent categories; and
- Useful *inventories and resources*.

Each primary non-air environmental issue is listed in order of priority; that is, the first issue (nonpoint source water pollution) is considered to present the greatest threat to the health of the environment.

Environmental mitigation activities related to each issue are identified below each issue description. Tables contain strategic policies, programs, actions and activities that, over time, will serve to avoid, minimize, rectify, reduce, or compensate for the impacts to or disruption of elements of the human and natural environment associated with the implementation of a long-range transportation plan.

Primary Non-Air Environmental Issues

A total of seven primary non-air environmental issue categories have been identified. Together, these categories cover the range of non-air environmental issues that can be associated with the implementation of a long-range transportation plan. These categories are prioritized as follows ("1" being the highest priority):

1. Nonpoint Source Water Pollution
2. Terrestrial Habitat Modification
3. Open Space Modification
4. Historical/Cultural Modification
5. Noise Pollution
6. Light Pollution
7. Thermal Pollution/Urban Heat Island Effect

Update and Maintenance Schedule for Inventories and Resources

Environmental issues and inventories identified within this scan should undergo regular review in order to accommodate new developments in best management practices as well as significant changes in Federal and state mandates. Review of best management practices across the primary categories identified above can generally occur in conjunction with routine LRTP updates and revisions, notwithstanding significant new developments in or alterations to Federal and state mandates.

Issue 1: Nonpoint Source (NPS) Water Pollution

Issue Description

Water is necessary for the health and function of all forms of life. The impairment of this resource can result in significant health impacts to a wide variety of organisms, including insects, fish, animals, flora and humans. Furthermore, the impairment of water resources can have a negative impact on the quality of life within natural and human communities, degrading the aesthetic value of lakes and streams as well as ancillary benefits such as recreation. When the cost and complexity of cleanup and treatment measures are taken into account, prevention of water resource degradation presents a far more efficient and cost effective method of maintaining the integrity of the resource.

Nonpoint source (NPS) water pollution is considered to be the most significant threat posed to the natural environment identified within this non-air environmental issue scan. Nonpoint sources of water pollution emanate from diffuse and variable sources. They are primarily conveyed to surface and ground water resources over impervious surfaces, such as pavement, and through appurtenances, such as storm water drainage systems. The implementation of a long-range transportation plan (LRTP) can therefore result in the generation of significant quantities of NPS pollution unless reliable mitigation measures are given serious consideration.

NPS water pollution is created through a variety of transportation system construction, maintenance and operation activities. This environmental issue has therefore been grouped into two subcategories: (1) *Stormwater Runoff from Roads, Highways and Bridges* and (2) *Hydromodification and Habitat Modification*.¹

1. Stormwater Runoff from Construction of Roads, Highways and Bridges

This subcategory refers to environmental issues associated with the construction of roads, highways and bridges, maintenance of such facilities, and anticipated impacts resulting from routine facility use and operation. The two specific types of NPS pollution that can be expected to result from road, highway and bridge use and construction include *storm water runoff* and *erosion/sedimentation*. Storm water runoff is a direct result of the impervious nature of the materials used for the construction of transportation facilities. As described by the USEPA:

Storm water discharges are generated by precipitation and runoff from land, pavements, building rooftops and other surfaces. Storm water runoff accumulates pollutants such as oil and grease, chemicals, nutrients, metals, and bacteria as it travels across land. Heavy precipitation or snowmelt can also cause sewer overflows which, in turn, may lead to contamination of water sources with untreated human and industrial waste, toxic materials, and other debris.²

Stormwater runoff can come in many forms and result from a variety of different actions. Road deicing materials are often a major component of storm water runoff and are a necessary component of cold-weather road and bridge operational maintenance. Other nonpoint source materials (metals, oils, grease,

¹ Major NPS categories as identified by the USEPA. Accessed 2/2/07 at <http://www.epa.gov/owow/nps/categories.html>

² US EPA. Primary EPA Topics: Stormwater. Accessed 2/2/07 at <http://www.epa.gov/ebtpages/watestormwater.html>.

etc.) can accumulate upon impervious surfaces from passing vehicles and impact local surface and ground water when storm and thaw events occur, flushing these pollutants into area water bodies. Impervious surfaces can also have an adverse effect on the natural function of rivers and streams. When storm water is collected and transported across impervious surfaces, its velocity and volume increases. These sudden surges of water – which would otherwise be diminished if allowed to percolate into the ground – increase the likelihood of stream bank erosion and sedimentation.

The construction of new facilities can also result in significant land erosion and water body sedimentation when proper stabilization techniques are not put in place at exposed construction sites. When vegetative cover is disturbed and/or removed for construction, underlying sediment becomes unstable and can be easily eroded and carried into streams, rivers, lakes and ponds. With this sediment come attached nutrients such as phosphorous and nitrogen as well as any associated contaminants or debris that may be on or near the construction site. The gradual accumulation of these contaminants and materials in water bodies can result in a variety of negative impacts, including eutrophication (i.e. algae blooms), decreased oxygen levels, organism death or impairment (such as fish kills), and water body use impairment (such as aesthetic degradation, foul odor or taste and/or a decline in recreational enjoyment).

2. Hydromodification and Habitat Modification

This subcategory refers to the disturbance that the presence of a transportation facility creates within the environment. Bridges, culverts, road ditching and road embankments all require the surrounding natural environment to be altered during their installation. As explained by the USEPA:

Hydromodification is one of the leading sources of impairment in streams, lakes, estuaries, aquifers, and other water bodies in the United States. [The] major types of hydromodification activities...change a water body's physical structure as well as its natural function. These changes can cause problems such as changes in flow, increased sedimentation, higher water temperature, lower dissolved oxygen, degradation of aquatic habitat structure, loss of fish and other aquatic populations, and decreased water quality. It is important to properly manage hydromodification activities to reduce nonpoint source pollution in surface and ground water.³

Once these facilities are installed, their presence can generally be assumed to be permanent or semi-permanent in nature, often causing an alteration to the local natural habitat, or *habitat modification*. Habitat modification refers to the permanent or temporary alteration of the aquatic or terrestrial environment. In the context of NPS water pollution, habitat modification refers specifically to aquatic impacts associated with new transportation facilities; terrestrial impacts are discussed in the following section under *Issue #2: Habitat Modification*.

³ USEPA. "National Management Measures to Control Nonpoint Source Pollution from Hydromodification." Accessed 2/2/07 at <http://www.epa.gov/owow/nps/hydromod/index.htm>.

Federal and State Mandates

Clean Water Act Compliance, §402: Implementation of Phase II Stormwater Rules and Regulations. EPA has granted NYSDEC the authority to implement this law through its State Pollution Discharge Elimination System (SPDES). Construction site operators statewide are required to conform to GP-02-01: SPDES General Permit for Stormwater Discharges from Construction Activity. Operators disturbing one acre or more of land must obtain permit coverage for their operation according to the following requirements:

- File a Notice of Intent (NOI) with NYSDEC before starting
- Prepare a Storm water Pollution Prevention Plan (SWPPP)
- Follow state technical guidance
- Control all wastes generated on-site

The NOI and SWPPP must be submitted to the local governing body and a copy must be made available to the public on-site.

Point source discharges are regulated through *GP-02-02: SPDES General Permit for Stormwater Discharges from Regulated Municipal Separated Storm Sewer Systems (MS4s)*.

Clean Water Act Compliance, §404: Corps of Engineers §404 Permits. A §404 permit is required for most discharges of dredged or fill material into US waters, including adjacent interstate and isolated wetlands. Regulated activities include placement of pilings as fill and side-casting associated with ditching, draining and excavating activities.

Safe Drinking Water Act: There can be no Federal assistance or participation in any project which the EPA Administrator has determined has the potential to contaminate sole source aquifers.

River and Harbor Act of 1899 (33 U.S.C. 403), US Army Corps of Engineers: §10 requires a permit to place a structure in navigable water of the US; §13 was modified by the Federal Water Pollution Control Act which established NPDES Permits.

Floodplain Management, Executive Order 11988, 1977: Basis for assessment of flood hazards which may be related to highway improvements. Combines the need to protect lives and property with the need to restore and preserve natural and beneficial floodplain values.

Impounding, Diverting or Controlling of Waters (16 U.S.C 662(a)): Requires consultation with FWS on any federal action that involves a surface area of 10 acres or more of modification to a stream or body of water.

Essential Fish Habitat, 1996 (16 U.S.C. 1801): 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act mandate that Federal Agencies identify and protect important marine and anadromous fish habitat.

Article 15 of the NYS Environmental Conservation Law: Water Resources: Title 5 of this law provides for the protection of the bed and banks of streams; DEC coordination is required to disturb

streambeds classified as AA, AA(T), A, A(T), B, B(T), C(T). Title 27 of this law provides certain protections for waterways designated as “wild, scenic and recreational rivers.” Outside the Adirondack Park, a DEC permit may be required for certain activities or projects located within certain distances of designated waterways, unless project is for maintenance or in-kind replacements of existing structures.

Partners for Consultation

Federal entities:

U.S. Department of Transportation (USDOT)	www.dot.gov
Research and Innovative Technology Administration (RITA)	www.rita.dot.gov
Federal Highway Administration (FHWA)	www.fhwa.dot.gov
Turner-Fairbank Highway Research Center (TFHRC)	www.tfhrc.gov
Federal Railroad Administration (FRA)	www.fra.dot.gov
Federal Transit Administration (FTA)	www.fta.dot.gov
National Highway Traffic Safety Administration (NHTSA)	www.nhtsa.dot.gov
Pipeline and Hazardous Materials Safety Administration (PHMSA)	www.phmsa.dot.gov
U.S. Environmental Protection Agency (EPA)	www.epa.gov
U.S. Army Corps of Engineers (USACE)	www.usace.army.mil

New York State entities:

New York State Department of Environmental Conservation (NYSDEC)	www.dec.state.ny.us
New York State Department of Transportation (NYSDOT)	www.nysdot.gov

Independent Organizations:

Transportation Research Board of the National Academies (TRB)	www.trb.org
American Association of State Highway and Transportation Officials	www.transportation.org
AASHTO Center for Environmental Excellence	www.environment.transportation.org

Inventories and Resources:

Publications:

- EPA. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. EPA Publication No. 840-B-92-002 (January 1993). Last access: February 20, 2007.
<http://www.epa.gov/nps/MMGI/>

Description: This is a comprehensive technical document on methods to abate and control nonpoint pollution in coastal areas. [The document is] primarily intended for State and local watershed project staff. Report includes chapters and fact sheets dedicated to subjects including: management measures for urban areas; management measures for hydromodification; and management measures for wetlands, riparian areas and vegetated treatment systems.

EPA. National Management Measures to Control Nonpoint Source Pollution from Urban Areas. 2005. EPA Publication No. 841-B-05-004 (November 2005). Last access: September 11, 2006
<http://www.epa.gov/nps/urbanmm/>

Description: This guidance helps citizens and municipalities in urban areas protect bodies of water from polluted runoff that can result from everyday activities. These scientifically sound techniques are the best practices known today. The guidance will also help states to implement their nonpoint source control programs and municipalities to implement their Phase II Storm Water Permit Programs. Report includes chapters dedicated to subjects including: watershed assessment and protection; site development; new development and runoff treatment; bridges and highways; construction site erosion, sediment, and chemical control; pollution prevention; retrofitting systems for existing development; and operation and maintenance guidelines.

Finger Lakes/Lake Ontario Watershed Protection Alliance. Highway Superintendent Road and Water Quality Handbook, 2nd Ed. 1996.

Description: The Highway Superintendents Road and Water Quality Handbook was a multi-agency project designed to assist local Highway Superintendents in the permit process associated with activities that may impact local and regional water quality. Although road and right-of-way maintenance is the primary source of water quality problems on only a few waterbodies in NYS, numerous waterbodies are impacted by these activities as secondary sources of pollution. Becoming familiar with the permitting processes and technical information concerning water-related impacts associated with roadway construction and maintenance should help reduce uncertainties and frustrations encountered by local highway superintendents. Incorporating best management practices should also serve to hasten the permit application process and serve to minimize the impacts of roadway activities on local water resources. The manual is broken down into three sections: *Sec. I: The Permitting Process*; *Sec. II: Technical Information*; and *Sec. III: Where to go for Assistance*.

Michigan Department of Transportation. The Use of Selected Deicing Materials on Michigan Roads: Environmental and Economic Impacts. 1993. Last access: September 27, 2006.
http://www.michigan.gov/mdot/0,1607,7-151-9622_11045-57246--,00.html

Description: This report analyzes the performance, environmental effects, and economic costs of seven deicing materials: sodium chloride (road salt), CMA (calcium magnesium acetate), CMS-B (a patented product, Motech, containing principally potassium chloride), CG-90 Surface Saver (a patented corrosion-inhibiting salt), calcium chloride, Verglimit (a patented concrete road surface containing calcium chloride pellets), and sand (an abrasive). The data for the analysis of deicer performance are derived from current literature.

NYSDEC Division of Water. New York State Standards and Specifications for Erosion and Sediment Control. 2005. Last access: February 20, 2007.
<http://www.dec.state.ny.us/website/dow/toolbox/escstandards/index.html>

Description: The purpose of this document is to protect water quality due to construction activity and reduce sediment damage and associated maintenance costs of road ditches, storm sewers, streams, lakes, and flood control structures. It is distributed by the Empire State Chapter of the Soil and Water Conservation Society and

also available on the New York State Department of Environmental Conservation stormwater web site. This manual should be used by site developers in preparing their erosion and sediment control plans, and by local municipalities in preparing and implementing their soil erosion and sediment control programs, reviewing proposed site development plans, establishing or encouraging uniformity through standards in applying erosion control techniques, and helping developers, private engineers, and planners make maximum use of potential development sites by proper management of their natural resources.

Useful Websites:

FHWA, Turner-Fairbank Highway Research Center “Hydraulics and Hydrology Research Webpage” Last access: October 4, 2006.

<http://www.tfhrc.gov/structur/hydrlics/index.htm>

Description: Provides research, technical support and advice regarding hydromodification and hydrology related to transportation facilities.

USEPA Section 319 Nonpoint Source Success Stories Website. Last access: February 20, 2007.

<http://www.epa.gov/owow/nps/Success319/>

Description: The *Section 319 Nonpoint Source Success Stories Website* features projects receiving grant funds from the section 319 program that have achieved documented water quality improvements. Water quality improvements are demonstrated through the achievement of water quality standards for one or more pollutants/uses; nonpoint source total maximum daily load allocations (and removal from the state's section 303(d) list of impaired waters); measurable, in-stream reduction in a pollutant; or improvement in a parameter that indicates stream health (e.g., increases in fish or macroinvertebrate counts). Stories also demonstrate innovative strategies used to reduce nonpoint source pollution, the growth of partnerships, and diversity of funding sources.

NYSDEC Stormwater Information Webpage. Last access: February 20, 2007.

<http://www.dec.state.ny.us/website/dow/mainpage.htm>

Description: The NYSDEC Stormwater Information Webpage was designed to provide NYS contractors, municipalities, and other entities with a comprehensive array of data pertaining to permitting process, key documents, timelines, and other important facts associated with Phase II Stormwater implementation.

NPS Water Pollution: Stormwater Runoff from Construction, Operation, and Maintenance of Roads, Highways and Bridges

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Stormwater Runoff from the Construction, Operation and Maintenance of Roads, Highways and Bridges	<p>Clean Water Act Compliance, §402: Implementation of Phase II Stormwater Rules and Regulations. Construction site operators statewide are required to conform to GP-02-01: SPDES General Permit for Stormwater Discharges from Construction Activity. Operators disturbing one acre or more of land must obtain permit coverage for their operation according to the following requirements:</p>	<ul style="list-style-type: none"> • SWPPPs must be prepared by a licensed professional (Certified Landscape Architect, Professional Engineer (PE), or Certified Professional in Erosion and Sediment Control (CPESC) • When properly prepared, SWPPPs offer the most comprehensive level of protection from sedimentation occurring off-site • Standards are national in scope, as stipulated under the Federal Clean Water Act 1987 Amendments 	<ul style="list-style-type: none"> • Regulations are complex • Procedures are not always enforced in a uniform manner between counties • Due to the complexity of the regulations and the dearth of private contractors working in the field, end results of regulation implementation can vary significantly
	<p>Stormwater Retrofitting is an innovative approach to updating outmoded stormwater transmission systems. They can reduce pollutants, restore habitats, and stabilize stream morphology. Different types of retrofitting solutions can be developed depending on the location, local geography and volume of stormwater anticipated. Types of retrofit approaches include:</p> <ul style="list-style-type: none"> • The overall reduction or elimination of paved surfaces; • Use of pervious pavement materials, which allow stormwater infiltration; • Vegetative swales or rain gardens, which convey stormwater and provide temporary storage for eventual infiltration; • Detention/retention areas, which provide either temporary or semi-permanent storage for storm water for eventual infiltration; 	<ul style="list-style-type: none"> • Replaces inadequate structures • Reduces pollutants entering water bodies • Reduces downstream volumes of stormwater, thereby reducing the potential for localized flooding and property damage • Potential to reduce stormwater volumes to local sewage treatment plants and the associated treatment costs 	<ul style="list-style-type: none"> • Potential for high initial construction costs • Developed areas are generally devoid of extra space, making retrofitted facility siting difficult • Facilities require routine maintenance and upkeep in order to ensure proper operation • Large stormwater surges can inundate retrofits and bypass the facility

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	<ul style="list-style-type: none"> • Constructed wetlands, which can treat stormwater, slow its velocity, and provide natural habitat; • Infiltration trenches/basins which can convey large volumes of water while allowing moderate infiltration; and • Sand filters, which trap harmful pollutants. 	<ul style="list-style-type: none"> • Stabilizes stream morphology by decreasing overall volume of storm water surges during rain/thaw events • Restores natural habitats • Vegetated areas and rain gardens can provide an aesthetically pleasing appearance in urban settings 	<ul style="list-style-type: none"> • Areas such as retention ponds incorporate standing water, posing a health and safety risk to the public
	<p>Road Deicing Best Management Practices: Alternative Spreading Considerations can limit the amount of deicing materials used on roads and highways or offer alternatives to their use.</p> <p>“Smart Salting” is a concept that raises awareness among operators and the public of the impacts associated with over-application of road deicing materials. Application rates, the location of streams and wetlands, and other relevant factors are considered. This enables highway departments to apply modest amounts of salt and avoid over-salting, particularly in environmentally sensitive locations. Public outreach efforts (signage, media, etc.) alert the public to the issue and need to drive with caution.</p>	<ul style="list-style-type: none"> • Prevents over-salting in environmentally sensitive areas and associated salinization of waterways • Decreases costs associated with salting due to a decrease in product and equipment use • Decreases costs associated with spring clean-up and repairs (potholes, storm sewer maintenance, street sweeping, ditch cleaning) 	<ul style="list-style-type: none"> • A commitment of resources for training and implementation is necessary • Locations must be identified which are most suitable for smart salting implementation • Commitment of education and outreach required in order to prepare the public for policy change • Possible road safety concerns
	<p>Road Deicing Best Management Practices: Storage Area Considerations</p> <p>Covering and stabilization of salt piles. Best management practices in storage of salt include locating areas outside of floodplains; designing storage facilities to prevent seepage of salt into the ground or onto the vehicle lot and neighboring waterways; designing facilities large enough so that vehicles can be loaded entirely within the covered area; and equipping storage facilities with drainage and collection devices that prevent losses from storm or melt water.</p>	<ul style="list-style-type: none"> • Environmental benefits • Decreases operational costs by preventing salt loss/seepage during wet weather events • Facilities provide a convenient and effective loading area for highway staff 	<ul style="list-style-type: none"> • Construction costs • Can be difficult to locate if space is limited

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		Benefits	Impacts
	<p>Road Deicing Best Management Practices: Alternative Deicing Materials: Alternatives to traditional rock salt have been developed in an effort to provide highway departments with flexible and environmentally-friendly approaches to road deicing.</p> <p>Calcium Magnesium Acetate (CMA) has a deicing range that is very close to salt. It is harmless to humans, plants, and animals; non-corrosive to metals; and nondestructive to concrete and other highway materials. Its main ingredient, dolomitic lime, is readily available throughout the country, making distribution feasible. The compound sticks to the highway longer than salt, thereby prolonging its lifespan on the roadway. Overall, CMA is considered to be less harmful to the environment than salt. It is known to be less toxic to fish and plants; it is, however, more deleterious to certain types of plankton.</p> <p>Verglimit (a proprietary product) consists of calcium chloride flakes encapsulated in linseed oil which are blended into the plant-mixed bituminous wearing surface. It essentially lengthens the response time and/or eliminates the need for added deicing maintenance.</p>	<ul style="list-style-type: none"> • Lengthens response time • Eliminates need for extra maintenance • Works well on bridges, ramps, and steep grades • Less corrosive than salt • Initial studies indicate that it is less harmful to the environment than salt 	<ul style="list-style-type: none"> • Does not work as well as salt at lower temperatures (below 23 degrees F) • Sticks to spreading equipment, requiring stop-and-go maintenance • More persistent in the environment • May decrease oxygen levels in water • Does not require storage considerations that salt does • Higher costs than salt
		<ul style="list-style-type: none"> • Effective in known hazard areas that are prone to icing • Decreases the need for quick responses during freezing events • Little environmental threat • Less corrosive than road salt 	<ul style="list-style-type: none"> • High cost relative to salt • Application is limited to specific areas, such as bridge decks, ramps, shaded areas, and steep grades • Compaction and cracking problems • Maximum traffic volume of 5,000 vehicles per day

NPS Water Pollution: Hydro-Modification and Habitat Modification: Bridges

There are several best management practices in bridge design that can mitigate hydro- and habitat modification from bridges. These include:

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Hydro – modification/Habitat Modification – <i>Bridges</i>	Incorporating best management practices into general bridge construction, maintenance and demolition considerations , which include guidelines for painting and enclosures for repairs that can trap harmful materials before entering the environment.	<ul style="list-style-type: none"> • Incremental addition of BMPs can gradually reduce environmental impacts • Can be voluntary 	<ul style="list-style-type: none"> • Costs associated with training and implementation of BMPs
	Bridge design and construction alternatives , which incorporate longer bridge spans, alternative materials that are less likely to degrade the surrounding environment, or designs that avoid environmentally sensitive areas altogether.	<ul style="list-style-type: none"> • Natural channels can be maintained; environmentally sensitive areas can be protected • Additional benefits include added protection from flooding hazards • Greater likelihood of species passage underneath 	<ul style="list-style-type: none"> • Additional length or materials will increase construction costs • Designs can be complex, also adding to costs • No design can provide 100% assurance that occurrences of environmental degradation will be eliminated
	Scupper drains are an example of a best management practice in design, which allow storm water to drain out of bridges into areas where it can be treated;	<ul style="list-style-type: none"> • Scupper drains effectively protect water resources from various harmful materials deposited on roadways • Stormwater can be routed away from direct drainage into a waterway • Stormwater can also be treated once on land • Retrofitting existing bridges with scupper drains is feasible 	<ul style="list-style-type: none"> • Cost of retrofits on existing bridges may be considerable • Maintenance is required in order to assume proper drain function • If treatment facilities are part of the design, additional space may be necessary

NPS Water Pollution: Hydro-Modification and Habitat Modification: Culverts

Key design consideration for culverts is to permit water, sediment and debris transport through the crossing by maintaining natural channel dimensions and slope through the structure, and considering flow through the entire riparian area. Incorporating alternative designs will very likely increase the complexity and costs of the project. Comprehensive analysis of the construction site, stream dynamics, and design alternatives can result in amenable solutions, however. Design considerations and alternatives include:

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Hydro – modification/Habitat Modification – Culverts	Box culverts , which are usually square or rectangular reinforced concrete structures with single or multiple openings; research indicates that a pre-cast inlet with the optimum bevel is the best performer when the inlet was submerged because the streamlined curve of the bevel provides a better path for the water flow.	<ul style="list-style-type: none"> • Culvert has minimal impact on natural stream flow 	<ul style="list-style-type: none"> • Cost associated with design and implementation
	No-slope designs , which are useful for new as well as replacement culverts due to their simple installations, low to moderate channel gradient, and suitability for species passage.	<ul style="list-style-type: none"> • Works as new, retrofit, or replacement culvert • Simple installation • Works for variety of species 	<ul style="list-style-type: none"> • Only works for low to moderate gradients • May be costly
	Stream simulation designs , which mimic natural channel flow; i.e. sediment transport, fish passage, and flood and debris conveyance function as they would in the natural channel. These can be used for new and replacement installations, complex installations with higher gradients and lengths, narrow stream valleys, and locations where all fish species require passage.	<ul style="list-style-type: none"> • Comprehensive approach to stream mitigation • Functions as natural channel would • Can be used for a variety of new and replacement installations 	<ul style="list-style-type: none"> • Costs associated with design and installation
	Fishways and fishrocks , which are used to slow water velocity in a steepened streambed and to create small fish resting areas. This technique involves placing “rocks” in the form of wet concrete or some other material that is secured to the existing streambed and culvert bottom.	<ul style="list-style-type: none"> • Allows fish to climb gradient • Creates resting areas for fish 	<ul style="list-style-type: none"> • Cost of construction

NPS Water Pollution: Hydro-Modification and Habitat Modification: Ditching and Embankments

Increased awareness of the negative impacts that erosion and sedimentation can have on waterways has led state and local highway departments to research best management practices in roadside ditch and slope designs. Most solutions are relatively simple and cost effective. These include:

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		Benefits	Impacts
Hydro – modification/Habitat Modification – Ditching and Embankments	<p>Ditch shape designs: Ditch shape designs should consider the proximity to receiving water bodies and the potential for erosion in the general vicinity. Vegetation above embankments should be maintained to avoid erosion. The ditch should be able to handle peak flows. Maintenance should occur during seasonally dry conditions, or immediately after any soil disturbance. Ditches should be cleaned and reshaped as needed. Constructing ditches in these shapes is simple and would not necessarily add time.</p>	<ul style="list-style-type: none"> • Long-term maintenance costs can decrease • Straight-forward designs • Little time required 	<ul style="list-style-type: none"> • Short-term design and maintenance costs may increase • Education and outreach to highway staff regarding proper designs and benefits of alternative designs and approaches • The best shape may not be best for project
	<p>Selection of lining materials: Concrete, stone bottom and sides, fabric, stone bottom/grassed sides, and vegetated swales are less prone to erosion and decrease waterway sedimentation. Weeds and tall grass, mowed grass, stone bottom/grassed sides, earth bottom/grassed sides, and stone bottom and sides have a higher ability to slow water velocity.</p>	<ul style="list-style-type: none"> • Long-term maintenance can decrease due to increased stability • Vegetated areas provide aesthetic and environmental benefits • Areas will become less prone to erosion due to a reduction in water velocity 	<ul style="list-style-type: none"> • Cost of materials: geo-textiles in particular can be expensive • Knowledge of proper installation and/or construction methods is required • Solutions are often site-specific: site designs and material selection are likely to vary significantly based on slope, soil type, soil stability and other site characteristics
	<p>Slope considerations refer to materials and approaches to the design of roadside slopes. The key considerations are stability, safety, and maintenance. Slopes can be stabilized with geo-textiles or other reinforcements such as reinforcing bars. Retaining walls may be needed at the toe of slopes. Signs and guardrails help warn people</p>	<ul style="list-style-type: none"> • Proper slope design can reduce area erosion • Maintenance can be decreased • Improved safety for motorists 	<ul style="list-style-type: none"> • Materials may be costly • Construction may be time-consuming • Costs associated with design are likely to be high

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Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	about steeply sloped embankments. Rip rap, vegetation, and fabrics can reduce erosion and ease maintenance.		

Issue 2: Terrestrial Habitat Modification

Issue Description

Terrestrial habitat modification refers to the modification (i.e. destruction, displacement, or impairment) of natural vegetative, animal or insect communities or the resources necessary for their survival. A variety of transportation system construction, maintenance and operation activities can result in significant terrestrial habitat modification. The types of habitat modification that are likely to occur can be grouped into two primary categories: *habitat loss and/or landscape fragmentation* and *mortality or injury* resulting from vehicle collisions.

1. Habitat Loss and/or Landscape Fragmentation

This category refers to the loss of habitat that may occur as new transportation facilities are created. All variety of insects and animals require a basic habitat that they depend on for their survival. Within this area exists the means for their sustenance, shelter and socialization. The construction of new facilities can either destroy an organism's habitat entirely or significantly impair it in a manner that decreases the organism's chances of survival.

Landscape fragmentation refers to the cumulative impacts that transportation facilities can have on habitat. The construction of basic transportation facilities has the potential to induce the growth of new supportive facilities over time. As such, areas of contiguous natural habitat are gradually intersected, reducing large, undivided areas into smaller patches of land. This phenomenon can have a negative impact on an organism's ability to survive over a prolonged period of time. As a species' habitat is slowly reduced, competition for scarce resources (food, shelter, etc.) will increase. All types of birds, reptiles, insects and vegetative organisms can be negatively impacted to various degrees by landscape fragmentation.

2. Species Mortality or Injury of Deer and/or Threatened or Endangered Species

Mortality or injury resulting from vehicle collisions is likely to occur as new transportation facilities are created that neglect to take organisms' migratory capabilities, preferences and patterns into account. Impacts with large animals – such as deer – can put individuals at significant risk due to losses associated with property damage, personal injury or death. Impacts with other species that may be endangered or threatened should also be given serious consideration as new transportation facilities are constructed. Retrofitting existing facilities in areas where such species are found to exist should also be given serious consideration.

Federal and State Mandates

Federal Highway Administration Wetland Policy, 1977 (23 CFR 777, Mitigation of Impacts to Wetlands and Natural Habitat): It is the FHWA's policy to prepare a formal wetland finding prior to the approval of any project involving new construction in wetlands and classified as an EIS or a Finding of No Significant Impact (FONSI).

Protection of Wetlands, Executive Order, 11990, 1977: Directs federal agencies to avoid unnecessary alteration or destruction of wetlands, and requires implementation of actions to minimize the loss or degradation of wetlands affected by a project that received federal funding.

Endangered Species Act, 1973 (50 CFR 402), Fish and Wildlife Service, Department of the Interior, National Marine Fisheries Service, Department of Commerce: Protects nationally designated threatened and endangered species.

Fish and Wildlife Coordination Act, 1958 (U.S.C. 661-667): Ensures that wildlife conservation will receive equal consideration.

National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd), U.S. Fish and Wildlife Service (FWS): Provides protection of wildlife refuges and ranges, game ranges, wildlife management areas, or waterfowl production areas as administered by the Secretary of the Interior through the U.S. Fish and Wildlife Service.

Environmentally Beneficial Landscaping, Executive Memorandum, 1994: Environmentally beneficial landscaping entails utilizing techniques that complement and enhance the local environment and seek to minimize the adverse effect that the landscaping has on it. In particular, this means using regionally native plants and employing landscaping practices and technologies that conserve water and prevent pollution.

Migratory Bird Treaty Act, 1918 (16 U.S.C. 703-712): Generally prohibits the taking, possession, transportation, sale, purchase, barter, importation, exportation, and banding or marking of migratory birds, and the taking of nests or eggs, except for scientific purposes.

NYS Freshwater Wetlands Act, Article 24 of the NYS Environmental Conservation Law: A permit is required for most activities that will alter freshwater wetlands or adjacent areas. The approximate boundary of all wetlands within jurisdiction are shown on official NYS Freshwater Wetlands Maps maintained by NYSDEC

NYS Tidal Wetlands Act, Article 25 of the Environmental Conservation Law: A permit is required from the NYSDEC for almost any activity that will alter tidal wetlands or adjacent areas. The approximate boundaries of all tidal wetlands within agency jurisdiction are shown on official NYSDEC maps.

Partners for Consultation

Federal entities:

U.S. Department of Transportation (USDOT)
Federal Highway Administration (FHWA)
U.S. Environmental Protection Agency (EPA)

www.dot.gov
www.fhwa.dot.gov
www.epa.gov

New York State entities:

New York State Department of Environmental Conservation (NYSDEC)

www.dec.state.ny.us

Independent Organizations:

Transportation Research Board of the National Academies (TRB)
American Association of State Highway and Transportation Officials

www.trb.org
www.transportation.org

Inventories and Resources

Publications:

EPA. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. EPA Publication No. 840-B-92-002 (January 1993). Last access: February 20, 2007.
<http://www.epa.gov/nps/MMGI/>

Description: This is a comprehensive technical document on methods to abate and control nonpoint pollution in coastal areas. [The document is] primarily intended for State and local watershed project staff. Report includes chapters and fact sheets dedicated to subjects including: management measures for wetlands, riparian areas and vegetated treatment systems.

FHWA. Critter Crossings: Linking Habitats and Reducing Roadkill. 2000. An electronic version of Publication No: FHWA-EP-004. Last access: February 20, 2007.
<http://www.fhwa.dot.gov/environment/wildlifecrossings/main.htm>

Description: The website describes transportation's impacts on wildlife and highlights exemplary projects and processes that are helping to reduce these impacts. The website includes illustrated chapters on subjects pertaining to: tortoise underpasses; tunnels for small burrowing animals and reptiles; tools to assess wildlife linkage areas; fish passages; passages for large mammals; and other related assessment tools and websites.

Transportation Research Board. Guidance for Estimating the Indirect Effects of Proposed Transportation Projects. 1998. Last access: September 15, 2006.
http://trb.org/news/blurb_detail.asp?id=3004

Description: TRB's National Cooperative Highway Research Program (NCHRP) Web Document 43: Guidance for Estimating the Indirect Effects of Proposed Transportation Projects is an instructional course based on research conducted for National Cooperative Highway Research Program Project 25-10: Guidance for Estimating the Indirect Effects of Proposed Transportation Projects. The course consists of a PowerPoint presentation and support materials.

Transportation Research Board, National Cooperative Highway Research Program. Interaction Between Roadways and Wildlife Ecology: A Synthesis of Highway Practice. 2002. Last access: February 20, 2007. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_305.pdf

Description: This synthesis report will be of interest to state department of transportation (DOT) staff involved in the development, operation, and maintenance of roadways and how they can effect wildlife and ecological systems across the country. Roadway development choices made in response to population growth can affect many, if not all, forms of wildlife. Such effects include loss of wildlife habitat, fragmentation, mortality, and

increased competition. The synthesis reviews and discusses regulatory context (laws, regulations, policies, and guidance); transportation planning and development processes; the types of effects, including habitat loss, fragmentation, and chemical and physical impacts; the scale and assessment of effects; analytical tools, including motorist safety studies and wildlife surveys; conservation measures and mitigation; maintenance (culverts and habitat restoration); and funding sources and deficiencies.

Useful Websites:

FHWA. Keeping it Simple: Easy Ways to Help Wildlife Along Roads. Last access: February 20, 2007. <http://www.fhwa.dot.gov/environment/wildlifeprotection/index.cfm?fuseaction=home>.

Description: This website highlights more than 100 simple, successful activities from all 50 states and from FHWA's Western Federal Lands Division. All these activities are "easy." Most are low- or no-cost. All benefit fish and wildlife or their habitat. Categories include mitigations measures organized in sections dedicated to roads, bridges, waterways, wetlands, and upland areas.

International Conference on Ecology & Transportation: Conference proceedings for the years 2001, 2003 and 2005. <http://www.icoet.net/index.asp>

Description: Conducted every two years, ICOET is designed to address the broad range of ecological issues related to surface transportation development, providing the most current research information and best practices in the areas of wildlife, fisheries, wetlands, water quality, overall ecosystems management, and related policy issues. ICOET is a multi-disciplinary, inter-agency supported event, administered by the Center for Transportation and the Environment.

Texas Transportation Institute. Deer Vehicle Crash Information Clearinghouse. Last access: February 20, 2007. <http://www.deercrash.com/>

Description: This website includes: detailed deer-vehicle crash statistics at regional, state and national levels; a "countermeasures toolbox" detailing deer-vehicle mitigation activities and approaches; and links to relevant partners and resources.

Habitat Modification: Habitat Loss and/or Landscape Fragmentation

The following considerations should be made regarding mitigation of the loss of environmentally sensitive habitats:

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Habitat Modification: Habitat Loss and/or Landscape Fragmentation	Alternative facility site considerations for wetland areas and other environmentally-sensitive areas should be a priority. The most sensitive areas are often irreplaceable and provide ecological benefits that are difficult to quantify. Destruction, relocation or alteration of sensitive habitats should be a choice if no other feasible alternatives exist.	<ul style="list-style-type: none"> • Maintenance of the integrity of natural areas • Species protection • Aesthetic benefits of open space preservation 	<ul style="list-style-type: none"> • Costs associated with land acquisition and alternative site planning
	Land and/or wetland banking is a process whereby entities set aside lands in anticipation of growth and development. In instances where destruction of the resource is unavoidable, lands that have been set aside can be used to offset losses.	<ul style="list-style-type: none"> • Replaces impacted or destroyed lands with lands of equal or greater value • Provides developers with a method of ensuring compliance with Federal and state mandates 	<ul style="list-style-type: none"> • Original natural resource is permanently altered • Mitigation costs are generally high • Difficulty reproducing the natural conditions of original resource
	Vegetative buffer zones between transportation facilities and adjacent areas of sensitive habitat should be promoted.	<ul style="list-style-type: none"> • Maintenance of the integrity of natural areas • Species protection • Aesthetic benefits of open space preservation 	<ul style="list-style-type: none"> • Costs associated with the design of feasible landscaping and approaches
	Encourage use of indigenous plants within buffer zones in an effort to maintain the integrity of the surrounding natural habitat.	<ul style="list-style-type: none"> • Maintenance of the integrity of natural areas • Species protection • Enhancement of ecological integrity 	<ul style="list-style-type: none"> • Costs associated with materials and necessary professional consultation

Habitat Modification: Species Mortality or Injury – Deer

Deer collisions present the most significant risk due to their potential to inflict losses including property damage, personal injury or death and should therefore be given the most consideration and priority.

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	Public Information and Education. Many collisions are often random and may be unavoidable altogether. Public awareness as to the problem of and hazards associated with deer collisions can work well as part of a comprehensive mitigation program.	<ul style="list-style-type: none"> • Cost effective • Capability of reaching a wide audience 	<ul style="list-style-type: none"> • Will not eliminate the problem altogether • Costs associated with reaching a wide audience
	Speed Limit Reduction in known high-frequency collision areas can provide the driver with extra time and distance to react to deer. There is a documented connection between the reduction of speed limit and the reduction of deer-vehicle crashes. Drivers, however, do not always follow posted speed limits. Roads with higher speed limits often already have better design features that increase visibility for the driver.	<ul style="list-style-type: none"> • Practical approach to decreasing collisions 	<ul style="list-style-type: none"> • Difficulty assuring enforcement and compliance
	Roadway Maintenance, Design, and Planning Policies: Various road designs can decrease collisions by improving driver awareness and sight lines. Four-lane roads have fewer crashes than two-lane roads due to visibility and room for evasive maneuvers.	<ul style="list-style-type: none"> • Long-term approach to overall reduction in impacts in known high-impact areas 	<ul style="list-style-type: none"> • Not feasible in all locations, particularly rural areas • Costs associated with research, design and construction implementation
	Deer Crossing Signs and Technologies, which can alert drivers to hazards caused by animals when and where they are observed to gather in numbers or with frequency.	<ul style="list-style-type: none"> • Innovative solution within high-impact areas 	<ul style="list-style-type: none"> • Costs associated with research and installation • Identifying appropriate sites can be difficult • If used too frequently, may decrease drive awareness due to complacency • Research regarding effectiveness inconclusive

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Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	Roadside Vegetation Management involves controlling vegetation near roadsides that either attract deer (for feeding) or obscure deer from passing motorists.	<ul style="list-style-type: none"> • Long term solution within areas experiencing a high frequency of impacts • Increase in overall safety and visibility for drivers • Part of an overall roadside vegetation strategy, which should include a variety of environmental considerations 	<ul style="list-style-type: none"> • No conclusive research proving that this method is an effective means of preventing collisions.
	Roadside Reflectors and Mirrors (Swareflex Wildlife Reflector (a proprietary product)) which work in conjunction with passing automobile headlights. The reflection of light may frighten, distract, or freeze deer enough so that they will not cross the road. Such reflectors are currently being tested along high-frequency collision areas of the NYS Thruway (Rt. 90 near Lancaster).	<ul style="list-style-type: none"> • Innovative solution within high-impact areas 	<ul style="list-style-type: none"> • Current research regarding effectiveness is inconclusive • Technology requires frequent maintenance in order to assure proper function (particularly in the winter time) •
	Deicing Salt Alternatives. Deer are attracted to salt. Using alternative deicing materials in known high-frequency collision areas can decrease deer's desire to congregate near areas with salt.	<ul style="list-style-type: none"> • Temporary solution within areas experiencing a high frequency of impacts 	<ul style="list-style-type: none"> • Use of alternatives may contradict or otherwise complicate a department's overall deicing strategy • Costs associated with materials
	Repellants , which can make food that otherwise has an attractive taste or smell offensive to deer. When placed near a road, this may cause them to avoid the road. Only specific types of repellents have been shown to be effective.	<ul style="list-style-type: none"> • Temporary solution within areas experiencing a high frequency of impacts 	<ul style="list-style-type: none"> • Costs associated with product purchase, application and monitoring the effectiveness • Can simply cause deer to migrate to other areas, transferring the hazard

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Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	<p>Exclusionary Fencing physically separates animals and vehicles. Research shows that this method is highly effective in reducing crashes in known high-frequency collision areas. This method does, however, adversely impact necessary animal movement patterns.</p>	<ul style="list-style-type: none"> • Permanent solution in known high-impact areas 	<ul style="list-style-type: none"> • Costs associated with design and construction • Deer are very likely to be capable of surpassing the barrier • Can simply cause deer to migrate to other areas, transferring the hazard • Devices often need to be combined with other barriers to be effective

Habitat Modification: Species Mortality or Injury – Threatened or Endangered Species

There are several effective methods that can be used to reduce mortality or injury to threatened or endangered species that should be given serious consideration and priority during transportation facility construction.

Environmental Issue	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
<p>Habitat Modification: Species Mortality and Injury – Threatened or Endangered Species</p>	<p>Signage, Education and Outreach to inform motorists that threatened or endangered species are likely to exist in the area and due diligence should be used</p>	<ul style="list-style-type: none"> • Cost effective • Capability of reaching a wide audience 	<ul style="list-style-type: none"> • Will not eliminate the problem altogether • Costs associated with reaching a wide audience
	<p>Wildlife Crossing Structures and barriers, including amphibian and reptile walls and culvert systems. These are designed to channel species into safe crossing areas (typically a culvert or tunnel). Crossing structures are typically designed to accommodate specific species. Animal Barriers prevent burrowing animals from crossing the highway through a fencing system that is placed partially underground, rising above the ground. Such animals are not able to burrow under the barrier and cross the road. Animals can be channeled to an appropriate crossing point or area if necessary.</p>	<ul style="list-style-type: none"> • Innovative solution proven to be effective with various species within known high-frequency collision areas 	<ul style="list-style-type: none"> • Costs associated with design and construction • Structures often must be customized to accommodate an individual species

Issue 3: Open Space Modification

Issue Description

Open space modification refers to negative impacts to local and regional open space resources due to the construction of new facilities. Open space resources include public and private lands such as grasslands, parks, or forests that are devoid of infrastructure, roads and permanent structures. Open space also includes land that is either actively used for agricultural production or grazing as well as fallow agricultural lands that are not presently used for such purposes. Specific benefits provided by open spaces include agricultural and timber production, air and water purification, recreational enjoyment and aesthetics.

This issue shares many similar attributes with *Issue 2: Habitat Loss*. The primary distinction here, however, is the destruction or impairment of open space resource characteristics that are enjoyed specifically by human communities. The enjoyment provided by scenic vistas or the utilitarian function and food security provided by agricultural areas are notable examples. As with habitat loss, the construction of new transportation facilities is likely to induce the growth of other supportive facilities, resulting in the loss of open space resources, gradually impairing or diminishing their value over time.

1. Preservation, Conservation and Adaptive Reuse

The preservation and conservation of open space resources is the surest way to safeguard their benefits. Outright purchase of resources and/or the protection of their current uses from various types of development are among the options available to the public and municipalities. Adaptive reuse of abandoned or underutilized developed spaces can further act to decrease the demand for open spaces.

2. Growth Management and Compact Development

Growth management refers to policies or procedures that can be used to provide for the sustainable growth of communities. The primary goal of growth management techniques is to ensure that adequate services (i.e. infrastructure, housing, etc.) are available to meet the demand created by new growth. Compact development refers to practices in community development that increase density, thereby reducing the overall need for new facilities. Furthermore, the close proximity of services available within compact developments reduces personal dependence on the automobile. When these two concepts are successfully applied to community development, an overall reduction in the need for and demand of open spaces may result.

Federal and State Mandates

Environmentally Beneficial Landscaping, Executive Memorandum, 1994: Environmentally beneficial landscaping entails utilizing techniques that complement and enhance the local environment and seek to minimize the adverse effect that the landscaping has on it. In particular, this means using regionally native plants and employing landscaping practices and technologies that conserve water and prevent pollution.

Federal Highway Administration Wetland Policy, 1977 (23 CFR 777, Mitigation of Impacts to Wetlands and Natural Habitat): It is the FHWA's policy to prepare a formal wetland finding prior to

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the approval of any project involving new construction in wetlands and classified as an EIS or a Finding of No Significant Impact (FONSI).

Land and Water Conservation Fund Act of 1965 (LAW-CON) (16 U.S.C. 460I-4 et seq.): Section 6(f): Requires that recreation land purchased or improved under the LAWCON Act cannot be used unless replacement land of equal value, use, and size can be supplied.

Protection of Wetlands, Executive Order, 11990, 1977: Directs federal agencies to avoid unnecessary alteration or destruction of wetlands, and requires implementation of actions to minimize the loss or degradation of wetlands affected by a project that received federal funding.

NYS Freshwater Wetlands Act, Article 24 of the NYS Environmental Conservation Law: A permit is required for most activities that will alter freshwater wetlands or adjacent areas. The approximate boundary of all wetlands within jurisdiction are shown on official NYS Freshwater Wetlands Maps maintained by NYSDEC

NYS Tidal Wetlands Act, Article 25 of the Environmental Conservation Law: A permit is required from the NYSDEC for almost any activity that will alter tidal wetlands or adjacent areas. The approximate boundaries of all tidal wetlands within agency jurisdiction are shown on official DEC maps.

Partners for Consultation

Federal entities:

U.S. Department of Transportation (USDOT)	www.dot.gov
U.S. Environmental Protection Agency (EPA)	www.epa.gov
Federal Highway Administration (FHWA)	www.fhwa.dot.gov
US Department of Housing and Urban Development	www.hud.gov

New York State entities:

New York State Department of Environmental Conservation (NYSDEC)	www.dec.state.ny.us
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Independent Organizations:

American Association of State Highway and Transportation Officials	www.transportation.org
AASHTO Center for Environmental Excellence	www.environment.transportation.org
American Planning Association	www.planning.org
Brookings Institution on Urban and Metropolitan Policy	http://www.brook.edu/metro
Congress for New Urbanism	www.cnu.org
Smart Growth Network	www.smartgrowth.org

Inventories and Resources

Publications:

American Planning Association. "How Cities Use Parks for...". 2003. Last access: September 18, 2006
<http://www.planning.org/cpf/briefingpapers.htm>

Description: The APA City Parks Forum is dedicated to providing information on how healthy parks are fundamental to many aspects of community prosperity. This briefing series includes ten pieces: one pertains specifically to how city parks can be used for green infrastructure; another pertains specifically to smart growth.

Belzer, Dena and Autler, Gerald. "Transit Oriented Development: Moving from Rhetoric to Reality." The Brookings Institution on Urban and Metropolitan Policy. 2002. Last access: September 29, 2006. <http://www.brookings.edu/es/urban/publications/belzertod.pdf>

Description: Discusses three modern trends in American land use: new investment in America's downtown areas, suburban growth and maturation of suburban communities, and transit oriented development. At the convergence of these three trends is the realization that a substantial market exists for a new form of walkable, mixed-use urban development around these new rail or rapid bus stations and transit stops.

EPA. Community Culture and the Environment: A Guide to Understanding a Sense of Place. 2002. Last access: October 6, 2006. <http://www.epa.gov/ecocommunity/pdf/ccecomplete.pdf>

Description: The Environmental Protection Agency (EPA) has compiled this technical document of tools and methods for understanding the human dimension of environmental protection. It is designed to provide leaders in the environmental field a means for better understanding community values and processes as they relate to environmental issues, thus resulting in more effective partnerships and approaches to solving environmental problems. The tools are intended to assist communities in meeting or exceeding current environmental protection standards.

EPA. Growing Toward More Efficient Water Use: Linking Development, Infrastructure, and Drinking Water Policies. 2006. Last access: February 20, 2007.
http://www.epa.gov/dced/pdf/growing_water_use_efficiency.pdf

Description: Land use decisions are often driven by the availability of infrastructure, specifically water and sewer. This resource provides information on policies and approaches that pertain to alternative development patterns, demand for water, and infrastructure provision.

EPA. Using Smart Growth Techniques as Stormwater Best management Practices. 2005. Last access: October 6, 2006. http://www.epa.gov/dced/pdf/sg_stormwater_BMP.pdf

Description: Examples of smart growth techniques and approaches covered in this publication include: regional planning; infill development; redevelopment policies; special development districts (e.g., transit oriented development and brownfields redevelopment); tree and canopy programs; parking policies to reduce the number of spaces needed or the footprint of the lot; “Fix It First” infrastructure policies; smart growth street designs; and stormwater utilities.

Office of the New York State Comptroller: Division of Local Government Services and Economic Development. Smart Growth in New York State: A Discussion paper. 2004. Last access February 20, 2007. http://www.osc.state.ny.us/localgov/pubs/research/smart_growth.pdf

Description: The report is intended to help stimulate a vigorous debate on smart growth in New York State by providing a general background and helping to define major issues.

Pendall, Rolf; Martin, Jonathan; and Fulton, William. Holding the Line: Urban Containment in the United States. 2002. The Brookings Institution Center on Urban and Metropolitan Policy. Last access: September 29, 2006. <http://www.brookings.edu/es/urban/publications/pendallfultoncontainment.pdf>

Description: Policies designed to deliberately control the spread of urban areas are increasing in popularity throughout the United States. Several states, and many local governments in the west, are adopting urban growth boundaries and other containment measures in their land-use planning laws and legislation. Whatever the primary purpose, it is clear that the precise impacts of containment policies are not well understood. This paper reviews the research on urban containment generally, and also examines the experience of such policies in particular metropolitan areas. It discusses some lessons learned and raises relevant research questions for practitioners as well as policymakers at the state and local level.

Smart Growth Network. “Getting to Smart Growth: 100 Policies for Implementation.” 2003. Last access: October 2, 2006. <http://www.smartgrowth.org/pdf/gettosg.pdf>

Smart Growth Network. “Getting to Smart Growth II: 100 More Policies for Implementation.” 2003. Last access: October 2, 2006. <http://www.smartgrowth.org/pdf/gettosg2.pdf>

Description: Getting to Smart Growth Vol’s I and II serve as a road map for states and communities that have recognized the need for smart growth but are unclear on how to achieve it. Each volume provides 10 policy options to achieve each of the 10 Smart Growth Principles. These policies are supported with “Practice Tips” which offer additional resources or brief case studies of communities that have applied the approach to achieve smart growth. Features of the Volume II include: a list of 100 policies for implementation; case studies and examples in each chapter; and an appendix listing funding resources for smart growth projects.

US Department of Housing and Urban Development. “Redeveloping Brownfields: How States and Localities Use CDBG Funds.” 1998. Last access: September 18, 2006. <http://www.huduser.org/publications/econdev/redevelo.html>

Description: Brownfield redevelopment is recognized as a tool to reuse developed urban spaces as an alternative to developing green spaces. In this publication, researchers recommend that HUD "maintain and highlight the availability and flexibility of CDBG funds for brownfields redevelopment" without displacing or earmarking existing CDBG funding. Sponsored by HUD's Office of Policy Development and Research, the study surveys States and urban areas that receive CDBG funds about their awareness, involvement, and technical assistance needs in this area.

Open Space Modification: Preservation, Conservation and Adaptive Reuse

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Open Space Modification: Preservation, Conservation and Adaptive Reuse	Outright purchase of environmentally sensitive lands for permanent protection or management, set aside for the public good.	<ul style="list-style-type: none"> Permanent protection of open space resources 	<ul style="list-style-type: none"> High costs associated with purchase Purchase negotiations are often complex Management and stewardship considerations can be equally complex Site selection and resource allocation are difficult choices that require public dialogue and input
	Land and/or wetland banking is a process whereby entities set aside lands in anticipation of growth and development. In instances where destruction of the resource is unavoidable, lands that have been set aside can be used to offset losses.	<ul style="list-style-type: none"> Replaces impacted or destroyed lands with lands of equal or greater value Provides developers with a method of ensuring compliance with Federal and state mandates 	<ul style="list-style-type: none"> Original natural resource is permanently altered Mitigation costs are generally high Difficulty reproducing the natural conditions of original resource
	Purchase/Transfer of Development Rights programs allow landowners to sever development rights from properties in designated low-density areas, and sell them to purchasers who want to increase the density of development. TDR programs provide advantages to local governments that want to control land use but also compensate landowners for restrictions on the development potential of their properties.	<ul style="list-style-type: none"> Innovative solution that allows development to occur while simultaneously preserving open space or environmentally sensitive lands TDR programs can be easier to implement than typical zoning. TDR programs are also more permanent than traditional zoning regulations. 	<ul style="list-style-type: none"> Complexity and expense associated with negotiating TDRs or PDRs Difficulty quantifying and comparing the costs and anticipated benefits associated with PDRs and TDRs – actual benefits realized by the public may not be equal to costs invested

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Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	Redevelopment of Brownfields/Grayfields conserve space by reusing an inefficient land use. Grayfields and brownfields are located in places with existing infrastructure and access to roads and public transportation. These are located in areas with high concentrations of people, reducing or eliminating the need for new roads.	<ul style="list-style-type: none"> • Reduction of the need for development on green spaces • Reinvestment in declining neighborhoods or urban areas • Increase in tax base for communities • Reduction in the need for new infrastructure to new facilities 	<ul style="list-style-type: none"> • Complexity associated with negotiating reuse of areas • Costs associated with necessary environmental mitigation of toxic hazards
	Cost of Community Services Studies (i.e., to encourage agricultural conservation) can demonstrate to local policy makers that development often requires more in municipal services than the tax revenue it produces. Agricultural land and open space, by comparison, often brings in more tax revenue than it costs to service. These studies can help guide local decisions on development in infrastructure provision.	<ul style="list-style-type: none"> • Helps land owners, community members and local officials make informed decisions regarding open space preservation 	<ul style="list-style-type: none"> • Costs associated with conducting study

Open Space Modification: Growth Management and Compact Development

Growth Management Techniques comprise a variety of regulatory and voluntary approaches to concentrating development in existing developed areas. Less new infrastructure is needed, specifically new roads.

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Open Space Modification: Growth Management and Compact Development	Traditional Neighborhood Design is based on a more compact form of development, similar to how communities were built prior to WWII. This differs from the currently dominant pattern of diffuse development that has different uses widely separated.	<ul style="list-style-type: none"> • Compact development requires less infrastructure per capita • Dense, mixed-use neighborhoods decrease the need to travel by car • Using different parking techniques, such as shared 	<ul style="list-style-type: none"> • Difficult to mandate • Relies on the assumption that such designs are desired by the public

L RTP Non-Air Environmental Scan

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
		parking and on-street parking, can reduce the amount of surface parking lots.	
	Transit Supportive Development is a type of traditional neighborhood design that provides more connections via transit with destinations across the region, reducing the need for more roads and parking lots.	<ul style="list-style-type: none"> • Decreases the need for individuals to travel by automobile • Provides marginalized citizens (poor, elderly, disabled) with increased mobility and housing options 	<ul style="list-style-type: none"> • Costs associated with site planning and design, which can be complex
	Balanced Transportation (walking, bicycling): Encouraging forms of transportation other than the currently dominant mode (private vehicles) reduces the need for, and capacity of, roads and parking lots. Creating a balanced transportation system that encourages modes such as walking, biking, and public transit can lower the impact of transportation infrastructure on open space.	<ul style="list-style-type: none"> • Health benefits associated with walking and bicycling • Decreased traffic congestion when a critical mass of users results 	<ul style="list-style-type: none"> • Need for facility planning, management and construction of pedestrian and bicycling facilities • Winter travel is not desirable for the majority of citizens

Issue 4: Historical/Cultural Modification

Issue Description

Poorly conceived transportation projects have the ability to damage and even destroy important parts of the nation's heritage. Historical/cultural modification, therefore, refers to the alteration of features, spaces, and spatial relationships of historically and culturally significant buildings, landscapes, and sites. As outlined below, considerable legislation is in place at the federal and state levels to protect these places and many programs exist at the local level for preserving community heritage. Knowledge of and adherence to these mandates are therefore the most important best management practices relating to the preservation of these features.

Historical and cultural modification can be divided into three primary categories:

- Archaeological Sites, Historical Structures, and Significant Landmarks
- Cultural Heritage Sites and/or Places of Unique Interest
- Neighborhood Modification

1. Archaeological Sites, Historical Structures, and Significant Landmarks

Federal and state agencies need to expand and focus efforts to consult with concerned parties when deciding what resources are important and to whom they matter. This is particularly true when it comes to representatives of the communities in which resources are located. Public disclosure and consultation is required by law when Federal and state agencies are considering various undertakings, but many agencies view these requirements as time-consuming hindrances rather than opportunities for creative problem-solving. While Federal and state agencies must consult with a wide range of stakeholders when they make major land-use decisions, a number of agencies could make major improvements in the way they identify stakeholders and seek their views in planning and decision-making.

Understanding requires effective communication. Federal and state agencies need to develop mechanisms to better inform and engage communities and business groups, such as those involved with heritage tourism, in decisions about resource protection and access. They also need to develop better means for addressing the concerns and interests of groups who have a special affinity with particular historic and cultural resources, such as Indian tribes and other Native Americans.

2. Neighborhood Modification

This category refers to the disruptive effects that new transportation facilities can have on a neighborhood (in particular, new railways and highways). The construction of new transportation facilities of this type can have a dramatic and deleterious impact on surrounding neighborhoods, particularly in more densely settled areas. Community consistency and cohesiveness can be agitated or severed by new infrastructure; attempting to mitigate these harmful impacts can prove to be difficult and costly.

Transportation planning agencies must take into account the structure and community connectivity of the places where new or expanded transportation corridors are proposed. Much in the way that environmental laws discourage the bisection of sensitive areas, these same laws and processes should strongly discourage the bisection of human habitat (i.e. neighborhoods and communities). Transportation corridors should be routed around identifiable neighborhoods and communities, so as not to divide them. Where divisions have already occurred, enhancements to these corridors should seek to correct past

errors. The divisive transportation corridor should be removed and rerouted, or redesigned to be less of a barrier. For example, a high speed highway with infrequent crossings can be redesigned into a lower-speed boulevard with more frequent crossing opportunities.

3. Cultural Heritage Sites and/or Places of Unique Interest

Heritage tourism presents transportation facility planners with an alternative for protecting cultural heritage sites and/or places of unique interest which are *not* officially designated as registered landmarks. The existing transportation system can be utilized to create new linkages and promote transportation improvements that enhance safety and ease of use for pedestrians, bicyclists, boaters, and users of mass transit.

Partnerships among Federal, State, local, tribal, and private sector entities lead to the most successful heritage tourism efforts and leverage substantial additional financial and technical support. However, overcoming institutional barriers to creating partnerships, balancing resource protection with the economic and educational benefits of increased tourism, and balancing public access with security concerns are some challenges. A close working relationship with the local community is essential. The community may or may not want the economic stimulus of increased tourism. Issues include increased trash, traffic, vandalism, theft, and invasion of privacy. Citizens and local communities need a central information resource for getting information from the various agencies involved. Agencies need to share relevant information with each other.

Federal and State Mandates

Archeological and Historic Preservation Act (AHPA) (1974): Greatly expanded the number and range of Federal agencies that had to take archeological resources into account when executing, funding, or licensing projects.

Archaeological Resources Protection Act (ARPA) (1979): Protects public archeological sites before Federal authorities can issue a permit to excavate or remove any archeological resource on Federal or Indian lands.

Department of Transportation Act (1966) (Section 4f): Prohibits federal approval or funding of transportation projects that require use of any historic site unless: (1.) there is “no feasible and prudent alternative to the project,” and (2.) the project includes “all possible planning to minimize harm.”

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Executive Order 12898, 1994: Requires that federal actions consider disproportionate impacts to low-income and minority groups.

Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4601-4639): Provides for the fair and equitable treatment of persons displaced from their homes, farms, or businesses by federal or federally assisted projects.

National Environmental Policy Act (NEPA) (1969): Authorizes State Environmental Quality Review Act (SEQRA) (see below).

National Historic Preservation Act (1966) (Section 106): Authorizes the identification of registered properties and properties determined “eligible” for the National Register of Historic Places. Landmark properties are eligible to receive a measure of protection from the effects of federal and/or state agency sponsored, licensed, or assisted projects through a notice, review, and consultation process. Identification of archaeologically and historically-sensitive areas: A field check or survey and documentation determine whether an “eligible” site is indeed “significant” for listing on the National Register.

New York State Historic Preservation Act (1980) (Section 14.09): State agencies must consult with SHPO if it appears that any projects being planned may or will cause any change, beneficial or adverse, in the quality of any property that is listed on the National Register of Historic Places or is listed or eligible to be listed on the State Register. Identification of archaeologically and historically-sensitive areas can be done using the New York State Historic Preservation Office Online Resource (SPHINX, “Document Imaging for National Register,” and “GIS for Archaeology and National Register”). A field check or survey and documentation determine whether an “eligible” site is indeed “significant” for listing on the National Register.

Protection and Enhancement of the Cultural Environment, Executive Order 11593, Section 1(3), 1971: Requires that federal agencies, in consultation with the Council, establish procedures regarding the preservation and enhancement of non-federally owned historic and cultural properties in the execution of their plans and programs.

State Environmental Quality Review Act (SEQRA), 6NYCRR Part 617 of the New York State Environmental Conservation Law: Establishes a set of uniform regulations by which all state, county and local governmental agencies must incorporate consideration of environmental impacts into their planning, review and decision-making processes. If an action may have a significant adverse impact, agencies must prepare or request an Environmental Impact Statement (EIS).

Partners for Consultation

Federal Entities:

Advisory Council on Historic Preservation (ACHP)	www.achp.gov
U.S. Department of the Interior, National Park Service (NPS)	www.nps.gov
U.S. Department of Transportation (DOT)	www.dot.gov
U.S. Environmental Protection Agency (EPA)	www.epa.gov

State Entities:

New York State Council on the Arts	www.nysca.org/public/home.cfm
New York State Department of Environmental Conservation (NYSDEC)	www.dec.state.ny.us
New York State Department of Transportation (NYSDOT)	www.nysdot.gov
New York State Office of Parks, Recreation & Historic Preservation, State Historic Preservation Office (SHPO)	www.nysparks.state.ny.us/shpo

Independent Organizations:

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American Cultural Resource Association	www.acra-crm.org
Archaeological Institute of America	www.archaeological.org/
Citizen's Environmental Coalition	www.cectoxic.org
Context Sensitive Solutions	www.contextsensitivesolutions.org
National Association of Tribal Historic Preservation Officers (NATPO)	www.nathpo.org
National Conference of State Historic Preservation Officers (SHPO)	www.ncshpo.org
National Trust for Historic Preservation (NTHP)	www.nationaltrust.org
Preservation Action	www.preservationaction.org
Preservation Easement Trust, Inc.	www.preservationeasement.org/home
Preservation League of New York State	www.preservenys.org
Register of Professional Archaeologists	www.rpanet.org
Society of Architectural Historians	www.sah.org
Society of American Archaeology	www.saa.org
Society for Historical Archaeology	www.sha.org

Regional Entities:

The Arts & Cultural Council of Greater Rochester	www.artsrochester.org
Landmark Society of Western New York	www.landmarksociety.org

Inventories and Resources

FHWA. [Flexibility in Highway Design](#). 1997. Last access: February 21, 2007.

<http://www.fhwa.dot.gov/environment/flex/index.htm>

Description: When faced with extreme social, economic, or environmental consequences, it is sometimes necessary for designers to look beyond the "givens" of a highway project and consider other options. The design exception process is one such alternative. In other cases, it may be possible to reevaluate planning decisions or rethink the appropriate design. This Guide illustrates the flexibility already available to designers within adopted State standards. These standards, often based on the AASHTO Green Book, allow designers to tailor their designs to the particular situations encountered in each highway project. Often, these standards alone provide enough flexibility to achieve a harmonious design that both meets the objectives of the project and is sensitive to the surrounding environment.

FHWA. [A Guide to Achieving Flexibility in Highway Design](#). 2004.

Description: 2004 update of [Flexibility in Highway Design](#). Selected excerpts available at:
<http://www.contextsensitivesolutions.org/content/reading/guide-for-achieving-flexibility/>

FHWA, National Scenic Byways Program. [Online Forums](#). Last access: February 21, 2007.

<http://www.bywaysonline.org/forums/index.html>

Description: These online forums provide readers with an opportunity to learn about and discuss various scenic byway topics.

National Trust for Historic Preservation and Federal Highway Administration. Building on the Past, Traveling to the Future: A preservation's Guide to the Federal Transportation Enhancement Provision. 2nd Ed. Last access February 21, 2007.
http://www.nationaltrust.org/help/downloads/Building_on_the_Past.pdf

Description: Transportation enhancement funds and historic preservation projects. Examples cited from throughout the US.

Mead & Hunt, Prepared for New York State Department of Transportation. Contextual Study of New York State's Pre-1961 Bridges. 1999. Last access: February 21, 2007.
<https://www.nysdot.gov/portal/page/portal/divisions/engineering/environmental-analysis/repository/bridgescontextuastudy-99.pdf>

Description: The contextual study establishes a framework for understanding the historic and engineering significance of New York's bridges. The study includes an overview of national trends in bridge engineering, the history of bridge design and construction in New York State, and the development of New York's transportation networks.

Mead & Hunt, Prepared for New York State Department of Transportation. and Federal Highway Administration. Historic Bridge Management Plan. Last assess: February 21, 2007.
<https://www.nysdot.gov/portal/page/portal/divisions/engineering/environmental-analysis/repository/historicbridgemanagementplan.pdf>

Description: The Historic Bridge Management Plan presents practices and recommendations consistent with the needs of transportation and preservation that NYSDOT and other bridge owners can apply to their historic bridges.

National Trust for Historic Preservation. Legal Tools for Fighting Freeways and Saving Historic Roads. 2000. Last access: February 21, 2007.
http://www.nationaltrust.org/issues/transportation/legal_tools.pdf

Description: This report summarizes the law and provides excellent examples of how reviews can help protect America's heritage.

National Trust for Historic Preservation. The Returning City: Historic Preservation and Transit and the Age of Civic Revival, Part 1. Last access: February 21, 2007.
http://www.nationaltrust.org/issues/transportation/returning_city_1.pdf

National Trust for Historic Preservation. The Returning City: Historic Preservation and Transit and the Age of Civic Revival, Part 2. Last access: February 21, 2007.
http://www.nationaltrust.org/issues/transportation/returning_city_2.pdf

Description: This study illustrates how many different places can benefit by connecting historic preservation and transit. The report also examines the historic neighborhoods immediately adjacent to downtown in cities like San Francisco, Cleveland, and Chicago, highlighting methods that support rather than undermine community preservation and transit-oriented development.

New York State Department of Transportation. Transportation Enhancement Guidebook. 2006. Last access: February 21, 2007.

<https://www.nysdot.gov/portal/page/portal/programs/tep/2006guidebook.pdf>

Description: This guidebook is designed to give sponsors and applicants a general understanding of the Transportation Enhancements Program, how the New York State Department of Transportation (NYSDOT) intends to administer this federal program, and how prospective applicants and sponsors can participate.

Historical/Cultural Modification: Archeological Sites, Historic Structures and Significant Landmarks

Public disclosure and consultation is required by law when Federal and state agencies are considering various undertakings, but many agencies view these requirements as time-consuming hindrances rather than opportunities for creative problem-solving. While Federal and state agencies must consult with a wide range of stakeholders when they make major land-use decisions, a number of agencies could make major improvements in the way they identify stakeholders and seek their views in planning and decision-making.

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
<p>Historical/Cultural Modification: Archeological Sites, Historic Structures and Significant Landmarks</p>	<p>Strict Adherence to current Federal and state mandates: If funded adequately, federal and state review processes have a wide array of effective tools that can be used to conduct archeological investigations, reports, and other kinds of activities to mitigate the impacts of projects on important archeological sites.</p>	<ul style="list-style-type: none"> • Designates historic properties based on uniform national criteria and procedures • Sets boundaries for historic districts based on the actual distribution pattern of intact historic properties in the area. • Provides recognition by the federal government that an area has historical or archeological significance. • Requires the effects of federally assisted work projects (actions) on historic properties be considered prior to the commencement of work. Makes available federal tax incentives for qualified rehabilitation projects. Requires conformance to the Secretary of the Interior's Standards for Rehabilitation (36 CFR 67). • Makes a property eligible for HPF pre-development planning grants (such as plans and 	<ul style="list-style-type: none"> • Laws apply only to sites officially recognized as landmarks • Limits growth, or regulates where growth takes place. Growth must be separately addressed through local zoning ordinances and preservation planning

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Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
		specs) and also "bricks and mortar" repair grants, if selected by SHPO for grant assistance. Work projects require conformance to the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR 68).	

Historical/Cultural Modification: Neighborhood Modification

Neighborhood modification refers to the disruptive effects that new transportation facilities can have on a neighborhood (in particular, new railways and highways). The construction of new transportation facilities of this type can have a dramatic and deleterious impact on surrounding neighborhoods, particularly in more densely settled areas. Community consistency and cohesiveness can be agitated or severed by new infrastructure; attempting to mitigate these harmful impacts can prove to be difficult and costly.

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Historical/Cultural Modification: Neighborhood Modification	Strict Adherence to current Federal and state mandates: If funded adequately, federal and state review processes have a wide array of effective tools that can be used to protect neighborhoods and the people that live in them. Environmental justice	<ul style="list-style-type: none"> • Provides neighborhoods with a level of protection from serious deleterious impacts from new transportation facilities • Provides a level of protection for marginalized populations 	<ul style="list-style-type: none"> • Project planning and design process is likely to be expensive

Historical/Cultural Modification: Cultural Heritage Sites and/or Places of Unique Interest

Heritage tourism presents transportation facility planners with an alternative for protecting cultural heritage sites and/or places of unique interest which are not officially designated as registered landmarks. The existing transportation system can be utilized to create new linkages and promote transportation improvements that enhance safety and ease of use for pedestrians, bicyclists, boaters, and users of mass transit.

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Historical/Cultural Modification: Cultural Heritage Sites and/or Places of Unique Interest	Individual Best Management Practices within Heritage Tourism Sites include (but are not limited to): <ul style="list-style-type: none"> • Increasing public access through acquisition of scenic easements and scenic and historic sites • Alternative modes of access and improved access to existing recreational areas • Providing attractive and accessible parking • Signage: roadside way finding signs, safety signs, logo signs, and identification signs for trail destinations • Interpretive exhibits for scenic overlooks, rest areas, historical sites, waterfront areas and recreational sites • Historic Highway Programs (including the provision of tourist and welcome-center facilities) • Creation or enhancement of pedestrian and bicycle facilities: new bicycle lanes, sidewalk improvements, safer pedestrian crossings, landscaping and other scenic beautification, handicapped improvements, and traffic calming measures 	<ul style="list-style-type: none"> • Conscientious designs can have many added benefits, including increased tourism and an improved quality of life for local residents • Partnerships can leverage additional technical and financial support • Community values and interests will be built into new designs, adding significant value to them 	<ul style="list-style-type: none"> • Cost would increase significantly • Complexity of developing and interpreting areas could be expected to be high • Consequences of increased tourism

Issue 5: Noise Pollution

Issue Description

The dominant form of noise pollution results from transportation sources, principally motor vehicles. Noise pollution is defined as displeasing human- or machine-created sound that disrupts the environment (or environmental noise). It encompasses roadway noise, aircraft noise, industrial noise, as well as high-intensity sonar. Noise pollution associated with L RTP implementation can be divided into two primary categories:

1. Noise Pollution from Transportation Facilities

This category includes excessive sounds emanating from facilities such as railway stations, airports, or from automobile traffic along highways.

2. Noise Pollution from Construction of Transportation Facilities

This category refers to the noise pollution that can be expected to occur during the construction and maintenance of transportation facilities. This type of noise pollution is generally assumed to be temporary in duration.

Federal and State Mandates

FHWA Procedures for Abatement of Highway Traffic Noise and Construction Noise, 1997 (Federal Aid Policy Guide, Part 772): *Establishes a set of policies and procedures related to traffic noise that is to be applied to federal-aid projects. Although this is a Federal requirement, the absence of an applicable State regulation has led to the practice of applying it to 100% state funded projects. This has been incorporated in the Noise Analysis Policy of NYS DOT.*

Partners for Consultation

Federal Entities:

U.S. Environmental Protection Agency (EPA)
U.S. Department of Transportation (DOT)

www.epa.gov
www.dot.gov

State Entities:

New York State Department of Environmental Conservation (NYSDEC)
New York State Department of Transportation (NYS DOT)
Citizen's Environmental Coalition

www.dec.state.ny.us
www.nysdot.gov
www.cectoxic.org

Independent Organizations:

Acoustical Society of America (ASA)
American Academy of Audiology
American Tinnitus Association
Better Hearing Institute

asa.aip.org
www.audiology.org
www.ata.org
www.betterhearing.org

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Institute of Noise Control Engineering	www.inceusa.org
International Committee on Biological Effects of Noise	www.icben.org
Laborer's Health and Safety Fund of North America: Construction Noise Control Partnership	www.lhsfna.org
League for the Hard of Hearing	www.lhh.org
National Hearing Conservation Association	www.hearingconservation.org
National Organization to Insure a Sound-Controlled Environment (NOISE)	www.aviation-noise.org/index.htm
Noise-Free America	www.noisefree.org
NoiseOFF: The Citizens Coalition Against Noise Pollution	www.noiseoff.org
Right to Quiet Society for Soundscape Awareness and Protection	www.quiet.org
Self Help For the Hard Of Hearing (SHHH)	www.shhh.org
U.S.-Citizens Aviation Watch (US-CAW)	www.us-caw.org
World Forum for Acoustic Ecology (WFAE)	interact.uoregon.edu/MediaLit/WFAE/home/index.html

Regional Organizations:

Rochester Soundscape Society groups.yahoo.com/group/rochestersoundscapesociety

Inventories and Resources

Publications:

FHWA. The Audible Landscape: A Manual for Highway Noise. 1976. Last access: September 29, 2006.
<http://www.fhwa.dot.gov/environment/audible/index.htm>

Description: This comprehensive manual covers all major mitigation measures associated with noise pollution. Administrative techniques, such as zoning, special development concepts and other legal controls are described in detail. Municipal ownership approaches are described, such as conservation easements and other land acquisition policies. Financial incentives and other municipal services are also detailed, along with implementation strategies and resources for further study.

FHWA. Highway Noise Barrier Design Handbook. Last access: September 29, 2006
<http://www.fhwa.dot.gov/environment/noise/manual.htm>

Description: The objectives of this document and accompanying video and CD-ROM are to provide: (1) guidelines on how to design a highway noise barrier that fits with its surroundings and performs its intended acoustical and structural functions at reasonable life-cycle cost; and (2) a state-of-the-art reference of common concepts, designs, materials, and installation techniques for the professional highway engineer, the acoustical and design engineers and planners, and the non-professional community participant. This handbook may also be used as a guide for other applications such as noise barriers used to attenuate noise from rail lines, as well as noise from other sources which are not necessarily found in transportation.

The San Diego General Plan. Noise Element (Draft). 2006. Last access: September 18, 2006.
<http://www.sandiego.gov/planning/genplan/pdf/generalplan/noiseelement.pdf>

Description: City of San Diego, CA municipal plan which provides goals and policies to guide compatible land uses and the incorporation of noise attenuation measures for new uses to protect people living and working in the city from an excessive noise environment. This purpose becomes more relevant as the city continues to grow with infill and mixed-use development consistent with the Land Use and Community Planning Element.

Noise Pollution from Transportation Facilities: Improved Site Planning and Design for Minimizing Operation Noises

The most effective means of mitigating the effect of noise associated from transportation systems is improved site planning and location of such facilities. Many negative effects can be overcome if planning is begun early to allow a wide variety of physical techniques. Specific planning techniques include:

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Transportation Facility Noise Pollution: Improved Site Planning and Design	Noise Compatibility Land Use Control Programs include local land use controls that segregate residential uses from transportation facilities that generate significant noise pollution	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Difficulty and costs associated with alternative site selection
	Acoustical site planning , which involves incorporating buffer zones, such as green space	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Costs associated with consultation and additional site planning
	Public Noise Ordinances which restrict noises generated from transportation facilities such as airports and locomotive facilities. Restrictions in departure times and adjustments in airplane take off trajectories can be incorporated in order to alleviate extreme sonic intrusion within residential areas during specific periods of time	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Training of local officials Complexity Monitoring and enforcement

Noise Pollution from Transportation Facilities: Physical Techniques for Minimizing Operation Noises

Site planning and design are not always a feasible approach to mitigating noise pollution, particularly within areas where facilities such as highways or rail systems are already in place. High-density residential and business areas also limit the types of site planning and design options that are available. In cases such as these, physical techniques can be used to mitigate the adverse effects of noise pollution.

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Transportation Facility Noise Pollution: Physical Techniques	Improved highway design , which incorporates techniques in the design and structure of highways and other transportation systems that can be used to reduce noise pollution	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Costs of planning, design and construction Costs associated with alternative site selection
	Acoustical construction of pavements which can reduce the noise made from vehicle contact with the pavement	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Costs of materials and construction

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Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	Barrier construction , consisting of earthen berms, walls and fences, thick plantings of trees and shrubs, and combinations thereof	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Aesthetic impacts Costs
	Acoustical architectural design , which has typically been limited to public use structures such as schools and hospitals. Builders can be influenced to voluntarily implement noise insulators and/or reconfigure the placement of doors and windows in high-noise areas	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Costs of planning, design and construction

Noise Pollution from Construction: Analytical and Physical Techniques for Minimizing Construction Noises

Noise from construction can be difficult to manage and often must be tolerated. Heavy machinery, for example, which is the major source of noise in construction, is constantly moving in unpredictable patterns. Several approaches do exist, however, to help manage excessive construction noise if it is expected to exist for prolonged periods of time.

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Construction Activity Noise Pollution: Analytical and physical techniques	Traffic Noise Analyses include work-hour limits, equipment muffler requirements, location of haul roads, elimination of “tail gate banging,” reduction of backing up due to equipment alarms, and particularly community notification and dialogue	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Costs associated with consultation
	Computerized prediction model aides in estimating noise levels	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Costs associated with consultation
	Portable noise barriers and special quieting devices for construction equipment	<ul style="list-style-type: none"> Maintenance of quality of life 	<ul style="list-style-type: none"> Costs associated with equipment

Issue 6: Light Pollution

Issue Description

Light pollution can be construed as “annoying, wasteful or harmful” light that intrudes on an otherwise natural or low light setting. Light pollution can be associated with the implementation of transportation projects and can cause obscuring of the night sky, interfere with astronomical observatories, and can be disruptive to a variety of nocturnal species. Light that is allowed to escape into the atmosphere also represents an inefficient use of electrical power.

Federal and State Mandates

No known federal or state mandates apply.

Partners for Consultation

Federal Entities:

U.S. Department of Energy	www.energy.gov
U.S. Department of Transportation (DOT)	www.dot.gov
U.S. Environmental Protection Agency (EPA)	www.epa.gov

State Entities:

New York State Department of Environmental Conservation (NYSDEC)	www.dec.state.ny.us
New York State Department of Transportation (NYSDOT)	www.nysdot.gov

Independent Organizations:

American Astronomical Society	www.aas.org
American Lighting Association	www.americanlightingassoc.com
Amateur Observers’ Society of New York	www.aosny.org
Citizen’s Environmental Coalition	www.cectoxic.org
Citizens for Responsible Lighting (CRL)	www.crlaction.org
Environmental Advocates	www.eany.org
IDA Youth Working Group	saveourstarryskies.homestead.com
Illuminating Engineering Society of North America (IESNA)	www.iesna.org
International Association of Lighting Designers (IALD)	www.iald.org
Institute of Electrical and Electronics Engineers (IEEE)	www.ieee.org/portal/site
International Commission on Illumination (CIE)	www.cie.co.at/cie
International Dark-Sky Association (IDA)	www.darksky.org
Low Voltage Lighting Institute of the Americas	www.lvli.com
National Dark Sky Week	www.ndsw.org
National Optical Astronomy Observatory	www.noao.edu
The National Parks Conservation Association	www.npca.org
Natural Resources Defense Council	www.nrdc.org
The National Lighting Product Information Program	www.lrc.rpi.edu/programs/nlpip/index.asp

Sierra Club
U.S. Green Building Council

www.sierraclub.org
www.usgbc.org

Regional Organizations:

The Astronomy Section of the Rochester Academy of Science

www.rochesterastronomy.org

Inventories and Resources

Publications:

IESNA. Lighting for Exterior Environments: An Illuminating Engineering Society of North America Recommended Practice. IESNA RP-33-99. 1999.

Description: A comprehensive resource addressing the basics of outdoor lighting, including: terminology; approaches for appropriate community lighting designs and standards; selection of light sources and ballasts; luminaire classification; energy conservation and maintenance issues; structure lighting; roadway/street lighting; walkway/bikeway lighting; pedestrian mall/park lighting; parking lot lighting; and other applicable subjects.

International Dark Sky Association. The Problem with Light Pollution. 1996. Last access: September 8, 2006. <http://www.darksky.org/resources/information-sheets/is001.html>

Description: Short position paper regarding the problems associated with light pollution.

The Institution of Lighting Engineers. Guidance Notes for the Reduction of Obtrusive Lights. 2005. Last access: Sept 11, 2006. http://ile.org.uk/uploads/File/02_lightreduction.pdf

Description: Comprehensive overview of the issues pertaining to light pollution and light pollution mitigation.

Rensselaer Polytechnic Institute. Lighting Answers. 2004. Last access: September 11, 2006. <http://www.lrc.rpi.edu/programs/NLPIP/publicationResults.asp?type=2>

Description: Twenty-one research papers can be found in the online series "Lighting Answers." Reports cover a wide range of subjects pertaining to lighting.

Light Pollution from Transportation Facilities: Implementing IESNA (Illuminating Engineering Society of North America) Recommendations

Lighting for the outdoor environment is different than lighting an interior space. Nuances of electric lights such as glare, luminance (quantity of light), localized needs (i.e. security vs. historic lighting), and a person’s visual acuity all play a significant role in the appropriate outdoor light selection. The IESNA puts forth general recommendations that should be seriously evaluated in order to minimize the negative impacts caused by excessive outdoor lighting and light pollution.

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Light Pollution: Implement IESNA Recommendations	Cutoff considerations describe the basic way to eliminate light pollution. “Cutoff” describes the manner in which lights are mounted, the intensity and distribution of light emitted, and the degree to which light is allowed to escape into the atmosphere. The primary cutoff goals should be to address glare, light pollution into the nighttime sky, and light trespass onto neighboring properties or areas.	<ul style="list-style-type: none"> • Reduction or elimination of light pollution or light trespass on neighboring properties • Best practices in outdoor lighting can greatly improve aesthetics of local districts and neighborhoods • Cost savings through increased energy efficiency can be achieved 	<ul style="list-style-type: none"> • Costs associated with equipment are likely to be high • Professional consultation is highly recommended and can also inflate costs
	Implement community responsive design , which involves a thorough review of community lighting goals, lighting themes, and a variety of options in lighting types. The ultimate goal of community responsive design is to facilitate better site planning design or to establish guidelines that clearly explain community themes, goals, and establishing a family of luminaries for different districts. Good site planning design strives to eliminate glare on roadways, reduce lighting spillover onto adjacent properties, etc. Design guidelines discuss existing conditions, efficient technologies, appropriate pole heights and spacing, current attempts to minimize light pollution, and maintenance and component life considerations.	<ul style="list-style-type: none"> • Consistent approach to outdoor lighting can be established • Once guidelines are established, they can provide a clear framework for contractors • Proper implementation can increase the quality of life of residents and the overall aesthetic appearance of the community • Energy efficiency can be a stated goal or outcome of designs 	<ul style="list-style-type: none"> • Requires professional consultation, which inflates costs • Requires community consensus • Conflicting goals are likely to arise • Difficult to enforce without legal authority, which would generally involve passing a land use ordinance
	Land use ordinances can be drafted in order to put community guidelines into	<ul style="list-style-type: none"> • Provides the legal authority to 	<ul style="list-style-type: none"> • Local lighting laws tend to

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Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
	law; these can work in conjunction with existing land use ordinances and zoning districts.	<p>enforce community lighting goals</p> <ul style="list-style-type: none"> • Can provide a clear framework so that developers and planning boards will consider the ramifications of lighting choices more carefully • Well conceived ordinances can greatly improve aesthetics of districts and neighborhoods • Cost savings through energy efficiency can be achieved 	<p>be more complicated than local zoning codes and therefore require professional consultation</p> <ul style="list-style-type: none"> • Room for misinterpretation or misapplication • Require added resources for their proper drafting, implementation and enforcement • Inappropriate application of ordinances can create unforeseen and negative results • Costs associated with mandated equipment are likely to be high

Issue 7: Thermal pollution/Urban Heat Island Effect

Issue Description

In this context, thermal pollution refers to the raising of localized temperatures and alteration of micro-climates in urban areas. Often referred to as the “urban heat island effect,” evening temperatures are often found to be higher in urban areas primarily due to the large percentage of land covered by paved surfaces, black asphalt in particular. These surfaces are effective at absorbing heat during the day and retaining it during evenings, creating temperatures slightly higher than would be found in the absence of paved surfaces. Furthermore, vegetated areas are more effective at reflecting or absorbing heat during the day and transferring it during the evening hours.

A USEPA fact sheet on the subject states:

In general, summertime heat islands raise air conditioning demand, air pollution levels (particularly smog), and greenhouse gas emissions. They also increase the incidence of heat-related illness and mortality...Heat islands augment this public health threat by directly increasing temperature and indirectly raising ground-level ozone concentrations.⁴

Alternatives to traditional patterns of sprawling development, which depend on large road networks and other impervious surface facilities, can help to mitigate the urban heat island phenomenon. Retrofitting existing facilities can also mitigate the negative effects while simultaneously improving overall aesthetics.

Federal and State Mandates

(No known Federal or state mandates apply)

Partners for Consultation

Federal Entities:

U.S. Department of Energy
Environmental Energy Technologies Division, Heat Island Group
U.S. Environmental Protection Agency (EPA)

www.energy.gov
eetd.lbl.gov/HeatIsland
www.epa.gov

State Entities:

(No state entities were identified)

Independent Organizations:

Cool Communities
Smart Growth Network

www.coolcommunities.org
www.smartgrowth.org

⁴ EPA. Smart Growth and Urban Heat Islands.

<http://www.epa.gov/heatislands/resources/pdf/smartgrowthheatislands.pdf>

Inventories and Resources

Publications:

EPA. The Heat Island Mitigation Strategies Guidebook. Currently unavailable: anticipated release date in 2007. http://www.epa.gov/heatislands/resources/publications/miti_strat_guidebook.html

Description: Guidebook will include: benefits from reducing summertime urban temperatures; background on four mitigation strategies: (1) trees and vegetation, (2) green roofs, (3) cool roofs, and (4) alternative pavement technologies; emerging opportunities to collaborate with urban planning, energy; environment programs that have related goals; and additional technical resources.

EPA. Smart Growth and Urban Heat Islands. . EPA 430-F-03-001.

<http://www.epa.gov/heatislands/resources/pdf/smartgrowthheatislands.pdf>

Description: Two page fact sheet on the subject.

Useful Websites:

U.S. Environmental Protection Agency (EPA). Heat Island Webpage. Last accessed February 20, 2007. <http://www.epa.gov/heatislands/>

Description: General information pertaining to the urban heat island effect, including an array of useful resources.

Thermal Pollution (Urban Heat Island Effect) Resulting from Transportation Facilities: Guidelines for New Facilities and Retrofitting Old Facilities

Common paving materials such as asphalt blacktop absorb heat during the daytime hours and release it during the evening, raising overall ambient temperatures. Retrofitting facilities with alternative materials can mitigate this effect

Environmental Mitigation Measure	Mitigation Activity	Mitigation Activity Considerations	
		<i>Benefits</i>	<i>Impacts</i>
Thermal Pollution: Retrofitting Facilities	<p>Elimination or reduction of impervious surfaces, which absorb heat;</p> <p>Proliferation of urban forests and green spaces, which constitute large green areas (made up primarily of mature tree stands) that shade road surfaces from the sun and cool surrounding areas through evapotranspiration;</p> <p>Use of concrete or other surfaces that have a light color, which will reflect light as opposed to absorbing it; and</p> <p>Use of permeable surfaces or porous paving materials, which allows stormwater to infiltrate the material, having a lasting cooling effect.</p>	<ul style="list-style-type: none"> • Improvements work in concert with best management practices for managing storm water • Improvements tend to be aesthetically-pleasing • Likely to result in a notable improvement in local quality of life 	<ul style="list-style-type: none"> • Solutions are interdependent – no single approach used alone will solve the problem • Costs associated with incorporating new materials and practices can be high • Locating experienced practitioners that specialize in devising comprehensive solutions for implementation can be difficult • Reflective materials (such as concrete) can have the adverse effect of increasing light pollution, as it would reflect the light from fixtures during the evening • Added consultation for retrofitting sites or improving landscaping is likely to be necessary, inflating costs • Costs associated with incorporating new materials and practices can be high

Appendix C

GTC Congestion Management Process Congestion Mitigation Strategies Toolbox

GTC Congestion Management Process Congestion Mitigation Strategies Toolbox

The GTC Congestion Management Process (CMP) provides a mechanism for measuring the performance of the region's transportation system. When a segment of the transportation system is not performing to the regional standard, actions will be taken to improve that segment's performance within the context of the overall system and available resources. Federal regulations require a CMP to include the identification of alternative congestion management/mitigation techniques for use in the region.

The following is a guide to congestion mitigation strategies that could be applied in this region. The techniques contained herein differ dramatically in size, scope, and purpose; however, they can all be used to potentially mitigate congestion on the region's transportation system. The strategies are categorized as supply-driven and demand-driven; then further broken-down by facility type.

Supply-Driven

1. Urban Freeways – Design

A. Providing Additional Lanes Without Freeway Widening

Definition: Options for creating additional capacity on existing infrastructure such as using shoulders during peak hours (left shoulder preferred) or reducing lane widths.

Congestion Mitigation Impacts: Increased traffic capacity; increased accidents

B. Park and Ride Facilities

Definition: Location for transfer from low-occupancy (e.g., automobile, bicycle) to high-occupancy (e.g., bus, rail) modes. There are three types of park and ride facilities: remote (suburban/satellite location with express service to destination); local (on local bus route, non-express); or peripheral (CBD edge to intercept cars before entering city streets). Must be convenient, safe, and easy-to-use; and can be either exclusive or shared-use.

Congestion Mitigation Impacts: travel time savings; less parking demand at destinations; increased non-SOV mode share; reduced energy consumption and vehicle emissions

C. High Occupancy Vehicle (HOV) Facilities

Definition: Provide travel lane on highways for buses, carpools, and vanpools. Four options: exclusive in separate right-of-way; exclusive in freeway right-of-way; concurrent flow lane (in peak direction of travel, not physically separated); contraflow lane (in off-peak direction traveling in peak direction, physically separated)

Congestion Mitigation Impacts: Increase people-moving capacity on highways; decrease emissions, decrease travel times, increase transit reliability

2. Urban Freeways – Operations

A. Incident Management

Definition: Involves coordination of three stages: detection/verification; response/clearance; recovery/information. Approximately 80 percent of recorded incidents are vehicle disablements, approximately 10 percent are accidents, remainder includes emergency maintenance work, debris, etc.

Congestion Mitigation Impacts: Reduce the amount of incident-based delay or, non-recurring congestion

B. Highway Information Systems

Definition: Communicate dynamic information regarding existing traffic conditions to travelers en-route on the transportation system. Includes technologies such as variable (dynamic) message signs, highway advisory radio (HAR), and in-vehicle systems.

Congestion Mitigation Impacts: reduce speeds of vehicles nearing queues (fewer secondary accidents); diversion to alternate routes/modes

C. Ramp Metering

Definition: Involves placing a modified traffic signal at end of highway entrance ramp. Controls flow of vehicles off arterials and onto highway. Although delays are often incurred by ramp traffic, mainline capacities are protected and overall operational efficiency is improved.

Congestion Mitigation Impacts: Increases freeway capacity; discourages short freeway trips; increases volume/capacity ratio on highways; decreases accident rate

D. Highway Pricing Strategies

Definition: Levy fee for driving during peak travel times or under congested conditions or surcharge for parking in congested area. Electronic toll collection eases congestion at booths.

Congestion Mitigation Impacts: Diversion, mode switch, destination switch, trip chaining

3. Arterials and Local Streets – Design

A. Intersection Improvements

Definition: Improve intersection operations. Eleven principals: reduce number of conflict points among vehicular movements; control relative speed of vehicles entering or leaving intersection; coordinate type of traffic control devices used with volume of traffic; select proper intersection type to serve traffic volume; high volumes may require separate turn lanes; avoid multiple and compound merging/diverging maneuvers; separate conflict points; favor heaviest and fastest flows to minimize hazard/delay; reduce area of conflict (use channelization); segregate non-homogenous flows; and design for bicycle/pedestrian access

Congestion Mitigation Impacts: Reduced accident rate; improved intersection operations; slower speeds

B. Arterial Access Management

Definition: Control spacing, location, and design of driveways, medians/median openings, intersections, traffic signals, and freeway interchanges. Specific improvements involved include: physically restricting left turns; restricting curb cuts and direct access driveways; eliminating parking; locating intersections at no less than minimum intervals; constructing frontage roads to collect and funnel local business traffic

Congestion Mitigation Impacts: Reduction in accident rate; improved throughput; less conflict points

C. Reversible Traffic Lanes

Definition: One or more lanes designated for one direction of travel for part of day and the other direction of travel for another part. Meant to provide an extra lane(s) for use by dominant direction of travel. Should be used if there is evidence of congestion, notably recurring congestion, as well as adequate capacity at access points. Especially effective on bridges and in tunnels.

Congestion Mitigation Impacts: Increase capacity, high efficiency, minimal capital costs

D. Traffic Calming and Street Space Management

Definition: ITE definition: "...the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users." Focused towards lowering vehicle speeds and reducing traffic volumes, most often using physical/operational changes to streets themselves.

Congestion Mitigation Impacts: Increased transit use; decreased auto use, truck traffic, decreased bicycle/pedestrian conflicts, reduced accident rate

E. One-Way Streets

Definition: Convert existing streets to one-way pattern. Reduces intersection delays caused by vehicle turning movement and pedestrian conflicts. Can allow lane-width adjustments that increase capacity of existing lanes or provide additional lane for transit, bicycles, etc. Permit improvements in public transit operations such as routings without turnback loops and permit turns from more than one lane at more intersections than possible with two-lane operation. May have negative (real or perceived) impact on businesses.

Congestion Mitigation Impacts: Increased speeds, capacity, less congestion on adjacent streets

F. Super Street Arterials

Definition: Wide, multi-lane limited access roadways whose major intersections are grade separated.

Congestion Mitigation Impacts: Reduces congestion at major intersections

4. Arterials and Local Streets – Operations

A. Traffic Signal Improvements

Definition: Improve the operation of traffic signals by updating signal equipment and making timing plan improvements. This technique includes interconnected signal systems, traffic signal removal/installation, and improved signal maintenance.

Congestion Mitigation Impacts: Increased throughput, improved intersection operations

B. Improved Traffic Control Devices

Definition: There are three classes of signs: regulatory, warning, and guide/informational. These signs are meant to reduce the level of driver uncertainty that can lead to congestion and accidents. Markings include lanes, symbols, words, object markers, and delineators.

Congestion Mitigation Impacts: low cost, high benefit; reduced accident rate

C. Parking Management

Definition: A variety of measures designed to control the availability of, and demand for, parking in a region or sub-region. The various techniques are as follows:

- a. On-Street Parking: increase or decrease the supply; change mix of short/long-term parking; institute parking restrictions (peak/off-peak, alternate, durations, prohibitions); permit programs; preference programs; loading zone regulations
- b. Off-Street Parking: increase or decrease the supply (zoning regulations, slow growth, build new); change mix of short/long-term parking; restricted/preferential parking
- c. Fringe and Corridor Parking: fringe/peripheral parking; park and rides; preferential parking
- d. Pricing: change rates (increase/decrease, free in CBD, differential); merchant shopper discounts (stamps, tokens); employer subsidies
- e. Enforcement and Adjudication: non-police enforcement personnel (ticketing, towing, booting); administrative; judicial
- f. Marketing: advertising (brochures, maps, media); convenience programs
- g. Shared parking: two or more land uses can share same parking spaces thereby devoting less land area to parking; may cause parking shortage if land uses change

Congestion Mitigation Impacts: Discourage traffic by adjusting the parking supply

D. Computerized/Interconnected Signal Systems

Definition: Coordinate groups of signals through interconnection or time-based coordinators, systematically optimizing the signal timing parameters of pre-timed signals or the interval settings of traffic actuated signals and include advanced traffic control functions by using master computers.

Congestion Mitigation Impacts: Increased throughput, improved intersection operations

E. Arterial Surveillance and Management

Definition: Involves incident detection and follow-up action (e.g., service patrols, roving tow vehicles, motorist information system, real-time transit information at stops or via telephone); intersection surveillance and monitoring (e.g., loop detectors, signal systems, video monitoring); parking control/management on arterials with more enforcement.

Congestion Mitigation Impacts: Reduce effects on incident-based delay

F. Enforcement

Definition: To be successful, strict enforcement of these actions is needed. Includes education and outreach efforts needed to inform the public of changes to be made and their expected benefits. More enforcement officials are needed in beginning to reinforce need for behavioral changes. Law enforcement agencies should be included in the planning process.

Actions should be designed to provide for self-enforcement when possible; fines should be reasonable so as to not invoke a backlash. There could be substantial expenses involved in strict enforcement, however the benefits are typically substantial.

Congestion Mitigation Impacts: enforces mitigation actions taken, ensures impacts are felt

G. Turn Prohibitions

Definition: Discourage/prohibit undesirable traffic movements while facilitating high priority movements and desired traffic control schemes. Prohibitions can be all-day or peak-hour. Desirable vehicular paths should be clearly defined, safe speeds encouraged, and conflict points separated. There is concern over the real or perceived impacts on local businesses.

Congestion Mitigation Impacts: Reduction in accidents; increased intersection efficiency, throughput; decreased delay

H. Bicycle and Pedestrian Networks

Definition: Encourage non-motorized travel by providing continuous, connected sidewalks for pedestrians and clear, visible lanes for bicyclists. Bicycle racks/storage should be made available at transfer stations. Facilitate movement through improved bicycle/pedestrian signage. Origins and destinations should be linked with both on-street and off-street routes.

Congestion Mitigation Impacts: decreased emissions; increased non-SOV mode share

I. Freight Movement Management

Definition: Changes in delivery schedules, terminal location, and delivery zones could help minimize unnecessary congestion that occurs due to mixing of different vehicle types. Could involve: traffic management; improvements at shipping/receiving points; reducing operational/physical constraints; changes in business operating practices or public policy; and investment in rail. An off-peak hour system for urban goods movement is recommended.

Congestion Mitigation Impacts: effective strategy to reduce overall congestion, and improve goods movement through region

J. HOV Facilities on Arterials

Definition: Provide an exclusive lane for high-occupancy vehicles (buses, vanpools, or carpools) on arterials. Two methods: concurrent flow lane along curb lanes using an existing lane, parking lane, or narrowing to achieve new lane; contraflow lane - one-way streets or two-way on opposite side of median or reversible center lane.

Congestion Mitigation Impacts: decreased single occupant vehicle use, increased transit use; less energy consumption/emissions; increased capacity

5. Public Transportation Services

Improved transit service in conjunction with other strategies such as parking management, congestion pricing and development strategies can increase vehicle occupancy and decrease congestion. There are three basic types of transit: rail/fixed guideway (including busways), bus, and paratransit.

A. System/Service Operational Improvements – Fixed Route and Express Buses

Definition: Increase productivity and cost-effectiveness of transit lines/services. Fixed-route buses provide service on a regularly scheduled basis along a specific route with buses picking up and discharging passengers at specified locations. Express buses operate without stops or a limited number of stops and are geared towards commuters in outlying suburbs.

There are a number of operational strategies and route planning devices to improve the transit service. For instance, flexibly-routed smaller buses servicing suburban commercial and office complexes can be implemented at the area or network level (e.g., route extensions, timed transfers, network realignment, feeders into line-haul services). Can focus on route structure and reliability (e.g., point/route deviation, zonal service, route replacement/consolidation, changes in route departures, use of automatic vehicle locator (AVL) devices), or can provide improved passenger services (e.g., bus shelters, passenger information, trailblazing to stations, marketing, or consolidated fares/passes).

This is most flexible form of transit since it can be re-routed, deviated, and/or rescheduled quickly. Off-peak ridership is more sensitive to changes in service. Ridership often responds more favorably to more frequent service than decreased travel time. Important to keep transfers to a minimum, increasing transfers will lead to decreasing ridership.

Congestion Mitigation Impacts: increased transit ridership; the percentage increase or decrease in ridership is less than the corresponding increase or decrease in service changes.

B. Fare Structures

Definition: Differentiation in fare structure can be used to enhance mobility options for target markets or to provide added incentive in specific geographic areas. One method is to differentiate by traveler type:

Demographic/socioeconomic aspects (e.g., age, income)

- a. Affiliation (e.g., employee, student)
- b. Mobility-impaired
- c. Frequency of use
- d. Payment method

- e. Time commitment of purchase (e.g., one-time, annual)

Another method is to differentiate by trip type:

- a. Specific origin/destination points
- b. Transit trip length or duration
- c. Quality of service (e.g., speed, crowding) by line or corridor
- d. Quality or price of competing service (e.g., congestion, tolls)
- e. Timing of trip
- f. Routing of trip
- g. Direction of trip
- h. Use of complementary modes
- i. Size of travel party

There are other reasons for differentiated fare structures, such as:

- a. Market building fare reductions
- b. Sales commissions for fare media distribution channels
- c. Joint promotion with other businesses or uses for payment media
- d. Two-part fare structures (e.g., time-based subscription with a use-based charge)

Fare elasticity is an important consideration. This is the ratio of percent change in transit ridership over percent change in fare. For every 1% increase/decrease in fares, ridership will increase/decrease 0.2-0.4%. Although the transit industry is increasingly embracing market-based pricing, there is concern about the equity implications of charging one individual more than another for same trip.

Congestion Mitigation Impacts: Increase transit ridership

C. System/Service Expansion: Rail/Fixed Guideway Transit Facilities

Definition: This form of service expansion can move large numbers of persons quickly, efficiently and reliably. There are five different options presented for this strategy:

- a. Automated Guideways/Peplemovers: Circulation systems relying on automated guideway technology to provide direct service to stations. Suited for use in high-density urban sites, often as connections to high-capacity, high-speed services.
- b. Light Rail: Medium capacity (<20,000 persons/hour) service operating on either grade-separated or reserved right-of-way, mixed traffic (streetcars), or a combination. Passenger platforms can either be low or high-level. Operation is usually manual and can occur either individually or in trains and can couple/uncouple easily. Suited for service to non-residential concentrations of 35-50 million square feet and residential areas with 9 units/acre. Light rail is much less expensive than heavy rail due to its' flexibility, but has less carrying capacity.
- c. Commuter Rail: Operates between urban centers and suburbs, often using mainlines with high-speed locomotives or self-propelled cars in trains. Best suited for service in areas with more than 100 million square feet of non-residential development. Can come on-line easier and faster than other forms. Although it

may be the cheapest rail service to build, commuter rail incurs heavy operating costs. Commuter rail conflicts with freight rail and is not convenient for handling reverse commutes or mid-day/off-peak commutes.

- d. Heavy Rail: High speed (~80 mph), high capacity (>20,000 persons/hour); exclusive right-of-way with multiple car trains, sophisticated signaling, platform loading at stations; third rail power supply and high degree of automation. Best suited for high-density areas (>12 units/acre) and high level of non-residential development (>50 million square feet). This is the most expensive transit option.

Congestion Mitigation Impacts: Direct impact on congestion is number of drivers diverted to service. Relies on package of incentives/disincentives ranging from tax breaks, zoning variances, public land purchases, and parking management.

D. Joint Development

Definition: Includes actions meant to share costs and/or revenue associated with transit stops/stations. Such actions are typically taken in conjunction with a rail transit station.

Numerous options for joint development are available. Revenue-sharing actions include:

- a. Leases: transit agency leases parcels, development rights, or unimproved space to developers or commercial tenants
- b. Facility Connection Fees: fee to connect a project to a transit station
- c. Land Sales
- d. Benefit Assessment Districts: special districts around transit stations where landowners pay on a pro-rated basis to help finance the public facility
- e. Tax Increment Financing (TIF): the property tax base in a special district is frozen and all gains above that point are earmarked for financing a transit facility
- f. Transit Impact Fee: developers are required to make one-time contribution to account earmarked for funding transit facilities needed to accommodate growth
- g. Negotiated Payments: negotiate with landowners to pay for transit investment

Cost-sharing actions include:

- a. Voluntary Agreements: transit agencies and developers agree to reduce each others' costs through coordination
- b. Incentive-Based Agreements: public authorities grant developers a bonus in exchange for partial or full-funding of on-site public infrastructure
- c. Mandatory Programs: developers are required to finance certain actions as a precondition to receiving a building permit

Congestion Mitigation Impacts: Reduce number of trips

E. System/Service Operational Improvements – Paratransit Services

Definition: Differs from standard ADA-related paratransit service. In this context, paratransit services include carpools, vanpools, subscription buses, shared-ride taxis, and route deviation services. Best suited for serving highly dispersed travel in low-density areas.

Private/contracted delivery of non-traditional services is cheaper and generally more cost-effective than public delivery. Biggest barriers to successful provision of paratransit service are restrictive regulations, subsidized bus fares, and prevalence of free parking.

Congestion Mitigation Impacts: increased transit ridership

F. Transit-Oriented Development (TOD) / Livable Communities

Definition: Requires local governments to establish a land use planning policy that promotes transit use. It is imperative that easy and convenient access to transit facilities is provided as well as other services that are supportive of transit. Characterized as dense and mixed use within a 5-10 minute walk of a transit stop. Increases transit use to employment centers; occurs in regions with a vision of a desired settlement pattern; occurs in regions where political culture supports transit; requires high quality transit service; and requires stations with development potential.

Congestion Mitigation Impacts: increase non-SOV trips; trip generation more evenly distributed through day and week; decrease VMT

Demand-Driven – Transportation Demand Management (TDM)

TDM is any action or set of actions aimed at influencing people's travel behavior in such a way that alternative mobility options are presented and/or congestion is reduced.

1. Site-Specific and Area-Wide Strategies

A. Alternative Modes of Transport

Definition: Encourage commuters to use modes of transportation other than the single-occupant vehicle. Ridesharing (i.e., carpool or vanpool) is one option. Ridesharing programs can be either company-sponsored, third party, or owner-operated and can be provided at four levels:

- a. regional
- b. sub-regional by government
- c. sub-regional by private employers
- d. residential

Another option is non-motorized transportation (i.e., bicycling and walking). It is important to provide an environment conducive to bicycling and walking. Bicycle lockers and/or racks should be found near destinations.

Congestion Mitigation Impacts: Decrease VMT, trips, emissions, costs, less congestion, parking demand

B. Alternative Hours to Travel

Definition: This strategy takes into consideration the times that the majority of commuters take to the roads to get to work. Changing those times can dramatically affect the numbers of drivers on the roads during traditional peak hours. One option here is the staggered work hour concept where groups are assigned different times to begin work. This allows workers to travel at times when traffic moves more freely and transit is less crowded.

Another choice is flextime, which allows employees to choose their own schedules within company-set guidelines. A third option is the compressed workweek, which consists of a four-day workweek in 10-hour days. This has a double impact since there is one day of

commuting eliminated and the early arrivals and late departures mean workers are traveling in the off-peak.

Congestion Mitigation Impacts: less peak hour traffic, less transit crowding, less parking pressures, decreased VMT (compressed work week)

C. Negotiated Demand Management Agreements

Definition: Government-mandated private sector involvement in traffic mitigation as a condition of individual development approval. In this, a municipality would set a traffic reduction goal (e.g., minimum level of ridesharing, specific number of auto trips) that can vary in degree of prescription concerning implementation. These are similar to trip reduction ordinances except negotiated demand management agreements are focused on a particular site and so do not provide area-wide consistency in trip reduction.

Congestion Mitigation Impacts: Ridesharing, transit trips increase; auto trip-making shifts to non-peak

D. Complementary Support Measures

Definition: TDM program effectiveness is directly related to the degree to which complementary measures are used to encourage the use of TDM actions. Such complementary support measures could include financial incentives. Defined as any action which adds or reduces the perceived cost of a particular mode will greatly influence the likelihood of it being chosen, financial incentives include:

- a. Transportation allowances
- b. Bicycle/pedestrian subsidies
- c. Carpool/vanpool subsidies
- d. Transit/transit pass subsidies
- e. Additional time off with pay

There are also assistance programs that can accomplish similar goals, such as:

- a. Commuter information centers/information booths/fairs
- b. New hire orientations
- c. Marketing
- d. Rideshare match
- e. Company-owned/leased vanpool
- f. Parking management

As mentioned previously, flexible work schedules (e.g., flextime, telecommuting, compressed workweek) will help further TDM as will rewards programs such as newsletter recognition or prize drawings and other things such as childcare centers, auto service, and assorted on-site services.

Congestion Mitigation Impacts: Unknown

E. Alternative Workplace Locations

Definition: Also known as telecommuting, this strategy would replace the traditional workplace with an alternative site. Telecommuting can occur either at home, at regional

worksites, or at a neighborhood telecommuting center. Implementation of such a program requires the support of top management and the human resources department.

Congestion Mitigation Impacts: Decrease trips, VMT, emissions/cold starts

F. Advanced Traveler Information Systems (ATIS)

Definition: These systems provide new ways to distribute expanded information to travelers for both pre-trip and en-route elements of trip making. ATIS provides multi-modal information for all system services so that travelers can make informed decisions on mode and route choice, or even whether the trip should be made.

Congestion Mitigation Impacts: Reduced travel time, increased network efficiencies

G. Growth Management

Definition: Growth management is the use of public policy to regulate the location, geographic pattern, density, quality, and rate of growth of development. Growth is to be limited to a level consistent with the existing capacity of infrastructure and level of service desired.

Congestion Mitigation Impacts: efficient service provision, infrastructure cost savings

H. Urban Design

Definition: Strategies that can enhance personal mobility include creating greater development densities, promoting mixed-use, pedestrian and transit-friendly site designs. Similar to transit-oriented development (TOD), this type of development would have much greater numbers of transit trips and bicycle/pedestrian trips than a typical auto-oriented development. Such a strategy requires modification of design guidelines. Standards should be established for transit stops, street configuration (connectivity), pedestrian connections, commercial configuration (clustering), building entries, building setbacks, mixed housing, parks, parking configuration, etc.

Congestion Mitigation Impacts: Decreased emissions, more transit trips, more non-motorized mode trips

I. Parking Management

Definition: Ninety five percent of all auto trips receive free parking, thus a parking management program must be implemented area-wide for it to be effective. There are two ways to view parking management; pricing and supply management. In the pricing side of parking management, there are a number of strategies available:

- a. Impose or increase fees or surcharges for single occupant vehicles or long-term parkers at public facilities
- b. Carpool/vanpool price preference
- c. Tax on parking providers
- d. Impose parking pricing mechanisms through regional regulations
- e. Tie investment in road improvements to implementation of parking management actions
- f. Remove or reduce employer-provided parking subsidies
- g. Reverse "early bird" incentives that encourage long-term commuter parking

- h. Provide preferential pricing to HOV users
- i. Develop parking regulations and pricing that reflects the true cost of providing parking

On the supply management side, there are a few strategies available as well:

- a. Parking regulations in zoning code
- b. Use of on-street controls
- c. Control amount of publicly-provided parking spaces

Congestion Mitigation Impacts: mode switch, change trip patterns

J. Trip Reduction Ordinances

Definition: Use the community's regulatory authority to limit trip generation from a development site. These ordinances can potentially achieve more significant trip reductions because they usually cover an entire local political subdivision rather than just an individual project. These spread the burden more equitably between existing and future development.

Congestion Mitigation Impacts: Ridesharing, transit trips increase; auto trip-making shifts to non-peak

K. Congestion Pricing

Definition: Charge a premium to motorists who wish to drive during peak periods or on congested facilities using tolls, entrance fees, parking charges, etc. Drivers can react to congestion pricing by either accepting it, adopting another mode, going another route, including more passengers to share the cost, or foregoing the trip. Six types of congestion pricing exist around the world:

- a. parking surcharges in congested areas
- b. point pricing at a specific location
- c. cordon pricing (vehicles are charged upon crossing a boundary)
- d. zone pricing (vehicles in a particular zone are charged a fee)
- e. pricing based on distance traveled in congested areas
- f. pricing based on time spent on congested facilities

Congestion Mitigation Impacts: mode shift, air quality

L. Auto-Restricted Zones

Definition: Commonly referred to as pedestrian or transit malls, these are any areas where vehicular travel is prohibited or restricted in some manner. This can be achieved through either physical barriers to auto access; parking controls; exclusive use lanes; or turn prohibitions. Three reasons to create an auto-restricted zone are to: preserve and enhance the vitality of urban centers; improve the environmental quality of urban centers; and encourage the use of non-auto modes.

Congestion Mitigation Impacts: reduce pedestrian delay and/or pedestrian congestion; increase transit usage