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Smart Transportation Economic Stimulation

Infrastructure Investments That Support Economic Development

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Investments and policies that create more multi-modal transportation systems can provide significant economic benefits, particularly over the long run.

Abstract

This report discusses factors to consider when evaluating transportation economic stimulation strategies. Transportation investments can have large long-term economic, social and environmental impacts. Expanding urban highways tends to stimulate motor vehicle travel and sprawl, exacerbating future transport problems and threatening future economic productivity. Improving alternative modes (walking and cycling conditions, and public transit service) tends to reduce total motor vehicle traffic and associated costs, providing additional long-term economic savings and benefits. Increasing transport system efficiency tends to create far more jobs than those created directly by infrastructure investments. Domestic automobile industry subsidies are ineffective at stimulating employment or economic development. Public policies intended to support domestic automobile sales could be economically harmful in the long run if they increase future energy consumption and transportation system inefficiency.

Introduction

Economic stimulation refers to policies and investments that increase employment and business activity (Litman 2009a). Some stimulation strategies are better than others overall because they help achieve additional strategic goals. This is particularly true of transportation investments, which result in durable facilities that have large, long-term leverage effects. For example, one federal dollar may attract five state and local matching dollars, which leverages fifty private investment dollars, which influences hundreds of consumer expenditure dollars, causing thousands of dollars in long-term economic, social and environmental benefits and costs.

Table 1 illustrates the impacts of different types of transportation investments. Walking, cycling and public transit investments help create communities where residents own fewer vehicles, drive less, and rely more on alternative modes, providing various benefits.

Table 1 **Highway Versus Transit Investment Impacts Illustrated**

	Highway-Expansion	Multi-modal Improvements
Investments	Spending focuses on urban highway expansion.	Spending focuses on road maintenance, and on walking, cycling and public transit improvements.
Land Use Impacts	More development at automobile-dependent locations along highways.	More development within existing urban areas or new transit-oriented suburbs.
Land Use Impacts Illustrated		
Transport Impacts	• Greater automobile ownership and use. • Higher traffic speeds. • Less walking, cycling and transit travel. • Less intense congestion (more driving occurs on moderate-traffic suburban and rural roads). • Poor accessibility for non-drivers. • Greater chauffeuring requirements.	• Less automobile ownership and use. • Lower traffic speeds. • More walking, cycling and transit travel. • Less per capita congestion delay (residents drive less during peak periods). • Good accessibility for non-drivers. • Reduced chauffeuring requirements.
Economic Impacts	• Greater per capita transportation expenditures. • Greater fuel expenditures. • Increased road and parking requirements, but lower unit costs. • Higher per capita traffic crash costs. • Greater chauffeuring requirements.	• Lower per capita transportation expenditures. • Lower fuel expenditures. • Reduced road and parking requirements, but higher unit costs. • Reduced per capita traffic crash costs. • Reduced chauffeuring requirements. • Improved physical fitness and health.

Infrastructure investments have long-term impacts that affect future travel activity and costs.

For this analysis it is useful to distinguish between roadway *rehabilitation* and *expansion* projects (Troth 2009). There is little controversy concerning the value of basic roadway rehabilitation, sometimes called *fix it first* (NGA 2004) or *asset management* ("Asset Management," VTPI 2008). However, there is growing debate over the value of urban highway expansion (new road links, additional traffic lanes, expanded intersections, etc.) because they tend to induce additional vehicle travel and stimulate more dispersed, automobile-oriented land use development (sprawl).

Much of this debate reflects differences in analysis scope (Litman 2009b). Highway expansion advocates tend to focus on traffic congestion reduction objectives and ignore the negative effects of induced vehicle travel and sprawl.[1] Advocates of investments in alternative modes tend to consider a wider range of impacts and objectives, including traffic congestion reduction, parking cost savings, consumer cost savings, accident reductions, improved mobility for non-drivers, energy conservation, pollution reductions, and public fitness and health.

This report investigates these issues and describes specific factors to consider when evaluating such investments. It describes various trends that are changing future travel demands, evaluates the long-term economic impacts of various transport policies and programs, and identifies best practices for selecting economic stimulation investments. It evaluates arguments by highway expansion advocates that highway investments are better overall than investments in alternative modes.

[1] *Induced travel* refers to additional vehicle travel that results from expansion of congested highways. For more information see *Generated Traffic; Implications for Transport Planning* (www.vtpi.org/gentraf.pdf). *Sprawl* refers to dispersed, automobile-dependent, urban fringe land use development. For more information see *Evaluating Transportation Land Use Impacts* (www.vtpi.org/landuse.pdf).

Direct Employment and Business Activity Impacts

Transportation project expenditures create jobs and business activity directly. An economic analysis tool called *Input-Output Tables* (http://en.wikipedia.org/wiki/Input-output_model) is used to quantify the direct and indirect jobs and business activity created by specific expenditures by tracking how dollars flow from one industry to another within a particular jurisdiction, such as a region or country.

Care is needed when interpreting this information since the data are aggregated and do not necessarily reflect the specific program or project being considered. Actual economic impacts can vary significantly depending on the type of project and the geographic scale of analysis (local, regional or national).

Because input-output modeling is costly to perform, particularly for a particular situation, it is common to extrapolate available data to a particular situation. For example, the U.S. Federal Highway Administration assumes that, on average, a $1 billion of Federal highway expenditure supported 30,000 jobs in 2007 (FHWA 2008). This number has been widely applied, although recent analysis by Heintz, Pollin and Garrett-Peltier (2009) suggests that actual impacts are somewhat lower.

In addition, the models include many assumptions that may be inaccurate or outdated. For example, the IMPLAN Input-Output Model apparently assumes that all service station jobs result from fuel sales, although most fuel stations sell many other goods and consider fuel one of their least profitable products (Chmelynski 2008). As a result, the number of regional and national jobs created per million dollars of fuel expenditures is probably far lower than this model would indicate.

Input-output tables are generally static and backward looking in terms for factors such as domestic inputs and productivity, and so will exaggerate future job creation if industries a rely more on imported goods or become more productive, both of which are expected to occur in some industries, such as petroleum and automobile production.

This type of economic analysis often assumes that the economy has excess capacity so public projects do not compete for workers, equipment and other resources with other industries – that without these government expenditures the resources would be wasted. This is often untrue. Without government projects a contractor might choose to accept other lower-profit but productive projects.

Table 2 is an example of input-output table results, in this case for Washington State, showing various industries' direct regional economic impacts ranked from highest to lowest direct employment generation. Overall, construction expenditures rank about average, creating approximately 16 state jobs per million dollars spent, which is better than some industries but less than labor-intensive services such as nursing care (36.43), arts and recreation (30.87) and education (27.13). If economic stimulation is the only objective, more labor-intensive industries such as medical services, education and public transit operation are better investments. Transport facility investments are only justified if they support other strategic objectives.

Table 2 **Washington State Input-Output Multipliers** (OFM 2008)

Industry	Total Jobs Per $million Final Demand	Total Employment Per Direct Job	Total Output Per $ Final Demand	Total Labor Income Per $ Final Demand
Animal Production	37.19	1.593	2.41	0.77
Nursing and Residential Care	36.43	1.461	2.21	0.95
Administrative Support	33.11	1.534	2.17	0.98
Food and Drinking Services	32.12	1.451	2.13	0.71
Arts and Recreation	30.87	1.479	2.01	0.75
Educational Services	27.13	1.550	2.07	0.71
Legal /Accounting services	24.37	1.995	2.24	1.07
Other Transport/Postal Offices	23.04	2.031	2.26	0.94
Architectural and Engineering	22.96	2.234	2.26	1.10
Ambulatory Health Care	22.88	2.012	2.16	0.99
Crop Production	22.74	2.033	2.30	0.64
Waste Management	21.99	1.773	2.04	0.65
Retail	21.92	1.623	1.89	0.66
Truck Transportation	21.57	2.165	2.20	0.83
Transport/Warehousing/Storage	21.49	2.341	2.24	0.95
Hospitals	20.38	2.108	2.11	0.86
Ship and Boat Building	19.97	2.428	2.20	1.06
Mining	19.37	2.320	2.23	0.80
Furniture	18.90	2.005	2.05	0.68
Printing	18.22	2.061	2.02	0.73
Fishing, Hunting, and Trapping	17.99	2.085	2.05	0.78
Textiles and Apparel	17.53	1.782	1.82	0.60
Forestry and Logging	17.30	1.845	1.82	0.37
Construction	*15.95*	*2.344*	*1.97*	*0.64*
Fabricated Metals	15.01	2.101	1.85	0.61
Other Information	14.96	3.359	2.17	0.68
Wood Product Manufacturing	14.78	3.052	2.16	0.54
Real Estate, Rental and Leasing	14.65	1.765	1.70	0.43
Other Finance and Insurance	14.43	2.918	2.10	0.69
Other Manufacturing	14.28	2.034	1.81	0.57
Food, Beverage and Tobacco	14.18	4.001	2.17	0.51
Machinery Manufacturing	13.86	2.229	1.83	0.61
Wholesale	13.76	2.298	1.80	0.62
Nonmetallic Mineral Products	12.56	2.555	1.88	0.52
Primary Metals	12.34	2.782	1.90	0.57
Credit Intermediation	12.34	2.735	1.93	0.51
Computer and Electronics	11.42	2.762	1.79	0.58
Other Utilities	11.05	2.193	1.64	0.47
Internet Service Providers	10.76	5.887	1.89	0.67
Telecommunications	10.71	4.006	2.00	0.50
Water Transportation	10.60	3.682	1.80	0.48
Paper Manufacturing	10.54	4.053	1.99	0.51
Electrical Equipment	10.50	2.436	1.69	0.48
Other Transportation	9.93	3.727	1.82	0.45
Air Transportation	9.60	2.811	1.72	0.44
Chemical Manufacturing	7.96	6.408	1.78	0.50
Electric Utilities	5.84	4.221	1.73	0.30
Aircraft and Parts	5.63	2.814	1.38	0.32
Gas Utilities	5.57	5.382	1.48	0.26
Petroleum and Coal Products	3.23	9.555	1.35	0.15

This table indicates various industries' regional economic impacts. Construction rates average.

Table 3 indicates the national economic impacts of highway expenditure. These have declined during the last decade due to improved labor productivity and increased imports of inputs such as fuel, aggregate and steel. These are upper-bound estimates because they assume resources would otherwise be unused, actual impacts are generally smaller.

Table 3 **Million Dollar Highway Expenditure Impacts** (FHWA 2008)

	1997	2005	2007
Construction Oriented Employment Income	$589,363	$428,842	$394,814
Construction Oriented Employment Person-Years	15.6	10.0	9.5
Supporting Industries Employment Income	$222,577	$192,752	$175,068
Supporting Industries Employment Person-years	5.5	4.5	4.3
Induced Employment Income	$545,182,399	$548,154,399	$492,090,698
Induced Employment Person-years	17.0	14.7	14
Total Employment Income	$1,357,125	$1,169,751	$1,061,973
Total Person-years	*37.9*	*29.2*	*27.8*

This table indicates total estimated economic impacts from a million dollar highway expenditure. These impacts are declining due to increased productivity and reliance on imported resources.

Expenditures on public transit operations (bus and train maintenance and driving) tend to create relatively large numbers of jobs. According to one study, money spent on public transport produces almost 9% more jobs than roadway repair and maintenance projects, and nearly 19% more jobs than new roadway projects, assuming half the transit funds are spent on new capital projects and half on operations (STPP 2004). Transit vehicle purchases tend to have smaller economic impacts because they are mostly imported, although this could change with improved domestic transit vehicle production.

Transportation maintenance and repair projects are generally faster to implement (minimal delay for planning or land assembly), create more jobs per dollar (little money is required for land acquisition or expensive equipment), employ more local workers (fewer tasks require specialized labor), and are more geographically distributed than large highway capacity expansion projects (Troth 2009). Table 4 summarizes employment generation from various infrastructure investments.

Table 4 **Employment Impacts Per Billion Dollar Infrastructure Expenditure** (Heintz, Pollin and Garrett-Peltier 2009, Tables 3.1 and 3.7.)

Category	Direct and Indirect	Plus Induced	Domestic Content
Energy	11,705	16,763	89.4%
Transportation	13,829	18,930	96.8%
Average Roads and Bridges	13,714	18,894	96.8%
New Construction	12,638	17,472	96.7%
Repair Work	14,790	20,317	96.9%
Rail	9,932	14,747	96.9%
Mass Transit	17,784	22,849	96.7%
Aviation	14,002	19,266	96.9%
Inland Waterways / Levees	17,416	23,784	97.3%
School Buildings	14,029	19,262	96.9%
Water	14,342	19,769	96.9%

Future Productivity Gains

Since other public investments can provide greater short-term employment and business activity per dollar spent, transportation projects would not be selected if economic stimulation were the only objective. Transportation investments justified if they also increase future economic productivity by reducing business transportation costs, such as traffic congestion and energy consumption, or achieve other objectives such as improved mobility for non-drivers. As a result, investments that increase transport system efficiency and diversity, and help create more accessible land use development patterns, can be justified for their long-term economic development benefits.

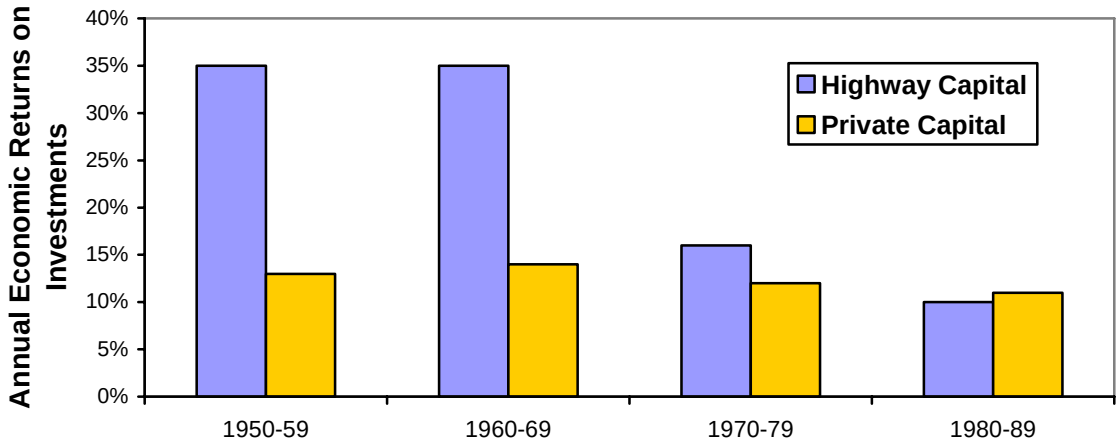
Conventional project evaluation tends to exaggerate highway expansion economic benefits by ignoring induced travel effects (Hodge, Weisbrod and Hart 2003; Litman 2007a). Urban traffic congestion tends to maintain equilibrium; it gets bad enough to discourage further growth in peak-period vehicle trips. Expanding congested roadways tends to provide only short-term benefit because much of the additional capacity is soon filled with latent demand, peak-period vehicle trips that motorists will make if roads are uncongested but will forego (they might shift defer the trip, shift route, mode or destination) if roads are congested.

Most highway expansion benefits are captured by consumers; it increases their mobility, allowing motorists to live in more distant suburbs and exurban areas. Only a small portion of these benefits are captured by businesses since commercial vehicles represent only a small portion of total traffic. Although some industrial trends, such as just-in-time production, increase the importance of road transport, other trends, such as telecommunications that substitute for physical travel, reduce its importance. More efficient roadway management, such as congestion pricing, can provide greater economic benefits by allowing higher-value trips (such as freight deliveries and business travel) to outbid lower value trips (such as SOV commuting) for scarce road space.

Conventional project evaluation also tends to undervalue public transportation service quality improvement benefits (Litman 2007b). High quality, grade separated public transit attracts people who would otherwise drive on congested roadways, which reduces the point of congestion equilibrium (the level of congestion at which travelers reduce their peak-period trips). Although congestion never disappears, it is not nearly as bad as would occur without such transit services. Since transit services experience economies of scale, service quality and cost effectiveness tend to increase as demand grows, providing additional user benefits.

Roadway supply experiences declining marginal benefits: building the first paved highway to a region usually provides significant economic benefits, but each additional unit of capacity provides less net benefits (SACTRA 1999; Kopp 2006). Although highways showed high economic returns during the 1950s and 60s, this declined significantly by the 1990s and has probably continued to decline since the most cost effective projects have already been implemented, as indicated in Figure 1.

Figure 1 **Annual Highway Rate of Return** (Nadri and Mamuneas 1996)



Highway investment economic returns were high during the 1950s and 60s when the U.S. Interstate was first developed, but have since declined, and are now probably below the returns on private capital, suggesting that highway expansion is generally a poor investment of scarce public resources.

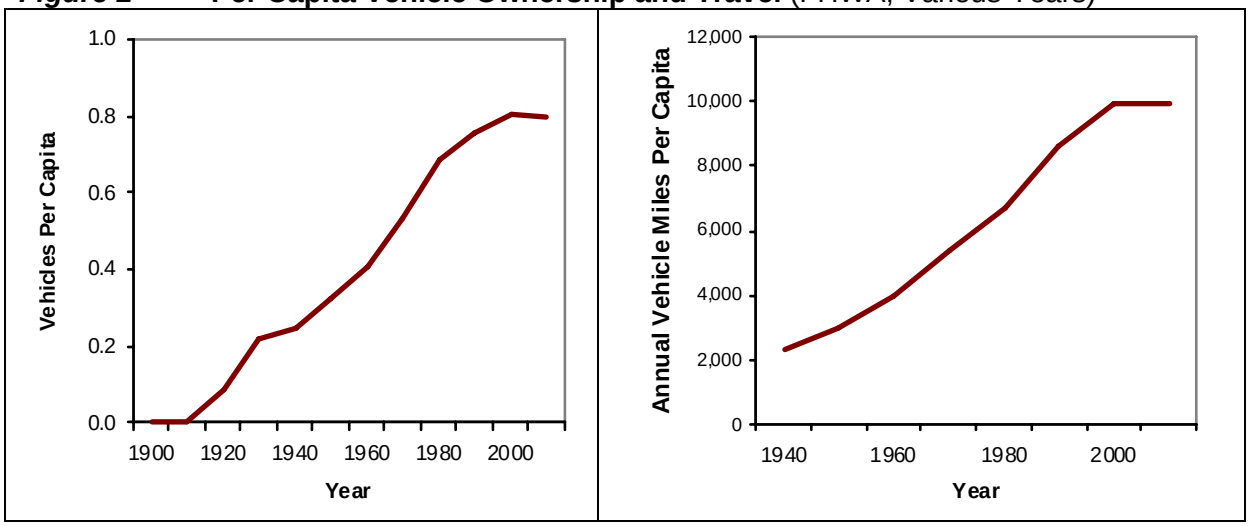
After analyzing highway investments impacts on local economic activity, Peterson and Jessup (2007) conclude, "*some* transportation infrastructure investments have *some* effect on *some* economic indicators in *some* locations." O'Fallon (2003) recommends these infrastructure investments to maximize productivity:

- Ensure macroeconomic policy is conducive to efficient resource allocation.
- Improve infrastructure efficiency through demand management and cost-based pricing.
- Recognise that reliability is particularly important to support trade and business productivity.
- Avoid infrastructure oversupply, which can have a negative impact on the economy as it draws scarce resources away from maintenance and operation of existing stocks.
- Investment in infrastructure projects should be done on the basis of national benefits and on a case-by-case basis. This implies the use of benefit-cost analysis.

Future Transport Demands

Transportation demand refers to the amount and type of travel people choose given specific prices and service options. Current trends are changing travel demands in ways that increase the value of alternative modes (walking, cycling, ridesharing, public transit, and telecommunications) and more accessible, multi-modal communities. Described differently, the last century was the period of the ascendency of automobile transportation so it may have made sense to invest significant public resources in developing roads and parking facilities, but now the roadway system is mature and various demographic and economic trends make other types of transportation investments more appropriate to meet the needs of the few decades.

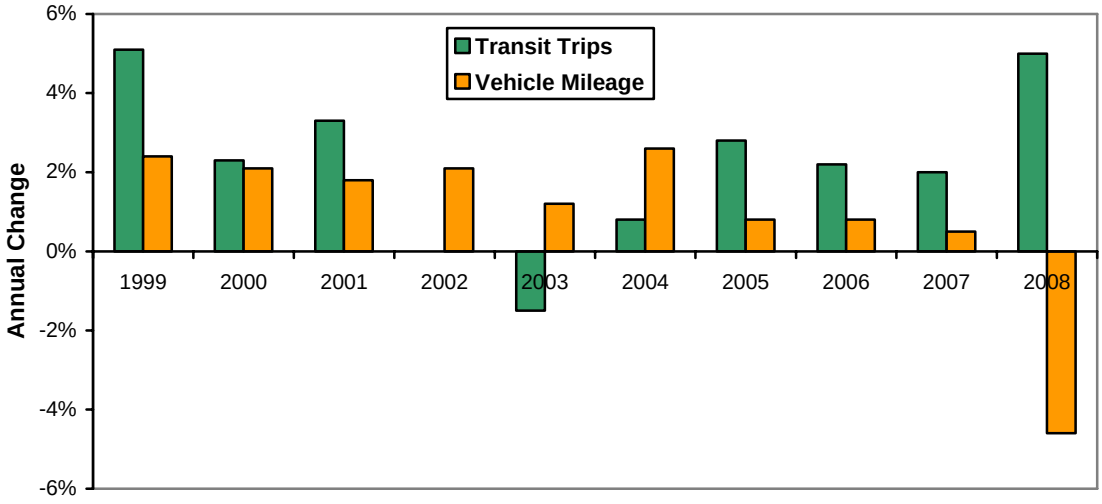
Figure 2 **Per Capita Vehicle Ownership and Travel** (FHWA, Various Years)



Per Capita vehicle ownership and use grew during the Twentieth Century but has saturated and is expected to decline in the future due to demographic and economic trends.

Highway advocates claim that automobile travel demand is large and growing while demand for other modes is small and declining (Moore and Staley 2008), but this is not completely true. Motor vehicle ownership and use grew steadily during the last century, but stopped growing about the year 2000, as illustrated in Figure 2. Transit travel increased more than automobile travel during seven of the last ten years and each of the last four years, as illustrated in Figure 3.

Figure 3 **Annual Change In Transit And Vehicle Travel** (APTA and FHWA data)



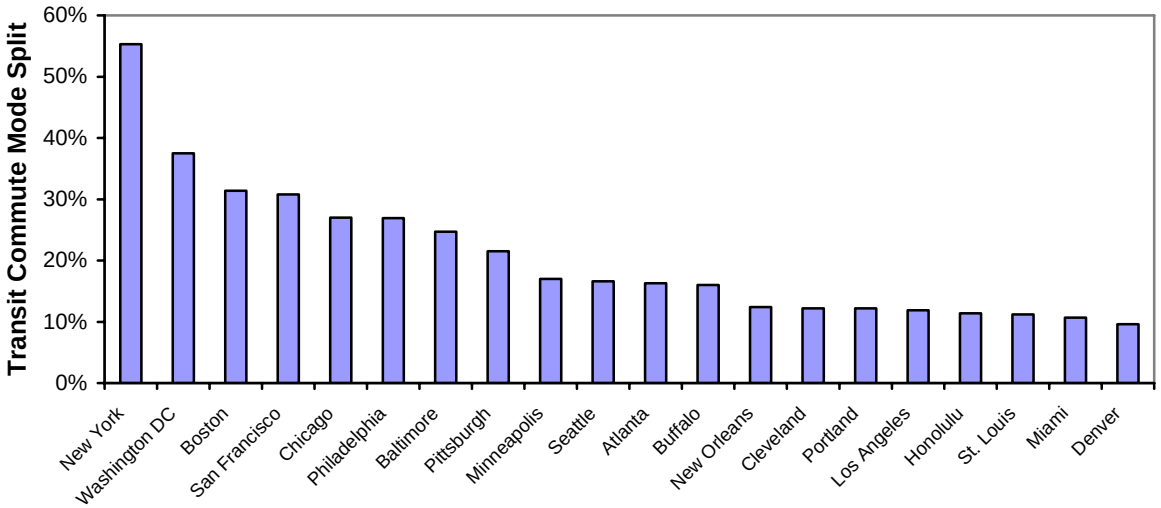
Transit trips increased more than vehicle mileage during seven of the last ten years. During this period transit travel grew 24% compared with a 10% increase in vehicle travel.

Much of this shift in demand predated the 2008 fuel price spike. It reflects demographic and economic trends (Litman 2006; Puentes 2008):

- *Aging population.* As the Baby Boom generation retires per capita vehicle travel will decline and their demand for alternatives will increase.
- *Rising fuel prices.* This increases demand for energy efficient travel options.
- *Increasing urbanization.* As more people move into cities the demand for urban modes (walking, cycling and public transportation) increases.
- *Increasing traffic congestion and roadway construction costs.* This increases the relative value of alternative modes that reduce congestion.
- *Shifting consumer preferences.* Various indicators suggest that an increasing portion of consumers prefer living in multi-modal urban neighbourhoods and using alternative modes.
- *Increasing health and environmental concerns.* Many individuals, organizations and jurisdictions are now committed to reducing pollution and increasing physical fitness.

Although public transit serves only about 2% of *total* U.S. trips, it serves a much larger portion of urban travel, as illustrated in Figure 4. Transit share is even higher for travel to large commercial centers, and so has relatively large economic importance. Many transit systems now carry maximum peak period capacity, constraining further growth. Increasing capacity and improving service quality would allow transit ridership growth.

Figure 4 **Public Transit Mode Split** (U.S. Census 2002)



A relatively large portion of urban-peak travel is by public transit.

Transit critics claim that consumers always prefer automobile travel and abandon alternative modes as they become wealthier, but there are many indicators that wealthy people will choose alternative modes if they are convenient, comfortable and affordable ("Success Stories," VTPI 2008). Transit ridership has increased significantly in U.S. cities that improved their public transit systems (Henry and Litman 2006).

Similarly, there is growing demand for housing in more accessible, multi-modal communities (Molinaro, 2003; Reconnecting America 2004; Nelson, et al. 2009). The 2004 *American Community Survey* found that consumers place a high value on urban amenities such as shorter commute time and neighborhood walkability: 60% of prospective homebuyers surveyed reported that they prefer a neighborhood that offered a shorter commute, sidewalks and amenities like local shops, restaurants, libraries, schools and public transport over a more automobile-dependent community with larger lots but longer commutes and poorer walking conditions (Belden, Russonello and Stewart 2004).

High levels of automobile travel result, in part, from market distortions that favor automobile transport over other modes, such as underpricing for road and parking facility use, fixed vehicle insurance premiums, and dedicate funding for roads and parking facilities that is unavailable for other modes or mobility management strategies, even if they are more cost effective overall ("Market Principles," VTPI 2008). Until such distortions are correcte, expanding congested roadways is economically harmful overall because it exacerbates problems such as congestion, crashes and pollution emissions.

To their credit, some highway advocates support tolling of added capacity to recover costs and control congestion, but this only addresses two of the external costs of induced travel. Only if all the pricing reforms described above are fully implemented can roadway expansion be justified and efficient. Efficient pricing and smart investments would not eliminate automobile travel demand, but this analysis indicates that at the margin (relative to current travel patterns) many Americans would prefer to drive less and rely more on alternative modes if they had more efficient pricing, and alternative modes were more convenient, comfortable and affordable. This demand for high quality transport alternatives is likely to increase in future decades due to previously described demographic and economic trends. As a result, investments that improve the quality of user modes respond better to future demands than urban highway expansion.

Comparing Highway and Transit Benefits

There is considerable debate concerning the relative merits of different transportation modes. As previously mentioned, there is little debate concerning the value of basic highway rehabilitation, and much of the U.S. highway system is now due for major maintenance and repair, as indicated in Federal Highway Administration *Conditions and Performance Reports* (FHWA 2006). Table 5 summarizes results of that report, indicating that current annual highway and transit investments are approximately $28 billion below what is needed for basic maintenance and operational improvements, without highway expansion. It makes little sense to expand the highway system if current funding is inadequate for required maintenance of existing supply.

Table 5 **Annual Highway And Transit Investment Requirements** (FHWA 2006)

	2004 Capital Outlays	Cost to Maintain	Percent Difference	Cost to Improve	Percent Difference
Highways	$26.0	$31.9	23.0%	$48.6	87.1%
Bridges	$10.5	$8.7	-16.6%	$12.4	18.6%
Transit Systems	$12.6	$15.8	25.4%	$16.4	30.2%
Total	*$49.1*	*$56.4*	*15%*	*$77.4*	*58%*

Substantial additional investments are needed to maintain and improve existing U.S. highways and bridges, even without system expansion.

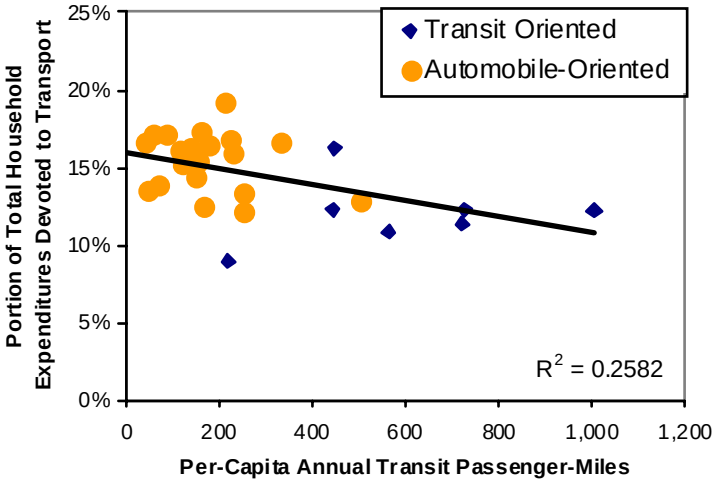
Table 6 compares the highway expansion and public transit improvement benefits. Both provide economic stimulation and congestion reductions (although highway expansion generally only provides temporary congestion reduction benefits), but transit improvements provide several other benefits, including improved convenience and comfort to current transit travelers, parking and consumer cost savings, improved mobility for non-drivers, and various environmental and social benefits.

Table 6 **Highway and Transit Benefits Compared** (Litman 2009)

Benefits	Roadway Expansion	Transit Improvements
Short-term economic stimulation	✓	✓
Long-term job creation		✓
Congestion reduction	✓	✓
User convenience and comfort		✓
Parking cost savings		✓
Consumer cost savings		✓
Reduced traffic accidents		✓
Improved mobility options		✓
Energy conservation		✓
Pollution reduction		✓
Physical fitness & health		✓
Land use objectives		✓

Public transit improvements provide a wider range of benefits than highway expansion.

Figure 5 **Percent Transport Expenditures** (BLS 2003)



The portion of total household budgets devoted to transport (automobiles and transit) tend to decline with increased transit ridership, and is lower on average in transit oriented cities.

For example, adding an urban highway lane typically accommodates about 2,000 additional daily vehicle trips.[2] Although this reduces congestion on that roadway (at least temporarily, until generated traffic fills the capacity), it often increases "downstream" surface street traffic congestion, increases parking demand, requires travelers to own and operate automobiles, and if additional vehicle travel is induced it increases accidents, energy consumption, pollution and sprawl, all costs that could be reduced if the same trips are made by alternative modes.

Residents of multi-modal communities tend to spend less on transportation overall, as illustrated in Figure 5, savings $1,000 to $3,000 annually per household in transport expenditures and so have more money to spend on other goods ("Affordability," VTPI 2008). In addition, governments and businesses have lower roadway and parking costs. Table 7 summarizes external costs of increased vehicle traffic and sprawl, costs that tend to be reduced with improvements to alternative modes.

Table 7 **External Costs of Increased Traffic and Sprawl** (Litman 2009b)

External Costs Of Motor Vehicle Traffic	External Costs of Urban Sprawl
Congestion delay imposed on other vehicle users	Higher public service costs
Delay to nonmotorized travelers	Impacts on openspace and habitat
Parking subsidies	Reduced accessibility, particularly for non-drivers
Uncompensated accident damages and risks	
Fuel consumption externalities	
Air and noise pollution	

Increased vehicle traffic and sprawl impose various external costs (costs imposed on other people).

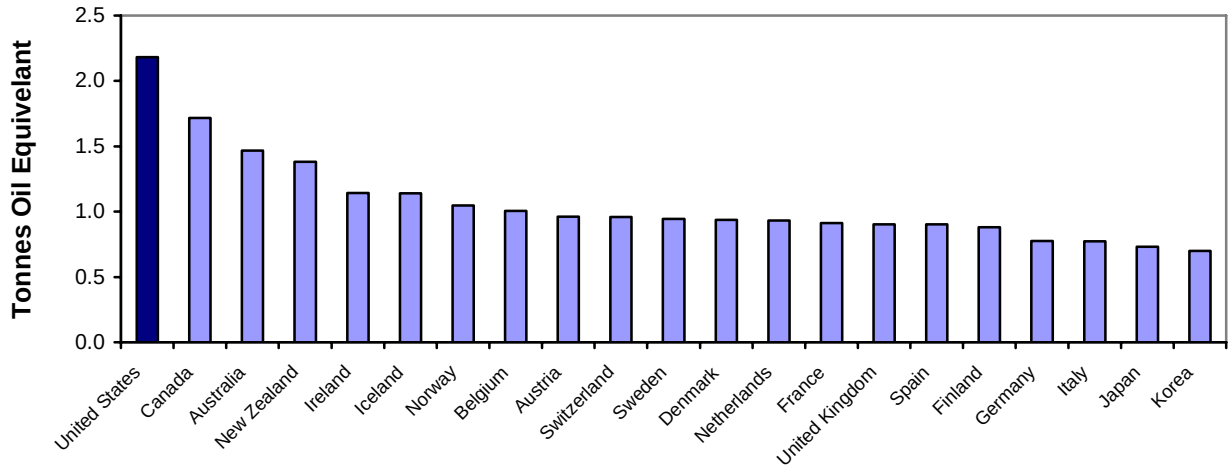
[2] Most traffic lanes carry far more total daily trips, but these are the additional trips that can occur because peak-period traffic is less congested.

Critics sometimes point out that public transit requires more public subsidy per passenger-mile than automobile travel, but this comparison is unfair ("Transit Evaluation," VTPI 2009). About half of transit subsidies are intended to provide basic mobility (service at times and locations with low demand, and special services for people with disabilities), which requires large subsidy per passenger-mile. Transit operates on major urban corridors where any form of transport is costly to provide. In addition, automobile travel receives significant non-government subsidies such as free parking. When properly evaluated, public transit often turns out to be more cost effective and require less total subsidy than accommodating additional automobile travel on the same corridors ("Transit Evaluation," VTPI 2009).

Energy Consumption Impacts

Transportation planning decisions significantly affect future economic development by influencing energy consumption, particularly oil imports. North Americans currently consume about twice as much transportation fuel per capita as peer countries, due largely to differences in fuel taxes, transportation investments and land use planning. Had North America implemented energy conservation policies comparable to peer countries two decades ago, national fuel consumption would be about half its current rate, keeping hundreds of billions of dollars in the economy annually.

Figure 6 **Per Capita Annual Transport Fuel Consumption** (OECD 2005)



Americans consume about twice as much transportation energy per capita as peer countries due to differences in transportation policies, including planning practices and fuel prices.

Dependency on imported petroleum is economically harmful. A US Department of Energy study estimated that excessive dependence on imported petroleum cost the U.S. economy $150-$250 billion in 2005, at a time when oil averaged $35-$45/bbl (Greene and Ahmad 2005). A U.S. Department of Energy study estimates the external costs of imported oil ("the quantifiable per-barrel economic costs that the U.S. could avoid by a small-to-moderate reduction in oil imports"), excluding military costs, to be $13.60 per barrel, with a range of $6.70 to $23.25 (Leiby 2007). These costs are expected to increase in the future as international oil prices rise and as U.S. oil production declines.

For this study we commissioned special analysis using the IMPLAN model, based on 2006 U.S. economic conditions (Lindall and Olson 2005). Table 8 summarizes results. This indicates that in 2006, each million dollars shifted from fuel expenditures to a typical bundle of consumer goods adds 4.5 jobs to the U.S. economy (17.3-12.8), and each million shifted from general motor vehicle expenditures (purchase of vehicles, servicing, insurance, etc.) adds about 3.6 jobs (17.3-13.7). Public transit expenditures create a particularly large number of jobs since it is labor intensive.

Table 8 **Economic Impacts per $1 Million Expenditures** (Chmelynski 2008)

Expense category	Value Added	Employment	Compensation
	2006 Dollars	FTEs*	2006 Dollars
Auto fuel	$1,139,110	12.8	$516,438
Other vehicle expenses	$1,088,845	13.7	$600,082
Household bundles			
Including auto expenses	$1,278,440	17.0	$625,533
Redistributed auto expenses	$1,292,362	17.3	$627,465
Public transit	$1,815,823	31.3	$1,591,993

This table summarizes input-output table analysis. In 2006, a million dollars shifted from fuel expenditures to a typical bundle of consumer goods adds 4.5 jobs to the U.S. economy, and each million shifted from general motor vehicle expenditures adds about 3.6 jobs.
(FTE = Full-Time Equivalent employees)*

These impacts are likely to increase in the future as international oil prices rise, U.S. oil production declines, and petroleum and vehicle production become more automated. Although exact impacts are uncertain and impossible to predict with precision, between 2010 and 2020 a million dollars shifted from fuel to general consumer expenditures is likely to generate at least six jobs, and after 2020 at least eight jobs. This indicates that reducing automobile ownership and use, , so current planning decisions can support future economic development by encouraging transportation system efficiency. For example, transport policies and investments that halve U.S. per capita fuel consumption would save consumers $300-500 billion annual dollars, provide comparable indirect economic benefits, and generate 3 to 5 million domestic jobs.

Consider three policy scenarios. The first maintains the current 34 mile-per-gallon (MPG) average new vehicle fuel economy target for 2020, which increases 2020 fleet economy to 28 MPG. This requires technical improvements, allowing continued production and sales of large numbers of SUVs, light trucks and performance cars. The second scenario raises the 2020 fuel economy target to 50 MPG, increasing average fleet efficiency to 38 MPG. This requires vehicle size reductions so the U.S. vehicle fleet becomes similar to those in Europe and Asia. The third includes this fuel economy target plus mobility management policies such as road and parking pricing, higher fuel taxes, and distance-based insurance and registration fees, more investment in alternative modes, and smart growth policies to reduce total vehicle ownership 10% and average annual vehicle travel from 12,000 to 10,000 miles per vehicle by 2020. The results are summarized in Table 9.

This suggests that transportation policies have large economic impacts by affecting consumer expenditures, particularly per capita fuel consumption. Policies that encourage fuel conservation and increase transport system efficiency tend to increase economic productivity, competitiveness and employment, creating far more jobs over the long run than most industry stimulation strategies.

Table 9 **Scenarios Compared**

	Scenario 1: Auto-industry favored policies	Scenario 2: Increased vehicle fuel economy	Scenario 3: Increased transport system efficiency
Practical requirements	Technical innovations	Technical innovations and smaller vehicles	Technical innovations, smaller vehicles, and mobility management.
Vehicles (millions)	260	260	234
New vehicle average MPG	35	50	50
Fleet average MPG	28	38	38
Avg. annual miles per vehicle	12,000	12,000	10,000
Avg. annual gallons per vehicle	429	316	263
Fuel expenses per vehicle	$2,143	$1,579	$1,316
Fuel savings per vehicle	$0	$564	$827
Percent fuel savings	0%	26%	39%
Total fuel expenditures (millions)	$557,143	$410,526	$342,105
Consumer fuel savings	$0	$146,617	$215,038
Economic costs at $27.20/barrel (millions)[3]	$72,163	$53,173	$44,311
U.S. economic benefits (millions)	$0	$18,990	$27,852
Domestic jobs created	-	1,172,932	1,720,301
Non-fuel expenses per vehicle	$3,031	$3,031	$2,728
Total savings per vehicle	$0	$564	$1,130
Percent total consumer savings	0%	11%	22%
Total vehicle expenditures (millions)	$788,060	$788,060	$638,329
Domestic jobs created	-	-	598,926
Total jobs created	-	*1,172,932*	*2,319,226*
Other economic benefits	-	• consumer fuel savings	• consumer fuel and vehicle savings • congestion reduction • road and parking savings • accident reductions • improved mobility for non-drivers • Improved public fitness and health

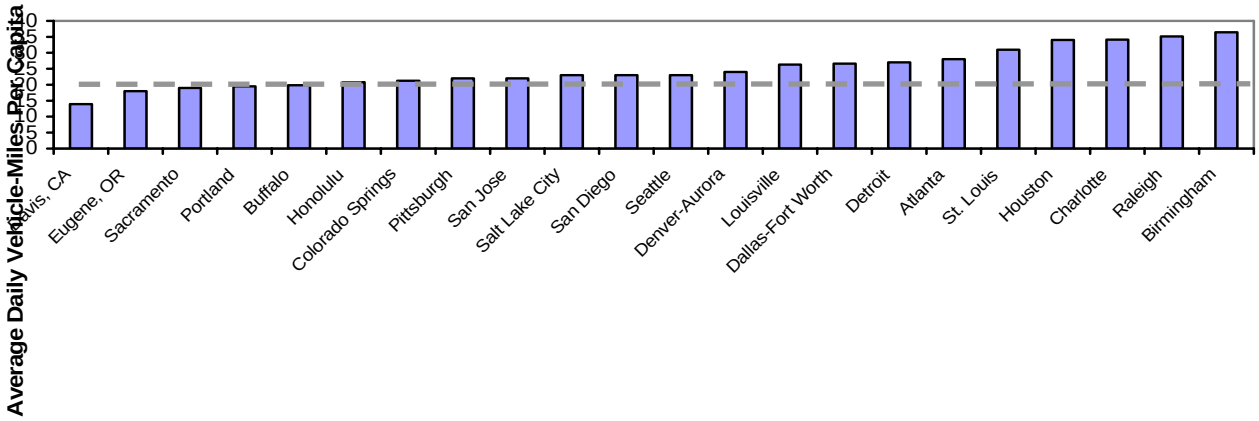
This table compares the economic impacts of various transport policies and investments. Scenario 1 is the baseline. It assumes $5 per gallon fuel prices, 8 net jobs created per million dollars in fuel cost savings and 4 net jobs per million dollars in non-fuel vehicle cost savings.

These scenarios are feasible. Many commercially available vehicles now exceed 50 mpg and their performance (load capacity, acceleration, amenities, etc.) is improving with new

[3] Twice the $13.60/barrel oil import economic costs to reflect the higher portion of imported oil in 2020.

technologies. Mileage reductions of 20-40% are also feasible using economically justified policies such as efficient road and parking pricing, increased investment in alternative modes and smart growth land use policies (VTPI 2008). The result would be communities similar to Eugene, Sacramento and Portland, where per capita motor vehicle travel is less than 20 daily vehicle miles per capita, due to investments in alternative modes and supportive transportation and land use policies (Figure 7).

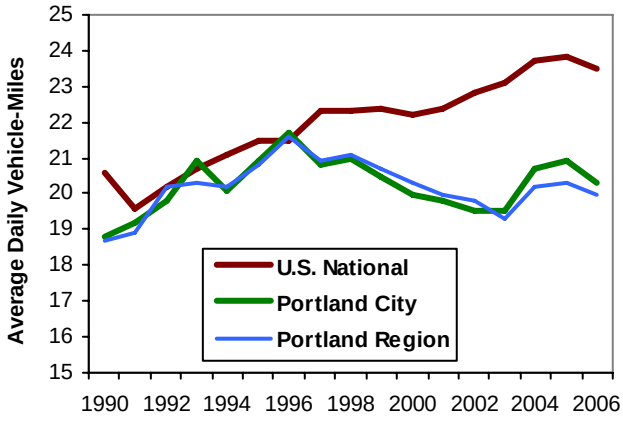
Figure 7 **Average Daily Vehicle Miles Per Capita** (FHWA 2007, Table HM72)



Average daily per capita vehicle travel varies significantly between different cities due to differences in transportation and land use policies. Cities with lower vehicle travel have invested in alternative modes and implemented supportive transport and land use policies.

A good example is Portland, Oregon, which demonstrates that rational transport and land use policies can reduce per capita vehicle travel in established cities, as illustrated in Figure 8. It reduced per capita vehicle travel about 20% compared with national trends by shifting investments from urban highway expansion to high quality transit systems and non-motorized facilities, and implementing supportive land use policies. This provided numerous benefits (Cortright 2007).

Figure 8 **Portland Travel Trends** (www.oregonmetro.gov/index.cfm/go/by.web/id=26796)



Portland vehicle travel declined 10-15% due to transport and land use policy changes.

Domestic Automobile Industry Subsidies

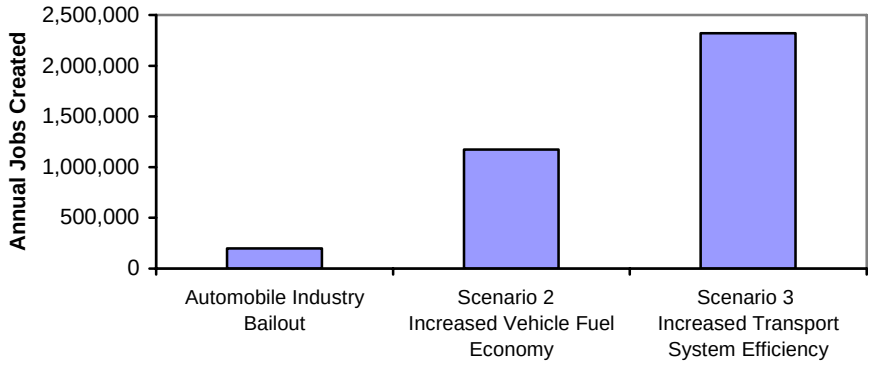
Domestic vehicle manufactures were once leaders in profits, employment and innovation, but now have low profits and average wages, and depend on government subsidies. GM, Ford and Chrysler currently have about 240,000 employees, less than 0.2% of the U.S. workforce, and are contracting (Rubin and Grauman 2009). Industry advocates exaggerate domestic vehicle manufacturer bankruptcy job losses by including all related employment (CAR 2008). Without domestic manufactures Americans would continue to purchase, service and produce vehicles (many foreign manufactures have US factories), and many affected employees would find other jobs or are soon scheduled to retire. This is not to deny that auto company bankruptcies would harm many employees and investors, but there is little reason to favor this industry over others with better futures.

The $34 billion vehicle industry loans represent about $150,000 per job, the approximate cost of a four-year university education. Current economic trends do not favor domestic vehicle production so full repayment is unlikely. These loans are in addition to numerous direct and indirect subsidies by local, state and federal governments. Automobile industry subsidies are an inefficient economic stimulation strategy (Wooders and Perera 2009).

Even worse, efforts to support domestic vehicle producers could distort public policies economically, socially and environmentally harmful ways. Large, fuel inefficient vehicles are the U.S. manufactures most profitable products. If U.S. citizens and public officials consider themselves vehicle industry shareholders, they may favor policies that favor inefficient vehicles and encourage automobile ownership. This has already occurred: in December 2008 the federal government stopped proposed increases in vehicle fuel efficiency standards on grounds that they threaten domestic manufacturers' competitiveness and profitability. Even worse would be transport policies favoring automobile travel over more efficient alternatives to support the automobile industry.

Automobile industry loans create fare fewer jobs than the previously described scenarios that increase fuel economy and transport system efficiency (Figure 9). This understates Scenario 3 benefits since improved transport system efficiency increases economic development in other ways, by reducing congestion, accidents and parking costs.

Figure 9 **Transport Policy Employment Impacts**



Increased transport efficiency creates far more jobs than automobile industry loan guarantees.

Additional Factors to Consider

Below are additional factors to consider when evaluating transportation investments.

Consumer Welfare

Improving transportation and land use options tends to increase consumer welfare by allowing individuals to choose the combination that best meet their needs. Demand for alternative modes and more multi-modal communities is increasing (Nelson et al. 2009). The current U.S. transportation system offers relatively good automobile travel options: it is possible to drive from nearly any origin to almost any destination with reasonable convenience and comfort, but travel without an automobile is often difficult. Investments that improve alternative modes tend to benefit consumers by letting them choose the options that best reflect their needs and preferences. As a result, improving walking, cycling and public transit, and providing more housing options in multi-modal communities, tends to increase consumer welfare by allowing individuals to choose options that match their needs and preferences.

Transportation Affordability

Improving affordable transportation options, such as walking, cycling and public transit, tends to be particularly beneficial for lower-income people ("Affordability," VTPI 2008). This further increases consumer welfare, helps achieve equity objectives, and helps solve specific problems, such as the difficulty some economically disadvantaged people have accessing education, employment and basic services.

Housing Affordability

A common criticism of smart growth and transit oriented development is that it increases housing costs, displacing lower-income residents (called *gentrification*). This is not necessarily true. Although urban areas tend to have high land unit costs (costs per acre) and many people want to live in accessible, transit-oriented areas, good public policies can offset these factors by increasing densities (reducing the amount of land required per housing unit), increasing the total amount of transit oriented development and incorporating affordable housing into such projects in order to reduce the price premium charged for accessible locations. In other words, housing is only unaffordable in transit oriented locations because demand exceeds supply, so the best solution is to expand supply. Since residents of multi-modal communities spend significantly less on transportation, such locations can be more affordable overall (transport and housing costs combined) even if housing costs are somewhat higher.

Transportation System Efficiency and Resilience

A more diverse transportation system tends to provide additional economic efficiency benefits because it is more flexible and able to respond to future changes, including sudden and unexpected changes that may result from a disaster or economic crisis. For example, a more diverse transportation system is less vulnerable to closure of a network link, a fuel shortage, or the need to evacuate.

Best Practices

Smart transportation economic stimulation reflects the following principles:

- Supports strategic planning objectives.
- Uses comprehensive analysis to select projects, considering all significant impacts and options, including economic objectives (such as improving accessibility and reducing dependency on imported fuel), social objectives (improving accessibility for non-drivers, and encouraging public fitness and health) and environmental objectives (such as reducing pollution emissions and pavement area).
- Responds to future demands, taking into account changing demographics, economics and consumer preferences.
- Protects past investments by rehabilitating existing transportation infrastructure (sidewalks, paths, roads, bridges and transit systems) and redeveloping existing communities.
- Supports strategic land use objectives, such as creating more accessible, multi-modal communities.
- Reduces household transportation costs, particularly future energy consumption.
- Improves transportation options for mobility disadvantaged people.

This suggests that the following investments are best:

- *Roadway repair, maintenance and safety improvements.* Highways are a critical component of the transportation system, and many are in need of major rehabilitation.
- *Increased public transit service.* This is an effective economic stimulation strategy because it increases short-term employment, improves mobility for lower-income people (allowing unemployed people better options for accessing schooling and job opportunities), and increases economic productivity by reducing traffic congestion and parking costs.
- *Improvements to efficient modes, including walking, cycling, ridesharing and public transit.* This responds to future travel demands, allows households to reduce their transport costs, supports economic development by reducing energy demand and other transportation costs, improves mobility for non-drivers, and improves public fitness and health.
- *High Occupant Vehicle (HOV) priority improvements.* This saves HOV users time, encourages use of these resource-efficient modes, and reduces traffic congestion.
- *Improvements to longer-distance travel, including rehabilitation of intercity highways, rail lines, rail and bus terminals, airports and ports.* This improves transport system efficiency and supports trade.
- *Investments that support smart growth land use policies.* This includes building more affordable housing in accessible locations, brownfield rehabilitation, urban infrastructure upgrades, improved public services (such as schools and medical clinics) in smart growth locations, and other forms of urban redevelopment. This increases transport system efficiency, reduces public service costs, and reduces environmental impacts associated with sprawl.

Conclusions

Many types of public investments can increase short-term employment and business activity, but some are much better overall because they also support other strategic goals. Smart economic stimulation responds to future demands and helps achieve various economic, social and environmental objectives.

This study indicates that highway rehabilitation and safety programs are economically beneficial, but urban highway expansion tends to stimulate more driving and sprawl, exacerbating transportation problems. Demographic and economic trends are increasing demands for alternative modes and reducing highway expansion benefits. Investments that improve alternative modes can provide the following benefits:

- Congestion reduction
- Road and parking facility cost savings
- Consumer savings
- Improved mobility for non-drivers
- Improved land use accessibility
- Accident reductions
- Energy conservation
- Pollution reductions
- Improved community livability
- Improved public fitness and health

Increasing fuel efficiency and transport system diversity is particularly important for long-term economic development. Fuel and vehicle purchases generate fewer domestic jobs and less economic activity than most other consumer expenditures. Each million dollar shifted from purchasing fuel to a typical bundle of consumer goods adds 4.5 U.S. jobs, and this is likely to increase significantly in the long run as international oil prices rise and domestic production declines. Each million shifted from general motor vehicle expenditures (purchase of vehicles, servicing, insurance, etc.) adds about 3.6 U.S. jobs. Public transit operations create a particularly large number of jobs.

A reasonable scenario of aggressive fuel economy targets, investments in alternative modes and supportive land use policies can reduce U.S. fuel consumption 20-40%, saving future consumers $150-350 billion annually in fuel and vehicle expenses, providing economic benefits from reduced fuel import costs of similar magnitude, producing additional economic, social and environmental benefits, and generating 1 to 2 million additional annual domestic jobs. This equals the total jobs created by $30 to $60 billion in infrastructure expenditures and is five to ten times greater than the jobs provided by domestic vehicle manufactures.

Financial support of U.S. automobile manufactures is not economically justified. The subsidy required to maintain an automobile factory job is greater than the cost of a typical college education, or could finance other programs that help make the U.S. economy more efficient and competitive. Investments that increase transport system efficiency create more total jobs per dollar and better prepare the economy for future demands.

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