

Review of Proposed Plan for Elementary School Renovation Carver, MA

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Edward J. Collins, Jr. Center for Public Management

MCCORMACK GRADUATE SCHOOL OF POLICY AND GLOBAL STUDIES



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INTRODUCTION AND OVERVIEW OF FINDINGS

The Edward J. Collins, Jr. Center for Public Management at the University of Massachusetts Boston (Center) was hired by the Town of Carver to perform an independent assessment of the Buildings Study Committee's proposals for the construction/renovation of three new public facilities, including a fire station, police station, and elementary school. Specifically, the team from the Center was asked to review: 1) the selected and considered sites for the facilities; and, 2) the funding plan recommended by the Buildings Study Committee. The report on the public safety facilities was submitted to the Town in November 2013; this report represents the second half of the study, analyzing the proposed elementary school facility.

The consideration of the elementary school facility focuses on slightly different questions than the study on the public safety facilities. Specifically, this report evaluates:

- 1) the need for a new/renovated school;
- 2) the proposed design, site plan, and construction phasing; and,
- 3) the proposed location for the school.

The report will also consider funding for the continued design and construction of the school in brief, due to the fact that a firm up-to-date cost estimate and a financing proposal are not currently available for review.

The project under consideration involves the renovation of and addition to the Governor John Carver Elementary Building and Edwin K. Washburn Primary Building located at 85 Main Street. Collectively, these two buildings operate as Carver's sole elementary school. The proposed project will substantially renovate both buildings and construct a new addition that will join the two buildings together. Overall, based upon projected school enrollment figures established in 2009, the school will grow by between 37,400 and 38,700 gross square feet (+39-40%) to more closely align with State guidelines for an elementary school with 850+ students.¹ Site improvements will provide additional parking and will separate on-site vehicle traffic to reduce the potential for conflicts between buses, delivery vehicles, private vehicles, and pedestrians. As of March 2011, the cost to complete the design work and construction was estimated to be approximately \$44.7 million.²

METHODOLOGY

To analyze the proposed project, the Collins Center project team reviewed extensive written materials provided by Carver School District officials, performed a site visit of both schools, and met with representatives of the Massachusetts School Building Authority (MSBA). In addition, the team held a

¹ At the time the conceptual design work was performed, school enrollment was anticipated to grow to 925 students.

² Design Partnership of Cambridge, "New Elem. School Renov./Add SD cost est. for C.149", March 8, 2011. (Note that estimates have varied over time from \$41.1 million in August 2009 to \$45.1 in spring 2011. A new cost estimate will be developed as the project progresses in 2014.)

conference call to ask clarifying questions of the project architect and reviewed correspondence from the Town regarding site constraints at the High School site. Written materials reviewed include:

- Carver Statement of Interest (May 21, 2013);
- Design Partnership of Cambridge, Inc. Feasibility Study (September 2009);
- Kingscott Feasibility Study (May 2006);
- Timeline of Events Associated with Determining the Facilities Needs in Carver Public Schools (prepared by the School District); and,
- Multiple design plans and cost estimates prepared by Design Partnership of Cambridge.

Project team member Henry Fitzgerald from First Stop Program Management also drew upon his extensive personal experience in constructing school facilities in Shrewsbury, Massachusetts, and his professional experience in worldwide capital facility planning and implementation for Genzyme.

OVERVIEW

Based upon its evaluation, the Collins Center's project team has found:

- 1. The existing elementary school facilities are overcrowded, are not equipped to meet current day instructional needs, and do not meet current code requirements. As a result, renovation/new construction is warranted.**

Built in 1974 and 1951, respectively, the Erwin J. Washburn (EJW) and the Governor John Carver (GJC) elementary school buildings have served the Town of Carver for decades and are now well past their reasonably expected lifetimes. While well-loved by those who have graduated from the schools, these facilities simply do not meet the needs of students today. They are overcrowded, do not meet applicable code requirements, including important safety requirements, and do not meet current day accessibility requirements. The buildings' key systems (e.g., plumbing, electrical, heating, and cooling) have been maintained diligently by District staff – in some cases for 63 years – but are in need of complete replacement. Of particular note is the electrical system, which does not accommodate the type of computer-based learning students need to function in the modern economy. The electrical system is so inadequate that teachers report that the system overloads on a regular basis, causing circuit breakers to trip. In addition, the heating system can be almost unbearably hot in the winter and the cooling systems inadequate in the warmer months of the year.

Instructors are challenged each day by significant difficulties created by the physical environment in which they have to teach. The open plan design of the EJW building has been rejected by districts across the country and internationally, having found to be noisy and disruptive of learning. Teachers and district officials have struggled to provide some closure to classrooms by building temporary partition walls or piling boxes or other materials along the outside edges of the instructional space. When groups of students go into the hall to put on their coats to go outside, the noise travels long distances, disrupting other classrooms. Additionally, since the GJC building has no adequate gym or lunchroom facilities, no library, and no computer lab, valuable instruction time is lost each day as students have to cross from the GJC building to the EJW building and back multiple times a day. Space is completely inadequate for special instruction and counseling in both buildings, so teachers and counselors regularly meet with students at tables in the hallways or in former storage closets. Despite the conditions, the

project team saw firsthand teachers' strong commitment to providing innovative, quality instruction to the student body.

Unfortunately, research has documented that inadequacies in school building environments have a profound negative impact on learning. In fact, "most researchers found students in poor buildings scored between 5 to 10 percentile rank points lower than students in functional buildings, after controlling for socioeconomic status....The difference in scores for students in poor buildings can be as high as 17 percentile rank points."³ Four aspects of the building environment have been found to be particularly impactful. These include:

- (1) *Human comfort – i.e., temperatures within the human comfort range as regulated by appropriate HVAC systems;*
- (2) *Indoor air quality – i.e., appropriate ventilation and filtering systems also as regulated by appropriate HVAC systems;*
- (3) *Lighting; and,*
- (4) *Acoustical control.*⁴

Overcrowding at the elementary school level was found to be the sixth most impactful aspect of a school environment (behind availability of science laboratories in secondary schools). Although research into this topic has not been done specifically in Carver so the impact on local test scores is not known, it is clear that the environmental conditions identified as problematic in academic studies can be found in Carver.

2. Carver's preferred alternative is the best design option of those explored.

It is clear from the documentation that the Carver School District and School Building Committee diligently explored multiple design options before selecting the preferred option for the Carver Elementary School. They developed and considered 22 different designs that reused portions of the existing buildings and one alternative that was for new construction on the existing school site. After reviewing the options considered, the project team concurs that the Town's preferred option, "Option B3", is the best of the three final alternatives. The benefits of Option B3 include, but are not limited to:

- Classrooms are clustered together to provide single community, yet different grades can be grouped;
- Space that can be used by the community after hours are separated from classroom areas so that they can be best monitored and controlled;
- The cafeteria and gym can be connected to provide a large gathering space, if desired;
- Lots of outside wall space will allow natural light to enter the classrooms and offices and views out into the landscaped area of the site;
- Circulation appears to be most efficient of all three; and,
- B3 replaces more of the Washburn School than the other renovation option.

³ Earthman, GI, "Prioritization of 31 Criteria for School Building Adequacy", submittal for *Bradford v. Maryland Board of Education*, American Civil Liberties Union Foundation of Maryland. Retrieved from http://www.schoolfunding.info/policy/facilities/ACLUfacilities_report1-04.pdf, February 19, 2014, p. 8-9.

⁴ Ibid.

The project team does have some concerns regarding the placement of the curb cuts to serve the three parking/loading areas, but that can be explored as the site design is further refined.

3. Alternate sites for the elementary school were not considered during the previous studies, but at least the high school site should be explored and documented.

Under Option B3, the renovation of the GJC school building, the partial renovation and partial new construction of the EJW building, and the construction of a new addition in between the two buildings will take place while students remain on site. A detailed phasing plan has been drafted and will be refined as the process moves forward to ensure that the students remain safe and that their classrooms remain functional and accessible. Although the phasing plan appears viable to the project team, the fact is that an extensive renovation project of this nature has complexities and risks to time and budget that new construction does not. This is particularly significant since per MSBA policy, if the project exceeds its agreed-upon budget, all of the overage will have to be borne by the local community. In addition, even after the renovation is complete, some building components will still be original to 1951 and 1974, even though other components will be completely new, and the school would remain on Route 58, a high speed arterial road. For these reasons, the project team recommends that some exploration of alternate sites take place.

At present, only the high school/middle school campus has been identified as a potential alternative site. Preliminary analysis reveals that the campus is highly constrained between well radii, leaching fields, storm water storage, and existing ball fields, but two areas that are potentially 10 acres in size do appear to remain. One is the wooded area between the high school and Pond Street and the other is where the baseball fields and tennis courts are currently located. This is markedly smaller than the existing 20+ acre site and less than the 14 acres that Town staff anticipate are needed, so this site would only work if considerable efficiencies, such as shared parking and loading, could be found. That said, even if the space challenges could be addressed, the cost of new construction on the site (and replacement of any displaced ball fields) would need to be evaluated in relation to Option B3 to determine which was most cost effective. Nevertheless, despite the already-identified challenges, in order for all members of the Carver community to feel confident that all options have been considered, the high school campus and other alternative sites should be explored and the findings documented as part of the 2014 feasibility study process.

BACKGROUND

OVERVIEW OF MSBA FUNDING PROCESS

Review Process

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.”⁵ As such, this quasi-independent State authority has a very important role in providing guidance and oversight to cities and towns across the Commonwealth as they seek to provide safe and healthy learning environments for their public school students. The MSBA was created in 2004 to replace the school building assistance program previously administered by the Department of Education (now the Department of Elementary and Secondary Education). Funding is generated by the State sales tax, where the MSBA receives 1 cent of every 6.25 cents collected through the statewide 6.25% sales tax. Over the past nine years, the MSBA has dispersed more than \$10.2 billion for school construction projects.⁶

The MSBA has established a multi-phase (aka, “modules”) process through which school districts can seek funding for proposed school facility projects. Throughout the process, various studies and documents must be submitted by a district to support its project. The initial submission is the **Statement of Interest (SOI)**,⁷ which school districts prepare in order to launch the MSBA’s consideration of a proposed project. One SOI will typically be submitted for each school that has a proposed project including construction, renovation, or repair. The priorities identified by the MSBA include:

- *Replacement or renovation of a building which is structurally unsound or otherwise in a condition seriously jeopardizing the health or safety of school children...*
- *Elimination of existing severe overcrowding...*
- *Prevention of the loss of accreditation...*
- *Replacement, renovation, or modernization of school facility systems such as roofs, windows, boilers...*
- *Short term enrollment growth...*
- *Replacement of or addition to obsolete buildings in order to provide a full range of programs consistent with state and approved local requirements...*
- *Transition from court-ordered and approved racial balance school districts to walk-to, so-called, or other school districts...”*⁸

The SOI is expected to identify the priority under which the district is applying, and explain the facility issue(s) that exist and their impacts on the educational environment. If an engineering study has been done to document structural issues, it would be submitted with the SOI. The local governing body and

⁵ MSBA website, <http://www.massschoolbuildings.org/>, retrieved February 5, 2014.

⁶ MSBA website, http://www.massschoolbuildings.org/about/from_the_executive_director, retrieved February 5, 2014.

⁷ MSBA, *Statement of Interest System User Guide for School District Users for Fiscal Year 2014*, January 2014.

⁸ *Ibid.*, p. 4.

the school committee must vote to authorize submission of the SOI, and documentation of the votes must be included. The MSBA indicates that they expect this document to be prepared in-house by district officials without the assistance of professional consultants.

A brief overview of the phases following submission of the Statement of Interest is provided below:

Module 1: Eligibility Period

A proposed project must be invited to participate in the MSBA process via a formal vote by the MSBA Board of Directors based upon a review of a district's SOI submission. This initiates a 270-day period during which a district must complete certain requirements that would allow the project to enter into the next phase of the process. A district's completion of the requirements during the Eligibility Period helps the MSBA determine if a district and a community are prepared to proceed with a proposed project.

Deliverables required by the MSBA during the Eligibility Period include:

- 1) *a certification of the District's understanding of the grant program rules by executing an Initial Compliance Certification;*
- 2) *forming a School Building Committee and submitting the membership to the MSBA for acceptance;*
- 3) *a summary of the District's existing maintenance practices;*
- 4) *certification of a design enrollment for the proposed project agreed upon with the MSBA (may not be applicable for Repair Assessments depending on the proposed scope of work);*
- 5) *confirmation of community authorization and funding to proceed; and,*
- 6) *execution of the MSBA's standard Feasibility Study Agreement, which establishes a process for the District to be reimbursed for eligible expenses.⁹*

During this phase of the process, a baseline reimbursement rate will be established. Per the statutory formula, all districts start at a Base Rate of 31%. From there, the Base Rate is adjusted based on three socioeconomic factors including:

- **Community Income Factor:** *the district's per capita income as a percentage of statewide average per capita income...*
- **Community Property Wealth Factor:** *the district's per capita equalized property valuations as a percent of statewide average per capita valuations...*
- **Community Poverty Factor:** *measured by the district's proportion of low income students, as defined by federal eligibility for free or reduced price lunch, as a percent of the statewide average proportion of low income students...¹⁰*

Later in the process, during the Project Scope and Budget stage (see module 4), "the MSBA will again calculate the base rate based upon the socio-economic indicators for that calendar year, which will either reduce the base rate, increase the base rate or the rate will be confirmed as no change."¹¹ In addition, projects may be eligible for certain incentive points which may increase the reimbursement rate.

⁹ MSBA, <http://www.massschoolbuildings.org/building/prerequisites>, retrieved March 27, 2014.

¹⁰ MSBA, "Massachusetts School Building Authority ("MSBA") Reimbursement Rate Calculation."

¹¹ Diane Sullivan, MSBA, email correspondence with Monica Lamboy, April 7, 2014.

Of particular importance during Module 1 is the community's allocation of funds sufficient for preparation of the Feasibility Study that would take place under Module 3 of the process. Without allocation of these needed funds, a project cannot move forward. The MSBA does not dictate the funding mechanism for this study and acknowledges that funds can be appropriated from existing resources, can be borrowed under the Prop 2 ½ levy limit, or can be borrowed via a Prop 2 ½ debt exclusion. If a Feasibility Study is prepared under Module 3 and accepted by the MSBA, the district will receive reimbursement for a portion of its expenses based upon the project's reimbursement rate.

A district that completes the Eligibility Period requirements may be invited to participate in the next phase. However, the MSBA advises that, "an invitation to the Eligibility Period is not an invitation to Feasibility Study and it does not guarantee an invitation to the MSBA's capital pipeline. Districts that do not successfully complete the preliminary requirements within the 270-day period will have to re-file an SOI during the next open SOI filing period."¹² If a district completes the requirements in less than 270 days, it may be able to move forward to the next phase shortly thereafter.

Module 2: Forming the Project Team

During this phase, the team hired to work on the project will be identified. A district must follow the MSBA's defined procurement processes to enter into contract with an Owners Project Manager (OPM) who will have overall project management responsibility. The OPM is responsible for controlling project costs, minimizing delays, and ensuring quality construction. Once selected and approved, the OPM will contribute to the process of selecting a Designer for the project. This engineer/architect will be responsible for developing the design for the facility and undertaking several of the required studies. Once the OPM and Designer are approved by the MSBA, the cost of their services can be reimbursed at the project's approved reimbursement rate.

Module 3: Feasibility Study

Considerable study and analysis will take place during the Feasibility Study phase of the process. Specifically, the OPM, Designer, and School Study Committee will work to define the educational program for the school, describe how the existing facility does or does not meet those needs, and will develop preliminary design alternatives to meet the program needs. During this phase, multiple alternatives will be explored by the design team and a recommended concept plan will be identified. Per the MSBA, a district must "document their educational program, generate an initial space summary, document existing conditions, establish design parameters, develop and evaluate alternatives, and recommend the most cost effective and educationally appropriate preferred solution to the MSBA Board of Directors for their consideration."¹³

A **Feasibility Study**¹⁴ will include several sub-components which are very substantial in and of themselves:

¹² MSBA, "Module 1: Eligibility Period", <http://www.massschoolbuildings.org/building/prerequisites>, retrieved March 27, 2014.

¹³ MSBA, "Module 3: Feasibility Study", <http://www.massschoolbuildings.org/building/feasibility>, retrieved March 27, 2014.

¹⁴ MSBA, Module 3: Feasibility Study, updated November 2011.

- Initial Space Summary – In preparation for the Initial Space Summary, the district and Designer will work together to define the educational activities currently offered and to be offered in the future. The summary will then itemize existing educational spaces and the types and square footages of spaces needed to meet the future educational program. To assist with this effort, the MSBA has defined allowable square footages per student and prepared templates for use in preparing the Initial Space Summary. The MSBA will review and approve a district’s proposed space program before the district begins working on a conceptual plan;
- Facility Assessment – The Designer will document the conditions of the existing school, including, but not limited to, compliance with the building code and ADA requirements, structural and other physical conditions that could impact future design options, and an assessment of hazardous conditions;
- Site Development Requirements – The Designer will describe site requirements and constraints, such as parking requirements, zoning setbacks, emergency vehicle access requirements, etc.;
- Preliminary Evaluation of Alternatives – The Designer and the district will work together to identify and document a series of alternatives to be considered. Each alternative is to be evaluated on how well it meets the educational program requirements, siting requirements, facility goals, phasing requirements, among other requirements. Conceptual cost estimates are also required to facilitate comparison of the alternatives. At least three alternatives are expected to be developed further for inclusion in the Preliminary Design Program document to be submitted to the MSBA; and
- Preferred Schematic Report – After the MSBA has reviewed and approved the Initial Space Summary and the Preliminary Evaluation of Alternatives and provided input, the district can proceed to refine three alternatives as it moves forward toward selecting a preferred plan. The Preferred Schematic Report will document the process and considerations that led toward selection of a preferred plan. Also included will be conceptual site plans and architectural drawings, an outline of the main structural systems, a narrative about needed building systems, among other requirements. The report will include a total project budget and construction cost estimate, in addition to a phasing plan and construction schedule.

A Facilities Assessment Subcommittee will be convened to review the submissions and the MSBA Board will vote on whether to move the project forward into the next phase of the process.

Module 4: Schematic Design

In the 4th phase, a high level of detail will be generated about the preferred design so that the project’s scope, budget, and construction schedule can be identified. Although schematic design submittals may vary depending upon the size and scope of a project, the MSBA expects to receive schematic drawings and a project manual along with:

- Designer’s estimated construction costs;
- OPM’s estimated construction costs;
- The estimated project cost; and,
- The District’s project budget.

The MSBA expects that all value engineering of the project will have been completed at this point and the results incorporated into the proposed project budget. A series of technical reports will also be submitted by the district, such as geotechnical report, code analysis, utility analysis, a description of building systems, such as plumbing and fire protection, and a checklist for green building credits, among other documents. The submission will also include an overall project schedule, indicating the time needed to prepare 60% and 90% construction drawings, receive construction bids and select a

contractor, and key construction milestones. Documentation of public participation in the process is also required.

The intent of the submissions at this phase is to provide the MSBA staff with sufficient detail to be able to reach agreement on the overall project scope and budget prior to submitting the project to the MSBA Board for review. It is expected that several meetings would take place at this stage between MSBA staff and District staff to review and refine the materials submitted. If a project is approved, the MSBA Board will invite the district to enter into a Project Scope and Budget Agreement. This agreement will identify the full budget agreed upon by the district and the MSBA and for which reimbursement can be received. Any expenses that occur in excess of the approved budget will have to be borne by the community alone; no reimbursement can be received for excess expenditures. After a project has been invited into a Project Scope and Budget Agreement, the municipality will then have 120 days to commit local funding for the project.

Module 5: Funding the Project

Prior to signing a Project Scope and Budget Agreement, a district must secure approval for **full funding** of the project per Department of Revenue requirements. The MSBA further prescribes that “all articles, motions, resolutions, orders, proposition two and one-half ballot questions and any other votes... related to the approval, funding, and/or debt authorization”¹⁵ must be solely for the project under consideration; it cannot be combined with any other project(s). The vote must include specific information about the location and scope of the project and the project budget. In addition, although the funding authorization to be voted upon by the public must include the full cost of the project, the language may acknowledge the fact that a portion of the cost will ultimately be paid by the MSBA. Specifically, the motion/vote/order must state “the amount of borrowing authorized pursuant to the vote shall be reduced by any amount received or expected to be received from the MSBA prior to the issuance of any bonds or notes under this vote.”¹⁶

The Project Scope and Budget Agreement is a contract that will be signed by the MSBA and a district setting out the parameters for working together after a project has been formally approved for funding. The contract template is standard for all projects, but several important appendices describe the project that is to be approved in detail. These include a detailed project budget (Exhibit A), a detailed project scope (Exhibit B), a project schedule (Exhibit C), a project cash flow (Exhibit D), a project site description (Exhibit E), and the furnishings and equipment that will be part of the project (Exhibit F). All of the exhibits will be prepared by a district before a vote by the MSBA Board of Directors will take place. Once agreed upon, the project schedule and project cash flow will be updated at least monthly by the district and submitted to the MSBA.

Once the Project Scope and Budget Agreement has been signed, a district can start submitting requests for reimbursement.

Module 6: Detailed Design

¹⁵ MSBA, “Bulletin 08-02 Local votes by communities invited to enter into a Project Scope and Budget Agreement with the Massachusetts School Building Authority”.

¹⁶ Ibid.

At this stage, the MSBA will assign a Commissioning Agent to work with the district and OPM as the project design documents are prepared. All activities leading toward identification of the contractor(s) must be in compliance with state and federal law. The MSBA will also closely monitor expenditures against the project budget. Once the construction award has been finalized, the MSBA will work with the OPM and the district to finalize the project budget to reflect actual construction costs, and may amend the grant amount as may be applicable. If the actual construction cost is higher than anticipated in the original Project Scope and Budget Agreement, the district will be responsible for closing the entire funding gap; the MSBA will not share in any increased costs. If the cost is less than anticipated, the MSBA will share in the savings.

Module 7: Construction

The MSBA will continue to monitor the project for schedule and budget throughout the construction process.

Module 8: Completing the Project

In the final stage, the MSBA will complete a project audit to determine the final payment to be made. A draft audit report will be submitted to the district for its review and approval. If a district disputes the findings in the audit report, it may submit an appeal with back up documentation.

Local Authorization – MSBA Appropriation Requirements

According to the MSBA, “districts invited into the MSBA grant program are required to appropriate and authorize funding twice in the life of a project; the first appropriation/authorization occurs during Module One-Eligibility Period to fund the costs associated with the work of the Owner’s Project Manager and design architect for the Feasibility Study/ Schematic Design phase of the grant program. The second appropriation/authorization occurs during *Module Five-Funding the Project* to fund design development, construction documents, project construction and project close-out.”¹⁷ Two significant deadlines are associated with these funding allocations. If those deadlines are not met, a project will not proceed forward. These deadlines are:

- Within the 270-day Eligibility Period, a district must have secured funding for the OPM and Designer sufficient to prepare the Feasibility Study, and Schematic Design; and,
- Within 120 days of approval by the MSBA of a proposed project and a Project Scope and Budget Agreement, a district will have to secure local funding for completion of construction drawings and for full construction.

CARVER ACTIVITIES TO DATE

The Carver School District began efforts to comprehensively address the facility needs of its elementary school students in fall 2005 when the School Committee convened a Space Needs Committee charged with determining the existing conditions and future needs of school buildings. That winter, the School

¹⁷ Diane Sullivan, MSBA, email correspondence with Monica Lamboy, March 18, 2014.

Committee hired Kingscott Associates, Inc., an architecture and engineering firm, to prepare a feasibility study “to identify and develop a series of concept planning options to address the short- and long-term facility needs of the Carver public schools.”¹⁸ The “Kingscott report” was completed in May 2006 and, using the information gathered, the Space Needs Committee determined that addressing the space needs at the Washburn Primary School and Carver Elementary School were the highest priority. In fall 2006, Carver submitted two SOIs – one for each elementary school - to the MSBA. After the MSBA recommended that the District only pick one project, the GJC was resubmitted to the MSBA.

The Carver submission was timed to take advantage of the fact that the five-year moratorium on state funding for school projects had just ended. Before the moratorium was put in place at the beginning of 2004, over 400 projects had been submitted to the then-Department of Education, resulting in a waiting list of 428 projects. After the moratorium was lifted, more than 400 additional SOIs were submitted to the new MSBA. When taken together, during this period over 800 of the Commonwealth’s approximately 1,800 schools had submitted funding requests.¹⁹

In November 2007, the MSBA Board of Directors voted to allow Carver to begin the MSBA process in 2008. At the time, only 49 projects were approved, out of the 423 that were submitted. After receiving the SOI for the GJC and performing a site visit, the MSBA agreed to treat the two schools on the site as one project, instead of two, since they both shared in delivering the educational program to the students. An updated SOI was prepared that incorporated both buildings. The baseline reimbursement rate established for Carver was 56.2% at that time. In June 2008, Town Meeting appropriated \$250,000 for the required feasibility study. The District followed the MSBA process to identify an OPM and a Designer. Following this, the Designer, Design Partnership of Cambridge, Inc., worked on the feasibility study, along with the OPM, Daedalus Projects Incorporated. Five public forums were held to review the three top alternatives and Option “B3” was identified as the preferred option. The feasibility study was completed in September 2009 and approved by the MSBA; reimbursement for 56.2% of the cost of the study has been paid to the District.

However, in October 2009, a vote on debt exclusion funding²⁰ for preparation of the Schematic Report (\$600,000 in requested funding) failed during a special election. At the same time, the voters did not approve funding to replace the school septic system (\$300,000 in requested funding). Following the October vote, over 100 residents solicited signatures to put the funding question on the ballot again. Over 2,000 signatures were received, so a second debt exclusion proposal was placed on the ballot in January 2010, strictly for the funding for the schematic design, since the septic work had been funded by borrowing under the levy limit. The second vote also failed. Ultimately, in November 2010, funding for the schematic design was approved at Town Meeting using funds borrowed under the levy limit.

From February to September 2010, the Designer worked with the School Building Committee and the community to refine and narrow the design alternatives. By October 2010, a preferred alternative had been selected and a cost estimate of \$45.1 million was established. Since Carver had not been successful in prior public votes, the MSBA asked the Town to hold a non-binding referendum to show

¹⁸ Kingscott, *Feasibility Study Phase I Problem Seeking*, May 2006, p. 1.

¹⁹ MSBA, *2010 Space Needs Survey Report*, 2011, p. 5.

²⁰ A debt exclusion is an increase to the Prop 2 ½ levy limits for the purpose of paying for a specific project or projects. The exclusion is only in effect until the project debt is paid off. In contrast, a voter override is an increase that remains in place until repealed.

support for the project before a Project Funding Agreement could be approved. In April 2011, the non-binding referendum failed by 31 votes (Yes: 890, No: 921, Blank: 45). Since Town Meeting had previously approved language for a debt exclusion, the MSBA let the Town consider moving forward with a debt exclusion vote even though the non-binding referendum had failed; however, the Board of Selectmen voted 3-2 to put it on the ballot, but since a 2/3 majority is required to place a debt exclusion on the ballot, the measure failed (i.e., 4 affirmative votes would have been needed). In June 2011, the MSBA officially removed the Carver project from its Statement of Interest capital pipeline.

In March 2013, the Carver School District submitted a new Statement of Interest to the MSBA for the elementary school project, beginning the review process anew. On January 29, 2014, the MSBA Advisory Board voted to invite the Carver Elementary School into the 270 day eligibility period.²¹ During this period, all of the above-described activities will take place, including updating the baseline reimbursement rate and school population estimates using current data.

DESCRIPTION OF EXISTING SCHOOL FACILITIES

The Erwin K. Washburn Primary School (EKW) was built in 1974 as a modular, open-plan system for 450 students with a life expectancy of 25-30 years. The open plan system was intended to allow students and teachers to work in groups throughout the day. Movable partitions were built into the design that would allow rooms to be formed at will. In 1984, an eight classroom addition was built and, in 1988, a double-wide portable classroom was added. The result, 40 years later, is 64,392 square feet of space housing classrooms accommodating 433 students from pre-kindergarten to second grade as of October 1, 2013. The building also contains the library media center, music, and art rooms serving the entire school, along with a cafeteria that serves students from both buildings. The open plan design was rejected by teachers and administrators years ago and, in an attempt to provide some structure to the classroom environment, “walls” have been put in place in many locations, including wooden half walls built by teachers or family members and materials stacked up around the edges of the classroom space, serving a dual purpose, since storage for classroom materials was absent in the original open plan. Space is at a premium in the school, so maintenance closets, offices, and other rooms have been converted into instructional space. The library, which is used by all elementary students, also serves as the computer lab, with more than one class often using the space at the same time. The gym is also used by students from both buildings. Since the building does not have any windows that open, heating and cooling systems must operate year round.

The Governor John Carver Elementary School (GJC) was built in 1951, with a two-story addition for the cafeteria and classrooms being constructed in 1957. As of October 1, 2013, it housed 416 students in 14 classrooms within 34,618 square feet. Classrooms are accessed via a double-loaded corridor with four sets of stairs moving between floors. Three classrooms on the first floor are separated from the rest of the school by the gym, so in order to access those classrooms, students and teachers must walk down into the sunken gym, across, and then up the other side, even when gym class is taking place. All walls are masonry or masonry covered with plastic, the floor is reinforced concrete, and ceilings on the 2nd floor are exposed concrete, with some type of drop ceiling installed on the first floor. As a result of the building materials, the wiring and plumbing systems are exposed and run outside of the walls. The

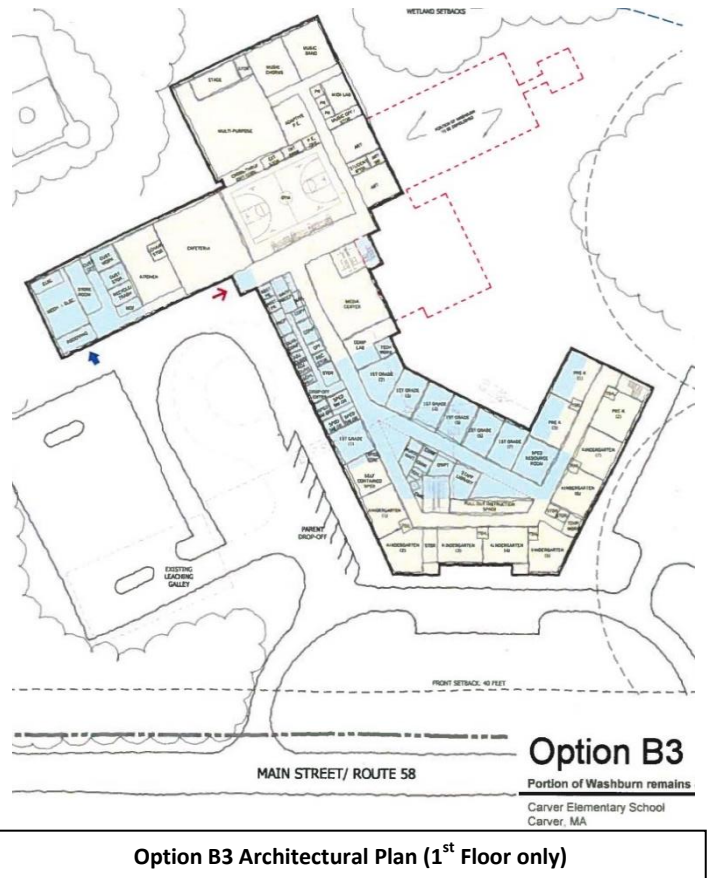
²¹ MSBA, “January 29, 2014 Board Meeting Press Releases”, retrieved from http://www.massschoolbuildings.org/news_events/1.29.14Board, March 27, 2014.

building has no library/media center, and the gym and cafeteria are sized for a smaller school population. However, the Governor Carver has the only cooking kitchen on-site, so food is transferred daily on carts to serve those students that have lunch in the Washburn building. One-on-one instructional stations, i.e., tables, have been set up in various locations in the hallway to allow teachers and students to work in smaller groups.

In fall 2013, the two-building campus served 849²² children from pre-kindergarten until grade 5. The school is led by a single principal.

DESCRIPTION OF PREFERRED ALTERNATIVE

After developing 22 different options and engaging in detailed analysis on three of them, the Carver School Building Committee selected Option “B3” as its preferred option. This alternative involves a mix of renovation and new construction on the existing elementary school site. The façade of the GJC building will be kept intact and renovated, as will be the classrooms along the front of the building. What is now the rear wall of the building will be pushed outward and a new row of classrooms will be built. In between the rows of classrooms – in a new triangular shaped area – shared, supportive services will be located. These include the school nurse, occupational therapy/physical therapy, and space for small group or one-on-one instruction. Under Option B3, taking into account a projected student population of 925 (2009 estimates), the resulting school facility will be approximately 35,000 square feet larger than the facilities today.



New construction will connect the GJC and the EKW buildings so that they become one building accessible to all students. In what is now the EKW building, spaces that serve the entire school will be located. These include the gymnasium, media center, cafeteria, multi-purpose room, music room, and classrooms for art. A computer room will also be located in this area. Portions of the existing EKW will be demolished and what is retained will be renovated. As planned, classrooms for pre-K, kindergarten, and first grade will be on the first floor of the school and classrooms for second through fifth grade will be on the second floor. Per the site plan, separate parking/loading areas will be provided for school buses, teachers/visitors, and drop off for pre-K and kindergarten. Parking capacity will be significantly increased.

²² By March 2014, total enrollment had increased to 854.

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CONSIDERATION OF NEED FOR NEW / RENOVATED ELEMENTARY SCHOOL

A Commonwealth-wide study in 2010 prepared by the MSBA gave the Carver Elementary School the lowest possible ratings for building condition and physical environment. When first studied in 2005, 62 schools out of 1,817 (3.4%) received the lowest ratings for condition and environment. By 2010, the number with the most poorest ratings in both categories had been reduced to 23 (1.09%) (see Appendix B), with the report finding that the State and local efforts to improve school environments were succeeding and that “about 40% of Massachusetts school square footage has been built new or renovated in the last 10 years.”²³ A description of the three evaluation components is as follows:

- *The **building system condition rating** is an overall score for the general conditions of a school facility’s major systems such as roofing, HVAC, windows, and flooring. The building systems conditions were rated on a scale of 1 to 4, with a score of 1 indicating the best conditions and a 4 indicating the poorest.*
- *The **general physical environment** score is also based on a 1 to 4 scale and reflects the school building’s physical elements such as access to daylight, classroom location and size, supporting teaching and learning.*
- ***Space utilization** at individual schools was rated based upon comparison to statewide norms. Each school building received an Above Average, Average, or Below Average Utilization score.*²⁴

In 2010, the Carver elementary school received “4” ratings for building systems and physical condition (the lowest possible) and an “above average” rating for space utilization (the worst possible), as the facilities offered only 109 gross square feet of space per student (as compared to 145 gross square feet per student allowed for new construction). Of the 23 schools that received the lowest scores in 2010, 17 have submitted at least one Statements of Interest and been accepted into the MSBA process. As a result, the Carver elementary school remains one of an increasingly small number of school facilities whose low scores remain unaddressed. The extraordinary nature of Carver’s scores can be seen in the bar graphs below which show how few of the Commonwealth’s schools received such poor ratings.

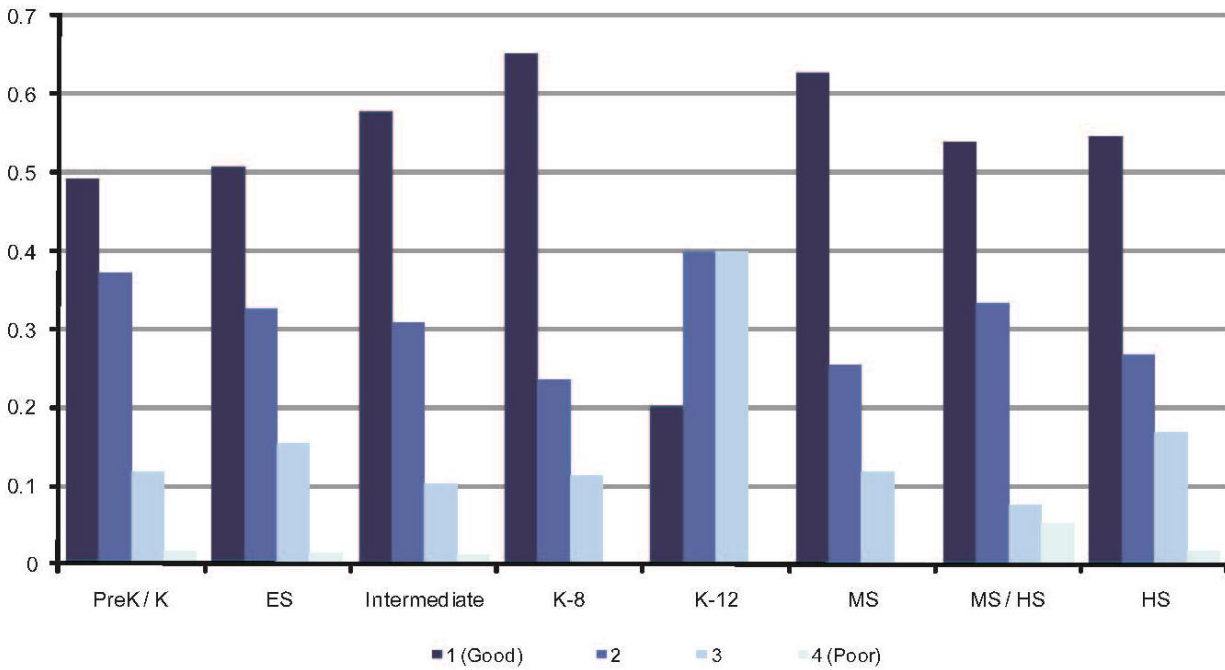
In addition to the analysis by the MSBA, the Carver School District has also had technical studies prepared by Kingscott Associates and Design Partnership of Cambridge, both of which identified significant issues with the elementary school buildings. Many of these issues were immediately visible to the Collins Center project team on its site visit, as well. (It should be noted that the project team was not asked to undertake an engineering analysis; the site visit was intended to provide a layperson’s understanding of the facilities.)

The project team’s findings regarding the need for a renovated or new facility for the Carver elementary school population follow.

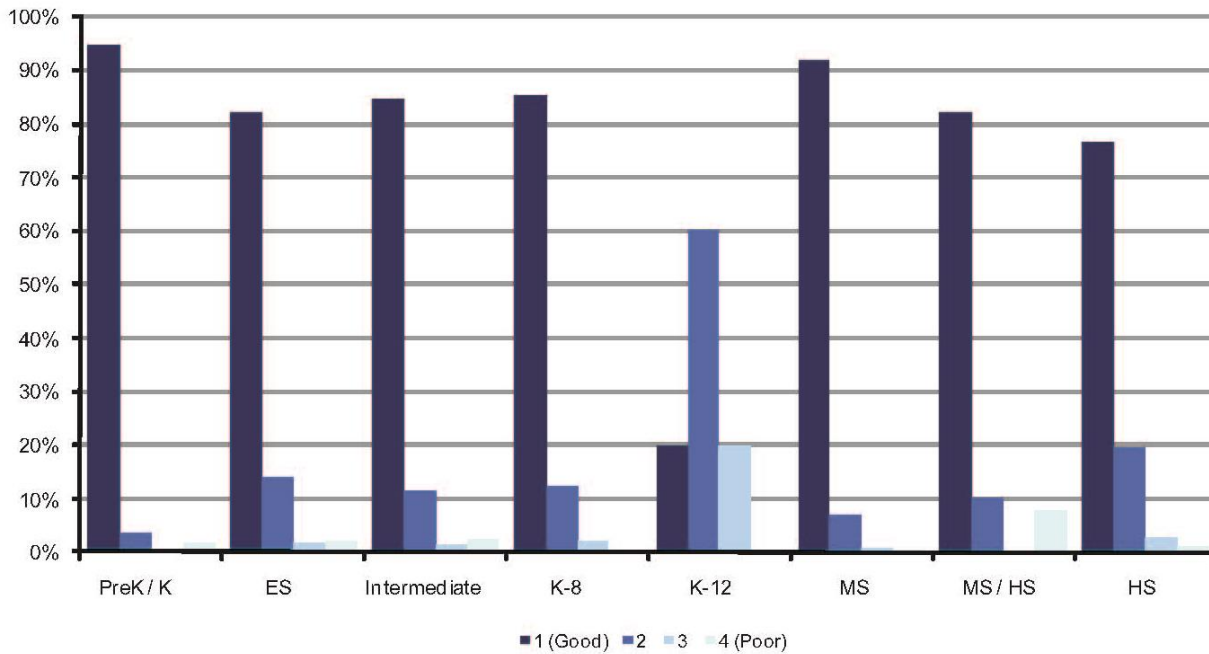
²³ MSBA, 2010 Space Needs Survey Report, 2011, p. 5.

²⁴ *Ibid.*, p.12.

Building Systems Condition Ratings by School Type



General Environment Ratings by School Type



(Source: MSBA, *2010 Space Needs Survey Report*, 2011, p. 25 and 30, respectively.)

Finding 1: The Carver elementary school buildings are inadequate, overcrowded, and do not meet current day space standards.

According to the National Institute of Building Sciences, “more than other building types, school facilities have a profound impact on their occupants and the functions of the building, namely teaching and learning. Children in various stages of development are stimulated by light, color, the scale of their surroundings, even the navigational aspects of their school. Children can also react negatively to adverse conditions.”²⁵ Considerable study has occurred across the U.S. and in other countries to define what quality educational facilities should contain, and several U.S. states have adopted guidelines for the sizes of different types of classrooms and other spaces.

In Massachusetts, the MSBA has not established official space standards for school facilities, making it clear that a school’s design should be based upon its educational program, which will differ from school to school. However, they do monitor overcrowding in schools and offer some size maximums that apply to projects seeking MSBA funds. As noted above, at only 109 gross square feet per student, the Carver Elementary School was found to be “above average” for space utilization in MSBA’s 2010 study. This is considerably less space than the gross 145 square feet per student maximum established for elementary schools with 600 or more students. In fact, based upon October 2013 school enrollment, if the Carver elementary school was at the MSBA allowance, it would be approximately 24% larger than it is today (approximately 123,100 gross square feet for 849 students instead of 99,000 square feet). When taking into account the 2009 growth projections, a new facility built for Carver per the MSBA guidelines would likely be between 132,000 and 134,000 gross square feet in size. (Note that this is subject to change in spring 2014 as the MSBA recalculates the projected population for the new process.)

In its Space Summary Template, used during the design process, the MSBA does offer greater detail about different types of spaces and the maximum and minimum sizes expected. In comparison, Carver’s existing facilities can be found to be considerably smaller than would be expected for a new school built today.

EXISTING SPACE AVAILABILITY VS MSBA GUIDELINES (figures equal net floor area unless otherwise noted)		
Use	Existing (sf)	MSBA (sf)
Kindergarten Classroom w/Toilet & Storage	942	1,100 – 1,300
Art Classroom	882	1,100
Gym	4,813	6,000
Media Center (based on total student population)	1,629	4,833
Dining & Food Service (based upon two lunch seatings)	5,024	6,938
Custodial & Maintenance Space (incl. telecom, recycling, receiving, etc.)	625	~1,900

Focusing closely on Carver’s specific academic needs, two substantial technical reports – the September 2009 Feasibility Study prepared by Design Partnership of Cambridge and the 2006 Kingscott study – analyzed the buildings in great detail, identifying inadequacies and the resulting impacts on educational programming.

²⁵ Vaughan, Ellen Larson, “Whole Building Design Guide – Elementary School”, retrieved from <http://www.wbdg.org/design/elementary.php>, March 28, 2014.

With regard to space availability at the EKW building, Design Partnership of Cambridge found that “The Erwin K. Washburn open plan design has a negative impact on the delivery of a quality Educational program...The EKW building has exceeded its capacity to accommodate the current educational program.” More specifically:

- There are not enough classrooms for special education, Title I, Speech/Language, OT/PT, School Psychologist, and School Adjustment Counselor. Students receive services in partitioned areas in the library/media center or in offices/closets converted to teaching spaces;
- The computer lab, media center, and gym are shared with students in the GJC; these spaces are not large enough to accommodate the student population of both buildings;
- One classroom is a temporary portable that is 31 years old;²⁶
- The cafeteria is also shared with the GJC students resulting in five lunch periods; this has a negative impact on the educational program;
- One music teacher must teach from a cart in the open plan building.²⁷ The noise distraction to other classes has a negative impact on the educational program; and,
- There is a lack of coat and backpack storage; student belongings are in the corridor between classrooms creating a safety issue.²⁸

Design Partnership further pointed out that several of the classrooms have no outside wall exposure and therefore no daylight or exterior views, that kindergarten classrooms are undersized (and many do not have toilets), and that support spaces (i.e., administration, guidance, nurse, teachers’ work rooms) are universally under-sized.²⁹

The Kingscott study found the same issues existing in 2006.³⁰

At the GJC building, Design Partnership found that “there is no library/media center, the gym and cafeteria are not able to serve the current enrollment. The building has reached the end of its useful life and is in need of major additions/remodeling or replacement.” Details include:

- Gym is not sized for two teaching stations to adequately meet program;
- Lack of space for Library/Media, Computer, and PE; students must travel to Erwin K. Washburn Building; valuable instructional time is lost;
- Building lacks adequate space for Art and Music, some classes taught from cart;
- Building lacks adequate space for OT/PT, students must travel to Erwin K. Washburn Building; valuable instructional time is lost;
- The building does not provide adequate space for Title I, Special Education, School Psychologist, and the School Adjustment Counselor;
- Nurse’s office does not meet MSBA guidelines;
- Building has no conference rooms (meetings must be held in the EKW building); and,

²⁶ Per direction of the building inspector, the modular building must be removed prior to the 2015 school year.

²⁷ In 2011, music instruction was moved to the EKW cafeteria. However, once the modular building is removed, music instruction will likely need to return to the cart due to the reduction in building space.

²⁸ Design Partnership of Cambridge, Inc., Feasibility Study, September 2009, p. 6-7 of 560.

²⁹ Ibid, p. 108 of 560.

³⁰ Kingscott, p. 5-16.

- Cafeteria is small; five lunch periods negatively impact the educational program.³¹

Design Partnership went on to conclude that “[t]he building does not provide adequate space for the educational program. Valuable instructional time is lost when students must move to the EKW building for library/media, computer/technology instruction physical education, special education, and lunch.”

The Kingscott study identified the same issues three years earlier and added that “[t]he current classrooms meet MSBA guidelines for size. All other teaching stations do not meet minimum size standards.”³²:

Carver’s Statement of Interest submission describes the impacts of the space challenges in vivid terms:

There are not enough rooms to provide effective spaces for teaching and learning. The Gov John Building has no rooms for reading, special education, speech and language services, OT/PT, music, art, library/media center or computer lab. The cafeteria cannot seat enough students and that creates the need for five lunch periods. The Washburn building provides spaces for the services just described for students in both buildings. Access to these programs and services is limited due to the lack of space. Every available seat is used. High risk students are receiving services in converted closets, offices and hallways.

Both buildings that comprise the Carver Elementary School lack the required and appropriate space for special education services. The District was cited [sic] in the Department of Education’s Program Review process for lack of adequate space to provide special education services. This cannot be mitigated without a total renovation and addition space. It is never appropriate to teach children in closets and hallways. Currently all reading intervention (targeted instruction for at risk students) is provided by grouping at least two classes of students in one classroom at all times. Math intervention classes meet in the cafeteria and the library/media center.³³

The project team observed students meeting with teachers in converted closets and in the hallway, and spoke with teachers who described the negative impacts on learning time of having their classes moving from building to building to have lunch, use the library, or go to the gym. They indicated that even if their classroom was not in the process of putting on their coats to move to the other building, the noise from a nearby classroom doing so was enough to affect the students who were receiving instruction. The project team observed that some areas such as the media center are grossly undersized by current MSBA guidelines, with multiple learning stations competing for their own quiet area while attempting to be respectful of others in the room. In addition, the chronic shortage of space means there is no area specifically designed for storage, so equipment, articles of clothing, and consumables are in constant motion. The project team finds that extra time and effort required to keep the facility organized takes away from learning opportunities.

³¹ Design Partnership, p. 5 of 560.

³² Kingscott, p. 17-22.

³³ Carver Public Schools, *Statement of Interest Submission*, March 21, 2013, p. 2-3 of 138.

Finding #2: Significant safety concerns exist at both school facilities.

Existing conditions in the Washburn and General Carver Schools existing were examined in detail in the Design Partnership and Kingscott facility studies. Both found that the buildings do not meet current building codes and standards in a number of ways. A partial list of those finding is listed below.

Health and safety issues identified at the EKW building include:

- Does not have 1 hour rated walls/doors between classrooms and hallways;
- Does not have fire rated space for storage, custodial, kitchen, and mechanical/electrical areas;
- Fire Alarm system does not meet current standards;
- Building lacks a fire sprinkler system
- Student crossing of vehicle traffic to access playgrounds is a safety concern;
- Site lighting is not adequate;
- Current routing of buses, staff and visitor parking, service traffic, and parent pick up and drop off is a safety concern;
- Students sharing hard-surface play area with parking is a safety concern; and,
- Playground surfaces do not meet accessibility and safety standards.³⁴

Health and safety issues identified at the GJC building include:

- Site lighting is not adequate;
- Playground surfaces do not meet accessibility and safety standards;
- Stairs do not have a rated enclosure; don't exit to the outside; do not have proper tread and riser dimensions;
- Mechanical rooms, storage rooms, and maintenance rooms need to have fire rated enclosures;
- Entry is at mid-level; Administration is located on upper level and has no visual control of the main entrance;
- Building lacks a fire sprinkler system;
- Fire Alarm system does not meet current code; and
- Emergency light system is inadequate.³⁵

The studies did find that both buildings were clean and well kept, and both appeared to be structurally sound. They also did not identify any issues with health code compliance.

The District's Statement of Interest submission specifically indicates that:

The open plan Washburn building presents health & safety issues due to the modular exterior wall system that integrates the windows into the walls. There is no emergency exit available through the windows, the windows do not open. The age and condition of the doors in relationship to the foundation present security and safety issues and the doors are part of the wall system. The open plan of common areas such as the cafeteria and library media center gives very little security and no fire rated walls for fire

³⁴ Design Partnership, Feasibility Study, p. 6-7 of 560 and Kingscott, p. 5-16.

³⁵ Design Partnership, *multiple documents*, p. 5-6 of 560 and Kingscott, p. 17-22.

*protection....The Gov John Carver building has structural problems with the doors and stairs that present security and safety issues....The entire building is a safety concern due to the lack of barrier free access due to the structural design of the building. The age and condition of the 63 year old steam piping system for the steam boiler is a constant risk. The piping is exterior to the interior walls and there have been three ruptures of those pipes since 2008. No students were in the building at the time. This cannot be mitigated without a structural renovation to the entire building.*³⁶

As a result of continued building deterioration and the tragedy in Newtown, Connecticut, changes have recently been made to building access. According to Superintendent Liz Sorrell, "In January of 2013 we closed the public entrances to the GJC because the doors would no longer lock automatically when a visitor was admitted and because all visitors entered at mid-grade between two floors and could not be monitored by the limited security system. We had to hire an additional clerk to accompany parents who check in at the EKW and then are escorted to the back doors of the GJC."³⁷

On the site visit, the project team noted that the lack of partitions and closets in the Washburn facility, in particular, created a unique environment whereby clothing, a variety of mismatched cabinets, equipment, and boxes of consumable materials acted as divisions between classes and hallways. Those conditions promote an increased risk to safety. During the site visit, the project team noted that many of the exterior panel systems had rusted areas on the sides and bottom, and did not seal adequately. The doors would be in similar poor condition, but for the fact that in the summer of 2013, at a cost of \$100,000, all exterior doors had been replaced at the EKW and double security doors installed with upgraded electronic keyless access.

While all of the identified items are of significance, of particular concern is the fact that both facilities lack modern fire alarm and fire protection systems, and the Washburn school, in particular, lacks proper architectural features that would limit the rate of smoke and fire spread.

Finding #3: Despite the district's efforts to maintain the schools, they are beyond their reasonable life. The age of the facilities, combined with the limited lifespan planned for the Washburn building due to the nature of its construction, have made the facilities obsolete. The majority of the existing infrastructure is in need of total replacement.

The Design Partnership and Kingscott studies identified significant deficiencies in nearly all building systems.

Building systems issues identified at the EKW building include:

- HVAC system is gas-fired rooftop air handling units and perimeter hot water radiation; system has reached its life expectancy and should be replaced;
- HVAC system does not provide consistent comfortable temperatures or adequate ventilation;
- Building shell is not energy efficient and does not meet state energy standards; the shell is membrane roofing with 1 ½ inch of insulation and a 4 inch insulated wall panel;

³⁶ Carver Public Schools, *Statement of Interest Submission*, p. 2 of 138.

³⁷ Correspondence from Elizabeth Sorrell, Superintendent, to Monica Lamboy, March 10, 2014.

- The inability to open windows means that air conditioning is running in moderate to cold weather; the back-up generator does not have the capacity to run the air conditioning system; the gymnasium is not air conditioned;
- Toilet rooms and fixtures do not meet accessibility standards;
- The classrooms do not have adequate access to technology because the infrastructure for electricity and technology are inadequate;
- There are only 2 duplex power outlets in each classroom; and,
- Lighting system and fixtures do not meet current energy standards.³⁸

Building systems issues identified at the GJC building include:

- Roof needs replacement and needs more insulation for energy efficiency;
- Infrastructure is 52- to 58-years old; reached the end of its useful life and needs extensive renovation and replacement;
- Hot water heater is original (1951); at the end of its useful life; has inadequate capacity;
- Steam boilers are at the end of their useful life and are not energy efficient;
- Unit ventilators in classrooms are original (1951) & at the end of their useful life;
- Steam Heating Piping is original (1951) and not energy efficient;
- Temperature controls are pneumatic and should be replaced;
- Domestic water piping is original and at the end of its useful life;
- Many plumbing fixtures are original and do not meet barrier free requirements;
- Sanitary piping is original cast iron and at the end of its useful life;
- Building lacks adequate power receptacles, grounding, and voltage surge suppression;
- Electrical fixtures and lighting systems are not energy efficient and do not meet state energy standards; and,
- Electrical systems do not support adequate use of technology in the classroom.³⁹

The septic system that was nearing failure was mentioned in the Design Partnership report, but has subsequently been addressed by the School District.

District officials wrote in the Statement of Interest that:

All roof top heating and cooling units are experiencing failure rates that are accelerating. The open plan of the Washburn building provides is inefficient and puts additional strain on the air handling units. The inability to open windows in this building comes at a cost of air conditioning the entire space in moderate weather. The steam boilers in the Gov John Carver are not efficient. The electrical service of 400 AMPS in the Gov John building does not provide the minimum need for the building and frequent brownouts and failures are experienced by the students and staff. The unit ventilator systems in this building are 63 years old and ventilation is a problem. All core systems in both buildings are in need of immediate replacement, except for the electrical system in the Washburn building.

³⁸ Design Partnership, Feasibility Study, p. 6-7 of 560 and Kingscott, p. 5-16.

³⁹ Design Partnership, p. 5-6 and Kingscott, p. 17-22.

There is not enough electrical service or computer drops to provide students access to computers as a teaching or assessment tool. In 2015 all students will be required to take a simultaneous test, online with an electrical device for the mandated state testing. We cannot provide this testing environment due to the lack of infrastructure to support the technology.⁴⁰

On a cold day in early December 2013, the project team observed excessive heat in rooms in the Governor Carver building. One office was well in excess of 90 degrees in temperature, and no teacher or administrator could have possibly functioned in the room for more than a few minutes at a time. In addition, the project team heard of regular instances where small appliances in one room, if turned on without consideration of power uses in another area, caused breakers to overload and trip. From the technical studies and observations, it is evident that the amount of electrical power and its distribution are not sufficient to meet the demands of a modern school. In fact, a modern school would have approximately three times the electrical capacity of that currently exists in the Governor Carver building.

A key point implied by the professional observations above is that virtually all of the systems in the schools are beyond their useful life. In the experience of the project team, replacing those systems is costly. Replacement of heating, cooling and ventilation systems and the associated piping, for example, would require significant access into various walls and ceilings, and replacement of architectural finishes throughout the buildings.

Finding #4: The buildings do not meet current day accessibility standards.

Federal law and public expectations relating to building accessibility have changed dramatically since the buildings were built, and even though some efforts have been made to address accessibility, the buildings currently do not meet American's With Disabilities Act ADA standards.

The Design Partnership and Kingscott studies found that:

- The Governor Carver lacks adequate provisions for accessibility at the front door and cafeteria door, and it lacks adequate accessibility to all levels;
- The Governor Carver does not offer places of refuge for physically impaired in the stairwell as is required by code;
- No barrier free routes are available to either building;
- Toilet rooms and fixtures do not meet accessibility standards in either building; and,
- Playground surfaces do not meet accessibility and safety standards.⁴¹

Given that Carver only has one elementary school facility serving the entire town, the project team is uncertain what accommodations could be made within town for a student, or students, who had significant physical disabilities.

Finding #5: Carver's elementary school facilities are not supportive of quality instruction and learning. Educators struggle each day to overcome the physical challenges of the environment in which they are expected to teach. Studies show poor environmental conditions have a quantifiable negative impact on learning.

⁴⁰ Carver Public Schools, *Statement of Interest Submission*, p. 3 of 138.

⁴¹ Design Partnership, p. 5-7 of 560 and Kingscott, p. 5-22.

Considerable research has been done in the U.S. and around the world into the relationship between building design/environment and student achievement, and the findings have been conclusive and significant. As reported by Glenn Earthman, professor emeritus at Virginia Polytechnic Institute and State University:

There is sufficient research to state without equivocation that the building in which students spend a good deal of their time learning does in fact influence how well they learn. Numerous studies have indicated that students in poor buildings perform less well than students in functional or acceptable buildings. Results of these studies indicate the following:

- *Students in poor buildings perform less well than students in functional buildings.*
- *Most researchers found students in poor buildings scored between 5 to 10 percentile rank points lower than students in functional buildings, after controlling for socioeconomic status.*
- *The difference in scores for students in poor buildings can be as high as 17 percentile rank points.⁴²*

Earthman goes on to prioritize those physical conditions that have the greatest influence on learning:

Research indicates that the following criteria, in the order listed, have a demonstrable impact on student achievement:

- (1) Human comfort – i.e., temperatures within the human comfort range as regulated by appropriate HVAC systems*
- (2) Indoor air quality – i.e., appropriate ventilation and filtering systems also as regulated by appropriate HVAC systems*
- (3) Lighting*
- (4) Acoustical control*
- (5) Secondary science laboratories*
- (6) Student capacity – elementary*
- (7) Student capacity – secondary.⁴³*

Criteria 6 and 7 relate to school overcrowding.

A literature review prepared by the Centre for Learning and Teaching at the University of Newcastle found other studies that emphasized heating and air quality, but also found considerable research into the impacts of noise on learning. The report states that, “chronic noise exposure impairs cognitive functioning and a number of studies have discovered noise-related reading problems, deficiencies in pre-reading skills, and more general cognitive deficits. As a result, reviews of the consequences of

⁴² Earthman, Gl, “Prioritization of 31 Criteria for School Building Adequacy”, American Civil Liberties Union Foundation of Maryland. Retrieved from http://www.schoolfunding.info/policy/facilities/ACLUfacilities_report1-04.pdf, February 19, 2014, p. 8-9.

⁴³ Ibid, p. 10-11.

aspects of the physical environment tend to conclude that acoustics and noise are important factors in a school environment.”⁴⁴ The report categorized specific noise impacts as follows:

- Attainment – reading scores, pre-reading scores, general attainment;
- Engagement – attention and distraction; time lost through noise interruption; internal noise;
- Affect – annoyance; learned helplessness; and,
- Well-being – some suggestion of other physical effects (e.g., raised blood pressure).⁴⁵

Teachers are possibly the best resource when seeking to understand the influence of physical environments on education. In a masters thesis at the University of Massachusetts Amherst, Amy Lynn Cole studied the differences between an open plan school and a double loaded corridor school in New York and Massachusetts, respectively. In the course of her research, she found that the open plan layout “only lasted approximately 10 years before the addition of partitions in the mid-1980s creating more traditional sized classrooms...These partitions allow sound from other neighboring classrooms to pass through, around, and above them disturbing the classrooms.”⁴⁶ Ms. Cole also surveyed teachers about their environments. Some of the quotes from the survey include:

What are the disadvantages of the classroom layout?

- *Having no walls is a HUGE disadvantage – the noise factor and distractions from walk-throughs from other classes going to the bathrooms on our end of the quad is crippling to attention – impaired students. LACK OF STORAGE and GOOD WALL SPACE IS ALSO PROBLEMATIC.*
- *Too noisy. Hard to get students’ attention at their desks.*
- *It is hard to find a quiet spot for an individual child to work alone quietly.*⁴⁷

If one accepts the research that human comfort, air quality, noise, and overcrowding influence student achievement, then many aspects of the Washburn School and Governor Carver School are not supportive of learning. These include, but are not limited to:

Washburn School

- Open plan design;
- Partition walls that do not reach the ceiling and are created by bookshelves, boxes, and other storage materials;
- Storage of coats and personal items in the hallway requiring classes to leave their room to get ready to go outdoors;
- Need to pass through other classroom space to get to one’s destination;
- Overcrowding;

⁴⁴ Higgins S, Hall E, Wall K, Wooner P, and C McCaughey, “The Impact of School Environments: A literature review”, The Center for Learning and Teaching, School of Education, Communication and Language Science, University of New Castle. Retrieved from <http://www.ncl.ac.uk/cflat/news/DCReport.pdf>, p. 18.

⁴⁵ Ibid, p. 16.

⁴⁶ Cole, Amy Lynn, “Critical Review of Elementary School Design”, Architecture + Design Program, Department of Art, Architecture and Art History, University of Massachusetts Amherst, May 2011, p. 62.

⁴⁷ Ibid, p. 126.

- Library, cafeteria, and gym that are smaller than needed for school populations;
- Windows that do not open; and,
- HVAC system which does not provide consistent comfortable temperatures or adequate ventilation.

Governor Carver School

- Excessive heat;
- Hard surfaces and exposed concrete ceilings resulting in noise reverberation;
- Gym is open to the first floor hallway creating noise distractions for classrooms;
- Lower level traffic flow must pass through the gym to get from one side of the building to the other; and,
- Need to break up the day to travel outdoors between the two buildings to access the cafeteria, gym, library, and other services in the Washburn School.

Additionally, as mentioned above, neither building is equipped for the technology needs of the student body – needs that will only continue to grow in the future.

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Based upon the above analysis, the Collins Center project team believes ample evidence exists to support the need for a new / renovated elementary school facility for the Town of Carver.

CONSIDERATION OF PROPOSED DESIGN, SITE PLAN, AND CONSTRUCTION PHASING

As described above, after a Statement of Interest has been accepted by the MSBA, a school district works with its Designer to develop a space summary which identifies the types of spaces needed for the academic program, their quantities and sizes, and their interrelationship(s). A similar type of report is prepared to identify site plan requirements, such as fields and play areas, parking, and circulation. These requirements are then used to develop and evaluate various design alternatives until the top three alternatives have been identified. Greater detail is then generated for the top three alternatives and, from these, a preferred alternative is selected.

The Collins Center project team has reviewed the materials produced by the Carver School District that have led to the selection of preferred conceptual design “B3” and the determination that the existing site is the preferred location for the elementary school. Considerable work was undertaken in 2008-09 by the Designer and the School Building Committee as they developed and analyzed 22 different options for the school’s design. Three of these were selected for cost estimation. These include B3 and E2, which both include a combination of renovation and new construction, and H, which is a plan for all new construction on the existing school site. B3 and E2 are similar in that they both connect the two existing buildings via new construction in the space in between them, renovate the GJC building, and renovate / partially demolish the EJW building. In Option H, after the new school is built, the GJC building will be demolished.

As can be seen below, all three options offer approximately the same gross square footage. All attempt to closely approach the MSBA’s maximum space allowance of 145 gross square feet per student, allowing for a student population of 925, as projected by the MSBA in 2009. However, the extent of renovation varies between alternatives B3 and E2, with E2 retaining more of the EJW building and B3 offering more new construction.

SPACE COMPARISON OF PREFERRED ALTERNATIVES (Gross Area)			
(square feet)			
	B3	E2	H
New construction	57,510	49,160	132,800
Renovated area	76,420	83,600	0
- <i>Carver School</i>	<i>36,600</i>	<i>36,600</i>	
- <i>Washburn School</i>	<i>39,820</i>	<i>47,000</i>	
Total area (gross)	133,930	132,760	132,800

The project team offers the following findings about the three preferred alternatives developed in 2009. It should be noted that as the process moves forward again in 2014, modifications may be needed to align with more recent school population projections. For the purpose of this report, the project team has reviewed the existing plans prepared in 2009.

Finding #1: The space summary closely aligns with MSBA guidance and, where differences exist, they are explained. The design concepts that led to the preferred design are clearly articulated.

As noted above, the MSBA expects facilities to be designed to meet the unique programmatic needs of their school populations. However, the agency does offer some guidance regarding the size of particular building components, requesting that a project designer articulate why a different solution may be more appropriate in the school's particular case. The Narrative to Accompany Proposed Space Program (August 21, 2009) and the Desired Functional Relationships (undated) are two forms required by the MSBA that document how a school's educational program will be reflected in the built environment, describe how the proposed program deviates from the MSBA standards, and articulates why those differences exist. These documents are reviewed by the MSBA in detail, and it is the understanding of the project team that the Carver forms received approval when the project was under consideration in 2009-10.

In terms of gross floor area, all three alternatives are slightly smaller than the MSBA guideline for new construction would allow. At 145 sf per pupil, the MSBA guideline would provide for 137,025 gross sf, where the alternatives are between 132,760 and 133,930 sf. However, the top three alternatives provide between 91,713 and 93,167 in net floor area, exceeding the MSBA figure of 89,500 net square feet. This means the Carver design plans use space more efficiently than is typically expected by the MSBA.

Some of the additional variations between the proposed plan and MSBA standards include:

- Two classrooms more than are needed for current population projections are being provided to accommodate for future growth, taking into account the 2009 school population projections. In the interim, they will be used for special education meetings and additional instructional space;
- The cafeteria has been designed for three lunch periods, instead of two periods, and a separate multi-purpose room is being added. The MSBA's guidance anticipates two lunch periods, with the expectation that the room would then be available for other uses. As a result of Carver's approach, the cafeteria is 2,400 sf smaller than the guideline and the multi-purpose room is larger, providing for space for one-half of the student body and teachers to attend an event at the same time. The report acknowledges that, in other communities, the Carver school population would be served by two schools, each of which would have a gym and cafetorium for a total of four rooms. In the proposed plan, the gym, multi-purpose room, cafeteria combination "is more efficient."⁴⁸
- Art, music, and technology area – total area for these uses will be 5,300 to 5,750 sf greater than MSBA guidelines.
- Special education area will be approximately 4,000 sf less than MSBA guidelines. "As explained by Superintendent Sorrell, 'We rely heavily on the small-group pull-out model, providing early and sustained intervention...This substantially reduces the need for special education classrooms, per se, and results in more specific and focused instruction with better outcomes.'"⁴⁹
- Health and physical education space will be 2,200 sf greater than MSBA guidelines to allow for bleachers in the gym to be used by spectators and also by health education classes so that a

⁴⁸ Design Partnership of Cambridge, "Narrative to Accompany Proposed Space Program", p. 3 of 5.

⁴⁹ Ibid, p. 2 of 5.

separate health education classroom will not be required.

All three design alternatives cluster the spaces that can be used by the community, i.e., gym, multi-purpose room, cafeteria, so that on-site activity after the regular school day can be better supervised and regulated.

The project team concurs that Option B3 is the best of the three final alternatives. The benefits of Option B3 include, but are not limited to:

- Classrooms are clustered together to provide single community, yet different grades can be grouped;
- Space that can be used after hours are separated from classroom areas so that they can be best monitored and controlled;
- The cafeteria and gym can be connected to provide a large gathering space, if desired;
- Lots of outside wall space will allow natural light to enter the classrooms and offices and views out into the landscaped area of the site;
- Circulation appears to be most efficient of all three; and,
- B3 replaces more of the Washburn School than E2.

Alternative B3 also maintains the façade of the Governor Carver School, a building that by all accounts the Carver community felt was important to retain.

Finding #2: The proposed site plan intends to address on-site safety issues, but the solution selected adds multiple curb cuts in a relatively short distance along a high speed road. Review by a traffic engineer is needed.

The Kingscott study described issues with on-site circulation including:

- The one-way drive off of Main street serves visitor parking, the bus loop, staff parking, parent drop-off and service/delivery;
- Cars that are parked in the visitor space can back out into the bus/parent unloading traffic lane; this is a safety concern;
- Service vehicles travel through the hard surface elementary playground;
- Parking Lot 2 is also the hard surfaced play area. It is a safety concern to use this area as both play area and parking; and,
- Parking occurs on the grass in Lot 3.⁵⁰



⁵⁰ Kingscott, p. 6-7.

At present, the site has two points of entry/exit that are approximately 360 -370 feet apart, both of which serve the entire site. Under Option B3, the above-listed issues are resolved by creating three separate parking/travel areas including: a pre-K drop off with parking; a bus loop with visitor parking; and a parent drop off with parking. In this plan, the existing northern entry would serve the pre-K area only, and two separate entrances would serve the bus loop and the parent drop off/parking, respectively, thereby adding a third curb cut along Main Street/Route 58, across from the Sedell Plaza commercial center on the other side of the street. Of particular concern is visibility for parents traveling northbound to drop off their children. If one or more northbound buses is backed up on Main Street trying to make a left turn into the site, could that obscure visibility for vehicles trying to turn left into the other entry so that a parent in a hurry could turn into oncoming traffic. Also, the fact that the bus loop and parking area do not have any connection means that if someone unfamiliar with the site incorrectly turns into the bus loop, they must exit the site onto the main road prior to entering into the parking lot. Prior to finalization of the design, analysis by a traffic engineer is needed. As an alternative, the bus loop and parent drop off/parking could be redesigned to use a single curb cut.

Finding #3: While B3, which involves renovation and new construction, was selected in part to optimize MSBA reimbursement and reduce cost to the Town, this approach adds considerable complexity and risk to the project. This risk can have financial implications.

As noted above, all projects accepted into the MSBA process are given a baseline reimbursement rate at the start of the process that takes into account three socio-economic factors including the community income factor, the community property wealth factor, and the community poverty factor. In addition, the MSBA, in its sole discretion, may award additional incentive points based upon the selected design. These incentive points translate into percentage increases to the reimbursement rate for the project. No district is eligible for more than 18 incentive points in total, and each incentive category cannot exceed 6 points. The current categories are:

- **Model School Program** (up to 5 points) – applies only to the use of a design pre-approved under the MSBA model school program;
- **Newly Formed Regional School District** (up to 6 points) – applies only to a newly created regional school district or one in which the membership has changed;
- **High Efficiency Green School Program** (up to 2 points) – can be granted for design elements that meet the Green School Guidelines;
- **Best Practices for Routine and Capital Maintenance** (up to 2 points) – can be granted when an applicant has exhibited best practices for routine and capital maintenance and upkeep of facilities, including long term capital improvement plans, the establishment of segregated local funds dedicated for the capital maintenance of school facilities, the use of facility maintenance manuals and practices that standardize preventative and routine maintenance procedures;
- **Overlay Zoning** (MGL 40R or 40S) (up to 2 points) – can be granted when a Town has adopted Smart Growth zoning to allow for more intensive development, including affordable housing, with reduced permitting requirements adjacent to transit or in a town center;
- **Use of CM-at-Risk** (up to 1 point) – can be granted when an applicant chooses to use an approved construction manager as certified by the Inspector General;
- **Renovation/Re-use of Existing Facilities** (up to 5 points) – can be allocated if the project is a renovation of an existing facility that requires no new construction. The MSBA may award an amount less than five percent for a project that has a combination of renovation and addition based on a sliding scale that relates percentage of renovated space to the percentage of newly constructed space. No points are awarded under this category for the construction of a new school; and,

- **Establishing a Maintenance Trust** (up to 1 point with district match) – can be granted when an applicant provides a local one-for-one match for any funds deposited in the Trust by the MSBA. A school district must provide MSBA with detailed budget information on historical and projected maintenance expenditures. Proceeds shall not be used for operating or recurring costs, salaries, or maintenance supplies.

As the project team has been told, the School Building Committee’s approach is to include sustainable design features that would make the project eligible for the Green School Program incentive points (up to 2 points) including “achieving a high level of energy-use performance relative to code requirements, in pursuing innovative site drainage strategies to control runoff, in incorporating strategies for daylighting and passive solar gain into the design, and in exploring options for renewable energy” and the preferred alternative (B3) has been designed to reach a LEED Silver designation.⁵¹ They also plan to seek points for routine and capital maintenance for any alternative selected (up to 2 points) and the Superintendent believes that Carver’s commitment to capital planning and maintenance will be recognized in this area. However, Carver is not eligible for other points, such as model school, since no plan has been accepted for an elementary school as large as is needed for Carver, it is not a regional school, and the zoning points do not apply.

In addition, alternatives B3 and E2 seek to increase the reimbursement rate by renovating portions of the Governor Carver and Washburn school buildings (i.e., 57% of the B3 project consists of renovation, as does 63% of E2). As noted by Design Partnership, one of the benefits of B3 and E2 is the high percentage of renovated area, which would lead to MSBA reimbursement. If B3, which is the preferred alternative, is approved by the MSBA, the MSBA and the District will engage in detailed calculations to determine how many incentive points will be granted out of the 5 points possible and to what aspects of the projects the percentage will be applied. Assuming that the MSBA grants 57% of the renovation incentive points – which is rather optimistic – this would increase the reimbursement rate by 2.85 percentage points, i.e., it could cover a maximum of 2.85% of the project cost, if all components of the project were fully reimbursable. (Carver officials indicate they have been very diligent and that “there were no designed spaces that went beyond the reimbursable expenses.”⁵²) Under the most optimal circumstances, the 2.85% of the total project cost would be \$1.17 million (of \$41.1 million). This is not a small figure by any means, but question must be asked whether the renovation approach will result in a net savings, given the complexity of the construction staging.

Under alternative B3 (and E2), construction would take place while students remained on the school campus “spread over two academic years and the three associated summers.”⁵³ The approach recommended by the Designer is that “in general, areas of new construction will be built first, then students will move into them, freeing up space in selected areas in existing construction for contractor work...In general, bulk demolition beyond the limits of new construction will not take place until the final summer.”⁵⁴ To open up space in the buildings during construction, the fifth grade (7 classrooms) will be moved to the high school, leaving 38 classrooms on site. The other grades would remain on site, saving the cost of modular classrooms which are not reimbursable by the MSBA.

⁵¹ Design Partnership of Cambridge, “Sustainable Design Features”.

⁵² Correspondence from Elizabeth Sorrell, Superintendent to Monica Lamboy, March 10, 2014.

⁵³ Design Partnership of Cambridge, “Section 1.12. Final Evaluation of Alternatives”, p. 290 of 560.

⁵⁴ Ibid.

The specific phases are identified below (years are as specified in Aug 2009 site plan)⁵⁵:

Option B3 – Phasing Plan			
Phase	Activity	Duration	Classrooms Avail.
1	2-story addition built along back of Carver, consisting of classroom and office space closing the space between the two buildings; add onto and convert the southern wing of the Washburn into a new cafeteria and mechanical/custodial rooms	14 months - Jun 2011 to Aug 2012	39
1B	Construct media center where Washburn gym currently located	5 months – Jun to Oct 2012	
2	Renovate classrooms along front of Carver, incl. building classrooms and hallway where gym currently located, and “complete Phase 1”	5 months – Nov 2012 to Mar 2013	47
3	Complete renovation of wing of Carver where cafeteria currently located	5 months – Apr to Aug 2013	57
4	Convert Washburn library and admin offices into gym	3 months – Jun to Aug 2013	57
5	Convert rear of Washburn to multi-purpose room, music, etc.; convert wing near parking lot to cafeteria, extend wing for custodial and equipment rooms; demolish west wing incl. chorus room, and existing cafeteria	4 months – Sep to Dec 2013	49

Although effort has been made to optimize use of summers for construction, as can be seen, considerable activity will continue to take place during the school year. This includes construction of the two-story addition, renovation of the front of the Carver building, and most of the work at the Washburn building. In addition, no gym appears to be available for 10 months (including one summer) from November of the second year of construction when the Gov Carver gym is converted into classrooms until the following August when the new gym is built, given that the Washburn gym would not be available after Phase 1B when it would be converted into the media center. District officials indicate that outdoor play space would not be compromised by construction staging, and the playfield adjacent to the parking lot of the Governor Carver building would remain available.

Renovation, in general, has considerable potential downsides including:

- Multiple phasing options are more complex than simple additions or new construction;
- Whenever components of existing construction are retained and reused, they tend to have a shortened life span relative to new construction. This may be mitigated to a great extent if the infrastructure is totally replaced and durable materials of construction are put in use; and,
- Whenever construction takes place immediately adjacent to the student population extra care has to be provided for the safety and security of students and staff.

⁵⁵ Maryann Thompson Architects, Design Partnership of Cambridge, “Option B3 – Phasing”, August 3, 2009.

It is not uncommon that unexpected issues arise, resulting in increased construction time and cost. In addition, compromised spaces or odd shapes could be created during the course of a renovation that might not have existed in simpler approaches such as new construction or major additions to one area of the existing facility. However, in the case of the Carver elementary, the project team did not observe any inefficient spaces and commends the design team for their diligence in this area.

Importantly, not only does complex phasing increase risk to any project, in the case of a school project, all of that risk burden is placed upon the local community funding the project. As noted above, it is MSBA's policy that once a project has been approved, and the MSBA and local officials have determined the project's budget, any overruns (outside of the agreed upon contingency) are not eligible for reimbursement. Due to this, communities must be very careful in not budgeting too low when determining what a project may cost; however, that may not be well received by voters considering a debt exclusion. In effect, a tension exists between attempting to budget a project as tightly as possible in order to minimize the amount of borrowing to be considered by local voters and potentially subjecting the project to cost overruns that are not reimbursable.

As the Carver school project moves forward into a new review process in 2014, the project team recommends that officials and community members very closely weigh the merits of receiving renovation incentive points against the potential risks to the project's budget and timeline. In other communities where renovation is the only option due to space constraints, then a school district will take whatever steps can be taken to mitigate against the potential issues generated by large scale renovation. However, as will be explored in the next section, in Carver this may not be the only option available, given the Town's existing land holdings and large undeveloped areas.

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CONSIDERATION OF SCHOOL SITE SELECTION

Finding #1: The high school site did not get full consideration previously and should be considered in the upcoming process. The Town should also seek out other sites for consideration.

Building a new school facility, or substantially renovating an existing facility, is often one of the most costly capital investments a town makes. Attempting to provide a high quality learning environment at a reasonable cost to the taxpayer is also a very complex endeavor. Massachusetts is fortunate to have the MSBA to help offset some of the cost of school facilities, but their participation adds time and process, and their funding methodology provides incentives and disincentives that may or may not align with local goals.

In the case of Carver, the School Building Committee and the Superintendent have been very diligent in their consideration of and documentation of 22 different options for the elementary school before selecting Option B3 as the preferred alternative. Many hours were clearly spent developing creative new design options and thoughtfully considering their merits. Where the group was constrained, however, was that their consideration focused predominantly upon the existing elementary school site, having determined seemingly early on that alternate sites were not viable.

Although the School Building Committee may, at the end of the day, be correct that the existing site is the optimal location for the elementary school, the project team believes that other sites do need to be considered and that consideration documented, even at a somewhat brief level of review, if obstacles are found that are too difficult to overcome. The reason for this is that, in addition to showing local voters that the investigatory process has been thorough, new construction has significant benefits that renovation does not. It also has drawbacks that would need to be taken into account. The below table lists some of the positive and negative attributes of the two approaches in Carver.

Merits of New Construction versus Renovation		
	Positives	Negatives
New construction	<ul style="list-style-type: none"> - All new systems, structure, etc. - Do not have to phase the construction, thereby reducing risk - No conflicts with students during construction - MSBA can reimburse for wastewater treatment/water if does not exceed total allowed for site improvement - No demolition costs, depending on site selected - Can move students off of busy main road - Main Street parcel can be sold to offset project cost; site can be used for mixed use or multi-family housing putting parcel on tax rolls; 	<ul style="list-style-type: none"> - Not eligible for renovation incentive points - MSBA only reimburses for site improvement expenses up to 8% of total project cost; depending on site selected, costs can be substantial - Land acquisition, if needed, is not reimbursable

Merits of New Construction versus Renovation		
	Positives	Negatives
	can require that Gov Carver building be retained as part of disposition	
Renovation	<ul style="list-style-type: none"> - Eligible for MSBA incentive points - Will retain existing Main Street site for purpose it has had for decades - Considerable time and money has been expended in developing Option B3 	<ul style="list-style-type: none"> - Complex construction phasing adds risk to project budget and timeline - Access to certain school amenities will likely be constrained for periods of time - Students must be kept safe at all times amidst a construction zone - School will remain on high speed street

As can be seen from the table, new construction would have significant benefits in reducing risk as the contractor would not have to undertake multiple phases and would not have to accommodate students and teachers immediately on site during construction. However, new construction would not be eligible for some of the MSBA incentive points and may have significant site clearance and development expenses. In addition, if a new site has to be acquired, this cost would not be reimbursable. In considering the potential increased costs associated with new construction, it should be recognized that the Town has a valuable asset in the existing site – a site which could be sold to a private developer. The site does have constraints in the form of well protection areas and nearby wetlands, but if it were redeveloped, that could bring additional residents and/or businesses into the town center. The existing school site is currently zoned General Business, which allows for commercial and other uses, such as multi-family housing which would be allowed by Special Permit. The number of allowable units would be determined by first establishing the NULA (New Usable Land Area) and by then calculating the number of units based upon two units per acre of NULA. The land sales proceeds could be used to offset the costs of building a new school at another location. In addition, the property tax base would be increased, providing additional revenue for the Town into the future.



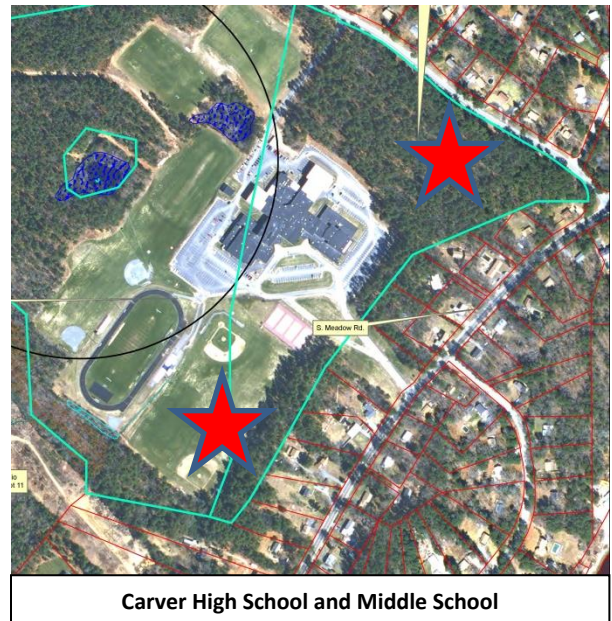
One of the sites that should be considered for new construction is the existing high school property. Although the high school site has significant constraints, the project team has identified two locations outside of the well protection areas that could be considered for a new elementary school. The two locations are in what is now a wooded area between the high school building and Pond Street, and where the baseball fields and tennis courts are current located. (These locations are shown with red stars on the map that follows.) In addition to the benefits of new construction as generally listed above, the high school site could offer potential additional benefits including:

- Elementary school would be relocated off of busy Route 58;
- Operational / administrative savings could be achieved due to proximity to HS;
- Potential space savings if bus drop off and parking areas be designed to work together; and,
- Per MSBA policy, a portion of sanitary treatment plant cost could possibly be reimbursed, if it met stipulated criteria. However, since in practice the MSBA has not funded sanitary treatment plants, Carver would need to pursue this issue with the agency.

That said, there are considerable challenges with the high school site that have been identified by Town and School District staff, especially when taking into account that the identified locations are each approximately 10 acres in size . Constraints include:

- Required 50 foot setback;
- Parking requirements (240 spaces are proposed; slightly fewer are required per Zoning Bylaw);
- Parking lot perimeter landscaping (25 feet buffer);
- Space for bus drop off, walkways, loading/servicing;
- Land area for water retention for new building, plus an existing water runoff (especially in the wooded area adjacent to Pond Street);
- Need for wastewater treatment plant to accommodate existing and new students and staff;
- Need for wastewater discharge area to accommodate existing and new students and staff; and
- Need for paved and unpaved play area.

When all of the requirements identified by Town staff are taken together, they indicate that just over 14.1 acres of land is needed for the elementary school. In addition, ball field space is very limited in town and if any fields at the high school were impacted, they would need to be relocated elsewhere and, even if another site were identified, relocation of the fields would have a cost associated. The project team concurs that all of the above points made by Town staff warrant further consideration, but believes that these points should be considered by the School District’s Designer and documented in the reports describing the alternatives considered. Once the high school site has been fully vetted by the Designer, then the District and the community can determine if it should be excluded from further consideration.



At present, the project team has not identified another site. So, once investigation of the high school site is complete, if it is determined the site is not viable, then it would become clear that the existing elementary school site offers the best location.

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FUNDING CONSIDERATIONS

The project team is well aware that at the ballot box the Carver community has expressed its hesitancy at funding capital investments in the elementary school. This was shown through the failed votes on debt exclusions for replacement of the septic system (\$300,000) and for design work and studies for the elementary school project (\$600,000) in 2010 and 2011. At times, as community members to be judicious about public resources and strive to feel comfortable that an investment is a wise one to make they focus predominantly on the added expense. At times, they may fail to fully consider the cost of not making the investment. In this section, the project team seeks to consider both sides of the issue, and give thought to other resources that could be used for the school project.

- **What are the implications of investing in the elementary school project?**

When considering whether a capital expense makes prudent financial sense, city and town officials often look to the short term impacts on the local operating budget, in addition to the long term risks associated with not doing a project. If a capital project can reduce ongoing expenses, the way that improving insulation in a public building can lower heating costs, it may be more favorably considered than one that increases expenses. A project that reduces long term risk may also receive a positive reception, since the cost of litigation over an avoidable injury can run into the millions of dollars.

In recent years, during the economic downturn, communities across the U.S. have had to make hard choices and often have reduced funding dedicated to building maintenance in the short term only to find themselves having to pay for significantly more for costly capital expenses that resulted from building deterioration. This could include an entire roof needing replacement because repairs were not done in a timely fashion or because the full extent of needed repairs was not done in order to save money. (For example, in the case of the Hamilton-Wenham School District, a decision was made not to include a \$1,600 roof drain on a \$460,000 roof replacement project in the 1980s to save money. That decision allowed water to intrude into the building so that the central support beam was damaged at a cost of \$130,000 to fix in 2012.⁵⁶) Disinvestment in public facilities has occurred even though studies have shown that the investment of time and financial resources into preventive maintenance returns \$2 in savings for every \$1 invested.⁵⁷

In the case of Carver, the School Committee has continued to invest money in maintenance and repair at the elementary school, costs that are meaningful because building systems have exceeded their expected lifetimes. As a result, hundreds of thousands of dollars have been spent on repairs or replacements, i.e., work done outside of regular day-to-day maintenance, over the past few years. The below table lists expenses incurred at the elementary school between 2007 and November 1, 2013.

⁵⁶ William Dery, School Committee Member, Hamilton-Wenham Regional School District, email to Monica Lamboy, February 26, 2014.

⁵⁷ "From Preventive to Proactive", Public Works Magazine, November, 2007.

RECENT MAINTENANCE EXPENSES (2007-2013)⁵⁸	
Item	Cost
Rooftop unit repairs	\$110,000
Plumbing	\$20,000
Electrical	\$20,000
Heating	\$18,000
Elevator	\$20,000
Abatements	\$8,000
Doors	\$50,000
Electronic access	\$50,000
Security alarm	\$40,000
Furniture replacement	\$25,000
Walk-in freezer/coolers	\$45,000 (paid by insurance)
Septic system	\$118,000
TOTAL	\$524,000

As can be seen, over \$500,000 dollars has been spent on the school in five years; this is in addition to the standard preventative maintenance work that happens every year. As the facilities continue to age, it can be anticipated that larger investments would be needed to replace worn out building systems. The Town’s own technical advisors have indicated that complete system replacement is needed for most, if not all, key building systems. From the perspective of the operating budget, investing in the proposed renovation/addition has the potential to considerably reduce expenses for capital repairs.

- **What are the implications of not investing in the elementary school?**

Just as the cost of investing in the elementary school needs to be fully understood, so do the costs of not investing. It appears there are at least three dimensions of cost that can be considered – cost to the Town/School District, cost to property owners, and cost to the students.

Based upon the studies performed by Design Partnership of Cambridge and Kingscott, it appears that no amount of maintenance, extraordinary or otherwise, can fully address the issues that exist at the Carver elementary school. As a result, if the Town continues to underinvest in the school, there is potential that at some point one or more of the building systems will fail, whether slowly or through some type of emergency event. Such failures or public safety incidents would be extremely costly. For example, if the entire air conditioning system at the Washburn School fail or if the hot water pipes at the Governor Carver School have a major rupture, the schools (or portions thereof) may need to be vacated for long periods of time as repairs are made. And, as home owners know, the cost of doing repair work on an emergency basis would likely be considerably more expensive than if it had been done in a preplanned fashion; reimbursement, if any, from the District’s insurance provider would need to be determined at the time of the event.

When considering the cost to property owners, several academic studies have analyzed the impact of underinvestment in elementary schools upon residential property values. These studies have shown in a quantifiable manner what realtors have known for some time – school quality influences the desirability of an area for buyers, which in turn influences the price. The studies, out of the University of

⁵⁸ Siedentopf, David B., “Extraordinary Repairs (2007-through Nov 1, 2013)”

Connecticut and the Federal Reserve Bank of St. Louis, among others, have attempted to pinpoint exactly what aspects of school quality appear to have the greatest influence on prices. After looking at overall school spending first, researchers have come to conclude that student test scores have a greater influence on price than any other aspect of school quality, including annual expenditures per pupil. This influence has even been quantified “[f]or a Connecticut home worth \$250,000, the OLS model suggests that a one standard deviation in test scores would raise the home’s value by about \$20,500.”⁵⁹ The same report went on to find that a slightly smaller, but still significant, figure of \$16,250 was a better reflection of test scores on home value. An article in the Wall Street Journal found that, even in a downturn, homes in neighborhoods with good quality schools kept their value and were desired by buyers.

It's supposed to be a buyer's market. Yet, for parents determined to buy in areas associated with top schools, those bargains may be harder to come by. When housing markets go south, "areas with exceptional schools tend to hold their value better than the market overall," says Michael Sklarz, president of Collateral Analytics, a Honolulu-based firm that specializes in real estate data analysis. In Chapel Hill, where the Adams family was looking, the average single-family home price, based on price per square foot, has declined about 4.8% since the market peaked in 2007, according to Collateral Analytics, but houses there still command about a 48% premium, per square foot, to homes in the Raleigh-Cary metro area.⁶⁰

Since other studies have shown that poor physical environment has an impact on student test scores, as was seen earlier in this report, by implication poor physical environment also has an impact on residential property values.

Not to be lost in this consideration of electrical systems, residential property values, and capital expenses, should be the impact upon students of not investing in school facilities. Although many adults in Carver today may look back fondly on their time at the Washburn School and the Governor Carver School, it is also important for to remember the years of wear and tear have happened to those schools since then. In addition, students today face markedly different expectations than those did in the past, especially in terms of needing to be highly adept at computer technology. Further, children growing up in today’s world are not only competing for jobs and opportunities against children from neighboring towns, but against children all over the world, including those in countries investing extraordinary amounts in education and education infrastructure.

What are the possible funding mechanisms the Town could consider for the project?

To date, much of the discussion in Carver appears to have been around the issue of funding by debt exclusion, in addition to the reimbursement. Per the Massachusetts Department of Revenue (DOR), “[a] community can assess taxes in excess of its levy limit or levy ceiling for the payment of certain capital projects and for the payment of specified service costs. An exclusion for the purpose of raising funds for

⁵⁹ Dhar, Paramita, “Isolating the Effects of School Quality on Property Values”, the Connecticut Economy, Fall 2011, p. 11.

⁶⁰ Sarah Max, “Good Schools, Bad Real Estate”, Wall Street Journal, updated June 25, 2010.

debt service costs is a **debt exclusion**".⁶¹ This type of exclusion "...requires a two-thirds vote of the community's selectmen or town or city council (with mayor's approval if required by law) in order to be presented to the voters. A majority vote of the electorate is required..."⁶² In other words, the amount of taxes to be paid by a community can be voluntarily increased by voters in order to fund a specific capital project. A debt exclusion differs from an "override" in that it is only in effect until the debt for a project has been paid off whereas an override will stay in effect until a vote is approved to end the override.

In addition to a debt override, Carver may want to consider whether some additional funding sources might be available to fund a portion of the costs of the elementary school project. These might include:

- Sale of surplus property – under Massachusetts law, municipalities seeking to sell or lease public property must follow a series of prescribed steps, but the outcome of those steps can be considerable funds that could be made available for other purposes, such as capital projects. In addition, depending on what entity purchases the property, previously untaxable land could become taxable;
- Community Preservation Act (CPA) funds – Carver CPA funds can be used for historic preservation, community housing, public recreation, and open space, and must be used to augment, not supplement existing funding. Perhaps Town officials, in collaboration with the Community Preservation Committee, could explore whether this resource could fund some of the fields and play areas for the school. Or, if the high school site is determined to be viable, fund the construction of new fields or open space amenities;
- Fundraising – although fundraising may not likely cover a substantial portion of the elementary school project, a capital campaign could help bring community members together in support of the school and could be a way for businesses to help show their encouragement for education;
- Developer mitigation funds – although Massachusetts does not allow for the assessment of linkage fees, as is allowed in other states, many municipalities negotiate with developers of large projects on how they can contribute to the community.
- Borrowing under the levy limit – as the Town moves forward in considering the elementary school project, it should determine how much of the cost of the project could be accommodated within the levy limit. The Town developed a very creative solution for funding of the new fire station and renovated police station, i.e., via growth in personal property tax, and through diligent review of existing revenue sources, would be able to see if any of the proposed debt for the school could be funded via resources available below the levy limit.

⁶¹ Massachusetts Department of Revenue, Division of Local Services, "Levy Limits: A Primer on Proposition 2 1/2", June 2007.

⁶² Ibid.

CONCLUSION

Although considerable work will need to be done during 2014 as the Town of Carver elementary school project moves through the MSBA process anew, much can be learned from the work that has been done to date.

First and foremost among the lessons learned is that the existing elementary school buildings do not meet the needs of Carver students today. The technical studies done in 2006 and 2009, in addition to the narratives prepared by School District officials, make it clear that the buildings have very significant physical deficiencies, including infrastructure systems that are more than 60 years old, poor design, lack of code compliance, lack of accessibility, among other issues. Although no Carver-specific data is available, studies in the U.S. and internationally have shown that the types of deficiencies found in the Carver Elementary School have an impact on a child's ability to learn. Locally, the project team heard from teachers that they struggle each day with the environment, whether in trying to keep a child's attention on the lesson when noise is spilling into the classroom from nearby, attempting to make the classroom warm and inviting when several of its "walls" consist of plywood or stacked boxes, or losing instructional time as students have to be escorted from one building to another to access the lunchroom, library, or gym.

Additionally, this report has shown that the School Building Committee and other community members worked through multiple design options geared toward meeting the unique needs of the student body before determining that Option B3 was the best solution. The project team also saw the merits of Option B3, including the fact that classrooms will be clustered together to provide single community, yet different grades can be grouped, spaces that can be used after hours are separated from classroom areas so that they can be best monitored and controlled, a gathering space can be created as needed by opening up the cafeteria and gym, outside wall space will allow natural light to enter the classrooms, and Option B3 replaces more of the Washburn School than the other options.

What is needed to ensure that all options have been fully vetted is one final review of the few alternate sites that would allow for all new construction, as opposed to renovation. The high school site warrants further consideration, even though significant hurdles do exist when considering adding another school to that site, including the size of the space available, need for sanitary treatment and storm water management systems to meet site needs, and the impacts to either the ball fields or wooded area on site. Ultimately, the high school campus may not be viable, but reviewing the site and documenting the findings will help community members understand whether it should or should not be considered further.

Lastly, the Town should explore all funding options available before determining what amount should be funded via debt exclusion. It is clear that Carver residents are both cost conscious and creative in their approach to funding significant public investments. A thorough review of funding sources that could be available, including CPA funds, land sales proceeds, fundraising, and borrowing under the levy limit, can help the Town identify an array of resources to fund the local portion of the project, in addition to debt exclusion and funding from the MSBA. At the same time, the Town should be careful not to underestimate the cost of the project, given that any cost overruns will need to be borne by the local community, as they will not be shared by the MSBA per MSBA policy.

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APPENDIX A

**CARVER ELEMENTARY SCHOOL
COMPARABLE SCHOOLS OVERVIEW (2013)**

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**Carver Elementary School – 2013 District Assistance Level – Level 2
Comparable Schools Overview**

*Schools most similar to your school in terms of grades span, total enrollment, and special populations

Orange-Shaded row: Your School

Blue-Shaded row: Highest performing of the other 10 school in 2012 and 2013.

ELA – English Language Arts

School Name	Accountability & Assistance Level	2012-13 October Enrollment				2013 MCAS % Proficient or Higher			2013 MCAS Growth Median SGP	
		Total Enrollment #	Low Income %	SWD %	ELL %	ELA %	Math %	Science %	ELA %	Math %
Belchertown-Chestnut Hill Community School*	L2	589	20.2	16	0.8	64%	59%	51%	45	49
Bridgewater-Raynham-Mitchell Elementary School*	L1	1,005	19.1	16.4	1	70%	70%		--	--
Bridgewater-Raynham-Williams Intermediate School*	L2	791	19.2	16.6	1.3	69%	62%	61%	51	53
Carver-Carver Elementary School*	L2	823	21.7	14.9	0.1	51%	52%	49%	38	45
Kingston-Kingston Intermediate*	L2	697	15.6	13.3	0.1	74%	66%	66%	47	52
North Middlesex-Varnum Brook*	L2	672	18.9	16.1	0	65%	63%		37.5	35
Northbridge-W Edward Balmer*	L3	622	28.3	16.7	0.3	47%	46%		27	49
Plymouth-Indian Brook*	L2	699	23.5	14	0.1	63%	65%	46%	41	40
Plymouth-South Elementary*	L2	686	19.4	18.5	0.1	61%	57%		62	54
Shrewsbury-Sherwood Middle School*	L2	989	15	14.5	1	87%	82%	74%	48	48
Somerset-North Elementary*	L2	492	20.7	15.4	0.2	63%	59%	40%	54.5	58.5

Source: Massachusetts Department of Elementary and Secondary Education, "School District Profiles", retrieved from <http://profiles.doe.mass.edu/analysis/default.aspx?orgcode=00520015&orgtypecode=6&>, March 28, 2014.

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APPENDIX B

SCHOOLS WITH LOWEST RATINGS FOR BUILDING CONDITION AND GENERAL ENVIRONMENT

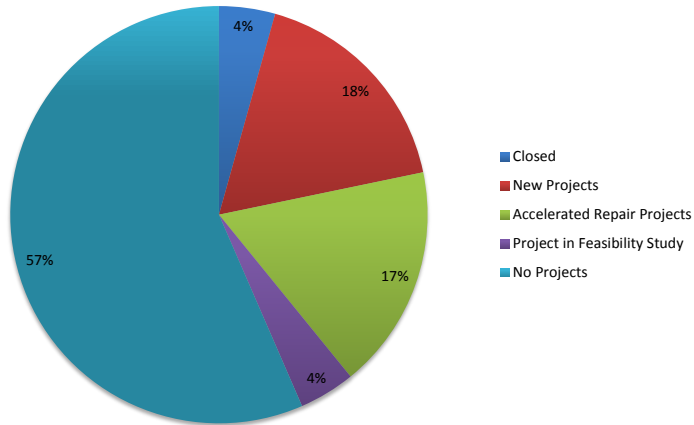
2010 Space Needs Survey Report Massachusetts School Building Authority

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Schools Rated 4 in the 2010 Needs Survey

23 total schools; 20 districts; 45 submitted SOIs since 2008

Schools Rated 4 in Needs Survey 2010



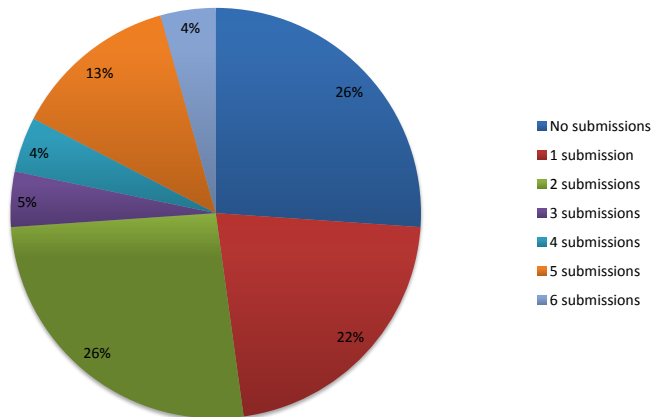
Schools Rated 4 in Needs Survey 2010

Status of School	Number of Schools	%
Closed	1	4%
New Projects	4	17%
Accelerated Repair Projects	4	17%
Project in Feasibility Study	1	4%
No Projects	13	57%
Total Schools	23	100

Number of SOIs Submitted by Schools Rated 4 in Needs Survey 2010

SOIs	Number of Schools	Number of New Projects	Number of Accelerated Repair Projects	Number of Early Projects
No submissions	6	0	0	0
1 submission	5	1	0	1
2 submissions	6	2	0	0
3 submissions	1	1	0	0
4 submissions	1	0	1	0
5 submissions	3	0	2	0
6 submissions	1	0	1	0
Total	45	4	4	1

Number of SOIs Submitted by Schools Rated 4 in Needs Survey 2010



School Detail

District Name	School Name	Year	School Status / Project Status	Number of SOIs
Boston	Mather Elementary	1905		0
Boston	O W Holmes Elementary	1906		0
Carver	Carver Elementary School	1951		2
East Bridgewater	East Bridgewater High	1958	New	2
Easthampton	Maple	1896		1
Fall River	Resiliency Preparatory School	1907		0
Gloucester	Milton L Fuller Elem	1965	Closed	1
Holbrook	Holbrook Jr Sr High	1954	Feasibility Study	1
Lawrence	High School Learning Center	1921		0
Lynn	Thurgood Marshall Mid	1923	New	2
Marblehead	Elbridge Gerry	1906		5
Marshfield	Marshfield High	1967	New	3
New Bedford	Elizabeth Carter Brooks	1956		0
Orange	Dexter Park	1951		2
Pittsfield	Crosby	1962		2
Plymouth	Hedge	1910		0
Somerset	Somerset High	1936		2
Springfield	Mary M Lynch	1961	Accelerated Repair	5
Springfield	Mary M Walsh	1941	Accelerated Repair	5
Springfield	Warner	1931	Accelerated Repair	4
Tantasqua (Wales)	Wales Elementary	1964		1
Westfield	Westfield Voc Tech High	1934	Accelerated Repair	6
Whitman-Hanson	Maquan Elementary	1963	New	1

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APPENDIX C

**JAMES F. McDONALD
“LURCHING FROM FAD TO FAD”**

**SOCIETY FOR QUALITY EDUCATION NEWSLETTER
(DECEMBER 1997)**

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Lurching from Fad to Fad

The open plan schools were but one costly craze in a long list.

by James F. McDonald

Ontario's publicly-funded school system made major, costly mistakes during the past 30 years, due in part to a lack of common sense. One of its costliest and silliest mistakes was the construction of hundreds of open plan elementary schools throughout the province. In keeping with the Ministry's pedagogy of joy philosophy, school boards built new schools with enormous playpen learning environments containing six to eight multi-grade classes in each of several large open area pods. At the time, there was not one shred of evidence that this physical arrangement would result in enhanced academic achievement. In fact, common sense — since confirmed — dictated that this was a really stupid way to house young children for instructional purposes. But trustees and education officers were not interested in common sense. This was the newest fad, and so they eagerly scrambled aboard the open plan bandwagon to be in the forefront of modern educational innovation.

For classroom teachers, the open plan classroom was akin to positioning a newly-designed open cockpit of a 747 jet in the passenger compartment surrounded by 250 exuberant, noisy customers and ordering the pilot to fly the plane with patience, empathy and skill. For many children, it was a loud, chaotic, confusing nightmare. Teacher stress levels rose dramatically, mainly because of the noise, the interruptions,

and the confusion of housing so many children in one space. Diverse teaching styles, effective in self-contained classrooms, often proved inappropriate in this throng of lively youngsters. Some special programs had to be radically altered or moved into storerooms in order to contain the noise level. Talk about stacking the cards to ensure teacher and student failure!

It wasn't long before distraught teachers appeared in droves at principals' doors pleading for walls or partitions to deaden the sound, lessen the confusion and lower the stress level of teaching young children in this mass of humanity. Gradually, the gurus at head office were forced to eat crow, admit defeat and order the erection of partitions or permanent walls to fashion self-contained classrooms out of the giant playpens. This, of course, was done at enormous cost, much like renovating the interior of a house after it had just been built. While these revamped classrooms resolved many of the glaring problems, the renovated make-shift interiors were seldom very satisfactory. They often resembled the work of a home handyman using the blueprints of a mad architect.

Thoughtful parents and skeptical teachers and principals were always mystified by the logic behind this really silly and costly educational experiment, but they were seldom consulted when these visually-beautiful white elephants were being planned and constructed. Most teachers knew better than to voice their serious misgivings. Educational leaders are big on group-think and tend to show displeasure towards lowly dissenters who express minority views.

This whole sorry fiasco would have fizzled had someone locked the board officials in the very first open plan school with 600 young students. Most of the education experts from the board offices would not have survived a week in the chaotic educational jungle. The scheme would have died in its tracks, thus saving taxpayers millions and millions of dollars. It would have relieved teachers and students of much anguish and stress. Instead, open plan schools spread like a plague across Ontario and North America before anyone could halt the trendy educational fad.

It is only recently that this bad idea has lost favour with some school boards. Common sense finally did force many officials to discard the open plan concept, but only because they were ready to move on to the next expensive bandwagon — computers. A wonderfully glitzy idea, requiring mega tax bucks. Perfect for the purpose.

(Dr. McDonald was an Ontario principal for 20 years and, for three of those years, he had to cope with an open plan school.)

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APPENDIX D

“THE EFFECT OF THE PHYSICAL LEARNING ENVIRONMENT ON TEACHING AND LEARNING”

VICTORIAN INSTITUTE OF TEACHING

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The Effect of the Physical Learning Environment on Teaching and Learning

Spanning all sectors in Victoria, schools have referenced research in their building design that suggests that particular architecture and design of learning spaces will contribute to effective teaching and improvements in student achievement. A number of these schools were built in the 1970s and 80s. Others are planned over the next few years.

In their current budget, the State government has promised a substantial investment in the building and refurbishment of government schools. This is likely to create much discussion about the best physical environment for effective teaching for student learning.

In this topic we look at how research can inform and challenge our views about the effect of the physical learning environment on student achievement and teachers' work. This discussion starter aims to promote the sharing of teachers' knowledge and experience on this important subject.

The physical environment and student achievement

Studies about student academic achievement and building condition conclude that the quality of the physical environment significantly affects student achievement. 'There is sufficient research to state without equivocation that the building in which students spend a good deal of their time learning does in fact influence how well they learn' (Earthman, G 2004:18).

Desirable designs include having 'friendly and agreeable' entrance areas, supervised private places for students, as well as public spaces that foster a sense of community, with particular attention to the colour used (Fisher, K 2000 in McGregor, J 2004:2). Today's schools must create spaces that students want to go to, similar to the way cafes attract people, rather than the space being purely functional (Bunting, A 2004:12).

Other research has acknowledged that 'student achievement lags in shabby school buildings' but go on to say that this research 'does not show that student performance rises when facilities go from ... decent buildings to those equipped with fancy classrooms, swimming pools, television studios and the like' (Stricherz in Higgins et al 2005:36). In one study the significant improvements in the learning environment were attributed to the better attitudes to teaching and learning the improvements in the physical environment created amongst all users (Berry in Higgins et al 2005:14).

Facilitating teachers' work

Decent facilities make additional contributions to teachers' work. Siegel has found there was a direct relationship between architecture and the collaboration of teachers. 'The arrangement of space has immediate and far-reaching consequences for teacher's ability to effectively and efficiently accomplish daily activities, the formation of social and professional relationships, and the sharing of information and knowledge' (Siegel, J 1999:4).

Consideration of the spaces where teachers meet and collaborate is just as important as the design of the classroom (McGregor, J 2004:4).

But it doesn't all have to be left to the architects. One study concluded that teachers who are more likely to modify their classrooms to produce what they believe is a more effective working environment are also more likely to collaborate with colleagues in the staffroom (Bissell, J 2004:29).

Designing learning spaces

Of course there are many arguments in the research about the optimal teaching and learning spaces and their contribution to improving student achievement. These range from those who advocate de-schooling – pulling down the walls – to those who propose open space arrangements, to those whose research reports the benefits of more traditional classroom arrangements.

Horne challenges us to 'tear down the school walls' because students are being forced to learn in contexts so different from the world where they are required to put their knowledge to use. His view of schools as being similar to 'fortresses' is the cause of lower levels of parental involvement with schools and prevents the much needed improvement to parent/teacher and parent/parent relationships that in turn contribute to improvements in teaching and learning (Horne, M 2004:6). Stevenson also advocates schools being opened more widely for community use, but points out the implications of this on materials, design and maintenance (Stevenson, K 2007:3).

Advocates of open plan schools argue that students 'should be allowed to learn in ways suited to their individual differences' and that the most effective teaching and learning strategies allow teachers to work collaboratively with each other and team teach. The traditional classroom boxes with desks lined up in rows impede teachers' efforts to work in teams and have students 'in the flexible and varied groupings necessary' (Mark, J 2001:5).

Stevenson and Bunting also favour this approach, suggesting that 'traditional academic classrooms may disappear, replaced by holistic learning labs and exploratory centres' (Butin, 2000; Keep, 2002 in Stevenson 2007:3). Bunting agrees, saying that 'traditional classrooms must change' and proposes a model of a generic space for students to be co-located with teachers, which are decorated by the students to give them ownership, and teachers and students only move when necessary to access specialised space (Bunting, A 2004:11–12).

Weinstein and David question some of the implied benefits of open planning. 'Open space in and of itself does not have a universal effect' while others comparing open and traditional environments argue 'the essential elements were the school's educational philosophy and physical layout, not merely the physical layout' (Higgins et al 2005:14).

Organising classroom space

There is a volume of research that suggests 'less attentive and less successful pupils are particularly affected by the desk arrangement, with their on-task behaviour increasing very significantly when seated in rows instead of tables' (Higgins et al 2005:26).

At a more erudite level researchers argue that teachers require a good knowledge of their students to implement an effective seating arrangement. Seating arrangements can be territorial (space organised by individual desk ownership) or functional (space organised by

a specific activity). There can often be an 'action zone' where an increased involvement between teacher and students occurs across the front and down the middle of the room (Higgins et al, 2005:6 Weinstein 1979:), whereas some favour a horseshoe formation to overcome the fact that often when clustering students, group size and placement can be driven more by furniture and arrangement than pedagogy (McNamara & Waugh, 1993 in Higgins et al, 2005:26).

It may be that a 'one size fits all' model or solution is not possible. It seems that different arrangements are required for different teaching and learning contexts. What researchers do agree upon is that it is imperative for a school to have a clear vision in order to design facilities which can accommodate this (Stevenson, K 2007:3; Higgins et al 2005:14).

Physical conditions

There is a plethora of research that examines the effect of the physical conditions of teaching spaces (which includes seating, furnishings, spatial density, privacy, noise and acoustics, climate and thermal control, air quality, windowless classrooms, vandalism and play-yards, light and colour) on students' engagement, attainment, attendance and wellbeing (Keep, G 2002; Higgins et al 2005; Lackney & Jacobs, 2004; Gump 1987; McGuffey 1982; Earthman 2004; Sundstrom 1987; McNamara & Waugh 1993; and Weinstein 1979).

Some interesting contentions about the physical aspects of learning spaces include:

- Temperature, heating and air quality are the most important individual elements for student achievement (Earthman, 2004: 11–16).
- Chronic noise exposure impairs cognitive functioning, with numbers of studies finding noise-related reading problems, deficiencies in pre-reading skills, and more general cognitive deficits. (Higgins et al, 2004:18).
- 'Colour remains the topic of some of the most optimistic claims about morale and efficiency' (Sundstrom, 1987:751). According to some research, the choice of the best use of colours is dependrnt on the age of children (brighter for younger students, more subdued for adolescents), as well as differences between males and females (males – bright colours, females – softer). Much research findings about colour is conflicting, and remains hotly debated (Higgins et al, 2004: 21–22).
- Using visual displays in classrooms breeds success because 'students are provided with specific examples of how success is obtained' (Culp, B 2006:14).

Identity and physical environments

Schools and classrooms can be more than a place to inhabit: they can also acquire an emotional significance. One perspective is that educators play an important role in constructing classrooms and schools, and therefore students' identities. An extension of this idea is that children's environments have an effect on their cognitive and behavioural development and on childhood vulnerability (Ellis, J 2005:57–61).

Looking at learning space is about more than the structures – it is about the social relationships within the space. Space can be conceptualised as being an interaction between physical and social spaces. McGregor claims that the space is 'made' by the social aspects

(McGregor, J 2004:2). This attitude is increasing in popularity as we move again towards creating more open spaces to improve social interactions and student learning opportunities.

Spaces and how we organise them can tell students much about adult expectations and power structures – for example, when grouping students according to 'ability'. (McGregor, J 2004:3). Similarly, a seminal work in the 1970,s argued that 'a broadly academic ethos seemed to promote academic achievement' (Rutter, M 1979:14). Bunting also makes the link between the physical school environment influencing general attitudes to learning. He argues that if students do not leave school with a love of learning, they will be disadvantaged in today's 'knowledge society' (Bunting, A 2004:12).

Considering design

While there can often be a separation between the designer and user in school design, there is a growing movement towards involving users in the design of teaching and learning spaces, with benefits for students and teachers alike – 'making meaning around what they want from education' (McGregor, J 2004:5).

Fisher and Wright propose that school designs should not be imposed or bought off the shelf – they must be the result of an articulated vision (in McGregor, J 2004:2), which should be facilitated by architects and designers 'to create integrated solutions' (Higgins et al, 2005:3).

Initiatives which aim to encourage young people to actively participate in the design process are enacting citizenship, rather than teaching it through transmission, and are opportunities to re-engage students with learning (McGregor J 2004:5). Keep also cites schools where the 'environment – walls, grounds, lights, mechanical systems – serve as active contributors to the students' learning process' (Keep, G 2002:1). He says that 'learning opportunities can be woven into the structure of a school, making it an active space rather than a passive space housing a disarray of "things"' (Taylor & Aldrich, 1998 in Keep, G 2002:1).

Another proponent for schools needing to have a clearly articulated vision when considering design is the fact that parents and students now have a greater choice about the school attended. Schools are placed in a position where they can offer specific learning opportunities to students.

'Planners and educators may increasingly find themselves challenged to develop individualised renovation and construction plans that support a particular school's mission' (Stevenson, K 2007:1).

What do you think?

What aspects of the physical learning environment contribute to or impede effective teaching and learning?

- Is there a 'one size fits all' model? Are there aspects of design or philosophies about the physical learning environment that are applicable to all contexts?
- How does the physical learning environment affect your practice (i.e. how you relate to colleagues, how student identities are formed)?

- How well do we use the facilities in schools to promote community interaction?

We are interested to hear from teachers and researchers who have investigated the issues raised in this discussion starter and have a view to express. Click on 'Respond here' on the webpage to complete the online form and submit your response.

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