

**Researching Design and Transportation  
Systems for Sustainable Communities.  
What can we learn and how can it be  
applied in Rhode Island.**

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16. Abstract <p>There has been a marked growth of interest in the topic of sustainable communities and sustainable transportation due to increased concerns about global warming and climate change. One of the leading causes is urbanization and its impacts on people and places. As the size of cities has grown; roads have been extended, traffic and congestion have worsened; there has been an increase in travel times and commuting distances while traffic has intruded into neighborhoods, hazardous conditions have increased and there remains a general lack of opportunities for walking and bicycling. These developments are seen to diminish the quality of life found in our cities and neighborhoods (ITE 2000).</p> <p>Due to these conditions, researchers are looking for effective options to the pervasive car-oriented development patterns. One alternative that has received much attention and which is the focus for this research is the sustainable community and its transportation infrastructure. For this project, the PI examined the literature pertaining to sustainable communities and sustainable transportation systems while looking at precedents, roadway and circulation patterns, and features including green streets, shared streets, skinny streets, green infrastructure and other sustainable practices. The author looked at publications describing new technologies, practices and policies that have been implemented in the United States and abroad. This paper summarizes his findings and concludes with recommendations.</p>			
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## ***INTRODUCTION***

There has been a marked growth of interest in the topic of sustainable communities and sustainable transportation systems. This interest is due in part to increased concerns about global warming and climate change and issues such as growing urbanization. As the size of cities and their populations have grown, roads have been widened and extended and yet, rather than solving transportation problems, there has been an increase in traffic and congestion, longer commuting and travel times, traffic intrusion into neighborhoods, roadway hazards and a lack of opportunities for walking and bicycling. All of which are seen to diminish the quality of life in our cities and neighborhoods (ITE 2000).

Urbanization has led to sprawl, a major factor which has not only consumed acres of farmland and forests, but has also contributed to the most significant ecological problems of the twenty-first century: habitat loss, habitat fragmentation, and the loss of ecological biodiversity. It has also led to problems of water and air quality, erosion, and reduced groundwater supplies, and is considered a contributor to a health epidemic with symptoms including obesity, heart disease, child diabetes, and respiratory illness (Rami, Benfield and Chen 2003, Girling and Kellett 2005). As a result, researchers, planners, designers and officials are looking for effective alternatives to the pervasive car-oriented development patterns found in our cities and towns.

An alternative that addresses many of these issues and has received considerable attention is the sustainable community which may be loosely defined as an environment in which people live and work and where buildings, infrastructure and landscapes are designed to enrich human interactions, celebrate places and reduce impacts on the environment and its underlying systems. They are places which are designed to be attractive and functional, and to rely less on cars and more on walking, biking and public transit. They are compact and reflect a concern with ecology, economy and equity. While such places may be rare, there are cities, neighborhoods and streets that employ practices that are considered sustainable and that provide benefits to those living in them or passing through.

## ***PURPOSE OF PROJECT***

The purpose of this project was to examine the literature pertaining to sustainable cities and communities with an emphasis on sustainable transportation and streets. As Phase I of a two-phased project, the investigator looked at national and international publications, journals and reports focused on sustainable transportation systems, sustainable streets, green streets, green infrastructure and associated features and practices. What follows will be a description of some of the alternatives that are associated with sustainable transportation, have been implemented and are suitable for use in Rhode Island communities.

## ***TRANSPORTATION AND SUSTAINABLE COMMUNITIES***

There is a clear and direct relationship between industrialization, urbanization and transportation and current conditions associated with global warming and climate change. In cities and urbanizing areas, where traffic is heaviest and transportation systems most extensive the effects are greatest. According to the Northeast Sustainable Energy organization, transportation uses two-thirds of all the oil in the US, and it emits 60 – 90% of the urban air pollution and one-third of the climate change emissions (NESE.org 2001). These statistics point out the need to focus our attention on discovering alternatives to the practices that have brought us to this point in time and applying them in our cities, towns and neighborhoods.

One approach that has attracted much attention is the design and layout of neighborhoods and streets that aims to bring people, businesses and needs closer together. In contrast to car dependent sprawling developments and those dominated by large multi-lane streets and highways, there are communities and neighborhoods that have been built according to principles of Smart Growth, New Urbanism, Neo-Traditional Design (NTD), Traditional Neighborhood Development (TND), Transit-Oriented Development (TOD), Pedestrian Oriented Development (POD), Context Sensitive Design and Walkable Community Design. Each of these has target goals and objectives, design standards, ideal layout patterns and projects that are cited as examples of each.

Motivating planners, architects, and landscape architects has been the desire to create denser places for living and working that have greater access and provide vital connections while making it easier to achieve important sustainable objectives like reducing a carbon footprint or reducing stormwater runoff. In general, denser neighborhoods can result in land and environmental protection as well as in construction cost savings. According to Trevor Hancock, a transportation system that is oriented to walking, cycling and public transportation rather than private cars contributes to ecological capital by saving energy and reducing emissions. It contributes to human capital by reducing health-damaging air pollution and motor vehicle accidents, and by increasing the amount of exercise people get. It may also contribute to social capital by increasing the social networking required for car-pooling and the use of public transport, while at the same time reducing congestion and transportation costs (Hancock 2001). Walkable communities, also, tend to have higher measures of “community health” and well-being and greater space for children’s play (Vaill in Hancock 2001).

Portland, Oregon is a city that has been at the forefront of efforts to reduce urban impacts by protecting the environment, improving transportation alternatives, and enhancing the quality of life in its communities. In the 1970’s, Portland adopted an urban growth boundary, which designated areas for development and for protection. Through 2008, it has continued to maintain and revise that important boundary. The city has also supported mass transit, light rail, and trolley-use while encouraging pedestrianism and bicycle travel. It has worked to integrate transit improvements with environmental protection. The city and region are working to implement green streets and livable streets policies that provide for pedestrian connections, streetscape improvements and drainage systems that can reduce the negative impacts of overall street networks on streams and associated habitat (Girling and Kellett 2005). Other North American cities that are implementing green / sustainable design practices and programs include Austin, Chicago, Sacramento, Seattle, and New York, as well as a host of Canadian and European cities.

### ***SUSTAINABLE TRANSPORTATION***

The concept of sustainable transportation has emerged from that of sustainable development. It is an attempt to balance the requirements of vehicles and drivers with those of environmental protection, social concerns and economic interests (Qureshi and Lu 2007, Litman 2003 and Steg and Gifford 2005). To enact such a change requires a new viewpoint that focuses not only on vehicles and transport, but on community, people, wildlife, environmental quality, recreation, and health. It is a perspective in which the automobile is viewed as part of a balanced system in which public transport, cycling, and walking are all viable options (Lowe 1990).

The City of Portland and its regional planning authority Metro, have been developing standards procedures and how-to publications aimed at achieving such a balanced system. According to Metro, the guiding principle for today’s road design and planning needs to be to conserve, protect and restore the environment as the first consideration (Metro 2002). Through its manuals “Green Streets Innovative Solutions for Stormwater and Stream Crossings” and “Creating Livable Streets”, it offers the region an integrated approach presenting definitions, objectives, design guidelines, and policies for implementing and achieving “green streets” and “livable communities” programs. Some of the methods which they explain include reducing the extent of street networks and pavements, decreasing street widths, using pervious pavements and other infiltration techniques, reducing parking and increasing public transit (Girling and Kellett, 2005). These practices and others are applicable to Rhode Island conditions and to those found throughout much of New England.

To achieve a functional and safe network requires that pedestrians, bicyclists and those in wheelchairs have safe access. For pedestrians the need is for well-connected and continuous travel ways. Buffering pedestrians as well as properties from traffic and noise and providing numerous connections to commercial and residential buildings, to transit facilities and adjacent land uses is also necessary. Bike paths and bike lanes should be part of “. . . a fully connected bicycle network that can provide bike access, on paths separated from road traffic, to destinations over a very large area (Low, Gleeson, Green and Radovic 2005). An interconnected street system with on-street bike lanes can also be effective for moving people through the city. Secure bicycle parking facilities are also needed and will encourage more bicycle trips (METRO 2002). According to Girling and Kellett, bicycle networks are best when they include choices for using both on- and off-street, routes.” They note that having a network can provide cyclists with choices suited to their purposes and abilities.

Calgary and Corvallis are two cities with extensive and well-connected on and off-street bicycle lanes and paths (Girling and Kellett 2005).

### ***LIVABLE STREETS, GREEN STREETS AND OTHER SUSTAINABLE IMPROVEMENTS***

Since streets are the form-givers in cities and neighborhoods, and their patterns, pavements, furnishings and landscapes contribute largely to both a location's sense of place and its ecological footprint, it is important to note some of the alternative and more sustainable designs being implemented and maintained.

#### ***Livable streets***

*Livable streets* are streets that carry low traffic volumes at low traffic speeds. They may be commercial or residential in nature, narrower than traditional streets and tend to be pedestrian, bicycle and transit friendly. They are laid out according to flexible design standards that may fit more comfortably within a particular context. Their use in an urban area is intended to enhance community livability by providing the environmental conditions that support independence and freedom of choice; provide orientation, safety and comfort; encourage a sense of community while also providing privacy, a sense of neighborhood responsibility and enhanced property values. (METRO 2002)

#### ***Green streets***

Green streets emphasize environmental quality, include circulation and landscape features designed to reduce impacts on streams and riparian corridors and include many pedestrian oriented features. Green streets may also be narrower than traditional layouts and thus reduce impervious surfaces and construction materials. They typically include sidewalks and drainage features that often seek to mimic or maintain the natural hydrology. For a more sustainable stormwater management system, they encourage the use of bioswales, planting strips, porous pavements, infiltration basins, and alternative construction materials in low-use areas (METRO 2002). Green streets are intended to be pedestrian friendly, reduce carbon footprints and balance demands for access with those of the environment.

#### ***Low speed roads***

Also known as shared or mixed-use roads, low speed roads are designed with pedestrian safety in mind. Where on-street parking is provided, road crossing widths may be reduced through the use of curb-extensions or reduced corner radii. With low traffic speeds there are many opportunities for pedestrians, bicycles and transit to share the road. For effective movement, convenient social and economic access to jobs, shopping, services and community facilities these streets are normally connected (without cul-de-sacs). They may make use of traffic calming devices to discourage speeding and through traffic. Where low-speed roads are part of a neighborhood, acceptable air quality and noise levels are usually found (METRO 2002). Drainage enhancements resulting in reduced runoff and improved water quality may be achieved provided space and soil conditions are favorable.

#### ***Living streets***

A *living street*, “woonerf” or unified street, is an option that has been effectively used to integrate traffic and residential activity in the same space. Sometimes referred to as a *shared street* these designs are largely used in European and Asian cities, but can also be found in Brookline, MA and West Palm Beach. A living street is one in which automobile traffic, parked cars and residential activities including walking, children's play, and bicycling occur in the same space. While the shared street requires careful design and driver attention, the emphasis is on providing an attractive urban design that signals a multi-use public space as opposed to a place dominated by traffic. While the streets are largely paved, designs result in social benefits as residents tend to view and use the street as an extension of personal space. There are more people including children using the spaces and also fewer accidents. (Southworth and Ben-Joseph 2003, Baker 2005).

Portland Oregon's *Skinny Streets Program* (1991), a variant, encourages the installation of narrower streets, which results in less impervious material. Benefits include reduced runoff and grading, lower costs and enhanced livability (Southworth and Ben-Joseph 2003). The “queuing street”, a variation on this theme makes

use of reduced pavement widths for a shared travel lane. For this to work, cars must slow down when passing. Roads of this type have been used in Vancouver, BC, for low-volume residential streets (Girling and Kellett 2005). Curbless green streets, skinny streets and livable streets are all designed to lessen environmental impacts, enhance the local and regional landscape and improve stormwater management practices. Their landscapes can also be used to reduce the carbon footprint.

### ***Drainage***

Systems designed to capture, redirect and treat runoff are being used to reduce environmental impacts, enhance water quality, protect and restore habitats and reduce infrastructure costs in cities and towns around the country. According to Girling and Kellett 2005, engineers are adopting ecosystem-based approaches to stormwater planning and management. The objective is to mimic a landscape's natural hydrologic processes which entail working with existing watershed patterns and natural surface drainage rather than designing and installing piped or channeled systems. Methods include integrating surface drainage and infiltration with practices that include the use of green roofs, curbless streets, rain gardens, bioswales, cisterns and biofiltration. When combined, these strategies, which are sometimes referred to as a "treatment train" can yield considerable stormwater and environmental improvements. In the State of Rhode Island, the Department of Environment Management (DEM) and the Rhode Island Coastal Resources Management Council (CRMC) are in the process of updating and reissuing the "Rhode Island Stormwater Design and Installation Standards Manual" which contains information on new methodologies for minimizing and treating runoff.

### ***Open Spaces***

Within any network of streets and buildings there is a need for *green/open spaces*. Researchers have noted the important role that these elements play in sustainable and healthy communities. The President's Council on Sustainable Development found that green infrastructure, the network of open spaces, airsheds, watersheds, woodlands, wildlife habitat, parks, and other natural areas, provide many vital services that sustain life and enrich the quality of life. They may cleanse and recharge water, mitigate the urban heat island effect, reduce cooling and heating needs, provide habitat, and cleanse air, and their green wastes can be composted and used to build urban soils (Girling and Kellett 2005). They are also associated with community health and well-being.

### ***Pavements***

Pavement choices can have a direct impact on a project's sustainability. In addition to addressing issues associated with traffic and parking, circulation and safety, environmental protection and aesthetics, pavements can be selected that help achieve sustainable goals. In addition to the direct benefits from using a product in a particular way, there are other benefits associated with selecting one product over another. There may be cost savings based upon a method of production, transportation, application, installation and even maintenance. Examples of some of the choices that result in more sustainable applications include specifying lower temperature asphalt, which cuts energy usage and reduces emissions; using recycled concrete and asphalt as aggregate for base courses and in mixes; specifying high extender cements, those that are blended with fly-ash, blast furnace slag and other recycled materials; and the use of higher percentages of recycled asphalt in asphalt concrete mixes. Optimization of pavement designs can also minimize material requirements and thus reduce material and energy requirements (Pears 2005). Other options include the use of pervious surfaces such as flexible pavements, porous asphalt and concrete, and stabilized aggregates and soils and the selection of lighter colored pavements which can reflect sunlight and reduce the heat island effect.

### ***Vegetation***

Trees, shrubs, perennial plants and groundcovers may be part of a buffer, boundary, green space, open space, restored landscape or part of the commercial/residential environment. Plants, particularly trees are valuable within a transportation corridor as they provide shade, relief from the engineered street, aesthetic enhancements, mitigate air pollution, attenuate sound, and provide erosion control and stormwater management functions. With the recognition of their value, it is important that the selection, placement, installation and maintenance of trees achieve goals consistent with green streets, livable streets and other enhancement programs.

Villebois in Wilsonville, Oregon is a town of 482 acres that uses green streets as part of a rainwater management system, designed to reduce the impacts of development and restore the groundwater system

damaged by a prior land use. Extensive natural landscapes and a rainwater management system are two components of the greenway system and several boulevards were constructed with biofiltration swales in the center medians.

Vancouver, British Columbia is a city that is working to integrate compact urban development and green infrastructure at the neighborhood scale. Some of the principles that it eschews include giving priority to transit, cycle, and pedestrian access in the downtown; emphasizing pedestrian scale improvements in its neighborhoods; providing a rich mix of housing types and tenures; and ensuring that open space and green linkages are achieved and that waterfront edges are accessible to the public (Girling and Kellett 2005). In Rhode Island tree planting programs in many communities are addressing issues that range from erosion control and aesthetics to reducing the heat island effect and a municipalities carbon footprint.

### ***THE FUTURE***

The need for communities with sustainable transportation systems is undeniable. The challenge is to develop 1) the tools (ongoing), 2) the models (still limited and incomplete), 3) a design process that emphasizes sustainable solutions, 4) a means for reliably assessing those sustainable solutions with benchmarks and environmental accounting (Low, Gleeson, Green and Radovic 2005) and 5) a source of transportation / design professionals able to balance the demands of access and safety with those of environment, ecology and quality of life. There is also the issue related to citizen expectations and behaviors. What must occur before individuals are willing to reduce the use of their cars and rely more on walking, biking and public transit? While improving technologies and achieving greater fuel efficiencies will help, technological fixes are unlikely to offset the impacts of growing populations of urban dwellers and car owners.

As the literature indicates, there is much available information to guide in our decision-making. There are regulatory changes which have been adopted and standards in Rhode Island (about to be released), and elsewhere. There are models around the nation and some exciting projects around New England. There are examples of policy incentives that have been implemented and design treatments that have been used to create more sustainable communities and transportation systems. The urge may be to adopt and apply some of them indiscriminately. However, solutions should grow from place and satisfy a particular set of circumstances. While the issues are considerable and challenges great, there is cause for optimism due to range of options, the growing list of completed projects and the expanding number of people and communities grappling with these critical issues.

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