OLO Report 2017-4

New School Construction Costs

Stephanie Bryant

OFFICE OF LEGISLATIVE OVERSIGHT

New School Construction Costs

OLO Report 2017-4 **November 15, 2016**

This Office of Legislative Oversight report responds to Council's request to compare school construction costs in the County with other counties in Maryland and Virginia. In sum, OLO finds that MCPS' construction costs per square foot increased by 19.0% from FY2008 through FY2015, a rate nearly identical to the national average of 18.0%. However, square foot cost comparisons, alone, fail to identify the root causes of construction cost differences, which are significantly impacted by polices and regulations.

State School Construction Program and Funding

The Maryland General Assembly established the Public School Construction Program in 1971 to provide a standard process for allocating State aid for school construction projects. Historically, MCPS has received $30 to $40 million annually in State aid for all eligible MCPS capital projects. For FY2017, MCPS received $50.1 million in State construction aid ($38.4 million in regular school construction funding and $11.7 million in funding from the Capital Grant Program for Local School Systems with Significant Enrollment Growth (or ERGC)).

In regard to new and replacement schools, State construction aid is limited to defined eligible costs based on square foot and capacity allowances, which is then reduced by a cost share formula based on a county's wealth. For FY2017, MCPS received 50.0% of total eligible costs per project. All ineligible costs are paid for by the counties. On average, MCPS receives State aid to fund 15.0% of the total cost of a new school and 20% of the total cost of a replacement school. As a result, local funds (i.e., General Obligation Bonds, current revenue, and Recordation and Impact Tax revenues), pay for 80% to 85% of new and replacement school projects.

School Construction Cost Trends

National school construction costs per square foot have increased 18.0% from $179 per square foot (CY2008) to $212 per square foot (CY2014). While regional cost data reveals cost increases of 25.0% over the same time period, MCPS costs per square foot trends have tracked the national average, increasing by 19.0% from FY2008 to FY2015. Increasing construction costs coupled with projected enrollment growth affect the ability of MCPS to address capital needs.

Construction Cost Factors

Comparisons of school construction costs data are most meaningful when each school is constructed to the same specifications and in the same environment. However, school construction costs are driven by interrelated State and local policies and practices, school design choices, and market conditions that vary over time and across school districts.

1. Procurement Policies and Practices

State mandated procurement policies, such as Minority Business Enterprise and Prevailing Wage laws, can lead to indirect and direct construction costs increases. These laws apply to all school systems in Maryland.

- *Minority Business Enterprise (MBE) Law*. The State and industry professionals note that the MBE law increases required reporting requirements, which may be especially burdensome for small businesses. As such, bid competition may decrease as these firms may elect not to bid on projects subject to MBE requirements. Reduced competition can indirectly increase school construction costs.

- *Prevailing Wage Law.* Data provided to the State Public School Construction Program by Anne Arundel, Carroll, Frederick, Howard, and Washington Counties from 2012-2015 show that the cost differential between prevailing wage bids and market wage bids ranged from 0.0% to 49.0% depending on trade. Of these, the average prevailing wage bid is 11.7% higher than the average market wage bid.

Prevailing Wage Law and State Construction Aid. Since 2014, school construction projects in Maryland trigger the prevailing wage requirement only if the State funds more than 25% of total project costs (prior to 2014 prevailing wage was triggered if the State funded 50% or more of total project costs). This threshold applies to all counties for school construction project valued at $500,000 or more. However, a school system can accept 24.9% of State funding and not require bidding contractors comply with prevailing wage requirements. As such, school systems can receive higher amounts of State aid if the school system uses contractors that pay prevailing wages and lower amounts of State aid if contractors do not.

MCPS does not require bidding contractors to comply with prevailing wage requirements because prevailing wage rates increase overall construction costs. Since 2014, MCPS has not requested more than a 24.9% State share for any individual project. As such, MCPS bids new and replacement school projects without prevailing wage requirements. This may reduce construction costs for MCPS as compared to other Maryland school systems that accept a higher State share of funding and require prevailing wage rates.

School systems can bid projects both with and without prevailing wage rates ("side-by-side" bids) and compare total costs at the different State funding levels. This method can result in cost savings. For example, Washington County saved almost $0.8 million by electing not to contract under prevailing wage rates for the replacement of Bester Elementary School. Since MCPS accepts a lower State share of funding and does not require bidding contractors comply with prevailing wage requirements, MCPS does not solicit side-by-side bids.

Comparison to School Systems in Virginia. The Maryland Prevailing Wage and Minority Business Enterprise laws add regulatory requirements to school construction projects that do not exist in Virginia. Increased reporting requirements can dissuade some companies from competing for projects in Maryland and thus decrease competition. Industry experts report that these requirements have led to higher labor costs for construction projects in Maryland as compared to Virginia.

2. Site Costs and Stormwater Management Regulations

Site costs vary from project to project and can be affected by geographic differences in the labor market, site topography and geography, and environmental considerations. State public school construction data reveals that grading, utilities, landscaping, and other site costs have increased since 2010, with many elements increasing by 20.0% or more.

Stormwater Management Regulations. In 2010, the Maryland Department of Environment implemented new stormwater management (SWM) regulations affecting all school construction projects after May 2013. These regulations require site specific SWM practices and multi-stage design reviews, resulting in higher civil engineering costs (Anne Arundel County staff estimate about a 20.0% increase in engineering costs). Further, the regulations reduce available land for site and building spaces and give preference to non-structural design alternatives to meet standards, such as vegetated roofs, which can increase overall project costs.

While State SWM regulations apply to all school systems in Maryland, the County has more stringent SWM requirements than the State. For example, the County requires redeveloped sites (i.e., replacements schools on existing school sites) to meet the same stormwater standards as new construction. MCPS estimates that employing the less stringent State standard for redeveloped sites could reduce square foot site costs by 10.0%

to 20.0%. For example, reduced site costs for a 95,000 square foot replacement school could equal roughly $5.0 to $10.0 per square foot, or a $.48 million to $.95 million reduction in total site costs.

Comparison to School Systems in Virginia. Similar to Maryland, site costs vary from project to project in Virginia. Additionally, Maryland and Virginia manage stormwater differently, making cost comparisons difficult.

3. High Performance Building Mandates

All school systems in Maryland must comply with the State's High Performance Building Act, which requires at a minimum Leadership in Energy and Environmental Design (LEED) Silver Certification. This requirement adds 2.0% to 5.0% to total construction costs compared to a non-LEED building.

For each project schools systems can use a combination of LEED credits to achieve required LEED certification points. As a result, a LEED Silver or Gold certified school in the County may have a different LEED score (higher or lower) and different design credits than a school constructed in another jurisdiction. OLO reviewed costs associated with two green building components, vegetated roofs and geoexchange systems, both used extensively by MCPS. OLO found that while upfront construction costs are more expensive than traditional counterparts, lifecycle costs are generally lower.

Comparison to School Systems in Virginia. School systems in Virginia can use LEED or other green building standards (i.e., the Virginia Collaborative for High Performance Schools) in school designs. However, Virginia does not require LEED certification.

4. School Design Practices

School design priorities and choices can affect construction costs. This report reviewed the following design practices:

- *School Building Size.* Schools today are larger than in previous years to accommodate modifications in educational programs and building specifications (i.e., full day kindergarten, project based learning, and larger health suites). These changes affect construction costs as it is simply more expensive to build larger buildings.
- *Community Involvement in the Design Process*. School systems establish their own policies guiding community involvement in the design process. All school systems reviewed invite community members, neighbors, and school staff to participate in the design process. This can impact final design choices, scheduling, and project timetables, all of which can affect project costs. OLO found that school systems using prototype school designs have more limited opportunities for community involvement, but this may reduce overall project schedules and design costs.
- *Use of School Buildings for Non-Educational Programs.* In many jurisdictions, including Montgomery County, schools serve as community assets, housing non-educational program space (i.e., enlarged gymnasiums and child care); however, this practice can result in additional construction costs. OLO found that when comparing school construction costs, variations in non-educational program use of a school building should be noted.
- *Use of Prototype School Designs*. School systems that frequently use prototype school designs see a reduction in average architectural fees of 10.0% to 25.0% or around 0.5% to 1.5% of total building construction costs. School systems may also see a reduction in change orders and contingency costs. However, cost savings associated with prototype designs depend on the number of times a prototype plan is used, whether the design is modified, and site conditions.

Comparison to Other School Systems in Virginia. Similar to Maryland jurisdictions, school design polices are determined locally in Virginia. Variances in policies relating to community involvement, non-educational program use of school facilities, and use of prototype school designs should be noted when comparing costs across jurisdictions.

5. **Market Conditions**

Reduction in the labor force and the number of construction-related companies following the 2009-2010 recession increased costs. Additionally, as the workforce ages and fewer people enter the trade professions, future labor costs are likely to increase. School construction projects compete in a regional labor market, with architecture firms and general contractors often working in both Maryland and Virginia. As such, increases and decreases in labor and materials markets are external cost factors that affect all school systems in the region.

OLO Recommended Discussion Questions

OLO recommends the following discussion questions for Council consideration:

1. **State Regulations**
   - What amendments to State regulations could the Council and MCPS pursue that might result in reduced construction costs?
   - Should the County propose amendments to the State aid construction formula to account for variations in school system policies, such as class size reduction? What impact would this have on funding?
2. **County Regulations**
   - Should the Council request additional information and data regarding the financial impact of County stormwater management regulations on school construction costs?
   - In addition to stormwater management regulations, are there other opportunities to align County and State regulatory requirements that could result in school construction cost reductions?
3. **Community Use**
   - As it is the County's policy to use school buildings as year round community facilities, how should the County measure its school construction costs relative to other jurisdictions that use school facilities differently?
4. **School Building Design and Construction**
   - Are there opportunities to adjust school building size and site requirements to reduce total construction costs?
   - Would the increased use of prototype school building designs for new and replacement schools, as implemented by other school systems, allow MCPS to build schools at a faster rate, for lower cost, and provide equity of school buildings County-wide?
   - Could project schedules and timelines be reduced through a review of policies and practices such as community involvement in the design process?
5. **Labor and Market Conditions**
   - Are there opportunities for the Council to promote programs or policies that could enhance competition and promote growth in the construction labor market in the County?

OLO Report 2017-4
New School Construction Costs

Table of Contents

CHAPTER 1. AUTHORITY, SCOPE, AND ORGANIZATION

A. Authority

Council Resolution 18-225, *FY2016 Work Program for the Office of Legislative Oversight*, adopted July 28, 2015.

B. Purpose and Scope of this Report

The purpose of this report is to compare public school construction costs in Montgomery County with counties in Maryland and Virginia. Office of Legislative Oversight (OLO) Report 2017-4, requested by the Council in OLO's FY2016 Work Program, reviews cost trends and the interplay between school construction policies and regulations to identify key factors that influence construction costs. In particular, this report:

- Reviews Maryland's School Construction Program and construction practices in Virginia;
- Examines local, state, and national school construction costs; and
- Identifies and describes factors that affect school construction costs in Montgomery County and other jurisdictions.

C. Methodology

Office of Legislative Oversight (OLO) staff member, Stephanie Bryant, conducted this study, with the assistance of Aron Trombka and Kelli Robinson. OLO reviewed literature, gathered information from interviews with Montgomery County Public Schools staff, other school systems' staff, and industry professionals, and analyzed State and Local school construction cost data. The scope of this review is limited to elementary schools for several reasons. First, the population of newly constructed elementary schools is the largest of all three categories (elementary, middle, and high school) allowing for the best possibility to find and compare schools across jurisdictions. Second, given the wide program variability found in middle and high schools, elementary schools provided the best opportunity to provide an apples to apples comparison. OLO limited the construction projects reviewed to those that meet the Maryland State definition of new or replacement schools.

D. Organization of Report

Chapter 2, State School Construction Program and Funding Public School Construction, provides an overview of Maryland's Public School Construction Program, allocation of State aid, and funding of the MCPS Capital Improvements Program.

Chapter 3, Capital Construction Cost Components and Trends, summarizes national, regional, and local construction cost trends.

Chapter 4, Cost Factor – Procurement Policies and Practices, reviews how State required procurement policies effect school construction costs and highlights two procurement practices currently utilized by MCPS to manage costs and project schedules.

Chapter 5, Cost Factor - Site Costs and Stormwater Management Regulations, reviews the impact of site conditions and State and County stormwater management regulations on school construction costs.

Chapter 6, Cost Factor – High Performance Building Mandates, reviews how State and County building performance mandates impact construction costs and highlights the cost select green building components.

Chapter 7, Cost Factor – School Design Practices, reviews how educational specifications and building design choices can affect construction costs and project timelines.

Chapter 8, Cost Factor – Market Conditions, reviews how cyclical labor and materials market conditions impact school construction costs.

Chapter 9, Major Report Findings and Recommended Discussion Questions, summarizes the major findings of this report and present's OLO recommended discussion questions.

E. Acknowledgements

OLO received a high level of cooperation from everyone involved in this study. OLO appreciates the information and insights shared by all staff from Montgomery County Public Schools Division of Construction. In particular, OLO thanks Seth Adams, Terry Miller, Donna Hanson, and Rachel Neel. OLO also extends thanks to Larry Alberts, Supervisor of Planning, Design, and Construction, Anne Arundel County Schools; Scott Washington, Director of the Office of Construction, Howard County Public Schools; Ray Barnes, Jr. Chief Operating Officer, Frederick County Public Schools; Ben Burgin Acting Director of Design & Construction, Arlington Public Schools; Dee Thompson Construction Supervisor, Prince William County Schools; Hunter Barnes, Architectural Consultant, Virginia Department of Education; and the industry professionals who participated in OLO's interviews.

CHAPTER 2. STATE SCHOOL CONSTRUCTION PROGRAM AND FUNDING PUBLIC SCHOOL CONSTRUCTION

This chapter provides an overview of the current school construction program in Maryland and is organized into four sections.

- **Section A**, Maryland's school construction program;
- **Section B**, Funding public school construction;
- **Section C**, Comparison to the school construction program in Virginia; and
- **Section D**, OLO summary observations and findings.

A. Maryland State School Construction Program

The General Assembly, acting on recommendations of Governor Marvin Mandel, established the Public School Construction Program in 1971 to equalize educational facilities across the State and provide State funds for school construction projects.[1] The State's Public School Construction Program oversees school planning, design, construction, and financing.

1. State Office's Roles in School Construction

The following outlines the roles of State offices, agencies, and departments involved in managing and reviewing school construction projects.

- Board of Public Works has direct authority over school construction funding, standards and procedures governing how schools are planned, approved, and constructed, and approves all payments for projects.
- Interagency Committee on School Construction (IAC) is a five-member policy board responsible for administering the State's Public School Construction Program. Board membership includes the State Superintendent of Schools, the Secretary of General Services, the Secretary of the Maryland Department of Planning, and two public members appointed by the Speaker of the House and the President of the Senate.
- State Board of Education adopts standards and guidelines for planning and constructing school projects, approves local school construction plans and specifications, and advises on educational effectiveness, construction, and cost efficiency of school plans.
- State Superintendent of Schools approves school sites and building purchases, locally funded projects costing more than $350,000 and any change orders costing more than $25,000.
- State Department of Education reviews educational specifications and schematic design for each approved project to ensure design is reasonable in terms of scope and capacity.
- State Department of Planning reviews school sites and Capital Improvements Project requests to determine eligibility for state funding with respect to current and projected annual enrollments.

[1] Md. Code Ann., ED. Art §§ 5-301 to 5-312; COMAR 23.03.01 to 23.03.05; The Maryland State Interagency Commission on School Construction, "Public School Construction Background," available at http://www.pscp.state.md.us/gi/giindex.cfm.

- State Department of General Services reviews design development and construction documents for compliance with industry design standards, State standards, and procurement policies. [2]

2. State Capital Improvement Program Procedures

Each fall, the 24 school systems in the State submit an annual and a five-year capital improvements program (CIP). After review, IAC staff recommend actions on each project. In December, the Committee holds a special hearing to permit local school systems to appeal funding decisions before forwarding recommendations to the Board of Public Works. For the most part, the CIP is approved by the Board of Public Works as recommended by the IAC. The Board reconvenes in April to respond to the appeals after the Legislature has approved the capital budget.

The Public School Construction Program operates under the Rules, Regulations, and Procedures for the Administration of the School Construction Program and the Public School Construction Program Administrative Procedures Guide. The Administrative Guide includes requirements and procedures for educational facilities master plans, the CIP, architectural selection, site selection, design documents, educational specifications, life cycle cost and energy conservation studies, contract awards, and financial disbursements.[3]

3. School Construction Timeline

Typical school construction projects take between three and four years to complete. This section describes the process for constructing a new school in the State of Maryland (Appendix A provides MCPS Division of Construction, Construction Process Documents).

- **Year One**. All school systems must submit both an Educational Facilities Master Plan and project-specific feasibility study for State review during the summer months. In October, MCPS requests individual project planning approval from the Public School Construction Program and State Board of Public Works.
- **Year Two**. In January, the Board of Public Works approves local planning for individual projects. In the spring and early summer, MCPS develops project-specific educational specifications and selects a project architect. In September, MCPS submits the schematic design plans to the IAC for review, comment, and approval. (Schematic Design Documents outline scope, specifications, and general school design.) MCPS will incorporate and address comments prior to moving forward in the process. MCPS submits its request for State funding in October and design documents are submitted for review and comment by the IAC in November. (Design Documents further define the design by laying out mechanical, electrical, plumbing, structural, and architectural details.)
- **Year Three**. In January, the Board of Public Works approves State funding for MCPS CIP projects. Construction documents are completed by April. This includes cost estimates, filing of permits, and submission of the construction documents to the IAC for review and comment. (Construction Documents are detailed drawings including specifications for construction details and materials.) If approved, usually around May, the project is bid. MCPS presents the project for bid to a list of prequalified bidders and awards the contract. By June, construction begins and can take between 12

[2] ED. Art §§ 5-301-02; §2-203-205; COMAR 23.03.02; Steven Bounds, et. al., *Maryland School Law Deskbook 2015-2016 Edition*. Lexis Nexis (2016).

[3] Interagency Committee on School Construction, Public School Construction Program Background, available at http://www.pscp.state.md.us/gi/giindex.cfm.

and 15 months to complete. Any change orders over $25,000 are reviewed by the State Superintendent.

- **Year Four.** By May or June furniture, fixtures, and equipment are moved into the building and the school is ready for an August opening.[4]

As described above, moving a school construction project from conception through design and construction requires coordination and collaboration between the State, local boards of education, and county governments. Currently, the General Assembly convened the 21st Century School Facilities Commission to review the relationship between State agencies and local governments on school construction projects, opportunities for cost-saving in construction and maintenance, alternative school construction financing options, construction industry best practices.

B. Funding School Construction Projects in Maryland

A 2016 report by the 21st Century School Fund profiles capital spending in each state. From 1994 to 2013, Maryland K-12 school districts reported spending $16.2 billion (inflation adjusted) on school construction capital outlays, with 40% of this funding directed to new school construction (replacement schools or new schools to meet increasing enrollments). Maryland counties paid 74% of the costs for K-12 capital projects with local funds. Comparatively the state provided 26% of the costs of capital construction, which is greater than a national average of 18%.[5]

1. Cost Share Formula

To allocate funding across all 24 school systems in Maryland, the State established a cost share formula. This cost share formula is calculated so that counties with higher numbers of students participating in the Free and Reduced Price Meal Program, higher unemployment rates, larger student enrollment growth rates, or that provide a larger share of local finances for school construction relative to the local wealth of the district, receive more State funding. This formula is reviewed every three years. Table 1 displays the cost share percentages for Montgomery County compared with other jurisdictions. For FY2017, the state cost share ranges from 50% to 64%.[6]

Table 1. State Share of the State/Local Cost Share Formula

County	FY2016	FY2017	FY2018
Montgomery	50%	50%	50%
Anne Arundel	50%	50%	50%
Baltimore County	52%	52%	52%
Frederick County	64%	64%	64%
Howard County	55%	55%	55%
Prince George's	63%	63%	63%

[4] Public School Construction Program, Administrative Procedures Guide §100; American Institute of Architects, Defining the Architect's Basic Services.

[5] 21st Century School Fund, Maryland K-12 Public School Facilities Profiles, available at http://www.bestfacilities.org/best-home/docuploads/pub/296_MDFacilitiesProfile2016.pdf.

[6] *Maryland School Law Deskbook 2015-2016 Edition;* FY2017 Board of Public Works Capital Budget Analysis Public School Construction.

2. Eligible and Ineligible Construction Costs

State funding is available for eligible costs, as defined in State law. All ineligible costs are paid for by the counties. For example, Federal mandates (such as compliance with the Americans with Disabilities Act) are not considered eligible costs. In addition, eligible costs do not include the total cost of constructing the building. As shown below, design fees, land acquisition, and furniture and equipment are not eligible for State funding.[7]

Table 2. Eligible and Ineligible Costs for State Funding[8]

Eligible Costs for State Funding, include:	Ineligible Costs for State Funding, include:
• New Construction (including new schools, additions, building replacements, and modular construction); • Renovation work necessary to restore and modernize existing facilities that are 16 years or older; • Systemic renovations; • State-owned relocatable classrooms; • Temporary facilities (including utilities and portable classrooms) that are necessary on-site during construction of State-funded projects; • Built-in equipment and furnishings; • Off-site development costs required by local, state or federal agencies; and • Emergency repairs established by law.	• Site acquisition; • Office development costs not listed as eligible by law; • Architecture, engineering, or other consultant fees; • Master plans, feasibility studies, programs, educational specifications or equipment specifications; • Ancillary construction (permits, test borings, soil analysis, bid advertising, water and sewer connection charges, topographical surveys, models, renderings, estimates); • Leasing or purchasing school facilities; • Construction inspection services; • Relocation costs for site occupants; • Salaries of local employees; • Construction of administrative or support facilities; • Moveable equipment, furnishings and artwork; and • Maintenance and temporary storage.

3. Project Specific Funding

For each approved project, the IAC establishes a maximum project budget. As previously discussed, this report reviews new and replacement schools, which are defined by the Public School Construction Program as follows:

- New School - is defined as projects to build new schools, generally to meet capacity needs, where neither redistricting of school populations nor additions to schools in existing neighborhoods and communities are possible or practical.
- Replacement School - is defined as projects to replace the majority or the entirety of an existing school where the cost of renovation is prohibitive, or site/building layout and other technical factors make renovation of the entire structure infeasible. Replacement may include expansion to increase capacity, and must typically be justified on the basis of a feasibility study.[9]

For purposes of this report, OLO used the State's replacement school definition and designation of MCPS projects as either new or replacement schools. As such, MCPS schools undergoing a revitalization/expansion

[7] MCPS FY2017 CIP, Chapter 1.
[8] *Maryland School Law Deskbook 2015-2016 Edition*.
[9] Administrative Procedures Guide §100.

project and that were classified by the State as a replacement school were included in OLO's review. This allowed for ease of comparison with all replacement schools across the State.

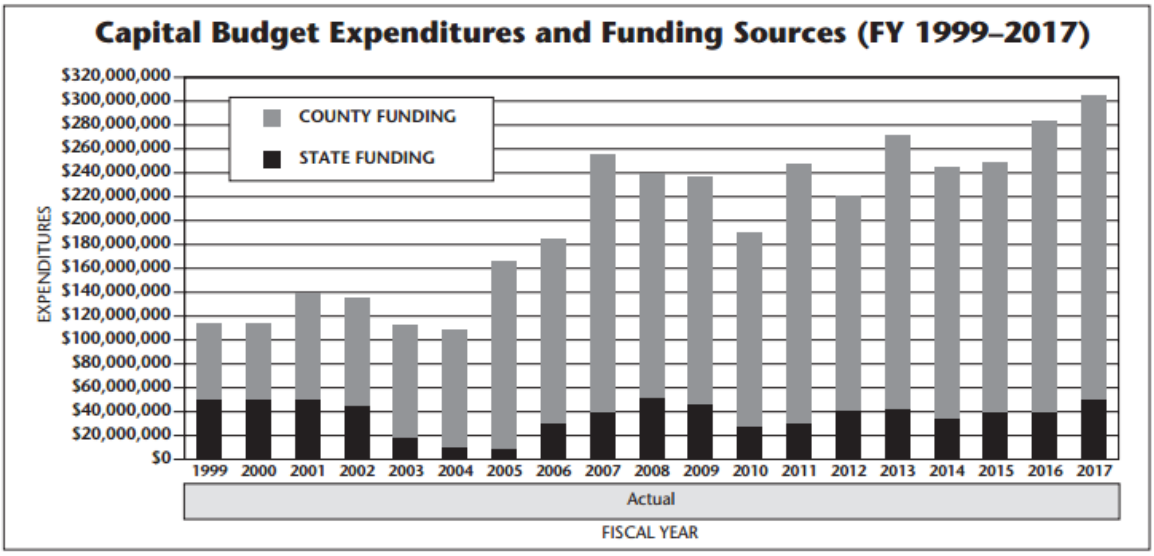
For new and replacement school construction projects, State funding is based on a State average cost per square foot, average square foot per student allowance, and State rated student capacity for each project. The cost share percentage is then applied to the eligible State project budget to determine the maximum State funding available. For example, eligible state funding for Wilson Wims Elementary School (opened 2014, Montgomery County) was based on a State average of $207 per square foot when the project was bid in 2012. Based on the FY2014 CIP, the State's cost share for the construction of Wilson Wims Elementary totaled $8,585,000 (building + site), or 50% of the total State eligible costs of $17,168,000. Actual cost of construction was $23.5 million.[10]

4. Funding Availability for MCPS Capital Improvements Program

In FY2017, MCPS was eligible for approximately $150 million in State aid for all school construction projects. However, with high competition for State funds, annual requests typically total two to three times budgeted funds. Since FY2007, MCPS historically has received between $30 and $40 million per year in State aid.[11] For FY2017, MCPS received $50.1 million in State construction aid ($38.4 million in regular school construction funding and $11.7 million in funding from the Capital Grant Program for Local School Systems with Significant Enrollment Growth (or ERGC)).

Specifically examining new and replacement school projects, on average, MCPS receives 15% of the cost of a new school, compared to 20% for replacement schools (difference is due to the state formulas used to calculate eligible expenditures). As a result, other sources of revenue are required to fund 80% to 85% of new and replacement school construction costs.[12] These sources of revenue include General Obligation bonds, current revenue, and Recordation and School Impact Taxes. Exhibit 1 below shows the capital budget expenditures and funding sources from FY1999 to FY2017. As shown below, the MCPS CIP is largely funded by local funds.

Exhibit 1. State/Local Share of MCPS Capital Budget Expenditures



[10] Public School Construction Program, Approved FY2014 Montgomery County CIP.
[11] Montgomery County Council Education Committee, FY2017-2022 MCPS Capital Improvement Program Review, February 19, 2016.
[12] MCPS FY2017 CIP, Chapter 1.

C. Comparison to Virginia

While the State of Virginia requires building codes, minimum educational program standards, and publishes school facility guidance, organizationally, the State program is not as highly-centralized as Maryland. Individual school systems are responsible for developing standards and designing and constructing schools.

Local Virginia school systems are supported through local tax revenues and financing. School systems do not have their own taxing authority to raise funds for school construction. The State permits local municipalities to use the State's credit rating and provides some construction funds at subsidized interest rates to school systems that meet specific program criteria. Additionally, the Virginia Public School Authority assists school systems in the sale of their local bonds for school construction.[13]

The 21st Century School Fund reported that from 1994 to 2013, Virginia K-12 school districts reported spending $22.0 billion (inflation adjusted) on school construction capital outlay, with 52% of this funding directed to new school construction. Local Virginia school systems paid 95% of the costs of K-12 capital projects with local funds (21% higher than school systems in Maryland). As such, the State of Virginia provides 5% of the cost of capital construction, compared with the national average of 18% and Maryland average of 26%. While reported spending is higher in Virginia, Maryland's total investment was about $1,400 more per student.[14]

D. OLO Summary Findings and Observations

1. State construction aid is limited to defined eligible costs based on square foot and capacity allowances, which is then reduced by a cost share formula based on a County's wealth. Local jurisdictions must fund all remaining construction costs.

State law defines eligible construction costs for new and replacement schools, including on- and off-site work. However, eligible costs do not include Federal mandates or the total cost of constructing the school building (i.e., design and engineering fees). Further, the maximum State funding award for a particular project is reduced by the cost share formula. In FY2017, MCPS receives 50% of total eligible State aid, compared to Howard County at 55% and Frederick County at 64%. For example, eligible state funding for Wilson Wims Elementary School totaled $8.6 million or 50% of the total eligible State costs of $17.2 million. Actual cost of construction totaled $23.5 million, with local dollars funding 63% of the project.

2. MCPS historically receives between $30.0 million and $40.0 million per year in State construction aid.

In FY2017, MCPS was eligible for approximately $150.0 million in State aid for all school construction projects. However, State-wide annual requests for aid from all school systems typically total two to three times State budgeted funds. Since FY2007, MCPS has historically received between $30.0 million and $40.0 million annually in State construction funding to cover all eligible MCPS capital improvement projects. For FY2017, MCPS received $50.1 million in State construction aid ($38.4 million in regular school construction funding and $11.7 million in funding from the Capital Grant Program for Local School Systems with Significant Enrollment Growth (or ERGC)). This increase funds roughly 33.0% MCPS capital project needs in FY2017.

---

[13] Maryland 21st Century School Facilities Commission, September 15, 2016.

[14] 21st Century School Fund, Virginia K-12 Public School Facilities Profiles., available at http://www.21csf.org/best-home/docuploads/Pub/326_VAFacilitiesProfile2016.pdf.

3. MCPS typically must fund 80% to 85% of the total construction costs for each new and replacement school project.

On average, MCPS receives State funding for approximately 15% of the total cost of a new school or addition and 20% for replacement schools. The percentage varies due to the funding formulas used to calculate aid for replacement schools. As such, the MCPS CIP relies primarily on General Obligation Bonds, current revenue, and Recordation and Impact Tax revenues to fund the cost of new and replacement schools.

CHAPTER 3. CAPITAL CONSTRUCTION COST COMPONENTS AND TRENDS

This chapter examines national, State, and local capital construction cost components and provides an overview on construction cost trends both nationally and on the state level. This chapter concludes by comparing square foot costs for new and replacement MCPS elementary schools. This chapter is organized into five sections.

- **Section A**, Capital construction cost components;
- **Section B**, National and regional construction cost per square foot trends;
- **Section C**, State and MCPS construction cost per square foot trends;
- **Section D**, Comparison of school costs per square foot for new and replacement MCPS elementary schools compared to schools constructed in other school systems in Maryland and Virginia; and
- **Section E**, OLO summary observations and findings.

A. Capital Construction Cost Components

Capital costs generally fall into two main categories - (1) maintenance and operations and (2) capital construction. Maintenance and Operations includes annual costs for routine and preventative maintenance. Capital construction costs include the cost of designing and constructing the building. The latter is the subject of this OLO review. Capital construction costs are typically divided into three cost components.

- **Site costs** - includes the initial land acquisition and development costs for the project;
- **Soft costs** - includes costs incurred by the school system to move the project forward, such as design and architecture, construction management, legal fees, taxes, and financing costs;
- **Hard costs** - these costs are most affected by decisions of the school system and the architect, and generally include building core and exterior features, interior enclosures, building services, finishes, and mechanical and electrical services. Hard costs can also include labor and materials and overhead costs. Furniture, fixtures, and equipment (FF&E) and specialized mechanical and electrical services may be considered hard costs, but are not typically included in the construction contract.[1]

B. National School Construction Trends

A 2015 report published by School Planning & Management found that in FY2014, school systems in the United States spent more than $14 billion on construction projects completed during the 2014 calendar year. A little over half of this amount ($7.8 billion) was spent to construct new schools. The study reviewed construction trends and costs for twelve regions of the Country. Region Three (Delaware, District of Columbia, Maryland, Virginia, and West Virginia) was the fourth highest spending region in the nation in 2014, spending $1.19 billion for school construction, 67% of which was dedicated to new schools.[2]

School Planning & Management's study also examined construction costs over time. In general, the cost to construct an elementary school has more than doubled since 1995, from $95 per square foot to more than $200

[1] The American Institute of Architects, *Emerging Professionals Companion: Project Cost and Feasibility*, 2013, pp. 67-77, available at http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aiab097759.pdf.
[2] Paul Abramson, 20th Annual School Construction Report, School Planning & Management, February 2015.

per square foot. Comparing costs per square foot reveals that Region Three had the fourth highest cost per square foot at $237 in 2014 ($25 more than the national average). Additionally, construction cost per square foot increases in Region Three outpaced national increases (Region 3: 25% (2008-2014), compared to National Average: 18% (2008-2014)).[3]

Table 3. School Construction Cost per Square Foot, 2008-2014[4]

	2008	2010	2012	2014	% Change (2008 - 2014)
National Average	**$179**	**$190**	**$204**	**$212**	**18.4%**
Region 1 (CT, ME, MA, NH, RI, VT)	$224	$273	$306	$400	78.5%
Region 11 (AZ, CA, HI, NV)	$179	$635	$209	$290	62.0%
Region 12 (AK, ID, OR, WA)	$206	$215	$216	$240	16.5%
Region 3 (DC, DE, MD, VA, WV)	**$189**	**$235**	**$248**	**$237**	**25.4%**
Region 2 (NJ, NY, PA)	$242	$310	$245	$235	-.03%

C. Current Construction Cost Trends in Maryland and MCPS

1. State Cost Per Square Foot Trends

Since the School Planning & Management study may mask trends within individual states, OLO reviewed State data on school construction costs. Based on a sample of 25 replacement schools (2014-2016) the State Public School Construction Program found that the average total construction costs (site plus building) was $26.5 million, with a range from $19 million to $37 million. Within this sample, the average cost per square foot was $286.[5] This is $49 more than the Region 3 average calculated by the School Planning & Management study.

As discussed in Chapter 2, State funding is based on a State average cost per square foot. In response to cost increases, the State has increased this allowance for 2017 to $335.58 per square foot (for all school levels), this is an increase from the $260.96 rate used for 2016 and substantially above the $155 rate used in 2003.[6]

2. MCPS Cost Per Square Foot Trends

Since 2010, MCPS has also experienced a steady increase in construction costs per square foot. Table 4, on the following page, provides the average cost per square foot from FY2008 to FY2015.[7]

[3] Ibid.
[4] Ibid.
[5] Public School Construction Program, Construction Costs for New and Renovated Schools, available at https://marylandassociationofcounties.files.wordpress.com/2016/04/construction-costs-for-new-and-renovated-schools.pdf.
[6] FY2017, Capital Budget Analysis Public School Construction, Board of Public Works.
[7] Montgomery County Council Education Committee, February 19, 2016.

Table 4. MCPS School Construction Costs per Square Foot

FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	% Change (FY2008 - FY2015)
$249	$283	$212	$220	$242	$258	$275	$297	19.3%

This steady increase in per square foot costs has implications on the CIP budget. While costs for projects already under construction in FY2017 to FY2022 did not increase, for those projects not yet under construction, increasing square foot costs will reduce resources otherwise available to fund these projects and could delay future projects.[8]

D. Cost per Square Foot Comparison – MCPS Elementary Schools

National, State, and lcal data reveal increases in the per square foot costs for school construction projects. To examine in more detail construction costs over the last decade, OLO compared cost data for new and replacement elementary schools.

OLO selected new and replacement elementary schools in Montgomery County, as well as Anne Arundel, Baltimore, Fredrick, Howard, and Prince George's Counties in Maryland and Arlington, Fairfax, Loudoun, and Prince William Counties in Virginia. Comparison of school construction costs in Maryland includes both new and replacement schools, while costs comparison to schools constructed in Virginia focuses only on new schools. Elementary schools were selected based on the following criteria:

- Opened in 2007 to 2010 and 2013 to 2015;
- Opened within +/- 1 year of an MCPS new or replacement elementary school; and
- Within +/- 20% total square feet of an MCPS new or replacement elementary school.

Final cost data was supplied by MCPS Division of Construction staff and school system staff in Anne Arundel and Howard Counties. Where available cost data provided for other Maryland schools are based on bid awards approved by respective Boards of Education or CIP data. Virginia cost data is based on bid awards submitted to the Virginia State Department of Education. As such, for both states, where final cost data was not available, the data may not take into account change orders or cost overruns.

It is important to note, that the sample size of schools compared by OLO is small and limited geographically. Additionally, the cost data provided on the following pages do not include costs related to land acquisition and permitting fees, design and engineering fees, and furniture and equipment. Further, cost per square foot data do not take into account State and County regulations and school systems' policies that may contribute to cost variations. When possible, OLO has noted design differences that may have contributed to cost variations. However, given these differences, cost comparisons are limited. These cost factors are explained more thoroughly in Chapters 4 through 8.

1. New Schools - 2007-2009

MCPS opened one new elementary school in 2009, William B. Gibbs, Jr. Elementary, Germantown, MD. Compared to other new schools constructed during this time, William B. Gibbs, Jr. Elementary is the second

[8] *Ibid*.

smallest school at 88,042 square feet and constructed on the smallest site at 10.8 acres. The cost per square foot to construct William B. Gibbs, Jr. Elementary was $262.76. As mentioned above cost per square foot data for schools constructed in Virginia are based on bid award data, as such final costs per square foot may be higher than the data shown. Additionally, these costs do not take into account building features or school system policies that drive construction costs. For example, William B. Gibbs, Jr. and Barack Obama Elementary Schools are Leadership in Energy and Environmental Design (LEED) Gold certified. As discussed in Chapter 6, this adds to construction costs.

Table 5. School Construction Costs – New Schools 2007-2009

State	District	Elementary School	Year Opened	Square Feet	Site Size (acres)	Total Construction Cost (Building + Site)	Total Cost/ Sq. Ft.
MD	Montgomery	William B. Gibbs, Jr.	2009	88,042	10.8	$23,134,180	$262.76
MD	Prince Georges'	Barack Obama*	2010	83,971	55.23	$25,583,000	$304.66
VA	Prince William	Gravley	2008	95,074	18.0	$17,250,455	$181.44**
VA	Loudon	K.W. Culbert*	2009	86,445	79.09	$15,393,576	$178.07**
VA	Loudon	Steuart Weller	2008	90,050	19.7	$15,385,000	$170.85**
VA	Fairfax	Lutie Lewis Coates	2009	89,439	14.4	$14,749,000	$164.91**
VA	Loudon	Creighton's Corner	2008	90,050	20.0	$14,677,424	$162.99**
VA	Loudon	Liberty	2008	90,050	21.3	$14,288,770	$158.68**

*Shared site with middle school.

**Total costs shown are based on bid award data and may not account for cost overruns or change orders, as such final costs per square foot may be higher than the data shown.

2. Replacement - 2008-2010

Between 2008 and 2010, MCPS opened four replacement schools. Compared to replacement schools opened in Anne Arundel County, these schools were larger and constructed on smaller sites. MCPS replacement schools' cost per square foot ranged from $245.0 to $301.0. It is important to note that the sample size of comparable schools is limited and these costs do not allow for a comparison of building features or school system policies that may drive construction costs. For example, Carderock Springs, Cresthaven, and Cashell Elementary Schools are LEED Gold certified and the design of Bells Mill Elementary school, although not LEED certified, incorporated sustainable design practices. Additionally, all four MCPS elementary schools utilize geoexchange systems. As discussed in Chapter 6, this adds to construction costs. In comparison, both Freetown and Pasadena Elementary Schools are not LEED certified.

Table 6. School Construction Costs – Replacement Schools 2008-2010

State	District	Elementary School	Year Opened	Square Feet	Site Size (Acres)	Total Construction Cost (Building + Site)	Total Cost/ Sq. Ft.
MD	Montgomery	Carderock Springs	2010	75,351	9.0	$22,763,449	$302.10
MD	Montgomery	Bells Mill	2009	72,862	9.6	$21,840,350	$299.75
MD	Montgomery	Cresthaven	2010	76,862	9.8	$22,517,682	$292.96
MD	Montgomery	Cashell	2009	71,171	10.2	$17,496,694	$245.84
MD	Anne Arundel	Freetown	2009	69,331	16.1	$17,483,000	$252.17
MD	Anne Arundel	Pasadena	2008	68,023	13.7	$14,548,000	$213.87

3. New Construction - 2013 - 2015

MCPS opened one new elementary school in 2014, Wilson Wims Elementary, Clarksburg, MD. Compared to other new schools constructed during this time, Wilson Wims Elementary is the smallest at 91,931 square feet and constructed on the second smallest site, 9.3 acres. Square foot construction costs are within range of comparable schools opened in 2013 to 2015. However, as noted, more thorough costs comparisons are limited. For example, Discovery Elementary (Arlington) was constructed to meet higher energy performance goals (including installation of solar panels) and incorporates community use spaces, such as two artificial turf fields and a larger gymnasium. This leads to higher costs per square foot compared to other schools without these dedicated community recreation spaces.

Table 7. School Construction Costs – New Schools 2013-2014

State	District	Elementary School	Year Opened	Square Feet	Site Size (Acres)	Total Construction Cost (Building + Site)	Total Cost/ Sq. Ft.
MD	Montgomery	Wilson Wims	2014	91,931	9.3	$23,454,982	$255.14
MD	Howard	Ducketts Lane	2013	102,028	10.1	$28,427,208	$278.62
MD	Prince George's	Edward M. Felegy	2014	92,391	7.0	$27,160,000	$293.97*
VA	Arlington	Discovery	2015	97,588	16.0	$32,305,808	$331.04
VA	Loudon	Cardinal Ridge	2014	105,951	36.7	$25,270,000	$238.51*
VA	Prince William	Chris Yung	2015	107,273	20.0	$20,286,000	$189.11*
VA	Prince William	Haymarket	2014	99,135	24.3	$17,888,000	$180.44*
VA	Loudon	Moorfield Station	2013	105,951	19.0	$18,842,791	$177.84*

*Total costs shown are based on bid award data and may not account for cost overruns or change orders, as such final costs per square foot may be higher than the data shown.

4. Replacement - 2014-2015

During this period, MCPS opened three replacement schools. Compared to replacement schools opened in Anne Arundel and Frederick Counties, these schools had similar square footage, but were constructed on smaller lots. Square foot construction costs are within range of comparable schools opened in 2014 to 2015. It is important to note that the sample size of comparable schools is limited and these costs do not allow for a comparison of building features or school system policies that may drive construction costs.

Table 8. School Construction Costs – Replacement Schools 2014-2015

State	District	Elementary School	Year Opened	Square Feet	Site Size (Acres)	Total Construction Cost (Building + Site)	Total Cost/ Sq. Ft.
MD	Montgomery	Candlewood	2015	82,222	11.8	$22,915,854	$278.71
MD	Montgomery	Rock Creek Forest	2015	98,140	8.0	$26,751,203	$272.58
MD	Montgomery	Bel Pre	2014	95,330	8.9	$23,884,182	$250.54
MD	Anne Arundel	Lothian	2015	84,588	17.1	$24,405,000	$288.52
MD	Frederick	North Frederick	2015	95,613	15.1	$26,726,230	$279.53

E. OLO Summary Findings and Observations

1. In recent years (FY2008 to FY2012), MCPS' construction costs per square foot have increased near the national average of 18% and have been lower than the regional increase of 25%.

Nationally, from CY2008 to CY2012, costs per square foot increased, on average, 18%, from $179 to $212 per square foot. While regional data reveals cost increases of 25% over the same time period, MCPS cost per square foot trends have tracked the national average, increasing by 19% from FY2008 to FY2015. As mentioned in Chapter 2, MCPS' allocation of State construction funding has remained relatively stagnant since 2007. As costs per square foot have increased, MCPS new and replacement school projects have increasingly depended on local funding.

2. A comparison among school districts of construction costs per square foot alone fails to identify root causes of construction cost differences, which are significantly impacted by regulations and policy decisions.

Cost per square foot data compare schools irrespective of the quality and characteristics of the school that was actually built. Comparisons of school construction costs data are most meaningful when each school is constructed to the same specifications and in the same environment. However, school construction costs are driven by interrelated State and local policies and practices, school design choices, and market conditions that vary over time and across school districts.

CHAPTER 4. COST FACTOR – PROCUREMENT POLICIES AND PRACTICES

State mandated procurement policies can lead to indirect and direct construction cost increases, however school system procurement practices can serve as tools to control construction costs. This chapter discusses both types of policies and practices. Each section provides a summary, describes associated costs where available, and compares MCPS with school systems in Maryland and Virginia.

- **Section A**, Minority Business Enterprise and Prevailing Wage Requirements;
- **Section B**, Project delivery methods;
- **Section C**, Practice of using add-alternates; and
- **Section D**, OLO summary observations and findings.

A. Maryland's Minority Business Enterprise and Prevailing Wage Requirements

This section provides an overview of the Minority Business Enterprise Program and prevailing wage requirements in the State of Maryland and their relation to school construction costs.

1. State of Maryland's Minority Business Enterprise Program

The State's Minority Business Enterprise Program is designed to encourage small, minority- and women-owned firms to participate in the State procurement process. Under State law, a Minority Business Enterprise (MBE) is defined as any legal entity, except a joint-venture, that is

- Organized to engage in commercial transactions; and
- At least 51% owned and controlled by one or more individuals who are socially and economically disadvantaged, including African Americans, American Indians/Native Americans, Asians, Hispanics, physically or mentally disabled individuals, women, or a non-profit entity organized to promote the interests of physically or mentally disabled individuals; and
- Managed by, and the daily business operations controlled by, one or more of the socially and economically disadvantaged individuals who own it.[1]

In 1978, the State enacted legislation establishing the Minority Business Enterprise Program. Initially the State set a MBE goal that at least 10% of the total dollar value of procurement contracts were to be awarded to minority business enterprises. Over time, the State increased this goal to 25% and for FY2014 and FY2015 the MBE goal was raised to 29%.[2]

Initially, the State School Construction Program required local boards of education to adopt procedures to attempt to include MBE firms in State funded school construction projects. These procedures were later revised to require the use of MBE firms in all State funded projects.[3]

[1] COMAR 21.01.02.01Maryland Department of Transportation, "MBE/DBE FAQs," available at http://www.mdot.maryland.gov/newMDOT/MBE/FAQs.html#1
[2] *Ibid*.
[3] COMAR 23.03.03

Local boards of education must establish project specific MBE overall goals. In addition, for every project over $50,000, a school system must establish a Procurement Review Group to develop MBE project goals and provide an analysis to the Public School Construction Program and Governor's Office of Minority Affairs to justify the goal setting method.[4]

Under the regulations, a bidder may request a waiver from meeting the MBE requirements either at submission of the original bid or after notice that the firm is the apparent low bidder on a contract. The bidder must submit to the school system documentation of their good faith effort in trying to meet the MBE requirement. This may include proof that the firm contacted certified MBE firms, information on activities to assist MBEs to fulfill bonding requirements, and information on activities to publicize contracting opportunities to MBE firms. The MBE liaison will review the submitted materials. If the liaison determines that the bidder/offeror made a good faith effort to meet MBE requirements, the waiver must be granted. Conversely, if a good faith effort was not made, the waiver is rejected. [5]

For example, in May 2010, MCPS received sealed bids for the mechanical trade package related to the replacement of Cannon Road Elementary School. The lowest bidder submitted a zero percent MBE participation and requested a full waiver from the MBE liaison. In this case, MCPS rejected the waiver and contracted with the second lowest bidder, which did meet MBE requirements. This change resulted in an increase in the contract award by $37,000. [6]

2. State of Maryland's Prevailing Wage Law

Prevailing wage laws assure that workers on public works projects are paid a wage that is most common or "prevailing" for a specific job in a specific geographic location. Prevailing wage laws serve two purposes - (1) to prevent employers from paying less than the amount commonly paid to workers in a region and (2) to prevent contractors from undermining local employment by low bidding or bringing in workers at lower wages. [7]

Modeled after the Federal Davis-Bacon Act of 1931, the State of Maryland enacted prevailing wage legislation in 1945. Maryland is currently one of 32 states and the District of Columbia with prevailing wage laws. The remaining eighteen states, including Virginia, do not require prevailing wages on public construction projects.[8] Each state with prevailing wage legislation sets a minimum dollar amount for construction contracts in which prevailing wage would apply.[9] In addition to State law, five jurisdictions in Maryland have local prevailing wage laws (including Allegany, Charles, Montgomery, and Prince George's Counties and Baltimore City). However, Montgomery County's prevailing wage law does not apply to school construction projects. Therefore, MCPS construction projects are governed solely by the State's prevailing wage law.

[4] Maryland Public School Construction Program, FY2017 Capital Improvement Program, p. 19.
[5] §00801 Minority Business Enterprise Procedures, pp.11-12.
[6] MCPS Board of Education, Award of Contracts – Cannon Road Elementary School Modernization, June 28, 2010.
[7] Maryland General Assembly, "Task Force to Study the Applicability of the Maryland Prevailing Wage Law," March 2014, p. 1.
[8] States without prevailing wage laws include Alabama, Arizona, Colorado, Florida, Georgia, Idaho, Iowa, Kansas, Louisiana, Mississippi, New Hampshire, North Carolina, North Dakota, Oklahoma, South Carolina, South Dakota, Utah, and Virginia.
[9] U.S. Department of Labor, "Dollar Threshold Amount for Contract Coverage," available at https://www.dol.gov/whd/state/dollar.htm.

a. Prevailing Wage Law and State-Funded Construction Projects

Maryland's Prevailing Wage Law applies to construction projects valued at more than $500,000 if either of the following criteria are met:

- The contracting public body is a unit of State Government or an instrumentality of the State, and there is any State funding for the project; or
- The contracting public body is a political subdivision, agency, person or entity and the State funds 50% or more of the project, except for school construction which must be 25% or more State funded.[10]

The Maryland Department of Labor, Prevailing Wage Unit conducts an annual wage survey in September and October. Contractors, subcontractors, trade associations, and labor groups voluntarily submit wage rates paid to workers on various types of projects across the State. From this survey, the Department of Labor sets the prevailing wage for each construction trade for each county and Baltimore City. Prevailing wage rates are then publicly issued for an individual project prior to the bidding process.[11] Table 9 displays informational prevailing wage rates for a sample of building trades in Montgomery County and compares prevailing wages in neighboring counties (Anne Arundel County, Baltimore County, Frederick County, Howard County, and Prince George's County).

With the exception of painters and stone masons, trade prevailing wage rates vary among the counties. For example, an electrician employed on a project in Montgomery County would be paid almost $8 per hour more than an electrician working on a prevailing wage project in Frederick County ($42.80 per hour compared to $35.10 per hour). Comparatively, the basic hourly wage rate for drywall trade is the lowest in Montgomery County compared to neighboring counties ($24.89 per hour compared to as high as $26.21 per hour).

Table 9. 2016 Maryland State Prevailing Wage for Construction Trades for OLO Selected Counties[12]

Trade Classification	Basic Hourly Wage Montgomery County	Basic Hourly Wage (Range) Neighboring Jurisdictions
Bricklayer	$28.17	$28.17 - $29.17
Carpenter	$27.56	$26.21 – $27.56
Cement Mason	$24.89	$24.61 – $27.15
Drywall - Spackling, Taping, Finishing	$24.89	$24.89 – $26.21
Electrician	$42.80	$35.10 – $42.80
Ironworker - Structural	$30.65	$26.16 – $30.65
Painter	$24.89	$24.89
Plumber	$38.92	$36.87 – $38.92
Roofer/Waterproofer	$28.50	$26.77 – $28.50
Sprinklerfitter	$32.40	$31.87 – $35.51
Stone Mason	$35.19	$35.19

[10] MD. Code. Ann., State Fin. And Procurement Art., §17-201.
[11] Maryland Department of Labor, Licensing, and Regulation, "Overview – Prevailing Wage for State Funded Construction Contracts," available at https://www.dllr.state.md.us/labor/prev/prevoverview.shtml#survey <accessed 8/29/2016>.
[12] Maryland Department of Labor, Licensing, and Regulation, "Prevailing Wage Informational Rates," available at https://www.dllr.state.md.us/PrevWage/web/content/PWRequestRates.aspx <accessed 8/29/2016>.

Additionally, the Maryland prevailing wage law regulates the use of journeymen, apprentices, and helpers. As a result, the profile of workers employed on a prevailing wage project shift toward higher paid workers, who receive a higher prevailing wage.

b. Threshold for Applying Prevailing Wage Rates to School Construction Projects

As mentioned above, Maryland law sets a minimum project value of $500,000, such that if a project is above the threshold amount, then prevailing wage is required. From 1983-2000, a school construction project in Maryland would trigger the prevailing wage requirement only if the State funded more than 75% of total project costs. In 2000, the State reduced the threshold from 75% to 50% to align school construction projects with other State-funded projects for which the threshold was set at 50%. As such, school systems that paid 51% of a project's total construction costs could bid the contract using market wages.[13]

However, the reduction in the State funding threshold amount did not affect all school construction projects equally. Under the State cost share formula, the State pays a minimum 50% of total eligible costs in all counties. With total construction costs often exceeding eligible costs, the State paid less than 50% of total construction costs in eight counties: Montgomery, Anne Arundel, Baltimore, Garrett, Kent, Queen Anne's, Talbot, and Worcester. As a result, prevailing wage rates were not applicable to large school construction projects in these counties. In 2014, the State again reduced the State funding threshold from 50% to 25%. This reduction resulted in the prevailing wage law being applied equally to all counties for school construction projects valued at $500,000 or more. However, a school system can accept a 24.9% share of State funding and not require bidding contractors comply with prevailing wage requirements.[14] Following, the 2014 legislative revision, MCPS has not requested more than a 24.9% State share for any individual project. As such, MCPS bids new and replacement school projects without prevailing wage requirements. This decision is related to increased construction costs associated with the prevailing wage requirement, discussed on the following page.

3. Cost Implications of MBE and Prevailing Wage Requirements

MBE and prevailing wage requirements indirectly and directly affect school construction costs.

a. Indirect Costs

The Maryland Public School Construction Program acknowledges the possibility of indirect costs resulting from the State MBE and prevailing wage requirements. For example, some contractors may decline to bid on school construction projects in Maryland because of this regulatory requirement. As reported, for small contractors in particular, paperwork associated with prevailing wage and MBE requirements is too cumbersome due to limited staffing, and the penalties for noncompliance are "particularly onerous for small contractors working to very narrow margins."[15] The absence of small businesses from bidding, especially on smaller projects, tends to drive up costs and limits available contracting opportunities for these firms. Interviews with area firms report similar circumstances, with paperwork requirements cited as potentially over burdensome for some contractors, which can dissuade companies from competing for jobs.

[13] "Task Force to Study the Applicability of the Maryland Prevailing Wage Law," pp. 2-3.
[14] Public School Construction Program, "Report to the Capital Debt Affordability Committee," September 16, 2015.
[15] David Lever, Public School Construction Program, "Report to the Capital Budget Subcommittee, Senate Budget and Taxation Committee," March 1, 2016.

b. Direct Costs associated with Prevailing Wage Laws

The Maryland Department of Legislative Services (DLS) estimates that labor costs represent 20.0-30.0% of total project costs. Since prevailing wage projects tend to cost more than market wage projects, DLS estimated that projects bid with prevailing wages would add between 2.0%-5.0% to the total cost of a project.[16]

Local school systems can solicit side-by-side bids with and without prevailing wages to help decide whether to accept the full State match (and be subjected to prevailing wage law) or achieve possible cost savings by accepting a lower State match. Data provided to the Public School Construction Program by Anne Arundel, Carroll, Frederick, Howard, and Washington Counties from 2012-2015 show that the cost differential between prevailing wage bids and market wage bids ranged from 0.0% to 49.0%. Of these, average prevailing wage bids are 11.7% higher than average market wage bids.[17]

As discussed previously, MCPS accepts a lower State share of construction aid and bids projects without prevailing wage requirements due to increased construction costs. On the following pages, OLO provides two examples of side-by-side bidding used in Howard and Washington Counties to demonstrate direct costs associated with the State's prevailing wage requirements.

Howard County: Side-by-Side Bids for Ducketts Lane Elementary School. Table 10 below shows the difference between prevailing and market wage bids for seven trades as part of constructing Ducketts Lane Elementary School. The project was bid in the spring of 2012 (before the State reduced the threshold in 2014). Prevailing wage bids ranged from 1.5% (Masonry) to 21.9% (Drywall) greater than market wage bids.[18] Howard County Public Schools made the decision to award the project at market wage rates since maximum State funding ($9,730,000) was less than 50.0% of the total project cost. As such, there was no cost savings to award the project at the higher prevailing wage rates.[19]

Table 10. Ducketts Lane Elementary School (New School)
Project Bids Prevailing vs. Market Wage Rates ($ millions)[20]

Job/Trade	No. of Bids	Total Contract w/ Prevailing Wage (Range)	Total Contract – Market Wage (Range)	Average Cost Differential Prevailing / Market Wage (All Bids)
Masonry	3	$2.49 - $2.97	$2.48 - $2.86	1.5%
Roofing	3	$2.10 - $2.15	$1.98 - $2.12	5.1%
Steel	3	$2.62 - $3.75	$2.28 - $3.60	9.5%
Concrete	4	$1.26 - $1.39	$1.15 - $1.18	12.5%
Electrical	2	$6.28 - $6.86	$5.69 - $5.96	12.7%
Mechanical	7	$6.15 - $8.15	$5.45 - $6.96	13.2%
Drywall	5	$1.02 - $1.76	$0.89 - $1.64	21.9%

[16] Department of Legislative Services, "Fiscal and Policy Note HB 23 - Prevailing Wage – Waiver From Provisions." 2016 Session.
[17] *Ibid*., p. 6.
[18] The construction estimate for all bids was $17,712,207. Bids received for site work and electrical trades exceeded project estimates and were rebid.
[19] Interview with Howard County Public School System, Interagency Specialist.
[20] HCPSS Board of Education, Bids and Contracts, 5/22/2012.

Washington County: Side-by-Side Bids for Bester Elementary School. Table 11 displays the increase between the prevailing and market wage bids for seven trades as part of constructing Bester Elementary School. Bids for this project were received in the summer of 2012 (before the State reduced the threshold in 2014). The average increase ranges from 6.5% (Steel) to 29.6% (Masonry).

Table 11. Bester Elementary (Replacement School)
Project Bids Prevailing vs. Non-Prevailing Wage Rates ($millions)[21]

Job/Trade	No. of Bids	Total Contract w/ Prevailing Wage (Range)	Total Contract – Market Wage (Range)	Average Cost Differential Prevailing / Market Wage (All Bids)
Masonry	3	$2.03-$2.35	$1.57-$1.92	29.6%
Roofing	5	$1.51-$2.00	$1.40-$1.77	8.7%
Steel	2	$1.62-$1.74	$1.52-$1.63	6.5%
Concrete	4	$0.78-$1.13	$0.78-$1.04	12.5%
Electrical	3	$2.16-$2.30	$1.76-$2.14	15.4%
Mechanical	3	$4.57-$4.88	$3.99-$4.53	12.3%
Drywall	5	$0.99-$1.13	$0.88-$0.96	18.1%

Washington County Public Schools received prevailing wage construction bids that totaled $26,456,000 for the replacement of Bester Elementary, compared to $24,049,000 for market rate bids, a difference of $2,407,000. The table below displays the cost comparison of a contract under prevailing wages and market rate contract with reduced State funding.[22] With almost $800,000 in savings, Washington County Public Schools selected to award the project at the market wage rates.

Table 12. Bester Elementary School - Cost Comparison[23]

	Prevailing Wage	Market Wage	Savings
Est. Total Project Cost	$26,456,000	$24,049,000	$2,407,000
Less Est. State Share of Cost	$10,191,000	$8,567,000	($1,624,000)
Cost to County	$16,265,000	$15,482,000	$783,000

While both school systems elected to accept a lower State share of funding and award trade contracts at market wage bids, it is difficult to establish trends within the individual building trades. For example, the prevailing wage masonry bid was only 1.5% greater than the market wage bid for Ducketts Lane Elementary School, but was 29.0% greater for Bester Elementary School. Many other variables such as project size, location, and timing influence labor costs.[24] These factors make comparing the effects of wage rates across projects difficult. Contemporary prevailing wage studies face difficulty in identifying control groups consisting of projects of similar size, timing, and location that do not pay prevailing wage rates. Additionally, where data is available, the comparison relies on bid prices rather than final costs. As a result, cost overruns and change orders are not included.[25]

[21] "Task Force to Study the Applicability of the Maryland Prevailing Wage Law," pp. 109-10.
[22] Washington County Public Schools Board of Education, Formal Action: Bid for Construction of Bester Elementary (Replacement) School, September 4, 2012.
[23] *Ibid*.
[24] "Task Force to Study the Applicability of the Maryland Prevailing Wage Law," p. 5.
[25] Department of Legislative Services, "Fiscal and Policy Note – HB23."

4. Comparison to Other School Systems in Maryland and Virginia

State MBE and prevailing wage requirements apply equally to all school systems in Maryland. However, trade prevailing wage rates, set by the State Department of Labor, can vary across counties, resulting in some variation among labor costs. Additionally, school systems in Maryland can elect to use side-by-side bids to help decide whether to accept the full State match (and be subjected to prevailing wage law) or achieve possible cost savings by accepting a lower State match. School systems that use this option, as shown above, have achieved cost savings, which can lower costs compared to schools contracted at prevailing wage rates. Although MCPS does not solicit side-by-side bids, MCPS does accept a lower State share of construction funding due to increased costs associated with prevailing wage requirements. This is a cost advantage for MCPS compared to other Maryland school systems that accept a higher State share of funding and require prevailing wage rates.

Unlike the State of Maryland, Virginia does not require MBE goals or prevailing wages. Without these requirements in Virginia, the regulatory environment is less burdensome compared to Maryland. Under Virginia State MBE guidance, school systems aim to increase utilization of small and minority owned business in all areas of procurement; relying on the Contractor to use his/her best effort to ensure minority and small businesses have the maximum opportunity to compete for subcontract work.[26] For example, Arlington Public Schools solicited bids for renovation and addition work for Abingdon Elementary School in FY2016. As part of the RFP, the contractor must obtain a list of MBE-certified contractors from the State and directly solicit bids from at least one certified business in each category to perform the work. However, there was "no obligation to give any preference to any such business in the award of subcontracts."[27] Additionally, without prevailing wage requirements, labor costs can be lower for school construction projects in Virginia compared to projects in Maryland.

B. Project Delivery Methods

State regulations permit school systems to use a range of different school construction contracting methods including general contracting, construction management agency, construction management at-risk, design-build, and job order contracting. School systems select a method depending on the size and scope of the project, the project's complexity, availability of general and trade contractors, schedule requirements, prior record of success with a specific model, and aversion to risk.[28] Two of these methods – construction management agency and construction manager at-risk – are frequently used for large scale school projects in some Maryland counties, and are the subject of the OLO review that follows.

1. Definitions

Construction Management Agency. In this procurement practice, the construction manager serves as an extension of the school system's staff (essentially eliminating the general contractor's role) and acts to protect the school system's interests. The school system retains the risk for coordinating and managing the sub-

[26] Virginia State Department of Small Business and Supplier Diversity, available at http://www.dmbe.virginia.gov/aboutus.html <accessed 8/29/2016>. Loudon County Public Schools, General Conditions of Contract, available at http://www.lcps.org/cms/lib4/VA01000195/Centricity/Domain/111/General%20Conditions%203-15-10.pdf .

[27] Arlington Public Schools, Bid #61 FY2016, March 24, 2016, p. 65.

[28] COMAR 23.03.04; Interagency Committee on School Construction, The Cost of School Construction, pp 29-31.

contracts.[29] The construction manager, under separate contract, oversees all work completed and reports directly to the school system. Typically a construction manager is hired early in the process to provide cost estimates, constructability reviews[30], value engineering[31], and other services that could affect time, scope, and schedule. [32]

Construction Management At-Risk. This arrangement blends both general contracting and construction manager agency. Similar to construction manager agency, the manager is involved early on in the design process. A school system and the construction manager enter into a guaranteed maximum price contract and project risk is transferred from the school system to the construction manager. Any budget overruns associated with the scope of work are assumed by the construction manager, rather than the school system. If a project is delivered under budget, cost savings are shared between the manager and the school system.[33]

2. Summary of Findings from OLO Interviews

Anne Arundel, Frederick, and Howard County School Systems use construction manager agency for large school projects. In contrast, MCPS uses construction manager at-risk. OLO spoke with school system staff and industry professionals about both contract methods. A summary of reported findings is included below.

Construction Manager Agency. For school systems with smaller construction staffs, a construction manager agency arrangement protects the school system's fiscal interests, especially since the schools can negotiate independently for trade contracts to receive the best price. Anne Arundel County Public Schools noted that a construction manager tends to know the bid environment and which firms may submit a bid. This allows for better cost estimates both across time and geographic location of a project. Similarly, Howard County Public School System has used this method for more than 20 years. Howard County staff mentioned that the construction manager routinely reviews and evaluates change order requests, and is well-informed to advise the school system whether to accept the change or not.

Construction Manager At-Risk. One of the advantages cited by MCPS for using the construction manager at-risk method is that the project risk is borne by the construction manager. This offers a more controlled environment that allows the project to proceed on schedule and decreases the likelihood of change orders. MCPS Division of Construction regularly tracks performance metrics related to project schedule and budget. From FY2011 to FY2015, on average 96% of projects were completed on budget (three years MCPS achieved 100% of projects completed on budget). Further all 41 school projects completed during FY2011 to FY2015 opened on schedule. Similar to an agency arrangement, MCPS noted that cost control measures start at the design phase.[34] By having a more collaborative environment, all parties look for value opportunities. OLO also spoke with industry representatives who mentioned that a large incentive exists to complete a project on time and under budget under a guaranteed maximum price contract. The industry representatives noted that, in some cases, if work is

[29] Ibid. See also Flint Co. Construction Services, "What are the Different Construction Delivery Types and Advantages of Each?" available at http://www.flintco.com/uploads/cms_uploads/2013/12/delivery-types-1387397104.pdf.
[30] Constructability review is a structure evaluation of project design documents by an independent third party.
[31] Value engineering is a process of looking for ways to provide the same design features or services at a lower cost.
[32] The Cost of School Construction, pp 29-31.
[33] Ibid.
[34] MCPS Division of Construction Performance Metrics.

completed according to the agreed upon cost and schedule, a school system pays back 10% of the guaranteed maximum price to the construction manager.

3. Cost Savings

According to the State Public School Construction Program, no particular contracting method offers clear cost saving measures over another process. However, the State listed several cost savings associated with both construction management agency and construction management at-risk.

Agency. As an agent to the school system, the construction manager is not at risk for the project. Construction manager agency allows the school system to procure the construction manager using a noncompetitive procurement process based on qualifications, past performance, and personnel. Professionalism, the desire for repeat work, and need for references, drives managers to perform at or better than general contractors with respect to quality control, schedule, safety, and cost control. Additionally, having a process that permits selection based on past work and references lends favor to the school systems. Although there are fees associated with hiring a construction manager, these fees typically offset traditional overhead and profit charges found in a traditional general contractor relationship.

At-Risk. In contrast to an agency arrangement, the at-risk arrangement, under State law, must be bid competitively. A school system can avoid costs by utilizing a manager early in the design process. Trade bids are also procured using a competitive sealed bidding process, resulting in open competition for each trade. Another cost benefit to this arrangement is that post-bid negotiation is possible between the school system, the construction manager, and trade contractors before establishing the guaranteed maximum price. Since the construction manager who determined the guaranteed maximum prices was also involved in the design, change orders resulting from errors and omissions are reduced potentially resulting in a cost savings to the school system.[35]

4. Comparison to Other School Systems in Maryland and Virginia

As mentioned above, selection of a project delivery method lies with individual school system preferences. While Montgomery, Anne Arundel, Frederick, and Howard all use a construction manager, Calvert and St. Mary's Counties do not to use these methods. Similar to Maryland, the use of a particular delivery method also varies in Virginia. Loudoun and Arlington Counties select a particular contract management method based on project type. In addition, Loudoun County will use construction manager at-risk for large high school projects, but general contracting for elementary schools.[36]

C. Practice of Using Add-Alternates

A procurement practice raised by the State of Maryland as means to manage school construction costs is the use of add-alternates. An add-alternate is an additional work item that may be added to a project if bids are received below the budgeted amount (i.e., different materials or addition/deletion of particular work). This

[35] Interagency Committee on School Construction, The Cost of School Construction, pp 29-31.
[36] School System and Industry Professional interviews.

allows school systems to maximize the amount of work awarded within the budget. By pricing the add-alternate separately, a school system can later determine the final scope of the project.[37]

1. Use of Add-Alternates by MCPS

MCPS often bids add-alternates with school construction projects. These items are often aesthetic improvements (such as higher level building finishes) and convenience items (such as bus canopies).[38] Add-alternates are not improvements that would alter the core building or educational program provided. All schools in the County are constructed to meet the same educational program standards.

In some cases, construction bids come in at funding levels that permit these alternates, however in other cases additional funding is needed. Table 23, on the following page, contains a list of recent add-alternates for elementary school projects, including funding sources. In addition to the examples outlined below, MCPS will also use add-alternates to determine costs for classroom shell space for future additions. Although additional funding may be needed to cover this space, these costs are routinely less expensive compared to building the project at a later date.[39]

[37] Add-alternate Bidding Definition available at http://epg.modot.org/index.php?title=147.2_Add_Alternate_Bidding.

[38] Montgomery County Education Committee Worksession October 12, 2015.

[39] A recent example, a 12 classroom shell space at the new Bethesda-Chevy Chase Middle School will cost approximately $50 per square foot, resulting in overall savings of approximately 40 to 65 percent off the total estimated $6 to $8 million cost to build the addition at a later date.

Table 23. Add-Alternates at Elementary School Construction Projects[40]

School	Add-Alternates	Total Cost	Funding Source
Bel Pre	• Daylight Harvesting Controls – South and North Classrooms • Exterior Sun Control Devices – Glazed Aluminum Curtainwall • LED Site Lighting in Parking Lot	$101,282	Funding Level within Total Budget
Candlewood	• Quarry Tile Base in Corridors in lieu of Rubber Base • LED Light Fixtures in Gym • Translucent Wall Lights in Gym	$33,620	Funding Level within Bid Contract
Wilson Wims	• Dimmable Daylight Harvesting Controls on Lighting • Additional Exterior Sun Control Devices • LED Site Lighting in Parking Lot • Vinyl Cushion Tufted Textile Carpet Backing for Carpet	$156,130	Funding Level within Total Budget
Wood Acres	Enclosed Courtyard Improvements	$34,000	PTA Funded
Garrett Park	Larger Stage in Multi-purpose Room	$38,398	Foundation Funded
Carderock Springs	• Habitat Garden with Seating for 35 Students • Exterior School Sign with Message Board • Amphitheater in Rear of School • Stone Materials for Steps in Front Entrance • Terrazzo Tile for Main Entry • Stone Base for Columns in Front of Main Entrance and Canopy Along Bus Ramp • Upgrade for Sound and Lighting Systems on the Stage in the Multi-Purpose Room	$154,648	Foundation Funded

2. Comparison to Other School Systems in Maryland and Virginia

The State Public School Construction Program recommends increasing the use of add-alternates to manage project costs.[41] This method is used in other school systems in Maryland and Virginia. For example, Howard County Public Schools bid a total of seven add-alternates for Ducketts Lane Elementary (opened 2013). Howard County Board of Education approved one add-alternate for ceramic wall tile at a cost of $4,000.[42] Examples of other add-alternates added to projects in Howard County include extended ceramic tile in the restrooms, parking lot expansions, and site entry improvements.[43] The practice of using add-alternates is also used for Virginia school construction projects. For example, recent add-alternates added to projects in Arlington Public Schools include garden space, new carpeting, and solar panels.[44]

[40] Data provided by MCPS staff and Board of Education Approved Contract Awards.
[41] Public School Construction Program, Report to the Capital Debt Affordability Committee, September, 16, 2015.
[42] HCPSS Board of Education, Bids and Contracts, May 22, 2012.
[43] HCPSS Board of Education, Bids and Contracts, October 4, 2016; Bids and Contracts, January 9, 2014.
[44] Arlington Public Schools Facilities Planning.

D. OLO Summary Observations and Findings

1. State of Maryland school construction requirements include procurement policies that provide economic benefits to small, minority-, women-, disabled-owned businesses, but which can also decrease competition and increase labor costs.

Maryland Public School Construction Program construction project and trades data reveals that paying prevailing wages increases bids 0.0% to 49.0%, with an average increase of 11.7% above market wages. However, it is difficult to measure the impact of prevailing wage rates on school construction costs in Maryland because other variables (such as bid timing and the project specifications) must be controlled to estimate the cost impact of the State law. In comparison, while there is the possibility of indirect costs, as noted in the case of Cannon Road Elementary School, the cost of abiding by MBE requirements resulted in only a nominal increase in project cost.

The Maryland Prevailing Wage and Minority Business Enterprises laws add regulatory requirements to school construction that do not exist in Virginia. The increased reporting requirements associated with Maryland procurement policies can dissuade some companies from competing for projects in Maryland and thus decrease competition. Additionally, industry experts report that these changing requirements have led to higher labor costs for construction in Maryland as compared to Virginia.

2. Maryland school systems are entitled to higher amounts of State aid if they require contractors pay prevailing wage rates. Requiring the payment of prevailing wage rates, however, may increase the cost of school construction. MCPS has opted to bid school construction projects without a prevailing wage requirement.

The State's prevailing wage requirement for school construction projects provides a higher amount of State aid if the school systems uses contractors that pay prevailing wages and a lower amount of State aid if contractors do not.

MCPS does not require bidding contractors to comply with prevailing wage requirements because prevailing wage rates increase overall construction costs. Following the 2014 legislative revision that lowered the State funding share percentage to 25.0% for school construction, MCPS has not requested more than a 24.9% state share for any individual project. As such, MCPS bids new and replacement school projects without prevailing wage requirements. This may reduce construction costs for MCPS as compared to other Maryland school systems that accept a higher State share of funding and require prevailing wage rates.

Some school systems solicit side-by-side bids to compare the costs of utilizing prevailing wage rates versus accepting a lower amount of State funding. These bids compare total costs at different state funding levels. Washington County Public Schools, for example, saved almost $800,000 by electing not to contract under prevailing wage rates for the replacement of Bester Elementary school. Since MCPS accepts a lower State share of funding and does not require bidding contractors to comply with prevailing wage requirements, MCPS does not solicit side-by-side bids.

3. MCPS has adopted procurement practices (i.e., use of bidding aesthetic or convenience items separately (also known as add-alternate bidding) that have resulted in better control of costs and maintenance of project schedules.

OLO examined two procurement practices used by MCPS and other school systems – construction manager agreements and use of add-alternate bidding.

MCPS hires a construction manager to assist with the design process, cost estimating, and managing the actual construction of the building. This arrangement offers benefits to MCPS including better cost estimates during the design phase, negotiation of a guaranteed maximum price contract, and the transfer of project risk to the construction manager (i.e., cost overruns and schedule delays). All three of these benefits contribute to MCPS performance metrics showing a 96% rate of projects completed on budget and 100% rate of projects opened on time.

Similar to other school systems in Maryland and Virginia, MCPS employs the practice of bidding aesthetic or convenience design elements as add-alternates. This practice allows the school system to maximize the base budget and determine the final scope of work after the bids are received. If current project budgets cannot fund these add-alternates, additional funds may be required, such as a CIP amendment or community raised funds.

CHAPTER 5. COST FACTOR – SITE COSTS AND STORMWATER MANAGEMENT REGULATIONS

Site costs generally include expenses incurred for land acquisition (including title, fees, and transfer taxes), surveys, demolition, and site work. This chapter examines site costs, specifically stormwater management regulations, as contributing factors to the cost of public school construction projects. The chapter includes five sections:

- **Section A**, Site costs and state-local cost burden;
- **Section B**, Stormwater management regulations;
- **Section C**, Impact of stormwater management regulations on costs;
- **Section D**, Comparison with other school systems in Maryland and Virginia; and
- **Section E**, OLO summary observations and findings.

A. Site Costs

Site costs can be influenced by a variety of factors, including:

- **Geographic Location**. Labor rates and material costs may vary geographically both across the State and within individual counties. In addition, local conditions can influence the type of building materials and design. For example, environmental requirements in sensitive areas surrounding the Chesapeake Bay may add to construction costs in some areas of Anne Arundel County in ways, not experienced in other portions of the State.[1]
- **Site Conditions**. Site characteristics vary from site to site. Characteristics like paved areas, required demolition, soil disposal and compaction, soil condition, extent of landscaping, and utilities not only affect budget estimates, but can also lead to unanticipated conditions requiring change orders.
- **Environment**. Existing environmental factors, such as forests or wetlands, can impact costs and the amount of land available for development. For example, during the replacement of Garrett Park Elementary School, MCPS needed to provide 0.46 acres of forest conservation to satisfy environmental requirements for tree loss during construction. Since there was insufficient space to accommodate the requirements on-site, the Board acquired off-site Forest Conservation Credits from a mitigation bank approved by the Maryland-National Capital Park and Planning Commission. MCPS staff negotiated a purchase price for the off-site credits of $11,580.[2]
- **Redeveloped Sites**. If a replacement school is being constructed on an existing school site (and holding facilities are not available), site work may be constrained by the existing building, construction phasing, and safety conditions. These conditions typically result in higher site costs.[3]

[1] School System and Industry Professional Interviews.
[2] MCPS Board of Education, Meeting Minutes, August 26, 2010.
[3] American Institute of Architects, "Emerging Professional's Companion – 2C Construction Costs." Kelcie Pegher, "Small Schools Big Issues: Candidates face off on Education," Capital Gazette, October 5, 2014.
Public School Construction Program, Report to the Capital Budget Subcommittee, Senate Budget and Taxation Committee, March 1, 2016.

Site costs are included in school construction contracts and a contingency is built into the contract to cover unanticipated costs after construction has started. In some cases, change orders are required to address previously unknown site conditions during the construction phase. For example, during grading and excavating for Wilson Wims Elementary School (Montgomery County) the site contractor encountered unsuitable soils, requiring modifications to the proposed building foundation. Additional costs were incurred to remove and replace the unsuitable soil and modify the foundation.[4]

State Funding for Site Costs. As part of the State construction funding formula, site costs are eligible for State funding (see Chapter 2 for description of State funding). Eligible site development costs include off-site development costs required by local, state, and federal regulations. The remaining site costs (funded entirely by the counties) include site acquisition, ineligible off-site costs, architecture and engineering or other consultant fees, and ancillary construction costs (including permits, test borings, soil analysis, water and sewer connection charges, topographical surveys, models, renderings, and cost estimates).[5]

The State calculates site costs as a percentage of building construction costs. This allows for State funding to increase based on the type of school constructed (elementary, middle, or high school) and is reflective of increasing building costs over time. Until FY2017, the State calculated eligible site costs as 12% of building costs. For FY2017, the State increased this percentage to 19%. As shown in Table 14, local jurisdictions pay the majority of site costs.

Table 14. Cost Share Formula and Site Development Costs for Selected Elementary Schools[6]

School (District)	Contract Award Date	State CIP Building Costs	State CIP Site Costs @12%	% Cost Share	Amt. Funded by State	Final Site Costs Paid by MCPS
New						
Wilson Wims (Montgomery)	2/2013	$15,329,000	$1,839,000	50%	$919,726	$4,178,942
Ducketts Lane (Howard)	5/2012	$13,272,012	$1,667,161	60%	1,000,297	$5,095,570
Replacement						
Candlewood (Montgomery)	5/2013	$10,509,000	$1,261,000	50%	$631,000	$3,699,000
North Frederick (Frederick)	7/2014	$1,5307,200	$1,836,864	72%	$1,322,542	$2,097,161

B. Stormwater Management Regulations and Site Development Costs

In 2010, the State Department of the Environment issued new stormwater management regulations.[7] Both school facility planners and industry professionals indicate that these changes are a factor in rising site costs. As discussed above, the State has increased the percentage of State funding allocated for site costs from 12% to 19% to account for increases since the new regulations went into effect.[8]

[4] MCPS Board of Education, "Change Orders over $100,000 – Clarksburg Village Site #1", 12/10/2013.
[5] COMAR 23.03.02.11-12
[6] Public School Construction Program FY2012-FY2014 CIP; School System Data; Frederick County 2015-2020 CIP.
[7] During storms, water is not absorbed by impervious surfaces (i.e., rooftops, roads, driveways, parking lots, sidewalks, and basketball and tennis courts) and instead flows quickly over the surfaces to nearby waterways.
[8] Public School Construction Program, "Report to the Capital Debt Affordability Committee" September 16, 2015.

1. Stormwater Management Regulatory Changes

The Maryland Stormwater Act of 2007 required environmental site design using small-scale management practices (i.e., rainwater harvesting, landscape infiltration, rain gardens, bio-swales, and micro-bio retention facilities around parking areas) and site planning to mimic natural hydrologic run off characteristics. For each project, a school system is required to use these techniques to the Maximum Extent Practicable. Maximum Extent Practicable varies from project to project and interpretation of this standard is different in each county. Additionally, these new requirements also align with Leadership in Energy and Environmental Design (LEED) sustainable site standards discussed in Chapter 6. For example, a Heat Island Credit can be obtained through providing light colored porous pavements and vegetated roofs.[9]

2. Effects of New Regulations

In 2010, the State Department of Environment implemented new stormwater management regulations, affecting all school construction projects after May 2013. As related to school construction, the new regulations produced the following effects:

- Civil and geotechnical engineers are required to be involved earlier in the design process (with submission of initial planning documents);
- Greater space is required to provide a whole site, systems-based approach. This reduces the amount of land available for site improvements and building spaces of upwards of 20% of developed area including increased environmental buffers and larger right of ways;
- Although alternatives (i.e., vegetated roofs) are permitted to reach the standard of maximum extent practicable, there are costs associated with using these alternatives; and
- There are potential cost savings associated with the lower cost of using nonstructural design practices (landscaping) and a decreased need for drainage infrastructure.[10]

C. Impact of Stormwater Management Regulations on Costs

The State Public School Construction Program found that grading, utilities, landscaping, and other site costs have increased since 2010, with many elements increasing by 20% or more.[11] OLO interviewed industry professionals and school system staff in other jurisdictions who confirmed that the new stormwater regulations have increased project costs. Most notably, these professionals noted that the new regulations require redesign of stormwater management practices for each site resulting in higher civil engineering fees (Anne Arundel County staff estimated about a 20% increase in costs). Additionally, since the new regulations require more space, constrained sites may require the use of alternative practices, like vegetated roofs, to meet increased standards.[12]

[9] COMAR 26.17.02.06 (A); MDE, "Maryland's Stormwater Management Program – Stormwater Management Act of 2007 Update," (2010); MDE, "Environmental Site Design and Innovative Technology."
[10] Loiederman Soltesz Associates, Inc. "2010 Stormwater Management Manual and Regulations in the State of Maryland," available at http://www.solteszco.com/sites/default/files/article-pdf/Stormwater%20Management%20Whitepaper.pdf.
[11] Report to the Capital Budget Subcommittee, Senate Budget and Taxation Committee, March 1, 2016.
[12] School System and Industry Professional Interviews.

D. Comparison to Other School Systems in Maryland and Virginia

State stormwater management requirements apply equally to all school systems in Maryland. However, several industry professionals indicated that Montgomery County has more stringent stormwater management standards than the State. The County reviews every stormwater management plan for school construction projects, compared to Frederick County, which has the State review plans.

An example of stricter County standards is the construction of replacement schools on redeveloped sites.[13] State regulations established less stringent stormwater management practices for redeveloped sites in order to meet the dual goal of improving water quality and supporting improvements to urban spaces. In general, these redevelopment standards can reduce stormwater management requirements upwards of 50%.[14] However, the County Code treats redeveloped and new construction sites equally. For example, both new and redevelopment projects must use environmental site design to maintain 100% of the average annual groundwater recharge for the developed site. In comparison, the State does not apply recharge requirements to redevelopment sites.[15]

As a result, replacement school sites are treated the same as new greenfield schools, leading MCPS to meet a higher standard for redeveloped sites compared to school systems elsewhere in the State.[16] Based on discussions with other jurisdictions and consultants, MCPS estimates that employing the less stringent State standard to a redeveloped site could reduce site costs by 10% to 20%. For example, using an average site cost of $47.0 per square foot, a 95,000 square foot replacement elementary school could see a reduction in site costs between roughly $5.0 and $10.0 per square foot, or an approximately $475,000 to $950,000 reduction in total site costs.[17]

Similar to Maryland, site costs in Virginia vary by project and unanticipated site costs can occur. For example, the original construction contract for Cardinal Ridge Elementary School in Loudoun County included turn lane improvements. However, after the contract was awarded, additional intersection improvements were identified, including the addition of a traffic signal. These improvements were required as part of the larger zoning agreement. This additional work increased costs by about $1.3 million.[18]

Further, similar to Maryland school systems, Virginia school systems must comply with State stormwater management regulations. However, both States administer stormwater management regulations differently, making cost comparisons difficult. There are a couple of policy differences to note. First, staff at the Virginia Department of Environment note that there are a variety of ways to meet stormwater management regulations for school sites. One option is to collocate schools on the same large parcel of land (i.e., elementary and middle schools). This allows a school system to comply with regulations across one large site (i.e., preserving one three acre section of forest), rather than implementing practices at two separate sites. Second, in contrast to the

[13] A redeveloped area as "any construction, alteration, or improvement performed on sites where existing land use is commercial, industrial, institutional, or multifamily residential and the existing site impervious area exceeds 40% (COMAR 27.17.02.02).
[14] COMAR 27.17.02.05
[15] Montgomery County Code §19-26
[16] MCPS Division of Construction Staff.
[17] Ibid.
[18] Loudoun County Public Schools, Department of Planning and Legislative Services, Dawson's Corner Cash Proffer Funds, December 19, 2013.

Maryland regulations, Virginia stormwater management regulations are more stringent for redeveloped sites than for new sites. This ties into the LEED requirement for low impact development in urban areas.[19]

E. OLO Summary Observations and Findings

1. Local jurisdictions pay a majority of site costs. Based on the State's wealth adjusted cost share formula, MCPS receives a lower percentage of State aid for site costs compared to most jurisdictions.

The State calculates aid for site costs as a percentage of building costs, which is then reduced by the cost share formula. As a result, wealthier school systems, like MCPS, receive a lower percentage of State aid compared to other school systems and must pay for the majority of site costs with local dollars. For example, final site costs for Wilson Wims Elementary (new school) totaled $4.2 million, of which MCPS received $0.92 million in State funding, or 22% of total site costs. In comparison, final site costs for North Frederick Elementary (replacement school) totaled $2.1 million, 63% of which was covered by State aid.

2. Recently updated State stormwater management regulations have increased the complexity of the construction process and site costs, requiring additional civil engineering services that are ineligible for State funds.

In 2010, the State Department of the Environment implemented new stormwater management regulations designed to improve water quality and protect natural resources. These regulations require school systems to move away from individual design requirements, such as stormwater management ponds, to a system-wide approach. This approach reduces the available land for site and building spaces and requires multistage design reviews and approvals. Additionally, the new regulations give preference to nonstructural design practices. However, for school systems like MCPS that use design alternates (i.e., vegetated roofs) to meet both stormwater management regulations and LEED certification, this approach is not without cost premiums.

Further, the new State regulations have increased site related costs, particularly civil engineering fees. Industry professionals reported that the new regulations require redesign of stormwater management practices for each site, resulting in higher civil engineering costs (Anne Arundel County staff estimated about a 20% increase in costs). As mentioned in Chapter 2, engineering costs are ineligible for State funding. As such, local jurisdictions bear the burden of complying with more stringent State stormwater management regulations.

3. More stringent County stormwater management requirements on redeveloped sites have the potential to increase site costs for replacement schools relative to other school systems in the State.

State redevelopment standards can reduce stormwater management requirements upwards of 50%. However, Montgomery County applies stricter regulations than other jurisdictions in the State requiring redeveloped sites to meet the same standards as new construction. MCPS estimates that employing less stringent State standards could reduce site costs per square foot by 10% to 20% for redeveloped sites. For example, a 95,000 square foot replacement elementary school could see a reduction in site costs between roughly $5.0 and $10.0 per square foot, or an approximately $475,000 to $950,000 reduction in total site costs.

[19] Interview with Virginia Department of Environment staff.

CHAPTER 6. COST FACTOR – HIGH PERFORMANCE BUILDING MANDATES

Schools constructed in Montgomery County are required to be Leadership in Energy and Environmental Design (LEED) Silver certified. This chapter reviews how this State and County building performance mandate impacts construction costs. This chapter includes four sections as follows:

- **Section A**, High performance building standards in Maryland and Montgomery County;
- **Section B**, High performance building costs;
- **Section C**, Comparison to other school systems in Maryland and Virginia;
- **Section D**, OLO summary observations and findings.

A. High Performance Building Standards in Maryland and Montgomery County

The 2008 Maryland High Performance Building Act applies to all new school construction projects and projects to expand or replace existing schools, when more than 80% of the final built square footage is new. The law does not apply to complete, systemic, or limited building renovations.[1] Under State law, a high performance building meets or exceeds LEED Silver requirements as certified by a third party. Schools may also be certified by a comparable rating system approved by the State Departments of Management and Budget and General Services or a green building code recommended by the Maryland Green Building Council.[2] Since LEED Silver standards are used for school construction projects in Montgomery County, as well as the rest of the State of Maryland, LEED costs are the focus of this OLO review.

1. Leadership in Energy and Environmental Design (LEED)

The U.S. Green Building Council (USGBC) developed LEED as a self-assessment tool to measure the extent to which a building meets green building criteria.[3] LEED prerequisites, credits, and points all contribute to the final certification of a building.

- **LEED Prerequisites** – While projects can pick and choose the credits to pursue, the USGBC established minimum requirements that all buildings must meet in order to achieve LEED certification. Fulfilling the prerequisite requirements for a construction project does not earn points towards final certification.
- **LEED Credits** – A school system can select any credit applicable to LEED criteria for schools. LEED Credits earn points towards a building's final certification.
- **LEED Points** – The number of points determines the level of LEED certification. There are four levels of certification: Certified (40-49 points); Silver (50-59 points); Gold (60-79 points); and Platinum (80 and above).[4]

In addition to LEED prerequisites, the State of Maryland established mandatory LEED credits in each of the following point categories displayed in the table on the following page.

---

[1] Public School Construction Program, "Administrative Procedures Guide § 105 High Performance Schools."
[2] Department of Legislative Services, Fiscal and Policy Note, Revised, HB207, 2014 Session.
[3] US Green Building Council, "LEED v.4 Building Design and Construction Guide – Category Overviews."
[4] US Green Building Council, "LEED 2009 for Schools – New Construction and Major Renovations," p. xiii, available at http://www.usgbc.org/Docs/Archive/General/Docs5547.pdf.

Table 15. Description of LEED Credits and State Requirements[5]

Point Category	Summary Description	State Requirement
Sustainable Sites	Credits for protecting environment, keeping open spaces, and managing rainwater, heat island, and light pollution	Light pollution reduction
Water Efficiency	Credits for types of fixtures and appliances used, water usage, site plan requirements, and alternative sources of water (i.e., rainwater harvesting)	50% minimum reduction in water usage for landscaping
Energy and Atmosphere	Credits awards based on building orientation, climate-appropriate building materials, natural ventilation systems, and smart controls to reduce energy usage	Designs demonstrating energy savings of at least 15% better than the current adopted version of the International Energy Conservation Code (IECC)
Materials and Resources	Credits rewarded for reducing construction waste (i.e., reuse of existing materials)	Minimum of 75% reduction in construction waste
Indoor Environmental Quality	Credits for air quality, lighting, acoustic design, and ability to control surroundings (ventilation and thermal controls) and use of low-emitting materials	Use of low emitting materials (i.e., paint, flooring) and development of an Internal Air Quality Plan during construction and before occupancy

Using these categories, school systems combine credits to meet desired LEED ratings. USGBC publishes a LEED Scorecard that details design elements and the total number of points awarded. The scorecard for Wilson Wims Elementary School, awarded LEED Gold in 2015, is shown in Appendix B.

2. Montgomery County Regulations

In 2006, the County Council enacted legislation requiring most new public buildings to achieve LEED Silver certification. The law applies to any new or extensively modified building, or a building that has or will have 10,000 gross square feet and where the County finances at least 30% of the new construction or modification.[6] Extensively modified means any structural modification that alters more than 50% of the building's gross square footage.[7]

To obtain initial permits, a project must submit a green building design concept plan to the Department of Permitting Services (DPS) that includes proof of registration with the USGBC. Before construction can begin, the applicant and the project's design official attend a green building construction meeting with DPS to demonstrate the processes in place to meet green building standards. Finally, before use and occupancy permits are issued, a final meeting takes place to verify how the design elements were achieved.[8]

In December 2015, the County Executive proposed Executive Regulation 21-15, which would require the use of International Green Construction Code.[9] As drafted, the regulation does not permit alternative certification procedures, such as LEED. The proposed regulation decreases the minimum square foot requirements that would trigger application of the green building code from 10,000 square feet to 5,000 square feet for new

[5] Maryland Green Building Council, High Performance Building Program, August 2015.
[6] LEED applies to additions only if the addition doubles the existing footprint of the building.
[7] Executive Regulation 19-07 AM - Buildings - Energy Efficiency and Environmental Design.
[8] COMAR 8.26.01.05
[9] Executive Regulation 21-15.

construction and additions.[10] MCPS notes that the IgCC employs many of the current LEED requirements, but will set additional requirements, such as envelope commissioning. Commissioning is an evaluation process for determining a building's energy performance at each stage of construction and for the life of the building.

3. MCPS High Performance Building Requirements

MCPS has a long history of incorporating sustainability into the design of its schools. Since 1993, MCPS has used standardized Facility Design Guidelines for new and replacement schools. In 2003, these guidelines were updated to align school design with LEED specifications (five years before the State enacted the High Performance Building Act). In 2007, MCPS opened the State's first LEED Gold certified school, Great Seneca Creek Elementary School. From 2006 -2015, 21 MCPS schools received LEED Gold certification and one received LEED Silver certification. [11] In comparison, Howard County Public Schools has 2 LEED Gold schools and 6 LEED Silver schools.

MCPS publishes guidance for architects and construction project managers regarding LEED certification. For example, as part of the architectural/engineering design service, the MCPS Division of Construction publishes a scope of work for the Architectural/Engineering LEED Administrator. The LEED Administrator is assigned by the architect/engineer and is responsible for general management and oversight of the LEED process. Under this scope of work, MCPS identifies that all projects must be submitted to the USGBC with a minimum of 15% more points than the minimum required for the project's certification. [12]

B. High Performance Building Costs

Costs to meet high performance building standards examine the total cost difference between LEED Silver schools and traditional schools and the costs associated with of green building components (i.e., vegetated roofs).

1. Cost Difference Between a LEED Silver Certified School and a Traditional School

A LEED certified building has two general cost components – the cost to incorporate building design elements to achieve LEED points and the actual cost of obtaining third party certification. Data from the State Public School Construction Program estimates that the LEED Silver requirement adds between 2% to 5% to building construction costs.[13] For example, if a non-LEED elementary school cost $25 million to construct (including site costs), the estimated cost of building that building to LEED Silver certification would be an additional $500,000 to $1.25 million. A secondary cost of building to LEED is the requirement for third party certification. The cost of registration and certification for LEED projects is between $3,150 and $23,400 for USGBC members, depending on the size of the project. Costs are slightly higher for non-members.[14]

---

[10] Jennifer Wellman-Andryuk, "USGBC National Capital Region: Montgomery County Legislative Update," US Green Building Council, Jan. 7, 2016.

[11] MCPS FY2016 Environmental Sustainability Management Plan, p. 15-16.

[12] MCPS Scope of Work for A/E's LEED AP Administrator – MCPS LEED for School Projects.

[13] "The Cost of School Construction" p. 28.

[14] US Green Building Council, "Registration and Fees," available at http://www.usgbc.org/cert-guide/fees.

2. Cost Examples Green Building Components

As mentioned above to achieve LEED certification, there are many building components used to meet requirements. This section explores design components used frequently for new and replacement schools in the County - vegetated roofs and geoexchange systems (geothermal systems). Each section provides an overview of the design component, intended benefits, and approximate installation costs.

a. Vegetated Roofs

Vegetated roofs offer a number of environmental benefits including serving as a sound barrier and reducing cooling loads, stormwater runoff, and heat island effect.[15] Additionally, as detailed in Chapter 5, vegetated roofs receive both LEED Silver credits and serve as an alternative practice to meet more stringent State stormwater management requirements (particularly on constrained school sites). Currently, 33 schools in Maryland have vegetated roofs; 21 of those schools are in Montgomery County.[16]

Vegetated roofs costs can vary based on a building's requirements and design, with costs ranging from $15.0 to $20.0 per square foot. This is approximately $10.30 to $12.30 more than the installation of a conventional roof.[17] Despite the higher upfront costs, the return on investment for a vegetated roof is between 10-20 years.[18] Additional costs savings produced by vegetated roofs include:

- **Increased roof longevity**. As green roofs are protected by ultraviolet light, they last longer, with a longevity of 40 years for the waterproof membrane under the vegetated roof, compared to 17 years for a conventional roof.

- **Decrease in building energy consumption**. Vegetated roofs reduce heating and cooling peak load demands. Nationally, the General Service Administration conservatively estimates that this produces an annual savings of $0.23 per square foot.

- **Reduced stormwater management costs**. Nationally, vegetated green roofs can provide $0.084 per square foot in annual savings in stormwater management costs based on current regulations.[19]

The Maryland Association of Floodplain and Stormwater Managers report that when examining the 40-year life cycle cost of a vegetated roof, the net present value of a vegetated roof is 20 to 25% less expensive than a conventional roof.[20]

[15] DC Green Works, "What is a Green Roof?" available at http://dcgreenworks.org/programs/rainwater-conservation-and-reuse/green-roofs-2-0/.
[16] Maryland Green Building Council, 2015 Annual Report.
[17] Lynn Mayo, "Staying on Top of Green Roofs," Maryland Association of Floodplain and Stormwater Managers, October 15, 2015.
[18] Michael Fickes, "School Roofs Aren't What the Used to Be," School Planning and Management, March 1, 2014.
[19] Green Roofs for Health Cities, "How Your Community will Benefit from Adopting a Green Roof Policy, available at http://www.greenroofs.org/resources/PolicyBrochure-HowYourCommunityWillBenefitFromGreenRoofPolicy.pdf
[20] Lynn Mayo, "Staying on Top of Green Roofs."

b. GeoExchange (Geothermal) Systems

Since 2001, MCPS has installed and operated geo-exchange systems to heat and cool 25 school buildings.[21] For new construction, geoexchange heat pumps costs up to twice as much as conventional heating and cooling systems. Further, replacing an existing conventional system with a geothermal system requires excavating and laying underground pipes on developed land.[22] The table below compares the bid award for geoexchange systems installed at MCPS new and replacement schools in 2008 and 2013 (adjusted for inflation). As shown, costs have decreased over time. For example, based on a per square foot cost, geoexchange systems were more expensive in 2008, almost 60% higher for Carderock Springs Elementary School with the contract awarded in 2008 than Bel Pre Elementary School in 2013.

Table 16. Geoexchange Cost Comparison (2008, 2013)

Elementary Schools	Project Type	Sq. Ft	Contract Award	Adjusted 2013 Constant Dollars	Adjusted Cost/sq. ft.
William Gibbs (Contract Awarded 1/2008)	New School	81,892	$795,000	$863,258	$10.54
Carderock Springs (Contract Awarded 11/2008)	Replacement	75,351	$998,300	$1,084,013	$14.39
Wilson Wims (Contract Awarded 2/2013)	New School	91,931	$611,000	$611,000	$6.65
Bel Pre (Contract Awarded 1/2013)	Replacement	95,330	$618,000	$618,000	$6.48

Similar to vegetated roofs, the initial cost of a geoexchange system is weighed against the lifetime costs. Geoexchange systems typically have fewer mechanical components and most components housed are underground, shielded from the weather. The underground piping system is usually guaranteed to last 25 to 50 years.[23] Additionally, geoexchange systems produce annual cost savings for MCPS. MCPS schools with geoexchange systems use less energy than schools without a geoexchange system (approximately 44 kBTUs per square foot compared to 55 kBTUs per square foot in traditionally heated and cooled buildings).

For MCPS, the space and maintenance avoidance, combined with the energy efficiency gains of a geoexchange system produce a 100% return on investment in 7 to 15 years.[24] Similarly, Frederick County Public Schools reported that it costs $1.21 per square foot to heat and cool Lincoln Elementary, a replacement school opened in 2013 using a geoexchange system, compared to $1.83 per square foot to heat and cool a traditional school.[25] As shown by Table 17 on the following page, utilizing geoexchange at Lincoln Elementary School produced a savings of $58,032 in energy costs annually. Based on the bid award for the geoexchange system at $650,000, the savings would provide a return on the investment in 11 years.

[21] MCPS FY2016 Environment Sustainability Management Plan. A geoexchange (geothermal) system uses the constant temperature of the earth to heat and cool buildings.
[22] Jeff Day, "Loss of Tax Incentives Could Doom Super-Efficient Heating/Cooling System," Bay Journal, 7/24/2016.
[23] California Energy Commission Consumer Energy Center, "Geothermal or Ground Source Heat Pumps," available at http://www.consumerenergycenter.org/residential/heating_cooling/geothermal.html.
[24] MCPS, FY2016 Environmental Sustainability Management Plan.
[25] Rachel S. Karas, "North Frederick Digs County School's Second Geothermal Wells," Frederick News-Post, July 26, 2013.

Table 17. North Frederick Elementary School - GeoExchange Bid Award and Cost Savings[26]

North Frederick Elementary, 93,600 Sq.					
Geothermal System @ $1.21/ sq. ft.	$113,256	Traditional System @ $1.83/sq.	$171,288	Annual Energy Savings	$58,032
Geothermal Bid Award $650,000		Return on Investment in 11 years (Bid Award/Annual Energy Savings)			

C. Comparison to Other School Systems in Maryland and Virginia

All school systems in Maryland must comply with the State's High Performance Building Act, which requires at a minimum LEED Silver certification. While the State sets forth mandated LEED credits, for each project, school systems can use a combination of LEED credits to achieve required point totals. As a result, a LEED Silver school in Montgomery County may have a different LEED score (higher or lower) and different design credits than a school constructed in another jurisdiction. For example, MCPS extensively uses vegetated roofs and geoexchange systems at new and replacement school projects. This may increase upfront costs to school construction projects in the County, but reduce lifecycle costs.

In comparison, the State of Virginia publishes school facility design guidelines that include green building recommendations, including maximizing daylight and building orientation, building materials, recycling of construction waste, and indoor environmental air quality.[27] Virginia adopted the Virginia Collaborative for High Performance Schools (VA-CHPS), a self-certification recognition program based on a 150 point scoring criteria. A new school may be recognized as verified if it reaches 40 points and defined as a verified leader if it meets 75 points. Similar to LEED, the Collaborative for High Performance Schools is divided into three categories: Strategy, Design, and Performance, and seven sections: Integration & Innovation, Indoor Environmental Quality, Energy, Water, Site, Materials and Waste Management, and Operations & Maintenance. Each section has both prerequisites and optional credits, with points assigned to each credit. Based on a review the Collaborative for High Performance Schools' website, to date no schools in Virginia have been verified or identified as a verified leader.[28]

Virginia school systems establish their own high performance or sustainability policies for building construction. For example, Loudon County High Performance Design Policy for new school construction identifies the development of best management practices, drawing on a range of standards, including LEED, VA-CHPS, and Department of Energy, Energy Star Program. Best management practices are examined during three phases - preconstruction, construction, and post construction.[29] LEED is used as reference, but the school system does not seek certification. Further, the upfront costs associated with green building technologies may be cost prohibitive for some jurisdictions. For example, to reduce costs, Fairfax County Public Schools has used water based heat pumps, which are less efficient than geothermal systems, but do not require underground pipes.[30]

[26] *Ibid*.
[27] Virginia Department of Education Office of Support Services, "Guidelines for School Facilities in Virginia Public Schools," June 2010, Revised September 2013, p. 4.
[28] Collaborative for High Performance Schools, "VA-CHPS Criteria for New Construction and Major Modernizations," available at http://www.chps.net/dev/Drupal/node/622 See also "Schools and Districts."
[29] Loudoun County Public Schools, Policy §6-41 Support Services Construction/Energy.
[30] Michael Alsion Chandler, "Can DC afford to build the greenest schools in the world?" The Washington Post, July 16, 2015..

D. OLO Summary Observations and Findings

1. State and County high performance building requirements mandating LEED certification add 2% to 5% to total construction costs compared to a non-LEED certified building.

Since 2006, all new and replacement MCPS schools must be at a minimum LEED Silver certified. Data from the Maryland Public School Construction Program shows that this requirement adds 2% to 5% to total construction costs. For example, if a non-LEED elementary school cost $25 million to construct (including site costs), the estimated cost of building that building to LEED Silver standards would be an additional $500,000 to $1.25 million. While school systems in Virginia can use LEED or other green building standards as a reference to design and construct schools, Virginia does not require LEED certification.

2. While high performance building components have higher initial costs, they have a lower lifecycle costs and potentially provide long term cost savings.

Flexibility is built into the LEED rating system. School systems can add different elements together to receive a total LEED point score. As such, MCPS schools may have different sustainability and energy efficient features than schools constructed in other school systems. OLO reviewed the costs associated with two green building components, vegetated roofs and geoexchange systems, both used extensively by MCPS. OLO found that while upfront installation costs for these systems are more expensive than traditional counterparts, lifecycle costs typically are lower.

Vegetated roofs last 40 years compared to an average life cycle for a traditional roof of 17 years. The Maryland Association of Floodplain and Stormwater Managers report that when examining the 40-year life cycle cost of a green roof, the net present value of a vegetated roof is 20 to 25% less expensive than a conventional roof. This is in addition to other related savings including heat and cooling costs and stormwater management costs.

Geoexchange Systems' underground piping is usually guaranteed to last 25 to 50 years and requires less maintenance and space than traditional chillers and boilers. For MCPS, the space and maintenance avoidance, combined with the energy efficiency gains, will produce a 100% return on investment in 7 to 15 years.

CHAPTER 7. COST FACTOR – SCHOOL DESIGN PRACTICES

While Chapters 4 through 6 discussed the impact of State and County regulations on school construction costs, this chapter focuses on local building design priorities and choices that can affect construction costs. Each section provides a summary, describes associated costs, and compares MCPS to other school systems in Maryland and Virginia. This chapter is organized into four sections.

- **Section A**, Impact of educational specifications on costs;
- **Section B**, Community involvement in the design process;
- **Section C**, Prototype school design plans; and
- **Section D**, OLO summary observations and findings

A. Educational Specifications

Educational specifications affect the size of school buildings and in turn affect the cost of construction. School systems in Maryland develop standardized educational specifications that translate into spatial requirements for the construction and use of the building. These specifications often are modified to accommodate site conditions, size and demographics of the expected student body, new education or building mandates, and new technologies.[1] For each project, State regulations require school systems to submit specifications to the State for review and approval during the design phase.[2]

As school buildings have changed over time, the size of the buildings, including number of stories, have increased. For example, Table 18 compares the size of MCPS elementary schools opened in the 1950's and 1960's with the size of the school building after undergoing a replacement project.

Table 18. Square Feet Comparison[3]

School	Square Footage at Original Opening	Square Footage after Replacement
Bel Pre (opened in 1968, replaced in 2014)	43,313	95,330
Candlewood (opened in 1968, replaced in 2015)	30,747	82,222
Rock Creek Forest (opened in 1950, replaced in 2015)	11,050	98,140

Several factors drive the need for larger schools. For example, in the 1960's classrooms were designed for rows of desks, a fixed teacher's desk, a blackboard, and an overhead projector. The current learning model focuses on flexibility and project based learning. As a result, classrooms are larger to allow for individual and group work, mobile teaching, mobile devices, and an integrated whiteboard and projector. Media Centers once designed for stacks of books, heavy tables, and fixed furniture are now designed for collaboration and

[1] Public School Construction Program, "The Cost of School Construction: A Comparison of the Monarch Global Academy and Conventional School Facilities."
[2] COMAR 23.03.02.14
[3] MCPS FY2017 CIP, Appendix J.

technology.[4] Additionally, in the 1930's – 1950's, physical education spaces were a low priority with schools built on smaller sites and not planned for playing fields or physical education spaces. Today, educational specifications recognize a greater need for physical education.[5] All told, these examples show how changing educational specifications modify the space requirements for school buildings.

In addition, in the last 15 years the following conditions/factors have also impacted school size:

- Prekindergarten and full-day kindergarten program requirements;
- More special needs students requiring Individualized Education Programs and the space to implement them (individuals with Disabilities Education Act and the Americans with Disabilities Act);
- Early childhood intervention space;
- More roaming support staff, teachers, and counselors;
- Separate gymnasium and enlarged spaces to meet community recreation needs;
- Enlarged health suites; and
- More stringent fire codes.[6]

A few of these changes are evident when comparing 1993 MCPS educational specifications for new elementary schools (target elementary school size of 640 students) and educational specifications for Wilson Wims Elementary School which opened in 2014 (740 students).[7] New or enlarged spaces in Wilson Wims include:

- An additional kindergarten classroom
- 2 additional grades 1-5 classrooms
- Preschool Education Program
- Small and large instructional breakout rooms
- Large media center and multipurpose room
- Before/aftercare and PTA storage
- Staff development areas
- Larger health suite

In sum, MCPS school buildings are larger today to accommodate advancements in the educational program and legal and regulatory requirements.

1. Educational Specifications as Cost Drivers

The changes in building specifications detailed above affect construction costs as it is simply more expensive to build larger buildings. As mentioned in Chapter 2, the State bases available funding by multiplying approved student enrollment by the State approved maximum gross square feet per student. This total square feet number is multiplied by the average construction cost per square foot to determine total State funding amount.[8] Local jurisdictions have the flexibility to design and construct schools larger or smaller than State gross area allowance. For example, the State approved square foot allowance for Wilson Wims Elementary School (2014)

[4] Maryland Association of Counties, 2016 School Construction Symposium.
[5] School System and Industry Member interviews.
[6] COMAR 13A.06.03; COMAR 13A.01.02.05; Len Lazarick, "Is Maryland Building 'Cadillacs or Buicks' for its new public schools?" Maryland Reporter, July 7, 2016Len Lazarick, "Is Maryland Building 'Cadillacs or Buicks' for its new public schools?"
[7] MCPS Elementary Educational Specifications, December 1993 available at http://eric.ed.gov/?id=ED428518. Clarksburg Cluster Elementary School (Clarksburg Village #1 Site) Educational Specifications Schematic Design, September 19, 2011.
[8] Maryland School Law Desk Book, 2015-16 Edition.

was 74,052 square feet (669 students multiplied by 108 square feet per student).[9] The State multiplied 74,052 square feet by the State average construction cost per square foot ($207.00) to determine total eligible construction costs of $15,328,764. This was then reduced by the 50% local state cost share formula for Montgomery County. However, the actual gross square feet for Wilson Wims is 91,931, a difference of roughly 17,800 square feet that was not included in the eligible square footage allowance funded by the State.

The actual square footage of a school differs from State allowances for a variety of reasons, including the addition of special programs at schools, larger community use spaces, or district policies to reduce class sizes, thereby requiring more classrooms. The State conducted a review of the FY2017 State CIP and compared actual building square footage to State gross area allowances. Out of a review of 13 school systems and 25 new elementary schools, the State found on average that new elementary schools were 132% larger than the State gross area allowances (on average 89,554 square feet compared to an average gross area allowance of 67,792).[10] The State approved square foot allowances were last updated in 2011 (before changes such as separate gymnasiums) and do not take into account school system policies, such as class size reduction.

2. Comparison to Other School Systems in Maryland and Virginia

Federal education requirements apply equally to all school systems in Maryland and Virginia. Similarly, State requirements (i.e., full-day kindergarten, enlarged health suites) apply equally to all school systems in Maryland. However, the State generally defers to school system policies and educational programs. For example, in two schools with the same total enrollment, one school system may elect to have smaller class sizes, necessitating construction of additional classrooms compared to the other school.[11]

The State of Virginia issues building codes to regulate the life safety design for schools and regulations that govern required program offerings, student-teacher ratios, maximum class sizes, and administrative staffing. Virginia also publishes recommendations for school systems to use in evaluating school sites and designs. However, choices for school design, materials, and types and number of spaces lies with local school systems.[12] School systems must certify to the Virginia Department of Education their compliance with meeting the minimum standards regarding construction of new and replacement schools, however waivers can generally be obtained if a school system wishes to deviate from the requirements.[13]

In light of the differences between state requirements, OLO compared three recently constructed elementary schools in Montgomery, Howard, and Arlington Counties to compare how educational specifications in MCPS align with educational specifications in comparable schools. The table on the following page presents basic information on the three schools.

[9] Public School Construction Program, Approved FY2014 MCPS CIP.
[10] 21st School Facilities Commission, Meeting held on September 15, 2016 available at http://mgaleg.maryland.gov/Pubs/CommTFWorkgrp/2016-21st-Century-School-Facilities-Commission-2016-09-15.pdf.
[11] School System and Industry Professional interviews.
[12] Virginia Department of Education, Office of Support Services, Guidelines for School Facilities in Virginia's Public Schools, Revised September 2013.
[13] Joint Legislative Audit and Review Commission of the Virginia General Assembly, "Review of Elementary and Secondary School Funding," available at http://jlarc.virginia.gov/pdfs/reports/Rpt277.pdf.

Table 19. Overview of OLO Selected New Elementary Schools[14]

School Name	Date Opened	State-Rated Capacity	Sq. Ft.	Site Size (Acres)
Wilson Wims (Montgomery)	2014	740*	91,931	9.3
Ducketts Lane (Howard)	2013	684*	102,028	10.1
Discovery (Arlington)	2015	669*	97,588	16.0

*State-rated capacity determined at the time of design and construction.

Wilson Wims Elementary School opened in 2014 to relieve overcrowding and enrollment increases. This school is based on a prototype design used previously at three elementary schools. The school is LEED Gold certified and is collocated with a local park. Of the three schools selected, Wilson Wims provides the smallest square feet per student at 124 square feet.

Ducketts Lane Elementary School opened in 2013 to relieve overcrowding in the northeastern region of Howard County. This school is a prototype school building design, LEED Gold certified, and provides additional space for Department of Parks and Recreation programs. Ducketts Lane Elementary provides 149 square feet per student.

Discovery Elementary School opened in 2015 to relieve overcrowding and increasing enrollments. The school is a certified Net Zero School, meaning the school building produces enough renewable energy to meet its own energy consumption requirements. The school design includes the following technologies - 1,706 solar panels; a geothermal well; solar pre-heat of domestic water; 100% LED lighting; and Building dashboard system that tracks energy usage in real time.[15] Additionally, the school has dedicated recreation program spaces as well as community amenities such as artificial turf fields. Discovery Elementary provides 145 square feet per student.

Table 20 on the following page provides a qualitative space summary for core curriculum spaces in each school. A summary of observations is provided on page 46.

[14] Clarksburg Cluster Elementary School (Clarksburg Village #1 Site) Educational Specifications Schematic Design; HCPSS Board of Education, New Elementary School #41 CD Report, December 20, 2011; APS New Elementary School on the Site of Williamsburg Middle School Final Design, November 19, 2013.

[15] Green Building News, "Arlington to Debut Net-Zero Energy Elementary School," Nov. 11, 2014, available at http://www.greenbuildingnews.com/articles/2014/11/19/arlington-debut-net-zero-energy-elementary-school <accessed 09/07/2016>.

Table 20. Qualitative Space Summary

Category	Wilson Wims Elementary		Ducketts Lane Elementary		Discovery Elementary	
Prekindergarten	1 Preschool Education Program classroom		2 Intense Needs classrooms	12-15 students	1 Virginia Preschool Initiative classroom	16 students
			2 Prekindergarten classrooms	20 students	1 Montessori classroom	23 Students
Kindergarten*	5 classrooms (1300 sq. ft. each)	22 students	5 classrooms (1,130 sq. ft. each)	22 students	4 classrooms (1,115 sq. ft. each)	23 students
General Classrooms	24 classrooms (900 sq. ft. each)	23 Students	22 classrooms (850 sq. ft. each)	19 students Grades 1 -2	4 Grade 1 classrooms (1,025 sq. ft. each)	20 students
				25 Students Grades 3-5	16 Grade 2-5 classrooms (825 sq. ft. each)	22-23 students
Special Education	See Prekindergarten		1 classroom (2,200 total sq. ft.)		6 classrooms (4,595 total sq. ft.)	
Special Programs and Extended Learning Areas	Large and small group rooms		• Dedicated classroom for ESOL and gifted students • Flexible learning Spaces		• Dedicated classroom for ESOL and gifted students • Flexible learning Spaces • Common Space work spaces	
Art and Music	• 1 art room • 1 music classroom • 1 instrumental music room • 1 multipurpose room		• 1 art room • 2 music classrooms		• 2 art rooms • 2 music classrooms • Stage	
Media Center	Media Center (4,590 sq. ft.)		Media Center (5,175 sq. ft.)		Media Center (3,570 sq. ft.)	
Multipurpose Room	Multipurpose Room (4,680 sq. ft.)		Multipurpose Room (5,060 sq. ft.)		Multipurpose Room (4,660 sq. ft.)	
Physical Education	4,450 total sq. ft., includes a 3,700 sq. ft. gym		5,320 total sq. ft., includes a 4,500 sq. ft. gym		7,210 total square feet, includes a 6,100 sq. ft. gym	
Community Use of Space	Extra storage for before and aftercare		Additional 1,900 square feet of space for recreation programming		• Larger gym • Storage and space for Parks and Recreation and before/after care	

*Includes Storage and Lavatory Space

Table 20 on the previous page highlights the space differences between the schools based on educational specifications established during the design phase. [16] A few observations can be made:

- Additional prekindergarten classrooms were constructed at Ducketts Lane and Discovery Elementary Schools.
- With similar kindergarten student ratios, Wilson Wims has the largest sized kindergarten classrooms.
- Wilson Wims Elementary has the highest number of grade 1-5 classrooms with the most square feet per classroom. However, both Ducketts Lane and Discovery have fewer students per classroom in early elementary years. Additionally, Grade 1 classrooms are larger at Discovery Elementary.
- Discovery has six dedicated special education classrooms.
- All three schools provide flexible learning spaces in addition to classroom space.
- Discovery provides an additional art room and music stage, while Wilson Wims includes an additional multipurpose room.
- Ducketts Lane was designed with the largest multimedia and multipurpose rooms of the three schools.
- Physical education spaces are larger at Ducketts Lane and Discovery to accommodate community use.

As discussed above educational specifications drive standards and school design. With schools designed to meet the 21st century learning models and programmatic standards, such as all-day kindergarten, schools today are larger than schools constructed fifty years ago. This increase in size leads to increased costs to construct larger buildings.

B. Community-Centered Design

This section explores the extent to which community-centered design policies and practices affect school construction costs.

1. MCPS Community Involvement Policies

MCPS prioritizes community involvement in the design process. Board Policy ABA, *Community Involvement*, presents the Board's commitment to ongoing collaborative communication processes with the community and defines MCPS' obligations to encourage community involvement.[17]

In accordance with Policy ABA, Regulation FAA-RA outlines the procedure for community involvement in the MCPS facility planning process. Under this regulation, the community is involved in the following processes: site selection for new schools, facility design, school boundary changes, facility-related focus groups, and school closures and consolidations. The regulation also outlines specific methods for soliciting community opinions.[18]

[16] Ibid. Interviews with School Systems.
[17] MCPS Board of Education Policy ABA, Community Involvement, Last Revised June 13, 2013.
[18] MCPS Board of Education Regulation FAA-RA Long-Range Educational Facilities Planning, Last Revised June 6, 2015.

2. Community Involvement in the Feasibility Study Process

As discussed in Chapter 2, MCPS, like other school systems in Maryland, is required to conduct a feasibility study as part of the planning process to determine options for new construction or replacement schools. As part of this process, MCPS involves the community in the facility design process. Feasibility study documents list participants and the number of meetings held. OLO examined the level of community involvement during the feasibility study process for new and replacement schools opened since 2014.[19] Table 21 shows the total number of participants and the number of meetings held for selected schools. OLO classified participants into one of four groups:

- *Instructional staff* includes teachers, principals, and other staff working at the school;
- *MCPS Central Office Staff* includes staff from the MCPS Department of Facilities Management;
- *Community* includes parents, neighbors, PTA representatives, cluster representatives, and child care providers; and
- *Other* includes elected officials, County agency representatives, and State agency representatives.

These totals do not include members of the design and construction team. In total, MCPS held between five and seven meetings for each project with a total of 30 to 100 participants involved.

Table 21. MCPS Feasibility Study Meeting Participants[20]

School	Year	No. of Meetings	Total Participants	Instructional Staff	MCPS Central Office Staff	Community	Other
New Schools							
Wilson Wims	2014	**	44	2	3	39	--
Richard Montgomery #5	2018	5	83	4	4	62	12
Replacement Schools							
Candlewood	2015	**	41	6	3	32	1
Rock Creek Forest	2015	5	46	13	3	29	1
Brown Station	2017*	**	36	20	3	11	2
Wayside	2017*	6	32	19	6	6	1
Wheaton Woods	2017*	5	100	18	3	58	1
Luxmanor	2020*	5	30	8	3	18	1
Potomac	2020*	7	78	6	6	61	2

*Estimated completion date FY2017 MCPS CIP, Chapter 4, Appendix E.
**Number of Meetings not available in published MCPS Feasibility Studies for Wilson Wims, Candlewood, and Brown State Elementary Schools.

[19] All Feasibility Studies for Schools included in the Table can be found at MCPS Division of Construction, Feasibility Studies, available at http://www.montgomeryschoolsmd.org/departments/facilities/construction/studies/feasability.aspx.
[20] *Ibid*.

Feasibility study meeting participants reviewed architectural design alternatives and provided input on changes to the design options. A number of different concepts were developed before final decisions are made. For example:

- **Wheaton Woods Elementary**. Over the course of five meetings, participants reviewed a total of 26 different architectural design versions from the seven designs originally presented.
- **Potomac Elementary**. Participants reviewed 11 different concept and option refinements to reach four final options.
- **Luxmanor Elementary**. Participants reviewed 10 different design versions derived from the four originally presented.[21]

3. Example of Feasibility Study Discussions – Wayside Elementary

The following is an example of the community engagement process during the feasibility study and schematic design phase for Wayside Elementary School (see page 4 for definitions). The feasibility study took place between March and June of 2011, with schematic design occurring between February and May of 2013.

As part of the design process, Wayside Elementary School teachers and staff toured other area elementary schools to view school design features. The feasibility participants were presented with three designs. The following is a summary of main building features that were altered based participants' comments.[22]

- **Number of Stories**. A two-story modernization was selected because it allowed for a larger media center, multipurpose room, and more play space. A three-story option was not preferred.
- **Drop Off Location**. Wayside Elementary staff recommended that the pick-up/drop-off location be located at the rear of the building and that it be made into "a destination spot with an architectural feature, like a canopy." The design team redesigned the entrance to bring in more daylight and create a "main street" design.
- **Flooring**. Wayside Elementary staff requested that the concrete flooring used in the existing building addition not be used for the replacement school due to maintenance issues. The design team used different flooring in both the new space as well as the existing addition.
- **Media center**. The office was relocated to the front of the media center with an exterior window.
- **Preschool Education Program Location**. Wayside Elementary staff expressed concern over initial location of the Preschool Education Program and requested that its location be flipped with the kindergarten classrooms to allow for direct access to the play space.
- **Flexible Learning Spaces**. The existing design of Wayside Elementary included spaces located along the corridors for small group instruction. These pods did not meet current fire codes or accessibility standards. However, Wayside Elementary staff greatly utilized the space and requested that it be retained in the new design. The design team presented several options for additional breakout spaces in addition to those already provided by MCPS standard educational specifications. The design team suggested a design currently used at Matsunaga Elementary School. However, staff did not feel that this

[21] Wheaton Woods Elementary School Feasibility Study; Potomac Elementary School; Luxmanor Elementary School Feasibility Study Feasibility Study.
[22] Wayside Elementary School, MCPS, Wayside Modernization, available at http://www.montgomeryschoolsmd.org/schools/waysidees/about/modernization.aspx.

would meet their needs for collaborative learning and the ability to supervise students from the classrooms. The design team presented two options – (1) a standard 900 square foot classroom with no pods or (2) smaller classrooms with either open or closed off pod spaces. Staff preferred to have the standard 900 square foot classrooms with connecting doors between the classrooms.

- **Play Areas**. Neighbors expressed concern over the large building and enlarged center courtyard and how these spaces could encroach on grass play areas at the back of the site. The final design placed the two story addition along the side of the school bordering a swim club and play areas closer to the residences.

The examples above demonstrate how current MCPS Board of Education policies and regulations allow community members and school staff to provide input in the school design process. This process can take several months and requires back and forth communication between the community and the design team. A comparison to the level of community involvement in other school system is provided in Section C.

4. MCPS Schools as Community Assets

While Section 2 of this chapter discussed community involvement in the design process, this section discusses schools as community assets. Today, schools in Montgomery County and many other jurisdictions are open before and after school hours as well as year round. They serve as performing arts centers, athletic facilities, community meeting/gathering spaces, school-based health and wellness centers, community centers, adult education classrooms, early childhood development centers, and before and after school care programs.[23]

When going through the design process, MCPS works with communities and County departments to determine whether additional space is required for specific County programs. This generally includes recreation spaces and co-location of Department of Health and Human Services programs.

a. Parks and Recreation Space

As mentioned previously, MCPS educational specifications outline approved specifications for physical education spaces. Building a gym larger than required by specifications to meet community needs can result in higher construction costs. Recently, the City of Rockville contributed $400,000 to fund a larger gym at the new Richard Montgomery Elementary School. This gym will be 20 feet wider than a standard MCPS elementary school gymnasium and includes bleachers, storage, scoreboard, adjustable basketball hoops and extra padding. In return for the funding, the City of Rockville receives a $400,000 credit against the future rental of any MCPS gymnasiums and facilities managed by Montgomery County Community Use of Public Facilities.[24] This type of agreement has allowed for larger gyms at College Gardens, Lakewood, and Meadow Hall Elementary Schools. Although agreements of this sort do not increase County CIP expenditures, they demonstrate the additional costs associated with meeting community needs.

b. Co-location of Health and Human Services Programs

Three County programs found in MCPS elementary schools that require dedicated program space are – Linkages to Learning, School Based Health Centers, and Child Care. As schools undergo major construction projects, the

[23] Paul H. Faulkenbury, AIA, REFP, White Paper on MCPS School Facilities and the Future, Samaha Associates, P.C., August 18, 2015.

[24] Larry Bowers, Memorandum to the Board of Education, Richard Montgomery Elementary School #5 (Hungerford Park Site) Request to Fund Larger Gymnasium, May 26, 2015.

Department of Health and Human Services notifies MCPS which communities would benefit from these programs. Although there are construction costs associated with building dedicated program space, costs are less than if the County were to construct spaces for these programs as stand-alone projects.

Linkages to Learning and School Based Health Centers. School Based Health Centers provide health and mental health services, social services, and youth development services. The Linkages to Learning Program provides accessible services to at-risk children and their families to improve performance in school, home, and community.[25] Between 2013 and 2018, dedicated spaces for these program have or will be constructed as part of two addition projects and three replacement schools. Costs for constructing dedicated program space for these programs ranged from $411,000 to $726,076.[26]

Child Care. This program offers offer high quality child care in communities where it might not be otherwise available. [27] The table below compares the projected cost of building a stand-alone child care center with actual costs of incorporating child care facilities on site in school buildings. Due a variety of construction cost factors that can affect project budgeting (i.e., increasing labor and materials markets), MCPS and HHS use the projected cost as an estimate until project-specific feasibility studies are conducted. Historically, actual costs to build dedicated space were at least 44% lower than the cost of stand-alone projects (with the exception of Sargent Shriver Elementary School in which actual costs were 18% higher than the projected costs).[28]

Table 22. Cost to Construct Child Care Spaces –
Standalone Projects (Projected Costs) vs. Incorporated with Major School Projects (Actual)

School	Year Open	Projected Cost: Stand Alone Facility	Actual Cost: In-School Facility	% Difference Projected and Actual
Sargent Shriver	2006	$368,000	$433,899	17.9%
Arcola	2007	$580,000	$303,700	-47.6%
Galway	2009	$839,000	$317,246	-62.6%
Takoma Park	2010	$500,000	$276,952	-44.6%
Weller Road	2014	$1,012,000	$432,470	-57.3%
Bel Pre	2015	$1,012,000	$407,688	-59.7%
Wheaton Woods	2017	$800,000	$379,277	-52.6%
Brown Station	2017	$800,000	$352,704	-55.9%

[25] Montgomery County Council, HHS/ED Committee Worksession Packet, February 12, 2015.
[26] Ibid. See Also Montgomery County Council, HHS/ED Committee Worksession Packet, February 29, 2015. Montgomery County Council, Worksession FY2015-FY2020 Capital Improvements Program (CIP) and FY2015 Capital Budget, Department of Health and Human Services Packet, March 25, 2014.
[27] Montgomery County Council, Worksession FY2015-2020 Capital Improvements Program (CIP) and FY2015 Capital Budget, Department of Health and Human Services Packet, March 25, 2014.
[28] Montgomery County Council, HHS/ED Committee Worksession Packet, February 29, 2015.

5. Comparison to Other School Systems in Maryland and Virginia

OLO compared both community involvement in the design process and schools as community assets in other school systems.

a. Examples of Community Involvement in the Design Process

Since a feasibility study is required in Maryland and used by school systems in Virginia, OLO reviewed these documents to compare the level of community involvement in the design process in other school systems. OLO found that the level of involvement varied between jurisdictions.

Anne Arundel County Public Schools. Similar to both MCPS, Anne Arundel County Public Schools involves the community in the feasibility study process. Table 23 shows membership characteristics of two feasibility study teams for recent replacement school projects (both prototype schools). In comparison to MCPS, there are fewer participants.

Table 23. Anne Arundel County Public Schools (ACPS) Feasibility Study Team[29]

School	Year	Total Participants	Instructional Staff	ACPS Central Office Staff	Community	Other
Lothian	2015	13	6	3	2	1
Rolling Knolls	2016	11	5	3	2	1

Howard County Public Schools. A Planning Advisory Committee is formed after the design concept development stage. Similar to MCPS' feasibility study process, this committee reviews and provides input on the designs. Table 24 shows that while the overall total number of participants is similar to MCPS' feasibility studies, there are fewer community representatives involved. Additionally, since Howard County Public Schools utilizes prototype schools, the number of meetings required is reduced. For example, the Planning Advisory Committee for elementary school #42 reached a consensus in two meetings.[30]

Table 24. Howard County Public School System (HCPSS) Planning Advisory Committees Membership[31]

School	Year	Total Participants	Instructional Staff	HCPSS Central Office Staff	Community	Other
Ducketts Lane	2013	26	9	12	2	1
New Elementary #42	2018	33	13	15	3	1

[29] Anne Arundel County Public Schools Board of Education, Lothian Elementary Feasibility Study, September 21, 2011. See also Anne Arundel County Public Schools Board of Education, Rolling Knolls Elementary Feasibility Study, September 21, 2011.

[30] Howard County Public Schools Board of Education, New Elementary School #42 Schematic Design Report, July 9, 2015.

[31] *Ibid*. See also Howard County Public Schools Board of Education, New Elementary School #41 Schematic Design Report, June 9, 2011.

Arlington County Public Schools. Community involvement in the school design process in Arlington County is similar to MCPS.[32] Arlington Public Schools establishes two community groups to provide advice on school construction projects.

- Public Facilities Review Committee. This Committee, established by the Arlington County Board, reviews plans for community impact and approves proposed plans. The Committee for Discovery Elementary School (opened 2015) was comprised of 12 standing members and 9 committee members specifically for the Discovery Elementary project. Other attendees included Arlington County Public Schools, County Staff, and community observers. From September 2012 through November 2013 the Committee met nine times.
- Building Level Planning Committee. Similar to the MCPS feasibility study, this committee reviews and comments on approved project space and capacity, schematic design, community use and impact, safety and accessibility, and project implementation schedules. The committee's job is to gather community input and reach a consensus on the school design elements. Table 25 displays characteristic of the Building Level Planning Committee for Discovery Elementary School. From September 2012 to November 2013, the Discovery's Planning Committee met 16 times.

Table 25. Arlington Public Schools (APS) Building Level Planning Committee[33]

School	Year	Total Participants	Instructional Staff	APS Central Office Staff	Community	Other
Discovery	2015	31	8	5	12	6

b. Examples of Community Input on School Design and Schools as Community Assets.

OLO found examples of how community input and needs shaped school designs in Anne Arundel, Howard, and Arlington Counties. A summary of these examples are provided below.

Anne Arundel County Public Schools. Similar to other jurisdictions, schools in Anne Arundel County serve as community recreation centers.[34] For example, the educational specifications for Rolling Knolls Elementary School (opened 2016) included a 6,000 square foot gymnasium with an additional 2,400 square feet for before/after care.

Howard County Public Schools. In reviewing the Planning Advisory Committee documents for Ducketts Lane Elementary School, the design team incorporated the following site design elements based on committee input: bus loop and car parking pulled away from adjacent neighbors and located near community entrance; widening of Ducketts Lane for parking; additional entrance/exit from parking lot in case of emergency; privacy fence on north side of property; and former wetlands area developed into infiltration and storm water management educational amphitheater. The cost estimate of site design between the schematic design and design document

[32] Interviews with Industry members.
[33] Public Facilities Review Committee, New ES#1 (Williamsburg MS Campus) Meeting Summary, April 17, 2013, available at https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/5/2014/01/pfrc_Apr1713_ESSummary.pdf.Arlington Public Schools, Design and Construction, Discovery Elementary School.
[34] The Cost of School Construction, pp 8-9.

stage increased 34% from approximately $2.4 million to $3.3 million. Additional design alterations were also made after the selection of the Ducketts Lane site, including rotating the building 180 degrees.[35]

Arlington Public Schools. Similar to Anne Arundel County, Arlington extensively uses their school facilities as recreation facilities. Table 26 highlights the cost of providing additional community recreation facilities at Discovery Elementary. Arlington County approved a total of 34 community amenities (with a combined cost of $3,136,242) at Discovery Elementary. The table highlights the items related to recreation facilities. These costs are shared by Arlington Public Schools and Arlington County. If bid awards come in lower than the budgeted amount, the money is returned to a joint Arlington County Government/Arlington Public School fund. For example, Discovery Elementary bids were received 7.78% below cost estimates thus $264,510 was returned to the joint fund.

Table 26. Discovery Elementary - Cost of Community Assets[36]

Community Amenity	Cost
Two Artificial Turf Fields, Including Stormwater Management Costs	$1,339,952
Increased Size of Gym beyond Elementary School Standard	$524,900
Baseball/Softball Field, including Bermuda Grass Outfield with Irrigation	$226,900
Offsite Safe Routes to School Improvements	$150,000
Baseball/Softball Field, including Bermuda Grass Outfield with Irrigation	$235,800
Restroom Facilities and Drinking Fountains	$76,300
Retractable Basketball Baskets in Gym	$52,600
Parks and Recreation Storage Room in Gym	$41,500
Soccer Goals for Artificial Turf Fields	$30,600
Exterior Basketball Court Lighting and Topcoat	$30,200
Total	**$2,708,752**

C. Prototype Designs

One design method utilized by school systems to reduce project schedules and to achieve costs savings is the use of prototype school building designs. The use of prototype school building designs varies depending on schools system policies, school location, and school type. However, the use of prototype school building designs can limit the level of community involvement in the design process discussed in Section B.

1. Prototype School Buildings

School building prototype designs are currently used in Maryland, including Montgomery County. This section addresses the use of prototypes.

[35] Howard County Public Schools Board of Education, New Elementary School #41 Design Document Report, September 8, 2011.
[36] Arlington Public Schools, Allocation of Funds for Community Amenities from Arlington County Government/ Arlington County Public Schools Joint Fund, March 25, 2014.

a. Definition

Prototype school designs are construction plans that can be used in the construction of multiple schools with minor modifications. School systems use prototype designs in three ways:

- School systems can hire an architect to design a prototype school that is tailored to the local educational program and future needs;
- School systems can utilize an "off the shelf" design from a selection of tested school plans; or
- School systems can use predesigned modules that can be arranged in different configurations to fit different sites.[37]

To date, school districts in Maryland primarily employ the first approach. As discussed below, the State's 21st Century School Facilities Commission is considering developing a set of "off the shelf" plans for school systems.

b. Use of prototypes

School systems use prototype school building designs to achieve time and cost savings. In practice, prototypes have most commonly been used by state-run programs and large, rapidly growing districts.

State-Run Prototype Design Programs. The State's 21st Century School Commission is considering an option to provide a certain number of "off the shelf" school designs to build schools more quickly and potentially at lower cost (See page 5 for a description of the Commission). However, while a few states offer state-wide school designs, a study by the Council of Educational Facility Planners International concluded that this approach was not practical on a statewide level and did not result in cost savings due to the large effort to maintain a significant number of designs and to keep them current. For example, the State of California estimated that it would need 32 designs to respond to grade configurations, capacity, varying terrain, soil conditions, and climate. Additionally, costs would increase to update the plans and develop new designs. According to the American Institute of Architects 2006 review of prototype plans, 25 states developed state-wide prototype designs and all 25 abandoned their use after learning that it was costly and were receiving an inferior product.

Large, Rapidly Growing School Districts. Rapidly growing districts utilize prototypes to achieve cost savings, provide an educationally sound learning environment, and build schools on a condensed time frame. When prototype designs are used repeatedly and consistently over time to build a large number of schools with favorable site conditions, fast growth districts are able to experience efficiencies of scale and accrue both cost savings and long term school quality.

This approach has been used in the past by MCPS. In 2005, to take advantage of economies of scale in an expensive construction market and manage enrollment growth, MCPS bid two new elementary schools as a joint project. Table 27, on the following page, shows the joint cost of construction for Great Seneca Creek (Germantown) and Little Bennett (Clarksburg) Elementary Schools. Although construction costs were bid jointly,

[37] Laura A. Wernick, et. al., "Prototype School Designs: Can Prototypes be Used Successfully?" p. 19.

the architecture award was bid separately. The cost of architectural services (bid in 2003) decreased for the second school, Little Bennett, by $238,537 compared to cost for the first school, Great Seneca Creek.[38]

Table 27. Cost of Joint Prototype Project – MCPS

School	Total Sq. Ft.	Architectural Contract Award	Cost/ Sq. Ft.	Adjusted Cost*	Adjusted Cost/Sq. Ft.
Great Seneca Creek	82,511	$850,000	$10.30	$1,103,069	$13.37
Little Bennett	82,511	$611,463	$7.41	$793,513	$9.62

*Based on 2016 CPI Semiannual Average

c. Examples of Prototype Design Use in Maryland

MCPS has utilized prototype school designs for elementary and middle schools. In addition Anne Arundel, Frederick, and Howard Counties use prototype school designs for elementary, middle, and high schools.

- **Montgomery County**. In the last 10 years, MCPS used a prototype school design for joint construction of two elementary schools – Great Seneca Creek and Little Bennett Elementary Schools. This prototype design was replicated at William Gibbs (2008) and Wilson Wims Elementary Schools (2014).[39] In addition to using prototypes for entire school buildings, MCPS staff note that successful designs for defined sections of a school (i.e., administration space, classroom wing, and gymnasium) may be replicated at other schools.[40]
- **Anne Arundel County**. Ten new and replacement elementary schools, with the eleventh currently in design, were constructed using an elementary school prototype design.[41]
- **Howard County**. Four elementary schools were constructed using the most recent prototype school design, including Ducketts Lane (opened in 2013) and New Elementary School #42 (currently in design). For Elementary School #42, the school district elected to modify the original 2003 design to accommodate larger capacity. In total, the school district adopted 16 design changes, including an enlarged administration suite and health rooms, added second ESOL room, added a 6th kindergarten classroom, and provided a special education extended learning room.[42]
- **Frederick County**. Frederick County developed its most recent prototype design in 2012 with the design and construction of a replacement school for North Frederick Elementary School (opened in 2015). This design is being used for two new elementary schools planned for opening in 2018 – Butterfly Ridge and

[38] MCPS Board of Education, Award of Contracts – Northwest Elementary School #7 and Clarksburg/Damascus Elementary School #7, April 25, 2005; MCPS Board of Education Resolution No. 453-03 Architectural Appointment – Northwest Elementary #7, September 9, 2003; MCPS Board of Education Resolution No. 500-03 Architectural Appointment – Clarksburg/Damascus #7, October 14, 2003.
[39] Interagency Committee on School Construction, Meeting Minutes June 13, 2013.
[40] Meetings with MCPS staff
[41] Maryland Association of Counties, 2016 School Construction Symposium, June 30, 2016.
[42] HCPSS Board of Education, New Elementary School #42 Schematic Design Report, July 9, 2015.

Sugarloaf Elementary. While both schools will include park and recreation spaces, the design for Butterfly Ridge will also include added space to accommodate Title I Programs.[43]

2. Cost Savings of Prototype Designs

Potential cost efficiencies depend on the number of times a prototype school design is used and how the design must change to meet subsequent program and code requirements.[44]

a. Architectural Fees

Cost savings are typically achieved through reduced architectural fees. Use of prototype designs is estimated to save between 10.0% and 25.0% of architectural costs or around 0.5% to 1.5% of total building construction costs.[45] For example, in September 2011, Frederick County Public Schools awarded an architecture contract for North Frederick Elementary School for $1,119,340. This prototype school design was also used in 2013 for Sugarloaf Elementary School. The architecture contract award for Sugarloaf Elementary was 23.0% lower ($935,000) than for North Frederick Elementary.[46]

Cost savings however are not always achieved. For example, while the use of a prototype design decreased architectural costs for Sugarloaf Elementary, costs increased for the third iteration of the design - Butterfly Ridge Elementary School. The contract award increased from $935,000 to $1,163,015, a difference of $228,015 or 20%. [47] As mentioned previously, the design for Butterfly Ridge incorporated additional space for Title I programs that were not included in Sugarloaf Elementary School. Additionally, if the site is not compatible with the prototype, then cost savings are not generated because the building will need to be redesigned.[48]

OLO reviewed approved MCPS architectural contracts in 2006 and 2011, two years in which MCPS utilized an elementary prototype in Germantown and Clarksburg. The two new schools that used prototype designs experienced architectural cost savings relative to replacement schools. In 2006, the architectural award for William Gibbs Elementary School was $703,000 ($8.58 per square foot) compared to Bells Mill Elementary, $672,000 ($9.22 per square foot) and Cashell Elementary School $1,140,605 ($16.02). A similar difference in cost is observed in 2011. The architectural contract award for Wilson Wims Elementary School was $825,000 ($8.97 per square foot) compared to Rock Creek Forest Elementary School, $1,130,000 ($11.51 per square foot) and Candlewood Elementary School, $1,300,000 ($15.81 per square foot). [49]

---

[43] Frederick County Public Schools, Butterfly Ridge Elementary School; Sugarloaf Elementary School, available at http://www.fcps.org/facilities/major-projects.cfm.
[44] Maryland Association of Counties, 2016 School Construction Symposium, June 30, 2016.
[45] Maryland Association of Counties, 2016 School Construction Symposium, June 30, 2016.
[46] FCPS Board of Education, Action Consent – Urbana Elementary School Architect Contract, September 11, 2003.
[47] FCPS Board of Education, The New West Frederick City Area Elementary School – Architect Appointment, July 9, 2014.
[48] Jenna M. Aker, "Get Educated on Prototype Design" Buildings – Smarter Facility Management, available at http://www.buildings.com/article-details/articleid/8020/title/get-educated-on-prototype-design.aspx.
[49] MCPS Board of Education, Architectural Appointment Candlewood Elementary, Clarksburg Village Site #1, and Rock Creek Forest, August 24, 2011; MCPS Board of Education, Gibbs (Clarksburg/Damascus #8), October 10, 2006, Bells Mill, August 24, 2006, Cashell, October 23, 2006.

b. Timeframe and Contractor Familiarity

Prototypes school designs enable a school system to modify an existing plan thus reducing the time needed to design a new building. Further, once a prototype is used several times, the design is well understood and the time to construct the building can be defined fairly precisely. Not only does a reduction in the project timeframe reduce costs, but also school systems can plan and construct within tighter, better defined time frames.[50]

c. Construction Costs and Contingency Costs

As successive iterations of prototypes are designed and constructed, contractors develop familiarity and expertise with the design, thus reducing construction errors. As familiarity increases, contractors bids become more accurate. Reuse of prototype designs may result in fewer construction errors and change orders.[51] This can result in a potential reduction of contingency costs by approximately 0.5% to 2.5%.[52]

3. Policy Tradeoffs with Prototype Designs

At a June 2016 Maryland Association of Counties symposium on school construction costs, a panel discussed policy tradeoffs with using repeat prototype designs. Table 28, on the following page, presents the benefits and drawbacks presented at the Symposium.

4. Comparison to Other Counties in Maryland and Virginia

As mentioned above, the use of prototypes varies based on individual school system priorities and practices, school location, and school type. Anne Arundel, Frederick, and Howard Counties use elementary school prototype designs more frequently than MCPS. These counties also use prototypes for both new and replacement schools. In contrast, MCPS prototype school design use has been more limited to new greenfield sites in rapidly growing areas in the northern part of the County. Nonetheless, MCPS will replicate successful designs of building sections at other schools.

Similar to Maryland, prototype design choices remain with individual Virginia school districts. Loudoun County Public Schools, a rapidly growing district, developed prototype designs for elementary, middle, and high schools. The use of prototype designs in Loudoun County began in the 1990's. Since then the school system has used four prototype designs to build 34 elementary schools.[53]

[50] Prototype School Designs: Can Prototypes be Used Successfully?"
[51] Interviews with school systems and industry members.
[52] Maryland Association of Counties, 2016 School Construction Symposium, June 30, 2016.
[53] Loudoun County Public Schools, "Elementary School Facility Spaces & Potential Full Day Kindergarten Implementation," June 3, 2015.

Table 28. Benefits and Drawbacks to Prototype School Designs

Category	Potential Benefits of Prototype Designs	Potential Drawbacks of Prototype Designs
BOE	• Familiarity streamlines BOE review process	• Requires state-wide uniformity to educational specifications • Board members may be less responsive to local constituent needs
Community Needs	• Program and amenities equity across jurisdictions	• Less responsive to community needs and input, local heritage, individual involvement
Educational Specification Planning	• Owner's program has been reviewed/approved • Scalability and modular approach meet site specific schools • Review by Board and Maryland State Department of Education easier because of previous approval of similar prototype	• Prototype may not match up with educational program • Little input from community/ stakeholders
Site Implications	• Times savings to concept plan	• No prototype sites - Less adaptable to size (capacity), site access, grading, utilities, climate, challenging sites • Site design governs critical schedule path
Design	• Time savings in all design phases • Owners/teachers can visit prototype • Modest cost savings in architect/engineering fees • Lessons learned applied to design • Standardized reuse of construction tested details • Minor individualization of brick, color, etc.	• Constraints to program and technology needs (magnet programs, special programs, community use) • Less community context, compatibility, scale • Less adaptability for LEED targets • Requires continual code adaptations
Codes and Permitting	• Streamlines Maryland State Department of Education and Department of General Services review process • Time savings on documents and County review • Fewer surprises from County inspectors	• Impact of local codes • Annual changing of codes, changes in national codes • Varying interpretations of authorities having jurisdiction and fire marshals
Bidding and Construction	• Easier to track • Familiarity of bidders – continuity of systems and less learning curve • Price modeling/budget control • Proven tested trade packaging • Efficiencies and submittal process • Already constructed conditions available for review • Refined construction schedule based on actual projects • Familiarity of the team resolves issues quickly	• Less adaptable to pricing trends • Less adaptable to material and contractors (assumes repeat contractors and perceived reduced competition for produces and vendors • Problems that occur later will be built into many buildings
Building Operations	• Familiarity with maintenance and systems • Stocking standardized materials • Benefits administration and safety agencies • Training standardization	• Less adaptive to current trends and newest products, systems • Less responsive to local services • Less competition for replacement part systems • Less compatibility with LEA system-wide components

Source: Maryland Association of Counties School Construction Symposium, Becoming One with Your School System: Repeat Design

D. OLO Summary Observations and Findings

1. State funding does not take into account variations in educational programs and policies of each school system, which affect total construction costs paid by local jurisdictions.

State funding is based on a standardized formula for calculating approved capacity and square feet requirements. As such, school system-specific policies and educational programs that require additional space beyond the State average are funded entirely by local dollars (i.e., class size reduction policies). For example, the State approved square foot allowance for Wilson Wims Elementary School was 74,052 square feet based on a student capacity of 669 students. The actual gross square feet for Wilson Wims is 91,931, a difference of roughly 17,800 square feet that was not included in the eligible square footage allowance funded by the State.

Two considerations arise when considering this gap. First, a funding calculation in which the State square feet allowance better mirrors the actual size of a current school building and would decrease the fiscal burden on counties. Second, unless the total amount of State funding increases, adjusting the maximum square feet allowance would not change the amount received by counties but merely would result in more funding for fewer schools each CIP cycle.

2. Board of Education policies prioritize community involvement in the design process, which can lengthen the planning stage of school construction.

School systems establish their own policies guiding community involvement in the school design process. All school systems reviewed conduct feasibility studies to determine the design and scope of a specific project. As part of this process, school systems invite community members, neighbors, school staff, and etc. to participate in the feasibility study process. However, OLO found variation in the level of community input across school systems. For example, as part of State-required feasibility studies, 32 to 100 individuals participate in MCPS project feasibility studies, compared with 26 to 33 individuals in Howard and Arlington Counties, and 11 to 13 individuals in Anne Arundel County. The number of meetings required ranged from two in Howard County to 16 in Arlington (MCPS held a maximum of seven meetings). Community involvement can impact design choices, scheduling, and project timetables, all of which affect project costs.

Anne Arundel, Frederick, and Howard County school systems use prototype school building designs, which are a single school design plan that is used to construct multiple schools. Prototype designs can limit opportunities for community input, but may reduce overall project schedules and design costs.

3. MCPS schools serve as community assets for non-educational programs, which often necessitate dedicated non-educational space within the school building resulting in construction cost increases.

In many jurisdictions, including Montgomery County, schools serve as community assets, housing recreation spaces (i.e., enlarged gymnasiums) and other County programs. There are costs associated with providing dedicated program space and these additional costs should be noted when comparing costs between schools. For example, dedicated recreation spaces added $2.7 million to the cost of Discovery Elementary in Arlington. Likewise, costs for constructing dedicated program space for School

Based Health Centers and the Linkages to Learning Programs in the County range from an additional $411,000 to $726,076, while dedicated child care space ranges from $276,952 to $433,899. Two cost savings approaches currently used by MCPS to reduce construction costs are (1) when possible MCPS establishes agreements with larger municipalities (i.e., the City of Rockville) to fund the difference between larger recreation spaces and current educational specifications and (2) provide opportunities to construct Health and Human Services program space as part of larger school construction projects versus stand-alone construction projects.

4. School systems that frequently using prototype designs see a reduction in architectural fees, change orders, and contingency costs. However, costs savings are dependent upon using a particular prototype plan multiple times.

Use of prototype designs is estimated to save between 10.0% and 25.0% of architectural costs or around 0.5% to 1.5% of total building construction costs. MCPS has realized architectural costs savings associated with use of prototypes, particularly in constructing schools in the northern region of the County. For example, the architectural contract award for Wilson Wims Elementary School (a prototype school) was $825,000 ($8.97 per square foot) compared to non-prototype schools like Rock Creek Forest Elementary School at $1,130,000 ($11.51 per square foot) and Candlewood Elementary School at $1,300,000 ($15.81 per square foot).

Further, once a prototype is used several times, the design is well understood and the timeframe to construct the building can be defined fairly precisely. This allows school systems to plan and construct within tighter, better-defined time frames. Additionally, reuse of prototype designs may result in fewer construction errors and change orders, which can reduce contingency costs by approximately 0.5% to 2.5%.

However, cost savings associated with prototype designs depend on the number of times a prototype plan is used, whether the design must be amended to meet new regulations or specific programs, and site conditions.

CHAPTER 8. COST FACTOR – MARKET CONDITIONS

Changing school construction costs reflect, in part, cyclical labor and materials market conditions. In the past decade alone, these market influences have contributed to rising costs in 2005-2006 resulting from increases in the prices of steel, petroleum-based products, labor, and fuel. By 2008, prices declined during the recession as construction companies bid at or below costs to win scarce contracts. More recently, construction costs have increased during the current post-recession recovery.[1] This chapter is organized into three sections.

- **Section A**, Labor and materials factors driving market conditions;
- **Section B**, Comparison to other school systems in Maryland and Virginia; and
- **Section C**, OLO summary observation and finding.

A. Drivers of Market Increases

One component of construction cost increases are external cost factors related to market influences.

1. Reduced Competition and Contractor Capacity

In recent years, improving economic conditions have increased work across all construction market segments, including residential, commercial, and public sector projects. These conditions have decreased the competition among bidders for school construction projects and indirectly led to greater school construction costs.[2]

While the post-recession market conditions increased job opportunities, construction industry capacity has not reached pre-recession numbers. The number of private construction firms in Maryland peaked in 2007 at approximately 22,300 employers. By 2013, there were approximately 19,400 employers, a decrease of 2,900.[3] This reduced the number of bidders for all projects. In addition, the reduction in capacity to supply construction materials increased costs and extended the timeframes for building completion.[4] For example, currently there are fewer large masonry subcontractors in the DC metropolitan region than existed prior to the recession. As masonry work is an essential component of school construction, this labor shortage has impacted general construction firms being able to find qualified subcontractors.[5]

2. Declining Skilled Workforce

Similar to the decrease in construction firms, the number of employees in construction fields in Maryland also decreased during the recession, from 225,000 workers in 2007 to 183,395 workers in 2013.[6] In addition, the current construction labor market is affected both by an aging workforce and fewer people entering the

[1] Larry Carson, "High Cost of Construction Hammers Md. Schools," The Baltimore Sun, September 9, 2005. See also, Office of the District of Columbia Auditor, Audit of Public School Construction Programs: A Literature Review, July 1, 2015.
[2] Robin Clark Eilenberg, "State Adjusts Formulas to Reflect Dramatic Increase in School Construction Costs," Maryland Association of Counties, September 18, 2015. See also David Lever, Report to the Capital Budget Subcommittee, Senate Budget and Taxation Committee, Public School Construction Program, March 1, 2016.
[3] Daraius Irani, Ph.D. and et al., "State of Maryland Construction Industry Bachelor's Degree Demand Analysis," Towson University Regional Economic Studies Institute, June 26, 2015, pp. 12-15.
[4] David Lever, March 1, 2016.
[5] School System and Industry Interviews.
[6] Daraius Irani, Ph.D. and et al., "State of Maryland Construction Industry Bachelor's Degree Demand Analysis,"

construction trades.[7] The most common effects of shrinking labor pools are the need to pay higher wages to maintain skilled workers and difficulty completing projects on time. [8] Further, the decline in the number of individuals entering construction trade professions could lead to higher project costs in the future.

B. Comparison to Other Counties in Maryland and Virginia

As mentioned by industry professionals and school systems staff, projects in the region compete in a similar labor market. Architectural firms and general contractors often work in multiple jurisdictions across the region. School construction projects in Montgomery County are bid and constructed within this regional economy. These projects are also affected by labor and materials markets both nationally and abroad. As such, increases and decreases in labor and materials markets are external cost factors that affect all school systems in the region.

C. OLO Summary Observation and Finding

1. Reduction in the labor force and the number of construction-related companies following the 2009-2010 recession increased costs for MCPS and all other school systems reviewed.

MCPS school construction projects are bid and constructed as part of a larger regional economy. As such, the effects of labor shortages and changes in material costs are external cost drivers largely independent of school system policies and practices. Additionally, as the workforce ages and fewer people enter the trade professions, MCPS is likely to see increases in labor costs in the future.

[7] School System and Industry Interviews.

[8] Gilbane, "Building for the Future: Construction Economics Market Conditions in Construction," Winter 2015-2016, available at http://www.gilbaneco.com/assets/Gilbane-Economic-Report-Winter-2015-16.pdf.

CHAPTER 9. MAJOR REPORT FINDINGS AND RECOMMENDED DISCUSSION QUESTIONS

This chapter summarizes the major findings of this report and presents the discussion questions developed by the Office of Legislative Oversight (OLO) based on the findings. This chapter includes two sections:

- Section A. Summary of major report findings; and
- Section B. OLO recommended discussion questions.

A. Major Report Findings

The major findings of this report include:

State School Construction Program and Funding Public School Construction (Chapter 2)

- State construction aid is limited to defined eligible costs based on square foot and capacity allowances, which is then reduced by a cost share formula based on a County's wealth. Local jurisdictions must fund all remaining construction costs.

- MCPS historically receives between $30.0 million and $40.0 million per year in State construction aid.

- MCPS typically must fund 80% to 85% of the total construction costs for each new and replacement school project.

Capital Construction Cost Components and Trends (Chapter 3)

- In recent years (FY2008 to FY2012), MCPS' construction costs per square foot have increased near the national average of 18% and have been lower than the regional increase of 25%.

- A comparison among school districts of construction costs per square foot alone fails to identify root causes of construction cost differences, which are significantly impacted by regulations and policy decisions.

Cost Factor – Procurement Policies and Practices (Chapter 4)

- State of Maryland school construction requirements include procurement policies that provide economic benefits to small, minority-, women-, disabled-owned businesses, but which can also decrease competition and increase labor costs.

- Maryland school systems are entitled to higher amounts of State aid if they require contractors pay prevailing wage rates. Requiring the payment of prevailing wage rates, however, may increase the cost of school construction. MCPS has opted to bid school construction projects without a prevailing wage requirement.

- MCPS has adopted procurement practices (i.e., use of bidding aesthetic or convenience items separately (also known as add-alternate bidding) that have resulted in better control of costs and maintenance of project schedules.

Cost Factor – Site Costs and Stormwater Management Regulations (Chapter 5)

- Local jurisdictions pay a majority of site costs. Based on the State's wealth adjusted cost share formula, MCPS receives a lower percentage of State aid for site costs compared to most jurisdictions.

- Recently updated State stormwater management regulations have increased the complexity of the construction process and site costs, requiring additional civil engineering services that are ineligible for State funds.

- More stringent County stormwater management requirements on redeveloped sites have the potential to increase site costs for replacement schools relative to other school systems in the State.

Cost Factor – High Performance Building Mandates (Chapter 6)

- State and County high performance building requirements mandating LEED certification add 2% to 5% to total construction costs compared to a non-LEED certified building.

- While high performance building components have higher initial costs, they have lower lifecycle costs and potentially provide long term cost savings.

Cost Factor – School Design Practices (Chapter 7)

- State funding does not take into account variations in educational programs and policies of each school system, which affect total construction costs paid by local jurisdictions.

- Board of Education policies prioritize community involvement in the design process, which can lengthen the planning stage of school construction.

- MCPS schools serve as community assets for non-educational programs, which often necessitate dedicated non-educational space within the school building resulting in construction cost increases.

- School systems that frequently using prototype designs see a reduction in architectural fees, change orders, and contingency costs. However, costs savings are dependent upon using a particular prototype plan multiple times.

Cost Factor – Market Conditions (Chapter 8)

- Reduction in the labor force and the number of construction-related companies following the 2009-2010 recession increased costs for MCPS and all other school systems reviewed.

B. Recommended Discussion Questions

Based on the findings presented above, OLO suggests that the Council discuss the following questions with MCPS representatives.

State Regulations. Construction costs in Maryland are, in part, dependent on State regulations and policies. Regulations, such as prevailing wage, MBE, LEED, and stormwater management regulations, promote larger public benefits, including higher wages and improved water quality. However, these regulations had a cumulative effect of increasing school construction costs.

Question #1. What amendments to State regulations could the Council and MCPS pursue that might result in reduced construction costs?

State Construction Aid. While the State provides school systems with construction aid, the funding formula is based on inadequate square foot allowances and fails to take into account variances in school system polices.

Question #2. Should the County propose amendments to the State aid construction formula to account for variations in school system policies, such as class size reduction? What impact would this have on funding?

County Regulations. County regulations and policies also contribute to school construction costs. OLO found that, in some cases, more stringent County polices, such as stormwater management regulations, could result in higher construction costs for MCPS relative to other jurisdictions in the State.

Question #3. Should the Council request additional information and data regarding the financial impact of County stormwater management regulations on school construction costs?

Question #4. In addition to stormwater management regulations, are there other opportunities to align County and State regulatory requirements that could result in school construction cost reductions?

Community Use. OLO found that schools in Montgomery County, similar to other jurisdictions, are used as extensively year round as community centers. While this policy demonstrates that MCPS schools are community assets, there are costs associated with constructing buildings to meet educational as well as community needs.

Question #5. As it is the County's policy to use school buildings as year round community facilities, how should the County measure its school construction costs relative to other jurisdictions that use school facilities differently?

School Building Design and Construction. As in other school districts, MCPS new and replacement schools provide flexible, adaptable space to accommodate changes in educational programs. School buildings across the State have increased in size to accommodate these changes leading to increased construction costs. Increasing construction costs coupled with projected enrollment growth affect the ability of MCPS to address current and future capital needs.

Question #6. Are there opportunities to adjust school building size and site requirements to reduce total construction costs?

Question #7. Would the increased use of prototype school building designs for new and replacement schools, as implemented by other school systems, allow MCPS to build schools at a faster rate, for lower cost, and provide equity of school buildings County-wide?

Question #8. Could project schedules and timelines be reduced through a review of policies and practices such as community involvement in the design process?

Labor and Market Conditions. Improving economic conditions in recent years have increased work across all construction market segments, including residential, commercial, and public sector projects. These conditions have decreased the competition among bidders for school construction projects and indirectly led to greater school construction costs. In addition, the construction labor market is affected both by an aging workforce and fewer people entering the construction trades, which can increase future costs.

Question #9. Are there opportunities for the Council to promote programs or policies that could enhance competition and promote growth in the construction labor market in the County?

CHAPTER 10. AGENCY COMMENTS

The Office of Legislative Oversight (OLO) circulated a final draft of this report to the Superintendent of the Montgomery County Public Schools (MCPS). OLO appreciates the time taken by MCPS staff to review the draft report and provide comments. The final report incorporates technical corrections provided by the MCPS. The written comments received from the Superintendent are attached in their entirety on the following pages.

MONTGOMERY COUNTY PUBLIC SCHOOLS
www.montgomeryschoolsmd.org
MARYLAND

November 9, 2016

Malcolm Baldrige National Quality Award
2010 Award Recipient

Dr. Chris Cihlar, Director
Montgomery County Office of Legislative Oversight
Stella B. Werner Council Office Building
100 Maryland Avenue
Rockville, Maryland 20850

Dear Dr. Cihlar:

Thank you for the opportunity to review and comment on the Office of Legislative Oversight (OLO) Report 2017-4, New School Construction Costs. We appreciate OLO's thorough review of the many factors that affect construction costs not only in the Montgomery County Public Schools (MCPS) construction program but for our regional colleagues as well.

We agree generally with the findings of the report. As the report clearly documents, a wide variety of national and local dynamics impact school construction requirements and costs. It is important to note, as the report does, that local funds support 80–85 percent of total new and replacement school construction costs. Without increases in the overall level of state aid for school construction, changes in these costs will continue to fall to local revenues.

MCPS is continually searching for more efficient and effective ways to deliver the facility projects in the MCPS Capital Improvements Program. In navigating the shifting landscape of construction costs and requirements, our focus will continue to be on quality control processes during the planning, designing, and construction phases of the projects. These processes are critical cost containment efforts to avoid, to the extent possible, unforeseen conditions that typically generate additional time and costly change orders.

Again, thank you for your thorough examination of school construction costs and for your collaborative work on this report. We look forward to discussing the report and the issues raised with the County Council. If you have any questions, please contact me at 301-279-3626 or Mr. James Song, director, Department of Facilities Management, at 240-314-1064.

Sincerely,

Andrew M. Zuckerman, Ed.D.
Chief Operating Officer

AMZ:JS:acs
Copy to:
Members of the Montgomery County Council
Members of the Board of Education
Executive Staff
Mr. Adams
Mr. Song
Ms. Bryant

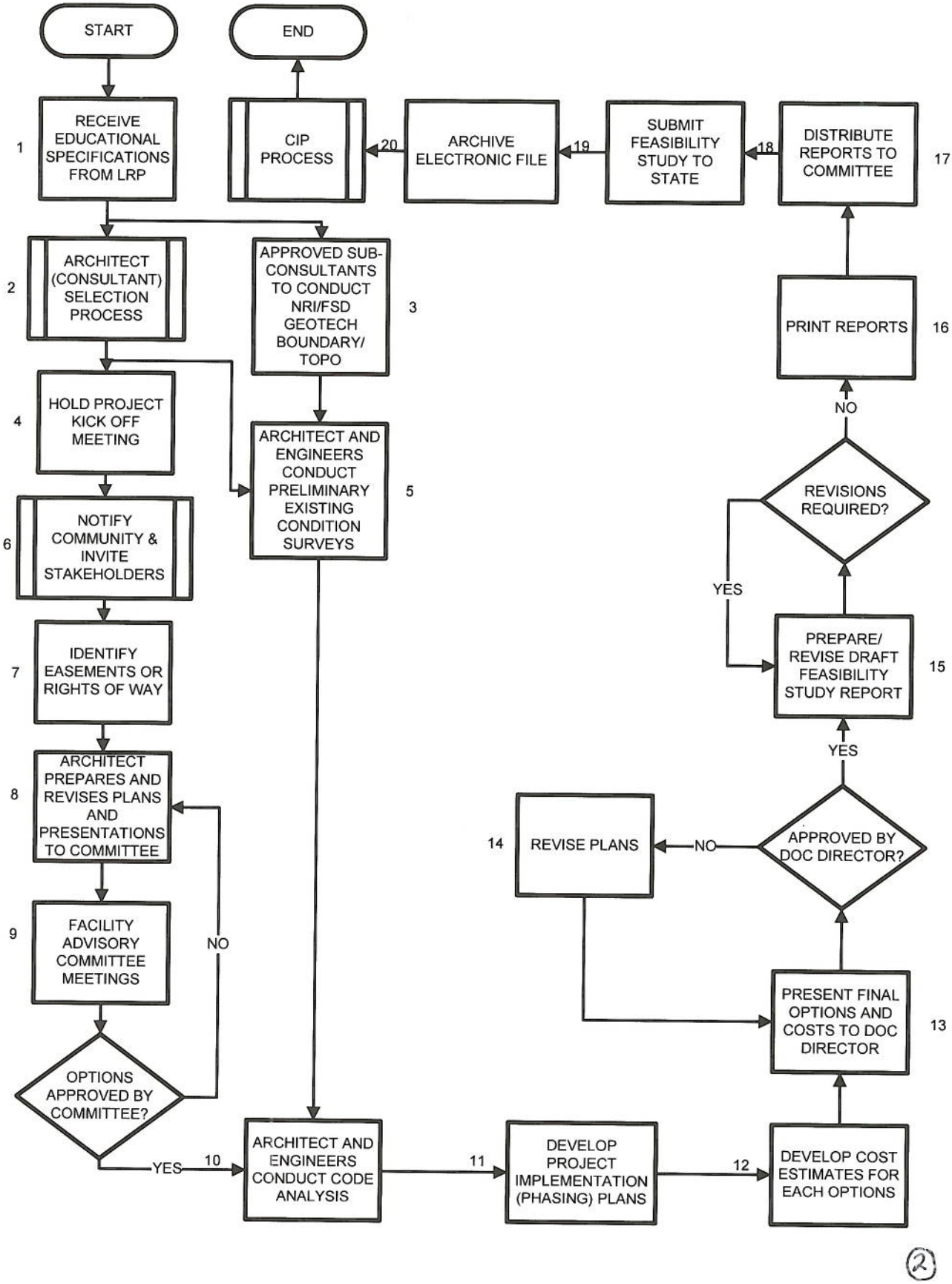
LIST OF APPENDICES

Appendix A

MCPS Division of Construction
Construction Process Documents

Feasibility Study Process

Division of Construction, MCPS



FEASIBILITY STUDY PROCESS

1. The space summary and educational specifications for a project are developed by the planners in the Division of Long-Range Planning.

2. An architect/engineer is chosen through the architectural selection process.

3. MCPS hires consultants to conduct a Natural Resources Inventory/Forest Stand Delineation plan, boundary and topographical surveys, and a geotechnical test and report.

4. The project kick-off meeting is held at the school site. This meeting consists of the school principal, another staff member, a representative of the PTA, the design architect, planner and the DOC project manager. The primary purpose of the meeting is to set the schedule for the Feasibility Study Committee (FSC) meetings to be held during the feasibility phase of design. Typically, there are 4-5 meetings which are held alternatively in the late afternoon or evening to accommodate a larger number of participants, both staff and community.

5. Architect and engineers conduct a preliminary existing condition survey of the site and building.

6. The principal is requested to put the meeting schedule on the school web-site (if any) or otherwise disseminate the information to parents. The PTA may also have on-line communication avenues to send out the meeting schedule to members. The Division of Construction sends out letters to adjacent property owners and community associations surrounding the school. Depending on the make-up of the community, the letters will be sent in several languages to notify as many people as possible. A sign advertising the meetings is to be posted on school property.

7. Easements or rights-of-way are identified for planning purposes.

8. The architect prepares a draft showing 2 or 3 possible design solutions for the project to present to the committee.

9. The FSC meets to review the architect's recommendations. If they disagree with his results, the plan will be revised and resubmitted to the committee until it meets with their approval.

10. In conjunction with the site studies, and existing condition survey, the architect/engineer conducts a code analysis to incorporate the information into the study.

11. An implementation plan for project phasing is developed, if required.

12. Costs for each option are developed to provide estimates for budgeting purposes.

13. The final options are presented to the DOC director for review and approval.

14. If the options do not meet with approval, they are revised and resubmitted.

15. The architect prepares a draft of the feasibility study report and will make revisions if required.

16. The report will be printed by the MCPS contract printer.

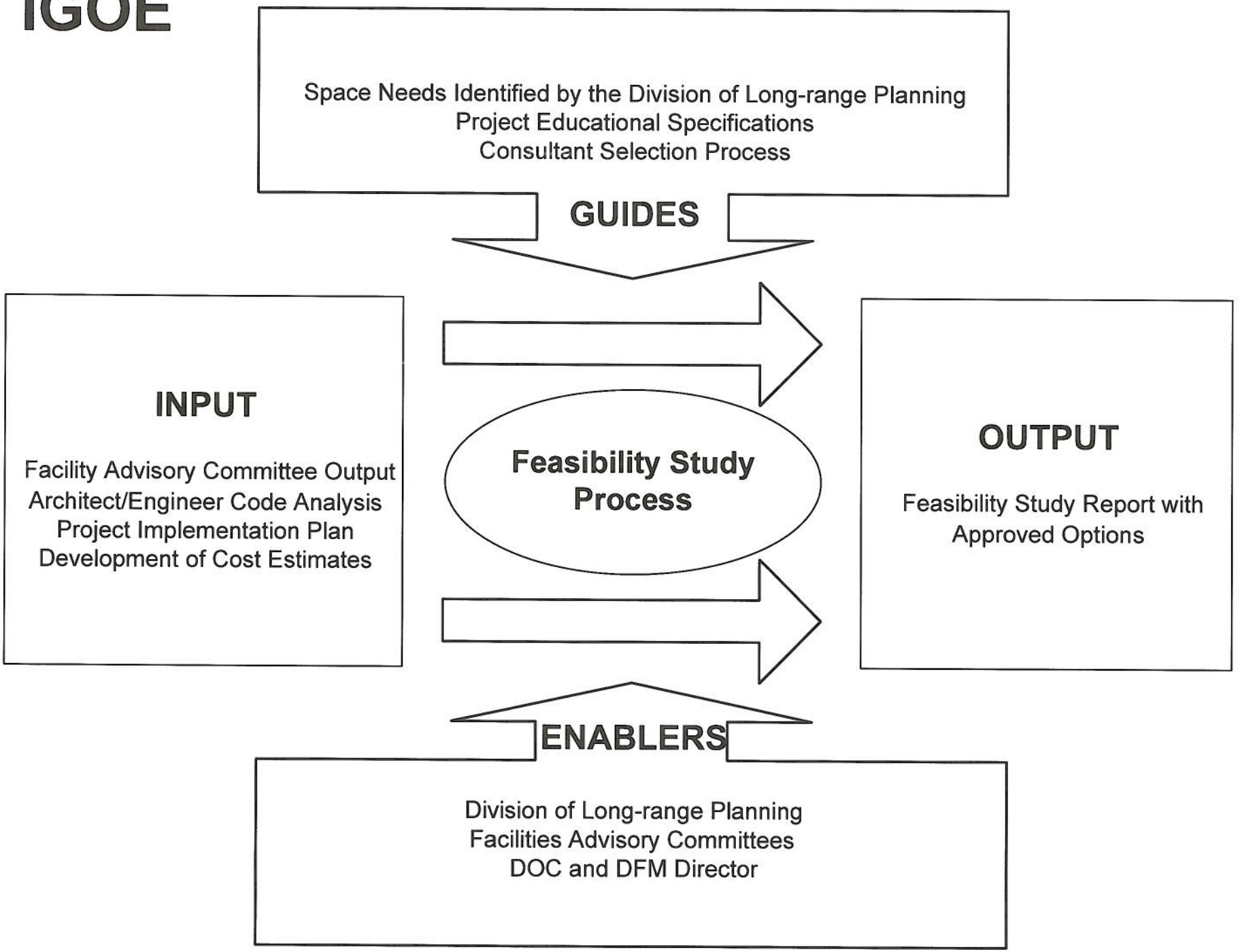
17. The report will be distributed to the committee and other stakeholders.

18. The feasibility study is submitted to the MSDE for review.

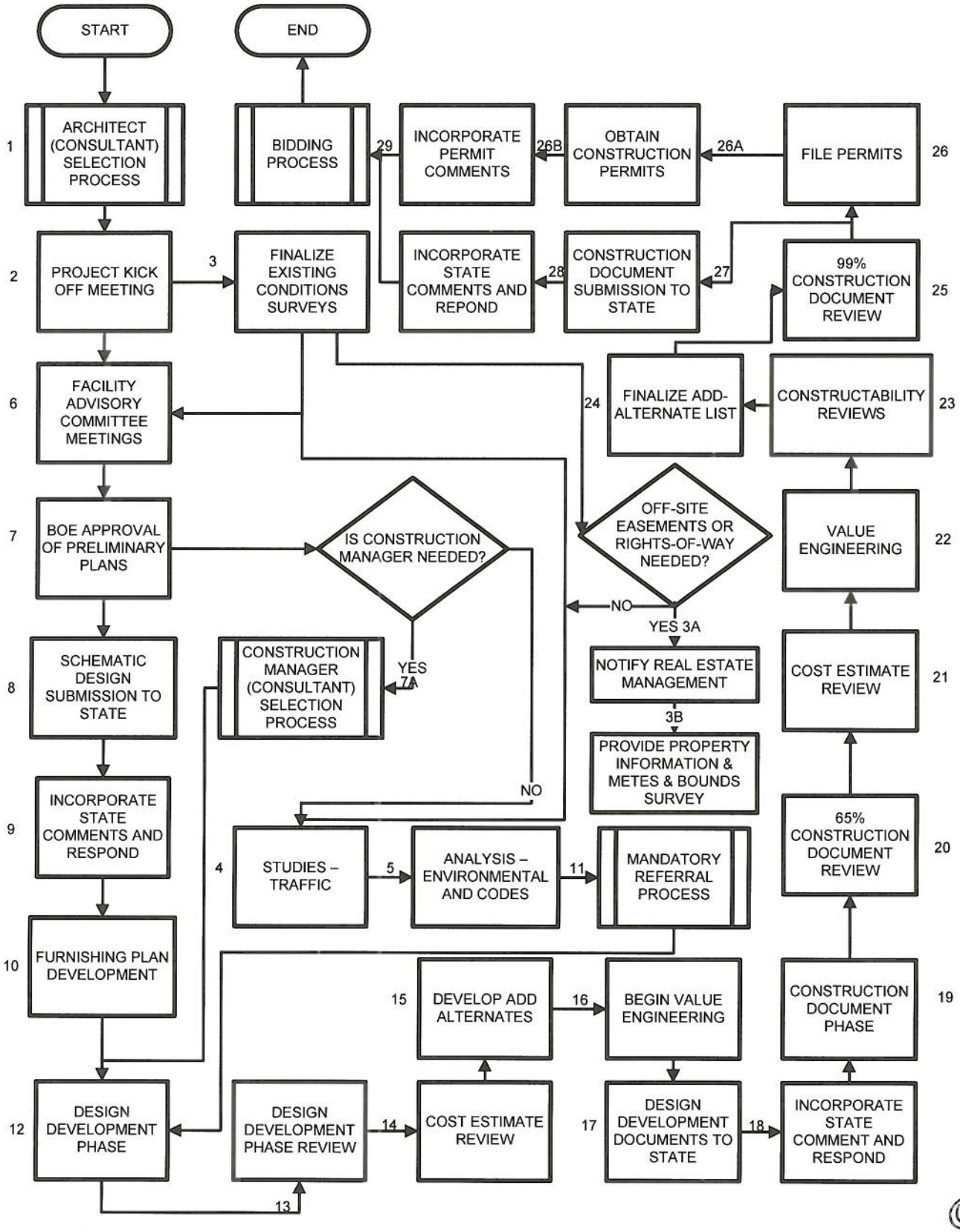
19. The architect sends an electronic file of the feasibility study to MCPS for archival purposes.

20. The project is included in the next CIP process for consideration.

IGOE


Space Needs Identified by the Division of Long-range Planning
Project Educational Specifications
Consultant Selection Process
GUIDES
INPUT
Facility Advisory Committee Output
Architect/Engineer Code Analysis
Project Implementation Plan
Development of Cost Estimates
Feasibility Study Process
OUTPUT
Feasibility Study Report with Approved Options
ENABLERS
Division of Long-range Planning
Facilities Advisory Committees
DOC and DFM Director

Design Process



DESIGN PROCESS

1. The architect is selected through the consultant selection process. The option is given to the selection committee to keep the same architect that was chosen and completed the feasibility study.

2. The project kick-off meeting is held at the school site. This meeting consists of the school principal, another staff member, a representative of the PTA, the design architect and the DOC project manager. The primary purpose of the meeting is to set the schedule for the Facility Advisory Committee (FAC) meetings to be held during the schematic phase of design. Typically, there are 4-5 meetings which are held alternatively in the late afternoon or evening to accommodate a larger number of participants, both staff and community.

    - The principal is requested to put the meeting schedule on the school web-site (if any) or otherwise disseminate the information to parents.
    - The PTA may also have on-line communication avenues to send out the meeting schedule to members.
    - The Division of Construction sends out letters to adjacent property owners and community associations surrounding the school. Depending on the make-up of the community, the letters will be sent in several languages to notify as many people as possible.
    - A sign advertising the meetings is to be posted on school property.

3. The existing conditions survey is done by the architect/engineers during the feasibility study process. The information needs to be finalized to prepare for the Mandatory Referral Process.

3A. If an off-site easement or right-of-way is needed, the real estate management team must be notified to begin the process.

3B. DOC will request the architect to have his consultants provide a metes and bounds survey to attach to the easement for approval by the Board of Education.

4. A traffic study needs to be completed by the architect's consultant to be submitted for the Mandatory Referral Process.

5. The environmental analysis which is done during the feasibility study and the code analysis are prepared by the architect/engineer to be submitted for the Mandatory Referral Process.

6. The composition of the FAC is anyone who wishes to attend the meetings to provide input to the design process. Educational specifications developed by MCPS staff will be reviewed in consultation with the FAC. Viewpoints of all participants will be included in the review of architectural plans and their

concerns will be considered during the design stage before the plans are finalized. The outcome of these meetings is a brochure produced by the architect showing the preliminary plans for the project that will be sent to the Board of Education for approval.

7. The Board of Education will review the preliminary plans presentation and solicit comments from the DOC, project architect, school staff and PTA representatives. If the Board approves the plans, a resolution doing the same will be passed.

7A. If the project is determined to be of significant complexity to require a construction manager, one will be chosen through the consultant selection process and sent to the Board of Education for approval for the construction manager to perform pre-construction services during the design phases.

8. The schematic brochure design is submitted to Maryland State Department of Education (MSDE) for review and response.

9. Comments sent by MSDE are responded to and incorporated into the design when necessary.

10. A quarter scale plan of the rooms are provided in order to make tentative furniture placements so that data and telephone outlets can be located on the plans. This takes place at a meeting of the DOC project manager, design architect, curriculum coordinators, school principal and staff for particular areas of the school. Once these decisions are made, the information is provided to the electrical engineer to incorporate into the drawings.

11. The Mandatory Referral Process while advisory in nature, requires submitting the project to the Maryland National Capital Park & Planning board for approval. They are reviewing the site plan, storm water management, LEED requirements, traffic patterns, light pollution, pervious areas and a general community concurrence with the project. MNCP&P environmental planning division reviews the forest conservation plan required by the County and State and enforce forest conservation laws. This process can be done simultaneously with the design development phase.

12. The design development phase can proceed while the Mandatory Referral Process is ongoing. Design development will refine the schematic design and locate all the required spaces into the design.

13. At the end of the design development phase, a set of 35% documents will be reviewed by DOC staff to determine if the plans are progressing in accordance with the educational specifications and facility design guidelines.

14. At this stage a cost estimate will be developed and reviewed to compare to the original budget estimate.

15. Add alternates to the construction documents are items that the team would like to see incorporated into the plans and specifications that are over and above the educational specifications. Should adequate funding be available to accept any of the alternates, they would be considered in the award process. However, it is understood that the base bid would fulfill all the required specifications. The process of developing add alternates to account for 10% of the project bid is by request of the Board of Education and would begin at this time.

16. A value engineering review will begin during this stage to find the most cost effective ways to construct the project.

17. The design development documents are submitted to MSDE for review and comment.

18. Comments sent by MSDE are responded to and incorporated into the design when necessary.

19. The preparation of construction documents for finalizing the design begins.

20. When the construction documents are 65% complete, sets will be printed for review by DOC staff, school staff and curriculum coordinators along with the project architect to determine if the design meets the program needs and is following the educational specifications and facility design guidelines.

    - Staff comments will be incorporated into the design.

21. Another review of the cost estimate takes place to compare to the original budget estimate.

22. Now that the plan is more developed, more extensive value engineering can take place to review systems and plans for cost effectiveness.

23. Constructability reviews will be done by either the construction manager or an outside consultant to determine if the plans as drawn are constructible.

24. The list of add alternates will be finalized to include with the bid documents.

25. The last review (99%) of the construction documents takes place to be sure all previous comments from staff and constructability reviews have been incorporated into the plans.

26. The architect/engineer files for the required permits for the project.

26A. Construction permits are reviewed and obtained from the various agencies.

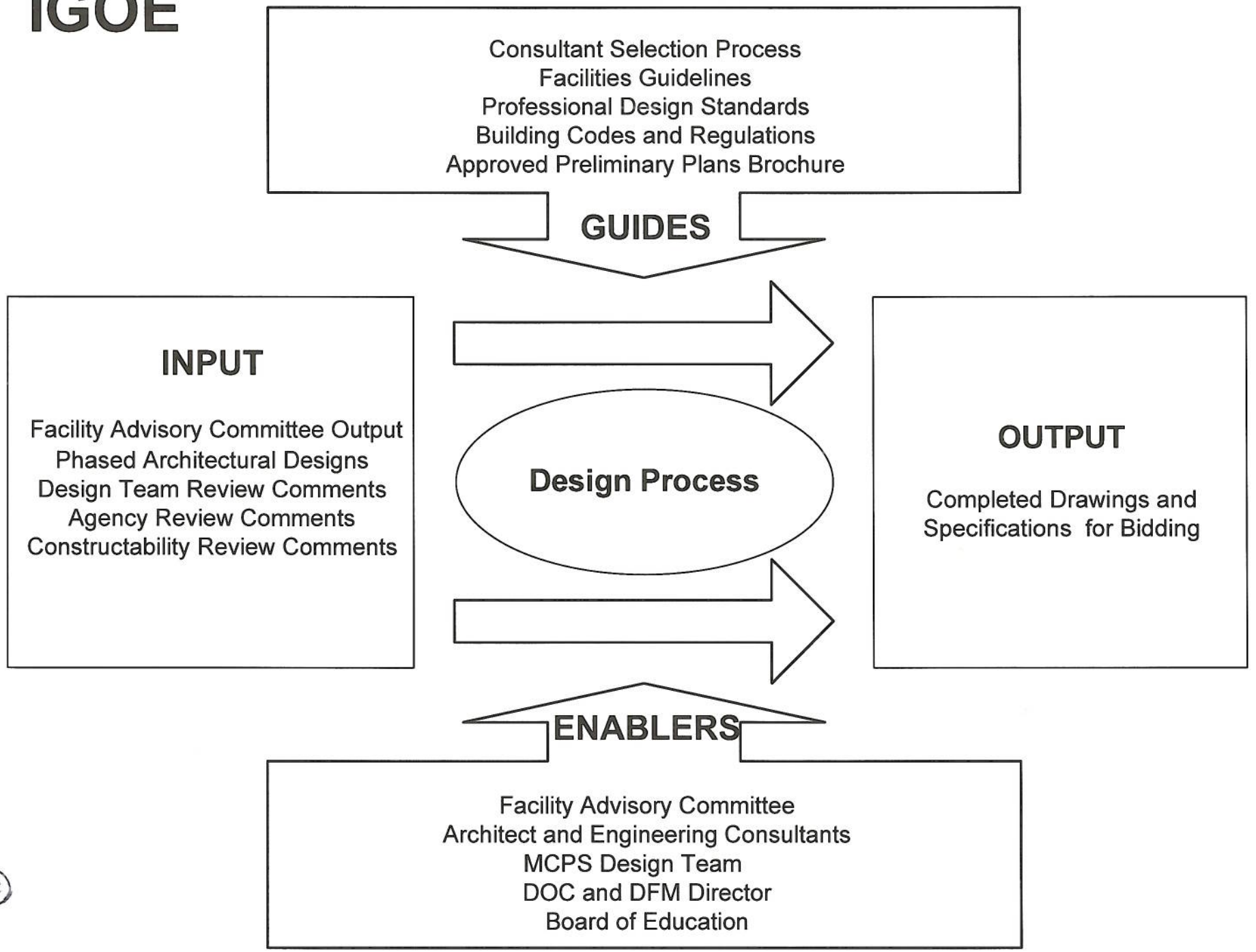
26B. Reviewing agency comments are incorporated into the construction documents.

27. The construction documents are submitted to MSDE for review and comment.

28. Comments sent by MSDE are responded to and incorporated into the design when necessary.

29. Plans are completed and the project moves into the bidding process.

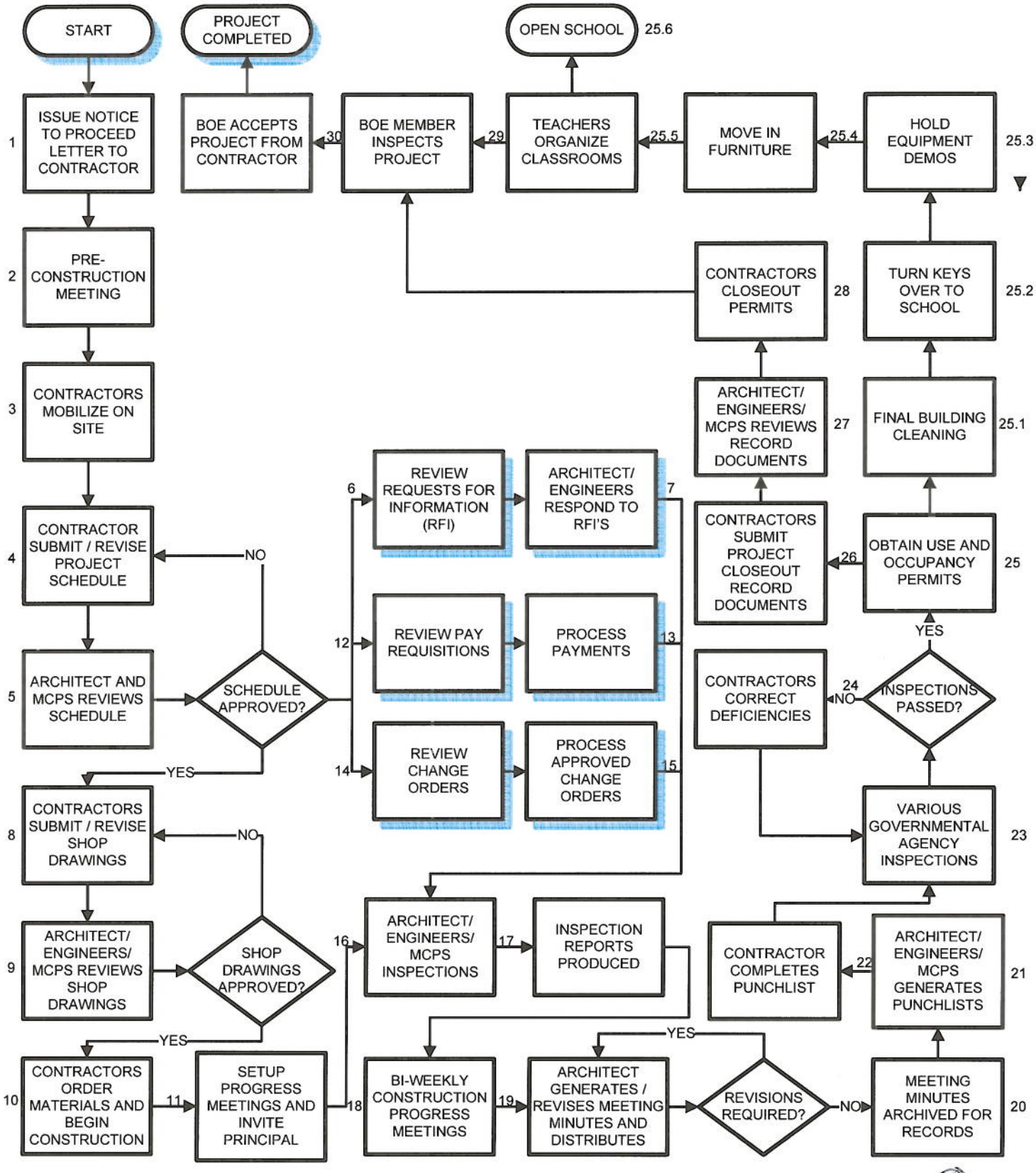
IGOE


Consultant Selection Process
Facilities Guidelines
Professional Design Standards
Building Codes and Regulations
Approved Preliminary Plans Brochure
GUIDES
INPUT
Facility Advisory Committee Output
Phased Architectural Designs
Design Team Review Comments
Agency Review Comments
Constructability Review Comments
Design Process
OUTPUT
Completed Drawings and
Specifications for Bidding
ENABLERS
Facility Advisory Committee
Architect and Engineering Consultants
MCPS Design Team
DOC and DFM Director
Board of Education

Construction Administration Process

February 1, 2009

Division of Construction, MCPS



CONSTRUCTION ADMINISTRATION PROCESS

1. The contractor is issued a Notice to Proceed and an inspector(s) is assigned to the project.

2. Construction team leader convenes a pre-construction meeting for the design team, contractor and sub-contractors on the project.

3. Contractors mobilize on site.

4. Contractor submits the project schedule.

5. Architect and MCPS construction team review the schedule for approval.

    - If the schedule is not approved, the contractor must revise and resubmit.

6. Contractors submit Requests for Information (RFI's) to the architect/engineer.

7. Architect/engineer responds to the RFI's in a timely manner (14 days).

8. Contractor provides submittals required by the contract.

9. Architect and MCPS construction team review the submittals for approval.

    - If the submittals are not approved, the contractor must revise and resubmit.

10. The contractors order the material and begin construction according to the schedule.

11. A bi-weekly progress meeting schedule is prepared. The principal is invited but not required to attend. Participants include, the construction team leader, project inspector(s), the general contractor's or construction manager's project manager, superintendent, and applicable trade contractors. The architect presides over the meetings. His consultants attend as necessary to the progress of the job.

12. The architect/engineer and MCPS construction team review the contractor's pay requisitions monthly at a progress meeting. The contractor usually will bring a pencil copy to the meeting and make revisions after comments by the team.

13. The architect signs off on the final pay requisition and forwards it to the financial team in DOC for payment.

14. The contractor or construction manager submits potential change orders (PCO's) to the architect.

- The architect sends the PCO to the appropriate consultant for review which includes the review of whether the request is actually a change to the contract documents and if the cost is appropriate.
- When the initial review is completed, the PCO is discussed at the progress meetings and given final approval by the architect and MCPS staff.

15. The architect or construction manager processes approved change orders for submission to the MCPS financial team.

    - The financial team reviews the documentation for compliance with the contract documents and forwards to the construction team leader for a final review. When that is completed, the director signs the change order and it is returned to the contractor.

16. The architect/engineer and MCPS staff inspects work in place.

17. The MCPS inspector produces a daily inspection report for the record.

18. The progress meetings are held to discuss outstanding issues and the schedule is updated if necessary.

19. The architect generates and distributes minutes of the meetings in order to track issues and record the progress of the project.

    - After distribution to all attendees, the recipients may have comments or disagree with the content of the minutes.
    - The architect will revise the minutes as necessary to reflect the actual discussions which took place.

20. The meeting minutes will be archived for the project records and as a starting point for the next progress meeting.

21. After substantial completion of the project and submission by the contractor of a punch list, the architect/engineer along with MCPS staff generate a final punch list of incomplete items or unacceptable work.

22. The contractor completes the punch list.

23. Inspections by various local and state agencies take place.

    - If inspections are not passed, a list of deficiencies is produced by the inspecting agency.

24. The contractor must correct the deficiencies and call for a re-inspection(s).

25. The final use and occupancy permit is given by the Montgomery County Fire Marshal.

    25.1 The final cleaning of the building is completed.
    25.2 The keys are turned over to the school administration.
    25.3 Equipment demonstrations are held for staff and maintenance personnel.
    25.4 The Department of Materials Management moves the furniture and equipment into the building.
    25.5 The teachers move in their supplies and organize the classrooms.
    25.6 School opens.

26. Contractors submit the project close-out documents which consist of the as-builts, Operations and Maintenance Manuals (O&M's) and warranties.

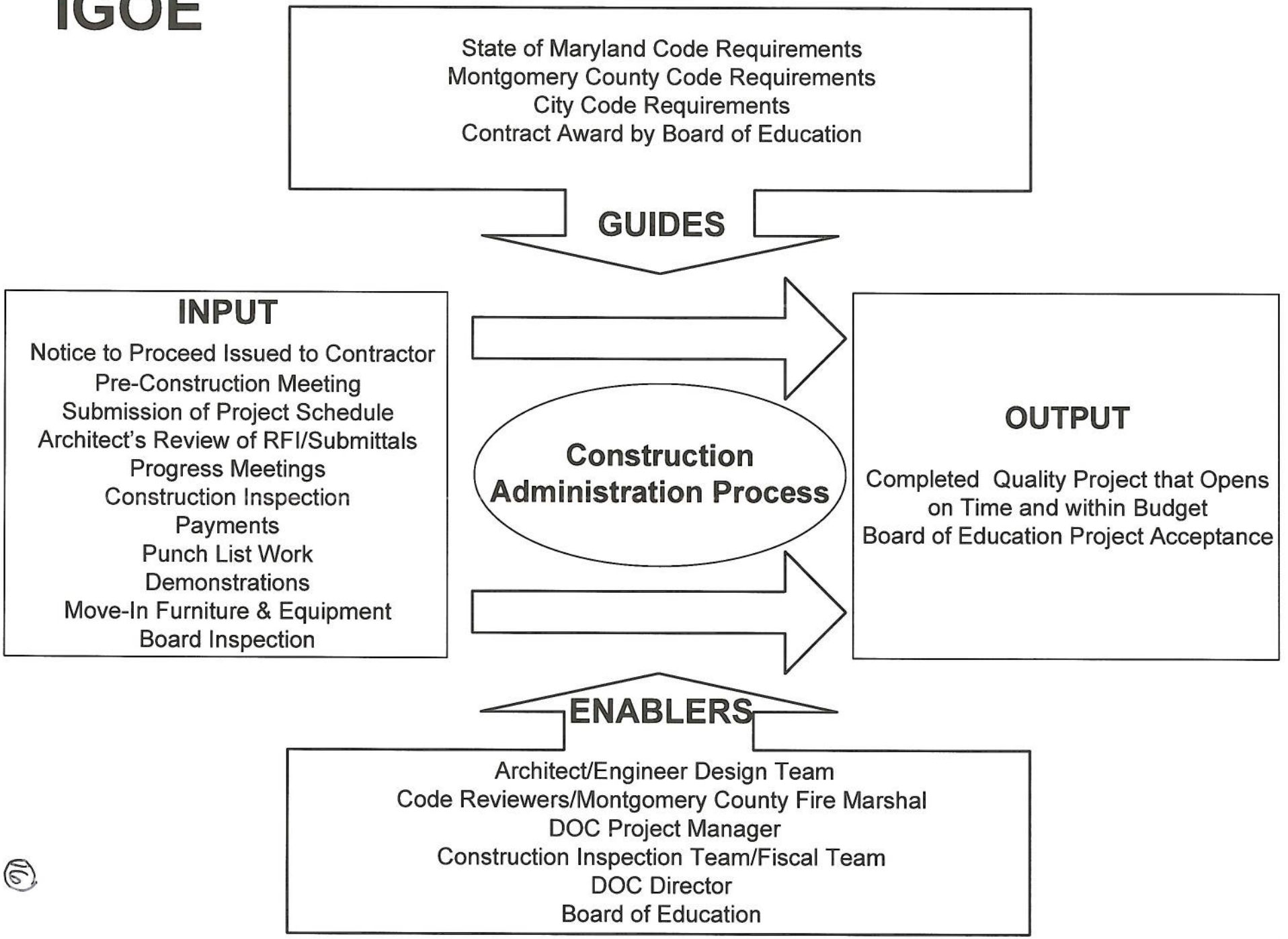
27. Architects/engineers review the close-out documents for accuracy and completeness.

28. The contractor closes out all the required project permits and submits documentation to various agencies.

29. The project is inspected by the Board of Education and an action item is put on the next available agenda for approval.

30. The Board of Education accepts the project from the contractor.

IGOE


State of Maryland Code Requirements
Montgomery County Code Requirements
City Code Requirements
Contract Award by Board of Education
GUIDES
INPUT
Notice to Proceed Issued to Contractor
Pre-Construction Meeting
Submission of Project Schedule
Architect's Review of RFI/Submittals
Progress Meetings
Construction Inspection
Payments
Punch List Work
Demonstrations
Move-In Furniture & Equipment
Board Inspection
Construction Administration Process
OUTPUT
Completed Quality Project that Opens on Time and within Budget
Board of Education Project Acceptance
ENABLERS
Architect/Engineer Design Team
Code Reviewers/Montgomery County Fire Marshal
DOC Project Manager
Construction Inspection Team/Fiscal Team
DOC Director
Board of Education

Appendix B

Wilson Wims Elementary School
LEED Scorecard

LEED BD+C: Schools v3 - LEED 2009

Wilson Wims Elementary School

LEED GOLD 2015

12520 Blue Sky Drive
Clarksburg, MD 20871
United States
Map

Overview | Scorecard | Stories

LEED Scorecard — Gold 65/110

SUSTAINABLE SITES		**15 OF 24**
SSc1	Site selection	1 / 1
SSc10	Joint use of facilities	1 / 1
SSc2	Development density and community connectivity	0 / 4
SSc3	Brownfield redevelopment	0 / 1
SSc4.1	Alternative transportation - public transportation access	4 / 4
SSc4.2	Alternative transportation - bicycle storage and changing rooms	1 / 1
SSc4.3	Alternative transportation - low-emitting and fuel-efficient vehicles	2 / 2
SSc4.4	Alternative transportation - parking capacity	2 / 2
SSc5.1	Site development - protect or restore habitat	0 / 1
SSc5.2	Site development - maximize open space	1 / 1
SSc6.1	Stormwater design - quantity control	0 / 1
SSc6.2	Stormwater design - quality control	1 / 1
SSc7.1	Heat island effect - nonroof	0 / 1
SSc7.2	Heat island effect - roof	1 / 1
SSc8	Light pollution reduction	1 / 1
SSc9	Site master plan	0 / 1
WATER EFFICIENCY		**6 OF 11**
WEc1	Water efficient landscaping	4 / 4
WEc2	Innovative wastewater technologies	0 / 2
WEc3	Water use reduction	2 / 4
WEc4	Process water use reduction	0 / 1
ENERGY & ATMOSPHERE		**19 OF 33**
EAc1	Optimize energy performance	14 / 19

EAc2	On-site renewable energy	0 / 7
EAc3	Enhanced commissioning	2 / 2
EAc4	Enhanced refrigerant management	0 / 1
EAc5	Measurement and verification	1 / 2
EAc6	Green power	2 / 2

MATERIAL & RESOURCES — 6 OF 13

MRc1.1	Building reuse - maintain existing walls, floors and roof	0 / 2
MRc1.2	Building reuse - maintain interior nonstructural elements	0 / 1
MRc2	Construction waste management	2 / 2
MRc3	Materials reuse	0 / 2
MRc4	Recycled content	1 / 2
MRc5	Regional materials	2 / 2
MRc6	Rapidly renewable materials	0 / 1
MRc7	Certified wood	1 / 1

INDOOR ENVIRONMENTAL QUALITY — 11 OF 19

EQc1	Outdoor air delivery monitoring	0 / 1
EQc10	Mold prevention	0 / 1
EQc2	Increased ventilation	0 / 1
EQc3.1	Construction IAQ management plan - during construction	1 / 1
EQc3.2	Construction IAQ management plan - before occupancy	1 / 1
EQc4	Low-emitting materials	3 / 4
EQc5	Indoor chemical and pollutant source control	0 / 1
EQc6.1	Controllability of systems - lighting	1 / 1
EQc6.2	Controllability of systems - thermal comfort	1 / 1
EQc7.1	Thermal comfort - design	1 / 1
EQc7.2	Thermal comfort - verification	1 / 1
EQc8.1	Daylight and views - daylight	1 / 3
EQc8.2	Daylight and views - views	1 / 1
EQc9	Enhanced acoustical performance	0 / 1

INNOVATION — 5 OF 6

IDc1	Innovation in design	+ 4
IDc2	LEED Accredited Professional	+ 1
IDc3	The school as a teaching tool	+ 0

REGIONAL PRIORITY CREDITS		3 OF 4 
SSc1	Site selection	+ 1
SSc4.4	Alternative transportation - parking capacity	+ 1
WEc1	Water efficient landscaping	+ 1

INTEGRATIVE PROCESS CREDITS		0 OF 3 
IPpc100	Passive Survivability and Functionality During Emergencies	0 / 1
IPpc98	Assessment and Planning for Resilience	0 / 1
IPpc99	Design for Enhanced Resilience	0 / 1