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Rediscovering the Transportation Frontier: Improving Sustainability in the United States through Passenger Rail

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*by Benjamin J. Wickizer and Andrew Snow**

Introduction

Societal sustainability is an increasing concern in the United States, especially the sustainability of urban environments. Transportation is an essential element to consider when assessing urban environmental impacts. How people travel, both within and between urban areas, is fundamental to any society's environmental footprint. Sustainability, a relatively amorphous concept, has been defined as meeting society's present needs without compromising the ability of future generations to meet their needs.[1]

The degree of environmental integrity characteristic of systems, policies, and infrastructures is fundamental to urban sustainability. Beyond this, the livability and hospitability of urban environments, often overlooked, are also critical. Sustainability is not limited to the realm of natural resources but can be examined using an economic framework. Of particular importance when considering sustainability from an economic perspective is the inclusion of less tangible—often difficult to measure—social benefits, including the promotion of improved quality of life, arising from investments undertaken to advance sustainability. A diverse, multi-modal transportation system is critical for creating sustainable urban environments.

How people travel, both within and between urban areas, is fundamental to any society's environmental footprint

The U.S. transportation system was constructed principally around automobiles with internal combustion engines. The future role of the automobile, at least automobiles operating with conventional technology and relying upon fossil-fuels, is uncertain due to increasing gasoline prices,[2] concerns about congestion and suburban sprawl,[3] and impacts from pollution.[4] Reliance on automobile use exacts a social cost in the form of compromised environmental, health, and quality of life factors.[5] This article discusses the need for diversification of the United States transportation system. Specifically, it examines the potential benefits of expanding passenger rail service in urban corridors within the United States and the implications that this holds for societal sustainability. It also briefly considers critiques offered by opponents of rail and highlights the shortcomings of these opinions.

Rail History

During the late nineteenth and early twentieth centuries, passenger rail traffic in the United States grew steadily; 1920 was the apex of passenger rail service, during which passenger trains made over 1.2 billion passenger trips.[6] Over the next two decades, rail use fluctuated but followed an overall pattern of decline as a result of increased car ownership and use.[7] At the end of the 1930s, however, rail service was still an important fixture of the transportation system.[8] During the first half of the 1940s, it played an important role in the war effort,[9] but after World War II, passenger rail service in the United States began a steady and prolonged decline.[10]

The ultimate cause of rail's decline may have been unfavorable and onerous government policies and discrepancies in transportation spending that favored road and air travel over rail.[11] Essentially, the deck was stacked against the rail system during the latter part of the twentieth century and could not compete financially with the government-supported and heavily subsidized road and air transportation systems.[12] Despite the federal government's subsidization of Amtrak, not much has changed since rail's decline in the 1950s, and the lack of public financial support for passenger rail still exists and serves as a central impediment to rail's expansion. For instance, in 2003, the U.S. rail industry received less than one percent of the government expenditure that U.S. highways received and less than five percent of the government expenditure that the air travel industry received.[13]

In the 1960s, Lewis Mumford provided an early but prescient critique of the growing highway system and its languishing alternatives:

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> The fatal mistake we have been making is to sacrifice every other form of transportation to the private motorcar—and to offer as the only long-distance alternative the airplane. But the fact is that each type of transportation has its special use; and a good transportation policy must seek to improve each type and make the most of it . . . . There is no one ideal mode or speed: human purpose should govern the choice of the means of transportation. That is why we need a better transportation *system*, not just more highways.[14]

Mumford realized earlier than most that having a multi-modal transportation system was prudent, efficient, and pursuant to the public good. Interestingly, it appears that in the United States more people are beginning to share Mumford's opinion about the shortcomings of a transportation system so reliant on the automobile. Between 1995 and 2008, the growth rate of public transit ridership has steadily increased at approximately three times the U.S. population growth rate while the growth rate of national vehicle miles traveled ("VMT") is beginning to decline.[15] An increasing number of people in the United States are realizing the benefits and value of public transit and the importance of having alternatives to the automobile. Furthermore, motorists ages twenty-one to thirty now account for fourteen percent of VMT, a seven percent reduction from this age group's mileage in 1995.[16] This suggests that younger generations of Americans may not be as dependent on automobiles as their predecessors.

Blueprint for Successful Rail

Passenger rail has the potential to significantly improve our transportation system and offer net benefits to society. However, passenger rail is not suited for all contexts. It has certain comparative advantages, which should be heeded in transportation development. The optimal location for rail is within densely populated corridors between major cities of approximately 100 to 300 miles distance.[17] The corridor connecting New York City to Washington DC, as well as intermediary cities including Baltimore and Philadelphia, fits the criteria for successful rail service. It spans a distance of 225 miles and serves multiple large, densely populated cities. This corridor has been very successful for fostering rail growth and ridership, and in 2008, Amtrak captured sixty-three percent of the combined air-rail market share between New York City and Washington, DC.[18] Another location that is well-suited for rail but is currently without service is the 3-C (Cincinnati, Columbus, and Cleveland) corridor in Ohio; which, incidentally, is one of the most highly populated corridors in the United States that is not served by passenger rail.[19]

Optimally, rail is a component of a larger transportation network that should include buses, street cars, bike trails, walkable neighborhoods, and car sharing. Such a system creates a variety of options for transportation users, enabling people to select what mode or modes are most appropriate for a given trip. The city of Portland, Oregon is one example of a city that has benefited from a robust multi-modal system, which has spurred transit oriented development and economic growth.[20]

In contrast, cross-country train routes have proven to be less efficient and provide less return on investment than shorter routes connecting populous cities.[21] For instance, eighty percent of Amtrak's financial losses result from its cross-country routes, despite the fact these routes account for only fifteen percent of Amtrak ridership.[22] Cross-country rail routes still provide social benefits, but their economic viability is considerably less than shorter corridor routes.

Trends that Support Rail Investment

In assessing the costs and benefits of passenger rail investment, it is important to consider not only how passenger rail functions today, but also how it could function in the future. Macro-societal trends suggest that investment in rail is worth serious consideration. The U.S. population is growing; demographic estimates indicate the population will increase by 130 million people by 2050.[23] A well-designed rail system could help reduce road congestion, especially in highly populated corridors, mitigating the adverse impacts of congestion.[24] Further, a growing number of U.S. residents desire urban rather than suburban living.[25] Increasingly, especially within younger generations of Americans,[26] individuals want to live in walkable urban environments with diverse transportation options. Passenger rail, as well as light rail and street cars, help facilitate this lifestyle choice. The trend of re-urbanization is presently in its infancy but is likely to continue and grow in what has been called the "fifth migration."[27]

Another trend that favors rail investment is the rising price of oil and gasoline.[28] There is little doubt that in the long run oil, and therefore gasoline, will become more costly as world supplies diminish and extraction becomes increasingly expensive.[29] Oil extraction will likely also become increasingly hazardous to the environment as seen in the recent environmental disaster in the Gulf of Mexico resulting from deep-water drilling[30] and by the heavy environmental toll from bituminous sand extraction and processing.[31] The increasing price of gasoline will invariably result in higher direct costs associated with automobile travel and therefore an increased desire for less costly alternatives. This shift in mode was evident during 2008 when gas prices peaked at more than four dollars per gallon and Amtrak achieved record levels of ridership.[32] Expanded passenger rail would address a growing desire for less costly alternatives to automobile travel.

Further, our society's reliance on rapid communication and technology continues to grow. Any transportation mode that allows users to access communication devices and computer technology safely and reliably will be in demand because it allows individuals to recover potentially lost work time during travel. Rail passengers can safely use these technologies and engage in more activities than other transportation modes allow. Because of these aforementioned trends, rail may become more appealing to travelers, although their importance in creating increased demand for rail is unclear. Nontheless, these trends are likely to continue to grow and support further investment in passenger rail.

Rethinking How the Merits of Rail are Assessed

Allocating resources for public projects presents a host of challenges because it almost always requires making assumptions about future conditions. A fundamental question for investment in rail is: Relative to other potential investments aimed at the same goal, is the potential return on investment for rail more favorable than for investments in alternative projects? Here is where the concept of urban sustainability becomes critical. It should be viewed as a legitimate goal of transportation planning, but what metrics should be used to measure it? Rail critics argue that passenger rail will never be able to bear the same burden as road or air travel, asserting that it is inadequate for addressing problems with our transportation system because of the limited numbers of riders that expanded rail would capture. These critics point to reductions in VMT, which they assert would be negligible, and use this as one of the litmus tests for whether or not the U.S. should expand its passenger rail system.[33] This is a flawed approach for determining the benefits of rail and the merits of further investment in it.[34]

This line of reasoning essentially postulates that passenger rail is worthwhile only if it can significantly reduce the negative externalities from other transportation modes. There is evidence that passenger rail does significantly reduce VMT in certain cases; for example, cities served by robust rail systems have twenty-one percent lower per capita motor vehicle mileage (which represents an annual average reduction of 1,958 miles traveled per person) than cities that are solely served by buses—but this is not the fundamental question for assessing rail.[35] Rather, the question is: Is rail's projected net economic benefit—including benefits arising from advancing urban sustainability and from potential enhanced rider work productivity owing to the use of personal computers and other devices—greater than that of alternative projects? It is difficult—some would say perhaps impossible—to quantify all of the marginal benefits and costs of different transportation investments. This highly complex, challenging task is outside the scope of this article; rather, its purpose is to identify and briefly examine critical factors that should be considered in assessing the potential value of passenger rail investment.

Energy and Air Pollution

Two central issues regarding the expansion of rail are its effects on air pollution and the energy required to power trains. Trains, both diesel and electric, require significantly less energy per passenger-mile than automobiles or airplanes. In 2008, Amtrak trains burned 1,745 British thermal units ("BTU") per passenger-mile, while passenger cars burned 3,501, and domestic air carrier planes burned 2,931 per passenger-mile.[36] This implies that in terms of energy conservation, trains are approximately fifty and forty percent more efficient than automobiles and airplanes, respectively, as measured by the amount of energy expended per passenger-mile. This superior energy efficiency results in more energy from fuel being converted to mechanical energy, which translates into less fossil fuel dependence and use. In 2004, passenger rail (including heavy, light, and commuter rail) accounted for 25,822,000,000 passenger-miles traveled and consumed 96,694,000 gallons of gasoline (or gasoline equivalent),[37] resulting in an average fuel consumption rate of 267 passenger-miles per gallon of gasoline. This means that using one gallon of gasoline (or gasoline equivalent), the average train moved its passengers a collective distance of 267 miles. In contrast, in 2004, the average fuel efficiency for U.S. automobiles was twenty-two and one-half miles per gallon.[38] If a car has two occupants, at this fuel efficiency, its fuel consumption rate would be forty-five passenger-miles per gallon of fuel. In short, on a per passenger-mile basis, trains are significantly more energy and fuel efficient than automobiles.

Trains are not only superior to automobiles and airplanes based on energy and fuel efficiency, but also on emissions levels and associated pollution. Trains emit sixty-six percent less CO_2 per passenger-mile than automobiles and fifty percent less greenhouse gases than airplanes,[39] as well as generally emitting less criteria pollutants.[40] Rail emission reductions also tend to be concentrated in densely populated urban areas,[41] some of which are non-attainment areas for Clean Air Act regulations. Reducing emissions in urban areas with high population densities is particularly important because of disproportionately high health and economic costs from pollution. The Center for Neighborhood Technology conducted a study to quantify the effects of current and proposed passenger rails on greenhouse gases in the future. It found that if rail plans are implemented as proposed, by 2025 rail would result in twenty-nine million fewer automobile trips and 500,000 fewer flights, as well as an annual abatement of six billion pounds of CO_2 emissions.[42] In 2004, the Environmental Protection Agency ("EPA") restricted the sulfur content allowed in diesel fuel for passenger trains.[43] This standard will further reduce the environmental footprint of passenger trains by decreasing particulate matter emissions by ninety percent and nitrogen oxide emissions by eighty percent when fully implemented, and make passenger trains more environmentally responsible and sustainable.[44]

Congestion and Reliability

Rail has the potential to improve urban sustainability through reducing congestion. Rail's reduction of VMT results in less congestion on the roads. For example, the Capitols, Pacific Surfliner, and the San Joaquin rail corridors in California reduce driving by approximately 500 million passenger-miles annually.[45] A survey conducted among passengers on the Heartland Flyer Train, which serves a 418 mile corridor from Oklahoma City to Fort Worth, indicated that approximately sixty percent of passengers would have traveled by automobile had they not taken the train.[46] In addition, the Heartland Flyer reduces VMT by 7.9 million miles annually.[47] Such evidence demonstrates that the majority of rail passengers are discretionary riders who have alternative modes of transportation but who choose to utilize the train, suggesting that rail investment is perhaps more efficacious for reducing VMT than bus investment.

Although critics argue rail does not remove enough individuals from roads to have a marked effect on congestion, this is certainly arguable as the above examples illustrate. Further, congestion is non-linear and removing a small number of cars can have a disproportionate effect on congestion by eliminating "bottlenecks" that result in traffic congestion and delays.[48] Rail also results in a positive externality for those that do continue to drive by reducing congestion on roads and the costs and hazards associated with it. The U.S. highway system is reaching its carrying capacity and will not be able to accommodate the nation's projected population growth over the next 30 years.[49]

Investment in a bus system could be thought to yield similar or superior results to investment in rail, but this is not true. Rail is distinct from buses, because it captures more discretionary riders who otherwise would likely be driving cars, and thus investments in rail have a larger effect on VMT reduction.[50] Furthermore, unlike rail, increased bus service has been linked with increased congestion costs to motorists.[51] However, an efficient bus system is important for a successful rail system because it extends access to areas not served by the rail. In some respects, these two modes of transportation could best be viewed as compliments rather than substitutes.

Rail is not a "magic bullet" that will solve the United States' transportation and energy woes, but it can be part of the solution to create a more sustainable future

In spite of public perception that trains are unreliable and often late, rail is in fact more reliable than other modes of transportation. In 2009, Amtrak trains were on time approximately eighty percent of the time.[52] Trains are less susceptible to inclement weather than automobiles or airplanes, making them particularly valuable in regions that experience violent or unpredictable weather. Only thirteen percent of Amtrak delays in 2009 were caused by external forces, such as weather.[53] Trains also are not subject to the same number of uncertain delays, such as accidents, of automobile travel. Automobiles by nature are subject to more unforeseen delays than trains, and it is difficult to predict when and where automobile congestion will occur.[54] In 2007, automobile congestion nationwide caused 4.16 billion hours of delays at a total cost of $87.2 billion, a sixty-five percent and sixty-one percent increase, respectively, from 1997.[55] These delays, incidentally, resulted in 2.8 billion gallons of wasted fuel.[56] Conversely, in 2007, Amtrak trains incurred only 101,655 hours of delays.[57] Because of their relatively high degree of reliability, trains allow individuals to plan their travel more precisely than they otherwise could using other transportation modes. Investment in roads generally does not yield significant congestion reductions and can result in static or increased congestion as a result of induced demand,[58] while the same investment in rail could lead to reduced congestion because of the discretionary riders choosing to take the train rather than drive.

Comfort, Productivity, and Option Value

Rail is a unique transportation mode because of the level of comfort and array of amenities it offers. Compared to other transportation modes, rail provides more space to work and relax, and it allows passengers to walk comfortably while in-route. Forty-one percent of passengers surveyed on the Heartland Flyer reported the superior comfort and relaxation of the train as a key reason for their decision to take the train.[59] There is little doubt a major benefit of rail is its ability to reduce stress normally associated with other travel modes. Road congestion associated with automobile travel has been linked to increased stress levels and negative physiological responses.[60] Road and air travel are often more stressful than train travel and, as such, for some people, can have adverse health implications.[61] Rail is also unique because, as mentioned previously, it allows passengers to accomplish work through superior comfort and access to technology. Many trains are now equipped with free wireless internet, allowing passengers to work. Also, unlike automobiles and airplanes, trains permit the safe use of mobile devices. These characteristics allow travelers to recover potentially lost work time or gain added leisure hours. Either outcome is desirable from the standpoint of economic efficiency.

As previously noted, passenger rail will not displace cars as the primary mode of transport for the majority of the U.S. population any time in the near future. But this is not the goal of expanding rail; rather, the goal is to provide a more diverse, sustainable transportation system that offers travelers expanded choice, particularly in urban corridors where congestion and pollution are particularly high. Passenger rail has option value for travelers, and although individuals may not travel by rail every day, they have the ability to use it when it is most convenient and efficient, creating a more sophisticated and dynamic transportation system. It allows travelers to choose their mode of transport based on their personal needs and preferences. Rail not only provides option value, it enhances quality of life. In so doing, it promotes more livable, and ultimately healthier, communities.

Conclusion

This is a pivotal moment for passenger rail in the United States, as well as for the transportation system as a whole. The Obama Administration's current level of investment and political will to expand rail significantly exceeds that of other recent administrations.[62] But creating a comprehensive and dynamic

rail system will require continued financial investment and political fortitude. The United States is at a tipping point in regards to its rail system. If the projects now planned and funded through the American Reinvestment Act[63] are completed, the country's rail infrastructure will be markedly strengthened, laying the groundwork for future rail development. But if this opportunity is lost and planned projects are not executed, passenger rail will continue to be confined to only certain cities and corridors, with little hope of fulfilling its potential role as a key component of a multi-modal transportation system. Unfortunately, at a time when the federal government is more willing to fund rail development, many states have staggering deficits that have rendered rail a highly politicized issue. If rail, as well as other modal alternatives, is not expanded, the auto-dependent transportation system in the United States will become even less viable as its population grows, its roads age, and the system's lifeblood, oil, becomes more expensive.

It is critical that the country begins to construct a more diverse transportation system. In twenty to fifty years, maintaining the current transportation system will become more costly, and from an environmental and economic perspective, increasingly less defensible. Development of intercity passenger rail will bring similar positive changes that subways have brought to U.S. cities throughout their long history. Imagine what the quality of life would be like today in Washington, DC if the city had not built an extensive subway system some thirty-five years ago and reduced congestion. The United States would benefit from expanded rail options to absorb some of the passenger load from roads and to facilitate the transition to a transportation system less dependent upon automobiles. It is also critical that rail does not stand on its own; rather, it should be a component of a larger effort to create a multi-modal transportation system. Rail is not a "magic bullet" that will solve the United States' transportation and energy woes, but it can be part of the solution to create a more sustainable future. Fundamentally, passenger rail is worth investing in, not only because it offers a means of reducing VMT, but because in many cases it provides a better overall return on investment than other transportation modes.

Endnotes: Rediscovering the Transportation Frontier: Improving Sustainability in the United States through Passenger Rail

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