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ABSTRACT

This document provides school systems and designers with design information that can be used as a basis for new schools, additions, and renovations when building public schools in North Carolina. Further, it serves as a planning guide for those in the process of building or renovating school facilities. The guidelines detail minimum requirements for each area of an educational facility, allowing for minor deviations in spatial requirements where design efficiency dictates. Comments and recommendations are offered for each area's guidelines. Appendices present the General Statute for erecting school buildings, feasibility and cost analysis required by the statute, class sizes and teacher allotments, suggested sizing for media center main rooms, recommended lighting systems with illumination levels, and forms for use when deviations from the guidelines are required. (GR)

North Carolina Public Schools

Facilities Guidelines

March 2000

Public Schools of North Carolina
State Board of Education
Department of Public Instruction

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North Carolina Public Schools

Facilities Guidelines

Foreword

The responsibility for providing public school facilities in North Carolina rests with the counties and the special chartered school districts within them. State support for school construction has been provided through state bond issues in 1949, 1953, 1963, 1973, and 1996 when it became apparent that local resources could not keep pace with growing facility needs. Local boards of education, which are the legal owners of school facilities, are responsible for planning and erecting appropriate facilities to support instructional programs.

The "Finance Act of 1987" established the North Carolina Public School Facilities Standards. In August, 1996 the North Carolina General Assembly enacted legislation which directed that these facility *standards* become facility *guidelines.* It further directed the State Board of Education to appoint the Public School Facilities Task Force to review and make recommendations for revision of the guidelines, which define and describe minimum facilities to ensure educational program appropriateness and long-term cost efficiency. The Task Force comprised educators, facilities management professionals, design and engineering professionals, and representatives of the North Carolina County Commissioners and School Boards associations and the State Treasurer's office. This publication, approved by the State Board in January, 1997 reflects the conclusions of the Task Force.

The North Carolina Public School Facilities Guidelines has been developed to provide school systems and designers with useful and reliable design information to use as a basis for new schools, additions and renovations. We believe that these guidelines will enhance the ability of local school systems to plan effective and efficient facilities which maximize instructional opportunities for students. It is our hope that these guidelines provide strong direction for school design, while maintaining local control of that process.

Phil Kirk, Chairman
State Board of Education

Michael E. Ward, State Superintendent
NC Department of Public Instruction

NOTE: Items shown in ***bold and italics*** indicate revisions to this edition.

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Appendix:

Purpose

In July, 1987 the North Carolina General Assembly enacted legislation to provide funds for public school construction to assist county governments in meeting their capital building needs and to provide additional funds for selected counties with the greatest critical school facility needs. The legislation follows the state's Basic Education Program, which assures every child in North Carolina "a program of instruction which is fundamentally complete and which will provide a thorough grounding in...the arts, communication, media and computer skills, second languages, healthful living, mathematics, science, social studies and vocational education."

This document, in accordance with the legislation's direction, defines and describes the educational spaces needed to support a modern, comprehensive educational program and to set minimal guidelines for types of spaces and for sizes of spaces. Consequently, it serves as a planning guide for those in the process of building, enlarging, or renovating school facilities. Administrators, teachers, lay persons and design professionals will find the document helpful as they plan and design educational spaces.

The document is also intended: (1) to serve as a guide in evaluating existing facilities for functional adequacy; (2) to determine facility needs; and (3) to develop sound, long-range building plans. Consequently, it includes guidelines and recommendations for improving facilities. The guidelines set forth in this document do not supersede or take precedent over existing laws and codes defined and enforced by other agencies.

All plans for new construction and renovations must have approval and specific permits from the appropriate state and local agencies.

These reviews, permits and approvals are issued by agencies which include the following:

- *State Department of Labor:* Approval of elevator installations.
- *State Dept. of Insurance/**Office of State Fire Marshall**:* Compliance with the State Building Code.
- *NC Department of Environment and Natural Resources:*
  Approval for new on-site water systems.
  Approval of on-site waste water.
  Approval of kitchen sanitation.
  Approval of soil sedimentation and erosion control plans, where one acre or more is to be disturbed.
- ***US Army Corps of Engineers: Approval of wetlands development (contact DENR first).***
- *State Department of Agriculture:* Approval of propane gas installations.
- *State Board of Education* G.S. 115C-521 (see Appendix)

The North Carolina School Facilities Guidelines are recommended *minimums* and should not be construed as averages or as standards. Although intended to assure adequacy, guidelines can sometimes be restrictive to the efficient design of a facility. In an attempt to avoid such inhibiting restrictions, the guidelines do allow for minor deviations in spatial requirements where design efficiency dictates. Such flexibility is essential to good design, but cannot be allowed to become a means of lowering guidelines. It should be understood that, in certain circumstances, some guidelines will not be appropriate or cannot be met due to atypical programs or special conditions. Also, older existing facilities may not meet many of the guidelines and the cost of renovations to bring them into compliance may be prohibitive.

Phased construction is often necessary and appropriate. When spaces to support the program are not provided, due to either a lack of funding or for other reasons, show it on the plans as a future phase of construction.

Purpose *continued*

Small schools may be unable to meet the guidelines, as multipurpose spaces may serve for specialized needs such as dance, theater arts or workforce development (vocational) labs. Multipurpose spaces should be designed so that the room, furniture, equipment and storage are compatible with the intended programs. The intent of the guideline is to assure that adequate space is provided for those classes and activities that make up instructional programs, as indicated by the North Carolina Standard Course of Study. Where single spaces can adequately provide for multiple uses, the guideline will be considered met.

The facilities guidelines do not replace the need for educational specifications. Educational specifications should be developed which describe the educational program to be implemented. Instructional staff should be involved in the development of educational specifications and the review of facility design. From educational specifications, the planners should be able to determine the unique spatial needs to support individual programs and which spaces can serve several activities or functions.

A permanent record of deviations will be prepared for each project which differs substantially from these guidelines. Copies of this record will be forwarded to the local Board of Education and the designer, and placed in the permanent file for that facility. This information will be reviewed quarterly by the State Board of Education.

Long-Range Planning

The School Facilities Finance Act of 1987 requires local boards of education to develop long-range organizational and facility plans. Specifically, the legislation states, "Local boards of education shall submit their long-range plans for meeting school facility needs to the State Board of Education by January 1, 1988 and every five years thereafter." To develop a long-range plan, which includes efficient utilization of existing facilities, priorities for new construction and renovation, cost estimates, and estimates of available resources, a board of education must address the following five questions:

- How many schools are needed?
- Which grades will they serve?
- How many students will they accommodate?
- Where will they be located?
- Which students will they serve?

In the 1950s, most rural school systems were organized to serve grades 1-12 or 1-8 and 9-12, while schools in urban areas were generally organized to serve grades 1-6, 7-9 and 10-12. In recent years, there has been a significant movement toward a middle school plan of organization across the state. A typical organization based on the middle school concept serves grades K-5, 6-8 and 9-12, but organizational patterns with schools for grades K-4, 5-8, 9-12 or K-6, 7-8 and 9-12 are not uncommon.

While the movement toward a middle school plan of organization has been substantial, other organizational patterns still exist. Alternative plans of organization will continue to be appropriate in some communities because of existing facilities, natural geographic boundaries, sparsity of students, road patterns, and travel times and distances. The Department of Public Instruction and the State Board of Education do, however, believe that a three-tier plan of organization which allows a program specifically designed for students in the middle grades is desirable and that a grades K-5, 6-8 and 9-12 plan of organization is preferable. The state curriculum and the Basic Education Program are designed around this organization. Local boards of education should continue to evaluate their organizational patterns and work toward this structure, where feasible.

Several school systems in North Carolina now have programs for three- and four-year-old children. This trend is expected to continue and is encouraged. For some school districts, programs for pre-school children will be more appropriately located in neighborhood centers; for others, these programs might be located on the campuses of neighborhood schools. Consideration should be given to housing three- and four-year-old children as boards of education develop long-range plans for possible reorganization and new facilities.

Boards of education are also encouraged to study the issue of optimal school size. As with grade structure, local conditions may require differences in school sizes, with schools which are smaller or larger in membership than the optimum.

Boards of education are urged to keep abreast of educational trends which affect the design of school facilities. Center-oriented instruction is being seen in the upper elementary grades. Team organization for each grade level in middle schools may vary and elements of center-oriented instruction may be present. There is some interest in dividing the students within a high school into academic houses or pods.

Boards of education are encouraged, however, to continue studying this issue and to strive for schools which are large enough to offer a comprehensive program and student services at a reasonable cost, yet small enough to offer a personal, caring atmosphere.

Long-Range Planning *continued*

The Department of Public Instruction and the State Board of Education believe that elementary schools ranging from 450 to 700 students; middle schools ranging from 600 to 800 students; and high schools ranging from 800 to 1,200 students can offer excellent educational programs, which include a comprehensive curriculum. However, middle schools of 1,000 students and high schools of 1,600 students are not uncommon. The Board also believes that schools of these sizes can offer the most efficient use of space and personnel at a reasonable cost per student, without losing personal contact with and among students. As with grade structure, school size must ultimately be determined by factors such as existing facilities, areas of population density, natural geographic barriers, road patterns, transportation times and distances, and local preferences.

The Department of Public Instruction no longer conducts comprehensive surveys of local school systems to help local boards develop long-range plans. Such surveys can be conducted by private consultants or by the school system's own staff (with guidance from School Planning) and can provide an evaluation of and recommendations for school organization and facilities.

School Site

Guidelines

Grades	"Developable Acreage"
K-6	10 + 1/100 ADM
5-8	15 + 1/100 ADM
7-9	20 + 1/100 ADM
9-12	30 + 1/100 ADM

The above may not be attainable in urban and certain other areas of the state. In these cases, innovative solutions for parking, physical education facilities and other site amenities may be required. School Planning will assist representatives of the local school unit in determining if the site will be ***safe and*** functionally adequate.

Traffic

Drives which completely circle a building or which have to be crossed when going from building to building or playground are hazardous and should be avoided. Parent auto traffic and bus traffic should be separated once on the school site. Student auto traffic and parking should be separate from all other and easily supervised.

Power Lines

Avoid locating facilities near electric power transmission lines. All site functions (except entry drives) and facilities should observe the clearances noted in *The School Site, Land For Learning.*

Site Evaluation

These factors should be used for evaluating existing or potential school sites:

- Size (number of acres)
- Road frontage
- Shape (rectangular 3:5 ratio preferred)
- Topography/Drainage (usable acreage)
- Access (to separate traffic types on site)
- Traffic (buses; cars; pedestrians)
- Soil conditions (foundations; waste disposal)
- Plant life (trees; bushes)
- Noise/Air pollution (airport; traffic; industrial)
- Utilities (availability)
- Television signals (ETV; school TV)
- Security/Protection (emergency access; lighting)
- First cost (cost per acre)
- Developed cost (actual cost)

Other Planning Resources: School Planning, *The School Site, Land for Learning*, ***June 1998***

Comments and Recommendations

The acreages refer to usable (land which can be developed) land. Purchase additional acreage to account for areas that cannot be built upon, such as steep slopes, wetlands, rights-of-way, easements, setbacks, buffers or poor soils, as well as oddly-shaped tracts. If on-site water or sewer is required, substantial additional acreage may be needed.

A high school may need an additional area of 10 acres or more if a stadium and spectator parking are anticipated.

Pre-kindergartens and kindergartens should have a separate shared play area. Fencing may be necessary for safety or control for kindergarten play areas, but fencing is required for pre-K by the NC Day Care Standards. Fence or wall height cannot exceed 32" if there is a locking gate.

All grade levels should have paved activity areas.

Comments and Recommendations *continued*

The number and types of physical education fields depend on the size and grade structure of the school. Guides for athletic fields may be found in *The School Site, Land for Learning* publication. ***Small schools should have a minimum of a rectangular, soccer-sized, multi-purpose, grassy field.***

Natural features of a new school site should be considered for their potential contributions to the teaching of science. Natural areas suited to the teaching of biology, earth science ***and related workforce development courses*** should be preserved and shown in a landscape plan.

Handicapped accessibility to all site functions, including athletic facilities, is required by the North Carolina State Building Code and the Americans with Disabilities Act (ADA).

Pedestrian traffic in auto and bus areas should be carefully studied. Safety on the school site will carry the same importance as building safety in the review process.

On-site parking needs have increased greatly. Spaces for all staff, itinerant specialists, and an additional 10%-20% for visitors should be provided. Student parking for high schools should be provided for a third or more of the student population.

Regular Classrooms

Guidelines

Grades	Net Square Footage
Pre-K (3-& 4-yr.-olds)*	1,200-1,400
K*	1,200
1-3*	1,000-1,200
4-8	850-1,000
9-12	750-850

Include an additional 15-20 square feet for each separate computer workstation when provided within the classroom.

*Some school systems have experimented with substantially reduced class sizes (18 children or less). In such cases, it may not be appropriate to include as many learning centers within the classroom. School Planning will assist local administrative units to evaluate spatial needs for these situations. Because of the need for shared program space and instructional amenities within each classroom, square footage-per-student ratios are not useful.

Ceiling Heights

Room Size	Ceiling Heights
850 sq. ft. or less	9'-4"
851 sq. ft. or more	10'-0"
Mobile classrooms	8'-0"

Windows (All classrooms should have windows for rescue, light, ventilation, and psychological reasons.)

Grades	
K-5	Classrooms should have windows equal to or greater than 8% of the floor area.
6-12	Classrooms should have windows equal to or greater than 6%-8% of the floor area.
9-12	No more than 20% of the total number of teaching stations should be windowless.

"Every room or space used for classroom or other educational purposes or normally subject to student occupancy shall have at least one outside window for emergency rescue and ventilation. Such window shall be openable from the inside without the use of tools and shall provide a clear opening of not less than 20 in. (50.8 cm) in width, 24 in. (61 cm) in height, and 5.7 sq. ft. (0.53 m^2) in area. The bottom of the opening shall be not more than 32 in. (81 cm) above the floor for grade 5 and younger pupils and 44 in. (112 cm) above the floor for grades 6 through 12. The clear opening shall permit a rectangular solid, with a minimum width and height that provides the required 5.7 sq. ft. (0.53 m^2) opening and a minimum depth of 20 in. (50.8 cm) to pass fully through the opening." Exceptions for windowless classrooms, other special exit provisions. (N.C.S.B.C. Volume I, section 1021.1.2. See also GS 521C 115.

Comments and Recommendations

The net square footage of a pre-K room should not be less than 1,200 sq. ft. The net square footage of a kindergarten or first grade classroom should not be less than 50 sq. ft. below the guidelines. Recessed doors, toilets, coat closets, offices, and storage rooms are not included in the net instructional area for pre-K through first grade.

To avoid the expense of a second exit door, 1st-3rd-grade classrooms may be 980 net sq. ft. This does not include storage rooms, teacher offices or wall thickness.

Comments and Recommendations *continued*

Classrooms should be equipped with computers or conduits for future installation.

Classrooms should be equipped with a two-way communication system for informational and emergency use.

Classrooms smaller than 1,000 square feet should not exceed a 3:2 length-to-width ratio. Because of problems with sight angles and distances, the minimum classroom width should be 24'. Individual toilets for pre-K-1 classrooms may be paired with adjoining classrooms to provide a boys' toilet and a girls' toilet. Individual toilets for the first grade may be used to provide flexibility.

Heat-producing appliances, such as ovens or ranges, in pre-K through grade 5 classrooms are hazardous and should not be installed. A separate cooking center (local option) will not be included in the classroom net square footage. Heat-producing appliances and counter outlets in instructional kitchens should be on a "kill switch" with a power-on light, located out of reach to students.

Twenty percent (20%) of a room's ceiling may be lower, provided the North Carolina State Building Code minimum is met.

State legislation requires the local board of education to consider the placement of windows to take advantage of the climate of North Carolina for both light and ventilation.

Cabinets

Cabinetwork should include file drawers, box drawers, wide drawers for poster paper, vertical slots, some open-front bins and a minimum of "kitchen" type cabinets. Wall units should be 60% open shelving for books and displays and 40% door cabinets. Tall reach-in cabinets are preferred for teaching supplies. Provide one section for hanging teacher coats. See design information (Page ***29***).

Wet Areas

A wet instructional area is required by the instructional program in grades K-3 and in grades 4-6 when science is taught in the classroom. Wet areas are also recommended for middle grades. See design information on page 57 for counter heights.

Wet areas should include a sink mounted in a countertop for instructional use. The location of the sink should allow maximum student participation. Hot water in most classroom wet areas is not recommended due to high cost of installation and operation. The Pre-K educational program requires warm water, and it is recommended for kindergarten.

Science

Guidelines

Grades	Rooms	Square Footage
6-8	Science	1,000-1,200 (with minimal lab equipment)
	Combination Math/Science	1,000 (with teacher demo table only)
9-12	Physical Science	1,200
	Biology	1,200
	Physics	1,200
	Earth Science	1,400
	Chemistry	1,500
	Multipurpose Science (if required)	1,500
9-12	Storage/Prep Rooms (Biology, Chemistry, Physics)	250 per 2 labs

Windows

K-12 Project and science rooms should have windows

Ceiling Height

10'-0"

Gas Outlets

Do not provide gas outlets in science rooms where not required by the program. ***If necessary for instruction,*** middle/junior high science rooms should only have gas to the teacher's demonstration table. ***Portable, self-contained bunsen burners could be considered for middle grades or where limited use is anticipated.*** Gas installations must include master cut-off valves and must comply with other safety code requirements.

Eye Protection/Showers

Classroom/lab areas where OSHA requires eye protection	Safety goggle cabinet and eyewash fountain
Chemistry labs	Add emergency deluge shower

Comments and Recommendations

When a middle school grade level has paired teams for language arts/social studies and math/science, there should be a 50% mix of each type of room for that grade level. For four-teacher teams (language arts, social studies, math and science), one-fourth of the classrooms should be science rooms.

A multipurpose science room is appropriate in small high schools where the enrollment does not justify separate specialized science rooms.

Sufficient work areas with sinks should be provided. Storage and teacher preparation rooms can be shared (square footage is not included in minimum size recommendations). Darkrooms, ***if required, could*** be shared with the art and workforce development (vocational) programs. A 1,500-square-foot chemistry room includes a lecture area and work stations.

Comments and Recommendations *continued*

Twenty percent (20%) of the room's ceiling may be lower, provided the North Carolina State Building Code minimum is met.

Access to a large-group instructional area, auditorium or teaching theater with AV capability is needed for special lectures.

Classrooms and labs should be equipped with a two-way communication system for informational and emergency use.

Fire extinguishers should be located in each laboratory area.

Chemistry labs should be equipped with fume hoods. For most labs, a low-volume exhaust fan that is controlled by the teacher is recommended. The fan will maintain a slight negative air pressure in the room and prevent the spread of odors to other parts of the building.

Small-Group Resource Rooms

Guidelines

Square Footage

4-12 student remediation & resource labs 450

1-4 student testing, speech and guidance rooms 200

Ceiling Height

Rooms	Ceiling Height
Remediation and resource labs	9'-4"

Windows

Windows are required by the North Carolina State Building Code for all rooms subject to student occupancy to the same extent as for regular classrooms. Windows are recommended, where possible, for smaller spaces. For certain conditions, a second exit is allowable.

Comments and Recommendations

One or more small-group classroom(s) should be provided for remediation, conferencing, guidance, testing, etc., for groups of up to twelve. Some smaller rooms may also be needed in addition to the 450-square-foot rooms for smaller group activities.

Storage space for various instructional materials and equipment should be provided.

Exceptional Children

Guidelines

Exceptional Children Self-Contained:

Rooms

Square Footage

Typically 8 to 12 students will require a minimum of 100 sq. ft. each.

Additional support spaces may be necessary depending upon the program ***(see comments and recommendations).***

Exceptional Children Resource: (See small-group rooms.)

Guides for detailed information can be found in the Exceptional Children Facilities Planner, June 1998

Wet Areas

Wet area requirements are the same as for regular classrooms except certain programs will require an instructional area with water in both classrooms and resource rooms.

Ceiling Heights

Room Size	Ceiling Heights
850 sq. ft. and less	9'-4"
851 sq. ft. or more	10'-0"
Mobile classrooms	8'-0"

Comments and Recommendations

Programs for exceptional children vary greatly, depending on local factors. Spaces should be planned to accommodate programs identified in educational specifications. Local factors often result in spaces which are larger than the minimum guidelines.

Spaces for exceptional children should be integrated into planned areas for other programs.

If resource rooms are clustered around a shared common area, they may be smaller.

Care should be taken to ensure that the characteristics of fluorescent lighting do not adversely affect children with certain disabilities.

Certain programs serving exceptional children may also require specialized support spaces, such as cooking areas, toilets, bath/shower rooms, laundries, and observation rooms, and special equipment to accommodate certain disabilities. The type and extent of these support spaces will vary significantly, depending upon the exceptionality of the children being served. Minimum requirements for handicapped accessibility outlined in the North Carolina State Building Code may not be adequate for special education programs. Warm water is required.

Wet areas should include a sink mounted in a countertop for instructional use. The location of the sink should allow maximum student participation. Storage designed for instructional supplies and student projects should be in this area. Coat and book storage may be located elsewhere.

Classrooms for hearing impaired programs will require special acoustical treatment of the finishes, the mechanical system and possibly the lighting ballasts.

Classrooms should be equipped with a two-way communication system for information and emergency use.

Guidelines

Music Rooms

Grades		Square Footage
K-6	General Music	850-1,000
6-8	General Music	850-1,000
	Vocal	1,000-1,200*
	Instrumental	1,000-***1,600****
9-12	Vocal	1,000-1,500*
	Instrumental	1,600-1,800*

* This space may be small; study carefully. Some references recommend 10-18 square feet per singer for vocal rooms (more if choreographed) and 25-35 square feet per student for instrumental rooms. Class sizes for these programs are often large; 40-80 students or more are not unusual.

Support Spaces	Square Footage
Instrument storage room (varies with enrollment)	400-600
Instrument Lockers along music room wall (Increase main room-no separate storage room)	200-300
Music Library	200
Instrument Repair	150
Office (each)	150
Uniform Storage	Varies
Practice Room	55-60
Ensemble Practice Room	150-200

Wet Areas

Workroom: A sink adequate for cleaning brass instruments is required by middle and high school band programs.

Ceiling Heights

Room Size	Ceiling Height
900 sq. ft. and less	9'-4"
900-1,000	10'-0"
1,000-1,200	12'-0"
1,200-1,800	14'-0"-18-0"
Over 1,800	16'-0"-18'-0"+

High ceilings in music spaces dramatically improve acoustics.

Guides for detailed information can be found in the Arts Education Facilities Planner, currently under development

Comments and Recommendations

The elementary music room should be designed to accommodate general, vocal and instrumental music. Acoustical treatment is essential and windows are recommended. In smaller elementary schools, spaces to accommodate music plus other programs may be combined into a multipurpose area.

A single music room of designated size is appropriate for small middle schools. Separate rooms for band and chorus may be required as enrollment increases and when programs are offered simultaneously.

Comments and Recommendation *continued*

The room sizes indicated here do not include program support rooms, such as offices and storage. These areas are listed separately.

Band instrument and orchestra instrument storage areas should be separate.

Rooms should be equipped with a two-way communication system for informational and emergency use.

Acoustical treatment for vocal and instrumental rooms should be provided. Some flexibility for adjusting the extent of absorptive and reflective surfaces should be provided. Many schools have had good success with acoustic control by providing a "Cash Allowance" in the construction contract for acoustic treatment to be installed after the room has been constructed.

The minimum ceiling heights relate to flat-floor rooms. Risers are not necessary, but rooms with risers will need ceiling heights adjusted to the highest riser so that appropriate ceiling height and room volume are achieved.

At least one handicapped station within a row of regular seating will be provided in accordance with the North Carolina State Building Code.

Provide an oversized door or pair of doors into the music classroom and instrument storage room.

Guidelines

Art Rooms

Grades	Square Footage
K-8	1,000-1,400
9-12	1,200-1,500

Support Spaces	Square Footage
K-12	
Kiln/Clay Storage	40-60
Art Material Storage	80-150

For fire safety and air quality, place kilns in a separate room with proper ventilation and exhaust. Do not locate in a storage room other than one used for clay products and projects.

Ceiling Height

K-12 10'-0"

Windows

K-12 An art classroom should have windows.

Incandescent task and display lighting should be switched separately to avoid use as general illumination.

Guides for detailed information can be found in the Arts Education Facilities Planner, currently under development

Comments and Recommendations

During the preliminary design phase, furniture and equipment plans should be developed showing studio and lecture relationships. Storage cabinets and shelving with flexibility are needed for a variety of supplies and projects.

In small elementary schools, the visual arts program may be in a project room, i.e., art, science, crafts, etc.

The ceiling heights may vary; however, the average height should not fall below the minimum guidelines. The minimum ceiling height may be reduced if the art room is the only space in the building or addition requiring more than a 9'-4" ceiling.

Light sources may vary from daylighting to artificial sources. Artificial light sources should provide full color spectrum and task-level illumination. Skylights, clerestories and rooftop light monitors are possible alternate daylight sources. Outside work patios adjacent to classroom exterior windows and doors are recommended. Fluorescent fixtures are recommended; however, incandescent may be used for critical tasks where color is important. Provisions for darkening part or all of the room may be a design consideration.

Kilns have special electrical and ventilation requirements that should be provided for, even if the equipment is not in the contract. Paint spraying and hazardous material storage will be subject to the North Carolina State Building Code. Do not locate kilns ***within*** storage areas for ***paper or other*** flammable materials.

Rooms should be equipped with a two-way communication system for informational and emergency use.

Arts Education – Theater Arts

Guidelines

Grades	Square Footage
K-12	1,800-2,000

Ceiling Height

K-12 10"-0"

Comments and Recommendations

The K-6 theater arts room should be a large, open space which is carpeted and acoustically treated. A small raised space with simple, individually controlled directional lighting is required for the presentation and viewing of special projects. Design features such as built-in furniture should be avoided in order to provide maximum flexibility.

The middle and junior high theater arts room should be similar to the elementary room. If no other performing facility is available in the school, then this space may be designed as a small teaching theater where both instruction and performance can take place. In either case, there should be a small, raised performance area with simple, individually controlled directional lighting.

In smaller elementary schools, spaces to accommodate theater arts plus other programs may be combined into a multipurpose area. Multipurpose spaces for middle and junior high schools should be evaluated on an individual basis.

The high school theater arts room should be a large, open space for activity-based instruction. It should have a small, raised space with individually controlled directional lighting. The raised space is not essential where an adequately equipped performing facility is nearby and accessible during theater arts instructional time. If a small teaching and performing facility is available for all theater arts instruction, then a separate theater arts room may not be necessary.

Arts Education – Theater Arts Auditorium

Guidelines

Grades	Seating Capacity	9-12 Auditorium Support Spaces	Square Footage
K-8	Not Recommended	Stage, Storage & Dressing Rooms	3,000-5,000
9-12	1/3-1/2 ADM (8 s.f./seat)	Light-lock Vestibule, Lobby, Concessions	800-2,000
		Toilets	As Req. by Code
		Scene, Costume Shops	Provide where extensive drama program is offered

Guides for detailed information can be found in the Arts Education Facilities Planner, currently under development

Comments and Recommendations

By locating band, chorus and drama classrooms adjacent to backstage areas, these spaces can serve double duty as staging, green rooms, dressing and set-up areas during large performances. Consideration should be given to allow relamping and/or changes in lighting levels and types without major effort or reconstruction. Stage lights are costly and the amount and types needed vary by the types of performances. Consider the purchase of minimal lights, with circuits and grid for installation of rental units.

If the board of education chooses to build a high school auditorium, consideration should be given to seating the largest class (ADM) x 8 sq. ft. plus about 4,000 square feet for the stage, storage and a small lobby. The auditorium should be planned as a theater, with suitable acoustical design, lighting system, sound system, storage, and support facilities such as make-up and scenery construction spaces. The entire facility should be designed for theater arts instruction, although this will be a multipurpose space. Adjacent study and work spaces should be available to provide and support instruction in theater history, literature, design, construction, acting, directing and performance. These support spaces could be unscheduled regular classrooms.

Rooms should be equipped with a two-way communication system for informational and emergency use.

Large, joint school/community-use auditoriums are discouraged. Large auditoriums are much more costly per square foot due to increased volume, structural spans and special building code requirements (especially if 1,000 or more seats). Generally, multiple performances to smaller groups are more successful than single performances to a large group.

The need for a separate control booth has diminished in recent years. Handicapped accessibility to these spaces is often difficult and costly. Generally, provisions should be made to set up a sound/light control board in the middle of the seating area.

Generous side stage areas are encouraged for prop, scene storage and staging. Flylofts and working stages are discouraged due to very costly building code requirements and hazardous conditions for children handling heavy weights and working at great heights unsupervised.

Orchestra pits are strongly discouraged for safety reasons and because members of a student orchestra are a part of the performance and should be visible to the audience. As an alternative, provide several rows of removable seats at the front of the auditorium to provide space for an orchestra.

Consideration should be given to providing overhead or oversized doors from a loading area to the stage and scene storage areas for moving large props and scene sets.

Handicapped accessibility to the stage in which the individual need not leave the auditorium is highly desirable.

Arts Education – Dance

Guidelines

Grades	Square Footage
K-8 Combined Dance/Drama (Incl. 100 sf storage/program)	1,800-2,000*
9-12 (Incl. 100 sf. storage)	1,800-2000*

*In smaller elementary schools, spaces to accommodate dance plus other programs may be combined into a multipurpose area. Multipurpose spaces for middle and junior high schools should be evaluated on an individual basis.

*In small high schools, theater arts and dance may be combined, provided the design and additional support space required demonstrate functional adequacy.

In high schools, dressing rooms and access to showers is desirable. Where located close to the gymnasium locker rooms, this space can be combined. Otherwise, provide 200-400 square feet for this function adjacent to the dance room.

Ceiling Heights

10'-0" Minimum
12'-0" recommended
(High ceilings are necessary where dancers perform lifts.)

Windows

Recommended where possible.

Guides for detailed information can be found in the Arts Education Facilities Planner, currently under development

Comments and Recommendations

The dance classroom should be a large, unobstructed space with either a suspended wooden floor or a floor covered with a portable or permanent dance surface which provides a resilient surface. Many wooden gymnasium floor systems are not resilient enough for thin dance shoes or socks. Dance classrooms should not be carpeted or have only a concrete and/or tile floor. It may be desirable to have mirrors on one wall which are of a shatterproof material or mounted to prevent shattering. An adjustable-height dance barre may also be desirable. The classroom should be soundproofed or located so that music and other noises associated with dance instruction do not conflict with adjacent classrooms. There should be storage and/or closet space for students to use to store their personal belongings during the class. A separate lockable, storage space for the teacher to store materials, equipment, recordings, props and other related items should be easily accessible. Bulletin boards and markerboards are needed. Storage should be provided for mats or cushions that students sit on while viewing films or during other instructional activities. It is desirable to locate the rooms near toilets and water fountains.

At the middle and high school levels, dressing room space is needed for students to change clothing.

Rooms should be equipped with a two-way communication system for informational and emergency use.

Workforce Development (Vocational Education)

Guidelines

Workforce Development (Grades 6-8)	Square Footage
Exploratory Programs:	
Exploring Career Decisions	1,300-1,600
Exploring Life Skills	1,400-1,600
Exploring Technology Systems	1,400-2,000
Exploring Business & Marketing	1,200-1,400
Exploring Biotechnology	1,400-2,000
Skill-Development Program:	
Keyboarding	1,200-2,000
Business Computer Technology	1,200-2,000

Workforce Development (Grades 9-12)	Guidelines

Facilities for high school Workforce Development programs are often large, extensively equipped and much more expensive than regular classrooms, paralleling the facility needs found in industry. Because of these factors, school systems should be careful when selecting programs to offer. Because the spatial needs vary significantly from one program to another, the list below gives general guidelines for use when performing initial planning and programming of spaces. For detailed information on specific programs, refer to the School Planning publication: *Workforce Development Facilities Planner.*

Square footage indicated in the ***Desirable*** column were proposed by curricula development staff and workforce development faculty to provide a comprehensive ***or magnet*** program in an optimal space. Square footage indicated in the **Guidelines** column are sizes of spaces that have historically been provided for their respective programs and have been approved by the State Board of Education.

For many of the programs listed below, space in addition to that indicated is needed for office, storage, vocational classroom (could be shared) or other support areas.

Programs and Courses	Guidelines Square Footage	Desirable Square Footage
Agricultural Education (All Courses)	**2,500-3,000**	*2,600-3,200*
Business Education Principles of Business, Small Business Entrepreneurship, Business Law, Business & Financial Management	**1,200-1,400**	*1,600-2,000*
Computer Applications, Business & Electronic Communications, Computerized Accounting, Network Administration, Business Management & Applications	**1,200-1,400**	*2,000-2,500*
Family and Consumer Sciences Education Parenting & Child Development, Early Childhood Education, or combined lab for Teen Living, Life Managment, Clothing Design, Foods & Nutrition, Interior Design & Housing, Parenting & Child Development	**1,400-1,600**	*1,400-1,600*
Clothing Design, Apparel Design Services, Interior Design & Housing, Interior Design Services, Culinary Arts & Hospitality, Food Service	**1,600-2,000**	*2,000-2,500*

Programs and Courses	Guidelines Square Footage	Desirable Square Footage
Health Occupations		
(All Courses)	**2,000-2,500**	*2,400-2,600*
Marketing Education		
(All courses)	**1,000-1,200** (Plus Store)	*1,500-2,000* (Incl. Store)
Technology Education		
Fundamentals of Technology	N/A	*1,800-2,200*
Principles of Technology	N/A	*1,300-1,600*
Trade and Industrial Education		
Trade and Industrial Work Development	**850-1,000**	*1,000-1,200*
Cabinetmaking, Drafting, Electrical Trades, Electro-Mechanical Technology, Electronics, Graphic Communications, Welding Technology	**1,600-2,000**	*1,800-2,800*
Automotive Technology, Collision Repair Technology, Construction Technology, Cosmetology, Masonry, Metals Manufacturing Technology, Textile Technology	**2,500-3,000**	*2,000-3,240*

Comments and Recommendations

For middle school programs, local school districts may select from exploratory courses, Business Computer Technology and Keyboarding. Smaller schools may combine certain programs in multi-use labs.

The Basic Education Program states:

"Vocational Education (grades 7-8) will be available to all students, but not required. A basic high school vocational education program must include offerings in at least three of the following areas:

Agricultural Education
Health Occupations Education
Business Education
Family and Consumer Sciences Education
Marketing Education
Technology Education
Trade & Industrial Education"

Many high schools offer all seven programs. The number and types of laboratories will depend on courses offered locally. More than one laboratory for a program such as family and consumer sciences education may be necessary in larger schools.

Career centers serving several schools will affect the types and number of facilities needed at a high school.

Many workforce development programs are moving away from the large and extensively-equipped trade and industrial shops. School Planning will review facilities based on new and innovative workforce development programs, as described in the educational specifications developed by the LEA.

Guidelines

Ceiling Heights

See regular classrooms for workforce development classrooms and light-equipment laboratories up to 1,200 square feet.

1,200-2,000 square feet	12'-0"
2,000 square feet and above	14'-0"

Windows

See regular classrooms for workforce development classrooms and light-duty laboratories. Laboratories with hazardous equipment should have windows, skylights, or some other daylight source.

Comments and Recommendations

Multipurpose workforce development laboratories may be necessary in small high schools. A lab-type facility, for example, could serve electrical and metals programs. Multipurpose laboratories should also have a detailed layout to establish functional adequacy. In addition, a multipurpose laboratory should meet the requirements outlined in the Purpose section of this guide.

A larger darkroom with additional storage could serve art and science, as well as workforce development programs.

A student conference area, office and storage area should be provided for cooperative method programs (Agriculture, Business, Marketing, Family and Consumer Sciences, and Trade & Industrial Education).

Laboratories that generate excess dust or other airborne pollution must have an exhaust system, as required by code, health and OSHA regulations.

Workforce development classrooms without an exterior wall may be windowless if they have windows into a shop or laboratory which has an ample daylight source.

Classrooms and laboratories should be equipped with a two-way communication system for informational and emergency use.

Media Centers

Guidelines

Grades	Spaces	Square Footage
K-12	Main Room (RLV)	4'-6'/student (ADM) but not less than 1,600 See graph in appendix.
K-5	Support Areas (See Below)	1,200
6-8	Support Areas (See Below)	1,800
9-12	Support Areas (See Below)	2,000
K-5	Video Production Room	300
6-12	Video Studio	400
	Control/Editing	260
	Equipment Storage	80

Capacity

40 students or 10% of the membership (ADM), whichever is greater.

The size and types of various support spaces needed are dependent upon the size and grade level of the school. Additional information can be found in "*Learning Connections: Guidelines for Media and Technology Programs*", Division of Media and Technology, NCDPI. Some of the typical support areas and their recommended sizes include:

Media Office/Administration	200 plus 50/add'l. staff
Workroom	400-600
Production	400-600
Darkroom	150
Professional Area	150
Conference/Small Group	150
Equip. Storage/Distribution/Maintenance	175
Periodical Storage (If not on CDROM)	150-250

Ceiling Heights

Main Room (RLV)	Minimum 12'-0"
Support Areas	9'-4"

Comments and Recommendations

The school's media center should be located on the ground floor, single story and convenient to all learning areas of the school. The plan arrangement should not result in the RLV (reading, listening and viewing) room becoming a major thoroughfare for student traffic. Convenience to an outside entrance with access to rest-rooms allows the center to operate after hours and facilitates the delivery of materials and equipment. The media center's location should not preclude future expansion of the facility.

Comments and Recommendations *continued*

A proposed furniture and equipment plan should be developed during the early design development stage, in order to determine functional adequacy. The minimum media collection should be equivalent to a school serving 400 students.

Minimum support areas include offices, work/production rooms, conference rooms, periodical storage, some audiovisual equipment storage and spaces for a professional collection. Audiovisual equipment storage rooms should have a second door leading into a corridor, for the convenience of teachers checking out equipment for their classrooms.

Video production areas are sized for consumer-grade equipment.

Many schools no longer include a computer room as part of the media program. The current trend is for the media center to house media retrieval head-end equipment to serve computers located in the classrooms or other labs. See the Technology section of this publication for guidelines on computer labs and infrastructure.

Elementary schools should have a group storytelling area for 29 pupils. Removable risers (carpeted) are often used. Storytelling pits are discouraged due to inflexibility, safety hazards and problems with waterproofing.

Varied ceiling heights in the main room (RLV) are desirable as part of an aesthetic, acoustical and lighting strategy.

HVAC System

The HVAC system should be separately zoned from those parts of the building which are not mechanically conditioned year-round. Special attention must be given to adequate ventilation and humidity control to prevent mold and mildew *year-round*. Computer hardware and software must be protected from temperature and humidity extremes.

Windows

Windows are recommended in the main media center room (RLV), but are not recommended for electronic equipment storage rooms. They are recommended in the support areas, but are not necessary if there are windows into the main room (RLV).

Wet Areas

A large, single, deep-bowl sink is needed for many tasks performed in the workroom.

Other planning data is available from:

- School Planning
- Media and Technology Services

Comments and Recommendations *continued*

Lighting controls should be convenient and capable of darkening or dimming specific areas. The RLV should have a switch at the entry to control some general lighting. Electrical outlets (some with surge protection) and network technology connections should be coordinated with the furniture and equipment plan. Computer and electronic equipment will require more electrical outlets than required by code. Use fluorescent lighting in most areas. Metal halide lighting may be used in the main area. Incandescent fixtures should be limited to special-effect lighting in low ceiling areas.

Windows should neither admit distracting light nor hinder space utilization and should be equipped with draperies or darkening shades.

Intercom speaker(s) should have independent volume control(s).

Consideration should be given to providing a MATV/CCTV system for the school (specialized satellite instructional television). Provisions should be made to receive the signal from the University of North Carolina Center for Public Television and bring it into the media center workroom.

Handicapped access to the media center must meet the requirements of the North Carolina State Building Code, except that the 32" clear spacing for existing shelving will not apply to renovated or remodeled public schools. The spacing between movable furniture must allow for handicapped access.

Physical Education

Guidelines

Grades	Spaces	Square Footage
K-6	Multipurpose/indoor P.E. (play area)	3,600 net Minimum+ 4 sf/pers over 600 pers
6-8	Gymnasium	Varies
Play area	42x74 court (54x90 with safety space*) ***recommended minimum for school & community use***	
	50x84 court (62x100 with safety space*) desirable ***for interscholastic play***	
Seating	400-500 square feet/100 seats	
9-12	Gymnasium	Varies
Play area	50x84 court (62x100 with safety space*)	
Seating	400-500 square feet/100 seats	

* Safety space of 6' on each side and 8' on each end of a basketball court should be provided to reduce accidents and injury

9-12 wrestling (competitive)	3,000
9-12 resistive exercise (weight room)	2,000-3,000

Windows

Play areas and gymnasiums should have windows or other daylight sources to provide a minimum amount of natural lighting.

Ceiling Heights

Grades	Ceiling Height
K-6 Multipurpose	15' (18' recommended)

The NC State Building Code will allow an exposed roof structure without fire protection if the structure is at least 20 feet above the floor in "Type II" or "Type IV, 1- Hour" buildings.

6-9 Gymnasiums	20'-22' min
9-12 Gymnasiums	20'-24' min (25' recommended)

Support areas under 850 sq. ft.	9'-4"
Dressing, showers, etc.	10'-0"
P.E. and athletic teaching areas (weight, team, wrestling rooms)	12'-0"

Comments and Recommendations

K-6 indoor P.E. areas should include additional square footage for an office, storage and toilets for boys and girls. Add space if a stage is included. The 6-8 gymnasium should include dressing and shower areas, offices and some storage. Assembly and spectator use may require increased size. The 9-12 gymnasium should include space for two play courts, spectator seating, dressing and shower areas, office areas, storage and a lobby. Additional P.E. and athletic facilities ***(such as an auxiliary gym)*** may be needed to schedule the program in larger schools.

Comments and Recommendations *continued*

Although use of showers has declined in recent years, some showers should be provided that can be used for both P.E. and athletics. To encourage their use and maintain modesty, private shower stalls with enclosed dressing areas should be provided for both boys and girls. Locker and dressing rooms should be visible from P.E. teachers' offices to reduce vandalism and violence.

An auxiliary gymnasium with a minimum of 3,600 sq. ft. is recommended for middle schools with 1,000 or more students. An auxiliary gym of 6,500 sq. ft. is recommended for high schools with 1,200 or more students.

Care should be taken when selecting a floor finish for elementary school multi-purpose rooms. Children of this age may spend considerable amounts of time sitting on the floor as well as activities such as dance, basic exercise, gymnastics, ball handling skills/games and other motor skills development. Because of the wide variety of activities, a highly resilient floor such as sports carpet, foam backed synthetic sheets or wood may be desirable. Standard vinyl tile may not offer enough resilience and plain concrete is not recommended.

A resilient floor finish such as high-density gym carpet is recommended for wrestling rooms and resistive exercise rooms. Resistive exercise and wrestling rooms should be located in an area accessible to both genders.

Lay out exercise rooms with 2'-0" clear around extended equipment parts or limbs and allow width for spotters and circulation.

A solid, blank, durable wall is desirable in gymnasiums and play spaces for use as a teaching wall or handball and tennis practice surface.

Windows in physical activity areas should be located to prevent glare. Locker rooms should have a daylight source for safety.

The N.C. State Building Code requires guardrails at the rear and open ends of elevated seating facilities, including tip-and-roll bleachers, where the seating height exceeds 30".

Twenty percent (20%) of the gymnasium and playroom ceiling may be lower, provided the North Carolina State Building Code minimum is met. All playrooms and gymnasiums are teaching stations and require good acoustics. The ceiling is the best area to treat acoustically. Many systems have been very satisfied with cement fiber roof decks. Conversely, many systems have been less satisfied with "acoustic metal deck" and/or slotted, insulated concrete block.

Administration

Guidelines

Rooms	Square Footage
Principal	***150***-200
Assistant principal (each)	***120***-150
Reception area	***200***-400
Secretary	***100***-150
SIMS K-5	***80***-120
SIMS 6-8	***100***-150
SIMS 9-12	***150***-200
Other student services	***80***-200
Workroom/Storage	*200
Conference room	200
Record storage	100
General storage	*100

*Considerably larger amounts of storage space are highly desirable.

Comments and Recommendations

Number and sizes of spaces will vary according to staffing. Partition construction should allow for flexibility.

An assistant principal is funded by the state when the enrollment reaches approximately 700.

Doors to all offices should have a view panel for security.

At least two unisex toilets are recommended for the administrative staff. Group toilets are appropriate in larger schools or where guidance personnel and teachers also use these facilities. Individual toilets in private offices are inefficient, expensive, and not recommended.

Student Support Areas

Guidelines

Grades	Rooms	Square Footage
K-5	Guidance	450
6-12	Guidance	300
9-12	Reception/Career center	varies
K-12	Counselor office	***100***-150
K-5	Other student services	***100***-150
6-12	Other student services	200
K-8	Health room	200
9-12	Health room	150
K-12	Health room toilet	50

Comments and Recommendations

Elementary guidance areas serve small-group and individual guidance and should include a private counselor office. Schools with more than one counselor may need additional space.

The 6-12 guidance recommendation is for a small school with one counselor. Larger schools will require additional counselor offices. Depending on the size of the school, the reception area may need to be expanded to handle the number of students who may use catalogs and other materials in the guidance center. A guidance/student services center in a large high school can be in the 2,000-3,000-square-foot range.

The health room may serve the nurse and other medical professionals and as a temporary station for sick students. The health room should be located to allow for easy supervision and should include an adjacent toilet. A large vision panel or window with blinds is helpful for supervision by office personnel.

Rooms designated for other student services may house social workers, psychologists or other health professionals. Student offices may be needed for student publications, student government and student clubs.

A vision panel with blinds in a door or wall should be provided for all guidance or consultation rooms where staff liability or issues could arise.

Guidance and other adminsitrative offices may need additional space to accomodate students with their parents, especially if confrontations arise.

Staff Support Areas

Guidelines

Grades	Rooms	Square Footage
K-12	Group teacher office/planning	80-100 Per Teacher
K-12	Special assistant and itinerant teacher office/work space	80-100 Per Teacher
K-12	Workroom	Varies 300 min. 0.75-1.25 sq. ft./ADM
K-12	Lounge	Varies 300 min 0.5-0.75sq. ft./ADM

Telephones

Faculty use — Each teacher should have access to a private telephone (exclusive of Child Nutrition and Administration)

Staff Toilets

Faculty toilets should be located near classrooms. Teachers must not have to travel over 200' to reach a toilet, per the N.C. Plumbing Code. The minimum fixture count for the staff must be based on Public Office Building Occupancy, not School Occupancy (Table 922.2 North Carolina State Building Code, Volume II), using a count of all permanently assigned and itinerant/visiting staff members plus 10%-15% for short-term growth. The ratio of male and female staff must be considered in the use of Table 922.2. Staff toilets should have a parcel shelf, a place to hang garments, a full-length mirror, and an appropriate area for grooming.

Comments and Recommendations

Combined or shared areas are recommended for efficient and flexible use of offices/workspaces. Teacher offices/workspaces should be near, but not in, the classrooms, where feasible. In addition to an appropriately sized desk and ergonomic chair, the workspace should include tables, shelving and storage.

Teachers, like other professionals, should have access to a private telephone, a networked computer, lockable storage, and a work area for planning, contacting parents, etc. Where the teacher has a permanently assigned classroom for their exclusive use, these amenities should be within the classroom. Where several teachers use the same classroom during different periods of the day, a separate teacher workspace containing these amenities should be provided.

Where separate teacher offices are provided, group office areas for four or more teachers are encouraged, to promote flexibility and improve space efficiency. Classroom area should not be reduced when separate teacher office facilities are provided.

Comments and Recommendations *continued*

The efficiency of high schools can be significantly enhanced by providing teacher office/planning areas in an area separate from but near to the classroom. Classrooms can be assigned for use by different teachers for all periods of the day if teachers have a separate space for planning, telephoning and other work.

Workspace dividers should have acoustical treatment which will allow telephone and computer use in combined or shared areas.

Workspace should be provided for instructional, lab, and clerical teacher assistants (one per 285 students in ADM). One office/workspace per projected itinerant teacher, plus an appropriate number for volunteers and student teachers, is recommended.

One or more centralized workrooms is/are recommended for copy machines, duplicators, specialized computers, and other equipment and supplies which are not typically located in teacher offices/workspaces.

Sizes and number of lounges will be determined by faculty size and building plan. Provide limited kitchenette facilities.

Commons, Circulation and Entries

Guidelines

Corridor	Widths
(minimum for safe and efficient movement)	
Serving more than two classrooms	8'-0"
Serving more than ***eight*** classrooms	9'-0"
Elementary and middle school major corridors	10'-0"
High school major corridors	12'-0"
Lockers along one wall add	2'-0"
Lockers along two walls add	3'-0"

Entries

Bus rider entries and automobile rider entries should receive equal attention.

Stairs

A single run of stairs should not exceed 8'-0" without a landing. (The North Carolina State Building Code limit, which is greater, is not satisfactory for schools.)

Toilets

Group toilet entries should have adequate privacy screening that does not depend on doors.

Group toilets for boys should have a minimum of two water closets.

Ceiling Heights

Corridors 9'-4"

Doors

Doors which open into a corridor must be recessed or protected by wing walls so that any part of the door swing does not project into the circulation path more than 7". (Also see 1012.1.5 NCSBC.)

Except for delivery areas, multiple single doors, rather than double doors, are recommended. Use oversized doors for exceptional children entries, shops, kitchens and music areas.

Comments and Recommendations

Corridors receive a high volume of traffic during class changes in middle and high schools. Wide, generous corridors significantly enhance safety and security.

The minimum corridor width that should be considered is 6'-0', except that those within office suites, guidance areas and P.E. locker rooms may be 5'-0".

Major corridors serve classroom feeder corridors and/or major spaces such as the cafeteria, media center, auditorium or gym.

During class changes, wide corridors in secondary schools serve a social function better than a student commons. Narrow corridors may amplify unacceptable behavior.

Comments and Recommendations *continued*

Commons should be designed as a student social center. Location and design of commons are more important than size.

Student entries and areas near the cafeteria are good locations for a commons. Ceremonial and visitor entries can be combined with student entries.

The minimum North Carolina State Building Code width for stairs may not be adequate for two-way traffic in 6-12 schools. Stair widths of 6'-7' are recommended. More stair towers function much better than very wide stairs for handling traffic during class changes.

Many schools have reduced social problems and maintenance by eliminating entry doors to group toilets and using screen walls for privacy at entrances. Where vandalism is a problem, reinforced masonry privacy partitions should be used around water closets and urinals. Natural lighting is desirable in all areas. Light switches located in the toilets and corridors should be key operated or located in administration areas or equipment rooms not accessible to students.

Group toilets for each gender with 5 to 7 flushing fixtures are most efficient. The N.C.S.B.C. minimum is 4 fixtures. Lay-in ceilings are discouraged because of abuse and moisture.

Group toilets should be located on main circulation paths between classrooms and major support spaces (cafeteria, media center, gymnasium, etc.).

Group toilets should be available to students from classrooms with self contained toilets for use when going to cafeteria, media center, etc.

Covered areas at all exterior doors and covered walks between separate buildings are recommended.

Child Nutrition – Cafeterias

Guidelines

Dining Room Seating Area

Grades	Square Footage
K-6	12-14*
5-8	12-14*
7-9	14*
9-12	14*

*Per Pupil dining including 2 square feet for circulation. 15-20 sq. ft. per pupil may be needed for more relaxed or intimate dining arrangements.

Dining Area Ceiling Heights

Minimum below 3000 Sq. Ft.	12'-0"
Minimum 3000 Sq. Ft. or above	14'-0"

Serving

20%-25% of Dining area

Kitchen

The total area for grades K-12 can vary from 856 square feet per 100 meals served to 2,880 square feet per 1,500 meals served.

Lunches Served	Square Footage
100	856
250	1,261
500	1,518
750	1,938
1,000	2,208
1,250	2,566
1,500	2,880

Other planning resources:

The New Design Handbook for School Food Service, National Food Service Managment Institute, Univ. of Mississippi

Comments and Recommendations

The dining area size is determined by dividing the number of participating children by the number of seatings multiplied by the square footage per pupil (size = ADM ÷ number of seatings x sq. ft. per pupil). A very small school may have one seating. A very large school may have four seatings. For the typical school, three seatings make the best use of cafeteria facilities. A program of continuous serving and seating requires some additional planning and may be most efficient.

These ratios relate to a complete lunch and are a valid basis for any public school child nutrition program which is operated in a self-contained cafeteria. The term "kitchen" includes all the usual support areas needed for preparing food for school children and staff.

Comments and Recommendations *continued*

The minimum guidelines for child nutrition facilities are based on a traditional program which includes a full-service kitchen and seating to accommodate the entire student body in shifts. The guidelines will not be appropriate where central kitchens or satellite food preparation areas are used. Likewise, the dining room area could be reduced for schools with open lunch periods which do not serve the entire student body. For these atypical situations, the board of education should provide a description of the child nutrition program which must be accommodated. Refer to Public School Laws of North Carolina, Article 17. Supporting Services, Part 2 Food Service, 115C-263 and 115C-264.

The Department of Environment and Natural Resources, Division of Environmental Health, Environmental Health Services Section (http://www.deh.enr.state.nc.us/ehs/food/plan2.htm) must review and approve all plans for child nutrition projects. The following are excerpts from their requirements :

1. If areas are rovided for customer self service, via food buffet/salad bars, then sneeze guards must be provided to protect all unwrapped food or drink from the direct line of the customer's mouth to the unprotected food. Unprotected food must be intercepted by glass or similar type shields. The minimum standard for food shields as recommended by NSF shall be followed for this facility. Food shields should be down sized for middle school children in order to be effective.

2. When a dumpster is used, provisions must be provided for the washing of the dumpster. A dumpster pad of adequate size and facilities for cleaning the dumpster should be provided or an approved contracting service that has the facilities for cleaning the dumpster may be accepted. A contract for cleaning the dumpster is accepted as long as the manager has the control to decide when the dumpster is to be cleaned by the servicing company or when the dumpster is to be replaced with a clean dumpster by the service company. When the dumpster is to be cleaned on site then the waste water will be required to be discharged to the sanitary sewer system.

3. Painted concrete masonry walls are accepted when properly finished. The following comments shall apply:

   The concrete masonry joints of concrete masonry walls shall be struck slightly or smoothly to achieve a contoured, easily cleanable depression of no greater than 1/8 of an inch to the center of the joint. If exposed concrete masonry walls are planned for this facility, they must be properly finished.

   All concrete masonry walls for toilets, showers, janitor's closets, can wash area, all storage rooms and all rooms where food is stored, prepared or cooked shall be carefully finished to be easily cleanable and nonabsorbent.

   All pores of each concrete masonry unit of the walls must be sealed by the application of a minimum of two (2) coats of an approved block filler. It has been experienced that contractors who apply block filler to masonry walls tend to accomplish this task by spraying.

   When spraying of the block filler is done, the proper spray nozzle must be used as specified by the block filler manufacturer. The block filler will then have to be rolled with the proper napped rollers as specified by the manufacturer to achieve the desired consistency of texture of the block before the paint is applied. Additional coats of block filler may be needed if the two (2) coats as required do not seal the pores of the blocks which are more porous than others.

Comments and Recommendations *continued*

An alternative to the use of spray on block filler is the sponge troweling portland cement or drywall compound over the wall in order to fill in the pores of the block. Depending on type of block used (fine, medium or course aggregate) this may be the preferred method for filling in the pores of the blocks.

Contractors are encouraged to check with and get approval from the local health department after block filler is applied and before final paints are applied to the concrete masonry wall.

4. Floor trenches are recommended in front of the cooler and freezer doors to prevent waste liquids from spillage or during cleaning from entering into the traffic areas.

Equipment Installation Recommendations

1. Equipment not readily movable (i.e. equipment ***without*** casters or rollers) or sealed to adjacent surfaces shall be spaced to allow access for cleaning. The amount of space required between and behind equipment depends on the size of the equipment and the accessibility needed for cleaning the equipment and adjacent surfaces.

   The following are equipment spacing recommendations for stationary equipment:

   A. If access is available from both ends of the equipment and the total equipment length is four feet or less, the equipment should be spaced at least six inches from walls and other equipment.

   B. If access is available from both ends of the equipment and the total equipment length is over four feet but less than eight feet, the equipment should be spaced at least 12 inches from walls and other equipment.

   C. When the total equipment length is eight feet or more, the equipment should be spaced at least 18 inches from walls and other equipment.

   D. A minimum of six inches of space should be provided between items of equipment to allow access for cleaning. Additional space may be required for large equipment when six inches is not adequate to provide access.

2. Equipment placed directly on the floor, such as counters display cases, cabinets, proofers, ovens, and retarders shall be effectively sealed to the floor using silicone, metal flashing, vinyl covered base, or other approved material. Metal kick plates which are readily removable will not be required to be sealed to the floor, provided the base of the equipment is sealed to the floor or the areas behind the kick plates are easily cleanable.

3. Equipment attached to walls, such as lavatories, preparation sinks, utensil washing sinks, dish tables, counters, and cabinets shall be effectively sealed to the wall to prevent splash, debris accumulation, and vermin harborage. Note: any combination of low profile or pan head bolts, screws, rivets, silicone sealers, or flashing that effectively closes the opening between the equipment and the walls in a smooth and sanitary manner is acceptable.

Building Support Areas

Rooms	Square Footage
Mechanical rooms	Varies
Electrical rooms	Varies
Custodial rooms	Varies
Storage areas	Varies
Book storage	Varies
General storage	Varies
Receiving	Varies

Comments and Recommendations

Sizes and locations of support area rooms are determined by need.

Where mechanical equipment is located on the roof or mezzanine, permanent stairs are recommended.

All support areas need ventilation.

Louvers in interior doors are not recommended; undercut doors instead.

A well-ventilated storage area for yard maintenance equipment and combustible materials should be provided. A building separate from the main building is preferred. A two-hour fire separation is required by the N.C.S.B.C.

Adequate space above mechanical equipment for ceiling installation and maintenance should be provided.

Separate boiler and furnace rooms with 2-hour-rated separation, with no openings except to the outside of the building (N. C. S. B. C. 405.2 and 1005.1). Note that the largest insurer of NC School Buildings also requires a 2-hour-rated ceiling.

Adequate illumination for reading mechanical equipment controls and gauges should be provided.

The installation of up-to-date technology infrastructure for use by all students, faculty and staff is encouraged. When funds are not available for the installation of a complete system, it is suggested that the capability to install these systems at a later date be provided by the use of empty conduits and cable trays, allocated space for head-end, file servers and other equipment.

Technology Infrastructure

Spaces

Regular/Science Classrooms	add 15-20 sq ft. per PC
K-5 Computer/Keyboarding Labs	850 sq. ft.
6-8 Computer/Keyboarding Labs	1,000-1400 sq. ft.
9-12 Computer/Keyboarding Labs	See Business Labs (Workforce Development)
Main Head-End Room	450-800 sq. ft.
Wiring Closets	15-120 sq. ft.

Comments and Recommendations

Full-size personal computers have a significant impact upon regular classrooms in terms of needed instructional space, additional electrical capacity and much higher air conditioning loads. See separate publication *Impact of Technology on School Facility Design* for additional design information.

Many school systems no longer associate computer labs with the media center. When computers are placed within the classroom, separate computer labs are used primarily for teaching keyboarding (usually in middle school), programming language, or business applications (Workforce Development).

The main head-end room contains the main connections to the outside, as well as the hubs, routers, file servers and other equipment to serve the school network. Racks for VCRs, Laser disk players, CDROM towers, etc. may be located here, or portions of this equipment may be located in a support area of the media center.

Current economics indicate that it may be more cost effective to eliminate wiring closets for regular classrooms by running fiber-optic cable from the main head-end room to a ***multi-station*** hub located on the computer wall or above the ceiling of each classroom.

When using copper cabling, network connection wiring closets must be located such that no workstation has a cable length of more than 300 feet from this space. A campus plan (separate buildings) school is likely to need a closet for each building. Large, single-story buildings may need a closet for each wing; smaller, more compact schools may be able to eliminate these closets altogether and make all connections directly at the main head-end room.

A closet serving only a few connections may require nothing more than a mounting board on the rear wall for punch-down blocks and hubs. Closets serving large numbers of connections will need space for floor-mounted racks for router and hubs, with access to both front and rear, as well as possible file servers and cross connections to telephone or other services.

Integrated communication systems combine bells, intercom, television, video tapes/discs, telephone and/or other technology systems. The extent of and requirements for these systems vary widely by manufacturer.

Designing Safer Schools

The State Board of Education and the Department of Public Instruction believe in enhancing safety and discouraging violence and crime by careful consideration in the design of sites and buildings. By applying principles of CPTED (Crime Prevention Through Environmental Design) and other design features to reduce or eliminate conflicts or hazardous conditions, a safe, functional and orderly environment can be established. School Planning endorses the concept that a safer environment can create a psychological advantage for positive behavior and for learning. Much of the "Facilities Guidelines" support this advantage. For additional information and references refer to the School Planning Publication entitled "Safe Schools Facilities Planner, Improving School Climate and Order Through Facilities Design."

CPTED Principles

Campus crime and violence can be significantly reduced through the application and interaction of the following seven key components of CPTED.

Access Control

Controlling campus access, either through natural or formal components, is a basic concept of creating a safe school climate. Access by non-students during, as well as after school hours should be carefully controlled, as should the timely and orderly access by students, visitors, staff and service personnel.

Campus Perimeter: Design the campus so that visitors and guests must pass through a particular point or entrance which is clearly visible to passersby and administration.

Entrances and Exits: Minimize the number of entrances and exits to the campus and direct traffic flow, both vehicular and pedestrian, to eliminate confusion and congestion and provide ease of observation. Design parking areas to limit and control access. Place student parking areas where clearly visible from administration and consider breaking up very large lots into smaller, more manageable ones.

Visitor Parking: Clearly identify visitor parking with proper signage and set up visitor traffic, both vehicular and pedestrian, in a way that it can be easily supervised from the main office or by assigned security personnel.

Visitor Screening: Clearly worded and placed signage should direct visitors to the main office or designated visitor reception area where they can be screened, using uniform visitor screening procedures, to ensure that they have legitimate business on campus.

Natural Surveillance

Formal Gathering Areas: Gathering areas should be formally identified in locations with natural surveillance and access control or assigned to locations out of view of the would-be offender. Informal areas then become off-limits and subject to automatic scrutiny. Clear spatial definition will cause unauthorized users to feel at greater risk and staff to assume greater challenging powers.

Natural Supervision: Enhance natural supervision by eliminating architectural barriers. Ensure open sight lines through the design and proper placement of buildings, landscaping components, lighting, and access control. Clear the understory and low branches in wooded areas; maintain visibility of play fields and tennis courts from major site circulation routes.

Formal Surveillance

High-risk Areas: Design high-risk areas to accommodate natural surveillance to the extent possible and to facilitate formal supervision where required. Such areas may include the main entrance or campus perimeter–especially where problems with intruders are typical. Toilet rooms and corridors, stairways, and locker clusters are often key trouble spots. Commons areas and courtyards frequently have similar problems. Remote locations, such as parking areas and outside play courts, may create additional risks.

Remote Surveillance: Where limited staff availability or a high number of identified problem areas generate a need for other, more formal surveillance options, security specialists should be consulted on equipment specifications, placement, operation, and management.

Territoriality

Territoriality is the personalization of space assigned to each person, in order to emphasize the perception of ownership. This translates to the identification of territories within the school campus, assignment of internal territories to "proprietors," and assignment of general supervision and care responsibilities that go with "ownership" of the identified spaces.

Delineation of Space: Space should be clearly delineated among the various areas of the campus to encourage territoriality and better control. For example, it should be clear when one is moving from the fine arts wing to the science department to the math department, or from one "house" to another in the lower grades. Smaller spaces may be assigned to individual teachers or staff. For instance, the locker area immediately outside a classroom door may be identified with that classroom teacher by means of color, pattern or other design features. Doorways and vision panels may need to be designed to facilitate natural surveillance of these areas from within the classroom

Defensible Space

Environmental concepts can contribute to the productive management of schools by providing clearly marked transitional zones that indicate movement from spaces designated for public, combined, and private use.

Access Points: Reduce access points to parking areas to decrease the perception that they are public spaces; reduce the possible escape routes for potential offenders; and increase the perception that they are risky for the potential intruder. Use gates to close off unnecessary entrances during low-use times to control access and reinforce the perception that the parking areas are private.

Target Hardening

Effective target hardening maintains a balance between the development and implementation of appropriate security measures and visually creating a prison or fortress. It must include the vigorous pursuit of identifying, apprehending, and prosecuting criminals, to the end that the school campus becomes unattractive as a target for entertainment or challenge.

Target Hardening: Design facilities with the idea of making the perpetrator's objective difficult to attain and of controlling crime by slowing the perpetrator's progress. Reduce the number of doors that are not observable from drives and parking; avoid deep recesses and potential hiding areas.

Program Interaction

Effective program interaction can be achieved through a combination of designing facilities that enhance both natural and formal supervision and the development and utilization of a close partnership among law enforcement and emergency service personnel, administration, staff, and students.

Enhanced Natural Surveillance: Activities which are easily supervised can be assigned to areas where unauthorized infringement might normally occur. Natural surveillance for these activities will be enhanced through the increased perceptions of safety for the legitimate user and risk for the potential offender. Activities which are more difficult to supervise can be assigned to areas where infringement is typically less likely to occur.

Conflict Reduction: Provide separate entrance and exit patterns to spaces with concentrated high-volume use, such as cafeterias and corridors, to reduce time required for movement into and out of spaces and to reduce the opportunity for personal conflict. Separation of student traffic flow can help define orderly movement and save time, and the illegitimate user will feel at greater risk of detection.

Communication: Design communication systems to overcome distance and isolation. Two-way intercom systems and telephones are even more critical for remote modular units (trailers) or isolated buildings.

Modifications: Redesign problem spaces and uses of spaces to provide natural barriers for conflicting activities. As an example, where congestion and conflict are likely to occur when classes are entering and leaving a cafeteria at the same time using the same entrance, separate the entrance and exit so that different traffic routes are utilized for moving from and returning to instructional areas.

Clear Borders: Provide clearly defined borders for controlled space. Design features such as changes in color, volume, or cased openings can be effective in defining boundaries.

School Size

The trend to school consolidation which began relatively early in the century continues. Schools and school districts continue to become fewer in number and larger in size. American school leadership continues to build large public schools in pursuit of cost effectiveness and curriculum diversity, but may be sacrificing positive school culture and meaningful education reform in the process (Conway, 1994).[1] The issue of school size, as it relates to school climate, safety and order, has been researched extensively over more than five decades, with remarkable consistency in the findings. Most researchers have determined a measurable positive relationship of smaller school size to safety, climate, and order. Some research has controlled for "ruralness" and revealed that it is the smallness of the school, regardless of setting, that is beneficial to the student.

There is no universal agreement on the ideal size for schools. What is clear from the research, however, is the positive relationship between smaller school size and a number of variables associated with school climate and order. Researchers on school size indicate ideal school sizes for improved safety and violence reduction to be:

Elementary:	300-400 students
Middle:	300-600 students
High:	400-800 students

The local school unit must determine school sizes that best serve its purposes. Often, size designation is a compromise among objectives for student achievement, student and staff safety, and effective and efficient utilization of fiscal resources.

Health, Hazard Reduction and Life Safety

Site

Drives and Parking: Hazardous entrances off main thoroughfares should be avoided. If possible, lanes into and out of a campus should be separated by a landscaped median.

Auto and bus traffic should be separated upon entry onto school property.

Landscaping, entries, screen walls, or building corners that block the vision of drivers entering or leaving school property should be avoided.

To decrease potential hazards to pedestrian traffic, bus parking should not be located so that buses have to back up to turn or park, nor should buses be parked in double rows.

Long, straight layouts for parking lots, especially those used by students, should be avoided in order to reduce vehicle speeds and lower risk to pedestrians. Traffic control devices, such as speed humps, can greatly reduce the potential for high-speed vehicular activity. Raised sidewalks can double as speed humps where pedestrian traffic merits.

Unloading areas for students should not be located so that children have to cross traffic.

Pedestrian traffic patterns in areas of vehicular traffic should be designed to minimize potential risks. Where students must cross drives, raised sidewalks with a texture/color differing from that of the drive, should double as speed humps and traffic should be one-way only.

Drives that completely encircle a building or which have to be crossed when moving between buildings or to playgrounds or athletic fields are potentially extremely hazardous and should be avoided.

Adequate campus access and circulation for emergency service personnel and vehicles should be ensured. Fire department vehicle access lanes that extend beyond parking lots or service drives should be avoided, due to potential hazards to pedestrians. If access lanes are required by local officials, they should be constructed as wide sidewalks or grassed hardened surfaces. Vehicular access should be over the curb, and, preferably with control bollards or gates. Curb cuts, which could encourage unauthorized or unintended use, are discouraged.

Vehicular routes and parking areas should be in proximity to sections of buildings, such as administration and classrooms, which can facilitate visual surveillance, and should be adequately lit with vandal-proof lighting.

If two entries to a campus are needed, they should be close enough to each other to allow an individual to monitor both.

To reduce the possibility of vandalism and other undesirable behavior, avoid the use of loose gravel or crushed rock for surfacing.

Environmental Issues: Avoid locating facilities near electric power transmission line easements that cross or border school property. All facilities and site functions (except drives) should observe the following minimum guidelines developed by the Southern California Edison Company:

100-110 kv line:	100 feet from easement
220-230 kv line:	150 feet from easement
345 kv line:	250 feet from easement

Noise levels that are generated by on-site mechanical equipment or by nearby industries or transportation systems can interfere with communication or create a hazard to hearing and should be avoided.

To reduce potential injury from industrial accidents, avoid locating schools near industries that utilize hazardous materials or processes or that generate hazardous by-products or discharges.

Play Areas: Pre-kindergarten and kindergarten classes should have play areas separate from areas for older children. Pre-Kindergarten classrooms are required to have adjacent protected (fenced) outdoor play areas. To avoid trapping children during emergency egress from buildings, perimeter walls or fences may not exceed 32 inches in height if gates are lockable.

Playground equipment with sharp edges, rough surfaces, or hazardous projections that may entangle clothing or cause injury should be avoided.

Support facilities, such as athletics or recreational fields, should be organized around a single axis to facilitate immediate visual surveillance of the entire area. School buildings placed on higher elevations than such facilities provide better opportunities for observation. On flat sites, vantage points should be identified and constructed to allow unobstructed visual surveillance.

Landscaping: Edges of school property can be defined with appropriate tree plantings and other landscaping elements. Careful design can maintain ample sight lines for effective surveillance. In urban settings where fences are used to border property, such plantings can soften edges while communicating to the public the message of privacy. Uninviting neighborhood development can be screened and intrusive noise softened, while discouraging unwanted visitors. In more rural settings, landscaping can be used to create visual lines that define boundaries without the use of fences.

Tree canopies should be maintained at a minimum height of eight feet and shrubs should be kept low enough not to provide places where people can hide. Landscaping should never prevent visual access into school property.

A less stressful and, therefore, safer school environment can be achieved through thoughtful, well-designed landscaping. Trees can provide shade and protection from the wind, and act as visual and noise buffers. Tree species that will resist winds should be selected. Species that could split should be avoided.

Landscaping can often provide access control just as well as walls or fences. Trees lining sidewalks or drives can give natural direction to pedestrian and vehicular traffic, while limiting or denying access to identified sections of the campus.

Pedestrian Site Circulation: Covered walkways between buildings should be bordered by low shrubs and hedges, not to exceed 18 inches in height, to reinforce controlled circulation. Taller hedges should be placed and maintained in such a way as to prevent someone from hiding behind them.

Walkways and corridors from student drop-off areas should be wide enough to accommodate peak periods of use and reduce the likelihood of congestion-related pushing and accidents.

Exterior covered walkways should be designed to prevent access to windows, roofs, or other upper-level areas, but to promote adequate illumination and visual surveillance. Support columns should be of a smooth, difficult-to-climb material. Trees should be planted away from buildings and covered walkways to prevent

access by climbing. "T" connections should be provided at entries to avoid using building niches and to provide clear sight lines and circulation paths unobstructed by doors or loitering students.

The main point of entry should be at the front of the school and should provide a safe, well-lighted, protected shelter for those entering the building. Sufficient windows and glazed doors should be provided to facilitate visual surveillance from the administration area or visitor desk.

Secondary entries should be recessed for protection from the weather, but should not provide places for people to hide. Completely hidden alcoves which shield doors and stairs from weather may also serve as concealed areas for untoward activity. Visibility into alcoves can be enhanced by the use of chamfered wall corners and adequate glazing and lighting

Enclosed exterior courtyards should permit visual supervision by one individual.

Miscellaneous Site Issues: Signs should have large lettering, bold graphics, simple directions, and be well lit. In order that signs not provide hiding places for people, the ground behind a sign can be bermed up or the sign can be raised high enough off the ground to expose the feet of a person hiding behind it.

Bicycle racks should be located in highly visible areas near a main entry or parking area, but with clear separation of bicycle and vehicular traffic.

Where walls undulate or project into small wings, dark niches where people can hide can be created. The planting of low hedges and the provision of windows or recessed exterior lighting can reduce the improper use of such spaces.

Walls in graffiti-prone locations should be of a material and finish which can tolerate repeated cleaning.

Screen walls of metal or decorative blocks should provide no footholds, and the top three to four feet nearest the roof should be smooth and unclimbable.

Exterior mechanical equipment enclosures should utilize designs and materials which make climbing difficult and provide side protection from thrown projectiles. Access doors should be solid, with concealed hinges and deadbolt locking.

Dumpsters should be secured and enclosed to prevent persons from climbing inside to play or hide. Eight-foot-high screen walls constructed to prevent climbing should surround three sides. The gate side should be lockable and should provide visual access to the inside of the enclosure.

Building Circulation

Corridors and Commons: Circulation areas should be adequate to avoid overcrowding during times of peak congestion. To reduce congestion, collision and conflicts at lockers, the minimum recommended corridor widths are:

Major corridors*	Elementary and middle: 10'-0"	High: 12'-0"
Serving more than two classrooms:	8'-0"	
Serving more than eight classrooms:	9'-0"	

For lockers along one wall, add 2'-0" of width. For lockers along both walls, add 3'-0". (* Major corridors serve classroom feeder corridors and spaces such as cafeterias, media centers, gymnasiums, multipurpose rooms, and auditoriums.)

Doors which open into corridors must be recessed or protected by wing walls so that no part of the door swing projects into the circulation path by more than seven inches. If recessed, the niche should be chamfered or wide enough to allow visibility and eliminate hiding places.

Multiple single doors reduce congestion and are recommended, rather than double doors. Oversize doors accommodate movement of equipment and supplies and are recommended for exceptional children entries and for music, workforce development, kitchen, and receiving areas.

During class changes, corridors also serve as commons areas. Spacious corridors may reduce undesirable behavior.

Fire-rated doors along main egress routes should be equipped with magnetic, wall mounted hold-opens. Where doors must remain normally closed, provide wire-glass openings for visibility.

Corridors should be broad and well lighted, with no projections. Sudden 90-degree turns and narrow hallways should be avoided. Smoother traffic flow and better visibility should be provided through chamfered wall corners.

The creation of deep alcoves along corridors for locating items such as lockers, vending machines, trash containers, and water coolers should be avoided, in order to eliminate difficult-to-supervise hiding places or spaces that promote criminal activity. Such items should be either low profile in design or mounted flush with corridor walls. Lockers which are single height, as opposed to an over-and-under configuration, reduce proximity of students and potential conflict during periods of heavy congestion, such as class changes and immediately before and after school.

Light switches for toilets and corridors should be keyed or located in remote locations not accessible to students.

Stairs: To reduce injuries from falls, single stair runs should not exceed 8'-0" without a landing. Minimum stair width for grades 6-12 should be 6'-0". For efficiently moving large numbers of students, additional sets of stairs may function more safely and effectively than very wide stairs. Stairs should be well lighted. Enclosed stairwells should have electronic surveillance equipment to provide motion detection at main access points and on landings. The entire area under all stairs should be enclosed and unavailable for any use. Stair handrails should be open to provide visual observation from areas immediately to either side of the stairs. (Solid handrails can provide hiding places on stairs and landings.) Handrails should be designed to discourage sliding on them and horizontal rails should incorporate vertical pickets to discourage climbing. Risers should be enclosed on the sides to prevent persons from grabbing the ankles of others.

Miscellaneous Circulation Issues: Fixed metal detectors can greatly reduce the incidence of weapons being brought into the school building. A modest, inconspicuous detector should help avoid bringing attention to the problem and the process.

Access to elevators should be limited to authorized individuals. Elevators should be located in lobbies or other areas with higher-than-normal natural surveillance. A five-foot-deep landing area should not obstruct student traffic. Video surveillance in elevators can significantly deter criminal or other undesirable activity.

Water fountains and toilet rooms should be located in areas where students normally gather and that are typically monitored by staff and teachers. Locating staff toilet rooms in the student toilet vestibules can enhance supervision.

Vending machines should be located adjacent to or inside cafeterias or other well-monitored spaces, rather than in isolated areas.

Standpipe cabinets and fire extinguishers in main corridors should be flush mounted.

In locating lighting, lines of sight between fixture locations and objects that can cause shadows should be considered as a means to avoid dark corners where undesirable activity can take place.

Classrooms and Laboratories

Two-way communication should be provided from all occupied areas, to include relocatable classrooms, to the administrative or security offices.

To enhance supervision and prevent accidents, science laboratory classes should have no more than 24 students.

To enhance safe movement during power interruptions, daylight or battery-powered lighting sources should be provided in locker rooms and in laboratories containing hazardous equipment.

Fluorescent lighting utilizing magnetic ballasts should not be used where it may adversely affect children with certain disabilities.

Fire extinguishers should be located in all laboratory areas.

Heat-producing appliances or receptacles where countertop appliances could be connected should be avoided in elementary schools and should be controlled via a "kill switch" with pilot light in middle and high schools.

Circuits for hazardous machines and tools in shops or laboratories should be controlled via "kill switches" with pilot lights.

Relocatable classrooms should be sufficiently separated to permit visual surveillance. In order not to provide hiding places for people, spaces underneath relocatables should be secured with chain link fencing or a similar material which can prevent access and maintain visibility.

Narrow windows or sidelights around doors enhance safety by permitting someone to see who is on the other side before opening a door and to observe circulation spaces. Where such windows are used, door hardware or glazing product should prevent the opening of a door through a broken pane.

Operable transom windows are not recommended for use over exterior doors.

Classrooms should be organized for ease of monitoring by staff. Visual access to the corridor, and in some instances to the building's exterior, is desirable.

Retractable partitions should contain windows or provide other visual access into the space beyond, and should be stored in permanent, lockable niches.

Support Areas

Administration and Health: To address potential liability and safety issues, a vision panel with blinds should be provided in guidance and administration offices and other areas where one-on-one adult/child conferencing is conducted.

For supervision of clients, a vision panel with blinds should be provided in health rooms. Health rooms should include locked storage for equipment and supplies. To prevent a child from blocking the door upon becoming incapacitated, toilet room doors in health rooms should swing outward.

Administration areas should be contiguous to main entries, with easy visual access into and from the area.

Arts and Auditoriums: To eliminate the potential for accidental falls and to allow visibility of the orchestra by their friends and parents, orchestra pits should be avoided. Several rows of removable seats at the front of an auditorium should be considered as an alternative.

To eliminate potentially serious injuries from falls and heavy weights, fly lofts or working stages are discouraged.

Large assembly areas, such as auditoriums, should provide clear sight lines and easy traffic flow. Niches along walls should be avoided and folding partitions should recess fully into walls to eliminate barriers behind which people can hide.

Stage curtains can be left open to allow visual surveillance. Electrical and lighting controls for an auditorium should be located in a locked panel or room.

Designs for areas in which there will be large congregations of students, such as music or band rooms, should support visual supervision of an entire area by one individual.

Dance classrooms should utilize suspended wooden floors or floor covering systems which provide specially designed resilient surfaces. Mirrors in dance classrooms should be shatterproof.

To reduce fire and toxic hazards, kilns should be located in separate rooms with adequate exhaust and ventilation. Kilns should not be located in storage rooms where materials other than clay products are stored.

Gymnasiums: To enhance player and spectator safety, safety borders should be provided around basketball courts – a minimum of six feet wide along the sides and eight feet wide on the ends. Where this safety space cannot be maintained, and where protrusions occur, wall pads should be provided.

Retractable gymnasium bleachers should be capable of being locked in place, when not in use, to prevent persons from hiding or engaging in undesirable activity in the space underneath.

Lockers and Toilet Rooms: To enhance surveillance and reduce damage to equipment, locker rooms and ***associated*** areas should be visible from inside teacher/coaches' offices.

Mirrors, windows, and light covers in toilet and locker rooms should be impact resistant. Ceilings in toilet rooms and locker areas should be of exposed concrete, plaster, or moisture-resistant drywall construction, rather than accessible materials such as lay-in tiles, to prevent the use of the spaces above as hiding places for persons or stolen property.

Group toilets should utilize screen walls to eliminate the need for entry doors. Locate toilet rooms directly adjacent to main corridors in order to maximize visibility and surveillance. Large event toilet rooms should provide secondary access and should remain locked or be reduced in size during normal school operation. Hardware should permit doors to be locked in the open position for event use.

Toilet and urinal partitions should be structurally sound and attached at floor, wall and ceiling. Partition walls should not exceed 5'-6" in height and should have a 12-inch clearance above the floor to allow visual surveillance. Toilet room hand dryers, vending equipment, and trash containers should be heavy duty, recessed, fire resistant, and lockable.

Free-standing or island lockers should be adequately spaced to avoid student crowding and should not exceed four feet in height, in order to permit visual surveillance. Perimeter lockers should be mounted flush to the walls to minimize opportunities to hide on top of them or to attempt access to ceiling areas.

Media Centers: Control points and the maintenance of clear sight lines in the media center should be used to minimize opportunities for theft and to eliminate possible hiding places. The reception area or circulation desk should be located to facilitate the monitoring of student traffic into and out of the facility. Interior media stacks should be a maximum of four feet in height, well-spaced, and parallel to staff lines of sight to aid in visual control and eliminate hiding places for persons or stolen goods.

To eliminate the potential for accidental falls, storytelling pits in media centers should be avoided. Removable, carpeted risers should be considered as an alternative.

Miscellaneous Support Issues: Single, designated control points with clear sight lines should be positioned near the entrances and exits to cafeterias. Avoid overcrowding and maintain free circulation in cafeterias by providing ample space between serving counters and between dining tables.

Permanent stairs with security features which prevent unauthorized use should be provided to mezzanine or roof areas where mechanical equipment is located.

A well-ventilated storage area (preferably in a separate building) should be provided for the storage of yard equipment and materials which pose a combustion hazard. A two-hour fire separation is required by state building code.

Skylights or clerestory windows on roofs should be tamper-proof and should be positioned well clear of any means of climbing down to the floor inside the building.

[1] Conway, G.E. (1992). Small Scale and School Culture: The Experience of Private Schools. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools.

Toilet Facilities for Classroom Areas

Group toilet rooms containing five (5) flushing fixtures each for both boys and girls are recommended as an optimum size. This is based on the ability of the toilet room to accommodate a full class of students in a reasonable time, yet not be large enough that violence and vandalism become a problem. Rather than increase the size of toilet facilities to over six or seven flushing fixtures, a safer and more functional solution is to increase the number of toilet rooms. These rooms should be appropriately placed in the building.

Carefully consider the location of toilet facilities to best serve the needs of students. The building code maximum of 200' may be too far, especially for elementary and middle schools. Keep in mind that this distance is also applicable to future modular or relocatable units. Because of this, it may be prudent to identify locations for such units and oversize the nearest toilet facilities so that the modular units can be legally installed without significant extra cost. Toilet rooms should also be located "on the way" to playfields, cafeteria, media center, etc. All facilities should be arranged so they are easily supervised by faculty/staff from the corridors.

Toilet Facilities for Cafeterias

Cafeterias are often used "after hours" for meetings, assemblies, dances, performances, etc. For this reason, toilet facilities must be available and sized on the basis of the building code occupancy factor of 15 square feet of cafeteria floor area per person. Other toilet rooms constructed for classroom areas can be used to partially or completely fulfill the cafeteria requirement, if they are within the prescribed distance and it is not possible for them to be "locked off" when school is not in session.

Toilet Facilities for Gymnasiums & Auditoriums

It may be prudent to locate the gymnasium and auditorium near to each other so that they can share the large and expensive event toilet facilities. These facilities should be sized to accommodate the larger of the two spaces, less any other facilities that are near enough (and not "locked off" during event hours) to serve a part of the need. Even with some sharing, these event toilets often are quite large and potentially susceptible to vandalism, fights or other undesirable student activities. It may be prudent to equip these toilets with lockable doors so that they are only used during events. Two means of exit, at opposite ends of the toilet room, will allow escape from a threatening situation, improve traffic flow and enhance supervision.

Toilet Facilities for Stadiums

The number of fixtures required for stadiums is even greater than for gymnasiums due to the very large seating capacity. Stadiums often seat two to three times the student population. The situation may be compounded by the distance of the stadium from the main building or the undesirability of opening the school itself. These factors frequently preclude the use of the main building toilets for athletics or other stadium events. Separate facilities for home and visitors bleachers may reduce confrontations. Two means of exit, at opposite ends of the toilet room, will allow escape from a threatening situation, improve traffic flow and enhance supervision.

High-Temperature Hot Water Needs

The greatest need for hot water and the highest temperature requirement is in the kitchen. For this reason, it is recommended that separate generating equipment be installed to provide 140°F+ water for the kitchen alone. If possible, this heater should be fossil fuel fired to reduce operating cost.

Moderate-Temperature Hot Water Needs

All hot water used for hand washing, showers, etc. should be set at a maximum of 110°F to prevent scalding and so that expensive ***and abuse prone*** insulation of waste and supply piping under lavatories is not required to meet handicapped regulations.

The showers serving the gymnasium locker rooms also have a relatively high demand factor. Because of its distance from other areas requiring hot water, this is usually separately generated.

Health codes require that group toilet rooms adjacent to the cafeteria have hot water for hand washing prior to eating. A small, 10-20 gallon electric heater is usually sufficient.

The art room, photographic dark room and some special vocational spaces may have limited need for moderate temperature hot water, as well. A small, 10-20 gallon electric heater is likely to satisfy these needs.

The health room and classrooms for very young (Pre-K and K) or exceptional children subject to "accidents" may benefit from hot water for enhanced sanitation during clean-up.

Many schools provide cold water only to the majority of classroom area group toilets and individual student toilet rooms.

Toilet Facilities for Faculty/Staff

The number of toilet facilities for faculty/staff is governed by building code, based upon ratios for office occupancy using actual number of faculty/staff. Because the number of faculty/staff is low in relation to building area, the 200' distance code requirement is frequently the governing factor. For this reason, in all but the largest schools, unisex, single fixture faculty restrooms may be appropriate (if acceptable to the building official).

Showers

Where the use of showers is encouraged or required, one shower for each four persons in the largest P.E. class may be a reasonable guideline. At least three to four showers for each gender should be provided.

When designing showers, consider modesty for both boys and girls. A shower stall of at least 3 feet by 6 feet will allow a shower area and a small separate area for dressing (with a bench and clothes/towel hooks), all within a privacy curtain. Such an arrangement may encourage the use of showers after physical activity.

Miscellaneous Considerations

The traps of floor drains in toilet rooms and elsewhere where use is infrequent should be primed, even where not required by building code.

Countertop lavatories are subject to damage from students sitting on them and become unsightly from splashed water, spilled soap and low maintenance. Individual wall hung lavatories are recommended.

Many school systems place lavatories so that they are open to view from the hall for supervision, especially in elementary and middle schools.

In order to allow repairs without turning off water to the entire building, isolation cut-off valves are required to isolate each wing of the building and each group toilet room, locker area and kitchen.

Miscellaneous Considerations *continued*

Exact locations of underground water and sewer lines should be indicated on the property accounting and "As-Built" drawings to simplify future maintenance or expansion.

24" or wider chases between back-to-back toilet rooms with an access door will allow maintenance of piping without costly demolition and rebuilding of walls.

Where water is provided in outbuildings, such as concession stands, stadium toilets, field houses, etc., slope all water piping to a main cut-off and waste valve/drainage point to simplify winterization.

Additional Information and Resources

North Carolina State Building Code, Volume II: Plumbing. Engineering Division, N.C. Department of Insurance. See Table 407 and Section 407.2.4 for minimum requirements and special school requirements.

Minimum Checklist for Mechanical and Electrical Plans & Specifications, School Planning, Division of School Support Department of Public Instruction.

Food Establishment Guide for Design, Installation and Construction Recommendations by the N.C. Food, Lodging and Institutional Sanitation Branch, Department of Environment Health and Natural Resources.

Heating Fuel Selection

Fuel selection should be based on a combination of factors, including cost/efficiency (as shown in the chart below), availability, safety, systems maintenance, ease of handling, etc.

The information below is a simplification of heating costs for different fuels, but may be useful in making preliminary selections. The unit costs used below are current costs as of 3/1/00. Oil and propane are state contract prices. The costs can vary widely with time and some of the costs can vary with location.

Type of Fuel	Unit Cost *(3/1/00)*	Unit of Sale	1,000 MBTU/Unit	Gross Cost of Heating/ 1,000 MBTU	Efficiency Rating of Fuel/System	Net Cost of Heating/ 1,000 MBTU	Notes
Electric Resistance	$0.08	KWH	0.003413 1,000 MBTU/KW	$23.44	100%	**$23.44**	Most costly
Electric Heat Pump (85%)	$0.08	KWH	0.003413 1,000 MBTU/KW	$23.44	(2.8COP) (85%)	$7.12	***Supplemental heat is costly.*** 15% use of supplemental heat may be indicative of central or eastern NC. Cost varies widely depending upon locale and demand rate.
(Assume 15% supplemental)	$0.08	KWH	0.003413 1,000 MBTU/KW	$23.44	(100%) (15%)	$3.52	
Total Heat Pump Cost						**$10.63**	
LP Gas (Propane)	***$0.8214***	Gal.	0.091690 1,000 MBTU/Gal.	***$8.96***	83%	***$10.79***	Costly. Heavier than air characteristic presents safety hazards.
Natural Gas	***$0.61***	Therm	0.1 1,000 MBTU/Therm	***$6.10***	83%	***$7.35***	Must be available nearby.
Oil	***$0.8384***	Gal.	0.14 1,000 MBTU/Gal.	***$5.99***	82%	***$7.30***	Must monitor tank for leaks and contain spills.

(Unit Cost/Unit of Sale) / (1,000 MBTU/Unit of Sale) = Gross Cost of Heating per 1,000 MBTU

(Gross Cost of Heating per 1,000 MBTU) / (Efficiency of Fuel) = Net Cost of Heating per 1,000 MBTU

System Type Selection

HVAC (heating, ventilating, and air conditioning) systems rank second only to roofs as the major source of problems and complaints in school buildings. They are also the major energy consumers. For these reasons and to also provide comfort conditions, sufficient thought and planning must go into selecting, designing and installing the optimum HVAC system for each building. Reasonable first cost, operating cost, ease of operation and maintenance, quietness of operation, and long life must be considered in the selection.

There are many HVAC systems and combinations of systems available. It is a difficult for even a trained professional to sort among the many options available and make a wise and practical choice. For this reason, a competent design team should be selected to help in the system selection and design.

System Types

Recommended System

The following components of a main system are recommended because they provide long-term reliability, excellent room temperature control, low operating cost, moderate first cost, low room noise level and ease of maintenance.

A. Central Air-Cooled Chiller(s)

B. Natural Gas or Oil-Fired Central Boiler(s)

C. 4-Pipe Chilled Water/Hot Water Piping System

D. Air Handling Units (AHUs) Located in Dispersed Mechanical Rooms or Mezzanine Areas Providing a Separate Zone for Each Individual Classroom

See Page 55 for Alternative Recommended Systems

Spaces Where Separate Systems Should be Considered

The Media Center and Administration Area are operated during summer months when traditional-calendar schools are closed. For this reason, separate system(s) to cool these spaces should be considered. A split system DX or split system heat pump is recommended. Heating may be tied into the central system.

The Main Head-End Room for computer equipment often generates so much heat that it must be cooled both summer and winter. This space should also have a separate system. A split-system DX or heat pump is recommended.

Types of Equipment that Are Not Recommended

Rooftop Units: Very difficult to maintain. Frequent cause of roof leaks. Add significantly to cost of reroofing. Potentially shorter life due to poor maintenance/harsh environment. Poorly maintained gas lines on roof can present fire hazards. Heavier-than-air propane on roof can seep into the building if a leak occurs. ***Noisy if placed over classrooms.***

Wall-hung self-contained heat pumps: Actual cost of installation may be deceptive due to high cost for electrical improvements. Often very noisy. Loss of windows/daylight. Poor aesthetics. Poor air distribution within classroom.

Recommended Locations for Equipment

Whenever possible, equipment should be floor-mounted in a separate mechanical room accessible from the exterior. This makes maintenance simple, without disruption of school activities.

When equipment is placed on a loft or mezzanine, permanent stairs to the mezzanine, with space for hoisting equipment, should be provided. Mechanical mezzanines should be isolated for sound and equipped with curbs and floor drains located to accommodate condensate piping.

Recommended Control Systems

Type	Description	Quality	Use	Maint. Frequency
Electric	Time clock with electric components	Good	Small or remote buildings	Low
Pneumatic (Air)	Central air operated system	Good to Excellent	Larger buildings	Medium
Electronic (DDC)	***Complete Energy management system***	Excellent	Large buildings, entire campuses, entire school system	Low

Design Conditions and Recommendations:

Space	Design Indoor Temp. Winter/Summer	Ventilation	Control
Classrooms	72°F/75°F ***50% RH***	***7.5 CFM/student fresh air***	1 t'stat/room(desirable) 1 t'stat/2-5 rooms (max. w/proper zoning)
Dining and Auditorium	72°F/75°F ***60% RH***	***7.5 CFM/student fresh air***	1 t'stat/assembly space (Pre-cool if possible)
Media Center	72°F/75°F ***50% RH***	***7.5 CFM/student fresh air***	1 t'stat/main room Separate HVAC system
Gyms	72°F/75°F ***60% RH***	5-10 CFM/SF total air movement ***5 CFM/student fresh air***	1 t'stat/gym, 1 t'stat/locker room (Pre-cool if possible)
Kitchen	72°F/75°F	Use pkg. hood w/exh. fan & make-up air fan. ***Deliver make-up air @ bottom of hood (short cycle).***	1 t'stat/kitchen area
Administration	72°F/75°F ***50% RH***	15 CFM/person fresh air	Separate HVAC system w/1 t'stat/zone

Note: Good control of humidity is very important in media centers for prevention of mildew on books.

Two-position, rather than modulating valves, usually result in better control of humidity conditions for chilled water.

Miscellaneous Considerations

High efficiency air filters should be specified to enhance indoor air quality. Filters should have an efficiency of 60%. Classrooms should be designed for a maximum noise criteria of NC-30.

It is important that air and water flows be balanced properly. The use of a certified air balance subcontractor is recommended.

Adequate space for mechanical equipment must be provided. Consider space requirements early in the design process.

Air handling units should not be placed in boiler rooms. Locate boiler rooms at or above grade.

Additional Information and Resources

See ***North Carolina State Building Code, Volume III Mechanical*** for additional information.

The following are alternatives to the above recommended system:

ALTERNATIVE COMPONENT/SYSTEM	ADVANTAGES	DISADVANTAGES
2-Pipe Circulation System in lieu of 4-Pipe	Lower initial cost.	Must shut down system for a day or two to switch between heating and cooling mode. System not applicable to some building designs which require simultaneous heating/cooling.
Same system except each AHU serves 2-5 classrooms	***Slightly lower first cost***	***Having more than one classroom on a single thermostat is a compromise in comfort.***
Fan Coil Units or unit ventilators mounted at ceiling in each classroom in lieu of AHUs	Individual room control Moderately lower cost than AHUs ***Don't occupy floor space***	Noisy. Difficult to service. (ladder) Poor air distribution. Routing of condensate drain line can be difficult. Moderate life of unit. ***Not easy to include fresh air***
Unit ventilators in lieu of AHUs	Individual room control. Slightly lower cost than AHUs. ***(no ductwork required)***	***Noisy.*** ***Fresh air is difficult for interior spaces.*** Take up space under windows. ***Care must be taken to avoid coil freeze-up.*** ***Unsightly if piping is not concealed.*** ***Better filtration not possible.***
Fan Coil Units mounted above ceiling in corridors with short ducts running to classroom diffuser(s) in lieu of AHUs	Individual room control. ***Slightly lower cost than AHUs.*** ***Don't occupy floor space***	Difficult to service. (ladder) Routing of condensate drain line can be difficult. Moderate life of unit.
Water-cooled Chiller (in lieu of air-cooled)	Good performance and reliability ***Energy efficient***	High cost. Maintenance/treatment of cooling tower not practical for most school systems.
VAV system with separate zone for each classroom	Excellent individual room control.	Very costly system. ***Very difficult to maintain requirements for fresh air.*** ***High maintenance cost. Can be noisy if units are above classroom ceilings.*** ***Requires reheat***
Hydronic Heat Pumps	***Relatively low first cost.*** ***Only one uninsulated pipe loop required. Energy savings during simultaneous heating/cooling.***	***Multiple compressors to maintain. Cooling tower maintenance.*** ***Noisy if mounted in or above classroom.***
Geothermal (ground-coupled) Hydronic Heat Pumps	Individual room control. ***Good reliability. Very low operating cost. No above-ground outdoor equipment required.***	***Drilling of wells and ground loop piping is very costly. Requires a lot of land for wells and even more for horizontal loops.***

* Notes:
As you approach smaller zone/individual room control, both initial and maintenance costs increase.

As you approach large zone/whole building with one control, reliability increases and initial and maintenance costs decrease; however, potential problems from temperature variation in rooms increases.

Electrical and Lighting

Electrical System Voltages

480Y/277 volt systems (with transformers for 208Y/120 volt uses) should be provided when connected loads exceed 500 KVA. A cost analysis may warrant maintaining the existing voltage system with addition/ renovation projects.

Service Entrance

The impact of the short circuit interrupting capacity of the electrical utility at the secondary terminals of its transformer MUST be used when designing service entrance equipment and panels. Consider placing this capacity on a plaque on the main panelboard for future reference.

The use of spare conduits from the utility transformer to the main panel for future growth is recommended.

Wiring Systems

Copper conductors should be used for feeder circuits from the main panel to its subpanels. Copper clad aluminum wiring for feeder circuits 100 amps and larger can be used if splices and terminations are mechanically crimped.

Electrical Panels

Verification should be made that the panels, conductors, and the over-current protection for each is coordinated.

Grounding

The proper grounding electrode system should be included with the correct sizes for the grounding "electrode conductors." Connections to ground rods and a second grounding point are required, such as the building steel or metallic water piping in contact with the earth for at least a ten-foot length. This applies to service entrance panels and step-down transformers. Refer to the National Electrical Code (NEC), Section 250. Bonding and grounding diagrams should be included.

Illumination

See recommended illumination levels in the appendix. Compact fluorescent fixtures should be installed where incandescent fixtures have been used traditionally for wall washing, display cases and down lighting in traffic patterns. Fluorescent lighting fixtures can be installed with equipment used in most desired applications for dimming, but where color rendition and brightness control may be critical, such as drama class settings in auditoriums, incandescent spot lighting fixtures (track lights) may be used.

Incandescent fixtures should be avoided due to high operation cost and short lamp life. The use of electronic ballasts and T-8 fluorescent lamps, metal halide and high pressure sodium lighting fixtures in appropriate locations is strongly recommended.

Light-emitting diodes (LED) exit lighting fixtures are recommended because of their very long life and very low operational cost. Incandescent exit fixtures should be avoided. Locations of exit and emergency lighting fixture are critical. See the North Carolina State Building Code.

Energy Controls

The use of remote switches for lighting in corridors, rest rooms, gymnasiums and common areas is recommended. These switches should be located in areas accessible only to designated staff. Key-operated switches are a second choice. All of the lighting systems in a building should be placed on the energy management systems, with motion detectors to turn off lights in non-sedentary spaces, if vacant for over 10 minutes. See HVAC section for other energy controls.

Fire Alarm System

See the North Carolina State Building Code for required locations of fire alarm pull stations and horns. Verify that enough horn/strobe lights are provided for sufficient coverage. Strobe lights are required in rest rooms. Connect ductwork smoke detectors into the fire alarm system and design to shut down the air handling units. Provide connections for the kitchen fire extinguishing system to the fire alarm system and the shunt trip mechanisms to disconnect the cooking equipment and the kitchen hood fans (NFPA).

Communications Systems

Thoughtful planning is required to accommodate sufficient numbers and proper locations of computers, telephones, TV, intercom/paging/radio and other integrated communication equipment. For the computer and other high-speed electronic equipment, the backbone can be fiber optic cables with "level 5" copper cables to the individual items of equipment. If connections to the State Information Highway are desired or required, fiber optic cables are required. Isolation transformers, surge suppression and lightning protection devices should be used to protect all electronic equipment and the panels to which they are connected. Sufficient wire ways should be installed and located for ample expansion. Cable tray over lay-in ceilings in corridors is the most common method for routing communications and computer cables.

Miscellaneous

Verify, *with the actual equipment installed*, properly sized circuit breakers, feeders and connections to elevators; mechanical and plumbing equipment such as boilers, chillers, pumps, air handling units, heat tape, fan coil units and water heaters; kitchen equipment such as steamers, ovens, fryers, mixers, dishwashers, booster heater for the dishwashers, exhaust and make-up fans in the hood, fly fans, serving lines, freezer and refrigerator compressors and evaporators; shop equipment and computers, intercom/paging/radio, telephone system, energy management system, intrusion equipment and TV.

Disconnect switches are required for all motors, water heaters and large laundry equipment. Even hand dryers are required to have disconnects as per NEC 422-21(b). The fifty feet and "in sight of" rules applies for all.

Additional Reference

A more complete document for the installation of mechanical and electrical systems in North Carolina schools is the MINIMUM CHECK LIST for MECHANICAL AND ELECTRICAL PLANS & SPECIFICATIONS. This publication can be ordered from School Planning.

Guidelines

Work Counter Heights

Pre-K-3	4-5	6-8	9-12
24" to 26"*	30"*	30" to 36"*	33"to 36"

* Handicapped standards for children up to age 12 must be met.

Marker/Chalkboard Rail Heights

Pre-K-3	4-5	6-8	9-12
21"-26"	28"-30"	29"-32"	33"-36"

Plumbing Fixture Mounting

Grades	Height (to rim)	*Handicap Requirements (Volume 1-C, NCSBC)*
Water Closets		
K-3	15"	***12"-15" Seat Height***
4-6	15"	***15"-17" Seat Height***
7-12	15"	16 °"-19°" Seat Height
Urinals		
K-3	14"-17"	14" max.
4-6	20"	14" max.
7-9	22"	17" max.
10-12	24"	17" max.
Lavatories		
PK-K	***24"***	***30" wide x 48" long side approach***
1-6	27"	***31" (24"min. knee space)***
7-12	31"	***34"-36"(29" min. bottom of apron)***
Drinking Fountains		
K-3	24"	30" ***max. spout height***
4-6	28"	30" ***max. spout height***
7-12	34"	36" ***max. spout height***
Showers		
K-5 Boys & Girls	50"-56" ***spray head***	***11"-17" high seat*** ***36" AFF controls if 60" flexible hose****
7-9 Boys	72" ***spray head***	***17"-19" seat height*** ***36" AFF controls if 60" flexible hose****
7-9 Girls	60"-66" ***spray head***	***17"-19" seat height*** ***36" AFF controls if 60" flexible hose****
10-12 Boys	72" ***spray head***	***17"-19" seat height*** ***36" AFF controls if 60" flexible hose****
10-12 Girls	66" ***spray head***	***17"-19" seat height*** ***36" AFF controls if 60" flexible hose****
		****48" AFF spray head if fixed***

Comments and Recommendations

Space Profiles

Upon request, School Planning can provide a computerized space profile for a given enrollment (Pre-K-5, 6-8 & 9-12).

Construction

School Planning strongly discourages any structural use of wood or other combustible material (type V or type VI) in new school construction or school additions.

Ceilings

2x2 Lay-in ceilings are most often used and are acceptable. Gypsum board is recommended in small spaces, low-ceiling areas, toilets and dressing rooms, and unsupervised areas. Multipurpose rooms and gymnasiums should have impact-resistant ceiling or a cementitious fiber roof deck for proper acoustics.

Walls

Masonry walls are preferred. Gypsum board stud walls require more maintenance. Chair rails and double layering of sheetrock are recommended for increased durability. Stud walls in administration and guidance areas may be preferred for flexibility.

Floors

Primary classrooms should have a good grade of carpet, since many activities take place on the floor. Resilient tile is recommended for other classrooms and for wet areas in carpeted rooms. Multipurpose rooms and gymnasiums should have resilient floors such as wood, synthetic or high density carpet.

Carpeting is often desirable in corridors for acoustical control. There should be a separate area of carpet at outside doors so that it can be replaced easily. Terrazzo is often used in corridors when durability is desired.

Lighting

Fluorescent lighting is recommended for general lighting. Incandescent lighting should only be used for limited accent lighting, stage lighting and special art room lighting. Gymnasiums should use metal halide fixtures. Metal halide should be considered in other large-volume spaces. Fluorescent fixtures should have T-8 lamps & electronic ballasts with three or four tubes, and double switching to control inside tube(s) separately. Fixtures in dishwashing areas and shower rooms should be rated for wet locations.

Handicapped Accessibility Standards

Many provisions of the Americans with Disabilities Act (ADA) are currently under consideration for incorporation into the North Carolina State Building Code.

Each teaching station should have an area that meets the requirements of the North Carolina State Building Code. In regular classrooms, this can be accomplished by rearranging the student work surfaces. Laboratories and other specialized areas may need one station modified for accessibility. Programs for exceptional children may entail design features that exceed the building code requirements.

Appendix

General Statute 115C-521. Erection of School Buildings

(a) It shall be the duty of local boards of education to provide classroom facilities adequate to meet the requirements of G.S. 115C-47 (10) and 115C-301. Local boards of education shall submit their long-range plans for meeting school facility needs to the State Board of Education by January 1, 1988, and every five years thereafter. In developing these plans, local boards of education shall consider the costs and feasibility of renovating old school buildings instead of replacing them.

(b) It shall be the duty of the boards of education of the several local school administrative school units of the State to make provisions for the public school term by providing adequate school buildings equipped with suitable school furniture and apparatus. The needs and the cost of those buildings, equipment, and apparatus, shall be presented each year when the school budget is submitted to the respective tax-levying authorities. The boards of commissioners shall be given a reasonable time to provide the funds which they, upon investigation, shall find to be necessary for providing their respective units with buildings suitably equipped, and it shall be the duty of the several boards of county commissioners to provide funds for the same.

Upon determination by a local board of education that the existing permanent school building does not have sufficient classrooms to house the pupil enrollment anticipated for the school, the local board of education may acquire and use as temporary classrooms for the operation of the school, relocatable or mobile classroom units, whether built on the lot or not, which units and method of use shall meet the approval of the School Planning Division of the State Board of Education, and which units shall comply with all applicable requirements of the North Carolina State Building Code and of the local building and electrical codes applicable to the area in which the school is located. These units shall also be anchored in a manner required to assure their structural safety in severe weather. The acquisition and installation of these units shall be subject in all respects to the provisions of Chapter 143 of the General Statutes. The provisions of Chapter 87, Article 1, of the General Statutes, shall not apply to persons, firms or corporations engaged in the sale or furnishing to local boards of education and the delivery and installation upon school sites of classroom trailers as a single building unit or of relocatable or mobile classrooms delivered in less than four units or sections.

(c) The building of all new school buildings and the repairing of all old school buildings shall be under the control and direction of, and by contract with, the board of education for which the building and repairing is done. If a board of education is considering building a new school building to replace an existing school building, the board shall not invest any construction money in the new building unless it submits to the State Superintendent and the State Superintendent submits to the North Carolina Historical Commission an analysis that compares the cost and feasibility of building the new building and of renovating the existing building and that clearly indicates the desirability of building the new building. No board of education shall invest any money in any new building until it has (i) developed plans based upon a consideration of the State Board's facilities guidelines, (ii) submitted these plans to the State Board for its review and comments, and (iii) reviewed the plans based upon a consideration of the comments it receives from the State Board. No local board of education shall contract for more money than is made available for the erection of a new building. However, this subsection shall not be construed so as to prevent boards of education from investing any money in buildings that are being constructed pursuant to a continuing contract of construction as provided for in G.S. 115C-441 (c1). All contracts for buildings shall be in writing and all buildings shall be inspected, received, and approved by the local superintendent and the architect before full payment is made therefor. Nothing in this subsection shall prohibit boards of education from repairing and altering buildings with the help of janitors and other regular employees of the board.

General Statute 115C-521. Erection of School Buildings

In the design and construction of new school buildings and in the renovation of existing school buildings that are required to be designed by an architect or engineer under G. S. 133-1.1, the local board of education shall participate in the planning and review process of the Energy Guidelines for School Design and Construction that are developed and maintained by the Department of Public Instruction and shall adopt local energy-use goals for building design and operation that take into account local conditions in an effort to reduce the impact of operation costs on local and State budgets. In the design and construction of new school facilities and in the repair and renovation of existing school facilities, the local board of education shall consider the placement and design of windows to use the climate of North Carolina for both light and ventilation in case of power shortages. A local board shall also consider the installation of solar energy systems in the school facilities whenever practical.

In the case of any school building erected, repaired, or equipped with any money loaned or granted by the State to any local school administrative unit, the State Board of Education, under any rules as it may deem advisable, may retain any amount not to exceed fifteen percent (15%) of the loan or grant, until the completed buildings, erected or repaired, in whole or in part, from the loan or grant funds, shall have been approved by a designated agent of the State Board of Education. Upon approval by the State Board of Education, the State Treasurer may pay the balance of the loan or grant to the treasurer of the local school administrative unit for which the loan or grant was made.

(d) Local boards of education shall make no contract for the erection or repair of any school building unless the site upon which it is located is owned in fee simple by the board: Provided, that the board of education of a local school administrative unit, with the approval of the board of county commissioners may appropriate funds to aid in the establishment of a school facility and the operation thereof in an adjoining local school administrative unit when a written agreement between the boards of education of the administrative units involved has been reached and the same recorded in the minutes of the boards, whereby children from the administrative unit making the appropriations shall be entitled to attend the school so established.

In all cases where title to property has been vested in the trustees of a special charter district which has been abolished and has not been reorganized, title to the property shall be vested in the local board of education of the county embracing the former special charter district. (1955, c. 1372, art. 15, ss 5-7; 1969, c. 1022, s. 1;1981, c. 423, s. 1; c. 638, s. 1; 1983, c. 761, s. 93; 1985, c. 783, s. 3; 1987, c. 622, s. 14; 1993, c. 416, s. 1; c. 465, s. 1; 1993 (Reg. Sess., 1994), c. 775, s. 6; 1995, c. 8, s. 1.)

(e) The State Board of Education shall establish within the Department of Public Instruction a central clearinghouse for access by local boards of education that my want to use a prototype design in the construction of school facilities. The State Board shall compile necessary publications and a computer database to distribute information on prototype designs to local school administrative units. All architects and engineers registered in North Carolina may submit plans for inclusion in the computer database and these plans may be accessed by any person. The original architect of record or engineer of record shall retain ownership and liability for a prototype design. The State Board may adopt rules it considers necessary to implement this subsection.

Feasibility and Cost Analysis, as Required by G.S.115C-521

The 1993 session of the General Assembly of North Carolina passed House Bill 1001, "AN ACT TO ENCOURAGE LOCAL BOARDS OF EDUCATION TO RENOVATE OLD SCHOOL BUILDINGS INSTEAD OF REPLACING THEM." This Act modifies General Statute 115C-521. It requires that "If a board of education is considering building a new school building to replace an older school building, the board shall not invest any construction money in any new building unless they submit to the State Superintendent and the North Carolina Historical Commission an analysis that compares the cost and feasibility of building the new building and of renovating the existing building and that clearly indicates the desirability of building the new building."

FEASIBILITY AND COST ANALYSIS forms shall be submitted to School Planning, NCDPI for review along with the first submittal of plans for review, whenever a new project would replace an older school building. The address for submittal of plans and the analysis is as follows:

NCDPI, School Planning
NC Education Building, 7th Floor
301 N. Wilmington St.
Raleigh, NC 27601-2825
(919) 715-1990

The feasibility and cost analysis forms are provided as a guideline. Other formats may be used, but comparisons must be based on useful life and cost per student.

FORMS AND ASSISTANCE ARE
AVAILABLE FROM
SCHOOL PLANNING.

Class Sizes and Teacher Allotments

State Regular Classroom Teacher Allotments (1996-97)

Grades	Teacher/Pupil Ratios
K-2	1:23
3-9	1:26
10-12	1:28.425

Maximum Legal Class Sizes (1995-96)

A class may exceed the allotment size by up to three students, provided the LEA average does not exceed the allotment (G.S. 115C - 301(c).

Pre-kindergarten Recommendations

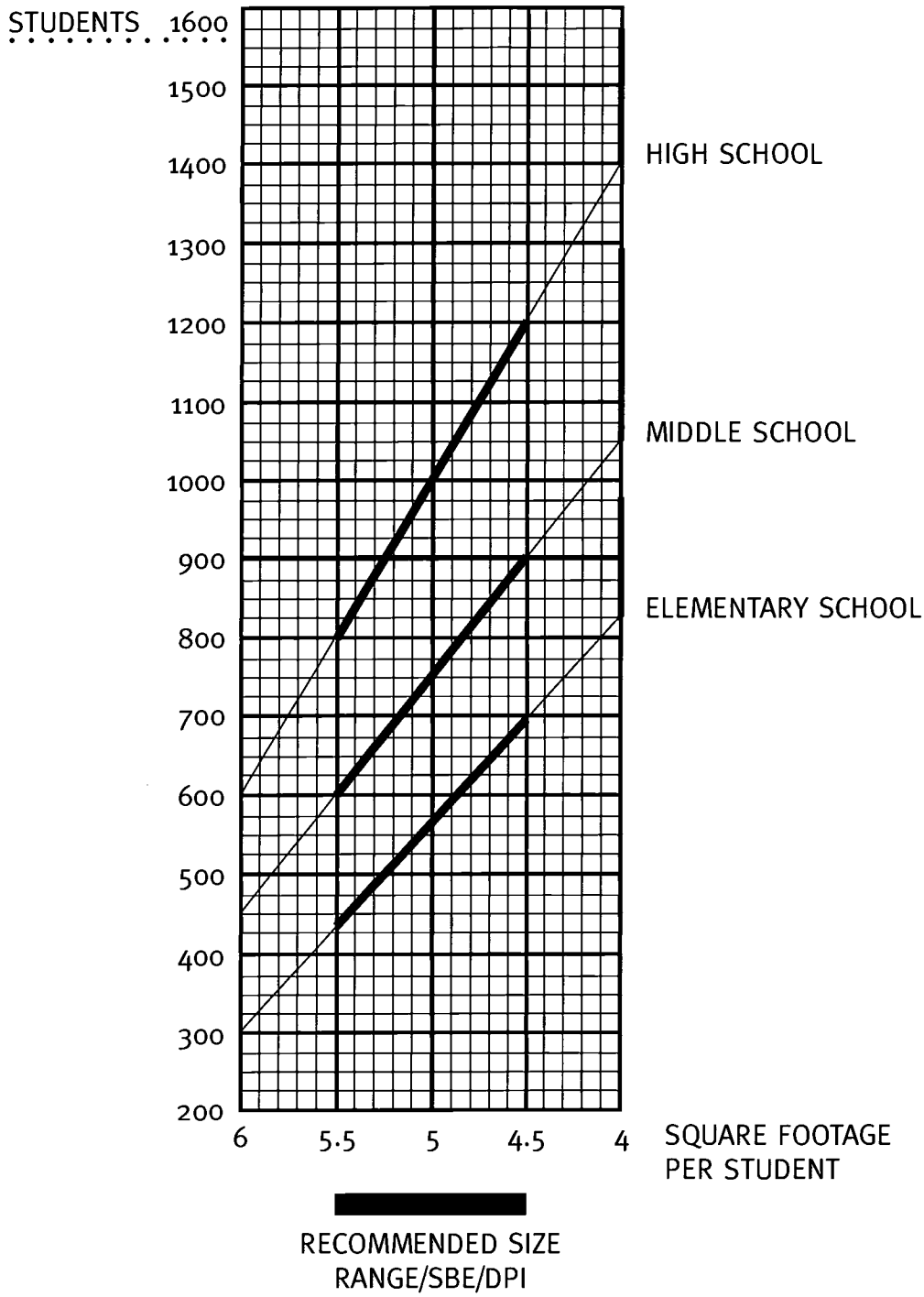
Grades	Teacher/Pupil Ratios
3 year old	1:8
4 year old	1:8 or 9

The maximum daily load for teachers teaching only in grades 7-12 is 150 students. Current State Board policy establishes the maximum class size at 50 students in selected areas such as music, physical education and similar classes, with the exception of activities such as band and choral music. Keyboarding classes are now subject to normal class size limits.

The maximum legal class size is a guide for determining the number of toilet fixtures required (see NCSBC, Volume II Plumbing 407.2.4.2).

Teacher allotments are a good guide, in the absence of more accurate information, for determining the population of individual classrooms, designing furniture layouts, etc. Note that by the use of local funds, or through the flexibility in the ABCs of Public Education, many local administrative units may reduce class sizes significantly below these allotment ratios or increase certain class sizes up to the maximum legal class size.

Suggested Sizing for Media Center Main Rooms



1600 SQ. FT. MINIMUM SIZE

Deviation from the NC Public School Facilities Guidelines

School Planning will evaluate plans for general compliance with the "Guidelines." Note that the "Guidelines" may not be applicable to facilities with non-traditional educational programs. Such facilities will be evaluated on the basis of their individual educational program. When deviations are identified during the review process, School Planning will prepare a "Deviation from the North Carolina Public School Facility Guidelines" form for inclusion in the permanent file for the individual school property, with a copy forwarded to the designer, and the local administrative unit. The completed form will describe the nature for the deviation. Deviations identified are available for reporting to the State Board of Education each quarter. Additional comments by School Planning may be submitted to the State Board along with the deviation form, if the issues are not clearly addressed.

The deviation form is on the following page.

Deviation from the NC Public School Facilities Guidelines

Date:
Local Board of Education:
Designer:
School Facility & Project:

The items noted below are significantly less than the guidelines adopted in the "North Carolina Public Schools Facility Guidelines." The failure to construct facilities equal to or better than these guidelines may result in the inability to provide an effective educational program, reduced function of the facility, impaired performance of building systems or other significant problems.

A copy of this notice is being placed in the permanent file for this school facility.

	Guidelines	Amount Shown	Comments/Explanation
Site			
K Regular Classrooms	1200 sq. ft.		
1-3 Regular Classrooms	1000 sq. ft.		
4-8 Regular Classrooms	850 sq. ft.		
9-12 Regular Classrooms	750 sq. ft.		
Science Classrooms/Labs			
Exceptional Children			
Music			
Visual Arts			
Theater			
Dance			
Workforce Development			
Media Center			
Physical Education			
Staff Offices			
Circulation			
Site pedestrian/vehicular separation	***no crossing***		
Other (Itemize)			

pc: _____ Board of Education
_____ Superintendent
_____ Designer
_____ Project File

Recommended Lighting Systems, with Illumination Levels

INTERIOR LOCATIONS	*Work Surface* Illumination in Foot-Candles* Minimum	Maximum	Maintained TYPE OF LIGHTING FIXTURES
Auditoriums			
Seating Area	10	15	Fluorescent (Dimming or Multiple Switching)
Stage Set-Up	20	30	Fluorescent
Concerts on Stage	50	75	Fluorescent
Drama with Accents	Variable	100	Incandescent (Tracks with Dimming Equipment)
Cafeterias			
Kitchen/Serving Area	50	75	Fluorescent
Dining Room	10	20	Fluorescent
Cashiers	20	30	Fluorescent (Task Lighting)
Dish Washing	20	30	Fluorescent (Listed for Wet Locations)
Classrooms			
General	50	75	Fluorescent
Art	50	75	Fluorescent and Incandescent
Computer	50	75	Fluorescent ***Indirect or Parabolic Lens***
Drafting	75	100	Fluorescent
Study Halls	50	75	Fluorescent
Home Economics	50	75	Fluorescent
Computer areas in classrooms	***50***	***75***	***Fluorescent indirect or parabolic lens***
General Laboratories	50	75	Fluorescent
Demonstration Laboratories	100	150	Fluorescent (Task Lighting)
Lipreading	100	150	Fluorescent
Music	50	75	Fluorescent
Sewing	75	100	Fluorescent (Task Lighting)
Shops	50	75	Fluorescent (Higher Levels Can be Used for Detail Works)
Typing	50	75	Fluorescent ***indirect or parabolic lens***
Corridors and Stairwells (Use Remote or Keyed Switching)			
Middle and High	20	30	Fluorescent
Elementary	10	15	Fluorescent
Trophy Cases	50	75	Compact Fluorescent
Wall "Washing"	Min. Amounts		Compact Fluorescent
Gymnasiums - Multiple Switching to Obtain Various Levels - Competition Games Versus Physical Education)			
Competition between Schools	30	50	Metal Halide
Physical Education	20	30	Metal Halide
Lockers and Showers	20	30	Fluorescent (Listed for Wet Locations)
Elementary (Multipurpose)	20	30	Metal Halide or Fluorescent
Mechanical, Electrical & Boiler Rooms	30	50	Fluorescent (Industrial Fixtures) or Incandescent if on while "Temporarily" Occupied

Recommended Lighting Systems, with Illumination Levels

INTERIOR LOCATIONS	***Work Surface*** Maintained Illumination in Foot-Candles* Minimum	Maximum	TYPE OF LIGHTING FIXTURES
Media Centers			
Reading Room, Check In/Out, Card Files	50	75	Fluorescent
Book Stacks, Magazine Racks	30	50	Fluorescent
Office Areas	50	75	Fluorescent
AV and Other Storage	7.5	10	Fluorescent
AV Repair	75	100	Fluorescent (Task Lighting)
Offices			
General Office Work	75	100	Fluorescent
Close Work	100	150	Fluorescent (Task Lighting)
Teacher Workroom	30	50	Fluorescent
Conference Room	30	50	Fluorescent
Storage Rooms, Pipe Chases, Attics, Crawl Spaces	7.5	10	Fluorescent (or Incandescent if on "Temporarily" While Occupied)
Swimming Pools	7.5	10	Metal Halide or Fluorescent (Listed for Wet Location)
Washrooms/Group Toilets	20	30	Fluorescent (Use Remote or Keyed Switching)
Washrooms/Faculty Toilets	10	15	Fluorescent

Exterior Locations (All Fixtures Shall be Listed for Wet Locations and Outdoor Use)

EXTERIOR LOCATIONS	***Work Surface*** Maintained Illumination in Foot-Candles* Minimum	Maximum	TYPE OF LIGHTING FIXTURES
Building Exterior (For Security Purposes)	1	1 1/2	High Pressure Sodium or Metal Halide
Parking Lots and Walkways	1	1 1/2	High Pressure Sodium or Metal Halide (Compact Fluorescent Can be Used for Walkways)
*Sports Complexes***			
Soccer/Football Stadium	30	50	Metal Halide
Badminton/Volley Ball/ Tennis Courts	20	30	Metal Halide
Baseball/Softball			
Outfield	15	30	Metal Halide
Infield	20	50	Metal Halide
Separate Running Tracks (Not a Part of a Football or Baseball Stadium)	15	15	Metal Halide
**Refer to NCHSAA for Their Requirements			

** Based on IES Recommendations*

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U.S. Department of Education
Office of Educational Research and Improvement (OERI)
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