



A report by the University of Vermont Transportation Research Center

Future Surface Transportation Financing Option: Challenges and Opportunities for Rural States

Report # 09-003 | May 2009

Future Surface Transportation Financing Options: Challenges and Opportunities for Rural States

**UVM Transportation Research Center &
The Snelling Center for Government**

May 1, 2009

Prepared by:
Jennifer Kenyan
Karen Glitman
Glenn McRae

Transportation Research Center
Farrell Hall
210 Colchester Avenue
Burlington, VT 05405
Phone: (802) 656-1312
Website: www.uvm.edu/transportationcenter

The Snelling Center for Government
130 S. Willard Street
Burlington, VT 05401
Phone: (802) 859-3090
Website: www.snellingcenter.org

i. Acknowledgements

The Project Team would like to acknowledge the efforts of Lisa Aultman-Hall and funding from the US DOT Research, Innovation and Technology Administration

ii. Disclaimer

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the UVM Transportation Research Center. This report does not constitute a standard, specification, or regulation.

Table of Contents

Acknowledgements & Disclaimer.....	ii
List of Tables	iv
1. Introduction.....	1
2. Research Methodology	2
3. Conditions of Surface Transportation Infrastructure and Funding.....	3
3.1. National	3
3.2. Vermont	10
4. Transportation Funding Approaches	13
4.1. Traditional Revenue Sources	13
4.2. Framing Innovative Financing	15
5. Funding Mechanisms.....	16
5.1. User Fees	16
5.2. User Benefit Assessments/Value Capture	22
5.3. Debt Financing and Bonds.....	24
5.4. Public-Private Partnerships	27
5.5. Regional/Inter-Municipal Financing	27
5.6. Emissions Fees	28
5.7. Road Utility Fees.....	28
5.8. Miscellaneous Fees.....	29
6. Modeling	30
6.1. State Characteristics for Consideration.....	30
6.2. Additional Challenges	31
7. Discussion and Future Research Needs.....	36
References.....	38
Appendices	
A. Residential Density Map: Vermont	41
B. Residential Density Map: Rhode Island.....	42
Abbreviations, Acronyms, and Symbols.....	43

List of Tables

Table 3-1. National Transportation System Extent, 2006.....	9
Table 3-2. Vehicles and Conveyances, 2006.....	9
Table 3-3. Commuting (percentage of workers), 2006	9
Table 3-4. Vermont Transportation System Extent, 2000.....	11
Table 3-5. Vermont Vehicles and Conveyances, 2000	11
Table 3-6. Vermont Commuting (percent of workers), 2000.....	11
Table 3-7. Vermont Road Conditions (miles), 2005.....	12
Table 3-8. Vermont Road Bridge Conditions, 2005.....	12
Table 4-1. Federal Excise Rates on Tires	21
Table 6-1. Population under age 18 and 65 and older: 2000 and 2030	33
Table 6-2. Total Tallies of Disability for People 5 Years and Older, Vermont, 2000.....	34
Table 6-3. Vermont Low Income Population, 1999.....	35

1. Introduction

The funding of America's transportation system is a complex process that includes a number of stakeholders, both private and public. The federal gas tax has been a major contributor to the funding of transportation projects— even those planned, designed and constructed by individual states. The cost to maintain, and preserve, the current national transportation system is well documented and has eclipsed the amount of funds available under the current financing structure. ^[1] In short, our transportation system is failing and so is the national system that funds it. Much of the current literature on transportation funding warns that failure to fund transportation infrastructure can lead to major consequences, as transportation plays a significant role in the national, state, and local economies for access to jobs, recreation, education, healthcare, and the shipment of goods. This situation is also true in Vermont where the challenges of small population, small tax base, rural setting and aging infrastructure have exacerbated the problem.

The federal gas tax (and most state gas taxes) is a fixed amount per gallon, not indexed for inflation. This has been long known as a weak revenue structure to transportation professionals. New environmental, economic and transportation policies seek to increase fuel efficiency for vehicles and encourage alternative fuels. The success of these policies will cause revenues from the gas tax to decrease. This paradox of conflicting policies is not widely observed in the public discourse. As the public becomes increasingly engaged in the debate over how the post-gas tax transportation system will be funded there is a need to construct a better framework so that the current financing structure and options can be readily displayed and made accessible to the public and to policy makers.

At the national level, the Commission on National Surface Transportation Policy and the Revenue Study Commission are considering short and long-term alternatives to replace or supplement the gasoline and diesel tax as the principal revenue source to support the Federal Highway Trust Fund (HTF) over the next 30 years. Actions are also being initiated on the state level in a number of states, in part to meet immediate resource shortfalls, but also to test new revenue systems for longer-term deployment. The outcomes of these various deliberations and experimentation inform this report and how it addresses questions such as:

1. How are other states and nations preparing themselves for a post gas tax world?
2. What are the differences between options that are being proposed for federal funding compared to options proposed for state funding?
3. Which new systems are in discussion at the federal level and do they include specific accommodations for small, rural states?
4. Which states might pursue similar alternative future financing procedures similar to those in Vermont?
5. What methods are proposed elsewhere to capture revenue from non-residents traveling on roads?
6. What types of road pricing schemes are being pursued in rural versus urban areas?
7. What types of private-public partnerships are being pursued in rural versus urban areas?

2. Research Methodology

A national and international review of current and proposed funding practices was conducted through literature review, web data collection, attendance at conferences and phone interviews and the results are synthesized in the following report.

3. Conditions of Surface Transportation Infrastructure and Funding

3.1. National

The Highway Revenue Act of 1956 established the Federal HTF for the direct purpose of funding the construction of an Interstate System and aiding in the finance of primary, secondary, and urban routes, what are also commonly known as the federal-aid highways. At the time, this Act increased the tax on gasoline. Each time the Congress has extended the HTF, it has also extended the Federal excise tax on gasoline.

Prior to the creation of the HTF, Federal motor fuels taxes were not deposited into a dedicated fund, but instead were pooled with the General Fund. Similarly, cash to pay for obligations incurred for the Federal highway program came from the General Fund of the Treasury. Today, the HTF contains a Highway Account and a Mass Transit Account. Funding for the Mass Transit Account, added in 1983, is also financed by taxes paid by highway users, including funds received by the tire tax, truck sales tax, and heavy vehicle use tax.

On August 10, 2005, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed into law for the years 2005-2009 with guaranteed funding of \$244.1 billion for highways, highway safety, and public transportation. The two landmark bills that brought surface transportation into the 21st century—the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21)—shaped the highway program to meet the Nation's changing transportation needs. SAFETEA-LU builds on this firm foundation, supplying the funds and refining the programmatic framework for investments needed to maintain and grow our vital transportation infrastructure. ^[2]

Federal funds for states are determined in two ways under SAFETEA-LU; first, individual programs receive federal-aid highway funds through an apportionment formula based on proscribed factors. Additionally, the Equity Bonus provision created under SAFETEA-LU distributes additional funds to states based on equity concerns, replacing the Minimum Guarantee condition under TEA-21, the transportation bill preceding SAFETEA-LU.

Distribution of funds for the Equity Bonus are determined by three factors:

- States are guaranteed a minimum rate of return on its share of contributions to the Highway Account of the Highway Trust Fund;
- States receive a minimum increase based on the average dollar amount of apportionments under TEA-21; and,
- Certain states will receive the share of total apportionments and Highway Priority Projects they received under TEA-21.

SAFETEA-LU identifies 12 programs with formulas that determine the distribution of federal funds to states, plus the Equity Bonus:

- Interstate Maintenance
- National Highway System

- Bridge, Surface Transportation
- Highway Safety Improvement
- Congestion Mitigation and Air Quality Improvement
- Metropolitan Planning
- Appalachian Development Highway System
- Recreational Trails
- Safe Routes to School
- Rail-Highway Grade Crossing
- Coordinated Border Infrastructure
- Highway Bridge Replacement and Rehabilitation Program

The “relative rate of return” for each state is a specified percentage of the State’s share of contributions to the Highway Account of the HTF: 90.5% for 2005 and 2006, 91.5% for 2007, and 92% for 2008 and 2009.

States with certain characteristics receive a share of apportionments and High Priority Projects that is the greater of the relative rate of return approach described above or their average annual share of total apportionments and High Priority Projects under TEA-21. This applies to States with:

- a population density of less than 40 persons per square mile and of which at least 1.25% of the total acreage is under Federal jurisdiction; or
- a total population less than 1 million; or
- a median household income of less than \$35,000; or
- a 2002 Interstate fatality rate greater than 1 per 100M VMT; or
- a State with an indexed State motor fuel tax rate higher than 150% of the Federal motor fuel excise tax rate as of the date of enactment of SAFETEA-LU

In any given year, no State is to receive less than a specified percentage of its average annual apportionments and High Priority Projects under TEA-21. These percentage floors are 117% for 2005, 118% for 2006, 119% for 2007, 120% for 2008, and 121% for 2009. ^[2]

Current Funding Conditions

There are several reasons why future revenues will fall short of meeting highway and transit investment requirements unless highway and transit revenues are increased. First, the gasoline and diesel tax, which is levied on a per-gallon basis, will fail to keep pace automatically with rising construction costs unless it is indexed to some measure of inflation. Second, in some cases transportation funds are being diverted to state’s general fund and used for a broader range of transportation purposes than previously was the case. ^[3] Third, there has been a lack of a demonstrated will at all levels of government to raise taxes and fees to the levels required to maintain current transportation condition. ^[1]

The National Surface Transportation Policy and Revenue Study Commission, established under SAFETEA-LU, projects that over the next half-century, the U.S. will need to add 150 million new residents, a 50 percent increase over its current population, in order to meet current policy goals and maintain the U.S. work force. As a result, this growing society will demand higher levels of goods and services, and will rely on the transportation system to provide them. In turn, this will cause travel to grow at an even greater rate than the population. As part of an increasingly integrated global economy, the U.S. will see greater pressures on its international gateways and domestic freight distribution network to deliver products and materials to where they are needed, and from where they come.

The Commission was directed to (among other things) conduct a comprehensive study of the current condition and future needs of the surface transportation system, including short-term resources of HTF revenues, long-term alternatives to replace or supplement the gasoline and diesel taxes as the principal revenue source to support the HTF, including new or alternate sources of revenue. Additionally, the Commission was charged with developing a conceptual plan, with alternative approaches, to ensure that the surface transportation system will continue to serve the needs of the United States, including specific recommendations regarding design and operational standards, Federal policies, and legislative changes.

In December 2007, the Commission released its report recommending restructuring the current 108 federal surface transportation programs into 10 programs that would advance the federal interest in transportation:

1. Rebuilding America: A National Asset Management Program
2. Freight Transportation: A Program to Enhance U.S. Global Competitiveness
3. Congestion Relief: A Program to Improve Metropolitan Mobility
4. Saving Lives: A National Safe Mobility Program
5. Connecting America: A National Access Program for Smaller Cities and Rural Areas
6. Intercity Passenger Rail: A Program to Serve High-Growth Corridors by Rail
7. Environmental Stewardship: A Transportation Investment Program to Support a Healthy Environment
8. Energy Security: A Program to Accelerate the Development of Environmentally-Friendly Replacement Fuels
9. Federal Lands: A Program for Providing Public Access
10. Research, Development, and Technology: A Coherent Transportation Research Program for the Nation.

The reform programs would be coordinated among the federal, state, and local levels. The reform of the Federal surface transportation program aims to accelerate the lengthy process by which transportation projects are delivered, consolidate the numerous investment categories of current law into a more focused, performance-based set of transportation programs, and create an independent National Surface Transportation Commission to oversee development of a national strategic plan for transportation investment and to recommend appropriate revenue adjustments to the Congress to implement that plan.

In order to finance future surface programs, the Commission recommended that legislation be passed in FFY 2008 to keep the Highway Account of the HTF solvent and prevent highway

investment from falling below levels guaranteed in SAFETEA-LU, that the Federal government should contribute approximately 40 percent of total surface transportation capital outlay in line with the Federal share in recent years, and that the Federal gasoline and diesel taxes be increased from 5 to 8 cents per gallon per year, totaling a 40 cent gas tax increase in the next 5 years (after which it should be indexed to inflation). The Commission also made recommendations related to freight, customs duties, ticket taxes on passenger rail, and carbon taxes or trading.

Additionally, the Commission recommended changes the Federal government could make to increase funding on the state and local levels, including an increase in State gasoline and diesel taxes and other highway user fees, providing new flexibility for tolling and pricing (including opening the interstate system to tolling), and encouraging the use of public-private partnerships. ^[1]

Project Planning and Delivery

Planning of transportation projects deserves additional attention as it links to finance. As the Commission showed in their report, there is a feeling among some that lengthy project development process costs money that could be better allocated. Others argue that an in-depth approach to project planning can lead to better project outcomes, and might even eliminate unneeded projects thus saving even more money.

Transportation project planning is usually a cooperative process that solicits participation from the business community, community groups, environmental organizations, the traveling public, freight operators, and the general public. Metropolitan Planning Organizations, state Departments of Transportation, and transit operators are ultimately responsible for creating and maintaining a Unified Planning Work Program, Metropolitan Transportation Plan or Long-Range Transportation Plan, Transportation Improvement Program, State Planning and Research Program, Long-Range Statewide Transportation Plan, and Statewide Transportation Improvement Program.

Transportation planning includes:

- Monitoring existing conditions;
- Forecasting future population and employment growth, including assessing projected land uses in the region and identifying major growth corridors;
- Identifying current and projected future transportation problems and needs and analyzing, through detailed planning studies, various transportation improvement strategies to address those needs;
- Developing long-range plans and short-range programs of alternative capital improvement and operational strategies for moving people and goods;
- Estimating the impact of recommended future improvements to the transportation system on environmental features, including air quality; and
- Developing a financial plan for securing sufficient revenues to cover the costs of implementing strategies. ^[4]

According to the Commission, the major barriers to transportation project delivery lie in administrative and planning costs, inflation, and lost opportunities for alternative use of

capital. Information compiled by the Federal Highway Administration (FHWA) indicated that major highway projects take approximately 13 years to advance from project initiation to completion, with the median time spent on the environmental review process varying between 54 and 80 months. For larger highway projects, planning and delivery can take 14 years or longer, during which time the initial cost estimate for a project can rise sharply.

Project planning and delivery in Vermont can also vary greatly depending on the project, but there is no formal data collection that can confirm or reject the Commission's national findings. In response to limited transportation funding at both the state and federal levels, Vermont adopted the "Road to Affordability" policy plan in 2006 which set preservation of existing assets (bridges, culverts, roads) as the priority over new roadway construction projects, so that the current infrastructure do not deteriorate to the point that they require major reconstruction and become a financial drain on the entire system. It is predicted that early intervention and preventative maintenance can result in significant savings. The new goals of the program also include making safety a critical component in the development, implementation and maintenance of the transportation system; cultivating and continually pursuing excellence in financial stewardship, performance accountability, and customer service; optimizing the future movement of people and goods with corridor and natural resource management, balanced modal alternatives, and sustainable financing through planning; and protecting the state's investment in its transportation system through preservation. ^[6]

"Donor v. Donee" States

An additional challenge in transportation funding is the method of distributing federal transportation funds. This can be simply summarized by noting that some states pay more in highway user tax payments than is returned to them in highway aid; these states are called donor states. Other states receive more in aid than they pay in user taxes; these states are called donee states. From the creation of the HTF in 1956 until 2005, California, Florida, Georgia, Indiana, Michigan, Missouri, New Jersey, North Carolina, Ohio, Oklahoma, South Carolina, Tennessee, Texas, and Wisconsin have been the historical donor states. In 2005 alone, eleven donor states received \$485 million less in aid apportionments than their residents paid in user taxes. Over the same period, 35 states (plus the District of Columbia) have received more federal highway aid than was contributed in user tax payments. Alaska, Hawaii, Montana, North Dakota, Rhode Island, South Dakota, and Vermont, plus the District of Columbia received more than twice as much in highway aid apportionments as their residents paid in user taxes.

The importance of the guarantee minimum policy in SAFETEA-LU and future transportation bills cannot be underestimated for so-called donee states. While it is unlikely that a 100% return to states would occur in the next transportation bill, if for no other reason than the cost of administering highway-aid programs by the federal government is covered through the payment of the federal gas tax, a change in the guaranteed minimum policy could have serious consequences. Vermont, for example, whose transportation agency budget is approximately 45.6% federal^[40] and has limited financial resources coupled with a sparse population, is heavily dependent on the current minimum guarantee policy with few alternatives to accommodate a change in funding sources.

The distribution of federal highway funds has long been a contentious issue for states, speaking to issues of equity and fairness. But the formula has also been known to serve social and policy purposes, with resources redistributed to aid states with high program needs, help poor states and localities invest in desired projects or programs (fiscal equalization), to maintain a national system (like the interstate system), to compensate states or localities for the benefits outsiders derive from their investments (correcting for benefit spillover), and to provide for the needs of the national defense. Some theories have been made that the apportionment program exemplifies pork barrel spending, is a result of programmatic inertia, and that the donor state issue is a reflection of underlying urban versus rural distinctions among the states. ^[8]

Current Infrastructure

The American highway system, as it currently stands, reflects the country's vast geography and widespread population, and is built to meet the needs inherent in this characterization. In 2004, about 75 percent of the 4 million miles of public roads in the United States were in rural areas (those with fewer than 5,000 residents). Another 20 percent of road miles were in urbanized areas with 50,000 or more people. The remaining 5 percent of miles lay within small urban areas with populations between 5,000 and 50,000 people. ^[1]

According to the Commission, in 2004 there were 594,101 bridges in the United States in 2004. The 'typical' bridge in the United States serves a local road in a rural community, and about 77 percent of the Nation's bridges in 2004 were in rural areas, while the remaining 23 percent were in urban communities.

In 2004, transit agencies in urban areas operated more than 120,000 vehicles. Rail systems included nearly 11,000 miles of track and nearly 3,000 stations. There were close to 800 bus and rail maintenance facilities in urban areas. In rural communities, according to the most recent survey of operators in 2000, there were over 19,000 transit vehicles in service. ^[1]

Table 3-1. National Transportation System Extent, 2006 ^[9]

Infrastructure	Total
All Public Roads	4.01 million miles
Interstate	46,873 miles
Road Bridges	591,078
Class I Railroad Trackage	95,664 miles
Inland Waterways	29,627 miles
Public Use Airports	5,270 (575 certificated for air carrier operations)

Table 3-2. Vehicles and Conveyances, 2006 ^[9]

Vehicle	Conveyance
Automobiles registered	136.6 million
Light trucks registered	95.3 million
Heavy trucks registered	8.5 million
Buses registered	0.8 million
Motorcycles registered	6.2 million
Rail transit systems	21 commuter rail, 14 heavy rail (subway), 29 light rail
Recreational boats registered	12.9 million

Table 3-3. Commuting (percentage of workers), 2006 ^[9]

Mode	Percentage of workers
Car, truck, or van—drove alone	77.0
Car, truck, or van—carpooled	10.7
Public transportation	4.7
Walked	2.5
Taxicab, motorcycle, bicycled or other means	1.6
Worked at home	3.6

Note that modal split is only available for commuting trips, which account for 17.7% of all trips according to the 2001 National Household Travel Survey.

3.2. Vermont

Current Funding Conditions

Historically, the State of Vermont has relied on a “pay as you go” (PAYGO) approach to funding transportation projects and programs. Most transportation revenue is derived from federal and state taxes and fees. Federal funds have been a crucial part of Vermont’s transportation funds, contributing upwards of 50 percent of transportation revenues in recent years, and have played a major role in supporting Vermont’s transportation system. State transportation funds are generated primarily through taxes on the sale of motor fuels and by fees and taxes on the sale and use of motor vehicles. In SFY 2007, the Vermont Agency of Transportation was appropriated \$454 million dollars, of which 53 percent was federal funding, 42 percent state, and 5 percent local or other. Of that, the Agency expended \$387 million, spending about 75 percent of their federal appropriations and 95 percent of state appropriations. ^[10]

The conclusions of the Chittenden County Workshop on Innovative Transportation Finance recently stated:

...our current transportation system funding and investment approach, particularly the state’s “pay as you go” spending philosophy, cannot meet our transportation needs.... Vermont needs to embrace and encourage flexibility and innovation in transportation finance and implementation. An “investment perspective” is needed to enable the use of new financial instruments, including debt-financing, user-fees and public-private partnerships. Local governments and regional partnerships must be able to raise additional revenues through expanded authority to levy taxes and fees, thus mitigating increasing property tax burdens on local residents.... [M]unicipalities will need to embrace new cooperative arrangements in order to maximize both revenue raising potential and returns on transportation investments. Achieving benefits from inter-municipal partnerships will require enhanced accountability for public agencies and authorities charged with transportation decision-making and management. ^[11]

Current Infrastructure and Conditions

The current state transportation infrastructure in Vermont includes:

- 3,200 two-lane miles of pavement on state roads;
- 2,765 bridges greater than 20 feet in length;
- 1,112 large culverts (6 feet or more in diameter) and 40,000 small culverts.
- 10 state-owned airports;
- 305 miles of state-owned rail line with 265 bridges;
- 122 heated and 289 unheated buildings;
- Other assets including a fleet of vehicles, park & ride lots, rest areas, and ancillary highway assets. ^[12]

Table 3-4. Vermont Transportation System Extent, 2000 ^[13]

	Vermont	% of National System
All public roads	14,273 miles	1<
Interstate	320 miles	1<
Road bridges	2,703	1<
Railroad trackage	669 miles	1<
Public use airports	17 (2 certificated for air carrier operations)	1<

Table 3-5. Vermont Vehicles and Conveyances, 2000 ^[13]

	Vermont	% of National System
Automobiles registered	296,000	1<
Light trucks registered	202,000	1<
Heavy trucks registered	2,900	1<
Buses registered	2,000	1<
Motorcycles registered	22,000	1<
Rail transit systems	1 commuter rail	4
Numbered boats	34,000	1<

Table 3-6. Commuting (percent of workers), 2005 ^[13]

	Vermont	Alaska	Montana	National
Car, truck, or van—drove alone	75.8	68.2	75.2	77.0
Car, truck, or van—carpooled	11.0	15.1	11.0	10.7
Public transportation (excluding taxi)	0.9	1.2	0.6	4.7
Walked	5.2	6.6	4.6	2.5
Other means	1.5	4.8	2.6	1.6
Worked at home	5.5	4.1	6.0	3.6

Vermont, Alaska, and Montana, which are among the most rural states in the U.S., also have the highest percentage of workers walking to work. One hypothesis to explain this is these states have clustered areas of high population density.

Table 3-7. Road Conditions, 2005 (Miles) ^[14]

	Very Good	Good	Fair	Mediocre	Poor	Not reported
Vermont	242 (6%)	946 (24%)	1,700 (44%)	480 (13%)	495 (13%)	0
New Hampshire	412 (13%)	1,233 (36%)	1,337 (39%)	217 (6%)	209 (6%)	0
Maine	322 (5%)	1,812 (29%)	2,636 (42%)	802 (13%)	757 (11%)	0
National	120,102 (13%)	259,853 (28%)	386,931 (41%)	96,890 (10%)	64,860 (7%)	4,416 (1%)

Table 3-8. Road Bridge Conditions, 2005 ^[15]

	All bridges	Structurally deficient
Vermont	2,701	455 (17%)
New Hampshire	2,361	320 (13.5%)
Maine	2,370	347 (14.6%)
National	592,473	75,621 (13%)

According to the Bureau of Transportation Statistics, “structurally deficient” refers to bridges needing significant maintenance attention, rehabilitation, or replacement.

4. Transportation Funding and Financing Approaches

There are a number of financing options available to policy makers and planners to fund transportation infrastructure. In consideration of this, a review of “innovative” financing, innovative finance options, as well as “traditional” financing tools is presented. Regardless of the financing structure chosen for securing the future viability of the national and state transportation infrastructure, the traditional sources are expected to play a significant role for the next several decades; indeed, the gasoline and diesel taxes are expected to remain viable for the next 20 years.^[1] In some cases traditional revenue sources will continue to be part of the funding mix though the source of funding or the formula for disbursement may change significantly. Nevertheless, the Commission called for state and local communities to immediately begin planning for alternative options to the gasoline and diesel tax.

For the purposes of this report, funding will be considered monies collected and distributed for transportation at the federal, state, and local levels; financing will be used to describe how those funds are leveraged.

4.1. Traditional Revenue Sources

Surface transportation improvements are funded from a variety of user fees, general taxes, special taxes, and private charges. Funds for highway and transit improvements come from all levels of government as well as the private sector. The Federal, State, and local governments all play substantial roles in financing the Nation’s highway system. The Federal government established the HTF in 1956 to guarantee revenue for constructing the Interstate Highway System and other Federal-aid highways. In 2005, motor-fuel and vehicle taxes deposited in the HTF generated about \$31.2 billion. State and local governments raised \$78 billion and \$44 billion, respectively, for highway purposes in 2005.^[1]

Gasoline and diesel taxes represent about 90 percent of total revenues to the HTF. Federal fuel tax rates have remained unchanged since 1993 (18.4 cents per gallon). Since that time, however, the real Federal gasoline tax rate has decreased by 40 percent as measured by changes in the Producer Price Index for Highway and Street Construction. Although the government collects the gasoline and diesel tax from fuel manufacturers for efficient collection and administration, fuel producers pass the tax on to retailers so that motorists pay the tax on every gallon of fuel purchased.

In addition to collecting taxes on gasoline, the U.S. government also levies taxes on a variety of other motor fuels. Users of liquefied natural gas, petroleum natural gas, diesel fuel, gasohol, and other highway fuels also face a Federal gasoline and diesel tax. These taxes are all collected from the refiner, manufacturer, or importer of the fuel and also passed through the retailer to the highway-user. Like the Federal government, all states collect taxes on gasoline and other motor fuels. In fact, gasoline taxation was pioneered at the state level. Today, virtually all revenues collected from the Federal tax on gasoline support the Highway Trust Fund, with only a portion funding for the Leaking Underground Storage Tank Trust Fund.

The other taxes supporting the HTF are truck-related taxes. The largest of those taxes, the truck sales tax, increases with the sales price of trucks and truck trailers. The other Federal taxes—the tire tax and the Heavy Vehicle Use Tax—do not vary with either prices or costs. Taxes levied on heavier vehicles through the Heavy Use Vehicle Tax aim to address the fact that heavier vehicles cause greater wear and tear on the highway system and, therefore, should pay more. For vehicles weighing 55,000 pounds or more, one must pay \$100 per vehicle for vehicles up to 55,000 pounds, increasing at the rate of \$22 per thousand pounds or fraction thereof, with a maximum annual fee of \$550 per vehicle for all vehicles with a gross weight of 75,000 pounds or more. This annual fee is pro rated for vehicles acquired part way through the year. ^[16] In 2005, about \$3 billion came from sales taxes on trucks and trailers, \$1 billion from the annual Federal Heavy Vehicle Use tax, and \$500 million from the Federal tax on tires rated for heavier loads. In total, Federal revenues accounted for 21 percent of the total of \$155 billion spent for highways by all levels of government in 2005.

Gasoline and diesel taxes vary from state to state. In 1998, for example, Connecticut had the highest state gas tax (36 cents) and Georgia, the lowest (7.5 cents). For that year, the weighted average of state gas taxes was 19 cents per gallon. States may also generate revenue by charging state license fees to wholesale and retail distributors of motor vehicle fuel.

The disposition of state imposed gasoline and diesel taxes also vary by state. A state may direct motor gasoline and diesel tax revenue to numerous destinations, including its Department of Transportation, special road or bridge funds, county governments, or even state General Funds. States may also charge motor carriers or truckers additional taxes on fuel usage or mileage. ^[1]

All states have a per gallon excise tax, and many States impose additional taxes on gasoline and other motor fuels. In Vermont, the excise tax is 19 cents per gallon, plus an additional 1-cent per gallon tax for the Petroleum Cleanup Fund. ^[16]

While the gasoline and diesel tax has historically been the major source of revenue for funding transportation infrastructure, other traditional sources include:

- Vehicle Tax
- Property Taxes and Assessments
- General Fund Appropriations
- Income Tax
- Utility Tax
- Sales Tax
- Registration Fees
- Rental Car Excise Tax: A fee for rental car use (Vermont charges a 7% tax on the rental charge of short-term rentals of motor vehicles as part of the Purchase and Use Tax). ^[16] State and municipality rental car taxes vary and affect both local and non-resident consumers, with fees and taxes as high as 17% plus a \$2.75 fee in Chicago, taxes of 20% in Las Vegas, and a \$3 per day vehicle surcharge in Hawaii. ^[27, 28]

4.2. Framing Innovative Funding and Financing

Innovative funding and financing for surface transportation infrastructure is a broadly defined term that encompasses a combination of techniques and specially designed mechanisms to supplement traditional financing sources and methods.

Innovative funding and financing for surface transportation includes such measures as follows:

- New or non-traditional sources of revenue;
- New financing mechanisms designed to leverage resources;
- New funds management techniques; and
- New institutional arrangements.

It is worthwhile to note that some of these techniques may not be new or particularly innovative outside of the transportation sector, and that the benefits associated with these tools are not mutually exclusive. There is potential synergy in combining tools on a single project.

Innovative finance tools are intended to maximize the ability of states to leverage Federal capital, attract new sources of funds to transportation investment, accelerate project completion dates, and more effectively utilize existing funds. ^[16]

5. Funding Mechanisms

5.1. User Fees

User fees encompass a variety of revenue sources. The term “user fee” refers to various sources of funding that derive from fees or charges assessed on the users of the infrastructure the fee supports. Revenues generated by taxes and fees imposed on the owners and operators of motor vehicles for use of public highways are “highway-user revenues.” The clearest example of a highway-user tax or fee is a toll. Most gasoline and diesel taxes are also classified as highway-user taxes as are motor-vehicle registration fees, certificate-of-title fees and driver-license fees. ^[10]

Tolling/ Farebox Collection

Tolls are a direct user fee charged for use of road capacity and services to the motorist. Historically, toll roads played a prominent role in the provision of road transportation in the eighteenth and nineteenth centuries. Private investors formed tollway companies that improved, constructed, and maintained roads and, in turn, charged the public for their use.

In the late nineteenth century, toll road development tapered as toll evasion as well as rail travel increased. However, by the 1930s, some states began developing public toll road programs to respond to growth in automobile ownership, the rising needs of commerce, and the absence of significant Federal-aid for highways. While private tollway companies dominated the "turnpike" industry in the earlier centuries, the toll facilities of the twentieth century have largely been authorized, constructed, and managed by quasi-public authorities established by state and local governments. The pursuit of toll roads declined again after 1956, when the Federal Highway Act established a federal gasoline tax to support the interstate highway system and prohibited tolling on new, federally funded highways.

The interest in toll roads today is largely an outgrowth of provisions in ISTEA and the more recent National Highway System Designation Act that liberalized and incentivized the use of Federal-aid in conjunction with private resources for road development purposes. Public-private toll roads have been the focus of most state Department of Transportation activities in "privatization."

Tolling is seen as an attractive option to close funding gaps for transportation projects because it can promote the following benefits in transportation spending:

- Fostering public-private partnerships by attracting private capital;
- Drawing on the public's willingness to pay direct user charges;
- Leveraging new sources of capital, such as additional debt;
- Freeing up traditional public resources for non-revenue-generating projects;
- Allowing additional transportation facilities to be developed more quickly than would be possible under conventional public procurement, funding, and ownership; and
- Facilitating value-pricing plans.

Toll facilities are traditionally associated with long queues and high emissions at collection points, but some of these disadvantages can be addressed with advances in toll collection technologies. Still, toll road and bridges face other challenges, including:

- The cost of borrowing capital;
- Lost time at toll collection booths;
- Increased fuel consumption;
- Emissions at toll barriers;
- Restricted availability because of the distance between access points;
- The high cost of collecting tolls;
- Disproportionate impacts of tolls on low-income motorists and associated equity issues; and
- Negative public opinion that views tolls, on top of gasoline and diesel taxes, as double taxation. ^[16]

Farebox or fare collection is similar to toll collection, but generally associated with transit use where users are paying for a portion of the operating cost of the system. Fare revenue covers only a small portion of actual operating expenses (while this generally averages to about 40%, the New York Metropolitan Transportation Authority reported a 36.3% farebox recovery in 2008 and Chittenden County Transportation Authority 26%), and transit systems often rely on governmental support to make up the difference. Much like tolls, fares can also be used to back traditional revenue bonds, but because most transit systems operate at a deficit this type of bond backing is rare. ^[16]

Congestion Pricing

Congestion Pricing, or value-pricing, varies the fee collected at a transportation facility in relation to peak-travel times, so tolls are lowest when demand is lowest, encouraging motorists to shift trip times to less congested periods. This tolling strategy counters congestion and the substantial burdens it places on individuals, families, businesses, and the nation.

In its 1999 survey of urban congestion trends, the Texas Transportation Institute found that in 1997, travelers in major urban areas experienced 4.3 billion hours of traffic delay due to congestion and 6.6 billion gallons of motor fuel were wasted as a result. The annual cost of traffic congestion (delay and wasted fuel) amounted to \$72 billion in the 68 urban areas surveyed. These costs may be just the tip of the iceberg when one considers the cost of economic dislocations and lost productivity that results from under pricing our roads.

A value-pricing program may aim to maximize either revenue or efficiency by altering behavior. To achieve the former, prices are set low enough to not significantly discourage users. To minimize congestion, prices must be set high enough to divert significant demand to the shoulders of the peak period. ^[16]

Intelligent Transportation Systems and Electronic Toll Collection

Intelligent Transportation Systems (ITS) technologies have expanded the viability of tolls by providing easy cost- and time-efficient toll collection. Electronic Toll Collection (ETC) employs various technologies to allow the manual in-lane toll collection process to be automated in such a way that customers do not have to stop and pay cash at a tollbooth. With ETC, an actual toll plaza is not even a requirement to collect tolls, although some staffed booths may be necessary to provide service to vehicles without the required electronic devices.

At collection points, the ETC equipment can be mounted on overhead gantries and/or in the pavement, which allows vehicles to be charged while they proceed at highway speeds, quickening motorists' trips through the plaza. Also, electronic toll collection makes it simpler to implement interstate tolling systems, vary tolls based on time of day, number of vehicle occupants, and travel distance, as well as - for heavy vehicles - the number of axles, vehicle length, and vehicle weight. ^[16]

Tolls and Bonding

Toll organizations use a variety of funding sources, although the two most common are tolls and revenue bonds. These funding sources are closely linked, in that future toll revenues are typically pledged as the security for bonds issued to construct, maintain, expand, or operate the associated toll facility and are used to make bond principal and interest payments.

Other types of bonds are utilized, albeit less extensively, by toll organizations. These include general obligation bonds, oil franchise tax revenue bonds, subordinate bonds from a local government unit, and transportation facilities bonds.

Bonds may be issued by toll agencies on a facility-specific or system-wide basis. Agencies with existing toll roadways can use their established revenue base to leverage additional funds for new roadways.

Shadow Tolls

Shadow tolling is a tolling approach initially adopted in the United Kingdom where governments pay tolls rather than motorists. In all cases, shadow tolling is used instead of award concessions to build-operate-maintain toll-free facilities and compensate the investors based on roadway usage and/or availability. Unlike traditional tolls paid by motorists for the use of a specific transportation facility, a government makes shadow toll payments to a private concessionaire for a highway facility's construction, operation, or both. The payments are based on traffic volumes and service levels. Motorists see no tollbooths or other visible evidence of government payments to the facility's contractor or operator.

A Shadow Toll System consists of a concession awarded to a private contractor who then has the responsibility to Design, Build, Finance and Operate (DBFO) a road section for an agreed period of time. One of its special characteristics is that the governmental entity will pay the contractor on an annual basis depending upon the volume of traffic using the road. The term "shadow tolling" is used as there are no visible tollbooths and the users do not actually pay direct charges to the operators.

The advantages of a shadow toll system are that it:

- Minimizes traffic risks, making it easier for private investment partners to find more advantageous financing;
- Accelerates construction and implementation of capital projects;
- Captures the profit-seeking motives of the private sector, often resulting in capital construction costs savings;
- Capitalizes on cost efficiencies of life-cycle costing;
- If structured properly, can dampen down the financial effect to the concessionaire of lower than expected traffic volumes;
- Transfers operating and maintenance risk to the concessionaire;
- Caps the public sector's exposure, thereby eliminating the risk of super-profitability by the concessionaire;
- Reduces public equity requirements; and
- Avoids the need for toll plazas.

Most, but not all, shadow toll projects involve upgrades of existing roads. This has important attractions for private investors: historic traffic data reduce traffic risk and the need to depend on forecasts for revenue projections. In certain cases, it can also provide opportunities for generating cash flows during construction. As with conventional tolling, shadow tolls can amortize capital costs over the useful life of the investment and can create early completion and other incentives by sharing traffic forecasting and other risks with the private partners. An important advantage of a shadow toll structure is its creation of incentives for the contractor to construct a road quickly and with high quality. Because payments to the contractor are based on traffic volume, the contractor benefits by completing the project early, avoiding construction delays and ensuring a well-maintained and long-lived road. ^[16]

Toll Credits

Investments in capital equipment made by private entities are treated as "toll credits" which can be used by a state to match federal funds. The guidelines for using toll credits are administered through the Tolling and Pricing Program by the FHWA under SAFETEA-LU.

Toll credits can be applied at any time during the development and implementation of a project, including after execution of the initial project agreement. The project agreement or modification indicates what the Federal share is and that toll credits are being used in lieu of all or part of the required State match, resulting in up to 100 percent Federal funds being used on a project. It is important to note that such credits are used to leverage designated Federal funds, not to obtain new funds.

The amount of credit earned is based on revenues generated by the toll authority (i.e., toll receipts, concession sales, right-of-way leases or interest), including borrowed funds (i.e., bonds or loans) supported by this revenue stream, that are used by the toll authority to build, improve, or maintain highways, bridges or tunnels that serve interstate commerce. The following are some of the requirements that apply:

- The facility generating the revenue must be open to public travel.

- The authority generating the toll credits may be a public, quasi-public, or private entity. Although a public or private entity other than the State Transportation Department may have statutory authority to collect tolls in a particular state, the State Transportation Department may be the designated toll authority in some cases.
- Expenditures can include revenues collected from a toll ferry provided the ferry serves as a link on a public highway and subsequently interstate commerce. Toll credits may be provided for capital investments to ferry services, such as purchase of a new ferry, engine or dock.
- For chartered multi-State toll entities, the amount of toll credit must be divided equally among all the charter States. ^[17]

Miscellaneous Tolling Mechanisms

The following tolling mechanisms were authorized under SAFETEA-LU:

- All states are allowed to make an unlimited number of High Occupancy Vehicle lanes to High Occupancy Toll (HOT) lane facilities conversions, with the caveat that variably priced tolls must be used to maintain superior traffic service on the HOT lanes. Automatic toll collection is required on the HOT lanes, together with enforcement and monitoring programs.
- Express Lanes Demonstration Program permits tolling on up to 15 demonstration projects nationwide— on either new or existing capacity – to manage congestion, reduce emissions in a non-attainment area, or finance added Interstate lanes for the purpose of reducing congestion.
- Interstate System Construction Toll Pilot Program authorizes up to three facilities nationally on the Interstate system to toll for the purpose of financing the construction of new Interstate highways. Tolling must be the most efficient and economical way to finance these facilities.
- Interstate System Reconstruction & Rehabilitation (R&R) Pilot Program allows tolling on up to three existing Interstate facilities (highway, bridge, or tunnel) to fund needed reconstruction or rehabilitation on Interstate highway corridors that could not otherwise be adequately maintained or functionally improved. Each of the three facilities must be in a different state, in cases where the costs to fund needed reconstruction or rehabilitation are demonstrated to exceed available resources. ^[16]

Vehicle Miles Traveled Fees

Fees assessed on vehicles, based on the number of miles driven, are the newest form of a user fee. A 2005 report from the National Chamber Foundation endorsed a vehicle mileage based transportation revenue system. The report recommended that a statewide Vehicle Miles Traveled (VMT) based fee could replace the funding from gas taxes. Fees can vary by vehicle type, weight, environmental impact, or other factors that may be appropriate to meet larger society public policy objectives.

Some argue that imposition of additional user fees are, in effect, a regressive form of taxation and most negatively affect those who least can afford them. At least two approaches have been suggested to counter this perceived regressivity: provide income sensitive mechanisms on VMT fees (it is difficult to achieve this with sales taxes and gas taxes); and fund public transportation, sidewalks and/or bike lanes to a higher degree when implementing additional VMT fees to ensure that people affected by rising vehicle fees have viable transportation options. ^[10]

A current concern regarding the viability of the VMT charge has been the recent downtrend in VMT nationally due to sustained high gasoline prices and the recent economic downturn. A recent study suggests demand for gasoline is influenced by price and income elasticity of various households, which in turn depend on income of households, demographics and location characteristics. Income elasticity was found to decrease as income increased, and households with multiple vehicles were found to be more price elastic. Additionally, rural households were less responsive to changes in gasoline price, perhaps reflecting a lack of availability of alternative means of transportation. Overall, the study found multi-car, multi-wage earner, urban households had the largest response to a price change and a single car, single (or no) wage earner, rural household had the lowest. ^[18]

Miscellaneous User Fees

Heavy Highway Vehicle User Tax

This Federal tax is required for vehicles with a gross weight of 55,000 pounds or more. Some exempted vehicles include those owned and operated by government agencies, the American Red Cross, and nonprofit volunteer emergency service vehicles. ^[41]

Studded Tire Fee

There is currently a Federal excise tax on the sale of heavier tires. This tax is collected from the manufacturer or importer and passed on to the retailer and the ultimate consumer. The tax is based on the weight of the tire, excluding the tire rim, and does not apply to tires that weigh less than 40 pounds. ^[16]

Table 4-1. Federal Excise Rates on Tires ^[16]

Tire Weight	Tax
0-40 pounds	No Tax
Over 40-70 pounds	15¢ per pound in excess of 40
Over 70 pounds to 90 pounds	\$4.50 plus 30¢ per pound in excess of 70
Over 90 pounds	\$10.50 plus 50¢ per pound in excess of 90

Parking Fees

Parking fees place a fee on parking spaces, but are largely viewed as a behavior modification tool rather than a major revenue source. ^[19] However, emerging research indicates that parking policy as it currently stands results in hidden costs such as parking subsidies,

increased traffic congestion and pollution, and wasted fuel. Parking fee reform to address social, economic and environmental inequalities would include charging fair-market prices for curb parking, returning the resulting revenue to neighborhoods to pay for public improvements, and removing the requirements for off-street parking. ^[26]

In general, city and town parking can be divided into three categories: on-street, surface lots, and parking garages. One study assessing on-street parking and land use implications found on-street parking spaces are consistently in highest demand, despite being associated with the highest fees and shortest maximum time allotment. However, on-street parking typically use less than 176 square feet per space compared to 512 square feet per space in a surface lot. Surface lots also require an additional 10-15% of total land area for landscaping requirements. The study found that if a town center with approximately 2,000 parking spaces were able to provide 15% on-street parking instead of surface lots, this would reduce the need for 2.3 acres of land.

Alternately, parking garages use less land area than either on-street parking or surface lots, but the cost of construction and maintenance was much higher at approximately \$29,508 per space in a 305-space garage. ^[29]

Petroleum Business Tax

New York State implements a Petroleum Business Tax in addition to traditional excise fuel taxes. The tax is imposed on gasoline at the initial point of distribution in New York, and automotive-type diesel is taxed upon the first otherwise non-exempt sale or use of the product in New York. ^[42]

Bicycle Fees

An excise tax on the sale of a new bicycle or a fee paid for the registration of a bicycle has been suggested as a way to assess a user fee on bicyclists. ^[21]

5.2. User Benefit Assessments/ Value Capture

Infrastructure Development Fees (Impact Fees)

Infrastructure development fees, or impact fees, are assessed on users who require increases in the carrying capacity of the transportation network, primarily by building new roadways. Impact fees are one-time charges applied to new development, as well as a form of land-use regulation designed to assure that communities maintain adequate levels of public facilities in the face of growth. To date, approximately twenty-six states have enacted impact fee enabling legislation and in most other states impact fees are enacted pursuant to home rule powers or pursuant to individual local government enablement. Impact fees have traditionally been assessed locally on developments occurring within a municipality by the permitting municipality. ^[10] Developers are usually assessed a one-time impact fee to support capital facilities like sewers, parks, libraries, schools, roads, transit, and general government facilities. ^[16]

Special Assessment Districts

The Special Assessment District or dependent financing district is a traditional method of privately financing local improvements. The use of special assessment districts reached its peak in the early part of the twentieth century. After the Depression, when there were numerous defaults on special assessment-backed bonds, the use of independent special districts for roadways declined significantly. Recently, however, there has been an increase in the use of Special Assessment Districts for funding transportation improvements.

Special assessments are authorized in all 50 states either under explicit enabling legislation or under state constitutional provisions. The major limitation on special assessments is that they can be used only to finance facilities that provide local benefits. They cannot be used to finance facilities that provide general, community-wide benefits. In recent years, there has been some liberalization of this policy, but, in most areas, it has not been significant enough to make special assessments a viable alternative to finance major components of the transportation system.

In many states, legislatures have passed new enabling legislation that allows special districts to be used to finance a broader range of facilities than in the past. These districts often go by such names as improvement districts, road districts, metropolitan districts, and building authorities. In most cases, the districts serve the same general purpose as the traditional special assessment district, but they often are not limited to the use of assessments on property, such as front footage charges or acreage fees. ^[16]

Business Improvement Districts

A Business Improvement District (BID) is a particular type of Special Assessment District. BIDs are in areas in central cities defined by state and local legislation in which “the private sector delivers services for revitalization beyond what the local government can reasonably be expected to provide.” ^[10]

Tax Increment Financing

Tax Increment Financing (TIF) is a way of raising local revenue that is commonly used to support the redevelopment of blighted areas. Using TIF, municipalities create special redevelopment districts and make public improvements in those areas to spur further development. TIF does not increase the level of tax liability of those benefiting from a TIF project; however, it does earmark a portion of the property tax revenues that the developer would have paid without TIF for specific purposes, which may include transportation improvements. During the development period, the tax base is frozen at the predevelopment level. Property taxes continue to be paid, but taxes derived from increases in assessed values (the tax increment) resulting from new development either go into a special fund created to retire bonds issued to originate the development, or leverage future growth in the district.

While tax increments are used more frequently for physical redevelopment of an area, they also may be used to finance local transportation improvements. Tax increment improvements can center on transit stations, for instance. ^[16]

System Development Charges

System Development Charges are paid by a developer for placing a new burden on a specific part of the road system that will require road improvements to accommodate increased traffic flow related to the development or a combination of developments. ^[19]

Development Exactions

Development Exaction can be any requirement placed on a developer as a condition of receiving municipal approval for a project. They can be in the form of a fee; the dedication of public land, habitat, or right-of-way; the construction or maintenance of public facilities or infrastructure; or the provision of public services.

Exactions have been traditional sources of financing on-site public facilities, such as local roads, sidewalks, streetlights, and local water and sewer lines. In cases of large-scale development, they may include improvements such as deceleration lanes, left-turn lanes, road widening, signalization, and, in a few cases, freeway overpasses and interchanges. In cases where proposed developments are too small to individually dedicate land or facilities of meaningful magnitude, some municipalities require in-lieu fees or impact fees. These fees are used to fund needed public amenities and infrastructure. ^[16]

Development exactions and variations thereof have been the subject of intense judicial scrutiny over the years. Many court challenges brought by developers maintain that local governments exceed their authority when demanding particular land dedications, facilities, or development fees. The legal issues surrounding development fees and agreement, exactions, and fees involve an entire body of land use and property rights case law. ^[20]

Joint Development

Joint Development is a project-specific application of Transit-Oriented Development (TOD), taking place on, above, or adjacent to transit agency property. It involves the common use of property for transit and non-transit, typically private sector commercial, purposes. Typical joint development arrangements are ground leases and operation-cost sharing, usually occurring at transit stations or terminals surrounded by a mix of office, commercial, and institutional land uses. To be eligible for federal funding, joint development projects must be related physically or functionally to public transportation, and must dedicate a fair share of the commercially derived revenue for public transportation. ^[4]

5.3. Debt Financing and Bonds

Bonds are long-term negotiable debt instruments signifying an issuer's obligation to repay a specified principal amount at a specified time with interest at a stated rate. They typically are sold in the public capital market to multiple investors. Municipal bonds are generally—but not always—issued on a tax-exempt basis such that the interest earned by investors is

exempt from federal income taxes and often from state and local taxes in the state (or local jurisdiction) of issuance.

Bonds have a longstanding successful history in many areas of public finance, including transportation. There are three general types of bonds utilized to varying degrees by transit agencies today. Listed roughly in order of their prevalence in financing transit capital investments, the bond types are as follows:

- Limited recourse bonds backed by dedicated or appropriated revenues other than those resulting directly from system operations, including state or local dedicated sales taxes, gasoline and diesel taxes, property taxes, and pledges of future federal or other grant funds;
- Bonds supported by a general promissory pledge of system revenues (e.g., fare box revenues, advertising, etc.); and
- Bonds supported by a general obligation full faith and credit pledge of supporting state or local governments. ^[21]

Borrowing is a way of moving the completion of capital projects to the present and the payment for those projects into the future. These temporal movements have a cost: interest expenses necessarily accrue when debt financing is used. Ultimately, the debt plus interest expense must be repaid from the pay-as-you-go revenue sources. However, the repayment with interest can be made over time as the capital facility is used.

The main advantages of debt financing (relative to pay-as-you-go) are as follows:

- Acquisition as needed. The state can enjoy prompt use and benefit of capital improvements. Immediate or rapid construction is limited with pay-as-you-go financing.
- Intergenerational equity. The cost of capital expenditures is spread more equally over all of its users.
- Repayment in cheaper dollars. With a positive inflation rate, repayment costs will be less burdensome than would full payment at the time of acquisition.
- Enhanced stability. Since debt service payments are known and predictable, wide fluctuation of required expenditures is avoided.
- Reduced operating cost. Newer, low-maintenance roadways more quickly replace older, high-maintenance roadways.

The main disadvantages of debt financing (relative to pay-as-you-go) are as follows:

- Interest costs. The cost for the use of money must be added to the total cost of the capital project.
- Encumbered future revenues. Potential revenues are dedicated to the repayment of debt and are thus not available for other uses.
- The temptation to take on too much debt. Because borrowing enables the political credit for the construction to accrue to current officeholders while passing the costs on to future administrations and legislatures there may be a temptation to take on too much debt. As the knowledge of what constitutes too much debt may not be known until after a default, some argue that it is better to not borrow at all. ^[22]

GANs and GARVEEs

Bonds backed by federal or state grants are commonly referred to as Grant Anticipation Notes (GANs) or Grant Anticipation Revenue Vehicles (GARVEEs), although this alternative term is used primarily with respect to highway-related projects. GANs (or GARVEEs) are similar to bonds backed by dedicated non-system local and state revenues, but instead of state and local tax revenues, they are backed (at least primarily) by inter-governmental grants. Even though use of the term “notes” suggests relatively short-term issuances, GANs are issued on a longer-term basis than most notes (although not as long as traditional bonds).

Grant anticipation financing is attracting the attention of transportation officials because:

- The financial markets have begun to accept the credit-worthiness of federal funds pledged from current and even future authorization acts;
- Favorable ratings from major rating agencies (such as Moody’s, Standard & Poor’s, and Fitch) have helped to reinforce market acceptance;
- GANs can be structured to meet each sponsor’s particular needs and financial parameters in the same manner as other types of debt; and
- Of the fact that GANs may not count against a political jurisdiction’s borrowing capacity or be subject to other local debt limitations.

One risk associated with this debt-financing vehicle is the risk that Congress could fail to fund the current program or could fail to reauthorize the federal transportation program with adequate funding levels to cover necessary grant levels in the future. ^[22] Another potential risk is that GARVEEs/GANs do not create “new” money, instead limiting the availability of future year’s federal funds.

Federal Credit Assistance

The Transportation Infrastructure Finance and Innovation Act (TIFIA) of 1998 established a credit program administered by the U.S. Department of Transportation to provide federal credit assistance to major surface transportation programs—including highway, transit and rail projects—of national or regional significance. TIFIA allows U.S. DOT to provide direct credit assistance, up to 33 percent of eligible project costs, to sponsors of major transportation projects. Credit assistance can take the form of a loan, loan guarantee, or line of credit. The program’s goal is to provide credit rather than grants to sponsors of surface transportation projects. However, TIFIA differs from these programs in two important ways. First, U.S. DOT directly negotiates with private and public sponsors of eligible transportation projects. Second, because the TIFIA legislation authorizes new funding for such credit assistance, TIFIA does not draw from funds already apportioned to the states for grant-assisted projects. Both public and private entities may apply for TIFIA assistance. In general, the candidate project’s eligible costs must reach at least \$100 million. There are two exceptions to this requirement. A project need cost only \$30 million if its principal purpose involves installation of intelligent transportation systems. Also, the \$100 million requirement can be waived if the cost of the project amounts to at least 50 percent of the state’s annual apportionment of Federal-aid highway funds. ^[10]

State Infrastructure Bank

State Infrastructure Banks (SIB) are investment funds for surface transportation that are

established and administered by states. SIBs may be capitalized with regular Federal-aid highway apportionments and state funds and can offer a range of flexible financial assistance, including loans and various forms of credit enhancement. Designed to complement traditional transportation funding programs, SIBs can give states significantly increased flexibility in project selection and financial management. Much like a private bank, a SIB uses seed capitalization funds to get started and offers customers a range of loans and credit enhancement products.

Loans are the most common form of assistance offered by SIBs. The primary benefit of providing loans to projects is that loan repayments are recycled for future generations of projects. Credit enhancement products offered through a SIB can provide additional security or credit support to transportation projects that are funded primarily through other means, such as the municipal bond market or private participation. This additional security can result in higher investor confidence, which in turn creates lower interest rates, improved marketability of bonds, and lower overall project financing costs. ^[10]

5.4. Public-Private Partnerships

Currently 23 states permit private participation in transportation funding, with 20 of these allowing such participation for highway projects. Where state and local governments have elicited such participation, it has occurred on mostly lower priority projects, such as toll roads built in anticipation of future development (see *Tolling*). To date, most major public-private partnership undertakings in the U.S. have been for toll road projects worth at least \$500 million or more and with a well-documented potential for significant returns on private investment. ^[10]

Leasing of Assets

The potential to lease public rights-of-way (for fiber optic cables, gas lines, and others), structures for wireless communications, and converting sections of highway to toll roads and leasing the highways to private entities is a growing consideration for many states looking to fund transportation infrastructure.

5.5. Regional/Inter-Municipal Financing Approaches

Across the country, there are many examples of approaches to raising revenue for transportation in a regional or inter-municipal setting. Some examples identified by Resource Systems Group in Burlington, Vermont, include:

- In the Boston metropolitan region, recent state legislation allocates 20% of all State sales tax revenue raised in the region to Massachusetts Bay Transportation Authority (MBTA), the main transit provider.

- In Portland, Oregon, the Tri-County Metropolitan Transportation District receives revenues from a regional payroll tax of .06218%.
- In Georgia, the legislature has enabled the “Special Purpose Local Option Sales Tax, or SPLOST,” which is an optional 1% county sales tax used to fund capital outlay projects proposed by the county government and participating municipal governments, including major transportation projects. Counties, municipalities and qualified regional authorities may receive funding through SPLOST-raised revenues.^[10]

Inland Waterways

Inland Waterways offer the opportunity for port sites to divert truck traffic off of highways and other roadways, easing congestion of rail lines and roadways, air emissions, and impact to roads. Shipping can be done more efficiently because barges can carry significantly more containers than trucks while reducing environmental impact and reducing gas and diesel usage. Additionally, ports can serve as a funding source through cargo handling fees and renting wharf space to commercial enterprises, as well as creating toll credits.

5.6. Emissions Fees

Enacting emissions fees in the transportation sector supplements transportation financing while also reducing greenhouse gas emissions from transportation. Two programs receiving considerable attention are carbon taxes, and cap-and-trade programs. Design challenges for a cap-and-trade program include upstream versus downstream trading design, offsets, administrative feasibility (including efficiency and implementation considerations), and scale i.e. local, regional, and/or national implementation of such a program. Transportation emissions cap-and-trade program design would also have to take into consideration similar greenhouse gas emission reductions program in industrial, commercial, and residential systems to ensure complementary programs and avoid overlaps in offsets and permit allocation.^[45]

While it may be argued that the gas tax could be interpreted as an emissions fee, one study found that to achieve a reduction in greenhouse gas (specifically carbon) emissions, the gasoline tax would need to be significantly higher: 309 cents/gal for a 50% carbon reduction, 471 cents/gal for an 80% carbon reduction.^[23] If the goal is to raise revenue (its stated purpose), then it could be argued that the gas tax is not a carbon tax or emission fee.

5.7. Road Utility Fees

A road utility fee adds an access charge to a utility bill for property that provides access to the trunk highway system. A key question is the basis upon which the fee should be charged—motor vehicle trip generation estimates, number of parking spaces, number of employees, front footage, or flat fee.^[19]

5.8. Miscellaneous Fees

There are a number of potential sources that could, or already do, provide additional revenue to transportation funding, although there is little research that indicates they would be major revenue sources. These sources include, but are not limited to:

1. **Battery Tax:** An excise tax on the sale of car batteries. Tax could be a percentage of the sales price or a flat fee.
2. **Drive-Through Service Fee:** A transaction fee on drive-up service at a retail establishment.
3. **Electricity Generated by Vehicles Tax:** A charge on wattage generated by an electric or hybrid electric vehicle.
4. **Safety Violation Fee:** A fee imposed for traffic safety violations.
5. **Fees for Marathons/Road Races/ Walk-A-Thons/ Parades/ Protests**
6. **Directional Advertising Signage:** Highway signage advertising food, gas, lodging and attractions near highway exits.
7. **Billboards:** Highway advertisement signage.
8. **Interstate Rest Areas:** Also known as Information and Welcome Centers, Rest Areas in Vermont offer a number of marketing opportunities to the business community including:
 - Locked glass display cabinets;
 - Touch screen service locator computers;
 - Areas to promote Vermont food and specialty products;
 - Bulletin boards for listing special and current events;
 - Audio and video systems for Vermont music and videos;
 - Internet exposure;
 - Space for hands-on demonstrations;
 - Brochure Program.

An estimated 4 million tourists visit the Information and Welcome Centers each year in Vermont, and many of the above services are provided to businesses free of charge. ^[24] Additionally, opportunities for privatization to construct, operate and maintain Centers may be an additional consideration for public-private partnerships, especially for those rest centers on toll roads or adjacent to the interstate highway right-of-way. ^[25] The Transportation Fund in Connecticut, for example, receives slightly over \$11,000,000 in fuel and non-fuel sales at its service plazas per year. ^[44]

6.0 Modeling

6.1. State Characteristics for Consideration

In “Transportation for Tomorrow,” the National Surface Transportation Policy and Revenue Study Commission indicated that one of the major flaws of provisions such as the Minimum Guarantee in TEA-21 and the Equity Bonus in SAFETEA-LU is that they shift the focus of Federal funding away from national priorities, opting instead to ensure that all States receive a minimum share of Federal-aid highway funds. The Equity Bonus program receives the greatest amount of funding under SAFETEA-LU, and with each reauthorization States push for a greater return-to-source funding formula. However, the Commission notes that surface transportation investment necessary to address national interests are not spread evenly across the States. Subsequently, a provision such as the Equity Bonus undermines the purpose of the Federal funding program: to improve or increase national productivity and economic efficiency. ^[1]

There are a number of other elements that could be equally important to determining the funding formula to identify investment needs that will improve the national system. These considerations might also change how states align themselves during the reauthorization of the next transportation bill.

Rural vs. Urban Characteristic of States

Urban, as defined by the U.S. Census Bureau for the 2000 Census, is broken down into two classifications: Urbanized Areas (UA), and Urban Clusters (UC). UAs and UCs contain densely settled areas with core areas of at least 1,000 people per square mile and surrounding areas of at least 500 people per square mile. UAs are all territory, population, and housing units within a densely settled area of 50,000 people or more. UCs are all territory, population, and housing units within a densely settled area of at least 2,500 but no more than 50,000 people. ^[30] Generally, rural areas are defined as not UAs or UCs—but what if urban were instead defined as “not rural”? How would this change the funding formula?

This definition should also receive consideration with regard to the funding formula for the Equity Bonus program under SAFETEA-LU, where states with population of less than 1 million people, or states with population density of less than 40 people per square mile where at least 1.25% of land area is under Federal jurisdiction, are considered “rural.” There is no alignment between SAFETEA-LU and the Census Bureau where the definition of rural is concerned. Under SAFETEA-LU, Vermont is in alignment with states and territories that have small populations: Wyoming, District of Columbia, North Dakota, Alaska, South Dakota, Delaware, and Montana. However, this does not mean these states share similar characteristics or needs in terms of their transportation infrastructure. A breakdown of rural and urban populations in states reveals Vermont, 61.8% rural as defined by the Census, might be better aligned with Alabama (44.5% rural), Arkansas (47.4%), Maine (59.7%), Kansas (44.2%), Mississippi (51.2%), Montana (45.9%), North Dakota (44.1%), South Dakota (48.1%), and New Hampshire (40.7%). ^[31]

Role of Climate Change on Age and Condition of Infrastructure in Rural Areas

States who play an integral role in facilitating interstate commerce and maintaining connectivity may also have further infrastructure investment needs based on the age of the infrastructure and the challenges faced because of adverse weather conditions (i.e. freeze/thaw cycles). An additional consideration is that older states with older infrastructure will . At this point, climate change as it impacts transportation is anticipated to cause an increase in the number of very hot days and heat waves, decrease in colder days, later onset of season freeze and earlier onset of seasonal thaw, increase in intense precipitation and changes in seasonal precipitation and flooding events, and increased intensity of cold-season storms. ^[32] In Vermont, these challenges to maintain infrastructure based on age, continued deterioration, and changing climate conditions will contribute to the growing unfunded gap over the next twenty years of \$8.717 billion. ^[33] States with similar weather challenges and aging infrastructures may need additional consideration as it relates to their role in supporting the advancement of the national economy. These changes will likely lead to a need for transportation adaptations, such as larger culverts, higher bridges, etc.

VMT resident v. nonresident travel

Non-resident travel on state roads can place an additional burden on local residents who are responsible for maintaining infrastructure. Vermont's tourism industry brings in many out-of-state drivers, however, tourism brings in additional tax dollars when non-residents purchase fuel in the state. There is currently no system that tracks whether non-resident tourists do so, and given Vermont's proximity to other states (New York, New Hampshire, Massachusetts and Canada) and relative size, it is possible that non-residents could be purchasing fuel out-of-state and utilizing infrastructure in Vermont.

Vermont's highways also act as a passageway for heavy vehicles and trucks to move between larger hubs such as Boston and Montreal. In April 2007 the Transportation Departments of Idaho, Montana, North Dakota, South Dakota, and Wyoming acknowledged similar transportation challenges when they submitted a statement to the National Surface Transportation Policy and Revenue Study Commission emphasizing the important connectivity function roadways in rural states play for the nation's large metro areas, and the national interest that exists in "facilitating interstate commerce and mobility that requires good highways in and connecting across rural areas." ^[34]

6.2. Additional Challenges

Looking forward, it will be important for transportation planners and policy makers to consider the additional challenges the national transportation system faces that could affect how it is or should be funded. Climate change, an increase in the population and demands on the system, aging infrastructure, and changing demographics are just a few of the issues that could determine what kind of system is needed and wanted.

Climate Change

The *TRB Special Report 290: Potential Impacts of Climate Change on U.S. Transportation* found that focusing on the problem of global climate change now could help transportation planners avoid expensive infrastructure investment later. The implications of climate change are expected to exacerbate weather extremes, such as heat waves and warming Arctic temperatures, rising sea levels, storm surges and land subsidence, and increased intensity of precipitation and hurricanes. The impacts of these extreme weather conditions will vary across the country and will affect different travel modes in different ways, but ultimately they are expected to be widespread and have significant implications in human and economic terms.

As a result of these anticipated changes, the Report urges a number of assessments and preparations for transportation planners, including:

- Inventory critical infrastructure
- Public and private infrastructure owners and operators should inventory infrastructure that is especially susceptible to climate change, including ports, airports, railroads, and pipelines and identify whether, when, and where projected climate change might be consequential.
- Incorporate climate change into investment decisions
- Adopt strategic, risk-based approaches to decision making
- Improve communication
- Agencies should work together to create a clearinghouse of climate change information relative to transportation planning.
- Integrate evacuation planning and emergency response into transportation operations
- Develop and implement monitoring technologies
- Share best practices
- Reevaluate design standards
- Include climate change in transportation and land use planning
- Evaluate the National Flood Insurance Program and flood insurance rate maps
- Develop new organizational arrangements
- Cross-jurisdictional cooperation for regional authorities could more adequately address the challenges of climate changes for transportation planning and operations. State and/or federal incentives could increase development of organization at the regional or multi-state level.

Increasing Population and System Demands

Over the next twenty years, the population of the United States is projected to increase by 17%, and Vermont's population is expected to reflect this trend, ^[35] with the exception of Chittenden County which is projected to increase by 30%. Transportation planners will have

to consider a number of variables, including how additional growth in Chittenden County will affect the demand on the transportation system.

In addition to addressing future population growth, transportation planners and policymakers must consider the changes that will accommodate citizens who cannot provide their own transport, such as children, seniors, people with disabilities, and people or families with low-incomes. These challenges are exacerbated by the rural character of Vermont and the need to work within current funding systems.

Children and Elderly

This category will become increasingly significant as a growing number of older Americans would prefer to stay in their homes as they age, but lack the awareness of community resources that make this possible (including transportation services). ^[36]

Table 6-1. Population under age 18 and 65 and older: 2000 and 2030 ^[37]

	2000			2030		
	Under 18	65 and Older	Total Pop.	Under 18	65 and Older	Total Pop.
Vermont	147,523	77,510	608,827	138,959	173,940	711,867

Vermont is projected to experience a 30.2% increase in persons 60 and over by 2030, according to the U.S. Administration on Aging. ^[38] The national increase is projected to be 25.1%. The following states are projected to experience similar growth rates to Vermont and higher than the rest of the States:

- Florida (33.9%)
- Maine (32.9%)
- Wyoming (32.2%)
- Montana (31.4%)
- West Virginia (31.3%)
- North Dakota (30.3%)
- Delaware (30%)

In persons aged 85 and older, Vermont is projected to have a 3.5% increase by 2030, compared to the national projection of 2.6%.^[38] The following states are projected to experience growth rates similar to Vermont and higher than the rest of the States:

- North Dakota (3.8%)
- Maine (3.7%)
- Wyoming (3.7%)
- Connecticut (3.6%)
- Iowa (3.6%)
- Montana (3.6%)

- New Mexico (3.6%)
- South Dakota (3.5%)

People with Disabilities

In Vermont, disability status is defined as “[p]eople 5 years old and over are considered to have a disability if they have one or more of the following: (a) blindness, deafness, or a severe vision or hearing impairment; (b) a substantial limitation in the ability to perform basic physical activities, such as walking, climbing stairs, reaching, lifting, or carrying; (c) difficulty learning, remembering, or concentrating; or (d) difficulty dressing, bathing, or getting around inside the home. In addition to the above criteria, people 16 years old and over are considered to have a disability if they have difficulty going outside the home alone to shop or visit a doctor’s office, and people 16-64 years old are considered to have a disability if they have difficulty working at a job or business.” ^[39]

Table 6-2. Total Tallies of Disability for People 5 Years and Older, Vermont, 2000 ^[39]

Age	Sensory Disability	Physical Disability	Mental Disability	Self-Care Disability	Go-Outside-Home Disability	Employment Disability	Total
5-15 years	903	728	5,435	584	n/a	n/a	7,650
16-64	9,631	23,847	16,467	5,412	13,946	38,669	107,972
65 and older	10,844	18,925	7,036	5,948	12,266	n/a	55,019

Low Income Individuals and Families

According to the U.S. Census Bureau, “poverty is measured by using 48 thresholds that vary by family size and number of children within the family and age of the householder. To determine whether a person is poor, one compares the total income of that person’s family with the threshold appropriate for that family. If the total family income is less than the threshold, then the person is considered poor, together with every member of his or her family. Not every person is included in the poverty universe: institutionalized people, people in military group quarters, people living in college dormitories, and unrelated individuals under 15 years old are considered neither as “poor” nor as “non-poor,” and are excluded from both the numerator and the denominator when calculating poverty rates. The Office of Management and Budget (OMB) mandates that all federal agencies (including the Census Bureau) use this poverty definition for statistical purposes.” ^[39]

Table 6-3. Vermont Low Income Population, 1999 ^[39]

Under 5 years old	4,476
5 to 11 years	7,013
12 to 17 years	5,106
18 to 64 years	32,694
65 to 74 years	2,785
75 years and older	3,432

Diversity in Funding Sources

There are many potential sources for states to obtain funding for surface transportation infrastructure. However, some of the options garnering the most attention at the national level, i.e. private investment in infrastructure, tolling, and Vehicle Miles Traveled fees may not be viable for states where the majority of infrastructure is found in rural areas, and concerns about the regressive nature of a VMT fees would negatively impact rural residents who depend on driving as their sole mode of transportation. Planners should consider the following elements of the VMT and how they could address equity issues related to a VMT fee, as compared to the fuel tax:

- Vehicle type
- Miles traveled (urban vs. rural road usage, purpose of travel)
- Income
- Employer/Employment status
- Origin/Destination of Trips
- Trip Chaining

Planners will have to consider a mix of funding sources based on the characteristics of their states (i.e. population changes, rural/urban centers, annual VMT) in order to meet infrastructure investment needs.

7.0 Discussion and Future Research Needs

During the course of this research, there were several areas of interest that surfaced but could not be addressed that merit further consideration for planners, policy makers and researchers.

Spatial Density and Demographic Trends

Transportation planners and policy makers must consider that infrastructure financing in rural states is going to be directly related to where people live. If there is limited funding to maintain new roads or build new infrastructure, it will be important for planners to see what roads will be primarily utilized for transport, and to know how spatial density has and will change based on demographic trends.

Comparing the spatial density of different states will also allow planners to see which states are in alignment and facing similar challenges of meeting the public's need for surface transportation infrastructure. For example, GIS mapping of states density and settlement patterns can offer new insight into how the transportation system is planned, and a new perspective on how states are considered for federal funding. It would offer new opportunities for different states to collaborate to address funding challenges.

At this point, there is a lack of information available for researchers to create spatial density maps of states. In Vermont, researchers have used E911 locations to create such a map of Vermont and Rhode Island (see *Appendix A, B*), but many states are only beginning to build the E911 database for their own states. This tool would allow for better comparison of state residential density, and could also be used to identify regional settlement patterns to determine if system planning makes more sense on a regional or inter-state level.

Trip Origin and Destination

The University of Vermont Transportation Research Center worked with Vanasse Hangen Brustlin (VHB), Inc. to obtain the Vermont road network file, origin destination matrices, and traffic analysis zones (TAZ) definition files, all in CUBE/Voyager format. The Vermont Agency of Transportation appointed VHB in 2005 to update Vermont statewide travel demand model and convert it to CUBE/Voyager format. The state model has 628 internal (inside Vermont) TAZs and 70 external zones. These files are used as input files to estimate VMT using TransCAD. The required results are VMT for i) trips originating and destined within Vermont (I-I), ii) trips originating in Vermont, but destined to outside Vermont (I-E), and iii) trips originating from outside Vermont destined to a location inside Vermont (E-I). The OD matrix developed for year 2000 in the Vermont state model is used.

Performing equilibrium traffic assignment in TransCAD using the total OD matrix would give the total VMT, but would not distinguish external-internal, internal-internal, and internal-external. Thus, the OD matrix was disaggregated into three as: i) only demand between internal TAZs, ii) demand from internal TAZs to external TAZs, iii) demand from external TAZs to internal TAZs. Since, the traffic assignment is not performed simultaneously for all three matrices, all-or-nothing (AON) method of traffic assignment is adopted. This

method does not account for the influence of congestion on path selection, which is a reasonable assumption for Vermont. Results of TransCAD analysis are not verified with the CUBE/Voyager results.

Following the above procedure, following VMT per day estimates are obtained.

Internal to Internal: 14,656,371
Internal to external: 1,815,278
External to internal: 1,193,491
External to External: 435,495

Non-resident travel patterns in states is of particular interest in Vermont which has a strong tourist industry, employs residents of neighboring states, and serves as a travel route between major hubs such as Boston and Montreal. However, researchers lack the infrastructure to track non-resident road usage and develop methods to charge non-residents for travel within the state. Researchers also hypothesize that non-resident travelers could easily enter and exit the state without purchasing fuel, the main funding source for surface transportation.

Redefining the Transportation System Vision

The purpose of the federal role in funding a national transportation system was historically to provide a national defense system and ensure a strong economy by providing a method for transporting goods and services. However, the needs of the now aging infrastructure coupled with the challenges facing the viability of the gas tax as a long-term funding source indicate a need to re-envision the role of the federal government in maintaining the current transportation system. Planners should consider whether the system currently in place is sustainable based not only on funding, but also on impending energy needs, costs, economic challenges, climate change, and the potential to shift away from the dependence on single-occupancy vehicles as the main travel mode.

States should also re-examine the funding sources and uses to ask the question “what do we want to do with the funding we have?” instead of “how can we continue to maintain our current infrastructure with the funding we have?” This change of focus on how we view our transportation system shifts the question away from how to raise additional revenues to maintain the status quo, to pushing transportation planners to consider alternative systems to meet the mobility needs of Americans that are more sustainable and can meet the challenges facing our state and nation.

References

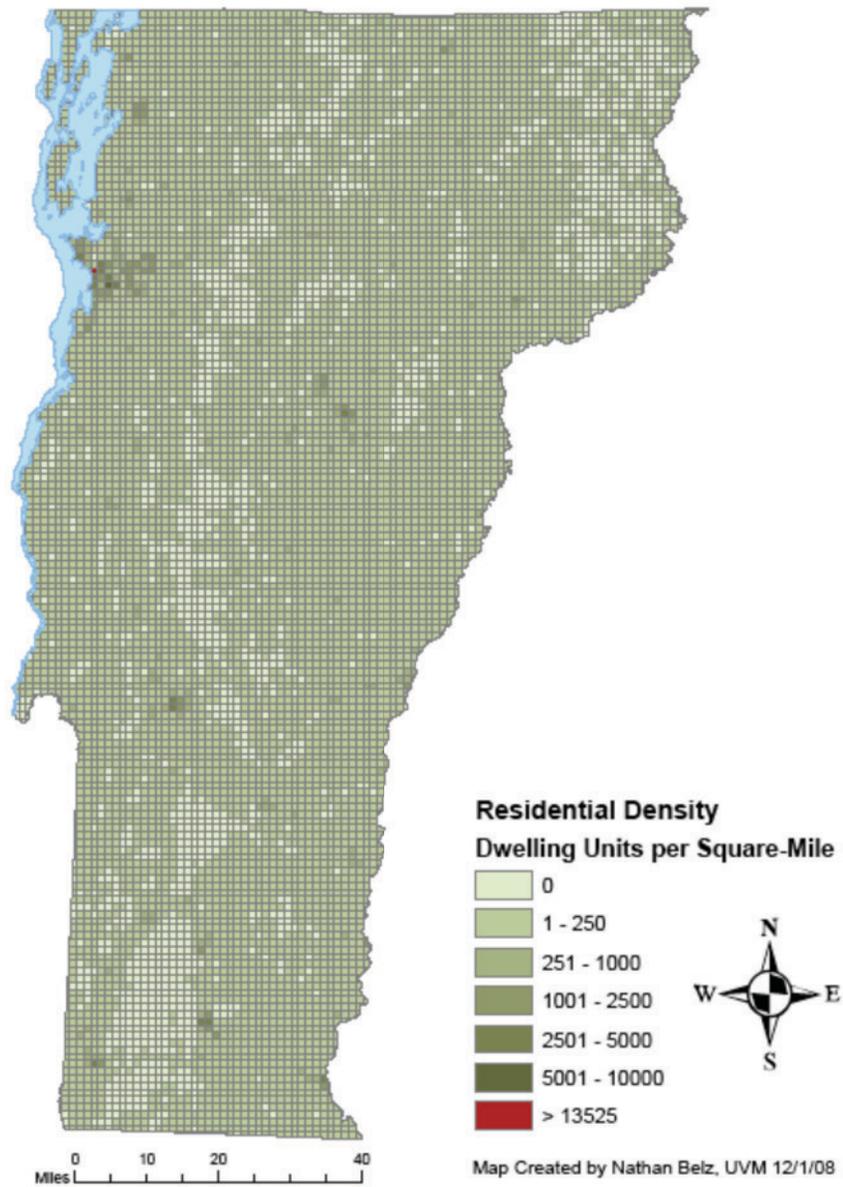
1. Transportation for Tomorrow, "Report of the National Surface Transportation Policy and Revenue Study Commission." Washington, D.C. (December 2007).
2. Federal Highway Administration, "Summary Information of SAFETEA-LU." Available at: <http://www.fhwa.dot.gov/safetealu/summary.htm>.
3. Ybarra, Shirley. "Spend transportation dollars on transportation." *The Examiner*, January 26, 2008.
4. Transportation Planning Capacity Building Program. "The Transportation Planning Process: Key Issues." The Federal Highway Administration and Federal Transit Authority. Publication No. FHWA-HEP-07-039. September 2007.
6. The Vermont Department of Finance and Management, "The Vermont Way Forward: A Responsibility for Affordability, Fiscal 2008 Executive Budget Recommendations." Montpelier, VT (2007).
7. Federal Highway Administration, "Highway Statistics." Washington, D.C. (1974-2005) Table FA-4A..
8. Brown, Jeffery R., and Zhu, Pengyu. "Donor States and Donee States: An Investigation of Geographic Redistribution in the U.S. Federal Highway Program." Transportation Research Board 87th Annual Meeting, Washington, D.C. Proceedings TRB 87th Annual Meeting Compendium of Papers DVD.
9. U.S. Department of Transportation Research and Innovative Technology Administration, "State Transportation Statistics 2006." Bureau of Transportation Statistics. December 2006.
10. Resource Systems Group, Inc, "Briefing Paper: Overview of Innovative Transportation Finance Options." Burlington, VT (October 2007).
11. Wilbur Smith Associates, "Summary Report: Workshop on Innovative Transportation Finance." Burlington, VT (June 4, 2007).
12. Vermont Agency of Transportation, "The Road to Affordability." Montpelier, VT (2006).
13. U.S. Department of Transportation Bureau of Transportation Statistics, "Vermont: Transportation Profile." Washington, D.C. (2000).
14. Bureau of Transportation Statistics, "State Transportation Statistics 2006." Washington, D.C. (2006). A-4.
15. Bureau of Transportation Statistics, "State Transportation Statistics 2006." Washington, D.C. (2006). A-7.
16. Innovative Finance for Surface Transportation, "Revenue Sources." Available at: http://www.innovativefinance.org/topics/revenue_sources/.
17. Federal Highway Administration, "Toll Credit for Non-Federal Share, Section 1905 of SAFETEA-LU." Retrieved from <http://www.fhwa.dot.gov/specialfunding/020807.cfm> on May 1, 2008.

18. Wadud, Zia, Graham, Daniel J., and Noland, Robert B. "Gasoline demand with heterogeneity in household responses." Transportation Research Board 87th Annual Meeting, Washington, D.C. Proceedings TRB 87th Annual Meeting Compendium of Papers DVD.
19. Road User Fee Task Force, "Report to the 72nd Oregon Legislative Assembly." Salem, Oregon (March 2003). Appendix L.
20. "Public and Private Partnerships for Financing Highway Improvements." *National Cooperative Highway Research Program Report 307*. Transportation Research Board, National Research Council, Washington, D.C. (1988).
21. "Financing Capital Investment: A Primer for the Transit Practitioner." *Transportation Cooperative Research Program, Report 89*. Transportation Research Board: Washington, D.C. (2003). 49-62.
22. Arizona Department of Transportation, "Analysis of Bonding vs. 'Pay-As-You-Go' Financing." Phoenix, AZ (March 1999).
23. Millard-Ball, Adam. "The Municipal Mobility Manager: A New Transportation Funding Stream from Carbon Trading?" Transportation Research Board 87th Annual Meeting, Washington, D.C. Proceedings TRB 87th Annual Meeting Compendium of Papers DVD.
24. Retrieved from the Department of Buildings and General Services Web site, <http://www.bgs.state.vt.us/infocenter/index.htm>, (June 26, 2008).
25. Alice W.M. Phillips, Michael A. Perfater. "Final Report: Opportunities for the Privatization of Virginia's Rest Areas and Welcome Centers." Virginia Transportation Research Council, Charlottesville, Virginia (May 1991).
26. Shoup, Donald. *The High Cost of Free Parking*. APA Planners Press: Chicago. 2005.
27. National Business Travel Association, <http://www.nbta.org/TravelTaxes/>, retrieved June 26, 2008.
28. Speer, Jack. "Study Questions Impact of Car Rental Taxes." National Public Radio. August 3, 2006.
29. Marshall, Wesley E., Garrick, Norman W., Hansen, Gilbert. "Reassessing On-Street Parking." Transportation Research Board 87th Annual Meeting, Washington, D.C. Proceedings TRB 87th Annual Meeting Compendium of Papers DVD.
30. United States Census 2000, "Census 2000 Urban and Rural Classification." http://www.census.gov/geo/www/ua/ua_2k.html.
31. U.S. Census Bureau, "American FactFinder." <http://factfinder.census.gov>.
32. "Potential Impacts of Climate Change on U.S. Transportation." *Transportation Research Board, Special Report 290*. Committee on Climate Change and U.S. Transportation, Transportation Research Board Division on Earth and Life Studies, Washington, D.C. (2008). 49-73.
33. "Financial Analysis." *Vermont Long Range Transportation Business Plan Working Paper 3*. Montpelier, Vermont (February 2007).

34. *Statement of the Transportation Departments of Idaho, Montana, North Dakota, South Dakota, and Wyoming to the National Surface Transportation Policy and Revenue Study Commission.* April 3, 2007.
35. U.S. Census Bureau, "Population Projections." Retrieved 2008.
<http://www.census.gov/population/www/projections/usinterimproj/>.
36. National Aging in Place Council, Retrieved 2008.
<http://www.naipc.org/NAIPCHome/AboutNAIPC/tabid/53/Default.aspx>.
37. U.S. Census Bureau, "U.S. Population Projections." Retrieved 2008.
<http://www.census.gov/population/www/projections/projectionsagesex.html>
38. U.S. Census Bureau Statistics, "U.S. Population Projections for Selected Age Groups by State: 2005-2030." Administration on Aging, Interim State Population Projections, 2005 Population Division. http://www.aoa.gov/prof/Statistics/future_growth/State-5-yr-age-projections-2005-2030.pdf.
39. Center for Rural Studies, "Demographic Profiles for Vermont." Burlington, VT (2004).
http://crs.uvm.edu/census/2000dps/About_the_profile.pdf
40. Klein, S. "Vermont Transportation Funding: An Ongoing Dilemma." Vermont Legislative Joint Fiscal Office. Montpelier VT (September 26, 2008).
41. Internal Revenue Service, Form 2290. www.irs.gov.
42. "Bridges and Culverts Long-Term Assessment and Funding Options." Report to the Governor and General Assembly. Prepared by the Office of the State Treasurer. State of Vermont. November 15, 2008.
43. Personal communication with Christopher Cole, Chittenden County Transportation Authority. March 30, 2009.
44. Personal email communication with Connecticut Department of Transportation, Office of the Commissioner. April 2009.
45. Santos, G. (2008) "Gasoline taxes to address CO₂ emissions from road transport." Washington, D.C. 2009 TRB Annual Meeting.

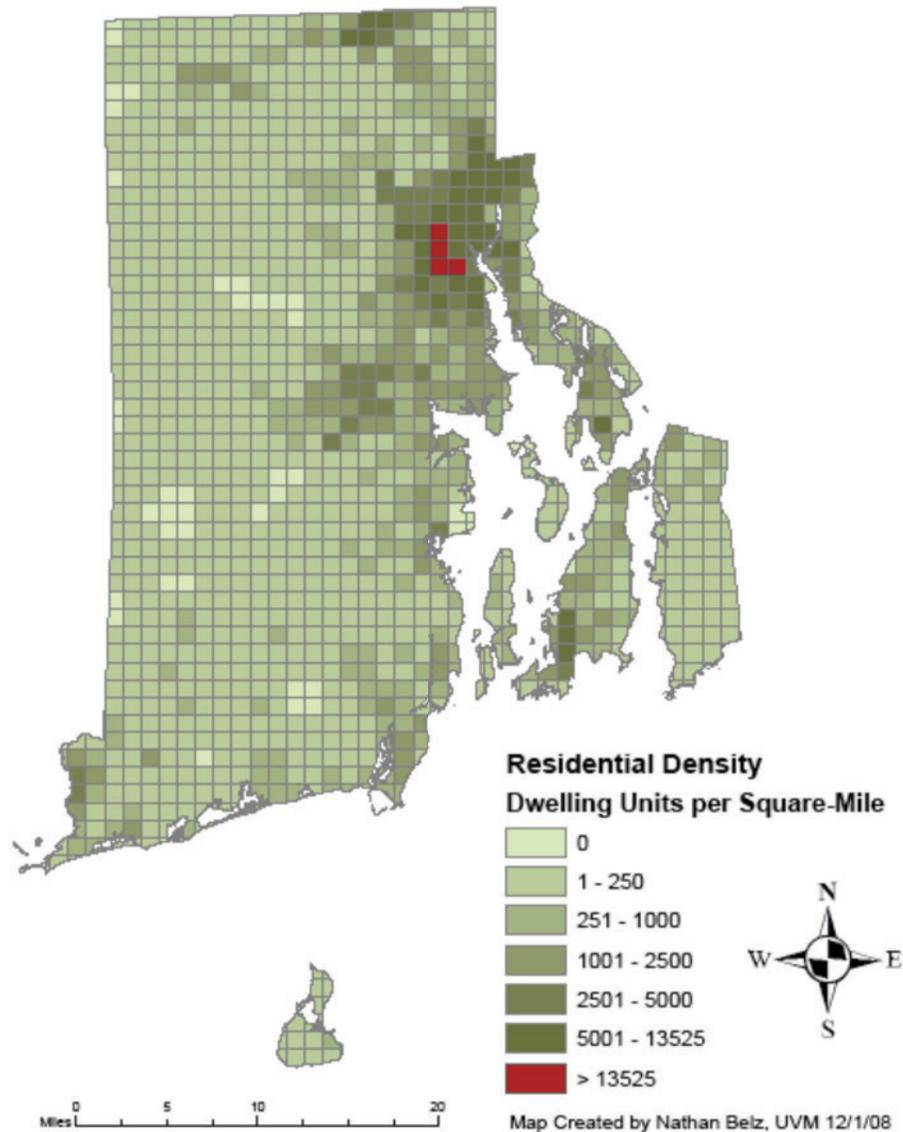
Appendix A. Residential Density Map: Vermont

Residential Density in Vermont



Appendix B. Residential Density Map: Rhode Island

Residential Density in Rhode Island



Abbreviations, Acronyms and Symbols

BID	Business Improvement District
DBFO	Design, Build, Finance and Operate
DOT	Departments of Transportation
ETC	Electronic Toll Collection
FHWA	Federal Highway Administration
GANs	Grant Anticipation Notes
GARVEEs	Grant Anticipation Revenue Vehicles
HOT	High Occupancy Toll
HTF	Highway Trust Fund
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITS	Intelligent Transportation Systems
MPO	Metropolitan Planning Organizations
PAYGO	“pay as you go”
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SHARE	States’ Highway Alliance for Real Equity
SIB	State Infrastructure Banks
SPLOST	Special Purpose Local Option Sales Tax
TEA-21	Transportation Equity Act for the 21st Century
TIF	Tax Increment Financing
TIFIA	Transportation Infrastructure Finance and Innovation Act
TOD	Transit-Oriented Development
VMT	Vehicle Miles Traveled