O'Connor Construction Management, Inc.

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Draft Report

COST STUDY for Arlington Public Schools

Arlington, Virginia

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EXECUTIVE SUMMARY

Summary

Arlington Public Schools' (APS) construction costs are, on average, comparable to those in Fairfax, Loudoun, Alexandria City, Washington, DC, and Montgomery County, Maryland.

Particular challenges - such as restrictive site constraints, lack of available undeveloped (or even developed) land, and a stringent community engagement process, to name a few - all add additional costs to APS' construction projects.

Other school divisions generally do not have to address these challenges. Their school costs (both hard and soft costs) are, as a result, sometimes lower than APS' costs.

In spite of these additional required costs, APS' most recent construction projects are comparable in price - in both hard and soft costs - to any of those in neighboring school divisions.

School Divisions Analyzed

OCMI collected cost data for about 30 schools including granular, line-by-line division cost data for 13 schools.

To ensure costs were accurately comparable, OCMI researched and analyzed new construction or major renovation projects completed within the past five (5) years. In addition, we gathered data on projects currently in design or construction.

County/Community Engagement Process

The intense level of community engagement and its required processes are one of the primary reasons why A/E and PM fees for APS' schools are higher, in some instances, than other similar neighboring schools.

In one example, for Discovery Elementary School, APS' A/E and Project Management fees were four (4) percent higher primarily because of this process.

Nonetheless, on average, APS' A/E and PM fees are still comparable to other division's costs.

APS-Unique Cost Items

Because of community engagement requirements and challenges with site density, APS' projects incur additional expenses unlike other school divisions.

For example, during construction, Contractors are unable to use a school's athletic fields for temporary parking purposes, because they must stay in use throughout construction.

Another high-cost item to APS is off-site parking requirements for staff and others during construction. Projected total parking costs are $554,000 due to these requirements: $314,000 for contractor parking, plus $240,000 for Middle School staff parking until the Fleet garage opens.

In addition, total permit fees for the construction of Fleet Elementary School are expected to exceed $500,000.

Uniform Design Specification

Each APS school is designed to meet the particular needs of the community's students. Unlike other school divisions, which can develop uniform design specifications for all of its schools, APS' schools are unique; no two schools are exactly alike. Thus, its overall construction costs reflect the community's design needs.

A/E Fees & Prototype Designs

Unlike other school divisions that do not have similar site constraints and that have readily accessible land for new construction development, APS is unable to take advantage

of any cost savings associated with the use of prototype designs.

Neighboring school divisions, such as Loudoun and Montgomery County, which use prototype design, generally have lower total A/E soft costs, ranging from 0.5% to 1.5% of the project's total construction cost.

These schools divisions are able to develop prototype designs due to readily accessible and available land for development of new school construction. APS' situation is dissimilar, and thus prototype designs are not an option.

Construction Manager-at-Risk

APS' use of the Construction Manager-at-Risk (CMaR) construction delivery method should decrease delays, cost increases, and poor construction quality. In addition, APS will be able to better manage and execute its projects, as the contracts risk is transferred to the awarded construction manager.

Construction/Project Management Fees

On average, APS' CM/PM costs are relatively similar to other neighboring school divisions. One explanation for why APS' costs are slightly higher is because of the increased staff involvement during the community engagement process (as previously discussed).

Furniture, Fixture, and Equipment Fees (FFE)

As a percentage of total construction costs, APS' FF&E fees are within the average of other neighboring school divisions. DC Public Schools is able to achieve additional cost savings with FF&E procurement due to their ability to access the GSA Federal Supply Schedule.

Elementary School Analysis

APS' elementary school costs are comparatively similar to Alexandria's and DC Public Schools - both school divisions which have challenges associated with site and land restrictions. Given the additional expenses associated with needed below-grade parking and costs stemming from Arlington County's community engagement process, APS' elementary school costs are still within the regional average.

High School Analysis

APS' high school construction costs are less than 9 of the 14 - or two-thirds - of the other projects analyzed for this cost comparison study.

In spite of additional costs associated with APS' site constraints and required public community engagement process, with few exceptions the costs of APS' high school projects are less than other equivalent projects in northern Virginia, the District, and Montgomery County.

Energy Usage Intensity

The Energy Usage Intensity (EUI) of recently completed APS projects is lower than nearly all other regional schools, in addition to besting the national average.

In addition, through its energy-saving design choices, APS is saving money in the long term on energy costs, and, in the instance of Discovery Elementary, it is generating excess power that may be used at other schools.

EXECUTIVE SUMMARY

Objective & Scope

The following “Cost Comparison Study” provides APS with a better understanding of the total project costs of its schools in comparison to several school systems from neighboring school divisions in Virginia (VA), Maryland (MD), and the District of Columbia (DC).

The data and information presented derives from publicly available sources, such as school division capital improvement plans/programs, respective state Departments of Education, and interviews with subject matter experts in the architecture, engineering, and construction industry. Project division costs are derived from division-provided contractor pay applications.

To support the conclusions presented, O’Connor Construction Management (OCMI) researched and analyzed construction projects completed within the past five (5) years for the following school divisions:

SCHOOL DIVISIONS STUDIED

- Arlington Public Schools (APS)
- Alexandria City Public Schools (ACPS)
- Fairfax County Public Schools (FCPS)
- Loudoun County Public Schools (LCPS)
- District of Columbia Public Schools (DCPS)
- Montgomery County Public Schools (MCPS)

- Denver Public Schools and San Diego Unified School District were not able to provide cost data for comparative purposes. Public information was not available to meet the needs of the APS cost study.

- Arlington Public Schools (APS)
- Alexandria City Public Schools (ACPS)
- Fairfax County Public Schools (FCPS)
- Loudoun County Public Schools (LCPS)
- District of Columbia Public Schools (DCPS)
- Montgomery County Public Schools (MCPS)

OCMI contacted Denver Public Schools and San Diego Unified School District. Neither was able to assist with providing cost data, nor was information comparable to meeting the needs of APS’ cost study publicly available.

In addition to OCMI’s coordination with APS, OCMI’s staff contacted other school divisions via phone calls and emails. On the following page are the results of these communications:

- Three (3) pay applications provided for LCPS via APS staff. LCPS informed us that additional information would not be made available, besides what is already publicly available.
- DCPS provided detailed pay applications on several projects; this information is included in our cost study and cost model.
- ACPS and FCPS did not return any of our requests for information.
- Absent detailed pay applications from school divisions, OCMI received missing cost data from the Virginia Department of Education.

Project Costs

Moreover, the data compiled of the school divisions' projects produce macro and micro perspectives that achieve the overall objectives APS has identified for its study.

Cumulatively, we have collected hard and soft cost data for about 30 schools and granular, line-by-line division cost data for 13 schools. The latter is included in Section 3 of our report.

For each of these school division projects, we have accumulated the following data:

- Total Project Cost
- Total Square Feet
- Total Seats
- Square Foot per Seat
- Total Cost per Seat
- Total Cost per Square Foot
- Occupancy Date

Hard & Soft Costs

When accurately comparing and analyzing costs between school divisions, OCMI defines hard and soft costs as follows:

- *Hard Costs* - Construction labor and materials, including building core and exterior/envelope, construction overhead, specialized mechanical and electrical services, specialized equipment, general requirements, and permitting.

- *Soft Costs* - Architecture/ Engineering, design, construction/ project management, and Furniture, Fixtures, and Equipment (FF&E).

Note: for FF&E costs, specialized and information technology equipment are included as part of the hard costs, when detailed cost information is available.

Energy Usage Data

Regarding Energy Usage Data, OCMI was able to obtain information related to some schools within APS, FCPS, and MCPS. Other school divisions did not provide this information publicly.

Overall, APS' energy usage intensity is better than local schools, in addition to the national average.

Additional Information

In OCMI's detailed write up of each school project, we provided a narrative that explains all, or parts of, the following: the project's scope, quality, amenities, sustainability, site challenges, and community satisfaction.

COUNTY/COMMUNITY ENGAGEMENT

WIMS & DISCOVERY ELEMENTARY COMMUNITY ENGAGEMENT COMPARISON

SCHOOL	YEAR COMPLETED	# OF MEETINGS	TOTAL PARTICIPANTS	INSTRUCTIONAL STAFF	DIVISION STAFF	COMMUNITY MEMBERS	OTHER
Wims Elementary School	2014	5	44	2	3	39	0
Discovery Elementary School*	2015	25	48	13	8	21	6

**Note: The above statistics for Discovery Elementary include participation from both the Public Facilities Review Committee and Building Level Planning Committee. The number of participants for Wims Elementary is estimated to the best of our ability, due to various conflicting pieces of information.*

County/Community Engagement

The stringent Arlington County approval and community engagement process is a significant factor contributing to APS' overall soft costs on each of its projects.

Requirements pertaining to the scope and level of Arlington County's approval and the local community's engagement process is unparalleled in comparison to other schools.

Arlington County established the Public Facilities Review Committee and APS the Building Level Planning Committee.

- *Public Facilities Review Committee*: "The Public Facilities Review Committee's mission is to ensure that the highest quality of land use planning, design, transportation planning, and other important community aspects are incorporated into civic projects as assigned to the Committee by the Arlington County Board. The Committee members are recommended by the County Commissions and, with the exception of Planning Commission members, are appointed by the County Board for staggered two year terms."
- *Building Level Planning Committee*: "Building Level Planning Committees work collaboratively with Design and Construction Services of the Facilities and Operations Department of the Arlington Public Schools to plan major renewal and new construction projects. These committees advise the project architects and school system staff on a variety of issues related to the preparation of the project plan including the application of approved program space requirements and capacity to meet local school needs, project schematic design, community

***To prevent any confusion on the part of the reviewer between Wilson Secondary School and Wilson Wims Elementary School, throughout the cost comparison study, the latter is referred to as Wims Elementary School.*

A&E / PM FEE COMPARISONS

SCHOOL	A&E FEE $	PM FEE $	TOTAL $
Wims Elementary School	$1.6M	$950K	$2.5M
Discovery Elementary School	$3.9M	$1.8M	$5.7M

**Note: the above costs represent the total A&E and PM fees for Wims and Discovery Elementary Schools. As much as 25% of the A/E fees and 15% of the PM fees are as a result of Arlington County's community engagement process.*

CONCLUSION

The intense level of community engagement and its required process are one of the primary reasons why A/E and PM fees for APS' schools are higher than other similar neighboring schools as evidenced in the comparison between Discovery Elementary and Wims Elementary Schools.

use and impact, safety and accessibility provisions, and project implementation schedules."

Wims & Discovery Elementary

To demonstrate the cost effects of the APS process on its school construction projects, OCMI presents data from Wims Elementary School** in Montgomery County and APS' Discovery Elementary School.

These schools were constructed within one (1) year of each other, and both offer similar - although not identical - program specifications.

Due to the County process imposed on APS' project, five (5) times the number of community meetings took place for Discovery versus Wims.

With respect to Discovery Elementary, while the total number of participants were only slightly higher, the number of meetings - which necessitated coordination and involvement of staffs from APS, and the A/E and PM firms - resulted in higher A/E and PM soft costs.

These additional costs derive from the significant investment of time associated with planning, preparing, participating, and following up for each County mandated meeting.

Other Division Community Engagement Process

Each school system has established their own policies regarding community engagement in the design and construction process of their projects. School systems include the community, school staff, and others to participate in the process.

Generally, school systems in the District, Maryland, and Virginia utilize a process that engages the community in the following areas:

- Site selection for new schools
- Facility design
- School boundary changes
- Facility-related focus groups
- School closures and consolidations

School systems that utilize prototype designs (which are not applicable to APS) – such as Loudoun and Montgomery Counties in particular – have limited opportunities for community engagement; thus, those school division's overall A/E and PM costs are lower, as evidenced by the instance of Wims as well as other school division projects.

Additional Cost Impacts

The level of engagement – number and type of participants, number of meetings, etc. – impacts the final design, scheduling, and construction time frame of a project. Each of these contributes and influences a project's overall construction cost.

On the following pages, OCMI discusses how the comprehensive nature of APS' community engagement process adds additional costs to its school construction projects.

COUNTY/COMMUNITY ENGAGEMENT

DISCOVERY ELEMENTARY COMMUNITY AMENITY COSTS

COMMUNITY AMENITY	COST	COMMUNITY AMENITY	COST
Field accessible walkways	$8,900	Drinking fountains serving gym and fields	$4,000
Field trash cans	$8,400	Field #3 grass infield	$27,100
Exterior basketball court lighting	$20,600	Field #3 player benches	$5,000
Exterior basketball court topcoat	$9,600	Field #3 backstop	$9,500
Class I bike storage	$0	Field 3 bases, home plate, and pitcher's mound	$2,000
Utility undergrounding	$93,800	Special inspection and testing for fields	$6,600
First responder network	$184,000	Field striping	$1,200
Portable generator connection	$178,000	Stormwater management associated with artificial turf fields	$32,300
Streetscape per Use Permit	$0	Soccer goals for artificial turf fields	$30,600
Connect Arlington conduit	$50,000	Field bleachers and accessible pads	$16,500
Bermuda turf outfield on field #3 w/ irrigation	$143,300	Stormwater pipe size upgraded at Harrison & 36th Streets	$111,000
Two (2) artificial turf fields (including base and underdrainage)	$1,307,652	Re-paving of Harrison & 36th Streets at end of project	$238,300
Parks and Recreation Storage Room	$41,500	Field #2 stormwater piping at softball fields	$40,000
Increased size of gymnasium*	$524,900	Offsite safe routes to school improvements	$150,000
Striping for Parks & Recreation gym use	$6,200	**Total**	**$3,400,752**
Volleyball court sleeves, standards, and net	$7,800	Reduction amount (bid received at 7.778% below cost estimate)	($264,510)
Retractable basketball baskets in gym	$52,600	**Revised Reduced Total**	**$3,136,242**
Restroom facility serving gym and fields	$72,300		

Community-Focused Spaces

Another side effect to greater community participation in the design and construction process is the increased opportunity to incorporate more community-focused spaces in schools, which add additional hard and soft costs to a school project.

APS' designs extensively integrate school and community spaces, increasing the overall costs of construction of their projects. The table above highlights the community amenities and their respective costs incorporated into APS' Discovery Elementary School.

As demonstrated, there is clear correlation between APS' community engagement process leading to additional design amenities, and thus increased construction costs.

**The increased size of the gym is now the size of the APS standard.*

SITE CONSTRAINTS

SITE CONSTRAINTS / PARKING COST COMPARISON

SITE CONSTRAINT / PARKING ALICE WEST FLEET ELEMENTARY SCHOOL	# OF PARKING SPACES	COST / PARKING SPACE	TOTAL PARKING COST
Existing Building with Below-Grade Parking	229	~$52,401.75	$12,000,000
Existing Building with On-Grade Parking**	229	~$20,000.00	$4,580,000
		DIFFERENCE IN PARKING COSTS	**$7,420,000**

Site Constraints

When evaluating costs by school division, for comparative purposes, it is best to review and analyze APS' school costs versus those in Washington, DC and Alexandria City.

Because, unlike other neighboring school divisions, like Fairfax, Loudoun, and Montgomery Counties, APS, Alexandria, and DC Public Schools have limited space to develop and build new school construction projects.

Namely, a dense urban environment presents unique site constraints to APS that affect its school construction costs in the following areas:

1. Parking
2. Education/Design Specifications
3. Prototype Designs

In the subsequent pages, OCMI provides detailed information on how each of these conditions, related to site constraints, represent a significant expense (in both hard and soft costs) to APS' school construction projects.

Parking Constraints

Because of site constraints, one of the most significant consequences imposed on APS' projects is parking availability.

For the new Alice West Fleet Elementary School, to accommodate the school and community's parking needs within the existing site constraints, APS has had to design and construct a below-grade parking garage, at considerable expense.

As the above chart illustrates, this expense is significant: the difference between below-grade and on-grade parking for the requisite number of parking spots is close to $7.5 million.

EDUCATION/DESIGN SPECIFICATIONS

Education/Design Specifications

Due to the dense urban environment of APS' schools, the school system does not have the luxury - like other similar school divisions - of developing uniform education and design specifications that can help control the costs of its projects.

With the availability of land (both developed and mostly undeveloped) school divisions, like Loudoun, Fairfax, and Montgomery Counties, can more easily and readily adopt education specifications that both meet the needs of its students and help control the costs of its projects.

To illustrate how education specifications affect the cost of a project's construction, OCMI has compared APS' Discovery Elementary School and MCPS' Wims Elementary School.

COMPARISON BETWEEN DISCOVERY & WIMS

SCHOOL	DATE OPENED	TOTAL COST*	CAPACITY	SQUARE FEET	SITE SIZE
Wims Elementary School	2014	$30,632,033	740	91,931	9.3
Discovery Elementary School	2015	$43,803,807	684	97,588	10.01

**Costs are normalized to reflect 2018 costs.*

- Wims Elementary School opened in 2014 to relieve overcrowding and enrollment increases. This school is based on a prototype design used previously at three (3) MCPS elementary schools.
- The school is LEED Gold certified and is collocated with a local park. Wims accommodates 740 students provides 124 SF per student.
- Discovery opened in 2015 to relieve overcrowding and increasing enrollments.
- Discovery is performing as a Net Zero School: the building produces enough renewable energy to meet its own energy consumption requirements.
- Discovery's design includes solar panels; a geothermal well; solar pre-heat of domestic water; 100% LED lighting; and building dashboard system that tracks energy usage.
- Discovery Elementary accommodates 684 students and provides 143 SF per student.

COMPARISON BETWEEN WIMS & DISCOVERY EDUCATION PROGRAM SPECIFICATIONS

PROGRAM	WIMS ELEMENTARY SCHOOL		DISCOVERY ELEMENTARY SCHOOL	
Prekindergarten	1 Preschool Education Program Classroom		1 Virginia Preschool Initiative Classroom	16 students
			1 Montessori Classroom	23 students
Kindergarten	5 classrooms (1300 sq. ft. each)	22 students	4 classrooms (1,115 sq. ft. each)	23 students
General Classrooms	24 classrooms (900 sq ft. each) - 23 students		4 Grade 1 classrooms (1,025 sq. ft. each)	23 students
			16 Grade 2-5 classrooms (825 sq. ft. each)	22-23 students
			2 flex classrooms, (1) for Grades 1-2, (1) for Grades 3-5.	
			6 multi-use classrooms (4,595 total sq. ft.)	
Special Programs & Extended Learning Areas	• Large and small group rooms		• Dedicated classroom for ESOL & gifted students • Flexible learning spaces • Common work spaces	
Art & Music	• 1 art room • 1 music room • 1 instrumental music room • 1 multipurpose room		• 2 art rooms • 2 music classrooms • Stage	
Media Center	Media Center (4,590 sq. ft.)		Media Center (3,570 sq. ft.)	
Multipurpose Room/Cafeteria	Multipurpose Room/Cafeteria (4,680 sq. ft.)		Cafeteria (4,660 sq. ft.)	
Physical Education	4,450 total sq. ft. includes 3,700 sq. ft. gym		7,210 total sq. ft. includes a 6,100 sq. ft. gym; the size of gym is beyond the then-standard	
Community Use of Space	• Extra storage for before and aftercare		• Larger gym • Storage and space for Parks & Recreation, and before/after care	

EDUCATION/DESIGN SPECIFICATIONS

The tables on the previous pages highlight the cost differences, as well as the education and design specification differences between Wims and Discovery Elementary Schools.

Several observations can be made on what has contributed to the cost differences between the schools.

- Additional prekindergarten classrooms were constructed at Discovery Elementary School.
- With similar kindergarten student ratios, Wims has the largest sized kindergarten classrooms.
- Wims Elementary has the highest number of grade 1-5 classrooms with the most square feet per classroom. However, Discovery has fewer students per classroom in early elementary years.
- Additionally, Grade 1 classrooms are larger at Discovery Elementary.

CONCLUSION

APS does not have the luxury of developing uniform design specifications, due to the dense urban location of its schools; thus, each school is designed to meet the particular needs of the community's students. Thus, its overall construction costs are going to be greater than those of other neighboring divisions.

- Discovery has six (6) multi-use special education classrooms.
- Both schools provide flexible learning spaces in addition to classroom space.
- Discovery provides an additional art room and music stage, while Wims includes an additional multipurpose room.
- Physical education spaces are larger at Discovery to accommodate community use.

As illustrated, the education and design specifications of Discovery Elementary School meet the needs of the school's pedagogy, its students, and the community, thus leading to a more customized program.

This level of customization - also influenced by the community engagement process - equated to a subsequent increase in the school's construction costs.

PROTOTYPE DESIGNS

CONCLUSION

Unlike other school divisions that do not have similar site constraints and that have readily accessible land for development of new construction, APS is unable to take advantage of cost savings associated with the use of prototype designs. As a result, neighboring school divisions will generally have lower total A/E soft costs, ranging from 0.5 % to 1.5% of the project's total construction cost.

Prototype Designs

Unlike other school divisions, APS is not able to advantage of cost savings associated with using prototype designs for its school division projects.

Because of site constraints and lack of available land for new construction development, APS is unable to create prototype designs that are uniform and consistent from school-to-school. As a result, APS' A/E costs will be higher than those other school divisions that use prototype designs.

Loudoun, Fairfax, and Montgomery County Public School Systems use some form of prototype designs in the construction of new and renovated schools, with only minor modifications on each project.

These school divisions use prototype designs in three (3) ways:

1. Hire an A/E team to design a prototype school that is tailored to the local educational program and future needs
2. Utilize an "off the shelf" design from a selection of tested school plans
3. Use pre-designed modules that can be arranged in different configurations to fit the needs of the school's program and site conditions

According to a recent report conducted for the Montgomery County Public School System, school systems using prototype school designs generally experience reduced A/E fees, from 10% to 25%, or 0.5% to 1.5% of the total construction cost.

In addition, the study found that these school systems typically note fewer change orders and contingency costs. Over the past five (5) to ten (10) years, Loudoun, Fairfax, and Montgomery County schools have employed the first approach and, once the prototype designs were finalized, they have used the second or third option, on a project-by-project basis.

The use of prototype designs is popular in rapidly growing school divisions that do not have site constraints and have readily accessible land for new construction development.

However, as previously demonstrated, APS is not able to take advantage of cost savings associated with prototype designs because of its site constraints and limited availability of land.

PROTOTYPE DESIGNS

HOW PROTOTYPE DESIGNS ARE NOT APPLICABLE TO APS CONSTRUCTION PROJECTS

CATEGORY	
Community Needs	• Less responsive to APS' community needs and input, local history, individual involvement, etc.
Educational Planning	• Prototype design does not match up with specific to needs of the community and student population • Little input from community/ stakeholders, which does not meet APS' community involvement requirements
Site Implications	• Prototype designs are less adaptable to size (capacity), site access, grading, utilities, climate, challenging sites
Design	• Prototype designs present constraints to program and technology needs • Less community amenities, context, compatibility, scale • Less adaptability for sustainability targets
Codes & Permitting	• Prototype designs do not account for annual changing of codes, or changes in national codes • Varying interpretations of authorities having jurisdiction
Bidding & Construction	• Prototype designs are less adaptable to pricing trends • Less adaptable to material and contractors • Problems that occur later will have already been built into many buildings
Building Operations	• Prototype designs are less adaptive to current trends and newest products and systems • Less responsive to local services • Less competition for replacement part systems • Less compatibility with system-wide components

CONSTRUCTION DELIVERY METHODS

CONCLUSION

APS' use of the Construction Manager-at-Risk (CMaR) delivery method should decrease delays, cost increases, and poor quality construction. In addition, APS will be able to better manage and execute its projects, as the risk is transferred to the construction manager.

Construction Delivery Methods

School divisions, like APS, are increasingly using the Construction Manager-at-Risk (CMaR) method on its construction projects.

One of the advantages to utilizing CMaR is that some of the project risk is transferred to the contractor, offering a more controlled environment that allows the project to proceed on schedule and decreases the chances of change orders and poor construction quality.

CMR has also enabled APS to start projects and lock in subcontracts earlier, thus saving money in times of rapid escalation, such as the present.

Loudoun and Arlington Counties select a contract management method based on project type. In addition, Loudoun County will use CMaR for large high school projects, but use the traditional design-bid-build contracting method for elementary school construction projects.

OCMI understands that APS is using the CMaR method for its current and future projects. As such, based on the past performance of MCPS' use of CMaR, APS can expect to achieve similar results:

- From FY 2011 to FY 2015, on average 96 percent of MCPS projects were completed on budget.
- For three (3) of those years, MCPS achieved 100 percent of projects completed on budget.
- All 41 school projects completed during FY2011 to FY2015 opened on schedule.

The use of the CMaR delivery method has shown to assist school systems in better managing and executing their construction projects.

In addition, as part of its CMaR process, APS will be able to initiate cost control measures from the beginning of the project, during the design phase, and continue it through project completion and building occupancy.

CONSTRUCTION DELIVERY METHODS

CONCLUSION

On average, APS' CM/PM costs are relatively similar to other neighboring school divisions. One explanation for why APS' costs are slightly higher is because of the increased staff involvement - in time and resources - during the community engagement process.

COMPARISON OF CM/PM FEES BY SCHOOL DIVISION

SCHOOL	ARLINGTON	FAIRFAX	LOUDOUN	ALEXANDRIA	DC	MONTGOMERY
Average PM% of Total Construction $	4%	3%	3%	4%	2%	2%

Construction/Project Management

Each school division examined for this Cost Comparison Study utilizes internal project/construction management staff to oversee their projects.

In addition, most divisions hire an independent project/construction management firm to assist with the design process, cost estimating, and managing the actual construction of the building (depending on the size, scope, and complexity of the school project).

Like most of its neighboring school divisions, APS utilizes internal and external staff for construction and project management services.

Based on OCMI's analysis of school division projects, APS' CM/PM costs are relatively comparable to other school division costs. APS' costs are only slightly higher, most likely as a result of increased staff involvement during the community engagement process, as previously discussed.

FF&E FEES

CONCLUSION

As a percentage of total construction costs, APS' FF&E fees are within the average of other neighboring school divisions. DC Public Schools is able to achieve additional cost savings with FF&E procurement through the GSA Federal Supply Schedule.

COMPARISON OF FF&E COSTS BY SCHOOL DIVISION

SCHOOL	ARLINGTON	FAIRFAX	LOUDOUN	ALEXANDRIA	DC	MONTGOMERY
Average FF&E% of Total Construction $	4.5%	5%	4%	5%	3%	6%

FF&E FEES

APS' average expenses for Furniture, Fixtures, and Equipment (FF&E) are similar to other neighboring school divisions. The exception is DC Public Schools, which accesses the federal government's GSA Federal Supply Schedule, allowing DCPS to purchase FF&E items under the "most valuable customer status."

- As illustrated above, APS' FF&E costs are 4.5 percent of the project's total construction.
- Other neighboring school divisions spend between 4 to 6 percent of their project's total construction costs on FF&E.

ELEMENTARY SCHOOLS

SCHOOL	Division	CONSTRUCTION COMPLETION	HARD COST	SOFT COST	TOTAL COSTS
Kimball Elementary School	DC	Sept. 2019	$44.5M	$5.5M	$50.0M
Payne Elementary School	DC	Sept. 2015	$25.0M	$2.3M	$27.3M
Fort Belvoir Elementary School II	Fairfax	Sept. 2016	$22.6M	$4.4M	$27.0M
Goshen Post Elementary School	Loudoun	Sept. 2018	$28.3M	$5.6M	$33.9M
Madison Trust Elementary School	Loudoun	Sept. 2016	$23.8M	$4.4M	$28.2M
Alice West Fleet Elementary School	Arlington	Sept. 2019	$46.7M	$12.3M	$59.0M
Discovery Elementary School	Arlington	Sept. 2015	$36.3M	$7.5M	$43.8M
Jefferson-Houston PK-8 Combined School	Alexandria	Sept. 2014	$39.1M	$9.1M	$48.1M
Richard Montgomery Elementary School (#5)	Montgomery	Sept. 2018	$32.0M	$7.3M	$39.1M
Wims Elementary School	Montgomery	Sept. 2014	$25.5M	$5.2M	$30.6M

Elementary School Analysis

Illustrated above and on the next page are construction costs for elementary schools across Arlington, Fairfax, Loudoun, Alexandria, DC and Montgomery Counties.

- Cost have been normalized for completed projects to reflect construction costs as of 3/22/2018.
- Costs have been rounded for presentation purposes.
- GSF for Fleet Elementary does NOT include parking garage.

- Arlington's costs are higher due to site constraints and compliance with the community engagement process; given these constraints, overall APS' costs are comparatively better in cost to DC Public Schools and similar to Alexandria City.

SCHOOL	SF	STUDENT CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Kimball Elementary School	83,400	400	$599	$124.9K	209
Payne Elementary School	68,000	272	$401	$100.2K	250
Fort Belvoir Elementary School II	95,341	576	$283	$46.9K	166
Goshen Post Elementary School	136,200	988	$249	$34.3K	138
Madison Trust Elementary School	105,757	1012	$267	$27.9K	105
Alice West Fleet Elementary School	111,635	752	$421	$62.5K	148
Discovery Elementary School	97,588	684	$449	$64.0K	143
Jefferson-Houston PK-8 Combined School	124,500	805	$387	$59.8K	155
Richard Montgomery Elementary School (#5)	92,000	600	$425	$65.1K	153
Wims Elementary School	91,931	740	$333	$41.4K	124

- Costs of elementary schools in Fairfax, Loudoun, and Montgomery are lower than APS, Alexandria, and DC, because those divisions do not have site and size constraints, and they're able to utilize prototype designs to save on A/E costs.

CONCLUSION

Given additional expenses associated with needed below-grade parking for Fleet Elementary and costs stemming from Arlington County's community engagement process, APS' elementary school costs are comparatively better than Alexandria's and DC Public Schools - school divisions which also have challenges associated with site and land restrictions and urban density.

MIDDLE SCHOOLS

SCHOOL	Division	CONSTRUCTION COMPLETION	HARD COST	SOFT COST	TOTAL COSTS
Brambleton Middle School (MS-9)	Loudoun	Sept. 2017	$50.0M	$9.6M	$59.6M
Willard Middle School (MS-7)	Loudoun	Sept. 2018	$51.1M	$9.3M	$60.1M
Hallie Wells Middle School	Montgomery	Sept. 2016	$49.5M	$8.4M	$57.9M

Middle School Analysis

Illustrated above and on the next page are construction costs for middle schools. No APS middle schools were analyzed for this study.

- Cost have been normalized for completed projects to reflect construction costs as of 3/22/2018.
- Costs have been rounded for presentation purposes.

SCHOOL	SF	STUDENT CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Brambleton Middle School (MS-9)	184,593	1354	$333	$44.0K	136
Willard Middle School (MS-7)	185,251	1354	$326	$44.6K	137
Hallie Wells Middle School	154,400	988	$375	$58.6K	156

HIGH SCHOOLS

SCHOOL	Division	CONSTRUCTION COMPLETION	HARD COST	SOFT COST	TOTAL COSTS
Ballou High School	DC	Sept. 2016	$150.8M	$17.8M	$168.6
Duke Ellington School of the Arts	DC	Sept. 2017	$134.2M	$14.7M	$148.9M
Dunbar High School	DC	Sept. 2014	$121.5M	$9.3M	$130.8M
Francis L. Cardozo Middle & High School	DC	Sept. 2013	$123.4M	$11.0M	$134.4M
Howard D. Woodson High School	DC	Sept. 2012	$100.0M	$7.0M	$107M
Roosevelt High School	DC	Sept. 2015	$136.9M	$8.7M	$145.6M
Wakefield High School	Arlington	Sept. 2013	$103.2M	$15.4	$118.6M
Wilson Secondary School	Arlington	Sept. 2019	$81.5M	$19.5M	$101.0M
Herndon High School	Fairfax	Sept. 2021	$84.0M	$17.0M	$101.0M
George C. Marshall High School	Fairfax	April 2015	$54.3M	$12.0M	$66.3M
TJ High School for Science & Technology	Fairfax	Sept. 2016	$59.0M	$12.0M	$71.0M
Independence High School (HS-11)	Loudoun	Sept. 2019	$92.0M	$16.0M	$108.0M
Riverside High School (HS-8)	Loudoun	Sept. 2015	$78.4M	$13.6M	$92.0M
Gaithersburg High School	Montgomery	Sept. 2013	$105.6M	$18.9M	$124.5M
Seneca Valley High School	Montgomery	Sept. 2021	$142.2M	$25.9M	$168.1M
Wheaton High School	Montgomery	Sept. 2016	$110.5M	$19.5M	$130.0M

SCHOOL	SF	STUDENT CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Ballou High School	365,000	1300	$462	$ 129.6K	281
Duke Ellington School of the Arts	271,000	600	$550	$ 248.2K	452
Dunbar High School	280,000	1100	$467	$ 118.9K	255
Francis L. Cardozo Middle & High School	395,000	1100	$340	$ 122.2K	359
Howard D. Woodson High School	231,000	639	$463	$ 167.3K	362
Roosevelt High School	331,900	1100	$438	$ 132.3K	302
Wakefield High School	403,940	1960	$294	$ 60.5K	206
Wilson Secondary School	181,803	775	$556	$ 130.3K	235
Herndon High School	421,940	2500	$239	$ 40.4K	169
George C. Marshall High School	364,000	2000	$182	$ 33.1K	182
TJ High School for Science & Technology	398,833	1820	$177	$ 38.7K	219
Independence High School (HS-11)	282,000	1800	$382	$ 59.8K	157
Riverside High School (HS-8)	275,386	1775	$334	$ 51.8K	155
Gaithersburg High School	418,000	2400	$298	$ 51.9K	174
Seneca Valley High School	440,000	2400	$382	$ 70.1K	183
Wheaton High School	330,200	1700	$394	$ 76.5K	194

HIGH SCHOOLS

CONCLUSION

APS' high school construction costs are less than 9 of the 14 - or two-thirds - of the projects analyzed for this cost comparison study. In spite of additional costs associated with APS' site constraints and required public community engagement process, with few exceptions the costs of APS' high school projects are less than other equivalent projects in northern Virginia, the District, and Montgomery County.

High School Analysis

Illustrated on the previous pages are construction costs for high schools across Arlington, Fairfax, Loudoun, DC and Montgomery Counties.

- Cost have been normalized for completed projects to reflect construction costs as of 3/22/2018.
- Costs have been rounded for presentation purposes.
- Costs of high schools in Fairfax, Loudoun, and Montgomery are sometimes lower than APS and DC, because those divisions do not have site and size constraints, and they're able to utilize prototype designs to save on A/E costs.
- Upon closer analysis, 9 of the 14 non-APS schools cost more than Wakefield High School and Wilson Secondary School, respectively.
- Construction costs of APS' high schools are lower than most other high schools, even in divisions that do not have site constraints.
- With only a few exceptions, APS' high school construction projects cost less than other equivalent projects across Northern Virginia, the District, and Montgomery County Maryland.

ENERGY USAGE INTENSITY

Energy Usage Intensity

The energy usage intensity (EUI) of APS' most recently completed construction projects is better than nearly all other regional schools, in addition to besting the national average.

- The U.S. national median of energy usage intensity for K-12 schools is 58.2 kBtu/SF.
- APS' Wakefield High School has an EUI of 36.3 KBtu/SF.
- Discovery Elementary's EUI is -3.2 kBtu/SF.

- Arlington Public Schools uses EPA's Energy Star Portfolio Manager to track site energy intensity as well as greenhouse gas emissions.

- Site energy intensity is defined as the amount of energy used at a site to include electricity and natural gas consumption divided by the gross square footage of a facility.

- Electricity and natural gas consumption is converted into a common measurable unit called a BTU (British Thermal Unit) to determine a facility's overall energy consumption.

- This overall consumption is then divided into the gross square footage to determine a site's energy intensity.

- The chart on the following page shows the energy usage intensity of APS' recently completed projects, in comparison to schools in DC, Fairfax, and Montgomery County.

- As of 2015, Loudoun County has a normalized EUI of 57.26 kBtu/SF, just below the national average.

- In addition, APS saves money, over the course of the building's life, as its schools use less energy.

- In the instance of Discovery Elementary School, APS is generating revenue and returning energy to the electrical grid.

CONCLUSION

As evidenced by its schools' Energy Usage Intensity, APS is saving money in the long term on energy costs, and, in the instance of Discovery Elementary the building produces enough renewable energy to meet its own energy consumption requirements.

ENERGY USAGE INTENSITY

SCHOOL	Division	BUILDING SIZE	kWH	KBTUs	ENERGY USAGE INTENSITY (EUI)
Wakefield High School	Arlington	382,000	4,068,099	13,880,353.79	36.33600468
Discovery Elementary School	Arlington	97,588	-93,894	-320,366.328	-3.282845514
Fort Belvoir Elementary School II	Fairfax	95,341	927,804	3,165,667.248	33.20362958
George C. Marshall High School	Fairfax	364,000	3558475	12,141,516.7	33.35581511
TJ High School for Science & Technology	Fairfax	398,833	5,500,740	18,768,524.88	47.05860568
Ballou High School	DC	271,300	1,485,232	5067611.584	18.67899589
Dunbar High School	DC	283,000	2,846,735	9713059.82	34.32176615
Francis L. Cardozo Middle & High	DC	394,000	5,289,063	18046282.96	45.80274862
Howard D. Woodson High School	DC	231,000	1,931,141	6589053.092	28.52403936
Payne Elementary School	DC	83,800	895,911	3056848.332	36.47790372
Gaithersburg High School	Montgomery	418,000	4,185,007	14,279,243.88	34.16087054
Wims Elementary School	Montgomery	91,931	1,226,056	4,183,303.072	45.50481418

ENERGY USAGE INTENSITY

Energy Usage Intensity Summary

Arlington Public Schools

Wakefield High School

- LEED Gold Certified 2013, Geothermal heating and cooling. 90 kW Solar PV system provides around 115,000kWh. Solar thermal for domestic hot water.
- https://www.apsva.us/aps-goes-green/energy-conservation/energy-report-card-high-schools/#Wakefield

Discovery Elementary School

- Design to be zero energy, solar panels on roof, solar thermal water heating, daylight sources.
- https://www.apsva.us/aps-goes-green/energy-conservation/energy-report-card-elementary-schools/#Discovery

Fairfax County Public Schools

Fort Belvoir Elementary School

- LEED Silver Construction

George C. Marshall High School

- New high efficiency HVAC system, Low E windows with passive solar shadings, green roof

TJ High School for Science & Technology

- Solar Panels, New high efficiency HVAC system
- http://get2green.fcps.edu/energy_db.html

DC Public Schools

Ballou High School

- 3 solar panels, design to be Gold Certified, occupancy lighting in each classroom, energy monitoring system that tracks both lighting and mechanical loads; green building materials and enhanced construction methods. Energy Star Rating 74

Duke Ellington School of the Arts

- Designed to be Gold Certified, Photovoltaic Glass on the skylights, geothermal, vrv system, dynamic glass

Dunbar High School

- 2015 Platinum LEED cert, Geothermal system, solar panel roof 482 kW, natural lighting

Francis L. Cardozo

- LEED Gold, skylights/natural lights , energy star rating 88

Howard D. Woodson High School

- Designed to achieve LEED Gold certification, Daylight Harvesting, reflective roof, green roof, recycled material

Payne Elementary School

- LEED Gold, LED lighting, HVAC refitting, solar panels (money has been set aside but not installed)

http://www.buildsmartdc.com/buildings/

Montgomery County Public Schools

Gaithersburg High School

- Geothermal Heating, Gold Certified LEED, green roof
- http://www.montgomeryschoolsmd.org/uploadedFiles/departments/facilities/greenschoolsfocus/energy/Data_Energy_66.pdf

Wims Elementary School

- LEED Gold Certified 2015. Green roof. Geothermal
- http://www.montgomeryschoolsmd.org/uploadedFiles/departments/facilities/greenschoolsfocus/energy/Data_Energy_196.pdf

COST RECOMMENDATIONS

CONCLUSION

O'Connor recommends several methods and proposals that other school divisions, public-sector entities, and private-sector firms utilize to improve cost control and save overall project costs. These suggestions include: pre-qualifying A/E and General Contractors; updating space guidelines and educational specifications; conducting formal value engineering workshops; and conducting market research / studies.

Proposals for Budget Development, Cost Control, & Cost-Saving Measures

School divisions across the United States continuously confront similar challenges: rising construction costs, growing student enrollment, and decreasing budgets and funding from federal, state, and local governing authorities, just to name a few. Each of these factors contributes to strains on the development, maintenance, and control of financial capital on these projects.

Like other public-sector entities and even private sector firms, school divisions are increasingly seeking out alternative means and methods to fund and monitor their construction budgets and control costs throughout the project's duration, looking for various cost-saving measures.

On the following pages, we outline several suggested methods and proposals that other school divisions, public-sector entities, and private-sector firms utilize to improve cost control and save overall project costs.

COST RECOMMENDATIONS

Pre-Qualifying A/E & General Contractors Through On-Call Contracts

Setting up a pre-qualified list of architecture and engineering (A/E) firms and general contractors (GCs) through an on-call contract allows a client, like APS, to consistently work with a select group of firms that APS has determined meet its level of standards for the design and construction of its schools.

Fairfax and Montgomery County Public Schools (MCPS), for instance, each utilize a pre-qualification process for A/E and/or General Contractors.

- Fairfax County Public Schools, Office of Design and Construction Services accepts pre-qualification applications from A/E and General Contractors for Capital Bond Construction/Improvement Projects. Firms complete a Pre-Qualification Application and submit it to the County for approval. The County then has the option to solicit services through a direct quote process, or through a competitive sealed bidding process, on a project-by-project basis through the list of pre-qualified firms.

- Like Fairfax, Montgomery County accepts technical offers throughout the year from firms interested in working with MCPS.

On its current projects, whether new construction, additions, partial renovations, feasibility studies or full-scale design, MCPS solicits qualifications and pricing from its pre-approved list of partners.

A pre-qualified list of professional service providers and contractors has several benefits, including many that can potentially save project costs.

- School division staff routinely work with a select pool of firms, promoting closer collaboration, communication, and understanding of school policies and procedures.

- A more intimate familiarity with a school's design and construction process reduces repetitive and oftentimes unnecessary steps, eliminating elements of soft costs that over the course of a project can result in savings to a project's overall costs.

- Working with a select group of consultants can promote a greater consistency and quality of deliverables, as individuals from APS and pre-selected firms will develop streamlined processes and synchronized approaches to project delivery, potentially reducing unnecessary change orders and RFIs either during the design or construction process.

- Further, additional cost-saving benefits can include reductions in procurement time and lessons learned from past APS projects.

COST RECOMMENDATIONS

Presenting Three (3) Schematic Design Options

As part of any on-call A/E contract, APS can require the awarded design firm to present three (3) schematic design options. Each would meet the overall programming and functional needs of the school.

The differences in options would allow APS and the community to assess the value and need of a program's element in comparison to its price. For example, during the initial schematic design phase, the selected A/E firm could present:

- One (1) design option that is approximately 10 percent below the project's budget
- One (1) design option that is roughly equal to the project's budget
- One (1) design option that is 10 percent above the project's budget

For each of these options, the A/E firm should include a detailed cost estimate broken down by divisional costs.

Offering committees and communities the chance to observe and debate three (3) designs at different price points that still meet the programming and functional needs of the school will promote greater transparency and facilitate decision-making processes when it comes to selecting the design that best meets the school's needs based on its perceived value and costs.

Updating Space Guidelines & Educational Specifications

According to APS' website, it last updated its School Space Guidelines in 2000 and 2001; its educational specifications were updated in December of 2004.

Since then, for each new construction, renovation, or addition project, APS has relied on the awarded design firm to develop new and/or updated space and educational specifications on a project-by-project basis. Such exercises require time and resources from an A/E team, resulting in increased A/E fees and time out of the project's schedule.

It is an industry-accepted best practice that school districts maintain – and routinely update – space guidelines and educational specifications. They serve as standards for educators and design professionals to meet the overall programmatic and pedagogical goals of the school division. They also identify design features, including spatial sizes, relationships, and other elements, that enhance educational and community outcomes through clear and consistent standards.

A common misnomer of space guidelines and educational specifications is that they are not scalable or cannot be modified based on the school's site constraints or a school's programmatic needs.

Rather, these guidelines serve as a benchmark – a baseline – in which the school division, the community, and the design professionals engage in a collective and agreed-upon understanding of where to start and how to begin the design of a school project.

COST RECOMMENDATIONS

ELEMENTARY SCHOOL
PROTOTYPE PROGRAM

SPACE	325 STUDENTS QTY	SF	TOTAL	400 STUDENTS QTY	SF	TOTAL	500 STUDENTS QTY	SF	TOTAL	700 STUDENTS QTY	SF	TOTAL
ACADEMIC CORE AREA												
Pre-S/Pre-K/Kindergarten /1st Grade Classroom	7	1,125	7,875	9	1,125	10,125	10	1,125	11,250	13	1,125	14,625
Early Childhood Montessori**	--	1,125	--	--	1,125	--	--	1,125	--	--	1,125	--
Pre-S/Pre-K/Kindergarten/ Restroom	7	50	750	9	50	750	10	50	700	13	50	700
Early Elementary Resource/ Small Group Room	2	450	350	2	450	450	2	450	500	2	450	650
Outdoor Storage-Early Childhood	1	200	200	1	200	200	1	200	200	1	200	200
Grades 2-5 Classroom	8	900	7,200	8	900	7,200	12	900	10,800	16	900	14,400
Project Lab/Science Lab	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000	1	1,000	1,000
Discovery Commons Activity Area	1	1,625	1,625	1	2,000	2,000	1	2,500	2,500	1	3,500	3,500
Resource/Small Group Room	3	360	1,080	4	360	1,440	5	360	1,800	7	360	2,520
Self Contained Classroom	1	900	900	1	900	900	2	900	1,800	2	900	1,800
Speech/OT/PT	2	450	900	2	450	900	2	450	900	3	450	1,350
Speech/OT/PT Storage	2	150	300	2	150	300	2	150	300	3	150	450
Independent Area*	1	75	75	1	75	75	1	75	75	1	75	75
Special Education Coordinator Office	3	150	450	3	150	450	3	150	450	3	150	450
Teacher Collaboration Room	3	300	900	4	300	1,200	4	300	1,200	5	300	1,500
Textbook/Cart Storage	5	200	1,000	5	200	1,000	5	200	1,000	5	200	1,000
Outdoor Classrooms	1	900	900	1	900	900	1	900	900	1	900	900
Garden***	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL			**25,255**			**28,640**			**35,375**			**45,320**

Comments //

*Independent Areas must be provided for certain Special Education programs. If these Special Education programs are not offered at a particular school, these areas are not required. The determination to include or exclude these programs will be made during the site-specific Ed Spec process.

***This space is optional. The inclusion of this space will be determined during the site-specific Ed Spec process and approved by DCPS.

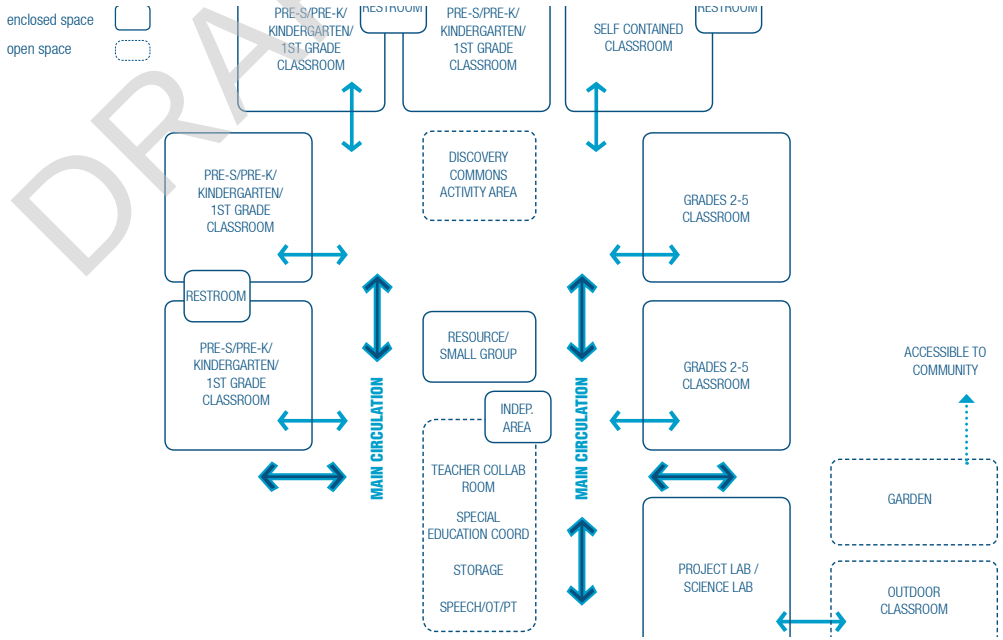
Note: In this document, staff assumptions were made to ensure staff spaces were approximately correct at each capacity model. Specific square footage requirements and quantity of spaces will be completed during the site specific ed spec process. Assumptions for the capacity model are:

325 students : 51 staff; 400 students : 57 staff; 500 students : 66 staff; 700 students: 81 staff.

8

While each school division varies in its guidelines, most have detailed specifications based on school type, e.g. elementary school, middle school, and high school.

For example, DC Public Schools (DCPS) maintains educational specifications for each of its school types. The guidelines incorporate the spatial utilization of a building along with a pre-design layout of each building's areas, from classrooms, restrooms, science labs, and common areas, to storage rooms, administrative offices, dining, and multi-purpose spaces, among others.



Above, excerpts from DCPS' Elementary School Educational Specification Guides

COST RECOMMENDATIONS

Creating APS-Specific FF&E Contracts

Throughout the District of Columbia, Maryland, and Virginia, there are several cooperative purchasing agreements that APS has access to, including the Metropolitan Council of Governments, which offers discounts on furniture and other equipment.

Other counties or jurisdictions, like Fairfax County, have organized individual procurement contracts for furniture manufacturers and dealers that encompass guaranteed discounts to county buyers. Clauses in these contracts also allow for Arlington County to "bridge" and take advantage of such price discounts.

To first understand the prices of furniture, fixtures, and equipment (FF&E), review a manufacturer's federal supply schedule, which is publicly available through GSA E-Library (www.gsaelibrary.gsa.gov/).

Most major FF&E manufacturers in the United States have a GSA schedule. The federal government has the greatest buying power and, under the law, any federal contract holder cannot offer prices for contracted services better than what the federal government receives. However, contractors can offer prices slightly below the GSA-scheduled prices or discounts.

Like most products, the price of FF&E depends heavily on volume. The greater the volume, the greater the discount. The buying power of a large school division, like APS, can necessitate even greater discounts than the ones offered through the Metropolitan Council of Governments or even Fairfax County. Manufacturers offer discounted prices on a tiered basis. The larger the order, the greater the discount.

For example, Knoll, Inc. is one of the premier furniture manufacturers in the country. Under its GSA schedule, an order of its most popular lines of furniture (for desks, tables, and general freestanding office furniture) between $0 and $400,000 list price automatically receives a 79 percent discount. An order between $400,001 and $2,564,103 receives a discount of 80.5 percent off list price.

> APS can take advantage of its purchasing and buying power by setting up FF&E contracts with pre-qualified furniture manufacturers that incorporate guaranteed discounts based on overall project volume.

While APS cannot expect to receive a discount as great as those offered under Knoll's GSA contract, it can, however, negotiate with Knoll (and other furniture manufacturers) to set up a specific contract that offers guaranteed discounts based on tiered pricing.

Moreover, should APS contract with multiple manufacturers, it can again leverage its buying power and have the pre-selected manufacturers compete on a project-by-project basis, further augmenting overall savings to the FF&E costs of its projects.

COST RECOMMENDATIONS

Standardizing Building Elements

When designing and constructing any building, it is important to consider construction costs and the standardization of building elements.

There are many cost elements during the design stage of a project, from time and schedule to the size of the structure, labor wages, and the cost of materials.

One main opportunity to save money during construction is the standardization and repetition of systems and components from school-to-school. Creating uniformity in APS' systems promotes a level of standardization that saves soft costs (in design) and hard costs (in construction), as well as future costs in maintenance and operations.

For example, if APS chooses to use variations of air handler units, pump pipes, or electrical conduits across its portfolio, this decision increases production and installation costs, while running the risk of creating future challenges to its ability to maintain and operate its systems.

The benefits of standardization go together with those of economies of scale. When units can be produced on a larger scale, production costs are more likely to decrease, and the less excess material is wasted.

Therefore, manufacturers are more willing to lower the unit price when larger quantities are purchased.

CONCLUSION

One main opportunity to save money during construction is the standardization and repetition of systems and components from school-to-school. Creating uniformity in APS' systems promotes a level of standardization that saves soft costs (in design) and hard costs (in construction), as well as future maintenance and operations costs.

Conducting Formal Value-Engineering Workshops

Often, value engineering occurs too late in the design process – typically after the design of working drawings or during the construction documents phases – at which point it has mostly become a cost-cutting exercise.

Clients that have routinely experienced over-budgeted projects have now proactively developed value engineering workshops that occur from schematic

COST RECOMMENDATIONS

through construction documents. As a means of controlling and saving costs, APS should consider a more formalized approach to value engineering for its projects, like the steps which the GSA and the State Department have implemented.

The **General Services Administration (GSA)**, the real estate arm of the federal government, has instituted formal value engineering exercises that analyze a "designed building's features, systems, equipment, and material selections for achieving essential functions at the lowest life-cycle cost consistent with required performance, quality, reliability, and safety."

During the design phase of a GSA project, the A/E firm, Construction/ Project Managers, and GSA teams consider alternative design solutions and solicit ideas to maintain or enhance the results and performance of the project without sacrificing quality or design intent.

There are generally two (2) VE studies – one at the completion of concept design and the other at the completion of design development.

In each session, a VE consultant leads the team to identify and evaluate changes that could increase functional value while reducing construction and maintenance costs. The level of VE effort is determined based on the size and scope of the project.

The reason why GSA focuses its VE efforts in the early stages of design is that these reviews increase the greatest potential for cost savings without affecting the project's delivery schedule.

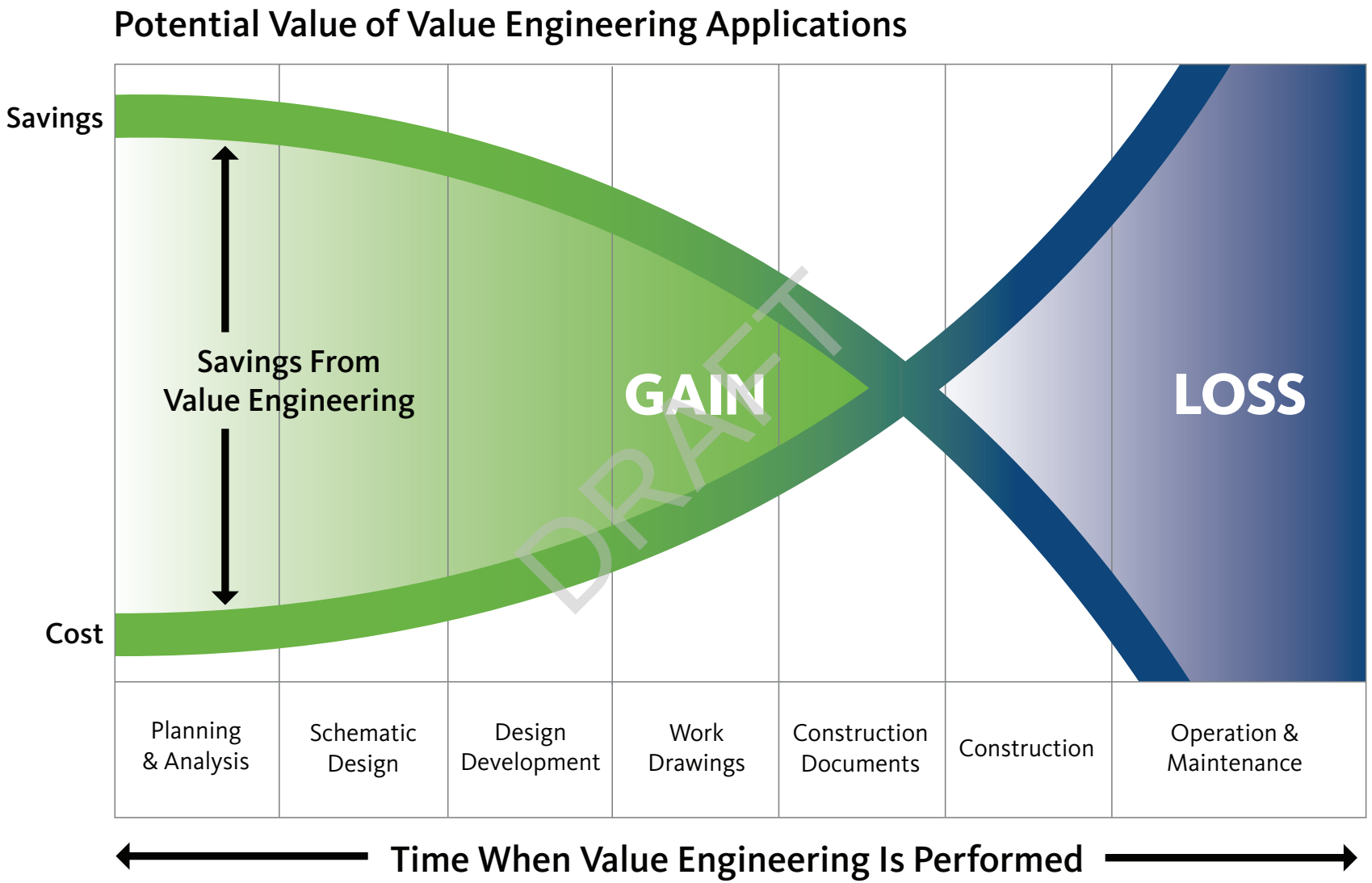
During the VE sessions, if the team uncovers savings, the project's budget can be reduced, or the capital can be reallocated to other programmatic elements of the project.

Further, during the construction phase of a project, GSA encourages its contractors to propose cost-cutting measures while maintaining the quality, value, and functional performance of the building. Using a contractor's experience and purchasing options can generate additional cost savings. GSA evaluates each proposed cost-saving change and, if approved, it modifies the contract and makes an incentive payment to the contractor. For instance, "the contractor's share of construction cost savings is 55 percent for fixed-price contracts but can be different for incentive-based contracts."

Another example is the **Department of State, Overseas Bureau of Operations (OBO)** which conducts formal, weeklong VE workshops.

The process includes reviewing the functions of the project and proposing ideas with cost implications that may provide the proposed functions in a more valuable way. The collaboration between subject matter experts allows for a peer review and evaluation of a proposed design. Projects range from new Marine Security Guard Residences (MSGR) and housing expansions to new embassy compounds ($500-plus million).

COST RECOMMENDATIONS



COST RECOMMENDATIONS

One of the keys to OBO's successful VE program is the award and selection of outside consultants to participate in the workshops. For instance, firms and individuals that are working with the awarded A/E or General Contractor are not permitted to participate in the VE workshops. This separation promotes autonomy and independence, ensuring OBO receives unbiased opinions and ideas.

The studies follow the Society of American Value Engineers (SAVE) International Value Engineering methodology. The principal goal of the SAVE VE process is to achieve a balance between function, performance, quality, safety, and cost.

The SAVE VE methodology encompasses six (6) phases:

1. Information: Gather information to better understand the project.

2. Function Analysis: Analyze the project to understand and clarify the required functions.

3. Creative: Generate ideas on all the possible ways to accomplish the required functions.

4. Evaluation: Synthesize ideas and concepts and select those that are feasible for development into specific value improvements.

5. Development: Select and prepare the 'best' alternative(s) for improving value.

6. Presentation: Present the value recommendation to the project stakeholders.

The implementation and execution of a more formal VE workshop or process could result in greater cost savings and overall better building performance of APS' projects.

CONCLUSION

As a means of controlling and saving costs, APS should consider a more formalized approach to value engineering for its projects, like steps the GSA and the State Department have implemented. The execution of more formal VE workshops or process could result in greater cost savings and overall better building performance of APS' projects.

COST RECOMMENDATIONS

Exploring Alternative Delivery Methods

As previously discussed in the Cost Study, APS uses a traditional design-bid-build (DBB) procurement and delivery method but has also begun using the Construction Manager at Risk (CMaR) method. The latter blends both general contractors with the A/E teams, so that all parties are involved early in the design process.

Under CMaR, the school division, such as APS, typically enters into a Guaranteed Maximum Price (GMP) contract and the project's risk is transferred from the school to the construction manager at risk.

As a result, the construction manager at risk assumes any budget overruns. On the other hand, if the project is delivered under budget, the school division and contractor can share in the cost savings.

Other school divisions, like neighboring Montgomery County, have experienced increased performance through CMaR, notably a greater percentage of projects completed on time and within budget. Please refer to the previous sections of our Cost Study report for more detailed information. Under this method, APS should look to gain from the continued utilization and best practices gleaned from CMaR.

In addition to DBB and CMaR, public-sector entities, including some school divisions, are utilizing the design-build (DB) method. Most recently, Falls Church City awarded a $108 million DB project for George Mason High School.

Under the DB method, one company, typically the general contractor, is financially and managerially responsible for architectural design and construction. With one firm in charge of all a project's aspects, the DB method can eliminate unnecessary challenges in managing and overseeing multiple parties. Thus, the cost savings can occur from the beginning to the end of the project.

The University of Nevada at Las Vegas (UNLV) conducted a study on the increasing use of the DB method. It showed that the overwhelming reason why owners chose DB was that it creates a single point of responsibility and accountability for design and construction.

CONCLUSION

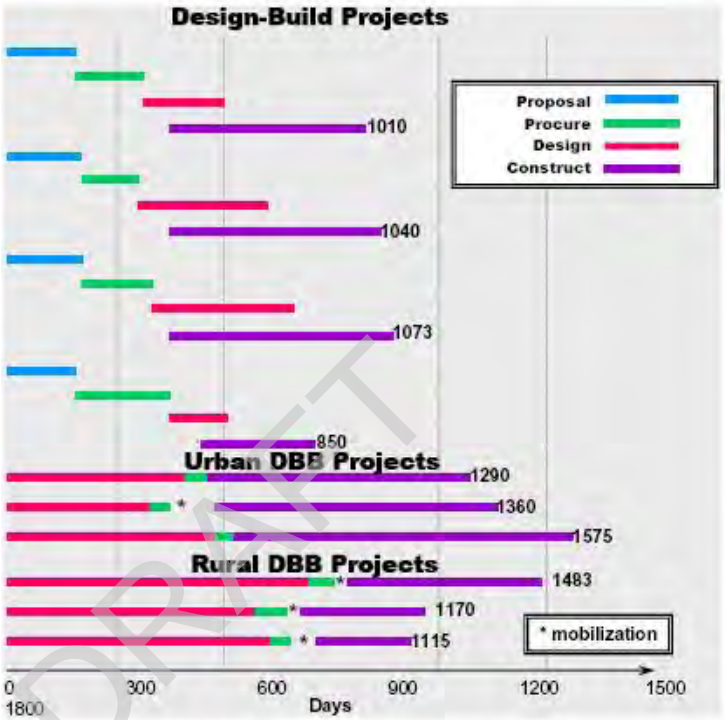
The Design-Build (DB) method is an alternative delivery method where one company, typically the general contractor, is financially and managerially responsible for architectural design and construction. With one firm in charge of all a project's aspects, the DB method can eliminate challenges in managing and overseeing multiple parties. Cost savings can occur from the beginning to the end of the project.

COST RECOMMENDATIONS

An owner's internal costs of managing and coordinating multiple parties can be substantially reduced through the DB method since this option allows for all aspects of design and construction to be housed under one roof of the DB contractor. Therefore, the benefits of the DB method to APS could include:

- Reduction in APS' project management workload
- Designation of one point of contact to APS for the entire project
- Promotion of continuous and convenient flows of communication between all parties
- Integration of the general contractor and A/E firm at the very start to leverage the team's collective experiences to reduce cost and schedule impacts

The U.S. Department of Transportation's Federal Highway Administration conducted an effectiveness study of DBB and DB projects completed in the State of Arizona. It measured the timeliness of each project under both methodologies.

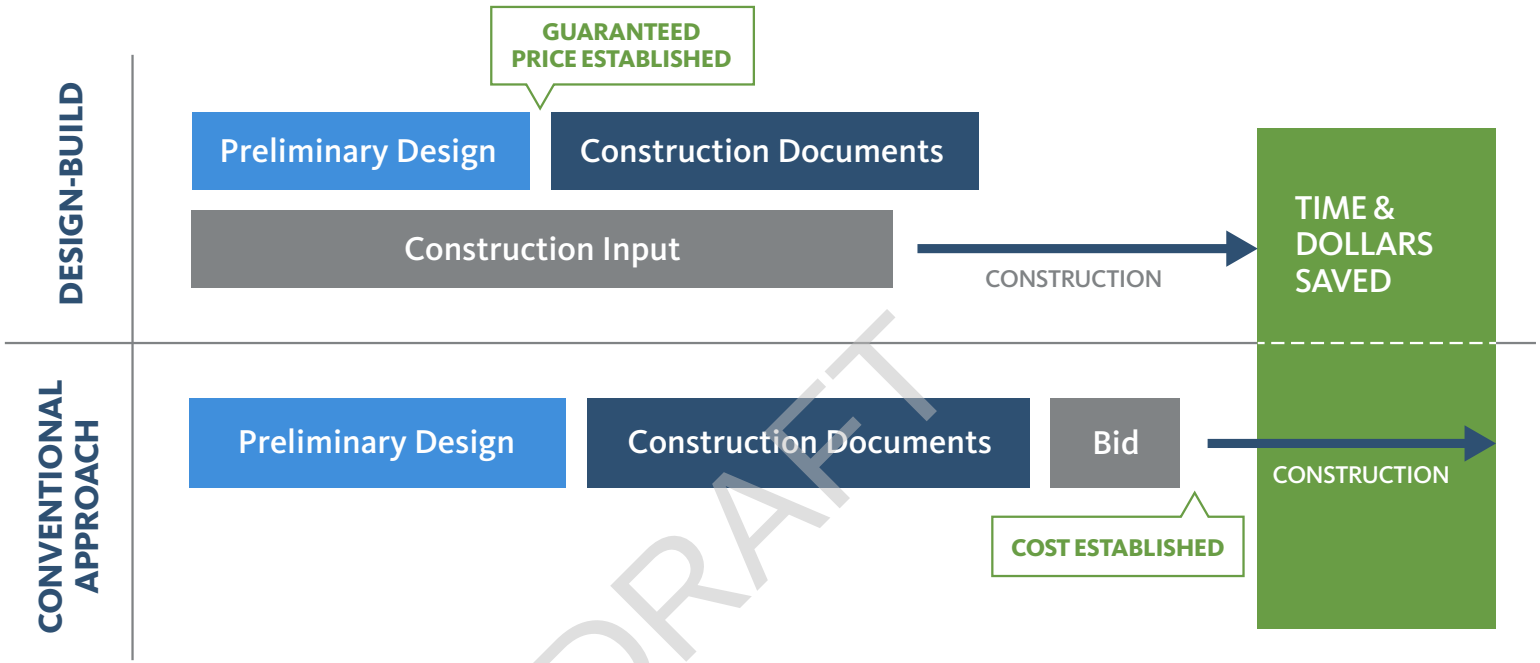


Source: Arizona Department of Transportation

In each instance, the DB project had shorter delivery times. The above chart, excerpted from the study's report, illustrates the effectiveness of the concurrent sequencing of project development phases of DB projects versus consecutive sequencing of phases of DBB projects.

As illustrated to the left, the effectiveness of the DB process, where the concurrent sequencing of project development phases versus consecutive sequencing of phases, leads to greater timeliness of project delivery.

COST RECOMMENDATIONS



Penn State University also conducted a study that evaluated the effectiveness of multiple delivery systems, and it found that DB outperformed DBB in every category.

The study concluded that DB had:

- 12.5% shorter construction duration
- 33.5% shorter total delivery cycle
- 6.1% lower construction costs

In conclusion, should APS explore the utilization of the DB approach, it can potentially reduce construction times and therefore overall project costs.

As illustrated above, the DB process has built-in parameters that promote cost-effectiveness and cost-savings.

COST RECOMMENDATIONS

Instituting a Pull Planning™ / Last Planner© Process

Seeking to continuously eliminate non-value-added items from the construction process, APS can institute the lean Pull Planning™ process to deliver and improve a workable construction schedule so that it is a truly collaborative tool for all project team members.

Lean principles stem from the process of continually eliminating waste. Through the Pull Planning™ process, APS and its project partners can create a valuable and collaborative tool that ensures a higher percentage of planned tasks are completed on time.

The process brings the project's players together to review how the team can remove constraints or obstacles that could increase costs or develop delays. Constraints that can be resolved through this proccess come in a variety of forms, from unnecessary RFIs to change orders during the construction process, all of which can result in cost savings to the project.

Conducting Market Research & Market Studies

In May of 2014, APS released a report, "Arlington Public Schools: School Cost and Risk Analysis," which noted, "Long-term average [of construction cost] in the DC metro region is 2.5 to 3.0% per year….Appropriate escalation is included in all APS cost estimates."

In 2018, the current year-over-year escalation of construction costs in the District, Maryland, and Virginia area is approximately 5 percent. O'Connor does not foresee a significant change of economic conditions to alter the continuing rising costs of construction.

Conducting market research and completing market studies on, at least, an annual basis, will better assist APS with understanding how national and local economic conditions impact the future costs of its construction projects.

Market research and studies allow APS to review data and analyze a variety of factors that may affect its construction costs. Interviews with industry-leading contractors and subcontractors, local business leaders, architects, engineers, and others, will reveal the underlining conditions that are influencing construction costs.

Moreover, market research and studies will help APS to make informed design, planning, and construction decisions on their projects, providing APS will an all-encompassing and clearer picture of the national and local construction markets. Topics that should be covered include:

- Overall market conditions and projections of future growth trends.
- Review of projects in progress or projected to be in progress during the period of APS' project construction, to determine the availability of labor and material resources.
- Interviews with local A/E/C industry professionals to identify market sector factors that could influence the overall cost and schedule of a project.

COST RECOMMENDATIONS

Local Market Trends

+ 5 - 6%

- Observations of a project's physical site can also determine accessibility, mobility, and other related items, all of which could affect a contractor's bid price.
- The capacity of local and regional contractors (both large and small businesses) to bid on the project.

Ultimately, should APS choose to conduct market research and studies, it will then be able to conclude the overall escalation of construction costs throughout a project's anticipated period of performance.

Source: Engineering News-Record Construction Economics Department & OCMI

Escalation of Construction Cost Indexes

2008-2023

Above, an illustration from a recent market study completed by O'Connor, underscores the past and current construction cost trends in the District of Columbia, Maryland, and Virginia areas.

COST RECOMMENDATIONS

Benchmarking & Cost Modeling

APS has at its disposal critical cost data on its recently completed construction projects (and those projects that are expected to be completed in the next couple of years) that can further assist in benchmarking and modeling future costs of similar projects.

By collecting data from comparable projects, APS' benchmarking and cost models can serve as planning guides for designing a budget during a project's early stages. Through the project's design, the cost model can measure and validate a project's cost, helping APS maintain its original budget.

Developing a Risk Register

For everyone involved, managing risk is a key component to promoting a successful project. The utilization of a risk register early in the project's lifecycle can identify the key and unique areas of exposure that can pose a challenge.

Other than general cost and schedule issues, other risk exposures could stem from the interface with public utilities or right-of-way easements, known soil conditions, agency approval timeliness, incorrect or inaccurate as-built documents, among others.

Once key risks have been identified, APS and its team can evaluate the potential for the risk to occur and categorize it as likely, probable, or unlikely, with a subsequent categorization for the overall risk impact being high, medium, or low.

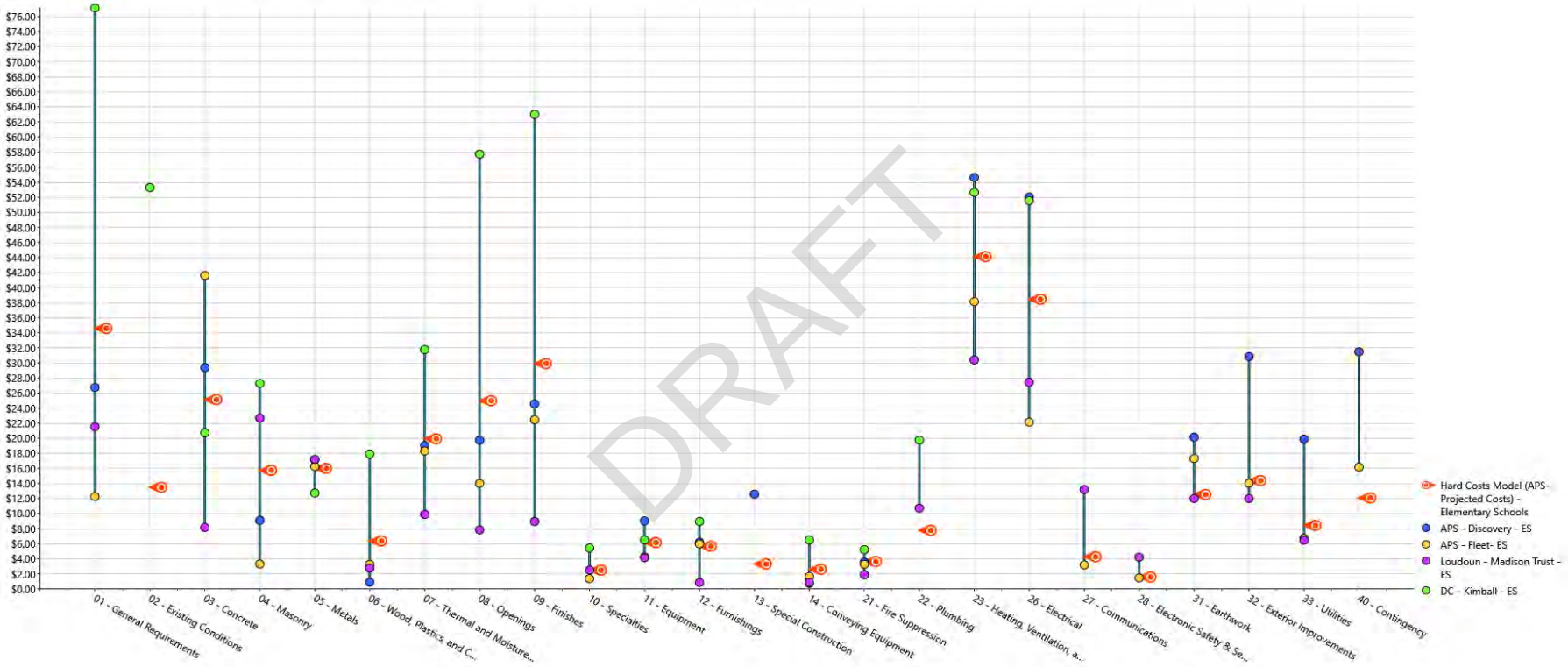
A project-specific risk register facilitates a knowledge-based approach of continually monitoring and addressing risks on an ongoing basis. As a result, this mentality and actions taken can proactively identify and resolve issues long before they arrive, thus, in most instances, preventing unnecessary cost overruns and schedule delays.

CONCLUSION

Through the use of benchmarking, cost modeling, and the development of a risk register, APS has at its disposal the opportunities to more accurately develop a budget for its projects - at the earliest stages - as well as identify key and unique areas of exposure that pose a risk to a project's success. Combined, these tools allow APS to proactively assess a project's budget and identify and resolve issues that could prevent unnecessary cost overruns and schedule delays.

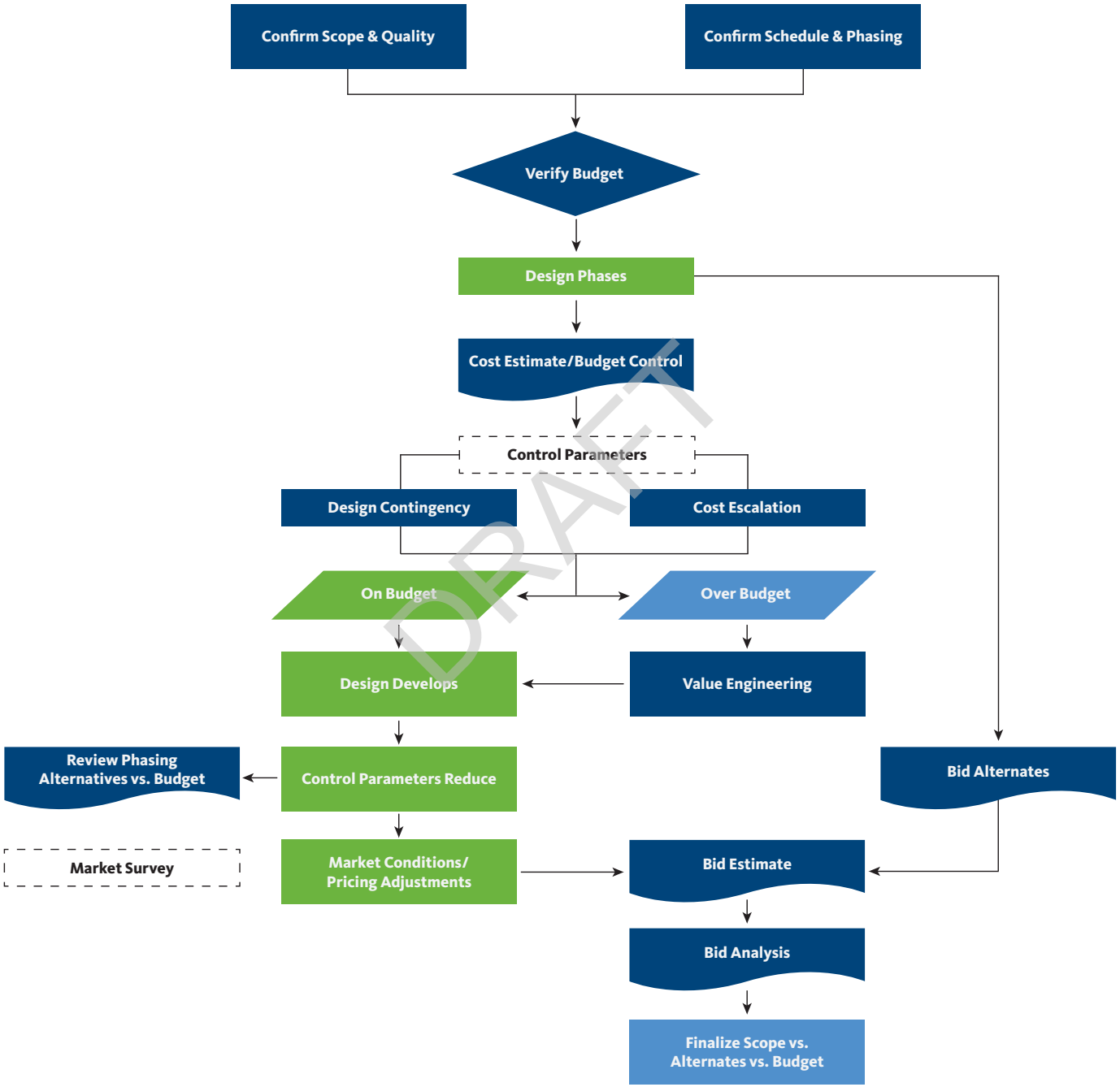
COST RECOMMENDATIONS

RANGE - UNIT COST



The above illustration is taken from O'Connor's cost model of elementary school costs gathered from APS, Loudoun County, and DC Public Schools. The graphic demonstrates (via orange arrows) the projected costs of elementary schools based on the actual costs of similar, past projects.

PROJECT BUDGET DEVELOPMENT & COST CONTROL PROCESS



2 | School Divisions

ARLINGTON PUBLIC SCHOOLS

SCHOOL	HARD COST	SOFT COST	TOTAL COST	SF	CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Alice West Fleet Elementary School*	$46,721,289.00	$12,250,000.00	$58,971,289.00	111,635	752	$ 421.00	$62,500	148
Discovery Elementary School	$36,328,307.00	$7,475,500.00	$43,803,807.00	97,588	684	$ 448.86	$64,040.65	143
Wakefield High School	$103,179,007.00	$15,446,993.00	$118,626,000.00	403,940	1960	$ 293.67	$60,523.47	195
Wilson Secondary School	$81,481,364.00	$19,518,636.00	$101,000,000.00	181,803	775	$ 555.55	$130,322.58	235

**Note: Total includes cost of garage; SF, Cost/SF, Cost/Seat, SF/Seat does not include data of garage.*

Alice West Fleet Elementary School

Occupancy: Sept. 2019

TOTAL COST	$58,971,289.00*
SF	111,635
Cost/SF	$421.00
SEATS	752
SF/Seat	148
Cost/Seat	$62,500

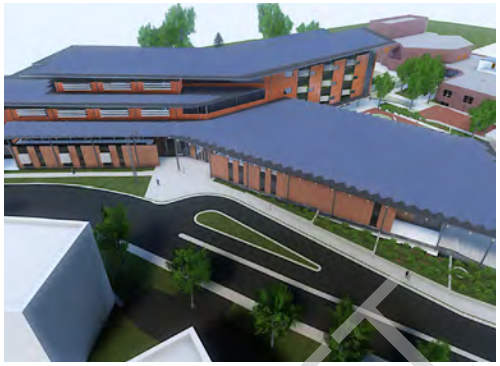
Project Scope

The new 752-seat elementary school will encompass approximately 112,000 GSF and accommodate students from pre-kindergarten to fifth grade. The new school will contain 35 classrooms over four floors, and will be built on top of a two-story underground parking garage.

Based on the design and lessons learned from Discovery Elementary School, the new Fleet school will foster connection between spaces – both inside and outside of the building – in ways that will involve and engage students, teachers, parents, and the community.

Core program elements of the school include: grade levels, special education, administration and teacher support, arts, music, library, food service, physical education, and extended day. The Fleet school will accommodate a range of spaces including: classrooms, hubs, innovation commons, team

**Note: Total includes cost of garage; SF, Cost/SF, Cost/Seat, SF/Seat does not include data of garage.*



rooms, conference rooms, nooks and crannies, and outdoor classrooms.

All spaces in the new school are designed to promote collaboration, interaction, innovation, and invention.

Amenities in the new school include a full-sized gymnasium, stage, dining commons, kitchen, and other spaces.

The school is designed to be net-zero energy ready and to achieve LEED silver certification or greater.

Selecting the location of the new Fleet Elementary School necessitated the coordination between the two (2) groups: the Thomas Jefferson Working Group and the South Arlington Working Group.

Each group conducted various studies and analyses, and after studying many other potential sites, determined that the new school could and should be built at the existing site.

As previously noted, the School Board charged two (2) groups with analyzing site options for the new school. In addition, the Board invited civic associations, PTA groups, and others throughout the site selection and design process.

Since April 2016 there have been numerous meetings with the Building Level Planning Committee (BLPC), Public Facilities Review Committee (PFRC), adjacent community members, County and School Boards, and other project stakeholders.

Discovery Elementary School

Occupancy: Sept. 2015

TOTAL COST	$43,803,807.00
SF	97,588
Cost/SF	$448.86
SEATS	684
SF/Seat	143
Cost/Seat	$64,040.65

Project Scope

The largest net zero-energy school in the United States, and the first in the Mid-Atlantic, Discovery Elementary School encompasses a 98,000 SF building that shares the site with an existing middle school planned for future school expansion.

The school was built to accommodate a capacity of 684 students from kindergarten through fifth grade.

The quality of Discovery's design and construction is evidenced by its numerous awards.

To date, it has received ten (10) awards for its design, sustainability, and technology.

Every space of Discovery is designed to create integration between design, sustainability, and learning. Using the

ARLINGTON PUBLIC SCHOOLS

site's topography, the school has distinct tiered academic zones that define early childhood, primary, and elementary grade levels. The use of color adds to the school's design, with warm colors on the street side and cooler colors on the north side located near the site's trees.

Discovery's way finding is tied to growth and expansion of the student's education; as students move up from grade-to-grade the building's design too expands to reflect more complex elements. For example, as students enter as Kindergarteners, they are Backyard Adventurers; when they finish in the fifth grade they are Galaxy Voyagers.

Throughout the school, one-to-one technology promotes research and collaboration. Classrooms and other learning spaces are easily reconfigurable.

The building's sustainability design features extend as part of school's pedagogy. The rooftop solar lab is accessible to students, who can utilize

Every space of Discovery is designed to create integration between design, sustainability, and learning. Using the site's topography, the school has distinct tiered academic zones that define early childhood, primary, and elementary grade levels.

it to conduct real-time and on-going experiences. Data and information from these experiences are tracked and graphed using the building's dashboard system, accessible on any device in the school.

According to the Former Director of the Center for Green Schools, Rachel Gutter, "This is the greatest green school I've ever seen. It is fully integrated with the educational program and serves as a pedagogical tool. VMDO does a great job at partnering with educators to ensure the educational aspect is a leading thought, not an afterthought."

The building was designed for an EUI of 23 kBTUY/sf/year, representing one

third of the energy use of a typical county elementary school. To achieve this EUI goal, the school's sustainability features include the following:

- 1,700 roof-mounted solar panels
- Geothermal well field
- Solar pre-heat of domestic water
- 100% LED lighting
- Solar orientation and shading
- Insulated concrete exterior walls with high thermal mass
- Bio-retention areas that clean and release water from the site
- Building dashboard system that tracks energy data

An APS school of similar size has annual energy costs of around $110,000. Discovery's sustainability features help it to buy and sell electricity back to the grid, redirecting funds back to APS' operating budget.

A specific site challenge was to integrate building footprint into a residential neighborhood. The project's architecture team addressed this challenge by integrating the building into a south facing hill, thus meeting local community goals on size, sustainability, preservation, recreation, and conservation.

Discovery's environmental and sustainability design features make it the first Net Zero energy school in the Mid-Atlantic Region, and only the third in the United States. The rooftop solar lab, as illustrated, is accessible to students, who can utilize it to conduct real-time and on-going experiences. Data and information from these experiences are tracked and graphed using the building's dashboard system.

Throughout the design and construction process of the project, the community was actively engaged. After occupancy, three (3) different surveys were conducted of the school's staff, facilities and operations personnel, and the community's building committee. The results reveal an overwhelming positive reaction to the school's design and construction.

As best summarized by Dr. Erin Russo, the Principal of Discovery: "I think what is most important about this building is that it allows teachers to think about how we learn and how students learn."

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Wilson Secondary School

Occupancy: Sept. 2019

TOTAL COST	$101,000,000.00
SF	181,803
Cost/SF	$555.55
SEATS	775
SF/Seat	235
Cost/Seat	$130,322.58

Project Scope

The new Wilson Secondary School expands and relocates existing county-wide secondary programs into one (1) building.

- The H-B Woodlawn program utilizes self-motivation by making students accountable for their choices
- The Stratford program educates students best served in a specialized environment.

The SF of the school is 181,803; the school will be eight (8) times the size of its predecessor.

It will accommodate an estimated 775 seats/students.

Situated in a dense urban environment, the school is designed and constructed to span five (5) vertical floors. Each

floor, which resembles a “bar,” rotates along a single hinge point. This rotation subsequently creates cascading green terraces that extend the learning environment outside of the classroom.

Wilson’s quality of design and construction corresponds to optimizing functional space that directly addresses the requirements of its students and teachers. Due to the co-location of two programs the school’s layout accommodates diverse technical requirements.

The large and public functions of the building, including auditorium and gymnasium, are located at the base of the building and accessible along busy Wilson Boulevard. This expansive ground floor features varying ceiling heights according to the rotated classroom bars above. The community will be able to access these major spaces from the public entrance. In addition, a semi-underground courtyard and covered entryway are beneath two corners of the sports field.

ARLINGTON PUBLIC SCHOOLS

The educational spaces extend outside of the building to the green terraces. Separate classroom blocks are adjacent to the terraces, which provide unique activities corresponding to the adjacent programs. The terraces also give the urban school a one-story feel that otherwise would not be possible.

The school is designed to be net-zero energy ready and earn LEED silver certification or greater.

The primary site challenge pertaining to the Wilson School was its need to be one building, five stories, above-grade. The vertical design of the school responds to the site constraints - located in a dense urban environment – while meeting the main goals of providing a central space that connects the building levels and provides access to outdoor spaces at all levels.

Since April 2015 there have been numerous meetings with the Building Level Planning Committee (BLPC), Public Facilities Review Committee (PFRC), Historical Affairs and Landmark Review Board (HALRB), adjacent civic associations and neighborhoods, County and School Boards, and other Project stakeholders.

Wakefield High School

Occupancy: Sept. 2013

TOTAL COST	$118,626,000.00
SF	403,940
Cost/SF	$293.67
SEATS	1,960
SF/Seat	195
Cost/Seat	$60,523.47

Project Scope

The new Wakefield High School replaces an existing 60-year-old building. It is three (3) stories and 403,940-gross square feet.

The project's scope encompassed 110 classrooms; a gymnasium that holds up to 2,300 people; a media center that includes the library and computer labs, housing 23,500 print volumes in it; a large student common that serves as the center or "heart" of the school; as well as administrative support spaces distributed throughout the building. Wakefield High School was awarded an Award of Excellence from DESIGNArlington. The Community Appearance Alliance of Northern Virginia recognized the project with its Community Appearance Award.

Designed to minimize its footprint, while blending within the context of

ARLINGTON PUBLIC SCHOOLS

its neighborhood, the school's design included user-friendly streetscapes and pathways throughout the site. Large open spaces connect the school's site to the surrounding neighborhoods.

The school's design incorporates outdoor and indoor gathering spaces, as well as public spaces, like courtyards, a rain garden, among others.

In addition, the school's main entrance opens into what Project Manager Bill Herring calls the "town hall," a large open space filled with couches and chairs. The outdoor courtyard is Wi-Fi enabled, allowing teachers, students and others to learn, explore, and discover outside of the classroom. The high school's design encompasses a variety of amenity spaces: a large student commons area, state-of-the-art science labs, music and art rooms, media center, 625-seat auditorium, two gyms, athletic fields, two indoor pools, a diving well, and a geothermal heating and cooling plant.

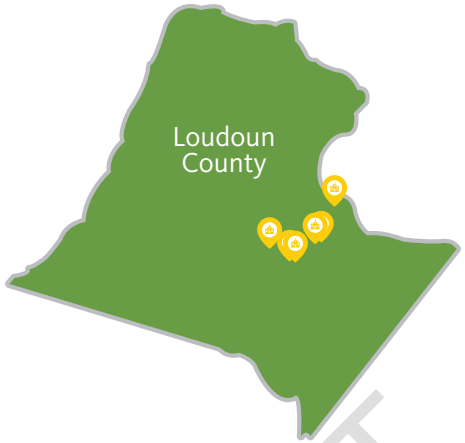
Wakefield High School has achieved LEED Gold certification for sustainability. In addition, its sustainable design features include 400 geothermal wells, each 500 feet deep, to heat and cool the school, and solar panels located on the roof.

From 2015 to 2017 the energy use index of Wakefield High School has declined from 66 to 41, a decrease of approximately 38 percent.

In an interview with The Washington Post, the school's principal noted, "This was a very difficult space to build, with all the restrictions. We have some green areas that they couldn't do anything with, which is nice, because they left the trees and we've got a couple of creeks. So when it's all said and done, this is going to look like a mini-college campus."

The architecture firm hosted design charrettes with the County and School planning committees, to establish goals for the new facility. In addition, the principal noted that there was heavy community engagement during the design and construction period of the school.

LOUDOUN COUNTY PUBLIC SCHOOLS



SCHOOL	HARD COST	SOFT COST	TOTAL COST	SF	CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Brambleton Middle School (MS-9)	$49,968,281.55	$9,634,772.01	$59,603,053.56	184,593	1354	$322.89	$44,019.98	136
Goshen Post Elementary School (ES-28)	$28,310,000.00	$5,567,677.54	$33,877,677.54	136,200	988	$248.73	$34,289.15	138
Independence High School (HS-11)	$91,823,998.00	$15,946,911.05	$107,770,909.05	282,000	1800	$382.17	$59,872.73	157
Madison Trust Elementary School (ES-27)	$23,849,887.19	$4,383,233.64	$28,233,120.84	105,757	1012	$266.96	$27,898.34	105
Riverside High School (HS-8)	$78,359,814.24	$13,608,610.11	$91,968,424.36	275,386	1775	$333.96	$51,813.20	155
Willard Middle School (MS-7)	$51,065,000.00	$9,276,888.08	$60,341,888.08	185,251	1354	$ 325.73	$44,565.65	137

LOUDOUN COUNTY PUBLIC SCHOOLS

Brambleton Middle School

Occupancy: Sept. 2017

COST	$59,603,053.56
SF	184,593
Cost/SF	$322.89
SEATS	1,354
SF/Seat	136
Cost/Seat	$44,019.98

RELEVANCY

- ✓ New Construction
- ✓ Middle School
- ✓ Completed Sept. 2017
- ✓ High-Performing Design
- ✓ Energy-Efficient Design

Project Scope

Because of the fast-paced growth of student enrollment and the need to create efficient education spaces, Loudoun County Public Schools developed prototype schools that can be adapted to meet the needs of various locations around the county.

Brambleton Middle School was the first prototype developed under the county's program. At nearly 185,000 SF, the school accommodates 1,354 students.

The middle school features a glass entry plaza which creates a welcoming entrance while also allowing for added security and oversight. The lobby and pre-functional spaces provide a place for student commons during the school day and public use space after hours.

The classroom wings are organized by grade level to allow for age-appropriate educational and emotional growth

through the students' time in the school.

In addition, the building includes a glass-enclosed crosswalk that connects one half to the other. The crosswalk includes benches where students can sit and journal or read.

"You can tell the building was designed with learning in mind," Principal Renee Dawson said. "They thought about how students would use every single space." Dawson also noted that the building is "all about spaces for learning."

In an interview with The Washington Post, Principal Renee Dawson remarked that the most significant feature of the school's design is "The [natural] light. The design of the building is completely different than any other building we have in the county."

She further added: "There's not a single space in this building where you can't see education happening, whether it's in a hallway, whether it's in a stairwell."

The school complies with the county's "High-Performance Design and Construction for Energy Efficiency and Environmental Impact" policies.

The school's design was developed so that it could be easily site-adapted to respond to differing site constraints, while maintaining continuity of circulation, outdoor gathering spaces, playing fields, and service.

Completed in 2017, Brambleton Middle School is the first "prototype" school developed under Loudoun County's program. At nearly 185,000 SF, the school accommodates 1,354 students. Its most significant feature, according to school's principal, is "the [natural] light."

LOUDOUN COUNTY PUBLIC SCHOOLS

Madison Trust Elementary School

Occupancy: Sept. 2016

TOTAL COST	$28,233,120.84
SF	105,757
Cost/SF	$266.96
SEATS	1,012
SF/Seat	105
Cost/Seat	$27,898.34

RELEVANCY

- ✓ New Construction
- ✓ Elementary School
- ✓ Completed Sept. 2016
- ✓ High-Performing Design
- ✓ Technology-Focused Design

Project Scope

Madison Trust Elementary School (ES-27) is a new elementary school site adaptation for Loudoun County Public Schools. The two-story, 106,000 SF prototype school serves up to 1,012 students in kindergarten through the fifth grade.

A classic brick façade serves as the inspiration for the school's architecture – a prominent design feature of the school division's prototypes.

One of the school's primary architectural highlights is a glass enclosed media center, which serves as a hub for students to access books and use technology to advance their educational experience. The media center then opens into a courtyard where students and teachers can extend the classroom environment outside.

The elementary school includes classrooms, a media center, cafeteria, multipurpose room and two outdoor physical education fields.

The school's two-story configuration provides natural daylight to all classrooms with rooms lining the building perimeter and overlooking a central educational courtyard.
The school's colors of red and green are used throughout, evidenced in the entrance canopy, stairwells, and finished.

The facility achieved an "Energy Star Certification" by the Environmental Protection Agency and the school is on track to be certified by the Virginia Collaborative for High Performance Schools.

LOUDOUN COUNTY PUBLIC SCHOOLS

Riverside High School

Occupancy: Sept. 2015

TOTAL COST	$91,968,424.36
SF	275,386
Cost/SF	$333.96
SEATS	1,775
SF/Seat	155
Cost/Seat	$51,813.20

RELEVANCY

- ✓ New Construction
- ✓ High School
- ✓ Completed Sept. 2015
- ✓ Site Challenges
- ✓ Consistent Community Engagement
- ✓ Energy-Efficient Design

Project Scope

The design of the Riverside High School honors Loudoun County's environmental policies and Landsdowne Conservancy's Design Guidelines, while confirming to the school division's educational specifications.

Loudoun County Public Schools initially reviewed three (3) potential sites as the future home of Riverside High School. The Board of Supervisors selected a site that had previously housed the National Conference Center (NCC).

There was consistent community engagement throughout the design and construction process. The principal noted that the school met with students and their families, teachers and community leaders on several occasions.

Willard Middle School

Occupancy: Sept. 2018

COST	$60,557,247.29
SF	185,251
Cost/SF	$326.89
SEATS	1,354
SF/Seat	137
Cost/Seat	$44,724.70

RELEVANCY

✓	New Construction
✓	Middle School
✓	Anticipated Completion Sept. 2018
✓	High-Performing Design
✓	Technology-Focused Design

Project Scope

Willard Middle School is the second iteration of the 1,354 student middle school prototype previously developed for Loudoun County Public Schools.

In adapting the building prototype layout for a new site, the challenge was to improve on the previous design and create a unique identity for the school that responds to the site conditions.

The main entry is arranged around a welcoming civic plaza engaging the auditorium and administration spaces on each side with a clearly defined entrance and sun dial tower that illuminates as a beacon for the school. Public spaces shared with the community are easily accessible and visible along the front of the school, but are secured through separate entrances for improved student safety. Distinct masonry patterns on the

building's exterior represent different uses of space on the interior and help to break down the overall massing of the building, while glass towers serve as entry points.

The educational program spaces are primarily organized by grade level, grouping core teaching areas into distinct "house" wings.

The design also features administrative offices located throughout the building, support spaces, and open locker commons filled with natural light.

A central media center features views spanning from the building entry to an enclosed courtyard for outdoor learning and provides ample daylight to all classrooms.

FAIRFAX COUNTY PUBLIC SCHOOLS

SCHOOL	HARD COST	SOFT COST	TOTAL COST	SF	CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Fort Belvoir Elementary School	$22,609,972.49	$4,408,944.64	$27,018,917.13	95,341	576	$ 283.39	$ 46,907.84	166
Herndon High School	$84,000,000.00	$16,968,000.00	$100,968,000.00	421,940	2500	$ 239.29	$ 40,387.20	169
George C. Marshall High School	$54,363,560.35	$11,882,354.36	$ 66,245,914.71	364,000	2000	$ 181.99	$ 33,122.96	182
TJ High School for Science & Technology	$58,577,312.00	$11,913,625.66	$70,490,937.66	398,833	1820	$ 176.74	$ 38,731.28	219

FAIRFAX COUNTY PUBLIC SCHOOLS

Herndon High School

Occupancy: Sept. 2021

COST	$100,968,000
SF	421,940
Cost/SF	$239.29
SEATS	2,500
SF/Seat	169
Cost/Seat	$40,387.20

RELEVANCY	
✓	Renovations & New Construction
✓	High School
✓	Anticipated Completion Sept. 2021
✓	Multi-Program Designs
✓	Collaboration & Socialization Spaces

Project Scope

The scope of this project includes major renovations to the existing building and new construction of additions.

The full renovation of the school will include 138,558 square feet of additions and modifications that will expand the school to around 422,000 square feet with a capacity for 2,500 students.

The Improvement Program will be implemented in six (6) successive phases while the building is in full operation over the next 5 years.

A major feature of Herndon High School will be collaborative learning spaces, which enable 21st century teaching methods, peer-to-peer teaching, socialization, and community.

These spaces include “Main Street,” a planetarium, a library, a cafeteria expansion (focusing on a coffeehouse collaborative model), and the activation of outside courtyards.

This project includes the following infrastructure improvements:

- HVAC system replacement
- Electrical system replacement
- Data/security upgrades

The project also includes the following expansion improvements: a new 80,000 SF science wing, new theatre support spaces, new gymnasium support spaces and new library and support spaces.

Lastly, the project includes the following improvements: all existing academic spaces, all existing support spaces, and all site and athletic support elements. Special Needs spaces include

integrated special education classrooms for each curriculum subject, autism classrooms, intellectually disabled classrooms, severely intellectually disabled classrooms, a life skills lab and a work awareness transition classroom.

FAIRFAX COUNTY PUBLIC SCHOOLS

George C. Marshall High School

Occupancy: Spring 2015

COST	$66,245,914.71
SF	364,000
Cost/SF	$181.99
SEATS	2,000
SF/Seat	182
Cost/Seat	$33,122.96

RELEVANCY

✓	Renovation & Addition
✓	High School
✓	Completed Spring 2015
✓	Revised School Program to Match Pedagogy
✓	Modern Architectural Design

Project Scope

The George C. Marshall High School project was a complete building renovation totaling 364,000 SF, including the addition of a 2-story classroom wing, administration area, and renovated Media Center, 1-story Band Room and Blackbox Theater. Smaller additions were located around the building.

The design phase included careful study of all spaces and programs directly and indirectly associated with the school, including academy programs, career development for special needs, bus driver training facility, assessment center, as well as the school proper.

Site facilities were evaluated and designed to better accommodate school functions. Program spaces were arranged in order to keep similar

program spaces adjacent to each other, as well as to include workrooms within each department.

The large 2-story addition, with twenty-two (22) classrooms in the rear of the school, contains science on the second floor, and business, marketing and art rooms on the first floor.

The courtyard created between the addition and the existing building will serve as an art courtyard for the adjacent art rooms. The addition in the front of the school contains the administration suite. Other additions provide a new band room, performing arts support spaces and athletic facility programs.

All additions are designed to give the school a modern appearance while still complementing the existing architecture. Entrances are designed as lanterns which give visual clarity to these spaces. This language is repeated in other primary programmatic spaces around the school including the media center, band room and science labs.

The exterior envelope received new doors and windows and door canopies and built-up roofing, re-roofing at various locations.

The interior of the existing building was completely renovated including new floor finishes, new paint, new ceilings, new interior doors, new lockers, renovated toilet facilities, new plumbing system, new HVAC systems, new fire alarm and protection system including building-wide sprinkler system, new power – lighting – communications – data and security systems.
New site work features included renovations to all parking areas, new tennis courts and sports press boxes, as well as a 300,000 gallon underground cistern facility, utilizing stored rainwater for playing field irrigation.

FAIRFAX COUNTY PUBLIC SCHOOLS

Thomas Jefferson High School for Science & Technology

Occupancy: Sept. 2016

COST	$70,490,937.66
SF	398,833
Cost/SF	$176.74
SEATS	1,820
SF/Seat	182
Cost/Seat	$38,731.28

RELEVANCY

✓	Renovation of Historically Significant Building
✓	Specialized High School
✓	Completed Sept. 2016
✓	Re-designed to Meet Flexible Learning Spaces
✓	High-Performance Design

Project Scope

A Virginia Academic-Year Governor's School, TJHSST provides an innovative, specialized learning environment for highly motivated students who have a genuine interest in biological, physical, mathematical, technological and computer sciences.

Among the many reasons behind the project are the creation of a flexible learning environment that supports a focus on collaboration and project-based learning, the creation of a variety of learning space sizes and the celebration of science and technology through the architecture of the building. Other goals include better use of – and enhanced visual and physical connections to – the school's courtyards, and the creation of a high-performance building.

The renovation of TJHSST more than doubles its size. Among the facilities

renovated or added were state-of-the-art laboratories for neuroscience, a wave tank for oceanography and an optics lab outfitted with lasers.

In addition, the facility is powered partially by solar panels and features an extremely efficient heating and cooling system.

The school includes two classroom wings, where subjects like math and science, will be paired together to allow for collaborative learning. Each hallway includes a collaborative learning space.

The school will include several patio and porch areas, including one off of the technology education and art classrooms that will allow students to go outside and study under natural sunlight.

An outdoor courtyard will be connected to the cafeteria where students can study or possibly eat lunch, he said.

The area will include a playground for the school's child development classes. The school has an open concept with large windows and wide hallways.

The main wall treatment will consist of a gray concrete block, instead of the green walls in the current school. Other colors will be added in, including a shade of green, that has been found to be calming.

ALEXANDRIA CITY PUBLIC SCHOOLS

SCHOOL	HARD COST	SOFT COST	TOTAL COST	SF	CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Jefferson-Houston PK-8 Combined School	$39,057,761.80	$9,064,339.65	$48,122,101.45	124,500	805	$386.52	$59,779.01	155

ALEXANDRIA CITY PUBLIC SCHOOLS

Jefferson-Houston PK-8 Combined School

Occupancy: Sept. 2014

COST	$48,122,101.45
SF	124,500
Cost/SF	$386.52
SEATS	805
SF/Seat	155
Cost/Seat	$59,779.01

RELEVANCY

✓	New Construction / School Replacement
✓	PK-8 Combined School
✓	Completed Sept. 2014
✓	New Set of Education Specifications Developed
✓	Situated in Dense Urban Environment
✓	Flexible Breakout & Collaborative Spaces

Project Scope

Alexandria City Public Schools embraced replacing the former Jefferson-Houston K-5 Elementary School with a new PreK-8 School in order to support growing enrollment and improve academic outcomes.

As part of the intensive planning process, the design team, VMDO Architects, authored a set of Educational Specifications connecting the community's needs to the school's innovative PreK-8 program and created a shared sense of ownership for the new school.

Situated in a dense urban environment, the Education Specifications outline a "nexus approach," in which people, programs, and services are located in close proximity to each other in order to maximize resource sharing and reinforce the neighborhood context.

ALEXANDRIA CITY PUBLIC SCHOOLS

The school's unique design features:

A transparent gymnasium provides a strong, shared-use presence at the intersection of Cameron and N. West Streets.

The Media Center serves as a monumental terminus for Queen Street, above which is a rooftop garden and outdoor classroom for students and community partners.

The school's prominent public entry is strengthened by a dynamic, circular tower. Housing communal learning spaces, the tower serves as an urban and academic locus for the school.

The new school features grade-specific "pods" carefully arranged to support adjacencies between students. Flexible breakout spaces promote individualized instruction and shared educational spaces contribute to the school's sense of place and community.

Instead of a centralized cafeteria, the school uses a distributed dining approach to integrate the social,

communal, and educational aspects of mealtime.

A LEED Gold school, the building acts as a teaching tool, encouraging students to participate in the revealed ecological and engineering functions of the building and its surrounding landscape. Outside, sustainable features include on-site storm water management, water efficient landscaping, and various shading strategies that maximize daylight and minimize energy consumption.

DC PUBLIC SCHOOLS

SCHOOL	HARD COST	SOFT COST	TOTAL COST	SF	CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Ballou High School	$150,767,600.00	$ 17,737,050.00	$168,504,650.00	365,000	1300	$ 461.66	$ 129,618.96	281
Duke Ellington School of the Arts	$134,213,030.11	$ 14,704,912.11	$148,917,942.22	271,000	600	$ 549.51	$ 248,196.57	452
Dunbar High School	$121,488,229.22	$9,258,176.70	$ 30,746,405.92	280,000	1100	$ 466.95	$ 118,860.37	255
Francis L. Cardozo Middle & High School	$123,360,689.90	$11,048,167.60	$134,408,857.49	395,000	1100	$ 340.28	$ 122,189.87	359
Howard D. Woodson High School	$99,928,533.63	$6,994,997.35	$106,923,530.98	231,000	639	$ 462.87	$ 167,329.47	362
Kimball Elementary School	$ 44,498,000.00	$ 5,471,960.00	$ 49,969,960.00	83,400	400	$ 599.16	$ 124,924.90	209
Payne Elementary School	$24,919,054.19	$ 2,337,147.87	$ 27,256,202.06	68,000	272	$ 400.83	$ 100,206.63	250
Roosevelt High School	$136,882,647.27	$8,691,514.45	$145,574,161.71	331,900	1100	$ 438.61	$ 132,340.15	302

DC PUBLIC SCHOOLS

Ballou High School

Occupancy: Sept. 2016

COST	$ 168,504,650.00
SF	365,000
Cost/SF	$ 461.66
SEATS	1,300
SF/Seat	281
Cost/Seat	$ 129,618.96

RELEVANCY

✓	New Construction / Modernization
✓	High School
✓	Completed Sept. 2016
✓	Multi-Program Design
✓	Situated in Dense Urban Environment
✓	Site / Construction Challenges

Project Scope

The 365,000-SF, three-story facility is home to a new fine arts center and state-of-the-art auditorium, two-story cafeteria, 37 classroom spaces, 13 science and bio-technology labs, multiple computer labs, an exhibition-style teaching kitchen, an auto-tech lab and numerous specialized spaces to support the school's various student programs.

The new modernized high school's design incorporates multi-level wings for academics, athletics and career development.

Besides providing long-awaited upgrades to Ballou's high-school classroom areas, the new facility's design had to accommodate a range of other activities: an outpatient health clinic; an 800-student adult education program; a full-service automotive shop; a collegiate-level competition swimming

pool; and a rehearsal/recording area for Ballou's nationally recognized marching band.

One of the major challenges of the project was its site constraints. The new building had to be integrated into a 16.4-acre hillside site, which had been partially leveled decades ago to construct Ballou's athletic fields.

The slope includes marine clay and other difficult soils that required foundations sturdy enough for a structural system to support expansive interior spaces and ample daylighting and also enable the school to fill a critical role as a neighborhood shelter-in-place in case of natural disasters.

Brian Hanlon, then-director of DC Department of General Services, said of the new modernized high school, "We didn't want to just plug another building into the grid. This was an opportunity to bring the community together in a lot of ways and provide a model of sustainability, with a design and materials that won't be torn down in 50 years."

The school has achieved LEED-Platinum rating, due to its high-efficiency heating and cooling systems, low-E glass coatings and rooftop solar panels generating power for purchase by the local electric utility.

In December of 2016, a few months after the project's completion, the design-build contractor, Chiaramonte-Hess, a joint venture between Chiaramonte Construction Company and Hess Construction and Engineering Services, Inc., sued the design architects, a joint venture between Bowie Gridley Architects and Perkins + Will, claiming at least $2 million in damages over claims they delivered incomplete design plans.

Chiaramonte-Hess said it based its Guaranteed Maximum Price on the architecture team's design documents, which were, according to their lawsuit, "incomplete, uncoordinated and not ready for construction."

DC PUBLIC SCHOOLS

Duke Ellington School of the Arts

Occupancy: Sept. 2017

COST	$ 148,917,942.22
SF	271,000
Cost/SF	$ 549.51
SEATS	600
SF/Seat	452
Cost/Seat	$ 248,196.57

RELEVANCY

✓	Renovation of Historically Significant Building
✓	Specialized High School
✓	Completed Sept. 2017
✓	Modernization of Space within Historic Context
✓	Situated in Dense Urban Environment
✓	High-Performing & Sustainable Design

Project Scope

The Duke Ellington School of the Arts is the only high school in the District of Columbia that combines a full college preparatory curriculum with intensive pre-professional arts training.

The grand Classical Revival was originally completed in 1898. Over the last century additions had been added to accommodate the growing needs of the school. However, to meet the needs of the 21st century, the school underwent a complete modernization from 2014 - 2017.

The original building spanned 171,000 square feet, while the newly renovated building offers 271,000 square feet. The new design finds the balance between restoring and respecting the historic fabric, while creating major new academic and performance venues. Some of the major renovated arts

spaces include a recording studio, control room, 100-seat band and orchestra rehearsal studios, jazz and percussion labs, and string ensemble rehearsal studio. There is also a 120-seat choir studio, six piano and music theory labs and classrooms, 22 sound isolation practice rooms, and nine sound isolation lesson studios.

In addition, there are three vocal technique studios, six dance studios and classrooms, eight museum studies and literary media and communication labs and classrooms, and three video, film, and editing labs.

Two music libraries, two green rooms, and a health center round out the project's comprehensive scope.

The project was consistently delayed and over budget. It opened more than a year behind schedule and approximately $100 million over budget.

Council woman Elissa Silverman described the project as "Exhibit A in how not to control cost."

DC PUBLIC SCHOOLS

Dunbar High School

Occupancy: Sept. 2014

COST	$ 130,746,405.92
SF	280,000
Cost/SF	$ 466.95
SEATS	1,100
SF/Seat	255
Cost/Seat	$ 118,860.37

RELEVANCY

✓	New Construction
✓	High School
✓	Completed Sept. 2014
✓	21st Education Design Principles
✓	Situated in Dense Urban Environment
✓	LEED Platinum

Project Scope

The completely new 280,000 square-foot Dunbar Senior High School includes energy efficient building systems, clean and maintainable interior finishes, and bright and healthy classrooms and public spaces.

The project included demolition of the existing 1977 high school, and construction of a new, state of the art, LEED Platinum high school for 1,100 students.

The “heart of the school” is an atrium-like armory, connecting the academic wing, sports fields, gym, pool, auditorium, and cafeteria.

The academic wing provides flexible learning environments that accommodate four (4) distinct academies.

At time of its certification for LEED Platinum, the school had achieved 91 points out of a possibility of 100, earning it the distinction of being the highest-scoring LEED school in the world.

The school's design incorporates a range of environmentally sustainable features, including a 500,000 kW photovoltaic panels (PV, or solar), two (2) 20,000-gallon geothermal wells for reusing rainwater, rainwater cisterns, enhanced acoustics, low VOC materials, and extensive interior day-lighting.

The shell of the school is still masonry and cast stone, with a curtain wall and punched openings.

DC PUBLIC SCHOOLS

Francis L. Cardozo Middle & High School

Occupancy: Sept. 2013

COST	$ 134,408,857.49
SF	395,000
Cost/SF	$313.02
SEATS	1,100
SF/Seat	359
Cost/Seat	$ 122,189.87

RELEVANCY

✓	Renovation of Historically Significant Building
✓	Combined Middle & High School
✓	Completed Sept. 2013
✓	Co-Program Design
✓	Situated in Dense Urban Environment
✓	High-Performing & Sustainable Design

Project Scope

The school, located at 1200 Clifton St NW, is an important historic landmark in the neighborhood and city - it was placed on the DC Inventory of Historic Sites in 1991 and the National Register of Historic Places in 1993.

Full modernization of Cardozo High School was completed in 2013.

The building now features a high school, a middle school, the Academy of Construction and Design, and the TransSTEM Academy.

The modernization project marries both high tech advancements – such as interactive whiteboards, classroom sound enhancement systems, and computer labs – with major renovations to many of the celebrated period features of the original Cardozo, including stone carvings and decorative

tile work, an historic lecture classroom, auditorium, and indoor pool.

The new campus features the following:

- Twenty-eight (28) classroom and project labs spaces
- Seven (7) science classrooms/labs
- Five (5) classrooms for specialized education
- Three (3) dedicated spaces for visual and performing arts
- Culinary arts kitchen with classroom
- New regulation-sized competition gymnasium addition complete with a state-of-the-art fitness center, aerobics and dance studio, activity room, training room and health classrooms
- Fully restored historic auditorium featuring state-of-the-art acoustical and audiovisual design elements
- New cafeteria central gathering space with flanking skylit atria, created from two existing exterior courtyards, designed for student activities and performances
- Historic indoor pool, fully renovated for use by both students and the community.

The high school is now up to 21st century DCPS standards for a school with over 1,100 students.

The modernization of Cardozo also incorporates a number of energy-efficient elements including:

- New mechanical, plumbing, and electrical systems designed to reduce the energy consumption of the building
- “Green” roof to aid with stormwater management
- It was also certified LEED Gold.

DC PUBLIC SCHOOLS

Howard D. Woodson High School

Occupancy: Sept. 2012

COST	$ 106,923,530.98
SF	231,000
Cost/SF	$ 462.87
SEATS	639
SF/Seat	362
Cost/Seat	$ 167,329.47

RELEVANCY	
✓	New Construction
✓	High School
✓	Sept. 2012
✓	STEM-based Program Design
✓	Situated in Dense Urban Environment
✓	High-Performing & Sustainable Design

Project Scope

The Howard D. Woodson High School was designed to support a progressive curriculum based on Science, Technology, Engineering and Mathematics (STEM).

The new, 231,000 square foot, three-story school features four (4) distinct learning communities, supported by an advanced technology infrastructure.

Each educational community includes an integrated learning suite, with laboratories and break-out areas surrounding a gathering space.

The campus includes a 1,000 seat, proscenium-style theater, with a raised stage, dressing rooms and support spaces. Its athletic facilities include an eight-lane, swimming pool with separate community locker rooms, two

gymnasiums, a football stadium with bleachers, ticketing and concessions buildings, tennis courts, a softball field, and practice fields.

The new school was designed to achieve LEED Gold certification and features a green roof, rainwater harvesting system, high-performance glazing, super-insulated perimeter envelope, daylight harvesting, water conserving plumbing fixtures, and the use of salvaged building materials and materials that emit lower volatile organic compounds.

DC PUBLIC SCHOOLS

Payne Elementary School

Occupancy: Sept. 2016

COST	$ 27,256,202.06
SF	68,000
Cost/SF	$ 400.83
SEATS	272
SF/Seat	250
Cost/Seat	$ 100,206.63

RELEVANCY

✓	Renovation of Historically Sensative Building
✓	Elementary School
✓	Completed Sept. 2016
✓	Supports Multiple Learning Programs
✓	Situated in Dense Urban Environment
✓	Services Students with Disabilities & ASL

Project Scope

Located on C Street in the Southeast section of the District, Payne Elementary School has been serving students and members of the local community for close to 120 years.

Over the course of its lifetime, the building has experienced growth and change, with a west wing added while an east-side building burned down in an accidental fire.

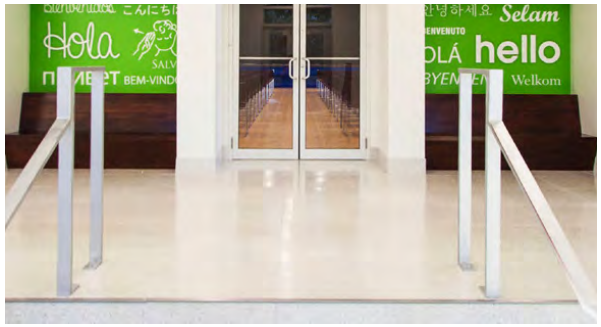
Payne is known for its strong leadership; its high quality early childhood curriculum; its program integrating children with hearing impairments with hearing students; its special education services, including a program for children with emotional behavioral disabilities; and as the neighborhood school for children from the DC General Families Shelter.

The renovation incorporated a responsive design that reprogrammed spaces within the existing footprint of the building, incorporated curriculum-centered graphics, and provided the programmatic support for special needs learning.

Existing finishes were replaced with colors, materials, spatial organization, and furniture that took into consideration the preferences and optimal learning environments for special needs children.

In addition to ADA upgrades, hearing impaired educational accommodations, American Sign Language requirements, and the right sizing of classrooms were part of the renovation's scope of work. The classrooms were also equipped with induction loops, or electromagnetic communication detection systems, that connect to hearing aids and amplify sound inside a classroom.

Other structural renovations included the addition of a connecting bridge and an elevator, linking both wings and making all levels ADA accessible. The project included an upgrade in HVAC systems for the dining and auditorium, and the incorporation of sustainable technologies and green initiatives designed to achieve LEED Gold certification.



DC PUBLIC SCHOOLS

Roosevelt High School

Occupancy: Sept. 2015

COST	$ 145,574,161.71
SF	331,900
Cost/SF	$ 438.61
SEATS	1100
SF/Seat	302
Cost/Seat	$ 132,340.15

RELEVANCY

✓	Renovation of Historically Significant Building
✓	High School
✓	Completed Sept. 2015
✓	21st Century Education Design
✓	Situated in Dense Urban Environment
✓	Historic Preservation

Project Scope

At the conclusion of its modernization in Sept. and October of 2015, Roosevelt High School was completely transformed from an old, dilapidated 1930's high school to a new 21st-century learning environment.

Its crumbling ceilings and cracked floors were restored to their 1930's glory, while the dark and gloomy interior became a thing of the past.

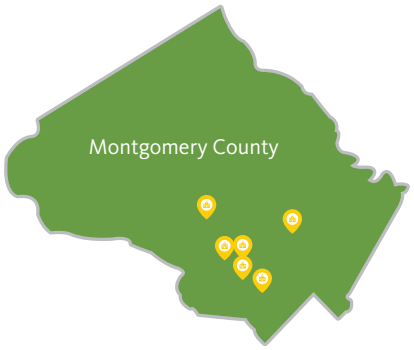
The renewed Roosevelt campus is centered around a new enclosed, central atrium that will serve as the "heart" of the modernized high school. In endeavoring to create a great 21st-century school for Roosevelt's students, staff and community, the new design will:

- Provide technology-enhanced classrooms and laboratories

- Nurture a sense of civic pride in the students by re-opening the 13th Street main entrance
- Promote proactive and subtle security
- Reduce the perceived scale of the school by streamlining the circulation through the building
- Enable active community use of the gym, pool natatorium, and health clinic
- Promote safe, accessible pedestrian patterns around the site
- Create a “high performance” school that both conserves resources

Because of the restoration and renovation, the high school has received the Preservation Award from the DC Preservation League, the Vision Award from The Committee of 100 on the Federal City, the Award of Merit in Renovation/Restoration from ENR Regional Mid-Atlantic, and the American InHouse Design Award from Graphic Design USA.

MONTGOMERY COUNTY PUBLIC SCHOOLS



SCHOOL	HARD COST	SOFT COST	TOTAL COST	SF	CAPACITY	COST/SF	COST/SEAT	SF/SEAT
Gaithersburg High School	$105,563,178.00	$18,903,559.66	$124,466,737.66	418,000	2400	$ 297.77	$ 51,861.14	174
Hallie Wells Middle School	$ 49,463,359.40	$ 8,415,922.19	$ 57,879,281.59	154,400	988	$ 374.87	$ 58,582.27	156
Richard Montgomery Elementary School	$ 31,776,000.00	$ 7,309,704.00	$ 39,085,704.00	92,000	600	$ 424.84	$ 65,142.84	153
Seneca Valley High School	$142,239,000.00	$25,899,032.00	$168,138,032.00	440,000	2400	$ 382.13	$ 70,057.51	183
Wheaton High School	$110,500,000.00	$19,500,000.00	$130,000,000.00	330,200	1700	$ 393.70	$ 76,470.58	194
Wims Elementary School	$ 25,466,515.50	$ 5,165,517.61	$ 30,632,033.11	91,931	740	$ 333.21	$ 41,394.64	124

Gaithersburg High School

Occupancy: Sept. 2013

TOTAL COST	$ 124,466,737.66
SF	418,000
Cost/SF	$ 297.77
SEATS	2,400
SF/Seat	174
Cost/Seat	$ 51,861.14

RELEVANCY

✓	New Construction
✓	High School
✓	Completed Sept. 2013
✓	Designed to Accommodate Multiple Programs
✓	Community Lobbied for New Building

Project Scope

The construction of this $125 million-dollar school was on the existing parking lot, with the area of 40.8 acres, replacing the original building built in 1951. The new high school is 418,000 SF and accommodates 2,400 students.

Students have access to a broad curriculum that includes landscaping and horticulture, cosmetology, automotive foundation, hospitality management, an art suite, a music suite and an information technology center.

Amenities include new practice fields, game fields, and a stadium. The school houses the latest technology, and classrooms are arranged to encourage collaboration from students, and the science labs are state of the art.

MONTGOMERY COUNTY PUBLIC SCHOOLS

The school's design earned the 2015 LEED for Schools Gold Certification. Sustainable features include a green roofing system, extensive use of local and recycled materials, and a geothermal HVAC system.

Traffic problems are one of the most difficult issues the school faced. The new construction was being built on the parking lot of the existing school, slowing down the traffic during the morning rush hour traffic, and when the school is released.

Before construction began two (2) parents and community members began lobbying the school board and city council, using the phrase, "The time is now," to call for a change. The school's original building was built in 1951, so the school was in desperate need of an upgrade.

The community was happy to see the construction of a new school.

The new high school accommodates 2,400 students. These students have access to a broad curriculum that includes landscaping and horticulture, cosmetology, automotive foundation, and hospitality management. Amenities includes new practice fields, game fields, and stadium.

Hallie Wells Middle School

Occupancy: Sept. 2016

COST	$ 57,879,281.59
SF	154,400
Cost/SF	$ 374.87
SEATS	988
SF/Seat	$156
Cost/Seat	$ 58,582.27

RELEVANCY

- ✓ New Construction
- ✓ Middle School
- ✓ Completed Sept. 2016
- ✓ Prototype Design
- ✓ Traditional/Modern Architecture Design
- ✓ High-Performing & Sustainable Design

Project Scope

When Hallie Wells Middle School opened in Sept. of 2016, it was the first new construction middle school in Montgomery County in 11 years; the last being Lakelands Park Middle School in 2005.

This school was designed as the fourth iteration of the prototype designed by the architecture firm, Grimm + Parker.

With traditional brick and mortar façade, the building features a classic country schoolhouse steeple, recalling the local area's agrarian past, imitating its older structures, and incorporating the traditional aesthetic of the surrounding community into the design.

The new facility was designed to house 988 students and includes traditional classrooms, science laboratories, a

MONTGOMERY COUNTY PUBLIC SCHOOLS

media center, art rooms, music rooms and administrative areas. Interior athletic features include a large gymnasium, wrestling gymnasium, weight lifting room and dance auxiliary gymnasium. Exterior campus athletic features include several baseball fields, outdoor basketball and tennis courts, as well as a new walking path that circles the campus perimeter.

The three-story design facilitates team teaching that clusters grade levels by floor allowing the educators to create developmentally appropriate, grade specific content.

One unique design feature of the school are classrooms with only stand-up desks. In four (4) classrooms, students have the option to stand for the 40-minute class or sit on a stool. Hallie Wells Middle School is the only middle school in Montgomery County with stand up desks.

Glass has been maximized, creating lighter, brighter interiors more easily observed, increasing visibility without compromising student health and safety.

“This school is bright and open,” says Principal Dr. Barbara Woodward. “There is natural light everywhere including the gym and all the classrooms.”

The new school achieved LEED Gold certification and features bio-filters, rain gardens, electric car charging stations, a geothermal well field, regional and recycled materials, and daylight harvesting controls and sensors for the classrooms.

Wheaton High School

Occupancy: Sept. 2016

COST	$ 130,000,000
SF	330,200
Cost/SF	$ 393.70
SEATS	1,700
SF/Seat	194
Cost/Seat	$ 76,470.58

RELEVANCY

✓	New Construction
✓	High School
✓	Completed Sept. 2016
✓	Shares Campus with Adjacent Tech School
✓	High-Performing & Sustainable Design

Project Scope

The $130 million, 330,200 SF new building replaces the original building built in 1954. The capacity of the school is 1,700 students. The new school has a joint campus with Thomas Edison High School of Technology.

Upon entering the school, students are greeted by a grand stair sitting in the core of the building at the intersection of the building's two main axes, representing the union of technology and the humanities. The stair provides a central gathering place for the school community, serving as a respite between classes and a place to socialize with friends.

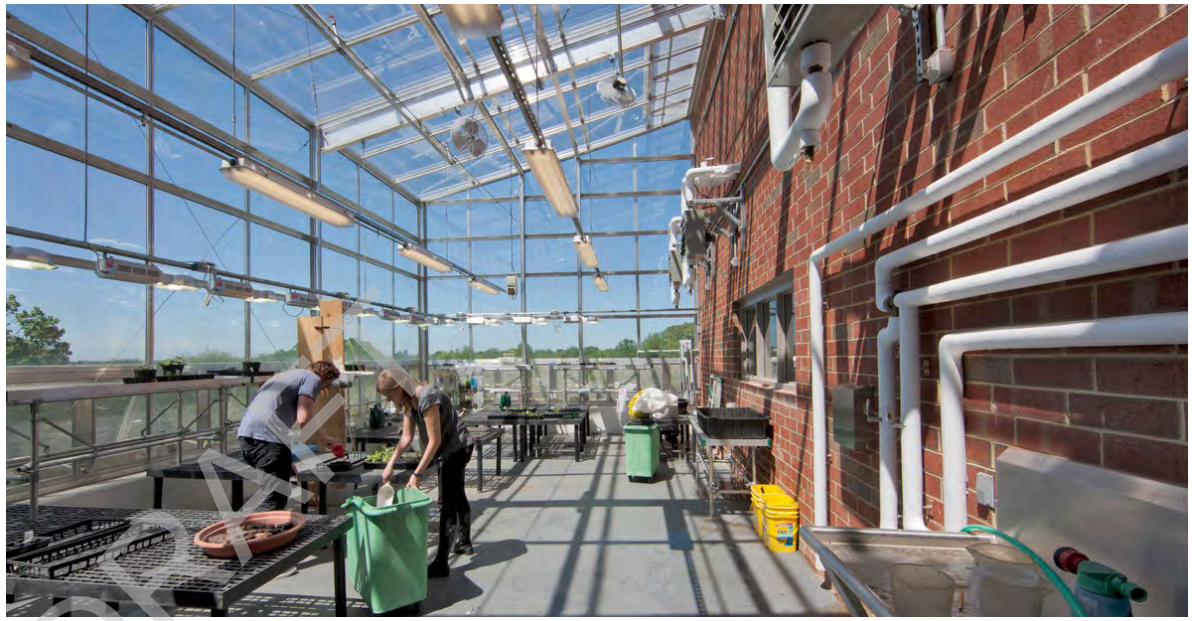
With almost all classrooms having glass windows looking out to the corridor, students are able to see their fellow classmates engaged in learning. At the heart of the building is the outdoor

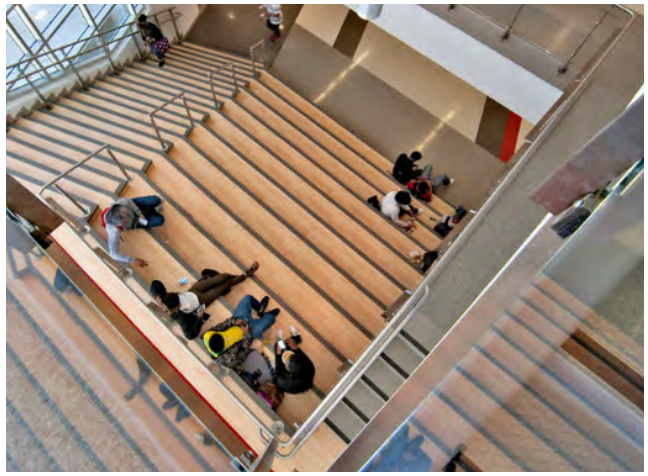
MONTGOMERY COUNTY PUBLIC SCHOOLS

courtyard, which floods natural light into the surrounding classrooms and provides

At the heart of the building is the outdoor courtyard, which floods natural light into the surrounding classrooms and provides additional learning, social, and activity space. The courtyard gives access to benches with a recessed face that display art students' mosaics.

The school is zoned to allow activity spaces—such as the auditorium, gymnasium, and cafeteria—to function during non-school hours without compromising the security of the building's academic areas.





Wims Elementary School

Occupancy: Sept. 2014

COST	$ 30,632,033.11
SF	91,931
Cost/SF	$ 333.21
SEATS	740
SF/Seat	124
Cost/Seat	$ 41,394.64

RELEVANCY

- ✓ New Construction
- ✓ Elementary School
- ✓ Completed Sept. 2014
- ✓ 21st Century Education Design
- ✓ Design Influenced by Site/Context

Project Scope

Evolving the prototype of Montgomery County's school design, Wims Elementary School is situated in a newly developed town, Clarksburg.

The elementary school includes a gymnasium and multi-purpose room that is accessible to the community during non-school hours. The students in the lower grades are located on the ground floor with second through fifth grades on the second level.

Classrooms are equipped with interactive educational technology. In addition, there are flexible spaces for alternate student group arrangements.

Wims supports a connected student body and a community of learners in an active learning environment.
The school's main feature is a 2-story media center that visually links to the

MONTGOMERY COUNTY PUBLIC SCHOOLS

outdoor courtyard. This core learning and gathering space highlight many features that are prevalent in the design overall: abundant natural daylight, flexible furniture, and state-of-the-art technology.

Carefully planned sight lines and the extensive use of glass allow daylight into entirety of the school learning environment. These features, combined with flexible furniture reconfigurable for project-based learning and various groupings, increase student engagement. Technology is integrated throughout the school, with smart boards, tablets, and robust connectivity supporting the learning styles of digital natives.

The school also promotes environmental literacy through its visible sustainable features, such as a sundial, lighting controls, dual flush toilets, and most significantly the green roof, which covers 75% of the building.

The school's interior courtyard also provides outdoor classroom space to learn about the natural environment.

In addition, educational signage ensures that students know the whats, hows, and whys of their sustainable school.

3 | COST MODEL

COST MODEL

INSIGHT

APS School Cost Comparison Study
Hard Costs Comparison by Elementary Schools
Washington, DC

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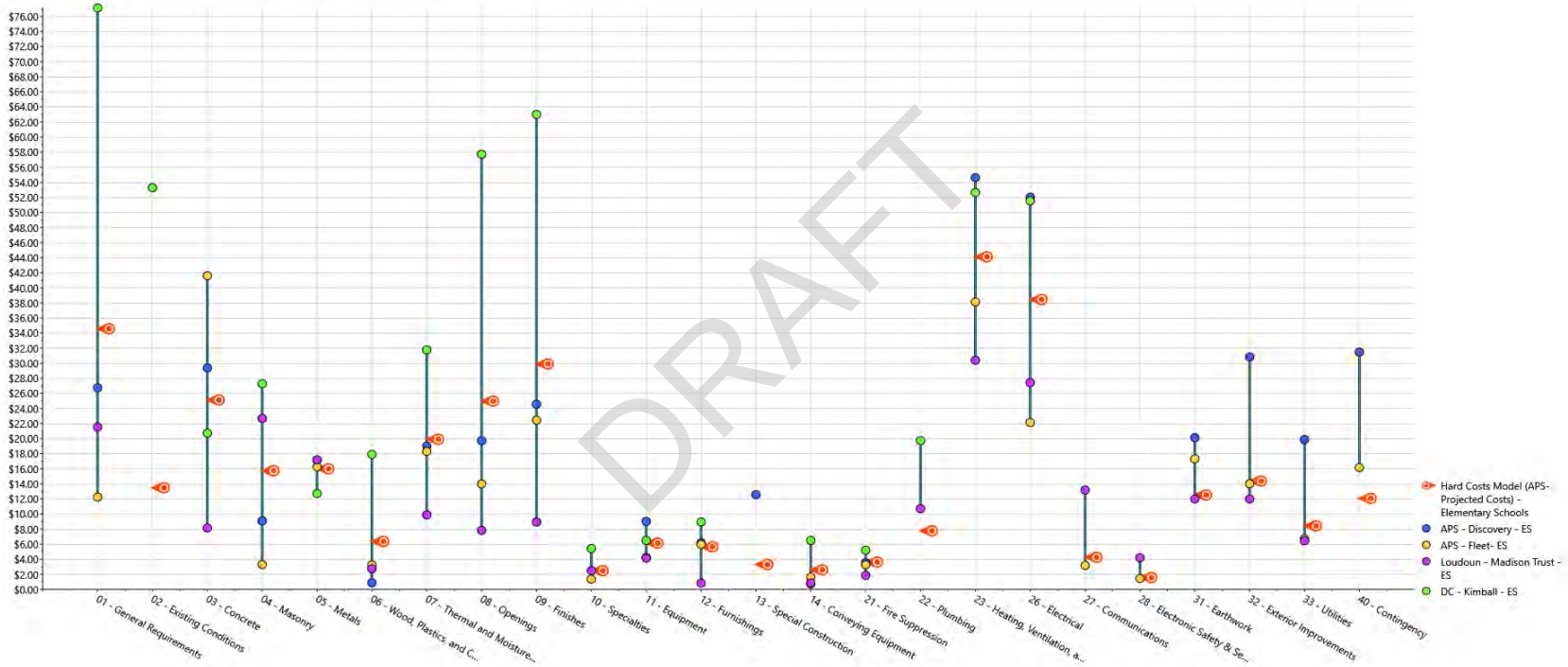
COST MODEL COMPARISON

COST MODEL

		APS - Projected Hard Costs (New School) 100,000 sqft 1426 N Quincy StreetArlington, VA 22207			APS - Discovery - ES 97,588 sqft 1426 N Quincy StreetArlington, VA 22207			APS - Fleet - ES 170,069 sqft 1601 Wilson Blvd, Arlington, VA 22209			Loudoun - Madison Trust - ES 105,757 sqft 42380 Creighton Road, Brambleton, VA 20148			DC - Kimball - ES 83,400 3375 Minnesota Ave SE, Washington, DC 20019		
		Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost
01 - General Requirements	sqft	100,000	$ 3,441,203.70	$ 34.41	97,588	$ 2,609,852.50	$ 26.74	170,070	$ 2,144,600.00	$ 12.61	105,757	$ 2,276,339.10	$ 21.52	83,400	$ 6,625,471.54	$ 79.44
02 - Existing Conditions	sqft	100,000	$ 1,332,223.03	$ 13.32	97,588	$ -	$ -	170,070	$ -	$ -	105,757	$ -	$ -	83,400	$ 4,577,818.74	$ 54.89
03 - Concrete	sqft	100,000	$ 2,496,485.94	$ 24.96	97,588	$ 2,866,774.46	$ 29.38	170,070	$ 7,280,700.00	$ 42.81	105,757	$ 862,749.51	$ 8.16	83,400	$ 1,779,935.75	$ 21.34
04 - Masonry	sqft	100,000	$ 1,558,394.13	$ 15.58	97,588	$ 887,578.51	$ 9.10	170,070	$ 576,800.00	$ 3.39	105,757	$ 2,397,952.11	$ 22.67	83,400	$ 2,342,673.10	$ 28.09
05 - Metals	sqft	100,000	$ 1,583,292.99	$ 15.83	97,588	$ 1,674,686.25	$ 17.16	170,070	$ 2,844,815.00	$ 16.73	105,757	$ 1,817,759.18	$ 17.19	83,400	$ 1,093,247.44	$ 13.11
06 - Wood, Plastics, and Composites	sqft	100,000	$ 619,912.39	$ 6.20	97,588	$ 85,998.81	$ 0.88	170,070	$ 572,337.00	$ 3.37	105,757	$ 289,622.77	$ 2.74	83,400	$ 1,538,231.38	$ 18.44
07 - Thermal and Moisture Protection	sqft	100,000	$ 1,974,395.03	$ 19.74	97,588	$ 1,855,637.74	$ 19.02	170,070	$ 3,203,043.00	$ 18.83	105,757	$ 1,045,396.44	$ 9.88	83,400	$ 2,729,400.08	$ 32.73
08 - Openings	sqft	100,000	$ 2,481,348.77	$ 24.81	97,588	$ 1,924,769.95	$ 19.72	170,070	$ 2,448,580.00	$ 14.40	105,757	$ 827,353.33	$ 7.82	83,400	$ 4,958,038.30	$ 59.45
09 - Finishes	sqft	100,000	$ 2,973,850.25	$ 29.74	97,588	$ 2,396,722.25	$ 24.56	170,070	$ 3,929,098.00	$ 23.10	105,757	$ 945,770.29	$ 8.94	83,400	$ 5,411,941.84	$ 64.89
10 - Specialties	sqft	100,000	$ 231,805.22	$ 2.32	97,588	$ -	$ -	170,070	$ 237,500.00	$ 1.40	105,757	$ 264,840.65	$ 2.50	83,400	$ 464,816.09	$ 5.57
11 - Equipment	sqft	100,000	$ 597,721.17	$ 5.98	97,588	$ 880,706.93	$ 9.02	170,070	$ 743,755.00	$ 4.37	105,757	$ 437,937.16	$ 4.14	83,400	$ 557,779.31	$ 6.69
12 - Furnishings	sqft	100,000	$ 548,798.06	$ 5.49	97,588	$ 604,594.53	$ 6.20	170,070	$ 1,044,768.00	$ 6.14	105,757	$ 88,877.48	$ 0.84	83,400	$ 768,495.94	$ 9.21
13 - Special Construction	sqft	100,000	$ 314,303.14	$ 3.14	97,588	$ 1,226,888.58	$ 12.57	170,070	$ -	$ -	105,757	$ -	$ -	83,400	$ -	$ -
14 - Conveying Equipment	sqft	100,000	$ 243,326.86	$ 2.43	97,588	$ 71,735.08	$ 0.74	170,070	$ 286,500.00	$ 1.68	105,757	$ 91,781.86	$ 0.87	83,400	$ 557,779.00	$ 6.69
21 - Fire Suppression	sqft	100,000	$ 346,401.27	$ 3.46	97,588	$ 344,828.15	$ 3.53	170,070	$ 569,200.00	$ 3.35	105,757	$ 196,821.11	$ 1.86	83,400	$ 447,463.00	$ 5.37
22 - Plumbing	sqft	100,000	$ 760,979.35	$ 7.61	97,588	$ -	$ -	170,070	$ -	$ -	105,757	$ 1,131,670.37	$ 10.70	83,400	$ 1,695,649.00	$ 20.33
23 - Heating, Ventilation, and Air Conditioning	sqft	100,000	$ 4,394,829.69	$ 43.95	97,588	$ 5,331,119.26	$ 54.63	170,070	$ 6,672,696.00	$ 39.23	105,757	$ 3,214,710.75	$ 30.40	83,400	$ 4,521,731.00	$ 54.22
26 - Electrical	sqft	100,000	$ 3,828,375.74	$ 38.28	97,588	$ 5,077,261.40	$ 52.03	170,070	$ 3,873,527.00	$ 22.78	105,757	$ 2,901,207.36	$ 27.43	83,400	$ 4,427,528.00	$ 53.09
27 - Communications	sqft	100,000	$ 409,200.63	$ 4.09	97,588	$ -	$ -	170,070	$ 556,783.00	$ 3.27	105,757	$ 1,394,541.79	$ 13.19	83,400	$ -	$ -
28 - Electronic Safety & Security	sqft	100,000	$ 141,372.11	$ 1.41	97,588	$ -	$ -	170,070	$ 253,763.00	$ 1.49	105,757	$ 444,682.11	$ 4.20	83,400	$ -	$ -
31 - Earthwork	sqft	100,000	$ 1,235,872.67	$ 12.36	97,588	$ 1,963,708.88	$ 20.12	170,070	$ 3,030,057.00	$ 17.82	105,757	$ 1,268,785.34	$ 12.00	83,400	$ -	$ -
32 - Exterior Improvements	sqft	100,000	$ 1,421,365.66	$ 14.21	97,588	$ 3,009,021.28	$ 30.83	170,070	$ 2,454,974.00	$ 14.44	105,757	$ 1,268,209.15	$ 11.99	83,400	$ -	$ -
33 - Utilities	sqft	100,000	$ 826,084.26	$ 8.26	97,588	$ 1,939,866.59	$ 19.88	170,070	$ 1,173,945.00	$ 6.90	105,757	$ 682,843.80	$ 6.46	83,400	$ -	$ -
40 - Contingency	sqft	100,000	$ 1,190,929.94	$ 11.91	97,588	$ 3,071,386.03	$ 31.47	170,070	$ 2,828,625.89	$ 16.63	105,757	$ -	$ -	83,400	$ -	$ -
TOTAL		**100,000**	**$ 34,952,472.00**	**$ 349.52**	**97,588**	**$ 37,823,137.00**	**$ 387.58**	**170,070**	**$ 46,726,067.00**	**$ 274.75**	**105,757**	**$ 23,849,852.00**	**$ 225.52**	**83,400**	**$ 44,498,000.00**	**$ 533.55**

Note: Costs above are illustrative of Unit Cost/SF.

RANGE - UNIT COST



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COST MODEL

INSIGHT

APS School Cost Comparison Study
Hard Costs Comparison by Elementary Schools
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COST MODEL COMPARISON

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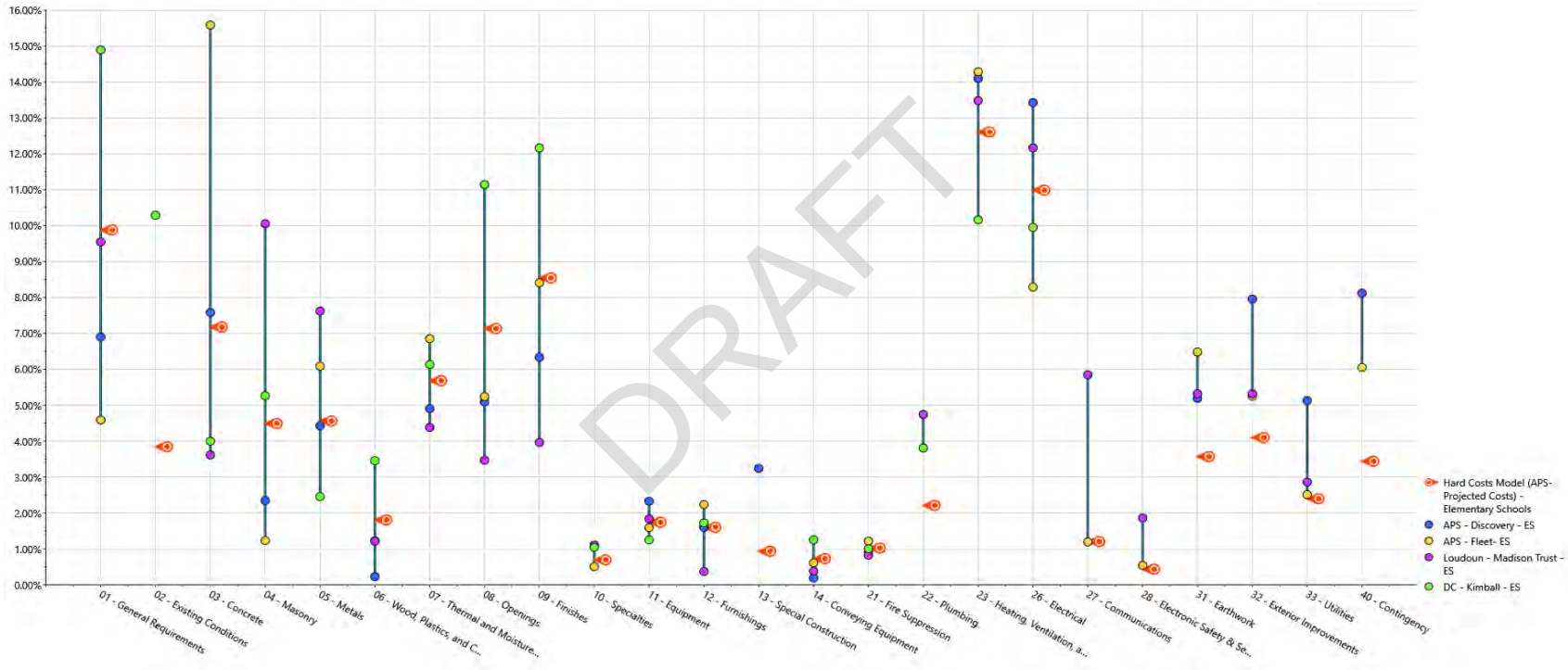
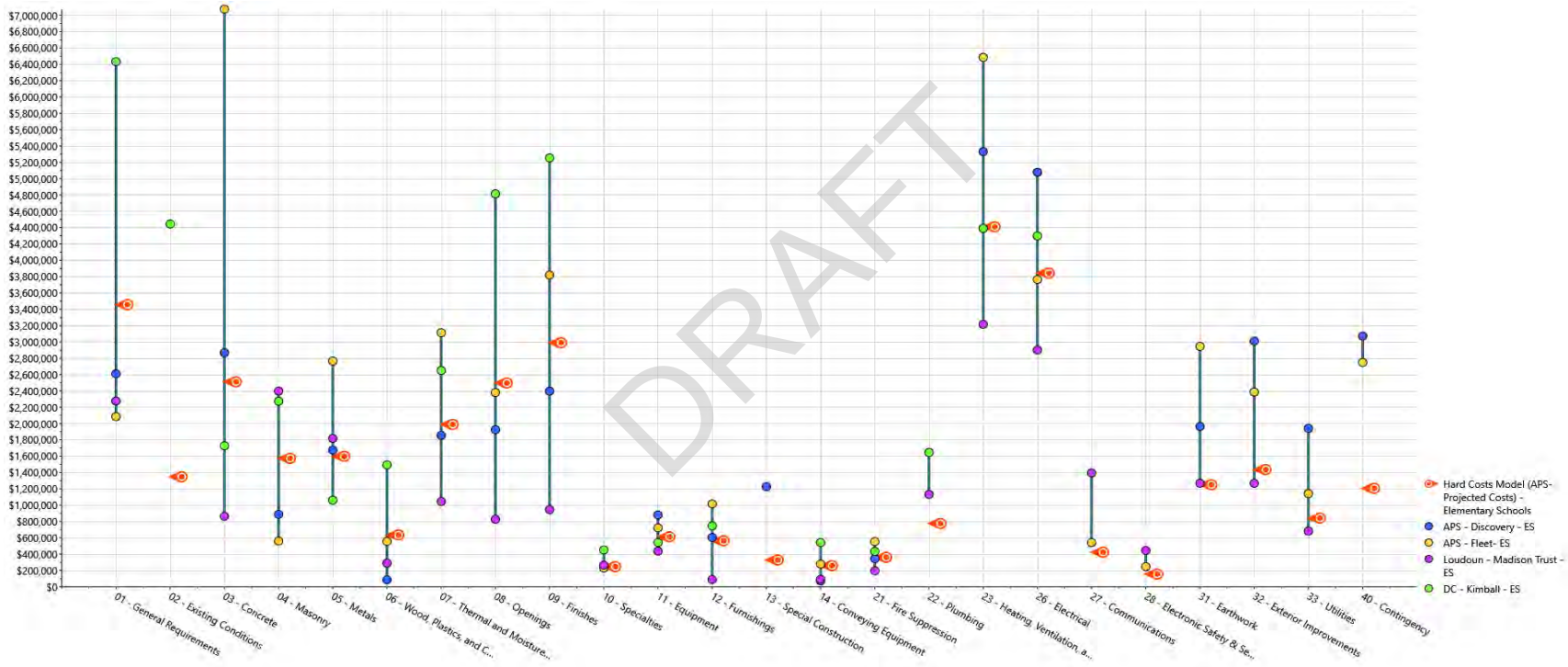
RANGE - PERCENT OF TOTAL



Note: Costs above are illustrative of Unit Percent/Total Cost.

RANGE - TOTAL HARD COSTS



Note: Costs above are illustrative of Total Costs/SF.

INSIGHT

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COST MODEL COMPARISON

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HARD COSTS MODEL - STATISTICS (UNIT COST)

	Mean	Median	Minimum	Maximum	Range	APS - Discovery - ES	APS - Fleet- ES	Loudoun - Madison Trust - ES	DC - Kimball - ES
01 - General Requirements	$ 34.41	$ 24.13	$ 12.26	$ 77.12	$ 64.87	$ 26.74	$ 12.61	$ 21.52	$ 79.44
02 - Existing Conditions	$ 13.32	$ -	$ -	$ 53.29	$ 53.29	$ -	$ -	$ -	$ 54.89
03 - Concrete	$ 24.96	$ 25.05	$ 8.16	$ 41.61	$ 33.45	$ 29.38	$ 42.81	$ 8.16	$ 21.34
04 - Masonry	$ 15.58	$ 15.88	$ 3.30	$ 27.27	$ 23.97	$ 9.10	$ 3.39	$ 22.67	$ 28.09
05 - Metals	$ 15.83	$ 16.71	$ 12.73	$ 17.19	$ 4.46	$ 17.16	$ 16.73	$ 17.19	$ 13.11
06 - Wood, Plastics, and Composites	$ 6.20	$ 3.00	$ 0.88	$ 17.91	$ 17.02	$ 0.88	$ 3.37	$ 2.74	$ 18.44
07 - Thermal and Moisture Protection	$ 19.74	$ 18.66	$ 9.88	$ 31.77	$ 21.89	$ 19.02	$ 18.83	$ 9.88	$ 32.73
08 - Openings	$ 24.81	$ 16.86	$ 7.82	$ 57.71	$ 49.89	$ 19.72	$ 14.40	$ 7.82	$ 59.45
09 - Finishes	$ 29.74	$ 23.51	$ 8.94	$ 63.00	$ 54.06	$ 24.56	$ 23.10	$ 8.94	$ 64.89
10 - Specialties	$ 2.32	$ 1.93	$ -	$ 5.41	$ 5.41	$ -	$ 1.40	$ 2.50	$ 5.57
11 - Equipment	$ 5.98	$ 5.37	$ 4.14	$ 9.02	$ 4.88	$ 9.02	$ 4.37	$ 4.14	$ 6.69
12 - Furnishings	$ 5.49	$ 6.08	$ 0.84	$ 8.95	$ 8.11	$ 6.20	$ 6.14	$ 0.84	$ 9.21
13 - Special Construction	$ 3.14	$ -	$ -	$ 12.57	$ 12.57	$ 12.57	$ -	$ -	$ -
14 - Conveying Equipment	$ 2.43	$ 1.25	$ 0.74	$ 6.49	$ 5.76	$ 0.74	$ 1.68	$ 0.87	$ 6.69
21 - Fire Suppression	$ 3.46	$ 3.39	$ 1.86	$ 5.21	$ 3.35	$ 3.53	$ 3.35	$ 1.86	$ 5.37
22 - Plumbing	$ 7.61	$ 5.35	$ -	$ 19.74	$ 19.74	$ -	$ -	$ 10.70	$ 20.33
23 - Heating, Ventilation, and Air Conditioning	$ 43.95	$ 45.38	$ 30.40	$ 54.63	$ 24.23	$ 54.63	$ 39.23	$ 30.40	$ 54.22
26 - Electrical	$ 38.28	$ 39.49	$ 22.14	$ 52.03	$ 29.89	$ 52.03	$ 22.78	$ 27.43	$ 53.09
27 - Communications	$ 4.09	$ 1.59	$ -	$ 13.19	$ 13.19	$ -	$ 3.27	$ 13.19	$ -
28 - Electronic Safety & Security	$ 1.41	$ 0.73	$ -	$ 4.20	$ 4.20	$ -	$ 1.49	$ 4.20	$ -
31 - Earthwork	$ 12.36	$ 14.66	$ -	$ 20.12	$ 20.12	$ 20.12	$ 17.82	$ 12.00	$ -
32 - Exterior Improvements	$ 14.21	$ 13.01	$ -	$ 30.83	$ 30.83	$ 30.83	$ 14.44	$ 11.99	$ -
33 - Utilities	$ 8.26	$ 6.58	$ -	$ 19.88	$ 19.88	$ 19.88	$ 6.90	$ 6.46	$ -
40 - Contingency	$ 11.91	$ 8.08	$ -	$ 31.47	$ 31.47	$ 31.47	$ 16.63	$ -	$ -
Total	**$ 349.52**	**$ 327.30**	**$ 225.52**	**$ 517.99**	**$ 292.47**	**$ 387.58**	**$ 274.75**	**$ 225.52**	**$ 533.55**

Note: Costs above are illustrative of Unit Cost/SF.

HARD COSTS MODEL - STATISTICS (PERCENT OF TOTAL)

	Mean	Median	Minimum	Maximum	Range	APS - Discovery - ES	APS - Fleet- ES	Loudoun - Madison Trust - ES	DC - Kimball - ES
01 - General Requirements	8.98%	8.22%	4.59%	14.89%	10.30%	6.90%	4.59%	9.54%	14.89%
02 - Existing Conditions	2.57%	0.00%	0.00%	10.29%	10.29%	-	-	-	10.29%
03 - Concrete	7.69%	5.79%	3.62%	15.58%	11.96%	7.58%	15.58%	3.62%	4.00%
04 - Masonry	4.73%	3.81%	1.23%	10.05%	8.82%	2.35%	1.23%	10.05%	5.26%
05 - Metals	5.15%	5.26%	2.46%	7.62%	5.16%	4.43%	6.09%	7.62%	2.46%
06 - Wood, Plastics, and Composites	1.53%	1.22%	0.23%	3.46%	3.23%	0.23%	1.22%	1.21%	3.46%
07 - Thermal and Moisture Protection	5.57%	5.52%	4.38%	6.85%	2.47%	4.91%	6.85%	4.38%	6.13%
08 - Openings	6.24%	5.16%	3.47%	11.14%	7.67%	5.09%	5.24%	3.47%	11.14%
09 - Finishes	7.72%	7.37%	3.97%	12.16%	8.20%	6.34%	8.41%	3.97%	12.16%
10 - Specialties	0.67%	0.78%	0.00%	1.11%	1.11%	-	0.51%	1.11%	1.04%
11 - Equipment	1.75%	1.71%	1.25%	2.33%	1.07%	2.33%	1.59%	1.84%	1.25%
12 - Furnishings	1.48%	1.66%	0.37%	2.24%	1.86%	1.60%	2.24%	0.37%	1.73%
13 - Special Construction	0.81%	0.00%	0.00%	3.24%	3.24%	3.24%	-	-	-
14 - Conveying Equipment	0.61%	0.50%	0.19%	1.25%	1.06%	0.19%	0.61%	0.38%	1.25%
21 - Fire Suppression	0.99%	0.96%	0.83%	1.22%	0.39%	0.91%	1.22%	0.83%	1.01%
22 - Plumbing	2.14%	1.91%	0.00%	4.74%	4.74%	-	-	4.74%	3.81%
23 - Heating, Ventilation, and Air Conditioning	13.00%	13.79%	10.16%	14.28%	4.12%	14.09%	14.28%	13.48%	10.16%
26 - Electrical	10.96%	11.06%	8.29%	13.42%	5.13%	13.42%	8.29%	12.16%	9.95%
27 - Communications	1.76%	0.60%	0.00%	5.85%	5.85%	-	1.19%	5.85%	-
28 - Electronic Safety & Security	0.60%	0.27%	0.00%	1.86%	1.86%	-	0.54%	1.86%	-
31 - Earthwork	4.25%	5.26%	0.00%	6.48%	6.48%	5.19%	6.48%	5.32%	-
32 - Exterior Improvements	4.63%	5.29%	0.00%	7.96%	7.96%	7.96%	5.25%	5.32%	-
33 - Utilities	2.63%	2.69%	0.00%	5.13%	5.13%	5.13%	2.51%	2.86%	-
40 - Contingency	3.54%	3.03%	0.00%	8.12%	8.12%	8.12%	6.05%	-	-
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**0.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Note: Costs above are illustrative of Unit Percent/Total Costs.

OC INSIGHT

APS School Cost Comparison Study
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COST MODEL COMPARISON

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HARD COSTS MODEL - STATISTICS (TOTAL)

	Mean	Median	Minimum	Maximum	Range	APS - Discovery - ES	APS - Fleet- ES	Loudoun - Madison Trust - ES	DC - Kimball - ES
01 - General Requirements	$ 3,350,670	$ 2,443,096	$ 2,084,265	$ 6,432,224	$ 4,347,959	$ 2,609,852	$ 2,144,600	$ 2,276,339	$ 6,625,471.54
02 - Existing Conditions	$ 1,111,074	$ -	$ -	$ 4,444,296	$ 4,444,296	$ -	$ -	$ -	$ 4,577,818.74
03 - Concrete	$ 3,133,353	$ 2,297,397	$ 862,750	$ 7,075,869	$ 6,213,119	$ 2,866,774	$ 7,280,700	$ 862,750	$ 1,779,935.75
04 - Masonry	$ 1,530,112	$ 1,580,961	$ 560,573	$ 2,397,952	$ 1,837,379	$ 887,579	$ 576,800	$ 2,397,952	$ 2,342,673.10
05 - Metals	$ 1,829,647	$ 1,746,223	$ 1,061,360	$ 2,764,781	$ 1,703,420	$ 1,674,686	$ 2,844,815	$ 1,817,759	$ 1,093,247.44
06 - Wood, Plastics, and Composites	$ 606,306	$ 422,929	$ 85,999	$ 1,493,365	$ 1,407,366	$ 85,999	$ 572,337	$ 289,623	$ 1,538,231.38
07 - Thermal and Moisture Protection	$ 2,165,939	$ 2,252,714	$ 1,045,396	$ 3,112,930	$ 2,067,534	$ 1,855,638	$ 3,203,043	$ 1,045,396	$ 2,729,400.08
08 - Openings	$ 2,486,310	$ 2,152,232	$ 827,353	$ 4,813,426	$ 3,986,072	$ 1,924,770	$ 2,448,580	$ 827,353	$ 4,958,038.30
09 - Finishes	$ 3,103,785	$ 3,107,641	$ 945,770	$ 5,254,090	$ 4,308,320	$ 2,396,722	$ 3,929,098	$ 945,770	$ 5,411,941.84
10 - Specialties	$ 236,729	$ 247,829	$ -	$ 451,259	$ 451,259	$ -	$ 237,500	$ 264,841	$ 464,816.09
11 - Equipment	$ 645,746	$ 632,171	$ 437,937	$ 880,707	$ 442,770	$ 880,707	$ 743,755	$ 437,937	$ 557,779.31
12 - Furnishings	$ 613,732	$ 675,338	$ 88,877	$ 1,015,375	$ 926,498	$ 604,595	$ 1,044,768	$ 88,877	$ 768,495.94
13 - Special Construction	$ 306,722	$ -	$ -	$ 1,226,889	$ 1,226,889	$ 1,226,889	$ -	$ -	$ -
14 - Conveying Equipment	$ 245,867	$ 185,111	$ 71,735	$ 541,510	$ 469,775	$ 71,735	$ 286,500	$ 91,782	$ 557,779.00
21 - Fire Suppression	$ 382,312	$ 389,620	$ 196,821	$ 553,186	$ 356,365	$ 344,828	$ 569,200	$ 196,821	$ 447,463.00
22 - Plumbing	$ 694,465	$ 565,835	$ -	$ 1,646,192	$ 1,646,192	$ -	$ -	$ 1,131,670	$ 1,695,649.00
23 - Heating, Ventilation, and Air Conditioning	$ 4,855,161	$ 4,860,482	$ 3,214,711	$ 6,484,970	$ 3,270,259	$ 5,331,119	$ 6,672,696	$ 3,214,711	$ 4,521,731.00
26 - Electrical	$ 4,010,352	$ 4,031,470	$ 2,901,207	$ 5,077,261	$ 2,176,054	$ 5,077,261	$ 3,873,527	$ 2,901,207	$ 4,427,528.00
27 - Communications	$ 483,915	$ 270,559	$ -	$ 1,394,542	$ 1,394,542	$ -	$ 556,783	$ 1,394,542	$ -
28 - Electronic Safety & Security	$ 172,826	$ 123,312	$ -	$ 444,682	$ 444,682	$ -	$ 253,763	$ 444,682	$ -
31 - Earthwork	$ 1,544,326	$ 1,616,247	$ -	$ 2,944,811	$ 2,944,811	$ 1,963,709	$ 3,030,057	$ 1,268,785	$ -
32 - Exterior Improvements	$ 1,665,784	$ 1,827,058	$ -	$ 3,009,021	$ 3,009,021	$ 3,009,021	$ 2,454,974	$ 1,268,209	$ -
33 - Utilities	$ 940,907	$ 911,881	$ -	$ 1,939,867	$ 1,939,867	$ 1,939,867	$ 1,173,945	$ 682,844	$ -
40 - Contingency	$ 1,455,108	$ 1,374,523	$ -	$ 3,071,386	$ 3,071,386	$ 3,071,386	$ 2,828,626	$ -	$ -
Total	**$ 37,571,151**	**$ 40,511,625**	**$ 23,849,852**	**$ 45,411,503**	**$ 21,561,651**	**$ 37,823,137**	**$ 46,726,067**	**$ 23,849,852**	**$ 44,498,000.00**

Note: Costs above are illustrative of Unit Costs/Total Costs.

COST MODEL COMPARISON

Note: Costs below are illustrative of Unit Cost/SF.

		APS - Projected Hard Costs (New School) 100,000 sqft 1426 N Quincy StreetArlington, VA 22207			APS - Wilson - HS 109,988 sqft 701 S Highland St, Arlington, VA 22204			APS - Wakefield - HS 403,940 sqft 1325 S. Dinwiddie St., Arlington, VA 22206			Loudoun - Riverside - HS 275,386 sqft 19019 Upper Belmont Pl, Leesburg, VA 20176		
		Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost
01 - General Requirements	sqft	100,000	$ 3,379,223.73	$ 33.79	181,803	$ 1,852,874.64	$ 10.19	403,940	$ 12,648,588.72	$ 31.31	275,386	$ 2,751,229.01	$ 9.99
02 - Existing Conditions	sqft	100,000	$ 1,579,982.46	$ 15.80	181,803	$ 6,212,624.65	$ 34.17	403,940	$ 10,385,378.91	$ 25.71	275,386	$ 710,699.99	$ 2.58
03 - Concrete	sqft	100,000	$ 2,259,242.03	$ 22.59	181,803	$ 12,623,737.27	$ 69.44	403,940	$ 5,292,690.18	$ 13.10	275,386	$ 4,515,678.42	$ 16.40
04 - Masonry	sqft	100,000	$ 1,481,712.84	$ 14.82	181,803	$ 3,114,526.55	$ 17.13	403,940	$ 4,746,245.26	$ 11.75	275,386	$ 7,271,007.63	$ 26.40
05 - Metals	sqft	100,000	$ 1,786,167.26	$ 17.86	181,803	$ 10,581,486.42	$ 58.20	403,940	$ 10,493,005.41	$ 25.98	275,386	$ 4,947,565.34	$ 17.97
06 - Wood, Plastics, and Composites	sqft	100,000	$ 568,154.87	$ 5.68	181,803	$ 2,231,999.72	$ 12.28	403,940	$ 1,458,727.40	$ 3.61	275,386	$ 951,244.61	$ 3.45
07 - Thermal and Moisture Protection	sqft	100,000	$ 1,830,704.69	$ 18.31	181,803	$ 3,609,600.86	$ 19.85	403,940	$ 5,073,257.51	$ 12.56	275,386	$ 3,247,352.28	$ 11.79
08 - Openings	sqft	100,000	$ 2,215,988.90	$ 22.16	181,803	$ 10,088,901.57	$ 55.49	403,940	$ 4,663,686.89	$ 11.55	275,386	$ 2,054,007.17	$ 7.46
09 - Finishes	sqft	100,000	$ 2,682,574.34	$ 26.83	181,803	$ 4,951,320.48	$ 27.23	403,940	$ 6,129,671.11	$ 15.17	275,386	$ 2,889,815.51	$ 10.49
10 - Specialties	sqft	100,000	$ 219,443.18	$ 2.19	181,803	$ 1,621,656.52	$ 8.92	403,940	$ 686,678.01	$ 1.70	275,386	$ 1,207,315.28	$ 4.38
11 - Equipment	sqft	100,000	$ 545,893.70	$ 5.46	181,803	$ -	$ -	403,940	$ 1,367,675.44	$ 3.39	275,386	$ 1,066,323.34	$ 3.87
12 - Furnishings	sqft	100,000	$ 465,910.22	$ 4.66	181,803	$ 1,859,300.00	$ 10.23	403,940	$ 542,729.18	$ 1.34	275,386	$ 1,841,314.35	$ 6.69
13 - Special Construction	sqft	100,000	$ 391,905.56	$ 3.92	181,803	$ -	$ -	403,940	$ 2,836,932.22	$ 7.02	275,386	$ 743,501.53	$ 2.70
14 - Conveying Equipment	sqft	100,000	$ 207,477.13	$ 2.07	181,803	$ 758,320.00	$ 4.17	403,940	$ 258,837.62	$ 0.64	275,386	$ 78,723.69	$ 0.29
21 - Fire Suppression	sqft	100,000	$ 308,315.11	$ 3.08	181,803	$ 687,904.00	$ 3.78	403,940	$ 630,027.20	$ 1.56	275,386	$ 492,023.07	$ 1.79
22 - Plumbing	sqft	100,000	$ 826,785.25	$ 8.27	181,803	$ -	$ -	403,940	$ 4,402,981.58	$ 10.90	275,386	$ 5,121,960.19	$ 18.60
23 - Heating, Ventilation, and Air Conditioning	sqft	100,000	$ 4,374,901.17	$ 43.75	181,803	$ 10,724,804.00	$ 58.99	403,940	$ 17,349,978.78	$ 42.95	275,386	$ 8,205,851.47	$ 29.80
26 - Electrical	sqft	100,000	$ 3,678,183.70	$ 36.78	181,803	$ 10,562,307.00	$ 58.10	403,940	$ 12,430,912.39	$ 30.77	275,386	$ 8,318,798.10	$ 30.21
27 - Communications	sqft	100,000	$ 327,360.50	$ 3.27	181,803	$ -	$ -	0	$ -	$ -	275,386	$ 2,368,677.80	$ 8.60
28 - Electronic Safety & Security	sqft	100,000	$ 113,097.69	$ 1.13	181,803	$ -	$ -	0	$ -	$ -	275,386	$ 367,979.68	$ 1.34
31 - Earthwork	sqft	100,000	$ 988,698.13	$ 9.89	181,803	$ -	$ -	0	$ -	$ -	275,386	$ 7,489,684.55	$ 27.20
32 - Exterior Improvements	sqft	100,000	$ 1,137,092.53	$ 11.37	181,803	$ -	$ -	0	$ -	$ -	275,386	$ 8,231,546.00	$ 29.89
33 - Utilities	sqft	100,000	$ 660,867.41	$ 6.61	181,803	$ -	$ -	0	$ -	$ -	275,386	$ 3,487,350.20	$ 12.66
40 - Contingency	sqft	100,000	$ 1,374,999.57	$ 13.75	181,803	$ -	$ -	403,940	$ 8,528,296.87	$ 21.11	275,386	$ -	$ -
41 - Change Order	sqft	100,000	$ 75,124.83	$ 0.75	181,803	$ -	$ -	403,940	$ 1,517,296.12	$ 3.76	275,386	$ -	$ -
43 - Capital Needs	sqft	100,000	$ 58,649.20	$ 0.59	181,803	$ -	$ -	403,940	$ 1,184,537.80	$ 2.93	275,386	$ -	$ -
TOTAL		**100,000**	**$ 33,538,456.00**	**$ 335.38**	**181,803**	**$ 81,481,364.00**	**$ 448.18**	**403,940**	**$ 112,628,135.00**	**$ 278.82**	**275,386**	**$ 78,359,649.00**	**$ 284.54**

	DC - Ballou - HS 365,000 sqft 3401 4th St Se, Washington, District of Columbia 20032			DC - Duke - HS 271,000 sqft 3500 R St NW, Washington, DC 20007			DC - Dunbar - HS 280,000 sqft 101 N St. NW, Washington, DC 20001			DC - Woodson - HS 231,000 sqft 540 55th St NE, Washington, DC 20019		
	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost	Quantity	Total	Total Unit Cost
	365,000	$ 529,854.72	$ 1.45	271,000	$ 11,339,228.02	$ 41.84	280,000	$ 11,367,757.32	$ 40.60	231,000	$ -	$ -
	365,000	$ 4,060,757.08	$ 11.13	271,000	$ 11,461,456.37	$ 42.29	280,000	$ 11,219,673.57	$ 40.07	231,000	$ 23,470,315.52	$ 101.60
	365,000	$ 17,588,672.60	$ 48.19	271,000	$ 13,868,214.95	$ 51.17	280,000	$ 8,181,443.53	$ 29.22	231,000	$ 3,356,342.30	$ 14.53
	365,000	$ 7,243,152.68	$ 19.84	271,000	$ 4,055,157.01	$ 14.96	280,000	$ 5,994,529.39	$ 21.41	231,000	$ 4,741,707.89	$ 20.53
	365,000	$ 13,918,831.04	$ 38.13	271,000	$ 14,727,401.08	$ 54.34	280,000	$ 9,064,329.96	$ 32.37	231,000	$ 7,074,755.46	$ 30.63
	365,000	$ -	$ -	271,000	$ 237,000.69	$ 0.87	280,000	$ 3,511,354.99	$ 12.54	231,000	$ 2,884,101.49	$ 12.49
	365,000	$ 4,539,187.58	$ 12.44	271,000	$ 3,496,867.93	$ 12.90	280,000	$ 4,948,960.28	$ 17.67	231,000	$ 4,774,580.06	$ 20.67
	365,000	$ 7,494,515.16	$ 20.53	271,000	$ 9,267,063.64	$ 34.20	280,000	$ 5,006,192.63	$ 17.88	231,000	$ 3,612,576.15	$ 15.64
	365,000	$ 18,500,391.49	$ 50.69	271,000	$ 15,360,177.49	$ 56.68	280,000	$ 6,877,687.74	$ 24.56	231,000	$ 7,750,308.29	$ 33.55
	365,000	$ 241,645.16	$ 0.66	271,000	$ 536,288.71	$ 1.98	280,000	$ 801,857.09	$ 2.86	231,000	$ 567,514.97	$ 2.46
	365,000	$ 1,304,797.94	$ 3.57	271,000	$ 557,004.21	$ 2.06	280,000	$ 1,075,996.08	$ 3.84	231,000	$ 615,290.71	$ 2.66
	365,000	$ 2,759,373.53	$ 7.56	271,000	$ 651,459.24	$ 2.40	280,000	$ 480,361.84	$ 1.72	231,000	$ 776,110.63	$ 3.36
	365,000	$ 1,917,658.75	$ 5.25	271,000	$ 1,239,730.17	$ 4.57	280,000	$ 1,584,112.36	$ 5.66	231,000	$ 1,548,681.46	$ 6.70
	365,000	$ 593,301.08	$ 1.63	271,000	$ 799,408.78	$ 2.95	280,000	$ 220,328.34	$ 0.79	231,000	$ 8,532.81	$ 0.04
	365,000	$ 1,303,621.20	$ 3.57	271,000	$ 1,409,364.14	$ 5.20	280,000	$ 1,059,613.36	$ 3.78	231,000	$ -	$ -
	365,000	$ -	$ -	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	$ 25,502,059.99	$ 69.87	271,000	$ 21,581,691.60	$ 79.64	280,000	$ 29,119,302.34	$ 104.00	231,000	$ 17,226,808.63	$ 74.57
	365,000	$ 21,855,933.80	$ 59.88	271,000	$ 22,894,497.21	$ 84.48	280,000	$ 14,968,434.75	$ 53.46	231,000	$ 21,446,557.57	$ 92.84
	365,000	$ -	$ -	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	$ -	$ -	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	$ 12,068,524.12	$ 33.06	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	$ 4,824,667.25	$ 13.22	271,000	$ 724,541.76	$ 2.67	280,000	$ 5,997,298.26	$ 21.42	231,000	$ 427,768.60	$ 1.85
	365,000	$ 4,522,665.82	$ 12.39	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	$ -	$ -	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	$ -	$ -	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	$ -	$ -	271,000	$ -	$ -	280,000	$ -	$ -	231,000	$ -	$ -
	365,000	**$ 150,769,611.00**	**$ 413.07**	**271,000**	**$ 134,206,553.00**	**$ 495.23**	**280,000**	**$ 121,479,234.00**	**$ 433.85**	**231,000**	**$ 100,281,953.00**	**$ 434.12**

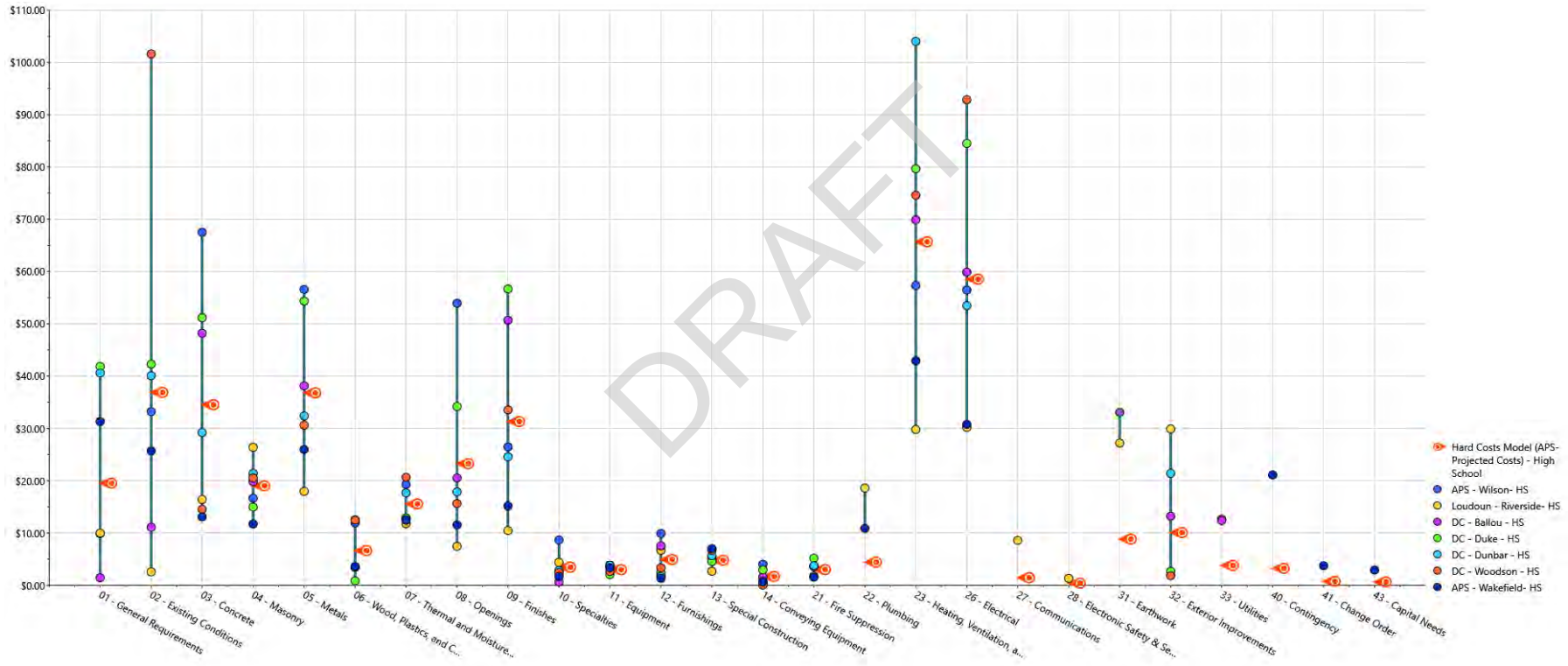
INSIGHT

COST MODEL COMPARISON

APS School Cost Comparison Study
Hard Costs Comparison by High Schools
Washington, DC

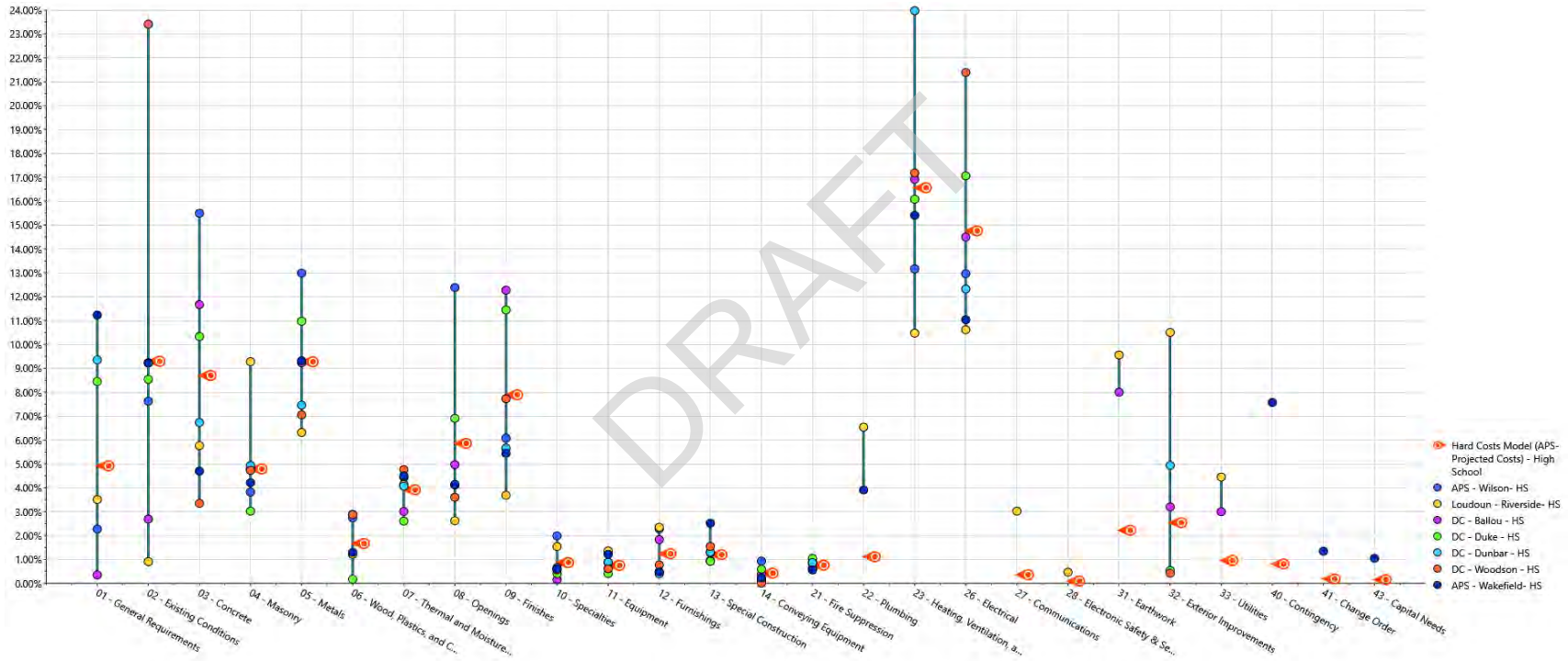
OCMI JOB #: 17211.000 | 27 March 2018

RANGE - UNIT COST



Note: Costs above are illustrative of Unit Costs/SF.

RANGE - PERCENT OF TOTAL



Note: Costs above are illustrative of Percent Cost/Total Costs.

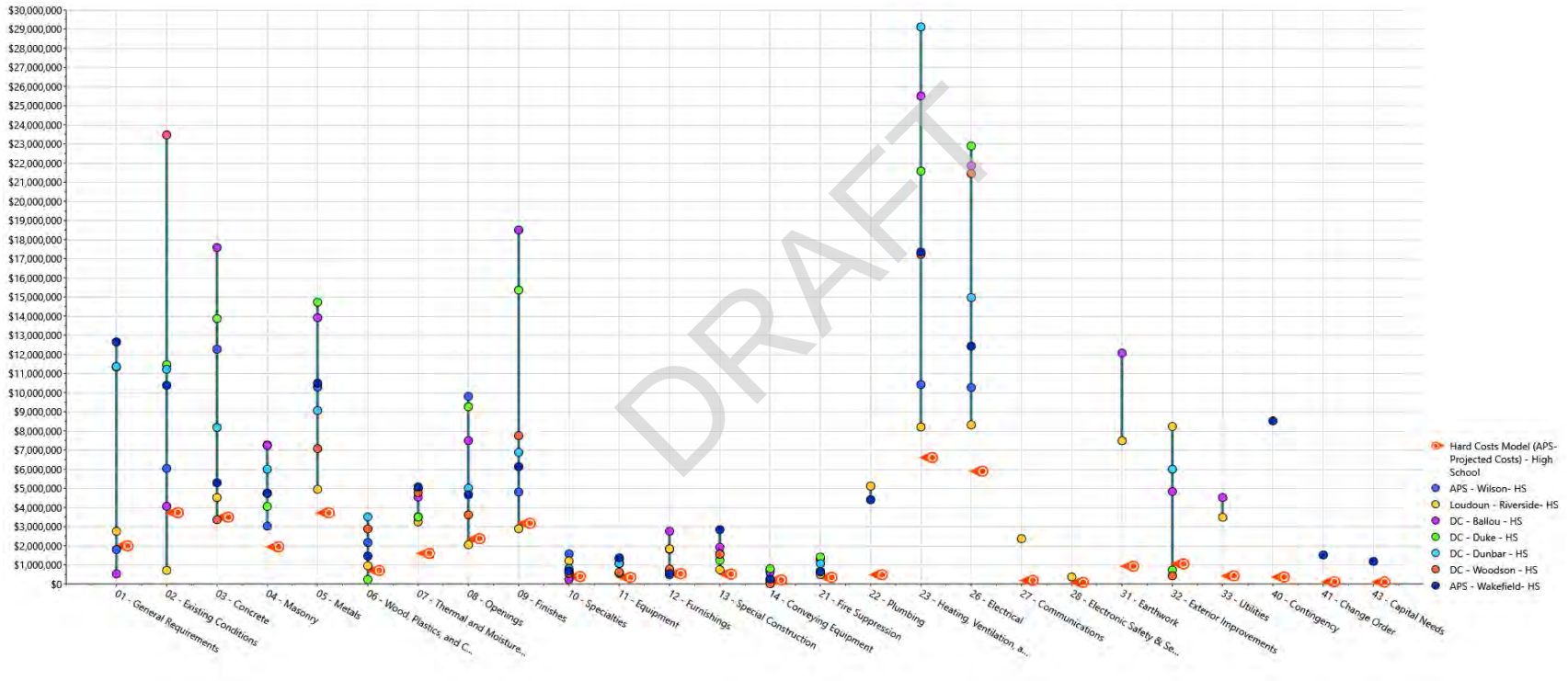
INSIGHT

APS School Cost Comparison Study
Hard Costs Comparison by High Schools
Washington, DC

COST MODEL COMPARISON

OCMI JOB #: 17211.000 | 27 March 2018

RANGE - TOTAL HARD COSTS



Note: Costs above are illustrative of Unit Costs/SF.

HARD COSTS MODEL - STATISTICS (UNIT COST)

	Mean	Median	Minimum	Maximum	Range	APS - Wilson- HS	APS - Wakefield- HS	Loudoun - Riverside- HS	DC - Ballou - HS	DC - Duke - HS	DC - Dunbar - HS	DC - Woodson - HS
01 - General Requirements	$ 19.30	$ 9.99	$ -	$ 41.84	$ 41.84	$ 9.90	$ 31.31	$ 9.99	$ 1.45	$ 41.84	$ 40.60	
02 - Existing Conditions	$ 36.66	$ 33.21	$ 2.58	$ 101.60	$ 99.02	$ 33.21	$ 25.71	$ 2.58	$ 11.13	$ 42.29	$ 40.07	$ 101.60
03 - Concrete	$ 34.30	$ 29.22	$ 13.10	$ 67.48	$ 54.38	$ 67.48	$ 13.10	$ 16.40	$ 48.19	$ 51.17	$ 29.22	$ 14.53
04 - Masonry	$ 18.79	$ 19.84	$ 11.75	$ 26.40	$ 14.65	$ 16.65	$ 11.75	$ 26.40	$ 19.84	$ 14.96	$ 21.41	$ 20.53
05 - Metals	$ 36.57	$ 32.37	$ 17.97	$ 56.57	$ 38.60	$ 56.57	$ 25.98	$ 17.97	$ 38.13	$ 54.34	$ 32.37	$ 30.63
06 - Wood, Plastics, and Composites	$ 6.41	$ 3.61	$ -	$ 12.54	$ 12.54	$ 11.93	$ 3.61	$ 3.45	$ -	$ 0.87	$ 12.54	$ 12.49
07 - Thermal and Moisture Protection	$ 15.33	$ 12.90	$ 11.79	$ 20.67	$ 8.88	$ 19.30	$ 12.56	$ 11.79	$ 12.44	$ 12.90	$ 17.67	$ 20.67
08 - Openings	$ 23.03	$ 17.88	$ 7.46	$ 53.93	$ 46.47	$ 53.93	$ 11.55	$ 7.46	$ 20.53	$ 34.20	$ 17.88	$ 15.64
09 - Finishes	$ 31.09	$ 26.47	$ 10.49	$ 56.68	$ 46.19	$ 26.47	$ 15.17	$ 10.49	$ 50.69	$ 56.68	$ 24.56	$ 33.55
10 - Specialties	$ 3.24	$ 2.46	$ 0.66	$ 8.67	$ 8.01	$ 8.67	$ 1.70	$ 4.38	$ 0.66	$ 1.98	$ 2.86	$ 2.46
11 - Equipment	$ 2.77	$ 3.39	$ -	$ 3.87	$ 3.87	$ -	$ 3.39	$ 3.87	$ 3.57	$ 2.06	$ 3.84	$ 2.66
12 - Furnishings	$ 4.72	$ 3.36	$ 1.34	$ 9.94	$ 8.60	$ 9.94	$ 1.34	$ 6.69	$ 7.56	$ 2.40	$ 1.72	$ 3.36
13 - Special Construction	$ 4.56	$ 5.25	$ -	$ 7.02	$ 7.02	$ -	$ 7.02	$ 2.70	$ 5.25	$ 4.57	$ 5.66	$ 6.70
14 - Conveying Equipment	$ 1.48	$ 0.79	$ 0.04	$ 4.05	$ 4.02	$ 4.05	$ 0.64	$ 0.29	$ 1.63	$ 2.95	$ 0.79	$ 0.04
21 - Fire Suppression	$ 2.80	$ 3.57	$ -	$ 5.20	$ 5.20	$ 3.68	$ 1.56	$ 1.79	$ 3.57	$ 5.20	$ 3.78	$ -
22 - Plumbing	$ 4.21	$ -	$ -	$ 18.60	$ 18.60	$ -	$ 10.90	$ 18.60	$ -	$ -	$ -	$ -
23 - Heating, Ventilation, and Air Conditioning	$ 65.45	$ 69.87	$ 29.80	$ 104.00	$ 74.20	$ 57.33	$ 42.95	$ 29.80	$ 69.87	$ 79.64	$ 104.00	$ 74.57
26 - Electrical	$ 58.30	$ 56.46	$ 30.21	$ 92.84	$ 62.63	$ 56.46	$ 30.77	$ 30.21	$ 59.88	$ 84.48	$ 53.46	$ 92.84
27 - Communications	$ 1.23	$ -	$ -	$ 8.60	$ 8.60	$ -	$ -	$ 8.60	$ -	$ -	$ -	$ -
28 - Electronic Safety & Security	$ 0.19	$ -	$ -	$ 1.34	$ 1.34	$ -	$ -	$ 1.34	$ -	$ -	$ -	$ -
31 - Earthwork	$ 8.61	$ -	$ -	$ 33.06	$ 33.06	$ -	$ -	$ 27.20	$ -	$ -	$ -	$ -
32 - Exterior Improvements	$ 9.86	$ 2.67	$ -	$ 29.89	$ 29.89	$ -	$ -	$ 29.89	$ 13.22	$ 2.67	$ 21.42	$ 1.85
33 - Utilities	$ 3.58	$ -	$ -	$ 12.66	$ 12.66	$ -	$ -	$ 12.66	$ 12.39	$ -	$ -	$ -
40 - Contingency	$ 3.02	$ -	$ -	$ 21.11	$ 21.11	$ -	$ 21.11	$ -	$ -	$ -	$ -	$ -
41 - Change Order	$ 0.54	$ -	$ -	$ 3.76	$ 3.76	$ -	$ 3.76	$ -	$ -	$ -	$ -	$ -
43 - Capital Needs	$ 0.42	$ -	$ -	$ 2.93	$ 2.93	$ -	$ 2.93	$ -	$ -	$ -	$ -	$ -
Total	**$ 396.46**	**$ 433.85**	**$ 278.82**	**$ 495.23**	**$ 216.40**	**$ 435.58**	**$ 278.82**	**$ 284.54**	**$ 413.07**	**$ 495.23**	**$ 433.85**	**$ 434.12**

Note: Costs above are illustrative of Unit Costs/SF.

INSIGHT

COST MODEL COMPARISON

APS School Cost Comparison Study
Hard Costs Comparison by High Schools
Washington, DC

OCMI JOB #: 17211.000 | 20 March 2018

HARD COSTS MODEL - STATISTICS (PERCENT OF TOTAL)

	Mean	Median	Minimum	Maximum	Range	APS - Wilson- HS	APS - Wakefield- HS	Loudoun - Riverside- HS	DC - Ballou - HS	DC - Duke - HS	DC - Dunbar - HS	DC - Woodson - HS
01 - General Requirements	5.02%	3.51%	0.00%	11.23%	11.23%	2.27%	11.23%	3.51%	0.35%	8.45%	9.36%	-
02 - Existing Conditions	8.80%	8.54%	0.91%	23.40%	22.50%	7.62%	9.22%	0.91%	2.69%	8.54%	9.24%	23.40%
03 - Concrete	8.29%	6.73%	3.35%	15.49%	12.15%	15.49%	4.70%	5.76%	11.67%	10.33%	6.73%	3.35%
04 - Masonry	4.97%	4.73%	3.02%	9.28%	6.26%	3.82%	4.21%	9.28%	4.80%	3.02%	4.93%	4.73%
05 - Metals	9.05%	9.23%	6.31%	12.99%	6.67%	12.99%	9.32%	6.31%	9.23%	10.97%	7.46%	7.05%
06 - Wood, Plastics, and Composites	1.60%	1.30%	0.00%	2.89%	2.89%	2.74%	1.30%	1.21%	-	0.18%	2.89%	2.88%
07 - Thermal and Moisture Protection	3.93%	4.14%	2.61%	4.76%	2.16%	4.43%	4.50%	4.14%	3.01%	2.61%	4.07%	4.76%
08 - Openings	5.53%	4.14%	2.62%	12.38%	9.76%	12.38%	4.14%	2.62%	4.97%	6.91%	4.12%	3.60%
09 - Finishes	7.47%	6.08%	3.69%	12.27%	8.58%	6.08%	5.44%	3.69%	12.27%	11.45%	5.66%	7.73%
10 - Specialties	0.85%	0.61%	0.16%	1.99%	1.83%	1.99%	0.61%	1.54%	0.16%	0.40%	0.66%	0.57%
11 - Equipment	0.76%	0.87%	0.00%	1.36%	1.36%	-	1.21%	1.36%	0.87%	0.42%	0.89%	0.61%
12 - Furnishings	1.23%	0.77%	0.40%	2.35%	1.95%	2.28%	0.48%	2.35%	1.83%	0.49%	0.40%	0.77%
13 - Special Construction	1.22%	1.27%	0.00%	2.52%	2.52%	-	2.52%	0.95%	1.27%	0.92%	1.30%	1.54%
14 - Conveying Equipment	0.35%	0.23%	0.01%	0.93%	0.92%	0.93%	0.23%	0.10%	0.39%	0.60%	0.18%	0.01%
21 - Fire Suppression	0.69%	0.84%	0.00%	1.05%	1.05%	0.84%	0.56%	0.63%	0.86%	1.05%	0.87%	-
22 - Plumbing	1.49%	0.00%	0.00%	6.54%	6.54%	-	3.91%	6.54%	-	-	-	-
23 - Heating, Ventilation, and Air Conditioning	16.17%	16.08%	10.47%	23.97%	13.50%	13.16%	15.40%	10.47%	16.91%	16.08%	23.97%	17.18%
26 - Electrical	14.27%	12.96%	10.62%	21.39%	10.77%	12.96%	11.04%	10.62%	14.50%	17.06%	12.32%	21.39%
27 - Communications	0.43%	0.00%	0.00%	3.02%	3.02%	-	-	3.02%	-	-	-	-
28 - Electronic Safety & Security	0.07%	0.00%	0.00%	0.47%	0.47%	-	-	0.47%	-	-	-	-
31 - Earthwork	2.51%	0.00%	0.00%	9.56%	9.56%	-	-	9.56%	8.00%	-	-	-
32 - Exterior Improvements	2.80%	0.54%	0.00%	10.50%	10.50%	-	-	10.50%	3.20%	0.54%	4.94%	0.43%
33 - Utilities	1.06%	0.00%	0.00%	4.45%	4.45%	-	-	4.45%	3.00%	-	-	-
40 - Contingency	1.08%	0.00%	0.00%	7.57%	7.57%	-	7.57%	-	-	-	-	-
41 - Change Order	0.19%	0.00%	0.00%	1.35%	1.35%	-	1.35%	-	-	-	-	-
43 - Capital Needs	0.15%	0.00%	0.00%	1.05%	1.05%	-	1.05%	-	-	-	-	-
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**0.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Note: Costs above are illustrative of Unit Percent/Total Costs.

HARD COSTS MODEL - STATISTICS (TOTAL)

	Mean	Median	Minimum	Maximum	Range	APS - Wilson- HS	APS - Wakefield- HS	Loudoun - Riverside- HS	DC - Ballou - HS	DC - Duke - HS	DC - Dunbar - HS	DC - Woodson - HS
01 - General Requirements	$ 5,776,772	$ 2,751,229	$ -	$ 12,648,589	$ 12,648,589	$ 1,852,875	$ 12,648,589	$ 2,751,229	$ 529,855	$ 11,339,228	$ 11,367,757	$ -
02 - Existing Conditions	$ 9,620,875	$ 10,385,379	$ 710,700	$ 23,470,316	$ 22,759,616	$ 6,212,625	$ 10,385,379	$ 710,700	$ 4,060,757	$ 11,461,456	$ 11,219,674	$ 23,470,316
03 - Concrete	$ 9,295,947	$ 8,181,444	$ 3,356,342	$ 17,588,673	$ 14,232,330	$ 12,623,737	$ 5,292,690	$ 4,515,678	$ 17,588,673	$ 13,868,215	$ 8,181,444	$ 3,356,342
04 - Masonry	$ 5,296,958	$ 4,746,245	$ 3,026,904	$ 7,271,008	$ 4,244,103	$ 3,114,527	$ 4,746,245	$ 7,271,008	$ 7,243,153	$ 4,055,157	$ 5,994,529	$ 4,741,708
05 - Metals	$ 10,072,812	$ 10,283,793	$ 4,947,565	$ 14,727,401	$ 9,779,836	$ 10,581,486	$ 10,493,005	$ 4,947,565	$ 13,918,831	$ 14,727,401	$ 9,064,330	$ 7,074,755
06 - Wood, Plastics, and Composites	$ 1,601,662	$ 1,458,727	$ -	$ 3,511,355	$ 3,511,355	$ 2,232,000	$ 1,458,727	$ 951,245	$ -	$ 237,001	$ 3,511,355	$ 2,884,101
07 - Thermal and Moisture Protection	$ 4,226,894	$ 4,539,188	$ 3,247,352	$ 5,073,258	$ 1,825,905	$ 3,609,601	$ 5,073,258	$ 3,247,352	$ 4,539,188	$ 3,496,868	$ 4,948,960	$ 4,774,580
08 - Openings	$ 5,986,158	$ 5,006,193	$ 2,054,007	$ 9,805,066	$ 7,751,059	$ 10,088,902	$ 4,663,687	$ 2,054,007	$ 7,494,515	$ 9,267,064	$ 5,006,193	$ 3,612,576
09 - Finishes	$ 8,902,868	$ 6,877,688	$ 2,889,816	$ 18,500,391	$ 15,610,576	$ 4,951,320	$ 6,129,671	$ 2,889,816	$ 18,500,391	$ 15,360,177	$ 6,877,688	$ 7,750,308
10 - Specialties	$ 802,476	$ 686,678	$ 241,645	$ 1,576,034	$ 1,334,389	$ 1,621,657	$ 686,678	$ 1,207,315	$ 241,645	$ 536,289	$ 801,857	$ 567,515
11 - Equipment	$ 855,298	$ 1,066,323	$ -	$ 1,367,675	$ 1,367,675	$ -	$ 1,367,675	$ 1,066,323	$ 1,304,798	$ 557,004	$ 1,075,996	$ 615,291
12 - Furnishings	$ 1,265,477	$ 776,111	$ 480,362	$ 2,759,374	$ 2,279,012	$ 1,859,300	$ 542,729	$ 1,841,314	$ 2,759,374	$ 651,459	$ 480,362	$ 776,111
13 - Special Construction	$ 1,410,088	$ 1,548,681	$ -	$ 2,836,932	$ 2,836,932	$ -	$ 2,836,932	$ 743,502	$ 1,917,659	$ 1,239,730	$ 1,584,112	$ 1,548,681
14 - Conveying Equipment	$ 385,160	$ 258,838	$ 8,533	$ 799,409	$ 790,876	$ 758,320	$ 258,838	$ 78,724	$ 593,301	$ 799,409	$ 220,328	$ 8,533
21 - Fire Suppression	$ 794,743	$ 668,551	$ -	$ 1,409,364	$ 1,409,364	$ 687,904	$ 630,027	$ 492,023	$ 1,303,621	$ 1,409,364	$ 1,059,613	$ -
22 - Plumbing	$ 1,360,706	$ -	$ -	$ 5,121,960	$ 5,121,960	$ -	$ 4,402,982	$ 5,121,960	$ -	$ -	$ -	$ -
23 - Heating, Ventilation, and Air Conditioning	$ 18,486,967	$ 17,349,979	$ 8,205,851	$ 29,119,302	$ 20,913,451	$ 10,724,804	$ 17,349,979	$ 8,205,851	$ 25,502,060	$ 21,581,692	$ 29,119,302	$ 17,226,809
26 - Electrical	$ 16,025,755	$ 14,968,435	$ 8,318,798	$ 22,894,497	$ 14,575,699	$ 10,562,307	$ 12,430,912	$ 8,318,798	$ 21,855,934	$ 22,894,497	$ 14,968,435	$ 21,446,558
27 - Communications	$ 338,383	$ -	$ -	$ 2,368,678	$ 2,368,678	$ -	$ -	$ 2,368,678	$ -	$ -	$ -	$ -
28 - Electronic Safety & Security	$ 52,569	$ -	$ -	$ 367,980	$ 367,980	$ -	$ -	$ 367,980	$ -	$ -	$ -	$ -
31 - Earthwork	$ 2,794,030	$ -	$ -	$ 12,068,524	$ 12,068,524	$ -	$ -	$ 7,489,685	$ 12,068,524	$ -	$ -	$ -
32 - Exterior Improvements	$ 2,886,546	$ 724,542	$ -	$ 8,231,546	$ 8,231,546	$ -	$ -	$ 8,231,546	$ 4,824,667	$ 724,542	$ 5,997,298	$ 427,769
33 - Utilities	$ 1,144,288	$ -	$ -	$ 4,522,666	$ 4,522,666	$ -	$ -	$ 3,487,350	$ 4,522,666	$ -	$ -	$ -
40 - Contingency	$ 1,218,328	$ -	$ -	$ 8,528,297	$ 8,528,297	$ -	$ 8,528,297	$ -	$ -	$ -	$ -	$ -
41 - Change Order	$ 216,757	$ -	$ -	$ 1,517,296	$ 1,517,296	$ -	$ 1,517,296	$ -	$ -	$ -	$ -	$ -
43 - Capital Needs	$ 169,220	$ -	$ -	$ 1,184,538	$ 1,184,538	$ -	$ 1,184,538	$ -	$ -	$ -	$ -	$ -
Total	**$ 110,987,735**	**$ 112,628,135**	**$ 78,359,649**	**$ 150,769,611**	**$ 72,409,962**	**$ 81,481,364**	**$ 112,628,135**	**$ 78,359,649**	**$ 150,769,611**	**$ 134,206,553**	**$ 121,479,234**	**$ 100,281,953**

Note: Costs above are illustrative of Unit Costs/Total Costs.

DISCLAIMER NOTICE

The information contained in the Cost Comparison Study is for informational purposes only. The information was obtained by O'Connor Construction Management, Inc. (OCMI) through representatives of school divisions; state education divisions; architecture, engineering, or project management and construction firms, as well as through publicly available sources of information, including websites and other publications. The information and calculations presented in this report are believed to be accurate but not guaranteed. They are intended for the purposes of projection and analysis, and shall not be used for any other purpose(s). OCMI has gone to great lengths to ensure that all information in the report itself is correct and factual. However, OCMI does not assume any responsibility for potential errors that this report or related documents may still contain, nor for any potential consequences, including financial damages or losses, arising from, relying on, or applying the information contained herein.

COST STUDY

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