

SHIFTING GEARS

20 Tools for Reducing Global Warming Pollution
from New England's Transportation System

ENVIRONMENT MAINE RESEARCH & POLICY CENTER

NATURAL RESOURCES COUNCIL OF MAINE

Spring 2006

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EXECUTIVE SUMMARY

Transportation is the leading source of global warming pollution in New England, responsible for more than one-third of the region's emissions of carbon dioxide, the leading global warming pollutant. Worse, transportation-sector emissions have been rising for decades and are projected to continue to increase if trends toward more vehicle travel and less fuel-efficient cars and trucks continue.

For the New England states to follow through on their historic commitment – made in concert with the eastern Canadian provinces in 2001 – to reduce global warming pollution, reducing global warming pollution from transportation is job number one.

Thankfully, there are many good opportunities for the region to reduce global warming pollution from transportation, while at the same time reducing oil consumption and insulating the regional economy from energy price shocks.

Shifting Gears lays out 20 “bright ideas” that the region's leaders should consider in their efforts to build a more sustainable transportation system for the region with less impact on the global climate. Many of these ideas are already being implemented in parts of New England or elsewhere.

Reducing Per-Mile Vehicle Emissions

1. **Adopt the clean cars program with carbon dioxide tailpipe limits** – States adopting the full clean cars program can expect to roughly stabilize emissions of carbon dioxide from cars and light trucks within the next two decades.
2. **Create incentives for the purchase of more fuel-efficient vehicles** – A program that combines fees for gas-guzzlers with cash rebates to purchasers of fuel-efficient vehicles could reduce global warming pollution from light-duty vehicles in the region by 5 to 31 percent below projected levels by 2020.
3. **Require fuel-saving tires** – By setting energy efficiency standards for tires, states could achieve a roughly 3 percent increase in vehicle fuel economy at little cost and without compromising safety.
4. **Reduce emissions from government and transit fleets** – Hybrid-electric buses can curb global

warming emissions by 10 to 15 percent versus conventional buses.

Encouraging Transit and Transportation Alternatives

5. **Invest in the region's rail infrastructure and develop a long-term rail plan** – Passenger trains emit about half as much global warming pollution per passenger-mile as car or air travel.
6. **Expand suburb-to-suburb transit opportunities** – By using smaller vehicles and more flexible routes, transit agencies in states like New Jersey have delivered effective service in hard-to-reach suburbs.
7. **Improve transit in small cities and towns** – Partnerships with local governments and major employers have helped rural and small-city transit agencies in New England extend their reach and bolster service.
8. **Expand pedestrian and bicycling opportunities** – Careful planning and infrastructure investments can reverse the decline in non-motorized transportation.

Promoting “Smart Growth”

9. **Redevelop urban areas in a sustainable way** – State policy can encourage the redevelopment of old industrial and residential areas in cities, where per-capita global warming emissions from transportation are much lower than in newer suburbs. Redevelopment should be pedestrian friendly, incorporate mixed uses, be accessible to transit, and provide opportunities for existing residents to benefit from neighborhood improvements.
10. **Encourage compact development** – Through revised zoning laws, many towns are returning to a more compact, traditional New England style of development that relies less on the automobile and can allow people to complete more of their daily tasks via transit, by bicycle or on foot.
11. **Support transit-oriented development** – Providing residential and commercial opportunities near transit stations can magnify the benefits of transit and reduce vehicle travel.

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12. **Discourage sprawl by making it pay its own way** – In Maryland and elsewhere, state and local governments are eliminating public subsidies for sprawling development, thereby encouraging more sustainable use of land and resources.

Reducing Single-Passenger Automobile Commuting

13. **Create and expand commute-trip reduction programs** – Employer-based programs to discourage single-passenger commuting can cut rush-hour automobile trips by as much as 20 percent.
14. **Encourage workers to live near their work or live near transit** – Long automobile commutes are responsible for an increasing share of global warming emissions. Public and private policies should encourage people to live nearer to their work or closer to public transit, thus reducing the need for long trips to and from work.

Reallocating the Costs of Driving

15. **Calculate auto insurance rates by the mile** – Shifting automobile insurance from a flat, yearly rate to one calculated by the mile can discourage excessive driving (particularly among the most dangerous drivers) – both reducing crashes and global warming pollution. Other insurance reforms can assign the proper risk premium to heavier, less-efficient SUVs.
16. **Allocate fairly the costs of parking** – Many employers provide free parking to employees – and many towns require ample parking for stores and businesses – but few subsidize transit or provide equal benefits to pedestrians or bike riders. Reducing parking requirements and “leveling the playing field” for transportation alternatives can eliminate these subsidies for driving.
17. **Eliminate other subsidies for driving** – From government highway maintenance expenditures to fuel subsidies, taxpayers often subsidize excessive driving. Making individuals pay the full cost of driving will encourage cleaner and less-expensive alternatives.

Reforming Transportation Planning and Finance

18. **Consider adoption of least-cost planning** – Demand reduction, transit and other alternatives are often cheaper and less polluting ways to solve transportation problems in the long run than building new highways. “Least-cost” planning that incorporates the social costs of automobile driving and the long-term benefits of stable transit infrastructure may reduce global warming emissions and reduce the cost of transportation overall.
19. **Consider global warming in transportation planning** – Transportation plans should fully factor in the impact of new highways and other projects on the climate.
20. **Fund transit and other alternatives at higher levels** – New England states have not taken full advantage of the ability to use federal funds for cleaner transportation options, and several lack any stable source of funding for transit. Prioritizing funding for transit and other clean options can help get badly needed projects off the drawing board and into place, as well as help transit agencies maintain high levels of service and reasonable fares.

INTRODUCTION

New England's transportation system has shaped the region's economy and culture since the beginning of its history. The bustling port towns of the colonial period grew up around vigorous trans-Atlantic commerce, while footpaths and country roads linked isolated inland communities with each other and the rest of the world. The 19th century brought an expanded network of turnpikes and the region's first railroads. With industrialization came bigger, more complex cities and urban streetcar networks to help residents of those cities get from place to place.

The creation of the Interstate highway network in the 1950s led to even greater changes, spawning massive suburbanization and greater reliance on the automobile for all forms of travel – even as it enhanced mobility and created new options for New Englanders. At the same time, air travel allowed New England residents to quickly travel to distant parts of the United States and the globe.

At the dawn of the 21st century, however, New England faces serious transportation challenges. Increasing highway congestion makes travel around and through the region's major cities a costly, time-consuming nightmare for many travelers. Our transportation system's reliance on cheap oil leaves our economy vulnerable to the wild swings of global petroleum markets – and will leave us even more vulnerable in the future as oil becomes harder to find. Many transportation systems – including highways, railroads and urban transit networks – suffer from aging infrastructure. And, not least of all, our transportation system imposes huge costs on the region's environment and public health – from the destruction of open space caused by automobile-dominated suburban sprawl to unhealthy levels of air pollution to a growing contribution to the warming of the planet.

Thankfully, there are many concrete steps New England states can take to deal with the many challenges facing our region's transportation system. Both within the region and elsewhere in the country, communities, states, businesses and others are taking innovative steps to make their transportation systems more efficient, more sustainable, and more supportive of a high quality of life.

This report focuses on one of the most important challenges facing New England's transportation system – the need to reduce pollution that contributes to global warming. We list 20 “bright ideas” that are being implemented either in New England or elsewhere, or that have been the subject of intensive study, and which can make a strong contribution toward reducing our impact on the global climate.

But while global warming is the primary focus of this report, many of the policies, programs and other efforts described here also address other key challenges facing the region: from oil supply challenges to suburban sprawl, and from traffic congestion to air pollution.

Addressing these challenges may seem daunting. Indeed, just as New England's current transportation system is the result of decisions made over the course of centuries, it will take a long-term, concerted effort to achieve the efficient, reliable and environmentally sustainable transportation system that the region must develop for the future.

The 20 ideas proposed in this report are a starting point for that long-term journey, but good ideas are not enough. It will take vision, leadership and cooperation for New England to meet its transportation challenges and do its part to reduce the threat posed by global warming. The time to begin is now.

TRANSPORTATION AND GLOBAL WARMING IN NEW ENGLAND

GLOBAL WARMING EMISSIONS FROM TRANSPORTATION

New England's transportation system is the region's number one source of carbon dioxide, which is the leading pollutant responsible for global warming. In 2001, the region's transportation sector produced approximately 71.8 million metric tons (MMT) of carbon dioxide – more than was produced by the direct use of fossil fuels in all the region's homes, businesses and industrial facilities. (See Fig. 1.)

Consumption of motor gasoline – the vast majority of which is used to power cars, light trucks and SUVs – produces three-quarters of the region's transportation-sector emissions of carbon dioxide. Distillate (diesel) fuel, which powers trains and heavy-duty trucks, was responsible for about 16 percent of the region's transportation emissions, with jet fuel producing another 7 percent.²

New England's transportation-sector emissions are significant on a global scale. In 2001, the region's transportation sector emitted more carbon dioxide than the entire economies of Austria, Portugal, Israel and more than 150 other nations.⁴

In 2001, the region's transportation sector emitted more carbon dioxide than the entire economies of Austria, Portugal, Israel and more than 150 other nations.

Ominously, transportation emissions in New England have risen significantly over the last decade – even in the years since the adoption of the New England Governors/Eastern Canadian Premiers Climate Change Action Plan in 2001. Between 2001 and 2003, gasoline sales in the region increased by 8.6 percent, with increases taking place in every New England state.⁵ Despite a dramatic run-up in gasoline prices, New Englanders drove only slightly fewer miles on the region's highways in 2005 than they did during 2004.⁶

THE CHALLENGE FACING NEW ENGLAND

Achieving New England's goals for reducing global warming pollution will require a strong effort to reduce transportation-sector emissions. Should New England continue to produce the level of transportation carbon dioxide emissions it produced in 2001, the region would have to slash emissions from the rest of the economy by nearly one-quarter in order to meet the goal of reducing emissions to 10 percent below 1990 levels by 2020. Such reductions would be achievable and beneficial, but their sheer size illustrates the importance of getting the transportation sector to do its share to meet the region's global warming goals.

To achieve meaningful reductions, the region will need to slow or reverse three long-term trends: the spread

Fig. 1. New England Sources of Carbon Dioxide, 2001¹

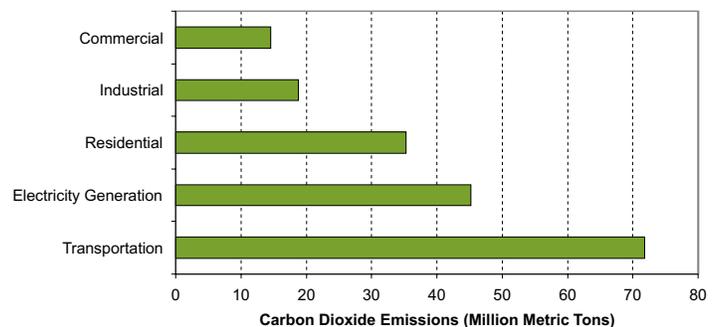
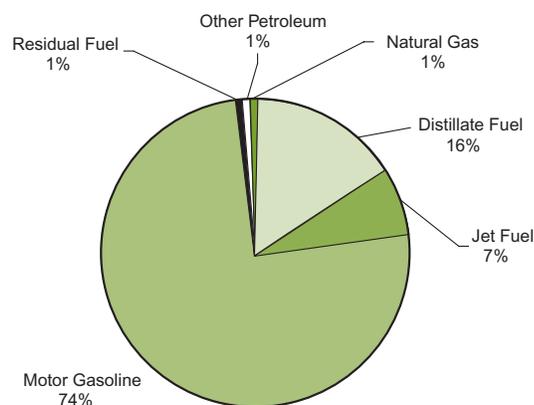


Fig. 2. Transportation Sources of Carbon Dioxide in New England, 2001³



of auto-dependent suburban sprawl as a dominant land-use pattern; stagnation in the fuel economy of the cars and light trucks that produce the vast bulk of carbon dioxide emissions; and the increased use of high-carbon modes of transportation such as cars and airplanes rather than transit or walking.

Automobile-Dependent Suburban Development

Prior to World War II, New England communities were largely organized along traditional lines, with industrial and commercial activity located in an urban or town center and residences either in close proximity to these centers of civic life and work or in rural areas. In some larger cities, “streetcar suburbs” – and, increasingly, suburbs reachable by automobile – allowed some to establish residences in less-populated towns outside urban centers.

Following World War II, a variety of government programs and social forces – ranging from the construction of Interstate highways to federal subsidies for home ownership – caused a boom in the construction of suburban housing, followed by the shift of commercial and industrial activity to the suburbs. The trend toward suburbanization – including the recent growth of “exurbs,” formerly rural communities that are now experiencing low-density residential growth – continues to the present. Between 1990 and 1999, the population of New England central cities declined by 2.4 percent, while the population of the metropolitan areas surrounding those cities increased by 4.1 percent.⁷ In 1960, nearly 17 percent of the population of the Boston metropolitan area lived in the city of Boston itself; by 2000, that percentage had dropped to 12 percent.⁸

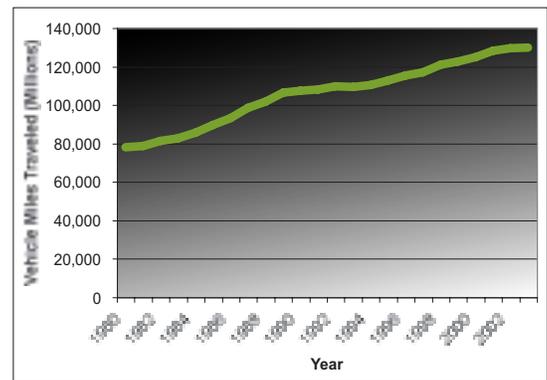
Coupled with the demise of many urban transit systems, these new development patterns increased the need to use automobiles to get to and from work and

In the Boston metropolitan area in 1980, 61 percent of workers drove to work alone. By 2000, 74 percent did.

to complete many daily tasks. In 1960, for example, 64 percent of American workers used private vehicles (either single-passenger or carpool) to get to and from work; by 2000, nearly 90 percent did.⁹ In the Boston metropolitan area in 1980, 61 percent of workers drove to work alone. By 2000, 74 percent did.¹⁰

As a result, vehicle travel has increased dramatically in New England over the last several decades. Since 1980, vehicle-miles traveled (VMT) on New England highways have increased by about two-thirds – from 78 billion miles per year to nearly 130 billion miles in 2003.¹¹

Fig. 3. Annual Vehicle-Miles Traveled in New England



This increase in vehicle travel would have less of an impact on global warming if global warming emissions from each vehicle mile had remained constant or declined. But the reverse has been true over the past decade – the car and light truck fleet has been getting *less efficient*, thus compounding the global warming impact of increased vehicle travel.

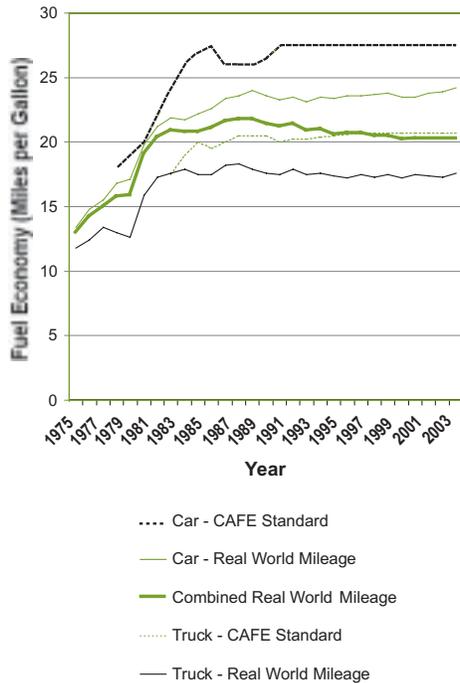
Declining Fuel Efficiency

Vehicle carbon dioxide emissions are directly related to the amount and type of fuel consumed. Thus, improving the fuel efficiency of vehicles can reduce carbon dioxide pollution.

Unfortunately, over the past decade and a half, the fuel efficiency of the overall light-duty vehicle fleet (which includes cars, SUVs and minivans) has been declining. An EPA analysis of fuel economy trends found that the average real-world fuel economy of light-duty vehicles sold in 2003 was lower than the

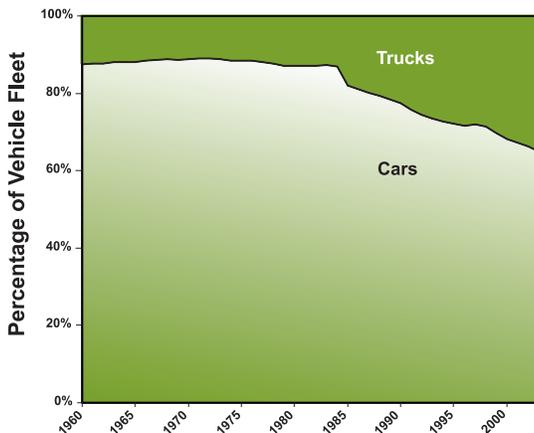
average fuel economy of vehicles sold in 1981. Indeed, the average real-world fuel economy of new cars and light trucks actually declined by 7 percent between 1988 and 2003.¹² (See Fig. 4.)

Fig. 4. Average Fuel Economy for New Light-Duty Vehicle Fleet on the Decline¹³



At the same time that vehicle fuel economy has been stagnating or declining, more and more Americans – including New England residents – have taken to driving SUVs and other light trucks, which are less efficient than cars. Cars make up a decreasing share of the vehicle fleet in New England – by 2003, about

Fig. 5. Automobile vs. Truck Share of New England Vehicle Fleet



one-third of all vehicles registered in the six New England states were trucks, compared to a little more than one-tenth in the mid-1970s.¹⁴ (See Fig. 5.)

Declining fuel economy and increasing vehicle travel are responsible for the trend toward increasing transportation-related carbon dioxide emissions in New England. But the trend has been exacerbated over time by the general shift from low-emission to high-emission forms of travel.

Shifts to High-Emission Travel Modes

The shift from transit to automobile use is just one example of the general shift from forms of transportation with low per-mile carbon dioxide emissions to forms with high emissions.

Inter-City Passenger Transport

Prior to the construction of Interstate highways and the expansion of commercial air travel in the 1950s and 1960s, a great deal of the travel between cities in New England (and from cities in New England to other regions) occurred by rail. Inter-city passenger rail service connected residents of all six New England states and tied the region to the rest of the nation.

However, since World War II, the nation's intercity passenger rail system has atrophied. (See Figs. 6 a-b, next page.) Even though New England remains one of the most significant bastions of passenger rail travel in the U.S., the system in the region is not as extensive, and service not as frequent, as it was in the early 1960s.

Passenger rail uses less energy and produces significantly less carbon dioxide pollution per passenger-mile than either automobiles or airplanes. (See Fig. 7, next page.) High-speed regional passenger rail, such as the Amtrak Acela service along the Northeast corridor, can provide door-to-door travel times comparable with air or automobile travel. Expanded high-speed rail service could satisfy much of this travel need. For example, approximately 20 percent of the flights to and from Boston's Logan airport serve destinations in the Atlantic states and eastern Canada, from Washington, D.C. to Toronto. Many of these 4 million-plus passengers could theoretically be served by high-speed rail.

Figs. 6 a-b. National Passenger Rail System, 1962 and 2004¹⁵

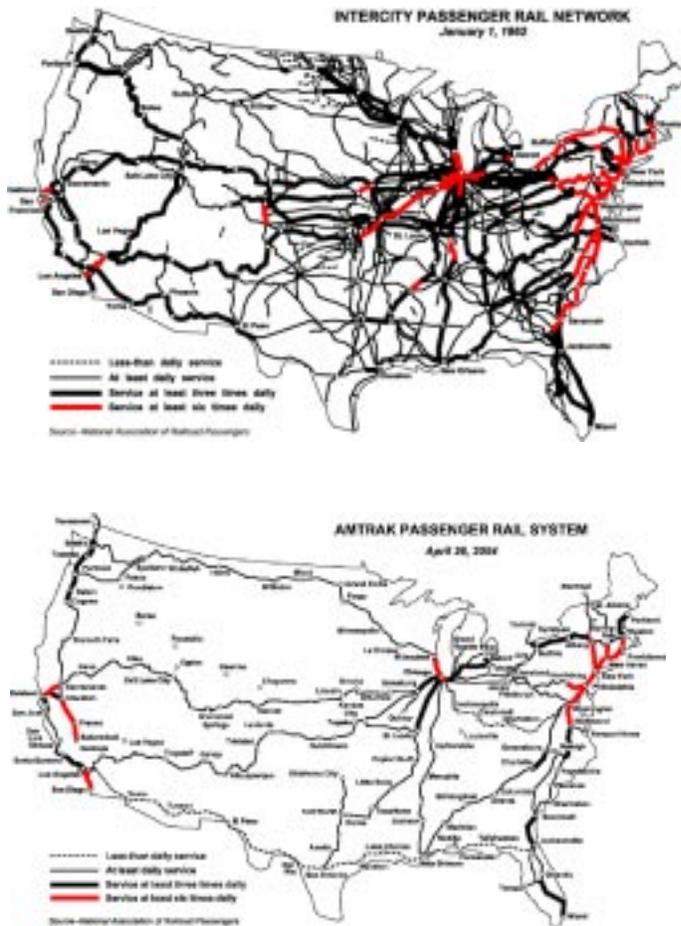
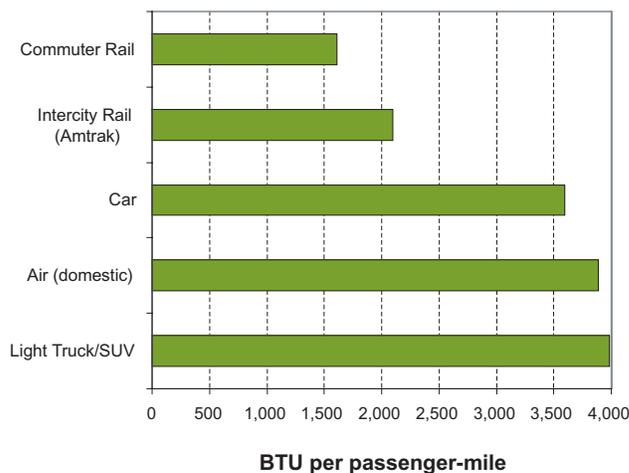


Fig. 7. Energy Use per Passenger-Mile (BTU) of Different Transportation Modes¹⁶



Freight

Freight transportation has also shifted toward modes with higher per-mile global warming emissions. In the past several decades, more freight has been shipped by truck (and to a lesser extent by air), moving away from railroads and waterways. Since trains and water-borne vessels are about three times more fuel-efficient than trucks for the movement of cargo, a shift toward the movement of freight by rail or water could significantly reduce carbon dioxide pollution.¹⁷

Rail remains a significant means of shipping freight in the U.S., accounting for approximately 28 percent of all freight ton-miles nationwide. But there is little freight railroad service provided by major national railroads in southern New England and none in northern New England (Maine, Vermont and New Hampshire), although numerous regional and local railroads do provide freight service.¹⁸ All six New England states ranked in the bottom 10 nationally in 2003 for rail freight tonnage originated in-state and only Massachusetts escaped the bottom 10 for rail freight tonnage received.¹⁹

In addition, New England's freight connections with other regions of the country are no longer adequate. Currently, New England's freight rail network is connected to the rest of the nation through only one main connection at Selkirk, NY, near Albany.²⁰ Freight from southeastern Connecticut, for example, must typically be shipped north to Massachusetts, across the Hudson River and back down the other side of the Hudson to reach the mid-Atlantic states.

Because of the lack of modern freight rail infrastructure in the region and inadequate connections to the rest of the nation, a great deal of New England's freight must arrive by truck, thus increasing carbon dioxide emissions from the movement of goods.

The Demise of Walking

No form of travel produces fewer carbon dioxide emissions than walking. Yet, walking – once an exceedingly common way to commute to work or complete daily tasks – has increasingly been replaced by motorized forms of transportation.

In 1960, for example, nearly 10 percent of workers nationwide walked to work.²¹ By 2000, only 3 percent walked to work.²² The same trend appears to

hold true in New England as well: in 2000, 4.1 percent of Boston metropolitan area commuters walked to work; compared with 5.2 percent in 1990 and 7.7 percent in 1980.²³

In 1960, nearly 10 percent of workers nationwide walked to work. By 2000, only 3 percent walked to work.

While detailed information on how people travel for purposes other than work – to shop, play or to complete other chores – is harder to come by, it stands to reason that the spread-out, automobile-dependent development patterns that have become prevalent in New England over the past several decades would also reduce pedestrian trips for these other purposes. A trip to a corner store that could easily be completed on foot in a traditional New England town characterized by compact development and mixed uses would likely require the use of a car in most New England suburbs.

REDUCING CARBON DIOXIDE EMISSIONS: A LONG-TERM PROCESS THAT MUST BEGIN NOW

The three shifts discussed above – toward auto-dependent suburban sprawl, toward lower fuel efficiency for cars and trucks, and toward higher-emission forms of transportation – have occurred over the course of several decades. Changing those trends will take time.

Nevertheless, it is important that New England begin to address the problem now – both to forestall the potentially devastating impacts of global warming on the region and to enhance the region's economy, health and quality of life.

The Dangers of Global Warming

Global warming poses a direct and serious threat to New England's environment, economy and health.

Global warming is, in fact, already affecting New England. Scientists estimate that temperatures in the region have increased by 0.7 degrees Fahrenheit over

the last century.²⁴ Sea levels have already risen by 2 to 11 inches over the last century at various points along the New England coast.²⁵ Reductions in maple syrup production in northern New England and earlier ice-out times on the region's lakes presage the greater ecological shifts that are to come if global warming emissions and temperatures continue to rise.²⁶

Should emissions continue along current trends, low temperatures in the region could increase by 5.7 to 9.7° F and high temperatures could increase by 3.6 to 9° F by 2100 – triggering greater sea level rise, changes in precipitation patterns, shifts in ecosystems, increased health threats from air pollution, extreme heat and insect-borne disease, and a host of other problems.²⁷ The skiing, maple syrup, tourism and fishing industries are particularly vulnerable to the impacts of global warming, but all New Englanders would likely see economic impacts as insurance premiums and property damage – particularly in the coastal areas that are home to most of the region's population – rise.²⁸

New England alone cannot solve global warming. But it can do its part to reduce global warming emissions and, in the process, set an example for other regions to do likewise. Each year that goes by without strong action to reduce emissions makes the future transition to a low-emission economy that much more difficult: both by increasing concentrations of global warming gases in the atmosphere and by forcing a quicker, more dramatic transition to low-emission technologies further down the line.

Other Benefits of Reducing Global Warming Emissions from Transportation

Reducing carbon dioxide emissions from transportation is often thought to require large expenditures and to hamper economic growth. But while reducing emissions will require investment, that investment will likely pay off in the long run through the establishment of a vigorous, sustainable economy.

- **Reduced dependence on oil.** The vast majority of the energy used to power New England's transportation system is in the form of petroleum. The recent rise in gasoline, diesel and home heating oil prices – which has been largely triggered by

increasing global demand for oil – has sucked billions of dollars out of the region’s economy. The more money consumers must spend on oil (all of which comes from outside the region), the less money they will have to invest in local, New England-based businesses.

Energy industry analysts suggest that the recent spike in oil prices – which has driven gasoline and diesel prices above \$2 per gallon – is not likely to abate in a significant way any time soon. In fact, some analysts suggest that the price of crude oil could double within the next several years.

A transportation strategy that moves people and goods more efficiently – either by improving the efficiency of vehicles or by shifting toward more efficient modes of travel – will reduce New England’s exposure to future oil price shocks and keep more dollars in the local economy, rather than sending them outside the region for fuel purchases.

- **Reduced highway congestion and maintenance.** New England’s regional highway network currently suffers under the strain of having to serve the bulk of the region’s passenger and freight transit needs. Choke points such as the I-95 corridor in Connecticut and Rhode Island, the I-93 corridor in southern New Hampshire, the Route 128 and I-495 corridors in Massachusetts, and parts of I-84 and I-91 have long experienced gridlock – wasting motorists’ fuel and their valuable time. Expanding these highways to accommodate even more vehicle traffic (and thus increasing global warming emissions over the long term) is an extraordinarily expensive solution. The I-93 expansion project in southern New Hampshire, for example, is estimated to cost \$421 million.²⁹

Reducing the number of single-passenger and freight trips on the region’s highways would reduce the demand for highway expansion, allow freer flow of people and goods through the region, and likely save on highway maintenance expenditures as well.

- **Vigorous, healthy communities.** A low-carbon transportation strategy can also help to create communities where people like to live and do business. Numerous studies have shown that

communities with walkable streets and available transit service have higher property values than other types of communities.³⁰ The resurgence of downtowns in Boston, Portsmouth, Portland, Providence and other New England cities points to the desirability of less auto-intensive forms of development. While sprawling suburban development remains a frequent choice for those who can afford it, transit-oriented and more compact development patterns have proven increasingly popular. People who live in more densely developed neighborhoods where they can walk safely and enjoyably have been shown to be more fit – with lower weight and lower blood pressure – than people who do not have the option of walking.³¹ Moreover, access to transit and reduced automobile dependence can reduce household transportation expenditures, again giving individuals more disposable income to pump into local economies. Thoughtful development that follows traditional New England development patterns has the potential to be both a more attractive and more sustainable alternative to sprawl.

- **A healthier environment and population.** Much of New England suffers from unhealthy air quality, due largely to emissions from motor vehicles. Reducing the amount of miles traveled on the region’s highways can reduce emissions of many harmful air pollutants, while the compact development patterns that allow for low-carbon transportation alternatives can help to preserve open space and water quality in the region.

Studies have shown that communities with walkable streets and available transit service have higher property values than other types of communities.

NEW ENGLAND'S TRANSPORTATION/ GLOBAL WARMING TOOLBOX

Reducing global warming pollution from transportation will not be easy, and there are no single, “silver bullet” solutions. But it is possible. There are many policy tools available that have already been put into place by companies, local governments and state governments – both in New England and elsewhere – that can be adapted and implemented here. Moreover, many of these tools have benefits that build off of one another, creating synergies that yield even greater reductions in global warming pollution and fossil fuel dependence.

These tools fall into six categories:

- Reducing per-mile emissions from vehicles
- Encouraging transit and other low-carbon transportation alternatives
- Promoting “smart growth”
- Reducing single-passenger automobile commuting
- Reallocating the costs of driving
- Revamping transportation planning

In this document, we focus mainly on policies that have either been implemented with success in New England or elsewhere, or that have been the subject of discussion and study for some time. By no means do these policies represent all of the options on the table for New England to use in its efforts to reduce global warming emissions from transportation.

REDUCING PER-MILE VEHICLE EMISSIONS

Key recommendations:

- *Implement the clean cars program*
- *Provide incentives for the purchase of more fuel-efficient vehicles*
- *Require the sale of fuel-saving tires*
- *Reduce emissions from government and transit fleets*

The declining fuel efficiency of New Englanders’ personal vehicles is a major contributing factor to the rise in carbon dioxide emissions from transportation. To reduce per-mile vehicle emissions, the vehicle fleet can either become more efficient in its use of gasoline

or rely on lower-carbon fuels such as plant-based biofuels or electricity.

Several policies have the potential to significantly reduce per-mile carbon dioxide emissions from vehicles. Many of these same policies can also lead to gains in fuel efficiency, which can save New Englanders money at the pump while protecting the region’s economy from wild swings in oil and gasoline prices.

Clean Cars Program

The state of California has adopted a series of emission standards for automobiles and light-duty trucks that will reduce carbon dioxide emissions from vehicles. In 1990, the state adopted the Low-Emission Vehicle/Zero-Emission Vehicle – or LEV/ZEV – program, which requires the sale of increasing numbers of low- and zero-emitting vehicles over time. The program currently requires the sale of significant numbers of hybrid-electric vehicles, with a long-term focus on the development of hydrogen fuel-cell vehicles, which hold the potential for extremely low emissions of carbon dioxide if the hydrogen fuel is generated from renewable sources.

More recently, in 2002, California adopted a law requiring tailpipe emission limits for global warming gases. The tailpipe standards, which were adopted by California officials in 2004, require reductions in carbon dioxide emissions from vehicles beginning in the 2009 model year. By 2016, new cars will be required to achieve 34 percent reductions from current carbon dioxide emission levels and new light trucks will achieve 25 percent reductions.³² While the vehicles that would be sold under the program would be somewhat more expensive, the expense would be more than made up over time in reductions in operating costs – primarily the cost of fuel. California officials anticipate that vehicles complying with the new standards will actually save motorists an average of \$3 to \$7 per month (and those savings are based on an average fuel price of \$1.74 per gallon, well below the \$2-plus prices recently charged at pumps in New England).³³

Collectively, these standards, known as the “clean cars program,” could lead to a substantial savings in car-

bon dioxide emissions. Savings from the five New England states that have thus far adopted the program will amount to approximately 10 million tons of carbon dioxide per year by 2020 – the equivalent of taking about 2 million of today’s vehicles off the road.³⁴

Among the New England states, only New Hampshire has not yet moved to adopt the program. States in the region should maintain their commitment to the clean cars program by finalizing adoption where they have not done so already. And New Hampshire should follow the lead of the majority of New England states and adopt the program itself.

Incentives for More Fuel-Efficient Vehicles

The recent rise in gasoline prices – coupled with the introduction of fuel-saving hybrid-electric vehicles – has caused many would-be car buyers to place more emphasis on fuel efficiency when making vehicle purchases. The New England states could further reinforce consumers’ willingness to purchase more fuel-efficient vehicles by providing financial incentives.

Financial incentives can come in several forms. In addition to a federal tax deduction, Maine and Connecticut already provide tax breaks to consumers who purchase fuel-efficient hybrids, and Rhode Island grants a tax credit for the purchase of electric vehicles.³⁵ But direct incentives tied to vehicle fuel efficiency (or to per-mile carbon dioxide emissions) can also play a role in encouraging more sustainable vehicle choices.

One alternative is to finance incentives through fees charged to purchasers of less-efficient vehicles. This approach – known colloquially as a “feebate” plan – has been under discussion in Rhode Island, Maine and Connecticut. Under such an approach, the state would calculate the fee or rebate a vehicle purchaser would pay or receive based on the vehicle’s fuel efficiency or its emissions of greenhouse gases. Purchasers of the most-efficient vehicles, such as hybrids, would receive the largest incentives; those purchasing the least-efficient vehicles, such as large SUVs and sports cars, would pay the greatest fees.

Depending on whether vehicle manufacturers opt to provide more fuel-efficient choices for consumers in

response to the program, the impact on overall fuel economy and vehicle emissions could be significant. One recent analysis conducted for the Rhode Island greenhouse gas stakeholder process estimated that a feebate program could reduce gasoline consumption (and therefore global warming emissions) from light-duty vehicles by between 5 percent and 31 percent below business-as-usual levels by 2020.³⁶

There are numerous issues that must be resolved for a state to implement an incentive program; specifically, which vehicles will receive incentives and how great those incentives will be, whether the incentive will be given out directly or passed along as a reduction in the vehicle sales tax, and whether the incentive will be given at the time of purchase or the time of registration.

Because the response of manufacturers to the program is critical, a regional or multi-state vehicle incentive plan with consistent provisions and aggressive targets would likely be more effective than a piecemeal state-by-state approach. New England states should work together to devise an incentive program designed to significantly reduce gasoline use and carbon dioxide emissions from vehicles and to reward New Englanders who make vehicle choices that contribute to achieving the region’s climate protection goals.

Fuel-Saving Tires

Automobile manufacturers typically equip their new cars with low-rolling resistance tires. These tires – installed on new vehicles to help manufacturers meet federal vehicle fuel economy guidelines – can reduce vehicle fuel consumption by about 3 percent versus conventional tires. That may not seem like much, but it is a significant reduction that is achieved at very low cost – the additional cost of the tires is typically recovered through fuel savings after about one year, with no loss in safety or tire durability.³⁷

Unfortunately, most consumers do not have the ability to choose replacement tires with low rolling resistance once their original tires have worn out. California adopted legislation requiring that replacement tires sold to consumers beginning in July 2008 have the same average energy efficiency as the original tires provided by automakers.³⁸ The state will rate the energy efficiency of different tires and this information will be readily available to New England states to develop similar requirements. Legislation currently

under consideration in Massachusetts would achieve a similar goal.

States should consider requiring, or encouraging the purchase of, fuel-saving tires as a “no regrets” measure to improve fuel economy and reduce global warming emissions.

Reduce Emissions from Government and Transit Fleets

State and local governments and transit agencies are major purchasers of cars, vans, and buses. Policies that require vehicle fleet operators to purchase the most energy-efficient vehicle that will meet a given purpose can reduce overall global warming emissions.

Issues in Focus: Alternative Transportation Fuels

Concerns over global warming and petroleum dependence have led many to look at other options to fuel America’s transportation system. Each of the options has advantages and disadvantages.

- **Biofuels** – Plant-based fuels such as ethanol and biodiesel can reduce global warming emissions from vehicles. Generally, plant-based fuels are blended with gasoline or diesel fuel at concentrations ranging from 2 percent to 85 percent. Low percentage blends of ethanol and biodiesel have the advantage of being usable in conventional vehicles – higher blends may require special equipment. While biofuels have the potential to reduce global warming pollution, much depends on the amount of energy used to grow the crops used to produce the fuels. Cellulosic ethanol, which is made from woody plant material and “energy crops” such as switchgrass, has the potential to have a much better energy balance than ethanol made from corn. Ethanol and biodiesel also affect emissions of smog forming and other pollutants – in some cases for the better and in others for the worse, depending on the blend of fuel. The impact on air quality, and the energy balance of the fuel itself, should be considered carefully in policies to promote biofuels.
- **Electricity** – In the 1990s, major automakers introduced limited runs of electric vehicles (EVs) that draw power from a home’s connection to the electric grid and store it in an on-board battery. While EVs were attractive to some consumers due to their efficiency, quiet and zero emissions, the vehicles also suffered from limited range and long recharging times. Recent advances in battery technology – including increased storage capacity and faster

charging times – have again made EVs an attractive, low-emission option for the future. In addition, electricity from the grid can be used to power “plug-in hybrid” vehicles, which couple the efficiency benefits of an electric motor with the range of an on-board internal combustion engine. Pure electric vehicles reduce per-mile carbon dioxide emissions by about 40 percent versus conventional gasoline-powered vehicles.³⁹

- **Hydrogen** – Hydrogen fuel-cell vehicles have the potential to be highly efficient and to release no pollution from their tailpipes. However, hydrogen faces a number of technological and economic hurdles before it can become a competitive automotive fuel and only a few fuel-cell vehicles currently exist as prototypes. The impact of hydrogen on global warming emissions and the environment depends on the efficiency of the process for producing the hydrogen and on its source. Some proposed sources of hydrogen – such as coal – may result in global warming pollution as great as or greater than the use of gasoline in a hybrid-electric vehicle.⁴⁰
- **Natural gas** – Natural gas has recently become an increasingly common fuel in centrally fueled fleets, particularly transit buses. Honda also makes a natural gas version of its Civic. Natural gas-powered vehicles may have lower emissions of both global warming pollutants and conventional pollutants that contribute to ozone smog. However, concerns about the future availability of natural gas, along with the high cost of natural gas filling stations and the need to carry large storage tanks on board the vehicle, argue against the potential of natural gas to become a widespread automotive fuel.

New England state, county and local governments own 140,000 vehicles, which consumed 86 million gallons of gasoline in 2003, representing 1.3 percent of total gasoline use in the region.⁴¹ To reduce emissions from public vehicle fleets, local and state governments can adopt purchasing policies that prioritize low global warming emissions as a criterion in selecting new cars and trucks for state use. Connecticut, for example, adopted a standard in 2004 requiring new vehicles purchased by the state to have the lowest carbon dioxide emissions per mile of any vehicle in that class.⁴² In Massachusetts, the state's Climate Protection Plan calls for the purchase of fuel-efficient vehicles.⁴³

New England's transit agencies operate more than 3,000 buses and 1,000 vans.⁴⁴ Replacing conventional gasoline- and diesel-fueled vehicles with more efficient vehicles or ones that are powered by lower-carbon fuels can reduce the region's global warming emissions. State, county and local governments already consider emissions of sulfur dioxide, oxides of nitrogen and

particulate matter from different technologies when making purchasing decisions, and could evaluate vehicles for their global warming impact also.

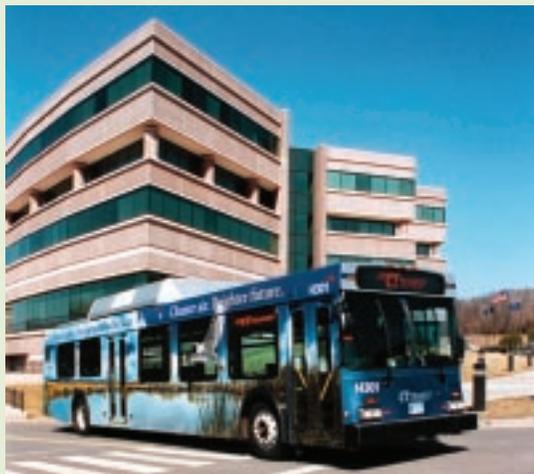
Currently, most transit vehicles operate on gasoline or diesel. Emissions can be reduced by switching to fuels with lower carbon content and by using lightweight materials such as carbon fiber for vehicle construction. Hybrid-electric buses, partially powered by electricity, can produce 10 to 30 percent less global warming pollution than conventional buses – a level of savings roughly confirmed by a recent pilot project in Connecticut.⁴⁷ Compressed natural gas, an increasingly common fuel valued for its reduced emissions of other air pollutants, currently does not provide reductions in global warming emissions in transit vehicles but may in the future as the technology develops. Biodiesel and ethanol also have lower emissions, and the high cost of petroleum may make those alternatives more cost effective in the future.

Signs of Progress: Connecticut's Hybrid-Electric Buses

In 2003, CT Transit, the transit agency for the Hartford, Stamford and New Haven areas, obtained two diesel hybrid-electric buses. The agency has closely monitored the buses' fuel consumption and emissions performance.

The hybrid buses proved 10 to 15 percent more efficient than diesel buses – less than the 50

CT Transit



CT Transit's hybrid buses are at least 10 to 15 percent more efficient than conventional diesel buses.

percent efficiency improvement promoted by the buses' manufacturer, but still a significant savings. The hybrid buses did not deliver reductions in emissions of health-threatening particulates versus comparable diesel buses.⁴⁵ While the hybrid buses currently cost an estimated \$200,000 more than conventional buses, today's volatile gasoline and diesel fuel prices, coupled with the prospect of declining costs for the buses as the technology becomes more common, could bring them within reach of additional transit fleets.

Some New England transit agencies have chosen to reduce the environmental impacts of their fleets by purchasing buses that run on compressed natural gas (CNG). CNG buses produce less soot and fewer smog-forming pollutants than conventional diesel buses and are far cheaper than gasoline-electric hybrids. However, CNG buses have lower fuel economy and emit methane (a potent global warming gas), and thus have no global warming benefit.⁴⁶

ENCOURAGING TRANSIT AND OTHER LOW-CARBON TRANSPORTATION ALTERNATIVES

Key Recommendations

- *Invest in improvements to inter-city, commuter, urban, and freight rail systems and devise a long-term regional rail plan.*
- *Promote connectivity within existing transit systems.*
- *Address suburb-to-suburb travel through expansion of transit infrastructure and the use of shuttle services, vanpools and carpools.*
- *Improve the effectiveness of transit in smaller urban and rural areas.*
- *Prioritize investment in pedestrian and bicycle facilities.*

Single-passenger automobile travel is among the most carbon-intensive forms of transportation. States can reduce global warming pollution from transportation by encouraging people to drive less and to rely more on other forms of transportation. But to achieve this, transportation alternatives must be available, affordable and convenient.

New England already possesses a substantial transit infrastructure, with a far-reaching and heavily traveled rail system and vital urban transit networks in many cities. The region's two largest metropolitan areas (Boston and New York City, whose metropolitan area extends into Connecticut) rank fifth and first in the nation, respectively, for percentage of commuters using transit.⁴⁸ In addition, the region's compact city and town centers and its growing network of bicycle trails provide ideal opportunities to walk or bicycle to work, shopping or recreational opportunities.

Yet, the New England states have only begun to develop the potential of transit and other alternatives to driving. To expand rail and bus service and improve pedestrian and biking facilities, states and communities can look to successful examples both within the region and elsewhere.

Rail Infrastructure

New England's robust passenger rail network is the product of investments dating back more than a century. As recently as the 1960s, the survival of inter-city and commuter rail in New England was in jeopardy, as it was elsewhere in the country. By the 1970s, a passenger rail network that just a few decades earlier had linked residents of all six New England states to eastern Canada, New York and more distant points had atrophied severely, with the end of service to New Hampshire and Maine, the retrenchment of commuter rail service in Connecticut and Massachusetts, and reduced service and aging infrastructure everywhere.

The past two decades, however, have witnessed a rail renaissance in New England. The expansion of commuter rail service in Massachusetts, the extension and renovation of several of Boston's subway lines, the creation of the new Acela Express high-speed rail service between Boston and New York City, and the return of inter-city rail service to parts of New Hampshire and Maine have signaled a growing appreciation of the benefits of rail travel as part of the region's transportation strategy.

In addition to providing a more energy-efficient means of transportation than either air or car travel (see page 10), rail can also be used as a tool to promote urban redevelopment, more compact development patterns, and other changes in land-use patterns that can provide an alternative to automobile-dependent suburban sprawl.

Major Priorities

INTER-CITY RAIL

Expanding and improving inter-city rail service in New England would provide a less carbon-intensive alternative to air travel and long car trips for journeys within the region and to nearby cities.

Recent efforts to expand inter-city rail service in New England have proven very successful. Amtrak's Acela Express high-speed rail service along the Northeast Corridor, while plagued with technical problems, has helped boost rail ridership in the region. In 2004, 14.2 million passengers rode trains in the Northeast Corridor, up 10 percent from 2000 and 41 percent from 1992.⁴⁹ The restoration of rail service between Bos-

Signs of Progress: Amtrak's Downeaster

Northern New England Passenger Rail Authority



Amtrak's Downeaster brought passenger rail service back to Maine after a 30-year hiatus.

In 2001, passenger rail service returned to parts of southern New Hampshire and southern Maine after a 30-year absence with the launch of Amtrak's Downeaster service between Portland and Boston. The state of Maine laid the groundwork for the restoration of rail with the 1995 creation of the Northern New England Passenger Rail Authority, which manages and provides funding for the Downeaster service.

While the service has experienced some ups and downs, ridership has been significant and continues to grow. In its first year of operation, the train collected \$1.5 million more in fares than anticipated. And ridership increased dramatically in 2005 with improvements that have reduced travel times, and with the rising price of gasoline, which has discouraged automobile commuting. In September 2005, the Downeaster reported its second-highest ridership ever, with more than 30,000 passenger trips. Ridership was up by 47 percent over the same month in 2004, with ridership on the Boston to Portland and Boston to Haverhill segments increasing by more than 80 percent.⁵⁰

The Downeaster plans to add a fifth roundtrip train because of the service's popularity.⁵¹ And the state of Maine is considering extending passenger service beyond Portland in an effort to build on the initial success of the Downeaster.

ton and southern Maine has succeeded as well. (See "Signs of Progress.")

The following improvements to inter-city rail service in New England are vital steps to reducing greenhouse gas emissions.

- Increase the frequency and speed of the trains on Amtrak's Downeaster and make the service permanent.
- In Maine, extend service northward from Portland to Freeport, Brunswick, Rockport and Auburn.
- Connect North and South stations in Boston to facilitate rail travel for passengers whose travel does not end in Boston.
- Add Amtrak lines in Vermont from Burlington to Albany and Whitehall, NY.
- Devise a long-term regional rail plan for New England designed to make inter-city rail (including expanded high-speed rail) a central cog in the region's transportation system within the next two decades.

Commuter Rail

Commuter rail service in New England is extensive and popular. Over 400 miles of commuter rail connect Providence, Worcester, Fitchburg, Newburyport and other cities to Boston's urban rail system. Eastern Connecticut is served by the Shore Line East service connecting New Haven to New London, and western Connecticut is linked to New York City via the MetroNorth New Haven Line and its various branch lines.

Completion of the Greenbush and New Bedford/Fall River extensions to the MBTA commuter rail network will allow nearly 17,000 additional riders to use the train daily.⁵⁴ If past ridership trends continue, far more people will soon use the routes. The following commuter rail improvements should also be prioritized:

- Extend the MBTA commuter rail line that currently ends in Lowell, Massachusetts to Concord, New Hampshire, serving towns in the fast-growing suburban regions of southern New Hampshire.
- Include Warwick and other Rhode Island towns on an extension of the MBTA's Providence commuter rail line.



The entrance hall of Worcester's Union Station was refurbished to serve commuter rail passengers after decades of decay.

Signs of Progress: MBTA's Worcester Commuter Rail Line

The expansion of the Massachusetts Bay Transportation Authority (MBTA) commuter rail network during the 1990s has paid dividends. Commuter rail ridership on the MBTA doubled between 1991 and 2004, with the number of miles traveled by commuter rail passengers increasing to more than 793 million by 2003.⁵²

One of the most successful commuter rail expansion projects was the extension of commuter rail service to Worcester in 1994. The route has been so successful that seats are frequently not available by the time the train arrives at suburban stations closer to Boston – despite 10 round-trips each day. Ridership is nearly double that anticipated by the MBTA and demand is expected to increase by nearly 50 percent by 2010.⁵³

The restoration of commuter rail service has also helped lend momentum to the redevelopment of downtown Worcester. Worcester's striking Union Station – originally built in 1911 – was rescued from two decades of abandonment and decay and now serves as the city's hub for commuter rail and bus service and also hosts dining and entertainment venues.

The Worcester line could attract even more users, but has run into serious capacity limitations. A lack of funding, coupled with conflicts with the freight railroad that owns the tracks, has made it impossible to add additional service. Nonetheless, the expansion of commuter rail service to Worcester has thus far been a success and points to the potential benefits of other rail expansion projects in the region.

- Increase rail service on crowded lines such as the MBTA's Worcester line. Purchase of the tracks by the MBTA or the addition of new track may be needed to accomplish this goal.
- Establish commuter rail service between Springfield, Massachusetts and Hartford and New Haven, Connecticut.
- Reinstate commuter rail service in the Burlington, Vermont metropolitan area.

Extending commuter rail service does not guarantee reduced emissions from transportation. New rail service must be well planned or it will foster sprawl that encourages more driving. Commuter rail is most effective when it serves an existing town, not a brand

new station surrounded by undeveloped land. Any new development that occurs near a rail station should be transit-oriented development that enables residents to travel without driving. (See page 32.) Such compact growth requires strong planning and zoning practices. (See discussion of land use patterns on page 30.)

Subway and Light Rail

Many New England communities once had local trolley service, and many could be candidates for light rail service in the future. Today, however, New England's only urban subway and light rail transit systems are in the Boston area.

Boston's "T" includes four lines with 63 line miles and 184 stations, and receives heavy use. (The city's

fifth line – the “Silver Line” – uses bus rapid transit rather than light rail.) Approximately 400,000 one-way trips are taken on Boston’s trains every day.⁵⁵ Upgrades to equipment and renovations of existing stations will facilitate some increased use, but expanding the reach of the system is vital to boosting ridership.

One proposed expansion is to link the “spokes” of the Boston subway system in an “Urban Ring.” The idea of a circumferential transit link around Boston is a good one, but much depends on how the idea is implemented. A permanent light rail line would be needed to achieve the idea’s full potential, while options that

Issues in Focus: Moving Freight by Rail

Moving more freight by rail rather than highway can significantly reduce global warming pollution. Shipping one ton of freight by rail rather than by truck requires 30 to 90 percent less fuel.⁵⁷ Modernizing the freight rail system, investing in interconnections with other regions, and improving connections across travel modes can increase the volume of freight that can be moved by rail.

Passenger trains and freight trains often share stretches of track, particularly for long-distance trips. Improving the tracks by replacing older rails or adding a second parallel track to allow trains to pass each other can benefit both passenger and freight operations. Trains can operate at higher speeds, reducing total travel time, or can run more frequently because trains do not have to pull over to let one another pass.

Freight rail has recently increased in visibility as a regional transportation issue. The I-95 Coalition (a group consisting of transportation officials from all the Atlantic Coast states) is currently engaged in a study of the region’s freight and passenger rail infrastructure. New England states should remain engaged in this process and develop and implement plans to modernize the region’s freight rail system.

would expand roadway capacity (presumably to allow better bus service) may fall well short of that potential or even make matters worse. In addition, the MBTA should prioritize extension of the Green Line to Medford and the Blue Line to Lynn, along with the conversion of the underused Fairmount commuter rail line into higher-quality service on the proposed “Indigo Line.”

Elsewhere in New England, states should begin to consider what role light rail or other alternatives (such as the provision of more frequent, subway-style service along existing rail lines or the construction of bus rapid transit systems along separate guideways) might play in serving future transportation needs. Light-rail transit has grown in popularity nationwide over the last two decades and could be an important part of the transportation system of many medium-sized or large New England cities. In Connecticut, the state should consider increased service on the New Haven, Danbury and New Canaan branch lines of MetroNorth.⁵⁶

Suburb-to-Suburb Transit

Traditional “hub-and-spokes” transit systems, such as Boston’s subway system, are designed to serve commuters who live in a suburb and commute to jobs downtown. In recent decades, however, jobs have increasingly moved to the suburbs, undermining the effectiveness of traditional urban transit systems. In fact, suburb-to-suburb commutes – in which an employee who resides in a suburb commutes to another suburb for work – are now the most common type of commute.⁵⁸

Providing effective transit for these suburb-to-suburb commuters is challenging. But there are several examples of metropolitan areas that have used novel tools to reduce the number of single-passenger automobile trips from these commuters. New England transit agencies and planners should draw on the experiences of other agencies to develop effective strategies to link workers with suburban jobs without increasing single-passenger commuting.

Bus and Rail Infrastructure

One strategy for improving suburb-to-suburb transit is to layer circumferential rail or bus routes over existing hub-and-spokes systems. Connecticut Transit created one such bus route that traverses the suburbs of

Bright Ideas from Elsewhere: Suburban Shuttle Buses in New Jersey

Commuters often don't use transit to get to work because it is difficult to get from home to a transit station or from a transit station to the workplace. New Jersey has responded to the problem creatively by launching a variety of shuttle bus services at both ends of the commute.

In 1994, NJ Transit (the statewide transit agency for New Jersey) created the WHEELS program, which uses minibuses to take transit riders to suburban employment sites. Within two years of deployment, monthly ridership had grown to over 15,000 passengers.⁶⁵ At least 10 WHEELS routes continue in operation to the present.

NJ Transit



Community shuttle buses like the one above in Maplewood, New Jersey ferry local residents to and from commuter rail stations, reducing the need for parking near stations and increasing transit accessibility.

At the home end of the commute, dozens of New Jersey municipalities have created community shuttle bus or jitney services that carry riders from residential neighborhoods to transit stations. The innovative, municipally run services began in 1997 when the town of Maplewood, faced with the need for a

dramatic increase in the number of parking spaces at its local commuter rail station, launched a jitney service using an old school bus. NJ Transit joined the effort by encouraging other nearby communities to launch similar services.

With the assistance of \$3 million in federal funding, NJ Transit has awarded 42 minibuses to nearly three dozen communities. Communities pledge to use the minibuses as shuttles during peak periods, but can also use the buses for other community transportation needs at their own expense. In addition, NJ Transit has used federal Congestion Mitigation and Air Quality (CMAQ) funds to pay for up to half the operating expenses of the shuttle buses for their first three years of operation.⁶⁶

NJ Transit reports that approximately 22,000 riders use the community shuttle buses each day. All but six of the communities that originally received minibuses through the program continue to operate shuttle services, even though more than 40 percent of those communities no longer receive operating assistance from NJ Transit. Real estate listings in these communities commonly tout proximity to jitney or shuttle bus services as a major selling point. And 12 towns are scheduled to receive shuttle buses in a third round of vehicle placements to occur by 2007.⁶⁷

The community shuttles and WHEELS program are not the only efforts in New Jersey to link commuters with transit. County governments and major institutions such as colleges, major employers, and business associations also operate shuttle buses to better connect New Jerseyans with the state's transit infrastructure.

Hartford and connects suburban employment locations such as shopping malls and office complexes.⁵⁹ This route has been successful, drawing more riders than many of Hartford's traditional bus routes.⁶⁰ A more extensive system would allow commuters to

travel further by bus with ease. Denver, Colorado recently approved a large transit plan that calls for expanding suburb-to-suburb bus connections and creating suburban transfer points to facilitate movement around the suburban ring.⁶¹

Circumferential rail could eventually play a role in solving the problem of suburb-to-suburb commutes. Chicago's METRA Suburban Transit Access Route (STAR) line – a \$1.1 billion project announced in January 2003 and targeted for completion by the mid-2010s – will link Chicago's suburbs and facilitate suburb-to-suburb commutes.⁶² Circumferential rail is also being considered as an option in Washington, D.C. and cities outside the United States.

As with all other new transportation infrastructure, circumferential rail or other forms of transit should be planned in concert with local land uses to promote more sustainable development patterns and not contribute to additional sprawl.

Transit Connectivity

Adding bus and rail routes, however, cannot fully address the challenge of reducing single-car suburb-to-suburb commutes. Because suburban residential and commercial developments typically have low density, it is difficult to serve commuters in these areas with centralized pick-up and drop-off locations. Many potential riders have long walks at each end of their bus or rail trip, and therefore may opt to continue driving to work or, at best, to a central park-and-ride location.

In many cases, shuttle bus and minibus services can be used to provide connections between dispersed residential and employment locations and existing transit infrastructure, thus boosting ridership and encouraging commuters to leave their cars at home.

The Greater Attleboro Taunton Regional Transit Authority (GATRA) operates a popular shuttle from Wheaton College in Norton to the Mansfield MBTA commuter rail station. The bus picks up passengers along the way from a satellite parking lot, shopping center, and a regular bus route. Indicative of the route's popularity, the 25-car satellite parking lot had 17 cars on the first day and filled to capacity within months. Though standard bus service is facing cuts, GATRA is able to operate the feeder shuttle because both Wheaton College and the town of Norton have provided funding.⁶³ Experience with a feeder shuttle in Virginia suggests that that one-third of shuttle riders will be new rail commuters.⁶⁴

To date, New England transit agencies have not made a major commitment to small-vehicle shuttle services,

although some private-sector entities have done so. The region should identify locations where shuttle bus services can increase transit use and seek out funding from public and private sources. Developing effective partnerships between transit agencies, communities, businesses and social service providers is key to the success of the effort. Community-based shuttle programs – like the successful program in New Jersey (see “Bright Ideas from Elsewhere” on page 21) – may be a useful model for New England's cities and towns to consider in linking their residents to transit services.

Vanpools and Carpools

Vanpools are a central element of suburb-to-suburb commuting programs for many transit agencies. To implement vanpools, transit agencies typically purchase passenger vans and lend them to interested groups of 5 to 15 commuters. In most systems, costs such as fuel, maintenance and insurance are covered by the transit agency, and passengers pay a mileage-based fare for use of the van. Successful vanpool programs are usually accompanied by marketing efforts, often coordinated through employers, to help identify potential vanpool participants.

There are numerous examples of successful vanpool programs. Chicago began a vanpool program in 1991 that has grown from 172 vanpools in 1995 to 456 in 2002.⁶⁸ As of 1995, 90 percent of vanpool trips were for suburb-to-suburb commutes, and the vanpool service recovered more than 100 percent of its operating costs.⁶⁹ King County Metro in the Puget Sound region of Washington operates nearly 700 vanpools – the largest such program in the country.⁷⁰

The Rideshare Company



Connecticut's Easy Street® van service is one of several successful vanpool services in New England.

In New England, several states have taken the lead in implementing vanpool services. In 2002, Connecticut's Easy Street® service (which operates in the Hartford and New London areas) served 3,000 commuters with 300 vans.⁷¹ Massachusetts' CARA-VAN service operated 40 vans in 2004, down from a peak of more than 100. The decline is attributed to the extension of commuter rail service and to the growth of suburban employment centers.⁷² In Maine, on the other hand, carpool and vanpool efforts are expanding through the Go Maine program, which coordinates 10 private and 12 Go Maine vanpools and is in the process of doubling that number.⁷³

Many transit agencies have also had success with programs that help bring together potential carpool participants. The Connecticut Department of Transportation helps fund three rideshare-matching programs, and publishes a statewide list of available carpools and vanpools.⁷⁴ Maine, Massachusetts and New Hampshire offer statewide rideshare databases that allow commuters to identify potential carpool partners.⁷⁵ A number of smaller rideshare programs operate as well.

Expanding the promotion of existing vanpool and ride-matching programs – particularly those serving suburban worksites – is one way to increase participation and reduce emissions from suburb-to-suburb commutes. The recent rise in gasoline prices provides an opening for vanpool and ride-matching programs to promote themselves as cost-savers. Other innovative strategies, such as the pairing of vanpool service with guaranteed rides home (see page 37), can also make vanpooling a more attractive alternative to commuters.

Transit in Smaller Urban Areas

While transit is often thought of as a big-city phenomenon, public transportation also plays a vital role in many of New England's smaller urban areas. There are 42 transit agencies in New England, from the MBTA, which operates 162 bus routes, to small rural agencies with just one or two fixed routes.⁷⁹ These bus services carry people to work, to school, and to health care appointments. These transit services not only reduce global warming pollution from trips that would otherwise be taken by car (provided that ridership is high enough), but they also provide mobility for the elderly, disabled and others who are unable to drive.

Issues in Focus: Reverse Commutes

The migration of jobs from the central city to the suburbs has spawned an increase in "reverse commutes" – commutes from city centers to distant suburbs. Reverse commuters are typically ill-served by transit systems, but new routes and extended service hours can help extend access to transit to these non-traditional commuters.

The Los Angeles area and the Bay Area in California have been in the forefront of serving reverse commuters. Los Angeles initiated a reverse commute bus route in late 2001. This route operates only at peak hours, running from downtown Los Angeles to the suburb of Thousand Oaks in the morning and in the reverse direction in the evening. Weekday ridership averages 1,600 riders.⁷⁶

Because many reverse commuters are lower-income employees working late-night or early-morning hours in the service industry, traditional transit operating hours often do not meet their needs. Contra Costa and Marin counties in California extended the hours of a bus route that serves primarily low-income residents of Richmond, California who commute to service sector jobs that do not follow traditional work schedules. Four months after the bus began to offer service later at night, ridership on the route had increased by 14.8 percent compared to the previous year.⁷⁷

New England's premier urban transit system – the MBTA – is notoriously unfriendly to commuters working late-night hours. The MBTA recently cut its "Night Owl" service, which ran from 1:00 a.m. to 2:30 a.m. on Friday and Saturday nights.⁷⁸ Though the service carried many people returning home from social activities, it also provided transportation for people who work late hours.

Operating successful transit service in smaller urban and rural areas is challenging. Ridership on fixed routes is lower (reducing revenues from fares) and buses often need to travel farther between destinations. Nonetheless, bus service can successfully be operated in communities of any size, and New England has sev-

eral systems that serve as potential models for small-urban transit.

In western Massachusetts, for example, the Pioneer Valley Transit Authority (PVTA) provides bus service to a large area including Springfield, Northampton and Amherst. The PVTA provides nearly 10 million rides annually by buses traveling fixed routes and van service available by request to those unable to ride regular buses. Students and faculty at Amherst Col-

Signs of Progress: Rural Transit in Vermont

As the most rural state in the nation, Vermont would not seem a likely candidate for a vigorous public transit system. Yet, in many corners of the state, Vermont communities have come up with unique ways to take advantage of the benefits of transit.

Green Mountain Express, for example, offers bus transit to the 36,000 residents of largely rural Bennington County, Vermont.⁸⁰ The local chapter of the Red Cross began providing on-demand transit service in 1991 to give low-income residents access to medical care, but service has been expanded to include two fixed routes within Bennington and four daily (seven days per week) roundtrips to Manchester for commuters.⁸¹ Demand for transit service is great enough that the Red Cross projects the Green Mountain Express could double its service, currently 70,000 rides annually, and still not meet the community's needs.⁸²

The Green Mountain Express has found ways to cope with the financial challenges of serving a small community. The service was started by the Red Cross and today receives its funding from state and federal sources.⁸³ The service has also received assistance from the U.S. Department of Agriculture (USDA) through the Community Transportation Association. To expand its facilities, the system is seeking support from the Federal Transit Administration's Bus and Bus Facilities discretionary funding program and another USDA program that supports rural development. Vermont also allocates some highway funds to transit facility construction.⁸⁴

lege, Smith College, Mt. Holyoke College, Hampshire College and the University of Massachusetts-Amherst ride the bus for free because the schools pay an annual fee to cover the cost of bus service.⁸⁵

Like many transit authorities, PVTA struggles to find adequate funding for both its operating needs and capital expenses. PVTA receives approximately half of its operating budget from the state and one-third from the communities that receive transit services.⁸⁶ The fee paid by each town is based on how many passenger miles were traveled in that community and how much its residents used van service.⁸⁷ For capital expenses, PVTA has relied heavily on federal support. When it needed to replace its entire bus fleet in the late 1990s, it issued bonds backed by anticipated federal transit funding, an approach that gave the agency adequate funds up front.⁸⁸

Transit agencies across New England use a variety of methods to boost ridership. Advance Transit, on the Vermont-New Hampshire border, offers free rides to all passengers, a benefit it can offer because the towns of Lebanon and Hanover – as well as Dartmouth College and the Dartmouth-Hitchcock Medical Center – have increased their financial support of the service.⁸⁹ South Portland Bus Service in Maine added more service on Saturdays, undertook a marketing effort focused at Southern Maine Community College students, and made other changes that increased ridership by 14 percent in a single year.⁹⁰ Other ways to boost ridership include increasing the frequency of service and extending the hours of operation.⁹¹

The key to the success of these and other small-urban transit systems in New England is the development of effective partnerships among a range of institutions that fund and benefit from the service. While state and federal funding provide the bulk of operational and capital costs, the participation of additional funders – including government agencies concerned with job training and placement and medical care, colleges, major employers, non-profits and town governments – frequently makes the difference between a bare-bones transit system and a vigorous system capable of adequately serving the needs of the community.

Finding adequate funding will remain a serious obstacle. State and federal transportation funding will continue to provide the bulk of funding for opera-

tional and capital costs, so small-urban transit must receive adequate prioritization in the transportation planning and funding process. (See “Funding Transit and Alternatives to Driving,” page 50.) Other public agencies are potential funders as well. But, as the examples above demonstrate, towns, major employers and non-profits are important partners for local transit agencies seeking to improve service. The success of small-urban transit in many New England communities is a direct result of these local initiatives and state officials should find ways to encourage and foster similar efforts.

Biking and Pedestrian Facilities

Biking and walking are zero-emission forms of transportation that can be an important component of any strategy to reduce global warming emissions. When routes are safe and attractive, people are more likely to walk or bike either to their final destination or to a transit stop. One study has suggested that, under the right conditions, a 10 percent increase in pedestrian amenities – adequate sidewalk space, shop fronts, benches, etc. – can result in a 15 percent decline in motorized trips.⁹²

A number of New England communities have been successful at encouraging walking and biking by improving roadways and sidewalks and by providing bike-friendly infrastructure.

Improving Pedestrian Facilities

Seemingly minor physical attributes of roadways and sidewalks can have a major impact on a citizen’s decision to walk instead of drive.

Clearly marked crosswalks and traffic islands allow pedestrians to cross busy streets safely. To increase visibility, Cambridge, Massachusetts installed raised crosswalks, which have raised the rate at which drivers yield to pedestrians from 13 percent to 53 percent.⁹³ Medians and traffic islands reduce the number of lanes pedestrians and cyclists must cross at one time, making travel safer and faster. Crossing a busy road without a median can take 10 times longer than a similar road with a median.⁹⁴

Reducing traffic speed makes roads safer for pedestrians and bicyclists. Road features that can reduce traffic speed include speed bumps, traffic circles, and lane

shifts that break up straightaways.⁹⁵ New England cities and towns ranging in size from Cambridge, Massachusetts to Durham, New Hampshire have employed these “traffic calming” measures to reduce the speed of traffic and to make streets safer and more comfortable for walkers and bicyclists.⁹⁶

Many cities and towns in New England have taken steps to make their streets more pedestrian-friendly with wider sidewalks and amenities such as benches, trees, and fountains. Hartford, Connecticut, for example, revised its construction plans for a major thoroughfare to make it more pleasant and easier for pedestrians to travel along the road by widening the median, adding trees, and reducing the number of traffic lanes. The pedestrian-oriented road also will be cheaper to build than the originally planned one.⁹⁷ Littleton, New Hampshire recently initiated a program to increase pedestrian amenities and make its streets safer for pedestrians using \$2.7 million in funding from the Federal Highway Administration’s Transportation and Community and System Preservation (TCSP) Pilot Program.⁹⁸ TCSP funding has been used to implement similar programs in Derby, Connecticut, Warren, Rhode Island and Burlington, Vermont.⁹⁹

In addition to designing roads with pedestrians in mind, designing communities according to “Smart Growth” principles (see page 27) and encouraging commuters to live near their work (see page 39) can enhance the ability of individuals to walk, rather than drive, to work, shopping and other destinations.

Improving Bike-Specific Facilities

Just as improving sidewalks and street crossings can encourage people to walk more, constructing bike lanes and making accommodations for cyclists can increase the number of people willing to bike. While snow, ice and cold may discourage would-be cyclists on winter days, New England’s weather permits cycling for most of the year. The larger obstacle is finding safe biking routes and having a secure way to store or carry a bike when switching to transit.

Bike lanes can be created on city streets or as separate paths. Research has shown that, for each mile of bike lane added per square mile of city, the percent of commuters who bike to work increases by 1 percent.¹⁰⁰ This seemingly small change can result in a significant percentage of commuters traveling by bike. Eu-

Signs of Progress: Promoting Bicycle Commuting in Providence

A unique effort in Providence is working to make bicycle commuting easier and more common in the capital of the Ocean State. Bike Downtown, a partnership between the non-profit group Groundwork Providence, the city of Providence and the Providence Foundation, has worked for the last four years to encourage bicycle commuting in the city.

Supported with federal CMAQ funds, Bike Downtown works with businesses in Providence to encourage bicycle commuting, advocates for improvements in bicycle infrastructure, and works to publicize bicycle commuting through the media and through special events. The organization is poised to launch a new initiative in which it will subsidize the purchase of bicycles for downtown workers who will use them in their commutes.¹⁰²

gene, Oregon, for example, has created 28 miles of off-street paths and 78 miles of on-street lanes, and 8 percent of commuters now bike to work.¹⁰¹

In New England, major existing bike paths include the Minuteman Bikeway, which connects four Boston suburbs to the Alewife subway and bus station;



Bike lockers, such as the one pictured above outside a train station in Maryland, can encourage transit patrons to use bicycles, thus reducing demand for parking and putting transit within pedaling distance of more commuters.

the Farmington Valley Greenway in central Connecticut; and the East Bay bike path in Rhode Island that connects Bristol to East Providence.¹⁰³ Much potential for improvement remains in certain parts of New England. Boston, for example, has been ranked the nation's worst city for cycling.¹⁰⁴

Bicycling can also facilitate the use of public transit if bike lockers are available in stations or if buses are equipped with bike racks. A transit stop normally draws riders within a 10-minute walking distance. Because a bicyclist can travel faster and farther than a pedestrian, the area served by a transit stop is 10 times larger for a cyclist than for a pedestrian.¹⁰⁵

However, for cyclists to transfer from bikes to public transit, they must be able carry their bike on the bus or train or store it at the transit stop. Over 40 public and private transit authorities in New England have installed bike racks on their buses, including the Pioneer Valley Transit Authority in western Massachusetts, CT Transit, and the Greater Portland Transit District.¹⁰⁶ Transferring from a bike to transit remains difficult in Boston, but there have been recent improvements. In September 2005, the MBTA announced that it would equip 250 buses with bicycle racks.¹⁰⁷

Funding for pedestrian and cycling infrastructure is available from federal, state, and local sources. In addition to the TCSP program mentioned above, other federal programs support pedestrian projects that will reduce car trips and connect people to transit.¹⁰⁸ In some states, it is possible to apply state highway funds to pedestrian and cycling projects. Though Maine, for example, does not allow this use of highway funds, the state does offer funding for landscaping and visual improvements that can make an area more appealing to pedestrians. Other ideas for funding include impact fees and assessments in business improvement districts.

PROMOTING “SMART GROWTH”

Key Recommendations:

- *Redevelop urban areas to provide affordable housing and commercial opportunities.*
- *Adopt zoning and planning policies that ensure that any newly built communities are designed according to “smart growth” principles.*
- *Encourage transit-oriented development.*
- *Ensure that sprawling developments pay their own way.*

Land-use patterns have significant consequences for how much people travel and by what means. Compact communities with a mix of residential and commercial uses allow residents to walk or bicycle to complete many of their daily tasks. By contrast, spread-out suburban forms of development, in which land uses are separated, require residents to use cars for virtually every trip. Compact development can even help expand transit use for longer trips by bringing transit stations within easy walking or biking distance.

“Smart growth” – which can be defined as a strategy for the efficient use of land and resources – can reduce the need for the automobile trips that are among the leading sources of global warming pollution.

Traditional New England communities often fit the definition of “smart growth,” with compact, walkable town centers in which shops, schools, parks and other amenities are close at hand (and with densities that can be served by transit). But in recent decades, traditional development patterns have often fallen by the wayside as suburban development practices prevalent elsewhere in the country have taken root in New England. Homes have been built in large residential-only clusters with no nearby shops, restaurants or public buildings. Office parks are isolated rather than being integrated into the surrounding community, meaning that workers cannot walk to a deli at lunchtime or easily run errands during their break. Nearly every trip in many of these communities must be completed in a car.

Better growth patterns are possible. New England communities can encourage development that mixes homes, shops, and offices in a more traditional village center pattern and gives residents more transportation choices. In addition, communities can

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Traditional New England town centers combine a variety of uses within a small, walkable geographic area, while creating a sense of beauty, dignity and character.

redevelop older urban areas by updating homes and converting empty factories into housing or office space to reap the full benefits of historic compact neighborhoods that are easily served by transit, driving or walking. And states can revamp their infrastructure planning and financing policies to encourage the spread of smart growth principles.

Compact Development

Compact development places many destinations a short distance from each other, allowing people to choose between different modes of travel. No longer is driving the only option for getting to work, taking a child to school, or going to the grocery store.

The most important benefit of compact development is the reduced need for people to drive. People who live in compact urban areas walk or use transit at twice the national average rate and drive 25 percent less, thereby reducing global warming pollution.¹⁰⁹

Compact development provides additional benefits, such as protecting open space, allowing greater mobility to those who cannot drive, such as children and the elderly, and saving money for families by reducing transportation expenses.

Communities seeking to reduce their global warming emissions through land use can focus on two areas: redevelopment of existing urban and suburban space and growth at the urban edge.

Signs of Progress: Compact Development in Hanover, New Hampshire

Local governments can work with major employers to ensure housing for employees is within walking distance of jobs, thus reducing daily commuting trips made by car. Universities in particular may be eager to provide reasonably-priced housing near campus.

Dartmouth College, located in Hanover, New Hampshire, built an infill residential project in 2001 within walking distance of downtown Hanover and the Dartmouth campus that should decrease the need for students and staff to drive.¹¹³ The college already owned the 3.9-acre city block, including a single family home, a house subdivided into apartments, a sorority, several multi-unit buildings and tennis courts. Though the area was owned by the college, the multiple lots on the block at South Park and East Wheelock streets were consolidated into one large lot. This eliminated problems with requirements that buildings not be too close to the edge of the lot or to buildings on adjacent lots. The completed project provides 38 units of rental housing, an increase of 22 units, for

Dartmouth faculty and staff in duplexes and larger multi-unit buildings that are no more than a 10 minute walk from campus, shopping and recreational opportunities.

Dartmouth oriented the buildings toward the street to keep the buildings consistent with the neighborhood and used the center of the block for parking and a common yard. In keeping with the project's proximity to jobs and in an effort to maintain the project's compact form, Dartmouth sought permission to reduce the amount of parking required at the site. The college argued that Hanover's parking minimums were more suited to a car-centered suburban development than to housing that would serve residents who could walk to work, but failed to persuade the town to reduce the parking requirement. Further demonstrating the low traffic demand of compact, walkable development and lessening the impact on the neighborhood of accommodating more residents on the block, Dartmouth reduced the number of driveways from five to two.

Restoring Compact Urban Development

As New England's urban economy has shifted away from industry and manufacturing toward service and educational employment, urban land use has changed also. Many mills and factories, often in city centers, are no longer in use and have either become vacant or been torn down. City-center homes built for factory workers may have become dilapidated and need to be replaced or renovated. These old buildings and urban sites, located in walkable neighborhoods, can be redeveloped into attractive homes and businesses.

Challenges to urban redevelopment include potentially higher costs for developers due to working in a more constrained space than on the urban fringe, reluctance from lenders to finance projects that are perceived as more complicated, concern that nobody will want to live in an urban home, and bureaucratic hurdles. Redevelopment experiences across New England have shown creative ways to address these challenges.

In Hartford, two non-profit developers and two for-profit developers drew upon a variety of state and federal financing options to convert seven historic but dilapidated apartment buildings into rowhouses and to construct five new residential buildings in the Frog Hollow neighborhood, creating a total of 52 units.¹¹⁰ Funding sources included the state's Historic Homeownership Tax Credit program that offers tax credits for rehabilitating historic, owner-occupied buildings; Hartford's gap financing program that helps cover the difference between the cost of rehabilitating a building and its assessed value after completion; and a loan and grant from Citibank.¹¹¹ All of the rehabilitated units sold before the project was complete.¹¹²

Other possibilities for infill development include converting former shopping malls into new town centers with offices, shops and post offices, and building homes nearby – such as the Mashpee Commons project in Mashpee, Massachusetts.¹¹⁴ Reusing and refashioning existing buildings can make them more

pedestrian- and transit-friendly, and reduce pressure to build a more car-centered project on open space farther from the city center.

A frequent concern regarding infill development or reusing old buildings in New England is worry about chemical contamination of the site caused by decades of industrial and commercial activity. While such problems do occur and pollution is of real concern, often the contamination can be cleaned up so that the site can be fully reused. Federal grants may be available to offset the cost of investigating and clean up a potentially contaminated site, also known as a brownfield.



Old mill buildings, such as this former chocolate factory in Boston, have been refurbished into commercial and residential space in many New England cities and towns.

Beginning with only a small amount of federal funding, Lowell, Massachusetts converted two empty light-industrial buildings into urban housing and commercial space. The city spent \$3,000 of a federal grant to test the two buildings for contamination. Confirmed contamination included asbestos, oil lubricant, and a 50-gallon drum of a carcinogenic chemical. A private developer paid the city for the right to clean up and develop the properties, converting them into a café and gallery and 49 lofts, nearly all of which sold before the building was complete. Residents of the buildings are within walking distance of Lowell's city hall, or can ride a shuttle to connect to an MBTA commuter rail line.¹¹⁵ In addition to creating walkable urban residences out of an empty industrial building, the city of Lowell raised its tax revenue by \$300,000 to \$400,000 annually.¹¹⁶

State government can take additional steps to promote the redevelopment of brownfields by reducing some of the risks of such projects. Cleaning up a brownfield can add significant cost to a redevelopment project because of testing and remediation expenses and possible project delays if the site proves more difficult to clean than expected. Financial support from the state can help offset some of these expenses. The state of Connecticut offers grants (rather than loans) and funding based on future tax payments to developers working at brownfield sites, and also seeks repayment from the party responsible for the contamination.¹¹⁷ Massachusetts offers tax credits for brownfield site cleanup and redevelopment.¹¹⁸

Promoting Compact Development in Suburbia

Unlike in urbanized areas, where there is little open land and undeveloped parcels are costly, land at the edge of town is relatively inexpensive and thus cost does not push developers to build compact projects. As a result, development that occurs at the edge of existing cities and towns often is spread out and not conducive to walking, biking or transit. However, communities can take steps to ensure that new homes and businesses built on "greenfields" outside the urban or village center are built in a way that is pedestrian and transit friendly.

Comprehensive plans and zoning are important components of ensuring new development is compact. Zoning should be driven by a comprehensive plan, which gives local government the opportunity to engage residents in creating a vision of what they want the community to look like in 10 or 20 years. Often, residents realize that they want to emulate the time-tested development pattern of their town's village center – a neighborhood of stores, public buildings and homes, all reachable on foot, by transit and by car. Following historic growth patterns offers a way to promote economic growth without undermining a town's character.

However, creating a comprehensive plan with this vision does not guarantee that a community will encourage more compact development. The comprehensive plan must be supported by zoning laws that encourage compact development, allow mixed residential and commercial uses, and enable residents

to travel without having to drive. Every New England state except Massachusetts requires that zoning laws be consistent with a town's comprehensive plan, but only Maine, Rhode Island and Vermont have any mechanism for verifying that this requirement is met.¹¹⁹ Too often, zoning laws prevent the type of development necessary to turn the comprehensive plan into reality and instead allow growth that undermines a community's traditional character.

Good zoning and related land-use policies (such as subdivision regulations) can direct growth to where it is wanted, create pedestrian-friendly neighborhoods, and reduce how much residents need to drive. The following guidelines can help communities create the vision of compact, traditional development identified in the comprehensive plan:¹²⁰

- Allow mixed-use development, both vertically and horizontally. Permitted uses should include:
 - ▲ Retail on the first floor of a building and residences or offices on the higher floors.
 - ▲ Commercial activity, which includes shops, offices, day care centers, and other quiet uses, adjacent to residential buildings.
- Create small lots in areas targeted for development and ensure the maximum use of those lots by:
 - ▲ Allowing owners to build to the edge of the lot in commercial areas, so that stores are side by side and there is no space lost between them.
 - ▲ Establishing a maximum, not minimum, setback from the street.
 - ▲ Increasing the number of residential units that may be built on a single lot.
- Limit development where it is not wanted by:
 - ▲ Establishing large minimum lot sizes (30-50 acres, not 5 acres) in rural areas to protect farming uses and open space.
 - ▲ Requiring homes be clustered together (rather than each centered in the middle of its lot), thus preserving open space nearby.
 - ▲ Creating "transfer of development rights" programs in which landowners in rural areas can sell their development rights to developers or others who wish to build at greater density in areas targeted for development.
- Ensure development is accessible to pedestrians by:

- ▲ Requiring sidewalks on both sides of the street.
 - ▲ Creating small blocks that are scaled to pedestrian use.
 - ▲ Connecting all streets on each end rather than allowing cul-de-sacs that greatly increase how far a person must walk to reach relatively nearby buildings.
 - ▲ Designing streets to control traffic speeds and allow pedestrians to cross streets safely.
 - ▲ Building parking lots behind buildings instead of in front of them, where they interfere with pedestrian access.
- Tailor parking requirements to devote as little valuable land as possible to parking by:
 - ▲ Allowing the use of shared parking, for example by shoppers during the day and by residents at night.
 - ▲ Encouraging developers to participate in programs that reduce driving, including efforts to promote transit use, help employers organize carpools and encourage telecommuting.
 - ▲ For downtown areas accessible by transit or on foot, change minimum parking requirements to parking maximums and require that parking spaces be set aside for shared cars.

The above list is far from exhaustive, but such policies and practices are becoming increasingly common in New England. Stowe, Vermont has highlighted select areas for pedestrian-friendly, mixed-use projects and designated other areas for far less growth. To en-

Retrovest Companies



Compact residential developments, like the one above in Stowe, Vermont, can maintain the style and flavor of traditional New England village living.

Issues in Focus: Regional Planning in New England

Land-use and transportation planning are integrally related. To achieve the goal of a transportation system that produces fewer global warming emissions, transportation and land-use plans must be closely aligned with each other and be at least reasonably consistent across city and town boundaries.

In New England, however, the power to plan for future land use and infrastructure needs is dispersed among hundreds of autonomous local governments. Transportation planning is carried out at both the local and regional levels. Regional planning organizations and councils of governments have been formed in many parts of New England to help communities plan appropriately and, in some cases, to develop regional plans. But regional bodies have little to no power to compel individual towns to carry out the details of a regional plan and state governments have traditionally been reluctant to impinge on local authority over land use.

New England's unique home rule tradition has many benefits. Local citizens are more likely to become engaged in planning discussions at the local level and municipal planning can

help individual towns preserve their unique character. But other states and metropolitan areas have benefited from strong regional planning authority. For the past two and a half decades, for example, Portland, Oregon's elected regional government (called Metro) has devised and implemented both regional land-use plans and regional transportation plans. Metro's consistent and strong focus on compact, transit-oriented development has achieved results, contributing to the 13 percent reduction in per-capita carbon dioxide emissions in Portland and its surrounding county since 1993.¹²²

To be successful in reducing global warming emissions from transportation, New England must arrive at a similar focused vision for future development. Creation of powerful regional governments or planning organizations may or may not be practical or desirable in New England. But the region's leaders do need to find creative ways to balance the ethic of citizen control and self-determination inherent in local planning with the synergies created by harnessing the region's intellectual and public resources behind a regional vision for sustainable development.

courage the creation of new village centers, Amherst, Massachusetts has adopted zoning to support compact, mixed uses in selected areas of town.¹²¹

The Palisade Street development in Stowe, Vermont provides an example of new compact housing that blends in with the existing village and of how zoning regulations influence the shape of projects. The town of Stowe has zoned the areas near its downtown for development and to allow mixed uses.¹²³ However, building a compact, walkable mix of homes and businesses near downtown required the developer to seek several exemptions from Stowe's zoning laws.

First, the developer sought a waiver to Stowe's requirement for how far each building must be from the edge of its lot. Building homes closer to the lot line can allow more compact development. In addition, the developer requested and received permission to re-

duce the minimum lot size. Further, the project qualified for a requested parking reduction by allowing shared parking between commercial and residential users.¹²⁴ The completed project includes both commercial space and residential units, all of which have sold out.¹²⁵

More so in New England than in other areas of the nation, comprehensive plans and zoning laws that support smart growth are the responsibility of towns. New England's strong home rule tradition allows municipalities to govern themselves in any way not prohibited by state or federal law and often curbs the power of state government to direct changes to land-use practices. As a result, though every New England state requires towns to develop a comprehensive plan (at least if the town wants to adopt any zoning laws), communities may establish a comprehensive plan and

zoning laws that do nothing to promote compact development.

In the absence of increased authority to direct land-use policy, state governments in New England are limited to voluntary approaches and the use of state infrastructure funding to encourage smart growth. (See page 34.) Rhode Island, for example, tries to steer comprehensive plans toward pedestrian- and transit-friendly compact growth by providing detailed suggestions for communities on how to shape the comprehensive plan. The state urges communities to encourage compact, mixed-use development and create new village centers, revitalize cities, and control sprawl.¹²⁶

Transit-Oriented Development

While compact development is an important step, compact development that is explicitly focused around transit is even more effective. Transit-oriented development (TOD) is characterized by residential units alongside or above stores, restaurants and offices, and a design that allows residents easy access to transit. TOD offers an attractive alternative to sprawling residential suburbs and malls that are accessible only by car. TOD also expands the range of housing, services and jobs that are easily accessible to lower income residents, the elderly, the disabled or others who are dependent on transit.

Not all development near transit qualifies as transit-oriented development. Too often, homes and offices near transit offer no pedestrian link to transit and are merely transit-adjacent rather than transit-oriented.

TOD can reduce driving in two ways. First, many residents of a transit-oriented development will live within walking distance of rail transit and will walk to the train to commute to work or to go shopping.

Issues in Focus: Compact Development and Affordable Housing

Zoning laws that encourage compact development have an additional benefit: they make housing more affordable. A study by Fleet Bank and the Rhode Island Public Expenditure Council found that in Rhode Island, purchasing and finishing land accounts for 45 percent of the cost of a new home. Labor and materials for constructing a home represent 52 percent of the total cost.¹²⁷

Zoning regulations typical of many suburban communities establish a large minimum lot size for new homes. Adjusting zoning requirements to allow smaller lot sizes in areas targeted for new development (near transit stations, for example) can encourage the development of more affordable housing, allow for walking and transit use to supplant driving, and lead to the creation of more attractive and sustainable communities.

Second, and perhaps more significant, is the effect of commercial development around a rail stop. Most car trips are not just for commuting but for completing errands on the way to or from work.¹²⁸ A survey of people's travel choices in Portland, Oregon demonstrates the impact of building homes, stores, and offices within walking distance of transit stations. People in neighborhoods with this mix of uses near transit drove 26 percent less compared to those near transit locations without this varied development.¹²⁹ (See Table 1.)

Table 1. Building a Mix of Homes, Stores, and Offices Near Transit Reduces Driving¹³⁰

Area Characteristics	Mode Share					VMT per Capita	Autos per Household
	Auto	Walk	Transit	Bike	Other		
Good Transit and Mixed Use	58%	27%	12%	2%	2%	9.80	0.93
Good Transit Only	74%	15%	8%	1%	1%	13.28	1.50

Signs of Progress: Transit-Oriented Development in Somerville, Massachusetts

Davis Square – long the commercial center of Somerville, Massachusetts, near Boston – had fallen upon hard times by the 1970s. During the decade of the 1970s, Somerville lost 2,000 jobs and 13 percent of its residents, and Davis Square lost many of its businesses.¹³¹ In 1970, the MBTA began planning for an extension of the Red Line subway to nearby Arlington. The initial proposals had the line bypassing Somerville altogether.

Local leaders launched a successful campaign to reroute the new line through Davis Square, and then to revitalize the square around the new station. Bucking the urban development trends of the time, local officials, residents and businesses developed a comprehensive plan for redevelopment of the square that limited parking for the new station, implemented traffic calming measures and improved amenities to make the square more



Once in steep decline, Somerville’s Davis Square has been transformed into a vibrant town center district thanks to effective planning centered around transit-oriented development.

friendly to pedestrians, and created new parks and bike paths in and around the square.¹³²

The planners’ foresight paid off. Today, Davis Square is a vibrant neighborhood center with theaters, restaurants, new commercial buildings and housing. And the number of transit riders boarding at Davis Square is more than triple original projections.

Making TOD Happen

Across New England, numerous transit-oriented developments have evolved, such as around Somerville, Massachusetts’ Davis Square. (See “Signs of Progress” above.) More recently, new transit-oriented developments have begun, such as at the Holbrook/Randolph stop on the Middleborough commuter rail line in Massachusetts. Tremendous potential for further TOD – and reduced driving – remains.

Canton, Massachusetts has undertaken a downtown revitalization that doubles as transit-oriented development. A town of 20,000 connected to Boston via the MBTA Attleboro commuter rail line, Canton revised its zoning laws affecting downtown in 2000. The town decided to encourage dense housing in downtown – unusual in Massachusetts, where towns usually are reluctant to mix residential and commercial activity – and reduced parking requirements to one space per residence. With the rail station nearby, Canton’s planners assumed that many downtown residents would commute to work by train.¹³³

In response to these zoning changes, developers have constructed more than 100 condos and other residential units above and behind new shops and restaurants. Additional housing has also been constructed downtown within walking distance of the commuter rail station.¹³⁴

Malden, Massachusetts is beginning to overhaul the area surrounding its subway and commuter rail station. Malden has already overcome some hurdles to TOD, such as general reluctance to embrace compact development or mixed uses; it recently revised zoning laws to allow more apartments downtown, including taller apartment buildings.¹³⁵ Now, Malden’s challenge is to draw more activity to the area surrounding the rail station. The city will reopen Pleasant Street, closed in the 1970s to allow construction of city offices on the site, to create a shopping district. In place of government offices, a developer will construct housing, office space, and ground floor retail. Also near the rail station are two more apartment complexes, a parking garage, and a new YMCA.¹³⁶

Massachusetts' TOD program offers financial assistance to communities seeking to redevelop urbanized areas, keep development compact, and offer residents transportation choices. Funding can be spent on housing, pedestrian and biking facilities, and parking within one-quarter mile of a transit station. In the program's first year, \$30 million will be available to local governments, public agencies, non-profit organizations, and private developers to build compact, walkable projects.¹³⁷ Separately, the MBTA is evaluating its surplus properties to identify those with TOD potential.

Infrastructure Funding and Impact Fees

Every development is served by public infrastructure – from roads and sewer systems to schools, parks and libraries – that must be expanded or newly built at significant cost. What public services are provided and how much of the cost is covered with public funds can influence growth patterns. Both state and local governments can use their financial power to promote pedestrian- and transit-supportive development that reduces global warming emissions from commuting. Given that home rule – which limits how much state governments can influence local decisions, including land use practices – remains strong in New England, state governments may find that one of the most immediate tools they have available to encourage compact development is to prioritize giving grants and financial incentives to communities that have developed strong land use policies.

Infrastructure Funding

Infrastructure projects are costly, and thus public funding is important. The cost of a lane-mile of new highway in a previously undeveloped area can be as high as \$500,000.¹³⁸ A new high school, necessary because students live in new homes too far from existing schools, can cost an estimated \$30 million (including interest payments).¹³⁹ One study has found that total public infrastructure costs per unit can be as much as nine times higher for a single home built on four acres compared to 30 units built on a single acre.¹⁴⁰ Though these expenses are often paid for by developers or local governments, state government also provides some support. State governments can influence growth patterns by limiting which of these infrastructure improvements they will pay for.

One policy option is for government to prioritize those projects that are located within walking distance of a village center or are dense enough to be easily served by transit. For example, Vermont stipulates that the state will not provide financial support for roads, buildings or other infrastructure unless the project complies with state planning goals – such as protecting rural areas and steering growth toward existing town centers – and with local growth plans.¹⁴¹ In 2000, Maine adopted a law that gives preferential treatment in awarding select state grants to communities that have adopted comprehensive growth plans.¹⁴² The Maine Municipal Investment Trust Fund, for example, operates under these guidelines. Towns may request state funding for projects such as downtown improvements, transportation enhancements, or sewer and water upgrades. The state prioritizes the applications of communities that have adopted a local growth management program or have created a plan to focus growth in designated areas.¹⁴³

In addition, states should consider how investments in public infrastructure promote or detract from sustainable development. Many states, for example, have minimum acreage requirements for schools that virtually dictate that new schools are built away from town centers in areas where walking or bicycling to school is next to impossible. Funding policies can also bias school building decisions toward the creation of large schools that require expensive bus networks or toward the construction of new schools where renovation of existing school buildings could serve student needs. States should ensure that their school construction policies – as well as decisions regarding the location of state office buildings and other public facilities – align with smart growth principles.

Impact Fees

A second fiscal policy that state or local governments can use is to assess impact fees, a one-time charge levied on new development to pay its share of infrastructure expenses needed to support those new homes and businesses. Because the infrastructure needs of sprawling development are so much greater than for compact or infill development – costing about 20 percent more for utilities (such as water and sewer lines) and 25 percent more for roads – location-sensitive fees should be higher for spread-out development.¹⁴⁴ Affordable housing projects and other socially desirable developments can be exempted from fees altogether.

By incorporating public infrastructure expenses into private development decisions, impact fees can help to make compact growth more attractive to developers.

The infrastructure needs of sprawling development are much greater than for compact or infill development – costing about 20 percent more for utilities and 25 percent more for roads.

Maine, Rhode Island, Connecticut, Vermont and New Hampshire allow communities to collect impact fees, and a number of towns in each state assess fees, particularly for school construction costs. Few, if any, however, have tailored their fees to account for the reduced infrastructure costs of more compact development.

REDUCING SINGLE-PASSENGER AUTOMOBILE COMMUTING

Key Recommendations:

- *Require, and provide state support for, employer-based commute-trip reduction programs.*
- *Encourage commuters to live near their places of work or to live near mass transit.*

Signs of Progress: Making Compact Development More Attractive in Maine

A serious obstacle to compact growth in smaller towns throughout New England is the absence of a sewer system. In a community without a central sewage facility, new homes are served by individual septic systems, which generally require relatively large lots for the drain field.¹⁴⁵ This means that homes cannot be built close enough together to create a walkable community.

Maine has recently begun to address the problem by attempting to reduce the cost to towns of extending sewer lines to new homes and building new sewage treatment plants in areas anticipating significant growth. In Maine, where roughly half of the

More than one out of every four miles driven in a car in the United States is traveled on the way to or from work.¹⁴⁷ In addition to being the largest source of vehicle travel, commuting behaviors also help to dictate how, where and by what mode of travel people complete other daily tasks. Thus, finding ways to encourage low-emission commuting choices is a key component in an overall strategy to reduce carbon dioxide emissions from transportation.

Numerous policy tools discussed elsewhere in this document can reduce emissions from commuting, including the expansion of transit and other transportation alternatives (page 17) and adoption of smart growth principles for development (page 27). But additional efforts focused specifically on commuting can also play a major role, as with employer-based commute trip reduction programs and programs to encourage workers to live near their place of employment. Both strategies rely on strong public-private partnerships to produce results that benefit commuters, businesses and the environment.

Commute Trip Reduction (CTR) Programs

Employers are in a unique position to help reduce global warming pollution from the transportation sector, given that a large percentage of driving involves

state's residents rely on septic systems, the state has begun to address this challenge by offering extended loans from the state's Clean Water Revolving Fund for sewer line construction to developments of 250-350 new homes in a "village" pattern that allows residents to walk to the store and schools.¹⁴⁶ Several developers have proposed projects that qualified for this funding, but none of the projects have been built due to other obstacles.

In addition, Maine is considering new tools to ease the creation of decentralized sewer districts that would allow communities to build community septic systems that would accommodate more compact development in town center areas.

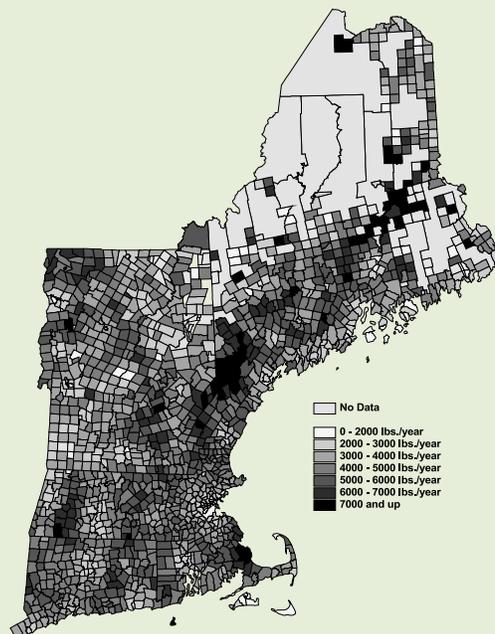
Issues in Focus: The Contribution of Commuting to Global Warming

In 2005 and 2006, the New England Climate Coalition issued a series of reports examining the global warming impact of commuting patterns in the six New England states. Among the studies' key findings are the following:

- **Global warming emissions from commuting vary greatly from town to town:** In Massachusetts, for example, the average commuter in portions of the South Shore produces seven times more carbon dioxide per year as the average commuter living in Boston's urban core.
- **Fast-growing "exurbs" produce high levels of emissions:** The growth of "exurban" development in formerly rural regions threatens further increases in emissions in the years to come. Workers living in these towns face long commutes that are unlikely to be completed via transit.
- **Living near work can significantly reduce emissions:** In states such as New Hampshire, nearly one-fifth of all commute-related carbon dioxide emissions are caused by the small fraction of commuters who travel more than 30 miles to work.

- **Compact residential development, transit use and non-motorized commutes all lead to lower emissions.**

Fig. 8. Per-Worker Commuting Carbon Dioxide Emissions by Place of Residence, 2000



To read the studies, visit the New England Climate Coalition's Web site, www.newenglandclimate.org.

commuting to and from work. Because of this, many businesses and other employers help their employees reduce vehicle travel through commute trip reduction (CTR) programs.

A CTR program benefits both employees and employers. A comprehensive program can reduce peak-period automobile trips by up to 20 percent at a worksite, meaning less traffic congestion, less air pollution, and less gasoline consumption.¹⁴⁸ Also, helping employees find better transportation options can reduce travel time and stress. This increases productivity and morale, and reduces turnover rates.

Many state and local governments, both in New England and nationwide, have taken steps to encourage or require CTR programs. These initiatives are most successful when they give businesses the support needed to make setting up a program easy.

Elements of a Good Program

It is important for any commute trip reduction program to be flexible to employees' needs, and to give as many positive incentives for alternatives to drive-alone commuting as possible. There are dozens of possible elements for a program, and because each worksite is unique, no one program is appropriate for all employers.

However, there are several elements that should appear in most worksites' programs. For example:

- Assisting with rideshare/carpool matching.
- Offering a monthly transit or vanpool subsidy.
- Providing preferential parking to carpools and vanpools.
- Providing secure bike parking/storage locations and changing facilities.
- Providing shuttles to nearby transit stations.
- Encouraging and facilitating telecommuting.
- Allowing flexible work schedules that allow workers to commute fewer days of the week.
- Allowing employees to “cash out” the value of employer-provided parking. (See page 45.)
- Ensuring access to a guaranteed emergency ride home. (See “Issues in Focus,” this page.)
- Reimbursing bicycle and transit mileage for business trips when these modes are comparable in speed to driving, rather than only reimbursing automobile mileage.

Employers should also keep information on commuter benefits in one place, designate one person as the central point of contact, and actively promote the benefits offered. Also, it often makes sense for small employers to band together, especially when located together in a commercial mall or industrial park, and form a transportation management association. This can allow them to establish a CTR program comparable to a large business.

Encouraging Employers to Develop CTR Programs

The most important part of any government effort to encourage CTR programs, whether through a voluntary or a mandatory program, is to create a partnership with the businesses involved. Government agencies should engage employers in planning and marketing CTR programs, keep program possibilities flexible, and give employers the tools they need

Issues in Focus: Guaranteed Ride Home

Commuters are often discouraged from using transit or carpooling to work because of the prospect that they will be stranded in case of a family emergency or if their work schedule suddenly changes.

To replace the “safety net” provided by a personal automobile, some transit agencies and employers have created “guaranteed ride home” programs. A guaranteed ride home program can address this problem by paying for an employee to take a taxi, use a company car, or even rent a car. A guaranteed ride home is a critical part of commute-trip reduction programs because it helps commuters take full advantage of alternative transportation options. Sometimes a state agency or non-profit organization will offer it on a regional basis.

to maximize benefits for both employees and business overall.

Commute Trip Reduction in New England

Currently, Massachusetts is the only state in New England to require employer-based CTR programs, though other states sponsor or support various organizations to facilitate voluntary programs. Making CTR programs mandatory would expand their reach, though it must be done in a way that gets employers invested in the actual results.

The Massachusetts Department of Environmental Protection has established a “Rideshare Regulation,” which requires employer-based CTR programs in a way similar to Washington’s CTR law.¹⁵⁶ The regulation requires large businesses and educational institutions to develop plans for reducing drive-alone commutes by 25 percent, including elements such as carpool matching and bicycling incentives.

Other New England states support voluntary commute trip reduction efforts. For example, Rideworks has been helping employers and individual commuters in south-central Connecticut drive less for about 20 years; the program removes an estimated 3,640

Bright Ideas from Elsewhere: Washington State's Commute Trip Reduction Program

The state of Washington operates one of the nation's most successful commute trip reduction programs. Launched in 1991, the program has succeeded because it combines a government mandate with ample assistance to employers and the creation of new partnerships between the state's Department of Transportation, local governments and employers.

King County Department of Transportation



The Seattle metropolitan area has one of the nation's strongest vanpool programs, in large part due to the active participation of employers in the region's commute trip reduction program.

The state's commute trip reduction law requires the development of a CTR strategy by all employers with 100 or more full-time employees at a single worksite in the state's nine most populated counties. Over 1,100 worksites currently participate, including about 100 worksites that participate voluntarily.¹⁴⁹ In addition to designating a transportation coordinator and supplying information to employees about commuting options, employers must develop a CTR program designed to reduce vehicle-miles traveled and drive-alone commuting, and make a good-faith effort to implement the program.¹⁵⁰ Additionally, employers must

report annually to their county or city, and survey their employees every two years to determine the program's progress.

Participation in Washington's program is widespread because it is mandatory for large companies, but its effectiveness hinges on the partnerships it has created. Implementation of the program is overseen by a 28-member CTR Task Force, containing representatives of major employers, cities and counties, state agencies and citizens. However, the program is actually administered through local jurisdictions (cities and counties), and this decentralization allows businesses a great deal of flexibility.

The stated goal of Washington's CTR program is three-fold: reduce traffic congestion, reduce air pollution, and reduce oil consumption by reducing the number of commute trips made by people driving alone.¹⁵¹ Judged against these goals, the program has been successful:

- The program has **reduced traffic congestion**. Statewide, the program removes over 20,000 vehicles from roadways every morning; if these cars were put back on the road, overall per-vehicle traffic delay would increase by 6.3 percent in the Puget Sound region.¹⁵² Employees at CTR worksites are less likely to drive to work alone compared to the statewide average, and Washington is one of only two states in which the proportion of people who drive to work alone decreased from 1990 to 2000; nationwide, the rate increased 3.4 percent.¹⁵³
- These changes in driving patterns have **reduced air pollution** by thousands of tons.¹⁵⁴
- It has also meant **reduced oil consumption**. Based on how many fewer miles are driven by employees commuting to CTR worksites, the program has resulted in \$10 million in fuel savings.¹⁵⁵

cars from the road each day, and resulted in 45.3 million fewer vehicle miles traveled last year.¹⁵⁷ In other parts of Connecticut, two other non-profit companies (Metropool and Rideshare) perform similar functions.¹⁵⁸

Other states have followed similar paths, with organizations like Go Maine (sponsored by the Maine Department of Transportation and the Maine Turnpike Authority) and Vermont Rideshare (part of the Vermont Agency of Transportation).¹⁶² These programs provide carpool matching, transit information, and a guaranteed ride home option.

Government initiatives to encourage CTR programs are strongest when they provide benefits both to commuters and to businesses themselves. Businesses that get the support they need, receive good publicity, and see real benefits in terms of reduced employee stress and increased retention are more likely to make a good faith effort to establish a CTR program.

State and local government officials should pursue policies that encourage employers to create CTR programs. Mandatory regulations will have a much wider reach, but, regardless of whether the programs are mandatory or voluntary, states should provide employers with the tools and resources they need to make the programs successful.

Live Near Work/Live Near Transit Programs

Another series of approaches to reducing carbon dioxide emissions from commuting is to reduce the length of the commute itself or to encourage workers to choose homes in close proximity to transit. A variety of innovative policies have been designed to encourage workers to make choices that reduce the impact of their commutes on the climate.

“Live near your work” programs were pioneered in Maryland in 1997 and later spread to Delaware. (The Maryland program was discontinued amid a state budget crunch in 2003, but the city of Baltimore has continued the program on a local basis.) The program provides cash grants to employees purchasing a home in a certain geographic zone near their place of employment (the grants are typically used to defray down payment or closing costs on a new home). The Maryland program provided grants of up to \$3,000

Signs of Progress: Best Workplaces for Commuters in the Upper Connecticut River Valley

To recognize businesses that offer commuting choices to their workers, the U.S. Department of Environmental Protection and U.S. Department of Transportation operate the “Best Workplaces for Commuters” program. Companies that provide commuting benefits meeting the program’s standards are permitted to promote themselves using the “Best Workplaces for Commuters” name and logo, providing a public relations benefit. To qualify for recognition, companies must provide one primary commuting benefit – either a transit subsidy, vanpool subsidy, telecommuting option, or parking cash-out – as well as three supporting benefits, such as rideshare matching, shuttle bus service, or bicycle facilities. Companies must also provide an emergency ride home service and attain a goal of having at least 14 percent of workers not drive alone to work.

Thus far, 130 New England workplaces, with more than 170,000 employees, have qualified for the “Best Workplaces for Commuters” designation.¹⁵⁹ But the Upper Valley region of New Hampshire and Vermont has gone one step further, becoming the first area in New England – and one of only 19 in the country – to achieve designation as a “Best Workplaces for Commuters” district, offering commuter benefits to more than 16,000 employees in the region.¹⁶⁰ The Upper Valley is also the only predominantly rural area in the nation to achieve “Best Workplaces for Commuters” status.

Through Upper Valley Rideshare, a project of Advance Transit funded by the Vermont and New Hampshire transportation departments, workers and employers in the area are eligible for a variety of transportation services, including rideshare matching, free bus service, commuter shuttles, and a guaranteed ride home program.¹⁶¹

Signs of Progress: Location-Efficient Mortgages in Massachusetts

In Massachusetts, the Massachusetts Housing Finance Authority (MassHousing) and the MBTA created the “Take the T Home” mortgage program, which enables low- and moderate-income residents to purchase housing near transit with little or no money down. Purchasers can also qualify for larger mortgages than they could otherwise afford by factoring in their reduced transportation expenses. Home purchasers must demonstrate that they are regular users of transit.¹⁶⁶ The program is also available to transit riders in Worcester and the Pioneer Valley and to participants in the Zipcar car-sharing service.

Since the inception of the program, more than 150 loans have been made to borrowers, totaling \$38.2 million. The program has been more successful in providing loans in the metro Boston area than it has been in the less-transit oriented areas of central and western Massachusetts.¹⁶⁷

The “Take the T Home” mortgage program is just one example of a “location-efficient mortgage” (LEM). The idea behind the LEM is that homeowners in densely populated areas with greater access to transit devote a smaller share of their household income to transportation expenses. As a result, they can devote a greater share of their income to housing than traditional income eligibility formulas allow. This, in turn, allows consumers to qualify to purchase housing that they would otherwise not be able to afford.

for homebuyers through a three-way match by the state government, the local government and the employer.¹⁶³ In the six years in which the Maryland program was in operation, grants were made to nearly 1,000 recipients.¹⁶⁴

In addition to reducing the length of commutes, “live near your work” programs can also promote urban residential redevelopment by encouraging workers to live in urban neighborhoods close to major centers of

employment, which, in turn, can spur further residential redevelopment in urban areas.

Similarly, states, local governments and transit agencies can create programs that encourage workers to live near transit. Among the most innovative approaches to “live near transit” is the creation of partnerships with lenders to offer a variation of the “location-efficient mortgage.”¹⁶⁵ (See “Signs of Progress,” this page.)

REALLOCATING THE COSTS OF DRIVING

Key Recommendations:

- *Reform automobile insurance policies to calculate premiums based on vehicle travel and vehicle-based risk.*
- *Create parity between subsidies for parking and the use of transit or other alternatives.*
- *Eliminate other subsidies for automobile use, including mandated parking subsidies.*

An individual’s decision to drive or not to drive should ideally be based on the costs of that behavior – and those costs should ideally represent the “true” cost of driving, including the costs inflicted on the environment and other members of society. However, driving is a heavily subsidized behavior – both directly by governments (through road maintenance, policing and other expenses) and indirectly through government mandates (for example, excessive parking requirements).

In addition, the current allocation of costs among the various aspects of driving (car purchase, maintenance, insurance, fuel, etc.) tilts heavily toward fixed charges – those that are required simply to own a vehicle. In other words, it often costs a great deal to have a vehicle, but very little to drive it. The result is that, once a vehicle has been purchased, an individual has incentive to use it for as many daily tasks as practicable and not to leave it parked in the driveway.

There are numerous ways to reallocate the costs of driving in such a way that drivers pay their fair share of the societal costs of operating a vehicle and that more of those costs are charged by the mile. The recommendations in this chapter assume that the overall costs of operating vehicles are held constant – that

is, that existing costs are merely reallocated. Other policy options that increase the cost of driving – such as increased gasoline taxes – may also have merit as emission-reduction tools.

Automobile Insurance Reform

Cents-Per-Mile Insurance

For almost all drivers, insurance is a “fixed cost,” meaning that you pay the same amount each year regardless of how much you drive. As a result, when drivers consider the cost of driving extra miles, insurance expenses do not come into play. Some insurance companies have low-mileage discounts; for example, granting a small discount for traveling less than 5,000 miles per year. But since there are typically only one

or two discount points, such programs only affect the behavior of those whose previous mileage was just above the break point. For example, if you drove 8,000 miles the previous year, you would be unlikely to try to reduce your driving by 3,000 miles just to receive a discount.

This fixed-cost system makes insurance an unusual product, since for most goods and services, we pay more the more we use – providing an inherent disincentive for additional consumption.

The same is likely true for insurance. Making insurance payments dependent on the number of miles driven should yield a real savings to society in gasoline and carbon dioxide emissions, while also reducing accident damages.

Signs of Progress: Car Sharing in Boston

For many urban residents, owning a car can be a costly burden – especially when the car is only needed for occasional errands and not for a daily commute to or from work. Yet conventional car rental is often inconvenient for urban drivers, and with its by-the-day rate structure, often prohibitively expensive.

Enter the notion of car sharing, a form of car rental in which vehicles are rented by the hour, reserved over the Internet, and available in designated parking places in the midst of urban neighborhoods. In the Boston area, Cambridge-based Zipcar has emerged as a leading car-sharing agency, with vehicles in most Boston neighborhoods and in surrounding towns.

Car sharing has numerous environmental benefits. By reducing the need for urban residents to own cars, car-sharing reduces the incentive for individuals to drive their vehicles more in order to justify the cost of car ownership. Zipcar estimates that its members drove more than 5,000 miles per year before joining the service, but less than 400 miles per year afterwards.¹⁶⁸ Car sharing can also reduce the amount of urban land that is devoted to parking, allowing for more compact development.



Car-sharing services such as Zipcar give urban residents access to a car when they need it – without the hassle and expense of owning a vehicle.

Governments and institutions can do a great deal to encourage car sharing. Several Boston-area universities already provide access to car sharing services as a means to reduce parking expenses. And governments can promote car sharing by creating reserved parking spaces for car sharing at transit stops, in municipal parking lots and on city streets, and by reducing parking requirements for new developments that reserve parking spaces for car-sharing services.

Of course, the injuries and damage that result from auto accidents are not solely a function of how many miles people drive. Insurance rates vary greatly depending on the demographic characteristics of drivers, their driving records, and the type of vehicles they drive. For example, rural drivers, though they frequently travel more miles than their urban counterparts, also tend to file fewer insurance claims. Thus, an equitable auto insurance rate structure would use miles driven as just one among many factors for determining rates.

Why don't insurance companies make more use of miles driven in setting rates? One argument is that it would be overly onerous to check and verify odometer readings to verify vehicle travel. However, third-party systems for confirming odometer readings are feasible and some states, such as Massachusetts, take odometer readings during annual safety inspections. Another argument suggests that insurance companies would not benefit from a cents-per-mile system because their profit comes largely from investments, not from premiums themselves. Any policy that reduces the gross income of insurance companies, this theory holds, would reduce investment income – even if the policy also manages to reduce claims.

Despite these concerns, cents-per-mile insurance has the potential to drive significant reductions in vehicle travel. Data from U.S. government surveys and the American Automobile Association (AAA) indicate that insurance is about 12 percent of the total cost of driv-

ing, depending on the vehicle.¹⁶⁹ In urban areas, including many in New England where insurance rates are much higher than the national average, the percentage devoted to insurance is likely higher.

One study estimated the impacts on vehicle travel for a range of mileage-based insurance charges, ranging from 1 to 10 cents per mile. (See Table 2.) The corresponding reductions in travel ranged from 1.8 percent to 15.2 percent – meaning that carbon dioxide emissions from travel would be reduced by about the same amount.¹⁷⁰

It is likely that cents-per-mile charges would be assessed to cover only the portion of the insurance bill that is affected by the amount of driving. Other costs, related to the potential for vehicle theft and other hazards not related to driving, would be collected annually. In Massachusetts, for example, the average cost of collision and liability coverage is about 10 cents per mile.¹⁷² Should even half of that amount be charged by the mile, it would lead to a reduction in vehicle travel of about 8.2 percent.

In addition to reducing VMT, cents-per-mile insurance would likely reduce accidents (particularly by assessing higher cents-per-mile rates to poor drivers, who would have added incentive to stay off the road) as well as highway congestion. In addition, charging insurance by the mile might reduce the financial impact of owning a vehicle for low-income citizens.

One major barrier to the implementation of cents-per-mile insurance is that many states (including Massachusetts and New Hampshire) prohibit it. However, a variety of trial programs in recent years show that cents-per-mile insurance is a workable option, and a number of states are giving the option strong consideration.

The Progressive insurance company, the U.S.'s third-largest auto insurer, has conducted pilot cents-per-mile projects in Texas and Minnesota. The Texas project, which ran from 1998-2001, relied on the use of GPS transponders to report mileage. Drivers were offered discounts based on their mileage and the location of their driving. Progressive reports that the average discount from those reporting their mileage was 25 percent.¹⁷³ In 2004, Progressive launched the "TripSense" program in Minnesota. By March 2005, 2,300 drivers had enlisted in the program by installing the TripSensor, a matchbox-sized device that plugs

Table 2. Travel Reduction Estimates Under Cents-Per-Mile Insurance (2001 Dollars)¹⁷¹

Cents per mile insurance charge	Travel reduction estimate (percent)
1	-1.8%
2	-3.5%
3	-5.1%
4	-6.7%
5	-8.2%
6	-9.7%
7	-11.2%
8	-12.5%
9	-13.8%
10	-15.2%

into their vehicles' on-board diagnostic ports. The sensor records how much, how fast, and when the vehicle is driven and the discount is based on these three factors. Consumers receive a 5 percent discount for installing the sensor, another 5 percent for reporting their data to Progressive, and up to 20 percent in additional discounts depending on their driving patterns.¹⁷⁴

In 2004, GMAC Insurance and OnStar made available a mileage discount program to selected consumers in four states. Consumers are asked to project their estimated annual mileage and are given a discount if they project less than 15,000 miles for the coming year. A couple of months before the policy renewal date, OnStar takes another odometer reading and reports the results to GMAC, which uses the data to determine the discount for the next policy term. Mileage discounts range from 5 percent for those who drive their vehicles between 12,500 and 15,000 miles to 40 percent for those who drive their vehicles less than 2,500 miles per year.¹⁷⁵

In addition to the domestic pilots, insurers in both the United Kingdom and South Africa have considered or experimented with cents-per-mile systems.¹⁷⁶ Several U.S. states have also shown interest in cents-per-mile insurance. In 2003, the Oregon Legislature enacted a bill providing insurers with a \$100 tax credit per policy if they offer cents-per-mile pricing. To date, the state of Oregon is not aware of any insurance companies that have taken advantage of the offer.¹⁷⁷ In addition, the state of Texas enacted legislation in 2001 allowing companies to offer mileage-based insurance; advocates had originally campaigned to require insurers to offer a cost-per-mile option.¹⁷⁸

New England states could take several actions to experiment with cents-per-mile insurance:

- Investigate the link between vehicle travel and accidents by linking existing databases that track the two phenomena.¹⁷⁹
- Give insurance companies the legal authority to offer cents-per-mile insurance where they do not have such authority.
- Provide incentives to insurance companies to offer cents-per-mile insurance.
- Require insurance companies to undertake trial cents-per-mile insurance programs.

Vehicle Risk-Based Insurance Pricing

The growing dominance of light trucks (SUVs, pickups and minivans) is a primary reason why average vehicle fuel efficiency is falling. (See page 8.) Light trucks have come to be favored by automakers in part because they are subject to less stringent regulation with regard to fuel economy and safety.

While fuel economy and safety may not seem related, evidence suggests that SUVs pose a greater danger to other vehicles and their occupants in accidents. And many of the characteristics of SUVs that add to those risks (for example, stiffer frames and greater weight) also reduce fuel economy. By accurately factoring the safety risks posed by SUVs and other light trucks into insurance premiums for those vehicles, consumers would see an additional financial benefit for purchasing automobiles, which are subject to stronger fuel economy standards.

Under current regulations, all cars are required to have frames that are approximately the same height off the ground. In an accident, the frames hit each other and buckle, protecting the occupants of both vehicles. SUVs and most pickup trucks, however, are designed with higher frames, to afford the possibility of going "off-road" (even though few of them are used in this manner). Because their frames are higher than those of cars and minivans, an SUV or pickup frame can ride over the frame of a car in an accident, driving through the car and causing bodily harm or death to the occupants. In addition, rather than having frames that buckle in an accident, most light trucks are built with stiff frames, and with front ends that do not slope downward. These factors are especially dangerous in side-impact collisions.

A number of statistical studies have documented the dangers of light trucks. One study, by economist Michelle White of University of California-San Diego, concluded that, in a two-vehicle accident, the likelihood of a fatality in a car is 38 percent less if the other vehicle in the accident is a car rather than a light truck. In addition, White concluded that accidents in which a light truck hits a pedestrian or cyclist are 82 percent more likely to cause a fatality than similar accidents involving cars.¹⁸⁰ Another study considered two-vehicle collisions in the U.S. from 1995 through 2001.¹⁸¹ Its results, given in the table below,

show the number of deaths per 100,000 crashes caused by the vehicle type shown to occupants of the other vehicle (regardless of type):

Table 3. Number of Deaths Among Occupants of the Other Vehicle per 100,000 Crashes by Type of Vehicle

Large pickups	293
Large SUVs	205
Small SUVs	151
Compact pickups	144
Minivans	104
Large cars	85
Midsize cars	77
Compact cars	60
Subcompact cars	41
Minicars	39

Another study, by researchers from the University of Michigan and Lawrence Berkeley National Laboratory, looked at the risks solely to drivers in two-car accidents, considering both the subject vehicle and the other vehicle, for model years 1995-99. They concluded that about 3,500 fewer people would die each year if 60 to 80 percent of the light trucks had been cars or station wagons instead.¹⁸² The authors found that the “combined risk” of deaths per million vehicle miles was over 200 for pickup trucks, 147 for subcompact cars, 136 for compact cars, 129 for SUVs, around 100 for large and midsize-size cars, and 85 for minivans. Not surprisingly, SUVs pose greater dangers to drivers of other cars (around 60 deaths per million vehicle miles), compared to, for example, 35 for compact cars. Dangers to their own drivers were lower for SUVs (75) than for compact and subcompact cars (100 and 110 respectively) but about the same as for drivers of midsize and large cars.¹⁸³

Auto companies have belatedly begun a small response to the thousands of deaths caused by their vehicles by lowering the frame rails on SUVs or adding an extra “blocker beam” below the front rail to make them less likely to ride over the frames of cars in accidents.¹⁸⁴ In addition, side-impact air bags are becoming a popular option on autos, to protect occupants from being struck by high-riding light trucks, and to protect SUV occupants in rollovers.

“If all drivers had to pay premiums based on their actual likelihood of killing or maiming somebody else, some drivers might choose the less deadly models on the market.”

- Keith Bradsher, formerly *The New York Times*' Detroit Bureau Chief, and author of the book *High and Mighty*.¹⁸⁵

Nevertheless, the pricing policies of insurance companies currently fail to fully take into account the added dangers that SUVs pose to occupants of other vehicles. As a result, individuals who choose to drive smaller, more fuel-efficient automobiles are, in effect, subsidizing purchasers of less-efficient SUVs.

Two companies, Progressive and Farmers, have bucked the industry trend, raising rates for owners of SUVs and pickups. In 1995 and 1996 Progressive raised liability premiums up to 20 percent for the largest SUVs and pickups. “The regular car drivers are subsidizing SUV and pickup drivers on liability insurance,” said Diane Tasaka, a Farmers spokeswoman.¹⁸⁶ But the other major insurers have to date refused to change their ratings systems, and insurance regulators have not encouraged or required them to do so.

The New England states should consider changes to their insurance regulations that would correct this disparity. Most insurance companies use a system for rating vehicle riskiness (weight to horsepower ratio) that fails to penalize light trucks for the dangers posed by their weight and body construction. State agencies could set new regulations that require the companies to take full account in their rates of the true accident liability costs posed by SUVs and pickup trucks.

Parking Reform

Employers, store owners and housing developers often offer free parking to their employees, customers or residents. These businesses then pass on the cost of providing parking by paying lower wages or charging higher prices, affecting drivers and non-drivers alike. In many cases, requirements that businesses provide an abundance of parking spaces are enshrined in local zoning laws.

The treatment of free parking by zoning laws (and, often by the tax code and by general custom) is in contrast to the treatment of public transportation or other transportation alternatives. Local zoning laws, for example, generally do not require developers to offer a transit alternative as a condition of site plan approval. And many employers do not provide subsidies of equivalent value to employees for using transit or other alternatives to single-passenger commuting.

There are several ways to resolve this inequity, including by charging employees the full value of their “free parking” or offering subsidies of equivalent value for carpooling or transit use. In addition, localities can reform their zoning laws to reduce parking requirements for businesses or establish local caps on the number of parking spaces available in the community. (For more on zoning reform, see page 29.)

Parking Fees

The value of free parking to commuters is significant. One study estimated that the value of employer-paid parking averages 4.8 cents per mile driven.¹⁸⁷ In comparison, the American Automobile Association (AAA) estimates that operating a medium size car costs 11.5 cents per mile (including fuel and maintenance costs, but not the purchase price).¹⁸⁸ Based on these figures, charging for parking would add about 40 percent to the cost of commuter driving – enough to substantially impact driving habits.

Employer-paid parking is also very widespread. By one estimate, only 5 percent of automobile commuters pay for parking at their worksites.¹⁸⁹

Increasing parking costs could be expected to have a small, but potentially significant impact on parking demand and, ultimately, vehicle travel. A variety of studies have yielded parking elasticities (the change in demand resulting from a change in price) ranging from -0.1 to -0.6, with -0.3 being the most common value. This means, for example, that a 10 percent increase in parking charges would yield a 3 percent drop in parking demand.¹⁹⁰

In one study of seven workplaces that created parking fees, the percentage of people driving to work dropped from 72 to 53 percent.¹⁹¹ Another survey compared transportation demand programs that imposed market rate prices for parking versus nominal charges or

no charge at all. Worksites with market rate parking prices had 32 percent fewer trips than sites in the surrounding area. Sites with nominal parking charges had 18 percent fewer vehicle trips, while sites with no parking charges (but other TDM programs) had only 8 percent fewer trips.¹⁹²

If raising prices for single-occupancy vehicle (SOV) parking is combined with reduced fees or other subsidies for carpools, vanpools, or ridesharing, then the reduction in SOV parking may cause a shift to these other modes (high-occupancy vehicles, or HOVs). “Of eight case study sites in the Los Angeles area, the SOV mode share decreased by 13 percentage points on average, HOV mode share increased by 9 percentage points, and transit mode share increased by 3 percentage points.”¹⁹³

The impact of parking charges is magnified when workers also have access to transit. One group of estimates found that the reduction in SOV travel varied from 10 percent where transit was weakest (suburbs of small cities with low-quality transit) to 36 percent where transit alternatives were strongest.¹⁹⁴

The assessment of parking fees by employers should be considered as one means to achieve commute-trip reduction goals (see page 35.) Another strategy is to provide cash payments or subsidies of equal value to free parking for the use of transit or other alternatives.

Parking “Cash Out” and Transit Subsidies

Some employers already provide subsidies to employees for transit use or other transportation alternatives, such as vanpooling. As of 2002, the IRS allowed transit subsidies as a non-taxable benefit up to \$100 per month.¹⁹⁵ Such subsidies can be an important part of employer-based commute trip reduction programs. (See page 35.)

Another option, implemented by California, is to “cash out” free parking by granting employees a cash benefit equivalent to the cost of parking. California enacted “parking cash-out” legislation in 1992 that requires some employers to allow employees the option of a cash payment instead of subsidized parking. The law is limited to large employers in air quality non-attainment areas who subsidize parking and can reduce the number of parking spaces leased without

penalty. One study of eight affected employers found that on average the SOV mode share was reduced by 12 percentage points due to the law.¹⁹⁶

Parking Limits

Several cities, including Bellevue, Washington and Cambridge, Mass., have implemented laws and regulations that limit the number of parking spaces that can be provided for new commercial and industrial buildings – reversing the typical tendency of local zoning laws to force the construction of more parking spaces than are truly necessary.

Bellevue: Bellevue is a suburb of Seattle with a densely-populated central business district (CBD). Since 1979, the city has restricted parking for new buildings to 2.7 spaces per 1,000 square feet, compared to the pre-1979 minimum of 5.0 spaces. The city's plan also included enhanced bus service. These policies reduced the number of workers driving to work alone. For example, the US West office in Bellevue provided lower-priced parking to carpools, but charged market rates for drivers traveling alone. More importantly, the company restricted parking for solo drivers to just one-quarter of the 408 garage spaces and made them available on a first-come-first-serve basis. Due to this program, only 26 percent of US West employees drove alone, 45 percent carpooled, 2 percent vanpooled, and 13 percent used public transit. Planners calculated a worst-case vehicle trip rate for the company of 0.57 per employee, 31 percent lower than the 0.83 percent average for downtown Bellevue.¹⁹⁷

Cambridge: Cambridge, Mass. passed a Vehicle Trip Reduction Ordinance in 1992 and a Parking and Transportation Demand Management (PTDM) Ordinance in 1998. The PTDM ordinance requires most new commercial buildings, or those that increase their parking spaces, to create a TDM plan. The plan must include a commitment to implement vehicle trip reduction measures such as subsidized transit passes, shuttle services, ride-sharing services, bicycle and pedestrian facilities, flexible working hours, and preferential parking for low- or zero-emission vehicles. In addition, the company must make a “commitment to establish and make reasonable efforts to achieve a specified, numerical reduction (or percent reduction) in single-occupant vehicle trips in and around Cambridge.”¹⁹⁸

Cambridge estimates that as of 2004, for the first 14 projects monitored, the two ordinances were responsible for reducing car travel by 22.1 million miles annually, preventing 11,300 tons of global warming pollution.¹⁹⁹

Other Subsidies for Driving

Insurance and parking are just two of many potential costs that can be reallocated in ways that promote fairness and discourage excessive driving. However, there are many other hidden subsidies that promote driving:

- **Road construction, maintenance and operation** – While federal and state gasoline taxes are a major source of funding for roadway repairs and maintenance, they do not come close to paying the entire bill. According to the Federal Highway Administration, federal, state and local governments spent more than \$36 billion in general funds and other revenues (that is, funds generated from sources other than fuel taxes, tolls and vehicle taxes) on highway-related expenses in 2003.²⁰⁰ By way of comparison, this \$36 billion outlay is greater than *the entire gross national expenditure for mass transit* in 2002 – including both operating and capital expenses, and not including the more than \$8 billion in transit expenses recovered from passengers through fares.

- **Environmental and social costs** – Automobiles produce a variety of negative environmental and social impacts that are not reflected in the price of driving. Air pollution, noise pollution, water pollution, wildlife impacts, land consumption, and impacts from the disposal of vehicle waste are among these impacts. In addition, automobiles impose social costs, such as impacts on property values, uncompensated health and economic productivity impacts from accidents and congestion.

- **Fuel subsidies** – A number of direct and indirect subsidies support the production and distribution of petroleum-based fuels for vehicle use. One 1996 study estimated the cost of tax subsidies to the petroleum industry of between \$3.3 billion and \$10.9 billion annually.²⁰¹ Additional costs, also totaling in the billions of dollars, can be attributed to military and security expenditures designed to ensure the continued supply of oil from overseas.

There are numerous public policy tools that can be used to reduce these inherent subsidies for driving – among them, “congestion pricing” schemes that seek to monetize the additional congestion caused by drivers at peak periods and gasoline or carbon taxes designed to internalize the contribution of motor vehicles to global warming. New England states should consider these and other measures to ensure that automobile drivers pay their fair share of the costs they impose on other segments of society.

REVAMPING TRANSPORTATION PLANNING AND FINANCE

Key Recommendations:

- *Consider the adoption of least-cost criteria in transportation planning.*
- *Include consideration of global warming impacts in transportation decision-making.*
- *Take advantage of available opportunities to better fund transit and other transportation alternatives.*

For decades, transportation planning has emphasized “supply-side” solutions to transportation problems. In other words, when congestion emerges on a highway, the reflexive response is to expand the highway, not to reduce demand or shift demand to other modes of transportation. In recent years, transportation planners have come to question this approach on both economic and environmental grounds by showing that highway expansion often leads to land-use patterns and other decisions that encourage more driving – eventually leading to the reemergence of congestion.

But while this approach to transportation planning is deeply ingrained, it is not the only possible approach – nor is it the most effective one. A more balanced transportation planning process that considers both a range of supply-side options as well as demand management is more likely to yield a transportation system that supports sustainable development and is less costly to taxpayers. In addition, states must revamp their transportation planning processes and funding decisions to recognize the impact that transportation makes on the climate and to support alternatives to automobile travel more aggressively.

Least-Cost Planning

Least-cost planning promotes a more balanced approach to transportation planning by including transit and reduced travel demand as serious options for meeting mobility needs. By adopting least-cost planning as the framework for measuring choices that will determine future transportation options, New England states could reduce global warming pollution and spend transportation funds more wisely.

Principles of Least-Cost Planning

Least-cost planning ensures that all transportation options (including demand management) are considered in transportation planning and identifies those that best improve mobility at the lowest total cost. Often, the cheapest option will also be the one that produces fewer global warming emissions. For example, widening a freeway to allow more people to drive to work at the same time can relieve (though often only temporarily) pressure on a crowded road. Alternatively, operating commuter rail trains more frequently, increasing the number of people who carpool, and working with employers to promote telecommuting can achieve the same improvements.

Determining the cheapest option requires first establishing the goal the transportation system will be designed to serve. Then, planners must assess the long-term costs and benefits of different projects. Factors that may be considered include the cost to governments to build a road or rail line, the expense of operating transit services or a vanpool program, and the cost of alternative air quality mitigation measures to offset pollution from transportation. Costs and benefits that accrue to consumers and businesses should be considered in addition to governmental costs. For example, consumers bear the cost of vehicle ownership and benefit from having alternatives to driving. Reducing congestion and the amount of time lost in traffic is a benefit for consumers and for businesses that ship goods. Businesses also save money when employees and customers need fewer parking spaces. Finally, vehicle-centered transportation and land-use systems impose environmental costs such as air and water pollution.

Least-cost planning must be practiced in such a way as to balance long-term costs and benefits – not merely minimize short-term costs. For example, some forms of transit, such as rail, are capital intensive to build,

but yield a variety of important benefits, including air pollution reductions, reductions in highway congestion, and support for compact, sustainable forms of development. Moreover, the benefits of capital investment in rail accumulate over a long period of time – New England, for example, continues to benefit from rail investments made over a century ago. These long-term benefits must be included in any least-cost planning decisions in order to derive the “right” mix of transportation investments for any particular region.

Benefits of Least-Cost Planning

Least-cost planning requires planners to evaluate a broad range of options for meeting future transporta-

tion needs and to consider all the impacts of each choice. It offers an opportunity to anticipate a community’s needs and evaluate policies and projects that will meet demand for not only mobility – the primary measuring stick by which highway projects are evaluated – but also clean air, lower private costs, hassle-free commutes, and mobility for those who cannot drive.

Often, after considering all these factors, the least expensive policy for meeting transportation needs will be reduced travel demand. Reduced travel demand can be achieved through a range of policies such as commute trip reduction, compact development, and rescheduling trips to occur at off-peak times. Reduced travel also reduces global warming emissions.

Issues in Focus: The Cost of Transit versus Highways

One common objection to least-cost planning is that it might produce a bias against investments in public transit that, while capital intensive, provide multiple environmental and other benefits for the long term.

There is a kernel of truth to the argument: by prioritizing transportation projects that provide maximum “bang for the buck,” least-cost planning can alter the current bias in favor of large capital projects for both transit *and* highways in favor of frequently ignored transportation solutions such as demand-reduction efforts, preventive maintenance, and improvements of service on existing facilities.

But, if implemented properly, there is no reason that least-cost planning should be biased against transit versus highways. In fact, the opposite should be true, for several reasons:

- True least-cost planning includes the negative environmental and social impacts of transportation projects, which are typically less severe for transit projects than for highway projects.
- True least-cost planning includes private as well as public expenditures in evaluat-

ing the costs of a given project. The costs of providing transportation services along a highway, for example, are far greater than the cost of laying asphalt – they also include the cost of purchasing, fueling and maintaining private vehicles, providing parking, and providing ongoing maintenance and traffic law enforcement.

- True least-cost planning considers the ripple effects of projects on other parts of the transportation system. A new highway, for example, will often generate traffic that creates congestion at other points of the system. Transit projects often have the opposite effect of reducing congestion on other transportation facilities.
- Least-cost planning is most useful when carried out over the long-term and when the goals established for the transportation system are clearly defined, devised with the participation and input of the public, and include not just traditional measures of mobility, but also measures of access to transportation and broader community health and well-being. This more holistic view of the role of transportation often favors transit.²⁰²

Bright Ideas from Elsewhere: Least-Cost Planning in the Puget Sound Area

The state of Washington requires that regional transportation planning organizations use least-cost planning when developing transportation plans.²⁰³ Planners are to consider both the direct and indirect costs of demand and supply. A planning document developed by the Puget Sound Regional Council (PSRC) demonstrates the potential of least-cost planning to weigh a variety of factors and help reduce global warming emissions.

The PSRC revised its planning document in 2000 using least-cost planning to evaluate alternatives for serving the increased transportation needs of a growing population. PSRC created four scenarios for meeting future demand:

- 1) An update of an earlier plan that included a variety of transit options, compact development, and building 1,240 regular lane miles and 403 HOV lane miles of highway.
- 2) The option above with only those projects for which funding had been identified or secured. This scenario would build relatively little transit, and 151 regular lane miles and 72 HOV lane miles.
- 3) A plan that greatly boosts transportation capacity, including a significant transit component and 641 lane miles and 53 HOV lane miles.

- 4) The first option above with an emphasis on improving system performance by reducing highway demand. The plan would include additional transit infrastructure, route areas and operating hours, and would add 52 regular lane miles and 157 HOV lane miles of highway. Pedestrian and bicycling facilities also would be expanded. Land-use policies would steer development to locations that can be served by transit and increase densities in targeted areas.²⁰⁴

Using money and time as measures, PSRC calculated the cost-per-trip of each option. The fourth, more transit-oriented alternative proved to be cheapest. (Notably, the public cost of Option 4 was significantly higher than the more highway-oriented options, but the private savings more than outweighed those additional costs.) Most expensive were the second and third choices, the second because it provides little benefit and the third due to high costs. (See Table 4.) Over the 30 years covered by the plan, these seemingly small differences in new trip costs add up to \$3 billion.²⁰⁵

PSRC did not evaluate global warming emissions from the different options, but the options involving more road construction would increase car travel and thus emissions. Those are also the options that proved the most expensive. Had PSRC included global warming emissions as another cost of each plan, the differences might have been even greater.

Table 4. Selected Per-Trip Costs of Different Transportation Plans Evaluated with Least-Cost Planning²⁰⁶

	Option #1	Option #2	Option #3	Option #4
Public Cost	\$0.60	\$0.30	\$0.83	\$0.80
Congestion Cost	\$0.21	\$0.47	\$0.14	\$0.18
Pollution Cost	\$0.06	\$0.10	\$0.04	\$0.04
Consumer Cost	\$0.66	\$0.78	\$0.70	\$0.59
Travel Time Cost	\$0.73	\$0.71	\$0.66	\$0.62
Total Cost	\$2.26	\$2.36	\$2.37	\$2.23

The concept of integrated or least-cost planning originated in the electric industry, where decision makers have long realized that reducing demand through efficiency and conservation can be less expensive than building a new power plant and will achieve the same end of delivering reliable power to everyone. Least-cost planning is newer to the transportation sector. It is currently in use in Washington state, and has been partially adopted elsewhere.

Considering Global Warming Emissions in Transportation Planning

A criterion that planning agencies should include when evaluating growth, land use, and transportation options is what impact different options will have on global warming. Whether a community decides to use least-cost planning or to continue with traditional plan evaluation methods, global warming should be a factor in the decision.

In New England, Massachusetts has begun to incorporate global warming emissions as one of many factors to be considered in planning. In spring 2004, Massachusetts announced that, as part of the state's climate protection plan, it would "include energy use and [greenhouse gas] emissions data as criteria in transportation decisions."²⁰⁷ To date, the state has created detailed instructions to help regional agencies evaluate emissions impacts.²⁰⁸ Though regional agencies are not required to include reduced global warming impacts as one of their transportation goals, all agencies in the state have voluntarily adopted the target.

Maine adopted the "Sensible Transportation Policy Act" in 1991 to update the state's transportation planning policies. The goal of the law is to reduce the extent to which Maine's transportation planning is separated from the comprehensive planning process that governs land use and to protect the state's economy by reducing dependence on foreign energy supplies.²⁰⁹ The law requires that non-road construction alternatives be considered in the planning process and be given preference, a stipulation that, if more rigorously applied, could help the state focus more on transit and alternatives to driving.

Funding Transit and Alternatives to Driving

Once a state has developed a transportation plan, complete with transit options and support for other alternatives to driving, it must be funded. States can draw on a variety of funding sources, including federal transit funding, federal flexible funds that can be applied to road projects or transit, and a variety of state-level revenue sources. State funds provide the bulk of transit funding in Connecticut, Massachusetts and Rhode Island, but Maine, New Hampshire, and Vermont are more reliant on federal funds.²¹⁰

Federal Funding

The federal government offers significant funding for transportation projects. Fortunately, states have a large amount of freedom in choosing how they spend their federal transportation funding and can use federal transit and highway funds to support transportation projects that will reduce greenhouse gas emissions.

TRANSIT FUNDING

The Federal Transit Administration (FTA), a division of the Department of Transportation, is the largest source of funding for states interested in developing and supporting transit systems that offer alternatives to driving. For 2005, the FTA allocated \$7.2 billion for transit, with \$5.6 billion designated to provide ongoing support to existing transit systems and \$1.6 billion set aside for the construction of new transit projects.²¹¹

The FTA allocated \$1.4 billion to new transit programs in 2005 through its New Starts Program.²¹² These funds are dedicated to the construction of new transit systems or significant expansions of existing systems, such as the addition of new service lines. New England states have made significant use of New Starts funding. The Massachusetts Bay Transportation Authority is using \$571 million in New Starts money spread over multiple years to pay for 60 percent of the cost of a tunnel for its Bus Rapid Transit Silver Line expansion, raising the remaining 40 percent from local bonds.²¹³ Similarly, the Vermont Agency of Transportation used New Starts funding to improve rail infrastructure in the Burlington area.²¹⁴

FLEXIBLE FUNDING

Flexible funding, or funding that can be used for either highways or alternatives to driving, is an underused yet large source of funding for state and local governments. Flexible funding gives states the option of using a portion of their Federal Highway Administration (FHWA) funds for transit or pedestrian and bicycle programs. Of the \$190 billion the federal government spent on transportation between 1992 and 1999, almost \$50 billion, or 26 percent, was in the form of flexible funds.²¹⁵

Flexible funding comes from two main sources in the FHWA. One is the Congestion Mitigation and Air Quality Improvement (CMAQ) Program. CMAQ funds are dedicated for transportation projects that will reduce air pollution in areas that fail to meet air quality standards.²¹⁶ The other source is the Surface Transportation Program (STP), which, in addition to funding pedestrian and biking projects through a program called Transportation Enhancements, funds a variety of transit projects.

New England states have used flexible funds for a variety of projects. In 2002, Connecticut used over \$5 million in CMAQ flexible funds to purchase buses, while Vermont used \$1.3 million in STP funds for a commuter rail project.²¹⁷ The city of Windham, Connecticut used \$800,000 in Transportation Enhancements money (a dedicated set-aside program within STP) and \$200,000 in local funds to make its streets more bicycle and pedestrian friendly, while Milford, Massachusetts used a similar combination of funding to build a bicycle and pedestrian trail.²¹⁸ New England states have also been able to use flexible funding budgeted for the Transportation and Community and System Preservation Pilot Program, which received \$90 million in funding in 2003. Funding for this program has been used in New England to make communities more pedestrian and bicycle friendly.²¹⁹

However, only a fraction of flexible funds are used for alternatives to driving. Vermont has been the most aggressive state in the region for using flexible funds to support transit. Between fiscal year 1998 and fiscal year 2004, Vermont used \$44 million in flexible federal funding for transit, or 22 percent of all the state's flexible funds. Vermont attributes some of its focus on transit to a long-standing effort to improve transportation for senior citizens and the disabled.²²⁰ By contrast, New Hampshire allocated only 5 percent of

its flexible funds to transit, for a total of only \$10 million.²²¹ (See Table 5.)

Interestingly, Massachusetts was identified in a 2000 Brookings Institution study as a national leader in the use of flexible funds for transit.²²³ But the percentage of funding used for transit in the state has dropped considerably in recent years.

States also have the opportunity to use flexible funds to support bicycle and pedestrian infrastructure programs, yet, nationally, few states have taken advantage of this opportunity. In 2005, for example, excluding funds from the Transportation Enhancements program (which is designed to promote pedestrian and bicycling projects as well as other cultural, historic preservation and environmental programs), states spent only \$86 million nationwide from other flexible funds on these projects.²²⁴

The availability of flexible federal funding provides a golden opportunity for states to promote strategic investments in transit and other transportation alternatives. While some New England states appear to be taking better advantage of that opportunity than others, all should consider devoting more of these resources to transportation strategies that will reduce automobile dependence and global warming pollution.

State Funding

State funding can play an important role in bringing about transportation programs that reduce greenhouse gas emissions. The New England states vary widely in their support for transit programs. Massachusetts directs significant state funding to transit while New Hampshire spends almost nothing. By using a variety of funding sources, states can increase their support for transit and alternatives to driving.

Table 5. Amount and Percentage of Flexible Funds Used for Transit by State, FY 1998-FY 2004 ²²²

	Flexible Funds Used for Transit	Pct. Of Flexible Funds
Connecticut	\$75,837,740	15%
Maine	\$27,985,693	13%
Massachusetts	\$88,415,297	11%
New Hampshire	\$10,200,400	5%
Rhode Island	\$26,361,816	13%
Vermont	\$44,089,727	22%

USING DRIVER TAXES AND FEES TO PAY FOR DRIVING ALTERNATIVES

While the mix of transportation funding sources is unique for each New England state, most states rely on a combination of general funds as well as taxes and fees collected from drivers. General funds include bonds and general tax revenue, while driving-related fees include gasoline taxes, motor vehicle fees and toll receipts.

All of these revenue sources are potential funding sources for transit and for pedestrian and cycling improvements. Though some argue that driving-related fees and taxes should be applied to road construction and maintenance expenses only, broader use of this revenue is sensible, for two key reasons. First, gas and vehicle fees provide revenue by taxing an activity with negative public impacts, such as air pollution. Using driving-related revenue to fund transit can help mitigate some of the consequences of driving. Second, improvements to bus and rail transit ease pressure on highways and roads, reducing the need for expensive road construction projects.

Massachusetts applies driving-related fees to transit services, and Rhode Island spends one-quarter of its gas tax revenue on transit.²³⁰ Unfortunately, not all New England states are as flexible in their use of driving-related fees. For example, New Hampshire's constitution requires that gasoline tax proceeds be used to pay for the state's highways only, prohibiting gas tax receipts from being used on transit and other alternatives to driving.²³¹ A similar limit on the use of state highway tax income restricts Maine's ability to fund transit.²³² This policy tilts transportation options toward driving and away from modes with lower global warming emissions.

Shifting toward less carbon-intensive modes of transportation will require public investment – although the benefits of that investment in cleaner air, reduced congestion and improved quality of life should more than cover the costs. States should work to eliminate legal barriers and outmoded practices that prevent them from putting adequate capital into the development of effective transportation alternatives.

Signs of Progress: Using Driving-Related Fees to Support Transportation Alternatives

Vermont is an example of a state that has successfully used driving-related fees to encourage alternatives to driving. The state collects \$240 million annually through motor vehicles fees and gasoline taxes.²²⁵ Of this income, \$68 million is directed to other programs, such as education. The remaining money is then complemented with \$128 million in federal and local funds to pay for the state's \$300 million annual transportation expenditures. Of this spending, 13 percent is spent on alternative modes of transportation.²²⁶ As a result, Vermont has the second-highest per-capita spending on bicycle and pedestrian programs in the country.²²⁷

The use of state and federal funds to support bicycling and pedestrian facilities has paid off. A total of 6 percent of Vermont residents now commute to work by walking or

bicycling.²²⁸ And Burlington, Vermont has been recognized by the League of American Bicyclists as one of 51 "Bicycle Friendly Communities" nationwide – one of only two communities in New England (the other being Brunswick, Maine) to earn the honor.²²⁹

Sandy Ridlington



Dedicated bicycle lanes and well-marked bike lanes on city streets can increase the number of commuters who feel comfortable riding their bikes to work or to transit.

ADDITIONAL OPTIONS FOR REDUCING GLOBAL WARMING EMISSIONS FROM TRANSPORTATION

The 20 “bright ideas” highlighted here are by no means the only options for reducing the impact of New England’s transportation system on global warming. There are several other policy tools that states could consider to reduce global warming emissions and address other energy-related problems.

Increased gasoline tax/petroleum conservation charge. The recent spike in gasoline prices has been painful for many New Englanders, but it has achieved one thing: it has convinced many people to drive less, to drive more carefully, and to use other transportation alternatives.

Preliminary data from the Federal Highway Administration suggest that the number of vehicle-miles traveled on New England highways decreased in 2005 for the first time in more than a decade, due in large part to the major jump in gasoline prices following Hurricanes Katrina and Rita.²³³ During October 2005, for example, when gasoline prices averaged more than \$2.50 per gallon, the number of vehicle-miles traveled in New England dipped by more than 6 percent compared to the year before.²³⁴ Meanwhile, transit ridership increased by more than 3 percent nationally in the third quarter (July through September) of 2005 compared to the previous year.²³⁵

Recent research suggests that every 10 percent increase in gasoline prices leads to a 1 percent reduction in fuel consumption in the short term.²³⁶ Even greater long-term reductions are possible from consumers’ decision to switch to more fuel-efficient vehicles.

An increase in the gasoline tax would continue this shift toward more efficient driving habits, even if the price of gasoline recedes. Such an increase would be even more effective if the revenues were placed into a “petroleum conservation fund” that would be used to provide incentives for the purchase of more fuel-efficient vehicles, increase funding for mass transit, and promote other strategies to reduce fuel consumption and global warming emissions. A similar strategy has been used since the late 1990s to promote the more efficient use of electricity through small “systems benefit charges” on consumers’ electricity bills.

New England states should consider the appropriate level of taxation on gasoline and other motor fuels in light of the need to reduce the dependence of the region’s transportation system on fossil fuels and reduce global warming emissions. States such as New Hampshire and Maine that currently restrict the use of gasoline tax revenue for transit and other transportation alternatives should reconsider those restrictions.

Renewable fuel standards. One way to reduce fossil fuel dependence and global warming emissions would be for states to require that a certain percentage of motor fuel come from renewable sources, such as biomass-based ethanol or biodiesel. The state of Minnesota, for example, will require that 20 percent of gasoline consist of ethanol by 2013 and has just implemented a requirement that 2 percent of the state’s diesel fuel consist of “biodiesel.”

New England states considering such an approach should ensure that the standard delivers the maximum environmental benefit. First, there is evidence that ethanol (particularly when used in low concentrations in gasoline) and biodiesel may increase emissions of some air pollutants. Any renewable fuels strategy should ensure that the region’s air quality is not negatively affected. Second, the states should encourage, wherever possible, the development of cellulosic ethanol from plant wastes and energy crops, rather than today’s more common corn-based ethanol. Cellulosic ethanol has been shown to deliver far greater global warming emission and energy benefits than corn-based ethanol.²³⁷

Federal vehicle fuel economy standards. Increasing vehicle fuel economy is one of the most effective ways to reduce global warming emissions from vehicles. Unfortunately, states are prohibited from adopting their own vehicle fuel economy standards under federal law. New England officials should use the tools they have available – such as financial incentives – to encourage improvement in the fuel economy of vehicles on the region’s roads. But they should also push Congress to improve federal fuel economy standards to at least 40 miles per gallon over the next decade.

NOTES

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THE NEW ENGLAND CLIMATE COALITION

The New England Climate Coalition (NECC) is a coalition of state and local environmental, public health, municipal and religious organizations concerned about the effects of global warming. NECC supports reductions in emissions of global warming gases sufficient to protect the region's environment and economy from the dangers posed by global warming.

For more information about NECC visit our web site at www.newenglandclimate.org, or contact the following NECC founding organizations:

Connecticut

- Clean Water Fund, 645 Farmington Avenue, 3rd Floor, Hartford, CT 06105, 860-232-6232, www.cleanwateraction.org/ct
- ConnPIRG Education Fund, 198 Park Road, 2nd Floor, West Hartford, CT 06119, 860-233-7554, www.connpirg.org

Maine

- Natural Resources Council of Maine, 3 Wade Street, Augusta, ME 04330, 207-622-3101, www.maineenvironment.org
- Environment Maine Research & Policy Center, 39 Exchange St., #301, Portland, ME 04101, 207-253-1965, www.environmentmaine.org

Massachusetts

- Clean Water Fund, 262 Washington St., Room 301, Boston, MA 02108, 617-338-8131, www.cleanwateraction.org/ma
- MASSPIRG Education Fund, 44 Winter Street, 4th Floor, Boston, MA 02108, 617-292-4800, www.masspirg.org
- Massachusetts Climate Action Network, 86 Milton St., Arlington, MA 02474, 781-643-5911, www.massclimateaction.org

New Hampshire

- Clean Water Fund, 163 Court St., Portsmouth, NH 03801, 603-430-9565, www.cleanwateraction.org/nh
- NHPIRG Education Fund, 30 S. Main St., Suite 101, Concord, NH 03301, 603-229-3222, www.nhpirg.org

Rhode Island

- Clean Water Fund, 741 Westminster St., Providence, RI 02903, 401-331-6972, www.cleanwateraction.org/ri
- RIPIRG Education Fund, 11 South Angell Street, #337, Providence, RI 02906, 401-421-6578, www.ripirg.org

Vermont

- Vermont Public Interest Research & Education Fund, 141 Main St., Suite 6, Montpelier, VT 05602, 802-223-5221, www.vpirg.org