RECENT EXAMPLES OF THE ECONOMIC BENEFITS FROM INVESTING IN INFRASTRUCTURE

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Introduction

Investments in transportation infrastructure have substantial economic benefits, in both the short and the long run. Evidence of these benefits is clearly visible in many of the infrastructure projects that have recently been completed throughout the country. These investments, some of which are described in this report, result in the following benefits for Americans and our nation's economy:

- Reduced congestion in key bottleneck areas, such as the I-10 bridge span replacement in New Orleans, LA and the new Woodrow Wilson Bridge connecting Virginia and Maryland, which helps to reduce the estimated $100 billion in congestion costs on roads and highways in urban areas.
- Improved safety on our nation's highways and bridges, such as the reconstruction of the I-10 / I-95 interchange in Jacksonville, Florida, which can both save lives and reduce bottlenecks on key thoroughfares.
- Expanded public transit services to new communities, such as the Green Line light rail extension in Portland, OR, which get commuters and other travelers to their destinations in more efficient, less congestion-prone ways.
- Rehabilitated and much-needed maintenance of aging infrastructure, such as the rehabilitation of a stretch of I-77 in North Carolina, which often results in the some of the highest returns on infrastructure investment.

The U.S. economy relies heavily on transportation infrastructure, and these investments to improve the condition and performance of our infrastructure allow people and goods to move more efficiently and safely around the country. Without a well-functioning system of roads and highways, public transit, railways, seaports, and aviation, much of the activity in the U.S. economy would grind to halt.

In order to meet the needs of a growing economy, there is an ongoing need for new investments to maintain, upgrade, and expand the nation's stock of transportation infrastructure. Moreover, the value of making such investments is especially great at a time when the economy continues to have substantial underutilized resources, including more than a million construction workers seeking employment.

Yet the U.S. has been underinvesting in infrastructure for many years. Recognizing the pressing need to revitalize America's infrastructure network, President Obama has proposed $50 billion in immediate investments in transportation infrastructure, as part of the American Jobs Act. The President's proposal includes investments to make highways safer and more efficient; to repair and modernize public transit systems; to improve intercity passenger rail service and develop high-speed rail corridors; to improve airports and modernize the air traffic system; and to support innovative multi-modal transportation programs. Among the innovative infrastructure efforts the President is championing through the American Jobs Act is a $10 billion proposal to capitalize an independent National Infrastructure Bank, which will both increase overall investment in infrastructure by attracting private capital to co-invest in specific infrastructure projects and help

to improve the efficiency of infrastructure investment by relying on a merit-based selection process for projects.

This report discusses the compelling economic rationale for making these investments now and lays out four types of infrastructure projects likely to yield large returns. The benefits of these investments are illustrated in this report through examples of recent projects that have already had a substantial positive impact. The report ends by discussing innovative methods of financing infrastructure, leveraging private funding and creating structures to direct infrastructure funds where they will be most effective.

The Economic Benefits of Transportation Infrastructure Investment

A large body of economic research has shown that investments in transportation infrastructure can have a substantial positive impact on the long-run performance of an economy.[1] Investments that create, maintain, or expand transportation networks are likely to promote improved economic efficiency, higher productivity, and more rapid growth of economic activity. Nonetheless, despite the potential for substantial long-run economic benefits from infrastructure investment, the U.S. has been underinvesting for many years. Relative to the size of our economy, the United States is investing less in infrastructure than many other nations. For example, while the U.S. is investing approximately 2 percent of GDP on infrastructure, China and Europe are investing close to 9 percent and 5 percent of GDP on infrastructure, respectively.[2] The American Society of Civil Engineers (ASCE) estimates that we face a $2.2 trillion need for infrastructure investment over the next five years.[3] In short, the U.S. has not been investing adequately in infrastructure. The infrastructure investments being proposed by the President in the American Jobs Act can serve to jump start critical infrastructure projects, and highlight the Administration's longer term commitment to enhance and reform the nation's surface transportation investments.

The benefits of investing in infrastructure are especially high when there are underutilized resources in the economy. In addition to the long-run effects on economic growth and productivity, investments in infrastructure can have short-run benefits by supporting employment in construction and in the production of materials. Moreover, increased spending by the workers hired in these sectors can have positive ripple effects throughout the economy. However, these short-run effects can vary greatly depending on the state of the overall economy. At the peak of a business cycle, when the economy is operating at or close to its full potential, the benefits from hiring workers for infrastructure projects will be partially offset by the diversion of these workers from other productive activities, and the investment of public funds may "crowd out" some private investment. Many valuable infrastructure investments will still be justified during such

[1] For more detail, see the report by the Department of the Treasury with the Council of Economic Advisers, "An Economic Analysis of Infrastructure Investment," October 11, 2010.
http://www.whitehouse.gov/sites/default/files/infrastructure_investment_report.pdf
See also Gramlich, Edward, "Infrastructure Investment: A Review Essay," Journal of Economic Literature, Vol. 32, No. 3 (Sept., 1993), pp. 1176-1196.

[2] Remarks by the President at CNBC Town Hall Discussion on Jobs" The White House Office of the Press Secretary, 2010. http://www.whitehouse.gov/the-press-office/2010/09/20/remarks-president-cnbc-town-hall-discussion-jobs

[3] "2009 Report Card for America's Infrastructure", ASCE. http://www.asce.org/PPLContent.aspx?id=2147484137

times, but the opportunity costs of diverting economic resources from other activities would reduce the net benefits of such investments.

By contrast, today the economy is gradually recovering from the most significant economic crisis since the Great Depression and is operating significantly below its full potential, with unemployment still unacceptably high. In September 2011, 1.1 million workers in the construction industry were unemployed, an unemployment rate of 13.3 percent.[4] In these circumstances, public transportation projects can freely hire with little risk that other employers will have difficulty finding available workers. With excess capacity widely available in the economy, increased public spending on construction materials and increased private spending by newly hired workers is unlikely to divert goods or materials from other uses. Similarly, with interest rates at exceptionally low levels, there is little risk that federal investment will crowd out private investment. Indeed, at a time when the U.S. Treasury can borrow for ten years at an interest rate near 2 percent, and a real interest rate near zero, many more infrastructure investments yield a positive rate of return. Moreover, state and local governments, which typically fund a significant portion of infrastructure spending, have been forced to cut back on spending due to revenue shortfalls since the recession of 2007-2009. Recent macroeconomic research confirms the intuition that the expansionary effect of federal investment spending is likely to be significantly greater during times when there is substantial slack in the economy.[5] Overall, with so many of the necessary resources sitting idle, the opportunity costs of using those resources for infrastructure investment are greatly reduced. Just as it makes sense for a household to stock up on consumer goods when they are on sale, the low opportunity cost of hiring unemployed workers and making use of underutilized resources provides a compelling economic rationale for the federal government to make substantial immediate infrastructure investments.

Recent Infrastructure Projects with Significant Economic Benefits

While infrastructure investments generally provide substantial positive benefits, economists have shown that not all infrastructure investments are equally valuable. For example, a study by John Fernald finds that the construction of the interstate highway system in the 1960s led to substantial productivity gains, while a comparable investment today would likely have a much smaller impact. As Fernald notes, "Building an interstate network might be very productive; building a second network may not."[6] In order to maximize the net benefits of additional infrastructure investment, new investments should be targeted towards projects where the return on investment is likely to be particularly high. This section of the report describes four types of infrastructure investment that can have particularly high returns, and provides some specific examples of recent projects that illustrate the economic benefits that can be achieved by targeting investments in these ways.

[4] Source: BLS News Release, October 7, 2011, "The Employment Situation – September 2011."
[5] See, e.g., Auerbach, A. and Y. Gorodnichenko, "Measuring the Output Responses to Fiscal Policy," NBER Working Paper No. 16311, August, 2010.
[6] Fernald, John G., "Roads to Prosperity? Assessing the Link Between Public Capital and Productivity," *The American Economic Review,* Vol. 89, No. 3 (Jun., 1999), pp. 619-638.

Expanding capacity by targeting investments towards key bottlenecks.

One of the most significant costs of inadequate transportation infrastructure is the congestion that arises when the demand for transportation exceeds the physical capacity of the available infrastructure. According to the Texas Transportation Institute, the total cost of congestion on roads and highways in urban areas was over $100 billion in 2010, reflecting the cost of time delays and wasted fuel.[7] In many instances, substantial congestion is caused by specific bottlenecks or "chokepoints" in the network. As a result, substantial net benefits may be available from targeted investments to expand capacity at those chokepoints, allowing the network to accommodate a greater flow of traffic.

One important way to address critical highway bottlenecks is to replace bridges that have become inadequate for the public's transportation needs. Often, bridges become bottlenecks when traffic has expanded dramatically on a major corridor, exceeding the levels anticipated when the bridge was originally constructed. In other instances, an old bridge may require replacement due to damage or deterioration.

[7] *2011 Urban Mobility Report*, Texas Transportation Institute. http://tti.tamu.edu/documents/mobility-report-2011.pdf

Example: Woodrow Wilson Bridge, VA, MD, and DC

The Woodrow Wilson Bridge (WWB) Project, spanning Virginia, Maryland, and Washington, DC, along 7.5 mile section of I-95, replaced the existing bridge and reconstructed the I-95 interchanges with MD 210 and I-295 in Maryland and US1 and Telegraph Road in Virginia. The old WWB, which opened in 1961, was one of the area's worst traffic bottlenecks and a huge safety concern. In 1969, only eight years after opening, the bridge started exceeding its designed capacity of 75,000 vehicles a day and prior to its replacement, the bridge was carrying more than 195,000 vehicles a day. As a result, commuters and interstate commerce were regularly plagued with several miles of gridlock when crossing the bridge. There were major safety concerns as well, as accidents occurred at twice the rate of those on similar highways in Maryland and Virginia.

The project involved replacing the existing six lane bridge with a new structure designed to accommodate four lanes of the Capital Beltway in each direction, an auxiliary lane in each direction to handle the heavy entrance and exit volumes between US 1 and I 295 interchanges, and a High Occupancy Vehicle/Express Bus/Transit lane in each direction when/if such a system is put in place on each side of the Potomac. In addition to the main river crossing bridge replacement, the project consists of 102 lane miles of reconstructed and new pavement and more than 1,169,000 square feet of retaining and sound walls for reconstruction of four interchanges with I-95 over a 7.5 mile section.

Excluding mitigation contracts, this project was constructed with 35 contracts of which 34 are completed and one is under construction. Construction began in 2000 and the new WWB opened to traffic in 2008 with the scheduled full completion of the project in early 2013. The project is more than 94 percent complete, and is expected to be completed at or below the Initial Financial Plan budget. The new WWB has virtually eliminated bottlenecks crossing the Potomac River and increased safety and mobility for Interstate and commuter traffic. The project has received numerous awards, including AASHTO's Grand Prize -- Nationwide America's Transportation Award and the OPAL Trophy for Outstanding Civil Engineering Achievement Award in 2008 awarded by the American Society of Civil Engineers.

Example: Mike O'Callaghan – Pat Tillman Memorial Bridge and the Hoover Dam Bypass, AZ and NV.

Between 2002 and 2010, the Hoover Dam Bypass Project constructed eight bridges, five miles of new road and one of the world's largest bridges to increase security at the Hoover Dam and to address traffic congestion issues in the area. It also eliminated the congestion problems, removing interstate traffic from atop the dam and improving the route's shoulders and poor sight distance. This project greatly improved safety for drivers and pedestrians. Notably, the project included construction of a 1,900-foot-long O'Callaghan-Tillman Memorial Bridge to provide a four-lane bypass that reroutes traffic for 3.5 miles from the two-lane bottleneck on U.S. 93 across the Hoover Dam. The project employed more than 1,200 workers, engineers and safety experts.

From extreme desert heat for months at a time to high winds, the area's rugged conditions made the project one of the nation's most demanding and difficult engineering challenges. U.S. 93 is a high-priority trade corridor and is a central part of the major transportation network in the western United States. Due to increases in commercial freight shipments to and from southern California, and population booms in Las Vegas and Phoenix, the road over the Hoover Dam became progressively more congested. Security concerns after Sept. 11, 2001, led authorities to ban commercial trucks from traveling across the dam, forcing truck drivers on the route to use a 75-mile detour which added cost and delay to businesses and consumers relying on such shipments.

Opened to traffic on Oct. 19, 2010, the new Hoover Dam Bypass shortens the route for commercial shippers along this major trade corridor and reduces traffic congestion for all who use it. In addition, the bypass accommodates migratory animals in the area -- such as Desert bighorn sheep (Nevada's state animal) -- with wildlife crossings built of concrete and anchored to ridgelines on each side of the highway. The surfaces are dirt and have been seeded with native plants. They are not accessible from the highway or from any developed trails. The crossings improve safety to drivers on US 93 and to the animals themselves who otherwise had no other means to cross the highway.

Earlier this year, the project received the Grand Conceptor Award, the highest honor given by the American Council of Engineering Companies. It was also recognized as National Project of the Year by the American Public Works Association, and is one of five finalists for the Outstanding Civil Engineering Achievement Award to be announced in March by the American Society of Civil Engineers.

Example: I-10 Twin Span Bridge replacement in New Orleans, LA

The replacement of the I-10 Twin Span Bridges -- a major conduit in and out of New Orleans destroyed by storm surge during Hurricane Katrina – was completed and opened to traffic in September 2011 several months ahead of schedule.[1] Spanning more than five miles over Lake Pontchartrain on I-10, the new bridges are a critical part of the east-west link between Slidell and New Orleans – particularly for the 8.6 million tons of commercial shipments traveling to and from the Port of New Orleans.

Replacing the I-10 Twin Span Bridges has been a national priority since 2005, when Katrina devastated the Gulf Coast. Realizing the dire nature of the situation, Louisiana Department of Transportation and Development (DOTD) personnel began working immediately with private-sector partners from the engineering and construction contractor community to make temporary repairs and restore single lanes of east and westbound traffic. This goal was realized after 40 days of around-the-clock activity. In addition, DOTD used in-house design professionals to produce construction bid documents for a new Twin Span Bridge. Through their efforts, workers broke ground for the new bridge in July 2006, less than one year after the hurricane.

I-10 is the southernmost, east-to-west transcontinental highway in the United States. It stretches 2,460 miles between Jacksonville, Fla., and Santa Monica, Calif. The interruption of this critical transportation link resulted in crippling impacts upon the regional and national economy. Two additional lanes on the new bridges relieve local traffic congestion and improve safety by providing a more reliable evacuation route. At the crest, the new bridges are 30 feet high – 21 feet taller than their predecessors, making the pair of new bridges more resistant to storm surge. In addition, it includes a high-rise navigational segment that provides 80 feet of vertical clearance for maritime traffic. The DOTD designed the new bridges to last 100 years, and the improved anchoring system will prevent bridge spans from “floating” off the structures as happened during Hurricane Katrina's storm surge. This is the first bridge in Louisiana built entirely with high-performance concrete. The concrete is stronger, denser and less porous than normal concrete, and less vulnerable to saltwater induced corrosion. The new bridge’s innovative design uses reinforced concrete walls to improve resistance to damage from barge collisions.

Example: Ocean City Causeway, NJ

Beginning in 2006, N.J. DOT started the first part of an effort to replace the Route 52 Causeway bridges and the roadway section between Somers Point and Ocean City – including the elimination of the Somers Point Circle. The project, anticipated to be completed next year, is one of the state's largest projects and is critical because it is the emergency evacuation route for Ocean City.

Two fixed and two moveable bridges will be replaced by two bridges that will have two high fixed spans over Ship Channel and Beach Thorofare (Intracoastal Waterway) and a touchdown on Rainbow Island. The new roadway section will have two 12-foot lanes and 8-foot minimum outside shoulders in each direction separated by a concrete median barrier. Construction will continue on the existing north- and southbound lanes of the Route 52 bridges at Elbow and Garrets Islands and the roadway over Rainbow Island. The northbound lanes are being built first to minimize interference with traffic. The rest of the causeway, including the elimination of the two drawbridges, at the Ocean City and Somers Point limits and the elimination of the Somers Point Circle will take place along with improvements to MacArthur Boulevard. This project extends from the intersection of Routes 9 and 52 in Somers Point, south along Route 52 (MacArthur Boulevard), through the Somers Point Circle and over Great Egg Harbor Bay to Ocean City at Ninth Street and Bay Avenue.

Many benefits have already been realized. For example, the completed new structure and raised roadway into Ocean City has improved the emergency evacuation route out of the city during flood conditions. Also, the new structure eliminates the need to raise the draw bridge at the old section that is still being replaced. This feature eliminated delay and reduced congestion that would have occurred due to the passing of ships through the channel. The completed section does improve safety (provides pedestrian/bike/emergency pull off) over that completed section, but not over the whole length. The completed section doesn't increase capacity from the overall roadway standpoint because of the short segment of old roadway still acts as a restriction.

Another important way to increase the flow of traffic over the transportation network is to expand highway capacity in heavily congested corridors, such as major trucking routes, commuter corridors in growing urban areas, or roads providing access to expanding airports.

Example: Manchester Airport Access Road, Manchester, NH.

The Manchester Airport Access Road (MAAR) project provides a new four-lane, limited access highway facility to the Manchester Airport to address the existing and future transportation needs of the expanding airport and surrounding developing industrial commercial areas. The new highway connects the F.E. Everett Turnpike and U.S. Route 3, west of the Merrimack River, with NH Route 3A (Brown Ave.) and the Airport's South Perimeter Road east of the river.

The project includes construction of two grade-separated interchanges, two roundabouts, seven bridges, a multi-use path, and other related roadway work. It improves safety and congestion by providing direct access on a new roadway facility to the Manchester Airport and removes traffic from local roads. This direct access makes it more convenient for the traveling public, and improves air quality by taking traffic off of the stop-and-go local network and provides a direct airport access option from the F.E. Everett Turnpike. This new facility will open to traffic on Nov. 11, 2011. The only work that remains will be landscaping, minor connection work to local roads, and removal of temporary roads. The use of ARRA funds allowed the New Hampshire Department of Transportation to accelerate the completion of the project by two years.

Example: The "Fort to Port" corridor between Fort Wayne, IN, and Toledo, OH.

In October 2009, a newly reconstructed 22.5-mile stretch of US-24 officially opened, from the Ohio-Indiana state border to Defiance, Ohio, where it connects with an existing bypass. This new stretch of roadway is part of the $300 million Major Moves construction project that is improving access between Fort Wayne to the Port of Toledo. US 24 has become a critical shipping route, with trucks representing a third of the overall traffic. By replacing the former two-lane highway to four lanes, this project will alleviate safety concerns about the mixture of truck traffic and residential travel. Studies on improvements to US 24 were initiated years ago for safety and economic development reasons. When combined with the Hoosier Heartland Corridor, the new, limited access travel corridor allows for the distribution of products from Lafayette to the Great Lakes ports. In addition to the 23-mile segment that opened in 2009, two additional sections between Defiance and Napoleon opened the previous year. Construction of the remaining portions of the road is under way, and is expected to be completed in 2012. U.S. 24 is a major transportation corridor linking agricultural and industrial areas, stretching from Ontario, Canada, through Detroit to Toledo, and westward to Fort Wayne. U.S. 24 provides access to the Port of Toledo, to Toledo Express Airport and to major rail carriers along the corridor.

Congestion does not only affect our nation's highways; many airports also face substantial congestion-related delays, imposing significant costs on passengers due to delays and flight cancellations. In 2007, the FAA projected that 27 airports would need additional capacity by 2025 to accommodate the likely demand for air travel.[8] Where feasible, expanding airport capacity can be a highly beneficial response to rising congestion.

Example: JFK Runway Reconstruction Project, New York, NY

The John F. Kennedy International Airport (JFK) Runway 13R-31L ("The Bay Runway") Reconstruction Project was completed in November 2010. The project took approximately three years to construct at a total cost of approximately $204 Million. The project received approximately $15M of American Reinvestment and Recovery Act (ARRA) funding. Additional projects that were part of the airport's Delay Reduction Plan also built as part of the project including new and improved taxiways. These projects were funded in part by an $89 Million Letter of Intent (LOI) from the FAA. At more than 2.75 miles long, Kennedy's Runway 13R-31L is the second longest commercial runway in North America.

The scope of the project included the concrete replacement of the existing asphalt runway and widening of the runway from 150 to 200 feet to accommodate larger airplanes. The new runway concrete overlay is 18 inches thick and will increase the service life of the runway pavement approximately 40 years compared to an 8-year service life for asphalt pavement the project replaced. This will reduce the overall runway's lifecycle costs as well as reduce the number of future runway closures required for maintenance of the pavement. The project also included taxiway improvements designed to reduce airport delays at JFK and incrementally improve the overall operational efficiency of the airport. Three new high speed exit taxiways were included to reduce the time planes spend on the runway and thus reduce arrival delays. New multiple entrance and bypass taxiways at both ends of the runway will reduce departure delays by providing additional queuing space and increased operational flexibility for airplanes departing from both runway ends.

The project, including the new taxiways, will enable both swifter arrivals and departures, allow easier access from the runway to the taxiways and to the terminal gates. This will save time on the ground for nearly every passenger flying both in and out of JFK. The reconstructed runway and its new enhancements are estimated to reduce overall delays at JFK by 10,500 hours per year. The project also supported approximately 1,000 direct and as many as 1,500 ancillary jobs, including construction positions, asphalt and concrete production, procurement and installation of aeronautical lighting, and food services creating $800 million in wages and economic activity.

[8] "Capacity Needs in the Airspace System," Federal Aviation Administration, May 2007. http://www.faa.gov/airports/resources/publications/reports/media/fact_2.pdf

Improving highway safety by addressing hazardous locations.

Highway travel in the U.S. has become significantly safer over time. For example, NHTSA reported that the fatality rate per 100 million vehicle miles traveled reached a new low in 2009, reaching a level close to one-fifth the level in 1966.[9] At the same time, traffic accidents remain a leading cause of injury and death.[10] As a result, investments that reduce safety risks, particularly in the most hazardous areas, can have substantial net benefits. One way to improve safety is to reduce congestion: with more cars on the road, and more dangerous stop-and-go driving conditions, congested roads are often also the most hazardous. Hence, investments that reduce congestion can have additional payoffs through improvements in safety. Similarly, many investments targeted at increasing safety have the added benefit of increasing the flow of traffic by replacing or upgrading obsolete infrastructure. The kinds of investments that can efficiently improve safety on highways include reconstructing hazardous interchanges, since a significant portion of crashes occur during lane crossings and other maneuvers at interchanges; and upgrading hazardous roads with safety features, such as medians, broader shoulders, and rumble strips.

Example: The Big I: I-10 and I-95 interchange reconstruction in Jacksonville, FL.

The "Big I" project in Jacksonville, FL, reconstructed the Interstate 10/Interstate 95 interchange. The project consisted of 17 bridges, 21 ramps, and 25 lane miles built over and around traffic moving through one of the busiest interchanges in the state. The interchange has three levels with the highest ramp at 60 feet above the ground. On average, 175,000 vehicles pass through it each day.

The interchange was originally built in the 1950s and desperately needed upgrading because geometric elements were well below current standards. For instance, the I-10 WB to I-95 SB turn was so sharp; traffic had to slow to 35-45 mph before making the movement. This condition is undesirable on a high speed facility because it increases the number of accidents and increases travel time and congestion.

Construction began in February 2005 and was opened to traffic in October 2010, six months ahead of schedule saving taxpayer dollars. There were 69 companies that provided services and 470 people were employed throughout the project phases. The project has greatly improved interstate traffic flow and safety through the interchange. The project was selected as the Grand Prize winner of the 2011 AASHTO Transportation Award.

[9] *2009 Traffic Safety Facts*, NHTSA. http://www-nrd.nhtsa.dot.gov/Pubs/811402.PDF

[10] According to the Centers for Disease Control and Prevention, Motor vehicle crashes are the leading cause of death among those age 5-34 in the U.S. http://www.cdc.gov/motorvehiclesafety/index.html

Example: US-17 in SC

US 17, known in South Carolina as the "Ocean Highway," is a part of the National Highway System and the Strategic Highway Network for Defense Preparedness. It provides a direct route between the coastal cities of Myrtle Beach, Charleston and Beaufort. Earlier this year, area residents celebrated the completion of eight miles of widening improvements for US 17/ACE Basin Parkway between Gardens Corner and Lightsey Plantation.

Prior to completing the improvements, this section of US 17 was primarily a two-lane section with narrow to no outside shoulders, and was considered to be among the most dangerous roads in the state. Twenty percent of the traffic using this portion of US 17 is trucks, many of which are container trucks traveling between the ports of Charleston and I-95. The percentage of trucks is approximately double that of other US primary routes in South Carolina and almost the same as many Interstates in the State. The fatality rate along this stretch of US 17 was calculated to be 2.3 times higher than that of the multi-lane portions of US 17 and 1.5 times that of other US primary routes in South Carolina. Between 1997 and 2005, there were 983 total crashes reported. Of these, almost 6% resulted in fatalities with 33 persons killed.

The project provided both operational and safety improvements to the original two-lane facility. A four-lane, primarily divided, corridor was constructed. Wide naturally landscaped medians were established throughout the new highway section, preserving many of the historic live oak trees and protecting the ACE Basin environment. As improved safety was the primary goal of this project, adequate clear-zones were established to the extent possible, with aesthetically pleasing guardrail installed in those environmentally sensitive areas. In addition, the project included an improved drainage system, safer shoulders with rumble strips, enhanced pavement markings/markers, and the placement of an open-graded friction course (a treatment almost exclusively reserved for Interstate). Two new bridges were constructed and the at-grade intersection with US 21 was replaced with an interchange that encompassed the use of a roundabout.

This project was accomplished using the design/build contracting method and was substantially complete on 5/27/2011. An additional 15 miles of two-lane US 17, adjacent to this project, is currently under construction through another contract and is scheduled to be complete by September 2013.

Investing in public transit to move commuters more efficiently.

Investments that extend public transit to new locations can also have substantial public benefits. They may help to reduce highway congestion and pollution by enhancing the opportunities for the use of public transit in major commuter corridors, and hence reducing the number of vehicles on the roads. They can also create benefits by providing workers with access to a broader set of potential employment opportunities, promoting economic development in new areas, and improving mobility for residents, including the elderly and disabled. Key investments that can help to shift commuters from highways to public transit include the construction of new rail lines in rapidly growing corridors within metropolitan areas; and extensions of existing transit lines to serve additional riders.

Example: Green Line light rail extension in Portland, OR

In September, 2009, Oregon's TriMet transit agency opened Portland's 15-mile MAX light rail Green Line, which runs along the rebuilt Portland downtown transit mall from Union Station south to Clackamas town center. The two-year-old Green Line remains very popular, with weekday trips rising nearly 13 percent, and weekend trips rising nearly 7 percent, in August 2011 over the same period last year. MAX is one of the nation's top light rail systems. The Green Line light rail received $32 million in ARRA funds to help advance the project, which has a $436.3 million overall federal commitment, with an FTA share of 76 percent. With the Green Line, Portland's extensive transit system now includes 52 miles of route and 84 stations, and connects central Portland with the suburban cities of Beaverton, Gresham, Hillsboro, and Clackamas, as well as the Portland International Airport. This project and the four previous light rail projects (Eastside, Westside, Airport, and Interstate) were completed on or ahead of schedule, and on or under budget. Portland's transit network, with direct service to the downtown business district and attractions, helps to make this one of the most livable cities in America, offering affordable access to jobs, while spurring a healthy downtown core and continued economic development.

Example: The Mid-Jordan Transit Corridor Light Rail Project, Salt Lake City, UT

In August, 2011, the 10.6-mile Mid-Jordan Light Rail line opened, providing a direct connection to the Salt Lake City central business district, the University of Utah, and other metro area destinations. The Mid-Jordan route will connect Murray, Midvale, West Jordan and South Jordan with the main Sandy/Salt Lake TRAX line already in operation. It's the latest completed project in Utah's ambitious plan to develop a world-class public transportation backbone by 2015. The state is on track to complete 70 miles of transit line in less than seven years. Utah's extensive transit network significantly improves access to jobs for many area residents, improves air quality, and reduces highway congestion. By offering good transportation choices, Utah, as the crossroads of the West, is well positioned to compete for new jobs, new businesses, and a vibrant tourist trade. The Federal Transit Administration has committed to provide 80 percent of the funding for mid-Jordan, including $90.9 million in ARRA funds and $337.4 million in other funding. A 2006 voter-approved sales tax for transportation helps Utah to leverage state, local, and federal funds for its $2.5 billion FrontLines 2015 public transportation plan, which includes building additional transit to the airport, a 45-mile commuter rail extension to Provo, and other key destinations.

Example: Light rail extension in the Dallas metro area, TX

The Dallas Area Rapid Transit's (DART) 24-mile Green Line light rail extension opened for service six months ahead of schedule in December, 2010. DART was able to finish the project early thanks to a $78.4 million-boost from ARRA as part of a seven-year, $700 million federal funding commitment to the project. The light rail extension runs southeast from the Transitway Mall in downtown Dallas to Buckner Blvd; and northwest from Victory Station to the city of Farmers Branch and on to Carrollton. Looking at the big picture, the DART rail system is responsible for $7 billion in current, planned and projected transit-oriented development. The Green Line expansion plays a part in this and includes large and visible projects such as Ambrose at Baylor University Medical Center Station. DART continues to demonstrate visionary leadership for transit, delivering the project ahead of schedule and under budget. DART's 2011 ridership survey found that 92 percent of Green Line riders use it for work, with over 75,000 riders on an average weekday, and 85 percent of riders survey said it eases their commutes. This is a remarkable transformation for a city, and a region, dominated by an automobile culture for most of the last century.

Providing needed maintenance to existing infrastructure.

One important finding from the economic literature on the economic impact of infrastructure investments is that, in countries like the U.S. where a relatively well-developed transportation network already exists, the highest return investments will often arise from the maintenance of existing infrastructure, rather than from investments in new infrastructure.[11] Investments that maintain existing infrastructure include, for instance, the resurfacing of aging highways and airport runways and the rehabilitation of rail transit systems.

Example: I-77 rehabilitation in NC.

The I-77 Rehabilitation project replaced 6.5 miles of poor and deteriorated concrete pavement with a new, high-quality and smooth riding surface. The existing pavement was more than 40 years old, 10 years beyond its anticipated service life, and had significant cracking, pitting, and distress. The project consisted of overlaying the existing concrete pavement with a thin layer of asphalt and 11 inches of concrete from US 21 to Asbury Church Road. It also included new pavement on the ramps, wider paved shoulders, and upgraded guardrail. With more than 36,000 vehicles - 26 percent of which was truck traffic - using I-77 each day, travelers now have a road that offers an improved ride and an extended service life of another 30 years. In addition, the wider shoulders and new guardrail will enhance safety and result in fewer accidents.

[11] See, for example: Gramlich, *supra* note 1. Kalaitzidakis P. and S. Kalyvitis, 2004, "On the macroeconomic implications of maintenance in public capital," *Journal of Public Economics*, 88, 695-712. Rioja F., 2003, "Filling potholes: Macroeconomic effects of maintenance vs. new investment in public infrastructure," *Journal of Public Economics*, 87, 2281-2304.

Example: Runway rehabilitation at Nashville Airport, TN.

Nashville International Airport (BNA) is a Medium Hub Airport that is served by 9 air-carriers serving 66 markets, with the major operator being Southwest Airlines. In Fiscal Year 2011, BNA had over 4.7 million passenger enplanements, which was a 5.3 percent increase over 2010. Runway 2L-20R is 7,703 feet in length and 150 feet wide.

Prior to rehabilitation the Runway was over 35 years old and showed extensive cracking and structural deficiencies. These structural deficiencies had the potential to cause foreign object debris that could damage aircraft engines. Testing showed that the runway would deteriorate and fall below minimal service levels within 5 years if not rehabilitated.

Runway 2L-20R is one of BNA's primary instrument runways. Losing this runway would require shifting aircraft arrivals and departures to other runways. This would overall increase congestion and delays because BNA has only one other runway besides Runway 2L-20R capable of low visibility operations.

The Rehabilitation of Runway 2L-20R took approximately 1 year to construct due to seasonal timing of the project and the use of two design firms that began construction on each end of the runway. The project sustained about 300 jobs over the course of the year.

The total project cost was $28.5 million of which $21,347,131 was funded with Airport Improvement Program grants.

Innovative financing mechanisms to engage the private sector in infrastructure investment.

One way to address the need for more infrastructure investment is to attract more private capital for direct investment in transportation infrastructure. Increased reliance on the private sector to finance transportation infrastructure investments can also improve the efficiency of project selection and drive greater returns on investment. For example, in order to attract private financing, many projects incorporate dedicated revenue streams, often from user fees or other forms of usage-based pricing. Because these revenue streams link investment returns directly to user demand, they can help to guide capital towards the most efficient projects. In general, innovative financing mechanisms have the potential to engage the private sector in infrastructure investments with important public benefits. In particular, this report considers three innovative approaches to private sector engagement: public-private partnerships, particularly in the area of rail freight; Build America Bonds (BABs), as an alternative to municipal bonds that can attract new sources of private funding into the market for financing infrastructure projects; and a National Infrastructure Bank, that has the potential to leverage private capital into projects of national significance.

Public-Private Partnerships

In the U.S., most investment in freight railway infrastructure is privately financed, as that infrastructure is largely owned by the rail carriers themselves. However, even in a network based on private ownership, there are important public benefits that can be realized through investments that improve the flow of freight across the railway network. These benefits include reduced highway congestion, greater safety, and reduced pollution, when freight can be efficiently diverted from trucks to rails. Public-private partnerships between state and federal agencies and the rail carriers can be an efficient way to promote such investments.

Example: Heartland Corridor Clearance Project (KY, OH, VA, WV)

This project is a public-private partnership among Norfolk Southern and federal and state agencies to increase vertical clearances in 28 tunnels and remove 24 overhead obstructions, to allow passage of double-stacked container trains between the Port of Virginia and Columbus, Ohio. It was among the most ambitious railroad engineering projects in the past century.

Construction began in 2007, and ended in 2010. The project excavated the roofs and replaced liners in 15 tunnels, carved notches into arch tunnel roofs to allow corners of containers to pass in seven tunnels, lowered or realigned track in six tunnels to improve vertical clearances along a heavily traveled freight rail route. Insufficient vertical clearances forced double-stacked container trains to take circuitous routes or to increase the volume of commercial trucks relying on highways when capacity of rail routes was insufficient.

The benefits of this project are numerous – increased corridor capacity and better use of assets helps the shipping community and reduces commercial traffic and fuel consumption on highways, thereby improving air quality all along the route. The project also helps to reduce transit time between Norfolk and Chicago from four days to three and improves overall reliability of service. It also makes the Port of Virginia more attractive to international shippers and inland terminals.

Example: The CREATE program in Chicago, IL

The Chicago Region Environmental and Transportation Efficiency (CREATE) program is a public-private partnership between the US DOT, the State of Illinois, City of Chicago, Metra commuter rail and Class I railroad companies. CREATE involves significant financial cooperation between the private railroad industry and public government entities. In 2003, this landmark public-private partnership was formed to develop and implement a set of multi-modal infrastructure improvements to untangle congestion choke points in the Chicago transportation hub. FHWA assumed program leadership for CREATE, facilitating the development, design, and construction of the 70 component projects that are estimated to cost $3.2 billion. The 70 projects in the CREATE Program include: grade separation of six railroad crossings (rail-rail flyovers); grade separation of 25 highway-rail crossings; extensive upgrades of tracks, switches, and signal systems via 36 rail projects; viaduct improvement program; grade crossing safety enhancements; and rail operations visibility improvements.

CREATE has multiple benefits, including improved safety and operations at proposed grade-separation locations; reduced traffic congestion on the region's highways; reduced fuel consumption by and emissions from locomotives and waiting autos and trucks; and improving livability in Chicago neighborhoods by improving drainage, reducing flooding, making sidewalks more appealing and safer, and improving the pavement condition of roadways.

CREATE has received $998.3 million in federal funds to date. With this funding, 12 component projects have been completed, 13 are under construction, four have been advanced to the design phase, and 16 projects are undergoing environmental review. A key CREATE strategy has been to fill a pipeline of developed projects that have completed environmental review and preliminary design so they are ready to advance to the final design and construction phases.

Build America Bonds (BABs)

Introduced in 2009, BABs are taxable bonds for which the U.S. Treasury Department pays direct subsidy to the issuer to offset borrowing costs for public capital infrastructure projects. These bonds can function as an attractive alternative to municipal bonds, which deliver a borrowing subsidy only indirectly through the federal tax exemption to investors for interest earnings. BABs appeal to a broader class of investors through tax-exempt municipal bonds, including non-profits, pension funds and many other institutional investors. Since the inception of the program in April 2009, BABs had a very strong reception from both issuers and investors, supporting more than $181 billion of financing in 2,275 transactions in all 50 states, the District of Columbia, and two territories, for new public capital infrastructure projects such as schools, bridges and hospitals. A recent empirical study by the Treasury Department found that state and

local governments that issued BABs realized considerable savings as compared to the cost of issuing tax-exempt bonds, and that expanding the BABs program would lead to continued savings on borrowing costs for state and local governments.[12] Although the initial BABs program expired at the end of December 2010, the Administration proposed extending BABs in the President's FY 2012 Budget at a subsidy rate of 28 percent and to expand the range of eligible municipal projects.

Example: Light rail projects, Seattle, WA

Sound Transit invested $377 million, which they raised by issuing BABs, on several projects, including the following: (1) Central Link Light Rail Transit: A $2.7 billion project funded with $92 million raised from BABs and $500 million in FTA competitively-awarded capital construction funds ("New Starts"). The initial 14-mile line connects downtown Seattle to Tukwila, WA. Line opened in July 2009; (2) Airport Link Extension: A 1.7-mile light rail extension carrying the Central Link line from Tukwila to SeaTac Airport. Service began in Dec. 2009; (3) University Link Light Rail: Extends the initial Central Link project three miles north, from downtown Seattle to the University of Washington. Project funded with $69 million from BABs and $863 million in FTA New Starts. (Total project cost is $1.9B). The project also received $44 million from ARRA funds. Project is currently under construction, about 35 percent completed, on time and on budget. Service scheduled to start in Sept. 2016. These projects add tremendous transit capacity to a fast-growing region plagued by congestion, and reduce travel times to the airport, improve access to jobs in the Seattle downtown business district, and provide transportation choices to other destinations, such as the University of Washington.

National Infrastructure Bank

Another innovative approach to increasing private sector participation in infrastructure investment would the creation of a National Infrastructure Bank (NIB), as President Obama has proposed as part of the American Jobs Act. The proposed NIB would help to increase overall investment in infrastructure by attracting private capital to co-invest in specific infrastructure projects, and would help to improve the efficiency of infrastructure investment by relying on a merit-based selection process for projects. To ensure substantial leverage of private capital, the NIB would finance no more than 50 percent of the total costs of any project. The NIB would also fill in an important gap in our infrastructure funding system, by focusing on projects of national or regional significance, whose effects cross over state and jurisdictional lines. Such projects are often at a disadvantage under current financing mechanisms, including state-level infrastructure banks and bonds issued by state and local governments. As a result, the NIB would be a valuable complement to existing sources of funding, and would improve the efficiency of infrastructure investment in the U.S.

[12] "Treasury Analysis of Build America Bonds Issuance and Savings," U.S. Treasury Department, May 16, 2011. http://www.treasury.gov/initiatives/recovery/Documents/BABs%20Report.pdf

Conclusion

This report has reviewed the economic rationale for making immediate, substantial investments in transportation infrastructure. The benefits from these investments will include long-run increases in the nation's economic performance, as well as a much-needed short-run boost to economic activity to accelerate the economy's recovery from the most severe recession since the Great Depression. This report has also discussed the importance of targeting infrastructure investments in ways that will have the greatest net benefits, and has reviewed some of the specific types of infrastructure investment that can have significant benefits, as illustrated by a number of recent case studies. Finally, this report has discussed the value of innovative financing mechanisms to improve the efficiency of public infrastructure investments by increased engagement with the private sector. The evidence discussed in this report shows that recent federal investments in transportation infrastructure have already created concrete economic benefits for the American people, and an expanded effort to promote further investments will build on those successes.