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Automobile Dependency and Economic Development

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Abstract

Automobile dependency consists of high levels of per capita automobile travel, automobile oriented land use patterns and limited transport alternatives. Automobile dependency has many impacts on consumers, society and the economy. It increases mobility and convenience to motorists. It increases consumers' transportation costs and resource consumption, requires significant financial and land resources for roads and parking facilities, and it increases traffic congestion, roadway risk and environmental impacts. It reduces the viability of other travel modes and leads to more dispersed land use and mobility intensive economic patterns that require more vehicle travel for access. This paper examines macroeconomic impacts of automobile dependency (impacts on overall economic development, productivity, competitiveness and employment). Both economic theory and empirical evidence indicates that excessive automobile dependency reduces economic development. Several current market distortions result in automobile dependency beyond what is economically optimal. Policies that encourage more efficient transportation and land use patterns can provide economic benefits.

Introduction

Automobile dependency is defined as high levels of per capita automobile travel, automobile oriented land use patterns and reduced transport alternatives.[1] The opposite of automobile dependency is a balanced transportation system with more mixed travel patterns. Automobile dependency is a matter of degree.[2] In its extreme, nearly all local trips are made by personal automobile because alternatives are so inferior.

To experience automobile dependency, forego driving for a few typical weeks. In a highly automobile dependent community you will encounter significant problems – you may have trouble commuting, running errands, and even crossing busy streets. In a community with balanced transportation you will have fewer problems.

Some people suggest that automobile dependency always increases as consumers become wealthier,[3] but this is not necessarily true. Many wealthier regions have balanced transportation systems while some poorer regions are quite automobile dependent.[4] The differences result from public policies that affect transport choices and land use patterns.[5]

This paper investigates the macroeconomic effects of automobile dependency, that is, its impacts on regional economic development (productivity, competitiveness and employment), and conversely the economic impacts of a more balanced transport system.

This is important because transportation is itself a major economic sector and impacts virtually all other sectors. Public policies influence transportation choices and activities in various ways. Many current policies favor automobile dependency, including public expenditures on roads and traffic services, abundant parking requirements, favorable pricing policies, and land use scaled for automobile travel.

These policies reflect an assumption that increased automobile use provides economic benefits and reflects consumer demand. However, evidence described in this paper suggests that current market distortions result in excessive automobile dependency which reduces economic development, that alternative policies which encourage more balanced transportation can increase economic development, and in response to such reforms, consumers would choose to drive significantly less and be better off overall as a result.

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[1] Peter Newman and Jeffrey Kenworthy, *Sustainability and Cities; Overcoming Automobile Dependency*, Island Press (www.islandpress.org), 1998. Also see *The Millennium Cities Database for Sustainable Transport*, International Association of Public Transport (www.uitp.com), 2001. "Automobile" refers to cars, vans, light trucks and SUVs.

[2] James Wickham and Maria Lohan, *The Social Shaping of European Car Systems*, Employment Research Centre, Trinity College (Dublin; www.tcd.ie/erc/cars/reports.html), European Commission, 1999.

[3] Kenneth Green, *Defending Automobility: A Critical Examination of the Environmental and Social Costs of Auto Use*, Reason Foundation (Los Angeles; www.reason.org), 1995.

[4] Jeffrey Kenworthy and Felix Laube, "Patterns of Automobile Dependency in Cities," *Transportation Research A*, Vol. 33, No. 7/8, Sept./Nov. 1999, pp. 691-723.

[5] John Pucher and Christian Lefèvre, *The Urban Transport Crisis in Europe and North America*, MacMillan (London), 1996.

Economic Development Impacts of Automobile Dependency

Automobile dependency has various impacts that affect economic development.[6] These are summarized below and some are discussed in detail later in this paper.

1. Increased Mobility And Convenience For Motorists

Automobile dependency directly benefits vehicle users: favorable pricing, investment, facility design, parking and land use practices make driving relatively fast, convenient and affordable. It also allows businesses to use more centralized distribution systems and Just-In-Time production, and to access a wider range of possible employees and customers, which can cause certain types of agglomeration efficiencies, such as large retail centers. These savings and efficiencies can increase economic development if they increase the productivity of local industries. These productivity benefits are separate and in addition to consumer benefits from increased mobility.

However, not all increased vehicle use by producers represents increased productivity. As discussed later in this paper, automobile dependent transportation systems and land use patterns require more travel to provide a given level of services.

2. Increased Vehicle And Fuel Expenditures

Automobile dependency increases per capita vehicles and fuel expenditures, often increasing average annual household transportation expenditures by thousands of dollars, and reduces expenditures on other consumer goods. This can have significant economic impacts, particularly because most vehicles and fuel are imported from other regions.

3. Increased Road And Parking Expenditures

Automobile dependency increases expenditures on roads, traffic services and parking facilities, often averaging hundreds of dollars annually per household. Annual per capita road expenditures average $264 in automobile dependent U.S. cities, $135 in less automobile dependent European cities, and only $88 in the least automobile dependent Asian cities, representing savings in both absolute terms and as a portion of Gross Regional Product.[7]

4. Increased Traffic Congestion, Crash Damages And Environmental Impacts

Increased automobile travel tends to increase total traffic congestion delays, crashes and environmental impacts such as air pollution and impervious surface coverages. Although some impacts may be relatively low per kilometer in automobile dependent areas (for example, traffic congestion is often high in older, multi-modal cities, and per kilometer crash rates are often high in developing countries where automobile ownership is low), total costs per capita tend to be higher due to high levels of vehicle use.

These costs can reduce regional productivity: Traffic congestion reduces the efficiency of businesses and services that involve local travel. Crash damage costs are borne directly through increased insurance fees and lost worker productivity, and indirectly through taxes to cover injuries and disabilities. Environmental damages can cause illnesses and disabilities, and degrades environmental amenities that have market value to real estate and tourism industries.

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[6] Todd Litman, *The Costs of Automobile Dependency*, VTPI (www.vtpi.org), 1999.

[7] Peter Newman and Jeff Kenworthy, *Sustainability and Cities; Overcoming Automobile Dependency*, Island Press (Covelo; www.islandpress.org), 1998, p. 144.

5. Automobile-Oriented Land Use[8]

Automobile dependency has many land use impacts: buildings become lower and wider, building are separated from each other and sidewalks by parking lots, activity centers (businesses and other public facilities) are located along arterials and highway intersections rather than in clusters and traditional commercial centers, and large areas are devoted to single uses (for example, residential areas may lack retail businesses and public services). Automobile dependency also increases the amount of land that is paved for roads and parking facilities.

These impacts have several costs that affect economic productivity and development.[9] They can increase the total amount of vehicle travel required for access, increasing travel time and vehicle expenses. They reduce the amount of land available for other productive uses and increase the costs of providing utilities, public services and stormwater management.

6. Reduced Travel Choices

Automobile dependency reduces the quantity and quality of transportation choices. At the street level, increased automobile traffic makes walking and cycling more difficult and unpleasant. As middle-class consumers drive more and depend less on other modes there is less political support for these alternatives. As demand for public transit decreases service quality declines. Although most automobile dependent communities subsidize public transit, such subsidies cannot offset the structural inefficiencies of operating public transit in unsuitable conditions.

In addition to the direct costs and inequity that this reduction in mobility choices imposes on non-drivers, it can also reduce economic productivity if it limits access to education and jobs. In automobile dependent areas, a lack of travel choices for non-drivers can be a major barrier for welfare-to-work efforts, and for many employers who rely on lower-income workers who often have limited access to an automobile.[10]

In summary, automobile dependency has both positive and negative economic development impacts. Benefits are associated with more efficient local travel that affects productivity and some retail efficiencies. Offsetting these are various inefficiencies and increased costs that are borne throughout the economy. By creating more dispersed land use patterns, fewer travel alternatives and a more travel intensive economy, a portion of the increased mobility is offset by reduced access: more driving is needed to reach goods and activities. This offsets the productivity benefits of increased mobility.

This paper explores how can society maximize the benefits and minimizing the costs associated with automobile dependency. The next section of this paper explores some of theoretical issues that can help answer this question.

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[8] Terry Moore and Paul Throsnes, *The Transportation/Land Use Connection*, American Planning Association, Report 448/449 (Chicago; www.planning.org), 1994.

[9] Robert Burchell, et al., *The Costs of Sprawl – Revisited*, TCRP Report 39, TRB (www.nas.edu/trb), 1998; Todd Litman, *Land Use Impact Costs of Transportation*, VTPI (www.vtpi.org), 1999.

[10] Evelyn Blumenberg, Steven Moga and Paul M. Ong, *Getting Welfare Recipients to Work*, University of California Transportation Center Report 389 (http://socrates.berkeley.edu/~uctc), 1998.

Theoretical Issues

Defining Transportation

Transport is necessary for most economic activities. A tree has little market value if it cannot be hauled to a mill, the lumber shipped to a store and then delivered to a construction site. Creating economic value from a tree also requires that employees can travel to logging, mill and construction sites, and that customers can travel to stores and the location of the finished building.

But mobility is not an end in itself. The ultimate objective of most travel is "access," the ability to obtain desired goods, activities and activities.[11] There may be many ways to achieve access, including various travel modes, destinations, and alternatives to physical movement. For example, shopping may involve a trip by car, bus or foot, to a near or far store, or goods can be ordered electronically and delivered by courier. It is important, therefore, to avoid measuring transportation quality only in terms of automobile travel, or to overlook ways that automobile dependency can reduce other forms of access.

Marginal Benefits

Most economic inputs exhibit diminishing marginal benefits: unit benefits decline with increased use. For example, if you only eat one meal a day, a second daily meal provides significant benefits, and a third daily meal is also beneficial, but a fourth meal provides much less benefit, and a fifth or sixth daily meal may not be beneficial at all.

Applied to transportation, a certain amount of automobile use can be expected to provide significant consumer benefits. For example, a community with no automobiles probably benefits a lot from having a local taxi that serves high-value travel: emergencies, celebrations, and special trips. However, as more residents obtain cars the benefits of additional vehicle trips decline since the most valuable trips have already been taken. This is not to say that more car trips provide no consumer benefits, just that the incremental benefits of additional trips tend to decline with increased use.

Thus, the first 2,000 miles of annual per capita automobile use probably provides significant benefits to consumers and society because it consists of high-value trips. But each 2,000 miles of additional annual automobile miles provides much less additional benefit.

While marginal benefits decline, many costs increase with more vehicle use. Congestion and crash risk increase as the roadway fills with vehicles, and adding capacity becomes more expensive as property values increase along busy roads. Thus, the unit price of automobile travel should increase with vehicle use. This would encourage motorists to limit their vehicle use to the system's capacity, which is to say, the social optimal mileage. However, consumers are accustomed to prices that decline with increased use.

[11] *Mobility and Access; Transportation Statistics Annual Report 1997*, BTS (www.bts.gov), Chapter 6.

Most consumer goods have increasing marginal benefits (efficiencies of scale). A single envelope purchased at a store might cost 10¢, but a box of 100 costs $2 (2¢ each), and a case of 1,000 only $10 (1¢ each). This occurs because much of the cost of such products are in the transactions; it takes a clerk the same effort to sell a single envelope as it does to sell a box or case. Thus consumers have come to expect discounts for larger purchases.

Automobile purchases and use may have provided economies of scale during the early periods of vehicle production and road development.[12] At that time you would benefit if your neighbors purchased more automobiles and drove them more miles because this reduced the unit costs of car and paved roads. But once an automobile industry develops and a basic road network exists these external benefits no longer exist. There is no evidence of economies of scale in the current automobile market.

Principles of Market Efficiency

A properly functioning market is usually the best way to allocate resources. Such a market must reflect certain principles, including consumer choice, competition, optimal pricing and economic neutrality. Current transport markets often violate these principles, as indicated in Table 1. Most of these distortions favor automobile use which leads to excessive automobile dependency, meaning more than would occur in an efficient market. This is not to suggest that automobile use is bad or would stop in a more optimal transport market. There are many trips for which automobile travel is the best choice overall. But consumers are predicted to significantly reduce their automobile use in a more economically efficient transportation system.[13]

Table 1 **Market Distortions That Contribute to Auto Dependency**[14]

Market Requirements	Common Transport Market Violations
Choice. Consumers need viable choices, and information about those choices.	Consumers often have few viable alternatives to owning and driving an automobile, and living in automobile-dependent communities.
Competition. Producers must face competition to encourage innovation and efficient pricing.	Most roads and public transit services are provided as public monopolies. There is often little competition or incentive for innovation.
Cost-based pricing. Consumers must bear the costs they impose. There should be no significant external costs unless specifically justified.	Automobiles use is underpriced: most costs are either fixed or external. Lower-density, automobile-dependent land use patterns are also underpriced.
Economic neutrality. Public policies (laws, taxes, subsidies, investment policies) must not favor one class of businesses or good over others, unless specifically justified.	Many public policies favor automobile use, including dedicated road funding, road designs that favor motor vehicle traffic over other road uses, zoning laws that provide generous free parking and lower density

[12] Marlon Boarnet, "New Highways & Economic Productivity: Interpreting Recent Evidence," *Journal of Planning Literature*, Vol. 11, No. 4, May 1997, pp. 476-486, , also available as Working Paper 291, University of California Transportation Center (http://sacrates.berkeley.edu/~uctc), 1995; Clay McShane, *Down the Asphalt Path*, Columbia University Press (New York), 1994, p. 105.

[13] Todd Litman, *Socially Optimal Transport Prices and Markets*, VTPI (www.vtpi.org), 1999.

[14] Todd Litman, *Transportation Market Distortions; A Survey*, VTPI (www.vtpi.org), 1999.

	development, and a lack of cost-based pricing.

Resource Costs Versus Economic Transfers

The focus of this analysis is on resource costs and productivity impacts which affect economic development. Although more efficient production will sometimes reduce employment and business activity in a particular sector in the short term, over the long term it frees up resources that increase overall economic activity, employment and social benefits. Policy changes often cause economic transfers so that one business or industry gains at the expense of others, but these balance out within the economy. Although automobile dependency may benefit some economic sectors, it burdens others.

Some policy changes involve transition costs, that is, economic costs of change. For example, businesses that now provide free parking may incur costs over the short term if they cash-out parking, which requires changing administrative practices and selling or renting surplus parking capacity. Similarly, the automobile industry may incur transition costs if they shift to producing other goods. These transition costs can be minimized through good planning so that changes are predictable and gradual.

Induced Travel

Because automobile dependency leads to more dispersed land use and more travel intensive activities, at least a portion of motorists' increased speed and mobility is offset by the need to travel more in order to maintain a given level of access. Some research indicates that virtually all travel time savings are eventually devoted to increased travel, resulting in a constant amount of personal time being devoted to transportation on average, regardless of the travel options available.[15] One geographer writes,

> "Those who use technology to travel at greater speeds still have to make the same amount of contacts--still work, eat, sleep and play in the same proportions as always. They simply do these further apart from each other."[16]

Although individual consumers benefit when they increase their vehicle travel in response to automobile dependent transportation and land use conditions, they might benefit more from a policy change that increases access and therefore reduces the amount of travel required to obtain goods, services and activities.

[15] Gordon Stokes, "Travel Time Budgets and Their Relevance for Forecasting the Future Amount of Travel, in *Proceedings of European Transport Forum*, PTRC, Sept. 1994, p. 25-36.

[16] John Whitelegg, "Time Pollution," *The Ecologist*, Vol. 23, No. 4, July/Aug. 1993, p. 131-134.

Economic Impacts of Automobile Dependency - Empirical Evidence

Automobile Use and Economic Activity

While automobile use often increases with economic development, this occurs because wealth allows more driving, not that increased driving leads to wealth. An international study found that per capita automobile ownership peaks at about $21,000 annual income and then declines due to increased congestion, loss of novelty, and public policy responses.[17] Many countries experience their greatest economic growth when per capita automobile use is relatively low, and economic growth rates decline as households become wealthy enough to afford more consumer goods such as private cars. Similarly, some impoverished regions are relatively automobile dependent.

International studies summarized in Table 2 indicate that automobile dependency reduces regional economic development. High levels of per capita automobile use are found to increase the portion of regional wealth devoted to roads and commuting, increase per capita accidents, and reduce the efficiency of transit service. Figure 1 illustrates the relationship between vehicle use and productivity.

Table 2 **Economic Data on Global Cities, 1990**[18]

	Australian Cities	US Cities	Metro Toronto	European Cities	Wealthy Asian Cities	Developing Asian Cities
Per capita GRP	$19,761	$26,822	$22,572	$31,721	$21,331	$2,642
Per capita car use (kms)	6,536	10,870	5,019	4,519	1,487	1,611
Per capita road expenditures	$264	$142	$150	$135	$88	$39
Road expenditure per $1,000 GRP	$7.19	$9.84	$6.65	$4.26	$4.13	$14.76
Transit operating cost recovery	40%	35%	61%	54%	119%	99%
Transport deaths per 100,000 pop.	12.0	14.6	6.5	8.8	6.6	13.7
Total car and transit operating expenditures as portion of GRP	13.2%	12.4%	7.4%	8.1%	4.8%	15.9%

(GRP = Gross Regional Product)

This research indicates that beyond an optimal level (about 7,500 kilometers of per capita annual motor vehicle travel overall, although this varies depending on geographic and economic factors), the economic costs of increased vehicle travel outweigh the marginal benefits. The researchers conclude that, "*there are no obvious gains in economic efficiency from developing car dependence in cities*," and, "*There are on the other hand significant losses in external costs due to car dependence*". Regions with balanced transportation systems appear to be most economically productive and competitive.

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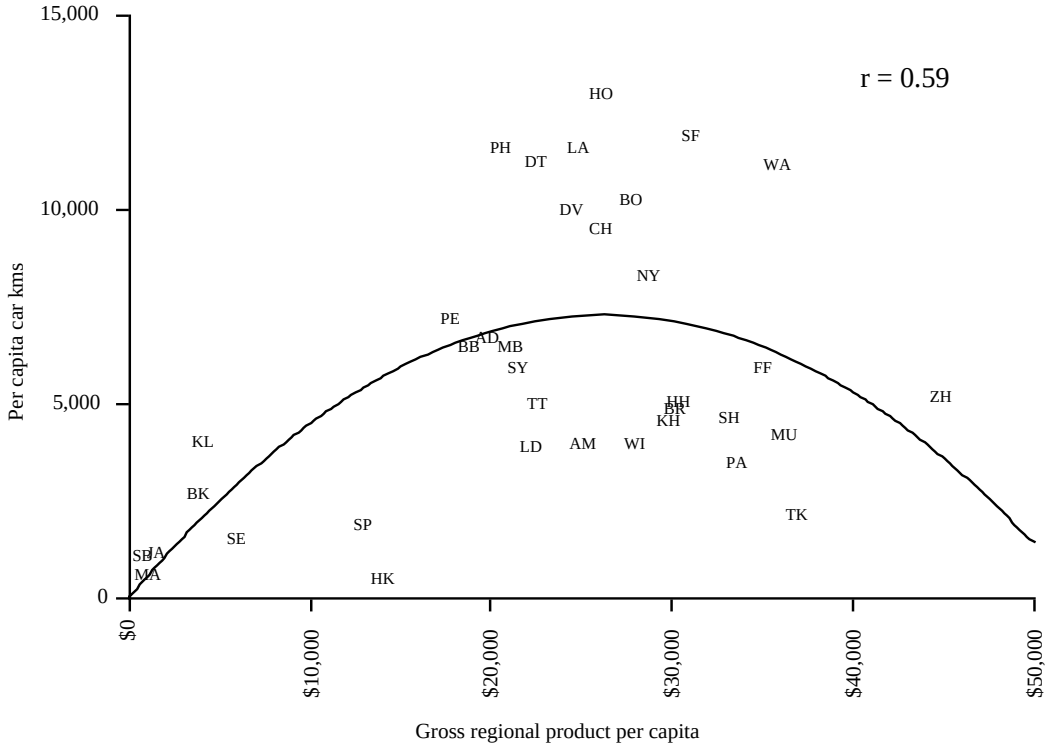
[17] D. Talukadar, "Economic Growth and Automobile Dependence," Thesis, MIT, 1997, cited in Ralph Gakenheimer, "Urban Mobility in the Developing World," *Transport. Research A*, Vo. 33, 1999, p. 680.

[18] Jeff Kenworthy, Felix Laube, Peter Newman and Paul Barter, *Indicators of Transport Efficiency in 37 Global Cities*, Sustainable Transport Research Group, Murdoch University (Perth; http://wwwistp.murdoch.edu.au), for the World Bank (Washington DC), February 1997; Peter Newman and Jeff Kenworthy, *Sustainability and Cities; Overcoming Automobile Dependency*, Island Press (Covelo; www.islandpress.org), 1999.

Figure 1 **Vehicle-Kms Versus Gross Regional Product in 37 Cities, 1990**[19]



This figure indicates that there is no clear relationship between wealth and vehicle travel. Beyond a certain income level per capita vehicle travel actually declines.

This research indicates that automobile dependency reduces economic development and competitiveness by increasing transportation costs, particularly since such expenditures tend to divert large amounts of capital from more economically productive uses, and increase the consumption of imported goods (vehicles and fuel).[20] Differences between the two groups of Asian cities highlight this point. The wealthy Asian cities are the most efficient overall, while the newly industrializing Asian cities are the least efficient. This seems associated with the high proportion of wealth devoted to roads and vehicle use (0.637 km/$ of Gross Regional Product [GRP] compared to 0.070 km/$ of GRP).

This suggests that automobile dependency approximately doubles the portion of regional wealth devoted to transport. An automobile dependent transportation system maximizes mobility (movement of people and goods), while a balanced transportation system can optimize access (the ability to obtain goods, services and acitivities). This reduces total transportation costs, as illustrated in Figure 2. The data indicate that each kilometer of transit travel "leverages" 5 or more kilometers of reduced automobile travel.[21]

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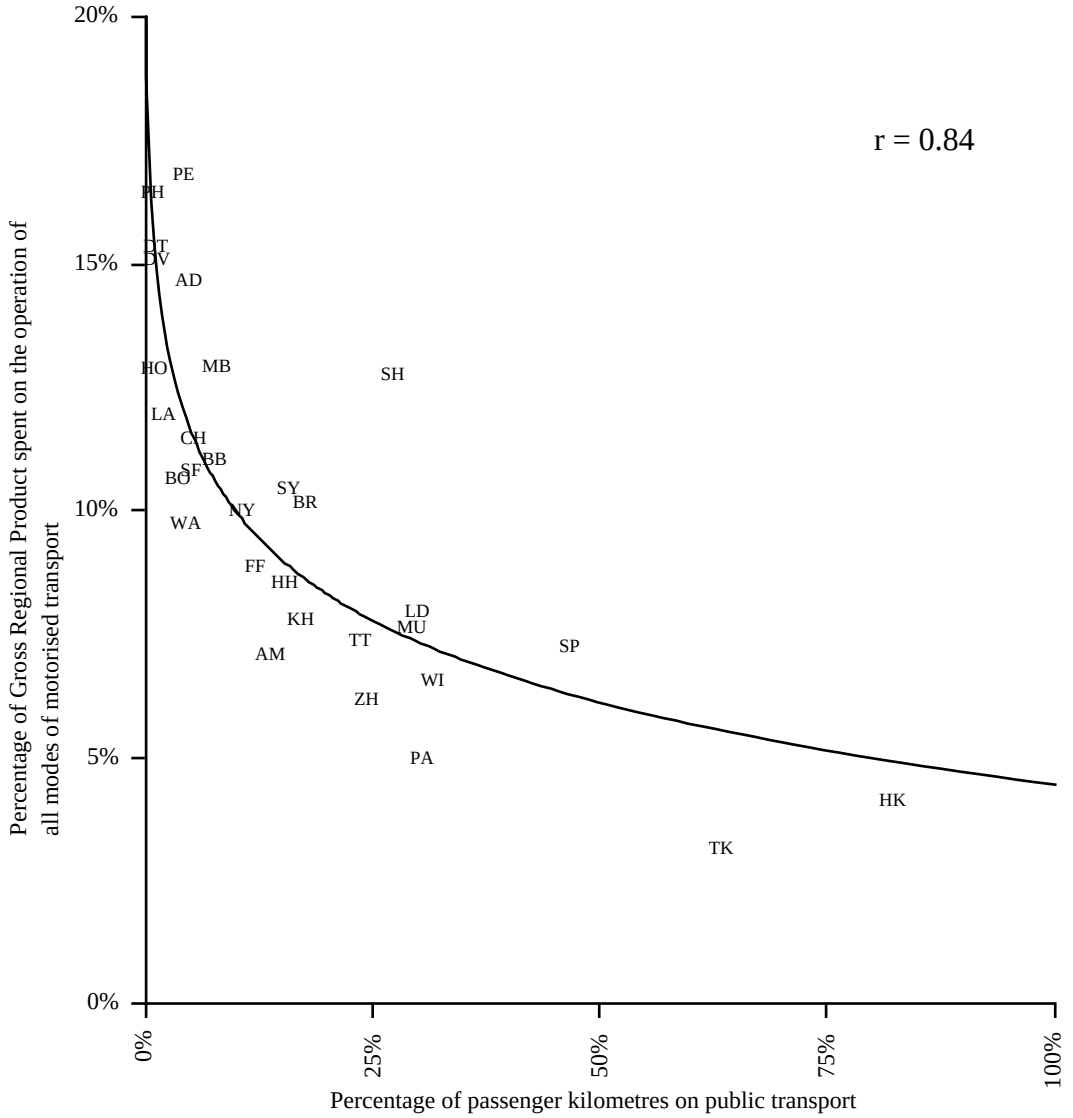
[19] Jeff Kenworthy, Felix Laube, Peter Newman and Paul Barter, 1997.

[20] Walter Hook, "The Evolution of Japanese Urban Transportation and Non-Motorized Transport," Transportation Research Board Annual Meeting, 1994.

[21] Peter Newman and Jeff Kenworthy, 1998, p. 87.

Figure 2 **Transport Expenditures Versus Transit Use**



This figure indicates that total transportation costs decline as transport and land use becomes multi-modal (indicated by the portion of personal travel by public transit).

In recent years some cities, particularly those in Northern Europe, have make concerted efforts to reduce automobile dependency by increasing transport choices and reducing automobile subsidies such as free parking.[22] The initial evidence is that these efforts can provide a variety of economic, social and environmental benefits. There is no evidence that such policies are economically harmful.

[22] John Pucher and Christian Lefevre, *The Urban Transport Crisis in Europe and North America*, MacMillan (London), 1997.

Economic Development Impacts of Automobile Expenditures

The automobile industry is a major economic sector, so many people assume that vehicle ownership and use stimulate economic development.[23] However, it is production and export of goods that supports economic development, not consumption. Expenditures on automobiles and fuel provide far less regional economic development or employment than expenditures on most other goods.

The automobile industry is now overcapitalized. World vehicle production capacity is expected to exceed demand by 30% or more over the next few years.[24] As a result, automobile manufacturing is less profitable than many other industries and may become even less profitable in the future. Although the automobile industry was once a leader in providing good wages, benefits and local taxes, this is no longer true. Many other industries now pay comparable or better wages, and manufacturers demand various financial incentives from governments (tax rebates, infrastructure expenditures and training programs) in exchange for locating industrial facilities in a jurisdiction that absorb much of their regional economic benefits.

Expenditures on automobiles and fuel provide little regional economic activity because they are capital intensive and mostly imported from other regions. A 1999 Texas case study used national input-output table data to calculate the regional economic activity and employment generated by expenditures on automobile use, transit use, and general consumer expenditures.[25] It found that each 1% of regional travel (53 million vehicle miles) shifted from automobile to public transit increases regional income by about $2.9 million (about 5¢ per mile shifted), resulting in 226 additional regional jobs. The impacts are summarized in Table 3.

Table 3 **Regional Economic Impacts of $1 Million Expenditure**[26]

Expenditure Category	Regional Income	Regional Jobs
Automobile Expenditures	$307,000	8.4
Non-automotive Consumer Expenditures	$526,000	17.0
Transit Expenditures	$1,200,000	62.2

This table shows economic impacts of consumer expenditures in Texas.

The British Columbia input-output table shows similar effects, as indicated in Table 4. Even in Germany, a major vehicle exporter, a shift to more environmentally responsible transportation would provide a net increase in national employment.[27]

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[23] Charles Lave, "Slowdown Ahead for the Domestic Auto Industry," *Access* (http://sacrates.berkeley.edu/~uctc), Vol. 6, Spring 1995, pp. 40-41.

[24] "The Car Industry" *The Economist*, 13 Feb. 1999, pp. 23-25.

[25] Jon Miller, Henry Robison & Michael Lahr, *Estimating Important Transportation-Related Regional Economic Relationships in Bexar County, Texas*, VIA Transit (San Antonio; www.viainfo.net), 1999.

[26] Jon Miller, Henry Robison & Michael Lahr, 1999.

[27] Frank Ebinger, et al., *Chief Benefits for the Future; New Jobs Created With Environmentally-Compatible Traffic*, Öko-Institut/VCD (Freiburg; www.oeko.de/english/transport/chief.htm), 1998.

Table 4 **Jobs Created in British Columbia by Transportation Expenditures**[28]

$1 Million Expenditure On:	Full Time Jobs Created
Petroleum	4.5
General Automobile Expenses	7.5
Public Transit	21.4

This table shows economic impacts of transportation expenditures in British Columbia.

Automobile dependency benefits some industries at the expense of others, as summarized in Table 5. Only if "Better Off" firms provide more regional economic activity or employment than those in "Worse Off" might automobile dependency support economic development. There is little evidence that automobile and truck dependent industries provide more economic benefits than other industries.

Table 5 **Business Impacts of Automobile Dependency**

Better Off	Worse Off
Motor vehicle production, sales and service.	Alternative transport modes.
Low-value manufacturing and bulk commodities.	High-value products.
Imports.	Communications and information industries.
Isolated businesses.	Domestic and local production.

Automobile dependency benefits some businesses and harms others.

Some people might argue that these regional economic losses may be offset by national economic development gains if vehicles and petroleum are produced in other areas of a country. However, both the automobile and petroleum industries have low labor input, and a significant portion of their input value is imported at the national level. Even if cars are assembled in a country, many of their parts are imported. Although economic losses may be smaller in a country that produces vehicles and fuel, expenditures on these goods appear to be far less beneficial to both the regional and national economy than most other consumer expenditures.

This analysis shows that expenditures on automobile travel provide much less economic development and employment than most other consumer goods, and far less than public transit expenditures. This indicates that automobile dependency is likely to have significant negative regional economic impacts, and policy changes that encourage more balanced transportation and reduce total transportation costs are likely to increase economic development and employment.

[28] B.C. Treasury Board Input/Output Table (Victoria), 1996.

Economic Development Impacts of Roadway Investments

Some research indicates that transportation infrastructure investments have high economic returns,[29] particularly freight improvements.[30] However, these studies have been criticized for using inappropriate analysis techniques.[31] Even if true, they do not prove that highways are the best economic development investment. Public transit investments may often provide even greater returns.[32]

Highway improvements in developed countries provide only marginal productivity benefits.[33] Transport facility investments only contribute to development if other conditions are ripe and transport costs are a significant economic constraint.[34] Inter-community transport improvements support economic development, but intra-community transport improvements (such as urban roadway widening) provide little economic benefit in developed regions.[35] Increased highway capacity tends to provide economic benefits in one part of a region at the expense of other areas.[36]

Although highways showed high annual return on investment (0.54) during the 1960s, this declined significantly (0.09) by 1991, and is likely to continue to decline since the most cost effective project have been implemented.[37] Strategies that lead to more efficient use of existing roadway capacity are likely to provide far greater economic benefits than increasing roadway capacity.[38] Highway investments are not a very efficient way to

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[29] *Transportation and the Economy*, AASHTO (Washington DC; www.aashto.org), 1998.

[30] Glen Weisbrod and Frederick Treyz, "Productivity and Accessibility: Bridging Project-Specific and Macroeconomic Analysis of Transportation Investments," *Journal of Transportation and Statistics*, Vol. 1, No. 3, October 1998, pp. 65-79.

[31] Amy Helling, "Transportation and Economic Development; A Review," *Public Works Management & Policy*, Vol. 2, No. 1, July 1997, pp. 79-93.

[32] David Aschauer, *Transportation Spending and Economic Growth: The Effects of Transit and Highway Expenditures*, American Public Transit Association (Washington DC), Sept. 1991; Cambridge Systematics and Economic Development Research Group, *Public Transportation and the Nation's Economy*, American Public Transit Association (www.apta.com), 1999.

[33] Marlon Boarnet, "New Highways & Economic Productivity: Interpreting Recent Evidence," *Journal of Planning Literature*, Vol. 11, No. 4, May 1997, pp. 476-486, also available as Working Paper 291, University of California Transportation Center (http://sacrates.berkeley.edu/~uctc), 1995.

[34] Kenneth Button, *Transport Economics*, Second Edition, Edward Elgar (Aldershot), 1993, Chapter 10; Nijkamp and Blaas, *Impact Assessment and Evaluation in Transport Planning*, Kluwer, 1993, p. 45-49.

[35] Harry Dimitriou, *Urban Transport Planning: A Developmental Approach*, Routledge, 1992, p. 144; Piet Rietveld, "Spatial Economic Impacts of Transport Infrastructure Supply," *Transportation Research*, Vol. 28A, No.4, 1994, p. 339.

[36] Marlon G. Boarnet and Andrew F. Haughwout, *Do Highways Matter? Evidence and Policy Implications of Highways Influence on Metropolitan Development*, Brooking Inst. (www.brookings.edu), 2000, p. 12.

[37] *Economic Effects of Federal Spending on Infrastructure and Other Investments*, Congressional Budget Office (www.cbo.gov), June 1998.

[38] Marlon G. Boarnet, "Road Infrastructure, Economic Productivity, and the Need for Highway Finance Reform," *Public Works Management & Policy*, Vol. 3, No. 4, April 1999, pp. 289-303.

stimulate employment since only about one job is created per $1.5 million in government expenditures, compared with $5,000 to $30,000 for other government programs.[39]

A recent expert review of economic impact research finds:[40]

- "The available evidence does not support arguments that new transport investment in general has a major impact on economic growth in a country with an already well-developed infrastructure. At the regional and local level, in particular, the issue of impact is made more complex by the possibility that changes in quality of access can either benefit or harm the area in question. We do not accept the results of macroeconomic studies which purport to identify very large returns from infrastructure investment. We are at present unpersuaded by the size of the impact of transport on jobs claimed by a number of European studies."
- Transportation investments may have broad economic impacts, but these can be either positive or negative. For example, a road improvement can lead to residents traveling elsewhere for shopping and services, reducing business in that community.
- Traffic reduction strategies can also achieve economic benefits by using existing capacity more efficiently. Travel demand management (including road pricing or improvements in alternative travel modes) should be considered as alternatives to capacity expansion.

Although traffic congestion increases vehicle users' costs and reduces productivity, there is little evidence that increasing roadway capacity is the most cost-effective way to address this problem. One study found that regions which invest heavily in road capacity expansion fared no better in reducing traffic congestion than those that invested much less.[41] Thousands of dollars would need to be spent annually per household to increase roadway capacity enough to simply maintain current congestion levels.

Transportation funding practices often make highway expenditures appear economically attractive from an individual jurisdiction's perspective. Federal, state or provincial grants appear to be "free" money that provide local jobs and business stimulation during the construction period, and are therefore attractive regardless of their long-term transportation impacts. This tends to distort investments toward highways and away from other solutions to transportation problems which may be more cost effective. New U.S. federal transportation polices allow some funds to be shifted from highway to transit services, but there are still many institutional distortions.

Many roadway improvement benefits are economic transfers, rather than true net benefits. A new highway intersection may attract businesses to a specific location, but this may

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[39] Hank Dittmar, "Highway Capital and Economic Productivity, *STPP Progress* (www.transact.org), Feb. 1999.

[40] SACTRA (Standing Advisory Committee on Trunk Road Assessment), *Transport Investment, Transport Intensity and Economic Growth*, Dept. of Environment, Transport and Regions (London; www.roads.detr.gov.uk/roadnetwork), 1999; ; Phil Goodwin and Stefan Persson, *Assessing the Benefits of Transport*, European Conference of Ministers of Transport; OECD (www.oecd.org), 2001.

[41] STPP, *Why Are The Roads So Congested? An Analysis of the Texas Transportation Institute's Data on Metropolitan Congestion*, Surface Transportation Policy Project (www.transact.org), 1999.

simply represents a shift of economic activity from one location to another, rather than true economic development. Of course, if business activity shifts to another region, one jurisdiction may enjoy economic benefits but at the expense of the other jurisdiction.

Economic Development Impacts of Policy Reforms

An optimal transport market requires several policy and price reforms.[42] These reforms could significantly increase productivity by improving mobility of higher value travel, such as freight and commercial activities, while reducing external costs. Although these reforms would be revenue neutral (higher fees would be offset by other consumer savings), the variable cost of driving would increase significantly. The petroleum industry argues that tax shifts would be economically harmful,[43] but their analysis ignores the economic benefits from more efficient resource use and reductions in more economically harmful taxes. Studies that incorporate these effects indicate that revenue neutral tax shifts could increase economic development.[44] A congressional study finds, *"...if a gasoline tax were coupled with an equal-revenue increase in investment tax credits, short-run macroeconomic losses resulting from motor fuel tax increases could be more than offset by the short-run macroeconomic gains"*.[45]

Fuel tax have little impact on the overall production costs of most industries. Fuel taxes are only about 4% of trucking industry gross revenues and 0.5% of railroad gross revenues, and so are small component of most products total costs.[46] Kågeson concludes, *"The effects from internalizing the social costs of transport on the ability of European industry to compete on the world market will be almost negligible. The total impact will amount to less than 0.5% of the annual turnover of most industries."*[47]

Sustainable Transportation Perspective

Conventional neoclassic economic theory, which is the basis for most analysis in this paper, assumes that the benefits of economic activity are accurately reflected in market indicators such as Gross National Product (GNP), and that non-market impacts can usually be ignored in economic decision making. Sustainable economics takes a broader view. It views economic, social and environmental impacts to be equally important, and demands consideration of non-market impacts.[48] Automobile dependency contradicts many sustainability objectives, not only because it is highly resource intensive and polluting, but also because it tends to reduce social equity and community livability, and

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[42] Todd Litman, *Socially Optimal Transport Prices and Markets*, VTPI (www.vtpi.org) 1999.

[43] Arthur Wiese and Barbara Tierney, *The Cost Impacts of a Carbon Tax on U.S. Manufacturing Industries and Other Sectors*, Research Study #081, American Petroleum Institute (www.api.org), 1996.

[44] Douglas Norland and Kim Ninassi, *Price It Right; Energy Pricing and Fundamental Tax Reform*, Alliance to Save Energy (Washington DC; www.ase.org) 1998; Dr. Rainer Walz, Dr. Joachim Schleich, Regina Betz and Carsten Nathani, *A Review of Employment Effects of European Union Policies and Measures for CO2 Emission Reductions*, Fraunhofer Institute (www.isst.fhg.de), May 1999.

[45] *Saving Energy in U.S. Transportation*, Office of Technology Assessment, US Congress, 1994, p.225.

[46] *Transportation, Taxation and Competitiveness*, Transport Association of Canada (www.tac-atc.ca),1993.

[47] Per Kågeson, *Getting the Prices Right*, European Fed. for Transport & Env. (Bruxelles), 1993, p. 183.

[48] Todd Litman and David Burwell, *Issues In Sustainable Transportation*, VTPI (www.vtpi.org), 1999.

reduces economic efficiency. Most plans for more sustainable transportation require more balanced, less automobile dependent transportation systems.[49]

[49] *Project on Environmentally Sustainable Transport*, OECD (www.oecd.org/env/trans), 1996; *Sustainable Transport; Priorities for Policy Reform*, World Bank (www.worldbank.org), 1996.

Strategies to Reduce Automobile Dependence

A number of strategies can help reduce automobile dependency and create more balanced and efficient transportation systems.[50]

1. Least-Cost Planning[51]

An efficient transportation system requires planning and investment policies that are unbiased in terms of mode, based on "least cost" transportation planning principles:

- Consideration of supply and demand management options on an equal basis.
- Consideration of all costs, including indirect and nonmarket costs.
- Use of standard measurements of costs and benefits for evaluating investments.
- Consideration of "generated" or "induced" travel.

2. Increase Transportation Choices/Viable Transit Network

An efficient transportation market requires that consumers have viable transport choices, including good walking and cycling conditions, and a range of transit services. High-quality transit can provide an effective alternative to automobile travel and serves as a catalyst for more efficient land use.[52] To be effective transit service must be competitive with automobiles in terms of speed, convenience, comfort, and prestige.

3. Transportation Demand Management[53]

Transportation Demand Management (TDM) includes a variety of strategies to encourage more efficient transportation patterns. These include strategies to encourage use of alternative modes, such as transit, ridesharing, bicycling and walking; strategies to discourage driving (for example, removing subsidies such as free parking); and strategies that reduce the need for travel altogether by creating more efficient land use and substituting electronic communications and delivery services for personal travel.

4. Land Use Management[54]

Increased residential and employment densities, mixed land use, and jobs-housing balance can reduce total vehicle travel by improving access. Even in suburban conditions, locating services such as retail shops and schools closer to residential areas, and accommodating walking and bicycle travel can reduce automobile trips.[55]

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[50] *Win-Win Transportation Strategies*, VTPI (www.vtpi.org), 1999.

[51] ECO-Northwest, *Least-Cost Planning: Principles, Applications and Issues*, Office of the Environment and Planning, FHWA (Washington DC), 1995.

[52] David Lewis & Fred Williams, *Policy and Planning as Public Choice*, Ashgate (www.ashgate.com), 1999; *International Transit Studies Program*, TCRP, APTA (www.apta.com), 1996.

[53] VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (www.vtpi.org), 2002.

[54] Reid Ewing, *Best Development Practices*, Planners Press (Chicago; www.planning.com), 1996; Ecotec Research and Transportation Planning Associates, *Reducing Transport Emissions Through Planning*, Dept. of the Environment, HMSO (London), 1993.

[55] R. Ewing, P. Haliyur and G. W. Page, "Getting Around a Traditional City, a Suburban Planned Unit Development, and Everything in Between," *Transportation Research Record 1466*, 1995, pp. 53-62.

Implications and Conclusions

Automobile dependency consists of high levels of automobile use, automobile-oriented land use patterns, and limited travel alternatives. Automobile-dependency can impose significant economic, social and environmental costs. Automobile dependency can cost an average household thousands of dollars per year, and increases problems such as congestion, road and parking facility costs, crash damages and environmental degradation. Automobile-dependent transportation and land use patterns reduce access, which increases the amount of vehicle travel required to maintain a given level of productivity, and reduces travel alternatives, making non-drivers worse off in absolute and relative terms. These costs are disperse through the economy and can reduce productivity.

It would be difficult to underestimate the economic and social benefits of basic access, that is, the ability of people and industry to reach the goods, services and activities they need. To the degree that automobile use provides basic access it supports economic and social development. But additional automobile use provides little economic development, and is economically inefficient to the degree that it results from market distortions.

There is both theoretical and empirical evidence that excessive automobile dependency reduces economic development. The theoretical evidence includes the principle of diminishing marginal benefits, which means that increased driving provides ever smaller incremental benefits; the observation that a significant portion of automobile dependency can be explained by market distortions which favor automobile use; the fact that many perceived benefits of increased automobile use are economic transfers rather than true productivity gains; and the tendency of automobile dependency to create less efficient transportation and land use patterns.

Empirical evidence also indicates that excessive automobile dependency reduces economic development. Although automobile use often increases with wealth, there is little evidence that automobile dependency *causes* economic development. Economic growth rates tend to be highest before a region becomes automobile dependent, after which growth rates usually decline. Automobile dependency can be considered a luxury consumer good which does not itself increase productivity or economic development.

International comparisons indicate that beyond an optimum level (which appears to average about 7,500 annual kilometers of vehicle travel per capita, but may vary depending on conditions), increased driving reduces economic development. Excessive automobile dependency may reduce productivity due to increased facility costs, congestion, accidents, more dispersed land use, and less efficient travel alternatives.

Automobile expenditures provides less economic benefit than most other consumer purchases, and far less than public transit expenditures. This is to be expected since automobile and petroleum production are capital intensive with little labor input, and because vehicles and fuel are largely imported goods in most regions.

Although historically vehicle manufacturing was an important contributor to economic development in some regions, the automobile industry is now mature, not very profitable and highly competitive. Except where automobile production is already established, other industries are likely to provide greater economic returns. Economic development associated with automobile dependency results primarily from *exporting* vehicles and fuel. There is no indication that inceased domestic consumption of automobiles and fuel increases economic development.

Regions that already have adequate paved highways are unlikely to see major economic development benefits from increased road capacity. Alternative investments and management strategies that lead to more efficient use of the existing transportation system are likely to provide greater economic benefits. Many benefits associated with roadway capacity expansion are economic transfers rather than true productivity gains. Roadway improvements can have negative as well as positive impacts on a local economy, for example by encouraging consumers to shop elsewhere.

Automobile dependency is particularly burdensome to developing countries that do not produce vehicles or petroleum. In such countries, vehicles and petroleum often account for a major portion of import value. This weakens the value of their currency and constrains investments that could increase productivity.

Market-based transportation reforms are likely to significantly reduce automobile dependency, increase economic development, and make consumers better off overall. These include changes in transportation planning and investment practices, pricing reforms and changes in land use development policies.

There is currently political and institutional resistance to such reforms, in part due to various interests that benefit directly from automobile dependency, and in part because many consumers have little experience with a balanced transportation system and are skeptical that they could benefit from less automobile use. These reforms may become more acceptable as they are better known, and as consumers realize the diminishing benefits of increased driving. A number of European and Asian cities are making progress developing more balanced transportation systems and appear to be benefiting economically as a result.[56]

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[56] Leo Lemmers, "How Amsterdam Plans to Reduce Car Traffic," *World Transport Policy and Practice*, Vol. 1, No. 1, 1995, pp. 25-28; John Pucher and Christian Lefevre. *The Urban Transport Crisis in Europe and North America*, MacMillan (London), 1997; Special Issue on Transportation Demand Management, *IATSS Research*, Vol. 22, No. 1, 1998.

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