

# MEMORANDUM

**TO:** Board of Directors, Massachusetts School Building Authority  
**FROM:** James A. MacDonald, First Deputy Treasurer, Chief Executive Officer  
John K. McCarthy, Executive Director, Deputy Chief Executive Officer  
**RE:** Staff Recommendation for 2018 Science/Technology/Engineering Area Guidelines  
**DATE:** February 6, 2019

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Based on the Massachusetts School Building Authority (“MSBA”) report Review and Recommendations of Best Practices for K-12 Science Technology Engineering Math (STEM) Learning Spaces by Dr. Jacob Foster and Laura Smith, an impact analysis by staff, and review with the MSBA Board of Directors, staff is recommending a policy revision to the MSBA space guidelines relating to the Core Academic and Vocations and Technology space categories.

## **Background**

Massachusetts school districts have shown an increased interest to include STEM oriented learning spaces in their proposed K-12 school projects. In response to this need, the MSBA Board of Directors requested that staff procure the services of an outside consultant to provide an analysis of the use and viability of a variety of STEM learning areas with an emphasis on grade kindergarten through grade eight. As a result, Dr. Jacob Foster and Laura Smith developed a detailed report that describes STEM pedagogy, types of learning spaces, safety considerations, and design and operational “best practices” for related STEM spaces. Summary presentations of this report were presented at the May 23, 2018 and September 26, 2018 Facilities Assessment Subcommittee Meetings, and at the December 12, 2018 Board of Directors meeting. A final version of the report was published on the MSBA website in December 2018 as a public resource for school districts and design teams.

Based on information in the report and following discussions and input received from the MSBA Board members, MSBA staff propose updated 2018 STE Area Guidelines for the Board of Director’s approval.

## **Recommendation**

The 2018 STE Area Guidelines include the following changes in program areas as summarized below by grades. See Attachment A: Proposed Space Summary for details.

### Elementary School Grades (Kindergarten – 6):

- The current guidelines do not differentiate between grades K/2 and 3/6, although there are differences in the Massachusetts STE curriculum framework. Therefore, these proposed updated guidelines create a distinction between grades K/2 and 3/6 regarding STE learning areas.
- Allow for a 1,080 net square feet (“nsf”) STE room and 120 nsf STE storage room (1,200 nsf total) for grades 3-6.
  - This size is in accordance with minimum space standards per the National Science Teachers Association (“NSTA”) and as recommended by the ‘Review and Recommendations of Best Practices for K-12 STEM Learning Spaces’ report. Therefore, if this STE room is to be provided, it must meet that minimum area.
  - The number of these STE rooms is derived from the calculation that grades three through six will be scheduled to occupy the room(s) two times per week per

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student. This is equivalent to approximately one room for every 350 (grades 3-6) students. It is expected that students in grades kindergarten through grade two will have science instruction in the general classrooms.

- Districts must articulate the need for these spaces in the educational program and provide budget confirmation that this room will have a dedicated teacher that has been trained in science and safety.
- If the District cannot indicate that the room will be properly staffed in this way, the MSBA may decline to participate in funding for this space, at the MSBA's discretion.
- Proposed areas in excess of guidelines will be considered ineligible for MSBA reimbursement unless substantiated with scheduling information and approved in writing by the MSBA.
- Require at a minimum two sinks in each General Classroom to facilitate project-based learning and STE exploration within the classrooms, and to encourage health and hygiene practices.
  - In conformance with existing state and federal regulations, one of these sinks must provide accessibility for persons with disabilities.
  - The remaining sink(s) should be designed to accommodate buckets or other similar large containers to facilitate STE exploration in the classroom.

### Middle School Grades (5 – 8):

- The proposed updated guidelines create a distinction between grades 5/6 and 7/8 due to differences in the 5/6 and 7/8 Massachusetts STE curriculum framework as noted above.
- For grades 5 and 6, Science Labs will be re-designated as 1,080 nsf STE Rooms and 120 nsf STE Storage (1,200 nsf total). These spaces were previously designated as 1,200 nsf Science Classroom Lab and 80 nsf Prep Room (1,280 sf total). This results in a net decrease of 80 nsf per STE Room. This change reflects the more elementary level curriculum in science grades 5/6. Like the STE Room in the Elementary school space summary, if these rooms are to be provided, they must meet these minimum areas.
- For grades 7 and 8, Science Labs will increase from 1,200 nsf to 1,440 nsf, and prep rooms will increase from 80 nsf to 200 nsf. This results in a net increase of 360 nsf per lab.
  - This increase in minimum size is in accordance with the NSTA standards and is recommended by the “Review and Recommendations of Best Practices for K-12 STEM Learning Spaces” report.
  - A 150 nsf Central Chemical Storage Room is added to promote safe and secure storage of chemicals.
- For grades 5 through 8, the current 1,200 nsf Technology Classroom and 2,000 nsf Technology Shop in the Vocations and Technology category will be re-designated as two Technology/Engineering Rooms at 1,440 nsf each. This results in a total reduction of 320 nsf per pair of Technology/Engineering Rooms.
  - Each Technology/Engineering Room must be within a range of allotted net area between a minimum of 850 nsf and a maximum of 2,000 nsf. This broad range of area will allow the flexibility of potential spaces by allowing a District to use the square footage of this category at its discretion, as documented in its educational program, for specials classes including makerspaces.

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- This improves the utilization of the building by allowing various room sizes and odd numbers of rooms.
- If a room is indicated as being a Makerspace type space, it must be a minimum size of 1,440 nsf.
- If a room is indicated as being a classroom type space, it must be a minimum size of 850 nsf.
- Proposed areas in excess of guidelines will be considered ineligible for MSBA reimbursement unless substantiated with scheduling information and approved in writing by the MSBA.

### K - 8 Schools Grades (K – 8):

- The proposed updated guidelines create a distinction between grades K/2, 3/6, and 7/8 due to differences in the Massachusetts STE curriculum framework as noted above.
- Within a K-8 school, grades K/6 align with the updates presented above for Elementary Schools and grades 7/8 align with the updated presented above for Middle Schools.

### High Schools (9 – 12):

- For grades 9 through 12, the current 1,200 nsf Technology Classroom and 2,000 nsf Technology Shop in the Vocations and Technology category will be re-designated as two Technology/Engineering Rooms at 1,440 nsf each. This results in a total reduction of 320 nsf per pair of Technology/Engineering Rooms.
  - Each Technology/Engineering Room must be within a range of allotted net area between a minimum of 825 nsf and a maximum of 2,000 nsf. This broad range of area will allow the flexibility of potential spaces by allowing a District to use the square footage of this category at its discretion, as documented in its educational program, for specials classes including makerspaces.
  - This improves the utilization of the building by allowing various room sizes and odd numbers of rooms.
  - If a room is indicated as being a Makerspace type space, it must be a minimum size of 1,440 nsf.
  - If a room is indicated as being a classroom type space, it must be a minimum size of 825 nsf.
- Proposed areas in excess of guidelines will be considered ineligible for MSBA reimbursement unless substantiated with scheduling information and approved in writing by the MSBA.

With these new guidelines, the MSBA will require more rigorous information related to the safety systems and training required associated with these spaces. Therefore, within the Science and Vocations and Technology (non-Chapter 74) sections of the educational program, the MSBA will be looking for information related to the staffing, professional development, safety systems, and safety policies for STE rooms, Science Labs, and Technology/Engineering Rooms. The District should include information in the educational program regarding the intended use of the space, associated STE equipment and identify specific safety protocols and systems based on these intended uses.

The impact of these recommendations on the space guidelines are summarized in the tables below:

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### Elementary School (K-6)

<b>Enrollment</b>	<b>Number of Additional STE Rooms</b>	<b>Additional Net Square Feet</b>	<b>Additional Gross Square Feet</b>
Less than 300-603	1	1,200	1,800
604 – 1,200	2	2,400	3,600
1,200 and above (or grade configurations focused on 3-6 greater than 345)	2+	2,400+	3,600+

### Middle School (6-8)

<b>Enrollment</b>	<b>Additional Core Academic Net Square Feet</b>	<b>Reduced Vocations and Technology Net Square Feet</b>	<b>Additional Gross Square Feet</b>
Less than 300-350	1,740		2,130
351-460	2,100		2,670
461-520	1,770		2,175
521-550	2,460		3,210
551-580	3,410	-2,080	1,995
581-700	3,080		1,500
701-820	3,440		2,040
821-870	2,160	-640	2,280
871-930	2,850		3,315
931-1,030	2,520		2,820
1,031-1,050	3,720		4,620
1,051-1,100	4,080		5,160
1,101-1,170	5,030	-2,400	3,945
1,171-1,200	4,700		3,450
<b>Weighted Average</b>	<b>2,970</b>	<b>-1,169</b>	<b>2,701</b>

### High School (9-12)

<b>Enrollment</b>	<b>Original Number of Tech Rooms</b>	<b>Proposed Number of Tech Rooms</b>	<b>Reduced Gross Square Feet</b>
Less than 600-690	4	4	-960
691-828	4	5	-225
829-966	6	6	-1,440
967-1,104	6	7	-705
1,105-1,242	8	8	-1,920
1,243-1,380	8	9	-1,185
1,381-1,518	10	10	-2,400
1,519-1,656	10	11	-1,665

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1,657-1,794	12	12	-2,880
1,795-1,932	12	13	-2,145
1,933-2,070	14	14	-3,360
2,071-2,208	14	15	-2,625
2,209-2,346	16	16	-3,840
2,347-2,484	16	17	-3,105
2,485-2,622	18	18	-4,320
2,623-2,760	18	19	-3,585
2,761-2,898	20	20	-4,800
2,899-3,036	20	21	-4,065
3,037-3,100	22	22	-5,280
<b>Weighted Average</b>			<b>-2,608</b>

### Conclusion

MSBA staff is recommending a policy update to the MSBA space guidelines specifically as related to the Core Academic and Vocations and Technology sections regarding STE learning areas. This recommendation would be effective for districts that are approved to proceed into schematic design after January 1, 2019.

# Attachment A

## Proposed Space Summary- Elementary Schools

Date: Enter Date      Enter Submittal

FILL IN SCHOOL NAME HERE
<u>ROOM TYPE</u>
<b>CORE ACADEMIC SPACES</b> <i>(List classrooms of different sizes separately)</i>
Pre-Kindergarten w/ toilet
Kindergarten w/ toilet
General Classrooms - Grade 1-6
STE Room- Grade 3-6
STE Storage
<b>SPECIAL EDUCATION</b>
<b>ART &amp; MUSIC</b>
<b>HEALTH &amp; PHYSICAL EDUCATION</b>
<b>MEDIA CENTER</b>
<b>DINING &amp; FOOD SERVICE</b>
<b>MEDICAL</b>
<b>ADMINISTRATION &amp; GUIDANCE</b>
<b>CUSTODIAL &amp; MAINTENANCE</b>
<b>OTHER</b> Other <i>(specify)</i>
Total Building Net Floor Area (NFA)
Proposed Student Capacity / Enrollment
<b>NON-PROGRAMMED SPACES</b>
Total Building Gross Floor Area (GFA) <sup>2</sup>
Grossing factor (GFA/NFA)

MSBA Guidelines (refer to MSBA Educational Program & Space Standard Guidelines)			
ROOM NFA <sup>1</sup>	# OF RMS	area totals	Comments
	<b>30</b>	<b>29,050</b>	
1,200		-	1,100 SF min - 1,300 SF max
1,200	5	6,000	1,100 SF min - 1,300 SF max; 2 sinks min. req
950	23	21,850	900 SF min - 1,000 SF max; 2 sinks min. req
1,080	1	1,080	assumed schedule 2 times / week / student
120	1	120	
		<b>7,550</b>	
		<b>5,000</b>	
		<b>6,300</b>	
		<b>3,595</b>	
		<b>8,504</b>	
		<b>610</b>	
		<b>2,635</b>	
		<b>2,250</b>	
		<b>0</b>	
		<b>65,494</b>	
		<b>650</b>	Enter grade enrollments below
		<b>500</b>	Lower Elementary; Grades K-2
		<b>150</b>	Upper Elementary; Grades 3-6
		<b>94,250</b>	
		<b>1.44</b>	

# Attachment A Proposed Space Summary- K - 8 Schools

Date: Enter Date    Enter Submittal

FILL IN SCHOOL NAME HERE
ROOM TYPE
<b>CORE ACADEMIC SPACES</b>
<i>(List classrooms of different sizes separately)</i>
Pre-Kindergarten w/ toilet
Kindergarten w/ toilet
General Classrooms - Grades 1-6
STE Room- Grades 3-6
STE Storage
General Classrooms - Grades 7-8
Science Classroom / Lab- Grades 7-8
Prep room
Central Chemical Storage Rm
<b>SPECIAL EDUCATION</b>
<b>ART &amp; MUSIC</b>
<b>VOCATIONS &amp; TECHNOLOGY</b>
Technology/Engineering Rooms
<b>HEALTH &amp; PHYSICAL EDUCATION</b>
<b>MEDIA CENTER</b>
<b>DINING &amp; FOOD SERVICE</b>
<b>MEDICAL</b>
<b>ADMINISTRATION &amp; GUIDANCE</b>
<b>CUSTODIAL &amp; MAINTENANCE</b>
<b>OTHER</b>
Other (specify)
Total Building Net Floor Area (NFA)
Proposed Student Capacity / Enrollment
<b>NON-PROGRAMMED SPACES</b>
Total Building Gross Floor Area (GFA) <sup>c</sup>
Grossing factor (GFA/NFA)

MSBA Guidelines (refer to MSBA Educational Program & Space Standard Guidelines)			
ROOM NFA <sup>1</sup>	# OF RMS	area totals	Comments
	52	47,940	
1,200		-	1,100 SF min - 1,300 SF max
1,200	6	7,200	1,100 SF min - 1,300 SF max; 2 sinks min. req Based on Grades K-2 / 3 grades
950	28	26,600	900 SF min - 1,000 SF max; 2 sinks min. req Based on K-2 - K
1,080	2	2,160	assumed schedule 2 times / week / student Based on Grades 3-6
120	2	240	Equals # of STE Rms
950	9	8,550	850 SF min - 950 SF max Based on Grade 7-8
1,440	2	2,880	1 period / day / student Based on Grades 7-8
80	2	160	
150	1	150	Based on Report, 1 per school, multi story buildings will be evaluated individually
		12,080	
		8,125	
		1,440	
1,440	1	1,440	Assumed use - 50% Population - 5 times/week; 850 SF - 2,000 SF Based on Grades 7-8
		8,323	
		5,386	
		12,283	
		710	
		3,595	
		2,572	
		0	
		102,453	
		1000	Enter grade enrollments below
		330	Lower Elementary; Grades K-2
		445	Upper Elementary; Grades 3-6
		225	Middle/Jr. High; Grades 7-8
		153,680	
		1.50	

# Attachment A Proposed Space Summary - Middle Schools

Date: Enter Date Enter Submittal

FILL IN SCHOOL NAME HERE
ROOM TYPE
<b>CORE ACADEMIC SPACES</b>
<i>(List classrooms of different sizes separately)</i>
Classroom - General
Small Group Seminar (20-30 seats) / Resource
STE Room- Grades 5-6
STE Storage
Science Classroom / Lab- Grades 7-8
Prep Room
Central Chemical Storage Rm
<b>SPECIAL EDUCATION</b>
<b>ART &amp; MUSIC</b>
<b>VOCATIONS &amp; TECHNOLOGY</b>
Technology/Engineering Rooms
<b>HEALTH &amp; PHYSICAL EDUCATION</b>
<b>MEDIA CENTER</b>
<b>DINING &amp; FOOD SERVICE</b>
<b>MEDICAL</b>
<b>ADMINISTRATION &amp; GUIDANCE</b>
<b>CUSTODIAL &amp; MAINTENANCE</b>
<b>OTHER</b>
Other (specify)
Total Building Net Floor Area (NFA)
Proposed Student Capacity / Enrollment
<b>NON-PROGRAMMED SPACES</b>
Total Building Gross Floor Area (GFA) <sup>2</sup>
Grossing factor (GFA/NFA)

MSBA Guidelines (refer to MSBA Educational Program & Space Standard Guidelines)			
ROOM NFA <sup>1</sup>	# OF RMS	area totals	Comments
		44,720	
950	35	33,250	850 SF min - 950 SF max
500	2	1,000	
1,080	1	1,080	assumed schedule 2 times / week / student
120	1	120	
1,440	6	8,640	1 period / day / student
80	6	480	
150	1	150	
		9,560	
		4,800	
		5,760	
1,440	4	5,760	Assumed use - 50% Population - 5 times/week; 850 SF - 2,000 SF
		8,400	
		5,555	
		11,375	
		710	
		3,850	
		2,375	
		0	
		97,105	
		900	Enter grade enrollments below
		300	Lower Middle; Grades 5-6
		600	Upper Middle; Grades 7-8
		144,000	
		1.48	



# Attachment A

## Proposed Space Summary - High Schools

Date: 12/25/2017 Enter Submittal

<b>FILL IN SCHOOL NAME HERE</b>
<u>ROOM TYPE</u>
<b>CORE ACADEMIC SPACES</b>
<b>SPECIAL EDUCATION</b>
<b>ART &amp; MUSIC</b>
<b>VOCATIONS &amp; TECHNOLOGY</b>
Technology/Engineering Rooms
<b>HEALTH &amp; PHYSICAL EDUCATION</b>
<b>MEDIA CENTER</b>
<b>AUDITORIUM / DRAMA</b>
<b>DINING &amp; FOOD SERVICE</b>
<b>MEDICAL</b>
<b>ADMINISTRATION &amp; GUIDANCE</b>
<b>CUSTODIAL &amp; MAINTENANCE</b>
<b>OTHER</b>
Other (specify)
Total Building Net Floor Area (NFA)
Proposed Student Capacity / Enrollment
<b>NON-PROGRAMMED SPACES</b>
Total Building Gross Floor Area (GFA) <sup>2</sup>
Grossing factor (GFA/NFA)

MSBA Guidelines (refer to MSBA Educational Program & Space Standard Guidelines)			
ROOM NFA <sup>1</sup>	# OF RMS	area totals	Comments
		25,050	
		5,040	
		5,125	
		4,320	
1,440	3	4,320	Assumed use - 100% Population - 5 times/week; 825 SF - 2,000 SF
		19,000	
		3,650	
		6,108	
		5,600	
		610	
		3,370	
		2,075	
		0	
		79,948	
		500	226
		113,000	
		1.41	