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ABSTRACT

This guide to basic principles of school design presents diagrammatic explanation of various developed standards and planning suggestions. The first section schematically develops patterns of school activity for primary, elementary, and high schools. The second discusses organization of activities--(1) contour adjustment, (2) landscaping, (3) outdoor landscape laboratories, (4) building complex expansion, and (5) site improvement. The last section covers building design data in terms of architectural criteria such as articulation, and develops specifications for--(1) primary, elementary, and high school classrooms, (2) administration, (3) libraries, (4) science rooms, (5) home economics, (6) agricultural shop, (7) lunch room, and (8) physical education facilities. (MH)

ED035175

north carolina department of public instruction

Clyde A. Erwin superintendent

SCHOOL DESIGN

EF 001 155

august 1952

prepared by:

THE DIVISION OF SCHOOL PLANNING

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P R E F A C E

Under the leadership of Superintendent Clyde A. Erwin, public school facilities in North Carolina were vastly improved. This publication, an evidence of his inspiration and guidance, is designed to further educational opportunities for the children of this state.

This book is based on the concept that a school may be planned as a pleasant environment for growing children, and need not be a group of unrelated buildings on an uncoordinated site. The material is not a formula for the perfect school plant; it is a guide containing certain basic principles of school design.

The material in this book follows the order of the design process, that is, from the general to the particular, according to the following outline:

1. Patterns of school activity
2. Organization of activities on the site
3. Design potentials in various site conditions
4. Building design data

The fourth section, treating of design for the various facilities in a school plant, is organized with a check list of design details on the left hand page. On the facing page is a pattern describing the affinities which determine plan relationships, and some small sample plans which conform to this affinity diagram.

This book is prepared for the use of architects, school officials, and teachers. It is inevitable that some portions have a limited interest for certain of those readers.

The previous publication of this Division, School Design Standards, is superseded by this book.

TO THE SUPERINTENDENT

While the school boards are charged by law with the responsibility for new construction, the major burden rests upon the superintendent. Pressed by myriads of other duties, it is often difficult for him to give the necessary attention to all the details of a building program. It is hoped that this publication will assist him in the development of a program of construction and will acquaint him with the aesthetic and practical problems which he should expect his architect to solve.

The superintendent and the school board have a right to expect that the architect will design within the financial limitations imposed upon him, but only if the architect is furnished with (1) an accurate topographic map of the school site prepared in accordance with specifications in this book, (2) a written program containing a detailed and accurate statement of present and future needs, and (3) a budget which is equal to the average construction costs prevailing in that region.

The architect cannot be expected to perform competently if he is asked to build a high quality building on an inadequate budget. He will also be hampered in the service he can perform if he is asked to accept a commission below the standards recommended by the profession. Boards who select their architect on the basis of fee alone are inviting inferior work and inadequate supervision for a saving which cannot possibly amount to more than a small percentage of the cost of construction.

Because of a somewhat more detached, but not unrealistic, point of view, the Division of School Planning is often able to aid the superintendent in the development of a long-range building program. For this reason, the Division is eager to cooperate with the superintendent at the beginning of each new school building project.

TO THE ARCHITECT

It is the aim of the State Superintendent of Public Instruction to have the best that is available in the design of public school buildings in this state. To produce for the growth and development of children an environment which is pleasant, efficient, and durable, requires the cooperation of the local superintendents, the architects, and the Division of School Planning. From this triangle of effort, the architect emerges as the one charged with the creative work of translating need into facility.

Although there may be a tendency toward stultification of design originality where the approval of a central agency is required, the architects may be assured that in the case of North Carolina schools, they are encouraged to design buildings expressive of their own thinking, yet conforming to the practices established by the several state services. Uniformity of design is not a goal to be compared with the virtues of individuality and imagination. The architect is invited to vary from previously acceptable designs in a continuous effort to improve subsequent projects.

Because of the great need for enclosed space, there has been a natural tendency to overlook the problem of site development in the planning of schools. It is clear, however, that the emphasis must gradually shift away from the building as an isolated unit, and include the entire building and grounds as a single facility. For this reason, this publication elaborates upon the problem of site development. It is hoped that the designers will be able to devote a greater effort in providing professional aid in this phase of planning.

It may be noticed that the word "function" has not been used elsewhere in this book for it seems that a "functional building" is the least that a community should expect from its architect. It is hoped that all schools, no matter what the cost, will reach well beyond this level of sheer performance in plan and structure, and will be works of high aesthetic quality, with studied relationships of voids and solids, well-chosen materials, and a fine relationship to the land and its environment.

P R O C E D U R E

The following outline lists the material and information which are to be submitted to the Division of School Planning of the North Carolina Department of Public Instruction for all public school building projects

PRELIMINARY SUBMISSIONS

A. PROGRAM

With the preliminary sketch plans, submit a program, prepared under the direction of the school superintendent, which will include the following information:

1. Present enrollment Elementary High School
2. Estimated enrollment after completion of this project Elementary High School
3. Funds available for this project Construction Equipment
4. Facilities to be provided by the project contemplated at this time
5. Future plans for this school
   a. Possible immediate growth
   b. Anticipated future growth, in 10 to 20 years
   c. Area of existing school grounds
   d. Expected land acquisitions
   e. Possible consolidations affecting this school
   f. Anticipated changes in curriculum

B. PRELIMINARY DRAWINGS

Include the following information on the preliminary drawings:

1. Topographic information
   a. Limits of site, showing use of adjacent land
   b. Existing contours
   c. Existing roadways, drives, or access on the site, indicating whether paved or not
   d. Existing roads, streets, or highways, adjoining or leading to site, indicating whether paved or not
   e. Major existing tree masses and large individual specimen trees worth saving
   f. Existing buildings, showing outline plan at grade level
   g. Existing water supply and sewer facilities
   h. Existing playground or special use areas
   i. North point and graphic scale
2. Plot plan
   a. Location of proposed structures, indicating floor elevations
   b. Possible future construction
   c. Roads, drives, access, parking areas, whether part of the immediate project or not
   d. Location of playground areas and athletic fields
   e. New sewage disposal facilities and water supply
3. Plans
   a. Floor plans Scale 1/16" - 1'-0" or larger
   b. Elevations (4) Scale 1/16" - 1'-0" or larger
   c. Typical sections showing construction Scale 1/4" - 1'-0" or larger
   d. Plans of the following special use rooms Scale 1/4" - 1'-0" or larger
      Lunchroom kitchen Science rooms
      Homemaking rooms Shops
   e. Perspective sketch, a line drawing of the project, showing relation to present site conditions
   f. Schedule of interior finishes
   g. Type of heating system and type of fuel

WORKING DRAWINGS & SPECIFICATIONS

A. Insurance approval

It is considered the responsibility of the architect to secure project approval from the office of the North Carolina Insurance Department to indicate compliance with the North Carolina Building Code. This is a prerequisite to approval by the State Superintendent of Public Instruction

B. Final Approval

After the preliminary drawings have been approved by the Division of School Planning, the architect's working drawings and specifications are to be submitted. These documents shall be as complete as those which are issued to contractors for the purpose of obtaining bids

The final approval of the State Superintendent is effective upon the receipt by the local superintendent and the architect of the official Certificate of Approval

(Sample form - Appendix A)

The Certificate of Approval must be received before advertising for bids

CHANGE ORDERS

In order that the completed construction agrees with the plans and specifications which have been approved by the State Superintendent, it is necessary that change orders which authorize contractors to make changes after the contracts have been executed be submitted in two copies to the Division of School Planning for approval. Return one executed copy to the Division.

(Sample form - Appendix B)

FORM SP-4
REPORT ON SCHOOL BUILDING PROJECTS

Form SP-4 is intended to provide information which will enable the Department of Public Instruction to compile data on all public school construction in the state

Submit the forms in accordance with the instructions given on the reverse side of the form itself. Note that "preliminary" and "final" reports are required

(Sample form - Appendix C)

APPLICATION STATE SCHOOL PLANT CONSTRUCTION, IMPROVEMENT AND REPAIR FUND

File the following with the Division of School Planning at least one week before scheduled meeting of the State Board of Education:

3 copies of Application
2 copies of tabulation of bids
2 copies of owner-architect agreement

After approval of the Application by the State Board, construction contracts may be executed, two copies of each contract to be filed with the Division of School Planning

(Sample form - Appendix D)

ADDENDUM TO APPLICATION

This form is to be used whenever there is a revision in the amount of money, either local or state, involved in a previously approved application for funds from the State School Plant Construction, Improvement and Repair Fund. Submit three copies to the Division of School Planning

(Sample form - Appendix E)

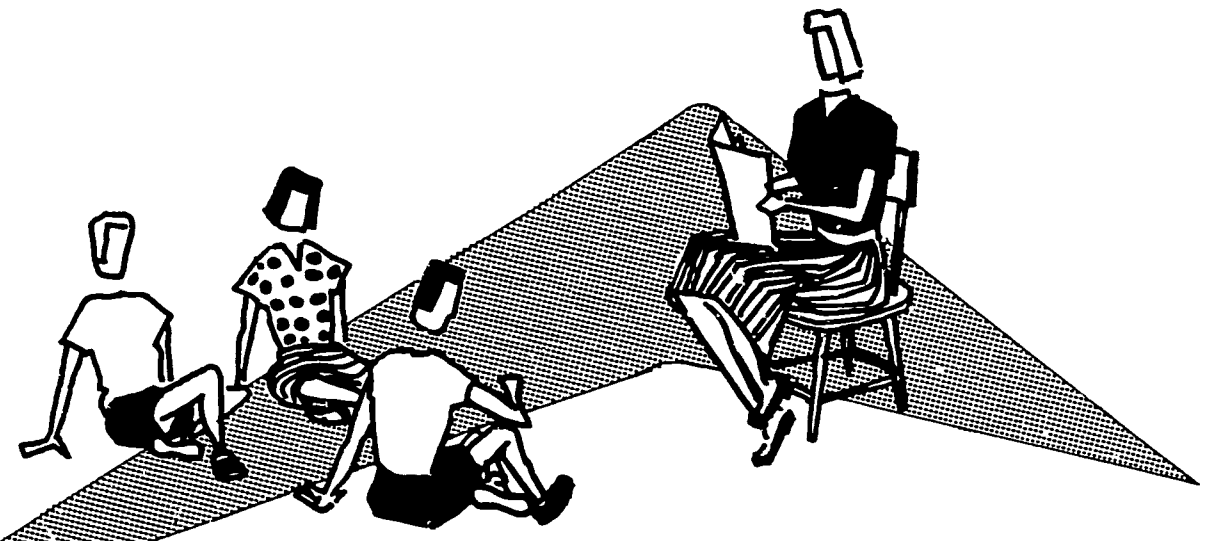
While the activities of primary grade children are more varied than those of any other group, the pattern of these activities is also more concentrated. Except for the noon-day trip to the lunch room, or an occasional visit to an indoor play room or assembly, practically the entire day is spent in the classroom or in the adjacent outdoor area. The affinity between the indoor and outdoor area is so strong that most designers consider it as a single space of which only a portion is roofed and protected from the weather.

The lack of other affinities and the variety of interests within this circle of activity bespeak the quality of the young mind which seems to thrive best on short periods of concentration and constant change from one subject to another. It also indicates the strong need of participation at this level of instruction. The primary classroom is then a multi-purpose area, which serves at various times as a formal classroom, a studio, a shop, a theater, a play room. These varied uses are best served by a large unobstructed floor area and movable furniture.

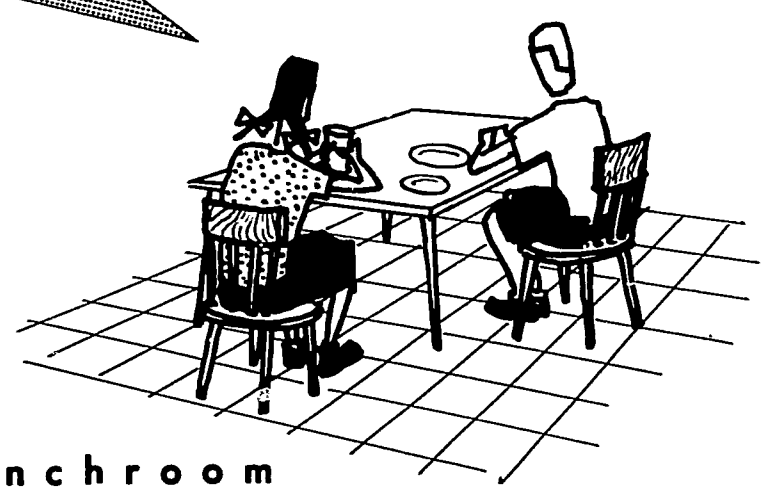
Enclosing the activities within a building will result in a series of self-contained units within easy reach of the cafeteria but undisturbed by other elements of the school which may accommodate the higher grades.

ACTIVITY PATTERNS

PRIMARY GRADES



indoor



lunchroom

outdoor

PEDESTRIAN

SERVICE

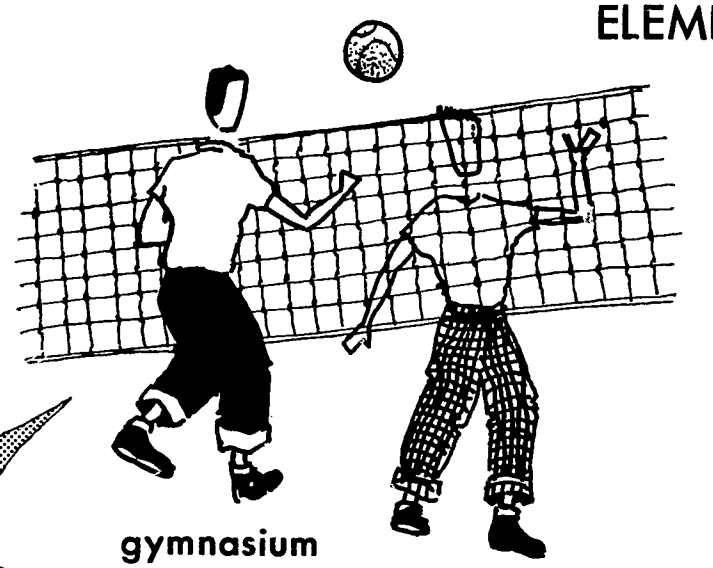
Beyond the primary grades, the student's horizon expands rapidly as the activities which were formerly accommodated within the classroom now demand special facilities. The classroom is becoming a center from which all extensions of activity are organized and dir ted.

The affinities which result from this growth are basically two: the academic area made up of the classrooms, library, and playground; and the other facilities which are semi-public in nature; the gymnasium, auditorium, and the lunchroom. A simple grouping of these related elements with the public and student entrances at a point between the two is generally the most efficient arrangement.

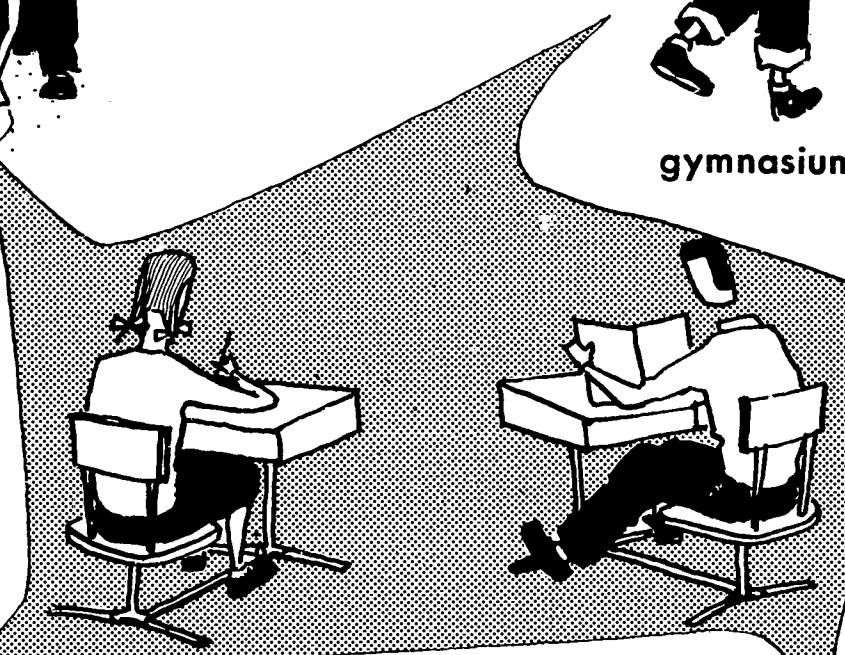
ACTIVITY PATTERNS

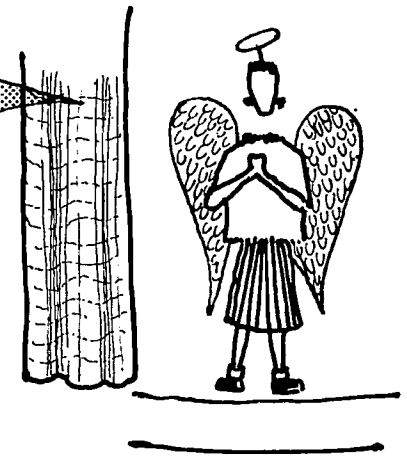
ELEMENTARY GRADES

outdoor play

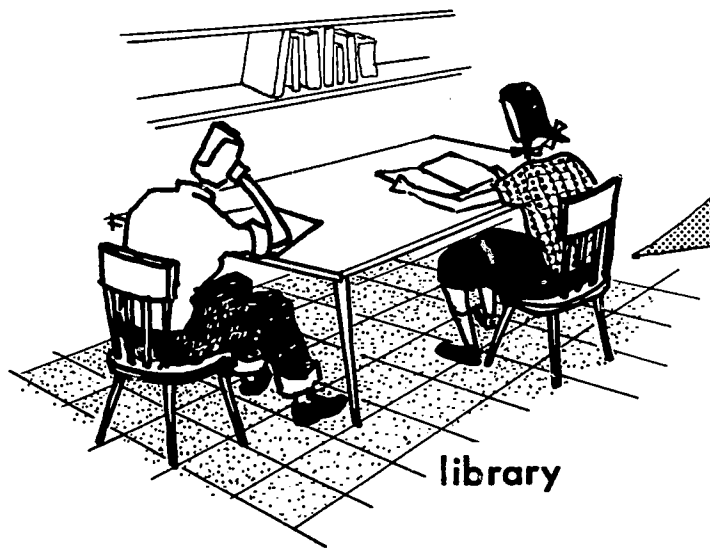


gymnasium

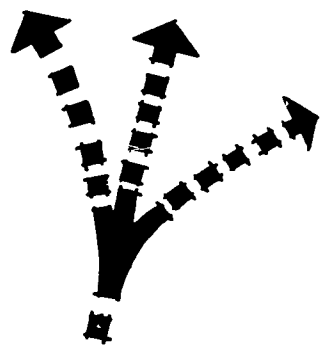




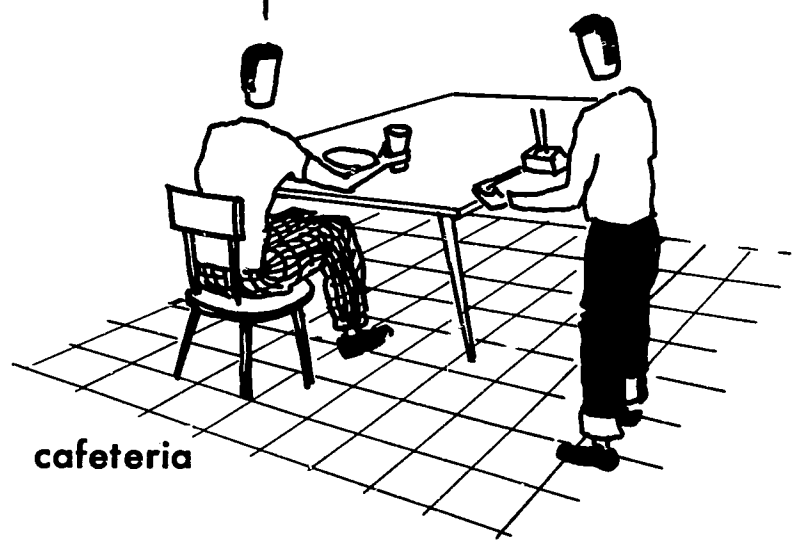
auditorium



library



PEDESTRIAN



cafeteria

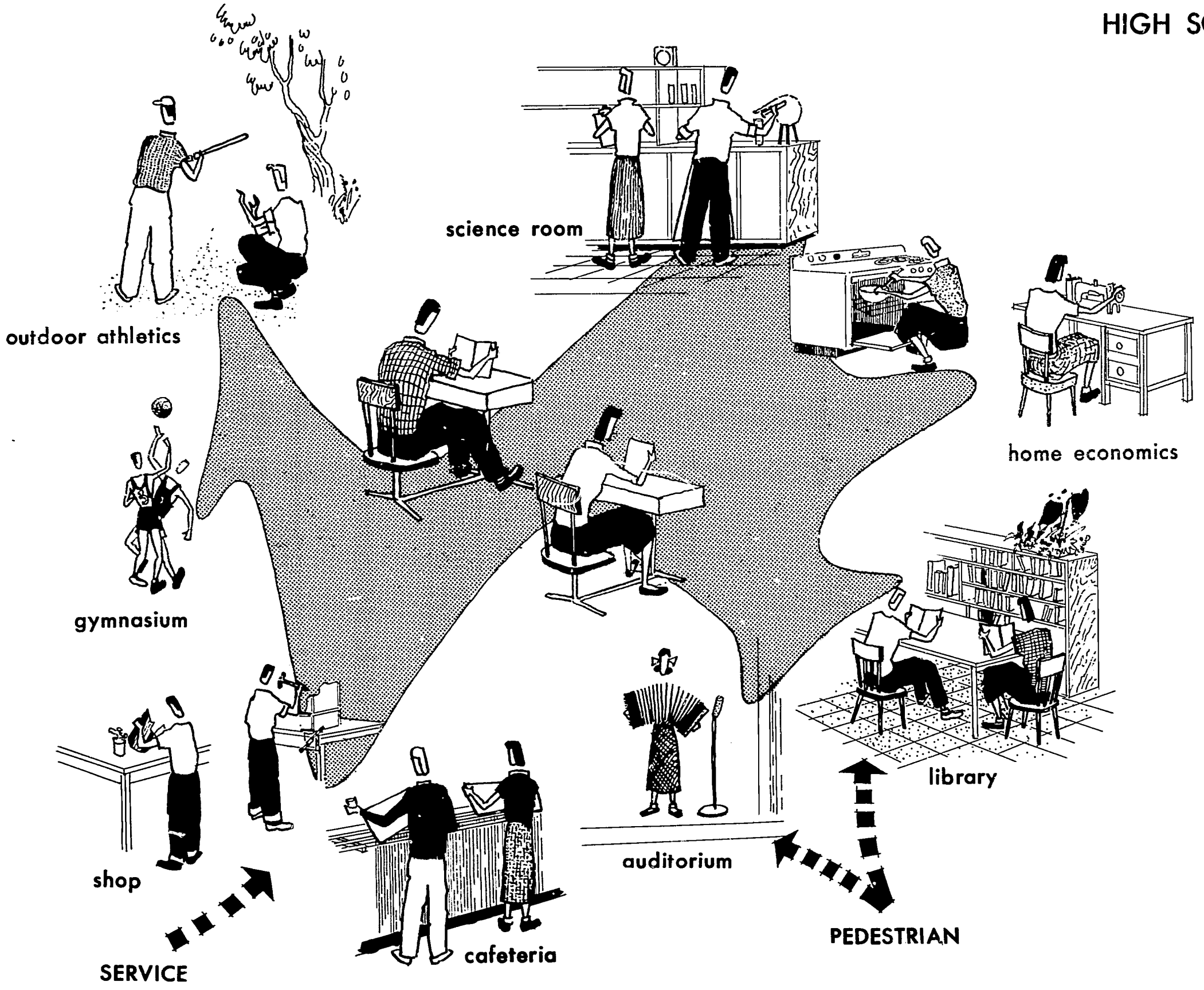
SERVICE

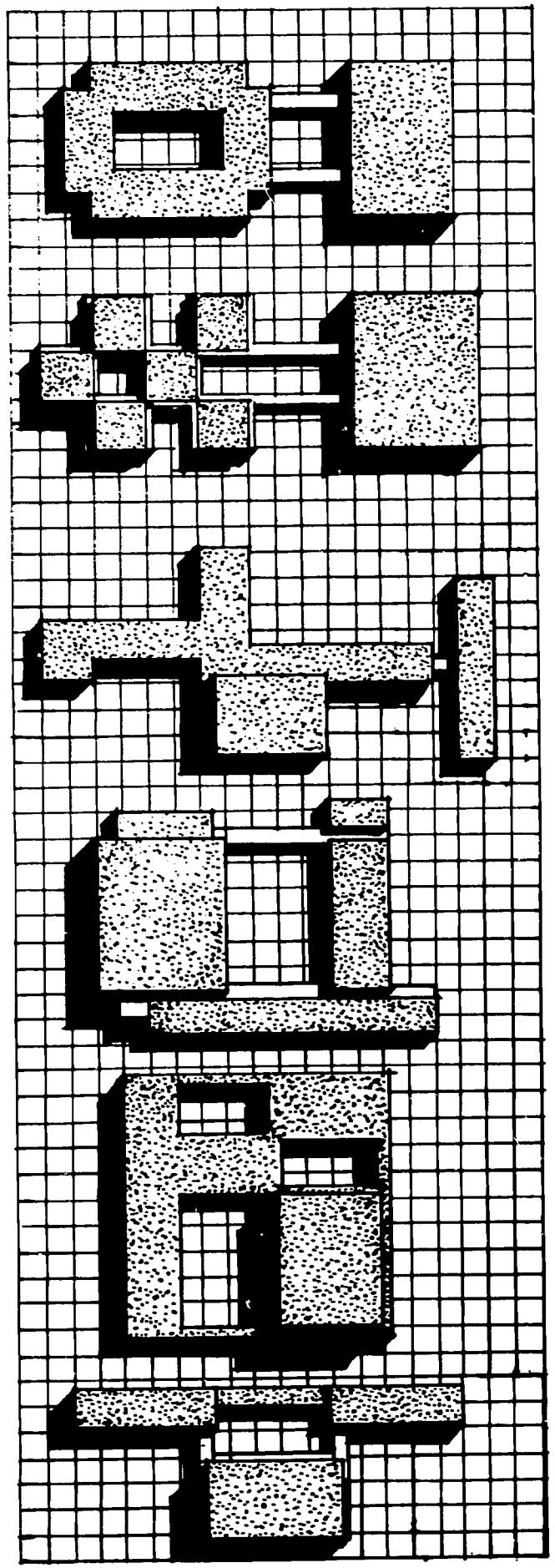
The specialization of activity that started in the lower grades accelerates rapidly in high school until the homeroom sees less and less of the student as the academic circle expands to include science, home economics, drama, et cetera. Basically, the affinities are still the same as for the lower grades but the degree of cross-over between the two essential circles of activity is on the increase as the importance of shop-work, drama, and physical education draws the students into the semi-public area for much of the day's work.

While the mind is now capable of longer periods of concentration, it is also demanding greater specialization of facilities, and the resulting pattern of activity begins to look very much like that of the adult outside world.

ACTIVITY PATTERNS

HIGH SCHOOL





THE LEVEL SITE

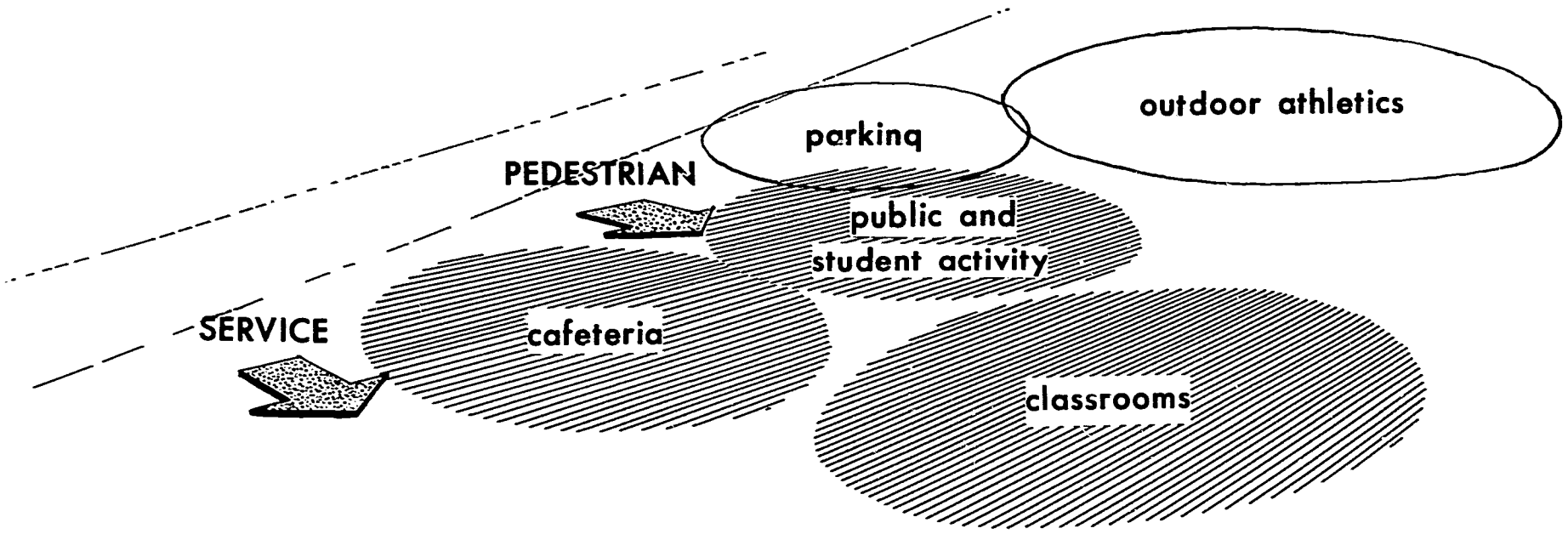
The school located on a level site is an architectonic reflection of the plan diagram. Since the positioning of elements is unhampered by topography, the development of the plan is not difficult if a traffic pattern for the entire site is first defined, and a roof then applied to the enclosed elements. Such a traffic pattern will allow for complete separation of pedestrian and motor traffic and will place all units in the handiest relation to one another and to the flow of people who use them. While such articulation of traffic is the most basic problem in site planning and rather easy to achieve, it is the factor most commonly overlooked in the planning of new schools and the expansion of existing buildings.

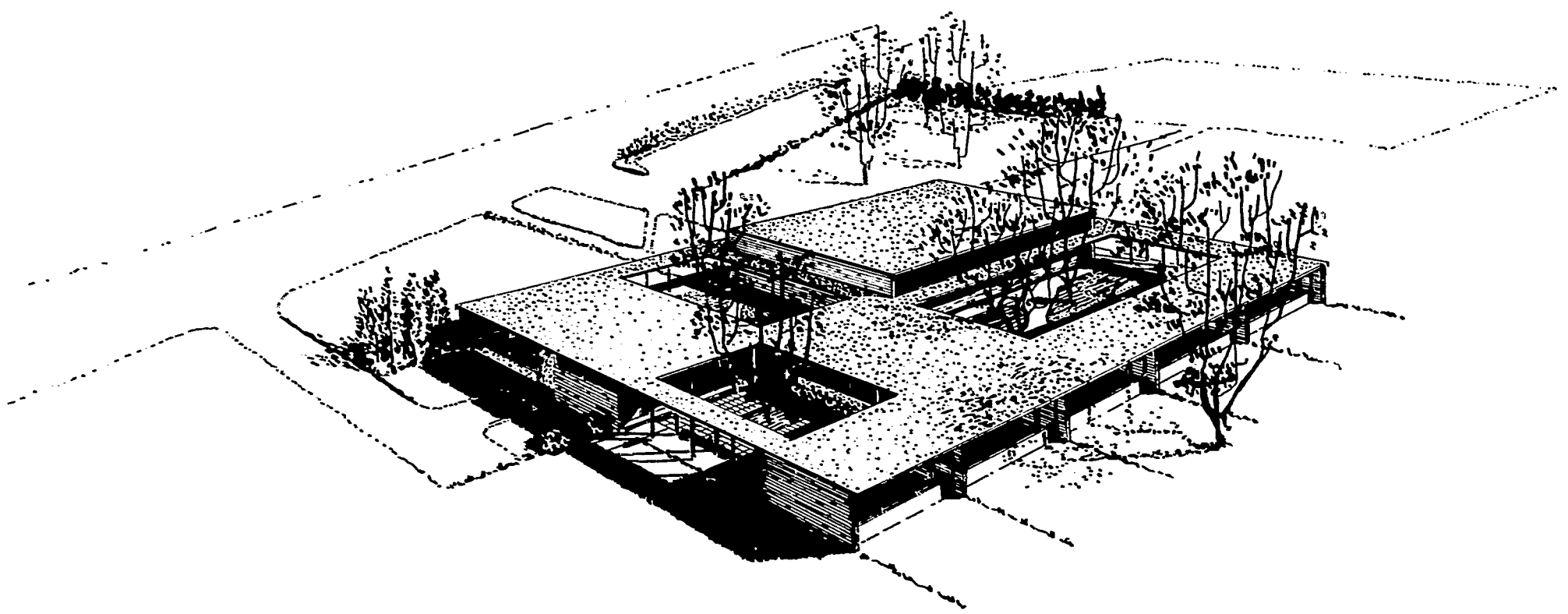
Because no topographic problems are encountered, the building may assume any of a variety of forms from the campus plan to the finger plan, or some more positive and studied arrangement. The campus plan will seldom be used except for the very large schools. The finger plan is the most popular since it is developed from an easy formula requiring little thought or imagination. It often produces a very dull effect since the lack of a dominant element or space taxes the visual memory so that the impression is one of monotony.

If our schools are to inspire those who use them, then they must be compositions of land and structure surpassing the usual demands of expediency. While the number of basic forms is limited, the variants are infinite and there seems to be little reason for the development of formless buildings either as simple structures, or as a building complex.

SITE STUDY

LEVEL TOPO





T H E S L O P I N G S I T E

In developing a school on a sloping site, the designer is conscious of the tensions set up by contours and orientation. It has generally been thought that orientation should be the determining factor on ground slopes which are less than five percent. However, new developments in classroom construction have made hard and fast rules less necessary. It is still desirable, however, that:

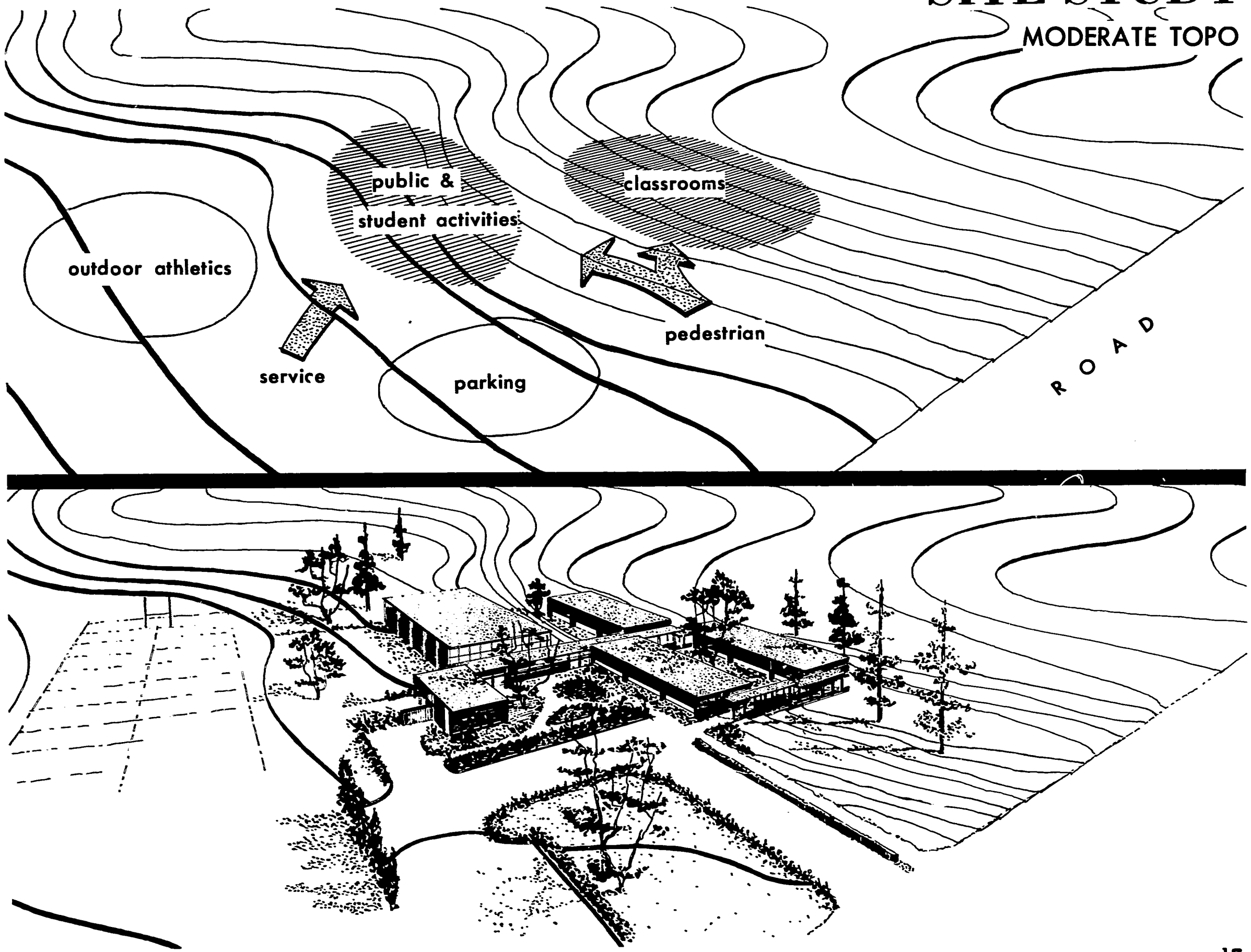
1. Sunlight should enter the classroom at some time during the day
2. Direct sunlight should not fall on the desk tops during school hours

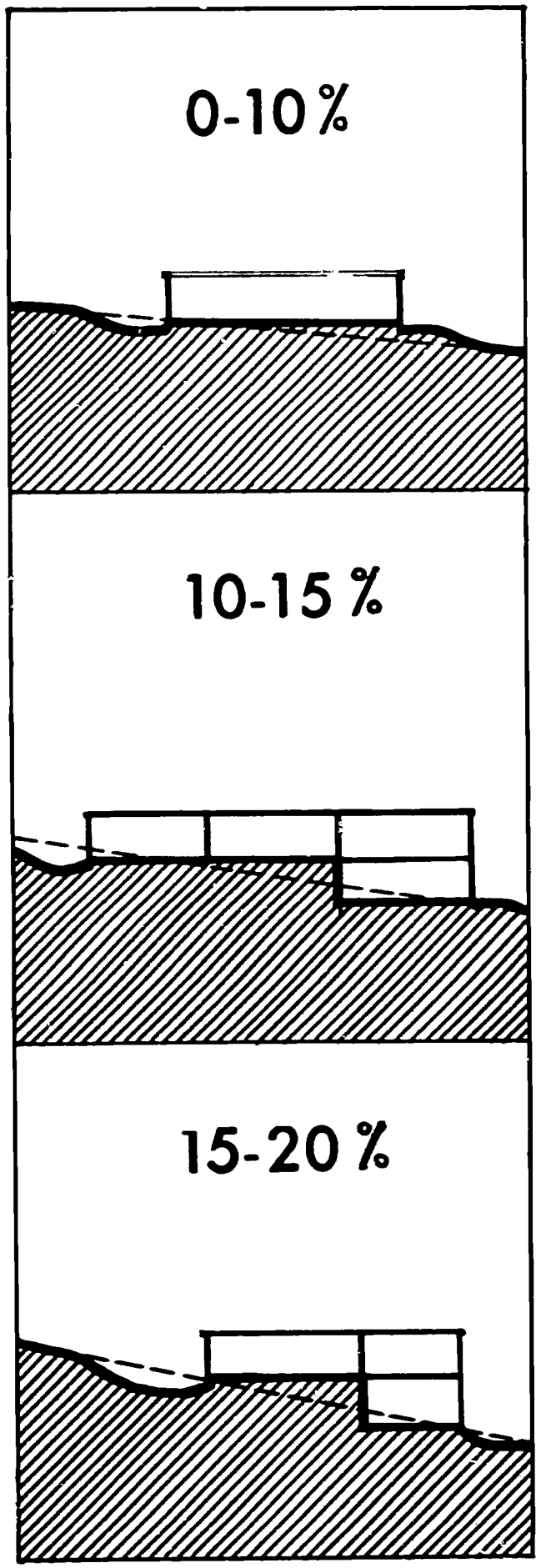
Classrooms facing south present the greatest problem so far as the control of the sun's rays is concerned, since the angle of the noon-day sun is extremely low in winter. Rooms facing north have no direct sun problem, but must be protected from the glare of the skydome. In most cases, a room facing north supplemented by bilateral lighting or skylighting is considered ideal. If a double-loaded corridor must be used, then facing the rooms east and west offers the least problem so far as sun control is concerned. In such a case, it should be noted that any substantial variation from a true east-west axis will greatly increase the control problems on one side of the building.

If proper orientation can be achieved by placing the wings of the building parallel to the contours, then it is often convenient to use a central stem in the form of a ramped corridor which connects the wings. Such an adherence to the natural slopes must, of course, be balanced against many other factors in the evaluation of the site. The absence of vegetation may make the use of the bulldozer more feasible in transforming a portion of the site into a level condition for the building area itself.

SITE STUDY

MODERATE TOPO





THE DIFFICULT SITE

In relating a building to steep land, the price we pay for contour adjustment must be within reason. The bulldozer has lessened the problem of earth removal, but visions of this easy levelling process have obscured other desirable means of solving the problem. When the cost of reconstructing a site approaches the price that might be paid for a more suitable location, then the wisdom of such procedure is doubtful. Another consideration, quite apart from cost, is the loss of vegetation, and any character the land may have possessed.

It seems that the following generalizations, with regard to sloping land, may be a help in determining a building scheme:

0 - 10% Place wings of the building parallel to contour, using shallow rooms where the slope is in excess of 7%

10 - 15% Place wings at right angles to the contours, using a split-level in the length of the building

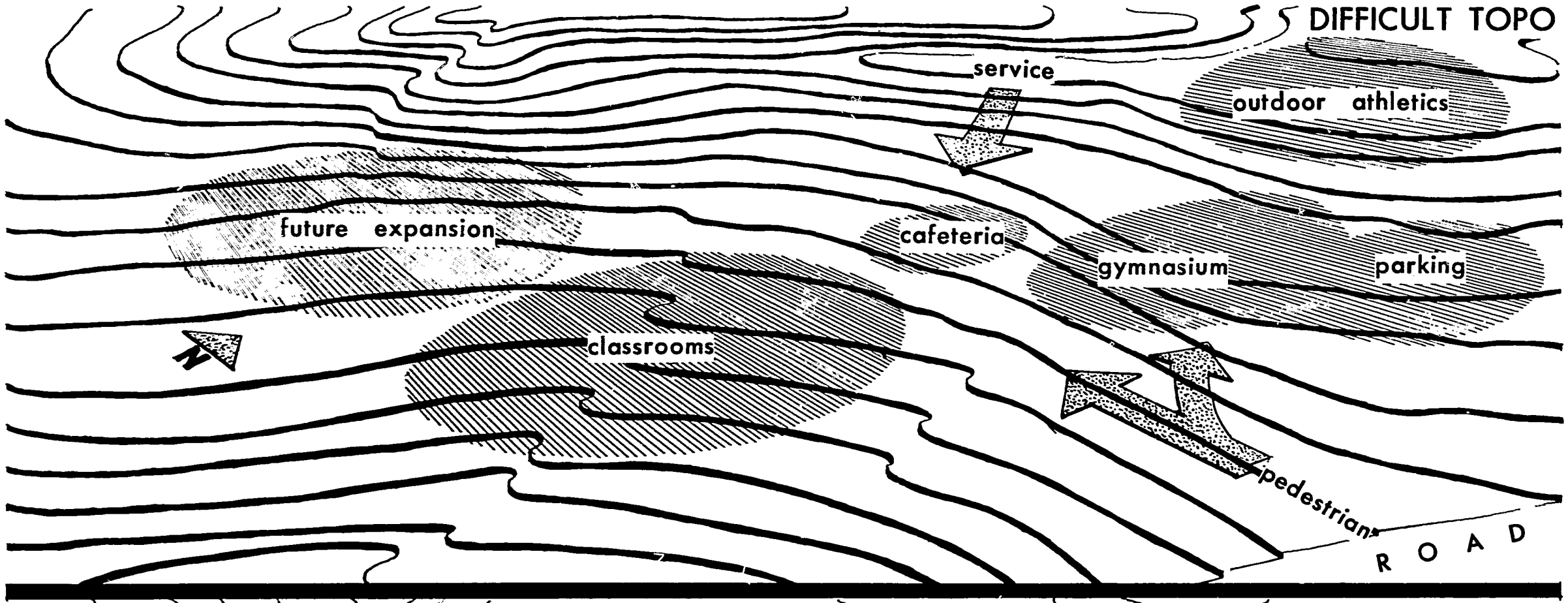
15 - 20% Place wings parallel to the contours using a split level in the cross-section of the building

If an athletic field is required, and the bulk of the land has slopes greater than 7%, locate the field on the flattest portion. In grading a field on slopes greater than 7%, the cost may become excessive and it frequently is more economical to position the buildings on the steep land.

The difficult site hampers the use of simple form and direct relationship, but it also invites compositions which are more varied and interesting.

SITE STUDY

DIFFICULT TOPO



SITE REQUIREMENTS

LOCATION

Near the center of existing and future student population
Free from the nuisance of railroads, factory smoke, noisy enterprises, and cheap commercialism
Travel time for elementary schools 30 minutes
for high schools 45 minutes

ACCESS

Over improved roads
Preferably not on a major highway

REQUIRED AREA in acres

Pupils	200	300	400	500	600	800	1000	1200	1400
Elementary school	10	10	10	12	12	15			
High school or union	12	12	12	14	16	20	24	26	28

These figures represent minimum areas and will necessarily vary in accordance with the percentage of the land which is usable

TOPOGRAPHY

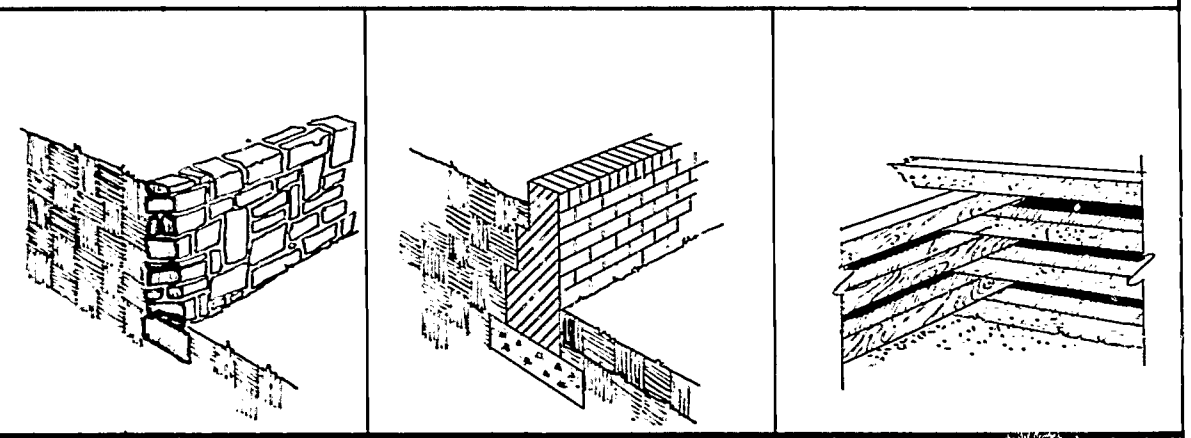
30 to 40 percent of the area shall have a slope of less than 10%

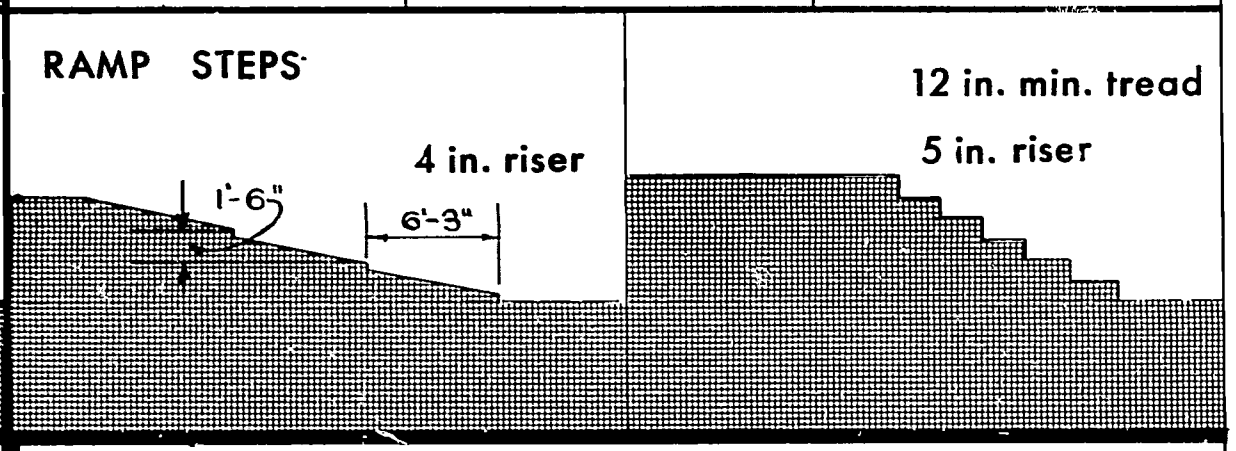
Grass sod or forest cover desirable
Soil should be well drained and capable of producing good turf

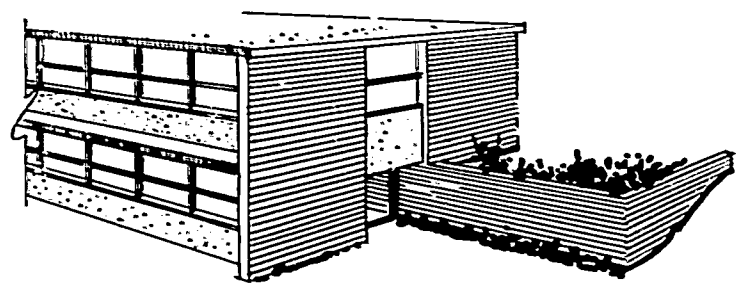
CONTOUR ADJUSTMENT

SLOPES

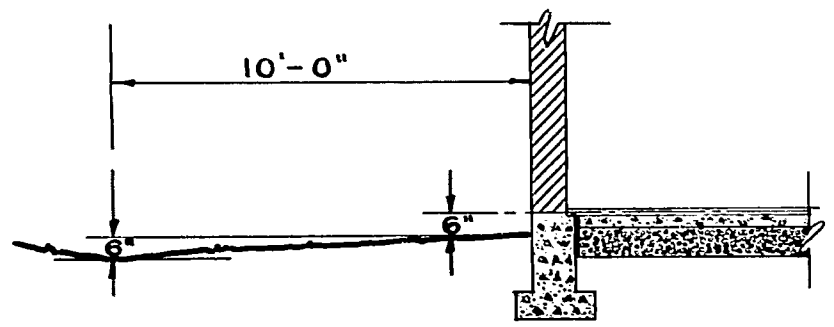
	MIN.	DESIRED MAX.	ABSOLUTE MAX.
TURF	2 percent	33 percent	50 percent
PAVING	1 percent	7 percent	10 percent



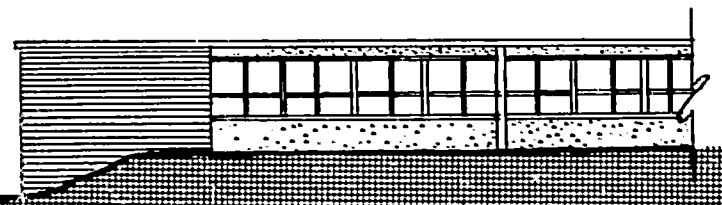


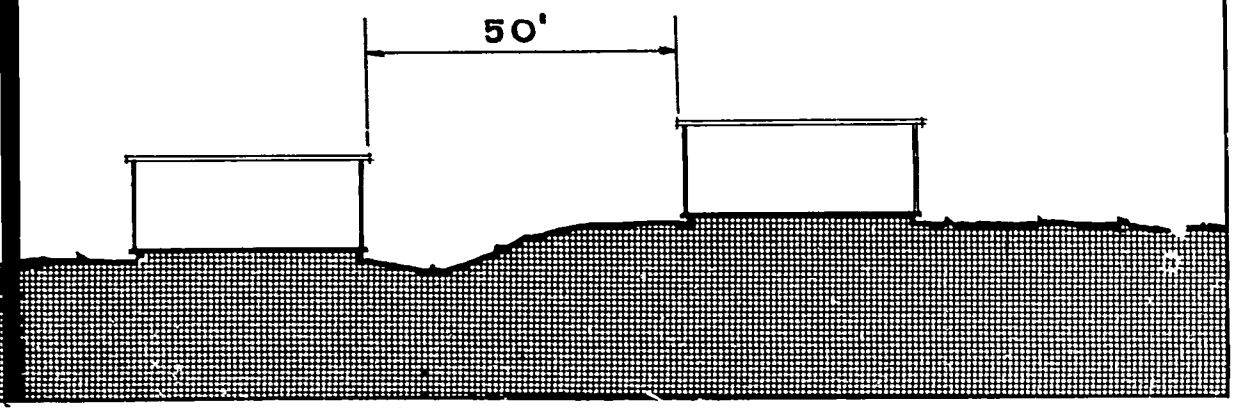


Whenever possible, the building should provide the means for adjusting itself to the varying ground elevations.



Sloping grade lines should be kept away from strong horizontal elements of the building





THE LANDSCAPE PLAN

The development of a landscape plan is an extension of the processes which took place in the determination of the site plan. If the site plan has effectively solved the problems of traffic, area disposition, and contour adjustment, then the landscape plan will offer no major problems. In general, there is little need for what one normally thinks of as "landscaping." To be sure, any situation will be improved by the judicious use of planting; but the greater need is for properly surfaced trafficways, protected walks, and well-defined playing fields.

Drives and Parking. The growing need for parking facilities presents itself in two patterns. One is the constant daily need for staff and bus parking and the other is the intermittent need for large public parking areas. Most schools can ill afford the cost of surfaced parking areas for the latter unless the space provides a double use as a play area. Generally, overflow parking during public assemblies will be accommodated on the playing fields, or nearby grass areas. It is imperative that the parking of buses be so arranged that it will not be necessary to use reverse gear while on the school grounds.

Walkways. The maintenance of grass areas will depend upon the skill with which the designer has solved the circulation pattern by consolidating the infinite directions of the herd into a few direct lanes. He is faced with another problem beyond the mere function of the walk, for paths divide the lawn into a pattern which may or may not be pleasant. The study of the "in-between" spaces is the key to a problem which appears to be very simple but in reality demands considerable skill to produce an aesthetically satisfactory result.

Playfields. Inevitably the soil will be exposed on the areas used as playgrounds. This need not be objectionable if such areas are delimited. If the play area can be separated from the balance of the grounds by a walk, curb, or hedge, then there is a fair chance that pupils and the public will respect the line dividing the areas of high maintenance and heavy use.

Planting. Proper planting will serve the school practically and aesthetically. Trees, shrubs, and ground cover are useful for:

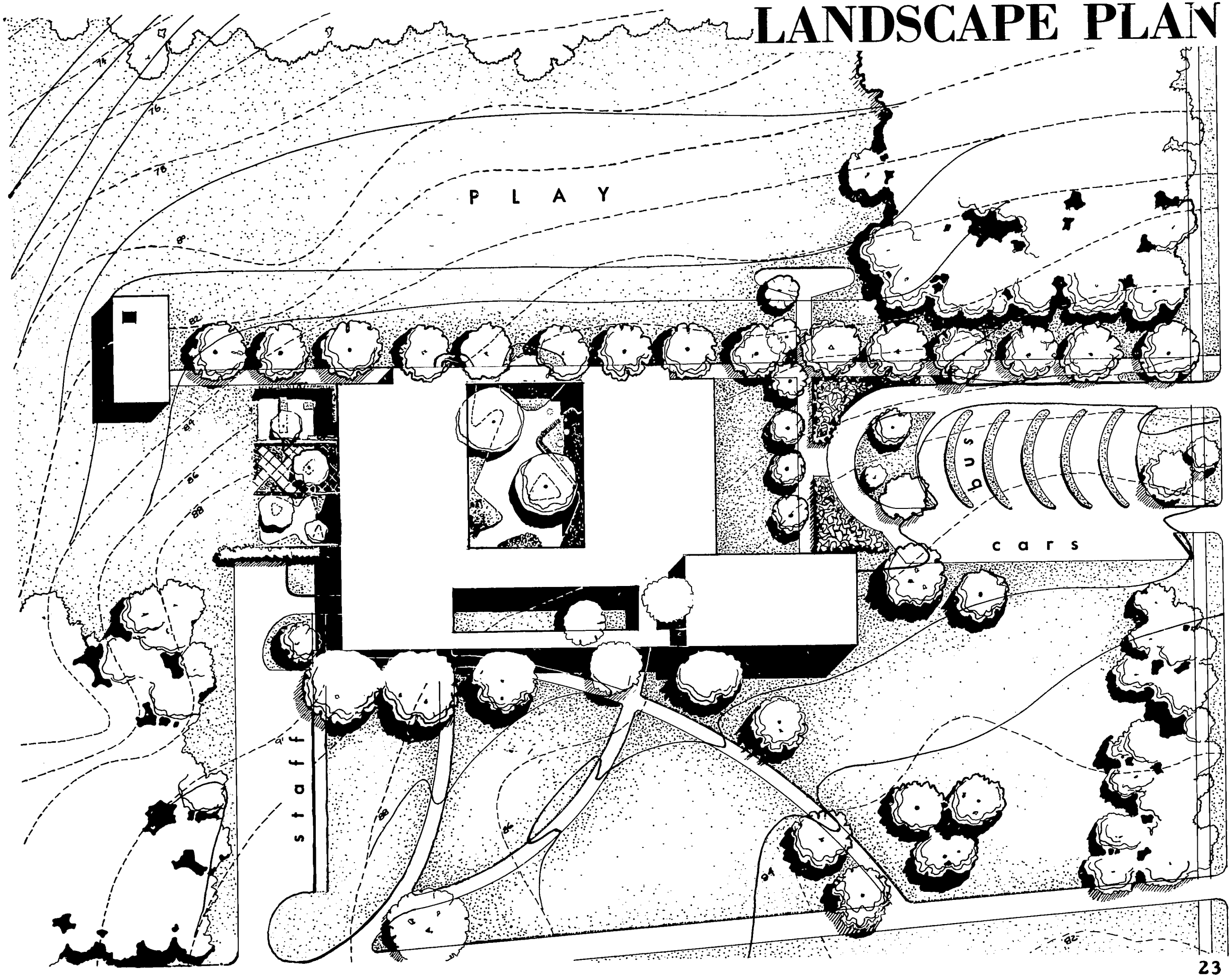
1. Erosion control
2. Sun control
3. Barriers

Their aesthetical value is to:

1. Enhance the structure
2. Define and limit areas
3. Provide contrasting patterns of light, shade and texture

The matter of "enhancing the structure" is the one which draws the most willing effort from interested parties. Usually this effort is misdirected and results in the overplanting of buildings with so-called "foundation planting." A safe approach to the problem would be the complete elimination of shrubbery close to the building. The best effects can generally be secured by the use of a few vines and trees with particular emphasis on the smaller flowering trees which are prized not only for the effects of foliage, fruit and flowers, but for the structure and the patterns of shadows which they cast.

LANDSCAPE PLAN



OUTDOOR LABORATORIES

Possibilities for the use of the school grounds as an outdoor laboratory are illustrated by the plan on the facing page. One would scarcely hope to find such a variety of teaching aids developed on one site, but every school ground will present the opportunities for some of these. The letters refer to the following:

A. School Gardens
B. Vegetables and Potted Plants
C. Growing Shrubs and Trees
D. Wildflower and Rock Gardens
E. Tree Growth Demonstrations
F Campus Arboretum
G. School Forests
H. Wildlife Sanctuary
I. Bog Gardens
J. Fish Pond
K. Turtle Pit
L. Erosion Control
M. Nature Trails
N. Weather Stations
O. Outdoor Classrooms
P. Picnic Area
Q. Outdoor Theater
R. School Campus
S. Fields for Crops and Horticulture

Numbers on the plan refer to the following plant lists: (Indented portions of lists are deciduous plants)

1. TREES

Long leaf Pine
Loblolly Pine
Shortleaf Pine
Hemlock
Holly
White Pine
Live Oak
Water Oak
Arbor Vitae
  Oaks
  Ash
  Tulip
  Winged Elm
  Hackberry
  Sycamore
  Maples
  Willow

2. LARGE SHRUBS, SMALL TREES

Abelia
Wintergreen Barberry
Ligustrum Lucidum
Osmanthus
Pyracantha
Rhododendron
  Forsythia
  Honeysuckle
  Mock Orange
  Viburnums
  Flowering Dogwood
  Flowering Cherry
  Apple

3. LOW SHRUBS

Japanese hollies
Cotoneaster
Barberry
Junipers, spreading
Ligustrum lucidum
  Winter Jasmine
  Red Chokeberry

HEDGE PLANTS

Privets
Eleagnus
Barberry
Hemlock

4. WINDBREAKS

Longleaf Pine
Loblolly Pine
White pine
Hemlock
Red Spruce

5. TREES FOR BOUNDARIES

Pines
  Oaks
  Maples
  Hickory
  Sycamore

6. TREES ALONG STREAMS

Hemlock
  Willows
  Alders
  Sycamores
  Elms
  Hackberry

7. SHRUBS FOR WILDLIFE

Multiflora rose
Lespedeza bicolor
Blackberry
Bayberry
Viburnum
Tartarian honeysuckle
Highbush cranberry
Flowering dogwood

81 TREES FOR WILDLIFE SANCTUARY

Mulberry
Elderberry
Sumac
Dogwood
Wildcherry
Black Locust
Walnut
Bayberry
Sassafrass
Hawthornes
Poison Ivy
Poison Oak

9. TREES FOR WILDLIFE SHELTER

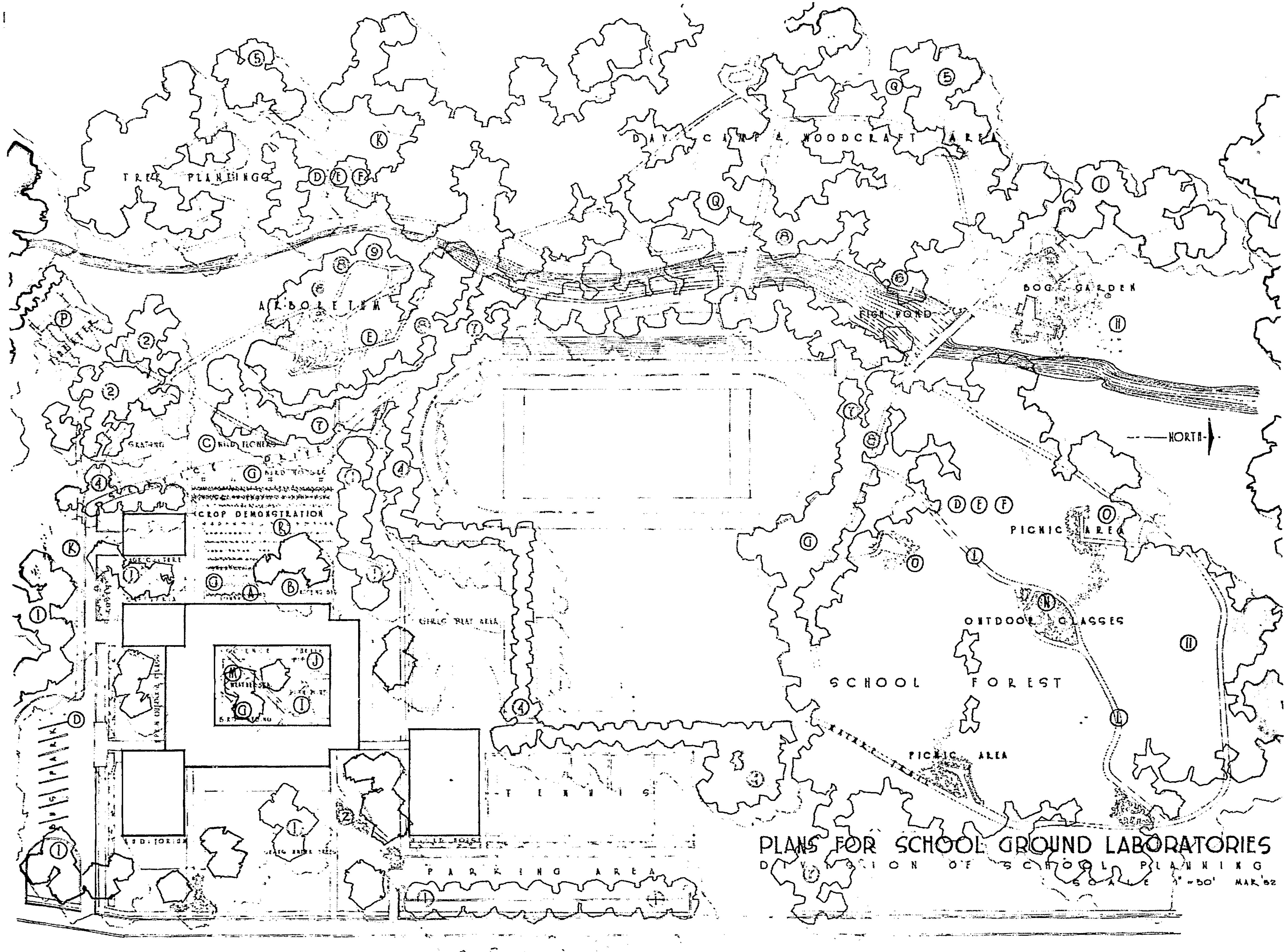
All evergreens

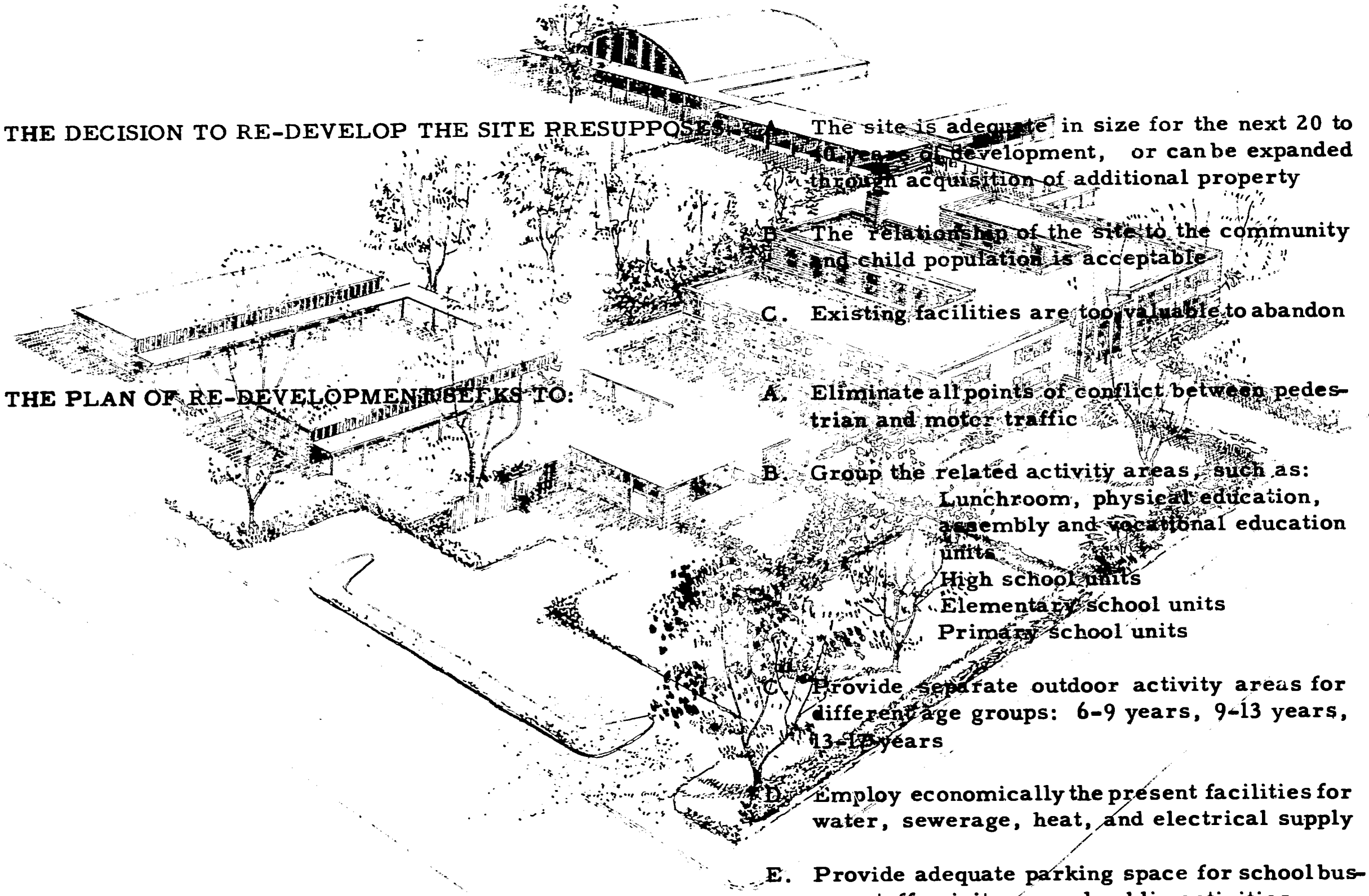
10. TREES FOR COMMERCIAL PURPOSES

Longleaf Pine
Loblolly Pine
Shortleaf Pine
White Pine
Spruce
  Tulip
  Locust
  Walnut
  Cherry
  Birch
  Oaks

11. FORRESTED AREA FOR CONTINUOUS ECOLOGICAL STUDY

These lists by Dr. R. L. Weaver, originally appeared in the May 1952 issue of the North Carolina Educator


TREE PLANTING
ARBORETUM
DAY CAMP & WOODCRAFT AREA
BOG GARDEN
FISH POND
NORTH
CROP DEMONSTRATION
GIRLS' PLAY AREA
PICNIC AREA
OUTDOOR CLASSES
SCHOOL FOREST
TENNIS
PARKING AREA
BUS PARK
AUDITORIUM
PLANS FOR SCHOOL GROUND LABORATORIES
DIVISION OF SCHOOL PLANNING
SCALE 1"=50' MAR '52



THE DECISION TO RE-DEVELOP THE SITE PRESUPPOSES:

A. The site is adequate in size for the next 20 to 40 years of development, or can be expanded through acquisition of additional property

B. The relationship of the site to the community and child population is acceptable

C. Existing facilities are too valuable to abandon

THE PLAN OF RE-DEVELOPMENT SEEKS TO:

A. Eliminate all points of conflict between pedestrian and motor traffic

B. Group the related activity areas, such as:
   Lunchroom, physical education, assembly and vocational education units
   High school units
   Elementary school units
   Primary school units

C. Provide separate outdoor activity areas for different age groups: 6-9 years, 9-13 years, 13-18 years

D. Employ economically the present facilities for water, sewerage, heat, and electrical supply

E. Provide adequate parking space for school buses, staff, visitors, and public activities

F. Induce a harmonious composition of building and site

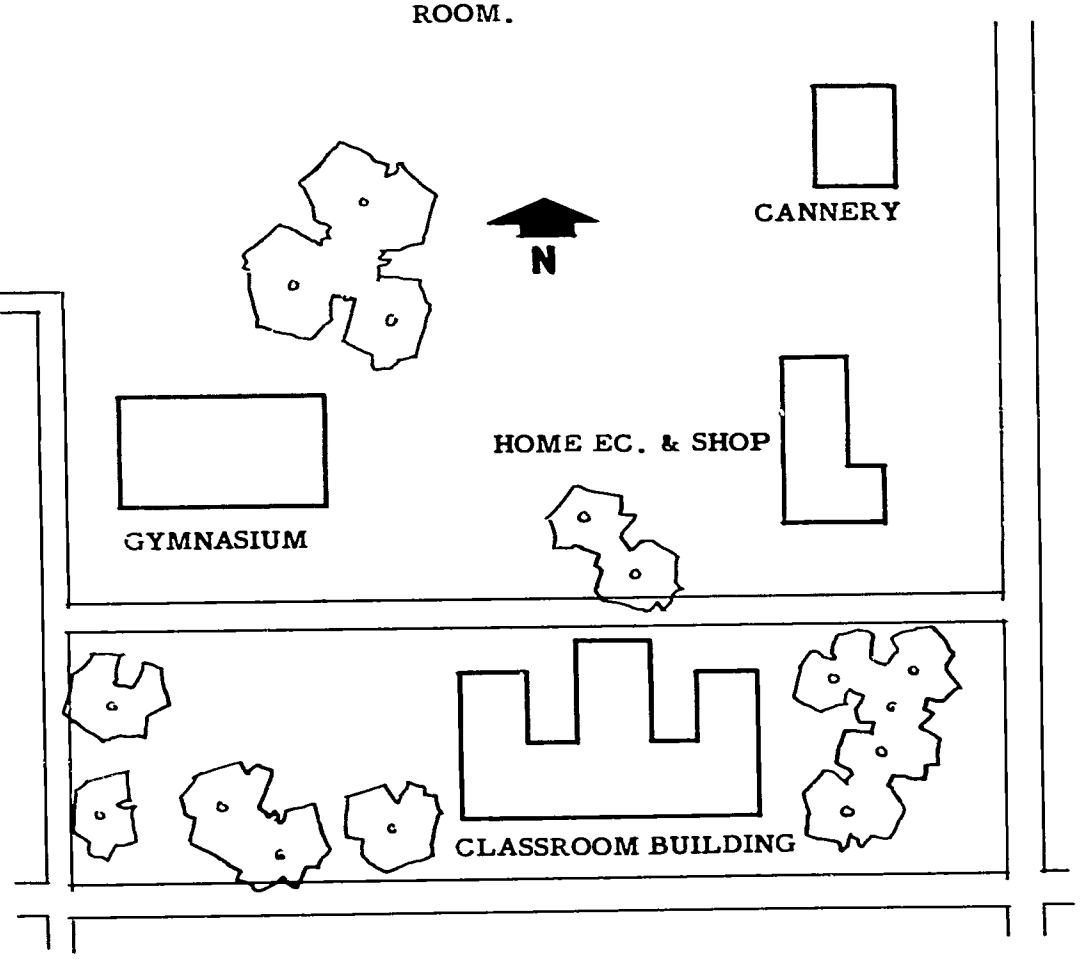
EXPANSION

ANALYSIS:

PROPERTY IS DIVIDED BY SERVICE ROAD. HIGH SCHOOL AND ELEMENTARY FACILITIES MIXED, WITHOUT REGARD TO NATURAL AFFINITIES.

PROBLEM:

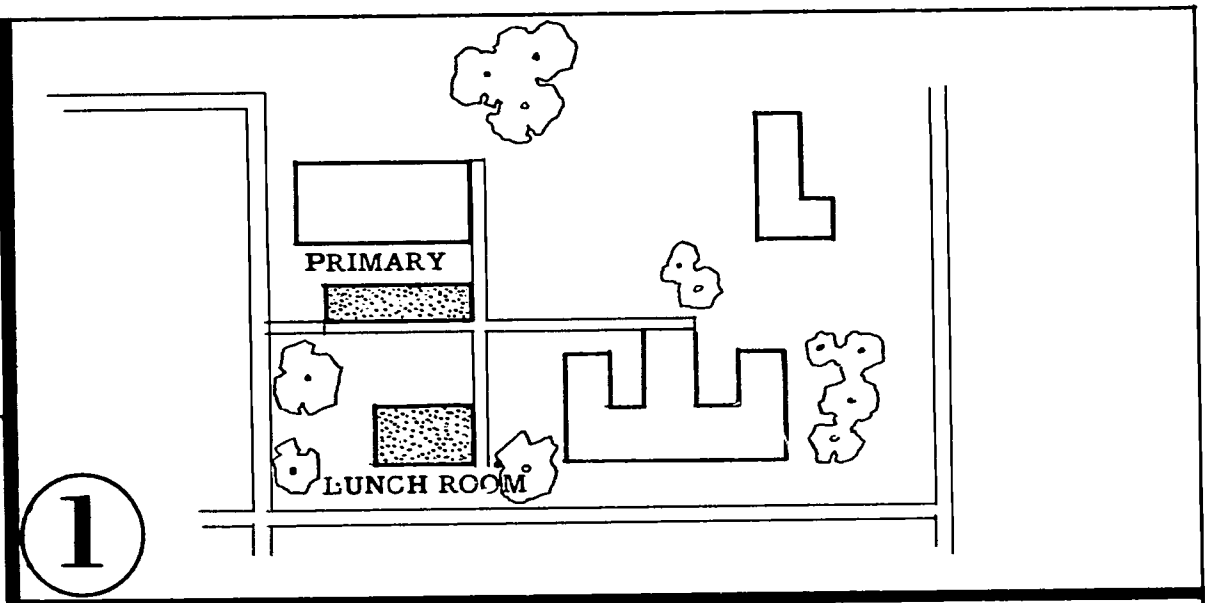
TO ADD 6-10 PRIMARY CLASSROOMS, 12-18 ELEMENTARY CLASSROOMS, 8-12 HIGH SCHOOL CLASSROOMS, GYM, AND LUNCH ROOM.

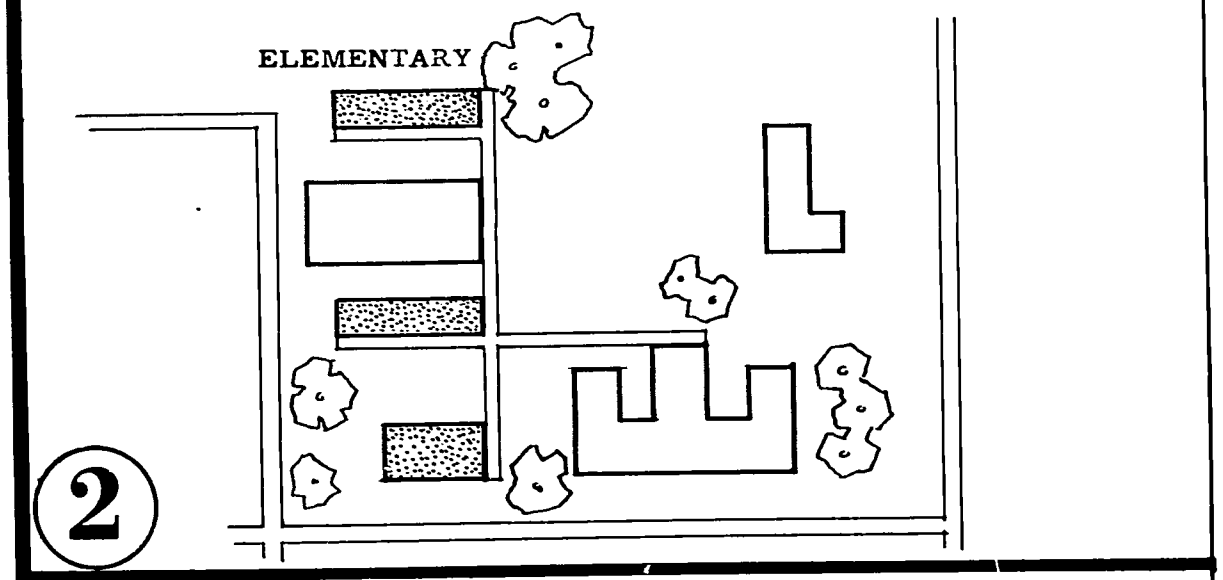


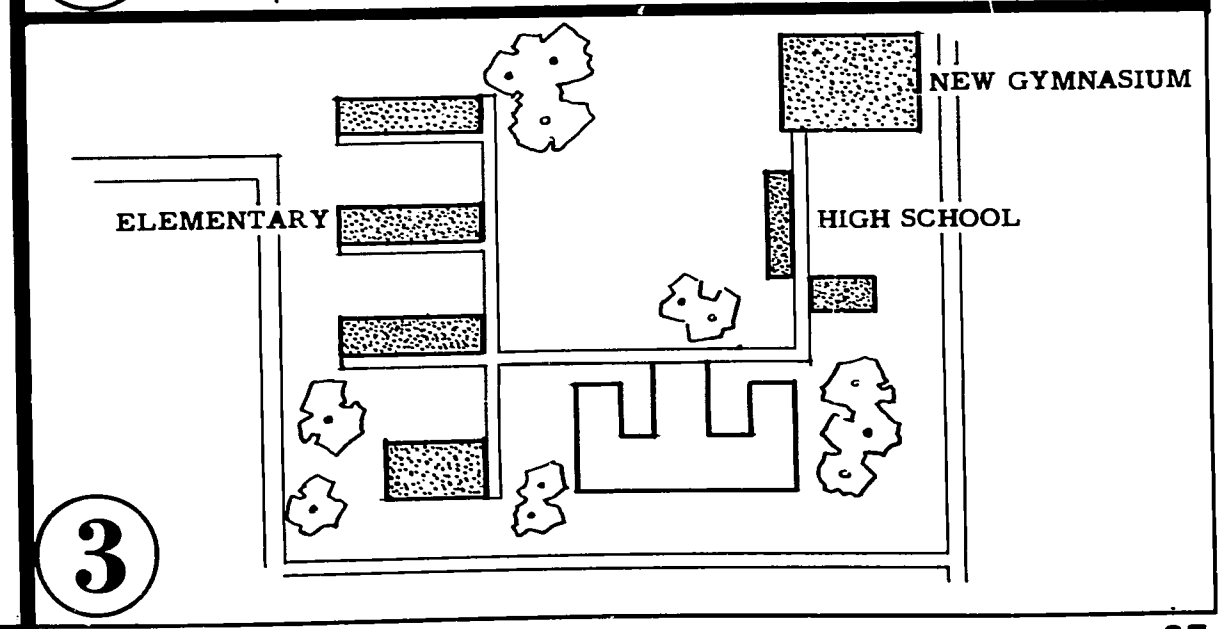
DECISION:

SINCE THE GYM IS TO BE REPLACED, IT SHOULD BE LOCATED NEAR THE HOME EC. AND SHOP TO FORM A NUCLEUS FOR THE HIGH SCHOOL.

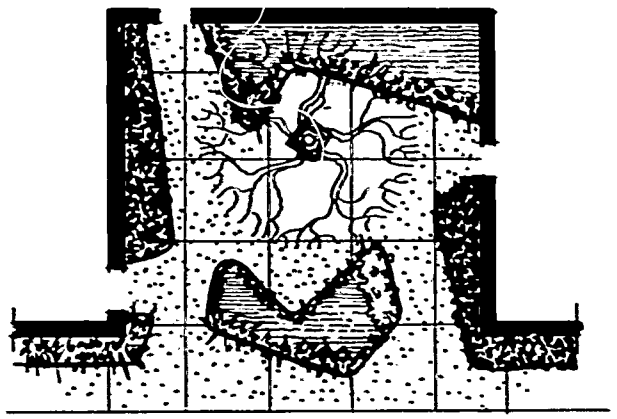
THE LUNCH ROOM IS PLACED ON CORNER OF PROPERTY BETWEEN THE EXISTING BUILDING AND PROPOSED ELEMENTARY UNIT, WHICH WILL DEVELOP ALONG THE WEST PROPERTY LINE.

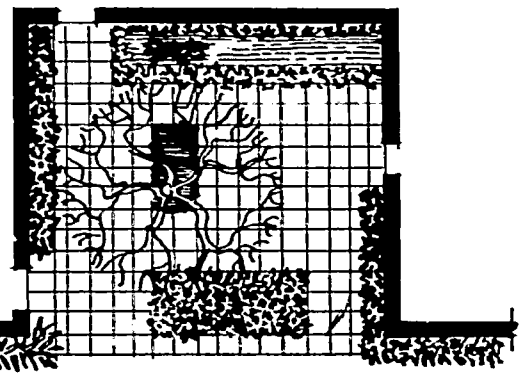


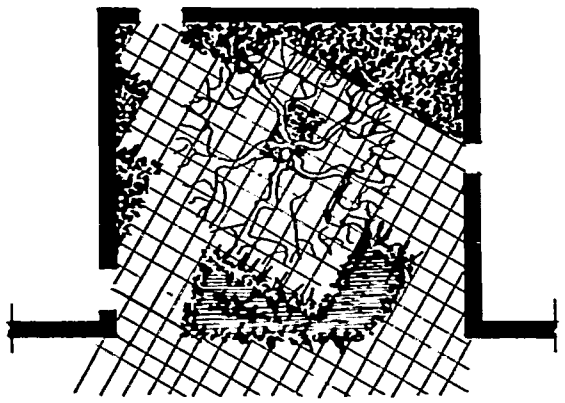




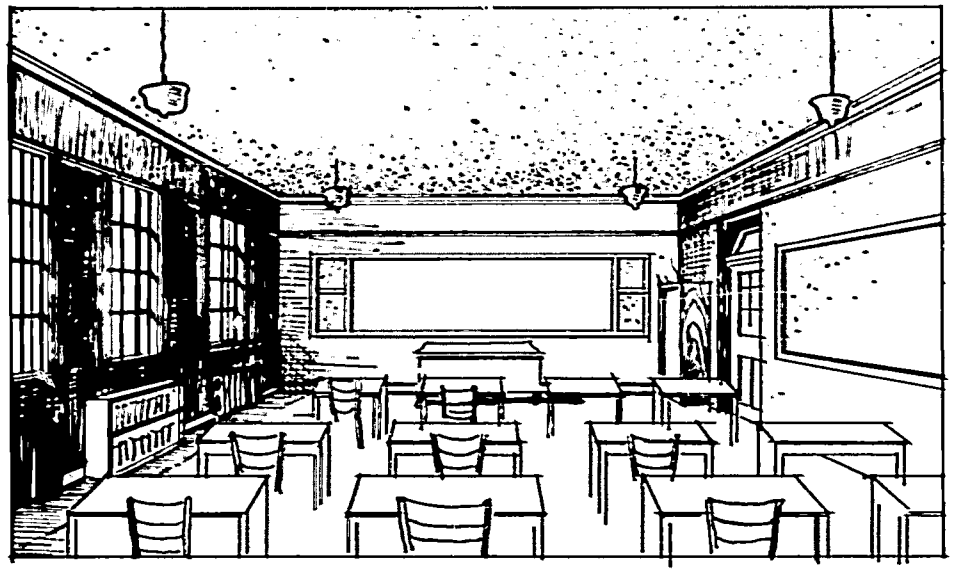
SITE IMPROVEMENT



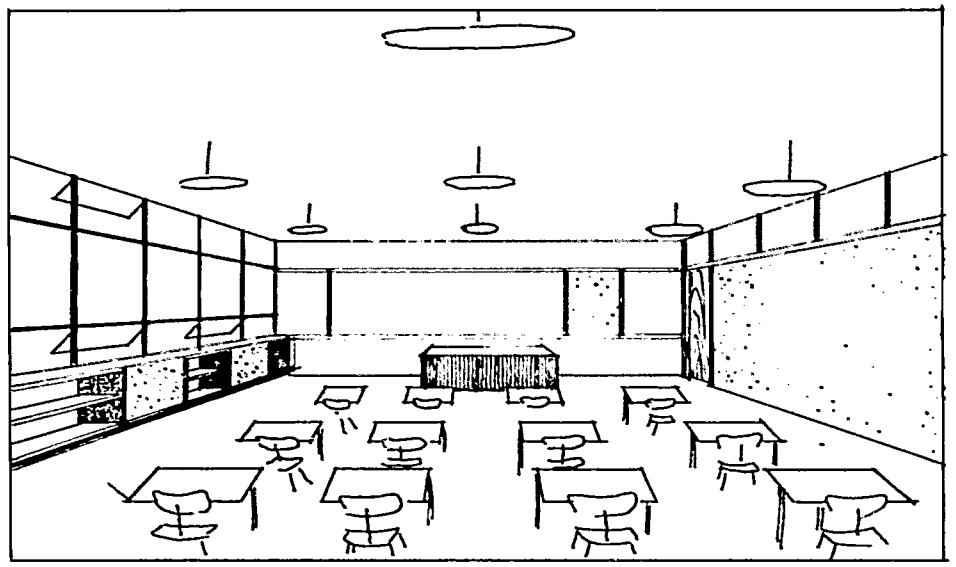


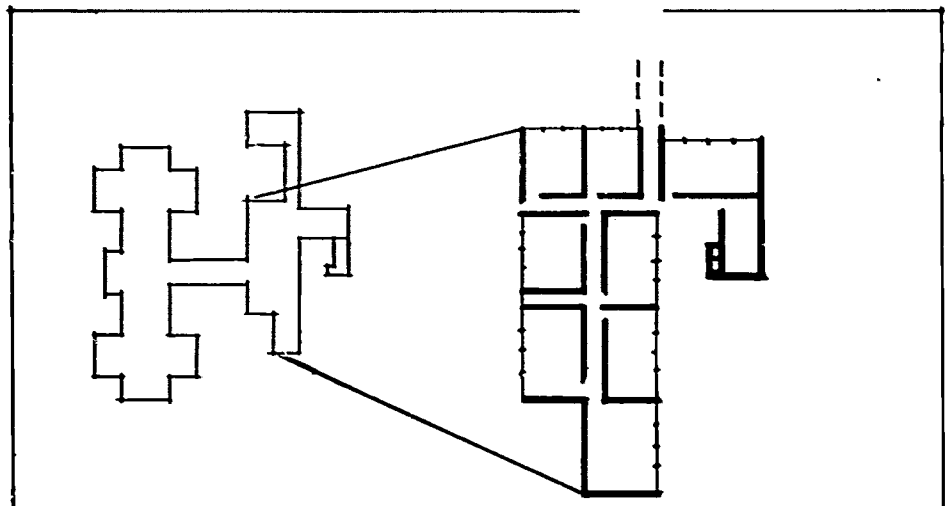


ARTICULATION

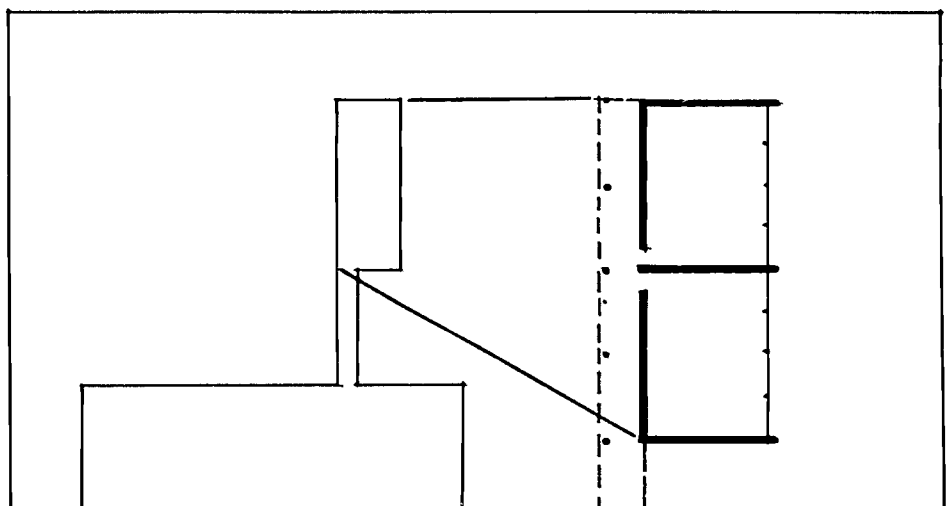


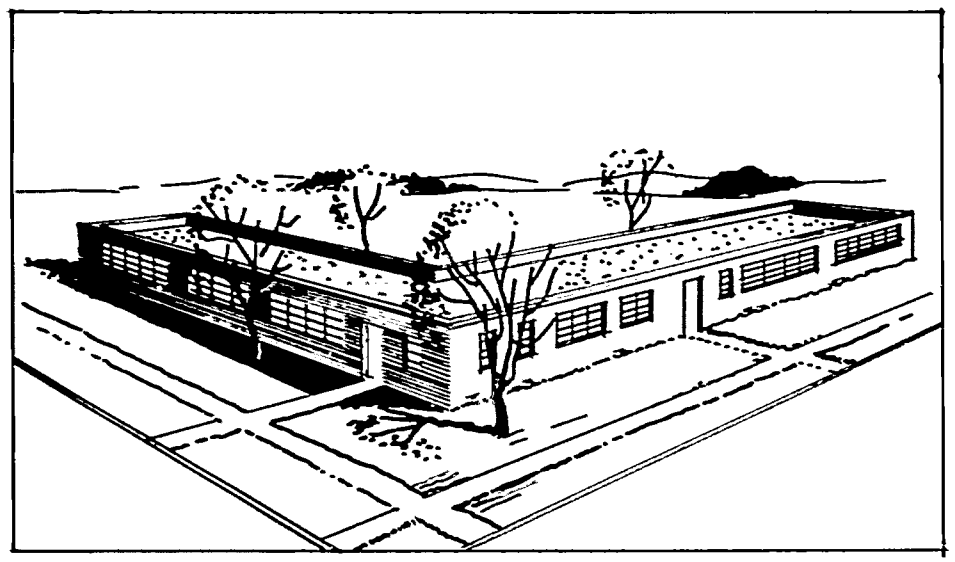
The feeling of clutter on the left is due to a lack of relationship between the walls and openings and the furnishings of the room. The room on the right first articulates the different elements and then integrates them to form a more restful interior with a sense of continuity with the outside space and the remainder of the building.



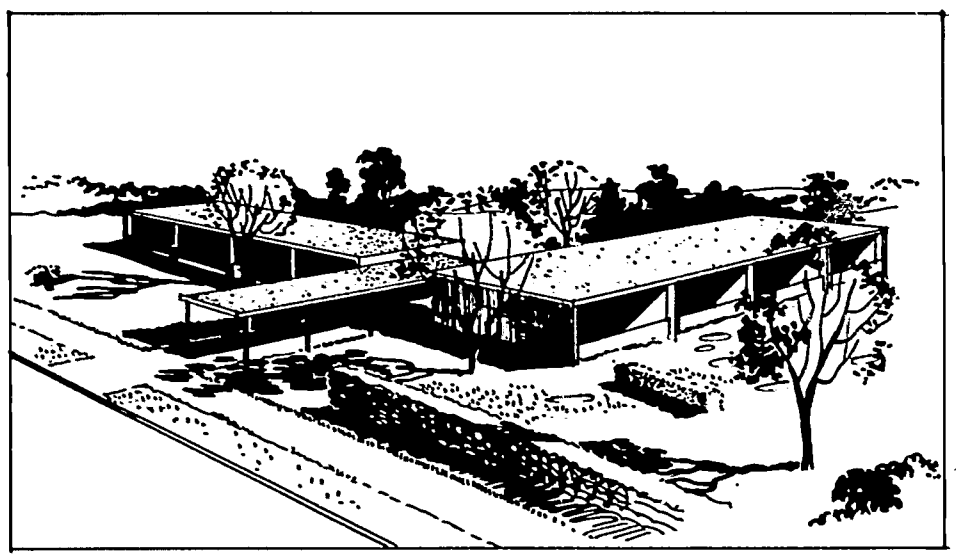


The confused plan on the left is typical of those which are the result of expediency and planning for the moment. The circulation is difficult, expansion is a problem, and the effect is cluttered. By proper planning a separation of the new plan elements into unified parts produces a quieter, more logical, comprehensible scheme as shown on the right





The building on the left lacks the unity it might have if the form of the building were completed Resolving it into two related elements as shown on the right produces a more satisfying building form. Complete in itself, the building is capable of expansion without impairing its effectiveness.



P R I M A R Y C R

SIZE Minimum, 950 sq. ft., including toilet room

OUTDOOR SPACE

Area immediately outside of classroom developed for learning and play activities
Door to outside directly from classroom

STORAGE

For teacher, a compartment with lock
Minimum, 5'-6" high, 3'-0" wide, 1'-8" deep
Pole for hanging garments, with shelf above
Shelving for teaching aids, and supplies

For pupils
Garment storage, enclosed but ventilated, with pole for hangers, varying heights with grades
For supplies, a compartment for each pupil, 12" wide, 10" high, 14" deep, doors not necessary, not located under chalkboards

WORK AREA

At least ten lineal feet of workcounter, 2'-0" deep, including a sink
Storage cabinets with doors and shelving under counter, including one cabinet space for large chart papers, 24" by 36", 8" shelf spacing

TOILET AND PLUMBING

Toilet room directly off classroom, convenient to outside door
Handwash lavatory in classroom area
Drinking fountain in classroom area, separate from lavatory and sink

EQUIPMENT

Chalkboard	12 to 16 lineal feet, 3'-6" wide
Tackboard	16 lineal feet or more, including at least one piece 8' by 3'
Outlets	Two or more convenience outlets, on opposite ends or sides of room
Shelving	For book storage and displays

HEIGHTS

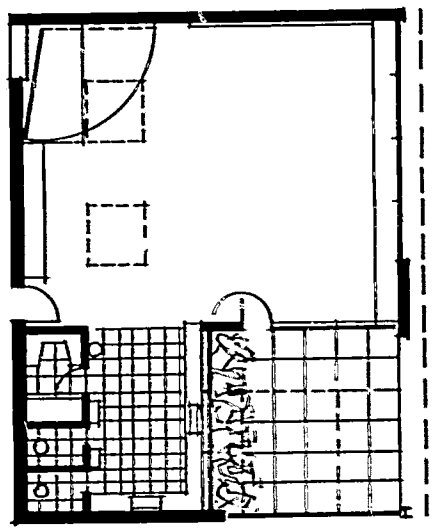
Chalkboard rail	21" to 26" or lower
Work counter and sink	24" to 26"
Lavatory	22" to 24"
Drinking fountain bubbler	25"
Clothes pole	40" to 44"

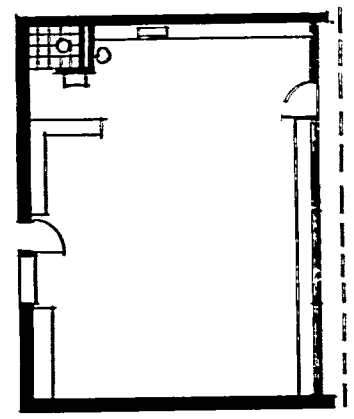
FINISHES

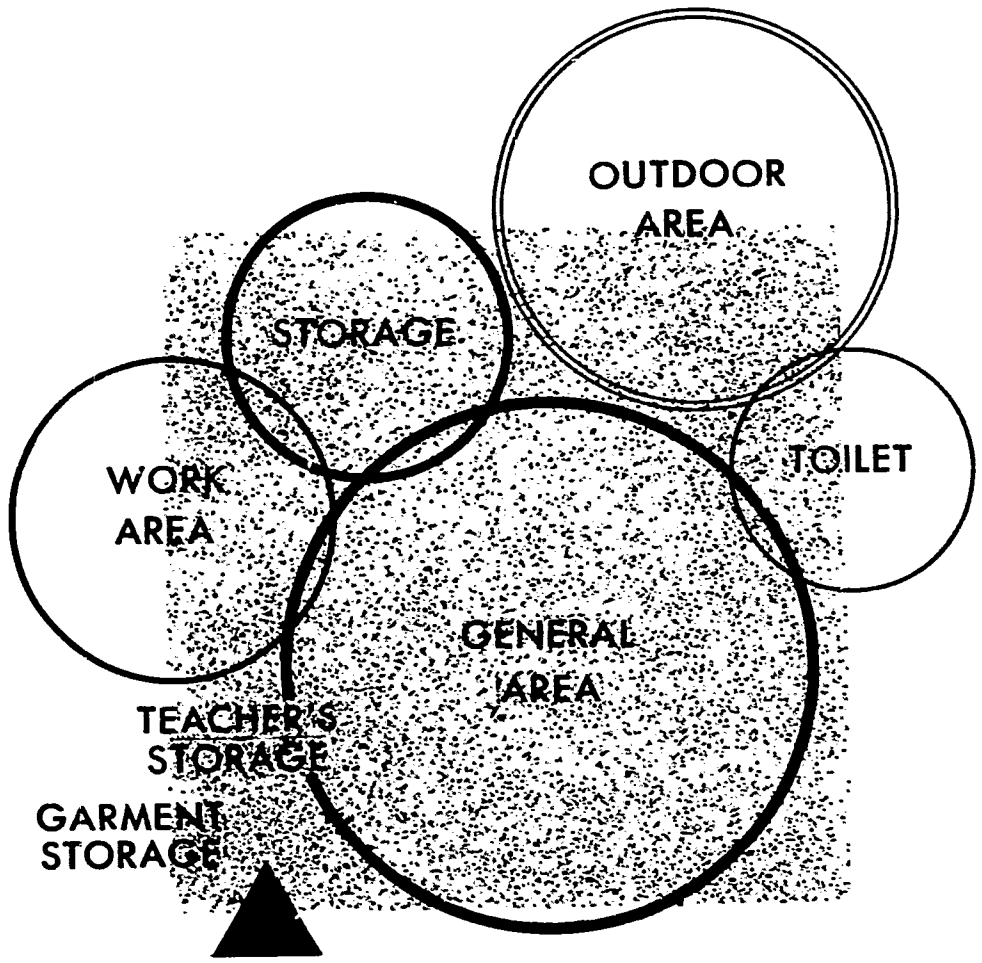
Classroom floor:	Asphalt or plastic tile
Work space floor:	Hard tile or terrazzo floor and base preferred
Toilet room:	Hard tile; ceramic tile floor and wainscot preferred
Counter tops:	Plastic or linoleum
Window stools:	Hard tile, slate, hard stone; not affected by moisture, requiring no paint

Suggestions
A library corner
Display box or cabinet in wall between calssroom and corridor, which may also serve as observation port
Floor to ceiling storage room of about 50 sq. ft.
Cleaning equipment storage
Two toiletsrooms for each classroom
Special lighting for tackboard, chalkboard, displays
Provision for darkening room for audio-visual aids

PRIMARY C.R.






OUTDOOR
AREA
STORAGE
WORK
AREA
TOILET
GENERAL
AREA
TEACHER'S
STORAGE
GARMENT
STORAGE

SIZE Grades 4 to 6 800 sq. ft. or more
Grades 7 to 12 750 sq. ft. or more

STORAGE

For teacher, a compartment with lock
Minimum, 5'-6" high, 3'-0" wide, 1'-8" deep
Pole for hanging garments, with shelf above
Shelving for teaching aids and supplies

For pupils, elementary grades
Garment storage, enclosed but ventilated, with pole for hangers, varying heights with grades
For supplies, a compartment for each pupil, with doors, 14" wide, 10" high, 14" deep, not located under chalkboards

For high school students, and others not in self-contained classrooms
Garment and equipment storage in corridor lockers

WORK AREA

For elementary school
At least six lineal feet of work counter, 2'-0" deep, preferably including a counter-type sink
Storage cabinets with doors and shelving under counter

For junior high school and high school
Work counter and sink desirable for classrooms which may be used for drawing and art classes

EQUIPMENT

Chalkboard 16 lineal feet, 3'-6" wide
Tackboard 16 lineal feet or more, including at least one piece 8' by 3'
Outlets Two or more convenience outlets, on opposite ends or sides of room, one preferably in the work area
Shelving For book storage and displays
Blackout Provisions for darkening room to permit use of audio-visual equipment

HEIGHTS in inches

	Grades 4 to 6	Grades 7 to 8	Grades 9 to 12
Chalk rails	28 to 30	29 to 32	33 to 36
Work counter	30 to 33	33 to 36	33 to 36
Clothes pole	44 to 48	48 to 52	

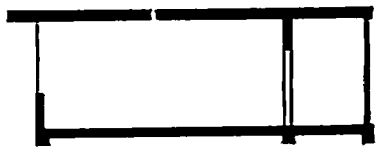
FINISHES

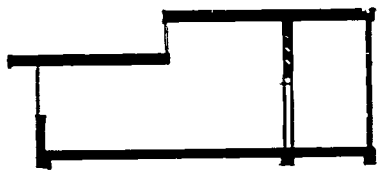
Classroom floor: Asphalt or plastic tile
Counter tops: Plastic or linoleum
Window stools: Hard tile, slate, hard stone; not affected by moisture, requiring no paint

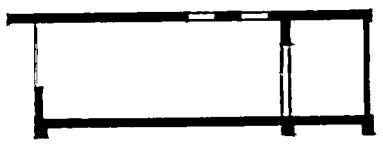
Suggestions

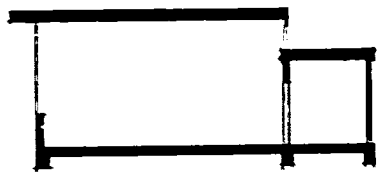
Two doors in each high school classroom to facilitate movement between classes
Special lighting for tackboard, chalkboard, displays, work counter
Display box or cabinet in wall between classroom and corridor.

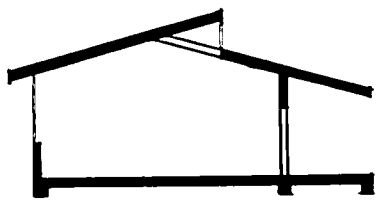
ELEM. & H.S.- C.R.

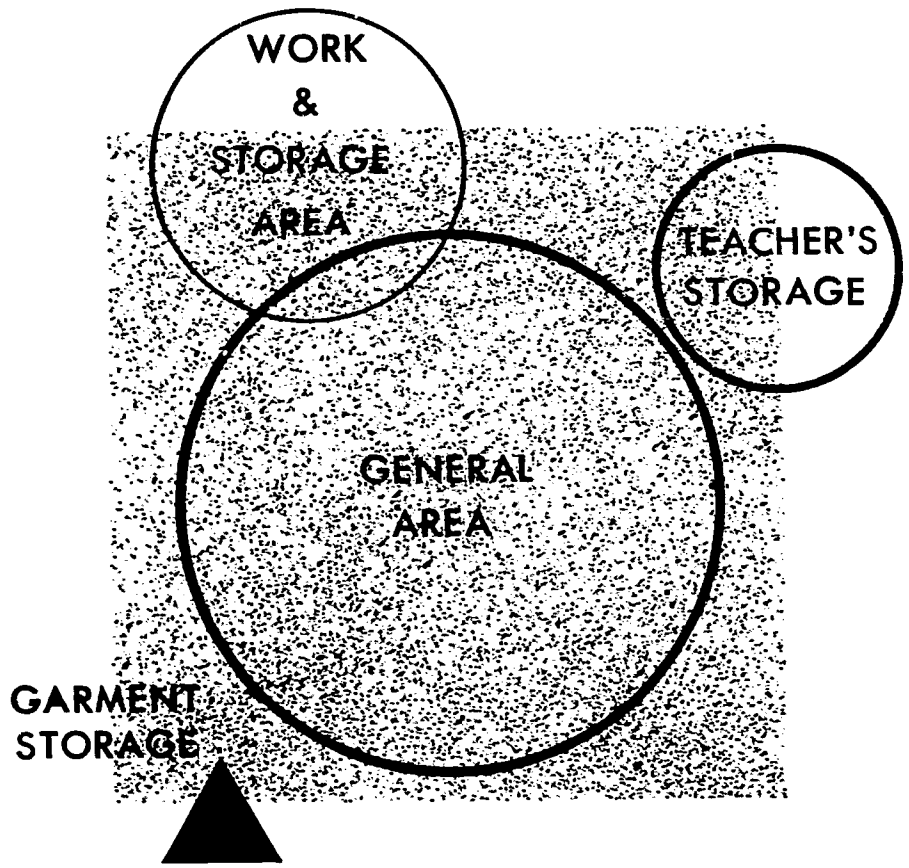











WORK
&
STORAGE
AREA
TEACHER'S
STORAGE
GENERAL
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GARMENT
STORAGE

ADMINISTRATION

OFFICES

Principal's office

In small schools, adjacent to one classroom
Separated in part from public office or corridor by a glazed partition equipped with blinds, shades, or drapes, to permit complete privacy
Convenient to small toilet room

Public office

Accessible from corridor or lobby
Adjacent to book storage and to supply room

Storage

Book storage room with open shelves required
Store room for office equipment and supplies
Vault desirable for large schools

Additional offices

In larger schools, additional offices for secretarial personnel, for counsellors, deans

Finishes

Equal to that of classrooms
Acoustical treatment recommended

TEACHERS' ROOMS

Location

In most schools, preferably adjacent to health clinic

Lounge

Area determined by size of school
Space for informal furniture
Toilet room adjacent

HEALTH CLINIC

Location

Adjacent to administration office or to teachers' rooms or to both, arranged to permit expansion for group health examinations

Facilities

Space for cots, tables, chairs
In larger schools, separate waiting room, examination room, dressing room, resting room
Toilet room with toilet, lavatory, and shower
Storage closet

Finishes

Equal to that of classrooms and toilet rooms

CIRCULATION

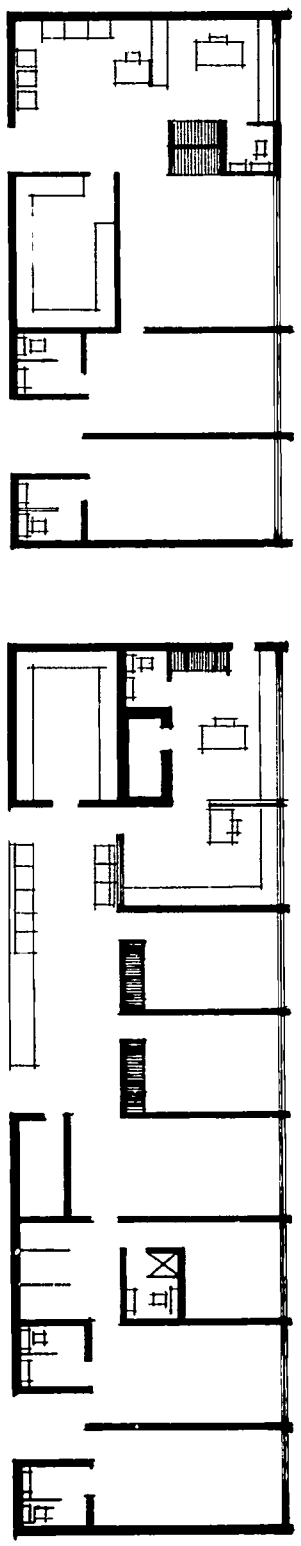
CORRIDORS

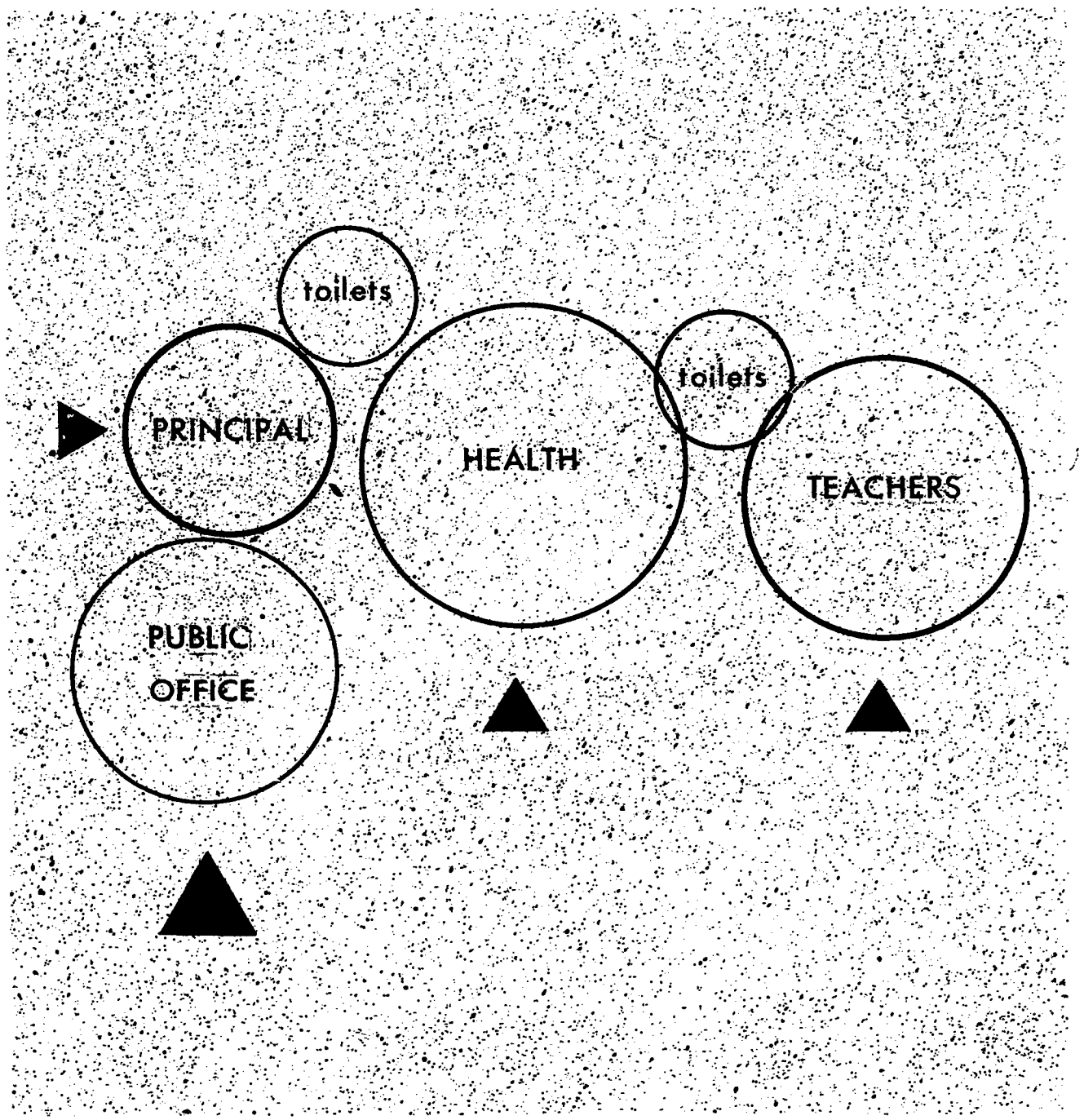
Minimum width, without corridor lockers: 8'-0"
Minimum width, with corridor lockers: 9'-0" clear
Greater widths required for long corridors
Adequately lighted, preferably with natural light
Corridors and lobbies may be used for exhibits, displays
Wire glass to be used in large panes in glazed doors

STAIRS AND RAMPS

Stairs to be avoided wherever possible
Ramps preferred to stairs
Maximum pitch of ramps: 10%; preferred pitch: 7%
Stairs to conform to requirements of NC Building Code
All stairs to be provided with safety treads
For stairs used mostly by elementary school pupils, use tread and riser dimensions comfortable for small children
Stair hand rail heights: adults: 2'-8", children: 2'-3"
For elementary school, provide two hand rails; one at each height.

ADMINISTRATION





L I B R A R Y

LOCATION Convenient to study hall
Near center of classroom traffic
Away from disconcerting noises
Where future expansion is possible
Where the prospect from the windows is pleasant and not distracting

CIRCULATION AND READING ROOM

Size

Enrollment	200	400	600	800	1000
Seating	50	70	80	90	100

25 to 30 square feet for each seating space

Adjustable open shelving

Maximum height: elem. 6'-0", H. S. 7'-0"
Low shelving, 36 to 48 inches high, beneath glass partitions, windows, and to separate special areas
Depth of shelves: Standard 8"
Oversize and reference 10"-12"
Magazines and newspapers 12"-15"
Maximum length of shelf units 36 inches

Furniture and equipment

Circulation desk, space for chairs at tables of various sizes, files, book truck
Display shelving and bulletin boards

WORK ROOM AND LIBRARIAN'S OFFICE

Size

Floor area of 150 to 230 square feet

Work space

Work counter, with built-in sink and cabinets
Wall cabinets for supplies
Shelving for books, newspapers, photographs

Office space

Located in work room, where librarian can control all library activities
In front of glass partition which separates work room from reading room
Space for librarian's desk, chair, files

CONFERENCE ROOM

Size and arrangement

Floor area of 150 square feet or more
Space for 3' by 5' table, 6 to 8 chairs, and some shelving
Part of separation from reading room to be a glass partition

AUDIO-VISUAL AIDS AREA

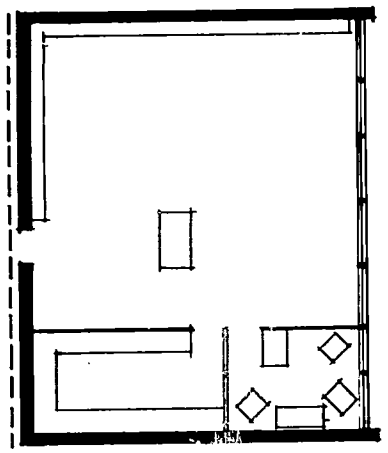
Use of space

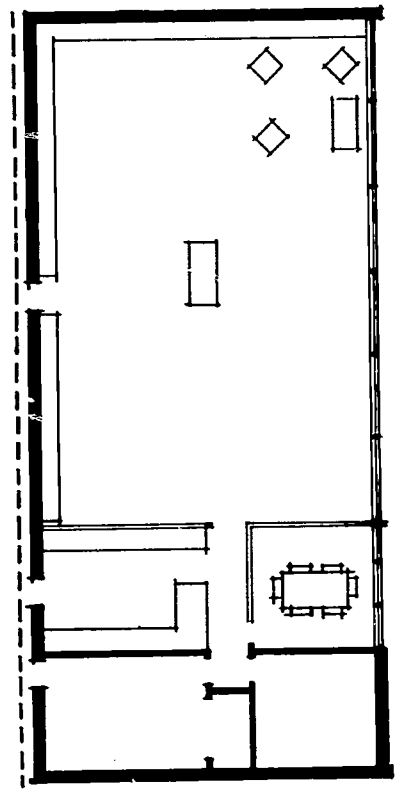
Screening, listening, preview, demonstration
Storage of equipment and materials
Processing, inspection, and repair
Display and exhibits
Shelving for films and recordings

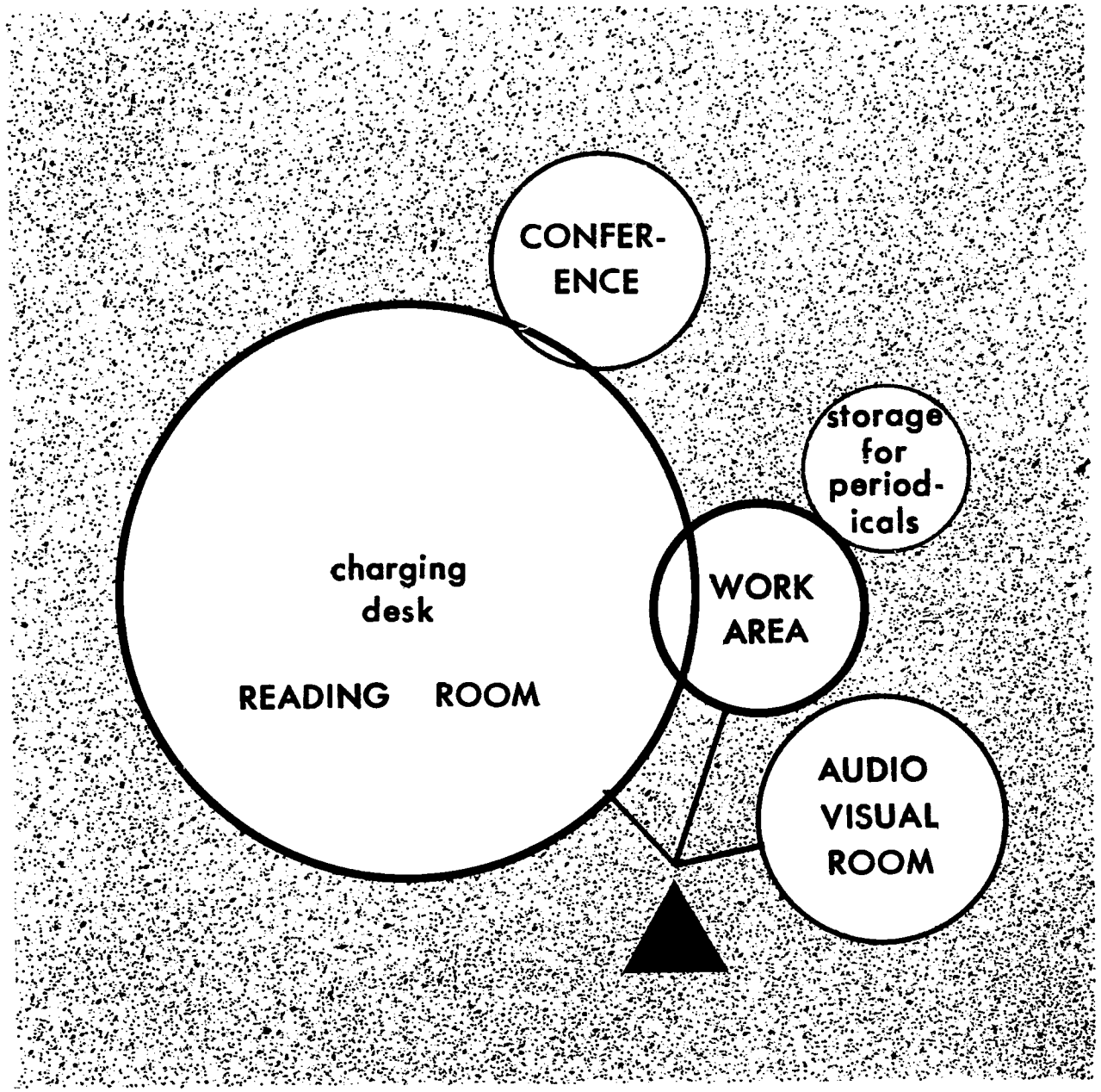
PERIODICALS STORAGE

Separate room with adequate wide shelving
In small library, deep shelving in work room

LIBRARY






CONFER-
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storage
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charging
desk
READING ROOM
WORK
AREA
AUDIO
VISUAL
ROOM

S C I E N C E

This outline describes the well-planned all-science room for the moderate-size school The larger school will require that these facilities and equipment be housed in one or more additional rooms, with the storage rooms between them

CLASSROOM AND LABORATORY

Flexible class-laboratory space for 20 to 30 students
Minimum of 30 square feet for each student, exclusive of storage
Orientation toward sunlight
Easy access to outdoors
12 to 20 feet each of chalkboard and of tackboard
Provision for use of motion pictures, filmstrips, opaque and micro-projectors
Means of reducing illumination to one foot-candle or less
Electric outlets providing 2 to 3 kilowatts

FURNISHINGS

Movable tables for two students each
Demonstration table, fully equipped, having 12 to 20 square feet of work space, 36 to 38 inches high, with one or more spotlights overhead
Permanent work space, supplied with gas, water, and electricity, and located at rear or sides of room
Germination or plant bed, 2 feet by 6 to 8 feet, equipped with water supply and drain
Suitable shelving for a library of books, pamphlets, and magazines
Display cabinet, 24 inches deep, of corridor or corridor-room type, with one or more spotlights, and preferably supplied with electricity, water and gas

STORAGE

100 to 150 lineal feet of open shelving, 12 to 16 inches deep
Safe storage for dangerous and expensive equipment
15 to 30 tote trays, 18 inches wide, 24 inches long, 10 inches deep, interchangeable between storeroom and class-laboratory space

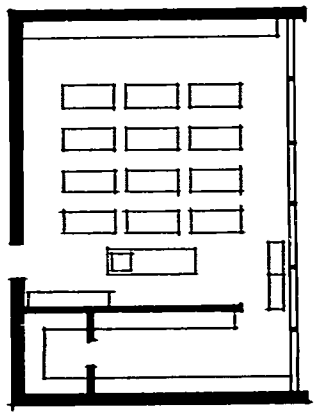
DARKROOM for photographic work and light experiments

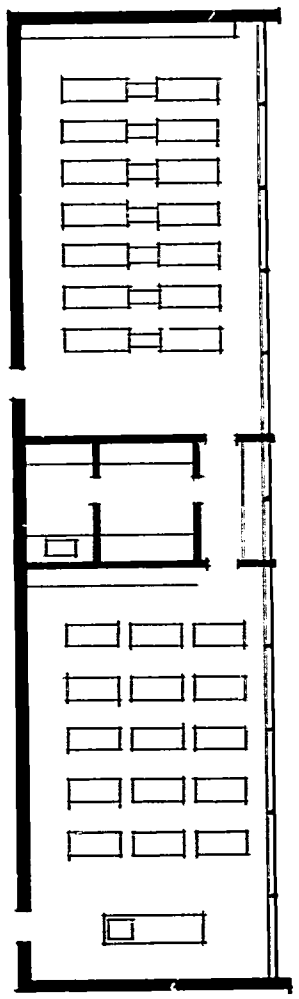
Space for 3 to 6 students
Large sink, counter space for enlarger, print boxes, light-tight storage for paper and films
Several 110-volt electric outlets

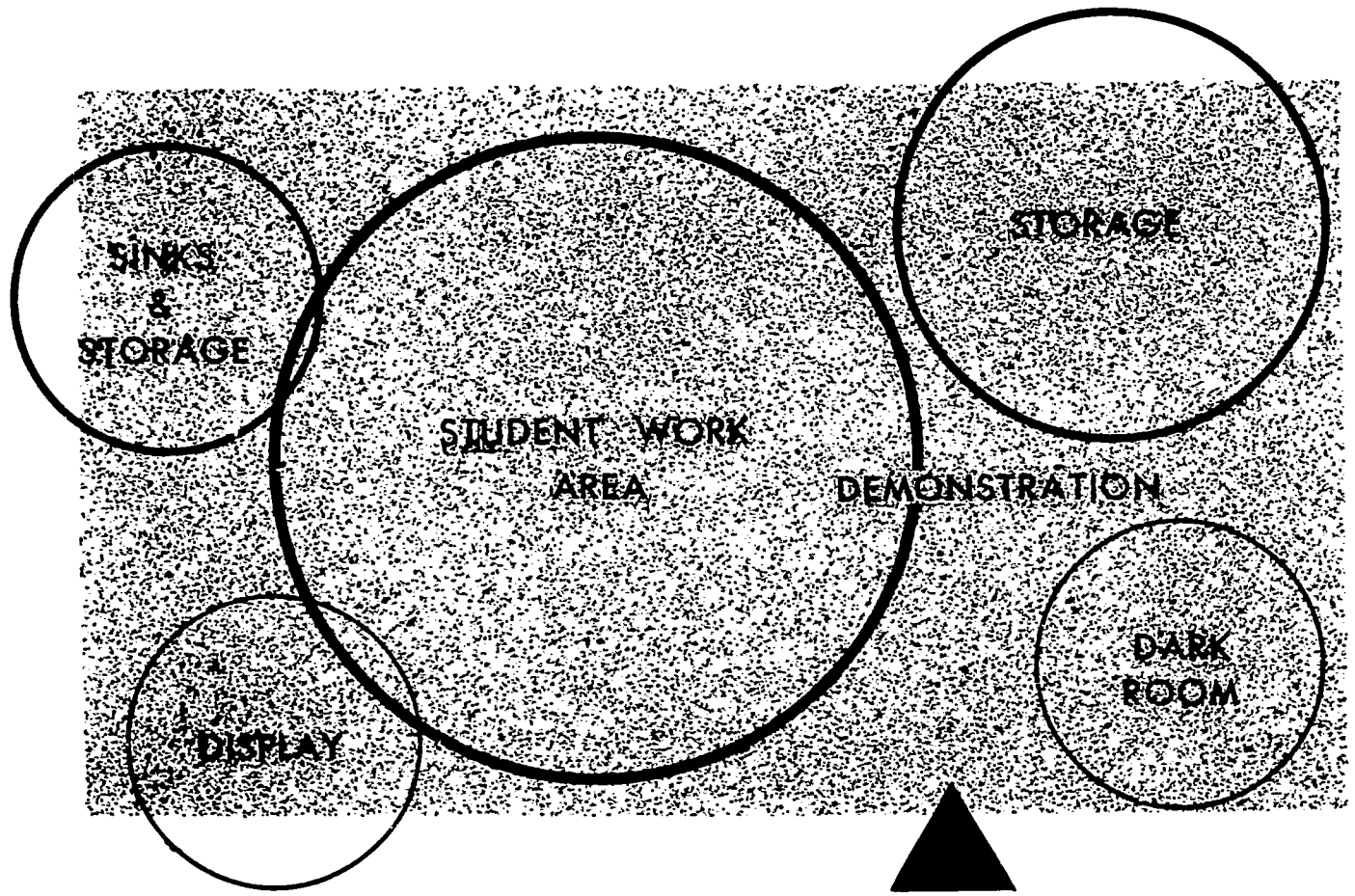
SUPPLEMENTARY WORK SPACE

Located outside of class-laboratory room, but easily accessible from it
Space for 3 to 6 students
Near supplies and equipment

SCIENCE ROOM







H O M E E C O N O M I C S

PURPOSE Provide space and equipment to afford instruction in any or all of the following:

Improving nutritional status
Selection, preparation, service, conservation, and storage of food
Selection and care of the home and its furnishings
Care and guidance of children
Use and conservation of home equipment
Maintenance of health and home safety
First aid and home care of the sick
Management of home and material resources
Maintenance of satisfactory personal and family relationships

LOCATION Near service and parking area
On ground floor
Possibly near other work-type activities such as science, shop, lunchroom

SIZE Space in all-purpose laboratory for a maximum class of 24 students

Approximately 1,250 sq. ft. of floor area

In large schools, more than one such all-purpose room will be needed

FURNISHINGS & EQUIPMENT

Unit kitchens 3 or 4, each with sink, counters, base cabinets and wall cabinets, range

Only one, or possibly two, refrigerators

Provide special ventilation when needed

Other equipment Provision for laundry facilities, deep freeze

Work tables, ironing board

Mirrors, bulletin board, 5'-0" chalk board

Sewing machines, providing wall outlets for electric machines

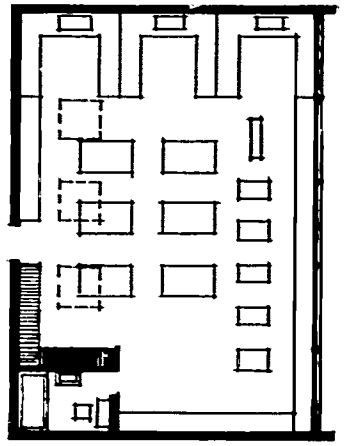
Cabinets for tote trays, located in several places in the room

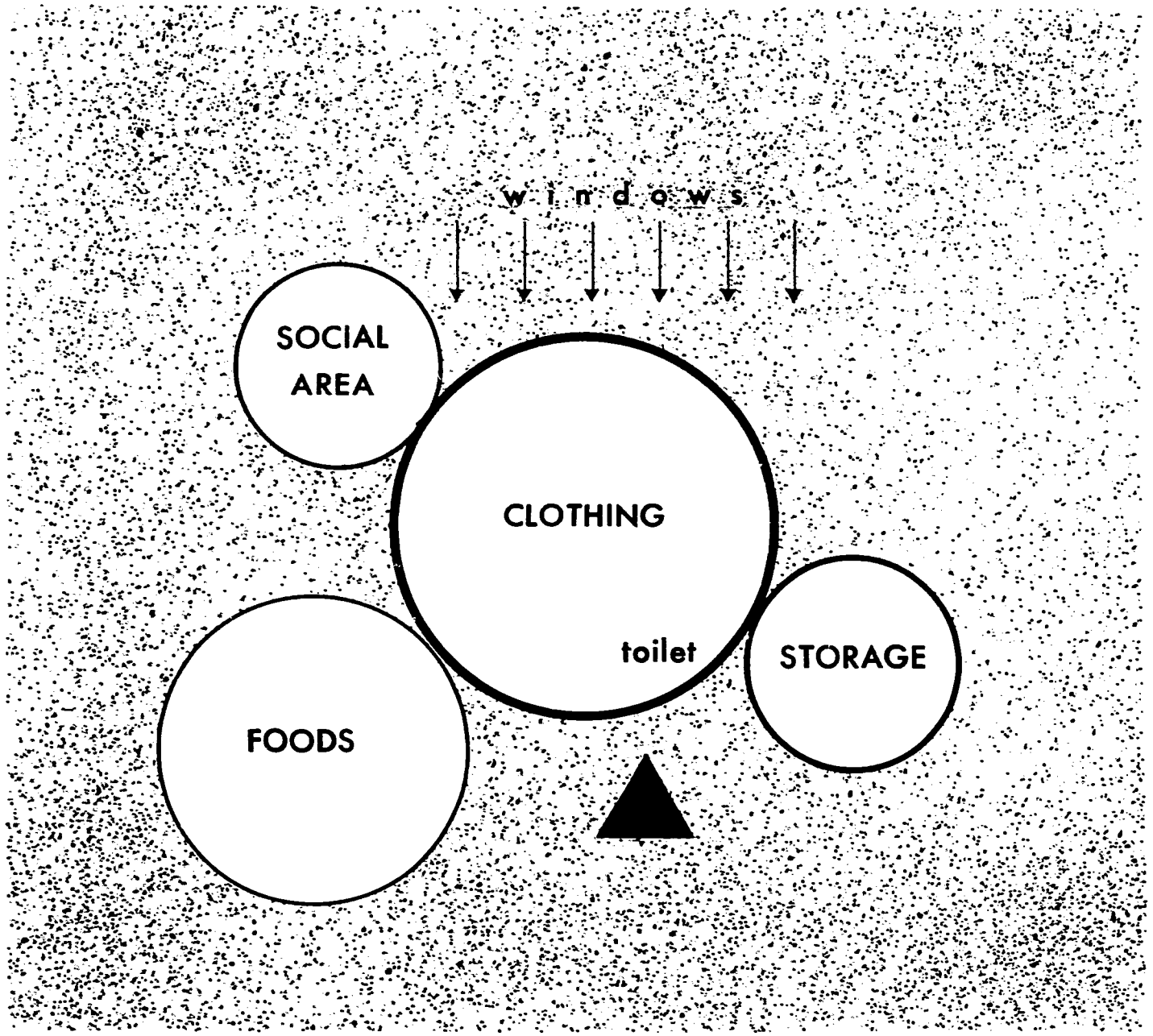
STORAGE SPACE for
Coats and school books
Individual pupil's supplies
Illustrative materials
Charts, pamphlets, and other teaching aids
Books and magazines
Linens for department
Extra food supplies
Garbage and other wastes
General repair tools
Roll-away bed
Child care equipment
Materials for teaching art and home furnishing

SCREENS removable for cleaning, required for all doors and windows

Suggestions

Complete residential size bath room, with high quality finishes, recommended
Provide some variety in type of equipment, arrangement, and furnishings
Provide a domestic quality and scale to space and equipment
Arrangement of entire homemaking area to permit supervision by instructor from any part of the room
Special lighting at work centers




windows
SOCIAL AREA
CLOTHING
toilet
STORAGE
FOODS

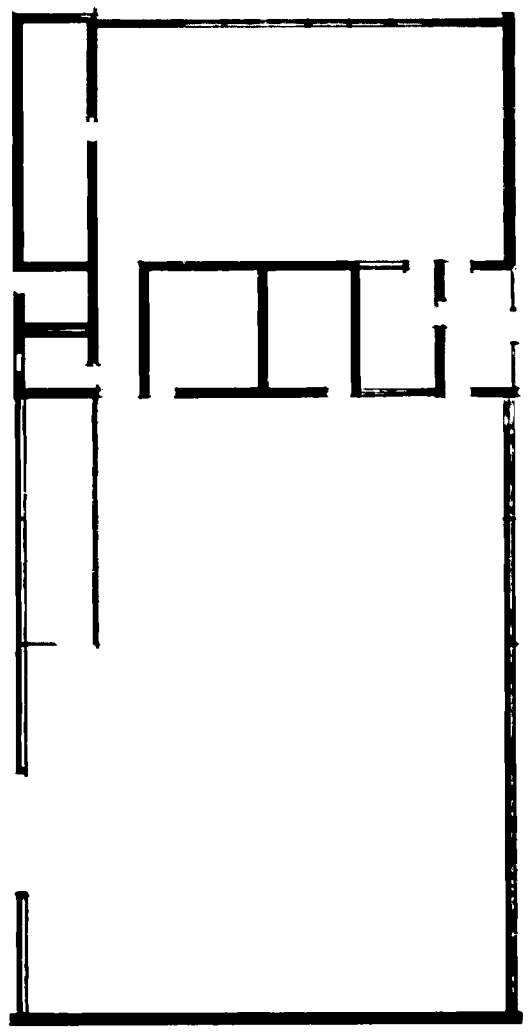
A G S H O P

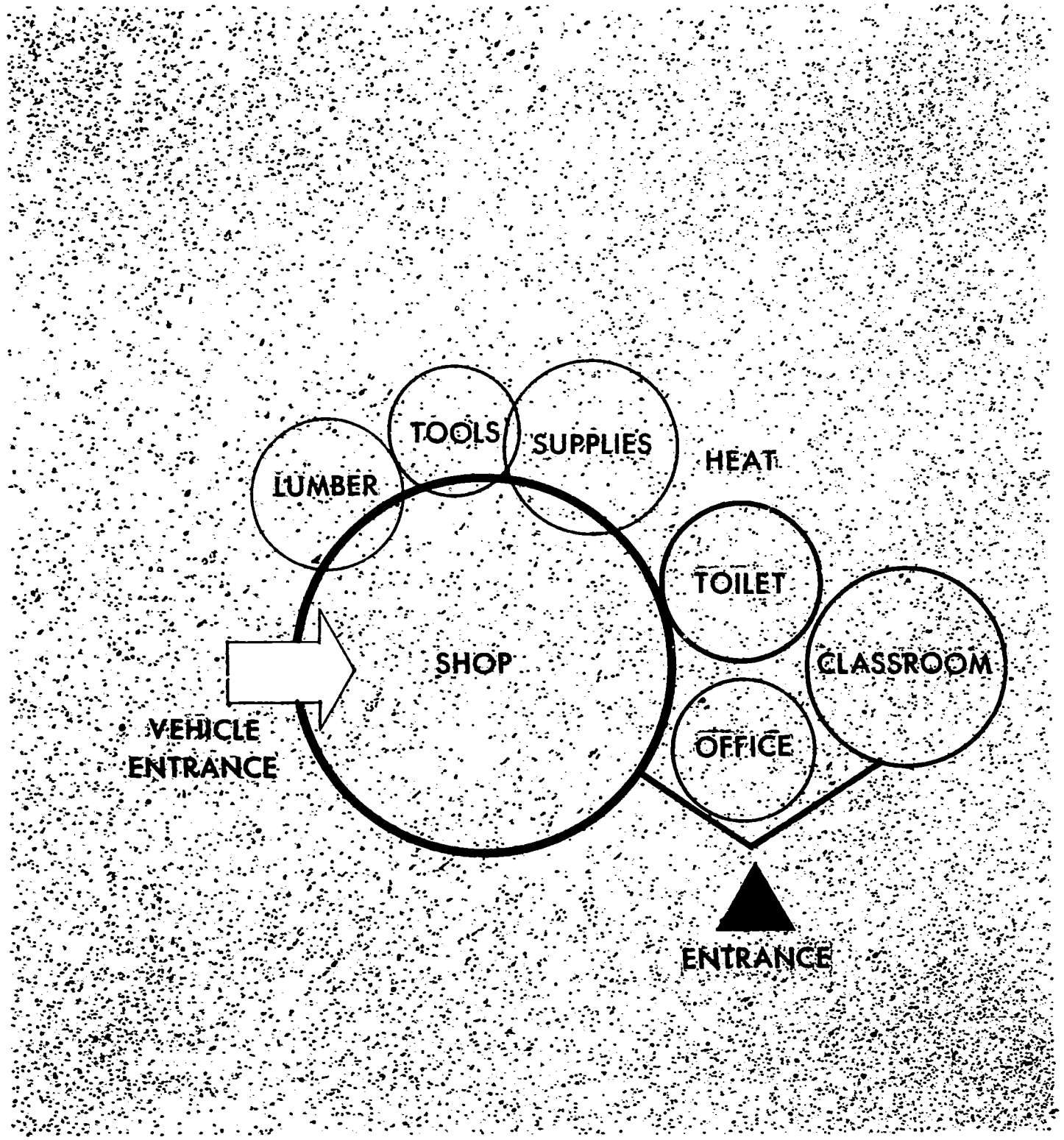
Because of the wide variation in local needs for shop facilities for trades and industries courses, it is recommended that each such shop be designed to meet the requirements of the specific area which it will serve.

Since there is a general pattern for the designing of vocational agriculture shops, the following outline presents recommendations for this type of building

LOCATION	Near service drive and parking area In separate building, connected to remainder of school plant by a covered walk
CLASSROOM	Floor area: approximately 850 sq. ft. Design and finishes equal to that of other classrooms Provision for reducing illumination to permit use of visual aids equipment Storeroom of approximately 60 sq. ft. floor area adjacent
OFFICE	Floor area: approximately 80 sq. ft. Glazed partitions between office and shop, and between office and classroom
STORAGE	
Tool room	Floor area: approximately 90 sq. ft. Adjacent to shop area
Supplies	Floor area: approximately 100 sq. ft. Adjacent to shop area
Lumber storage	Length of space to permit storage of 18-foot pieces of lumber Located near large shop door
TOILET	Accessible from shop and classroom Equipped with toilet and lavatory Shower optional Finishes equal to that of other toilet rooms
HEATING	Heating plant separate from that of main school heating plant recommended
SHOP AREA	Floor area: approximately 2,900 sq. ft. Located to permit expansion Ceiling height: 12 feet, minimum Large door, 12 feet wide, 8 to 10 feet high, off service drive Positive ventilation from forge, welding area, and painting area Adequate electric power capacity for all tools and equipment Exposed overhead wiring in shop area recommended Drinking fountain in shop space Floor drains required away from foot traffic

AG. SHOP




TOOLS
SUPPLIES
LUMBER
HEAT
TOILET
CLASSROOM
SHOP
OFFICE
VEHICLE ENTRANCE
ENTRANCE

L U N C H R O O M

DINING AREA

Seating

For two shifts, number of seats: Enrollment x 0.40
For three shifts, number of seats: Enrollment x 0.25
Tables of various sizes and shapes

Arrangement

Entrance located so that waiting line does not form in center of dining area
If dining area is used for other purposes, provide complete separation from kitchen
Drinking fountains located near exit

Finishes

Equal to that of classrooms
Acoustical treatment of ceiling or walls, or both

KITCHEN

Service Entrance

No conflict between service drive and pupils
Height of loading dock preferably equal to that of truck deck, but on same level as kitchen and storage

Storeroom for Food

One door only, located indoors near service entrance
Size approximate equal to one-third of kitchen area
Minimum width of storeroom: 9'-0"
Continual ventilation required, preferably by means of louvered opening. For windows, use security-type sash
Floor drain required, located away from foot traffic
Local conditions determine need for walk-in refrigerator

Employees' Space

Locker space for each employee
Entrance to toilet concealed from public view
Handwash lavatory near but not in toilet room, within view of manager
Service sink may be used for handwash lavatory

Preparation Area

Centralized cooking and baking facilities, under ventilating hood
Refrigeration near preparation section, with easy access to serving area
Floor drains required, located away from foot traffic

Serving

Counter 16 feet or longer for each line
Two lines, totaling 28 feet or more, necessary if seating capacity of dining area exceeds 250
Provision at serving counter for refrigerating milk

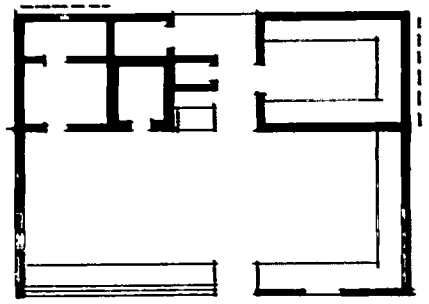
Dishwashing and Disposal

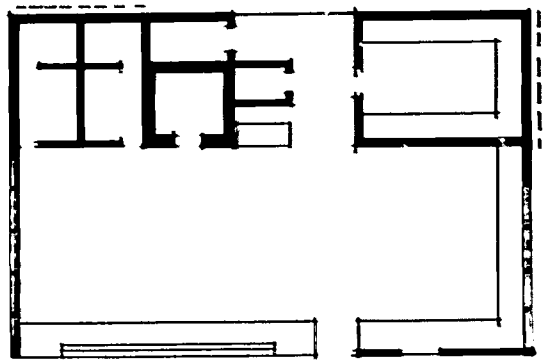
Dish return counter near exit from dining area
Mechanical dishwasher economical when approximately 400 meals or more are served at each lunch period
Rinse water at 180° F. required
Floor drain required, located away from foot traffic
Adequate ventilation needed. Positive system desirable
Canwash room near dishwashing area and near service entrance; hot and cold water and floor drain required
Incinerator near boiler room

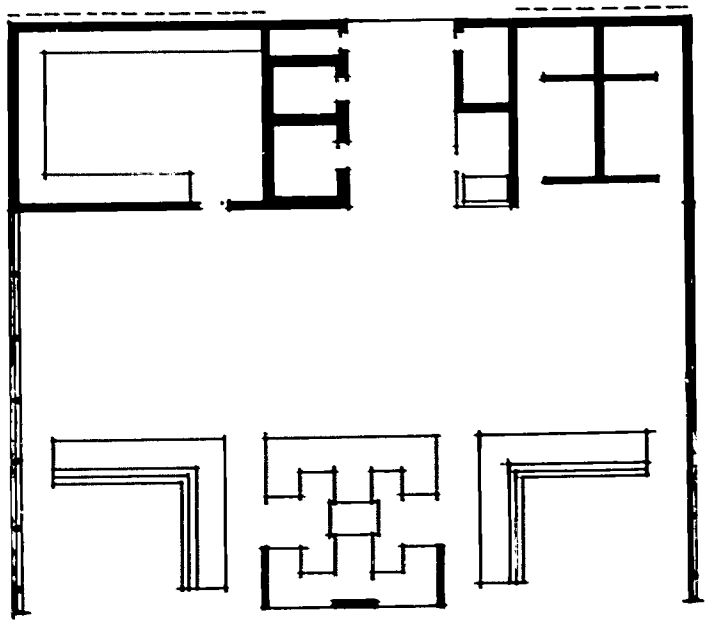
Kitchen Finishes — Minimum acceptable quality

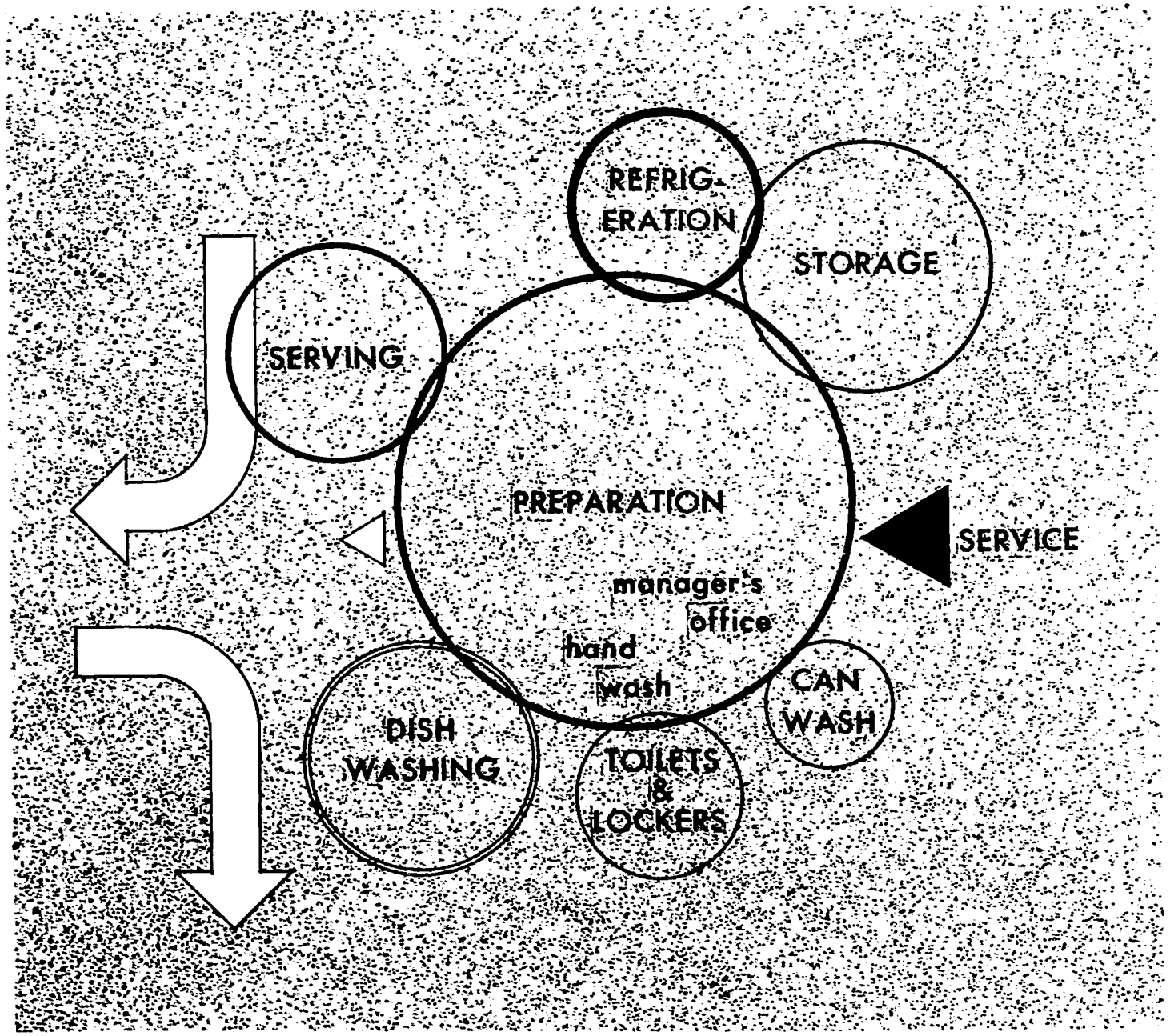
	Storeroom & Canwash	Employees' Space	Preparation Serving and Dishwashing
Floor and base	Concrete	Quarry tile	Quarry tile
Wainscot	Brick	Cement plaster or tile	Cement plaster or tile
Wall	Masonry	Masonry	Masonry

LUNCH ROOM








REFRIG-
ERATION
STORAGE
SERVING
PREPARATION
manager's
office
hand
wash
SERVICE
CAN
WASH
DISH
WASHING
TOILETS
&
LOCKERS

P H Y S I C A L E D U C A T I O N

DRESSING ROOMS AND SHOWERS

Dressing Area

Locker space for street clothes adequate for largest physical education class plus inter-scholastic team
Dressing space adequate for largest group
Basket room with sufficient space for one basket for each student in school
Toilets near dressing space and showers, with number of fixtures as follows:

	boys					girls				
Size of group	20	30	40	50	60	20	30	40	50	60
Shower heads	6	7	8	10	12	6	8	10	12	14
Lavatories	2	2	3	3	4	2	2	3	3	4
Drink fountains	1	1	1	2	2	1	1	1	2	2
Water closets	2	2	2	3	3	2	3	3	4	5
Urinals	1	2	3	3	4					

Shower Rooms

For junior high or high school, minimum of 6 shower heads in gang showers
For girls, at least three shower heads may be in private shower and dressing combinations
Minimum width of gang shower room, with heads on opposite walls: 9'-0"; heads on one wall only: 6'-0"
Distance between adjacent shower heads: 3'-6"
Height of shower heads: for boys--6'-0"; for girls--4'-6"
Shower gutters and drains at wall under shower heads, not in center of room
Tamper-proof adjustable heads
Moisture-proof lighting fixtures, with switches outside shower room

Drying and Toweling Area

Size nearly equal to that of shower room
Built-in benches and foot rests

Light and Ventilation

Operable windows, area equal one-tenth of floor area
Window stool height: 5'-6" or more

Finishes

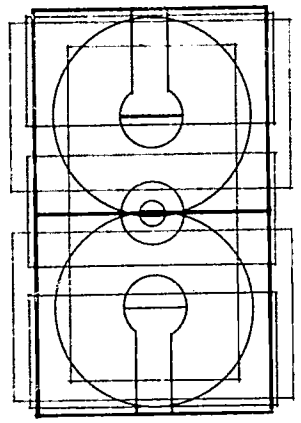
		Dressing area	Shower room Drying area Toilet area
Floor and base	Preferred	Hard tile	Ceramic tile
	Minimum	Concrete	Quarry tile
Wainscot	Preferred	Glazed tile	Glazed or ceramic tile
	Minimum	Masonry	Cement plaster
Wall	Preferred	Glazed tile	Glazed or ceramic tile

Equipment

Adequate hot water supply, with anti-scalding precautions
Provisions of laundry facilities
Several electric outlets in dressing area
Bulletin board in dressing area

turn to page 48

PHYSICAL ED.



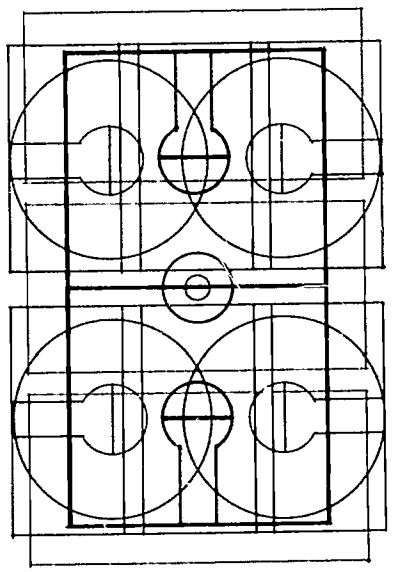
Basketball 1
42'-0" x 72'-8"

Volleyball 1
30' x 60'

Volleyball 2
30' x 50'

Badminton 3
20' x 44'

Circles 2
30' diameter



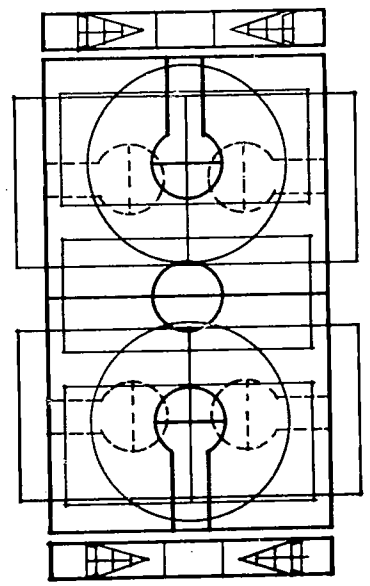
Basketball 1
86' x 46'

Basketball 2
66' x 44'

Volleyball 3
30' x 60'

Badminton 6
44' x 20'

Circles 4
20' diameter



Basketball 1
50' x 84'

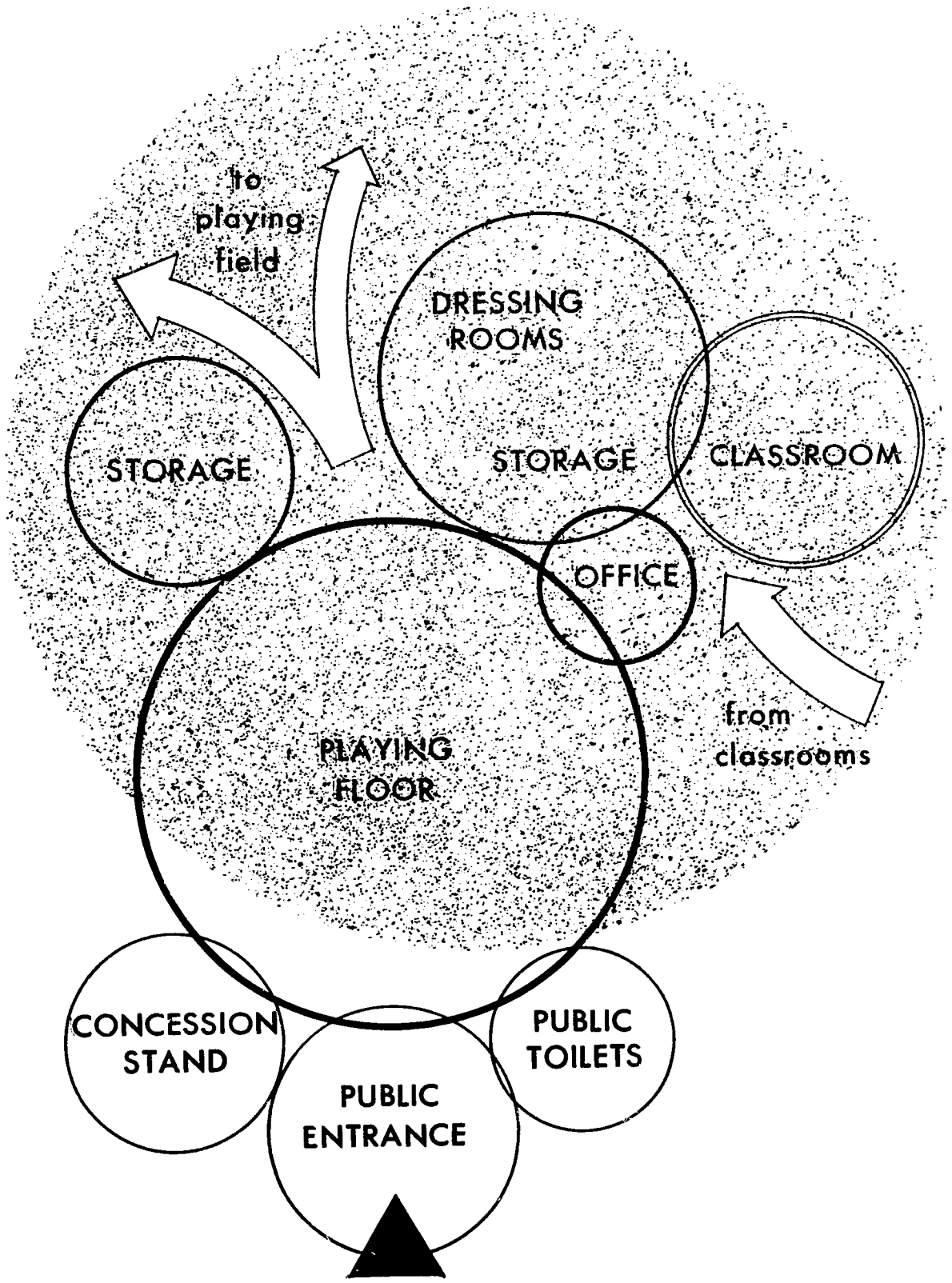
Basketball 2
50' x 42'

Volleyball 2
30' x 60'

Shuffleboard 2
6' x 50'

Circles 2
30' diameter

Badminton 3
20' x 44'



INDOOR PLAYING AREA

Play floor for elementary school

Recommended size: 40' x 70', ceiling 16' - 18'
Local conditions determine whether shower facilities are provided

Basketball court sizes

	Court	Ceiling height
Junior high	42'-0" x 72'-8"	18' to 20'
High school	50'-0" x 84'-0"	20' to 22'

Natural lighting

Continuous windows, preferably on side walls only
Window stools at least 12 feet above floor
Sun control or glare-reducing glass on sunny sides
Convenient operation of windows

Finishes

Floor: Wood, preferably maple
Walls: Smooth, non-abrasive surfaces for a height of 6'-8" to 7'-0" above floor

STORAGE

For indoor play area

Space for play equipment, apparatus, piano
On same floor level as play area, with double flush doors

For outdoor play field

Space for outdoor athletic equipment and apparatus
On grade level, with double flush door

For uniforms

Provide adequate space, well-ventilated, for storage of uniforms, in season, and out of season

OFFICE in large schools

Location and use

Adjacent in indoor play courts and to dressing room
For use of physical education staff and game officials

CLASSROOM in large schools

Use

For health and physical education classes
For auxiliary exercise room, corrective gymnastics

Size and quality

Approximate 1,200 square feet floor area, to permit use of unobstructed floor area when furniture is moved to one part of room
Natural and artificial lighting, finishes, and equipment similar to other classrooms

T O I L E T R O O M S

Minimum width of room, if fixtures are located on both sides of room: 10'-0"

Window stool height from floor: 4'-0" or more

Operable window area: one-tenth of floor area, unless mechanical ventilation is provided

Toilet partitions, with doors, recommended for girls' toilets

Toilet partitions, with or without doors, recommended for boys' toilets

Locate lavatories near door

Provide adequate baffles at entrances to toilet rooms to avoid depending on doors for proper screening

Provide one wall hydrant and floor drain in each toilet room, except in small individual rooms

HEIGHT OF FIXTURES in inches

	Grades 1-3	Grades 4-6	Grades 7-9	Grades 10-12
Lavatory	22-24	25-27	27-30	29-32
Drinking fountain	24-26	28-30	30-32	33-35
Toilet bowl	10	13	13	13*

*If building is used by high school only, 16" high fixtures may be used

FINISHES

	preferred	minimum
Floor and base	Ceramic tile	Quarry tile
Wainscot	Ceramic or glazed tile	Cement plaster or brick
Wall	Cement plaster	Masonry
Ceiling	Cement plaster	Exposed concrete

NUMBER OF FIXTURES REQUIRED

Total students (boys and girls)				200	300	400	500	600	700	800
Approximate number of classrooms				7	10	13	17	20	23	27
	Drinking fountains			3	4	6	7	8	10	11
Elementary schools	Lavatories	Girls		3	3	4	5	6	7	8
		Boys		3	3	4	5	6	7	8
	Toilets	Girls		4	5	7	8	10	12	14
		Boys		2	3	4	4	5	6	7
	Urinals			3	5	7	8	10	12	13
High schools	Lavatories	Girls		3	3	4	5	6	7	8
		Boys		3	3	4	5	6	7	8
	Toilets	Girls		3	4	5	6	7	8	9
		Boys		2	3	3	4	4	5	5
	Urinals			3	5	7	8	10	12	13

M U S I C

Facilities for music departments must usually be designed to meet the specific needs of a given school

LOCATION
- Separated from quiet portions of school plant
- Convenient to play field
- Convenient to assembly hall stage
- Sound from music rooms must not interfere with activities in assembly hall

BAND AND CHORAL ROOMS

- Separate rooms desirable but not imperative.
- Semi-circular arrangement of tiered platforms
- No windows behind director's station
- Illumination equal to that of other classrooms
- Acoustical treatment necessary

INDIVIDUAL PRACTICE ROOMS

- Floor area of 40 to 50 square feet each
- Provided with outside windows and with adequate artificial lighting
- Glass partition, or glazed door to corridor
- Acoustical treatment necessary

INSTRUMENT STORAGE

- Directly accessible from music room, or assembly hall stage, or both
- Lockers or racks for specific instruments

MUSIC LIBRARY

- Space for metal filing cabinets, tables and chairs
- Adequate illumination

C O M M E R C I A L

SHORTHAND, TYPING AND BUSINESS MACHINES

Location

- Removed from quiet portion of school plant
- Preferably near administration suite

Facilities

- Shorthand room similar to regular classroom
- Space for thirty typewriter tables and chairs in typing room
- Business machines in separate room in large schools
- Glazed partitions and doors between rooms in commercial department
- Lavatory in typing room
- Acoustical treatment necessary in rooms for typing and business machines
- Finishes, lighting, equipment equal to that of other classrooms

D I S T R I B U T I V E E D U C A T I O N

- Location preferably near administration suite
- Floor area: approximately 1,000 square feet
- Provide for darkening room for use of visual aids
- Provide for installation of telephone
- Compartments for storing students' equipment
- Storage space for large charts, poster boards
- Shelving for books and magazines
- Finishes, lighting, equipment equal to that of other classrooms
- Display window in corridor wall recommended
- Small office, of 100 sq. ft. floor area, desirable
- Glazed partition to separate office from classroom

HEATING

Central heating is required for all new construction

Type of system and kind of fuel is determined by local conditions and preferences

Fuel Storage

Service drive not to interfere with pedestrian traffic and play areas
Space adequate for one heating season without refilling, if possible. Coal storage requires about 40 cubic feet per ton
Coal room access doors adequate in size and number to reduce handling

Boiler Room

Meet fireproofing requirements of North Carolina Building Code
Meet rules and regulations of state Boiler Inspection law
Adequate in size to permit future expansion of plant
Adequate space to permit servicing boiler tubes
Properly ventilated, with adequate provision for introduction of air to support combustion
Stack adequate in height and area for maximum efficiency of heating plant
Provision for proper draining of floor
Not to be used for store room and shop

Inspections

Engineer who designed heating system should inspect it before acceptance by architect and owner
Frequent preventive maintenance inspections by competent engineer recommended
Boiler inspection by representative of North Carolina Department of Labor is required

VENTILATION

Mechanical ventilation recommended for all classrooms, lunch rooms and kitchens, assembly halls, gymnasiums, dressing rooms, toilets

Mechanical ventilation is necessary where darkening of room for visual aids purposes seriously restricts natural ventilation

MAINTENANCE AND STORAGE

It is recommended that a separate room be provided for maintenance shop and store room, and that the boiler room not be used for this purpose

This room should be located near boiler room about grade level. It should be fireproof to the same degree as the boiler and fuel rooms.
Floor drain is desirable in this room

L I G H T I N G

NATURAL ILLUMINATION

Methods of fenestration

One side — whereby daylight is admitted through windows on one side of a room only. For this method, in classrooms, the height of the window head from the floor must be at least one-half the width of the room. Also, the window head must not drop more than six inches below the ceiling

Bilateral — whereby daylight is admitted through windows on two opposite sides of the room

Skylight — whereby daylight is admitted through glazed apertures in the roof

Clerestory — whereby daylight is admitted through windows in strips which are at different levels from the floor and usually in different vertical planes

Daylight Control

The elimination or avoidance of objectionable high brightness differences resulting from panels of direct sunlight on the inside of rooms is the purpose of daylight control devices. These measures are generally more important where high degrees of concentration are expected from the students, and where all pupils are engaged in close work such as reading, writing, or drawing.

It is usually desirable that daylight control measures be designed as part of the building, thereby removing the need for control of these devices by the teacher.

ARTIFICIAL LIGHTING

Type — Local conditions and preferences determine the choice of fluorescent or incandescent lighting

Amount of illumination

Except for rooms for lower grades, artificial illumination must be calculated with the assumption of total darkness conditions prevailing outdoors, since any other spaces may be used at night

Illumination required at desk and table heights, in foot candles:

Classrooms	30	Auditorium	10
Drafting, sewing, typing	50	Lunchrooms	10
		Gymnasiums	20
Shops	30	Kitchens	10
Offices	30	Corridors	5-10
Libraries	30-50	Toilets	10

Luminaires

Incandescent: Concentric ring type, with silver bowl lamp, is acceptable. This should be used with smooth, flat white ceiling

Fluorescent: Equipped with brightness-reducing devices, such as translucent diffuser, or louvers which preferably offer 45° shielding from all directions

Switching of lights arranged to permit partial use of artificial lighting to supplement daylight where necessary