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THE DESIGN OF CONTEMPORARY SCHOOL BUILDING

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TABLE OF CONTENTS

INTRODUCTION	1
CONCEPTION OF SPACES	3
SITE	5
Size of Site	5
Parking	6
Character of the Site	6
Environment	7
Landscaping	7
BUILDING STRUCTURE	10
ADMINISTRATIVE SPACE	14
General Office	14
Principal's Office	14
Health Service Facilities	15
Teachers' Room	15
Teachers' Working Room	15
Guidance Office	16
Superintendent's Office	16
Conference Room	17
Custodian's Room	17
REGULAR CLASSROOMS	18
Kindergarten	18
Elementary Classroom	19
Secondary Classroom	19
SPECIAL ROOMS	22
Science	22
Mathematics	23

Foreign Language	23
Arts and Crafts	24
Business	25
Industrial Art	25
Homemaking	26
English and Social Studies	27
Music Room	28
Vocational Agriculture	29
GENERAL SERVICE AREAS	31
Gymnasium	31
Auditorium	32
Library	34
Cafeteria	35
OUTDOOR PLAY SPACE	39
SERVICE SYSTEMS	40
Heating and Ventilating	40
Sanitary and Plumbing Facilities	41
Lighting	42
Safety Features	44
ACKNOWLEDGMENTS	45
BIBLIOGRAPHY	46
EXAMPLES	47
APPENDIX	50

INTRODUCTION

The school is a children's community. The people who build schools will strongly influence the next generation by the kind of schools they build. Stamina, attitudes, and abilities are to quite an extent acquired in an early and plastic stage of life, in and through the atmosphere we create in schools; so planning and building a school today is a very complex undertaking.

In kindergarten, children learn to live and work together, learn to do things by themselves and with others, learn to use tools, begin skills and play safely. They do all of this as individuals and gradually understand that they are parts of a social organization.¹

The elementary school is a place to further develop the beginnings made in kindergarten and the learning of subject skills;² to help the child to become socially adjusted and also to encourage his individual talents, as well as to make him literate and to provide him with a basic fund of knowledge.

Junior high school has a special responsibility to help adolescents make the change from elementary school. The junior high school catches the young and adolescent at a stage in life where it is practical to help him discover himself and where he can start planning for the future and preparing for senior high school. It is important that a junior high school should not be a small scale senior high school. The junior high school has an

¹James D. MacConnell, Planning for School Buildings, 1957, p. 1.

²Ibid., p. 2.

exploratory function, offering a wide choice which allows the students to enjoy and explore many areas of activity.

Today, the business of the senior high school is mostly to prepare students for college by way of formal academic study of those subjects now classified as liberal arts, despite the fact that only a relative few of them go on to college. Actually, the senior high school should prepare the child for whatever he is going to do in life and make him a responsible and productive voting citizen, as well as to prepare him for college.

A good school is one which children find a happy place to be in and to grow. Parents enjoy working in it and studying the problems of growing children. Teachers like its refreshing environment, the availability of instructional aids and the planned incentives toward superior professional service.

Buildings and their equipment should not only be suitable for the present-day program of the school, but should be planned for the future too.

The creators of school architecture today should have the spirit of trying to understand youth and of looking ahead with imagination and wisdom.

CONCEPTION OF SPACES

In school, space is the common denominator between architecture and education. Education requires certain kinds of spaces and equipment to carry out its function--architecture involves the ways and effects of arranging and enclosing these spaces. Therefore, if the aims of education are to be facilitated by the school plant, planners must know those aims and have some idea as to the kind of spaces and equipment needed to carry them out.

These are not Richard Neutra's (one of the world's greatest architects) exact words, but in a sense, this is his explanation about planning a school:

If I were given the task of designing a school building, the first thing I would do would be to find out what would take place within the building..... I would study the process of education. I would find out the spaces required and equipment necessary to carry out the process effectively in terms of the child and efficiently in terms of the teachers. Then I would mold my architecture around this process. Only the qualifying word of warning--this process of education concerns living, growing young humans, about the most sensitive, precious goods on the planet, and we are readying and preparing them for shipment into our communities of tomorrow.

With these comments, Neutra has pointed the way to keep us on the right approach to school planning.¹

There is usually a portion of the space at the center which is far enough from the outside wall so that the likelihood of obtaining a view of the outside is remote. Views of natural outside surroundings of buildings are desirable; but if contact by

¹William W. Caudill, Toward Better School Design, 1954, p. 21.

all internal space with an outside wall can be secured only at a sacrifice of the effectiveness of the educational operation, then a choice must be made.

The interior areas can be pleasant and stimulating. Perhaps the belief of most of us, that a view of the outside is a fundamental human requirement, may be instead a habit acquired through centuries of custom and experience. This does not mean interior areas without views are suitable for daily periods of long sustained work.

The plan should permit a high degree of flexibility in the location and movement of partitions. There is great opportunity to construct rooms of any size or proportion with a maximum of choices in solving complex problems of space assignment and relationships.

If we talk about rooms, our thinking is limited. A principal's office may be more or less than a room. It may be a space within a general service area, or it may be an alcove off the main concourse. So the plan should permit the architect freedom to plan spaces, and the latter offers to the educator an equally wide opportunity to adapt his school plant to changing requirements and uses, no matter how it may change, to determine the shape of the space needed.

SITE

To begin the hunt for a school site for a modern educational program, it is important to have background information on the requirements of the community, the neighborhood, and the educational program of the school.

A successful survey will show not only the locations of existing schools which are to be retained, but general areas within which new schools should be built, together with a time table for occupancy, shifting of usage, expansion, remodeling, or retirement of the various school plants.

Size of Site

A good school site should be centrally located to and easily accessible for all pupils. Size is usually the most important single point to be considered in choosing a school site. The too-small site can never be educationally adequate regardless of expenditure on development. It must be recognized, however, that size is not the only criterion and that among several sites of adequate size the largest may not be the best, because this may be hazardous or have noisy surroundings, poor character, difficult access, or high development costs inherent in the land. The National Council on Schoolhouse Construction suggests that an elementary school should have five acres plus one additional acre for each 100 pupils; twenty acres plus one additional acre for each 100 pupils for junior high school; and thirty acres plus one additional acre for each 100 pupils in senior high school.

Parking¹

With the present extensive use of automobiles, planning of parking space is becoming increasingly important as school buses, private cars, motor scooters, and bicycles increase in number around the school plant. Parking areas have increased in importance not only for the football and dance crowd, but for daily use of both faculty and students. School buses, when provided, ought to have an adequate loading area so that all buses present may load simultaneously. This area should be apart from the stopping space for private automobiles.

Character of the Site

For reasons of safety and environmental advantage, no school site should be placed near hazardous elements such as transportation arteries or centers, industrial plants, business districts, or shopping centers. The site should be free from disturbing noises, obnoxious odors, and unsanitary conditions.

While there is great value in finding land with woods, rock area, water, and some hills or knolls, it also is necessary to have some relatively level land for playing field. Amphitheaters, parking areas, and informal play areas can often use rolling land to good advantage, but playing fields and courts for formal games need fairly level ground.

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 7.

The perfectly flat field is undesirable because it will retain surface water after rains, particularly so if the soil has much clay in it or if subsurface rock strata do not allow seepage.

Environment

It is generally considered that a school should be located in an attractive residential district with a park adjacent to the school ground on one side, rather than a business or industrial area. The view in any direction from the building should be pleasing and attractive. Experience has given educators a commendable desire to provide educational buildings and surroundings which are friendly and where the young student finds an atmosphere which allows him to develop his individual characteristics and interest. They will have a feeling of pride in their school.

A one-story building should be about 50 feet back from the street, with the main play area at its rear (see photos, Appendix, pp. 4 and 8), but for two-story buildings, 100 feet back is much better¹ (see photo, Appendix, p. 10). Service drives should be kept separate from bus and passenger drives insofar as possible.

Landscaping

Landscape architects are being used more frequently. With the trend today toward the development and use of large sites for the location of schoolhouses, the term "Landscaping" comes to

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 9.

mean a lot more than merely planting grass and trees and shrubbery. It includes scientific planning for drainage, water supply, and other service lines, and the orientation of buildings and outdoor areas with respect to the wind and sun and traffic.

Surrounding the school building with a grass area and letting daily use determine the circulation pattern is not good planning. Drives and parking areas must be ample but should be located apart from play areas. Associated with the walk pattern are paved play areas for all-season use. In most cases, these paved areas should be for multiple use. These areas should be large enough to accommodate the majority of children likely to use them and should, preferably, be divided between shade and sunlight. Paving in different colors is quite useful for the purpose of dividing different areas.

Ample sitting space of rigid construction will add to usefulness of areas.

In planting trees and shrubs, care should be taken not to impair the natural light received by a building, not to crowd steps, drives, or play areas, and not to impair visibility of streets to pupils leaving the building. Trees may well be placed so as to protect buildings from cold winds or to temper them to mild breezes in order to facilitate natural ventilation. Trees and shrubs selected should be those that will flourish in the existing climatic conditions and that will require minimum care. Consideration should be given to their future growth too. For example, grass is attractive and cool, but it is quite costly because of initial expense and problems of maintenance. Ivy,

which is attractive and requires little maintenance, is difficult to start and cannot be used to play on.

Usually, plant or shrub screens should be used to hide unsightly areas and to separate drives, parking, and play areas from the remainder of the site. Hedges and shrubbery should be kept closely trimmed, grass mowed, and weeds eliminated. Safety fences should be provided where needed.

BUILDING STRUCTURE

The difference between architecture today and architecture 50 years ago is in the structure as much as anything else. In older schoolhouses the emphasis was on making the load-bearing walls look even more heavy by deep-set windows and doors. Today the emphasis, because of the skeleton construction, is on making the walls and partitions appear as screens. They now make use of the structure itself. Open web joists, trusses, and beams are often left exposed for interest, with one or two singled out of a group and painted a bright color accent. The results are surprisingly pleasing. The structure itself may be an artistic component in the composition (see photo, Appendix, p. 3).

The obvious fact is that the composition of the main elements of space cannot possibly be made without thinking of how the roof can span over the spaces. There is good reason to believe that the old time classroom was 24 feet wide simply because that was the maximum length of a stick of structure lumber. If so, the structure certainly controlled the composition, at least of the classroom wing. And it does to a certain extent today. But just as we have found many ways to achieve adequate environment controls, we have found many ways to span the various spaces required for teaching. The desire for flexibility has led to larger spans for classrooms.

Architect Eberle M. Smith lists two trends which apply to the structure and the general architectural composition of space. He says,

There seems to be a uniform trend toward one-story construction. This is especially true at the elementary school level and has also influenced the secondary school design.

And he noted,

the continuing movement towards skeleton construction. This structural arrangement allows for complete freedom and flexibility in locating interior partitions and arrangements of rooms. It allows the designer complete freedom in the exterior envelope of the building.... The umbrella type of structure is generally used in connection with a more or less flat roof which covers quite a large area, may be simple in design and construction, and should result in maximum economy. By concentration of a large floor area in one rectangle, this umbrella type eliminates much of the principle cost of the structure.¹

In any structural system, the basic materials used are concrete, steel, and wood. All have their advantages and disadvantages. Some architects favor one over the other because of local conditions such as availability, workability, and labor conditions. No doubt there are desirable situations for each material--even for a combination of them. Anyway, the structural system, if it is honestly thought out and clearly expressed, will help produce good design.

In a school building, chimneys, parapets, and all walls should be plumb. All exterior doors must open outward, must be equipped with panic bolts, and should be properly marked. Doors, window frames, and all exterior wood should be in good repair and painted. All doors and window panes should be in place and properly glazed. All brick work should be properly pointed

¹William W. Caudill, Toward Better School Design, 1954, p. 145.

up.¹ Floors and stairs should be rigid. Entrance areas should be provided with interdoors. Floors should be perfectly level, finished with hardwood or a resilient floor covering. Walls and ceilings should be flat, true and smooth, and painted in light pastel colors.² According to the National Council on Schoolhouse Construction, the stairways should be equipped with firm hand-rails, should be at least four feet wide and well lighted, and should be provided with non-skid stair treads 10½ inches wide and with 6-inch risers. All corridors, stairs, and exits must provide direct outlet from the building. Corridors should be free from obstructions, pockets, and dead ends, and the floor materials should be fire-resistant. Corridors should be acoustically treated.³ The building should be free of all concealed or "dead" spaces as under floors through which fire may spread. Regular disposal should be made of all oily rags, paints, and varnishes.⁴

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 12.

²Ibid., p. 12.

³Ibid., p. 13.

⁴Ibid., p. 14.

Space Relationship for A Senior High School



ADMINISTRATIVE SPACE

A school administration building succeeds or fails depending upon whether or not it stimulates teachers in their daily work with children. An administration building is not just an office building. It is a teaching device. One of the most effective central office activities to improve teaching is good teacher committee work, where ideas are exchanged and teachers are stimulated to think about what they are doing.

The administration building should place education on display, and will encourage staff participation in decision-making where such participation is meaningful. The building should be planned to attract attention to displays. A most effective approach is to show the accomplishments of all students.

General Office

The General Office should be located on the first floor near the center of a building close to the main entrance in a reasonably quiet zone. The general office area should serve staff members, pupils, and the public. The work and public spaces are usually separated by a counter. Space should be provided for duplication materials and storage of supplies. There should be conveniently at hand a cloakroom and toilet, sink, and lavatory (see photos, Appendix, pp. 5, 9, 11).

Principal's Office

The principal of every school should have a private office for his use. It should be immediately adjacent to the general

office and reception room, with connecting door, and should also have an exit to a corridor. There should be provided a fireproof vault. The size should be sufficient to accommodate the necessary office equipment and chairs for perhaps five or six visitors at one time. There should be ample space for book shelves for the principal's library.

Health Service Facilities

The clinic of a school should provide facilities for the protection of pupils. It should have a small waiting room where six pupils may wait their turn to be admitted, and it should also have an isolation room where the pupil can be isolated for the protection of others and for his own welfare. There should be a nurse's room with toilets convenient to it. The location of the clinic can be near the gymnasium or in the administrative suite (see photos, Appendix, pp. 5, 9, 11).

Teachers' Room

Every school should have at least one restroom for its teachers. It should not only provide toilet and lavatory facilities. The main purpose of the lounge is to provide an area where the teachers may relax for a moment during a free period, so it should be equipped with attractive and functional furniture (see photos, Appendix, pp. 5, 9, 11).

Teachers' Working Room

It should be located adjacent to the administrative office

and equipped with a work table, storage space for instructional supplies, cupboard, filing cabinet, typewriter, duplicating machines, and a sink. The purpose of a workroom is to provide a place for the teachers to prepare teaching and testing materials. One or more conference rooms connected with it are desirable.

Guidance Office

Guidance is a specialized function to be performed by special guidance counselors working directly with students. It should be sufficiently large to accommodate the pupil, teacher, and/or parent. Of key importance to the effective operation of the guidance center is the provision of a suitable case conference room which is convenient to the office of the director and the pupil record files.

Superintendent's Office

In this concept of school building planning as a cooperative venture, the superintendent becomes a dominant factor--not as mechanical administrator but as creative educator. This is contrary to some older practices in which a standing committee of the Board of Education is dominant, or such matters are left to the business manager.

It is desirable to locate the superintendent's office so that it is accessible by a direct entrance from the corridor, and separate from but near the administrative office. It should provide an attractive and comfortable reception area, a private counseling room, and a multipurpose room for case consultation,

individual testing, etc.

Conference Room

A conference room is a desirable adjunct to a central office suite. It may be used for such groups as Board of Education, teachers' committees, parent-teachers, and pupils. Storage for wraps and lavatory and toilet facilities should be provided.

Custodian's Room

The one or more men who serve as custodians of a building should have a small office, storeroom, and locker room with toilet, lavatory, and shower. The best location is near both the mechanical plant and a secondary entrance to the building. Custodian should have convenient places to deposit lawn mowers, hose, hedge trimmers, other outdoor tools, and movable playground equipment (see photos, Appendix, pp. 5, 9, 11).

REGULAR CLASSROOMS

The regular classrooms must be readily accessible to the administrative offices, the library, the cafeteria, the health area, lavatory facilities, playgrounds and physical education facilities, and to any other special facilities areas for students. They should be in an area with quiet and appropriate surroundings and good acoustic treatment.

Kindergarten

In kindergarten, from 1200 to 1500 square feet of floor should be provided to accommodate 25 kindergarten children, including toilet and storage.¹

It should be located on the school's first floor, easily accessible to the play area and to the outside entrance. It should be isolated from the rest of the plant but have easy access to the administrative offices and multi-purpose areas. The desirability of adequate daylighting suggests a southern exposure and fenestration light.

The kindergarten classrooms should have space such as a work area, an art area, the teacher corner, and the main activity area. Toilet and lavatory room should be accessible both from the kindergarten room and from the outdoor play area.

Walls should be decorated in light pastel colors in a non-gloss paint. Ceilings should be finished with a white or off-

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 26.

white acoustical material covering not more than 50 per cent of area for good diffusion (see photo, Appendix, p. 5).

Elementary Classroom

An elementary classroom should have a minimum instructional area of 1000 square feet, exclusive of space for toilet.¹ It should be as nearly self-contained as possible and have access to the outdoor play area. Individual toilets are desirable in the first grade. It should have a "home" feeling.

Elementary classrooms should have a sufficient amount of chalkboard and tackboard space provided at eye level. It is suggested that at least two entire walls be utilized for this purpose.

The floor covering should be resilient and fairly light in color with a substantial light reflection. It should blend with the rest of the visual environment.

Many of the activities of an elementary classroom may be accommodated in an activity alcove equipped with a work bench, work sink, tool cabinets, and materials storage (see photo, App. p. 5).

Secondary Classrooms

Regular secondary classrooms should be designed for learning and for teaching. Instructional space for secondary schools must be designed to help the teacher provide an environment which

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 26.

encourages the right kind of learning.

In general, unless they are in quite a small school, most regular classrooms may well be of uniform size. They should be large enough to permit pupils to divide into several working groups. Twenty-five square feet of floor space per pupil should be considered a minimum.¹ Many secondary schools favor lengthening the class period and using a portion of the period for directed study. There is also a trend today toward more small group activities within the classroom.

Secondary school classrooms should be equipped with built-in teachers' closets to provide space for the instructor's wraps and teaching materials.²

Windows should not merely admit light, but should be features which add to the attractiveness of rooms. It is important that windows be so constructed as not to admit rain or snow, but to be easily opened when desired, and they should be of a light translucent color that harmonizes with the walls of the room they are in.

The essential characteristics of a floor are that it be durable, resilient, noise reducing, not cold, and easily cleaned. Ideally, acoustical material ABS should be calculated for ceilings and walls and should be distributed for good diffusion. It is desirable to have two doors in each classroom. Each door

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 23.

²Ibid.

should be approximately 7 feet high by 3 feet 3 inches wide. There should be abundant built-in space of various types in every classroom. These should include spaces for materials handled and for pupils' possessions also. For the latter, each pupil should have a space at least a foot square by 15 inches deep (see photos, Appendix, pp. 9, 11).

SPECIAL ROOMS

These are different kinds of spaces, some noisy, some quiet, some outside. They all pose special problems and require special equipment. These rooms accommodate projects and experiments that cannot be done satisfactorily in the regular classrooms. The spaces are for such subjects as science, homemaking, shop, music, agriculture, etc.

Science

A science room should not only have good table space, but the environment should also encourage scientific thinking.

A science program should provide opportunities for student experimentation, teacher and student demonstrations, project activity, group work, student responsibility for the care of aquariums, terrariums, animals, cork and chalkboard, work with many reference materials, use of science equipment, and space for displays of student work.

All science rooms should be grouped together. This may be a separate building or it may be part of a larger building, and it should be located in an area convenient to the shop and library.

There should be at least 35 square feet of floor space in the main room for each pupil to be accommodated there at any one time.¹ A science suite requires a considerable amount of storage.

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 31.

For physical science, consideration should be given to a dark-room. There should be a project-workroom which serves several functions. It provides storage space for equipment and supplies. It can be a small laboratory where experiments that might take several days to complete may be set up.

Science laboratories require special consideration with reference to ventilation. Special attention should also be given to safety provisions in them, including the installation of suitable fire extinguishers, fire blankets, master shutoffs, alternate exits, etc. (see photos, Appendix, pp. 9, 11).

Mathematics

Rooms for the study of mathematics should be closely grouped and should be located near the library. Some of the consultation on projects or problems takes place in the regular classrooms. There should be provided a small workroom which, with a capacity of about 15 pupils to work, adjoins and is visible from the suite of mathematics offices. This is used by advanced students during the time they are doing work that requires frequent consultation with the teacher (see photos, Appendix, pp. 9, 12).

Foreign Language

The teachers in foreign languages are engaged in a variety of activities for furthering pupil interest in language study, for increasing skill in language use, and for evaluating progress and accomplishment. Each teacher needs a separate office for consultation with pupils. The office is equipped to make and

read back voice recordings for pupils, and to record teaching materials that are to be presented in this manner.

Storage space for special language books and periodicals is accessible to the teacher offices, as are a group of recording and read-back cubicles and a small pupil instruction room with a capacity of about 15 pupils work stations (see photo, App. p. 11).

Arts and Crafts

Art classrooms should be located on the main floor near the homemaking units and general shop. North lighting is desirable. Because of the more active nature of the learning process and the need for use of model stands, easels, and displays, more room area per pupil will be required than is provided in the average classroom. It is about 30 to 35 square feet of floor space per pupil, exclusive of storage area.¹

The arts and crafts room should have good architectural design, color schemes, furniture, fixtures, and fabrics in order that a child may be constantly reminded of the part which good form, color, and line can play in his life.

Much storage space of various kinds is needed in such rooms. Each pupil using the room during any semester should have an individual locked drawer or other space in which to keep his drawing board and materials, supplies of paper, and whatever he may need. There should also be space for the storage of general

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 32.

supplies (see photos, Appendix, pp. 9, 11).

Business

The business education programs of most high schools are of a two-fold nature. They serve students who are looking toward vocational training in the business field as well as those who wish to acquire skills or knowledge in specific business areas.

There should be one typing instruction and practice room. All rooms in the business education suite should allow 25 to 30 square feet of floor space per pupil.¹

A smaller separate practice room which can be used by typing pupils in their free time during and after school hours is a very desirable adjunct to the business education suite.

Storage space for specialized books, pamphlets, periodicals, and testing materials in the field of business are in, or adjoining, the suite of offices. The suite of offices should be provided with a bench and running water (see photos, App., pp. 9, 11).

Industrial Art

Education in industrial and vocational arts--the development of basic tool skills for employment in industry--is occurring throughout the entire school for much of the school time. Some kinds of machines, differing according to community and regional industrial emphasis, are provided for instruction and

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 35.

practice, but there is not the demand for heavy equipment.

School shops should be located for convenient delivery of supplies from outside the building. It is frequently desirable that shop units be so placed that their noise does not disturb other activities in the school, or in a completely separate building.

Generally, for a high school, shops for woodworking, metal working, and printing may be included. In shops, the minimum floor area per pupil should be 45 square feet--some authorities even put the figure at 75. It is generally considered that a class of 24 is the maximum desirable size.¹ Classroom facilities should be available for every shop class. The shop should be rectangular with a minimum width of 30 feet and a ceiling height varying from 12 to 14 feet. The shop should have a tool room, a storage room, and a separate room for unfinished projects.

Since practically all shops offer unusual fire hazards, they should be well equipped with extinguishers (see photos, Appendix, pp. 9, 11).

Homemaking

On the high school level instruction is given in the preparation of foods, and in textiles and the making of clothing. The school might be equipped for teaching home furnishings, child development, family relations, family health and might provide

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 29.

a home living unit.

The preferred location for the homemaking department is on the first floor in the main building. If possible it should be located near the school cafeteria. An outside entrance is important to facilitate delivery of groceries, installation of equipment and plumbing.

A general guide for the amount of space needed is 60 to 80 square feet of floor space per student. It is generally considered that the unit kitchen, designed for three or four students, is usually most functional when arranged in V or L-shape. Usually one refrigerator will serve as many as six units. Special forced ventilation should be provided. There should be sufficient storage space for all equipment.

A clothing room should be planned not only for sewing, but also for the study of designing, textiles, and purchasing problems. A clothing room needs an unusually large variety and number of storage provisions. Adjoining a clothing room should be one or more small, well-lighted fitting rooms. There should be space for display too.

A living or living-dining room is often a part of this department. This area should be accessible from both rooms and from the corridor (see photos, Appendix, pp. 9, 11).

English and Social Studies

In English, the multiple-class approach is designed to allow various members or groups in the class to engage in different aspects of English according to their needs and abilities.

The social studies room can be located with the English room. It should be planned to accommodate a maximum of 30 students. Flexibility is a very important consideration, for there is an increasing trend toward small group activity (5-7 students), as well as a need for the assembling of the entire class for lectures by the instructor and also for individual student and small group reports.

As much area as possible should be provided on one wall for displaying posters, maps, and other projects. (See photos, Appendix, pp. 9, 12).

Music Room

A music room or suite should receive careful acoustical treatment, but not such as to reduce the period of reverberation below that needed for desirable brilliancy. Ventilating ducts should be separate from those of the remainder of the building so as not to carry sound thereto. Moreover, the room or suite should be so located with regard to the rest of the building as to minimize possible sound transmission. It is desirable to have such rooms near auditoriums, so that for performances in which pupils participate, they may prepare themselves in the music room and go to the auditoriums directly and easily. Certainly the choral groups and the band should be separated. Practice rooms are necessary in connection with the music suite. They may vary in size but should contain not less than 60 square

feet.¹

For group vocal work, 16 square feet of floor space per pupil will usually prove sufficient; for instrumental work, at least 20 square feet per pupil is needed.² These space requirements are exclusive of storage and other facilities.

The storage facilities may be built into or against the wall of the music room or may be in a separate music storage. An office for the music instructors is essential for a good program (see photos, Appendix, pp. 9, 11).

Vocational Agriculture

The agricultural program, as now found in high schools, illustrates best what can be accomplished in an individualized educational program which is built around problems and projects that have real meaning for pupils.

The agricultural unit requires much the same type of space as the shops. It often has similar space requirements and may sometimes be located near them. It should be on the ground level near the terminal point of the building group, so that it will be accessible to the agricultural fields and convenient for servicing and demonstrating tractors and other farm equipment.

Facilities required include an office equipped for consultation, combination library and conference room, agricultural

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 34.

²Ibid., p. 33.

laboratory, and some site area suitable for plant-growing by pupils who do not have home opportunities for such projects. Display space for pupils' work is also an essential (see photo, Appendix, p. 11).

GENERAL SERVICE AREAS

The major factors to be considered in providing the general facilities for a high school are flexibility and multiple use of space. Usually, they need a library, a gymnasium, a cafeteria, and a place for school and public meetings and performances. Typically, some small high schools have economized on these facilities by omitting or combining them. The problem is to find the best combination of uses to provide for multiple use of space without limiting the educational program.

Gymnasium

The gymnasium should be fairly isolated from the rest of the main elements of space because it is one of the noisiest units of the school plant. It also should have direct entrances from out-of-doors for the public and, in addition, one or more leading directly to play areas. A standard-sized basketball court, 50 by 84 feet, is generally considered desirable for a high school teaching floor. Clear height from the floor to ceiling should be at least 18 to 25 feet.¹ It is desirable that parts of ceilings as well as upper walls be acoustically treated for good diffusion.

The gymnasium should have adequate numbers of doors connective with corridors, public approaches, recreational, playing area, and shower, lockers and dressing rooms. There should be an instructor's office which opens directly upon the gymnasium

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 39.

floors, adequate locker facilities, towel and equipment storage space, equipment drying area, safe and sanitary shower rooms, and adequate toilet facilities. There should also be a private toilet and shower room for each sex of instructor.

Today, many schools will find it advantageous for physical education classes to have two gymnasiums, one for the boys and one for the girls. Other schools prefer to have a large gymnasium which may be divided, one side for the boys and the other side for the girls (see photos, Appendix, pp. 5, 9, 11).

Auditorium

The auditorium is one of the features of a school concerning which much thought should be given to its service of the public as well as pupils. It should be located on the first floor where it is easily accessible from the outside as well as from within the building, and to related school units such as music, speech.

The size of the auditorium should depend upon school policies. Usually a minimum capacity of 300 persons is required for any small high school, and as a maximum, seating is provided for the entire student body.

All aisles in an auditorium should lead directly to an exit. The seats should be arranged to provide for safety, comfort, and unobstructed sight lines. Preferably, a seat in one row should not be directly in front of a seat in the next row. It is also essential that the rows be far enough apart to provide sufficient knee room.

Acoustics are an important consideration in many parts of a

school building. In an auditorium they should be calculated so that from all seats the speakers on the stage can be heard without unusual exertion. It is also important from the point of view of sight line.

Toilets and lavatories for both sexes, drinking fountains, and a ticket office should be conveniently located adjacent to the auditorium.

For an ideal stage, a minimum depth (from edge to rear wall) of 18 to 20 feet is commonly recommended for elementary and 25 to 35 feet or more for secondary schools. A proscenium opening of about 25 feet is suggested as the minimum width for small auditoriums, and as much as 40 to 50 feet for larger auditoriums.¹ The height of the proscenium arch must provide suitable sight lines from the rear seats of the auditorium.

There should be at least one dressing room for each sex at the ends of the stage. These rooms should be equipped with toilets, lavatories, tables, mirrors, and lockers. They should have direct connections to the stage. There should be another room which is large enough to care for large pieces of scenery and equipment.

Special attention should be given to artificial lighting, electric switches and safety features. Exit lights are required and should have separate circuits ahead of the main switch (see photos, Appendix, pp. 5, 9, 11).

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 41.

Library

The best location of the library is a central location in as quiet a part of the building as is possible. Today academic subjects such as English, languages, and social studies include many library reference projects too.

A complete school library requires, as a minimum, a reading room, an office space, a work space, storage space for books, and storage for materials.

It is generally agreed that the library reading room is not a study room, but a place to which pupils are allowed to go or to which they are referred if they need to use the materials available there. In secondary schools the reading room should accommodate about 10 to 15 per cent of the enrollment, and should be approximately 30 to 35 square feet per pupil. It should not seat more than 100 to 150 pupils at one time, otherwise it may be necessary to provide more than one such room.¹ Generally, it is considered good practice to have tables seating six or eight pupils. There should be some variety of sizes of tables and chairs. The necessary conditions of quiet for a library reading room require careful acoustical design.

Adjacent to the reading room and so placed as to have a door conveniently near the charging desk should be a workroom for the librarian. It should be about 200 square feet. In the larger school, the workroom should be separated from the office.

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 42.

The stack area should be located near the reading room, but not a part of the library reading room. The stack area should provide sufficient space between stack sections for normal student traffic (see photos, Appendix, pp. 5, 9, 11).

Cafeteria

A lunchroom should provide a pleasant place in which pupils not only eat but enjoy doing so. The location of a cafeteria should be such that its noise and odors do not permeate the remainder of a building. If it is possible, it should be directly accessible to the playground.

The dining area should be large enough to feed all of the children in two shifts. The amount of space needed for the dining area is 10 to 12 square feet per pupil to be seated.¹ This does not include serving space.

Since the amount of noise in a lunchroom is usually quite great, it is one of the portions of a school building in which it is most important to have acoustical treatment.

Lunchroom traffic should be planned to avoid interference from corridor to service area, to tables, to soiled dish return, and to corridor.

A kitchen should have a minimum floor area of 300 square feet, with 1 - $\frac{1}{2}$ additional for each pupil above 200 served at

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 44.

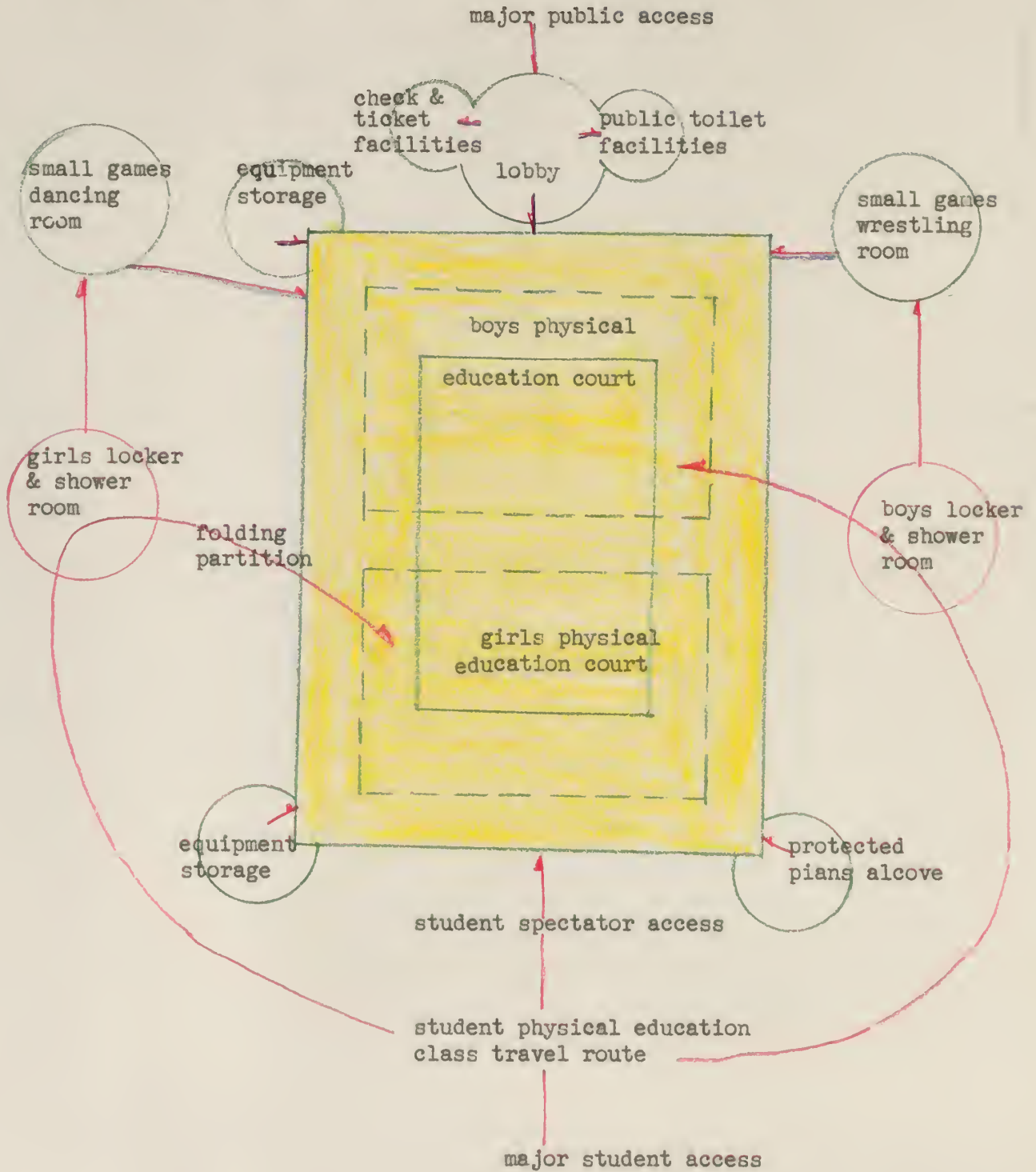
one time.¹ A service entrance should be adjacent to the kitchen and storeroom.

When dining rooms are used for other activities, portable roll-away tables and folding chairs are preferable. Storage should be provided for tables, chairs, and other equipment used in connection with multiple use activities too.

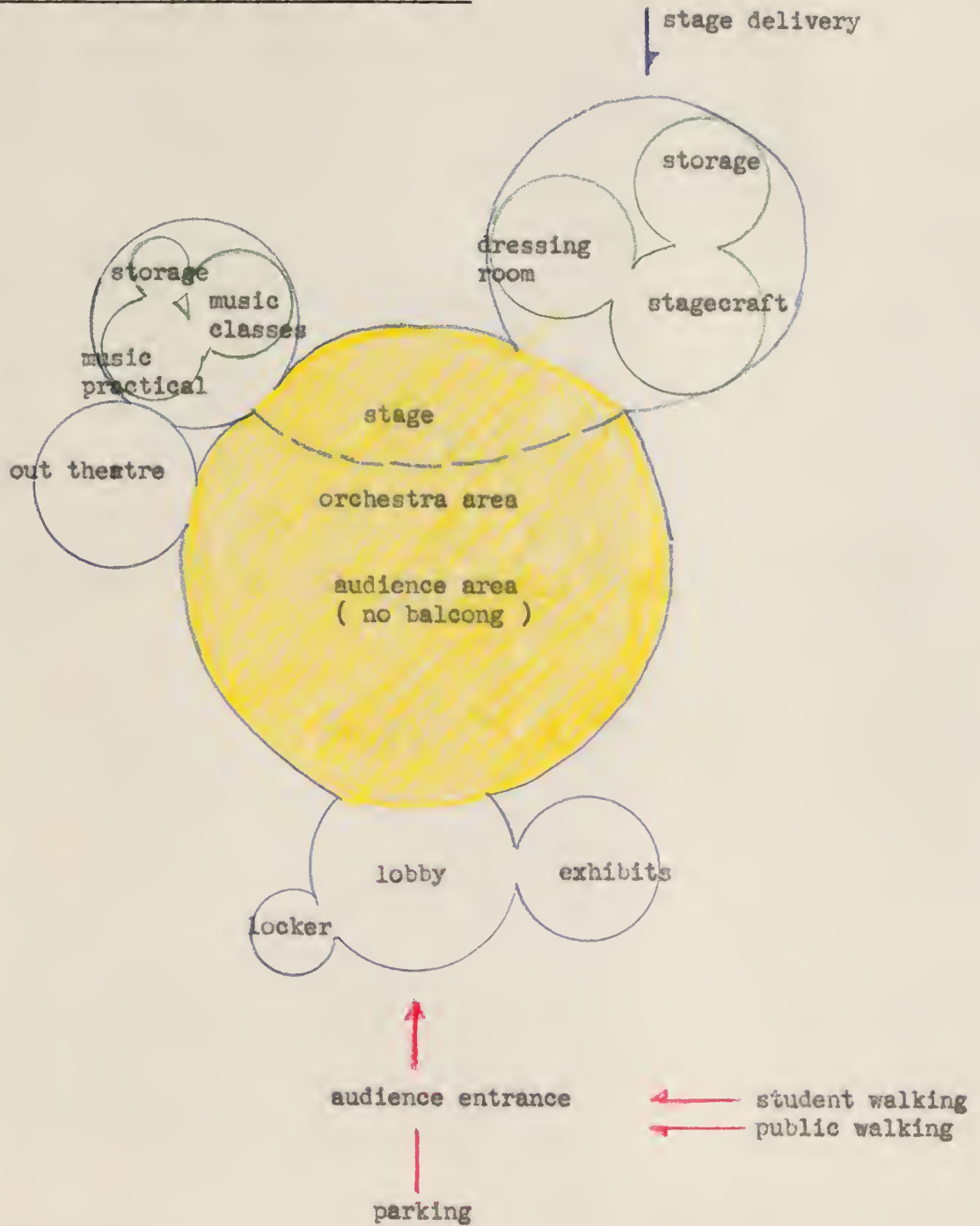
In a good lunchroom, there should be good ventilation, good sanitary conditions, good lighting, cheerful colors, and screens for windows and doors (see photos, Appendix, pp. 5, 9, 11).

¹C. W. O'Dell, Standards for the Evaluation of Elementary School Buildings, 1950, p. 42.

Space Relationship for Indoor Physical Education



Space Relationship for Auditorium Unit



OUTDOOR PLAY SPACE

Play areas liable to produce dust should be located where this dust will not be carried toward the building by prevailing breezes. Wherever such areas are bordered by streets or private property, strong fences six to eight feet high should be provided. In addition, features such as tennis courts, ball diamonds, and others which need backstops or special types of fences should be equipped with them.

In planning for various outdoor recreational activities, both those which require vigorous physical exercise and those of less strenuous type should be kept in mind.

Complete outdoor educational facilities for physical, social, and mental development will require not less than five acres for an elementary school for 200 pupils, and up to 20 or 25 acres for a secondary school for 1200 students.¹ These acreages allow for some overlapping of outfields of adjacent baseball or softball fields, moderate circulation and overrun spaces between fields, and for multiple use of the spectator sport field.

Equipment appropriate for kindergarten and primary school includes the lawn, sandbox, wading pool, swings, and jungle gym. For secondary school and intermediate classes, skating, basketball, tennis, softball, baseball, and football are activities to be planned for. Girls' playfields and boys' playfields are also desirable (see photos, Appendix, pp. 1, 4, 8, 11).

¹American School and University, School Plant Reference, 1957-1958, p. 105.

SERVICE SYSTEMS

Heating and Ventilating

A heating system should provide all parts of a building with sufficient heat to keep temperatures at comfortable levels during the coldest weather. This should be provided for corridors, shops, laboratories, and kitchens, as well as for all rooms. All steam and hot water boilers and pipes in the boiler room should be covered with material that is non-conductive of heat, is easily put on, does not readily deteriorate, is fire-proof, lightweight, not damaged by water or steam, and sturdy. Piping should be sufficient and well placed. Main control valves should be near the boiler with separate controls for each stack of direct radiation. If so located that there is danger of rust, pipes should be painted and enclosed in tile or masonry. In order to insure efficient and economical operation of heating and ventilating systems, care should be taken that crevices around outer doors and windows are tightly caulked.

Usually, classrooms should be maintained at a temperature of 70° to 74°F; shops, corridors, laboratories, and other activity rooms 66° to 70°F.¹ A school should have its heating and ventilating systems.

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 49.

Sanitary and Plumbing Facilities

The water supply should be adequate and safe, particularly the water for drinking purposes. Drinking fountains should be provided in the ratio of 1 to 50 pupils with a minimum of at least one fountain on each floor.¹ They should be conveniently located, but never in toilet rooms. A central cooling system serving all drinking fountains is preferable; if this is not possible, unit refrigerated fountains should be provided.

Hot and cold water connections should be provided for the areas as needed.

Toilet rooms should not be located in basements. It is good practice to provide a separate toilet directly connected with the kindergarten room. Separate toilet rooms may be provided for the first and second grade children. For high school, one for each sex should be located on each floor. These should be easily cleaned, well-lighted, and well-ventilated. Suggested ratios for sanitary facilities are as follows:

Toilet bowls	-	1 for 20 girls	1 for 30 boys
Urinals	-		1 for 30 boys
Lavatories	-	1 for 20 girls	1 for 20 boys ²

Additional toilet room facilities should be located near the auditorium, gymnasium, offices, and other parts of the building used by the public.

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 65.

²Ibid., p. 66.

Secondary school pupils need locker and shower facilities. General purpose lockers for street clothes should be from 60 to 73 inches in height and not less than 12 inches wide and 12 inches deep.¹ Shower rooms should be equipped with numerous drains, surfaced and finished in slip-proof materials, and a curb to prevent overflow.²

Lighting

It is important that the classroom environment be such as to make it possible for the child to see comfortably and efficiently.

Direct sunlight on windows and reflection of sunlight from walls of adjacent buildings are common sources of excessive brightness.

Since toplighting provides for great freedom, it is especially significant to school planners. Public lines can be lessened, and weather-exposed corridors can be eliminated. School plant maintenance and operation costs can be materially reduced since window maintenance is minimized. Of course, in a building of this type, forced air ventilation systems will be necessary.

¹A Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 68.

²Ibid.

Table 1. Recommended reflection factors for classroom surface.¹

	Reflection factors
Ceilings (white or off-white)	80-85%
Window walls (pastel colors)	75-80%
Other walls (pastel colors)	50-60%
Trim	30-60%
Desk and equipment	35-50%
Floors	20-50%
Chalkboards	15-20%

Measurements of brightness and computation of reflection factors may be obtained by proper use of a foot-candle meter.

Table 2. Light intensities for Kansas schools.²

	Recommended foot-candle levels	Minimum foot-candle levels
Classrooms, office, laboratories	70	30
Drafting rooms	100	50
Sewing rooms	150	50
Sight-saving rooms	150	50
Art rooms	100	50
Shop rooms	100	50
Libraries	70	30
Cafeterias (Not for study)	20	20
Cafeteria kitchens	30	30
Gymnasium, exhibitions, matches	50	30
Multi-purpose rooms	35	30
Swing pool	30	30
Auditoriums	20	15
Corridors and stairways	20	15
Locker rooms, team rooms, etc.	20	20
Entrances, porticos, vestibules, etc.	15	15
Walks and parking areas	1/2	1/2

¹Manual for Evaluating School Facilities, issued by Kansas State Department of Public Instruction, Topeka, Kansas, Adel F. Throckmorton, Superintendent, 1962, p. 55.

²Ibid., p. 57.

Safety Features

The school building should not only be structurally safe but fireproof, or at least fire-resistant, as well. Corridors should be wide, should contain no projections, and should terminate on a stairway or exit. Stairways should be located so that there is a direct exit from the ground floor. Exit doors should open outward, should be provided with panic bolt locks, and every building of one or more rooms should have at least two exits. The exit will be less than 100 feet away from the doorway of every classroom. Separate exits and entrances are desirable in order to segregate older and younger pupils.

ACKNOWLEDGMENTS

The author wishes to take this opportunity to express her deepest appreciation and acknowledgment to Professor Theodore A. Chadwick of the Department of Architecture, Professor L. R. Quinlan of the Department of Horticulture and Landscape Architecture, Dr. O. Kenneth O'Fallon of the Education Department, and Dr. Marjorie M. Stith of the Child and Family Development Department, for their cooperation and encouragement in the supervision of this work.

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EXAMPLES

The Child Development Center occupies a flat site at the opposite side of the Home Economics Building. It is surrounded by trees on the East and West side. It is a very suitable place for a nursery school as a practice school for this campus.

The elementary school is located on Marlatt Ave., between College Ave. and Denison Ave. There are trees on the right hand side. It is a suitable place for the new development of Manhattan.

The Junior High School is located near the city-county park and covers about 35 acres. The Senior High School is west of the Junior High School. It is about 40 acres. These four schools are developed to meet the needs of an expanding population in Manhattan.

The nursery school accommodates 40 students. There are 300 students in the elementary school, 500 students in the Junior High School, and 600 students in the Senior High School.

The classrooms are arranged with individual toilets and vestibules to the outdoor play areas in the nursery school and kindergarten. These rooms are cheerfully decorated and furnished with built-in bookcases, work counters, sinks, tinted chalkboards, and modern furniture. All are designed to fit the age group which will use them and provide a healthful, comfortable, and practical environment for learning.

All the special classrooms, auditorium, gymnasium, and cafeteria are designed to be used for educational programs.

Administrative areas include the principal's office, health room, lounge, and teachers' work room. A vault has been provided

in the principal's office for the storage and protection of permanent school records. Each library is located in a quiet part but convenient for the students.

Corridor and classroom ceilings are surfaced with textured acoustical materials. The acoustical treatment of the auditorium ceiling employs an efficient sound absorbent material. These schools are served by their own single boiler house. Because of the extreme climate of the area, the use of glass in the east and west side is much reduced and overhangs are provided for protection.

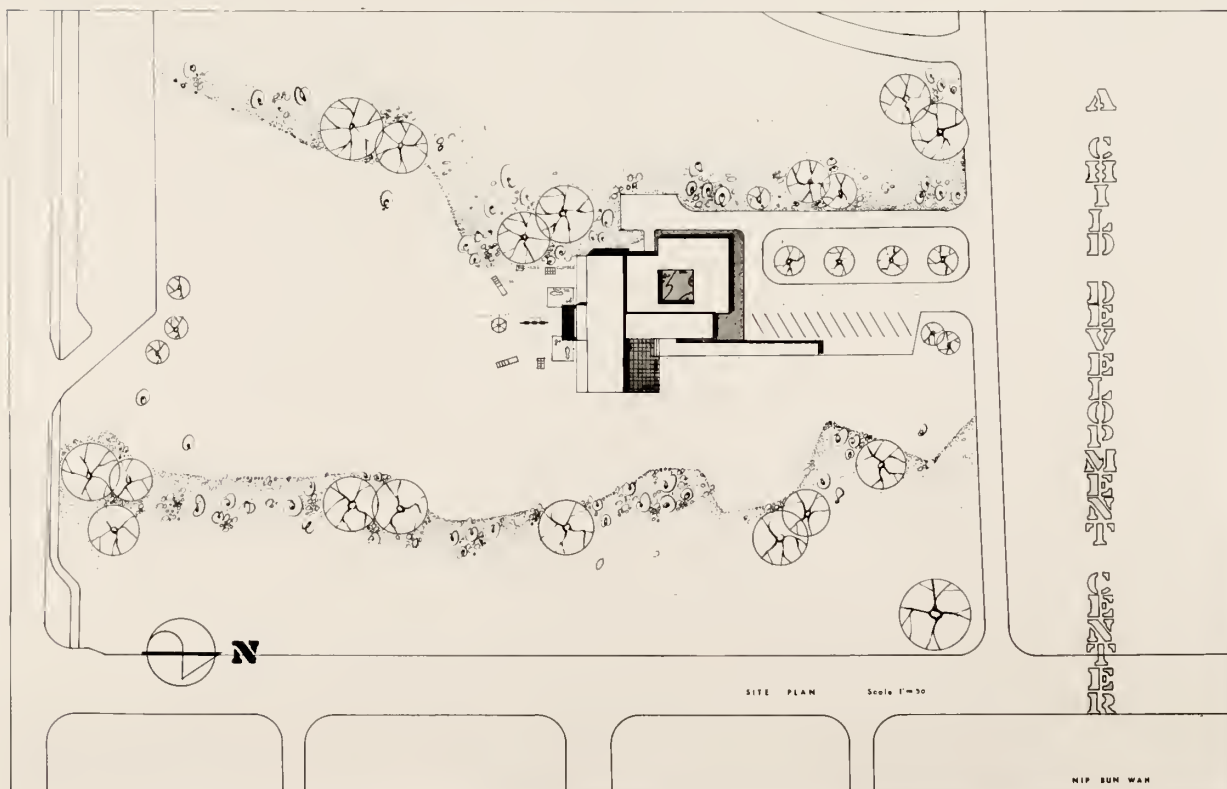
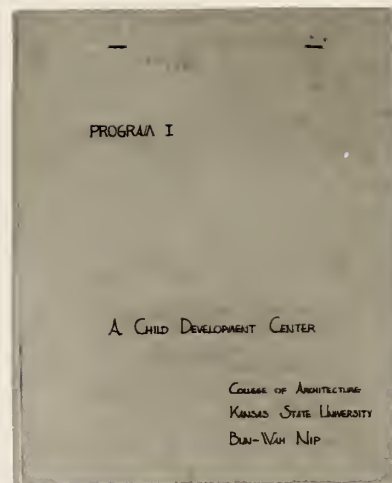
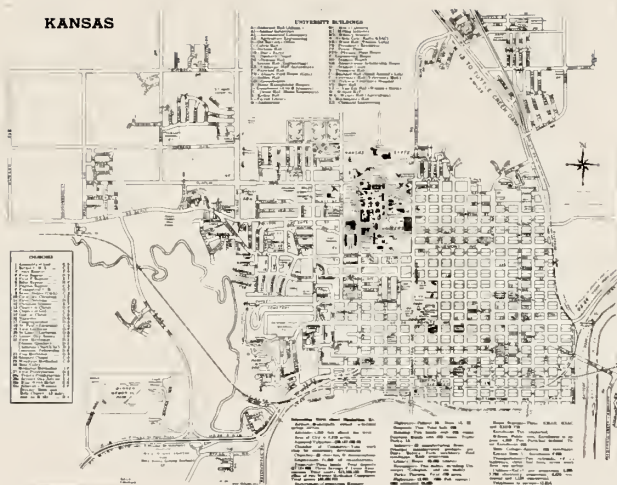
APPENDIX

EXPLANATION OF APPENDIX PAGE 1

A CHILD DEVELOPMENT CENTER

Location: Opposite side of the
Home Economics Building

40 students

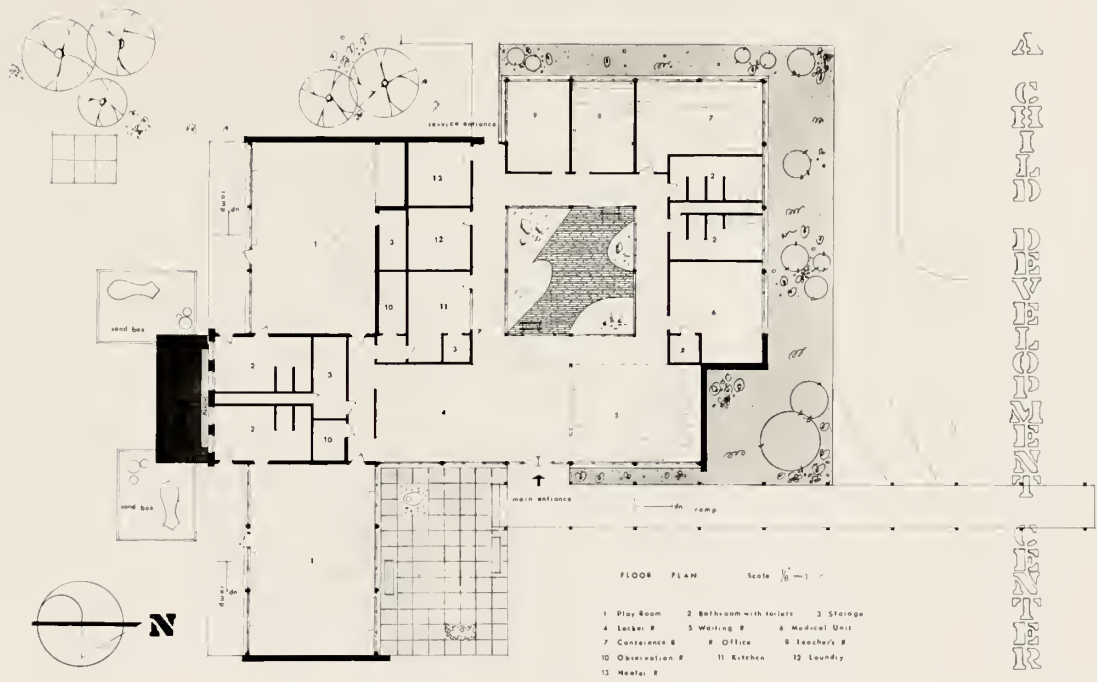


EXPLANATION OF APPENDIX PAGE 2

A CHILD DEVELOPMENT CENTER

Location: Opposite side of the
Home Economics Building

40 students



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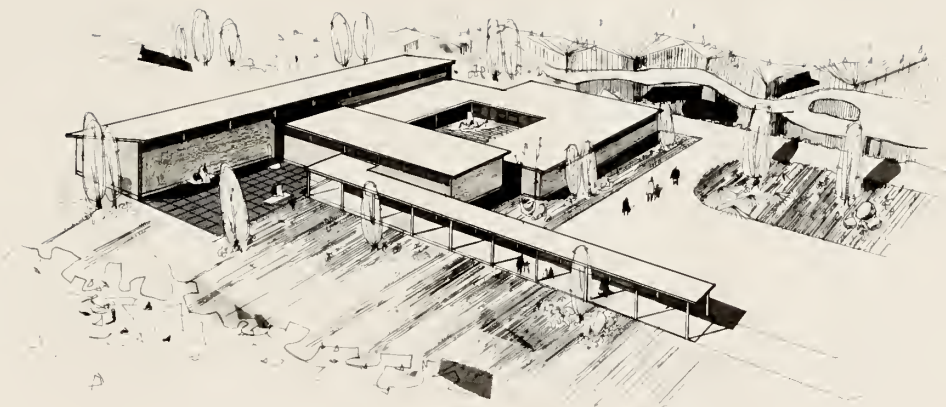
EXPLANATION OF APPENDIX PAGE 3

A CHILD DEVELOPMENT CENTER

Location: Opposite side of the
Home Economics Building

40 students

A CHILD DEVELOPMENT CENTER

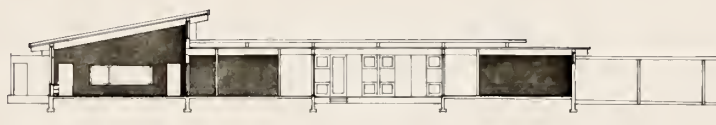


PERSPECTIVE



WEST ELEVATION

Scale $\frac{1}{8} = 1'-0"$



SECTION 1-1

Scale $\frac{1}{8} = 1'-0"$

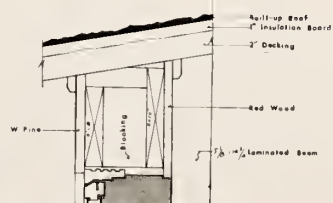


ELEVATION OF SHELVES UNDER
SOUTH WINDOW

Scale $\frac{1}{8} = 1'-0"$



SECTION 2-2. Scale $1 = 1'-0"$



SECTION 3-3
Scale $3' = 1'-0"$

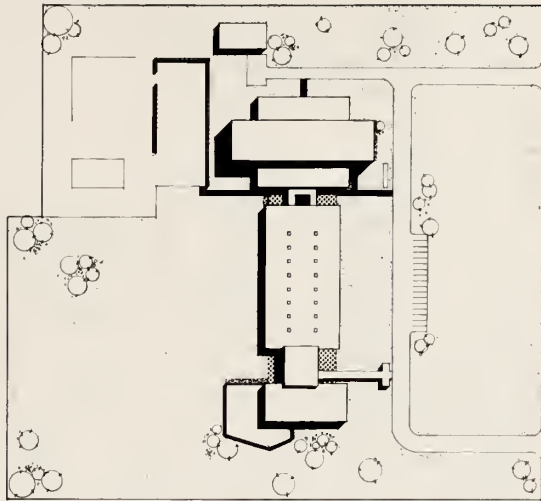
A CHILD DEVELOPMENT CENTER

EXPLANATION OF APPENDIX PAGE 4

AN ELEMENTARY SCHOOL

Location: Marlatt Ave., between
College Ave. and Denison Ave.

300 students



Site Plan

1" = 60'-0"

COURSE OF ARCHITECTURE
KANSAS STATE UNIVERSITY
BUN-VAH NIP

A ELEMENTARY SCHOOL

EXPLANATION OF APPENDIX PAGE 5

AN ELEMENTARY SCHOOL

Location: Marlatt Ave., between
College Ave. and Denison Ave.

300 students

EXPLANATION OF APPENDIX PAGE 6

AN ELEMENTARY SCHOOL

Location: Marlatt Ave., between
College Ave. and Denison Ave.

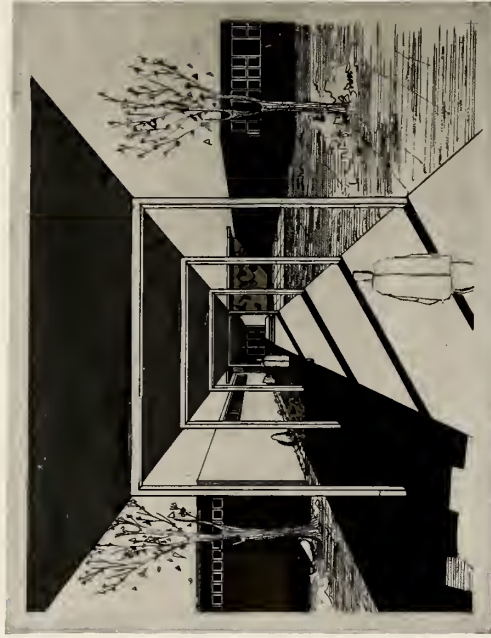
300 students



WEST ELEVATION
1" = 20'-0"



EAST ELEVATION
1" = 20'-0"



MAIN ENTRANCE PERSPECTIVE



NORTH ELEVATION
1" = 20'-0"

EXPLANATION OF APPENDIX PAGE 7

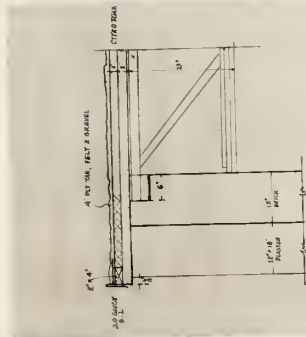
AN ELEMENTARY SCHOOL

Location: Marlatt Ave., between
College Ave. and Denison Ave.

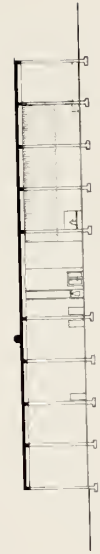
300 students



REDUCTIVE



MONTANA ROOF Scale 1"=10' 0"



SECTION B-B 1"=20'-0"



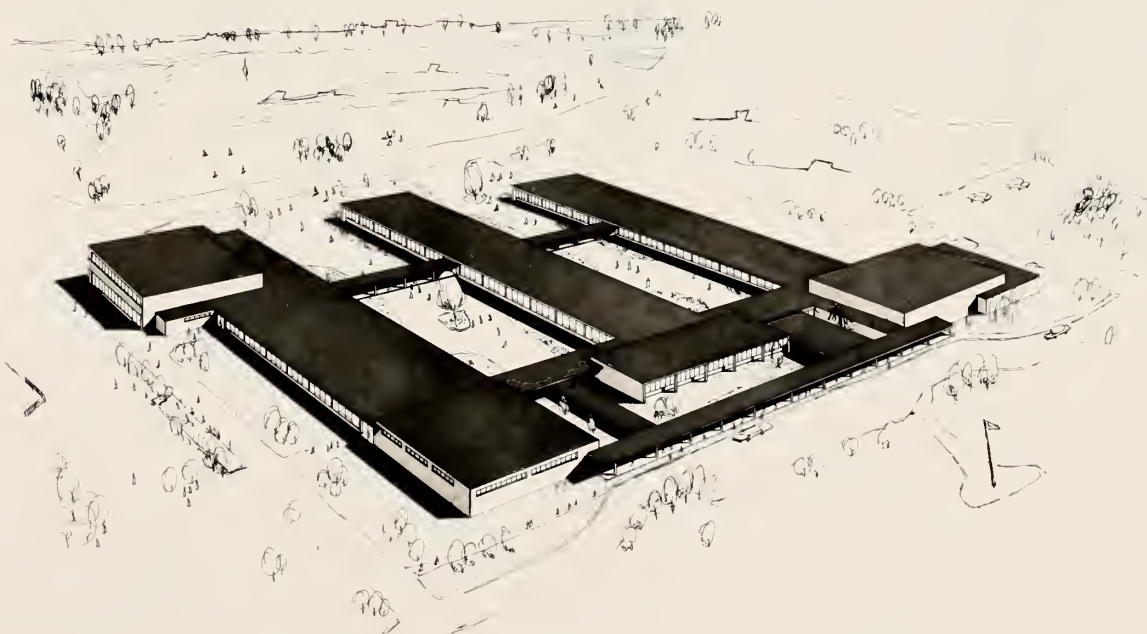
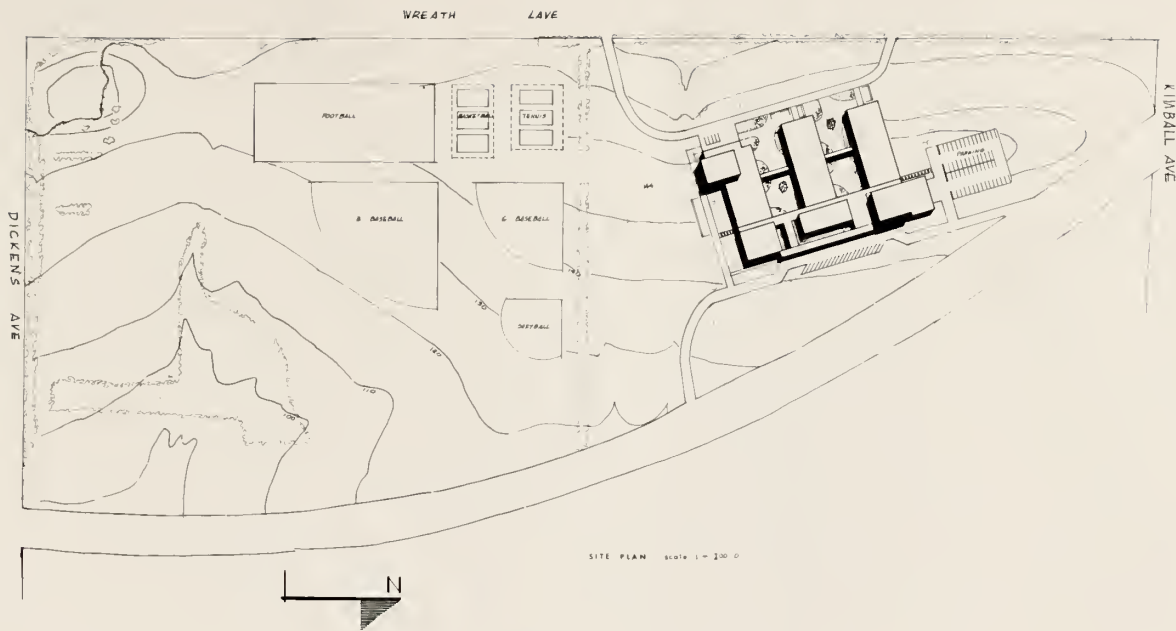
SECTION A-A 1"=20'-0"

EXPLANATION OF APPENDIX PAGE 8

A JUNIOR HIGH SCHOOL

Location: Near the City-County Park
on Kimball Ave.

500 students



DESIGN FOR A

EXPLANATION OF APPENDIX PAGE 9

A JUNIOR HIGH SCHOOL

Location: Near the City-County Park
on Kimball Ave.

500 students

EXPLANATION OF APPENDIX PAGE 10

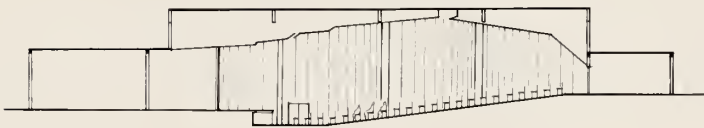
A JUNIOR HIGH SCHOOL

Location: Near the City-County Park
on Kimball Ave.

500 students



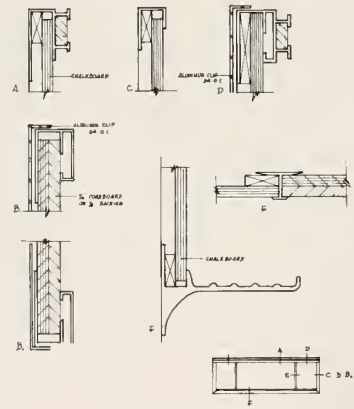
PERSPECTIVE FROM MAIN ENTRANCE



SECTION C-G scale 1"=10'-0"



PERSPECTIVE FROM MAIN HALL



CHALKBOARD'S DETAIL Full size except elevation



SECTION A-A scale 1"=10'-0"



SECTION B-B scale 1"=10'-0"



SOUTH ELEVATION scale 1"=20'-0"

DL

KANSAS STATE UNIVERSITY
COLLEGE OF ARCHITECTURE

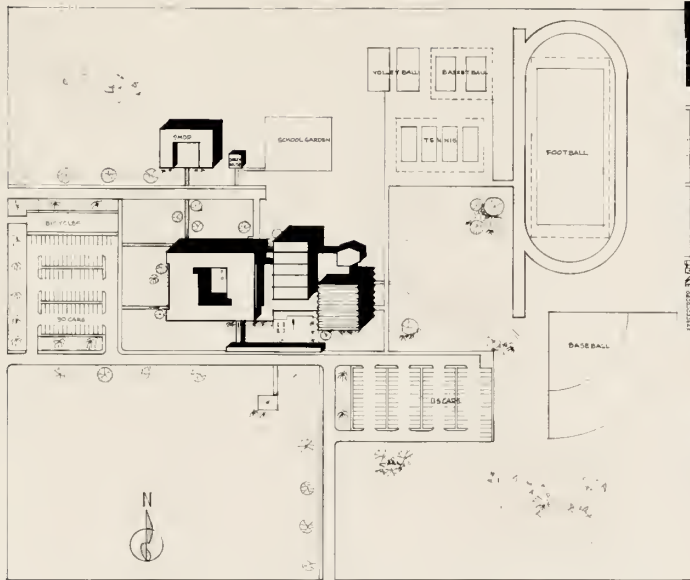
NAME: HIP BUN NAM

EXPLANATION OF APPENDIX PAGE 11

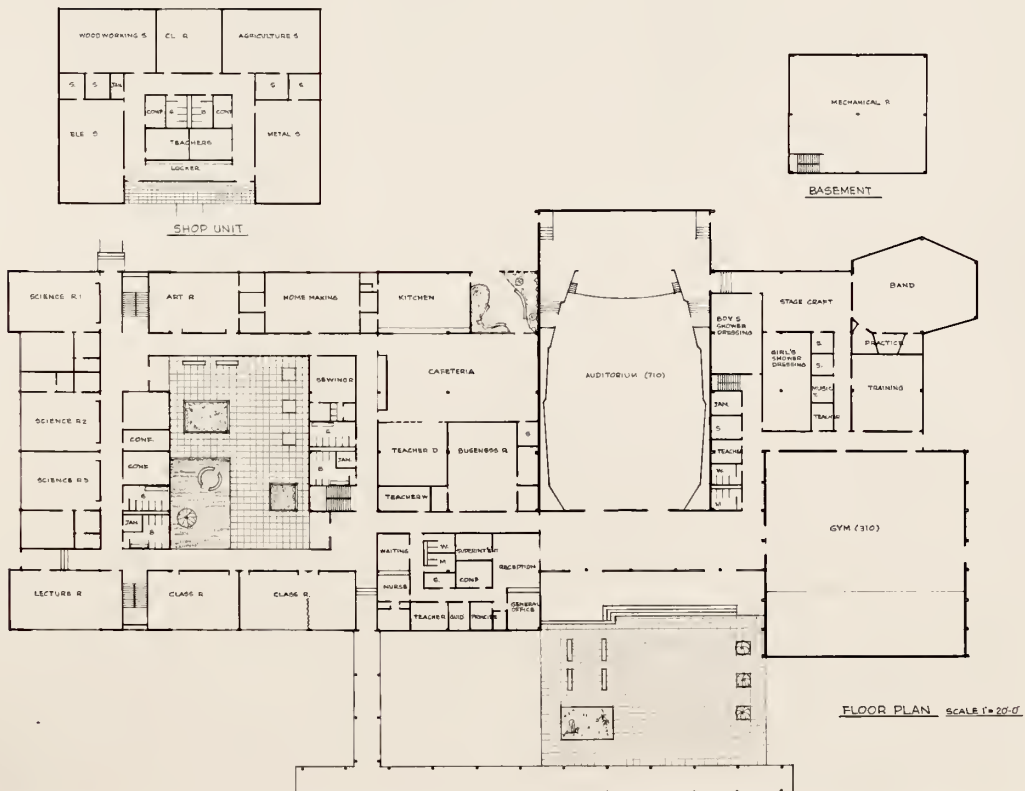
A SENIOR HIGH SCHOOL

Location: West of the Junior High School

600 students



A SENIOR HIGH SCHOOL DESIGN



EXPLANATION OF APPENDIX PAGE 12

A SENIOR HIGH SCHOOL

Location: West of the Junior High School

600 students



SOUTH ELEVATION



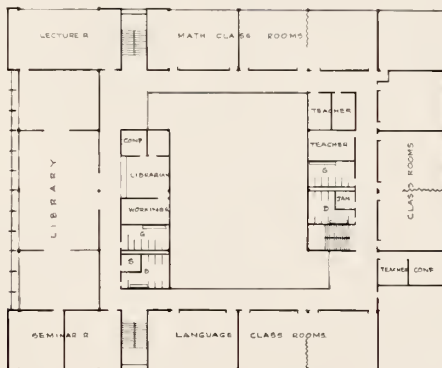
WEST ELEVATION



NORTH ELEVATION



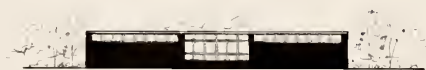
EAST ELEVATION SCALE 1/20' 0"



SECOND FLOOR SCALE 1/20' 0"



SOUTH ELEVATION OF SHOP



NORTH ELEVATION OF SHOP



WEST ELEVATION OF SHOP SCALE 1/20' 0"



SECTION A-A SCALE 1/20' 0"

THE DESIGN OF CONTEMPORARY SCHOOL BUILDING

by

BUN-WAH NIP

B. S., Chung Kung University, Taiwan, 1960

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARCHITECTURE

College of Architecture and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1966

The educational survey is very important in planning comprehensive school facilities. Before we can consider the design problem profitably, we must first understand how the school can best organize its educational program; what and how to teach in the years ahead; how many and what kinds of buildings are needed; where the school should be located; etc. A school building should be safely and educationally functional. It must have structural stability and it must protect the students from weather. The light, air, ventilation, temperature, and sound must be controlled.

An elementary school is usually defined as one kindergarten and the first six grades; a junior high school is from seventh to ninth grade; and a senior high school is from tenth to twelfth grade.

The school facilities survey, as outlined in this report, covers ten different major areas of the school plant as follows:

- | | |
|-------------------------|---------------------------|
| 1. Introduction | 6. Regular classrooms |
| 2. Conception of spaces | 7. Special rooms |
| 3. Site | 8. General services areas |
| 4. Building structure | 9. Outdoor play space |
| 5. Administrative space | 10. Service systems |

These present-day standards are designed for use in evaluating from kindergarten to grade 12. At the beginning of each of the ten major areas and at the beginning of each sub-area, this report gives a brief statement recommending the standards for that particular area of the plant. We should keep in mind how the school plant fulfills its purpose.

The rapid increase in population and the analysis of the use of present space is cast against a background of enrollment trends. These are going to change and change fast. For this reason, especially in the big city, schools will soon offer the greatest architectural challenge of all.