

Prepared for the
Build America Investment Initiative



40 Proposed U.S. Transportation and Water Infrastructure Projects of Major Economic Significance

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This report was prepared by a team led by AECOM under contract TOS-15-F-0014 for the U.S. Department of the Treasury on behalf of the Build America Investment Initiative.

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Disclaimer

All project costs and benefits are based on assumptions and methodologies established by the authors. All findings, conclusions, and recommendations set forth in this study are those of the authors, and may not reflect those of the U.S. Department of the Treasury or the Build America Investment Initiative. The inclusion of a project in this study is not itself evidence that the project is suitable for federal funding.

AECOM is among the largest architectural and engineering consulting firms in the world and has a market share over 25 percent, as compared to the total market share of the 10 largest firms in the sectors considered in this study. AECOM has been involved in about half of the projects identified in this study. The authors' methodology for identifying these projects is described beginning on page 9.

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Executive Summary

In recognition of the important role that public works infrastructure plays in supporting national economic growth, the U.S. Department of the Treasury (Treasury), on behalf of the Build America Investment Initiative, commissioned this study. Its objective is to identify 40 proposed transportation and water infrastructure projects in the United States of major economic significance, but whose completion has slowed or is in jeopardy.¹ This study provides the public with a picture of how, if completed, these proposed infrastructure projects would have a positive impact on national and regional economic activity, such as reducing congestion, improving safety and reliability, decreasing flood hazard, and other benefits.²

This study also identifies the primary challenges facing each project, including funding shortfalls, regulatory considerations, and lack of consensus, in an effort to inform federal, state, and local debates over infrastructure policy. This project-focused approach allows the reader to more easily grasp how infrastructure investment can create real and substantial value for businesses, consumers, travelers, and community residents, and helps put a “face” to our nation’s infrastructure challenge in various regions of the country.

We were asked to focus on transportation and water projects because such projects are primarily funded by the public sector, and have experienced problems with moving forward. Projects are divided into two groups: 1) those where planning activities are underway and 2) those where planning activities are still underway and some funds have been obligated to permit limited implementation but delivery of the complete project remains pending. Other important infrastructure investments, such as those in the energy and telecommunications sectors, were not considered. These investments are typically funded directly by private investors, and have not experienced the same degree of completion uncertainty.

Different projects offer different types of benefits, and our analytical approach was sufficiently flexible to accommodate this diversity of outcomes. This is important because project sponsors develop these projects to address specific problems in their communities. For example, some projects may deliver substantial travel time savings, but not much savings in users’ travel costs. Others improve safety, but do not add capacity. Where studies already had assessed a project, our team evaluated the inputs and methodology, and adjusted the values so that net benefits would be comparable across projects. Where data was

available but a study was not completed, our team made an estimate of each project’s benefits and costs consistent with federal assessment guidance for that type of asset.

Total Net Economic Benefits

The 40 projects identified in this study would generate an estimated \$800 billion (midpoint) of net economic benefits across the nation if they were completed and available for use. This represents a range of \$700 billion to \$1.3 trillion in total benefits less capital costs over \$200 billion in net present value terms.

Our team analyzed individual proposed projects having capital costs greater than \$300 million that could be commenced (and, for many, completed) within the next five to ten years if major obstacles to completion – most often a lack of funding – are addressed.³ This minimum capital cost threshold allowed us to focus on those projects that would generate the largest absolute net economic benefits.

This study highlights a broad, representative sample of projects from across the country covering all the major types of transportation and water infrastructure such as highways, rail, waterway navigation, and dams. Traditional projects, as well as a few that emphasize new technology or the use of pricing to manage capacity, are featured. Several projects are, in fact, part of broader programs, since they include multiple, individual projects. Many promising, early-stage projects were not included because reliable data needed to estimate net economic benefits were unavailable.

Undoubtedly, this study omits many good projects.

Our team also chose to highlight two important initiatives that represent large-scale programs rather than projects. The enormous size and transformative nature of these programs warrant a deeper discussion around them, separate from that of the 40 projects of major economic significance.

An annex to this report provides in-depth profiles for all 40 projects and the two large-scale programs. Each profile is a two-page illustrated summary that describes the project, why it is an important investment, the market that would use it, considerations in its delivery, and the primary challenges to its completion, while also providing estimates of the project’s net economic benefits, capital costs, and benefit-cost ratio.

¹ We characterize projects as being “economically significant” if they have the potential to generate net economic benefits (benefits in excess of costs) that are large in magnitude.

² Certain social welfare benefits, such as quality-of-life improvements, are difficult to measure, and were not assessed.

³ Environmental elements of project costs, such as mitigation of environmental impacts or creation of environmental amenities such as wetlands or shoreline protection were included in project costs to the extent that project planning documents included them. In some cases, environmental costs (e.g. some externalities) were not measured by project sponsors, in which case they were not included as project costs.

Exhibit 1: Distribution of Projects by Region and Mode

Region	Highways	Water Resources	Railways	Ports-Waterways	Air	TOTAL
South	4	4	5	4	0	17
West	4	3	1	0	0	8
Midwest	4	1	1	1	0	7
Northeast	0	0	2	1	0	3
National	2	1	1	0	1	5
TOTAL	14	9	10	6	1	40

Note: Some projects span more than one region; in those instances the project has been assigned to the region with the greatest share of the project.

The first of two major findings from this analysis is the relative scarcity of projects that are truly national in scale, or even cover multiple states. Most projects have a state or metropolitan-area focus. While national projects frequently generate the greatest economic returns because of their larger geographic scope, they are a comparatively small percentage of the 40 projects of major economic significance. This is logical since, with few exceptions, federal programs distribute funds to regional, state, or local infrastructure agencies that make investment decisions on projects that generate benefits at the regional, state, or local levels. However, it also reflects a fragmented national vision for infrastructure. With a few exceptions, our national process for project delivery does not yield a national or regionally coordinated outcome (the Next Generation Air Transportation System, a project that would modernize the air traffic control system nationwide, stands out as a notable exception).

Total Benefit-Cost Ratio

The 40 projects identified for this study vary widely in their size and the magnitude of the net benefits generated. The total benefit-cost ratio across all 40 projects falls between 3.5 and 7.0. This means that if all the projects on the list were constructed, the nation would gain benefits in the range of \$3.50 to \$7.00 for every \$1.00 spent on capital costs.

The second major finding is that a lack of funds is by far the most common challenge to completing these projects (including those that have commenced but since been delayed). Thirty-nine of the 40 projects require increased funding, whether from taxes, user fees, or other sources.

The completion of these projects would deliver significant economic benefits to every region of the nation. In some cases, completing these projects could be transformative, potentially offering businesses and travelers large savings in time or cost that allow them to access larger markets or travel more frequently. The investments encompass freight and passenger modes with the result that the benefits generated by these projects would span the consumer, manufacturing, and service sectors of the national economy. And, as noted earlier, this list is not exhaustive. There are many good projects that have not been included – primarily due to data constraints – which would still benefit the nation's economic performance if they were undertaken. In short, overcoming the barriers to the completion of these projects represents a large economic opportunity for the United States.

1.0 Introduction

1.1 Purpose and Overview

Treasury, on behalf of the Build America Investment Initiative, commissioned our team to develop this study in order to address three basic questions:

- *What is a representative list of significant transportation and water infrastructure projects that have been proposed but face challenges to completion?*
- *What would be the economic gains to various regions and the nation if these projects were to be completed?*
- *What are the primary challenges to completing these projects?*

At the national level, the value of infrastructure investment has historically been demonstrated by “needs” studies that sum engineering estimates of the capital costs required to meet broad service delivery and/or regulatory objectives. The first such study was published in 1983, and its title made its message clear – “America in Ruins.”⁴ Since that pioneering work, numerous updates have been published by federal agencies and trade associations, including the American Society of Civil Engineers (ASCE). ASCE’s 2012 report, *A Failure to Act*, took this approach one step further by estimating the loss of value associated with system deterioration in the aggregate.

This study takes a different approach. Because the focus is on projects, the team was able to 1) screen for the most economically productive individual projects; 2) capture the benefit of technology or changing operating practices that would make existing assets more efficient; and 3) capture detail about why there is a gap between needed and actual investment levels other than a lack of adequate funding.

Working through the questions outlined above, our team compiled a list of projects that have begun development, and in some cases are moving forward, but for which there exist barriers to completion. Projects are divided into two

groups: 1) those where planning activities are underway and 2) those where planning activities are still underway and some funds have been obligated to permit limited implementation but delivery of the project remains in jeopardy. We describe each project and its major attributes, such as location, type of infrastructure, cost, expected net economic benefits (benefits less costs) for the region and the nation – and critically – the primary challenges they face. By identifying specific projects, this report allows readers to assess concretely how infrastructure impacts their daily lives, both personally and commercially.

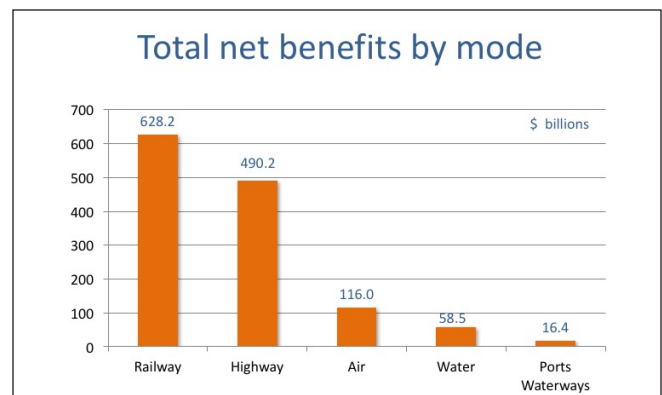
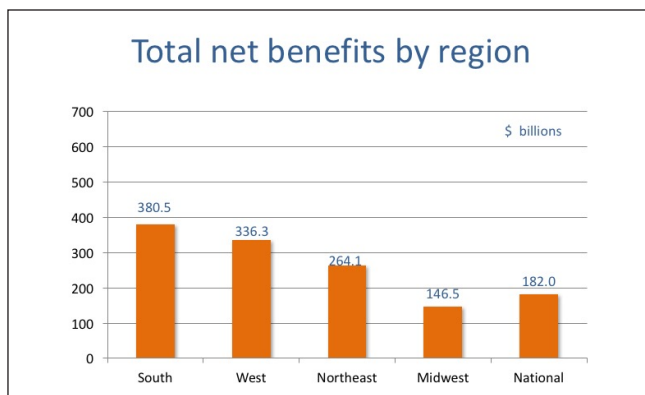
The study’s project-based approach extends a practice – frequently used at a particular locality – to a nationwide application to help justify and motivate investment, and complements existing national needs-based studies. By building from a base of vetted and assessed projects, there is an opportunity to identify actions in addition to funding that could move these projects forward to the benefit of communities and businesses across the nation.

2.0 Projects and Programs of Major Economic Significance

2.1 The 40 Projects

The 40 identified projects would generate an estimated \$500 billion to \$1.1 trillion of net economic benefits across the nation if they were completed and available for use. This represents about \$700 billion to \$1.3 trillion in total benefits less capital costs over \$200 billion in net present value terms. The benefits for many of these 40 projects at the regional or metropolitan level would be pronounced. Economic benefits that would be seen from the completion of these projects include, but are not limited to: safer passenger travel, more reliable freight shipments, less congestion on highways, and less risk of and fewer adverse consequences from flooding. A more detailed description of how infrastructure may positively affect the economy can be found in Section 4.0. The exhibits below illustrate that these benefits would be distributed across every region of the United States.

Exhibit 2: Total Net Benefits by Region and Mode (40 projects)



Note: One multi-state highway project runs across the South region, leading to the large allocation of benefits in that region.

⁴ Choato, Pat, and Susan Walter. 1983. *America in Ruins: The Decaying Infrastructure*, NC: Duke University Press.

Exhibit 3: 40 Proposed U.S. Transportation and Water Infrastructure Projects of Major Economic Significance

#	Project	Type	Region	Analysis Period (years)	Net Economic Benefits ⁽¹⁾ \$M	Benefit-Cost Ratio
Planning/ Implementation Underway						
1	I-10 Program	Highway	South	25	> \$236,000	> 10.0
2	National Traffic Signal Coordination	Highway	National	35	> \$3,900	> 10.0
3	California High Speed Rail	Railway	West	50	\$195,450	4.0 – 7.0
4	Next Generation Air Traffic Control System	Air	National	18	\$87,000	4.0 – 7.0
5	Positive Train Control	Railway	National	20	\$40,600	4.0 – 7.0
6	Hampton Roads Crossing	Highway	South	35	\$28,500	4.0 – 7.0
7	Chicago CREATE	Railway	Midwest	30	\$16,800	4.0 – 7.0
8	Rural Water Supply Program	Water	West	40	\$8,350	4.0 – 7.0
9	Northeast Corridor Improvements	Railway	Northeast	35	\$150,000	2.0 – 4.0
10	Southeast High Speed Rail	Railway	South	30	\$8,550	2.0 – 4.0
11	I-70 Missouri	Highway	Midwest	30	\$7,750	2.0 – 4.0
Planning Underway						
1	I-70 East	Highway	West	35	> \$15,700	> 10.0
2	Texas Freight Shuttle System	Railway	South	20	> \$9,400	> 10.0
3	New Orleans Rail Gateway	Railway	South	20	> \$5,500	> 10.0
4	Mississippi River Crossing	Highway	South	35	> \$5,000	> 10.0
5	Medium Diversion at White Ditch	Water	South	50	> \$3,500	> 10.0
6	Medium Diversion at Myrtle Grove	Water	South	50	> \$2,500	> 10.0
7	Brent Spence Bridge	Highway	Midwest	20	\$18,600	7.0 – 10.0
8	Savannah Harbor Expansion	Ports-IW	South	50	\$4,750	7.0 – 10.0
9	Houston-Galveston Grade Crossing Improvements	Railway	South	20	\$3,000	7.0 – 10.0
10	Atchafalaya River/Navigation	Water	South	50	\$2,250	7.0 – 10.0
11	Boston Harbor Dredging	Ports-IW	Northeast	50	\$2,200	7.0 – 10.0
12	I-35 Trade Corridor	Highway	Midwest	35	\$61,650	4.0 – 7.0
13	MTC Managed Lanes	Highway	West	35	\$7,200	4.0 – 7.0
14	2nd Avenue Subway - Phase 2	Railway	Northeast	35	\$22,150	2.0 – 4.0
15	I-11 Corridor	Highway	West	30	\$19,400	2.0 – 4.0
16	Morganza to the Gulf	Water	South	50	\$18,350	2.0 – 4.0
17	I-69 Extension	Highway	South	30	\$13,550	2.0 – 4.0
18	Puget Sound Gateway - Phase 2	Highway	West	30	\$5,250	2.0 – 4.0
19	I-5 Columbia River Crossing	Highway	West	33	\$5,000	2.0 – 4.0
20	Fargo-Moorhead Metro	Water	Midwest	50	\$3,350	2.0 – 4.0
21	Sabine Neches Waterway	Ports-IW	South	50	\$2,350	2.0 – 4.0
22	Watershed Rehabilitation Program	Water	National	100	\$2,200	2.0 – 4.0
23	Sutter Basin	Water	West	50	\$1,250	2.0 – 4.0
24	Jacksonville Harbor Dredging	Ports-IW	South	50	\$1,200	2.0 – 4.0
25	Soo Locks Modernization	Ports-IW	Midwest	50	\$1,150	2.0 – 4.0
26	Long Bridge	Railway	South	20	\$1,000	2.0 – 4.0
27	Heartland Expressway	Highway	Midwest	40	\$800	2.0 – 4.0
28	Corpus Christi Ship Channel Implementation	Ports-IW	South	50	\$650	2.0 – 4.0
29	Truckee River	Water	West	50	\$610	2.0 – 4.0

(1) To recognize the natural uncertainty in any estimate of economic benefits and costs, a range of net benefits was generated. The net economic benefits were estimated as the midpoint of the range of (1) the product of the discounted project costs and the upper bound of the benefit-cost ratio range less the value of discounted costs and (2) the product of the discounted project costs and the lower bound of the benefit-cost ratio range less the value of discounted costs, except where there is no upper bound (i.e. > 10), in which case only the lower bound figure is reported.

Notes:

- Net economic benefits are total benefits less total capital costs on a net present value basis. All benefits expressed in millions of 2015 dollars discounted at a three percent rate.
- All selected projects have a capital cost of \$300 million or more.
- IW is the abbreviation for Inland Waterway.
- One of the largest differences across project assessments was the length of the analysis period—the time over which benefits were accrued to the project. As this is an important difference across assessments and one that the project team could not adjust, we included the length of the assessment period in the table for the reader's use in reviewing the list.

While railways and highways make up the largest share of potential benefits, there are projects across all modes/project types that would benefit the U.S. economy if they could be advanced.

Exhibit 3 on the previous page presents the list of 40 projects, noting each project's type, region, net economic benefits, and ratio of net economic benefits to capital cost (benefit-cost ratio). Reflecting underlying uncertainties, a project's net economic benefits represents the midpoint of the estimated range. The list is divided into two groups: 1) those where planning activities are underway and 2) those where planning activities are underway and some funds have been obligated to permit limited implementation but delivery of the complete project lags.

See the annex for in-depth profiles of each project.

Multiple transportation modes and types of water projects are represented on the list; challenges to project delivery are not restricted to particular types of projects. Among those with the largest benefit-cost ratio are projects that relieve a bottleneck in the system or otherwise improve the performance of existing assets. Examples of these projects include Texas Freight Shuttle, National Traffic Signal Coordination, New Orleans Rail Gateway, NextGen, and Chicago CREATE.

Several highway capacity or improvement projects (different from bringing the system into a state of good repair) generate large economic benefits because of the size of the population served and their role connecting to marine, rail and air facilities. The list also contains transit projects. Though transit typically supports local mobility needs, these should be understood to deliver national economic benefits, because the projects included on the list unlock additional capacity in the heart of large established urban transit networks and thereby support the continued labor market growth of these large urban markets.

2.2 Two Large-Scale Programs

The two programs highlighted here encompass multiple projects, and are national in scale: 1) recapitalization of the entire Interstate Highway system and 2) investments to accommodate the shift to connected and automated vehicles.

The first program, the rebuilding of the Interstate Highway system, is one of the most important infrastructure challenges facing the nation. In an environment characterized by periods of uncertain and constrained funds and eroding purchasing power, state DOTs are necessarily

scaling their annual capital programs to available resources. While the reconstruction of relatively short interstate segments (which does not include projects included in Exhibit 3) is part of a national program to reconstruct the entire interstate system, individual project segments would not by themselves yield substantial net economic benefits.⁵ Recapitalization of the entire interstate highway system has projected net economic benefits of over \$1.6 trillion.

The second program, accommodating the shift to connected and automated vehicles, or simply, "autonomous vehicles," is no less challenging and arguably even more important to the future of the U.S. economy. There are many unknowns that make it difficult to develop an estimate in the same way that the 40 projects are assessed. These include the rate of adoption and the evolution of regulation among others. Over approximately the next 30 years, this new technology could generate between \$5.0 and \$7.5 trillion in net economic benefits. While not a traditional infrastructure project, the public sector has several vital roles in ensuring that adoption not be hindered. Most important of these involves regulation, both at the state and federal level. There also are infrastructure-related investments that would help speed deployment, ranging from infrastructure-based sensors to exchanging data with moving vehicles to improved and consistent pavement markings and road signs.

2.3 Why Are Some Types of Infrastructure Missing?

The list of infrastructure projects was not generated with the goal of finding an equal distribution of projects across all categories of infrastructure. Indeed, the list does not include examples of airports, toll roads, or large water and wastewater treatment facilities. These categories are similar in that the majority of them are managed by independent quasi-public regional and state authorities or by enterprise funds of a local jurisdiction and financed by revenue bonds secured by direct fees paid by facility users and concessionaires.

Federal capital grants for large airports are limited to airside facilities. Federal loans and loan guarantees via the U.S. Department of Transportation's Transportation Infrastructure Finance and Innovation Act (TIFIA) program are frequently important in the financing of new or expanded toll roads, but these are provided late in the process after most project barriers have been overcome. In sum, despite the regional and national importance of many airport and toll road projects, they do not face the same set of funding and financing hurdles that many other infrastructure projects must overcome. Thus, they did not meet one of the key

⁵ The search for projects identified many interstate projects on state DOT capital improvement plans. These projects typically represent incremental investments (mile marker 25 to 75 for example) to improve a larger corridor that by themselves do not yield benefits on a national scale but collectively represent a much larger effort that does support national economic outcomes.

criteria for selecting projects to be included in our list of projects.

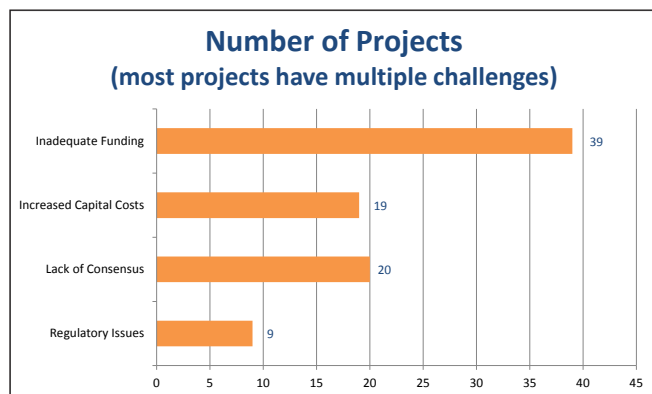
One important class of projects – municipal water supply and wastewater management – do not meet our criteria to appear on the list because they are driven by regulations and compliance timetables, not explicit benefit-cost economics. That does not mean that there is no benefit to accelerating this class of projects. Clearly, failures to meet regulations for environmental, public health, or service level standards exact costs on families and businesses that rely on clean and safe water. But by and large, these investments follow agreed timeframes for compliance with environmental and public health regulations and in the case of service level standards, norms for quantity and reliability consistent with rates and revenues agreed through either formal regulatory or governing board policy decisions.

3.0 Primary Challenges to Completion

3.1 What Are the Challenges to Completing Each Project?

A review of the 40 transportation and water infrastructure projects described in Exhibit 3 suggests that they face four major challenges to completion: (a) limited public resources, (b) significantly increased capital costs, (c) extended program and project review and permitting processes, and (d) lack of consensus among multiple public and private sector entities. A lack of public funding is by far the most common factor hindering the completion of transportation and water infrastructure projects.

**Exhibit 4:
Primary Challenges Across
the 40 Projects**



Limited Public Sector Resources. With a few exceptions, constrained public budgets, tight fiscal policies, and a general reluctance to raise taxes or user fees limit available funding—the primary challenge to advancing the projects identified in this study. Conditions are perhaps most striking at the federal level, where, for example, the 18.3 cents per gallon federal gas tax that capitalizes the federal Highway Trust Fund (HTF) has not been raised since 1993 and annual HTF revenues have shown limited growth as a result of increased vehicle fuel efficiency and reduced growth in vehicle miles traveled. Some observers believe that greater funding for the Army Corps of Engineers' direct investment program in water resources projects are needed to maintain current services at the Army Corps' existing flood control, navigation, hydropower, and multi-purpose projects.⁶

Funding at the local level – where the investment rubber meets the road – has been more responsive to demand, and fewer projects seem to be challenged by shortfalls in local funding roadblocks, especially for the most worthwhile of projects. Approximately half of the states (23) have increased their transportation user fees (e.g., gas tax, vehicle registration fee) since 2012 and other states are considering increases but a larger proportion of their expenditures have been devoted to operations and maintenance rather than capital investment. Also, many local jurisdictions, for example, have increased both revenues and expenditures for urban transit.

In response to growing regulations, replacement of old and failing infrastructure, and expansion of systems to meet growth, urban water and wastewater utilities have had to raise water and sewer rates by three percent above inflation, on average, every year for more than the last decade.⁷ Affordability concerns related to constructing expensive, but mandated, solutions to sewer overflows during rain events have resulted in 20- and 30-year construction programs to solve these multi-billion dollar challenges. In some cases – The Fargo-Moorhead Flood Diversion Project for example – local sponsors of Corps of Engineers' projects are stepping forward with innovative public-private partnership (PPP) proposals and advance funding from local sources to accelerate construction of critical water projects. Airports and maritime ports are organized primarily as enterprise funds under local and state governments; most are funded by the fees paid by users of their respective facilities or services. As a result, fees more closely reflect services that users demand, so raising fees to finance the construction of needed capital facilities tends to be somewhat less complicated.

⁶ Edward E. Belk, Jr P.E., "ASCE COPRI: Corps Infrastructure Strategy Overview and P3/P4 Review," presented to the ASCE COPRI P3 Subcommittee Symposium on Alternative Project Finance, New Orleans District of the US Army Corps of Engineers, September 10, 2015.

⁷ National Association of Clean Water Agencies, 2014 Cost of Clean Water Index, Washington DC, 2015.

Significantly Increased Capital Costs. Capital costs of transportation and water infrastructure have increased much faster than the general rate of inflation over the past 20 years — at the same time that the financial resources available for transportation and water capital investment have declined (in real dollar terms). When projects fail to make progress, financing costs may increase faster than the ability and sometimes willingness of users to pay, further complicating the delivery of good projects until users are willing to accept higher taxes or fees. Some projects are eventually downsized or eliminated entirely. Increased capital costs are also a product of enhanced design standards and regulatory requirements related to performance, safety, environmental protection, reliability, and resiliency. Recent decreases in energy prices may ameliorate the rate of capital cost inflation.

Extended Review & Permitting Processes. Successful completion of the review and permitting processes required by the National Environmental Policy Act of 1969 (NEPA), which requires federal agencies to assess the environmental effects of their proposed actions, is an important part of project development. NEPA helps promote efforts to prevent or eliminate damage to the environment, but has also extended the schedule and generally increased the cost of implementing major infrastructure projects. This is a long-standing challenge that has spanned the last 20 to 30 years. Studies conducted for the Federal Highway Administration concluded that the average time to complete a NEPA study increased from 2.2 years in the 1970s, to 4.4 years in the 1980s, to 5.1 years in the 1995 to 2001 period, to 6.6 years in 2011.⁸ In recent legislation and executive actions, policymakers have recognized the growing length of time needed for environmental review and permitting, and its impact on project delivery times and development costs, and have implemented process reforms.⁹ Effectively implementing these reforms going forward will be crucial to addressing this challenge.

Lack of Consensus Among Multiple Public and Private Sector Entities. Projects that cross jurisdictions often take longer than those within a single jurisdiction. We found evidence of this for several large multi-jurisdictional projects where proponents disagreed on project components, alignments and rights of way, allocation of project costs and benefits, or voting structure in governing and/or management boards. Examples include bridges that connect two states (the I-5 Columbia River Crossing and the Brent Spence Bridge), rail projects across state boundaries (the NY-NJ Gateway Project included as part of the NEC Corridor Reliability Improvements), or programs of national

scale where state and local coordination is complicated (National Traffic Signal Coordination Program). Large national programs often experience this same phenomenon in the program development stage. Key differences of views with regard to the program design are often settled through compromises during the legislative debate. The same is true for some regional programs where federal intervention can avoid state confrontations, such as federal and interstate compacts that govern water resource allocation and management rules across multiple states.

3.2 *How Could Challenges to Completion Be Addressed?*

Limitations on public sector resources are identified in this study as the single most common factor contributing to project completion uncertainty — particularly for highway, railway, inland waterway, and water resource projects, which rely primarily on public funding. There has been significant discussion over the past decade about increasing federal taxes or fees to fund critical infrastructure programs. In the absence of such action, however, states and local jurisdictions have stepped up to fund an increasing share of the infrastructure they consider important. This process contributes to a loss of network benefits on a broader, more coordinated scale.

Since most challenges to project completion are related to funding, and there is clear evidence that a lack of funding results in loss of economic output, it is fair to examine ways in which funding might be enhanced to create positive returns to the U.S. economy. While full consideration of funding alternatives and public finance options are beyond the scope of this study, it may be useful to examine broadly several principles around which funding solutions might be based.

Market-Based User Fees. Where infrastructure services can be allocated unambiguously to users (beneficiaries) according to their use and users can access infrastructure services only by paying for them (e.g. no “free riders”), the infrastructure finance literature maintains that the most efficient form of project finance is user payments that ideally reflect full (marginal) costs of providing (building, operating, and maintaining) service flows.¹⁰ Resurgence in the development of tolled highways, bridges, and tunnels over the last 30 years, particularly in rapidly growing states such as Florida and Texas illustrates this approach. The introduction of reliable and enforceable electronic toll collection coupled with open road tolling (i.e., toll collection with no toll booths to impede traffic flow) has further

⁸ Transportation For America, “State Transportation Funding: States Successfully Raising New Transportation Revenue,” 2015. Accessed January 2016. <http://t4america.org/maps-tools/state-transportation-funding/>

⁹ National Association of Clean Water Agencies, 2014 Cost of Clean Water Index, Washington DC, 2015.

¹⁰ Congressional Budget Office (CBO), “Approaches to Making Federal Highway Spending More Productive,” Washington, D.C., 2016.

accelerated growth in toll facilities. These new technologies provide significant savings in toll collection costs and reduced congestion through congestion-based or time-of-day pricing.

Federal Intervention for Projects of National Significance. Strict marginal cost-based user fees may prove inadequate for some new investments in infrastructure technology or economic development that will generate benefits over long periods of time. In these cases, there may be few immediate or easily identifiable beneficiaries. Such projects represent long-term commitments to the future with benefits that accrue to the nation as a whole. When this is the case, it may be more efficient from a national economic perspective to finance such projects out of general funds or a user-fee base that includes both present and future beneficiaries. Road improvements to enable autonomous vehicles may be the prime example of such a national scale program.

Government Funding to Protect Public Goods and Correct Market Failures. Efficiency is not the only criterion on which to base infrastructure financing decisions. In some cases, the outcome of infrastructure investment is so important for the welfare of the nation as a whole that fairness considerations require that all people receive at least some minimal benefit, regardless of their ability to pay. This is the rationale underlying many environmental programs that the federal and state governments help fund, such as federal grants to help capitalize State Revolving Funds that finance water and wastewater infrastructure. Environmental restoration projects, especially those that generate benefits broadly available to individuals and businesses in multiple geographies, also are examples for which additional federal and/or state general funding may be warranted.

Efficient, Alternative Project Delivery. For some types of projects, alternative project delivery methods can accelerate project delivery times and deliver more infrastructure services or less risk for every public dollar invested. In effect, more efficient project delivery substitutes in part for more investment. Innovative project delivery methods include Design-Build (DB), Design-Build-Finance (DBF), Design-Build-Operate-Maintain (DBOM), and Design-Build-Finance-Operate-Maintain (DBFOM). Innovative procurement methods generally allow competitors to propose “alternative technical concepts” (ATCs) which are reviewed and approved in advance by the customer and remain proprietary to the competitor proposing the ATC. The use of ATCs encourages competitors to introduce innovative solutions that meet client requirements but at a reduced cost.

Leveraging Limited Government Financial Resources. Leveraging limited federal dollars can stimulate state and local investment as well as private investment (or operating efficiencies) through PPPs. Virtually all surface transportation PPP projects rely in part on a TIFIA loan

to finance about a third of their project costs. The 2015 Fixing America’s Surface Transportation (FAST) Act provides sufficient funding for the USDOT to make about \$36 billion in TIFIA loans — or about \$7.5 billion annually. The Railroad Rehabilitation and Infrastructure Financing (RRIF) program administered by the Federal Railroad Administration has \$35 billion to finance the development of railroad infrastructure. The 2014 Water Resources Reform and Development Act (WRRDA) authorized two other infrastructure funds designed around a leveraging concept — one to support EPA’s water and wastewater grant program and a second for the Army Corps of Engineers. The President’s 2017 budget calls for funding EPA’s water infrastructure fund (WIFIA) but little progress has been made regarding the program authorized for the Corps of Engineers.

4.0 Infrastructure’s Contribution to the Economy

Infrastructure of all types, but especially transportation and water, is the one asset that is used every day by every business and household. Most analysis of the economic impact of infrastructure focuses on direct benefits to travelers and consumers and indirect benefits from people and industries that depend on these changes.

More important, however, are changes as individuals and businesses divert from business as usual to adjust their practices in response to improved infrastructure. As the transportation network is improved, either through new assets or improvements to existing ones, travelers reap a variety of benefits. Improvements to safety translate into lives saved and injuries avoided. Improvements to bottlenecks translate into time saved. New connections allow existing trips to be made by a shorter route, translating into reduced travel costs. And collectively, less vehicle miles traveled and less idling to accomplish the nation’s travel needs translates into cleaner air. When flooding is avoided or cleaner water delivered, resources are not spent recovering from damage and health is not compromised. When these things happen, the economy typically becomes more efficient, which supports long-term economic competitiveness. These types of changes are not relevant for projects with a local impact (say, adding a lane to an existing highway) but there is a long history of private industry change in response to investments with a national or regional scale impact. This response can occur in several ways:

- **Productivity Effects.** An improved transportation system or an expanded water resource (either larger in size or higher in the quality of service that it provides) allows industry to either produce the same amount of goods and services for less or more goods and services with no added cost.

Ex: Investments to reduce travel congestion allow a national retailer's distribution network to make the same volume of deliveries in less time, saving driver and fleet costs.

- **Factor Demand Effects.** An improved transport system also allows firms and industries to change how much they use of other economic inputs — labor, intermediate goods, and private capital. These changes may result in greater efficiencies as the investment allows firms to substitute for one or more of their traditional economic inputs.

Ex: Investments to improve connectivity and travel times allow a manufacturer to reduce inventories of production inputs and to consolidate its supply network, reducing production costs overall.

- **Output Expansion Effects.** The cost reductions or increases in output caused by the first two changes will, in turn, stimulate increased overall demand.

Ex: As production or distribution becomes less costly, firms may pass along some portion of the savings to consumers, who may purchase more as the price falls.

Our nation's history includes a series of examples of infrastructure investments that have generated national economic gains on a large scale. Examples range from the earliest decades of the republic when the Army Corps of Engineers was tasked with opening up the Ohio and Mississippi Rivers to the transcontinental railroads, funded in large part by federal and state land grants (these totaled eight to ten percent of the Continental United States). More recently, the Interstate Highway System was a prime mover for the nation's economy for at least two decades, accounting for fully one fourth of the nation's overall gains in productivity when it was first built.

Transportation

Today, transportation is in the midst of a quiet but profound revolution. Urban travelers now have choices that go beyond the classic dichotomy of private cars versus bus and rail transit. Many of these changes take advantage of new technology, with some of the most dramatic changes yet to come, including self-driving vehicles. New transportation services are now available, including many stimulated by private entrepreneurs. These changes also respond to market forces, including a world where mobile communications provide near real-time access to information for businesses and individuals. The specific impact of these changes on demand for traditional modes, such as private cars, transit, walking, biking, and taxis, as well as telecommuting is unknown but will have important implications for how we plan, fund, and operate urban and regional transportation.

Water and Wastewater

Similarly, today's wastewater management utilities, having largely made key investments to comply with government clean water mandates are transforming themselves into "Utilities of the Future" where instead of managing waste, they take actions to manage valuable resources such as water, nutrients, biosolids, heat, and latent energy. When clean water utilities reuse wastewater and offset demand for fresh water resources, generate all the energy they need to operate from their own digested methane, or substitute natural green infrastructure for concrete and steel structures, they not only reduce costs of service to residential and business customers, they produce fewer environmental residuals and cleaner waterways as well as more urban green spaces for all to enjoy. These benefits, in turn, create communities in which more people and businesses choose to locate, helping to stimulate economic productivity often associated with urban areas.

Environmental Restoration Projects

Environmental restoration projects bring the nation's natural capital into a state of good repair. Such projects can benefit communities in a variety of ways such as by buffering shore communities from hurricanes and shoreline erosion, by mitigating flooding and damage to homes and roads, and by providing wildlife habitat and recreational areas for residents.

5.0 How Was the List Developed?

The development of any list requires judgment about which projects to include and which to exclude. This process involved both developing criteria to identify eligible candidates but also pragmatic compromises — information needed to estimate net economic benefits was simply unavailable for some candidate projects. Identifying candidate projects required a set of operational definitions. Chiefly, these were:

- *How do we define infrastructure?*
- *How do we define a project?*
- *How do we define a challenge to completion?*

5.1 How Do We Define Infrastructure?

For the purposes of this study, infrastructure is taken to mean traditional public works:

- Highways
- Railways
- Airports
- Maritime Ports and Inland Waterways
- Water Resources
- Water Supply/Wastewater Management

All share common characteristics in that they are delivered largely through long-standing intergovernmental programs that require legislative, executive, and sometimes judicial action at the federal, state, and local levels. They generally require federal or state authorization at the program or project scale, state or local program administration and management, a state or local government “sponsor” or advocate, interaction with public and sometimes private capital markets, user willingness to pay taxes or fees in exchange for services, and environmental and/or economic regulatory approvals — generally at an early stage of project delivery.

5.2 How Do We Define a Project?

Like all long-lived capital investments, infrastructure projects in these categories typically share a common value chain from planning to preliminary engineering, environmental review and permitting, final engineering, funding and finance, construction, operations, and reconstruction or decommissioning. For purposes of this study, a project had to be sufficiently advanced in its delivery process that a basis for estimating its capital and operating costs had been established as had a basis for projecting its economic benefits. Typically, this meant that a project had to have progressed at least through planning and about half of preliminary engineering (e.g., about 15 percent of the design work needed to prepare a project for construction) and for some types of infrastructure, through a portion of the environmental review stage. A project also had to demonstrate that it could be delivered in whole or in part within a 10-year period. This was interpreted as requiring that the project has applicable legislative authorization; that funding requirements were roughly understood (even if funding sources had not as yet been identified), and that a local sponsor or advocate had been identified. In sum, projects on a wish list did not qualify.

5.3 How Do We Define a Challenge to Completion?

Some projects, particularly large complex projects or those using new and untested technology, may take a decade or more to begin to deliver benefits to the economy. A project was considered to face a challenge to completion if it was halted at some stage in its normal delivery process, as identified by federal, state, local, or private proponents of the project, and supported by reasonable evidence. Even if a project is moving forward in some capacity, these barriers can exist. Complex projects can face multiple challenges, including insufficient funding and/or financing, regulatory/permitting/legal issues, or a lack of consensus among project stakeholders.

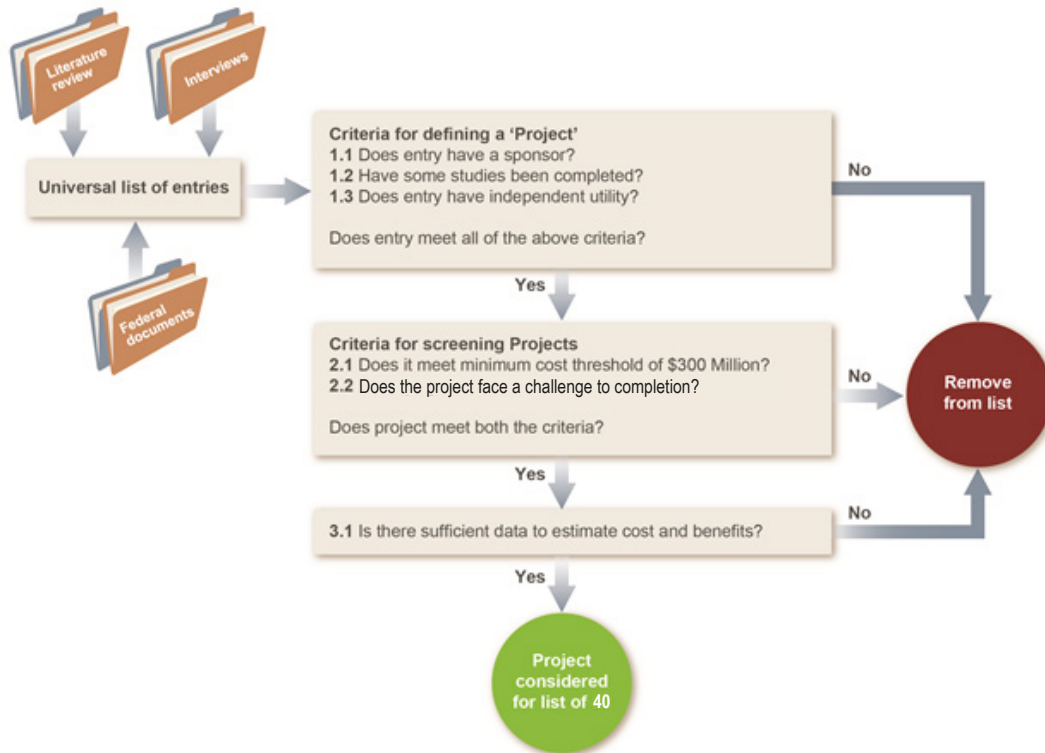
Municipal water supply and wastewater management projects are not included on our list of 40 economically important projects. Most such projects are driven by regulatory or service level requirements and not by economics. Many are costly — in the hundreds of millions to billions in total project costs — and most deliver significant public health, environmental, social, and economic benefits well in excess of these costs. These large and economically important projects can take 20-30 years to complete, which is allowable without penalty under applicable environmental and public health regulations. So, while project completion can exceed our standard for challenged projects and might otherwise be considered here, long completion times are planned and expected, so these projects do not meet our criteria for challenged projects.

5.4 Outline of the Approach

An overview of the study approach is provided in Exhibit 5. The study team first identified a “long-list” of significant and challenged infrastructure projects in the planning or planning/implementation stage of development. These were then screened to select the 40 or so projects (the “short-list”) that would deliver strong positive national or regional net economic benefits if they could be accelerated. The estimated costs and benefits of projects on the short-list were then reviewed and for some projects, created from project outputs, and then normalized around a common benefit-cost calculus. The primary challenges facing the project were then confirmed. Finally, the study team created two-page project profiles for each of the 40 identified infrastructure projects (which are presented as an Annex to this document).

Key statistics characterizing projects reviewed for the long- and the short-list were catalogued for future reference. Projects are grouped by infrastructure category for ease of access.

Exhibit 5: Development Process for the Short List of Projects



5.5 Creating the Initial List

An initial list of potential projects was developed based on news articles, published documents, and interviews with federal and state agency representatives, regional planning associations, and trade and professional organizations.

The criteria for inclusion on the initial universal list were broad, with most candidate entries being included. Entries included everything from well-defined and advanced projects, to comprehensive plans, to well-defined visions. The study team selected a broad range of entries for consideration from the universal list of entries.

Initial entries were categorized by infrastructure type:

- Airports
- Highways
- Ports/ Inland Waterways – entries related to seaports and inland waterway ports and to inland waterways
- Railways – entries related to rail transportation for both passengers and freight and both intercity and urban
- Water – entries related to water resources, environmental restoration, water supply, and wastewater management

Initial entries were also grouped into one of four national regions: Midwest, Northeast, South, and West. Several projects covered more than one region or were national in scope.

Initial entries were reviewed to identify which should be considered a project for the purposes of this study using the following criteria:

- Criterion 1.1 – Does the project have a sponsor? The entry needed to have support from a viable sponsor to have a reasonable probability of being implemented.
- Criterion 1.2 – Have some studies been completed? The entry must have had some studies (e.g. technical, environmental, or financial) completed to show it is reasonably well defined.
- Criterion 1.3 – Does the project have independent utility? The entry must be able to stand alone and not rely on other components or predecessor (but as yet unbuilt) projects to achieve individual benefits.

Entries meeting all of the above criteria were considered a project and retained for further evaluation. Those that did not were removed from the list. About 200 candidate projects were identified.

5.6 *Creating the Long-List*

Projects were then screened to identify those qualifying for inclusion on the long-list of projects – projects that were capable of providing strong positive net economic benefits on a national or regional scale – using the following criteria:

- Criterion 2.1 – Does the project have an implementation cost (undiscounted and not adjusted for inflation) of at least \$300 million? Projects costing less than this amount would be unlikely to deliver significant national or regional net economic benefits.
- Criterion 2.2 – Does the project face challenges to completion? Projects facing such challenges are those that are not being implemented according to expected schedules because of insufficient funding, lack consensus among the major stakeholders, or regulatory or permitting challenges, among others.

Projects that met both these criteria were retained on the long list of projects for further analysis. Those which did not meet these criteria or for which sufficient data were not available to permit evaluation did not advance for further study. The selection of the \$300 million threshold was a judgment and reflects a tradeoff between expanding the project search to the maximum possible scope and considering every project regardless of its size and the pragmatic need to have a workable number of projects and the expectation that projects below that threshold were unlikely to have major regional or national impacts. The \$300 million value was chosen as the study team felt it was still on the low side for a project likely to have a regional or national impact, thus ensuring that the maximum number of likely projects were considered in subsequent evaluation. About 200 projects were identified for the long list, of which about 75 were retained for the short list.

5.7 *Creating the Short-List and Final List*

Some of the projects were elements of larger programs and were therefore grouped and evaluated at the program scale. This was done for programs whose projects would not have gone forward on a stand-alone basis because the real value to the nation would be delivered only if the entire program or a large portion thereof was completed. These are clearly identified on all study materials and in this Final Study. Examples include the Northeast Corridor Intercity Rail Rehabilitation Program between Washington DC, New York City, and Boston and the California High Speed Intercity Rail Program.

The study team selected those projects for the final list which had significant net national or regional economic benefits based either on estimates of costs and benefits that had already been calculated using acceptable methods or on interim project outputs that could be converted to estimates of costs and benefits. Projects in the final list were chosen based on their net economic benefits, making sure

that they were broadly representative of various regions of the country, as well as the major transportation modes and types of water projects.

Because the projects on the list are in different phases of implementation, the full list was divided into two sections to highlight this distinction (see Exhibit 3). Projects where the implementation is underway but not advancing at the pace initially anticipated are listed at the top of the table. Those in the planning stage where implementation has not yet begun are listed in the second section of the table.

5.8 *Establishing a Common Benefit-Cost Calculus*

Projects were examined to estimate their net economic benefit to the national economy and their benefit cost ratio. This process relied on existing benefit-cost results, or where an existing assessment was not available, project data necessary to permit the project team to perform an assessment. The project team evaluated projects as presented by project sponsors and did not develop independent estimates of costs, ridership, traffic volumes, service plans, or other inputs to support the net economic benefit assessment. The methodology and guidance for developing project information and assessments thus varies across projects, following the available guidance and practice for that mode. Similarly, the level of detail with which project information is reported varies by project — for example some studies report the summary results, others provide year-by-year results. Collectively, these factors prevented the project team from fully reconciling each of the assessments. Because of these uncertainties, net project benefits were reported in a range. If a project's BCR rose above a 10.0 threshold, we reported the value as simply "over 10.0."

Projects with smaller benefit-cost ratios were reported in one of three ranges: 2.0 – 4.0, 4.0 – 7.0, and 7.0 – 10.0. The ranges were chosen by looking at the estimate ratios and selecting the breakpoints based on the groupings in the results.

In general, the process was to:

- Identify project costs and adjust to common year used for this study
- Adjust project benefits (or estimate) to common year used for this study
- Discount costs and benefits to yield net present value if not already discounted, adjusting to a common year and rate. Discount rates applied to federal infrastructure projects originate in statute and are updated periodically by the federal Office of Management and Budget (OMB) in conjunction with the federal infrastructure agencies. The Water Resources Planning Act of 1965 and the Water Resources Development Act of 1974, for example,

require an annual determination of a discount rate for federal water projects, including those of the US Bureau of Reclamation and the US Army Corps of Engineers that are covered in this project. The rate for federal fiscal year 2017 (October 1, 2016 to September 30, 2017) was reset to 2.875 percent on October 13, 2016, based on guidance from the US Treasury on the average yield of marketable US government securities with maturities of 15 years or more. The 1992 Circular A-94 (Appendix C), pursuant to the Budget and Accounting Act of 1921, the federal Office of Management and Budget (OMB) establishes real discount rates to be used to evaluate benefits and costs of all federal capital programs or policies, including transportation projects like those analyzed here, but specifically excluding federal water projects. The rate to be applied is related to the type of the project and its expected benefits and costs. If the project is anticipated to have benefits to the general public (societal benefits such as travel time savings or crash reductions), the guidance currently suggests a discount rate of 7 percent, which represents the real discount rate on private investment. If the analysis includes benefits and costs exclusively related to the public agency, for example, an analysis of an investment that would bring about a cost savings to the agency, the guidance suggests using the real discount rate for public-sector investments, which is often lower due to the lower risk associated with government borrowing. Real discount rates for 2016 range from 1 percent (10-year investment) to 1.5 percent (30-year investment). For consistency, we used both a 3 percent and 7 percent discount rate in our analysis, but for simplicity, presented results only using a 3 percent rate.

Finally, one of the largest differences across project assessments was the length of the analysis period — the time over which benefits were accrued to the project. As this is an important difference across assessments and one that the project team could not adjust, we included the length of the assessment period in the table for the reader's use in reviewing the list.

Another challenge related to the reporting of operations and maintenance costs; some projects had advanced to the point of having estimates, but many had not. Presentation of an “apples to apples” comparison required estimating net economic benefits relative to capital costs only.

5.9 *Identifying the Primary Challenges Faced by Projects*

Information collected describing project delivery was verified through interviews with relevant parties. In nearly all cases, funding was an impediment to project delivery.

Lack of consensus among stakeholders was an impediment for half of the projects. As large projects most likely to deliver national benefits are often multimodal and multi-jurisdictional, this highlights the challenge of advancing these projects. Increased capital costs as the project develops similarly play a role in half of the projects, helping to explain many of the funding challenges. As complex projects advance, the engineering requirements to solve the problem are increasingly better understood and defined — often leading to better cost estimates. Moreover, as projects advance through the public environmental process, project features may be added and the least cost alternative may not be selected. Finally, a variety of regulatory issues played a role in a quarter of the projects.

5.10 *Projects that Were Not Considered for the Short-List*

In addition to the projects discussed above, certain types of projects that might provide sufficient national or regional net economic benefits to be advanced to the short-list were not considered for various reasons including the following:

- Publicly available data were insufficient to project costs and/or benefits.
- Projects critical to the U.S. economy which have high likelihoods of being built in the future, but that are insufficiently developed at this time.
- Projects of national significance, but that are simply slow to complete and are therefore not facing challenges to completion under our definition.
- Projects that do face challenges, but the net economic benefits of which are too small to be in the list of projects of major economic significance.
- Projects without a clear sponsor.

6.0 What Did We Learn from Constructing the List?

First, there are a large number of attractive transportation and water infrastructure projects nationwide. These cover all modes and all regions of the country. Alone, the 40 projects identified in this study are estimated to generate net economic benefits of \$800 billion. Our analytic work showed that there are many similar projects behind this list. As a group, the 40 projects highlighted in this study return between \$3.50 and \$7.00 for every dollar of capital expenditure.

The greatest concentration of projects is in the South and the West. As the fastest-growing regions of the U.S., these regions are developing numerous projects to accommodate their expanding economies, rising freight flows associated with the numerous ports located here (some of the nation's busiest) and vigorous cross-border trade with Mexico. Nine of the eleven megaregions projected to develop in the U.S. between now and 2040 are in these regions. Railways and highways dominate the distribution of projects by mode, but the distinction can be misleading in some cases as these projects are supporting other modes such as ports and airports. For example, the Hampton Roads Crossing and the I-5 Columbia River Crossing are both important corridors for the maritime ports in their regions. Some I-5 Columbia River crossing project alternatives included transit too.

Second, no surprise, but lack of adequate funds is the major hurdle to completing these projects. While responsibility for this shortfall can be shared among many government agencies, it is hard not to recognize a long running reluctance by legislative decision makers at all levels to increase funding for infrastructure.

Third, there is limited interest in regional or even national projects. Part of this problem results from a general reduction in federal funds for major transportation and water infrastructure programs. This has shifted the responsibility for infrastructure funding to state and local governments. In one respect, this may produce a desirable outcome – these governments are closer to the delivery of infrastructure services and should make more efficient investment decisions and manage limited financial resources more carefully. However, as agencies are developing projects in line with their own more limited resources, there are fewer large multi-state initiatives that address the larger regional issues created by rising freight volumes and evolving logistics patterns for example. U.S. DOT's work to develop a national rail and national freight plan may eventually counter this trend.

Today there is limited incentive for state and local agencies to invest in projects with broad benefits. This is not just an

issue related to lack of funds, but partly a lack of financial and planning incentives. For example, the Interstate Highway System was built rapidly once the federal match changed from 50-50 to 90-10. Today such incentives are limited — one example is a slightly higher federal match for freight projects that reflect a statewide freight plan.

A related problem is that most of the debate over infrastructure tends to focus on “needs,” with projects of all sizes and types lumped together. This makes it difficult to focus on projects likely to have the largest national economic benefits. This study aims to help re-focus the debate on projects with significant national economic benefits relative to their costs.

Finally, the analytic work to identify the 40 projects of major economic significance relied on existing studies where available. These used a variety of assumptions and methods. Any national view regarding the value of infrastructure would benefit from a more uniform and consistent approach to reporting. The Corps of Engineers' water resource investment program, U.S. DOT's TIGER program (which both use a BCR) and the Federal Transit Administration's (FTA) New Starts Program (which uses consistent metrics across projects but not a BCR) stand out in this regard, but many other parts of infrastructure development assess projects in a less formal manner. The nation's approach to developing candidate infrastructure investments has evolved gradually over time and largely in modal silos. A consistent set of project planning and development guidelines could improve this process, although care would still be needed in making inter-modal comparisons. Similarly, care would still be needed to ensure that state and local infrastructure financing programs that are working well can continue to work well. A recent Congressional Budget Office (CBO) study identified the practice of allocating highway investment on the basis of benefits and costs, and user fees (discussed in Section 3.2) as two potential approaches for making highway investment more productive.¹¹

¹¹ Ibid.

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I-10 Program

U.S. REGION: **South**

PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: > **\$236.0 B**
BENEFIT-COST RATIO: > **10.0**



PROJECT SPONSORS:

- Florida, Alabama, Mississippi, Louisiana, Texas, New Mexico, Arizona, and California state Departments of Transportation

PROGAM:

- Related to Recapitalization of the National Interstate Highway System

PROJECT DESCRIPTION

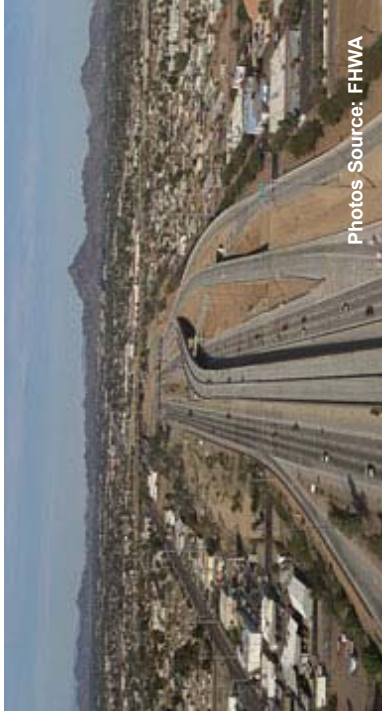
- Add capacity as needed along the I-10 corridor between Florida and California. This is particularly important for interstate movements. I-10 connects several of the nation's fastest growing states as well as major international airports and ports.

CONSIDERATIONS

- The I-10 Corridor is more than 2,600 miles long. As of 2002, the Corridor had approximately 400 miles operating at an unacceptable level of service (LOS). By 2025, the deficient mileage is forecast to reach approximately 1,500 miles.
- The average number of lanes needed by 2025 is expected to increase from 6 to 10.1 lanes along urban sections, and from 4.1 lanes to 5.2 lanes along rural sections.
- Increasing national freight flows in the corridor will result in increasing congestion and delays.

Sources: (1) Wilbur Smith

I-10 Program



Photos Source: FHWA

STATES OF FLORIDA, ALABAMA, MISSISSIPPI, LOUISIANA, TEXAS, NEW MEXICO, ARIZONA, AND CALIFORNIA MARKETS SERVED:

Population (Census, 2015 value)	108,320,000
Employment (BLS, 2015 value)	44,494,000
GDP (BEA, 2014 value, \$M)	\$ 5,721,182

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 28,629
Discounted Capital Cost	\$ 26,222
Discounted Benefits	\$ >262,220
Net Economic Benefits	\$ >235,998
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

PROJECT BENEFITS

- With capacity improvements, travel time reliability along the Corridor is expected to increase significantly over the forecast period, translating into significant reductions in delay for freight and passengers.
- Inter-regional trade, among the eight states and between the I-10 Corridor region and the rest of the United States, generates significant economic benefits in terms of jobs, earnings, and economic output.
- Provides for an improved high-speed, safe, low cost-per-mile interstate system.

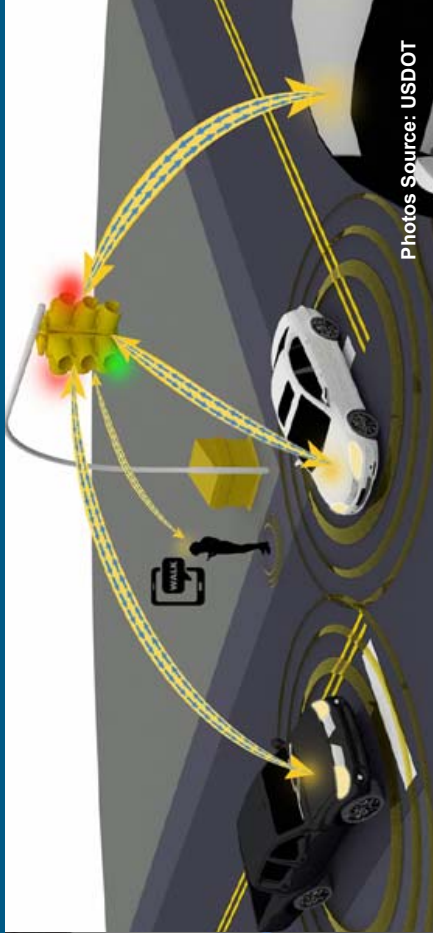
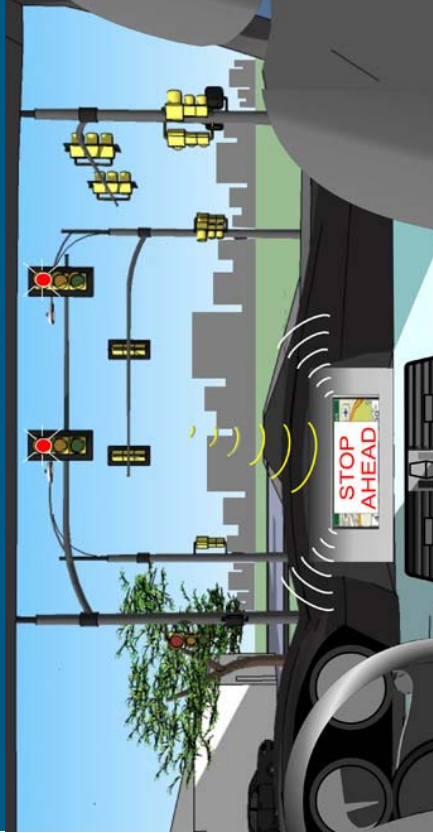
PRIMARY CHALLENGES

- Difficult to coordinate a multi-state investment strategy.
- States need funding for additional capacity to keep interstates operating at an acceptable LOS.

National Traffic Signal Coordination

U.S. REGION: **National**
PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: > **\$3.9 B**
BENEFIT-COST RATIO: > **10.0**



Photos Source: USDOT

PROJECT SPONSORS:

- Individual state DOTs, cities, and Metropolitan Planning Organizations
- Institute of Transportation Engineers

PROJECT DESCRIPTION

- Program to coordinate traffic signals nationwide provides a broad array of benefits, including reduced traffic congestion, reduced emissions (including CO₂), and reduced energy consumption.

CONSIDERATIONS

- Improving traffic signal operations can have a large impact on transportation system efficiency.
- Delays in highway travel have been increasing, and delays at traffic signals contribute an estimated 5-10% of all traffic delay, or 295 million vehicle hours on major highways alone.
- Some cities have not made the proper investments since they do not want to encourage through traffic.

Sources: (1) ITE

National Traffic Signal Coordination



PROJECT BENEFITS

- Delay savings, even when just considering major arterials, are significant.
- Fuel savings resulting from less idling and related environmental benefits including CO2 reductions as a result of smoother traffic flow.
- Improvements for freight and transit operations.
- Costs are low, at approximately \$500 to \$3,000 per intersection.

PRIMARY CHALLENGES

- Coordination among local cities and towns can be difficult since they may have different objectives and different levels of funding.
- Adaptive signal control systems are more expensive but also more effective.
- While costs are low for individual traffic signals, real gains depend on corridor improvements and many towns and cities are still short of funds.
- Traffic signals need to be maintained properly, creating additional local budget issues.

NATIONAL MARKET SERVED:

Population (Census, 2015 value)	321,419,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 455
Discounted Capital Cost	\$ 435
Discounted Benefits	\$ >4,350
Net Economic Benefits	\$ >3,915
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

California High Speed Rail

U.S. REGION: **West**

PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **\$130.3 – 260.6 B**

BENEFIT-COST RATIO: **4.0 – 7.0**



Photos Source: hsr.ca.gov

PROJECT SPONSORS:

- California High Speed Rail Authority
- Federal Railroad Administration

PROJECT DESCRIPTION

- The high-speed rail system planned for California will eventually encompass over 800 miles of rail, with up to 24 stations. Full build-out of the system will connect Los Angeles to San Francisco.

CONSIDERATIONS

- The capacity of California's intercity transportation system is insufficient to meet existing and future demand, and the current and projected future congestion of the system will continue to result in deteriorating air quality, reduced reliability, and increased travel times.

Sources: (1) CA HSR Benefit Cost Analysis

California High Speed Rail

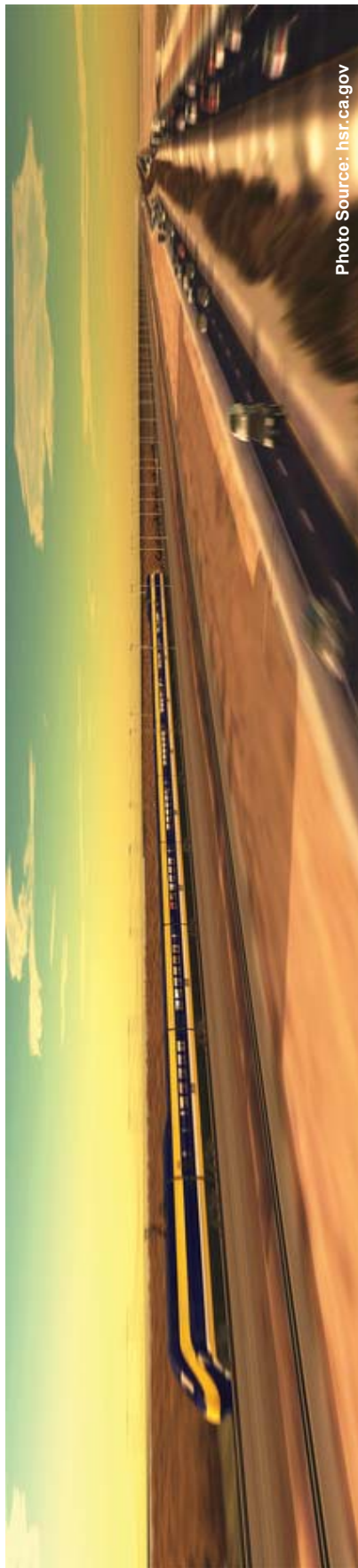


Photo Source: hsr.ca.gov

PROJECT BENEFITS

- Travel time, reliability, travel cost and productivity benefits for users transferring from auto to HSR.
- Travel time, reliability, safety and emission benefits for highway users traveling in less congested conditions due to mode shift from auto to HSR.
- Passenger delay, operating cost and emission savings in the aviation sector due to mode shift from air to HSR.

PRIMARY CHALLENGES

- Funding
- Litigation against the Authority for noncompliance with Proposition 1A and other cases over the project's environmental certification and use of cap-and-trade money.
- Logistics and scheduling at Union Station in LA

CALIFORNIA MARKET SERVED:

Population (Census, 2015 value)	39,145,000
Employment (BLS, 2015 value)	16,093,000
GDP (BEA, 2014 value, \$M)	\$ 2,305,921

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 58,794
Discounted Capital Cost	\$ 43,425
Discounted Benefits	\$ 173,700 – 303,975
Net Economic Benefits	\$ 130,275 – 260,550
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Next Generation Air Traffic Control System

U.S. REGION: **National**
PROJECT TYPE: **Air**

NET ECONOMIC BENEFIT: **\$58.0 – 116.0 B**
BENEFIT-COST RATIO: **4.0 – 7.0**



Photo Source: FAA

PROJECT SPONSORS:

- Federal Aviation Administration in partnership with individual airports nationwide



PROJECT DESCRIPTION

- NextGen is a long-term initiative that is transforming the current ground-based radar air-traffic control system to a system based on satellite navigation, automated position reporting, and digital communications.

CONSIDERATIONS

- Growth in passenger and cargo air traffic have contributed to congested airspace that creates delays, increases the likelihood of safety incidents involving aircraft, increases emissions, and reduces convenience to passengers.
- Technology advancements have made the traditional radar surveillance, ground-based navigation systems, and voice communications utilized by air traffic control outdated and inefficient.

Source: FAA

Next Generation Air Traffic Control System



Photo Source: FAA

PROJECT BENEFITS

- Increase air transportation-system capacity by allowing the nation's airports to use existing runway and terminal capacity more efficiently.
- Greater airspace safety and security by proactively identifying and resolving potential hazards and a reduction in delays experienced by airlines and passengers.
- Fuel savings and reduced GHG and emissions.
- Provide a better travel experience, with less time spent sitting on the ground and holding in the air, increases airport access, predictability, and reliability.

PRIMARY CHALLENGES

- Rollout is slower than planned due to insufficient funding by airports/airlines and disagreements among implementation partners that have slowed decision-making by FAA.

NATIONAL MARKET SERVED:

Population (Census, 2015 value)	321,419,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 25,312
Discounted Capital Cost	\$ 19,340
Discounted Benefits	\$ 77,360 – 135,380
Net Economic Benefits	\$ 58,020 – 116,040
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Positive Train Control

U.S. REGION: **National**
PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **\$27.1 – 54.1 B**
BENEFIT-COST RATIO: **4.0 – 7.0**



Photo Source: FRA

PROJECT SPONSORS:

- US Department of Transportation
- Individual privately-owned railroads
- Commuter rail lines
- Amtrak

PROJECT DESCRIPTION

- Positive Train Control (PTC) systems will prevent train-to-train collisions, overspeed derailments, and incursions into roadway work limits. PTC sends and receives a continuous stream of data transmitted by wireless signals about the location, speed, and direction of trains. PTC systems utilize advanced technologies including digital radio links, global positioning systems and wayside computer control systems that aid dispatchers and train crews in safely managing train movements.

CONSIDERATIONS

- Freight railroads will ultimately be required to install PTC on an estimated 60,000 miles of track.
- Railroads must self-fund PTC.
- Congressional deadline of December 2018.

Sources: (1) AAR

Positive Train Control

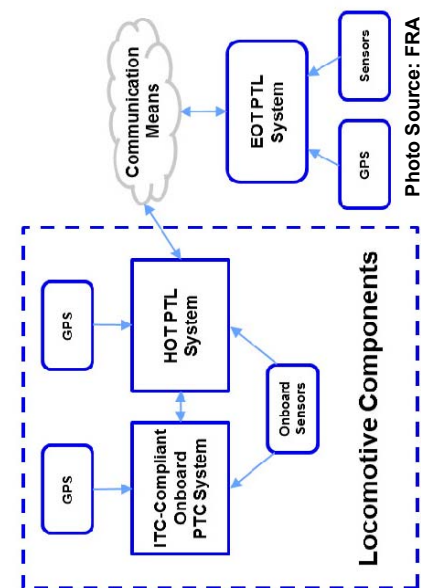


Photo Source: FRA



Photo Source: FRA

PROJECT BENEFITS

- When fully up and running, PTC will complement existing safety technologies in important ways. It will help prevent train collisions, derailments caused by high speeds, unauthorized incursions by trains onto sections of track where maintenance is taking place, and movement of a train through a track switch left in the wrong position.
- Because of modal diversions, highway accident costs, air pollution, and rail accidents would be reduced. Shippers would receive a benefit from service quality improvements.

PRIMARY CHALLENGES

- Meeting the December 2018 deadline
- Interoperability among systems

NATIONAL MARKETS SERVED:

Population (Census, 2015 value)	321,418,820
Employment (BLS, 2015 value)	141,958,417
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost (total program)	\$ 10,000
Discounted Capital Cost	\$ 9,022
Discounted Benefits	\$ 36,088 – 63,154
Net Economic Benefits	\$ 27,066 – 54,132
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Hampton Roads Crossing

U.S. REGION: South
PROJECT TYPE: Highway

NET ECONOMIC BENEFIT: \$19.0 – 38.0 B
BENEFIT-COST RATIO: 4.0 – 7.0



Photos Source: VDOT

PROJECT SPONSORS:

- Virginia Department of Transportation



PROJECT DESCRIPTION

- The program would provide a new crossing parallel to the I-664 Monitor Merrimac Memorial Bridge Tunnel with a connection from the new bridge tunnel to Norfolk and Portsmouth.
- Widen I-664 to the I-64/I-264 interchange in Chesapeake, VA.
- New interchanges and connections for existing highways and new roadways, and a tunnel to the west of the existing I-664 Monitor Merrimac Memorial Bridge Tunnel for vehicular and multimodal traffic.

CONSIDERATIONS

- Improve accessibility, mobility, and goods movement to help relieve congestion at the existing I-64 Hampton Roads Bridge Tunnel.
- Connect ports, the military, and major freight corridors to controlled access highways.

Sources: (1) HRT Planning Organization

Hampton Roads Crossing



Photos Source: VDOT

PROJECT BENEFITS

- Reduces congestion at Hampton Roads Bridge Tunnel for an average of over 90,000 vehicles per day.
- Increases travel at underutilized Monitor Merrimac Memorial Bridge Tunnel by an average of over 63,000 vehicles per day.
- Other benefits include improved regional travel times, improved safety, direct connections to the port and Navy, accommodating future growth in the western part of the region.
- The Port of Virginia is able to accommodate post-Panamax ships and is a designated strategic military port.

PRIMARY CHALLENGES

- Funding

VIRGINIA MARKET SERVED:

Population (Census, 2015 value)	8,383,000
Employment (BLS, 2015 value)	3,812,000
GDP (BEA, 2014 value, \$M)	\$ 462,861

STATES EAST OF THE MISSISSIPPI RIVER MARKETS SERVED:

Population (Census, 2015 value)	185,224,000
Employment (BLS, 2015 value)	82,689,000
GDP (BEA, 2014 value, \$M)	\$ 9,727,377

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 8,171
Discounted Capital Cost	\$ 6,328
Discounted Benefits	\$ 25,312 – 44,296
Net Economic Benefits	\$ 18,984 – 37,968
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Chicago CREATE

U.S. REGION: **Midwest**
PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **\$11.2 – 22.4 B**
BENEFIT-COST RATIO: **4.0 – 7.0**



Photos Source: createprogram.org

PROJECT SPONSORS:

- State of Illinois
- City of Chicago
- Metra
- Amtrak
- Freight railroads



PROJECT DESCRIPTION

- CREATE will invest in improvements to increase the efficiency of the region's passenger and freight rail infrastructure and enhance the quality of life for Chicago-area residents.
- The full program includes 37 freight, 7 passenger, and 25 grade separation projects.

CONSIDERATIONS

- Due to geometric constraints and shared tracks with passenger operations, it can take up to 30 hours for freight trains to pass through the Chicago region.
- Freight rail delays lead to increased traffic congestion on roadways, generate unnecessary levels of air pollution, raise safety concerns, adversely affect the reliability and speed of rail passenger service, and make it harder for farmers to make a profit.
- At-grade rail crossings negatively impact communities and cause chronic traffic delays on roadways.

Sources: (1) CREATE Program

Chicago CREATE



Photos Source: createprogram.org

PROJECT BENEFITS

- Reduced delay to passenger trains, freight trains, and motorists at grade separations and on the highway due to avoided truck traffic.
- Increased rail capacity and logistics cost savings through avoided truck diversions and avoided highway pavement damage.
- Safety from grade separation projects and truck travel avoided.
- Sustainability through fuel savings resulting from increased rail capacity and avoided truck trips, reduced motorist trips, and reduced emissions due to fuel savings.

PRIMARY CHALLENGES

- Funding

CHICAGO MSA MARKET SERVED:

Population (Census, 2014 value)	9,555,000
Employment (BLS, 2015 value)	4,557,000
GDP (BEA, 2014 value, \$M)	\$ 610,552

NATIONAL MARKETS SERVED:

Population (Census, 2015 value)	321,419,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost (total program)	\$ 3,910
Discounted Capital Cost	\$ 3,741
Discounted Benefits	\$ 14,964 – 26,187
Net Economic Benefits	\$ 11,223 – 22,446
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Rural Water Supply Program

U.S. REGION: West
PROJECT TYPE: Water

NET ECONOMIC BENEFIT: \$5.6 – 11.1 B
BENEFIT-COST RATIO: 4.0 – 7.0



Photo Source: EPA



Photo Source: EPA



Photo Source: Bureau of Reclamation

PROJECT SPONSORS:

- States of New Mexico, North Dakota, South Dakota, Minnesota, Montana and Iowa
- North Central Montana Regional Water Authority
- Rocky Boy's Reservation
- Garrison Diversion Conservancy District
- Eastern New Mexico Water Utility Authority
- Fort Peck Tribes
- Dry Prairie Rural Water Authority
- Bureau of Reclamation

PROJECT DESCRIPTION

- As part of the Rural Water Supply Program, financial and technical assistance is provided to serve rural communities (less than 50,000 people) and Indian tribes and tribal organizations in 17 states, to undertake appraisal investigations and feasibility studies, however, construction of a project requires a specific Act of Congress.

CONSIDERATIONS

- Insufficient water is limiting economic growth and ability to meet demands of increasing population.
- Poor water quality and inconsistent water pressure due to aging infrastructure causing extensive regulatory violations and water system shutdowns.
- Some water supplies contain high levels of manganese, iron, sulfate, copper and other minerals unsafe for long-term human consumption.

Sources: Bureau of Reclamation and Project Sponsors

Rural Water Supply Program



Photos Source: EPA

AZ, CA, CO, ID, KS, MT, NE, NV, NM, ND,
OK, OR, SD, TX, UT, WA, WY MARKETS
SERVED:

Population* (Census, 2015 value)	111,678,000
Employment (BLS, 2015 value)	47,838,000
GDP (BEA, 2014 value, \$M)	\$ 6,233,933

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 2,236
Discounted Capital Cost	\$ 1,854
Discounted Benefits	\$ 7,416 – 12,978
Net Economic Benefits	\$ 5,562 – 11,124
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs.

PROJECT BENEFITS

- Deliver safe and reliable water supply to meet the long-term water needs of rural and disadvantaged communities.
- Expands economic development opportunities.

PRIMARY CHALLENGES

- Federal funding for selected projects has not been adequate to complete the project and does not cover cost increases due to inflation.
- A lack of Federal funding at an adequate level significantly extends each project's completion date, increasing the total project cost and affecting the sponsor's ability to provide matching funding.

Northeast Corridor Improvements

U.S. REGION: **Northeast**
PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **\$75.0 – 225.0 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: NEC Future

PROJECT SPONSORS:

- Individual state DOTs, including Massachusetts, Connecticut, Rhode Island, Pennsylvania, New Jersey, New York, Delaware, Maryland, Virginia, and the District of Columbia
- Amtrak
- Federal Railroad Administration
- Corridor operators including SEPTA, NJTransit, MTA, MetroNorth, VRE, MARC, MBTA

PROJECT DESCRIPTION

- Improvements to passenger rail transportation in the Northeast Corridor from Washington, D.C. to Boston, MA. Growth in population and employment in the region, combined with changes in travel preference, will increasingly require a level of service and connectivity that cannot be supported by the existing corridor infrastructure.

CONSIDERATIONS

- The quality of service falls short due to the aging and obsolete infrastructure that has resulted from insufficient investment to maintain a state of good repair.
- A transportation system that provides capacity and options for reliable, efficient, environmentally sustainable, and cost-effective movement of passengers and goods is needed to support continued economic growth.

Sources: (1) NEC FUTURE

Northeast Corridor Improvements



Photos Source: NEC Future

DC, VA, MD, DE, NJ, PA, NY, CT, RI, AND
MA MARKETS SERVED:

Population (Census, 2015 value)	69,005,000
Employment (BLS, 2015 value)	32,424,000
GDP (BEA, 2014 value, \$M)	\$ 4,355,899

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 100,800
Discounted Capital Cost	\$ 75,000
Discounted Benefits	\$ 150,000 – 300,000
Net Economic Benefits	\$ 75,000 – 225,000
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

PROJECT BENEFITS

- Collectively, the investments would improve the state of good repair and reliability.
- Travel times between the region's economic centers would be reduced.
- Improved reliability would benefit both intercity travelers and transit commuters who share the corridor.

PRIMARY CHALLENGES

- Funding
- Governance

Southeast High Speed Rail

U.S. REGION: **South**

PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **\$4.3 – 12.8 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photo Source: Virginia CTB



Photo Source: GDOT



Photo Source: SEHSR

PROJECT SPONSORS:

- Individual state DOTs, including DC, Virginia, North Carolina, South Carolina, and Georgia
- Federal Railroad Administration

PROJECT DESCRIPTION

- Extending high-speed passenger rail services from Washington, D.C. south through Richmond, Hampton Roads, Raleigh, Charlotte, and Atlanta.
- SEHSR would connect to the Northeast Corridor in Washington, DC.

CONSIDERATIONS

- The goal is to improve intercity travel and mobility between Atlanta and DC by expanding the region's transportation capacity and reliable mode choices through improvements in passenger rail services.
- Parts of the corridor, especially along I-95, are highly congested. Regional highways and the airports along the Eastern seaboard are nearing the limits of capacity.

Sources: (1) Southeast Corridor PRCIP SDP

Southeast High Speed Rail

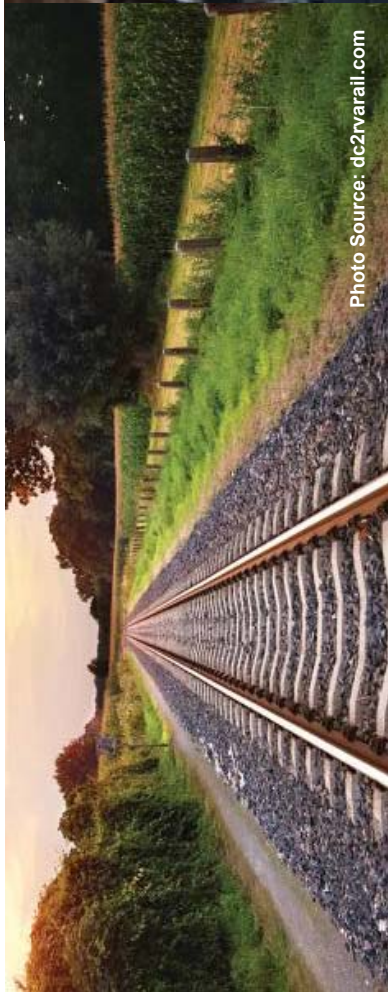


Photo Source: dc2rvrall.com



Photo Source: NC DOT

PROJECT BENEFITS

- Reductions in passenger vehicles result in safety savings, emissions reductions, highway congestion savings, highway maintenance savings, and land value accretion.
- The availability of a reliable and high-speed connection between the region's economic centers would support long-term economic development in the region.

PRIMARY CHALLENGES

- Funding
- Trackage rights agreements

DC, VA, NC, SC, AND GA MARKETS SERVED:

Population (Census, 2015 value)	34,209,000
Employment (BLS, 2015 value)	15,082,000
GDP (BEA, 2014 value, \$M)	\$ 1,725,090

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 4,644
Discounted Capital Cost	\$ 4,254
Discounted Benefits	\$ 8,508 – 17,016
Net Economic Benefits	\$ 4,254 – 12,762
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

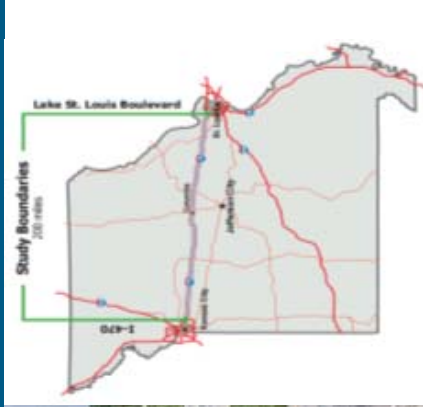
I-70 Missouri

U.S. REGION: **Midwest**
PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **\$3.9 – 11.6 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: improvei70.org



PROJECT SPONSORS:

- Missouri Department of Transportation

PROGRAM:

- National Interstate Highway System

PROJECT DESCRIPTION

- Reconstruct and add capacity (approximately 200 miles) in Missouri between Kansas City and St. Louis. The corridor is truck-heavy both between Kansas City and St. Louis and also as part of interstate routes.

CONSIDERATIONS

- I-70 is the most important transportation corridor in Missouri, connecting the state's two largest cities and carrying more rural daily traffic than any other route.
- Many portions of the facility are strained beyond capacity, increasing delays and dampening economic activity. Deteriorating pavement and poorly functioning interchanges compound the problem.
- By the year 2030, all segments of I-70 are expected to operate at unacceptable levels of service.

I-70 Missouri



Photo Source: improvei70.org

PROJECT BENEFITS

- The increased capacity and improved roadway geometrics will improve operational conditions, relieve congestion and reduce the density of traveling vehicles, thereby reducing the crash rate, improving freight movement efficiencies, and providing increased accessibility to recreational activities.
- The project will upgrade substandard bridges, interchanges, and roadways.
- The selected alternative will generally be constructed along the existing alignment to preserve the general location of the existing facility.
- Additional lanes and frontage roads will allow for redundancies and improve response times to regional and national emergencies.

PRIMARY CHALLENGES

- Funding

MISSOURI MARKET SERVED:

Population (Census, 2015 value)	6,084,000
Employment (BLS, 2015 value)	2,764,000
GDP (BEA, 2014 value, \$M)	\$ 279,835

KANSAS, MISSOURI, AND ILLINOIS MARKETS SERVED:

Population (Census, 2015 value)	21,855,000
Employment (BLS, 2015 value)	10,086,000
GDP (BEA, 2014 value, \$M)	\$ 1,160,527

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 4,208
Discounted Capital Cost	\$ 3,854
Discounted Benefits	\$ 7,708 – 15,416
Net Economic Benefits	\$ 3,854 – 11,562
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

I-70 East

U.S. REGION: **West**
PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **> \$15.7 B**
BENEFIT-COST RATIO: **> 10.0**



Photos Source: CDOT

PROJECT SPONSORS:

- Colorado Department of Transportation

PROGRAM:

- Recapitalization of the National Interstate Highway System

PROJECT DESCRIPTION

- The project in Denver would remove the deteriorating, 50-year old viaduct, rebuild I-70 below grade on the existing alignment, and place a nearly four-acre landscaped cover over the highway between Columbine Street and Clayton Street. It also would add managed lanes in each direction of the highway from I-25 to Tower Road to improve mobility.

CONSIDERATIONS

- The purpose of the project is to implement a transportation solution that improves safety, access, and mobility and addresses congestion on I-70, a key east-west national corridor.
- The need arises from increased transportation demand, limited transportation capacity, safety concerns, and transportation infrastructure deficiencies in the corridor.
- The corridor also connects to a nationally-recognized bottleneck at the intersection of I-70 and I-25.

Sources: (1) FHWA

I-70 East



Photos Source: CDOT

PROJECT BENEFITS

- The addition of new lanes, improvement to ramps, addition of auxiliary lanes, improvements to roadways, and modification of interchanges will better facilitate traffic movements.
- Implementation of managed lanes will provide additional benefits to operations of I-70 as a whole, will preserve capacity on I-70, and will provide reliable travel times. The general purpose lanes in these alternatives will operate slightly less efficiently than the managed lanes.
- Daily vehicle hours traveled will decrease with the build alternative, resulting in travel time savings for users.

PRIMARY CHALLENGES

- Funding

COLORADO MARKET SERVED:

Population (Census, 2015 value)	5,457,000
Employment (BLS, 2015 value)	2,516,000
GDP (BEA, 2014 value, \$M)	\$ 305,871

UTAH, COLORADO, AND KANSAS MARKETS SERVED:

Population (Census, 2015 value)	11,364,000
Employment (BLS, 2015 value)	5,298,000
GDP (BEA, 2014 value, \$M)	\$ 590,309

ECONOMIC BENEFITS AND COSTS

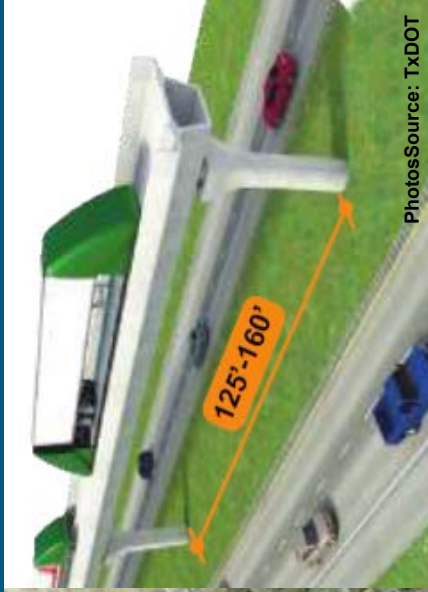
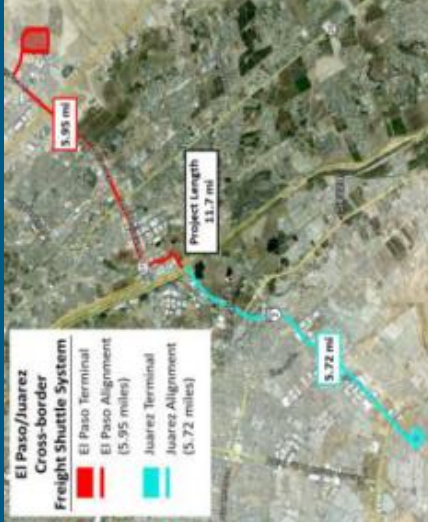
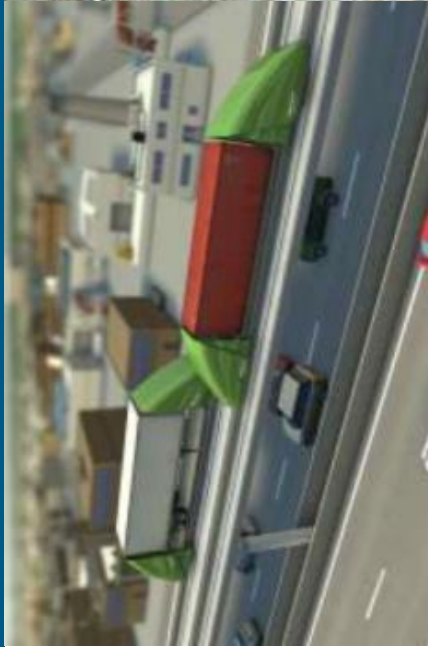
	2015\$ (M)
Capital Cost	\$ 1,904
Discounted Capital Cost	\$ 1,744
Discounted Benefits	\$ >17,440
Net Economic Benefits	\$ >15,696
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Texas Freight Shuttle System

U.S. REGION: **South**
PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **> \$9.4 B**
BENEFIT-COST RATIO: **> 10.0**



PhotosSource: TxDOT

PROJECT SPONSORS:

- TxDOT
- Freight Shuttle International
- Texas A&M Transportation Institute
- FSS Consortium

PROJECT DESCRIPTION

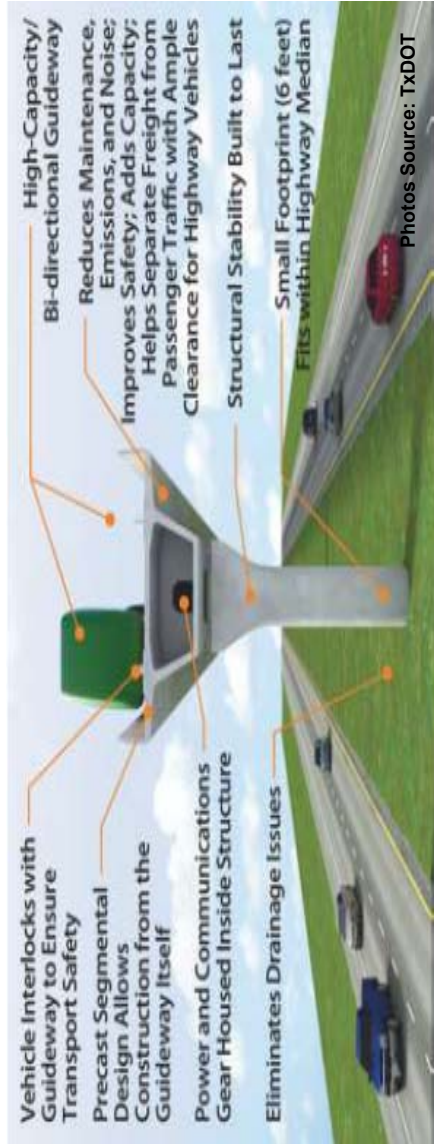
- The Freight Shuttle System (FSS) is an automated system of transport vehicles operating on an elevated and secure guideway between specially designed, secure terminals.
- The project would construct 11.7 miles of cross-border FSS connecting El Paso, TX to Ciudad Juarez, Mexico.
- FSS will use single-unit transporters propelled by linear induction motors to move freight on an electric, elevated guideway built on highway right-of-way or other available public or private ROW.

CONSIDERATIONS

- Major landside ports-of-entry to the U.S., including those along the U.S./Mexico border, experience truck volumes during peak hours that exceed capacity. In addition, the existing border crossing processes are inefficient.

Source: TxDOT

Texas Freight Shuttle System



PROJECT BENEFITS

- Reduces border congestion, security, infrastructure damage, air quality, carbon emissions and fossil fuel dependency.
- Enables trucking interests, retailers and manufacturers to improve their supply chain efficiency by automating freight movement.

PRIMARY CHALLENGES

- Funding

NATIONAL MARKET SERVED:

Population (Census, 2014 value)	321,413,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

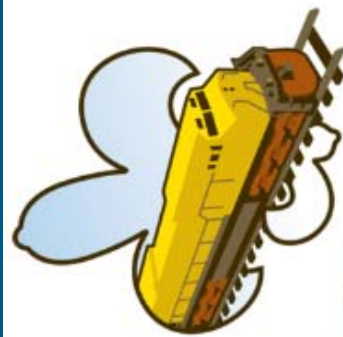
	2015\$ (M)
Capital Cost	\$ 1,094
Discounted Capital Cost	\$ 1,046
Discounted Benefits	\$ >10,460
Net Economic Benefits	\$ >9,414
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

New Orleans Rail Gateway

U.S. REGION: **South**
PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **> \$5.5 B**
BENEFIT-COST RATIO: **> 10.0**



PROJECT SPONSORS:

- Louisiana Department of Transportation and Development
- New Orleans Regional Planning Commission
- Freight operators



PROJECT DESCRIPTION

- The New Orleans Rail Gateway is the fourth largest in the country. Upgrades are required to accommodate growing rail traffic. The Project is a program of individual improvements designed to collectively reduce vehicle congestion, correct rail and roadway physical and operational deficiencies, improve safety, and facilitate emergency evacuation from the region. Significant planning work is ongoing.

CONSIDERATIONS

- The New Orleans Gateway is one of five major rail interchange points between the eastern and western Class I railroads and also has one of the four major Mississippi River rail bridges. The Gateway rail network is operating near capacity with freight trains experiencing a combined 30 hours of delay per day.

Sources: (1) LA DOTD (2) New Orleans Rail Gateway Infrastructure Feasibility Analysis

New Orleans Rail Gateway



Photo Source: LA DOTD

PROJECT BENEFITS

- Addressing capacity constraints and delay issues could expedite the transfer of railcars between the eastern and western railroads, reduce transit time and costs that are borne by shippers, and eventually benefit the consumer by providing a lower cost of living.

PRIMARY CHALLENGES

- Funding
- Governance and coordination of multiple stakeholder interests

NEW ORLEANS MSA MARKET SERVED:

Population (Census, 2014 value)	1,252,000
Employment (BLS, 2015 value)	563,000
GDP (BEA, 2014 value, \$M)	\$ 80,278

NATIONAL MARKET SERVED:

Population (Census, 2015 value)	321,413,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 721
Discounted Capital Cost	\$ 615
Discounted Benefits	\$ >6,150
Net Economic Benefits	\$ >5,535
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Mississippi River Crossing

U.S. REGION: **South**

PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **> \$5.0 B**
BENEFIT-COST RATIO: **> 10.0**



Photos Source: TDOT

PROJECT SPONSORS:

- Tennessee Department of Transportation
- Arkansas Department of Transportation

PROJECT DESCRIPTION

- The new bridge will improve cross-river mobility for people and freight in the Memphis, Tennessee area. This includes safeguarding cross-river mobility against earthquakes, crashes, hostile acts, or other catastrophe to maintain local, regional, and national traffic flow and commerce.

CONSIDERATIONS

- The Memphis area is a major multi-modal distribution center with limited rail and highway crossings of the Mississippi River. The crossings are susceptible to bridge failure and closures or restrictions due to vehicular incidents, earthquakes, and other catastrophes.
- There are two highway bridge crossings near downtown, but there is little highway redundancy north or south of Memphis since the next nearest bridge crossings lie 70 miles to the south and 90 miles to the north.

Source: Mississippi River Crossing Feasibility and Location Study

Mississippi River Crossing



Photo Source: TDOT

PROJECT BENEFITS

- Mobility for future growth including lower transportation costs for goods, enhanced productivity, and competitiveness for Memphis area businesses.
- Capacity relief will decrease operating costs and travel times, and improve economic competitiveness for businesses in the region and increase the quality of life for residents.
- Enhance freight movement for the five Class 1 railroads that serve Memphis and the inland port.
- Meet current and future transportation demand as traffic continues to increase and freight traffic is expected to double in the next two decades.
- Improve efficiency and effectiveness of the transportation system by diverting traffic from the downtown crossings and providing an alternate route.

PRIMARY CHALLENGES

- Funding

TENNESSEE, ARKANSAS, AND MISSISSIPPI MARKETS SERVED:

Population (Census, 2015 value)	12,571,000
Employment (BLS, 2015 value)	5,206,000
GDP (BEA, 2014 value, \$M)	\$ 521,947

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 603
Discounted Capital Cost	\$ 561
Total Discounted Benefits	\$ >5,610
Net Economic Benefits	\$ > 5,049
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Medium Diversion at White Ditch

U.S. REGION: **South**

PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **> \$3.5 B**
BENEFIT-COST RATIO: **> 10.0**



PROJECT SPONSORS:

- Coastal Protection and Restoration Authority
- US Army Corps of Engineers

PROGRAM:

- Louisiana Coastal Area Program

PROJECT DESCRIPTION

- Construct diversion to provide additional freshwater, nutrients, and fine sediment to the area between the Mississippi River and River aux Chenes ridges for wetland restoration.
- Restore functional hydrology and improve habitat conditions for fish and wildlife.

CONSIDERATIONS

- Wetlands deteriorating due to subsidence, lack of sediment and nutrient deposition, and erosion.
- Recent hurricanes and tropical storms have also caused significant damage and land loss.
- With an average loss of about 275 acres of marsh per year, the ecosystem is vulnerable to complete collapse.

Sources: USACE, CPRA

Medium Diversion at White Ditch



Photo Source: USACE

PROJECT BENEFITS

- Restore and maintain ecological integrity, including habitats, communities, and populations of native species.
- Contribute to achieving and sustaining a larger coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana.
- Maintain the current marsh habitat of 41,200 acres by restoring sediment inputs averaging about 1.3 million cubic yards per year.
- Restore functional hydrology.

PRIMARY CHALLENGES

- Recommended plan exceeds the cost authorization for this project.
- Pending agreement between USACE and the State of Louisiana.

LOUISIANA MARKET SERVED:

Population (Census, 2015 value)	4,671,000
Employment (BLS, 2015 value)	1,987,000
GDP (BEA, 2014 value, \$M)	\$ 251,673

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 421
Discounted Capital Cost	\$ 391
Discounted Benefits	\$ >3,910
Net Economic Benefits	\$ >3,519
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs.

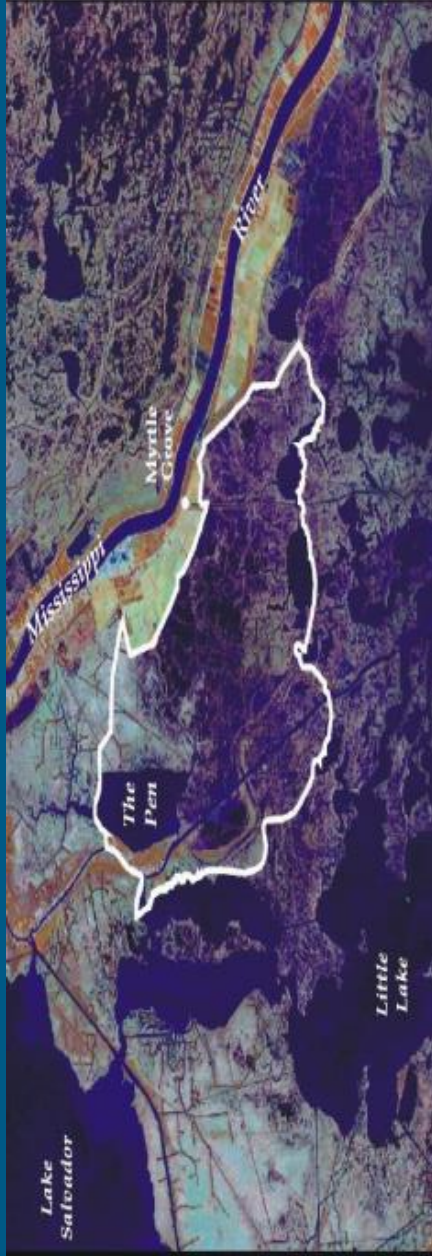
Medium Diversion at Myrtle Grove

U.S. REGION: **South**

PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **> \$2.5 B**

BENEFIT-COST RATIO: **> 10.0**



Photos Source: USACE

PROJECT SPONSORS:

- Coastal Protection and Restoration Authority
- US Army Corps of Engineers

PROGRAM:

- Louisiana Coastal Area Program

PROJECT DESCRIPTION

- Construct control structure to divert additional sediment and nutrients to nourish highly degraded existing fresh to brackish wetlands in shallow open water areas.
- Complement sediment diversion through dedicated dredging along the Mississippi River.

CONSIDERATIONS

- Substantial loss of wetlands with a shift to more saline marshes in the last 50 years.
- Moderately high wetland loss rates are primarily caused by the altered hydrology associated with navigation and flood control projects, as well as oil and gas activities.
- Without remediation, about 14,500 acres of wetlands will be lost over the next 20 years and wetland types will continue to shift towards more saline habitats.

Sources: USACE, CPRA

Medium Diversion at Myrtle Grove



PROJECT BENEFITS

- Provide up to 13,400 acres of new emergent marsh and prevent the loss of another 6,300 acres of marsh.
- Restore and maintain ecological integrity, including habitats, communities, and populations of native species.
- Contribute to achieving and sustaining a larger coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana.
- Sustainable reintroduction of riverine resources.
- Preservation and maintenance of critical coastal geomorphic structures and critical areas within the coastal ecosystem.

PRIMARY CHALLENGES

- Funding has not been obligated to construct project (partial funding could come from Coastal Wetlands Planning Protection and Restoration Act).
- Pending agreement between USACE and the State of Louisiana.

Photo Source: USACE

LOUISIANA MARKET SERVED:

Population (Census, 2015 value)	4,671,000
Employment (BLS, 2015 value)	1,987,000
GDP (BEA, 2014 value, \$M)	\$ 251,673

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 302
Discounted Capital Cost	\$ 281
Discounted Benefits	\$ >2,810
Net Economic Benefits	\$ >2,529
Benefit-Cost Ratio	>10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs.

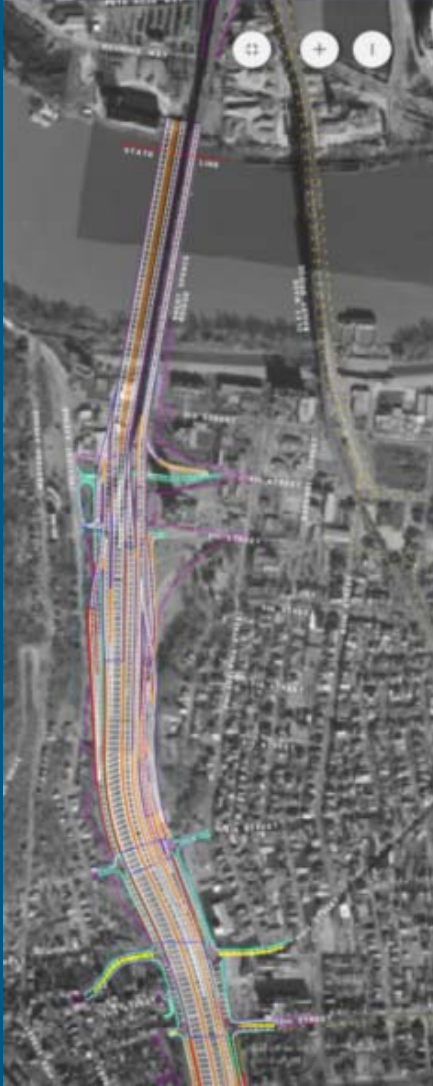
Brent Spence Bridge

U.S. REGION: Midwest
PROJECT TYPE: Highway

NET ECONOMIC BENEFIT: \$14.9 – 22.3 B
BENEFIT-COST RATIO: 7.0 – 10.0



Photos Source: brentspencebridgecorridor.com



PROJECT SPONSORS:

- Ohio and Kentucky state Departments of Transportation

PROGRAM:

- Recapitalization of the National Interstate Highway System

PROJECT DESCRIPTION

- The bridge carries both I-75 and I-71 traffic through the Greater Cincinnati and Northern Kentucky area, but it also connects 10 States (including Kentucky and Ohio) from as far north as Michigan to as far south as Florida.
- The bridge was listed as "functionally obsolete" by the National Bridge Inventory in 1998, due in large part to limited visibility and safety concerns.

CONSIDERATIONS

- The Brent Spence Bridge is a key part of America's mid-west transportation infrastructure and is important to commerce in Alabama, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Michigan, Ohio and Tennessee. The aging bridge does not adequately serve current volume and certainly cannot meet increasing demand.

Sources: (1) Report to Congress

Brent Spence Bridge



PROJECT BENEFITS

- The project will improve delivery times, reduce congestion costs resulting from excessive time spent in traffic, and improve national productivity and economic performance.
- Other positive impacts include economic returns on increased transportation network efficiencies.

PRIMARY CHALLENGES

- Funding
- Disagreements between Ohio and Kentucky and local communities about proposed tolls for the bridge

OHIO AND KENTUCKY MARKETS SERVED:

Population (Census, 2015 value)	16,039,000
Employment (BLS, 2015 value)	7,293,000
GDP (BEA, 2014 value, \$M)	\$ 763,845

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 2,826
Discounted Capital Cost	\$ 2,480
Discounted Benefits	\$ 17,360 – 24,800
Net Economic Benefits	\$ 14,880 – 22,320
Benefit-Cost Ratio	7.0 – 10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Savannah Harbor Expansion

U.S. REGION: **South**

PROJECT TYPE: **Ports-Waterways**

NET ECONOMIC BENEFIT: **\$3.8 – 5.7 B**
BENEFIT-COST RATIO: **7.0 – 10.0**



PROJECT SPONSORS:

- Georgia Ports Authority
- US Army Corps of Engineers



PROJECT DESCRIPTION

- Deepen the Savannah Harbor federal shipping channel from a depth of 42 feet to 47 feet
- Extend entrance channel by 7 miles
- Construct three bend wideners and two meeting areas
- Enlarge turning basin and terminals

CONSIDERATIONS

- Port is not able to efficiently accommodate the growing number of large container vessels demanded of world trade.

Sources: USACE, Georgia Ports Authority

Savannah Harbor Expansion



Photos Source: Georgia Ports Authority

PROJECT BENEFITS

- Reduction in harbor transit times and consequent vessel delays.
- Reduced meeting area and tide delays as a result of channel modifications, which reduce congestion within the harbor.
- Able to accommodate supersized cargo ships expected to begin arriving through an expanded Panama Canal.

PRIMARY CHALLENGES

- Available funding (federal plus local) does not currently cover the project cost, extending the project completion date, increasing the total project cost.

GEORGIA MARKET SERVED:

Population (Census, 2015 value)	10,215,000
Employment (BLS, 2015 value)	4,260,000
GDP (BEA, 2014 value, \$M)	\$ 474,697

STATES EAST OF MISSISSIPPI RIVER MARKET SERVED:

Population (Census, 2015 value)	185,224,000
Employment (BLS, 2015 value)	82,689,000
GDP (BEA, 2014 value, \$M)	\$ 9,727,377

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 691
Discounted Capital Cost	\$ 633
Discounted Benefits	\$ 4,431 – 6,330
Net Economic Benefits	\$ 3,798 – 5,697
Benefit-Cost Ratio	7.0 – 10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs

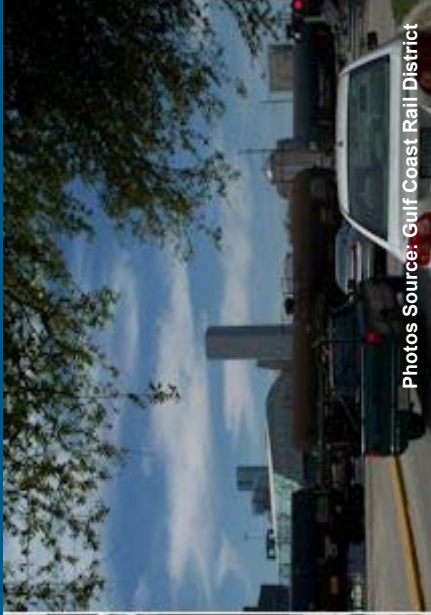
Houston-Galveston Grade Crossing Improvements

U.S. REGION: **South**

PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **\$2.4 – 3.6 B**

BENEFIT-COST RATIO: **7.0 – 10.0**



Photos Source: Gulf Coast Rail District

PROJECT SPONSORS:

- Gulf Coast Rail District



PROJECT DESCRIPTION

- Rail infrastructure investments included those designed to address congestion at key locations in the 8-county Greater Houston region. Additional investments were proposed to improve the throughput capacity for existing mainline tracks by making investments in yards, switching, and track capacity designed to increase train speeds and improve system operating performance.

CONSIDERATIONS

- Shippers expressed a general dissatisfaction with the quality and quantity of rail infrastructure in the Houston region.
- Although businesses in several sectors are ready to make expansions and investment decisions, they are hesitant due to chronic congestion in specific subdivisions in the rail system.

Sources: (1) Gulf Coast Freight Rail District

Houston-Galveston Grade Crossing Improvements



Photos Source: Gulf Coast Rail District

PROJECT BENEFITS

- Addresses congestion at five of the most significant rail system bottlenecks in the region.
- Extensions and expansions of second main tracks, and extension of the Englewood East yard tracks to increase the receiving capacity for the Englewood Yards.
- New trackage is designed to relieve congestion by allowing trains to pass one another along the highly trafficked Glidden Subdivision.
- Re-routing of about 30 trains from the East Belt to the West Belt, thereby reducing overall train delays.

PRIMARY CHALLENGES

- Funding

TEXAS MARKET SERVED:

Population (Census, 2015 value)	27,469,000
Employment (BLS, 2015 value)	11,807,000
GDP (BEA, 2014 value, \$M)	\$ 1,641,044

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 433
Discounted Capital Cost	\$ 402
Discounted Benefits	\$ 2,814 – 4,020
Net Economic Benefits	\$ 2,412 – 3,618
Benefit-Cost Ratio	7.0 – 10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

ARTM/MOHNL

U.S. REGION: **South**
PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **\$1.8 – 2.7 B**
BENEFIT-COST RATIO: **7.0 – 10.0**



Photos Source: USACE

PROJECT SPONSORS:

- Coastal Protection and Restoration Authority
- US Army Corps of Engineers

PROGRAM:

- Louisiana Coastal Area Program

PROJECT DESCRIPTION

- Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of the Houma Navigation Lock (ARTM/MOHNL) will increase freshwater flow into the northern Terrebonne Marshes through repairing banks along the GIWW, enlarging constrictions in the GIWW, and diverting additional Atchafalaya River freshwater into the Bayou Chene/GIWW system.

CONSIDERATIONS

- Natural processes combined with human activities have accelerated wetland loss and ecosystem degradation to the Northern Terrebonne Marshes.
- Loss of wetlands will have negative impacts on essential fish habitats and threatened and endangered species, as well as potential impacts to oil and gas infrastructure and navigable waterways, which currently benefit from protection provided by the wetlands.

Sources: USACE, CPRA

ARTM/MOHN



Photos Source: USACE

PROJECT BENEFITS

- Restore and maintain ecological integrity, including habitats, communities, and populations of native species.
- Prevent, reduce, and/or reverse future wetland loss.
- Achieve and maintain characteristics of sustainable marsh hydrology.
- Increase sediment and nutrient load to surrounding wetlands.
- Increase residence time of freshwater and reduce salinity levels.

PRIMARY CHALLENGES

- Pending agreement between USACE and the State of Louisiana

LOUISIANA MARKET SERVED:

Population (Census, 2015 value)	4,671,000
Employment (BLS, 2015 value)	1,987,000
GDP (BEA, 2014 value, \$M)	\$ 251,673

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 332
Discounted Capital Cost	\$ 304
Discounted Benefits	\$ 2,128 – 3,040
Net Economic Benefits	\$ 1,824 – 2,736
Benefit-Cost Ratio	7.0 – 10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs.

Boston Harbor Dredging

U.S. REGION: **Northeast**

PROJECT TYPE: **Ports-Waterways**

NET ECONOMIC BENEFIT: **\$1.8 – 2.6 B**

BENEFIT-COST RATIO: **7.0 – 10.0**



Photos Source: Massport

PROJECT SPONSORS:

- Massachusetts Port Authority
- US Army Corps of Engineers



PROJECT DESCRIPTION

- Widen and deepen main shipping channel to a depth of 47 feet.
- Additional shipping channels in port will be deepened to a depth of 40 feet.

CONSIDERATIONS

- Growth in waterborne shipping of containers and bulk commodities is constrained by lack of adequate channel dimensions, particularly depth, to meet the needs of Massport, its customers, and other terminal operators.
- Port is not able to efficiently accommodate the growing number of large container vessels demanded of world trade.

Sources: USACE, Massachusetts Port Authority

Boston Harbor Dredging

massport



Photos Source: Massport

PROJECT BENEFITS

- Effectively and efficiently accommodating existing and prospective deep-draft vessel traffic in the Port of Boston.
- Minimize the cost of transporting existing cargo volumes and anticipated future increases in cargo volumes to and from New England in an environmentally acceptable and sustainable manner.
- Use of dredged material, particularly the large volume of rock that channel deepening would yield, for habitat creation and enhancement or other purposes.

PRIMARY CHALLENGES

- Available funding (federal plus local) covers design work but not the full capital project cost, extending the project completion date and increasing the final cost to deliver the project.

MASSACHUSETTS MARKET SERVED:

Population (Census, 2015 value)	6,794,000
Employment (BLS, 2015 value)	3,482,000
GDP (BEA, 2014 value, \$M)	\$ 455,732

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 317
Discounted Capital Cost	\$ 294
Discounted Benefits	\$ 2,058 – 2,940
Net Economic Benefits	\$ 1,764 – 2,646
Benefit-Cost Ratio	7.0 – 10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs

I-35 Trade Corridor

U.S. REGION: Midwest
PROJECT TYPE: Highway

NET ECONOMIC BENEFIT: \$41.1 – 82.2 B
BENEFIT-COST RATIO: 4.0 – 7.0



Photo Source: USDOT



Photo Source: Public Domain



Photo Source: USDOT

PROJECT SPONSORS:

- Texas, Oklahoma, Kansas, Missouri, Iowa, and Minnesota state Departments of Transportation

PROGAM:

- Recapitalization of the National Interstate Highway System

PROJECT DESCRIPTION

- Recommended investment strategy for upgrading the I-35 Corridor from Texas to Minnesota to accommodate future public traffic volumes as allowed by available right of way. Includes maintaining the existing facility to rehabilitate pavements and bridge decks.
- Upgrades bridge structures to maintain integrity and widens I-35 along approximately 65% of the route to meet demand.
- Includes special provisions for truck-only lanes. Connections enhance NAFTA trade between Mexico, the US, and Canada.

CONSIDERATIONS

- I-35 is ideally positioned to be a major route for increasing levels of international trade activity. Project presents a strategy to guide future, potential improvements to I-35.

Sources: (1) Iowa DOT

I-35 Trade Corridor



Photo Source: Public Domain



Photo Source: FHWA

PROJECT BENEFITS

- Implementation of improvements along I-35 will improve travel times along the corridor and reduce vehicle operating costs and accident costs.
- The economic impact of the project will support jobs, income, wages, and value added.
- Encourage NAFTA-related trade.

PRIMARY CHALLENGES

- Funding
- Cohesive planning among impacted states

TEXAS, OKLAHOMA, KANSAS, MISSOURI, IOWA, AND MINNESOTA MARKETS SERVED:

Population (Census, 2015 value)	48,989,000
Employment (BLS, 2015 value)	22,060,000
GDP (BEA, 2014 value, \$M)	\$ 2,735,404

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 15,606
Discounted Capital Cost	\$ 13,693
Discounted Benefits	\$ 54,772 – 95,851
Net Economic Benefits	\$ 41,079 – 82,158
Benefit-Cost Ratio	4.0 – 7.0

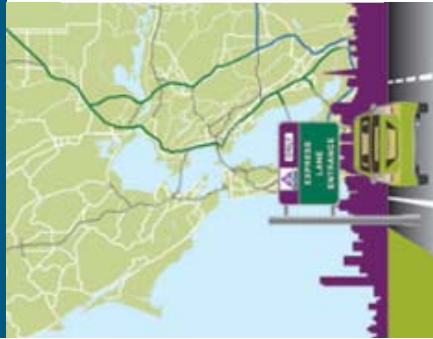
Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

MTC Managed Lanes

U.S. REGION: **West**

PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **\$4.8 – 9.6 B**
BENEFIT-COST RATIO: **4.0 – 7.0**



**METROPOLITAN
TRANSPORTATION
COMMISSION**



Photos Source: mtcexpresslanes.org

PROJECT SPONSORS:

- Alameda County Transportation Commission (ACTC)
- Metropolitan Transportation Commission (MTC)
- California Highway Patrol (CHP)
- Caltrans
- Contra Costa Transportation Authority (CCTA)
- Solano Transportation Authority (STA)

PROJECT DESCRIPTION

- The Express Lanes network is comprised of specially-designated highway lanes (HOV, HOT, express toll lanes) throughout the San Francisco Bay Area operated under MTC.
- The mission of Express Lanes is to provide a reliable travel choice, encourage ridesharing and bus ridership, as well as create transparency for customers.

CONSIDERATIONS

- Persistent congestion on Bay Area freeways continues to cause significant delay, emissions, and lost productivity for Bay Area travelers.
- Given current congestion, projected population and job growth, increased travel demand, limited opportunities for system expansion, and scarce transportation funding, the Bay Area must take a harder look at ways to more actively manage the performance of its transportation system, particularly the freeways.

Sources: (1) MTC

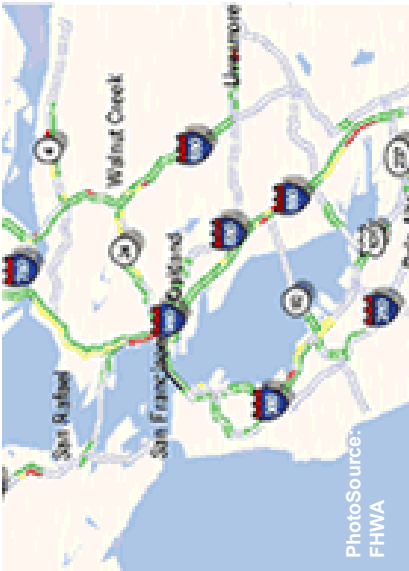
MTC Managed Lanes



Photo Source: Public Domain image attributed to Kevin Casper



Photo Source: FHWA



PhotoSource: FHWA

PROJECT BENEFITS

- Express/managed lanes are designed to improve overall mobility in the Bay Area.
- Express Lanes are free for qualifying carpools, vanpools, motorcycles and other toll-exempt vehicles.

PRIMARY CHALLENGES

- Funding

SAN FRANCISCO MSA MARKET SERVED:

Population (Census, 2014 value)	4,594,000
Employment (BLS, 2015 value)	2,255,000
GDP (BEA, 2014 value, \$M)	\$ 411,969

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 2,000
Discounted Capital Cost	\$ 1,592
Discounted Benefits	\$ 6,368 – 11,114
Net Economic Benefits	\$ 4,776 – 9,552
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

2nd Avenue Subway – Phase 2

U.S. REGION: Northeast
PROJECT TYPE: Railway

NET ECONOMIC BENEFIT: \$11.1 – 33.2 B
BENEFIT-COST RATIO: 2.0 – 4.0



Photos Source: MTA

PROJECT SPONSORS:

- New York MTA
- Federal Transit Administration

PROJECT DESCRIPTION

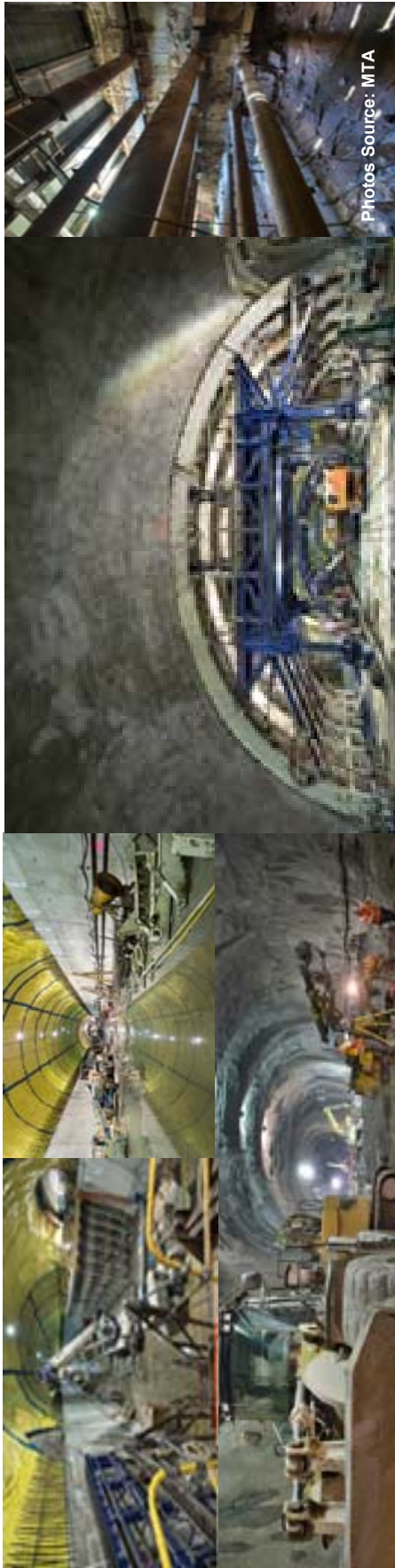
- Extension of the 2nd Avenue Subway in New York City from 125th Street to Wall Street.
- Builds on the Phase I investment which is substantially complete.

CONSIDERATIONS

- The area served by the 2nd Avenue Subway is the densest, highest value commercial corridor in the nation.
- The existing Lexington Line provides north-south mobility and operates at full capacity during peak periods. There is no ability for the transit system to support additional growth.
- Without the ability of New York's transit system to accommodate additional growth, the competitiveness of the nation's largest urban economy will erode.

Sources: (1) City University of New York

2nd Avenue Subway – Phase 2



PROJECT BENEFITS

- Will decrease crowding on the adjacent Lexington Avenue Line.
- Improved access to labor and businesses.
- Reduce travel times for those on the far east side of Manhattan and those traveling from the east side to west Midtown.

PRIMARY CHALLENGES

- Funding for Phase 2

NEW YORK CITY MSA MARKET SERVED:

Population (Census, 2014 value)	20,093,000
Employment (BLS, 2015 value)	9,279,000
GDP (BEA, 2014 value, \$M)	\$ 1,558,518

ECONOMIC BENEFITS AND COSTS

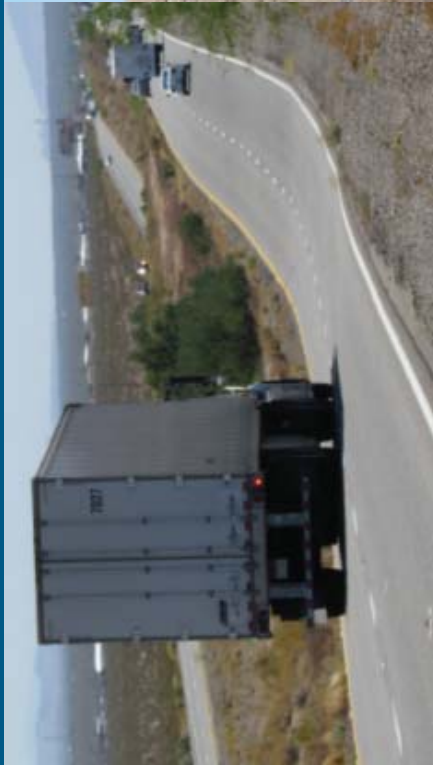
	2015\$ (M)
Capital Cost	\$ 12,600
Discounted Capital Cost	\$ 11,056
Discounted Benefits	\$ 22,112 – 44,224
Net Economic Benefits	\$ 11,056 – 33,168
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

I-11 Corridor

U.S. REGION: **West**
PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **\$9.7 – 29.1 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: AZDOT



PROJECT SPONSORS:

- Arizona Department of Transportation
- Nevada Department of Transportation

PROJECT DESCRIPTION

- Bi-state Corridor interstate highway to link Phoenix, AZ and Las Vegas, NV, as well as new routes north and south of both cities via the potential Intermountain West Corridor.

CONSIDERATIONS

- This investment would address ongoing growth in the regional economy, while providing the Intermountain West with needed north-south transportation capacity to expand its manufacturing capabilities with Mexico and Canada.
- Phoenix and Las Vegas are the largest neighboring cities not connected by an interstate. This connection would support the growth of the Megaregions in the Southwest.

Sources: (1) Nevada and Arizona DOTs

I-11 Corridor



Photos Source: AZDOT

PROJECT BENEFITS

- Travel time savings and vehicle operating cost savings result from improved reliability and changes in average network speeds with the project.
- The I-11 and Intermountain West Corridor may result in new trips that would not have otherwise been made. Induced trips create both travel time and vehicle operating cost impacts, as well as increased economic and social activity.
- Safety benefits occur as traffic switches to the safer Interstate level road.
- Crash reduction factors for new roadway improvements as well as changes in VMT results in safety benefits.
- Due to more reliable transport times and lower transport costs as a result of the I-11 and Intermountain West Corridor improvements, local manufacturers may choose to hold less inventory and reduce overhead costs. As a result, the manufacturing and machinery industries may become more competitive or profitable, resulting in freight logistics benefits.

PRIMARY CHALLENGES

- Funding

ARIZONA AND NEVADA MARKETS SERVED:

Population (Census, 2015 value)	9,719,000
Employment (BLS, 2015 value)	3,878,000
GDP (BEA, 2014 value, \$M)	\$ 421,592

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 11,370
Discounted Capital Cost	\$ 9,699
Discounted Benefits	\$ 19,398 – 38,796
Net Economic Benefits	\$ 9,699 – 29,097
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Morganza to the Gulf

U.S. REGION: **South**

PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **\$9.2 – 27.5 B**
BENEFIT-COST RATIO: **2.0 – 4.0**

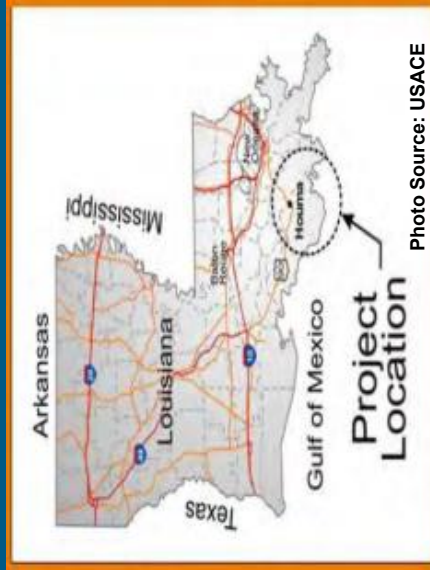


Photo Source: USACE

PROJECT SPONSORS:

- Louisiana Coastal Protection and Restoration Authority Board
- Terrebonne Levee and Conservation District
- US Army Corps of Engineers



Photo Source: Louisiana Recovery Authority

PROJECT DESCRIPTION

- About 98-miles of earthen levee, 23 water control structures, a lock complex in the Houma Navigational Canal, an adjoining floodgate, and a dam closure.
- Designed to provide hurricane and storm damage reduction benefits while ensuring navigational passage and tidal exchange.
- Located about 60 miles southwest of New Orleans, LA.

CONSIDERATIONS

- Extreme deterioration of coastal marshes have steadily increased storm surge inundation over time, resulting in greater damage and safety concerns in the vicinity of Houma, LA.
- The area is also significantly affected by tides emanating from the Gulf of Mexico.

Source: USACE

Morganza to the Gulf



PROJECT BENEFITS

- Safety of more than 150,000 people and 1,700 square miles of farmlands, industrial and residential areas.
- Protect against tidal and storm surge up to a Category 3 hurricane.
- Provides a safe harbor for fishermen in a storm event.
- Beneficial to marshes and wetlands in the Terrebonne Basin.
- Floodgates would reduce storm damage during tropical storms and allow navigable waterways to remain open during non-storm conditions.

PRIMARY CHALLENGES

- While state and local funds have been used to construct interim features, additional funding is needed to complete the project.
- No Federal funds have been appropriated for construction.

HOUMA – BAYOU CANE – THIBODAUX MSA MARKET SERVED:

Population (Census, 2015 value)	211,000
Employment (BLS, 2015 value)	100,000
GDP (BEA, 2014 value, \$M)	\$ 13,198

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 10,746
Discounted Capital Cost	\$ 9,166
Discounted Benefits	\$ 18,332 – 36,664
Net Economic Benefits	\$ 9,166 – 27,498
Benefit-Cost Ratio	2.0 – 4.0

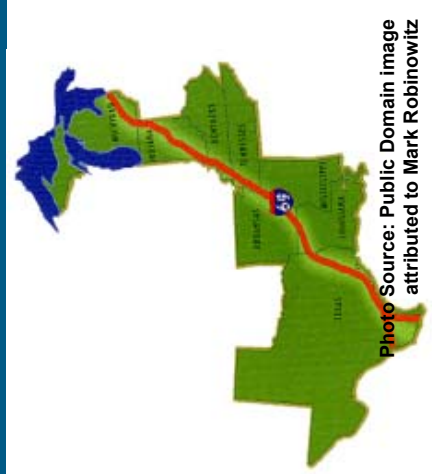
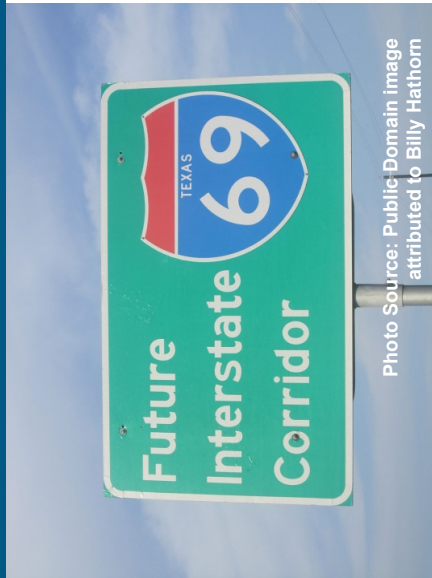
Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs

I-69 Extension

U.S. REGION: **South**

PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **\$6.8 – 20.3 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



PROJECT SPONSORS:

- Indiana Department of Transportation
- Kentucky Department of Transportation
- Mississippi Department of Transportation
- Arkansas Department of Transportation
- Louisiana Department of Transportation
- Texas Department of Transportation

PROJECT DESCRIPTION

- Extension of I-69 from Indianapolis to the Mexico border through Indiana, Kentucky, Tennessee, Mississippi, Arkansas, Louisiana, and Texas. Connection to the existing I-69 in Michigan will provide access for the auto markets between Detroit and Mexico.

CONSIDERATIONS

- The corridor was designated a High Priority Corridor of National Significance in ISTEA, is a North American trade route, an international trade route, and a NAFTA corridor. Congress has designated the new interstate to be I-69.
- The corridor upgrade to interstate designation will improve international and interstate trade, and facilitate economic development.
- Better connections are needed between auto parts distributors in Mexico and auto manufacturing along the potential corridor.

Sources: (1) Wilbur Smith and HNTB

I-69 Extension



Photo Source: Public Domain image attributed to MUTCD



Photo Source: Public Domain image attributed to Chicago Independent Media Center



Photo Source: FHWA

PROJECT BENEFITS

- Improves international and interstate movement of freight.
- Improves capacity to meet current and future needs.
- Facilitates economic development and enhances domestic and international growth through efficient and flexible transportation.
- Facilitates connections to intermodal facilities and major ports along the corridor.
- Facilitates the safe and efficient movement of people and goods resulting in improved reliability and time savings and vehicle operating cost savings.
- Directly connects urban areas of Indianapolis, Evansville, Memphis, Shreveport/Bossier City, Houston, Laredo, Brownsville, and the Lower Rio Grande Valley with an interstate.

PRIMARY CHALLENGES

- Funding
- Coordination among states

INDIANA, KENTUCKY, TENNESSEE,
MISSISSIPPI, ARKANSAS, LOUISIANA,
AND TEXAS MARKETS SERVED:

Population (Census, 2015 value)	55,755,000
Employment (BLS, 2015 value)	22,807,000
GDP (BEA, 2014 value, \$M)	\$ 2,815,783

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 10,500
Discounted Capital Cost	\$ 6,775
Discounted Benefits	\$ 13,550 – 27,100
Net Economic Benefits	\$ 6,775 – 20,325
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Puget Sound Gateway – Phase 2

U.S. REGION: **National**
PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **\$2.6 – 7.9 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: WSDOT



PROJECT SPONSORS:

- Washington State Department of Transportation

PROJECT DESCRIPTION

- The SR 509, I-5 and SR 167 Puget Sound Gateway Project in Seattle would relieve traffic congestion and improve freight mobility by completing the long-planned SR 167 and SR 509 corridor connections to I-5.
- Provides improved connections to the Port of Seattle and the Port of Tacoma.
- Builds on substantial Phase I investment in corridor.

CONSIDERATIONS

- The major goals of this project are to provide a significant time savings to peak-hour travel time between Seattle and Tacoma, to improve access to SeaTac International Airport, and to improve freight mobility within the state's most traveled freight corridor.

Sources: (1) WSDOT

Puget Sound Gateway – Phase 2

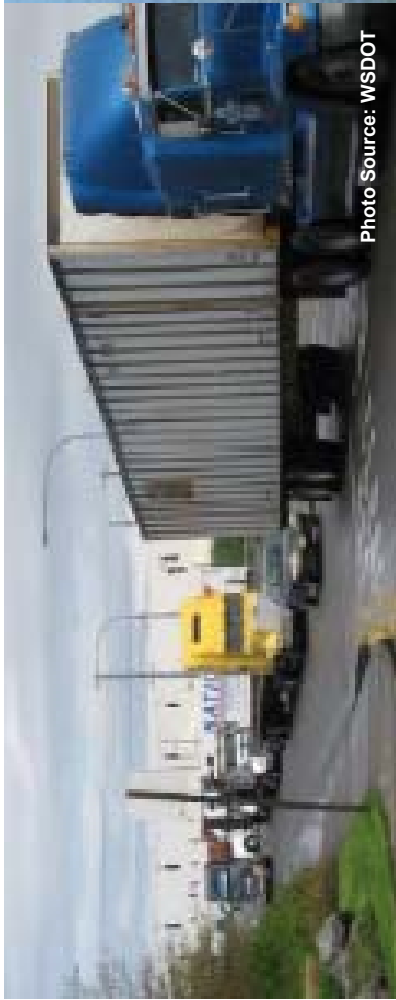


Photo Source: WSDOT



PhotoSource: USDOT

PROJECT BENEFITS

- Improves regional mobility and relieves traffic congestion on local roads and highways by providing new and more efficient travel options, improving overall system performance for freight, commuters and transit.
- Completes critical freight links between the ports of Seattle and Tacoma and key distribution centers, warehouses, and industrial areas in King and Pierce counties.
- Provides direct access to Seattle-Tacoma International Airport from the south, better connecting the state's hub airport to I-5 and improving movement of air cargo.
- Provides quantifiable travel time savings, vehicle operating cost savings, safety savings, air quality/global warming savings, and noise/external cost savings.

PRIMARY CHALLENGES

- Funding

SEATTLE MSA MARKET SERVED:

Population (Census, 2014 value)	3,671,000
Employment (BLS, 2015 value)	1,902,000
GDP (BEA, 2014 value, \$M)	\$ 300,827

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 3,000
Discounted Capital Cost	\$ 2,632
Discounted Benefits	\$ 5,264 – 10,528
Net Economic Benefits	\$ 2,632 – 7,896
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

I-5 Columbia River Crossing

U.S. REGION: **West**
PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **\$2.5 – 7.5 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: Columbia River Crossing Coalition

PROJECT SPONSORS:

- Washington State Department of Transportation
- Oregon State Department of Transportation
- Federal Highway Administration
- Federal Transit Administration
- With input from Metro (the metropolitan planning organization in Portland), Southwest Washington Regional Transportation Council, TriMet, C-TRAN, and the cities of Portland and Vancouver

PROJECT DESCRIPTION

- I-5 is the only continuous north/south interstate highway on the West Coast, providing a commerce link for the United States, Canada, and Mexico. The segment crossing the Columbia River between Portland and Vancouver serves two international ports, 5 major highways and influences the operating performance of this international corridor. Light rail is proposed on the bridge to connect Vancouver, WA to Portland's rail network.

CONSIDERATIONS

- The existing I-5 crossing of the Columbia River consists of two side-by-side bridges, built four decades apart. The crossing, which served 30,000 vehicles per day in the 1960s, now carries more than 130,000 automobiles, buses, and trucks each weekday. The bridges are stretched far beyond capacity—the hours of stop-and-go traffic grow every year.
- The existing I-5 bridges do not meet current seismic standards.

Sources: (1) Columbia River Crossing Economic Benefits Analysis

I-5 Columbia River Crossing



Photo Source: Public Domain



Photo Source: Columbia River Crossing Coalition

PROJECT BENEFITS

- Traveler savings for both passengers and truck freight from improved system efficiency impacts include savings in travel time, reliability, vehicle operating costs, safety and emissions.
- Market access impacts include positive changes to freight delivery markets, logistics, labor markets, and business productivity.

PRIMARY CHALLENGES

- Disagreement over need for light rail system
- Funding
- Disagreements among multiple stakeholders and state DOTs
- Competition from the nearby I-205 bridge

WASHINGTON AND OREGON MARKETS SERVED:

Population (Census, 2015 value)	11,199,000
Employment (BLS, 2015 value)	4,947,000
GDP (BEA, 2014 value, \$M)	\$ 635,684

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 2,712
Discounted Capital Cost	\$ 2,484
Discounted Benefits	\$ 4,968 – 9,936
Net Economic Benefits	\$ 2,484 – 7,452
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Fargo-Moorhead Metro Flood Control

U.S. REGION: **Midwest**
PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **\$1.7 – 5.0 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: USACE

PROJECT SPONSORS:

- City of Fargo, ND
- City of Moorhead, MN
- US Army Corps of Engineers

PROJECT DESCRIPTION

- Construct retention dams and 36 mile diversion channel around Fargo-Moorhead to reduce risk of flooding.
- Incorporate non-structural measure to reduce flood risk to selected residential and nonresidential structures.

CONSIDERATIONS

- Average annual flood damages are estimated at more than \$195 million.
- Red River has exceeded flood stage in 49 of the past 110 years.
- Significant emergency measures have been implemented multiple times to prevent catastrophic flooding.

Source: USACE

Fargo-Moorhead Metro Flood Control



Photo Source: USACE

PROJECT BENEFITS

- Risk of a catastrophic flood event would be reduced for the Fargo-Moorhead Metropolitan Area.
- Maintain manufacturing base of region (many companies stated they would relocate outside of the United States if facilities flooded).
- Reduce significant costs incurred during emergency flood fights.
- Protect vibrant local economy, which generates \$4.35 billion in annual non-farming wages and over \$2.77 billion in annual taxable sales along with \$14 billion in property value.

PRIMARY CHALLENGES

- Available funding (federal and local) sources are not sufficient to complete the project.
- The Minnesota Department of Natural Resources has denied a permit application for the proposed Fargo-Moorhead Flood Risk Management Project.

FARGO MSA MARKET SERVED:

Population (Census, 2015 value)	228,000
Employment (BLS, 2015 value)	140,000
GDP (BEA, 2014 value, \$M)	\$ 15,026

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 1,897
Discounted Capital Cost	\$ 1,665
Discounted Benefits	\$3,330 – 6,660
Net Economic Benefits	\$1,665 – 4,995
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate;
O&M excluded from costs.

Sabine Neches Waterway

U.S. REGION: **South**

PROJECT TYPE: **Ports-Waterways**

NET ECONOMIC BENEFIT: **\$1.2 – 3.5 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: Sabine Neches Navigation District

PROJECT SPONSORS:

- Sabine Neches Navigation District
- US Army Corps of Engineers



PROJECT DESCRIPTION

- Deepen and widen the Sabine-Neches Waterway (SNWW) along the border of Texas and Louisiana to allow for larger vessels and lessen congestion.

CONSIDERATIONS

- Navigational safety on the SNWW is a concern given the large traffic base, the number of crude oil and LNG vessels, and dangerous cargo transits.
- Congestion is increased during times when the SNWW serves an important military function as one of the busiest ports for military cargo in the world.
- The most significant trend adversely affecting the study area is the high rate of wetland loss that has occurred over the last century.

Sources: USACE, Sabine Neches Navigation District

Sabine Neches Waterway



Photo Source: Sabine Neches Navigation District



Photo Source: USACE

PROJECT BENEFITS

- Improve the navigational efficiency along the SNWW waterway.
- Improve safety for all vessels.
- Maintain the ecological value of coastal and estuarine resources within the project area.
- National security.

PRIMARY CHALLENGES

- Available funding (federal plus local) does not currently cover the project cost, extending the project completion date, increasing the total project cost.

TEXAS AND LOUISIANA MARKET SERVED:

Population (Census, 2015 value)	32,140,000
Employment (BLS, 2015 value)	13,794,000
GDP (BEA, 2014 value, \$M)	\$ 1,892,716

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 1,262
Discounted Capital Cost	\$ 1,173
Discounted Benefits	\$2,346 – 4,692
Net Economic Benefits	\$1,173 – 3,519
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs

Watershed Rehabilitation Program

U.S. REGION: **National**
PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **\$1.1 – 3.3 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: NRCS

PROJECT SPONSORS:

- Local sponsors and dam owners located across the country
- Natural Resource Conservation Service

PROJECT DESCRIPTION

- Rehabilitate aging dams that are reaching the end of their 50-year design lives and/or have been reclassified as high hazard due to downstream development.

CONSIDERATIONS

- Many of these dams are classified as high hazard with a potential for loss of life if the dam should fail.
- During the past 20 years, more than 4,300 dams reached or exceeded their 50-year design life.
- Over the next 10 years, another 3,500 dams will have met or exceeded their design life.

Source: NRCS

Watershed Rehabilitation Program



Photo Source: NRCS

PROJECT BENEFITS

- Rehabilitated dams would continue to provide flooding and erosion damage reduction, improved wildlife habitat, recreation, and improved water quality through sediment and erosion control.
- Creates rural economic growth and job opportunities.
- Rehabilitated dams would reduce potential for catastrophic failure and loss of life.

PRIMARY CHALLENGES

- Funding

NATIONAL MARKET SERVED:

Population (Census, 2015 value)	321,419,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

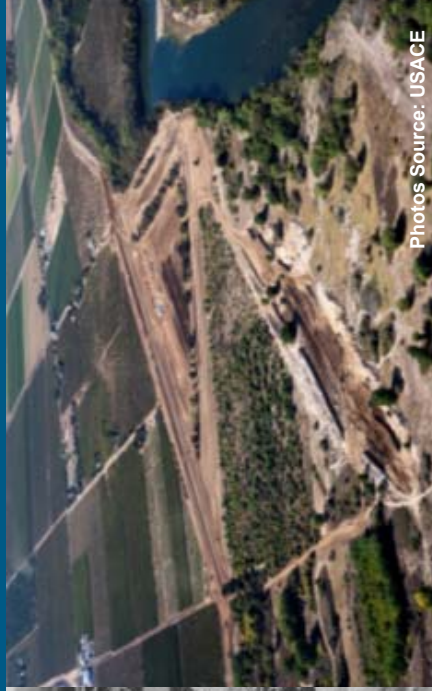
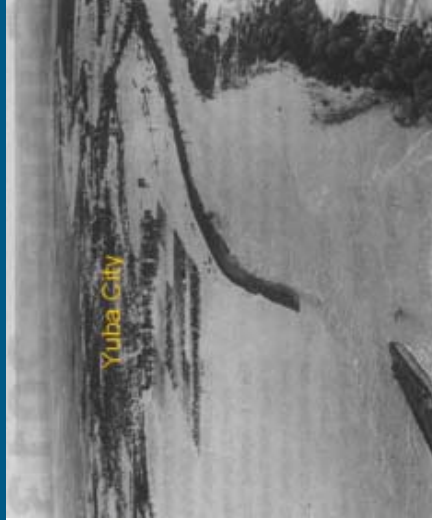
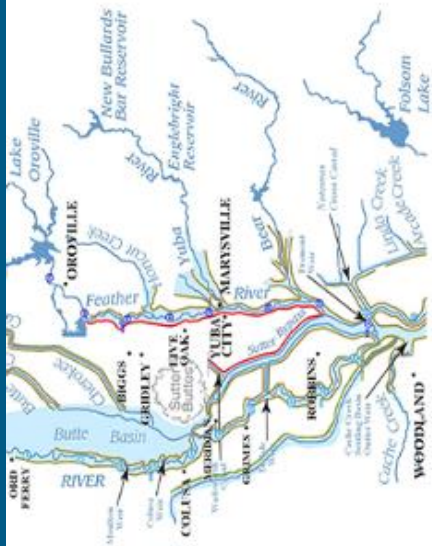
	2015\$ (M)
Capital Cost	\$ 1,200
Discounted Capital Cost	\$ 1,099
Discounted Benefits	\$2,198 – 4,396
Net Economic Benefits	\$1,099 – 3,297
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs.

Sutter Basin

U.S. REGION: **West**
PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **\$0.6 – 1.9 B**
BENEFIT-COST RATIO: **2.0 – 4.0**



PROJECT SPONSORS:

- State of California
- Sutter County
- Central Valley Flood Protection Board
- Sutter-Butte Flood Control Agency
- US Army Corps of Engineers

PROJECT DESCRIPTION

- Strengthen 41.4 miles of existing project levees to reduce risk of flood damage.
- Restore the ecosystem for the communities of Yuba City, Live Oak, Gridley, and Biggs.

CONSIDERATIONS

- The existing project levees within the study area are at risk of failure.
- The unique geography, small number of transportation corridors, and population distribution cause ineffective or hazardous evacuation conditions.
- Economically disadvantaged community with a vulnerable senior population.

Sources: USACE

Sutter Basin



Photos Source: USACE

PROJECT BENEFITS

- Five additional evacuation routes.
- Reduce the risk of flooding for 88,000 people.
- Reduce the risk of flooding to 27 critical infrastructure facilities.
- Increase developable land by about 30,000 acres.
- Increase recreational resources.

PRIMARY CHALLENGES

- USACE policy restricts woody vegetation on Federal project levees, consequently, about 20 acres of riparian vegetation may require removal to comply with the policy, resulting in effects on fish and wildlife habitat and social values like recreation and aesthetics. This policy has led to an environmental dispute with those who would preserve the vegetation and question the necessity of the removal.

YUBA-SUTTER MSA MARKET SERVED:

Population (Census, 2014 value)	170,000
Employment (BLS, 2015 value)	41,000
GDP (BEA, 2014 value, \$M)	\$ 5,472

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 709
Discounted Capital Cost	\$ 631
Discounted Benefits	\$1,262 – 2,524
Net Economic Benefits	\$ 631 – 1,893
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs.

Jacksonville Harbor Dredging

U.S. REGION: **South**

PROJECT TYPE: **Ports-Waterways**

NET ECONOMIC BENEFIT: **\$0.6 – 1.8 B**

BENEFIT-COST RATIO: **2.0 – 4.0**



PROJECT SPONSORS:

- Jacksonville Port Authority
- US Army Corps of Engineers



**US Army Corps
of Engineers®**

PROJECT DESCRIPTION

- Increase the depth of the existing channel along the St. Johns River from its current depth of 40 feet to a maximum depth of 47 feet.

Photo Source: **USACE**

CONSIDERATIONS

- The Port of Jacksonville is mentioned in the President's "We Can't Wait" initiative, which works to expedite the permitting and review process.
- Government and business leaders at the state and local level along with the local sponsor have expressed interest in growing the local economy by making Jacksonville a hub for logistical activity.
- Super Post-Panamax Vessels (PPX2) vessels are displacing less efficient vessels and require a deeper channel.

Sources: **USACE**, Jacksonville Port Authority

Jacksonville Harbor Dredging



Photos Source: USACE

PROJECT BENEFITS

- Allow for larger vessels to access the channel; therefore reducing transportation costs and providing increased navigational safety, while avoiding or minimizing impacts to environmental resources.
- Deeper channels can accommodate an increase in the TEU weight, which means that the cargo is relatively denser. Denser cargoes imply that more freight can be stored per unit volume.
- The increase in forecasted cargo requires a greater number of port calls in the future, and greater port traffic in the future means greater cost savings with deeper channel depths.
- Port able to accommodate supersized cargo ships expected to begin arriving through an expanded Panama Canal.

PRIMARY CHALLENGES

- Available funding does not currently cover the project cost, extending the project completion date, increasing the total project cost, and delaying benefits.

FLORIDA MARKET SERVED:

Population (Census, 2015 value)	20,271,000
Employment (BLS, 2015 value)	8,075,000
GDP (BEA, 2014 value, \$M)	\$ 838,939

STATES EAST OF MISSISSIPPI RIVER MARKET SERVED:

Population (Census, 2015 value)	185,224,000
Employment (BLS, 2015 value)	82,689,000
GDP (BEA, 2014 value, \$M)	\$ 9,727,377

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 673
Discounted Capital Cost	\$ 616
Discounted Benefits	\$1,232 – 2,462
Net Economic Benefits	\$ 616 – 1,848
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs

Soo Locks Modernization

U.S. REGION: **Midwest**

PROJECT TYPE: **Ports-Waterways**

NET ECONOMIC BENEFIT: **\$0.6 – 1.7 B**

BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: USACE

PROJECT SPONSOR:

- US Army Corps of Engineers



PROJECT DESCRIPTION

- Rehabilitate or construct second lock for the Poe Lock at the Soo Lock system. These facilities connect the Great Lakes in Michigan, permitting shippers in the western portion of the Great Lakes to access the St. Lawrence Seaway and use the lakes for commercial shipping.

CONSIDERATIONS

- More than 60% of the current U.S. and Canadian fleet is restricted by size to the Poe Lock.
- Any type of service disruption or closure may result in delays to vessel transit.
- Closures of the ageing Poe Lock are expected to increase.
- In the event of a closure (short or long term) of the Poe Lock, there may not be viable alternatives to transporting the more than 40 million tons of iron ore and coal to U.S. manufacturers along the Great Lakes.

Source: USACE

Soo Locks Modernization



PROJECT BENEFITS

- Increased reliability, fewer outages and less delay would allow shippers to move more tonnage during the shipping season with greater efficiency and fewer emissions.
- Enhanced reliability of the locks would lower the operators' risk profile to prospective lenders. This would make lenders more inclined to finance the operators' capital investments (e.g., fleet improvements, infrastructure, plant operations).
- Other factors such as Canadian vessel movements, commodities, and outages from additional lock components, can be expected to further increase benefits.
- Federal guidance (followed by the US Army Corps of Engineers) does not fully capture impacts to the nation for each closure of the Poe Lock.

PRIMARY CHALLENGES

- Available funding (federal plus local) does not currently cover the project cost, extending the project completion date, increasing the total project cost.

MICHIGAN MARKET SERVED:

Population (Census, 2015 value)	9,923,000
Employment (BLS, 2015 value)	4,265,000
GDP (BEA, 2014 value, \$M)	\$ 448,244

GREAT LAKE STATES MARKET SERVED:

Population (Census, 2015 value)	46,787,000
Employment (BLS, 2015 value)	21,515,000
GDP (BEA, 2014 value, \$M)	\$ 2,368,286

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 626
Discounted Capital Cost	\$ 582
Discounted Benefits	\$1,164 – 2,328
Net Economic Benefits	\$ 582 – 1,746
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs

Long Bridge

U.S. REGION: **South**

PROJECT TYPE: **Railway**

NET ECONOMIC BENEFIT: **\$0.5 – 1.5 B**

BENEFIT-COST RATIO: **2.0 – 4.0**



Photo Source: DDOT

PROJECT SPONSORS:

- Virginia Railway Express
- Virginia Department of Transportation
- District Department of Transportation
- CSX
- Amtrak

PROJECT DESCRIPTION

- The Long Bridge is an important element of the District of Columbia transportation infrastructure and a critical component in the national system of railroads. It is the only railroad crossing of the Potomac River east of Harpers Ferry, West Virginia and the only railroad crossing directly connecting the Commonwealth of Virginia and the District.
- Today the bridge carries local, regional, and national freight traffic, along with regional and longer-distance or intercity passenger rail traffic and commuter rail traffic.

CONSIDERATIONS

- The volume of rail traffic on the bridge is growing as more local commuter trains and regional trains are added to the ever-increasing number of freight and intercity passenger trains, pushing the aged bridge structure to the limits of its functional capacity and threatening the District and Northern Virginia with gridlock.

Source: Long Bridge 2014 TIGER Application

Long Bridge



Photos Source: DDOT

PROJECT BENEFITS

- A new four-track Long Bridge would create the bridge capacity needed to accommodate project growth in VRE, Amtrak, and freight traffic and offer significant time savings for these passengers and goods.
- Time savings translate into person hours saved for rail passengers, highway users (if future demand for commuter rail service cannot be accommodated with a new bridge), operating cost savings for both passenger and freight operators, inventory savings for freight shippers, and reduced vehicle miles traveled (VMT) in an already congested Washington, D.C. MSA.

PRIMARY CHALLENGES

- Funding

WASHINGTON, D.C. MSA MARKET SERVED:

Population (Census, 2014 value)	6,034,000
Employment (BLS, 2015 value)	2,581,000
GDP (BEA, 2014 value, \$M)	\$ 471,584

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 575
Discounted Capital Cost	\$ 511
Discounted Benefits	\$ 1,022 – 2,044
Net Economic Benefits	\$ 511 – 1,533
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Heartland Expressway

U.S. REGION: **Midwest**
PROJECT TYPE: **Highway**



Photos Source: NDOR

NET ECONOMIC BENEFIT: **\$0.4 – 1.2 B**
BENEFIT-COST RATIO: **2.0 – 4.0**

PROJECT SPONSORS:

- Nebraska Department of Roads
- Colorado Department of Transportation
- Wyoming Department of Transportation
- South Dakota Department of Transportation

PROJECT DESCRIPTION

- The Heartland Expressway is a key portion of the larger Ports-to-Plains Corridor that extends from Mexico to Canada. Approximately 200 miles of the Heartland Expressway's 498 miles is located within Nebraska's borders.

CONSIDERATIONS

- Fulfillment of the legislative intent of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), which calls for the development of High Priority Corridors on the National Highway System
- The lack of north-south highways contributes to increasingly severe traffic congestion, especially in Colorado, and contributes to homeland security issues involving defense mobility.

Sources: (1) NDOR

Heartland Expressway



Photos Source: NDOR

PROJECT BENEFITS

- Improves the efficiency of commerce and travel by providing for increased transportation demand resulting from new regional sources of energy development, expanding agricultural markets, and commercial development
- Increases intermodal transportation by improving links between roadway, railway and airport facilities
- Enhances safety through modifications that better enable passenger cars and oversize trucks to share the road
- Saves travel times for existing and diverted corridor users

PRIMARY CHALLENGES

- Funding

NEBRASKA MARKET SERVED:

Population (Census, 2015 value)	1,896,000
Employment (BLS, 2015 value)	1,002,000
GDP (BEA, 2014 value, \$M)	\$ 111,007

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 568
Discounted Capital Cost	\$ 414
Discounted Benefits	\$ 828 – 1,656
Net Economic Benefits	\$ 414 – 1,242
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Corpus Christi Ship Channel

U.S. REGION: **South**

PROJECT TYPE: **Ports-Waterways**

NET ECONOMIC BENEFIT: **\$0.3 – 1.0 B**

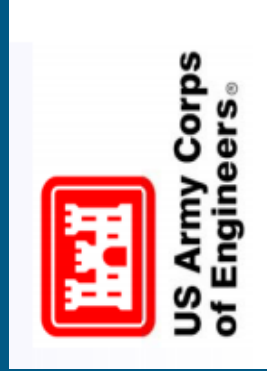
BENEFIT-COST RATIO: **2.0 – 4.0**



Photos Source: **Port Corpus Christi**

PROJECT SPONSORS:

- The Port of Corpus Christi Authority
- US Army Corps of Engineers



PROJECT DESCRIPTION

- Deepen existing ship channel to a depth of 52 feet and widen it to 530 feet to accommodate larger vessels.

CONSIDERATIONS

- More energy companies are trying to reduce costs by using larger cargo vessels, placing more pressure on the nation's 5th largest port to deepen and widen the existing ship channel.
- Periodic dredging of the La Quinta Channel Extension Deepening is needed to maintain the channel to its authorized depth to provide for safe and efficient navigation of commercial vessels.
- A record 8,528 vessels passed through the port in 2014.

Sources: **USACE**, The Port of Corpus Christi Authority

Corpus Christi Ship Channel



Photo Source: Port Corpus Christi

TEXAS MARKET SERVED:

Population (Census, 2015 value)	27,469,000
Employment (BLS, 2015 value)	11,807,000
GDP (BEA, 2014 value, \$M)	\$ 1,641,044

TX, OK, AR, LA MARKETS SERVED:

Population (Census, 2015 value)	39,029,000
Employment (BLS, 2015 value)	16,669,000
GDP (BEA, 2014 value, \$M)	\$ 2,195,925

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 358
Discounted Capital Cost	\$ 328
Discounted Benefits	\$ 656 – 1,312
Net Economic Benefits	\$ 328 – 984
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs

PROJECT BENEFITS

- Provide channel access to a proposed multi-purpose dock and container handling facility.
- Barge lanes and a deeper channel will increase maritime safety and reduce costly vessel delays, leading to a reduction in transportation costs.
- The ecosystem restoration components will protect and enhance several important habitats. In addition, the improvements include constructing approximately 1,000 acres of shallow water habitat using dredged material.

PRIMARY CHALLENGES

- Congressional reauthorization of the project may be required before construction of the Main Channel and Barge Lanes Elements of the Corpus Christi Ship Channel project can commence. The process for moving forward is in negotiation.
- Available funding (federal plus local) does not currently cover the project cost, extending the project completion date, increasing the total project cost and delaying benefits.

Truckee River

U.S. REGION: **West**
PROJECT TYPE: **Water**

NET ECONOMIC BENEFIT: **\$307 – 921 M**
BENEFIT-COST RATIO: **2.0 – 4.0**



Photo Source: USACE

PROJECT SPONSORS:

- Truckee River Flood Management Authority
- US Army Corps of Engineers

PROJECT DESCRIPTION

- Flood risk management and recreation features along approximately six miles of the Truckee River in Nevada from U.S. Route 395 to the town of Vista, NV.

CONSIDERATIONS

- Flooding from the Truckee River poses a life and safety hazard to downtown Reno and Truckee Meadows.
- The quality and quantity of riparian and related floodplain habitats have diminished along the Truckee River causing adverse effects on the aquatic ecosystem, including special status fish species.
- Passage of spawning fish species from Pyramid Lake is obstructed by various artificial barriers.
- The Truckee River is no longer a stable river system.

Source: USACE

Truckee River



Photo Source: USACE

PROJECT BENEFITS

- Project features are designed to provide “100-year flood protection” in high-value commercial and industrial areas near the Truckee River, including the Reno-Tahoe International Airport.
- Recreation features include a new pedestrian/bike bridge, bike lanes on bridges, pedestrian/bike paths, and new access sites and improvements in downtown Reno.
- Fish and wildlife enhancement features, consisting of riparian plantings, marsh habitat preservation, and fish habitat improvements.

PRIMARY CHALLENGES

- In 2012, the study was re-scoped to assess the feasibility of modifying the Congressionally-authorized project to reduce flood damages in the Truckee Meadows project area while avoiding or minimizing adverse effects.
- Funding.

RENO-SPARKS AREA MSA MARKET SERVED:

Population (Census, 2010 value)	318,000
Employment (BLS, 2015 value)	211,000
GDP (BEA, 2014 value, \$M)	\$ 20,554

ECONOMIC BENEFITS AND COSTS

	2015\$ (M)
Capital Cost	\$ 336
Discounted Capital Cost	\$ 307
Discounted Benefits	\$ 614 – 1,228
Net Economic Benefits	\$ 307 – 921
Benefit-Cost Ratio	2.0 – 4.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate; O&M excluded from costs.

Accommodating Autonomous Vehicles

U.S. REGION: National
PROJECT TYPE: Highway

NET ECONOMIC BENEFIT: \$5.0 – 7.5 T
BENEFIT-COST RATIO: 7.0 > 10.0

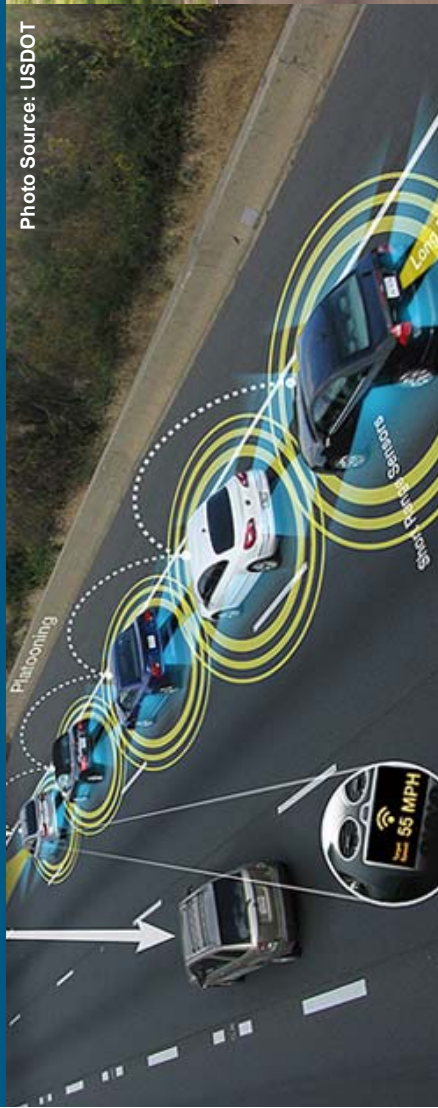


Photo Source: USDOT



Photo Source: Google

PROJECT SPONSORS:

- Primarily private vehicle manufacturers and owners and technology firms
- Some infrastructure investments from individual state DOTs
- Some federal grants to support technology development
- Federal and state regulatory agencies

PROJECT DESCRIPTION

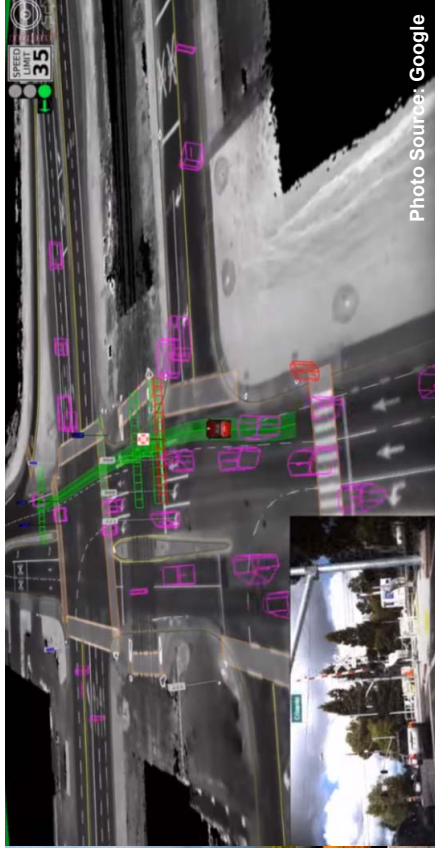
- Autonomous vehicles represent a breakthrough in surface transportation. They depend on in-vehicle technology including vehicle to vehicle communication (V2V). V2I refers to a variety of ways to share vehicle information with other public and private users.

CONSIDERATIONS

- Several auto manufacturers will have semi-autonomous vehicles (for expressways and major arterials during good weather) available later this year. Fully autonomous cars (all roads) will likely be available before the end of the next decade.
- No set of consistent state (and perhaps federal) safety regulations currently exist.
- More technical development is called for in order to handle poor weather, local roads, V2V communication, and interface with the driver.
- State and local governments have yet to decide how these new vehicles affect investment and operations.

Sources: USDOT, Morgan Stanley

Accommodating Autonomous Vehicles



PROJECT BENEFITS

- Autonomous cars bring obvious social benefits—significant reduction in highway fatalities, fewer road crashes, reduced traffic congestion, higher occupant productivity, fuel savings.
- Improved access for people who are mobility impaired whether due to disabilities or age.
- Improved roadway capacity since there will be fewer crashes and autonomous vehicles will allow reduced space between traveling vehicles.
- Potential efficiency gains from freight and transit operations.

PRIMARY CHALLENGES

- Consistent national and/or state regulations regarding safety and technical compatibility while not discouraging innovation.
- Uncertainty over pace of deployment of new vehicles and critical mass needed in order to generate significant safety and capacity benefits.
- Financial impacts on state and local agencies.
- Other effects including changes in transit use, urban form, and VMT.

NATIONAL MARKET SERVED:

Population (Census, 2015 value)	321,419,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232,618

ECONOMIC BENEFITS AND COSTS

(Assumes Low Costs and Benefits)		2015\$ (T)
Capital Cost	\$	1.3
Discounted Capital Cost	\$	0.83
Total Discounted Benefits	\$	5.8 – 8.3
Net Economic Benefits	\$	5.0 – 7.5
Benefit-Cost Ratio		7.0 – 10.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

Recapitalization of the National Interstate Highway System (IHS)

U.S. REGION: **National**

PROJECT TYPE: **Highway**

NET ECONOMIC BENEFIT: **\$1.6 – 3.1 T**
BENEFIT-COST RATIO: **4.0 > 7.0**



Photo Source: Public Domain image attributed to Richmond Times-Dispatch



Photo Source: USDOT

PROJECT SPONSORS:

- Individual State DOTs
- Federal Highway Administration

PROJECT DESCRIPTION

- The nation's 46,876 mile IHS has long provided a consistent, national network for freight and personal movement, but most infrastructure is now more than fifty years old. NCHRP developed options to recapitalize the network, including additional capacity where needed. This project follows the "Reduced Service/Lower Investment" scenario that includes one half of the cost-effective lane additions.

CONSIDERATIONS

- Cost-effective and reliable movement of freight remains vital to future economic growth.
- State and federal funds for highways has not kept pace with the growth in demand for travel.
- Some states have been able to increase highway revenues, but their focus has been on maintenance and in-state improvements rather than inter-state routes.
- The recent FAST Act provides no net growth in federal funds.

Sources: NCHRP, FHWA

Recapitalization of the National Interstate Highway System (IHS)



Photos Source: FHWA

PROJECT BENEFITS

- Provides a reliable and safe national road network.
- Encourages business access to national and regional markets.
- Supports access to other parts of the freight network, including ports, airports, and intermodal freight.

PRIMARY CHALLENGES

- Adequate funds are key, given the political reluctance in many states to increase highway user fees.
- Need to find incentives for states to focus on inter-state connections. As with the original Interstate, federal incentives would help.
- Local opposition is likely regarding environmental concerns and different development scenarios.
- Will the growth in autonomous cars and trucks call for a different roadway system? For example, truck platoons may need truck-only lanes, at least during part of the day.

NATIONAL MARKET SERVED:

Population (Census, 2015 value)	321,419,000
Employment (BLS, 2015 value)	141,958,000
GDP (BEA, 2014 value, \$M)	\$ 17,232.618

ECONOMIC BENEFITS AND COSTS

(Assumes Low Costs and Benefits)	2015\$ (T)
Capital Cost	\$ 0.79
Discounted Capital Cost	\$ 0.52
Total Discounted Benefits	\$ 2.1 – 3.6
Net Economic Benefits	\$ 1.6 – 3.1
Benefit-Cost Ratio	4.0 – 7.0

Note: All values in 2015 dollars; values were discounted using a 3% discount rate. O&M excluded from costs.

