

A N I C E A R E N A

P378
.P2465

LIBRARY
Montana State University
BOZEMAN

A

418 West Harrison
Bozeman, Montana
March 16, 1964

Prof. H. C. Rose¹, Director
School of Architecture
Montana State College
Bozeman, Montana

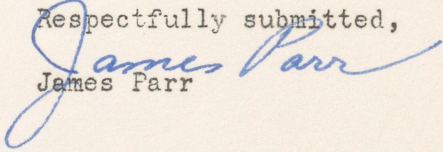
Dear Professor Rose¹:

I am submitting this preliminary research in partial compliance with the requirements of Arch. 490.

In this thesis I have presented research material for an ice arena in Great Falls, Montana. The material presented concerns existing conditions, history of skating, climate, site conditions, aesthetics, and economics. I have also developed a building program; including the size, function, equipment, and circulation pertaining to each space.

It is the purpose of this thesis to provide research material necessary in the design of an ice arena.

Respectfully submitted,


James Farr

Copy 2

PRELIMINARY RESEARCH FOR AN ICE ARENA IN GREAT FALLS,
MONTANA

PART ONE OF AN UNDERGRADUATE DESIGN THESIS

SUBMITTED TO THE SCHOOL OF ARCHITECTURE AT MONTANA
STATE COLLEGE FOR PARTIAL REQUIREMENTS TOWARD A
DEGREE OF BACHELOR OF ARCHITECTURE

BY: JAMES PARR

MARCH 16, 1964

P378
.P2465

~~720.6~~ NA ~~740~~
M76
P246

ACKNOWLEDGEMENT

I am greatly indebted to Mr. Robert Y. Ellis,
U.S.F.S.A. Business Manager, and to Mrs. Winston F.
Coy whose interest in skating contributed needed
information to make this document possible.

I also wish to thank Professor H. C. Rose' and
Professor John P. Parker who gave of their time to
provide advice and guidance throughout the preparation
of this research.

IN MEMORIAM

I wish to dedicate this thesis to the memory of my close friends and fellow skaters who lost their lives in a tragic plane crash near Brussels, Belgium while on their way to the 1961 World Championships in Prague, Czechoslovakia.

"For us who are left to carry on, the future presents a great challenge-- perhaps the greatest that has ever confronted figure skaters in the United States. It is to close ranks, to dig in, and work harder than ever to develop our younger skaters to fill the great void that now exists. This will not be done quickly nor easily, especially since we have also lost some of our finest teachers. However, with the vigor and the devotion that is typical of our country, and especially of figure skaters, I know that all will work hard and harmoniously to carry on the high traditions exemplified by those who have passed the Supreme Test."¹

¹ Shumway, F. Ritter, "A Tribute to the U.S. World Team", Skating, Vol. 38, No. 3 (March 1961), p. 21.

TABLE OF CONTENTS

	page
Proposal	
General	1
Introduction	
General	2
Conditions Creating A Need	
General	6
Size	7
View	7
Lighting	8
Ice surface	8
Local Conditions	
Geographical	11
Climate	11
Precipitation	12
Site Conditions	
General	15
Orientation	15
Adjacent Environment	17
Topography, vegetation, and natural features	20
Soil Analysis	20
Zoning regulations	23
Prevailing winds	23
Immediate and distant views	24
Availability of utilities	24
Traffic pattern	27

(continued)

Function of the Building	
General	28
Aesthetic Considerations	
General	30
Building Program	
General	36
Outline	
Entry	37
Ticket sales	38
Skate shop	38
Arena manager's office	39
Club secretary's office	39
Dressing rooms and lockers	40
Instructor's office	40
Ice surface	41
Spectator seating	42
Observation area	42
Multi-purpose club room	43
Small cafeteria	44
Storage for ice resurfacing	
machine	44
Music room	45
Skate sharpening room	45
First aid room	46
Miscellaneous	46
Mechanical equipment room	47
General areas	49
Economic Considerations	
General	52
Initial cost	52
Financing	53
Operating cost	54
Income	55
Appendix	
Bibliography	57
Correspondences (in master copy only)	

LIST OF ILLUSTRATIONS

	page
Fig. 1 Seating along the sides	9
Fig. 2 Seating in the balconies	9
Fig. 3 Sun angles	14
Fig. 4 Site location map	16
Fig. 5 Aerial photo	18
Fig. 6 View of golf course	19
Fig. 7 View of Prospect Heights	19
Fig. 8 View of island	21
Fig. 9 View of island	21
Fig. 10 View of island	22
Fig. 11 View of island	22
Fig. 12 View to north	25
Fig. 13 View to west	25
Fig. 14 View to southeast	26
Fig. 15 View to south	26
Fig. 16 Aesthetics	31
Fig. 17 Aesthetics	31
Fig. 18 Aesthetics	32
Fig. 19 Aesthetics	32
Fig. 20 Aesthetics	33
Fig. 21 Minimum parking dimensions	50
Fig. 22 Flow diagram	51

PROPOSAL

My thesis for the degree of Bachelor of Architecture shall be the design of an Ice Arena for Great Falls, Montana. The work will be divided into two parts.

First Quarter (Winter quarter 1964)

1. Collect research material concerning the project
2. Study and select a site for the project
3. Present an analysis of existing conditions and a building program for the new building

Second quarter (Spring quarter 1964)

4. Present a design solution of the ice arena, including all drawings and models
5. Present a schematic site development plan showing the possible development of the site as a recreational center

INTRODUCTION

Figure skating is one of the most scientific of all sports, and the artistic division of skating. It is also the most difficult, requiring skill in plain skating both forwards and backwards, a high degree of body control, and assiduous practice.

Modern figure skating was influenced by an American named Jackson Haines (1840-1876). A ballet master, Haines combined dance movements with his skating, which gave a freedom of movement to skating, instead of the previous stiff and rigid style.

The United States Figure Skating Association (U.S.F.S.A.) was founded in 1921 for the purpose of improving and advancing figure skating, to provide standards, to prescribe tests and rules for holding competitions, and to generally take all steps necessary to regulate figure skating through its membership clubs. A steady increase of interest in the sport has been seen since the 1930's. The U.S.F.S.A. has at the present time approximately 130 member clubs.

The Great Falls Figure Skating Club had its humble beginning in 1937 when a few hardy skaters banded together on the ice of Gibson Lake. The late Charles P. Wells led the organization of the club. Since then the club has had a steady growth, and now has 240 members.

Skating on Gibson Lake had its hazards along with its fun. For a few evenings there would be smooth ice and cool, clear weather, just perfect for skating. Then there would come either a wind, depositing sand and sticks on the ice, or a snowfall, burying the ice, or a chinook, turning the ice to water.

In February 1940, the city of Great Falls began planning its Civic Center. Two of the skating club members, Wells and Stoker, appeared before the city council to advocate the need for an ice arena in the plans. As a result of their efforts, the present Civic Center Ice Arena was built. The skating club began their first season in the Civic Center in the Fall of 1940. The 1963 season begins the 26th consecutive skating season. *

* Information was taken from an article written for the Great Falls Tribune in October 1960

What is broadly called Figure Skating, is divided into various divisions; these are school figures, free skating, dancing, and pairs.

School Figures

The elements of school figures are simple curves and turns which are done in the direction of motion and forced turns done against the direction of motion. There are four directions in which the skate may go: outside edge, both forwards and backwards; and the inside edge, both forwards and backwards. Skated first on the right foot and then on the left foot to form full circles, these simple curves become the fundamental figure eights. Using these basic eights with various combinations of edge change and turns, the skater can perform 69 combinations of figures. Each figure is given a factor value from 1 to 5 according to the degree of difficulty. Definite rules have been set down concerning the correct tracing of school figures on the ice.

Free Skating

The free skating is the spectacular and exciting part of skating, which is enjoyed by the spectators. A free skating program is a sequence of smooth harmonious

dance steps, jumps, spins, and turns which the skater performs in time to music. The skater, performing in an interesting and varied manner, interprets the feeling and mood of the music.

Dancing

Unlike ballroom dancing, in which steps may be improvised, ice dancing is skated in a set pattern and with set steps.

Pair Skating

A pair skating program is very similar to the singles free skating program in its content and performance. An important element in pairs, which is not in singles free skating, is the lift. In this move, the man lifts his partner in the air while skating.

C o n d i t i o n s
C r e a t i n g
A N e e d

CONDITIONS CREATING A NEED

General

At the present time, the only skating club in Montana is the Great Falls Figure Skating Club. I believe the reason there are no other clubs in the state is the lack of adequate ice facilities. By adequate facilities, I mean an indoor ice arena which is equipped with refrigerating equipment, for freezing ice artificially, and operates year around.

The only arena in Montana, other than the one in Great Falls, which had such facilities was in Butte. Because of financial conditions, the city was unable to support the arena; with the closure of the Civic Center, the Butte Figure Skating Club disbanded.

Since figure skating, like most sports, is dependent on public support, it must promote events which will create interest in skating. The present facilities used by the Great Falls Figure Skating Club are of inadequate size for promoting such events

as professional ice shows and sectional or national skating competitions.

Size

The size of the present arena is 160' x 76'.

The United States Figure Skating Association has set the minimum size ice surface for holding sectional or national competitions at 185' x 85'.

View

The existing arena has the proper amount of seating capacity; however, about one-fourth of it affords poor visibility for the spectators. The seating along the sides of the arena, which should have the best view, are built at such a shallow slope that the view is blocked by the heads of spectators, and by the boards around the ice surface. Also, the circulation of people to the seating passes between the spectators and the ice, thus blocking part of the view, (see Fig. 1). The balconies, do not offer a much better view. The seating is built at a steeper slope, but the circulation still passes in front of the spectators. In addition, the end of the rink is directly below the edge of the

balcony, which leaves an area at the ends of the rink hidden from the view of spectators seated in the balconies, (see Fig. 2).

Lighting

The ice arena is unable to take advantage of any natural light. The west wall has eight very large windows which must remain covered by curtains in order to prevent the afternoon sun from shining on the ice and softening it. The windows and doors on the north and south ends of the arena let in little light, and what light is let in, causes undesirable reflections and glare on the ice.

The artificial lighting is also inadequate. The lights are placed in rows in between the steel trusses; this arrangement of lights creates shaded strips of light and dark on the ice. This uneven distribution of light on the ice makes the tracing of school more difficult.

Ice Surface

The present methods of resurfacing the ice are unsatisfactory; not only from the standpoint of quality, but also from length of time involved. The present

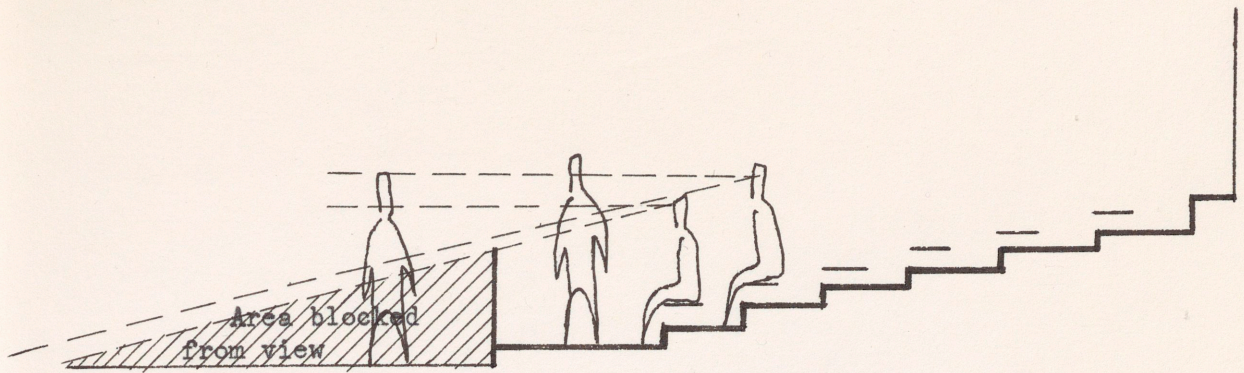


Fig. 1 Seating along the sides

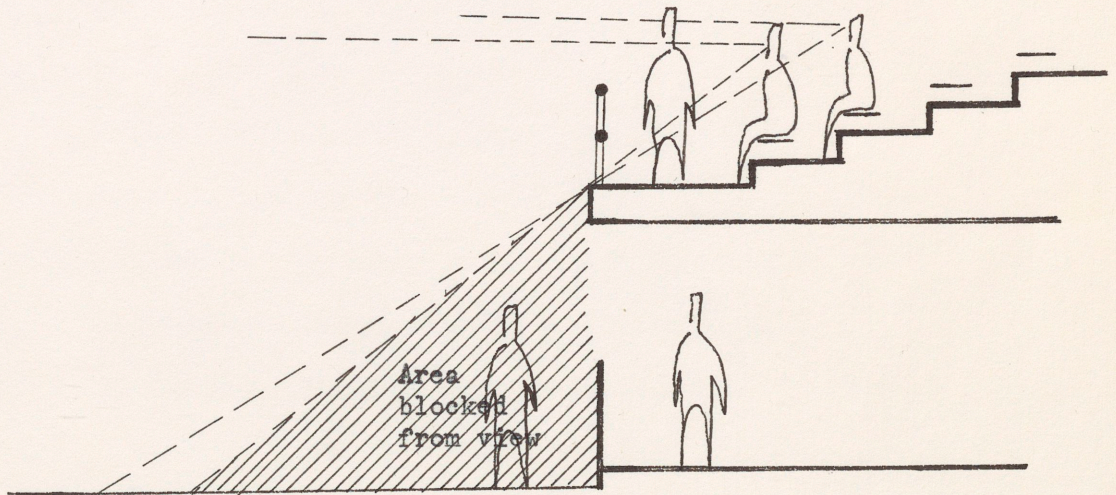


Fig. 2 Seating in the balconies

procedure is as follows: first the ice is swept with a broom to remove all loose snow. This process takes about 15 to 20 minutes. After this the ice is then flooded by using a tractor, which pulls a canvas bag full of hot water over the ice. This method does an uneven job of flooding; some spots are missed while other areas get too much water. About 15 minutes is needed to flood the ice, after which the water takes about 20 minutes to freeze. Because of the time involved, the skating club can not have more than one figure patch an evening, since each patch requires clean ice.

The figure skating club must have new adequate facilities if its members are to be able to compete with other clubs on a national level. These new facilities would bring greater popularity to ice skating as a healthful and enjoyable form of recreation.

L o c a l

C o n d i t i o n s

LOCAL CONDITIONS

Geographical

The site of the new ice arena is located in Great Falls, Montana. The city of Great Falls is located astride the main stem of the Missouri River at its confluence with the Sun River, of latitude $47^{\circ} 29' N$ and longitude $111^{\circ} 21' W$, at an elevation of 3333'.

Except to the north and northeast, the city is encircled by mountain ranges, which lie about 30 miles away from east to south, 40 miles to the southwest, and 60 to 100 miles from west to northwest.

Climate

Topography plays an important part in Great Falls' climate, which is described as moderate.

Summertime in the area is quite pleasant, with cool nights, moderately warm and sunny days, and very little weather that can be called hot or humid. In the summer, the average temperature is $69.0^{\circ} F$. Freezing temperatures do not occur in July or August, very rarely in June, and are observed only on two or

three days in the usual May or September. Frost occurs frequently in April and October.

Winters are not as cold as might be expected of a continental location at this latitude, largely as a result of the "chinook" winds for which this area is noted. The average temperature during the winter is 23.6° F. While sub-zero weather is experienced normally several times during the winter, the coldest weather seldom lasts more than a few days at a time. As a result of recurring "chinooks" throughout the winter season, snow seldom lies on the ground for more than a few days. In fact, the ground usually is bare, or nearly bare of snow, most of the winter.

Percipitation

Although Great Falls' average annual percipi-
tation is 14.40 inches, about 70% or nearly 10 inches of it falls during the months from April to September. Most summer rainfall occurs in showers or thundershowers; while snow falls during late fall, winter, and early spring.

<u>Month</u>	<u>Mean Temperature</u>	<u>Precipitation</u>
Jan.	23.0	.66 in.
Feb.	25.2	.78 in.
March	31.3	.90 in.
April	44.0	1.02 in.
May	53.6	2.35 in.
June	60.2	2.92 in.
July	69.7	1.28 in.
Aug.	67.6	1.07 in.
Sept.	57.8	1.28 in.
Oct.	48.5	.74 in.
Nov.	34.9	.84 in.
Dec.	28.7	.56 in.

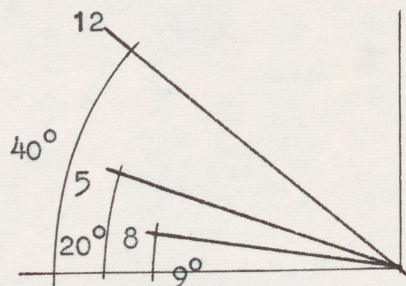
Mean Temperature - 45.4° F.

Mean Precipitation - 14.40 inches

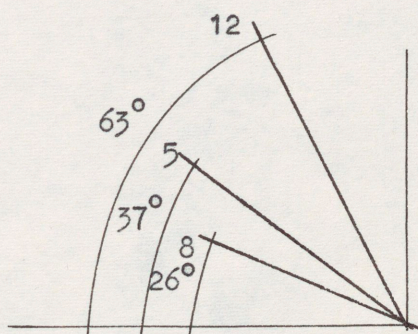
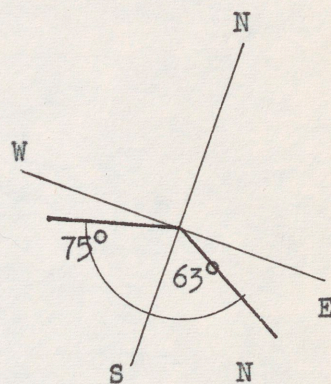
Sun Angles, Fig. 3

Vertical

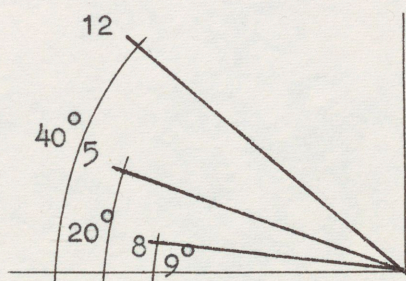
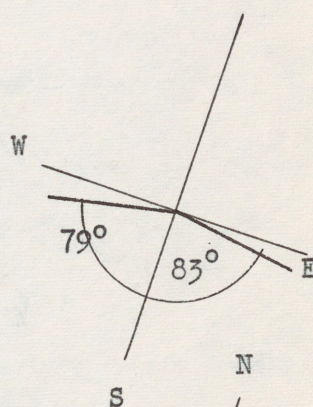
Horizontal



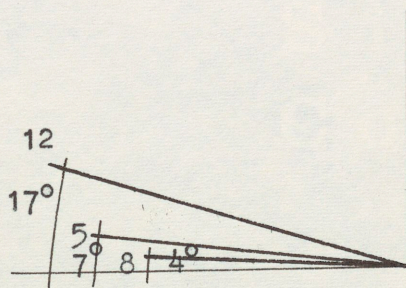
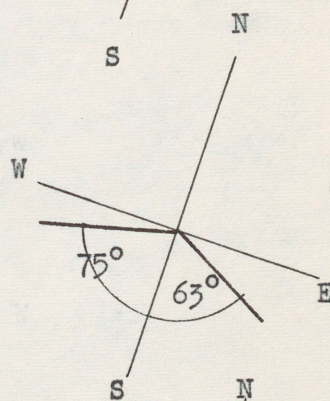
March



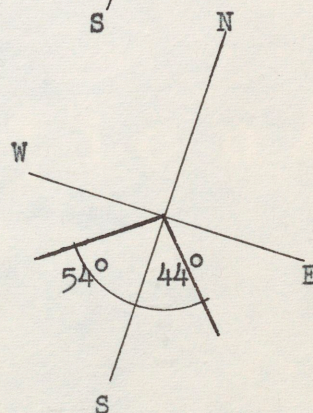
June



Sept.



Dec.



SITE CONDITIONS

General

When considering a site for the ice arena, I felt that wherever it was located it should be an area with the potential for development as a recreational area. I selected the Park Island, because it is an island and as such it would remain as a recreational area, free from the encroachment of housing developments which are rapidly extending south along both sides of the Missouri River.

The Park Island is the property of the city of Great Falls and is the largest of three islands located in the vicinity of Great Falls; it contains 43.81 acres, (See Fig. 4).

At the present time the island is leased to the Boy Scouts of America for camping and recreation.

Orientation

Since the site is an island, it faces all directions. The island is roughly oval in shape and projects to a point at the north and south ends. The

long dimension of the island lies in a north-south direction, (See Fig. 5).

Orientation of the building will be an important factor in the design of the ice arena. Natural light would be the most ideal type of lighting; but the orientation and the sun angles (See Fig. 3) must be thoroughly checked so the sun does not shine directly on the ice, because that part in the sun becomes soft and the rest remains hard, making a poor surface for skating.

Adjacent Environment

Across the west channel of the Missouri River is located the Meadowlark Country Club golf course. The golf course is relatively flat and has only a few trees. On the east side of the river the ground rises steeply; this area is called Prospect Heights Addition. See Figures 6 & 7.



Fig. 5 Aerial photo



Fig. 6 View of golf course



Fig. 7 View of Prospect heights

Topography, Vegetation, and Natural Features

The site is relatively flat, with only minor variations in elevation. The elevation of the river is about 5' below the level of the island. The Missouri River flows around the island from the south to the north. The island's vegetation consists of elm and cottonwood trees, dense shrubbery along the river banks, and grass. During the winter months the river is partially covered with ice; however it does not freeze over completely and the ice does not get thick enough to walk on. See Figures 8, 9, 10, & 11.

Soil Analysis

To date, there have been no known soil borings, strata tests, or loading tests taken on the site. However, the soil in the country club area consists of sandy-clay and gumbo; since there is no evidence to indicate that the island is any different, I will assume that the soil is sandy-clay and gumbo, and that it has adequate values of bearing and stability. Ground water can be reached at a depth of approximately 6' or just slightly below the level of the river.



Fig. 8 View of island



Fig. 9 View of island



Fig. 10 View of island



Fig. 11 View of island

Zoning Regulations

Park Island is City owned Park Property. The island at the present time is outside the city limits; therefore no zoning control or restrictions are placed upon it. A new county zoning district, which would include the island, is being planned. It is anticipated that the land will be zoned for Park purposes; this would restrict the construction to government owned recreational buildings.

I am assuming, for the purposes of this report, that the Great Falls Skating Club has already purchased the island, and has had it zoned Local Business Use.

Prevailing Winds

The prevailing winds are from the southwest. Although the average wind speed is relatively high (13.9 m.p.h.), extremely strong winds (over 70 m.p.h.) seldom are observed.

Immediate and Distant Views

The view to the north looks down the river to the Warden Bridge and the city center in the distance. To the northwest and west, the view looks out across the Country Club golf course, with the plateau called Gore Hill in the distance. The view to the south looks up river to the wooded areas along the river bank. Figures 12, 13, 14, and 15 show the views in each direction.

Availability of Utilities

There are no existing utilities on the island. For the purposes of this report, I will assume that all utilities, which are available in Prospect Heights, would be furnished to the island. Gas and electricity (both 110 v. and 440 v.) can be supplied with little trouble. To provide the island with sewer service, it would mean building a force main and a lift station in order to connect to existing sewer lines. Although costly, this type of installation is necessitated by the high water table on the island, which eliminates the possibility of a septic tank and drainfield. The water

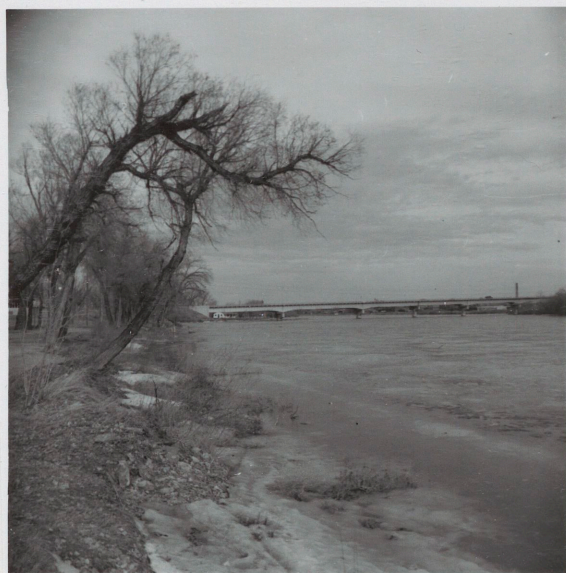


Fig. 12 View to north



Fig. 13 View to west



Fig. 14 View to southeast



Fig. 15 View to south

line would have to be run under the river; this would also be costly. The water needed for the refrigerating equipment can be pumped from the river.

Traffic Patterns

Access to the island would be by a bridge, which I will assume has been built. Park Drive, which parallels the river, and 10th Avenue South provide easy access from all parts of the city. 10th Avenue South is a main east-west arterial highway, while Park Drive is a secondary paved road. The arrows shown on Fig. 4 indicate the routes of access to the island.

F u n c t i o n o f
t h e B u i l d i n g

FUNCTION OF THE BUILDING

General

An ice arena has one main function, which is to provide an ice surface upon which the sport of skating can be performed. The ice surface and the seating surrounding it, constitute the major area of the arena.

Permanent ice skating arenas are becoming more and more popular with sports-minded people. Ice skaters need no longer depend upon the whims of nature for their enjoyment. Freezing rinks artificially allows the skating season to begin earlier, to continue without interruption, and to last longer. Therefore, probably the most important item that must be considered in the designing of an ice arena is the ice surface and the refrigerating equipment. This equipment makes it possible for an indoor arena to operate year around; without it, the arena could not function.

The circulation of people within the arena can be divided into 3 parts: 1) the general public, 2) the skating club members, and 3) the maintenance personnel.

Primarily the ice arena will be used by the members of the club and their families. The members of the skating club will be using the arena quite extensively. Figure skaters will spend an average of from 4 to 5 hours a day practicing. During these practice sessions, either one or both parents are at the arena watching.

The general public will use the arena only occasionally; as spectators for ice shows or skating competitions and as skaters during public sessions.

The maintenance personnel must check the mechanical equipment periodically, and resurface the ice after each skating session.

The functions of the individual spaces within the arena will be discussed in the section "The Building Program".

A e s t h e t i c s

AESTHETIC CONSIDERATIONS

General

Skating is a sport associated with ice and chilly temperatures. The cold, freezing temperatures associated with outdoor skating are a thing of the past. Today, the indoor arenas are kept at a comfortable 50° F. The skater is able to dress comfortably, and thus is not hampered by excessive clothing. Figures 16, 17, 18, 19, and 20 show the typical dress of figure skaters.

Figure Skating is a sport of contrasts; the school figures are skated with graceful movements of precision in an atmosphere of quiet concentration, whereas free skating is done with an exuberance of energy in an atmosphere of exciting activity.

The concept of the building should capture the feeling and excitement of activity, while providing a warm, inviting atmosphere for concentrated practice. This type of atmosphere seems essential, since the



Fig. 16 Aesthetics



Fig. 17 Aesthetics



Fig. 18 Aesthetics



Fig. 19 Aesthetics



Fig. 20 Aesthetics

skater will be spending as many as 5 hours a day there. There is also a functional requirement which will greatly influence the concept of the building; an ice surface 185' x 85' with seating for 3000 people around it. These requirements indicate a stadium-like plan.

The site, being an island, seems like a place where one can express the special nature of this absolutely independent building. Being isolated from the surrounding environment by the Missouri River, the island allows the arena a freedom of individual expression because there are no other buildings to influence its character. The island is located next to the Country Club golf course and close to the Broadwater Bay boating facilities. This location has great potential for development as a recreational area. The existing landscaping should be retained as much as possible, and be incorporated into the site development.

The interior space should have a feeling of luminosity and lightness. It should have the feeling of being airy and open, like an outdoor arena.

To create this type of atmosphere, the selection of the materials will be an important factor.

The materials used in the arena should be selected so that they complement the ice surface. The ice is a smooth, hard, and cold material. The materials used might either have similar or contrasting characteristics. For example, concrete is a hard, cold material; it can either be rough or smooth depending upon its texture. Stone is rough and hard, and can be warm or cold depending upon the color of the stone. These materials have similar characteristics to the ice. A material which contrasts to this is wood; it is a relatively soft, warm material which may have a rough or smooth texture.

Color can play an important part in creating the proper atmosphere. The use of warm colors in the area around the ice surface would give the psychological feeling that the temperature is warmer than it actually is. Color determines the mood which an area will have; for instance, dull, drab colors are depressing. Therefore, to have a mood of joy and excitement, it is essential that the colors be bright and cheerful.

Program

BUILDING PROGRAM

General

This program is general in scope and is by no means unchangeable. The sizes and relationships of areas are only a tentative guide for use in the preliminary design stage.

The building program has been analyzed by 2 different methods. First, the building program outline; which gives a brief description of the function of each room, its size, and the areas adjacent to it. The second method is the flow diagram, which shows the relationship of one area to another.

BUILDING OUTLINE

Entry

There are two distinct groups that will be using this ice arena; the entry must provide for control of access to the areas serving the general public and the members of the skating club.

Size

Area: 350 sq. ft.

Adjacent public areas

Ticket sales

Skate shop

Arena manager's office

Rest rooms

Access to seating

Adjacent club areas

Club secretary's office

Dressing rooms and lockers

Instructor's offices (2)

Access to observation area

Access to ice surface

Ticket sales

During ice shows or public sessions, admission would be charged. The public would purchase their tickets here.

Size

Area: 50 sq. ft.

Adjacent area

Entry

Skate Shop

This area would sell excessories needed by the skaters; such items as shoe laces, girls tights, mittens, sweaters, skating skirts and dresses, and other sports wear associated with skating. Rental skates for use by the public would be furnished. The shop would take orders for custom-made skates, but would not sell stock skates.

Size

Area: 400 sq. ft.

Adjacent areas

Entry

Arena Manager's Office

From this office the manager controls the arena. He controls the refrigerating equipment, the ice resurfacing, and the general maintenance of the building.

Size

Area: 150 sq. ft.

Adjacent areas

General public areas

Access to mechanical room

Access to resurfacing machine storage

Club Secretary's Office

The secretary of the club needs a small office for keeping records, writing correspondences, and organizing the skating schedules.

Size

Area: 120 sq. ft.

Adjacent areas

Arena manager's office

Access to general skater's area

Dressing Rooms and Locker Facilities

Separate areas are needed for men and woman.

The skaters use this area for storing their skates, for putting on or changing their skates, and for changing clothes. During competitions or ice shows this area will be used for putting on and changing costumes.

Size

Area: allow approx. 8 sq. ft. per locker

Adjacent areas

Entry

Access to ice surface

Access to Multipurpose club room

Instructor's Office

The skating instructor spends most of his day in the arena, giving private lessons or supervising and instructing the Club's groups. During the times in between lessons, he needs a place to go to relax and get warm.

Size

Area: 120 sq. ft.

Instructor's Office (cont.)

Adjacent Areas

Entry

Access to ice surface

Access to Multipurpose club room

Ice Surface

This area is the major area in the building, since all the activity which occurs during skating takes place on this area. The construction of this area will be explained under the mechanical section.

Size

Area: 185' x 85'

Adjacent areas

Dressing rooms and lockers

Instructor's office

Storage area for resurfacing machine

Size

Area: Can be combined with Multipurpose

club room. Seating for 15-20 people.

Spectator Seating

The purpose of the grandstand is to provide an audience with a good view of a performance under comfortable conditions. The view is affected by both the distance to the action and the obstructions in the line of sight.

Size

Area: allow 4.2 sq. ft. per person

Adjacent areas

Entry

Public rest rooms

Observation Area

Parents spend almost as much time in the arena as do the skaters. They need a warm area where they are able to sit and relax while watching the skaters practice. This area should have a view of the entire ice surface.

Size

Area: Can be combined with Multipurpose

club room. Seating for 15-20 people.

Observation area (cont.)

Adjacent areas

Multipurpose club room

Entry

Multi-purpose Club Room

This area is just what the name implies, an area of multi-purposes. It serves as an area for skaters to lounge in and warm-up during their periods off the ice. The area will serve as a banquet room and social room for parties. The skating club will conduct its business meetings here. During competitions, it will be the center of activity, with the area being used for registration, organizing the events, and posting the scores of the various events.

Size

Area: 2000 sq. ft.

Adjacent areas

Observation area

Small cafeteria

Storage for tables and chairs

Small Cafeteria

Provides facilities for serving grilled sandwiches, and soft and hot drinks. ~~There is.~~ The

Size ~~room contains a turn table, tape recorder, and~~
~~equipment.~~ Area: 600 sq. ft. The area will require

Adjacent areas ~~a space which provides the proper acoustics.~~

~~Storage space~~ Multi-purpose club room is necessary.

Storage Area For Ice Resurfacing Machine

This machine is a driven vehicle approx. 8'-0" wide, 12'-0" long, and 7'-0" high. The machine shaves the loose snow off the ice, picks it up, melts it, and uses the water to resurface the ice.

This storage area should have an industrial type door for access to the outside. The area should be immediately adjacent to the ice surface. ~~rooms will~~

Size ~~used table upon which this machine will be~~

~~utilized.~~ Area: adequate for storing and maneuvering
~~Equipment.~~ the vehicle.

Adjacent areas

Ice surface ~~sq. ft.~~

Music Room

Music is an integral part of skating. The skater uses music to free skate and dance to. The room should contain a turn table, tape recorder, and equipment for cutting records. The arena will require a speaker system to achieve the proper acoustics. Storage space for records and tapes is necessary.

Size

Area: 100 sq. ft.

Adjacent areas

Indirect connection with ice surface

Skate Sharpening Room

Sharpening figure skates is a delicate operation requiring special skill and equipment. A special electric driven, rotary stone is used. The room will need a work table upon which this machine will be mounted, storage areas for skates, tools, and other Equipment.

Size

Area: 150 sq. ft.

Skate Sharpening Room (cont.)

Adjacent areas

Easily accessible from areas used by skaters.

First Aid Room

Serious accidents seldom happen, but minor injuries requiring treatment occur occasionally.

Size

Area: 150 sq. ft.

Adjacent areas

Close proximity to the ice surface

Miscellaneous

Provide public rest room facilities as required by building code.

Provide storage areas as needed.

Provide maintenance facilities.

Mechanical Equipment Room

The mechanical equipment consists of the refrigerant carrying pipes and floor construction for the ice surface, the refrigerating machinery, and a chemical solution.

Rink Base

The ice rink grid consists of numerous closely spaced pipes, either 1" or $1\frac{1}{2}$ " in diameter spaced on 3 to $4\frac{1}{2}$ inch centers. These pipes are embedded in a concrete floor slab upon which the ice is made.

The floor construction consists of a concrete slab poured on the ground, upon which is placed 2" of rigid insulation. The pipes are supported by 3" herring bone supports and are embedded in a 6" concrete slab. Between this slab and the insulation are placed 3 sheets of mil-thick polyethylene and a layer of talcum powder to facilitate expansion and contraction. A $1\frac{3}{4}$ " terrazzo floor is used as the finished floor.

A refrigerant is used to cool a brine solution which in turn cools the slab and the water on it.

Brine Solution

The freezing solution (brine) which circulates between the grid and refrigerating equipment serves as a heat absorber. It draws and carries away heat from the rink, to lower the water's temperature to below its freezing point. The heat absorbed by the solution then goes to the refrigerating system which removes the heat and sends the rechilled fluid back to the rink. Once the sheet freezes, only the heat absorbed by the ice from the atmosphere, from the skaters, and from the ground needs dissipated. The amount of chilling solution depends entirely on the amount of heat to be removed and the rate at which it must be removed. The chilling solution is a calcium-chloride brine.

Refrigerating Machinery

This equipment consists of 3 reciprocating compressors, of which 2 are used to make the initial freeze while the third maintains the ice. Driving each compressor is a 125 hp., 3 phase, 60 cycle, 440-volt motor.

Mechanical Equipment Room (cont.)

Size

Area: 1500-2000 sq. ft.

Adjacent areas

Ice surface

General Areas

Public parking for 600 cars

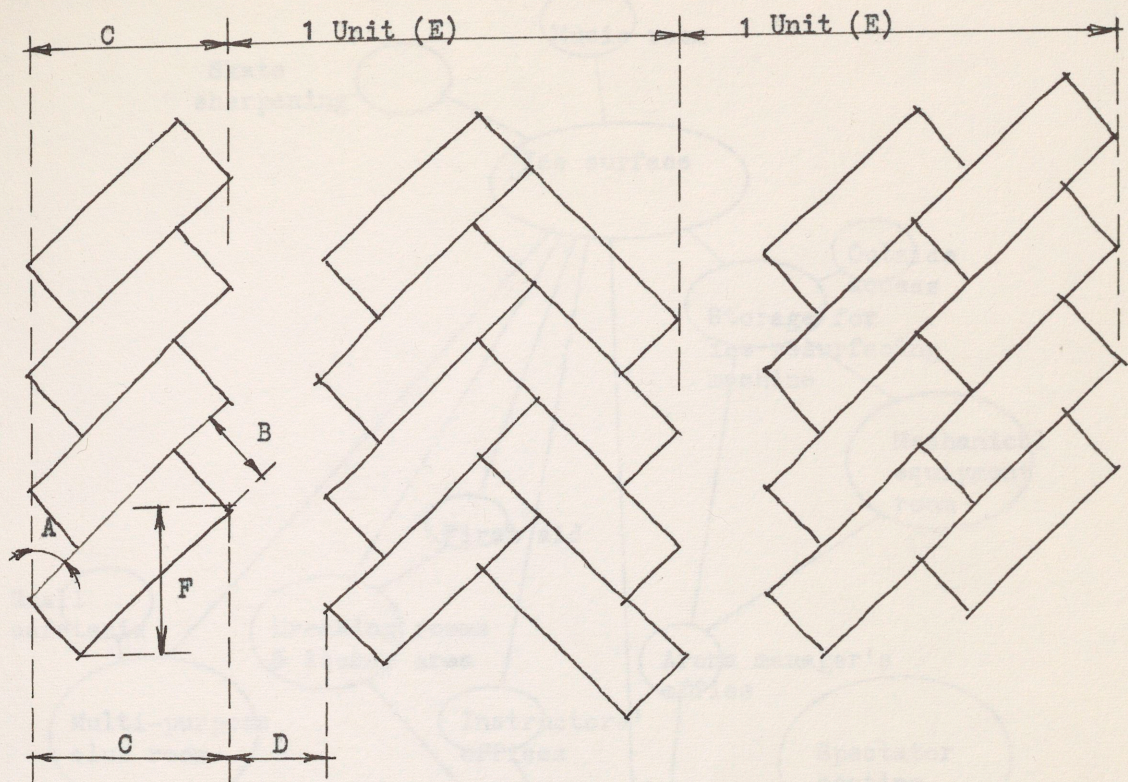
Personnel parking for 15 cars

All necessary access roads

Size

Area: See figure 21

Fig. 21 Minimum Parking Dimensions¹

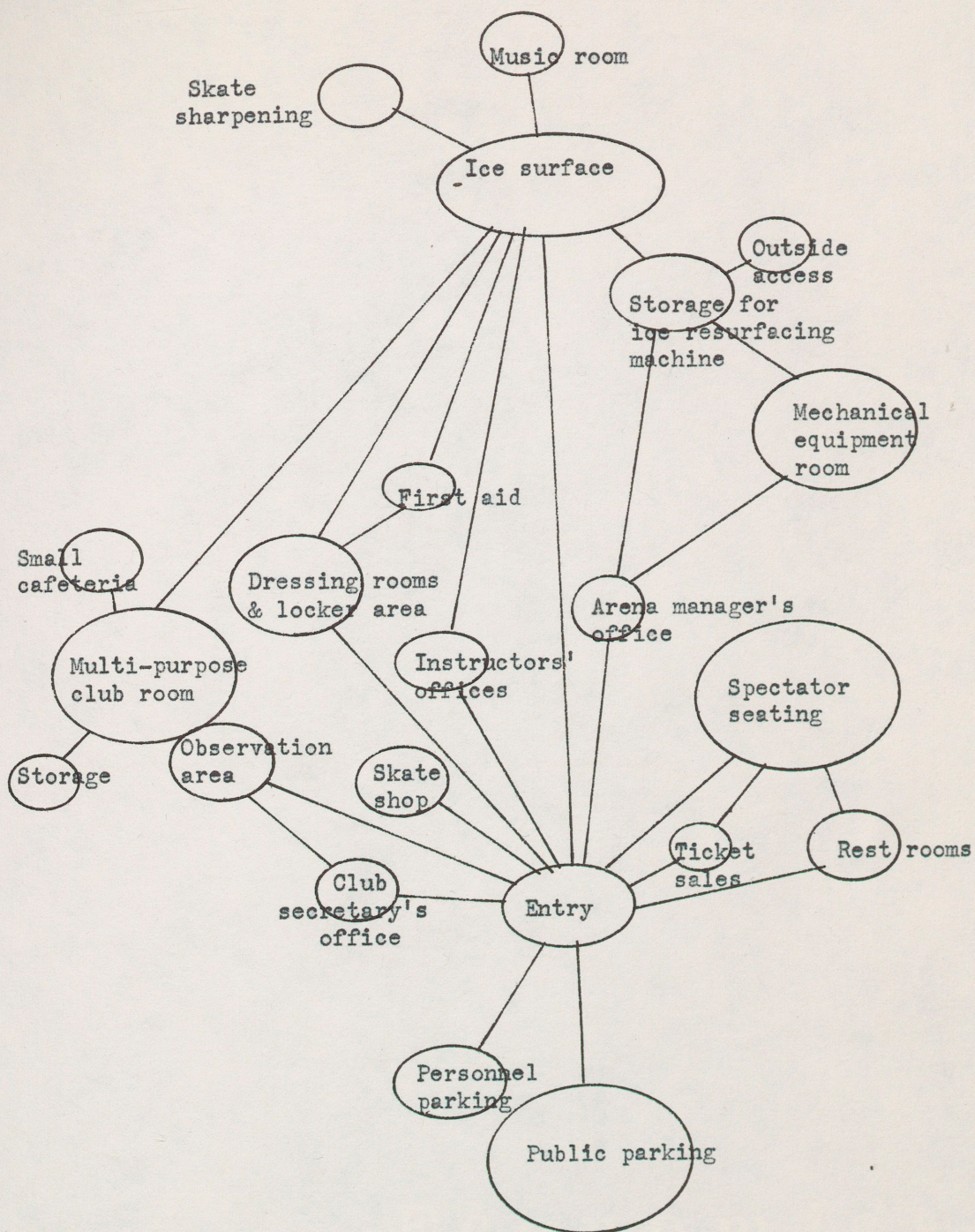


Recommended stall and aisle dimensions for cars

A	Dir. of parking	B	C	D	E	Area per car
90	back-in	8'-0"	18'-0"	22'-0"	58'-0"	232 sq. ft.
60	back-in	8'-0"	18'-10"	17'-2"	55'-0"	254
45	back-in	8'-0"	17'-2"	12'-8"	47'-0"	266
90	drive-in	8'-6"	18'-0"	22'-0"	58'-0"	247
60	drive-in	8'-6"	18'-10"	18'-4"	56'-0"	270
45	drive-in	8'-6"	17'-2"	12'-8"	47'-0"	282

Use 8'-6" for self-parking and 8'-0" for attendant parking

¹ Ramsey and Sleeper, *Architectural Graphic Standards*, John Wiley and Sons Inc., N. Y., (1956, 5th edition), p. 611



FLOW DIAGRAM, Fig. 22

E c o n o m i c s

Initial Cost (cont.)

ECONOMIC CONSIDERATIONS
Cost of this analysis.

General

With only the proposed program determined,
I can only estimate the probable cost of construction.

This section on economics will be divided into
3 parts: 1) initial cost, 2) operating cost, and 3)
Income. All costs are figured on a yearly basis.

Initial Cost

Cost of building construction	\$125,000.00
Cost of mechanical equipment (includes rink piping, headers, and refrigerating equipment) at \$6.00 per sq. ft. of ice surface	\$100,000.00
Cost of parking facilities and access roads at \$1.40 per sq.yd.	\$ 25,000.00
Architect's fee at 6 % of cost	<u>\$ 15,000.00</u>
Total	\$265,000.00

Initial Cost (cont.)

Cost of land and utilities is not figured as part of this analysis.

Financing

In order to finance a building of this type, 30 % of the total cost must be in cash capital. The remainder of the cost would be financed through a loan.

Total cost	\$265,000.00
30 % capital	<u>\$ 79,500.00</u>
Amount of loan	\$185,500.00

The cash capital would be collected from donations and other promotional events.

The loan would be paid back over a period of 30 years. The interest rate would be 6 %. This would mean making an annual payment of \$17,320.00 (including principal and interest).

The life of the building is estimated at 40 years. Therefore, depreciating the cost of the building over this period of time amounts to an annual figure of \$6,250.00 which must be added to the cost of operation.

Operating Cost

Electric power (at 1350 KWH per day)	\$ 8,000.00
Heating	\$ 2,000.00
Building maintenance	\$ 500.00
Equipment maintenance	\$ 300.00
Gas and oil	\$ 150.00
Salaries	
Arena manager	\$ 6,000.00
Engineer	\$ 5,800.00
Club secretary	\$ 2,000.00
Senior professional	\$ 2,400.00
Junior professional	\$ 1,200.00
Depreciation	\$ 6,250.00
Payment for loan	<u>\$17,320.00</u>
Total	\$51,920.00

Figures for taxes and insurance have not been included in this analysis, because they will vary depending upon the construction of the building.

Income (cont.)

Memberships (based on 400 members)

Seniors (at \$19.50 per yr.) \$ 975.00

Intermediates (at \$17.50 per yr.) \$ 1,750.00

Juniors (at 15.00 per yr.) \$ 3,750.00

Dance sessions (at \$10.00 per yr.) \$ 500.00

Patch sessions (at \$10.00 for 1st
and \$7.50 each additional) \$ 2,000.00

Unlimited time (at \$25.00 per yr.) \$ 400.00

Professional ice shows (3 per yr. for
3 performances each; tickets at
\$2.50 per seat; based on 75 %
attendance; profits are divided
a 65-35 % basis. \$16,875.00

Local ice show

Children (at \$.50) \$ 1,750.00

Adults (at \$1.00) \$ 2,100.00

Public skating

Children (at \$.50) \$ 7,500.00

Adults (at \$1.00) \$12,000.00

Income (cont.)

Skate rental (based on 12 % of attendance at \$.75)	\$ 2,400.00
Skate sharpening and repair (based on 5 % of attendance at \$.75)	\$ 1,000.00
Rink rental (to private groups, based on 10 rentals a year at \$100.00 each)	\$ 1,000.00
Advertising and sponsorships	<u>\$ 1,500.00</u>
Total	\$55,500.00

The above analysis is to be used only to give
an indication of completed construction costs to
the client so that a budget may be prepared.

A p p e n d i x

BIBLIOGRAPHY

1. Beltz, Charles R. Personal letter to author
dated February 13, 1964
2. Coy, Mrs. Winston F. Personal letter to the
author dated February 4, 1964
3. Ellis, Robert Y. Personal letter to the author
dated January 24, 1964
4. Hanson, R. T. Personal letter to the author
dated February 11, 1964
5. Heil, J. F. Personal letter to the author dated
February 6, 1964
6. Pallanch, F. T. Personal letter to the author
dated February 24, 1964
7. Ramsey and Sleeper, Architectural Graphic
Standards, John Wiley and Sons Inc., N. Y.,
(1956, 5th edition), p. 611
8. Shumway, F. Ritter, "A Tribute to the U. S. World
Team", Skating, Vol. 38, No. 3 (March 1961), p. 21
9. Swingley, Don E. Personal letter to the author
dated February 27, 1964

OCT 21 1964
JAN 20 1965

NOV 14 1965

FEB 1 1966

FEB 14 1966

FEB 24 1967

FEB 6 1968

05 1968

DEC 08 1993

DEC 15 1994

MONTANA STATE UNIVERSITY LIBRARIES
stks 720.6.M76P246 CA
An ice arena in Great Falls, Montana /



3 1762 00158502 3

NA 2540

720.6

M76

P246

USE ONLY

