Regional Plan Association

METROPOLITAN
RAIL
DISCUSSION
GROUP

The Need for Greater Federal Investment in Metropolitan Rail

A Crisis for the American Economy

October 2015

Acknowledgements

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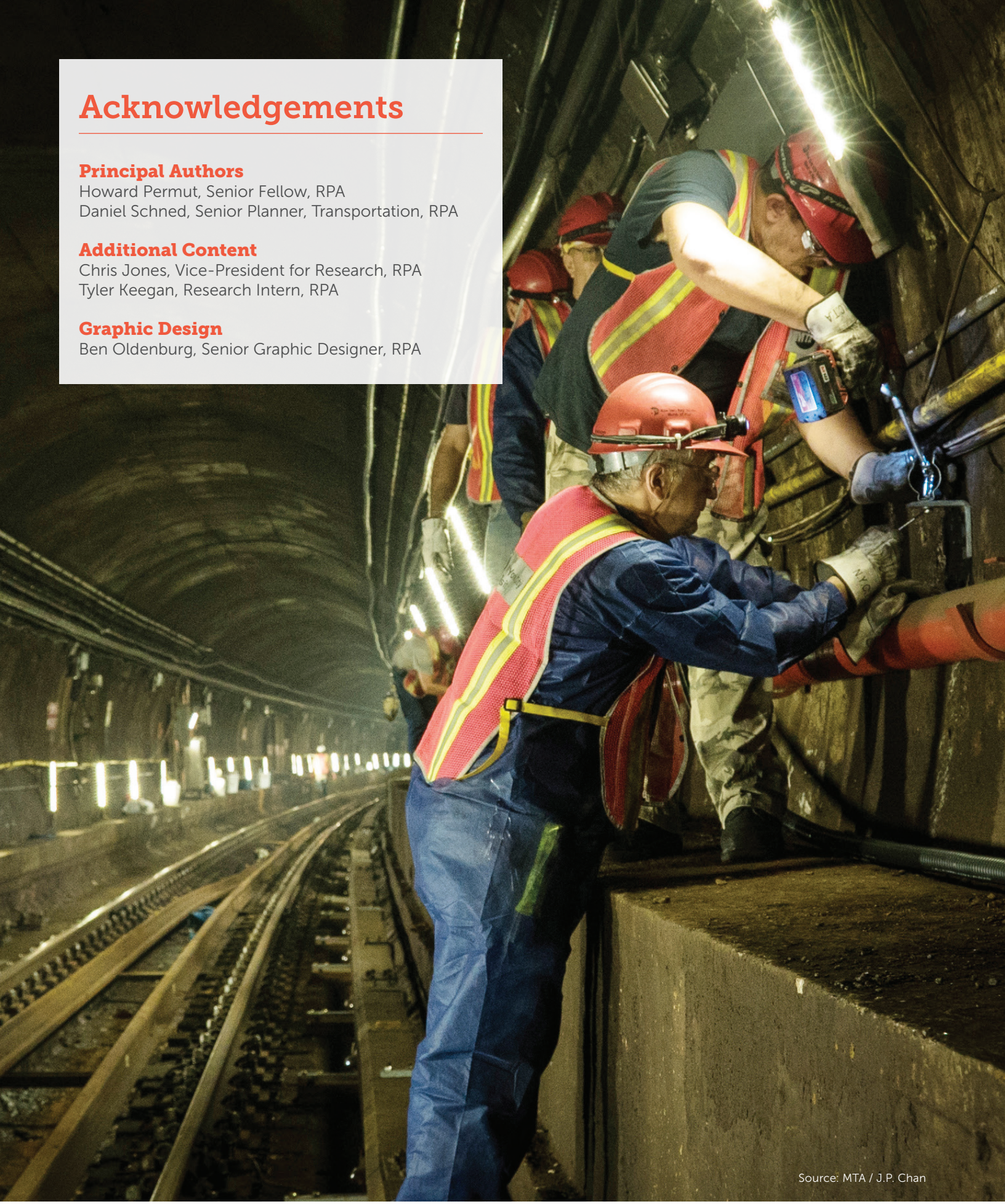


Source: MTA / J.P. Chan

Contents

Source: GCRTA

Executive Summary

Regional Plan Association (RPA) developed this report for the Metropolitan Rail Discussion Group (MRDG), an alliance of 10 of the largest transit agencies in the United States, which own and operate the vast majority of the nation's metropolitan rail network. The report highlights the critical need for federal investment in the MRDG transit systems' capital infrastructure to address and reverse the expanding state of good repair backlog and growing normal replacement needs.

The report reaches a number of important conclusions:

- MRDG agencies face two conflicting trends: (i) growth of ridership on their systems driven by population growth in the nation's largest metropolitan areas, along with aging Baby Boomers, who are increasingly transit dependent, and working-age Millennials, who use transit with great frequency, and (ii) severe deterioration of their physical assets due to an inadequate investment over the years. These trends are not sustainable over the long run.
- MRDG agencies face different and more complex challenges than the rest of the U.S. transit industry. MRDG systems carry 60% of the nation's transit trips and are growing twice as fast as other transit systems around the country, yet they have been unable to expand service at the same rate as others due to the extremely high capital costs needed to maintain their legacy transit infrastructure.
- The collective state of good repair backlog for the MRDG agencies is $102 billion (2015$) and the annual normal replacement need is $13 billion (2015$).[1] These costs are driven largely by the capital-intensive needs of their rail systems. Unfortunately, this backlog has grown over the past decade and all of the agencies have facilities beyond their useful lives. In fact, in 2013, the MRDG agencies were only able to invest 20% of the monies needed to achieve and maintain a state of good repair on their transit systems over a six-year time horizon.
- This backlog is a crisis for the American economy as the MRDG transit systems drive the economic growth of the metropolitan areas they support, which create more than a quarter of U.S. GDP. The MRDG regions are the centers of innovation in America and their success or failure will significantly impact the fate of the entire country.
- If current trends continue and investment in the MRDG transit systems remains inadequate, the overall mobility within these regions will be greatly reduced and their viability as engines of national economic growth will be challenged as other world centers become more attractive to business and the innovation economy. Conversely, substantial and sustained investment in the MRDG systems will promote national and regional economic growth as well as providing a number of social, environmental and fiscal benefits.
- Finally, surveys throughout the country have shown that the public views transit investment very favorably.

Robust funding levels by the federal government would enable the MRDG agencies to achieve and maintain a state of good repair over the next six to ten years and get back onto the path to fiscal sustainability. Alternatively, inadequate levels of federal funding for transit state of good repair needs has significant consequences in terms of achieving our national transportation, economic development and sustainability goals.

A long-term commitment to invest in America's metropolitan rail systems to bring them into a state of good repair and sustain this level is needed in the next federal surface transportation bill.


Source: GCRTA

1 Excludes NJ Transit.

Introduction

Regional Plan Association developed this report for the Metropolitan Rail Discussion Group, an alliance of ten of America's largest and oldest public transit agencies, which own and operate the vast majority of the nation's metropolitan rail network. This data-driven research report examines the vital role transit plays in these regions and the enormous capital infrastructure challenges faced by the MRDG agencies. It also highlights the urgent need for the federal government to invest in the rehabilitation and maintenance of these major urban transit systems.

Metropolitan Rail Discussion Group

The ten agencies that make up the MRDG (in alphabetical order) are listed below along with their transit subsystems:

- San Francisco Bay Area Rapid Transit District (BART)
- Greater Cleveland Regional Transit Authority (GCRTA)
- Massachusetts Bay Transportation Authority (MBTA)
- Metropolitan Atlanta Rapid Transit Authority (MARTA)
- Metropolitan Transportation Authority (MTA)
  - MTA Bus Company
  - MTA Long Island Rail Road
  - MTA Metro-North Railroad
  - MTA New York City Transit
- New Jersey Transit (NJT)
- Port Authority of Allegheny County (PAAC)
- Regional Transportation Authority (RTA)
  - Chicago Transit Authority (CTA)
  - Metropolitan Rail Corporation (Metra)
  - Pace Suburban Bus Service (Pace)
- Southeastern Pennsylvania Transportation Authority (SEPTA)
- Washington Metropolitan Area Transit Authority (WMATA)

The MRDG agencies support nine metropolitan regions, as two of these transit systems serve the New York Tri-State Area. These nine metropolitan regions (in alphabetical order) are listed below and shown in Figure 1.1:

- Atlanta
- Boston
- Chicago
- Cleveland
- New York
- Philadelphia
- Pittsburgh
- San Francisco/Oakland
- Washington, D.C.

These regions are the major drivers of the American economy. They create 27% of the country's gross domestic product[1] on only 2% of its land[2], making them the densest and most economically productive areas in the nation. Their importance to the national economy is discussed in detail later in the report.

Regional Plan Association

RPA is one of America's most distinguished independent urban research and advocacy organization. RPA improves the New York metropolitan region's economic health, environmental sustainability and quality of life through research, planning and advocacy. Since the 1920s, RPA has produced three landmark plans for the region and is working on a fourth plan that will tackle challenges related to sustained economic growth and opportunity, climate change, infrastructure and the fiscal health of our state and local governments. RPA also conducts research and provides leadership on a range of transportation, sustainability and economic-development issues in the Northeast and in the U.S. Recent research has focused on restoring the nation's

1 U.S. Census Bureau (2013). *American Community Survey.*
2 Bureau of Economic Analysis (2013). *Regional Economic Accounts.*

Figure 1.1: Map of the MRDG Regions

Source: Regional Plan Association (2015).

infrastructure and identifying ways to accelerate the completion of critical projects.

Structure of the Report

This report is organized into two major sections. The first section – *The State of Transit in the MRDG Regions* – describes the MRDG transit systems and agencies, and current aggregate system trends. It calculates the cumulative state of good repair backlog, demonstrates the magnitude of the infrastructure crisis facing the MRDG transit agencies and outlines the implications of continued disinvestment. The second section – *America's Future is Riding on MRDG Transit* – describes the national economic importance of the MRDG transit systems and the benefits of investing in these systems.

The State of Transit in the MRDG Regions

For the purposes of this analysis, the MRDG regions are defined by the U.S. Census Bureau's metropolitan statistical areas (MSA) served and supported by the MRDG transit systems.[1] For each transit agency, the MSAs included in that particular region are listed in Appendix I and shown in Figure 2.1.

Two Trends Facing the MRDG Transit Systems

The first exploration of this report is into the state of transit in the MRDG regions, and two primary trends are identified: (i) the significant growth in the amount and use of their transit services, and (ii) the increasingly deteriorated and vulnerable condition of many of these systems' transit assets. These two contradictory trends that the public transportation systems in the MRDG regions are experiencing have created a situation that is unsustainable in the long term for the transit agencies.

Growth in the Amount & Use of Transit

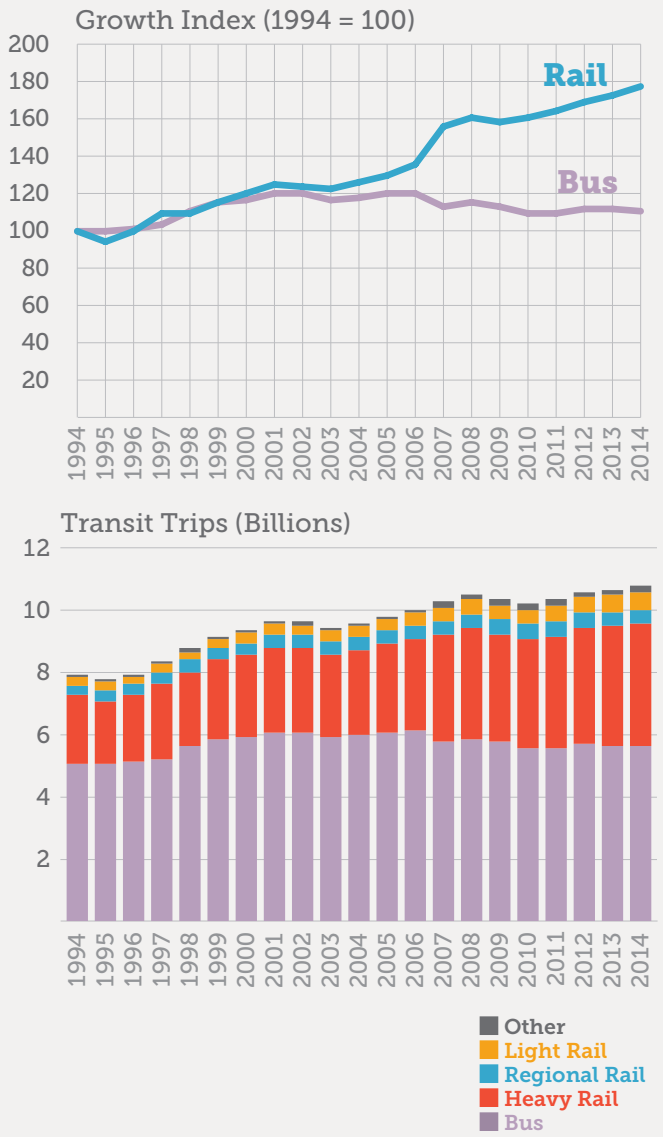
Nationally, transit ridership is higher than it has been in nearly six decades. In 2014, total annual transit ridership on the more than 7,000 transit systems throughout the country reached 10.8 billion unlinked passenger trips. This growth has been driven by increased ridership on the nearly 100 systems with rail modes, particularly heavy rail, which added 1.8 billion trips over the last 20 years, or 81%, as shown in Charts 2.1. On a percentage basis, light rail grew the most, nearly doubling since 1994, but on a much smaller base. The growth on bus modes was much slower, where 409 million trips were added, or 8.4%. The MRDG tran-

1 Note that throughout this report only data for the MSAs that are served by the transit agency are included in the analysis, as opposed to the Combined Statistical Areas for each metropolitan region.

Figure 2.1: Map of MRDG Metropolitan Statistical Areas

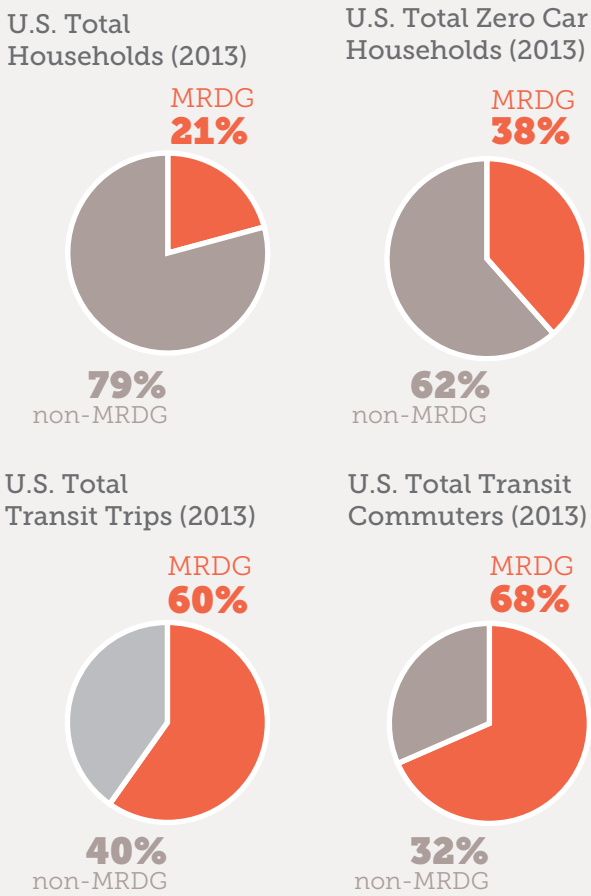
Source: U.S. Census Bureau (2013). *American Community Survey.*

Charts 2.1: Transit Unlinked Passenger Trips in the U.S. by Mode



Source: American Public Transportation Association (2014). *Ridership Report.*

Charts 2.2: The MRDG Regions' Residents & Workers Depend on Transit



Source: U.S. Census Bureau (2013). *American Community Survey.*

sit systems are primarily responsible for driving these national trends.[2]

The majority of transit usage occurs in the MRDG systems as nearly 60% of all unlinked transit trips in America take place in these systems. Furthermore, more than 78% of all rail trips in the country are in the MRDG systems.[3] In addition, these nine metropolitan areas are where the largest percentage of households and workers that depend on transit reside. As shown in Charts 2.2, the MRDG regions contain 21% of all U.S. households and yet nearly 40% of households without access to a private automobile. Furthermore, these regions are where 22% of all U.S. commuters live, but more than two-thirds of commuters that use transit to get to and from work on a regular basis.[4] Without transit, the MRDG regions would be unable to function the way they do today.

Transit ridership on all of the nation's transit systems is growing, but growth in ridership on the MRDG systems has outpaced the rest of the country. In 1993, the MRDG transit systems carried 4.05 billion unlinked passenger trips, accounting for 55% of the nation's transit trips. In 2013, these twelve systems carried 6.23 billion trips and their share of the nation's total trips grew to 60%. **That means the MRDG systems added 2.2 billion trips in 20 years, nearly three-quarters of the growth of the entire nation over that time period.** Chart 2.3 shows that the number of annual transit trips taken on the MRDG systems grew by 54% over the last 20 years, but the rest the U.S. transit systems grew by only 24%. This growth rate outpaced national increases in population and the use of highways during the same time period.

In addition to moving *more* riders, the MRDG systems are also moving riders *farther* than they did two decades ago. Between 1993 and 2013, the average transit trip grew in length by more than a quarter of a mile. This means that the MRDG systems

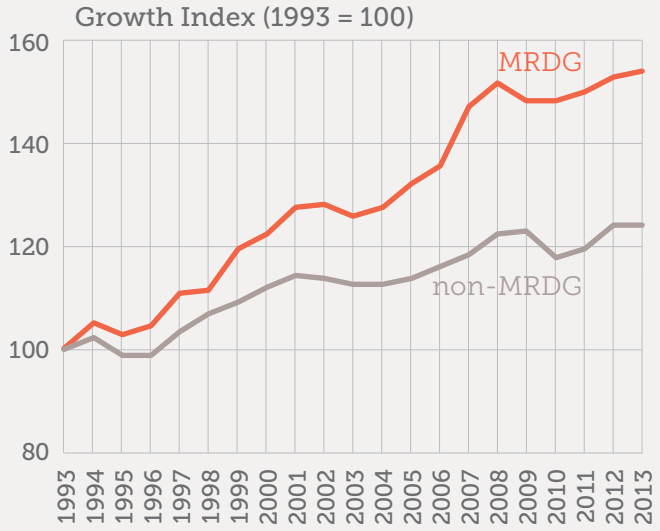
2 American Public Transportation Association (2014). *Ridership Report.*
3 National Transit Database (2013).
4 U.S. Census Bureau (2013). *American Community Survey*

carried passengers 12.9 billion more miles in 2013 than they did in 1993. Like the growth in transit trips, the growth in passenger miles traveled on MRDG systems outpaced the rest of the U.S. as the number of passenger miles traveled on the MRDG systems has grown by 62% since 1993, but only 48% on the rest of the U.S. transit systems.

While the use of transit in the MRDG regions has grown significantly in recent years, the systems have not been able to expand fast enough to keep pace with the explosion in ridership described above. As a result, the MRDG transit systems are straining to move more riders on essentially the same network and with a similar or slightly greater amount of service. As shown in Chart 2.4, the extent of, or geographic span of service on the MRDG transit systems – measured in terms of directional route miles, or the number of miles over which transit vehicles travel in revenue service – has basically flat lined, growing by only 7.3% (versus a 62% increase in passenger miles traveled) while the rest of the U.S. transit networks have grown by 39% (versus a 48% increase in passenger miles traveled).

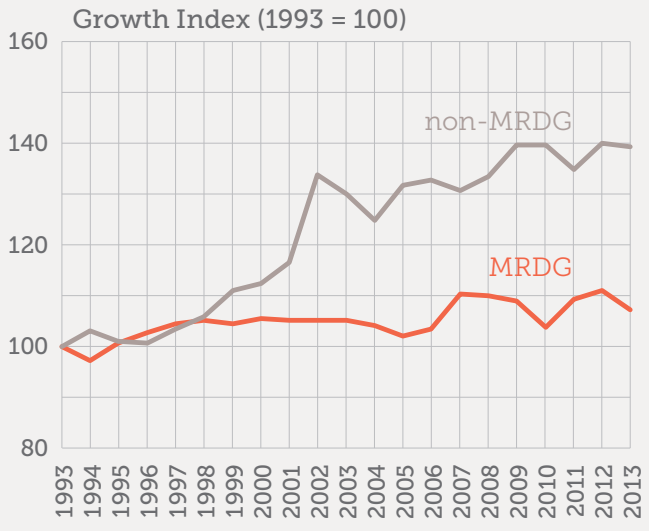
Likewise, the number of (i) vehicles in operation during maximum service, (ii) vehicle revenue miles and (iii) vehicle revenue hours traveled – all good measures of the amount of transit service provided with respect to the volume, frequency and span of service, and hence also the number of vehicles and other assets that must be maintained – have grown by only 35%, 37% and 41% respectively on the MRDG systems while the rest of the nation's systems have expanded at a much faster pace, 76%, 70% and 60% respectively, as shown in Charts 2.5.

Chart 2.3: Transit Unlinked Passenger Trips



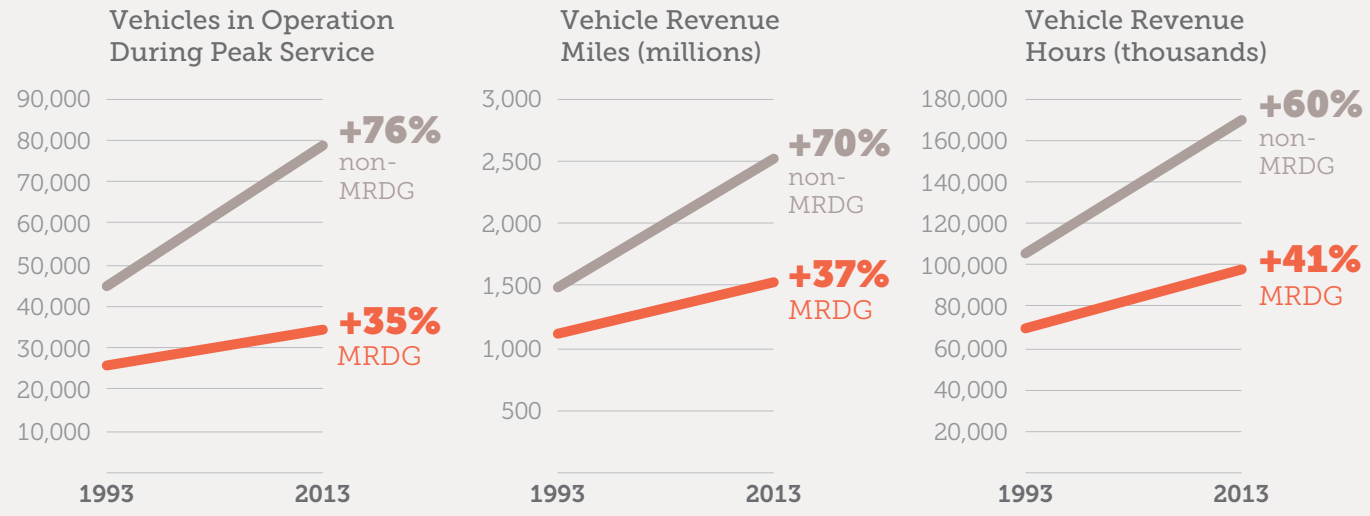
Source: National Transit Database (2013).

Chart 2.4: Transit Directional Route Miles



Source: National Transit Database (2013).

Charts 2.5: Transit Service Provided in the MRDG Regions & the Rest of the U.S.



Source: National Transit Database, 2013

Transit systems around the country are expanding service, but the transit systems in the MRDG regions are expanding at a much slower rate. In part, this is due to the fact that the MRDG regions are large, established urban areas with mature, legacy transit systems. These systems, and particularly the rail systems, require huge annual capital investment simply to maintain existing assets as opposed to building new ones.

Deterioration & Vulnerability of Transit Assets

In addition to transit ridership, the MRDG agencies own a disproportionate share of the nation's transit infrastructure, rolling stock, systems and facilities. They include the oldest rail infrastructure in the country as well as rail infrastructure that is entering its initial rehabilitation cycle. As shown in Table 2.1, the MRDG agencies operate and maintain tens of thousands of buses and rail cars, thousands of rail stations, and thousands of miles of commuter and heavy rail directional route miles and crossings, all large portions of the nation's total transit asset base.

Table 2.1: Transit Capital Assets in the MRDG Regions & the Rest of the U.S.

Assets	MRDG Regions	Percent of the U.S.
Rail Cars	17,769	80.3%
Buses	24,791	19.8%
Rail Stations	1,715	52.1%
Rail Grade Crossings	2,948	40.8%
Commuter Rail Route Miles*	4,447	57.5%
Metro (Heavy) Rail Route Miles*	1,430	88.2%

Source: National Transit Database (2013).

* The MRDG rail systems contain a majority of the nation's multi-track right-of-way and as such, "route miles" underrepresents the amount of tracks and other associated rail infrastructure these systems contain.

These transit assets are crucial components of the national transportation network. Unfortunately, as detailed in the following section, the MRDG agencies are experiencing severe deterioration of many of these transit assets, particularly the rail assets. Decades, and in some cases more than a century, of heavy use has caused significant wear-and-tear, in addition to the impact of natural elements and other weather events. Capital investment in these systems has been insufficient to maintain their core infrastructure components, resulting in tough choices by asset managers to best maintain their systems on a stretched budget. Many of their assets are now beyond their useful life and the agencies are approaching a tipping point at which unfunded capital needs will overwhelm their ability and capacity to operate high-quality transit service.

Table 2.2 contains the replacement age of different rail assets as determined by the FTA's Transit Economic Requirements Model. All of the MRDG systems contain numerous facilities that are well beyond their recommended replacement age.

Table 2.2: Sample Replacement Ages & Deterioration Rates by Asset Class & Sub-Class

Asset Class	Asset Sub-Class	Replacement Age (Years After Built)
Facilities	Buildings	50
Facilities	Equipment	15
Facilities	Major Shops/Yards	50
Guideways	Guideway	125
Guideways	Track work	20
Stations	Rail	25
Stations	Structural	50
Systems	Communications	20
Systems	Electrification	30
Systems	Fare Collections	25
Systems	Train Control	30
Systems	Utilities	50
Vehicles	Equipment/Parts	10
Vehicles	Revenue Vehicles	25

Source: Federal Transit Administration (2015). *Transit Economic Requirements Model.*

MRDG State of Good Repair Backlog

Research Process

To determine the magnitude of the existing state of good repair backlog for the MRDG regions, a detailed research process was undertaken. RPA began by reviewing current literature about state of good repair issues and past calculations of transit state of good repair backlogs, most of which has been produced and published by the Federal Transit Administration as part of its State of Good Repair Initiative, a close collaboration between the FTA and the nation's transit providers. A list of the various reports, articles, and studies analyzed by RPA is included at the end of this document.

Next, RPA developed a survey that was used to collect data from the MRDG agencies on (i) their unfunded state of good repair backlogs broken down by the FTA's capital asset categories and transit modes, and (ii) their annual normal replacement needs averaged over the next 10 and 20 years.

The following definitions were used for the survey questions to ensure that the information collected was as consistent as possible (i) with previous information presented in the FTA's *State of Good Repair Initiative* reports and (ii) among all of the MRDG agencies, to allow for the most reasonable "apples-to-apples" comparisons:

State of Good Repair Backlog: The total cost of all unfunded investments needed so all of an agency's capital assets are within their normal, useful design life based on asset age *and/or* condition *and/or* performance, as calculated by each agency.[5]

5 Note on data consistency: The assignment of responsibility to bring a

Normal Replacement: The annual cost to complete all projects that replace assets at the end of their normal, useful life based on asset age *and/or* condition *and/or* performance, as calculated by each agency, as needed to ensure the state of good repair backlog does not grow larger than it is in 2015.

Project Costs: All elements of project cost (e.g. design, planning, construction, construction management and contingency), as calculated by each agency. This includes the costs of any system improvements or capacity expansions when part of a project to replace or rehabilitate an asset in the backlog (e.g. CBTC) as well as costs incurred during construction (e.g. building temporary facilities and adding substitute bus service, etc.). Needs are not constrained by the feasibility of construction.

Year of Dollars: Costs are expressed in 2015 dollars as opposed to year of expenditure (YOE) dollars. Agency costs calculated in different year dollars have been adjusted for inflation to 2015 dollars, as calculated by each agency.

Transit Mode:

- **Bus**: All modes with rubber-tired vehicles powered by diesel, gasoline, battery or alternative fuel engines contained within the vehicle; and
- **Rail**: All modes whose vehicles travel along fixed rails.

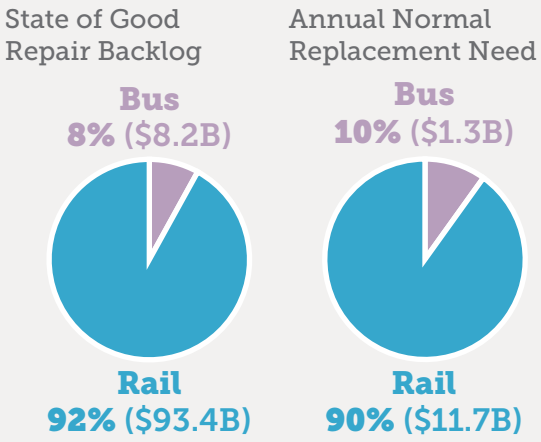
Capital Asset Types:

- **Guideways** are tracks, ties and ballast that trains operate over, and supporting structures, including bridges, tunnels, viaducts, trenches and ramps that create the transit right-of-way.
- **Facilities** are rail yards to store and maintain trains, maintenance facilities and parking lots to support and store buses, and administrative buildings for transit professionals.
- **Stations** are where passengers spend time waiting for transit service to arrive, including train stations and major bus terminals, park-and-rides, and shelters.
- **Systems** are transit's power, including substations, overhead catenary wires or third rails; signals and control systems; communications equipment; and fare collection technology.
- **Vehicles** are what drive and carry a transit system's paying customers from point A to B, including locomotives and rail cars, buses and vans, and other paratransit vehicles.

The Condition of MRDG Transit by Mode

The following section examines the state of good repair backlog and annual normal replacement needs data that were collected from the MRDG agencies. The MRDG systems' total collective state of good repair backlog is $102 billion and annual normal replacement need is $13 billion. As shown in Charts 2.6, the needs of the MRDG agencies' rail systems drive the total state of good repair backlog and annual normal replacement need. The rail infrastructure needs are $93.4 billion, or 92%, of the total state of good repair backlog, and $11.7 billion, or 90%, of total annual normal replacement need. Rail modes have greater needs because they are more capital-intensive than bus modes, in terms of guideways, systems and stations. However, in general, trains are more cost effective than buses as they offer greater capacity at a lower operating cost per passenger mile and require less land.[6] Furthermore, rail assets are the sole responsibility of the transit agencies that operate rail service, whereas buses operate over road and highway infrastructure built and maintained with funding from other sources, such as the Federal Highway Administration, and state and local departments of transportation.

Charts 2.6: MRDG State of Good Repair Backlog & Annual Normal Replacement Need by Mode



Source: MRDG Agencies excludes NJ Transit) (2015).

The Condition of MRDG Transit by Capital Asset Type

Transit infrastructure largely falls into two categories: those that are seen and used daily by riders and those that provide behind-the-scenes support to operations. Guideways, facilities, and systems are the "invisible" infrastructure that customers normally do not notice if all is running smoothly. Stations and vehicles are transit components that riders interact with each time they enter and use the system, and therefore notice when, say an elevator is out of service, a platform is crumbling or a train car is leaking.

As shown in Table 2.3, the major elements of the MRDG rail systems requiring the greatest investment are bread-and-butter basic infrastructure, including: (i) critical power, signal and fare collection systems, which need $38.9 billion (ii) guideways, such as bridges, tunnels and tracks, which need $23.2 billion and (iii) transit vehicles, which need $15.5 billion.

commuter railroads assets into a state of good repair is complex as portions of many of these services are provided on facilities owned by others. Treatment of these needs varies by agency. In general, with the exception of the state of good repair needs of the freight railroad infrastructure used by Metra and the infrastructure that agencies are contractually responsible for maintaining, the costs to bring the backlog assets owned by others into a state of good repair are excluded.

6 Victoria Transport Policy Institute (2015). *Evaluating Public Transit Benefits and Costs.*

Table 2.3: MRDG State of Good Repair Backlog by Mode & Capital Asset Type

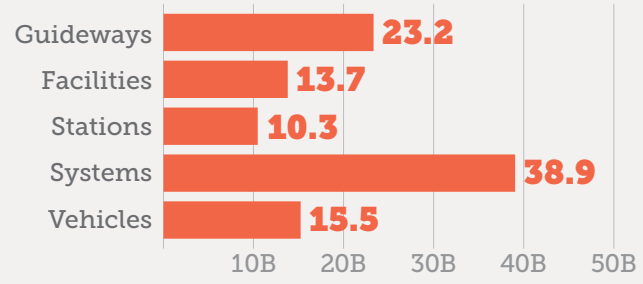
Mode	Capital Asset Type	State of Good Repair Backlog (Billions of 2015$)	Annual Normal Replacement Need (Billions of 2015$, 10-Year Average)
Bus	Guideways	0.26	0.02
	Facilities	5.11	0.25
	Stations	0.30	0.05
	Systems	0.43	0.08
	Vehicles	2.05	0.88
	Subtotal*	**8.15**	**1.28**
Rail	Guideways	22.97	2.43
	Facilities	8.61	1.41
	Stations	10.01	1.40
	Systems	38.44	4.01
	Vehicles	13.40	2.43
	Subtotal*	**93.44**	**11.68**
	Grand Total	**101.60**	**12.97**

Source: MRDG Agencies (excludes NJ Transit) (2015).
*Totals do not add up due to rounding

The Consequences of the MRDG State of Good Repair Backlog

The general condition of transit infrastructure in the MRDG regions is in decline. Despite the significant capital investments made and transit asset management practices in place, the collective MRDG state of good repair backlog has grown to reach $102 billion. For riders, this trend will increasingly manifest itself in declining speeds, volume and reliability, and hence the attractiveness of transit as a travel option. For operators, aged assets drive increasing maintenance costs and limit the ability to expand system capacity and improve service to attract new riders at a time of high demand. Lastly, all share a mutual concern over the potential impacts on safety and security, and a responsibility to do something about it.

Charts 2.7: MRDG State of Good Repair Backlog by Capital Asset Type (Bus + Rail Modes)



Source: MRDG Agencies (excludes NJ Transit) (2015).

The MRDG agencies report that their systems' **guideways** face a state of good repair investment backlog of **$23.2 billion**. As guideways deteriorate, transit agencies are forced to implement slow zones to prevent derailments and further damage to tracks. This means fewer trains can move through the system per hour and at slower speeds, drastically impacting service for customers.

The systems report **$13.7 billion** in critical, unfunded repairs to **facilities**. If a bus maintenance center goes out of service, agencies have to send fewer buses onto the streets every day, or increase the time between inspections of critical components. This can lead to service cut backs and even potentially dangerous conditions for both workers and passengers.

The thousands of transit **stations** owned and operated by the MRDG agencies face a **$10.3 billion** backlog in unfunded capital needs. For customers, stations are an incredibly important part of the transit experience, as a large portion of many trips involves waiting on platforms or transferring between them. Unclean, poorly lit or otherwise unsafe conditions at transit stations deter ridership and invite further vandalism and crime.

An unfunded backlog of capital needs totaling **$38.9 billion** is reported for **systems** infrastructure, such as electrical traction that power trains, signals that allow trains and buses to safely move through interlockings and intersections, and communications equipment that connect drivers, conductors, police and other transit staff to headquarters. System infrastructure in a state of disrepair leads to lower on-time performance, system breakdowns, more crowded buses and trains, and increasingly disorganized and inefficient operations.

MRDG's **vehicles** – locomotives, rail cars, buses and paratransit vehicles – face a **$15.5 billion** backlog in state of good repair need. If left unrepaired, this could mean customers must pack into dim, smelly, or overheated buses and trains that are more likely to break down. As one of the main customer experiences in transit, using outdated vehicles is a serious deterrent to transit ridership.

In 2012, BART completed a comprehensive study of the implications of not maintaining its system in a state of good repair. They found that if BART is unable to maintain a state of good repair,

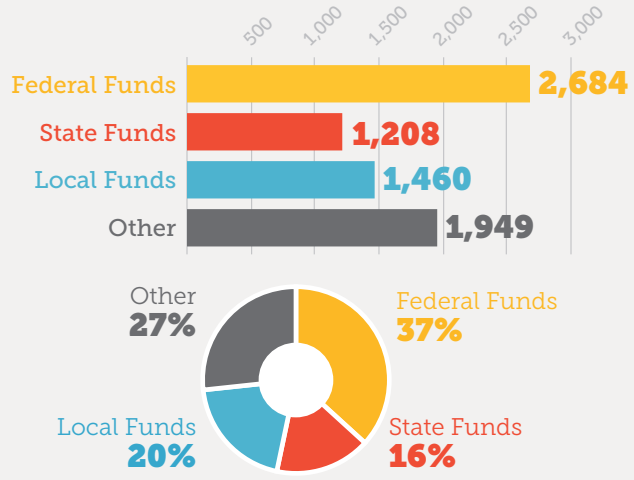
> *"the consequences will be drastically negative. BART's aging infrastructure will fail more frequently, causing substantial declines in reliability and more crowding. In turn, BART ridership, which is expected to increase to half a million riders a day if current levels of service can be maintained, will stagnate or even decline. Both peak and off peak services will be negatively affected. Some travelers will choose to drive instead of using BART. The results will be more congestion, more pollution, and lower service quality for transit users."*[7]

7 University of California, Berkeley (2012). *A State of Good Repair for*

Vicious Cycles

If the MRDG transit agencies are unable to achieve and maintain a state of good repair, ridership will be reduced due to unpleasant stations, slower and more sporadic trains and buses, and cutbacks in service once assets completely fail. With fewer riders, transit agencies will lose vital fare revenues and roads will become more congested. The result will be slower bus services and cutbacks to rail service, which will make transit less attractive. As a result, property values near transit will likely be diminished, businesses near transit will also fall on hard times, and the tax revenues derived from these activities will decline as well – resulting in further service reductions for transit agencies. Without an infusion of capital to revive the service to acceptable levels, a transit agency would face a "death spiral" – eventually losing so many riders and so much money that its current level of service cannot be maintained.

Charts 2.8: MRDG Capital Investment by Source, 2013 (Millions of Dollars)



Source: National Transit Database (2013).

Improving Transit Asset Management Planning

Since the summer of 2008, the Federal Transit Administration has engaged in a productive dialogue with many of the nation's transit providers and state departments of transportation about the state of repair of the nation's transit infrastructure. This effort has explored ways of (i) improving the measurement of the condition of capital assets and the prioritization of investment decisions, and (ii) implementing preventive maintenance practices and tools to help agencies cope with this growing problem.

The FTA's *State of Good Repair Initiative* began in 2008 with the report "Transit State of Good Repair: Beginning the Dialogue", which sought to "comprehensively articulate the problem, define a commonly adopted definition of 'state of good repair', and identify strategies, technical assistance briefs, peer to peer exchanges, and best practices aimed at achieving such a state industrywide". This report included an estimate of the total state of good repair backlog of several of the nation's largest transit agencies. The most recent report that builds off of the work of this initiative is the "Report to Congress – 2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance", which includes another estimate of the backlog. Two other federal reports between 2008 and 2013 also included estimates of the backlog. Table 2.4 below lists these estimates and their details. The backlog estimated by the MRDG agencies in 2012 is also included.

As shown in Table 2.4, the backlog has grown significantly over the past decade. This is due to two reasons: (i) continued improvement in the agencies' asset management abilities has led to more thorough reporting of needs, and more importantly, (ii) infrastructure assets have continued to age and deteriorate at a faster rate than investments have been made.

BART: Regional Impacts Study.

Table 2.4: History of State of Good Repair Backlog

Year	Name	Author	Agencies included	State of good repair backlog (adjusted for inflation, 2015$)
2008	Transit State of Good Repair: Beginning the Dialogue	FTA, U.S. DOT	All U.S. transit agencies	$31.6 billion
2009	Report to Congress – Rail Modernization Study	FTA, U.S. DOT	BART, CTA, MBTA, MTA, NJT, SEPTA, WMATA	$55.4 billion
2010	National State of Good Repair Assessment.	FTA, U.S. DOT	All U.S. transit agencies	$86.4 billion
2012	MRDG Compilation of Transit Infrastructure Needs.	MRDG	BART, CTA, GCRTA, MARTA, MBTA, Metra, MTA, NJT, PAAC, SEPTA, SFMTA, WMATA	$74.9 billion
2013	Report to Congress – 2013 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance	FHWA & FTA, U.S. DOT	All U.S. transit agencies	$94 billion
2015	The Need for Greater Federal Investment in Metropolitan Rail	MRDG & RPA	BART, CTA, GCRTA, MARTA, MBTA, Metra, MTA, PAAC, Pace, SEPTA, WMATA	$102 billion

Table 2.5: MRDG Agency Investment Needs
(Billions of $2015)

Mode	State of good repair backlog	Annual normal replacement need	Annual investment needed to eliminate state of good repair backlog over:			Annual investment needed to attain a state of good repair (e.g. also fully-fund annual normal replacement) over:		
			20 years	12 years	6 years	20 years	12 years	6 years
Bus	8.2	1.3	0.4	0.7	1.4	1.7	2.0	2.6
Rail	93.4	11.7	4.7	7.8	15.6	16.4	19.5	27.3
Total	**101.6**	**13.0**	**5.1**	**8.5**	**16.9**	**18.0**	**21.4**	**29.9**

Source: MRDG Agencies (excludes NJ Transit) (2015).

Current Funding for Asset Preservation

In 2013, total investment into MRDG agencies' rolling stock and infrastructure for the preservation and expansion of their transit services by federal, state and local governments was $5.4 billion. An additional $1.9 billion was reinvested back into the systems through "directly-generated" funds, such as fares, tolls and dedicated taxes. **In 2013, the total amount of capital funding available to these MRDG agencies was $7.3 billion; 37% of which came from the federal government, the single biggest source of capital funding for these transit systems.**

Of the total $7.3 billion invested into the MRDG systems, approximately $6 billion[8], or more than 80%, was invested in the preservation of existing assets and the rest was spent on expansion. Investment in "preservation" refers to the repair and replacement of existing assets as opposed to new construction or rolling stock to expand service. It is also important to note that preservation and expansion are activities eligible for federal funding from separate federal transportation programs. As a result, an increase in total federal funding for transit does not necessarily translate into greater funding for preservation. That would depend on which surface transportation programs receive the increased funding. In 2013, of the $6 billion that was available for asset preservation, $5 billion, or 83%, was used to preserve rail assets and the rest was for bus and other modes.

The rest of the U.S. transit industry, or all non-MRDG agencies, spent less than half of their capital funding on system preservation and only 38.7% on preserving rail assets. This is indicative of the fact that most transit agencies throughout the U.S. own and operate service on younger systems with fewer capital-intensive rail assets than the MRDG agencies and therefore are able to invest more of their capital funding into new services and system expansion activities. In contrast, given their large state of good repair backlogs, MRDG agencies are not able to afford the same level of investment in critical system expansion projects.

Despite the ongoing investments, the MRDG agencies' state of good repair backlog is growing and current rates of investment are insufficient to reverse this trend, let alone eliminate the backlog.

Achieving a State of Good Repair

The MRDG agencies' total collective state of good repair backlog is a minimum of $102 billion (2015$) and an annual investment of $13 billion (2015$) is also needed to replace existing assets as they reach the end of their useful life to ensure that the state of good repair backlog does not continue to grow, as shown in Table 2.5. Also provided below are estimates of the annual investment needed to: (i) eliminate the current state of good repair backlog, but not fully fund normal replacement, which only ensures that other assets will fall into a state of disrepair, and (ii) to attain a state of good repair, meaning all annual normal replacement needs are also fully funded, over 20-, 12- and 6-year timeframes.

The annual investment needed to eliminate the current state of good repair backlog and fully fund normal replacement needs over the course of a long-term surface transportation authorizing bill, assuming it is a six-year bill, is $30 billion from all sources. In 2013, the amount of funding available to MRDG agencies for preservation of existing assets was $6 billion, but, again, not all of this was actually invested into the existing capital asset base as some was redirected to fund operations. However, even if all of it were spent on capital, this would not even prevent the collective backlog from growing as it does not reach the level of investment needed to fully-fund normal replacement, let alone attain a state of good repair in any of the timeframes considered in Table 2.5. In fact, this level of expenditure is between 20.2% and 33.5% of what is needed to attain and sustain a state of good repair within these timeframes. In the absence of additional funding, more of the MRDG systems' assets will fall into a state of disrepair and the backlog will grow with the attendant impacts of deteriorating service and difficulty in meeting ridership needs.

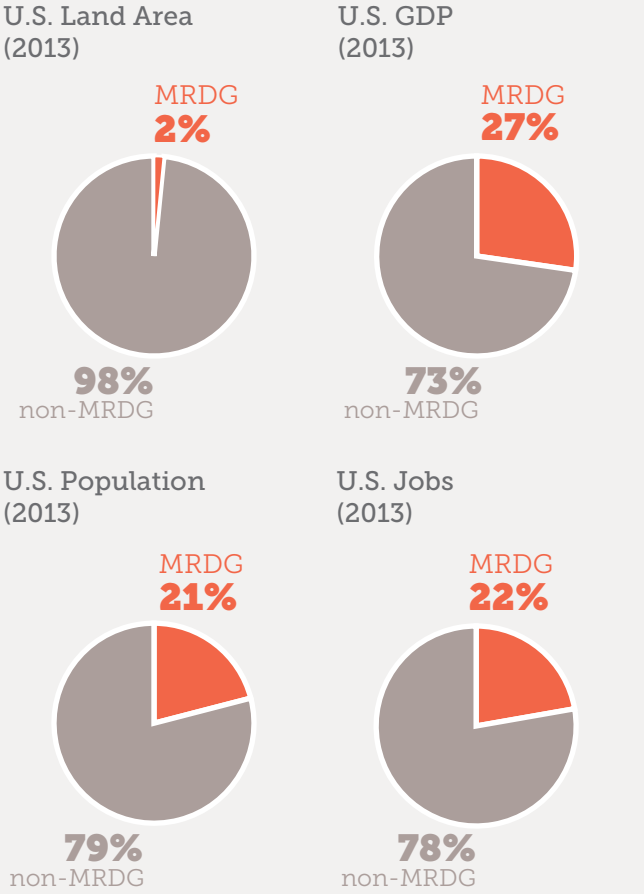
8 Note that the actual level of expenditure is likely less than $6 billion because as the operating budgets for many agencies have tightened, some have redirected funding made available for asset preservation activities to fund their operations and maintenance needs.

America's Future is Riding on MRDG Transit

Bringing the infrastructure of our nation's largest public transit agencies into a state of good repair may be expensive, but the investment would create vast benefits to the American public, businesses and communities. The MRDG regions generate 27% of the nation's gross domestic product and house 21% of the population on just 2% of the land, and their vast bus and rail transit systems are the fundamental infrastructure that supports their incredible density and productivity. With transit ridership reaching historic levels, now more than ever investment in transit is an investment in America's future.

Many of America's strategic national goals, including transportation, economic, energy, environmental and public health, are interconnected with and dependent on increased transit usage. Because the MRDG regions comprise an enormous share of U.S. transit service and ridership, achieving these goals is also dependent on the MRDG transit systems' ability to sustain their service in the future. If the MRDG transit systems are not brought back up to a state of good repair soon, the most dramatic effect will be the downward pressure it puts on these critical regional economies. As their transit infrastructure assets continue to deteriorate and services worsen, urban congestion will skyrocket causing gridlock in the nation's densest and most economically-productive metropolitan areas and the resulting adverse impacts would reverberate throughout the country.

Charts 3.1: The MRDG Regions' Share of America



Source: U.S. Census Bureau (2013). *American Community Survey.*; Bureau of Economic Analysis (2013). *Regional Economic Accounts.*

MRDG Regions Drive the National Economy

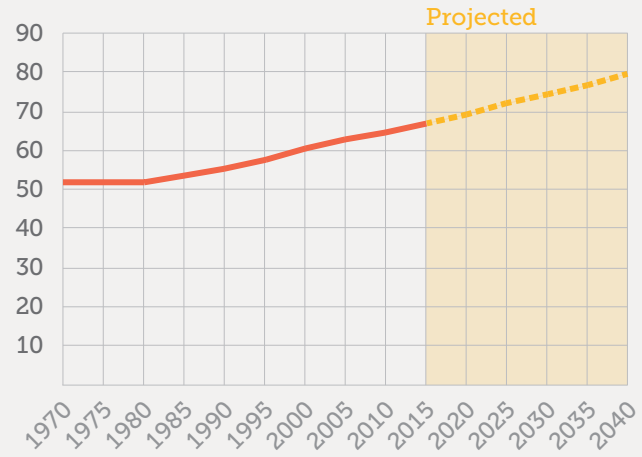
Together, the regions served by the MRDG agencies are 56,000 square miles, less than 2% of the total land area of the U.S. Despite their relatively small size, these regions are of critical strategic importance to America because of the large proportions of the nation's (i) population they house and (ii) economy they generate. As shown in Charts 3.1 below, the MRDG regions collectively contain more than 65 million people and 41 million jobs, both more than one-fifth of the U.S. total,[1] and generate $4.5 trillion in gross domestic product, more than a quarter (27%) of the national economy.[2]

This makes these MRDG regions some of the densest and most productive areas in America – the backbone of our national economic power. **In 2013, the MRDG regions produced a larger share of U.S. GDP than the 33 least-producing states.** In fact, when comparing economies of metropolitan regions and countries around the world, the MRDG regions are more productive than many of the world's largest industrialized nations. **Together, the MRDG regions produce more GDP than Germany.**[3,4]

As shown in Chart 3.2, demographic projections indicate that the MRDG regions could grow by an additional 14 million people or more than 20%, by 2040 for a total of nearly 80 million if the capacity to support this population growth is provided.[5]

1 U.S. Census Bureau (2013). *American Community Survey.*
2 Bureau of Economic Analysis (2013). *Regional Economic Accounts.*
3 Ibid.
4 CIA (2015). *The World Fact Book.*
5 Woods & Poole Economics (2010). *Complete Economic and Demographic Data Source.*

Chart 3.2: The MRDG Regions' Historical and Projected Population



Source: Woods & Poole Economics (2010). *Complete Economic and Demographic Data Source.*

The MRDG regions also contain a high share of the nation's educated workers. More than a third of the MRDG regions' population over the age of 25 or 16.4 million people have bachelors, graduate or professional degrees, compared to just 27% of the population over 25 in the rest of the country.[6] This is in part due to the fact that eight of the nation's top ten universities, as ranked by U.S. News & World Report, are located in the MRDG regions.[7] The MRDG regions are also centers for commerce and industry. Approximately 200, or nearly 40%, of the nation's Fortune 500 companies are headquartered in the nine MRDG regions.

MRDG Regions Face Stiff Global Competition

America's metro regions now compete not only with one another, but also with the likes of London, Paris, Shanghai, Dubai, Bogota and more. No longer do major corporations concern themselves with choosing to locate in one city within a region versus another, but rather choose between global metropolitan regions, preferably with strong transit connections to other nearby regions, when opening or relocating offices, production facilities or other major employment centers.

Regions around the world recognize that to come out on top in the new global economy, they must invest in their transit systems to increase the mobility of workers, information and goods to give their metropolitan areas a competitive advantage, especially in knowledge-based economies, where value is created by saving time and increasing productivity. Transit is a direct input for a country's innovation economy by drawing in the entrepreneurial class and allowing for easy networking and collaboration.

The 2015 World Economic Forum's Global Competitiveness Report lists a well-developed infrastructure as a key pillar for a country's competitiveness, finding a positive correlation between levels of infrastructure investment, and economic development and income.[8] This report ranks the United States 16th in terms of the quality of its overall transportation infrastructure behind:

1. Switzerland
2. Hong Kong
3. United Arab Emirates
4. Finland
5. Singapore
6. Netherlands
7. Austria
8. Iceland
9. Japan
10. France
11. Germany
12. Portugal
13. Spain
14. Luxembourg
15. Denmark

This is largely because the U.S. is not spending enough money on overall infrastructure to support its projected economic growth, and is spending less on infrastructure as a percentage of its gross domestic product than its peers. According to a 2013 report by the McKinsey Global Institute, the business and economies research arm of McKinsey & Company, the U.S. would need to reach spending levels of 3.6% of its GDP to keep pace with projected economic growth through 2030. However, the U.S. is currently spending only 2.6%, which is below the recent global average investment rate in roads, rail ports, airports, power, water and telecommunications of 3.8% of global GDP, and far less than many of our closest competitors, such as China (8.5%), Japan (5%) and India (4.7%). Other industrialized nations, including Australia, Canada, Croatia, Iceland, Lichtenstein, New Zealand, Norway, Singapore, South Korea, Switzerland, Taiwan, and the UAE invest on average 3.9% of national GDP.[9]

Major state of good repair backlogs are not unique to the U.S., but most of the other regions around the world that are the MRDG regions' primary competitors are aggressively addressing their problems and making far greater investments in transit than the U.S. makes in its metropolitan transit systems. Paris and London, regions that compete closely with New York, San Francisco, Chicago, and Washington, D.C., have both embarked on long-term renewal efforts for their metro systems, while at the same time investing in major capacity expansion efforts. For example:

Paris, France: The 115-year-old Paris Metro is currently undergoing a long-term project to modernize its stations, track and rolling stock to a state of good repair by 2030.[10] The national government is also investing billions in Grand Paris Express,

6 U.S. Census Bureau (2013). *American Community Survey.*
7 U.S. News & World Report (2015). *National Universities Rankings.*
8 World Economic Forum (2015). *Global Competitiveness Report: 2014-2015.*
9 McKinsey Global Institute (2013). *Infrastructure productivity: How to save $1 trillion a year.*
10 Régie Autonome des Transports Parisiens (Accessed in 2015). *Metro 2030.*

a massive expansion of the Metro to connect the region with automated trains.[11]

London, UK: Since 1999, Transport for London has replaced half of the London Underground's tracks, upgraded many of its most crowded stations and installed a new signaling system on most of its lines, and made massive investments to expand the capacity of Greater London's rail network, including the $16.7 billion Crossrail project.[12]

Shanghai, China: Up to 25 years ago, Shanghai did not even have a Metro system. Today, its subway network has more tracks, stations and trains than MTA's New York City Transit network, the largest transit network in America.

Helsinki, Finland: Opened in 1982, similar in age to the rail transit systems in Atlanta or San Francisco, the Helsinki Metro has already replaced its rolling stock and is set to soon open a suburban extension.[13]

Buenos Aires, Argentina: With a metro system more than 100-years-old, Buenos Aires recently launched a massive infrastructure rehabilitation program jointly funded by the city and federal governments.[14]

Perth, Australia: With a population similar to Pittsburgh or Cleveland, more funding goes to upgrading the regional rail network in Perth than to repaving roads.

While their peers worldwide are maintaining their infrastructure well and expanding access to transit, the MRDG regions are struggling to maintain the legacy transit infrastructure they already have. The MRDG state of good repair backlog and lack of sufficient funding make significant new transit services and customer service improvements very difficult to achieve. With strong transit, global peer regions will move ahead into the 21st century economy while the MRDG regions are left behind, as talented workers and innovative businesses may locate in other global regions.

MRDG Transit Drives Metropolitan Economies

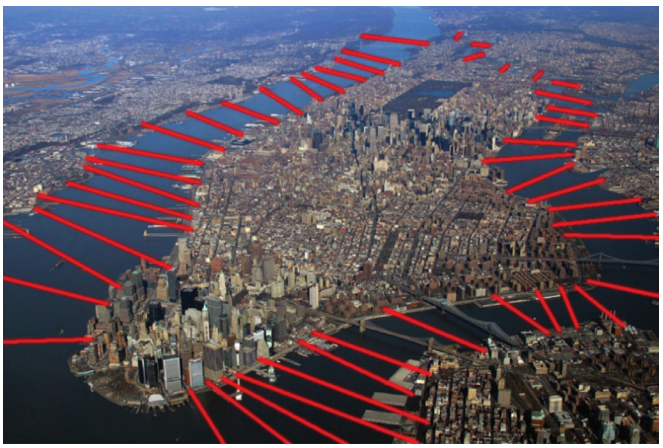
America's largest, densest metropolitan economies are built on a backbone of transit – without it these engines of the national economy would be unable to function and grow. Transit systems are a prime development mechanism for these regional economies and trends in demographics, business and real estate all reinforce the fact that Americans increasingly depend on, and want more and better transit service. Urban areas where transit services are concentrated are now growing faster than suburban areas, reversing a decades-long trend of rapid suburban expansion and decline of central cities.

Transit Benefits All Commuters

First, to understand the benefits of transit, it is important to know who uses transit and why they use it. According to surveys completed by the American Public Transportation Association, the majority of transit trips, 59%, are between home and work or vice versa. However, only 18% of all U.S. household trips are work-related.[15] This indicates that transit service is of the utmost importance in connecting U.S. businesses and workers, especially those located in central business districts.

The transit systems in the MRDG regions are primarily laid out in a hub-and-spoke design, connecting outlying areas to central cities, as is the case with most legacy transit systems. Transit is key to serving these dense, urban cores, especially during peak hours. For example, more than 2 million people enter and exit the island of Manhattan every day and most use transit.[16] However, according to an analysis by Matt Taylor, a Master's of Engineering Student at the University of British Columbia, if everyone took a single-occupant car instead, to keep both the morning and evening rush hours to less than four hours, Manhattan would need 48 more eight-lane bridges to accommodate the increased traffic, as well as two layers of parking underneath the entire island. This is illustrated in Figure 3.1, which shows 48 new Manhattan vehicle crossings in arbitrary locations.[17] Needless to say, this is simply not feasible.

Figure 3.1: Additional Vehicle Crossings Needed to Serve Manhattan with No Transit



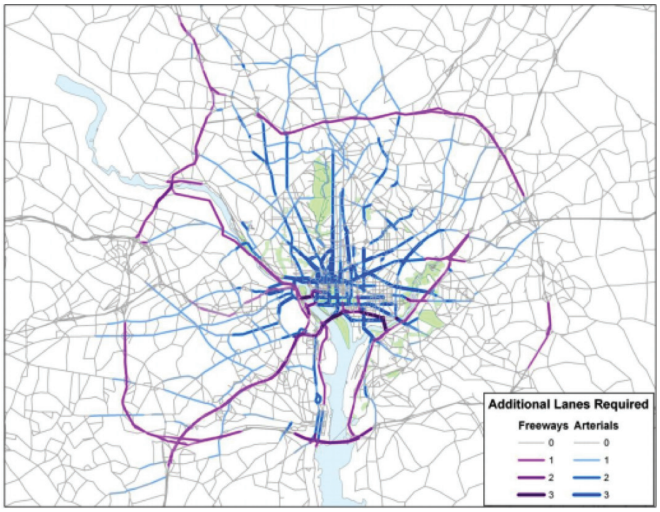
Source: Matt Taylor, University of British Columbia (2015). *Personal website.*

Likewise, a study by WMATA found that without its regional transit system, the Washington, D.C. region would need to add more than "1,000 lane-miles of arterials and highways to maintain current travel speeds, assuming people kept choosing the same destinations—this length is equivalent to adding more than 15 lanes to the entire circumference of the Capital Beltway. Many bridges would require 2 or 3 additional lanes

11 Société du Grand Paris (2015). *Grand Paris Express.*
12 House of Commons Transport Committee (2010). *Update on the London Underground and the public-private (PPP) partnership agreements.*
13 Helsingin Seudun Liikenne (2015). *Strategic Vision.*
14 Buenos Aires Ciudad (2015). *Subte (website).*
15 American Public Transportation Association (2015). *Transit Rider Profile.*
16 New York Metropolitan Transportation Council (2013). *HubBound Report.*
17 Matt Taylor, University of British Columbia (2015). *Personal website.*

in each direction."[18] The expansion needed is shown in Figure 3.2. It is highly unlikely that this amount of highways could be constructed. Even if it were feasible, the costs would be very high and the impacts severe.

Figure 3.2: Additional Lanes Needed to Serve Washington, D.C. Region with No Transit



Source: WMATA (2011). *Making the Case for Transit.*

It goes without saying, but the likelihood that a person will use transit is positively correlated with the quality, reliability and convenience of the transit service. With a strong transit system in place, those people that have access to it are more likely to use it. Every person that is attracted to use transit represents either (i) a new, "induced" trip or (ii) a trip diverted from another mode. Because most trips in America are in a single-occupant personal automobile, transit reduces the number of vehicles on the road and the total number of vehicle miles traveled, and hence congestion.

Congestion hinders economic growth and development in most metro areas around the US. The Texas Transportation Institute estimates that Americans lose $120 billion every year on wasted time in traffic and that rush hours are lengthening across our largest cities.[19] Having a strong transit system to relieve congestion in metropolitan areas with dense concentrations of jobs is especially important during rush hours when regions experience a lane capacity shortage. As TTI's Urban Mobility Report shows, in the MRDG regions, transit is so important that without it, streets would become gridlocked with devastating consequences for the regional economies. Table 3.2 shows that without transit, drivers in the MRDG regions, which already waste 666 million hours sitting in traffic every year would see delays jump 40% on average, resulting in an additional $15 billion in congestion costs. Some regions would be affected more than others. New York, which has a higher share of trips taken by transit would be crippled, with congestion-related delays up 81%, costing the region nearly $10 billion (2012$) in lost productivity.[20]

18 WMATA (2011). *Making the Case for Transit.*
19 Texas Transportation Institute (2012). *Urban Mobility Report.*
20 Ibid.

Table 3.2: Impacts on Delay & Congestion if Transit Discontinued by Metropolitan Area, 2012

Metro Area	Total Delay (hours / year, thousands)	Increase in Total Delay (%)	Increase in Congestion Costs (2012$, millions)
Atlanta	10,520	7.41	232
Boston	37,943	27.70	809
Chicago	67,432	24.82	1,542
Cleveland	3,432	9.81	72
New York	440,647	80.99	9,587
Philadelphia	30,167	19.33	655
Pittsburgh	5,753	12.31	124
San Francisco	36,714	23.66	776
Washington	33,810	18.85	711
MRDG	666,418	39.98	14,508

Source: Texas Transportation Institute (2012). *Urban Mobility Report.*

Transit service can be leveraged to further reduce auto ownership, use and hence congestion if their infrastructure is kept in a state of good repair as the systems could move more people with fewer delays and disruptions. Transit does more to reduce congestion than anything else and keeping it in a state of good repair is the most effective method of combating congestion.

Transit Drives Location Decisions

People are also increasingly choosing lifestyles based on the availability of transit because of the access and mobility that transit provides, as well as one of transit's other major benefits – its encouragement of denser, more walkable urban land use.

In America's largest metropolitan regions, the central cities are growing faster and suburbs are growing slower than they have in years.[21] Millennials in particular are more attracted to walkable, urban communities and have a greater proclivity for using transit and other non-driving modes than older generations. According to the Urban Land Institute (ULI) "America in 2015" survey, more than half of all Americans want to live in walkable communities where they do not have to use a car very often, and almost two-thirds of Millennials want to live in car-optional places.[22] The U.S. PIRG report, "Millennials in Motion," also shows that young Americans are driving less and taking transit more, and that these trends appear likely to last.[23] Several surveys and reports have found that for Americans born after 1980 access to a variety of high-quality transportation options is a top priority when choosing where to live.

As more and more people move to central cities and use non-driving modes to get to and from work, a central location near transit maximizes businesses' ability to draw from this large and growing labor pool. Several studies have concluded that the residential preference of an industry's workers is the dominant factor explaining the centralization or decentralization of the firms in

21 Brookings Institution (2015). *New Census data: Selective city slowdowns and the city-suburb growth gap.*
22 Urban Land Institute (2015). *America in 2015.*
23 U.S. PIRG (2014). *Millennials in Motion.*

that industry. For many industries, particularly knowledge-based firms, access to talented workforce is of critical importance. In other words, jobs follow people. If workers live in the urban areas, employers are more likely to locate in these urban areas.[24] [25]

Of particular importance is the fact that certain industries, which are powering the nation's future growth in the knowledge- and information-based economy, prefer high-density urban locations because they benefit more than other industries from the agglomeration that density creates and transit helps promote. The 2011 report, "Transit and Regional Economic Development" by the Center for Transit-Oriented Development found that firms in government and high-skill, professional industries are the most likely to be attracted to transit-rich areas. This confirms the findings from the 2001 National Bureau of Economic Research study by Edward Glaeser and Matthew Kahn, which found that industries with high "intellectual intensity" (e.g. those which are more skilled or use computers) are more likely to locate in city centers.

Transit Promotes Agglomeration Economies

As workers and businesses cluster in more transit-oriented places, additional economic benefits to firms and metropolitan economies accrue. Transit promotes this clustering of land use and economic activity in urban areas, thereby altering the economic geography of metropolitan regions because it: (i) has a concentrating effect on physical development, (ii) creates greater proximity between complementary businesses, increasing productivity, (iii) leads to more overlap among job markets and labor pools for firms and specific industries, and (iv) generates increased interaction between residents, workers and students, leading to knowledge spillover effects.

According to a 2000 FTA report,

> *"Agglomeration economies refer to the decline in production costs due to the concentration of economic activity in a specified geographic area. In this context, the presence of a well-functioning transit system is thought to strengthen the impact of agglomeration economies, and thereby, to help cities function even better. This concept helps explain, in particular, why firms and industries located in urban areas tend to be more efficient than firms and industries located in rural areas."*[26]

Businesses tend to locate in places that minimize transportation costs by reducing the distance between its suppliers, partners or customers. Firms in specific industries – both competing and complementary – tend to cluster because they benefit in the same way from this geographic proximity. This process of geographic clustering promotes agglomeration benefits for the existing firms and leads to knowledge spillover effects, which can spark whole new firms and industries. These larger markets also allow for greater firm and industry specialization, which creates additional opportunities for businesses to thrive.

Clustering also promotes job market and workforce pooling for workers and businesses, respectively. When more and more businesses, industries and diverse, talented workers cluster, firms have access to an experienced workforce without having to spend substantial sums recruiting and relocating. Workers also have access to more jobs, and in the event of a loss of employment can more easily find work at a firm within their set of skills and expertise.

Furthermore, evidence exists in academic literature to support the notion that dense, urban places facilitate knowledge creation and diffusion, and skill acquisition. In her book, the Economy of Cities, Jane Jacobs wrote that complex urban areas create many opportunities for experimentation in innovation and foster a sense of entrepreneurialism. A 1993 study by Jaffe, Trajtenberg and Henderson explored the knowledge spillover effect in cities by examining the citations that inventors use in their patents. The study found that patent citations are geographically localized. In other words, inventors are much more likely to cite patents by other inventors in the same city than inventors in other cities, states or countries. This confirmed one of the key theories of economic geography – that knowledge spillover is one of the major reasons academic research activity and commercial innovation cluster in cities.[27]

Transit encourages agglomeration economies because development concentrates near transit stations – a phenomenon known as transit-oriented development – as opposed to highways, which encourage sprawling suburban development. In some places, transit provides a justification for greater building height and development intensity around transit stations than would otherwise be allowed because of the congestion they cause. In this way, transit helps make economies of agglomeration possible.

As the global economy becomes more based on knowledge and innovation, creating places where talented workers want to live and businesses want to locate is crucial to the success of America's metropolitan economies and hence the national economy.

24 Center for Transit Oriented Development (2011). *Transit and Regional Economic Development.*
25 Glaeser, E. & Kahn, M., National Bureau of Economic Research (2001). *Decentralized Employment and the Transportation of the American City.*
26 FTA (2000). *Transit Benefit 2000 Working Papers: A Public Choice Policy Analysis.*
27 Jaffe, A., et al. (2003). *Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations.*

The American People Want More & Better Transit

Finally, it is also important to recognize that the American people understand the importance of transit investment. According to numerous recent surveys and reports, Americans want more and better transit service, and to live in walkable, transit-oriented places; American businesses want to locate near their workers; and American communities have become more reliant on transit to function. Lastly, the results of recent state elections and ballot initiatives show that voters broadly support greater investment in transit infrastructure.

A recent 2015 telephone survey sponsored by the American Public Transportation Association (APTA) found that of the 156 million Americans that planned to visit a major U.S. metropolitan area during the summer of 2015, 57% said they would use transit for at least one activity and 30% said that the availability of transit affected their destination choice.[28] The most common reasons respondents cited for their decision to take transit for an activity or visit a city with transit options is that they would not have to look for parking, and it would be less expensive and easier to get around.

Several surveys by the Mineta Transportation Institute (MTI) have consistently found positive attitudes toward transit and greater transit investment. A 2013 survey found that:

- 76% of people believe transit investments create jobs, revitalize communities and pave the way to a stronger economy, especially in tough economic times;
- 87% believe transit expands affordable access to economic opportunities, such as new jobs and careers, as well as to medical care, schools, and colleges; and
- 72% believe transit reduces our dependence on foreign oil and helps transition America toward a more energy efficient economy.

This same survey found that three-quarters of respondents support using tax dollars to create, expand and improve transit options in their communities, and two-thirds support the federal government increasing its level of investment in transit.[29]

A more recent MTI survey in 2015 found that two-thirds of Americans support using the gas tax to fund transit with support remaining high among both Democrats and Republicans, drivers and non-drivers, transit users and non-users, and even those who live in communities without transit service (57%).[30]

28 American Public Transportation Association (2015). *2015 Summer Travel Survey.*
29 Mineta Transportation Institute (2015). *Americans' Support for Public Transportation.*
30 Mineta Transportation Institute (2015). *What Do Americans Think About Federal Tax Options to Support Public Transit, Highways, and Local Streets and Roads? Results from Year Six of a National Survey.*

State Initiatives

Americans have not only shown their support for transit in surveys, but also at the ballot box. According to Transportation for America, 21 states have approved plans to raise their own additional revenues for transportation since 2012. This indicates that voters are generally more supportive of raising revenue for transportation than many politicians believe. For example, in 2013 the Pennsylvania General Assembly passed a bill that raises an additional $2.3 billion for transportation, including nearly $500 million for transit.[31]

Additional Benefits of Transit Service & Investment

In addition to transit service driving the metropolitan economies of the MRDG regions, investment in transit also creates significant: (i) returns for MRDG metropolitan economies; (ii) benefits for the bottom line of MRDG transit agencies; (iii) benefits for the environment where automobile ownership and use, and land consumption are reduced; (iv) benefits for property values and development potential; and (v) benefits for individuals whether they use transit or not.

Regional Economic Benefits

When investments are made in transit systems, wealth is protected and new wealth is created. When a transit system is not in a state of good repair, the existing transit services and the significant benefits that they create are at risk. Hence, capital investment to help a transit system achieve a state of good repair protects the benefits of the existing service. However, that investment also fuels the economy in other important ways – (i) it creates direct jobs in the regions, which increases gross income, and leads to greater consumer spending and local business revenue; (ii) it creates indirect jobs as transit agencies buy goods and contractors buy raw materials from firms locally and across the country; (iii) as transit is made more reliable from state of good repair investments, productivity increases and businesses thrive, which induces even more job creation; and (iv) it improves property values and stimulates development, which leads to even more construction jobs created.

According to the National Transit Database, in 2013 U.S. transit agencies employed more than 250,000 workers for a total of nearly 475 million work hours to build, rebuild, administer and operate transit, and paid out more than $60 billion in total compensation, including salaries, wages and fringe benefits. This is a significant amount of income that individuals spend on goods and services in their local community, creating profit for local firms to expand and tax revenue for governments to provide essential services. When investments are made in a transit system

31 Transportation for America (2015). *State Transportation Funding (website).*

to achieve a state of good repair, these funds help to protect these jobs, which are a major component of their local and regional economies.

These investments also stimulate new economic activity in the form of new jobs, either directly, indirectly or induced. Capital investment in transit creates a broad mix of direct jobs, at firms that construct the guideways, systems and stations, and manufacturers that build trains and buses. It also creates indirect jobs at the suppliers of products that support the construction and manufacture of transit facilities and equipment, and at other business supported by the spending of wages earned at all of the new jobs created.

According to the 2009 Transit Cooperative Research Program (TCRP) J-11 (7), Economic Impact of Public Transportation Investment, by Weisbrod and Reno, for every $1 billion invested in transit infrastructure, on average 36,000 direct, indirect or induced jobs are supported or created.[32] These 36,000 new jobs generate additional sales volumes of $3.6 billion, an increase in GDP (or value added) of $1.8 billion, increased worker income of $1.6 billion and corporate income of $0.2 billion, and all of this increased economic activity generates nearly $500 million in tax revenue at all levels of government. [33]

The MRDG agencies spent $18.7 billion on operating costs and capital needs in 2013, which, according to the factors calculated by Weisbrod and Reno in 2009, created or supported 675,000 jobs throughout the American economy.[34] [35]

A study by MARTA in 2007 found that the Atlanta region's transit system alone generated $2.1 billion in economic output across the State of Georgia, and created as many jobs statewide as the number of employees in all of the gas, water, and electric utility companies throughout the state combined.[36]

In contrast, the 2012 report, A State of Good Repair for BART: Regional Impacts Study, found that if BART were only able to spend 30% of the funds needed to maintain a state of good repair over the next 30 years, it would cost the San Francisco region between $33 and $50 billion in total lost business sales. The total state of good repair need over 30 years was estimated at $15.4 billion. So the net economic loss to the region due to not maintaining a state of good repair would be more than two or three times the cost of maintaining a state of good repair.[37]

These benefits are spread throughout not only the metropolitan area where the investment is made, but also nationwide. When investments are made in transit vehicles, manufacturers ramp up production at an existing factory or build a new factory nearby and hire new workers. For example, MTA Metro-North Railroad's M8 cars were built and WMATA's 7000-series railcars are being constructed over 1,200 miles from Washington, D.C. in Lincoln, NE. Having more people at work nationwide induces even more economic benefits as retail spending increases, families become more stable, and unemployment falls.

Fiscal Benefits for Transit Agencies

A state of good repair backlog is not only bad for transit services, commonly resulting in diminished quality and reliability, but also for the bottom line of transit agencies, as assets in a state of disrepair cost more to maintain than assets in excellent or good condition. When assets are in a state of disrepair, they can quickly become far more expensive emergency repair or heavy maintenance projects causing far greater disruption to travelers. Furthermore, poor service will discourage ridership and reduce passenger revenue. Achieving and maintaining a state of good repair will save the MRDG transit agencies money in the long run.

Fully funding normal replacement is also critical because while responsible transit asset management and preventative maintenance can typically double the life of an asset. Eventually every asset will have to be replaced and older facilities and equipment are more expensive to repair or replace than newer ones and fail more frequently. Deferring necessary investments in a transit system's state of good repair needs will save money in the short run, but result in higher costs and worse service in the long run.

Environmental Benefits

As detailed earlier in the report, one of transit's fundamental benefits is that it reduces automobile ownership, use and hence congestion. Reduced automobile use and congestion benefit users of the transportation network, while helping conserve energy, combat climate change and reduce our nation's dependence on oil at the same time.

Private cars account for 43% of transportation-related greenhouse gas emissions in the US – nearly 12% of the nation's total CO2 emissions.[38] With many commuters using single-occupant cars to commute in the same direction each day, transit provides an opportunity to divert many would-be drivers onto buses and trains – effectively reducing each commuter's carbon footprint. As the world grapples with how to avoid a climate catastrophe in the coming century, American cities can contribute to emissions reductions through strong transit systems.

Suburban, car-oriented development patterns pose difficult challenges for efforts to reduce greenhouse gas emissions, as lower-density places tend to have higher energy and car usage. This

32 This calculation reflects the national average mix of operating (71%) and capital (29%) funding spent on transit in 2013 whereby every $1 billion of capital investment in transit creates 24,000 new jobs and every $1 billion spent on transit operations supports or creates more than 41,000 jobs.
33 Weisbrod, G., & Reno, A. (2009). *Economic Impact of Public Transportation Investment.*
34 National Transit Database (2013).
35 Weisbrod, G., & Reno, A. (2009). *Economic Impact of Public Transportation Investment.*
36 Tanner, T. & Jones, A. (2007). *The Economic Impact of the Metropolitan Atlanta Rapid Transit Authority: An Analysis of the Impact of MARTA Operations on and around the Service Delivery Region.* Carl Vinson Institute of Government, University of Georgia.
37 BART (2012). *A State of Good Repair for BART: Regional Impacts Study. What Could Happen if BART Fails to Maintain a State of Good Repair*
38 U.S. EPA (2013). *U.S. Transportation Sector Greenhouse Gas Emissions: 1990-2011.*

is another reason that investment in transit will help the U.S. achieve its national environmental policy goals.

All transit, but particularly rail, is extremely energy efficient per passenger mile traveled. Reduced fossil fuel consumption also leads to significant environmental benefits in the form of fewer greenhouse gas emissions that contribute to global warming and other air pollutants, and the compact development patterns that transit encourages consume less land and reduce water pollution due to toxic runoff from roads and parking lots.

According to APTA's 2014 Transit Fact Book, transit annually saves more than four billion gallons of gasoline and 37 million metric tons of carbon dioxide emissions by reducing auto ownership and usage, lessening congestion and attracting people to live in higher densities near transit, which generally puts them in greater proximity to their jobs and other locations.[39] Transit agencies around the country are also on the forefront of adopting clean technology, so the reduction in gasoline consumption and resulting emissions is likely to be greater in the future.

By reducing air pollutants that produce smog, greenhouse gases that contribute to global warming, and run-off from paved surfaces that degrade the water supply, and by conserving ecologically sensitive lands and open spaces, transit is helping America meet many of its environmental goals and improve the health of its citizens. For example, improving air quality can lower rates of respiratory illnesses and heart disease. Increased transit use would also result in fewer automobile accidents that cause tens of thousands of serious injuries and deaths every year. The fatality rate per billion passenger miles for the drivers and passengers in automobiles and light trucks between 2000 and 2009 was 7.28. In comparison, the same fatality rate on buses, urban, commuter and intercity rail was between 0.11 and 0.43.[40]

Community Benefits

Transit benefits communities by fostering neighborhoods around transit corridors that the public values more highly than other properties. Transit improves the quality of life of an area, especially as residential preferences shift towards more walkable communities, which makes a community more livable for everyone regardless of whether they take transit or not. Dense, mixed-use, walkable, transit-oriented development (TOD), in addition to the other important economic and environmental benefits already described, creates enormously valuable real estate for residential, commercial and office uses.

For decades, U.S. communities were built around the promise of reliable and convenient means of transportation for trips of all types. Since the 1950s, our communities have been built around the car, but for decades before that transit was at the heart of urban design. With both people and corporations increasingly moving to urban areas, the real estate industry now invests heavily in TOD nationwide. New mega-projects now often emphasize walkability, mixed-use, and accessibility to transit to attract more tenants and raise property values. However, this all requires an existing and well-functioning transit system. Without efficient, reliable transit, the trend of transit-oriented development will disappear, and many thriving new communities will become decidedly less desirable places to live and work.

The recent ITDP study, More Development for Your Transit Dollar, looked at 21 transit corridors around the country and found that the transit investments that GCRTA had made in Cleveland leveraged "many times" more TOD investment than the capital costs. Two corridors in Cleveland leveraged more than $100 in TOD investment per $1 invested in transit and five other corridors leveraged more than $10 in TOD investment per $1 invested in transit.

High-quality transit also raises existing property values. Two studies by Regional Plan Association have found that improving transit boosts home values and local economies, and that the impact is greater the closer you are to a transit station. In 2010, RPA found that three major improvements to the NJ Transit rail system that reduced travel times to Midtown Manhattan boosted home values in New Jersey by $11 billion (2009$) in the first ten years. Furthermore, this increased property tax revenue for municipalities by $250 million a year. The average home value increased nearly $23,000 and homes within walking distance of train stations gained the most value – up to $34,000. RPA also found that a proposed trans-Hudson rail tunnel that doubles capacity to Midtown Manhattan would also (i) double the number of residents living west of the Hudson River with a train commute to Midtown Manhattan under 50 minutes, (ii) boost property values a total of $18 billion, and (iii) generate $375 million a year in new property tax revenue.

Likewise, the 2013 RPA study, Rail Rewards: found that the MTA Long Island Rail Road's East Side Access project will shorten travel times by an average of 18 minutes a day for commuters to East Midtown, and increase homes values by an average of $7,300 for 587,000 households in Queens and Long Island. Cumulatively, East Side Access will raise homes values by $4.7 billion.

The value of properties around transit is also resilient, having fared better during the last recession than suburban properties. The 2013 report by CTOD, *The New Real Estate Mantra: Location Near Public Transportation*, studied the impact of transit access on home values before and after the 2008 recession. They found that while nearly all homes experienced some setback following the housing crash homes with transit access were insulated from the worst of it, outperforming areas not served by transit by nearly 50% in the regions they studied. Homes in MBTA station areas outperformed the rest of the Boston region by 129%, BART station areas outperformed the rest of San Francisco by 37%, and Chicago station areas outperformed the rest of the region by 30%.

Finally, transit is crucial to providing mobility during emergency. Transit is a critical back-up alternative for moving people

39 American Public Transportation Association (2014). *Transit Fact Book.*
40 Victoria Transport Policy Institute (2015). *Safer than you think! Revising the Transit Safety Narrative.*

quickly during emergency events and disasters — both natural and man-made — to maintain basic access, mobility and safety for individuals as well as emergency response professionals.

Individual Benefits

Transit creates access to opportunity for all – universal, affordable mobility. Affordable, fast and reliable transit is more attractive for many people. When a transit trip substitutes for an automobile trip and can eventually lead to an individual selling a car, or putting off a purchase or opting not to purchase a new car, they can save enormous sums of money on vehicle ownership, and all of its attendant costs, such as gas, maintenance and parking. A two-adult household with no car where the owners take transit saves an average of $6,251 each year (2006$), compared to a household with two cars and no transit access.[41] They save on the cost of financing, insurance, fuel, repairs and parking.

As described earlier, Millennials have shown a greater preference for transit and urban areas, but as the U.S. continues to age and physical impairments that prevent driving or make driving more difficult and less safe become more prevalent, more and more of the population is becoming reliant on transit. The denser, more walkable communities encouraged by transit foster a more active lifestyle. This improves public health outcomes for transit riders as they walk to and from transit service.

Nearly 40% of all U.S. households without access to a car live in one of the MRDG regions. While many American families take their car for granted, among those with low incomes costs for repairs, gas, and insurance can add up to nearly 30% of their income, which is how much they spend on food.[42] When families have to decide between getting to work or buying their children food, the cycle of poverty becomes a trap that bridges generations. In many cases, high paying jobs are totally out of reach to the poor due to a lack of transportation options. This is true for access to healthcare, government, and cultural institutions as well.[43] Public transit, offering an affordable and convenient means of transportation to even the most vulnerable populations, is a lifeline for many Americans. For a transit-dependent household, transit is not a luxury, but an imperative to get to and from work, and essential services.

41 ICF International (2007). *Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil.*
42 Ibid.
43 Kain, J. (2003). *A Pioneer's Perspective on the Spatial Mismatch Literature.*

Conclusion

Unfortunately, the transit systems in the nation's largest and most productive metropolitan regions are in a deep hole that is getting deeper, as they now face a total state of good repair backlog of $102 billion and annual normal replacement needs of $13 billion. At the same time that they are carrying record numbers of people, their core assets are aging and crumbling under the pressure. Despite laudable efforts to improve asset management practices and make more efficient use of scarce resources, capital investment at all levels of government has not and is not keeping pace with these agencies' growing needs.

Inadequate levels of federal funding for transit state of good repair needs has significant consequences in terms of achieving our national transportation, economic development and sustainability goals. It also has negative impacts on the metropolitan regions where a large proportion of U.S. companies do business, and residents and workers live, including some of the most disadvantaged populations.

Without additional federal investment to recapitalize the legacy transit infrastructure in the MRDG regions, increased pressure will be put on strapped state and local governments, and the transit agencies to make up the difference. Securing the public funding necessary to pay for these critical capital expenditures will be challenging and likely insufficient funding will be provided.

Alternatively, robust funding levels by the federal government could enable the MRDG agencies to attain and maintain a state of good repair over the next six to ten years and get back onto the path to fiscal sustainability. This would produce enormous benefits for the regions these systems support and the nation as a whole.

A federal commitment to substantial investment to bring America's major transit systems into a state of good repair and then sustain this level is needed in the next federal surface transportation bill.

Appendix I

Definition: MRDG Metropolitan Areas & Supporting Transit Agencies

Metropolitan Statistical Area	Transit Agency 1	Transit Agency 2
San Francisco-Oakland-Hayward, CA	BART	
Chicago-Naperville-Elgin, IL-IN-WI	RTA	
Cleveland-Elyria, OH	GCRTA	
Atlanta-Sandy Springs-Roswell, GA	MARTA	
Boston-Cambridge-Newton, MA-NH	MBTA	
Manchester-Nashua, NH	MBTA	
Providence-Warwick, RI-MA	MBTA	
Worcester, MA-CT	MBTA	
Bridgeport-Stamford-Norwalk, CT	MTA	
Kingston, NY	MTA	
New Haven-Milford, CT	MTA	
New York-Newark-Jersey City, NY-NJ-PA	MTA	NJ TRANSIT
Atlantic City-Hammonton, NJ	NJ TRANSIT	
Trenton, NJ	NJ TRANSIT	SEPTA
Pittsburgh, PA	PAAC	
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	SEPTA	NJ TRANSIT
Washington-Arlington-Alexandria, DC-VA-MD-WV	WMATA	

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