

STATE OF NEW JERSEY
DEPARTMENT OF EDUCATION

175 West State Street

Trenton 8

GUIDE FOR
SCHOOLHOUSE PLANNING
AND
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Suggestions, Recommendations, and

The Laws and the Rules and

Regulations of the State

Board of Education

Concerning Public

Schoolbuildings

Revision
as Adopted by the
State Board of Education
Trenton, New Jersey

MARCH, 1952

GUIDE FOR SCHOOLHOUSE PLANNING AND CONSTRUCTION,

Adopted by the
State Board of Education
Trenton, New Jersey

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DEPARTMENT OF EDUCATION
175 West State Street
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Because of the impending great increase in enrollment, a crisis in school housing has been rapidly approaching all of our American states and most of our American communities. New Jersey is no exception. Many districts have already been forced to construct new buildings. Within the next decade it is probable that, for every three children now enrolled in our schools, another child will seek admission. One of the major tasks facing boards of education today is to provide the proper educational facilities for our growing school population.

For two years a committee of educators, architects, and school-board members has been working on the preparation of this Guide for Schoolhouse Planning and Construction, to replace the former New Jersey Schoolbuilding Code. The committee has tried to find ways by which the cost of school construction could be reduced, without impairing the educational opportunities offered to pupils. It has also sought to bring building requirements and recommendations in line with modern thinking and with new constructional materials now available.

What every community needs in its schoolhouse is a structure, and a setting for it, that will permit a community to have the best educational program that today's wisdom can devise, at the same time keeping the way open for the constantly improving program that the future will develop. Today's school building should be built to house, and make effective, the educational program which the community desires and needs. This Guide, with its minimum code requirements and its richness of suggestions and recommendations, is designed to protect the health, safety, and comfort of all pupils while simultaneously pointing out directions in which individual districts may move in providing buildings that far surpass minimum requirements.

This Guide has been adopted by the State Board of Education and is now operative. In its mimeographed form during the school year of 1950-51, it was distributed widely among educators, architects and school board members, Suggestions concerning its improvement were received from many sources. These have been considered on the basis of experience in use of the Guide to date by the

Code Revision Committee and in many instances have been incorporated as changes in this edition of the Guide.

It should be pointed out that the local Board of Education is primarily responsible for many features of the schoolhouse which is erected. Consultation by the Board, with the administration and staff concerning the nature of the educational program to be housed should be considered so advisable as almost to be mandatory. It is equally as important to select carefully an architect who can give wise guidance to the Board of Education as it makes decisions about the building problems confronted. Probably the most important step which the Board takes in consummating its building program is the selective process by which its architect is chosen.

The State Board of Education desires to express its great appreciation to the committee, whose names appear on the following page, for the earnest and capable service it has rendered by its preparation of this Guide. It is a service that will pay certain dividends in improved education for the children of New Jersey.

JOHN H. BOSSHART

Commissioner of Education

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Almost as urgent as the construction of new school buildings in New Jersey is the renovation, rehabilitation, and modernization of some of our existing school plants. Alterations in present facilities are least effective when haphazardly made; they are most effective when they are part of a carefully planned program of improvement.

Many school buildings of necessity have been continued in use, even after they have approached obsolescence. Because boards of education have desired not to spend too much money on such old buildings, repairs and maintenance costs have been pared to the minimum. In many instances safety conditions have grown increasingly worse, often aggravated by the non-fireproof interior construction of the buildings.

In such buildings it is not uncommon to find ancient toilet installations located in the basement; heating plants operating ineffectively on borrowed time; improper and inadequate lighting reduced to its lowest possible factor by dingy walls, somber ceilings, and dark woodwork; classroom facilities insufficient to meet pupil and teacher needs in today's educational program; and unimproved school sites deficient in provisions for proper outdoor activities. The health, safety, and comfort of pupils housed in such buildings merit the sincere attention of boards of education.

In many older buildings, programs involving major improvements can be undertaken, and will prove both advantageous and economical. Even a minor improvement program, possible in any building, will produce astounding benefits to pupils, teachers, and community. Interiors can be painted to develop the maximum reflection values of walls and ceilings. Artificial lighting can be improved, by increasing the number of fixtures and raising the wattage. A lighter, brighter learning environment is easily obtained even in the oldest buildings, and will pay dividends in the protection of children's vision.

It is neither necessary nor advisable for boards of education to postpone improvement programs until their resources permit them to embark upon the construction of new buildings. A planned survey of existing conditions will realistically approach the problem of providing better opportunities for those pupils whose educa-

tion is at present sorely handicapped by obsolete facilities. The rejuvenation of existing school plants is often the first step that should be taken to protect the safety, sight, health, and comfort of pupils.

A school building is erected to house an educational program, and therefore should be planned from the inside out. The school plant should ideally be considered an instrument of great value in furthering, facilitating, and making effective the type of educational program desired by the community.

The first task facing a school system considering new school construction is, therefore, to decide what grades and courses should be taught, what the curriculum content should be, and what basic educational methods should be encouraged. Underlying such decisions, of course, will be the philosophy of education, especially in respect to aims and purposes, accepted as desirable by the community.

To be able to plan intelligently a school building today, the persons responsible for planning should be at least cognizant of such points of view as the following, which have received wide-spread acceptance:

1. The schoolhouse is a place for many kinds of learning. No longer is the mastery of the three R's the only objective sought. Every member of a school staff is expected to guide pupils toward the attainment of a wide variety of objectives, each of which has a part in the development of a wholesome, effective, and well-rounded personality.
2. The schoolhouse itself can help teach children an appreciation of beauty, the orderly usefulness of space, the profitable interrelationships of parts, and the spirit of harmonious living.
3. A school building should be a place that will help children grow to their best, physically as well as mentally. Their sight, posture, nutrition, and every bodily process should be helped toward the ideal by the conditions of life at school.
4. School buildings should serve not only pupils and teachers, but also the community which provides the school.
5. Classes should not average more than twenty-five pupils, if the community hopes to provide an educational program fitted to the individual needs of children and to achieve a wide horizon of objectives. Children differ greatly in abilities, attitudes, needs, and other characteristics, and teachers cannot adapt

instruction to all the children unless class size is limited.

6. Classrooms and all instructional areas should be designed and equipped to provide the conditions under which children learn best. It is now known that children do not learn best when they sit, silent and unmoving, at a desk, with a book before them. They learn best when they work in a classroom designed as a laboratory for purposeful group planning, individual study and research, and class evaluation. The new classrooms, therefore, are provided with maps, globes, radio, record player, library corner, bookcases, encyclopedias, work bench, art easels, running water, storage for supplies, and movable desks and tables. Such learning laboratories, although housing fewer pupils, require larger floor areas than the learning program of former eras.
7. Larger buildings, serving larger areas, together with a realization of the need for nutrition education, have made advisable the inclusion of kitchens and lunchrooms in both elementary and high schools.
8. A modern program of education has come to need gymnasiums in high schools, together with related facilities such as dressing rooms, lockers, and showers. They are also considered essential in all except the very small elementary schools.
9. The music program in good schools, once limited to classroom choral work, now emphasizes bands, orchestras, a variety of choral groups, and individual instrumental work.
10. Play areas, for elementary and high schools, are increasing in size, thus forcing school boards to search for larger acreages for school sites. Such play areas are often adapted to community and adult use in evenings, on Saturdays, and in vacation periods.
11. Schools are, more and more, being made to house an educational program. There is a present trend toward one-story buildings. Basements have almost entirely been eliminated in new buildings except for heating plant and storage space.

12. Teachers and custodial employees should be brought early and continuously into the planning of the building, and should be encouraged to present suggestions for consideration. There is a trend, now, for pupils and citizens to participate also.
13. Every new building should possess possibilities for expansion.

In the planning of buildings, trends in educational organization, programs of instruction, and teaching methods are very worthy of serious consideration, since a school plant is built to serve not only the needs of today, but the needs of the future.

A well-planned school building will reflect thoughtful consideration of the:

1. Orientation of classrooms to obtain the best and most easily controlled daylight.
2. Various sizes and shapes of rooms, to fit the types of instruction and activity carried on in those rooms.
3. Reduction of traffic on stairs and in corridors, for pupils and materials.
4. Provisions for orderly pupil traffic flow with a minimum of congestion.
5. Relationship of classroom and service facilities, to make coordination more effective and to minimize student traffic.
6. Attempt to keep as much as possible of the school site area available for playground and outdoor educational purposes.
7. Shielding of such work areas as the library and classrooms from noise-producing activities carried on in rooms for choruses, band and orchestra, gymnasium, shop, and playground.
8. Protection of class, study, and assembly groups from the disturbing odors of laboratories and kitchens.
9. Construction materials used, the financial ability of the district, the community being served, the safety of the pupils, maintenance costs, and beauty.
10. Location of entrances easily available to persons who walk, come by bus, or come by automobile.

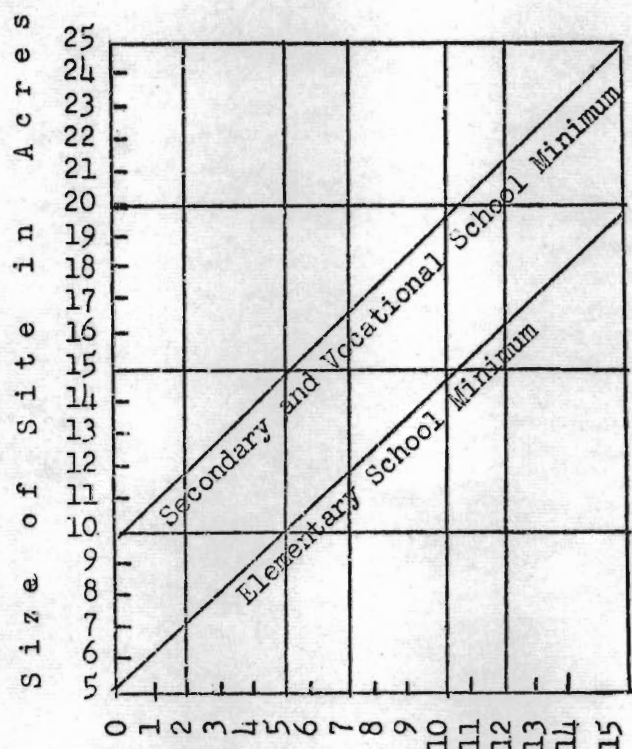
11. Pupil safety in approaching and leaving the building.
12. Health, safety, comfort, and efficiency factors, applicable to both pupil population and employed personnel.
13. Provisions for parking facilities, for pupils, teachers, visitors, and community.
14. Flexibility of the building, to permit reorganization of space to fit changing concepts of education and changing needs of the pupil population.
15. Possibilities of community use of the school facilities.

Selecting an Adequate Site

In the selection of a site for a school plant it is recommended that consideration be given to the following factors: size, topography, accessibility, environment, safety, health of pupils, accessibility to public utilities and services, and the orientation of the projected building on the site.

A. Size

The desirable size of a school site should be determined by the nature and scope of the contemplated educational program. As can be seen from the following chart on recommended minimum sizes, it is believed that every elementary school should be built on a site containing at least five acres, plus one acre for every hundred pupils enrolled. For high schools and vocational schools a minimum of ten acres is recommended, plus one acre for every hundred pupils enrolled.



Ultimate Number of Pupils in School in Hundreds

B. Topography

Fine grounds are essential to a fine building. A natural elevation with satisfactory approaches for avoiding long or difficult climbs makes a desirable setting. The site should be free from drainage from contiguous territory and should permit proper drainage throughout at a reasonable cost. Rapid drainage and

quick drying should characterize the parts of the plot which are expected to serve as recreational and play areas. A clay subsoil is not considered to be so satisfactory as sandy loam, fertile enough to produce good lawns and vigorous landscaping growth.

C. Accessibility

Schools should usually be located near the center of the present and the probable future school population which is to be served. The travel time of pupils to be transported should rarely exceed thirty minutes for elementary school pupils or one hour for secondary school pupils.

D. Environment

Most school grounds are planned to contain lawns, foundation plants to "tie" the buildings to the ground, hardy shrubs placed at the angles and curves of drives and walks, tall trees to frame the building, and trees planted in groves for shade. Among the common classes of plants used are shade trees, smaller ornamental trees, coniferous evergreens, broad-leaved evergreen shrubs, deciduous flowering shrubs, vines, and ground covers. Whatever is planted should be grouped with respect to height, color, and cultivation requirements.

Because attractive physical surroundings have an especially strong influence on youth, the environment of a school site is a very important factor. The activities conducted within a school call for quiet surroundings, clean fresh air, abundant sunshine, and freedom from disturbing noises and the turmoil of crowded neighborhoods. Isolation from undesirable commercial enterprises should be sought. If possible, close proximity to sanitariums and hospitals should be avoided. Resourceful treatment of landscaping can usually minimize the disfiguring effects of such essential but unsightly facilities as parking areas, service drives, and refuse-disposal units.

E. Safety

A major objective in selecting a site is to provide conditions conducive to the safety of children. The location of the building on the site should permit children to pass through a safety zone before being confronted by traffic dangers. If at all possible, children should not be forced, by the location of the

school, to cross railroads, automobile speedways, or heavy traffic lines. The site should be free from fire, water, air, or land hazards. Automobile roads within the site should be constructed to accommodate one-way traffic only, with proper signs indicating clearly their directional use. Where buses are used for transportation, careful consideration should be given to the loading and unloading facilities, to achieve the maximum of safety for the children. Parking space should be provided, properly related to school use. If possible, a separate parking space for school visitors, located near the main entrance, should be provided. Dividends will accrue when parking facilities used for evening functions are amply lighted.

F. Health of Pupils

Since the building in its environment is expected to be a healthful place for human beings to live, work, and mature, there should be present no factor that will interfere with the natural lighting of the rooms, nor should the site suffer from odors, dust, or polluted air blown from industrial centers, streets, or unfinished playgrounds.

G. Accessibility to Public Utilities and Services

Economy, as well as convenience and efficiency, would dictate that inexpensive access to gas, water, sewer, electric, and telephone service be considered in acquiring a site. Since it is recommended that all public utility services be placed underground, it can readily be seen that extensive pipe-laying and wiring, connected with distant points, would involve large financial expenditures.

H. Orientation of the Building

It is advisable to locate the building on the site in such a way as to permit the maximum use of the light area and to allow for possible future additions. For unilateral lighting it is more important to orient the building to provide the best seeing conditions in the classrooms than to locate it with regard to the axis of roads, streets, or other physical features. East and west exposures for the majority of the rooms are generally considered most satisfactory. Because the best orientation is that which avoids early morning or late afternoon sun at

right angles to the classroom, it is desirable that the building be built to face slightly south of east and north of west.

Constructing a Serviceable School

This chapter deals with the planning of rooms and school facilities to the end that the educational program to be housed in the building will achieve its potential effectiveness. Included herein are code requirements and recommendations concerning floor areas, rooms below grade, ceiling heights, chalkboards, tackboards, corridors, exits, floors, interior courts, interior doors, lockers and wardrobes, stairways, ramps, and windows.

It must be remembered that these are requirements and recommendations for new buildings and additions. Alterations to existing buildings shall comply with the guide as far as practicable.

A. Floor Areas

1. Minimum requirements -- Every instructional area shall contain at least 20 square feet for each child to be accommodated exclusive of lockers, clothing wardrobes and other fixed storage spaces, and cabinets, except that kindergartens shall contain not less than 24 square feet per pupil.
2. Recommendation -- It is recommended that:
 - a. Classroom areas contain a greater number of square feet per pupil than the minimum requirements and shall contain adequate storage space for projects, books, materials, supplies, teachers' equipment, lavatories, sinks, and drinking fountains.

B. Rooms Below Grade

1. When a school building has a basement the ceiling of which is 7'6" or more above the finished grade line at any point, such basement shall be considered a story in determining the number of stories.
2. No room used for instructional purposes in new buildings shall have its floor more than 2 feet below the outside grade on those sides that contain windows or exterior doors.
3. In no case shall an auditorium, assembly room, or gymnasium be so situated that an occupant of its main floor, using main exits, must descend or ascend more than 8'0" to reach outside grade.

C. Ceiling Heights

13.

1. Minimum requirements for classrooms with unilateral lighting: The distance from the floor to the top of the glass of the windows shall be equal to or greater than one-half the width of the room less one foot. In no case shall the average ceiling height be less than 10'6". No part of the ceiling height at any point shall be less than 9'0".
2. Minimum requirements for classrooms with bilateral or multilateral lighting: The average ceiling height shall be equal to or greater than one-third the width of the room, but in no case shall the average height be less than 10'6". No part of the ceiling height at any point shall be less than 9'0".
3. Minimum requirements for classrooms with lighting from one side and one end: The ceiling height shall be the same as for unilateral lighting.
4. Minimum requirements for shops and laboratories: The ceiling height shall be appropriate to the use of the room, but in no case shall it be less than 10'6".
5. Minimum requirements for home economics, food and clothing laboratories, when in separate new home economics cottages: The ceiling height shall be at least 9'6". The ceiling height of other areas in these rooms may be normal to home environment. (See Appendix, page 56, for regulations pertaining to use of former private residences as home economics buildings.)

D. Chalkboards

Recommended height from floor to chalk rail:

<u>Kindergarten</u>	<u>26 inches</u>
<u>First to third grades</u>	<u>28 inches</u>
<u>Fourth to sixth grades</u>	<u>30 inches</u>
<u>Seventh to ninth grades</u>	<u>32-34 inches</u>
<u>Tenth to twelfth grades</u>	<u>34-38 inches</u>

E. Tackboards

Recommended height from floor to tackboard is the same as for chalkboards.

F. Corridors

1. For corridors which contain no lockers:
 - a. With rooms on one side, the clear width shall be not less than 7'0".

- b. With rooms on two sides, the clear width shall be not less than 8'0".
 - c. Corridors may be reduced 1'0" in width where classrooms are provided with exterior door exits direct to grade and doors to corridors may open into the room.
 - d. Where doors to corridors when opened at 90 degrees project into corridor not more than 1'0", such corridors may be reduced 1'0" in width.
2. For corridors which contain lockers:
- a. With lockers on one side, the clear width for secondary schools shall be not less than 9'0" from face of lockers.
 - b. With lockers on two sides, the clear width for secondary schools shall be not less than 10'0" between face of lockers.
 - c. For elementary schools the width of the corridors may be 1'0" less than "a" and "b" above.
3. There shall be no structural projections more than 8" and in no case shall the width of the corridor at piers or projections be reduced below the prescribed minimum.
4. Drinking fountains shall not project more than eight inches.
5. Radiators, fire extinguishers, and other recessed equipment shall not project more than 2" beyond the face of corridor walls.
6. Each corridor on the first floor shall terminate with a direct exit to exterior of building.
7. Minimum ceiling height of corridors shall be 8'0".
8. Recommendations:
- a. Acoustical ceilings should be used in all corridors.
 - b. Doors to rooms should be recessed in corridor walls where possible.

G. Exits

1. A unit of exit door width shall be 24" clear, except that a 42-inch opening may be considered as two units.
2. No single exit door shall be less than 36 inches wide. Leaves of double doors or mullioned doors shall be not less than 30 inches wide.
3. The minimum number of exit door widths from the first or entrance story shall be:
 - a. One unit of exit width for every three instructional rooms on the

first or entrance story, plus

- b. One unit for each required unit of stairway width from upper floors, plus
 - c. One unit of exit for each required unit of stairway width from the rooms below grade.
 - d. One unit of exit for each 750 square feet of floor area of auditorium, or gymnasium if it is used for assembly or as an auditorium.
 - e. One unit of exit for each 300 square feet of floor area of the auditorium or gymnasium in one-story frame buildings.
4. At least one stairway or exit shall be within 120 feet or not more than the length of three classrooms, as measured along the line of travel, of each door of all rooms used by pupils.
 5. Every room, gallery, balcony, or other space having a capacity of 100 or more persons, shall have at least two exit doorways. Every room, gallery, balcony, or other space having a capacity of 600 to 700 persons shall have at least three exit doorways. Where the capacity of such space is more than 700 persons, there shall be not less than four exit doorways.
 6. Such required exits may use communicating hallways or corridors leading to exterior exits, but the required exit ways from any one place of assembly shall not use a common stairway.
 7. There shall be at least two exits for all heater rooms, one of which must lead to the exterior of the building. The exit to the interior of the building shall have two doors equipped with self-closing hardware.
 8. Exit doors from the building shall be provided with bar type anti-panic hardware.
 9. Recommendation
Where classrooms are provided with individual exterior doors, the corridor doors may swing into the classroom.

H. Floors

1. Concrete floors without floor covering shall not be permitted in instruc-

tional areas, except in shops.

2. Wood floors shall not be permitted in corridors, except in one-story buildings of frame construction.

3. Recommendations

- a. Linoleum, asphalt tile, rubber tile, and hardwood are recommended for the floors of instructional rooms.
- b. Terrazzo, linoleum, asphalt tile, ceramic and quarry tile are recommended for corridor floors.
- c. Wood floors in woodworking shops and other similar areas are recommended.

- I. Interior Courts

The horizontal distance from any school room window to any light obstruction of an interior court wall, top of cornice, or parapet opposite the window shall be twice the height from the window sill to the top of the obstruction.

- J. Interior Doors

1. No door opening from an instructional room into the corridor shall be less than 36 inches wide, and all such doors shall swing out into the corridor towards the nearest exit of stairway, unless otherwise permitted. No door shall be located to offer any obstruction or blocking of maximum free opening from rooms, stairways, and exits.
2. Locks on all doors of instructional rooms shall be operative from the inside at all times.
3. Doors to toilet rooms and smoke screens shall have door closers.
4. Doors to smoke screens shall be solid core veneered doors, 1-3/4 inches thick, kalamein or hollow metal, except in one-story buildings. Doors shall contain glass panels of clear wire plate glass.
5. Exterior entrance and exit doors shall contain glass panels of clear plate glass. Any glass area behind anti-panic bolts shall be clear wire plate glass.

6. No door to an auxiliary room shall be less than 24 inches wide. No single leaf of double doors used as exits shall be less than 30 inches wide.
7. Heater rooms shall be shut off from the interior of a building by a Class "B" Fire door.
8. Doors to the stage, fan room, head of basement stairs, and attic and roof spaces shall be metal clad doors.
9. Recommendation: Doors to instructional rooms should contain vision panels.

K. Lockers and Wardrobes

1. Provision shall be made for the ventilation and storage of pupils' clothing.
2. Corridor lockers shall be recessed and ventilated.

L. Stairways

1. Every building of two or more stories not exceeding 12 classrooms above the first floor shall have not less than two stairways remote from each other. For each 6 additional classrooms or fraction thereof above the first floor, one additional stairway shall be provided.
2. At least one stairway or exit shall be within 120 feet or not more than the length of three classrooms as measured along the line of travel.
3. Stairways shall be so located with respect to corridors, passages, and rooms that no corridor shall extend beyond the stairs a greater distance than the width of the corridor.
4. A unit of stairway width shall be 24 inches, except that 42 inches may be considered as two units, the same as the exit unit width. All widths shall be taken clear (not including handrails and newels). No exit stairway shall be less than 42 inches wide between handrails.
5. One unit of stairway width shall be required for every three classrooms or instructional rooms, or fraction thereof, above the first floor.
6. No stairrun shall exceed 15 risers in height.
7. Risers in stairways shall not exceed seven inches in height.
8. Treads shall be not less than 12 inches, including nosing, which shall not exceed 1 inch.

9. Treads and landings shall have an approved non-slip surface flush with the adjoining surfaces.
10. Landings shall maintain a width and depth not less than the stairs they serve.
11. Winders will not be permitted on exit stairs.
12. The distance from the first riser to the smoke-screen door shall be equal to twice the width of the smoke-screen door.
13. Handrails shall be provided upon both sides of the stairs. Inside handrails shall be continuous from the top to the bottom. Balustrades at sides of stairs shall be not less than four feet high.
14. All stairways shall be built of incombustible materials. The enclosing walls shall be of fire-resistive construction, with two-hour rating.
15. All stairs shall be enclosed with smoke doors.
16. There shall be no storage spaces or closets under or over stairs.
17. Stairways shall be lighted by natural light.
18. All stairs and landings shall be designed to sustain a live load of 100 pounds per square foot.
19. Open wells shall not be permitted.
20. Recommendation: The corners at the exterior wall of landings should be splayed at an angle of 45° for a distance of 12".

M. Ramps

1. No ramp for pupil use shall exceed a one-foot rise for each ten feet of run,
2. Ramp floors shall have a non-slip finish.

N. Windows

1. For classrooms with unilateral lighting, windows shall be located in one wall only, parallel to the longest axis of the room.
2. For classrooms with multilateral lighting, the principal windows shall be located as for unilateral lighting. Supplementary windows in the opposite wall or in the rear wall will be permissible.

3. Windows in all instructional rooms shall provide a net glass area (exclusive of sash stiles and mullions) of not less than 18 per cent of the floor area. Glass block will be permitted in window areas of instructional rooms, starting at a height of not less than six feet above the floor. All glass block used in classroom areas shall be of the directional type.
4. Where glass block is used, the glass area shall be approximately 25 per cent greater than the area required for clear glass, to offset the loss of light transmitted. The top of the glass shall be as near to the finished ceiling as the construction will permit.
5. Window guards, when used, shall be of open-wire mesh, arranged so that they may be easily opened from the inside.
6. Natural light shall be provided in all pupil toilet rooms except individual toilets, and the glass area of window or windows shall be not less than 10 per cent of the floor area.
7. Recommendation:
Multilateral lighting is recommended for kindergartens, science laboratories, homemaking laboratories, and shops.
8. Recommendation:
Shades, venetian blinds, or other approved light diffusers should be provided on all classroom windows, so that any portion of the window can be shaded.
9. Recommendation:
Fly screens should be provided for windows of food laboratories, kitchens, and cafeterias.

Building a Healthful School Plant

Developing and maintaining good health is part of a pupil's education.

In the designing of a new school plant, health is an objective in itself; it is also a means by which other objectives can be better realized. Tests indicate that unless pupils have adequate lighting, reading deficiencies increase and learning suffers. If pupils aren't protected against excessive noise, distractions may affect adversely the learning rate. Unless the temperature is a comfortable one, classroom accomplishment is handicapped. It is a matter of immediate and ultimate economy to provide children with healthful and wholesome conditions.

In this chapter are described the requirements and recommendations regarding lighting, ventilation, heating plants, sanitation, toilet facilities, and drinking fountains. Also, because school lighting is now in a period of rapid transition and wide-spread experimentation, a background of information concerning present-day thinking is presented.

A. Lighting

A new concept of lighting for visual comfort and efficiency uses the foot-lambert as a unit of measurement, in addition to the foot-candle.

The foot-candle, which has traditionally been our only measuring unit, gives the light intensity at a given point while the foot-lambert is the unit employed to measure the brightness of surfaces or the light reflected back to the eye from the task-surface, which is in reality the light we see with. In other words, it is the light reflected back to the eye from the pages of the book in the child's hand, or the light reflected from the paper upon which the pupil is writing, that determines whether "seeing" conditions are good.

In any consideration of school lighting today, the quality of light merits as much attention as the quantity of light, for it has been proved that the ability to see comfortably and efficiently does not increase in direct ratio to the quantity of light available.

Brightness-balance is now accepted as the key to visual comfort and efficiency. Brightness-balance is controlled by the brightness-differences that are

maintained within the total visual field. A desirable balance can be established in a visual environment surrounding a task if the brightness-difference within the central field (for example, the light reflected from the floor, the desk top, and the paper) are kept high, while the differences between the central field and the surrounding and peripheral fields are kept low. Thus a pupil raising his eyes from his desk to look at a blackboard or a picture in the far corner of the room should have reflected back to his eyes approximately the same amount of light to which he had become accustomed when looking at the paper on his desk. Eye comfort can often be obtained by reducing sources of excessively high brightness and by brightening the dark areas that exist in the total visual field.

A desirable goal for visual comfort and efficiency is so to light a room that no area or light source in the total visual field will be brighter than three times the task or less than one-third as bright as the task, with the general level of illumination kept high. Any room conditioning which works toward this goal is a step toward creating a better visual environment.

Although not theoretically ideal, the following conditions of brightness-differences are attainable in schoolrooms today at reasonable costs: (1) The brightness of any surface within the surrounding field can be so controlled that it will not be more than three times nor less than one-third that of the task. (2) The brightness of any surface of appreciable area within the peripheral field can be so controlled that it will not be more than ten times nor less than one-tenth that of the task.

The central field is not a fixed environmental factor since it varies with the task. With other factors remaining constant, visual comfort and efficiency increase with the increase in brightness-difference within the task or central field. A brightness-difference within the central field of from 80 to 90 per cent is readily attainable.

In schoolrooms where critical seeing is done, brightness is commonly created by daylight and artificial light. Most schools depend upon daylight as the prime source to create brightness, and use artificial light to supplement daylight when acceptable brightness levels cannot be maintained without it. All recommenda-

tions or requirements mentioned in this section refer to brightness or foot-candle levels, and are based upon the combined light energy produced by daylight and any system of artificial lighting used in schoolrooms. If it becomes necessary to choose between two artificial lighting systems, one of which produces high intensities with extreme brightness and the other a reasonable intensity with comfortable brightness, the latter should be chosen.

In order that the proper quality of light be provided, attention should be paid to the reflection factors present in the entire classroom: windows, lighting fixtures, ceiling, walls, doors, furniture, and equipment. Otherwise the brightness-difference suggested for the surrounding field is almost unobtainable, for the efficient utilization of light energy, whether from daylight or artificial sources, is dependent upon the reflection factor of the surface upon which it falls.

It seems agreed that the brightness of any schoolroom surface should never exceed 500 foot-lamberts. The necessity for controls is very evident when the foot-lamberts derived from various light sources and surfaces are studied:

Clear sky.....	1000 F. L.
White clouds.....	3000-5000
Sunlight on white building.....	8000
Sunlight on trees.....	320
Bare 200-watt filament lamp.....	65000
Enclosing globe.....	1200
Bare fluorescent lamps (48")	
at 90°angle to axis.....	1900
at 30°angle to axis.....	1400
shielded fluorescent fixtures (U.R.C.).....	500
White ceilings above indirect fixtures	
500-watt hung 30" from ceiling.....	75
500-watt hung 48" from ceiling.....	45
750-watt hung 48" from ceiling.....	65
Blackboard with 25 F.C. (10% R.F.).....	2.5

The importance of good classroom lighting cannot be too strongly stressed. Regardless of where a pupil sits in a classroom, he should have the quantity and quality of light sufficient for seeing comfort and efficiency.

The intensity of light entering through the windows of a classroom falls very rapidly as the distance from the windows increases. Even under the most favorable conditions of weather and orientation, the amount of light as measured by foot-candles usually falls far below the desired standards for artificial lighting.

Most authorities agree that satisfactory minimum intensities for natural lighting are higher than those deemed satisfactory for artificial lighting. Since the higher values are desirable, it is advisable to evaluate lighting on the basis of the minimum intensities provided rather than on the average. Because glare, either direct or reflected, affects adversely the eyes of pupils, no pupil, except in certain shop situations, should have to use a desk facing a window. It has long been recognized that strong contrasts and shadows were objectionable, a fact which has largely been responsible for unilateral lighting becoming the standard for school design. The height of windows has a direct bearing on light distribution, for it is from the upper part of a window that the far side of a room receives its greatest benefit.

School lighting is in a period of wide-spread experimentation at the present time. Practical versus optimum conditions dictate that a code make specific requirements which are both educationally acceptable and pragmatically feasible now. As science and research make optimum conditions more attainable, revisions in code requirements will undoubtedly occur.

The purpose of this section will be served, however, if schoolhouse planners consider seriously both the quality and the quantity of the artificial lighting they provide. To obtain quality of light, they must supply more than glass area and wattage; they must be concerned with the brightness-balance of natural and artificial light sources and of reflecting surfaces within the total visual field. In considering quantity of light, they must realize that schoolroom conditions often subject pupils engaged in visual tasks to such brightness-differences as 65,000 foot-lamberts from a bare 200-watt lamp, 3000 foot-lamberts from an overcast sky, and two foot-lamberts from dark furniture and the blackboard. Such quantitative differences do not build eye health.

The foot-candle intensities in the code requirements that follow will produce desirable foot-lambert brightnesses if surfaces are properly prepared and if the light sources are properly directed and shielded.

1. The various rooms and areas in a school building shall be so lighted that the following minimum foot-candle intensities on working planes can be achieved,

when installed. The measurements shall be taken at night, with only the artificial sources of light used. The second column of foot-candle intensities contains recommendations, not requirements.

Foot-Candles on Working Plane When Installed

	<u>Mandatory Minimum</u>	<u>Recommended</u>
Classrooms, Offices, Laboratories	20	30
Sewing, Drafting Rooms	25	35
Sight-Saving Rooms	50	50
Art Rooms	25	35
Shops (generally same as classrooms)	20	30
Shops - Vocational (micrometer work)	25	35
Study Halls	20	30
Libraries	20	30
Cafeterias (not for study)	10	15
Cafeteria kitchens	20	30
Gymnasiums	15	20
Swimming Pools	10	20
Auditoriums (not for study)	5	10
Corridors and Stairhalls	10	10
Lockers, Team Rooms, etc.	10	15

2. Lamps and tubes must be adequately shielded.
3. Classroom lights shall be operated by at least two switches, one switch controlling the lights parallel to and nearest the windows, the other controlling lights nearest the inside wall of the room.
4. The following reflection factors are recommended for instructional areas:
 - Ceilings: at least 85%
 - Walls: at least 60% (as soon as practicable)
 - Wainscot, trim, etc.: at least 40%
 - Furniture: at least 30%
 - Chalkboards: at least 20%

B. Ventilation

1. All school buildings shall have a mechanical system of ventilation by means of which, during the period of occupancy, each classroom and other instructional areas shall be supplied with a minimum outdoor change of ten cubic feet of standard air per minute per pupil, and exhausted by mechanical or gravity exhaust.
2. Mechanical ventilation shall be provided at the rate of two changes per hour for gymnasium and combined gymnasium-auditoriums, and four changes per hour for auditoriums. It is recommended that auxiliary summer-ventilation be provided.
3. Mechanical ventilation shall be provided in student cafeterias on the basis of not less than four air changes per hour; for cafeteria kitchens on the basis of not less than twelve air changes per hour; and for locker rooms, shower rooms, toilet rooms, and janitors' service rooms on the basis of not less than six changes per hour.
4. A mechanical air supply and exhaust system shall be provided for all swimming pools, with not less than six air changes per hour.
5. Re-circulation of air is permitted, provided that the minimum quantity of outdoor air, as previously mentioned, is furnished for the several different locations.
6. Ventilating flues or ducts leading from toilet rooms shall not connect with those leading to or from any other areas, except slop-sink or certain utility areas.
7. It is recommended that special consideration be given to provide an exhaust system for the removal of dust, fumes, smoke, and heat from all shops.

C. Heating Plants

1. The heating plant shall be capable of heating all parts of the building to

a uniform temperature of 70 degrees in zero weather, and shall have an automatic temperature control system with a mechanical ventilating system that will furnish the required amount of fresh air in each area as required.

2. Heater rooms shall be provided with outside air intake for the proper combustion of fuel. The free area of the intake shall be not less than 75 per cent of the smoke-stack area.
3. All coal, liquid, gas-fired boilers, vessels, or furnaces used for heating or for domestic hot water shall be provided with all prescribed safety devices recommended by the National Board of Fire Underwriters (January, 1950) and required by the local municipal ordinances if approved by the State Board of Education. These shall include solinoid vapor valves on all gas pilot lines serving oil-burning equipment.
4. Where bottled gas is used for any purpose, location of containers shall be in accordance with standards of the National Board of Fire Underwriters for the storage and handling of liquefied petroleum gases as recommended by the National Fire Protection Association, September, 1951.
5. It is strongly recommended that, in general, piping be run exposed, or otherwise accessible, to make possible low maintenance cost.

NOTE: This Guide does not prevent the use of direct radiation, central warm-air heating, radiant heat, heating by unit ventilators, or any combination of such methods, providing automatic temperature control is provided as required by Section C-1.

D. Sanitation

1. All plumbing installations shall conform to the requirements of the published local plumbing code of the municipality where the school building is located, provided that the municipal code has been submitted to and approved by the State Board of Education.

2. Where approved plumbing codes do not exist, all plumbing work shall be installed in accordance with the latest recommended requirements for plumbing, as issued by the United States Department of Commerce, Bureau of Standards, Washington, D. C.
3. Where adequate sewage disposal facilities are not available, septic tanks and drainage systems shall be constructed in accordance with the rules and regulations prescribed by the New Jersey State Department of Health.
4. Where an approved public water supply is not available, provisions for drinking water shall be made in accordance with the rules and regulations as prescribed by the New Jersey State Department of Health.

E. Toilet Facilities

1. The following ratio of sanitary fixtures shall be considered minimum requirements in school buildings:

Water closets

Girls - Grades one through eight	One to 25 pupils
Boys - Grades one through eight	One to 40 pupils
Girls - Grades seven through twelve	One to 45 pupils
Boys - Grades seven through twelve	One to 60 pupils

Urinals

Boys - Grades one through six	One to 30 pupils
Boys - Grades seven through twelve	One to 45 pupils

When flushometer valves are used, they shall be provided with approved vacuum breakers.

Lavatories

Boys and Girls -- All Grades One to 40 pupils. This ratio shall include individual classroom fixtures, except that there shall be at least two lavatories in every general toilet room.

2. Kindergarten rooms shall be equipped with separate water closet facilities.

men teachers, women teachers, custodians, cafeteria workers, health rooms, and shower and locker rooms. Such facilities should also be provided for public use, near the auditorium-gymnasium.

14. It is recommended that all wash basins, sinks, service sinks, and showers be provided with domestic hot water, installed with a circulatory line that will provide hot water immediately at each location.
15. The temperature of hot water, when used, shall be thermostatically controlled.

F. Drinking Fountains

1. Two drinking fountains shall be provided in any school; in an elementary school, one fountain shall be supplied for each 50 pupils up to 250 pupils. Thereafter, add one fountain for each 75 pupils up to 550 pupils. Thereafter, add one fountain for each 100 pupils. In a high school, one fountain shall be supplied for each 75 pupils up to 300 pupils. Thereafter, add one fountain for each additional 125 pupils up to 550 pupils. Thereafter, add one fountain for each 200 pupils.
2. Drinking fountains shall be of the angle-spray type.
3. Separate drinking fountains shall be provided in kindergarten rooms.
4. Drinking fountains shall not be installed in toilet rooms or attached to lavatories or sinks.
5. The following are the recommended heights from floor to rim of fixture:

<u>Grades one to three.....</u>	<u>24"</u>
<u>Grades four to six.....</u>	<u>28"</u>
<u>Grades seven to nine.....</u>	<u>32"</u>
<u>Grades ten to twelve.....</u>	<u>36"</u>
6. It is recommended that drinking fountains be distributed throughout the building and that special consideration be given to placing auxiliary drinking fountains in cafeterias, lunch rooms, play areas, and play grounds.

Building a Safe School Plant

School officials have no greater responsibility to their communities than to provide and maintain school plants that will assure every reasonable safeguard to the life, limb, and health of persons required or permitted to enter upon the premises or to use the facilities. This responsibility first evidences itself in the selection of the site, and carries through the planning of the building, the development of the school grounds, and the utilization of the plant.

This chapter contains code requirements and recommendations concerning fire escapes, protection from machinery in industrial shops, fire resistance, structural design standards, minimum design loads, and installations for safety and convenience.

A. Fire Escapes

1. Where fire escapes are found necessary:

- a. They shall be constructed of iron strings, treads, platforms, and closed risers, said risers being not more than seven inches high and the treads not less than $10\frac{1}{2}$ inches in width. Treads and platforms must have gratings of the reticulated type with interstices not exceeding $\frac{3}{4}$ of an inch.
- b. The top platform shall be not more than five inches below the adjoining floor, and entrance to the platform shall be by means of a door, which shall be cut down to the level of the floor. Platforms shall be at least the width of the masonry opening of the doors which they serve.
- c. The stairs shall be not less than 36 inches wide, supported on metal columns. Stairs shall extend uninterrupted to the ground level.
- d. Long runs shall have intermediate landings not less than 3'6" wide. Runs shall not be continuous in the same direction, but shall return on themselves.

- e. The outside strings shall be protected by a heavy galvanized wire-mesh screen or other approved protective railing not less than five feet high.
- f. Whenever windows are located beneath or within 10'0" of fire escapes, they shall be glazed with wire glass.
- g. Handrails shall be provided for each side of the stairs.
- h. Gates shall not be permitted at the foot of any fire escape.

B. Protection from Machinery in Industrial Shops

The protection from machinery in industrial shops shall be in accordance with the requirements of the Vocational Division of the New Jersey State Department of Education.

C. Fire Resistance

Four types of construction affected differently by fire are recognized by this Guide as follows:

1. Frame Construction. This shall be as defined by Subsection "a-1" of section 18:7-91 of the Revised Statutes of New Jersey.
2. Non-Fireproof Construction. This shall be as defined by Subsection "a-2" of section 18:7-91 of the Revised Statutes of New Jersey.
3. Semi-Fireproof Construction. This shall be as defined in the National Building Code, 1949 Edition, as Recommended by the National Board of Fire Underwriters.
4. Fireproof Construction. This shall also be as defined in the National Building Code, 1949 Edition, as Recommended by the National Board of Fire Underwriters. The above types of constructions may be used as follows in school buildings:
 - a. Frame Construction may be used for one-story school buildings, without basement or room below grade, provided that each classroom shall have an outside exit and that no other frame structure shall be located closer

than 100 feet to any part of such frame school building. Space necessary for the heating plant may be located in the room below grade if such room meets code requirements. No room shall contain more than 2,500 square feet.

- b. Non-fireproof Construction or Semi-Fireproof Construction may be used for all one and two-story school buildings provided that the stair halls, corridors, boiler rooms, coal vaults, picture booths, and permanent stages equipped to fly scenery are of fireproof construction with a two-hour rating for the corridor and stair hall walls and with a four-hour rating for heater room walls. If individual exits direct to grade are provided for each classroom, fireproof corridors are not required.
- c. Fireproof Construction may be used for all school buildings, and shall be used for all those which are three stories and over in height. Corridor and stair hall walls shall have a two-hour rating; floors shall have a three-hour rating; and heater room walls and ceilings shall have a four-hour rating. Roofs, except over stages equipped to fly scenery and boiler rooms, may be of semi-fireproof construction.
- d. All auditoriums with permanent stages equipped to fly scenery shall conform to the requirements of the National Building Code, 1949 Edition.
- e. The furnace-room fire and explosion hazards shall be isolated from pupil-occupied areas by location or treatment. Furnace and fuel rooms adjacent to or in school buildings shall have fireproof floors, walls, and ceilings except that one-hour fire-resisting ceilings will be permitted for one-story heater rooms in one-story buildings. Where coal is used, adequate fire-safe storage shall be carefully planned to reduce the dangers from spontaneous combustion. Fuel-oil or gas-burner installations shall comply with standards established by the Board of Fire Underwriters. (January, 1950)

D. Structural Design Standards

1. The following structural design standards shall be a part of the New Jersey School Building Code:
 - a. "Building Code Requirements for Reinforced Concrete", (ACI 318-47).
Approved as American Standard by the American Standards Association,
January 12, 1948.
 - b. "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings". Revised February, 1946. American Institute of Steel Construction.
 - c. "American Standard Building Code Requirements for Masonry". Issued March 15, 1944. Approved January 22, 1944, by the American Standards Association as American Standard A41.1-1944.
 - d. "National Design Specification for Stress-Grade Lumber and Its Fastenings, 1944." Revised 1948. Recommended by the National Lumber Manufacturers Association, Washington, D. C.
2. All future revisions of, amendments to, or new issues of any or all of the publications referred to in this Guide shall not become effective until approved by the State Board of Education.

E. Minimum Design Loads

1. School buildings and their accompanying structures shall be designed for all conditions of loading, as specified in the American Standard Building Requirements A58.1-1945, "Minimum Design Loads in Buildings and Other Structures," approved June 19, 1945, by the American Standards Association, and sponsored by the National Bureau of Standards, except as hereinafter specifically modified or as modified by future revisions, subject to the approval of the State Board of Education.

2. The live loads assumed for purposes of design shall be the greatest loads that probably will be produced by the intended occupancies or uses. The assumed live loads, considered as uniformly distributed, shall be not less than the values given in the following table:

Occupancy or Use	Live Load lbs. per Sq. Ft.
Auditoriums and Assembly Halls	
Fixed seats on sloping or stepped floor	60
Movable or fixed seats on level floor	100
Stage floor	150
Balconies	
Fixed seats	60
Movable seats	100
Classrooms - Up to 900 square feet	50
Classrooms - More than 900 square feet	60
Libraries, larger than normal classroom (Weight of book stacks shall be computed at not less than 20 lbs. per cubic foot)	80
Laboratories, larger than normal classroom	80
Stairs and Fire Escapes	100
Shops	
For light operations	125
For agriculture, machinery, automobile repair, etc.	200
Store Rooms	100
Toilet Rooms	60
Corridors	100
Cafeterias	100
Kitchens	150
Fan Rooms	150
Floor over Boiler Room	100
Gymnasiums	100
Grandstands, Bleachers, etc.	100

3. In open-type grandstands and bleachers each footway and seat shall be designed for a live load of not less than 120 lbs. per linear foot.

4. All grandstands, bleachers, etc., shall be designed for horizontal forces, resulting from occupancy, applied at the level of each seat. In the direction lengthwise of the seats, the force shall be 24 lbs. per linear foot of each seat. In the direction crosswise of the seats, the force shall be 10 lbs. per linear foot of each seat.
5. Grandstands, bleachers, etc., shall be designed for a wind of 20 lbs. of vertical projection acting in any direction, in addition to occupancy loads.
6. There shall not be placed, or caused or permitted to be placed, on any floor or roof of a building or other structure a load greater than that for which such floor or roof is designed.
7. Roofs shall be designed for a uniformly distributed load (including snow loads) on the horizontal projection as described in the following schedule of loads and zones. The load shall be in addition to the dead load and wind load. The Southerly Zone shall be defined as any place south of a line drawn between Riverton, N. J. and Point Pleasant, N. J. The Northerly Zone shall include any location north of this line.

Uniform Load over Horizontal Projection
Lbs. per Square Foot

Roof Slope	Southerly Zone	Northerly Zone
Less than 20°	30	40
From 20° to 45°	20	30
More than 45°	20	20

8. Roofs to be used for promenades shall be designed for a minimum load of 60 pounds per square foot in addition to the dead loads. Roofs to be used for other special purposes shall be designed for appropriate loads as directed or approved by the building official.

NOTE: Earthquake loads shall not be required by this Guide.

F. Installations for Safety and Convenience

1. Classrooms shall be provided with at least one duplex outlet.

2. In industrial arts and vocational shops, every portable and stationary electrically operated device or motor, grinder, glue pot, and portable hand and stand lamp shall have its framework effectively grounded and all portable electrical tools and machinery shall be equipped with electrical plugs and receptacles to ground the electrical connections in conformity with the regulations of the New Jersey Department of Labor. At least two emergency cut-out switches shall be provided, one at or near each end of the shop.
3. Assembly rooms and auditoriums shall be provided with a convenience outlet at the probable location of a portable projector. A built-in speaker cable shall be run from that location to a stage outlet.
4. Recommendation: Corridor and stairhall lights should be controlled by three-way switches located at each end of these spaces.
5. Recommendation: Remote control switches should have pilot-light protection.
6. Special rooms, such as science laboratories, libraries, commercial suites, and home economics and industrial arts rooms, should receive particular attention and the necessary convenience and other outlets should be installed.
7. It is recommended that, means should be provided whereby sufficient emergency lighting can be made available and that exit lights be provided over exits from rooms of assembly.

Sight-Lifting for Building Construction

Today schools are faced with a rapidly increasing enrollment of children, high costs of school construction, and statutory limitations upon the amount of indebtedness which can be assumed. Of necessity a state code for school buildings must be concerned with the minimum requirements consistent with safety, health comfort, and efficiency. But some school districts, favored with a very wholesome financial status and with a population imbued with a desire to provide their children with the best possible educational environment, look beyond the minimum requirements and seek those additional facilities from which extra educational dividends can be derived.

This chapter is intended to "lift the sights", to point out the extra features that money and vision can provide, when boards of education do not have to limit themselves to the bare minimum requirements of schoolhouse construction. Probably no board can afford to incorporate all of these features into its building plans. But all boards can adopt some of them, to make their buildings fit the special needs of their communities.

Below are 74 features that make good educational investments for communities which have the staff and the program to use them wisely.

A. Selecting an Adequate Site

1. School playgrounds and community recreational parks can often be combined, with each complementing the other.
2. Space for a school garden and an agriculture demonstration area is essential for many schools. In addition to their instructional values, both of these areas can contribute foods for the lunchroom program.
3. Extensive parking facilities are especially desirable where space is now plentiful.
4. Although the recommended minimum site for an elementary school is five acres plus another acre for each 100 pupils, and for a secondary school ten acres plus an additional acre for each 100 pupils, schools will find larger acreages very beneficial.

5. When site facilities are planned, consideration should be given to outdoor drinking fountains, hose connections near the various courts and playing fields, covered bicycle racks, a picnic area with one or more outdoor fireplaces, and lights for courts, playground areas, walks, driveways, and parking areas.
6. Separate playground areas should be provided for children in the lowest grades.

B. Constructing a Serviceable School

1. As far as possible, internal partitions should be non-bearing, to permit maximum flexibility.
2. For reasons of both safety and educational usefulness, school plants should be designed with the smallest practicable number of stories.
3. Acoustical treatment is recommended for corridor ceilings and walls, and for classroom and cafeteria ceilings. Resilient floor coverings in corridors contribute to the reduction of noise.
4. An outside entrance from the playground should be provided to at least one toilet room for each sex.
5. All locks installed in school buildings should be master-keyed.
6. Many schools, in cooperation with the community, will want to plan school-community libraries, health clinics, and adult education facilities.
7. The club program may require certain specialized areas, such as a darkroom for the photography club and an inside greenhouse for the garden club.
8. Metal corridor gates, recessed in the wall when not needed, should be located so as to separate the areas frequently used by the community from the rest of the school plant.
9. The heating system should be so designed that any one or all of the areas frequently used after school hours can be heated separately from the rest of the building.
10. When areas are used by both school and community groups, separate storage spaces for materials and equipment should be supplied.

11. If the gymnasium is to be regularly used by community groups, additional lockers for gym clothing should be provided.
12. Auditoriums, lunchrooms, and gymnasiums or playrooms are special rooms from which great values for elementary schools can be derived.
13. Classrooms larger than the minimum prescribed by the Guide will often prove an economy in terms of the educational return from the investment.
14. Elementary classrooms find desirable such planned units as a library corner, an art center, a project center, a science corner, and a music unit, each equipped with appropriate furniture.
15. A recessed rod equipped with sliding hooks for hanging maps and other similar instructional materials should be provided above all chalkboards and tackboards.
16. Built-in equipment usually provides for the storage of materials and projects, for bookshelves, for work counters, for filing cabinets, for teachers' lockers, for sinks, for a cleaning cabinet, and for student wardrobes.
17. The need for built-in equipment in high school classes is often as great as in elementary rooms, but school designers have been slower in meeting the need.
18. Each classroom should be equipped for the use of visual aids, with electrical connections, speaker cables, projection screens, and darkening provisions.
19. Special rooms require unusual provisions for storage and display, because of the many students using the rooms.
20. Lockers for high school pupils' wraps, books, and other personal belongings should not be located in classrooms.
21. Separate, master-keyed combination locks are usually preferable to built-in locks opened by key or combination.
22. A recessed area for a piano is desirable in a gymnasium.
23. A combination science room, arranged and equipped for a wide variety of activities, is usually preferred to the separate classroom and laboratory. It is essential that equipment needs be carefully studied and made a part of

the original planning of the unit, because of the necessity for properly locating utility connections and drainage lines.

24. If the school centers many of its business activities in the commercial department -- school bank, ticket sales, school store, etc. -- it is often advisable to provide windows accessible from the corridor.
25. Exploratory arts and crafts shops, usually housed in large rooms, frequently have a central area for group planning, with unit areas around the walls for such specialized crafts as leather work, block printing, simple sheet metal work, wood carving, pottery making, bookbinding, showcard writing, simple mechanical drawing, woodworking, weaving, basket making, photography, regular and silk-screen printing, and home mechanics.
26. Individual practice rooms, small in size, should be a part of the music unit, with provisions made for storing instruments, sheet music, and uniforms. Each room should be acoustically treated, and thermostatically controlled, because of the effect of temperature variations on instruments.
27. A home economics unit should contain a classroom laboratory (for instruction in clothing, the home, child care and guidance, health, safety, and home nursing), a foods laboratory, and a combination living-dining-bedroom unit used for teaching the selection and care of house furnishings, serving, entertainment, and home care of the sick. A service entrance for supply deliveries is helpful, as is also nearness to the school lunchroom. Unit kitchens should be as homelike as possible. One unit kitchen should be provided for each four pupils. A fireplace adds to the attractiveness of the living-dining-bedroom unit.
28. In the field of industrial arts, the trend is toward general shops rather than specialized shops. In vocational shops, of course, specialized training is essential.
29. A well-planned office unit will provide space for the reception of visitors, the work of secretaries and student-assistants, private offices for the administrators, fireproof and safe storage of money and records, storage of office supplies, toilet facilities, the use of duplicating and other office

machines, and conference rooms.

30. A public-address system, used as a teaching device, often requires careful planning in respect to its location.
31. For auditoriums with fixed seats, used only for assembly purposes, a sloping floor is desirable.
32. A ticket booth is desirable outside the auditorium, as are also toilet rooms for the use of patrons.
33. A stage depth of not less than 25 feet is desirable, and ample off-stage space, not including dressing rooms and other auxiliary rooms, should always be provided. Both sides of the stage should be accessible.
34. Stage curtains and draperies should be flameproof.
35. A well-planned library often contains a reading room, a workroom, one or more group conference rooms, a room for storing and using audio-visual equipment and material, and the librarian's office. In the reading room a browsing area equipped with informal homelike furniture is desirable.
36. A teachers' combination workroom and conference room is often provided as a part of the administrative office suite. In this room are usually located a conference table, desks for individual study, library chairs, a professional library of books and magazines, a bulletin board, a typewriter, and a duplicating machine.
37. Rest rooms, equipped with comfortable chairs and toilet facilities, should be provided for teachers.
38. To handle the problem of storage, schools need a supply room, a bookroom, a room for uniforms and athletic equipment, a stage scenery room, a costume room, and a repair room for furniture and other equipment.
39. Program clocks, in each classroom and instructional area, can be equipped with single and two-tone chimes of pleasing quality.
40. Radio-sound systems can be designed to provide broadcast listening, in-school program origination, recording and playbacks for all classrooms, and local amplification of special events in the gymnasium, auditorium, and other activity areas.

41. Microphone outlets should be provided in the gymnasium, auditorium, lunchroom, the bus-loading platform, athletic field, and playground.
42. For radio receiving sets, a central antenna and ground system, into which individual radio sets in the classrooms can be plugged, is a desirable construction feature.
43. For many schools, television antennae should be built into the building at the time of construction.

C. Building a Healthful School Plant

1. The trend toward separate toilets for primary rooms is a commendable one.
2. Colored chalkboards, because of their higher reflection factors, are replacing blackboards in most schools.
3. Classroom furniture should be of the movable type, and should be in natural or blond finishes.
4. In gymnasiums provision should be made for a regulation basketball court, with a ceiling height of not less than 20 feet.
5. For a large school, separate gymnasiums for boys and girls are desirable. Some large gymnasiums are often divided by a motor-driven partition, with the whole space available for interscholastic games.
6. Folding bleachers in gymnasiums provide the maximum seating capacity for a given space, and take up little room when not in use. Overhanging balconies are never recommended.
7. For gymnasium locker rooms, the best recommendation is for a small locker for every pupil who uses the gymnasium, for the storage of his gym clothes, and for enough larger lockers to contain the street clothes of the pupils who use the gymnasium at any one time.
8. Gang showers are recommended for boys. There is a trend toward gang showers for girls, with several individual showers and adjoining dressing cubicles. Each community should decide the type of showers to provide for girls in terms of local customs and desires.

9. Provisions for liquid or bar soap should be made in the shower room. 43.
10. A towel room should be provided, where each may obtain a clean towel for each gymnasium period. Some schools have found a small laundry economical over a long-time period.
11. Small-game rooms, space for corrective gymnastics, team rooms, and rest rooms for pupils unable to take strenuous activities are provided in some schools.
12. A well-planned playground for a junior or senior high school will include facilities for outdoor basketball, tennis, volley-ball, paddle tennis, badminton, softball, baseball, football, track, quoits, archery, shuffle-board, and similar activities.
13. Volleyball, paddle tennis, and softball courts are recommended for elementary school playgrounds, but the chief need is for space for informal games. In elementary schools, especially, a portion of the playground should be hard-surfaced.
14. The health unit should include a waiting area, an examination room, and separate rest rooms for boys and girls, each equipped with one or more cots. Lavatory and toilet facilities should be conveniently accessible.
15. All windows in the lunchroom should be screened.
16. A dressing room equipped with lockers, lavatory, and showers should be provided for lunchroom workers, near but not opening directly into the kitchen.
17. An acoustically treated dining room for teachers, separated from the rest of the lunchroom, will provide the teachers with a brief oasis of quietude.
18. A drinking fountain is a desirable feature in every elementary classroom.
19. Variations in the color scheme from room to room are desirable; in general, warm colors should be used for northern and eastern exposures and cool colors for southern and western exposures.
20. Each row of classroom lights should be separately controlled by wall switches.
21. A swimming pool is a valuable adjunct to a modern health and physical education program.

22. A small, well-lighted clinical room equipped with mirrors and phonographic recorder is helpful where programs are built to provide remedial help for speech-defective children.
23. A doctor's office, a dental clinic, dressing booths, and a health classroom make desirable adjuncts to the health unit.

D. Building a Safe School Plant

1. A fire-alarm system, operable from easily accessible locations, should be installed, separate from other signal systems in the buildings, and should produce a distinctive sound.
2. Fire extinguishers, of a type that is most effective in fighting the kind of fire most likely to occur in the several locations, should be recessed in walls near fire-alarm stations.

E. Provision for the Physically Handicapped Pupil

It is recommended that consideration be given to the strong likelihood that in the future school buildings will be used by more pupils who are physically handicapped by orthopedic defects, by cardiac disorders or other physical disabilities. Experience has shown that, with proper facilities and the counseling of physicians and other professionally qualified persons, the education of many physically handicapped children proceeds best in association with normal children. If the pupil with certain physical handicaps must climb a number of steps to get into the building or must use the stairs to reach his classroom, he may find that he cannot attend school, or, if he continues to attend, he takes the chance of bringing upon himself further injury. The presence of an entrance which permits easy access to the building from the ground level or the availability of an elevator in a building of more than one story may often be the controlling condition which permits a handicapped pupil to continue attending school.

Will Your School Building Pass This Test

Curriculum adequacy -- Does it provide the space and facilities for the educational program that your community needs for its children?

Safety and well-being -- Does it not only protect against danger but also provide a positive influence for improving the health and physical welfare of the pupils?

Functional relationships -- Is it so planned that the activity in each part of the building may be coordinated harmoniously with related activities and may be carried on effectively without disturbing other activities?

Efficiency and utility -- Is it so planned that the handling of materials and the comings and goings of pupils, school staff, and the public are accomplished with a minimum of interference and a maximum of ease and satisfaction to all concerned?

Beauty -- Is it pleasing in appearance, with simplicity, usefulness, and balance as ideals, rather than ornamentation or symmetry?

Adaptability -- Is it so planned that it can be enlarged or rearranged internally to meet new educational demands with a minimum of additional cost?

Economy -- Is it so planned that in original outlay and in future operation the utmost in educational utility can be secured for every dollar spent?

Adapted from American School Buildings

American Association of School Administrators

A P P E N D I X

Policy, Services, and Procedure
Relating to Plan Preparation, Filing, and Approval

A. Policies and Services

and Construction

1. The object of the Guide for Schoolhouse Planning is to further the interests of the public schools of New Jersey by making the school buildings of the State healthful and safe, while at the same time preventing extravagance or wastefulness in their construction. The State Board of Education cordially invites suggestions from local boards, architects, and other citizens, in improving the provisions of the Guide.
2. The approval of the plans and specifications is limited to the various matters mentioned as prescribed in the specific requirements of the Guide and does not contemplate the endorsement of any particular kind of materials, apparatus, mechanical equipment, or any special devices which may be mentioned in the specifications or shown on the plans.
3. No responsibility is assumed by the State Board of Education for the structural features of the building, the efficiency of the mechanical equipment, the grade of materials, or the quality of fixtures which are to be installed.
4. The principal function of the State Department of Education is that of service rather than regulation. The State Department of Education welcomes the opportunity to give all possible assistance to those asking advice about the erection of new school buildings or the remodelling of existing schools, or in school planning as the demands upon its staff permit.
5. The foregoing regulations and requirements shall apply to every new public school building within the State and to all modifications to any existing school building involving additions, alterations, or reconstruction. These are requirements and recommendations for new buildings and additions. Alterations to existing buildings shall comply with the Guide as far as practicable.

The definitions of new buildings and existing buildings shall be understood to be as follows:

- a. New buildings shall mean and include any building or unit of a building in which the entire work is new, or an entirely new addition connected to an existing building or any existing structure proposed to be remodelled or enlarged by building into it fifty per cent or more of new work.
- b. Existing buildings shall mean and include all buildings erected, remodelled, or enlarged, prior to publication of the Guide, or to buildings remodelled or enlarged after publication of the Guide, Provided that less than fifty per cent of the remodelled or enlarged building is new work.
- c. Any changes to existing construction, necessitated by any remodelling or repairs, shall conform to the requirements as set forth. When existing schoolhouses are enlarged, these provisions shall apply only to the added portion or portions. It is recommended, however, that the old portions of such buildings shall be made to conform to the provisions of the Guide as far as practicable.

B. Approval and Filing of Plans and Contracts

1. No contract for the erection of any public school building or any part thereof shall be made until and after plans and specifications therefor have been submitted to and approved by the State Board of Education. A copy of the plans and specifications as approved shall be filed forthwith with the State Board of Education. (18:11-8)
2. No change in the plans or specifications shall be legal unless the same have been submitted to and approved by the State Board. A copy of all changes as approved shall be filed forthwith with the said Board.
(18:11-8)

3. A copy of the contracts for the erection of the whole or any part of the school building and for the furnishing thereof shall be filed with the State Board of Education within ten days after the same have been signed.
(18:11-9)

NOTE: They may be filed by the architect, Board's attorney or the District Clerk.

4. No Board of Education of any school district nor any board of education of a county vocational school shall be required to secure the approval of its plans and specifications for the erection or alteration of any school building or vocational school building or any part thereof by the municipality therein, nor shall any board of education or any board of education of a county vocational school or any contractor doing work in connection with school buildings or county vocational school buildings be required to secure a building permit from the municipality.

(Revised Statutes 18:11-11, as amended P. L. 1948, c. 56, p. 144.)

5. Plans and specifications so far as they relate to plumbing installations shall conform to the requirements of the published local plumbing code of the municipality in which the school building is located, subject to the approval of such code in part or in whole by the State Board of Education. In all instances, plumbing installations as shown on the drawings or included in the specifications shall receive the approval of the State Board of Education and such installation shall be subject to inspection as provided in the Guide.
6. In the preparation of plans and specifications for the erection, construction, alteration, or repair of a public school building, when the entire cost of the work will exceed one thousand dollars in amount, the architect, engineer or other person preparing such plans and specifications, shall prepare separate plans and specifications for the plumbing and gas fitting, and all work kindred thereto, and of the steam and hot water

heating and ventilation apparatus, steam power plant and all work kindred thereto, and electrical work, structural steel and ornamental iron work.

(18:11-7)

7. In the erection, construction, alteration, or repair of a public school building, when the entire cost of the work will exceed one thousand dollars in amount, the Board of Education shall, in the manner provided by law, advertise for and receive separate bids for the plumbing and gas fitting and all work kindred thereto, the steam and hot water heating and ventilating apparatus, steam power plant and all work kindred thereto, and electrical work, structural steel and ornamental iron work. The Board shall award contracts for such work to the lowest responsible bidder for each of such branches respectively. (18:11-10)
8. No contract for the building of a new schoolhouse or for the enlargement of an existing schoolhouse shall be entered into without first advertising for proposals therefor. No contract for repairing of an existing schoolhouse at a cost of more than one thousand dollars shall be entered into without first advertising for proposals therefor. The advertisements required by this section shall be made under such regulations as the Board may prescribe. (18:6-25 as amended P. L. 1949, c. 150.)
9. No bid for building or repairing schoolhouses or for supplies shall be accepted which does not conform to the specifications furnished therefor, and all contracts shall be awarded to the lowest responsible bidder. (18:6-26)

C. Application and Conditions for Approval of Plans and Specifications

1. All plans and specifications for school building work of any nature must be prepared by an architect registered to practice in this State or by a consulting mechanical or structural engineer registered to practice in this State and within the limits covered by such registration. All plans and specifications must bear the seal of the architect and/or the consulting mechanical or structural engineer. It is recommended that the name of the consulting mechanical or structural engineer be placed on the plans when the architect has engaged such consultants.
2. Duplicate copies of all plans and specifications embracing each and every contract shall be submitted, together with an application for approval.
3. All applications for approval shall be directed to the Secretary of the State Board of Education and made upon the blank form prepared and supplied by him. These forms are furnished upon request of the architect, and it is requested that they be used instead of duplicate copies made by the architect. The application must be signed by the architect, or by the consulting mechanical or structural engineer in the case of specific planning being undertaken in these areas exclusive of other areas. Applications signed by others will not be accepted.

All information requested on the application for approval must be given and all queries fully answered.

4. Approval by the State Board of Education is valid only for the specific project indicated on the application. Every building project requires separate submission and approval of its plans and specifications. Any

changes or revisions to the plans and specifications as approved must be submitted for approval in the same manner as the original submission, as such changes or revisions invalidate the original approval.

5. Approval of plans and specifications shall be held as in effect for a period of one year only after the date of such approval. After this period a renewal of the approval must be secured for the work not under contract.
6. It shall be incumbent on the architect, or on the consulting mechanical or structural engineer for specific areas, to give written notice to the Architectural Supervisor of School Buildings at least ten days before plastering is started or any work is closed in so that an inspection can be scheduled of all work in place and written approval given before proceeding with plastering. Strict attention to this requirement will enable the Department to schedule inspections and expedite approval. Unless specifically advised by letter otherwise, plastering work may not proceed without approval.

It is also required that the architect, or the consulting mechanical or structural engineer, advise on the completion of all contracts so that a final inspection may be made.

D. Preliminary Plans

The policy of the State Department of Education is not to accept any preliminary plans for tentative approval unless and until the architect submitting the plans has been regularly retained as the architect for the project.

Educational needs should determine the plan and design of the school; therefore, before preliminary plans are developed for the project the educational program and accommodations required should be definitely determined by the school board and its staff. The architect can be very helpful to the board and its staff at this stage. However, the architect should not be expected to plan the educational program as well as the building and facilities to carry on the program.

The experience of the State Department of Education indicates that the period of preliminary planning offers fruitful opportunities for its cooperation with architects and Boards in the evolution and development of building plans. It is the period in planning when the architect studies and endeavors to solve all the major problems that confront him in determining the overall scheme and layout of planned spaces and use, to best meet the needs and functions of the desired educational program. Since final plans are basically a development of the preliminary plans, complete and comprehensive studies are practically essential at this stage of plan-development.

In order to minimize the amount of revision in the final plans or working drawings, it is required that preliminary plans be submitted to the State Department of Education before the final plans are started. This permits the Department to review them in the light of requirements and to offer such constructive comments or advice that may be deemed advisable. Preliminary plans submitted for review and tentative approval shall include the following:

1. A plot plan of the school property, drawn to scale, giving overall dimensions, the points of the compass, general topographical conditions, the location of existing structures and their relation to the proposed building, the relation of the school to highways and streets, and such physical features that present any deterrents in maintaining adequate protection of the safety, health, sight, or comfort of the pupils. The plot plan may be drawn to any scale, so long as it indicates with clarity the required features.
2. Floor plans drawn not less than 1/16" to the foot, giving overall dimensions; the location, size, and intended use of all areas of the plans; the tentative layout of equipment features of special rooms including built-in equipment; future additions; and a statement giving general method of heating and ventilating.

3. A drawing, using the same scale, of elevations and sections to indicate the finished floor and ceiling levels and their relations to the finished outside grade; together with the steps or other features related to the exit facilities.

Three important practices, followed undeviatingly by the State Department of Education, should be noted by those submitting preliminary plans:

1. Any preliminary plans not in conformity with the above requirements will be returned, without review.
2. Preliminary plans submitted prior to those submitted as the architect's solution of the planning to meet the educational program, or "schematic" plans to indicate general schemes under consideration, will be reviewed when the Department's advice on specific or unusual cases is desired.
3. Duplicate copies of prints, preferably black and white to identify preliminary plans from final plans in blueprint form, are required in submitting preliminary plans for review and tentative approval. These should be mailed to the State Department of Education.

E. Final Plans and Specifications

Final plans and specifications submitted for review and approval by the State Board of Education shall meet the following requirements and shall conform with the best professional practices. They shall show clearly, accurately, and completely information on all phases of the work to be undertaken.

1. Plans and specifications shall be submitted in duplicate, together with an application for approval properly filled out and signed as required.
2. When the plans and specifications have been reviewed and approval has been granted by the State Board of Education, formal notice will be sent the architect and the Board of Education advising of the approval.

3. One set of the plans and specifications will be retained by the State Department of Education, and the duplicate set, stamped with the State Board of Education's seal of approval, including the official notice of approval signed by the President and Secretary of the State Board, will be forwarded to the District Clerk or the Secretary of the local Board of Education. A copy of the official notice of approval signed by the Secretary of the State Board will be forwarded to the architect and the County Superintendent of Schools.
4. Plans and specifications submitted for approval shall not be eligible for review and recommendation for approval until all the requirements of procedure have been complied with.
5. The following specific items are suggestive of the information required in plans and specifications submitted for approval. They are not intended to enumerate all the items that should be covered but rather to establish uniformity in presenting data for review.
 - a. All specifications should be indexed for quick identification of individual items. It is recommended that the five sections of the specifications be in different colors for the same reason.
 - b. Specifications preferably should be of letter-size, bound at the left-hand side, with covers the same size as the inside specifications, to facilitate filing and use.
 - c. In addition to the duplicate copies of the plans submitted for filing with the State Department of Education, it is strongly urged that there be submitted, when contracts are begun, one set of plans reproduced as photostats of the original drawings or blueprints, on sheets 18" x 24", to permit sufficient clarity in reproduction for inspection purposes in the field and for uniformity in filing.
 - d. Wherever possible, drawings should not exceed 36" x 48".

- e. Architectural, structural, and other kinds of mechanical work should be shown on separate drawings. They should be combined only when clarity and completeness are not impaired.
- f. A key plot plan should be given on one of the drawings to indicate the location of the school building with relation to the school property and to existing structures when additions are made, and the established orientation of the building to points of the compass.
- g. A better practice than that of submitting a key plot plan is to include with the final plans one sheet showing all of the items referred to under the preliminary plot plan, fully developed and including the contours and the finished grades at the building and the elevation of the first-floor level. Included should be such items as the location of walls, drives, parking areas, play and organized activity areas, kindergarten play yards, and adjoining streets and sidewalks. The boundaries, the size and shape of the entire school property, the location of existing sewage disposal system, and walls are other possible items for inclusion.
- h. All drawings of any nature shall be fully dimensioned to give over-all and individual unit dimensions, both horizontal and vertical, for all portions of the building, and should include the thickness of all walls, floors, and foundations, together with the present and finished grades at building.
- i. General drawings should be on not less than 1/8" scale, except in specific cases where the size of the building program requires a 1/16" scale, with plans for each floor and roof, elevations sufficient to indicate all exteriors of the building and materials, sections sufficient to show clearly all and any special conditions. Stairs, classrooms and corridors, furred ceilings, equipment and fixtures, floor construction, levels and thickness; wall construction; and typical windows, should be shown.

Consideration will be given to any exceptions an architect may find

necessary in the scale and layout of his plans due to the unusual size of the program, provided however, that the clarity and completeness of information will not be impaired.

- j. Typical details should be given at larger scale where necessary for clarity, providing complete information on wall sections, floors, and windows, with complete details for each type of window and with data on the glass area, including the vertical distances of the sill and the vision strip, if any, the top of the window glass above the floor, and the distance below ceiling. Stair details should show the construction and materials, riser heights and tread widths, the over-all dimensions of the stair runs, both vertical and horizontal, and the landing levels. Details of chalkboard and tackboard trim, standing trim, etc., should be pictured. Built-in equipment, wardrobes, and all special features requiring details for proper development should be clearly portrayed.
- k. Plumbing, heating, ventilating, electrical and structural plans should be scaled to conform with the general drawings. All mechanical and structural plans and details should be developed with the same clarity and completeness that are required for the general plans.
- l. There should be shown on the drawings the interior finish, including the floor, base, wainscot, wall, ceiling, and trim. A complete door and window schedule should be given. The materials used in all walls, partitions, etc., should be indicated by means of a symbol key. A standard symbol key should also be used in describing electrical work. The use intended for each room or space should be indicated on the floor plans.

F. Regulations Pertaining to the Use of Former Private Residences as Home Economics Buildings

When any school district establishes a homemaking course approved by the State Department of Education for which the use of facilities in a building originally planned for a private residence is especially adapted the board of

education may operate the course in such building, owned or rented by the board; provided that the Architectural Supervisor of School Buildings of the State Department of Education shall have examined and approved the property as being free from fire hazard or other objectionable features which might endanger the health and safety of the pupils enrolled in the course. Such a building may not be used by the board or school for the conducting of any other type of school work. The board of education shall adopt regulations for safety of buildings used for instruction in home-making which regulations shall be approved by the State Department of Education.

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