The Economic Impact of MSBA Investments on the Massachusetts Economy

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Executive Summary

The mission of the Massachusetts School Building Authority (MSBA) is to "partner with Massachusetts communities to support the design and construction of educationally-appropriate, flexible, sustainable, and cost-effective public school facilities."[1] In pursuing this mission, the MSBA has distributed since FY2005 more than $10.5 billion in grants to school districts throughout the Commonwealth. These grants have been used to fund the cost of constructing, renovating, and repairing elementary, secondary, and vocational schools in local and regional school districts throughout the state.[2] All of this activity is to help assure that Massachusetts continues to have school buildings that can meet the challenge of 21st century education.

What is often overlooked, however, are the direct and indirect economic benefits that flow to the state and its workers as a result of these large construction investments. This report, we hope, rectifies this shortcoming by providing an assessment of the impact of MSBA spending on state gross domestic output, employment, income, and state tax revenue. As this report will demonstrate, even relying on a conservative set of assumptions, the economic impact on the state is substantial.

The main conclusions of our research suggest that between FY2005 and FY2014, MSBA investments generated the following economic benefits:

- $7.764 billion addition to Massachusetts value-added (Gross State Product)

- Annual employment creation of close to 10,000 jobs per year

- $4.526 billion in total employment earnings

- $411.8 million in total additional state tax revenue including

    o $296.3 million in additional state personal income tax revenue

    o $67.1 million in additional state sales tax revenue

    o $48.5 million in additional state business tax revenue

These estimates only pertain to the funds allocated to the cities and towns for their schools and do not include spending on school construction, renovation, and repair out of local school budgets that may have been encouraged by MSBA funding. These estimates also do not include $3.63 billion in grant payments the MSBA made for projects authorized and approved under the Department of Education's former school building assistance program and $13 million the MSBA has spent on commissioning construction projects. As such the ultimate economic impact of MSBA investments is likely larger than the estimates listed here. That much of this investment occurred while the economy was suffering the effects of the Great Recession suggests that MSBA activity played a significant role in boosting what otherwise would have been even more dire economic straits, putting unemployed workers to work, increasing consumer spending power, and augmenting the state treasury.

A note on the job-year metric. A job-year represents a person year of work. For example, if a construction job hired 100 construction workers, each of whom worked for two years on the project, then that would represent 200 job-years. The estimate that MSBA spending created

95,653 job-years means that, over this 10-year period, employment in the Commonwealth was, on average, 9,565 higher than it would have been without the spending.

Background

The Massachusetts School Building Authority ("MSBA") is a quasi-independent government authority established by the Legislature in 2004 to fund capital improvement projects for the Commonwealth's public K-12 schools. The MSBA created a new competitive grant process to replace the former school building program. The MSBA works in collaboration with local districts to create affordable, sustainable, and energy efficient schools across Massachusetts.

The Former Program

In 1948, the Legislature created a temporary school building assistance program to encourage municipalities to regionalize local educational facilities to accommodate the post-World War II baby boom population. Originally set to expire in 1951, the school building assistance program was administered by the Department of Education and only grew in popularity over the years. The rate at which the Commonwealth was reimbursing cities and towns for school construction projects eventually grew to range from 50 to 90 percent of approved project costs.

In the 1980s, two recessions and the passage of a statewide local property tax limitation initiative petition, "Proposition 2½," limited the ability of cities and towns to raise local funds. As a result, by the 1990's, the demand by cities and towns for funding for school construction projects had outpaced the then current funding and management structure. By the early 2000's, the "temporary" program had become unsustainable, accumulating more than $11 billion in unfunded promises to local districts. By 2003, there were 428 projects on a waiting list to begin

construction, and communities that actually broke ground, routinely waited years – sometimes decades – to receive their first reimbursement payment from the state.

The MSBA

The MSBA was created in 2004 to administer and fund a new program to provide assistance to cities, towns, regional school districts and independent agricultural and technical schools to finance school construction, repair and renovation projects. The MSBA is mandated with achieving the effective planning, management and financial sustainability of a new program for school construction, repair and renovation. Since 2004, the MSBA has made over $10.5 billion in payments to cities, towns and regional school districts, including full or partial payments to all of the eligible Waiting List Projects. In addition, the MSBA has completed 784 of the 788 backlogged audits inherited from the former program, saving the taxpayers of Massachusetts more than $1 billion in project costs and $2.9 million in local interest costs. The MSBA's grant program places tremendous emphasis on planning, due diligence and prioritization of scarce MSBA resources. The MSBA approves new projects through a competitive process that stresses need and urgency, and reimbursement can range from 31 to 80 percent of eligible project costs. There are currently more than 300 construction, renovation and repair projects in the MSBA's Capital Pipeline.

The MSBA, which has a designated revenue stream of one penny of the state sales tax, collaborates with municipalities to invest approximately $500 million per year in schools across the Commonwealth. The mission of the MSBA is to fund the right-sized, most fiscally responsible and educationally appropriate solutions to create safe and sound learning environments, and it is committed to protecting the taxpayer dollars by improving the school

building grant process and avoiding the mistakes of the past in the funding and construction of school facilities.

The MSBA has worked to improve the school building grant process in a number of innovative ways discussed below:

Progress Payments

In 2004 MSBA accelerated payments to school districts that would have been waiting, on average, 10-15 years for state funding under the former program. The MSBA pays school districts as they incur project costs through the "Pro-Pay" system. Districts can now use the MSBA's web-based system to enter cost information and submit a request for reimbursement electronically for project costs that have been incurred and paid locally. The MSBA audits the submitted invoices and reimburses the district for its share of eligible project costs – typically within 15 days of receiving a complete reimbursement request.

The Pro-Pay system has saved districts millions in interest charges and makes school construction and repair more affordable. School districts no longer have to bond for the full cost of their projects, only their share.

Commissioning

MSBA funded buildings undergo an intensive quality assurance process that begins during design and continues through construction, occupancy, and operations. This process is known as commissioning. Building commissioning involves an independent third party testing a building's systems and materials and the operation of the building as a whole. The MSBA requires and pays for the entire cost of building commissioning for all MSBA-funded projects. Commissioning ensures that the new building operates efficiently and as the owner intended.

Commissioning also prepares the building staff to operate and maintain building systems and equipment.

The benefits of commissioning for the District include:

- Construction cost savings
- Improved coordination between design, construction, and occupancy
- Fewer system deficiencies at building turnover
- Energy savings
- Improved indoor environmental quality

Building commissioning is a critical component in any "green" building program employing several strategies to reduce a building's energy use. Early in the design phase, energy issues are discussed among the project team. In design review, they look for design issues that may have an impact on maintenance accessibility or lead to inefficient system operation and wasted energy.

Part I   MSBA Programs

The MSBA operates a number of different programs, each of which funds new construction, repair, or renovation of the Commonwealth's schools. The MSBA reimburses school districts for eligible school construction costs as they are incurred. The grant amount is determined by the scope of the project and a reimbursement rate based on various economic and socioeconomic factors set by statute and ranges from 31% to 80%.

New Construction and Addition/Renovation

The MSBA's grant program for all school building construction and renovation projects is a non-entitlement competitive program. The MSBA's Board of Directors approve grants

based on need and urgency as expressed by city, town, and regional school districts or independent agricultural and technical schools and validated by the MSBA.

The MSBA collaborates with districts to conduct feasibility studies and recommend the most cost-effective and educationally appropriate solution for a district's needs. The solution may involve new construction or addition/renovation to existing school facilities. Upon board approval the MSBA may enter into a Project Scope and Budget Agreement which defines the project scope, budget, schedule, and potential MSBA participation in a project. As of FY 2014 the MSBA has distributed approximately $2.88 billon to districts for new construction and $2.53 billion for addition/renovation projects.

New Construction – Model Schools

The goal of the Model School Program is to effectively adapt and re-use the design of successful, recently-constructed elementary, middle, and high schools. This program provides school districts that demonstrate "good fit" with model design plans that save design cost.

Districts participating in the Model School Program are eligible to receive up to five additional percentage points of funding which are added to the base rate of MSBA reimbursement. In practice, the higher reimbursements can mean the difference between a school district being able to afford a new facility and being forced to continue using a deficient one. As of FY 2014 the MSBA has distributed approximately $483 million to districts for new model school projects.

Major Repair

The Major Repair Program is designed to address deficient school building systems to materially extend the life of a school and preserve an asset that is otherwise capable of supporting the required educational program. This program allows for a broad scope of work

and for this reason it follows a process closely aligned with the MSBA's new construction or renovation programs. As of FY 2014 the MSBA has distributed approximately $149 million to districts for major repair projects.

Green Repair

The Green Repair program, launched in March 2010, was a one-time $300 million investment into the Commonwealth's schools. The MSBA issued bonds for the program and the federal government subsidized the interest payments through the *American Recovery and Reinvestment Act of 2009.* This lowered the cost of the borrowing for the MSBA and brought cost effective funding for local school districts. The program offered districts the ability to complete repairs to roofs, windows, and boilers and allowed the MSBA to fund needed repairs to more than one school in a district. In order to maximize the impact of this program, The MSBA required participating districts to maintain an aggressive project schedule, appropriate funding quickly, and utilize a streamlined consultant selection process developed by the MSBA. As of FY 2014 the MSBA has distributed approximately $171 million to districts for green repair projects.

Accelerated Repair

The Accelerated Repair Program was created based on lessons learned from the Green Repair Program. Like the Green Repair Program, the Accelerated Repair Program primarily targets windows, roofs, and boiler systems with a streamlined project timetable. Typically these projects are completed within 18 months of a district being invited to participate in the program. The goal of the Accelerated Repair Program is to preserve existing assets by performing energy-efficient and cost saving upgrades which result in direct operational savings for school districts.

As of FY 2014 the MSBA has distributed approximately $44 million to districts for Accelerated Repair Projects.

Other – Feasibility Study/Schematic Design

Some projects do not fall under a specific program. Many of these projects are early on in the MSBA process and have not yet defined a scope of work. Other projects fall in this category because they did not receive the appropriations necessary from the local community for the project to move forward. The majority of payments in this category represent reimbursements for feasibility studies.

Spending Across Programs

Between FY2005 and FY2014, the MSBA made payments to school districts totaling $10.5 billion. These payments represent funding for projects approved under the MSBA's new program, projects the MSBA inherited and moved forward under the waiting list, and projects authorized and approved under the Commonwealth's prior school building program. For the purposes of this study, $3.63 billion of spending related to the prior program will be excluded as those grants were authorized and approved prior to the creation of the MSBA. This brings the total funding provided by the MSBA between FY2005 and FY2014 to $6.76 billion.

Table 1 provides data on the amount spent in each fiscal year across all Waiting List and New Program projects.

A breakdown of spending by Program Type is shown in Table 2 and Figure 1. *Addition/renovation* and *new construction* accounted for 87.4 percent of total MSBA project spending. *Model School Program new construction* accounted for another 7.1 percent of total spending.

Table 1   MSBA Funding by Fiscal Year

	Waiting List Payments	New Program Payments	Total Payments
FY 2005	$666,302,638		$666,302,638
FY2006	$1,684,328,685		$1,684,328,685
FY2007	$1,187,045,543		$1,187,045,543
FY2008	$356,937,182	$5,000,000	$406,937,182
FY2009	$290,279,211	$52,393,326	$342,672,537
FY2010	$283,388,665	$101,347,617	$384,736,282
FY2011	$146,094,312	$235,135,956	$381,230,268
FY2012	$110,220,287	$504,298,322	$614,518,609
FY2013	$111,762,391	$615,406,874	$727,169,265
FY2014	$28,949,241	$384,683,095	$413,632,336
FY2005-FY2014	**$4,865,308,155**	**$1,898,265,190**	**$6,763,573,345**

Source: Massachusetts School Building Authority

Table 2   MSBA Funding (FY2005-FY2014) by Program Type

All Projects (Waitlist and New Program)

Project Type	Grant Payments
Accelerated Repair	$ 44,581,576.00
Green Repair	$ 171,180,959.00
N/A	$ 2,983,583.00
New Construction	$ 2,882,689,257.06
New Construction - Model School	$ 483,003,926.00
Repair - Major	$ 149,064,564.00
Addition/Renovation	$ 3,030,069,479.45
Grand Total	**$ 6,763,573,344.51**

Source: Massachusetts School Building Authority

Figure 1

Total MSBA Spending by Program
FY2005-FY2014 (in $millions)

Addition/Renovation: $3,030.1
New Construction: $2,882.7
New Construction – Model Schools: $483.0
Green Repair: $171.2
Repair – Major: $149.1
Accelerated Repair: $44.6
Other – No Fixed Scope: $3.0
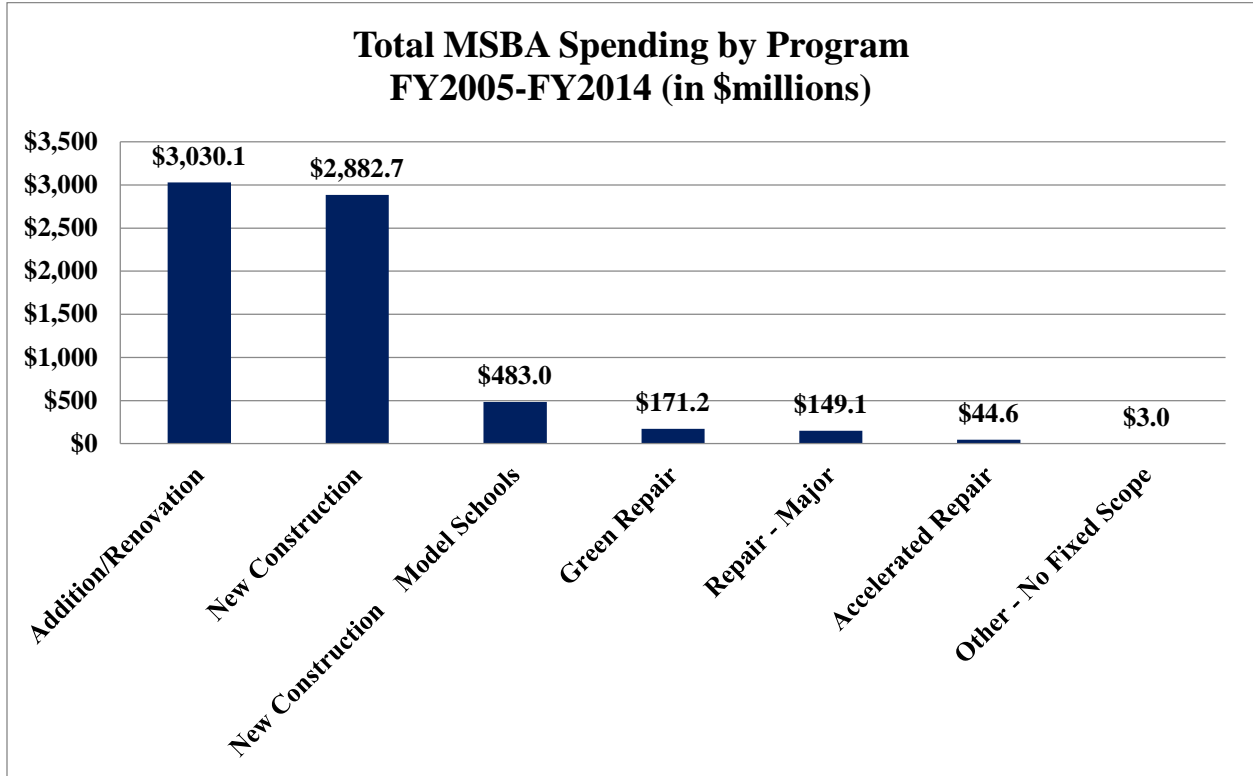
Source: Massachusetts School Building Authority

Part II   Methodology for Calculating Economic Impact of MSBA Funding[3]

The estimates for the impacts of spending on school building construction on the Massachusetts economy were derived using economic impact multipliers from the U.S. Bureau of Economic Analysis' Regional Input-Output Modeling System (RIMS II)[4]. Input-output modeling allows one to track the spending for an MSBA-funded project from the district to the prime contractor to the subcontractors and onto the range of suppliers who supply building materials and services to the project including all of the inputs that go into the production of these supplies. As such it permits a full accounting of all of the total impact of MSBA funding.

This type of model is widely-used by analysts to estimate the economic impact of development projects on a region. Vocabulary terms that are specific to input-output models are highlighted in bold the first time they appear below.

The BEA's Input-Output Model and RIMS II

The economic impact multipliers provided by the RIMS II model are derived by the BEA from the U.S. national input-output accounts. These accounts show the goods and services produced by each industry and the use of these goods and services by final users. These accounts are used to construct an input-output (I-O) model of the U.S. economy. This model is then adjusted to a regional level to account for the fact that many inputs at the regional level are imported from outside the region. Finally, the BEA uses the regional model to construct the impact multipliers used in this study.

To understand how I-O accounts can be used to estimate an industry's economic impact on an economy, consider the workhorse of I-O analysis, the **direct requirements table**. This table, derived from inter-industry transactions, is a two-dimensional table where the columns consist of producing industries, and the rows consist of supplying industries or sectors. Each column of the table describes the inputs required from each industry or sector to produce one dollar of output in the column industry. **Table 3** is a version of this BEA input-output table, aggregated to the sector level, taken directly from the U.S. I-O model. Notice that the sum of each column adds to one (1.0000), which reflects how each dollar of output – equivalent to gross revenue – is distributed to suppliers of goods and services to the producing sector.

Focus on the construction industry column (column 23), and consider an increase in **final demand** spending of $10,000 on construction – say, of new schools. For the U.S., for the construction industry as a whole, each $10,000 (multiplying all the figures in the column by

10,000) of construction output requires purchases of $12 from industries supplying agriculture, forestry, fishing, and hunting products – probably clearing land of trees and so on. That $10,000 of construction final demand also requires, according to the table $95 of mining products, $21 dollars of utility services, and so on. Notice that the majority of purchases come from the manufacturing sector, $2,325, and labor services, $3,673. Gross profits in the construction industry are $1,978 for each $10,000 of output, and taxes paid to governments at all levels are $71 per $10,000 of output. All these purchases exhaust the $10,000; that is, each dollar of output is accounted for.

This table is aggregated to the sector level. The BEA accounts actually contain much more detail, for example that the $2,325 in manufacturing inputs consist of $334 in non-metallic mineral products (such as cement), $495 in fabricated metal products (such as steel), $210 in electrical equipment, appliances, and components, etc. The input detail in the RIMS II accounts used for this analysis consists of 406 supplying industries in all.

Table 3

Commodity-by-Industry Direct Requirements, After Redefinitions (selected industries)							
(in producers' prices)							
Bureau of Economic Analysis							
2012							
Commodities/Industries		**11**	**21**	**22**	**23**	**31G**	**81**	**G**
IOCode	**Name**	Agriculture, forestry, fishing, and hunting	Mining	Utilities	Construction	Manufacturing	Other services, except government	Government
11	Agriculture, forestry, fishing, and hunting	0.1939	0.0002	0.0000	**0.0012**	0.0479	0.0001	0.0009
21	Mining	0.0046	0.0778	0.0757	0.0095	0.1017	0.0009	0.0057
22	Utilities	0.0089	0.0052	0.0064	**0.0021**	0.0103	0.0060	0.0090
23	Construction	0.0050	0.0083	0.0083	0.0001	0.0029	0.0055	0.0207
31G	Manufacturing	0.1797	0.0693	0.0622	**0.2325**	0.3374	0.0892	0.1140
42	Wholesale trade	0.0474	0.0105	0.0098	0.0365	0.0475	0.0141	0.0126
44RT	Retail trade	0.0003	0.0003	0.0007	0.0575	0.0023	0.0100	0.0001
48TW	Transportation and warehousing	0.0260	0.0167	0.0401	0.0166	0.0251	0.0086	0.0194
51	Information	0.0009	0.0012	0.0025	0.0036	0.0038	0.0132	0.0259
FIRE	Finance, insurance, real estate, rental, and leasing	0.0663	0.0223	0.0210	0.0240	0.0133	0.1150	0.0295
PROF	Professional and business services	0.0097	0.0418	0.0379	0.0357	0.0585	0.0605	0.0891
6	Educational services, health care, and social assistance	0.0008	0.0000	0.0003	0.0000	0.0000	0.0032	0.0108
7	Arts, entertainment, recreation, accommodation, and foo	0.0009	0.0011	0.0046	0.0018	0.0033	0.0050	0.0095
81	Other services, except government	0.0019	0.0008	0.0013	0.0041	0.0029	0.0098	0.0083
G	Government	0.0001	0.0000	0.0009	0.0000	0.0010	0.0027	0.0029
Used	Scrap, used and secondhand goods	-0.0001	0.0001	0.0002	0.0001	0.0029	0.0036	0.0000
Other	Noncomparable imports and rest-of-the-world adjustment	0.0018	0.0022	0.0029	0.0025	0.0035	0.0006	0.0056
V001	Compensation of employees	0.0968	0.1448	0.1847	0.3673	0.1446	0.4722	0.5113
V002	Taxes on production and imports, less subsidies	0.0058	0.0754	0.1608	0.0071	0.0116	0.0385	-0.0069
V003	Gross operating surplus	0.3494	0.5221	0.3797	0.1978	0.1796	0.1414	0.1317
	Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Legend / Footnotes:

Note. Detail may not add to total due to rounding.

Source: BEA RIMS II Input Output Model

The three highlighted rows at the bottom of the table with codes V001, V002, and V003 represent the "**value-added**" components of output. They are called "value-added" because these three components comprise the net addition to gross domestic output that result from each dollar of spending in the construction industry. Each $10,000 of spending on construction adds $3,673 in new wage and salary compensation to construction workers, $71 in new tax revenues for governments, and $1,978 in new profits to construction industry owners. These value-added components, $5,712 in all, comprise what is called the "**direct impact**" on value added or gross domestic product in the economy. It represents the additional value of goods and services produced in the construction industry by an increase of $10,000 in construction output. Equivalently, the direct impact is .5712 per dollar of construction spending.

The effect of $10,000 in spending on construction output on the economy does not end there, however. Each of the inputs purchased by the construction industry must be supplied – and therefore produced – by the supplying industry, and this creates additional value added (or gross domestic product) in the economy. For example, using the manufacturing column of the direct requirements table, the $2,325 of purchases from the manufacturing industry generates an **indirect impact** in the manufacturing industry of an additional $781 in value-added (=$2325*[.1446+.0116+.1796]). Each other supplying industry generates additional indirect impacts. Accounting for all of these supplying industries generates the first round of indirect impacts. These indirect impacts continue for many rounds. For example, the manufacturing industry that supplies the construction industry generates additional value added in the industries that supply *it*, generating a second round of indirect impacts. Conceptually, these rounds of indirect impacts continue forever, but mathematically, each subsequent round adds less and less to value added, so that the sum of these rounds approaches an easily calculated limit – using

matrix algebra. The sum of all these rounds of indirect impacts is simply called the indirect impact. It represents the total value added in the economy necessary to produce the initial increase in final demand for construction spending of $10,000.

These impacts, expressed per dollar of the initial increase in final demand, are called **multipliers**. RIMS II produces three sets of **Type I** multipliers (see **Table 4**) for each industry, one for *value added*, one for *earnings* (the earnings part of value added), and one for *employment*, which is scaled to jobs per million dollars of the initial increase in demand. Continuing with the example of the construction industry, each set of the three multipliers for construction contains one multiplier for each supplying industry. For example, the value-added multiplier for the construction industry reflects the direct and indirect impacts on value-added in the construction industry, while the value-added multiplier for the manufacturing sector and each other industry reflects the indirect impacts on value-added in that industry.

Based on the RIMS model, $10,000 spent on the construction of a high school in Massachusetts results in total in-state direct and indirect value-added of $7,721. The total direct and indirect value-added substantially exceeds the $10,000, but much of it is received by workers and owners from out-of-state suppliers. Of the $7,721 of value-added generated in Massachusetts, $5,000 is generated in the construction industry itself. Another $544 is generated by Massachusetts manufacturing companies; almost $600 by professional, scientific, and technical services such as architects, designers, accountants, and lawyers; nearly $280 by the wholesale trade services; and $290 by retail trade services. Smaller amounts are generated in a range of industries from mining, utilities, transportation and warehousing, finance, real estate and rental services, waste services, and even health care, accommodations, and food service. When

all of these are added up, one obtains the Type I multiplier for the high school construction project in the state.

The Type I earnings multipliers reflect the direct and indirect impacts of each dollar of spending in construction on the earnings part of value-added. Of the $7,721 in value-added created by $10,000 in final demand spending on construction, $4,986 would be in the form of earnings paid to workers, and $3,588 of that amount would be in earnings paid in the construction industry itself.

The Type I employment multipliers translate the earnings multipliers into jobs. This is accomplished by dividing the earnings impact in each industry by the ratio of annual earnings to average annual employment in that industry and region. These ratios are taken from the quarterly census of employment and wages (QCEW) and other sources. The QCEW data are taken from quarterly reports required by each employer that contributes to the unemployment insurance system. In order to avoid decimals with a large number of leading zeroes, these multipliers are scaled to jobs per million dollars of final demand spending. For example the direct and indirect impact of a million dollars ($1,000,000) of final demand spending in construction would result in the creation of 9.88 jobs, 7.01 of them in the construction industry itself.

Since the translation from earnings to jobs involves the ratio of annual earnings to average annual employment, the employment multipliers have the interpretation of job-years. For example, if the final demand spending were $1 million per year, then the employment impact would be to increase annual employment by 9.88 jobs. On the other hand if it were $1 million per month, then the annual employment impact would instead be 119 jobs (12 x 9.88); or it were $1 million spread over a period of 10 years, then the annual employment impact would instead

17

be .988 jobs (9.88/10). In the case of this study, the direct and indirect impacts of $6,781 million in spending by the MSBA (in 2010 dollars) is the creation of 67,000 job-years. Since this spending occurred over a period of 10 years, the average annual employment impact was 6,700 jobs.

These Type I multipliers account for only the inter-industry effects (direct and indirect) of a final demand change. I-O models also can be used to estimate what the BEA calls the **induced impact**. This impact is the result of changes in final demand by households for consumption purchases that follow from households' increases in incomes due to the employment and earnings impacts given by the Type I multipliers. Thus, for example, induced spending includes the additional jobs and income generated within the region as a result of a construction worker buying a pickup truck, work clothing, or a restaurant meal with the income earned on the construction job.

The I-O model accomplishes this by adding a **household** column to the direct requirements table shown in **Table 3**. This column represents consumer spending per dollar of income. Unlike the other columns in the direct requirements table, the entries do not add to one because of income that goes to savings. The induced impacts are conceptually calculated in the same manner as the indirect impact. Each additional dollar of household income results in a change in final demand for each industry that "supplies" consumer spending. These impacts can also be expressed per dollar of the initial increase in final demand.

The **Type II** multipliers include these induced impacts in addition to the direct and indirect impacts given by the Type I multipliers. For school construction, the RIMS model estimates a Type II valued-added multiplier of 1.145 (see **Table 4**). For every $10,000 originally spent on the construction of the high school, an additional $507 of value-added accrues to the

Table 4

RIMS II Construction Industry Multipliers for Massachusetts, 2010						
	Value-Added		Earnings		Employment	
SECTOR	**TYPE I**	**TYPE II**	**TYPE I**	**TYPE II**	**TYPE I**	**TYPE II**
Agriculture, forestry, fishing, and hunting	0.0001	0.0006	0.0001	0.0003	0.0029	0.0151
Mining	0.0024	0.0024	0.0010	0.0010	0.0218	0.0222
Utilities	0.0038	0.0106	0.0012	0.0035	0.0112	0.0315
Construction	0.5000	0.5022	0.3588	0.3605	7.0065	7.0381
Manufacturing	0.0544	0.0737	0.0295	0.0385	0.5438	0.7141
Wholesale trade	0.0277	0.0483	0.0122	0.0214	0.1703	0.2976
Retail trade	0.0292	0.0665	0.0146	0.0332	0.5430	1.2370
Transportation and warehousing	0.0080	0.0150	0.0050	0.0097	0.1083	0.2125
Information	0.0122	0.0307	0.0047	0.0115	0.0668	0.1714
Finance and insurance	0.0199	0.0648	0.0092	0.0321	0.1425	0.5049
Real estate and rental and leasing	0.0205	0.1066	0.0044	0.0108	0.1751	0.5463
Professional, scientific, and technical services	0.0597	0.0803	0.0369	0.0508	0.4915	0.6794
Management of companies and enterprises	0.0100	0.0172	0.0064	0.0109	0.0617	0.1056
Administrative and waste management service	0.0127	0.0223	0.0082	0.0143	0.3362	0.5843
Educational services	0.0001	0.0058	0.0001	0.0040	0.0030	0.1252
Health care and social assistance	0.0005	0.0507	0.0003	0.0378	0.0060	0.7607
Arts, entertainment, and recreation	0.0009	0.0050	0.0005	0.0029	0.0197	0.1262
Accommodation	0.0015	0.0056	0.0007	0.0026	0.0203	0.0768
Food services and drinking places	0.0022	0.0154	0.0013	0.0091	0.0669	0.4636
Other services	0.0063	0.0205	0.0035	0.0117	0.0869	0.2931
Households	0.0000	0.0008	0.0000	0.0008	0.0000	0.0970
SUM	**0.7721**	**1.1450**	**0.4986**	**0.6674**	**9.8844**	**14.1026**

Source: BEA RIMS II Input Output Model

health care and social assistance sector as the result of purchases by both the construction workers on the school project as well as those whose incomes increased as a result of spending by the construction workers from the income they earned. Similarly, there is an increase of nearly $740 in the value-added in the manufacturing sector; another $665 in retail trade; and another $154 in restaurants and drinking places.

The Type II earnings multipliers indicate that for each $10,000 in final demand spending on construction, the direct, indirect and induced impacts increase earnings by $6,674. Of that

amount, $3,605, or 54 percent, accrues to construction workers, while the remaining 46 percent of earnings are received by workers in other industries and sectors.

The Type II employment multipliers indicate that for each $1 million in final demand spending on construction, the direct, indirect and induced employment impacts amount to 14.10 job-years, roughly evenly split between construction workers and workers in the rest of the economy.

It is this induced spending that makes the original MSBA investments in school construction, renovation, and repair so valuable in terms of generating employment, earnings, and state tax revenue far beyond the construction project itself.

In sum, the impact of MSBA spending has three impacts on the economy. The **first** is the value-added, earnings, and employment *direct* impact of the initial spending on a construction, renovation, or repair project. Most of this occurs through the construction industry itself and directly benefits construction workers, managers, and construction firms. The **second** is *indirect* and effects the workers, managers, and owners of firms in other industries that supply goods and services to the construction firms building or remodeling the district schools. This also includes firms that supply the supplying firms such as the coal mine that supplies coal to a steel industry blast furnace which produces i-beams or re-bar for the school built in Massachusetts. Finally, the **third** impact is the *induced* effect that occurs when workers, managers, or investors building or renovating a school spend some of their earnings to buy all the things they purchase for their families. The assumption here is that if the worker was not employed, he or she would have less to spend and therefore induced impact would not exist.

Accounting for Leakages to Other Regions

Since I-O models are usually used to estimate economic impacts of a change in final demand on a *region*, some account has to be made for demand that is fulfilled by suppliers *outside* the region. Demand that **leaks** to other regions affect those other regions' economies, but not the economy in the "originating" region. At the national level, this is handled by international trade accounts, so the numbers in the adjusted direct requirements table reflect only demand that is filled by suppliers located in the U.S. This means that the columns in this table no longer sum to one, but rather, to less than one, depending on how important imports are in each industry.[5]

At the subnational regional level (RIMS II provides multipliers at the level of states and counties), accounts that measure inter-regional flows within the U.S. do not exist, so the BEA uses another method to account for leakages to other regions. For each entry in the national adjusted direct requirements table (which has already been adjusted for leakages to other countries), the BEA applies a **location coefficient** for that supplying industry. The location coefficient for a regional industry is the ratio of that industry's share of regional wages and salaries divided by that industry's share of national wages and salaries. Thus a location coefficient of one indicates that the share of that industry's activity in the regional economy is the same as in the national economy, while a location coefficient greater than one indicates that that industry is more concentrated in the region than the nation as a whole, and a location coefficient of less than one indicates that that industry is less concentrated in the region than the nation as a whole. If the industry's location coefficient is less than one, the entry in the regional direct requirements table is equal to the national adjusted direct requirements table multiplied by the location coefficient. If the industry's location coefficient is greater than or equal to one, the

entry in the regional direct requirements table is equal to the national adjusted direct requirements table. The implication of this methodology is that, in supplying industries that are less concentrated than the nation as a whole, some proportion of the domestically (U.S.) produced inputs purchased from that industry originate from suppliers located outside the region, that proportion being one minus the location quotient.

The upshot is that both the **Type I** and **Type II** multipliers in **Table 4** reflect leakages to other states and countries. This simply reflects the reality that a large proportion of final demand is supplied by firms located outside the state.

The Assumption of No Supply Constraints

One important assumption when using I-O models such as RIMS II is that there are no supply constraints. This means that increases in demand are filled by suppliers from new production, rather than by denying other customers who want orders filled; and also that labor supplied in the new jobs does not come at the expense of net outflows of labor from other jobs. In a fully-employed economy, this assumption is likely to be violated, unless resources are brought into the region from other regions to fulfill the demand, through new plant construction or expansion and in-migration of households that expand the workforce.

Given the Great Recession and the housing collapse that preceded it when construction employment began to decline in the spring of 2006, this assumption of no supply constraints appears to be reasonable. According to the Bureau of Labor Statistics, construction employment in Massachusetts declined 26 percent after April 2006, and in March 2014, was still 15 percent below the pre-recession peak. Manufacturing, an important supplying industry to the construction sector, was the second-worst hit sector (after construction) in the recession. Its employment level in March 2014 was still 14 percent below pre-recession levels.[6] Hence, it can

be assumed that much of the work that went into building, renovating, or repairing schools in Massachusetts during the FY2005-FY2014 period did not come at the expense of foregone construction somewhere else in the Massachusetts economy. As such the values here represent something close to net additions to economic growth.

Part III   Economic Impacts on Value-Added (Real State Gross Domestic Product), Employment, and Earnings

The economic impacts of the MSBA funding during the FY2005-FY2014 period are summarized in the following tables. The total impacts for each table are calculated by applying the RIMS II Type II multipliers in Table 4 to the total MSBA funding in 2010 dollars of $6,781 million[7]. In each table, the total impact is separated into two components:[8]

1. The direct impact on the construction industry in Massachusetts.

2. The sum of the indirect and induced impacts on the Massachusetts economy.

These estimates are further separated by program in Appendix Tables 1 through 7.[9]

The Value-Added (Real Massachusetts Gross Domestic Product) Impact of MSBA Funding

The direct impact of total MSBA spending of $6.78 billion (in 2010 dollars) between FY2005 and FY2014 reflects an addition to Massachusetts real gross domestic product of $3.38 billion (also in 2010 dollars) by the construction industry during this period due directly to the construction, renovation, and repair of schools (see **Table 5**). This is comprised primarily of wages and salaries paid to Massachusetts construction workers (of $2.42 billion, reported later in Table 7), secondarily of profits to construction firm owners, and lastly of tax revenue paid to all levels of governments by the construction industry.

Table 5

Value Added Impacts			
(Millions of 2010 Dollars)			
SECTOR	Direct	Indirect + Induced	Total
Agriculture, forestry, fishing, and hunting		4	4
Mining		16	16
Utilities		72	72
Construction	3,380	26	3,406
Manufacturing		500	500
Wholesale trade		328	328
Retail trade		451	451
Transportation and warehousing		102	102
Information		208	208
Finance and insurance		439	439
Real estate and rental and leasing		723	723
Professional, scientific, and technical services		545	545
Management of companies and enterprises		117	117
Administrative and waste management services		151	151
Educational services		39	39
Health care and social assistance		344	344
Arts, entertainment, and recreation		34	34
Accommodation		38	38
Food services and drinking places		104	104
Other services		139	139
Households		5	5
SUM	3,380	4,385	7,764
Addenda			
Program Spending (Millions of current dollars)			6,764
Program Spending (Millions of 2010 dollars)			6,781
Note: totals might not add exactly due to rounding.			

But that $3.38 billion in direct spending within the Commonwealth induced another $4.385 billion in in-state value-added between FY2005 and FY2014. This represents value-

added in industries supplying construction – the indirect impacts, plus value-added in industries providing goods and services to:

- workers in the construction industry,

- workers in the industries supplying construction, and

- workers in the industries supplying goods and services to these other workers.

These last three items comprise the induced impacts. The total direct, indirect, and induced value-added in Massachusetts amounted to $7.764 billion. According to the input-output model, manufacturing firms in Massachusetts benefited to the tune of $500 million in value-added. Retailers value-added was increased by more than $450 million; finance and insurance firms increased their value-added by nearly $440 million; while real estate, rental and leasing firms experienced a boost of more than $720 million. Other winners were professional, scientific, and technical services ($545 million); health care and social service providers ($344 million); and wholesale trade ($328 million). Ultimately, restaurants and drinking places had another $104 million in business as an indirect and induced result of MSBA spending.

The Employment Impact of MSBA Funding

With such a large increment in value-added across a broad array of industries, the spending generated by MSBA-funded projects has created a large number of jobs during the 2005 to 2013 period. The additional jobs in construction were particularly critical for during this nine year period which included the Great Recession, total construction employment in Massachusetts plummeted from 141,200 in 2006 to 107,100 in 2010 before partially recovering to 121,700 in 2013. As such, the large number of construction workers employed to construct, renovate, or repair district schools as a result of MSBA funding would likely have been otherwise unemployed. These workers would have had reduced purchasing power and many

would be receiving state unemployment benefits rather than contributing income and sales tax revenue.

Table 6

Employment Impacts			
(Number of Job Years)			
SECTOR	Direct	Indirect + Induced	Total
Agriculture, forestry, fishing, and hunting		102	102
Mining		151	151
Utilities		214	214
Construction	47,366	360	47,727
Manufacturing		4,842	4,842
Wholesale trade		2,018	2,018
Retail trade		8,388	8,388
Transportation and warehousing		1,441	1,441
Information		1,162	1,162
Finance and insurance		3,424	3,424
Real estate and rental and leasing		3,705	3,705
Professional, scientific, and technical services		4,607	4,607
Management of companies and enterprises		716	716
Administrative and waste management services		3,962	3,962
Educational services		849	849
Health care and social assistance		5,158	5,158
Arts, entertainment, and recreation		856	856
Accommodation		521	521
Food services and drinking places		3,144	3,144
Other services		1,988	1,988
Households		658	658
SUM	47,366	48,266	95,633
Addenda			
Program Spending (Millions of current dollars)			6,764
Program Spending (Millions of 2010 dollars)			6,781
Note: totals might not add exactly due to rounding.			

Table 6 provides the input-output generated data for employment resulting from MSBA funding

during this period. According to this analysis, nearly 47,400 construction job-years were created on these MSBA-funded projects sometime between FY2005 and FY2014. Over this period, this would have raised construction employment by an average of roughly 5,000 per year over what it would have been otherwise, which means that construction employment would have been about 4 percent lower during this time without MSBA funding.

But these construction jobs comprised only about half of all jobs that were ultimately generated as a result of MSBA funding. The value-added generated in other sectors as a result of the indirect and induced impacts of MSBA funding provided another 48,266 job-years in the Commonwealth for a total of nearly 96,000 job-years statewide. These included more than 4,800 jobs[10] in manufacturing; nearly 5,200 jobs in health care and social services; 4,600 jobs for professionals, scientific, and technical workers; 3,700 jobs in real estate, rental and leasing; 3,400 jobs in finance and insurance; and more than 3,100 jobs in restaurants and drinking places. In addition, the local purchases generated by these workers provided nearly 8,400 full or part-time jobs in retail trade and another 2,000 in wholesale trade.

The Earnings Impact of MBSA Funding

Of the $6.78 billion of funding for school construction projects, $2.42 billion (**Table 7**) was spent for wages and salary compensation to the workers who built, maintained, or repaired the schools. Indirect and induced earnings amounted to an additional $2.10 billion for a total of $4.526 billion. Of the total of induced earnings, nearly $345 million went to those who work in professional, scientific, and technical services; $261 million went to those in manufacturing; $256 million in health and social services; and $225 million in retail trade.

Table 7

Earnings Impacts			
(Millions of 2010 Dollars)			
SECTOR	Direct	Indirect + Induced	Total
Agriculture, forestry, fishing, and hunting		2	2
Mining		7	7
Utilities		24	24
Construction	2,424	21	2,445
Manufacturing		261	261
Wholesale trade		145	145
Retail trade		225	225
Transportation and warehousing		66	66
Information		78	78
Finance and insurance		218	218
Real estate and rental and leasing		73	73
Professional, scientific, and technical services		344	344
Management of companies and enterprises		74	74
Administrative and waste management services		97	97
Educational services		27	27
Health care and social assistance		256	256
Arts, entertainment, and recreation		20	20
Accommodation		18	18
Food services and drinking places		62	62
Other services		79	79
Households		5	5
SUM	2,424	2,102	4,526
Addenda			
Program Spending (Millions of current dollars)			6,764
Program Spending (Millions of 2010 dollars)			6,781
Note: totals might not add exactly due to rounding.			

Part IV   Impacts on State Tax Revenues

All of this economic activity generated a large amount of additional tax revenue for the Commonwealth. For this analysis, state tax revenue estimates are based on average relationships between tax revenue components and corresponding income and product account relationships over the FY2005 through FY2014 period, with special treatment for profit income, and for the sales tax exemption for spending on the construction of school building materials. Withholding revenues are based on the average ratio of state withholding tax revenues to wage and salary income. Sales tax revenues – with the exception of direct spending on school building materials – are based on the average ratio of state sales and excise tax collections to state gross domestic product. Business tax collections are based on the average ratio of state business taxes to state gross domestic product. The methodology for the estimation of these tax revenue impacts is given in more detail in an appendix.

Total state tax revenues generated in Massachusetts flowing from the $6.781 billion of MSBA funding between FY2005 and FY2014 are shown in **Table 8**. As a result of this infusion of direct and induced earnings in the state, the Commonwealth's coffers benefited as well. Over the FY2005 through FY2014 period, we estimate that the average personal income tax rate on the $4.526 billion in earnings was 4.84 percent. Over the FY2005 - FY2014 period this yielded a little more than $219 million in additional state income tax. In addition, interest and dividend income generated in the course of MSBA projects amounted to an estimated $1.470 billion.   At a tax rate of 5.25%, this yielded nearly $77.2 million in "Part B" income taxes.

Table 8 Massachusetts Tax Revenue Generated by MSBA Funding

Additional State Personal Income Tax	$296.3 million
Additional State Sales Tax Revenue	$67.1 million
Additional State Business Tax Revenue	$48.5 million
TOTAL ADDITIONAL STATE TAX REVENUE	$411.8 million

Based on historical relationships between state GDP and sales and excise tax revenue, we estimate that the average effective sales tax rate during this period of time was 1.53 percent (taking into account that the Massachusetts sales tax exempts rent, most food purchased in grocery stores, most clothing, and virtually all services). While the MSBA funded projects are tax exempt, much of the induced spending is not. Applying this average tax rate to the total amount of indirect and induced value-added yields additional state revenue of $67.1 million.

Finally, there are business taxes based on the profits of Massachusetts firms. Again, based on historical relationships we estimate that over the FY2005 - FY2014 period, these amounted to $48.5 million.

Adding all of these revenue streams together suggests that MSBA funding generated $411.8 million in tax revenue to the Commonwealth. As such, the net cost to the state of its investment in district schools was smaller by this amount than the gross cost.

Figure 2 provides a further breakdown of tax revenues generated by each MSBA program. More detail is given in Appendix Table 8.

Figure 2

Massachusetts Tax Revenue Generated by MSBA Funded Projects
FY2005 - FY2014 (in $millions)

Category	Value
Addition/Renovation	$184.50
New Construction	$175.53
New Construction Model Schools	$29.41
Green Repair	$10.42
Repair - Major	$9.08
Accelerated Repair	$2.72
Other -- No Scope	$0.18
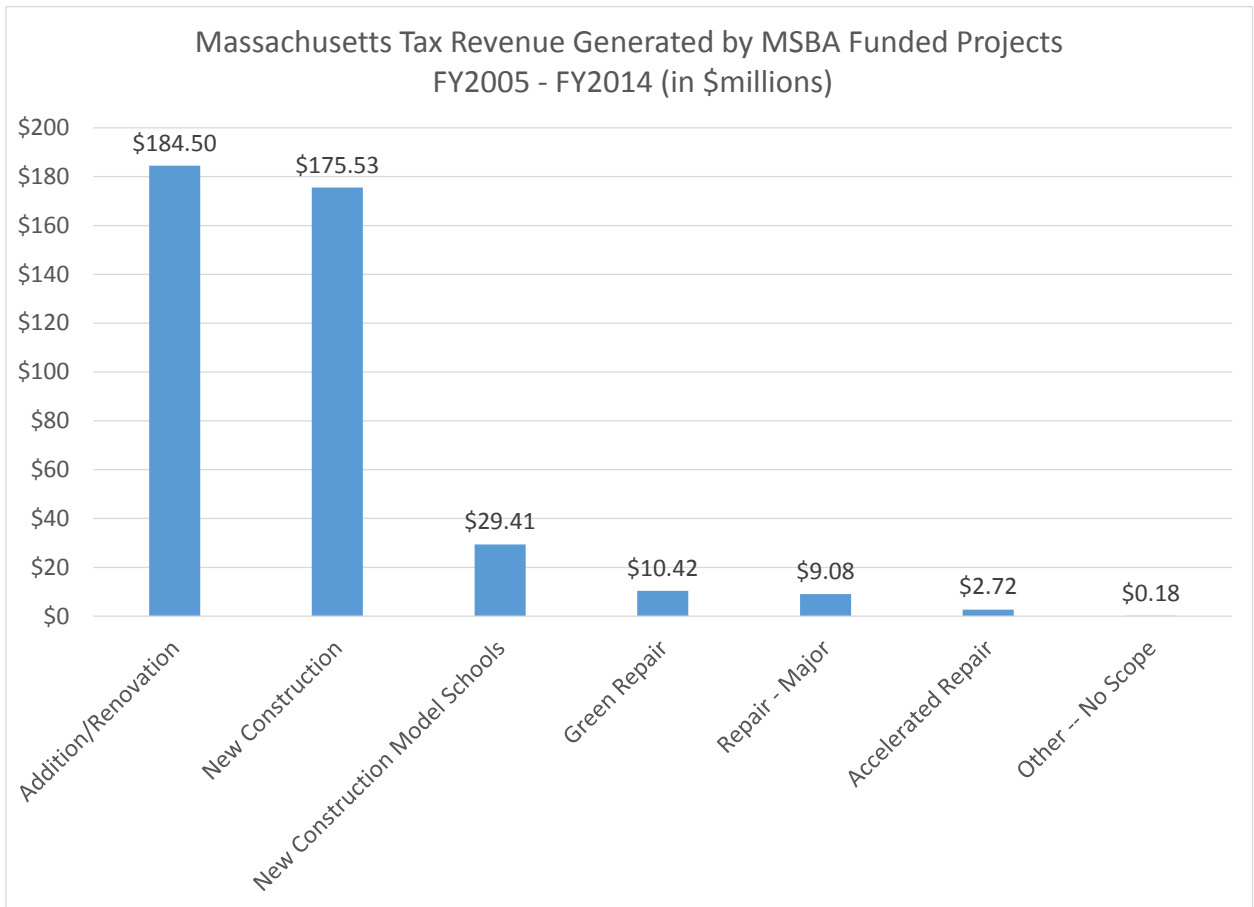
Summary and Conclusions

Generally, when economists consider the economic impact of government programs on the aggregate economy, they focus on the role of federal policies. A good example of such "fiscal policy" would be the impact of federal highway dollars or the stimulus spending associated with the American Recovery and Reinvestment Act (ARRA) on national gross domestic product and employment. But large-scale spending by state governments can have an impact at least on a regional economy. As this report has amply demonstrated, the $6.7 billion infusion of funds into the construction, renovation, and repair of Massachusetts elementary,

secondary, and vocational schools has had a large positive impact on output, employment, and earnings in the state.

Using input-output analysis the research described here was able to measure the direct, indirect, and induced effect of the funds granted to individual school districts by the Massachusetts School Building Authority over the period FY2005 through FY2014.

Overall, the $6.7 billion in funding injected $3.38 billion directly into the construction industry and its workforce within the state of Massachusetts. The remaining funds went to purchase construction materials and other necessary goods and services from firms operating in other states while some went to construction workers who live outside the state but traveled to Massachusetts to work on school projects here.

But that $3.38 billion in direct spending within the Commonwealth was responsible for indirect and induced spending of another $4.385 billion spread across a wide variety of Massachusetts industries from manufacturing to retail trade providing a total value-added within the state of $7.764 billion.

With the economy in recession during much of this period and construction employment plummeting from 141,200 jobs in 2005 to 107,100 in 2010 before recovering to 121,700 in 2013, the large infusion of MSBA funding provided an enormous boost in employment to what would have in many cases been unemployed workers. Altogether, 47,400 job-years of employment were created on an MSBA project. According to our analysis, at any one time during the FY2005 to FY2013 period, there were approximately 5,000 Massachusetts construction workers on a school construction, renovation, or repair site because of MSBA funding – roughly four percent of the total number of construction workers employed on all private and public construction projects in the state. And this was only about half of all the direct, indirect, and

induced jobs that can be credited to MSBA projects. Another 48,300 jobs were generated in the course of supplying goods and services to these projects or were the result of spending by workers in construction, employees of firms supplying the construction industry, or employees of firms providing goods and services to these workers. Our best estimate of the total number of job-years that can be credited to MSBA programs is nearly 96,000.

Such a large boost in employment obviously resulted in a substantial boost in total wages, salaries, and benefits earned by workers in the state, both those working on MSBA-funded construction sites or the indirect and induced result of spending on these projects. We estimate construction workers and managers working directly on MSBA-funded projects earned $2.4 billion in wages, salaries, and benefits during the FY2005 to FY2014 period. Induced earnings from their spending of this income generated another $2.1 billion in earnings for employment earnings of $4.526 billion. These earnings went to workers in virtually all industrial sectors in the Commonwealth.

Finally, some of the MSBA funding came back to state coffers as a result of increased personal, sales, and business taxes. Our best estimate is that the over the FY2005 to FY2014 period, the Massachusetts treasury received $296.3 million in additional personal income tax revenue, $67.1 million in additional sales and excise tax revenue, and $48.5 million in added business tax revenue for a total of nearly $412 million.   As such, the long term net cost to the state for MSBA programs is somewhat smaller than the gross cost.

It should also be pointed out that these estimates may be underestimates of the total economic impact of MSBA funding. If the existence of MSBA funds permitted local school districts to invest their own funds in school construction, renovation, or repair that would not have otherwise been undertaken, the total impact of MSBA funding could be even larger.

The bottom line is that MSBA funding activity not only leaves the Commonwealth with better schools for our children, but continues to play a not insignificant role in boosting the economy of the state, providing jobs for thousands and thousands of our workers.

Appendix: Methodology for Estimating State Tax Revenue Impacts

For this analysis, state tax revenue estimates are based on average relationships between tax revenue components and corresponding income and product account relationships over the FY2005 through FY2012 period, with special treatment for profit income, and for the sales tax exemption for spending on the construction of school building materials. Withholding revenues are based on the average ratio of state withholding tax revenues to wage and salary income. Sales tax revenues – with the exception of direct spending on school building materials – are based on the average ratio of state sales and excise tax collections to state gross domestic product. Business tax collections are based on the average ratio of state business taxes to state gross domestic product.

Massachusetts wage and salary income, and Massachusetts gross domestic product are from the U.S. Bureau of Economic Analysis, and Massachusetts state tax revenues are from the Massachusetts Department of Revenue. All estimates are deflated to 2010 dollars.

Withholding Tax Revenue

The withholding tax revenue impact is equal to the average ratio of state withholding taxes to wage and salary income over the FY2005-FY2012 period, .048414, times the total earnings impact of $4.526 billion.

Non-Withholding Personal Income Tax Revenue

The personal income impacts generated from construction spending are comprised of two components: wage and salary earnings, and profit income. Tax revenues derived from earnings are captured in withholding tax revenues. What remains are tax revenues derived from profit income. The profit income impact is calculated as the ratio of gross operating surplus (profits) to value-added, .3786[11], times the valued-added impact of $7.764 billion. It is assumed that half of this profit income generated in Massachusetts was received by Massachusetts residents and therefore was taxable at the .0525 average Part B state income tax rate.

Sales and Excise Tax Revenues

Sales and excise taxes are estimated as the average ratio of sales and excise tax revenues to state gross domestic product over the FY2005-FY2012 period, .015342, times the indirect plus induced value-added impact. This excludes the direct value-added impact since that reflects direct spending on school construction and is therefore exempt from state sales taxes. The indirect plus induced value-added impact is approximated with a high degree of accuracy by the

difference between the Type II and Type I value-added multipliers, .645, times the construction spending of $6.781 billion.

Business Taxes

The business tax revenue impact is estimated as the average ratio of business tax revenues to state gross domestic product over the FY05-FY12 period, of .006241, times the value-added impact of $7.764 billion.

Appendix Tables

Appendix Table 1

Total Value-Added Impacts, by Sector and Program (Millions of 2010 Dollars)								
SECTOR	Accelerated Repair	Addition/Renovation	Green Repair	Other -- No Scope	New Construction	New Construction Model Schools	Repair - Major	All Programs Total
Agriculture, forestry, fishing, and hunting	0.0	1.8	0.1	0.0	1.7	0.3	0.1	4.1
Mining	0.1	7.3	0.4	0.0	6.9	1.2	0.4	16.3
Utilities	0.5	32.2	1.8	0.0	30.6	5.1	1.6	71.9
Construction	22.4	1,525.7	86.2	1.5	1,451.5	243.2	75.1	3,405.5
Manufacturing	3.3	223.9	12.6	0.2	213.0	35.7	11.0	499.8
Wholesale trade	2.2	146.7	8.3	0.1	139.6	23.4	7.2	327.5
Retail trade	3.0	202.0	11.4	0.2	192.2	32.2	9.9	451.0
Transportation and warehousing	0.7	45.6	2.6	0.0	43.4	7.3	2.2	101.7
Information	1.4	93.3	5.3	0.1	88.7	14.9	4.6	208.2
Finance and insurance	2.9	196.9	11.1	0.2	187.3	31.4	9.7	439.4
Real estate and rental and leasing	4.8	323.8	18.3	0.3	308.1	51.6	15.9	722.9
Professional, scientific, and technical services	3.6	243.9	13.8	0.2	232.1	38.9	12.0	544.5
Management of companies and enterprises	0.8	52.3	3.0	0.1	49.7	8.3	2.6	116.6
Administrative and waste management services	1.0	67.7	3.8	0.1	64.5	10.8	3.3	151.2
Educational services	0.3	17.6	1.0	0.0	16.8	2.8	0.9	39.3
Health care and social assistance	2.3	154.0	8.7	0.2	146.5	24.6	7.6	343.8
Arts, entertainment, and recreation	0.2	15.2	0.9	0.0	14.5	2.4	0.7	33.9
Accommodation	0.3	17.0	1.0	0.0	16.2	2.7	0.8	38.0
Food services and drinking places	0.7	46.8	2.6	0.0	44.5	7.5	2.3	104.4
Other services	0.9	62.3	3.5	0.1	59.2	9.9	3.1	139.0
Households	0.0	2.4	0.1	0.0	2.3	0.4	0.1	5.4
SUM	51.2	3,478.5	196.5	3.4	3,309.3	554.5	171.1	7,764.5
Addenda								
Program Spending (Millions of current dollars)	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Program Spending (Millions of 2010 dollars)	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	6,781.2
Note: totals might not add exactly due to rounding.								

Appendix Table 2

	Total Employment Impacts, by Sector and Program							
SECTOR	Accelerated Repair	Addition/Renovation	Green Repair	Other -- No Scope	New Construction	New Construction Model Schools	Repair - Major	All Programs Total
Agriculture, forestry, fishing, and hunting	1	46	3	0	44	7	2	102
Mining	1	67	4	0	64	11	3	151
Utilities	1	96	5	0	91	15	5	214
Construction	315	21,382	1,208	21	20,342	3,408	1,052	47,727
Manufacturing	32	2,169	123	2	2,064	346	107	4,842
Wholesale trade	13	904	51	1	860	144	44	2,018
Retail trade	55	3,758	212	4	3,575	599	185	8,388
Transportation and warehousing	9	646	36	1	614	103	32	1,441
Information	8	521	29	1	495	83	26	1,162
Finance and insurance	23	1,534	87	2	1,459	245	75	3,424
Real estate and rental and leasing	24	1,660	94	2	1,579	265	82	3,705
Professional, scientific, and technical services	30	2,064	117	2	1,964	329	102	4,607
Management of companies and enterprises	5	321	18	0	305	51	16	716
Administrative and waste management services	26	1,775	100	2	1,689	283	87	3,962
Educational services	6	380	21	0	362	61	19	849
Health care and social assistance	34	2,311	131	2	2,199	368	114	5,158
Arts, entertainment, and recreation	6	383	22	0	365	61	19	856
Accommodation	3	233	13	0	222	37	11	521
Food services and drinking places	21	1,408	80	1	1,340	225	69	3,144
Other services	13	890	50	1	847	142	44	1,988
Households	4	295	17	0	280	47	14	658
SUM	630	42,843	2,420	42	40,759	6,829	2,108	95,633
Addenda								
Program Spending (Millions of current dollars)	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Program Spending (Millions of 2010 dollars)	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	6,781.2
Note: totals might not add exactly due to rounding.								

Appendix Table 3

				Total Earnings Impacts, by Sector and Program (Millions of 2010 Dollars)				
SECTOR	Accelerated Repair	Addition/Ren ovation	Green Repair	Other -- No Scope	New Construction	New Construction Model Schools	Repair - Major	All Programs Total
Agriculture, forestry, fishing, and hunting	0.0	0.9	0.1	0.0	0.9	0.1	0.0	2.0
Mining	0.0	3.0	0.2	0.0	2.9	0.5	0.1	6.8
Utilities	0.2	10.6	0.6	0.0	10.1	1.7	0.5	23.7
Construction	16.1	1,095.2	61.9	1.1	1,041.9	174.6	53.9	2,444.6
Manufacturing	1.7	117.0	6.6	0.1	111.3	18.6	5.8	261.1
Wholesale trade	1.0	65.0	3.7	0.1	61.9	10.4	3.2	145.1
Retail trade	1.5	100.9	5.7	0.1	96.0	16.1	5.0	225.1
Transportation and warehousing	0.4	29.5	1.7	0.0	28.0	4.7	1.4	65.8
Information	0.5	34.9	2.0	0.0	33.2	5.6	1.7	78.0
Finance and insurance	1.4	97.5	5.5	0.1	92.8	15.5	4.8	217.7
Real estate and rental and leasing	0.5	32.8	1.9	0.0	31.2	5.2	1.6	73.2
Professional, scientific, and technical services	2.3	154.3	8.7	0.2	146.8	24.6	7.6	344.5
Management of companies and enterprises	0.5	33.1	1.9	0.0	31.5	5.3	1.6	73.9
Administrative and waste management services	0.6	43.4	2.5	0.0	41.3	6.9	2.1	97.0
Educational services	0.2	12.2	0.7	0.0	11.6	1.9	0.6	27.1
Health care and social assistance	1.7	114.8	6.5	0.1	109.2	18.3	5.6	256.3
Arts, entertainment, and recreation	0.1	8.8	0.5	0.0	8.4	1.4	0.4	19.7
Accommodation	0.1	7.9	0.4	0.0	7.5	1.3	0.4	17.6
Food services and drinking places	0.4	27.6	1.6	0.0	26.3	4.4	1.4	61.7
Other services	0.5	35.5	2.0	0.0	33.8	5.7	1.7	79.3
Households	0.0	2.4	0.1	0.0	2.3	0.4	0.1	5.4
SUM	29.8	2,027.5	114.5	2.0	1,928.9	323.2	99.7	4,525.8
Addenda								
Program Spending (Millions of current dollars)	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Program Spending (Millions of 2010 dollars)	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	6,781.2
Note: totals might not add exactly due to rounding.								

Appendix Table 4

	Indirect + Induced Value-Added Impacts, by Sector and Program (Millions of 2010 Dollars)							
SECTOR	Accelerated Repair	Addition/Ren ovation	Green Repair	Other -- No Scope	New Construction	New Construction Model Schools	Repair - Major	All Programs Total
Agriculture, forestry, fishing, and hunting	0.0	1.8	0.1	0.0	1.7	0.3	0.1	4.1
Mining	0.1	7.3	0.4	0.0	6.9	1.2	0.4	16.3
Utilities	0.5	32.2	1.8	0.0	30.6	5.1	1.6	71.9
Construction	0.2	11.6	0.7	0.0	11.0	1.8	0.6	25.8
Manufacturing	3.3	223.9	12.6	0.2	213.0	35.7	11.0	499.8
Wholesale trade	2.2	146.7	8.3	0.1	139.6	23.4	7.2	327.5
Retail trade	3.0	202.0	11.4	0.2	192.2	32.2	9.9	451.0
Transportation and warehousing	0.7	45.6	2.6	0.0	43.4	7.3	2.2	101.7
Information	1.4	93.3	5.3	0.1	88.7	14.9	4.6	208.2
Finance and insurance	2.9	196.9	11.1	0.2	187.3	31.4	9.7	439.4
Real estate and rental and leasing	4.8	323.8	18.3	0.3	308.1	51.6	15.9	722.9
Professional, scientific, and technical services	3.6	243.9	13.8	0.2	232.1	38.9	12.0	544.5
Management of companies and enterprises	0.8	52.3	3.0	0.1	49.7	8.3	2.6	116.6
Administrative and waste management services	1.0	67.7	3.8	0.1	64.5	10.8	3.3	151.2
Educational services	0.3	17.6	1.0	0.0	16.8	2.8	0.9	39.3
Health care and social assistance	2.3	154.0	8.7	0.2	146.5	24.6	7.6	343.8
Arts, entertainment, and recreation	0.2	15.2	0.9	0.0	14.5	2.4	0.7	33.9
Accommodation	0.3	17.0	1.0	0.0	16.2	2.7	0.8	38.0
Food services and drinking places	0.7	46.8	2.6	0.0	44.5	7.5	2.3	104.4
Other services	0.9	62.3	3.5	0.1	59.2	9.9	3.1	139.0
Households	0.0	2.4	0.1	0.0	2.3	0.4	0.1	5.4
SUM	28.9	1,964.4	111.0	1.9	1,868.8	313.1	96.6	4,384.8
Addenda								
Program Spending (Millions of current dollars)	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Program Spending (Millions of 2010 dollars)	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	6,781.2
Note: totals might not add exactly due to rounding.								

Appendix Table 5

	Indirect + Induced Employment Impacts, by Sector and Program							
SECTOR	Accelerated Repair	Addition/Ren ovation	Green Repair	Other -- No Scope	New Construction	New Construction Model Schools	Repair - Major	All Programs Total
Agriculture, forestry, fishing, and hunting	1	46	3	0	44	7	2	102
Mining	1	67	4	0	64	11	3	151
Utilities	1	96	5	0	91	15	5	214
Construction	2	161	9	0	154	26	8	360
Manufacturing	32	2,169	123	2	2,064	346	107	4,842
Wholesale trade	13	904	51	1	860	144	44	2,018
Retail trade	55	3,758	212	4	3,575	599	185	8,388
Transportation and warehousing	9	646	36	1	614	103	32	1,441
Information	8	521	29	1	495	83	26	1,162
Finance and insurance	23	1,534	87	2	1,459	245	75	3,424
Real estate and rental and leasing	24	1,660	94	2	1,579	265	82	3,705
Professional, scientific, and technical services	30	2,064	117	2	1,964	329	102	4,607
Management of companies and enterprises	5	321	18	0	305	51	16	716
Administrative and waste management services	26	1,775	100	2	1,689	283	87	3,962
Educational services	6	380	21	0	362	61	19	849
Health care and social assistance	34	2,311	131	2	2,199	368	114	5,158
Arts, entertainment, and recreation	6	383	22	0	365	61	19	856
Accommodation	3	233	13	0	222	37	11	521
Food services and drinking places	21	1,408	80	1	1,340	225	69	3,144
Other services	13	890	50	1	847	142	44	1,988
Households	4	295	17	0	280	47	14	658
SUM	318	21,623	1,222	21	20,572	3,447	1,064	48,266
Addenda								
Program Spending (Millions of current dollars)	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Program Spending (Millions of 2010 dollars)	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	6,781.2
Note: totals might not add exactly due to rounding.								

Appendix Table 6

						New Construction Model		All Programs
	Accelerated	Addition/Ren		Other -- No	New			
SECTOR	Repair	ovation	Green Repair	Scope	Construction	Schools	Repair - Major	Total
Agriculture, forestry, fishing, and hunting	0.0	0.9	0.1	0.0	0.9	0.1	0.0	2.0
Mining	0.0	3.0	0.2	0.0	2.9	0.5	0.1	6.8
Utilities	0.2	10.6	0.6	0.0	10.1	1.7	0.5	23.7
Construction	0.1	9.4	0.5	0.0	9.0	1.5	0.5	21.1
Manufacturing	1.7	117.0	6.6	0.1	111.3	18.6	5.8	261.1
Wholesale trade	1.0	65.0	3.7	0.1	61.9	10.4	3.2	145.1
Retail trade	1.5	100.9	5.7	0.1	96.0	16.1	5.0	225.1
Transportation and warehousing	0.4	29.5	1.7	0.0	28.0	4.7	1.4	65.8
Information	0.5	34.9	2.0	0.0	33.2	5.6	1.7	78.0
Finance and insurance	1.4	97.5	5.5	0.1	92.8	15.5	4.8	217.7
Real estate and rental and leasing	0.5	32.8	1.9	0.0	31.2	5.2	1.6	73.2
Professional, scientific, and technical services	2.3	154.3	8.7	0.2	146.8	24.6	7.6	344.5
Management of companies and enterprises	0.5	33.1	1.9	0.0	31.5	5.3	1.6	73.9
Administrative and waste management services	0.6	43.4	2.5	0.0	41.3	6.9	2.1	97.0
Educational services	0.2	12.2	0.7	0.0	11.6	1.9	0.6	27.1
Health care and social assistance	1.7	114.8	6.5	0.1	109.2	18.3	5.6	256.3
Arts, entertainment, and recreation	0.1	8.8	0.5	0.0	8.4	1.4	0.4	19.7
Accommodation	0.1	7.9	0.4	0.0	7.5	1.3	0.4	17.6
Food services and drinking places	0.4	27.6	1.6	0.0	26.3	4.4	1.4	61.7
Other services	0.5	35.5	2.0	0.0	33.8	5.7	1.7	79.3
Households	0.0	2.4	0.1	0.0	2.3	0.4	0.1	5.4
SUM	13.9	941.8	53.2	0.9	896.0	150.1	46.3	2,102.2
Addenda								
Program Spending (Millions of current dollars)	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Program Spending (Millions of 2010 dollars)	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	6,781.2

Indirect + Induced Earnings Impacts, by Sector and Program (Millions of 2010 Dollars)

Note: totals might not add exactly due to rounding.

Appendix Table 7

Direct Impacts, by Program (Millions of 2010 Dollars)

	Accelerated Repair	Addition/Ren ovation	Green Repair	Other -- No Scope	New Construction	New Construction Model Schools	Repair - Major	All Programs Total
Employment	312	21,220	1,199	21	20,188	3,383	1,044	47,366
Earnings (Millions of 2010 dollars)	16.0	1,085.7	61.3	1.1	1,032.9	173.1	53.4	2,423.6
Value Added (Millions of 2010 dollars)	22.3	1,514.1	85.5	1.5	1,440.5	241.4	74.5	3,379.7
Addenda								
Program Spending (Millions of current dollars)	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Program Spending (Millions of 2010 dollars)	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	6,781.2

Note:
1. Direct impacts are in the construction industry only.
2. Total impacts = direct + indirect + induced impacts.
3. Totals might not add exactly due to rounding.

Appendix Table 8

	Total Spending and Tax Revenues Generated (Millions of 2010 Dollars)							
	Accelerated Repair	Addition/Renovation	Green Repair	Other -- No Scope	New Construction	New Construction Model Schools	Repair - Major	Total
Spending	44.7	3,038.0	171.6	3.0	2,890.2	484.3	149.5	**6,781.2**
Tax Revenues								
Withholding	1.4	98.2	5.5	0.1	93.4	15.6	4.8	**219.1**
Non-Withholding Income	0.5	34.6	2.0	0.0	32.9	5.5	1.7	**77.2**
Sales and Excise	0.4	30.1	1.7	0.0	28.6	4.8	1.5	**67.1**
Business	0.3	21.7	1.2	0.0	20.7	3.5	1.1	**48.5**
Total Tax Revenues	**2.7**	**184.5**	**10.4**	**0.2**	**175.5**	**29.4**	**9.1**	411.8
Addendum:								
Spending in Current Dollars	44.6	3,030.1	171.2	3.0	2,882.7	483.0	149.1	6,763.6
Note: Totals might not add exactly due to rounding.								

ENDNOTES

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[1] See the MSBA website http://www.massschoolbuildings.org/.

[2] MSBA funds have also been used for the purchase of school equipment.

[3] For an excellent explanation of the RIMS II Input-Output Model, see Rebecca Bass and Zoë Ambargis, "Input-Output Models for Impact Analysis: Suggestions for Practititioners Using RIMS II Multipliers," 50th Southern Regional Science Association Conference, March 23-27, 2011, New Orleans, Louisiana.

[4] Bureau of Economic Analysis, U.S. Department of Commerce. 2012. RIMS II: An Essential Tool for Regional Developers and Planners. (November 2012). Available at:
http://www.bea.gov/regional/pdf/rims/RIMSII_User_Guide.pdf

[5] Note: This also applies to the household column. For example, the coefficient in the row representing automobile purchases by households would only represent the purchases of automobiles produced in the U.S.

[6] Data on Massachusetts employment come from the ES-202 records collected by the Massachusetts Department of Labor. http:// http://www.mass.gov/lwd/

[7] Because inflation was low during this period, and because 2010 was near the middle of the FY2005-FY2014 time period, the deflation factor was close to one. The $6,765 million in funding in current dollars was $6,781 in 2010 dollars.

[8] This division is accomplished by a simple mathematical manipulation of the Type I and Type II multipliers. The induced impact is given by the difference between the Type II and Type I multipliers. For non-construction industries, the indirect impact is given by the Type I multipliers. For the construction industry, the Type I multiplier consists of both the direct and the indirect impact. Of these two parts, the indirect part is relatively small and can be approximated by the proportion of the induced impact attributed to construction times the non-construction indirect impact. The direct impact multiplier for construction is then estimated as the Type I multiplier for the construction industry minus the indirect part.

[9] Since RIMS II provides multipliers for the construction industry as a whole, but not for detailed sectors within the construction industry (for example, repair vs. new construction), estimates for the individual program impacts are scaled down from the impacts for total MSBA funding in proportion to their share of total funding.

[10] For simplicity, the word "job" will be used instead of "job-years" in the remainder of this section, and "job" should be interpreted as "job-years", unless explicitly stated otherwise.

[11] This ratio of gross operating surplus to value-added is not available at the regional level because RIMS II only provides the regional multipliers, not the whole regional I-O model. This ratio is calculated from the U.S. I-O accounts, as a weighted average of the ratio for the construction industry and the entire economy, with the weights reflecting the proportion of total value-added received by the construction industry in this study.