Transportation and the Economic Health and Attractiveness of Metropolitan Regions

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Executive Summary

Central places have been a feature of human existence for centuries, serving as locations for goods distribution, common defense, and other forms of human economic and social interaction. Just as cities are essential to modern civilization, good transportation between and within urban places is critical to their success. This paper addresses the economic benefits of investing in efficient metropolitan transportation systems. The paper surveys the recent history of urban development patterns in the U.S., then focuses on the role of balanced transportation systems featuring healthy public transit in the revitalization of urban areas. It also includes a brief discussion of the role of efficient supply chains in fostering urban vitality.

The history of metropolitan area development in the U.S. from the end of World War II to the present is well known, and has often been described as the "flight to the suburbs." More recently many urban areas have been seeing somewhat of a return to the city. New urban design concepts, such as planned communities and new urbanism, are attracting some new residents to housing types unlike the traditional isolated suburban enclaves. These new urban residents want walkable communities, social and cultural amenities, and good public transportation services that will enable them to access all of the opportunities that vibrant central cities have to offer.

To met these demands, metropolitan areas strive to develop balanced transportation systems, in which each mode that is appropriate to the area's size and resources is developed to efficiently serve its market segments. In addition to an extensive system of highways and streets, every urbanized area has some form of public transportation, and the largest metro areas are served by several transit modes.

For the first time since World War II driving in the U.S. has been decreasing rather than increasing, which may be at least partly due to the reduced reliance on the private automobile that accompanies new urbanism. Other possible factors include the increasing cost of owning and operating an automobile; increasing urban congestion levels; and use of social media as a substitute for or augmentation of travel.

Metropolitan transportation investment is needed to support urban revitalization. Shifting urban housing and travel choice patterns, the increasing difficulty of building new major urban highways, and increasing urban population density, mean that much new investment will be in public transportation systems.

Investments in public transportation have a broad array of social and economic benefits , including direct cost savings by riders, congestion cost savings for those driving on urban roadways, and improved business productivity and growth. Transit also helps to sustain and increase property values, and there is some evidence to indicate that cities with good public transportation fare better during economic downturns.

Investing in supply chains produces a more efficient economy, as more output can be produced at lower total production cost, and goods can be sold at lower prices, which generates higher demand and boosts economic output. Since efficient and reliable freight transportation is crucial to supply chain performance, it follows that investments in the U.S. freight system are needed to maintain and improve both urban vitality and international competitiveness.

Introduction

Central places have been a feature of human existence for centuries, serving as locations for goods distribution, common defense, and other forms of human economic and social interaction. Advances in agricultural, industrial, communication, and transportation technology over the past 200 years have allowed central places to evolve into the familiar mix of villages, towns, cities, and metropolitan areas that dot the landscape worldwide. In his classic text on urban economics, Arthur O'Sullivan sums it up as follows: "The transformation of a rural society into an urban one occurred because technological advances increased the agricultural surplus, increased the productivity of urban workers, and increased the efficiency of transportation and exchange." (O'Sullivan, 2009)

Just as cities are essential to modern civilization, good transportation between and within urban places is critical to their success. The basic role of transportation is to connect people and places, so as to support economic and social activity. Transportation demand is a derived demand, arising from society's need and desire to accomplish these other activities. The report of the National Surface Transportation Policy and Revenue Study Commission (2008) summarized the importance of good transportation in the following words: "A modern, smooth-functioning national surface transportation system is essential for economic success in a global

economy and is also a key determinant of the quality of life enjoyed by citizens throughout America."

This paper addresses the economic benefits of investing in efficient metropolitan transportation systems. The paper surveys the recent history of urban development patterns in the U.S., then focuses on the role of balanced transportation systems featuring healthy public transit in the revitalization of urban areas. It also includes a brief discussion of the role of efficient supply chains in fostering urban vitality.

The Reurbanization of America: Renewal of Our Central Cities

Vibrant and well-functioning central cities are essential to a state and a nation's economic well being. This was true even in agrarian societies the of antiquity. Cities began to emerge as early as 3000 BC, and the city states of the Greek and Roman empires date to at least the eighth century BC (Christian, 2008). A modern view is expressed in a recent report from the European Union (2011): "Today, more than two thirds of the European population lives in urban areas and this share continues to grow...Cities play a crucial role as engines of the economy, as places of connectivity, creativity and innovation, and as centres of services for their surrounding areas." The same could be said about U.S. cities.

The emergence of a knowledge-based economy, both in the U.S. and worldwide, has made the role of the city even more important. A recent IBM report (Dirks, Gurdgiev, and Keeling, 2010) notes that the traditional "bricks-and-mortar" drivers of economic growth are giving way to an economy based on knowledge workers, and cities, as hubs of the global economy, are the focal points for this transformation. The report goes on to posit that "three interconnected factors will place even more emphasis on the role of cities in talent-based economic development:

- The world is at an unprecedented level of urbanization.
- Cities contain an increasingly large share of the world's highly skilled, educated, creative and entrepreneurial population, giving rise to highly concentrated and diverse pools of knowledge and knowledge-creation networks.
- Cities can support large-scale business and investment networks that create economies of scale in absorbing and extending innovation."

Changing patterns of urban settlement

Today's central cities are the geographic focal points of complex metropolitan areas. The definitions adopted by the U.S. Census Bureau (2012) are instructive. An "urbanized area" consists of a central place and the adjacent urban fringe that together have a minimum residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile of land area. The largest urbanized areas are "metropolitan areas," which have a core area with a large population nucleus–generally at least 100,000 inhabitants–plus adjacent communities having a high degree of economic and social integration with that core. (See the Census Bureau reference for more detailed technical definitions of these concepts.) The U.S. has 59 metropolitan areas with populations exceeding one million, including twelve areas with populations of over five million.

The history of metropolitan area development in the U.S. from the end of World War II to the present is well known, and has often been described as the "flight to the suburbs." During most of this period rising household incomes fueled by the postwar economic boom, coupled with housing policies that favored home ownership and the development of our highway system, enabled millions of households to attain the "American dream" of owning a detached single-family home on a spacious lot in the suburbs (Nelson, 2013).

Sinha (2003) analyzed data on urban density, automobile ownership and use, and transit ridership for 38 major metropolitan areas worldwide, for the period 1960 through 1990. Nearly all of these cities experienced decreases in population density, with changes typically from -10 to -30 percent. Only four cities (Los Angeles, San Diego, Toronto, and Phoenix) recorded gains in population density, but still ranked among the least densely populated cities in the sample. Automobile use, as measured by annual veh-km of travel per capita, increased by a factor of four over that same period.

More recently many (though not all) urban areas have been seeing somewhat of a return to the city. Mulherin and Howell (2012), for example, examined Census and other data for Los Angeles for the period 1990 to 2010, and found that " downtown Los Angeles has begun to witness measurable population growth within the metropolitan region," but for complex and subtle reasons that are not well understood. Similar tends have been observed elsewhere, but this phenomenon is so new that there is little in the way of research findings to explain what is happening. Further research would help us to understand the factors that are contributing to central city population increases, and what this means for future transportation system investments.

New urban design concepts

Some parts of today's reurbanization are occurring as people move to towns and cities that differ quite a bit from the cities of the 1950s. The earliest manifestation of new urban settlements designed to combat what were perceived as the adverse effects of the urban sprawl type developments described above were the "planned communities" or "new towns" that were planned and built starting in the late 1960s. Examples of these communities include Reston, VA, Columbia, MD, Irvine, CA, Woodlands, TX, Jonathan, MN, Peachtree City, GA, Las Colinas and Valley Ranch in Irving, TX, and dozens of other planned communities.

These new towns were meant to be mixed use developments with a variety of housing types and commercial districts, but completely planned before construction began. The vision of developer James Rouse for Columbia, MD is representative of what these new planned communities hoped to accomplish. His vision (Columbia Archives, 2013) was to build a complete city, with business and industry, houses and apartments, schools and churches, libraries, a college, a hospital, concert halls, theaters, restaurants, hotels, offices and department stores. Other design goals were to respect the land by integrating nature and open space throughout the community; provide for the growth of people via facilities and organizations for education, involvement, and community service; and make a profit to show that good development can also be good business. By all accounts this vision for Columbia has been largely realized.

A contemporaneous and complementary development was the advent of the "festive marketplace" concept as a means of redeveloping and revitalizing city core areas so as to attract visitors, both metropolitan area residents and tourists, to the downtown. Typical examples include Ghirardelli Square, San Francisco; Faneuil Hall, Boston; Harborplace, Baltimore; Navy Pier, Chicago; and Station Square, Pittsburgh. These developments offer a trendy mix of specialty shops, restaurants, galleries, and entertainment venues, often with nearby or co-located hotels and major attractions, and feature public parking and good transit and pedestrian access.

The most recent form of redesigned urban living is often referred to as "new urbanism," which features compact development with a range of housing and job types, walkable neighborhoods, public transit accessibility, and in general less reliance on driving everywhere. The new urbanism movement began in the U.S. in the 1980's as a reaction to land zoning and transportation development practices that created sprawling suburbs with rigidly segregated land

uses, low residential densities, and little consideration for the needs of pedestrians, cyclists, and public transit. Further details and design principles are available from the Council for New Urbanism (http://www.cnu.org/Intro_to_new_urbanism), and Newurbanism.org (http://www.newurbanism.org). There are two basic types of new urbanism development (though the exact details vary widely): (1) relatively small and compact new communities, usually near major metropolitan centers, and resembling the small towns and urban neighborhoods that were found across America prior to the wave of postwar suburbanization described earlier; and (2) urban infill and brownfield redevelopments. Some examples of each type are listed in Table 1.

Table 1. Examples of New Urbanism Developments

New Communities	Infill/Brownfield Developments
Baxter Village, Fort Mill, SC Charlotte, NC area	Atlantic Station, Atlanta, GA Former Atlantic Steel site
Prospect New Town, CO Boulder-Denver area	The Gulch, East Nashville, and Germantown Nashville, TN
Daybreak, South Jordan, UT Salt Lake City area	Orenco Station, OR Hillsboro-Portland area
Kentlands, Gaithersburg, MD Washington, DC area	Shockoe Slip, Richmond, VA Former tobacco industry district

Attracting urban residents

The recent urban design concepts summarized above are all intended to make cities vibrant and exciting places where people will choose to live. But there are many other factors that are important for attracting new residents. The list found in the current comprehensive plan for the city of Tampa, FL is typical (Tampa Comprehensive Plan, 2008):

- Vibrant neighborhoods that are part of a complete community;
- Affordable housing choices that meet the needs of everyone throughout their life;
- Attractive, tree-lined streets with shops and housing that are made for walking;
- A comprehensive, high quality and affordable transit system that lets people move around the city quickly and conveniently;
- A strong and competitive economy that creates and sustains well-paid, stable, safe and fulfilling employment opportunities for all who live here;
- A vibrant Downtown;
- Clean air, land and water;
- A great place for children;

- Green spaces of all sizes and public squares that bring people together;
- A wealth of recreational opportunities that promote health and wellness;
- A spectacular waterfront that is healthy, diverse, public and beautiful;
- Cultural facilities that celebrate the best of city living; and
- Beautiful architecture and excellent urban design that add to our identity.

The short list of what people are looking for as they choose where to live is a mix of affordable housing, social and cultural amenities, a variety of shopping, good schools, excellent public safety, and balanced metropolitan transportation systems.

Will this list of housing preferences translate into more urban (vs. suburban or exurban) living in the future? In large measure this will depend on the housing choices of those population generations (see box) who will enter the peak household formation and home buying age group over the next 30 years. Nelson (2013) analyzed the demographics (using slightly different generational boundaries), and shows that Boomers and Millennials will dominate the housing market over that period. He also looked at several recent housing preference surveys that tracked generational differences, and other data on trends that affect housing, and concludes that significant numbers of this group, as many as one-third of Gen Y, will select housing locations and types with new urbanism characteristics, rather than traditional suburbs.

Generation Birth Years

Baby Boomers	1946 - 1964
Generation X	1965 - 1982
Generation Y (Millennials)	1983 - 2000
Generation Z	2001 -

(Dutzik and Baxandall, 2013)

The housing preference surveys referenced by Nelson basically asked respondents if they would rather have large homes on large lots with long commutes to work, or small homes on small lots (on-sixth acre or less) and short commutes. Over half of the respondents chose the latter option, and one-third also reported their ideal home size as less than 2000 square feet.

Does actual home construction track the stated preferences noted above? The general commercial success of planned and new urbanist communities suggests that people are acting on these preferences. There is also some empirical evidence in a series of reports on residential construction trends in America's metropolitan regions published by the Environmental Protection Agency (EPA) (2013). The 2009 and 2010 editions of this report examined residential building permits in the 50 largest U.S. metropolitan regions, for the period 1990 to 2008. Some of the reported findings are:

- In more than half of the largest metropolitan areas, the share of new residential building permits that were in urban neighborhoods dramatically increased.
  - In 15 regions, urban neighborhoods more than doubled their share.
  - The increase was particularly dramatic from 2002 to 2008, showing that the trend of increasing development in urban neighborhoods continued in the wake of the real estate market downturn.
- Redevelopment in urban neighborhoods added up to more than half of new residential construction in only one metropolitan region: New York.
- In eight regions, redevelopment in urban neighborhoods accounted for one-quarter to one-half of new construction.
- In 18 regions, redevelopment in urban neighborhoods significantly increased but accounted for less than one-quarter of new residential units.

The 2012 EPA report compares the location of new homes to data about pre-existing land cover to determine where infill development was taking place in 209 U.S. metropolitan regions between 2000 and 2009. Some findings of that report:

- Nearly three out of four large metropolitan regions saw an increased share of infill housing development in 2005-2009 compared to 2000-2004.
- Infill accounted for one-fifth of new housing construction.
- Infill residential development varied widely among metropolitan regions.
- Infill is associated with higher home prices and rail transit investment.

These findings are not necessarily due to newly emerging Boomer and Millennial housing preferences, as there are many factors that affect housing choice trends, and others have interpreted the data differently (Kotkin, 2013; Bitter and Krause, 2012). Even the EPA data summarized above show that in 205 of the 209 metropolitan regions surveyed more than half of new residential construction is occurring outside of the developed urban core. Nonetheless the new housing patterns noted are significant. As Nelson (2013) concludes, the new urbanism agenda "is not about thwarting the option to live in homes on large lots away from centers; indeed those options are more plentiful than ever before...It is rather about expanding choices for ...Americans who do not want single-family detached homes on large lots isolated from services, jobs, and people."

We now turn our attention to transportation systems as a key enabler for urban location choice.

Efficient Transportation Systems Are Key Elements of Urban Vitality

Cities exist as centers of commerce and other forms of human interaction, so their form and functionality are largely determined by their transportation systems. Early settlements were limited in size by the distance that a person could walk in less than one day. Animal-drawn carriages traveling on improved cart paths and streets, and later electric streetcars on their own tracks, greatly expanded the city's radius, as housing and commercial construction followed the new streetcar lines into the hinterlands. As Grava (2003, p. 437) notes: "The defining images of the American city in the early twentieth century were traffic-choked streets where the streetcar offered the only real promise of mobility and blossoming suburban enclaves that were accessible only because a trolley line was in operation."

Commuter railroad service also extended the city's influence, allowing residents in smaller outlying towns to access city jobs and services. The personal automobile made its debut as a means of carrying mainline residents from their homes to their town's commuter rail station, and did not come into its own as a principal commuter travel mode until the advent of mass production of vehicles and vastly expanded all-weather roads and streets. The impact of the postwar highway building era, sometimes called "the freeway age," has already been noted. It is clear that modern metropolitan areas could not exist without the extensive transportation infrastructure that both shapes and serves them.

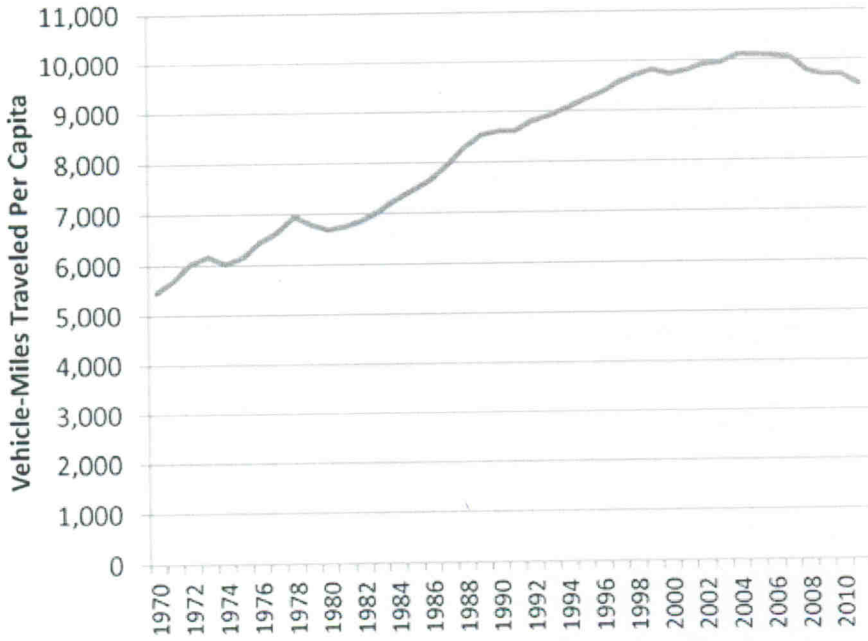
Efficient metropolitan transportation systems allow families to choose housing locations which provide desired open space and lifestyle amenities, while still being within reasonable commuting distance and time to their employment locations. The metropolitan transportation system must also provide easy access to shopping choices, schools, healthcare and cultural institutions, and social and recreation facilities, since these non-work related trip purposes now dominate metropolitan transportation (less than 25 percent of trips are now work-related). Likewise businesses need efficient transportation in order facilitate worker access, receive inbound materials and services, and distribute their output to customers. Hence transportation is a major factor in business siting, both the larger decision of in which city to locate, and the micro decisions of where in the city to site their facilities. Other types of institutions face similar location choices that are partly driven by transportation availability, efficiency, and cost.

Balanced transportation to meet a variety of demands

In the face of these varied demands metropolitan areas strive to develop balanced transportation systems, in which each mode that is appropriate to the area's size and resources is developed to efficiently serve its market segments. Grava (2003) provides an excellent compendium on the history, technology, and development of the various metropolitan transportation modes. Today the basic fabric of a city's transportation system is its extensive network of highways and streets. Limited access expressways and other arterial highways serve longer distance radial and cross-town trips (and through traffic), local streets provide direct access to businesses and residents, and collector streets connect those two subsystems. The street system also provides for pedestrian and bicycle travel, serves the highway-based public transportation modes, and provides highway access to the fixed guideway transit modes. Trucks moving on the streets and highways often provide the pickup or delivery legs of intercity freight movements regardless of the linehaul mode, and, of course, serve the urban goods distribution function.

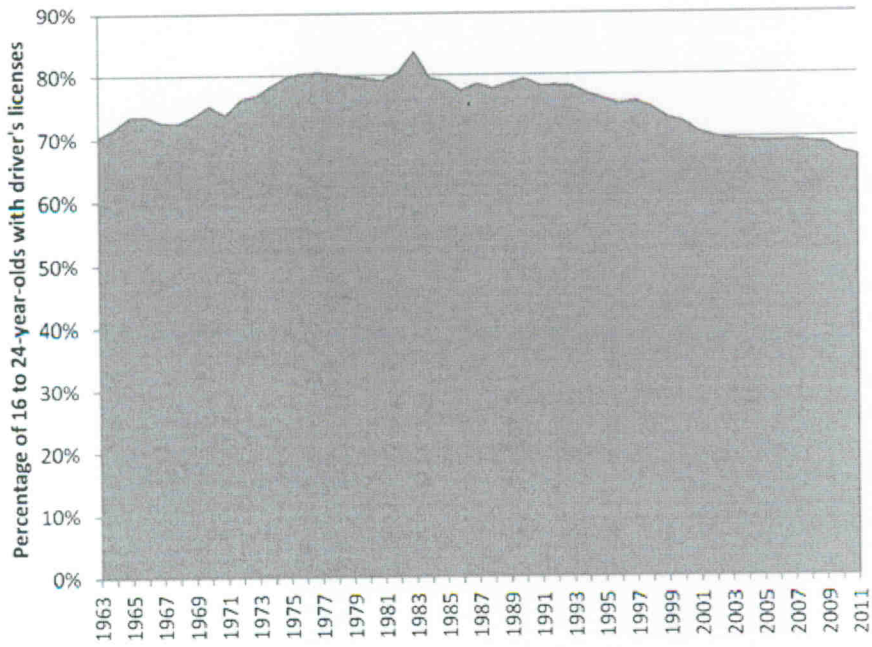
Every urbanized area has some form of public transportation, and the largest metro areas are served by several transit modes. Virtually every city has a bus system, and most have taxi service. Smaller towns, and even rural areas, have specialized transportation services, sometimes called paratransit, to carry passengers to healthcare, churches, community centers, and other social service agencies. The largest cities have fixed guideway systems appropriate for the area's scale and density, including commuter rail, heavy rail, light rail (streetcars), trolley buses, and bus rapid transit (BRT). In a few cities with unique geography other transit modes, such as ferries, water taxis, tramways, and funicular railways exist.

There is some recent evidence that the demographic and socioeconomic forces that are affecting housing demand are also affecting metropolitan transportation demand. As shown in Figure 1, for the first time since World War II driving in the U.S. has been decreasing rather than increasing (Davis, et al., 2012). This is partly due to the fact that auto travel by both Millennials and Gen X has been falling recently. The percentage of 16 to 24 year-olds with a driver's license has been dropping since 1983 (Figure 2), and was down to 67 percent in 2011, which is the lowest level since at least 1963 (Dutzik and Baxandall, 2013). Concomitantly urban rail transit travel has been increasing, as shown in Figure 3. Nelson (2013) posits that a partial explanation for this trend may be found in the results of recent housing preference surveys, which show that about half of Americans want to live in



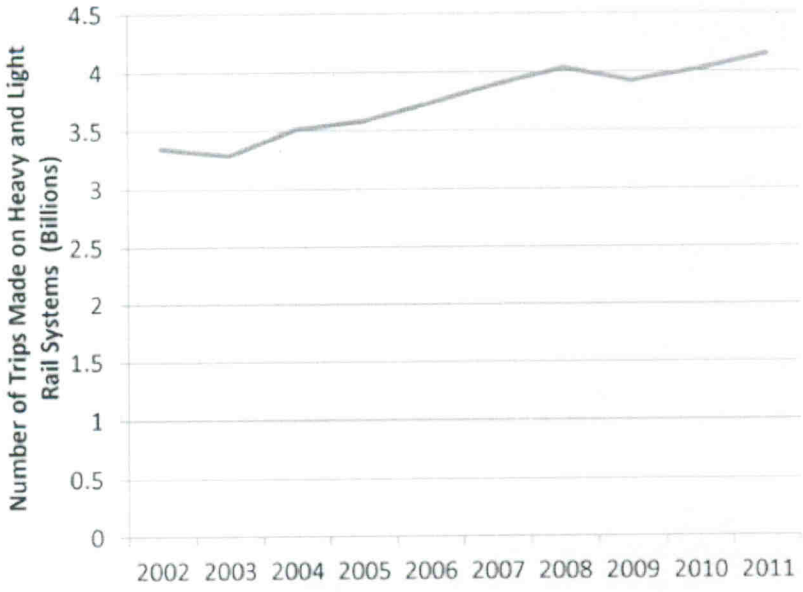
Source: Davis, et al. (2012)

Figure 1. Vehicle-Miles Traveled Per Capita Peaked in 2004



Source: Dutzik and Baxandall (2013)

Figure 2. Percentage of 16 to 24-Year-Olds with Driver's Licenses



Source: Davis, et al. (2012)

Figure 3. Heavy and Light Rail Ridership Increases Across the US

walkable communities with mixed housing and other mixed uses, and with transit options. A recent report (Resource Systems Group, et al., 2012) states that "comparisons of travel data among regions of different urban forms, among communities within those regions and development areas within those communities all demonstrate that smart growth development vehicle travel rates are lower than conventional suburban forms. They show that the extent of reduction is proportional to the degree to which the development is compact, diverse, location efficient, served with a variety of transportation choices, and endowed with a sense of place."

Various explanations have been offered as to why driving is decreasing, particularly among younger people. Three that we consider here are: (1) the increasing cost of owning and operating an automobile; (2) increasing urban congestion levels; and (3) use of social media as a substitute for or augmentation of travel.

The cost of driving in the city goes well beyond paying for fuel and parking. A recent Victoria Transport Policy Institute (2011) study lists the elements of full driving cost as follows:

Fixed Costs	Variable Costs
• Vehicle purchase or lease	• Maintenance and repair
• Insurance	• Fuel, fuel taxes and oil
• Registration and vehicle taxes	• Paid parking and tolls

They estimate the total driving cost for an average vehicle in the U.S. at about $0.44 per mile. (To this could be added the cost of garaging a vehicle at the driver's residence, which is usually rolled into the cost of buying or renting housing.) And these costs have been going up. The AAA (2013) estimates the current average cost of driving at 61 cents per mile, which is up from 54 cents five years ago, and from 9 cents per mile in 1950 when gasoline sold for 27 cents per gallon. Vehicle registration costs have also been increasing in recent years, as states have been trying to compensate for the decreasing fuel tax revenue related to the decline in driving noted above.

Increasing traffic congestion has made driving in metropolitan areas an unpleasant experience, especially during the daily morning and evening peak periods associated with commuting to and from the workplace. The Texas A&M Transportation Institute (2012) reports that in the 15 large urban areas with populations exceeding 3 million, the average hours lost due to traffic delays increased from 19 hours per driver in 1982 to 52 hours in 2011. In aggregate over all urban areas, congestion caused drivers to travel 5.5 billion hours more and to purchase an extra 2.9 billion gallons of fuel, amounting to an estimated congestion cost of $121 billion. In 1982 the comparable congestion cost was $24 billion. Over that same period the average Travel Time Index (TTI) for those same areas, which is the ratio of travel time in the peak period to the travel time at free-flow conditions, increased from 1.12 to 1.27. In cities such as Washington, New York, and Los Angeles the TTI is about 1.33, which means that a trip that takes one hour when traffic is comparatively light takes about an hour and twenty minutes during the peak traffic periods. To make matters worse, in the largest 15 urban areas congested driving conditions prevail for an average of six hours per day, and to arrive on time for important trips travelers need to allow for 60 minutes to make a trip that takes 20 minutes in light traffic.

Finally, there is a trend among younger people to use communication technology to substitute for some trips, and to support their use of public transit and other transportation services (Davis, et al., 2012). Younger people today value constant contact with their peers, through technologies such as websites and mobile phone applications that offer social networking, instant messaging, and video chatting, to the point that they have less time and desire to drive to see someone. This is substantiated by a recent survey by Zipcar and KRC Research. According to the survey, 54 percent of young people polled strongly or somewhat

agreed with the statement that "I sometimes choose to spend time with friends online instead of driving to see them." In comparison, only 18 percent of Baby Boomers agreed.

These same technologies provide real-time transit data, informing riders when the next bus, train, or subway will arrive, how long the trip will take, and what transfers will be necessary. Technology advances have also allowed the creation of transportation options that did not exist 15 or 20 years ago, such as car-sharing services. Zipcar, for example, uses the Internet and smart phone applications to allow users to reserve, pay for, locate, acquire, and return cars easily, at any time of the day. The Zipcar system is currently available in major cities and on college campuses in 37 states (www.zipcar.com). This type of car-sharing service enables some people to avoid purchasing a vehicle–or a second vehicle–of their own, thus saving money that can then be spent for other purposes.

Metropolitan transportation investment to support urban revitalization

Cities need two basic types of transportation: (1) urban highways and public transit systems to allow residents to access the employment and other opportunities that are available within the metropo0litan region; and (2) intercity highway, rail, and marine systems to connect to the larger regional, national, and international economies. Historically, investments in transportation to serve these purposes have produced substantial economic benefits. The Federal Highway administration (19966) reported that investments in non-local roads over the period 1950 to 1989 yielded annual production cost savings to industry of 24 cents for each dollar of investment, and the net social rate of return on investment in the road network was 10 percent. For non-local roads the return was an even higher 16 percent.

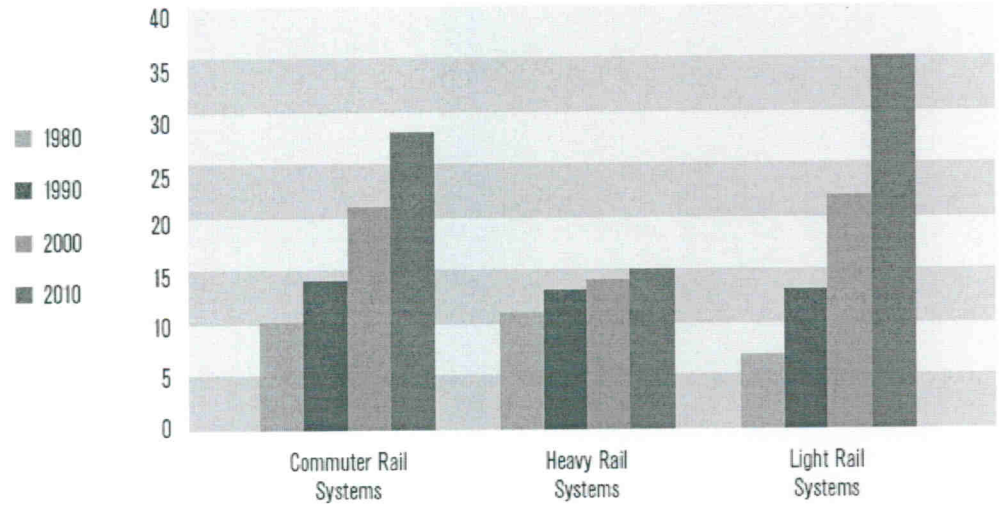
The economic benefits noted above were characteristic of projects built during the heyday of the Interstate highway construction era, which has largely run its course. Cambridge Systematics (2012) recently completed a study of what types of economic returns might be available today, as the investment scenario has shifted to a mature U.S. transportation system. They reported on a Strategic Highway Research Program 2 examination of 100 case studies of the economic and land development impacts of recent highway and intermodal projects. The case studies encompassed a range of project types that are representative of today's investment opportunities, including the development of major highways, beltways, connector routes, bypasses, bridges, interchanges, industrial access roads, highway widening projects, and intermodal freight and passenger terminals. All 100 cases had measures of job impact, with 85

showing evidence of a positive change in jobs for the impact area. For those cases that measured other economic impacts the direction of change was positive in all cases. They also reported on a study for the New York/New Jersey metropolitan region which showed that improved land accessibility, as measured by travel times between different locations, is correlated with economic growth in the region.

Building new major highways in metropolitan areas has become exceedingly difficult. A principal reason is that most areas simply do not have land available to devote to this purpose, as using land for highways reduces the land that is available for the housing, commercial, and cultural facilities that are vitally needed to maintain and improve the vibrancy of urban places. Thus urban area highway projects now are mostly limited to repaving and rehabilitation of roads and bridges, building spurs and other access roads to serve newly developed areas on the urban periphery, spot improvements (such as widening) to increase capacity and safety, and operational improvements (such as freeway service patrols and upgraded traffic signal systems) to reduce traffic congestion and squeeze more throughput out of existing highways. Consequently many areas are turning to public transit systems of all types to provide urban mobility.

The American Public Transportation Association (APTA) (2011) reports that the number of public transit agencies operating rail systems has grown continuously over the past three decades (Figure 4). In 1980 there were only 10 commuter rail systems; by 2010 there were 28. Four new heavy rail systems opened between 1980 and 2010. The number of light rail systems increased five-fold, from seven in 1980 to 35 in 2010. Rail transit systems now provide public transportation service in 32 states, the District of Columbia and Puerto Rico. Existing systems have also expanded during those years, extending and adding routes.

In summary, as urban areas continue to grow investments in metropolitan transportation systems will be needed to support the redevelopment and revitalization of downtown areas. Many metropolitan areas are choosing to invest in new and expanded public transportation services as part of their urban vision. Recent trends in urban travel choices underscore the need for transit options. The benefits of public transportation investment are covered next.



Source: APTA (2011)

Figure 4. Since 1980 The Number of Rail Systems Has Increased

Public Transportation Systems Provide Mobility Benefits to All

General benefits of public transit

Urban transit systems have their own unique benefits. It is an observable fact that every major city in the world has successful public transit. Rail transit systems running on their own separate guideways carry significantly more passengers per hour than urban expressway lanes, and often have faster peak-period travel times as well. Public transit also has equity benefits, in providing mobility to urban residents who lack access to automobiles, and to those who cannot drive due to age or physical limitations. In some cities transit permits low-income inner city residents to commute to good jobs in suburban locations. Finally, urban transit resources can be an important security asset in responding to natural disasters or terrorist threats. Many city emergency response plans call for heavy use of transit and school transportation assets. Transit has a unique role in evacuating the carless and special-needs populations—such as the disabled, the elderly, and the medically homebound—in an emergency (Transportation Research Board, 2008).

Economic benefits of transit investment

Investments in public transit also produce economic benefits. A study by Weisbrod and Reno (2009) listed the following categories of these benefits:

- Travel and vehicle ownership cost savings for public transportation passengers and those switching from automobiles, leading to shifts in consumer spending.
- Reduced traffic congestion for those traveling by automobile and truck, leading to further direct travel cost savings for businesses and households.
- Business operating cost savings associated with worker wage and reliability effects of reduced congestion.
- Business productivity gained from access to broader labor markets with more diverse skills, enabled by reduced traffic congestion and expanded transit service areas.
- Additional regional business growth enabled by indirect impacts of business growth on supplies and induced impacts on spending of worker wages. At a national level, cost savings and other productivity impacts can affect competitiveness in international markets.

They showed that each $1 spent on transit generates an increase in Gross Domestic Product (GDP) of $1.80, and that properties near rail transit stations sell for 10 to 25 percent more than other comparable properties.

One element of the business productivity benefit stems from so-called "agglomeration economies" arising from public transportation's role in facilitating higher levels of metropolitan population and employment density. These higher densities increase business productivity because (Weisbrod and Reno, 2009):

- some businesses will have access to a larger and more diverse labor market, providing them with a better capacity to find workers with the desired skills;
- some trade and service sector establishments will be able to access broader customer bases, allowing them to more efficiently arrange locations and resources to serve customers
- specialized knowledge spreads more quickly through social networks, enhancing human capital and labor productivity in technology and skill industries; and
- greater diversity in economic activity and labor force skills breeds creativity and innovation.

These metropolitan level benefits can also translate into greater national level productivity if they take place across a broad spectrum of metropolitan areas.

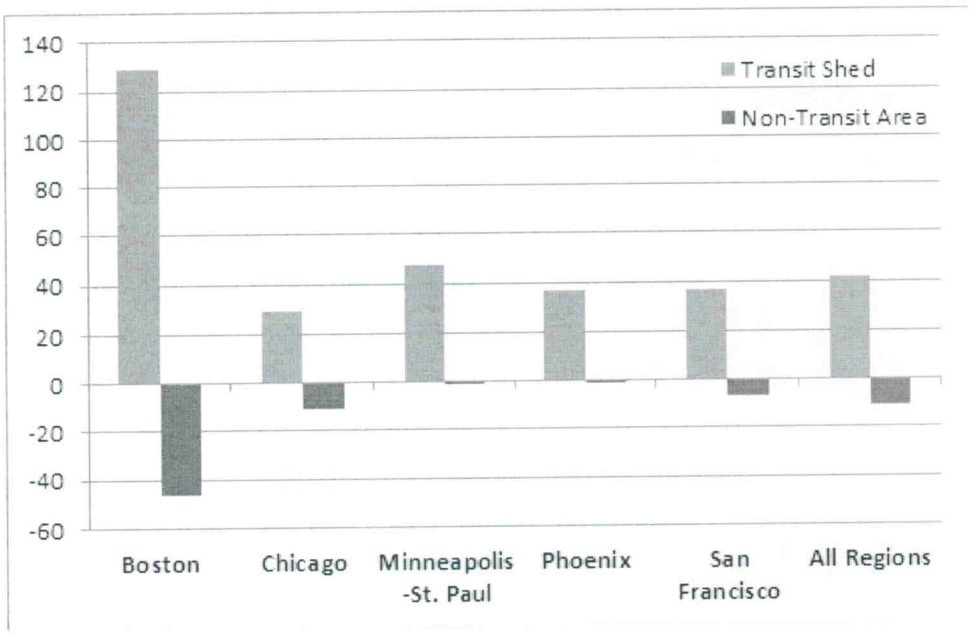
Investing in public transportation also gives urban residents the option of reducing their automobile ownership, which can produce considerable savings to household budgets. For example, if improved transport options (better walking and cycling conditions or public transit services) allow households to avoid purchasing a second car, the savings average $3,000 to $4,000 per vehicle (Victoria Transport Policy Institute, 2011). This is an annual benefit, so the

cumulative savings can be large. A study by McCann (2000) found that households in communities with better transit services and more accessible land use patterns spend less than $5,500 annually on transportation while residents of more automobile dependent regions spend more than $8,500.

A study of transportation projects by the University of Utah (Nelson, et al., 2009) reported that public transportation investments generate 31 percent more jobs per dollar than new construction of roads and bridges. Putting or keeping public transportation in communities with high unemployment produces up to 2.5 times more jobs than putting public transportation in communities with low unemployment. Similarly, a Smart Growth America (2011) report on the impacts of American Recovery and Reinvestment Act project spending found that public transit investments produced 1.7 times as many jobs per dollar as did investments in highways and bridges.

The Center for Neighborhood Technology (2013) examined how well residential properties located in proximity to fixed-guideway transit maintained their value during the depressed residential housing market between 2006 and 2011, as compared to residential properties without transit access. The study looked at five regions: Boston, Chicago, Minneapolis-St. Paul, Phoenix, and San Francisco. Across the study regions, the transit shed outperformed the region as a whole by 42 percent. In all of the regions the drop in average residential sales prices within the transit shed was smaller than in the region as a whole or the non-transit area. Boston station areas outperformed the region the most (129%), followed by Minneapolis-St. Paul (48%), San Francisco and Phoenix (37%), and Chicago (30%).
Figure 5 shows the percent change in average residential sales prices in the transit shed and non-transit area relative to the regional percent change in price. In addition to more resilient residential property values, households living in transit sheds had better access to jobs and lower average transportation costs than the region as a whole.

The results reported above begin to get at the question of transit's role in helping urban areas weather and recover from economic downturns. The success of transit in producing jobs in high unemployment areas and preserving housing values leads to the postulate that areas with good public transportation service recover more quickly from recessions than those without it. There is no definitive evidence to either support or refute this, so more research will be needed.



Source: Center for Neighborhood Technology (2013)

Figure 5. Percent change in average residential sales prices relative to the region, 2006-11

Finally, it is worth noting that spending to improve public transportation generates economic impacts throughout the U.S. economy, often in places far removed from the site of the improvement. Fitzgerald, et al. (2010) looked at the locations and employment levels of the transit vehicle industry in the U.S. While there are no transit railcar manufacturers in the U.S., there are 153 firms identified as parts and component systems suppliers that have their global headquarters in the United States; 128 of these are U.S. firms. Table 2 shows the employment by geographic region in the U.S. rail rolling stock manufacturing industry, which indicates where railcar investment dollars flow into the economy. Today, only five companies produce 98 percent of U.S. transit buses, but there are at least 76 U.S. companies that manufacture inputs to buses. The current level of spending on new buses supports nearly 25,000 jobs. Of this total, roughly 8,000 jobs are in the heavy truck manufacturing and motor vehicle parts manufacturing industries, and nearly 17,000 indirect and induced jobs are created. To these impacts could be added those related to construction of new guideways and other fixed facilities, plus increased ongoing employment and other expenditures to operate and maintain the expanded transit systems.

Table2. Employment in the U.S. Railroad Rolling Stock Manufacturing Industry by Geographic Division, 2006–08

Geographic Division*	States	Employment
Middle Atlantic	NY, NJ, PA	10,350
East North Central	IL, IN, MI, WI, OH	6,812
West North Central	IA, KS, MN, MO, NE, ND, SD	2,091
South Atlantic	DE, FL, GA, MD, NC, SC, VA, WV	3,348
East South Central	AL, KY, MS, TN	1,513
West South Central	AR, LA, TX, OK	5,671
Mountain	AZ, ID, CO, MT, NV, NM, UT, WY	1,333
Pacific	CA, WA, OR, AK, HI	1,576
New England	ME, VT, NH, MA, CT, RI	—†
U.S. Total		**32,722**

* Based on U.S Census Bureau geographic divisions Fitzgerald, et al. (2010)

† Less than 30 adults were employed in this industry in New England. The total at the bottom of the table includes some New England workers.

In summary, public transportation systems produce a variety of social and economic benefits, including direct cost savings by riders, congestion cost savings for those driving on urban roadways, and improved business productivity and growth. Transit also helps to sustain and increase property values, and there is also some evidence to indicate that cities with good public transportation fare better during economic downturns. Hence continued investment in public transportation will both support urban revitalization and produce more than commensurate economic returns.

We now take a brief look at the role of supply chains in supporting urban revitalization.

Supply Chains to Feed Urban Vitality

Metropolitan areas have linkages to far flung areas throughout the U.S. and the globe, due to the nature of the supply chains involved in serving urban economic demand. Supply chains may be defined as follows (Chopra and Meindl, 2004):

> "A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves. Within each organization, such as manufacturer, the supply chain includes all functions involved in receiving and filling a customer request. These functions

include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service."

In other words, supply chains include every company that comes into contact with a particular product, either directly or indirectly. For example, the supply chain for most products will encompass all the companies manufacturing parts for the product, assembling it, delivering it and selling it. (Investopedia, 2013)

One problem that hampers reurbanization efforts in many cities is the "urban commodity desert" problem. For example, some inner city areas have "food deserts," which Abell, et al. (2011) describe as follows: "Food deserts are found in inner city areas where residents... have limited access to affordable, healthy food. Among the consequences of living in a food desert are poor nutrition, diabetes, and obesity. " The same phenomenon often exists for other types of retail outlets, such as department stores, building supply outlets, and electronics stores (so-called "big box" retailers). Solving this type of problem may require interventions at numerous points along urban supply chains. Additional research is needed to identify effective strategies.

Role of efficient transportation

Transportation cost puts a cap on prices in local markets, equal to the cost of producing something at a low cost production point plus the cost of transporting it to the local market. Investing in supply chains produces a more efficient economy, as more output can be produced at lower total production cost, and goods can be sold at lower prices, which generates higher demand and boosts economic output.

The spatially distributed nature of our economy means that supply chain investment benefits are widespread. Supply chains comprise both rural and urban elements. Rural activities include mineral extraction (including energy resources) and agriculture. Manufacturing enterprises exist in towns and cities of all sizes. Distribution activities are located throughout the U.S. but with a focus on our 100 largest cities, due to a need to be located near both transportation centers and the labor force. Hence rural investments generate urban area jobs, and vice versa, and both types of investment are needed. The spatial distribution of firms in the transit vehicle supply chain discussed earlier provides one example.

Dabson (2007) explains this as follows: "America's rural and urban areas share many degrees of interdependence; rural areas provide critical consumption goods for metropolitan consumers, such as food, energy, lower-cost land and labor, and unique experiences; metro areas

constitute the end market for rural production; provide specialized services; offer diverse job opportunities; and generate resources for public and private investment in rural America. [Thus] If metropolitan America is to drive national prosperity, metropolitan areas will need a healthy and sustainable rural economy and culture. Likewise, if rural America is to flourish, it will surely depend upon vibrant, well-functioning cities and suburbs.

Since efficient and reliable freight transportation is crucial to supply chain performance, and supply chains underpin the entire economy, it follows that investments by both the public and private sectors in the U.S. freight system are needed to maintain and improve both urban vitality and international competitiveness.

Summary and Conclusions

Vibrant and well-functioning central cities are essential to a state and a nation's economic well being, and good transportation between and within urban places is critical to their success. The history of metropolitan area development in the U.S. from the end of World War II to the present is well known, and has often been described as the "flight to the suburbs." More recently many urban areas have been seeing somewhat of a return to the city.

New urban design concepts, such as planned communities and new urbanism, are attracting some new residents to housing types unlike the traditional isolated suburban enclaves. These new urban residents want walkable communities, social and cultural amenities, and good public transportation services that will enable them to access all of the opportunities that vibrant central cities have to offer.

Metropolitan areas strive to develop balanced transportation systems, in which each mode that is appropriate to the area's size and resources is developed to efficiently serve its market segments. In addition to an extensive system of highways and streets, every urbanized area has some form of public transportation, and the largest metro areas are served by several transit modes.

For the first time since World War II driving in the U.S. has been decreasing rather than increasing, which may be at least partly due to the reduced reliance on the private automobile that accompanies new urbanism. Other possible factors include the increasing cost of owning and operating an automobile; increasing urban congestion levels; and use of social media as a substitute for or augmentation of travel. These changes in urban travel choices are quite recent,

and the reasons for them are not well understood, so more research will be needed to both track their persistence and develop evidence as to their underlying causes.

Metropolitan transportation investment is needed to support urban revitalization. The increasing difficulty of building new major urban highways, coupled with increasing urban population density, means that much new investment will be in public transportation.

Investments in public transportation have a broad array of social and economic benefits , including direct cost savings by riders, congestion cost savings for those driving on urban roadways, and improved business productivity and growth. Transit also helps to sustain and increase property values, and there is some evidence to indicate that cities with good public transportation fare better during economic downturns.

Metropolitan areas are connected to the U.S. and global economy through a complex network of supply chains. Investing in supply chains produces a more efficient economy, as more output can be produced at lower total production cost, and goods can be sold at lower prices, which generates higher demand and boosts economic output. Since efficient and reliable freight transportation is crucial to supply chain performance, it follows that investments in the U.S. freight system are needed to maintain and improve both urban vitality and international competitiveness.

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