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The planning of field houses for schools and colleges is discussed in relation to their various uses, such as for physical education programs, intramural and extramural athletics, and intercollegiate athletics. Following a presentation of the historical development of field houses and their educational significance, designing the field house is considered, focusing on the equipment and facilities to be included in the structure. The operating and servicing of field houses is also considered. (FS)

A GUIDE

for Planning the Field House as a College or School Physical Education Facility

ALEXANDER PETERSEN, Jr., Ed.D.
Professor of Health and Physical Education
and
Chairman, Physical Education and Health Department
Southern Oregon College
Ashland, Oregon

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EDITOR'S INTRODUCTION

This is one of a series of monographs dealing with selected aspects of educational plant planning that are published under the sponsorship of the Institute of Field Studies, Teachers College, Columbia University. The several monographs are reports of individual research projects undertaken by graduate students at Teachers College as part of their programs of studies leading to the Doctor of Education degree. The respective authors are men who have broad knowledge of the areas they write about, and their intensive studies of these areas should give readers new ideas and suggestions for improved planning of specialized educational plants.

This volume, prepared by Dr. Alexander Petersen, Jr. under the direction of Dr. Harry A. Scott, Professor Emeritus of Health and Physical Education at Teachers College, Columbia University, deals primarily with the planning of field houses for colleges and universities. Field houses are not numerous in educational institutions; they are rather unique structures. Specialists in physical education are not unanimous in their views regarding the usefulness of this type of structure as a basic plant or "tool" but it is certain that there will be additional field houses constructed in the future, so it is important that those who participate in the planning should be aware of points that ought to be considered. Dr. Petersen, in this helpful monograph, discusses not only what to do but also what not to do. This project merits serious study by school and college officials and architects faced with the problem of planning a field house.

Henry H. Linn

AUTHOR'S PREFACE

The field house as a facility in which to conduct programs of physical education is an innovation of the twentieth century. It has been used for many activities in many ways. Much has been claimed for it, most of it valid. The tenor of feeling among physical educators contacted by the writer during a survey of field houses was highly favorable to such a facility. Several administrators, however, who have had experience with field houses, consider such structures unsatisfactory and believe that the day of the "dirt" surfaced field house is ended. This negative attitude is significant and points to the fact that if such a structure is being considered for an educational institution, great care must be given to the planning if the project is to fulfill its several purposes. This monograph calls attention to the many factors that should be considered in connection with such planning.

The author wishes to express his sincere appreciation and gratitude to the many persons who contributed so materially to this publication:

To the administrators, coaches, teachers, custodians, and students in many schools and colleges, without whose help the material presented herein would be less meaningful.

To the many representatives of commercial agencies who contributed so freely of technical and background information.

And especially to Professor Emeritus Harry A. Scott of Teachers College, Columbia University for his liberal help and encouragement.

Alexander Petersen, Jr.

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CHAPTER I

THE DEVELOPMENT OF THE FIELD HOUSE

The term field house as used in this book is defined as a building or that portion of a building in which outdoor activities can be carried on indoors, and which is characterized by a "dirt" floor and a relatively large, unobstructed area.

The Early Field Houses

The precept and example for the often large and elaborate facility known as the field house appears to have evolved from a simple, unpretentious building referred to most often as a cage. The first such building, used to house early season baseball practice, may well have been on the campus of Yale University at New Haven, Connecticut. Casper W. Whitney, in the March 26, 1892 issue of Harper's Weekly, refers to the indoor practice of baseball in a cage as within the last decade. Whitney specifically mentioned the "long, low, narrow shed of humble pretentions" which had housed Yale's championship baseball teams for about ten years.

The completion of a new gymnasium in the spring of 1886 at Williams College, with a cage in the basement "for the winter practice of the nine", was reported in the November, 1890 issue of Outing.

Whitney's 1892 article in Harper's Weekly also mentioned such structures at Harvard and Princeton. The Carey building at Harvard had a cage for baseball and football practice. It was reported to have been built about two years before the article was written. Princeton's field house was said to have been the biggest and most complete at that time.

In the December 17, 1892 issue of Spirit of the Times and the New York Sportsman, it was reported that a recent graduate had donated $5, 000 to Yale University to help build "an indoor baseball diamond and running track".

The activities in these first field houses by no means represent the first occasions of outdoor sports taking place indoors. As early as 1868, track and field meets took place indoors. Spirit of the Times and the New York Sportsman of November 14, 1868 reported that November 11, 1868 had been the date of the New York Athletic Club's First Semi-Annual Games. This was a track and field meet held in the nearly completed Empire City Skating Rink. It would be difficult to determine when baseball was first practiced indoors. There would seem little doubt that practice in throwing and possibly even hitting took place indoors before the advent of netting in gymnasiums, which roughly paralleled the field house movement. Some colleges which did not have an earth surfaced cage had nets rigged up in the gymnasium. The January, 1905 Outing showed pictures of a net batting cage in the gymnasium of Columbia University.

From such humble beginnings as these, the field house idea has grown to its present status. Today (1962) there are something over 100 such buildings for college and secondary school use with almost as many variations in design and accommodations. About 85 percent of the field houses are built on college campuses.

The links which bridge the gap between the simple structures of the past with the sometimes near-colossal field houses of the present were built in 1926. The cage at Amhurst College was completed in 1926. It is 160 feet square with a ceiling clearance of 70 feet in the center. The truly near-colossal University of Iowa Field House was ready for use December 1, 1926, and it still stands as a monument to the field house idea.

The Iowa building consists of four sections. The field house proper is flanked on the north by a gymnasium and on the south by a swimming pool; across the front of the building is an exhibition hall and offices. The over-all building is 464 feet long, 430 feet wide, with an average height of 60 feet. A one-sixth of a mile cinder track encircles a combined field house and armory arena, probably the largest such indoor track in the United States, and there is room for two 100 yard straightaways with room for starting and finishing. Balconies in the field house portion of the arena help provide seating for intercollegiate basketball contests. Not only was this the first of the near-colossal field houses, it is still one of the most pretentious in the country.

The field house building, as a type, has much in common with several other forms of architecture. In particular, the field house is much like the dirt surfaced armory used for military training, and also like the unfloored, unfinished play-shed of elementary schools of a previous era, both of which have a basic purpose of physical activity, and have an earth surfacing. The problem of wide span, one of the major considerations in the building of a field house, is shared with other buildings such as skating rinks, gymnasiums, exhibition arenas, airplane hangers, and long-span warehouses. Field house construction has undoubtedly been influenced by these buildings, and in some cases these buildings may well have been influenced by the field house. The huge, two-hinged structural steel arches, which combine support for both wall and ceiling in the same stress-bearing member, were first designed for the span of the University of Chicago field house. Such arches are excellent for field houses and basketball arenas since they provide necessary clearance for seating spectators, and balconies can be hung from such arches to further aid in providing large numbers of seats.

In listing a hierarchy of field houses in terms of size and accommodations, the play-shed ranks as the simplest. The next in line are the simple baseball cages ranging from small to large. The cage is followed by the track and field house which, in turn, is superseded by the combination cage and track and field house. The largest and most elaborate of the latter top the order. Such a facility can provide accommodations for gymnasium functions, allow for the practice of a wide variety of outdoor activities, and can provide seating arrangements for many spectators.

Types of Field Houses

While it has been indicated that each field house has certain individual characteristics, it is possible to classify the largest kinds of these structures under three basic types.

The first type would be that of the functional shell similar to the first field houses built. The Indoor Sports Building of the University of Minnesota is a good example of this type for a large institution. The building is 400 feet long, 200 feet wide, and its wood, bowstring trusses set on laminated-wood posts allow a constant clearance above the floor. No accommodations are generally provided for spectators. The building has no skylights and very few windows. Artificial lighting is used for all activities. A natural clay combination used for the floor surface has given excellent results for both baseball and football.

Figure 1 illustrates the floor arrangement which permits football, baseball, and track practice to be carried on simultaneously without interference. A full infield at one end of the structure is enclosed by a net. A 220 yard track is provided around the infield net. The other end of the arena is free space for football practice, field events practice, or similar activities.

It is pertinent to note that the University of Minnesota saw fit to remodel an earlier field house completed in 1928 into a permanent basketball and hockey pavilion, and to build the new Indoor Sports Building as a functional, non-spectator shell available at all times for the true purposes of the field house.

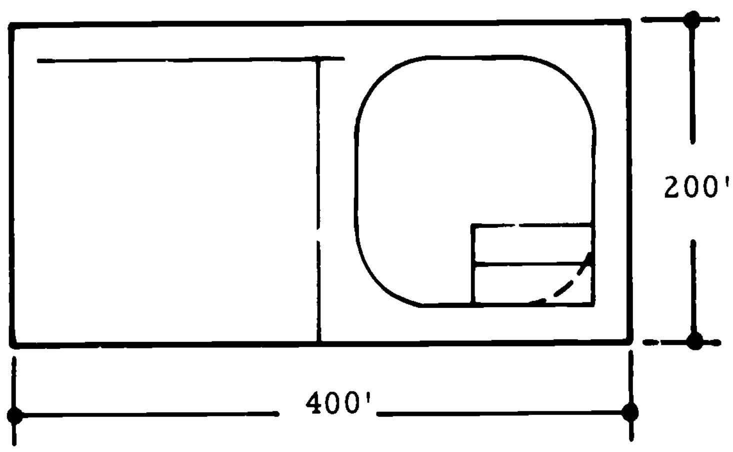
The second type of field house, and usually the largest, includes those which provide seating for large crowds for basketball games, and also for outdoor sports practice during inclement weather. In these cases, the gymnasium type of activities usually will be carried on in separate rooms or buildings. Three examples of this category will be given to show different approaches to the problem of providing seating.

The Jennison Field House of Michigan State University, completed in 1940, has one wall in common with a gymnasium building. It is 334 feet long, 172 feet wide, and 80 feet high at the center of the steel cantilever arches. The field house has a 220 yard track. A portable basketball floor is centered in the arena. (See Figure 2.) A permanent balcony around the arena provides seating for 4, 500 spectators, and an additional 4, 500 can be accommodated for basketball games on temporary bleachers. (The seating for basketball has been increased since the original completion of the structure.) There are no skylights, but glass block windows are built into the ends of the building. The artificial lighting is provided by 1, 000 watt floodlights, with additional spotlights of 1, 000 watts each centered over the basketball floor. All of these lights can be serviced from two catwalks hung lengthwise from the ceiling.

While the Michigan State University building provides seating in both permanent balconies and knock-down bleachers, several other institutions provide seating in their field houses entirely on knock-down bleachers. The University of Pittsburgh has one such, the Pitt Memorial Field House completed in 1951. The main arena is 275 feet long, 164 feet wide, and allows a height clearance of 52 feet at the center. A permanent basketball floor, 72 by 112 feet in size, runs from side to side. (See Plate 1.) One of the most significant features of the Pitt Memorial Field House is the absence of windows which, with a built-up roof, results in control of condensation of moisture. At present, the knock-down bleachers when installed overlap the track so that its use is limited during basketball season. It has been the feeling at Pittsburgh that it would have been more desirable to have made the building 40 feet wider, and to have provided permanent balconies.

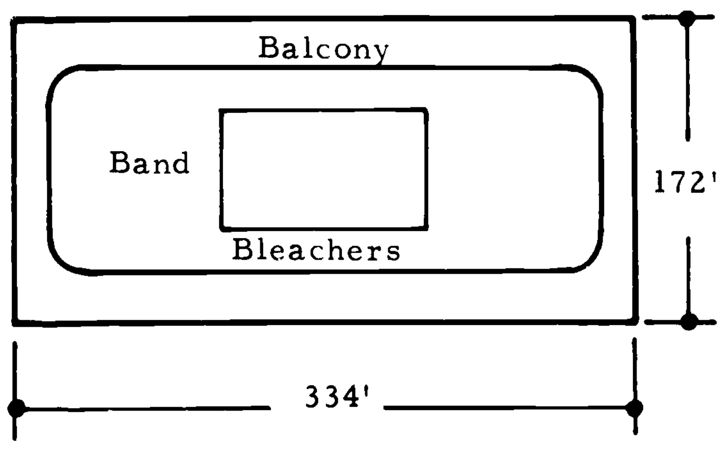
The University of Wyoming completed a new field house in 1951 which is one of very few with a dirt floor and rolling bleachers as a part of spectator accommodations. The central arena is 221 feet long, 156 feet wide, and has a ceiling clearance of 60 feet. Seating for 4, 500 is provided by a permanent balcony, with 4, 500 additional seats in rolling bleachers set on U channel steel runners; knock-down bleachers on the ends of the basketball floor provide another 2, 000 seats for a total capacity of 11, 000. (See Figure 3.) The surface is covered entirely with tanbark. The entire roof is insulated with aluminum foil to avoid condensation.

The third type of field house would be those which provide gymnasium functions and field house activities in the same arena. The Boy's Field House of the Oak Park and River Forest High School in Illinois and the field house of the University of West Virginia are examples of this category.



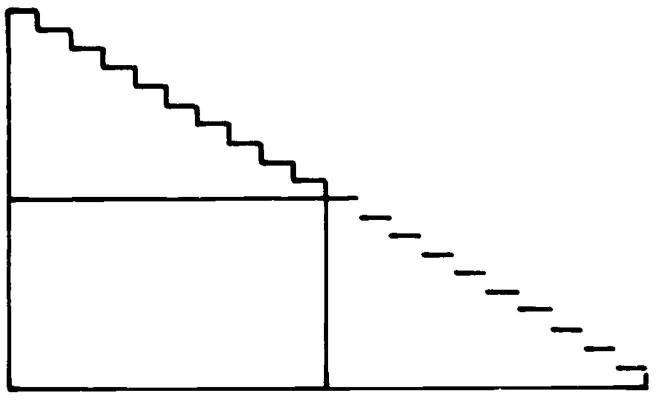
THE INDOOR SPORTS BUILDING
UNIVERSITY OF MINNESOTA

FIGURE 1



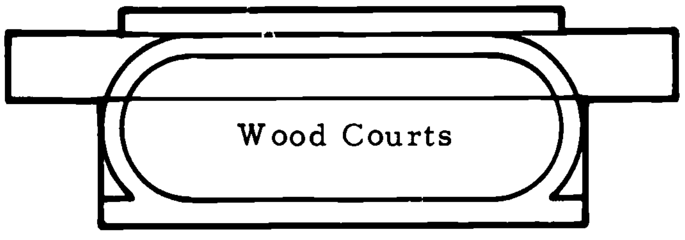
LAY-OUT OF JENNISON FIELD HOUSE
MICHIGAN STATE UNIVERSITY

FIGURE 2



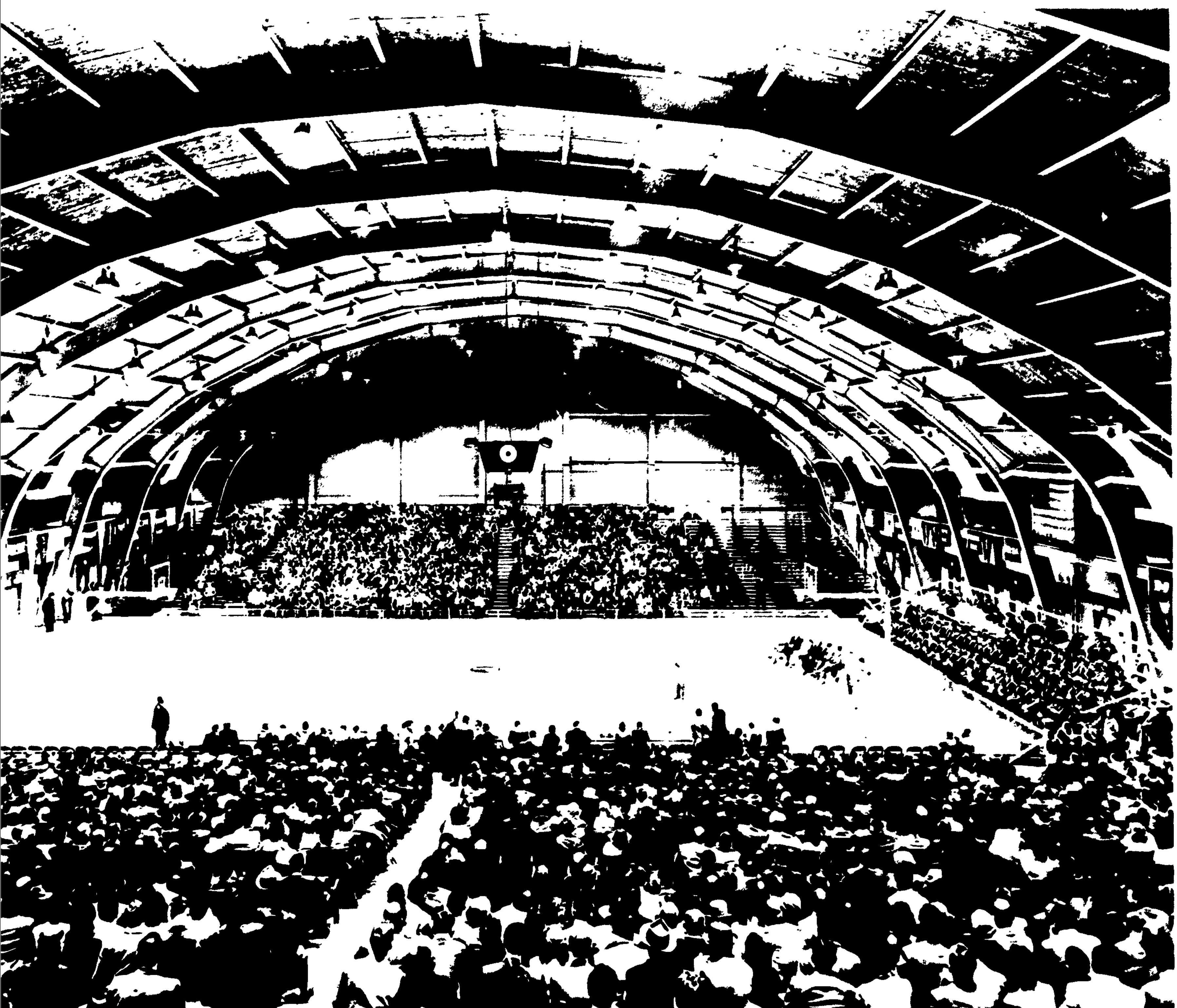
BALCONY - BLEACHER SIGHT LINES

FIGURE 3
(no scale)



FIELD HOUSE LAY-OUT
UNIVERSITY OF WEST VIRGINIA

FIGURE 4
(no scale)



'E 1. Field House, University of Pittsburgh. Courtesy of Arch Roof Construction Co., Inc., New York

The Oak Park and River Forest High School Building was designed to take care of the indoor physical education needs of 1,600 boys. The total structure is 246 feet long and 193 feet wide with an arena 240 feet long and 128 feet wide. A swimming pool, locker rooms, offices, and several other rooms are included. At one end, inside a one-ninth of a mile track, a basketball floor is permanently set which provides three cross-courts as well as the main court. It was found that additional facilities were necessary, including two additional gymnasiums.

The field house of the University of West Virginia is also a dual purpose arena combi gymnasium and field house functions. (See Figure 4 for lay-out.) West Virginia did not build a separate large gymnasium at the time the field house was built in 1928. The planning procedures and ideas of West Virginia, giving consideration to the needs of all students, were exemplary for the pre-1930 period. It is warned, however, that while the procedures of planning might well be the same today, the end result might be quite different.

Educational Significance of the Field House

Any expenditure by an educational institution, to be legitimate, must contribute to the aims and objectives of that institution. The expense of building a field house is no exception. If an institution cannot justify a field house educationally, then it should not have a field house, and the funds that would be involved should be spent for things that will better enable the accomplishment of its educational ends.

Justification of a facility in terms of relative values will be difficult if the facility is planned primarily for the exclusive use of a few highly selected varsity team members. The need for the construction of a field house should develop from a well-planned program of physical education and recreation (including athletics), based upon consideration for the needs of all students. When the weather conditions of the area and the limitations of existing facilities unduly hamper the desired program and, therefore, affect the attainment of the educational ends, then additional indoor facilities are needed and the unique provisions of a field house may be appropriate.

In general, outdoor sport activities are considered more beneficial to health than those carried on in the confines of an enclosed air space. Yet in the field house belt, which is approximately the northern half of the United States, the best three months of the year for outdoor activities come at a time when most schools and colleges are not in regular session. These institutions must work toward their educational goals in physical education without benefit of this optimum period. If the institution cannot accomplish its goals concerning outdoor activities in the remaining good weather periods of fall and spring, then the instruction in these activities must, if possible, be carried on in some manner in indoor facilities. The student, when he is physically educated, can then be counted on to make good use of the summer period to help satisfy his health and recreation needs. An important part of the program of physical education for the motor scholar, interscholastic or intercollegiate athletics, is often well-served by the field house in cold or damp climates.

The field house is not intended to take the place of the gymnasium. It is intended only to make its unique contribution toward an institution's complete group of indoor facilities in aiding and adding to the total program of physical education. The field house and gymnasium, by careful planning, have been combined in the same arena, but this practice is not recommended.

The field house can provide for participation in a wide variety of activities during inclement weather. With careful organization, the instructional program in physical education, programs of intramural and extramural sports, intercollegiate or interscholastic athletics, and voluntary recreation can continue with little interruption despite bad weather conditions. The field house often provides a large auditorium or arena for a number of institutional and community meetings or exhibitions. The building can be planned to accommodate large crowds at athletic contests. However, its functional utility is not only dependent upon the planning and construction of the unit, but also upon the administrative and guiding ability of persons who operate programs of physical education.

CHAPTER II

PLANNING FOR THE FIELD HOUSE

This chapter, in dealing with the problem of planning for the field house, will take up the nature of functional planning. Developing out of functional planning, it will be found necessary to take up the program of physical education and the part a field house might have to play in providing adequate facilities for that program. To get the most value out of the structure, other uses besides those related to physical education will, of course, be considered. This analysis of the functions of a field house can be presented only in general terms, as such an analysis should be made and interpreted for each individual situation.

Functional Planning

Functional planning can be defined as planning which leads to the optimum use of a facility for the fulfillment of the objectives of a specific, total program. The definition implies the need for the participation in the planning of all those in any way concerned with the operation of a facility.

The president of a college, the college board of directors, the superintendent of schools, or a committee of the Board of Education will usually be responsible for the over-all planning for facilities for an institution. Consideration should always be given by these persons to the long range building needs. The head of the department of physical education is responsible for seeing that the departmental needs are presented to the committee or to the single administrator if no committee exists. To get the most out of facilities, the staff of the department must be able to look at the future and be able to anticipate with reasonable accuracy the changing and growing nature of the program of physical education, including athletics and recreation. To represent the department for the purposes of planning, a program specialist, often the head of the department, should be selected to interpret the educational program to the planning groups, architects and engineers.

The Program Specialist

The program specialist is that person in the department selected to serve in that capacity because he knows most about the program. The specialist should also have a knowledge of the problems involved in planning facilities. He need not necessarily be the head of the department, although the head usually will be the one who best meets the requirements. The program specialist will interpret the program for the planning group and to the designers. The specialist must be able, with the assistance of the departmental staff, to anticipate the future needs of the program, and a good deal of the success of the completed facility will depend upon the accuracy of the predictions. If no one in the department has appropriate knowledge of facility problems, a consultant should be called in to work with the department to outline the program needs and future trends, and then to work with the architects in the design of the general lay-out.

Good planning is not a simple process which can be accomplished in a short period of time. Meetings of those involved in planning concerned with just one of the topics in the process may be numerous and detailed before conclusions commonly agreed upon may be reached. Any list of processes of planning for one situation might have to be modified for any other situation. Following is a list of the steps in the planning of a facility for physical education that might be followed for one situation.

1. The program specialist of the physical education department will meet with the institutional administrators to learn of their projections of anticipated growth of the school and the community. It should also be determined at the beginning whether the proposed facility will be expected to provide for specific non-departmental uses.

2. The program specialist will hold a departmental meeting to determine program trends, and to arrive at conclusions as to the specific nature of the future program of physical education over a period of at least a decade.

3. The program specialist will meet with the department to determine necessary teaching stations and specific space requirements to meet the needs of the proposed program and the anticipated student body. It should also be determined which of the needs can be provided for in the new facility.

4. The program specialist will meet with others concerned with the use of the building such as the institutional administrators, members of the building committee where there is such a committee, custodians and equipment men, and representatives of departments for which non-departmental uses of the structure might be planned, to present and interpret the program needs.

5. The program specialist will receive ideas generally, and specific needs from persons representing areas concerned other than for the physical education program.

6. There should now be a general meeting of all concerned to reach basic conclusions, such as general location, about provisions to meet the needs of the program and other areas, and any other problems about which there might be disagreement.

7. An architect should be selected acceptable to the administration, the building committee, and the program specialist.

8. A general meeting should be held with the architect The program specialist should present the needs and conclusions approved by the group, but individuals should be encouraged to clarify points involving their areas with the architect.

9. The program specialist alone should now be the contact man with the architect until the architect develops his ideas for a preliminary plan, or alternative plans, for the general design and construction.

10. The program specialist will present the preliminary plans to individual departmental area leaders and other area representatives for their reactions and further ideas, and organize the results.

11. A general meeting of all institutional representatives concerned will now be held to discuss and reach conclusions concerning the reactions and ideas.

12. The architect will meet with the group to discuss and clarify the results of the general meeting.

13. When the preliminary plans are considered satisfactory, they will be presented to the institutional governing board for their approval. Upon the approval by the board, the architect will be instructed to proceed with the working plans.

14. The program specialist again becomes the sole institutional representative for contacts with the architect. He may have to check with others for the architect on specific problems during this time.

15. The program specialist will submit the final working plans to individuals for their reactions.

16. A general meeting will be held to reach conclusions on the reactions.

17. If conclusions are clear and satisfactory, the program specialist may submit them to the architect; otherwise there should be a general meeting with the architect.

18. The final steps are represented by institutional acceptance of the final plans, and submission to the board for their final approval.

It must be cautioned that some of these steps might involve several meetings rather than one. Further, the series of submission of plans, reactions and group study, and discussion with the architect might have to be repeated several times for preliminary plans as well as later developments.

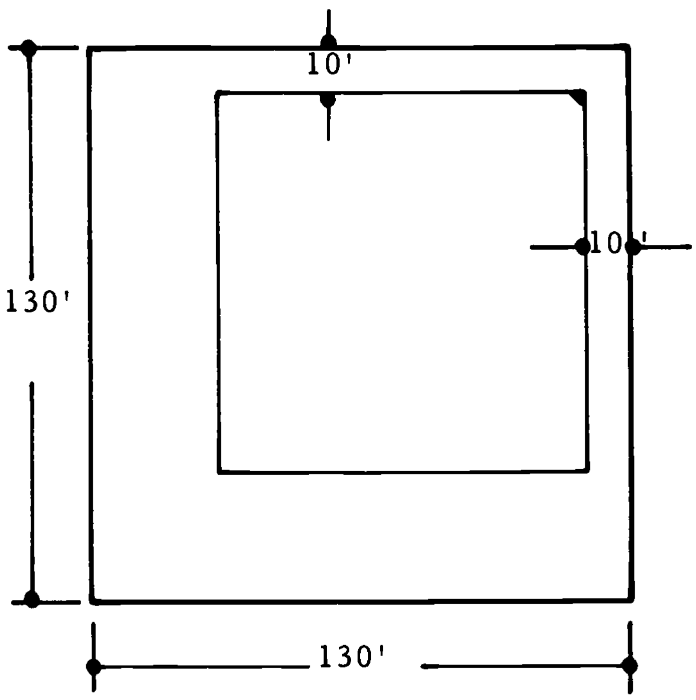
It may appear that the building committee does not have a major role to play in the planning of a specific facility. While this group may be primarily concerned with the overall development of the campus, they can still play an important part in planning a particular building. They should be selected for their special knowledge, and particularly for their judgment. Thus, they will be greatly concerned with the approval steps in planning, and in resolving differences which arise among members of the planning group.

One of the functions of the program specialist will be to provide information concerning space requirements of the various activities to be carried on in the field house. Because of the uniqueness of providing a natural surface for the practice of outdoor activities indoors, space requirements for the common activities carried on in the field house are provided as indicated by illustrations shown in Figures 5 - 16.

The Nature of the Program of Physical Education

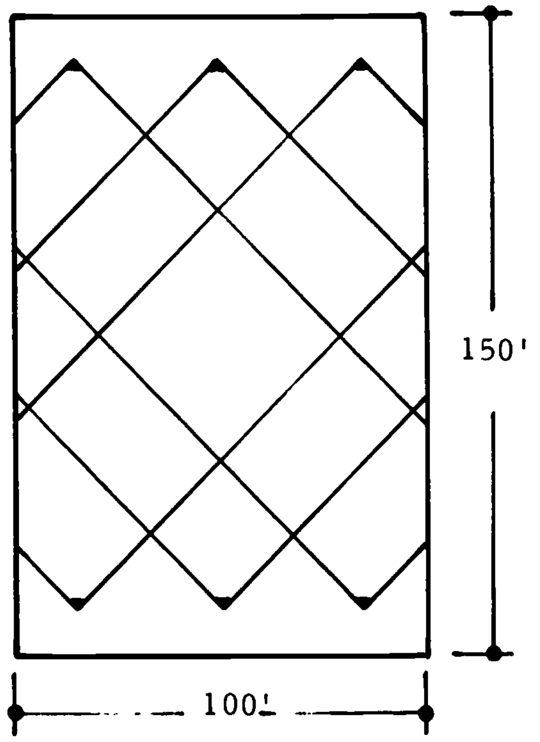
Modern planning for physical education facilities should have a definite program as its starting point. This program should be based upon the accepted philosophy and aim of an institution. The program will then be used to determine the number of various facilities, the size and shape of the various facilities, and the provisions of each facility.

The program on which planning is to be based should be the program of that particular institution for which the field house is to be built. Furthermore, the program should not necessarily be the one in operation, but the one toward which the staff of the school or college is working. If a plan for the improvement of the physical education program has not already been prepared by the staff, assuredly such effort should be made before planning the new facilities. Such program planning is essential to assure that the new facility will serve best not only for today, but for tomorrow also. Such care in looking to the future may help to prevent the construction of a building that is out-dated at the time of its completion.



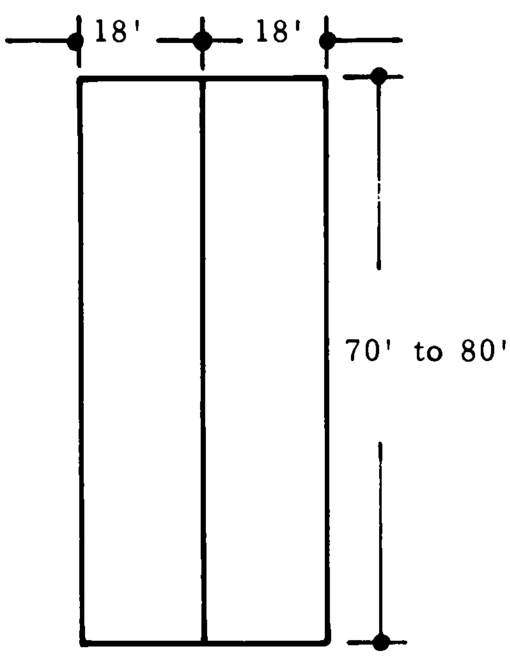
FULL BASEBALL INFIELD
MINIMUM SIZE

FIGURE 5



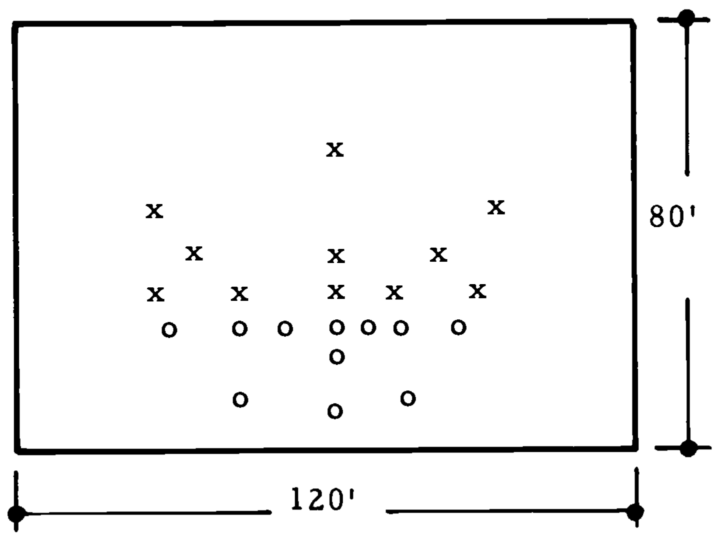
PARTIAL BASEBALL INFIELDS

FIGURE 6



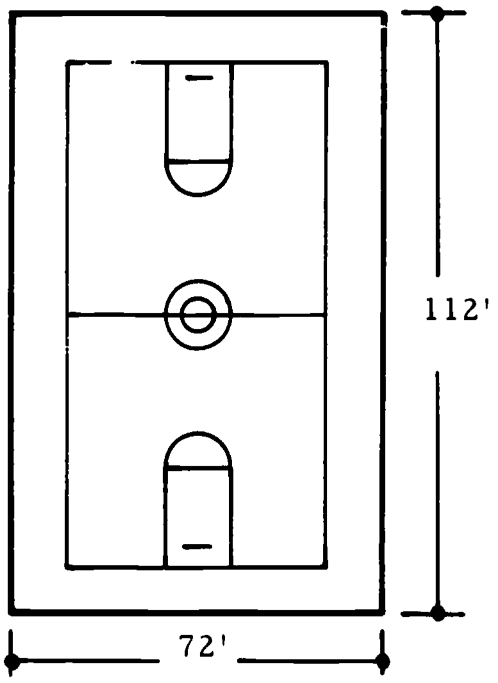
BATTING CAGES

FIGURE 7



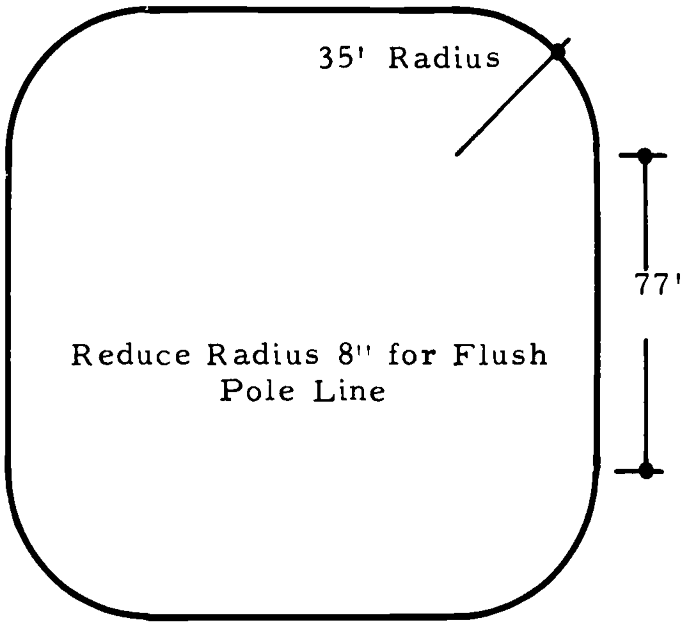
FOOTBALL SCRIMMAGE
MINIMUM SPACE

FIGURE 8



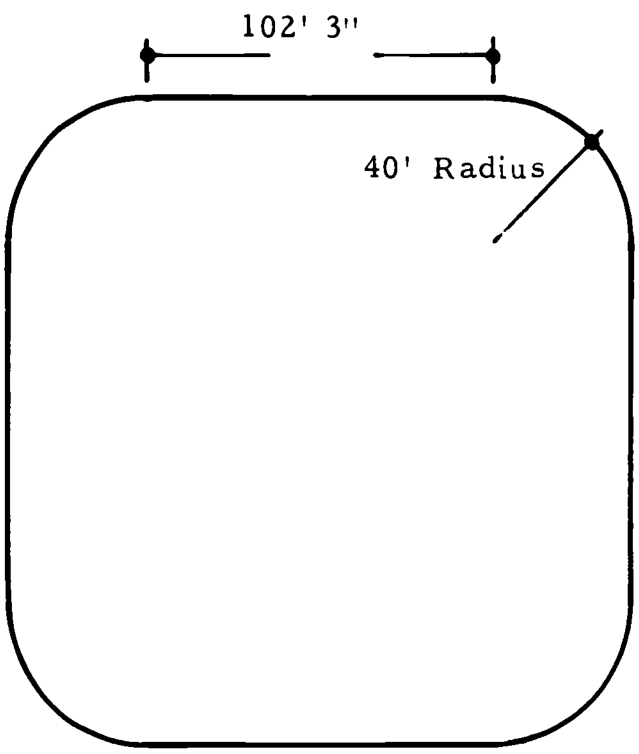
PORTABLE BASKETBALL FLOOR

FIGURE 9



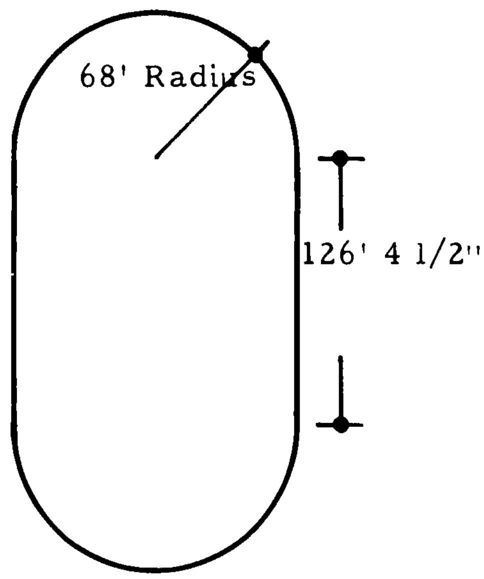
ONE-TENTH MILE SQUARE TRACK

FIGURE 10



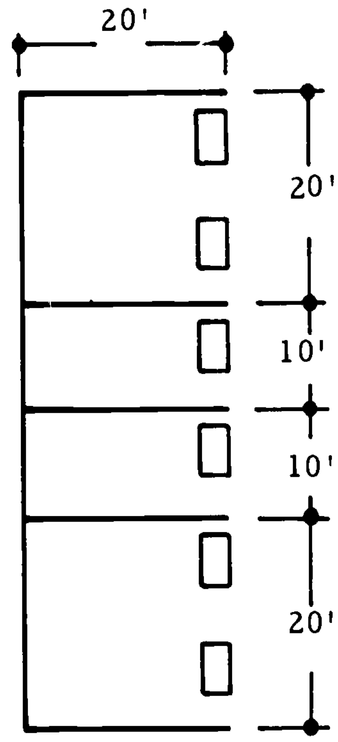
ONE-EIGHTH MILE SQUARE TRACK

FIGURE 11



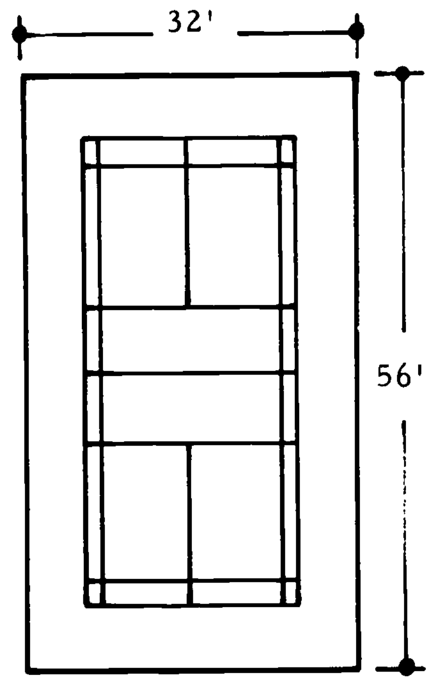
ONE-EIGHTH MILE TRACK

FIGURE 12



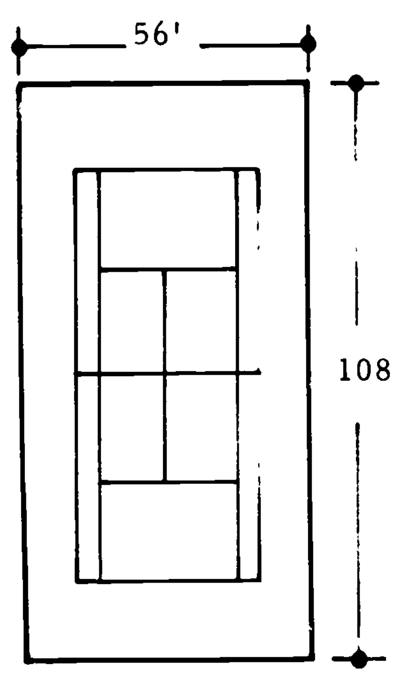
GOLF CAGES

FIGURE 13



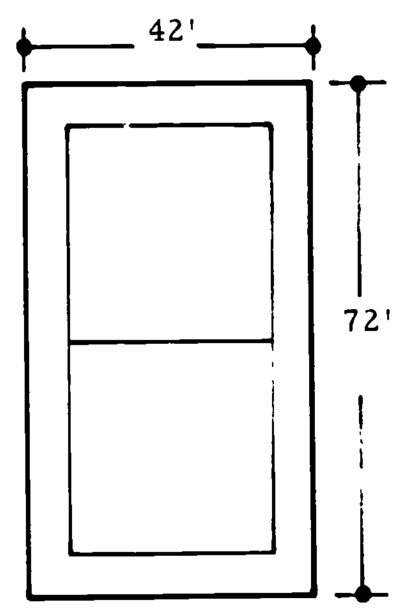
SPACE FOR BADMINTON

FIGURE 14



MINIMUM SPACE FOR TENNIS

FIGURE 15



SPACE FOR VOLLEYBALL

FIGURE 16

The specific activities of the various phases of the program of physical education will be considered herewith. It should be noted that the intercollegiate athletic program is considered a part of the total program of physical education. The corrective or adaptive program will not be considered separately although this program might use the field house for modified games and sports during periods of inclement weather. The instructional, intramural, intercollegiate, and recreational phases of the total program of physical education will be reviewed generally.

The Instructional Program

The instructional program in physical education is for all students. A common requirement for participation is three hours per week for the first two years of college. Some colleges require four years of participation in physical education with the last two years being given to an elective program. In planning facilities for this part of the physical education program, allowance must be made for the possibility of the extension of the requirements.

In order to design facilities to best allow for carrying on all of the desired activities, consideration must be given to the specific activities of the instructional program which might be carried on in the field house. The activities which might be carried on in the field house arena are:

Archery	Golf
Badminton	Lacrosse
Baseball	Marching
Calisthenics	Six-man Football
Casting	Soccer
Croquet	Softball
Field Hockey	Speedball
Flag Football	Touch Football
Football	Volleyball

By including a basketball floor, basketball and other court games could be played in the arena. The provision of a skating rink could take care of skating and ice hockey. Tennis could be provided for on special clay courts, or on hard surfaced areas included in the arena.

In several instances, indoor tennis has been provided for on basketball courts by laying down a canvas surface. Such a provision has proved satisfactory from the standpoint of play, but the practice is not very economical in terms of time and space. In the first place, such quantity of canvas is very heavy and requires several persons to handle it; and it takes considerable working to smooth it out and tighten it in place. Secondly, once the court is ready for tennis, two or four people monopolize the entire basketball court, which is probably the most popular special facility in physical education.

It would be possible for institutions with field houses to include regular football and baseball practice in their instructional programs of physical education. If football and baseball are good physical educative activities, -and it is contended that they are, - then they are good activities for more students than presently manage to participate in them. The practice equipment used by the football team in the fall could be used in the winter and spring for the instructional program instead of being put in dead storage. Some of the baseball equipment, likewise, could be used for the instructional program in the fall and winter. The problem of equipment expense, which is one of the reasons why these sports are not usually included in the instructional program, could be somewhat alleviated by this method.

In planning facilities for physical education, consideration must be given to the women's program as well as the men's. Also, the possibilities of coeducational instruction should be carefully considered.

The Program of Intramural and Extramural Athletics

The program of intramural and extramural athletics will be voluntary for all students of the institution. From the standpoint of planning, it is important to note that the program will be conducted largely during the afternoon and evening hours. This means that facilities should be planned to take care of this program during these hours as well as the other phases of the total program. Sufficient facilities will have to be available in order to carry on a well-rounded program of intramural sports.

Activities which have been a part of intramural programs of various institutions include the following:

- Archery
- Badminton
- Baseball
- Basketball
- Bowling
- Boxing
- Casting
- Crew
- Cross Country
- Fencing
- Field Hockey
- Golf
- Gymnastics
- Handball
- Horseshoes
- Ice Hockey
- Lacrosse
- Rifle Shooting
- Sigma Delta Psi
- Skating
- Skiing
- Soccer
- Softball
- Squash
- Speedball
- Swimming
- Table Tennis
- Tennis
- Touch Football
- Track
- Trampoline
- Trap Shooting
- Volleyball
- Wrestling

Some of these contests could be played in the field house if the weather prohibited their being played outdoors. Some of them could be played during the winter months in the field house, thereby expanding the program and allowing for a greater participation on the part of students. Providing for the playing of contests is not the only contribution of a field house. One of the greatest problems related to intramural sports is that of the training of those taking part and the possibility of injury because of its inadequacy. The field house would provide a facility for increasing the training period for purposes of developing skills and condition, both of which are essential to safety in the active sports of the program.

The Program of Intercollegiate Athletics

Baseball, football, and track and field are the sports of the intercollegiate program which will be served most in the field house. Lacrosse and soccer are served well by the field house where these sports are in the program. Golf and tennis might be practiced in the arena. With special provisions, basketball and ice hockey can be carried on in the field house.

These sports will be practiced daily during their seasons by selected students. The time for practice will most likely be in the afternoon and evening. This means that during the afternoon, the facilities will be taxed to their utmost. Consideration in planning for facilities must be given to satisfy the needs of this peak period.

Incident to the operation of an intercollegiate program, field houses have been designed to accommodate large crowds of spectators. There is no doubt that an educational institution needs an indoor facility providing seating space for the student body and public for sports contests and exhibitions. There is, however, some question as to which facility would best provide such accommodations. The problem of the spectator will be discussed in greater detail later in the chapter.

The Secondary School Program of Physical Education

The activities of the secondary school program of physical education are similar to those of the college program, although ordinarily secondary schools cannot offer as wide a variety of activities as the colleges. This limitation is due to problems of staff, facilities, and finances.

Secondary schools are closer to a daily period standard than colleges, which must be considered in planning. The length of the period will depend, of course, upon the type of schedule used by the school. Consideration must also be given to the modification of field and court sizes for secondary level participation.

While the intramural and recreational programs are not usually as extensive in high schools as in colleges, they do have a similar organization for their program. That is a total program of instruction, intramural athletics, interscholastic athletics, and recreation.

The Elementary School Program of Physical Education

The elementary school physical education program differs sharply from the high school and college program. Although some of the same sport activities will take place in the upper grades, the characteristics of the program at this level show rhythms and games of low organization. These activities can readily be carried on in the regular gymnasium during periods of inclement weather. It is possible, however, to carry on vigorous outdoor activities in spite of poor weather in a play-shed or small field house.

Other Uses of the Field House

There are many non-physical education uses for which the field house can be used. Such activities should be determined in the planning stage, and consideration for the requirements of these activities should be given in the original planning. Following is a list of some of the non-physical education activities for which the field house can be used:

- Alumni Picnics
- Commencements
- Community Uses
- Concerts
- Examinations
- Exhibitions
- Registration
- R. O. T. C
- Stock Shows and Rodeos
- Student Body Meetings

In developing a program for the use of the field house, the cooperation of all those involved is essential. Priority for the use of the structure should be based upon the contribution that the activity makes towards the fulfillment of the institution's educational goals. If non-physical education uses begin to seriously interfere with the physical education program, the institution should re-evaluate the use of the facility in terms of the welfare of its students.

The Problem of the Spectator

A survey of institutions which have field houses has indicated that several administrators in physical education, including athletics, would not provide the spectator accommodations in the field house if the planning and construction were to be done over again. The results of the survey also indicated that administrators over field houses with no spectator facilities were pleased with the utility and availability of their structures for activities, without the bother of expensive and time consuming operating and maintenance procedures. On the other side of the ledger, of course, were several field houses which provided for spectators satisfactorily.

In any event, the provisions for a basketball floor and bleachers in the arena interfere with several of the valid uses of the field house. For one thing basketball and the baseball and track seasons overlap, particularly in the early training of the latter. Baseball and track are the most commonly practiced sports in the field house. But with the extensive basketball seasons in most areas, their early season practice must be delayed at least a month and sometimes more. In some instances, the basketball floor and portable bleachers are in such a position that the track cannot be used at all until they are taken down after basketball season. Such a situation is unwarranted if the unique provisions of the field house are truly valid.

Another grave problem arises, where basketball floors and bleachers are in the field house arena, because of the dust. While it is usually possible to keep the well-finished floor clean by daily effort, it is almost impossible to keep the seating facilities adequately clean. Cleanliness and sanitary standards should be kept high in making provisions for the public. This is much more easily done in a completely finished building or arena where there is only normal dust to contend with rather than in a facility with extensive and ever-present dirt-dust. The finished gymnasium arena is needed for the program in secondary schools and colleges in any case.

The idea of a simple shell from which the field house movement arose, to provide only for the activities of the program, is returning in enough situations where there has been experience with field houses to constitute a growing trend. Such a trend is not so clearly in evidence where institutions are building their first field house. The shell building is economical enough in comparison with other construction so that most college institutions could build both a separate field house and a basketball arena with seating without much more money, if any more, than would be necessary for a near-colossal field house. As a result of a study of the returns of a survey of field houses made by the author, the simple, separate field house is strongly recommended. One of the best single examples of this idea is the University of Minnesota's new field house discussed earlier. The original near-colossal field house remodeled into permanent basketball and hockey arenas, and a relatively inexpensive 400 by 200 foot shell-type field house available at all times for field house functions, are the result of good planning for a given situation. In spite of the tremendous size of this building, it cost less than $650, 000 in 1949. Many other institutions could be well served by a much smaller field house as will be shown in the next chapter.

The existence of inadequate gymnasiums with insufficient seating gives rise to the problem in many instances. To expand facilities, many institutions add a field house because they feel the need for such a facility, but because additional seating is needed, the field house is built to provide for inter-school contests in basketball and sometimes other activities as well. In other cases, the planning results in the combination because it is not realized that the additional costs of providing for both "dirt" and gymnasium activities might provide sufficient funds for the two separate arenas.

The crux of the problem is that planning is always extremely important for any type of facility, and when it comes to providing spectator facilities, planning becomes critical. By careful planning the field house can provide seating accommodations without seriously impairing program operation. Consideration must be given to the fact that maintenance costs will be higher when the field house is used for activities requiring a wood floor, or when provisions are made for spectators, or both combined. It may be worth the cost, but the alternatives should be carefully considered. There is no getting around the fact that when the field house is used as a spectator facility, particularly for court games on wood or ice surfaces, the utility and flexibility of the structure for the operation of the total program of physical education will be limited to a greater or lesser degree.

Recommendations for Field House Planners

Administrators of the majority of school and college field houses were asked about the design, construction, and use of their earth surfaced facilities. They were specifically asked about those things which they would want to do differently if they should have the opportunity to start over again with the planning and design of these buildings. The following recommendations and the list of errors concluding the next chapter grow out of the answers to these questions.

1. The field house should be designed and used in relation to the total program of physical education for all students. The field house should not be controlled and used exclusively by the department of athletics for the activities of a few highly selected students. Consideration should be given to the possible use of the field house by women students as well as by the men. The more people who can utilize this facility for wide varieties of indoor and outdoor activities, the more valid the structure will be.

2. Field houses should only be constructed in such situations where the need for the unique functions of the field house is indicated by the institutional program of physical education. Such situations will arise where prolonged periods of inclement weather unduly limit the desired program. Where the need for the field house is not felt in relation to the total program of physical education, one may well question the need for such a structure.

3. The program of physical education should be re-evaluated by an institution prior to the design and construction of a field house or other physical education facility. This, along with a reasonably accurate prediction of future needs and developments by the program specialist, will assure that the facility will serve best in the future as well as for today.

4. The over-all facility requirements for physical education in the institution should be surveyed before the field house is designed and built. The field house building can then be designed to provide additional instructional-recreational, administrative, and service facilities as might be required.

5. The field house should be functionally planned giving opportunity for each interested group to be represented in the planning. Careful consideration should be given to selecting the activities that are to be carried on in the field house. The building should then be designed for utility and flexibility to provide for the various activities.

6. The program specialist should interpret the program of physical education to planning committees, architects, and engineers. He should have sufficient knowledge of

facilities to insure that the architect is following sound principles in design and choice of materials.

7. The field house should be designed to supplement and complement the gymnasium and other facilities, and not to take the place of the gymnasium. The unique function of the field house is to provide for outdoor activities to be practiced indoors. It should be designed to perform this function well, and to serve such other functions as can readily be carried on in such an arera.

8. The field house should be located in relation to existing facilities such as the physical education building, stadium, and athletic fields. As with other facilities, it should be reasonably near the focal point of the living accommodations of the students who will use the building.

9. In many instances, the field house can profitably be designed to share one or more walls with the stadium, gymnasium, or other facilities. Such design might contribute to the development of the under-stadium area.

10. Where existing locker rooms, showers, and toilets are adequate, the field house should be designed and located to utilize the existing facilities rather than duplicate them. Provisions for women should be designed in the field house if none are located nearby.

11. The field house should not be used as a spectator facility for basketball or other contests played on other than the arena surface if such contests can be accommodated elsewhere. One reason for this is the interference with the normal activities of the arena. Spectator facilities would not interfere with the central basketball court in a gymnasium. Another reason is that maintenance problems and costs are greatly increased because of the dust inherent in the field house.

12. The design of the field house should allow for future expansion. One of the reasons why facilities for physical education are inadequate is that little can be done to expand and improve them in many instances.

13. All field house planning, design, and construction should be continually checked against the list of errors for each specific type of area.

14. The field house should be planned to accommodate certain community purposes where these do not conflict with the needs of the institution.

15. Students, faculty and employees, alumni, and community groups should be the priority list for the use of the field house. Cooperation in planning the field house program is essential.

16. It is desirable that the field house be large enough to accommodate a full baseball infield surrounded by a running track. An additional area is desirable for football and other activities. Small arenas may be satisfactory if planned for definite modification in the activities.

17. Secondary schools should consider building smaller, low-cost field houses although the large size would be highly desirable. The activities of the high school program are much the same as for colleges. The space requirements, if the means are available to provide them, are about the same.

18. Grade schools could consider the desirability of providing a small field house.

In mild, but damp climates, consideration should be given to providing a play-shed as a field house. The play-shed type structure might also be used advantageously by schools and colleges in the warm, southern climates where considerable rainfall is encountered.

19. If it is decided to provide spectator accommodations in the field house, rolling or folding type bleachers should be considered whether in balconies or on the main floor. The balcony areas released when the stands are closed should be utilized for various court activities.

20. Wood court areas should be separated from the field arena by solid partitions. Portable wood floors manufactured by commercial specialists will probably offer better service than home-made portable floors.

21. The floor surface of the arena where used for both baseball infield and football scrimmage should represent a compromise between firmness and resilience. It would be ideal for areas to be provided in the arena for each of these activities. The baseball area should have soil consisting of approximately 65 per cent clay, with 35 per cent loam and sand. The football area soil should consist of approximately 60 per cent clay, 25 per cent loam and sand, and 15 per cent peat or sawdust. In the midwest, many schools and colleges are using a natural combination of clay soil with good success. The surface will require periodic working, rolling, and wetting.

22. Steel or wood arches which conform to the shape of the roof and provide both roof and wall support are desirable. Where economy transcends other considerations, wood bowstring truss construction can be used satisfactorily.

23. The field house ceiling should be at least 30 feet high. More clearance is desirable if cost is not unduly increased thereby. Field houses which do not provide spectator accommodations can offer lower ceilings than those which provide extensive seating.

24. The lobby and corridors should be designed to provide for the efficient circulation of traffic. Public conveniences should be located in or near the lobby. The traffic control system should be arranged to keep casual spectators off the arena surface.

25. Nets should be utilized for the baseball infield, baseball batting cages, golf cages, and drop nets used for tennis court backstops and for practice of the discus throw. An efficient net system will greatly increase the utility and flexibility of the field house. Mechanical winches and overhead track systems should be utilized to raise or move nets quickly. Nets should be fairly light in color except for certain backgrounds such as behind the pitcher in the batting cage.

26. When windows are provided, they should be set high in the north and east side and end walls of the arena. Glass brick with directional slanting for entering light can be used to advantage in these areas. The arguments for not providing windows have been enumerated in the text of the study.

27. Vertical skylights, such as the pent-house type and the sawtooth type, with interior gutters will ease the condensation problem. Several new field houses have been built without skylights, and this feature should be considered by field house designers.

28. The lighting system of the field house arena should provide at least thirty foot-candles of light at the floor level. If basketball contests are to be played in the arena, the level of illumination over the court should be 50 to 55 foot-candles. Either low glare incandescent luminaires or fluorescent tubing should provide the lighting.

29. The lighting system should be designed with specific maintenance provisions in mind. Catwalks or mechanical lowering devices should be provided.

30. The ceiling should be finished in flat white or other light colors, and the walls should be finished in light tints. The reflection factor of the finish can contribute significantly to the efficient lighting of the arena.

31. Unit heating which automatically maintains a temperature throughout the arena ranging from 60 to 65 degrees F. should be provided in the field house. The units, pipes, ducts preferably should be recessed in walls. The heating equipment should not obstruct spectators or participants. Recirculating units of the heating system should be provided with dust screens.

32. Mechanical ventilation should be provided for the arena. The ventilation system should be planned in conjunction with the heating system.

33. The arena ceiling should be insulated with waterproof material. A waterproof combination insulation and acoustical material with a light finish is desirable.

34. Sliding doors should be provided in the wall at the end of the track straightaway. This provides a vehicular entrance to the arena as well as providing a safety factor at the end of the dashes and hurdles.

35. Provisions for sufficient storage should take precedence over the use of areas for more activity facilities. Plans should be made for all known storage requirements, and then 25 per cent more space provided as a reserve for unanticipated needs.

CHAPTER III

DESIGNING THE FIELD HOUSE

The Nature of the Structure

The field house, as has been indicated, is a comparatively large, long-span structure. Its uniqueness lies in the "dirt" surface upon which outdoor sports can be played and practiced indoors. The building is related by type to hangers, armories, and other long-span facilities. Armories with earth floors are particularly akin to field houses in structure and purpose, and several college armories are used for field house functions. The field house should conform to certain general standards for all physical education facilities such as those suggested by the College Physical Education Association's National Conference report on facilities for athletics, recreation, health, and physical education.[1]

The problem of span is one of the major considerations in the design and construction of the field house, and several of the ways this problem has been solved should be surveyed. While there are many variations of basic roof design, there are three types of spans which lend themselves particularly well in providing for the necessary width of the field house. (See Figures 17, 18, 19.)

The majority of the field houses built within the last decade have been spanned by steel fabricated arches of some type. The clearance allowed by these kinds of arches is very desirable in field house construction, especially when the structure is to be used as a spectator facility. Some such arches also provide an economical advantage in that a lower side-wall is allowed. These arches offer a variety of roof shapes from the round, such as the Swarthmore College Field House, to the straight pitched roof, such as was introduced for long-span building in conjunction with the two-hinged arches used for the University of Chicago Field House. The arches for the field houses of Swarthmore College and the University of Pittsburgh were fabricated from standard, straight lengths of H or I beams with riveted or bolted joints. This type of roof construction has been patented by the Arch Roof Construction Company, Inc., of New York City. (See Plates 1 and 2.)

Wood and concrete arches which follow the curvature of the roof have been used for long-span structures, but these are not nearly so common as the steel arches. The field house of Springfield College has laminated wood arches, but this unit was converted from a surplus Navy drill hall. A wood fabricated dome was supplied for the roof of the field house for Montana State College by Timber Structures, Inc., of Portland, Oregon. This field house is round following the pattern of the roof.

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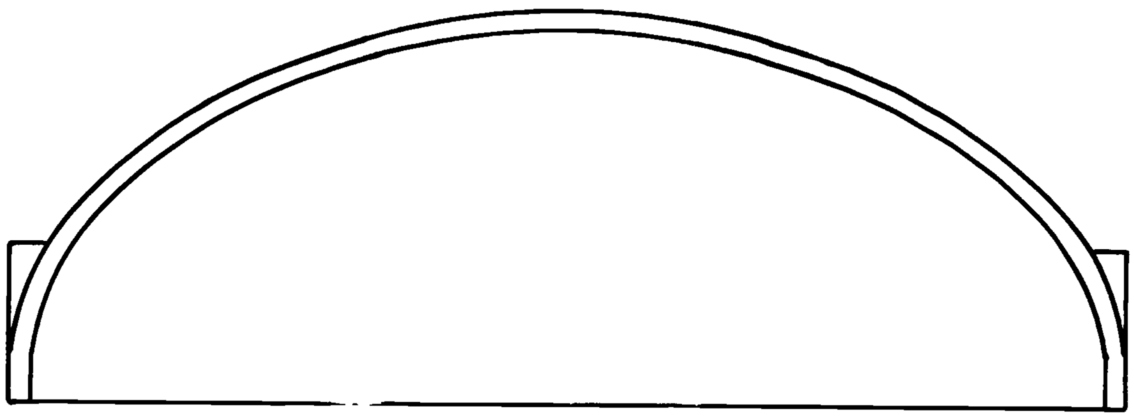
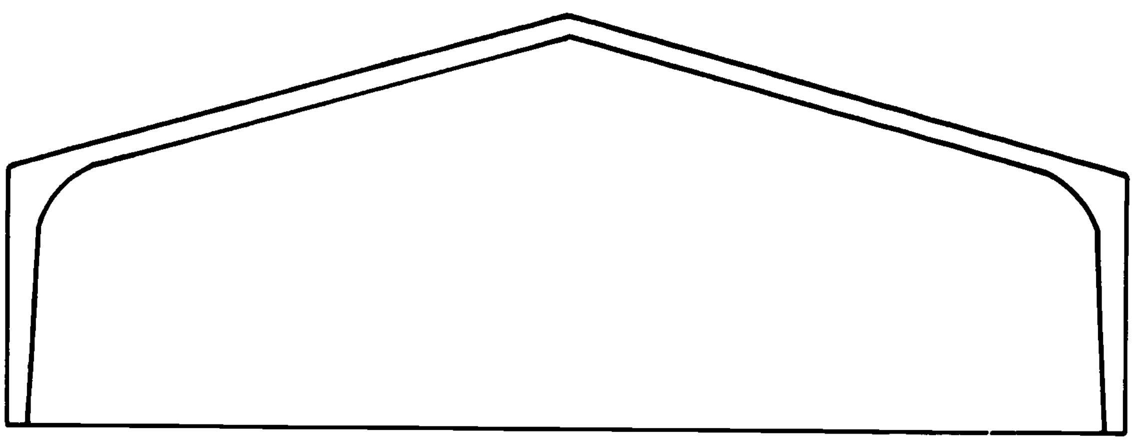
[1]Karl W. Bookwalter, editor, College Facilities for Physical Education, Health Education, and Recreation, The College Physical Education Association, 1947. pp. 8-12.



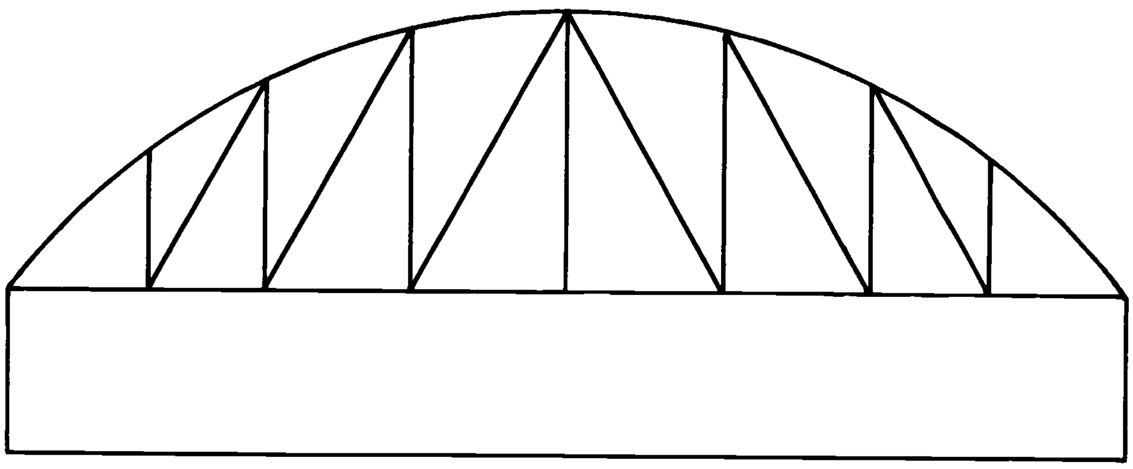
Oval Shaped Arch

FIGURE 17



Cantilever Arch

FIGURE 18



Bowstring Truss

FIGURE 19

COMMOM TYPES OF DESIGN FOR WIDE SPANS

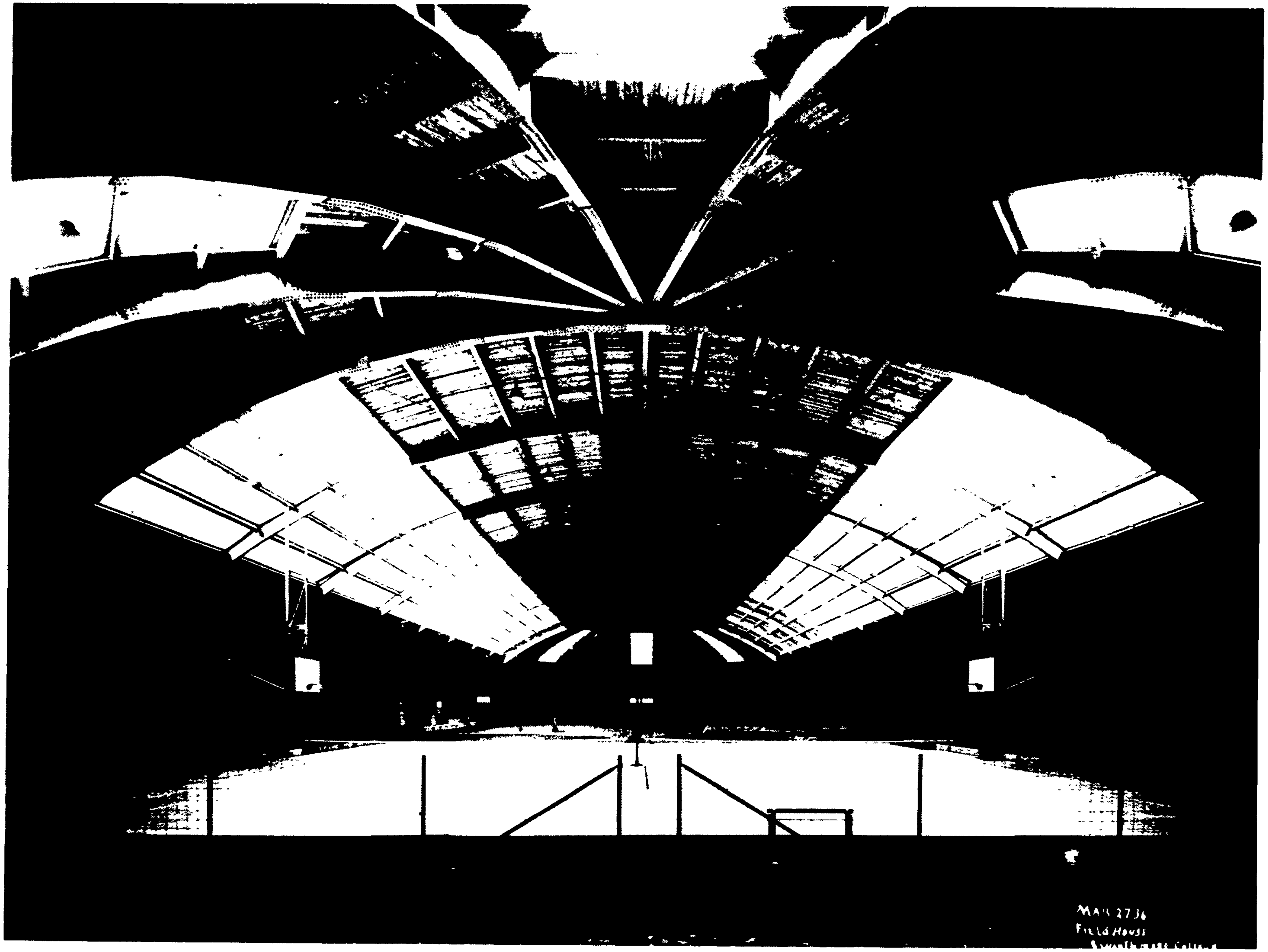


PLATE 2. Field House, Swarthmore College, Pa. Courtesy of Arch Roof Construction Co., Inc., New York.

An important exception to the trend toward steel arch construction is the wood, bowstring truss type of fabrication such as was used for the new field house of the University of Minnesota. This building, with an arena 400 feet long and 200 feet wide, was completed in 1950. The 200 feet trusses rest on laminated wood posts providing a constant inner ceiling clearance. This building provides no spectator facilities, and the arena is the same size as the building. This unpretentious but highly usable structure cost less than $650, 000.

The Rockwell Cage at Massachusetts Institute of Technology is another economical example also spanned by wood trusses. It is evident that this is a relatively inexpensive form of construction. However, it must be noted that these buildings are field houses and nothing more; no portable floors and no spectator accommodations. Any building construction would be less expensive without such provisions. The desirability of omitting woc d courts and extensive spectator accommodations in the field house was indicated in seve .al instances by the survey of field houses. The M. I. T. athletic director called his facility "strictly a functional practice unit, available when you need it."

The cost of building field houses varies with each unit because of the great range of accommodations and types of construction. The cost also varies with the geographical location. The size of the building and the length of the span obviously are elemental variables in cost determination. Aside from additional rooms or areas other than the field house arena, another important cost factor is the number of spectators provided for.

In reviewing the cost of selected field houses built in the decade since 1946, it is necessary to make allowance for the constantly increasing costs during that period. The figures listed in the following paragraphs will then have some definite meaning at this time.

Two field houses constructed prior to 1950 are first considered. The Rockwell Cage at Massachusetts Institute of Technology was completed in 1947 at a cost of $160, 000. The building is 200 by 160 feet, and the wood truss construction for the roof allows a ceiling clearance of 30 feet. The arena is divided into two halves so that one half can be used for track and the other half for baseball. The University of Idaho completed the first unit of their field house in 1949. The 100 by 175 foot unit cost only $73, 000. Wood truss construction and aluminum siding helped keep costs low.

Of three field houses constructed in 1950, the University of Minnesota's Indoor Sports building has already been mentioned. The 400 by 200 foot wood truss building cost less than $650, 000. The Alumni Memorial Field House of Lake Forest College in Illinois cost $200, 000. The building is 200 by 140 feet with an arena 200 by 120 feet. A 30 foot ceiling clearance is allowed by wood trusses. Seating for 4, 500 is provided on knock-down bleachers. A 290 by 196 foot building for the University of Omaha cost $700, 000. The arena is 268 by 174 feet with a "dirt" surface 268 by 160 feet. Cantilever steel arches give a ceiling height at the center of 60 feet. Rolling bleachers seat 3, 600 and knock-down bleachers seat 5, 000 for a total of 8, 600 spectators. The field house was built next to the back of the football stadium.

The year 1951 was a big year for field house construction. A complete physical education plant was erected at the Lawrenceville School of Lawrenceville, New Jersey at a reported cost of $1, 200, 000. The building provides the field house, separate basketball arena, natatorium, dressing and locker rooms, and a lounge and entrance lobby. The field house arena is 313 by 134 feet, but a wood basketball floor is set in one end of the arena without partition. Rigid steel frame cantilever arches are used for the span. Fluorescent tubing provides the arena lighting. Brigham Young University of Provo, Utah completed their Brigham Young University Fieldhouse and Gymnasium at a cost of $1, 250, 000. The total structure is 428 by 180 feet with a "dirt" field arena 180 by 160 feet. Handball, squash, boxing, wrestling, and corrective rooms are also provided. Seating for the intercollegiate basketball contests is included. The Pitt Memorial Field House of the University of Pittsburgh is another 1951 completion. The 350 by 164 foot building with an arena 275 by 164 feet cost $1, 300, 000. Fabricated steel arches give a rounded ceiling with a 52 foot center clearance. Extensive seating is provided on knock-down type bleachers for basketball contests. The basketball court is left permanently in place in the arena. The University of Wyoming provides seating for 11, 000 in the $1, 250, 000 Memorial Field House. Rolling bleachers seat 4, 500, balconies seat 4, 500, and knock-down bleachers at the ends of the basketball floor seat another 2, 000 spectators. The 274 by 262 foot building is spanned by cantilever steel arches 60 feet high. The field arena is 221 by 156 feet. In addition to the arena, two handball courts, a boxing, wrestling, and gymnastics room, steam room, training room, and six locker and shower rooms are included. The physical education plant of Central Michigan College of Mt. Pleasant, including a field house, will be the last 1951 structure considered. The gymnasium, natatorium, field house, locker and shower rooms, class rooms, and offices cost $1, 200, 000. The field house is 263 by 139 feet with a one-tenth of a mile track. Balconies provide seating for 5, 200 spectators.

Northwestern University completed McGraw Hall in 1952 at a cost of $1, 300, 000. The 332 by 186 foot structure has an arena 300 by 180 feet. Steel arches span the building giving a 51 foot center clearance. Steel bleachers provide seating for 13, 000 spectators. Another 1952 field house is that of the University of Kansas costing $2, 500, 000. Balconies provide seating for 10, 338, and knock-down bleachers seat 6, 700 for a total of 17, 038 spectators. The structure is 344 by 254 feet with an arena 341 by 252 feet. The "dirt" area is 341 by 134 feet. Rigid steel frame arches 78 feet high at the center make up the span. Concordia College of Moorhead, Minnesota was to have completed a field house in 1952 at an estimated cost of $500, 000. The 212 by 200 foot building with a 70 foot ceiling was to seat 8, 000. Bent steel arches provide the span.

Consideration will be given to two field houses completed since 1952. A field house unit of a physical education plant for the University of Connecticut was completed in 1954 at a cost of $930, 000. The unit has a 325 by 140 foot arena with a 125 x 28 foot balcony area. Gymnasium and pool sections cost an additional $846, 000. The Union College field house of Schenectady, New York was ready in 1955. The laminated wood arch building cost $500, 000. The arena is 210 by 197 feet, and the wood arches are 66 feet high at the center. Dressing rooms, locker rooms, and coaches and officials rooms are included.

While size is related to cost, it should be noted that an arena too small for the activities desired is not truly an economical building although it might be a cheap building. A significant number of replies to the survey indicated that a wider arena than the one constructed would have been desirable. From Swarthmore College with a field house arena only 125 feet wide, but with 24 feet taken up by a running track, it was indicated that the arena should have been wide enough for the track as well as for a full infield practice area. Even the University of Pittsburgh, with an arena 164 feet wide, suggested that a width of 40 more feet would have been desirable. This, however, was primarily due to the desire to provide seating. A full basketball infield practice area inside a running track appears to be ideal for the width of the field house arena. The Indoor Sports Building at Minnesota accomplishes this with a width of 200 feet, but it can be done with less width. The accommodation of a large number of spectators will require a much larger structure than a simple field house. A building accommodating many spectators will have to be a higher one than those which do not. A ceiling clearance of 30 feet is adequate for most activities although more than this is desirable if it can be obtained without undue increases in cost.

There are a great number of possible sizes and shapes in field house design, several of which will be illustrated.

The first two examples provide for the running track inside a part of the baseball infield area. The track must necessarily be of the same material as the infield in such cases. Both examples offer a one-twelfth of a mile track. Figure 20 shows the track with four, three foot lanes, and Figure 21 has three, three foot lanes.

The next two examples have one-tenth of a mile tracks. In Figure 22, the track could be moved three feet to one side to provide a six-lane straightaway, but this would reduce the full track to four lanes. Figure 23 shows a 180 foot square building with a five lane track. The number of straightaway lanes could be increased in the same manner as above, or the building could be reduced to 174 feet square if four lanes were acceptable.

The next three examples show one-eighth of a mile running tracks. The 166 foot span of Figure 24 could be reduced to 160 feet if a four lane straightaway would be satisfactory. The field house shown in Figure 25 could be expanded at a later date to accommodate an additional area for separate football practice such as is shown in Figure 26. A 100-yard straightaway could easily be accommodated in the latter building.

Figure 27 shows a plan for a building with a one-sixth of a mile track. There is room inside the track for a baseball infield plus separate space for football or other activity.

In Figures 28 and 29, an inexpensive method for providing a long straightaway for a small field house is shown. This idea was used for a preparatory school field house, but the wings were centered to give the building symmetry causing the straightaway to cross the center of the running track and arena.

Many types of building materials have been used for various construction needs in the field house. The material for the outer walls of the structure can be selected to match or complement the existing architectural style and appearance. With the current type of arch construction generally favored, the walls carry very little stress and can be lighter and of more economical material. More areas of glass in the form of window glass or glass block can be designed in wall areas where it is desired. Light-colored, pre-finished materials are available that can be used for the interior roof construction that will help to provide pleasant brightness-balance. Building tile with ceramic finish on one or two sides is available for lobbies corridors, and other interior areas. The program specialist should interpret the needs of the various areas, but the architect and engineers should dominate the selection of materials to be used.

Design in Relation to Other Facilities

Consideration should be given to the possibility of including other instructional-recreational, service, and administrative facilities in the design of the field house where they are not already provided in conjunction with the physical education building or stadium. However, portions of the building under the main span should not be used for offices and small rooms because such space is too expensive to be used for facilities that do not require the space and height of the span. This, of course, does not apply to under balcony areas which should be used to the greatest extent possible. If funds were available, any number of facilities could be constructed in units connected to the field house.

The field house should be located close enough to other buildings to make duplication of service rooms unnecessary. It should also be within easy reach of participants even in bad weather when the arena will probably be most used. Building a field house connected to a physical education building or group of buildings such as the University of Iowa, Purdue University (Plate 3), or Michigan State University, among others, provides an excellent arrangement of indoor facilities. Consideration should be given to building a field house connected to the stadium such as has been constructed for the University of

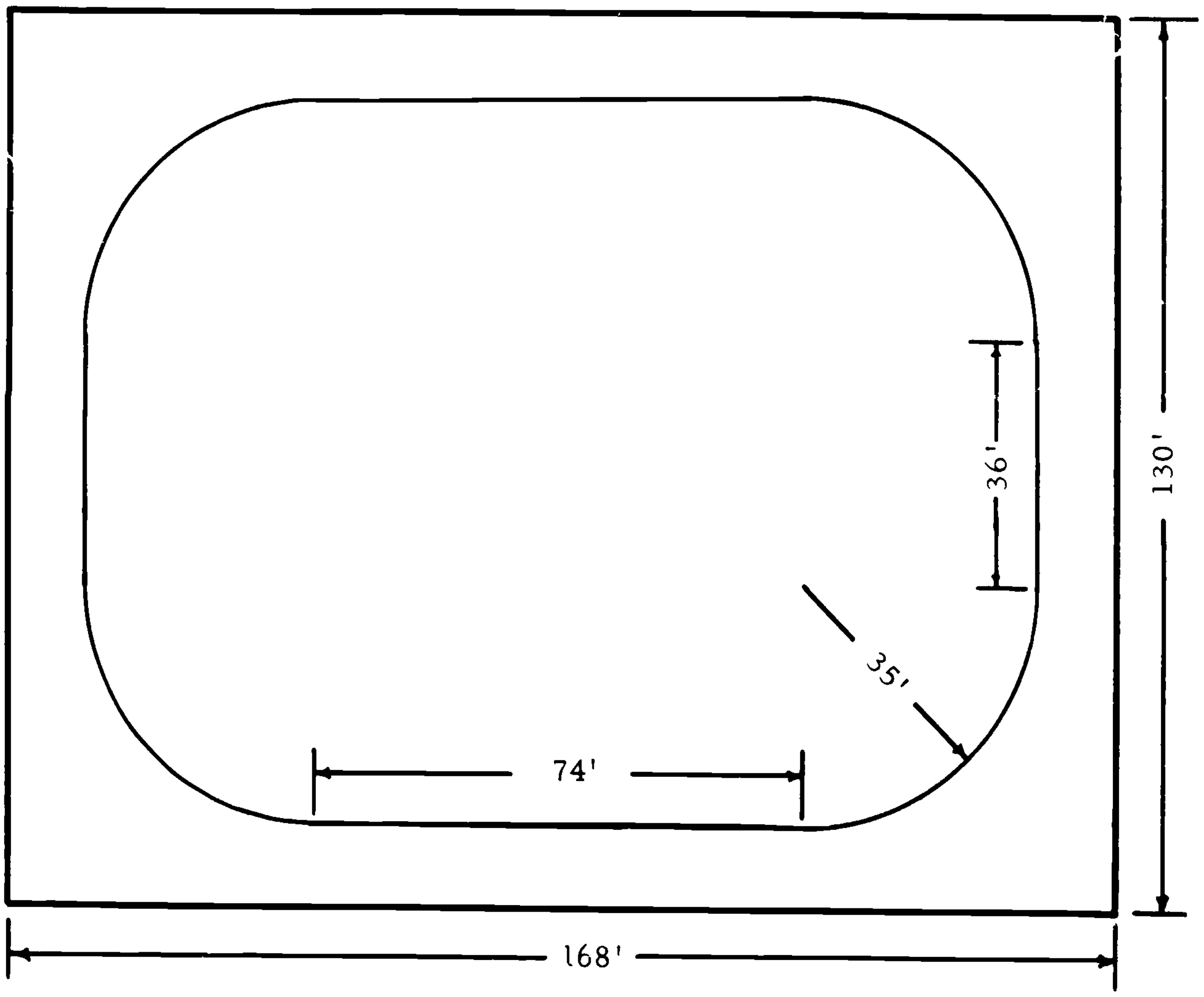


FIGURE 20. One-Twelfth of a Mile Track, Four Lanes.

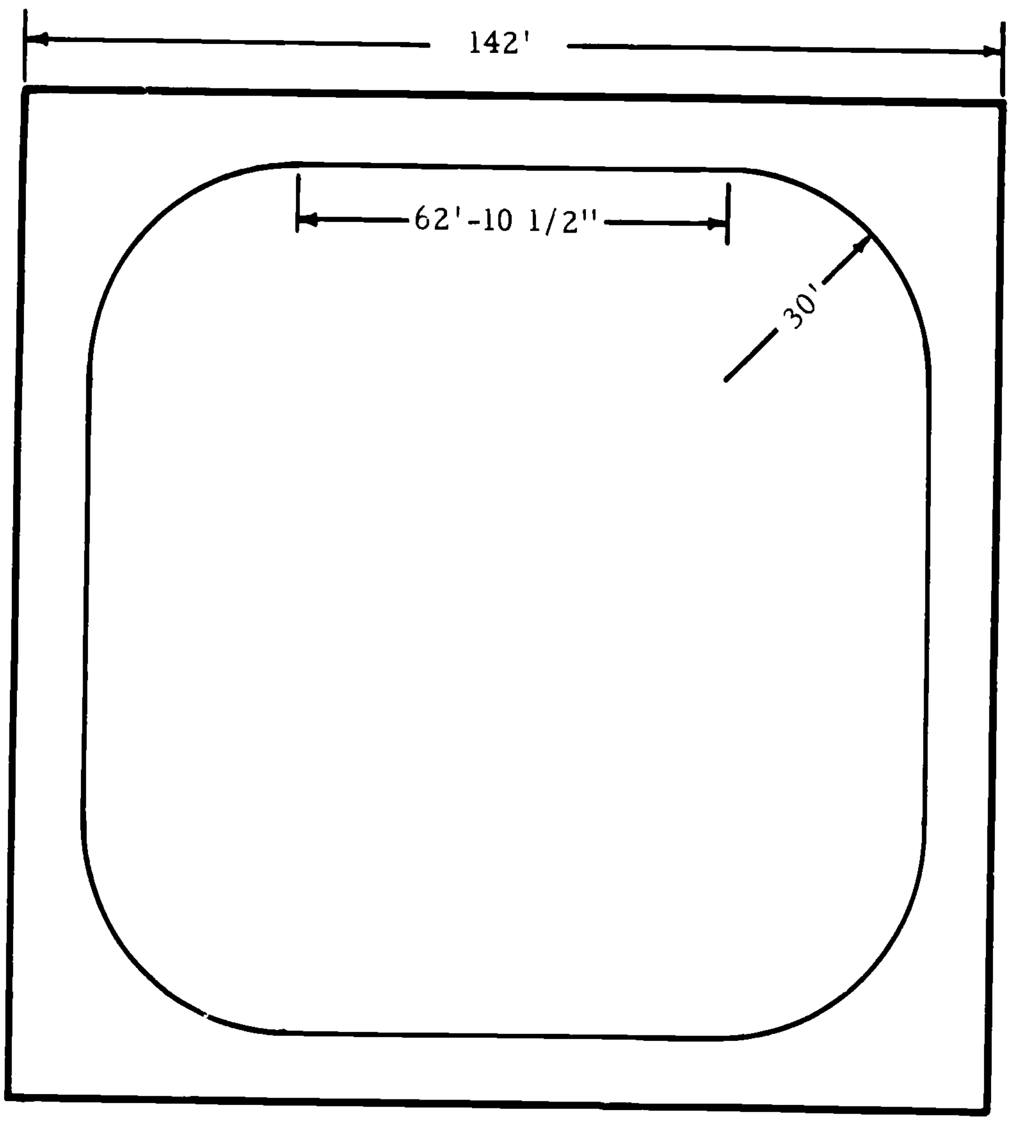


FIGURE 21. One-Twelfth of a Mile Track, Three Lanes.

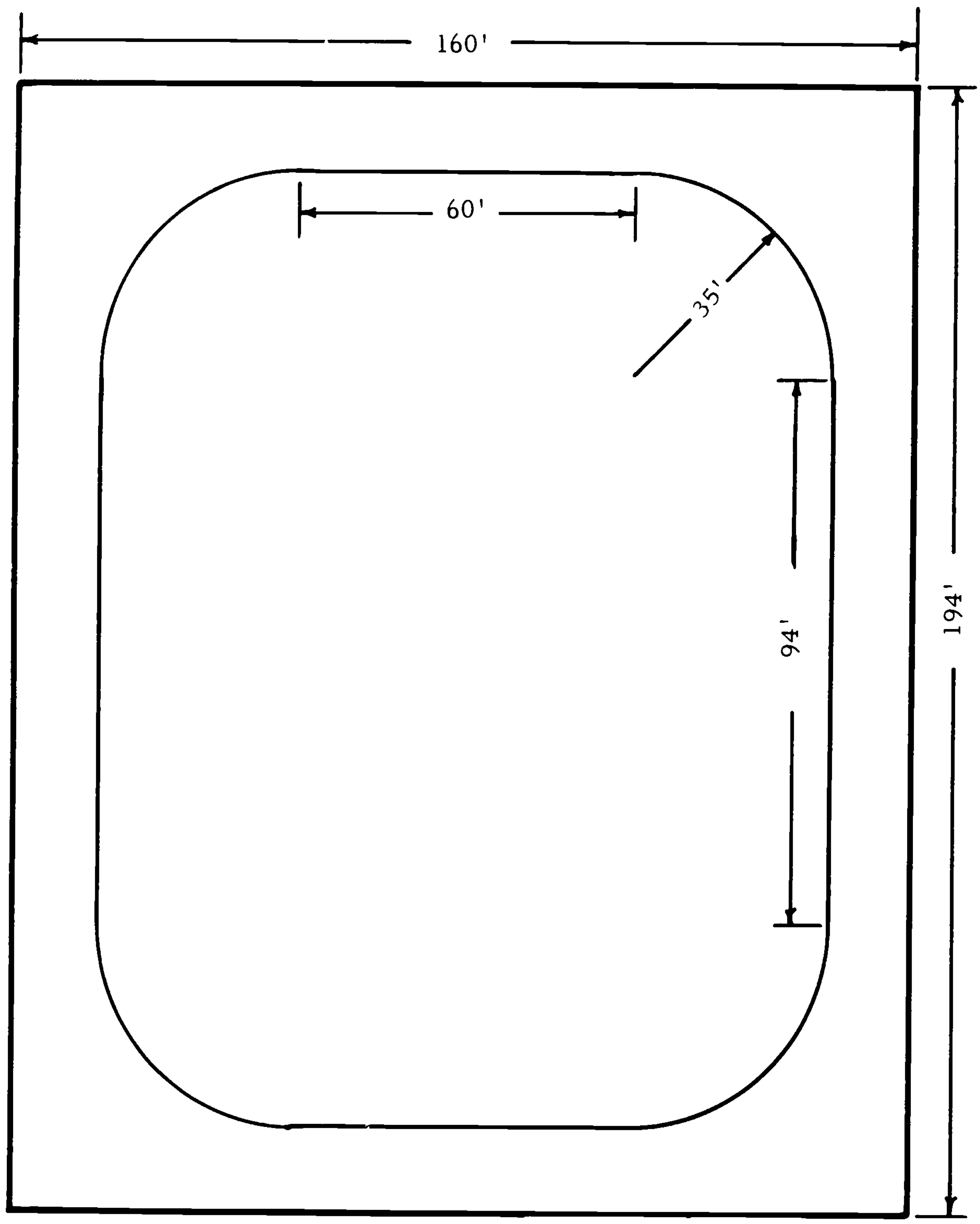


FIGURE 22. One-Tenth of a Mile Track.

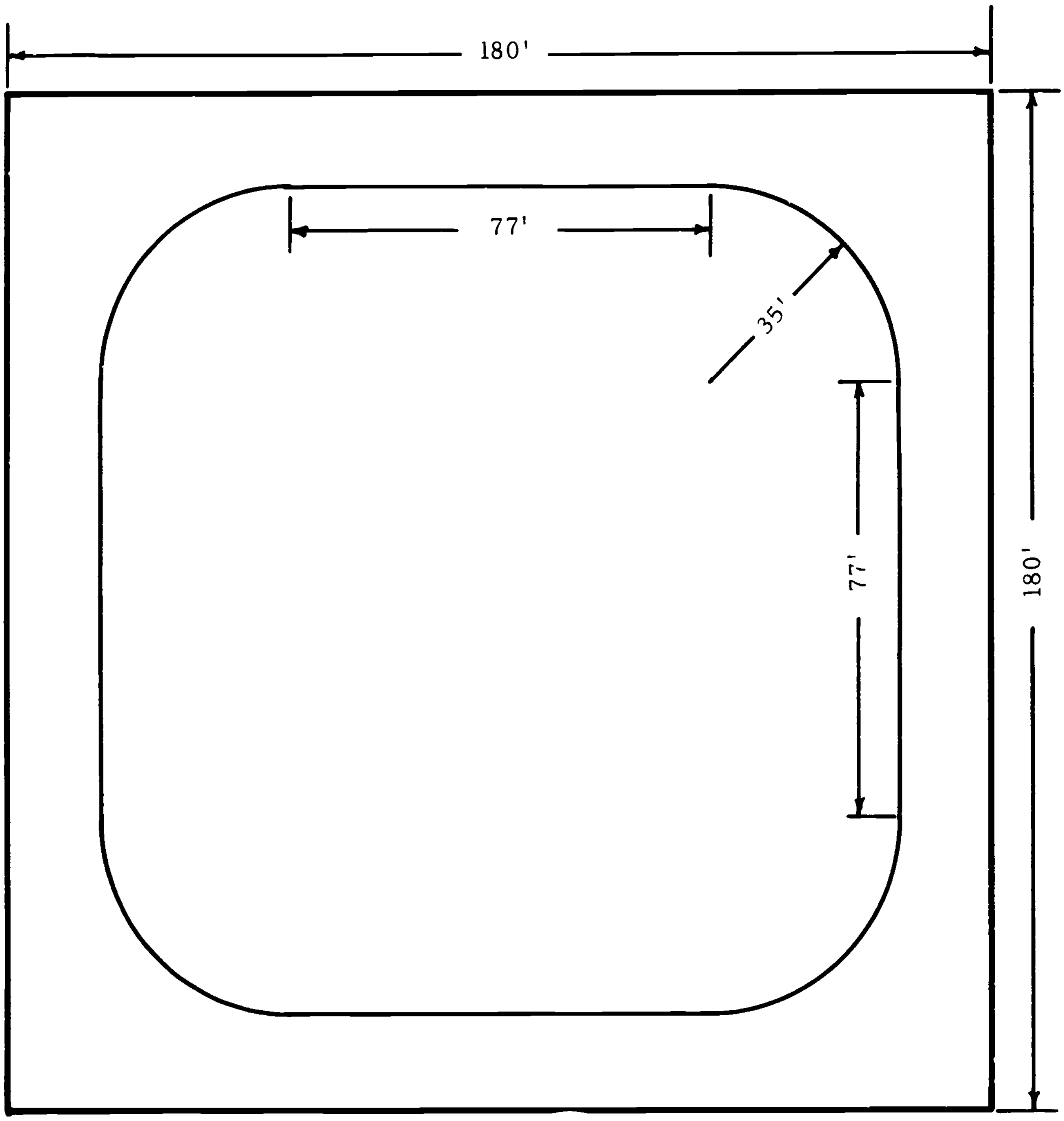


FIGURE 23. One-Tenth of a Mile Track, Five Lanes.

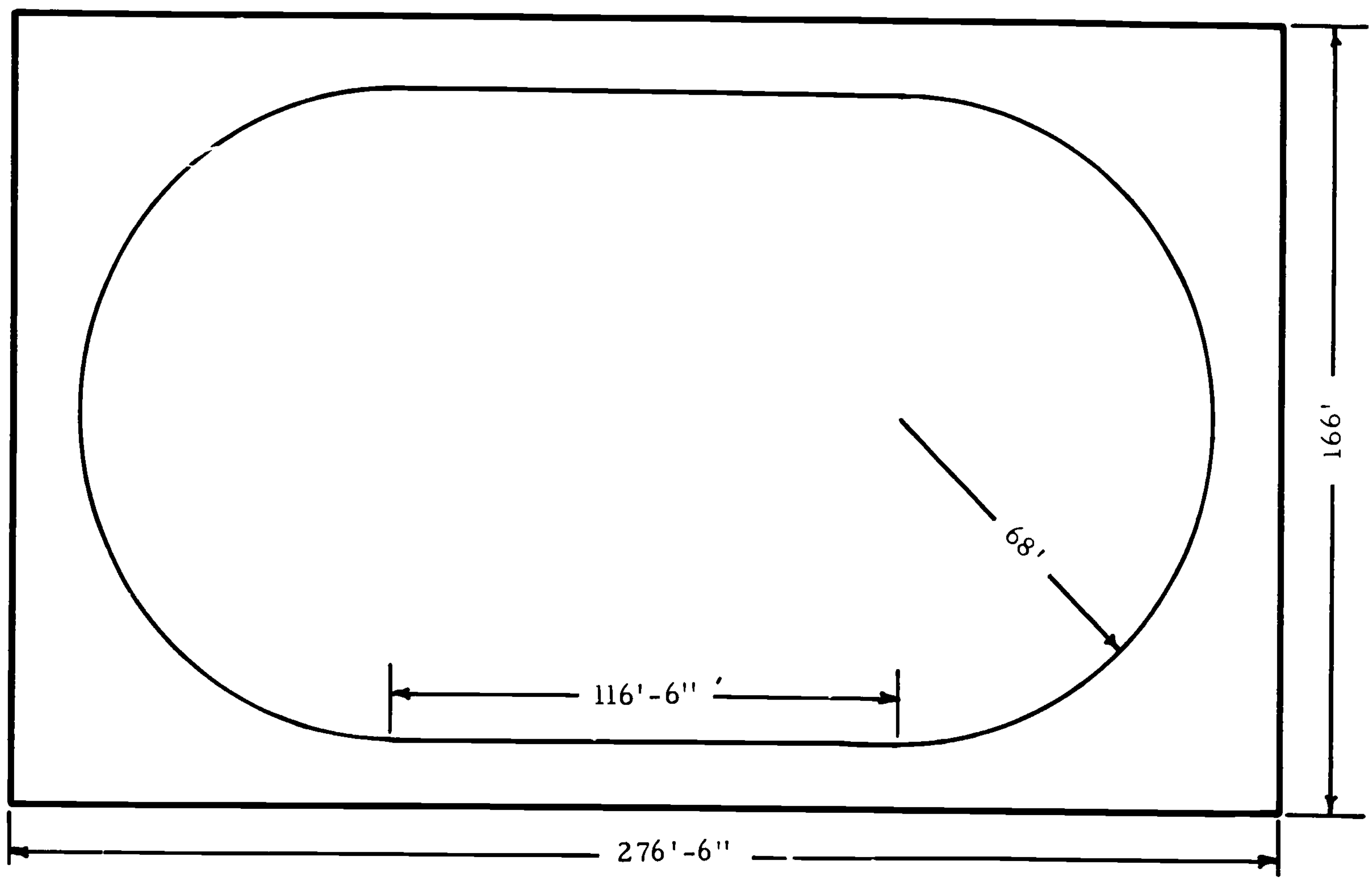


FIGURE 24. One-Eighth of a Mile Track.

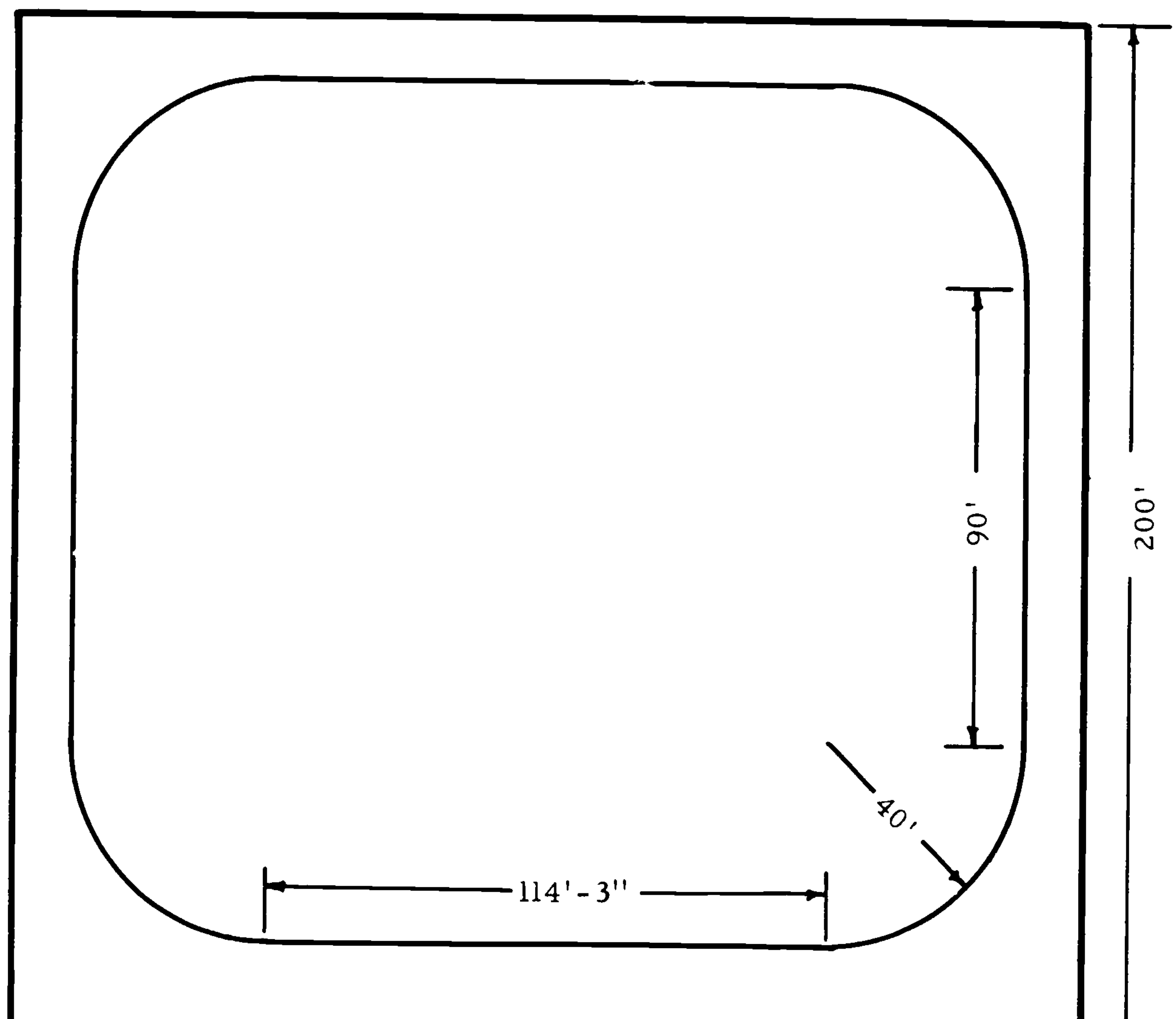


FIGURE 25. One-Eighth of a Mile Track.

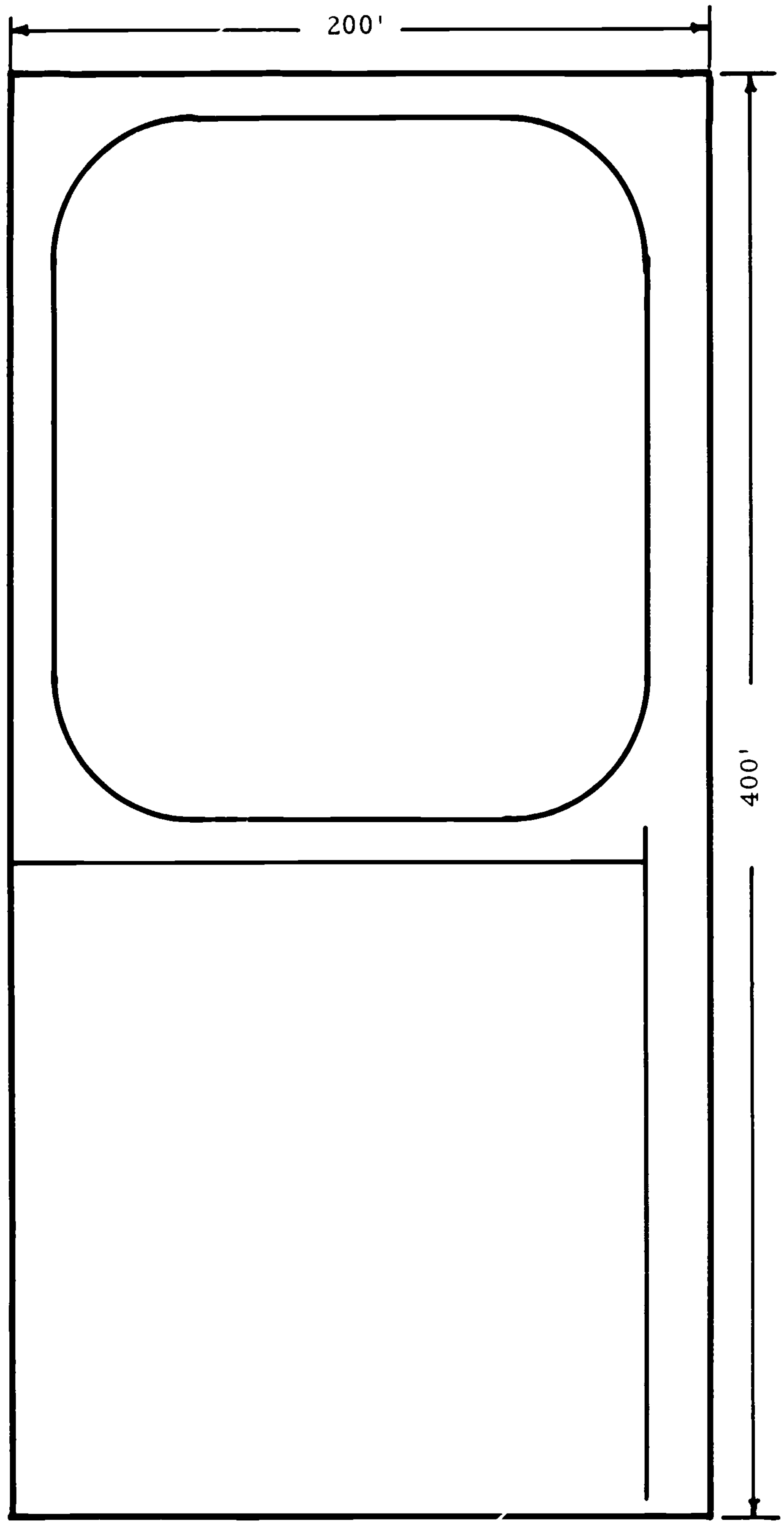


FIGURE 26. One-Eighth of a Mile Track Plus Football Practice Area.

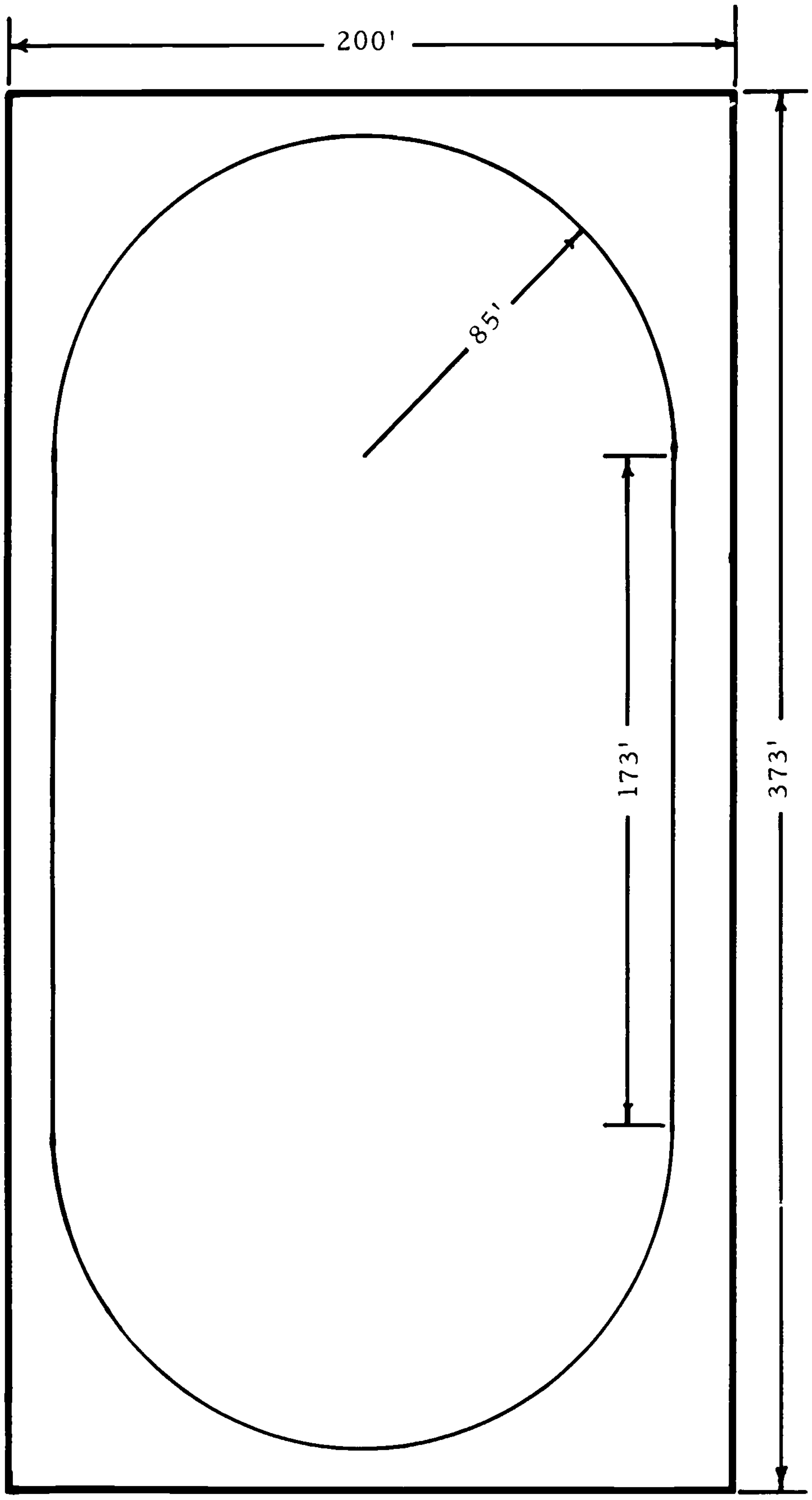


FIGURE 27. One-Sixth of a Mile Track.

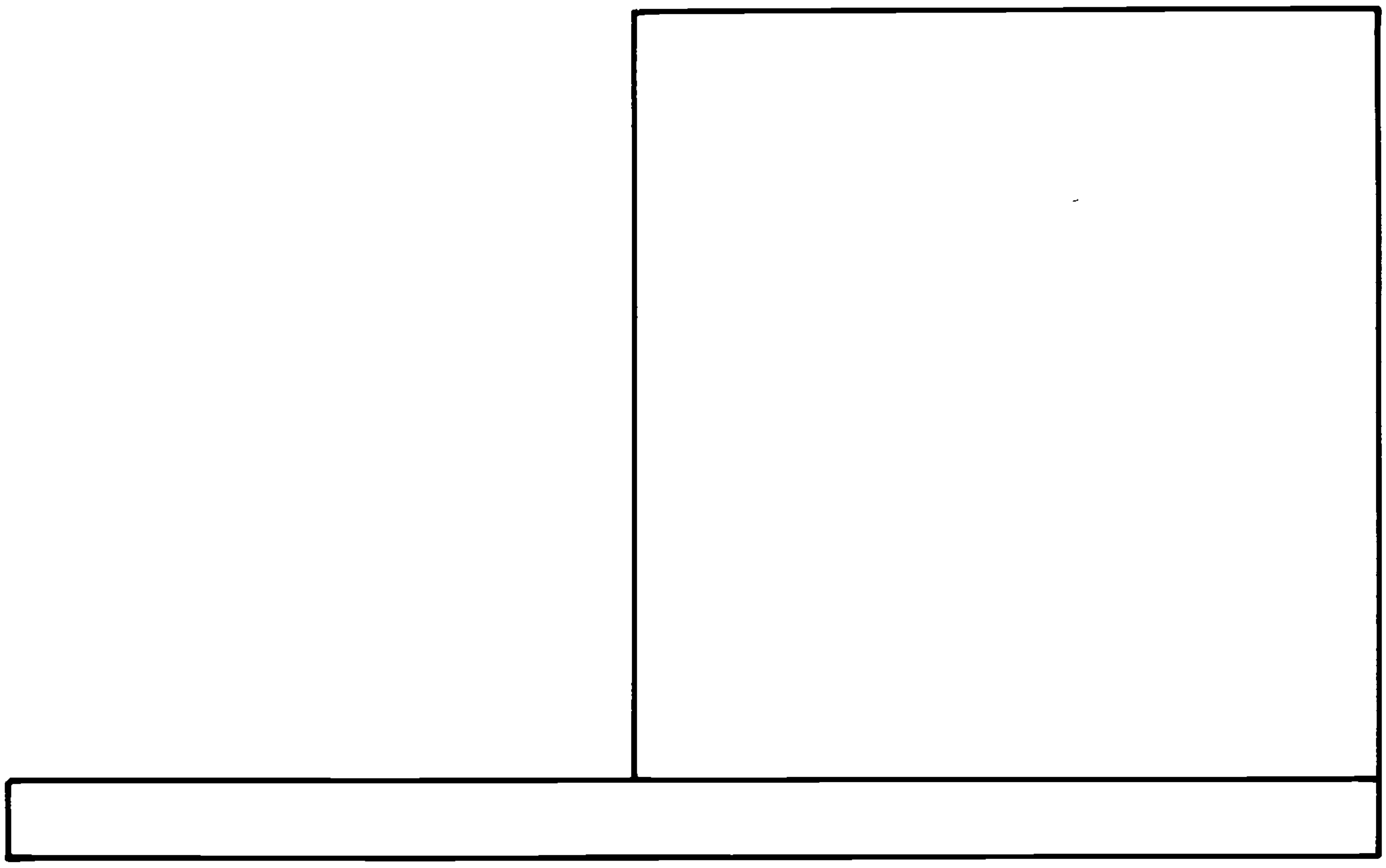


FIGURE 28. Low Cost Design for Long Straightaway.

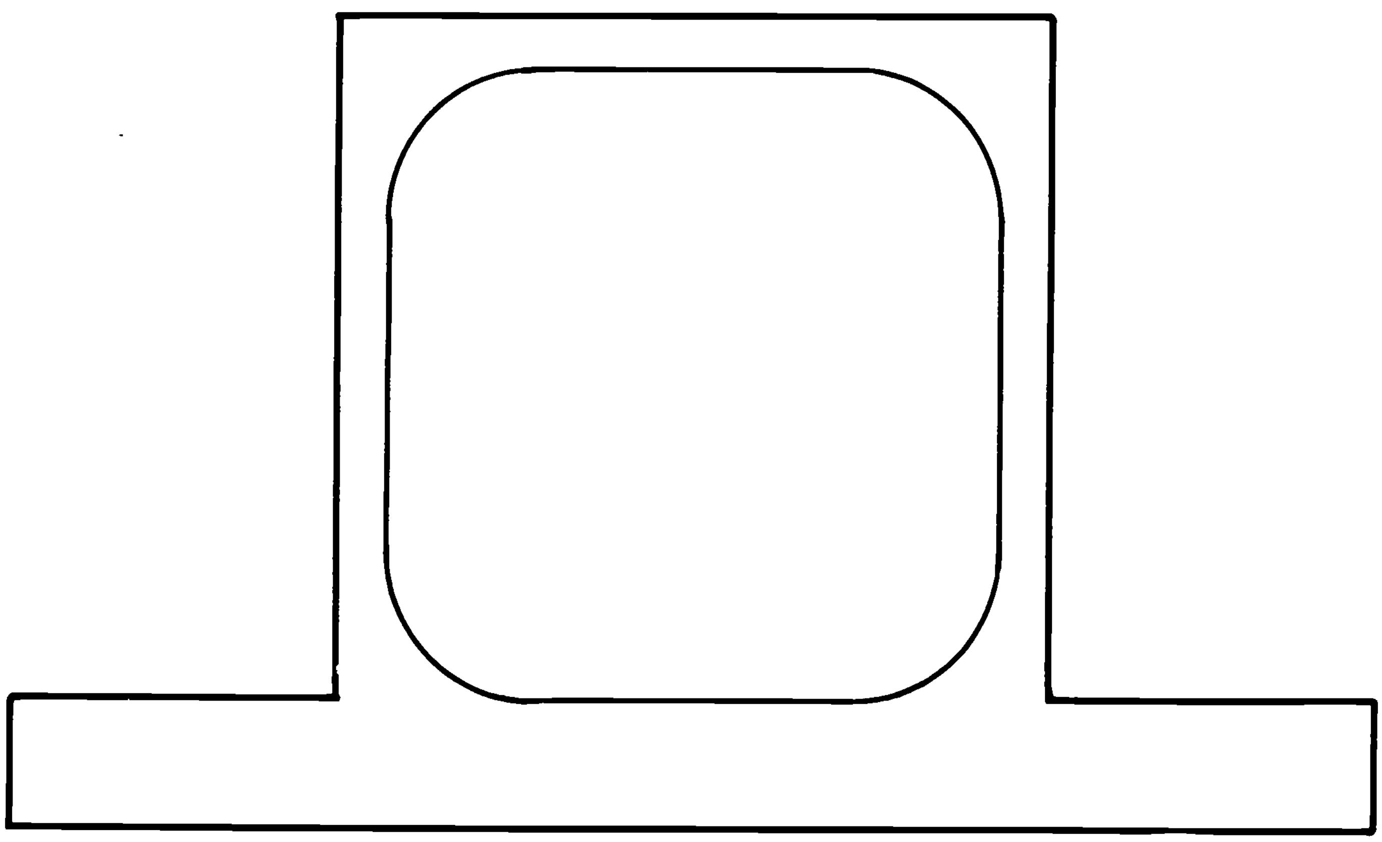


FIGURE 29. Low Cost Design for Long Straightaway.

PLATE 3. Physical Education Building and Field House, Purdue University. Courtesy of Purdue University. This represents an excellent relationship between the physical education building and the field house. Note the continuation of the architectural design in the field house.

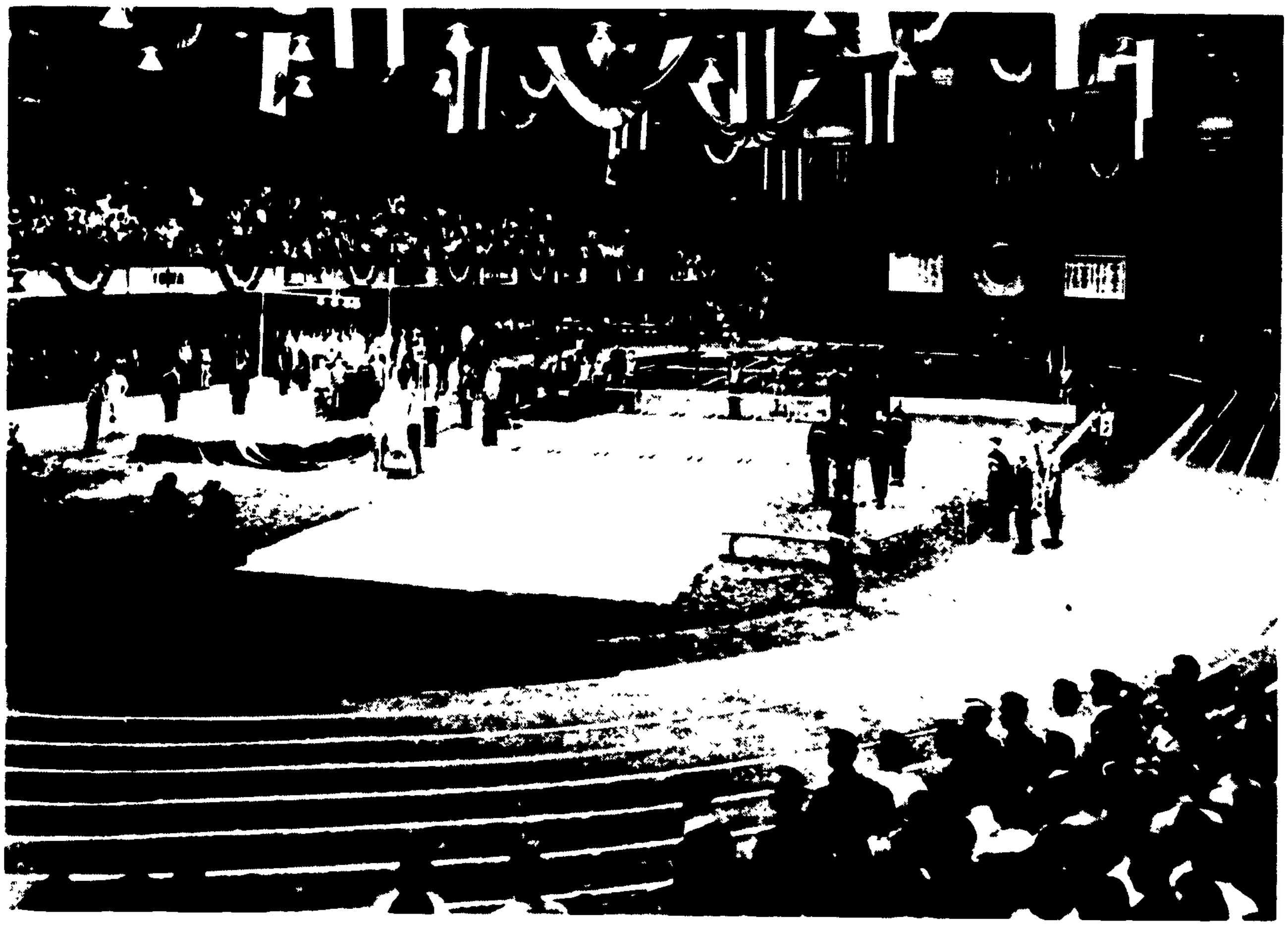


PLATE 4. Indoor Track Meet, Purdue University. Courtesy of Purdue University. These spectators have a fine view of this meet. However, it would not be necessary for every institution to provide exhibition facilities on earth or cinders as most meets are held on board tracks.

Omaha. The possibilities of providing field house facilities under large stadia might be worthwhile.

Designing for Flexibility

The functional utility of the field house will depend largely upon the flexibility of the equipment and facilities within the arena. Those provisions on which flexibility will depend most are seating, temporary floors and stages, net and partitions systems, and teaching stations.

Spectator Accommodations

As previously mentioned, there is considerable objection to providing extensive spectator accommodations for athletic exhibitions in the field house. Persons from the University of Pittsburgh, Butler University, and several other institutions indicated that when knock-down bleachers were in place for basketball spectator accommodations, the track and most of the arena could not be used for the normal field house activities. Also, it was too expensive an operation to move them before the end of basketball season. It seems unjustifiable to build an expensive field house to care for a program of outdoor activities during periods of inclement weather, and then be unable to use it for its true function during the major period of bad weather.

Notwithstanding the arguments advanced against spectators in the field house, seating provisions will be demanded in the planning of some of these structures, so the topic of seating cannot be ignored. The number of spectators for which accommodations will be provided will depend on the size of the student body of the institution, the population of the local community, the extent of past attendance, and the provisions for future needs. The program specialist will be responsible for providing the necessary information to the designers.

Permanent seats, whether in balconies or on the main floor, are expensive and waste space that can be utilized for activities of the program of physical education and recreation. Knock-down bleachers require expensive and time consuming operations to be set up and taken down. For some seating arrangements, however, they are the only accommodations that could be provided. Unfortunately, they not only take up their own space, but they also interfere with the use of nearby areas. Neither permanent seating nor knock-down bleachers are desirable in the field house unless unlimited funds make the luxury of permanent seating possible. Every consideration should be given to other types of seating.

The types of seating providing the most flexibility are rolling or telescoping bleachers, movable rolling bleachers, and folding bleachers. This type seating can be used in balconies, on hard surfaced or wood surfaced areas in the main arena, or on the "dirt" area of the arena.

The field houses of the University of Omaha and the University of Wyoming have stands that roll on steel U channel beams laid on the "dirt" arena which can be removed after the stands are rolled back. Both of these installations were made by the Horn Brothers Company of Fort Dodge, Iowa; the only known company to make such "dirt" arena installations at the time. (See Plates 5, 6 and 7.)

Specifications and space requirements for this type bleacher can be obtained from any of the commercial firms supplying such equipment. Each company has certain variations in the stands they supply, and the merits of each should be studied for each specific installation. Aisles can be built into the stands without hindering their operation. Some

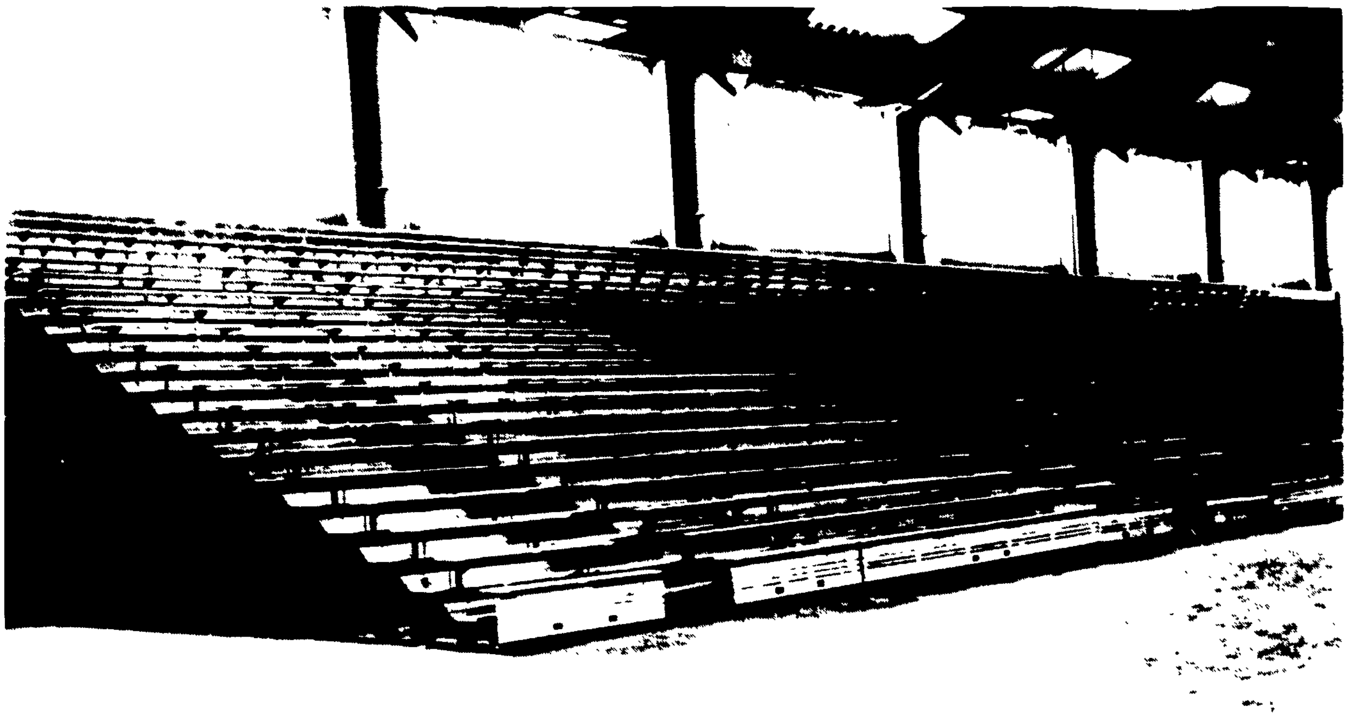


PLATE 5. Folding Seats on Arena, University of Omaha. Courtesy of Horn Brothers Company, Fort Dodge, Iowa. These bleachers can be rolled back to the wall after each contest allowing the track to be used.

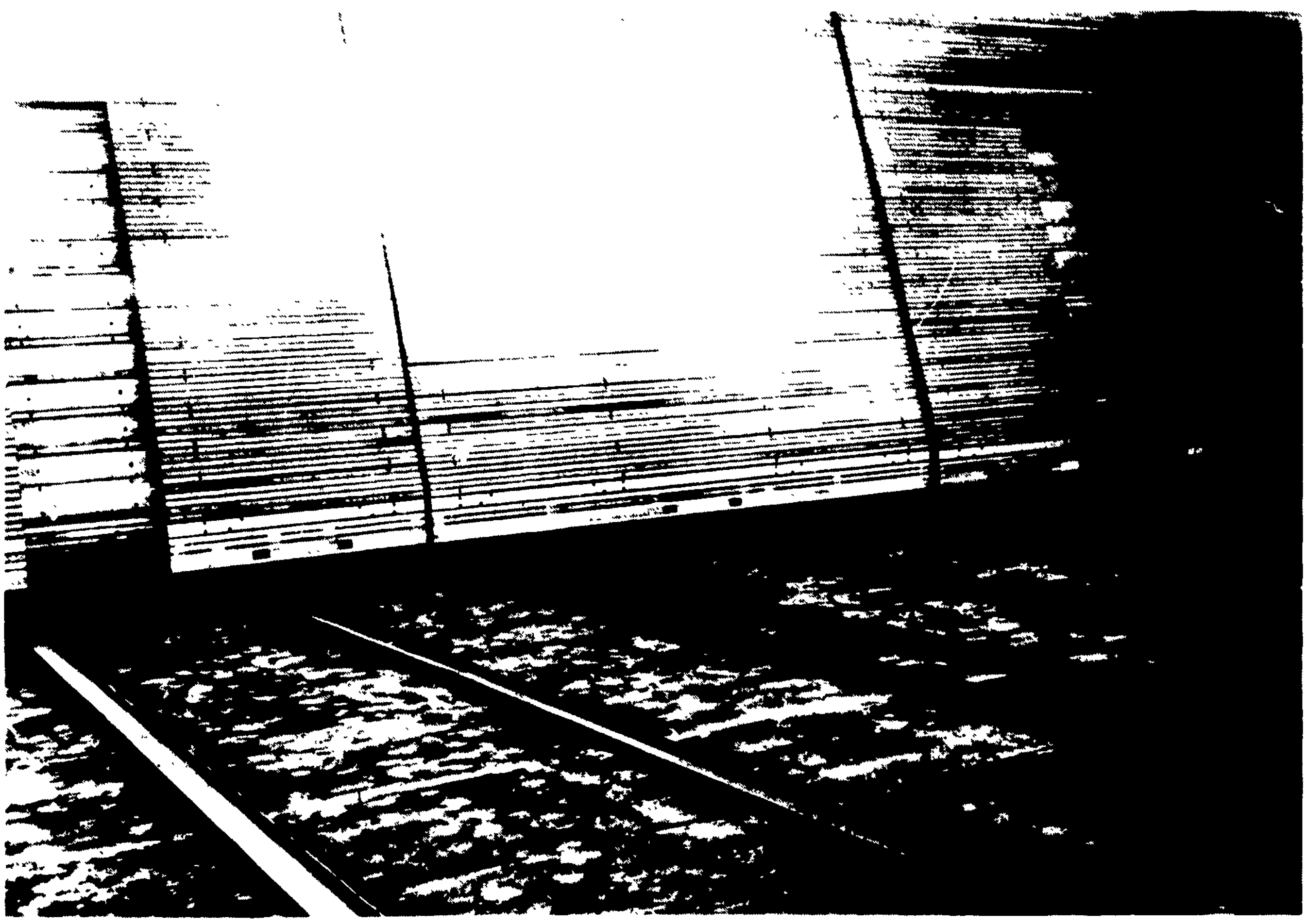


PLATE 6. Folding Seats on Arena, University of Omaha. Courtesy of Horn Brothers Company, Fort Dodge, Iowa. After the bleachers have been rolled back to the wall, the channel beams can be picked up on dollies and put in storage nearby.

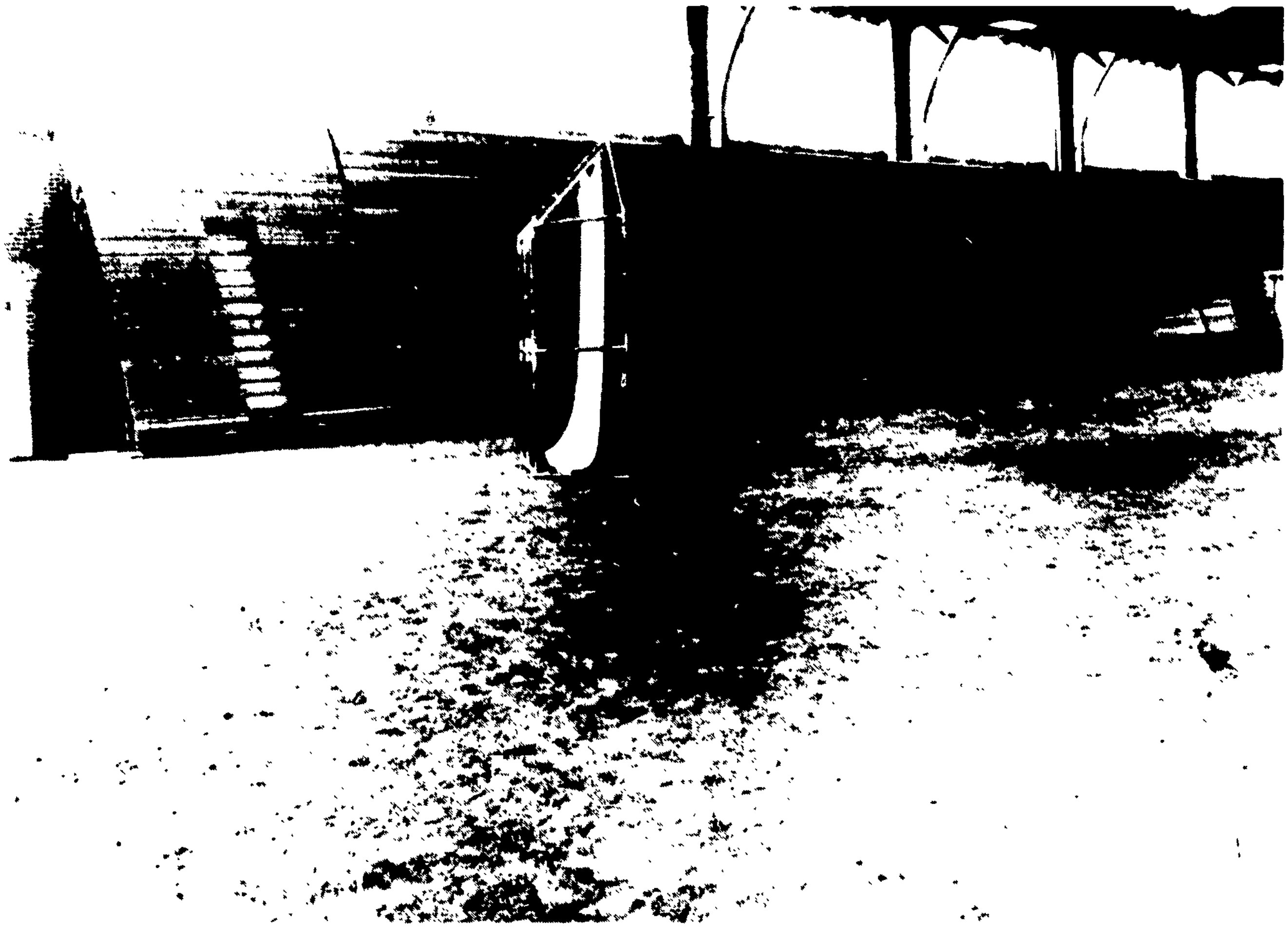


PLATE 7. Folding Seats on Arena, University of Omaha. Courtesy of Horn Brothers Company, Fort Dodge, Iowa. The seats have been rolled back and channel beams removed.

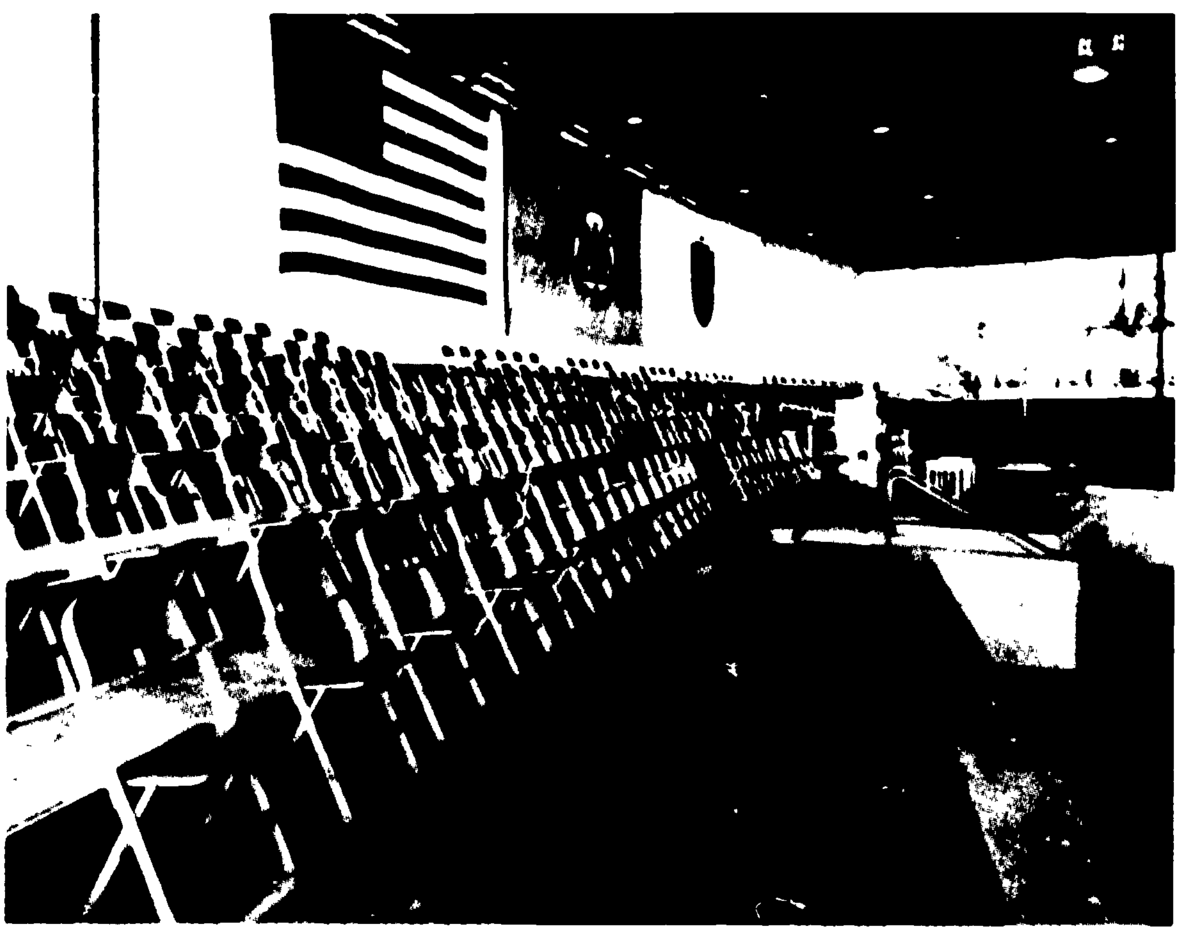


PLATE 8. Portable Stage, Massachusetts Institute of Technology. Courtesy of DiNatale Floors, Inc., Boston, Massachusetts. The stage is arranged for commencement.

building codes require such aisles. Also, end rails can be provided which can be removed and stored inside the folded stands.

Where rolling or folding stands are provided in balconies, the space thus released can be used for various physical education activities. In some cases it would be possible to provide a concrete area large enough to practice tennis or other court games. Also, the surface could be provided with a wood floor and used for auxiliary basketball courts. Smaller stands would provide areas for activities requiring less space. Partitions, such as ones currently used to partition gymnasiums, could be used between the balcony and the arena when the stands were not in use. The balconies preferably should not have any supports which interfere with the vision of the spectators viewing the arena.

The most convenient plan for spectator arrangement is probably represented by a continuous line of seats from the top of the balcony to the first row of seats on the main floor. The space under the balcony should be utilized for storage, toilets and showers, dressing rooms, concession booths, offices, or activity areas.

Although permanent seating is not recommended in the field house, it will undoubtedly be provided in some cases. The minimum requirements for permanent seating, and also a common allowance for rolling bleachers, call for row spacing of at least 22 inches back to back, a rise not less than eight inches, and a seat to floorboard height of not less than 17 inches. For more comfortable sitting and viewing, greater dimensions are desirable. Where sufficient room is available, a back to back spacing up to 30 inches per row can be utilized. A rise up to 17 inches will enhance viewing comfort. These latter dimensions are used for Gill Coliseum of Oregon State College in Corvallis, Oregon. A lineal bench allowance of 18 inches for each spectator is standard. For chair seating, 20 inches for each spectator is a common allowance. The extent of funds and the architectural dimensions, as well as seating demands, should be considered in determining the space to be allotted for seating.

Chair seating is the most comfortable and also the most expensive. Such seating is desirable if funds are available. However, in most situations wood plank benches will be adequate. The best lumber for seating purposes will have a vertical grain. It should be smooth and the corners should be rounded. It should be finished with a wood sealer of some type. A plank 10 inches wide makes an excellent bench. The seat, whether chair or plank, should be fastened to the face of the riser rather than to the floor of the row. This contributes to ease of cleaning, and eliminates unnecessary framework that might interfere with the feet of spectators. Concrete, although it will perform the function of seating, is not desirable because of its discomfort. Concrete for the riser structure, however, is desirable because it is durable, is not slippery, and it is easy to clean.

In solving the problem of spectator accommodations in the field house, an attempt should be made to add to the flexibility of the structure rather than to restrict it.

Temporary Floors and Stages

Temporary floors in the field house arena, as with seating, present problems of flexibility and maintenance. A portable basketball floor providing one competitive court should be approximately 72 feet wide and 112 feet long. Maple is the most desirable flooring material. Sections four feet by eight feet are desirable for moving and storage. Each section will weigh approximately 150 pounds. According to advertising literature, it will take twelve men approximately three and one-half hours to assemble the court in the field house arena. To store such a floor, each row should be stacked on a separate dolly. The space required for storage is about 400 square feet in area and high enough for men to walk into the room.

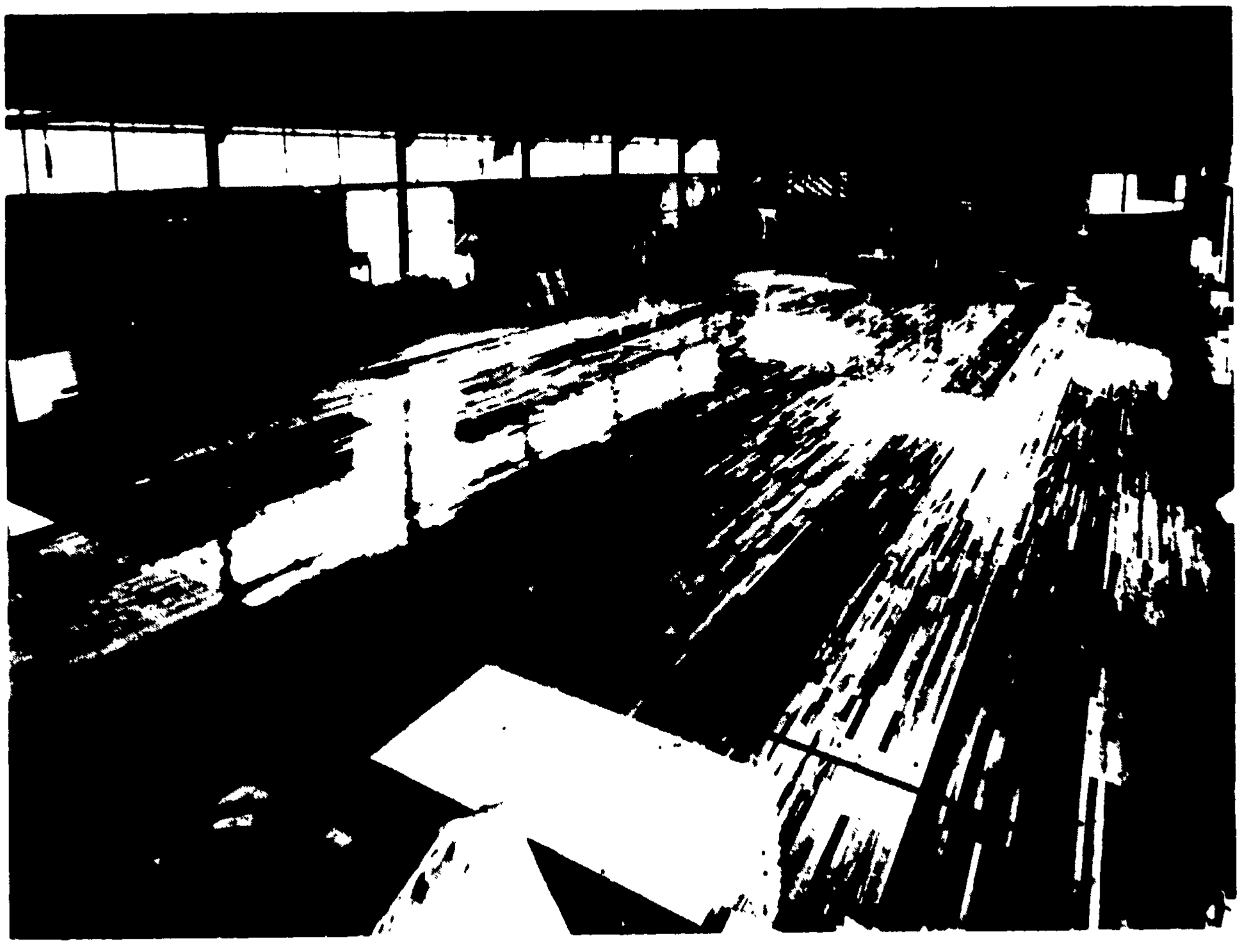


PLATE 9. Portable Basketball Floor at Factory. Courtesy of DiNatale Floors, Inc., Boston, Massachusetts. A portable basketball floor installed in a field house may cost between $10,000 and $20,000.

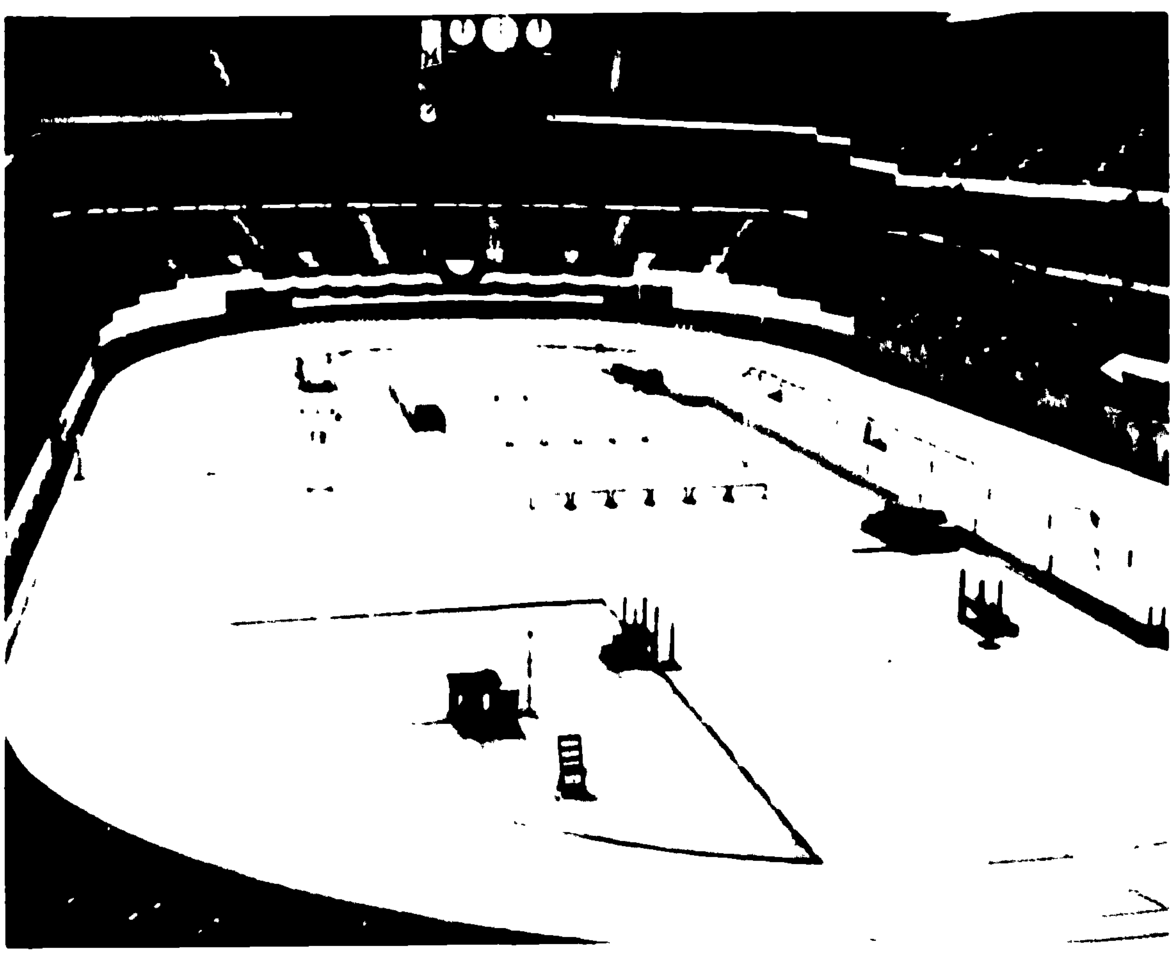


PLATE 10. Portable Track in the Boston Garden. Courtesy of DiNatale Floors, Inc., Boston, Massachusetts. Most of the large indoor track meets are held on board tracks. Note four-way clock.

When a floor is set up on a "dirt" surface, a raised sill framework is required. The supports fc r this framework should rest on concrete piers buried 6 to 12 inches below the arena s rface.

A survey of field house operations indicates that some institutions leave their portable floor perma iently in place to reduce operating costs.

Temporary stages are less of a problem because they are used only occasionally. Under such conditions, either rolling or knock-down stages are adequate. If the stage is to be used often, special consideration should be given to the ease of the assembly operation. (See Plates 8 and 11.)

Nets and Partition Systems, and Teaching Stations

Nets are essential to the optimum utilization of the field house arena for physical education activities. A full infield net is desirable for baseball with one or two batting cages 18 by 70 feet. A net approximately three feet high is often placed around the basketball floor to prevent balls from rolling off. Drop nets can be used for tennis backstops as well as for practicing the discus throw. Golf cages 20 feet square, or smaller sizes as provided by manufacturers, can be installed. These may be canvas backed. It should be possible to raise and lower, or to move nets in only a few minutes. Nets used most often can be attached to mechanical winches which can raise nets in a matter of seconds.

Canvas is an unpopular partitioning material as it is difficult to handle and the canvas partitions are not generally as desirable as net partitions. Its only real advantage is to isolate certain areas or stations from the view of other groups, thereby reducing distracting influences.

It would be possible to divide the arena with various types of solid partitions such as are now used in gymnasiums, although generally this would incur an unnecessary expense. These partitions, however, can be used advantageously to partition balcony activity areas from the main arena.

Teaching stations in the main arena are provided by the running track, field events area, baseball infield, batting cages, golf cages, and perhaps an additional area for football and other field games. If a portable basketball floor is provided in the arena, it will provide one or two more teaching stations. Concrete or clay tennis courts can also be provided in the arena. The program specialist must be able to provide information concerning the number of students to be accommodated in the various teaching stations. The number of teaching stations will be determined by the needs of all students and others who will use the facility. As has been indicated; all types of teaching stations can be provided in related units designed in the over-all field house building.

Floor Surface

The "dirt" floor surface is the unique provision in the field house. It is evident that the success of the field house will depend greatly upon the success of the floor surface which must be soft enough to allow a player to fall without bruising or getting abrasions, yet must be durable enough to stand up to several years use without needing fresh materials. The surface must be so built up that quick drainage is permitted.

The field house is a particular problem because of the variant requirements of the surface for baseball infield and football scrimmage activities. Where the same area is used for both activities, some compromise will have to be worked out which will slightly favor one or the other of the two games. In an arena large enough to provide separate

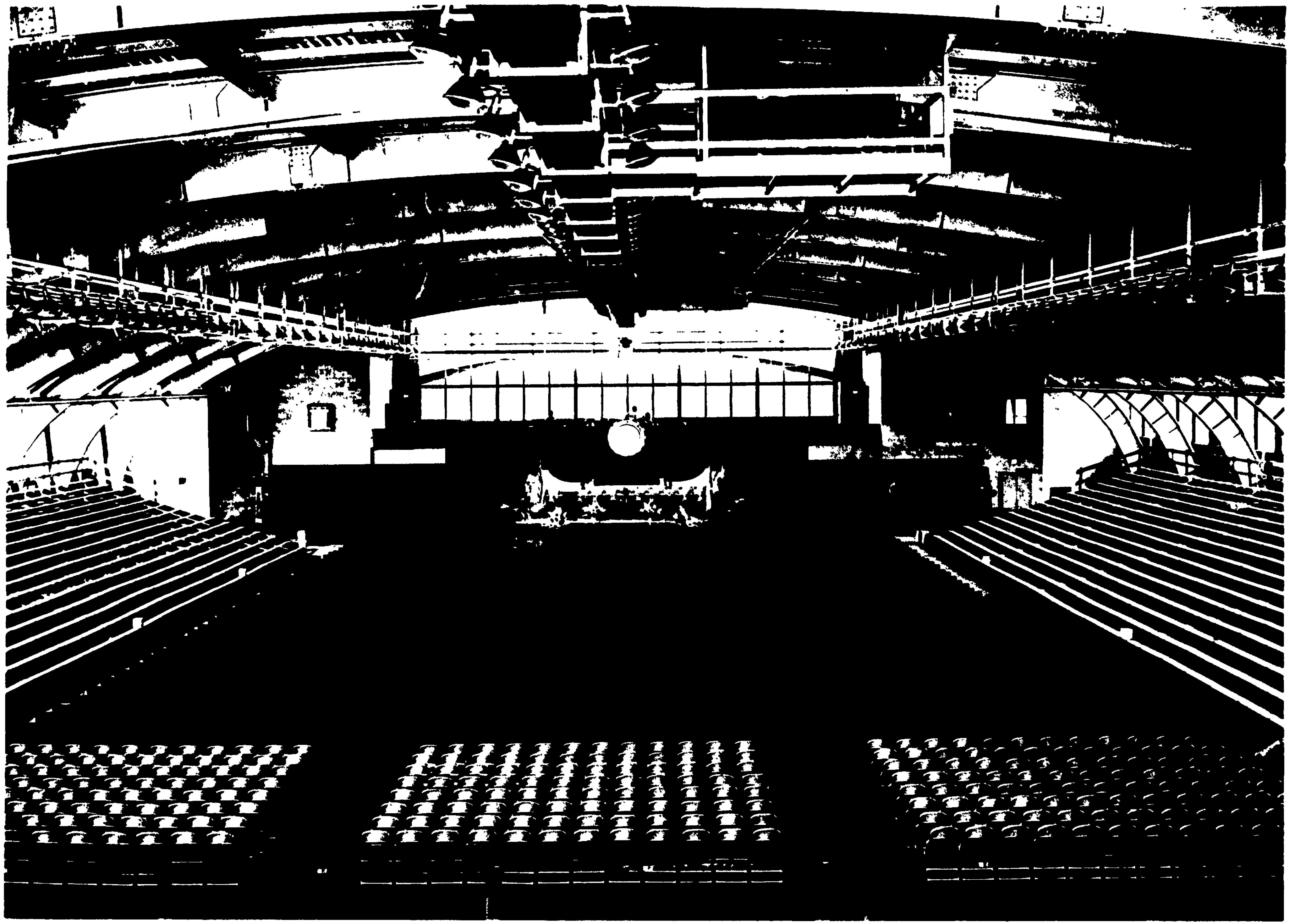


PLATE 11. Field House Arranged for University Function, University of Connecticut. Courtesy of University of Connecticut, Storrs, Connecticut. Note balcony at end for band or orchestra.

stations for these activities, a portion of the floor can be provided with the firmness necessary for baseball, and another part can be made resilient enough for football activities. Such an arrangement would be ideal. The baseball surface should have a high clay content with not more than thirty percent sand or loam mixed in. The football surface will use the same combination but with peat, sand, or shavings mixed in. Additional resilient material will have to be provided each year. The survey indicated that several midwestern institutions were fortunate enough to get excellent results from natural soil with a high clay content. The percentage of clay and sand or loam found in most existing field houses runs from 60-40 to 70-30. Precise proportions are difficult to quote because of the range of impurities, often beneficial, to be found in clay and loam.

In construction of a "dirt" floor, the arena should be excavated to a depth of 18 to 24 inches. The bottom of the bed for the top surfacing should be at least 12 inches of crushed rock or fairly course gravel or cinders. There should be an intermediate layer of small rock or gravel of about three inches. Topping this will be another three inch layer, this time of coarse sand. This is the final bed for the playing surface. The specifications for the preparation of this top dressing for one field house required that the materials be machine mixed. This will assure uniformity of traction for the surface. Peat is often used with this upper stratum mixture to provide resilience. Such material would be a part of the second set of percentage figures noted above.

Sand and clay can be cleaned somewhat before mixing to help in controlling dust in the arena.

About one-fourth of the top layer of an indoor cinder track should be clay mixed with the fine cinders. This provides the necessary firmness and helps to keep down the dust by holding the cinder bed compact.

Careful planning for the field house surface will result in increased quality of performance in the various activities which will be carried on in the arena.

Traffic Control

Traffic circulation in the field house should be designed to provide for maximum safety and ease of movement about the building.

The entrance to the field house will depend upon the location of the field house in relation to outdoor traffic lanes and parking space. If the field house is connected to other units, separate entrances should be provided in addition to those used for the connected unit. Lockers, dressing rooms, and toilets should be accessible to the arena, although these will often be provided in related structures. Storage rooms should be provided near the activity areas. They should be on the same level, and they should have doors large enough to handle dollies and various equipment.

The traffic lanes should be such that spectators do not have to cross over the "dirt" surface of the arena. This principle cannot be followed in those structures providing bleachers on the arena surface. In such instances, the traffic lanes should be direct routes to the exits of the building.

The lobby of the field house should be attractive and well lighted. It should play an important part in traffic circulation, and should be large enough to accommodate the sale and exchange of tickets when the building is used as a spectator facility. Several institutions report that the lobbies of their field houses are too small, considering the large number of spectators accommodated. Obviously, there is no need for large lobbies if there are no spectator facilities.

Public conveniences such as cloak rooms, toilets and lavatories, drinking fountains, and public telephones should be accessible to the lobby. A building directory and a lighted bulletin board at a standing reading level are desirable. These provisions should not interfere with the main traffic movement.

The entrance to the lobby should have at least two sets of double doors equipped with anti-panic hardware, and more if required by the fire exits code. The doors should be light, strong, and durable.

The lobby should lead to corridors without obstructions of any nature. The corridors should be of sufficient number and size to permit the rapid circulation of traffic within the building.

The corridor walls preferably should be smooth and of attractive color. Ceramic finished building tile is excellent and reasonably economical from the long point of view, as the need for frequent painting is eliminated. Floors should provide sure footing, yet be attractive and durable. Another consideration for corridor floors is the ease with which they can be cleaned. Light colors are desirable for the ceiling and upper wall finishes. Indirect or diffused artificial illumination should be provided in corridors. The corridors should be designed for natural light when natural lighting is provided in the field house. Corridors should be free of obstructions and none should lead to a dead end.

The number of exits and entrances will be determined by the use of the field house. The corridors, ramps, and stairways should be designed to facilitate the seating of spectators. The traffic control plan and exits should provide for the building to be emptied in from four to six minutes.

Doors should be arranged to open outward. All exits should be provided with anti-panic hardware. It should be possible to hook the doors open after contests and meetings when the crowds are leaving.

Fenestration

Windows are used to admit light and also to provide ventilation. However, ventilation is becoming dependent on mechanical provisions in the more recently constructed field houses. The arch type construction, currently the most popular for field houses, permits large expanses of windows if they are desired. The field houses at the University of Pittsburgh and the University of Minnesota do not provide natural lighting for any of the field house activities. Minnesota has a few side windows so that there is sufficient light to find one's way and to work in the building. With the omission of windows these institutions have eliminated problems of condensation and glare. This is a reasonable solution in certain areas because during periods of bad weather, artificial lighting will be required in addition to natural lighting anyway.

Windows can be placed high up in the end or side walls of the arena. They should, if possible, be limited to north and east walls. Directional glass block can be used to advantage in some cases. Light from windows preferably should be distributed evenly over the entire floor. When windows are located in the line of sight behind goal areas such as for basketball, it would be possible to use louvres or colored venetial blinds of large proportions to provide a better background. Such an arrangement could give the appearance of providing a solid background, yet light could be allowed to enter by being directed upwards or downwards. Glass with a low transmission quality also might be used to reduce sky glare.

All glass windows subject to breakage should be guarded by wire mesh screens. These screens should be so constructed that they do not interfere with the opening or closing of the windows.

Some skylights used in early field houses presented the problem of condensation collecting and dripping into the arena. Even when double panes of glass were used in one installation, the condensation problem was only reduced and not eliminated. Saw-tooth skylights have been used with good results, but even they have not always eliminated problems of condensation and leakage. The best antidote for the condensation problem is the elimination of skylights, careful roof construction, provision of water-proof insulation, and designing the heating system to keep wall and ceiling at approximately the same temperature as the rest of the arena. When skylights are provided, they should be directed north or east for low-glare light.

Artificial Lighting

The quantity standards for the lighting of various athletic activities, as measured in terms of foot-candles, have risen sharply over the years. However, in recent times more attention has been placed on the quality factors of light such as improving brightness-balance, distribution, and reduction of glare. A review of the literature on field houses indicates that, until recently, neither the quantity nor the quality factors associated with illumination have been given appropriate consideration in the planning of field houses.

For the normal functions of the field house, at least 30 foot-candles of light is desirable. For the basketball program, 50 to 55 foot-candle of illumination should be provided over the court. Basketball coaches, through their association, have recommended 55 foot-candles. Luminaires of more than 1, 000 watts should be used with care to avoid excessive surface brightness.

The arena of the Lavino Field House of the Lawrenceville School is lighted with fluorescent tubing. Union College of Schenectady, New York uses a new type of fluorescent set-up for their field house. Fluorescent lamps have a lower surface brightness than incandescent lamps, and also it is more economical to operate the fluorescent lighting system which requires less electric energy.

Provisions for maintenance of the lighting should be planned in the original installations. Failure to provide such arrangement was indicated to be a recurring error in the survey results. These provisions can be in the form of catwalks, platforms, or mechanical lowering devices, or specially designed ladders.

All light fixtures within the range of the activity area should be provided with guards to prevent breakage.

Light switches for the arena should be centrally located in a safe, recessed switch-box equipped with a tamper-proof lock. The operator should be able to see the lights from the switch-box.

Outdoor floodlights may be placed high on the sidewalls of the building directed toward all exits and entrances, and towards the parking area. In some cases, the floodlights can be installed to advantage on strategically located standards or poles.

Lighting is a highly technical field for which illumination experts and architects should do the designing. The program specialist will interpret needs of particular activities and areas for light intensities.

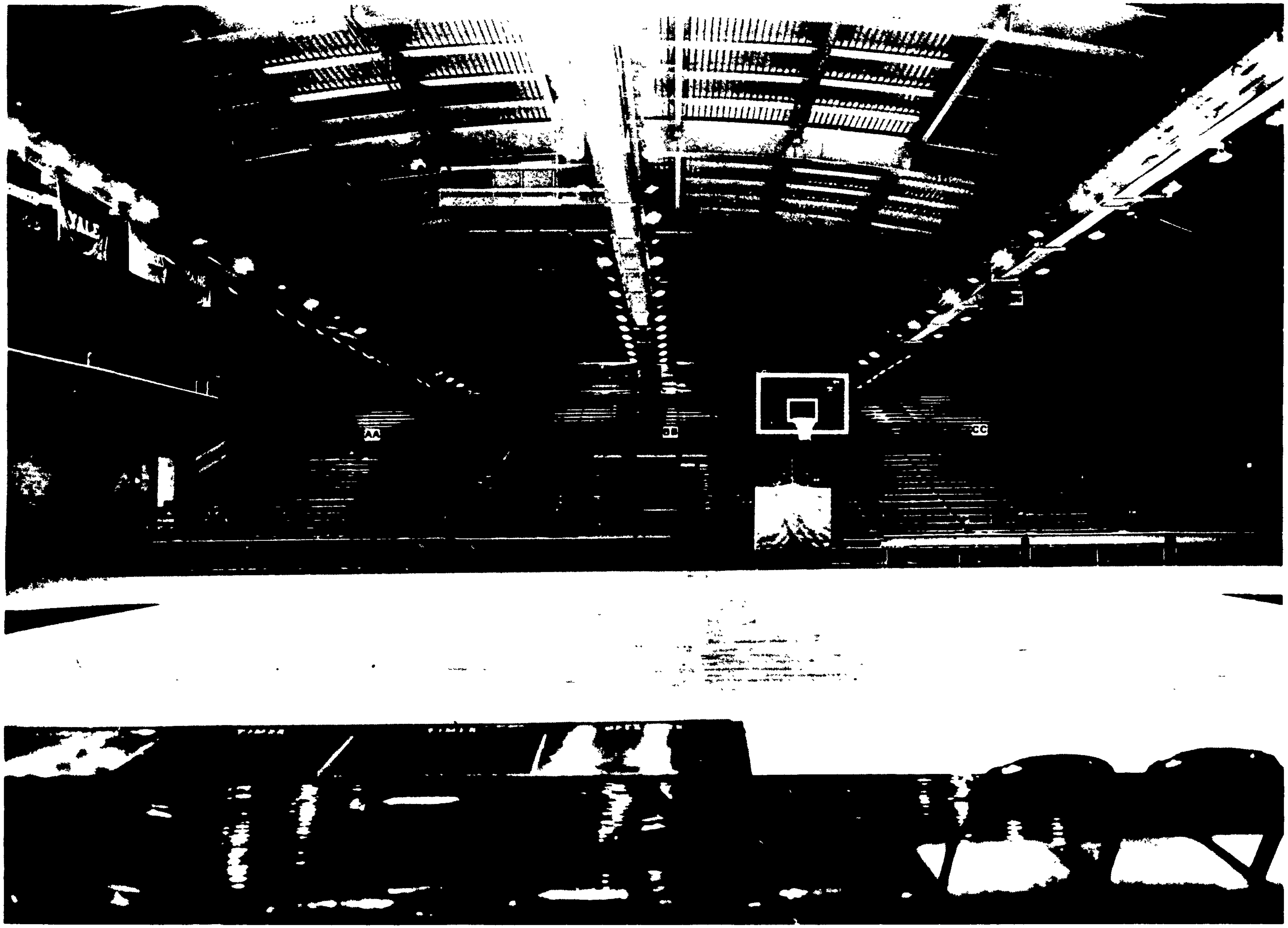


PLATE 12. Field House Arranged for Basketball, University of Connecticut. Courtesy of University of Connecticut, Storrs, Conn. Note double rows of lights and catwalks for servicing; also rollaway backboard.

Heating and Ventilation

Zoned heating is essential in the field house arena if uniform heat is to be provided. The temperature should be maintained between 60 and 65 degrees Fahrenheit. If it is too warm in the arena, the participants will tend to become uncomfortable, and also the higher temperatures will result in more condensation on walls and ceilings. Furthermore, there is the additional cost for fuel.

The design of the heating system will depend on an experience record of weather in the locality, the immediate needs of the structure, and future capacity requirements. The University of Minnesota gave special consideration in their heating provisions to bring air near the arena surface into circulation, as they found a tendency for cold air to settle along the ground.

Heating units, pipes, and ducts preferably should be recessed in walls and between trusses. Units should not be placed where they can interfere with participants or spectators. Hot elements should be so located or provided with guards to protect persons from direct contact.

Mechanical ventilation, designed in relation to the heating system, is more desirable than natural ventilation. Former arguments against the noise of such equipment are no longer valid. Dust filters should be planned in relation to all recirculating equipment.

Air conditioning is desirable but expensive. Few institutions in the field house belt will be in critical need of air conditioning provisions.

Acoustical Treatment

Acoustical treatment is very desirable in the field house arena. Such acoustical material should be non-moisture absorbent, light in color, economical, and easy to apply. Tile is much more desirable than acoustical plaster in the field house. It might be possible to use a material that will perform the dual function of acoustical treatment and insulation.

Oregon State College completed a basketball arena in 1950 with seating for 11,000 spectators. The ceiling was treated with acoustical tile costing $41,000. The administrators of the institution consider the money well spent. It is possible to hear clearly in the highest part of the balcony.

The highly technical nature of acoustical treatment should be planned in the original design of the field house by the architect and acoustical engineer. The program specialist can aid the acoustical designers by providing information concerning the type and number of activities, the usual noises resulting from the activities, the number of participants, and the number of spectators, if any.

Insulation

In cold regions, insulation is necessary to control condensation as well as to help prevent heat loss. It is essential that the insulating material be non-moisture absorbent. In an attempt to alleviate a condensation and indoor rain problem, an insulating material was blown onto the interior roof of the field house at West Point. The material was of a type that would become saturated with water. At night it would often freeze and expand so that when the sun came out the next day the ice would melt, and water would almost pour onto the arena. Rather than replace the roof at the time, a canvas roof was hung over the portable basketball floor.

Communication

The building communication system will include many elements such as a fire alarm, sprinkler alarm, telephone system, electric clock system, public address system, radio and television system, and perhaps a scoreboard and timing clock arrangement.

One or more electric clocks should be provided in the arena, large enough and located in such positions that they can be seen from any part of the field house arena. A protective guard should be provided over each clock. The clocks should be connected to the central control clock of the institution.

Telephones should be included in the custodial offices, administrative and supervisory offices, and at the press box. Public phone booths should be provided near the main lobby.

Fire alarm and exit light provisions should conform to building codes and fire control regulations.

At least one electric scoreboard and time clock will have to be provided if basketball contests will be played in the arena. Two clocks and scoreboards, one at either end of the court, are preferable to one. A four-way clock and scoreboard can be hung directly over the center of the court. The four-way system is best for spectators, and two end clocks are best for participants. A four-way sound system can be combined with the central scoreboard or hung separately over the center of the court. The four-way speakers can be arranged so that any one, or any combination of the directional speakers can be connected.

The control wiring of the clocks and scoreboards should be permanently connected to the scoring table. This will enable the scoring device to be plugged in at the table rather than using the long lines run temporarily from the indicator units.

Press, Radio, and Television

Where the field house will be used as a spectator facility, the original design should include accommodations for press, radio, and television. A sound proof broadcasting booth can be provided that will be specially wired, lighted, and ventilated. It should be at the top level of the balcony and centered in relation to the playing court. It should permit an unrestricted view of the entire floor, and the front window should be at right angles to the line of vision to the center of the court. The press portion of the booth should provide a table large enough to take care of press equipment,including typewriters.

Telephones should be available at the press table, and special lighting should be provided after games when the main arena lights will be turned off.

Storage Space

Sufficient storage space accessible to the arena should be provided in or near the field house for the physical education and maintenance supplies and equipment used in the structure. Inadequate storage provisions are a common error in field house design. To help alleviate this problem, it is recommended that storage space be designed for all the specific needs that can be foreseen, and then an additional storage area equal to 25 per cent of the total size of planned storage should be added to take care of future developments.

Storage rooms, for the most part, should be designed to meet specific needs. Doors should be large, in many cases five or six feet wide. Floors should be flush with the corridor floors of the building. Lighting and ventilation should be provided. The use of dollies for large and heavy equipment will decrease the time and effort required for the storage operations.

Sanitary Facilities and Plumbing

The number of the various sanitary fixtures that will be required for the field house will vary with each situation depending on the location and the relationship of the field house to other existing facilities. The standards for sanitary fixtures for gymnasiums will not apply to the field house unless the field house is the physical education building.

Every field house will need hose connections in the arena for servicing the "dirt" surface. There should be a minimum of two hose bibs on opposite sides of the arena. Exterior water connections are also needed for cleaning and irrigation.

Drinking fountains should be located at strategic spots in or near the arena, in the lobby, and in the corridors. The fountains should be recessed and should not interfere with the normal flow of traffic. Water coolers are desirable.

Where toilets, lavatories, and locker-shower rooms are provided in the field house, the general standards for school or college should be maintained.

Self-flushing vomitories should be set along the inner walls of the arena accessible to persons wearing cleated shoes.

Fixtures should be non-corrosive. Hand operated liquid soap dispensers should be located at convenient levels. A central soap tank connected by pipes to the individual stations is more tamper-proof and easier to supply than individual containers. Mirrors, as with all other fixtures, should be securely fastened with as near tamper-proof hardware as is obtainable. Waste containers with swinging, automatically closing lids should be provided in toilet and dressing rooms.

Custodial Facilities

At least one commodious custodial supply room and one sink closet should be provided adjacent to the field house arena. The supplies room should be large enough to take care of the earth tilling equipment and a supply of the materials used in the arena. The sink closet should have a water supply and provide for the storage of cleaning equipment.

Other custodial facilities will depend on the extent of facilities other than the arena provided in conjunction with the field house building.

Careful consideration should be given to factors related to provisions and services in planning the field house. A large part of the functional utility of the structure will depend upon adequate planning of these facilities.

Common Errors in Design and Construction

To enhance the quality of planning, and profit from the experience of those who have built and operated field houses, the following list of errors, more or less common, should be given consideration continually during the processes of design and construction.

1. Building a field house too small for the activities that are desired. Most schools and colleges want the field house to accommodate full infield baseball practice.

2. Expecting an inadequate field house to provide adequate facilities for the total indoor program of physical education. While the field house can be designed to provide for a considerable portion of the indoor program, other gymnasium areas are almost essential. One college built such a small field house to house their total indoor program that it could not satisfactorily serve the needs of the program and the number of students at the college. It was finally converted into a gymnasium with a complete wooden floor as funds were not available to build a new gymnasium.

3. Failure to design and include other instructional-recreational, administrative, and service facilities in the over-all field house building. Any time a new facility is to be built, the needs of the total program should be given full consideration as it is usually more economical to construct contiguous buildings or to use some of the space of the new facility to be planned.

4. Designing and building a field house that has failed to provide for future needs. Indications are that a considerable number of field houses of the past were planned by people who failed to predict the future program trends with any accuracy.

5. Building a field house that is difficult to expand or change.

6. Designing the arena in such a manner that the portable facilities and equipment impair the program of physical education. Portable basketball floors and knock-down type bleachers require expensive and time consuming operations to set them up and take them down. None of the institutions surveyed set up the basketball floor for each game or series although several of them had intended to do this. It was found to be too expensive a process so the floor was either set up for the entire basketball season,or permanently.

7. Designing the field house to accommodate spectators in situations where other facilities would have served this purpose better.

8. Failure to provide for correctly designed spectator exits which will allow the building to be emptied in five minutes in case of emergency.

9. Failure to provide women's accommodations in the field house.

10. Designing the traffic control system in such a way that spectators have to cross or enter the "dirt" arena.

11. Failure to provide for drainage around the exterior of the building.

12. Failure to provide a large enough lobby or vestibule for adequate traffic control of spectators and participants.

13. Using bleachers of the knock-down type on the arena area which are too expensive to move daily to make way for the program of physical education (including athletics).

14. Providing permanent seating on the main floor or in balconies if additional teaching stations are needed, which could be provided in these areas by the use of rolling or folding bleachers.

15. Providing a "dirt" surfacing that is too hard or too soft for the activities to be carried on. Usually a compromise must be worked out between the surface demands of football scrimmage and baseball infield practice.

16. Failure to clean the clay, sand, cinders, or other material to be used on the floor to remove the dust-type dirt.

17. Attempting to build a home-made portable basketball floor without adequate plans or facilities. Also, certain types of floors have not been well received by basketball players, such as those which are unstable and those which allow too much variation in the bounce of the ball.

18. Failure to provide adequate net partitions for the various activity areas.

19. Designing net systems that are difficult and awkward to move. The most functional and flexible net systems should be such that nets can be moved or raised out of the way in a very few minutes.

20. Failure to provide adequate storage space, and failure to plan storage space for specific needs. The error seems to have been universal. It appears that the utility of many field houses has been unduly limited because the importance of storage space was slighted in favor of using available space for activity areas. While extending other indoor sports facilities is favored in the design of the field house, storage space is essential to the efficient operation of the basic functions of the field house and should be given prior consideration.

21. Failure to provide sufficient lighting for the activities to be carried on in the arena.

22. Providing lighting in the arena with a high glare factor.

23. Failure to plan for a simple, efficient, and economical system for the maintenance of the light fixtures. This is a common error.

24. Failure to provide sufficient convenience outlets for the electrical system.

25. Failure to provide high voltage outlets in the field house.

26. Providing inadequate service lines to accommodate increases in electrical load.

27. Failure to consider brightness-balance in painting or choosing material for the interior surfaces of the arena.

28. Having windows or skylights that have a high glare intensity for the participants in the building. Skylights should face north or east to reduce glare from natural lighting.

29. Designing windows along the lower portion of the end walls of the arena which face basketball goals or the goal lines of other activities and cause glare which interferes with the conduct of the activities.

30. Providing single pane skylights in cold areas which result in condensation collecting and dripping into the arena. The double pane glass with air space between, or glass

blocks, help to prevent condensation; however, many gymnasiums and field houses are being designed with no skylights.

31. Failure to plan adequately for the natural ventilation of the field house building during periods of warm weather.

32. Failure to provide zone heating for the arena and other areas in the field house. One college built its heating system at one end of the building without appropriate zone heating provisions. The result was that only one end of the building was warm enough, the heat was uneven, and hot water from the system was cooling off in the pipes carrying it to shower rooms at the far end of the building.

33. Failure to include filters in air circulation systems.

34. Failure to provide adequate exhaust outlets and fans. All elements of the heating system must be carefully planned if the system is to do its job well.

35. Failure to provide waterproof acoustical material for the field house.

36. Failure to have the acoustical designing done by a specialist.

37. Failure to provide water proof insulation for the ceiling of the arena. Insulation is important not only for heating economy, but also for the prevention of condensation which can collect and drip from the ceiling. Other factors involved in the condensation problem are inadequate heating, metal bolts or tie-bars extending from the outside of the roof to the inside, the use of too much water in arena maintenance, and improperly designed skylights.

38. Allowing pipe lines to run too close to the surface of the arena which might interfere with floor maintenance. It would be well to plan plumbing arrangements so that no pipes run under the arena proper.

39. Failure to provide sufficient rest room accommodations for the number of spectators who will attend athletic events or meetings in the field house.

40. Failure to provide large enough shower and locker facilities when these are designed in the field house.

41. Failure to provide an efficient and sufficient ticket procurement and taking systems.

42. Failure to provide telephone and telegraph communication from press facilities in the field house.

43. Failure to provide adequate press, radio, and television facilities in field houses where they may be needed.

44. Failure to provide an adequate and efficient sound system where spectators will be accommodated.

45. Allowing pipes, columns, or other hazardous obstructions to be placed in the arena.

46. Providing partial walls in the arena that might be a danger to participants in the activities of the field house.

47. Failure to provide adequate facilities for cleaning and maintaining the field house.

48. Failure to provide means for cleaning shoes before entering upon the wood courts after walking in the "dirt" arena.

49. Failure to provide adequate water outlets for the maintenance of the arena and other areas of the building.

50. Failure to provide a large enough entrance for large equipment to be hauled into the arena. In small field houses, a large doorway at the end of the track straightaway is an aid in the safe conduct of the dashes and certain other track activities. It should be noted, however, that one institution which had an entrance large enough for trucks to come into the arena by crossing the circular track found that the trucks were damaging the track to the extent that considerable maintenance work had to be done each time the entrance was so used.

Good planning, design, and construction will help avoid the errors listed above that have grown out of the experience of field house administrators. Along with good maintenance, which the next chapter will deal with, the field house should then do a superior job of fulfilling the objectives for which it was intended.

in the soil. Two men with hoses, one on each side of the arena, can do the job quickly. Daily rolling is not required unless the soil is quite badly worked up or unless a specific activity requires a more firm surface. Rolling will not always be necessary after baseball practice, but it might be after football practice. The flexible steel matting might have to be drawn over the surface during the day between activities, particularly before baseball practice.

For tennis practice or mass meetings, extra rolling of the surface will be necessary For a concert in which individual folding chairs rest directly on the floor, the surface of the field house at Trinity College is wetted and rolled three times in succession At least two hours must be allowed after wetting before rolling can be started.

At Trinity College, a pitcher's mound of the same structure as the other soil is built as soon as the basketball floor is taken down. New material is brought in for this purpose. After the baseball team moves outside, the mound is broken up and the dirt used to fill in any low spots in the arena, and then leveled. The daily servicing of the mound has to be done with hand equipment. It should be raked and scraped from the perimeter upwards. Holes dug by the baseball pitchers in their normal delivery should be filled and tamped or rolled.

After three years of operation, Trinity College planned its first extra application of peat. By using extra material annually for the mound, and then using it on the over-all surface, other special applications of the general surfacing material have been avoided.

The cinder track in Coxe Cage at Yale has been very easy to maintain. The track adds to the dust problem, however, and must be sprayed with water each day. When the field house is used for football, supervision is required to keep the men from running their laps on the track and breaking it up. These laps in football shoes should be run just inside the track on the earth surface.

An oil substance was used to treat the dirt surface at the Lawrenceville School, but apparently without success. Although 32 barrels of the oil were used in the original application, the dust problem was worse ra·· than better. The oil, instead of helping to to bind the soil as was expected, tended t · break it down. When activities are conducted on the surface, the cleats work up the soil into fine sand. This increases dust, and is a hazard due to insecure footing Even small bits of gravel in the surface are breaking down into sand. The oil is too expensive to treat the arena often enough to hold down the dust. Water is not effective on the oil-impregnated dirt.

Calcium chloride has been used by several institutions for surface soil treatment but in every case reported the surface caked and became unusable for the regular activities. Expensive repair of the top surface was required to alleviate the situation.

Other Servicing

There are other less extensive but necessary service operations aside from the problem of the arena surface. These other facilities requiring service are lighting, heating, nets, and portable units. Cleaning of hard surfaced areas and balconies is another service function necessary in the field house.

Lighting units should be cleaned periodically and at the very least, once each year. This is required of both lamps and reflectors. All non-functioning lighting units should be repaired or have lamps replaced promptly on the same day of the failure or before use the following day. An efficient service system will have to be designed in the structure to make this possible. For example, all but three light fixtures in the Trinity College field house can be serviced from catwalks above the ceiling or at the side wall of the arena by operating running gear to which individual light units are attached. At Yale University, artificial lighting service is done by a man using a boatswain's chair rigged to the ceiling, which must be manipulated into position for each individual fixture. A knock-down elevated platform that travels on wheels is used at the Lawrenceville School field house. It required an hour and a half to two hours to put together the sections of the platform, so burned out lamp units are replaced only after six or so units become defective. The problem at Lawrenceville is further complicated in that the rows of lighting are installed at three different levels in the ceiling. Catwalks or lights on running gear are obviously a more desirable provision.

The servicing of heating units involves the lubricating of mechanical gear and the cleaning or replacement of dust screens or filters Because of the amount of dust in a field house, these filters must be inspected several times a year. Experience in a given situation is the best criterion for the timing of such an operation because of the large variation among field houses in the amount and type of dust.

The servicing of nets is ordinarily an occasional process. The one constant problem in connection with the net system results from the variation in the length of the net caused by differences in humidity in the builidng and from a gradual stretching of the nets by their own weight. If nets are allowed to fold on the moist dirt surface, rapid rotting will result. To prevent this, some system must be used to keep the nets hung down to the floor level but not resting upon it.

The setting up and cleaning of portable facilities is a real problem for limited periods of time. The first year that a new portable basketball floor was used in the Trinity College field house, the floor expanded and warped to such an extent that the floor had to be returned to the factory and rebuilt. The following year four provisions were made to adjust to the problem. First, a water-proof paper was laid on the dirt under the basketball floor Second, two by six inch boards were used on the dirt surface to raise the stringers. Third, six small holes were drilled in each panel for air circulation resulting from pressure on the floor causing variations in air pressure between the wood and dirt floors. Fourth, old tennis nets were used to replace the canvas and net combination as a ball-stop around the floor because the net would stretch allowing the canvas to hang below the wood floor with a stoppage of air circulation.

The portable floor must be dust mopped regularly, and mats should be provided on which players may wipe their shoes to avoid grinding away the floor finish by abrasive dirt or sand.

Trinity College purchased rubber matting which is used for aisles between the basketball court and the knock-down bleachers. This has been considered highly successful by the caretakers in reducing dust caused by spectators and cheerleaders. A wood panel walkway used several years earlier had proven unsuccessful.

Cleaning of the "dirt" arena is not ordinarily a problem. Participants are supervised to keep debris from being thrown on the floor. However, when spectators are accommodated on seating over the floor, the cleaning becomes difficult. If smoking is permitted this problem is greatly increased. Debris should be raked up and removed immediately after each event or series.

Hard surfaced areas and balconies require sweeping each day they are to be used. Waste chutes might be built into balconies to reduce the time and effort required in sweeping and eliminating debris.

Fortunately skylights do not have to be cleaned often. Rain will help to keep the skylights clean on the exterior but over a period of time other supplementary means will have to be used. If the skylights are not overly dirty, water under pressure might be satisfactory. However, in some areas there will come a time when even more stringent means will be necessary. At such a time, cleaning can be done using wide mops with extra long handles to scrub the skylights with a solution of detergent. The skylights should then be washed with a stream of water to remove the detergent and loosened dirt. For the interior cleaning of skylights, the problem will be delayed if precautions are used to control the dust in the field house. When the cleaning operation does become necessary, a traveling platform or a boatswain's chair used to service lights may be used to reach the skylights.

Operation of the Field House

Providing spectator facilities in the field house greatly increases operational problems. The seating and activity facilities must be prepared, certain rooms and corridors must be locked, heat reduced, loose equipment and supplies stored and locked, and police provided to supervise the crowd.

For the regular activities, the standard servicing, renewing of temporary markings, and maneuvering of nets fulfills most requirements. For tennis or volleyball, the floor must be rolled firm and special markings provided. For mass meetings of various kinds, extra rolling will be required. Also, seating will have to be set up and the stage prepared. Nets might have to be raised or moved,depending upon the situation.

In the fall, the field houses are prepared for football and track. Near the end of October or early in November, the portable basketball floor is set up. Winter track will be taking place in many areas. As soon as basketball season is over, the field house is prepared for baseball. The baseball men at Yale can start in January or February because there is no portable floor to impede the beginning of practice. At Trinity,only baseball throwing can be practiced until the portable floor is removed about the first of March.

At Trinity College, field house participants are not allowed to wear cleats to and from the dressing rooms. This relieves a large amount of cleaning which would otherwise be necessary. A "no smoking" rule aids the cleaning of the arena surface.

When the use of the field house is granted to community groups, the administrator in charge of the structure should make certain that adequate supervision will be provided before approving such use.

It should not be expected that the field house must provide revenue for its upkeep and operation. The facility will probably serve its purpose best if the cost of operation is included in the budget of the department or division of physical education. Of course, many field houses are used only for intercollegiate athletics.

While other factors previously discussed are important, the real effectiveness of the operation of the field house will depend upon those persons who administer programs of physical education (including athletics) in schools and colleges. It is hoped that the information contained in this volume will help these people to make optimum use of the field house for better physical education in its totality.