Policy Analysis

CATO INSTITUTE

October 24, 2017 | Number 824

The Coming Transit Apocalypse

By Randal O'Toole

EXECUTIVE SUMMARY

With annual subsidies of $50 billion covering 76 percent of its costs, public transit may be the most heavily subsidized consumer-based industry in the country. Since 1970, the industry has received well over $1 trillion (adjusted for inflation) in subsidies, yet the number of transit trips taken by the average urban resident has declined from about 50 per year in 1970 to 39 per year today.

Total transit ridership, not just per capita, is declining today, having seen a 4.4 percent drop nationwide from 2014 to 2016 and a 3.0 percent drop in the first seven months of 2017 versus the same months of 2016. Many major transit systems have suffered catastrophic declines in the past few years: since 2009, for example, transit ridership has declined by 27 to 37 percent in the Bakersfield, Detroit, Fresno, Memphis, Richmond, Toledo, and Wichita urban areas.

Four trends that are likely to become even more pronounced in the future place the entire industry in jeopardy: low energy prices; growing maintenance backlogs, especially for rail transit systems; unfunded pension and health care obligations; and ride-hailing services.

The last is the most serious threat, as some predict that within five years those ride-hailing services will begin using driverless cars, which will reduce their fares to rates competitive with transit, but with far more convenient service. This makes it likely that outside of a few very dense areas, such as New York City, transit will be extinct by the year 2030, leaving behind a huge burden of debt and unfunded obligations to former transit employees.

Despite these trends, the transit industry's main response is to seek greater subsidies to build, maintain, and operate transit, often relying on rail transit and similar modes that were obsolete many years ago and won't be able to compete against driverless ride-hailing services. Instead, transit agencies should begin to prepare for an orderly phase-out of publicly funded transit services as affordable, shared driverless cars become available in the next decade. This means the industry should stop building new rail lines; replace most existing rail lines with buses as they wear out; pay down debts and unfunded obligations; and target any further subsidies to low-income people rather than continue a futile crusade to attract higher-income people out of their cars.

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*.

> "Many transit agencies plan to use subsidies in ways that will impose heavy costs on taxpayers for decades to come."

INTRODUCTION

Across the nation, transit agencies are in financial trouble as ridership declines while costs rise. But these troubles merely foreshadow the real problems the transit industry will face in the next few years. It is quite likely that, outside of New York and possibly a handful of other cities, transit as we know it will go extinct within 15 years, and many transit agencies will leave behind a mountain of debt that local taxpayers will be obligated to pay.

Public transit is quite possibly the most heavily subsidized consumer-based industry in the United States. Federal, state, and local subsidies approaching $50 billion a year cover 76 percent of the costs of transit services. It is also one of the most useless industries, as much of what it does could be done for less money through other means.

Led by the American Public Transportation Association (APTA), a $30-million-a-year organization that puts out a stream of reports and press releases promoting more subsidies for transit, the transit industry has persuaded many that public transit relieves congestion, saves energy, reduces pollution, is a vital part of urban economies, and helps low-income people. In fact, in the vast majority of urban areas in the United States, none of these things are true.

Lumbering transit buses and railcars not only do not relieve congestion, they often use more road space than the number of automobiles they take off the road.[1] They also use more energy and emit more greenhouse gases per passenger mile than the average car.[2] In most urban areas they carry so few people that transit could disappear tomorrow and almost no one would notice (see Table 1). As for low-income people, studies have found that giving unemployed people access to a car will do far more to help them get and keep a job than providing subsidized transit.[3]

In 2014, transit ridership reached 10.75 billion trips, its highest level since 1956. This is hardly a great achievement, however, as increased urban populations meant that annual transit trips per urban resident declined from 98 in 1956 to 42 in 2014. Yet the transit industry responded to this increased ridership by calling for more subsidies.

"The record ridership in 2014 is a clear message to Congress that the citizens of this country want expanded public transit services," said APTA president Michael Melaniphy. "Congress needs to work together now to pass a long-term, well-funded surface transportation bill that invests in our country's public transit infrastructure."[4]

From 2014 to 2016, nationwide ridership declined by 4.4 percent. While this may seem small, some urban areas have seen catastrophic losses in riders in the past few years. Since 2009, transit ridership has fallen by 37 percent in Wichita, 36 percent in Memphis, 31 percent in Sacramento and Richmond, 29 percent in Detroit, 28 percent in Bakersfield and Toledo, and 27 percent in Fresno. Transit systems in Atlanta, Cincinnati, Los Angeles, Milwaukee, St. Louis, and Washington have all suffered double-digit declines since 2009. Moreover, data for the first seven months of 2017 suggest that declines are accelerating.[5]

Although agencies in these urban areas may depend on fares to cover only 20 to 40 percent of their operating costs, a 10 to 35 percent drop in that share of funding still hurts. Today, transit agencies are furiously lobbying for more subsidies to make up for declining revenues from transit riders. In other words, agency responses to both increases and decreases in ridership are to ask for more subsidies.

In many cases, the agencies plan to use those subsidies in ways that will impose heavy costs on taxpayers for decades to come, including by borrowing money to build new transit lines or rehabilitate old ones. Instead, they should be attempting to find a dignified path towards shutting down their systems in ways that minimize disruptions to transit riders and costs to taxpayers.

A BRIEF HISTORY OF TRANSIT

A century ago, America was nearing the end of the Golden Age of urban transit. Electric streetcars had been perfected in the late

1880s, and by 1902 every American city of 15,000 people or more had streetcar service.[6] Electric rapid transit was perfected in the early 1890s, and by 1917 it was trundling people across, or under, Boston, Chicago, New York, and Philadelphia. These and other major cities were also connected to their suburbs by frequent steam-powered commuter trains.

Hub-and-spoke transit systems worked at the turn of the 20th century because, as late as the 1910s, most American cities were *monocentric*, with most jobs, retail stores, and other services located in the city centers and most residents living around those centers. Yet even at its peak, when the average urban resident rode transit nearly 300 times per year, transit mainly served the well-to-do, as fares were too expensive for most working-class employees and their families.

In 1913, Henry Ford developed the disruptive technology that would end the Golden Age of urban transit: the moving assembly line. The moving assembly line allowed Ford to reduce the price of his cars even as he doubled worker pay, thus making it possible for even unskilled workers to buy automobiles. The share of American families that owned an automobile rapidly grew from less than 5 percent in 1913 to more than 50 percent in 1926.

Perhaps even more important for public transit, the moving assembly line changed the nature of factories and jobs. Where once a single city block could hold a factory employing several thousand workers, moving assembly lines required far more land. Ford's Highland Park Plant, which built the Model T, covered 130 acres. His River Rouge Complex, which built the Model A, was 900 acres. Such large factories couldn't locate within city centers, where land was expensive, so they moved to the suburbs, thus turning monocentric cities into polycentric urban areas.

Transit didn't work as well for polycentric areas, and the transit that worked best was buses, not streetcars. As of 1922, buses cost more to operate than streetcars, but it cost transit companies far less to expand services using buses than streetcars because they didn't have to build new track. The number of miles of streetcar lines peaked in 1919, while streetcar ridership peaked in 1920 and declined through most of the 1920s, a decline that was entirely made up for by increased bus ridership. Except for a new streetcar line in Miami and subway lines in New York, almost all new transit service in the 1920s used buses, not rail transit.

By the end of the 1920s, technological improvements made internal combustion engines smaller and more economical to operate. Fitting the smaller engines over the rear axle instead of under a long hood also increased the capacity of a bus by about a third. This made buses less expensive to operate, and far less expensive to maintain, than rail transit. As a result, cities such as Albuquerque, Ann Arbor, Boise, Burlington, and Danbury all replaced their streetcars with buses by 1930. In 1933, San Antonio became the first city of more than 200,000 people to do so, as well.

Between 1910 and 1973, streetcar systems were scrapped and, in most cases, replaced with buses, in more than a thousand American cities. The few cities in which streetcars survived after 1973 did so because they used tunnels that would become polluted if used by diesel buses (Boston, Newark, Philadelphia, and San Francisco) or exclusive rights of way that the transit company did not want to give up (Cleveland and New Orleans).

Urban areas continued to evolve in ways making them even less suited for transit. In 1920, 40 percent of American jobs were in factories, but by 1980 most jobs were in service industries such as health care, education, wholesale and retail trade, government, and utilities. These jobs were even more finely spread across the landscape, so that today just 8 percent of jobs are located in central city downtowns and only about 20 percent are located in edge cities and other urban centers.[7] Thus, increasing automobile ownership was only part of the reason for transit's decline, the other part being the increasing diffusion of jobs, most of which are not easily accessible by any form of transit.

In the early 1960s, the vast majority of American transit systems were still privately

"Since Henry Ford developed the moving assembly line in 1913, urban areas have evolved in ways that make them unsuited for mass transit."

Table 1
Transit's share of travel and commuting in urban areas and central cities (percent)

	Urban area share of total travel	Urban area share of commuting	Central city share of commuting
New York	11.07	34.60	58.10
Los Angeles	2.02	5.60	11.80
Chicago	3.73	13.70	27.70
Miami	1.26	4.00	10.80
Philadelphia	2.77	10.90	28.00
Dallas–Ft. Worth	0.60	1.90	3.80
Houston	0.78	2.60	4.60
Washington	3.84	17.60	40.30
Atlanta	0.95	3.80	12.30
Boston	2.86	15.50	34.20
Detroit	0.39	1.40	8.70
Phoenix	0.65	2.50	3.30
San Francisco–Oakland*	5.51	19.40	36.50
Seattle	3.34	10.70	19.50
San Diego	1.48	3.90	4.60
Minneapolis–St. Paul	1.10	6.10	14.00
Tampa–St. Petersburg	0.40	1.70	3.80
Denver	1.66	4.50	6.70
Baltimore	2.42	8.20	18.10
St. Louis	0.76	3.30	11.40
Riverside–San Bernardino	0.50	1.80	3.30
Las Vegas	0.99	4.40	4.90
Portland	2.39	8.50	13.00
Cleveland	0.89	3.90	11.90
San Antonio	0.69	2.60	3.10
Pittsburgh	1.40	7.30	18.70
Sacramento	0.72	2.80	3.50
San Jose	1.07	4.50	3.20
Cincinnati	0.44	2.60	8.60
Kansas City	0.25	1.30	3.60
Orlando	0.64	2.80	3.30
Indianapolis	0.15	1.10	1.80

	Urban area share of total travel	Urban area share of commuting	Central city share of commuting
Virginia Beach–Norfolk	0.36	2.00	0.80
Milwaukee	0.83	4.50	8.10
Columbus	0.38	2.60	3.00
Austin	0.77	3.00	4.60
Charlotte	0.53	3.00	3.90
Providence	0.68	3.20	8.70
Jacksonville	0.37	1.70	1.40
Memphis	0.24	1.30	1.90
Salt Lake City*	1.29	3.30	5.70
Louisville	0.51	2.40	3.70
Nashville	0.27	2.00	2.20
Richmond	0.32	1.90	5.00
Buffalo	0.71	4.40	14.00
Hartford	0.72	3.60	17.90
Bridgeport–Stamford	0.34	11.20	12.30
New Orleans	0.57	4.40	7.50
Raleigh	0.18	1.10	1.70
Oklahoma City	0.09	0.50	0.60
Tucson	0.75	3.10	3.00
El Paso	0.81	1.20	1.90
Honolulu	4.07	10.50	13.60
Birmingham	0.12	0.80	2.20
Albuquerque	0.87	1.40	2.50
McAllen	0.00	0.60	0.80
Omaha	0.16	1.20	1.20
Dayton	0.43	2.00	6.30
Rochester	0.51	3.60	4.60
Allentown	0.37	2.00	5.70

* Data for the San Francisco–Oakland urban area include the Concord and Livermore urban areas, as all are served by the same regional transit system. Likewise, data for the Salt Lake City urban area include the Ogden and Provo–Orem urban areas. This table shows the top 60 urbanized areas by population; 60 are shown because showing only 50 would leave out Honolulu, where transit has particularly high shares of travel and commuting, probably because of high fuel prices.

Sources: Transit's share of total travel is calculated from the 2015 National Transit Database (Washington: Federal Transit Administration, 2016), www.transit.dot.gov/ntd, Service spreadsheet; and 2015 Highway Statistics, tinyurl.com/FHwAHwyStats, Table HM-72, with vehicle miles of travel multiplied by 1.67 to convert to passenger miles of travel; transit's share of commuting is from the 2015 American Community Survey, Table B08301, for urban areas and places.

> "Per passenger mile, urban transit is by far the nation's most expensive and most heavily subsidized form of passenger travel."

owned and profitable, although declining. The railroads that offered commuter trains to the nation's largest cities, however, were losing money and petitioning to discontinue those services. Since commuter trains that serve Boston, Chicago, New York, and Philadelphia cross state lines and thus were interstate commerce, Congress agreed to help state governments take over such operations.

Politically, however, Congress couldn't pass a law that benefitted just four cities, so it offered to help any city that took over its transit system. Within a decade, the nation's transit industry was almost completely socialized or municipalized.

To fund their operations, transit agencies sought as large a tax base as possible, usually an entire county or a multi-county region. To justify the taxes, the agencies had to extend transit service to low-density suburbs with high auto ownership rates, sometimes at the expense of cutting service in their core markets near city centers.

This resulted in a huge decline in productivity. Between 1970 and 2015, the number of passengers carried per operating employee declined by almost exactly 50 percent.[8] The average number of passengers on board a bus declined by 25 percent.[9] After adjusting for inflation, transit industry spending on operations and improvements has more than quadrupled, while fare revenues haven't quite doubled.[10]

Growing automobile ownership meant that transit's core market of low-income workers and others who did not drive was shrinking. Between 1970 and 2000, the share of American households without cars shrank from 17 percent to 9 percent, while the share with three or more cars tripled from 6 to 18 percent. Today, just 4.3 percent of American workers live in households without cars, and most of them don't take transit to work.[11]

In a classic example of mission creep, transit agencies responded to the decline in the number of transit-dependent people by giving themselves a new goal: attracting middle-class people out of their cars and onto transit. One of the main ways they did so was to build expensive rail transit projects that they hoped would appeal to middle-class commuters. While they achieved some success with this in a few areas, for the most part the increase in so-called choice riders failed to make up for the decline in transit-dependent riders. Indeed, in some areas the emphasis on providing expensive transit for well-to-do riders forced transit agencies to cut services to low-income areas, thus losing more riders than they gained. The National Association for the Advancement of Colored People (NAACP) even successfully sued the Los Angeles County transit agency for cutting service to minority neighborhoods in order to finance rail into middle-class neighborhoods.[12]

After adjusting for inflation, transit agencies have spent more than $1.6 trillion on operations and improvements since 1970, while collecting less than $500 billion in fares.[13] Per passenger mile, transit is the nation's most expensive and most heavily subsidized form of travel. In 2015, transit agencies spent an average of $1.14 per passenger mile, while Amtrak costs averaged nearly 60 cents, driving averaged about 26 cents, and flying averaged about 16 cents per passenger mile. Of those costs, transit subsidies averaged 87 cents per passenger mile, compared with about 30 cents for Amtrak and less than 2 cents for flying and driving.[14]

More than a trillion dollars in subsidies since 1970 has produced minimal transportation benefits. Transit ridership grew from about 7.5 billion rides in 1970 to 10.5 billion in 2015. However, urban populations grew faster, so the number of annual transit trips taken by the average urban resident declined from 50 in 1970 to 39 in 2016. Urban congestion has grown dramatically, partly because many urban areas spend most of their transportation funds on transit systems that carry less than 1 or 2 percent of passenger travel and virtually no freight, rather than the roads and streets that carry around 95 percent of passengers and around 99 percent of local freight.[15]

Contrary to transit industry claims, outside of New York transit is not vital to urban economies and is barely perceptible in most American urban areas except as a tax burden

and a source of congestion. Table 1 shows that transit carries more than 20 percent of commuters to work in just 6 central cities and in just one of the nation's 60 largest urban areas. Transit carries just 11 percent of total passenger travel in the New York urban area. It carries less than 1 percent of total passenger travel in the vast majority of urbanized areas, since it is less than 1 percent in all but a handful of the approximately 360 census-defined urbanized areas not shown in Table 1. Thus, transit could disappear tomorrow in most places and most people would hardly notice.

THE "FOUR HORSEMEN OF THE TRANSIT APOCALYPSE"

The prospects for the transit industry are only going to get worse, thanks to four trends that are making mass transit even less viable as a form of urban transportation. These "Four Horsemen of the Transit Apocalypse" are: low oil prices; growing maintenance costs; unfunded pension and health care obligations; and ride-hailing services, such as Uber and Lyft, and the impending expansion of such services using driverless vehicles. Other than seeking tax increases and other subsidies, transit agencies are doing little to respond to these trends.

Low Oil Prices

The 1960s government rescue of the transit industry seemed to be vindicated by the energy crises of the 1970s. Since then, the industry has been able to count on rising energy prices to boost both ridership and political support for subsidies. For example, with higher gas prices, ridership rose to a peak of 8.9 billion trips in 1989. But then falling gas prices led ridership to decline to fewer than 7.8 billion trips in 1995. When gas prices rose in the mid-2000s, ridership grew to more than 10.5 billion trips in 2008 and nearly 10.8 billion in 2014. Now that gas prices are lower again, ridership is falling.

Gasoline prices have little influence on whether well-to-do people ride transit, but they can have a significant influence on low-income people. One recent study found that "the low-income population reduced gasoline consumption and increased their transit ridership during the period of rising gasoline prices; the high-income population with a strong commitment to vehicle use maintained fairly inelastic demand for gasoline and public transit."[16]

Historic fluctuations in fuel prices were not due to any real resource shortages but to geopolitical events, including Middle East strife and efforts by the Organization of the Petroleum Exporting Countries (OPEC) to flex its oligopolistic power. While there may be no end in sight to problems in the Middle East, the transit industry can no longer count on spikes in energy prices to boost ridership or justify increased subsidies.

This is thanks to new energy technologies, notably hydraulic fracturing (fracking), that have made increased oil production feasible within the United States. While the United States continues to import oil, it is a master of its own destiny when it comes to energy prices because domestic oil production can easily increase in response to international shortages, keeping American gasoline prices relatively stable. Thus, the recent losses in transit ridership that the industry has blamed on low fuel prices are not likely to be reversed anytime soon.

Rising Maintenance Costs

In 2010, the Federal Transit Administration (FTA) estimated that the nation's transit industry had a maintenance backlog of $77.7 billion ($87 billion in 2016 dollars).[17] The agency added that the backlog was growing because transit agencies weren't spending enough on maintenance to keep their systems in their current conditions, much less to reduce the repair backlog. In 2015, the Department of Transportation estimated that the backlog had indeed grown to $89.8 billion ($95 billion in 2016 dollars), which was probably a conservative estimate. To eliminate the backlog in 20 years, the department calculated, 100 percent of funds now being spent on improvements would have to be shifted to maintenance.[18]

> "Outside of New York, transit is not vital to urban economies and in most urban areas is barely perceptible except as a tax burden and a source of congestion."

> "Transit systems in Austin, Dallas–Ft. Worth, Houston, Kansas City, San Antonio, and San Jose only collect enough fares to cover around 10 to 15 percent of operating costs."

Unlike the maintenance backlog for highways and bridges, which could be easily eliminated with a small increase in fuel taxes or other user fees, the transit industry has no hope of fixing its backlog by raising transit fares. Those fares do not begin to cover operating costs, much less the costs of maintenance or improvements. In 2015, transit systems in the New York urban area collected enough fares to cover 49 percent of their operating costs. Systems in Boston, Chicago, Philadelphia, San Francisco, and Washington were all around 40 percent.[19] This means they would need to increase fares by 100 to 150 percent just to cover operating costs, much less leave anything left over for maintenance.

Those are the best cases. At the other extreme, transit systems in Austin, Dallas–Ft. Worth, Houston, Kansas City, San Antonio, and San Jose only collect enough fares to cover around 10 to 15 percent of operating costs.[20] Kansas City and San Antonio were wise enough not to build expensive rail systems with long-term mortgages and maintenance needs, but the other cities are facing growing maintenance costs.

Rail infrastructure has an expected life of about 30 years and must be thoroughly rebuilt or rehabilitated at the end of that time or risk suffering numerous delays, accidents, and other problems. New York's subway system went through such a crisis in the 1980s, but it fixed the problems by spending billions of dollars and going heavily into debt. Now, roughly 30 years later, the debt remains, and the delays and breakdowns have returned, punctuated by a recent derailment that injured 34 people.[21] While New York's Metropolitan Transit Authority (MTA) tried to blame deteriorating service on overcrowding, in fact it is due to maintenance issues and obsolete equipment.[22] By the end of 2016, the MTA was saddled with $37 billion in long-term debt and double that in total liabilities, leaving it in a poor position to fix the problems.[23]

The original lines of the Washington Metrorail system turned 30 in 2006. Soon after that, riders began experiencing episodes of smoke in the tunnels, forcing the agency to stop and evacuate the trains.[24] By 2013, such incidents were happening twice a month, and the agency had discovered they were caused by water in leaky tunnels short-circuiting fiberglass insulators in the third-rail power system, causing them to catch fire.[25] In 2009, a train collision that killed nine people was blamed on poorly maintained signaling systems.[26]

As early as 2002, the Washington Metropolitan Area Transit Authority (WMATA) warned that the agency would need to spend more than $12 billion on maintenance in the next few years to prevent such problems. The system "stands at the precipice of a fiscal and service crisis," the agency predicted.[27] But neither the federal government, which had paid for most of the costs of building the system, nor local governments, which paid for most of the costs of operating it, stepped up to pay for maintenance. Today, WMATA's general manager says the system has "$25 billion of unfunded capital needs."[28]

Legacy rail systems in Boston, Chicago, and Philadelphia, and rail systems built in the 1970s in Atlanta and San Francisco, are all undergoing maintenance crises. Rail systems built in the 1980s, such as those in San Diego, Portland, Sacramento, and San Jose, are beginning to have similar problems. In every case, the people who decided to build these systems found the money for construction and operations but made few to no plans for maintenance. In short, rail transit is a lot more expensive than its advocates have told the public.

Contrary to what people might think, one of the main causes of the maintenance crises is not a shortage of funds, but too much money spent in the wrong places. Since transit systems rely on tax dollars for most of their funds, politicians have a major say in how to spend that money. Such politicians tend to favor "ribbons over brooms"—that is, they prefer to spend money on glitzy new projects rather than on maintaining old ones.

New York's MTA estimates that it has a $6.3 billion maintenance backlog.[29] Rather

than reduce this backlog, New York is spending more than $10 billion building the 3.5-mile East Side Access Line connecting the Long Island Railroad to Grand Central Terminal. It also just finished spending $4.5 billion on the first two miles of the planned eight-mile Second Avenue Subway (at a total cost of $16.8 billion). In addition, it just spent $2.4 billion extending the 7 subway line by one mile.[30]

WMATA estimates that the D.C. Metrorail system has a $6.7 billion maintenance backlog and needs to spend $17.4 billion over the next 10 years to fix this backlog and keep it from growing again.[31] But rather than maintain the existing Metrorail system in the Virginia suburbs of Washington, D.C., the state of Virginia decided to spend $6.8 billion on the Silver Line, which (since both it and the Blue Line share the crossing of the Potomac River) actually reduced the capacity of the Blue Line to carry traffic. Rather than maintain the Metrorail system in the Maryland suburbs of Washington, Maryland wants to spend $5.6 billion to construct and operate the Purple light-rail line, which will significantly increase congestion in the areas it crosses.[32]

In 2014, the Massachusetts Bay Transportation Authority (MBTA) estimated that it had a $3 billion maintenance backlog and that it "needs to spend approximately $470 million per year" to keep the backlog from growing.[33] Instead, it spent only about $100 million per year on maintenance, and by 2016 the backlog had grown to $6.7 billion.[34] One of the reasons the backlog grew was that, rather than maintain the system, Boston decided to spend $2.3 billion extending the Green Line to Medford, Massachusetts.[35]

Rapid-transit systems are not the only ones that wear out. Portland's first light-rail line was two years shy of 30 years old in 2014 when it began experiencing repeated breakdowns.[36] A state audit found that TriMet, Portland's transit agency, had fallen behind on scheduled track and signal maintenance.[37]

Transit agencies may protest that funds available for building new lines are not available for maintenance. This is only partially true, but to the extent that it is true, it reflects the political preference for building new projects over maintaining existing ones, which is one good reason why transportation infrastructure should be funded out of user fees rather than tax dollars. The federal government has funds for capital projects that require state and local matching funds. The transit agencies therefore lobby state and local governments to get those matching funds even as they neglect the maintenance of their existing systems. The politicians are at fault for not funding maintenance, but the transit agencies are just as much at fault for accepting—and even demanding—funds for new projects when they can't afford to maintain what they already have.

"Politicians are at fault for not funding maintenance, but transit agencies are just as much at fault for demanding funds for new projects when they can't afford to maintain what they already have."

Unfunded Obligations

In addition to debts incurred to build, maintain, and operate their transit systems, many transit agencies have allowed unfunded pension and health care obligations to grow to staggering levels. Table 2 shows the unfunded obligations reported in the most recent comprehensive annual financial statements and actuarial valuations (usually for 2016) for selected transit agencies. The unfunded pension obligations are not available for some transit agencies because their pension plans are combined with state or city pension systems.

Any unfunded obligation is worrisome, but the problems in some transit agencies are extreme. Boston's Massachusetts Bay Transportation Authority and Sacramento's Regional Transit District both have unfunded obligations that are more than double their operating budgets. The Maryland Transit Administration, New York's Metropolitan Transportation Authority, Portland's TriMet, and the Washington Metropolitan Area Transportation Authority all have unfunded obligations larger than their annual operating budgets. The Southeast Pennsylvania Transportation Authority (SEPTA) and Rochester Regional Transit Service (RTS) both have unfunded health care obligations that are nearly as large as their operating budgets and, when pension obligations are added, are likely

Table 2
Unfunded pension and health care obligations (millions of dollars)

City	Transit agency	Pension	Health care	Operating expenses
Atlanta	MARTA	21	160	676
Boston	MBTA	1,209	2,266	1,688
Chicago	CTA	1,524	12	1,844
Dallas	DART	52	24	739
Houston	Metro	198	576	783
Los Angeles	Metro	N/A	1,080	3,993
Maryland	MTA	402	607	937
Nashville	MTA	N/A	52	93
New York	MTA	334	18,172	16,150
Oakland	AC Transit	297	152	431
Philadelphia	SEPTA	N/A	1,558	1,729
Pittsburgh	Port Authority	N/A	828	538
Portland	TriMet	202	760	632
Rochester	RTS	N/A	71	99
Sacramento	RTD	117	478	197
Salt Lake City	UTA	113	0	443
San Francisco	BART	515	111	910
Washington	WMATA	1,027	1,767	2,629

Sources: *AC Transit Employees' Retirement Plan Actuarial Valuation as of January 1, 2016* (Oakland: AC Transit, 2016), p. 17; *Quarterly Report of the Controller-Treasurer Period Ending 12/31/16* (Oakland: Bay Area Rapid Transit District, 2017), p. 3; *Retirement Plan for Chicago Transit Authority Employees Financial Statements and Supplementary Information for the Years Ended December 31, 2015 and 2014* (Chicago: Chicago Transit Authority, 2016), p. 7; *Dallas Area Rapid Transit (DART) Employees' Defined Benefit Retirement Plan Actuarial Valuation Report as of October 1, 2016* (Dallas: DART, 2017), p. 9; *Metropolitan Transit Authority Union Pension Plan January 1, 2014 Actuarial Valuation* (Houston: Metropolitan Transit Authority, 2015), p. ES-1; *Metropolitan Transit Authority Non-Union Pension Plan January 1, 2016 Actuarial Valuation* (Houston: Metropolitan Transit Authority, 2016), p. ES-1; *The Long Island Rail Road Company Plan for Additional Pensions Financial Statements as of and for the Years Ended December 31, 2015 and 2014* (New York: LIRR, 2016), p. 23; *Manhattan and Bronx Surface Transit Operating Authority Pension Plan Financial Statements as of and for the Years Ended December 31, 2015 and 2014* (New York: MTA, 2016), p. 23; *Metropolitan Transit Authority Pension Plan Financial Statements as of and for the Years Ended December 31, 2015 and 2014* (New York: MTA, 2016), p. 23; *MBTA Retirement Fund May–June 2017* (Boston: MBTA, 2017), p. 36; *Maryland Transit Administration Pension Plan Actuarial Valuation as of July 1, 2016* (Hanover, MD: MTA, 2016), p. 1; *Retirement Plans for Sacramento Regional Transit District Employees Financial Statements with Independent Auditor's Report for the Fiscal Year Ended June 30, 2016* (Sacramento: RTD, 2016), pp. 21, 23; *Review Plan Actuarial Reports and Performance* (Washington: WMATA, 2016), p. 10; *Comprehensive Annual Financial Report for the Years Ended June 30, 2016 and 2015* (Atlanta: MARTA, 2016), pp. 6, 49; *Financial Statements and Supplementary Information, June 30, 2016 and 2015* (Boston: MBTA, 2016), pp. 7, 62; *Financial Statements and Supplementary Information, Years Ended December 31, 2016 and 2015* (Chicago: Chicago Transit Authority, 2016), pp. 7, 81; *Comprehensive Annual Financial Report Fiscal Year Ended September 30, 2016* (Dallas: Dallas Area Rapid Transit, 2017), pp. 5, 39; *Comprehensive Annual Financial Report for the Years Ending September 30, 2016 and 2015* (Houston: Metro, 2017), pp. 12, 62; *Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2016* (Los Angeles: Los Angeles County Metropolitan Transportation Authority, 2016), pp. 21, 117; *Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2015* (Hanover, MD: Maryland Department of Transportation, 2016), pp. 28, 71; *Audited Financial Statements and Other Financial Information June 30, 2016 and 2015* (Nashville: Metropolitan Transit Authority, 2016), pp. 12, 50; *Consolidated Financial Statements as of and for the Years Ended December 31, 2016 and 2015* (New York: Metropolitan Transportation Authority, 2017), pp. 8, 83; *Annual Report Fiscal Year 2016* (Philadelphia: Southeast Pennsylvania Transportation Authority, 2017), pp. 20, 48; *Single Audit, June 30, 2016* (Pittsburgh: Port Authority of Allegheny County, 2016), pp. 2, 29; *Report of Independent Auditors and Financial Statements with Supplementary Information June 30, 2016 and 2015* (Portland: TriMet, 2016), pp. 9, 47, 52, 59; *Comprehensive Annual Financial Report for the Year Ended March 31, 2016* (Rochester: Rochester Genesee Regional Transportation Authority, 2016), pp. 7, 64; *Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2016* (Sacramento: Sacramento Regional Transit District, 2016), pp. 6, 73; *Comprehensive Annual Financial Report for Fiscal Year Ended December 31, 2016 and 2015* (Salt Lake City: Utah Transit Authority, 2016), pp. 28, 58; *Annual Financial Report for the Years Ended June 30, 2016 and 2015* (Oakland: Bay Area Rapid Transit District, 2016), pp. 17, 73; *Financial Report for the Fiscal Years Ended June 30, 2016 and 2015* (Washington: Washington Metropolitan Area Transit Authority, 2016), pp. 11, 67.

to be larger. Most of these agencies also have large debts and/or maintenance backlogs.

The unfunded pension and health care obligations facing Portland's TriMet are so serious that the agency's general manager has warned that, to fulfill those obligations, the agency will have to cut all transit service by 70 percent by 2025.[38] Despite these problems, the agency is planning another $2 billion light-rail line.[39]

Ride-Hailing Services

A recent survey of users of Uber, Lyft, and other ride-hailing services found that a third of them would have used public transit if such services were not available.[40] Based on the rapid growth in Uber and Lyft ridership, it appears likely that close to three-quarters of the decline in transit ridership in 2016 was due to people using shared vehicles instead of transit.[41]

The transit systems most likely to be affected by ride hailing are high-end systems, especially rail transit. In November 2014, the Bay Area Rapid Transit (BART) District opened the Oakland Airport Connector, a 3.2-mile, half-billion-dollar automated rail line between Oakland Airport and the nearest BART station. BART expected that $6 fares would cover the line's operating costs. Instead, it is losing money, and agency officials blame competition from Uber and Lyft. BART officials say that no one could have foreseen the impact of such ride-hailing services, which didn't exist when they were planning the Airport Connector.[42]

What is foreseeable today, however, is that shared driverless cars are going to have a significant impact on transit ridership in the very near future. One projection estimates that, by 2030, 95 percent of all travel will be by shared driverless cars.[43] That leaves very little room for urban transit. Manhattan, and possibly the Chicago Loop and BART's crossing of San Francisco Bay, may be the only places in America where traffic densities are so great that transit will survive.

More than three dozen companies from four different industries, including some of the wealthiest corporations in the world, are racing to produce the first marketable driverless cars. Ford, Mercedes, Nissan, Tesla, Volkswagen, and Volvo are among the many auto manufacturers with driverless car programs, with Ford vowing to start mass producing driverless cars—cars with no steering wheels or brake or accelerator pedals—by 2021.[44] In the software industry, Apple, Google (under the name Waymo), and Nvidia are developing driverless cars. In the auto parts industry, Bosch, Continental, and Delphi all have driverless car programs. In the transportation services industry, Uber and Lyft (the latter in cooperation with General Motors) are both working on driverless cars.[45] With this kind of intense competition, there can be no doubt that driverless cars will become a reality within the next decade.

Shared driverless cars may cost little more to use, and be far more convenient, than transit. In 2015, Americans spent $1.08 trillion buying, operating, maintaining, and insuring their cars and light trucks.[46] In exchange, they drove those automobiles close to 2.8 trillion miles, for an average cost of 40 cents a vehicle mile.[47] At average occupancy rates of 1.67 people per car, that works out to 24 cents a passenger mile.[48] Highway subsidies in 2015 totaled about $59 billion, which works out to 2.1 cents per vehicle mile, or 1.3 cents per passenger mile.[49]

In 2015, transit agencies spent $1.14 and collected fares of 28 cents for every passenger mile they carried.[50] This means driving at average occupancies costs less than transit fares, and total costs are far less than transit after subsidies are counted. Current users of ride-hailing services such as Uber and Lyft must also pay for the driver, which makes them more expensive than transit. Once driverless ride-hailing services are available, their cost will be closer to the cost of owning a car—in other words, the same as or less than transit fares. Door-to-door driverless service will also be far more convenient than transit, thus making transit inferior to shared driverless cars in every way.

In a world of driverless cars, driverless buses may be able to compete in price in high-use

"One projection estimates that, by 2030, 95 percent of all travel will be by shared driverless cars, leaving very little room for urban transit."

> "Too many transit agencies have responded to declining ridership by seeking more subsidies to build new transit infrastructure that they can't afford to maintain."

corridors, particularly in congested areas. But private fixed-route services are already beginning to compete with public transit agencies. Lyft is experimenting with Lyft Shuttle, a fixed-route service that competes directly with public transit in San Francisco and Chicago.[51] In addition, a Ford-owned company called Chariot is providing bus services in San Francisco and will soon be providing them in New York.[52]

If driverless buses can compete with driverless cars, it will be in high-density cities, meaning Boston, Chicago, New York, Philadelphia, San Francisco, Washington, and maybe one or two more. But it is also likely that such services can be provided by the private sector, eliminating the need for publicly subsidized transit services.

In short, outside of New York City and perhaps a few other places where driverless cars will not be able to substitute for subways and other high-capacity rail systems, it is likely that all need for public transit will disappear within a decade. Transit agencies will survive mainly to pay off their debts and fulfill their pension and health care obligations.

THE TRANSIT AGENCIES' RESPONSE

The transit industry has responded to these trends in a variety of ways, including

- seeking more subsidies to make up for declining ridership and increasing costs
- seeking subsidies to build new rail transit lines and dedicated busways
- working with city or regional planners to redesign cities to make them more supportive of transit
- reorganizing transit lines to focus on markets in the urban core rather than the suburbs
- contracting with ride-hailing services to offer subsidized rides, and
- experimenting with driverless buses.

While some of these approaches are creative, by far the most common approach is to seek more subsidies. This is predictable, but ironic, because the industry responded to 2014's high rate of transit ridership by seeking more subsidies, and it is now responding to declining ridership by seeking more subsidies.

Some agencies, such as WMATA and New Jersey Transit, blame their problems on the lack of a dedicated tax, which means they need to seek annual appropriations from state and local governments.[53] Metro is seeking a sales tax that will raise $500 million a year to help it reduce its maintenance backlog, but it admits that even if the sales tax is approved, it won't be enough to completely fix the system.[54]

Dedicated funds are hardly a panacea. In 2013, Philadelphia's Southeast Pennsylvania Transportation Authority persuaded the Pennsylvania legislature to dedicate several taxes to the agency, yet the revenues are well short of what is needed to restore the system to a state of good repair.[55] Similarly, in 1999, Massachusetts dedicated 20 percent of state sales tax revenues to the Massachusetts Bay Transportation Authority, and New York's MTA has long had a number of taxes and fees dedicated to it, yet this hasn't prevented Boston's and New York's transit systems from suffering severe maintenance problems.[56]

Other cities have persuaded voters to dramatically increase the dedicated taxes that were already in place so they can build more light rail and other transit infrastructure. Yet buses can move more people faster, more safely, and for far less money than light rail, meaning light rail was obsolete even before San Diego built the nation's first modern light-rail line in 1981.[57] It will be even less able to compete against shared driverless cars.

Despite this, in November 2016 Los Angeles County's transit agency persuaded voters to approve new taxes that will raise $120 billion, mostly to build new light-rail lines.[58] Seattle's Puget Sound Transit similarly persuaded voters to support tax increases that will support a $54 billion expansion of the region's light-rail and commuter-rail systems.[59] Virtually all of this money will be wasted, especially since driverless cars will

probably be on the streets of those cities before any of the light-rail lines funded by the new taxes will open.

Indianapolis, Spokane, and other cities persuaded voters in November 2016 to increase taxes to pay for dedicated bus lanes. Spokane plans to spend $1.2 million per bus for electric buses capable of carrying 120 people to operate on a bus route that agency planners predict will carry an average of only 3.5 riders at a time.[60] Considering that very few corridors in the United States attract enough transit riders to fully utilize a dedicated bus lane, such lanes and their grandiose buses are almost as foolish as light rail. For example, Los Angeles built a set of dedicated bus lanes known as the Orange Line and operates buses at most 15 times per hour on those lanes.[61] By comparison, Istanbul has a bus line called Metrobus that runs 240 or more buses per hour during peak periods, suggesting that the Orange Line is at least 94 percent empty.[62]

Some transit agencies, recognizing that transit can't serve most people in modern urban areas with widely diffused jobs, have worked with land-use planners to try to rebuild the cities of the 1920s, with higher-density housing and more jobs concentrated in a few centers. The benefits of these efforts are insignificant. University of California–Irvine economist David Brownstone concluded after a review of the literature on the subject that the impact of changes to urban form are "too small to be useful" in reducing driving or saving energy.[63]

Sometimes the impacts on transit can be negative. Portland, Oregon, spent hundreds of millions of dollars in urban renewal funds enticing developers to build high-density, mixed-use residential communities north and south of the downtown area and then connected those communities with downtown using a streetcar in the expectation that downtown workers would commute from those communities by streetcar. Instead, those workers quickly found that they could commute faster by walking or bicycling than by streetcar. Since 2001, when the streetcar opened, the number of downtown jobs has grown by 12 percent. The number of people commuting to those jobs by automobile grew by 21 percent and the number commuting by walking and cycling grew 79 percent, but the number commuting by public transit *declined* by 5 percent.[64]

A few transit agencies are reorganizing to focus on core markets rather than outlying suburbs. Dallas Area Rapid Transit (DART) has spent more than $5 billion building the nation's largest light-rail network connecting suburbs to downtown Dallas—and has little to show for it. Since 1995, the year before the city's first light-rail line opened, transit trips per capita in the Dallas–Ft. Worth urban area have declined by 28 percent, and transit's share of commuting has declined by 32 percent. In June 2017, a frustrated Dallas city council replaced several members of DART's board with people committed to serving Dallas transit riders rather than distant suburbs, which will probably mean cancellation of some new light-rail projects.[65]

Tampa's Hillsborough Area Regional Transit (HART) is similarly regrouping, but for different reasons. Voters had rejected plans to build light rail, and declining ridership is reducing revenues available for operations. So the agency is cutting some suburban bus routes in order to "focus its resources on the more crowded urban core." While the *Tampa Bay Times* argues that this policy is "a disappointment," it makes sense if you believe the purpose of transit is to serve people who need it rather than to try to socially engineer people out of their cars.[66]

Other transit agencies are attempting to make use of ride-hailing services to provide "last-mile" transportation between transit stops and people's actual destinations. San Joaquin's Regional Transit District is offering to subsidize half the cost of Uber rides from transit centers to remote locations in San Joaquin County.[67] But this is a dangerous course for transit agencies, as some smaller communities are completely replacing public transit with ride-hailing services, and this may expand when people realize that subsidies to Uber can cost taxpayers less than subsidies to traditional transit systems.[68]

"Since the year before Dallas opened its first light-rail line, Dallas–Ft. Worth transit trips per capita have declined by 28 percent, and transit's share of commuting has declined by 32 percent."

"Instead of caving in to demands for more subsidies, elected officials should begin to prepare for an orderly phase-out of publicly funded transit services."

Some transit advocates object to substitutions of rail-hailing services for public transit. "Uber is unprofitable, which means its prices are unsustainable," argues transit consultant Jarrett Walker. This means "it would be folly to plan your city around the assumption that this will continue."[69] Of course, the same logic applies to all public transit systems, which collectively are losing far more money than Uber.

A few transit agencies are tentatively experimenting with driverless buses in limited situations. Contra Costa County, California; Las Vegas; and the University of Michigan have all tested, or are testing, driverless buses or shuttles, as are a number of European cities.[70]

For the most part, however, transit agencies are responding to stagnant ridership numbers and rising costs by seeking more subsidies. In the face of declining ridership, Toledo's transit agency is seeking to replace a property tax that provides it with $13 million a year with a sales tax that would provide it with $30 million a year.[71] Denver's Regional Transportation District (RTD), which is already collecting sales taxes from everyone in an eight-county region, recently asked the Colorado legislature to pass a state sales tax for transit.[72]

CONCLUSION

It is not easy to accept that new technologies are replacing one's core business, a prospect that is currently facing many retailers, such as Sears. Private companies such as RadioShack and Blockbuster Video have been able to wind down their operations without fuss, but owing to its self-perception as serving the public good, the transit industry continues to feel entitled to its $50 billion in annual subsidies. Instead of caving in to demands for more subsidies, elected officials and policymakers should begin to prepare for an orderly phase-out of publicly funded transit services as driverless cars become available in the next decade.

First, transit agencies should stop building rail transit. Buses made most rail transit obsolete nearly 90 years ago, which is why more than 1,000 American cities with streetcars replaced those rail lines with buses between 1910 and 1972. Cities and regions don't need to be saddled with billions of dollars of debt from construction of new lines that, thanks to shared driverless cars, will end up carrying few riders.

Second, as existing rail lines wear out, transit agencies should replace them with buses. The costs of rehabilitating lines that have suffered from years of deferred maintenance is nearly as great as (if not greater than) the cost of building them in the first place. In most cases, even in such heavily used systems such as the Washington Metro, buses can provide equivalent service at a far lower cost. Unlike rail infrastructure, buses can be sold if and when shared driverless cars replace transit services, and driverless cars can use the same pavement used by buses today, so unlike rail, buses do not represent an irreversible commitment of resources. New York City is the one place where maintaining existing rail lines may make sense, but even there the use of electric buses in subway tunnels should be considered an alternative to spending billions on rehabilitating rail infrastructure.

Third, transit agencies that want to offer competitive services before driverless cars become available should plan express buses or bus rapid-transit lines that use lanes shared with other traffic. Dedicating existing lanes to buses increases congestion, while use of high-occupancy vehicle (HOV) or high-occupancy toll lanes can allow buses to avoid congestion while providing congestion relief for everyone else. As previously noted, very few corridors in the United States generate enough transit riders to require dedicated bus lanes, and most of those places are already served by heavy-rail transit, such as in New York and a few other cities.

Fourth, transit agencies should make a priority of paying down their debts and unfunded pension and health care obligations. Agencies should not saddle future taxpayers with those obligations, especially if there is a real chance that existing transit systems will be completely replaced by shared driverless vehicles.

Fifth, instead of subsidizing all transit riders, transit agencies should target future subsidies

to low-income people. Census data reveal that a higher percentage of people who earn more than $75,000 a year take transit than any other income class.[73] To the extent people believe that low-income people can benefit from transportation assistance, such assistance should be in the form of vouchers (similar to food stamps) that can be used with any transportation provider, from a ride-hailing service to an airline.

Transportation is a vital part of the American economy. Public transit, however, is not, especially outside of New York City, and shared driverless cars will make it even more redundant. Whether or not shared driverless cars will put transit agencies out of business in the next decade, those agencies should stop wasting money on expensive and noncompetitive transit services and focus on providing basic, cost-effective services for those who need transit the most, while putting their economic houses in order by reducing maintenance backlogs, debts, and unfunded obligations.

> "Transit agencies should not saddle future taxpayers with heavy infrastructure debts, maintenance needs, and unfunded pension and health-care obligations."

NOTES

1. Thomas A. Rubin and Fatma Mansour, *Transit Utilization and Traffic Congestion: Is There a Connection?* (Los Angeles: Reason Foundation, 2013), p. 3.

2. Randal O'Toole, "Does Rail Transit Save Energy or Reduce Greenhouse Gas Emissions?" Cato Institute Policy Analysis no. 615, April 14, 2008, p. 14.

3. Kerri Sullivan, "Transportation and Work: Exploring Car Usage and Employment Outcomes in the LSAL Data," National Center for the Study of Adult Learning and Literacy Occasional Paper, June 2003, p. 27; Katherine M. O'Regan and John M. Quigley, "Cars for the Poor," *Access* (Spring 1998): 24.

4. "Record 10.8 Billion Trips Taken on U.S. Public Transportation in 2014," American Public Transportation Association, March 9, 2015, tinyurl.com/mbr74ql.

5. *National Transit Database Monthly Module Adjusted Data Release* (Washington: Federal Transit Administration, 2017), spreadsheet for July 2017.

6. Hugo R. Meyer, "Municipal Ownership in Great Britain," *Journal of Political Economy* 13, no. 4 (September 1905): 481.

7. Wendell Cox, *United States Central Business Districts (Downtowns), with Data for Selected Additional Employment Areas* (Belleville, IL: Demographia, 2014), p. 5; William T. Bogart, *Don't Call It Sprawl: Metropolitan Structure in the Twenty-First Century* (New York: Cambridge University Press, 2006), p. 7.

8. *Public Transportation Fact Book* (Washington: American Public Transportation Association, 2016), Tables 1 and 18.

9. Ibid., Tables 3 and 8; the average number of passengers is calculated by dividing passenger miles by vehicle miles.

10. Ibid., Tables 68, 80, and 92. Dollars adjusted for inflation using gross domestic product deflators was published by the Bureau of Economic Analysis.

11. *American Community Survey* (Washington: Bureau of the Census, 2016), table B08141.

12. "Our Campaigns," Labor/Community Strategy Center, 2015, tinyurl.com/ychunwfu.

13. *Public Transportation Fact Book*, Tables 68, 80, and 92.

14. Transit costs and subsidies are calculated from *2015 National Transit Database* (Washington: Federal Transit Administration, 2016). Amtrak costs and subsidies are calculated from *Monthly Performance Report for September 2015* (Washington: Amtrak, 2016), pages A.2-2 and A.4-1. Costs of driving are calculated from National Income and Product Accounts, Bureau of Economic Analysis, Table 2.5.5, and *2015 Highway Statistics* (Washington: Federal Highway Administration, 2016), Table VM-1, using 1.67 as average automobile occupancy. Highway subsidies are calculated from *2015 Highway Statistics*, Tables HF-10 and VM-1, using 1.67 as average automobile occupancy. Airline subsidies are calculated from *National*

Transportation Statistics (Washington: Bureau of Transportation Statistics, 2017), Tables 1-40, 3-32, and 3-35.

15. See, for example, Randal O'Toole, *Twin Cities Traffic Congestion: It's No Accident* (Golden Valley, MN: Center of the American Experiment, 2017), pp. 4–10.

16. Hojin Jung, Gun Jea Yu, and Kyoung-Min Kwon, "Investigating the Effect of Gasoline Prices on Transit Ridership and Unobserved Heterogeneity," *Journal of Public Transportation* 19, no. 4 (2016): 70–71.

17. *National State of Good Repair Assessment: 2010* (Washington: Federal Transit Administration, 2010), p. 3.

18. *Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance* (Washington: Department of Transportation, 2017), p. L (Roman numeral 50).

19. *National Transit Database*, Fare Revenue and Operating Expenses spreadsheets.

20. Ibid.

21. Marc Santora and Emma G. Fitzsimmons, "Subway Derailment in Manhattan Injures Dozens," *New York Times*, June 27, 2017, tinyurl.com/y95p5k2t.

22. Alon Levy, "The Real Reason New York City Can't Make the Trains Run on Time," *Vox*, July 11, 2017, tinyurl.com/y8f5t3jg.

23. *Consolidated Financial Statements as of and for the Years Ended December 31, 2016 and 2015* (New York: Metropolitan Transit Authority, 2017), p. 25.

24. Lena H. Sun and Martin Weil, "More Metro Stations Shut Down by Smoke," *Washington Post*, August 28, 2007, tinyurl.com/jjy8gyn.

25. "What Is Arcing?" *Washington Post*, January 13, 2015, tinyurl.com/h68vybd.

26. "Collision of Two Washington Metropolitan Area Transit Authority Metrorail Trains Near Fort Totten Station, Washington, D.C., June 22, 2009," NTSB, 2010, p. 127.

27. *America's Transit System Stands at the Precipice of a Fiscal and Service Crisis* (Washington: Washington Metropolitan Area Transit Authority, 2002), p. 1.

28. Paul J. Wiedefeld, "Keeping Metro Safe, Reliable and Affordable," WMATA, April 19, 2017, tinyurl.com/y7xmnfm6.

29. *MTA Capital Program 2015–2019: Amendment 2* (New York: MTA, 2017), sum of all projects listed as "SGR" (for State of Good Repair).

30. Emma G. Fitzsimmons, "Subway Station for 7 Line Opens on Far West Side," *New York Times*, September 13, 2015, tinyurl.com/y7ejaqyz.

31. *10-Year Capital Needs Inventory and Prioritization: CY2017–2026 Needs* (Washington: WMATA, 2017), p. i-2.

32. Katherine Shaver, "Maryland Board Approves $5.6 Billion Purple Line Contract," Washington *Post*, April 6, 2016, tinyurl.com/yd4ccw9t; Randal O'Toole, *Review of the Purple Line* (Rockville, MD: Maryland Public Policy Institute, 2015), p. 11, for a discussion of how the Purple Line will increase congestion.

33. *MBTA Capital Investment Program FY2014–FY2018* (Boston: MBTA, 2013), p. 9.

34. *Capital Investment Program FY2016* (Boston: MBTA, 2016), p. 10.

35. "Green Line Extension, Cambridge to Medford, Massachusetts," Federal Transit Administration, 2016, p. 2, tinyurl.com/y9syz4bo.

36. Joseph Rose, "TriMet's MAX Trains Knocked off Track by Expensive, Deferred Maintenance, Records Show," *Oregonian,* August 12, 2014, tinyurl.com/mfwma8t.

37. "TriMet: General Management Review and Issues Deserving Additional Attention," Secretary of State Audit Report, Salem, Oregon, 2014, pp. 1, 41.

38. Joseph Rose, "TriMet General Manager Warns of 70 Percent Service Cuts by 2025 if Union Doesn't Budge on Health Benefits," *Oregonian*, February 13, 2013, tinyurl.com/goba5d8.

39. "Staff Memo Recommends Light Rail for Portland-to-Bridgeport Village Rapid Transit," *Metro* (Portland, Oregon), April 4, 2016, tinyurl.com/jr4lwgx.

40. Susan Shaheen, Nelson Chan, and Lisa Rayle, "Ridesourcing's Impact and Role in Urban Transportation," *Access* (Spring 2017), tinyurl.com/y8cdmcfd.

41. Brian Solomon, "Lyft Rides Tripled Last Year, but Remains Far Behind Uber," *Forbes*, January 5, 2017, tinyurl.com/y92r7qk4.

42. Erin Baldassari, "BART's Oakland Airport Connector Losing Money; Uber, Lyft to Blame?" *East Bay Times*, November 27, 2016, tinyurl.com/jxppqg8.

43. James Arbib and Tony Seba, *Rethinking Transportation 2020–2030* (San Francisco: RethinkX, 2017), p. 9.

44. Speech by Mark Fields, Ford Motor Company Research Center, Palo Alto, August 16, 2016, tinyurl.com/hrcvmek.

45. For a list of companies that have obtained permits to test driverless cars in California, see "Testing of Autonomous Vehicles," California Department of Motor Vehicles, Sacramento, 2017, tinyurl.com/zh9vfst.

46. "National Income and Productive Accounts" (Washington: Bureau of Economic Analysis, 2017), Table 2.5.5, tinyurl.com/BEANationalData.

47. *Highway Statistics 2015* (Washington: Federal Highway Administration, 2016), Table VM-1.

48. *National Household Travel Survey: Summary of Travel Trends* (Washington: Federal Highway Administration, 2011), Table 16.

49. *Highway Statistics 2015*, Table HF-10. Subsidies calculated by adding "Other taxes and fees" to "Less: amount for nonhighway purposes" and "Less: amount for mass transportation," cells O16, O17, and O32.

50. *National Transit Database*, "Capital Use," "Operating Expenses," and "Service" spreadsheets.

51. "Shuttle," Lyft, www.lyft.com/shuttle.

52. "Chariot," Chariot, www.chariot.com; Andrew J. Hawkins, "Can Ford Fix New York City's Transportation Crisis with a Crowdsourced Shuttle Bus?" *Verge* (New York), July 27, 2017, tinyurl.com/y7gk5wfw.

53. Janna Chernetz, "NJ Transit Lacks Dedicated Funding, and That's Not Normal," Tri-State Transportation Campaign, December 13, 2016, tinyurl.com/j9raqdv.

54. "GM: Metro Needs $15.5B over 10 Years," NBC News, April 19, 2017, tinyurl.com/ydxeewbb.

55. Joel Mathis, "Act 89 Kept SEPTA Trains in Service. Now Funding Is Falling Short," *Philadelphia Magazine*, February 2, 2016, tinyurl.com/y9xpjucx.

56. Brian Kane, *Born Broke: How the MBTA Found Itself with Too Much Debt, the Corrosive Effects of This Debt, and a Comparison of the T's Deficit to Its Peers* (Boston: MBTA Advisory Board, 2009), p. 5.

57. Randal O'Toole, *Rapid Bus: A Low-Cost, High-Capacity Transit System for Major Urban Areas*, Cato Institute Policy Analysis no. 752, July 30, 2014.

58. "LA County's Measure M Would Boost Sales Tax Forever to Fund Transportation," *Los Angeles Daily News*, August 19, 2016, tinyurl.com/ybcd9kq4.

59. Daniel Beekman, "Sound Transit Puts $54 Billion Light-Rail Plan on the Ballot," *Seattle Times*, June 23, 2016, tinyurl.com/ya64hxj7.

60. "Potential LPA Extension to Spokane Community College: Staff Recommendation," City of Spokane, July 3, 2014, p. 2, tinyurl.com/y7w2cqgw; calculated by dividing projected passenger miles by projected vehicle miles.

61. Richard Stanger, "An Evaluation of Los Angeles's Orange Line Busway," *Journal of Public Transportation* 10, no. 1 (2007): 104–105, tinyurl.com/ydcl8f7j. Since Stanger's paper was written, Los Angeles Metro has increased peak-hour frequencies on the Orange Line from once every five minutes to once every four minutes; see "Metro Orange Line Timetable," Los Angeles Metro, tinyurl.com/hab68mt.

62. *IRU Bus Excellence Award 2015* (Geneva: International Road Transport Union, 2015), p. 9, tinyurl.com/y98kf5mg.

63. David Brownstone, "Key Relationships between the Built Environment and VMT," Special Report 298, prepared for the Transportation Research Board, 2008, p. 2.

64. *Downtown Portland Business Census & Survey* (Portland: Portland Business Alliance, 2007), p. 11; *2015 Downtown Portland Business Census & Survey* (Portland: Portland Business Alliance, 2016), p. 10.

65. Peter Simek, "Dallas City Council Shakes Up DART Board," *D Magazine*, June 28, 2017, tinyurl.com/ybtvnolk.

66. "Editorial: Failure to Invest in Transit Means Fewer HART Routes," *Tampa Bay Times*, June 23, 2017, tinyurl.com/y98euxbn.

67. Alex Breitler, "A Lift for Public Transportation? RTD Launches Uber Discounts," *Record* (Stockton, California), July 13, 2017, tinyurl.com/y7uzyxgn.

68. Spencer Woodman, "Welcome to Uberville," *Verge* (New York), September 1, 2016, tinyurl.com/n3u4n84; and Craig S. Smith, "Canadian Town Wanted a Transit System. It Hired Uber," *New York Times*, May 16, 2017, tinyurl.com/muze8kf.

69. Jarrett Walker, "Sounding the Alarm about Uber's Impacts on Transit, and on Cities," *Human Transit*, December 15, 2016, tinyurl.com/jmptvy8.

70. Josh Cohen, "Driverless Bus Testing Coming to Bay Area," *Next City*, October 12, 2015, tinyurl.com/y8c7d6yg; Kelsey E. Thomas, "Las Vegas Tests Driverless Buses," *Next City*, January 11, 2017, tinyurl.com/y82vmrcp; Andrew J. Hawkins, "This Adorable Driverless Bus Will Soon Be Making Stops at the University of Michigan," *Verge* (New York), June 21, 2017, tinyurl.com/ycan6kvp; and Alissa Walker, "5 Cities with Driverless Public Buses on the Streets Right Now," *Gizmodo*, October 12, 2015, tinyurl.com/y8x8k48f.

71. "TARTA Faces Uphill Push in Bid to Change Funding Model," *Blade* (Toledo, Ohio), July 9, 2017, tinyurl.com/yc7wqadr.

72. "HB17-1242, New Transportation Infrastructure Funding Revenue," Colorado General Assembly, 2017, tinyurl.com/yb6atyqc.

73. *American Community Survey*, Bureau of the Census, Table B08119.

RELATED PUBLICATIONS FROM THE CATO INSTITUTE

Rails and Reauthorization: The Inequity of Federal Transit Funding by Randal O'Toole and Michaelangelo Landgrave, Cato Institute Policy Analysis no. 772 (April 21, 2015)

Policy Implications of Autonomous Vehicles by Randal O'Toole, Cato Institute Policy Analysis no. 758 (September 18, 2014)

Rapid Bus: A Low-Cost, High-Capacity Transit System for Major Urban Areas by Randal O'Toole, Cato Institute Policy Analysis no. 752 (July 30, 2014)

The Worst of Both: The Rise of High-Cost, Low-Capacity Rail Transit by Randal O'Toole, Cato Institute Policy Analysis no. 750 (June 3, 2014)

"Paint Is Cheaper Than Rails": Why Congress Should Abolish New Starts by Randal O'Toole, Policy Analysis no. 727 (June 19, 2013)

The Great Streetcar Conspiracy by Randal O'Toole, Cato Institute Policy Analysis no. 699 (June 14, 2012)

Ending Congestion by Refinancing Highways by Randal O'Toole, Cato Institute Policy Analysis no. 695 (May 15, 2012)

Fixing Transit: The Case for Privatization by Randal O'Toole, Cato Institute Policy Analysis no. 670 (November 10, 2010)

Defining Success: The Case against Rail Transit by Randal O'Toole, Cato Institute Policy Analysis no. 663 (March 24, 2010)

RECENT STUDIES IN THE CATO INSTITUTE POLICY ANALYSIS SERIES

823. **Zoning, Land-Use Planning, and Housing Affordability** by Vanessa Brown Calder (October 18, 2017)

822. **Unforced Error: The Risks of Confrontation with Iran** by Emma Ashford and John Glaser (October 9, 2017)

821. **Why the United States Should Welcome China's Economic Leadership** by Colin Grabow (October 3, 2017)

820. **A Balanced Threat Assessment of China's South China Sea Policy** by Benjamin Herscovitch (August 28, 2017)

819. **Doomed to Repeat It: The Long History of America's Protectionist Failures** by Scott Lincicome (August 22, 2017)

818. **Preserving the Iran Nuclear Deal: Perils and Prospects** by Ariane Tabatabai (August 15, 2017)

817. **Reforming the National Flood Insurance Program: Toward Private Flood Insurance** by Ike Brannon and Ari Blask (July 19, 2017)

816: **Withdrawing from Overseas Bases: Why a Forward-Deployed Military Posture Is Unnecessary, Outdated, and Dangerous** by John Glaser (July 18, 2017)

815. **Cybersecurity or Protectionism? Defusing the Most Volatile Issue in the U.S.–China Relationship** by Daniel Ikenson (July 13, 2017)

814. **Step Back: Lessons for U.S. Foreign Policy from the Failed War on Terror** by A. Trevor Thrall and Erik Goepner (June 26, 2017)

813. **Commercial Speech and the Values of Free Expression** by Martin H. Redish (June 19, 2017)

812. **Would More Government Infrastructure Spending Boost the U.S. Economy?** by Ryan Bourne (June 6, 2017)

811. **Four Decades and Counting: The Continued Failure of the War on Drugs** by Christopher J. Coyne and Abigail R. Hall (April 12, 2017)

810. **Not Just Treading Water: In Higher Education, Tuition Often Does More than Replace Lost Appropriations** by Neal McCluskey (February 15, 2017)

809. **Stingray: A New Frontier in Police Surveillance** by Adam Bates (January 25, 2017)

808. **Curse or Blessing? How Institutions Determine Success in Resource-Rich Economies** by Peter Kaznacheev (January 11, 2017).

807. **Surveillance Takes Wing: Privacy in the Age of Police Drones** by Matthew Feeney (December 13, 2016)

806. **Will China Solve the North Korea Problem? The United States Should Develop a Diplomatic Strategy to Persuade Beijing to Help** by Doug Bandow (December 6, 2016)

CATO INSTITUTE

Published by the Cato Institute, Policy Analysis is a regular series evaluating government policies and offering proposals for reform. Nothing in Policy Analysis should be construed as necessarily reflecting the views of the Cato Institute or as an attempt to aid or hinder the passage of any bill before Congress. Contact the Cato Institute for reprint permission. All policy studies can be viewed online at www.cato.org. Additional printed copies of Cato Institute Policy Analysis are $6.00 each ($3.00 each for five or more). To order, please email catostore@cato.org.