MODERN TRENDS IN THE PHYSICAL EDUCATION PLANT AS APPLICABLE TO THE SCHOOLS OF MICHIGAN

Thesis for the Degree of M. A.

MICHIGAN STATE COLLEGE

Joseph James Panella

1950

This is to certify that the

thesis entitled

Modern Trends in the Physical Education Plant
as Applicable to Michigan Schools

presented by

Joseph J. Panella

has been accepted towards fulfillment
of the requirements for

M.A. degree in Physical Education

Randolph W. Webster
Major professor

Date November 8, 1950

O-169

MODERN TRENDS IN THE PHYSICAL EDUCATION PLANT AS APPLICABLE TO THE SCHOOLS OF MICHIGAN

By

Joseph James Panella

A THESIS

Submitted to the School of Graduate Studies of Michigan State College of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

Department of Physical Education, Health, and Recreation for Men

1950

THESIS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

<u>Statement of the problem</u>. The purpose of this study is to determine what the modern trends in physical education plants are at the present time, and to apply these trends to the schools of Michigan. There has been some uncertainty by school officials, architects, and physical educators as to what materials, types of construction, and facilities should be included in the modern physical education plant. For that reason, this study is written to compile the recent information on the problem, and insofar as possible, bring forth the information that seems to be the concensus of opinion of the experts in the field.

<u>Importance of the problem</u>. With the expectancy of an ever increasing school population in the next ten years, the problem of providing adequate facilities for work and play falls directly into the hands of parents, administrators, and teachers. The role that physical education will play in the planning of tomorrow's schools looms ever large, and it must be met with a knowledge of what is needed and the methods of providing for these needs.

Planning a school plant, and more specifically a physical education plant, was in the past a matter that was handled solely by the architect. If he were unaware of the needs that these facilities were to fill, the result, in many cases, was inadequate from the standpoint of satisfying the purpose of the program; and as a result, the program failed quite miserably. This situation, however, has been somewhat changed since the depression, and more recently with conclusion of World War II.

Since the depression of the thirties there has been a general backlog of outdated and outmoded buildings, plus the need for many new ones, which up to the present time has never been remedied. With World War II came a cessation of all non-war construction. Since V-J Day industrial and home housing needs have, until recently, had priority on building materials, manpower, and money.

To these general factors may be added the retarded school and the lay conception of program needs for the physical education program. More positively, there has arisen an awareness of the school responsibility for many community recreational functions. Among these is the provision for physical education, the physical education spaces, structures, and fixtures, which with adequate planning may serve on the neighborhood and community basis.

A brighter day appears to be drawing near in all these matters, and a boom in the provision of school health and physical education facilities is imminent. To provide those comtemplating such provisions with relatively authoritative guidance based upon intense study of this special problem, this thesis is written.

Method of collecting data and sources of data. In securing data that is to apply to a problem that pertains to the modern trends in the physical education plant, it was necessary to talk first to the people who are at present time working with this problem. Letters were sent to the architectural firms that are concerned with the construction of school buildings in Michigan to get their opinions as to the modern trends. Experts in the field of physical educational planning were also consulted to obtain their philosophy in regard to the placement and to the requirements for an adequate plant. Information was received from private concerns whose job it is to supply materials and lend information to those constructing new buildings. After talking to these people in reference to the trends of construction, the next step was to secure the latest bibliographical research that has been done on this topic, and to assemble all the data into one common concensus of opinion of all these experts. Visits were then made to some of the new schools in Michigan to see some of these modern trends being put into practice.

Letters were sent to Perkins and Will Architectural Firm in Chicago, Illinois; Maple Flooring Manufacturers Association in Oshkosh, Wisconsin; Luria Engineering Corporation in New York, New York; The Belden Brick Company in Canton, Ohio; The Pittsburgh Corning Corporation in Pittsburgh, Pennsylvania; American Standard Radiator and Santary Corporation in Pittsburgh, Pennsylvania; Westinghouse Electric Corporation, Lighting Division in Cleveland, Ohio; and to Mr. Ted Bank of the Athletic Institute in Chicago, Illinois, from whom permission was obtained to use information from "A Guide for Planning Facilities for Athletics, Recreation, Physical and Health Education."

The information that these companies have given has lent much support in the final preparation of this thesis.

Data was also secured from many people who are affiliated with the State Department of Instruction in Michigan, and particularly from Mr. Charles Forsythe, Mr. Roland F. Strolley, and Mr. Wilfred F. Clapp.

Mr. Malcolm M. Williams of the Warren Holmes Architectural Firm in Lansing, Michigan, has given much assistance in the study of this problem.

Organization of the thesis. In preparing a thesis of this type, it was decided that the problem should be broken down into separate and distinct units which could be more easily handled and interpreted by the reader.

The first consideration was given to the indoor physical education and recreation facilities, and the supplementary spaces that are of a permanent nature within the building itself. In close relation to these facilities is the swimming pool, which is also an indoor unit, but of such great importance that it was decided to handle the pool as a separate unit. Outdoor facilities, which are a necessity for an effective and complete program of physical education, were used as a separate unit too. Consideration was also given to requirements and regulations as set down by the State of Michigan in its "Guide for Planning School Plants." It is hoped that these special units while being handled separately will lend continuity to the thesis as a whole.

CHAPTER II

REVIEW OF LITERATURE

Historical analysis. Not too many years ago the gymnasium was a maze of pipes, protruding obstructions, exposed radiators, and oil slick floors. It was thought in the twenties that the longer and thinner the gymnasium, the better it would be for all concerned,[1] however, that has all been changed, and the modern trend is to make the gymnasium and class rooms as square as possible.

Galleries located above the gymnasium was the method of seating spectators, and any school that had its seating facilities on the same floor as the activity was considered "old fashioned". Radiators were placed under the windows to compensate for the cold air that would come in through the windows. How silly that all seems now with the modern mechanical ventilation system in the new plants. It was quite a problem, too, to try and find a way to cover all the pipes that passed through the gymnasium on their way to the shower room. That has been done away with, and now all the pipes that are used are concealed within the construction itself.

---

[1] Society of Directors of Physical Education in Colleges, "Gymnasiums and Lockers", Physical Education Buildings for Educational Institutions, Part I, Society of Directors of Physical Education in Colleges, 1923, P.6.

No gymnasium was considered complete without a small pantry and a storage place for banquet tables and chairs. This is still done by some of the smaller schools, but is not considered one of the modern trends.

The following is an exerpt from a pamphlet that was published in 1923 on physical education buildings:

> When it is necessary to cross wet or muddy ground before reaching the locker or gymnasium, ample provision must be made on the line of circulation for the storage of overshoes, or the cleaning of shoes, and the member must be able to go to his locker and from his locker to the gymnasium without having to pass over the space that he has already walked on, thus avoiding the tramping of mud into the gymnasium.[2]

How unnecessary that all seems now with our modern paving and the amount of grass that surrounds our school buildings.

Running tracks were usually located above the early gymnasium and were considered the "fad". Skylights and window screens were also a must in most gymnasiums. However, these items are still considered controversial.

In constructing the floor, it was considered wise to use an eight to ten inch mopboard of wood. This has been replaced with a ten to twelve foot wainscotting of tile or some other impervious material. The walls of most gymnasiums were constructed of brick with a protrusion every time a mistake was made or whenever a ventilation duct was to be

---

[2] _Ibid_. p. 12.

covered. Ceilings were considered adequate if wood was used to seal them, and if not, they were left open. Now effort is made to treat them accoustically.

Oiling of the gymnasium floor, which is now not recommended and in Michigan condemned, was done as a matter of course twenty years ago. Cement flooring in all shower and locker rooms was recommended shortly after World War I. Now it is considered inadequate and dangerous from the bacteriological standpoint. Water proofing for all spaces below the ground level was recommended; this is still an excellent idea. However, spaces below the ground level are not recommended.

Gray walls in the gymnasium and other spaces were widely used. The modern trend is to use a white non-glaring or a pastel colored paint that can be easily washed and one that gives brightness. Fixtures were chosen from the standpoint of heaviness and simplicity, and ball bearing hinges were considered standard equipment for all doors. Locker room floors of the sloping type were not recommended because it was thought that the custodian would wash down the floors rather than mop them.

Facilities for outdoor activities, according to the experts in the field, have been about doubled since 1920, and the acreage once used is now far from satisfactory.

Stadia were something that belonged to the larger universities, and the ones that were used by the lucky high schools were usually constructed of wood. Tennis courts were constructed primarily of clay and cement, and the upkeep of the former was such that not many people were able to use them.

There were many peculiarities in our physical education plants of a few years ago and some still remain, but due to the efforts of school planners and architects these peculiarities are slowly disappearing from the scene.

Previous related studies. Not too much research has been done on the particular problem of modern trends in physical education planning; however, Roger Jackson Sharman can be cited for his early work on school planning in connection with the schools of Alabama, and due to his influence many state school systems now can boast of excellent planning facilities for their respective schools. The National Conference on Facilities for Athletics, Recreation, Physical and Health Education for 1947 can also be commended for its work in promoting this important problem of planning. N. L. Engelhardt and his son have done much too, along with Stanton Leggett, in their aid to planning both indoor and outdoor facilities.

The National Council on Schoolhouse Construction in the 1949 edition of "A Guide for Planning School Plants" has lent additional support in school construction. The American Association of School Administrators in their recent yearbook, 1949, give valuable information. Men like E. LaMar and Karl Bookwalter have given much of their lives to the promotion of better physical education facilities, and by carrying on their work, the bright day in the field seems to be approaching.

CHAPTER III

INDOOR FACILITIES FOR PHYSICAL EDUCATION AND RECREATION

In planning the indoor facilities in a new high school, the concern must be in providing those essential features that will enable this part of the physical education plant to function efficiently as well as effectively. Provision for safety features, spectator seating, auxiliary spaces, and sanitary facilities must be included and considered in order to complete the plant.

I. GYMNASIUM

The gymnasium will in most cases be the workshop for the physical education plant. Generally, it should be a well ventilated and well lighted room that will be suitable to serve the needs of the students as well as the members of the community. Its many and varied uses will in most cases determine its size and dimensions. In planning the gymnasium, it must be kept in mind that the prime purpose of this room is to provide space and equipment for a program of physical education for the students. If the gymnasium is in a separate building, a passageway that will connect with the main building is desirable; however, an underground pass is not highly recommended.

Size and location. The size of the gymnasium will depend primarily on the particular school involved. The suggested minimum mean sizes as recommended by the experts in the field are:

1. Elementary school playroom, 40' x 60'
2. Secondary schools, 76' x 96'

In both cases these areas can be broken down into ideal teaching stations by the use of mechanical sliding doors. likewise, in the secondary school by splitting these areas in two, activities for both boys and girls may be held.

The gymnasium should be located on the ground floor. It should definitely be an integral part of the total school plant, that is, readily accessible to the pupils and to the public. It should also be located so as not to cause interference with quiet classroom areas. Utmost consideration should also be given to building materials. (see Table III)

Floors. Almost all the many people engaged in physical education planning at the present time agree that a maple floor is the best type that can be installed in a new building; however, some agree that in cases where maple flooring is impossible from the budget standpoint, a substitute of asphalt tile or hard rubber may be used. The trouble with these two substitutes is that they are usually laid on a concrete slab which provides little or no resiliency.

Since the construction of the gymnasium floor is probably one of the most important items in the indoor physical education plant, a complete detailed instruction plan of a suggested floor is given. The information was furnished by the Maple Flooring Manufacturers Association, Oshkosh, Wisconsin.[3] However, this is by no means standard or recommended as the only plan.

For best results the underside of the cement floor slab shall be at least one (1) foot above the ground. After the metal clips have been inserted into the concrete and leveled with a straight edge, the entire surface of the cement is primed with hot asphalt pitch poured from a dipper to ¼" to ½" thickness. Ventilation of the area beneath the slab is advisable,if such can be arranged. Concrete sub-slab level shall be carried to the rough walls, columns, pipes, and so on. Not more than 1/8 tolerance is permitted. All projections of aggregate or rough concrete are smoothed off in sleeper lanes.

Floor clips shall be of 20 gauged annealed metal similar to the Bull Dog or approved equal. The clips near the wall shall be at least two (2) inches from the rough wall. Clips shall be installed at time of pouring concrete slab and spaced not more than 16" O.C., preferably 12" O.C.

Sleepers or screeds shall be of 2"x2"x4" Pine, Douglas Fir, Spruce, or Hemlock, according to requirements.

---

[3]Maple Flooring Manufacturers Association, Oshkosh, Wisconsin

Sleepers shall be treated with creosote or Repello or equal, before installation to retard deterioration. All sleepers shall be brought to a dead level with wood edges or cement grout.

The rough sub-floor shall be of dry 1x4" or 1x6", S1S or S2S, Pine, Douglas Fir, Spruce, or Hemlock boards, preferably creosoted or treated with Repello or equal, and laid in a diagonal direction and spaced no less than 1/8" apart across the sleepers, nailing at each bearing with 8d common nails. For expansion purpose, rough floor shall terminate not less than 2" from the walls on all sides of the room. Directly over the sub-floor shall be laid sisalcraft flooring paper or an approved equal to protect the finished flooring from moisture and dampness that may arise from the concrete. (Exception--where concrete slab rests on the ground.)

It shall be stipulated in the specifications for the general contractor and heating contractor that: The general contractor shall close the building as soon as possible after all the plastering is completed and provide correct ventilation to assure proper drying out of the building. The heating contractor shall provide heat directly after the plastering is completed and the building is closed in. A temperature of not less than 50 degrees F, and not less than 5 degrees higher than outside temperature in any season shall be maintained. Delivery of the flooring shall be made only after the building has been pronounced thoroughly dry. All flooring shall be delivered to and stored in areas to be floored at least three days before laying, the floor areas to be under proper and protected ventilation and heating.

Directly over the diagonally laid and prepared subfloor shall be laid at right angles to the sleepers 25/32x$1\frac{1}{2}$", 2" or $2\frac{1}{4}$" First Grade or Second Grade strip Northern Hard Maple Flooring. Flooring should not be drawn up too tight. This will provide for distributed expansion throughout the floor area. For expansion space, the first piece of flooring should be started not less than 2" from the rough wall or tile facing, all ends and sides of floor to finish not less than 2" from the wall. The expansion space at the walls shall not be filled with any material that will stop circulation of air or retard the movement of the floor construction. All plaster droppings and laitenance should be removed.

A 4x3" angle iron base should be installed so that the underside of horizontal leg is $\frac{1}{4}$" above the finish floor line. This is to allow the free movement of air under and around the floor. (see Figure II)

A good sanding job is necessary to insure a satisfactory finish and prolong its wear. Finished wood floors shall be sanded with power driven equipment, the speed of the sanding mechanism to be automatically variable so as to eliminate burning of the floor surface. After the floor has been swept clean of all debris and laitenance, the first cut shall be made with medium coarse sandpaper with the grain. The second cut shall be done with No. 1 sandpaper across the grain. The third cut shall be with No. 0 or No. 00 sandpaper with the grain, but in the opposite direction of the first cut. If the final sanding is done with No. 0 paper, it is good practice to remove the fuzz with steel wool of No. 1 coarseness. This operation should be with the grain. When sanding is completed, the surface of the flooring should be swept dust-free and the entire area covered with building paper until ready for the sealing or finishing process.

The type of finish to be used on a gymnasium floor is best selected from two distinct methods, the penetrating sealer which leaves practically no film on the surface or the semi-penetrating sealer which leaves a varnish-like film on the surface. In selecting the type of sealer for the playing floor, it is well to consider if the building is to be used for public functions, or exclusively for gymnasium work. The penetrating type of sealer does not show traffic wear as quickly as the varnish type.

Walls and ceilings. Ceiling heights will vary with the type and size of the building. Recommended heights for ceilings are:

1. Elementary school, 16 to 18 feet
2. Junior high school, 18 to 20 feet
3. Senior high school, 20 to 22 feet.[4]

The walls and ceilings should be free of all obstructions such as, pilasters, vent-ducts, radiators, and pipes. The gymnasium walls to a height of around seven feet should be a glazed tile or other non-abrasive material with all the cornets rounded. Above the glazed wall, cinder block, ordinary brick, or some other type of masonry may be used. Many of our Michigan schools have gone into cinder block construction of the gymnasium due to the money saving factor and the ease of installation.

The problem of acoustics should also be handled in the gymnasium ceiling, and the best method is to cover the underside of the ceiling with a non-rusting perforated or matte mineral material. Acoustical plaster has been used, but it must be expertly mixed and the end result does not work as well as the various types of acoustical fibre. Care must be taken in maintaining acoustical materials. Oil paint will reduce the effect of most acoustical material.

---

[4] "Guide for Planning School Plants", National Council on Schoolhouse Construction, 1949, P. 99.

The most common treatment of acoustical fibre tile is a light brush coat of water-brush paint.[5]

<u>Seating arrangement</u>. In determining the seating arrangement for most gymnasiums, the fact that most times the full seating capacity will not be used should be considered. Not only the original cost of the building, itself, should be considered, but also the cost of operation and maintenance should be considered. Heating such a large building, too, must be considered. For those communities with high spectator demand, it is suggested that plans be made accordingly; however, it must be remembered that the prime function of the gymnasium is for the students and not the community.

The method that is now being used by most schools to meet their seating problem in new buildings is a type of folding or telescopic bleacher that can be pushed against the wall during daily activity classes and then extended during competition in the evening. Overhanging balconies are not recommended.

<u>Equipment</u>. The problem of gymnasium equipment is not so much a total problem as one of individual schools. The

---

[5] "A Guide for Planning Facilities for Athletics, Recreation, Physical and Health Education", National Facilities Conference, 1947, p. 119.

main things to be considered are apparatus mountings, mat hangers, bankboards, and movable partitions. If suspended apparatus is to be used, then proper consideration should be given before the ceiling is installed. Likewise, wall and floor mountings should be provided during construction of these units. Mat hangers should be provided in a recessed storage in the wall of the gymnasium; however, mat trucks in storage are preferable and recommended.[6] Bankboards should be adjustable and located as provided by the markings of the floor. No special number is required, but the size of the floor usually determines the number. For a class "A" senior high school, a total number of six is satisfactory. Windows should not be placed directly behind bankboards so players will not have to look directly into the sun.

In schools where both boys and girls are to use the gymnasium at the same time, provision should be made for a motor driven sliding type movable partition that when closed will be recessed within the side walls. Good examples of this partition are found in the Sexton High School, Lansing, Michigan, and the Arthur Hill High School, Saginaw, Michigan.

---

[6]Ibid., p. 41.

If drinking fountains and cuspidors are used in the gymnasium proper, they should be recessed in the wall and so arranged that the fountain flushes the cuspidor.

Exits. The National Fire Protection Association (current "Building Exit Code") recommends one unit of door width for each 600 square feet or fraction thereof of floor area of auditoriums and gymnasiums on the first floor.

Single leaf doors should be used whenever possible, and where double leaf exterior doors are used, a center mullion should be provided. At least one exit should be provided with a movable mullion to permit passage of large objects. Exit doors should open outward. The unit width of door openings is 22", but a doorway of 40" clear opening may be considered two units. The minimum width of any single doorway should be 36", which, however, will be counted as only one unit width.

Exit doors should be fitted with anti-panic hardware, check stops, and closers. All gymnasium exits should have illuminated signs with the word "Exit" in plain letters. The electrically lighted sign should be on a separate circuit and approved by the National Electric Code.[7]

---

[7] "Guide for Planning School Plants", National Council on Schoolhouse Construction, 1949, p. 122.

Heating. Heating in our schools has ranged from individual room stoves to complex automatic units that maintain a constant temperature.

The common methods of transferring heat from one space to another are by water, steam, and air; although some heat is transferred in the form of electric current. Heat dispensing units may be located anywhere within the main school building or as a special unit within the plant. There are many ways of transferring it to the place of usage:

1. Direct radiation
2. Unit ventilators
3. Warm air furnace systems
4. Fan blast of furnace air
5. Split systems
6. Hot water systems
7. Radiant panel heating[8]

This does not in any way indicate a preference, and any or all are good ways of adequately heating the indoor spaces.

Heating plants should be designed to meet present as well as future needs. A type of zoned heat works well when all spaces are not used constantly; for example the gymnasium at night. All heat should be thermostatically controlled in order to regulate the different heat needs for the different spaces.

---

[8] *Ibid*., pp. 132-133

A list of temperature ranges approved by the New York State School System and which can be applied to Michigan schools are: vigorous activity in the gymnasium 60° to $70^\circ F$, locker and shower room 76° to $80^\circ F$, swimming pool area 80° to $86^\circ F$. The temperatures were measured 60 inches above floor level. Differences in temperatures from the floor level to a level of 60 inches should not be more than 3°.[9]

Lighting. Experts agree that artificial lighting should provide a uniform distribution of shadow-free, glare-free illumination. (see Table II) Consideration should be given to the probable deterioration of efficiency under school conditions of operation and maintenance. Light fixtures should not produce a surface brightness that exceeds 10 to 1 brightness difference limit for the surrounding field, assuming the line of sight to be horizontal.[10]

Multi-source lighting, which caused much concern in the pioneer days due to the cross lighting and glare problems involved, is now coming into its own again. The National Council on Schoolhouse Construction warns that multi-source

---

[9] "American School Buildings", Twenty-Seventh Yearbook of the American Association of School Administrators, (Washington D.C., 1949), p. 147

[10] "Guide for Planning School Plants", National Council on Schoolhouse Construction, 1949, pp. 146-47.

daylighting calls for special devices of daylight control.[11] In breaking away from unilateral lighting, some architects and school administrators have violated sound principles of balanced brightness by locating unshielded windows and glass panels on two or more sides of the classroom. Good designs of multi-lateral daylighting can be effective, but all sources (except possibly from one direction) must be permanently shielded so as to throw light to the ceiling without producing "hot spots" in the vision field.

Progress in structural design and intelligent use of multi-source daylighting have made possible the widening of schoolroom spans and the re-introduction of the square type classroom. Structural design has also done much to dictate the type of fenestration that is being used in the modern plant.

Awning type sash is not too popular because some of the types of hardware on this type of sash do not close the windows as tightly as required. Where prismatic glass block is used in walls, the vision strip of clear glass is usually of a pivoted type either wood or metal sash. Metal windows of the casement type have not been popular because of the difficulty of getting sash to fit well enough to prevent

---

[11] _Ibid._, p. 147

excessive moisture from getting into the building. (see Figure I)

Where steel sash or double-hung type are used, it is important that periodic painting be used to prevent corrosion. It was thought that after the war, aluminum double-hung sash would be as cheap as those of wood. While the price has been reduced, it still does not compete with wood or steel on an equal basis. However, in computing costs, it is well to remember that aluminum requires little upkeep and no paint. It is wise to provide the type that provides the most light and is the easiest to clean.

Lighting in the gymnasium should be controlled so that artificial lighting is not less than 15-foot-candles at floor level. No lighting should cause a glare. Recessed lights should be provided whenever possible. All lighting needs protection of a sort. The light intensities as recommended by the Illuminating Engineering Society are: gymnasium and swimming pool 20 foot-candles maintained in service, locker and shower rooms 10 foot-candles maintained in service, and store rooms 5 foot-candles maintained in service.[12] When using a type of diffusing globe, consult

---

[12] "Better School Buildings for Alabama", State of Alabama Department of Education, (Montgomery, Alabama, Bulletin 1950, No.3), p. 239.

the recommended diameter of diffusing globe. (see Table I)[13]

Ventilation. Various methods of ventilation are used to ventilate different school plants. Open windows provide fresh air for different spaces, but they do little in the way of providing air control. In some cases, air is exhausted by suction fans (mechanical) located in ducts above the rooms. If it is desirable, several rooms may be brought together, and thus, one exhaust fan will serve several ducts. Forced air systems, which force air into rooms, give a slight impetus to the movement of the air, and are used by many of the newer schools. The gymnasium and larger spaces should have sufficient ventilation, if proper fenestration is used. Toilet rooms and other rooms that give off odorous fumes should have a system of ventilation directly through the roof. Drying rooms should have a positive system of mechanical ventilation.

The same rate of ventilation is not needed in all areas, and the system should be constructed accordingly. Proper ventilating, which in turn provides proper humidity, means lower heating costs, better health, and better condition of structures. A relative humidity of 40 to 60% in gymnasiums

---

[13] Ibid., p. 232.

TABLE I

RECOMMENDED DIAMETER OF DIFFUSING GLOBE

Bulb Size	Recommended Diameter of Globe
100 Watt	10 Inches
200 Watt	14 Inches
300 Watt	16 Inches
500 Watt	18 Inches

TABLE II

FOOTLAMBERT CHART

Illustration of Brightness	Footlamberts
Clear	1,000
Hazy sky	2,000
White clouds	3-5,000
Sunlight on white buildings	8,000
Sunlight on trees	320
Bare 200 watt filament lamp	65,000
Enclosing globe	1,200
Bare fluorescent lamp (48")	
at 90° angle to axis	1,900
at 30° angle to axis	1,400
shielded fluorescent fixtures (U.R.C.)	500
White ceiling above indirect fixtures	
500 watt hung 30" from ceiling	75
500 watt hung 48" from ceiling	45
750 watt hung 48" from ceiling	65
Blackboard with 25 F.C. (10% R.F.)	2.5

These footlambert figures given by the Illuminating Engineering Society are some of the average values for some of the brightnesses found in the different areas of a school building. Notice the reduced ceiling brightness made possible by a longer hanging stem on indirect fixtures. This primarily the type of lighting used in most gymnasiums.

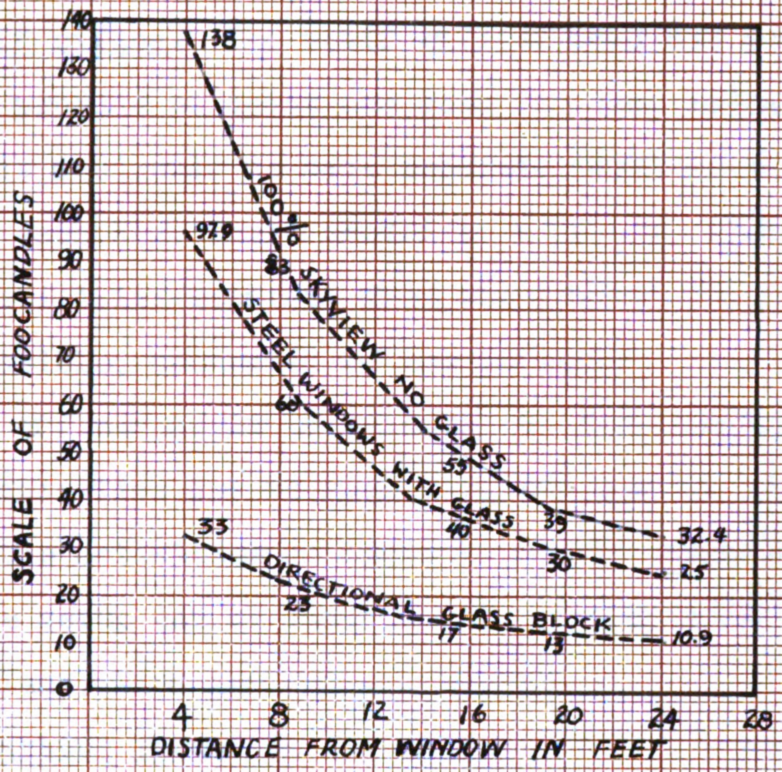


FIGURE I

A COMPARISON OF TWO TYPES OF DAYLIGHT OPENINGS

10 FOOTCANDLES = 5 SQUARES
4 FEET = 10 SQUARES

and activity rooms has been found to be satisfactory.[14]

II. AUXILIARY SPACES

Staff office. The staff offices need not be large, but should provide at least one desk for each member of the staff. It is desirable to have separate facilities for the use of each sex. There should be a toilet, shower and dressing facilities separate from the student facilities and, if possible, connected to the offices.

The office should be situated so that the maximum possible activities can be seen from it, and the best supervision of the activities be assured. A good example of this type office setup can be seen in some of the newer schools in the Midland, Michigan, school system.

Apparatus room. In the larger school systems provisions are being made for an apparatus room that will store any of the large equipment that is used during an activity. Some schools combine the use of this room to include wrestling. If such is the case, the additional provision must be made for mat storage. The room should be near the gymnasium and, if possible, directly adjacent to it. Outdoor apparatus should be stored in a room accessible to the play-

[14] "Guide for Planning Facilities for Athletic, Reccreation, Physical and Health Education," National Facilities Conference, 1947, p. 114.

ground, preferably opening onto the playground. The doors of the apparatus room need to be large enough for the largest piece of equipment to pass through. A door seven or eight feet wide is the best size and highly desirable.[15] Flush doors and sliding sills are practical for this area. Durable materials should be used for floors, and plaster walls are contra-indicated. Storage space must also be provided for any particular equipment such as a piano, phonograph, costumes, and other equipment.

Combined gymnasium and auditorium. It is generally agreed that a combined gymnasium-auditorium is undesirable, and that when such a combination is made, neither facility can be of maximum usefulness. However, because of financial limitations, many of these units will be made in the new buildings now being erected.

The following precautions will tend to lessen some of the disadvantages of the combination:

1. Locate the stage at one side of the gymnasium with the bleacher seating facing the stage. The stage can be used for seating during games and the bleachers can be used for seating when the facility is used as as an auditorium.

2. The type of ornamentation usually used in an auditorium should be eliminated. The general structural features should be designed for gymnasium use.

---

[15]Carolyn W. Bookwalter, Karl W. Bookwalter, "Suggestions for Modern School Health, Physical Education, and Recreation Facilities," The American School and University, 21st. annual edition, 1949-50, p. 237.

3. A room should be provided elsewhere in the school for small meetings.

4. A storage room off the stage wings should be provided for the stage piano, floodlights, and other stage properties.

5. Adequate and convenient storage space for folding chairs should be provided.

6. Special attention should be given to acoustical treatment.

7. Heating and ventilation should be adaptable to the kind of temperature and ventilation needed for physical education and the somewhat different requirements when the room is used as an auditorium.[16]

The high school gymnasium-auditorium should be considered as primarily a physical education area, which is to be used only on occasions as an auditorium. In schools where the plant provides a little theater, it is not essential that the gymnasium-auditorium contain a permanent stage. A platform that can be stowed in the gymnasium can be used as a platform during large gatherings.

In smaller elementary schools the situation is somewhat different. A reasonable solution is a flat floor to accommodate 200 to 400 persons. The finish of the floor will be determined by whether the space will be used primarily as a gymnasium or an auditorium. If it is to be used as a gymnasium, then by all means, a wooden floor is recommended.

Class room. It is highly recommended that every

---

[16] "American School Buildings," Twenty-Seventh Yearbook of the American Association of School Administrators, (Washington D.C., 1949), p. 117.

physical education plant provide for at least one room that can be used as a physical education lecture and health instruction room.

Corner rooms are desirable from the standpoint of cross ventilation. The room should contain all the features of the ordinary classroom within the building. It should incorporate the features of good heating, lighting and ventilation and should meet the requirements of good construction. Electrical outlets should be provided for the use of movie projectors and other electrical teaching devices. The ceilings and walls should be acoustically treated to minimize gymnasium noises.

III. SANITARY FACILITIES

Locker room. The greatest deficiency of physical education planning has been the lack of adequate locker facilities. The provision of locker rooms in the elementary school is entirely dependent upon the policy of the school, however, many of the new elementary schools being built have included locker facilities.

A modern secondary school must provide locker or other gymnasium facilities for gymnasium clothing for each pupil in the school, accessible to the gymnasium or outdoor areas. The area required for lockers is large, and should not be considered the last phase in planning the physical education plant, but rather one of the first. Lockers should not be relegated to the basement, but instead should be on the gymnasium floor level. It should also be accessible to the toilet, gymnasium, and the playground.

The construction of the locker room must be considered with the utmost care. The upper wall of the locker room may be of cinder block that can be painted to harmonize with the color scheme. Cinder block also has the acoustical qualities needed, if the blocks are cured before using. Glass block can be substituted nicely for windows, if there is proper mechanical ventilation. Again there are two schools of thought on this. Some say to use only a ceramic tile for the wall, and as much window space as possible toward the sunny side.

The new junior high school at Midland, Michigan has incorporated in its new school a system of skylighting. This controversial issue has been thrown around for many years now, and the conclusion seems to be that if skylights and their maintenance can be afforded and some way found to prevent leakage, then, they can be justified.

Since cement is no longer recommended for the floor of locker rooms, a new method had to be found. The two types most widely used now are non-slip tile or terrazzo. A terr-azzo floor, which is made of marble chips embedded in cement, with the surface ground to a smooth finish, is excellent surfacing, although somewhat expensive. Terrazzo can be made non-slip by the addition of metal particles used in the mixture. The floor is further improved by a sealing and hardening process which gives a smooth sheen and a stain-resistant finish. Tile, which is also used quite widely, works well, but some experts say that the cement joints are a good breeding place for harmful bacteria. Whether tile or terrazzo is used for flooring, the floor should be sloped to drains to aid in washing.

Lockers should be installed on a solid base 6" to 8" high. This will facilitate cleaning and mopping the floor. Locker benches should be included as permanent fixtures. They should provide at least 12" to 18" of seating space for each pupil and should be installed between the rows of lockers. It is advisable that the benches be securely fastened to the floor. This can be done by using pipe standards set water tight in the floor. The benches should be at least 8" wide and 16" off the floor.

A recommended arrangement is the provision of one full or half length locker for each pupil in the largest class group and an additional small locker for each person who uses the gymnasium.[17]

---

[17] "Better School Buildings for Alabama," State of Alabama Department of Education, (Montgomery, Alabama, Bulletin 1950, No.3), p. 108

Proper ventilation is secured by separating back-to back lockers five to six inches. This space is enclosed on all sides by steel panels, vents being taken in the top of the panel and connected to a mechanical exhaust. If the backs of the lockers are perforated with small holes, air can be drawn through louvers in the fronts of the doors, through the lockers, and through these holes into the ventilating chamber. To facilitate drying and ventilating of gymnasium clothing, a locker 7½" by 24" by 12" will permit clothing to hang freely on the hooks instead of being stored in a lumpy mass as is usually the case in a locker 12" by 12" by 12". At present a 7½" locker is not included as a standard size in the Simplified Practise Recommendations of the United States Bureau of Standards, but an effort is being made to secure its inclusion. The narrowest standard locker is now nine inches in width.[18] Separate combination locks that can be opened with a master key, rather than built in locks, seem to be most satisfactory.

Additional items to be included in the modern locker room are adequate mirrors in both boys' and girls" locker rooms, built in drinking fountains and cuspidors, and toilet facilities.

---

[18] American Association of School Administrators, op. cit., p. 120.

Built-in hair dryers with foot pedal control and adjustable nozzles are necessary for the girls and desirable for the boys. Electrical drying equipment for hands and face has much to be said for it from the standpoint of sanitation.[19]

Showers. Showers must be provided near the lockers. A drying area is also being used between the locker and shower room. The towel room (a towel room is recommended in the newer schools) should open into the drying room area. For larger schools a separate entrance is being used.

Wall material should be waterproof in sufficiently light colors to expediate cleaning. If cinder block is used, a wainscotting of tile terra cotta or tile should be used to a height above the splash level. Ceilings should be high for ventilating purposes and acoustical reasons. Floors of the shower should be of non-slip tile or terrazzo or other non-absorbative material. Bare concrete is not recommended for shower rooms. The floors should be sloped enough to drain into gutters next to the wall rather than into a center drain. Some experts recommend two drains, one on either side of the shower to take care of excess water. The entire shower area should be underlaid with a lead pan to eliminate

---

[19] N.L. Engelhardt, N.L. Engelhardt Jr., Stanton Leggett, Planning Secondary Schools, (New York: Reinhold Publishing Company, 1949) pp. 132-33.

all possibility of leakage. All gutters should be covered with screens.

Hardware, pipes, and all other metal fittings should be of non-corrosive construction. The exposure of pipes at the top, or on the wall, of the showers constitutes a safety hazard, and because of the excessive abuse they will receive, may cause maintenance problems. Therefore, the pipes that are being used should be concealed, but they must also be tested before the final wall finish is applied.

Non-clogging, swivel type shower heads of a standard design and size should be installed in each shower unit. In using gang showers a thermostatic mixer which eliminates the possibility of scalding should be used.

Common showers and gang showers are being used for boys, with one shower head provided for each four boys in the class. The tendency is to provide gang showers for the girls also. Individual showers should also be provided. Around ten to twelve feet for each shower head is considered adequate by most experts. Shower heads should be at shoulder height for the taller pupils.

Portable foot bath receptacles are usually more satisfactory than the built-in type, but experts question their inclusion in the plant. If built-in receptacles are used, they should be provided with individual drains.

An additional item to be considered in the modern shower room is liquid soap dispensers that should be installed at control valve height at the rate of one for each two showers. All lighting fixtures should be moisture proof with switches outside the shower room.

Heating and ventilation should be of a mechanical nature to expedite removal of stale air.

Drying rooms are now being included in the modern plant. When planning on this facility, it must be remembered that sufficient space should be provided, at least as much as in the shower room. Some experts recommend a ledge 18" high and 8" wide as the drying room area wall. This can also be used as a foot drying aid.[20]

Toilets. Complete, well arranged and maintained toilet facilities are essential for the health of the school student. Since the standards of design, finish, and materials have improved in recent years, the modern Michigan school seeks to incorporate many of the trends, newer ideas, and proved conclusions from study, research, and practice.

Toilets for public use should be conveniently located and available to the gymnasium and other parts of the school used by the public. Toilets should also be located near the locker rooms of both boys and girls.

---

[20]"Guide for Planning Facilities for Athletic, Recreation, Physical and Health Education," National Facilities Conference, 1947, p. 61.

Positive mechanical ventilation with separate air ducts should be provided in all toilet rooms. The recommended window area is not less than 12% of the floor area. Artificial lighting should be provided for a minimum of six foot-candles at eye level.[21]

Toilet room floors should be composed of ceramic tile, terrazzo, or similar impervious masonry. Concrete floors are not recommended and are not widely used in the new buildings. Walls should also be of some impervious material such as glazed tile. Ceiling construction is usually of plaster.

Stall partitions should be of an impervious material, with a baked enamel finish if metal, and must be securely anchored. Slate is not recommended or widely used in the newer buildings.

Girls' toilet compartments should be provided with flush doors, substantial and non-corroding hardware, and rubber bumpers. Boys' toilet compartment doors are optional.

Floor drains should be provided in every toilet with the floor pitched toward the drain. In schools where floor type urinals are used, these may serve as drains. However, there is a difference of opinion on floor type urinals.

---

[21] "Guide for Planning School Plants," National Council on Schoolhouse Construction, 1949, p. 154.

Some experts agree that the wall type is better because it is not susceptible to clogging from floor refuse.

Soap dispensers should also be provided. Toilet paper holders, waste containers, mirrors, and hand drying facilities are essential. Sanitary napkin dispensers and waste receptacles should be installed in the girls' toilet rooms.

The type of bowl that is used in toilet rooms should also be considered. A 13" bowl should be provided in the junior and senior high school. Bowls should be of vitreous china type with the extended lip or elongated type, and should be equipped with impervious open front seats. Individual flush valves are recommended, and it might be wise to have these work by hand rather than foot. In supplying sinks in the toilet rooms, it is recommended that they be installed at least 30" from the floor.[22] Tempered water should be supplied through all spigots, and sinks without stoppers should be used. Artificial lighting should be used over the sinks.

Drinking fountains. Fountains should be located conveniently to gymnasiums and playgrounds. Where construction permits, drinking fountains should be recessed to their full depth. Where electric cooling units are used, a recess must also be provided for them. Drinking fountains of the frost-

---

[22] *Ibid.*, p. 156.

proof type should be located on the playground area.

Fountains should be of an impervious material, of the type that will not permit the mouth of the student to come into contact with the nozzle or permit water to fall back on the nozzle. The fountain jets and all the openings in the water supply piping should issue above the level of the rim of the fountain bowl. Satisfactory height for junior high schools is 32", and for senior high schools 36".

Additional spaces. Spaces that may be included in modern plant are: the visiting team locker and shower room. These will be of the same standards as the home facilities. Laundry rooms may, or may not, be included in the modern plant. This is primarily a matter of the individual school. Physical reconditioning rooms are slowly making their way into some of the physical education plants, and these facilities will aid immensely in the total picture of the plant.

Rooms such as rhythm rooms, wrestling rooms, rifle rooms, and club rooms are not covered in this thesis because it is impossible to find many of these spaces in Michigan schools, However, the writer is cognizant that these facilities are very necessary to adequately meet the needs of the physical education program.

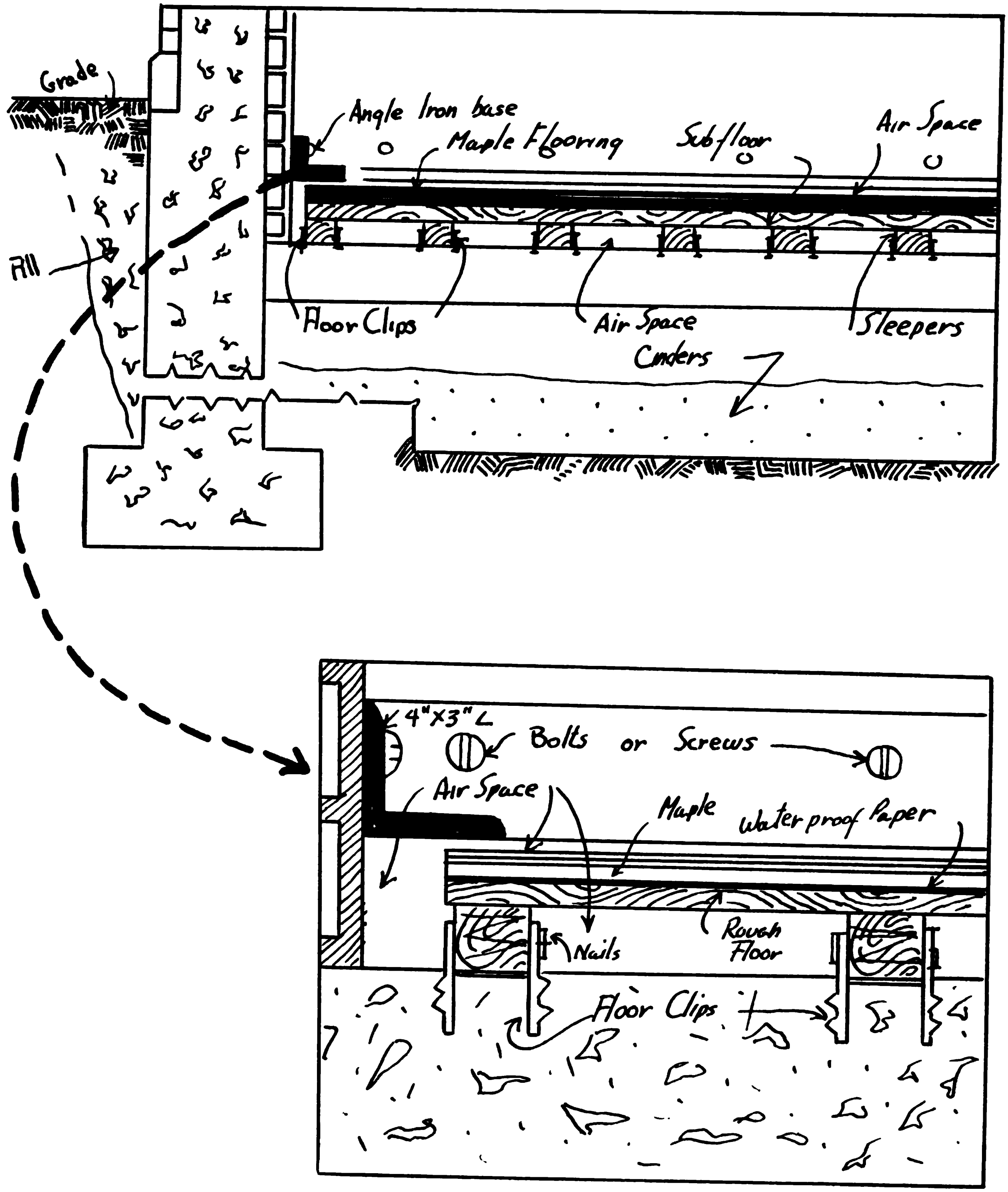


FIGURE II:

SUGGESTED DETAILS OF THE CONSTRUCTION OF GYMNASIUM FLOORS

TABLE III

SUGGESTED CONSTRUCTION MATERIALS FOR PHYSICAL EDUCATION SPACES

SECTION	FLOOR	BASE	WAINSCOT	WALL	CEILING
Gymnasium	W	3"	X	SFT	HC / Ac. T
Administrative Office	AT	SL R / AT W	X	P	CRP
Instructors Office	AT	SL R / AT W	X	P	CRP
Health Training Room	W	3"	X	SFT	Ac. T
Storeroom	C	C	X	P	CRP
Locker Room	Ct	X	X	CFT	HC
Shower Room	VCT	VCT	GT	P / GT	HC / RCRP
Toilets	VCT	VCT	GT	P	HC / CRP
Team Room	VCT	VCT	X	GT	GRP

LEGEND

Ac. T	Acoustical Tile	P	Plaster
AT	Asphalt Tile	R	Rubber
C	Cement	SL	Slate
Ct.	Cement Terrazzo	VCT	Vitreous Ceramic Tile
CRP	Concrete smooth for plaster	W	Wood
GT	Glazed Tile	X	None
HC	Hung Ceiling	SFT	Saltglazed Facing Tile
G	Glass		

CHAPTER IV

THE SWIMMING POOL UNIT

In planning the swimming pool unit, it must be remembered that for a unit that costs around $150,000 much planning and analyzing should be done. It should be stated, too, that not every school should plan on having a swimming pool. It might be wise for some of the smaller schools to devote the money that would go into pool construction to some other type of recreation and physical education facilities. However, for the larger schools, whose budget and policy can afford a pool unit, this chapter is written.

Shape and size. There are many shapes and sizes that can be used for the construction of the indoor swimming pool, but the one that is easiest to maintain and to construct is the rectangular type. This is the type that is being constructed in the newer high schools. Some of the other types, the "L" and the "T" or modifications thereof, will not be considered in this chapter.

Pool dimensions. The minimum length that will meet the requirements for interscholastic competition is 75' and the smallest fraction of an inch possible, to allow for any contraction. A length that is any shorter can not be used for a world record. (see Figure III)

The minimum width that is required in high schools is 35'. However, most college standards recommend 42'. Pool widths should always be in multiples of 7'.[1] While 35' is the required width, some schools are constructing pools with four 7' lanes. There is now some thought given to an additional foot width on either side of the pool in order to counteract pool wash. Mr. R. E. Daubert of Michigan State College agrees that this feature would insure evener competition.

Due to the change in the height of the diving board for the year 1950, it is recommended by the National Collegiate Athletic Association that the depth of the new pools be "... at least 11', in an area 3' back, 24' in front, and 10' each side of a vertical dropped from the front end of the board".[2] The Association also recommends that the depth of the shallow end be increased from 3' to 3½'.

Spring boards. To comply with the 1950 rules of the National Collegiate Athletic Association, (which governs interscholastic meets), "The spring board shall be 1 meter and 3 meters above the water level, at least 14' long, and preferably 16' long, and 20" wide, covered along the whole length with cocoa matting, or some adequate non-skid material".[3]

---

[1] "A Guide for Planning Facilities for Athletics, Recreation, and Health and Physical Education," National Facilities Conference, 1947, p. 85.

[2] National Collegiate Athletic Association, 1950

[3] Ibid.

Construction of the pool. Once the location of the pool has been determined, the actual construction must begin.

The pool basin should be built from materials that will guarantee a leak-proof structure which can be used for many years. If reinforced concrete is used, it should be poured in one complete operation to insure uniform density and strength. The lining of the bottom and sides of the pool should be of a light colored impervious material that is free from cracks and joints. At the ends of the pool from the waterline to a depth 3' below, the lining should have a rough unglazed finish to facilitate racing turns.[4] For the rest of the pool walls an impervious tile of some type is satisfactory.

Lane markings should be of the same material that is used in the bottom of the pool, but preferably of dark blue or black. The size of the lane marking should be 10" wide and should terminate 4' from either end of the pool. The lanes should be clearly marked with numerals.

The recommended width of the pool deck is 10' on the sides and 20' on the ends.[5] The materials for the deck

---

[4]Fredrick W. Luehring, Swimming Pool Standards (New York: A.S. Barnes and Company, 1939), p. 98.

[5]National Facilities Conference, op. cit., p. 86.

should be of an impervious nature that can be washed down and easily drained. There should be ample provision for sloping the deck to open trap drains.

Care should be exercised in spacing the water inlets and drainage inlets to assure proper circulation. In addition to the main drains, there should also be included a system of overflow drains, placed at 10' to 20' intervals, and overflow gutters around the perimeter.[6]

It is desirable that a tunnel under the deck of the pool be constructed to contain all the electrical and piping fixtures. This will aid in maintenance and repair of these items.

Recessed type steps seem to be the type that are commonly recommended within the pool. Hand rails of a non-corrosive material may be utilized and located on the curb or perimeter, but not projecting into the pool or obstructing the runway.[7]

There should be a curb or coping around the entire pool of a height from at least 12" to 18". The curb should be sloping away from the pool, and constructed of non-slip

---

[6]"American School Buildings," Twenty-Seventh Yearbook of the American Association of School Administrators, (Washington D.C., 1949), p. 165

[7]Luehring, op. cit., p. 118.

tile or some other rough surface material.

The recommended depth for underwater lighting is 3' below the waterline spaced every 10'. However, in a recent conference with Mr. Charles McCaffree, swimming coach at Michigan State College, the writer was informed that a system of lighting that was lower at the deep end of the pool would reduce glare. This seems to be a very logical conclusion and worth consideration.

Ceilings, walls, and acoustical treatment. The recommended ceiling height that most experts agree upon is 22'. The walls of the pool room to a height well above the surface of the water should be constructed of some impervious material such as glazed tile or smooth brick. Sound absorptive material should compose the upper walls of the pool room and the ceiling. This treatment will guard against reverberations, and aid the instructors in their speaking.

In relation to the problem of condensation on the pool walls, little can be said. Many experts feel that the problem can never really be solved. However, Mr. Charles McCaffree informs the writer that the problem could be remedied by injecting a jet of live steam into the air duct, which in turn would seem to de-humidify the air, causing reduced condensation.

Seating. A spectator gallery should be provided.

It should be accessible to the pool proper from somewhere above the pool. The gallery should be a permanent construction that is free from pillars, glare, and any obstruction. The materials used for construction should be smooth, non-absorbant, and non-corrosive. All seats should be off the deck or runways of the pool and at no time should spectators with street shoes be allowed on these areas. The number of seats to be included will depend entirely on the particular school involved.

Heating and ventilation. The first thing to be considered in relation to heating and ventilation is a separate heating and ventilating unit for the swimming pool proper. The reasons for this are that the pool should be the warmest space in the plant, and that pool heating has to be changed to meet the needs of the different groups.

The pool heat for beginners should be warmer than for experienced swimmers. Merriman, coach and teacher of swimming at the University of Pennsylvania, feels that the new swimmer has a difficult time with the aquatic breathing and a feeling for safety, which tends to over-fatigue the body of the young swimmer. As a consequence, he feels that warmer water will aid in reducing colds and in developing swimming skills.[8] In the Detroit school system, all

---

[8] Ibid., p. 186.

beginning classes in swimming are held on the same day so that the pool can be a few degrees warmer.[9]

There seems to be some difference of opinion as to the temperature of the water for swimming, but the concensus seems to favor a temperature of around 80° and a few degrees warmer for beginners.

The air in the pool room should be from 3° to 5° warmer than the water. A system of forced air heat is recommended for the pool unit. Where the pool leads directly to the locker or shower room, some experts feel that a system of double doors aid in preventing drafts from these spaces.

Where it is logical to use windows in the pool room, a system of real and mechanical ventilation should be used.

Lighting. When windows are used for lighting, unless these windows give an even brightness, a system of artificial lighting must be used to supplement the natural light. Provision must be made for an even, glare-free lighting throughout the pool room. A recommended light intensity for the pool is 20 footcandles maintained in service.[10] A system of indirect

---

[9] Loc. cit.

[10] Cf. ante., p. 24.

lighting is recommended. Lights should be vapor-proofed with protective shields.[11]

Servicing. Since the servicing of the pool will include all the items that are of a technical as well as a chemical nature, it is recommended that the reader contact the Michigan State Health Department to secure the requirements and recommendations that are offered through it.[12]

Because the swimming pool is such an expensive item, it does not seem feasible to recommend its construction for all schools. However, the writer feels it is a definite need in the school of tomorrow, and for that reason, has included a brief chapter on its place in the modern physical education plant.

It is hoped that some information may be gained by the reader, and that his recognition of the problem will lead him to the many authorities that are more than willing to disseminate what information they have in relation to the swimming pool unit.

---

[11] "A Guide for Planning Facilities for Athletics, Recreation, Health and Physical Education," National Facilities Conference, 1947, p. 90.

[12] "Swimming Pool Operation," Engineering Bulletin No. 18, Michigan Department of Health, Lansing, 1945.

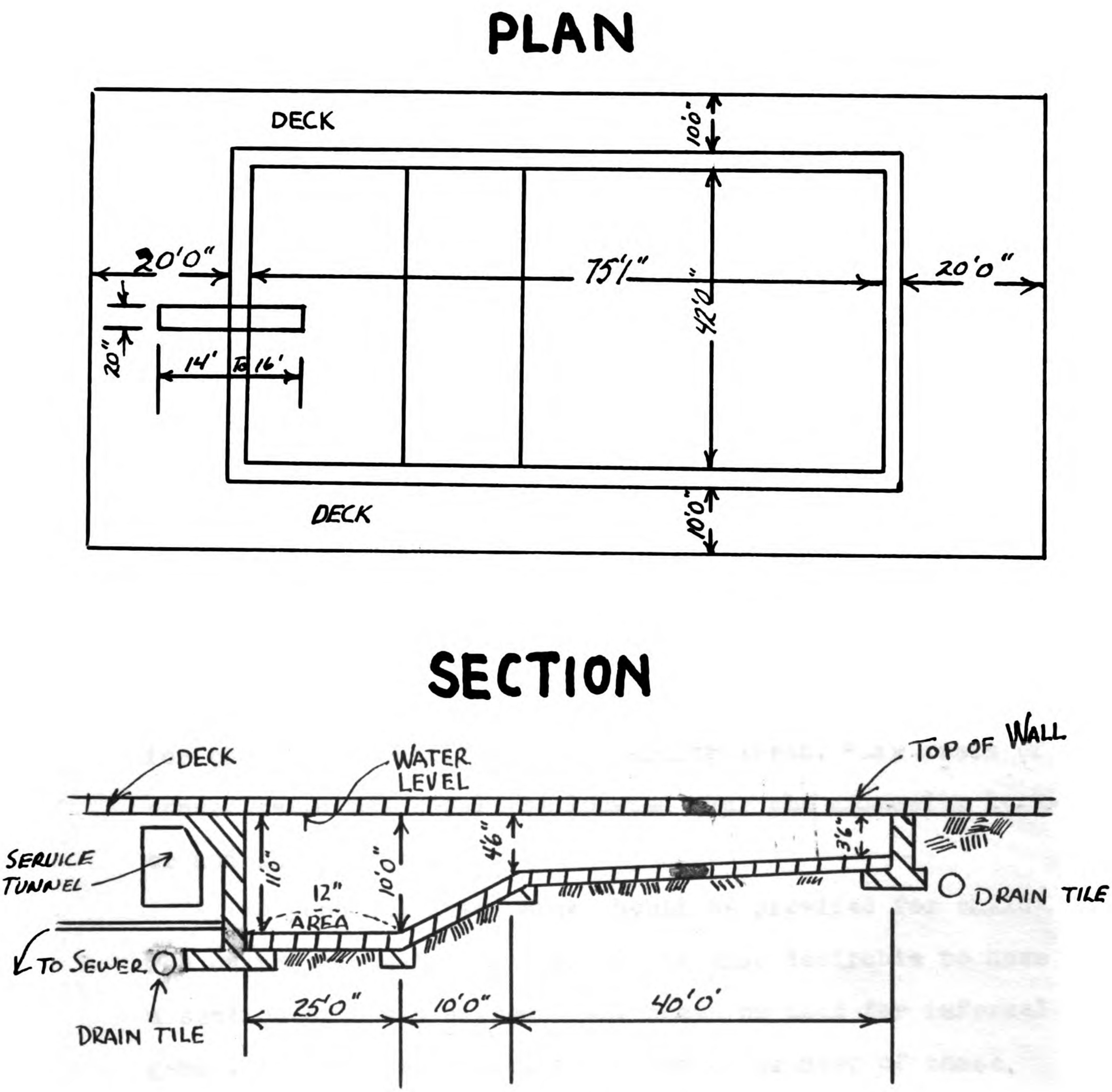


FIGURE III

RECTANGULAR POOL

SHOWING N.C.A.A. RECOMMENDATIONS

CHAPTER V

OUTDOOR FACILITIES FOR PHYSICAL EDUCATION AND RECREATION

Facilities should be provided for a variety of outdoor activities suited to children, youth, and adults. Selection of the areas will depend on the type and ultimate size of the center to be served, other community facilities available, and the extent to which the school site can be devoted to recreation.

Activity areas which require constant supervision should be located near a central point of control. Those areas having close relationships or used by the same age groups should be placed close to one another. Facilities for spectators should be near parking areas. Play areas of concentrated use should be located near the gymnasium locker and shower room.

A separate shady area should be provided for children of the elementary grades. It is also desirable to have a section of the playground which can be used for informal games. A level open space is adequate for most of these games. It is advisable to provide separate play areas for the boys and girls in the upper elementary grades and junior high grades, if there are conflicting schedules. Areas should be provided for such games as softball, volleyball, badminton, archery, basketball, baseball, football, soccer, and track and field events.

Larger schools should make provisions for some type of athletic stadium that can also be used for community functions. Many state school sites contain picnic areas, outdoor theaters, and band shells.

I. STADIUM

Stadia, insofar as possible, should be permanent outdoor facilities that will be used for the expression of interscholastic events and community affairs. Each school should include in a stadium those features which will best suit its needs and budget. It is the intention of this part of the thesis to bring out some of the important things that must be considered by the athletic director, administrator and architect prior to the construction of a particular stadium.

Most of the principles involved in building a large stadium are also applicable to the construction of a small stadium; primarily in reference to capacity, location, and use, both present and future. In planning the stadium, attention should be given to the uses other than football contests. As in the gymnasium, the stadium should not be planned for one particular event.

Size. The size of the stadium will depend entirely on the school involved, and the amount of money available.

It would not be wise for a class "C" school to construct a stadium that would hold 25,000 people, nor would it be wise to construct a stadium that is going to be too small for future needs. It is well to remember that the larger the stadium, the more complex the management and maintenance problems become.

Shape. The shape of the stadium will depend on many factors: the types of activities that will be carried on, the relation of sun to the stands, the provision of the best number of seats for the greatest number of people, and the maintenance of official distances for the contests involved.

For most Michigan schools, stands on both sides of the field seem to be most practical; but some schools like to have a curved stand to use as a grandstand during the baseball season. Either or both of these seems to be satisfactory.

Drainage. The drainage in relation to the stadium will again vary with the size and type of stadium involved, and the availability of a storm sewer connection. It is wise to plan for the maximum amount of drainage and for the utmost safety. Generally speaking, the drainage problem for the stadium should be the same as for the other outdoor play areas.

Seating. In seating, the problem to be considered is the type of activity to be witnessed and the duration of the game. The concensus of opinion seems to favor a 10" by 2" wooden seat with metal supports as the best. It should be remembered that in using wooden seats, a preservative of some kind must be used to prevent deterioration.

Sanitary facilities. In providing sanitary facilities, the items of light, ventilation, and sanitary care must be given consideration. Drinking fountains should be placed so as not to incite confusion of the crowd. Where locker and shower facilities are located in the stands, the same principles that are involved in providing these spaces indoors, should be observed. Insofar as possible, dressing rooms, drying rooms, training rooms, and a hospital room should be planned, if the stadium is to provide for maximum service. It is also essential that some place under the stands be provided for the stowing of track and field equipment. A workshop for such people as carpenters, painters, and others can also be included here.

Directional signs, exit signs, and telephone booths are necessities.

Press boxes and ticket offices. In most of our high school situations today the item of press boxes of some sort becomes necessary. A place for scouts, radio, and press are now pretty much of a general design for the new stadium. Included in the press box can be the public address system and the direct telephone communication to the bench.

Ticket offices should be located near the main entrance points to the stadium, and if the stadium does not have an enclosure, it is advisable to have movable booths available.

Stadium at St. Joseph, Michigan. Since it does not seem advisable to set any specific standards for a particular stadium, because of the many different factors involved, it might be wise to include a specific stadium that was constructed for one of our Michigan schools. St. Joseph, Michigan, is now in the process of completing their new stadium and football field. The work they have done should inspire some of the other schools throughout Michigan.[1]

The subsoil of their field was constituted of light sand, over which they spread 4" of clay after it was leveled. This was then roto-tilled to a depth of 4", and again roto-tilled with the blade set at 8". The surface is now approximately 50% black dirt, 25% clay, and 25% sand.

The grass seed that they used was an alta fescure that was recommended to them by Michigan State College. This seed is known for its deep root system, quick recovery, and resistance to drought.

Under the field at the center runs an 18" storm sewer. Because of the nature of the soil, there is no drain

---

[1]Leon Burgoyne, "St. Joseph's New Stadium," Scholastic Coach, 19:8-9, January, 1950.

tile; but there are catch basins at 50' intervals around the inside of the track.

On each side of the 50 yard line there is a 1" water line. The field will be watered at night by a large Buckner sprinkler. It will travel along a 300' cable, dragging 175' of hose, and will be able to sprinkle an area 100' in diameter as it goes. The sprinkler will be able to travel 300' in one night, and it will shut itself off automatically at the end of its run. In two nights it will be able to water both sides of the field.

The stadium will have a capacity of slightly more than 5000 people. It will be composed of two 180' stands on either side of the field and located between the 20 yard lines. The construction will be of steel. This conforms with the new stadia that were built by Lansing Sexton and Saginaw Arthur Hill.

The west stand of the new St. Joseph stadium will be backed with concrete in a futuristic design. This stand will have 23 rows of seats, with 26 box seats located at the top of the stands. Each box will be able to accomodate four persons and will be protected by a metal canopy.

The east stand will have 25 rows of seats, and both stands will be pitched to 28° to insure good vision. For easy entrance and exit to and from the stands, there will be four vormitories.

Press box and radio facilities will be provided on top of the west stands, and will include separate rooms for the press and radio staffs. An intercommunication system will connect the press box with the players' bench. The roof of the press deck will be used as a photographic deck.

For lighting the field, six steel 90' poles located behind the stands will be used. They will carry 16 lights each, and will have a total wattage of 144,000. An electric scoreboard and timer will be located at the north end of the field.

Plans for facilities under the west stand will include a 25'8" by 42'8" home team dressing room. The coach will have in one corner of this room a 10' by 11' office, private toilet and shower. The trainer will have a 10' by 12' working room. An equipment room 178' by 20' opening into the main dressing room will be used to hand out equipment. The home team will have a shower room 8' by 16'. At the south end of the stands there will be a visiting team locker and shower room, an officials' room, public toilets, and a room for the heating plant. A concession will be located directly across from the west stand.

The complete field and stadium will be enclosed by a wire fence to insure complete control of the crowd.

A turfed parking lot that will accommodate 800 cars will be located at the north end of the field, and there will also be additional facilities for 1,200 cars. The stadium drive which is 100' wide can accommodate four lanes of traffic in exit. This drive will lead into the parking area.

II. THE TRACK

The running track in most of the newer high schools is located around the football field and within the stadium. This seems to be the most practical arrangement since the stadium can then serve as seating for the spectators.

There are many ways of constructing a track, but there are still some main items to be included in the consideration of any of the ways. The items that should be included are drainage, track fill, and curbing. (see Figure IV.)

Drainage. One way to secure adequate drainage is to dig about 28" to 30" down the center of the track and about 18" on either side. This will then slope to a 6" or 8" tile drain in the center. It is advisable to have cross drains all the way around the track. If a creek is available, it would be an easy matter to have a 30" pipe line flow from the base of the track into the creek. If this is not possible, then a 30" drain will have to connect with a storm sewer. It must be assured that the drain tile to the sewer has a 1% fall. The joints of the tile should be cemented only at the bottom and the rest of the joint covered with burlap to keep dirt out and still have seepage outward from the tile. Before covering the drain ditch, it is advisable to partially fill the ditches with some form of filter material.

There should be drainage vents every 30' to 40' around the track to take care of the surface water. The man holes and storm sewers should be walled with brick and large enough to work in, in case cleaning is necessary.

Outside the outside curb of the track, it is advisable to have a 2" water line with outlets. These outlets could be on either end of the straightaway, one on each oval, and one on each side of the oval. The hose should be sunk in a galvanized pit that can be locked.

Track bed. Every layer in the track bed should be rolled with a pneumatic roller as it is applied. The rough fill can be a 2½" limestone and about 18" deep in the center of the track. Next is a 6" layer of cinders that can be graduated from pea size to about the size of a walnut. The top 3" should be 80% head and cinder and about 20% dry clay and loam, ground together before being applied. The cinders should be screened through a ¼" mesh before they are mixed and applied.

There should not be any silt or soft spots on the inside lane as the top is level and comes to within 2" of the top of the curb. The concrete curb should be about 6" wide at the top, and about 10" wide at the bottom, and 28" to 30" deep with beveled edges at the top. The curbs should be perpendicular on the inside and battered on the outside. Expansion joints are necessary every 100' and contraction joints every 20'. All metal markers should be set in concrete curb.

The runways can be built the same way as the rest o f the track, and the sides may be lined with wood rather than cement curb.

Jumping and vaulting pits should not be outlined with anything. They can be filled with building sand, topped with cottonwood sawdust and shavings.

It will not be practical for all high schools in Michigan to construct their track with the above recommendations. However, if the principles of drawings, track fill, curbing are adequately met, the schools will be assured of a decent running track. (see Figure IV.)[2]

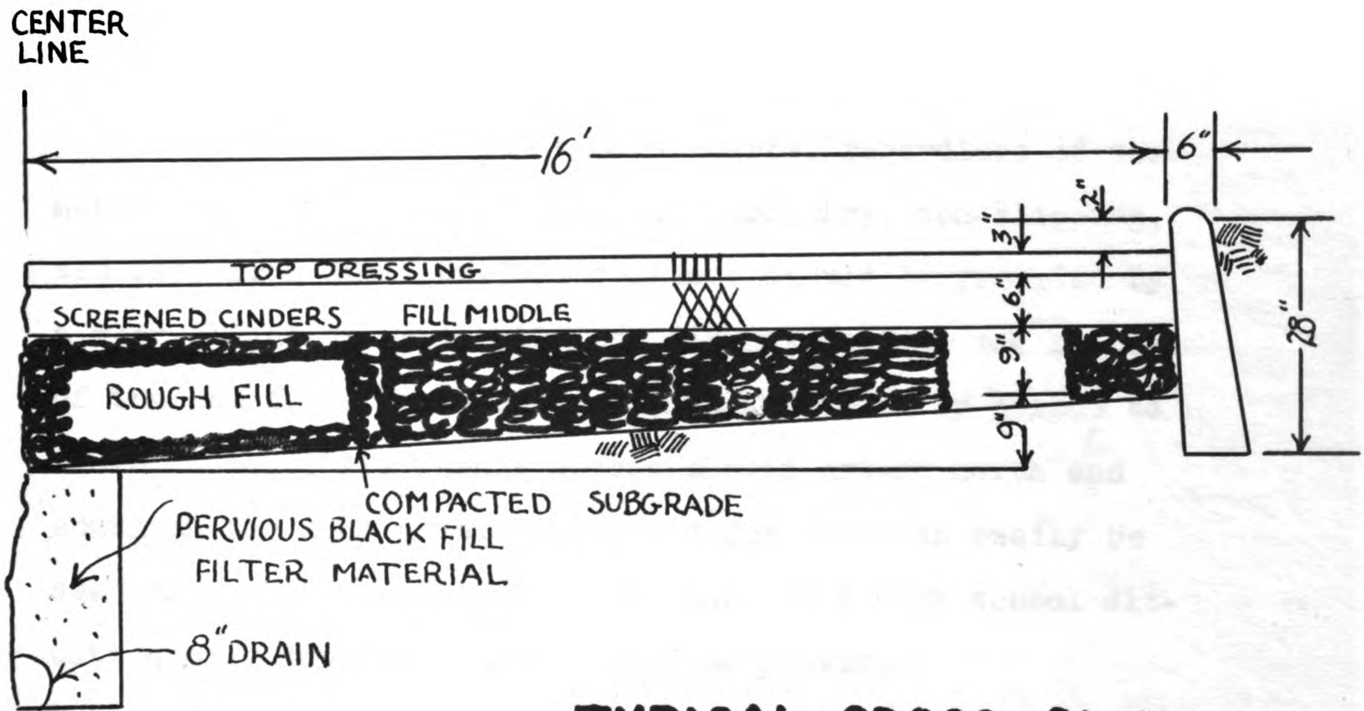
III. TENNIS COURTS

Tennis court construction can, if done properly, enhance the outdoor physical education program, and at the same time beautify the total recreational area.

Tennis courts can be of many materials: turf, clay, macadam, asphalt, cork, concrete, or a bituminous concrete.

---

[2] John Jacobs, "University of Oklahoma's New Track Stadium", Athletic Journal, 29:11, June, 1949.



TYPICAL CROSS SECTION OF TRACK

HALF SHOWN

FIGURE IV

The last, bituminous concrete, consists of hard aggregates of varying gradations which are bound together by minute particles of cement, which takes the form of an adhesive material when water is added. This type of material is recommended when performance, durability, and hard surfaces are required.[3] In a high school situation, where all the factors that a bituminous surface can give are desired, this type of surfacing seems to be the best.

The surface of the tennis courts, regardless of the materials used, should be smooth, hard, dry, non-slipping, and free from dust. Surface drainage should be provided by a very slight slope in all four directions from the center of the court, if the surface is not sufficiently porous to drain rapidly. All tennis courts should extend north and south on the long axis. The reason for this can easily be seen from the sun control standpoint. In a high school situation only doubles courts should be provided.

Fencing. Tennis courts should have a fencing at least 12' high, place 21' beyond the base line, and extending at least 10' beyond the sidelines.[4] Many schools find that it is satisfactory to fence only behind the baseline;

---

[3] "A Guide for Planning Facilities for Athletics, Recreation, Health and Physical Education," National Facilities Conference, 1949, p. 28.

[4] Ibid., p. 29.

but where a battery of courts are set up, it is advisable to fence all around. In constructing more than one court, it is wise to plan them side by side rather than having them spread over different areas. This tends to cut construction costs and keeps maintenance materials in a central location.

IV. PLAYFIELDS AND PLAY AREAS

Playfields and play areas which are included in the total physical education plant must be planned carefully. These areas should not be the space that is left over after the varsity has provided for its facilities. Since the greatest number of people that use the play areas are non-varsity people, provision should be made for more space for these people. This has been one of the shortcomings of the total program in the past. The modern planners are cognizant of the situation; and as a consequence, the new schools are beginning to provide more space for the intramural and inter-class programs. (see Tables IV and V)

In providing playfields, the same principles of drainage and watering should be used as were suggested for the varsity areas. The baseball diamond, which can be used for the physical education program, as well as for the varsity, should be constructed much the same as the track. The difference is in the top layer, which should be a fertile loam on the baseball field. If drainage is to be provided, then the field will need no artificial slope. However, if no drainage is provided, then the field should be sloped from the pitcher's mound outward. The problem of whether to have a grass or dirt infield will be solved by whether maintenance is available. Mr. John Kobs, a baseball coach at Michigan State College, feels that once a school provides a grass infield, the maintenance problem will be reduced. His reason for this is that a grass infield provides better natural drainage, keeps dust from blowing holes in the infield, and makes for better playing.

The only two items on the field that need special attention are the pitching mound and the home plate. Both should be constructed according to standards, and clay is usually recommended to insure solid ground. Clay may also be used on the base line to serve the same purpose.

The rest of the play area should be divided into ball fields and informal game areas. Where possible, cross use of areas should be avoided. Grassy spaces should be planned, where possible, for the smaller children, and a minimum of unsupervised facilities should be provided.

A picnic area including all the facilities, plus an abundance of foliage should be provided for the students, as well as for the members of the community.

TABLE IV

SAMPLE STATEMENT OF A HIGH SCHOOL'S NEEDS FOR RECREATIONAL AND PLAY SPACE

ACTIVITY	AREA REQD. SQ. FT.	NO. OF GAMES IN PROGRESS AT ONE TIME	TOTAL AREA	MAXIMUM PUPILS BOYS	MAXIMUM PUPILS GIRLS
BASEBALL	62,500	2	125,000	36	
FOOTBALL	57,600	1	57,600	22	
SOCCER	49,500	2	99,000	44	
FIELD HOCKEY	54,000	2	108,000		44
BASKETBALL	3,600	2	7,200		20
TENNIS	2,808	15	43,120	40	20
SOFTBALL	25,600	2	51,200	20	20
VOLLEY BALL	1,800	3	5,400	16	32
HANDBALL	680	4	2,720	16	
CROQUET	1,800	1	1,800		8
CLOCK GOLF	576	1	576		8
HORSESHOES	500	4	2,000	16	
HAND TENNIS	640	4	2,560		8
PADDLE TENNIS	880	2	1,760		4
TOUCH FOOTBALL	28,800	2	57,600	44	
DODGE BALL	2,000	1	2,000		30
TAG GAMES	1,400	1	1,400		30
RING GAMES	625	1	625		30
TOTALS			570,561	254	254

TABLE V

DIMENSIONS FOR GAMES AND ACTIVITIES
FOR HIGH SCHOOL STUDENTS

GAME	LENGTH	WIDTH	NOTES
ARCHERY	150 yds.	30 to 100 yds.	Turf
BADMINTON DOUBLES	44'	20'	Turf, cold as-
BADMINTON SINGLES	44'	17'	phalt
BASEBALL	300' to 200'	300' to 200'	90'-60' diamond
PLAYGROUND BALL	160'	160'	Turf
BASKETBALL BOYS	94' to 60'	50' to 35'	Cold asph-
BASKETBALL GIRLS	100' to 69'	50' to 35'	alt
CLOCK GOLF	Diameter 20' to 30' golf green		
CROQUET	60'	30'	Level lawn
DECK TENNIS	40'	18'	Turf
FIELD HOCKEY GIRLS	300' to 255'	180' to 135'	Turf
FOOTBALL	360'	160'	Turf
HANDBALL	34'	20'	Concrete
HORSESHOES	50' to 40'	10'	Dirt, Clay
LACROSSE	450' to 390'	225' to 210'	Turf
SHUFFLEBOARD	52'	6'	Concrete, Wood
SOCCER	330' to 300'	195' to 120'	Turf
SOFTBALL	200' to 125'	200' to 125'	60'-45' diamond
TENNIS DOUBLES	78'	36'	Clay, Turf, dirt
VOLLEY BALL	60'	30'	Concrete, asphalt

CHAPTER VI

REQUIREMENTS AND RECOMMENDATIONS BY THE STATE OF MICHIGAN

This chapter, devoted to the particular topic of requirements and recommendations by the state of Michigan, is included to complete the total picture of modern trends in relation to the physical education plant. Michigan, which is one of the leaders in this important phase of school planning has made great strides in aiding her schools in the construction and maintenance of physical education plants.

Recommendations. The location of the school plant should, if possible, be on the ground floor with easy access to the cafeteria.

Gymnasium floors should be from 40' to 60' long for elementary schools, and 70' to 90' long in secondary schools. Ceiling heights should range from 18' to 22'. It is recommended that the large floors be divided by sound-proof doors, with each section leading to the boys' or girls' locker rooms. Separate floors are desirable for boys and girls in the larger schools. (see Table VI.)

A system of folding or telescopic bleachers is recommended, and overhanging balconies are not considered satisfactory.

It is desirable that each school provide a locker for each member of the largest class and one small locker for each pupil enrolled. Boys' and girls' routes to the locker room or from the locker room to the gymnasium floor should not cross at any point. All locker rooms should be directly accessible to the recreation area. There should also be connecting toilet facilities for one class group, but not accessible for general or public use. One shower head for each three pupils in one class is recommended. Where gang showers are used, one or two individual showers should be included.

Special attention should be given to ventilating and sanitary finishes. Adequate ventilation for locker and other rooms must be provided by introducing conditioned air and by exhausting the foul air directly to the outside.

The physical education director should have an office, and in large schools two offices should be provided, one for each sex. These should be in close contact with the gymnasium floor, locker, shower, and toilet rooms.

There should be adequate space for storage for each division of the gymnasium floor, and one or more rooms directly accessible to recreation areas for outdoor equipment.

One public toilet for each sex, except in very small schools, should be included. In the large schools it is necessary to provide community locker rooms that are connected to showers and toilets and separate from the student lockers. Team rooms that are connected to separate shower and toilet facilities are recommended.

There should be drying rooms equipped for drying uniforms and contents of the locker baskets. Laundry rooms equipped for service of towels, gymnasium equipment, and uniforms are necessary in the larger schools. They should be equipped with washers, tumblers, and dryers to suit the anticipated load. An athletic storage room should also be included in the larger schools.

For smaller schools the school organization and the size of the school should determine the desirability of including some of the features that are included in the larger schools. Combined gymnasiums and auditoriums are desirable only where communities cannot afford these separate facilities.

The swimming pool is desirable in all secondary schools and essential in large schools. The gymnasium, locker, and shower facilities should be within close contact to the swimming pool. The pool should be insulated and isolated from the rest of the building, and easily accessible from the outside for meets and exhibitions without having to go through other spaces.

The recommended size and depth of the pool is 35' by 75' with a pool platform of 5' width around the plunge. The width at the deep end should extend to a distance of 25' to aid in diving. The depth is to provide shallow places for swimming instruction and deep places for diving. The depth at the diving end should be a minimum of 8' deep with a minimum length of deep portion of 18'. The shallow portion of the pool should be not less than 3'6" deep. Minimum height from pool platform to the ceiling should be 12'.

The entrance to the pool should be through the shower room and foot bath. Water treatment equipment is necessary and essential. In large schools it may be desirable to provide two swimming pools, one for each sex. Since this is exceedingly expensive, it is possible to design a single double pool divided by specially constructed sight-proof, sound-proof gates.

Spectator space should be provided at the sides or end of the pool, completely separated from the pool deck. Acoustical treatment and mechanical ventilation are necessary. Special attention should be given to types of windows or glass area, and to exterior wall construction because of condensation. A specific construction permit and license to operate are legally necessary.

Requirements. Two means of egress, remote from each other, for every floor of the school building, including the gymnasium, must be provided. The following spaces should be provided with outside doors distinct from the school exits: the gymnasium and the locker room to the recreation fields. The door area to be provided is one unit for each 600 square feet or fraction thereof of floor area of the gymnasium, plus the already required units for the school buildings. Doors shall not be less than 6'8" in height. All doors shall swing outward with exit travel. Gymnasium exits shall be distributed so that all parts of the occupied area will have equally ready means of egress directly to the outside of the building.

Drinking fountains shall be recessed so that they do not extend more than 8" from the corridor wall.

Ordinary cement floors in locker and shower rooms will not be approved. Toilet stall partitions and doors, where installed, shall be of metal or other smooth-surfaced non-absorptive material. Floor drains are required in all pupil toilets, except where floors are pitched to stall urinals.

Windows in rooms used for physical education shall provide a net glass area (exclusive of sash tile, mullions, mutins, and meeting rails) of not less than 20 per cent of the floor area.

The reader can readily see from the description of the Michigan requirements and recommendations that our state is making great gains in the field of planning. The members of the state's planning committee are always ready to lend assistance and to supply information to the schools of Michigan. Much can be done with cooperation of school planners, architects, and state planning committees to aid in the total problem of physical education planning.

I. DESIRABLE FEATURES TO BE INCLUDED, THINGS TO BE AVOIDED

It was recommended by several experts that some space be devoted to the mistakes that are sometimes made in construction and to the things that should be included in a modern plant. The following is a list that has been compiled.

Desirable features to be included.

1. Recessed drinking fountains
2. Recessed corridor doors
3. Non-slip floors in locker, shower, and pool spaces
4. Adequate facilities for staff members
5. Adequate space for equipment storage
6. The use of safety glass where breakage might occur
7. Adequate space for outdoor facilities
8. Good lighting for all auxiliary spaces
9. The use of terrazzo floors
10. Panic bolts on all doors
11. Ventilated spaces below the gymnasium

Things to be avoided.

1. Planning for beauty rather than adaptability
2. Failure to provide the type of construction that can be easily expanded or remodeled
3. Failure to provide enough spectator seating, and likewise, providing too much seating and not enough play space.
4. Failure to provide the required space necessary by the rules governing a particular activity

5. Failure to provide equal facilities for women as well as men

6. Failure to provide exits to recreational spaces

7. The placement of sanitary facilities that are not accessible to all concerned

8. Failure to provide ready maintenance facilities to all parts of the plant not readily accessible by normal effort

9. Placing windows directly behind the bankboards on the basketball floor

10. Failure to provide enough drains to take care of the maximum load in showers, and in drainage for outdoor spaces

11. No provision for an air space in the construction of the gymnasium floor

12. Failure to provide mechanical ventilation in all toilet rooms

13. Failure to provide acoustical treatment for all required spaces

14. Planning a pool unit by copying another

15. Failure to meet standard regulations in pool construction and maintenance

A great many schools have, in the past, completely disregarded the help and information that is available to them on the construction of the modern school. This section of requirements and recommendations by the State of Michigan is included to stimulate the thinking of the modern planner toward those agencies and people who are willing and ready to lend valuable assistance. With the many uses for the already over-burdened tax dollar in the country today, it is not wise, nor will it be tolerated by the public, if school funds are used improperly or wastefully. This makes it doubly important for those concerned to do a thorough job in providing physical education facilities.

TABLE VI

FLOOR COVERING PLAN AS APPROVED
BY THE STATE OF MICHIGAN

SPACE	HARD CEMENT	ASPHALT TILE	COMPO-SITION	CORK	LINO-LEUM	RUB-BER TILE	TERR-AZZO	CER-AMIC TILE	WOOD
GYMNAS-IUM		x		x	x	x			X
HEALTH ROOMS		X			X	x	x	x	
LOCKER SHOWER							X	X	
STORE-ROOM	X						X	X	
TOILET WASH ROOM							X	X	
			Properly prepared dirt floor						
SWIMMING POOL							x	X	

X Denotes type preferred
x Denotes type of floor suitable for consideration

CHAPTER VII

SUMMARY

Physical education planning as one phase of the total school planning has, since the end of World War II, taken on a new and somewhat more important meaning. With the country once again starting toward normalcy, and with ever increasing funds being allocated to the schools, it seems as though new buildings are now a reality. This means new and more complete facilities for the physical education program and for the community as well.

With the discovery of new materials and the revision of old techniques, the schools, along with the other modern buildings, are beginning to take on a new look. Where buildings were once built for conventional hard wear and for academic endeavor, they are now being built for safety, comfort, beauty, and ease of facility.

Modern gymnasiums are no longer a maze of pipes and inconveniences, but are constructed as a modern recreation plant that can house boys and girls at the same time, and provide both with adequate programs, facilities, and privacy. Their size has increased so that many activities can be carried on at the same time. The gymnasium, itself, has now been elevated to the ground floor where the natural light can produce the most natural situations. Floors are now constructed for safety and health, and the old cement floor has been replaced by resilient wood floor that benefits both health and safety.

Cinder block construction in the new gymnasiums can insure safety, beauty, and enough savings to provide larger gymnasiums.

Ceiling heights have been increased. This seems to aid in the participation of certain activities and tends to emit more natural light. Walls are now free of obstructions that once plagued them, and consequently, provide a safer situation. Acoustical treatment is no longer an architect's dream, but in the newer schools exists in those spaces that are most deserving.

Storage for gymnasium equipment has finally been provided in the modern plant, and additional rooms adjacent to the gymnasium have made a well rounded program possible. The new building seems to be a safer place in which to acquire a well rounded education. Fire laws have provided the necessary exits that were lacking in the past, and doors, too, have become fire-proof and panic-proof.

Wood stoves and even the "good old furnace" have been replaced by a cheaper and safer system of forced air. This modern method of heating also does more for the money and is based on the future as well as the present needs. Temperatures are automatically controlled from a central point, and any space may be heated or cooled by adjusting a thermostat. Mechanical ventilation is now used to rid the gymnasium and locker room and all other spaces of all unpleasant odors, while at the same time providing a system of ventilation that is entirely automatic.

Lighting, which has maintained solid principles of balanced light, has forged ahead with modern methods in the way of facilities and space. With the inclusion of glass block, modern aluminum sash, and much more space devoted to windows, a school is now provided with more natural and beneficial light. Artificial lighting, too, has provided modern techniques in lighting and lighting fixtures which are far superior to the techniques and fixtures of old.

Classrooms for physical education which include all the modern facilities of an ordinary classroom make ideal teaching stations for the instructor and generally enhance the program. The inclusion of technical equipment in this room can also lend added support as a testing device for some of the problems that arise in the laboratory. Modern dressing facilities for coaches and physical educators have made the gymnasium a pleasanter place in which to work, and at the same time improved the quality of instruction.

Sanitary facilities have improved in design and construction; and the inclusion of more and better equipped facilities has provided for greater use, cleanliness, plus ease of facility. Locker rooms now provide a locker for each member of the total school plus an addition of space in which to prepare for the laboratory period. The inclusion of these dressing facilities tends to more interest and importance in the physical education program. Showers are included not as a luxury, but as a necessity and are available to all. This aids to entice the student to dress for the laboratory period. Drying rooms and sanitary facilities within the shower room are now commonplace in the modern school and tend to place a healthful atmosphere on this area.

Modern construction methods have also gone into these spaces; cement floors have been replaced by terrazzo or tile; an impervious tile can be seen on almost all the walls of the modern physical education plant. Excluded from these spaces are the many plumbing and heating obstructions that once plagued them. These rooms are now adequate, beautiful, and useful. Modern plumbing in all required places is now not only more attractive, but also more efficient.

The whole inside physical education plant from the offices and classrooms to the shower rooms has been made more efficient, attractive, and enjoyable through the use of improved techniques and materials in construction, heating, lighting, ventilation, and fixtures. These modern trends have been applied to the other areas of the physical education plant too.

With the increase in the interest of swimming and the emphasis placed on it in the last war, the pool has now become a very necessary and important part of the physical education and recreation program. Standards of construction have been raised and a cautious watch is being kept over the bacteriological aspect of the pool. New machinery and modern construction techniques have enabled the pool to function more safely and satisfactorily than it has in the past.

Better materials are aiding in the beautification and more satisfactory construction of the pool. Non-slip terrazzo and tile plus other important construction materials are making their way into the pool and helping to make a safer and more complete physical education program. Modern lighting is now included under the surface of the water as well as from the ceiling of the pool. Mechanical ventilation and separate heating plants help to keep the pool at an even temperature and free it from excessive humidity. Many states, of which Michigan is one, through their departments of health, provide material on both design and operation of the swimming pool unit.[1]

---

[1] <u>Cf</u>. <u>ante</u>., p.50.

Outdoor facilities are no longer provided solely for the use of varsity teams. Administrators and planners are now cognizant that the majority of the students, who in the past have not been provided for, are as deserving of and need the activity as much as the varsity participants. No longer do schools buy only enough land to provide the bare essentials for varsity endeavors. They are now purchasing additional land that can be turned into play and recreational space. Modern methods of construction have also been used in the construction of stadia and other outdoor facilities. Drainage and seeding are done with the utmost care and full knowledge of the latest techniques. Construction materials such as asphalt, bituminous concrete, and others are being used to surface play areas, tennis courts, and roadways. There is now, and will continue to be, much time, money, and effort devoted toward the improvement and enlargement of the outdoor play area.

Educators and administrators are now realizing that the physical education plant should be set up to serve the whole student body and not just the varsity teams. There is, perhaps, a greater need for a complete physical education program for the non-varsity students than for those who participate in varsity competition. Because of the newer trends, features, and materials that are now available to the physical education plann ers, they are beginning to bring into reality the physical education program and plant that will be of most benefit to the entire student body and the community.

The state of Michigan has made great strides in this important phase of planning. With its extensive interest and staff of personnel equipped to meet these needs, our state is fast becoming a leader in developing new ideas and in providing an excellent opportunity for Michigan school people to do a good job in physical education planning.

With the availability of resources and information from both public education agencies and private concerns that can be used to the fullest capacity by the modern school planners, there is now little or no excuse for inadequacies in the physical education plants in the schools of today and tomorrow.

BIBLIOGRAPHY

BOOKS

Engelhardt, N.L., N.L. Engelhardt Jr, and Stanton Leggett, Planning Secondary School Buildings. New York: Reinhold Publishing Company, 1949. 525 pp.

Luehring, Fredrick W., Swimming Pool Standards. New York: A.S. Barnes Company, 1939. 273 pp.

Nash, Jay B., The Administration of Physical Education. New York: A.S. Barnes Company, 1931. 491 pp.

Voltmer, Edward F., Arthur A. Esslinger, The Organization and Administration of Physical Education. New York: F.S. Crofts and Company, 1946. 467 pp.

PERIODICAL ARTICLES

Burgoyne, Leon, "St. Joseph's New Stadium," Scholastic Coach, 19: 9-10, January, 1950.

Jacobs, John, "University of Oklahoma's New Track Stadium," Athletic Journal, 29: 10-11, June 1949.

"School Plant Trends," School Executive, 68: 62-63, January 1949.

PUBLICATIONS OF LEARNED ORGANIZATIONS

American Association of School Administrators, "American School Buildings," Twenty-Seventh Yearbook. Washington D.C., 1949. 525 pp.

American Institute of Architects and Illuminating Engineering Society, "American Standard Practice for School Lighting," The American School and University. New York, 1949-50, pp 266-283.

Bookwalter, Carolyn W., Karl W. Bookwalter, "Suggestions for Modern School Health, Physical Education, and Recreation Facilities," The American School and University. New York, 1949-50, pp 235-244.

Hoeltje, Herbert, George Avery, Father Rigney, Wesley Parrott, and William Van Wienen, "The Gymnasium as We See It," The American School and University. New York, 1949-50, pp. 245-250.

National Council on Schoolhouse Construction, Guide for Planning School Plants. Nashville, Tennessee, 1949, 173 pp.

National Facilities Conference, A Guide for Planning Facilities for Athletics, Recreation, Health and Physical Education. Washington D.C., 1947, 127 pp.

Society of Directors of Physical Education in Colleges, Physical Education Buildings. Part I, New York, 1923, 52 pp.

BULLETINS

Elliot, Eugene B., "A Guide for Planning School Plants," Lansing, Michigan, State Department of Public Instruction, 1945, 147 pp.

Engineering Bulletin No. 17, "Swimming Pool, Minimum Standards of Design," Lansing, Michigan, Michigan Department of Health, 1950, 55 pp.

Engineering Bulletin No. 18, "Swimming Pool Operation," Lansing, Michigan, Michigan Department of Health, 1945, 21 pp.

Forsythe, Charles E., "Safety Implications of Athletic Accident Benefit and Protection Plans," reprinted from The Progressive Physical Educator, December 1948.

Metal Window Institute, "Better Environment Through Daylighting in Schools," Cheltenham, Pennsylvania, 1950.

Maple Flooring Manufacturers Association, "Outline Specifications for Gymnasium Floors," Oshkosh, Wisconsin.

State of Alabama Department of Education, "Better School Buildings for Alabama," Montgomery, Alabama, Department of Education, 1950, 283 pp.

Westinghouse Electric Corporation, "ABC Plan for School Lighting," Lighting Division, Cleveland.

PUBLISHED THESIS

Sharman, Roger Jackson, "Physical Education Facilities for the Public Accredited High Schools of Alabama," New York: Bureau of Publications, Teachers' College, Columbia University, 1930, 78 pp.