Policy Analysis

April 21, 2015 | Number 772

Rails and Reauthorization

The Inequity of Federal Transit Funding

By Randal O'Toole and Michelangelo Landgrave

EXECUTIVE SUMMARY

Federal transportation aid programs often create perverse incentives for states and metropolitan areas. The worst incentives are created by discretionary funds that encourage state and local governments to adopt wasteful programs in order to get the largest possible share of those funds.

For example, instead of encouraging cities and transit agencies to spend funds efficiently, the New Starts capital grants program encourages them to build the most expensive projects. By building a wildly expensive rail transit system, for example, Salt Lake City has collected $2.17 in federal funds per transit rider over the last 22 years. In comparison, by focusing exclusively on buses, Milwaukee has collected only 26 cents per transit rider.

Nearly all of this variation is due to the New Starts and other discretionary funds, while formula funds are more equitably distributed. New Starts is inequitable in other ways, as well. Over the last three sessions of Congress, having a Democrat on the House Transportation and Infrastructure Committee has given states "bonuses" in transit funding of $120 million to $160 million per year. Having a Republican on the committee produced much smaller bonuses, and even produced a penalty during the 111th Congress.

To get as much New Starts money as possible, transit agencies have planned increasingly expensive rail projects. While the average light-rail project in the 1980s cost about $25 million per mile (in 2013 dollars), by 1997 the average cost was more than twice that much, and light-rail projects in the 2016 New Starts report cost nearly $200 million per mile.

Such expensive projects not only waste federal transportation dollars, they impose huge burdens on local taxpayers. As a result, far from promoting urban growth, regions that build rail transit end up growing slower than ones that don't.

To fix these problems, Congress should convert the New Starts and other discretionary funds to formula funds. To encourage states and regions to build transportation systems that respond to user needs, Congress should incorporate user fees into the formulas.

Randal O'Toole is a senior fellow with the Cato Institute and author of *Gridlock: Why We're Stuck in Traffic and What to Do About It*. Michelangelo Landgrave is a graduate student in economics at California State University, Long Beach.

> “The average inflation-adjusted cost of light rail rose from $17 million per mile in 1981 to $198 million per mile in 2015.”

INTRODUCTION

Debate over the federal surface transportation law, which expires on May 31, 2015, has focused primarily on where the money needed to fund federal transportation programs will come from and how it should be spent. This debate misses a question that is actually far more important: What incentives should federal transportation spending create?

This is important partly because the answer to the last question really controls the answers to the first two. If federal transportation spending creates incentives to waste money, then no amount of money will be enough to satisfy transportation needs. On the other hand, properly designed incentives will go a long way toward defining how transportation funds should be spent.

An excellent example of this can be found in federal transit funding, particularly funding for rail transit. This paper will look at the incentives created by such funding and their implications for the first two questions listed above.

ESCALATING COSTS

Federal funding of rail transit has led to an incredible increase in the cost of rail construction. This increase is most striking with regards to light rail. San Diego opened America's first modern light-rail line in 1981. Built without any federal funds, the line cost less than $10 million per mile ($17 million per mile in today's dollars).[1]

Since that time, the federal government has helped fund almost every new light-rail line built in the country and—not coincidentally—the costs have grown rapidly. Light-rail projects in the Federal Transit Administration (FTA) 1997 New Starts report—the agency's annual recommendations for which rail projects deserve federal funding—cost an average of $40 million per mile, which is about $55 million in today's dollars, or more than three times the per mile cost of the San Diego line.[2]

Costs more than doubled by the time of the 2013 New Starts report. The average cost of light-rail construction in that report was $138 million per mile.[3] Just three years later, average light-rail costs in FTA's 2016 report had risen another 43 percent to $198 million per mile, more than 11 times the inflation-adjusted cost of the original San Diego light rail. The least expensive line in the 2016 report, a 2.3-mile extension of an existing line in Denver, is expected to cost nearly $100 million, or almost twice as much as the average in 1997. The most expensive one, a 3.3-mile route in Seattle, is expected to cost $628 million per mile.[4] None of these lines will be able to carry significantly more people than the 1981 line.

Costs of building heavy rail have also grown. In the 1980s, heavy-rail lines built in Atlanta, Baltimore, Miami, and Washington cost an average of less than $140 million per mile (about $265 million in today's dollars).[5] Heavy-rail lines in the 2016 New Starts plan cost an average of nearly $340 million per mile.[6]

For comparison, various state highway agencies estimate that building a new four-lane freeway typically costs around $10 million per mile ($2.5 million per lane-mile) in rural areas and $12 million per mile ($3 million per lane-mile) in urban areas.[7] These numbers presumably do not include the costs of right-of-way acquisition. However, the 125,000 lane-miles of the Interstate Highway System cost less than $4 million per lane-mile, including right-of-way, in today's dollars.[8]

One of the most expensive segments of the interstate system, Hawaii's H-3, cost $20 million per lane-mile in 1997, or about $28 million per lane-mile in today's dollars.[9] Perhaps the most expensive road ever built, Boston's Central Artery project, cost about $90 million per lane-mile, or about $100 million per lane-mile in today's dollars.[10] This is little more than half as much as the average cost of light rail today.

The high cost of rail relative to highways would be justified if rail carried far more people than roads. In fact, despite claims that rail lines can carry as many people as a multilane freeway, no mile of light-rail line in the country carries as many people per day as a typical lane-mile of urban freeway. Table 1 shows that, in urban areas with light-rail transit, the average freeway lane-mile carries more than three times as many passenger miles per day as the average two-track route mile of light rail.

Table 1
Passenger Mles Per Rail Route Mile and Freeway Lane-Mile

Mode	Passenger Mile per Route Mile	Passenger Mile per Lane Mile	Rail as Percentage of Freeway
Light Rail	8,448	26,476	31.9
Heavy Rail	27,207	28,288	96.2
Commuter Rail	5,253	28,022	18.7
Hybrid Rail	2,436	26,395	9.2
Streetcars	1,916	24,571	7.8

Source: Federal Transit Administration, 2012 National Transit Database, Service spreadsheet, **http://www.ntdprogram.gov/ntdprogram/datbase/2012_database/NTD_database_2012.exe**; Federal Highway Administration, 2012 Highway Statistics, Table HM-72, **http://www.fhwa.dot.gov/policyinformation/statistics/2012/xls/hm72.xls**. See Table 7 for a system-by-system breakdown of these data.

Note: This table compares the average use of rail systems with the average use of freeway lanes in the same urban areas; only heavy rail comes close to moving as many people as a single freeway lane.

Heavy-rail lines do only a little better; the average mile of two-track heavy rail in Boston, Chicago, Los Angeles, Philadelphia, San Francisco, and Washington carries about as many people per day as the average freeway lane-mile on those urban areas. Only in New York do rail lines carry significantly more people than a freeway lane. Elsewhere, heavy rail does poorly; a mile of average freeway lane in Baltimore, Cleveland, and Miami, for example, carries more than twice as many passenger miles than a mile of two-track heavy rail in those cities.

The number of urban areas with light-rail, heavy-rail, or commuter-rail transit has grown from 8 in 1966 to around 30 today, with around 10 more having streetcars or automated guideways. Although San Diego's first light-rail line was an exception, most new rail transit lines built since 1980 received some form of federal funding. Most of these cities didn't choose rail because it was an effective transportation solution to their transportation problems, instead they chose it because rail was an effective way of getting federal dollars.

The high cost of federally funded construction is often blamed on federal standards, such as prevailing wage laws and buy-American requirements. Light-rail lines built with federal funding in the late 1980s in Portland, Sacramento, San Diego, and San Jose cost an average of $12.5 million per mile, or about $22 million per mile in today's dollars. While that's nearly 30 percent more than San Diego's original 1981 line, at least some of the increase in costs could be accounted for by the need for rights-of-way purchases and other local factors.

While federal standards would account for a one-time increase in costs, they would not cause the steady rise in costs since 1990. Instead, the dramatic increase after 1990 is due to the creation of the New Starts capital grants program in 1991. This program offered between $1 billion and $2 billion a year in matching funds to new "fixed guideway" projects, which usually meant rail. The federal government usually paid up to 50 percent of the costs, but some projects received more than 80 percent of their costs from federal funds.

The New Starts fund quickly suffered the tragedy of the commons as cities and transit agencies realized that, in order to get "their share" of federal funds, they needed to select the most expensive, rather than the most efficient, transit alternatives in any corridor. Urban areas were soon in a race with one another to build ever-more expensive rail projects.

Under the Moving Ahead for Progress in the 21st Century Act (MAP-21), more than half of

"The New Starts fund suffered the tragedy of the commons as transit agencies realized that, in order to get the maximum federal funds, they needed to plan the most expensive, rather than the most efficient, transit projects."

> "Federal transit funding is highly inequitable, ranging from $2.17 per transit rider in Salt Lake City, which has built several expensive rail lines, to just 26 cents per rider in Milwaukee, which has focused on buses."

federal transit dollars are dedicated exclusively to urban areas with fixed-guideway transit systems. This puts pressure on urban areas that have no fixed guideways to build such transit routes in order to be eligible for those funds. Having decided to build a fixed guideway, many transit agencies choose rail over busways because rail is more expensive and thus allows the agency to capture a larger share of the New Starts fund.

While most federal transportation funds are distributed to states and metropolitan areas using formulas based on such factors as population, land area, highway miles, and transit ridership, the New Starts fund is something of a first-come, first-served grant program. Though the program nominally requires the FTA to evaluate projects based on several congressionally set criteria and then pick the best ones, in fact the criteria are so subjective that few projects are rejected for failing to meet the standards.

An exception to this rule occurred starting in 2005 when then FTA administrator Jennifer Dorn set a firm standard for meeting the cost-effectiveness requirement in the law. Under the Dorn standard, any project that cost more than $25 per hour of travelers' time saved by the project would be automatically ineligible for federal funding.[11] Congress made exceptions for a few projects that failed to meet this requirement, but the new threshold put several other projects on hold.

In 2013, the Obama administration published a new rule eliminating the Dorn standard, allowing transit agencies to submit increasingly expensive proposals.[12] This relaxation of the rule contributed to the huge increase in average costs in the past few years as projects that the FTA had previously rejected found their way onto the annual list of recommendations.

The high cost of fixed guideway systems produces inefficient transit systems. An analysis of historic transit data reveals that every 1 percent increase in federal transit funding as a percentage of total transit funding leads to a 2.1 cent increase in the cost per passenger mile and a 5 cent increase in the cost per transit trip. State funding can actually produce the opposite effect: for states with major transit programs, a 1 percent increase in state transit funding leads to a 0.8 cent decrease in cost per passenger mile and a 2.3 cent decrease in the cost per transit trip. States with smaller transit programs saw a small increase in costs from increased state funding, but it is nowhere near as large as the increase associated with federal funding.[13] For comparison's sake, the median cost per transit trip for the period observed (1997–2013) was $6.26 and the mean cost per passenger mile was $1.32.

INEQUITABLE FUNDING

The fixed guideway capital grants program has led to huge disparities in federal transit funding among urban areas. Since 1991, transit agencies have received an average of 65 cents per transit trip in federal capital funds. But Table 2 shows that many urban areas are far from this average, with funding in major urban areas ranging from 26 cents per trip to $2.17 per trip. Urban areas at the top of this range tend to be ones that have built expensive rail lines in the past 22 years, while urban areas at the bottom tend to be ones that rely mainly on bus service or, in the case of Austin, built a rail line without federal funding.

At the top end of the scale, Salt Lake City, Dallas–Ft. Worth, Virginia Beach, Charlotte, and Phoenix are all big winners, collecting more than $1.35 per transit trip, more than twice the average. Houston, St. Louis, Baltimore, Denver, Portland, Minneapolis–St. Paul, Pittsburgh, San Jose, and Seattle also did very well, collecting more than $1.00 per trip. All of these urban areas built light-rail lines during these years. At the bottom end of the scale, Milwaukee, Austin, and San Antonio are the big losers, getting less than 40 cents per trip. Raleigh, Indianapolis, Cincinnati, Louisville, and Detroit are also below average. None of these areas used federal funds to build rail transit during these years.

In general, urban areas that did not have rail before 1975 and built new rail transit lines after 1980 received federal funds equal to an average of 80 cents per transit rider. Regions that have no rail transit received 61 cents per rider, while regions that had rail transit before 1975 received just 54 cents per transit rider.

Table 2
Federal Capital Funding per Transit Trip, 1991–2013

Urban Area	Dollars per Trip	Gain/Loss (millions of dollars)
Salt Lake City-West Valley City, UT	2.17	48.3
Dallas-Fort Worth-Arlington, TX	1.67	75.9
Virginia Beach, VA	1.48	10.1
Charlotte, NC-SC	1.45	14.4
Phoenix-Mesa, AZ	1.36	34.9
Jacksonville, FL	1.27	6.5
Hartford, CT	1.24	10.8
Houston, TX	1.19	48.5
St. Louis, MO-IL	1.16	26.4
Baltimore, MD	1.13	54.0
Memphis, TN-MS-AR	1.12	5.9
Denver-Aurora, CO	1.10	37.5
Portland, OR-WA	1.10	46.8
Minneapolis-St. Paul, MN-WI	1.06	33.4
Pittsburgh, PA	1.06	30.9
San Jose, CA	1.05	19.4
Seattle, WA	1.01	59.3
Tampa-St. Petersburg, FL	0.98	7.7
Providence, RI-MA	0.95	5.7
Sacramento, CA	0.94	9.2
Orlando, FL	0.92	6.0
Washington, DC-VA-MD	0.90	110.6
Riverside-San Bernardino, CA	0.85	4.8
Nashville-Davidson, TN	0.81	1.4
Bridgeport-Stamford, CT-NY	0.79	1.6
Cleveland, OH	0.79	8.8
Oklahoma City, OK	0.76	0.5

“It is clear that the best way to gain federal transit dollars is to aggressively build new rail lines, as Salt Lake City and Dallas have done.”

"Since 1991, the New York urban area, where 40 percent of all transit use takes place, received $11.5 billion less in federal transit funds than it would have received if funds were distributed by ridership."

Table 2 ***Continued***

Urban Area	Dollars per Trip	Gain/Loss (millions of dollars)
Columbus, OH	0.75	2.0
Kansas City, MO-KS	0.74	1.7
Miami, FL	0.74	13.3
Las Vegas-Henderson, NV	0.71	2.6
Chicago, IL-IN	0.70	37.1
Philadelphia, PA-NJ-DE-MD	0.67	12.2
San Francisco-Oakland, CA	0.65	5.7
New Orleans, LA	0.61	-1.4
Raleigh, NC	0.58	-0.3
Atlanta, GA	0.58	-9.3
Boston, MA-NH-RI	0.56	-29.2
Indianapolis, IN	0.56	-1.0
San Diego, CA	0.55	-8.3
Cincinnati, OH-KY-IN	0.52	-3.4
Buffalo, NY	0.50	-3.7
New York-Newark, NY-NJ-CT	0.49	-500.9
Richmond, VA	0.45	-5.3
Louisville/Jefferson County, KY-IN	0.45	-3.2
Detroit, MI	0.43	-12.5
Los Angeles-Long Beach-Anaheim, CA	0.40	-141.8
San Antonio, TX	0.38	-11.6
Austin, TX	0.37	-8.5
Milwaukee, WI	0.26	-21.7

Source: Calculated from National Transit Database Capital Funding Time Series, tinyurl.com/pdeglaj, and Service Data Time Series, tinyurl.com/njwg98b.

Note: "Dollars per Trip" shows the amount of federal funds spent per transit trip on transit capital improvements between 1991 and 2013 in 2013 dollars. "Gain/Loss" shows the annual bonus or loss each urban area collected vs. what they would have collected if federal funds had been distributed equally per transit trip.

In total, from 1991 through 2013, Baltimore, Dallas, Houston, Portland, Salt Lake City, and Seattle each received well over $1 billion more than they would have received if federal funds had been distributed among major urban areas proportional to actual transit ridership. Denver, Phoenix, Minneapolis–St. Paul, and St. Louis all received between $500 million and $1 billion more; while San Jose, Charlotte, Norfolk, and Sacramento received between $200 million and $500 million more than the average. All of these regions earned these bonuses by building expensive light-rail lines.

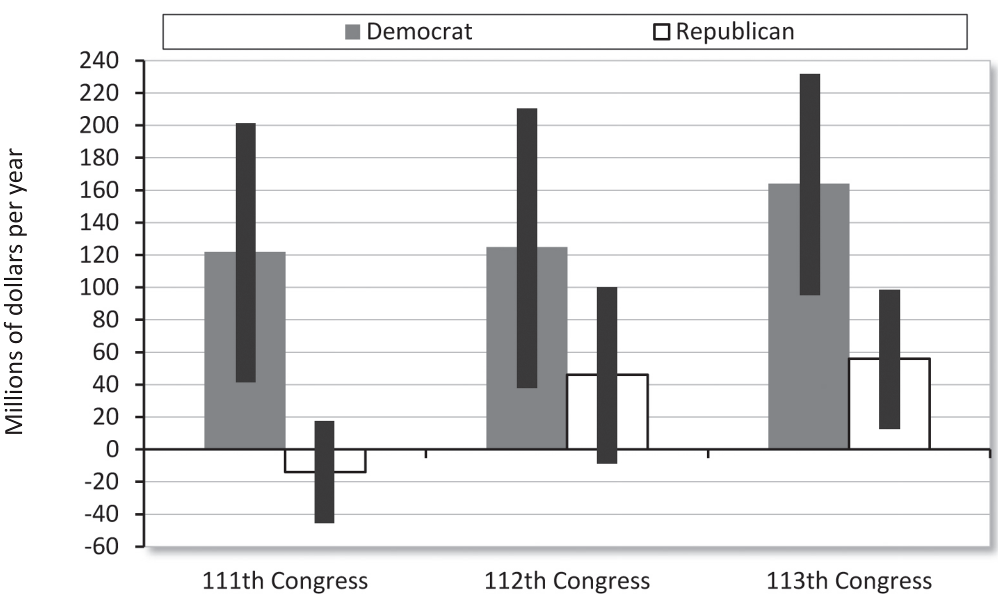
On the other hand, the New York urban area—where 40 percent of all transit use takes place—received nearly $11.5 billion less than it would have received in 1991 through 2013 if federal funds were distributed proportional to ridership. Los Angeles was shorted $3.3 billion, Boston $672 million, Milwaukee $498 million, Detroit $288 million, and San Antonio $267 million.

A few areas that didn't build major new rail lines during these years managed to collect above-average shares of federal funds, including Hartford, Memphis, Tampa, and Providence. Most of the Hartford money actually went to the Connecticut Department of Transportation for rail transit elsewhere in the state. It is likely that transit agencies in some of the other areas, such as Tampa, did well per transit trip simply because they carry so few transit trips. However, it is clear that the best way to gain federal dollars is to aggressively build new rail lines, as Salt Lake City and Dallas have done.

Notably, many of these equity issues disappear when we look at federal transit funds distributed by formula programs. The National Transit Database uses several categories to identify the source of federal transit funds, including formula funds and capital programs. According to these data, no statistically significant penalty or bonus was found among formula programs in regards to mode of transit. Almost all of the inequity issues arise from the capital program category, which is discretionary and therefore easily captured by the political process.

> "Building new rail lines slows economic development. The regions that spent the most on transit capital improvements in the 1990s were among the slowest growing in the 2000s."

Figure 1
Annual Bonus for Having a Member on House Transportation and Infrastructure Committee (in millions of dollars)



Source: Calculated from National Transit Database data using Stata statistical software.

Note: Having a Democrat on a state's House Transportation and Infrastructure Committee typically added more than $100 million per year to the amount of federal transit funding going to that state. Having a Republican on the committee resulted in a much smaller bonus. The dark lines show the 95 percent confidence interval, meaning (for example) that 95 percent of states with a Democrat on the committee in the 113th Congress received bonuses between $95 million and $233 million.

> "There is a distinct bias in federal transit funding going to urban areas in states that have a Democratic representative on the House transportation and Infrastructure Committee."

Figure 1 shows there has been a distinct bias for federal funding going to urban areas in states that have a Democratic representative on the House Transportation and Infrastructure Committee. Each Democratic congressman that a state had in the committee during the 113th Congress received a predicted bonus of $163 million in federal transit funding in 2013. Having a Republican member on the committee produced a far smaller bonus, and that bonus is not as statistically significant. A similar bias toward states with Democrats on the House committee existed during the 111th and 112th Congresses, while states having Republicans on the committee received nearly no bonuses during those years.

EXPENSIVE TRANSIT SLOWS URBAN GROWTH

Rail advocates have discovered that one of the most politically effective arguments for rail construction is that it will magically promote economic development. Buses cannot do the same, say rail advocates, because bus routes can be changed overnight. According to this argument, rail's inflexibility is actually an advantage because developers know the rail line will stay there for years, and plan their developments accordingly.

In fact, by giving urban areas and transit agencies incentives to build rail transit, the federal government is impeding the growth and development of those areas. New transportation infrastructure promotes economic development only if the transportation it supports is faster, cheaper, or more convenient than previous transportation. Light-rail transit is slower, far more expensive, and less convenient than the door-to-door service offered by automobiles, so it will do little to promote economic development.

"Urban rail transit investments rarely 'create' new growth, but more typically redistribute growth that would have taken place without the investment," according to a study commissioned by the FTA.[14] "The greatest land-use changes have occurred downtown, in the form of new office, commercial, and institutional development," adds the report. "The strengthening of downtowns stems in part from the fact that downtowns are the hubs of all rail systems." The study's authors—University of California–Berkeley planning professor Robert Cervero and Parsons Brinckerhoff consultant Samuel Seskin—are far from hostile to rail transit; indeed, Cervero is a strong proponent of transit-oriented development while Parsons Brinckerhoff is one of the leading consultants to transit agencies that plan and build rail lines.[15]

In other words, rail transit does not stimulate economic development, but it might shuffle it around. In this shuffle, the main winners are property owners near the busiest rail stops, while other property owners who might have benefited from development that would have occurred without the rail line end up losing. At best, the overall tax base does not change.

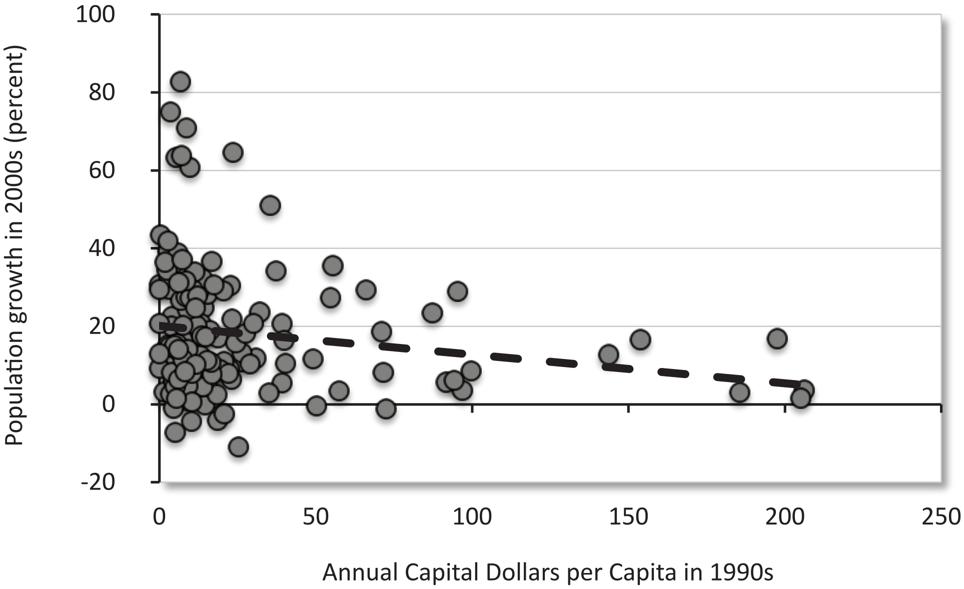
At worst, the rail lines actually slow economic development. One indicator of economic growth is population growth. If rail lines truly promoted economic development, then urban areas that invest most heavily in rail construction should tend to grow faster than ones that do not. In fact, the opposite appears to be true.

Many factors affect urban growth, but Figure 2 shows that urban areas that spent the most on transit capital improvements in the 1990s tended to grow the slowest in the 2000s. Meanwhile, the regions that grew the fastest in the 2000s were among those that spent the least on transit capital improvements in the 1990s. Spending less on transit does not guarantee rapid growth, but spending more on transit could hinder growth by increasing local tax burdens.

Table 3 shows the correlations between transit spending and population growth. A correlation of 1.0 or –1.0 is perfect; a 0.0 correlation means there is no correlation. A negative correlation means more of one factor correlates with less of another.

While correlation does not prove causation, the strongest correlations are between spending in one decade and growth in the next decade. This suggests spending more on transit has a negative influence on population growth and not the other way around. In most cases, the correlations are stronger when just the top 64 urban areas are compared than when 160 urban areas are considered, indicating that the

Figure 2
Transit Spending and Urban Growth



Source: U.S. Census data for urbanized areas; capital expenditures from the National Transit Database.

Note: Out of 160 major urban areas, the fastest-growing urban areas in the 2000s (upper left portion of the chart) spent the least on transit capital improvements in the 1990s. On the other hand, those that spent the most on transit capital improvements (lower right portion of the chart) ended up among the slowest-growing urban areas.

Table 3
Correlations Between Transit Spending and Urban Area Growth

Correlations	64 Urban Areas	160 Urban Areas
1990s Capital Spending and 1990s Growth	−0.09	−0.04
2000s Capital Spending and 2000s Growth	−0.07	−0.09
1990s Capital Spending and 2000s Growth	−0.23	−0.18
1990s Operating Spending and 1990s Growth	−0.19	0
2000s Operating Spending and 2000s Growth	−0.26	−0.21
1990s Operating Spending and 2000s Growth	−0.30	−0.21

Source: Calculations based on National Transit Database historical time series for capital and operational spending and 1990, 2000, and 2010 census data for urbanized area populations. Census data have been corrected to account for Census Bureau lumping and splitting of some urban areas between census years.

> “Many regions that claim rail transit has stimulated economic development conceal the fact that they had to subsidize new developments along the rail lines.”

> "The Massachusetts Bay Transportation Authority needs to spend $470 million per year just to keep its maintenance backlog from growing, yet its 2016 maintenance budget is less than $100 million."

correlations aren't due to a few small, but fast-growing, urban areas.

Most places that claim rail transit has stimulated economic development are concealing the fact that they had to provide subsidies to developers to attract new development to the rail lines. When Portland's first light-rail line opened in 1986, for example, it rezoned all of the land around its rail stations for redevelopment. Ten years later, planners admitted to the city council that "we have not seen any of the kind of development—of a mid-rise, higher-density, mixed-use, mixed-income type—that we would've liked to have seen" along the light-rail line.[16] Council members noted that Portland at that time was in the midst of an economic boom, yet a high percentage of the city's remaining vacant land consisted of rezoned parcels near light-rail stations.[17]

As a result, Portland's city council decided to start subsidizing development along its light-rail and, later, streetcar lines. To date, the city has given developers more than $1.4 billion worth of subsidies in the form of below-market land sales, infrastructure improvements, tax breaks, and other incentives.[18] Even more subsidies are given to developers along rail lines in Portland's suburbs.

For example, the city built several parking garages along the route of its first streetcar line, then claimed that all of the development around the parking garages was due to the streetcar. A city list of developments that were supposedly inspired by the streetcar includes numerous structured parking garages with more than 7,000 parking spaces, many of which were built with city money.[19] Meanwhile, a segment of the streetcar line that received no subsidies also attracted almost no new development, showing that subsidies—not the streetcar—generated the development.

Other cities around the country that have built light-rail lines in the hope that they will spur economic development have been disappointed unless they subsidized that development. Norfolk, Virginia's, light-rail line, for example, has done so little to promote economic development that the city's newspaper, the Virginian-Pilot, has proposed to reduce fares by two-thirds to stimulate ridership.[20] The newspaper was probably unaware that, even though the nominal fare on the light-rail line is $1.50, the actual fares collected are only 50 cents per ride, the second-lowest of any light-rail system in the country. By comparison, Norfolk bus riders pay an average of 91 cents per ride for transportation that costs taxpayers less than the light rail.[21]

HIDDEN LONG-TERM COSTS

Rail transit projects include a large hidden cost that is never mentioned by rail proponents: they must be rebuilt, almost from the ground up, about every 30 years. That's the useful life of tracks, power facilities, signals, and stations. After that, keeping them in a state of good repair becomes increasingly expensive, and few, if any, present-day transit agencies have successfully done so.

The recent numerous problems on the Washington Metro system, from broken rails to smoke in the tunnels that killed a woman in January 2015, and the 2009 accident that killed nine people, can be directly attributed to the failure of the Washington Metropolitan Area Transit Authority to find the funds for such rehabilitation.

According to the FTA, as of 2010, America's rail transit systems suffered from a $59 billion maintenance backlog.[22] The backlog has only grown since then as transit agencies are spending less on maintenance than is needed to keep their rail systems from deteriorating any further, much less enough to restore them to a state of good repair. "There will never be enough money" to bring rail transit systems up to a state of good repair, a New York transit official lamented in 2007.[23]

For example, the Massachusetts Bay Transportation Authority (MBTA) has a $3 billion maintenance backlog and needs to spend $470 million a year on maintenance just to keep that backlog from growing further.[24] Yet MBTA's 2016 budget provides less than $100 million for maintenance.[25] Meanwhile it spends $424 million a year servicing the debt it has incurred in building new rail transit lines or extensions.[26]

The situation is only going to get worse. Nearly all the maintenance backlog documented by the FTA in 2010 was comprised of older rail systems in Atlanta, Boston, Chicago, Cleveland, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, and Washington. But newer rail systems in many cities are approaching 30 years of age and most of them are also suffering maintenance shortfalls. Rail lines in Baltimore, Buffalo, Miami, Portland, Sacramento, and San Diego are all 25–33 years old, while rail lines in Los Angeles, San Jose, and St. Louis are not much younger.

For example, Portland's first light-rail line is 29 years old and began experiencing serious maintenance issues last year. A 2014 audit by the Oregon secretary of state found that Portland's transit agency, TriMet, was only spending 53 percent as much as needed to keep its light-rail tracks in good repair and only 72 percent as much as needed to keep signals in good repair.[27] As a result, Portland's light-rail lines suffer frequent delays from breakdowns. In May 2014, Portland's transit agency tweeted an apology to riders for having breakdowns three times in three days. Within 22 minutes of the apology, the system suffered another breakdown.[28]

The Sierra Club says these problems are not "a result of mismanagement," meaning they aren't the fault of agency managers. Instead, the club claims, the problem is "longtime neglect to properly fund the system."[29] While it's theoretically true that any problem could be solved by throwing enough money at it, the sad truth is that the world does not have an infinite supply of money. The fact that fares cover less than a quarter of the amount transit agencies spend operating and maintaining their rail systems is a market signal that rails are not economically feasible. The fact that politicians are unwilling to spend the money to adequately maintain those systems is a political signal that rails are not fiscally feasible. Rail advocates want to live in a fantasy world where neither markets nor politics are relevant, but that world doesn't exist.

COST OVERRUNS

The high construction costs quoted in the FTA *New Starts* reports represent only the projected costs. Actual rail construction costs are often much higher. The appropriate measure of a cost overrun is between the cost projection at the alternatives analysis stage and the final cost, because it is at the alternatives analysis stage that the final decision to build rail is made and from that point on most other alternatives are excluded from consideration.

Cost overruns for rail transit are the rule rather than the exception. Table 4 shows that, while a few lines have been built for less than their projected cost, most have gone well over the original projection, with an average cost overrun of close to 100 percent. Moreover, the record is not improving: lines completed in the last few years have had overruns as great, or greater than, the average. Table 4 does not include every federally funded light-rail line ever built, but all but three of the lines in the table are from a series of U.S. Department of Transportation reports on predicted and actual costs, so presumably those lines are a representative sample.

Three projects—the El Cajon line of the San Diego light rail, the St. Clair line of the St. Louis light rail, and the Tasman West line of the San Jose light rail (in Table 5)—appear to have been finished for less than their original projected cost. However, the Tasman West line was originally supposed to be 12.2 miles long, but the final project was just 7.6 miles, while the St. Clair line was supposed to be 25 miles long, but the final project was only 17.4 miles. Adjusting for mileage, the cost per mile of the Tasman West line was 16 percent more than projected, while the cost per mile of the St. Clair line was 32 percent more than projected.

There is no sign that cost estimates being made for project analyses are more reliable today than they were 30 years ago. Boston's MBTA recently broke ground on a 4.7-mile extension of its Green light-rail line to Medford, Massachusetts. The 2005 alternatives analysis for the line projected it would cost $390 million, which after adjusting for inflation is less than $500 million.[31] The current cost projection is $1.99 billion, or more than four times as much as originally projected.[32]

A major portion of many cost overruns takes place between the alternatives analysis (which is

> "Cost overruns for rail transit are the rule rather than the exception, and the record is not improving as recently completed lines have had overrruns as great or greater than the average."

Table 4
Projected and Actual Costs of Federally Funded Rail Transit Lines (costs in millions of dollars)

Urban Area	Rail Line	Transit Mode	Year Opened	Projected Cost	Actual Cost	Percent Overrun	Data Source
Washington, DC	Red and Blue	HR	1986	4,352	7,968	83	P
Atlanta	Initial	HR	1987	1,723	2,720	58	P
Baltimore	Subway	HR	1987	804	1,289	60	P
Portland	Eastside	LR	1988	172	266	55	P
Sacramento	Initial	LR	1988	165	188	14	P
Miami	Metromover	AG	1988	84	175	108	P
Detroit	Peoplemover	AG	1988	144	215	49	P
Miami	Metrorail	HR	1988	1,008	1,341	33	P
Buffalo	Initial	LR	1989	478	722	51	P
San Diego	El Cajon	LR	1989	114	103	-10	F3
Los Angeles	Blue	LR	1990	561	877	56	T
San Jose	Guadalupe	LR	1991	258	380	47	F3
St. Louis	Initial	LR	1993	317	387	22	F3
St. Louis	St. Clair	LR	1995	368	339	-8	F3
Miami	Extension	AG	1995	221	228	3	F3
Baltimore	Hopkins	HR	1995	314	353	12	F3
Dallas	S. Oak Cliff	LR	1996	325	360	11	F3
San Francisco	Colma	HR	1996	113	180	59	F3
Baltimore	BWI-Hunt Vly.	LR	1997	82	116	42	F3
San Jose	Tasman West	LR	1997	452	325	-28	F3
Portland	Westside	LR	1998	454	782	72	F3
Salt Lake	I-15	LR	1999	206	299	45	F3
Denver	Southwest	LR	2000	150	178	19	F3
Atlanta	North	HR	2000	440	473	8	F3
Jacksonville	Skyway	AG	2000	66	106	61	F3
New Jersey	Hudson-Bergen	LR	2001	930	1,756	89	F7
Dallas	North Central	LR	2002	333	437	31	F7
Sacramento	South	LR	2003	202	219	8	F7
San Francisco	Airport BART	HR	2003	1,283	1,552	21	F7
Minneapolis	Hiawatha	LR	2004	244	697	186	F7
Portland	Interstate	LR	2004	283	350	24	F8
Memphis	Extension	SR	2004	36	58	61	F7
Washington	Largo	HR	2004	375	426	14	F7
San Diego	Mission Valley	LR	2005	387	506	31	F7
San Juan	Tren Urbano	HR	2005	1,086	2,228	105	F7
Denver	Southeast	LR	2006	585	851	45	F7
New Jersey	Newark	LR	2006	181	208	15	F7

Urban Area	Rail Line	Transit Mode	Year Opened	Projected Cost	Actual Cost	Percent Overrun	Data Source
Charlotte	Lynx	LR	2007	331	463	40	F11
Phoenix	East Valley	LR	2008	1,076	1,405	31	F13
San Diego	Sprinter	LR	2008	214	478	124	F11
Los Angeles	Gold ext.	LR	2009	760	899	18	F13
Seattle	Link	LR	2009	1,858	2,558	38	F13
Denver	West	LR	2012	350	707	102	D
Norfolk	Tide	LR	2012	198	338	71	N
Minneapolis	Green	LR	2013	581	957	65	M

Sources: See note 30.[30]

Notes: HR = heavy rail; LR = light rail; SR = streetcar rail; AG = automated guideway.

based on preliminary engineering studies) and the final engineering. Maryland is proposing to build the Purple light-rail line in the Washington, D.C. suburbs. The alternatives analysis projected a cost of $1.4 billion in 2007 dollars; after adjusting for inflation, this would be about $1.7 billion.[33] By 2014, the cost projection had grown to $2.4 billion, more than 40 percent above the projected cost.[34]

Costs often continue to increase after the final engineering. For example, a rail line currently being built in Honolulu has already gone $910 million, or 17.5 percent, over the cost that was estimated by the final engineering.[35]

Rail advocates sometimes argue that some or all of the high construction costs of rail transit can be recovered by its low operating costs. On average, for example, light-rail operations cost 65 cents per passenger mile while bus operations cost 94 cents per passenger in 2012. But these operating costs exclude the costs of maintenance and capital replacement. In 2012, transit agencies spent an average of 24 cents a passenger mile on light-rail maintenance but only 18 cents on bus maintenance.

The 23-cent-per-passenger-mile savings on operations and maintenance does not begin to compensate for rail construction costs that are typically around 100 times as much as the cost of starting comparable bus service. As just one example, amortizing the cost of the Charlotte, North Carolina, light-rail line at a low 2 percent interest rate over 30 years results in an annualized cost of more than $20 million per year. This line carried 25.7 million passenger miles in 2012, meaning each passenger mile's share of capital costs was 80 cents, far more than any savings on operations and maintenance.

OPTIMISM BIAS INFLATES RIDERSHIP ESTIMATES

Rail transit planners have a long history of overestimating ridership as well as underestimating costs. Of the 45 rail lines listed in Table 5, planners for 38 of them overestimated ridership by a total of 79 percent, while planners for the other 7 underestimated ridership by a total of 21 percent. The total overestimate for all of them together is 70 percent.

"The systematic tendency to over-estimate ridership and to under-estimate capital and operating costs introduces a distinct bias toward the selection of capital-intensive transit improvements such as rail lines," noted U.S. Department of Transportation analyst D. H. Pickrell in 1990.[36] High-cost projects only make sense if the costs can be spread over large numbers of riders, so overestimating ridership or underestimating costs makes high-cost projects appear more feasible.

The near-universal optimism bias in cost estimation and preponderance of optimism bias in ridership estimation led Danish planning profes-

Table 5
Projected and Actual Rail Transit Ridership (average number of weekday riders)

Urban Area	Rail Line	Transit Mode	Year Opened	Projected Riders	Actual Riders	Percent Over-estimate	Data Source
Washington, DC	Red and Blue	HR	1986	959,000	762,013	26	P
Atlanta	Initial	HR	1987	472,860	222,372	113	P
Baltimore	Subway	HR	1987	103,000	43,044	139	P
Portland	Eastside	LR	1988	42,500	32,146	32	P
Sacramento	Initial	LR	1988	50,000	30,326	65	P
Miami	Metromover	AG	1988	41,000	16,836	144	P
Detroit	Peoplemover	AG	1988	67,700	5,928	1042	P
Miami	Metrorail	HR	1988	41,000	16,836	144	P
Buffalo	Metro	LR	1989	9,200	19,398	-53	P
Pittsburgh	Recon.	LR	1989	90,500	25,733	252	P
San Diego	El Cajon	LR	1989	21,600	24,950	-13	F3
San Jose	Guadalupe	LR	1991	41,200	21,035	96	F3
St. Louis	Initial	LR	1993	41,800	42,381	-1	F3
Miami	Extension	AG	1995	20,404	4,158	391	F3
Baltimore	Hopkins	HR	1995	13,600	10,128	34	F3
Dallas	S Oak Cliff	LR	1996	34,170	26,884	27	F3
San Francisco	Colma	HR	1996	15,200	13,060	16	F3
Baltimore	BWI HV ext.	LR	1997	12,230	8,272	48	F3
San Jose	Tasman West	LR	1997	14,875	8,244	80	F3
Portland	Westside	LR	1998	60,314	43,876	37	F3
Salt Lake	I-15	LR	1999	26,500	22,100	20	F3
Denver	Southwest	LR	2000	22,000	19,083	15	F3
Jacksonville	Skyway	AG	2000	42,472	2,627	1517	F3
Atlanta	North	HR	2000	57,120	20,878	174	F3
St. Louis	St. Clair	LR	2001	20,274	15,976	27	F3
Dallas	N. Central	LR	2002	17,033	16,278	5	F7
Sacramento	South	LR	2003	12,550	10,543	19	F7
SLC	University	LR	2003	10,050	21,811	-54	F7
Minneapolis	Hiawatha	LR	2004	37,000	33,477	11	F7
Pittsburgh	Recon.	LR	2004	49,000	25,733	90	F7
Portland	Interstate	LR	2004	13,900	11,800	18	F8
Washington	Largo	HR	2004	14,270	8,623	65	F7
Memphis	Extension	SR	2004	4,200	707	494	F7
San Diego	Mission Valley	LR	2005	10,795	8,895	21	F7
San Juan	Tren Urbano	HR	2005	114,492	31,749	261	F7
Baltimore	Double track	LR	2006	44,000	28,541	54	F7
Denver	Southeast	LR	2006	38,100	31,320	22	F7

Urban Area	Rail Line	Transit Mode	Year Opened	Projected Riders	Actual Riders	Percent Over-estimate	Data Source
Newark	Elizabeth I	LR	2006	12,500	2,500	400	F7
NJ	H-B 1 and 2	LR	2006	66,160	41,525	59	F7
Charlotte	Lynx	LR	2007	9,100	11,678	-22	F11
Phoenix	East Valley	LR	2008	26,000	34,800	-25	F13
Seattle	Link	LR	2009	34,900	23,400	49	F13
Denver	West	LR	2012	19,500	13,800	41	D
Norfolk	Tide	LR	2012	10,400	4,347	139	N
Minneapolis	Green	LR	2013	34,300	37,000	-7	M

Source: See note 30.

Note: HR = heavy rail; LR = light rail; SR = streetcar rail; AG = automated guideway.

sor Bent Flyvbjerg to use the term "strategic misrepresentation."[37] In other words, the consulting firms that make the estimates and the agencies that pay them deliberately make the projects appear less costly and more productive than they will be in reality in order to get the funding that boosts the agencies and leads them to hire the consultants for more work.

To fix this problem, Flyvbjerg argues that transportation agencies should use *reference class forecasting,* which means adjusting forecasts based on previous experience. For example, if past light-rail projects typically cost 40 percent more and attract 50 percent fewer riders than projected, then cost estimates for proposed light-rail projects should be increased by 40 percent and ridership estimates decreased by 50 percent. Having already effectively abolished the cost-effectiveness rules, however, the FTA is not likely to require agencies to use reference class forecasting.

CAPACITY

Perhaps the worst outcome of federal capital funding for transit is that many transit agencies are spending enormous amounts of money building low-capacity transit systems when buses could provide the same or better service at far less cost. Rail advocates often call streetcars and light rail "high-capacity transit" because individual transit vehicles have more capacity than a bus. But the capacity of a transit line is a function of both the capacity of the vehicles and the number of vehicles that can be moved through the line in an hour or other given amount of time.

In 1966, two years after Congress passed the Urban Mass Transportation Act, St. Louis replaced its last streetcar line with buses.[38] This left just eight American urban areas with some form of rail transit: Boston, Chicago, Cleveland, New Orleans, New York, Philadelphia, Pittsburgh, and San Francisco. At the time, most transit agency officials agreed that buses were superior to rail transit because of their greater flexibility and lower capital and maintenance costs. The only exceptions were high-density corridors or job centers where buses could not move as many people as rail, and in those cases only heavy rail or, in a few places, commuter rail, could move more people than buses.

Portland has dedicated one lane and a parking strip of two downtown one-way streets to buses. TriMet has scheduled as many as 160 buses per hour on each of those streets. Using standard 40-foot buses with about 40 seats and room for about 25 standees, the streets can each move more than 10,000 people per hour. This capacity can be increased to nearly 13,000 people per hour using articulated buses and more than 17,000 people per hour using double-decker buses.

By comparison, for safety reasons most light-rail lines can only handle 20 trains per hour. To avoid blocking traffic when trains stop to let passengers on and off, trains can be no longer than a city block, which in most cities means three

> "To devise formulas for distributing transit funds, Congress should focus on outcomes such as transit trips or transit fares (which are easier to verify than trips)."

cars. Typical 90-foot light-rail cars have about 70 seats and room for 80 standees, resulting in a capacity of just 9,000 people per hour.

Streetcar capacities are even lower. The "modern," 66-foot streetcars being used in Portland, Atlanta, Washington, and other cities have about 30 seats and room for 70 people standing. They cannot be coupled together into trains, so at 20 railcars per hour a streetcar line can move just 2,000 people per hour.

Heavy-rail lines have much higher capacities because train lengths are limited only by platform lengths, which in most cases is 8 to 11 cars. But Honolulu is building a heavy-rail line whose platforms are only long enough to allow four 60-foot cars. While the railcar manufacturer claims the cars can hold 150 people, that would require more crowding that Americans find acceptable.[39] At a more reasonable 100-people-per-car, the line's capacity is about 12,000 people per hour. The $300 million per mile that Honolulu is spending on this line seems absurd when articulated buses could carry more people with a higher percentage of them being comfortably seated.

Ironically, rail interests actually benefit from installing such low-capacity transit lines. When the railcars are full—which, in many cases, they will be for an hour or two a day—rail advocates can argue this proves the systems are successful when in fact the problem is their capacities are too low.

Actual use never reaches capacity, of course, partly because of ebbs and flows in transportation demand over the course of a day and days of the week. Table 6 compares passenger miles per route mile of transit lines with passenger miles per lane mile of freeways in the same cities as transit lines. This provides a good comparison of system capacity and efficiency.

Of course, many proposed rail corridors don't need much transit capacity. In 2014, Austin's transit agency proposed to build a so-called high-capacity light-rail line. Yet the agency projected that peak-hour ridership on the proposed route would only be 2,500 people per hour, which was so low that it planned to operate single-car trains just six times per hour.[40] The fact that so many transit agencies want to build low-capacity rail lines in corridors where demand is low shows just how the incentives created by the New Starts fund have warped transportation priorities.

GETTING THE INCENTIVES RIGHT

Current federal transit funding, particularly through the New Starts process, gives transit agencies and urban areas incentives to choose the high-cost solutions in any transit corridor in order to be eligible for the largest possible share of New Starts and other transit funds. Fixing this means replacing the New Starts discretionary fund with a formula fund.

The original formula fund in the 1956 highway bill based the distribution of funds to the states on population, land area, and road miles in each state.[41] In the short run, all of these factors were beyond the control of the states, so they had little incentive to change their behavior in order to gain more funding.

The formulas for transit funding in more recent transportation bills contain a bewildering variety of factors, including population densities, vehicle miles of travel, transit vehicle revenue miles, passenger miles, operating costs, and fixed guideway route miles. A few of these (particularly the ones involving operating costs) are clearly intended to give transit agencies incentives, but most are simply congressional attempts to distribute funds based on system need for subsidies to continue operations. One formula, for example, distributes funds based on the number of rail route miles and railcar miles of travel whether anyone is riding those railcars or not.

To devise better formulas, Congress should focus on the outcomes it wants to see from federal transportation programs. In the case of transit, the most important outcome is the personal mobility of transit users. Two possible measures of this outcome are transit trips and transit passenger miles. One problem with using these measures is that they are difficult to verify.

A better measure is the fares collected from transit riders. Not only are fares easier to verify,

Table 6
Passenger Miles Per Rail Route Mile and Freeway Lane-mile

Urban Area/System	Passenger Miles per Route Mile	Passenger Miles per Lane Mile	Rail as percentage of Freeway
Light Rail			
Baltimore	5,455	28,767	19.0
Boston	13,764	26,413	52.1
Buffalo	7,509	17,128	43.8
Charlotte	15,122	22,361	67.6
Cleveland	2,805	19,967	14.0
Dallas	6,689	27,592	24.2
Denver	13,264	27,226	48.7
Houston	7,896	27,777	28.4
Los Angeles	14,737	38,635	38.1
Minneapolis	10,346	27,061	38.2
Phoenix	11,855	26,550	44.7
Pittsburgh	3,626	11,511	31.5
Portland	11,747	28,046	41.9
San Diego	10,376	31,501	32.9
San Francisco	8,941	34,146	26.2
San Jose	3,848	34,222	11.2
Seattle	9,581	26,753	35.8
St. Louis	8,545	20,660	41.4
Heavy Rail			
Atlanta	24,407	29,167	83.7
Baltimore	12,445	28,767	43.3
Boston	29,432	26,413	111.4
Chicago	29,263	28,861	101.4
Cleveland	5,680	19,967	28.4
Los Angeles	37,127	38,635	96.1
Miami	13,096	29,718	44.1
New York MTA	68,562	26,782	256.0
New York PATH	52,196	26,782	194.9
Philadelphia PATCO	13,371	26,782	49.9
Philadelphia SEPTA	25,016	23,841	104.9
San Francisco BART	31,564	34,146	92.4
Staten Island	6,638	26,782	24.8
Washington	32,095	29,397	109.2
Commuter Rail			
Albuquerque	2,610	23,966	10.9
Boston	5,620	26,413	21.3
Chicago Metra	7,620	28,861	26.4
Chicago NICTD	4,442	28,861	15.4
Dallas DCTA	1,299	27,592	4.7

continued

Urban Area/System	Passenger Miles per Route Mile	Passenger Miles per Lane Mile	Rail as percentage of Freeway
Dallas–Ft. Worth	5,055	27,592	18.3
Ft. Lauderdale	4,144	29,718	13.9
Los Angeles	3,684	38,635	9.5
Maryland	4,363	29,397	14.8
Minneapolis	1,437	27,061	5.3
Nashville	1,044	23,664	4.4
New Jersey Transit	12,026	26,782	44.9
New York LIRR	16,328	26,782	61.0
New York Metro North	16,558	26,782	61.8
North San Diego	2,446	31,501	7.8
Philadelphia PennDOT	1,625	23,841	6.8
Philadelphia SEPTA	4,697	23,841	19.7
Portland, ME	2,054	26,413	7.8
Salt Lake City	2,921	24,803	11.8
San Francisco	11,196	34,146	32.8
San Jose ACE	3,122	34,222	9.1
Seattle	3,077	26,753	11.5
Seattle	5,804	26,753	21.7
Virginia Railway Express	7,463	29,397	25.4
Hybrid Rail			
Austin	858	22,193	3.9
North San Diego	3,566	31,501	11.3
Portland	1,402	28,046	5.0
Trenton	3,918	23,841	16.4
Streetcars			
Little Rock	261	12,807	2.0
Memphis	870	21,176	4.1
New Orleans	4,510	21,466	21.0
Philadelphia	1,648	23,841	6.9
Portland	2,518	28,046	9.0
San Francisco	3,476	34,146	10.2
Seattle	1,374	26,753	5.1
Tacoma	1,763	26,753	6.6
Tampa	821	26,151	3.1
Averages			
Light Rail	8,448	26,476	31.9
Heavy Rail	27,207	28,288	96.2
Commuter Rail	5,253	28,022	18.7
Hybrid Rail	2,436	26,395	9.2
Streetcars	1,916	24,571	7.8

Source: 2012 National Transit Database, Service spreadsheet; 2012 Highway Statistics, Table HM-72.

Note: For most rail transit lines, and all non-heavy-rail lines, passenger miles (PM) carried per route mile are far less than the passenger miles per freeway lane-mile on freeways in the same urban area.

they better reflect the actual value of the transportation being provided. Distributing federal funds based on the amount of fares transit agencies collect would give those agencies a powerful incentive to focus on providing the best possible services to transit riders. It wouldn't encourage them to simply raise fares to unaffordable rates, as that would cause them to lose customers and total revenue. Instead, they would try to tailor transit operations to provide the best possible service for transit riders.

The same incentive could more broadly be provided to all surface transportation. Rather than basing federal funds to highways on population or land area, they could be based on the user fees collected by states from highway users. Such user fees would include fuel taxes, weight-mile taxes, vehicle registration fees, and tolls, provided those revenues were dedicated to highways. Such revenues that are diverted to non-highway purposes would not, for the purposes of determining federal funding, be counted as user fees.

Focusing on user fees would not only give states and metropolitan areas incentives to meet the needs of transport users, it would also encourage them to spend funds as effectively as possible to generate more transportation value (and more user fees). But whether Congress chooses to focus on user fees or some other positive value, it needs to eliminate the perverse incentive to waste money on mediocre transit systems that is found in the New Starts program.

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