Smart Growth America
Better Choices For Our Communities

THE UNIVERSITY OF UTAH

THE BEST STIMULUS FOR THE MONEY

Briefing Papers on the Economics of Transportation Spending

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INTRODUCTION

The tens of billions in federal stimulus funds for transportation, coming to states and regions at a time of substantial budget difficulties, adds urgency to the question "what is the best use of transportation dollars?" Transportation touches all aspects of our communities, but the current economic downturn and the stimulus have placed an extra emphasis on the economic purposes of transportation investments. Two economic goals have been paramount:

1. put as many people to work as quickly as possible, and
2. make the investments that best position the nation for long term prosperity.

With respect to the first goal, much has been made of "shovel ready" projects—those projects that can be started immediately. The speed goal of "shovel ready" has been embraced by states and regions across the country. The second goal has occupied a decidedly secondary position. There has been relatively little debate over the location and types of transportation investment that do the most to prepare the country for long-term economic prosperity. Where discussions have occurred they tend to be cursory and anecdotal. Either it has been assumed that all "shovel ready" projects inevitably contribute equally to long term prosperity, or it has been asserted that selecting for the projects that do the most to position the country for long term prosperity will slow the rate at which new money puts people to work.

Are all transportation projects of equal value to long-term economic growth? If not, is it possible to select projects with better return and still move money and employ people in the economy quickly? Smart Growth America commissioned the following papers to answer these questions. The findings are encouraging. The research shows there is ample opportunity to pursue long term prosperity through projects that are "shovel ready"—provided we pick the right projects.

The research results are doubly encouraging because, though immediate economic needs have taken center stage, transportation's impact on equity, neighborhoods, energy security, and the environment remains. Real-world results show that transportation projects that help the nation meet these broader challenges are frequently the same projects that deliver the best short-term job production and long term economic returns.

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FOR FURTHER INFORMATION

For further information about Smart Growth America's work on the American Recovery and Reinvestment Act, visit stimulus.smartgrowthamerica.org, or contact Will Schroeer, State Policy Director, wschroeer@smartgrowthamerica.org.

Briefing Paper No. 1

ECONOMIC STIMULUS BY CREATING TRANSPORTATION JOBS NOW

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1.1 Overview

A major purpose of the stimulus package is to put as many people to work as quickly as possible. Another purpose is to make the investments that best position the nation for long-term prosperity. Transportation investments are seen as one way to do both. Lessons from Japan suggest caution. When Japan faced a similarly challenging economic period, it invested billions in new transportation projects that barely a decade later turned out to be an economic drain on the economy. So, while it created jobs in the short term—many thousands being only temporary jobs—in just a few years those investments became economic burdens.[1]

This briefing paper is the first of ten addressing, broadly, transportation investments made through the stimulus package. The paper begins with a review of how transportation investments will be staged. It then estimates the jobs to be created for each year of stimulus transportation investments—showing that most jobs will likely be created *after* the economy recovers. Next it presents an alternative route that stimulates jobs now, based on the lessons of Pennsylvania and Maryland. The paper concludes with suggestions for truly stimulating new jobs now through stimulus transportation investments.

1.2 Transportation Stimulus Expenditure Rate

The transportation element of the stimulus package calls for about $38.6 billion in capital investments for highways and transit. However, in a controversial report, the CBO indicated that it could take as long as 11 years to actually spend down the money allocated to transportation—despite transportation projects being "shovel-ready."[2] In particular, the CBO analysis shows transportation stimulus spending extending from federal fiscal year 2009 through FY 2019. While there has been controversy about the exact timing estimated by CBO, there is no doubt that it will

[1] Martin Fackler, "Japan offers lessons on stimulus spending", International Herald Tribune, February 6, 2009 http://www.iht.com/articles/2009/02/06/asia/japan.php.

[2] Transportation Weekly, "New CBO Analysis Says House Stimulus Bill Will Stimulate Much More Slowly than Anticipated", January 21, 2009. This briefing paper uses data and analysis presented in this article as the authors have found no more accurate information. Moreover, analysis by FHWA confirms the effective spend rate reflected in this analysis (see www.whitehouse.gov/the_press_office/Highway-Spending-from-Recovery-Act-Expected-to-Create-or-Save-150000-Jobs-By-End-of-2010/).

take some time to get this money into the economy, whether it turns out to be 11 years or 7 years. For the moment, let us assume that it is 11 years, this time period is based on the most definitive analysis of Congressional information on this subject identified by the authors and others. The pattern of spending is shown in Table 1.1. By the end of 2011, only about $5.2 billion of the entire $38.6 billion in the stimulus package will have been spent and it won't be until the end of 2013 that about half of it would be spent. The next section provides some assessment of the accuracy of the CBO estimates based on the pace of job creation.

Table 1.1
Schedule of Stimulus Transportation Investments, 2009-2019

Fiscal Year	Highways ($millions)	Annual Share	Cumulative Share	Transit ($millions)	Annual Share	Cumulative Share	Total ($millions)	Annual Share	Cumulative Share
2009	$788	2.7%	2.7%	$330	3.7%	3.7%	$1,118	2.9%	2.9%
2010	$3,000	10.1	12.8	$670	7.4	11.1	$3,670	9.5	12.4
2011	$4,200	14.2	27.0	$1,000	11.1	22.2	$5,200	13.5	25.9
2012	$4,200	14.2	41.2	$1,140	12.7	34.9	$5,340	13.8	39.7
2013	$4,200	14.2	55.4	$1,220	13.6	48.4	$5,420	14.0	53.8
2014	$3,300	11.2	66.5	$1,030	11.4	59.9	$4,330	11.2	65.0
2015	$2,400	8.1	74.7	$950	10.6	70.4	$3,350	8.7	73.7
2016	$2,100	7.1	81.7	$710	7.9	78.3	$2,810	7.3	81.0
2017	$1,800	6.1	87.8	$710	7.9	86.2	$2,510	6.5	87.5
2018	$1,800	6.1	93.9	$700	7.8	94.0	$2,500	6.5	93.9
2019	$1,800	6.1	100.0%	$540	6.0	100.0%	$2,340	6.1	100.0%
Total	$29,588	100.0%		$9,000	100.0%		$38,588	100.0%	

Source: Adapted from *Transportation Weekly* (January 21, 2009).

1.3 Transportation Stimulus Job Creation Rate

How many jobs will be created and how quickly? The FHWA uses a flat estimate of 30,000 new jobs created (or those saved) for all transportation investments including highways and transit, and capital expansion and repairs.[3] (Briefing Paper # 2 uses more refined, conservative analysis to explore job impacts of transportation investments – showing for instance that highway maintenance and repair produces many more jobs than new highway construction.) According to the CBO and using the FHWA assumption, Table 1.2 illustrates the number of jobs created for each year of the stimulus investments, and cumulatively. Of the 1.157 million jobs anticipated to be created because of stimulus investments in transportation, only about a quarter, about 300,000 jobs, will be created by the end of 2011 and only about half will be created by the end of 2013.

[3] See www.fhwa.dot.gov/policy/otps/pubs/impacts/index.htm. See also FHWA, *Employment Impacts of Highway Infrastructure Investment,* www.fhwa.dot.gov/policy/otps/pubs/impacts/index.htm.

Is the CBO accurate? Or will jobs be created faster than it projects? The White House has estimated that about 150,000 jobs will be created (or saved) by highway spending by the end of 2010.[4] This is exactly the pace of job formation that can be imputed from the CBO analysis.[5]

Let us put this into perspective. Federal Reserve Board Chairman Ben Bernanke suggests that the current recession will be over by the end of 2010.[6] By then only about 12 percent of the $38.6 billion in stimulus transportation investments will have been made, creating fewer than 150,000 jobs or just 28 percent of the new jobless claims reported in early January 2009 alone.[7]

Table 1.2
Schedule of Stimulus Transportation Jobs Created or Saved, 2009-2019

Year	Jobs Created or Saved (1000s)	Annual Share	Cumulative Amount	Cumulative Share
2009	33,540	2.9%	33,540	2.9%
2010	110,100	9.5	143,640	12.4
2011	156,000	13.5	299,640	25.9
2012	160,200	13.8	459,840	39.7
2013	162,600	14.0	622,440	53.8
2014	129,900	11.2	752,340	65.0
2015	100,500	8.7	852,840	73.7
2016	84,300	7.3	937,140	81.0
2017	75,300	6.5	1,012,440	87.5
2018	75,000	6.5	1,087,440	93.9
2019	70,200	6.1	1,157,640	100.0%
Total	1,157,640	100.0%		

Source: Adapted from *Transportation Weekly* (January 21, 2009).

1.4 Fix-it-first and Small-scale Projects are Key

For some states, stimulus investments and jobs may not produce the types of short-term effects on the economy that the stimulus legislation aims to produce. States may be able to remedy this, however, by choosing to invest their stimulus transportation funds into immediate repair and maintenance projects. According to veterans of federal and state departments of transportation, these kinds of projects spend money at a faster pace than most other types of transportation

[4] www.whitehouse.gov/the_press_office/Highway-Spending-from-Recovery-Act-Expected-to-Create-or-Save-150000-Jobs-By-End-of-2010/.

[5] By the end of 2010 which includes the last quarter of 2010, a total of $4.838 billion will have been spent ($788 million for FY 2009 plus $3 billion for FY2010 plus $1.05 billion for the first quarter of FY2011 (the last quarter of calendar 2010). At 30,000 jobs per $1 billion spent this comes to about 145,140 jobs or 150,000 jobs rounded to the nearest 10,000.

[6] www.npr.org/templates/story/story.php?storyId=101936728

[7] money.cnn.com/2009/01/15/news/economy/jobless_claims/index.htm

projects. By spending most of the money on these types of projects, states and Metropolitan Planning Organizations may greatly increase the speed of their spending and thus job creation. As will be seen in Briefing Paper No. 2, in addition to spending money quicker, highway repair and maintenance investments actually generate more jobs per $1 billion spent than new highway construction: 20,317 compared to 17,472, respectively.[8]

Pennsylvania[9] and Maryland[10] are doing just this. In both states, the first set of projects financed from stimulus funds are for such things as repaving and highway repairs. Although some funds will go for highway construction, much will go for bridge repair and replacement, repaving, and deferred maintenance.

Small-scale projects can have the same effect. For instance, bikeway and pedway projects, while often considered new construction, are often much more easily undertaken than major new highway or transit projects. The Rails-to-Trails Conservancy has inventoried roughly 1,200 bikeway/pedway projects that are ready-to-go totaling about $3.7 billion.[11]

1.5 Job Stimulus as a Priority

Even when approved and "shovel ready," large, new transportation construction projects take years to build. This is likely the underlying assumption used by the CBO to project spending over an 11 year period. The CBO's imputed rate of expenditure is thus slow, as shown in Table 1.1, as is their rate of creating jobs, seen in Table 1.2. In contrast, fix-it-first and small-scale projects can result in expenditures made quickly with jobs created equally quickly. These kinds of maintenance projects are smaller, more numerous, and more distributed among different firms, and require less specialized expertise and equipment than large projects, Indeed, one danger of infusing too much money into new construction is that bottlenecks could be created among several projects competing for the same expertise and equipment.

Pennsylvania and Maryland, among other states, understand this and are prioritizing these kinds of projects over new construction. Indeed, there is several hundreds of billion dollars worth of such projects, according to the American Society of Civil Engineers.[12] In addition, highway repair and maintenance expenditures generate more jobs per $1 billion expended than new construction, as will be seen in Briefing Paper No. 2. Finally, despite the recession, now is the time to spend transportation funds quickly while construction costs are favorable. Utah for instance, recently decided to spend $1.7 billion for shelved transportation projects that were previously priced at $2.6 billion.[13]

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[8] See Heintz, J., Pollin, R. and Garrett-Peltier, H. (2009). How Infrastructure Investments Support the U.S. Economy: Employment, Productivity and Growth. Political Economy Research Institute, University of Massachusetts at Amherst, reviewed in Briefing Paper No. 2.

[9] See www.transportation.org/?siteid=99&pageid=3010.

[10] See www.transportation.org/?siteid=99&pageid=3007.

[11] Rails to Trails Conservancy (2009), *Ready to Go: Bike and Pedestrian Projects*, Washington, DC.

[12] See www.infrastructurereportcard.org/fact-sheet/roads.

[13] www.sltrib.com/ci_11829680?IADID=Search-www.sltrib.com-www.sltrib.com

Briefing Paper No. 2

ECONOMIC STIMULUS THROUGH CONSTRUCTION AND REPAIR OF TRANSPORTATION INFRASTRUCTURE

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2.1 Introduction

Transportation infrastructure projects create a range of short and long run economic impacts. This paper focuses on the near term national employment impacts of both construction and repair of transportation infrastructure. The bottom line is that construction, expansion, and repair of these projects directly create jobs at the work site, as well as at the many firms that provide the necessary materials, equipment, and services required to complete the projects. These supply chains especially reach into the manufacturing sectors, but others are reached as well. Because wages in the heavy construction sector exceed those of many other sectors, this leads to higher household incomes than would have been the case if stimulus spending were targeted at lower wage industries.[14] These higher household incomes finance additional downstream spending that, in turn, creates employment. The immediacy of the employment creation, in combination with relatively high wages in the heavy construction sector and extensive domestic supply chains, result in effectively more stimulus per-dollar-invested than many alternative uses. Of course transit and road projects have longer-term economic impacts as well as implications for regional economic viability and development. This paper considers the very narrowly defined short run job and income creation resulting from alternative government fiscal policies.

2.2 Economic Impact Generation

Economic impacts and job creation occurs when net new demand or spending is directed towards our nation's goods- and services-producing industries. The federal government can accomplish this directly by purchasing from industries, or indirectly by reducing taxes (or providing payments) to individuals or firms. The magnitude and timing of total economic impacts varies significantly depending upon the specific composition of the spending.

If the policy goal is to create the maximum possible number of jobs as soon as possible, then direct spending is most effective. Tax rebates may or may not be spent, being used to pay down debt or increase savings instead. If the timing and composition of spending is uncertain this will delay and

[14] Bureau of Labor Statistics, Occupational Employment Statistics: May 2007 National Industry-Specific Employment and Wages Estimates, *http://www.bls.gov/oes/current/oessrci.htm*.

decrease the potential impact. Because of globalization, there is no guarantee that purchases resulting from tax cuts or rebates will necessarily be from domestic producers. In the case of import purchases, the stimulus would effectively add to the trade deficit rather than create jobs in the U.S.

Purchases from firms operating in the U.S. will, in contrast, directly create or sustain jobs and the timing of these impacts is much more certain. In the case of transit or road construction projects, the first round of economic impacts, termed direct effects, is composed of the jobs and income of people designing and building the transit lines and roads. The second round, or indirect impacts are generated by purchases made by construction firms to acquire the materials, equipment, and services that are required to complete their projects. These second round purchases set off a sequence of purchases from all the backward linked industries. Input-output models are routinely used by economists to estimate the cumulative supply chain purchases and the associated cumulative employment and income impacts. The greater the domestic content of the supply chain purchases, the larger the indirect economic impacts. Finally, there are the induced effects, consisting of the cumulative household spending made possible by incomes of workers at the construction site and at all of the firms in the supply chain. As in the case of increasing disposable income via tax rebates, not all additional income will result in consumption of domestic production. Improving the balance sheet position of the household sector (by decreasing debt obligations) certainly has long run aggregate economic effects, but does not contribute to the direct goal of employment creation.[15]

Another consideration in the evaluation of the impact of stimulus spending is the degree of excess capacity in the economy. If labor markets are tight and industrial sectors are operating at near capacity, the additional demand will introduce bottlenecks and inflationary pressures. This is surely not the case in the current circumstance, especially in the construction sector, which has borne much of the brunt of job losses in the current economic downturn. In the current economic environment, transportation infrastructure projects will reduce unemployment, not contribute to inflation.

2.3 Economic Impacts of Transportation Projects

A vast literature chronicles the economic impacts of infrastructure projects.[16] Most recently, Heintz, Pollin, and Garrett-Peltier[17] evaluated the economic impact of baseline and high-end scenarios of infrastructure spending packages. They consider the spectrum of public infrastructure investment, including energy, transportation, school buildings, and water. The deteriorated condition of much of the nation's infrastructure is well-established,[18] so their analysis includes rebuilding as well as

[15] Roger E. Miller (1999) "Regional and Interregional Input-Output Analysis," Chapter 3 in Izard, *et al.*, Methods of Interregional and Regional Analysis. (Aldershot: Ashgate). H. Craig Davis (1990) "Income-Expenditure Analysis," Chapter 3 in Regional Economic Impact Analysis and Project Evaluation. (Vancouver: University of British Columbia Press).

[16] Transportation Research Board. (1998) Economic Impact Analysis for Transit Investments: Guidebook for Practitioners: TCRP Report 35, Washington, D.C.: National Academy Press.

Cambridge Systematics, Inc. (1999) Public Transportation and the Nation's Economy: A Quantitative Analysis of Public Transportation's Economic Impact.

[17] Heintz, J., Pollin, R. and Garrett-Peltier, H. (2009). How Infrastructure Investments Support the U.S. Economy: Employment, Productivity and Growth. Political Economy Research Institute. University of Massachusetts at Amherst.

[18] American Society of Civil Engineers. 2005. *Infrastructure Report Card: 2005.*

expanded capacity. They utilize standard economic models and categories to construct their estimates. They further refine their analysis by altering assumptions about the domestic content of upstream supply chain industries. Their summary results are presented in the Table 2.1.

Table 2.1. Employment Impacts per $1 Billion in Infrastructure Spending

Category	Direct and Indirect	Plus Induced	Domestic Content of Inputs
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

Source: Heintz, Pollin, Garrett-Peltier (2009), Tables 3.1 and 3.7.

Their results indicate that for each $1 billion in infrastructure investment, direct and indirect employment effects range from 9,932 to 17,784, with mass transit at the high end. Including induced effects yields a total employment impact of 14,747 to 22,849 with mass transit again having the highest employment impact. When assuming inputs are all domestic, the employment impacts further increase by 4 percent. This results in a total employment impact ranging from 15,337 to 23,763. Within the transportation infrastructure, mass transit and repair of roads and bridges generate the largest impacts. In fact, according to this work, mass transit generates 5,377 or 31 percent more jobs than new construction of roads and bridges per $1 billion spent. Repair work on roads and bridges generates 2,845 or 16 percent more jobs than new bridge and road construction.

The Federal Highway Administration collaborated with Boston University and Battelle Memorial Institute to build an economic impact model specifically for transportation infrastructure impact evaluation. The American Public Transportation Association also worked with the same analysts to develop the same model for public transportation projects. The initial work conducted in 2004, used a model called JOBMOD and resulted in total employment impacts significantly higher than the Heintz work. Total employment impacts per $1 billion investment in new road and bridge capacity was reported to be 34,565, for maintenance and repair it was estimated to be 37,658, and for public transportation it was 41,028.[19] The relative results were consistent with the Heintz work, showing a greater impact for investments in public transportation infrastructure and repair work of bridges and roads than for new construction of roads and bridges. A subsequent revision of the model

[19] Surface Transportation Policy Project, Setting the Record Straight: Transit, Fixing Roads and Bridges Offer Greatest Job Gains, Washington DC, January 2004.

generated total employment impacts that were 17 percent lower than the original version.[20] FHWA estimated that for 2007, $1 billion in highway infrastructure expenditures would generate direct and indirect employment of 14,906 (which is just 18 percent higher than the Heintz estimates) and induced employment of 15,094 (which is more than double the induced employment in the Heintz estimates.)[21]

Given the available literature, there is no way to precisely decompose the sources of difference in the two sets of estimates. Estimates of induced impacts account for 82 percent of the total difference. Heintz *et.al* use standard Bureau of Economic Analysis accounts to create synthetic construction industries. However, the methodology they use to produce induced impacts is a dynamic, econometric approach that greatly reduces the estimates of induced impacts relative to standard methodologies. Decomposing the exact reasons for difference in direct and indirect employment estimates is more difficult. JOBMOD2 is based on an original, customized input-output model using administrative data combined with other federal data sets. They are also evaluating construction two years ago, so an equivalent nominal dollar value undoubtedly produced more jobs based on the inflation in construction costs that has occurred in the subsequent years. Further, the following caveat has recently been added to the FHWA estimates website:

> ***NOTE**: This estimate does not represent an estimate for the highway construction expenditures under the American Recovery and Reinvestment Act. FHWA is reviewing the parameters of the legislation and will update this estimate as necessary.*

Finally, communication with a FHWA researcher clarified this point by deferring to the work of the Council of Economic Advisors.[22]

Standard input-output models are static and based on historical data. In the current economic environment, models based on conditions in 2007 will not accurately represent the contemporary economic dynamics and linkages. While the technical coefficients may come close to representing the direct and indirect effects, the induced effects will undoubtedly be overestimated. In the run-up to the financial crisis of 2008, household savings rates were near zero and induced impacts generally quite large as a result. The balance sheet position of households is quite different in 2009, with households highly indebted with greatly diminished assets, and far less confidence in the future. Credit conditions have become much less favorable for potential borrowers and households have begun saving at higher rates. The bottom line is that induced effects of spending programs will probably be much smaller in 2009 than would have been the case during the real estate boom. FHWA recommends NOT using their impact estimates. The impact estimates produced by Heintz, *et al.* have very small induced impacts, compared to standard economic impact methodology. Consequently, in the current economic context, the impact estimates of Heintz, *et al.* are both technically and empirically more defensible than the work of FHWA.

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[20] Boston University Center for Transportation Studies, JobMod2.1: A Comprehensive Model for Estimating Employment generation from Federal Aid Highway Projects: Technical Documentation, July 2006, www.fhwa.dot.gov/policy/otps/pubs/jobmod/jobmod2.pdf

[21] FHWA, "Employment Impacts of Highway Infrastructure Investment," accessed March 2, 2009 from: www.fhwa.dot.gov/policy/otps/pubs/impacts/index.htm

[22] Christina Romer and Jared Bernstein, "The Job Impact of the American Recovery and Reinvestment Plan, access March 2, 2009 from http://otrans.3cdn.net/45593e8ecbd339d074_l3m6bt1te.pdf.

2.4 Employment Creation is Necessary and Desirable but Not Sufficient

This discussion has focused on short run employment impacts of infrastructure projects. Because these are investments, by definition they are implemented for the long run. Clearly it is not wise to simply generate immediate "make work" projects; the long run impacts should be included in the decision criteria for the exact configuration and type of project. Different models and theoretical considerations are the basis for evaluating long run impacts on economic development and economic efficiency. Noneconomic policy objectives involving such issues as environmental, land use, equity and quality of life impacts are also relevant to project evaluation and selection. This paper has addressed only the efficacy of transportation infrastructure projects as short run economic stimulus policies. In the current policy context, these are certainly necessary and desirable, but not sufficient for final project selection and configuration.

2.5 Summary

It is clear that spending on infrastructure in general and transportation projects in particular, does generate significant short run economic impacts. Once these projects are initiated, there is a short lag time to employment creation. Employment and income impacts of transportation projects are relatively large as compared to many other spending alternatives for two reasons: First, heavy construction jobs generate relatively high wages. Second, there is an extensive domestic supply chain of required inputs that generates significant demand from manufacturing and other sectors.

Among transportation infrastructure projects, mass transit projects generated the greatest short run economic impacts. Repair of existing roads and bridges results in higher short run economic impacts than new road construction.

Briefing Paper No. 3

ECONOMIC STIMULUS BY LEVERAGING STATE SPENDING WITH PRIVATE SECTOR REAL ESTATE INVESTMENT

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3.1 Introduction

Transit-oriented development (TOD) has been promoted as a strategy for enabling public transportation ridership, reducing emissions of air pollutants, easing traffic congestion, and decreasing energy consumption.[23] A co-benefit not as frequently touted is TOD's positive role in stimulating the investment of private capital into real estate development markets. By building public transportation facilities and related supportive infrastructure and coupling that with appropriate planning and zoning, local and state governments can use public dollars to leverage private-sector economic development. This leads to the creation of numerous public goods, including direct private spending and related multiplying effects, job creation, community development, increased property values, and enhanced sales, property, business, and income tax revenues. These effects can be both substantial and lasting.

3.2 Market Support

Naturally, these effects do not happen on their own or simply because government has invested public money into public transportation and other infrastructure. The numerous public benefits of TOD are realized, most fundamentally, because there is a market for that type of development. Though market analyses from just ten years ago indicated modest support for TOD-style development, the situation is changing rapidly. The National Community Preference Survey, conducted in 2004 for Smart Growth America and the National Association of Realtors®, asked respondents to choose between two community types: Community A was a standard suburban pattern with single-family homes on large lots, no sidewalks, shopping and schools located a few miles away, commutes to work of 45 minutes or more, and no public transportation; Community B was a TOD-based pattern with a mix of single-family and other housing, sidewalks, shopping and schools within walking distance, commutes of less than 45 minutes, and high-quality transit. Fifty-five percent of Americans expressed an overall preference for Community B; the percentage increased to 61 percent among those thinking of buying a house in the next three years.[24] Similar

[23] Robert Cervero, *et al.*, Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects (TCRP 102), Transportation Research Board (2004).

[24] Belden Russonello & Stewart, *National Community Preference Survey,* National Association of Realtors® and Smart Growth America (2004).

consumer preference surveys of U.S. households in 2003 and 2005 produced comparable responses.[25]

Shifts in the real estate market are evident already. Downtown and in-town housing has topped the list of hot markets for the Urban Land Institute's annual *Emerging Trends in Real Estate* for several years in a row.[26] In 2003, for the first time in the country's history, the sales price per square foot for attached housing—that is, the condominiums and townhouses typical in TOD developments—was higher than that of detached housing. Because the demand is greater than the current supply, the price-per-square foot values of houses in mixed-use neighborhoods show price premiums ranging from 40 to 100 percent, compared to houses in nearby single-use subdivisions.[27]

Considering these changes in residential preferences, plus substantial shifts in national demographic trends toward older and smaller households, Nelson projects that in 2025, the demand for attached and small-lot housing will exceed the current supply by 35 million units (71 percent), while the demand for large-lot housing will fall short of the current supply.[28] If he is right, the U.S. already has more of the big stuff than it needs. These calculations were made before the recent fluctuations in energy prices and increases in home foreclosure rates. Indications are that those factors could accelerate, and perhaps increase the magnitude, of Nelson's projections.[29]

In addition to the growing attraction to TOD housing types, interest in easy access to high-quality transit services is also growing. Seniors, in particular, are concerned about access to transit, with 71 percent indicating transit accessibility as a priority in 2000.[30] A 2008 AARP poll found: "44 percent of elderly say they do not have access to public transportation. 54%, said they would walk, bicycle, and take transit more if their streets were improved".

3.3 Mini-Case Studies

The degree of private-sector value generated by TOD will depend on several factors, including national and local economic conditions, the natural and built environmental circumstances of the lands surrounding transit stations, and the planning and regulatory environment created by state and local governments. The following mini-case studies present some of the leading examples where these conditions combined favorably to create significant private investments in TOD real estate projects.

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[25] Susan Handy, "Is support for traditionally designed communities growing?," *Journal of the American Planning Association, 74(2),* 209-221 (2008).

[26] ULI and PricewaterhouseCoopers, *Emerging trends in real estate* (2005, 2006, 2007)

[27] Christopher Leinberger, Back to the future: the need for patient equity in real estate development finance, The Brookings Institution (2007).

[28] Arthur C. Nelson, "Leadership in a New Era," *Journal of the American Planning Association, 72(4),* 393-407 (2006).

[29] Joe Cortright, *Driven to the brink: how the gas price spike popped the housing bubble and devalued the suburbs*, CEOs for Cities (2008) www.ceosforcities.org/newsroom/pr/files/Driven%20to%20the%20Brink%20FINAL.pdf.

[30] Malizia, E. and S. Exline, "Consumer Preferences for Residential Development Alternatives," Working Paper 2000-02, Center for Urban and Regional Studies, University of North Carolina, Chapel Hill, NC, February 2000.

Hudson-Bergen Light Rail (New Jersey)

The initial portion of the Hudson-Bergen Light Rail (HBLR) line opened in 2000, providing service to a 20.6 mile corridor in Hudson County, New Jersey. The line facilitates north-south movement through the county and connects with other rail, bus, and ferry services that serve New York City, Newark, and a variety of other activity centers. Much of the line passes through former abandoned rail yards and industrial sites, which provides a substantial cache of land that may be redeveloped for TOD. With strong government policy support for TOD and a strong market for office development, the HBLR has had remarkable success in attracting a large amount of high value development. A recent study of five stations along the HBLR show that in the 8 years since the line opened, more than 10,000 units of new housing have been constructed in the station areas, with an estimated sales value in excess of $5.3 billion.[31]

Dallas Area Rapid Transit

The light rail system operated by Dallas Area Rapid Transit (DART) is considered one of the leading transit systems in the U.S. Despite its location in one of America's more sprawling metropolitan areas, DART has had remarkable success in promoting TOD at a number of its station areas. A 2007 study of TOD for the entire DART system concluded that since 1999, more than $4.2 billion in development had occurred in station areas that was directly attributable to the presence of the DART facilities and services. In the year the study was completed, this development generated more than $78.4 million in property tax revenues and $48.1 in sales tax revenues for state and local governments.[32]

Washington Metrorail – Rosslyn-Ballston Corridor

The Washington Metrorail system is one of the most successful new generation heavy-rail transit systems in the country. A key part of that success is the TOD planning that occurred in advance of the system's construction, particularly by Arlington County, Virginia and Montgomery County, Maryland. The Rosslyn-Ballston Corridor, just across the Potomac River from Washington, has been especially successful in attracting TOD. By 2006, the areas surrounding the corridor's five stations had seen construction of more than 13,000 new housing units and 18 million square feet of commercial development, totaling more than $14.5 billion in taxable real estate value (which includes land plus improvements).[33]

Portland Streetcar

Portland, Oregon, long a leader in transit system development and progressive land use planning, scored another first in 2001 with the opening of the first modern streetcar in the U.S. The initial 4.8 mile system snakes through two close-in neighborhoods on the city's north side and then along the west side of downtown. In 2005, the system was extended 1.2 miles into a neighborhood to the

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[31] Martin Robins and Jan Wells, *Land Development at Selected Hudson-Bergen Light Rail Stations,* Rutgers University (2008), http://policy.rutgers.edu/vtc/REPORTS/REPORTS/HBLR%20Final%20Report.pdf.

[32] Terry Clower, Bernard Weinstein, and Michael Seman, Assessment of the Potential Fiscal Impacts of Existing and Proposed Transit-Oriented Development in the Dallas Area Rapid Transit Service Area, DART (2007).

[33] Center for Transit Oriented Development, Making the Case for Evaluating the Economic Benefits of Potential Transit Investments (2006).

south. The city reports that since the opening of the first line, more than 10,000 housing units and 5.4 million square feet of commercial space have been constructed within two blocks (450 feet) of the line. The total private investment of that development is estimated to be $3.5 billion.[34] An earlier study of the line compared the amount of private development investment with the capital costs associated with construction of the streetcar, showing an astounding 1,795 percent return on investment for the initial line and an even more impressive 7,501 percent return on the extension. The same study showed similar returns for streetcar lines in Kenosha, Wisconsin, Little Rock, Arkansas, and Tampa, Florida.[35]

[34] City of Portland, *Portland Streetcar Development Oriented Transit* (2008) www.portlandstreetcar.org/pdf/development_200804_report.pdf

[35] Reconnecting America, TOD 101: Why TOD? Why Now? (n.d.), www.commentmgr.com/projects/swne/docs/Reconnecting%20America%20Presentation%20August%202007.pdf

Briefing Paper No. 4

ECONOMIC STIMULUS BY CONNECTING THE MOST PEOPLE TO ECONOMIC OPPORTUNITIES FOR THE SAME INVESTMENT

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4.1 The Big Picture

The United States will add about 100 million people between 2006 and the middle 2030s[36] or about 40 million new households. Of those additional 40 million households, only about 5 million or about 12.5 percent will include those raising children. Put differently, nearly 90 percent of the net growth in households will be in those not raising children.[37] Single person households will grow by about 13 million, accounting for about a third of the gain.[38]

Housing markets will need to accommodate the needs of the new households; yet the characteristics of the net new households will be very different from the past. Preference surveys indicate that about 38 percent of households want the option to choose from among attached housing types (apartments, condominiums, townhouses, cooperatives and the like), and of the 62 percent that want detached homes, 60 percent want small lots (less than 7,000 square feet). In effect, to achieve this distribution, virtually all new housing units constructed in the U.S. would need to be attached or small lot. Even if this were to happen, the nation already has 20 million more residential units on large lots than the market may demand by 2030.

4.2 Mobility Implications

Demographic and preference changes have mobility implications. One implication is that demand for alternatives to highways appears large and may be growing. A 2004 survey, for instance, indicated that 46 percent of all Americans want to live within walking distance of public transit.[39]

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[36] Census Bureau (2008), www.census.gov/population/www/projections/files/nation/summary/np2008-t1.csv

[37] There will be more children and more households with children in the 2030s than the 2000s, but their share of growth in total households will be small relative to the total.

[38] Figures extrapolated and adapted from Arthur C. Nelson, Leadership in a New Era, *Journal of the American Planning Association*, 72(4): 393-409 (2006).

[39] National Association of Realtors and Smart Growth America (2004), National Community Preference Survey, www.smartgrowthamerica.org/narsgareport.html.

More recent surveys indicate this figure is growing and may now approach 60 percent.[40] In 2030 there will be about 363 million people[41] living in about 140 million households.[42] At least half of them, or 70 million households, will want to live near transit. Of the nation's 116 million households in 2007, about 43 million or 37 percent lived within a 10-minute walk of transit.[43] The implication is that of the 24 million new housing units needed between 2007 and 2030,[44] 100 percent of them will need to be built where transit exists or is planned, and even this will not meet all the demand.

There is little doubt where the market is heading. As such, it is important to make the transportation investments that support where the market is going rather than making investments in infrastructure that supports single family subdivisions where values are already declining, the supply is already glutted and likely to continue to be so. More than just meeting the demand for public transportation accessibility is at stake, however. Sustained economic development depends in large part on engaging as many people as possible in the economy. For the broad economy it is often better for someone who is unemployed to get a job than for someone who is already employed to switch jobs. Putting transit in those communities with high unemployment has a disproportionately positive impact on reducing unemployment than putting it in communities already with low unemployment—by up to 2.5 times.[45] In the next two sections we review ways in which these benefits may be realized. One is by meeting the demand for public transit options—especially rail. The other is by seizing the market response to rail investments.

4.3 Rail Transit Demand and Opportunities

Emerging studies are showing an increasing demand for and growing supply of rail transit, especially light rail. As noted earlier, perhaps at least 46 percent of Americans want to be within walking distance of public transit.[46] One study indicates that about a quarter of all new residential development may be accommodated in existing or planned "transit zones" across nearly 40 metropolitan areas with existing or planned rail systems.[47] We have analyzed existing and planned (including planned expansions of) rail transit systems in 22 substantially growing metropolitan areas and conclude that collectively they may be able to accommodate more than a third of growth projected for them by 2040, shown in Table 4.1.

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[40] Susan Handy, James F. Sallis, Deanne Weber, Ed Maibach Marla Hollander (2008) "Is Support for Traditionally Designed Communities Growing? Evidence From Two National Surveys", Journal of the American Planning Association, 74(2): 209-221.

[41] US Bureau of the Census, www.census.gov/population/www/projections/summarytables.html.

[42] Assuming 2.5 persons per household.

[43] US Census Bureau and HUD (2009), *American Housing Survey for the United States: 2007*, Table 2-8. Neighborhood-Occupied Units compared to Table 1-1, including interpolation.

[44] Assuming each household occupies its own dwelling.

[45] See generally Ronald F. Ferguson and William T. Dickens, eds. (1999), Urban Problems and Community Development, Brookings Institution (Washington, DC).

[46] National Association of Realtors and Smart Growth America (2004), National Community Preference Survey, www.smartgrowthamerica.org/narsgareport.html.

[47] Center for Transit Oriented Development (2006), Preserving and Promoting Diverse Transit-Oriented Neighborhoods (Washington, DC), www.reconnectingamerica.org/public/tod.

Table 4.1
Absorption Potential of Existing and Planned Rail Systems in Fast-Growing Metropolitan Areas

Metropolitan Area Growing Faster than National Average	Existing or Planned Rail Stations	Estimate of Population Accommodation Near Stations[a]	Growth to 2040[b]	Potential Share of Growth Accommodated
Atlanta	38	570,000	2,650,000	22%
Austin	8	120,000	1,300,000	9%
Charlotte	10	150,000	900,000	17%
Dallas	48	720,000	3,500,000	21%
Denver	24	360,000	1,200,000	30%
Houston	67	1,005,000	2,800,000	36%
Jacksonville	8	120,000	600,000	20%
Las Vegas	9	135,000	1,600,000	8%
Los Angeles	113	1,695,000	2,200,000	77%
Miami	60	900,000	2,900,000	31%
Minneapolis-St. Paul	17	255,000	1,200,000	21%
Nashville	6	90,000	900,000	10%
Norfolk	11	165,000	600,000	28%
Phoenix	32	480,000	2,700,000	18%
Portland	108	1,000,000	1,000,000	100%
Sacramento	55	825,000	1,000,000	83%
Salt Lake City	22	330,000	600,000	55%
San Diego	56	840,000	1,300,000	65%
San Francisco Bay	286	1,300,000	1,300,000	100%
Seattle	29	435,000	1,300,000	33%
Tampa Bay Area	10	150,000	1,100,000	14%
Washington	127	1,905,000	2,600,000	73%
Total	1,144	13,550,000	35,250,000	38%

Notes

a. Assuming 1-kilometer capture area around stations and an average of 15,000 residents or 7,500 occupied residential units per capture area, equivalent to about 10 residential units per gross acre.

b. Growth in 2040 capped at the capture area figure to avoid over-counting growth absorption capacity (applicable to Portland and San Francisco Bay Area).

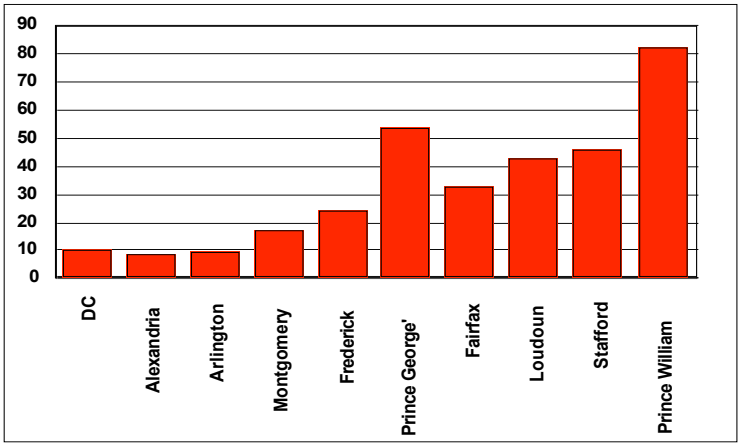
Source: Arthur C. Nelson, Metropolitan Research Center, University of Utah.

4.4 Market Responsiveness to Making Transit more Accessible

Markets may already be responding to demographic changes and the economic advantages of locations served by public transportation. Residential vacancy rates and foreclosures, for example, tend to vary by distance from the center of metropolitan areas, as seen in Figure 4.1 for

metropolitan Washington, DC, and Figure 4.2 for metropolitan Atlanta, Georgia.[48] In both cases, foreclosures and vacancy rates increase with distance. But something else is happening. In the Washington, DC area, foreclosures are lowest where there is a substantial network of public transit in the form of busses and rail, such as in the cities of Washington and Alexandria, and Arlington and Montgomery counties. (Atlanta's network of public transportation is nowhere near as developed so similar comparisons cannot be made with respect to it.)

Figure 4.1
Spatial distribution of homes in various stages of foreclosure in metropolitan Washington, DC



Source: Realtytrac foreclosure summaries by counties, data converted to foreclosures per 10,000 residential units, as of February 10, 2009 http://www.realtytrac.com/.

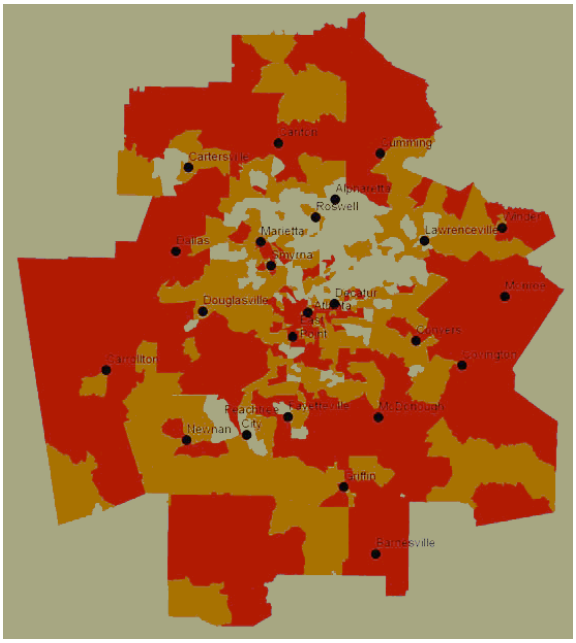
Let's take a closer look at Atlanta. Since the late 1990s, the Atlanta Regional Commission has been encouraging development in 50-some "livable centers". In all, it has steered about $140 million to these centers for:[49]

- Pedestrian-only Facilities 58%
- Multi-Use Trails 6%
- Bikeway/Pedway Facilities 14%
- Roadways 12%
- Transit Facilities 9%

[48] Alan Mallach (2009), Stabilizing Communities: A Federal Response to the Secondary Impacts of Foreclosure, Brookings Institution (Washington, DC). www.brookings.edu/reports/2009/02_foreclosure_crisis_mallach.aspx

[49] www.atlantaregional.com/html/308.aspx.

Figure 4.2
Spatial distribution of residential vacancy rates by zip code for the Atlanta metropolitan area



Source: Alan Mallach (2009). The darker the shade, the higher the vacancy rate.

Although the livable centers account for less than 10 percent of its total land area, during the 2000s they accounted for a third of the residential development and more than half of nonresidential development in the 10-county ARC area including:[50]

- 62,000+ residential units
- About 9,500 hotel/motel rooms
- 12+ million square feet retail space
- 40+ million square feet office space

Total private investment is estimated at $25 billion[51], compared to $140 million in public investment. At least 150,000 jobs have also been attracted to these centers.[52] This is a ratio of 178 to 1.

4.5 Summary

Markets are changing dramatically and so must the modes of transportation. The challenge is to determine how best to make transportation investments that connect the most people to economic opportunities. In metropolitan areas, it would appear that public transportation may be the future option that best meets the needs of emerging demands with the greatest economic returns.

[50] Estimates by the authors.

[51] Assuming, conservatively, $300,000 per residential unit, $100,000 per lodging unit, $100 per square foot for retail space, and $150 per square foot for office space.

[52] Assuming, conservatively, one employee per lodging unit; 400 square feet of retail space, and 300 square feet of office space. The calculations actually sum to 170,000 jobs.

Briefing Paper No. 5

ECONOMIC STIMULUS BY ADDING VALUE TO REAL ESTATE

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5.1 Introduction

Focusing development around public transportation has been a successful method for advancing environmental and quality of life goals in metropolitan areas around the country. The benefits credited to transit-oriented development (TOD) include protection of open space, creation of pedestrian-friendly neighborhoods, less reliance on automobiles for daily needs, and decreases in energy consumption and emissions of air pollutants and greenhouse gases.[53] TOD has also proven an effective tool for achieving economic development objectives. This is not a terribly surprising result, given public transportation's historic ties to land development—most of the transit facilities developed in the early 20th century were constructed by private entrepreneurs intent on opening new lands to commercial and residential development.[54] Public transit agencies, cities, and developers are rediscovering that transit can again serve as an economic engine for local and regional economies.

5.2 Accessibility and Property Values, Generally

The old adage about real estate being about location, location, location, is really a statement about the role that accessibility plays in the development potential of property and, hence, its value. Any discussion about the urban economic influence of accessibility invariably starts with the work of Johann von Thünen,[55] who in 1863 theorized about the value of farmland as a function of the land's relative proximity and, thus, its accessibility to the marketplace. The closer (and more accessible) the land, the higher the value. Assuming equal levels of soil productivity, as values rise, farmers are induced to plant crops that yield higher returns per unit of land. Thus, accessibility to the market place not only influences the relative price of land, but also the intensity to which the land is used. Later work translated von Thünen's work beyond the farmland context to other types of land use categories, showing similar relationships between accessibility, property value, and development

[53] Robert Cervero, *et al.*, Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects (TCRP 102), Transportation Research Board (2004).

[54] Brian J. Cudahy, Cash, Tokens, and Transfers: A History of Urban Mass Transit in North America, Fordham University Press (1990).

[55] Johann Heinrich von Thünen, Der Isolierte Staat in Beziehung auf Landwirschaft und Nationaloekonomie. Munich: Pflaum (1863).

intensity.[56] The underlying function behind these relationships is the relative market attractiveness of a given piece of land. As land becomes more accessible, its perceived usefulness as a location for business or residential activity increases, leading to increased demand for the land, which raises its value and induces the ultimate land developer/user to use the land more efficiently by increasing the development intensity.

5.3 Accessibility and Transit

Traditionally, these relationships between accessibility, property value, and land use intensity have been explained by physical proximity to a city or region's central business district (CBD). Because CBDs have, at least historically, been the areas with the greatest accessibility to the largest number and variety of activities, land values were observed to be inversely proportional to distance to the CBD—the shorter the distance to the CBD the higher the land values, and vice versa. However, the introduction of significant public transportation services (usually rail-based) to a particular area increases travel options and frequently reduces travel times to the CBD and other activity centers from that area.[57] This has the net effect of increasing the relative accessibility of that area compared to other areas at the same distance from the CBD/activity centers but without public transit connections.[58] In theory, the increase in relative accessibility translates into increased development potential and land values.

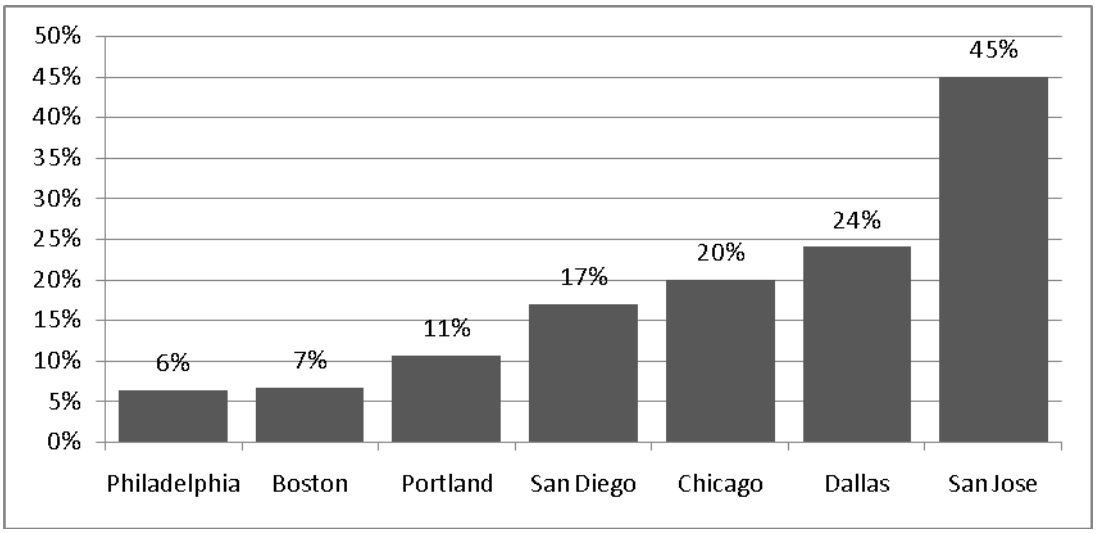
Results from empirical studies of these relationships are varied. However, most of the evidence points to the introduction of transit facilities leading to enhanced land values, as the theory predicts. Cervero synthesizes studies completed since 1993, showing price premiums of between 6.4 percent and 45 percent for housing located within a ¼ to ½ mile radius of rail transit stations, compared to comparable housing outside of the station areas (see Figure 5.1). Premiums for commercial property values ranged from 8 percent to 12 percent along Denver's 16th Street Mall to 40 percent for the area surrounding Dallas' Mockingbird light rail station.

[56] William Alonso, Location and Land Use: Toward a General Theory of Land Rent, Harvard University Press (1964).

[57] R.A. Fejarang, Impact on property values: A study of the Los Angeles metro rail, Transportation Research Board (1994).

[58] Nathaniel Baum-Snow & Mathew E. Snow, "The Effects of New Public Projects to Expand Urban Rail Transit," *Journal of Public Economics, 77,* 241-263 (2000).

Figure 5.1 Percent Price Premium for Housing in Transit Station Area vs. Non-Station Areas[59]



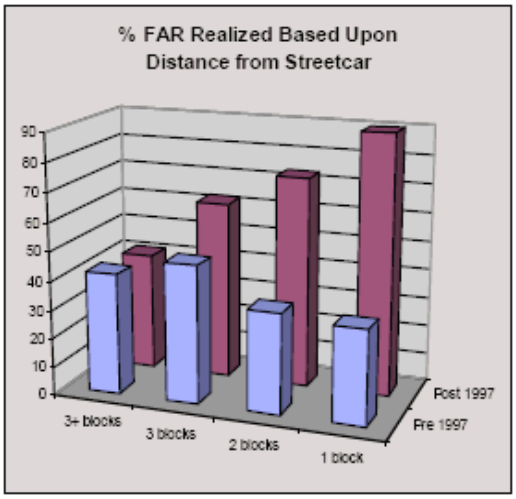
Not all of the studies show such strong value/transit relationships, and in a small number of cases the data indicate a negative relationship (i.e., proximity to the transit station results in a price penalty). In an effort to rationalize the wide-ranging results, Debrezion, Pels, and Rietveld conducted a meta-analysis that used data drawn from multiple studies, giving them 57 transit/property value observations. The conclusion from their regression analysis is that transit proximity still matters, with residential property values increasing 2.4 percent for every 250 meters closer to a station and commercial properties increasing 0.1 percent for every 250 meters.[60] This is, in all likelihood, a conservative estimate, given the number of potentially confounding factors that could not be controlled for, including levels of automobile traffic congestion, local real estate market conditions, and whether other complementary TOD planning strategies were being used (e.g., pedestrian-oriented street design, mixed-use zoning).

As outlined above, the theory would predict that these increased property values would translate into higher intensity/higher value development projects. The anecdotal evidence indicates that this is, indeed, what is occurring. A leading example of this effect is the Pearl District, near downtown Portland, Oregon where the city constructed a new streetcar line in 1997. Before the streetcar was built, development in the area was constructed at less than half the density (as measured by floor-area-ratio (FAR)) allowed by zoning. Projects built since 1997, however, have been constructed at 60 percent to 90 percent of the allowable density (see Figure 5.2). To date, more than $3.5 billion in private capital has been invested within the two blocks of the streetcar alignment, including more than 10,000 units of new housing and 5 million square feet of commercial space.

[59] Based on Robert Cervero, *et al.*, Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects (TCRP 102), Transportation Research Board (2004).

[60] Ghebreegsiabiher Debrezion, Eric Pels, and Piet Rietveld, "The Impact of Railway Stations on Residential and Commercial Property Value: A Meta-Analysis," *Journal of Real Estate Finance and Economics, 35,* 161-180 (2007).

Figure 5.2 Percent of Allowable Density Constructed within 3+ Blocks of the Portland, OR Streetcar Line[61]

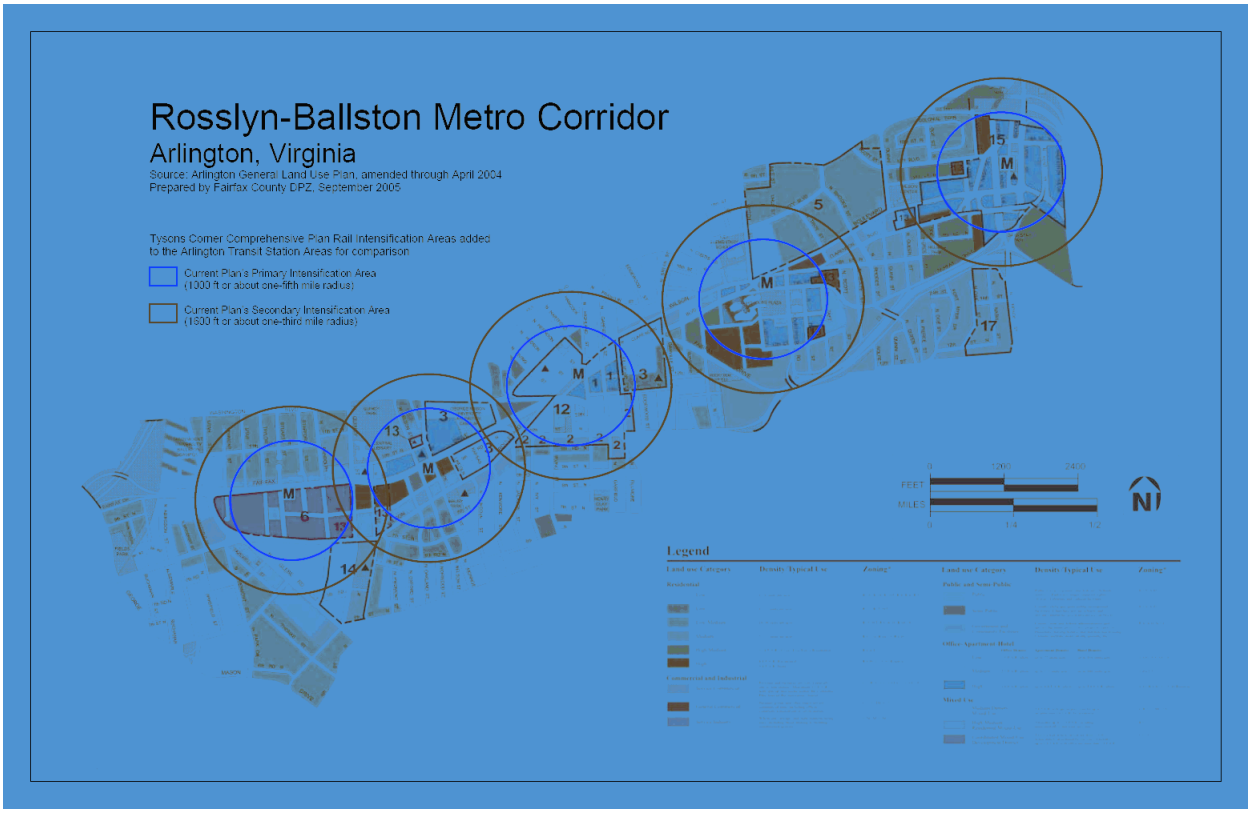


Another example is the Rosslyn-Ballston corridor of Arlington County, Virginia, which includes five stations along the Washington Metrorail system's Orange Line. In the 1960s, this corridor was characterized by failing low-density strip-malls, but by 2004, the corridor had become host to more than 58 million square feet of new commercial and residential development.[62] Plans for the corridor's station areas, began well before the Orange Line's opening in 1979 and focused high-intensity development in Primary Intensification Areas that include lands within 1,000 feet of each station. Secondary Intensification Areas, running from 1,000 to 1,600 feet along the station, bring down density levels in stages, both to facilitate blending with surrounding neighborhoods and to help focus the market for high-density development in the primary areas (see Figure 5.3).

[61] City of Portland, *Portland Streetcar Development Oriented Transit* (2008) www.portlandstreetcar.org/pdf/development_200804_report.pdf.

[62] Fairfax County Dept. of Planning and Zoning, "Land Use and Development along the Rosslyn-Ballston Metro Corridor" (2005), www.fairfaxcounty.gov/dpz/tysonscorner/nofind/arlingdoc.pdf.

Figure 5.3. Plan for the Rosslyn-Ballston Metrorail Corridor, Arlington, Virginia



By 2004, development in these planning areas had resulted in the construction of more than 21 million square feet of office space (plus another 2 million approved), 2.8 million square feet of retail space, and 26,000 units of housing (see Table 5.1). As with Portland's Pearl District, the Rosslyn-Ballston Corridor shows how the accessibility advantages provided by a transit investment can, when supported by appropriate planning and zoning, result in higher intensity/higher value developments.

Table 5.1 Development Approved, Existing, and Under Construction in the Rosslyn-Ballston Corridor, Arlington, Virginia (2004)[63]

Land Use	Unit of Measurement	Approved	Existing & Under Construction
Office Space	(square feet)	2,106,269	21,439,286
Retail Space	(square feet)	176,785	2,809,684
Total Office/Retail	(square feet)	2,283,054	24,248,970
Residential	(units)	3,065	26,415
Hotel	(rooms)	436	3,913

[63] Fairfax County Dept. of Planning and Zoning, "Land Use and Development along the Rosslyn-Ballston Metro Corridor" (2005), www.fairfaxcounty.gov/dpz/tysonscorner/nofind/arlingdoc.pdf

Another phenomenon suggested by the Arlington example is the tapering off of the accessibility-related property value impacts as the transit station distance from the CBD increases. Zoning around the Rosslyn station—the closest station in the corridor to the Washington, D.C. CBD—generally allows for floor-area ratios (FARs) of 3.8 to 4.8. In recent years, however, the county board has allowed denser projects to be built, some of which are as high as 9.9 FAR. This has effectively bumped up the average FAR of development constructed or permitted in the station area to 1.78, which is 23% higher than the built FAR in the next station area in the corridor (Courthouse) and 36% higher than the corridor average.[64] Studies of other Metrorail station areas show a similar effect: the further a station is from the CBD, the lower the property value, other things being equal.[65] These findings comport to theory-based expectations, which posit that the capitalization of accessibility benefits in transit station area property values is not only a function of a property's proximity to a station, but also the station's proximity to the center of the region. Similar studies in other metropolitan areas confirm these expectations.[66]

5.4 Summary

Investing in major transit facilities and services not only facilitates achievement of important environmental and quality of life goals, but can substantially advance private sector economic development objectives as well. The accessibility benefits provided by transit are being translated into significant enhancements to the value of nearby real estate, reflecting increased market interest in potential development on those lands. The evidence shows that these enhancements are both a function of a property's proximity to a transit station and that station's proximity to a regional activity center, such as a central business district.

It seems highly probable that the level of market interest in centrally located properties with good transit access is likely to increase in coming decades as the baby-boomers age and the percentage of households with young children decline.[67] Both demographic trends are likely to result in increased market attraction to the higher-density, smaller housing unit developments that are facilitated through TOD.

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[64] Fairfax County Dept. of Planning and Zoning, "Land Use and Development along the Rosslyn-Ballston Metro Corridor" (2005), www.fairfaxcounty.gov/dpz/tysonscorner/nofind/arlingdoc.pdf

[65] Federal Transit Administration, Transit Benefits 2000 Working Papers: A Public Choice Policy Analysis (2000).

[66] Ghebreegziabiher Debrezion, Eric Pels, and Piet Rietveld, "The Effects of Railway Investments in a Policentric City: A Comparison of Competitive and Segmented Land Markets," *Environment and Planning A, 39,* 2048-2067 (2007); Haixiao Pan and Mind Zhang, "Rail Transit Impacts on Land Use: Evidence from Shanghai, China," *Transportation Research Record, 2048,* 16-25 (2008); Robert Cervero and Michael Duncan, "Transit's Value-Added Effects: Light and Commuter Rail Services and Commercial Land Values," *Transportation Research Record, 1805,* 8-15 (2002); Saksith Chalermpong, "Rail Transit and Residential Land Use in Developing Countries: Hedonic Study of Residential Property Prices in Bangkok, Thailand," *Transportation Research Record, 2038,* 111-119 (2007); David R. Bowes and Keith R. Ihlanfeldt, "Identifying the Impacts of Rail Transit Stations on Residential Property Values," *Journal of Urban Economics, 50,* 1-25 (2001).

[67] Arthur C. Nelson, "Leadership in a New Era," *Journal of the American Planning Association, 72(4),* 393-407 (2006).

Briefing Paper No. 6

ECONOMIC STIMULUS THROUGH TRANSPORTATION INVESTMENTS THAT FACILITATE AGGLOMERATION ECONOMIES

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6.1 Introduction

Metropolitan areas tend to grow faster and generate more wealth when they can take advantage of *agglomeration economies*. The concept of agglomeration economies is that economic development is enhanced when there is a clustering of economic activity, measured usually through employment density. Agglomeration economies are central to metropolitan growth and resiliency to economic distress over time. Generally, we find that transportation investments that induce lower population and employment density also reduce economic productivity over time whereas transportation investments that attract growth into nodes or corridors, increase population and/or employment density. We will first review the role of agglomeration economies in economic development; second summarize research on the relationship between highway investment and agglomeration economies; and third identify the relationship between transit investment and agglomeration economies.

6.2 Agglomeration Economies Generally

In economic development, density matters. Generally, the more densely settled an area the more jobs per capita, the higher incomes, the lower unemployment, and the more resilient it is to economic downturns. While less densely settled areas may grow faster, densely settled ones grow better in terms of income, wages, and job accessibility. In a pioneering study, researchers found that doubling employment density increases labor productivity by about 6 percent.[68] Another study found that a doubling of population density also increases labor productivity by about 6 percent.[69] This would be on top of the jobs and wages that would occur anyway. These economic development benefits accrue across all economic sectors.

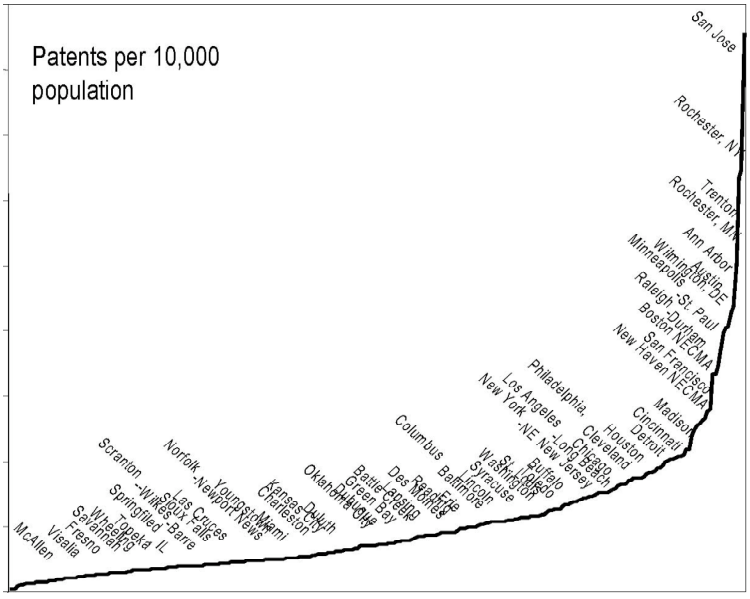
[68] For a review, see Antonio Ciccone Robert E. Hall (1996), "Productivity and the Density of Economic Activity." American Economic Review, v86, n1, pp. 54-70.

[69] Timothy F. Harris and Yannis M. Ioannides (2002), Productivity and Metropolitan Density, Department of Economics, Tufts University.

An increase of jobs by 6 percent with a doubling of density is not trivial. In 2007, the average single family home sat on a lot of more than 15,000 square feet.[70] If lot size were half this or about 7,500 square feet (roughly the standard subdivision lot of the 1960s), and other land uses were adjusted accordingly, the implication is that ***at such higher density, jobs in the U.S. would increase by more than 8 million***,[71] more than twice the jobs lost in 2008 and projected to be lost in 2009 combined.[72] This is on top of the jobs that would exist anyway.

A special consideration is the extent to which innovation, a form of economic activity, benefits from population and/or employment density. Innovation is needed to sustain economic development over time. Patents are a good indicator of innovation. Research shows that, controlling for location, education, and other factors, agglomeration economies measured in part simply as employment density, stimulates innovation.[73] Figure 6.1 shows that as population density increases so will patent activity. Put differently, a doubling of residential density increases patent activity by 20 percent. As innovation presages future economic development, this is an important benefit of agglomeration economies associated with density.

Figure 6.1. Agglomeration Effect of Patents per 10,000 population for U.S. Cities



Note: Y-axis is population from zero to 18,000 persons per square mile.
Source: Carlino, Chatterjee and Hunt (2006).

[70] Calculated from the American Housing Survey for the United States 2007, Table aA-3.

[71] For 2007, the Bureau of Economic Analysis indicates there were a total of 135.5 million jobs in 2007. See Table K. National Estimates of BEA Wage and Salary Employment and BLS Total Employment, www.bea.gov.

[72] For jobs lost in 2008, see www.nytimes.com/interactive/2009/01/09/business/20080109_jobs_graphic.html and jobs projected to be lost in 2009, see money.cnn.com/2008/12/11/news/economy/anderson_forecast/index.htm.

[73] See Gerald Carlino, Satyajit Chatterjee, and Robert Hunt (2006), "Urban Density and the Rate of Invention," WP 06-14, www.philadelphiafed.org/research-and-data/regional-economy/regional-research/index.cfm?tab=3

How transportation investments affect economic development through agglomeration economies is addressed next in terms of highways and then transit.

6.3 Transportation Investments that Reduce Agglomeration Economies

Ewing summarizes research on the association between highway investments and agglomeration economies, and economic development.[74] A key finding is that major highway investments have small net effects on the growth and development of metropolitan areas, instead mostly moving development around the region. Highway investment patterns tend to favor suburbs over central cities, and thereby contribute to decentralization and low-density development. Indeed, major highway investments may actually hurt regional productivity if they induce inefficient (low density) development patterns. This is seen next.

Another aspect relevant to agglomeration economies is the extent to which minimum thresholds are achieved to support retail and service firms. If density is too low, an area may not support shopping and certain services; spending that does not occur in the area is "leaked" to other areas including outside the region. Many metropolitan regions have one or more beltways; these highways disperse population and employment growth. One study found that a metropolitan area of 2 million residents with one beltway loses $1.6 billion in retail and service sales annually and with two it loses $2 billion annually. This is comparable to 68,000 and 85,000 jobs, respectively.[75] Roughly speaking, of the 30 metropolitan areas with at least one beltway, this sums to more than 2.5 million jobs or about all the jobs that were lost to the nation's economy in 2008.[76]

In short, highway investments that facilitate low-density development will likely reduce jobs relative to other transportation investments, including highways that facilitate agglomeration economies along corridors connecting nodes. This is not to say that all road projects *per se* reduce agglomeration economies. In early stages of urbanization, roads establish initial trade between places and facilitate opportunities for firm specialization thus leading to exports using roads. In modern times, it was only roads that created the very agglomeration economies around which urban areas were formed. Atlanta, Dallas, Denver, and Phoenix come to mind. Eventually, agglomeration economies are sustained best with multi-modal options. Even as they mature, however, there will often be selected highway investments that sustain or even enhance agglomeration economies. These may not be large projects such as perimeter highways or major expressways, but arterials and collectors within the established metropolitan fabric that reduce bottlenecks, for instance.

6.4 Transportation Investments that Increase Agglomeration Economies

The implication of economic theory is that agglomeration economies increase with respect to labor market size. Congestion can undermine agglomeration economies because of automobile use. The reason is that while agglomeration benefits occur because of greater accessibility—meaning more

[74] Reid Ewing (2009), "Highway Induced Development: What Research in Metropolitan Areas Tells Us." Forthcoming in Transportation Research Record.

[75] Arthur C. Nelson and Mitchell Moody (2000), Effect of Beltways on Metropolitan Economic Activity, Journal of Urban Planning and Development 126(4): 189-196. Figures adjusted from 1997 to 2008 using the consumer price index. Employment estimates based on 2006 data from http://censtats.census.gov/cgi-bin/cbpnaic/cbpsel.pl.

[76] www.nytimes.com/interactive/2009/01/09/business/20080109_jobs_graphic.html

labor becomes available to employers, congestion reduces accessibility thereby negating benefits of agglomeration. In contrast, because transit is mostly uncongestible it may be the transportation mode that is best suited to sustaining agglomeration economies at least in downtowns and other nodes of agglomeration, and along the corridors that connect them.[77] Unfortunately, there is not enough research into these relationships and far less than for highways.

6.5 Summary

A key driver of economic development is the formation and maintenance of agglomeration economies because they generate more employment than would occur otherwise. Where highway investments disperse population and jobs, agglomeration economies are undermined, resulting in fewer jobs than would otherwise be created. Public transportation is however, essentially, uncontestable. There may thus be more opportunities for enhancing existing agglomeration economies and creating new ones through public transportation than perhaps through any other transportation investment.

[77] Adapted from Richard Voith (1998), Parking, Transit, and Employment in a Central Business District, Journal of Urban Economics 44(1): 43-48.

Briefing Paper No. 7

ECONOMIC STIMULUS THROUGH HIGHER RETURNS TO TRANSPORTATION INVESTMENTS

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7.1 Maximizing Transportation Investment Returns

Investors typically try to maximize their investment return. A real estate investment may earn 10 percent the first year, increase by two percent for each of the next nine years peaking at 28 percent, and then lose one percent each of the next 10 years. In the 20th year, the investment return is 18 percent but in the 10th year it is the highest at 28 percent. Investors will sell the asset after the 10th year because every year thereafter their "marginal rate of return" falls. The investors are still making money, just less of it. Another investment scenario involves choosing between options. The first might cost $100 million and generate $500 million in benefits. The second might cost $1 billion but generate $10 billion in benefits. The third might cost $2 billion but generate $30 billion in benefits. Clearly, at 1:15, the third option has the highest ratio of benefits to costs. But maybe we don't have $2 billion. We're left choosing between two "second-best" options with benefit-cost ratios of 1:5 and 1:10, respectively. If we don't have $2 billion but have $1 billion instead, we would choose the second option.

Maximizing transportation returns follows similar logic. This briefing paper uses literature to compare rates of return for different transportation investments generally and through case studies of specific metropolitan areas—one slow-growing and the other fast-growing.

7.2 Declining Rate of Return for Highways

Highways have been a principal economic development engine in the post-war era. They connected metropolitan centers and stitched the nation together. This helped the nation cope with unprecedented growth rates in terms of population and productivity. But as highway systems were built, their marginal rate of return fell, as seen in Table 7.1. The annual return on highway investments peaked in the 1950s and 1960s then began tapering to low-double digits by the end of the 1990s.[78] While one reason may be that the pace of highway construction also fell since the 1960s, another is that on average new highway investments may not generate marginal rates of return as high as earlier investments. The new freeway extension for instance might not generate as many benefits as the initial freeway itself- a phenomenon known as diminishing rate of return.

[78] Eno Transportation Foundation, Inc. (1996), Economic Returns from Transportation Investment, www.fhwa.dot.gov/policy/otps/060320a/index.htm.

Table 7.1
Annual Rate of Return by Type of Investment

	1950-89	1950-59	1960-69	1970-79	1980-89
Total Highway Capital	28%	35%	35%	16%	10%
Non-Local Highway Capital	34%	48%	47%	24%	16%
Private Capital	13%	13%	14%	12%	11%

Source: Eno Transportation Foundation (1996), p. 16.

7.3 Comparing Metropolitan Transportation Investment Options

If a metropolitan area already has a mature highway system, which transportation option generates the greatest returns? Two case studies are reviewed: Cincinnati, Ohio, a slow-growing Northern metropolitan area, and Atlanta, Georgia, a fast-growing Southern one.

Cincinnati In the early 2000s, the Cincinnati metropolitan area investigated economic returns to investments options in regional bus service, light rail, and new highway capacity.[79] The study found that bus improvements generated the highest rate of return but it was regional light rail that generated the largest amount of total and net benefits, and the second highest rate of return (see Table 7.1). Adding to the region's existing highway capacity generated the fewest net benefits and lowest rate of return. As rail systems are designed to connect nodes along corridors and as those locations are most commonly associated with agglomeration economies, it would seem that the rail transit option does the better job of leveraging agglomeration for regional economic development opportunities. Similar results may be expected in other metropolitan areas.

Table 7.1. Comparison of Bus, Light Rail and Highway Capacity Investments in Cincinnati, Ohio (in present value of millions of year-2000 dollars, over 30 years)

Measure	Bus Improvement, Region Wide	Light Rail Region- wide	New Highway Capacity
Total Cost	$522	$6,218	$1,209.1
Total Benefits	$1,141	$10,784	$1,365.2
Net Benefits	$619	$4,566	$156.1
Internal Rate of Return	27.1%	8.7%	4.9%

Note: Dollar figures in millions.
Source: HLB Decision Economics (2001)

[79] HLB Decision Economics, The Economic and Community Benefits of Transportation Options for Greater Cincinnati, February, 2001, prepared for Ohio-Kentucky-Indiana Metropolitan Planning Organization.

Atlanta In 2008, the Georgia Legislative Assembly commissioned a study to evaluate transportation investment options for metropolitan Atlanta.[80] The study evaluated

(1) transportation demand management,
(2) construction of "connecting infrastructure" to relieve congested corridors,
(3) "doubling down" congestion through investments in the "first and last mile" of a trip such as through transit circulators and arterial roads to compliment the "connecting infrastructure", and
(4) better coordination between where development occurs and where investments are made.

Analysis was conducted cumulatively, in that order, with the results shown in Table 7.2.

Table 7.2
Cumulative Returns to Different Transportation Investments, Atlanta Regional Commission, 30 years

Investment Type	Incremental and *Cumulative* Investment	Incremental and *Cumulative* Returns	Cumulative Ratio
Transportation Demand Management	$0.22B	$40B	182.0:1
Connecting Infrastructure	$26.00 B	$40B	
	$26.22B	***$80B***	**3.1:1**
Doubling Down on Congestion	$17.20 B	$10.B	
	$43.42B	**$90B**	**2.1:1**
Better Coordination with Development Patterns	$0	*$39B*	
Total Direct Return (all investments)	***$43.20B***	***$129B***	**3.0:1**

Note: "B" means billion.
Source: McKinsey and Company (2009).

TDM had by far the largest return to investment. Except for better coordination of new development with existing transportation infrastructure, incremental returns to connecting infrastructure (expanding highway capacity) and doubling down on congestion added considerably fewer benefits to the cumulative total. Indeed, at a cost of $17.2 billion, doubling down on congestion actually added $10 billion fewer benefits than costs. Assuming the market responded to these investments in anticipated ways and through better coordination of land use decisions based on transportation investments, the incremental (marginal) return to investment is infinite: $0 would generate $39 billion in return.[81]

7.4 Comparing State-wide Transportation Investment Options

Several states have embarked on "economic development" highways to connect urban areas to rural ones, and rural centers to each other. The argument is that major highway investments leading to expressways or other multi-lane facilities crisscrossing states will inherently stimulate

[80] McKinsey and Company, *IT3 Scenario Results and Implications*, Briefing to the General Assembly, State of Georgia, Discussion Document, December 3, 2008.

[81] Pro-rata calculation using ratio based on regional development product to total direct return.

economic development. The results of such highways are mixed but not usually positive. Research has shown, generally that

(1) rural counties close to metropolitan areas benefit economically, at least in the short term, by new highways, but benefits may not be sustained in the long term, and

(2) there is little consensus that rural areas benefit over the long term and those that do, may merely redistribute development potential from other areas – in other words, simply taking economic development away from other communities.[82]

These expectations appear to be confirmed by analysis done for the Georgia Legislative Assembly also by McKinsey and Company. The analysis was done to determine the economic return to making two different kinds of highway improvements. For such cities as Athens, Augusta, Columbus, Macon, and Savannah, $13.6 billion in highway improvements would generate $44 billion in benefits over 30 years. However, completion of Georgia's rural economic development highway program at cost of $15.6 billion would have virtually no economic benefits.[83]

7.5 Summary

While highway investments likely have initially high rates of economic return when used to create the baseline network (as was the case in the 1950s and 1960s) needed to provide access within and between metropolitan areas, subsequent investments likely have declining rates of return. The next wave of transportation investments in metropolitan areas would be investments that elevate accessibility within the area through multi-modal options, and especially by integrating land uses and facilitating higher densities. Economic returns from these investments seem to eclipse highway investments by a multiple.

The Atlanta metropolitan area is large and continues to grow; in some respects, it is not yet the kind of mature metropolitan area that many Northeastern and Midwestern ones are. Yet, even in metropolitan Atlanta, the highest returns are associated not with building new highways but by managing the current highway investments better. In a metropolitan area with a built out road system which already has thousands of lane miles, even very large investments in highways may have relatively little difference to economic improvement because of diminishing returns. This is illustrated in Table 7.1, which shows returns to metropolitan Cincinnati from new bus, light rail and highway investments, with highways having by far the smallest outcome.

[82] Dennis M. Brown (1999), Highway Investment and Rural Economic Development: An Annotated Bibliography, Economic Research Service, U.S. Department of Agriculture (Washington, DC).

[83] McKinsey and Company, *IT3 Scenario Results and Implications*, Briefing to the General Assembly, State of Georgia, Discussion Document, December 3, 2008, slide 11.

Briefing Paper No. 8

ECONOMIC STIMULUS BY FIXING IT FIRST

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8.1 Transportation Infrastructure Overview

America's infrastructure is extensive. It was built to facilitate economic development and commerce but maintaining it is proving to be challenging. Table 8.1 summarizes the value of transportation infrastructure as of 2007.[84]

A common misconception is that the federal government owns much of the nation's infrastructure including its transportation systems. In fact, excluding national defense, the federal government owns only 7 percent of the nation's infrastructure. The federal government's share of transportation infrastructure is even smaller. Of the nation's $3.17 trillion in transportation assets the federal government's share is less than 2 percent. The federal government may provide significant levels of financial support for capital expansion and some maintenance of transportation infrastructure but it is state and local governments that end up owning and managing.[85]

8.2 Deteriorating Transportation Infrastructure

That infrastructure is largely in disrepair. The American Society of Civil Engineers recently gave the nation's infrastructure a "D" grade with highways getting a D- (down from D in 2005) and transit a D (down from D+ in 2005).[86] The grades may be self-serving to the construction industry and to the civil engineering profession but that serious problems exist is not in dispute. The ASCE estimates the cost of bringing existing transportation facilities up to its standards would be $186 billion annually for highways and $21.6 billion for public transportation.[87]

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[84] Bureau of Economic Analysis, Table 7.1B. Current-Cost Net Stock of Government Fixed Assets. www.bea.gov/national/FA2004/DownSS2.asp?3Place=Y&3Place=N (August 21, 2008).

[85] *Id.,* BEA.

[86] American Society of Civil Engineers (2009), *2009 Report Card for America's Infrastructure*, www.asce.org/reportcard/2009/. See also *2005 Report Card for America's Infrastructure*, www.asce.org/reportcard/2005/index.cfm

[87] American Society of Civil Engineers (2009), Report Card 2009 Grades, www.asce.org/reportcard/2009/grades.cfm

U.S. Department of Transportation information suggests where road improvements are needed most, which is summarized in Table 8.1.[88] More than a third of all collectors and more than a quarter of all other principal and minor arterials are in the greatest need of repair. Together, they account for more than 95 percent of the most immediate highway repair needs; they are also the most likely to serve existing development.

Table 8.1. Government Fixed Asset Value

Fixed Asset Class	Asset Value 2007 (billions)	Share
Total Government Assets	$9,210.9	
Defense	$1,053.8	11.4%
State & Local Assets	$7,510.2	81.5%
Equipment and software	$267.3	
Transportation	***$3,108.9***	***41.4%***
Highways & streets	$2,586.9	34.4%
Other transportation[a]	$522.0	7.0%
Structures	***$4,134.0***	***55.0%***
Residential	$234.2	3.1%
Office	$526.7	7.0%
Commercial	$9.8	0.1%
Health care	$185.3	2.5%
Educational	$1,590.2	21.2%
Public safety	$150.5	2.0%
Amusement & recreation	$177.7	2.4%
Power	$234.0	3.1%
Sewer systems	$529.6	7.1%
Water systems	$382.4	5.1%
Conservation & development	$95.6	1.3%
Other structures	$18.0	0.2%

Note: *a:* Includes airport, waterway, and transit facilities but not equipment.
Source: Bureau of Economic Analysis (2008)

8.3 Fixing Transportation Infrastructure an Important Investment

Fixing transportation infrastructure is an important investment in three respects. First, it likely improves capacity of facilities. Second, it resets the depreciation clock so that users can enjoy high-

[88] U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Transportation Statistics Annual Report 2007 (Washington, DC: 2007)

quality facilities for several years before it needs another round of maintenance. Third, it is actually more productive economically than expanding the capital stock.

Table 8.2. Distribution of Mediocre or Poor Highway Facilities by Type, 2007

Facility Type	Mediocre or Poor, 2006	Miles
Interstate	21.4%	3,402
Other freeway/expressway	6.5	693
Other principal arterials	25.6	15,632
Minor arterials	26.8	27,239
Collectors	34.9	37,288
Total	28.5%	84,255

Source: Adapted from Bureau of Transportation Research (2007).

When transportation facilities deteriorate they lose capacity. How much depends on the nature of deterioration. Potholes can slow speeds and increase space between vehicles, which may reduce flow. Crumbling or functionally inoperative shoulders have the same effect. Turning lanes and acceleration/deceleration lanes may be inadequate or even non-existent. Bridges may be restricted to lighter loads or even occasionally to fewer travel lanes. Signage and traffic signalization that may have been adequate years earlier may today cause delays due to a lack of upgrading. In these and other respects, the capacity of highways may be compromised thus increasing congestion. Repairing and maintaining highways, with flow-related improvements, can increase capacity.[89]

Highways have a reasonably long useful life. If kept in reasonable repair, they can last a century or more. Three main factors contribute to longevity: repaving, drainage, and the base condition. Repaving is needed about every five to 15 years, depending on such factors as the nature of use, climate, and paving materials. Drainage must also be maintained regularly, often seasonally, to assure the road is not over-washed or undermined by water. Improperly maintained drainage may also require reconstruction of the entire road.[90] If a road is not repaved in a timely manner, and its drainage system is not maintained, the road base may be compromised. If the base is compromised, the entire road may need to be rebuilt. The Sacramento Area Council of Governments lays out the consequences of deferred maintenance:[91]

> Deferred maintenance drives up long term cost; it shortens the cycle for rehabilitation, which is four times as costly. Deferred rehabilitation compounds the problem, often leading to pavement failure and the need to reconstruct the whole roadbed, at ten times the cost.

[89] See generally Transportation Research Board (2000), *Highway Capacity Manual 2000*, National Academy of Sciences (Washington, DC).

[90] See, for example, American Association of State Highway and Transportation Officials (1990), *Construction Manual for Highway Construction, 4th Edition* (Washington, DC).

[91] Sacramento Area Council of Governments, *MTP2035 Issue Papers: Road Maintenance*, accessed March 13, 2009 from www.sacog.org/mtp/pdf/MTP2035/Issue%20Papers/Road%20Maintenance.pdf.

> Routine preventive maintenance, particularly to seal cracks, patch potholes, and keep drains open, on a continuing basis takes an average of $20,000 per mile of road per year to do right.
>
> Regular heavy maintenance, meaning a slurry or chip seal coat, adds costs in the range of $50,000-$80,000 per mile for residential streets, on about a seven year cycle.
>
> For well-maintained roads, the pavement rehabilitation cycle, meaning an asphalt overlay, comes due in 15 years for arterials and 30 years for local streets, costing $300,000-$400,000 per mile.
>
> Reconstruction of poorly-maintained roads, which entails removing the pavement and repairing the gravel base underneath, costs as much as $2 million per mile.

In its *2009 Report Card for America's Infrastructure*, the American Society of Civil Engineers gave the nation an overall "D" and estimated the cost of deferred maintenance at around $2.2 trillion.[92] The ACSE gives bridges a "C" grade and notes that:

> More than 26%, or one in four, of the nation's bridges are either structurally deficient or functionally obsolete. … A $17 billion annual investment is needed to substantially improve current bridge conditions. Currently, only $10.5 billion is spent annually on the construction and maintenance of bridges.[93]

The failure in 2007 of the I-35W Bridge in Minneapolis which killed 13 people and injured 145, was clearly costly. Yet the ASCE gives its worst grade, a "D-" to roads. In addition to improperly maintained roads killing 14,000 people annually, the ASCE reports that:

> One-third of America's major roads are in poor or mediocre condition and 36% of major urban highways are congested. The current spending level of $70.3 billion per year for highway capital improvements is well below the estimated $186 billion needed annually to substantially improve the nation's highways.[94]

There are important near- and long-term economic development effects of proper maintenance of transportation facilities. Briefing Papers No. 1 and No. 2 reported that the job multipliers for road repairs and maintenance are higher than for new construction, even considering any development induced by new construction. Briefing Paper No. 7 showed that the marginal return from new highways is less than for improving existing highways or construction higher-capacity transportation systems. Recent research has further confirmed that repairing and maintaining existing transportation facilities does more to stimulate economic growth than new facilities. One international study found that the return for road maintenance projects financed by the World Bank over the period 1961 to 1988 was about 38.6 percent compared to about 26 percent for all

[92] See www.asce.org/reportcard/2009/

[93] See www.asce.org/reportcard/2009/grades.cfm

[94] *Id.,* www.asce.org/reportcard/2009/grades.cfm

transportation projects, and 21 percent for all investment projects generally.[95] A forthcoming work confirms a similar outcome for the United States.[96]

8.4 Summary

The U.S. has historically preferred new construction over its repair and maintenance. For a time, this may have been sensible as new construction facilitated growth, and indeed leveraged more growth than other investments.[97] But the nation has matured into several hundred metropolitan areas containing more than 80 percent of its population and jobs, and a higher percent of its economic activity. It would seem sensible that the next wave of infrastructure investment would make the metropolitan areas more productive. Research indicates that perhaps a larger share of this investment than in the past should be for the repair and maintenance of existing transportation infrastructure.

[95] I. G. Heggie and P. Vickers (1998), "Commercial management and financing of roads", World Bank Technical Paper 409, Washington DC.

[96] Sarantis Kalyvitis (2008), Capital vs. O&M Spending on Public Infrastructure and their Role for U.S. Productivity Growth, www.kepe.gr/pdf/US_Public_Maintenance_paper.pdf.

[97] See Eno Transportation Foundation, Inc. (1996), *Economic Returns from Transportation Investment*, www.fhwa.dot.gov/policy/otps/060320a/index.htm.

Briefing Paper No. 9

COMPACT DEVELOPMENT, SPRAWL, AND INFRASTRUCTURE COSTS

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9.1 Introduction

Planners and academics have, for much of the past half century, studied development patterns to assess whether certain patterns are more costly than others in providing public infrastructure and services. The bell-weather analysis on this subject was the Real Estate Research Corporation's 1974 study *Costs of Sprawl*.[98] Although the limitations of that study have provided fodder for scores of critical articles in academic journals, the study stands as the seminal analysis for understanding how compact development can help reduce public expenditures for a host of public services and facilities.

9.2 The Literature

The "cost of sprawl" literature is vast and not easily summarized. There are, however, several key studies that provide the outlines of the genre. Robert Smythe's 1986 study of Loudoun County, Virginia for the American Farmland Trust sought to create a methodology that was easily replicable using readily available data sources. Though the study found a net revenue shortfall (public expenditures vs. tax revenues) for all four of the density levels tested, the public costs for the lowest density development pattern were three times higher per household than the highest density pattern. These results are consistent with the bulk of the literature reviewed by James Frank in 1989.[99] Frank's summary shows a cost gradient of $48,000 per home for the lowest density development pattern located the furthest from sewer and water treatment facilities, to $18,000 for denser developments more proximate to public facilities. The 2002 study by Robert Burchell, *The Costs of Sprawl—2000*,[100] combined with his earlier *The Costs of Sprawl—Revisited*,[101] comprise some of the most comprehensive research on the subject. The earlier work sought to review and synthesize the literature; the latter study used that material to project into the future the

[98] Real Estate Research Corporation. (1974). The costs of sprawl: Environmental and economic costs of alternative residential development patterns at the urban fringe. Washington D.C.: U.S. Government Printing Office.

[99] Frank, James E. (1989). The costs of alternative development patterns: A review of the literature. Washington, DC: Urban Land Institute.

[100] Burchell, Robert W., *et al.* (2002). *The Costs of Sprawl—2000* (TRB Report No. 74). Washington, DC: National Academy Press.

[101] Burchell, Robert W., *et al.* (1998). *The Costs of Sprawl—Revisited* (TRB Report No. 39). Washington, DC: National Academy Press.

infrastructure cost implications of "Uncontrolled" and "Controlled" growth scenarios over a 25-year planning horizon. The study concluded that the Uncontrolled Growth scenario would cost $122.3 billion more for basic infrastructure (water, sewer, and roads) than the Controlled scenario (see Table 9.1).

Table 9.1. Selected Data from *The Costs of Sprawl—2000*

	Uncontrolled Growth	Controlled Growth	Savings from Controlled Growth
Water & Sewer Demand (Mgal/day)	18,121	17,965	156 million gal/day
Water & Sewer Laterals (000)	45,867	41,245	4,621 laterals
Road Lane Miles Required	2,044,179	1,855,874	188,305 lane miles
Total Cost (billions)	$1,116.78	$994.47	$122.31 billion

9.3 The Scenario Literature

Between 1989 and 2003, more than 50 U.S. metropolitan areas conducted visioning studies to assess the impacts of a variety of different possible future development patterns.[102] The studies, which used scenarios similar to those constructed by Burchell, sought to estimate the impacts of the different development patterns across a wide range of indices. While the most often used measurement was for transportation outcomes, eighteen of the studies assessed the scenarios' relative impacts on infrastructure costs. For each study, various forms of compact development were compared against trend-based scenarios that assume continuation of recent development practices. These studies are summarized below and their results are synthesized in Figure 10.1.[103]

In its Alternative for Future Growth in California's **Central Valley** (1995), the American Farmland Trust estimated that, over a 45-year period, the costs of an urban sprawl scenario with an average density of 3 dwelling units per acre would result in $985 million more for public infrastructure and services than the tax revenues generated by that development pattern. In contrast, doubling the average density to 6 units per acre was projected to result in a $217 million public surplus.

The **Sacramento** Region Blueprint Transportation-Land Use Study (2004) tested four 50-year growth scenarios for the impacts on a number of indices. The trend scenario, which would consume 166 square miles of additional land, would cost approximately $14.7 billion for new transportation capital facilities. The most compact scenario, on the other hand, would consume only 66 additional square miles and would cost $1.7 billion less for transportation capital facilities.

[102] Bartholomew, Keith. (2007). Land use-transportation scenario planning: Promise and reality, *Transportation, 34(4),* 397-412.

[103] Bibliographic information on each study is contained in Bartholomew, Keith. (2005). *Integrating land use issues into transportation planning: Scenario planning—An annotated bibliography.* Salt Lake City, UT: University of Utah. http://faculty.arch.utah.edu/bartholomew/Bibliography.pdf. In addition, many of the original study reports can be obtained through a digital library on scenario planning, maintained by the University of Utah's Marriott Library.

The **Denver** Regional Council of Government's Metro Vision 2020 (1997) also tested four scenarios, using a 25-year planning horizon (through 2020). The trend scenario (referred to as the "Dispersed Scenario"), with an average density of 2,000 persons per square mile, would cost an estimated $5.4 billion in new local infrastructure. The most compact scenario ("Compact Development"), with an average density of 4,100 persons per square mile, would be 80 percent less expensive for infrastructure, costing only an estimated $1.1 billion.

A scenario analysis in **Gainesville**, Florida (2000) estimated transportation capital costs for six 20-year scenarios as a technical analysis for the update of the region's long-range transportation plan. The analysis showed that the trend scenario ("Westward Growth") would consume an additional 19.5 square miles for development and would cost approximately $184 million. The most compact scenario would consume just 2.5 additional square miles and cost almost $100 million less ($88 million).

West Palm Beach, Florida conducted a scenario analysis in 2002, showing that trend growth conditions—with an average density of 2.21 housing units and 6.67 employees per acre—would cost approximately $1.5 billion in transportation capital costs. A Community Centers scenario that concentrated growth in nodes at major intersections, would result in average densities of 2.86 housing units and 8.83 employees per acre and cost only $614 million.

The **Georgia** Regional Transportation Authority's analysis of the proposed Northern Arc freeway (2003) showed that over a 25-year planning horizon, the trend scenario would result in 473,700 developed acres in the study area and cost nearly $7.4 billion in transportation capital costs. A Policy Based Scenario that would focus growth in central business districts, transportation corridors, activity centers, and town centers and build a variety of transit improvements would results in 429,100 developed acres, but would actually cost more than the trend ($11.5 billion). Interestingly, a Local Plans Scenario, which merely assumed implementation of local government land use plans, would consume about 40,000 fewer acres (469,400), cost one-seventh of the amount of the trend scenario, and yet result in lower levels of traffic congestion.

In the **Twin Cities**, the Metropolitan Council (2002) assessed total infrastructure costs for three different growth scenarios over a 30-year planning period. The trend scenario, which would maintain current average density levels of 1.32 housing units per acre region-wide and a split of single-family to multi-family housing of 68 percent to 32 percent, would cost more than $20.8 billion. By contrast, the most compact scenario would concentrate development in walkable mixed-use centers along the transit network, resulting in a 11 percent increase in average density (to 1.46 units per acre), a 50/50 split between single- and multi-family housing, and a 14.26 percent decrease in infrastructure costs.

Another analysis from the **Twin Cities** conducted by the nonprofit Center for Energy and Environment (1999) showed even greater cost savings. The study compared a 20-year smart growth-based regional development scenario against a trend scenario, showing that when constructing new development at 5.5 housing units per acre, instead of the trend density of 2.1, infrastructure costs would drop from $5.3 to $2.3 billion.

A 2001 study by the Mid-American Region Council of Governments in **Kansas City** demonstrates that these types of cost savings can accrue at the project/neighborhood level, as well as at the regional scale. The study compared conventional suburban designs and densities against denser, mixed-use designs for six different new development sites across the region. The density increases ranged from 60 percent to 200 percent, while the cost savings ranged from 8 percent to 48 percent.

At the other end of the scale, two analyses, in 1992 and then in 2000, conducted by the State of **New Jersey** show that the same effects can be observed at the state level. A reduction of 34 percent to 60 percent in the amount of land consumed for development over a 20-year period lead to reduced infrastructure demands that would save the state between $1.5 and $2.3 billion.

Not content with simply analyzing infrastructure costs and development patterns, the City of **Albuquerque** (2000) studied these relationships to create a tiered impact fee system that would reflect the cost efficiencies of compact development. The analysis shows that while trend development patterns would likely result in more than $2.1 billion in marginal capital costs for water, drainage, sewer, roads, and transit, a more compact form would save the city more than $355 million.

Philadelphia's Regional Analysis of What-If Transportation Scenarios (2003) sought to quantify the effects of what might happen if the region's current plans were not achieved. While achieving those plans would cost an estimated $68.7 billion in additional infrastructure, if actual development consumes 50 percent more than the planned amount of raw land, infrastructure costs would balloon to $96.8 billion. On the other hand, consuming 25 percent less land than planned would reduce costs to $55 billion.

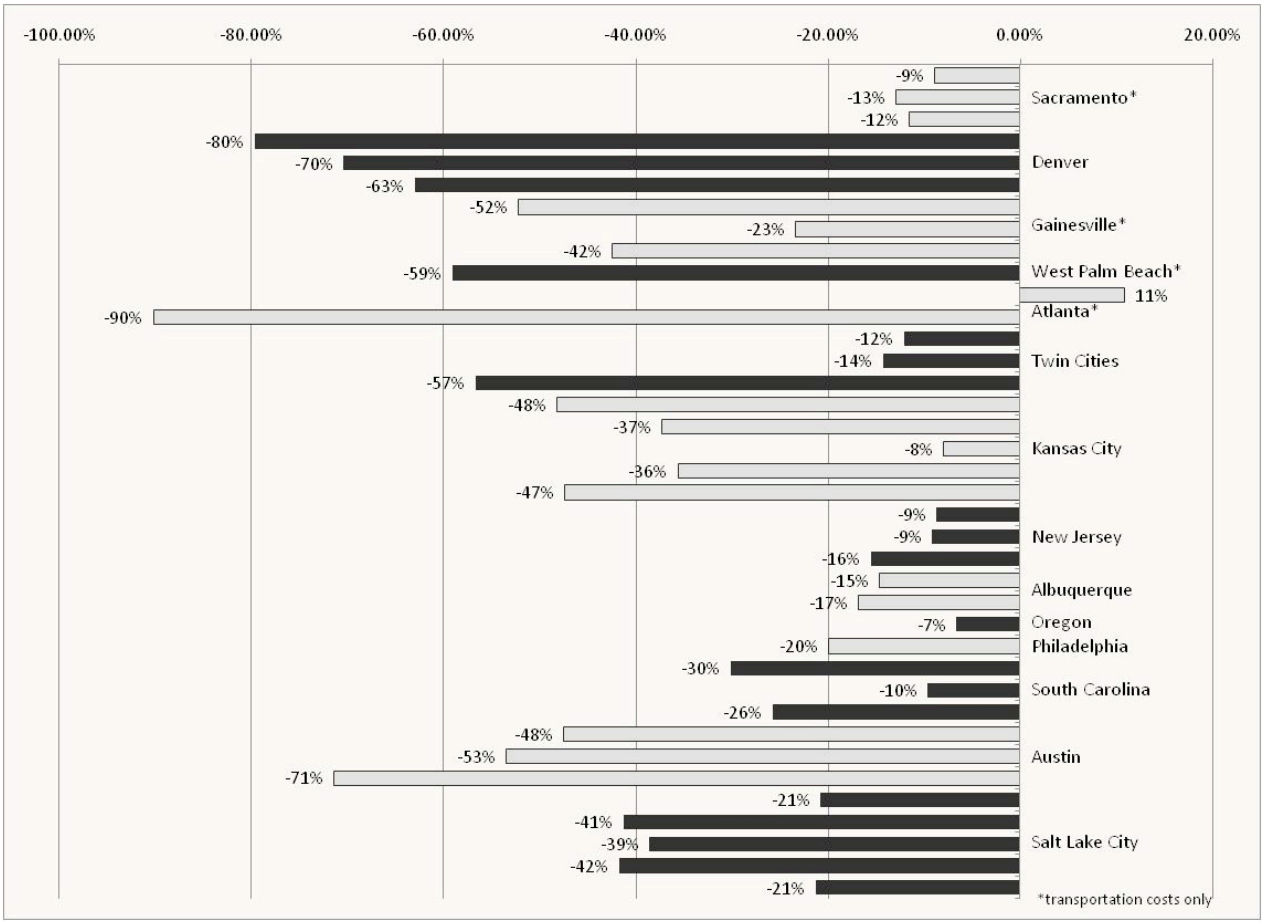
A series of analyses coordinated by the **South Carolina** DOT in the Catawba, Pee Dee, and Santee-Lynches regions shows that urban form-based cost savings are important in smaller regions, too. The analyses demonstrate that moving toward more compact development could save the regions between 10% and 30% ($60 to $147 million) over 25 years for water, road, and sewer systems.

Two "Envision" projects—one in **Salt Lake City** (1999) and one in **Austin** (2003)—are perhaps the most urgent of these analyses, given their location in the fast-growing Inter-Mountain West. Both analyses tested growth scenarios at four levels of compactness. In Austin, the trend scenario was estimated to result in more than $10.6 billion in costs for new infrastructure over 30 years. The most compact scenario, which uses 32% less land for development, would cut the infrastructure bill by more than two-thirds (to $3.04 billion). The trend scenario in Salt Lake City would cost $37.6 billion in infrastructure costs over 23 years, while the most compact scenario uses 38% less land and would save $15.7 billion.

9.4 Summary/Synthesis

Naturally, there is a wide degree of economic and demographic variation between the regions covered in these studies. Moreover, each study uses a slightly different methodology in calculating infrastructure cost and there is some variation in the types of infrastructure included in each analysis. Because of these factors it is not possible to conduct a rigorous statistical analysis across the different projects. Nevertheless, a sense of scale and direction of effect are possible to observe by calculating the percentage difference between the compact development scenarios and their corresponding trend scenario (see Figure 9.1). The results, while widely varying in their effect sizes, demonstrate a consistent pattern of infrastructure efficiency associated with compact development patterns.

Figure 9.1. Percent Difference in Infrastructure Costs for Compact Development vs. Trend Scenarios



Source: Author's analysis of data derived from original study documents.

Briefing Paper No. 10

ECONOMIC STIMULUS THROUGH EQUITABLE TRANSIT INVESTMENTS

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Many arguments for public transit investments tend to focus on the benefits from the *service* resulting from these investments instead of the economic development and business activity that occurs within the transport *industry* due to construction and operation. Increased employment from transit project construction and operations, and increases in job access provided by transit, are direct and indirect benefits. Both provide desired economic outcomes, which combined make good sense. This is particularly true when these investments: investments that could spur redevelopment bringing jobs and increased incomes to a neighborhood, occur in distressed neighborhoods. These are areas of high unemployment, and providing greater opportunity to engage in the economy by reducing geographic isolation not only helps the economy by increasing access to labor, but also lowers the cost of unemployment taxes and transforms unemployed people into taxpayers.

On the transportation service side of the equation, these investments are an opportunity to reduce household transportation costs for households spending high proportions of their budgets on transportation. This frees up discretionary income that can go to supporting existing and new businesses in low-income areas. By leveraging past investments in neighborhood infrastructure and providing more active transportation opportunities, the public can address the connection between health care costs and obesity rates among the poor and minorities.

Recent research shows that a dollar invested in transit generates over six dollars in economic activity.[104] In addition, other analyses report that investments in transit result in nearly 20 percent more jobs than similar investments in roads and bridges. Investments in transit projects therefore not only increase employment access and mobility among low income populations, but also increase household income and decrease transportation costs. This has important implications for working class families heavily burdened by the combination of transportation and housing costs.

[104] See Todd Swanstrom (2008) *The Road to Good Jobs: Patterns of Employment in the Construction Industry,* Transportation Equity Network and Public Policy Research Center, University of Missouri, St. Louis; Phineas Baxandall, Tony Dutzik, and Joshua Hoen (2008) *A Better Way to Go: Meeting America's 21st Century Transportation Challenges With Modern Public Transit*, U.S. PIRG Education Fund and Frontier Group; Todd Litman (2009) *Evaluating Transportation Economic Development Impacts: Understanding How Transportation Policies and Planning Decisions Affect Productivity, Employment, Business Activity, Property Values and Tax Revenues*, Victoria Transport Policy Institute.

10.1 Overview

Transportation equity is rooted in environmental racism and environmental justice and, over the last several years, has focused primarily on racial discrimination. The negative impacts identified include residential displacement, neighborhood disintegration, and environmental and health impacts resulting from new or expanded transportation infrastructure. More recent research has broadened the range of impacts to include employment accessibility, transportation service quality, wage inequality, transit fares, and safety issues. Equity analyses have remained focused on race and economic class and while these are strong and inextricably linked factors, the connections are often more complicated than this duality. Events arise, that expose an underclass whose situations are worsened by a lack of transportation equity and show that limited transportation mobility choice affects an underclass that reaches beyond race and class.[105]

While minorities often suffer the burdens of having large transportation construction projects placed in their neighborhoods, they do not usually reap the benefits of lucrative contracts or high-paying jobs in the construction industry. Many communities have noted that too many of these jobs are filled by workers living in other neighborhoods and completely outside the area. Additionally, for communities affected by these investments, the associated noise, dust, and inconvenience of the construction further intensify frustrations with transportation policies. Too little attention has been paid to who gets these jobs and whether any of those who live in the communities burdened by the transportation projects benefit by obtaining employment to construct the highways and associated infrastructure.

10.2 Local Minority and Low-Income Hiring Preferences

Federal law has acknowledged the value of allowing hiring preferences for individuals in certain low-income communities—local hiring preferences for workers on tribal reservations and in the Appalachian region of the country are or have been allowed—but these preferences overlook most of America's low-income communities, particularly in urban areas. TEA-21 allowed states to use a percentage of federal transportation funding to pay for supportive services to help women and minorities enter the transportation construction trades, but few states exercise this option.

In Los Angeles, a coalition of community groups, churches, and local elected leaders persuaded the Alameda Corridor Transportation Authority to incorporate a local hiring preference into the contract for a multibillion-dollar multimodal project. The project involved excavation of a 21-mile trench under numerous major and minor roads to lay a rail bed that now links the ports of Long Beach and Los Angeles to distribution centers in downtown Los Angeles. The project runs through a number of very poor and minority communities in South Central and East Los Angeles.

The contract required that 30 percent of all hours worked on the mid-corridor portion of the project go to local residents. It also funded a pre-apprenticeship program, which provided stipends for 650 local residents. More than 700 pre-apprenticeship program graduates were placed in jobs in the construction industry; 188 received jobs on the project. Local residents performed 31 percent of all hours worked on the mid-corridor section of the project, and 75 percent of them were minorities. Of that group, 190 were former welfare recipients, and 102 were women with children. The project finished on time and under budget.

[105] See Thomas W. Sanchez and Marc Brennan (2007), The Right to Transportation: Moving to Equity, American Planning Association (Chicago).

The Alameda Corridor program succeeded only because a portion of the project was funded by a loan from DOT rather than a federally aided highway grant. The only portion of the project on which the Alameda Corridor Transportation Authority could require a local hiring preference was on the mid-corridor portion; other portions of the project were excluded. Initially, the Alameda Corridor Transportation Authority would not agree to a local hiring preference unless DOT clarified that such a preference was legal. Grassroots groups successfully sought an opinion from DOT, which authorized the local hiring preference on the mid-corridor portion of the project but concluded that Congress would need to create a new exemption to allow future local hiring preferences on federally aided highway projects.

The significance of hiring local residents to work in the transportation construction industry extends beyond a particular construction project. These job opportunities provide the real possibility of sustained employment in a well-paying industry with the prospect for career growth. Given projected growth in the industry and the transferability of construction skills, such strategies that ensure greater participation by minorities in local construction projects may create significant employment opportunities for minorities, particularly for low-income families with few other options.

10.3 Job Accessibility and Transportation + Housing Costs

Transportation is the second-largest expenditure category for American families: in 2007 US households spent on average 17.6 percent of their annual income on transportation.[106]Only shelter, at 32.6 percent, exceeds transportation. Transportation has not always consumed such a high percentage of the family budget. But as public investments in transportation began to emphasize roads and highways over public transit, private spending on transportation increased dramatically. The resulting lack of public transportation options has shifted household spending more toward private transportation. The large initial down payment cost associated with car purchase, combined with the added financing and maintenance costs, has increased the relative transportation cost burden for low-income families who rely on auto-based transportation. Families living in sprawling metropolitan areas, with little public transportation and destinations so spread out as to be unreachable by foot or bicycle, must spend even more on transportation, in some cases more than they do on rent or mortgages.

Public transportation access is a significant factor in determining average rates of labor participation in local economies.[107] Perhaps one reason is purely the cost of transportation, as illustrated in Figure 10.1, which shows households earning between $20,000 and $35,000 sorted by job location from the central city where transit is available to suburbs where it is problematic.[108] Unfortunately, most jobs are found in dispersed suburban locations without reasonable, if any,

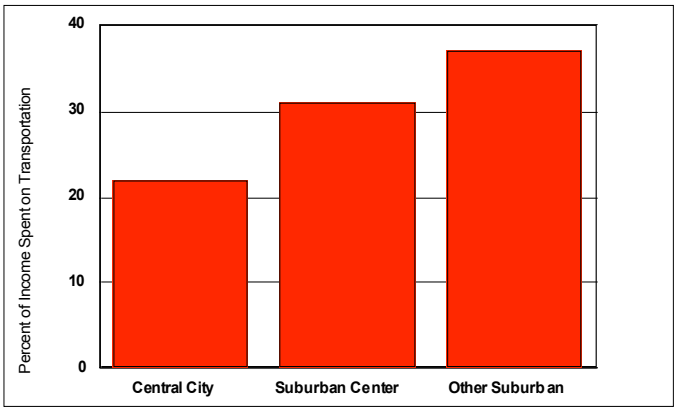
[106] www.bls.gov/news.release/cesan.nr0.htm. See also written testimony of Secretary of Housing and Urban Development Shaun Donovan on March 18th: www.hud.gov/offices/cir/test090318.cfm. For a broader discussion, see STPP (2005), Driven to Spend: Pumping Dollars out of Our Households and Communities, www.transact.org/library/reports_pdfs/driven_to_spend/Driven_to_Spend_Report.pdf.

[107] Thomas W. Sanchez (1999). The Connection Between Public Transit and Employment: The Cases of Portland and Atlanta. Journal of the American Planning Association, 65(3): 284 – 296.

[108] Barbara Lipman (2006), *A Heavy Load: The Combined Housing and Transportation Burdens of Working Families*, Center for Housing Policy www.nhc.org/pdf/pub_heavy_load_10_06.pdf.

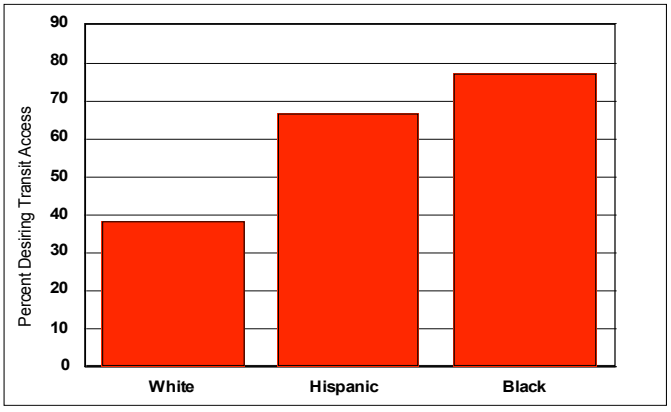
public transit access. Perhaps this is one reason why the desirability of transit accessibility varies markedly by minority status, a proxy also for income, as shown in Figure 10.2.[109]

Figure 10.1 Share of Income Spent on Transportation by Job Location



Source: Adapted from Lipman (2006).

Figure 10.2 Percent of Households Desiring Transit Access by Ethnicity



Source: National Association of Realtors and Smart Growth America (2004).

As families are forced to spend thousands of dollars annually on owning and operating cars and trucks (which are rapidly depreciating assets), they have less money to invest in home ownership, hindering wealth creation and the ability to enjoy other benefits of home ownership. The poorest Americans are especially hard hit, spending nearly 40 percent of their take-home pay on transportation costs, an expense that may require those families to dip into savings, borrow from relatives, and look for nontraditional sources of income to make ends meet.

10.4 Review

Although the impacts of transportation are widely distributed throughout American society, the benefits and disadvantages have uneven impacts on different social and economic groups. Some analysis has been devoted to differential impacts on the basis of race and class. But relatively little

[109] See National Association of Realtors® and Smart Growth America (2004), *National Community Preference Survey.*

analysis has been done on adverse impacts on the basis of age, national origin, English proficiency, disability, and gender. More can be done, including data collection, soliciting public input and participation, making changes according to this input, and using transportation as a tool for increased social equity.

Effective federal policy should not only link transit investments with economic development, job creation, and transportation/housing affordability, but also address energy efficiency and job development in green industries. Although such policy integration is rare, these interconnections are increasingly becoming more visible and feasible given the current economic climate.