

CATO

WORKING PAPER

REVIEW OF THE PANAMA CITY METRO PROJECT

BY RANDAL O'TOOLE
SENIOR FELLOW, CATO INSTITUTE

MARCH 12, 2014

The Cato Working Papers are intended to circulate research in progress for comment and discussion. Available at www.cato.org/workingpapers.

Review of the Panama City Metro Project

By Randal O'Toole
Senior Fellow, Cato Institute

Executive Summary

The Metro rail transit system now under construction in Panama City, and planned extensions to that system, are poor investments for Panama. Depending on ridership, the US\$1.88 billion construction cost of the first 13.7-kilometer line of the system could cost as much as \$15 per rider. The costs of operating the line are likely to be greater than fare revenues, and maintenance costs for the system will grow until, after about 30 years, much of the infrastructure will need to be replaced at a probable cost of more than \$1 billion.

The government says Panama City needs a rail system because buses do not have the capacity to move the large numbers of people who enter and leave the center city each day. But the government has designed and is building a low-capacity rail system that will not be able to move more than about 6,400 people per hour. By comparison, transit buses can move more than 10,000 people per hour on city streets and double-decker buses can move at least 17,000 people per hour.

The Panama City Metro will use three-car trains that the manufacturer says have a capacity of 600 people per train. But this is what transit experts call “crush capacity” in which everyone on board is pressed up against other people and/or car walls. Few people are willing to accept such crowding, so the actual capacity of each train is likely to be closer to about 375 people. At peak operation, the wait between trains will be about 3.5 minutes, which means the system can move about 6,400 people per hour in each direction.

A single train can hold more people than a transit bus, but buses can safely operate far more frequently than trains. Studies have found that a single bus stop can serve 42 buses per hour. If bus stops are staggered, with four stops every 400 feet, they can serve 168 buses per hour.

Double-decker buses can easily hold more than 100 people, so they can move more 2.5 times as many people per hour as the Panama City Metro.

The one thing rail transit does is create winners and losers. The winners include the companies that design and build the expensive rail lines, owners of property near rail stations, and the few people who will find it convenient to take a train from where most people don't live to where most people don't want to go. The losers include the taxpayers who have to support the train, owners of property away from the rail stations, and anyone who wants to travel to the many places the trains don't go who suffers congestion and poor quality transportation because money that could have helped the entire city was spent on the rail line for an elite few.

Introduction

The government of Panama is planning and building a rail transit system, Metro, for Panama City. The first 13.7-kilometer leg of the system is nearly complete and is expected to cost US\$1.88 billion.¹ Additions to this line that are currently under consideration include a 22-kilometer line to San Migulieto, a 21-kilometer line to La Chorrera, a line to Rana de Oro, and extensions to the current line.²

Two questions must be asked when considering projects of this magnitude. First, is the project worthwhile; that is, do the benefits exceed the costs? Second, is the project cost-effective; that is, is there no other technology that could achieve the same benefits at a lower cost?

In the case of the Panama City Metro project, the answer to both questions is “absolutely not.” In other words, the costs of this and future Metro projects greatly exceed the benefits, while alternatives could have produced the same benefits at a far lower cost.

-
1. A 2.3-kilometer extension to the line is expected to cost another \$145 million. This report focuses on the initial 13.7-kilometer line.
 2. “Panama Metro, Panama,” *Railway Technology*, 2013, tinyurl.com/myhjpa.

Costs and Benefits

An important indication that a transit project (and most other goods) offers benefits greater than its costs is if its consumers are willing to pay the full cost of the system. Rail transit fares cover operating costs only in a few extremely large Asian urban areas, such as Tokyo, Osaka, Hong Kong, Taipei, and Singapore. Virtually all metros outside of Asia fail to cover operating costs out of fares³—let alone the costs of construction and depreciation. That means taxpayers must subsidize all of the construction costs, part of the operating costs, and all future maintenance and replacement costs.

For example, the San Juan, Puerto Rico, Tren Urbano rail transit system has earned an average of less than \$9.4 million per year in fares since its first full year in 2005, while it has cost nearly \$54.5 million per year to operate. That means that fares cover just 17 percent of operating costs.⁴ The Santo Domingo, Dominican Republic, Metro system collected just \$11 million in fares against \$36 million in operating costs in 2009.⁵ Lima, Peru's rail transit system was so costly to operate that it had to be shut down for a time just six months after it opened "due to lack of funds to cover current operating costs."⁶

Deferred Maintenance

Future maintenance costs are a hidden cost of rail transit that proponents never acknowledge. Most rail infrastructure wears out after about 30 years, and the cost of replacing or rehabilitating such worn-out systems is often nearly as great as the original cost of construction. Structures, signals, electrical facilities, and trackwork have a design-life of 30 years; railcars just 25 years.⁷ Transit agencies rarely take those costs into account when planning new rail lines.

3. "Farebox Recovery Ratio," Wikipedia, 2013, tinyurl.com/28myxvl.

4. *National Transit Database: Transit Profile for Puerto Rico Highway and Transportation Authority* (Washington: Federal Transit Administration, 2006–2013), profiles for 2005–2012.

5. "Fewer Traffic Jams, Pollution, and Road Accidents," *Santo Domingo Live.com*, January, 2012, tinyurl.com/l35h7ym.

6. "Lima," UrbanRail.net, 2007, tinyurl.com/kzwhneg.

7. "Cost Effectiveness," Federal Transit Administration, Washington, DC, 2001, tinyurl.com/qazxt6j/

Although there is no need to rebore subway tunnels, replacing or rehabilitating tracks and other infrastructure without disrupting service is very costly. As of 2000, the Washington, DC, Metrorail system had cost \$8.8 billion to build (about \$18 billion after adjusting for inflation).⁸ In 2002, the agency announced that it needed \$12.2 billion to rehabilitate older portions of the system, the oldest of which were just 26 years old.⁹ None of that money was available, leading system officials to defer the work, which in turn has resulted in frequent breakdowns and service disruptions.¹⁰

Metrorail's problems came to a head in 2009, when a moving train collided with a stationary train, killing nine people. The collision resulted from a failure of the signaling systems. Although each Metrorail train has an operator, the trains were actually computer controlled; the operator's main job was to open and close the doors and start the train when doors were closed. The computers determined train speeds, stopped them in stations, and prevented collisions. After the accident, Metrorail managers announced that signals were malfunctioning throughout the rail system. Since then, trains have been driven without computer assistance, forcing a reduction in frequencies and less comfortable rides as operators inexpertly apply brakes to stop trains in stations.¹¹

The Washington Metrorail system is not the only rail system in the United States suffering from a lack of maintenance. The Chicago Transit Authority system is "on the verge of collapse" and trains in some parts of the system must slow to less than 10 kilometers per hour for safety reasons.¹² Boston's transit agency "can't even pay for repairs that are vital to public safety," says a report that was commissioned by the Massachusetts governor in 2009. Moreover, the

8. "Washington, DC Metrorail Construction," Federal Transit Administration, Washington, DC, 2001, fta.dot.gov/grants_1268.html.

9. "America's Transit System Stands at the Precipice of a Fiscal and Service Crisis," Washington Metropolitan Area Transit Authority, 2004, p. 1.

10. Lyndsey Layton and Jo Becker, "Efforts to Repair Aging System Compound Metro's Problems," *Washington Post*, June 5, 2005, tinyurl.com/98e2n; Lena H. Sun and Joe Holley, "Aging Equipment Blamed in Metro Incidents," *Washington Post*, August 28, 2007, tinyurl.com/2sm269.

11. Lena H. Sun and Lyndsey Layton, "Metro Discovers Problems In Additional Track Circuits," *Washington Post*, July 22, 2009, tinyurl.com/pjb3orv.

12. "Chicago Rail System on Verge of Collapse," *Engineering News Record*, November 21, 2007.

maintenance backlog was growing because the system was deteriorating faster than the agency's maintenance budget could repair it.¹³ In 2010, the Federal Transit Administration estimated that rail transit systems in the United States faced a \$59 billion maintenance backlog and, as in the case of Boston, the national backlog was growing faster than it was being fixed.¹⁴

Such maintenance shortfalls are almost guaranteed in a transport system that is not funded entirely out of user fees. Politicians love to support grandiose capital projects, especially if they can get someone else to fund them. That allows the politicians to bask in glory when the projects open for business. But they routinely underfund maintenance, as there is little political benefit in replacing a worn-out rail, brake shoe, or electrical signal, while accidents, delays, and other problems can always be blamed on someone else.

Construction

Long before the Panama City Metro line needs rehabilitation, the construction cost alone will overwhelm all possible benefits of the system. If amortized over 30 years at 7 percent interest, the US\$1.88 billion cost of the first leg, alone, represents an annual cost of \$150 million. Even at a mere 4 percent interest rate, the cost is nearly \$108 million per year.¹⁵ Those numbers represent the opportunity cost of spending money on the Metro system that could otherwise be spent more effectively on something else. The proper discount rate should be based on the expected return from other investments; since a 4 percent rate would barely keep up with Panamanian inflation, a higher rate is more appropriate.¹⁶

Based on the ridership of similar systems in other Central and South American cities, ridership on the Panama City Metro is likely to be between 10 million and 30 million trips per year. At 7 percent interest, that means the capital cost alone is \$5 to \$15 per trip; at 4 percent it is

13. "Don't Let MBTA Go off the Rails," *Boston Globe*, November 8, 2009, tinyurl.com/ye39jmg.

14. "National State of Good Repair Assessment," Federal Transit Administration, 2010, p. 19, tinyurl.com/3yws53z.

15. Calculated using the standard amortization formula in which the periodic payment equals the capital cost times $(i + (1/((1+i)^n - 1)))$ where i is the interest rate and n is the number of payments.

16. "Panama Inflation Rate," *TradingEconomics.com*, 2014, tinyurl.com/kltwyu7.

\$3.60 to \$10 per trip.¹⁷ When added to the operating subsidies and maintenance costs, the cost per trip will be much higher.

Social Benefits?

When compared with those costs, the social benefits that are often claimed for rail transit systems are small or, in some cases, imaginary. For example, rail systems are supposed to increase the property values of land near stations. That may be true, but the increase comes at the expense of property values elsewhere in the city. In other words, rail systems don't lead to increased development; at most they lead developers to put a project near a station that might otherwise have gone somewhere else.¹⁸ The net benefit is therefore zero.

Table 1
Trips Per Kilometer for Metros Similar to Panama City

	Annual Trips	Kilometers	Trips/Km	× 13.7 Km
Brasília, BRA	54,750,000	42.4	1,291,274	17,690,448
Lima, PER	48,000,000	21.5	2,232,558	30,586,047
Santo Domingo, DOM	30,856,515	27.4	1,126,150	15,428,258
Los Teques, VEN	13,000,000	10.2	1,274,510	17,460,784
San Juan, PRI	11,023,500	17.2	640,901	8,780,346
Maracaibo, VEN	9,000,000	6.5	1,384,615	18,969,231
Teresina, BRA	4,300,000	14.5	296,552	4,062,759

The Panama City Metro that is scheduled to open in March 2014 is 13.7 kilometers long. Based on the experience of these cities that use similar metro technology, ridership on the Panama City Metro is likely to be somewhere between 10 million and 30 million trips per year. Source: "List of Latin American Rail Transit Systems by Ridership," Wikipedia, tinyurl.com/m6ayyy3.

Other supposed benefits of rail transit, such as reduced roadway congestion reduction because some car and bus commuters switch to rail, cannot possibly be equal to \$108 million to \$150 million per year. Some people imagine that the Metro will lead people to stop driving, leaving

17. Calculated by dividing annualized construction cost by number of riders; for example, 10 million annual trips at 7 percent interest would be \$150 million divided by 10 million equals \$15 per trip.

18. Robert Cervero and Samuel Seskin, *An Evaluation of the Relationship between Transit and Urban Form* (Washington, DC: Transportation Research Board, 1995), p. 3.

uncongested roads for those who continue to drive. In fact, most metro riders are likely to be former bus riders, so the congestion relief will be negligible.

According to Metro planners, central Panama City currently has 290,000 inhabitants and 373,000 workers.¹⁹ In the one-hour period between 6:00 a.m. and 7:00 a.m. on weekday mornings, 94,000 workers commute into central Panama City from other parts of the urban area.²⁰ The 6,400 people that can be moved per hour by the new Metro line represents less than 7 percent of that number.

The average cost of construction for the Panama City Metro is \$137 million per kilometer, which is low when compared with rail lines built in the United States but high when compared with rail lines built in other Latin American countries. Parts of Panama City's system will run underground, while other parts will run on elevated tracks above ground. Subways cost far more than elevated lines: in the United States, subways currently under construction cost between \$350 million and \$1.3 billion per kilometer, while elevated lines cost around \$100 million per kilometer.²¹ The U.S. costs are much higher than the Panama City costs, which is partly attributable to higher labor and material costs in the United States.

However, when compared with at least some Latin American transit rail lines, Panama City construction costs are high. Santo Domingo's first line, which began operation in 2009, cost \$53 million per kilometer even though a greater share of that line is underground than Panama City's.²² Santo Domingo's second line, which is entirely underground, opened in 2013 at a cost of \$66 million per kilometer, less than half of Panama City's cost even though Panama's metro is

19. Robert Roy, "Metro de Panama," presentation to Ga Tech, Metro Secretariat, Government of Panama, p. 4.

20. Ibid, p. 11.

21. Subway costs based on individual project profiles for subway lines being built in Los Angeles, New York, San Francisco, and Seattle; see "Capital Investment Program Project Profiles: FY 2013," Federal Transit Administration, 2012, fta.dot.gov/12304_14783.html. Elevated costs based on a line recently built in Seattle; see "Central Link Initial Segment Project Profile," Federal Transit Administration, 2007, fta.dot.gov/documents/WA_Seattle_Initial_Segment_07_TZ.doc

22. Santiago Cumbreira, "El Metro Costará 44% Más," *La Prensa*, November 22, 2013, tinyurl.com/l8pgxa.

mostly above ground.²³ On the other hand, San Juan Tren Urbano cost \$2.28 billion, or about \$133 million when completed in 2004. After adjusting for inflation to today's dollars, that is about \$180 million per mile—quite a bit more than Panama City's, even though a greater percentage of the Panama City line is underground than the San Juan line. The higher cost may reflect the fact that Puerto Rico is a U.S. territory, and thus may experience higher costs just like U.S. states.

Other Modes

Many factors affect rail construction costs, and an assessment of whether the Panama City costs are higher than what they should be is beyond the scope of this report. However, rail is always far more expensive than bus transit, and when buses are considered as an alternative to trains, there are few places where rail proves absolutely necessary or superior.

Buses cost far less than rail transit. A single rail car can cost 10 or more times as much as a bus. The cost of a rail car per rider is greater than of a bus even after accounting for the rail car's additional capacity and typically longer lifespan. Moreover, rail cars require dedicated rail lines that are far more expensive than roads, while buses share roadways—and their costs—with cars, trucks, and other vehicles. For example, the cost of constructing a lane of high-quality, limited-access road is less than US\$2 million per kilometer, while the Panama City Metro is costing more than \$50 million per kilometer of rail.

Rail supporters tout the fact that trains can avoid existing traffic, and thus supposedly can speed along. But the Santo Domingo trains average just 35 kilometers per hour, which is hardly speedy, and Panama City trains are not likely to be much faster.²⁴ Moreover, when compared with the alternatives, the trains' ability to avoid traffic is actually a major disadvantage. It means the hefty expenditures on the trains help only the people who use the Metro, not other commuters.

23. "The Second Line of the Santo Domingo Metro Starts Operation Today," *DiarioLibre.com*, April 1, 2013, tinyurl.com/nrmu82s.

24. Ezra Fieser, "Santo Domingo's Subway Thriving," *Infosurhou.com*, February 25, 2011, tinyurl.com/opfn9ln.

Since most rail riders will be former bus riders, and their move to rail will eliminate few vehicles from the roads, the rail system is not likely to reduce roadway congestion significantly.

Elevated Highways

As an alternative to the Metro, Panama could have built elevated highways supported by 1.8-meter pillars in the median of existing highways, thus augmenting the existing surface road system. The roadways supported by such pillars can be 17 meters wide, providing room for up four lanes of traffic, or three lanes and two breakdown lanes. In the United States, the Tampa-Hillsborough Tollway Authority recently built a 15-kilometer elevated structure with three lanes that it uses for inbound traffic in the morning and outbound traffic in the afternoon. The total cost was \$338 million, or \$22 million per kilometer, which is less than a quarter of what elevated rail projects cost in the United States.²⁵ If shared with both buses and cars, such elevated structures could relieve congestion for everyone, not just provide a congestion-free alternative for a small percentage of commuters.

Transit Capacities

The Panama government argues that a Metro rail system is needed for Panama City because central city is too dense to be served by buses. Yet the government has chose to build a low-capacity rail system whose expense cannot be justified by its use.

Transit experts divide metro systems into *light* and *heavy* rail. In English, “light” and “heavy” usually refer to weight, but both the rails and rail cars of light- and heavy-rail systems weigh about the same. Instead, “light” and “heavy” refer to capacities, so light rail should properly be called *low-capacity rail* while heavy rail should properly be called *high-capacity rail*.

Most light-rail lines sometimes run in city streets, and the length of a city block limits their capacity. If a light-rail car is 30 meters long and a city block is 90 meters long, then trains can be no more than three-cars long; otherwise, they will block traffic whenever they stop to pick up or

25. Martin Stone and Jose M. Rodriguez, “The Best Thing That Ever Happened to Tampa,” *Structure Magazine*, October 2008, pp. 58-59.

drop off passengers. To avoid that problem, heavy-rail lines are built in exclusive rights-of-way, usually as elevated or subway lines. Those systems costs roughly twice as much to build as a light-rail line, but when constructed with long platforms, heavy-rail lines can run trains of 8 to 11 cars, thus carrying more than twice as many people as a light-rail train.

Buses: Superior Capacity

The capacity of a line is also determined by the frequency of the vehicles. Most light-rail lines operate every 7 to 15 minutes, but have the capacity to run as frequently as every 3 minutes, or 20 times an hour. Heavy-rail lines can operate a little more frequently, but no more than once every 2 minutes, or 30 times an hour.

Buses have fewer seats and less standing room than rail cars, but can operate much more frequently. Studies by transportation researchers at Portland State University found that a single bus stop on a city street can serve 42 buses per hour.²⁶ If bus stops are staggered so that there is a distinct stop at the ends of every block, and buses stop every other block, then the four distinct stops every other block can serve 168 buses per hour.

Light- and heavy-rail cars typically have about 40 to 70 seats and standing room for about 70 to 100 more people, for a total capacity of no more than 150 people. Cars may be rated for more people, but only at “crush capacity,” in which every person is literally crushed against someone else or a wall. While people in a few Asian cities may tolerate crush-capacity conditions, most people will not, so actually capacities are lower than the ratings.²⁷ (It may be no coincidence that Asian rail systems are also the only ones whose fares cover operating costs.)

Buses typically have about 40 seats and standing room for another 20 or so people. That is far less than the 450 people that can be carried in a three-car light-rail train or the 1,500 people that can be carried in a 10-car heavy-rail train. However, buses compensate with increased frequencies. At 20 trains per hour, three-car light-rail trains can move 9,000 people per hour, but

26. Robert L. Bertini, “Bus Facility Capacity,” Portland State University, May 2, 2006, p. 15.

27. Photographs illustrating Tokyo metros operating at crush capacity can be seen at tinyurl.com/cryhzhxk.

at 168 buses per hour, buses can move more than 10,000 people per hour. Moreover, two out of three bus riders will be comfortably seated, while most light-rail riders are forced to stand.

Bus capacities can be nearly doubled with double-decker buses. Such buses typically have about 80 seats and room for at least 22 people standing. Thus, they can move more than 17,000 people per hour, far more than a light-rail line. Double-decker buses can be built to be little more than 4 meters tall, which means they can easily fit under most overpasses and overhead wires.

Bus Rapid Transit

While buses on a single city street cannot approach the 45,000 people per hour capacity of a heavy-rail line running 10-car trains every two minutes, a 100-km/hr. highway lane can safely move more than 1,000 double-decker buses per hour for a total capacity of well over 100,000 people per hour. As previously described, the buses could use an elevated highway that could be built at a small fraction of the cost of a rail line, and any excess highway capacity could be shared with autos, thus relieving congestion on existing roads.

Once arriving at the city center, buses exiting from such elevated highways need not be confined to a single street. Buses coming into central Panama City from east Panama City could use one pair of streets (one for inbound and one for outbound travel); buses from north Panama City another pair; buses from Ancón a third set; and buses from west Panama City a fourth pair. However designed, four or more pairs of central city streets could move many tens of thousands of people per hour.

Sometimes called bus-rapid transit, a bus system like this was first pioneered in Curitiba, Brazil, in 1974. Bus-rapid transit has been described as buses running on train schedules, with higher frequencies and fewer stops than ordinary buses. Such buses could easily average higher speeds than the Santo Domingo rail system's 35 kilometers per hour.

If demand warrants, even higher average speeds could be attained through the use of express buses. Instead of one bus route starting at the fringe of Panama City and stopping 10 times on the way to the city center, several different buses could each start at major points along the route and

then continue, non-stop, to the city center. To better serve more commuters, each express bus could begin as a local collector, making several stops in a neighborhood near the starting point for express service, then traveling non-stop to the center. With fewer intermediate stops, express buses could provide service as fast as trains even during congested parts of the day.

Panama City Metro's Design Flaw

In planning the Panama City Metro, the Panama government chose to pay the added expense of having an exclusive right-of-way, like a heavy-rail system. But it chose to use that right-of-way to run three-car trains, like a light-rail system. Thus, it combines a high-cost disadvantage of heavy rail—right-of-way acquisition—with the low-capacity disadvantage of light rail.

Moreover, each car of the three-car trains that will be used on the Panama City Metro is just 23 meters long, compared with 27 to 28 meters that is the standard for many light-rail systems. According to the manufacturer, Alstom, “Each train can accommodate up to 600 passengers, and services will operate at 3.5-minute headways initially, which will enable the metro carry up to 15,000 passengers/hour/direction during peak periods.”²⁸ There is an arithmetical error here, as 600 people every 3.5 minutes is only 10,286 people per hour, not 15,000.

More important, squeezing 600 people into one train would be very uncomfortable for most of the passengers. Each train has only 150 seats, and 450 more people could stand only in crush conditions, in which every one is pressed up against other people and/or a wall. A more realistic capacity for the trains is closer to 375 people. Running every 3.5 minutes, the trains can move no more than about 6,400 people per hour in each direction.

Although the system may have a capacity of moving about 6,400 people per hour, it will not work at capacity at all times. Some people may board the Metro at Los Andes in the morning; more will board at Pan de Azucar and later stations. The train may appear quite full by the time it gets to Via Argentina, but it was not full for the entire trip. Further, outbound trains in the

28. David Briginshaw, “Panama City’s First Metro Line Nears Completion,” *International Railway Journal*, January 7, 2014, tinyurl.com/mma3zmb.

morning and inbound trains in the evening are likely to be much emptier than trains going in the other direction, while trains at midday and the evening will also operate well below capacity. For that reason, transit systems tend to operate at less than 20 percent of capacity over the non-rush-hour course of a day.

Ironically, the low capacity of the system may give people the impression that it is popular and successful. After the system opens, the trains will no doubt appear full when near central Panama City during a few hours of each day, where a true, high-capacity rail system would not have appeared so full. The appearance of crowds in low-capacity rail cars will lead rail supporters to claim it is a success and urge that more rail lines be built, when in fact buses could have moved more people in the same corridors at a far lower cost.

The platforms built at each Metro station are 100 meters long, which means the government could buy additional center cars from the manufacturer and run trains that are five cars long. The manufacturer also says that frequencies could be increased to one train every 1.5 minutes, but that would probably require spending more money on more advanced signaling.²⁹ Five-car trains at that frequency would move up to about 25,000 people per hour, which is more than double-decker buses on a city street but far less than buses on elevated highways. Rebuilding platforms to allow even longer trains would be extremely expensive, especially in the case of the eight underground stations.

While it is easy to couple two three-car trains together to run as a six-car train, it is difficult to add or subtract cars from the Alstom trains, and this is not something that would be done several times a day. As a result, if Panama City Metro ever gets to the point of running five-car trains, it would run them all day long, meaning they would be nearly empty most of the day. That would put unnecessary wear-and-tear on the cars and require more energy to move extra cars. In contrast, Santo Domingo designed its platforms to be long enough for six-car trains, and when it needs more capacity it can just couple two three-car trains together, uncoupling them during those

29. Ibid.

hours when less capacity is needed. Panama's decision to build platforms long enough for just five cars is a serious mistake.

Transportation for the Future

By 2035, planners project the number of commuters into central Panama City during the 6–7 a.m. hour to increase to 228,000.³⁰ However, this 143 percent increase is extremely unlikely.

Panamanian car ownership rates—the number of motor vehicles per thousand people—are growing at about 4 percent per year.³¹ At that rate, they will double well before 2035.

Increased car ownership invariably results in a decentralization of jobs and population. The only places that successfully avoided this were Soviet nations that imposed draconian policies that kept a majority of urban residents in poverty. When the Soviet governments fell, large numbers of people purchased cars and moved into decentralized areas.

Increased auto ownership is also associated with declining or, at best, stagnant transit ridership. Panama had about the same auto ownership rate—132 cars per thousand people—in 2010 as the United States had in 1925. Transit ridership in the United States peaked in at 17.3 million trips 1926 and (except for the war years) has declined or been stagnant since, currently averaging around 10 million trips per year. Considering population growth, per capita transit rides declined from 278 per year in 1923 to about 40 per year today.³²

Many western European nations had similar auto ownership rates in 1960: France was 158 per thousand people, Great Britain 137, Germany 73, and Spain had a mere 14 vehicles per thousand people, while the United States in 1960 had more than 400 vehicles per thousand. By

30. Ibid, p. 12.

31. *World Development Indicators*, World Bank, “Motor Vehicles (Per 1,000 People),” 2013, tinyurl.com/y32omcv.

32. *2012 Public Transportation Fact Book* (Washington: American Public Transportation Association, 2012), appendix A, table 1.

2000, auto ownership rates in all those European countries had gone far beyond the United States' 1960 levels: France was 576, Great Britain 515, Germany 586, and Spain 564.³³

Meanwhile, transit ridership in most major European cities was stagnant or declining. London trips fell from 3.5 billion per year in 1960 to 2.5 billion in 1990; Hamburg from 615 million to 563 million; Brussels from 339 million to 251 million; and Copenhagen from 311 million to 280 million. While Paris transit ridership grew from 2.5 billion to 3.2 billion, that was due solely to population growth; per capita transit trips in 1990 were the same as in 1960.³⁴ Today, the average resident of western Europe (the nations commonly referred to as the EU-15) travels less than 160 kilometers per year by trams and metros, compared with well over 10,000 kilometers per year by automobile.³⁵

It appears, then, that Panama is investing heavily in rail transit at a time when irreversible forces will lead to declining transit ridership no matter what kind of transit is offered. That is like investing in manual typewriters as microcomputers became popular or investing in telegraphs when cell phone use was growing.

Consider San Juan's experience with the Tren Urbano. When the line opened in 2004, two public bus agencies were carrying 33 million trips per year. Ridership on the Tren Urbano reached 10.9 million trips in 2012, which was little more than a third of the projections for 2010.³⁶ Meanwhile, bus ridership declined to less than 13 million trips. That means virtually every train rider was a former bus rider, and total transit ridership had declined by 10 million trips per year. Rail transit can actually accelerate such declines because the high cost of rail forces governments to cut back on or fail to add to bus service to keep up with population growth. Interestingly, San Juan also has private bus operators known as *publicos*—the approximate

33. Joyce Dargay, Dermot Gately, and Martin Sommer, "Vehicle Ownership and Income Growth, Worldwide: 1960-2030," *The Energy Journal*, Vol. 28, No. 4 (2007), p. 146.

34. Jeffrey R. Kenworthy and Felix B. Laube, *An International Sourcebook of Automobile Dependence in Cities 1960-1990* (Boulder, CO: University of Colorado, 1999), 704 pp.

35. "Panorama of Transport," European Commission, Brussels, 2009, pp. 103, 108.

36. Peter Samuel, "Tren Urbano PR Another Way Low Transit Ridership Forecast," *Tollroads News*, November 19, 2005, tinyurl.com/l3cmaf.

equivalent of Panama City's "Red Devil" buses—that carry more riders more miles per year than the public buses and trains combined and without any subsidies.³⁷

Will the Panama City Metro be as big a disaster as the Tren Urbano? That is a difficult question to answer, partly because the Government of Panama has not, to my knowledge, published any ridership projections for the metro. But even if the metro met projections, its high cost and low capacities make it unsuitable for modern urban transportation.

Aside from their low cost, the major advantage of buses is their flexibility. Roads are inexpensive to build and go everywhere throughout the metropolitan area. Bus routes can change overnight in response to changes in travel demand and can serve decentralized as well as centralized areas. Bus routes can also diverge in outer parts of the city so more people can travel to the central city without a transfer, whereas most people would have to transfer from a bus to the train to take the Metro. Because road costs are shared with other vehicles, costs per rider are roughly the same whether bus routes carry 1,000 riders per day or 100,000, while rail systems have to attract ridership at crush levels to be economical.

On top of this, the high cost and inflexible nature of rail lines often lead governments to adopt land-use policies aimed at forcing people to live and work in certain areas in order to increase rail ridership. Such policies infringe on property rights and reduce the efficiency of urban areas.

Rail's Political Advantage

Except in very large, high-density urban areas, the only thing rail transit can do that buses cannot do is cost lots of money. That extraordinary spending on obsolete transit technology allows government to pick winners and losers. The winners are naturally very grateful for their gains and lobby hard to promote rail transit.

37. *National Transit Database: Transit Profiles for Puerto Rico Highway and Transportation Authority, Metropolitan Bus Authority, and Department of Transportation and Public Works* (Washington: Federal Transit Administration, 2005, 2013), profiles for 2004 and 2012.

The contractors who engineer, design, and build rail lines and railcars are winners. The taxpayers who pay for them are losers. The property owners whose land is next to rail stations are winners; all other property owners are losers. The people who happen to both live and work next to a rail station, or who are willing to adjust their lives to do so, are winners—and the system's low capacity will insure that only a few people will be such winners. Everyone else loses because resources that could have improved transportation for everyone were spent on an elite few.

In reviewing government documents for the Panama City Metro, I've found no evidence that the government conducted a feasibility study or alternatives analysis that objectively compared rail transit with the alternative of improved bus transit. Even if such an analysis had been commissioned, I would not expect it to be objective. When required to do such analyses, government officials interested in creating winners and losers will hire consulting firms that stand to make huge profits on engineering and design work if the rail alternative is selected. Those firms go out of their way to make rail appear more attractive and buses less attractive.

For example, Madison, Wisc. hired Parsons Brinckerhoff—a company that has earned millions helping plan and design hundreds of rail transit projects—to analyze a proposed rail line. The company first imagined that Madison would make significant improvements in bus service, costing about \$60 million. Then it assumed the addition of the rail line, which cost an additional \$188 million. To its dismay, its computer models projected that the rail line plus the bus improvements actually carried fewer transit riders than the bus improvements alone. To justify the rail line, Parsons Brinckerhoff went back and reduced the bus improvements so that the rail line would appear to increase ridership, though the increase was only 7 percent more than the modified bus alternative alone.³⁸ The government agency that paid for the study never revealed

38. Parsons Brinckerhoff, *Transportation Alternatives Analysis for the Dane County/Greater Madison Metropolitan Area* (Madison, WI: Transport 2020, 2002), pp. 7-6, 10-2, and 10-22.

its full findings to the public, instead making it appear that the rail line alone was responsible for all of the increased ridership that was actually the result of the planned bus improvements.³⁹

Such deceptions are so common in rail transit planning that several researchers have commented on them. Danish planner Bent Flyvbjerg calls them “strategic misrepresentations, that is, lying.”⁴⁰ UCLA planning professor Martin Wachs says that planning “models are manipulated in order to promote systems which have been chosen on the basis of political criteria.”⁴¹ Hence, merely doing feasibility studies is not enough. Such studies must be rigorously reviewed and challenged by members of the public interested in safeguarding the interests of both taxpayers and travelers.

Conclusion

The government of Panama should not spend the billions of dollars required to expand the Panama City Metro. Instead, it should explore innovative ways to use buses, and the option of double-decker buses, to move as many or more people than a rail line at a much lower cost.

39. Transport 2020, *Transport 2020 Oversight Advisory Committee (OAC) Summary Report* (Madison, WI: Transport 2020, 2002), p. 21;

40. Bent Flyvbjerg, Mette Skamris Holm, and Søren Buhl, “Underestimating Costs in Public Works Projects: Error or Lie?” *Journal of the American Planning Association*, 68, no. 3 (2002): 285.

41. Martin Wachs, “Ethics and Advocacy in Forecasting for Public Policy,” *Business and Professional Ethics Journal* 9(1&2):148.