

Growing Wealthier

Smart Growth,
Climate Change
and Prosperity

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Center for
Clean Air Policy
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About CCAP

Since 1985, CCAP has been a recognized world leader in climate and air quality policy and is the only independent, non-profit think-tank working exclusively on those issues at the local, national and international levels. Headquartered in Washington, D.C., CCAP helps policymakers around the world to develop, promote and implement innovative, market-based solutions to major climate, air quality and energy problems that balance both environmental and economic interests.

For more information on CCAP's Transportation and Climate Change Program, please see <http://www.ccap.org/transportation.html>, or contact: Steve Winkelman, swinkelman@ccap.org, or Chuck Kooshian, ckooshian@ccap.org.



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Build houses and live in them
plant gardens and eat their fruit.

Seek the welfare of the city
in which you live
and pray to the Eternal in its behalf;
for in its prosperity you shall prosper.

- Jeremiah 29



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Executive Summary

What we build – where and how – has a tremendous impact on how we sustain our communities, protect the environment and bolster prosperity. Common sense and empirical evidence, such as that documented in the *Growing Cooler* study,¹ make it clear that building our neighborhoods, towns and cities in ways that require less driving can reduce greenhouse gas (GHG) emissions while making us less dependent on finite sources of energy. CCAP analysis has established that it will be difficult to achieve climate protection goals without slowing growth in vehicle miles travelled (VMT) even with rigorous vehicle efficiency standards and carbon prices.²

But how many Americans want to live in more walkable neighborhoods, with homes and businesses closer to each other, with transportation options in addition to the car – the kinds of places created by following the principles commonly referred to as smart growth? Quite a few, according to real estate market trends and demographic analyses.³

⁴ Are smart-growth strategies cost effective for reducing GHG emissions? Yes, according

to the *Growing Cooler* study,¹ make it clear that building our neighborhoods, towns and cities in ways that require less driving can reduce greenhouse gas (GHG) emissions while making us less dependent on finite sources of energy.

1. Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Walters and Don Chen, *Growing Cooler: The Evidence on Urban Development and Climate Change* (Washington: Urban Land Institute, 2008)
2. Center for Clean Air Policy. (2009). "Cost-Effective GHG Reductions through Smart Growth and Improved Transportation Choices." Washington, DC. <http://www.ccap.org/dollarperton.html>
3. Patrick Doherty and Christopher Leinberger, "The Next Real Estate Boom," *Washington Monthly*, November/December 2010. http://www.washingtonmonthly.com/features/2010/1011_doherty-leinberger.html
4. *Growing Cooler* (Ewing, et al, 2008), *op. cit.*, Chapter 2.

to analyses such as *Moving Cooler*⁵ and CCAP’s “dollar per ton” study.⁶

What, then, is the economic impact of following these strategies? Clearly, the cost per ton of reducing CO₂ is not the only consideration. How does this approach affect the bottom line for businesses, household budgets and government balance sheets? Those are the questions elucidated in *Growing Wealthier*, as we also examine quality-of-life concerns beyond traditional economic measures, such as public health and well-being, community vibrancy, thriving ecosystems and global climate protection.

Smart Growth, VMT and GDP

While local experience can vary, three well-documented studies released in the past two years estimate that communities following smart-growth strategies either have succeeded in or have the potential to reduce their citizens’ driving by 5 to 60 percent.^{7, 8, 9}

Growing Wealthier opens with a review of why slowing VMT growth is important for climate protection. We consider the historical trend of urban development in the US and the rising popularity of smart-growth planning and design as a compelling alternative model. We then explore the mechanisms by which this approach can reduce driving levels. We highlight the critical concept of accessibility – bringing origins and destinations closer together. After all, that is the very reason that cities exist.

We begin our exploration of wealth and prosperity with an analysis of the relationship between VMT and Gross Domestic Product (GDP), challenging the misconception that reducing VMT by enhancing accessibility will have a harmful effect on economic growth. While VMT and GDP have grown concurrently since World War II and in lock step for much of that time, we present data showing that GDP began growing faster than VMT around 1996. According to U.S. Chamber of Commerce analysis, the importance of travel as a component of the US economy has been declining since the early 1990s, and is expected to continue to decline through 2030. Our analysis shows that states with lower VMT per capita tend to have higher GDP per capita. On a metropolitan level the data indicate no discernable pattern between VMT per capita and GDP per capita.

Transportation is vital to the production and exchange of goods and services. But we think it is important to distinguish between more economically productive travel

It will be difficult to achieve climate protection goals and energy security without slowing growth in vehicle miles traveled. But how many Americans want to live in more walkable neighborhoods, with homes and businesses closer to each other, with transportation options in addition to the car? More than enough to make a difference, the evidence suggests.

5. Cambridge Systematics, Inc. (2009). *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions*. Washington, D.C.: Urban Land Institute.

6. CCAP 2009, *op cit*.

7. *Growing Cooler* (Ewing, et al, 2008), *op. cit*.

8. TRB Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy Consumption, *Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO₂ Emissions*. (Washington: Transportation Research Board, 2009).

9. Cambridge Systematics (2009), *op. cit*.

and what CCAP has dubbed “empty miles” that contribute less to, or serve as a drag on, the economy. In fact, over the last few decades most Americans drove substantially more but did not share proportionately in income growth – overall household VMT increased by 70% from 1969 to 2001, but incomes for the bottom three quintiles (60%) of U.S. households only increased 18%.

As driving distances have grown along with fuel and other vehicle costs, the hit to the household budget has expanded so that, on average, transportation and housing together take nearly half of every dollar earned. Fuel costs, in particular, are only projected to grow. The International Energy Agency projects that oil prices will more than double by 2035.¹⁰ Implementation of smart growth policies can improve household resilience to rising oil prices by enhancing their travel choices with more efficient land use patterns.

While travel is essential to economic productivity, many of the additional miles we are forced to drive simply because of the layout of our cities and a lack of options might be dubbed “empty miles”.

Beyond GDP: Prosperity and Sustainability

In this transforming economy, moving information is as vital as moving containers of goods. Economic activity can happen in a myriad of ways; vehicles and people in motion are only a part of a much greater whole. It is important to recognize that GDP includes many of the negative aspects of motorized travel: fuel consumed waiting in traffic jams, oil spills, vehicle repairs and medical treatment resulting from collisions and air pollution, and US military operations aimed at preserving energy security. In fact, many costs of sprawling land use patterns (particularly increased infrastructure) themselves boost GDP figures. It is important to ask, however, whether these are the investments that can best sustain long-term prosperity.

As we examined issues of wealth, we tried to distinguish prosperity from simple aggregate GDP. Many factors beyond material goods contribute to a broader definition of wealth and well-being, including public health, a thriving natural environment, resilient communities, and choices in travel and housing. There are not yet standard methods for measuring happiness and long-term sustainability, so most of the evidence presented in *Growing Wealthier* presents economic benefit in conventional terms: property values, infrastructure costs, fuel expenditures, jobs, etc. It remains for future research to develop the spectrum of applications that a broader understanding of prosperity offers for designing and evaluating transportation and land use policies.

10. International Energy Agency, *World Energy Outlook 2010*. <http://www.iea.org/weo/index.asp>

Economic Benefits of Pursuing Smart-Growth Strategies

Working in conjunction with public officials, real estate professionals, architects and designers and a wide range of non-governmental entities, urban planners have reached a consensus around a set of ten smart-growth principles that are valuable for guiding new development in ways that improve accessibility and alleviate many of the problems of sprawling land use, while enhancing Americans' quality of life.

The core of *Growing Wealthier* is a walk through each of those principles to identify a variety of economic and prosperity benefits: **Returns on Investment**, **Savings on Expenditures** and **Improved Quality of Life**. We indicate who reaps the benefits, whether businesses, households, municipal governments, metropolitan regions or the nation as a whole (as summarized in Table 1). We provide examples and studies from around the country, as well as an annotated bibliography of evidence on smart growth, climate change, the economy, and sustainability (Appendix).

Economic Benefits: Real-world Snapshots

Creating a range of housing opportunities in proximity to jobs saves households money. Transportation is the second-largest share of most household budgets, after housing, and the two are connected. Locating homes near job centers can lower the combined housing and transportation costs for families of all income levels. A study of the Washington, DC, region found that households living in the jobs-rich core spent about 30% of their income on housing plus transportation while those in the car-dependent outer suburbs spent over 40%.¹¹

Improving neighborhood "walkability" tends to enhance property values. The web site WalkScore.com rates locations according to a walkability index from 1 to 100. One study found that, in general, every one-point increase in the Walk Score increased a home's value by \$700 to \$3,000.¹²

Walkability also enhances health. In Seattle, researchers found that every 5% increase in the overall level of walkability was associated with a 32% increase in minutes of walking or biking and a reduction in Body Mass Index.¹³

Fostering a sense of place through pleasing architectural design, public art, tree plantings, etc., creates a "placemaking premium" that encourages business growth and investment. In Washington, DC, the Barracks Row Main Street Program invested about \$8 million to create a pedestrian-friendly and ecologically-smart urban corridor that would blend in with historic Capitol Hill. As a result of this investment since 1999, 44 new businesses have opened and overall economic activity has tripled.¹⁴

Preserving critical environmental areas can provide valuable savings through the natural provision of services that would otherwise need to be paid for. In New York, a comprehensive

11. Urban Land Institute Terwilliger Center for Workforce Housing, *Beltway Burden: The Combined Cost of Housing and Transportation in the Greater Washington, DC, Metropolitan Area*, (Washington, 2009). <http://commerce.uli.org/misc/BeltwayBurden.pdf>

12. Joe Cortright, "Walking the Walk: How Walkability Raises Home Values in US Cities" CEOs for Cities, 2009. <http://www.ceosforcities.org/pagefiles/WalkingTheWalk-CEOsforCities.pdf>

13. Lawrence D. Frank et al., "Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality," *Journal of the American Planning Association* 72, no. 1 (2006): 75-87.

14. Barracks Row Main Street, "2006 Annual Report," as referenced in <http://www.completestreets.org/webdocs/factsheets/cs-revitalize.pdf>

Table 1. Highlights of Smart Growth Economic Benefits

Business	Household	Municipal & Regional	National
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Return on Investment

Access to new markets	Enhance or preserve housing values	Higher public revenues	More efficient use of transportation investments
Reduced investment risks	Better access to jobs	Reduced citizen opposition to development	Construction & transit jobs
Construction & transit jobs		Attracts private investment	
Higher property values		More efficient economy	
Productivity enhancements due to agglomeration			

Savings on Expenditures

Employee health care savings	Save on travel costs	Infrastructure savings (construction & operation)	Energy security
Better information & decision making	Reduced energy & water use		Reduced costs from urban decline
	Health care savings		
Reduced parking requirements	Lower taxes for infrastructure services	Green infrastructure (such as natural filtration) replaces gray infrastructure	
Reduced energy & water use			

Improved Quality of Life

Quality places attract high quality workers	Better access to services	Reduced exposure to congestion	Reduced GHGs
Improved environment for small businesses	Affordable housing	Thriving public spaces	
	Access to nature & recreation	Growth reflects community values	
	Increased physical activity	Protects natural	

watershed protection plan protects water sources by strategically restricting development, avoiding the need for a filtration system that would cost \$9 billion to construct and \$350 million each year to operate.¹⁵

Creating a range of transportation options can increase property values, attract investment and create jobs. A real estate analysis of Denver showed that homes within a half-mile of stations on the Southeast light rail line have risen in value an average of 17.6% between 2006 and 2008, while homes in the rest of Denver *declined* by an average 7.5%.¹⁶ A recent report on the impacts of the 2009 American Recovery and Reinvestment Act determined that investment in public transportation created almost twice as many jobs as the same investment in highway projects – 16,419 vs. 8,781 job-months.¹⁷

Directing development towards existing communities can reduce infrastructure costs. Sacramento calculated the infrastructure price tag of their Blueprint smart-growth scenario to be \$9 billion less than conventional development.¹⁸ Housing values also seem to be more stable in central communities during economic downturns. A Standard and Poors study in the greater Boston metropolitan area found homes located further from the central business district (CBD) lost an average of 5-7% percent of their value due to housing market shifts while those near the CBD lost only about 2.5%.¹⁹

Building within a smaller footprint can enhance sustainability by reducing water use and improving storm water runoff management. A 2006 EPA report found that in a compact single family housing development in Sacramento, California, water demand was 20-30% less than conventional subdivisions in the same city.²⁰ Another EPA study found that development at a density of eight units per acre produced 74% less runoff than development at one unit per acre.²¹

Reducing the need to drive saves big money. The Vision California project calculated that a “green” compact growth scenario could save California households \$8,600 each year in driving-related costs by the year 2050, or more than \$170 billion per year statewide.²² The Metropolitan Transportation Commission in the San Francisco Bay area calculated that reducing VMT to achieve a 15% reduction in GHGs would also reduce other pollutants enough to generate \$140 million in health care savings by the year 2035.²³

15. New York City Watershed Program. <http://www.dec.ny.gov/lands/25599.html>
16. Margaret Jackson, “Light-rail Can Turn into Money Train,” *Denver Post*, October 30, 2008. http://www.denverpost.com/breakingnews/ci_10850014
17. Center for Neighborhood Technology, Smart Growth America and US Public Research Interest Group, “What we learned from the stimulus,” January 5, 2010. http://www.smartgrowthamerica.org/documents/010510_whatwelearned_stimulus.pdf
18. David Shabazian, “The Cost of Growth: Blueprint Infrastructure Cost Analysis” (presentation as Item #05-5-3 at meeting of the Sacramento Area Council of Governments Housing and Land Use Committee, May 2, 2005).
19. David Stiff, “Housing Bubbles Collapse Inward,” Standard and Poors. May 27, 2008. http://www2.standardandpoors.com/spf/pdf/index/052708_Housing_bubbles_collapse.pdf
20. Paula Van Lare and Danielle Arigoni. “Growing towards More Efficient Water Use”. EPA. 2006 http://www.epa.gov/dced/pdf/growing_water_use_efficiency.pdf
21. Richards, Lynn, “Water and the Density Debate: When it comes to protecting water resources, higher density may be the way to go.” *Planning Magazine*, June 2006 <http://www.epa.gov/NCEI/stategrants/PDFs/wqanddensitydebate.pdf>
22. Calthorpe and Associates. (2010) “Vision California - Charting Our Future. Berkeley”, CA: Calthorpe and Associates <http://www.visioncalifornia.org>
23. Metropolitan Transportation Commission staff. (2010). “GHG Target Setting Impacts”. Presentation to the Commission, July 28, 2010.

Recommendations

We close with some recommendations to transportation policy makers and practitioners at all levels of government for getting on path to a sustainable and prosperous future.

Do. Measure. Learn.

CCAP recommends an incentive-based policy program centered on the themes of action, measurement, and analysis. Transportation-related policy at all levels of government should make it easier to implement measures shown to be successful elsewhere, aid in evaluating the results, and make adjustments based on lessons learned.

Equip and Empower

New goals and responsibilities require new tools and motivations. Transportation practitioners need enhanced ability to plan, implement and evaluate smart growth and travel efficiency policies. Thus, effective delivery of technical assistance for state and local practitioners is critically needed and would be an important role for federal agencies, such as US DOT, to enable a smooth transition to this new milieu. It is especially important to develop tools to assess the economic and sustainability benefits of smart growth and transportation policies to help communities develop a compelling vision of the future that they will enthusiastically strive to implement.

Do More, Get More (Merit-based Public Investment)

Government infrastructure programs – such as the federal transportation authorization and other infrastructure subsidies – should reward those communities that make the most efficient use of resources to promote economic and environmental sustainability. The US Department of Transportation’s TIGER program,²⁴ which awarded grants based to innovative projects that economic and environmental criteria, is a move in this direction, as are the Sustainable Community Grants awarded by the department of Housing and Urban Development.²⁵ Proposed legislation, such as the CLEAN TEA bill offered in 2009, offers a compelling approach for such incentives and could serve as an important framework for surface transportation authorizing legislation.²⁶

24. US Department of Transportation, “Transportation Investment Generating Economic Recovery (TIGER)”, <http://www.dot.gov/recovery/ost/> and, “TIGER II”, <http://www.dot.gov/recovery/ost/tigerii/>.
25. US Department of Housing and Urban Development, “Sustainable Communities Regional Planning Grants,” http://portal.hud.gov/portal/page/portal/HUD/program_offices/sustainable_housing_communities/Sustainable%20Communities%20Regional%20Planning%20Grants
26. H.R. 1329, “Clean, Low-Emission, Affordable, New Transportation Efficiency Act,” <http://www.govtrack.us/congress/bills/111/1329>

Empirical Research

Basic and applied research have an important place as the foundation of knowledge, and there is still much to be learned about accessibility and the economy. As the appendix shows, there is a solid foundation of research on the economic effects of smart growth. Building upon that base will enhance communities' and policy makers' ability to deliver effective smart growth policies. In 2009, CCAP provided Congressional testimony on top transportation research and data improvement needs;²⁷ the Federal government should increase funding for such research and data collection and provide support for evaluating pilot projects and innovative policies.

Ask the Sustainability Question

When making infrastructure and land development decisions, CCAP encourages policy makers to Ask the Climate Question: How does the decision affect GHG emissions and our resilience to climate impacts?²⁸ Based upon the findings in *Growing Wealthier* we believe that it is equally important to Ask the Sustainability Question: Does this policy choice promote long-term environmental and economic health in an equitable way?

27. S. Winkelman. Testimony to House Subcommittee on Technology and Innovation, House Committee on Science and Technology, "The Role of Research in Addressing Climate Change in Transportation Infrastructure." March 2009. <http://science.house.gov/Media/hearings/ets09/march31/winkelman.pdf>

28. CCAP, "Ask the Climate Question." June 2009. http://www.ccap.org/docs/resources/674/Urban_Climate_Adaptation-FINAL_CCAP%206-9-09.pdf

Conclusions

Even as the evidence in favor of smart-growth strategies continues to mount, multiple barriers are slowing widespread implementation, including institutional inertia, out-moded zoning codes and transportation policies, investor cautiousness, and citizen resistance to change.

While these barriers are being addressed in community after community, and increasingly at the federal level, it is our belief that the “tipping point” will come when the economic payoff is more broadly understood. It is with this in mind that we have written *Growing Wealthier*. The preponderance of the evidence leads us to conclude that an inclusive planning process that yields more walkable neighborhoods with broader housing and transportation options can help communities, businesses and individuals make money, save money and improve quality of life.

Understanding how to design urban forms for the 21st century that address the multiple goals of economy, environment and equal opportunity is a challenge that we can meet head on. The opportunity is here to build upon our knowledge of successful places and create more of them. Success begets success. It is our hope that *Growing Wealthier* will aid policymakers, planners, developers and citizens in creating happier, healthier and more prosperous communities while conserving natural resources.

There are many steps we must take to ensure that our children inherit a planet and an economy with a bright future. Investing the time and money to grow our communities to be more resilient, more efficient and more satisfying to the soul surely offers a tremendous payoff.

The “tipping point” for smarter urban development will come when the economic payoff is more broadly understood. The preponderance of the evidence shows that smart growth can help communities, businesses and individuals make money, save money and improve quality of life.



Growing Wealthier: Smart Growth, Climate Change and Prosperity

Introduction

What we build – where and how – has a tremendous impact on how we sustain our communities, protect the environment and bolster prosperity. Common sense and empirical evidence, such as that documented in the *Growing Cooler* study,²⁹ make it clear that building our neighborhoods, towns and cities in ways that require less driving can reduce greenhouse gas (GHG) emissions while making us less dependent on finite sources of energy. CCAP analysis has established that it will be difficult to achieve climate protection goals without slowing growth in vehicle miles travelled (VMT) even with rigorous vehicle efficiency standards and carbon prices.³⁰

But how many Americans want to live in more walkable neighborhoods, with homes and businesses closer to each other, with transportation options in addition to the car – the kinds of places created by following the principles commonly referred to as smart growth? Quite a few, according to real estate market trends and demographic analyses.^{31, 32} Are

hat we build – where and how – has a tremendous impact on how we sustain our communities, protect the environment and bolster prosperity. Common sense and empirical evidence, such as that documented in the *Growing Cooler* study,²⁹ make it clear that building our neighborhoods, towns and cities in ways that require less driving can reduce greenhouse gas (GHG) emissions while making us less dependent on finite sources of energy. CCAP analysis has established that it will be difficult to achieve climate protection goals without slowing growth in vehicle miles travelled (VMT) even with rigorous vehicle efficiency standards and carbon prices.³⁰

29. Reid Ewing, Keith Bartholomew, Steve Winkelmann, Jerry Walters and Don Chen, *Growing Cooler: The Evidence on Urban Development and Climate Change* (Washington: Urban Land Institute, 2008)

30. Center for Clean Air Policy. (2009). "Cost-Effective GHG Reductions through Smart Growth and Improved Transportation Choices." Washington, DC. <http://www.ccap.org/dollarperton.html>

31. Patrick Doherty and Christopher Leinberger, "The Next Real Estate Boom," *Washington Monthly*, November/December 2010.

32. *Growing Cooler* (Ewing, et al, 2008), *op. cit.*, Chapter 2.

smart-growth strategies cost effective for reducing GHG emissions? Yes, according to analyses such as *Moving Cooler*³³ and CCAP’s “dollar per ton” study.³⁴

What, then, is the economic impact of following these strategies? Clearly, the cost per ton of reducing CO₂ is not the only consideration. How does this approach affect the bottom line for businesses, household budgets and government balance sheets? Those are the questions elucidated in *Growing Wealthier*, as we also examine quality-of-life concerns beyond traditional economic measures, such as public health and well-being, community vibrancy, thriving ecosystems and global climate protection.

Climate Change and the Climate of Change

Over the past 20 years, climate change has advanced in the American consciousness from a dimly perceived debate among scientists to a widely accepted, but challenging reality. The challenge arises from uncertainty about how we can most effectively respond, and how such responses may impact our society and daily lives.

What is clear is that as a major generator of the world’s annual greenhouse gas (GHG) emissions, the United States faces great challenges in doing our part to prevent climatic disaster. Individual actions will not be enough; widespread, coordinated transformations of our infrastructure and the ways we use natural resources will distinguish any future in which climate change is slowed or reversed.

The change we are required to make is large, but there is every reason to believe it can be for the better. As the economist Jeffrey Sachs has noted: “The ultimate solutions to climate change are workable, cost-effective technologies which permit society to improve living standards while limiting and adapting to changes in the climate.”³⁵ This paper considers a transformative vision for our built environment – the buildings, neighborhoods, cities and metropolitan areas we inhabit – and the ways we travel within it, with particular attention to ideas and models holding most promise for a low-carbon future that also improves the well-being and prosperity of individuals, communities and the nation as a whole.

In our estimation, “prosperity” is much more than simple Gross Domestic Product (GDP). Many factors beyond material goods contribute to a broader definition of wealth and well-being, including public health, a thriving natural environment, strong communities, travel and housing choices and open government. Still, dollars are the common currency of economic debate, so we looked at the ways that urban development models that reduce GHG emissions directly affect the balance sheets of governments, households and businesses.

The first section of *Growing Wealthier* explains why the ability to reduce total vehicle travel must be part of our response to global climate disruption. We look at the historical trend of

33. Cambridge Systematics, Inc. (2009). *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions*. Washington, D.C.: Urban Land Institute.

34. CCAP 2009, *op cit*.

35. Center for Research on Environmental Decisions, *The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public* (New York, 2009).

urban development in the US and the role it has played in driving up vehicle miles, and we introduce the “smart growth” model of building walkable neighborhoods with homes and businesses closer to each other and transportation options in addition to the car. The second section explores the evidence that communities that develop using smart-growth principles can reduce the need for travel and thereby reduce GHG emissions. In the third section we dig deeper into the idea of what wealth is, and how it is related to motor vehicle travel. The fourth section then examines each of ten basic smart-growth principles and identifies the positive economic impact they can have on households, governments and businesses. We close with some recommendations for getting on path to a sustainable and prosperous future. The appendix provides an annotated bibliography of the literature on smart growth, climate change and the economy for those seeking further information.

Why Reducing Vehicle Miles will be Necessary

Transportation planners refer to the tally of all the miles we all drive every day as “vehicle miles traveled”, abbreviated as VMT. Total VMT began to rise steadily after World War II as we built the interstate highway system and Americans migrated out of cities and into suburbs. In the 30 years between 1977 and 2007, VMT in the US grew by 110% even though the population as a whole increased by only 37%.³⁶ For the year 2009, the Federal Highway Administration estimates that Americans drove 2.93 trillion vehicle miles.³⁷

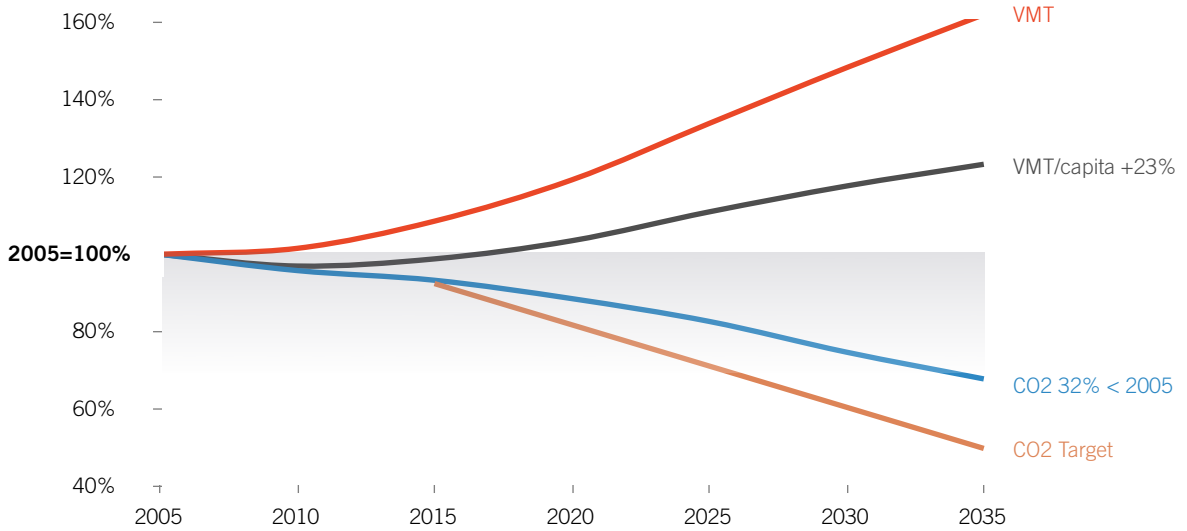
Transportation-related activities account for 71 percent of US oil consumption³⁸ and nearly one-third of annual CO₂ emissions in the US. In 2008, 62 percent of this came from passenger cars, sport utility vehicles, minivans and pickup trucks.³⁹ The upshot is that there is no viable way to become less oil-dependent or meet climate-protection targets without addressing transportation.

Improved technology can take us a good part of the way there by making both vehicles and our highway network more efficient. A study funded by the National Cooperative Highway Research Program projected that tailpipe emissions could be reduced by up to 50% per vehicle mile traveled if a number of technologies continue to improve.⁴⁰ The report also concluded that emissions per mile could go down 20% if there were no traffic congestion.

But as Figure 1 demonstrates, these kinds of measures – even if aggressively applied – won’t be enough for the US transportation sector to meet a target of 80 percent below 1990 levels by the year 2050.^{41, 42} For that to happen, Americans will need the ability to live their lives without driving as much. The actual drop in miles driven per person that is required is relatively modest: We calculate that a 9 percent reduction in per capita VMT (roughly equivalent to each person driving 2.5 miles less per day) will be sufficient (Figure 2). The good news is that shaping our future growth and development according to smart-growth principles turns out to be a cost-effective way for transportation to meet its share of GHG

36. Calculation is based on data from the following sources: US Census. “Historical National Population Estimates: July 1, 1900 to July 1, 1999” <http://www.census.gov/popest/archives/1990s/popclockest.txt>; US Census, “Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2007” <http://www.census.gov/popest/states/NST-ann-est2007.html>; Federal Highway Administration. “Annual Vehicle - Miles of Travel, 1980-2007.” http://www.fhwa.dot.gov/policyinformation/statistics/vm02_summary.cfm and Federal Highway Administration, “Annual Vehicle Distance Traveled in Miles, 1936-1995” <http://www.fhwa.dot.gov/ohim/summary95/vm201.pdf>.
37. Federal Highway Administration, “December 2009 Travel Trends,” <http://www.fhwa.dot.gov/ohim/twtw/09dectvt/page2.cfm>
38. U.S. Energy Information Administration, “Oil: Crude and Petroleum Products Explained,” http://www.eia.doe.gov/energyexplained/index.cfm?page=oil_home#tab2, accessed August 25, 2010.
39. U.S. Environmental Protection Agency, “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008” U.S. EPA # 430-R-10-006, (April 2010) p. 3-12.
40. Cynthia Burbank, “Strategies for Reducing the Impacts of Surface Transportation on Global Climate Change”, National Highway Cooperative Research Program Project 20-24(59), Feb 2009.
41. European Commission, “Limiting Global Climate Change to 2 degrees Celsius: The way ahead for 2020 and beyond, Impact Assessment,” 2007.
42. We assume that economy-wide GHG emissions will need to be 50% below 2005 levels by 2035 to be on a path to 80% below 2005 levels by 2050. Specific sectors of the economy may achieve lesser greater reductions depending upon cost-effectiveness and supportive policies. Given the deep reductions required, and the lack of cost-effective reductions consistent with the magnitude needed, major efforts will be required from all sectors of the economy – including transportation.

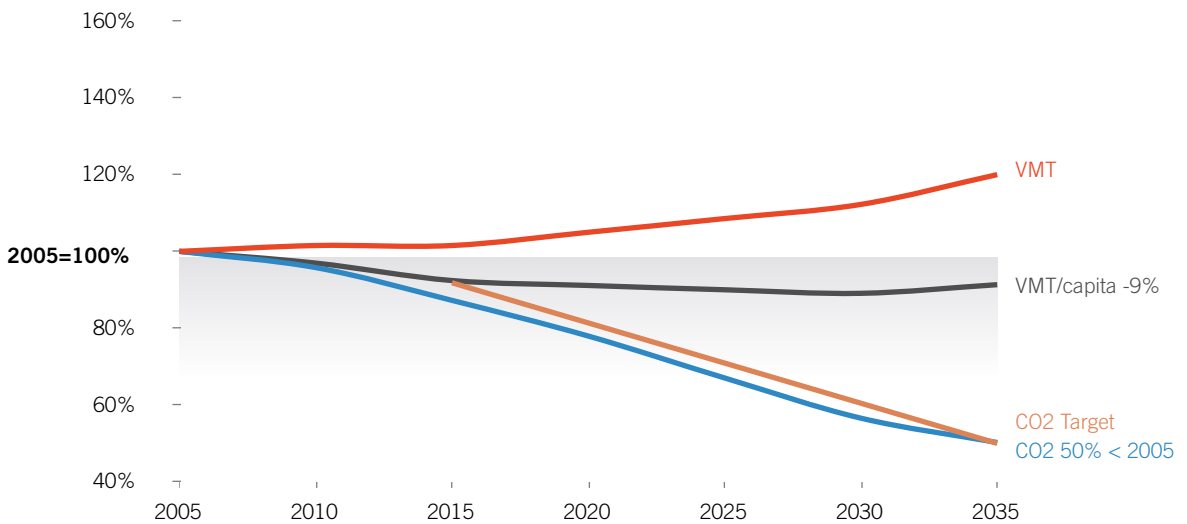
Figure 1. US Passenger Vehicle GHG Emissions: Business-as-usual Scenario



S. Winkelman, CCAP. 60 mpg in 2035, -15% fuel GHG.

Each variable is shown relative to the 2005 baseline. Overall VMT is projected following the US EIA's projection of Per Capita VMT increasing by 23% by 2035. CO2 Emissions resulting from VMT assume gradual improvements in carbon intensity of fuels (-15% by 2035), and a 60 mpg CAFE standard in 2035. CO2 Target Levels of 50% less than 2005 by 2035 would not be met by the US transportation sector in this scenario.

Figure 2. US Passenger Vehicle GHG Emissions: 9% Reduction in VMT per Capita



S. Winkelman, CCAP. 60 mpg in 2035, -15% fuel GHG. -9% VMT/capita

Each variable is shown relative to the 2005 baseline. Overall VMT is projected assuming a 9% decline in Per Capita VMT by 2035. CO2 Emissions resulting from VMT assume gradual improvements in carbon intensity of fuels (-15% by 2035), and a 60 mpg CAFE standard in 2035. CO2 Target Levels of 50% less than 2005 by 2035 would be met by the US transportation sector in this scenario.

reductions.⁴³ As future sections of this report will make clear, the even better news is that this approach will meet the demographic, market and economic demands of the future.

The Evolution of Urban Development in the United States

Prior to the 20th century, the general trend of human development had been away from the countryside and into cities. Cities offered many advantages: access to markets, security, social and cultural opportunities, political consolidation. Cities grew rapidly, and often haphazardly, during the industrial age, and then suffered from crowding and underinvestment during the Depression and through the years of the Second World War. After the war, the U.S. made a conscious effort to take advantage of cheap energy and abundant natural resources in order to extend many of the advantages of urban agglomeration – access to jobs, services and activities – back to the “countryside.” Through an unprecedented public investment in roads, water and other infrastructure, the suburbs offered relief from crowding along with a cleaner environment plagued by fewer communicable diseases, lower taxes, isolation from poverty and crime, self-government and privacy.

Problems with the spread-out, driving-intensive development patterns emerged early on in the form of traffic congestion, air pollution and concentrated poverty in the cities. Each problem was addressed with a discrete solution: building more and wider roads to address traffic, concentrating shopping in malls to reduce the need for car trips, switching to unleaded gas to reduce smog, attempting “urban renewal” to disperse poverty. Gradually farther-reaching troubles took root: environmental degradation, loss of habitat, reduced access to open space, decline of older suburbs and the suburbanization of poverty, higher costs for public services, and ever-increasing traffic congestion that never seems to be relieved by roadway expansion. Again we tried piecemeal solutions that addressed problems symptom by symptom: arduous environmental approvals for individual infrastructure projects; gated communities and private security and other services to provide insulation from decline; revolts such as Proposition 13 against California property taxes that seemed to rise inexorably; retrofitting a dangerous and dysfunctional road network with “traffic calming” devices and attempting to reduce traffic with entreaties to car pool and other “travel demand management” efforts. Individual solutions often interfered with each other and were hard pressed to keep up.

The good news is that shaping our future growth and development according to smart-growth principles is a cost-effective way to reduce transportation emissions. The even better news is that this approach will meet the demographic, market and economic demands of the future.

43. S. Winkelman, A. Bishins and C. Kooshian. “Planning for Economic and Environmental Resilience.” *Transportation Research Part A: Policy and Practice*, October 2010. <http://www.sciencedirect.com/science/journal/09658564>.

Key Principles of Smart Growth

Meanwhile, the size of new houses continued to increase along with lot sizes as metro areas became increasingly spread out. Urban land area increased twice as fast as population between 1945 and 2002.⁴⁴ The median size of a house in the US increased from 1,525 square feet in 1973 to 2,135 square feet in 2007.⁴⁵ At the same time, happiness index studies such as the General Social Survey indicate that personal satisfaction has not changed even as incomes, house sizes and availability of consumer goods increased substantially.⁴⁶

In reaction – and, interestingly, coinciding with the rise in climate change awareness – urban planners embarked on a top-to-bottom re-assessment of their built environment, searching for ways to promote the advantages of cities and suburbs while minimizing the chronic problems of both. Groups ranging from the American Planning Association, the U.S. EPA and the State of Maryland began coordinating their ideas to offer guidance to the numerous state and local governments that were considering how to change their planning policies. The diverse threads of the resulting integration and experimentation came to be bundled under the rubric of “smart growth” (see box).

1. Create a Range of Housing Opportunities and Choices
2. Create Walkable Neighborhoods
3. Encourage Community and Stakeholder Collaboration
4. Foster Distinctive, Attractive Communities with a Strong Sense of Place
5. Make Development Decisions Predictable, Fair and Cost Effective
6. Mix Land Uses
7. Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas
8. Provide a Variety of Transportation Choices
9. Strengthen and Direct Development Towards Existing Communities
10. Take Advantage of Compact Building Design

Source: Smart Growth Network, “Principles of Smart Growth,” Smart Growth Online, <http://www.smartgrowth.org/about/principles/default.asp>

44. Economic Research Service/USDA, “Major Uses of Land in the United States”, 2002/EIB-14

45. National Association of Homebuilders, “Median and Average Square Feet of Floor Area in New Single-Family Houses Completed by Location”, http://www.nahb.org/fileUpload_details.aspx?contentID=80051

46. Paul Taylor, Cary Funk and Peyton Craighill, “Are We Happy Yet?” Pew Research Center, Feb 2006.

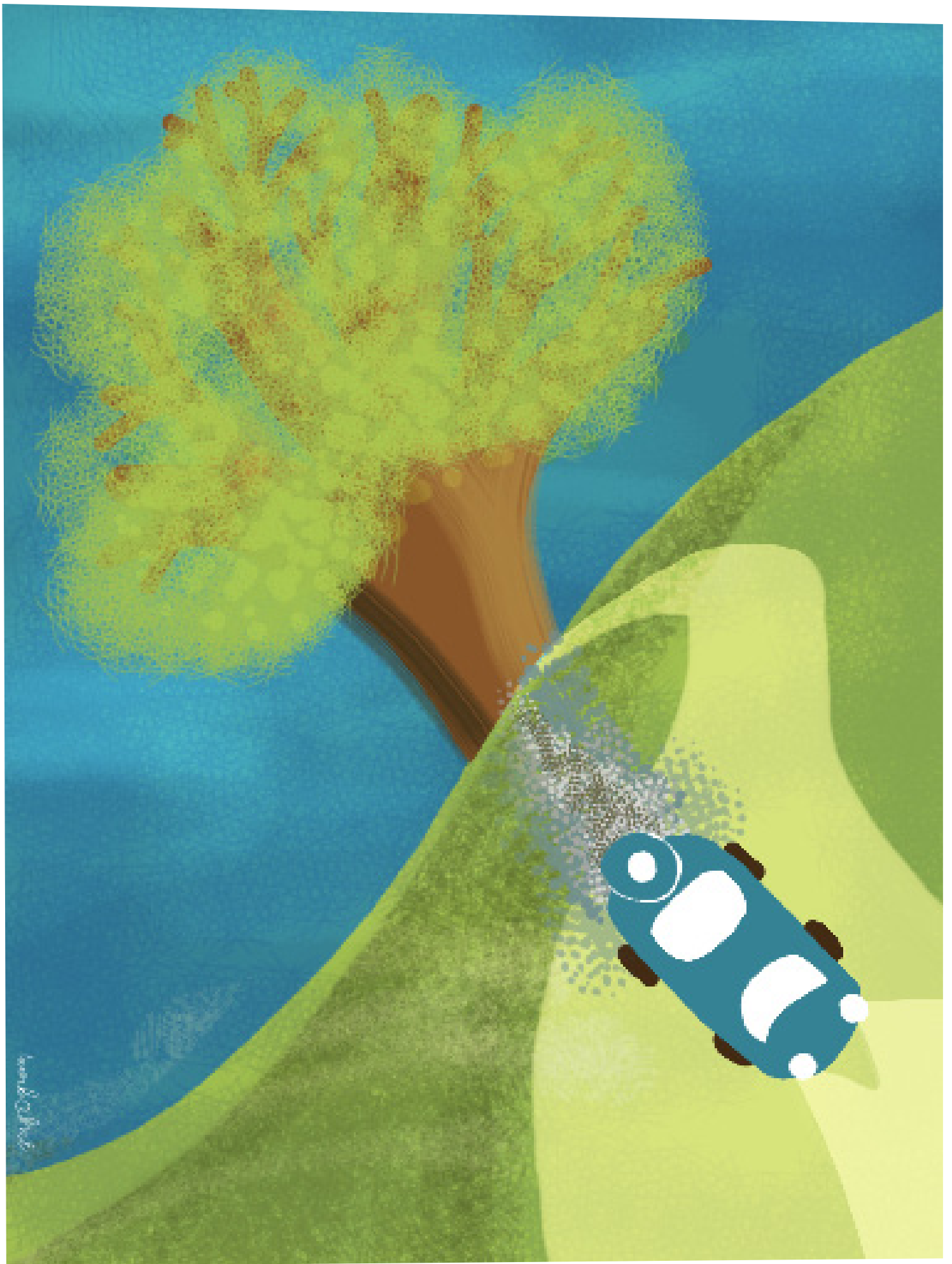
The core assumption behind the smart-growth approach is that, when people in a community plan together for their future growth and development, the result will be smarter use of resources to produce more of what we love about where we live, and less of what we’d

rather not have. While the principles are universal, the local outcome is unique, because it is based on the community's assets and resources, as well its aspirations and constraints. The smart-growth process is different from conventional planning, because it takes a more holistic approach. Citizens and their governments make decisions about where they want to see development, and in what form, before making plans for transportation investments. Too often in the past, transportation planning and land use decisions were made independently from one another. As a result, local and state governments found themselves playing catch-up after unexpected development demanded new roads and other infrastructure, or building highways that opened new land to development as existing areas were neglected. Growing smart also requires looking at the big picture: Communities don't live in isolation, but are part of larger regions, transportation networks, ecosystems and watersheds, and planning must take them into account. It is important to appreciate that, as the Brookings Institution's Center on Urban and Metropolitan Policy points out, "almost never does smart growth mean no growth."⁴⁷

The core assumption behind the smart-growth approach is that, when people in a community plan together for their future growth and development, the result will be smarter use of resources to produce more of what we love about where we live, and less of what we'd rather not have.

For this paper our interest lies in the potential impact of smart growth on the economy, on personal and civic wealth and on climate protection. We will review the literature and assess the state of the art with these particular questions in mind: What effect is the smart-growth approach to planning and development likely to have on our standard of living, however we define it? What are the links among smart growth, economic growth and greenhouse gas emissions? Is it possible for smart growth to enhance prosperity, even as it helps meet goals for climate and energy security?

47. Mark Muro and Robert Puentes, "Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns" (Washington: The Brookings Institution, 2004). http://www.brookings.edu/reports/2004/03metropolitanpolicy_muro.aspx



Smart Growth, VMT and Climate Change

The smart growth principles are not a radical departure from past practices or an attempt to reinvent human settlements. Rather, the impulse is to borrow the best of traditional neighborhoods and cities (such as Boston, Charleston or San Antonio) while acknowledging that the automobile and other modern technology – from broadband to smart phones – must also be taken into account. They offer a vision as much like *Back to the Future* as *The Jetsons*. The principles were not devised specifically to slow climate change, but evidence is growing that they can help with that difficult task. Although academics have studied the relationship between urban form and travel demand for at least 20 years⁴⁸, only recently have researchers begun to explore and quantify the potential for smarter urban development to reduce GHGs – in studies such as by the Center for Clean Air Policy⁴⁹ and *Growing Cooler*.⁵⁰

The key to understanding how well-designed urban development can help to reduce emissions, as well as energy use, is the concept of “accessibility”. As explained in “What is Accessibility,” next page, accessibility is a measure of how easy it is to get to a variety of desirable destinations and is a result of interaction between urban form and transportation infrastructure. Accessibility, and the economic benefits provided by bringing together origins and destinations, is the very reason that cities exist. Mobility often is held out as

48. See, for example, Ewing, R and Cervero, R. (May 2010), “Travel and the Built Environment,” *Journal of the American Planning Association*.

49. See Center for Clean Air Policy, *Recommendations to Governor Pataki for Reducing New York State Greenhouse Gas Emissions*, April 2003, http://www.ccap.org/docs/resources/534/NYGHG_Report.pdf; CCAP Transportation Guidebook, 2007 <http://www.ccap.org/safe/guidebook.php>.

50. *Growing Cooler* (Ewing, et al, 2008), *op. cit.*



What is Accessibility?

Accessibility is a measure of the ease of reaching desired services and facilities. It is focused on connecting people to destinations. An important concept in urban and transportation planning, accessibility reflects the value of the urban system as a whole for residents living in it. It should not be confused with mobility, which is the ability to cover distances. While access requires mobility it also requires destinations. Thus a person in a fast car on a smooth, empty highway in the desert would have high mobility but, in the absence of any desirable destinations, would have low access.

Accessibility evaluates the ease of reaching destinations, and the magnitude, quality, and character of activities in these destinations. VMT is a mobility measure that indicates the number of miles that vehicles are driven. Managing VMT is a pure transportation goal; improving accessibility, however, can factor in mode, quality of travel and land use. Compact development on a metropolitan scale can enhance (multi-modal) regional accessibility, while mixed-use development and pedestrian-oriented design can enhance local accessibility. In terms of improving residents' quality of life, accessibility can be seen as a better measure than mobility and it can be further broken down into different levels: statewide, citywide, neighborhood, etc., and by different socio-economic measures (income, race, age, etc.). Such measures can provide insights about the living conditions of different locales and social groups in a region, and can guide urban policy-making.

Measuring Accessibility

Geographic Information System (GIS) data mapping techniques are widely adopted to assess accessibility of neighborhoods to various facilities by combing transportation networks, land use data, and geo-coded business and residential data.* For an example of accessibility research see the University of Minnesota Access to Destinations Study.**

There are three main types of accessibility measures:*** (1) Cumulative opportunities measures simply calculate the number of services and facilities that one can access from the starting location within a certain time by some mode of transportation. (2) Gravity-based measures weight each destination by distance, time, or cost, so locations that are farther away are less valuable than those more readily reached. (3) Utility-based measures use probability theory by assuming services providing higher utility are more likely to be patronized. The utility-based accessibility is calculated as the sum of the utilities of all choices available to the residents.

* Talen, E. 1998. "Visualizing Fairness: Equity Maps for Planners." *Journal of the American Planning Association* 64:1, pp. 22–38, Winter. See also Grengs, J. 2000. *Sprawl, Supermarkets, and Troubled Transit: Disadvantage in the Inner City of Syracuse*. Cornell University.

** University of Minnesota Center for Transportation Studies, "Access to Destinations." <http://www.cts.umn.edu/access-study/>

*** Handy S L, Niemeier D A, 1997, "Measuring accessibility: an exploration of issues and alternatives", *Environment and Planning A* 29(7) 1175 – 1194

the object of transportation policy, but mere movement in and of itself does not equate to economic productivity, while accessibility is critical to it. High levels of accessibility mean that employers have ready access to a labor pool, workers have multiple means to gain access to jobs, students can reach schools, and older citizens can make it to the doctor or to life-sustaining activities. Accessibility is highest when more homes are closer to shops and offices (*mixing land uses*), when there are multiple ways to get around (*a variety of transportation choices*) and the distances to be covered to accomplish daily life are kept to a minimum (*compact design*). Under these circumstances, people have greater access to economic activity and recreation, but with lower VMT.

Alternative Transportation Modes Reduce GHG Emissions

To get a handle on how improving transportation choices might be an effective climate change policy, we can begin with a 2002 study commissioned by the American Public Transportation Association (APTA) that concluded, “Moving a person over a given distance by public transportation consumes, on average, about half the energy of moving a person the same distance by private automobile, [SUV], or light truck.”⁵¹ The same study found that travel by public transportation produces, on average, about 45 percent less carbon dioxide per passenger mile than travel by private vehicles. Over all, public transportation is already credited with reducing vehicle travel by 102 billion miles per year across the country, according to APTA figures, equivalent to 3.4% of total annual VMT in 2007.⁵² It is true that private vehicles tend to emit more GHG per passenger mile in higher-density areas as a result of slower speeds, but research has documented that this is more than offset by the reduction in overall driving.⁵³ Transit, on the other hand, tends to become more efficient in such areas due to increased ridership.

Some researchers have tried to put a dollar value on the difference in GHG emissions among modes. A recent University of California analysis calculated that automobiles cause up to three times more climate change damage per passenger mile than public transit.⁵⁴

Comparisons to non-motorized transportation alternatives are even more striking. Recognizing that 48% of car trips are less than three miles, the Rails-to-Trails Conservancy in 2008 calculated VMT and carbon dioxide savings from a “modest” scenario shifting 9% of trips of less than 1 mile, and 6% of trips of 1 to 3 miles from car to walking or bicycling. The projections (shown in Table 2) indicate a total reduction of 49 billion VMT per year. Acknowledging uncertainties regarding how to assign a monetary value to GHG emissions reduction, the study used a low figure of \$10 per ton of CO₂. Taking account of additional emissions avoided by the decrease in automotive congestion due to the mode switch, the authors project this scenario “would justify investments into bicycle and pedestrian infrastructure of \$330 million annually for the purpose of CO₂ reductions alone.”⁵⁵ CCAP calculated that annual fuel savings would amount to more than \$5 billion.⁵⁶

51. Robert J. Shapiro, Kevin A. Hassett and Frank S. Arnold, “Conserving Energy and Preserving the Environment: The Role of Public Transit,” American Public Transit Association, http://www.publictransportation.org/pdf/reports/shapiro_report.pdf (July 2002), p. 9

52. Linda Bailey, Patricia L. Mokhtarian and Andrew Little, “The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction,” American Public Transit Association, http://www.apta.com/resources/reportsandpublications/Documents/land_use.pdf (Feb 2008).

53. *Growing Cooler* (Ewing, et al, 2008), *op cit.*, pp. 45-47.

54. Delucchi, M. and D. McCubbin. “External Costs of Transport in the U.S.” *Handbook of Transport Economics*, ed. by A. de Palma, R. Lindsey, E. Quinet, and R. Vickerman. Edward Elgar Publishing Ltd., 2010.

55. Thomas Gotschi and Kevin Mills, “Active Transportation for America,” Rails-to-Trails Conservancy, 2008. http://www.railstotrails.org/resources/documents/whatwedo/atfa/ATFA_20081020.pdf.

56. CCAP calculation: 49 billion VMT ÷ 25 mpg x \$2.75/gal = \$5.3 billion.

Compact, Mixed Use Communities Reduce GHG Emissions

Building neighborhoods and cities within a smaller footprint, in part by accommodating growth within existing developed areas, has further potential to reduce emissions. A 2008 Urban Land Institute study found that Americans living in compact urban neighborhoods where cars are not the only transportation option drive a third fewer miles, on average, than those in automobile-oriented suburbs.⁵⁷ In 2009, the National Research Council's Transportation Research Board projected that "doubling residential density across a metropolitan area might lower household VMT by about 5 to 12 percent, and perhaps by as much as 25 percent, if coupled with higher employment concentrations, significant public transit improvements, mixed uses, and other supportive demand management measures."⁵⁸ That study assumed a doubling of the density of new development by reducing or eliminating development of less than one dwelling unit per acre; nearly half (47 %) of new housing between 1990 and 2000 was built on one-acre lots. To put this in context, the current density in Sacramento or Portland is over 5 dwelling units per acre.^{59, 60} As an academic exercise, this demonstrates that building in even a slightly more compact form can have a major impact on reducing VMT. Of course, merely going from one-acre lots to half-acre lots, without ensuring that homes are in proximity to jobs, shops and activities would miss many of the synergies that come from more complete, walkable communities. These synergies are the source of many of the larger VMT reductions found by the other studies.⁶¹

An analysis performed by ICF International in 2008 found that the benefits of high quality transit extend beyond VMT reductions from transit trips themselves. In the context of transit-oriented development, driving trips are shorter and walking and bicycling are viable options.⁶² So, for every mile of driving avoided due to transit riders themselves, three more miles of driving are avoided due to transit-oriented development. The report concludes, "This result suggests that public transit is a significant enabler of an efficient built environment."

These lessons, that compact growth and transportation choices can reduce VMT, are being applied on a regional scale in California by the Sacramento Area Council of Governments (SACOG). In the early 2000s, SACOG conducted a comprehensive analysis of several growth scenarios in their Sacramento Blueprint process. In December, 2004, SACOG's board of local officials adopted their Preferred Blueprint Scenario, described on their web site as "a bold vision for growth that promotes compact, mixed-use development and more transit choices as an alternative to low-density development." Then, in 2008, SACOG incorporated this scenario into its Metropolitan Transportation Plan, linking land use and transportation planning for the programming of \$42 billion in transportation investments in six counties through the year 2035. Although computer modeling projected that *total* VMT in the region will climb as population increases, miles driven *per capita* were expected to decline by 6% to 10% as the walkable neighborhoods and improved travel options built under the Blueprint plan help to reduce and shorten car trips.⁶³ More recently, SACOG has

57. *Growing Cooler* (Ewing, et al, 2008), *op. cit.*, p. 55.

58. TRB Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy Consumption, *Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions*. (Washington: Transportation Research Board, 2009).

59. SACOG "Description of SACOG Scenario Testing For SB375 Greenhouse Gas Reduction Target Setting" http://www.arb.ca.gov/cc/sb375/mpo/sacog/sacog_rnac_scenarios.pdf.

60. TRB 2009, *op. cit.*, p. 86.

61. For more insight into differences among studies on land use and climate interactions, see Fehr and Peers' blog: <http://coolconnections.org/2009/11/30/growing-cooler-key-differences-misconceptions-part-2-of-3/>.

62. Bailey, Mokhtarian and Little, 2008, *op. cit.*

63. Sacramento Area Council of Governments, *Metropolitan Transportation Plan for 2035*, 2007.

Table 2. VMT and CO2 savings from Shifting Some Short-distance Trips from Car to Walking or Bicycling

Trip length	Current Share of trips by walk or bike	Active Transportation “Modest Scenario”				
		Share of trips by walk or bike	Annual VMT reduction	Annual CO2 savings	Value at \$10 per ton CO2	Annual Fuel Cost Savings
Less than 1 mile	31%	40%	28 billion	21 million tons	\$330 million	\$5.3 billion
1 to 3 miles	4%	10%	21 billion			

Adapted from Gotschi and Mills, 2008.

modeled further policy scenarios that could further reduce per capita VMT between 10% and 14%.⁶⁴

As a metro area that has pursued smart growth within a state-imposed urban growth boundary since the 1970s, the experience of Portland Oregon offers further evidence of the potential for VMT reduction. For decades, Portland has worked to develop a light rail, bus, and streetcar system that is well integrated with its pedestrian- and bicycle-friendly road network. While national VMT per capita grew by 8% between 1990 and 2007, in the Portland/Vancouver (WA) region VMT per capita fell by 10%.⁶⁵ During the same period population grew by 14% and Portland’s economy expanded, but by 2008 GHG emissions stood at only 1% above 1990 levels.

Similar results have been seen in the county of Arlington Virginia. Since the 1970s, local government there has implemented transit-oriented development policies in its Rosslyn-Ballston and Jefferson Davis Metro Rail corridors, creating entire mixed-use neighborhoods with substantial amounts of office, retail and residential development. In the period between 1980 and 2009, nearly 23 million square feet of commercial space and more than 28,000 new housing units were built in an area of less than three square miles around seven transit stations.⁶⁶ This new construction allowed Arlington to accommodate population and jobs growth of more than 1% each year with almost no increase in traffic congestion on the surface streets.⁶⁷ This is because only about half of the people living on Arlington’s Metro corridors drive to work, while nearly 40 percent rely on public transportation, bicycling or walking.⁶⁸ Altogether, households in Arlington’s Metro two corridors drive an average of 12 or 17 miles per day as opposed to nearby suburban counties, whose residents average 35 to 50 miles each day.⁶⁹

- 64. SACOG, “Description of SACOG Scenario Testing for SB375 Greenhouse Gas Reduction Target Setting,” Appendix 3, Table 4, May 2010.
- 65. “Daily VMT (Vehicle Miles of Travel) Per Person - 1990 To 2007: Portland, OR Only, Portland-Vancouver OR-WA, And The U.S. National Average Data,” prepared by D. Horowitz. http://library.oregonmetro.gov/files/1990-2009_dvmt-portland-us.pdf
- 66. Arlington County Department of Community Planning, Housing and Development (CPHD), “Profile 2009: Fall Update.” http://www.arlingtonva.us/departments/CPHD/planning/data_maps/profile/file72015.pdf
- 67. “Arlington County TOD Highlights”. Information provided by Arlington County Department of Environmental Services, Division of Transportation. September 2010.
- 68. Arlington County CPHD “Means of Transportation.” http://www.arlingtonva.us/departments/CPHD/planning/data_maps/Census/commuting/Censuscommuting.aspx
- 69. “Greater Washington Metropolitan Region 2007/2008 Household Transportation Survey.” Information provided by Arlington County Department of Environmental Services, Division of Transportation. September 2010.

The Effect of the Cost of Driving

“A carbon economy embeds fossil fuels in the fabric of its infrastructure,” notes the economist Dieter Helm.⁷⁰

As we’ve seen above, smart growth policies actually alter that infrastructure to give people more transportation choices that lessen dependence on fossil fuels. In lieu of that there are other approaches to reducing VMT, such as raising the price of driving to directly reflect more of the infrastructure and external costs.⁷¹ In historical experience it has required a large price increase to see a

VMT response.⁷² One reason is because even at relatively high prices, fuel costs remain only a fraction of total vehicle ownership and operating costs. Another reason is a lack of transportation alternatives for most Americans. These factors have maintained Americans’ growth in driving through cycles of rising and falling prices.

Accessibility, and the economic benefits provided by bringing together origins and destinations, is the very reason that cities exist.

More recently though, Americans’ driving behavior has indeed proved to be responsive to sustained changes in price: growth in VMT per capita decreased from 2005 to present, concurrent with steep rises in gasoline prices and the onset of a severe recession.⁷³ This change is part and parcel of the pain of the economic turmoil, but the general rise in fuel prices is expected to become a growing feature of American life. The International Energy Agency projects that oil prices will more than double by 2035.⁷⁴ While there’s no doubt a future low-carbon economy will change household spending patterns for many kinds of goods and services, smart-growth strategies hold promise as a way to ensure that when the cost of driving increases, families and communities will not experience a corresponding drop in quality of life and prosperity – the subject of our next section.

70. Dieter Helm, “Climate-change Policy: Why has so Little been Achieved?” in *The Economics and Politics of Climate Change*, ed. Dieter Helm and Cameron Hepburn, 14 (New York: Oxford University Press, 2009).

71. For a comprehensive proposal for congestion pricing, see David Lewis, “America’s Congestion Problem: A Framework for National Reform” (Washington: The Brookings Institution, 2008).

72. The relationship between fuel prices and travel behavior, quantified as the long-term “elasticity” of VMT with respect to fuel price, had been estimated by some economists as -0.22. See: Small, Kenneth A. and Kurt Van Dender, “Fuel Efficiency and Motor Vehicle Travel: The Declining Rebound Effect.” UC Irvine Economics Working Paper #05-06-03, July 2006. Observed short-run elasticity have been even smaller (more inelastic), consistent with the expectation that neither peoples’ driving patterns nor the efficiency of the vehicle fleet respond immediately to heightened fuel prices.

73. For an elegant graphic presentation of per capita VMT charted against gasoline prices over the past 55 years, see Fairfield, Hannah “Driving Shifts Into Reverse,” *New York Times*, May 1, 2010. <http://www.nytimes.com/2010/05/02/business/02metrics.html>.

74. International Energy Agency, *World Energy Outlook 2010*. <http://www.iea.org/weo/index.asp>



rayogram

Does Driving Equate to Wealth?

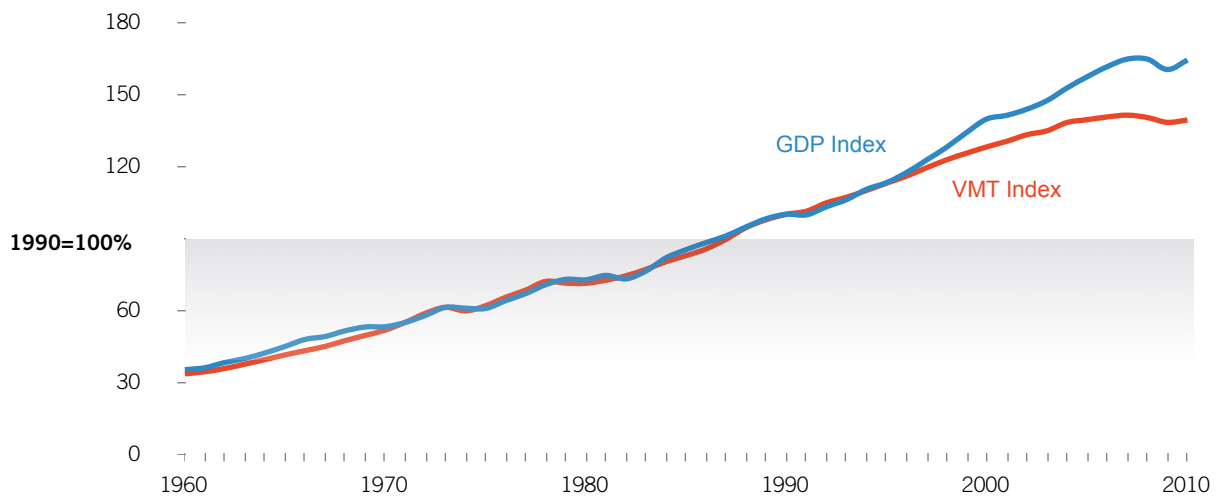
For decades after World War II, the total number of miles Americans drove each year rose in sync with the country's gross domestic product (GDP), a measure of the nation's economic output equal to the sum of the market value of all goods and services produced within our borders in a year. Observing the concurrent increases in VMT and GDP, many policy-makers have come to perceive a causal relationship between the two. As a result, they see policies aimed at tempering VMT as threats to economic growth, and by extension, to quality of life.

Is this a reasonable expectation? Figure 3 shows that GDP growth clearly began to outpace VMT growth starting around 1996. A study by Stanford University researchers Adam Millard-Ball and Lee Schipper shows that growth in VMT relative to GDP has halted in recent years in eight industrialized countries, including the US.⁷⁵ According to U.S. Chamber of Commerce analysis (based on US Energy Information Administration data), the importance of travel as a component of the US economy has been declining since the early 1990s and is expected to continue to decline through 2030 (Figure 4).⁷⁶

75. Millard-Ball, Adam and Schipper, Lee (2010), "Are We Reaching Peak Travel? Trends in Passenger Transport in Eight Industrialized Countries", *Transport Reviews*, November 2010.

76. U.S. Chamber of Commerce, *Index of U.S. Energy Security Risk: Metrics and Data Tables*, 2010 edition, p. 35. <http://www.energyxxi.org/reports/Datatables.pdf>

Figure 3. Historical Growth of Total On-road VMT and GDP



Data Sources: VMT: US DOT, BTS, Table 1-32: US Vehicle Miles, FHWA Traffic Volume Trends August 2010. GDP: BEA National Income and Product Account Table, Table 1.1.6 Real GDP, Chained (2005) Dollars

Beyond GDP

Transportation is vital to the production and exchange of goods and services. But excessive travel is more likely to be an economic detriment than a benefit. Ironically, GDP counts as economic productivity many of the counter-productive aspects of motorized travel, such as fuel consumed waiting in traffic jams,⁷⁷ oil spills, vehicle repairs and medical treatment resulting from collisions, costs of air pollution, and defense operations to protect US petroleum interests around the world. In fact, many costs of sprawling land use patterns (particularly increased infrastructure) themselves boost GDP figures. As far as the economic health of individuals and households goes, we should ask whether the increased driving associated with a lack of viable alternatives is creating an unnecessary economic burden, while imposing opportunity costs in terms of time lost and impacts on quality of life.

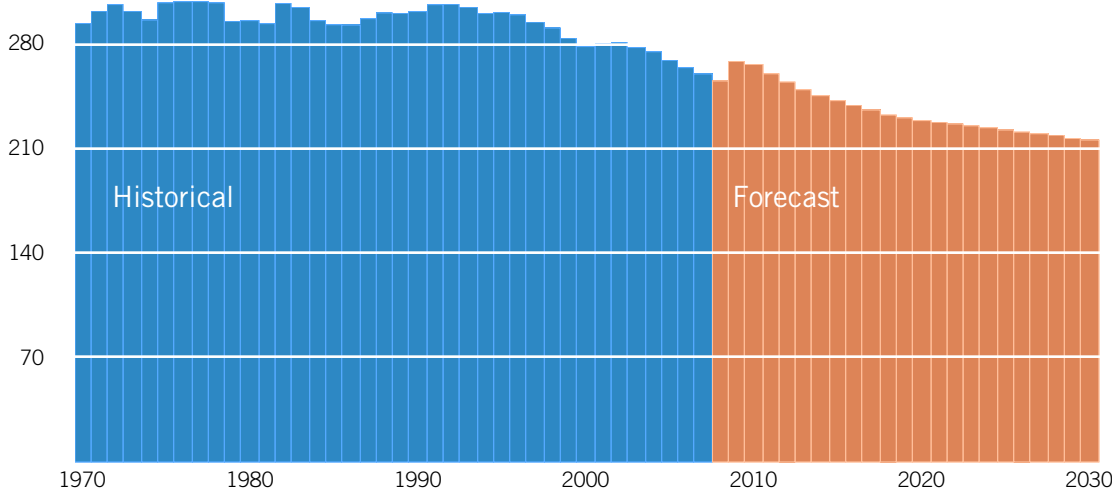
According to U.S. Chamber of Commerce analysis, the importance of travel as a component of the US economy has been declining since the early 1990s, and is expected to continue to decline through 2030.

77. The 2009 Annual Urban Mobility Report published by the Texas Transportation Institute placed the total amount of fuel wasted in the US due to traffic congestion at 2.8 billion gallons for the year 2007. <http://mobility.tamu.edu/ums/report/>

78. Ben S. Bernanke, "The Economics of Happiness" (speech, commencement ceremony at the University of South Carolina, Columbia, SC, May 8, 2010).

Today some economists are working to enhance the GDP yardstick, adopting a more nuanced approach to assessing the effects of policies on people's lives. As Federal Reserve Chairman Ben Bernanke recently argued: "Notwithstanding that income contributes to well-being, the economics of happiness is also a useful antidote to the tendency of economists to focus exclusively on material determinants of social welfare, such as the GDP."⁷⁸ Researchers and practitioners are seeking to shift from measures that emphasize production

Figure 4: Travel Intensity of the US Economy: VMT per \$1,000 GDP (1970-2030)



Source: U.S. Chamber of Commerce, Index of U.S. Energy Security Risk: Metrics and Data Tables, 2010 edition, p. 35. <http://www.energyxxi.org/reports/Datatables.pdf>

to those that gauge multiple facets of well-being, such as real household income and consumption, income distribution, health, education, social relationships, environmental impacts and economic security.⁷⁹

A commission created by French president Nicolas Sarkozy and chaired by former World Bank Chief Economist Joseph Stiglitz recently reviewed the state of statistical information used to design and evaluate public policies. The commission’s report noted,

“[E]mphasizing well-being is important because there appears to be an increasing gap between the information contained in aggregate GDP data and what counts for common people’s well-being.... [GDP] has often been treated as if it were a measure of economic well-being. Conflating the two can lead to misleading indications about how well-off people are and entail the wrong policy decisions.”⁸⁰

Income Distribution and VMT

Viewed through the prism of income distribution, for example, the assumption of a positive VMT/economy relationship quickly loses its salience. Between 1969 and 2001 in the US, average annual VMT per household increased by 71%,⁸¹ while the mean household income for the bottom three quintiles (that is, for 60% of all households) increased by only 18%.⁸² Mean household income for the top quintile increased by 66%. During the same period, GDP rose by an impressive 166%, but because income inequality also increased, the gains

The experience for most Americans from 1969 on was one of driving substantially more, but not sharing proportionately in income growth.

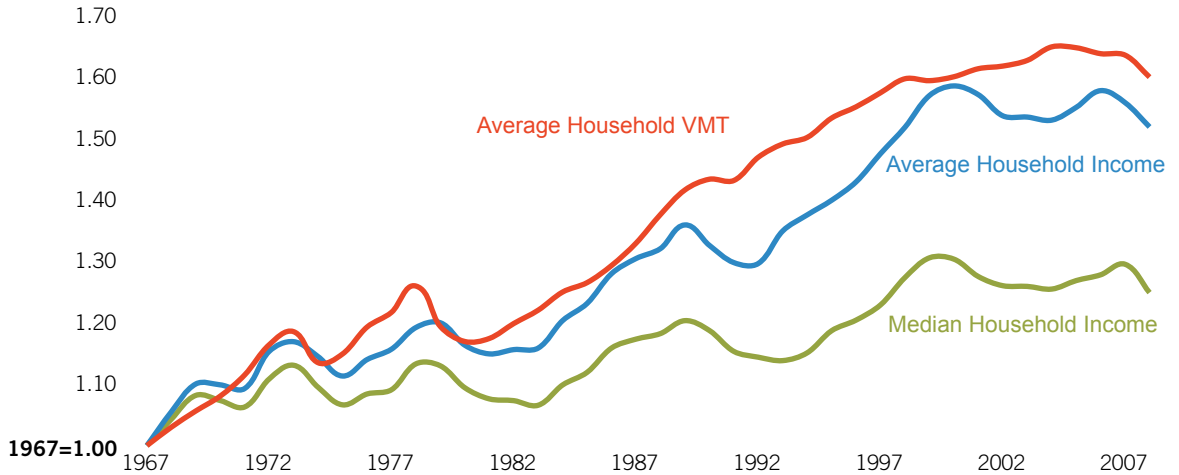
79. See for example Herman Daly, *Beyond Growth: The Economics of Sustainable Development*, (Boston: Beacon Press, 1996). Also see Dieter Helm and Cameron Hepburn, editors, *The Economics and Politics of Climate Change*, (New York: Oxford University Press, 2009)

80. Joseph E. Stiglitz, Amartya Sen and Jean-Paul Fitoussi, “Report by the Commission on the Measurement of Economic Performance and Social Progress” September 2009, http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf

81. Derived from Pat S. Hu and Timothy R. Reuscher, “Summary of Travel Trends: 2001 National Household Travel Survey,” US Department of Transportation, Federal Highway Administration, December 2004. <http://nhts.ornl.gov/2001/pub/STT.pdf>

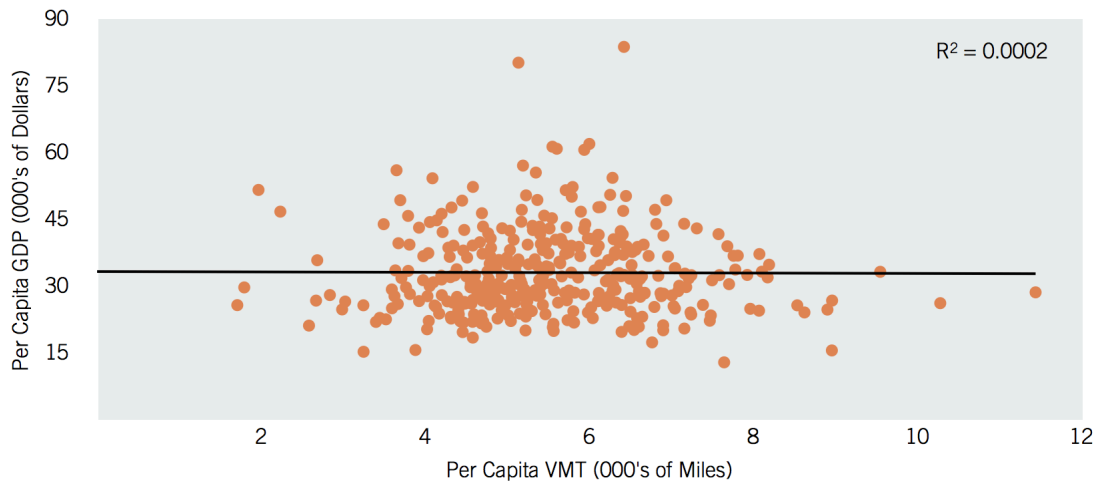
82. Derived from Carmen DeNavas-Walt, Bernadette D. Proctor and Jessica C. Smith, “Income, Poverty, and Health Insurance Coverage in the United States: 2008,” US Census Bureau, September 2009. <http://www.census.gov/prod/2009pubs/p60-236.pdf>

Figure 5: U.S. Household VMT and Income (1967-2008)



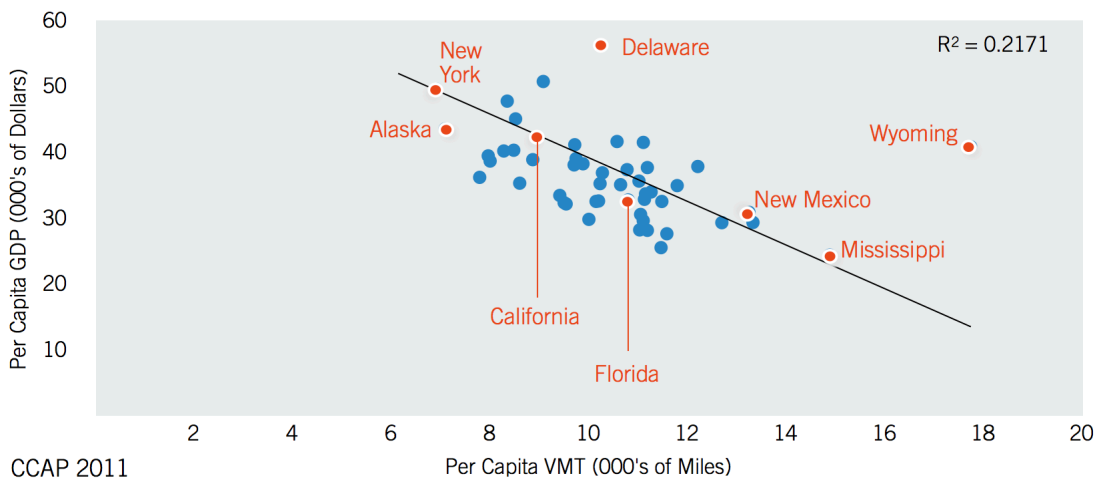
Source: US Census Table H-5. Race and Hispanic Origin of Householder – Households by Median and Mean Income, www.census.gov/hhes/www/income/data/historical/household/index.html; HH VMT calculated by CCAP using: US DOT Table 1-32: US Vehicle Miles, www.bts.gov/publications/national_transportation_statistics/html/table_01_32.html; U.S. Households, Families, and Married Couples, 1890–2007, <http://www.infoplease.com/ipa/A0005055.html#axzz0ys3tXCAW>

Figure 6. Per capita GDP and Annual VMT for US Metro Areas (2007)



Source: Bureau of Economic Analysis, U.S. Department of Commerce, BEA, Real GDP by state (millions of chained 2000 dollars), <http://www.bea.gov/regional/gsp/> and FHWA HPMS, CCAP custom data request. August 2009

Figure 7. Per capita GDP and VMT for US States (2008)



Source: Bureau of Economic Analysis, U.S. Department of Commerce, BEA, Real GDP by state (millions of chained 2000 dollars), <http://www.bea.gov/regional/gsp/> and FHWA Highway Statistics, 1997-2008, Table VM-2, <http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.cfm>

accrued primarily to upper income households.⁸³ In other words, the experience for most Americans during those 30 years was one of driving substantially more but not sharing proportionately in income growth, as Figure 5 illustrates by including the median household income. The transition to a dispersed urban form has required more household driving to get to work and gain access to basic needs; this type of driving has not proportionately contributed to quality of life in the form of increased incomes for most people.

While travel is essential to economic productivity, many of the additional miles we are forced to drive simply because of the layout of our cities and a lack of options might be dubbed “empty miles”.

Metropolitan and State Level VMT and GDP Trends

While national VMT rates and GDP tracked similar patterns after World War II, VMT rates vary far more widely across geographic areas than do rates of economic output (Table 3). When looking at VMT and GDP across metro areas, the data indicate no discernable pattern connecting high rates of driving with increased economic output (Figure 6).

At the state level, CCAP and others have found a *negative* relationship between vehicle travel and productivity (Figure 7); that is, many states with higher VMT per capita actually performed worse economically than those with lower rates of driving.^{84, 85} Figure 5 clearly shows the negative tendency, although the statistical correlation (R^2) is not strong in this example. Clearly multiple factors are at play and will require more research to better understand these relationships.⁸⁶

Economically Productive Miles, or “Empty Miles”?

While travel is essential to economic productivity, many of the additional miles we are forced to drive simply because of the layout of our cities and a lack of options might be dubbed “empty miles”. In its strategic planning document, “Smart Mobility 2010”, the California Department of Transportation proposed a framework to gauge and improve the state transportation system’s efficiency, congestion and productivity by breaking down VMT into four categories:

- Sustaining** – Travel essential to the household economy (work, school, shopping etc);
- Productive** – Movement of goods and people essential for state or regional economic vitality;
- Induced** – Increases in car travel resulting from changes in development patterns and/or infrastructure investment [a form of “empty miles” –Ed.]
- Managed** – Vehicle travel that could be reduced through Best Management Practices.⁸⁷

We suggest this scheme could also be usefully applied to household- or community-level analysis. Willa Cather once said, “The end is nothing, the road is all.” This may be instructive philosophically, but in the world of transportation policy, arrival at destination is what really matters (pleasure trips and joy riding aside). Teasing apart the different kinds of travel that make up overall VMT helps in assessing the value that

83. Derived from “Current dollar and ‘real’ GDP,” Bureau of Economic Analysis: National Economic Accounts. <http://www.bea.gov/national/xls/gdplev.xls>

84. S. Winkelman & A. Amey, “VMT & the Economy: What’s going on here?” slide 16. CCAP September 2009. [http://www.ccap.org/docs/fck/file/Winkelman%20-%20VMT%20and%20Economy%20\(9_10_09\).pdf](http://www.ccap.org/docs/fck/file/Winkelman%20-%20VMT%20and%20Economy%20(9_10_09).pdf)

85. Todd Litman, “Evaluating Transportation Economic Development Impacts: Understanding How Transport Policy and Planning Decisions Affect Employment, Incomes, Productivity, Competitiveness, Property Values and Tax Revenues,” Victoria Transport Policy Institute, March 2010. http://www.vtpi.org/econ_dev.pdf

86. Of note, current research by B. Starr McMullen of Oregon State University is examining the relationship between VMT and economic activity, controlling for metropolitan specific factors that might influence economic health. <http://otrec.us/project/417>

87. California Department of Transportation, “Smart Mobility 2010: A Call to Action for the New Decade,” February 2010. <http://www.dot.ca.gov/hq/tpp/offices/ocp/smf.html>; and Jerry Walters, e-mail communication, March 23, 2010.

US Metropolitan Area	2005 VMT per capita
New York-Northern New Jersey-Long Island	5,889
Honolulu	6,680
Las Vegas-Paradise	7,408
Chicago-Naperville-Joliet	7,540
Los Angeles-Long Beach-Santa Ana	7,672
Seattle-Tacoma-Bellevue	8,552
San Francisco-Oakland-Fremont	8,779
Phoenix-Mesa-Scottsdale	9,097
Dallas-Fort Worth-Arlington	9,693
Detroit-Warren-Livonia	9,958
Columbus, OH	10,848
Columbia, SC	11,351
Oklahoma City	12,325
Bakersfield, CA	13,128
Jacksonville, FL	13,160
Top 100 Metro Area average	9,078
US average	10,083

Table 3. Per capita VMT for 15 metropolitan areas (2005)

Adapted from "Vehicle Miles Traveled (VMT)," Brookings Institution, <http://www.brookings.edu/reports/2008/-/media/4DD7C188F57849CC8390ED686CAB3A26.ashx>.

institutions as well as individuals get out of their built environment.

For decades, house-hunting families were admonished to "drive 'til you qualify" for an affordable mortgage. But with the rising cost of transportation, that equation has fallen out of balance, a phenomenon documented by the Housing + Transportation Affordability Index created by the Center for Neighborhood Technology.⁸⁸ The

index, covering more than 330 metropolitan areas in the US, takes into account variables like residential and job density and transit connectivity, and includes both the costs of both commuting and other routine household travel. The analysis shows that in many cases, the cost of driving long distances more than offsets the higher home prices typical of closer-in areas. This is especially true for lower-income families, as shown in Figure 8.

The notion of sustainability is challenging to quantify because it necessarily involves forecasting future costs and conditions, and assigning values to desirable outcomes for which no current market value exists, such as GHG reductions, leisure time, social equity or social connectivity. Some organizations have begun using techniques such as the Sustainable Return on Investment (SROI) model, developed by David Lewis of HDR, Inc, to account for externalities (positive and negative) that otherwise are overlooked in standard cost-benefit studies. Such a model tries to monetize many of the hidden costs and benefits of investing money in a given project. By looking at changes in GHG and air contaminant emissions, health and safety effects, water saved, productivity and so on, this type of analysis helps reveal economic, environmental and equity effects of decisions. A schematic overview of one SROI model is shown in Figure 9.

Beyond the aspects of wealth considered above are the broader views of what should be measured and pursued. Within the health care bill passed earlier this year Congress provided for the establishment of a Key National Indicator System. The National Academy of Sciences, in partnership with the non-profit State of the USA⁸⁹ will make available as a public service more than 300 statistical measurements of the country's social, economic and physical trends.⁹⁰ This national effort, along with the work done over the past two decades by many local and state jurisdictions to create their own multi-faceted "prosperity indices," will provide decision-makers with powerful and readily available tools for a subtler understanding of transportation and land use policies, the ways they interact, and their impact on people's daily lives. And, across the pond, the UK Office of National Statistics is currently developing an index to gauge general wellbeing, or happiness.^{91, 92}

88. Center for Neighborhood Technology, "The Housing + Transportation Affordability Index." <http://htaindex.cnt.org/index.php>

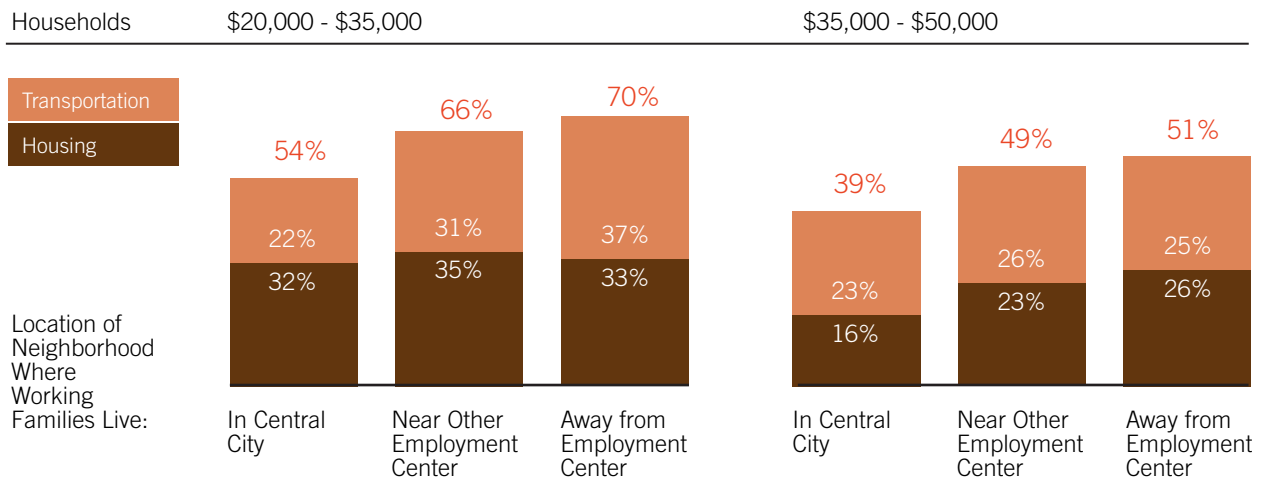
89. The State of the USA. <http://www.stateoftheusa.org/>

90. Jon Gertner, "The Rise and Fall of the G.D.P.," *New York Times Magazine*, 10 May 2010, <http://www.nytimes.com/2010/05/16/magazine/16GDP-t.html?hpw>

91. Allegra Stratton, "Happiness index to gauge Britain's national mood," *The Guardian*, 15 November, 2010. <http://www.guardian.co.uk/lifeandstyle/2010/nov/14/happiness-index-britain-national-mood>

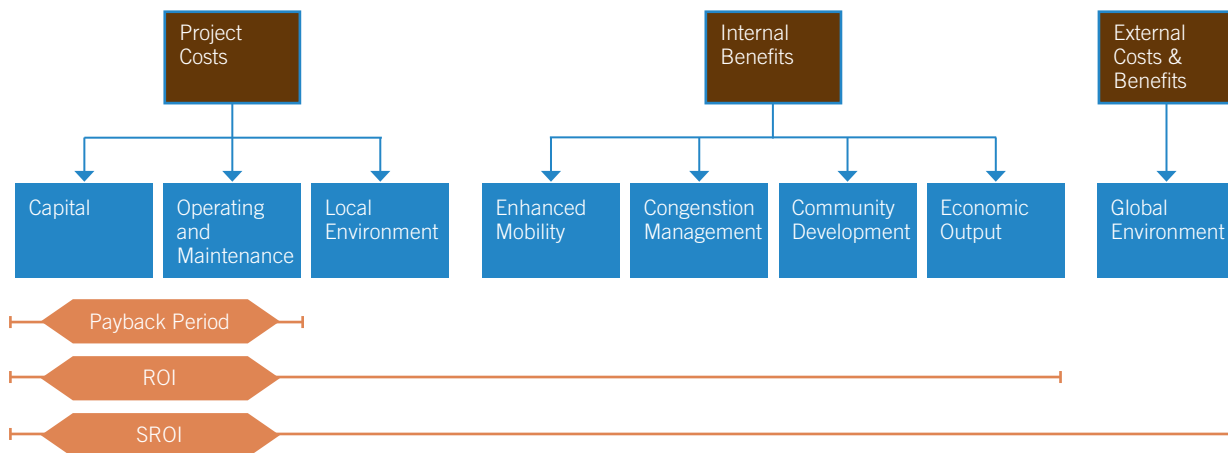
92. Jennifer Thomas and Joanne Evans, "There's more to life than GDP but how can we measure it?" *Economic & Labour Market Review*, Vol 4, No 9, September 2010.

Figure 8. Share of Income Spent on Housing and Transportation



Source: Barbara J. Lipman, "A Heavy Load: The Combined Housing and Transportation Burdens of Working Families." Washington: Center for Housing Policy, October 2006. http://www.cnt.org/repository/heavy_load_10_06.pdf. Note: employment centers are job locations with a minimum of 5000 employees.

Figure 9. Framework for Measuring Sustainable Return on Investment



Source: Metropolitan Transit Authority Stat of New York, "Greening Mass Transit and Metro Regions: The Final Report of the Blue Ribbon Commission on Sustainability and the MTA," January 2009. <http://www.mta.info/sustainability/pdf/SustRptFinal.pdf>



marco fusi

The 10 Principles of Smart Growth and Their Economic Impacts

B

earing in mind the limitations of conventional economic metrics in assessing the full value of less car-dependent development patterns, we turn now to analysis of how the application of smart growth principles performs terms in those conventional terms: property values, infrastructure costs, fuel expenditures, jobs, etc.

Each section below describes ways in which implementing a smart-growth principle can bring about economic benefit to families, businesses and communities. These benefits come in three different varieties:

Returns on Investment, such as increased property values and rents, job creation, higher tax revenues, attracting other investment to the area, and so on.

Savings on Expenditures for households and local government, including reduced costs for transportation time and fuels, infrastructure construction and maintenance, health care, water, police and fire services, etc.

Quality of Life Improvement, including access to a diversity of restaurants and shops, parks and open space, street trees, lively public spaces, sidewalks, bike paths, and public transportation. (Some quality of life improvements have been quantified in studies; others are difficult to measure but can be judged qualitatively.)

The evidence shows that smart growth can make money. The **returns on investment** are at least comparable to – and in many cases better – than that of conventional development.

Beyond this, smart growth can also save money. Costs are reduced and the **savings on expenditures** for households and local government on gasoline, health care, road maintenance and a host of other defensive expenditures can then be cycled into the economy as socially-beneficial spending or reduced taxes.

Finally, the non-monetary **quality of life improvements** from well-planned development will raise the standard of living in ways that, while not seen in the GDP, could be revealed in happiness measures or other metrics of well-being.

The examples found for each principle come from many sources. Although long-term regional plans often attempt to encompass all ten smart growth principles, individual projects often follow only a few. Many principles have not been studied in isolation. A number of examples of case studies that combine several smart growth principles are available in the references listed in the appendix at the end of this paper.

Growing the Economic Pie – or Just Moving the Pieces?

The economic benefits of smart growth will not accrue evenly. As the examples in this paper make clear, communities that pursue smart growth principals stand to gain more than communities that do not and often compete better for jobs and businesses. When attempting to determine overall economic benefits it can be challenging to determine what is a “transfer” from one community to another and what increases net prosperity.

As an example, consider the intensive smart-growth development in Arlington Virginia, mentioned above, that has helped reduce per-capita driving levels. Would the economic impacts have been different if the 23 million square feet of new commercial space and 28,000 new housing units built in Arlington over the past 30 years had instead gone to more suburban locations?

On the one hand, business owners would still realize profits if they put up shop in Fairfax County, and Fairfax would enjoy increased tax revenues instead of Arlington. Economists refer to this as a transfer of benefits and would conclude that there is no net economic gain.

On the other hand, as documented in this report, with conventional development patterns we could expect higher infrastructure costs, higher fuel bills, hindered worker access to jobs and more limited market reach for businesses than in a smart-growth scenario. Moreover, under conventional growth we could expect greater vulnerability to rising oil prices, lower rates of walking, higher health care costs, higher GHG emissions and greater ecosystem disruption. Thus, a narrow view of the impact of smart growth on local government might only reveal the ubiquitous competition for tax revenues. But a broader perspective reveals a tremendous range of prosperity benefits.

Moreover, communities that do not pursue smart growth – but are proximate to ones that do – stand to benefit from improved access to jobs, services and community spaces. Further research and analysis will allow for better assessment of the multiple impacts and benefits of different development patterns. Nevertheless, the preponderance of evidence makes it clear that smart growth pays and smart growth saves.

Principle 1: Create a Range of Housing Opportunities and Choices.

Providing quality housing for people of all income levels is an integral component in any smart growth strategy.⁹³

Color Key:

Return on Investment
Savings on Expenditures
Improved Quality of Life

Business Benefits	Household Benefits	Regional Benefits	National Benefits
Access to new markets	Save on travel costs	Reduced exposure to congestion	Energy security
Construction jobs	Better access to jobs		Reduced GHGs
	Affordable housing		

As noted earlier, locating households of varying types and income levels in accessible areas can reduce their combined housing and transportation costs. In particular, opportunities for lower income families to live closer to jobs can result in better employment rates and higher incomes. Putting more people near jobs in general, i.e., achieving a jobs/housing balance, can also reduce VMT through shorter trip lengths, and lessen *exposure to* congestion. Constructing housing for all price points has the potential to meet an untapped market demand, thus creating jobs in construction and attracting additional residents and employers.^{94, 95, 96, 97}

For many years, our nation’s de facto housing policy was to supply infrastructure predominantly for one housing type – the stand-alone house – and to keep homes “affordable” by building on cheap land farther and farther from job centers. That equation has collapsed in most regions in recent years. In 2009 the Urban Land Institute published a study of the average household combined housing and transportation costs in the metropolitan Washington DC region. In *Beltway Burden*, they found that combined housing and transportation costs are lowest in the central jurisdictions of the DC region. Households spent about 30% of their income on housing plus transportation in the central jurisdictions whereas in the outer suburbs they spent over 40%.⁹⁸

Residents’ attempts to reduce their housing costs by relocating further to the urban fringe were frustrated by higher transportation costs; in the Washington Metro region, “transportation cost increases begin to exceed housing savings when families locate roughly 15 to 17 miles from employment centers.”⁹⁹ Figure 10 shows the way these costs add up. By taking

93. The 10 Smart Growth Principles in this section and the italicized descriptions immediately following each are taken from the Smart Growth Network’s web page <http://www.smartgrowth.org/engine/index.php/principles/>

94. Leinberger, Christopher. *The Option of Urbanism: Investing in a New American Dream*. Island Press, 2007.

95. Nelson, A.C. “Leadership in a New Era.” *Journal of the American Planning Association* 72 (2006): 393-407.

96. *Growing Cooler* (Ewing, et al, 2008), *op. cit.*

97. Thomas, John V. “Residential Construction Trends in America’s Metropolitan Regions.” U.S. Environmental Protection Agency. January 2009.

98. Urban Land Institute Terwilliger Center for Workforce Housing, *Beltway Burden: The Combined Cost of Housing and Transportation in the Greater Washington, DC, Metropolitan Area*, (Washington, 2009). <http://commerce.uli.org/misc/BeltwayBurden.pdf>

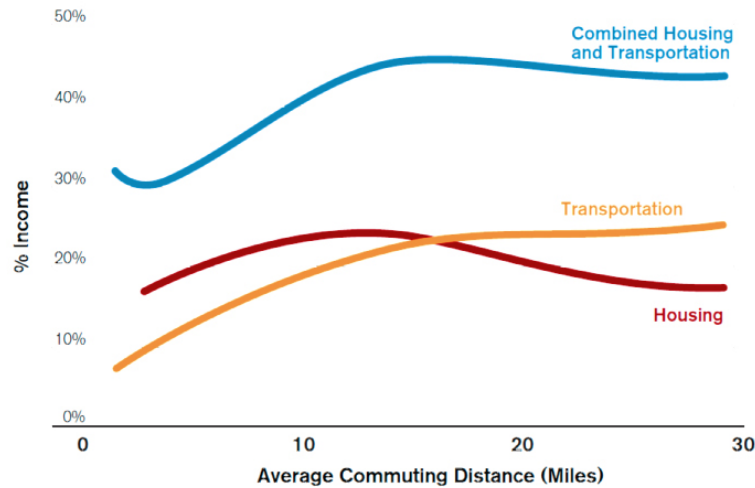
99. *Ibid*, p. 6

steps to increase housing options near public transit stops and in more centrally located neighborhoods, local governments can thus create opportunities for more households to reduce their combined housing-transportation burden.

In the course of the suburbanization of the last several decades, job centers emerged in suburban locations with little or no public transportation service, far from neighborhoods with housing affordable to lower-wage workers. In the wake of welfare reform in the 1990s, the federal government began a program to provide those workers transportation to suburban jobs from central-city neighborhoods. A report on that program, the Job Access and Reverse Commute program (JARC), found that it helped many workers and their families avoid poverty. Those already working earned 40% more because they now have the flexibility to take jobs with varying hours or pick up extra shifts. Providing transit connections to get low-wage workers to suburban jobs not only helped those families, it boosted government coffers through avoided assistance and the potential for tax receipts on higher income, and saved on the external costs associated with all workers driving to those jobs – congestion, pollution, etc. Successful though the effort has been the evidence indicates that the savings would be exponentially greater if more affordable housing were built near employment centers so that workers could live in closer proximity to their jobs. The opportunities to build this housing, as well as homes for the more-affluent, is emerging in the trend toward redeveloping parking lots and fallow shopping centers in suburban “edge cities” and commercial corridors to be more like traditional town centers and walkable neighborhoods.

Indeed, the market for new housing appears to be shifting away from conventional suburban products and toward these traditional configurations, what Christopher Leinberger of the Brookings Institute and others have called “walkable urbanism”. The market strength of these locations has shown up recently in the real estate recession, as they have tended to hold value better than other locales. Leinberger has performed a new analysis of real estate data and found that, as a rule of thumb, housing prices in automobile-oriented, fringe Zip Codes have fallen at twice the rate of their metropolitan average since the peak of 2006.

Figure 10. Housing and Transportation Cost Burdens by Commute Distance



Source: Urban Land Institute Terwilliger Center for Workforce Housing, Beltway Burden: The Combined Cost of Housing and Transportation in the Greater Washington, DC, Metropolitan Area (2009)

Home values in walkable urban areas have dropped by only half the regional rate. In other words, if regional housing prices fell by 4% over all, housing prices would have fallen by 8% in exurban areas and by 2% in areas with easier access to job centers.

Leinberger notes that these recent developments reverse the trend of the previous few decades. As recently as 2000, the most expensive houses in a metro area tended to be in the suburbs in the sector that had attracted executive housing and corporate offices, what he calls the “favored quarter”. “By 2010,” he writes, “after the boom and bust experienced in housing prices during the decade, many metropolitan areas saw the most expensive housing prices on a price per square foot were in walkable, urban locations. The lines crossed during the decade. The last time this happened was probably in the 1950s and 1960s but the trend lines were going in the opposite direction.”¹⁰⁰

Allowing more people, of all incomes, to live closer to job centers can boost employment rates and incomes levels for low-wage workers while reducing exposure to congestion for all workers.

100. Chris Leinberger, email communication, Oct 11, 2010.

Principle 2: Create Walkable Neighborhoods.

Neighborhoods are walkable when destinations are easily reachable from homes, and street networks are designed for the safety and convenience of people on foot or bicycle.

Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits	National Benefits
Meets new demand for walkable product	Health care savings	Generates more public revenue per acre	Reduced exposure to congestion	Health care savings
Higher property values	Save on travel costs			Energy security
Improves environment for small businesses	Access to goods, services			
Employee health care savings	Feeling of community			

Color Key:

- Return on Investment
- Savings on Expenditures
- Improved Quality of Life

Attention to the design of sidewalks and streetscapes can foster a sense of community by providing safe shared spaces for neighbors to interact. This is often reflected in property values. Walkable neighborhoods can also increase outdoor exercise rates by encouraging “active travel”, substituting walking or bicycling for trips otherwise made by car.¹⁰¹ Active travel not only reduces VMT but has been linked to better health, which in turn has its own economic benefits.

We noted above the market trends now favoring mixed-use, walkable town centers and neighborhoods. The link between walkability and improved real estate value has been demonstrated most recently in a pair of studies using the walkability index created by WalkScore.com.¹⁰² The Walk Score algorithm computes the walkability of a specific address based on distance to daily needs and amenities (businesses, parks, schools, etc.) and assigns the location a score on a scale of 0 to 100. Walk Score values are now regular components of residential real estate listings on websites such as Zillow, ZipRealty and MyNewPlace. A 2009 study by Gary Pivo and Jeffrey D. Fisher found that walkability was associated with higher value for all types of properties. Table 4 shows the average market value, net operating income and other benefits to a property of having a Walk Score of 80 compared to a property having a Walk Score of only 20.¹⁰³ An analysis by economist Joe Cortright for CEOs for Cities found that when controlling for other variables, high Walk Score values had a significant positive effect on housing prices in 13 of 15 cities surveyed.

101. For a detailed discussion of whether residents of walkable neighborhoods are “self selected” proponents of walking, see *Growing Cooler* (Ewing, et al, 2008) Chapter 5.

102. Walk Score. <http://www.walkscore.com/>

103. Gary Pivo and Jeffrey D. Fisher, “Effects of Walkability on Property Values and Investment Returns.” Working Paper, Responsible Property Investing Center and Benecki Center for Real Estate Studies, August 2009. <http://www.u.arizona.edu/~gpivo/Walkability%20Paper%208.4%20draft.pdf>

Table 4. Summary of Results for Walk Scores of 80 vs. 20

Property Type	Market Value	Net Operating Income	Appreciation per quarter	Income Return per quarter	Total Return per quarter
Office	+54%***	+42%***	1.92%*	--	--
Retail	+54%***	+42%***	--	-0.72%**	--
Apartments	+6%**	--	--	-0.54%***	--
Industrial	--	--	--	--	--

* = sig. at .05 level ** sig. at .01 level *** = sig. at .001 level -- = insignificant effect

Source: Gary Pivo and Jeffrey D. Fisher, "Effects of Walkability on Property Values and Investment Returns."

The study found that in the typical city, a one-point increase in Walk Score correlated with an increase in housing values of \$700 to \$3000.¹⁰⁴

Walkability has other economic benefits as well. Urban configurations that allow residents and workers to avoid trips they would otherwise take by car save money both for travelers and communities. A 1999 study by Todd Litman of the Victoria Transportation Policy Institute estimated that for each trip not driven, society saves between \$1 and \$3.50 in avoided costs associated with congestion, road maintenance, parking, pollution, noise, safety and other environmental costs.¹⁰⁵ In 2009 the National Research Council published a report monetizing the damage of major air pollutants – sulfur dioxide, nitrogen oxides, ozone, and particulate matter – on human health, grain crops and timber yields, buildings, and recreation. They assigned a cost to society due to motor vehicles and fuels ranging from 1.2 cents to about 1.7 cents per mile traveled,¹⁰⁶ equivalent to \$0.35 to \$0.50 per gallon (at 30 mpg).

The cost of traffic injuries and deaths may be reduced significantly in walkable communities. Street networks that are designed with the safety and convenience of all users – motorists, pedestrians and cyclists – in mind have been shown to be safer for everyone who uses them. Although one might expect that walking in cities increases exposure to the danger of being hit by a vehicle, walkable communities have been found to be safer for pedestrians on a per mile walked basis. A 2009 report from Transportation for America made the point clearly.¹⁰⁷ The study uses a Pedestrian Danger Index (PDI), in order to establish a level playing field for comparing metropolitan areas based on the danger to pedestrians. The PDI corrects for the fact that the cities where more people walk on a daily basis are likely to have a greater number of pedestrian fatalities, by computing the rate of pedestrian deaths relative to the amount of walking residents do on average.

The PDI shows that the most dangerous places to walk are those that fail to make smart infrastructure investments that make roads safer for everyone. The most dangerous metropolitan areas in the U.S. for walking in 2007-2008 were: Orlando, Tampa, Miami, Jacksonville, Memphis, Raleigh, Louisville, Houston, Birmingham and Atlanta. Orlando tops the list because of its high pedestrian fatality rate of 2.9 pedestrian deaths per 100,000 residents, despite a very low

104. Joe Cortright, "Walking the Walk: How Walkability Raises Home Values in US Cities" CEOs for Cities, 2009. <http://www.ceosforcities.org/pagefiles/WalkingTheWalk-CEOsforCities.pdf>

105. Todd Litman, "Traffic Calming Benefits, Costs and Equity Impacts" Victoria Transport Policy Institute, 1999 <http://www.vtppi.org/calming.pdf>

106. National Research Council Committee on Health, Environmental, and Other External Costs and Benefits of Energy Production and Consumption, "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use," October 2009, http://www.nap.edu/catalog.php?record_id=12794

107. Transportation for America, "Dangerous By Design: Solving the Epidemic of Preventable Pedestrian Deaths (and Making Great Neighborhoods)," 2009. <http://t4america.org/resources/dangerousbydesign/>

proportion of residents walking to work, only 1.3 percent. In other words, the few people who do walk in Orlando face a relatively high risk of being killed by traffic, due largely to the automobile-centric design of the road network.

In 2003, Reid Ewing, et al. created a sprawl index of 448 US counties in the largest 101 metropolitan areas and applied regression analysis to determine associations between the index and traffic fatalities. They found that for every 1% increase in the index toward more compact development, traffic fatality for all users fell by 1.5% and pedestrian fatality rates fell by as much as 3.6%, after adjustment for local rates of walking.¹⁰⁸ New York City, which had the most compact urban form, had 4.4 traffic fatalities per 100,000, while more-sprawling places like Atlanta or Richmond, VA had higher fatality rates of 19.8 and 38.5 per 100,000, respectively. In another analysis, the Brookings Institution recently showed that as VMT declined due to the recession, traffic fatalities declined as well, representing a significant cost savings to society for each fatality prevented.¹⁰⁹

Public health officials believe that increasing the level of physical activity would provide great dividends in public health. In fact, the Centers for Disease Control recommend 150 minutes of moderate aerobic activity, like walking, each week for adults.¹¹⁰ Lawrence Frank and colleagues have conducted several studies that show community walkability is associated with active travel, lower body mass index (BMI), reduced VMT and reduced emissions per person. In Seattle, a 5% increase in the overall level of walkability was associated with a 32% increase in minutes of active transport and about one-quarter-point reduction in BMI.¹¹¹ A similar study in Atlanta found walkability to be a significant factor in explaining the number of minutes per day of moderate physical activity. Residents of the most walkable environments in Atlanta were found to get approximately 37 minutes of moderate activity per day, whereas residents of the least walkable environments got only 18 minutes.¹¹²

A before-and-after study in Charlotte North Carolina found that the use of light rail and increased physical activity are associated with a nearly 1.2 point reduction in body mass index and an 81% reduction in the likelihood of becoming obese;¹¹³ another study estimates annual health care savings of \$1.4 million from light rail in Charlotte.¹¹⁴ A Florida study calculated that smart growth could cut public health costs by between \$6 and \$23 million per year.¹¹⁵ A national study found that the prevalence of obesity increased by 37 percent between 1998 and 2006, adding \$40 billion to health care costs.¹¹⁶

While more research is needed to assess the health savings associated with greater walkability, we can conclude that the impacts of walkability on public health are worthy of consideration in local, regional and national decision making.

Street networks that are designed with the safety and convenience of all users – motorists, pedestrians and bicyclists – in mind have been shown to be safer for everyone who uses them.

108. Reid Ewing, Richard A. Schieber and Charles V. Zegeer, "Urban Sprawl as a Risk Factor in Motor Vehicle Occupant and Pedestrian Fatalities," *American Journal of Public Health* 93, no. 9 (2003): 1541-1545.
109. Robert Puentes and Adie Tomer, "The Road... Less Traveled: An Analysis of Vehicle Miles Traveled Trends in the U.S." (Washington: The Brookings Institution), December 2008.
110. See <http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html>
111. Lawrence D. Frank et al., "Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality," *Journal of the American Planning Association* 72, no. 1 (2006): 75-87.
112. Lawrence Frank and Peter Engelke, "Multiple Impacts of the Built Environment on Public Health: Walkable Places and the Exposure to Air Pollution," *International Regional Science Review* 28, no. 2 (2005): 193-216.
113. MacDonald JM, Stokes R, Cohen D, Kofner A, Ridgeway G. The Effect of Light Rail on Body Mass Index and Physical Activity. *American Journal of Preventive Medicine*, 2010; 39(2):105-112, as cited in the Council of Economic Advisors (CEA), "An Economic Analysis of Infrastructure Investment," October 2010.
114. Stokes RJ, MacDonald J, Ridgeway G. Estimating the effects of light rail transit on health care costs. *Health & Place*, 2008;14(1):45-58, as cited in CEA 2010, *op. cit.*
115. Simmons, Melanie, and Darryl Crawford. "Does 'Smart Growth' Matter to Public Health Finance?" Florida State University, Healthy Communities Program, (2008).
116. Finkelstein EA, Trogdon JG, Cohen JW, Dietz W. Annual Medical Spending Attributable to Obesity: Payer- And Service-Specific Estimates. *Health Affairs*, 28, no. 5 (2009): w822-w831, as cited in CEA 2010, *op. cit.*

Principle 3: Encourage Community and Stakeholder Collaboration.

Communities are more likely to realize long-term benefits from development when growth and change conform to a shared vision, developed with the participation of all stakeholders.

Color Key:	Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits	National Benefits
Return on Investment					
Savings on Expenditures	Better information and decision making	Growth reflects community values and vision	Reduced citizen opposition to public projects	Improved regional reputation	More effective use of federal funds
Improved Quality of Life					

When citizens contribute to a plan they reveal their vision for the neighborhood or city or region, while also gaining insight into the trade-offs associated with decision making. A good planning process puts all the issues on the table: How do we grow a tax base but ensure that neighborhoods remain intact? How do we ensure we have open space while also meeting housing needs? Can we build in a spread-out fashion and still have free-flowing traffic? Once a community has thought through some of these issues, they can create zoning and urban design codes that help developers shape proposals that are likely to be approved, with greater confidence in both the risk and return of their investment.

Economist David Lewis has argued that

“It is the procedures of deliberation, and the release of peoples’ communicative instinct to allow better arguments to come into play, that precipitate the formulation of values as a basis for collective, welfare-maximizing policy making.”¹¹⁷

Amartya Sen also writes about the importance of “decision by discussion,” arguing that peoples’ values and beliefs form during discussion (rather than existing as “data” in preference studies and market research).¹¹⁸

Sacramento’s Blueprint planning process is an example of a public visioning effort that achieved high participation. The regional planning agency held numerous workshops at the regional, county, city and neighborhood levels. At the end of the workshop series, the region’s residents had created approximately 250 planning scenarios for about 60 study areas, both within existing developed districts and on open land, ranging in size from nine acres to 1,500 acres. SACOG planners then extrapolated from the results to create re-

117. Lewis, D. (2005). “The New Cost Benefit Analysis.” Paper Presented to the MacArthur Foundation. Chicago, IL.

118. Sen, A. (2009). *The Idea of Justice*. Cambridge, MA. The Belknap Press.

gional scenarios, further refined them with input from citizens and local officials, and then compiled them into coordinated regional scenarios. These regional scenarios were then again evaluated by the public, after which the SACOG policy board voted to select a preferred alternative.¹¹⁹

“If you had suggested a year ago that so many people would come out to talk about land use, we would have laughed,” Mayor Christopher Cabaldon commented to the *Sacramento Bee*.¹²⁰ Experiences like SACOG’s suggest that public participation in planning has significant benefits. Further research to assess the qualitative and quantitative benefits of community and stakeholder collaboration is warranted.

When citizens contribute to a plan they reveal their vision for the neighborhood or city or region, while also gaining insight into the trade-offs associated with decision making.

119. SACOG Regional Blueprint. “Frequently Asked Questions” <http://www.sacregionblueprint.org/faq/>

120. Mary Lynne Vellinga, “Public Turnout Greater Than Expected at Sacramento Planning Workshops,” *Sacramento Bee*, December 22, 2003.

Principle 4: Foster Distinctive, Attractive Communities with a Strong Sense of Place.

Communities are more likely to prosper when they set standards for development and construction that respond to community values of architectural beauty and distinctiveness, as well as expanded choices in housing and transportation.

Color Key:

Return on Investment	Improved Quality of Life
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Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits
Attract workers	Preserves housing values	Generates more public revenue per acre	Improved regional reputation
Enhance tourism	Feeling of community	Attracts private investment	
Construction jobs		Thriving public spaces	

Many projects that create a sense of place using smart-growth principles demonstrate economic success in the form of increased tax revenue, more jobs, higher income levels, downtown revitalization, and business growth. In some regions, well-designed districts stand out because there is a relative scarcity of similar places with pleasing architectural design, public art, tree canopy, benches, fountains or other similar amenities, so they are able to command higher rents – what some have called the “place-making premium.”¹²¹

In Washington, DC, the Barracks Row Main Street Program sought to revitalize an historic district through investment of about \$8 million to better manage parking and public transportation analysis and improve drainage and add street lighting, trees and other greenery. The vision was to create a pedestrian-friendly and ecologically smart urban corridor that would blend in with historic Capitol Hill. As a result of this investment since 1999, 44 new businesses have opened, including 12 new outdoor cafes; 200 new jobs have been created; and overall economic activity has tripled.¹²²

The International Economic Development Council published a set of case studies that demonstrate the ability of such place-making projects to generate economic returns.¹²³ Some highlights:

121. Victor Dover, “Placemaking: Creating the Product,” Environmental Protection Agency, 2009, <http://www.epa.gov/piedpage/pdf/dover.pdf>

122. Barracks Row Main Street, “2006 Annual Report,” as referenced in <http://www.completestreets.org/webdocs/factsheets/cs-revitalize.pdf>

123. Alex Iams and Pearl Kaplan (editors), “Economic Development and Smart Growth: 8 Case Studies on the Connections between Smart Growth Development and Jobs, Wealth, and Quality of Life in Communities,” International Economic Development Council, 2006, http://www.iedcouncil.org/Downloads/Smart_Growth.pdf

- Silver Spring, MD, located on a Metro rail line just outside of Washington, DC, successfully revitalized its downtown over the course of five years. A \$360 million public/private investment in a mixed-use shopping center provided the initial impetus. Part of the public money went toward renovating the historic American Film Institute Silver Theatre, an attraction that now draws thousands of visitors annually. From 1997 to 2005, Silver Spring gained almost 1 million square feet of office space, even as the office vacancy rate declined from 18% to 9.8%. Annual property tax revenue increased 30% – nearly \$1 million greater than pre-project levels.
- The Arena District in Columbus Ohio features bricked alleyways that link the arena with nearby restaurants, offices, and residential uses, and establishes seamless connections between the district and downtown. The project, funded by \$35 million in public money, leveraged \$500 million in private investment and spurred creation of thousands of jobs since opening in 2000. The site previously generated almost no tax revenue, but topped \$4 million annually after seven years.
- With \$1.2 million in public money and \$15.5 million in private investment, Paducah, Kentucky created a flourishing arts district. The project spurred creation of 97 jobs and 25 new businesses, and vacancy rates declined 46% in just 5 years.

While the effects of architectural “feel” or public art can be difficult to monetize, the environmental benefits provided by vegetation – whether in parks or on city streets – can be quantified. Urban street trees reduce air pollution. One modeling study estimated that nationwide they remove 711,000 metric tons of pollutants from the air annually, a \$3.8 billion value.¹²⁴ The US Forest service found that urban trees could increase commercial and residential property values, sometimes by 10-20%.¹²⁵ A study by the non-profit American Forests found that in Garland, Texas, the city’s tree canopy diffuses 19 million cubic feet of storm-water per major rain storm. Accommodating a similar amount of water in the storm sewer system would have required the municipal utility to build \$38 million in retention infrastructure with annual, amortized costs of \$2.8 million.¹²⁶ The same organization estimates that the Washington, DC, metropolitan area’s tree cover “has reduced the need for additional storm-water retention structures by 949 million cubic feet. ... Washington’s trees have saved the region \$4.74 billion in gray [concrete] infrastructure costs per 30-year construction cycle.”¹²⁷

Well-designed districts with pleasing architectural design and attractive, public spaces are able to command higher rents – a “place-making premium.”

124. David J. Nowak, Daniel E. Crane and Jack C. Stevens, “Air pollution removal by urban trees and shrubs in the United States,” *Urban Forestry and Urban Greening* 4 (2006): 115-123.

125. US Department of Agriculture, Forest Service Pamphlet #R1-92-100.

126. American Forests, “Local Ecosystem Analysis Garland Texas: Calculating the Value of Nature,” April 2000, http://www.americanforests.org/downloads/rea/AF_Garland.pdf

127. National Association of Local Government Environmental Professionals, Trust for Public Land and ERG, “Smart Growth for Clean Water: Helping Communities Address the Water Quality Impacts of Sprawl,” 2003 <http://www.resourcesaver.com/file/toolmanager/Custom093C337F42157.pdf>

Principle 5: Make Development Decisions Predictable, Fair and Cost Effective.

For a community to be successful in implementing smart growth, it must be embraced by the private sector.

Color Key:

- Return on Investment
- Savings on Expenditures

Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits
Lower risk of investment	Better access to jobs	Attracts private investment	Improved regional reputation
		Streamlined processes	

Streamlining the bureaucratic process for projects a community actually desires can attract investors, who value quicker turnaround and lower costs, and seek to minimize uncertainty. Montgomery County, MD, for example, created a “green tape zone” to help direct growth to downtown Silver Spring, substantially streamlining the approvals process for development projects that met community goals.¹²⁸ This was a key factor in delivering the significant economic benefits noted above.¹²⁹

In the San Francisco Bay Area, the advocacy group Greenbelt Alliance sponsors the Compact Development Endorsement team that reviews proposed development projects and serves as a channel for community input. After a comprehensive review by the Alliance, endorsed projects get a letter of support and a news release that can be used to publicize and promote the project. The Alliance actively supports some projects at hearings and other public forums. This program provides reassurance to the developers that once a project receives this endorsement it is unlikely to face additional opposition from the environmental community. Many of the projects endorsed by the Greenbelt Alliance have won state and national level awards after completion. From 1990 to 2004, the Greenbelt Alliance endorsed 95 development projects and 17 neighborhood plans that will create more than 48,000 residences within existing city limits at build-out.¹³⁰

ULI looked at the impacts of California’s SB375 law, which requires metropolitan planning organizations (MPO) to develop plans for reducing GHG emissions from transportation, and concluded that increased development certainty would be a clear benefit of the law. They said it having such plans would, “provide greater clarity and certainty to developers, and send a powerful signal to the development industry about the state’s desired direction for future growth and development.”¹³¹

128. US Environmental Protection Agency, “Smart Growth: Illustrated Green Tape Program, Silver Spring, Maryland,” <http://www.epa.gov/dced/case/greentap.htm>

129. Iams and Kaplan, 2006, *op. cit.*

130. US Environmental Protection Agency, “Smart Growth Illustrated: Compact Development Endorsement Program,” <http://www.epa.gov/dced/case/compact.htm>

131. Urban Land Institute. (June 2010). “SB375 Impact Analysis Report”. Washington, DC: The Urban Land Institute.

Principle 6: Mix Land Uses.

Allowing the mixing of residential, office and commercial uses in appropriate locations improves access while reducing the need for car travel.

Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits	National Benefits
Improves environment for small businesses	Save on travel costs	Generates more public revenue per acre	Reduced exposure to congestion	Energy security
Higher property values	Health care savings	Attracts private investment		Reduced GHG
Parking, energy, maintenance, energy and marketing savings	Enhanced vitality of public spaces	Reduced need for parking and road infrastructure		
	Access to goods, services and recreation			

Color Key:

- Return on Investment
- Savings on Expenditures
- Improved Quality of Life

A diversity of land uses can result in fiscal and economic benefits. Mixed-use developments can generate economic activity with less GHG and energy use because they put businesses and customers close together. Demand for mixed-use development is increasing. For developers, mixed land uses can save costs for parking, which often can be shared between daytime and night-time uses, and can achieve savings on maintenance, energy and even marketing. For communities, mixing land uses may also make sense from a fiscal point of view.

The National Research Council found that more compact, mixed-use development can produce reductions in energy consumption and CO₂ emissions both directly and indirectly.¹³² A study in King County, WA, showed that residents walk more in neighborhoods that provide a wide variety of retail services.

Builders and developers recognized the business opportunities in mixed use during the past decade. The National Homebuilders Association told their members in 2005 that “homebuilders and land developers should not underestimate the growing opportunities within the mixed-use sector, not just in large metropolitan areas, but also in smaller communities as well.”¹³³ By 2007 one report for a national association of commercial developers and investors explained how “financial success depends on being able to maximize and mix the uses in a way that responds to market conditions, opportunities and economics”.¹³⁴ At the

132. Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled and Energy Consumption, “Driving and the Built Environment”, Transportation Research Board, 2009

133. Edward Tombari, “Smart Growth, Smart Choices Series: Mixed-Use Development”, National Association of Homebuilders, January 2005 http://www.nahb.com/fileUpload_details.aspx?contentID=39196

134. Joseph Rabianski, J. et al, “Mixed-Use Development: A Review of Professional Literature”, The National Association of Industrial and Office Properties Research Foundation, November, 2007

end of the decade, an EPA study had found that in more than half of the largest metropolitan areas, “urban neighborhoods had dramatically increased their share of new residential building permits”. The urban share more than doubled in 15 regions and the trend was holding steady through the market downturn.¹³⁵ Leinberger and Nelson have both written about the growing and unmet market demand for walkable communities, reinforced by demographic shifts and higher fuel prices.^{136, 137}

Financial success depends on being able to maximize and mix the uses in a way that responds to market conditions, opportunities and economics.

The Urban Land Institute reports, “Mixed use development can achieve economies of scale in operation, including savings on items such as parking operations, common area maintenance, central HVAC systems and marketing and promotion.”¹³⁸ For many years ULI has offered guidance on calculating the reduction in parking needs that comes from mixed use and shared parking, which can be significantly less than the sum of individual uses.¹³⁹

Mixing land uses may help dilute the taxpayer costs of purely residential development with commercial expansion that uses the same infrastructure. For example, fiscal impact data from three Falls Church, VA, mixed-use projects indicates that they are generating approximately twice their annual service costs in revenues after five years.¹⁴⁰

135. Thomas, 2009, *op. cit.*

136. Leinberge, 2007, *op. cit.*

137. Nelson, 2006, *op. cit.*

138. Schwanke, D. et al, “Mixed Use Development Handbook” Urban Land Institute, Washington D.C. 2003

139. Urban Land Institute, “Shared Parking”, 1983, (latest revision in 2006)

140. “Mixed Use Development Fiscal Impact Comparisons”, Economic Development Office, Falls Church, VA, 2/26/09 <http://www.fallschurchva.gov/Content/Government/Council/Meetings/2009/March5/MUDFiscallImpactComparisons030509.pdf>

Principle 7: Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas.

Open space preservation helps to bolster local economies by keeping farming economically viable, guiding new growth and prosperity into existing communities and ensuring the ongoing appeal of treasured landscapes.

Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits	National Benefits
Attract workers	Preserves housing values	Green infrastructure (such as natural filtration) services replaces need for gray infrastructure	Regional reputation improves	Preserves natural habitat
Enhance tourism	Access to nature and recreation		Protect natural resources	

Color Key:

- Return on Investment
- Savings on Expenditures
- Improved Quality of Life

Open space can raise the value of nearby property. Natural open space areas within or near cities can attract not only tourism but retirees and businesses wanting to relocate to attractive communities. Working farmland helps promote local food production and brings in more revenue than it costs in public services. Natural open space also provides a number of “natural services” that would otherwise either cost society money to provide artificially or cost society money due to their lack. Finally, open space can offer a psychological escape valve for those seeking respite from the stresses of modern life.

A 1997 paper by Fausold and Lileholm offered a framework of different concepts of economic value in relation to open space and described methods for quantifying those values. Their concepts include market value, enhancement value, production value, natural system value, use and non-use value and intangible values.¹⁴¹

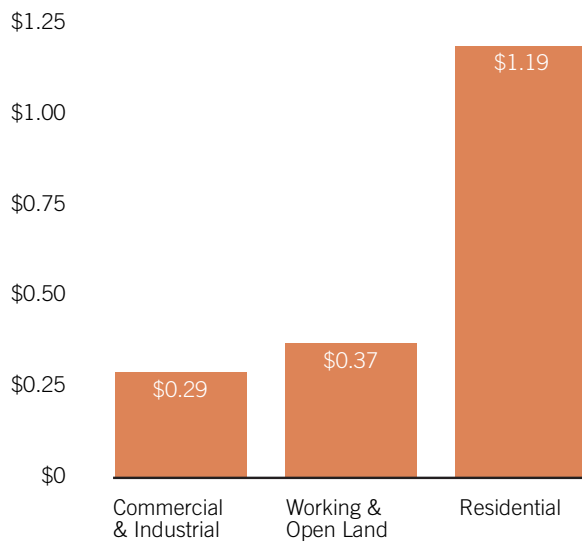
Conservation lands often provide “enhancement value” to adjacent or nearby properties. A joint US-UK study found that houses near parks and other open spaces sell at prices 5-20% higher than comparable houses located further away.¹⁴² Attracting business and new residents is another form of enhancement value. In a report done for the Trust for Public Land in 2006, John L. Crompton reviewed research on the hypothesis that businesses and retirees move to an area because there are open space amenities.¹⁴³ He found a strong case for designing communities with such amenities in order to attract these key constituencies. For

141. Charles J. Fausold and Robert J. Lillieholm, “The Economic Value of Open Space: A Review and Synthesis”, *Environmental Management*, Vol 33, No. 3, (1999): 307-320 <http://www.agecon.ag.ohio-state.edu/class/aede680/irwin/pdf/64.pdf>

142. Neil Dunse, Michale White and Carolyn Dehring, “Urban Parks, Open Space and Residential Property Values.” *RICS Research Paper* Volume 7, Number 8. 2007. www.rics.org/site/download_feed.aspx?fileID=5728&fileExtension=PDF

143. John L. Crompton, “Competitiveness: Parks and Open Space as Factors Shaping a Location’s Success in Attracting Companies, Labor Supplies, and Retirees”, in *Economic Benefits of Public Spaces*, Trust for Public Land, 2007

Figure 11. Costs of Public Services for Different Land Use Types



Median Cost per Dollar of Public Revenue Raised to Provide Public Services to Different Land Uses. Source: American Farmland Trust. "Fact Sheet: Cost of Community Services Studies" 2007.

example, in his own study of 174 new, re-located or expanded Colorado businesses, he and a co-author found that quality of life was the top reason for their location decision and that parks, recreation and open space topped the list of quality-of-life features.

While the production value of open space also includes forestry or mining, farming is generally considered more compatible with urban development than is resource extraction. Writing in the same in the 2006 TPL report, after reviewing her own findings and other relevant research, Lynch concludes:

"Farmland preservation can benefit local communities in many ways, resulting in economic viability, better quality of life, possibly positive fiscal impacts, and local produce."¹⁴⁴

In many places, farmland in proximity to metro areas is seeing a resurgence in economic productivity with the rise of the local food movement and urban farmers' markets. Open space also has value for sustainable, recreational uses, such as hiking, birding, hunting or fishing. The economic value of open space tourism activities is often calculated based on visitor spending per day. For example, the State of Virginia estimated that in 2005 visitors to Virginia State Parks contributed \$157 million to the state's economy while visitors to Virginia National Parks contributed \$263 million.¹⁴⁵ The US Fish and Wildlife Service estimated that the total overall economic output nationwide gained from bird watchers in 2001 was \$85 billion.¹⁴⁶ Open space and farmland also generate more than they cost to local governments (Figure 11).¹⁴⁷

Natural ecosystems of plants, animals and microbes, and their processes, make the environment fit for human life. Natural "services" include recycling waste, keeping water fit for drinking, moderating runoff from storms and floods and cleaning air pollution. These services can be extended and amplified through "green infrastructure" approaches, such as installing green roofs, permeable pavement, rain swales, buffer zones and increasing tree cover. Green infrastructure can also increase community resilience to climate change impacts, as documented in a new CCAP report.¹⁴⁸

144. Lori Lynch, "Economic Benefits of Farmland Preservation" in *Economic Benefits of Public Spaces*, Trust for Public Land, 2007

145. Virginia Department of Conservation and Recreation, "2007 Virginia Outdoors Plan, Chapter V", p 59-60 http://www.dcr.virginia.gov/recreational_planning/documents/vopchapt05.pdf

146. Genevieve Pullis La Roche, et al "Birding in the United States: A Demographic and Economic Analysis", US Fish and Wildlife Service, 2001 <http://www.bridgerlandaudubon.org/documents/Still2009Sept.pdf>

147. American Farmland Trust. "Fact Sheet: Cost of Community Services Studies." Farmland Information Center, 2007 http://www.farmlandinfo.org/documents/27757/COCS_09-2007.pdf

148. Center for Clean Air Policy (2010). "The Value of Green Infrastructure for Urban Climate Adaptation."

The New York Watershed Protection Program has made perhaps the best known use of ecosystem services to save billions of public dollars. The drinking water for New York City system is the largest unfiltered water supply in the US. It provides approximately 1.2 billion gallons of high-quality drinking water each day to nearly one-half the population of New York State. In order to safeguard this irreplaceable natural resource, a comprehensive and innovative watershed protection plan was developed and is embodied in the landmark New York City Watershed Agreement, signed in 1997 as a partnership agreement. The partnership provides for New York City to purchase land in outlying towns, villages and other areas and preserve it in a natural state. The partnership was organized to ensure that New Yorkers continue to enjoy high quality, affordable drinking water and to avoid the need for costly filtration – a cost that would amount to \$8-10 billion to build and \$350 million each year to operate and maintain the filtration plant.¹⁴⁹

Open space provides a number of “natural services” that would otherwise cost society money.

Open space also provides intangible values such as preservation of species, scenic and aesthetic values and more. One interesting co-benefit of open space is the psychological value it may have. A report by the Trust for Public Land reviewed a growing body of research and made a convincing case that mere contact with the natural world improves physical and psychological health.¹⁵⁰

149. New York City Watershed Program. <http://www.dec.ny.gov/lands/25599.html>

150. Erica Gies “The Health Benefits of Parks: How Parks Help Keep Americans and Their Communities Fit and Healthy”, Trust for Public Land, 2006

Principle 8: Provide a Variety of Transportation Choices.

Everyone benefits when urban dwellers have more, better and more affordable transportation options – as does the environment.

Color Key:

- Return on Investment
- Savings on Expenditures
- Improved Quality of Life

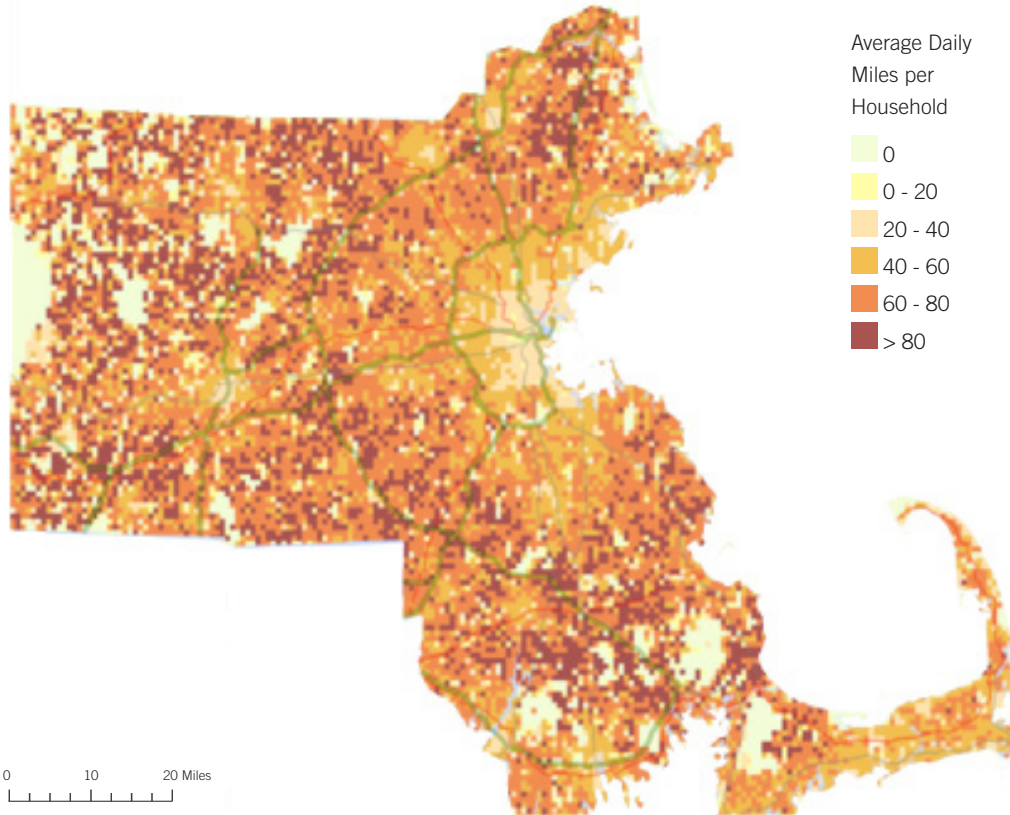
Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits	National Benefits
Better access to workers	Better access to jobs	Attracts private investment	Reduced exposure to congestion	More efficient use of transportation investments
Higher property values	Higher property values	Enhance tourism		Construction and transit jobs
Construction and transit jobs	Save on travel costs	Reduced need for parking and road infrastructure		Energy security
Enhance tourism	Health care savings			Health care savings
Reduced parking requirements				Reduced GHGs

We have already discussed how public transit and non-motorized travel consume less energy, save on fuel and car costs, emit less pollution and make it possible for some auto drivers to drive less. We also examined the way that increases in accessibility can help workers get to better jobs and reduce household travel costs. There are additional economic benefits to enhancing travel choices. “Fixed guideway” transit – such as rail and rapid busways – generally increases nearby property values and attracts private investors seeking to profit from the appeal of increased accessibility. Public transit can also provide jobs during construction and long term employment for operations. Walking and biking amenities can also spur economic activity by attracting tourists, commuters and walkers.

A real estate analysis of Denver showed that homes located within a half mile of stations on the Southeast light rail line rose in value an average of 17.6% between 2006 and 2008, while homes in the rest of Denver *declined* an average 7.5%. Even homes up to two miles away from the stations generally maintained or increased their value.¹⁵¹ A nationwide investigation by Pivo and Fisher revealed that commercial properties near transit in the suburbs had 12.7% higher net operating incomes, 16.2% higher market values, 1.1% higher annual appreciation and 0.9% higher annual total returns than other suburban office prop-

151. Margaret Jackson, “Light-rail Can Turn into Money Train,” *Denver Post*, October 30, 2008. http://www.denverpost.com/breakingnews/ci_10850014

Figure 12. VMT per Household in Massachusetts (from odometer data)



Source: Christian Jacqz, MassGIS.

erties. Properties near transit in Central Business Districts had 4.5% higher net operating incomes, and 10.4% higher market values, although their appreciation and total returns were similar to other CBD office buildings.¹⁵²

The Center for Transit Oriented Development estimates that investments in streetcars in several cities have helped stimulate private investment at levels several times that of public investment in the rail projects, ranging from 920 percent to 7,500 percent of the initial public investment.¹⁵³ Portland, OR, spent \$103 million on the Portland Streetcar, which helped attract \$3.5 billion in private investments adjacent to the line.¹⁵⁴ In Dallas, the introduction of a 20-mile, 21-station light rail system in 1996 contributed to increased retail activity in downtown Dallas. During the first year after the system began operations, retail sales grew by 33 percent in the downtown area, while retail sales in the rest of the city grew by only 3 percent.¹⁵⁵ Even if this represented a transfer of growth that would have occurred in outlying areas, it is clear that private investment recognizes and values the accessibility provided by transit.

Investment in public transportation is also a strong jobs creator, both in construction and operations. A recent report on the impacts of the 2009 American Recovery and Reinvest-

152. Gary Pivo, and Jeffrey D. Fisher, "Investment Returns from Responsible Property Investments: Energy Efficient, Transit-oriented and Urban Regeneration Office Properties in the US from 1998-2008," Working Paper, Responsible Property Investing Center and Benecki Center for Real Estate Studies, March 2009. http://www.responsibleproperty.net/assets/files/pivo_fisher_10_11_08.pdf

153. Gloria Ohland and Shelley Poticha, editors, *Street Smart: Street Cars and Cities in the Twenty-First Century* (Washington: Reconnecting America, 2009).

154. Portland Office of Transportation and Portland Streetcar, Inc., "Portland Streetcar: Development Oriented Transit," April 2008, p.7. http://www.portlandstreetcar.org/pdf/development_200804_report.pdf

155. American Public Transportation Association, "Public Transportation Means Business," http://www.apta.com/gap/policyresearch/Documents/brochure_transit_means_business.pdf

ment Act determined that investment in public transportation created almost twice as many jobs as the same investment in highway projects – 16,419 vs. 8,781 job-months.¹⁵⁶

Walking and bicycling infrastructure also has positive economic impacts. According to Rails-to-Trails Conservancy, existing walking and biking trails add \$1.4 billion in economic activity nationwide each year in retail and tourism alone, on top of increased real estate values, business profits from bicycle and pedestrian facility improvements, time savings, and healthcare cost savings.¹⁵⁷

Investment in public transit is a strong jobs creator and can enhance household resilience to rising fuel prices.

As gasoline prices rise, affordable transportation options are growing in importance to the economy. Households in more accessible communities appear to be more resilient to increases in fuel prices. For example, if the price of gasoline increased from \$2.50 to \$3.50 per gallon, then households in the most travel-efficient communities in Figure 12 would see fuel expenditures increase from \$1 per day to \$1.40 per day, while households in the least travel-efficient communities would face an increase from \$8.00 to of \$11.20 per day.

Reducing dangerous air pollutants like reactive organic gases and nitrogen oxide by reducing VMT can have substantial economic benefits through reduced health costs. The Metropolitan Transportation Commission of the San Francisco Bay Area calculated that reducing vehicle travel so as to achieve a 15% reduction in GHG would also reduce other dangerous pollutants enough to generate \$140 million in health care savings by the year 2035.¹⁵⁸

156. Center for Neighborhood Technology, Smart Growth America and US Public Research Interest Group, "What we learned from the stimulus," January 5, 2010. http://www.smartgrowthamerica.org/documents/010510_whatwelearned_stimulus.pdf

157. Thomas Gotschi, "Cost-effectiveness of Nonmotorized Transportation Investments as a Greenhouse Gas Reduction Strategy," Rails-to-Trails Conservancy, April 2009.

158. Metropolitan Transportation Commission staff. (2010). "GHG Target Setting Impacts". Presentation to the Commission, July 28, 2010.

Principle 9: Strengthen and Direct Development Towards Existing Communities.

Directing development towards existing communities makes the most efficient use of infrastructure and supports those local economies, rather than undermining them.

Business Benefits	Household Benefits	Municipal Benefits	Regional Benefits	National Benefits
Productivity enhancements due to agglomeration	Save on travel costs	Generates more public revenue per acre	More efficient regional economy	Energy security
	Lower taxes for infrastructure services			Health care savings
		Infrastructure savings	Protect natural resources	Reduced GHGs
		Reduced costs from urban decline		

Color Key:

- Return on Investment
- Savings on Expenditures
- Improved Quality of Life

We have already seen that compact infill development can reduce VMT while supporting a vigorous economy in places like Portland, OR, Arlington, VA. Directing growth to existing communities also helps to reduce the cost of infrastructure on a per capita basis and helps to prevent abandonment and blight. Denser central cities have enhanced productivity due to agglomeration effects.

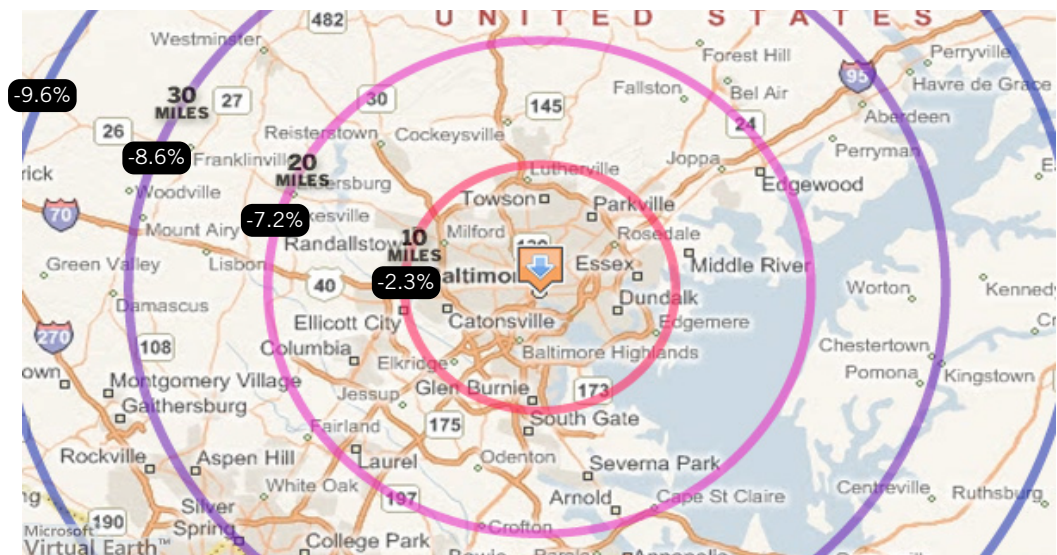
Many planning studies project infrastructure savings from more compact regional growth. In Sacramento’s Blueprint Plan, SACOG calculated the price tag of the business-as-usual scenario to be \$47.4 billion through 2050, versus \$38 billion for the more centralized blueprint scenario – a savings of \$9.4 billion dollars. One-third of the savings would come from transportation infrastructure (even with increased transit operating costs), another third from water infrastructure, and the last third from flood control and utilities. This amounts a savings of about \$18,000 for every housing unit or 2,500 square feet of office or commercial space.¹⁵⁹

A similar public visioning process for the Wasatch Front/Salt Lake City region, dubbed Envision Utah, found that the “quality growth” scenario would save \$4.5 billion over 20 years on infrastructure.¹⁶⁰ A Kentucky study of 10 counties found that, in a compact county with a central city, each new household brought in \$1.08 more in revenue than it cost to provide police, fire, highways, schools, sewer and garbage pickup. In a more spread-out, suburban

159. David Shabazian, “The Cost of Growth: Blueprint Infrastructure Cost Analysis” (presentation as Item #05-5-3 at meeting of the Sacramento Area Council of Governments Housing and Land Use Committee, May 2, 2005).

160. Envision Utah Quality Growth Strategy and Technical Review, 2000 <http://www.envisionutah.org/pdf/January2000.pdf>

Figure 13: Changes in Housing Price by Distance from Downtown for Baltimore MD



MICROSOFT VIRTUAL EARTH AND ZILLOW.COM

Source: Prashant Gopal, "The Unraveling of the Suburban Fringe", REAL ESTATE NEWS, July 12, 2008, http://images.businessweek.com/ss/08/07/0711_suburbs/3.htm

county, those same services cost \$1,222 more than the new household produced in revenue.¹⁶¹ The landmark study by Robert Burchell, *et al*, on the costs of sprawl looked at the entire nation. Their report for the Transportation Research Board concluded that if managed growth policies were able to shift a modest 15% of expected new growth into more developed areas by the year 2025, the country could save \$109 billion in reduced road infrastructure alone. Additional savings would be gained in water infrastructure (\$4.8 billion), sewer infrastructure (\$7.8 billion), and public services (\$4 billion).¹⁶²

Compact cities can save households money on gasoline as well. In California, the governor's strategic growth council and the state High-Speed Rail Authority created a project called Vision California that is modeling the impacts of several growth scenarios for the state. Their consultants' modeling concluded that a "green" compact growth scenario could save California residents \$8,600 in driving-related costs per household by the year 2050, or more than \$170 billion annually statewide.¹⁶³

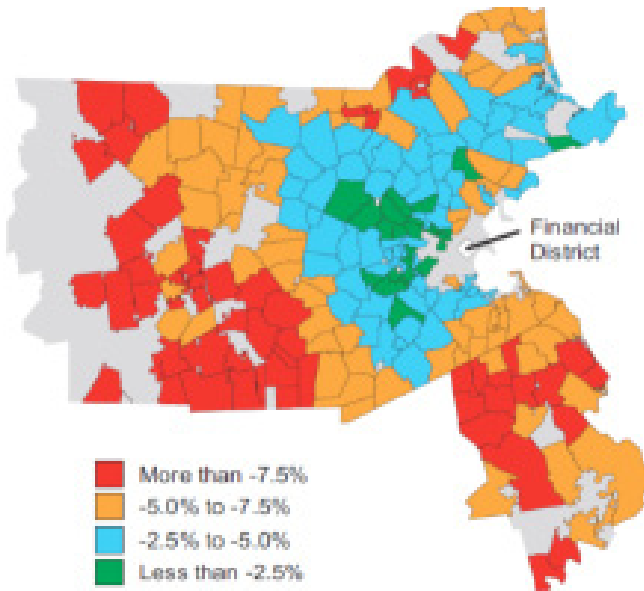
Directing development toward existing areas, and halting the disinvestment that often comes with sprawling development, can also help counter the drag local economies experience from vacant or abandoned properties. A study by the National Vacant Properties Campaign quantified an array of costs these properties place on cities:

161. Christopher R. Bollinger, Mark Berger, and Eric Thompson, "Smart Growth and the Costs of Sprawl in Kentucky: Phase I & II." University of Kentucky Center for Business and Economic Research, 2001.

162. Robert W. Burchell, George Lowenstein, William R. Dolphin, Catherine C. Galley, Anthony Downs, Samuel Seksin, Katherine G. Still and Terry Moore, *Costs of Sprawl – 2000, TCP Report 75* (Washington: National Academy Press, 2002).

163. Calthorpe and Associates. (2010) "Vision California - Charting Our Future." Berkeley, CA. <http://www.visioncalifornia.org>

Figure 14: Changes in House Price Indices from Peak to Second Half of 2007 in the Boston Metro Area



Source: Stiff, David. "Housing Bubbles Collapse Inward," 2008. http://www2.standardandpoors.com/spf/pdf/index/052708_Housing_bubbles_collapse.pdf

- More than 12,000 fires break out in vacant structures each year in the US, resulting in \$73 million in property damage annually. Most are the result of arson.
- Over a five-year period, St. Louis spent \$15.5 million (nearly \$100 per household) to demolish vacant buildings. Detroit spends \$800,000 per year and Philadelphia spends \$1.8 million per year cleaning vacant lots.
- A 2001 study in Philadelphia found that houses within 150 feet of a vacant or abandoned property experienced a net loss of \$7,627 in value.
- A study in Austin, Texas found that "blocks with unsecured [vacant] buildings had 3.2 times as many drug calls to police, 1.8 times as many theft calls, and twice the number of violent calls" as blocks without vacant buildings."¹⁶⁴

Being in a location close to city and town centers appears to protect housing values. A market study of large cities by BusinessWeek.com and Zillow.com showed that house prices were least volatile "within a 10-mile radius of the center of the city, but generally worsened with each successive radius ring as far as 50 miles from the center of the city." (Figure 13)¹⁶⁵

164. All examples from: National Vacant Properties Campaign, "Vacant Properties: The True Costs to Communities," August 2005. http://www.vacantproperties.org/latestreports/True%20Costs_Aug05.pdf

165. Prashant Gopal, "The Unraveling of the Suburban Fringe", *REAL ESTATE NEWS*, July 12, 2008, www.businessweek.com/lifestyle/content/jul2008/bw20080711_257959.htm?campaign_id=aol

A Standard and Poor's study in the greater Boston metropolitan area found a similar pattern: homes located further from the central business district (CBD) lost a greater percentage value due to housing market shifts than those near the CBD (see Figure 14).¹⁶⁶ Cortright studied the relationship between the recent collapse of the housing "bubble" and the rise in transportation costs nationwide. He found that houses located more than 12 miles from CBDs dropped in price an average of 2-4% versus those in more close-in neighborhoods.¹⁶⁷

The Salt Lake City region found that their quality growth scenario would save \$4.5 billion on infrastructure over 20 years.

Finally, researchers have quantified the benefits to productivity that come from agglomeration effects in a city. One of the central concepts in urban economics, "agglomeration" refers to the efficiencies that occur when economic activities are concentrated in relatively dense development patterns.¹⁶⁸ UK research on agglomeration in relation to transportation investment found an additional economic value from increasing urban densities of as much as 25% beyond the normally-measured benefits of transit projects.¹⁶⁹ The Federal Reserve Bank of Philadelphia showed that a metro area that is twice the density of another metro area will generate 20 to 30 percent more patents.¹⁷⁰ Muro and Puentes found that as smarter development patterns improve center-city incomes and vitality, they also enhance the economic well-being of the suburbs.¹⁷¹

166. David Stiff, "Housing Bubbles Collapse Inward," Standard and Poors. May 27, 2008. http://www2.standardandpoors.com/spf/pdf/index/052708_Housing_bubbles_collapse.pdf

167. Joe Cortright, "Driven to the Brink: How the Gas Price Spike Popped the Housing Bubble and Devalued the Suburbs" CEOs for Cities, 2008. <http://community-wealth.com/pdfs/articles-publications/tod/paper-cortwright.pdf>

168. McDonald, John F. *Fundamentals of Urban Economics*. Upper Saddle River: Prentice Hall Press, 1997.

169. Daniel J. Graham, *Agglomeration, Productivity and Transport Investment*, *Journal of Transport Economics and Policy*, Volume 41, Part 3, September 2007, pp. 317-343

170. Gerald A. Carlino, Satyajit Chatterjee and Robert Hunt, "Knowledge spillovers the the new economy of cities," Working Papers 01-14, Federal Reserve Bank of Philadelphia, 2001. <http://deas.repec.org/p/fip/fedwp/01-14.html>

171. Muro and Puentes, 2004, *op. cit.*

Principle 10: Take Advantage of Compact Building Design.

Denser development uses less land while creating greater efficiencies.



Principle 9, above, results in a more compact regional footprint at the metropolitan scale. At the neighborhood and project scale, compact building design means higher built densities per acre of land. Together with compact regional design, this can save significant sums in infrastructure and services costs. In addition, urban buildings with shared walls and smaller floor areas consume less energy and water per household. There is also evidence that building within a smaller footprint is better for handling storm water runoff.



Principle 9 above showed the range of infrastructure cost savings that could result from smart growth. Litman has surveyed the literature on infrastructure cost savings from smart growth and found reports estimating the savings effect of both density and distance from the existing urban centers.¹⁷² While it is difficult to determine which effect is the stronger, it appears that density has as important effect as location does.

A study in Sarasota, Florida compared the economic performance of an urban and a suburban residential development of about 350 dwelling units each. The first was downtown on about 3½ acres. The second covered more than 30 acres in the suburbs near a freeway interchange. The anticipated property tax revenues from the downtown project were over 8 times higher than the suburban development. Although the downtown costs were higher per acre, the total infrastructure cost to the city of the downtown project was about half of the suburban project's. Public Interest Projects, Inc. calculated that the annual return on infrastructure investment for the city was 35% on the downtown development, and only 2% for the suburban development (Figure 8).¹⁷³

172. Todd Litman, "Understanding Smart Growth Savings What We Know about Public Infrastructure and Service Cost Savings, And How They are Misrepresented By Critics", Victoria Transport Institute, 2010.

173. Joseph Minicozzi and J. Patrick Whalen, AICP of Public Interest Projects, Inc., Presentation to the Sarasota County Board of County Commissioners on September 4, 2009.

Figure 15: Tax Returns on Urban and Suburban Development in Sarasota, FL

	Property (357 residential units)	Acres Consumed	Infrastructure Cost/Unit*	Total Infrastructure Cost	Total County Tax Return
	Downtown Sarasota Urban residential @100 units/acre	3.4	\$15,956	\$5,696,292	\$1,980,900
	NW Quadrant of Fruitville and I-75	30.6	\$28,042	\$10,010,994	\$238,529

Source: Public Interest Projects, Inc., J. Patrick Whalen and Joseph Minicozzi, AICP.

* 1989 Brookings Institute Metropolitan Study adjusted to current values by Dept. of Labor CPI

Reducing Storm Water Runoff

Higher densities can actually improve storm water management. A City of Portland study estimated that 70% of flow originates from transportation related surfaces.¹⁷⁴ Because compact development builds less road surface and other impervious cover per dwelling unit, it can reduce runoff at the regional level. An EPA study found that increasing development density from one unit per acre to eight units per acre decreases runoff rates by about 74%.¹⁷⁵ They also point out that site level techniques need to be employed to address the more concentrated runoff from those areas that are developed.

174. Nisensen, Lisa, Using Smart Growth Techniques as Stormwater Best Management Practices, U.S. Development, Community and Environment Division, US EPA, 2005, p 78 http://www.epa.gov/smartgrowth/pdf/sg_stormwater_BMP.pdf

175. Richards, Lynn, "Water and the Density Debate: When it comes to protecting water resources, higher density may be the way to go." Planning Magazine, June 2006 <http://www.epa.gov/NCEI/stategrants/PDFs/wqanddensitydebate.pdf>

176. Paula Van Lare and Danielle Arigoni. "Growing towards More Efficient Water Use". EPA, 2006 http://www.epa.gov/dced/pdf/growing_water_use_efficiency.pdf

177. Natural Resources Defense Council, "Environmental Characteristics of Smart Growth Neighborhoods." 2000. Cited in US EPA, "Growing towards More Efficient Water Use," 2006.

178. Dave Eckhoff, "Per Capita Residential Water Use as a Function of Density" June 24, 2003; cited in "Growing towards More Efficient Water Use," EPA 2006.

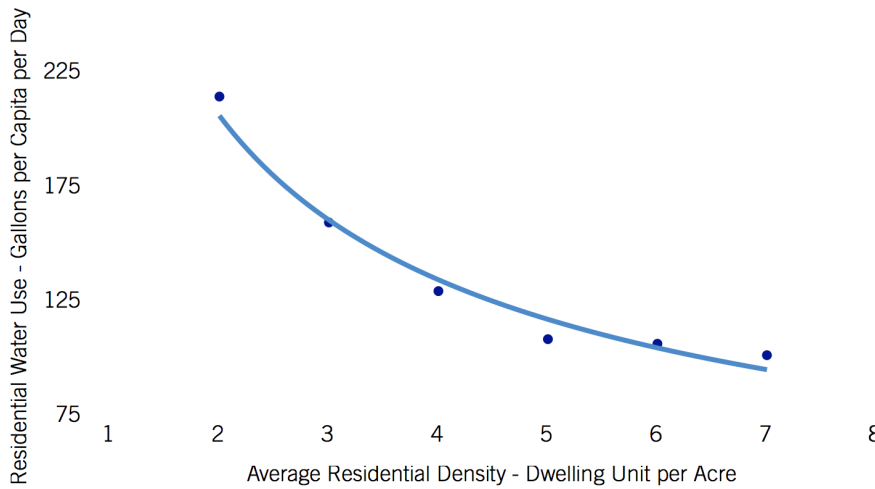
Reducing Household Water Use

A 2006 EPA report gathered multiple studies that suggest compact development reduces outdoor water use, which in turn reduces overall household water use.¹⁷⁶ Lawn care, car washing, swimming pools, and other outdoor uses can account for 50-70 percent of household water use.¹⁷⁷ For example, in a compact, single-family housing development in Sacramento, California, water demand was 20-30% less than suburban single-family homes in the same city. As residential density increases in Utah, water demand, as shown in Figure 16 below, is expected to drop from approximately 220 gallons per capita per day to about 100 gallons per capita per day.¹⁷⁸

Reducing Household Energy Use

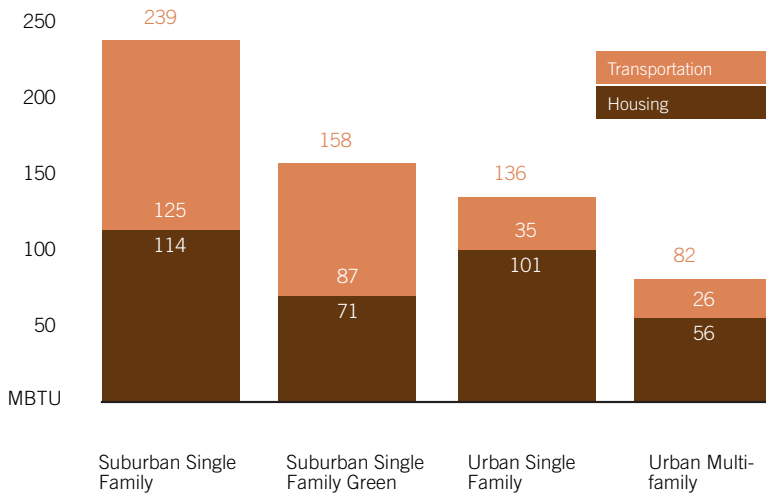
Compact growth reduces household energy use as well. Ewing and Rong found that although houses in sprawl areas are often detached and larger, their household energy use is

Figure 16: Per Capita Water Use as a Function of Residential Density



Source: Dave Eckhoff, "Per Capita Residential Water Use as a Function of Density" June, 2003.

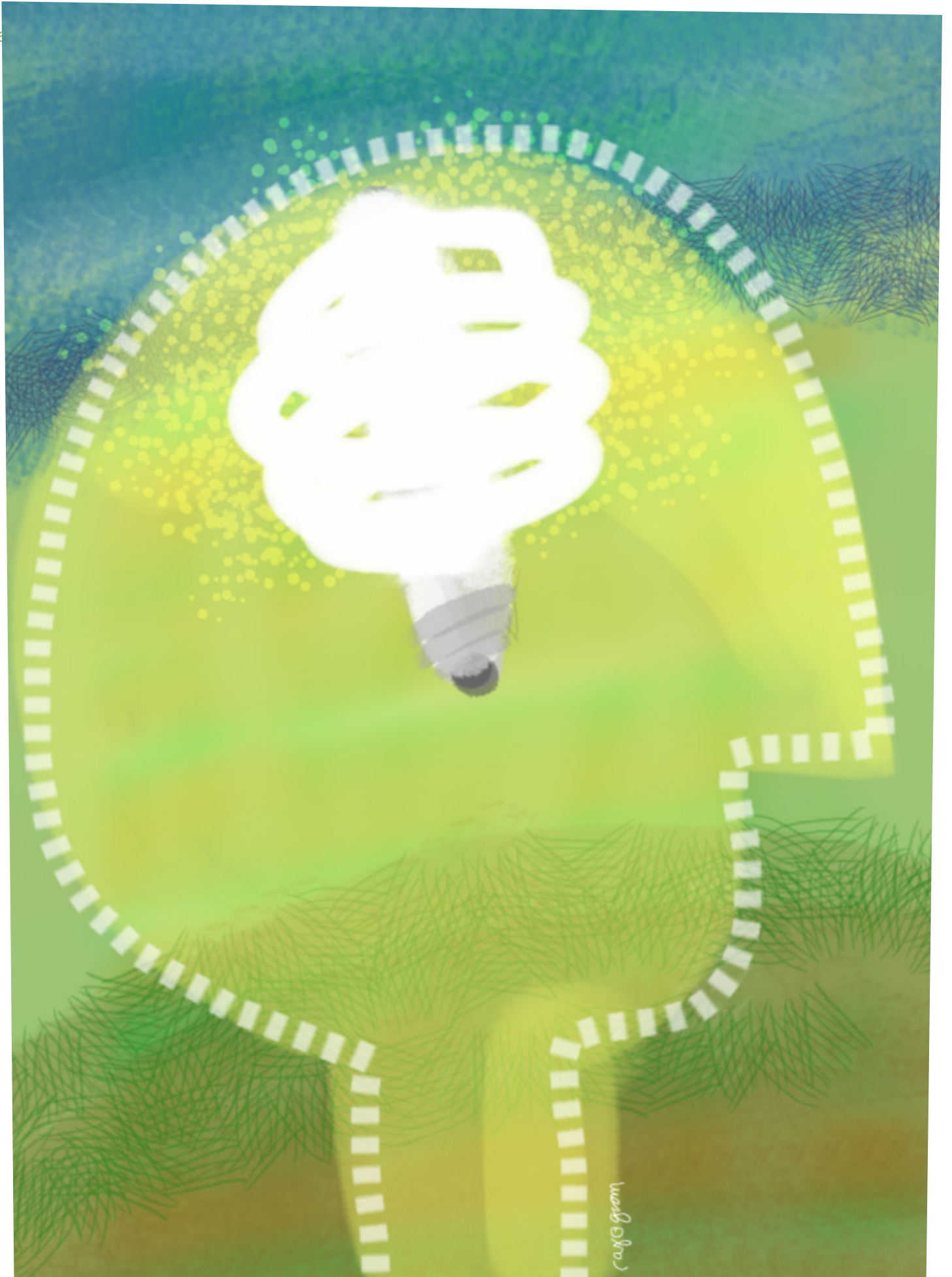
Figure 17: Household Energy Use in Compact versus Sprawling Neighborhoods: Average In-Town House Outperforms Even a "Green" Sprawl House (with Hybrid Cars)



Source: Jonathan Rose Companies, LLC (cited in Blue Ribbon Commission on Sustainability, "Greening Mass Transit and the Metro Regions, the Final Report of the Blue Ribbon Commission on Sustainability and the MTA", New York Metropolitan Transit Authority, January, 2009.)

partly counteracted by the heat island effect experienced by urban housing.¹⁷⁹ However, other studies, such as the New York MTA report (Figure 17), demonstrate that the household energy use gap widens substantially in favor of urban housing when taking into account the energy used for transportation.

179. Reid Ewing; Fang Rong "The impact of urban form on U.S. residential energy use", Housing Policy Debate, Volume 19, Issue 1 2008, pages 1 - 30.



Recommendations



Work with some recommendations to transportation policy makers and practitioners at all levels of government for getting on path to a sustainable and prosperous future.

Do. Measure. Learn.

Aligning transportation and land use policy around these principles has proven difficult in the past. CCAP believes that a promising route to advance smart growth and tap its many benefits is through an

incentive-based policy program centered on the themes of action, measurement, and analysis. Such a framework means that transportation policy should address GHG emissions by making it easy for implementing agencies to “do” things that have been shown to have a positive effect elsewhere, then rigorously “measuring” the magnitude of the effect, “learning” what works for them and what doesn’t and modifying policy and practice accordingly.

Equip and Empower

Orienting policy around travel efficiency and accessibility, along with other smart-growth principles, will require a transformative change in the goals and processes of land use and transportation planning. Many state, regional and local agencies feel that they are not yet prepared to meet the challenge. Transportation practitioners will need enhanced ability

to plan, implement and evaluate smart growth and travel efficiency policies. Thus, effective delivery of technical assistance for state and local practitioners is critically needed and would be an important role for federal agencies, such as US DOT, to enable a smooth transition to this new milieu.

CCAP sees it as especially important to develop tools to assess the economic and sustainability benefits of smart growth and travel efficiency policies. Vision California's Rapid Fire model is an important step in this direction. Such information is crucial for engaging the public and decision makers to help them shape a compelling vision for a prosperous and sustainable future that they will enthusiastically strive to implement. Capacity building and training to use these tools, and to assemble the new types of data to feed them, should be a part of any federal transportation policy proposal.

Do More, Get More (Merit-based Public Investment)

Government infrastructure programs – such as the Federal transportation authorization and other infrastructure subsidies – should reward those communities that make the most efficient use of resources to promote economic and environmental sustainability. The US Department of Transportation's TIGER program,¹⁸⁰ which awarded grants based to innovative projects that economic and environmental criteria, is a move in this direction, as are the Sustainable Community Grants awarded by the department of Housing and Urban Development.¹⁸¹ Proposed legislation, such as the CLEAN TEA bill offered in 2009, offers a compelling approach for such incentives and could serve as an important framework for surface transportation authorizing legislation.¹⁸²

180. US Department of Transportation, "Transportation Investment Generating Economic Recovery (TIGER)", <http://www.dot.gov/recovery/ost/> and, "TIGER II", <http://www.dot.gov/recovery/ost/tigerii/>.

181. US Department of Housing and Urban Development, "Sustainable Communities Regional Planning Grants," http://portal.hud.gov/portal/page/portal/HUD/program_offices/sustainable_housing_communities/Sustainable%20Communities%20Regional%20Planning%20Grants

182. H.R. 1329, "Clean, Low-Emission, Affordable, New Transportation Efficiency Act," <http://www.govtrack.us/congress/bills/111/1329>

183. S. Winkelman. Testimony to House Subcommittee on Technology and Innovation, House Committee on Science and Technology, "The Role of Research in Addressing Climate Change in Transportation Infrastructure." March 2009. <http://science.house.gov/Media/hearings/ets09/march31/winkelman.pdf>

Empirical Research

Basic and applied research has an important place as the foundation of knowledge, and there is still much to be learned about accessibility and the economy. As the appendix shows, there is a solid foundation of research on the economic effects of smart growth. Building upon that base will enhance communities' and policy makers' ability to deliver effective policies. In 2009, CCAP provided Congressional testimony on top transportation research and data improvement needs;¹⁸³ the Federal government should increase funding for such research and data collection and provide support for evaluating pilot projects and innovative policies.

We need a more detailed understanding of the relationships among the different purposes and types of travel and specific sectors of economic activity, and how these relationships vary with urban form. We need to know more about how productive miles and "empty miles" affect household income, health and happiness. More practical studies and demonstrations would be helpful to learn how transportation, land and housing policies and

practices effectively build wealth and prosperity as shown in our matrix of economic benefits (Table 1).

Research on relationship between accessibility and infrastructure costs would be valuable for jurisdictions seeking to do more with less. We also want to understand the ways urban form affects the happiness, prosperity and wealth of individuals and families. To do that, we need new approaches to measure those concepts so that they can be compared across communities. A particularly interesting study might look at the effect higher gas prices have on household budgets and daily life in neighborhoods and regions with high versus low accessibility. Where in America are households of varying income levels uniformly enjoying the highest happiness and prosperity, and what can we say is the contribution of urban form? Deeper research in these areas would help politicians and community leaders understand how to guide growth in the future. The more examples we have for them to learn from the better.

Ask the Sustainability Question

When making infrastructure and land development decisions, CCAP encourages policy makers to “Ask the Climate Question”: How does the decision affect GHG emissions and our resilience to climate impacts?¹⁸⁴ Based on the findings in *Growing Wealthier* we believe that it is equally important to Ask the Sustainability Question: Does this policy choice promote long-term environmental and economic health in an equitable way?

184. CCAP, “Ask the Climate Question.” June 2009. http://www.ccap.org/docs/resources/674/Urban_Climate_Adaptation-FINAL_CCAP%206-9-09.pdf




Conclusions

T

he preponderance of the evidence leads us to conclude that smart-growth strategies can help communities, businesses and individuals make money, save money and enhance quality of life. An approach to development and urban design that encourages travel efficiency and improves accessibility while also providing more housing and travel options is not an experiment that will harm the economy. Rather, these are time-tested principles that provide multiple economic and quality-of-life benefits while helping to ensure that natural systems can sustain life and human health.

These planning and design concepts, and the policies to support them, can help to create communities where people not only can find the homes, neighborhoods and lifestyles they desire, but also accomplish more with less time, energy and investment per person. People can save money while also reducing greenhouse gas emissions. Developing in ways that provide amenities people want – parks and open space, walkable neighborhoods and plentiful housing and transportation choices – attracts residents and businesses, maximizing public investments while creating opportunities for the private sector. Opening up the planning process to include more people in evaluating the big picture makes for smarter and more predictable decision-making, while empowering stakeholders to make decisions that will affect their lives now and long into the future.



The preponderance of the evidence leads us to conclude that smart-growth strategies can help communities, businesses and individuals make money, save money and enhance quality of life.

Even under optimistic assumptions about the progress of motor vehicle technology, we cannot meet targets for mitigating global climate disruption – nor achieve energy security – without also finding a way to accomplish more while driving less. Achieving the required 9% reduction in per capita VMT might happen on its own, involuntarily, if we find ourselves subjected to stratospheric fuel prices. Or we could reach the target over time by choice, as accessible, travel-efficient communities become more prevalent. While the former would have serious effects on our economy, the latter can lead to new jobs, consumer savings and improved quality of life.

Each individual principle of smart growth on its own provides a mechanism for development to have a positive economic impact. We have presented a number of examples in this report and there are many more in the appendix. Yet the holistic urban fabric that arises when all the principles are invoked should be our ultimate goal.

Understanding how to design urban forms for the 21st century that address the multiple goals of economy, environment and equal opportunity is a challenge that we can meet head on. The opportunity is here to build upon our knowledge of successful places and create more of them. Success begets success. It is our hope that *Growing Wealthier* will aid policy-makers, planners, developers and citizens in creating more prosperous communities while conserving financial and natural resources.

There are many steps we must take to ensure that our children inherit a planet and an economy with a bright future. Investing the time and money to grow our communities to be more resilient, more efficient and more satisfying to the soul surely offers a tremendous payoff.

Appendix

Annotated Bibliography of Literature on Smart Growth, Climate Change and the Economy

The literature on smart growth and on the economic impacts of transportation and land use investment is always increasing. This bibliography is intended as a supplement to the Growing Wealthier report for readers who are interested in pursuing the various lines of inquiry. We have tried to concentrate on sources that contain quantitative details but have also included works that offer a compelling framing of the issues of wealth, prosperity, travel and urban form.

This is by no means a complete listing of all sources on the subjects above. We have placed more emphasis on the economic impacts of smart growth that can be measured or predicted. As more examples are implemented and studied and the body of knowledge increases, we will develop an even clearer understanding as to how development and transportation policies can enhance wealth and prosperity.

I. Climate Change and Changing Urban Form

- A. Climate Change and Social Context
- B. Historical Data on Population, Land Use and Housing Change in the United States
- C. Climate Mitigation Role of the Transportation Sector

II. Smart Growth and VMT Reduction

- A. Principles of Smart Growth
- B. Potential for Smart Growth to Reduce GHG Emissions
- C. Reducing Transportation GHG Emissions through Smart Growth and Transportation Choices
- D. Reducing Transportation GHG Emissions by Pricing Transportation, Fuel and Carbon
- E. Smart Growth VMT Reduction Cases

III. Vehicle Travel and Prosperity

- A. VMT and GDP
- B. Measuring Prosperity
- C. Measuring the Economic Impacts of Transportation

IV. Smart Growth, Wealth and Quality of Life

- A. Growing the Economy
 - i. Creating Jobs and Increasing Productivity
 - ii. Meeting Market Demand
 - iii. Enhancing or Protecting Property Values
 - iv. Increasing Tax Revenue
 - v. Attracting Private Investment
- B. Saving on Costs
 - i. Health Care Costs
 - ii. Household Travel and Housing Costs
 - iii. Municipal Infrastructure and Services Costs
- C. Improving Quality of Life
 - i. Enhancing Sustainability
 - ii. Psychological and Physical Health
 - iii. Pollution and Climate Change

I. Climate Change and Changing Urban Form

A. Climate Change and Social Context

Center for Research on Environmental Decisions. “The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public.” New York, NY, (2009).

Offers techniques for effectively framing and communicating climate change issues in order to increase public awareness and concern.

Krugman, Paul. “Building a Green Economy.” *New York Times Magazine*, (5 April 2010). [<http://www.nytimes.com/2010/04/11/magazine/11Economy-t.html>].

A long article discussing the economic arguments centering on climate change and society’s response to it.

Taylor, P., Funk, C., & Craighill, P. “Are We Happy Yet?” Pew Research Center, (Feb. 2006). [<http://pewresearch.org/pubs/301/are-we-happy-yet>].

A web page summarizing the results of a number of happiness surveys over several decades. Links to a longer report.

B. Historical Data on Population, Land Use and Housing Change in the United States

Economic Research Service/USDA . “Major Uses of Land in the United States 2002/EIB-14.” [<http://www.ers.usda.gov/Publications/EIB14/>].

Study that gathered statistics to estimate the square miles of coverage of various types of land use for the entire United States.

Federal Highway Administration. “Annual Vehicle - Miles of Travel, 1980 – 2007.” [http://www.fhwa.dot.gov/policyinformation/statistics/vm02_summary.cfm].

Source of nationwide vehicle miles traveled aggregate figures derived from state DOT estimates.

National Association of Homebuilders. “Median and Average Square Feet of Floor Area in New Single-Family Houses Completed by Location.” [http://www.nahb.org/fileUpload_details.aspx?contentID=80051].

New home characteristics as reported by the industry.

US Census. “Historical National Population Estimates: July 1, 1900 to July 1, 1999.” [<http://www.census.gov/popest/archives/1990s/popclockest.txt>].

Source of historic population nationwide estimates.

US Census. “Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2007.” [<http://www.census.gov/popest/states/NST-ann-est2007.html>].

Source of recent nationwide population estimates.

US Census. “Characteristics of New Housing.” [<http://www.census.gov/const/www/charindex.html>].

Source of many useful statistics about the characteristics of housing constructed in a given year.

C. Climate Mitigation Role of the Transportation Sector

Burbank, Cynthia. “Strategies for Reducing the Impacts of Surface Transportation on Global Climate Change.” National Highway Cooperative Research Program Project 20-24 (59), (2009).

This report examines the potential for different strategies to reduce transportation GHG emissions. It calls attention to the importance of improving fuel economy and fuel carbon content. Different scenarios are explored that assume various possible reductions from fuel economy improvements, fuel carbon reductions and VMT reductions.

Center for Clean Air Policy. “Cost-Effective GHG Reductions through Smart Growth and Improved Transportation Choices.” Washington, DC. (2009).

[<http://www.ccap.org/dollarperton.html>].

CCAP presents an argument that VMT reduction is necessary for climate protection, that smart growth and transportation choices can achieve that reduction with a net economic benefit. The report is a precursor to Growing Wealthier.

European Commission. “Limiting Global Climate Change to 2 degrees Celsius: The Way Ahead for 2020 and Beyond, Impact Assessment.” (2007).

The European Council and the European Parliament confirmed that a 2 degree limit was Europe’s objective. This report discusses the need for industrialized nations to take the lead and explore options for reductions of up to 80% of 1990 by 2050.

U.S. Department of Transportation. Transportation's Role in Reducing Greenhouse Gas Emissions Volume 1: Synthesis Report. Washington, DC: US DOT. (April 2010). [http://ntl.bts.gov/lib/32000/32700/32779/DOT_Climate_Change_Report_-_April_2010_-_Volume_1_and_2.pdf].

This synthesis reviews the main categories of strategies, such as vehicle fuel economy, fuel carbon content, reduction in vehicle activity, system efficiency, etc. It looks at the potential reductions from each category and offers a series of policy options for the federal government.

II. Smart Growth and VMT Reduction

A. Principles of Smart Growth

Muro, M., Puentes, R. "Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns." Washington: The Brookings Institution (2004). [http://www.brookings.edu/reports/2004/03metropolitanpolicy_muro.aspx].

This review of the economic literature was done in 2004 as the economy was coming out of the dot com crash. The report summarizes the evidence at that time, to conclude that compact development lowers the fiscal demands of infrastructure costs and that it may improve a region's overall economic performance. They also found that investment in healthy urban cores can also economically benefit the surrounding suburbs. The authors suggested that more research should be done involving actual case studies.

Smart Growth Network. "Principles of Smart Growth." Smart Growth Online. [<http://www.smartgrowth.org/about/principles/default.asp>].

One of a number of sources that list the ten principles of smart growth. The principles have become standardized over the years although some other sources may list them in a different order.

Smart Growth America. "What is Smart Growth?" [<http://www.smartgrowthamerica.org/whatissg.html>].

SGA is a coalition of organizations supporting smart growth. This link has a list of the characteristics of smart growth. It also has a link to their version of the ten principles list.

U.S. EPA. "About Smart Growth." [http://www.epa.gov/smartgrowth/about_sg.htm].

This is EPA's official comprehensive web site on smart growth.

B. Potential for Smart Growth to Reduce GHG Emissions

Center for Clean Air Policy. Recommendations to Governor Pataki for Reducing New York State Greenhouse Gas Emissions. (April 2003). [<http://www.pewclimate.org/docUploads/NY%20Recommendations%20Apr2003.pdf>].

This comprehensive set of recommendations, based on stakeholder input and extensive analysis, offers an outline of a plan for GHG reductions in each of various economic sectors of the State of New York. It concludes that smart growth efforts have an important place in the overall framework for reducing GHG, especially in the transportation sector.

Ewing, R., Bartholomew, K., Winkelman, S., Walters, J., & Chen, D. Growing Cooler: The Evidence on Urban Development and Climate Change. Washington: Urban Land Institute (2008).

This book reviews empirical and modeling research on the impacts of urban development on driving, making the case that smart growth strategies to reduce VMT should be a critical part of climate policy. The authors conclude that compact development generates 20 to 40 percent less VMT than an equivalent amount of sprawling development. The authors calculate that robust Smart Growth could, by itself, reduce total metropolitan VMT by 12 to 18 percent and US transportation GHG emissions by 7 to 10 % from current trends by the year 2050.

Ewing, R and Cervero, R. "Travel and the Built Environment." Journal of the American Planning Association, (May 2010).

A meta-analysis of the built environment-travel literature existing at the end of 2009. Found that vehicle miles traveled (VMT) is most strongly related to measures of accessibility to destinations and secondarily to street network design variables. Walking is most strongly related to measures of land use diversity, intersection density, and the number of destinations within walking distance. Bus and train use are equally related to proximity to transit and street network design variables, with land use diversity a secondary factor.

C. Reducing Transportation GHG Emissions through Smart Growth and Transportation Choices

Arrington, G. B. & Cervero, R. "TCRP Rpt 128 – Effects of TOD on Housing, Parking and Travel." Washington, DC: Transportation Research Board, (2008).

Reviewed the literature and actual performance of 17 TOD projects. Concludes that TOD residents have vehicle trip rates of nearly 50% less than the ITE Trip Generation Manual would predict.

Bailey, L., Mokhtarian, P. L., & Little, A. "The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction." American Public Transit Association (Feb 2008). [http://www.apta.com/resources/reportsandpublications/Documents/land_use.pdf].

This is an analysis of the secondary effect that transit has in reducing GHG by inducing changes in land use form and accessibility. Because the denser land use forms attracted by transit allow large numbers of auto drivers and pedestrians to go about their activities with lower VMT, the secondary effects are calculated to be about three times the primary effect from the actual transit riders themselves.

Cambridge Systematics, Inc. "Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions." Washington, D.C.: Urban Land Institute, (2009).

This comprehensive study, funded by a coalition of stakeholder groups and Federal agencies, offers a detailed technical analysis of the potential GHG reductions from a range of transportation strategies building upon a baseline of fuel economy and carbon content assumptions. The analysis attempts to take into account the synergistic effects of combining measures that support one another into bundles, an important milestone in evaluation studies. The report concludes that there is a potential for reducing transportation GHG emissions from 4 to 24% below the baseline by the year 2050. It also estimates the cost effectiveness of various bundles.

Center for Clean Air Policy. CCAP "Transportation Emissions Guidebook." (2007). [<http://www.ccap.org/safe/guidebook.php>].

Downloadable, quantitative guide to transportation measures and the potential GHG reductions they can achieve. It includes a spreadsheet tool that can be used as is or customized to reflect characteristics of projects or measures to be analyzed.

S. Winkelman, A. Bishins and C. Kooshian. "Planning for Economic and Environmental Resilience." Transportation Research Part A: Policy and Practice, October 2010.

CCAP estimates that that comprehensive application of best practices could reduce VMT per capita by 10 percent and reduce annual GHG emissions 145 MMTCO₂ in 2030 — equivalent to the annual emissions of some 30 million cars or 35 large coal plants.

Feigon, S., Hoyt, D., McNally, L. & Mooney-Bullock, R. "TCRP Rpt 93 – Travel Matters: Mitigating Climate Change with Sustainable Surface Transportation." Washington, DC: Transportation Research Board, (2003).

This study looked at three categories of ways to reduce transportation GHG emissions: reducing per capita VMT through transit supportive land use, implementing energy efficient transit fuels and technologies and educating the public about travel and climate change linkages.

Gotschi, T., Mills, K. "Active Transportation for America." Rails-to-Trails Conservancy, (2008). [http://www.railstotrails.org/resources/documents/whatwedo/atfa/ATFA_20081020.pdf].

This report concludes that modest increases in bicycling and walking could reduce passenger vehicle GHG emissions by 3 to 8 percent. Quantifies a number of other benefits including more time exercising and reduced miles of driving.

TRB Committee for the Study on the Relationships among Development Patterns, Vehicle Miles Traveled, and Energy Consumption. Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO₂ Emissions. Washington: Transportation Research Board (2009).

This study examines the relationship between land development patterns and VMT in the United States. The committee estimated that the reduction in VMT, energy use and CO₂ emissions resulting from more compact, mixed use development would be in the range of less than 1 percent to 11 percent by 2050, although they disagreed about whether the changes in development patterns and public policies necessary to achieve the high end estimates are plausible.

Urban Land Institute. "Land Use and Driving: The Role Compact Development Can Play in Reducing Greenhouse Gas Emissions." Washington, DC: Urban Land Institute, (Aug. 2010).

This report reviews the three recent studies, Growing Cooler, Moving Cooler and Driving and the Built Environment, to suggest that compact growth policies can play an important role in reducing GHG emissions through lower VMT.

U.S. Department of Transportation. Transportation's Role in Reducing Greenhouse Gas Emissions Volume 1: Synthesis Report. Washington, DC. U.S. DOT, (April 2010). [http://ntl.bts.gov/lib/32000/32700/32779/DOT_Climate_Change_Report_-_April_2010_-_Volume_1_and_2.pdf].

This synthesis reviews the main categories of strategies, such as vehicle fuel economy, fuel carbon content, reduction in vehicle activity, system efficiency, etc. It looks at the potential reductions from each category and offers a series of policy options for the Federal government.

D. Reducing Transportation GHG Emissions by Pricing Transportation, Fuel and Carbon

Helm, D. "Climate-change Policy: Why has so Little been Achieved?" *The Economics and Politics of Climate Change*. Ed. Dieter Helm and Cameron Hepburn. New York: Oxford University Press, 2009. 14. Print.

This article argues that most people are unable or unwilling to reduce carbon emissions because there are presently no alternatives that would not require a drastic change in either current or desired lifestyles.

Komanoff, C. "Carbon Tax Model Spreadsheet." Carbon Tax Center. New York, NY. [http://www.komanoff.net/fossil/CTC_Carbon_Tax_Model.xls].

A spreadsheet model that allows users to estimate the impacts of a federal carbon tax on fuel use, carbon emissions and revenues, using a four-sector model (electricity, gasoline, aviation, and other).

Langer, A., and Miller, N. "Automobile Prices, Gasoline Prices, and Consumer Demand for Fuel Economy." University of California, Berkeley, (Sep. 2008). [<http://faculty.haas.berkeley.edu/wolfram/InnovSem/PapersF08/langer-miller-gasprice.pdf>]. Statistical study that looks at the market for higher and lower gas mileage vehicles from the consumer and manufacturer standpoints as fuel prices vary.

Lewis, David, "America's Congestion Problem: A Framework for National Reform." Washington: The Brookings Institution, (2008). [http://www.brookings.edu/~media/Files/rc/papers/2008/07_congestion_lewis/07_congestion_lewis.pdf]. Argues that implementing congestion pricing would be an effective way to reduce traffic congestion inefficiencies.

Litman, Todd. "Changing Vehicle Travel Price Sensitivities: The Rebounding Rebound Effect". Victoria, BC: Victoria Transport Institute, (Aug. 2010). [http://www.vtqi.org/VMT_Elasticities.pdf]. Argues that the rebound effect is lessening and that drivers have become more sensitive to the effects of gas price or other travel price increases. Suggests that pricing measures could be more effective than in the past.

Small, Kenneth A. and Kurt Van Dender. "Fuel Efficiency and Motor Vehicle Travel: The Declining Rebound Effect." UC Irvine Economics Working Paper #05-06-03, (July 2006). [<http://www.economics.uci.edu/docs/2005-06/Small-03.pdf>].

Estimates elasticity of travel with respect to fuel costs and how travel rebound as vehicles become more efficient over time.

E. Smart Growth VMT Reduction Cases

Arlington County, VA. Planning Division Land Use Studies, Reports, and Other Documents. [<http://www.arlingtonva.us/departments/CPHD/planning/docs/CPHDPlanningDocsMain.aspx>].

The main web page for the planning documents of Arlington County, VA, which includes the comprehensive plan and the corridor plans for the transit oriented development corridors. Also includes historical plans and studies showing the evolution of the smart growth initiatives.

Atlantic Station. "Atlantic Station 2008 Project XL Report". Atlanta, GA: Atlantic, (2008). Station. [http://www.atlanticstation.com/concept_green_projectXL08.php]. Atlantic Station, in Atlanta, GA, was projected to reduce VMT by 33%, but the initial measured reduction was 59%.

Horowitz, D. "Daily VMT (Vehicle Miles of Travel) Per Person - 1990 To 2007: Portland, OR Only, Portland-Vancouver OR-WA, and the U.S. National Average Data." [http://library.oregonmetro.gov/files/1990-2009_dvmt-portland-us.pdf]. Data from the Portland regional government showing that VMT per capita fell by 10 percent in the Portland/Vancouver region, while national VMT per capita grew by 8 percent from 1990 to 2007.

Sacramento Area Council of Governments. "Metropolitan Transportation Plan for 2035". (2007). [<http://www.sacog.org/mtp/2035/final-mtp/>].

This plan is the result of the Blueprint Planning Process for the Sacramento Region. It is an example of the way such a process can result in a set of planning assumptions that reflect more of a smart growth vision.

Sacramento Area Council of Governments. "Description of SACOG Scenario Testing For SB375 Greenhouse Gas Reduction Target Setting." (2010). [http://www.arb.ca.gov/cc/sb375/mpo/sacog/sacog_rtac_scenarios.pdf].

This information was submitted by SACOG to the Air Resources Board to show the GHG reductions estimates from SACOG's land use and travel models for seven different transportation and land use policy scenarios. The estimated reductions from 2005 levels for the year 2020 varied between 4 and 8 percent and for 2035 between 13 and 17%.

State of California Air Resources Board. "Staff Report: Proposed Regional Greenhouse Gas Emission Reduction Targets for Automobiles and Light Trucks pursuant to Senate Bill 375." (Sept. 2010). [http://arb.ca.gov/cc/sb375/staffreport_sb375080910.pdf].

The recommendations of the Air Resources Board staff for GHG reduction targets from land use and transportation measures under SB 375 in each MPO region of California. Staff is proposing per capita GHG reductions below 2005 levels ranging from 7 to 8 percent in 2020 and 13 to 16 percent in 2035.

III. Vehicle Travel and Prosperity

A. VMT and GDP

Busch, C. "Climate Policy and Economic Growth in California: A Comparative Analysis of Different Economic Impact Projections." Center for Resource Solutions, (3 Dec. 2009).

Reviews a number of studies that evaluated the potential impacts of California's AB 32 GHG legislation. Concludes that the studies macroeconomic analyses yield a broad consensus that climate solutions are affordable and economic growth will be robust at the same time that pollution reductions of the magnitude called for by AB 32 are achieved.

Bureau of Economic Affairs. "Current dollar and 'real' GDP," Bureau of Economic Analysis: National Economic Accounts." [<http://www.bea.gov/national/xls/gdplev.xls>].

A source of historic GDP data from the Bureau of Economic Affairs

DeNavas-Walt, Carmen, Bernadette D. Proctor and Jessica C. Smith. "Income, Poverty, and Health Insurance Coverage in the United States: 2008." US Census Bureau, (Sept. 2009). [<http://www.census.gov/prod/2009pubs/p60-236.pdf>].

The US Census produces various compilations of statistics for special purposes. This document provides a good look at how household income had changed over the past few decades.

Fairfield, Hannah "Driving Shifts Into Reverse," *New York Times*, May 1, 2010. [<http://www.nytimes.com/2010/05/02/business/02metrics.html>]

Elegant graphic presentation of per capita VMT charted against gasoline prices over the past 55 years.

Hu, Pat S. and Timothy R. Reuscher. "Summary of Travel Trends: 2001 National Household Travel Survey." US Department of Transportation, Federal Highway Administration, (Dec. 2004). [<http://nhts.ornl.gov/2001/pub/STT.pdf>].

Summary data from the National Household Travel Survey conducted in 2001 showing how much the average household drives. Another survey was not conducted until 2009 and only partial results are available (as of summer 2010).

Lipman, Barbara J., "A Heavy Load: The Combined Housing and Transportation Burdens of Working Families." Washington: Center for Housing Policy, (Oct. 2006). [http://www.cnt.org/repository/heavy_load_10_06.pdf].

This study makes the connection between quality of life and the tradeoffs among expenses within households. Drawing on the Center for Neighborhood Technology's calculations of combined housing and transportation costs, it suggests that working families' households could improve their quality of life by locating in more transit rich, compact communities.

McMullen, B. Starr, "The Relationship Between VMT and Economic Activity," Oregon State University (research in progress, results expected in September 2011). [<http://otrec.us/project/417>]

This study will provide an econometric analysis of the relationship between VMT and economic activity, while controlling for metropolitan specific factors that might influence economic health.

Millard-Ball, Adam and Schipper, Lee (2010), "Are We Reaching Peak Travel? Trends in Passenger Transport in Eight Industrialized Countries", *Transport Reviews*, November 2010. This study shows that growth in VMT relative to GDP has halted in recent years in eight industrialized countries, including the US.

Puentes., Robert and Adie Tomer, "The Road... Less Traveled: An Analysis of Vehicle Miles Traveled Trends in the U.S." (Washington: The Brookings Institution), December 2008. [http://www.brookings.edu/reports/2008/1216_transportation_tomer_puentes.aspx]

A thorough analysis of US national, state, and metropolitan VMT between 1991 and 2008.

QuantEcon, Inc. "Driving the Economy: Automotive Travel, Economic Growth, and the Risks of Global Warming Regulations". Cascade Policy Institute (2009) [<http://www.cascadepolicy.org/pdf/VMT%20102109.pdf>]. Asserts that VMT has a statistical relationship to GDP consistent with possible causality, hence policies that reduce VMT may harm the economy.

Texas Transportation Institute. "The 2009 Annual Urban Mobility Report." College Park, TX: Texas A&M University. [<http://mobility.tamu.edu/ums/report/>]. The annual report of the TTI which compiles congestion data from MPO sources and calculates the various rankings and impacts of traffic congestion. This 2009 report offers calculations for the year 2007. They report that traffic congestion in that year cost drivers a total of \$87.2 billion and caused the waste of 4.2 billion hours of time and 2.8 billion gallons of fuel.

U.S. Chamber of Commerce, Index of U.S. Energy Security Risk: Metrics and Data Tables, 2010 edition. [<http://www.energyxxi.org/reports/Datatables.pdf>]. U.S. Chamber of Commerce presents analysis (based on US Energy Information Administration data), indicating that the importance of travel as a component of the US economy has been declining since the early 1990s and is expected to continue to decline through 2030.

B. Measuring Prosperity

Bernanke, Ben. "The Economics of Happiness." University of South Carolina, Columbia, SC. Speech (8 May 2010). The Chairman of the Federal Reserve Bank gave a speech discussing the fact of surveys showing that after a certain point happiness does not rise with income increases and that it has remained distributed in the same proportions in the US even when real incomes overall have risen dramatically.

Boyle, David and Andrew Simms. *The New Economics: A Bigger Picture*. London, EarthScan, (2009). Another look at how conventional economics is not always effective in measuring what people care about. Describes efforts to develop new ways of incorporating environment and well being into economic theory.

Fleurbaey, M. "Beyond GDP: Is There Progress in the Measurement of Individual Well-Being and Social Welfare?" (Aug. 1, 2008). [http://stiglitz-sen-fitoussi.fr/documents/Beyond_GDP.pdf]. Another product of the Stiglitz Commission created by President Sarkozy. This report looks at recent developments in the analysis of sustainability, in the study of happiness, in the theory of social choice and fair allocation and in the capability approach, as well as other aspects of welfare economics.

Gertner, Jon, "The Rise and Fall of the G.D.P." *New York Times Magazine* (10 May 2010). [<http://www.nytimes.com/2010/05/16/magazine/16GDP-t.html?hpw>]. Journalistic review of the debate concerning whether GDP is measuring the progress toward goals that society desires.

Helm, Dieter and Cameron Hepburn. *The Economics and Politics of Climate Change*. New York: Oxford University Press, (2009). The volume brings together leading climate change policy experts to set out the economic analysis and the nature of the negotiations at Copenhagen and beyond. In the course of reviewing the fundamental issues discussed above, a number of the articles question some basic assumptions in the economics of climate change including some that formed the basis of the Stern Report's main findings. Especially of interest to the authors are considerations of whether capital and technology can continually be substituted for environmental resources or if there is a limit beyond which environmental damage should not be accepted. It also addresses the choice of discount rate that is used when valuing current versus future actions.

Jackson, Tim. *Prosperity Without Growth: Economics for a Finite Planet*. London, EarthScan, (2009).

The book looks at the possibilities for an economy that is not based on continuous growth. It reviews the literature on happiness and increases in GDP and other alternative indications of well being that have been developed and suggests that a slow or no growth economy would not necessarily be disagreeable.

State of the USA official web site. [<http://www.stateoftheusa.org/>].

This project hopes to provide a number of online statistics of key national indicators, to illustrate a more diverse measure of well being than more common economic figures such as GDP.

Stiglitz, Joseph E., Amartya Sen and Jean-Paul Fitoussi. *Report by the Commission on the Measurement of Economic Performance and Social Progress* (Sept. 2009). [http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf].

This report was commissioned by President Sarkozy and the French Government to look into the ways economic performance is measured statistically. The Commission found that aggregate GDP statistics may not be capturing the complexity of modern civilization. In particular GDP does not measure sustainability or possibly even well being. Some of their recommendations were that new measures should look at income and consumption rather than production, look more at household level statistics and equity issues and include non-market activities.

Storper, M., and A. Scott. "Rethinking Human Capital, Creativity and Urban Growth." *Journal of Economic Geography*. (2009): 9. Revisits the idea that skilled labor flows towards cities based on amenity preferences. Posits that historic economic geography of production is more important.

Thomas, Jennifer and Joanne Evans. "There's more to life than GDP but how can we measure it?" *Economic & Labour Market Review*, Vol 4, No 9, September 2010.

The study identifies relevant UK Government Statistical Service outputs and initiatives that support this broader societal wellbeing agenda. It addresses classical GDP issues, quality of life and sustainable development and the environment and outlines next steps.

C. Measuring the Economic Impacts of Transportation

California Department of Transportation. "Smart Mobility 2010: A Call to Action for the New Decade." (Feb. 2010). [<http://www.dot.ca.gov/hq/tpp/offices/ocp/smf.html>]

Offers a transformative framework for goal setting and performance measurement for California's state transportation policy, planning and implementation that embraces the principles of environment, economy and equity. Calls for a state wide interregional Blueprint planning process.

Delucchi, M. & McCubbin, D. "External Costs of Transport in the U.S." *Handbook of Transport Economics*. Ed. by A. de Palma, R. Lindsey, E. Quinet, and R. Vickerman. Edward Elgar Publishing Ltd. (2010). Print.

Attempts to estimate the external costs of transport such as congestion, accidents, pollution, climate change, energy security, etc. It compares the cost estimates by mode.

ECONorthwest and Parsons, Brinkerhoff, Quade and Douglas, Inc. *TCRP Rpt 78- Estimating the Benefits and Costs of Public Transit Projects: A Guidebook for Practitioners*. Washington DC: Transportation Research Board, (2002).

This offers practical guidance to those who are trying to calculate the costs and benefits of a specific public transit project. It includes sections on "secondary impacts" such as travel option value, environmental externalities and traffic safety. It also looks at impacts on land use, economic development and equity issues. The original publication included spreadsheet software for calculating costs and benefits.

Forkenbrok, D. J. & Weisbrod, G. *NCHRP Rpt 456: Guidebook for Assessing the Social and Economic Effects of Transportation Projects*. Washington, DC: Transportation Research Board, (2001).

This report offers techniques for assessing the impacts of transportation projects in terms of many types of effects. Includes areas such as accessibility, community cohesion, economic development, and equity.

Metropolitan Transit Authority Stat of New York. “*Greening Mass Transit and Metro Regions: The Final Report of the Blue Ribbon Commission on Sustainability and the MTA*”. (Jan. 2009). [<http://www.mta.info/sustainability/pdf/SustRptFinal.pdf>].

In addition to its numerous short and long term recommendations, this report recommends that future proposed projects and strategies of the Metropolitan Transit Authority be evaluated using a Sustainable Return on Investment model.

Pollack, S., Bluestone, B. and Billingham, C. “Maintaining Diversity in America’s Transit-Rich Neighborhoods: Tools for Equitable Neighborhood Change”. Evanston, IL: Dukakis Center for Urban and Regional Policy, (2010).

Raises concerns that the growing popularity of rail transit can bring undesirable changes to nearby neighborhoods. Found that renters are forced to pay more for housing and vehicle ownership becomes more common as neighborhood incomes rise.

Litman, Todd. “*Evaluating Transportation Economic Development Impacts: Understanding How Transport Policy and Planning Decisions Affect Employment, Incomes, Productivity, Competitiveness, Property Values and Tax Revenues*”. Victoria Transport Policy Institute, (Mar. 2010). [http://www.vtpi.org/econ_dev.pdf]

This report examines how transportation policy and planning decisions affect economic development, methods for evaluating these impacts, and ways to maximize economic development benefits in transport decisions.

IV. Smart Growth, Wealth and Quality of Life

Section 4 of this study organized the economic benefits of smart growth by looking at each of the ten smart-growth principles in turn. We showed that each principle can contribute something positive to the economy, if it is implemented properly. In this part of the bibliography we take a different tack. Studies of the economic impacts of smart growth development, which may combine several principles into a whole, are organized by type of impact. Another study has followed a sort of hybrid version of these two approaches. We list it separately here because it reaches many of the same broad conclusions that we do.

Urban Land Institute. SB 375 Impact Analysis Report. Washington, DC: The Urban Land Institute, (June 2010).

ULI looked at the impacts of California’s SB375 law, which requires MPOs to develop plans for reducing transportation GHG emissions, and concludes the beneficial impacts will fall into the following categories:

- Long-term savings in municipal service costs
- Increased development certainty
- More efficient use of public transportation systems
- Enhanced public health of citizens
- Reduced development pressure on agricultural lands
- Decreased dependence on fossil fuels.

Here, in this appendix to *Growing Wealthier*, traditional measures of economic growth are addressed first as Growing the Economy, and then we take a look at studies illustrating the potential to Save Money on costs that would be higher under conventional style growth. Finally we list a few studies that attempt to capture the Quality of Life benefits that might accrue from well-designed smart growth policies.

There are certainly other ways to look at the economic impact of changes in urban form, and each approach can provide a different perspective. For example, a third framework might be to observe the differing impacts on households, businesses and governments, examining changes in private and public forms of wealth. Since these institutions are inextricably intertwined through jobs, taxes and consumer spending, much of the economic impact is in the form of transfers from one sector to another. For that reason this viewpoint is more difficult to analyze and remains an area for future research.

A. Growing the Economy

i. Creating Jobs and Increasing Productivity

Alam, Bhuiyan M. "Transit Accessibility to Jobs and Employment Prospects of Auto-less Welfare Recipients: A GIS Assisted Case Study of Broward County, Florida." (2009). Found inverse association between transit accessibility to jobs and length of time spent on welfare. This association implies that transit accessibility plays a significant role on the employment prospects of the welfare recipients in the study area.

American Public Transportation Association. "Public Transportation Means Business." [http://www.apta.com/gap/policyresearch/Documents/brochure_transit_means_business.pdf].

Contains numerous examples such as Dallas, where the introduction of a 20-mile, 21-station light rail system in 1996 contributed to increased retail activity in downtown Dallas. From mid-1997 to mid-1998, the year after the light rail system began operating, retail sales grew by 33 percent in the downtown area, while retail sales in the rest of the city grew by only 3 percent during that same time period.

Apollo Alliance, Make it in America: The Apollo Clean Transportation Manufacturing Action Plan. (2010) [<http://apolloalliance.org/tmap/>].

Proposes \$40 billion in annual transportation investments, which they calculate would create 3.7 million direct and indirect jobs – 600,000 alone in the manufacturing sector over the next six years.

Barracks Row Main Street. "Annual Report, 2006." Washington, DC.

The Barracks Row Main Street Program took an integrated, context-sensitive approach to a historic Washington neighborhood, and in doing so leveraged tremendous private investment from a relatively minimal initial funding outlay. Barracks Row Main Street Program attracted 44 businesses, 200 jobs, and tripled its economic activity in the first 7 years.

Ciccone, Antonio and Robert E. Hall. "Productivity and the Density of Economic Activity." NBER Working Papers 4313. National Bureau of Economic Research, Inc. [<http://ideas.repec.org/p/nbr/nberwo/4313.html>].

Found that doubling employment density improves productivity by approximately 6% and also improves income levels.

Gao, Shengyi and Robert A. Johnston. "Public vs. Private Mobility for Low Income Households: Transit Improvements vs. Increased Car Ownership in the Sacramento Region." Proceedings of the 88th Transportation Research Board Annual Meeting. Washington, DC, (11-12 Jan. 2009).

Strategies that improve accessibility can lower overall household costs and improve access to jobs for workers who lack private transportation. Sacramento modeling shows that increasing transit frequency (reduce headways on existing routes by 50%) provides access to 10 times more jobs for low income workers within the same travel time (30 minutes).

Graham, Daniel J., "Agglomeration, Productivity and Transport Investment" *Journal of Transport Economics and Policy*. 41.3 (Sept. 2007): 317-343

This study on agglomeration in relation to transportation investment finds that economic value arises from increasing urban densities over and above the benefits normally captured in Cost-Benefit Analysis. Such benefits can add as much or more than 25 percent to the normally-measured benefits of transit projects

HDR Corporation. "Economic Benefits of Public Transportation." Wisconsin Department of Transportation, (2003).

Research indicating that Wisconsin communities with public transit services have exhibited superior employment figures, largely due to citizens' enhanced access to a wide range of job opportunities.

Iams, Alex and Pearl Kaplan (ed.). "Economic Development and Smart Growth: 8 Case Studies on the Connections between Smart Growth Development and Jobs, Wealth, and Quality of Life in Communities." International Economic Development Council, (2006). [http://www.iedconline.org/Downloads/Smart_Growth.pdf].

Includes eight well documented case studies, including Portland, Oregon, Silver Spring, Maryland, Pittsburgh, Pennsylvania, Burlington, Iowa, Columbus, Ohio, Lakewood, Colorado, Indianapolis, Indiana, and Paducah, Kentucky

Joint Venture Silicon Valley Network. "Climate Prosperity: A Greenprint for Silicon Valley." (February, 2009).

Outlines a plan for achieving green economic growth in the Silicon Valley through a combination of high-tech energy-efficient industry and alternative transportation and urban infrastructure policies. Suggests that protecting the environment can be an economic driver for the area. Recommends more "livable, walkable, sustainable" communities coupled with efficient, clean energy technologies.

Mattera, P. & LeRoy, G. "The Jobs are Back in Town: Urban Smart Growth and Construction Employment". Washington, DC: Good Jobs First, (2003). [<http://www.goodjobsfirst.org/pdf/backintown.pdf>].

Looked at the construction job growth in regions with growth management policies versus those without. Determined that areas promoting smart growth have more job creation and similar labor intensity compared to "business as usual" areas.

Sawichi, D. S., and Mitch Moody. "Developing Transportation Alternatives for Welfare Recipients Moving to Work." *Journal of the American Planning Association*. 66 (2000): 306–318.

Shows that there is a spatial separation between welfare recipients and low income households from entry level jobs and that expanding transit can improve access to a greater job market.

Smart Growth America. "What We Learned From the Stimulus." Washington, DC: Smart Growth America, (2010). [http://www.smartgrowthamerica.org/documents/010510_whatwelearned_stimulus.pdf].

A recent report on the impacts of the 2009 "stimulus" bill which found that \$1 billion of investment in public transportation created almost two times more jobs than the same investment in highway projects – 16,419 vs. 8,781 job months

ii. Meeting Market Demand

Leinberger, Christopher. *The Option of Urbanism: Investing in a New American Dream*. Washington: DC Island Press, (2007).

An insightful look at the rise and fall of suburban sprawl. Considers the development market and opportunities for walkable urban projects from a developer's point of view. Discusses how the financial and real estate communities can respond to market demand and build more sustainable communities.

Patrick Doherty and Christopher Leinberger, "The Next Real Estate Boom," *Washington Monthly*, November/December 2010. [http://www.washingtonmonthly.com/features/2010/1011_doherty-leinberger.html]

Concludes that "The burgeoning demand for homes in walkable communities has the potential to reshape the American landscape and rejuvenate its economy as profoundly as the wave of suburbanization after World War II did."

Nelson, A.C. "Leadership in a New Era." *Journal of the American Planning Association*. 72 (2006): 393–407.

Explains that more than half of the built environment of the United States we will see in 2025 did not exist in 2000, giving planners an unprecedented opportunity to reshape the landscape. Smart growth is needed because changing demographics (e.g., fewer new households with children) and changing consumer preferences (e.g., wanting shorter commutes) contribute to this demand

Price Waterhouse Coopers. "Emerging Trends in Real Estate: 2010 Survey." (2010).

Annual publication that reviews the past year in real estate investment market and tries to identify trends through interviews with industry leaders. 2010 report is concerned with lack of new development and the continuing drop in real estate prices. Mentions the tension between developing sustainable (smart growth) projects for the long haul and trying to resume the old model to recoup losses quickly. Suggests the wise investor will look at smart growth and infill alternatives over suburban sprawl.

Thomas, J. V. "Residential Construction Trends in America's Metropolitan Regions." U.S. Environmental Protection Agency, (Jan. 2009). [http://www.epa.gov/smartgrowth/pdf/metro_res_const_trends_09.pdf].

EPA report concludes that the share of building permits in the central city, as a portion of the entire region, has increased by over 50% in 15 regions throughout the US between 1990 and 2007, and the urban share of permits increased "dramatically" in almost half of the studied regions during this period

iii. Enhancing or Protecting Property Values

Cortright, J. "Driven to the Brink: How the Gas Price Spike Popped the Housing Bubble and Devalued the Suburbs".

CEOs for Cities, (2008). [<http://www.ceosforcities.org/files/Driven%20to%20the%20Brink%20FINAL.pdf>].

Shows that there is a direct relationship between the economic health of a central city and its suburbs. Additionally, as land-use density increases, household VMT decreases, insulating households in denser communities from rising fuel prices.

Cortright, J. "Walking the Walk: How Walkability Raises Home Values in U.S. Cities." CEOs for Cities, (2009). [http://www.ceosforcities.org/files/WalkingTheWalk_CEOsforCities1.pdf].

Walkable neighborhoods are more resilient to real estate market volatility. One point increase in Walk Score was associated with between a \$700 and \$3,000 increase in home values.

Gopal, P., "The Unraveling of the Suburban Fringe." Real Estate News, (12 July 2008). [http://www.businessweek.com/lifestyle/content/jul2008/bw20080711_257959.htm?campaign_id=aol].

A Business Week and Zillow.com analysis of foreclosures found that house values were most stable within a 10-mile radius of the center of a city, but generally worsened with each successive radius ring as far as 50 miles from the center of the city.

Jackson, M. "Light-rail can Turn into Money Train." Denver Post, (30 Oct. 2008). [http://www.denverpost.com/breakingnews/ci_10850014].

The values of homes located in close proximity to Denver's light rail network have consistently outperformed area-wide figures. This is emblematic of a historic premium of 15 to 20 percent for houses in and around transit-oriented developments.

Paull, E.. "The Environmental and Economic Impacts of Brownfields Redevelopment." Washington, DC: Northeast Midwest Institute, (2008). [<http://www.nemw.org/images/stories/documents/EnvironEconImpactsBFRedev.pdf>].

Shows that in general, brownfields redevelopment leads to property value increases on the order of 5-15% for properties that are up to 3/4 mile from the site, with some individual projects showing an improvement of up to (and over) 100%.

Pivo, G. and Fisher, J. D. "Effects of Walkability on Property Values and Investment Returns." Responsible Property Investing Center and Benecki Center for Real Estate Studies, (Aug. 2009). Working Paper. [www.u.arizona.edu/~gpivo/Walkability%20Paper%208_4%20draft.pdf].

Properties with a high Walkscore (e.g., 90 of 100) are more "walkable," an amenity that is quickly becoming a common metric in real estate. The results show that "walkability was associated with higher value for all types of properties." Properties with a Walk Score of 80 were worth 29% to 49% more than properties with a score of 20.

Stiff, David. "Housing Bubbles Collapse Inward," 2008. [http://www2.standardandpoors.com/spi/pdf/index/052708_Housing_bubbles_collapse.pdf]

Zip code analysis of foreclosure rates shows graphical evidence of higher rates in suburban areas.

Pivo, G. & Fisher, J. D. "Investment Returns from Responsible Property Investments: Energy Efficient, Transit-oriented and Urban Regeneration Office Properties in the US from 1998-2008." Responsible Property Investing Center and Benecki Center for Real Estate Studies, (Mar. 2009). Working Paper. [http://www.u.arizona.edu/~gpivo/Walkability%20Paper%208_4%20draft.pdf].

Properties near transit in CBDs had 4.5% higher net incomes, 10.4% higher market values, and 0.2% lower cap rates although their appreciation and total returns were similar to other CBD office buildings. Pivo and Fisher also found that suburban properties with access to transit had "12.7% higher net incomes, 16.2% higher market values, 0.3% lower capitalization rates, 1.1% higher annual appreciation and 0.9% higher annual total returns than other suburban office properties."

iv. Increasing Tax Revenue

Atlanta Development Authority. "Atlantic Steel Brownfield Redevelopment Plan." (2000). [http://www.atlantaga.gov/client_resources/government/planning/atlantic_steel_redevelopment_plan.pdf].

Initial calculations estimated that Atlantic Station would generate over \$30 million annually in revenue from property and sales tax, and this funding stream will continue to benefit the city long after the initial investment debt is retired.

Costello, D. "The Returning City: Historic Preservation and Transit in the Age of Civic Revival." National Trust for Historic Preservation, (2003). [http://www.planning.dot.gov/documents/casestudy/cities/returning_city.htm#clv].

Cleveland, Ohio, transformed Shaker Square with \$8 million in public money, \$17 million in private costs Begun in 2000, the project was mostly complete within 12 months. In just two years, vacancy rates went from 30% to zero and the tax base increased from \$4 million to \$18 million.

Economic Development Office Falls Church, VA. "Mixed Use Development Fiscal Impact." (2009).

Mixing condominium and commercial space in three Falls Creek, VA developments has resulted in tax revenues that far outstrip service costs per year.

v. Attracting Private Investment

Comprehensive smart growth efforts that include robust initial public funding have the potential to attract significant private investment in the medium- to long-term, above even that of general infrastructure funding. Close work with members of the community, along with the implementation of context-specific development strategies, are the first steps towards creating vibrant live/work communities.

Costello, D. "The Returning City: Historic Preservation and Transit in the Age of Civic Revival." National Trust for Historic Preservation, (2003). [http://www.planning.dot.gov/documents/casestudy/cities/returning_city.htm].

Publicly funded transit-oriented housing development in Shaker Square, Cleveland, OH brought vast amounts of additional and popular real estate and retail investment to the community, revitalizing an underutilized area.

Ohland, G., & Poticha, S., Editors. *Street Smart: Street Cars and Cities in the 21st Century*. Washington, DC: Reconnecting America, (2006).

The Center for Transit Oriented Development estimates that investments in streetcars helped attract private investment of 920 per cent to 7,500 percent of public cost.

Paull, E., "The Environmental and Economic Impacts of Brownfields Redevelopment." Washington, DC: Northeast Midwest Institute, (2008). [<http://www.nemw.org/images/stories/documents/EnvironEconImpactsBFRedev.pdf>].

Estimates that \$1 of public investment in brownfields leverages \$8 of total investment.

Portland Office of Transportation and Portland Streetcar, Inc., "Portland Streetcar: Development Oriented Transit." Portland, OR: City of Portland, (2008).

Portland, OR provided \$103 million in order to implement a streetcar system which leveraged \$3.5 billion in private investment.

B. Saving on Costs

i. Health Care Costs

Several public health issues have been linked to sprawl, including obesity, general lack of exercise, auto crashes and respiratory disease due to criteria pollutants. A body of research has attempted to calculate the potential for health improvements that are possible, and the health care cost savings that could accrue, under various scenarios of smart growth development.

Environmental Defense Fund "All Choked Up: Heavy Traffic, Dirty Air and the Risk to New Yorkers." (2007). [<http://www.edf.org/page.cfm?tagID=1285>].

Looked at the effects of vehicle-related pollution on respiratory health and found that there are significant links between traffic, roads, vehicle pollution, and diseases like asthma, bronchitis, and cancer

Ewing, Reid, Richard A. Schieber, and Charles V. Zegeer. "Urban Sprawl as a Risk Factor in Motor Vehicle Occupant and Pedestrian Fatalities." *American Journal of Public Health*. 93 (2003).

2003 study on urban sprawl and traffic fatalities which found that the 10 least sprawling metropolitan areas had approximately 75% fewer fatalities than the 10 most sprawling metropolitan areas.

Finkelstein EA, Trogdon JG Cohen JW Dietz W. Annual Medical Spending Attributable to Obesity: Payer- And Service-Specific Estimates. *Health Affairs*, 28, no. 5 (2009): w822-w831. [<http://content.healthaffairs.org/cgi/content/abstract/28/5/w822>]

Found that the prevalence of obesity in the US increased by 37 percent between 1998 and 2006, adding \$40 billion to health care costs.

Frank, Lawrence and Peter Engelke, "Multiple Impacts of the Built Environment on Public Health: Walkable Places and the Exposure to Air Pollution." *International Regional Science Review*. 28.2 (2005): 193-216.

This county-by-county study of Atlanta residents found a strong negative correlation between mixed land use areas and citizens' rates of obesity.

Frank, L. D., et al. "Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality." *Journal of the American Planning Association*. 72.1 (2006): 75-87.

Documents the establishment of a 'culture of activity' in Seattle, WA, based on the concept of improved walkability, that has been strongly associated with a decrease in body mass index

Frumkin, H., Frank, L., & Jackson, R. *Urban Sprawl and Public Health: Designing, Planning, and Building for Healthy Communities*. Washington, DC: Island Press, (2004).

Written by two physicians and an urban planning scholar, this book was one of the first to comprehensively analyze the positive and negative links between urban sprawl and health issues.

Litman, T. "Evaluating Public Transportation Health Benefits." Victoria, BC: Victoria Transport Institute, (June 2010). [http://www.apta.com/mediacenter/pressreleases/2010/Pages/100811_Public%20Health%20Benefits.aspx].

This report finds that potential public health benefits could accrue from developing in ways that encourage more people to use public transit. Looks at multiple benefits ranging from fewer auto accidents to lower disease rates.

MacDonald JM, Stokes R. Cohen D. Kofner A. Ridgeway G. "The Effect of Light Rail on Body Mass Index and Physical Activity." *American Journal of Preventive Medicine*, 2010; 39(2):105-112. [<http://www.ncbi.nlm.nih.gov/pubmed/20621257>]

A before-and-after study in Charlotte North Carolina that found that the use of light rail and increased physical activity are associated with a nearly 1.2 point reduction in body mass index and an 81% reduction in the likelihood of becoming obese.

Metropolitan Transportation Commission. "GHG Target-Setting Impacts." (28 July 2010). Staff presentation.

MTC staff worked with the Bay Area Air Quality Management District to calculate the reductions in criteria pollutants and greenhouse gases that could be expected under various SB 375 target scenarios. They then looked at the potential health benefits from those reductions and estimated the monetary savings for healthcare, lost productivity, school absences and mortality that would accrue. Estimates ranged from \$100 million under a 10% GHG per capita reduction scenario to \$140 million under a 15% GHG reduction per capita scenario.

McCann, B., & Ewing, R. "Measuring the Health Effects of Sprawl." Washington, DC: Smart Growth America, (2003). [<http://www.smartgrowthamerica.org/healthreport.html>].

Reports on the seminal study linking obesity to urban form as measured by a "sprawl index". A 50-point increase in the degree of sprawl on the county sprawl index was associated with a weight gain of just over one pound for the average person.

Rader, M. "Health Impact Assessment on Policies Reducing Vehicle Miles Traveled in Oregon Metropolitan Areas."

Portland, OR: Upstream Public Health, (May 2009). [<http://www.upstreampublichealth.org/sites/default/files/Binder1.pdf>].

Examined the public health implications of various policies aimed at reducing VMT. Recommended a set of smart growth style policies that would both reduce VMT and positively impact public health.

Simmons, Melanie, and Darryl Crawford. "Does 'Smart Growth' Matter to Public Health Finance?" Florida State University, Healthy Communities Program, (2008).

This study estimates that smart growth could save the state between \$6 and \$23 million per year in public health costs alone.

Stokes RJ, MacDonald J. Ridgeway G. "Estimating the effects of light rail transit on health care costs." *Health & Place*, 2008;14(1):45-58. [<http://www.ncbi.nlm.nih.gov/pubmed/17543570>]

Estimates that health care savings from light rail in Charlotte could amount to \$1.4 million per year.

Transportation for America, "Dangerous By Design: Solving the Epidemic of Preventable Pedestrian Deaths (and Making Great Neighborhoods)," (2009). [<http://t4america.org/resources/dangerousbydesign/>].

The study uses a Pedestrian Danger Index (PDI) to compare metropolitan areas based on the danger to pedestrians. The most dangerous metropolitan areas in the U.S. for walking in 2007-2008 were: Orlando, Tampa, Miami, Jacksonville, Memphis, Raleigh, Louisville, Houston, Birmingham and Atlanta.

Urban Design 4 Health. "The Hidden Health Costs of Transportation: Backgrounder." Washington, DC: American Public Health Association, (March 2010). [<http://www.apha.org/NR/rdonlyres/B96B32A2-FA00-4D79-99AB-F0446C63B254/0/TheHiddenHealthCostsofTransportationBackgrounder.pdf>].

This report identifies various ways that transportation systems affect public health and describes methods for quantifying and monetizing these impacts.

ii. Household Travel and Housing Costs

Household transportation expenditures in urban areas tend to increase consistently as one travels farther from the urban center. Government policies that support cheap fuel and extensive investment in roadways have promoted the “drive ‘til you qualify” approach to buying a house. In fact, in many suburbs without adequate access to public transit, these incurred transportation costs can equal or surpass any housing savings that might have been seen. A true analysis of cost of place must pay heed to both housing and transportation expenses.

Smart growth practices, whether they manifest themselves in the form of mixed-use suburban development, transit-oriented development, variety in housing and transportation choice, community involvement, or any combination of these and more, can be of tremendous help both in clearly representing and in reducing these costs.

Bekka, Khalid. “Economic Benefits of Public Transportation.” HDR Corporation for Wisconsin Department of Transportation, (Nov. 2003). [<http://www.completestreets.org/webdocs/factsheets/cs-individuals.pdf>].

The Wisconsin Department of Transportation found that riding public transit can save riders an average of \$7 per trip over driving, and that “because of these individual savings, additional money is invested in the economy, resulting in 11,671 new jobs, \$163.3 million in tax revenue, and \$1.1 billion in total output.

Center for Neighborhood Technology. “Penny Wise and Pound Foolish: New Measures of Housing + Transportation Affordability.” Chicago, IL: Center for Neighborhood Technology, (Feb 2010). [<http://www.cnt.org/repository/pwpf.pdf>].

Updated guide to the Housing and Transportation Index created by the CNT that shows the combined estimated cost of housing and transportation for households in different neighborhoods within 337 US metropolitan regions.

Cohen, S., et al. “Windfall for All-How Connected, Convenient Neighborhoods can Protect our Climate and Safeguard California’s Economy.” Oakland, CA:TransForm, (2009). [<http://www.transformca.org/files/reports/TransForm-Windfall-Report.pdf>].

A study that calculates the potential savings in household transportation costs if all California residents had the same good access to transit as available in transit-rich areas of the major metropolitan regions. It estimates household savings of \$3,850 annually.

Cortright, J. “Portland’s Green Dividend.” CEOs for Cities, (2007). [<http://www.ceosforcities.org/files/PGD%20FINAL.pdf>]. This estimates that Portland’s savings from reduced driving due to smart growth policies is \$2.6 billion annually.

Urban Land Institute Terwilliger Center for Workforce Housing. “Beltway Burden: The Combined Cost of Housing and Transportation in the Greater Washington, DC, Metropolitan Area.” Washington DC: Urban Land Institute, (2009). [<http://commerce.uli.org/misc/BeltwayBurden.pdf>].

This paper from the Urban Land Institute presents the case that a number of Washington, DC metro-area locations with seemingly low costs of living are actually rather expensive once transportation costs are included. It highlights a number of smart growth developments that have been successful in the region. A similar study has been done for the San Francisco Bay Area.

iii. Municipal Infrastructure and Services Costs

Smart Growth development principles offer several avenues to reduced municipal infrastructure and service costs. Infill and compact development reduce the amount of new wet and dry infrastructure needed per dwelling unit. Shorter distances between activities also reduce the cost of services such as police, fire and solid waste management. Including green infrastructure by designing around crucial open spaces can take advantage of natural ecosystem services instead of building man-made structures to accomplish the same tasks. In addition, compact infill development policies can reduce the number of vacant, deteriorating structures in a city, saving money.

American Forests. “Local Ecosystem Analysis Garland Texas: Calculating the Value of Nature.” (2000). [http://www.americanforests.org/downloads/rea/AF_Garland.pdf].

The Urban Ecosystem Analysis in Garland, TX found substantial savings gained from using the natural services provided by local ecosystem instead of building manmade infrastructure to perform the same tasks

Burchell, R. W. *Sprawl Costs: Economic Impacts of Unchecked Development*. Washington, DC: Island Press, (2005).

This landmark look at the differing costs and benefits of sprawl versus compact growth covers many different aspects of the issue. One of Burchell’s central conclusions is that nationwide compact development would cost municipal governments about 10% less than sprawl development would.

Calthorpe and Associates. "Vision California - Charting Our Future." Berkeley, CA: Calthorpe and Associates, (2010). [<http://www.visioncalifornia.org>].

Vision California is a project that uses a 'Rapid Fire Model' spreadsheet tool to evaluate the impacts of different regional and statewide land use and transportation scenarios on a number of variables including public infrastructure costs. Calthorpe and Associates conclude that a "green" scenario of compact growth could save California residents \$8,600 in driving related costs per household by the year 2050, or over \$170 billion annually statewide. This best case scenario would also reduce the GHG emissions from transportation by nearly 70% from the 2050 "business as usual" scenario.

Constance T.F. de Brun, editor. "The Economic Benefits of Land Conservation." Trust for Public Land, (2007). [http://www.tpl.org/content_documents/econbens_landconserve.pdf]. Summarizes data on how tree cover saves money on water treatment costs. Their basic finding is that increased forest cover reduces treatment costs by 20% for every additional 10% in coverage.

Envision Utah. "Quality Growth Strategy and Technical Review." (2000). [http://www.envisionutah.org/eu_qgs_economicgrowth.html]. The "Envision Utah" planning process found that the "quality growth" scenario would save a total of \$4.5 billion over 20 years on infrastructure alone.

H. C. Planning Consultants, Inc. "The Costs of Suburban Sprawl and Urban Decay in Rhode Island. Providence." RI: Grow Smart Rhode Island, (1999). Found that Rhode Island could save over \$1.43 billion over 20 years, or \$71.6 million per year if the next 20,000 housing units were built more compactly.

Kimley Horn. "Modeling of GDOT's Investing in Tomorrow's Transportation Today (IT3) Project." Atlanta Regional Commission. Microsoft PowerPoint File, (Feb. 2009). [<http://www.it3.ga.gov/Documents/Meeting-Georgias-Mobility-Challenges.pdf>].

A study commissioned by the Georgia State Department of Transportation with research conducted by McKinsey and Company showed that strategic investments in transportation infrastructure (including transit, HOV/HOT, demand management, and changes to the freight system) and aligning development with transportation, could yield \$515 billion in economic benefits over 30 years and 320,000 jobs over 20 years. Most of the benefits would come from reduced congestion and increased GDP. These investments would require expenditures of \$57-168 billion.

National Vacant Properties Campaign. "Vacant Properties: The True Costs to Communities." (2005). [http://www.vacantproperties.org/latestreports/True%20Costs_Aug05.pdf].

The National Vacant Properties Campaign has found that rehabilitation of abandoned buildings can provide extensive savings in maintenance and public safety, well beyond those achieved through demolition.

Paull, E. "The Environmental and Economic Impacts of Brownfields Redevelopment." Washington, DC: Northeast Midwest Institute, (2008). [<http://www.nemw.org/images/stories/documents/EnvironEconImpactsBFRedev.pdf>].

Shows that brownfields do not require as much of an investment in infrastructure, with the scale of savings ranging from 10% to 90%.

US Environmental Protection Agency. "Solving Environmental Problems through Collaboration: A Case Study—New York City Watershed Partnership." (2006). [<http://www.dec.ny.gov/lands/25599.html>].

The use of open space as a natural filtration system has resulted in savings for the New York City region that amount to between \$8 to \$10 billion in avoided construction and about \$350 million each year to operate and maintain a filtration plant

University of Kentucky Center for Business and Economic Research. "Smart Growth and the Costs of Sprawl in Kentucky: Phase I & II." (2001).

A Kentucky study of 10 counties found that the annual cost to serve an average new household with police, fire, highways, schools, sewer and solid waste ranged from a savings of \$1.08 less than the amount of tax revenue collected from the average new household in a compact county with a central city to a cost of \$1,222 more than the amount of tax revenue obtained from the average new household in a spread out suburban county.

Sacramento Area Council of Governments. "The Cost of Growth: Blueprint Infrastructure Cost Analysis." (2 May 2005). [http://www.sacog.org/regrpt/pdf/2005/10-Oct/OCT_RR_2005_V6_5.pdf].

SACOG found a savings of more than \$9 billion over forty years in a compact growth scenario as opposed to 'business as usual'. Two-thirds of the savings came from reduced transportation and water infrastructure costs.

C. Improving Quality of Life

i. Enhancing Sustainability

Protecting natural resources improves quality of life if the same living standards can be achieved with less impact on the natural environment. More efficient design through smart growth can often save energy, preserve natural resources and save money at the same time.

Bailey, L. P. Mokhtarian, and A. Little. "The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction." American Public Transportation Association, (2008). [http://www.icfi.com/Markets/Transportation/doc_files/public-transportation.pdf].

Found that households with one car and access to public transportation annually save an average of \$6,251, when compared to an equivalent household with two cars and no access to public transportation.

Brown and Wolf. "Energy Efficiency in Multi-Family Housing a Profile and Analysis." Energy Programs Consortium, (June 2007). [<http://www.energyprograms.org/briefs/O706.pdf>].

Compact development can significantly reduce water and energy usage in a number of ways.

Center for Clean Air Policy. "The Value of Green Infrastructure for Urban Climate Adaptation." Washington, DC. (2010).

Evaluates the performance and benefits of a selection of green infrastructure solutions to climate-related risks. Given the challenge of accurately calculating the incremental costs and benefits of climate adaptation policies, the report uses the costs, benefits, and performance of various green infrastructure practices as proxies for their value to climate adaptation. Green Infrastructure solutions profiled include: Eco-roofs, Urban Forestry, Green Alleys, Permeable Pavement and Low Impact Development. Some of the benefits of green infrastructure identified by the report include: avoided costs and damages from weather impacts, lower storm-water management costs, increased quality of life, energy savings and even GHG emissions reductions.

Cherokee. "2007 Annual Sustainability Report". Raleigh, NC: Cherokee Fund, (2007). [<http://www.cherokeefund.com/pdfs/CherokeeAnnualSustainabilityReport07.pdf>].

A 23-acre mixed use Transit Oriented Development (TOD) in Charlotte, NC, located along a light rail line, is projected to reduce commute times, vehicle GHG emissions, and land use by 75% each; reduce building energy use by 25%; and increase properties and tax revenues of 25% each, compared to a traditional mixed use suburban development

Herman Daly. *Beyond Growth: The Economics of Sustainable Development*. Boston: Beacon Press, (1996).

This classic work by a former World Bank economist argues that development can take the form of economic growth or improvement in quality of life. It argues that striving for unlimited growth may not achieve the goals society hopes for and that other types of change may improve well being to a greater extent.

Kirk, K. et al. "Framework for Measuring Sustainable Regional Development for the Twin Cities Region." Minneapolis, MN: Center for Transportation Studies, (Jan 2010). [<http://www.cts.umn.edu/Publications/ResearchReports/pdfdownload.pl?id=1328>].

Study by the University of Minnesota provides an example of a framework for evaluating sustainable development in the Twin Cities metropolitan region. Based on six sustainability principles inspired by the HUD-DOT-EPA Sustainability Partnership.

National Association of Local Government Environmental Professionals, Trust for Public Land and ERG. "Smart Growth for Clean Water: Helping Communities Address the Water Quality Impacts of Sprawl." (2003). [<http://www.resourcesaver.com/file/toolmanager/Custom093C337F42157.pdf>].

Urban runoff is a major issue that impacts communities far and wide. Rainwater interception techniques, if used in concert with smart growth innovations like permeable sidewalks, can generate far-reaching savings in all communities. Washington, D.C. metropolitan area has used trees to reduce the need for additional storm-water retention structures by 949 million cubic feet, saving the region \$4.74 billion in gray infrastructure costs per 30-year construction cycle.

Sacramento Region Blueprint Transportation/Land Use Study. "Special Report: Preferred Blueprint Alternative." (2007). [<http://www.sacregionblueprint.org/sacregionblueprint/home.cfm>].

Sacramento's compact growth scenario reduced future land conversion by 40% from the "business as usual" scenario, potentially preserving natural beauty and wildlife habitat.

Richards, Lynn. "Water and the Density Debate: When it Comes to Protecting Water Resources, Higher Density May Be the Way to Go." *Planning Magazine*, (June 2006).

The article reports that increasing development density from one unit per acre to eight units per acre decreases runoff rates by about 74 percent.

Nisensen, Lisa. "Using Smart Growth Techniques as Storm-water Best Management Practices." US EPA Division of U.S. Development, Community and Environment Division, (2005). [http://www.epa.gov/smartgrowth/pdf/sg_stormwater_BMP.pdf]. Portland, Oregon calculated it could save \$35,000 per mile through shaving 4 feet from new streets. This change would also reduce stormwater runoff since 70% of flow originates from transportation-related surfaces. San Diego in 2002 adopted a policy of shared storm-water abatement for infill developments, saving \$40,000 per project.

Richards, Lynn. "Turning Storm-water Runoff into a Community Amenity" U.S. Environmental Protection Agency's Office of Policy, Economics, and Innovation - Smart Growth Program. Denver saved \$20 million in redeveloping the former Stapleton Airport site using green storm-water approaches

Shapiro, R. J., Hassett, K. A., & Arnold, F. S. "Conserving Energy and Preserving the Environment: The Role of Public Transit." American Public Transit Association, (July 2002). [http://www.publictransportation.org/pdf/reports/shapiro_report.pdf]. The authors compare the energy use per passenger mile of public transit and private vehicles. They conclude that because public transit in general uses fewer BTU per passenger mile not only does public transit conserve energy right now, but there is the potential to save large amounts of energy and reduce GHG emissions by increasing the percent of travel done by public transit. For example, the report states that if ten percent of Americans switched to public transit the US could achieve ¼ of the CO2 reductions mandated by the Kyoto treaty. The report includes a number of quantitative tables illustrating how the conclusions were obtained.

Van Lare, Paula and Danielle Arigoni. "Growing towards More Efficient Water Use: Linking Development, Infrastructure, and Drinking Water Policies." US Environmental Protection Agency. (2006). [http://www.epa.gov/smartgrowth/pdf/growing_water_use_efficiency.pdf]. The EPA calculates that "lawn care, car washing, swimming pools, and other outdoor uses can account for 50 to 70 percent of household water use." In a compact, single-family housing development in Sacramento, California, water demand was 20-30% less than suburban single-family homes in the same city. In Utah, EPA reports that as residential density increases, water demand will drop from approximately 220 gallons per capita per day to about 110 gallons per capita per day. In-town, close-in, and compact developments require shorter water and sewer transmission lines, costing about 50% less to build and maintain than their sprawling counterparts while also reducing the incidence of leaks

ii. Psychological and Physical Health

Kuo and Sullivan. "Aggression and Violence in the Inner City: Effects of Environment via Mental Fatigue." *Environment and Behavior*. 33 (2001). [<http://www.naturalearning.org/docs/Kuo=SullivanAgression.pdf>].

Access to green space may improve mental health and reduce violent incidences

Stutzer, A. and B. S. Frey. "Stress That Doesn't Pay: The Commuting Paradox." Institute for the Study of Labor, Bonn Germany, (2004). [<http://www.econstor.eu/bitstream/10419/20544/1/dp1278.pdf>].

Reduced commute times can increase happiness.

Trust for Public Land. "The Health Benefits of Parks: How Parks Help Keep Americans and Their Communities Fit and Healthy." (2006). [http://www.tpl.org/tier2_cl.cfm?folder_id=725].

This Trust for Public Land paper assembles and presents a compelling case for the beneficial nature of open spaces in an urban setting.

iii. Pollution and Climate Change

Bürer, Mary Jean, David B. Goldstein, and John Holtzclaw. "Location Efficiency as the Missing Piece of the Energy Puzzle: How Smart Growth can Unlock Trillion Dollar Consumer Cost Savings." (Aug. 2004). [http://docs.nrdc.org/air/files/air_06031001a.pdf].

Analysis by the Natural Resources Defense Council projects the nationwide potential benefits of smart growth over ten years – assuming all new housing starts to be relatively location-efficient and compact, with half as infill and half in suburban areas. Analysis projects about \$2.2 trillion in economic savings, accompanied by GHG savings of 595 MMTCO2 over the course of ten years – representing an economic benefit of more than \$3,000 per ton CO2. Even at more modest penetration rates the benefits are compelling.



Charles Kooshian, Senior Transportation Policy Analyst at CCAP, has more than twenty years experience in transportation and land use planning for regional and local government. At CCAP he evaluates transportation policy alternatives and their effects on GHG emissions, governmental planning processes and institutional coordination issues. He has analyzed the cost effectiveness of various land use and transportation measures to reduce GHG emissions and the data needs for monitoring and performance evaluation. He led a study to examine barriers hindering state and local governments from implementing climate change mitigation projects. During the preparation of *Growing Wealthier* he became interested in measuring how urban form affects the economic and other benefits that a city provides to households, businesses and governments.

Before joining CCAP Chuck developed travel demand models for public and private use in California, Michigan, Florida and Texas. He also worked as a long range comprehensive land use planner in El Paso, Texas where he managed the Open Space and Green Infrastructure Planning process and facilitated the adoption of the Smart Code. As a land use planner he was particularly concerned with how the selection and planning of transportation projects has long term effects on land use. Chuck holds an MS in Urban and Environmental Systems from Florida International University and a BA in Political Science from the University of California at Berkeley. He lives in Washington, DC.



Steve Winkelman, Director of the Transportation Program at CCAP, has twenty years of experience in the transportation, energy and environmental fields. Steve assists government officials with policy design, implementation and evaluation in the U.S. and abroad. He is a co-author of the book, *Growing Cooler: The Evidence on Urban Development and Climate Change* (ULI 2008). Steve has successfully focused policy attention on the importance and cost-effectiveness of slowing growth in travel demand to reduce greenhouse gas (GHG) emissions, popularized with his phrase, “Sidewalks are as sexy as hybrids.” He crafted and generated broad support for an incentive program to reduce transportation GHGs, and for recommendations to improve travel data and modeling in support of performance-based policy. Steve has testified to four Congressional committees on these topics. He developed the CCAP Transportation Emissions Guidebook with tools for quantifying savings from vehicles, fuels and travel efficiency. Steve also directed the Urban Leaders Adaptation Initiative, helping local governments to “Ask the Climate Question” when making infrastructure and land use decisions.

Prior to joining CCAP, Steve managed ICF’s Climate Wise industrial energy efficiency program for the US EPA. At Argonne National Laboratory he designed, built and tested a magnetically levitated vehicle (maglev). Steve is a member of the National Academy of Sciences’ Sustainable Transport Committee. He holds a BS in Physics from the University of Michigan and an MA in Public Policy from the University of Minnesota. Steve lives in Montréal with his inspiring wife, Heather, and charming son, Benny.



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