

Attachment E:

Baltimore County Sustainability Network

Our Built Environment Working Group

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Introduction

The group, Our Built Environment (OBE), is one of four working groups of citizens and County government staff that were created as part of Baltimore County's Sustainability Network. The groups were established to identify ways to reduce energy consumption and mitigate climate change. The groups have also been encouraged to identify "co-benefits", including cost savings.

The OBE group was asked to explore ways in which Baltimore County might encourage both new and revitalized communities that are more walkable, provide convenient services to residents, and offer options less dependent on automobiles. The group was also asked to find ways to utilize more sustainable modes of transportation, including public transit, to create more vibrant commercial and residential opportunities. The group was also asked to identify cost effective opportunities to create businesses, homes, and offices in ways that use fewer non-renewable resources and provide cost savings to citizens, businesses, and government.

The group's charge was to identify existing tools to create sustainable results in the areas discussed above, including tools already implemented in the County, and organize them in a manner in which they could be reviewed by the larger network and possibly incorporated into an implementation strategy. The group was asked to look beyond County government operations, which are being addressed by a different group.

The OBE group realized that the scope of its assigned task was large. After meeting together several times, the members divided into two sub-groups for more focused work. One sub-group focused on energy efficiency in new and existing buildings, while the other focused on land use, transportation, and vehicle miles traveled.

The group identified two additional topics that members considered important, but which time did not allow the group to pursue in any depth: food production and distribution, and renewable energy. The sense of the group is that there are significant opportunities to reduce energy consumption and greenhouse gas emissions by producing food and renewable energy more locally and at a smaller scale. Renewable energy generation is discussed briefly in the report.

Organization

The report is divided into three parts. Part I addresses energy efficiency and greenhouse gas emissions in buildings. It includes a short introduction followed by recommendations for

existing buildings, new construction, and related professional development. Part II consists of a short discussion of energy generation.

Part III focuses on the potential to reduce petroleum consumption and related greenhouse gases from automobiles. The introduction explores the relationships among land use, transportation, and vehicle miles traveled. While the primary focus is on automobiles as greenhouse gas generators, this section briefly addresses the impact of land use patterns on energy use and conservation in buildings. The discussion is followed by recommendations.

Format of Recommendations

In all sections, the recommendations include a discussion of issues and possible solutions, followed by the identification of some or all of the following: *Benefits*, meaning potential to affect climate change; *Co-Benefits/Spillovers*, including broader economic, social, or environmental benefits, or possible unintended consequences; *Existing Programs/Resources*, including initiatives which could be adopted or enhanced, or models which could be emulated, by government or the private sector entities; and *Educational Component*, meaning efforts to inform or engage the public or specific groups about the issue.

Integrated Approach

In its report, *Toward A Climate Friendly Built Environment*, the Pew Center on Global Climate Change recommends an integrated approach to reducing GHG emissions "from the diverse and fragmented building sector." The recommended approach "coordinates across technical and policy solutions, integrates engineering approaches with architectural design, considers design decisions within the realities of building operation, integrates green building with smart growth concepts, and takes into account the numerous decision-makers within the industry."ⁱ

The working group has addressed issues related to 'Our Built Environment' in as integrated a manner as possible, given the constraints of time and our collective expertise. Much work remains to be done. There remain many gaps to be filled and many dots to be connected.

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Part I

Existing & New Buildings

Introduction

We have all heard about the impacts buildings have on our environment. Here are some examples as reported by the US EPA:

- Buildings accounted for 39.4 percent of total U.S. energy consumption in 2002. Residential buildings accounted for 54.6 percent of that total, while commercial buildings accounted for the other 45.4 percent.
- Buildings accounted for 67.9 percent of total U.S. electricity consumption in 2002. 51.2 percent of that total was attributed to residential building use, while 48.8 percent was attributed to commercial building usage.

As a consequence:

- Buildings in the United States contribute 38.1 percent of the nation's total carbon dioxide emissions, including 20.6 percent from the residential sector and 17.5 percent from the commercial sector.

Thus, as we look toward reducing our contribution to the production of green house gases, we must address energy conservation in buildings. Presented is a set of recommendations that are directed at the buildings in Baltimore County, both commercial and residential. They address things that can be done as we build new buildings and as we remodel, repair, and rebuild existing buildings. These recommendations also address building inspection and those that work in the building construction trades. The recommendations are intended to support the County's commitment to sustainability by creating buildings that are durable and will serve the people of Baltimore County for years to come.

Recommendations for Existing Buildings:

1. *Energy Certification of Buildings.*

- A. Require an energy performance certificate for all buildings at the time of sale or lease.** The certificate documents the building's energy performance rating, which is assigned

based on an energy performance assessment. The rating, similar to miles per gallon rating for autos, helps consumers make better-informed decisions.

B. Mandate that the required energy performance certificates be posted in a building's lobby or other prominent location.

Benefits. The simplest number to understand energy usage in buildings is the cost of the utility bills for heating, cooling, and electrical use. These costs can be quantified and divided by the size or square footage (SF) of the building to arrive at an annual cost per SF. This number is the bottom line for all the efforts of the various high performance building rating systems and energy retrofitting programs to save energy (LEED, energy star etc.) and could be used to see how well these programs are doing. Expanding the use of these measures will help to improve the rating systems and make them more useful to consumers over time. Just as people use the miles per gallon (MPG) number to make their automobile purchases, so could kWh/SF or BTU/SF numbers be used to guide people in deciding which building to purchase or rent. Over time, those buildings that are more wasteful than others will have less value in the market place.

Co-Benefits/Spillover: One of the major spillover effects will be to provide a constant awareness to the general public. It will provide them with a constant reminder of energy use and cause them to think of ways to reduce unnecessary usage. This could affect both commercial and residential markets. People would be willing to spend more on a structure that had a verifiably lower energy cost.

Existing Programs/Resources: “Most drivers know about how much gasoline their cars use on average. The consumer takes note of the efficiency rating of a refrigerator or washing machine when about to buy one. Yet more often than not no objective information is available on the energy quality of a residential building, despite the fact that most of the energy consumed by citizens is used for heating, cooling and hot water generation in private households. To correct this situation Germany has begun to require buildings to have an Energy Certificate whenever they are sold or leased. These bring more transparency to the real estate market and provide all market participants with reliable information on the energy requirements and energy quality of a building. There are two types of Energy Certificates; a Demand Certificate and a Usage Certificate. A Demand Certificate is issued when an expert

closely examines such aspects of energy efficiency as the walls, roof, windows and furnace. The Usage Certificate is based, much more simply, on the actual energy use of the property over the past three years. Only specialists are authorized to issue the Demand Certificate.”

Source: www.howtogermaany.com

- 2. *Require the installation of a real-time energy display in all buildings whenever the energy meter is changed out, and provide a tax credit for installing the display.*** As part of a building automation system, real time displays have the capability of showing a variety of information about the current amount of energy being used by the building. In addition to the current usage, these displays can show energy usage over time, how much the energy costs, and can compare these numbers to past usage and cost. In commercial buildings, these displays tell the building operator how well the system is doing and often give early warning of equipment malfunction. When used as part of a public display, it tells the public how good they are doing as environmental stewards. In residential buildings, the systems are referred to as home automation and provide the same kind of information to homeowners or renters. Displaying real time information in homes provides instant feedback on energy use and costs. This kind of information provides an incentive to adjust usage. Such as, changing the timing of use for high-energy demand appliances such as dishwashers or cloths dryers to off-peak hours. This saves the homeowner money and improves power plant efficiency. Studies show that access to home energy information typically saves 5-15% on monthly electricity bills.

Benefits: Studies have shown that when people are given real time information on their energy use they moderate that use; using less and using less frequently. These changes in behavior can help to balance the demand on the local power utility. This can result in lower utility bills and lower green house gas emissions.

Co-Benefits/Spillovers: Because of the reduced per capita demand, existing power plants can handle the anticipated increases in regional population.

Existing Programs/Resources: GE currently has a “smart meters” program. This program is part of their new Smart Grid initiative: <http://ge.ecomagination.com/smartgrid>

- 3. *Require that all new refrigerated beverage vending machines be Energy Star qualified.*** According to the EPA, Energy Star qualified new and rebuilt refrigerated beverage vending

machines can save building and business owners more than 1,700 kWh/year, or \$150 annually on utility bills. New and rebuilt refrigerated beverage vending machines that have earned the Energy Star qualification are 50% more energy-efficient than standard machine models. These new and rebuilt vending machines incorporate more efficient compressors, fan motors, and lighting systems to keep beverages just as cold, without sacrificing visibility, while using less energy. They also come with a low power mode option that allows the machine to be placed in low-energy lighting and/or low-energy refrigeration states during times of inactivity.

Benefits: The direct short and long term benefit of this recommendation is the reduction in energy use by buildings with these more efficient vending machines. This will translate into cost savings and a reduced demand for electric generation. This in turn will create a reduction in green house gases.

Existing Programs/Resources: The US EPA has an active program to promote the use of Energy Star vending machines. The program has information on manufactures, savings calculator, fact sheets and case studies. This information is available at: http://www.energystar.gov/index.cfm?c=vending_machines.pr_vending_machines.

Educational Component: The primary educational effort would be to help make consumers, along with County and corporate purchasing agents aware of the program and the provide access to the EPA web site.

4. *Design and establish a competition among County Council Districts to save energy.*

Alone, no one action or individual can significantly reduce green house gases. However, collectively, we can make significant progress. Working together often provides the incentive to do that one additional action we are not motivated to do on our own. Having Council Districts compete against each other is a means of involving the general public in the effort to reduce energy usage and lower green house gas production. It would provide the opportunity for new innovative ideas to be presented that help to lower energy use and provide the stimulus to help change our consumer patterns.

Benefits: The direct benefit would be the reduction of energy use and the creation of a mass public awareness campaign towards that goal.

Co-Benefits/Spillovers: Participation will result in cost savings to consumers and help strengthen community ties.

Existing Programs/Resources: There are no existing programs.

5. *Encourage Energy Retrofits*

- A. *Establish a revolving loan fund to provide low-interest or interest-free loans for energy-efficiency retrofits in residential and commercial properties based upon the result of an energy audit in that building.*
- B. *Provide incentives to have an energy audit done on all existing structures older than 5 years to identify ways to optimize energy efficiency.*
- C. *Require that for any building receiving County assistance, an energy audit should be performed.*
- D. *Require that the retrofits or substantial improvements affecting 50% or more of the building meet the LEED Silver standard or comparable; create incentives for retrofits <50%.*

“Forty-three percent of America’s carbon emissions come from heating, cooling, lighting and operating our buildings. Older homes are particularly wasteful: Homes built in 1939 or before use around 50 percent more energy per square foot than those constructed in 2000. But with significant improvements and retrofits, these structures could perform on a par with newer homes.” NY Times “This Old Wasteful House” 04/05/09. Most of the existing housing stock in Baltimore County predates 2000. Increasing the energy efficiency of this vast quantity of built space would have a commensurately large effect on reducing greenhouse gas emissions in Baltimore County.

The first step in making these homes more efficient should be an energy audit. An audit can help assess how much energy a home uses and evaluate what measures can be taken to improve efficiency. However, audits alone don't save energy. The identified recommendations need to be implemented. A baseline audit can be performed by homeowners using the EPA’s Home Energy Yardstick:

http://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGetStarted.

For best results, a more detailed audit that is based on a whole-house approach should be considered. A professionally trained home energy auditor can do the audits.

Benefits: The primary benefit would be to reduce residential energy use by 15-20%. This reduction would result in direct savings to consumers and a reduction in the generation of electricity demand from utilities. Reducing generation will directly reduce green house gas emissions.

Co-Benefits/Spillovers: One of the major spillover effects will be the creation of new business opportunities for people doing the energy audits and people acting on the recommendations. Making the changes suggested by the audits will also result in homes that are healthier for the occupants. Many of the energy saving changes will result in the reduction of drafts, better moisture control, and reduction of mold, dust, and other allergens. These are the major components of better indoor air quality, which support healthier homes.

Existing Programs/Resources: The National Trust for Historic Preservation “is also working with the Natural Resources Defense Council and members of Congress on legislation to help cover the costs of making all older homes more energy-efficient. Under this proposal, a homeowner would receive a \$3,000 incentive for improving energy efficiency by 20 percent, and \$150 for each additional percentage point of energy savings. If 300,000 homes could be retrofitted each year, we estimate that after 10 years we could see a reduction of 65 million metric tons of carbon emitted into the atmosphere, and the equivalent of 200 million barrels of oil saved.”

The US EPA Energy Star Program has been one of the primary promoters of home audits. They have an existing program with an array of consumer education materials. Maryland has partnered with EPA’s home energy audit program and developed the Maryland Home Performance with Energy Star program. More information about this program can be found at: <http://www.mdhomeperformance.org>

Educational Component: The primary educational effort would be to make consumers aware of the existing programs by directing them to the websites.

Recommendations for New Buildings:

6. *Mandate separate energy meters for each unit in multifamily buildings.*

Many multifamily buildings have a central heating and cooling system that feeds into every unit. As a central unit, the management pays the energy costs and usually passes this on to the occupants in their monthly rental fee. Regardless of their usage, occupants pay a set fee.

Thus, there is no incentive to conserve energy. Installing individual meters to each unit provides a way to directly charge each occupant for the energy they consume. The more they use the higher their bill. Conversely, the less they use the smaller their bill. This creates a market-based incentive for each occupant to conserve energy. It also provides the occupants with a direct feed back of their energy usage that was not available without the individual meters.

Benefits: This action would produce a reduction in energy usage and a corresponding reduction in GHGs.

Co-Benefits/Spillover effects: Being aware of and responsible for their own energy use occupants will have an incentive to reduce their use. A reduction in use directly results in a reduction in costs. This is a direct incentive to reduce usage and save money.

Existing Programs/Resources: Local utilities have consumer education programs and Internet based information already in place that can be used. They also have rebate and other incentives that can help the occupants implement energy reduction efforts.

Educational component: Occupants should be provided with an educational program that teaches where energy is usually wasted and steps they can take to reduce energy usage and prevent waste. This should be a written document that is affixed to a cabinet or other structure of the residence and explains the energy saving features of the residence, what they need to do to ensure that these features work properly, as well as other things they can do to save energy.

7. *Require all new commercial and residential buildings to be built to the USGBC's LEED Silver rating or a nationally recognized equivalent.*

Since buildings account for about one-third of the world's greenhouse gas emissions, how we build them becomes a significant issue. The US Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria. LEED is a third-party certification program and the nationally accepted benchmark for the design, construction, and operation of high performance green buildings.

Buildings are certified and given higher ratings based upon how many sustainable features are incorporated in the design. Inherent in the LEED criteria are designs and building techniques that promote buildings that are typically 20 – 30% more energy efficient. This reduction in energy use translates into a significant reduction in greenhouse gas emissions.

Benefits: The direct short and long term benefit is the reduction in the production of GHGs.

Co-Benefits/Spillovers: In addition to the energy reduction features in LEED and the associated reduction in GHGs, requiring buildings to be LEED certified provides environmental health, occupant health, and social benefits.

Existing Programs/Resources: The USGBC has evolved into a well-established national and international program based upon intense peer review and third party verification. It has an infrastructure that provides for training and testing of accredited professionals in the LEED system. They are supported by a well-established and growing industry of trained professionals in testing and verifying the operation of the buildings to be certified. All of this reduces the burden on county government to create and administer similar programs. The USGBC web site will provide more information www.usgbc.org.

Educational Component: The USGBC has a growing education program for all levels of the building industry. The County could help to advertise or even sponsor some of these training programs in various locations to provide easier access for members of the industry.

8. ***Require that all new commercial and residential buildings be solar ready.*** This will require including conduits and chases in the design and construction that will accommodate the future installation of alternative energy products (solar photovoltaic panels, solar hot water, wind, etc). Making buildings solar ready during construction can be done at minimal cost: typically \$200-\$300 per home and \$500-\$600 per story for buildings. The costs post-construction can be prohibitive and aesthetically unattractive.

Benefits: Having buildings solar ready will encourage and support the future installation of solar panels or other alternative energy equipment. In the long run, expanded use of solar technologies will reduce the consumption of electricity produced from power plants.

Co-Benefits/Spillovers: In addition to reduced green house gases, there will be long term cost savings to the consumer.

9. *Create incentives to incorporate passive solar techniques/best practices in the design and construction of new commercial and residential buildings for heating, cooling, and increasing natural daylight.*

Passive solar is a concept of using sunlight for useful energy such as converting sunlight into usable heat (water, air, thermal mass) or to cause air-movement for ventilating. Passive solar systems have little to no operating costs, often have low maintenance costs, and emit no greenhouse gases in operation. They do, however, need to be optimized to yield the best performance and economics. One way to optimize the yield is to build with a passive solar, or climatic, design. Passive solar building design uses a structure's windows, walls, and floors to collect, store, and distribute the sun's heat in the winter and reject solar heat in the summer. It can also maximize the use of sunlight for interior illumination. The technology is called passive solar design, or climatic design. Unlike active solar heating systems, it doesn't involve the use of mechanical and electrical devices (such as pumps, fans, or electrical controls) to circulate the solar heat. Buildings designed for passive solar use incorporate large, south-facing windows and construction materials that absorb and slowly release the sun's heat. The longest walls run from east to west. In most climates, passive solar designs also must block intense summer solar heat. They typically incorporate natural ventilation and roof overhangs to block the sun's strongest rays during that season. Another major component of passive solar is "daylighting": which takes advantage of natural sunlight, through well-placed windows and specialized floor plans, to provide interior lighting. This is one of the most cost-effective means of reducing energy usage in buildings

Benefits: Passive solar design is highly energy efficient and has the short and long term benefit of reducing the demand for lighting, heating, and cooling. By reducing the demand for energy, passive solar design also helps conserve fossil fuel resources and saves homeowners money. Incorporating passive solar design elements into buildings and homes can reduce heating bills by as much as 50%. Since it relies on solar energy (a renewable, nonpolluting resource), passive solar design also reduces greenhouse gases.

Co-Benefits/Spillovers: In addition to the reduction in energy use, passive solar designs and increased "daylighting" have been shown to increase worker productivity in offices, increase test scores and reduce absenteeism in schools, and increase spending by shoppers in retail

establishments. These effects are the result of the attractive, relaxed atmosphere created by these designs.

There is a potential conflict with another recommendation that needs to be mentioned. For good walkability, buildings should be oriented toward the street, and generally not on angles. Streets in some cases may run north-south, possibly making it difficult to orient buildings toward or away from the sun for optimum solar benefit. To avoid this potential conflict, passive solar design needs to be considered in the design of walkable communities.

Existing Programs/Resources: There are a number of programs that support passive solar design. For example, the US EPA encourages passive solar design in their energy savings programs (www.energysavers.gov). There are also programs focused on an integrated passive solar design. One such program is the Passive House (Passiv Haus) standard, which is an ultra-low energy building design system that uses extremely efficient building envelopes to significantly drive down energy consumption in structures.

10. Require or incentivize solar heating of the domestic hot water system in all new commercial and residential buildings; provide low-interest loans or grants for low-income housing.

Water heating can account for 14%–25% of the energy consumed in a home. This energy consumption can be reduced with the use of solar water heaters to generate hot water.

Benefits: Direct short and long-term benefits are the reduction in GHGs that are associated with the reduced demand for energy.

Co-Benefits/Spillovers: One of the significant spillover effects is the cost savings for energy. Reducing energy costs by 14-25% can provide additional savings to working families or increased profitability for commercial users.

11. Water Efficiency: Adopt the US EPA WaterSense Labeled program. Require all new commercial and residential buildings to use WaterSense labeled products for water related use.

WaterSense is a partnership program sponsored by the EPA that seeks to promote water efficiency and bringing more water-efficient products to the market. Products bearing the WaterSense label are generally 20 percent more water-efficient than similar products in the

marketplace. The WaterSense label is an aid to identify high-performance, water-efficient products and professional certification programs that embrace and encourage the use of water-efficient design. The EPA issues the requirements that products and programs must meet to earn the WaterSense label. By reducing water usage, there is a corresponding reduction in wastewater produced from buildings. This reduction in wastewater directly results in a reduction in energy required to pump the reduced volume to a wastewater treatment facility. This energy reduction translates into a reduction in GHG emissions.

Benefits: The average home, retrofitted with WaterSense labeled toilets and bathroom faucets or faucet accessories, can save more than 11,000 gallons per year. That directly translates into a reduction of 11,000 gallons per year of wastewater the County has to pump to the wastewater treatment facility. When multiplied by the number of potential homes in the county, this could result in a tremendous reduction in the energy usage related to pumping, cost savings to the county and a reduction in energy production from utilities. This all leads to a reduction in green house gases.

Co-Benefits/Spillovers: One direct spillover benefit would be the cost savings to consumers associated with using less water. Any reduction on operating expenses for homeowners makes ownership more affordable.

Existing Programs/Resources: This is an existing program promoted by the US EPA. They already have promotional and educational material available and are working with the industry to increase the availability of products and services that meet the WaterSense requirements.

Professional/Green Jobs Development:

12. Provide training to inspectors and building plan reviewers on the basic practices of green building.

In some instances, buildings with enhanced energy efficiency and sustainable designs present new approaches to construction. These methods meet all code requirements and represent sound construction techniques. The benefit of these approaches is founded on an understanding of building science and an understanding of sustainable development concepts. Many of these concepts are relatively new and were not part of the traditional educational foundation for many inspectors and building plan reviewers. Providing them

with a basic understanding of these concepts will help to facilitate their review of more innovative approaches and help expedite the permitting process. Similarly, there are many improvements in the way buildings are now constructed. Providing new training programs for inspectors will help ensure that energy saving features designed in the project are properly installed and work as planned.

Benefits: The short term benefit will be to reduce the review time necessary for projects featuring sustainable and innovative designs.

Co-Benefits/Spillovers: The spillover effect will be a cost savings to the developer/builder that could be shared with the buyer, making homes more affordable. In the long run, this will produce homes that are more durable (better constructed buildings that use less energy and are healthier for the occupants).

Existing Programs/Resources: Commercial Inspectors of America – Yellow Belt system for energy efficiency. A Yellow Belt inspector shall be certified in energy efficiency and conservation; and shall be able to evaluate a property and provide assessments regarding the reduction of energy used by that property. This is done by calculating each building's potential energy savings relative to T-12/T-8 ballast conversion, infrared scans, area motion sensors, insulation requirements, and energy considerations. Carbon foot printing shall also be part of this discipline where buildings shall be rated at Zero Net Energy consumption. This membership can be achieved by the completion of twenty-five (25) energy efficiency assessments and written confirmation of passing CIA's Energy exam.

Several programs exist that can provide the desired training:

- a) The US Green Building Council (www.USGBC.org) has training in sustainable development concepts and their LEED rating system.
- b) The Building Performance Institute (www.bpi.org) has courses in a variety of building trades.
- c) Residential Energy Services Network (www.natresnet.org) has courses that will provide a understanding of home energy performance.

13. Conduct outreach to inform members of the construction industry that the use of greywater (non-potable wastewater from bathtubs, shower drains, sinks, washing machines, dishwashers, and downspouts) for activities such as irrigation, toilets, and exterior washing, is now permitted by code in Baltimore County.

Greywater is wastewater from bathtubs, shower drains, sinks, washing machines, and dishwashers. Greywater accounts for 60% of the outflow produced in homes. It contains little or no pathogens and 90% less nitrogen than black water (toilet water). Because of this, it does not require the same treatment process. By designing plumbing systems to separate it from blackwater, greywater can be recycled for irrigation, toilets, and exterior washing in order to conserve water. When planned into new residential construction, the home's wastewater treatment system can be significantly reduced, resulting in cost and space savings.

Use of greywater systems has a direct impact on GHGs by reducing the amount of wastewater produced from buildings. Wastewater from residential and commercial areas is typically moved to wastewater treatment facilities by pumping stations along the way. These pumping stations require considerable energy to pull wastewater from populated areas and push the waste finally to a treatment facility. Reducing the amount of wastewater being generated from buildings reduces the energy load required to pump the water to a treatment facility.

Benefits: The benefit of this system is the reduction in energy use required to pump wastewater produced from buildings to wastewater treatment facilities.

Co-Benefits/Spillovers: This will not only reduce the energy usage from pumping stations, but will also reduce the output from wastewater facilities into the Chesapeake Bay. To achieve the State's commitment for nutrient reduction in the Chesapeake, wastewater treatment facilities have to install state-of-the-art treatment technologies and cannot exceed a permitted annual flow. By diverting greywater from the system, waste treatment facilities now have additional capacity that will accommodate planned additional growth in local communities. Additional spillover effects include the reduction in water usage for irrigation. This region has experienced several years with water shortages. Because of these shortages, use of water for car washing and watering lawns and plants has been interrupted. The

installation of greywater systems would provide a source of water suitable for these purposes without jeopardizing limited potable supplies during these periods.

Educational Component: The building industry will need to be educated on these changes and the benefits they provide. Homeowners will need to be provided with educational programs about greywater systems; how they should be used and what homeowners need to do differently.

14. Facilitate the establishment of a model curriculum in Building Science and Green Building Best Practices to be used by organizations such as trade schools, Job Corps, and the County Community Colleges to create a well-trained pool of qualified inspectors, installers, auditors, etc.

Sustainable designs are based upon a whole-house systems approach. Energy efficiency along with moisture and air control are based on the principles of building science. The more the construction trade worker knows and understands about the basic concepts of building science and sustainability, the better he or she will understand how to help build a better building. Until recently, these principles had not been a part of the curriculum in most construction trade training programs. Green building designs also require that certain jobs be done differently than in the past and there are completely new jobs created specifically to green development. As a consequence, workers are going on green development job sites and have to go through additional training to learn these concepts and skills. Construction companies want workers that are ready to meet the requirements of green building designs. They want workers that are ready to contribute from the first day they are hired. There must be a Green jobs curriculum to meet the increasing demand for workers already trained in green jobs and the basic concepts of sustainability and building science

Benefits: Proper training for those entering the trades will provide them with a basic foundation in sustainable designs. This will enable them to quickly become part of work crews and insure timely completion of projects. Having more projects completed that reduce energy use will result in the overall reduction of green house gases as well as the reduction of operating expenses for the buildings and homes. The creation of a model curriculum will provide a benchmark “standard” for green training. This will help construction companies anticipate the level of skills of new workers coming to the job site.

Co-Benefits/Spillovers: Having new workers come on the job site and able to share the workload without additional training will provide cost savings to the companies.

Existing Programs/Resources: The Woodstock Job Corps Center is beginning to modify their construction trade program to include green job training. Towson University has developed an online Green Training program: <http://www.towson.edu/eeol>. While there are pieces being developed, there is no coordination of the efforts or any quality control to ensure that the programs are comparable.

Educational Component: A comprehensive approach to training can be outlined as follows:

- a. Trade schools that train people how to inspect for envelope integrity, proper vapor barrier placement, proper air barrier installation etc.
- b. Local community colleges and universities that develop curriculums to educate energy auditors, engineers, microbiological inspectors, mold inspectors, green supply chain professionals, wastewater treatment operators, LEED inspectors, and other emerging green career fields.
- c. Encourage access to, and membership in, professional associations that provide ongoing professional development in green and sustainable development such as the U.S. Green Building Council that provides opportunities and resources towards the pursuit of LEED accreditation.
- d. K-12 Education to include strengthened competencies in math, science, and biology to prepare students for new emerging career fields related to the built environment

Part II. Energy Generation

Maryland is in one of the most congested sections of the electrical grid in the country. Maryland will need to have increased electrical generation to avoid electrical service disruption.

Incentivize the use of on-site renewable energy.

Benefits: Electricity generated on-site is behind the meter. This will allow consumers to decrease the amount of energy purchased from the grid lowering utility bills and green house gas emissions.

Co-Benefits/Spillovers: It is estimated that 20% of the cost of electrical generation is caused by the 100 peak hours of generation. Renewable energy sources like solar energy generate the most energy during peak load periods, reducing the amount of energy that must be generated by expensive peak plants. If the 100 peak hours of generation could be generated by renewable sources, it would lower everyone's electric bills by 20%. When energy is used where it is generated it does not have to be transmitted, eliminating the need to construct transmission lines. Transmission lines have a large economic, environmental and social cost.

Existing Programs/Resources: There are federal tax credits and accelerated depreciation. Solar renewable energy credits (SREC's) can also be sold. Maryland has a \$1.25/watt incentive for systems up to 5kW.

Part III. Land Use, Transportation, and Vehicle Miles Traveled

Introduction

Climate Change and Driving

Carbon Dioxide, CO₂, is a major component of the greenhouse gases that cause global climate change. Transportation accounts for one third of CO₂ emissions in the United States, and the percentage has risen as other sources declined; the share was 33 percent in 2007, up from 31 percent in 1990.ⁱⁱ In Baltimore County, motor vehicles travel 22.3 million miles *on a single, typical summer day*, and these 'vehicle miles traveled', or VMT, generate *12.7 million tons of CO₂ emissions* (see Attachment A). Over 90% of these VMT, and 75% of the resulting CO₂ emissions, are generated by cars, motorcycles, and light trucks, including pickups and SUVs. Nationally, an estimated eighty-seven percent of all trips are made by personal vehicle.ⁱⁱⁱ

There are three principle ways to reduce CO₂ emissions from motor vehicles: improve fuel efficiency, reduce the carbon content of the fuel, and reduce vehicle miles traveled, or VMT. It will take action on all three fronts to meet widely accepted greenhouse gas (GHG) emission reduction targets for climate stabilization, according to the recent *Growing Cooler* study. Improvements in vehicle efficiency and fuel content alone will not be enough.^{iv}

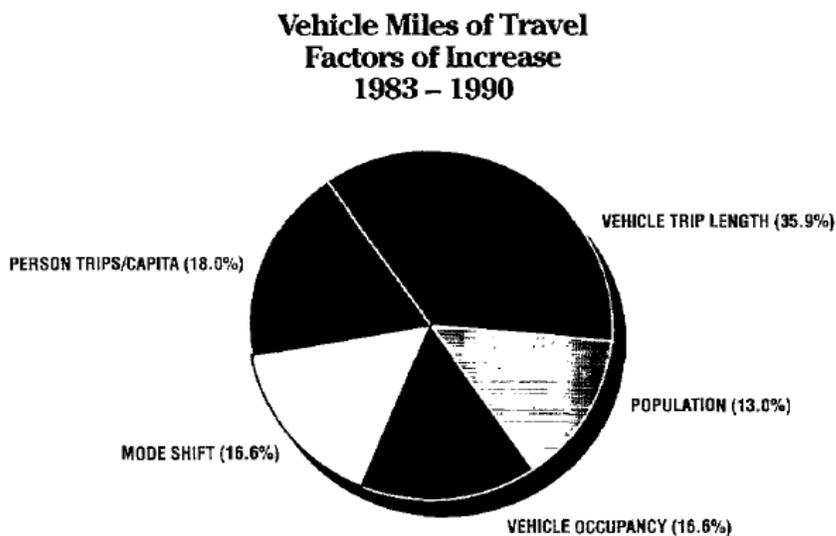
The US Department of Energy (DOE) projects a 48 percent increase in VMT for the period of 2005 to 2030. At that rate, growth in driving would overwhelm the gains in fuel economy and reductions in carbon fuel content that are mandated under the Energy Independence and Security Act of 2007.^v

On May 19, 2009, President Obama announced new [stricter federal rules](#) for emissions and mileage.^{vi} The new rules are expected to make all new vehicles 40 percent cleaner and more fuel-efficient by 2016. They represent a significant step toward addressing the impact of motor vehicles on climate change. Nevertheless, continuing growth in VMT will still offset the benefits. According to Lee Schipper, a researcher with the Center for Sustainable Transport in Washington, DC, "as long as the numbers of cars and the distances cars are driven keep creeping up, technology alone will have a difficult time offsetting all of these trends to lower fuel use and CO₂ emissions from this important sector."^{vii}

VMT Growth

Since 1980, VMT in the United States have grown three times faster than the population, and almost twice as fast as vehicle registrations nationwide. VMT is projected to grow more than twice as fast as population between 2005 and 2030.^{viii} In Baltimore County, VMT grew by 75 percent between 1980 and 2007, nearly four times the population growth rate of 20 percent for the period.^{ix}

The chart below shows that population growth was the least significant factor contributing to VMT growth nationally between 1983 and 1990; the most significant was longer trips, followed



source: NPTS

Source: Travel Behavior Issues in the 90's Prepared by Alan E. Pisarski For the Office of Highway Information Management, HPM-40, US DOT, Federal Highway Administration

by more trips per capita, lower vehicle occupancy, and a shift to automobiles from other modes. All of these factors, except the minimal impact of population growth, are related to land use patterns. People drove further because their destinations were further away. They drove rather than walked because the route to their destination was unnecessarily long and circuitous, or they felt unsafe. They drove alone because everything was so spread out that no one else was going their way. And they drove because other modes of travel were increasingly inconvenient, or simply not available.

While the chart represents a short period of time, it reflects trends that have been under way for several decades.

Americans drive so much because we have given ourselves little alternative. For 60 years, we have built homes ever farther from workplaces, located schools far from the neighborhoods they serve, and isolated other destinations—such as shopping—from work and home. From World War II until very recently, nearly all new development has been planned and built on the assumption that people will use cars every time they travel.^x

Build on Record of Sustainability

Baltimore County has a forty-year record of leadership in sustainability through effective planning, stewardship of land and natural resources, and conservation of older communities. The County established an urban growth boundary in 1967 to delineate urban and rural land management areas, and adopted policies to focus infrastructure investments in the urban areas, and preserve important natural and agricultural resources in the rural areas.

Baltimore County instituted urban and rural zoning in 1975, designated two growth areas to absorb future growth and development in 1979, and has maintained and strengthened its land management framework through subsequent planning, comprehensive rezoning, targeted reinvestment in older communities, and forward-thinking policies to protect and preserve natural resources.^{xi}

Through its land management framework and related policies, Baltimore County has preserved substantial amounts of agricultural and forestland, effectively protected the region's drinking water reservoirs, continued economic growth, and sustained its older communities, providing good schools, and excellent public services for County residents.

This land management framework has served the County well, and should be retained. Yet, the County should now reexamine and further refine its land management policies to address the 21st century challenges of energy dependence and climate change. Land development patterns—both within and outside the URDL—have increasingly shaped and been shaped by the demands of automobiles. Baltimore County could reduce growth in VMT and related greenhouse gas emissions by instituting policies and developing plans that more fully integrate land use and transportation, and by supporting a range of good transportation choices. Baltimore County has taken significant steps in this direction, such as supporting transit-oriented development at the Owings Mills Metro Station.

Maintain Regional Perspective

Baltimore County and Baltimore City have played complementary roles in limiting potential growth in regional greenhouse gas emissions; the county by effectively limiting growth outside the URDL, and the city by sustaining a dense population in an area that is compact, walkable, transit-served, and central to the region. While central cities generate more GHG per acre, city dwellers have smaller carbon footprints; they produce relatively low amounts of GHGs on a per-household basis, as shown graphically at the link below.

<http://www.travelmatters.org/maps/regional/sf?sid=4bceb8f13ace8fb08a1efcc7a0635088>^{xii}

The County has enormous potential to reduce GHGs in the next several decades by managing its growth in even more sustainable ways. At the same time, Baltimore City can uniquely contribute to GHG reduction due to its historic role as the urban center of a large region. Policies and investments that support the city as a livable environment for large numbers of people, particularly investments in regional public transit, will continue to benefit Baltimore County and the entire region.

Issues and Objectives

Baltimore County could reduce energy consumption and greenhouse gas emissions associated with VMT and land use by pursuing the following objectives:

1. Reduce automobile commuter trips by facilitating teleworking, flex scheduling, van- and car-pooling, and parking cash-out (a cash allowance from the employer in lieu of a parking space).^{xiii}
2. Reduce automobile trips by substituting bicycle and pedestrian trips.
3. Reduce the length of automobile trips, and support walking and biking as alternatives to vehicle trips, by providing a well-connected network of streets and roads.
4. Reduce automobile trips, and support walking and biking as alternatives to vehicle trips by supporting high-quality public transit.
5. Reduce GHG emissions from automobiles and buildings by creating, restoring and sustaining walkable communities.

These objectives can be pursued while maintaining or enhancing a high quality of life and personal mobility for Baltimore County residents. While the objectives are highly interrelated,

they fit two categories for purposes of discussion: 1) the creation, restoration, and sustenance of walkable communities; and 2) improvement in connectivity and modal choice.

Create, Restore and Sustain Walkable Communities

Walkable vs. Auto-Oriented Communities

Until the end of World War II, most towns, neighborhoods and cities were walkable. Before the war, suburban development took the form of streetcar suburbs—villages located along rail corridors.^{xiv} With the advent of widely available private automobiles following the war, the physical pattern of communities began to change.^{xv}

New development was increasingly characterized by spread-out places with low-density, single-story buildings; the rigid separation of housing, shopping, recreation, and jobs; and ample, convenient free off-street parking. In place of traditional neighborhoods with "main street" shopping areas, the new development consisted of housing subdivisions, strip shopping centers, and office and industrial "parks." In place of a walkable street grid connecting residential areas to parks, schools, and main streets, the new development generated a street system consisting of cul-de-sacs accessed by arterial roads. The "built environment" became increasingly inhospitable to anyone who wanted to walk, or was not able to drive, including children and many elderly people.

Disinvestment in Older Communities

Many older towns and neighborhoods that had once been walkable became blighted from disinvestment. Private investment leapfrogged further from the urban core of old cities, with public investment following to provide services for the new communities. When redevelopment occurred in older, walkable communities, it often took on the character of auto-oriented places—strip shopping along old Main Street.

In the past couple of decades, there have been efforts in many communities to create a new version of traditional, walkable communities that accommodate private automobiles without allowing them to dominate. A variety of planning and design tools have been crafted to help create such places. In addition, there has been a renewed appreciation of walkable older towns and neighborhoods, and an increased desire to preserve and restore their best features.

Characteristics of Walkable Communities

In this draft report, the term "walkable community" refers to communities that support driving, but make walking more convenient. Such communities have the following characteristics:

- Mixed-use development, including housing, employment, shopping, recreation, and services within a close comfortable walk or in the same building, to support origin-destination trips on foot.
- A mix of housing types and sizes.
- Activity centers within ¼ to ½ mile of perimeter.
- Moderate to high levels of density or intensity of land use in the center—at least seven dwelling units per acre of buildable land or 0.50 FAR or greater for non-residential development, to support basic public transit and walk-to retail services.^{xvi}
- Interconnected street network having a density ratio of 90-150 intersections per square mile in the core^{xvii}, and having short blocks—generally not more than 400 feet in length, for efficient pedestrian trips.
- Design & post low traffic speed—maximum 25 mph in the core.^{xviii}
- Ample street activity and visual interest (people-watching, window shopping).
- Ample on-street parking; off-street parking in the rear with alley access; structured parking in the rear or in stories above ground floor.
- Effective parking management (the right amount, location and price).^{xix}
- Buildings oriented toward the street; small frontages with functional pedestrian entrances on the street at frequent intervals (no more than 50 feet).
- High-quality, centrally located and well-maintained public open space, such as squares and greens.
- Well-designed, multi-modal streets (see discussion of "Complete Streets" and Context Sensitive Solutions, pp. 32-33).

Locational Criteria

When walkable communities are newly established, their locations should be carefully evaluated and selected on the basis of criteria including: proximity to existing walkable places; easy access

to existing or planned public transit service (as well as interstate highways); and limited potential to disturb sensitive environmental features.

Transit-oriented development.

Transit-oriented development (TOD) and transit supportive development (TSD) are terms that refer to highly walkable communities. In this draft report, the term "walkable community" encompasses TOD and TSD. It should be noted that TOD has special characteristics, such as intensified development at transit stations and a strong design focus, connecting stations to nearby destinations.

Impacts on Greenhouse Gas Emissions

According to the Pew Center on Global Climate Change, higher density, more spatially compact, and mixed-use developments offer the potential for significant reductions in GHG emissions through three complementary effects: reduced VMT, reduced per-unit-area consumption of district energy for heating and cooling, and reduced municipal infrastructure requirements.^{xx} One study found a direct relationship between housing density and greenhouse gas emissions. Per-household CO₂ emissions were estimated to be 25 percent higher at suburban densities of four homes per acre than in an urban neighborhood with 20 homes per acre.^{xxi}

Less Driving

Studies show that people living in walkable communities drive up to 40 percent less than their counterparts who live in sprawling low-density places.^{xxii} Walkable communities have lower levels of automobile use per capita, generate shorter trips, and facilitate destination travel by a variety of modes, including walking and biking. Walkable communities with sufficient density support high quality public transit, a critical tool for reducing VMT and GHG emissions (discussed below).

For people who live or work in walkable communities, walking serves as a mode of transportation, a means of travel to destinations, not merely a form of recreation. Studies show that the "walk mode share" can rise to 20 percent in walkable communities, *even without high quality transit service.*^{xxiii}

Lower Energy Use in Buildings

In addition to the greenhouse gas reductions associated with lower VMT, studies show that energy consumption and greenhouse gas emissions are also lower in buildings located in walkable communities. The result is due to differences in housing size and type.^{xxiv}

"Greyfield" Redevelopment

The amount of open land for new development within Baltimore County's URDL has become increasingly limited, and the County is not expected to significantly alter the URDL. The question has been raised: Where might the County expect to see the development of walkable communities, given limited open land? Baltimore County is perceived by some as almost "built out." But in fact, there are many opportunities for redevelopment that could provide numerous public and private benefits.

While the County has established a pattern of development within the URDL that is largely automobile-oriented, that pattern can be altered through selective redevelopment of property at appropriate locations along transportation corridors. Some of the greatest opportunities may be found in "greyfields," underused and undervalued land—particularly shopping centers with substantial surplus parking—that could be converted from auto-oriented to walkable development. These shopping centers are generally considered obsolete, and become candidates for redevelopment at intervals of 10 to 15 years. Many will reach this threshold in the next decade. They are usually given a facelift and filled with new tenants, but many remain economically marginal, and some could be reformatted as walkable places.

Greyfield redevelopment replaces underperforming shopping centers with a mix of housing, employment, shopping and entertainment in a compact, walkable format.^{xxv} It can be highly profitable to land owners, adding value to real estate, and enhancing the tax base, while providing attractive amenities for nearby residential neighborhoods.

Theoretically, much of the County's growth in the next couple of decades could be absorbed through this type of development, helping to curb growth in GHG emissions.

LEED for Neighborhood Development

The US Green Building Council, in collaboration with the Congress for the New Urbanism and the Natural Resources Defense Council, has developed the first national system for rating

neighborhood design.^{xxvi} LEED-ND certification provides independent, third-party verification that a development's location and design meet accepted high levels of environmentally responsible, sustainable development. LEED-ND provides further evidence that community design is becoming widely regarded as an important component of sustainability. Baltimore County may want to consider strategies that utilize LEED-ND directly or indirectly in evaluating development proposals.

Improve Transportation Connectivity and Modal Choice

Multi-Modal Transportation

One of the characteristics of a walkable community mentioned above is that activity centers—with destinations such as shopping, jobs, and services—are located within a quarter- to a half-mile. While these short distances are highly conducive to walking and bicycling, most pedestrians and bicyclists need to travel longer distances routinely to work and other destinations. Convenient, well-connected public transit enables them to do so without driving. A multi-modal transportation system comprised of walking, biking, driving, well-connected public transit, and other modes of transportation helps to reduce VMT by giving more people more choices about ways to move around and enabling drivers to reduce oil consumption and GHGs by reducing trips by private auto.^{xxvii}

Impacts on Greenhouse Gas Emissions By Mode

Walking and Bicycling: Non-motorized travel emits no greenhouse gases. It holds significant potential for greenhouse gas reduction when destination trips are made on foot or by bicycle, rather than by car.

Public Transit reduced global warming pollution by nearly 26 million metric tons nationwide in 2006—the equivalent of taking 4.9 million cars off the road.^{xxviii} In the same year, Baltimore's public transit network kept 36 million gallons of gasoline from being burned, and reduced global warming pollution by 960,000 metric tons.^{xxix} Commuting on public transportation can reduce *an individual's* carbon footprint by 4,800 pounds of CO₂ emissions a year.^{xxx}

Rail transit provides the greatest reduction in oil consumption and related global warming emissions for two reasons. First, light and heavy rail are more effective at leveraging reductions in VMT than buses because they are generally more efficient at moving large numbers of people

in densely populated areas. And second, rail is generally electrified, and therefore does not consume oil.^{xxxix}

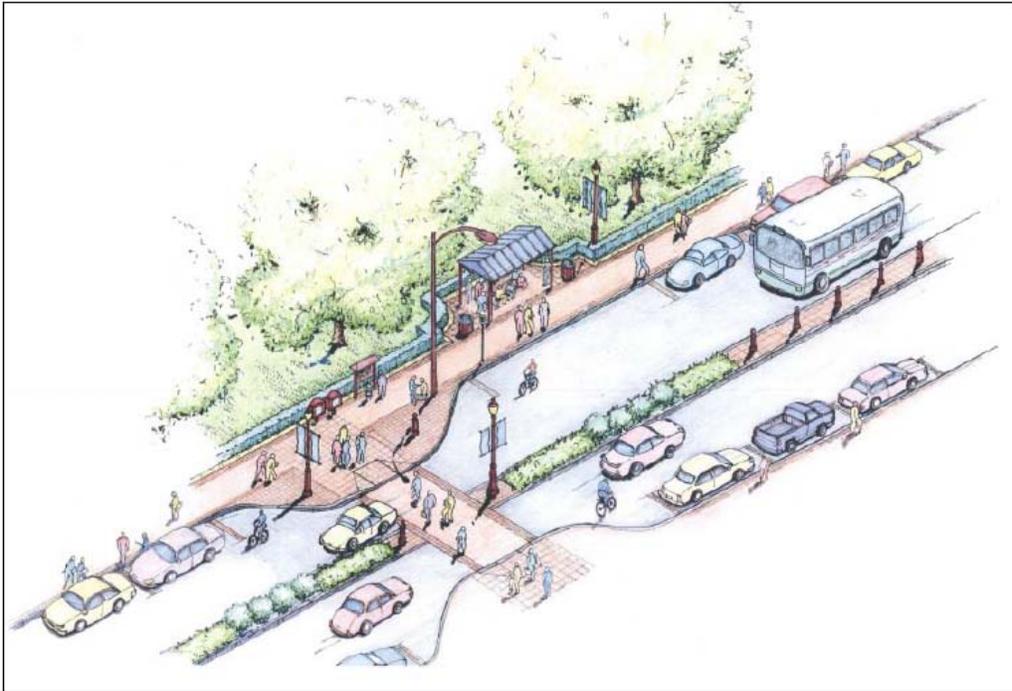
Bus service also provides substantial savings in oil consumption, primarily by improving efficiency in the transportation system.^{xxxix} During peak hours, city buses carry 40 or more people, compared to the commuter driving a single-occupant vehicle.

Vanpooling reduces commuter trips on a per passenger basis by increasing the number of passengers in a vehicle, but provides significantly smaller reductions than bus and rail transit. Vanpools can be an effective solution for suburban communities that are difficult to serve with conventional public transit.^{xxxix} Carpooling provides the same kinds of benefits.

Complete Streets

The concept of "complete streets" has been popularized by a coalition of civic organizations and individuals that advocate for streets such as the one depicted below. Complete streets are designed and maintained to safely and comfortably accommodate people with a variety of mobility needs using various transportation modes—all within the same public right of way—from pedestrians, wheelchairs, and baby carriages, to bicycles, automobiles, and transit vehicles.

Complete streets employ design features such as raised crosswalks and bump-outs that allow pedestrians to cross safely, and provide ample sidewalks for pedestrian traffic. They accommodate bicyclists in designated bike lanes or off-street paths, or merged with automobile traffic, depending upon traffic speed. Complete arterial streets may include on-street parking, street trees, and medians with frequent cuts to optimize the carrying capacity of automobiles while moderating their speed. Complete streets provide amenities that make the street comfortable for pedestrians, such as appropriately scaled street lighting, benches and shelters at transit stops, and street trees for protection from the elements.



Source: Kimley-Horn & Assoc., as shown in *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*, Institute of Transportation Engineers, Washington, DC, 2006, sponsored by the US Federal Highway Administration and the US Environmental Protection Agency

Context-Sensitive Solutions

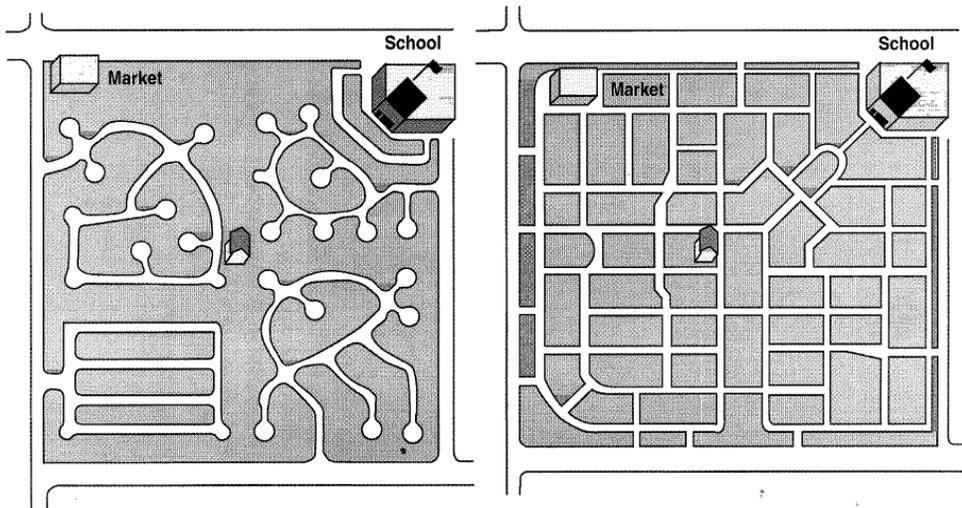
"Context-sensitive solutions" (CSS) is a concept pioneered by transportation engineers and planners to balance the competing needs of interest groups with respect to streets and roads. It seeks to balance safety, mobility, community, and environmental goals, while addressing all modes of travel.^{xxxiv} CSS also recognizes that streets and roads do not all function alike. There is a need for design flexibility, and the design should be appropriate to the context. Main Street should not be designed like a busy arterial road, but both should accommodate walkers, bikers, and drivers. Moreover, not all Main Streets are alike, nor are all busy arterials.

Street/Road Connectivity

Street and road connections enable all travel modes—cars, trucks, buses, bicyclists, and pedestrians—to find their way efficiently. An interconnected street network with short blocks helps walkers and bikers take the most direct routes to their destinations, as illustrated below. A dense street network—along with other features of a walkable community—makes people more likely to choose to walk for some of their trips, thereby reducing VMT.

Typical Cul-de-Sac Subdivision

Well-Connected Street Network



Source: TGM Guidebook, Neighborhood Street Design Guidelines; An Oregon Guide for Reducing Street Widths.

Similarly, greater street/road connectivity can help to reduce VMT by reducing circuitous automobile travel. The further one must drive out of the way to reach a destination, the unnecessary VMT, wasted fuel and wasteful emissions.



Severe congestion is more likely to occur on arterial roads and highways that serve areas with limited connectivity, than in areas with well-connected street networks, in which traffic can disperse. Traffic jams waste fuel, and emit greenhouse gases, as cars idle and nerves fray.

Improved connectivity reduces emergency response time, and allows for more efficient delivery of services such as postal and sanitation. It creates a more balanced demand, rather than the overuse of some streets and the under-use of others.

Connectivity indexes have been developed for motorized and non-motorized travel to quantify how well a street or road network connects destinations.^{xxxv}

With greater connectivity, it is important to reduce the potential impacts of through-traffic on neighborhoods by incorporating "traffic calming" into the original design of a community, or retrofitting traffic calming features into an existing community.^{xxxvi} Much of the negative impact that community residents attribute to through traffic is actually the noise and hazard of speeding cars, which can and should be effectively mitigated.

Modal Connectivity.

Modal connectivity is also important in reducing VMT. Travelers should be able to make seamless connections between transit vehicles, driving, bicycling, or walking to public transit. Transit vehicles need to be able to accommodate bicycles (as many MTA conveyances now do), and station areas should have secure facilities for bicycles.

Co-Benefits of Walkable Communities and Multi-Modal Transportation

In addition to reducing greenhouse gas emissions, walkable communities along with multi-modal transportation provide the additional benefits of broadening consumer choice; enhancing housing affordability; boosting real estate values and tax base; supporting healthy lifestyles; and sustaining a healthy economy, with less harm to land and water resources.

Consumer Choice.

While a majority of homebuyers continue to prefer single-family houses on large lots, a large minority—about one in three—expresses a preference for more compact, walkable communities near transit. Yet, in many communities, including Baltimore County, virtually no new housing is built for this market segment. Providing a range of lifestyle choices, including the choice to live and work in urban, walkable places, is a key to attracting a talented labor force. A region's ability to attract and retain a talented labor force will be a significant driver of economic competitiveness in the 21st century.^{xxxvii} The preference for housing in walkable communities is expected to increase due to demographic trends and smaller households, as well as social, cultural, and economic changes.^{xxxviii} Higher and more volatile energy prices are likely to reinforce the preference.

Enhanced Real Estate Value and Tax Base

New development in walkable communities can command sale price premiums of \$5,000 to \$30,000.^{xxxix} Higher real estate values translate into higher property tax revenues.

Household Savings

In walkable communities that are well served by public transit, higher real estate values are offset by reduced household transportation costs. Transportation is the second largest item after housing in most household budgets. Transportation costs can be reduced by living in communities where some household members can walk, bike or take transit to work or school, a

phenomenon referred to as "location efficiency." Transportation costs can range from 15% of household income in walkable neighborhoods with access to transit, to over 28% in more sprawled communities.^{x1}

Economic Competitiveness

While they disagree on the magnitude, the major studies on the cost of sprawl draw the same conclusion: Sprawl development is an inefficient way to provide public services and infrastructures. Sprawl is more costly to local governments, developers, and housing consumers than compact, walkable development, and creates an unnecessary tax burden.^{xli} The costs of sprawl will increase in the future with the rising cost of energy. According to Daniel Lerch, author of *Post Carbon Cities*, "Our built-in [oil] dependence will increasingly threaten local economic health as the price of oil rises and becomes more volatile. Those cities and suburbs that have redesigned themselves for the post-peak oil world will succeed, while other localities will find it more and more expensive to move people and goods around."^{xlii}

Public Health

Strategies to increase land-use mix and distance walked while reducing time in a car can be effective as health interventions in controlling obesity and related chronic health problems, such as diabetes and heart disease.^{xliii} Walking associated with taking public transit may save \$5,500 per person in medical costs over a lifetime by reducing rates of obesity.^{xliv} In addition, more than 130 million Americans live in counties where they are exposed to dangerous levels of air pollution. The Baltimore region, in particular, remains a non-attainment area for ground-level ozone.

Public Safety

A more dramatic effect of our automobile-oriented transportation system on human health is injury and the loss of life from traffic accidents. More than 43,000 Americans died, and more than 2.7 million were injured, in auto accidents in 2005.^{xlv}

Natural Resources

Sprawling development, surface parking, and road right-of-ways have absorbed many acres of farmland and forest, interrupted wildlife corridors, and contributed significantly to stormwater runoff: carrying oil, salt, metals and other contaminants into waterways. Redevelopment of

already disturbed land into compact, walkable communities can mitigate further loss of urban forest and other natural resources, even within the URDL. Denser development produces less runoff and less impervious cover per household than low-density development. At eight housing units per acre, runoff is reduced by about 74%, compared to development at one unit per acre, according to Lynn Richards of US EPA.^{xlvi} Compact development tends to increase the heat island effect, which can be significantly mitigated by green roofs, increased urban forest cover, and like strategies.

Recommended Actions

A. Create, Restore and Sustain Walkable Communities

- 1. Develop analytical and visual tools to engage the public and decision makers about the implications of various land use policy options with respect to energy, climate change, and other factors.***

Identify a specific geographic area, such as a conventional shopping center, that could be redeveloped as a walkable neighborhood. As an example, the Lutherville light rail station area might be a good location, since it has transit access but is dominated by auto-oriented land development, including large parking lots that could be converted to mixed-use development. Design and digitally model alternative re-development scenarios, including one or more dense, mixed-use places. Use existing software models based on metrics from rigorous case studies to show the impacts of land use intensity, land use mix, street connectivity, proximity to public transit, and other metrics on vehicle miles traveled, energy consumption, and greenhouse gas emissions. Use high-quality visual simulations to illustrate the scenarios. Package the model and simulations into slide shows for public meetings, web sites or other formats.

Benefits: These models can serve as valuable tools in quantifying the impacts of local land use patterns and alternatives on climate change, which in turn can influence policy changes.^{xlvii}

Co-Benefits and Spillovers: The models are most effective for engaging the public when applied to familiar local sites.

Existing Programs/Resources: Software has been developed that employs data from case studies of actual places (such as those cited in the *Growing Cooler* study) to model and analyze alternative development scenarios. The models utilize various indices to correlate features of walkable places (in contrast with sprawling places) with variables such as VMT and GHG emissions. See http://www.crit.com/documents/cool_spots.pdf.

2. Assess, Revise, and/or Design New Development Policies/Processes.

- a. Assess the local development infrastructure, including development-related County policies and programs; the needs, perceptions, and practices of the local development industry; and the views of civic and business leaders to identify opportunities for, and constraints to, the development of walkable communities in Baltimore County. Identify past successes, determine what worked, and identify barriers.
- b. Identify model policies and processes, locally, regionally, and across the country that facilitate walkable development.
- c. Integrate this information into a comprehensive set of recommendations for new policies or systems.

This recommendation addresses questions raised by author Daniel Lerch in *Post-Carbon Cities*, a guidebook for local governments: "Are your regulations and procedures encouraging developers to build the best possible buildings and neighborhoods for a world without cheap oil? Are you discouraging the kinds of developments that will function poorly when gasoline is three times as expensive as today?"^{xlviii}

The working group has identified several issues that might be addressed as part of such an assessment and suggested possible solutions for consideration. The list is by no means exhaustive and the issues raised have not been thoroughly explored.

- a) **Zoning to Implement Policy Goals.** Historically, conventional zoning regulations played a critical role in shaping sprawl development in Baltimore County and throughout the US by strictly separating uses, setting very low density limits, and requiring large amounts of off-street parking. Baltimore County's zoning regulations include zones that permit high-density and mixed-use development, but they were not crafted to generate walkable development. These zones have generally produced auto-oriented, single-use development that is physically separated from other uses by highways or other barriers.

Now, virtually all new development in the County, except minor subdivisions, is being approved through the PUD (planned unit development) process.^{xlix} The *PUD process* removes barriers to walkable development by providing for design flexibility and density bonuses. However, the PUD regulations fail to stipulate design and locational criteria that would ensure walkable development and the PUD process does not appear to yield walkable development.

Baltimore County's *Renaissance Redevelopment Pilot Program* provides for a "floating zone" combined with a developer-driven "collaborative design process" to foster walkable development. The program employs form-based zoning and other best practices, but local developers have not embraced or made use of it. Some assert that the program entails higher front-end costs for design and environmental analysis than are generally incurred under standard "by-right" zoning, along with greater risk for developers, since development approval hinges on community consensus.

Possible Action: Consider creating a "walkable PUD" using LEED-ND as a framework for design and locational criteria. Consider reviewing the Renaissance Redevelopment Pilot Program and determine whether it could be modified to remove the perceived disadvantages. Utilize form-based zoning.

- b. *Other Polices and Regulations.*** Many County regulations are written or enforced in a way that induces sprawl. There is often little or no flexibility to meet performance goals through different means and often when some flexibility exists, the alternative approach is treated as an exceptional situation requiring special approval.

*Adequate Public Facility (APF) requirements*¹ are important in concept to ensure that adequate infrastructure accompanies new development. However, when key infrastructure improvements lag, these requirements can contribute to sprawling, "leapfrog" development. Moreover, APF requirements that may be appropriate in a conventional suburban context can serve as barriers to good, walkable development. Intersection Level of Service (LOS) requirements for example, which are designed to move automobile traffic through an area, often result in intersections that are difficult for pedestrians and bicyclists to navigate.

Minimum parking requirements^{li} can induce excessive amounts of parking even in shopping centers and office parks. Applying suburban parking standards universally can make it

impossible to create, sustain, or restore walkable places because these standards make driving highly convenient while compromising the quality of the pedestrian environment. The amount of parking should be tailored to the place and supplemented with effective parking management. Baltimore County regulations provide limited relief from onerous parking and LOS requirements in some areas, such as Towson.

Storm water management regulations are often perceived as a barrier to compact development, because they focus on reducing impervious surface, and treating all storm water on site. Requirements and illustrations in the County's *Landscape Manual* reinforce conventional suburban design rather than more walkable formats. Moreover, the policies in the manual could be updated to take better advantage of the benefits of major deciduous trees in storm water management, carbon sequestration, and reducing the heat island effect.

The *Local Open Space Manual* may be insufficiently flexible to easily accommodate the kinds of small squares and parks that should be found in a high-quality, walkable community. And this manual could be updated to address the potential for the dual use of public open space for storm water collection and treatment.

Possible Actions: Review, and if appropriate update, regulations and policy manuals to make them more supportive of walkable and otherwise sustainable development. Set policies to ensure that environmental and other regulations are applied on a performance basis, and appropriate for the context. Identify and publicize best practices that support walkable and otherwise sustainable development. Consider alternative public facility requirements for highly walkable areas in lieu of conventional APF requirements. Florida's Multi-Modal District provides one model.^{lii}

- c. **Development Planning.** Creating good, walkable communities requires a level of detailed planning that can be challenging for developers. Developers who desire to create walkable places face a number of challenges, in addition to regulatory barriers and the lack of appropriate zoning tools. They include: higher front-end costs for design and environmental analysis; difficulty assembling land; the challenge of creating a cohesive plan when County agency requirements conflict; and the perceived risk of protracted legal appeals, even after receiving formal development approval, due to public opposition to higher-density development.

A particular problem is the developer's lack of authority to establish a development pattern and street network that continues on adjacent property. Good walkable places do not end at property lines. An effective network of local and collector streets is not only an essential element of walkable communities, but facilitates more efficient use of land and reduces congestion on arterial roads. Without an existing or planned street network the developer of each parcel seeks the most direct access to nearby arterials: using land wastefully in the process, generating multiple access points on the arterial, and funneling traffic onto the arterial rather than enabling it to disperse.

There is evidence that some developers would prefer to operate in a regulatory environment in which local government assumed more responsibility for front-end community-wide development planning and provided for a greater level of developer certainty. (See Attachment B.) Moreover, it is unlikely that developers will initiate innovative model projects without greater County involvement in front-end planning.

Possible Actions: Explore and consider adopting alternative planning models similar to California's 'Specific Plans',^{liii} which combine elements of community plans and development plans; Arlington County, VA's Columbia Pike Redevelopment Process^{liv}, which provides by-right zoning approval for walkable development; and Baltimore County's Honeygo Plan^{lv}, which was an early, innovative local model. Consider making greater use of design charrettes (based on the National Charrette Institute model) to achieve sound plans that effectively integrate stakeholder (including public agency) interests.

- d. Roads and Rights of Way.** Much of the County's infrastructure design and development is developer-driven. Private developers are generally required to build or upgrade segments of collector or arterial roads adjoining private land as parcels are developed. This approach can leave gaps in the street/road system that are filled belatedly or not at all. Delay in completing the street network can also affect the value of land, the efficiency of land use, and the timing of development.

Proposed Action: Consider using a revolving fund or employing alternative financing tools—such as Payments in Lieu of Taxes (PILOTs); The County's BILP (Building Improvement Loan Program); Tax Increment Financing (TIFs), and especially the recently enacted TIF for TODs legislation—to support timely right of way acquisition and/or construction of

critical infrastructure to support the development of walkable communities. (See Attachment C)

e. Sewer capacity is allocated by the County on a first-come, first-served basis. This policy encourages piecemeal development at the expense of longer-range, more comprehensive planning by making phased development projects more risky. The sewer capacity needs to be ready when the market is ready.

Proposed Action: Revisit the issue of sewer allocation to determine whether exceptions to the policy could be made for well-planned walkable communities.

- 3. Identify and Enhance Walkable Older Communities.** Identify existing walkable communities, or those with a strong potential to become walkable, particularly the old "main street" communities; conduct assessments to determine what interventions would enhance their walkability; and implement the interventions. Develop criteria for identifying and enhancing the targeted communities. Identify a source of funds for the enhancements. Develop capacity for conducting the assessments.

Interventions could range from the relatively simple, inexpensive, and short-term (installing missing curb cuts, raising cross-walks, re-striping roads to include bike lanes, bike facilities and equipment, traffic calming, count-down pedestrian signals, street trees, etc., or designating more on-street parking) to more complex, relatively more expensive, and generally longer term (infill redevelopment on selected parcels to restore damaged building "fabric" or enhance commercial activity; creating or restoring links in the street network to improve connectivity and reduce block length; reconfiguring streets to maintain capacity while reducing speed, such as the addition of medians or turn-arounds). Communities might include Dundalk Village (already highly walkable) or Catonsville (strong potential).

Benefits: Build on the walkable formats of the County's older "main street" communities.

Co-Benefits/Spillovers: Build on established County programs to enhance the older communities. Contribute to the economic revitalization of the County's older, main street neighborhoods by enhancing the business climate and attracting residents who are seeking a more walkable community. Commercial vitality is a key to walkability, as is the reverse.

Existing Programs/Resources: Baltimore County government has undertaken several, high-quality streetscape programs through the Office of Community Conservation, many in collaboration with the State Highway Administration. The County is working to enhance the older main street neighborhoods through the "Commercial Revitalization" efforts of the Department of Economic Development,^{lvi} including low interest business loans and tax credits and the ReDiscover Your Neighborhood Downtown marketing campaign.^{lvii}

- 4. *Facilitate a Pilot Redevelopment Project.*** Identify properties that have strong potential to be transformed from automobile-oriented development, such as aging shopping centers, to walkable communities and facilitate their redevelopment. Establish location criteria, such as the availability of infrastructure and services to support the development; assess potential locations; select several of the locations for possible redevelopment; engage the owner(s) to determine their interest; and select one location to serve a pilot. Design and implement a redevelopment project at one of the locations with private partners and in collaboration with key stakeholders (property owners, community members, government officials, etc.). Use best practices in urban design and sustainable building, landscaping, storm-water management, parking management, etc.

Benefits: Demonstrate success.

Co-Benefits/Spillovers: County may lack an appropriate system to legally entitle the project for development. May need to determine or create the legal authority.

Existing Programs/Resource: Many resources and models exist, including design charrettes, form-based codes, LEED-ND standards, and successful greyfield re-development projects throughout the country.

- 5. *Establish Locational and Design Standards for New Public Facilities***

Adopt a policy to give preference to walkable communities in the siting of new public facilities including schools, libraries, senior centers, parks and playgrounds. Additionally establish standards for such facilities that address design, location, scale, and size of site. Incorporate an educational component into the facilities' programming regarding greenhouse gases, carbon footprint, etc.

Co-Benefits/ Spillovers: Use public facilities as an incentive to leverage private investment in walkable communities. Land costs may be higher, but less land may be needed if more urban formats are used, such as multi-story or multi-use buildings for libraries or senior centers.

B. Increase Transportation Connectivity and Modal Choice

6. *Establish and Enforce Policies to Make Streets and Roads Connect When Development Occurs; Identify Important Un-built Segments, and Prioritize their Construction.* The County should review existing policies regarding street connectivity and determine how to make them more effective. The County should institute traffic calming wherever new street connections are likely to increase automobile traffic through neighborhoods, and put it in place before the street/road connections are finalized. Determine whether there are feasible ways to acquire rights of way and make the connections ahead of the development. Establish and fund an account with adequate capital to address necessary ROW acquisitions and street connections. Determine how to ensure that developers share appropriately in the cost.

Benefits: Include creating balanced demand so that traffic can disperse rather than converge on arterials; facilitating walking and biking; facilitating efficient delivery of public services; reducing time waste and other effects of traffic congestion.

Co-benefits and Spillovers: Efforts to connect streets may generate a negative reaction from neighborhoods, who fear through-traffic, and from developers, who want to maintain control over the arrival sequence of their projects. The County should effectively address these concerns, through traffic calming and other measures.

Existing Programs/Resources: The Baltimore County Master Plan and Section 260 of the Zoning Regulations require street connectivity, but the requirement is not consistently enforced. Pages 91-98 of Master Plan 2010 spell out specific transportation infrastructure projects, some of which constitute important links in the street network. Baltimore County has expertise in implementing traffic calming measures. The state of Virginia will no longer accept streets for public maintenance unless they meet connectivity requirements.^{lviii} The second link below is a model street connectivity ordinance. At the end is a reference list of street connectivity ordinances.

Virginia & Delaware Mandate Connected Streets (abbreviated version at link)
Connectivity Index and Intersection Density measures used to quantify connectivity.
<http://virginiadot.org/projects/ssar>
Narrower, More Connected Streets in New Urban News: <http://www.newurbannews.com/>
[http://www.planning.kytc.ky.gov/congestion/AccessManagement/Kentucky Connectivity Model Ordinance FINAL.pdf](http://www.planning.kytc.ky.gov/congestion/AccessManagement/Kentucky%20Connectivity%20Model%20Ordinance%20FINAL.pdf)

Public Transit

7. *Develop a Comprehensive Regional Transit System.* In 2001, the Maryland Secretary Transportation established a blue-ribbon task force—the Baltimore Region Rail System Plan Advisory Committee—to recommend a Regional Rail System long-term plan and to identify priority projects to begin implementing. The plan was completed a year later. The proposed system would be a comprehensive, 109-mile regional rail system with 66 new miles added to the existing 43 miles of Metro Subway and Light Rail line, and as many as 68 new stations in addition to the 54 stations that exist now. The County should join with other jurisdictions in the region and the Maryland Transit Administration in expediting implementation.

Benefits: The proposed plan provides an extraordinary opportunity to achieve significant reductions in regional greenhouse gas emissions over the next 40 years, but progress on implementation has lagged.

Co-Benefits/Spillovers: Significant opportunities to leverage regional economic growth. While MTA is not a County agency, Baltimore County can support and facilitate plan implementation through the Baltimore Regional Transportation Board, and the County's delegation to the Maryland General Assembly.

Existing Programs/Resource: The Regional Rail Plan
http://www.baltimoretrailplan.com/linked_files/brreportfinal.pdf

8. *Improve the Quality & Reliability of MTA's Bus Service.* Convenient reliable service is the best way to build ridership and support for system expansion.

- a) Install automated real-time "Next Bus" information signs employing GPS technology at all stops to let riders know when the next bus will arrive. These systems, common in many other towns and metro areas, allow riders to coordinate by phone with family

members or day care providers, or shift to another bus line or mode, when buses are late.

- b) Provide shelters and lighting at bus stops.
- c) Improve training and management to ensure that drivers are consistently courteous and helpful.
- d) Provide adequate personnel coverage to ensure reliability.

Benefits: Significant mitigation of GHG emissions.

Co-Benefits/Potential Spillover Effects: Enhance existing service to build a constituency for an expanded system.

Existing Programs/Resources: Next Bus

<http://www.nextbus.com/predictor/stopSelector.jsp?a=howard>

9. *Accelerate the conversion of MTA buses to hybrids. Consider running smaller buses during off-peak hours to reduce emissions.*

Benefits: Substantial direct reduction of GHGs and other air pollutants

Co-Benefits/Potential Spillover Effects: Economic stimulus: Create jobs and spur economic growth building clean buses.

Existing Programs/Resources: MTA program underway.

Bicycle and Pedestrian Facilities

10. *Complete and Implement Countywide planning for bicycle and pedestrian facilities; Implement the Eastern County Bicycle and Pedestrian Plan. Provide additional Bike Facilities.*

The Eastern plan provides a comprehensive inventory of bike and pedestrian facilities—including bike paths, off-road/shared trails, sidewalks, curb cuts, and crosswalks. It lists bike and pedestrian capital projects to be constructed either in conjunction with road projects or separately. Provide or incentivize secure bike racks, bike lockers, and showers at employment centers; bike lockers at transit facilities; and bike racks at shopping areas, public facilities (schools, libraries), and other destinations

Benefits: Support alternatives to driving

Existing Programs/Resources: The Baltimore County Pedestrian and Bicycle Access Plan, and the Regional Bicycle, Pedestrian, and Greenway Plan

http://www.baltimorecountymd.gov/Agencies/planning/community_planning/adopted_community_plans/easterncountbikeandped.html

<http://www.baltometro.org/content/view/301/323/>

11. Adopt the Principals of "Complete Streets" and the Practices of "Context-Sensitive Solutions." Apply these principles and practices in capital projects and development review.

Benefits: Make streets work for all life conditions, and support multi-modal transportation.

Co-Benefits/Spillovers: See discussion, page 35.

Existing Programs/Resources: Context Sensitive Solutions, Institute of Transportation Engineers: <http://www.ite.org/css/>; National Complete Streets Coalition,

<http://www.completestreets.org/changing-policy/policy-elements/>

12. Conduct Public Education Program to Improve Bicycle and Pedestrian Safety. Improve pedestrian and bicycle safety through a regional public education program. The Baltimore Regional Council will soon implement a program similar to Washington, DC's StreetSmart Program—designed to increase public awareness about pedestrian and bicycle safety—as a pilot in Baltimore City and County.

Washington DC Metro Area's StreetSmart Program:

<http://www.mwcog.org/uploads/committee-documents/uV1WWFs20041215132011.pdf>

Programs Aimed at Commuters

13. Require or incentivize a parking cash-out program. Encourage employers who provide free or subsidized parking to compensate employees who walk, bike or take transit to work. California law requires certain employers who provide subsidized parking for their employees to offer a cash allowance in lieu of a parking space. This law is called the parking cash-out program. The intent of the law is to reduce vehicle commute trips and emissions by offering employees the option of "cashing out" their subsidized parking space and taking transit, biking, walking, or carpooling to work.

Benefits: Eliminate an incentive to drive.

Co-Benefits/Spillovers: Potential cost, if successful. Need ways to finance.

Existing Programs/Resources: California's cash-out law.

<http://www.arb.ca.gov/planning/tsaq/cashout/cashout.htm>

14. *Promote Programs Aimed at Increasing Transit Ridership.* Publicize existing MTA programs intended to encourage increased commuter use of public transit, including Commuter Choice Maryland. Expand promotion of the County's "BC Rider" ride-sharing program. Ridesharing involves the establishment of a transportation professional as the County Ridesharing Coordinator, who would assist citizens in setting up a carpool, vanpool, or personalized commuter trip plan. Commuter Choice Maryland is a program through which an employer can arrange to have employees use MTA buses at less than full fare with a minimum of 20 employees in the program.

Benefits: Reduce VMT in single-occupant vehicles.

Co-Benefits/Potential Spillover Effects:

Existing Programs/Resources: BC Rider, Commuter Choice Maryland

15. *Establish HOV (high occupancy vehicle) lanes on selected highways and the beltway.*

Benefits: Reduce commuter trips

Appendix A

Vehicle Miles Traveled (VMT) And CO2 Emissions by Vehicle Type For Average Summer Weekday Baltimore County: Urban and Rural Areas

Baltimore County URBAN

	Vehicle Miles Traveled (VMT)	Percent of Total	Tons of CO ₂	Percent of Total
Auto/Motor Cycle	9,814,394	51.1%	4,028.297	36.8%
Light Truck/SUV	7,526,563	39.2%	4,203.342	38.4%
Heavy Truck	1,682,455	8.8%	2,366.417	21.6%
Buses	170,490	0.9%	346.391	3.2%
Total	19,193,902	100%	10,944.447	100.0%

Baltimore County RURAL

	Vehicle Miles Traveled (VMT)	Percent of Total	Tons of CO ₂	Percent of Total
Auto/Motor Cycle	1,569,424	51.0%	643.086	36.5%
Light Truck/SUV	1,199,721	39.0%	670.007	38.0%
Heavy Truck	286,164	9.3%	402.496	22.8%
Buses	22,854	0.7%	46.433	2.6%
Total	3,078,163	100.0%	1,762.022	100%

Baltimore County URBAN & RURAL

	Vehicle Miles Traveled (VMT)	Percent of Total	Tons of CO ₂	Percent of Total
TOTAL	22,272,065	100%	12,706.469	100%

Source: Baltimore Metropolitan Council, Performance Report 104D

Appendix B

Incentives for Walkable Communities

TO: Built Environment Committee
Baltimore County Sustainability Network Team of Advisors

FROM: Jennifer R. Busse

DATE: February 9, 2009

RE: Incentives for Walkable Communities

Dear Committee Members:

Below are my thoughts on how barriers could be removed and incentives provided in order to promote the development of walkable communities.

Ideas for promoting the development of walkable communities:

- Create a mini master plan/community plan for an area desired for redevelopment.
 - McCormick essentially developed Hunt Valley, and Nottingham essentially developed White Marsh, in this fashion. Here obviously, however, it is Baltimore County that would need to act as the master developer. It would be during the creation of the plan that public input would be obtained. This way, whenever a property owner/developer is ready to develop property within that area, so long as the proposal conforms with the scheme agreed upon in the plan, he/she could go directly to permit. The benefit here would be that hopefully any battles would be fought up front and the developer could quickly proceed to the permit phase.
 - Common facilities could be included on the plan (such as parking, storm water management, a community center, etc.), and in order to avoid having one particular property owner bear the burden of providing such a community benefit and/or infrastructure/facility, the plan could require that all developers contribute financially toward that facility.
- Move away from Euclidian zoning towards form based zoning for areas on which a walkable type of community is desired. The focus therefore would be on impacts, not uses.
- For the rural areas (or anything outside the URDL), the following items could be considered:
 - Identify the maximum amount of density which would be allowed up front.
 - Provide for the ability to accommodate the transfer of development rights (TDRs).
 - Require the clustering of development.
 - Permit community septic systems.
 - Make PUDs available for areas outside the URDL.
 - In general, our zoning code has evolved to require larger lots in the rural areas, but for a village in the rural area, the requirements should be the opposite.

Appendix C

Alternative Financing Tools

The purpose of a PILOT (payment in lieu of taxes) is to provide for an exemption from Baltimore County property tax for certain real estate located in Baltimore County.

HB 300, “Tax Increment Financing and Special Taxing Districts - Transit-Oriented Development” (“TOD”), adopted in the 09 session of the Maryland General Assembly, provides a development financing tool that facilitates the involvement of multiple levels of government in TOD projects, making it much easier to pursue these highly sustainable projects.

End Notes

- ⁱ Brown, et. al., *Towards a Climate-Friendly Built Environment*, Pew Center on Global Climate Change, 2005, Forward.
- ⁱⁱ *Growing Cooler: The Evidence on Urban Development and Climate Change*. Reid Ewing, et al, 2007.; Published by Urban Land Institute, page, 2
- ⁱⁱⁱ Stevens, Josh, *Putting Parking in Reverse: Professor's Theories Influence Cities to Reconsider pervasive Free Parking*, *InTransition*, (http://www.intransitionmag.org/Winter_2009/Free_Parking.html), a review of Donald Shoup's book, *The High Cost of Free Parking*, 2005. Stevens cites data from Shoup's book.
- ^{iv} *Ibid.*, page 2
- ^v *Growing Cooler* study, page 4
- ^{vi} See related article in the NY Times and Washington Post:
http://www.nytimes.com/2009/05/19/business/19emissions.html?_r=3&ref=todayspaper;
<http://www.washingtonpost.com/wp-dyn/content/article/2009/05/18/AR2009051801848.html>
- ^{vii} *Automobile Fuel; Economy and CO2 Emissions in Industrialized Countries: Troubling Trends through 2005/6*, Lee Schipper, the World Resources Institute Center for Sustainable Transport, 10 G Street, NE, Suite 800, Washington, DC, 20002, schipper@wri.org
- ^{viii} *Growing Cooler* study., pages 2-4
- ^{ix} *Transportation Data: 1980 Travel – Millions of Annual Vehicle Miles, State of Maryland, All Systems.*; and *2007 Travel – Millions of Annual Vehicle Miles, State of Maryland, All Systems*. Prepared by Highway Information Services Division - SHA - (410) 545-5511; *Population Data: Baltimore County Office of Planning*.
- ^x *Growing Cooler*, page 2
- ^{xi} See Master Plan 2010, Baltimore County:
<http://www.baltimorecountymd.gov/Agencies/planning/masterplanning/downloadplanparts.html>
- ^{xii} Go to the following link to see a similar set of maps for the Washington-Baltimore Region. Link opens slowly. When it opens, make selections for region and metric.
http://htaindex.cnt.org/mapping_tool.php?theme_menu=3®ion=New%20York--Northern%20New%20Jersey--Long%20Island,%20NY--NJ--CT--PA
- ^{xiii} <http://www.arb.ca.gov/planning/tsaq/cashout/cashout.htm>
- ^{xiv} Cervero, Robert, *Transit-Oriented Development in the United States--Experiences, Challenges, and Prospects*, Transit Cooperative Research Program (TCRP) Report 102, Transportation Research Board
- ^{xv} Jackson, Kenneth T., *Crabgrass Frontier: The Suburbanization of the United States*, 1987. This book provides a good overview of the factors that precipitated widespread suburbanization after WW II.
- ^{xvi} As determined by the LEED for Neighborhood Development (LEED-ND) core committee, cited in Douglas Farr, *Sustainable Urbanism: Urban Design With Nature*, pg. 55.
- ^{xvii} LEED for Neighborhood Development Rating System (LEED-ND), 2nd Public Comment Draft, 2009, pp. 47-48.
- ^{xviii} See LEED-ND for Neighborhood Development Rating System, 2nd Public Comment Draft, 2009, page 54
- ^{xix} See Tumlin and Millard-Ball, "The Mythology of Parking," *Line Magazine*, December 2004
<http://www.walkablestreets.com/parking.htm>
- ^{xx} Brown, et. al., *Towards a Climate Friendly Built Environment*, Pew Center on Global Climate Change, June 2004, pg. 39.
- ^{xxi} Mazza, P. 2004, *Transportation and Global Warming Solutions*. Issue briefing. Climate Solutions, Olympia, WA, May 2004, cited in *Towards a Climate Friendly Built Environment*, Pew Center on Global Climate Change, June 2004.
- ^{xxii} *Growing Cooler*, page 55
- ^{xxiii} *Growing Cooler*, page 68
- ^{xxiv} Ewing, Reid, and Fang Rong, "The Impact of Urban Form on US Residential Use," 2008, Metropolitan Institute at Virginia Tech.
- ^{xxv} Sobel, Lee, *Greyfields to Goldfields, Dead Malls Become Living Neighborhoods*, 2002, Congress for the New Urbanism.
- ^{xxvi} See draft standards at: <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148>

^{xxvii} Locational standards for new development are laid out in the LEED for Neighborhood Development Rating System (LEED-ND), 2nd Public Comment Draft, 2009,

^{xxviii} Baxandall, Phineas, PhD, et al. "A Better Way to Go: Meeting America's 21st Century Transportation Challenges with Modern Public Transit," US PIRG (Public Interest Research Group), Education Fund, March 2008, page 23, http://www.reconnectingamerica.org/public/display_asset/abetterwaytogouspirg?docid=291

^{xxix} Sarah Payne, et al, "Making Tracks: The Case for Building a 21st. Century Public Transportation Network in Maryland," Maryland PIRG Foundation, March 2009, page 9.

^{xxx} News Release, American Public Transportation Association:
http://www.apta.com/media/releases/documents/090421_save_the_planet.pdf

^{xxxi} Baxandall, page 28.

^{xxxii} Baxandall, page 29

^{xxxiii} Baxandall, page 31

^{xxxiv} Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, Institute of Transportation Engineers, Washington, DC, 2006, sponsored by the US Federal Highway Administration and the US Environmental Protection Agency

^{xxxv} See Kentucky Model Ordinance at link below:

<http://www.planning.kytc.ky.gov/congestion/AccessManagement/Kentucky%20Connectivity%20Model%20Ordinance%20FINAL.pdf>

^{xxxvi} Information about Baltimore County's traffic calming program can be found on the website of the Department of Public Works: http://www.baltimorecountymd.gov/Agencies/publicworks/traffic/traffic_calming.html

^{xxxvii} Richard Florida and others, cite to be provided.

^{xxxviii} Dowell Myers, et al, 2001, Current Preferences and Future Demand for Denser Residential Environments, study for the Funders Network for Smart Growth and Livable Communities.

^{xxxix} Eppli, Mark S. and Charles Tu. 1999. Valuing the New Urbanism: The Impact of New Urbanism on Prices of Single Family Homes. Washington, DC, Urban Land Institute (cited in Dowell Myers)

^{xl} <http://htaindex.cnt.org/>; see also, The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice, January 2006, the Brookings Institution

^{xli} Burchell, Robert W., et al, *Costs of Sprawl 2000*, page 21, sponsored by the Transportation Research Board of the National Research Council, Washington, DC. Also see Benfield, Kaid F., et al, Once There Were Greenfields, Natural Resources Defense Council, 1999, pages 94-116

^{xlii} Lerch, pg. 63

^{xliii} Frank, Lawrence D., et al, "Obesity relationships with community design, physical activity, and time spent in cars," American Journal of Preventative Medicine, August 2004, Study Abstract.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VHT-4CW43KM-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=5a314f4bde25c61446ca9b01ce5dcf78

^{xliv} Baxandall, page 15

^{xlv} Baxandall, page 15

^{xlvi} See "Water and the Density Debate," Lynn Richards, in Sustainable Urbanism: Design with Nature, Douglas Farr, 2008, pp. 108-110.

^{xlvii} Methodologies discussed in detail in Chapter 4, Growing Cooler. See esp. page 67.

^{xlviii} Lerch, Daniel, Post-Carbon Cities: Planning for Energy and Climate Uncertainty, 2007, Post Carbon Institute, pg. 63.

^{xlix} <http://www.baltimorecountymd.gov/Agencies/planning/PUD/index.html>

^l Baltimore County Code, 2003, Article 32, Title 6.

<http://www.amlegal.com/nxt/gateway.dll/?f=templates&fn=default.htm>

^{li} Baltimore County Zoning Regulations, Sec. 409, <http://www.ecode360.com/?custId=BA1714>

^{lii} Florida's Multi-Modal Districts: <http://www.nctr.usf.edu/pdf/527-07.pdf>

^{liii} Specific Plans, <http://ceres.ca.gov/planning/specific/>

^{liv} Columbia Pike Initiative:
<http://www.arlingtonva.us/Departments/CPHD/Forums/columbia/CPHDForumsColumbiaColumbiaPikeInitiativeMain.aspx>

^{lv} Honeygo Plan:

http://www.baltimorecountymd.gov/Agencies/planning/community_planning/adopted_community_plans/honeygotoc.html

^{lvi} Baltimore County Commercial Revitalization:

http://www.baltimorecountymd.gov/Agencies/economicdev/CommRevitalization/edd_commrevitprograms.html

^{lvii} ReDiscover Shopping In Baltimore County's Neighborhood Downtowns

http://www.baltimorecountymd.gov/Agencies/economicdev/CommRevitalization/edd_rediscover.html

^{lviii} Virginia & Delaware Mandate Connected Streets (abbreviated version at link)
Connectivity Index and Intersection Density measures used to quantify connectivity.

<http://www.newurbannews.com/>