Laurel Golf Club
Laurel Golf Club
Laurel, Montana

by
Lynette M. Burrowes

Montana State University
Bozeman, Montana

May 1993

Programming analysis submitted in partial fulfillment of requirements for degree of

Bachelor of Arts

in

Interior Design

Approved:

[Signature]
Pamela H. Bancroft, Advisor

[Signature]
Thomas R. Wood, Director, School of Architecture
STATEMENT OF PERMISSION TO COPY

In presenting this programming analysis in partial fulfillment of the requirements for the degree of Bachelor of Arts in Interior Design at Montana State University, I agree that the library shall make it freely available for inspection. I further agree that permission for copying this document for scholarly purposes may be granted by the major professor or, in her absence, by the Dean of Libraries. Any copying or use of the material in this book for financial gain shall not be allowed without my written permission.

Signature: Lynette M. Burke 2003
Date: May 25, 1993
TABLE OF CONTENTS

I. INTRODUCTION
II. THE HISTORY OF GOLF AND THE CLUBHOUSE
III. ANALYSIS OF SITE
IV. HISTORY OF LAUREL GOLF CLUB
V. ANALYSIS OF EXISTING LAUREL GOLF CLUBHOUSE
VI. GOALS
VII. CASE STUDIES
VIII. INTERIOR SPACE ANALYSIS
IX. SPATIAL DIAGRAMS
X. UNIVERSAL DESIGN REQUIREMENTS
XI. BUILDING CODE REVIEW

BIBLIOGRAPHY
APPENDICES
   Appendix A: Map of Site
   B: Existing Floor Plan
   C: Climate and Solar Data
   D: Slides of Existing Building
   E: Slides of Project
Introduction
INTRODUCTION

This document is written for Laurel Golf Club. Presently, there is an eighteen hole course and clubhouse. The existing clubhouse does not represent the course status. The clubhouse also has many existing space planning problems. Therefore, I have chosen to redesign the clubhouse.

An ideal design would be to tear down the existing and completely rebuild. I truly believe this would be the most cost efficient solution in the long run.

However, I have chosen to renovate the existing building and to deal with the constraints set forth.

The new clubhouse shall be a focal point for the golf club and the surrounding area. It shall maximize overall space and provide adequate area and separation for each use.
The History of Golf and The Clubhouse
THE HISTORY OF GOLF AND THE CLUBHOUSE

The game of golf originated in sixteenth century Scotland where the first course, St. Andrews, was constructed for royalty. There is, however, recorded evidence of the game as early as the 1400's.

John Reid, a Scot, is known as "the father of American golf". He is responsible for the founding of the first golf club in the United States, St. Andrews in Yonkers, New York. The first clubhouse was built at Shinnecock Hills Golf Club on Long Island.

Throughout the years, the golf course and clubhouse have undergone many transitions. What started as a three hole course in a pasture with a tent acting as a clubhouse has developed into an elaborate eighteen hole course with a clubhouse to match.

The game of golf along with the clubhouse have gained a certain status over the years. This stemmed from the social advantages of a clubhouse which were determined from economic factors. Wealthy members were a necessity to the club for such purposes. Because of this reason, golf clubs charged high initiation fees and stout annual dues. Thus, golf grew in America to be a rich persons game.
THE HISTORY OF GOLF AND THE CLUBHOUSE (Continued)

Golf Clubs, in the beginning, were all male clubs. Women were informed that the sport would provide them unbecoming muscles and that the frontiers of the courses possessed wild animals. Women were, however, allowed in the clubhouse because, after all, one cannot expect a social event without women!

As time passed, the golf club and clubhouse integrated into one design. The necessities of golfers were recognized and incorporated into the clubhouse. Separate uses of pro-shops, club storage, lockers, and a lounge, commonly referred to as the nineteenth hole, developed. Along the same lines, women took interest and realized they would not develop unbecoming muscles and that the only wild animals on the course were those playing the frustrating game of golf. Thus, women became part of the whole.

Clubhouses transitioned from all-male clubs to family clubs. Today, clubhouses are designed for the needs of all users. The general principles may be the same, but the user group has vastly expanded.
Analysis
of
Site
ANALYSIS OF SITE

LOCATION:

Laurel, Montana is located 20 miles west of Billings, Montana in Yellowstone County. The Beartooth Mountains are to the south and west, while the Great Plains begin north and east. One mile southeast of Laurel, the Clark Fork River flows into the Yellowstone which is south parallel to the city.

CLIMATE:

Laurel's climate is generally considered semiarid. Average precipitation is around fourteen inches. Average temperatures range from 15 degrees in January to 76 degrees in July. Prevailing winds are from west and southwest. Winter storm winds blow from north and northeast. Wind velocity can attain 35-40 mph.

ECONOMIC:

Laurel is, historically, a railroad town. The railroad yards were a main economic source until the mid 1940's. Agriculture is also an economic source. Laurel possesses an oil refinery which began in the early 1920's.
History
of
Laurel Golf Club
HISTORY OF LAUREL GOLF CLUB

Laurel Golf Club originated as Laurel Golf Recreation and Association in 1969. It was to be a golf club with other activities available such as swimming, tennis, horseback riding, and target ranges. The golf course and the clubhouse were to be built first with other activities following.

Though Laurel Golf Club is private for golf purposes and social events, the dining / lounge area is open to the public. A stipulation of the liquor license has proved beneficial to the community. Laurel is not, at present, equipped with a public facility of such standard or capacity. Therefore, public use is appreciated.

Laurel Golf Club exists with 477 members. Unlike other private clubs, each member obtains equity of the club when purchasing a membership. Annual dues and convenience fees remain, however, at a much lower cost than many similar clubs.

There are nine board members who oversee activities. The board includes president, vice-president, secretary, treasurer, and five seats. There is an annual meeting open to all members for input concerning activities and business.
HISTORY OF LAUREL GOLF CLUB (continued)

The club employs twelve to thirty people depending upon the season. This includes a golf pro and assistant, chef, waitpersons, office personnel, and grounds people.

The user group ranges, though generally, ages 45-60 are most dominant. There is a golf program targeted for youth. Social events are available for all.
Analysis of Existing Laurel Golf Clubhouse
ANALYSIS OF EXISTING LAUREL GOLF CLUBHOUSE

**INTERIOR:**

<table>
<thead>
<tr>
<th>Room Type</th>
<th>Square Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>68</td>
</tr>
<tr>
<td>Office</td>
<td>256</td>
</tr>
<tr>
<td>Coat Storage</td>
<td>114.75</td>
</tr>
<tr>
<td>Men's Watercloset</td>
<td>46.75</td>
</tr>
<tr>
<td>Women's Watercloset</td>
<td>60</td>
</tr>
<tr>
<td>Kitchen</td>
<td>598.50</td>
</tr>
<tr>
<td>Pantry</td>
<td>80</td>
</tr>
<tr>
<td>Waitstaff Area</td>
<td>112</td>
</tr>
<tr>
<td>Bar</td>
<td>85</td>
</tr>
<tr>
<td>Dining / Lounge</td>
<td>2373</td>
</tr>
<tr>
<td>Men's Locker</td>
<td>647</td>
</tr>
<tr>
<td>Women's Locker</td>
<td>502.50</td>
</tr>
<tr>
<td>Pro Shop</td>
<td>921</td>
</tr>
<tr>
<td>Club Storage</td>
<td>419</td>
</tr>
<tr>
<td>Mechanical / Electrical</td>
<td>92.5</td>
</tr>
<tr>
<td>Storage / Janitorial</td>
<td>35</td>
</tr>
<tr>
<td>Circulation</td>
<td>533</td>
</tr>
</tbody>
</table>

**TOTAL INTERIOR SQUARE FOOTAGE**

6944 square feet

**EXTERIOR:**

<table>
<thead>
<tr>
<th>Room Type</th>
<th>Square Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry Portico</td>
<td>96</td>
</tr>
<tr>
<td>Patio</td>
<td>384</td>
</tr>
</tbody>
</table>

**TOTAL EXTERIOR SQUARE FOOTAGE**

480 square feet
Goals
GOALS

1. Further develop my abilities to gather, evaluate, and apply my conclusions during the design process.

2. Investigate techniques and practices as they apply towards golf club design.

3. Design a facility that addresses and improves existing spatial problems.

4. Enhance present clubhouse.

5. Create a space that captures the spirit of golf.

6. Have fun and do my best!
Case Studies
CASE STUDIES

The case studies researched and presented in this section deal with a wide range of facility size and function. The variety used was an attempt to understand design considerations and function pertaining to the clubhouse.

Major implications in clubhouse design include concept, light, maximization of space and separation of areas, views, and creative use of color and materials to control interior climate. The case studies following share at least one or more of these implications.
Features:
1. Grand entrance.
2. Handmade feel.
3. "Neo Flyer One" concept.
5. Views provided and controlled.
Sectional detail of dome.

- basic triangle
- 3V alternate division
- Development of dome
Harborview at Kil-Conga Park
Winnepeg, Manitoba
by IKOY Architects
Municipal

Features:
1. Area separation.
2. Function maximization.
3. Small fishing village concept.
4. Views provided and controlled.
5. Water usage.
This one-floor plan incorporates all functions in a simple rectangular building in which the various areas are scaled to the needs of the club's 200 members. Winner of the Progressive Architecture magazine Merit Award for 1954, this building has already received recognition for its restrained design and well-conceived plan.

Features:
1. All functions in one building.
2. Functional.
3. One-floor plan.
4. Rectangle.
5. Restrained.
7. Small scale.
Palo Alto Municipal Golf Course
Palo Alto, California
by A. Quincy Jones and Frederic C. Emmons
Municipal

Features:
1. Minimum, efficient facility.
2. Minimum personnel.
3. Possible expansion.
4. Separation of areas.
5. Views controlled.
1. Clubhouse  
2. "Mountain" golf course  
3. "Desert" golf course  
4. Swim and tennis complex  
5. Cottages (sirplexes)  
6. Patio homes  
7. Temporary sales office  

Vintage Club  
1988, Indian Wells California  
by Fisher Friedman Associates  
Private  

Features:  
1. Elegance through simplicity.  
2. Forms from landscape.  
3. Integration of water.  
4. Prestige through solidity.  
5. Provision of views.  
6. Rhythm.  
7. Separation of areas.  
8. Skylight.
Interior
Space
Analysis
INTERIOR SPACE ANALYSIS

LIST OF SPACES:
1) Entry / Matre' de / Waiting
2) Coat Closet
3) Office
4) Water Closets
5) Dining
6) Lounge / Bar
7) Patio
8) Kitchen
9) Waitstaff
10) Proshop
11) Club Storage
12) Men's Locker
13) Women's Locker
14) Storage / Janitorial / Employee Room
15) Mechanical / Electrical
16) Circulation
17) Summary
ENTRY / MATRE' DE / WAITING: The entry is a transitional space. It defines exterior from interior. The Matre’ de and waiting space is used for greeting, reservations, and waiting.

Approximate Area: 261 square feet

Number of Occupants: varies

Soft Requirements: comfortable
distinguishable
intriguing
inviting
relaxing

Hard Requirements: barrier free access
glazing
overhang / recess
seating
security
signage
COAT CLOSET: This space will provide space for users to leave coats.

Approximate Area: 21 square feet

Number of Occupants: 0

Soft Requirements: organized
well lit

Hard Requirements: coat rack
shelving
OFFICE: The office is for a business manager. It will contain office equipment and office storage.

Approximate Area: 104 square feet
Number of Occupants: 1-3 People
Soft Requirements: naturally lit
organized
private
Hard Requirements: 3 chairs
computer
1 desk
files
phone
security equipment
WATER CLOSETS: These will constitute two facilities; for men and women. They will be used by public and employees.

Approximate Area: 234 square feet
Number of Occupants: 2 people each
Soft Requirements: organized
private
well lit

Hard Requirements: barrier free sink in each
barrier free stall in each
hand dryers and towel dispensers
full length mirrors
soap dispensers
1 stall in men's / 1 urinal in men's
2 stalls in women's
toilet paper dispensers
DINING: The space will accommodate users with sitting / eating areas.

<table>
<thead>
<tr>
<th>Approximate Area:</th>
<th>1008 square feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Occupants:</td>
<td>up to 75</td>
</tr>
</tbody>
</table>

**Soft Requirements:**
- centralized
- comfortable
- flexible
- intimate
- inviting
- naturally lit
- open
- view

**Hard Requirements:**
- seating for 75 people
- tables for 75 people
LOUNGE / BAR: This space will be for relaxation and service of alcoholic beverages.

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate Area:</td>
<td>672 square feet</td>
</tr>
<tr>
<td>Number of Occupants:</td>
<td>up to 40</td>
</tr>
<tr>
<td>Soft Requirements:</td>
<td>comfortable, inviting, naturally lit, view</td>
</tr>
<tr>
<td>Hard Requirements:</td>
<td>seating for up to 40 people, tables for up to 40 people</td>
</tr>
</tbody>
</table>
PATIO: This space will be for relaxation and food / drink service.

Approximate Area: 1618 square feet

Number of Occupants: up to 38 people

Soft Requirements: comfortable
inviting
open
relaxing

Hard Requirements: barbeque
chairs for up to 38
tables for up to 38
KITCHEN: This space will offer commercial kitchen equipment to serve the dining.

Approximate Area: 420 square feet
Number of Occupants: 1-10 people
Soft Requirements: organized, well lit
Hard Requirements: cold storage, counter space / prep, dishwashing, dry storage / pantry, frozen storage, hard surfaced floor, hot storage, microwave, stove / oven
WAITSTAFF AREA: This will accommodate waitstaff for partial food prep and beverage service.

**Approximate Area:** 80 square feet

**Number of Occupants:** 1-5 people

**Soft Requirements:** organized well lit

**Hard Requirements:** counter / prep space cold / dry / hot storage drink dispensers
PRO SHOP: This space will provide an area for the golf pro to display and sell equipment, and set up golf times.

Approximate Area: 700 square feet
Number of Occupants: varies

Soft Requirements: naturally lit
organized
view

Hard Requirements: chairs
counter space
display area
intercom speaker
phone
swing area
view of first and tenth hole
CLUB STORAGE: This space will provide club storage and allow an area for club cleaning and repair.

Approximate Area: 560 square feet
Number of Occupants: varies
Soft Requirements: organized
well lit
Hard Requirements: hard surfaced floors
shelving
MEN'S LOCKER: This space will offer locker storage to male members. There will also be shower / water closet facilities private to members.

Approximate Area: 592 square feet
Number of Occupants: varies
Soft Requirements: inviting masculine organized private relaxing
Hard Requirements: 1 barrier free shower 1 barrier free sink 1 barrier free stall 1 full length mirror lockers for 110 people seating urinal
WOMEN'S LOCKER: This space will offer locker storage to female members. There will also be shower / water closet facilities private to members.

Approximate Area: 594 square feet
Number of Occupants: varies
Soft Requirements: feminine
inviting
naturally lit
private
relaxing

Hard Requirement: 1 barrier free sink
1 barrier free shower
1 barrier free stall
1 full length mirror
lockers for 100 people
lounge seating
STORAGE / JANITORIAL / EMPLOYEE ROOM: This area will provide for miscellaneous storage and a breakroom for employees.

Approximate Area: 160 square feet
Number of Occupants: varies
Soft Requirements: organized well lit
Hard Requirements: hard surfaced floors seating shelving table
MECHANICAL / ELECTRICAL: This room will contain the HVAC system, hot water tank, and necessary electrical panels.

Approximate Area: 110 square feet

Number of Occupants: 1-3 people

Soft Requirements: well lit

Hard Requirements: hard surfaced floors necessary equipment
CIRCULATION: This will include circulation amongst separate clubhouse functions.

Approximate Area: 1446 square feet

Number of Occupants: varies

Soft Requirements: comfortable functional

Hard Requirements: barrier free access
### INTERIOR SPACE ANALYSIS SUMMARY

| 1) Entry / Matre' de / Waiting | 261 square feet |
| 2) Coat Closet | 21 square feet |
| 3) Office | 104 square feet |
| 4) Water Closets | 234 square feet |
| 5) Dining | 1008 square feet |
| 6) Lounge / Bar | 672 square feet |
| 7) Kitchen | 420 square feet |
| 8) Waitstaff | 80 square feet |
| 9) Pro Shop | 700 square feet |
| 10) Club Storage | 560 square feet |
| 11) Men's Locker | 592 square feet |
| 12) Women's Locker | 594 square feet |
| 13) Storage / Janitorial / Employee Room | 160 square feet |
| 14) Mechanical / Electrical | 110 square feet |
| 15) Circulation | 1446 square feet |

**TOTAL** | 6994 square feet

### EXTERIOR SPACE ANALYSIS SUMMARY

| 1) Patio | 1618 square feet |

**TOTAL** | 1618 square feet
Spatial Diagrams
SPATIAL MATRIX

<table>
<thead>
<tr>
<th></th>
<th>ENTRY</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COAT CLOSET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>OFFICE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>WATER CLOSET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DINING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>LOUNGE / BAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>PATIO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>KITCHEN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>WAITSTAFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>PROSHOP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CLUB STORAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>MEN'S LOCKER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>WOMEN'S LOCKER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>STOR. / JANT. / EMPL. ROOM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>MECHANICAL / ELECTRICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
BUBBLE DIAGRAM

PRIVATE
- CLUB STORAGE
- LOCKERS
- OFFICE
- PRO SHOP

PUBLIC
- KITCHEN
- WC
- SOCIAL FACILITIES

TO PATIO

TO 1ST TEE
TO PUTTING PRACTICE
TO DRIVING RANGE
TO 10TH TEE

MAIN ENTRANCE
Universal Design Requirements
UNIVERSAL DESIGN REQUIREMENTS

ADA TITLE III: NONDISCRIMINATION BY PUBLIC ACCOMMODATIONS AND IN COMMERCIAL FACILITIES (Final Rule - Privately Funded Facilities).

Alterations: Comply with ADAAG for alteration for first occupancy after January 26, 1992 (date of beginning physical alteration). Area being altered plus paths of travel, which include restrooms, telephones, and drinking fountains serving altered area, unless disproportionate.

New Construction: Comply with ADDAG for facilities with first occupancy after January 26, 1993, or having obtained the last application for a building permit by January 26, 1992. (Elevator exception in ADDAG does not apply.)

Existing Facilities: Removal of architectural barriers, structural in nature, where readily achievable (easily accomplishable and able to be carried out without much difficulty or expense). January 26, 1992.

Public Accommodation:
Definition: Privately owned accommodation open to the public including hotels, restaurants, theaters, places of public gathering, sales and rental establishments, banks, shops, accountant, lawyer, and insurance offices, health care provider offices, hospitals, service establishments, public transportation stations.

Integrated Setting: Provide goods and services in integrated setting unless otherwise necessary to ensure equal opportunity.

Auxiliary Aids: Furnish when necessary to ensure effective communication, unless it results in undue burden. Qualified interpreters, assistive listening headsets, television captioning and decoders, telecommunications devices for deaf persons, videotext displays, readers, taped text, brailled materials, and large print materials are examples. (Wheelchairs, eyeglasses, hearing aids, and personal services are not required.)

Alterations: Areas altered to comply with ADAAG and where a primary function area, provided path of travel alterations include toilet facilities, drinking fountains and telephones, unless disproportionate, over 20% of nonaccess construction cost.

Existing Facilities: Remove existing architectural barriers where readily achievable, required extent to be determined on a case to case basis. Modifications are for existing public accommodations, not commercial facilities.

SITEM Accessible Route: Accessible entrances to public transportation stops, parking, passenger loading zones, and to public streets and sidewalks.

Cross Slopes: Maximum 1:50 (approx. 1.4" per foot).

Sidewalks:
Width and Slope: 3'-0" (36") width, 1:20 maximum slope (a ramp is steeper.)
Level Change: 1/4: at 90°, 1/2 at 1:2 slope.
Curb Cut Width: 3'-0" (36").
Curb Cut Flared Sides: 1:10 slope if pedestrians cross.
Built up Curb Ramps: Shall not project into traffic.
Detachable Warnings: Required at new curb ramps: 4.92.2.
Marked Crossings: Curb ramps to be wholly contained.
Islands: Level cuts through raised islands or curb ramps at both sides with 4'-0" (48") clear space between. Gratings maximum 1/2" opening in direction of travel.

Accessible Parking:
Locate as close as possible to accessible entry.
Width: 8'-0" (96").
Adjacent Spaces: 8'-0" (96") for vans, 5'-0" (60") others; one van parking space in eight accessible spaces.
Verticle Clearance: 8'-2" (98") for accessible parking.
Thresholds: maximum 1/2" total height with maximum verticle changes of 1/4" and maximum slope of 1 in 2.

Door Passage Hardware: 4'-0" (48")

Passenger Loading Zones:
Length: 20'-0".
Access Aisle (Adjacent): 5'-0" (60") wide
Verticle Clearance: 9'-6" (114"), for vehicle route

Route

Doors and Entrances:
Provide accessible entrances to accessible spaces; min 50% entrances accessible.
Level Space at Outswing Doors: 5'-0" (60")
Space at Strike Side of Outswing Doors: 1'-6" (18") required, 2'-0" (24") preferred exterior
ADAAG: additional space sometimes required depending upon approach to door.
Space at Strike Side of Door away from Swing: 12" min.
Level Space at Inswing Doors: 4'-0" (48") typical, 3'-6" (42") permitted depending upon the approach to the door.
Width 3'-0" (36") door, 2'-8" clear opening.
Double Doors: Active leaf min. 2'-8" (32") clear opening.
Door Height: 6'-8" (80").

Hardware:
Operable at a single effort, no grasping: levers, pulls, panic devices.
Allowable closure Pressure:
Interior Doors: 5 pounds of pressure
Fire Rated Doors: 15 pounds of pressure (fire codes).

Corridors and Aisle:
Aisle Width: 3'-0" (36").
Passing Space: 5'-0" (60") space maximum 200' apart.
Carpet: Maximum 1/2" pile height; secured to substrate.
Floors: Stable, firm and slip resistane.

Stairs:
Rise and Run: Uniform rise [max. 7" UBC], min 11" run.
Nosings: Max. 1-1/2" extension, rounded or bevelled.
Risers: Closed type.

Ramps:
Ramps (slope over 1:20): Least slope possible required!
maximum Slope: 1:12.
Provided Landings Min. 30" Verticle Rise: 30' at 1:12.
Handrails Required: Both sides where rise is greater than 6" and runs greater than 6'-0" (72")
Curbs: Provide 2" curbs at unprotected edges with drops.

Handrails:
Height: 2'-10" (34") to 3'-2" (38")
Extension at Top of Stairs and Ramps: 1'-0" (12").
Extension at Stair Bottom: Tread width + 1'-0" (12");
Extension at Ramp Bottom: 1'-0" (12").
Size: 1-1/4" to 1-1/2": 1-1/2" clear.

Elevators:
Width 6'-8" (80") centered doors; 5'-8" (68") doors at front side.
Depth: 4'-3" (51") to front wall; 4'-6" (54") to door.
Door: 3'-6" (42")
Highest Allowable Control Side Approach: 4'-6" (54")
Highest Allowable Control Front Approach: 4'-0" (48").
Lowest Allowable Controls: 2'-11" (35"). Controls: Front wall for center opening doors, side wall or front wall adjacent to door for side-opening doors. Hall Call Buttons: Center at 3'-6" (42"). Floor Indicators: 2" high letters, including Braille, 5'-0" (60") above floor both sides of door jamb. Hall Lanterns: Sound once for up, twice for down; mount min. 6'-0" (72") high; min. 2-1/2" high lantern light.

Special Access Lifts (From Referenced ANSI A17.1):
New Construction: Not permitted as alternative to ramps. Maximum Travel: 12'-0" and shall not penetrate floor. Capacity: 400 pounds minimum. 750 pounds maximum. Platform Size: 2'-6" (30") by 4'-0" (48"). Maximum Speed: 30 feet per minute.

ELEMENTS

Drinking Fountains
Spout: maximum 3'-0" (36") high; with water flow parallel to front of unit and water flow height minimum 4". Controls: At or near front edge of fountain. Clear Space Beneath Wall Mounted and Post Mounted Fountains: Minimum 2'-3" (27") high; 2'-6" (30") wide; and 1'-3" (17") to 1'-5" (19") deep. Free Standing Fountains: Both high and low fountains required, no less than 50% of fountains wheelchair accessible.

Public Telephones:
Mounting Height: 4'-0" (48") to 4'-6" (54") depending upon approach and type of telephone. Provide pushbutton controls where service is available. Cord Length: Minimum 2'-5" (29"). Hearing-Impaired: Magnetic field receivers required; volume control required at bank of telephones. TextTelephones: Requirements are in 4.13(17) and 4.31.9

Toilet Facilities:
Toilet Rooms:
Entrance to Room: 2'-8" (32" clear.

Turning Space: 5'-0" (60") diameter Provide Accessible Path to Accessible Fixtures. At least one type of each fixture and accessory provided is required to be accessible. Controls: One hand operable, no grasping, maximum 5 pounds of pressure.

Wheelchair Accessible Toilet Compartments: Space in Front of Door: 4'-0" (48") typical, 3'-6" (42") allowed for side approach from latch side of door. Door Width: 2'-8" (32") clear. Lateral Transfer Compartments (Middle of Row):
Compartment Width: 5'-0" (60") min. Length: Wall Mounted W.C. 4'-8" (56") Floor-Mounted W.C. 4'-11" (59") Rear Grab Bar: 3'-0" (36") Side Grab Bar: 3'-4" (40")

Lateral Transfer Compartments (End of Row - Side Entry):
Compartment Width: 5'-0" (60") min. Length: Wall-Mounted W.C. 7'-8" (92"), Floor Mounted W.C. 7'-11" (95"). Rear Grab Bar: 3'-0" (36"). Side Grab Bar: 3'-4" (40"). Alt. (Existing Facility Only) Lateral Transfer Compartment:
Compartment Width: 3'-0" (36") min. Length: Wall-Mounted W.C. 5'-6" (66"), Floor Mounted W.C. 5'-9" (69"). Side Grab Bar: 3'-6" (42").
Flush Controls: Mount on wide side of toilet (manufactures typically mount controls on left side when facing water closet). Water Closet to Near Wall: 1'-6" from center line of water closet. Grab Bar Height: 2'-9" (33") to 3'-0" (36"). Toilet Paper Holder: Centered min. 1'-7" (19") above flr. Flush Control Heights: Maximum 3'-8" (44").

Ambulatory Disabled Accessible Toilet Compartments:
Where 6 or more toilet stalls are provide, at least one ambulatory accessible stall is required. Door: Outswing, Self closing. Compartment Width: 3'-0" (36"). Side Grab Bars: 3'-6" (42"), both sides Grab Bar Height: 2'-9" to 3'-0").
Urinals:
Stall-Type: Permitted under ADAAG
Wall Hung: Elongated type maximum 1'-5" (17") from floor.
Flush Control Heights: Maximum 3'-8" (44").

Lavatories:
Height: Maximum 2'-10" (34"0 to countertop or sink rim.
Depth: Minimum 1'-5" (17") apron to wall.
Clearance:
Front of Apron: Minimum 2'-5" (29")
Knee Clearance: 2'-3" (27") for 8" of apron
Toe Clearance: 9" high for minimum 6" from wall.
Insulated exposed water and drain pipes.
Faucets: One hand operable without grasping, maximum 5 pounds pressure.

Accessories:
Mirrors: Max. 3'-4" (40") to bottom of reflective surface.
Medicine Cabinets: Usable shelf max. 3'-8" (44") of floor, dispensers, disposals, etc.
Front Approach: Max. 4'-0" (48") minimum 1'-3" (15").
Side Approach: Maximum 4'-8" (56") minimum 9"
Refer to ADA Access Guidelines where over obstruction.

SHOWERS
Size: 3'-0" (36") by 3'-0" (36") with seat; 1/2" high curb allowed.
Alternate: 2'-6" (30") by 5'-0" (60") without seat; no curb allowed (wheelchair enters shower).
Grab Bars: 3'-0" (36") on control wall, 18" adjacent; height of 2'-9" (33") to 3'-0" (36").
Alternate: Full surround all three sides.
Seat: Full depth of stall L shaped seat.
Seat Height: 17" to 19" above floor.
Control Height: 3'-2" (38") to 4'-0" (48").

FUNCTIONAL AREAS
Assembly Areas: Where 50 or more persons and where an audio amplification system is provided, permanently installed assistive listening system is required.

<table>
<thead>
<tr>
<th>Capacity of Seating in Assembly Areas</th>
<th>Number of Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 25</td>
<td>1</td>
</tr>
<tr>
<td>26 to 50</td>
<td>2</td>
</tr>
<tr>
<td>51 to 300</td>
<td>4</td>
</tr>
<tr>
<td>301 to 500</td>
<td>6</td>
</tr>
</tbody>
</table>
| over 500                             | 6, 1 plus additional space for each total seating capacity increase of 100

Theaters: Where more than 300 seats are provided, dispersal of wheelchair seating is required. Fixed seating for companion seating is required adjacent to wheelchair seating. In addition, at least one percent of fixed seats must be aisle seats without armrests or moveable armrests.

Restaurants: All dining areas and min. 5% of fixed tables (at least one) must be accessible. Counters and Bars: Min. 6’ length to be accessible as required for counters and tables.
Building
Code
Review
## CODE SEARCH

### Required Code
- **Building**: 1991 Uniform Building Code
- **Plumbing**: 1991 Uniform Plumbing Code

### Code Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occupancy Group</strong></td>
<td>A-3, B-2</td>
</tr>
<tr>
<td><strong>Fire Resistance of Exterior Walls</strong></td>
<td>2 hours less than 5 feet</td>
</tr>
<tr>
<td></td>
<td>1 hour less than 20 feet</td>
</tr>
<tr>
<td><strong>Openings in Exterior Walls</strong></td>
<td>Not permitted less than 5 feet</td>
</tr>
<tr>
<td></td>
<td>Protected less than 10 feet</td>
</tr>
<tr>
<td><strong>Occupation Separation</strong></td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Construction Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A-3</strong></td>
<td>Allowable Floor Area: 6,000 square feet</td>
</tr>
<tr>
<td><strong>B-2</strong></td>
<td>Allowable Floor Area: 8,000 square feet</td>
</tr>
<tr>
<td><strong>Occupation Separation</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>A-3</strong></td>
<td>Allowable Height: 1 story</td>
</tr>
<tr>
<td><strong>B-2</strong></td>
<td>Allowable Height: 2 stories</td>
</tr>
</tbody>
</table>

### Fire Resistive Requirements (assuming V/N)

<table>
<thead>
<tr>
<th>Walls</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exterior Walls</strong></td>
<td>N</td>
</tr>
<tr>
<td><strong>Interior Walls</strong></td>
<td>N</td>
</tr>
<tr>
<td><strong>Partitions</strong></td>
<td>N</td>
</tr>
<tr>
<td><strong>Structural Frames</strong></td>
<td>N</td>
</tr>
<tr>
<td>Fire Resistive Requirements (continued)</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Shafts</td>
<td>N</td>
</tr>
<tr>
<td>Floors - Ceilings / Floors</td>
<td>N</td>
</tr>
<tr>
<td>Roofs - Ceilings / Roofs</td>
<td>N</td>
</tr>
<tr>
<td>Exterior Doors and Windows</td>
<td>Refer to exterior openings previous page</td>
</tr>
</tbody>
</table>

**Exits**

<table>
<thead>
<tr>
<th>Use</th>
<th>Clubhouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignable Square Footage</td>
<td>5600 sq. ft.</td>
</tr>
<tr>
<td>Occupant Load Factor</td>
<td>15/sq. ft.</td>
</tr>
<tr>
<td>Occupant Load</td>
<td>477</td>
</tr>
<tr>
<td>Number of Exits Required</td>
<td>2</td>
</tr>
<tr>
<td>Width of Exits Required</td>
<td>9.54</td>
</tr>
<tr>
<td>Distance Between Exits</td>
<td>60 feet</td>
</tr>
<tr>
<td>Distance to Exits</td>
<td>150 feet without sprinklers</td>
</tr>
</tbody>
</table>

**Doors**

| Swing Out Required                             | Yes       |
| Special Hardware Required                      | No        |
Corridors

Width
44 inch minimum

Height
7 feet

Flame Spread Requirements

Stairs
I

Corridors
II

Rooms
A-3 II3
B-2 III

Plumbing Requirements (fixtures per person)

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Closets</td>
<td>1 1:50</td>
<td>1 1:50</td>
</tr>
<tr>
<td>Urinals</td>
<td>1 1:50</td>
<td>-------</td>
</tr>
<tr>
<td>Lavatories</td>
<td>1 1:50</td>
<td>1 1:50</td>
</tr>
<tr>
<td>Drinking Fountains</td>
<td>-------</td>
<td>-------</td>
</tr>
</tbody>
</table>
Bibliography
BIBLIOGRAPHY

BOOKS


International Conference of Plumbing and Mechanical Officials. 1991 Uniform Plumbing Code. Walnut, California: The International Association of Plumbing and Mechanical Officials


Western Sun. 1980 Montana, Solar and Weather Information. Portland, Oregon. Western Sun

INTERVIEWS

Woods, Mike, Interview with the president of Laurel Golf Club, Billings, Montana, January 1993.

MAGAZINES


APPENDICES
Appendix

A

Map of Site
Appendix B
Existing Floor Plan
Appendix C

Climate and Solar Data
**ZONE 10: The Great Plains**

**BILLINGS, MONTANA**

**Station Data**

LatITUDE: 45°48'N  
LONGITUDE: 108°32'W  
TIME ZONE: Mountain  
ELEVATION: 3567'

**TABLE 1: Daily Solar Data (mean)**

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Horizontal Insolation (KJ/M²-Day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5516</td>
<td>8661</td>
<td>13499</td>
<td>17322</td>
<td>21708</td>
<td>24699</td>
<td>27053</td>
<td>22952</td>
<td>16683</td>
<td>11199</td>
<td>6371</td>
<td>4780</td>
</tr>
<tr>
<td><strong>Direct Beam Normal Incidence (KJ/M²-Day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14756</td>
<td>18355</td>
<td>22314</td>
<td>26633</td>
<td>31311</td>
<td>34550</td>
<td>35630</td>
<td>33111</td>
<td>27712</td>
<td>22674</td>
<td>16555</td>
<td>13676</td>
</tr>
<tr>
<td><strong>Total Horizontal Insolation (BTU/FT²-Day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>486.0</td>
<td>763.2</td>
<td>1189.5</td>
<td>1526.3</td>
<td>1912.8</td>
<td>2173.7</td>
<td>2383.7</td>
<td>2022.4</td>
<td>1470.0</td>
<td>986.8</td>
<td>561.4</td>
<td>421.2</td>
</tr>
<tr>
<td><strong>Direct Beam Normal Incidence (BTU/FT²-Day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1302.0</td>
<td>1619.0</td>
<td>1968.0</td>
<td>2349.0</td>
<td>2762.0</td>
<td>3048.0</td>
<td>3143.0</td>
<td>2921.0</td>
<td>2444.0</td>
<td>2000.0</td>
<td>1460.0</td>
<td>1206.0</td>
</tr>
<tr>
<td><strong>Total South Wall Insolation (BTU/FT²-Day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>825.0</td>
<td>981.0</td>
<td>1079.0</td>
<td>888.0</td>
<td>794.0</td>
<td>751.0</td>
<td>844.0</td>
<td>1029.0</td>
<td>1166.0</td>
<td>1208.0</td>
<td>893.0</td>
<td>713.0</td>
</tr>
<tr>
<td><strong>Percent of Possible Sunshine</strong></td>
<td>48.0</td>
<td>54.0</td>
<td>61.0</td>
<td>59.0</td>
<td>61.0</td>
<td>64.0</td>
<td>78.0</td>
<td>77.0</td>
<td>68.0</td>
<td>62.0</td>
<td>46.0</td>
<td>45.0</td>
</tr>
<tr>
<td><strong>Mean Cloud Cover</strong></td>
<td>7.2</td>
<td>7.1</td>
<td>7.2</td>
<td>7.1</td>
<td>6.5</td>
<td>5.9</td>
<td>4.0</td>
<td>4.1</td>
<td>5.3</td>
<td>5.6</td>
<td>6.8</td>
<td>6.8</td>
</tr>
<tr>
<td><strong>Percent of Total Horizontal to Extraterrestrial Insolation</strong></td>
<td>49.3</td>
<td>52.5</td>
<td>54.2</td>
<td>56.0</td>
<td>59.2</td>
<td>61.4</td>
<td>64.5</td>
<td>64.0</td>
<td>61.4</td>
<td>58.9</td>
<td>52.0</td>
<td>49.3</td>
</tr>
</tbody>
</table>

**TABLE 2: Climate Data**

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Monthly Temperature (°F)</strong></td>
<td>21.9</td>
<td>27.4</td>
<td>32.6</td>
<td>44.6</td>
<td>54.5</td>
<td>52.6</td>
<td>71.8</td>
<td>70.1</td>
<td>58.9</td>
<td>49.3</td>
<td>35.7</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average Daily Maximum</strong></td>
<td>31.2</td>
<td>37.1</td>
<td>42.1</td>
<td>55.8</td>
<td>65.7</td>
<td>73.7</td>
<td>85.6</td>
<td>83.8</td>
<td>71.3</td>
<td>61.0</td>
<td>45.0</td>
<td>35.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average Daily Minimum</strong></td>
<td>12.5</td>
<td>17.7</td>
<td>23.1</td>
<td>33.4</td>
<td>43.3</td>
<td>57.5</td>
<td>58.0</td>
<td>56.3</td>
<td>46.5</td>
<td>37.5</td>
<td>26.4</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Winter/Summer Design</strong></td>
<td>-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total Heating Deg-Days for Month | 1336 | 1053 | 1004 | 612 | 333 | 131 | 10 | 15 | 221 | 487 | 879 | 1184 |
| Total Cooling Deg-Days for Month | 0 | 0 | 0 | 0 | 8 | 59 | 220 | 173 | 38 | 0 | 0 | 498 |
| Percent Relative Humidity (Night) | 63 | 63 | 62 | 60 | 60 | 60 | 48 | 45 | 57 | 55 | 62 | 63 |
| Wind Direction | SW | SW | SW | NE | SW | SW | SW | SW | SW | SW | WSW | SW |
| Wind Speed (MPH) | 13.1 | 12.5 | 11.7 | 11.8 | 11.1 | 10.5 | 9.8 | 9.7 | 10.5 | 11.2 | 12.2 | 13.0 |
TABLE 3: Daily Solar Radiation on Tilted Surfaces
(Calculated Values) (Engineering Units [BTU/FT²-Day])
(To find Total Solar Radiation on a Tilted Surface add the figure from TABLE 3a. to that of TABLE 3b.)
(Reflectivity = 0.2) (Multiply values by [RHO/0.2] for other reflectivities)

**TABLE 3a: Direct Beam + Diffuse**

<table>
<thead>
<tr>
<th>ORIENT</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>15</td>
<td>657</td>
<td>956</td>
<td>1379</td>
<td>1635</td>
<td>1975</td>
<td>2215</td>
<td>2458</td>
<td>2161</td>
<td>1671</td>
<td>1229</td>
<td>745</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>792</td>
<td>1093</td>
<td>1488</td>
<td>1654</td>
<td>1926</td>
<td>2129</td>
<td>2284</td>
<td>2170</td>
<td>1773</td>
<td>1398</td>
<td>887</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>880</td>
<td>1167</td>
<td>1512</td>
<td>1581</td>
<td>1769</td>
<td>1922</td>
<td>2166</td>
<td>2050</td>
<td>1770</td>
<td>1483</td>
<td>977</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>916</td>
<td>1173</td>
<td>1448</td>
<td>1421</td>
<td>1516</td>
<td>1608</td>
<td>1820</td>
<td>1807</td>
<td>1662</td>
<td>1479</td>
<td>1009</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>898</td>
<td>1109</td>
<td>1300</td>
<td>1185</td>
<td>1183</td>
<td>1208</td>
<td>1369</td>
<td>1459</td>
<td>1456</td>
<td>1385</td>
<td>980</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>825</td>
<td>981</td>
<td>1079</td>
<td>888</td>
<td>794</td>
<td>751</td>
<td>844</td>
<td>1029</td>
<td>1166</td>
<td>1208</td>
<td>893</td>
</tr>
<tr>
<td>45°</td>
<td>15</td>
<td>603</td>
<td>894</td>
<td>1316</td>
<td>1591</td>
<td>1943</td>
<td>2135</td>
<td>2416</td>
<td>2106</td>
<td>1604</td>
<td>1150</td>
<td>686</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>687</td>
<td>977</td>
<td>1371</td>
<td>1583</td>
<td>1880</td>
<td>2088</td>
<td>2326</td>
<td>2082</td>
<td>1650</td>
<td>1251</td>
<td>774</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>732</td>
<td>1006</td>
<td>1360</td>
<td>1502</td>
<td>1738</td>
<td>1907</td>
<td>2136</td>
<td>1961</td>
<td>1618</td>
<td>1281</td>
<td>818</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>795</td>
<td>977</td>
<td>1272</td>
<td>1348</td>
<td>1522</td>
<td>1649</td>
<td>1854</td>
<td>1744</td>
<td>1494</td>
<td>1236</td>
<td>814</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>697</td>
<td>900</td>
<td>1129</td>
<td>1144</td>
<td>1251</td>
<td>1334</td>
<td>1501</td>
<td>1458</td>
<td>1306</td>
<td>1130</td>
<td>766</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>620</td>
<td>773</td>
<td>926</td>
<td>897</td>
<td>948</td>
<td>991</td>
<td>1112</td>
<td>1121</td>
<td>1054</td>
<td>959</td>
<td>675</td>
</tr>
<tr>
<td>90°</td>
<td>15</td>
<td>476</td>
<td>751</td>
<td>1163</td>
<td>1489</td>
<td>1866</td>
<td>2118</td>
<td>2320</td>
<td>1968</td>
<td>1438</td>
<td>968</td>
<td>549</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>458</td>
<td>720</td>
<td>1107</td>
<td>1403</td>
<td>1743</td>
<td>1979</td>
<td>2162</td>
<td>1848</td>
<td>1359</td>
<td>925</td>
<td>527</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>430</td>
<td>676</td>
<td>1025</td>
<td>1281</td>
<td>1589</td>
<td>1786</td>
<td>1954</td>
<td>1680</td>
<td>1253</td>
<td>864</td>
<td>493</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>394</td>
<td>613</td>
<td>915</td>
<td>1129</td>
<td>1389</td>
<td>1554</td>
<td>1700</td>
<td>1473</td>
<td>1114</td>
<td>780</td>
<td>451</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>342</td>
<td>529</td>
<td>785</td>
<td>953</td>
<td>1161</td>
<td>1290</td>
<td>1412</td>
<td>1236</td>
<td>953</td>
<td>672</td>
<td>389</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>265</td>
<td>438</td>
<td>637</td>
<td>759</td>
<td>914</td>
<td>1009</td>
<td>1104</td>
<td>977</td>
<td>769</td>
<td>554</td>
<td>323</td>
</tr>
</tbody>
</table>

**TABLE 3b: Reflected**

<table>
<thead>
<tr>
<th>ORIENT</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANY°</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>7</td>
<td>10</td>
<td>16</td>
<td>20</td>
<td>26</td>
<td>29</td>
<td>32</td>
<td>27</td>
<td>20</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>14</td>
<td>22</td>
<td>35</td>
<td>45</td>
<td>56</td>
<td>64</td>
<td>70</td>
<td>59</td>
<td>43</td>
<td>29</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>24</td>
<td>38</td>
<td>59</td>
<td>76</td>
<td>96</td>
<td>109</td>
<td>119</td>
<td>101</td>
<td>73</td>
<td>49</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>36</td>
<td>57</td>
<td>88</td>
<td>113</td>
<td>142</td>
<td>161</td>
<td>177</td>
<td>150</td>
<td>109</td>
<td>73</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>49</td>
<td>76</td>
<td>119</td>
<td>153</td>
<td>191</td>
<td>217</td>
<td>238</td>
<td>202</td>
<td>147</td>
<td>99</td>
<td>56</td>
</tr>
</tbody>
</table>
Billings, Montana, at an elevation of 3,100-3,600 feet above mean sea level, is situated in the borderline area between the Great Plains and the Rocky Mountains and has a climate which takes on some of the characteristics of both regions. Its climate may be classified as semiarid, but with irrigation and the favorable distribution of the precipitation during the spring and fall months, it is possible to raise a variety of crops in the area.

The average annual precipitation for the immediate area is a little more than 14 inches with about a third of this amount falling during May and June. June is the wettest month, followed in order by May, April, September, and October. The period of least precipitation is from November through February. These four months normally produce no more than 20 percent of the year's precipitation; even so, heavy snows of from 6 inches to 1 foot are not uncommon during these winter months, particularly during November and December. The heaviest snows, however, occur during the spring and fall months when the temperature and moisture conditions are most favorable. Snow seldom accumulates to great depths on the ground because of the occurrence of thawing periods, even during mid-winter. Thunderstorms, which occur on slightly over 30 days out of the year, are restricted mainly to the warm season, May through September. These storms are frequently accompanied by strong, gusty winds and occasionally by hail. Destructive hailstorms, however, are rather infrequent. The most recent one occurred on July 2, 1958. Upslope fog and low clouds are common with east and northeast winds during the colder two-thirds of the year with an occasional occurrence of these conditions during the warmest months. Radiation fogs seldom occur and are usually of short duration.

Winter is usually cold, though not extremely so, and generally affords several mild periods of a week to several weeks in length. The winter cold periods are ushered in by moderately strong north to northeast winds and snow, with the coldest period coming the first or second night after the snow ends and the sky clears. True blizzard conditions are not observed very often in town, but in the surrounding rural areas this condition may develop several times during an average winter. The cold waves "break" abruptly with the onset of moderate to strong west to southwest winds, attended by variable or increasing cloudiness. This wind is sometimes a Foehn condition (Chinook), but is more often a drainage wind moving down the Yellowstone Valley which transports warmer air of Pacific origin to the area. Occasionally an "open winter" is experienced; this happens when many of the severe cold waves pass far to the east. A recent example of a "mild winter" was the winter of 1968-1969 when only 2 days of below zero temperatures were observed with the coldest -7° on January 17.

The spring brings a period of frequent and rapid fluctuations in the weather. It is usually cloudy and cool with frequent periods of rain and/or snow. A snowstorm in April of 1953 left over 42 inches of snow in a 4-day period. As the season progresses, snows become less frequent until late May and June when rain is the rule. The last freezing temperatures in spring usually occur in the valley before May 15, though they have occurred as late as June 23.

The summer season is characterized by warm days with much sunshine and low humidities, but the nights are cool because of the altitude and the air drainage from the higher terrain nearby. Seldom is there a protracted rainy spell during this season. However, frequent thunderstorms bring threatening afternoon thunderstorms, but usually only small amounts of rain.

The first freezing temperatures of the fall season occur around September 25 in the valley, but they have been noted as early as August 25. Over the years, the fall months have been about evenly distributed between cold, wet ones and mild, dry, pleasant ones. The change to severe winter weather does not as a rule arrive before the middle of November, but there have been years when the more severe type of winter weather has been delayed until late in December. The snows which occur during the early fall months seldom accumulate and stay on the ground for any appreciable period.

The only tornado ever reported within the city limits of Billings, occurred in connection with the severe hail and windstorm of July 2, 1958 when a small funnel hit the then unpopulated SW corner of the city. Almost all of the high winds recorded during the warmer months occur in connection with thunderstorms while most of those during the remainder of the year are associated with the movement of major storm systems and cold fronts.
<table>
<thead>
<tr>
<th>Month</th>
<th>Average Temperature</th>
<th>Heating Degree Days</th>
<th>Cooling Degree Days</th>
<th>Snowfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sep</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Footnotes**

- Note: Details about the source and methodology of the data collection.
- Additional information: Specific remarks or clarifications regarding the data.
Appendix D

Slides of Existing Building
Appendix E

Slides of Project