

# HILLSBOROUGH COUNTY MPO 2035 LONG RANGE TRANSPORTATION PLAN

## LRTP SUSTAINABILITY AND GHG REDUCTION STRATEGIES



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## Executive Summary

Metropolitan Planning Organizations will play important roles in addressing the issue of greenhouse gas (GHG) reductions in the transportation sector. Florida law now encourages MPOs to consider strategies to integrate land use and transportation planning to reduce greenhouse gas emissions, and the Hillsborough County MPO is doing so as part of its Long-Range Transportation Plan update process, and has set specific goals that support GHG reduction.

GHG reduction will require participation and cooperation by government agencies at all levels, as well as the private sector. No single entity controls all aspects of land use and transportation planning and project implementation. The three fundamental requirements for a collaborative effort are a common vision, consistent application of the philosophy of reducing vehicle miles traveled (VMT) in evaluating needs and setting priorities, and creative incentives through transportation demand management (TDM) to change driving habits.

Like many United States areas, Hillsborough County experiences high traffic volumes during commuting hours, and has created a system of limited access and arterial highways to handle that demand. The Hillsborough County MPO has been focusing on supporting expansion of transit services to help reduce peak-hour demand. The MPO also has supported making roads safer and more appealing to pedestrians and bicycle riders.

These efforts will form the basis for three focus areas of GHG reduction strategies for the MPO – promoting transit service expansion and usage, promoting transit-oriented design, and promoting transportation demand management (TDM) programs. These strategies are not individual concepts to be pursued alone, but must fit together in order to have more than minimal impact on GHG reduction.

Both the Tampa Bay Area Regional Transportation Authority (TBARTA) and Hillsborough Area Regional Transit (HART) have proposals to expand transit services that will link business and commercial areas of the County. In addition, the City of Tampa has updated its comprehensive plan to provide incentives for development in locations that will be future centers for transit operations. Third, TDM concepts will emphasize other modes of travel to single passenger car trips.

The other aspect of dealing with climate change is to plan for impacts that are anticipated in the not-so-distant future. Adaptation planning has essentially already begun in Florida due to the severe storm damage in the recent hurricane seasons, evacuation planning, construction code updates, and bridge replacements or rehabilitation of older structures. Adaptation is being studied at all levels of government, and the likely first step will be a comprehensive risk assessment of transportation and other asset vulnerability.

GHG reduction goals in Florida and elsewhere present significant challenges, and will take time to reach. The key will be collaborative, creative, and consistent application of criteria that make reduction a priority.

## Introduction

In 2008, the Florida Legislature enacted legislation with regard to reducing GHG emissions through strategic planning for sustainable growth. Section 339.175, Florida Statutes, was amended by House Bill 7135 and now states that “Each M.P.O. is encouraged to consider strategies that integrate transportation and land use planning to provide for sustainable development and reduce greenhouse gas emissions.” In addition, Section 163.3177, Florida Statutes, was also amended in 2008 within several subsections to now require local governments to adopt GHG emissions reductions strategies both generally and specifically with regard to transportation planning.

These new statutory requirements followed Governor Crist’s Executive Order 07-127 that established greenhouse gas reduction targets for Florida, which are by 2017 to reduce emissions to 2000 levels, by 2025 to 1990 levels, and by 2050 reduce to 20 percent of 1990 levels. Although not specifically called out in the Order, the transportation sector plays a significant role in GHG emissions, and can therefore play a significant role in meeting these targets.

The Hillsborough County MPO (MPO) has set several goals for its 2035 Long Range Transportation Plan update that address GHG reduction and sustainability:

**Goal I:** Improve the quality of life, promote energy conservation, and enhance the environment, while minimizing transportation-related fuel consumption and greenhouse gas emissions.

**Goal III:** Promote accessibility and mobility by increasing and improving multimodal transportation choices, and the connectivity across and between modes, for people and freight.

**Goal IV:** Assure that transportation improvements coordinate closely with comprehensive land use plans and support anticipated growth and development patterns.

While these Goals have some separate aspects, essentially they spell out the interrelationship between transportation, land use, greenhouse gas emissions, and quality of life. In a recent presentation, Department of Community Affairs (DCA) Secretary Tom Pelham reviewed the role of land use and transportation planning in reducing GHG emissions. He stated that over 40 percent of CO<sub>2</sub> emissions in Florida come from the transportation sector, and of this 83 percent from vehicles. He further stated that the Florida Department of Transportation (FDOT) projects that vehicle miles traveled in Florida is expected to increase

four-fold by 2060 based on current trends. Reversing the growth in vehicle miles traveled is therefore crucial to GHG reduction.<sup>1</sup> DCA is in the process of developing administrative rules relating to comprehensive planning requirements for GHG reduction strategies.

In its December 4, 2008 guidance document for MPO Long-Range Transportation Plan (LRTP) updates, the Federal Highway Administration (FHWA) Florida Division makes clear that climate change is “anticipated” to be discussed in the updates, including strategies aimed at addressing climate change. FHWA’s guidance states that its recent report, “Integrating Climate Change Considerations into the Transportation Planning Process” should serve as a good resource.

Thus, the stage is set for collaborative transportation planning efforts to address GHG emissions. As part of the MPO 2035 LRTP update, the MPO has requested a review of potential approaches to addressing GHG emissions and sustainability that can be included in the update. Although the MPO does not have the direct authority to control land use, the MPO and the local governments that do control land use can plan collaboratively to implement these strategies. This already occurs in other aspects of transportation and local land use planning as the staff of the MPO is also staff to the local land planning agency, the Hillsborough County Planning Commission.

This memorandum will first review the concept of “sustainability” in terms of transportation, review the current information on the role of transportation and GHG emissions, will then discuss the fundamentals of planning necessary to achieve GHG reductions, and focus on the most potent GHG reduction strategy for transportation – reducing vehicle miles traveled by single occupancy vehicles. It will examine generally the reduction impacts of certain transportation improvements, and how these may relate to Hillsborough County and certain regional and local planning initiatives. The memo also will briefly discuss adaptation planning, that is, preparing for the anticipated impacts of climate change.

It should be noted at the outset of this discussion that the MPO already has taken key steps toward implementation of several of the strategies mentioned herein, and that other government entities in the Hillsborough region appear to be philosophically aligned with these strategies as well.

## Sustainability

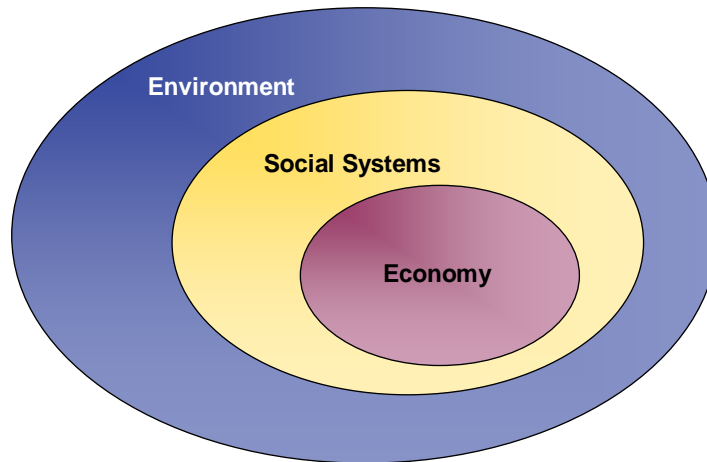
*“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*<sup>2</sup>

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<sup>1</sup> *The Role of Local Land Use and Transportation Planning in Reducing GHG*, Tom Pelham, Secretary, FDCA 2008.

<sup>2</sup> U.N. World Commission on Environment and Development. *Our Common Future: Report of the World Commission on Environment and Development (A/42/427)*. 4 August 1987.

There are three dimensions of sustainability – environmental preservation, social equity, and economic efficiency.<sup>3</sup> Intergenerational equity means ensuring that current and future generations enjoy an acceptable quality of life, as well as equitable distribution of resources between communities and generations. Sustainability assessments should be dynamic (adapt to changes over time), sensitive to local context, and represent a continuum of varying degrees of sustainability, rather than a discrete assessment of what is sustainable or unsustainable.



A sustainable transportation system is one that meets the needs of today's population without jeopardizing the health of tomorrow's. Definitions range from including purely basic environmental outcomes to those including the economy, historic preservation, community development, quality of life, and more. While "sustainability" is not explicitly mentioned in the mission and vision statements of most U.S. transportation agencies, a majority of them touch upon sustainability concerns by addressing issues such as the environment, future needs, and social equity.

Sustainability needs to be measured across a transportation agency's entire spectrum of activities, including: long-range planning and programming; project development and design; construction; maintenance; and operations. The American Association of State Highway Officials (AASHTO) stresses achieving "better than before" outcomes in which the natural, social, and built environments are improved concurrently with the implementation of transportation improvements. AASHTO's sustainability recommendations cover five areas, including climate change, the coordination of land use and transportation, and the development and delivery of transportation projects and services. Climate change and GHG reduction are generally one component, but not the only component, of a sustainable transportation system.

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<sup>3</sup> AASHTO Center for Environmental Excellence.  
[http://www.environment.transportation.org/environmental\\_issues/sustainability/](http://www.environment.transportation.org/environmental_issues/sustainability/).

As mentioned above, Goals I, III, and IV of the 2035 LRTP relate to sustainability. Goal I is directly tied to environmental outcomes, including GHG reduction specifically. Goal III is targeted at increasing mobility efficiency and choices, which indirectly address GHG reduction, but also can address equitable and economic issues. Goal IV seeks to coordinate transportation with land use, which promotes sustainability as long as the land use plans promote sustainability. The Florida Legislature’s charge to all MPOs to “consider strategies that integrate transportation and land use planning to provide for sustainable development and reduce greenhouse gas emissions” in essence combines these three goals – reduce GHG emissions while providing better mobility and stimulating compatible development.

## GHG Background

Transportation-related GHG emissions are related to four factors – vehicle technology/efficiency, fuel characteristics, vehicle miles traveled (VMT), and traffic operations. Although in the last 30 years progress has been made in reducing vehicle emissions of pollutants such as nitrous oxide, carbon monoxide, and volatile organic compounds, across the country there are many more miles driven today, resulting in increases of each type of emission.<sup>4</sup> Carbon dioxide (CO<sub>2</sub>) emissions per mile have not improved since 1991, and are the primary GHG and focus of climate change discussion.<sup>5</sup>

According to Florida’s Energy and Climate Change Action Plan (the “Action Plan”), as of 2005 the transportation sector accounted for 36 percent of the State’s GHG emissions, is the second largest GHG contributor, and has been responsible for 41 percent of the emissions increases since 1990.<sup>6</sup> On road gasoline vehicle use accounts for 63 percent of emissions, and diesel use another 12 percent.<sup>7</sup> The Action Plan estimates that current trends would result in a growth of GHG emissions of 64 percent above 2005 levels by 2025.<sup>8</sup>

Reducing GHG emissions in today’s world of transportation is a difficult challenge, and one that will take consistent effort to implement. With respect to climate change, the debate and focus have shifted from whether it is occurring to how to slow or even begin to reverse the changes, and to adapt to expected long-term effects of climate change. Lowering GHG emissions, with a current trends analysis showing such expected increases, will mean that current trends will have to be significantly altered.

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<sup>4</sup> Center for Clean Air Transportation Emissions Guidebook, Part One, page 6.

<sup>5</sup> Ibid.

<sup>6</sup> Florida’s Energy and Climate Change Plan, Chapter 5, page 5-1.

<sup>7</sup> Ibid.

<sup>8</sup> Ibid, 5-2.



With respect to transportation, there are four overall methods to reverse the growth in GHG emissions – improve vehicle efficiency, shift fuel sources, reduce VMT, and improve traffic flow. Aggressive fuel efficiency standards and ultimately finding alternatives to carbon-based fuel sources may likely result in the largest reductions in GHG emissions in the future, but reducing both the amount of miles driven by single occupancy vehicles and making traffic flow more efficiently will be critical, as well.

Several factors influence VMT – land use patterns, the availability of alternative modes of transportation, the cost of driving, and personal driving habits. Americans drove over 100 billion fewer miles between November 2007 and October 2008 than the same period a year earlier, primarily as a result of increased fuel prices coupled with a slowing economy. This drop in VMT represented a reduction of approximately 3.5 percent, and a resulting GHG reduction of approximately the same percentage.<sup>9</sup> Referencing Florida Governor Crist’s Executive Order 07-127 that set targets for GHG reductions for the State to 1990 GHG emission levels by 2025, to achieve such a reduction through VMT alone could require another 30 percent drop.

At the local level, reducing VMT will be the result of transportation planning coupled with land use planning and decision-making. The challenge is large, especially in light of the anticipated 64 percent increase in GHG emissions under current trends analysis. Achieving meaningful reductions will require creativity and strong collaboration among all stakeholders – government, private industry, and the citizenry.

## **GHG Reduction Strategies that Integrate Transportation and Land Use Planning**

What does an MPO do? An MPO identifies transportation system needs and prioritizes those needs based on projected funding and funding sources. The basic question for an MPO in terms of GHG reduction is how does it put in place strategies to get people to drive less, that is, reduce vehicle miles traveled? Things the MPO cannot influence are vehicle fuel efficiency, alternative fuel development and availability, and costs of alternative fuel vehicles. If everyone switched to cars that had double the efficiency of current cars, GHG emissions

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<sup>9</sup> This trend has apparently continued. On January 22, 2009, USDOT released the following statement regarding November 2008 VMT: “With new data released today, America’s trend of declining driving started its second year with a loss of 12.9 billion vehicle-miles traveled (VMT), or 5.3 percent less, in November 2008 compared to the same month a year earlier. It is the largest such decline of any November since monthly data estimates began in 1971.” December 2008 data showed a 1.6% decrease. As of March 19, 2009, the decline now exceeds 122 billion VMT, compared to the same 14-month period – December 2006 to January 2008 – a year earlier.

are cut in half, assuming current driving habits did not change. An MPO needs to focus on what it can influence, either directly or indirectly, to reduce VMT.<sup>10</sup>

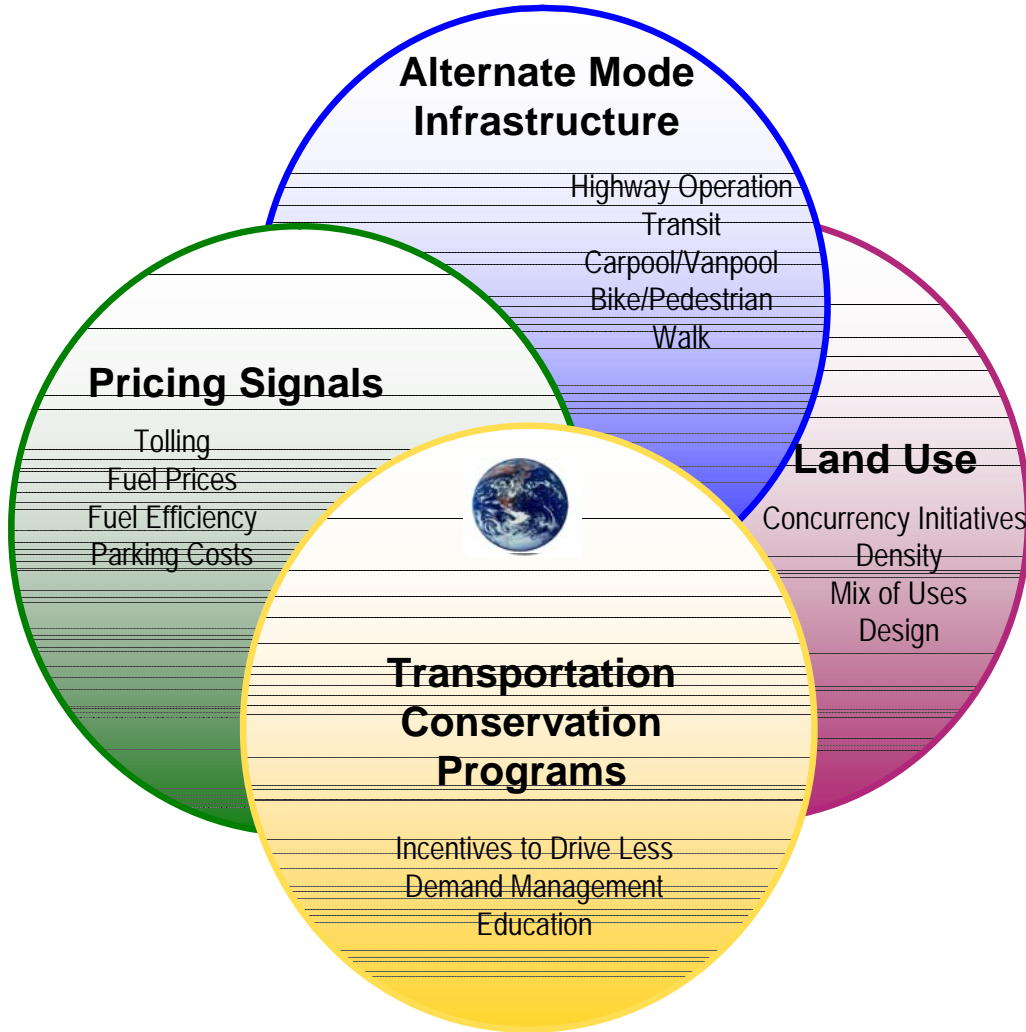
An MPO can also concentrate on improving the efficiency of existing roads (i.e., reducing congestion and stop/start traffic) so that fuel consumption and GHG emissions per mile traveled are reduced. In general, vehicles use fuel more efficiently when they operate at consistent, moderate speeds, rather than when they accelerate and decelerate frequently or operate at very low or high speeds (high-speed driving is less fuel efficient). Keeping traffic flowing more smoothly by use of roundabouts and signal timing can reduce fuel consumption without substantial induced demand impacts. Incident management can reduce nonrecurring or unexpected congestion that leads to lost time and wasted fuel. However, some means of reducing congestion, especially increasing capacity, also may lead to increased VMT and GHG. If congestion is reduced, there is more “room” on the road and this will encourage more drivers to use the road or people to travel longer distances, allowing the road to refill to congested levels. This is particularly true under Florida’s growth management strategy of concurrency. New roadway capacity means reduced barriers for new development. The end result may be a road with more GHG emissions, not less.

It is a reality that the Hillsborough County area will continue to experience population growth, and unless current trends are changed, growth in VMT and related GHG emissions. In order to reverse growth in VMT, then, it will be critical that transportation planning and land use planning point toward common goals. Thus, one of the most important strategies for integrating transportation and land use planning efforts to reduce GHG emissions is to establish common goals and clear lines of communication between the entities that are planning – the MPO and local governments, as well as regional entities and FDOT. Each partner brings a unique piece of the GHG reduction solution, but all must be working to solve the same puzzle, so a coordinated approach is the key. The necessity of a clear unified vision is illustrated by the following representation of integrated strategies.

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<sup>10</sup> On March 31, 2009 the National Highway Traffic Safety Administration released the 2011 model year minimum fuel efficiency standards. The final standard for model year (MY) 2011 is 30.2 mpg for passenger cars and 24.1 mpg for light trucks, which represents a rise of 2.7 mpg and 0.6 mpg, respectively, over the standards for MY 2010. See 74 F.R. 14196.

**Figure 1 Integrating Strategies to Reduce Greenhouse Gas Emissions and Promote Sustainability**

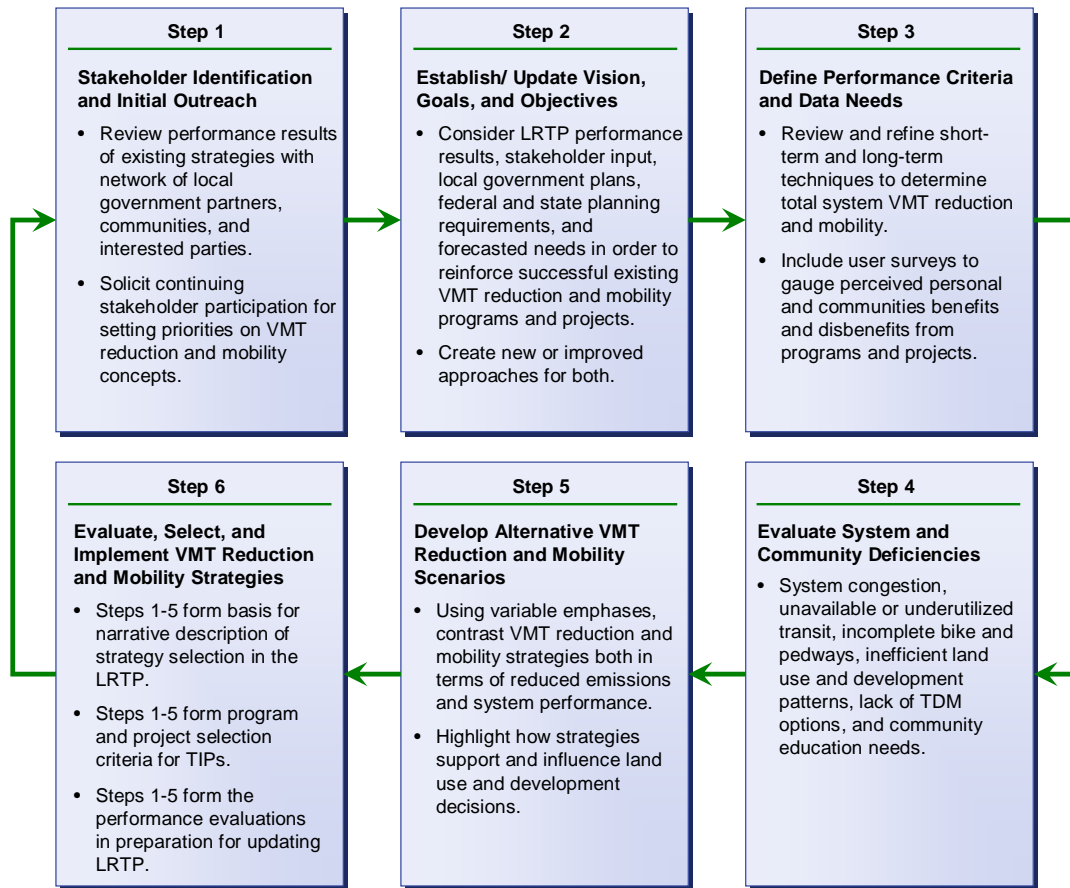


As suggested by the graphic, various entities and agencies must work together in order to realize the benefits of their individual abilities and authorities. In the Hillsborough area, TBARTA and HART are transit agencies, but must work with land use jurisdictions to optimize the location and operation of current and future transit systems. The MPO also must take cues from the future land use plans, and those of the transit agencies, when setting its priorities, so the plans need to be reflective of VMT reduction. FDOT would need to support efforts to congestion price limited access highways not already tolled, and the Tampa-Hillsborough Expressway Authority would likewise need to implement congestion pricing on its toll roads. Project selection and design policies by FDOT and the Expressway Authority also need to be consistent with land use planning objectives. Transportation Demand Management programs and driver education efforts can be implemented by all parties mentioned. Many incentives to drive less can be put in place by private entities – businesses encouraging

telecommuting, subsidizing transit fares, and/or encouraging carpooling and biking – but encouragement and tools are needed from the public sector.

A second overarching consideration is to continuously and consistently apply GHG reduction priorities throughout the MPO planning process. The following graphic illustrates how a philosophy based on addressing climate change could be woven into all planning steps.

**Figure 2 Building Mobility While Integrating Vehicle Mile Reduction Strategies in Long-Range Transportation Planning**



For example, building public support for projects that address GHG reduction can involve different outreach strategies for public comment than the traditional approach to more conventional road capacity projects. Waiting until it is time to evaluate alternative approaches to solving transportation needs to overlay a GHG reduction approach could lead to difficulties. Thus, if GHG reduction is going to be an element in evaluating alternatives, then GHG reduction needs to be part of the public discussion from the outset. It is noted again that the MPO’s Goals, Policies, and Objectives statement for the LRTP contains a specific goal on this point:

**Goal I:** Improve the quality of life, promote energy conservation, and enhance the environment, while minimizing transportation-related fuel consumption and greenhouse gas emissions.

The third key to GHG reduction is creativity. There is much more flexibility for use of Federal funding than there once was, and likely more flexibility will be granted in coming years. Strategies to reduce VMT, especially in the area of Transportation Demand Management, are evolving rapidly – existing strategies are being refined and new strategies are appearing. There are any number of ways to reduce VMT beyond what is being practiced and funded today.

At this time, for the MPO there appear to be three primary strategies to address GHG reduction – supporting transit modes, notably the TBARTA plan; supporting transit-oriented design, notably the City of Tampa’s Transportation Concurrency Exception Area; and congestion relief through Transportation Demand Management (TDM). Conversely, creating additional arterial and limited access highway capacity through adding lanes should be de-emphasized as a need. Due to the operation of transportation concurrency requirements in growth management – comprehensive plan amendments and development approvals are tied to it – it has proven difficult if not impossible to add capacity by adding lanes without inducing even higher demand, thereby creating need for even more lanes/capacity.

### **Transit Service**

While the most effective GHG reduction strategies are to eliminate trips (e.g., via telecommuting or electronic commerce) or shift them to non-motorized travel, converting car and light truck trips to transit trips also is effective. As demonstrated in the MPO presentation to TBARTA, one commuter rail car can take the place of 177 single occupancy vehicles at a fraction of the GHG emission. Some estimates are that for each commuter that chooses transit over a single occupancy vehicle for a 20-mile round trip commute can save 4,800 pounds of CO<sub>2</sub> per year.<sup>11</sup> Thus a single commuter rail car operating at around 56 percent capacity (or 100 commuters) in the peak hours might save almost 500,000 pounds per year. These are best-case estimates, but even under average conditions (considering lower ridership in off-peak hours, less productive routes, and reverse-commute service) the average bus emits 32 percent less CO<sub>2</sub> than the average single-occupant car per passenger mile, and the average light rail vehicle emits 57 percent less.<sup>12</sup> Of course, other GHG savings occur as a result of transit use reducing congestion on roadways.

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<sup>11</sup> “Public Transportation’s Contribution to U.S. Greenhouse Gas Reduction,” Davis and Hale, SAIC, September 2007.

<sup>12</sup> See the U.S. DOT report “Public Transportation’s Role in Responding to Climate Change” at Appendix 1 for a comparison of ridership and emissions levels from the nation’s largest commuter rail, light rail, and bus transit systems.

There are several notes of caution about this scenario. First, it will take years to achieve high levels of ridership. Land use patterns will take time to respond to even generous incentives for creating transit-oriented development to support strong ridership. Second, buses and trains produce emissions as well. If ridership levels are too low, GHG benefits will be minimal or even nonexistent. Third, at this time there is uncertainty as to how Florida's development laws and regulations address how those theoretical 100 "trips" per rail car would relate to 100 available trips for purposes of concurrency. Adding "capacity" by adding commuter rail could contribute to further sprawl development patterns in areas outside Hillsborough County.

The MPO already has signaled support for the TBARTA vision of regional commuter rail, light rail, and Bus Rapid Transit for the Tampa Bay Area. As TBARTA progresses with its planning, other area MPOs and transit agencies will hopefully also demonstrate support for the overall vision. Of course, the central question for TBARTA is funding.

HART currently provides bus services, in-town trolleys, vanpools, and park-and-ride services in Hillsborough County. HART currently is planning for Bus Rapid Transit along several major corridors which will ultimately connect the Airport, Westshore area, Downtown, and around the University of South Florida (USF), out to I-75. When combined, HART's services can reduce VMT by encouraging commuters to reach destinations and travel within those destinations without the need for automobiles. As discussed below, this project, combined with the City of Tampa's plan for concurrency exceptions, could yield significant VMT reductions.

Summary recommendations:

- Support transit agencies – HART, TBARTA – to create/expand transit options for commuters to the Hillsborough area and travel within its business and commercial centers. TBARTA 2035 transit needs plan and HART's BRT projects can be used for prioritizing transit needs/spending.
- Support transit-oriented design ordinances by prioritizing congestion relief and transit expansion in those areas, as well as pedestrian-supportive design.
- Land for right-of-way is less expensive now than in a long time. Identify future corridors for transit and transit stations, as well as park-and-ride areas, and prioritize land acquisition.

### **Transit-Oriented Development**

As mentioned previously, transit will not approach efficient operation without land use patterns that provide a steady supply of passengers. Transit-oriented developments must go hand in hand with expanding transit services. Their relationship is one of mutual dependence.

The City of Tampa has updated its comprehensive plan and the Transportation Concurrency Exception Area (TCEA). The strategy is to focus new development and redevelopment into three main locations – Downtown, the Westshore business district, and around USF. The concept is to create urban residential, commercial, and business locations that will support alternate modes of transportation – walking, biking, and transit. The City plans to adopt land development ordinances which will promote transit-oriented development, and will be providing incentives to those developments that fit the concept.

In order for the City’s vision of high density and intensity land use in these areas to occur with multimodal alternative transportation options, the existing road networks may need to be “replumbed” to accommodate increased transit, and more user friendly bike and pedestrian facilities. Supporting the City’s TCEA will have multiple impacts on GHG reduction. First, more people can live in proximity to the business locations in each area – downtown, Westshore, and USF – reducing commuting distances. Second, the planned transit for these areas will provide connectivity and encourage transit use both within and between these areas. Third, the availability and attractiveness of other nonmotorized modes combined with compact, mixed-use development will contribute to reduced VMT. For example, short trips such as midday errands may be taken on foot rather than by car. Other local governments with land use authority in Hillsborough County also can be encouraged to implement land use patterns which support transit and pedestrian mobility to de-emphasize automobile use.

Hillsborough County’s Comprehensive Plan’s Future Land Use element also encourages mixed use development along designated transit corridors and waives transportation highway concurrency if one or more of the following factors are met:

The amount of internal trip capture for the project is in excess of 10%;

Transit ridership is increased by using TOD features such as direct pedestrian access to transit facilities, bus shelters, bus pull in bays, and contributions to transit improvements are greater than typically required; or

The area is included in a Multimodal Transportation District, Community Redevelopment Area, or other similar designation.

The Center for Clean Air Policy Transportation Emissions Guidebook estimates that infill and brownfield redevelopment can reduce site-level VMT by 15 to 50 percent.<sup>13</sup> That is, the average trip length of persons accessing such a site will be 15 to 50 percent less than if the site were a greenfield development. This

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<sup>13</sup> “CCAP Transportation Emissions Guidebook,” Part 1, page 18.

reduction would be realized simply by having people work and shop in closer proximity to their residences. Adding in smart school locations can add to this reduction.

Pedestrian-oriented design (POD) features also can decrease VMT. Land use features of POD include compact and street-oriented mixed use, short blocks, and parks; public spaces; and attractive design features.<sup>14</sup> Ways that transportation improvements contribute to POD include an interconnected street network, narrower roadways, sidewalks, access to transit, safe street crossings, and landscaping features.<sup>15</sup> Although some estimates are more aggressive, a safe estimate is that POD will result in 10 percent VMT reduction at the site-level.

MPOs can support transit- and pedestrian-oriented developments in a variety of ways, and in fact such support is crucial for the long-term success of such projects. TOD and POD require the correct “plumbing” to support both the transit itself and the people using transit. In the short-term, such improvements will likely reduce capacity for cars and trucks, thereby increasing congestion. Successful implementation of this long-term strategy highlights the necessity of a unified vision by the transportation and land use agencies, consistent application of the vision, and creatively addressing short-term barriers to success. Funding programs can target regional transportation funds to both planning activities and transportation projects that support TOD and POD areas. An example is the Atlanta Regional Commission’s Livable Centers Initiative (LCI), which has provided \$10 million over 10 years for planning studies and \$500 million for funding of priority transportation projects resulting from these studies.<sup>16</sup> LCI basic concepts are connectivity, enhancing streetscapes, emphasizing the pedestrian, improving transit options, and expanding housing options, and LCI won a 2008 National Award for Smart Growth Achievement.<sup>17</sup>

Summary recommendations:

- TCEA in Tampa – how will mobility be planned and funded? Support the success of transit-oriented development patterns by prioritizing “plumbing” the system for transit – walkability, biking, multimodal, and perhaps limiting parking availability.
- Examine city and county proportionate share ordinances for ways to direct funds to MPO priority projects for transit and congestion relief. Work with local governments to line up priorities to leverage private developer payments and fees. Focus proportionate share contribu-

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<sup>14</sup> Ibid, 23.

<sup>15</sup> Ibid. Some refer to these improvements collectively as “Complete Streets.” See [www.completestreets.org](http://www.completestreets.org), for examples.

<sup>16</sup> <http://www.atlantaregional.com/html/308.aspx>.

<sup>17</sup> [http://www.atlantaregional.com/documents/SG\\_Awards\\_2008\\_FINAL\\_508.pdf](http://www.atlantaregional.com/documents/SG_Awards_2008_FINAL_508.pdf).



tions (DRI and sub-DRI) on areawide priorities instead of ad hoc improvements.

- Coordinate with local partners during comprehensive plan updates to ensure consistency in GHG reduction strategies in transportation and land use elements.
- Encourage lasting land use pattern changes to support lasting transportation mode shifts.

### **Transportation Demand Management**

TDM can be defined as a broad set of strategies that strive to either reduce or reallocate automobile travel to achieve benefits such as reduced roadway congestion, improved air quality, reduced energy use and GHG emissions, improved public health for those biking or walking, and reduced commuting and travel costs. Successful TDM programs are typically supported through partnerships of agencies at the local, regional, and state levels. MPOs are frequently the lead agency in a TDM program, with support from the state DOT, local jurisdictions, transit agencies, employers, and schools.

The benefits of TDM programs are realized through policies that emphasize the movement of people and goods, rather than motor vehicles, and treat mobility as a means to an end rather than the end goal of transportation policy. The result is increased efficiency of a region's transportation network, with benefits in reduced costs of new facilities and fuel, increased access for those without a private vehicle or who prefer not to rely on one, improved public health through emissions reductions and increased physical activity, and decreased negative impacts on the environment that result from reliance on single-occupancy vehicles.

For worksite-based TDM programs, the most successful implementation is found at locations with high-quality transit and other travel options (such as walking to local services), and by employers that offer "exemplary" programs, including a range of financial and other incentives for alternative mode use or travel reduction. At such worksites, vehicle trip-reductions can range up to 15 to 20 percent. The benefits of worksite-based TDM are diluted by a number of factors, however. First, TDM programs have traditionally worked through large employers to implement workplace-based strategies, but this only reaches a fraction of employees (for example, about 42 percent of all working Americans are employed by companies with 100 or more employees). Second, not all employers will be willing or able to offer "exemplary" programs. Finally, work trips represent less than one-third (31 percent) of all VMT. The net result is that worksite-based programs should be capable of reducing all daily VMT in a region by roughly one to three percent.

Nonworksite TDM strategies include school-based programs as well as individualized marketing, a strategy that works with residents to inform them about their travel options. Studies of individualized marketing programs in the U.S. have reported reductions in VMT of two to eight percent for targeted populations.

However, it is important to note that these programs were voluntary, and participants were selected based on their interest in changing travel behavior.

TDM strategies may face barriers at an individual level that make them challenging to implement, or difficult for travelers to use, such as limited travel alternatives, unpredictable schedules, demands outside of the workplace that require flexible transportation, personal preferences, convenience and travel time, and social factors. Agencies implementing TDM programs have successfully used a number of strategies to overcome these barriers. In the Hillsborough County area, many TDM services are provided by Bay Area Commuter Services (BACS), a private non-profit organization funded by the Florida Department of Transportation with a mission “to promote transportation alternatives to the single-occupant vehicle in the Tampa Bay area and surrounding counties.” The BACS website ([tampabayrideshare.org](http://tampabayrideshare.org)) highlights the commuting alternatives available in the area, and facilitates car, van and bike pooling, employer-based incentives such as telecommuting, and offers emergency rides home.

High-occupancy vehicle lanes on major commute corridors offer time-saving benefits to non-SOV commuters. FDOT Districts 7 and 1 are currently investigating high-occupancy tolls (HOT) lanes on I-75.<sup>18</sup> Ramp metering, i.e. using traffic signals at interstate on-ramps to control the rate of vehicles entering the interstate, can be used to reduce congestion on limited access facilities. Cities can charge higher daily rates for parking in central business districts and other activity centers to increase the cost of driving alone. Land use strategies such as compact, mixed-use development and pedestrian-friendly design make it easier for people to use nonauto modes for travel. These types of policies fall under the jurisdiction of many organizations, again highlighting the importance of a cooperative approach to ensure success in addressing GHG emission reductions.

Summary recommendations:

- Initiate discussion with BACS as to how to improve use of regional TDM programs to promote TDM at worksites, schools, and other venues throughout the region;

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<sup>18</sup> Potential forms of road tolling and pricing include expanded use of traditional road and bridge tolls; implementation of systems of high-occupancy toll (HOT) lanes, express toll lanes, and truck-only toll (TOT) lanes; the use of cordon or area pricing around or within a defined area such as a central business district (CBD); and various approaches to mileage-based pricing. Systems of high-occupancy toll lanes, express toll lanes, and truck-only toll lanes adopted on a regional basis are likely to have a potential for contributing to measurable but not large reductions in greenhouse gas emissions. A mileage-based fee could be as simple as a fixed price per mile regardless of when or where traveled. However, the fee could vary either by time-of-day or historical level of congestion. Other possibilities include a fee based on the carbon content of the vehicle’s fuel, the type of fuel or power utilized, and fuel efficiency of the vehicle.

- Focus TDM strategies on specific areas, including Downtown, Westshore, and USF; and
- Work with the HART to continue to provide transit incentives through employers (e.g., discounted or pretax monthly passes).

## GHG Target-Setting

In November 2008 the Metropolitan Washington Council of Governments Board of Directors released a report on climate change in the metropolitan Washington, D.C. area that includes significant regional greenhouse gas emissions reduction targets. The voluntary regional targets include a proposal to reduce greenhouse gas emissions by 10 percent, to 2005 levels by 2012, and a long-term goal for a reduction to 80 percent below 2005 levels by 2050. Recommended measures include reducing regional greenhouse gas emissions from transportation by 30 percent through increasing fuel efficiency, reducing the carbon content of fuel, and reducing vehicle miles traveled. The report also recommends changes in land use planning such as tree canopy preservation, promoting walkable communities and green infrastructure, and integrating greenhouse gas analysis into project planning.<sup>19</sup>

In May 2008 the Association of Bay Area Governments in California staff made recommendations to reduce regional CO<sub>2</sub> emissions by 40 percent below 1990 levels by 2035. One component of this would be a 10% reduction in VMT per capita for 2035 vs. today.<sup>20</sup> These recommendations likely have been superseded by statewide legislation which will result in GHG reduction targets being set for all metropolitan areas in California as discussed below.

No other examples of GHG reduction targets set by metropolitan planning agencies or COGs could be identified. However, some MPOs (especially in California) have begun to analyze the GHG reductions from various plan alternatives. Two examples are:

- Sacramento, CA (SACOG) – Regional Blueprint plan, which includes significant land use actions, forecast to reduce daily CO<sub>2</sub> by 9 percent in 2035 compared to No-Project alternative (50,200 vs. 55,280 tons/weekday).

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<sup>19</sup> MWCOG, National Capital Region Climate Change Report, November 2008.  
[http://www.mwco.org/store/item.asp?PUBLICATION\\_ID=334](http://www.mwco.org/store/item.asp?PUBLICATION_ID=334).

<sup>20</sup> Memo to Joint Policy Committee, May 7, 2008.  
[http://www.abag.ca.gov/jointpolicy/Performance%20Targets\\_JPCMemo\\_May2008.pdf](http://www.abag.ca.gov/jointpolicy/Performance%20Targets_JPCMemo_May2008.pdf).

- San Francisco, CA (MTC) – 2035 Long Range Transportation Plan – Project alternative reduces GHG by 2 percent compared to No-Project alternative (113,610 vs. 116,010 tons/weekday).<sup>21</sup>

In March 2008, FHWA hosted an MPO workshop on Planning for Climate Change. The attendees were from across the United States and varying sizes of urban areas. Although anecdotal in nature, statements from the attendees indicated that many MPOs are wrestling with the appropriate role for themselves in climate change planning. Others seem to have placed climate change below more immediate and pressing issues, such as decreasing funding amid increasing demand. One problem cited with MPOs engaging in climate change planning was conflict among local land use and development plans and lack of a clear regional vision.

The Boston MPO put on a presentation at the workshop that highlighted its basic three-pronged approach: funding projects that provide alternatives to SOV travel; funding projects to reduce VMT and congestion; and funding the use of alternative fuels, when appropriate. The Puget Sound Regional Council presented information regarding its improvements to its travel demand modeling efforts that would allow more accurate forecasting in terms of mode choices and costs of driving.

Seen in the context of this workshop information, the MPO has several “head starts” in terms of GHG reduction strategies and planning. First, as previously discussed, there will be a regional vision for transit-based transportation system growth in the form of TBARTA’s needs assessment. Second, within the City of Tampa there will be an incentive-based land use implementation model for pedestrian-oriented and transit-oriented development and redevelopment/infill. Third, Florida now requires all of its local government comprehensive plans to include GHG reduction strategies in relation to transportation, giving those local governments incentive to build upon strategies adopted by neighboring jurisdictions and the MPO.

Many states have set GHG reduction targets, but have not allocated these targets to sectors or metropolitan areas (see tables below). Some key findings:

- Overall GHG reduction targets are typically 1990 levels by 2020, or 50-80 percent below 1990 levels by 2050
- Surface transportation GHG reduction targets typically range from 20-30 percent of total surface transportation GHG emissions in 2020 or 2025

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<sup>21</sup> See Travel Forecasts Data Summary p. 200,  
[http://www.mtc.ca.gov/planning/2035\\_plan/index.htm](http://www.mtc.ca.gov/planning/2035_plan/index.htm).

- Surface transportation typically accounts for ~6-12 percent of total GHG reductions across all sectors (up to 20 percent or more in a few states)
- Within the transportation sector, the following are the median percent reductions (of all surface transportation GHG) from specific strategies: Vehicle improvements – 40 percent; Low carbon fuels – 21 percent; Smart growth and transit – 25 percent; Other – 7 percent.<sup>22</sup>

The California Air Resources Board has two years – until September 30, 2010 – to give each of California’s MPOs a GHG emissions reduction target for cars and light trucks through changes in the development pattern. A “Regional Targets Advisory Committee” has been established that includes all stakeholders, including local governments, builders, and planners. MPOs can propose their own target. The total amount of GHG reductions to be allocated to regions, through their land use targets, is relatively small (about three percent of state-wide reduction target of 174 million metric tons of CO<sub>2</sub> equivalent (mmt CO<sub>2</sub>e) in 2020). The statewide targets in 2020 for transportation actions are:

- Light-duty vehicle GHG standards – 31.7 mmt CO<sub>2</sub>e
- Low-carbon fuel standard – 15 mmt
- Regional targets – 5 mmt
- Vehicle efficiency measures – 4.5 mmt
- Goods movement – 3.7 mmt
- Medium/heavy-duty vehicle efficiency – 1.4 mmt
- High-speed rail – 1.0 mmt

The Washington Climate Action Team in November 2008 finalized its report and recommendations, *Leading the Way: Implementing Practical Solutions to the Climate Change Challenge*. For transportation, the report summarized its recommendations as follows:

Transit, Ridesharing, and Commuter Choice Programs, including recommendations to expand and enhance current programs to increase viable transportation options available to Washington residents to conduct the activities, trips, and travel needed and desired for daily life.

Compact and Transit Oriented Development (CTOD) and Bicycle and Pedestrian Accessibility that supports the development of compact walking, bicycling, and public

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<sup>22</sup> Burbank, C.J. and Kassof, H. *Strategies for Reducing the Impacts of Surface Transportation on Global Climate Change: A Synthesis of Policy Research and State and Local Mitigation Strategies*. NCHRP 20-24 Task 59 draft final report, November 2008.

transportation-friendly communities and to increase the travel choices available.

Transportation Funding and Pricing Strategies that identify and create potential pricing mechanisms to support and incentivize GHG and VMT reductions, and stress key considerations for revenue use to support transportation infrastructure maintenance and operations.<sup>23</sup>

Washington state has set a target to reduce VMT by 18 percent by 2020, 30 percent by 2035, and 50 percent by 2050, compared to what it would be with no state-imposed restrictions.

### Statewide Climate Action Plans – Overall GHG Reduction Goals/Targets<sup>24</sup>

State	2020 or Other Near Term Goal	2050 or Other Long Term Goal
<b>Western</b>		
Arizona	2000 level by 2020	50% below 2000
California	1990 level by 2020	80% below 1990 by 2050
Colorado	20% below 2005 by 2020	80% below 2005 by 2050
Hawaii	1990 level by 2020	
Montana	1990 level by 2020	80% below 1990 level by 2050
New Mexico	10% below 2000 by 2020	75% below 2000
Oregon	10% below 1990 by 2020	75% below 1990 by 2050
Utah	2005 levels by 2020	
Washington	1990 levels by 2020, 25% below 1990 levels by 2035	50% below 1990 levels by 2050
<b>Midwestern</b>		
Illinois	1990 level by 2020	60% below 1990 level by 2050
Iowa		50% below 2005 level by 2050; additional scenario recommended at 90% below 2005 level by 2050
Kentucky	7% below 1990 levels by 2012(per Kyoto Proposal)	
Michigan	10-20% below 2002 levels by 2015; 25-35% below 2002 levels by 2025	80% below 2002 levels by 2050
Minnesota	15% below 2005 levels by 2015, 30% below 2005 levels by 2025	80% below 2005 levels by 2050
Wisconsin	1990 level by 2020	60 – 80% below 1990 levels by 2050
<b>Southeastern</b>		
Florida	2000 levels by 2017, 1990 levels by 2025	80% below 1990 levels by 2050
North Carolina	<i>Targets in Progress</i>	

<sup>23</sup> See the full report at [http://www.ecy.wa.gov/climatechange/2008CATdocs/ltw\\_app\\_v2.pdf](http://www.ecy.wa.gov/climatechange/2008CATdocs/ltw_app_v2.pdf).

<sup>24</sup> Burbank & Kassof, *op cit*.

State	2020 or Other Near Term Goal	2050 or Other Long Term Goal
South Carolina	5% below 1990 levels by 2020	
Tennessee	7% below 1990 levels by 2008-2012 timeframe	
<b>Northeastern</b>		
Connecticut	1990 levels by 2010, 10% below 1990 by 2020	75 – 85% below 2001 levels
Delaware	7% below 1990 by 2010	N/A
Maine	1990 levels by 2010, 10% below 1990 by 2020	75% below 1990
Maryland	10% below 2006 by 2012, 15% below 2006 by 2015, 25-50% below 2006 by 2020	90% below 2006 by 2050
Massachusetts	1990 levels by 2010, 10% below 1990 by 2020	75 – 85% below 2001 levels
New Hampshire	1990 levels by 2010, 10% below 1990 by 2020	75 – 85% below 2001 levels
New Jersey	1990 levels by 2020	80% below 2006 levels by 2050
New York	5% below 1990 by 2010, 10% below 1990 levels by 2020	
Pennsylvania		80% reductions from current levels by 2050
Rhode Island	1990 levels by 2010, 10% below 1990 by 2020	75-85% below 2001 levels
Vermont	1990 levels by 2010, 10% below 1990 by 2020	75-85% below 2001 levels

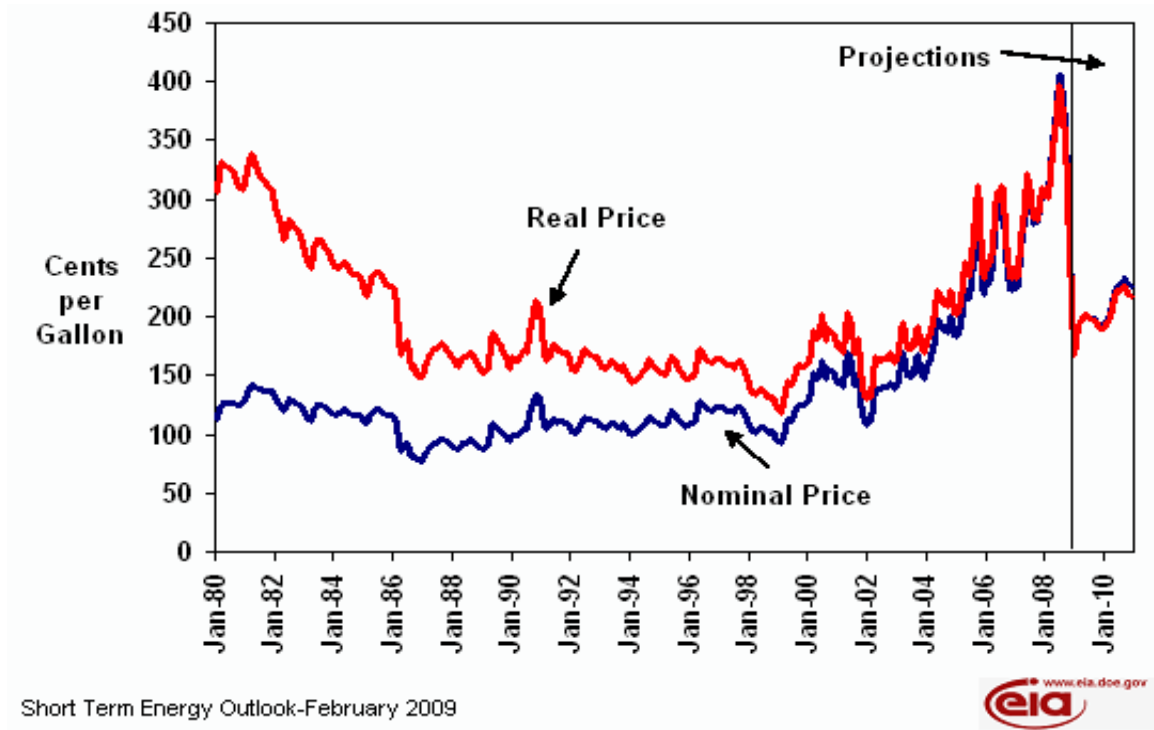
## Impacts of Fuel Price Changes on Consumption and VMT

Fuel prices experienced an unprecedented and rapid increase during 2008, which impacted the amount of driving in U.S. as a whole. Between May of 2007 and March of 2008, the price of fuel averaged around \$3. Although a dip occurred from August through October, it was short lived, unlike the typical patterns of fuel price over the last couple of years where a seasonal dip in price occurs between October and March.

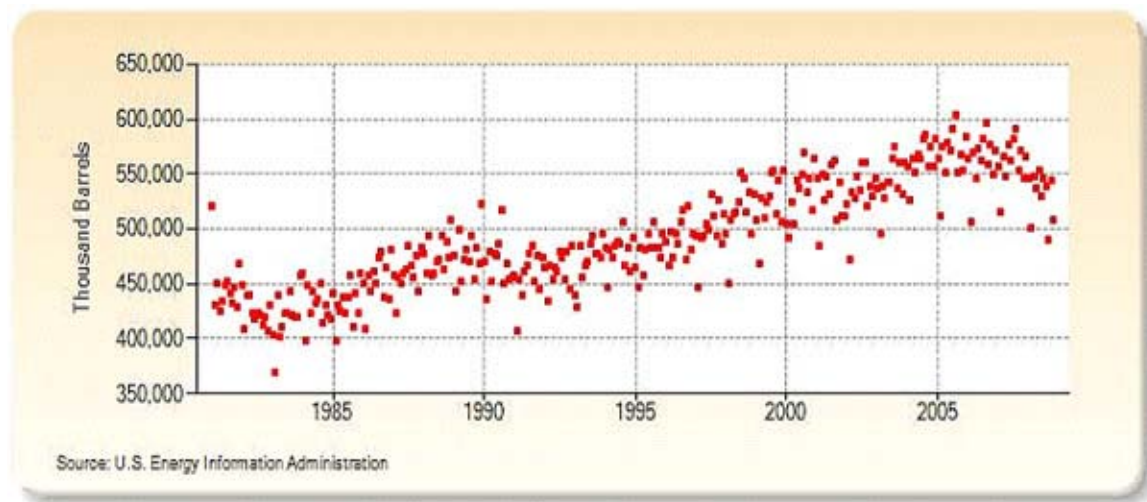
During April of 2008, fuel price started to climb and continued at a very aggressive rate to above \$4.00. Even with the rise of fuel prices to \$3.00 between February and May of 2007, drivers did not noticeably adjust their driving patterns. Once fuel prices started to significantly rise beyond \$3.00, to levels not yet experienced, driving behavior significantly changed. Studies of toll collections during this period calculated an elasticity of -0.17, meaning a 100 percent increase in fuel price would cause a *short-term* reduction in transactions of 17 percent.

Data from the U.S. Department of Energy showing gasoline prices and fuel consumption since 1980 also demonstrate the resiliency of consumption. Figures 3 and 4 show in the early 1990s and again in 2007-2008 that sharp increases in price were followed by declines in products supplied:

**Figure 3 Regular Gasoline Prices: Nominal and Real**



**Figure 4 Monthly U.S. Finished Petroleum Products Supplied**



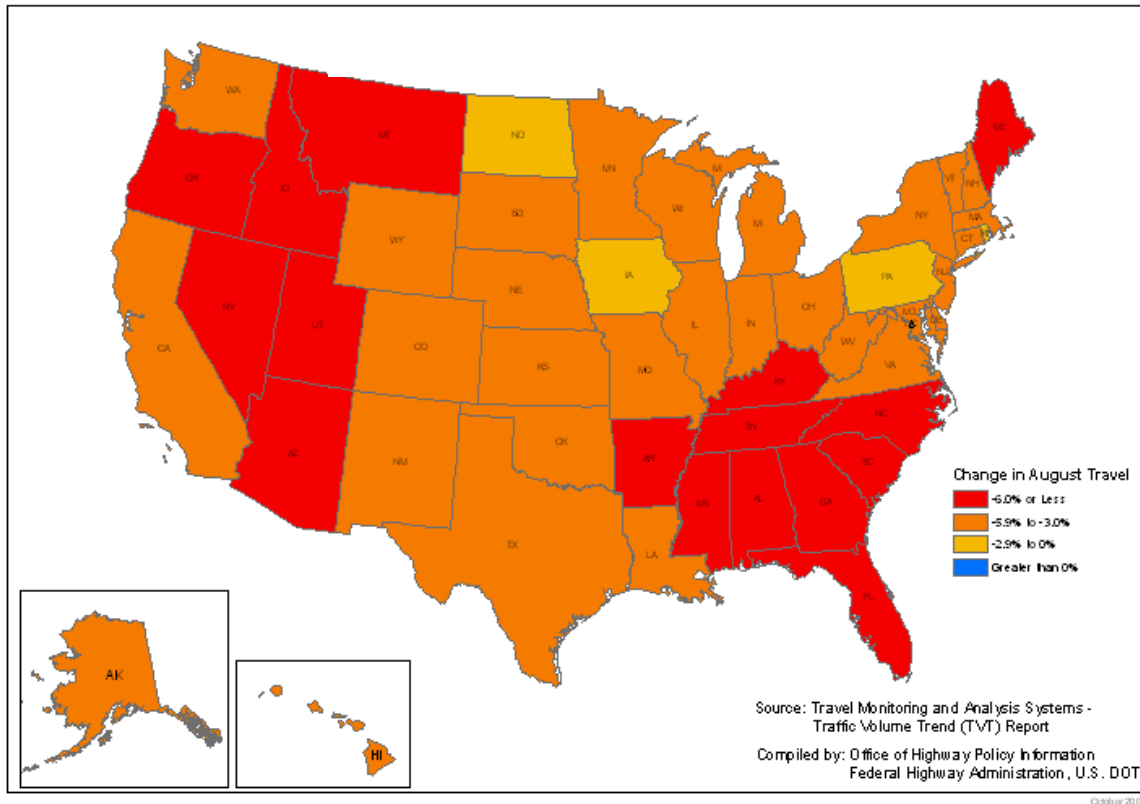
As the data shows, though, the declines in consumption were tied to dramatic price increases and appear short term. The spike in the Real Price in the early



1990s drove consumption down approximately 50,000 barrels a month. However, when that same Real Price was reached again in 2001, consumption did not drop, but was approximately 100,000 barrels per month higher. More gradual increases in price do not have the same dramatic impact on consumption as price spikes; it would appear, regardless of the real price.

It remains to be seen whether the price increases in 2007 to 2008 have lead to short term or more lasting consumption reductions. From August 2007 through August 2008, nationwide VMT dropped significantly, as shown in Figure 5, below, from U.S. DOT. As mentioned earlier in this report, VMT continued to drop nationwide at a 3 to 5 percent rate monthly, until December 2008 when the decrease was 1.6 percent, with some parts of the country experiencing small increases in VMT.

**Figure 5 Change in Vehicle Miles of Travel (VMT)**  
*August 2008 compared to August 2007*



Gas consumption’s relative resistance to small price increases contains both good and bad in terms of GHG reduction. The bad is that unless gas prices rise significantly, and in a short amount of time, consumption and VMT do not appear to be impacted. However, the good news is that small increases in price due to local revenue raising will not drive down consumption and thus will not drive down revenue from consumption. Those revenues can be used to provide capi-

tal to finance other GHG strategies, such as transit, which can have significant impacts on GHG reduction.

## Air Quality Improvement Strategy

It appears that Hillsborough County will be designated by the USEPA as an air quality non-attainment area, although that formally will not occur until 2010. In preparation for this designation and others expected in Florida, FDOT has begun discussions on the potential development of an air quality post-processor prototype within the Florida Standard Urban Transportation Model Structure (FSUTMS). If developed and integrated within the Tampa Bay Regional Planning Model, this air quality post-processor would enable the MPO to calculate ozone emissions within the FSUTMS/Cube Voyager modeling platform.

The post-processor will apply emissions factors for Nitrogen Oxide (NO<sub>x</sub>) and Volatile Organic Compounds (VOC), the pollutants which make up ozone, to link-level Vehicle Miles Traveled (VMT) within the FSUTMS travel demand model to calculate emissions estimates for each pollutant by County. These emissions factors will be developed by running MOBILE6, or MOVES dependent upon when the final version is released. The output emissions factors will then serve as look-up tables input into the air quality post-processor in FSUTMS/Voyager. FDOT recently met with the Florida Department of Environmental Protection to begin coordinating on this potential effort and is anticipated to be meeting in the near future with those MPOs and FDOT Districts that are expected to be designated as ozone nonattainment areas.

The key to air quality improvement is identical to GHG reduction – reduce VMT. Thus, by initiating GHG reduction strategies as part of the LRTP update, the MPO has also set in motion strategies for improving air quality, as well.

## Adaptation

While reduction of GHG emissions is critical to slowing climate change, transportation agencies also must plan for what may be unavoidable impacts of anticipated climate changes, some already underway. Increased average worldwide temperatures, rising sea levels, changing precipitation patterns, and increased storm activity will have a disproportionate impact in coastal areas, especially densely populated low-lying coastal areas that comprise much of Florida, notably Hillsborough County. There also are possible impacts on transportation structures from increased acidity in rainfall.

Draft results from the Transportation Research Board Gulf Coast Study show that relative sea level will likely rise one to six feet, with a two- to four-foot increase most probable. Sea level rise would result in massive inundation, and will be caused both by thermal expansion and ice melt, as well as sinking lands masses. Hurricane vulnerability will worsen, with a 5 to 20 percent increase in storm intensity due to climate change. Average temperature is likely to increase by two

to four degrees Fahrenheit over the next 50 to 100 years, and extreme daily high temperatures also will increase. Models show mixed results for changes in average precipitation, but the intensity of rainfall events, however, will likely increase.<sup>25</sup>

In 2007, Governor Crist issued Executive Order 07-128, which required the Florida Governor's Action Team on Energy and Climate Change issue recommendations including any necessary legislative initiatives to address Adaptation strategies to combat adverse impacts to society, public health, the economy, and natural communities in Florida. The Governor's Action Team issued recommendations in a final report, the Florida's Energy and Climate Change Action Plan, on October 15, 2008. Chapter 8 dealt specifically with "Adaptation Strategies." In the discussion of the need for such strategies, the Plan quotes the International Panel on Climate Change (IPCC) and other sources as indicating that Florida would experience a 4-6 degree Fahrenheit temperature increase, and somewhere between 9 inches and 5 feet of sea level rise by the end of the century. In terms of what this means to Florida, the Plan states:

In general, elevations of barrier islands are only minimally above sea level and much of Florida's barrier islands have been subject to extensive development of high value oceanfront real estate. These areas are at significant risk from SLR [sea level rise] and increased intensity of hurricanes. Beach erosion, which already costs Florida more than \$600 million per year, is likely to increase. Coastal wetlands could be inundated by sea level rise. The Everglades represent the largest and most important of Florida's coastal wetlands. As sea levels rise, brackish waters will extend further inland and dramatically change these and other freshwater ecosystems. Unconfined coastal aquifers, such as the Biscayne Aquifer in South Florida, will become more saline because of sea level rise.<sup>26</sup>

The report also lists a series of other impacts these changes could cause, including prolonged droughts and more wildfires, more flooding due to more torrential rains, more frequent and lengthy heat waves creating health hazards,

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<sup>25</sup> Transportation Research Board Special Report 290, *Potential Impacts of Climate Change on U.S. Transportation*, page 61: "[B]y the end of the 21<sup>st</sup> century, a conservative projection of climate change has the recurrence period (or average expected waiting time) for the current 1-in-20-year, heaviest daily precipitation event reducing to every 6 to 8 years over much of North America."

<sup>26</sup> *Florida's Energy and Climate Change Action Plan*, at 8-2.

potential disease-causing insect infestation, bleaching of coral reefs, and economic, environmental, and social impacts.<sup>27</sup>

At this time, the United States' DOT, many states, and several policy "think tanks" are exploring the ranges of avenues for approaching adaptive strategy development. The apparent consensus is to begin with vulnerability assessments of potential impacts based on locations, especially in low-lying and coastal areas. Again, Florida and Hillsborough County have somewhat of a head start in this area as a result of the last four years of hurricane impacts. These impacts have brought high focus on the fragility of shorelines and areas further inland. In summary, Florida already is in the midst of adapting to some apparent effects of climate change, but may have much more adapting to do.

## Conclusion

GHG reduction and sustainable transportation systems are long-term propositions requiring multiple transportation and land-use decision-makers to work together toward a common set of goals. The Hillsborough County MPO is well-positioned to play a leading role in setting those goals and taking tangible steps to meet them. Supporting expanded transit systems and the land uses necessary to sustain those systems already are MPO priorities, and other governing bodies in the region appear poised to play their parts in meeting the challenges, as well.

Transportation demand management initiatives can also decrease VMT and have positive impacts in many cases without construction projects. Traffic operation modifications are also important, and may be achievable with only minor design and construction. Simply reducing the emphasis on adding vehicle capacity through additional lane miles can result in savings in terms of funds and increase the viability of alternate modes, spurring GHG reduction.

As strategies for addressing all aspects of climate change are implemented across the country, innovative programs and projects will take shape, so it is important to be aware of when other MPOs and DOTs are seeing successes. Federal regulations also will evolve as new concepts are tried and bear fruit. From now on, GHG reduction and adaptation planning will be vital to the future of sustainable transportation and beyond.

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<sup>27</sup> Florida's Energy and Climate Change Action Plan, at 8-3.

**Appendix: Hillsborough County MPO – GHG Reduction Efficiency Analysis –  
Transportation Strategy Qualitative Screening**

No.	Strategy Name	Effectiveness*	Costs	Feasibility	Other Considerations
1	Increasing Bus Rapid Transit (BRT)	+/++ Highly dependent upon complementary measures to discourage commuting by single occupancy vehicles. 1-2 percent VMT reduction, dependent upon ridership and routes.	+ Upfront capital investments in buses, station additions, park-and-ride areas, and corridor improvements. Longer-term operating costs.	++ Generally utilizes existing infrastructure, but requires some modification. Primary barrier to success is convincing commuters to utilize the service consistently.	Expanding BRT not as likely to spur long-term private investment in transit-oriented design, BRT not seen as a permanent commitment to transit in some cases.
2	Light/Commuter Rail	++/+++ Highly dependent upon complementary measures, but potential 1-5 percent VMT reduction.	+ Upfront investment is substantial plus long-term operating costs.	++ Tri-Rail, Sunrail, and TBARTA all demonstrate that public will accept, issue is funding.	Will take years to complete, funds used to construct will not be available for other projects, causing potential additional congestion until operational. Has potential for long-term economic benefits related to private development.
3	Transit-Oriented Development	+++ Highly dependent upon transit services, can achieve 20-30 percent VMT reduction at site level. TOD in infill/brownfield areas adds to effectiveness.	++/+++ Dependent upon the type(s) of transit service (costs included) and success of private development efforts.	++/+++ Direct government control; negotiation/incentives for private development readily conducted. Needs market support.	Longer term solution but can have permanent impact on VMT reduction. Might meet local resistance to increased density/intensity of development.

No.	Strategy Name	Effectiveness*	Costs	Feasibility	Other Considerations
4	Pricing Strategies	+++ Commuter incentives/disincentives, road pricing, and parking pricing can be highly effective, 5-25 percent VMT reduction for area/market affected.	++/+++ Minor costs along existing tolled routes, substantial costs to convert free facility to some type of tolled/HOV/HOT configuration.	+ / ++ On existing interstates, most feasible on regional basis, will require multiple agency collaboration.	Expect high local resistance to tolling free facilities and increasing tolls and fees for existing facilities. Potential equity concerns with lower-income travelers potentially experiencing a negative impact unless revenues reinvested in transit, lower taxes, etc. Benefit is revenue enhancements to fund other strategies.
5	Improved Bus Service	+ Affordable transit measures alone not likely to significantly reduce vehicle travel in short- or even medium-term Offsetting bus emissions could negate benefits if insufficient ridership.	+ Cost of operating new or expanded services may be significant.	++ Cost/funding would need to be addressed.	Equity benefits would be substantial – young, old, disabled, and those unable to afford one car per driver would see significant benefits.
6	Worksite TDM _ Telecommuting, compressed work week, car and van pools	+ Affects a relatively small percentage of total trips Partially offset by extra discretionary trips and home energy use.	+++ Minor costs – program administration, some technology investment, but mainly addressing institutional (employer and employee awareness) concerns.	++ Some employers may be resistant Difficult to apply specific requirements/mandates.	In most ways, a “no regrets” measure unless forced with mandatory targets. Increased employee satisfaction; mixed productivity benefits or impacts Incentives can be implemented immediately.

No.	Strategy Name	Effectiveness*	Costs	Feasibility	Other Considerations
7	Operational level congestion relief, e.g., intersection improvements, signal coordination, incident management	+ Limited. Improved efficiency reduces time spent driving, not necessarily VMT, and may be offset by increased trips/induced demand.	+ / +++ Intersection improvements can be costly in urban areas. Signal timing can often be improved at low cost; other operations-based strategies often relatively inexpensive compared to capital investment.	++ / +++ Primary barriers are institutional/ coordination, and potentially community impacts for physical improvements.	Likely to produce benefits to travelers in terms of reduced delay. May be necessary as part of overall GHG strategy, especially long-term transit improvements.
8	Education and outreach campaign	+ Likely to have relatively minor impacts.	+++ Minor program costs.  Likely to lead to consumer cost savings through reduced fuel use through multiple avenues.	+++ No significant barriers to implementing.	Leverages off of and reinforces other climate change measures.

<b>Legend:</b>		
+++ = High (effectiveness >10%)	+++ = Low costs	+++ High feasibility
++ = Moderate (effectiveness 3-10%)	++ = Moderate costs	++ Moderate feasibility
+ = Low (effectiveness <3%)	+ = High costs	+ Low/uncertain feasibility

## Effectiveness

- Total VMT reduced.

## Costs

- Actual Costs (+++ ~<\$10 million; ++ ~\$10-50 million; + ~>\$50 million).

## Feasibility

- Political.
- Technological.
- Social.
- Financial.

## Other Considerations

- Cobenefits: Non-GHG benefits – e.g., reduced air pollution, traffic fatalities.
- Distribution of cost; distribution of potential offsetting credits.
- Equity: Distribution of costs and benefits.
- Timing of costs and benefits.
- Durability: Resiliency of favorable criteria (When will noncost and nonbenefit criteria turn downwards).
- Existing or Planned Programs: How many, how well-established, successful.
- “Additionality”: Degree to which measure is new or “additional” to the base scenario (including national or international strategies).
- Consistency: Consistency with national and international programs and/or likely programs.