



**Virginia's Long-Range Multimodal
Transportation Plan
2007-2035**

**Natural and Human
Environment
Report**

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Introduction

Stewardship of Virginia's human and natural environment and the promotion of environmental quality are priorities of the Commonwealth's transportation agencies. A sound transportation system must address the relationship between the movement of people and goods, and the impact upon the environment. The Commonwealth's transportation agencies work closely with federal, state, regional, and local governments and offices to coordinate and preserve Virginia's environment and natural resources. The agencies strive to protect and enhance the aesthetic value of transportation corridors in order to preserve quality of life for our citizens.

Today, approximately 42 percent of the energy consumed in Virginia is for the transportation of goods and services. This massive consumption can negatively affect air, noise, and water pollution levels if not properly managed, and the resulting impact on climate change has emerged as a global concern. Until the latter part of the 20th century, transportation decisions were made with little consideration of the environmental impacts. Roads and airports were built through wetlands, parks, neighborhoods, and other environmentally sensitive areas, and public transportation services were allowed to decline. Loss and/or degradation of habitat endangered some species. As a result of the National Environmental Policy Act of 1969, Clean Air Act, Clean Water Act, and a better informed and involved public, environmental considerations and community impacts are now an important part of transportation decision-making. In fact, transportation projects are now expected to include mitigation measures, and in many cases improvement of the environment to support community needs.

This section of the VTrans2035 report focuses on the affects that transportation planning activities can have on the human and natural environment, and highlights some of the progress that the Commonwealth has made in recent years to help improve in these areas. This report begins by addressing the impact that transportation activities can have on climate change and energy usage, and includes a summary of the findings and recommendations of the Governor's Commission on Climate Change. The report then addresses the impact that transportation projects can have on air quality, water quality, noise, cultural and historic resource preservation, and habitat preservation. A discussion of State and Federal environmental review processes ensues, followed by a discussion of how transportation activities can affect the quality of life, and of potential environmental mitigation activities that can help reduce adverse environmental impacts. It concludes with a set of strategies that the Commonwealth plans to implement to help further improve the natural and human environment where additional progress is still needed.

Climate Change and Energy Use

Climate change refers to any significant change in measures of climate (e.g., temperature, precipitation, or wind) lasting for an extended period of time. Climate change can result from natural factors such as changes in the sun's intensity or in the Earth's orbit around the sun, natural processes within the climate system such as changes in ocean circulation, and from human activities that change the atmosphere's composition (e.g., through burning fossil fuels) and the land surface (e.g., through deforestation, urbanization, etc.). The burning of fossil fuels releases certain gases, commonly referred to as greenhouse gases (GHG), which can trap heat in the atmosphere and cause the Earth's temperature to rise. The most common GHG are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases.

Climate change has emerged as an international concern in recent years, and efforts to curb GHG emissions have become an important public policy objective at the local, state, and federal levels of government. According to the Intergovernmental Panel on Climate Change (IPCC), current climate models predict that the Earth's atmosphere will warm between 1.1°C to 6.4°C by the end of the 21st century under various scenarios, and the best estimate for the mean temperature rise is 2.8°C.

Climate change poses serious and growing threats to Virginia's roads, railways, ports, utility systems and other critical infrastructure, as it is widely believed that elevated atmospheric temperatures will lead to rising sea levels. Sea level rise is a major concern for coastal Virginia, particularly in the highly populated Hampton Roads region, as existing hazards such as storm surge, coastal flooding and erosion will become more severe because of sea level rise. The Chesapeake Bay Program's Scientific and Technical Advisory Committee projects that sea levels in the Chesapeake Bay region will rise between 2.3 to 5.2 feet by the end of the 21st century. Across the Commonwealth, an increased frequency of severe storms could produce more frequent and intense flooding and other hazards such as more frequent tornados. Ironically, unstable weather patterns could also produce periods of extended drought that threaten all municipal and private water supplies. Temperature rise and the threat of more frequent and intense heat waves can also seriously impair the functioning of critical infrastructure such as roads and bridges since they will be more prone to failure due to extreme heat expansion and contraction.

Climate change is also likely to have wide-ranging and adverse impacts on human health, both directly and indirectly. Extreme weather events (e.g., floods, droughts, hurricanes or windstorms, wildfires and heat waves) can directly affect health through injuries, drowning, or mental health problems. These extreme weather events could lead to compromised water and food supplies resulting in increases in waterborne and food-borne illnesses. Indirect impacts could include disruptions of natural systems that could also make vector-borne diseases (i.e., arthropod-borne diseases such as West Nile virus, malaria, dengue and Lyme disease) to spread or emerge in areas where they had been previously limited or non-existent. Climate change is also expected to increase the

incidence of diseases associated with air pollutants and aeroallergens and exacerbate other respiratory and cardiovascular conditions. An increase in the amount of precipitation is very likely in high latitudes, while decreases are likely in most subtropical regions. Increases are not evenly distributed throughout the year; rather, major rain events followed by extended droughts are expected.

Energy consumption is the largest manmade contributor to GHG emissions. Transportation accounts for approximately 42 percent of the energy consumed in Virginia, and approximately 61 percent of this is attributed to gasoline use. The three largest sources of GHG emissions in Virginia are electricity generation, transportation, and non-utility uses of fuel in industrial, commercial, and residential facilities. Emissions from all of these sources must be addressed in order for climate change mitigation efforts to be successful. The transportation sector accounts for approximately 31 percent of manmade GHG emissions in Virginia, and therefore any comprehensive efforts to curb GHG emissions will likely involve transportation policy and practices.

The 2007 corporate average fuel economy (CAFE) standards adopted by Congress are expected to significantly decrease transportation-related GHG emissions in Virginia, since a vehicle fleet averaging 35 mpg will emit significantly less GHG emissions than one averaging 25 mpg. The Virginia Department of Environmental Quality (VDEQ) has completed a preliminary analysis of the effect of the 2007 CAFE standards and projects that the Commonwealth will see a 20 million metric ton reduction from the business-as-usual (BAU) forecast in 2025. This would represent a 30% reduction from the projected transportation GHG emissions in 2025.

In September 2007, Governor Timothy M. Kaine released the Virginia Energy Plan, an implementation document designed to demonstrate how the General Assembly-enacted state energy policy (SB-262; *Code of Virginia* § 67-100) could be executed. Included in the Virginia Energy Plan was the recommendation that the Governor create a commission to address climate change and its possible impacts on Virginia.

Governor Kaine responded by issuing Executive Order 59 (2007), establishing the “Governor’s Commission on Climate Change.” Executive Order 59 charged the Commission to create a Climate Change Action Plan that would do the following:

- Inventory the amount of, and contributors to, Virginia’s GHG emissions, and projections through 2025;
- Evaluate expected impacts of climate change on Virginia’s natural resources, the health of its citizens, and the economy, including the industries of agriculture, forestry, tourism, and insurance;
- Identify what Virginia needs to do to prepare for the likely consequences of climate change;
- Identify the actions (beyond those identified in the Energy Plan) that need to be taken to achieve the 30% reduction goal; and
- Identify climate change approaches being pursued by other states, regions, and the federal government.

The work of the Governor's Commission on Climate Change represented the first comprehensive global warming climate change initiative undertaken by the Commonwealth to date. The Commission was comprised of more than 40 citizens that included scientists, economists, environmental advocates, and representatives from the energy, transportation, building, and manufacturing sectors. The Commission also included local government representatives and state lawmakers from the VDEQ, VDOT, the Virginia Department of Conservation and Recreation (VDCR), the Virginia Department of Health (VDOH), the Virginia Department of Agriculture and Consumer Services (VDACS), and the Virginia Department of Forestry (VDOF).

The final Climate Change Action Plan, which includes the full list of recommendations as adopted by the Climate Change Commission, can be downloaded from the following website; <http://www.deq.virginia.gov/info/climatechange.html>. Taken directly from the Action Plan, the following recommendations pertain specifically to the transportation sector, and also include individual actions that should be pursued to achieve them.

Virginia will advocate for federal actions that will reduce net GHG emissions.

- The Secretary of Transportation should work with stakeholders to develop specific goals and priority measures for the coming reauthorization of the federal surface transportation act that will reduce the GHG emissions from transportation. The Governor should ask Congress to incorporate these goals and measures into the transportation reauthorization legislation.

Virginia will reduce GHG emissions related to vehicle miles traveled through expanded commuter choice, improved transportation system efficiency, and improved community designs.

- The General Assembly should amend current law pertaining to the Statewide Transportation Plan to require that the Plan include coordination of transportation and land use as a key policy goal and to require the Plan to include quantifiable measures and achievable goals relating to GHG reduction.
- The VDRPT should expand the Telework!Va program and encourage private employers to adopt these standards and should consider rewarding high-performing public and private employers.
- State and local transit and rail funding should be increased, first to maintain existing infrastructure and services, second, to meet increasing demand by expanding the frequency and scope of transit and rail services across the Commonwealth, and, third, to encourage local and regional land use patterns which minimize GHG emissions.
- Within its allocation formula and funding decisions, the CTB should target available transportation funds towards existing communities and designated urban development areas and promote compact, walkable, transit-oriented development areas. VDOT and natural resources agencies should provide technical assistance, funding, and authority to localities to amend comprehensive plans and zoning

ordinances to promote compact, walkable, transit-oriented development areas and to guide development to such areas.

- The CTB should study and evaluate the impact of High Occupancy Toll (HOT) lane networks on GHG emissions. This should be considered as one factor in deciding whether to expand HOT lane networks.
- Virginia should require that environmental analysis and review of major transportation projects/networks include projections of the resulting GHG emissions. Virginia's metropolitan planning organizations (MPO) should include consideration of GHG emissions in their regional transportation analyses and seek outcomes that help reduce GHG emissions. The CTB should use such analyses in its consideration of project selection.
- The CTB has amended its road construction standards to make new or upgraded roads more pedestrian and bike-friendly. The CTB should ensure that funding is available for localities to implement these standards, develop and provide funding and technical assistance to encourage local governments to construct pedestrian and bicycle improvements, and compile and coordinate local and regional plans to develop a pedestrian and bicycle network.
- The Secretary of Transportation should explore ways to send consumers better, more accurate signals of the costs of transportation. Pricing transportation on miles driven and on the timing and congestion of the trips taken can do much to reduce and consolidate discretionary travel (as much as 40% of all trips and 54% of trips during peak periods).
- The Commonwealth should fund and support, through VDOT and other agencies, such as the Virginia Department of Housing and Community Development, the Virginia Housing Development Authority, the VDRPT, and the VDMME, working with Planning District Commissions, MPOs, and local governments, a set of statewide region-by-region scenario analyses of local transportation and land use planning. This effort should model and compare the differences in transportation and infrastructure costs, land used, environmental impacts, housing availability, energy, water, fuel used, and GHG emissions of compact versus sprawling land use patterns.
- The Secretary of Transportation should evaluate the costs/benefits of a commuter tax credit, offering businesses tax savings for providing their employees with transportation benefits that provide an alternative to single occupancy vehicle commuting, such as transit passes, vanpool expenses, and cash in lieu of parking.
- VDOT should amend its corridor analysis and project analysis process to make sure that transit, freight and passenger rail, and other transportation modes are included in every analysis. VDOT should develop and implement access management plans to preserve new transportation corridors and to help restore the capacity of existing roads.
- VDOT should adopt a "complete streets" policy to design and operate roadways to allow safe, attractive, and comfortable travel for all users.
- VDOT should develop and provide funding and technical assistance to local governments to amend zoning codes that currently establish excessive minimum parking space standards and encourage local governments to apply parking maximums, market pricing of parking, shared parking, and other tools.

Virginia will reduce GHG emissions from automobiles and trucks by increasing efficiency of the transportation fleet and use of alternative fuels.

- VDOT should promote and support siting of refueling and recharging stations for low-carbon fueling stations on state and local government-owned land, including interstate highways, rest stops, and truck stops. VDOT should assess the feasibility and benefits of vehicles that can plug into the electric grid and identify and enhance plug-in charging areas and services to make and market Virginia as “hybrid friendly.” VDOT should work with alternative fuels providers to enable convenient location of alternative fuels infrastructure and with equipment and vehicle manufacturers to support a vibrant alternative energy market in Virginia.
- The Secretary of Transportation should investigate the availability of existing funds to support a program that seeks to reduce emissions from older diesel engines (e.g., trucks, school buses) through the establishment of a retrofit or retirement program, including incentives that encourage retrofits.
- The Secretary of Transportation should investigate the availability of existing funds to support increased enforcement of the state anti-idling statute and evaluate the cost effectiveness of providing state funding to accelerate the electrification of truck stops and the adoption of anti-idling technology.
- The Secretary of Transportation should promote efforts to educate all drivers, including those taking driver education, about behavioral changes that can significantly boost energy efficiency, including considering participating with other states in EcoDrivingUSA.
- The CTB should create signalization standards to improve the timing and intelligence of traffic signalization across the Commonwealth in order to support improved traffic flow, transit preference and priority, and improved pedestrian access. The CTB has established roundabouts as the preferred alternative for projects involving reconstruction of intersections or new intersections, when roundabouts are determined to be feasible. The CTB should establish simple design criteria to make roundabouts easier to build.

Virginia will reduce GHG emissions by increasing the proportion of energy demands that are met by renewable sources.

- VDOT should, in cooperation with local governments, allow its rights-of-way to be used for connection of renewable power projects, such as from solar and wind sources, or combined heat and power projects to the power grid.

Virginia will reduce net GHG emissions by protecting/enhancing natural carbon sequestration capacity and researching/promoting carbon capture and storage technology.

- VDOT should amend its landscaping standards to minimize mowing, support tree preservation and planting, where appropriate, as infill and as part of construction site stabilization practices and increase carbon retention.

The Commonwealth and local governments will lead by example by implementing practices that will reduce GHG emissions.

- In cooperation with adjacent states and the federal government, VDOT, Virginia Department of General Services (VDGS), and the Virginia Department of Education (VDOE), working with other agencies such as the VDEQ and Virginia Department of Mines, Minerals, and Energy (VDMME), should implement standards for government use of alternative transportation fuels (such as biodiesel or low-carbon fuels), equipment, and vehicles – all of which reduce GHG emissions compared with traditional fuels, equipment, or vehicles.
- All state agencies and institutions and local governments should take necessary actions to minimize vehicle miles traveled related to state and local operations. Virginia agencies and institutions should implement programs to promote alternatives to driving, including creating new or expanded benefits for state workers who take transit, walk, or bike to work, and create program examples for local governments and private businesses.

Virginia state agencies and local governments will prepare for and adapt to the impacts of climate change that cannot be prevented.

- The Secretary of Transportation should ensure that climate change impacts, particularly sea level rise and storm surge vulnerability in coastal areas of Virginia, are taken into account in all transportation planning, project design, and prioritization of projects for funding as well as transportation systems management, operations, and maintenance. Where existing transportation infrastructure already is vulnerable to sea level rise, more intense storm events and other climate change impacts, state, regional, and local transportation agencies should develop plans to minimize risks, move infrastructure from vulnerable areas when necessary and feasible, or otherwise reduce vulnerabilities.
- State agencies and local governments should develop climate change adaptation plans for critical infrastructures for which they are responsible. Climate change impacts, particularly sea level rise and storm surge vulnerability in coastal areas of Virginia, should be taken into account in all critical infrastructure planning, project design, and prioritization of projects for funding, as well as infrastructure management, operations, and maintenance. VTrans2035, the Commonwealth's statewide long-range multimodal transportation plan, should include a complete reevaluation of the state's transportation plans, capital investment programming, and projects in light of climate change, higher energy prices, and changing demographics.

The Climate Change Commission finalized the Climate Change Action Plan on December 15, 2008.

Air Quality

In response to the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for various pollutants, called criteria pollutants, that adversely affect human health and welfare. The three major transportation-related criteria pollutants are;

- Ozone (O₃) and its key precursors to control and reduce: volatile organic compounds (VOC) and nitrogen oxides (NO_x). Ozone is the main component of summertime smog.
- Fine Particulate Matter (PM_{2.5}), such as road dust, dirty diesel exhaust, etc.
- Carbon Monoxide (CO), a product of combustion that is also a blood-oxygen asphyxiate.

Other non-transportation criteria pollutants exist that include sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and lead (Pb). In the past, motor vehicles were a major source of lead emissions but these were virtually eliminated when leaded gasoline was phased out in the 1970s.

Toxic air pollutants (or air toxics) are pollutants that cause or may cause cancer or other serious health effects, such as birth defects. The CAA identifies 188 air toxics, and EPA has identified 21 of these as mobile source air toxics, including diesel particulate matter, benzene, and other organic material and metals, however the EPA has not set NAAQS for these as of yet.

Although transportation systems can contribute to poor air quality, significant progress has been made in reducing criteria pollutant emissions from motor vehicles and improving air quality in the last few decades, even as vehicle travel has rapidly increased. Federal, state, and local regulations are now in place to reduce mobile source pollutant emissions. Through the federal CAA and state implementation plans, numerous strategies have been developed and implemented to reduce transportation emissions. Vehicle engine and fuel standards (diesel and gasoline) are now much more stringent than in the past. In addition, vehicle emissions inspections, reformulated gasoline, gasoline vapor recovery controls, and many other local transportation emission reduction measures are now in place in many parts of Virginia.

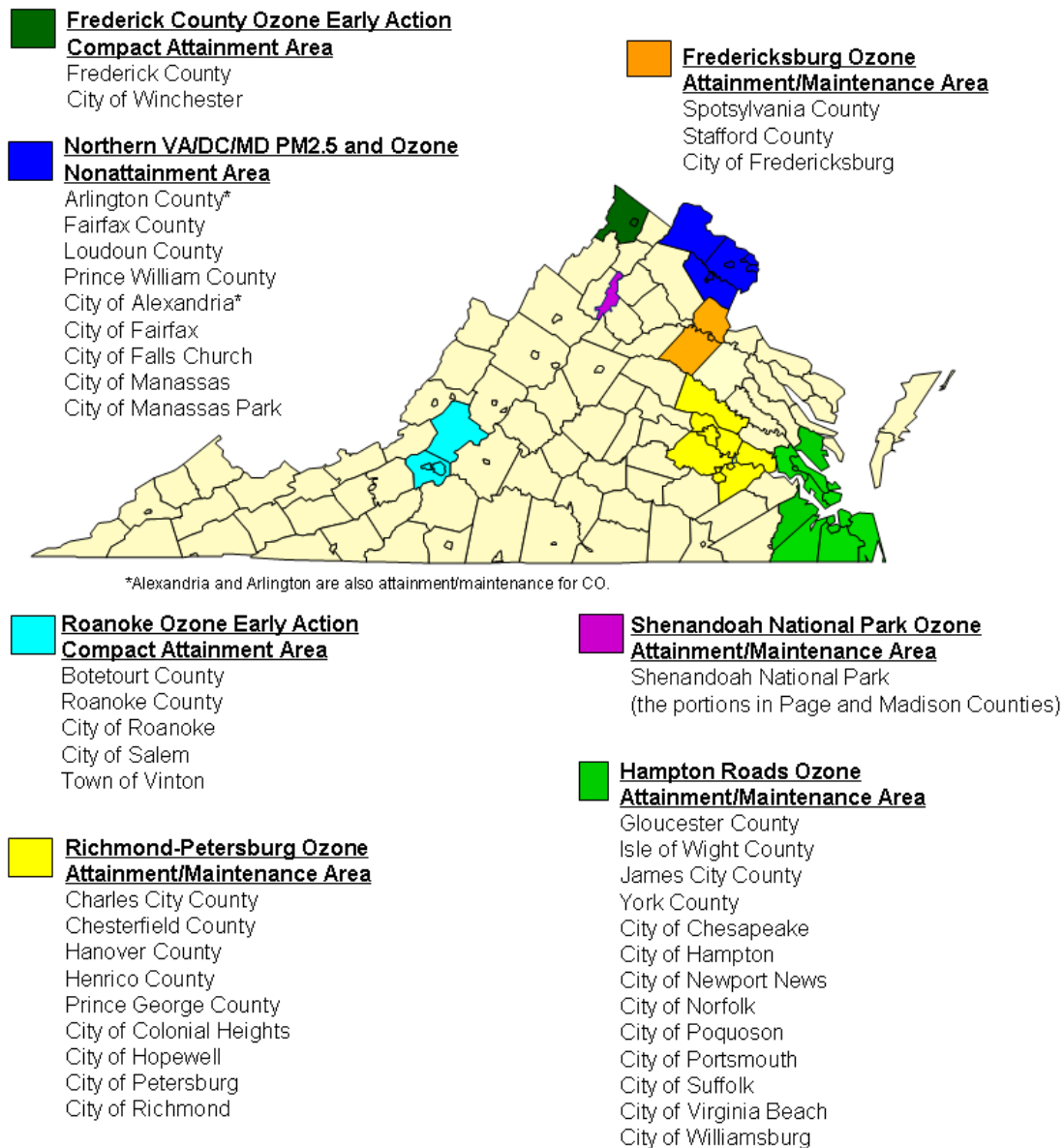
The air quality impacts of transportation plans, programs, and individual projects are analyzed for their environmental impact prior to implementation as mandated by the National Environmental Policy Act and the Clean Air Act transportation conformity rule. The air is noticeably cleaner today than in 1970, and total criteria pollutant emissions from motor vehicles are significantly less than they were in 1970 despite a near tripling of vehicle miles of travel nationally. With the reduction in criteria pollutants, many air toxics emissions have also been reduced.

Still, challenges remain. In 1997, EPA lowered the air quality standards for both fine particulate matter and ozone, and again in 2006 and 2008, respectively, to reflect

improved understanding of the unhealthy medical effects of these pollutants. While Virginia has made great progress in reducing air pollution over the last decade, there are still some areas of Virginia that have had trouble attaining these new more stringent standards.

As shown in Figure 1, only one region of Virginia is currently not meeting all of the federal air quality standards, typically referred to as “nonattainment” areas. The Northern Virginia area is currently designated as an ozone and fine particulate matter (PM_{2.5}) nonattainment area, although recent PM_{2.5} monitoring data shows that the region is now

FIGURE 1. AIR QUALITY PLANNING AREAS IN VIRGINIA



attaining both the annual and daily PM_{2.5} standards. A few regions of Virginia were previously in nonattainment with the ozone standard but have since come back into compliance, and areas such as these are referred to as “maintenance” areas. These include the Richmond, Tri-Cities, Hampton Roads, and Fredericksburg regions of Virginia. In March 2008, EPA lowered air quality standard for ozone and it appears likely that many regions of Virginia will initially be designated nonattainment with this new ozone standard in March 2010.

Additional motor vehicle, fuel, and localized transportation control measures are available and can be planned to cost-effectively accomplish further reductions in air pollution, even despite population and economic growth and increases in travel forecasted for future years. The emission reduction measures are identified in official State Implementation Plans (SIP) to attain and maintain air quality standards. These are developed by states in collaboration with regional and local governments, and can include the following types of controls:

- Stationary source control measures, which limit emissions primarily from larger commercial/industrial facilities and operations.
- Mobile source control measures which limit tailpipe and other emissions primarily from motor vehicles, and can include federal motor vehicle emission standards, fuel volatility limits, reformulated gasoline, anti-tampering programs, and vehicle emission testing programs.
- Transportation emission reduction measures, which are transportation improvement projects (traffic signal coordination, transit, rideshare, turn lanes, etc.) that are implemented to help improve air quality in nonattainment and maintenance areas.

The Congestion Mitigation Air Quality Program (CMAQ) was created to fund projects that improve air quality and reduce congestion. CMAQ funds are allocated by a formula based, in part, on the severity of a region’s air quality problems, and can only be used for projects that demonstrate an air quality benefit in an air quality nonattainment or maintenance area. In 2007, Virginia’s CMAQ projects yielded an estimated 6.7 tons per day reduction in volatile organic compounds and 3.4 tons per day reduction in nitrogen oxides, the two main precursors to ozone formation.

The Port of Virginia (Port) ranks 5th among all U.S. ports handling over 2,000,000 TEU’s (twenty-foot equivalent unit) of cargo in 2008. In recent years, regulatory officials have increased their focus on air emissions generated from U.S. port operations. Diesel exhaust generated from cargo handling equipment is responsible for approximately 25% of emissions from port facilities. In 1999, the Port voluntarily implemented an emissions reduction program through a series of revisions to its equipment purchasing policies. The Port specifies to its suppliers that all new cargo handling equipment contain the lowest emission engine available on the market. From 1999 to 2005, air emissions from cargo handling activities at the Port decreased by 30% despite a 55% increase in cargo volume.

For 2005-2015, emissions are expected to decline by an additional 38% with a 49% projected increase in cargo volume.

In July 2007, Virginia International Terminals voluntarily began using ultra-low sulfur diesel (ULSD) fuel port-wide and three years ahead of federal mandate. This has resulted in a 30% reduction in particulate matter emissions and a 99% reduction in sulfur-oxide emissions. In October 2007, the Port launched a pilot program in partnership with the EPA to encourage the voluntary purchase of new or retrofitted low emission trucks by local drayage truckers. It is the first voluntary diesel retrofit program at a U.S. port.

In July 2008, the Port received a \$750,000 grant from the EPA for the purchase of a 2,000 horsepower hybrid locomotive and two 2,000 horse power ultra-low emission gen-set locomotives. These locomotives are expected to reduce nitrogen oxide emissions by 80% and reduce fuel consumption by 30%. The hybrid locomotive has been in service at Norfolk International Terminals since October 2008.

In December 2008, a container barge service was launched connecting the Port of Virginia to the Port of Richmond. The “64 Express” extends the waterways of the Port of Virginia 100 miles inland to the Port of Richmond’s multimodal freight and distribution gateway. The tug boats in this service are powered by EPA Tier II engines and fueled by ULSD fuel. The barge service is expected to eliminate 100-200 weekly truck trips from the I-64 corridor between Richmond and Norfolk. The Virginia Port Authority (VPA) has identified more than 100,000 annual container moves that might qualify for inter-terminal and intra-harbor barge services, and has applied to the EPA for assistance to expand the service to include drayage of containers between its terminals in Norfolk and Portsmouth. The project has the potential to preserve/create approximately 100-150 regional maritime industry jobs and eliminate approximately 1,500 tons of NOx over the next 5 years.

In January 2009, the Port teamed with the VDEQ to re-launch its diesel retrofit program to encourage local trucking companies to voluntarily retrofit and reduce emissions from trucks servicing the Port. The Port’s “Green Operator” or “GO” program hopes to retrofit 175 to 200 trucks by September 2010. Virginia is the first state in the nation to receive federal money and build a voluntary program specifically for creating a cleaner, more fuel efficient fleet of local trucks.

In May 2009, the Port completed Phase 1 of its on-dock rail expansion at Norfolk International Terminals. Approximately 31% of the Port of Virginia’s cargo moves by rail to Midwest destinations. With completion of the Central Rail Yard expansion, the Rt. 164 Medial Rail corridor in 2009, and the Heartland Corridor in 2010, the Port expects to double its shipment of freight by rail to 440,000 movements per year. It is estimated that this movement of additional cargo by rail will result in a 75% reduction in emissions from moving this same freight by truck from Hampton Roads to the Midwest.

Water Quality

From dredging in ports to construction across wetlands, transportation operations affect water quality. Federal, state, and local regulations require that the transportation community does its fair share in protecting and improving water resources. Programs to reduce sedimentation in streams from dirt and gravel roads, highway designs to reduce runoff and minimize associated contaminants, and the avoidance or restoration of wetlands are now part of doing business.

Development and implementation of an Environmental Management System (EMS) is underway at the Port. The Port received ISO 14001 certification for its terminal operations in June 2008. The Port is also the first major port on the East Coast to receive the ISO certification. The EMS targets air and water quality improvements at Newport News Marine Terminal, Norfolk International Terminals, and Portsmouth Marine Terminal.

To assist in efforts to improve water quality in the Chesapeake Bay watershed, the VPA has implemented several innovative improvements to treat stormwater runoff. Through a series of structural controls and terminal master planning, the pollutant removal from storm water discharges at the VPA's three marine terminals exceeds state requirements by 50%. Where feasible, treatment devices, structures, or ponds are designed to exceed pollutant removal requirements for specific drainage areas on the marine terminals. This compensates for areas on the marine terminals that are not slated for redevelopment or areas where installation of storm water treatment controls are not practical and storm water runoff is not treated.

As part of the VPA's overall philosophy to help preserve the natural environment, the following measures have been implemented since 2002;

- In collaboration with the City of Norfolk, the VPA preserved 5 acres of open space, removed 500 tons of debris from the Elizabeth River and restored 1 acre of tidal wetlands with the creation of Plum Point Park along the Elizabeth River in Norfolk.
- 1.6 acres of non-tidal wetlands were created within a storm water pond at Norfolk International terminals. This project provided valuable wildlife habitat without sacrificing valuable cargo storage area.
- 1.5 acres of oyster reef in the Elizabeth River were constructed adjacent to Portsmouth Marine Terminal. To date, the reef is one of the more populated man-made reefs in the Chesapeake Bay.
- A 2.0-acre forested riparian buffer along the shoreline of the Elizabeth River was planted between Norfolk International Terminals and the residential community. The forested area provides a visual and sound screen between terminal operations and waterfront residents, as well as 2 acres of native habitat/open space for

various species of wildlife. The buffer also serves to reduce impacts to water quality from shoreline erosion. Over 700 trees were planted.

Noise

In 1989, VDOT formally established a policy to lessen the impact of highway traffic noise in neighborhoods and other noise-sensitive areas, such as churches, schools, hospitals and certain public recreational areas. Due to technological advances, a better understanding of highway traffic noise, and national common practices and procedures, the State Noise Abatement Policy was updated in 1997 and is currently undergoing revisions.

It is the Commonwealth's policy to assess the noise impacts of federally-aided transportation improvement projects and to give consideration to the incorporation of appropriate avoidance and/or mitigation measures into the design and construction of those facilities. In order to consider incorporation of noise abatement measures, the appropriate level of noise analysis must be completed to adequately answer all portions of the warranted, feasible, and reasonable criteria, which therefore justifies the recommendation to construct the proposed noise mitigation measure. Proposed transportation improvement projects which may be considered for noise impacts could include the following:

- A proposed highway project for the construction of a highway on a new location;
- The physical alteration of an existing highway which significantly changes either the horizontal and/or vertical alignment;
- An increase in the number of through-traffic lanes. This includes the addition and/or physical alteration of interchanges, ramps, auxiliary lanes, truck-climbing lanes, through-traffic lanes, and high-occupancy vehicle (HOV) lanes.

Currently, VDOT has constructed approximately 126 miles of noise barriers throughout the Commonwealth.

Cultural and Historic Resource Preservation

Virginia's transportation system, including its network of more than 2,200 highway historic markers, is the backbone of its historic tourism industry and provides access to historic sites that draw visitors from around the world. Historic tourism creates jobs and economic opportunities, which in turn promote historic preservation and the protection of community character. Development, maintenance, and enhancement of a safe, efficient, and comprehensive transportation system are the best ways to protect and promote Virginia's heritage.

The Commonwealth's transportation agencies have a superior record of compliance with state and federal historic preservation requirements. Great care is exercised to avoid or

minimize effects to historic properties. In addition, the Commonwealth's transportation program directly benefits historic preservation in Virginia. Since 1992 the CTB has awarded more than \$58 million in transportation enhancement funds to more than 250 transportation-related historic preservation projects across Virginia. These projects have ranged from the rehabilitation of historic railway stations and bridges to streetscape improvements in historic areas and public interpretation of historic sites. The CTB's administration of the federal Transportation Enhancement Program is one of the most definitive illustrations of the meaningful and positive relationship between the Commonwealth's transportation and historic preservation interests.

The historic Hawthorne Street Bridge in Covington was built ca. 1885-1900 and is one of the few remaining "Phoenix" truss bridges in Virginia. Through FHWA's Innovative Bridge Research and Construction Program, VDOT rehabilitated this historic structure and replaced its concrete deck with a new deck made from fiber-reinforced polymer. The use of this distinctively modern, lightweight material raised the structure's load capacity from 5 to 20 tons and allowed the historic bridge to remain in service. This project demonstrates VDOT's commitment to preserving Virginia's historic resources, including the Commonwealth's historic bridges.

Habitat Preservation

The rapid consumption of open land and the consequent loss of sensitive and diverse habitats is another environmental and transportation issue of concern to the Commonwealth. Transportation infrastructure can fragment wildlife habitats, or eliminate them all together. Avoiding impacts to habitats that support threatened and endangered species presents another challenge for Virginia's transportation system.

Virginia is committed to maintaining habitat and watershed quality and connectivity:

- Through placement of nesting boxes on bridges maintained by VDOT, endangered peregrine falcons – considered the world's fastest birds – once again fly high over Virginia's eastern seaboard. Because of the significant role it played in the recovery of the peregrine falcon in Virginia, VDOT earned the 1998 FHWA Excellence Award in the category of Environment Protection and Enhancements.
- As part of a mitigation package for improvements to 12 miles of Route 17 in Chesapeake, 758 acres of Great Dismal Swamp forested wetlands were purchased by VDOT and transferred to the Virginia Department of Game and Inland Fisheries.
- The Commonwealth also constructs black-bear underpasses (deer, raccoons, opossums, and foxes will use them too) to reduce wildlife habitat fragmentation.

Falcon Nesting on Virginia Bridges

Peregrine falcons enjoy a unique relationship with the Virginia Department of Transportation (VDOT). Through placement of nesting boxes on bridges maintained by VDOT, the endangered peregrine falcons - considered the world's fastest birds - once again fly high over Virginia's eastern seaboard. Because of the significant role it played in the recovery of the peregrine falcon in Virginia, VDOT earned the 1998 Federal Highway Administration Excellence Award in the category of Environment Protection and Enhancements.

VDOT has a role in falcon recovery largely because nesting pairs are attracted to bridge structures, which happen to be similar to their normal nesting environment on cliff faces. VDOT first placed a falcon nesting box on the Coleman Bridge in the late 1980s. Additional boxes were placed where the falcon's presence was evidenced. Bridge pairs now represent approximately 30 percent of the Virginia peregrine falcon population.

In recent nesting seasons, the program has celebrated as many as 13 hatchings of fledgling falcons. The successful management of these birds represents a model of federal, state and university cooperation. Along with the U.S. Fish and Wildlife service, the Virginia Department of Game and Inland Fisheries and the Conservation Center at the College of William and Mary, VDOT monitors the falcons on each bridge to ensure that they and their habitat are doing well. VDOT has even established falcon-specific contract requirements for bridge construction and maintenance as it continues to identify other nesting sites.

Bridges with falcon nesting boxes

- James River Bridge on Route 17
- Berkley Bridge on Interstate 264
- West Norfolk Bridge on Route 164 over the western branch of the Elizabeth River (no nesting pairs)
- Mills Godwin Bridge on Route 17 over the Nansemond River
- I-64 High-rise Bridge (George Treakle Memorial Bridge) over the southern branch of the Elizabeth River (no nesting pairs)
- Coleman Bridge on Route 17 crossing the York River (no nesting pairs)
- Monitor-Merrimac Bridge-Tunnel on Interstate 64 over and under the Chesapeake Bay (no nesting pairs)
- Benjamin Harrison Bridge on Route 156 over the James River
- Varina-Enon Bridge on Interstate 295 over the James River (no nesting pairs)
- Norris Bridge on Route 3 over the Rappahannock River

State Environmental Review Process and the National Environmental Policy Act

In Virginia, environmental engineers partner with more than two-dozen state and federal agencies to facilitate compliance with various environmental laws, regulations, and Executive Orders that can be applicable to transportation projects. To ensure that all applicable environmental regulations are considered in the highway planning and construction process, Virginia performs a State Environmental Review Process (SERP) on projects and conducts environmental studies for federal actions to assist in the preparation of National Environmental Policy Act (NEPA) documents.

SERP provides the basis for a balanced consideration of environmental and transportation needs for VDOT projects; while NEPA is an approach to balanced transportation decision-making that takes into account the potential impacts on the human and natural environment and the public's need for safe and efficient transportation. In both processes, environmental agencies are provided the opportunity to comment and provide environmental resource information at the earliest stages of project development. The information from the agencies is used to consider alternative courses of action that can be evaluated and result in decisions that are in the best overall public interest based upon a balanced consideration of the need for safe and efficient transportation; of the social, economic, and environmental impacts of the proposed transportation improvement; and of national, state, and local environmental protection goals.

The intent of SERP is to provide state natural and historic resource agencies an opportunity to review and comment on appropriate projects and categories of projects to address the environmental impact; any adverse environmental effects which cannot be avoided if the project is undertaken; the measures proposed to minimize the impact of the project; any alternatives to the proposed construction; and any irreversible environmental changes which would be involved in the project. This consultation ensures a meaningful evaluation of the potential impacts to the environment prior to final commitments to a transportation project. NEPA on the other hand requires, to the fullest extent possible, that the policies, regulations, and laws of the Federal Government be interpreted and administered in accordance with its environmental protection goals. NEPA also requires the use of an interdisciplinary approach in planning and decision-making for any action that adversely impacts the environment.

Quality of Life

The development of infrastructure projects, such as transportation systems needed for the functioning of a community or society, can sometimes negatively impact the natural and human environment, which in turn can affect our quality of life. Processes, systems, or specific methods that incorporate environmental and community values into transportation decisions at an early point in planning and all the way through project design and construction can be considered an integrated process approach to decision-making. A primary purpose in advancing an integrated process approach to transportation decisions is to improve the environmental quality of the end product. At a systems level this is accomplished through earlier and better coordination of environmental concerns during the transportation planning process. At the project level, such integration can be enhanced through the application of context sensitive solutions. These strategies integrate environmental and community values into transportation decisions at an early point in planning, and continue through project design. One critical component of an integrated process is the incorporation of public participation. It is crucial to ensure that community needs are served by state investments in transportation.

The public has a voice when transportation decisions are made for their communities. Often early on, it can be through a core group of public participants such as citizen

advisory committees, community people serving on decision and policy making boards, or even a citizen task force involved with a particularly difficult situation to resolve. For public involvement to be successful, it is important that it be a two-way street, and it is critical that open communication occurs. This is accomplished in a variety of methods such as mailing lists, public information materials, websites, briefings, and news media, not to mention citizen information meetings, workshops, retreats, public hearings, or key person briefings with representatives of the community.

When meaningful stakeholder participation with the public occurs, keeping the human and natural context foremost in mind, it results in a plan for a transportation system that will be an asset to the community and/or region, maintain or enhance the quality of life and result in context sensitive solutions such as the follow examples:

Traffic Calming

Traffic calming can provide benefits for bicycling and walking, such as reducing motor vehicle speeds, reducing the number of motor vehicles on streets, and better defining operating space. Treatments for traffic calming that can increase safety for pedestrians include curb extensions, raised pedestrian crossings and intersections, and crossing islands. Some treatments, such as narrowed lanes and devices that change the surface level, can create unsafe and uncomfortable conditions for bicyclists.

Traffic-calming techniques used by Virginia include:

- Enhancements at a town's approach via architecture, signage, landscaping, etc.
- Imprint areas: Sections of textured pavement that provide audible indicators to encourage motorists to decelerate.
- Raised crosswalks: Pedestrian crossings made of brick or a textured material.
- Landscaped medians: Medians with curb and trees, bushes, etc.
- Roundabout/traffic circles: A type of intersection that provides counter-clockwise traffic flow and reduces left-turn accidents.
- Landscaping: Trees, bushes, flowers, etc. which limit sight distance to encourage slower driving.

Context-Sensitive Design

Context-sensitive design (CSD) is a collaborative approach to developing and redesigning transportation facilities that fit into their physical and human environment while preserving the aesthetic, historic, community, and natural environmental values. CSD contributes to safety, mobility, and providing a sense of community. CSD also considers access for other modes of transportation, such as bicycling and walking. Dispersed, low-density development reduces the feasibility of bicycling and walking. As the distances between origins and destinations increase, bicycling and walking become less effective as a means of transportation.

Transit-oriented Design

Transit-oriented design is a general description implying higher density land uses and activities designed and located to encourage ridership on public transit. Transit-oriented design projects attempt to attract people to the transit system by creating an atmosphere

that is safe, convenient, and easily accessible by foot, bicycle, or an alternative transit mode. If people can safely walk to the transit stop and bank, buy groceries, and return library books on their way home from the station, they are more likely to use the transit system. It is essential to integrate transit stations into other activities of the community to maximize the benefits of the transit investment and ridership.

Potential Environmental Mitigation Activities and Areas

A long range transportation plan identifies and recommends strategies to meet the priority existing and future transportation needs of the public. The plan would be accomplished gradually, over a time span as long as 20 or more years. The planning predominantly utilizes concepts reflecting tentative, future transportation improvement projects. A transportation concept's inclusion in a draft or final long range transportation plan represents prerequisite preliminary support for that concept. Transportation improvements go through several steps from conception to completion and take many years to successfully develop, even if they are placed on a priority schedule.

The considerations made during long range transportation planning, made with many tentative concepts, are "preliminary" in nature. Detailed environmental processes such as those of the National Environmental Policy Act (NEPA) do not apply to long range transportation plans or to shorter range transportation improvement programs. With exceptions for regional ambient air quality, offsetting environmental impacts during long range planning is not required. Nonetheless, federal consultation and public involvement requirements apply for the development of both State and Metropolitan long range transportation plans. Interagency consultation is required for comparing plans, as well as for developing a discussion on potential environmental mitigation activities, areas to provide the mitigation, and activities that may have the greatest potential to restore and maintain the environment. The mitigation discussion, as provided in this section, is to be at the policy-strategy level (not project specific) and reflect consultation with federal, state and tribal wildlife, land management and regulatory agencies.

Numerous federal and state laws apply to the environmental analysis of individual transportation projects, and these analyses are typically completed during the preliminary engineering stage, yet always prior to a decision on whether to proceed to construction. At this stage, pending project features may be narrowed and refined, and the environmental impacts and public needs for environmental mitigation activities can be appropriately ascertained. Virginia's SERP process directs the project-by-project interagency review, study and identification of environmental concerns. Related requirements that typically apply at this stage regard public hearings, environmental permit-processing, and NEPA. Usually, a variety of project environmental document, permit and mitigation needs are identified. The environmental findings are closely considered and evaluated. Common project environmental mitigation measures (required silt-fence barriers, precautions to control dust, etc.) are managed using Road and Bridge Standards that apply to all VDOT construction activity. Special environmental concerns, however, may differ widely by project and location. As the environmental studies are

conducted and undergo public and interagency review, needed mitigation plans are specified and committed to in the environmental documents on the particular transportation project or activity. Environmental management systems then are used to monitor and ensure compliance with the environmental mitigation commitments.

Potential environmental mitigation actions may include: avoiding impacts altogether, minimizing a proposed activity, project size, or its involvement, rectifying impacts (restoring temporary impacts), precautionary and/or abatement measures to reduce construction impacts, employing special features or operational management measures to reduce impacts, and/or compensating for environmental impacts by providing suitable, replacement or substitute environmental resources of equivalent or greater value, either on or off-site. Where on-site areas would not be reasonable or sufficient, relatively large off-site compensatory natural resource mitigation areas generally may be preferable, if available. These may offer greater mitigation potential with respect to planning, buffer protection and providing multiple environmental habitat value (e.g., wetland, plant and wildlife banks).

Mitigation activities will be consistent with legal and regulatory requirements relating to the human and natural environment. These may pertain to neighborhoods and communities, homes and businesses, cultural resources, parks and recreation areas, wetlands and other water sources, forested and other natural areas, agricultural areas, endangered and threatened species, and air quality. The following table illustrates some potential mitigation activities and potential mitigation areas for these resources.

<i>Resource</i>	<i>Key applicable requirements</i>	<i>Potential mitigation activities to occur during project implementation</i>	<i>Potential mitigation areas to occur during project implementation</i>
Neighborhoods and communities, and homes and businesses	Uniform Relocation Assistance and Real Property Acquisition Policy Act at 42 USC 4601 et seq.	Impact avoidance or minimization; context sensitive solutions for communities (appropriate functional and/or esthetic design features)	Mitigation on-site or in the general community. (Mitigation for homes and businesses is in accord with 49 CFR 24)
Cultural resources	National Historic Preservation Act at 16 USC 470	Avoidance, minimization; landscaping for historic properties; preservation in place or excavation for archaeological sites; Memoranda of Agreement with the Department of Historic Resources; design exceptions and variances; environmental compliance monitoring	On-site landscaping of historic properties, on-site mitigation of archeological sites; preservation in-place
Parks and recreation areas	Section 4(f) of the U.S. Department of Transportation Act at 49 USC 303	Avoidance, minimization, mitigation; design exceptions and variances; environmental compliance monitoring	On site screening or on-site replacement of facilities; in some cases, replacement of affected property adjacent to existing

Wetlands and water resources	Clean Water Act at 33 USC 1251-1376; Rivers and Harbors Act at 33 USC 403	Mitigation sequencing requirements involving avoidance, minimization, compensation (could include preservation, creation, restoration, in lieu fees, riparian buffers); design exceptions and variances; environmental compliance monitoring	Based on on-site/off-site and in-kind/out-of-kind sequencing requirements; private or publicly operated mitigation banks used in accordance with permit conditions
Forested and other natural areas	Agricultural and Forest District Act (Code of VA Sections 15.2-4305; 15.2-4307-4309; 15.2-4313); Open Space Land Act (Section 10.1-1700-1705, 1800-1804)	Avoidance, minimization; Replacement property for open space easements to be of equal fair market value and of equivalent usefulness; design exceptions and variances; environmental compliance monitoring	Landscaping within existing rights of way; replacement property for open space easements to be contiguous with easement; replacement of forestry operation within existing agriculture/forestal district
Agricultural areas	Farmland Protection Policy Act of 1981 at 7 USC 4201-4209, Agricultural and Forest District Act (Code of VA Sections 15.2-4305; 15.2-4307-4309; 15.2-4313)	Avoidance, minimization; design exceptions and variances; environmental compliance monitoring	Replacement of agricultural operation within existing agriculture/forestal district
Endangered and threatened species	Endangered Species Act at 16 USC 1531-1544	Avoidance, minimization; time of year restrictions; construction sequencing; design exceptions and variances; species research; species fact sheets; Memoranda of Agreements for species management; environmental compliance monitoring	Relocation of species to suitable habitat adjacent to project limits
Air quality	Clean Air Act at 42 USC 7401-7671, and conformity regulations at 40 CFR 93	Transportation control measures, transportation emission reduction measures	Within air quality non-attainment and maintenance areas

Strategies to Address the Natural and Human Environment

The creation and adoption of this Statewide Transportation Plan is an important accomplishment, but it is only a first step toward implementation of the Commonwealth's long term transportation goals. In order to move the Plan forward, a series of strategies and action steps must be enacted to help preserve and maintain the natural and human environment. This will require a collaborative approach between the various local, state, and federal agencies, along with significant input from the public. The following provides an overview of key environmental strategies and action steps that the Commonwealth's transportation agencies plan to undertake:

- Reduce GHG emissions from the Commonwealth's transportation sector to 30% below the business-as-usual projection of emissions by 2025, which is essentially equivalent to the 2000 level of emissions.
- The GHG emission reductions shall be achieved through the following actions;
 - expanding commuter choice, improving transportation system efficiency, and improving community designs,
 - increasing the efficiency of the transportation fleet and use of alternative fuels,
 - accelerating research and development in the field of low-carbon alternative fuels, and
 - advocating for federal actions that will reduce GHG transportation emissions.
- Ensure that climate change impacts, particularly sea level rise and storm surge vulnerability in coastal areas of Virginia, are taken into account in all transportation planning, project design, and prioritization of projects for funding as well as transportation systems management, operations, and maintenance. Develop climate change adaptation plans for critical infrastructures.
- Ensure that all transportation projects, plans, and programs do not cause or contribute to a violation of an ambient air quality standard.
- Increase involvement and collaboration with the Commonwealth's resource agencies (e.g., VDCR, VDEQ, VDGIF, etc.) during transportation planning activities.
- Increase access to, and use of, alternatives to the single-occupant vehicle (e.g., expanding mass-transit, promoting carpooling, etc.).
- Implement solutions to traffic congestion to improve transportation efficiency and quality of life.
- Increase intermodal and non-highway freight shipments to improve efficiency in moving goods and people in addition to promoting effective use of existing infrastructure.
- Work with MPOs and localities to ensure that the coordination of transportation and land use is a key policy goal.
- Provide technical assistance to localities to amend comprehensive plans and zoning ordinances to promote compact, walkable, transit-oriented development areas and to guide development to such areas.
- Recognize community excellence in land use and transportation and the importance of neighborhood design to limit residents' and workers' dependence on cars.
- Ensure that new or upgraded roads are more pedestrian and bike-friendly.

- Create signalization standards to improve the timing and the intelligence of traffic signalization across the Commonwealth to improve traffic flow.
- Promote efforts to educate all drivers about behavioral changes that can significantly boost energy efficiency and reduce air pollution.
- Amend landscaping standards to minimize mowing, support tree preservation and planting, and increase carbon retention.
- Minimize vehicle miles traveled related to state and local operations by promoting carpooling, videoconferencing, teleconferencing, etc.
- Encourage comprehensive regional resource assessments, both natural and cultural, to ensure the implementation of informed land-use planning protocols.