

# School Building Authority of West Virginia

## Quality and Performance Standards

1st Edition - June 2008

2nd Edition - April 2011

Revised - June 2013



## **Preface**

The purpose of this Quality and Performance document is to provide a design standard and level of quality for building systems and materials to be incorporated into new school facilities funded by the School Building Authority (SBA). This document is not intended to pre-exempt or substitute for the judgment of the project design professionals. Information regarding designs, building products, materials or required building systems deemed to be most appropriate will remain the responsibility of the design professional, construction manager and contractors. Where variations from the minimum specified Quality and Performance Standards are desired, a request for variance may be submitted to the SBA office for review and approval. Additionally, proto-typical site diagrams, building space relationships and various academic spaces have been developed. Typical academic areas, classrooms, science classroom/labs and technology spaces are identified as proto-typical for all schools. These spaces will be reviewed annually to insure compatibility with every changing academic needs. The Quality and Performance Design Criteria Guide describes major building systems, materials, features, components and performance standards. Where required by the SBA, it will require life cycle cost analysis of these components to assure uniformity, energy efficiency, functionality, and to determine the most cost effective and maintainable school building designs.

A Quality and Performance Committee was formed to address issues of standardizing SBA school components and proto-typing areas of new school designs, where possible. The Authority established the initial Quality and Performance Committee made up of design professionals, contractors, suppliers and professional educators. Several sub-committees were established to study various building systems in more detail and to provide recommendations on specific design areas of schools. Additionally, on-site meetings were held around the state and post occupancy surveys were performed to gather input from superintendents, teachers, parents and students. All comments were compiled and reviewed by the Quality and Performance Committee as well as the SBA staff. This document includes the input from all stakeholders in the school planning, design and construction process. Special thanks must be given to N. Kent Gandee, AIA, REFP, for his assistance in the preparation of the original document. Mr. Gandee's experience and background in school planning and design proved invaluable in the development of this document.

Systems and materials are not rigidly structured and will allow designs to reflect and enhance the community desires for aesthetically pleasing and functional school buildings. The SBA reserves the right to consider all systems and building components based on the scope of the project and specific design conditions.

Systems and materials proposed for use in building designs that differ from those outlined in this document will be considered providing a written request with supporting documentation is submitted to the SBA for review and approval.

Alternate building systems and materials that are not approved or are proposed for use and not critical to the building design will become the responsibility of the county board of education.

High Performance Green School building systems and materials are referenced within this document to provide unique comprehensive tools to construct Green School components that address acoustics, indoor air quality, energy use reduction, water conservation, day lighting and thermal comfort of SBA school buildings.

A single building project will be selected from each needs funding cycle to incorporate a High Performance Green School philosophy within the design and to obtain a LEED Silver Certification. The SBA will review this matter annually to determine the expansion and/or continuation of the LEED certification program.

The SBA feels good architecture in West Virginia schools is achievable and can be affordable. The SBA encourages high-quality decision making to create stimulating and aesthetically pleasing architecture. School planners should explore spaces, materials and resources with imagination and efficiency and create flexible, durable, and sustainable schools that are both attractive and healthy for students and faculty. With each new project, the SBA develops higher expectations with respect to design and construction standards to deliver a school that becomes a proud legacy to the communities within the State of West Virginia.

The School Building Authority recognizes that building systems, material and technologies advance at a rapid rate in an ever-changing economic society, thus, this Quality and Performance Design Criteria Document will certainly require reviews, updates and adjustments on a yearly basis.

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Executive Director

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Original June 2008

Revised May 2013

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Revised May 2013

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**SECTION I****Quality and Performance Standards  
DESIGN DOCUMENTS/INSTRUMENTS OF SERVICE****PROGRAM AND BUILDING SQUARE FOOTAGE**

Design professionals shall comply with SBA Policy and Procedures Handbook for space requirements and curricular programs. The latest version of the Quality and Performance document shall be followed with regard to minimum building material quality. Variation from this document shall have SBA approval before incorporating changes into the design documents. Current and projected enrollments shall be utilized to develop the building gross square footage. The approved building program and gross square footage shall not exceed the SBA allowable square footage as defined in SBA Form 166 of the SBA Handbook.

**PLANNING AND DESIGN SCHEDULE**

The preparation of design documents/instruments of service shall be completed by the design professionals in accordance with the following “Project Development Schedule.” Submit the required submission documentation in accordance with the SBA Project Submission checklist, Form 176.

**PROJECT DEVELOPMENT SCHEDULE**

## High School Schedule

<b>Milestone</b>	<b>Timeframe (months)</b>
1. Planning (1)	3
2. Schematic Design	2.5
3. Design Development & Technology Plan	5
4. Bidding Documents	3.5
5. Bidding and Contract Award	1
6. Construction (2)	21
<b>Total Time</b>	<b>36</b>

## Middle School Schedule

<b>Milestone</b>	<b>Timeframe (months)</b>
1. Planning (1)	3
2. Schematic Design	2.5
3. Design Development & Technology Plan	5
4. Bidding Documents	3.5
5. Bidding and Contract Award	1
6. Construction (2)	18
<b>Total Time</b>	<b>33</b>

Elementary School Schedule

<b>Milestone</b>	<b>Timeframe (months)</b>
1. Planning (1)	3
2. Schematic Design	2
3. Design Development & Technology Plan	4
4. Bidding Documents	3
5. Bidding and Contract Award	1
6. Construction (2)	14
<b>Total Time</b>	<b>27</b>

**Note (1)** The project development schedule begins with the SBA notice of grant award. It is imperative that the project move forward based on the schedule provided. To meet the critical timelines, you will be required to have all planning, design, and when applicable, construction management professionals under contract and the educational program of space completed within 90 days of the grant award notice. The scope and complexity of each project will be considered and the development schedule will be adjusted to reflect greater or less planning and design time as determined by the SBA. Submission requirements for items 1-4 are provided on SBA Form 176 A-E in the SBA Policy and Procedure Manual. If the project is delayed at any phase at the county level as a result of timelines not being met, the SBA will require the grant recipients to pay the delay costs based on the current annual construction inflation rate, prorated over the number of months the project is delayed. Design Build project schedules will be adjusted to comply with the requirements of code and SBA Design/Build Policy. Major addition and renovation project schedules will be established jointly with the grant recipient, project architect or design builder and the SBA based on the size and complexity of the project.

**Note (2)** Unless approved by the SBA, the construction timeline for a lump sum contract will be dictated by the completion days provided by the contractors within the bid. The construction timeframes indicated above are approximate.

**Note (3)** The construction timeline substantial completion days for multi-prime contract construction method will be established jointly with the cost analyst, project architect and the SBA for the general trades, plumbing, HVAC, electrical and sprinkler contracts. The construction timeframes indicated above are approximate.

## REVIEW AND APPROVALS

In accordance with the “Project Development Schedule,” the grant recipient, via their design professional, shall submit to the SBA for review comments and approval, educational specifications with concept drawings, submissions phases including planning phase, schematic phase, design development phase and construction document phase. Approvals and comments will be completed within 14 days of submittal for educational specifications/concept drawings and a maximum of 30 days for the other phases.

The design professional is required to submit, for review, design documents and contract documents to the owner, SBA, Construction Manager (CM) and Construction Analyst (CA), when CM and CA services are assigned, and all approving state agencies. Upon request, the State Office of Homeland Security may review the building design. Provide SBA design review documents in accordance with the SBA Project Submission form, SBA Form 176A-E.

School construction projects that exceed \$50,000 and do not involve SBA funding must be submitted to the SBA for review and approval in accordance with SBA project review procedures.

The SBA feels that clear and concise design document information is paramount to receiving comprehensive bids from contractors desiring to work on SBA projects. This same desire is echoed in the design community. Estimates of probable cost are also critical to the development of well-planned schools that meet curricular needs within the funding available for the project. The SBA may assign a Construction Manager (CM) or a Construction Analyst (CA) to projects to assist with cost control or construct administration. The CM or CA assigned to the project will act as agents representing the owner and SBA. Their task during the design process is to provide constructability and document coordination reviews, estimates of probable cost and upon request provide alternative design suggestions if the scope of the project exceeds the funding available during the design stages of the project. The CA services will terminate once the contract for construction is executed. However, CM services will continue during the construction phase of the project. As per the CM service agreement, the CM will assist the owner, architect and the SBA by providing service construction administrative services.

The architect/engineer (A/E) shall submit the design documents to the CM and CA, the owner and the SBA for review comments as required in SBA policy and the design contract. All CM, CA and

owner/SBA comments must be satisfactorily addressed by the A/E to assure the project is moving forward with all parties clearly understanding the project scope and cost. All parties will work cooperatively to reconcile the estimate of probable cost. Reconciliation is achieved when all parties agree that the estimate is within 2% of each parties estimate or agreement is reached that no further scope of work can be reasonably accomplished and additional funding will be committed to the project if the deficit becomes a reality after bids are received. Projects with budget differences greater than 2% may only move forward with owner and SBA approval. CM and CA review comments relative to the **clarity of the design intent** shall be incorporated into the documents by the A/E, unless the A/E determines the clarifications will change the design intent of the project or conflict with applicable codes or standards. The A/E will notify the owner and SBA of comments not being incorporated into the documents. However, should clarification comments not incorporated into the documents result in construction change orders, the SBA will not provide funding for the change order.

## **BIDDING PHASE SCHEDULES**

The design professionals, in conjunction with the SBA, shall establish the project bidding schedule.

## **SUBMISSION DRAWING STANDARDS**

Provide the SBA for review, documents no greater than 24" x 36" in size. If the architect is designing the project in a size greater than 24" x 36", provide ½ size drawings to the SBA for review. Upon request, provide full size drawing to construction analyst and construction manager.

When the SBA assigns a construction analyst or a construction manager to a project, the design professional shall submit project information to the construction analyst, the construction manager and the SBA in accordance with the SBA project submission checklist and the task order agreement between the SBA and the construction analyst for the project.

**SECTION II****Quality and Performance Standards  
CONSTRUCTION CONTRACTS****GENERAL**

SBA funded school project bid documents shall be organized by the design professional to accommodate project bidding as defined hereinafter. The SBA reserves the right to approve all bidding packages and determine the most appropriate bidding scenario.

**LUMP SUM CONTRACTS**

All SBA projects with construction costs up to ten million dollars shall be bid as single lump sum contracts by the general contractor. Exception to this requirement shall be approved by the SBA.

Without prior SBA approval, addition and renovation projects shall be bid as a single prime contract.

**MULTI-PRIME CONTRACTS**

New school construction projects with construction costs greater than ten million and up to thirty million dollars shall be bid as multiple prime contracts with the general trades contractor responsible for providing all management and project scheduling within their bid. Other multiple prime contracts shall be Site Preparation, HVAC, Plumbing, Electrical and Sprinkler work. Furniture and equipment and food service equipment may be bid as a separate contract or purchased directly by county board.

Each prime contractor for HVAC, Plumbing, Sprinkler and Electrical work shall submit to the general trades contractor a schedule of work to be completed coordinated with the general trade construction schedule. The coordinated construction schedule shall be submitted to the owner, architect and SBA for review and approval prior to submission of the second application for payment. The SBA will not process the second project application for payment if the construction schedule has not been approved and no further payments will be processed without an approved schedule. Further, each prime contractor shall submit applications for payment to the general trades contractor in the multiple prime contracting scenario for review, approval and processing. The construction manager will assume this responsibility when utilized.

Generally, addition and renovation projects shall not be bid as multiple-prime contracts. However, the SBA reserves the right to establish the most advantageous bidding scenario for all projects.

## **CONSTRUCTION MANAGEMENT/CONSTRUCTION ANALYST**

Projects with construction costs over thirty million dollars or as otherwise determined by the SBA shall have a construction manager (CM) using multiple prime contracts. CM services would include providing all management services and project scheduling and other services as described in the latest edition of the AIA construction management contract. SBA supplement conditions shall be incorporated into the CM contract.

When assigned by the SBA for projects that do not utilize CM services, a construction analyst (CA) shall be required to perform all pre-bid services as described in the SBA Construction Analyst Agent Task Agreement for the project.

## **SITE PREPARATION CONTRACTS**

A separate site preparation bid shall be utilized for all new construction projects. All site work shall be substantially complete prior to bidding of the other multiple prime contracts. Exceptions to these requirements shall have SBA approval prior to bidding. Site preparation contract may not be bid until design development documents are approved by the SBA.

## **PRIME CONTRACTOR SERVICES**

All prime contractors shall comply with SBA Supplemental conditions as defined in Appendix J of the SBA Handbook.

The general trades contractor shall prepare, manage and coordinate the project construction schedule. The construction manager (CM) shall be responsible for the schedule coordination where a CM is used.

The general trades contractor shall review, approve and forward applications for payment of all prime contractors performing work on the project as defined in the construction documents to the owner/architect for review and final approval.



All prime contractors shall coordinate and process submission of project shop drawings to the A/E or CM when a CM is utilized.

All prime contractors shall provide full time project coordinator.

All prime contractors shall provide full time project superintendent.

All general trades contractors shall erect the temporary SBA project identification and sign.

#### Temporary services facilities

- a. The general trades contractor shall provide temporary water service and distribution.
- b. The electrical trades contractor shall provide temporary electric power, distribution and lighting.
- c. The HVAC contractor shall provide temporary heat, humidity control and ventilation. Building HVAC systems may be used for temporary HVAC upon approval by the design professional. However, the system warranty and maintenance program will commence at substantial completion.

Note: All other temporary project requirements shall be defined in the bidding documents. Temporary facilities shall be maintained until permanent facilities are operational as determined by the architect and the SBA. When construction managers are used, the SBA /owner may assign portions of these services to the construction manager. The following shall be addressed but is not intended to be an all-inclusive list of temporary services.

- d. Temporary telephone.
- e. Field offices.
- f. Temporary roads and parking including maintenance during construction schedule.
- g. De-watering facilities and drains.
- h. Temporary enclosures.
- i. Waste disposal services.
- j. Rodent and pest control.
- k. Temporary fire protection.
- l. Barricades, warning signs and lights.
- m. Enclosure fencing for materials and equipment.

- n. Temporary toilets including supplies.
- o. Security enclosures and lock-up.
- p. Environmental protection.
- q. Temporary site lighting.
- r. Temporary stairs and hoists, where applicable.
- s. Temporary trash removal and project clean-up.
- t. Temporary waste storage units for recycle of construction materials.
- u. Internet access where specified.

## **PROJECT CLOSEOUT**

Provide at Project Close-out the following documentation, but not limited to:

1. Contractor's Affidavit of Payment of Debts and Claims (AIA G706)
2. Contractor's Affidavit of Release of Liens (AIA G706A)
3. Consent of Surety Company to Final Payment (AIA G707)
4. Confirmation of Receiving Operation and Maintenance Manuals and As-Built Drawings and Specifications
5. Certificate of Insurance (Acord Form and AIA G715) Covering required/specified products and completed operation
6. Certificate of Release from the Department of Tax and Revenue stating all appropriate taxes have been paid
7. SBA Certificate of Project Completion – For lump sum projects use “WVDE BP-13-A” and for multiple prime contract projects use “SBA 139.” Both of these forms are found in the SBA Guidelines and Procedures Handbook (Appendix J). These forms should be filled out and signed by the local board of education then forwarded to the contractor and the architect and engineer for signing
8. Verification from the Owner (county superintendent) that all Owner training required by the contract documents has been conducted (SBA 159)
9. Contractor Evaluation Form (SBA 124)

10. Architect/Engineer Evaluation form (SBA 135)
11. Fire Marshall's Certificate of Occupancy
12. SBA Certificate of Occupancy (SBA 146)
13. Affidavit of Debt Paid (SBA 177)
14. Notification of 11<sup>th</sup> month walkthrough date
15. Electronic & Hard copy of diagrammatic floor plan of new or renovated schools. Provide the following items:
  - a. One line drawing of floor plans including only diagrammatic walls, exiting, doors and windows, existing school
  - b. One line drawing with all school access safety data (submit electronic file to Office of Homeland Security)
  - c. One line drawing including only walls, doors, windows, room number/names and color coded HVAC zones with multi-zone equipment located in the HVAC zone
16. Provide a Final TAB report
17. Provide Final Commissioning Report when applicable
18. Prepare quality training videos

## **MULTI-PRIME CONTRACTORS – CONSTRUCTION SCHEDULE COORDINATION**

The general trade contractor shall coordinate with other prime contractors in order to establish a coordinated project construction schedule as soon as construction contracts are awarded. The coordinated construction schedule shall be submitted to the owner, architect and SBA for review and approval prior to submission of the second application for payment. The SBA will not process the second project application for payment if the construction schedule has not been approved and no further payments will be processed without an approved schedule.

Multi-prime contractors shall cooperate with the general trade contractor and comply with the "Project Construction Schedule" and conduct work so as not to interfere or hinder the progress or

completion of the work. All prime contractors shall be clearly notified in the bidding documents that the timely submission of the coordinated construction schedule to the owner, architect and SBA shall be linked to the approval of progress payments.

## **ENVIRONMENTAL STUDY AND ASBESTOS INSPECTION PROCEDURES FOR DEMOLITION**

1. An environmental study (where required) shall identify existing conditions and site and structure hazards.
2. The Asbestos Inspection Reports shall thoroughly locate and quantify any and all asbestos containing materials located in a structure.
3. Samples shall be taken from areas based upon both selective and random sampling strategies depending upon the nature of the suspect material and its condition, size and type.
4. Asbestos Inspection Reports shall contain the following:
  - a. Summary with a description, location, quantity and results of the laboratory analysis of each sample
  - b. Drawings with location of sampling points and any asbestos on that respective floor of the building
  - c. Laboratory sample analysis
5. Asbestos Inspection Reports shall include materials not only in visible spaces, but also in and behind other materials including the following but not limited to:
  - a. Material content of floor tile
  - b. Mastics below floor covering and behind rubber base
  - c. Material content of ceiling tile
  - d. Discs above ceiling tiles
  - e. Material content of plaster and sheetrock
  - f. Material content of fireproofing
  - g. Material content of insulation
  - h. Exterior finish material
  - i. Window glazing
  - j. Material content of chalkboards
  - k. Material content of roof coating and sealants
6. Pertinent site hazard conditions shall be provided in all demolition and site preparation bidding documents.

**SECTION III****Quality and Performance Standards  
TYPICAL DESIGN CRITERIA****SITE**

1. Site selection process is outlined in the SBA Handbook and shall include SBA staff participation in the site selection process. Refer to WVBE Policy 6200 for additional site selection criteria.
2. Site design and layout shall comply with the proto-typical site spatial relationship concept as shown in Section IV. Exceptions must be approved by the SBA.
3. The SBA allows for basic site development, including utilities (storm, sanitary, electric, water, gas, etc.), which shall be accessible at the site boundary for connection, and clearing, grubbing and grading. Sites with soil characteristics and/or conditions that require excess rock excavation or unsuitable soils removal for building foundations systems other than conventional spread footings, along with sites that require excess cut and fill, shall be avoided. The site development goal shall be to balance quantities (cut and fill) and not export/waste excess soils off site. Site preparation costs that exceed SBA reasonable and customary costs shall be reviewed by the SBA and additional preparation costs shall become the responsibility of the grant recipient.
4. Sites within an existing flood plain or floodway shall be prohibited. Wetland designated areas requiring mitigation shall be avoided for building, roads and parking areas.
5. Bus and vehicular traffic shall comply with the National Highway Traffic Safety Administration Guidelines.
6. Provide separate parent drop off – pick up zone separated from bus loading, capable of stacking 30-40 vehicles, where possible.
7. Provide staff parking to accommodate total staff personnel, administrative staff and traveling professional staff.
8. Provide separate service personnel parking convenient to service entrance to accommodate service personnel.
9. Provide visitor parking convenient to main entrance, minimum of 8% of student enrollment.

- 10. Provide high school student parking separated from bus zone, where possible, with a direct vehicle entrance and exit for approximately 30% of student enrollment.
- 11. Pavement Designs - Without prior SBA approval, the following paving cross sections are minimum requirements unless Geo-technical report recommends increased requirements:

Bus Roadways:           Geo - Filter Fabric  
                                   8” stone base  
                                   4” asphalt base course  
                                   2” asphalt wearing course

Vehicle Roadways:   Geo - Filter Fabric  
                                   6” stone base  
                                   3” asphalt base course  
                                   1 1/2” asphalt wearing course

Parking Areas:         4” stone base  
                                   3” asphalt base course  
                                   1 1/2” asphalt wearing course

School Access  
       Roads:               Roadways designated to be accepted by the WV Department of Transportation (DOT) into the state highway system shall be constructed in accordance with the DOT construction standards. Additional cost to construct to Department of Transportation standards shall be at the owner’s expense.

- 12. Provide handicapped parking for visitors and student parking in accordance with ADA requirements.
- 13. Parking stalls shall be sized as follows:
 

Visitors	9’0” x 18’0”
Staff	9’0” x 18’0”
Student	9’6” x 18’0”
- 14. Provide positive drainage away from building and entrances.

15. Locate catch basins, drop inlets and swales in accordance with WVDEP regulations for post-construction storm water run-off.
16. Where emergency access roads are required around and thru grassed site areas, provide a paved area constructed of a flexible porous paving “Grass Pave” grid system or similar detail, where possible.
17. Slope grade from building to walks, a minimum of 1” per foot.
18. Bollards, sufficient enough to stop a passenger vehicle traveling 25 mph, shall be installed at all entrances accessible by vehicular traffic. Bollards shall be spaced in a manner necessary to prevent vehicular entrance to the facility, yet provide adequate space for occupants to exit.

#### **BUILDING DESIGN CRITERIA**

1. All new schools shall be designed and constructed to comply with all applicable codes and standards. Where possible, domestic materials and equipment shall be used.
2. Building design shall comply with the proto-typical space relationship diagrams for Elementary, Middle and High Schools as shown in Section VII.
3. The design professionals shall study and analyze various building technologies to provide the most efficient, cost effective, energy efficient and maintainable building systems. All new schools and schools with total HVAC replacements will maintain historic utility records of electricity, natural gas or other primary fuel usage and provide annual reports to the SBA and WVDE Office of School Facilities that provide the utility cost per square foot and KBTU cost per square foot for the project. SBA funded projects of this type shall be bench marked and this data shall be maintained in the EPA’s Portfolio Manager. This information shall be reported annually with the CEFP annual update.
4. Design professionals shall incorporate design elements in accordance with the School Access Safety Plan. Elements of the “Crime Prevention through Environmental Design” concept shall also be incorporated. Where risk and

vulnerability assessments are conducted, incorporate recommendations into the design. All new school designs shall incorporate numbering graphics on all exterior doors made of a reflective material that are legible from a distance of 200' in low light conditions. The interior of all exterior doors shall have this same corresponding number located on the door that is legible from within the building area to occupants.

5. Design professionals shall study and analyze the feasibility of various building systems found in the Quality and Performance Document, such as:
  - a. Use of structural steel columns and beams
  - b. Use of insulated concrete forms for exterior and interior bearing walls.
  - c. Use of precast concrete panel construction.
6. Orient the classrooms to take advantage of natural light sources and day lighting technology where possible.
7. Classrooms and science labs shall comply with prototypical designs as shown in Section VII. Other classroom and science lab layouts may be used, provided layouts are pre-approved by the SBA. Flexibility and the use of technology shall be considered within all designs.
8. Administrative offices shall be oriented adjacent to the main entry vestibule with direct line of sight to the main building entrance and parking areas. Where possible, the administrative offices shall have line of sight to all site access roads.
9. Provide security foyer at main entrance with locked exterior entry doors, controlled from the general office. A separate visitor entrance and waiting area shall be designed adjacent to the main entrance. Provide a pass-thru transaction window constructed of security glass from waiting area to the general office. Design strategies shall incorporate School Access Safety Plan requirements.
10. Cafeteria/commons area shall be separated from the main entrance and administrative office by use of mechanically operated access doors. Additionally, all academic spaces shall be separated from common building spaces by use of similar doors. All doors shall remain in open position



during normal school functions with the capability to be closed and locked mechanically from the office area.

11. Miscellaneous New Building Design Elements
  - a. Ship ladders for roof access
  - b. Frostless water hydrants for each roof level area
  - c. Weatherproof electrical roof outlets
  - d. Technology data drops for roof access
  - e. 25” minimum clearance between finish ceilings and bottom of joist (minimum clearance of 25” may be reduced if HVAC or other equipment do not conflict)
  - f. Taper roof insulation abutting all HVAC equipment and parapets for positive slope drainage to roof drains
  - g. Specify epoxy grout for ceramic tile
12. Provide a space of adequate size to store equipment and fuels for grounds keeping and other maintenance duties that meets the West Virginia State Fire Marshal’s requirements for this type of equipment.

## **LEED FOR SCHOOLS DESIGN CRITERIA**

1. LEED (Leadership in Energy and Environmental Design) is a third-party certification program developed by the U.S. Green Building Council. The Green Building Certification Institute (GBCI) has assumed administration of LEED certification for all commercial and institutional projects registered under any LEED Rating System.
2. The SBA will designate certain new construction projects to be designed to achieve LEED Silver Certification. Additional funding may be allocated by square footage cost.
3. Architects providing design services for SBA projects shall have an in-house LEED Accredited Professionals (LEED AP) to meet any USGBC relevant specialty requirements for credit.
4. Coordinate with SBA designated staff on all Charrette meetings.
5. Submit LEED Project Checklist and a report explaining how each credit will be achieved at Schematic Design and

update this checklist at Design Development and Construction Document submissions. Include Regional Priority Credits which are specific to a project's ZIP code.

6. Set-up access for SBA designated staff to USGBC account of the project. This account is set-up by the designated LEED AP known as the Project Administrator by the Schematic Design Phase.
7. The other SBA Projects funded each year may incorporate sustainable design components where feasible, based on the LEED standard of measurement but is not mandated to register as a LEED project with USGBC.
8. Refer to the latest version of the USGBC's LEED for Schools Checklist.

## **PLUMBING DESIGN CRITERIA**

1. The design professional shall consider all various technologies to provide the latest energy use practical and economical for the application.
2. Plumbing systems for projects with construction costs less than ten million dollars will be bid as part of a single lump sum contract.
3. The plumbing design shall also consider the latest technologies available to include but not limited to:
  - a. Low-flow plumbing fixtures
  - b. Vacuum plumbing systems
  - c. High efficiency water heaters
  - d. Waterless Urinals (where owners are committed to the cleaning and maintenance of urinals)
4. Comply with applicable state building code for the number of fixtures required.
5. Utilize PVC sanitary plumbing lines as permitted by applicable codes. Consider cost of insulated PVC vs cast iron above floor applications.
6. Sanitary lines from gang toilets and kitchens shall exit from the building as quickly as possible for ease of service. Avoid sanitary lines passing through the entire length of building.

## **HVAC DESIGN CRITERIA**

1. In the design of all HVAC systems and equipment, year-round comfort, energy conservation, durability and ease of maintenance shall be emphasized consistent with the required performance characteristics. The design professional shall consider all various technologies to provide the lowest practical and economical use of energy for the application. To this end, the latest energy and environmental technologies shall be considered. SBA approval of the design strategies is required.
2. The design of HVAC systems shall conform to the recommended practice in ASHRAE 90.1 (most recent standard) as adopted by the State of West Virginia.

3. Performance and design standards outline acceptable heating, ventilating and air-conditioning systems for consideration and evaluation. (Section IV – HVAC)
4. Life Cycle Cost Analysis shall be provided for the proposed building HVAC system. Refer to Section IV – Heating, Ventilation and Air-Conditioning for specific requirements.
5. Approved computed energy calculation programs acceptable for use in generating a detailed system evaluation are:
  - a. Dept. of Energy – DOE.2, detailed energy analysis by the United States Department of Energy.
  - b. Trane Trace 700 – detailed building energy/economic analysis by the Trane Company.
  - c. Carrier HAP – detailed building energy/economic analysis by the Carrier Company.
 (Others must be approved by the SBA)
6. Occupancy student load for building spaces:
  - Early Childhood Education – 20, 2 instructors
  - Classrooms – 25, 1 instructor
  - Computer Lab – 30, 1 instructor
  - Gym – 50, 2 instructors
  - Reference – State Board Policy 6200 for additional data
7. HVAC design documents shall include requirements for the HVAC contractor to provide a separate cost within their bid for a two year preventative maintenance contract for HVAC equipment and components as described in the bidding documents.

## **ELECTRICAL DESIGN CRITERIA**

1. All electrical work shall be in compliance with NFPA, NEC, state and local codes.
2. Emergency power, where required by West Virginia State Fire Marshal, to deliver water to the building sprinkler system shall be delivered by an on-site standby power generator or self-contained engine-driven fire pump (where applicable) in accordance with NEC.

Note: Where state adopted building code requires, emergency stand by power generators will be required when adequate water supply and pressure is not available for sprinkler system. All emergency lighting and exits shall be battery pack.

3. Maximum lighting loads at desk top must comply with ASHRAE 90.1 general guidelines:  
Classroom Lighting Load – 1.2 watts sq. ft.  
Corridor Lighting Load - .5 watts sq. ft.  
Commons/Dining Lighting Load – 1.2 watts sq. ft.  
Media Center Lighting Load – 1.2 watts sq.ft.  
Administrative Lighting Load- 1.2 watts sq.ft  
Computer Lab – 130 watts x 30 computers  
Computer Lab using lap tops – 3 watts x 30 computers  
Note: Where design conditions dictate, comply with latest state adopted codes and standards.

## **TECHNOLOGY DESIGN CRITERIA**

1. Technology systems shall be coordinated and designed by a Certified Network Systems Engineer. Technology planning and design shall commence at the completion of the Schematic Design Phase and be submitted to the SBA with the Design Development documents. Technology requirements (academic and building systems) must be identified and approved by the SBA in the design development phase of the project to receive funding consideration from the SBA for the technology. Locations of technology equipment (i.e. switches, routers, projectors) in the design documents for reference and/or installations within the bid documents.
2. Technology system shall include, and provide for, a school access, safety and security system. The cost for additional video surveillance equipment beyond the building access security system will be the responsibility of the county board or grant recipient.
3. Technology system shall provide capabilities for both hard wired data drops and wireless access points for entire building areas, where specified.
4. Refer also to SBA diagrammatic designs (Section VII) and State Board Policy 6200 and technology design standards for technical data and/or specific networking requirements.

**GENERAL PURPOSE**

Structural systems shall be designed in strict conformance with state and local codes and with current structural codes and specifications.

Geo-technical investigations and reports shall be performed for all school projects. Geo-technical reports shall provide the design soil bearing criteria and capacity for all foundations. Final geo-technical report shall provide subsurface condition information a minimum of seven feet below anticipated ground floor finish floor elevation to a point five feet beyond the building pad.

Structural designs shall be performed by qualified engineers in accordance with SBA Policy and Procedures Manual. Design criteria and structural design conditions shall be established by the design engineer within codes and standards. Should SBA Quality and Performance Standards differ from State Adopted Building Code requirements, the State Adopted Code shall prevail. Alternative systems that may differ from the building systems and materials described in this section shall be approved by the SBA.

**A. FOUNDATIONS**

1. Foundations shall be designed ~~on~~ from the recommendation of the geo-technical engineer and the design engineer.
2. Where the geo-technical investigation and soils report determines the soil will not support conventional wall and spread footing, other sites or building areas shall be explored. Any proposed use of Floating Concrete Mat Foundation or Deep Foundation Systems shall require approval of the SBA prior to proceeding.
3. Conventional reinforced concrete shall be utilized for all masonry and insulated concrete form bearing walls.
4. Foundation reinforcing steel shall be supported by chairs.
5. Conventional reinforced concrete spread foundations shall be utilized for all column foundations, where possible.

6. Minimum concrete compressive strength shall be 3,000 PSI at 28 days. The design engineer will determine the design conditions for the project.

## **B. SLAB ON GRADE**

1. Interior concrete minimum compressive strength of 4,000 PSI at 28 days. Exterior or air entrained concrete minimum compressive strength of 4,500 PSI. The design engineer will determine the design conditions for the project.
2. Provide a minimum 4" drainage dry bed fill course over compacted soil sub-base.
3. Provide minimum 10 mils polyethylene sheet vapor retarder over drainage dry bed fill course. Where excessive moisture conditions exist, use 15 mil thick polyester cord reinforced and laminated non-woven geo-textile fabric. Seal and tape all seams with contrasting color tape.
4. Vapor retarded for gyms; minimum 30 mils thick, polyester cord reinforced and laminated to non-woven geo-textile fabric. Seal and tape all seams with contrasting color tape.
5. Reinforce 4" concrete slabs with 6x6 – 1.4 x 1.4 ga. welded wire fabric or fibrous reinforced concrete is acceptable for exterior air entrained concrete walks.

## **C. MASONRY WALL SYSTEMS**

1. Engineered masonry wall systems shall be used for load bearing and shear walls.
2. Engineered masonry wall systems or insulated concrete form walls shall be used for all exterior wall systems. Steel frame construction is acceptable for all areas but schedule and cost must be considered when determining structural support systems.
3. Reinforcing in masonry wall systems shall be in accordance with applicable codes.
4. Floor and roof members supported by masonry bearing walls shall bear on bond beams with bearing plates anchored to bond beam and bond beam reinforcing.

## **FLOOR FRAMING**

1. Steel members shall comply with ASTM Standards and the Manual of Steel Construction.
2. Metal deck/concrete topping shall be used for all suspended floor framing.
3. Design deck in accordance with the Steel Deck Institute, latest edition of "Design Manual."
4. Metal decking shall be 22 ga. – designed and installed based on decking support spacing and load bearing conditions.
5. Concrete fill shall be 4,000 PSI at 28 days.
6. Reinforce concrete fill with 6x6 #1.4 x 1.4 ga. minimum welded wire fabric or fibrous reinforced concrete.
7. Pre-cast concrete planks are acceptable design in accordance with ACI 318 and Pre-cast Concrete Handbook with 2" concrete topping and fibrous reinforcing.

## **ROOF FRAMING**

1. Use ALSC, Type 2, Simple Framing System with shear walls or braced frames.
2. Analyze use of columns and beams roof framing rather than masonry bearing walls or insulated concrete forms for interior supports.
3. Joist, structural framing and wall bearing shall provide a primary slope of 1/4" per foot.
4. Open web steel joists designed in accordance with SJI Standard Specifications and load tables.
5. Steel framing members design in accordance with the AISC Manual of Steel Construction.
6. Steel roof deck designed in accordance with the SDI Design Manual.



7. Steel roof deck shall be galvanized ASTM 525, G60 min. 22 gauge, profiles shall be determined by the design professional.
8. Deck shall be mechanical fasteners or puddle welded, unless specifically required otherwise by structural engineer.
9. Use prefinished acoustical galvanized steel deck for exposed construction building areas.
10. Cementitious decks and steel purlins on open web steel joists should be prohibited.
11. Pre-fabricated wood trusses and wood sheathing shall not be used for roof systems.

**D. REINFORCED CONCRETE MASONRY RETAINING WALLS**

1. Reinforced concrete masonry walls may be utilized for exterior retaining walls. Walls shall be designed by the structural engineer on the basis of certification of the proprietary masonry unit by the manufacturing professional engineer.
2. Vertical and horizontal reinforcing shall be in accordance with applicable codes and standards.

**E. REINFORCED INSULATED CONCRETE FORMS**

1. Refer to Building Systems and Materials, Exterior Walls, Section IV.

**F. LINTELS**

1. All exterior wall lintels shall be hot-dipped galvanized in accordance with ASTM-A123. Lintels shall not be painted.
2. Interior lintels shall be shop primer with finish field painting.
3. Reinforced masonry or pre-cast concrete lintels are approved for use.

**GENERAL PURPOSE**

The purpose of this section of the Performance Criteria Standards is to establish standardization for exterior wall construction and level of quality for materials to be incorporated.

Conventional load bearing masonry or insulated concrete form walls are the preferred wall systems. Other systems and materials may be considered, however, if proposed, a life cycle cost comparison study shall be submitted to the SBA for review and comments.

**A. MASONRY BEARING WALL**

1. Exterior masonry walls shall be load bearing design complying with State adopted Building Code (IBC) and American Concrete Institute (ACI).
2. Masonry veneer – standard type SW face brick meeting ASTM C-216 Grade SW FBX, utility size 4”x12”x4” or jumbo 4”x8”x4”. Brick shall be ASTM C67 tested for efflorescence. Through body color is preferred.  
Note: FBS brick may be used with SBA and owner approval. Where a new building abuts an existing building, face brick may match existing building brick. Modular face brick may be considered, provided its use is cost effective. Prior approval of the SBA is required. Masonry veneer brick shall be provided by a single manufacturer for each individual project. Exceptions must be approved by the SBA.
3. Mortar – Portland cement – lime mix ASTM C150 Type 1 or Type 11, standard pigmented color.  
Use type “S” mortar below grade and type “N” above grade.
4. Wall anchor – adjustable two piece hot dipped or galvanized.
5. Insulation – 2” extruded polystyrene insulation, all joints taped.

6. Medium weight Concrete Masonry Units (CMU). Thickness determined by wall height with an average density of 105-115 lbs/cu.ft.
7. Below grade foundation: normal weight Concrete Masonry Units (CMU) with an average density of 125 lbs/cu.ft. or above.
8. Flashing: Use metal fabric flashing/drainage system. EPDM thru wall flashing 0.040 inch thick is also acceptable (comply with IMI recommendations).
9. WEEPS: Provide plastic tubing, cotton rope wicks, rectangular vents, corrugated or fibrous mat weep system.
10. Vapor Barrier: Provide bituminous dampproofing where called for in bid documents on vertical surfaces.

## **B. MASONRY CAVITY WALL**

1. Masonry cavity wall shall be used where structural steel framing system is used for exterior walls.
2. Masonry veneer – standard type SW face brick meeting ASTM C-216 Grade SW FBX. Brick shall be ASTM C67 tested for efflorescence.  
Note: FBS brick may be used with SBA and owner approval. Where a new building abuts an existing building, face brick may match existing building brick with prior approval of the SBA.
3. Mortar – Portland cement – lime mix ASTM C150 Type I or Type II, standard non-pigmented color.
4. Wall anchor – two piece adjustable stainless steel or hot dipped galvanized.
5. Insulation – Minimum 2” extruded polystyrene insulation, all joints taped in air space.
6. Interior – lightweight CMU thickness based on wall height.

**C. PRE-CAST CONCRETE PANELS**

1. Pre-cast concrete panels may be used as an alternate to exterior cavity wall system. Perform life cycle cost analysis for SBA review and approval.
2. Panels shall be wall bearing and may be tilt-up or pre-cast concrete.
3. Interior: Face interior with 2" Steel stud wall, insulated with 2" fabric faced batt insulation and 5/8" abuse resistant gypsum board.

**D. SPLIT FACED CONCRETE MASONRY UNITS**

1. Split faced concrete masonry units shall not be used for exterior wall "field" material.
2. Split faced Concrete Masonry Units (CMU) may be used for building design accents no lower than 32" above finish grade.
3. All split faced CMU shall be manufactured using water repellent admixture.

**E. EIFS (EXTERIOR INSULATION FOAM/PLASTER)**

1. EIFS material system shall not be utilized for exterior walls, or building design elements and trim shapes.

**F. CEMENT BOARD**

1. Exterior cement board 1/2" thick complying with ASTM C 1325 may be used for decorative design elements provided bottom of system is 10'0" above finish floor.
2. Provide weather resistive barrier for walls and soffits over substrate materials.
3. Base coat: 100% acrylic, fiber-reinforced base coat mixed with portland cement.
4. Finish coat: Acrylic-based 100% acrylic resin finish.

5. Comply with manufactures specifications for product installation and finishing.

#### **G. INSULATED CONCRETE FORMS**

1. Insulated concrete forms may be substituted for concrete masonry for interior and exterior bearing wall construction with SBA approval.
2. Insulated concrete forms and concrete fill shall be reinforced in accordance with American Concrete Institute and applicable state codes.
3. Exterior wall facing shall be brick veneer as defined in Paragraph A of this section.
4. Interior face shall be full height 5/8" abuse resistant gypsum board mechanically attached to insulated concrete form and mechanically attached at edges of panel. Alternative interior finishes may be considered with prior approval of the SBA.

#### **H. STEEL FRAME CONSTRUCTION**

Structural steel frame construction is acceptable and should be considered as the project schedule and budget is determined.

**SECTION IV****Building Systems and Materials  
ROOFING****GENERAL**

All roofing systems shall be designed with a minimum of twenty (20) year total systems warranty and must comply with applicable codes and standards.

Pro-rated warranties shall not be acceptable.

Include accidental puncture warranty of 16 hours per year.

**LOW SLOPE ROOFING**

1. Low slope roofing shall consist of a minimum .060 Standard FR EPDM fully adhered membrane single ply roofing system. Mechanically fastened installations are acceptable with prior SBA approval.
2. Where highly reflective roofing is selected for energy benefits, a cost/benefits analysis must be conducted and approved by the owner and SBA before incorporating the reflective roof into the design.
3. All roof seams to be 6" factory applied tape seams.
4. Roof slope shall be designed to a minimum 1/4" per foot slope throughout roof areas. Structural framing and/or masonry ICF wall bearing shall provide primary slope.
5. Provide tapered insulation for crickets and saddles for secondary 1/2" per foot slope.
6. Roof drains shall be installed at lowest roof points in accordance with manufactures recommendations.
7. Provide overflow scuppers per IBC.
8. For new construction and new additions, provide polyisocyanurate (20 PSI) insulation of thickness required to comply with latest IECC and/or ASHRAE 90.1 and achieve R-32 Ratings.
9. For re-roofing conditions, provide the greatest R- value possible based on existing condition, using polyisocyanurate as needed to maintain or achieve

minimum roof slope requirements and a minimum parapet flashing height to achieve specified warranty.

10. Insulation to be two layers or more with staggered joints. Overlay boards are not required.
11. Roof curbs shall be pre-fabricated welded one piece insulated units. Install tapered insulation to provide positive roof slope at all major roof penetrations.
12. Provide walk pads from roof access point to and around all major roof mounted equipment.

## **METAL ROOFING**

### **GENERAL**

Prior to proceeding with the design of sloped metal roofing, the design professional shall perform a life cycle cost analysis for SBA review and approval.

Metal roofing is permitted for building design elements provided metal roofing area does not exceed five (5) percent of the gross roof area. Additional metal roofing area must be approved by the SBA. The cost for additional metal roofing exceeding the 5% maximum not approved by the SBA shall be the responsibility of the building owner.

1. Metal roofing shall consist of a minimum of 24 ga. aluminum zinc alloy coated Class AZ-50 coating pre-formed finish; fluoropolymer, 70 percent Kynar 500, 2 coat system. Deviations must be approved by the SBA.
2. All metal roof systems shall be factory fabricated including factory applied in seam sealant.
3. Fasteners shall be concealed.
4. Provide polyisocyanurate (20 PSI) insulation of thickness required to comply with latest IECC and/or ASHRAE 90.1 and achieve R-32 Ratings in occupied spaces.
5. Provide a continuous sealed 6 mil poly thermal barrier vapor between steel roof deck and insulation
6. Minimum roof slope of 4 in 12. Areas of lower slope must be pre-approved by the SBA and proposed manufacturer.

7. Accessories: gutters, down spouts, snow guards, trims and other accessories to match metal roofing material and finish.
8. Fasteners and connections – as per manufacturer’s and state building code requirements.

## **SHINGLE ROOFING**

### **GENERAL**

Prior to proceeding with the design of sloped shingle roofing the design professional shall perform a life cycle cost analysis for SBA review and approval.

Shingle roofing is permitted for building design elements provided shingle roofing area does not exceed five (5) percent of the gross building area. Additional shingle roofing area must be approved by the SBA. The cost for additional shingle roofing exceeding the 5% maximum not approved by the SBA shall be the responsibility of the building owner.

1. Shingles shall comply with ASTM D3462 standard specifications for asphalt shingles, 325 lb., 30 year, three dimensional, laminated strip, UL Class “A”, mineral surfaced, self sealing UL 997 (110 MPH) wind resistant label.
2. Provide vented strand nail board insulation of thickness to comply with latest IECC and/or ASHRAE 90.1 and achieve R-32 Ratings in occupied spaces.
3. Provide polyethylene vapor retarded per ASTM D4397, 6 mils thickness, joints sealed.
4. Install synthetic underlayment.
5. Staple fasteners shall not be used.
6. Minimum roof slope shall be 4 in 12. Lower slopes will not be permitted without prior approval from the manufacturer and the SBA.
7. Accessories and Trims: Minimum pre-finish, brake formed 24 gauge Kynar or .032 aluminum Kynar finish.



**SECTION IV****Building Systems and Materials  
DOORS, WINDOWS AND WINDOW WALLS****GENERAL**

1. Building systems and materials are listed for new construction building conditions. Where existing structures and systems occur and the design condition dictates that the new material match the existing conditions, deviations from the SBA Quality and Performance document requirement may occur.
2. Submit deviations from the SBA Quality and Performance materials and systems with the design development submission to the SBA for approval.
3. Where existing conditions to remain differ from SBA standards, match existing conditions where desirable.
4. All glazing at exterior entry doors and sidelights shall be constructed of security glass from the finished floor elevation to a point 7'0" A. F. F..
5. All exterior doors, not intended as a means of ingress, shall have panic exiting devices installed on the interior and no exterior hardware.

**MAIN ENTRANCE DOORS AND FRAMES**

1. Main entrance doors shall be wide stile monumental architectural aluminum doors.
2. 0.187" Extruded Tubular Rail and Stiles.
3. Welded Construction.
4. Single Acting Exterior Swing.
5. Integral Fitted – Panic Hardware.
6. 1/4" Security Glass Infill.
7. Standard Clear Anodized Class I Finish. Use of Color Anodized Finish shall be bid as alternate.
8. Continuous Geared Hinge.

## **STOREFRONT FRAMING**

1. Fixed Window Framing shall be nominal 2"x4" sized for opening and local code windows.
2. 0.187 inch extruded members.
3. Reinforce Members for Fasteners.
4. Include Sub-frames.
5. Flush Glazing System for 1" Insulated Glass.
6. Standard Clear Anodized Class I Finish. Use of Color Anodized Finish shall be bid as alternate.

## **SECONDARY ENTRANCE DOORS & FRAMES**

Secondary Entrances (corridors and similar locations) shall be wide stile monumental architectural aluminum doors. High use secondary entrances shall require installation of main entrance doors and frames.

## **STEEL DOORS AND FRAMES**

1. Exterior doors, including stair towers, exits, individual curriculum space exits, service entrances and interior building service, except where door exits into public circulation areas, and maintenance areas shall be insulated full flush steel doors
2. Level 2 – 16 ga. Interior.
3. Full flush door edge.
4. Provide exterior polystyrene insulating core.
5. Continuously laser welded edge.
6. 14 ga. Closer reinforcement.
7. Exterior doors shall be flush 18 ga. Galvanized top channel.

8. Inverted 18 ga. Galvanized bottom channel.
9. Prime finished SDI A250.10.
10. 14 ga. Steel door frames, welded construction.
11. Provide for all pair of interior doors full continuous geared hinge. Comply with NFPA and IBC as required.
12. Provide continuous geared hinge for all exterior exit doors.
13. Grout frames solid.

### **WOOD DOORS**

1. Interior doors for all spaces except building service areas shall be solid core flush wood 5 ply construction. Comply with applicable codes.
2. 1 3/4" thick particle board core.
3. Premium grade.
4. Natural birch or oak, plain sliced.
5. .0478 inch cold rolled metal light frames.

### **FIXED INTERIOR FRAMES**

1. Fixed interior glazed frames shall be fabricated of .0598 inch 16 ga. steel sheet.
2. Pre-fabricated welded construction.
3. .032 inch glazing stops.
4. Prime Finish ANSI 250.10.
5. Provide horizontal members 4"-6" above floor per OSHA.
6. All glazing shall be tempered safety glass, Category II ANSI Z97.1.
7. Wire glass is prohibited and shall not be installed.

## **ALUMINUM WINDOWS**

1. Single hung window units, AAMA/WDMA certified quality. Double hung windows may be used for two story buildings.
2. Pre-fabricated welded construction.
3. Three year warranty.
4. Sound transmission rating of 35.
5. Factory glazed 1" insulating with low E-coating.
6. Standard Clear Anodized Class I Finish. Use of Color Anodized Finish shall be bid as alternate.

**SECTION IV****Building Systems and Materials  
INTERIOR WALLS****MASONRY PARTITIONS**

1. Wall bearing: medium weight concrete masonry units with an average density of 105-115 lbs/cu.ft.  
Non-bearing: medium weight concrete masonry units with an average density of 105-115 lbs/cu.ft.
2. Non-load bearing masonry units between classrooms and other academic spaces shall bear on thickened concrete support where permitted by State Building Code and extend 8" above ceiling heights.
3. Brace top of non-bearing walls from floor or roof joists at third points
4. Extend walls to deck and seal openings where sound alteration or privacy in the space is required.
5. Protect masonry work from elements to allow for proper curing of mortar prior to loading wall with floor or roof loads.

**STEEL STUD/DRYWALL**

1. Steel stud/drywall partitions may be used in administrative areas, pupil services, media center and faculty planning areas. Obtain SBA approval for steel stud/gypsum board use in classrooms and other areas as desired or as required for LEED certified projects.
2. Steel Studs: 3 5/8"- 20 gauge hot dipped galvanized.
3. Sound insulation batts for 44 db. decibel ratings in all above areas in paragraph 1.
4. Where steel stud/gypsum board partitions are used to divide classrooms, extend partition to the deck above. Provide sound insulations batts 4' 0" on each side of partition. Extend the insulation in the cavity wall to deck.
5. Wall board: 5/8" standard gypsum board. Use 5/8" abuse resistant gypsum wall board in student occupied spaces.

Use abuse resistant gypsum board 4 feet above finish floor in elementary schools and 8 feet above finish floor in secondary schools.

6. Accessories: Metal trim, hot dipped steel zinc coated materials.
7. Where insulated concrete forms are used for exterior walls, abuse resistant gypsum board may be adhered directly to inside face of forms, edges shall be mechanically attached.

**SECTION IV****Building Systems and Materials  
FLOORING****GENERAL**

1. Perform installation, cleaning and protection in accordance with manufacturer's printed instructions.
2. Provide moisture substrate test prior to any flooring installation

**A. ARCHITECTURAL POLISHED CONCRETE**

A/E shall establish performance based polish concrete installer qualification within the bidding specification. These experienced based standards shall include requirements that the installer provide verification of qualifications, experience and project references. Only qualified installers meeting the established performance standards will be approved for the project.

1. Delineate architectural polished concrete floor finish area on the drawings.
2. Generally polished concrete floors will be applied to a 4" concrete slab on grade. Minimum 3500 PSI. See concrete design specification.
3. Polished concrete floors shall comply with International Polishing Concrete Institute specifications and ACI 130.
4. The polishing contractor, in cooperation with architect, shall determine the location of all concrete control joints.
5. Concrete pour sequencing shall be indicated on the drawing for both polished and non-polished concrete floors.
6. Pour non-polished concrete floors first and use these areas for construction staging as polished concrete floors cannot be used for staging. Protect all polished floors from damage after polishing is completed.
7. Water based pigmented penetrating cement stain application color as selected.

8. Polish Contractors shall provide qualifications and certifications from manufacturers of products being applied.
9. The Polish Contractor shall provide the architect/owner and SBA job references of previous projects for review.
10. Protect all concrete to receive polished surfaces from the time of placement until time of turnover to owner.
11. Polish concrete installer to do joint filling in conjunction with the polish process to ensure proper materials are used with the process.
12. No eating or drinking of any other liquids on the floor to receive polished surfaces other than WATER.
13. No pipe threading on surfaces to receive polish.
14. All hydraulic equipment used on surfaces to receive polish shall be diapered. Along with ensuring all tires are free from nails, screws, and rocks to eliminate any possible surface defects from scratching.
15. Polish Contractor shall provide a Performance Bond equivalent to the cost of the polishing contract.
16. Have FF and FL numbers specified and tested to ensure that they are met by the Concrete Finisher to ensure a desirable look of the floor.
17. Architect shall specify a gloss level for the sheen of the floor. A gloss meter testing shall be required to ensure that the desired sheen has been achieved.
18. A slip meter testing shall be required after the floor is polished and before the owner takes possession to ensure SCOF (Static Coefficient of Friction) is in line with OSHA guidelines.

## **B. MODULAR CARPET FLOORING**

1. Modular fiberglass reinforced Carpet Tile with moisture-proof backing system, lifetime edge ravel, delamination and zippering warranty is acceptable.



2. Anti-static and anti-microbial.
3. Soil and stain resistant.
4. Direct glue down installation or tackable surface system.

**C. VINYL COMPOSITION TILE FLOORING**

1. 12”X12”X1/8” Class 1 or 2 (through pattern tile) non asbestos formula with a static load limit of 125# or higher is acceptable.
2. Product to comply with ASTM F 1066.
3. Water resistant low VOC adhesives.
4. Perform substrate moisture and alkalinity test prior to installation.
5. Flooring material requiring concrete ad-mixtures to prevent migration of sub-grade moisture shall not be used.

**D. RESINOUS FLOORING**

1. Trowelled epoxy-resin composition flooring is acceptable.
2. Epoxy-resin flooring, nominal 1/4” thick system comprised of penetrating two component epoxy primer, three component mortar consisting of epoxy-resin curing agent and graded aggregate.
3. Slip resistant texture.
4. Perform concrete substrate moisture tests per ASTM F 710 and manufacturers printed instructions.

**E. RESILIENT FLOORING**

**GENERAL**

1. Perform all substrate test for subfloor suitability prior to installation as recommended by product manufacturer. Provide test results with recommendation regarding installation to the architect and owner prior to installation of material.

2. Use only manufacturer's recommended welds, adhesive and leveling compounds compatible with flooring material.

### **RESILIENT RUBBER FLOOR TILE**

1. Manufactured from 100% synthetic rubber to meet the performance requirements of ASTM F 1344, Class 1-A and 1-B Specification for rubber flooring.
2. Physical characteristics:  
Tile sizes, 24" x 24", 12" x 24", and 18" x 18"  
Tile thickness, .125", .100" and .80"

### **COMMERCIAL HOMOGENEOUS TILE OR SOLID VINYL TILE**

1. Solid vinyl floor tile to meet the performance requirements of ASTM F 1700, with a static load limit of 800 psi.
2. Physical characteristics:  
Tile size 16" x 16", 12" x 12" or planks.  
Tile thickness 1/8" or .100"

### **HOMOGENEOUS SHEET AND TILE**

1. Homogeneous sheet vinyl that meet performance requirements ASTM F 1913, single layered sheet vinyl, with a static load limit of 800#. Homogeneous tile that meet performance requirements ASTM F 1700, class 1, type A, with a static load limit of 800#.
2. Physical characteristics:  
Sheet, 6'6" wide rolls  
Tiles, 24" x 24"  
Thickness, .080" or 2.0mm.

### **LINOLEUM AND LINOLEUM TILE**

1. Linoleum sheet goods that meet performance requirements ASTM F 2034, type 1. Linoleum tile that meet performance requirements ASTM F 2195.
2. Physical characteristics:

Sheet, 6' 6" wide rolls.  
Tiles, 20" x 20"  
Thickness, minimum 0.100" or 2.5 mm.

## **F. CERAMIC TILE**

### **GENERAL**

1. All tile listed are standard grade complying with ANSI A137.1, for types, composition and other characteristics indicated. All specifications for ceramic tiles should take some or all of the following standards into consideration. Tiles should:
  - a. meet or exceed ASTM C-1028 test method for coefficient of friction where applicable.
  - b. meet or exceed the requirements of ASTM C-648 standard breaking strengths appropriate for each application.
  - c. meet or exceed requirements of ASTM C-650 standard test method for determining resistance to chemical substances appropriate for each application.
  - d. meet or exceed the requirements of ASTM C-1026 standard test method for determining tile's ability to withstand repeated cycles of freezing and thawing.
  - e. be abrasion resistance and glaze durability subjected to the testing procedure ASTM C-1027 should be considered on all applications. Ratings are from Class 1 light traffic to Class 5 heavy traffic. Specify tile rating for each area receiving tile.

### **CERAMIC TILE**

1. Quarry tile  
Size, 6" x 6", 8" x 8", 4" x 8"  
Thickness, 1/2" or 3/4"
2. Unglazed mosaic  
Size, 1" x 1", 2" x 2", 3" x 3", 1" x 2", octagon, hexagon or round  
Thickness, 1/4"
3. Glazed Wall Tile and Glazed Mosaic  
Size wall tile, 4 1/4" x 4 1/4", 6" x 6", 3" x 6", 8" x 10", 8" x 8", 6" x 8"

Mosaic size, 2" x 2", 3" x 3"  
Thickness, 1/4" to 5/16"

4. Porcelain pavers, glazed and unglazed  
Size, 6" x 6" thru 48" x 48" tiles  
Thickness: 5/16" minimum

#### **G. GYMNASIUM WOOD FLOORING – Middle and High Schools**

1. Provide DIN certified wood sports floor assemblies consisting of:
  - a. Northern hard maple, grade MFMA-RL second and better.
  - b. Face Width – 1 1/2" gym
  - c. Thickness: 25/32".
  - d. Random lengths – 4'0" to 8'0".
  - e. Install over 6 mil polyethylene vapor retarder.
  - f. Manufacturers' standard resilient pads or resilient mat.
  - g. 2"x3"x4' of kiln dried pressure treated wood sleepers.
  - h. 1/2" C-D plugged exterior glue plywood sub-floor.
  - i. Molded 4"x3"x48" vented rubber base with pre-molded corners.
  - j. Epoxy resin floor sealer.
  - k. Epoxy resin high gloss finish.
  - l. Floor system shall be leveled and shimmed to prevent dead areas in the floor.

**SECTION IV****Building Systems and Materials  
ACOUSTICAL****A. GENERAL**

Comply with ANSI 12.60 – 2002 Acoustical Classroom Guidelines.

**B. ACOUSTICAL CEILING PANELS**

1. Products for classrooms, administrative areas, media center and faculty areas.
  - a. 2'x4'x 3/4" fine fissured panels.
  - b. Non-directional pattern.
  - c. Color: white.
  - d. Light reflectance – LR minimum .81.
  - e. NRC: 0.70 UL Certified.
  - f. Square lay end edge.
  - g. Attenuation class of certified CAC Min. of .35.
  - h. Wide face heavy duty steel suspended grid system, white finish.
  - i. Anti-microbial.
  
2. Products for commons, foyer and lobbies instruction:
  - a. 2x4 or 2x2 x 3/4" fine fissured panels.
  - b. Non-directional pattern.
  - c. Color: White.
  - d. Light reflectance – LR .55.
  - e. NRC UL Certified 0.90.
  - f. Square lay in edge.
  - g. Attention Class UL Certified CAC Min. of .33.
  - h. Wide faced heavy duty steel suspended grid system, white finish.
  - i. Anti-microbial.
  
3. Products for food service areas and other:
  - a. 2' x 2' x 1/2" Type XX Gypsum Board with 2 mil vinyl surface.
  - b. Color: White.
  - c. Light Reflectance – LR .88.
  - d. Square lay in edge.
  - e. Wide face heavy duty all aluminum suspended grid system, white finish.
  - f. Anti-microbial.
  - g. Sag resistant.
  
4. Products for acoustically sensitive spaces

- a. 24"x24"x1" fiberglass with acoustically transparent surface.
- b. Color: White.
- c. Light Reflectance – LR 0.89.
- d. NCR: 0.95 UL Certified.
- e. Square lay in edge.
- f. Attenuation Class UL Certified CAC MIN 25.
- g. Wide face intermediate steel suspended grid system, white finish. Use aluminum in wet areas.
- h. Sag resistant.

### **C. ACOUSTICAL WALL PANELS**

1. Multi-sized spline mounted acoustical wall panels.
2. Minimum 1" thick panels perforated mineral fiberboard or cementitious fiberboard core.
3. Where coverings are specified, use standard manufacturers fabrics.
4. NCR – 0.75 UL Certified. 1 1/2-2" tectum or conweb panels are acceptable.
5. Extruded aluminum edge trims and connecting splines.

**SECTION IV****Building Systems and Materials  
PAINTING****A. GENERAL**

1. Develop and provide, as part of the contract documents, a project paint schedule to include, but not limited to paint for concrete masonry, exterior and interior finishes.
2. Paint schedule – minimize special graphics and number of colors. Colors must be coordinated with owner.
3. Prepare all surfaces to receive paint finish and apply paint finish in accordance with manufacturers printed instruction.

**B. PAINTING**

1. Concrete masonry: one coat masonry block filler, two finish coats semi-gloss acrylic-latex enamel.
2. Exterior metals: one coat rust-inhibitive metal primers; two finish coats exterior full-gloss alkyd enamel.
3. Interior drywall: one coat latex based primer, two coats eggshell acrylic-latex enamel.
4. Interior metals: one coat rust-inhibitive alkyd based primer, two coats full-gloss acrylic latex enamel.

**SECTION IV****Building Systems and Materials  
FIRE SUPPRESSION SPRINKLERS****GENERAL**

1. Provide, in accordance with NFPA Bulletin 13 accepted latest version, Fire Suppression Sprinkler Systems.
2. System: Wet Pipe including automatic sprinklers, piping, valves and specialties. Dry pipe in non-conditioned spaces.
3. Fire service water line from building to available PSD service.
4. Ordinary Hazard Group 1 for all building areas except administration.
5. Testing and flow reports in accordance with NFPA 13.
6. Piping:
  - a. Service line, ductile iron, or C900 PVC (where code allows) mechanical joint pipe.
  - b. Wet pipe lines SCH 10 steel pipe.
7. Provide sprinkler system commissions to verify installation, sprinklers, tests and alarms comply with NFPA 13.
8. Where inadequate water flow and pressure will not support fire suppression system, comply with requirements of the West Virginia State Fire Marshal and NFPA Bulletin. (See also SBA Site Selection Process)
9. Provide sprinkler head guards where heads may be exposed to abuse from gym, play areas, etc.
10. Sprinkler rooms shall have direct exit (eliminate the need for PIV)



All plumbing materials and work shall be in accordance with the International Plumbing Code.

**PLUMBING AND PIPING MATERIALS**

1. Exterior sanitary piping shall be constructed of PVC-SDR-35.
2. Building water piping shall be constructed of Type L copper for above ground systems and Type K copper for underground systems.
3. Site water lines shall be constructed of PVC-C900.
4. Underground gas piping shall be fusion welded HDPE Polyethylene. Interior and above grade gas piping shall be Schedule 40 black steel.
5. Underground sanitary and grease waste lines from kitchen equipment shall be cast iron hub and spigot between kitchen and grease interceptor.
6. Balancing valves with memory stop shall be used in domestic water systems. Ball type valves shall not be permitted for balancing.
7. Snubbers and liquid filled pressure gauges shall be installed on the suction or discharge ports of pumps.
8. Side stream filtration units will be installed on all closed loop hydronic systems. The take off from the main line for the inlet side of the filter will be on the bottom side of the pipe. The units will have the capability of providing filtration levels down to 5 microns. A pinwheel or flow-metering device will be used to determine the flow rate going through the units.
9. Provide a water treatment test station at each site that has a hydronic loop system with one year of testing chemicals.
10. Meters for water and natural gas systems will provide a signal to the Building Automation System (BAS) system for utility tracking purposes.

11. Provide lockable ball valves on all expansion tanks. This is to include loop water and domestic water systems.

## **DESIGN ELEMENTS**

1. Headers supplying auto flush valve fixtures shall run full size to last fixture.
2. Top access sediment traps shall be installed in areas such as vocational agriculture, art rooms etc.
3. Emergency eye wash/shower with mixing valve and floor drain shall be provided in all high school (and middle school where required) science labs.
4. Provide hinged cover floor drains in custodial closets and main mechanical room.
5. Valves for piping systems shall be calibrated balancing type with memory stop.
6. All roof areas shall have hose bibbs for maintenance and cleaning. Frost proof hose bibbs should be located on the exterior of the building to accommodate 200' hose in any direction.
7. Service sinks shall be floor mounted 10" molded stone.

## **PLUMBING FLOWS**

1. All plumbing fixtures, valve faucets, shower heads and fittings shall be water conservation type with a maximum flow as follows:
  - a. Water Closets 1.6 gallons per flush
  - b. Faucets 0.5 gallons per minute
  - c. Showers 2.5 gallons per minute
  - d. Urinals 1.0 gallon per flush  
(consider waterless and dual flush fixture where appropriate)

## PIPING

1. Above grade domestic water distribution piping throughout the building shall be located above the ceiling.
2. Domestic hot and cold lines' HVAC chilled water lines and heating hot water lines shall be insulated. Vapor barriers will be maintained on domestic cold and HVAC chilled water lines. Provide valve handle extensions on all ball valves installed on insulated piping.
3. Hot water return with re-circulating pump shall be required for all hot water piping. Control pumps by thermostat, timer or building automation system (BAS). The cost of installing electric heat tracing or point of use hot water heating should be considered if the installation is feasible (first cost vs. energy efficiency).
4. Sanitary piping below grade shall be Schedule 40 Polyvinyl Chloride. Note: Piping below roadways shall be Schedule 80.
5. Sanitary piping above grade in plenum spaces shall be cast iron no hub or insulated PVC to comply with State Fire Marshal requirements.
6. Sanitary piping above grade not in a plenum space shall be Schedule 40 Polyvinyl Chloride.
7. Acid waste piping below grade shall be non-fire rated SCH 40 Polypropylene with fusion joints. Acid waste piping above grade shall be fire rated SCH 40 Polypropylene with mechanical joints in non-plenum locations. Non-fire rated SCH 40 Polypropylene may be used in plenum locations provided piping is insulated to meet AHJ requirements. PVDF piping may be used in plenum spaces.
8. Provide a smoke test of the completed sanitary sewage system, including fixtures, prior to final occupancy of the facility.

**SECTION IV****Building Systems and Materials  
HEATING, VENTILATION & AIR-CONDITIONING (HVAC)****A. ENERGY DESIGN**

Prior to the design for construction or renovation of SBA building projects an analysis of the cost of operation, maintenance and energy usage of the mechanical systems over the life of the buildings shall be completed based on the mechanical systems being considered. The analysis shall identify measures for the conservation of energy as per State adopted energy standards and shall consider the use of alternate energy sources.

The analysis shall include initial, operating, maintenance and replacement cost comparisons of the system as selected by the owner and the SBA. (See also Section IV, Item C HVAC Systems) Based on the square footage of the project, the different HVAC system types being evaluated shall be reviewed and approved by SBA prior to initiating the analysis and the results of the analysis along with the system type recommendation shall also be provided to the SBA at the conclusion of the report.

A separate narrative in the outline specification shall be provided outlining the building envelope insulating values for walls, roof, glass, etc., and specific HVAC system components such as demand ventilation, variable frequency drives and energy recovery systems as they relate to energy conservation.

After review and approval of the analysis of the cost of operating the HVAC systems and narrative by the owner and SBA, such measures shall be adopted as part of the HVAC building system selection and design.

**B. HVAC CRITERIA**

1. Generally, consider the school size, the complexity of the system, the life cycle costs and the county's ability to operate and maintain the selected HVAC system. School designs of 30,000 square feet or more for a central plant design should be considered with a chiller, boiler, and pumps with air handlers, wall units to deliver the comfort air to the desired space. Variable Refrigerant Volume systems can also be used as an alternative to a central plant if it is desirable by the application and approved by the SBA. (See Section IV, Item C – HVAC Systems)

2. Other HVAC systems described in Section IV, Paragraph C may be considered for new or major renovation buildings after performing a life cycle cost analysis as described in Item A and pending review of the proposed system by the SBA. Additionally, geothermal systems should be considered where feasible.
3. A detailed life cycle cost analysis shall be performed on schools designed to achieve LEED certification.
4. HVAC systems shall include energy conservation and ease of maintenance materials and the following equipment:
  - a. Air distribution systems with ducted returns including VRV package units with ducted return air.
  - b. Classroom fan coil units are required where building areas are not compartmentalized and not served by a dedicated HVAC unit for that space.
  - c. Air distribution systems with plenum returns are acceptable in compartmentalized design where the space is served by a dedicated HVAC unit except in kitchens.
  - d. All HVAC systems shall be equipped with minimum MERV 8 filtration systems.
  - e. HVAC systems shall incorporate DDC controls for a fully integrated network with remote access to be used to control major HVAC equipment including specialty rooms where applicable, based on the system selection. Classrooms shall have individual climate controls.
  - f. Air Handling Units exceeding 5 tons shall be double wall constructed with non-corrosive double sloped drain pans and easily accessible hinged doors. HVAC units shall be equipped with maximum outside air and return air mixing efficiency. Cooling coils shall be sized to avoid moisture carry over.
  - g. Stringent EPA refrigerant guidelines shall be followed when specifying and designing air-conditioning systems. Refrigerants scheduled to be phased out shall not be used.
  - h. All HVAC systems shall have an economizer cycle capability that will be controlled by outside/inside enthalpy where required by ASHRAE 90.1.
  - i. Demand control design ventilation strategies shall be incorporated for HVAC designs as defined by ASHRAE 90.1.

- j. Design engineers shall specify non-battery powered CO sensor alarms in kitchens, boiler rooms and other spaces where natural gas or other fuels are used. The sensors shall be monitored and alarmed using the BAS. Provide audible alarm in large group meeting areas (cafeteria, auditorium, etc.) as per code requirements.
- k. A detailed sequence of operations for the HVAC system shall be provided in the bidding documents by the design engineer. At the conclusion of the project, the sequence of operations will be tested and results documented. This information will then be reviewed with the HVAC installation and HVAC controls contractors and revised as required to match as built conditions. This document shall be incorporated into the owner's HVAC training provided by the contractor.
- l. Packaged equipment, as opposed to field fabricated equipment shall be used to the greatest extent possible.
- m. Provide the design criteria for indoor and outdoor maximum and minimum temperatures on the mechanical equipment schedule of the construction document set.
- n. Design specifications shall require all new HVAC units on site to have labels with unique mechanical identification numbers coordinated with existing nomenclature where applicable.

**C. HVAC SYSTEMS**

The following systems are acceptable HVAC systems and shall be evaluated for their application on all SBA projects.

- System 1      Central Plant with Four Pipe Chilled Water and Hot Water Delivery, Roof Top or Indoor Air Handlers with VAV (Variable Air Volume) Zone Control and Hot Water Reheat
- System 2      Central Plant with Four Pipe Water Delivery, Terminal Units with Constant Volume and Reheat
- System 3      Variable Refrigerant Volume (VRV) system with fan coil units, Dedicated Outside Air Units and Reheat Capability.

- System 4      Geo-Thermal Heat Pumps (where feasible)
- System 5      Roof Top or Wall Type Package Units with modulating or multi-staged Electric Heat and modulating or multi-staged Cooling
- System 6      Roof Top Packaged Units with modulating or multi-staged Gas Heat, modulating or multi-staged DX Cooling and put mounted electric reheat coils and SCR control for each classroom.

Note: Alternative systems such as active, passive or integrated/multiservice chilled beam systems should be explored and where budget and design conditions are favorable, can be considered.

A detailed life cycle cost analysis is required when Systems 4, 5, and 6 are considered.

**D. DEDICATED SYSTEMS**

1. For normally unoccupied rooms that primarily house electronic equipment such as networking equipment, switchgears and transformers, provide a dedicated 24 hour, 7 days a week, 12 months a year HVAC system, that is independent of the primary HVAC system such as a ducted roof-top HVAC unit with economizer with controls integrated into the BAS. The system shall be provided with a low ambient kit to operate down to near 0 degrees Fahrenheit or equipped with a method to provide year round cooling.
2. For administration and pupil services areas occupied in normally unoccupied time periods, provide a separate HVAC system capable of operating independent of the central system to minimize operating costs when the central system is not operating. Fully integrate this system into BAS.
3. The design engineer shall provide HVAC design strategies for special systems (dust collection, welding exhaust, lab exhaust, fume hood, etc.)

**E. MAINTENANCE AND WARRANTY**

The HVAC bid documents shall require a two year maintenance and operations contract for the HVAC system commencing at the issuance of the HVAC substantial completion certification. The HVAC bid documents shall also require the mechanical contractor to provide complete preventative maintenance program for all equipment installed under the scope of work for the project. The scope of work within the maintenance contract shall be described in the bidding documents. Additionally, bidding documents shall require the mechanical equipment contractor to provide video training. The West Virginia Department of Education, Office of School Facilities will assist in training of county HVAC personnel during the two year maintenance and service agreement period to assure that the county personnel fully understand the HVAC system operations as an integrated system. The West Virginia Department of Education, Office of School Facilities shall additionally provide training to the maintenance personnel with the creation of a preventative maintenance plan that would go into effect after the two year maintenance program expires.

The provisions of WV Code 18-9D-16(d) shall be followed with regard to maintenance of equipment after the two year maintenance periods. Should the county fail to comply with maintenance requirements after the two year contractual maintenance period, the SBA, will request the State Board of Education to restrict the counties use of State Aid Funds and redirect these funds to a maintenance contract for the HVAC equipment.

**F. HVAC SOUND, NOISE & VIBRATION**

1. Select fans and equipment with low noise operation characteristics.
2. Locate noisy equipment away from noise sensitive space or provide neutral buffer spaces such as storage rooms and corridors in between.
3. Provide proper vibration isolation and mounting for all mechanical equipment sized to provide a high degree of isolation based on the load characteristics of the equipment.
4. Provide good aerodynamic flow through ductwork. Avoid ductwork shapes that restrict airflow and lead to turbulence.



5. Duct silencers shall be required to meet continuous background sound levels. Mechanical equipment room and/or equipment locations and layouts shall allow space for duct silencers on both supply and return airside where duct silencers are required.
6. For air terminals in classrooms, careful attention shall be given to:
  - a. Design for smooth aerodynamic airflow from branch ducts to air terminal devices.
  - b. Locating balancing dampers sufficiently upstream of air terminal devices.
  - c. Air velocity design and diffuser selection based on Noise Criteria performance.
7. Establish objectives regarding acoustical treatment of mechanical equipment.

**G. BUILDING AUTOMATION SYSTEM (BAS)**

1. Provide communication between all unitary control systems used on chillers, pumping station, etc., to the BAS to allow the system users to view/modify the system parameters.
2. Control all domestic hot water re-circulation pumps using the BAS using control logic to start and stop the pump based on return water temperature and time schedules.
3. Provide a secure and remote access to the BAS system outside of the schools network.
4. Provide a monitor with a minimum screen size of 21" for all BAS workstations.
5. Provide a color laser printer with each BAS workstation.
6. The units of measure for all values on the BAS displays will be provided.
7. Provide graphics that show a summary list view of the general control points of all HVAC units on the project. Possible points to include:
  - a. Occupancy Status
  - b. Override Status
  - c. Supply Fan Command
  - d. Supply Fan Status
  - e. Cooling Command

- f. Heat Command
  - g. Room Temperature
  - h. Room Set Point
  - i. Discharge Air Temperature
  - j. Mixed Air Temperature
  - k. Outside Air Damper Command
  - l. Other Points as Applicable
8. Specify that values displayed on graphic represent accuracy limits of the sensors or calculations.
9. Specify that values displayed for dampers and valves be expressed to represent a % open value.
10. Require bug screens to be installed on the tubing of all pressure differential sensors referencing the outdoor pressure.
11. The Sequence of Operations provided by the designer shall:
- a. Provide a list of time schedules and the associated equipment for each schedule.
  - b. Include details to monitor, alarm and control humidity levels in all media centers and gymnasiums with wooden floors.
  - c. Include details to monitor and alarm humidity levels in representative areas of the school facility to prevent mold growth.
  - d. Provide details to use a demand controlled ventilation strategy in larger single zone spaces such as gymnasiums, auditoriums, cafeterias, media centers, band rooms and other areas that have variable or intermittent occupancy loads.
  - e. Provide details to utilize the data from a power monitor to provide electrical demand control to limit peak demand charges.
  - f. Provide details to shut down all HVAC units that moves air into or out of the facility during a shelter in place event.
  - g. Provide details for a Summer Mode of operation that allows the facility to be operated at greatly reduced occupancy load and prevents elevated humidity levels.
  - h. Provide details that prevent simultaneous heating and cooling of multiple units serving the same space. HVAC units should be controlled using a common set point and the average temperature of the zone sensors in the space.

- i. Provide details that will cause the facility to return to an unoccupied state in the event that school is suddenly cancelled such as a snow day or other similar event. Provide system override switches for isolated community-used spaces that will allow the system to be placed in occupied mode during normal unoccupied hours.
- j. Limits the high and low range of set points in classrooms and other spaces to a 4°F differential when served by a single unit. Applies mainly to VAV and constant volume reheat systems.
- k. Require lead/lag operation of loop pumps, units with multiple refrigeration compressors and common areas that are served by multiple HVAC units.
- l. Require a valve exercise program for all automated hydronic valves and evaporative cooler damper actuators to keep the devices from seizing during long periods of inactivity.

#### **H. TESTING, ADJUSTING, BALANCING (TAB)**

- 1. Specifications for the TAB contractor shall be included as part of the construction documents for the project. TAB specifications, if provided separately, shall also contain the design criteria for the equipment to be serviced under the TAB scope of work.
- 2. Fixed sheaves are required to be installed on all belt driven equipment after the TAB contractor has made final adjustments.
- 3. The design engineer, owner, SBA and commissioning engineer (when used), in cooperation with the mechanical contractor, will verify the TAB results before payment for services are made.

## I. COMMISSIONING

### GENERAL

The SBA has determined that fundamental commissioning is a beneficial service that will help reduce energy usage, lower operating costs, reduce contractor callbacks, provide improved building documentation, improve occupant comfort and productivity and most importantly verify that the building systems perform in accordance with the owner's and design team's requirements.

1. Fundamental commissioning, when required by the SBA, will be performed by separate contract by a qualified and independent third party commissioning engineer (CE). Commissioning requirements shall be described within the bidding documents and approved by the SBA.
2. The specific systems that will be commissioned may vary from project to project. Additionally, the commissioning engineer may be introduced to the project design process at various stages of the design or construction. The design review services will minimally include the CE participating, in cooperation with the design engineer, in determining the owner's project requirements, the basis for the design and design development and construction document reviews. The focus of the commissioning process will be key systems and assemblies and include but not be limited to the following depending on the HVAC design requirements:

#### HVAC system

- Heating
- Cooling
- Air distribution
- Building automation and temperature controls

#### Plumbing systems (where applicable)

Domestic hot water

Electrical system (optional)

Lighting and day lighting

Building envelope (optional)

Additional responsibilities of the CE will be to partner with the design engineer regarding energy analysis reports and preparation of the HVAC sequence of operations. Where

feasible, thermal imaging of the roof and R/A plenum design may be performed.

The CE shall be hired by the county board as an independent third party agent based on qualifications and experience. Additional project specific responsibilities shall be defined in the request for qualifications established for the project by the design engineer, owner and SBA.

3. All HVAC projects greater than \$1,000,000 are required to have fundamental commissioning on the new HVAC system by the independent third party commissioning engineer.
4. Minimum commissioning engineer qualifications shall:
  - a. be an independent third party representative of the owner and SBA.
  - b. be a registered vendor in the State of West Virginia with licensing in West Virginia.
  - c. be a registered mechanical engineer with registration in West Virginia
  - d. have minimum of five years experience in mechanical engineering and at least two prior building commissioning projects.
  - e. be a LEED on projects requiring LEED certification.
  - f. have relevant experience in building commissioning of similar facilities for which the CE is submitting a proposal for services.
  - g. have knowledge of indoor air quality issues and resolution methods.
  - h. have knowledge in HVAC testing adjusting and balancing of both air and water systems and AABC and NEBB standards.
  - i. have experience in monitoring and analyzing systems with building automation controls.
  - j. provide insurance and bonding as required by the project expression of interest.

**SECTION IV****Building Systems and Materials  
ELECTRICAL****SERVICE AND DISTRIBUTION**

1. Building electrical service shall be underground and sized to accommodate a 25% capacity growth.
2. Service entrance cabling shall be copper. Aluminum in PVC conduits may be used where desired. Provide Buss Bar Lugs for aluminum when used.
3. A separate main electrical equipment room shall be provided. Coordinate size for clearance around free standing switchgear. Plan size of room to accommodate 25% capacity growth upgrades.
4. Provide surge protection unit on main switchgear.
5. Provide separate sub-panel electrical rooms. Rooms shall not be utilized for any other purpose, including custodial spaces.
6. Panel board feeders may be run in PVC conduits below concrete slabs provided they are encased in concrete below the slab.
7. Branch circuits shall have dedicated neutrals.
  - a. Provide power monitoring equipment capable of interfacing with a building automation system that provides information about voltages, power usage (KWH) and power demand (KW). This device may be an integral part of the main switchgear or an independent unit where desired by the owner.
  - b. Provide single point metering for all new and renovated projects if possible.
  - c. Provide electrical connections for sites that intend to utilize hydraulic powered trash compactors.

## **WIRING AND DEVICES**

1. All branch circuits shall be copper.
2. Generally, run wiring in EMT conduit unless exposed in mechanical or electrical rooms. Provide ridged conduit up to 5' in height.
3. Provide ceiling mounted occupant sensors with wall override for classrooms and toilets or other approved spaces. Use daylight harvesting where possible.
4. Provide multi-level classroom lighting controls in accordance with applicable codes and as desired to accommodate A/V use.

## **LIGHTING**

1. Lighting levels shall be in accordance with I.E.S.
2. Use energy-efficient and space appropriate light fixtures. Consider initial cost and replacement cost.
3. Provide linear disconnects for all fixtures.
4. Use electronic ballasts.
5. Use T-5 or T-8 2850 Lumen fluorescent lamps. T-12 shall not be used.
6. Use 2'x4' recessed fluorescent fixtures with battery pack for emergency lighting.
7. Provide in gymnasium, high output fluorescent fixtures with T-5 bulbs and wire guard.
8. Use light emitting diode "LED" exit lights.
9. Incandescent fixtures shall be avoided.
10. Metal Halide fixtures shall not be used in gymnasiums.

## **SITE LIGHTING**

1. Provide site lighting in accordance with codes and standards.
2. Locate all site lighting poles on perimeter of roads and parking areas.
3. Provide digital control lighting sensors or photo cell controls. Exterior lighting may be controlled by the BAS using ambient light sensor and schedules.



**A. GENERAL**

When technology is used to support the instructor, the technology requirements shall be dictated by the educational programming planned for each school population. SBA technology funding for each project will be determined by the specific requirements of each school educational delivery model and the corresponding technology plan that supports the curricular delivery model. SBA funding for technology will only be provided once the educational plan and the technology plan have been blended together and one supports the other. The project technology plan shall be finalized and submitted with the design development submission documents.

Consideration should be given to curriculum delivery that may be vastly different from traditional lesson planning. Therefore, the technology needs must be determined based on the lesson planning anticipated for each school. SBA technology funding will only be provided when specific technology needs are identified in the educational plan and companion technology plan. The School Building Authority will review technology configuration annually and issue updates as curriculum delivery changes.

1. A certified network engineer shall assist with the planning and design of the technology plan for all projects where educational technology is being incorporated into the design.
2. The certified network engineer and the county technology specialist in cooperation with the design engineer shall coordinate locations of technology conduit boxes, outlets and other devices based on the educational and technology plan for the school.
3. A detailed schematic design of the technology infrastructure and devices shall be developed by the project engineer in cooperation with the educational and technology plan, county technology specialist and the certified network engineer's requirements. The electrical/technology contractor at the conclusion of project shall provide a copy of the as built schematic plan of the final technology equipment and wiring documents. A copy of these documents shall be maintained in the MDF wiring room and IDF wiring room for reference.

4. The technology plan and schematic plan shall be submitted to the SBA with the design development submission. Revisions to the technology plan and schematic technology layout shall be approved by the SBA.
5. Provide technology cable tray/wire basket throughout building – 12”x6” center hung wire raceway in all corridors.
6. Cable tray shall connect between main technology equipment room (MDF) and all intermediate technology equipment rooms (IDF). Provide from main technology equipment room (MDF) to all intermediate technology rooms (IDF).
7. Run fiber optic cable from main technology equipment room (MDF) to each intermediate technology equipment room.
8. Typical classroom - two gang junction boxes for hardwired drops shall have 1” minimum conduit from box extended to cable tray:
  - 1 – Teacher work station hardwired data drop
  - 1 – Hardwired drop located in center of back wall
  - 1 – Hardwired ceiling drop – for LCD projector
  - 1 – Hardwired interactive whiteboard – outlet at 48” where desired)
  - 1 – Hardwired printer station (centralized printer shall service groups of classrooms)
  - 1 – IP Phone drop adjacent to teacher drop
 This arrangement will vary if program needs change and wireless technology is incorporated. Individual classroom needs will vary based on curriculum delivery.
9. Provide 2 – 30 amp circuits for rack mounted UPS units in each technology equipment room.
10. Provide ceiling tile projector mounting plate, 2 single gang boxes, and one gang duplex electrical outlet. Connect projector gang box with 1” conduit to instructor’s work station gang box. Connect projector gang box to cable tray with 1” conduit.

## **B. EQUIPMENT ROOMS/DISTRIBUTION FRAME**

1. Technology equipment rooms will support low voltage services including but not limited to: local area network (LAN), wireless (Power Over-ETHERNET), Voice-Over-IP telephone, Video-Over IP, CCTV, intrusion alarm, access control systems, fire alarm and clock/intercom. 1 GB Ethernet Layer III switching is recommended and shall be utilized for local area network (LAN) drops.
2. Main technology equipment room (MDF) shall be 17' 0" x 12' 0" with 10' 6" ceiling height. Refer to proto-typical layout.
3. Intermediate technology equipment rooms shall be 10' 0" x 9' 0" with 10' 6" ceiling height and support two 24" wide equipment rack installations. Note: Should only one 24" wide equipment rack be required, reduce room size to 10'0"x 7'0". Should 3 24" wide equipment racks be required, room dimension changes to 11' 6" x 11". Refer to proto-typical layout.
4. General Technology equipment room requirements:
  - a. Rooms shall be interior spaces with direct corridor access.
  - b. 3' 6" door.
  - c. Provide 2' 0" plenum above entire room if ceiling is installed.
  - d. Use surface mounted lighting if suspended acoustical ceiling is used.
  - e. Resilient rubber flooring.
  - f. Avoid running sanitary, water or roof drains above entire room.
  - g. Maintain 20' separation between technology equipment rooms and toilets and electrical equipment.
  - h. Locate intermediate technology equipment rooms within 150' radius of each other and furthest point of the building, with a 20% overlap for complete building coverage.
  - i. Provide full wall plywood backboard on two walls left and rear of entrance door.
  - k. Provide UPS emergency equipment power unit for each technology equipment room in accordance with network engineer design requirements.
  - l. Provide independent HVAC system for main technology equipment room.

## **C. CLASSROOM EQUIPMENT**

1. Provide projector screens where technology plans require. (See also SBE, Policy 6200 and SBA technology planning requirements)
2. All classrooms shall be provided with LCD ceiling mounted projector with extension column, located 8' 0" to 10' 0" from surface of projection screen and approximately 8' 6" above finish floor.  
Note: Maintain-proper clearance of suspended light fixtures above finish floor.

### **TYPICAL CLASSROOM**

1. Hardwired installation shall provide:
  - a. 1- Teacher work station drop
  - b. 1- Computer drop center of back wall
  - c. 1- Computer printer station
  - d. 1- IP phone drop
  - e. 1- Ceiling drop for LCD projector
  - f. 1- Interactive white board
2. Wireless installation shall provide:
  - a. 1- Wireless access point
  - b. 1- Wireless mobile interactive presenter
  - c. 1- Wireless interactive white board with blue tooth
  - d. 1- Hardwired teacher work station drop
  - e. 1- Hardwired IP phone drop
  - f. 1- Wireless LCD projector
3. All hardwired data drops shall be 1" conduit extended from junction box and terminated at corridor cable tray.
4. Wire Mould 4000 Series Raceway shall be used for rear wall hardwired classroom computer stations. Note: Use 4000 Series Raceway for all computer labs.

### **CABLING**

1. All backbone cabling from main technology equipment room to intermediate technology equipment rooms shall be six strand fiber optic cables in 4" conduit.

2. All cabling shall be plenum rated.
3. All cabling from intermediate technology equipment room to drop point shall be CAT 6 cable. Maximum cable runs of 300'.

## **PHONE SYSTEMS**

1. Where "IP" phone systems are used, provide a dedicated IP phone in desired areas.

## **SECURITY**

1. Security system shall be tied to a network wiring system for access door control and shall include video monitoring.
2. Video monitoring system shall be tied to a network wiring system for monitoring of school interior public spaces, corridors, commons, gym, library, kitchen and all exterior entry door locations. Video monitoring software shall be added to all administrative office staff computer workstations to allow office staff to monitor facility at all times.
3. Security system shall be tied to the emergency power system if emergency power system is provided. Battery back up shall be provided for stand-alone systems.
4. Security system shall monitor the open/close status of all exterior doors. An alert shall be sent to the administrative office staff in the event a door is left in the open position.
5. Security system shall notify emergency responders immediately upon activation in the event of a crisis situation.
6. All school access safety data shall be provided to the State Office of Homeland Security in an electronic format.

## **WIRELESS**

1. Provide wireless hubs in building corridors, each hub shall be located within 150 feet of each other with a 20% overlap.

2. Provide for each classroom, lab, media center, commons and administration area wireless network connection.

### **MOBILE COMPUTER LABS**

1. When used, comply with State Board of Education Policy 6200 and provide a 30 station mobile computer cart with power adapter for computer charging.
2. Locate equipment within media center technology A/V room.
3. Provide 20 amp outlets at 36" above finish floor. One for each mobile computer lab outlet.

### **TECHNOLOGY UPDATES**

Technology updates and requirements will be reviewed annually and revised based on the most current technology delivery models.

**SECTION IV****Building Systems and Materials  
FIXED FURNISHINGS****GENERAL**

Refer to proto-typical classrooms, science classrooms and science labs for fixed furnishings. For other curricular area furnishings, refer to Policy 6200.1.

**ELEMENTARY CLASSROOMS**

1. Casework except sink and work unit shall be manufactured with plastic laminate facing over  $\frac{3}{4}$ " particle board or 7 ply veneer plywood. Rigid PVC extrusion edge banding.
2. Casework for sink and wet areas shall be 7 ply veneer plywood base casework, plastic laminate over plywood top and rigid PVC extruded edge banding.

**SCIENCE CLASSROOM**

1. Demonstration unit shall be 7 ply plywood with 1" epoxy resin top and sink.
2. Casework except sink and work unit shall be manufactured with plastic laminate facing over  $\frac{3}{4}$ " particle board. Rigid PVC extrusion edge banding.
3. Casework for sink and wet areas shall be 7 ply veneer plywood base casework, plastic laminate over plywood top and rigid PVC extruded edge banding.

**SCIENCE LABS**

1. All casework, demonstration units and science lab tables shall be plain sliced 7 ply veneer plywood.
2. Counter tops – 1" epoxy resin.

**SCIENCE TABLES**

1. Two student solid wood frame and legs with 1" epoxy resin tops.

**SECTION V****Quality and Performance Standards  
PROTO-TYPICAL SPACE RELATIONSHIPS AND LAYOUTS**

This section of the Quality and Performance Standards provides the design professional the space relationship criteria for site development and elementary, middle and high school plan organization. These proto-typical space relationships shall be closely adhered to and deviated from only after approval of the SBA.

This section further provides proto-typical diagrams for various curriculum areas including possible equipment layouts of these spaces. Please note, except for fixed science tables in the science lab and the fixed instructor's area, the majority of furnishings will be "mobile" and thus accommodate a number of layouts capable of responding to the various curriculum delivery methods.

**Proto-Typical Areas:**

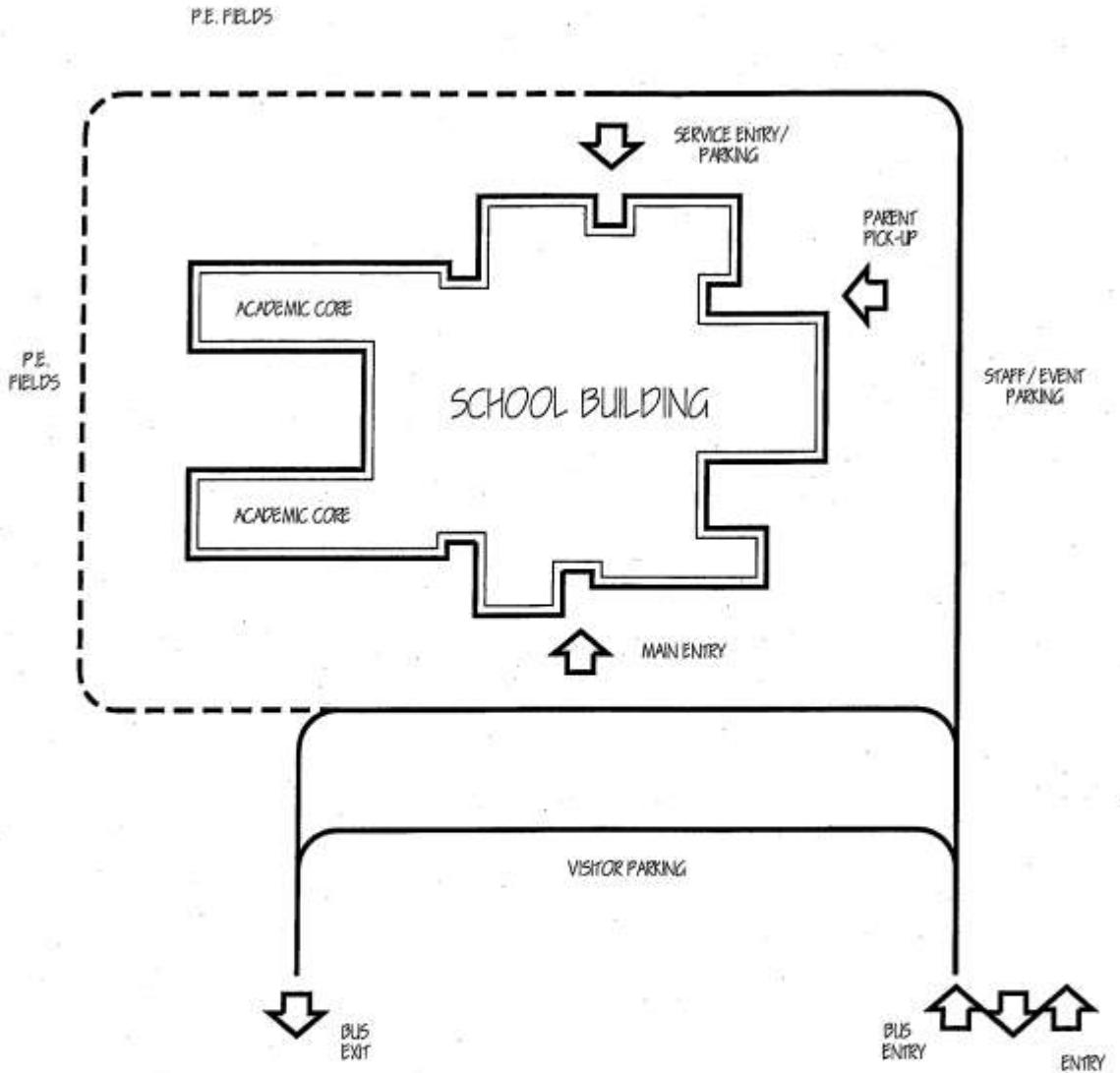
1. Early Childhood Classroom
2. Elementary Classroom
3. Middle and High School Classroom
4. Middle and High School Science Classroom
5. Middle School Science Lab
6. High School Science Lab

Design professionals shall also refer to SBE Policy 6200 for space relationships and furniture/equipment guidelines within each curricular area. Project based learning and additional 21<sup>st</sup> Century learning models will alter the prototypical classroom layouts and these modifications will be approved by the SBA once the local board approves the delivery model for new schools.

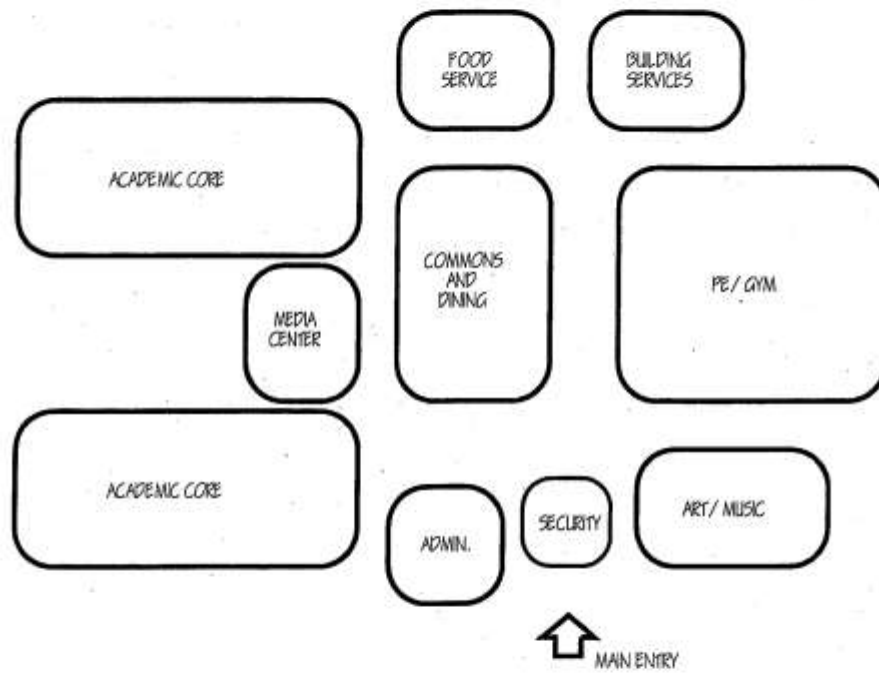


**SECTION V****Quality and Performance Standards**

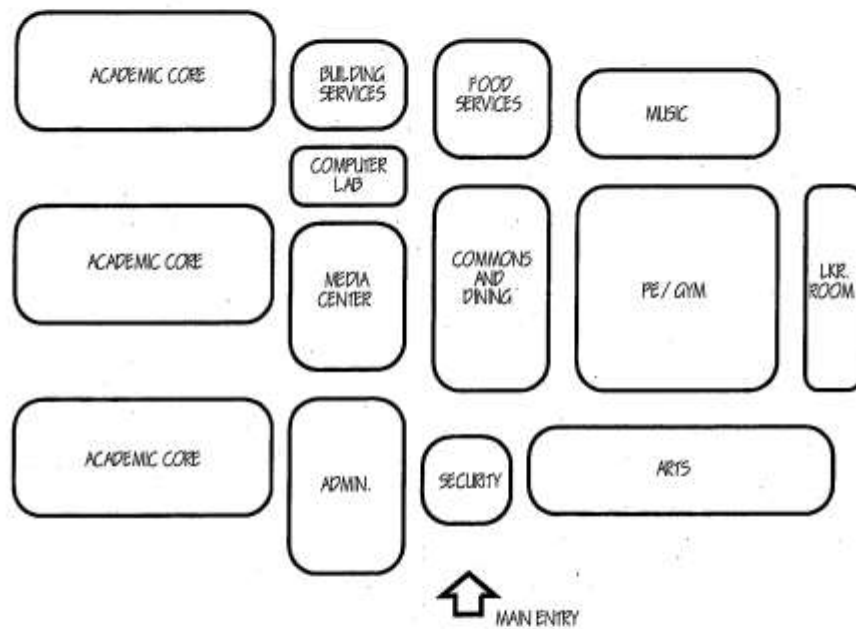
- I. Conceptual Proto-Typical Site Relationships
- II. Elementary Proto-Typical Spatial Relationships
- III. Middle School Proto-Typical Spatial Relationships
- IV. High School Proto-Typical Spatial Relationships
- V. Proto-Typical Early Childhood Classroom
- VI. Proto-Typical Elementary School Classroom
- VII. Proto-Typical Middle and High School Classroom
- VIII. Proto-Typical Science Classroom
- IX. Proto-Typical Middle School Science Lab
- X. Proto-Typical High School Science Lab
- XI. Proto-Typical Technology Equipment Rooms



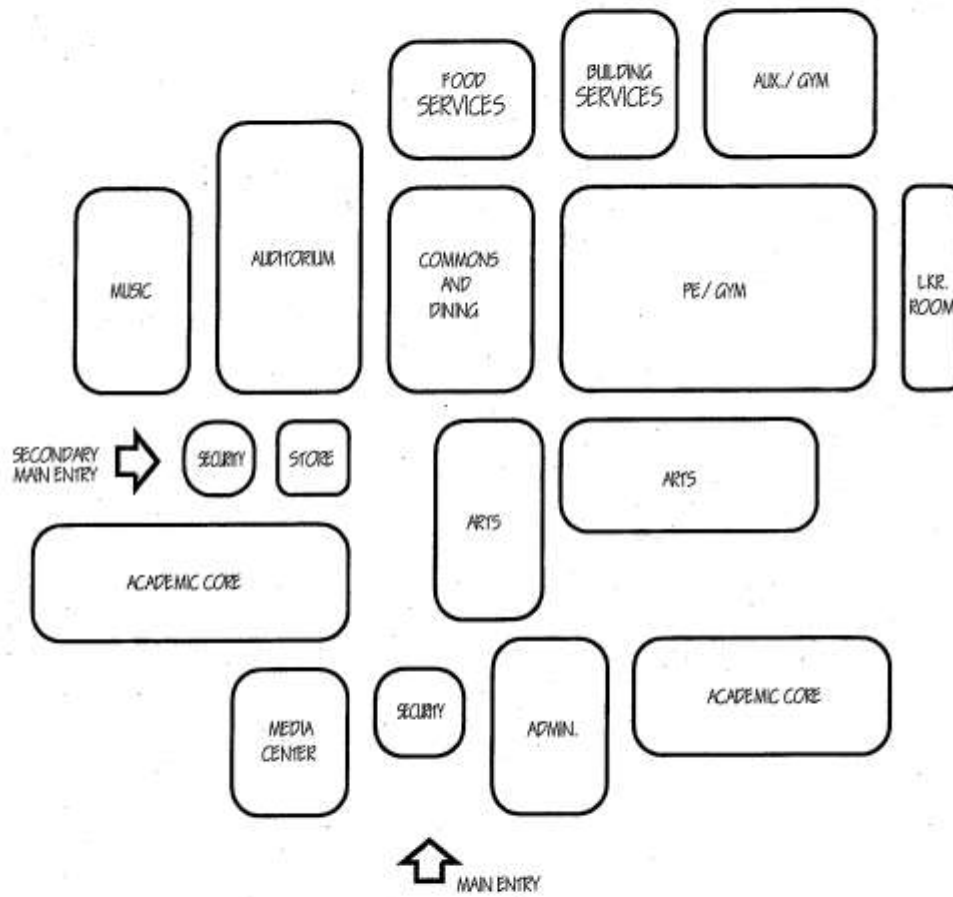
CONCEPTUAL PROTO-TYPICAL SITE RELATIONSHIPS



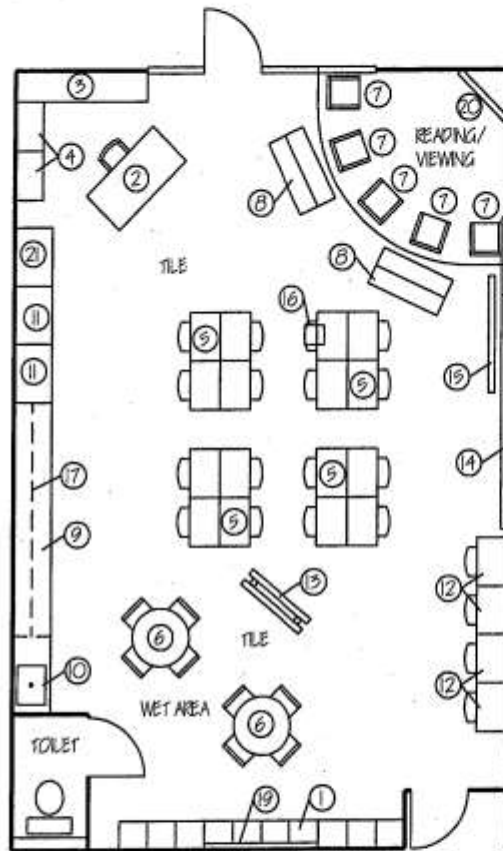
ELEMENTARY PROTO-TYPICAL SPATIAL RELATIONSHIPS



MIDDLE SCHOOL PROTO-TYPICAL SPATIAL RELATIONSHIPS



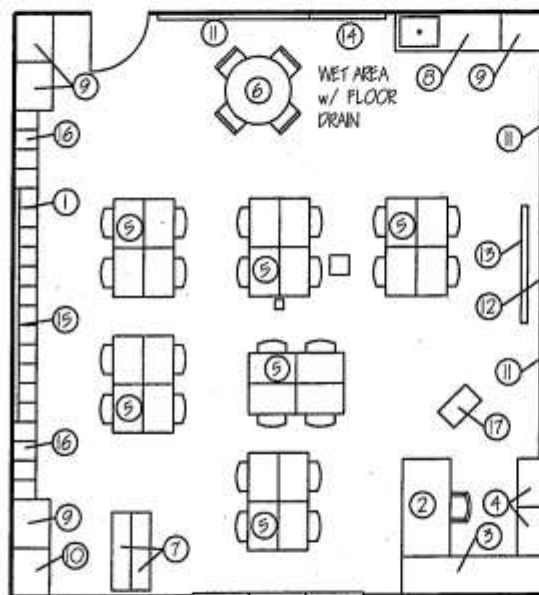
HIGH SCHOOL PROTO-TYPICAL SPATIAL RELATIONSHIPS



## LEGEND

1. LOCKER CUBICAL
2. MOBILE INSTRUCTOR'S DESK & CHAIR
3. INSTRUCTOR'S WORK UNIT
4. HORIZONTAL FILE CABINET
5. MOBILE STUDENT DESK & CHAIR
6. ROUND TABLE & CHAIR
7. LOUNGE SEATING
8. MOBILE BOOK SHELVING UNIT
9. 12' WORK COUNTER/CABINET
10. 4' SINK/COUNTER
11. 30 x 84 STORAGE CABINET
12. COMPUTER DESK & CHAIR
13. MOBILE TACK / CHALK BOARD
14. 12' MARKER BOARD
15. PROJECTION SCREEN
16. LCD PROJECTOR
17. WALL CABINETS
18. 4' TACK BOARD
19. 8' TACK BOARD
20. TV MONITOR
21. 30x84 WARDROBE

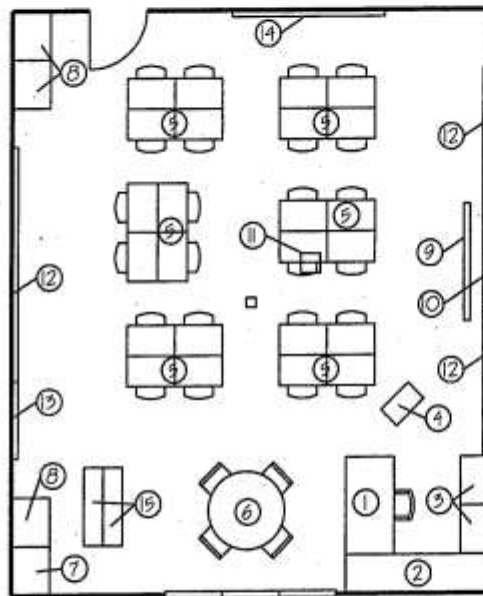
## PROTO-TYPICAL EARLY CHILDHOOD CLASSROOM



### LEGEND

1. 18x30x12 STUDENT LOCKERS
2. INSTRUCTOR'S DESK & CHAIR
3. MOBILE INSTRUCTOR'S WORK UNIT
4. HORIZONTAL FILE
5. MOBILE STUDENT DESK & CHAIR
6. ROUND TABLE & CHAIRS
7. MOBILE SHELVING BOOK UNIT
8. 6' SINK COUNTER
9. 30 x 84 STORAGE CABINET
10. 30 x 84 WARDROBE
11. 8' CHALK BOARD
12. WHITE BOARD
13. 72" PROJECTION SCREEN
14. 4' TACK BOARD
15. 12' MARKER BOARD
16. WALL CUBICLES ABOVE LOCKERS
17. MOBILE LECTURN

## PROTO-TYPICAL ELEMENTARY SCHOOL CLASSROOM

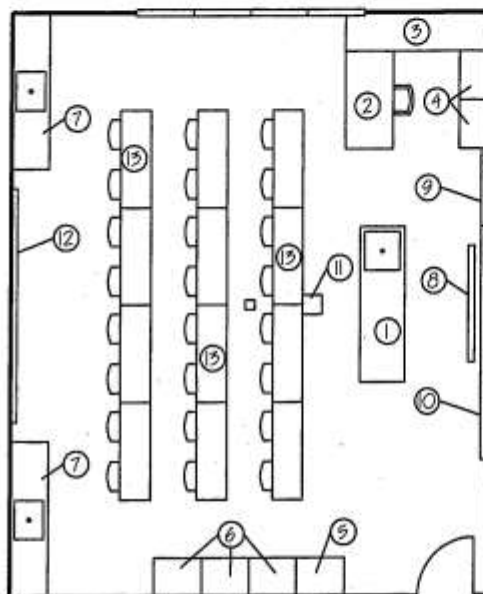


## LEGEND

1. MOBILE INSTRUCTOR'S DESK & CHAIR
2. MOBILE INSTRUCTOR'S WORK UNIT
3. HORIZONTAL FILE CABINET
4. MOBILE LECTURN
5. 2-STUDENT MOBILE DESK & CHAIR
6. 4-STUDENT 48" ROUND DESK & CHAIR
7. 50 x 84 WARDROBE
8. 50 x 84 TALL STORAGE CABINET
9. 72" PROJECTION SCREEN
10. WHITE BOARD
11. LCD PROJECTOR
12. 8' MARKER BOARD
13. 4' TACK BOARD
14. 8' TACK BOARD
15. MOBILE BOOK SHELF UNIT

PROTO-TYPICAL MIDDLE and HIGH SCHOOL CLASSROOM

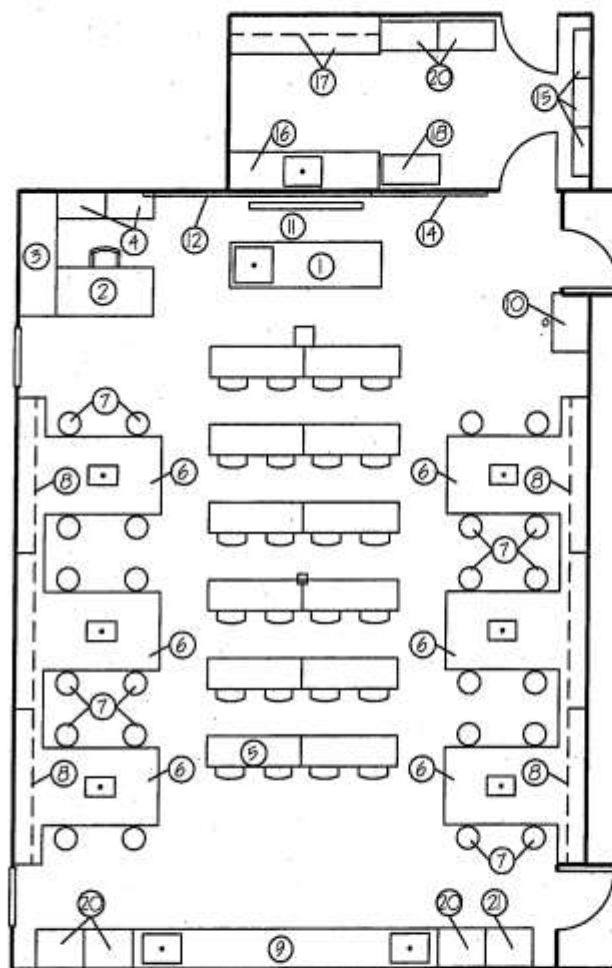




## LEGEND

1. DEMO TABLE w/ SINK
2. MOBILE INSTRUCTOR'S DESK & CHAIR
3. MOBILE INSTRUCTOR'S WORK UNIT
4. HORIZONTAL FILE CABINET
5. 30 x 84 WARDROBE
6. 30 x 84 TALL STORAGE CABINET
7. 10' COUNTER w/ SINK
8. 72" PROJECTION SCREEN
9. WHITE BOARD
10. SLIDING MARKER BOARD
11. LCD PROJECTOR
12. 12' TACK BOARD
13. MOBILE 2-STUDENT DESK & CHAIR

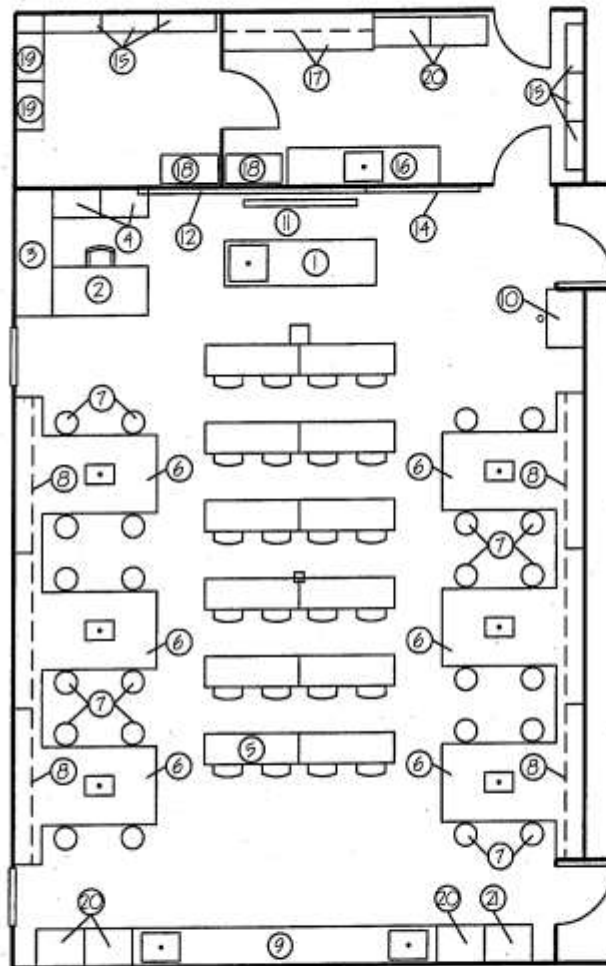
## PROTO-TYPICAL SCIENCE CLASSROOM



## LEGEND

1. DEMO TABLE w/ SINK
2. MOBILE INSTRUCTOR'S DESK & CHAIR
3. INSTRUCTOR'S WORK UNIT
4. LATERAL FILE CABINET
5. 2-STUDENT SCIENCE TABLE & CHAIR
6. 4-STUDENT LAB TABLE w/ SINK
7. STUDENT STOOL
8. WALL CABINETS
9. 16' WORK COUNTER w/ SINKS
10. EMERGENCY SAFETY UNIT
11. 72" PROJECTION SCREEN
12. 12' x 0" SLIDING MARKER BOARD
13. LCD PROJECTOR
14. SMART BOARD
15. 12 x 30 SHELVING
16. 8' SINK CABINET
17. 8' BASE & WALL CABINETS
18. MOBILE CART
19. 18 x 30 SHELVING
20. 30x84 STORAGE CABINET
21. 30x84 WARDROBE

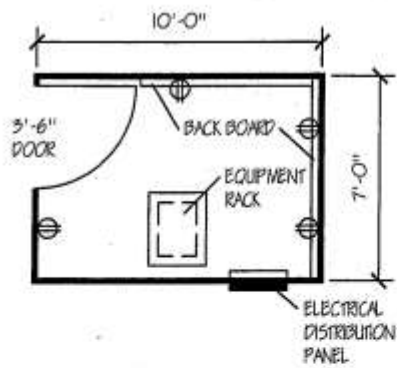
## PROTO-TYPICAL MIDDLE SCHOOL SCIENCE LAB



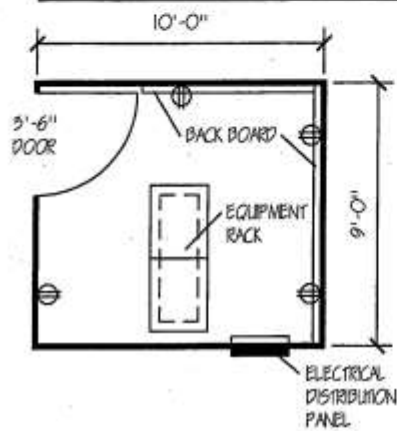
## LEGEND

1. DEMO TABLE w/ SINK
2. MOBILE INSTRUCTOR'S DESK & CHAIR
3. INSTRUCTOR'S WORK UNIT
4. LATERAL FILE CABINET
5. 2-STUDENT SCIENCE TABLE & CHAIR
6. 4-STUDENT LAB TABLE w/ SINK
7. STUDENT STOOL
8. WALL CABINETS
9. 16' WORK COUNTER w/ SINKS
10. EMERGENCY SAFETY UNIT
11. 72" PROJECTION SCREEN
12. 12'-0" SLIDING MARKER BOARD
13. LCD PROJECTOR
14. SMART BOARD
15. 12 x 30 SHELVING
16. 8' SINK CABINET
17. 8' BASE & WALL CABINETS
18. MOBILE CART
19. 18 x 30 SHELVING
20. 30x84 STORAGE CABINET
21. 30x84 WARDROBE

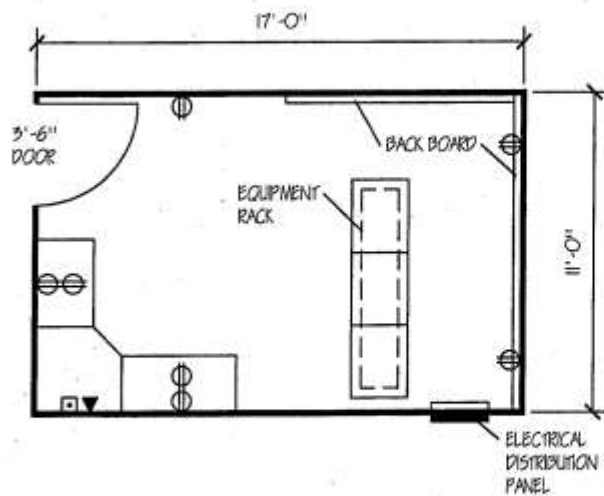
## PROTO-TYPICAL HIGH SCHOOL SCIENCE LAB



SINGLE RACK TECHNOLOGY EQUIPMENT ROOM



TWO RACK TECHNOLOGY EQUIPMENT ROOM



MAIN TECHNOLOGY EQUIPMENT ROOM