

# Infrastructure: Worth the Investment

It sounds pretty obvious to most individuals: investment in infrastructure is a good idea. However, over the past decades federal, state, and local agencies have not made the necessary investments in our infrastructure. With other higher profile social issues, such as healthcare, garnering much of the attention, our infrastructure has been forgotten... that is until it is broken and needs repair. These years of deferred investment have resulted in deteriorating infrastructure that is not at the level it needs to be. The World Economic Forum ranked the United States 12th out of 144 countries in overall infrastructure quality.<sup>1</sup>

Percentage of GDP spent on infrastructure in the People's Republic of China, the European Union, and the United States<sup>2</sup>



9%



5%



2%

A common measure used to evaluate infrastructure investment levels is the percent of Gross Domestic Product (GDP) dedicated to infrastructure. The US as a whole and most states, including Massachusetts, are well below the investment levels of China and the European countries, creating a substantial backlog of projects.

Percentage of GDP spent on infrastructure in Massachusetts<sup>3</sup>

1.67%

Massachusetts GDP = \$421 billion<sup>4</sup>  
Infrastructure Investment = \$7.03 billion

Massachusetts' infrastructure needs

Roads/Bridges	Need + \$962 million per year <sup>5</sup>
Transit	Maintenance backlog of \$3.1 billion <sup>5</sup>
Water/Wastewater	Need + \$1.71 billion per year <sup>6</sup>
Energy	Need \$9 billion through 2020 <sup>7</sup>

The solution is relatively simple: invest. There exists a multitude of infrastructure projects (roads, bridges, water, sewer, transit, etc.) that are needed to promote economic development and maintain our quality of life. A concerted effort to evaluate projects and dedicate sustainable funding sources is needed. It has been estimated that for every \$1 billion invested in infrastructure, over 20,000 jobs are created in a variety of industries.<sup>8</sup>



The rebuilt Government Center MBTA station opened in April, 2016.  
Photograph: ©Pi.1415926535, CC-BY-SA-3.0



The Government Center MBTA station prior to being rebuilt  
Photograph: ©Matthew G. Bisanz, CC-BY-SA-3.0

Turn the page to discover salient examples in Massachusetts where the investment in infrastructure was made... and was worth it.

# Sound Investment Pays Dividends Across the Commonwealth



*Institute of Contemporary Art, Seaport District, Boston, MA*  
Photograph: © Smart Destinations/CC-BY-SA-2.0

## Boston's Seaport Revitalization

The Boston Harbor, which was severely polluted from years of combined sewer overflow (CSO) discharges and stormwater pollution, has been revitalized as a result of the Boston Harbor cleanup project. A Massachusetts Water Resources Authority (MWRA) success story, the Boston Harbor Project clearly shows the benefits of investing in our infrastructure and especially highlights the role that civil engineers play in making our environment safe and clean. As MWRA states on their website: "It was only a little over 20 years ago that Boston Harbor was known as the dirtiest harbor in America. Today, it's a Great American Jewel."<sup>9</sup> The increased real estate investments in the Seaport District and the increased desire for people to spend time and attend events along the waterfront confirms the success of the project and also demonstrates that in addition to public safety and environmental protection, infrastructure investment, when done correctly, produces economic benefits that improve our quality of life.

In order for the Boston Harbor project to remain a success story, however, we need to make sure that development in the Seaport District is done sustainably and resiliently. Increased development, combined with increased probability of higher sea levels and greater flooding, means more risk. In order not to increase our risk, we need a good Climate Adaptation Management Plan (CAMP) to make sure that the development and infrastructure we build near the seaport today will continue to serve its intended purpose for at least the next 50 to 100 years.



*Longfellow Bridge Reconstruction, Boston and Cambridge, MA*  
Photograph: © Anthony Puntin

## Fixing Bridges... Fast

There are currently over 5,100 bridges in Massachusetts with almost 2,000 of them 50–70 years in age.<sup>10</sup> Massachusetts, like most states, has been playing catch-up for many years when it comes to the repair or replacement of its bridges. With approximately 9% of the bridges in the state classified as structurally deficient, Massachusetts currently ranks in the middle of all states relative to the percent of bridges in this category.<sup>10</sup> Unfortunately, Massachusetts ranks almost at the bottom (#48) relative to the overall surface area of bridges that are structurally deficient.<sup>10</sup>

In a focused effort to address this issue, MassDOT developed and implemented a \$3 billion Accelerated Bridge Program (ABP).<sup>11</sup> This program was developed to reduce the number of structurally deficient bridges in the state system while creating thousands of construction jobs.

The program was also developed to permit innovative and accelerated project development and construction techniques. The prime example is the award-winning Fast 14 project; replacing 14 bridges on I-93 over the span of 10 weekends with minimal disruption to traffic.<sup>12</sup> As of September 1, 2015, the ABP has completed 170 bridge projects, with another 23 bridge projects in construction, and an additional five bridge projects scheduled to start construction within the next calendar year. Over the course of the eight-year program, well over 270 bridges are planned to be repaired or replaced.<sup>11</sup>

The ABP helped to reduce the number of structurally deficient bridges and addressed some of Massachusetts' more prominent and high traffic bridges. Unfortunately, due to the age of the bridge inventory and years of deferred maintenance, the number of structurally deficient bridges is rising again. A sustainable funding source for bridge maintenance is needed to ensure public safety and maintain quality of life.





*Northfield Mountain Reservoir, Northfield, MA*  
*Photograph: Courtesy of The Recorder*

## Northfield Mountain Pump Storage Plant

In the 1960s, the terms “green energy” or “renewable energy” were not in the forefront of energy discussion as they are today. The Northfield Mountain Pump Storage facility, designed in the late 60s and opened in 1972, was ahead of its time. Currently owned by FirstLight Power Resources, a subsidiary of GDF SUEZ Energy North America, the 1,000+ megawatt operation utilizes a unique “pump and storage” method to generate electricity.<sup>13</sup>

Water from Northfield Mountain’s upper reservoir (300 acres) flows 700 feet vertically to the powerhouse. Located underground within the mountain, the powerhouse includes four large reversible turbines that generate electricity during peak demand.<sup>13</sup> The water is then stored in the Lower Reservoir for re-use. During periods of lower electrical power demand, the turbines are reversed and they perform as plant pumps, transporting the water back up to the upper reservoir. Power from the plant is quickly available to help maintain system reliability in emergencies or to help meet peak power requirements of over 1.7 million electric customers.<sup>13</sup> This methodology is economically viable due to the variation in electrical costs between peak and off-peak times. The cost of the electricity needed to pump the water back up to the storage is less than the revenue generated during peak demand.

The success of this facility is due to wise initial long-term investment, continuous maintenance, and periodic reinvestment. The facility, originally designed with its own in-house machine shop, relies on an evaluation of the life-cycle cost of its many components.



*Assembly Row, Somerville, MA*  
 © Matthew Bosch-Willeit, 2016

## Assembly Square Development

Assembly Square is a redeveloped 145-acre parcel situated in Somerville, Massachusetts. Once home to a Ford Motor Company assembly plant, the area has had various property ownership turnover since the assembly plant shut down in 1958.<sup>14</sup> The City of Somerville adopted a 20-year urban renewal plan in 1979 specifically targeting Assembly Square, resulting in developing the assembly plant buildings into a strip mall complex that lasted for about 20 years before the property was foreclosed on.<sup>14</sup>

Life was breathed back into the area in 2000 when the Somerville Redevelopment Authority (SRA) acquired a 9.3-acre former railroad parcel in Assembly Square.<sup>14</sup> Subsequently, the City of Somerville launched a public planning process for this area. Assembly Square was sought to be developed as a lively, mixed-use district, according to public opinion. The old 20-year urban renewal plan was extended and development work began, starting in 2005 with a \$1.5 billion development plan by the Federal Realty Investment Trust to build Assembly Row.<sup>14</sup> The plan included mixed-use, smart growth development including residential and hotel units, almost 2 million square feet of office space, and 0.5 million square feet of retail and restaurant space.<sup>15</sup> State approval for a nearly \$30 million new Orange Line T station in 2011 was quickly followed in 2012 with the beginning of construction of the first phase of the Assembly Row development.<sup>16</sup> The Assembly Row Orange Line station opened up in Fall 2014 and is a 10-minute ride from downtown Boston.<sup>15</sup>

Assembly Square is currently thriving as the district that was envisioned in the 2000 Planning Study and can be considered a shared success story that highlights public participation, City planning, state infrastructure funding, and private development.

# ASCE's Report Card for America's Infrastructure

Every four years for the past couple of decades, the American Society of Civil Engineers (ASCE) has released a *Report Card for America's Infrastructure*. The Report Card provides national grades for a number of infrastructure categories including highways, bridges, dams, water/wastewater systems, solid/hazardous waste, transit, waterways and energy, as well as data on how the grades were developed. ASCE's most recent report card (released in 2013), gave the nation's infrastructure a cumulative grade of D+ and estimated a total investment need of \$3.6 trillion by 2020 to bring the nation's infrastructure to an acceptable level (i.e., a "B", see [www.infrastructurereportcard.org](http://www.infrastructurereportcard.org).) Based on 2013 funding projections, ASCE estimated a funding gap of \$1.6 trillion through 2020 and cited the following steps that are needed to improve our nation's infrastructure:

1. Increase Leadership in Infrastructure Renewal
2. Promote Sustainability and Resilience
3. Develop and Fund Plans to Maintain and Enhance America's Infrastructure

## A Failure to Act

### (You can pay me now, or you can pay me later)

In the end, deferring maintenance of our nation's infrastructure will cost us more than if we invest to maintain it in a state of good repair. As legislative bodies struggle with tight budgets, too often infrastructure maintenance and repairs are cut. Not only does this result in larger capital costs in the future, it also creates economic losses for end users. ASCE commissioned a series of economic studies to determine the costs associated with not investing in our infrastructure to the level cited above and found that by investing an additional \$157 billion per year through 2020, we can prevent a loss of \$3.1 trillion in GDP, save the average household \$3,100 per year and prevent 3.5 million job losses. The full *Failure to Act* reports can be found at [www.asce.org/failure\\_to\\_act\\_economic\\_studies](http://www.asce.org/failure_to_act_economic_studies).

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## A New Way of Thinking...

Correcting the current situation is going to take strong leadership and a concerted national effort that crosses political party lines. We need to make sure that when new capital projects are funded, a complete life cycle cost analysis is part of the equation and dedicated funds for continued operation and maintenance are also funded too. New methods of project delivery, like Design-Build, and new financing methods, like Public-Private Partnerships, all need to be used to bring in new capital and new operational efficiencies. Most importantly, we need to consider the **"triple bottom line"** when we make our infrastructure investment decisions in order to make sure we fund the right projects—those that are **environmentally, socially and economically sustainable** and not funded mainly for political expediency. For more information on sustainable infrastructure, go to [www.sustainableinfrastructure.org](http://www.sustainableinfrastructure.org).

## Who Can Help Lead this Effort in Massachusetts?

The Boston Society of Civil Engineers Section/ASCE (BSCES), established in 1848, is the oldest engineering society in America with over 3,400 members working in the civil engineering and construction industry in Massachusetts. BSCES is also one of the largest sections of ASCE, which has over 146,000 members worldwide and is recognized as the leading professional association for the stewardship of our nation's infrastructure. BSCES has been working diligently with ASCE over the past several decades to increase public awareness relative to the condition of the Commonwealth's infrastructure and the crucial role that civil engineers play in designing and building infrastructure. BSCES members, as civil engineers and leaders in our communities, have the necessary knowledge and expertise to assist state legislators in improving our infrastructure. For more information on BSCES, go to [www.bsces.org](http://www.bsces.org).



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