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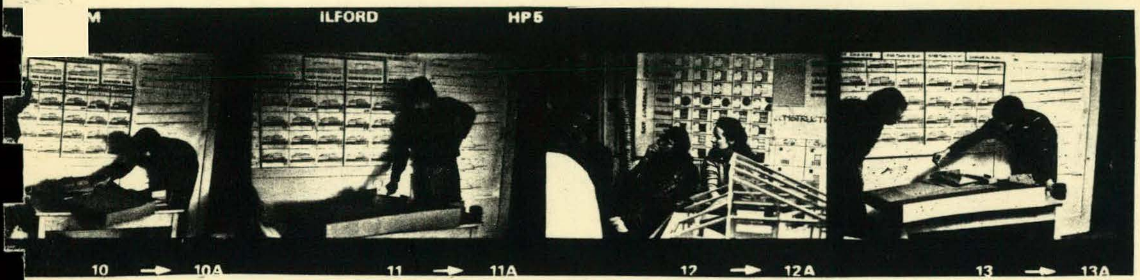

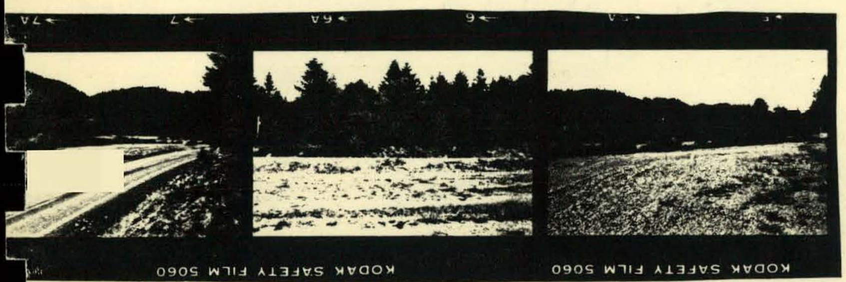

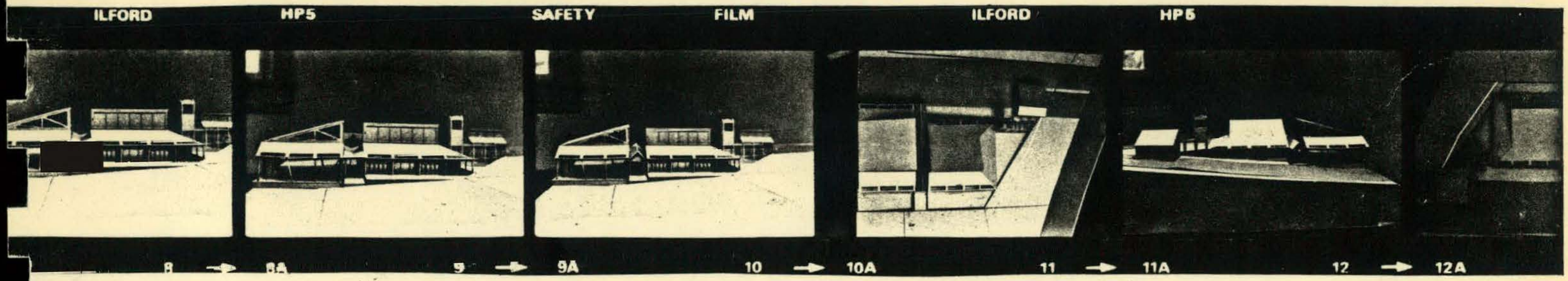

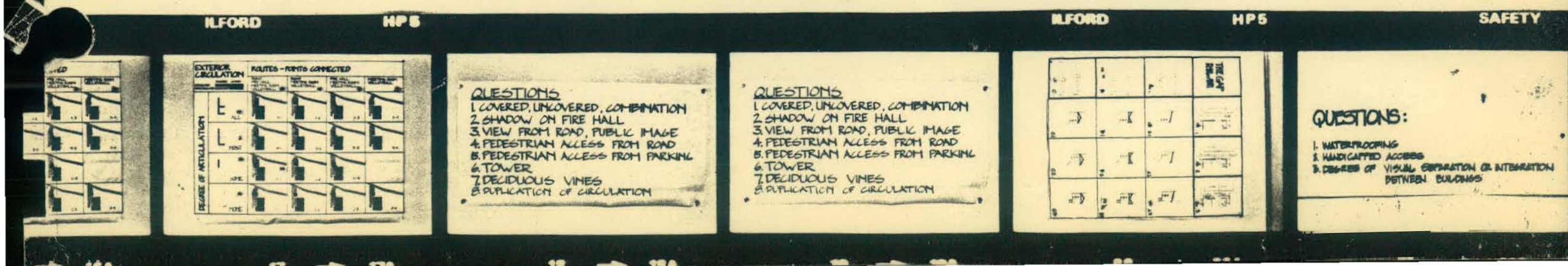

DISCLAIMER

Cooperative Agreement No.
DE-FC02-80CS30336

Deadwood Creek Services, Inc.

DEADWOOD COMMUNITY CENTER AND FIREHALL

DEADWOOD, OREGON

PHASE I

DESIGN DOCUMENTATION REPORT

prepared for U.S. DEPARTMENT OF ENERGY
PASSIVE SOLAR COMMERCIAL BUILDINGS
DESIGN ASSISTANCE AND DEMONSTRATION

by EQUINOX DESIGN, INC.
P.O. BOX 30085
EUGENE, OREGON 97403

G.Z. BROWN
R. KELLETT
JOHN S. REYNOLDS

DEADWOOD COMMUNITY CENTER AND FIREHALL
PASSIVE SOLAR COMMERCIAL BUILDINGS DESIGN
ASSISTANCE AND DEMONSTRATION
PHASE I - FINAL REPORT

OUTLINE - DECEMBER 1980

DEADWOOD COMMUNITY CENTER AND FIREHALL
PASSIVE SOLAR COMMERCIAL BUILDINGS DESIGN ASSISTANCE AND DEMONSTRATION

DOE FINAL REPORT REQUIREMENTS KEYED TO EQUINOX
PHASE I - FINAL REPORT OUTLINE - DECEMBER 1980

III. GENERAL PROJECT DOCUMENTATION REQUIREMENTS

(Refer to Part I - Summary)

i) Overview of the final design
- I•A. INTRODUCTION
- I•B. DEADWOOD PLACE AND COMMUNITY
- I•C. THE DESIGN PROCESS
- I•E. THE FINAL DESIGN
- I•F. THE CONSTRUCTION PROCESS
- I•G. PROGRESS TO DATE
- I•L. ACKNOWLEDGEMENTS

ii) Unavailable solar design information
- I•H. Same

iii) Incremental passive design costs
- I•I. Same

iv) Performance analysis/results
- I•J. Same

v) Economic analysis/results
- I•K. Same

vi) Architectural compatibility
- I•B. DEADWOOD, PLACE AND COMMUNITY
- I•C. THE DESIGN PROCESS

IV. DESIGN PROCESS DOCUMENTATION REQUIREMENTS

PRE - DESIGN:

1. Building Energy Needs

Refer to Part II - A. BUILDING ENERGY NEEDS

i) Task overview
- II•A-1. Introduction
- II•A-2. Overview of Process

ii) Unavailable information
- II•A-3. Same

iii) Incremental passive design costs
- II•A-4. Same

iv) Performance analysis/results
- II•A-5. Same

v) Economic analysis/results
II-A-6. Same

vi) Architectural compatibility
I-B. Deadwood: Place and Community

2. Site Energy Potentials

Refer to Part II - B. SITE AND COMMUNITY ENERGY RESOURCES
F. ENERGY ISSUES IN DESIGN PROCESSES

i) Task overview
II-B-1. INTRODUCTION
II-B-2. OVERVIEW

ii) Unavailable information
II-B-3. Same

iii) Incremental passive design cost
II-B-4. Same

iv) Performance analysis of site energy potentials
II-B-5. Same

v) Economic factors
II-B-6. Same

vi) Architectural compatibility
II-B-7. Same

3. Matching Energy Needs and Site Energy Potentials

Refer to Part II - D. MATCHING ENERGY NEEDS AND SITE POTENTIAL
E. ENERGY ISSUES IN DESIGN PROCESS
Part III - A. INCREMENTAL PASSIVE DESIGN COST BREAKDOWN
B. FINAL PERFORMANCE RESULTS
C. FINAL ECONOMIC ANALYSIS
D. EXTENDED CLIENT INVOLVEMENT

i) Task overview

II-D-1a)

II-E-1. Introduction to energy issues in design process

ii) Unavailable information
II-E-2b). Energy issues at site scale

iii) Incremental passive design cost
III-A-2. Same

iv) Performance comparisons of alternatives
II-E-2c). Energy issues at site scale

v) Economic analysis of alternatives
II-D-3. Design Meetings (Preliminary
(cost estimate)
II-E-2d). Energy issues at site scale

vi) Architectural compatibility
II-D-3. Design meetings

4. Design Indicators for Best Strategies/Concepts

Refer to Part II - D. MATCHING ENERGY NEEDS AND SITE ENERGY POTENTIAL
E. ENERGY ISSUES IN DESIGN PROCESS
Part III - A. INCREMENTAL PASSIVE DESIGN COST BREAKDOWN

i) Task overview
II-D-1a). Same
II-E-2a). Energy issues at site scale

ii) Unavailable information
II-E-2b). Energy issues at site scale

iii) Incremental passive design cost
III-A-3. Same

iv) Performance design indicators
II-E-2c). Energy issues at site scale

v) Economic design indicators
II-D-3. Design Meetings (preliminary cost estimate)
II-E-2d). Energy issues at site scale

vi) Architectural compatibility
II-D-3. Design meetings
II-E-3e). Energy issues at building scale

DESIGN

5. Schematic Design Alternatives

Refer to Part II-D. MATCHING ENERGY NEEDS AND SITE ENERGY POTENTIALS
-E. ENERGY ISSUES IN DESIGN PROCESS
Part III-A. INCREMENTAL PASSIVE DESIGN COST BREAKDOWN

i) Task overview
II-D-1a). Same
II-E-3. Design meetings
II-E-2a). Energy issues at site scale
II-E-3a). Energy issues at building scale

ii) Unavailable information
II-E-2b). Energy decisions at site scale
II-E-3b). Energy desicisons at building scale

iii) Incremental passive design cost
III-A-3. Same

iv) Performance considerations
II-E-2c). Energy issues at site scale
II-E-3c). Energy issues at building scale

v) Economic considerations
II-D-3. Design Meetings (preliminary cost estimate)
II-E-2d). Energy issues at site scale

vi) Architectural compatibility
II-D-3. Design meetings
II-E-3e). Energy issues at building scale

6. <u>Performance Testing the Schematic Design Alteratives</u>

Refer to Part II-D. MATCHING ENERGY NEEDS AND SITE ENERGY POTENTIALS
E. ENERGY ISSUES IN DESIGN PROCESS
Part III-A. INCREMENTAL PASSIVE DESIGN COST BREAKDOWN

i) Task overview
II-E-3a). Energy issues at building scale

ii) Unavailable information
II-E-3b). Energy issues at building scale

iii) Incremental passive design cost
III-A-5. Same

iv) Performance analysis of the designs
II-E-3c). Energy issues at building scale

v) Economic analysis of the designs
II-D-3. Design meetings

vi) Architectural compatibility
II-D-3. Design meetings

7. <u>Design Selection</u>

Refer to Part II-D. MATCHING ENERGY NEEDS AND SITE ENERGY POTENTIALS
E. ENERGY ISSUES IN DESIGN PROCESS
Part III-A. INCREMENTAL PASSIVE DESIGN COST BREAKDOWN

i) Task overview
II-D-3. Design meetings
II-E-3a). Energy issues at building scale

ii) Unavailable information
II-E-3b). Energy issues at building scale

iii) Incremental cost
III-A-6. Same

iv) Performance revisions
II-E-3c). Energy issues at building scale

v) Economic revisions
II-D-3. Design meetings

vi) Architectural compatibility
II-D-4. Schematic design drawings
II-D-5. Summary of passive solar energy systems

8. <u>Design Development</u>

Refer to Part II-D. MATCHING ENERGY NEEDS AND SITE ENERGY POTENTIALS
E. ENERGY ISSUES IN DESIGN PROCESS
Part III-A. INCREMENTAL PASSIVE DESIGN COST BREAKDOWN
B. FINAL PERFORMANCE RESULTS
C. FINAL ECONOMIC ANALYSIS
D. EXTENDED CLIENT INVOLVEMENT

i) Task overview
II-D-6. Construction drawings and specifications
II-E-4a). Energy issues at component scale

ii) Unavailable information
II-E-4b). Energy issues at component scale

iii) Incremental passive design cost
III-A-7. Same

iv) Final performance results
III-B-1. Introduction and overview
III-B-2. Firehall performance
III-B-3. Meeting hall performance

v) Final economic analysis
III-B-1. Introduction and overview
III-C-2. Firehall cost estimate
III-C-3. Meeting hall cost estimate

vi) Architectural compatibility
III-E-4e). Energy issues at component scale
III-D-1. Extended client involvement

ACKNOWLEDGEMENTS:

The information and design process presented throughout this project resulted from the co-operative efforts of many people. The design work was undertaken by Equinox Design, Inc., the Willamette Community Design Center, and the Building Committee of Deadwood Creek Services, Inc. Funding for materials and professional design services has come from a federal Housing and Community Development Block Grant administered by Lane County Department of Housing and Community Development and the U.S. Department of Energy through the Passive Solar Commercial Buildings Design Assistance and Demonstration Program. The authors would also like to thank Michael Pyatok and Hanno Weber for our introduction to the basic idea s which underlay the participatory methodology used in this project.

PART I: THE SUMMARY

DEADWOOD COMMUNITY CENTER AND FIREHALL
DEADWOOD, OREGON
OWNER: DEADWOOD CREEK SERVICES
DESIGNERS: EQUINOX DESIGN, INC.

I. SUMMARY

A. INTRODUCTION:

This report describes the energy related portions of an architectural design process that directly incorporated the needs, values, and aspirations of the people who will construct and use the buildings. The project is an example of a viable, comprehensive, energy responsive building formed in public by a group of professional and lay designers.

Hundreds of hours of group designing, discussion, and learning afford a unique opportunity to examine the potential of citizen involvement in building scale energy decisions in public education and policy definition.

The project was to design the first public buildings (a community center and firehall) for the rural community of Deadwood, Oregon. In addition to constructing the building on an extremely limited budget, the community was very interested in providing a significant learning experience for its members. They intended to organize, design, and construct these buildings as much on their own as possible. It was their intention that the project process as well as the completed buildings be an expression of community values, purpose, and vision.

B. THE PLACE AND THE COMMUNITY:

Deadwood, Oregon is a rural community of approximately two hundred. The extent of the community is most appropriately defined by its environmental boundary, the watershed of Deadwood Creek, a tributary of the Siuslaw River in the Coast Range of the western part of the state. The community is situated at 44^{o}N. Latitude on the floor of a north-south valley that experiences approximately 4600 degree days annually. The people of Deadwood Creek are a unique group with a strong commitment to community, independence, and the environment as the values that bind them together. It was important to them to build these buildings within the community as a means of encouraging the thrifty use of resources, demonstrating their indenpendence, and stretching the limited budget as far as possible. The community attitude toward energy proposes that it is never an independent problem but always integral with a social, political, and economic understanding of their valley and their community.

C. THE DESIGN PROCESS:

The design process had to direct more than the resolution of the building program on this particular site. Simultaneously, it needed to actively educate and engage the community through an open discussion of design that acknowledges their multiple perspectives and values. Ultimately the design proposal should be a reflection of the unique values, aspirations, and education of the participants.

This definition of a public role for design process runs somewhat contrary to a more conventional one that maintains design is a expert, private, and detached task performed for others. Public building design within a society of divergent opinions is a legitimately public task requiring direct involvement and confrontation of all concerned. Designing can be a discourse for mutual learning which accepts conflict and welcomes public debate as a means to externalize values and extend knowledge about a problem. It is appropriate then that the design process should solicit and include lay people to help make informed judgments about the environmental modification they are about to undertake for themselves.[1]

The designers' role within the process becomes one of an informed contributor to a public task. As professionals they become one more biased participant, part of whose role is to make the design activity continually clear and publicly accessible. The remainder of a professional role exceeds that facilitating function to become one of equal and active participation motivated to expand the public perception of what could be.

The design methodology which addresses that role proposes that design decisions are made accessible by presenting for public discussion an intentially wide range of physically definable alternatives or choices particular to the project.

The techniques with which alternatives are presented within those groups involves preparation of a matrix.

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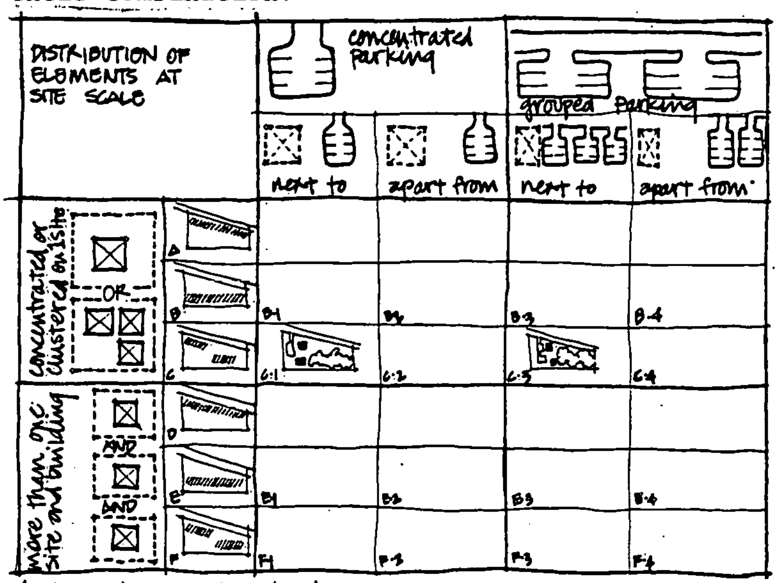
[1] Michael Pyatok "Mexico '76", School of Architecture, Washington University, St. Louis, Missouri, 1976.

This is intended to clarify the variables within the decision by identifying those more basic choices along the axes while the cells assess or describe their combination.



A Design Matrix:

As design decisions are made, participants remain overtly aware of the idealogies and viewpoints within their group yet are able to reach agreement on a physically definable design alternative. The understanding is that ones does not necessarily have to agree with another participant philosophically in order to reach agreement on a design decision.

At Deadwood, the bulk of the design process took place in eight lengthy public design sessions over seven months and included the extensive effort of a professional design team and 10-12 community building committee members. Twenty three different groups of alternatives were used to make design decisions that ranged from locating the program components on the site to selecting solar storage and shuttering methods.

D. ENERGY DECISIONS IN THE DESIGN PROCESS:

It is not possible to isolate energy as a singular motivating attitude in the design process. Energy has nonetheless played a significant generative role for both professional and lay designers and can be found throughout the design process.

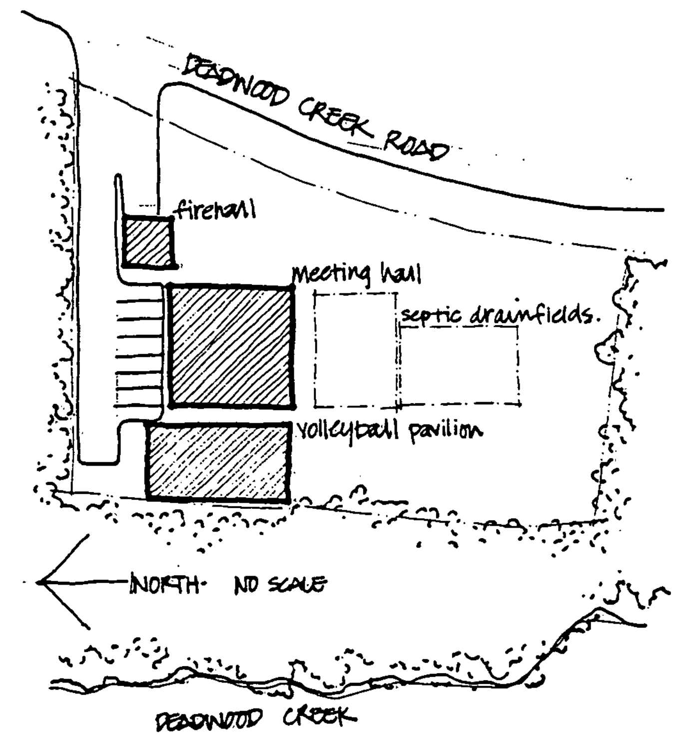
In architecture, important design strategies are frequently formulated at three scales; the site, the building, and the component. These three scales of designing will be used to discuss the formulation of strategies that utilize natural systems for the heating, cooling, and lighting of buildings.

AT SITE SCALE:

Site level design decisions directly affecting energy consumption were made at three different public meetings using five separate matricies. In these decisions, design was directed by energy conscious attitudes toward the size, number, and location of buildings, their orientation to the sun and wind, and the overall form they take on the site. At a very preliminary stage both the design team and the community characterized this task as making possible the utilization of sun and wind for heating and cooling, while minimizing the amount of site area that would be consumed by building or paving. Those issues were initially addressed at the very first meeting of the design team and the community with a matrix that sought to identify how much construction and enclosure was actually required to support the program. The matrix "Sizes of Spaces, Degree of Sharing" asks programmatic questions about how compact or overlapped can these facilities become and how much infiltration-controlled space need be provided. So, from a qualitative point of view, both lay and professional designers were formulating the first strategy for reduction of energy consumption: how much of the architectural program requires its own thermally maintained environment?

The product of this design step with the community was the identification of four kinds of space to be dealt with on the site, a large enclosed meeting room that could be shared with other spaces, a large separate enclosed firehall, a large partially enclosed volleyball court and some smaller rooms. This information allowed the design team to formulate a series of alternatives for arranging those spaces on the site. For example, one typical site level design step involved determination of a specific site or sites for the program given a land parcel elongated in a north-south direction. A matrix, "Distribution of Elements at Site Scale" began the design sessions in earnest at the second public meeting. This decision determined an overall strategy for site use and placed the community center spaces within that.

Ultimately, any scheme that provided a high percentage of south facing skin, also presented a good orientation to summer winds, facilitating cooling of the buildings, and winter wind shading for adjacent south facing outfoor spaces.



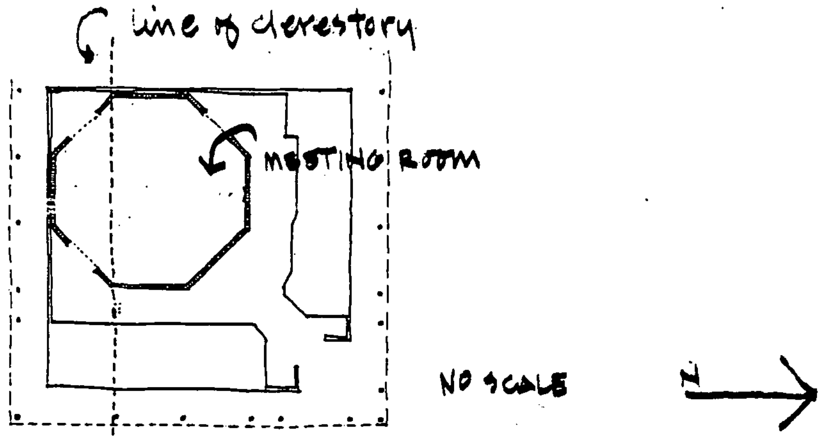
Diagrammatic Site Plan Derived From Site Scale Design Decisions

AT BUILDING SCALE:

Building level design decisions deal most directly with energy consumption through development of architectural strategies for passive solar heating, cooling, and daylighting. They were made at six different public meetings with nine separate matricies and are the most extensively documented decisions with respect to energy. They most clearly present the interaction between attitudes about the way buildings should look, the ways they should support the people inside and the ways they should obtain and consume energy. Together, the professional designers and community had defined a goal of accommodating at least 50 percent of the annual heating load with solar energy. More was desired if possible, but subject to a better understanding of the subsequent impact on the architectural program. Equally important was the understanding that these buildings be an expression of the unique social and political values held by the community. The buildings should be responsible additions to a rural agricultural valley and symbolize a compatibility with the landscape. Several of those matricies develop and make those conflicts clear. One, "Form of Meeting Room and Relationship to Other Rooms," determines the location and configuration and image of the main meeting space and resolves its relationship with the smaller rooms. At this point, a social value and energy value held by the community came into conflict.

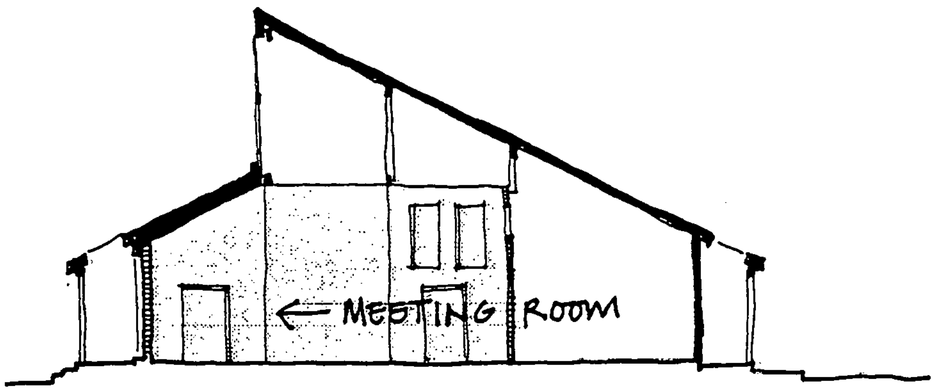
It was consistently felt that the meeting room express in its configuration the centrally focused, non-hierarchical organization of the community. In contrast were some very directional and hierarchial environmental conditions such as the amount and location of solar collection in the room and degree of access to comfortable outdoor spaces. Oversimplified, the task became a matter of architecturally defining a symmetrical social organization within a assymmetrical environment. The resolution of that conflict maintained the strength of the interior of the meeting spaces as a unique symmetrical room unlike any other found in Deadwood. The building which would wrap that space could be more directionally defined in response to environmental forces.

The conflict is approached in a more direct manner in a later matrix "Meeting Room Form and Building Configuration." This decision represents the resolution of a functional relationship between the large space and the smaller space and the expression of the meeting room as it combines with the skin. By this time, the configuration of the building as a whole had become squarish, producing less than ideal solar penetration. At that point a range of exceptions to the simple roof was introduced to bring light and sun deeper into an almost square building.



Diagrammatic Plan of the Meeting Hall

There was extremely strong community reaction against saw-tooth and single shed forms. Despite their solar efficiency they were seen to be unacceptable opposition to the rural building forms typical within the valley. Consequently the roof form includes a single south facing clerestory over the meeting room.

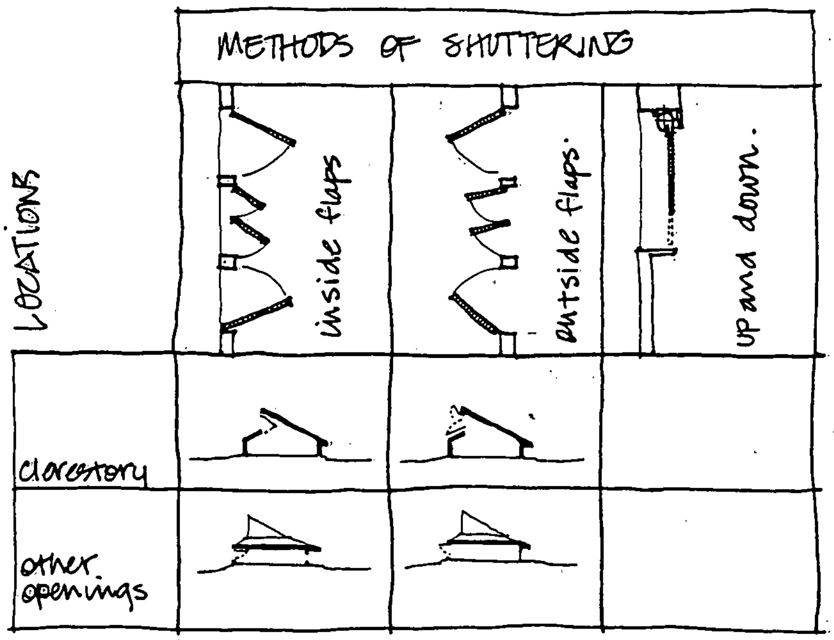


Most of these discussions centered on the image and visual implications of this building for its rural, agricultural context. Continually, there was a desire to soften the impact of a directional solar form and express a building that merged with its landscape. In November, the entire design process was re-enacted for the community and the scheme presented the model of the buildings. Following discussion of the financial and labor implications of the design, the project was given the encouragement and unanimous approval of the community.

AT COMPONENT SCALE:

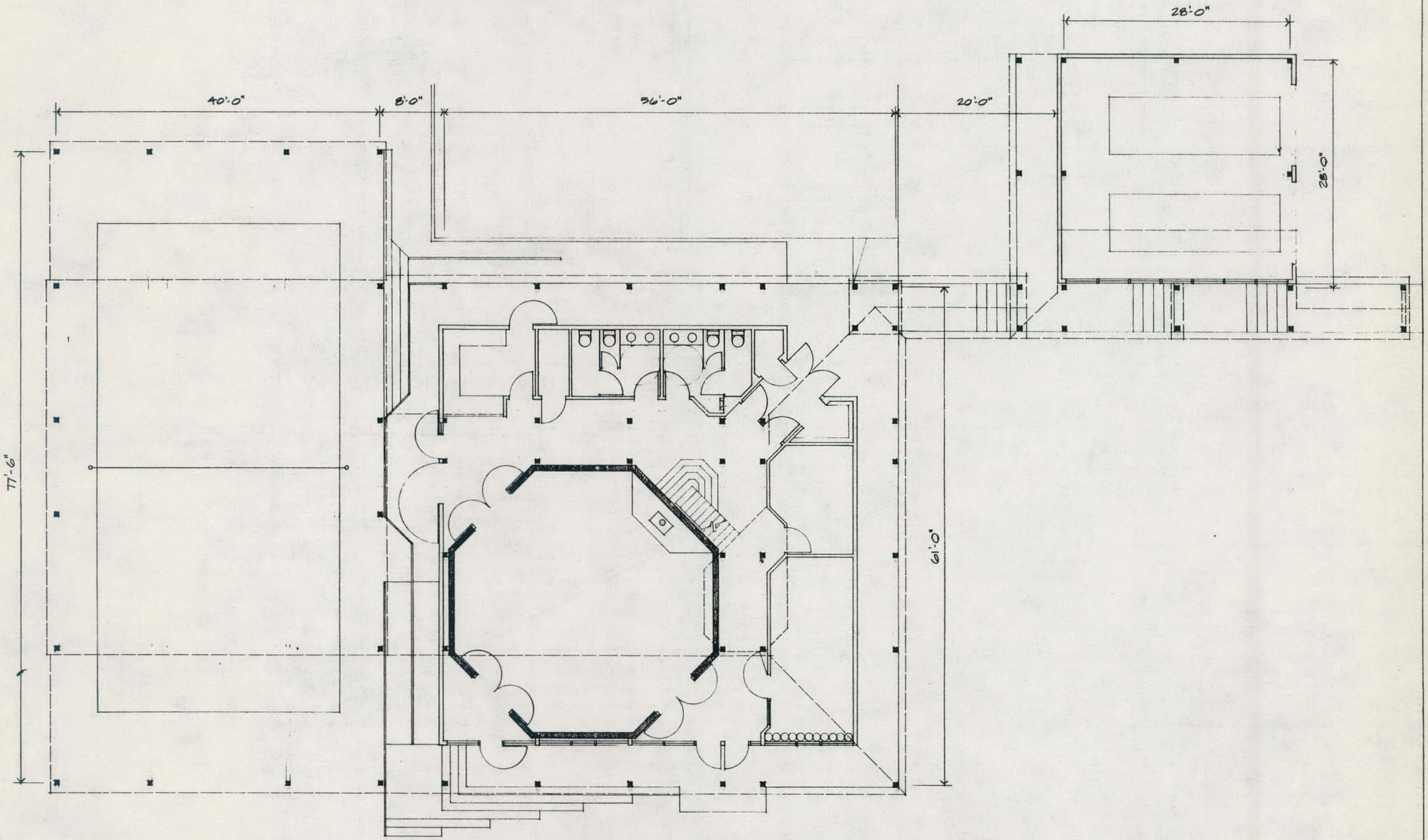
Component level design decisions directly affect heating, cooling, and lighting techniques. These were made at three different public meetings using four separate matricies. Energy consumption was seen to be affected by the relative efficiency of the component to block or admit sun, store and release energy, reduce or increase heat loss, be fabricated of local materials or be supplied at a local or regional scale.

A convenient link between the building scale decisions and the component scale decisions is the matrix "Structural System and Construction Sequence." This decision illustrates the simplest energy principle at the component scale. The community selected a post and beam structural system with nonload bearing walls in order to employ a technology that would maximize the use of their least energy intensive resources, wood, time, and volunteer labor. In another sense, component choice was also a part of a group of design decisions that were throught to be better addressed in the field, with the buildings under construction and the volunteer labor force more able to assess the technology and level of finish appropriate to the spaces they have just built. For example, the matrix "Solar Collection and Storage, Methods of Shuttering" was the means by which shuttering and thermal storage decisions were made.



shuttering component alternatives

E. THE FINAL DESIGN:



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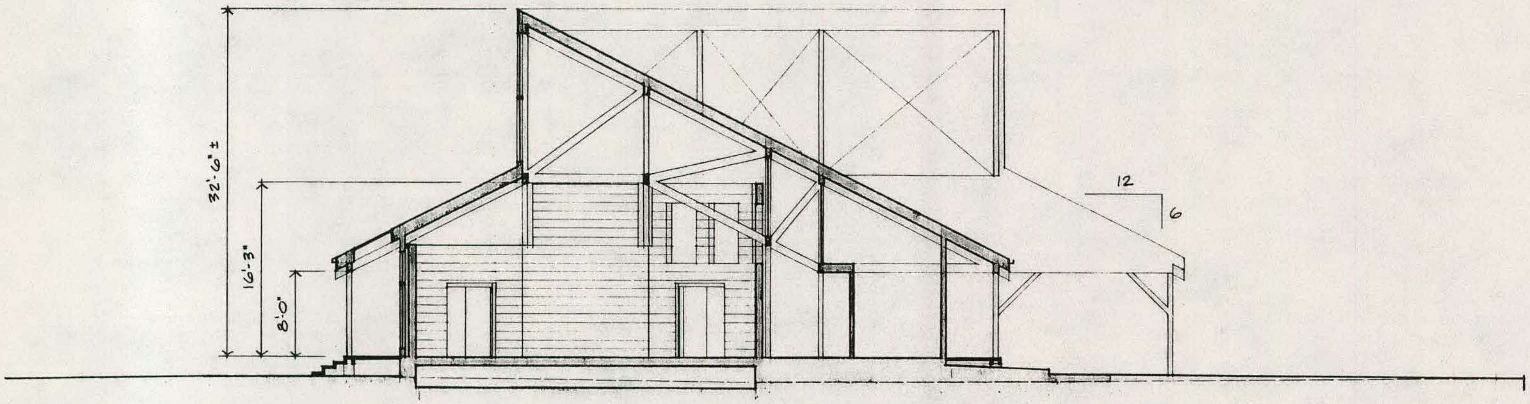
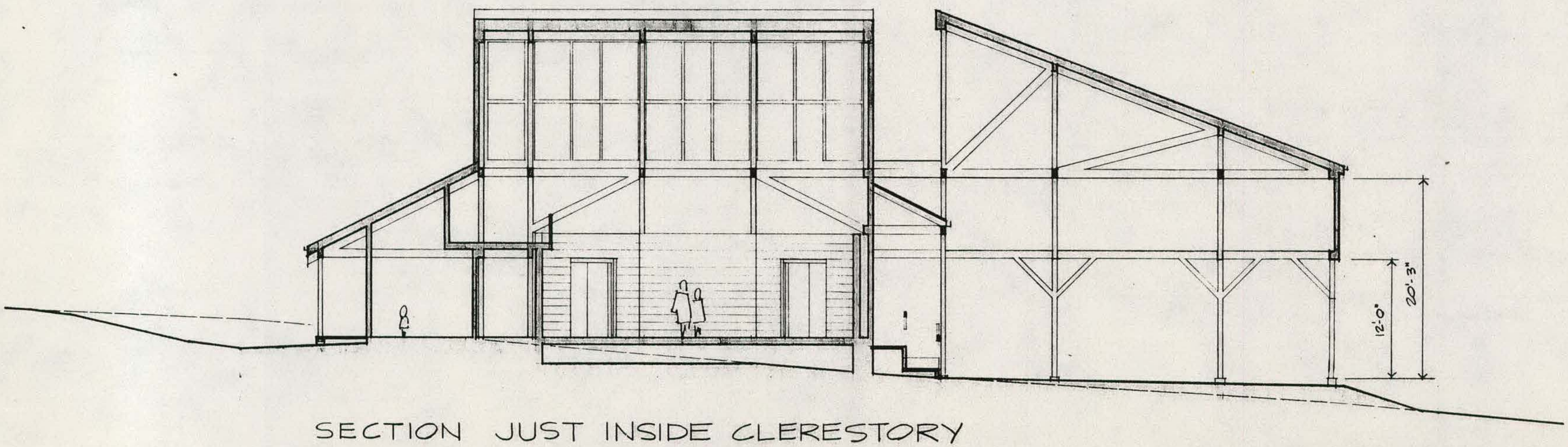


SECTION THROUGH CENTER OF MEETING ROOM



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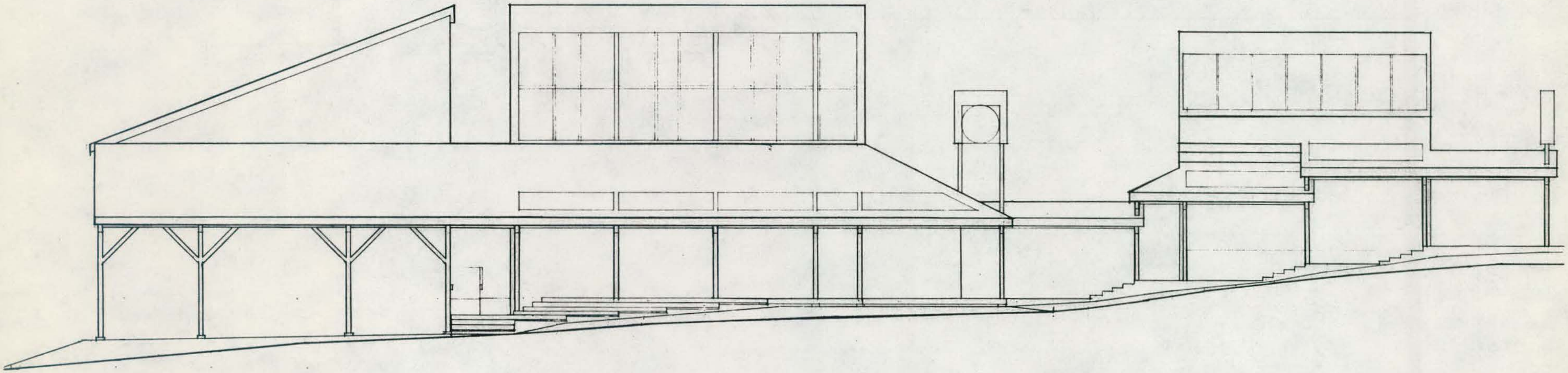
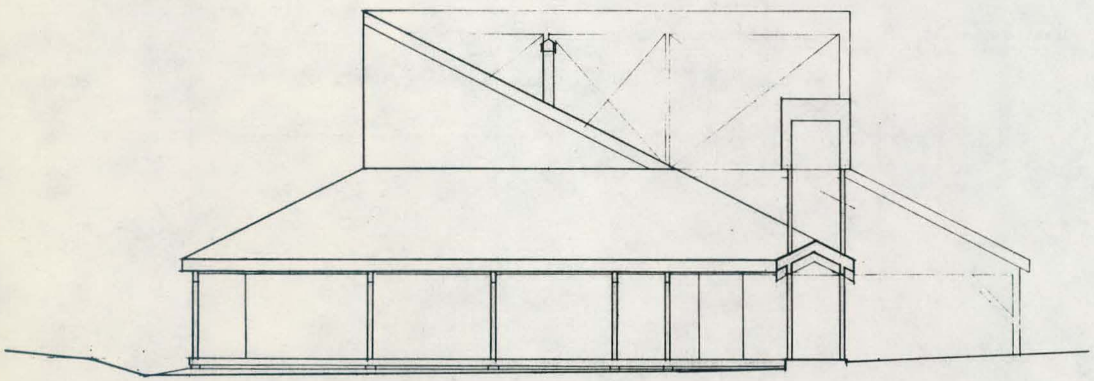
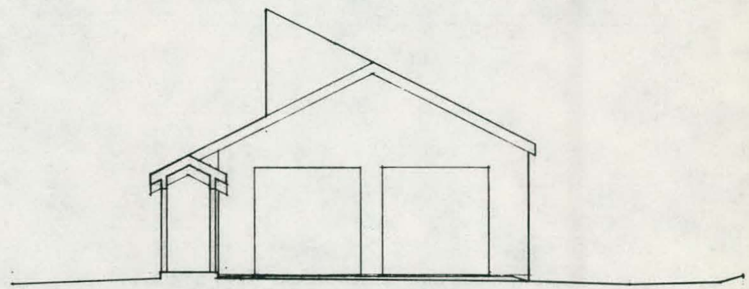
DEADWOOD COMMUNITY CENTER • 2·14·80 • 1/8" = 1'-0"



SOUTH ELEVATION

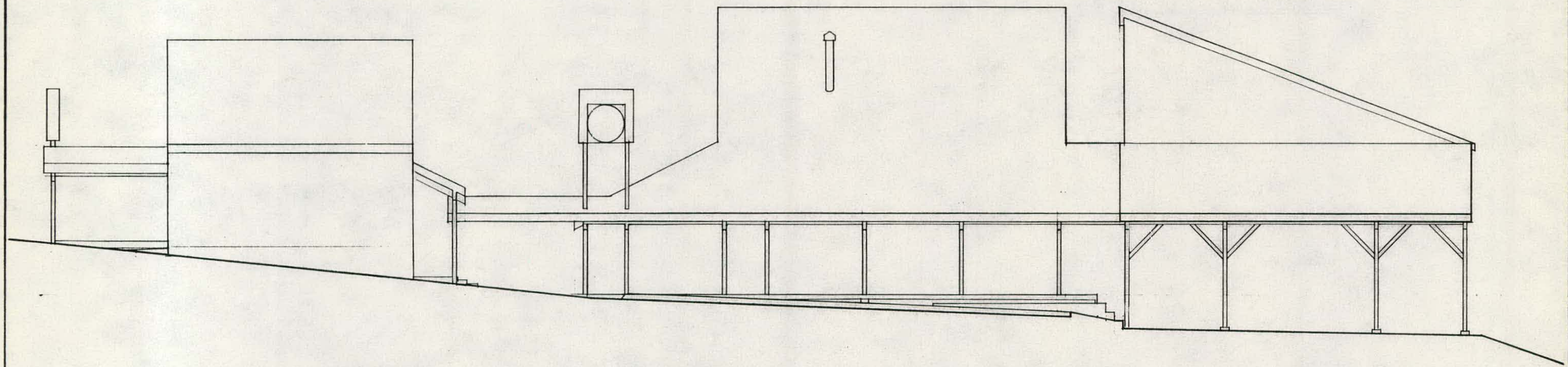


EAST ELEVATION

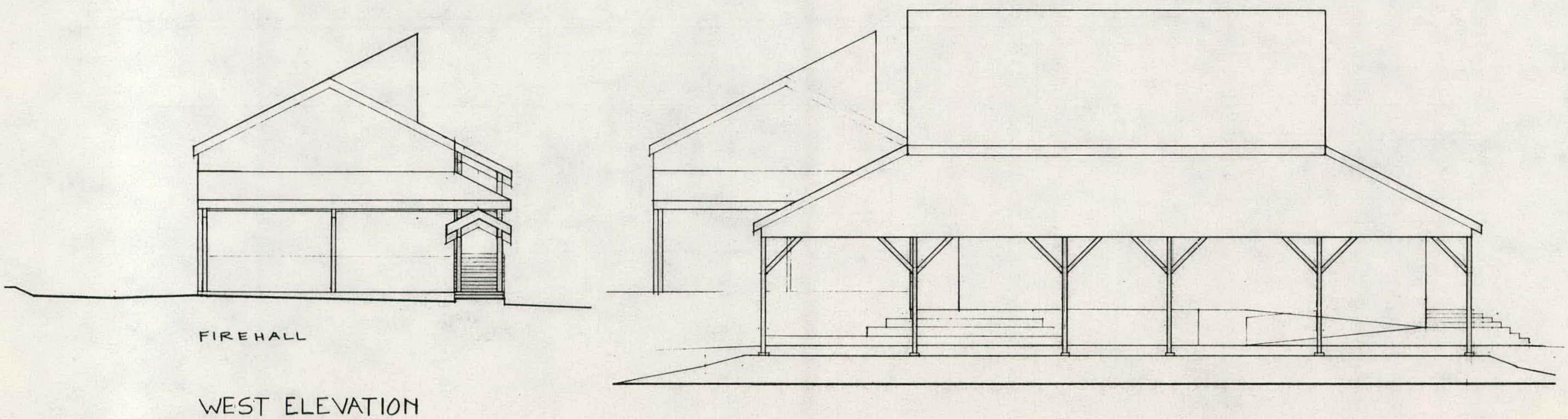


FIREHALL

DEADWOOD CREEK COMMUNITY CENTER 2·14·80 1/8" = 1'-0"



NORTH ELEVATION



WEST ELEVATION

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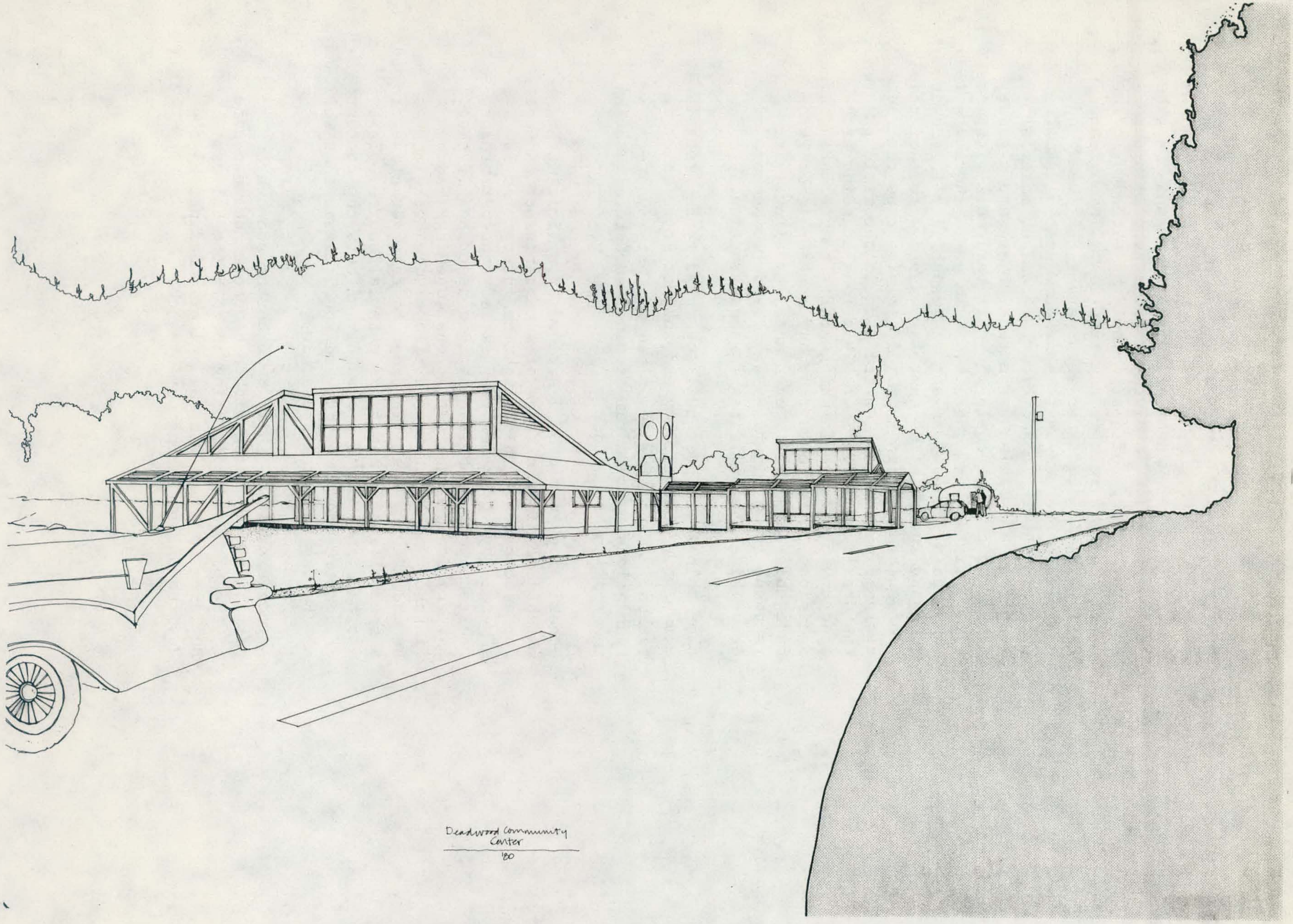


View from Deadwood Creek Road:

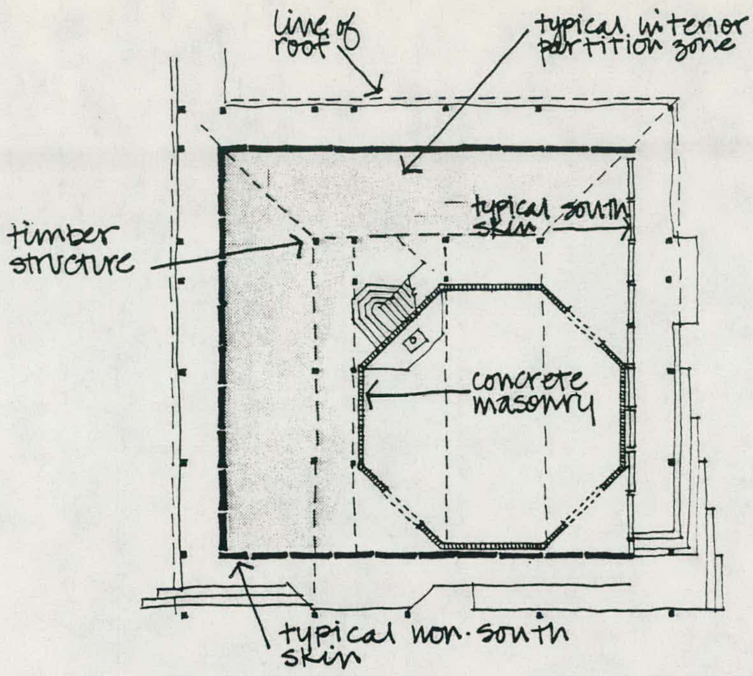
F. THE CONSTRUCTION PROCESS:

Part of the uniqueness of this project was that the active community involvement and interest throughout programming and design would be extended to an equally active role in construction. Through the design sessions, it became apparent that Deadwood had within the community some very special skills and materials. In addition to framers, material suppliers and finish carpenters, there are a great number of crafts people who work very well with wood, clay, paint, fabric, etc.... In sum, there was in Deadwood a range of talent and capability in construction and specialities that far exceeded that of the professional design team. It is also true that some design decisions are better made in the field than on the drawing board. There is a long standing architectural heritage in which crafts people make design decisions. It seemed that a volunteer labor force made this possibility even more appealing. In response the design team developed two methods of describing the buildings for construction.

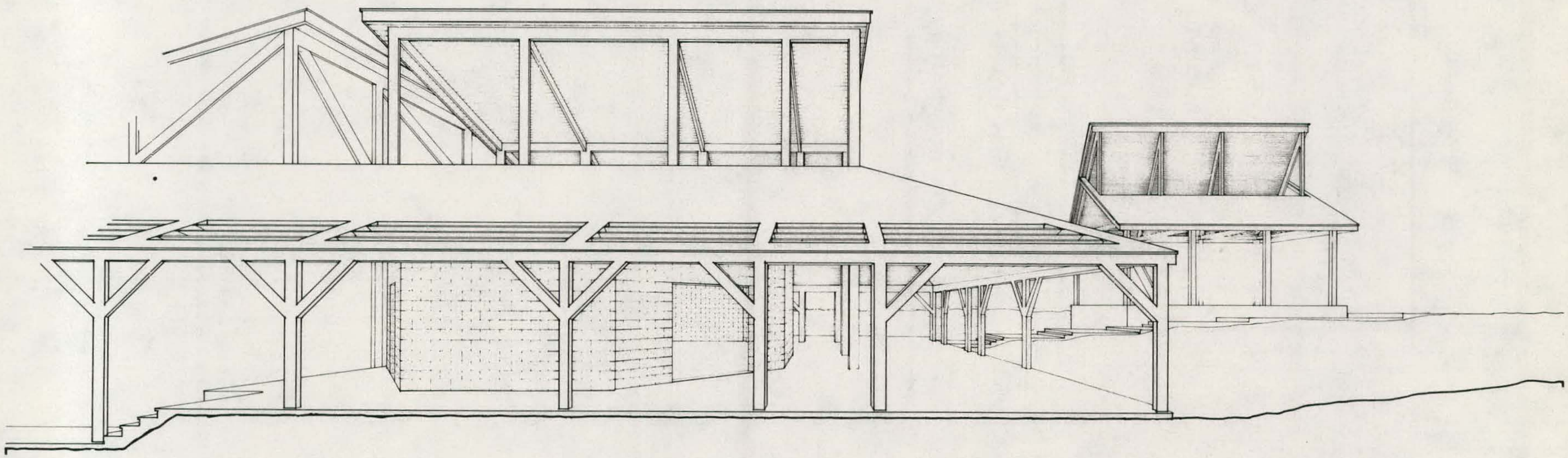
Some things in these buildings need to be prescribed, drawn very specifically and subject to no interpretation. Assemblies described in that way are foundations, structural framing, structural bracing, the roof and the floor.

Other things could be described by a limit method which determines a range of acceptable performance for assemblies. These might be interpreted in several ways provided they satisfy the performance creiteria. Assemblies that are described in that way are non-bearing partitions, openings, and finishes. A limit method allows some decisions to be made in the field in order to take advantage of a special skill, labor, or material source. This attitude and method profoundly affects the content of construction drawings and specifications as well as the way they are prepared.

A good example of this would be the non-bearing partitions occurring within a general defined zone on the plan and conforming to both the Uniform Building Code and thermal criteria defined by the desired solar heating performance.

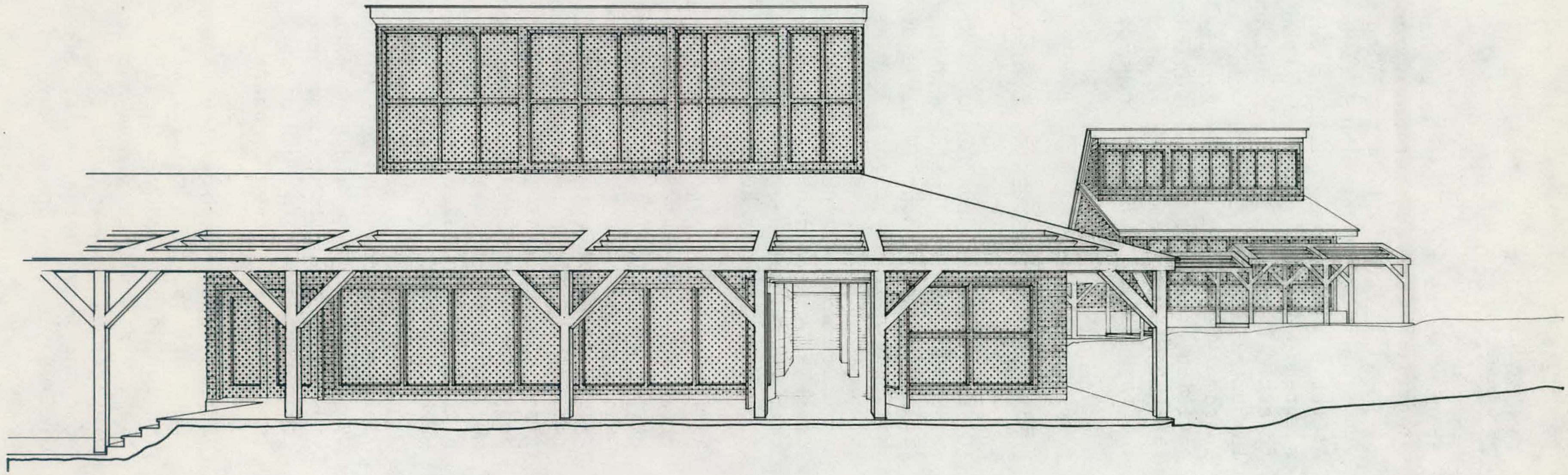


Plan Showing Wall Placement Zones



Deadwood Community Center
'80

components designed and specified by EQUINOX DESIGN:



Deadwood Community Center
'80

components described by a performance specificiation, designed by client on site:

G. PROGRESS TO DATE:

At this writing the community has made significant progress toward completion of the project. The firehall and volleyball pavilion will be built this summer and the meeting hall in summer of 1981. At the present time, building permits have been secured. The logs have been brought down from the forest. A sawmill has been set up on the site and lumber milled. Site excavation and rough grading is complete. Foundations for the firehall and pavilion have been poured. Community enthusiasm for the project remains high and is expected to increase as the buildings rise out of the ground.

H. UNAVAILABLE SOLAR DESIGN INFORMATION

Climate data for the Deadwood Creek valley is non-existent. We used solar and degree day data for Salem, Oregon (about 70 miles away, and on the Willamette Valley floor), and assumed wind conditions for Eugene. Based on interviews with long-time Deadwood residents, we believe that our degree-day data is reasonable good, but suspect that insolation and wind speed-direction data should be locally available for reliability.

At the early stages of building design, rules-of-thumb for "thermal envelope" (double wall-greenhouse) construction would have been useful. Later on, we needed a technique for predicting thermal swings that was more exact than rough graphs, but considerably less tedious than hour by hour simulation. As the design developed further, we needed programs for hand-held calculators that dealt with more than three passive systems simultaneously, and a thermal swing simulation program that includes more than seven thermal nodes.

Finally, component selection would have been aided by some in-place evaluation data (such as is provided by Skylid for their product), and a chance to inspect products such as thermal shades at local installations (of which there are almost none).

Had the above information been available, we speculate that the solar aperture would have been smaller, since Deadwood residents often experience clear weather when Eugene and Salem are foggy in winter. This would have the associated impacts of somewhat less thermal mass, and somewhat smaller wind ventilation openings to cool the building in summer.

I-I INCREMENTAL PASSIVE SOLAR COST

The project incurred additional costs as a result of the passive solar design. Most of these costs were in staff design time not expenses or consultant fees. Of the total time spent on the project approximately 19 percent of it can be allocated to the passive solar design. Because of the "learning curve" we estimate that future solar projects will have 12 percent more design time than that required for a conventional building.

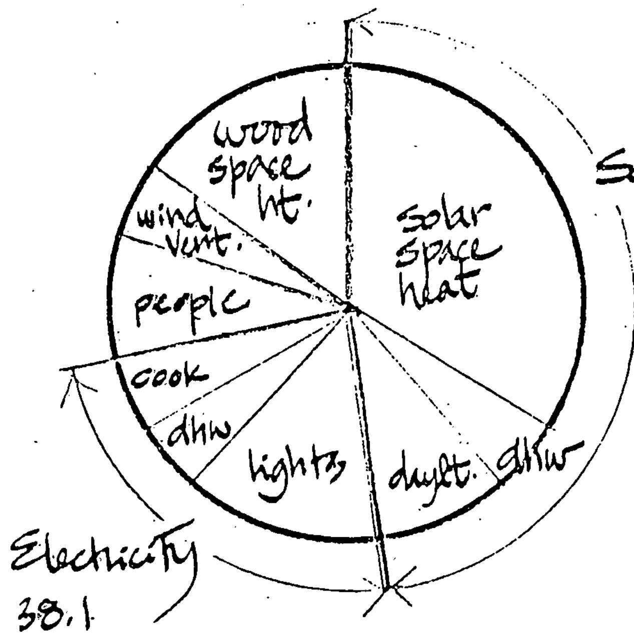
I-J PERFORMANCE ANALYSIS, RESULTS

The following pages summarize the yearly energy end use and typical daily performance we estimated for the meeting hall and firehall. To obtain the daily performance graphics, total skin and infiltration losses were estimated per degree day, then adjusted for the average temperature on these typical days. Typical solar gains were estimated, using solar data and estimated aperture. For the final design, detailed data on skin and infiltration losses and solar aperture were available, yielding more dependable results.

The final design achieves these energy savings by relying on solar heating, wood auxiliary heating, solar domestic water heating, and daylighting and wind ventilation for cooling.

MEETING HALL PRE-DESIGN

TOTAL ENERGY NEEDS 92,500 BTU/S.F.-YR.
FLOOR AREA 2,000 S.F.

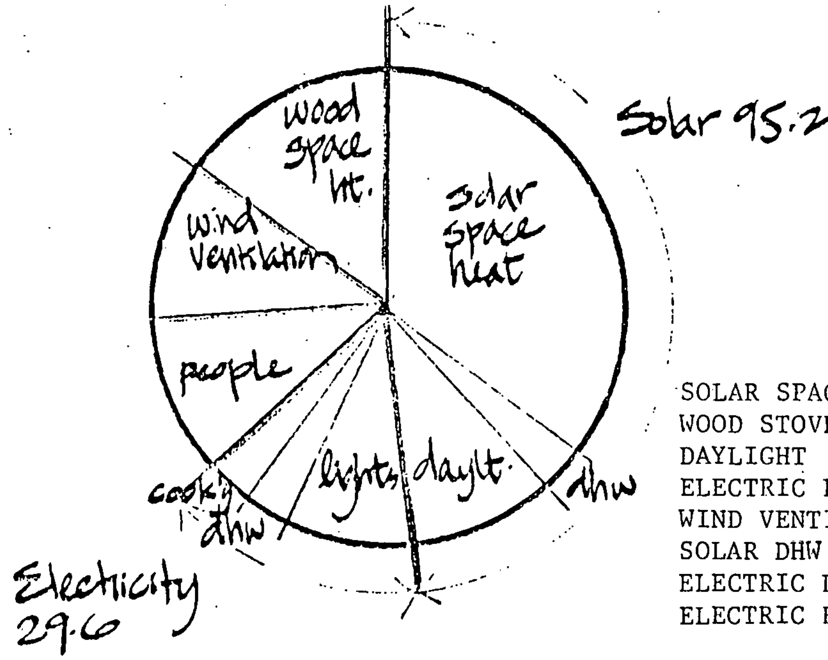


SOLAR SPACE HEAT
WOOD STOVE SPACE HEAT
DAYLIGHT
ELECTRIC LIGHT
WIND VENTILATION
SOLAR DHW
ELECTRIC DHW
ELECTRIC RANGE

MEETING HALL FINAL DESIGN

TOTAL ENERGY NEEDS: 76,500 Btu/sf-yr.

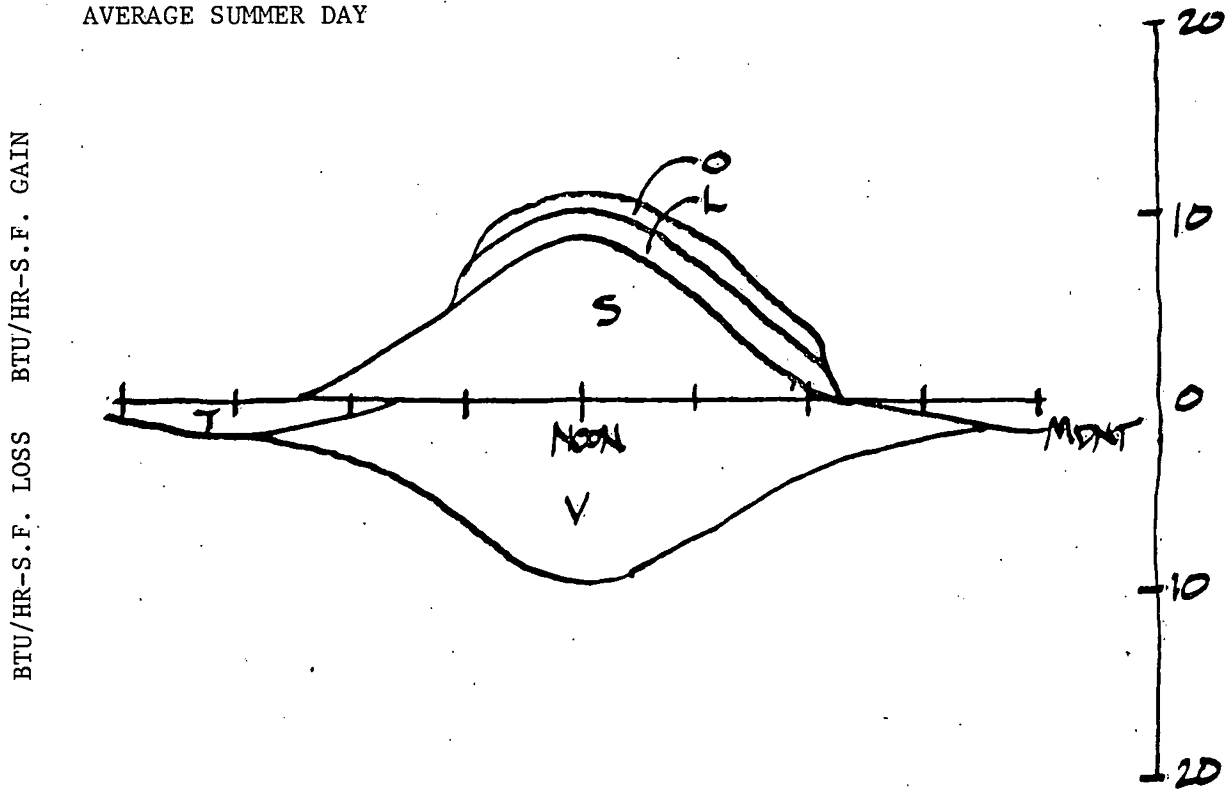
FLOOR AREA: 2,555 SF



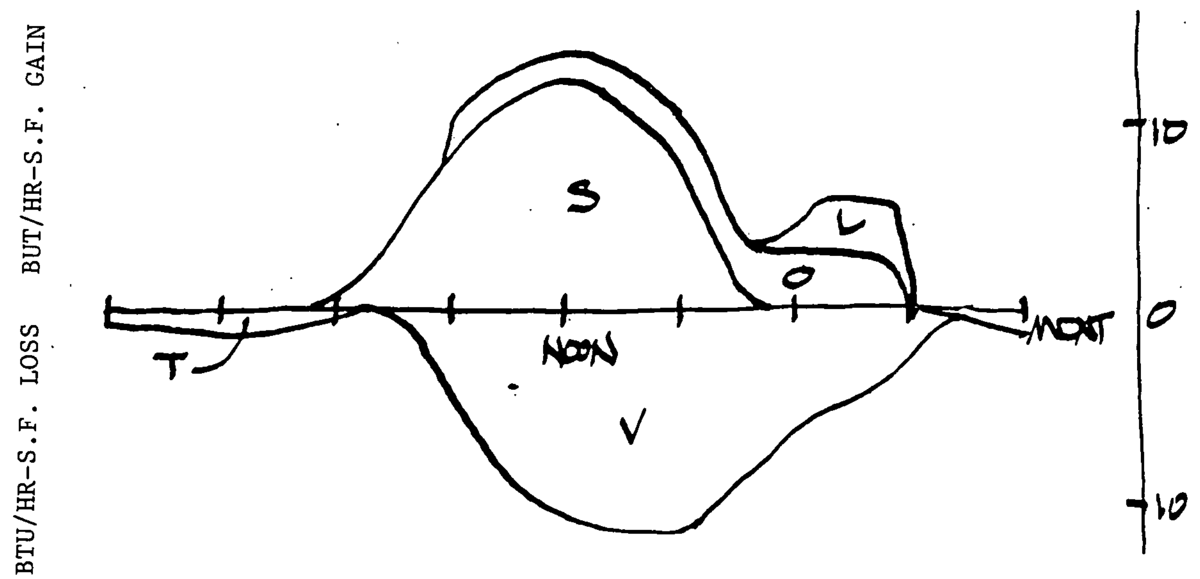
SOLAR SPACE HEAT
WOOD STOVE SPACE HEAT
DAYLIGHT
ELECTRIC LIGHT
WIND VENTILATION
SOLAR DHW
ELECTRIC DHW
ELECTRIC RANGE

COMPARISON OF PRE-DESIGN AND FINAL DESIGN ESTIMATES OF DYNAMIC ENERGY NEEDS

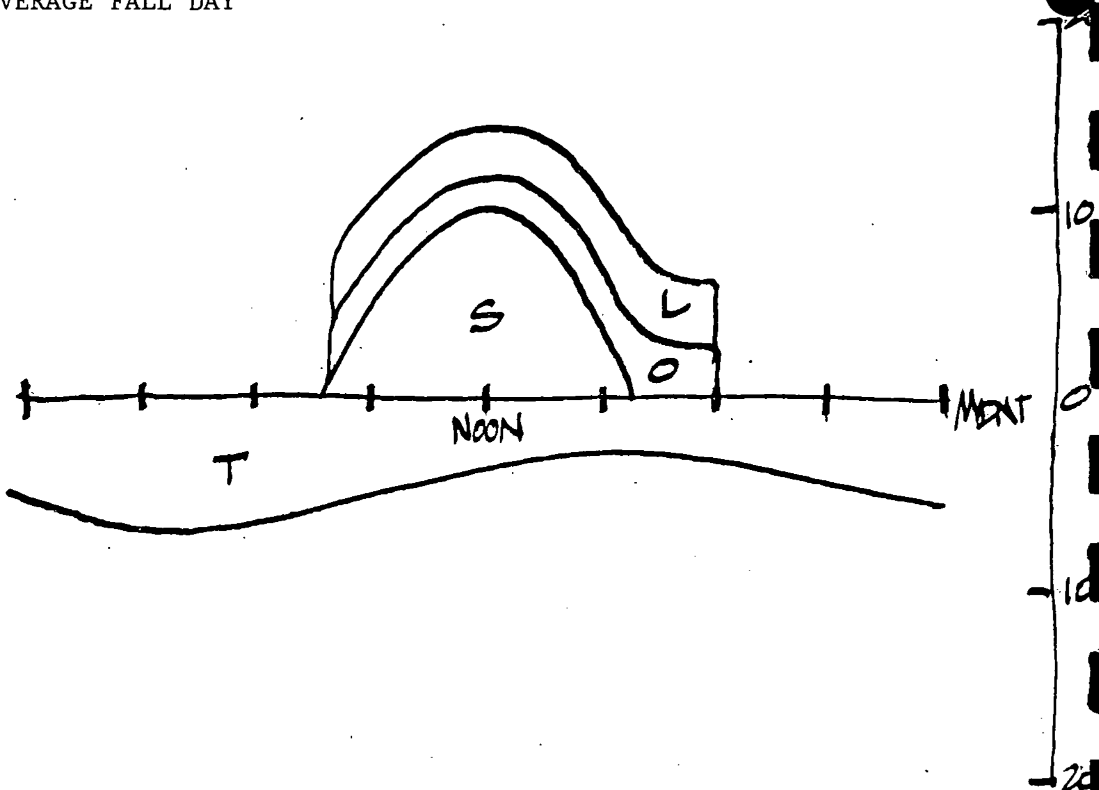
PRE-DESIGN MEETING HALL
AVERAGE SUMMER DAY



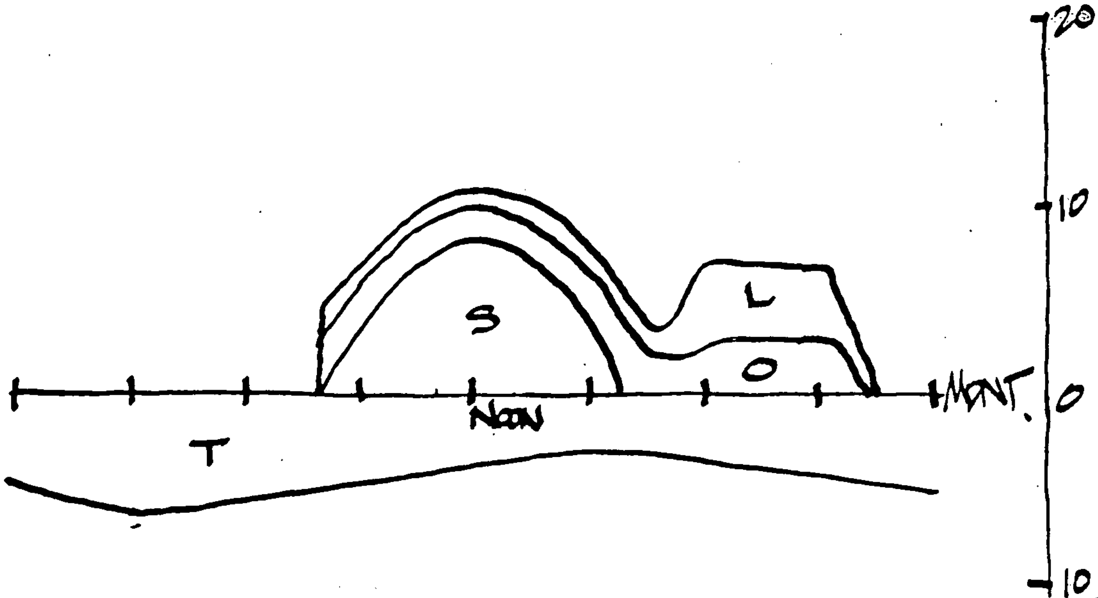
FINAL DESIGN MEETING HALL
AVERAGE SUMMER DAY



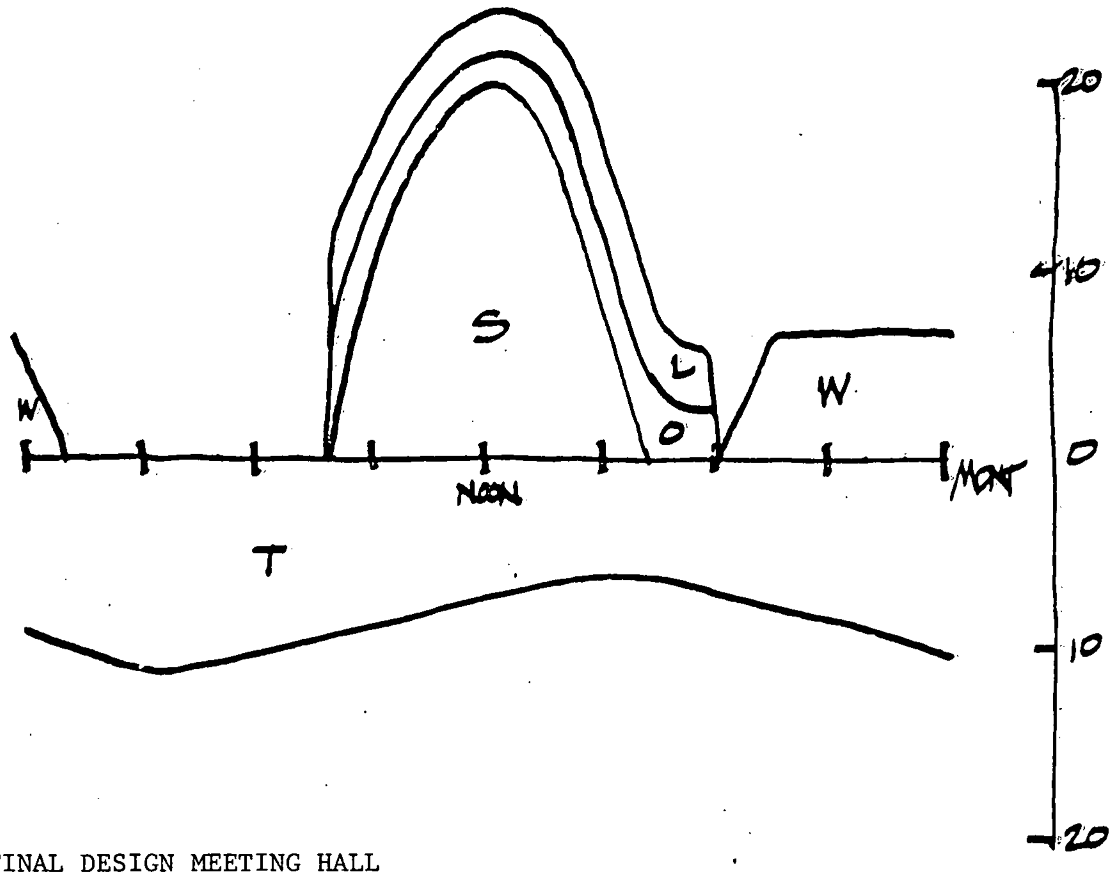
PRE-DESIGN MEETING HALL
AVERAGE FALL DAY



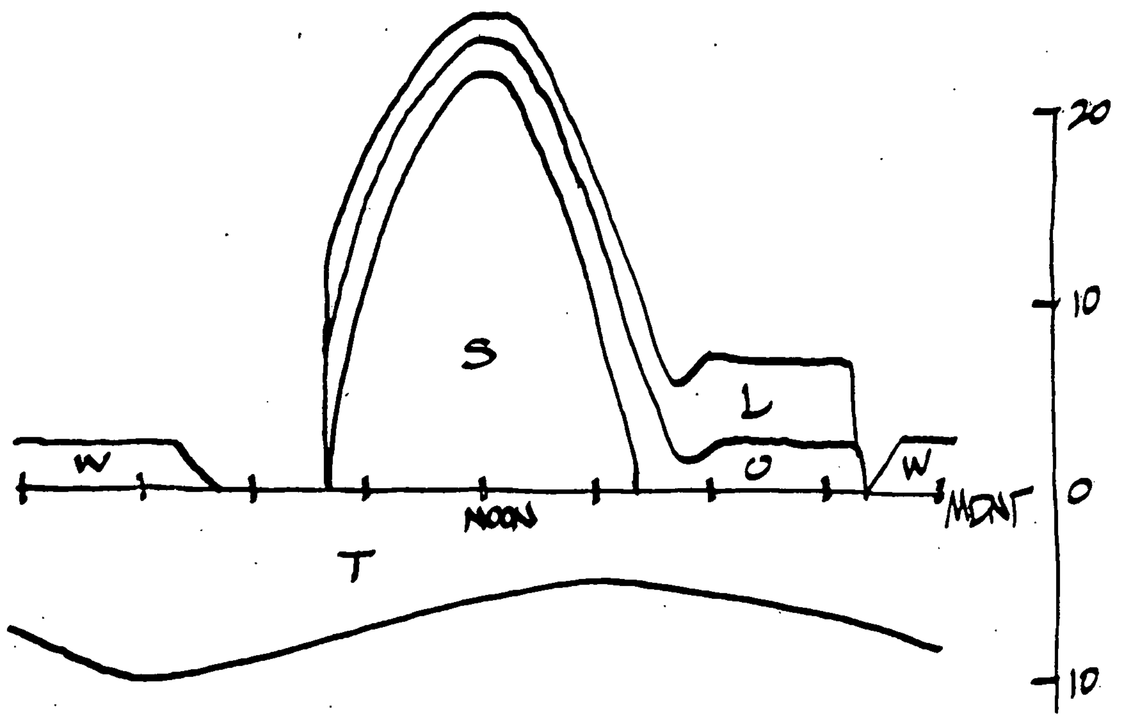
FINAL DESIGN MEETING HALL
AVERAGE FALL DAY



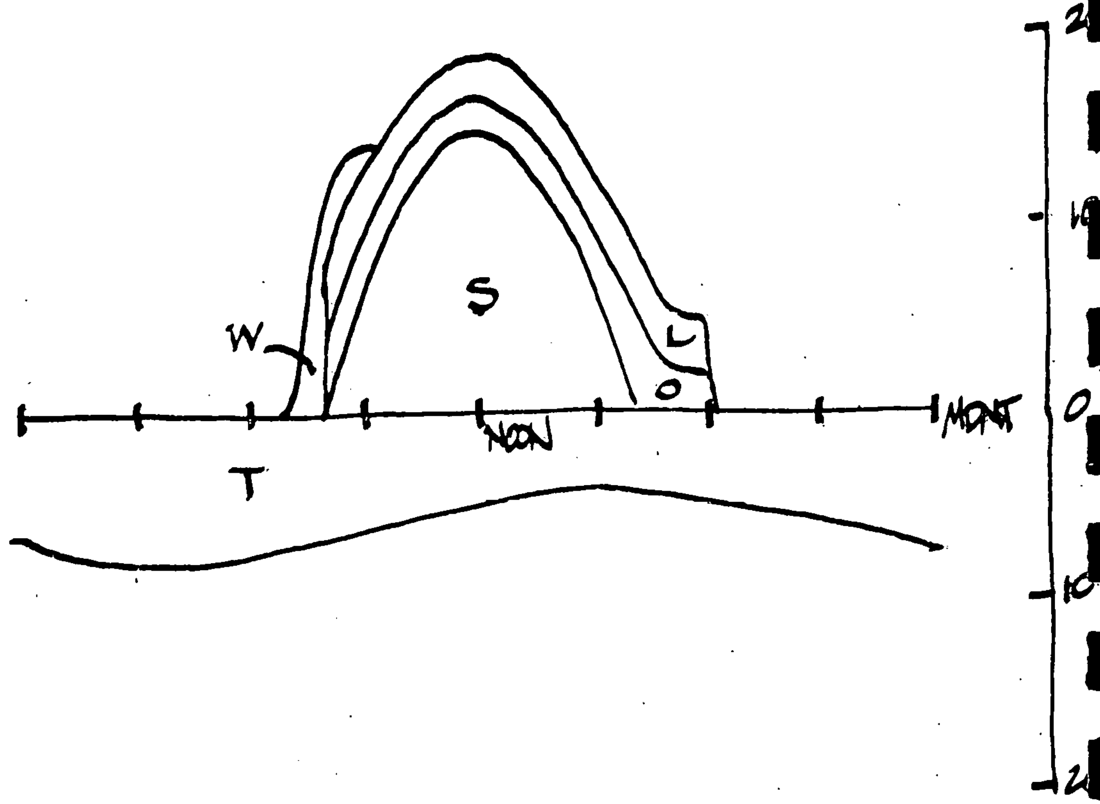
PRE-DESIGN MEETING HALL
AVERAGE WINTER DAY



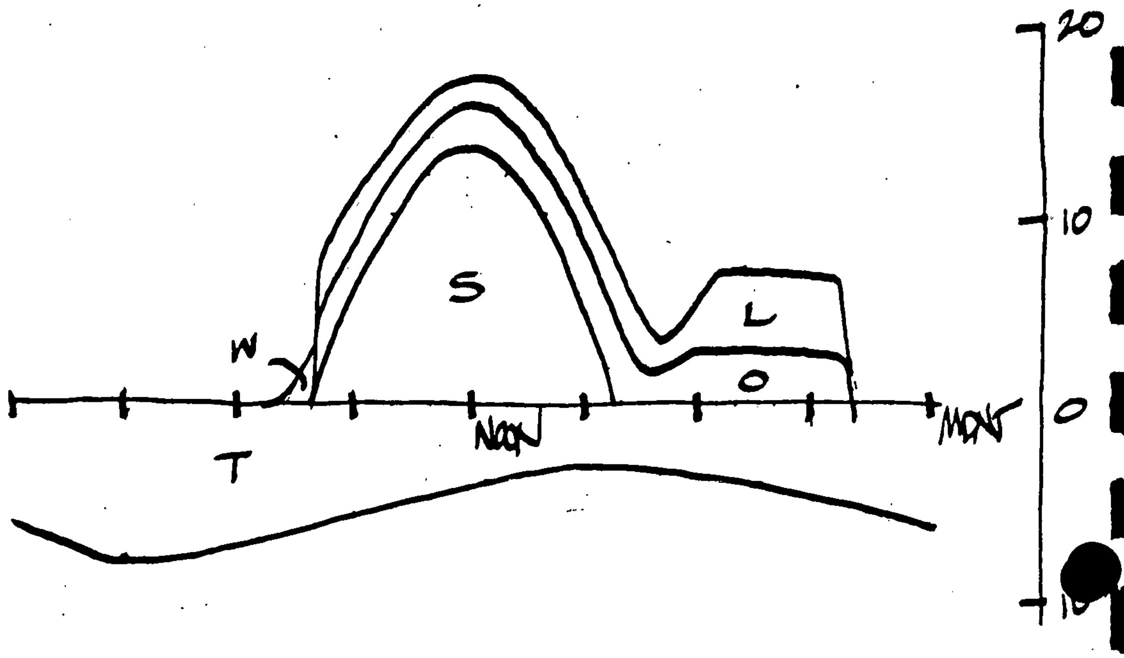
FINAL DESIGN MEETING HALL
AVERAGE WINTER DAY



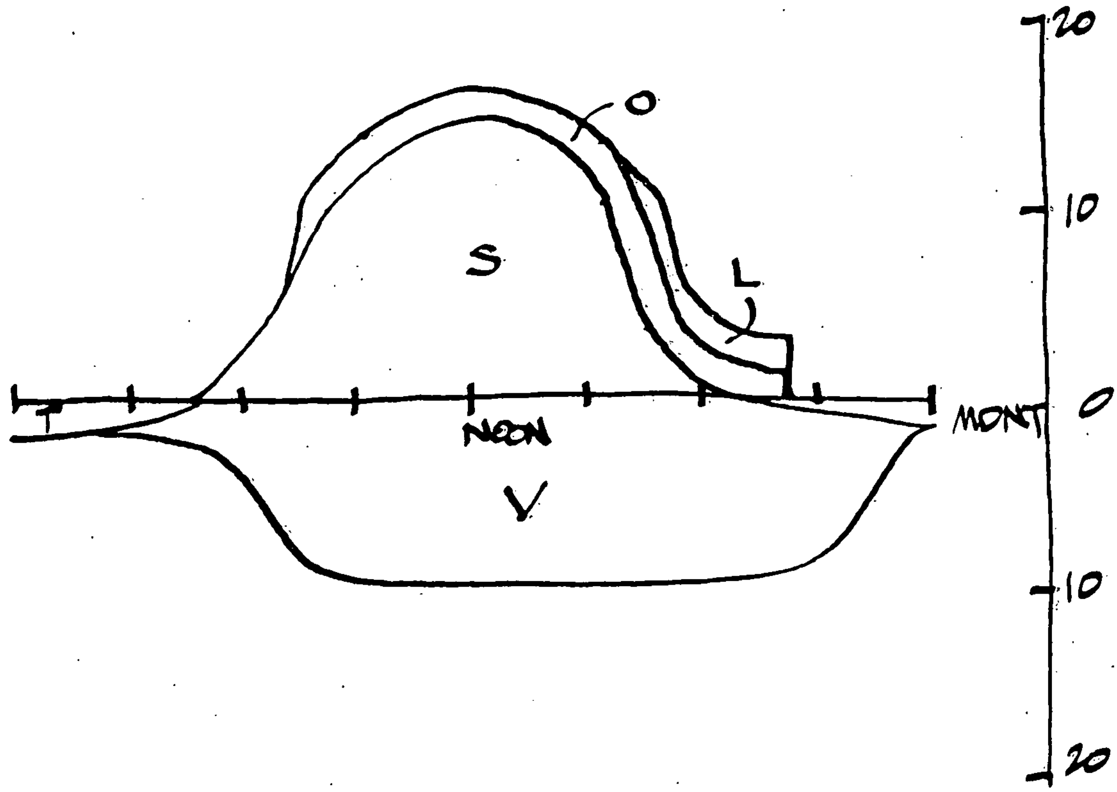
PRE-DESIGN MEETING HALL
AVERAGE SPRING DAY



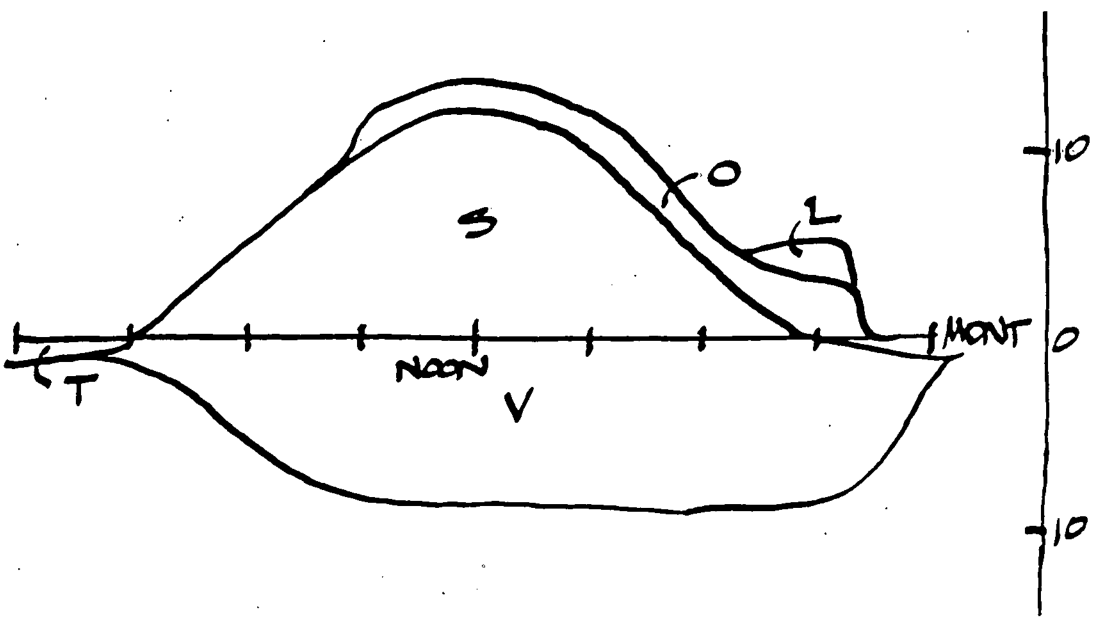
FINAL DESIGN MEETING HALL
AVERAGE SPRING DAY



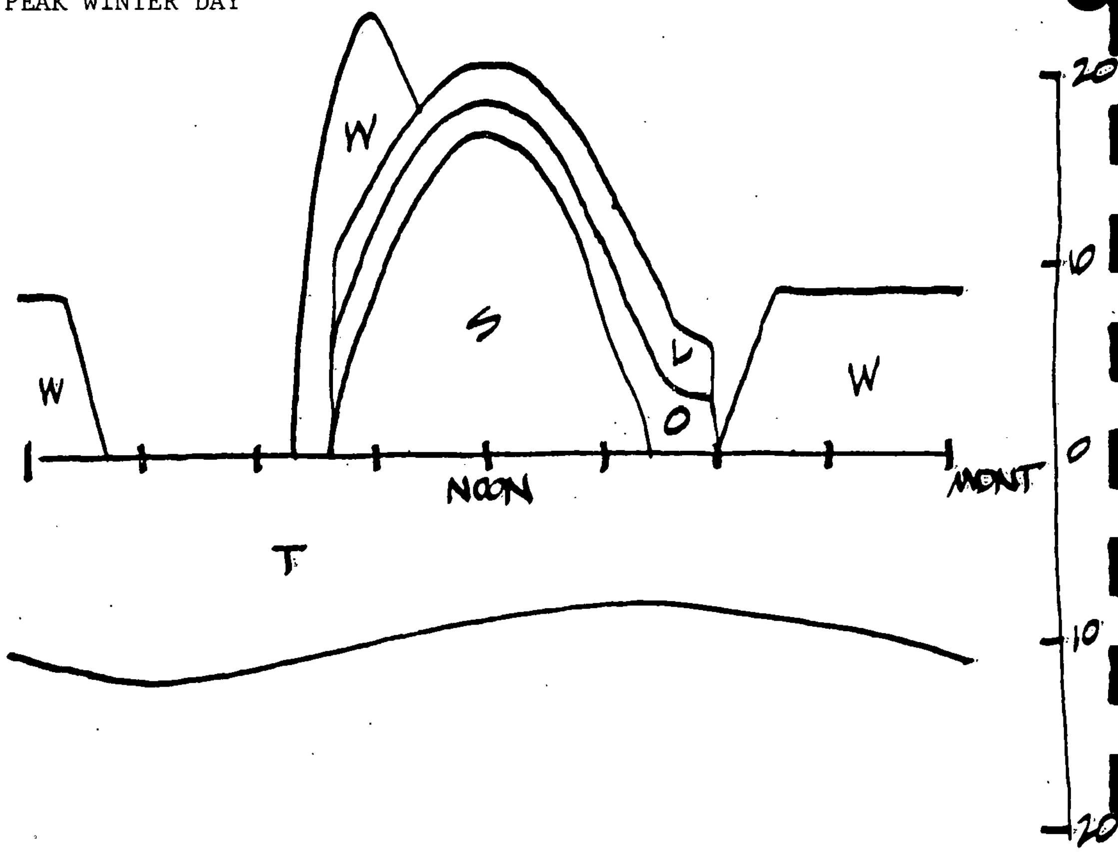
PRE-DESIGN MEETING HALL
PEAK SUMMER DAY



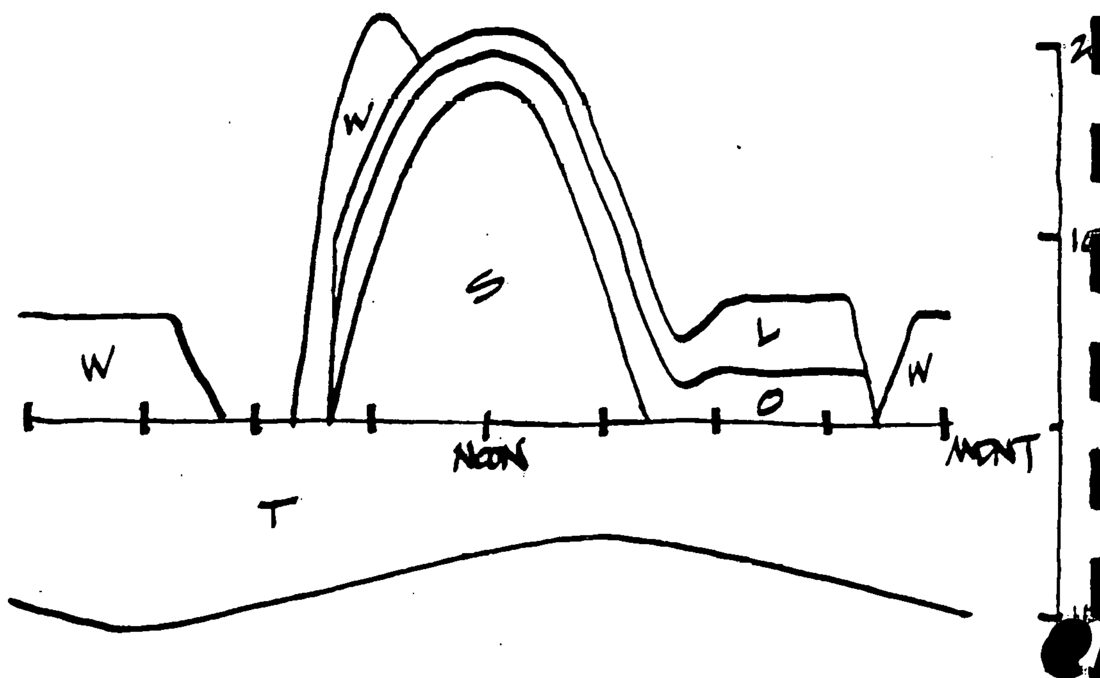
FINAL DESIGN MEETING HALL
PEAK SUMMER DAY



PRE-DESIGN MEETING HALL
PEAK WINTER DAY



FINAL DESIGN MEETING HALL
PEAK WINTER DAY

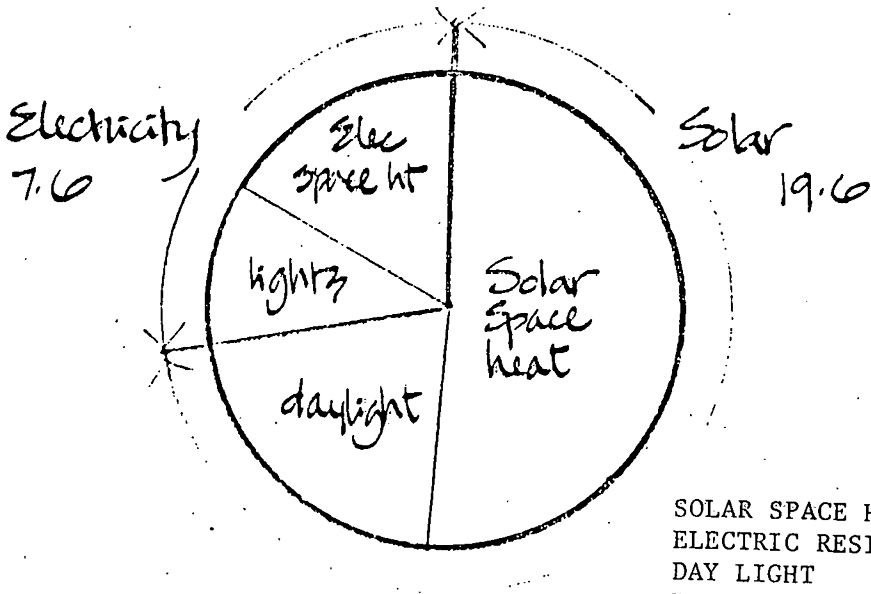


MEETING HALL

A comparison between the preliminary view and the final calculations indicates similar performance, as would be expected from the similarities between this project and the commercial project (as adjusted) used as a guide to the preliminary calculations. Certain differences are also evident: we underestimated the heat contributed by people, and overestimated the need for electric lighting. The earlier project had a larger ratio of windows to floor area, so our final design needed much less space heating per square foot floor area.

FIREHALL PRE-DESIGN

TOTAL ENERGY NEEDS 30,200 BTU/S.F.-YR.
FLOOR AREA 900 S.F.

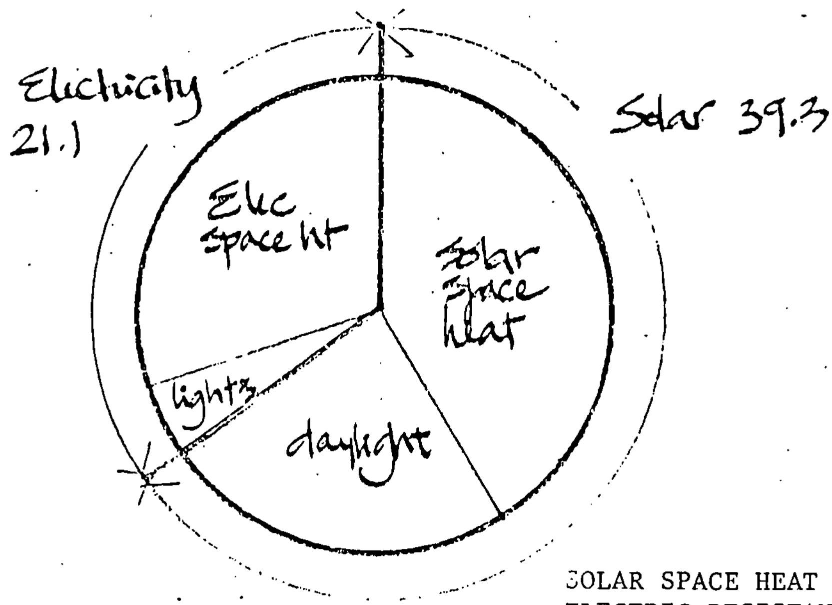


SOLAR SPACE HEAT
ELECTRIC RESISTANCE HEAT
DAY LIGHT
ELECTRIC LIGHTING

FIREHALL FINAL DESIGN

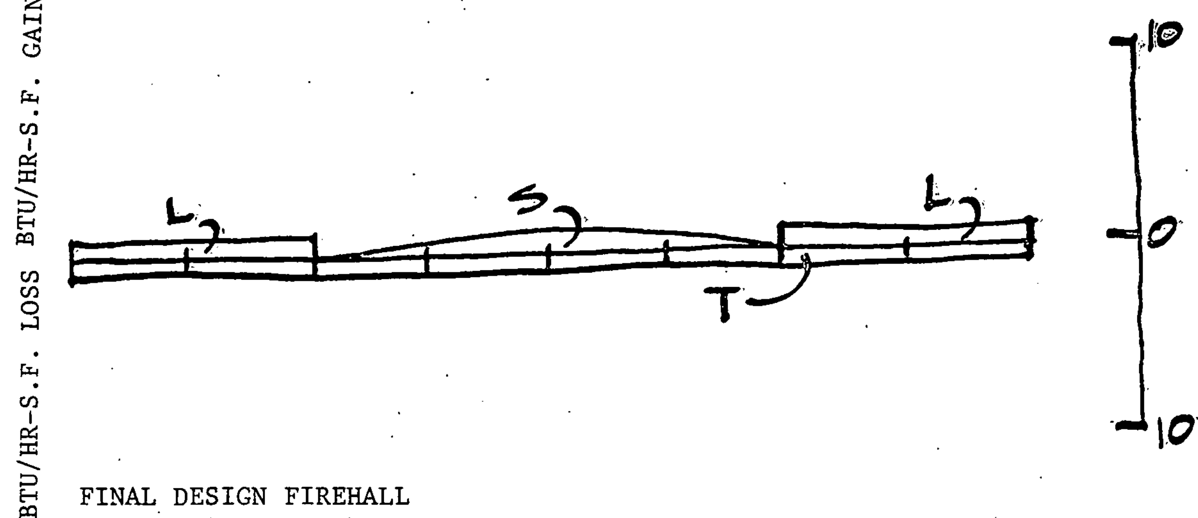
TOTAL ENERGY NEEDS: 63,600 Btu/sf-yr.

FLOOR AREA: 950 SF

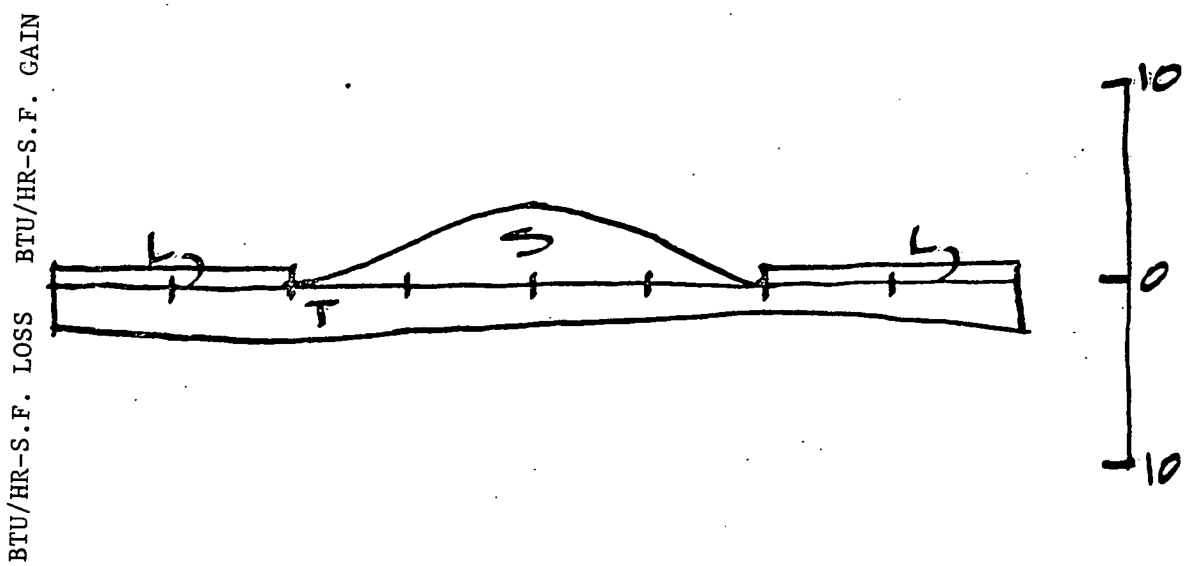


SOLAR SPACE HEAT
ELECTRIC RESISTANCE SPACE H
DAYLIGHT
ELECTRIC LIGHT

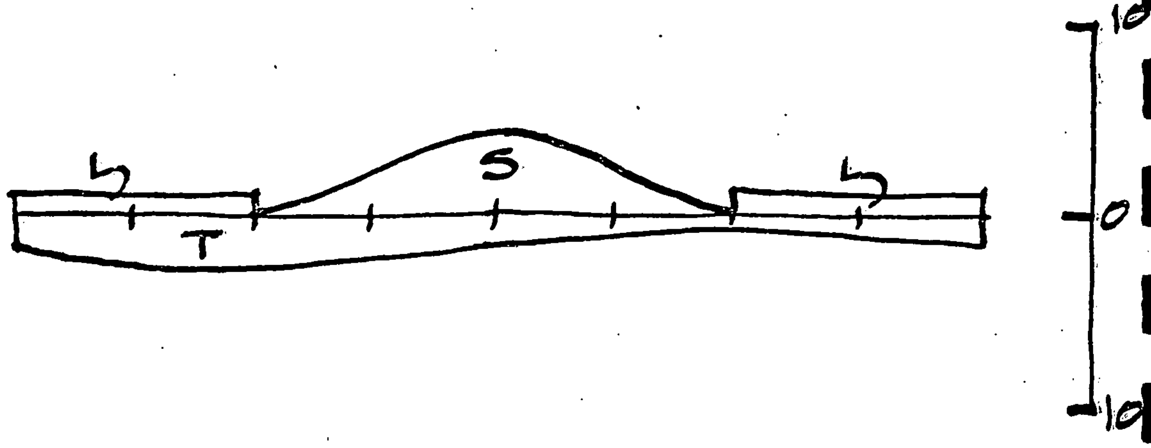
PRE-DESIGN FIREHALL
AVERAGE SUMMER DAY



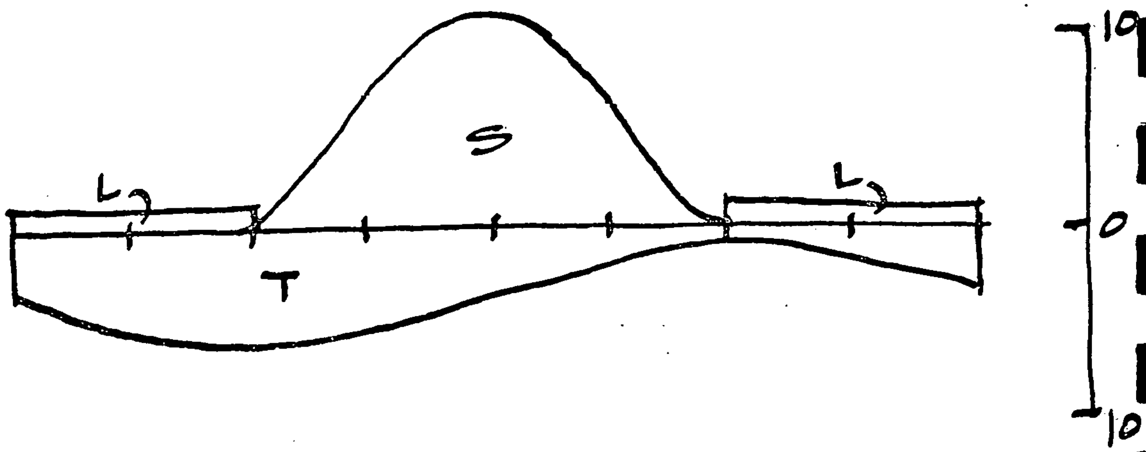
FINAL DESIGN FIREHALL
AVERAGE SUMMER DAY



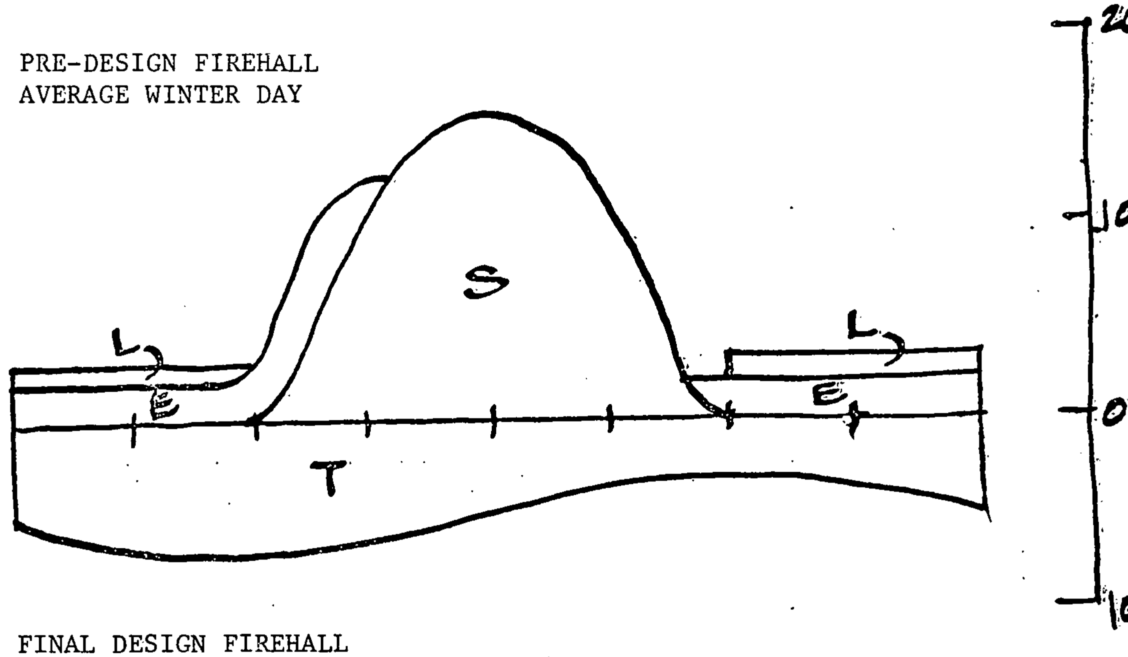
PRE-DESIGN FIREHALL
AVERAGE FALL DAY



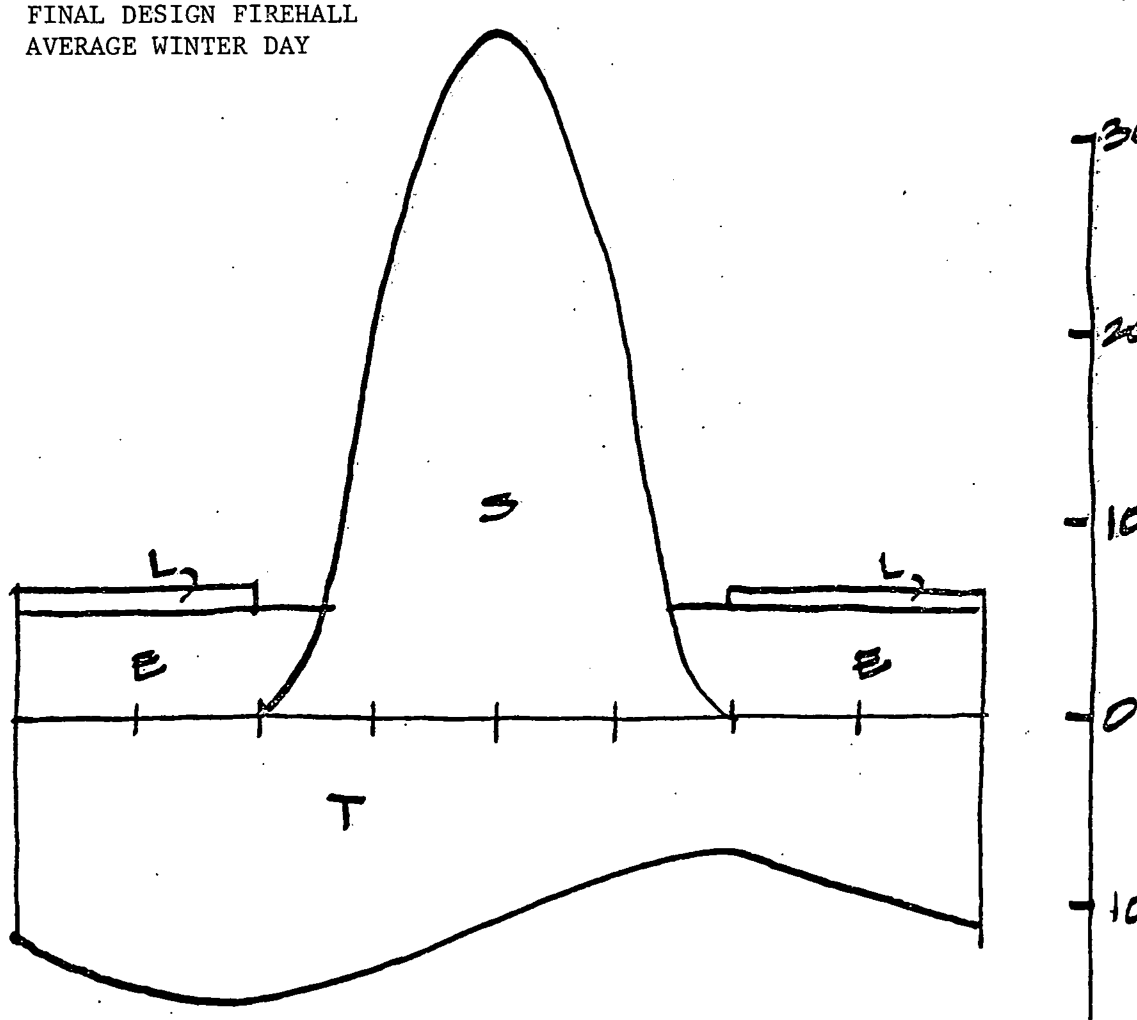
FINAL DESIGN FIREHALL
AVERAGE FALL DAY



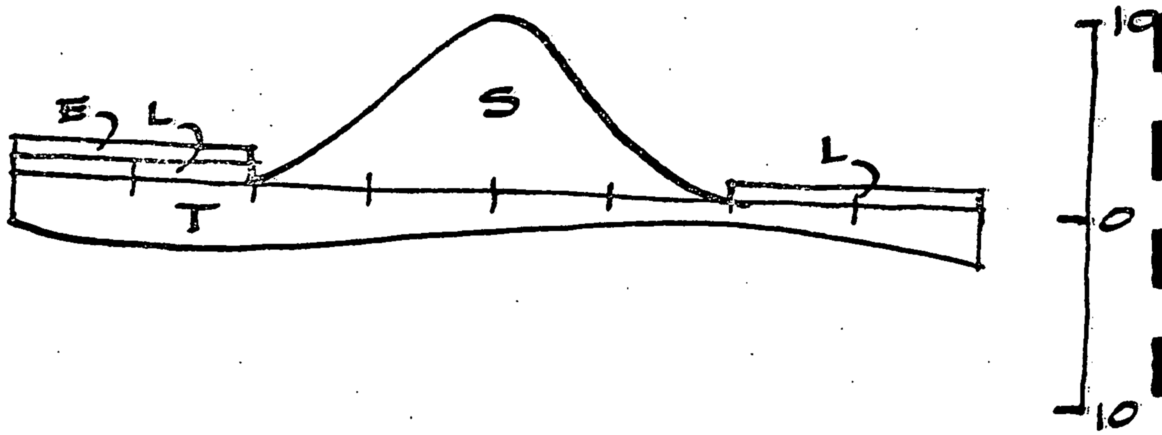
PRE-DESIGN FIREHALL
AVERAGE WINTER DAY



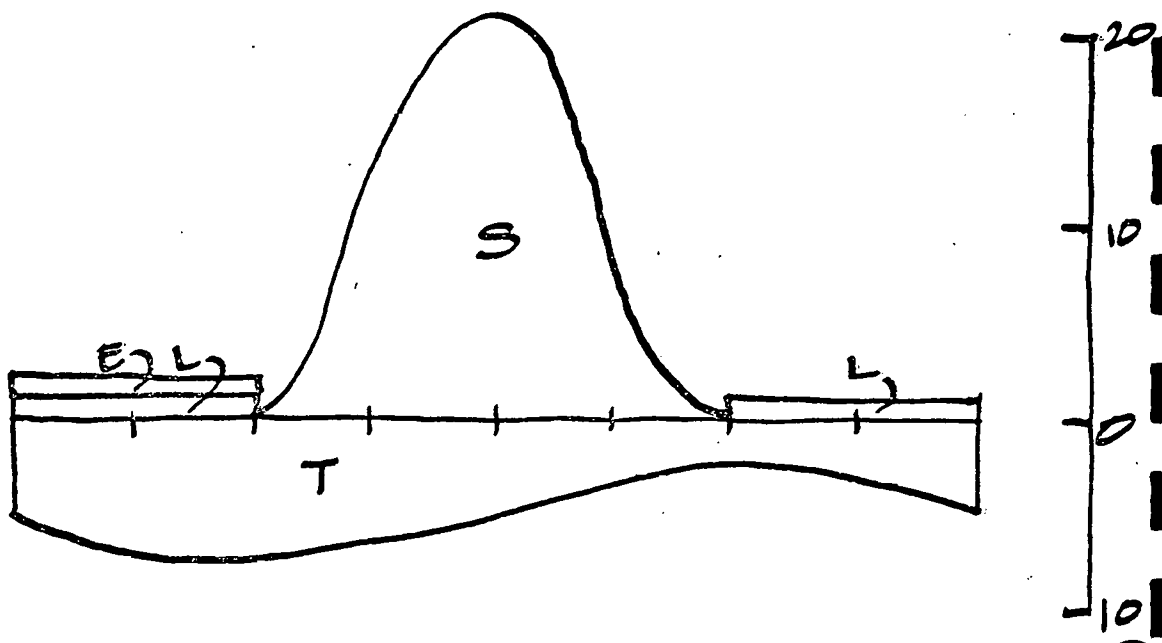
FINAL DESIGN FIREHALL
AVERAGE WINTER DAY



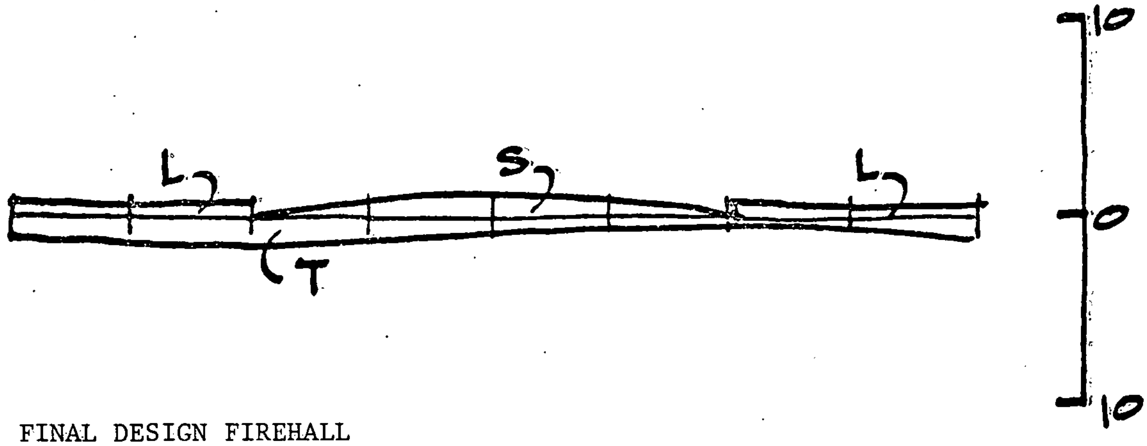
PRE-DESIGN FIREHALL
AVERAGE SPRING DAY



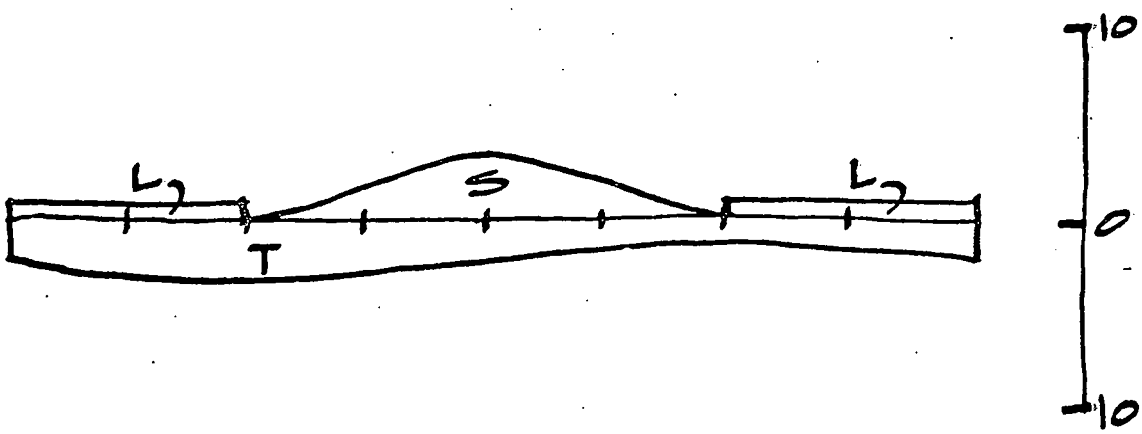
FINAL DESIGN FIREHALL
AVERAGE SPRING DAY



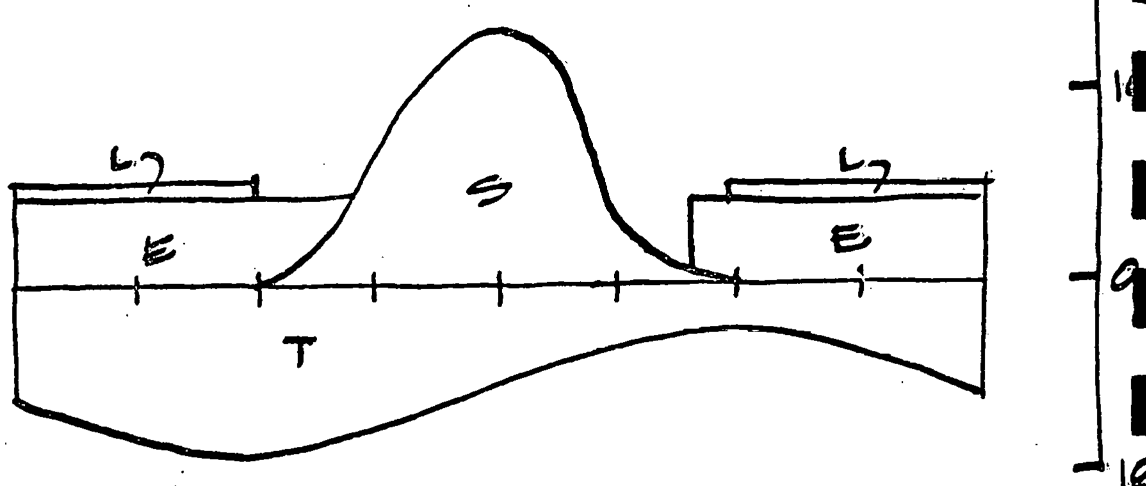
PRE-DESIGN FIREHALL
PEAK SUMMER DAY



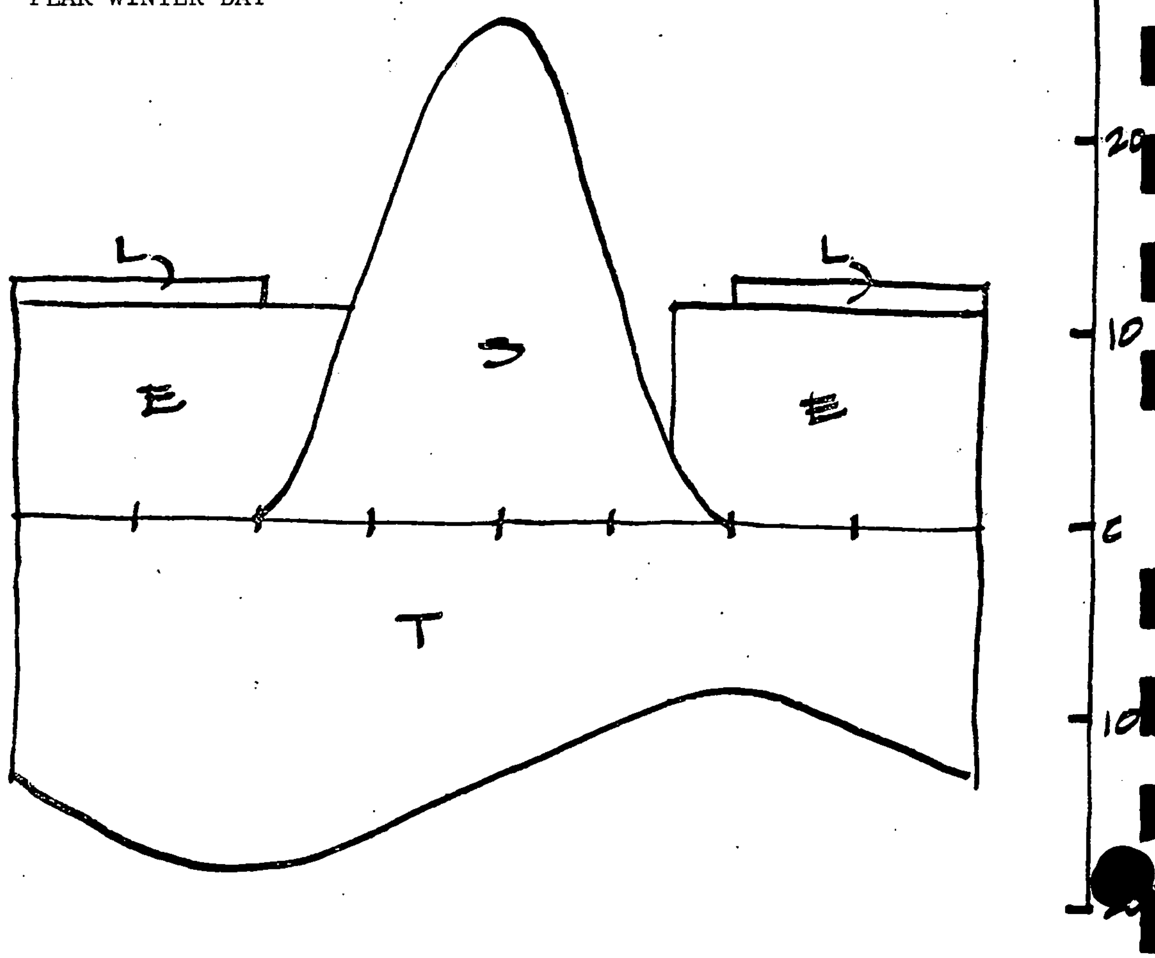
FINAL DESIGN FIREHALL
PEAK SUMMER DAY



PRE-DESIGN FIREHALL
PEAK WINTER DAY



FINAL DESIGN FIREHALL
PEAK WINTER DAY



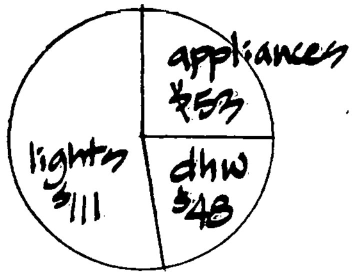
FIREHALL

The firehall's energy needs, based upon calculations as designed, indicated more energy consumption per square foot than we had estimated. This is primarily due to the users' decision not to utilize shutters on their direct gain, low internal temperature building.

I-K ECONOMIC ANALYSIS, RESULTS

The clients were interested in using minimal electricity and in providing most of the labor for the building, utilizing indigenous materials. Dollar costs of energy were secondary - electricity was undesirable, regardless of its relative cheapness here in the Pacific Northwest.

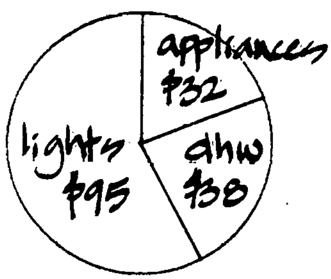
MEETING HALL PRE-DESIGN



Electricity: 38.1 MBTU
cost: 1.9¢/kwh
(no demand charge)
Total yearly cost: $212)

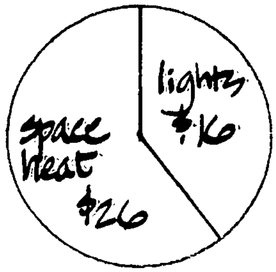
(wood is free for the cutting and hauling)

MEETING HALL, FINAL DESIGN



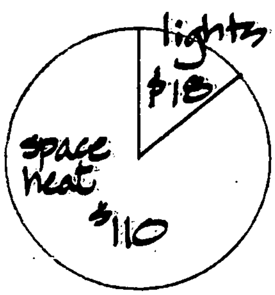
Electricity: 29.6 MBTU
cost: 1.9¢/kwh
(no demand charge)
Total yearly cost: $165

FIREHALL, PRE-DESIGN



Electricity: 7.6 MBTU
cost: 1.9¢/kwh
(no demand charge)
Total yearly cost: $42

FIREHALL, FINAL DESIGN



Electricity: 21.1 MBTU
cost: 1.9¢/kwh
(no demand charge)
Total yearly cost: $128

the increased electricity use in the final design was due to the clients decision not to utilize thermal shutters in the firehall.

For a comparison with conventional building costs, see the PASCALC economics analysis in the Final Economic Analysis, Part III-C.

PART II: THE DESIGN PROCESS

II A IDENTIFICATION OF BUILDING ENERGY NEEDS

INTRODUCTION

Energy needs for the Deadwood Community Center are generally derived from the community survey defining the building program as well as from their environmentally based political position. Consequently project needs must be described more qualitatively than quantitatively.

Generally, the Deadwood Community was interested in ways to apply the least energy and capital intensive resources and technology possible to the construction and maintenance of the community center. So, at least part of the building's need was to eliminate energy consumptive materials, technologies, construction processes and maintenance practices. In replacement, the community wished to utilize those that demonstrated environmentally compatible materials, methods, and practices.

TASK OVERVIEW

With that understanding the design team interpreted and characterized quantifiable energy needs. Initially, we took the simulated performance of a passively solar heated retail store we had recently designed and added more evening usage to estimate the meeting hall performance. For the firehall, we took the space heat needs of the retail store, and adjusted it for fewer degree days (space heating only is involved, and internal temperature only needs to stay above freezing). Space heating was the dominant ending for both buildings.

The meeting hall is of a size and usage quite similar to a residence with the occasional exception of a large meeting and the absence of daily inputs of kitchen heat. Based on this usage pattern, estimates were made of lighting, space heating, domestic hot water, and cooking energy consumption, as they would vary by season. The firehall has no regular human occupancy and need only maintain a temperature above freezing. Seasonal variations in electric lighting and space heating were estimated accordingly.

For preliminary design, energy needs were estimated using the publication "Passive Solar Heating" by S. Baker which contains residential design rules-of-thumb for the several climate zones of Oregon.

UNAVAILABLE INFORMATION

There was no reliable climate data for the Deadwood area. TEA's PASCALC climate data for Salem, Oregon was substituted. Similar data for the Oregon coastal range would have been useful.

INCREMENTAL PASSIVE DESIGN COST

a) At the pre-design phase, this analysis consisted of deriving information from graphs of a LASL solar fraction analysis previously prepared for a similar sized commercial building in Western Oregon. Some additional inhouse labor and materials were required to prepare those estimates. Having designed a similar solar building, the design team incurred only five additional hours of labor in preparing this information.

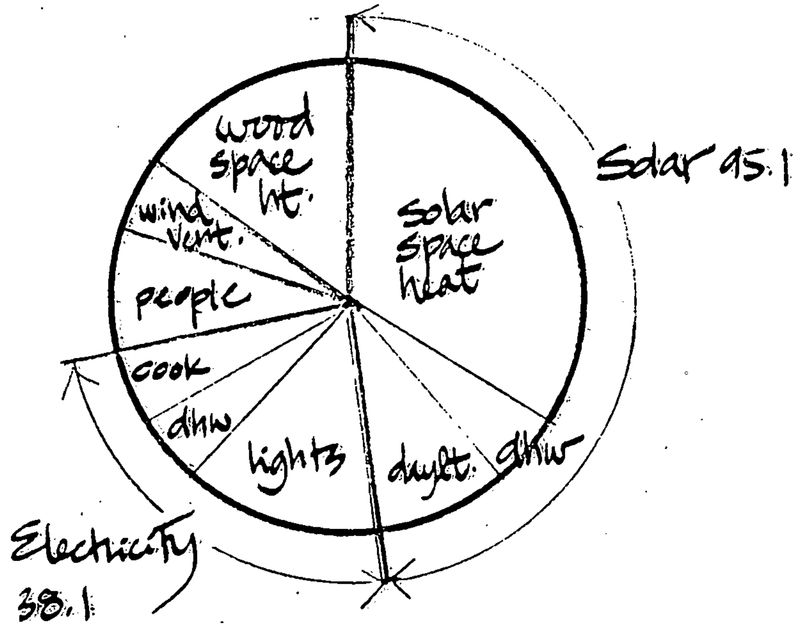
b) Future passive design efforts will likely incur greater incremental design costs if they are of a different size and use pattern. In this instance all the incremental costs were incurred transposing already collected information to a project specific form.

PERFORMANCE ANALYSIS

The following graphs represent a preliminary view of expected performance, and are based upon calculations for a commercial building designed for a similar Western Oregon climate. It resembled our community center project in that it was a similar size, relied heavily upon passive solar heating, provided daylighting through a clerestory, relied upon wood back-up heat, utilized thermal shades and shutters, and relied upon wind ventilation cooling, aided by distributed thermal mass.

MEETING HALL PRE-DESIGN

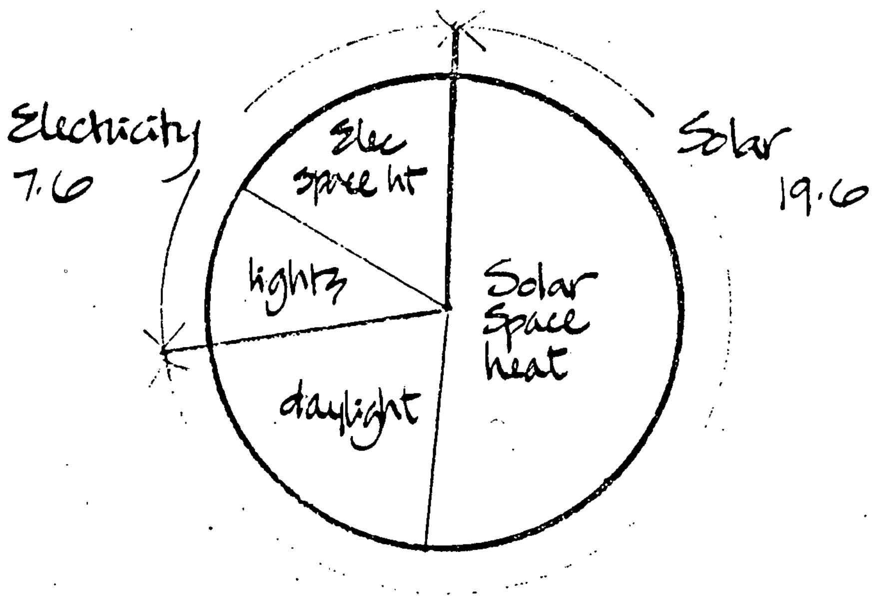
TOTAL ENERGY NEEDS 92,500 BTU/S.F.-YR.
FLOOR AREA 2,000 S.F.



SOLAR SPACE HEAT
WOOD STOVE SPACE HEAT
DAYLIGHT
ELECTRIC LIGHT
WIND VENTILATION
SOLAR DHW
ELECTRIC DHW
ELECTRIC RANGE

FIREHALL PRE-DESIGN

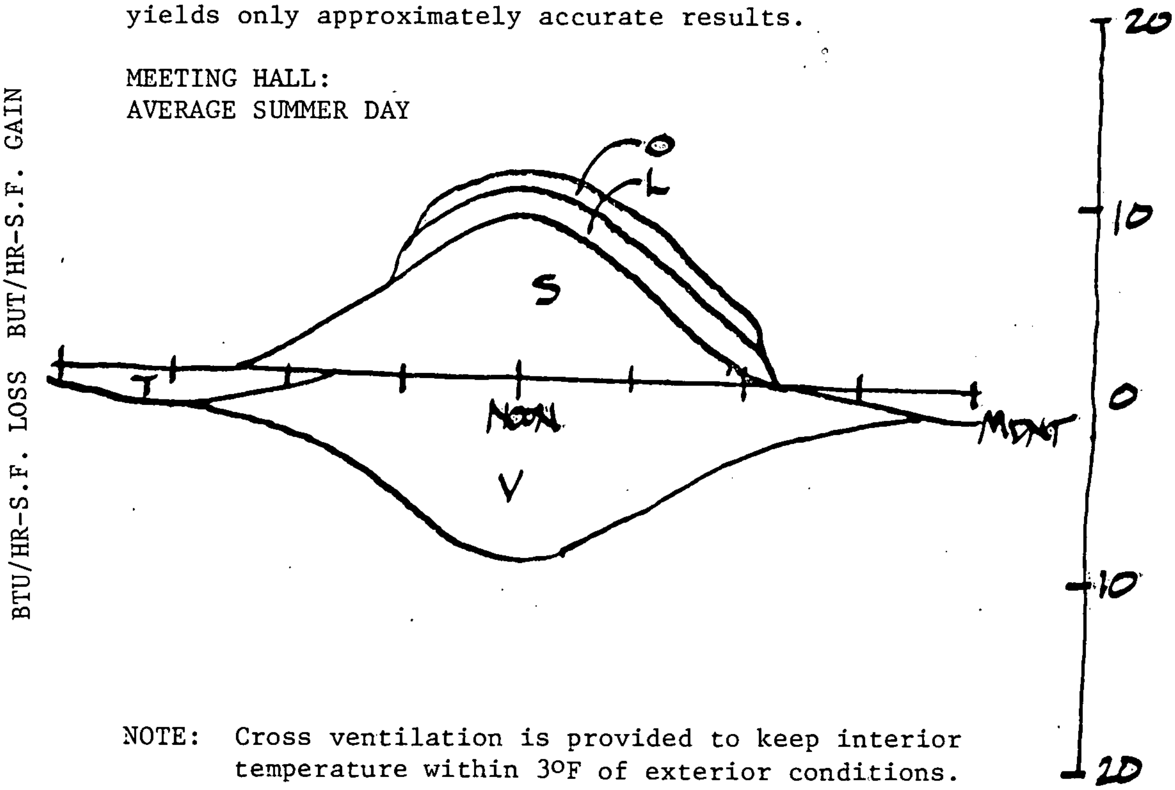
TOTAL ENERGY NEEDS	30,200 BTU/S.F.-YR.
FLOOR AREA	900 S.F.



SOLAR SPACE HEAT
ELECTRIC RESISTANCE HEAT
DAY LIGHT
ELECTRIC LIGHTING

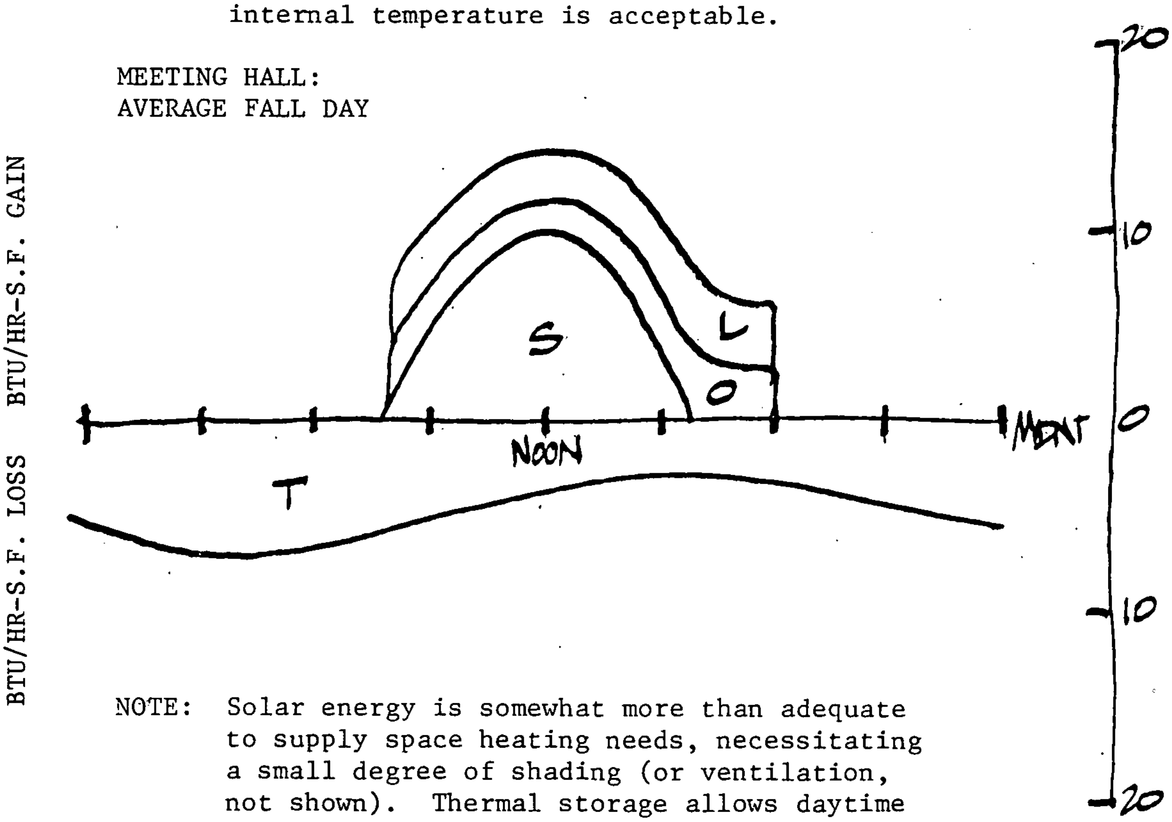
The daily load profiles were derived from a Solar Fraction analysis (LASL), with a simplified heat gain analysis used for summer performance. The transfer of information from monthly data to an hourly graph was somewhat time consuming, and yields only approximately accurate results.

MEETING HALL:
AVERAGE SUMMER DAY



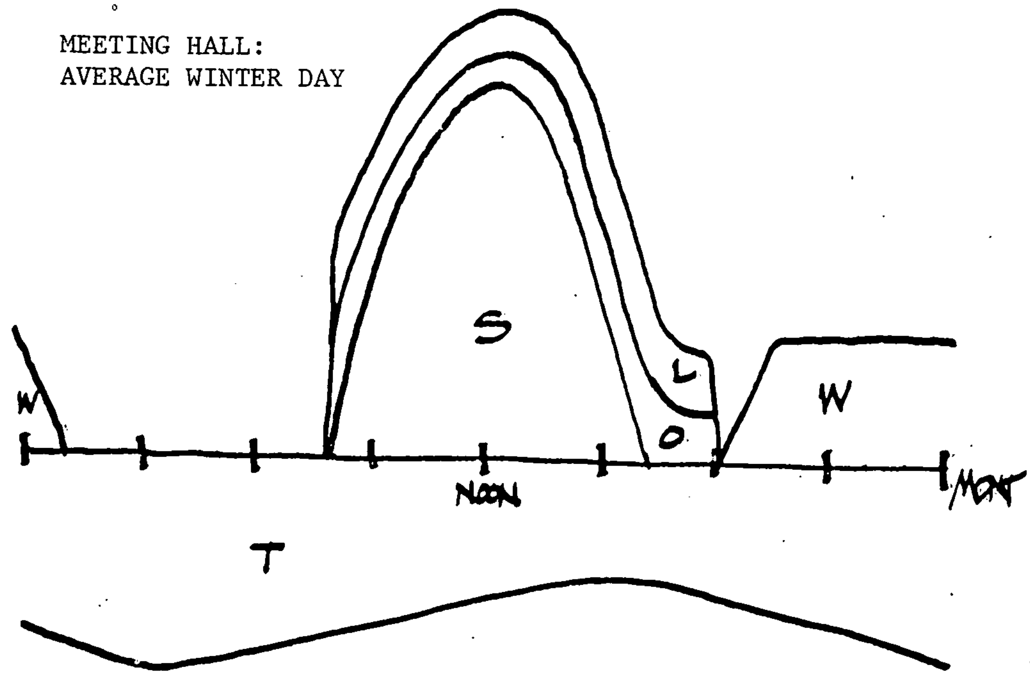
NOTE: Cross ventilation is provided to keep interior temperature within 3°F of exterior conditions. Under average Oregon summer conditions, this internal temperature is acceptable.

MEETING HALL:
AVERAGE FALL DAY



NOTE: Solar energy is somewhat more than adequate to supply space heating needs, necessitating a small degree of shading (or ventilation, not shown). Thermal storage allows daytime heat to balance nighttime heat loss.

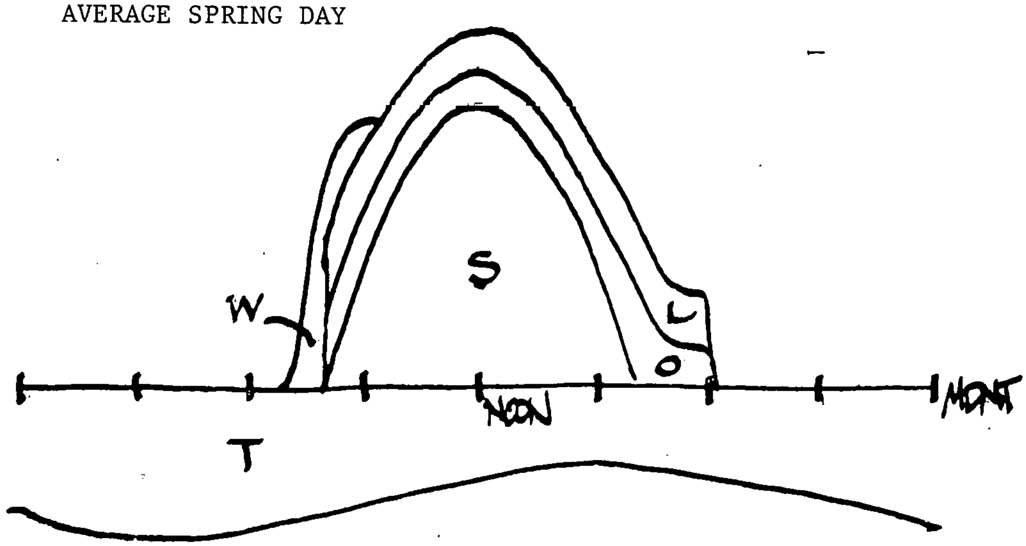
MEETING HALL:
AVERAGE WINTER DAY



BTU/H

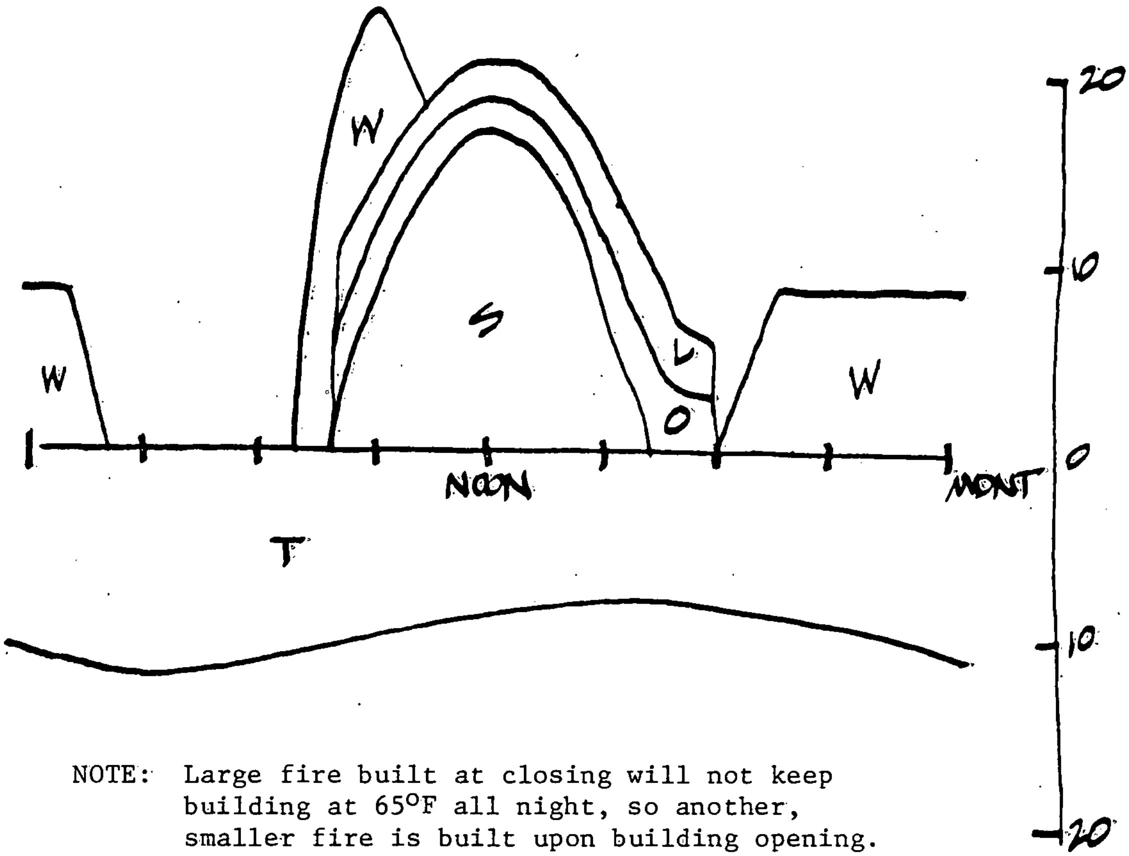
NOTE: Wood back-up combined with thermal storage allows a large fire to be built at closing time, keeping building warm enough for comfort upon opening.

MEETING HALL:
AVERAGE SPRING DAY



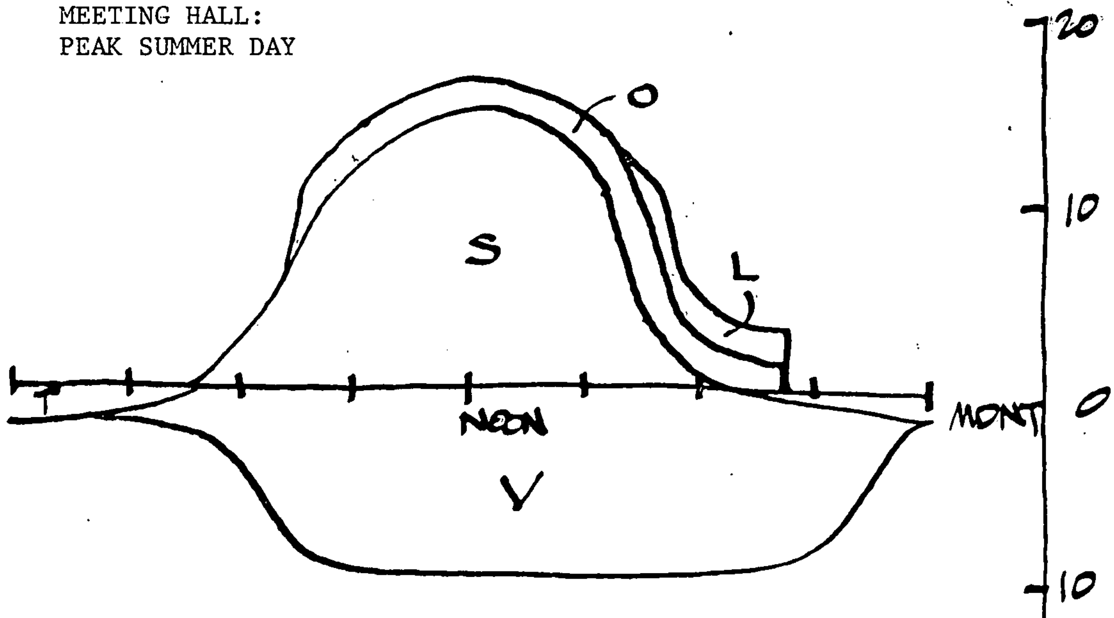
NOTE: Stored solar energy not quite adequate to hold building at 65°F all night, so a small fire built upon building opening brings building up to a comfortable temperature quickly.

MEETING HALL:
PEAK WINTER DAY



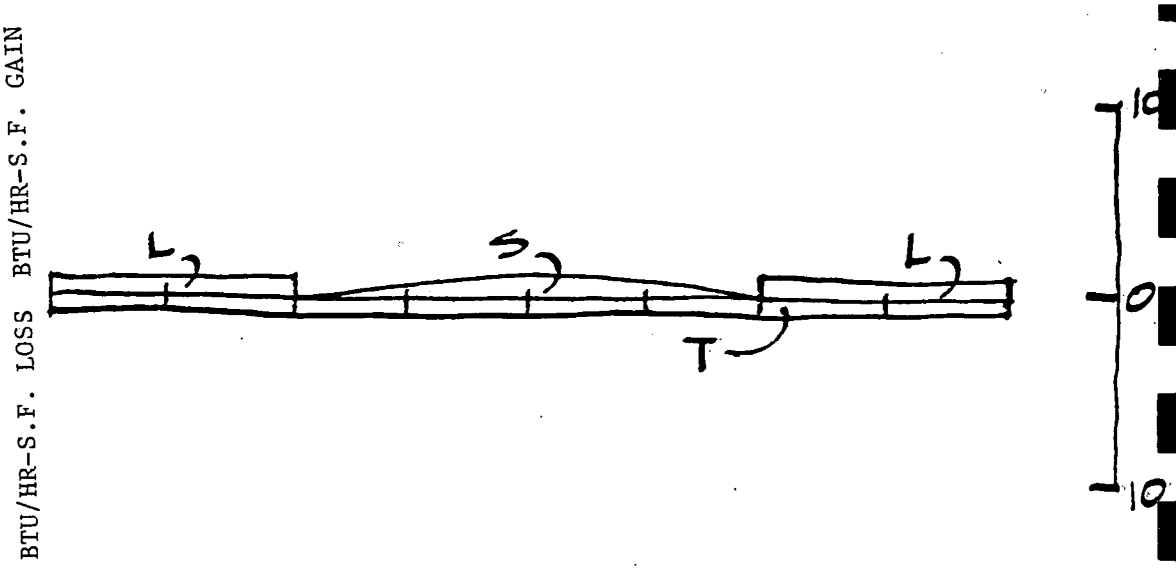
NOTE: Large fire built at closing will not keep building at 65°F all night, so another, smaller fire is built upon building opening.

MEETING HALL:
PEAK SUMMER DAY

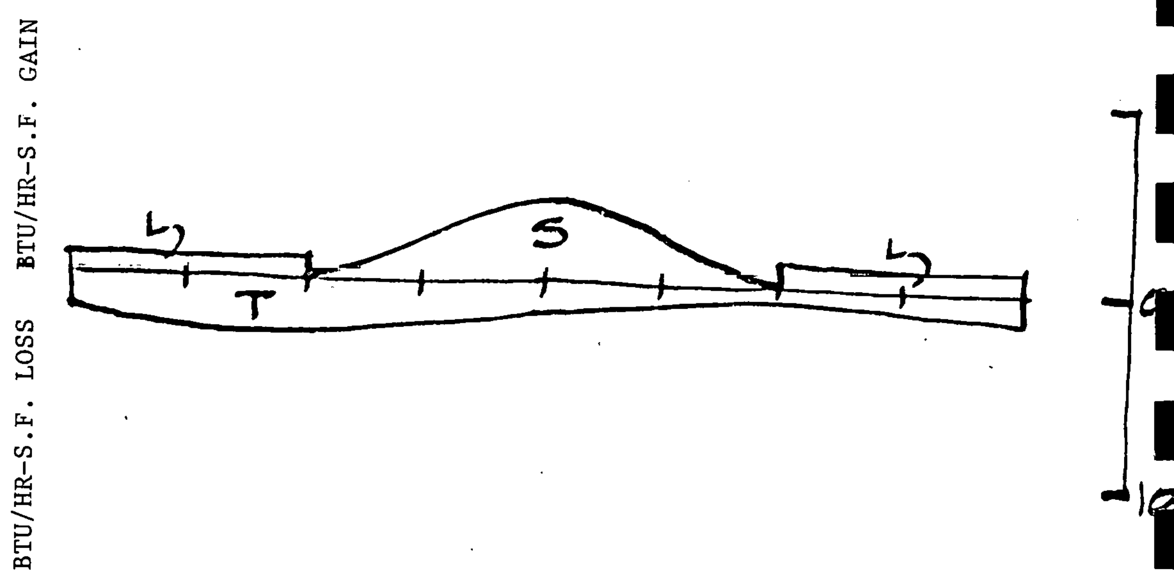


NOTE: Cross ventilation at hottest time of day would overheat interior, so night ventilation is also employed, to lower mass temperature and thus aid in maintaining comfortable interior temperature by day.

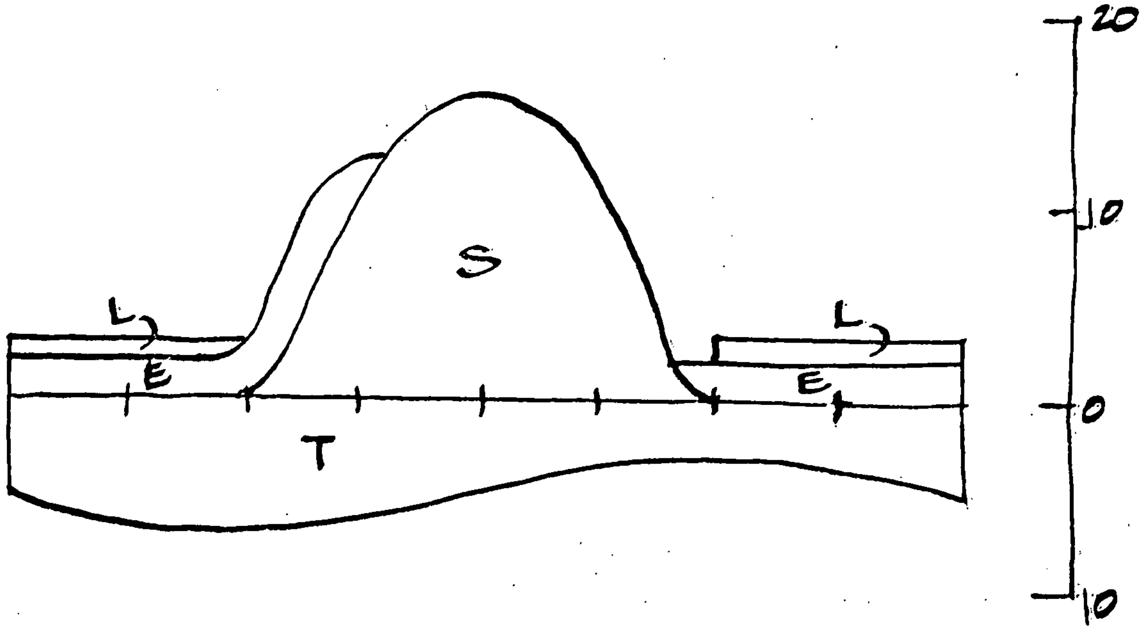
FIREHALL:
AVERAGE SUMMER DAY



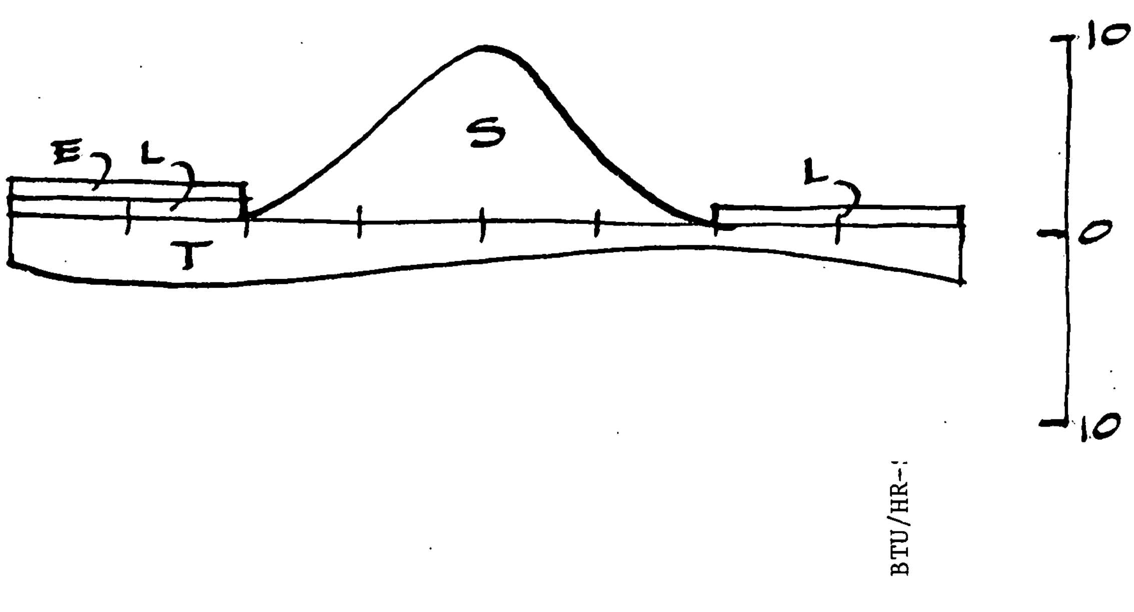
FIREHALL:
AVERAGE FALL DAY



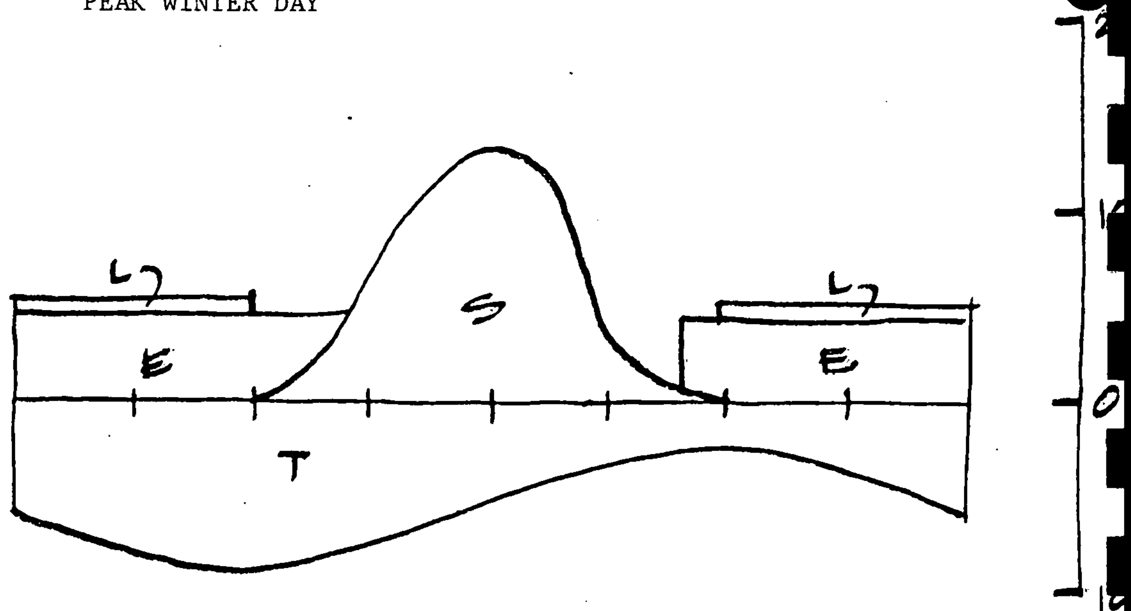
FIREHALL:
AVERAGE WINTER DAY



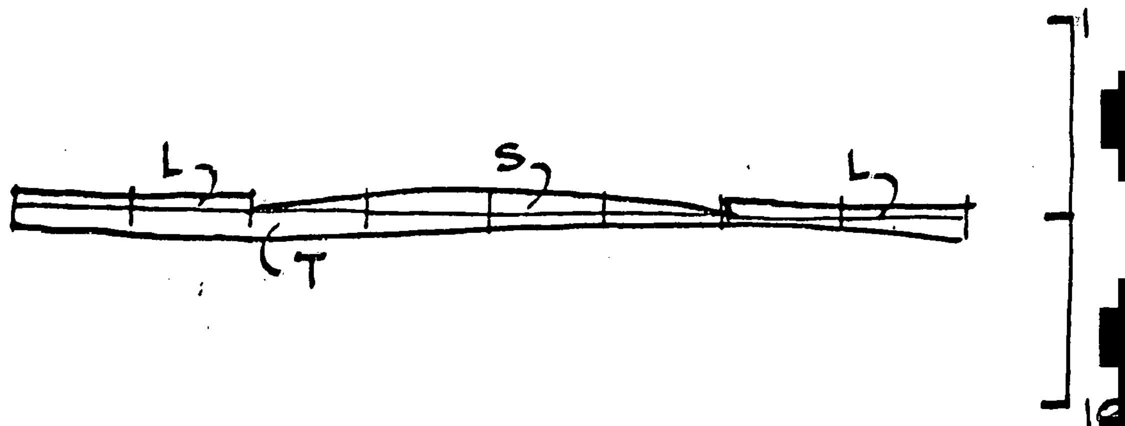
FIREHALL:
AVERAGE SPRING DAY



FIREHALL:
PEAK WINTER DAY



FIREHALL:
PEAK SUMMER DAY



c) Transportation to and from the building will be primarily by automobile. Because of the rural location and lack of origin and frequency of trip data, it is impossible to estimate the yearly energy consumption by transportation. However the building site is centrally located in the community and the people are experienced in organizing car-pooling efforts to reduce redundant automobile use.

d) Water is abundant in the Valley. This location receives ground water through a well. Water consumption is estimated at 80 gallons/day, or about 29,000 gal./year. Water conservation became an issue not because of supply, but because of septic tank treatment considerations. By utilizing water-conservation fixtures (water closets in particular), a reduction is allowed in the required size of the drainage field. Since a back-up, or secondary, drainage field is required by the county in this location, waste treatment consumes a significant portion of the site. Water conserving fixtures thus allowed somewhat more building-site flexibility by reducing the size of both the primary and secondary drainage fields.

ECONOMIC ANALYSIS

a) The construction budget is fixed by a $50,000 grant from Lane County (HCD funds) to finance site and material purchases. Labor, however, is volunteered and limited only by the ability of the community to motivate itself. Potential construction funding from DOE will enable the community to purchase solar related materials and products that were previously unaffordable.

ARCHITECTURAL COMPATIBILITY

As discussed elsewhere, the clients are in complete support of maximizing use of renewable energy sources, processes and materials.

II- B IDENTIFICATION OF SITE/COMMUNITY RESOURCES AVAILABLE

INTRODUCTION

The notion of site must be expanded to include the energy of a community and its people. The community and its organization offers opportunities to utilize human energy in planning, construction, and maintenance of these buildings. Consequently, some labor-intensive energy sources and technologies become more attractive by including a willing community.

a) TASK OVERVIEW

Examination of the site and discussion with clients identified solar and wood as likely energy sources. Fuel oil could easily be delivered to the site but wood is strongly preferred. Wind energy on this valley floor is a remote possibility but reliable data of velocities and duration at the site are unknown. (A wind timetable for nearby Eugene is included for reference.) Electricity is readily available, is hydroelectrically generated and distributed through a public co-operative. It is, however, to be used sparingly. The community prefers to use this high grade energy only for high grade tasks: lights and motors.

General climate data was used from Eugene. Solar and temperature data for calculator runs was from Salem, as the data for SOLMET from Corvallis proved faulty for the winter months.

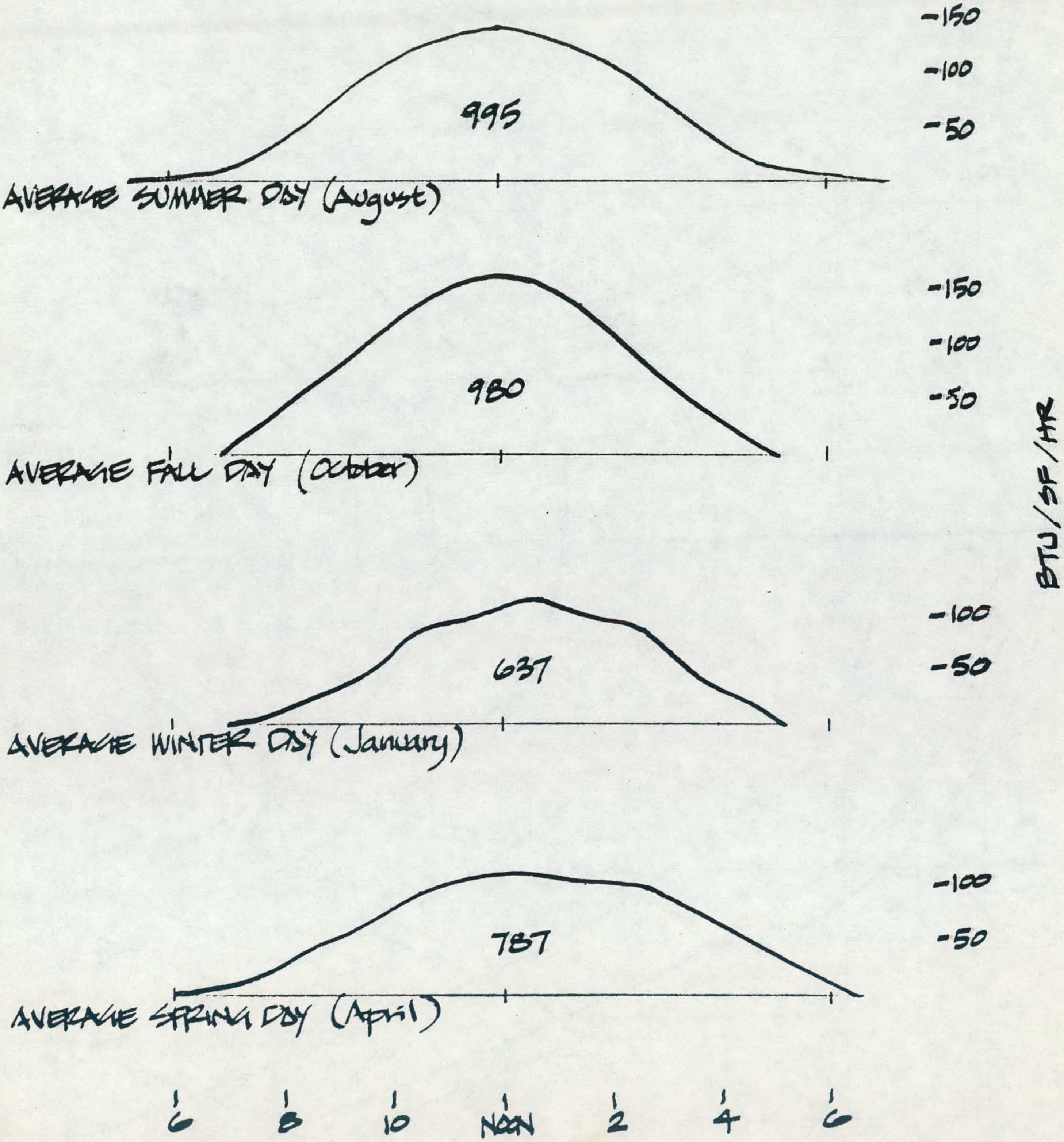
In order to assess the availability of solar energy, skyline profiles were plotted for three potential building locations. These were prepared using a sun-chart for 44°N. latitude developed by the University of Oregon Solar Energy Center. The three alternative building locations were derived to represent the most-concentrated to the most-dispersed utilization of site area. As indicated, no serious winter sun blockage exists between the hours of 10:00 a.m. and 3:00 p.m., at the northern portion of the site. Copies of those plots are available within this section.

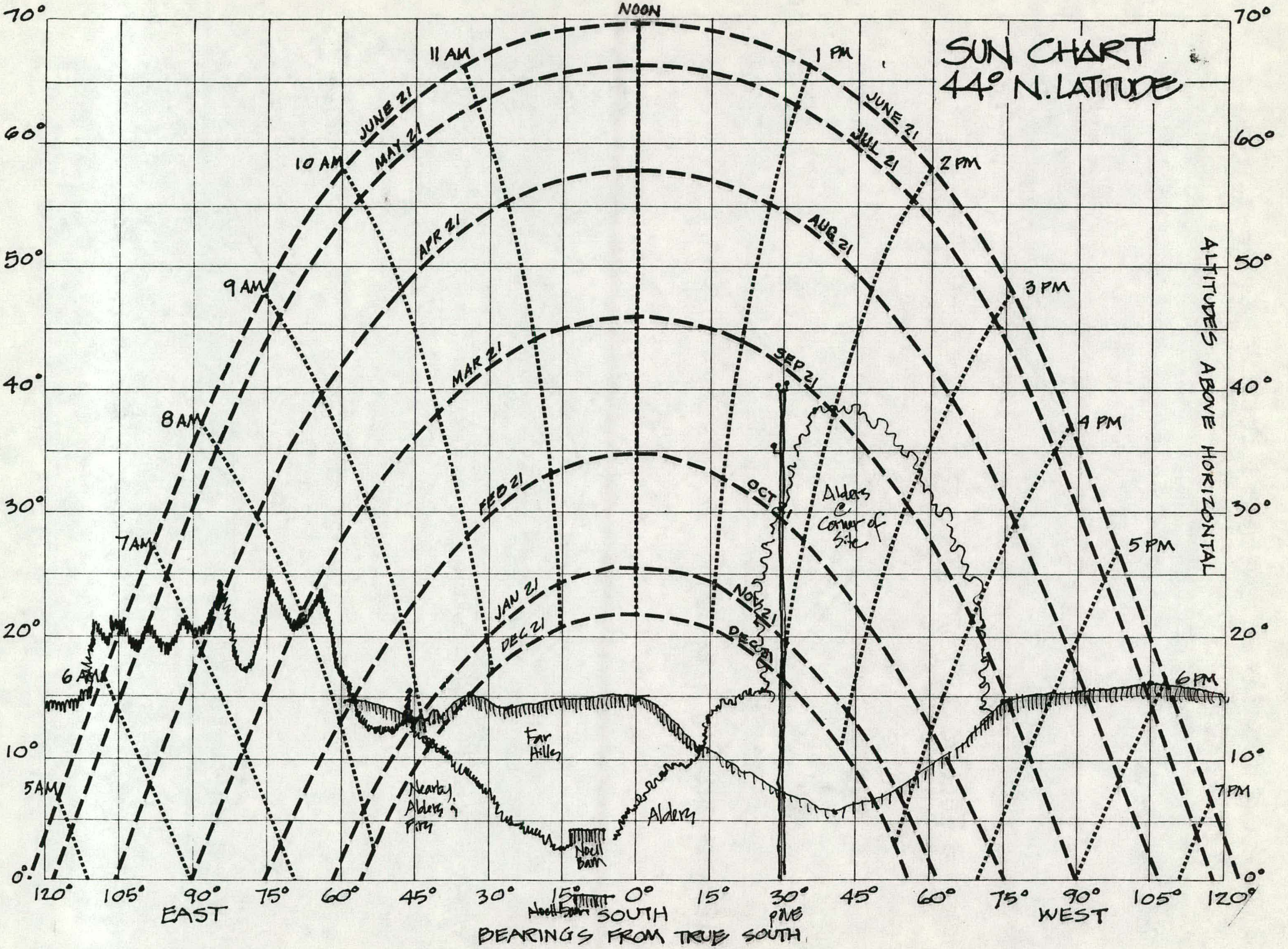
This valley floor site is somewhat protected by the surrounding hills that diminish the intensity of winter storm winds. On the immediate site, however, no windbreak exists that might further diminish storm winds as well as encourage the use of outdoor spaces on sunny spring, fall, and winter days.

Breezes are assumed available on the valley floor for summer ventilation, from the experience of the user group.

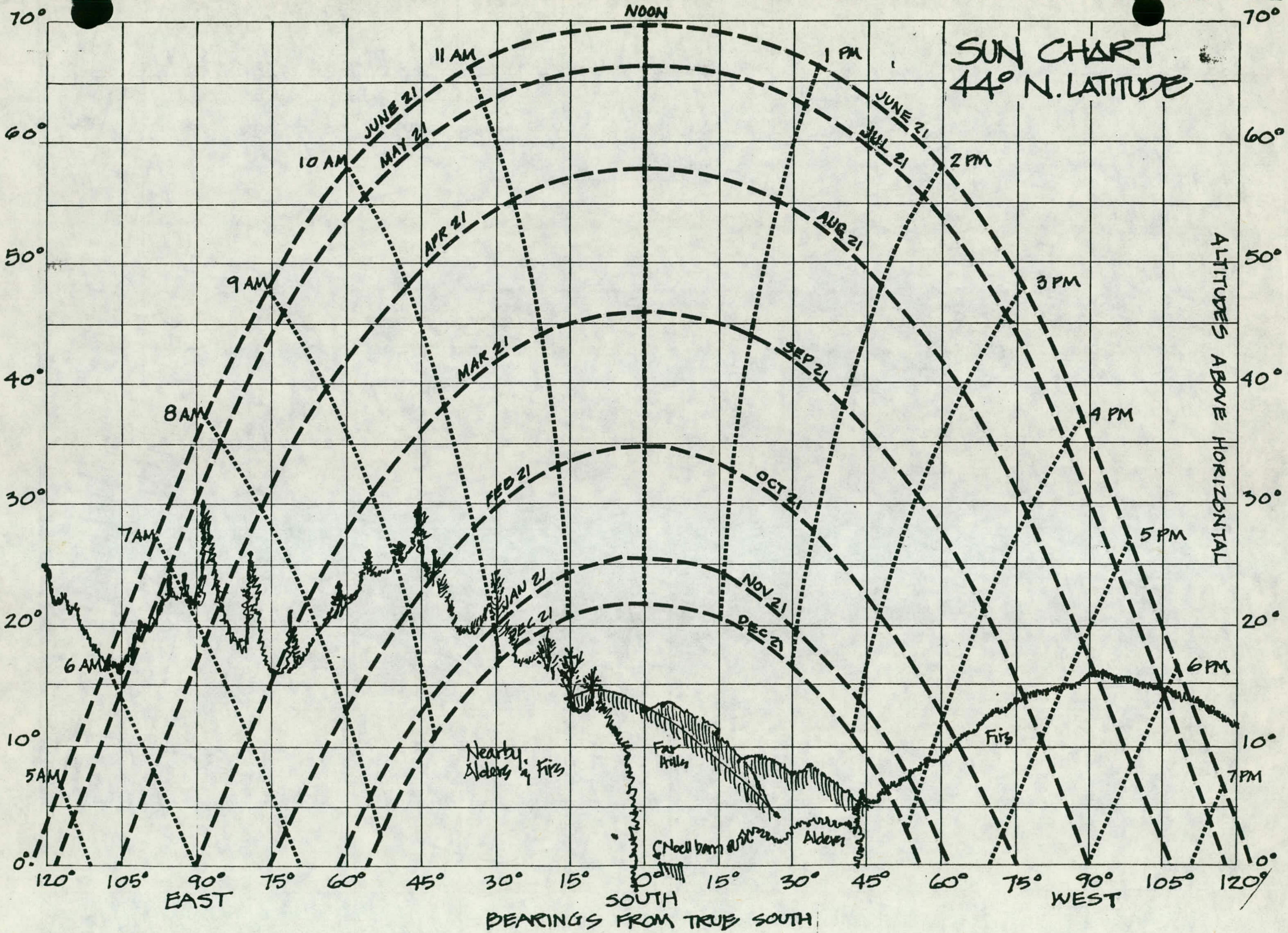
TOTAL SOLAR ENERGY AVAILABLE ON VERTICAL, SOUTH FACING UNSHADED SURFACE

Data for Corvallis, OR.



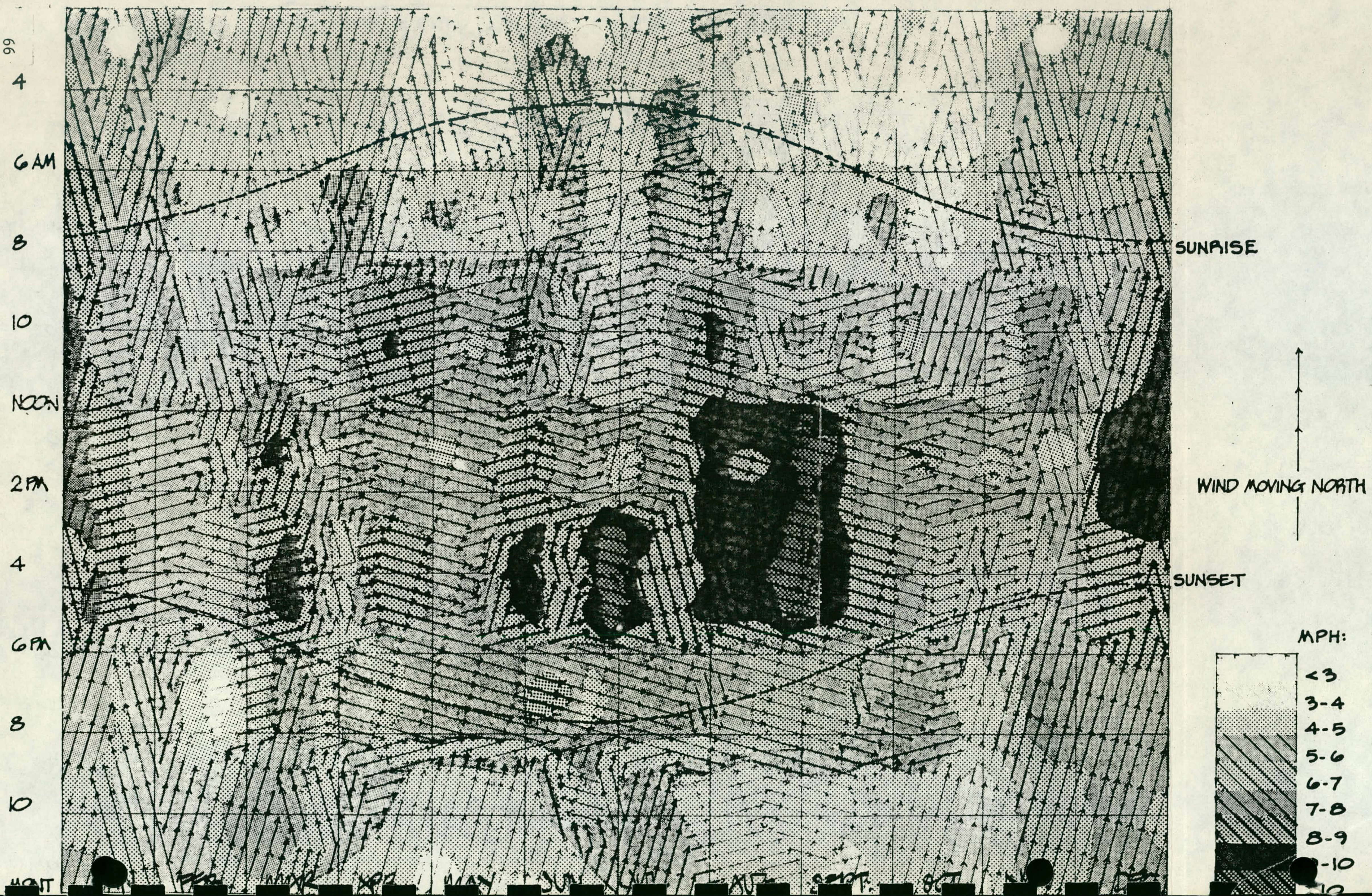


DE[illegible]WOOD: SKYLINE FROM S.W. CORNER OF SITE



DEADWOOD: SKYLINE FROM N.E. CORNER OF SITE

EUGENE, OR. WIND TIMETABLE


4
6 AM
8
10
NOON
2 PM
4
6 PM
8
10
SUNRISE
WIND MOVING NORTH
SUNSET
MPH:
<3
3-4
4-5
5-6
6-7
7-8
8-9

b) UNAVAILABLE INFORMATION

Well-documented wind data specific to the Deadwood Creek valley would have been an asset.

c) INCREMENTAL PASSIVE DESIGN COST

1) Some additional in-house labor and materials were required at the first site visit. Approximately 10 hours of additional design time was invested in surveying and plotting the skylines. Equinox is experienced in preparing this data, consequently time spent was dedicated to site-specific information collection rather than staff learning.

2) This particular task is typical for projects designed by Equinox.

d) ANALYSIS OF SITE ENERGY POTENTIALS

Solar energy: available, on-site, year-round. See graphs.
Wood: available nearby, for labor/transportation costs only.
Electricity: available on-site. No seasonal variation; Oregon utilities experience winter peaks.
Bottled gas: deliverable to site. No seasonal variation.
Fuel oil: deliverable to site. No seasonal variation.
Natural gas: unavailable on site.
Wind energy: available, but in unknown quantity. See Eugene graph.
Hydro (creek): very small summer flows, significant Salmon spawning makes creek unattractive as energy source.
Cattle dung: available adjacent to site, but considered better used as fertilizer than as fuel. Seasonal variations unknown.

ECONOMIC FACTORS

Electricity is commercially available on the site. It is distributed by Blachley-Lane Electric Co-op and ultimately purchased from the Bonneville Power Administration. After many years of cheap electrical power, a recent rate increase of 33 percent set the current commercial rate at 1.9¢/kwh. Hookup charges are approximately $200. Anticipated rate increases are estimated at 30 percent next year, and at least 15 percent thereafter. There is, at present, no demand charge for smaller users (under 50 KVA).

LP gas can be delivered to the site, at a current cost of 75¢ per gallon.

Fuel oil can be delivered to the site, at a current rate of $1 per gallon at a 600 gallon tank size. In the near future, an extra 3¢/gallon charge for delivery to remote sites such as Deadwood may be levied.

Wood is available, free for the cutting and hauling, by permit from the nearby Siuslaw National Forest. It is the typical space heating fuel for the Deadwood community.

ARCHITECTURAL COMPATIBILITY

The obvious advantages of solar energy and wood fuel as renewable and low technology energy sources are completely compatible with the architectural and environmental program for these buildings. Since the buildings are made exclusively for and by the Deadwood Community, the clients are anxious to utilize and demostrate the potential of solar energy toward the education of the community at-large. They place a high value on utilization of resources that are renewable and locally available as a means of increasing self-reliance and diminishing human impact on their environment.

The site's advantages include adjacency to a paved road for ready access to delivered fuel, power lines already on site, and proximity to a National Forest for low cost wood fuel. Unobstructed access to winter sun for the four best collection hours is also available.

The site's disadvantages include great distance from bottled gas or fuel oil supplies, necessitating considerable transportation fuel costs if either of these sources is utilized. Early morning and late afternoon sun is blocked in winter by the hills that envelope Deadwood Creek valley. These hills also reduce the wind speed at the floor of the valley.

The building program itself is not a particularly demanding one and easily affords this opportunity for the community to demonstrate its resourcefulness and environmental perspective.

C ARCHITECTURAL DESIGN PROCESS

Consistent with the motivation of Deadwood's first public building, it was intended that the design be an expression of the community purpose and vision. Significantly, it was also seen as an excellent learning opportunity for its members.

The design process actively seeks to educate and engage design activity as a deliberative dialogue recognizing multiple perspectives and values. Contrary to the belief that design is an expert, private, and detached task performed for others, public design among divergent opionions is a public task requiring direct involvement and confrontation by all concerned. Designing can be a discourse for mutual learning which accepts conflict and welcomes public argument and debate as a means to externalize and extend knowledge about a problem. Therefore it must solicit and include lay people to help make informed judgments about the environmental modification they are undertaking for themselves.

The designers' role within that process becomes that of an involved contributor to a public task. Professionally they become one more biased participant whose role is to make the design activity continually clear and accessible. This role exceeds a simpler facilitating function to become one of equal and active participation motivated to expand the public perception of what could be.

The design methodology which addresses that role proposes that design decisions are made accessible by presenting for discussion an intentionally wide range of physically definable alternatives of choices particular to the project. Choices are organized and made clear through a structure or agenda of physical issues typically arranged on the basis of scale, from general to specific (site, building, component).

The technique with which alternatives are presented involves preparation of a matrix. This clarifies the design decision to be made by isolating more elementary alternatives along the axes while the cells illustrate in an orderly way a range of considerations possible. Part of determining an acceptable alternative is knowing its opposite.

Public debate determines the acceptability of specific alternatives. As design decisions are made, participants remain overtly aware of the idealogies and viewpoints within their group, yet are able to reach agreement on a physically definable design alternative.

The design process is not linear in that it does not separate or make distinct phases of analysis, programming, design, and development. Rather these phases are continuously addressed and refined throughout the project. They recur at the decision making levels of site, buildings, and components. Ultimately the design proposal is a reflection of the unique values, aspirations, and education of the participants.

In application to the Deadwood Community Center and Firehall this design methodology took the general form of the Deadwood Building Committee and the design team meeting independently and together to prepare and resolve design problems. The design team would schedule and prepare design alternatives, while the building committee would research data necessary to prepare those alternatives. Meetings would include presentation and discussion of several matracies in conjunction with supporting information and design models. Design decisions addressed issues present at site, building, and component levels of complexity.

In total, there were eight design sessions and twenty-three matracies comprising the bulk of the design process. The scheme was presented for community-wide approval at a public meeting.

The following pages document that process more completely.

II - D. MATCHING ENERGY NEEDS AND SITE ENERGY POTENTIALS

A) INTRODUCTION AND TASK OVERVIEW

Energy needs were matched to the site and community energy potential through presentation of design alternatives to a decision making body comprised of client representatives and the design team. As described earlier, design decisions are made explicit through public debate and subject to majority rule. Each decision is introduced with the necessary background information and presented in a graphic format that allows community members to make their own informed assessment of design alternatives, their performance, economics, construction, and architectural implications.

In a sense then, the process of matching energy needs with site and community energy potential was the participatory design process. The people who would design, construct, inhabit, and maintain these buildings adequately represent the architectural, social, economic, and performance criteria through which decisions are made.

"Matches" were still very much scrutinized and evaluated by the designers but the assessment of their viability comes more directly from the community.

Energy in the eyes of these people is never an isolated issue but always integral with a social, political, and economic perspective. An energy awareness is expressed through the ways they farm, recycle materials, work collectively, and organize politically. Accordingly, energy occupies a clearly important but inseparable role within design decisions. Rarely is energy a primary motivator in decision making.

As a consequence, several difficulties arise when one attempts to describe only the role of energy in this project. The first is that in order to assist the community in making their own decisions, the design team employed a fairly broad range of tools and methods in presenting both background information and design alternatives. They are primarily intended to educate and make the community aware of the relative merit and implications of a variety of energy strategies. They do not often result in definitive numerical assessments fixed and controlled by a professional designer.

Secondly, energy decisions are often inseparable from other decisions. It is difficult to isolate energy for discussion when it is so integral with the ways the community thinks, works, and designs. The professional design team shares that view and approach energy and design as important parts of a larger understanding of physical context, environmental systems and fit. Overall, the integration of energy conservation with other design issues has been particularly thorough.

Also, the design process is less linear than that typically undertaken by a solely professional design team. Since its aim is the inclusion of users, a necessary step is the education of them as lay designers to make decisions from as informed a position as the professional designers enjoyed. In order to do that, it is necessary to demonstrate the present variables and future implications in any particular design decision for users. The structure of program, concept, schematics, design and design development is for the most part an inefficient and inflexible method to undertake that educational task. In this instance it is often necessary to engage programming, site planning, building design, and construction technology simultaneously or even in reverse order to make a design decision.

In response to these complications, the process of matching energy with site and community energy potentials is presented in two forms. The first is chronologically, with meeting by meeting summaries and documentation of design decisions, how they were made and with what intent. The second is an attempt to bring energy decisions closer to the surface by removing design decisions from the order in which they actually occurred and aligning them on the basis of scale (site, building, component) as a means to discuss the community's energy conserving strategies as applied to these buildings.

Viable "matches" between energy potentials and energy needs were approached with a fairly wide range of presentation, design and analysis tools. These are easily identifiable parts within the participatory design process described in some detail below. It seems more appropriate then to describe them more fully as they come up in the design process.

Simply stated, however, there were three generic kinds of tools and indicators used in design sessions with the community. First, background information in a variety of formats suited to content was prepared to explain a context for a particular design decision.

Secondly, design decisions are presented using a matrix of alternatives. These are intended to clarify the variables within a decision by identifying those more basic choices along the axes, while the cells assess or describe their combination. This format was used extensively throughout the design process and is well documented on the following pages.

Thirdly, variable architectural models were used to test design alternatives both formally and for performance.

B) UNAVAILABLE INFORMATION

We had no way of estimating how much the building was going to cost.... It is virtually impossible to estimate the availability and impact of volunteer labor, donated materials, and careful material purchases before they happen.

C) PERFORMANCE COMPARISION OF ALTERNATIVES

a. Solar energy used for space heating, cooling, domestic hot water, and day-lighting has enormous potential to off-set non-renewable energy consumption in the building. It potentially represents 19.9 MBU/year in the firehall and 05.1 MBU/year in the meeting hall. This replaces conventional electrical fuel.

Wood used for auxiliary space heating can also off-set non-renewable energy consumption in the meeting hall. It potentially represents 27.3 MBU/year in the meeting hall and replaces conventional electricity. Natural ventilation used for cooling represents 9.5 MBU/year in the meeting hall. Cooling was always assumed possible by natural means and therefore represents no potential saving of conventional fuel.

Human energy in the form of labor intensive construction and maintenance practices can also potentially reduce non-renewable energy consumption. The community exhibits a tendency to avoid energy intensive building materials, construction technologies and maintenance practices. It is possible to estimate the number of end use BTU/year saved in this manner, but is seems nonetheless a significant strategy in reducing non-renewable energy consumption, albiet indirect.

b) These graphs are unchanged from the Building Energy Needs section.

c) At this point, the energy goals for these buildings were modeled after a building of similar size and use already designed by Equinox. The goal can be stated as providing approximately 70 percent of the space heating with solar energy. The remaining 30 percent would come from wood heat in the meeting hall and electricity in the firehall. The domestic hot water goal was 50 percent solar with the remainder supplied by electricity. The lighting goal was 54 percent to be supplied by daylight in the meeting hall and 65 percent in the firehall. Cooling was never considered to consume nonrenewable energy. Natural ventilation was assumed to be adequate to cool a building of this size and use.

D) ECONOMIC ANALYSIS OF ALTERNATIVES

An economic comparison of source/use combinations was not undertaken as a predesign task. In this design process those comparisons were made in design meetings when particular alternatives came up for discussion. In that way economic criteria are given equal public discussion and assessment with performance and compatibility criteria.

ARCHITECTURAL COMPATIBILITY

The compatibility of all source/use combinations was also not assessed as a predesign task. Decisions of this nature were made in design meetings and are documented in Section II-E-3 of this paper.

II.D.3 DESIGN MEETINGS

The following pages document chronologically the participatory design process used in this project. Particular attention is paid to the content and method of each decision as they were prepared and discussed in the public meetings.

SCHEDULE OF DESIGN DECISIONS (broken down by meetings)

MEETING ONE AUGUST 14, 1979	- DEADWOOD CREEK SERVICES SURVEY - SIZES OF SPACES, DEGREE OF ENCLOSURE, DEGREE OF SHARING
MEETING TWO AUGUST 31, 1979	- DISTRIBUTION OF ELEMENTS, SITE SCALE - BUILDING ELEMENTS RELATIONSHIP TO SITE AND TO EACH OTHER - FORM OF MEETING ROOM AND ITS RELATIONSHIP TO OTHER ROOMS
MEETING THREE SEPTEMBER 14, 1979	- ROOM RELATIONSHIPS - SITE USES - MEETING ROOM FORM AND BUILDING CONFIGURATION - THE SMALL ROOMS
MEETING FOUR OCTOBER 11, 1979	- SOLAR HEATING - WORKING ENTRY LOCATION - BUILDING FORM
MEETING FIVE NOVEMBER 17, 1979	- DRIVEWAY/BULLETIN BOARD - COST ESTIMATE
MEETING SIX NOVEMBER 29, 1979	- ARRANGEMENT OF SITE SPACES - POSITION OF MEETING ROOM RELATIONSHIP TO STAGE - GRADE CHANGE, RELATIONSHIP BETWEEN MEETING ROOM AND VOLLEYBALL - ADJACENT SPACES - STRUCTURAL SYSTEM AND CONSTRUCTION SEQUENCE
MEETING SEVEN JANUARY 22, 1980	- PLAN REFINEMENT - METHODS OF SOLAR HEATING, STORAGE AND SHUTTERING - STRUCTURE - EXTERIOR CIRCULATION - THE GAP
MEETING EIGHT FEBRUARY 14, 1980	- THERMAL STORAGE OPTIONS - THERMAL SHUTTERING OPTIONS - SCHEMATIC DESIGN - CONSTRUCTION DOCUMENTS (DRAWINGS AND SPECIFICATIONS)

SCHEDULE OF DESIGN DECISIONS
(broken down by scale)

SITE SCALE:

- Sizes of spaces, degree of enclosure, degree of sharing
- Distribution of elements, site scale
- Building elements relationship to site and to each other
- Site uses
- Driveway/bulletin board
- Arrangement of site spaces
- Grade change, relationship between meeting room and volleyball
- Adjacent spaces
- Exterior circulation

BUILDING SCALE:

- Building elements relationship to site and to each other
- Form of meeting room and its relationship to other rooms
- Room relationships
- Meeting room form and building configuration
- The small rooms
- Solar heating
- Working entry location
- Building form
- Position of meeting room, relationship to stage
- Grade change, relationship between meeting room and volleyball
- Adjacent spaces
- Plan refinement
- Exterior circulation
- The gap

COMPONENT SCALE:

- Structural system and construction sequence
- Methods of solar heating, storage and shuttering
- Structure
- Thermal storage options
- Thermal shuttering options

MEETING ONE: AUGUST 14, 1979
Goertzen Residence, Deadwood, Oregon

INTRODUCTION

This was the first meeting of the design team and the building committee. The meeting was convened at the residence of one of the building committee members immediately across Deadwood Creek Road from the Community Center site.

The purpose of this meeting was to familiarize the design team with the Deadwood Community and establish activities and spaces for the community center and site.

Community members prepared a brief history and overview of the Deadwood Community as well as a summary of their work on the project.

The design team prepared a matrix to clarify activity and space requirements for the project.

Meeting No 1

August 14, 1979.

DEADWOOD CREEK SERVICES SURVEY: AUGUST 14, 1979

The design process began in May of 1979 when Deadwood Creek Services initiated a building program. The community was surveyed to determine priorities among spaces and ideas to be incorporated into the community center prior to the selection of an architect.

Community members placed highest priority on provision of a large meeting room, firehouse, children's room, library, and food storage. The building should provide outside play areas and a volleyball court. Utilization of solar energy to the greatest extent feasible was a top priority.

	least desirable 0	1	2	3	4	most desirable 5
LARGE MULTIPURPOSE	-	-	-	3	3	39
LIBRARY	4	3	2	13	6	17
KITCHEN	5	5	4	3	10	10
LAUNDROMAT	14	9	7	-	3	11
SOLAR HEAT	6	-	3	7	5	23
SOLAR GREENHOUSE	23	10	4	5	2	1
COMPOST TOILETS	9	3	5	9	7	12
OFFICE/SMALL MEETING ROOM	12	2	2	11	9	8
OUTSIDE PLAYGROUND	3	3	-	7	7	26
KIDS ROOM	4	2	1	8	10	21
FOOD STORAGE AND DISTRIBUTION SPACE	2	3	2	9	14	8
FIREHOUSE	2	4	2	-	6	32
FREE BOX FACILITY	6	5	6	10	9	7
MULTI PURPOSE ROOM LARGE ENOUGH FOR VOLLEYBALL	6	1	2	4	7	24
DESIRABILITY OF ATTRACTIVE LANDSCAPING	3	1	11	6	6	22

DEADWOOD CREEK SERVICES DESIGN & CONSTRUCTION COMMITTEE

Questionnaire Results:

	0	1	2	3	4	5
1) large multi-purpose room (meetings - movies - dances - etc)	/	/	/	1 / 2 (3)	2 / 1 (3)	32 / 7 (39)
2) library	1 / 3 (4)	3 (3)	1 / 1 (2)	12 / 1 (13)	5 / 1 (6)	13 / 4 (17)
3) kitchen	3 / 2 (5)	4 / 1 (5)	1 / 3 (4)	11 / 1 (3)	9 / 1 (10)	7 / 3 (10)
4) laundromat	11 / 3 (14)	8 / 1 (9)	7 (7)	/	2 / 1 (3)	7 / 4 (11)
5) solar heat	4 / 2 (6)	/	3 (3)	5 / 2 (7)	3 / 2 (5)	20 / 3 (23)
6) solar greenhouse	17 / 6 (23)	9 / 1 (10)	2 / 2 (4)	5 (5)	1 / 1 (2)	1 (1)
7) composting toilets	5 / 4 (9)	3 (3)	4 / 1 (5)	7 / 2 (9)	5 / 2 (7)	11 / 1 (12)
8) office / small mtg. room	8 / 4 (12)	1 / 1 (2)	2 (2)	8 / 3 (11)	8 / 1 (9)	8 (8)
9) outside playground	2 / 1 (3)	2 / 1 (3)	/	6 / 1 (7)	4 / 3 (7)	21 / 5 (26)
10) kid's room (separate)	2 / 2 (4)	2 (2)	1 (1)	7 / 1 (8)	8 / 2 (10)	17 / 4 (21)
11) food storage & distribution space	1 / 1 (2)	1 / 2 (3)	2 (2)	7 / 2 (9)	16 / 3 (19)	6 / 2 (8)
12) firehouse / shed for fire, rescue equipment	1 / 1 (2)	3 (3)	2 (2)	/	4 / 2 (6)	25 / 7 (32)
13) "free box" facilities	5 / 1 (6)	4 / 1 (5)	5 / 1 (6)	9 / 1 (10)	7 / 2 (9)	3 / 4 (7)
14) multipurpose room large enough for volleyball	3 / 3 (6)	1 (1)	2 (2)	2 / 1 (3)	6 / 1 (7)	20 / 4 (24)
15) desirability of attractive landscaping	3 (3)	1 (1)	10 / 1 (11)	5 / 1 (6)	5 / 1 (6)	19 / 3 (22)

MUD PORCH DCS MEMBER – black NON-MEMBER – red (do join!)

Compiled by DCS Associates © 1979

Deadwood Creek Services Survey August 14, 1979.

SIZES OF SPACES, DEGREE OF ENCLOSURE DEGREE OF SHARING: AUGUST 14, 1979

INTENT

The intention of this matrix is to describe the enclosure character ideally suited to the rooms and functions identified through the community survey. Underlying these alternatives was an idea that the more programmatic functions could overlap spatially or be accomodated within non-infiltration controlled spaces, requiring less building and therefore less energy consumed.

VARIABLES

Primary variables in this decision were: size (large or small), degree of enclosure (separate enclosure, defined area within another enclosure, alcove off of another enclosure or open), and activities to be included. A secondary concern was whether spaces could or could not be shared with others.

METHOD

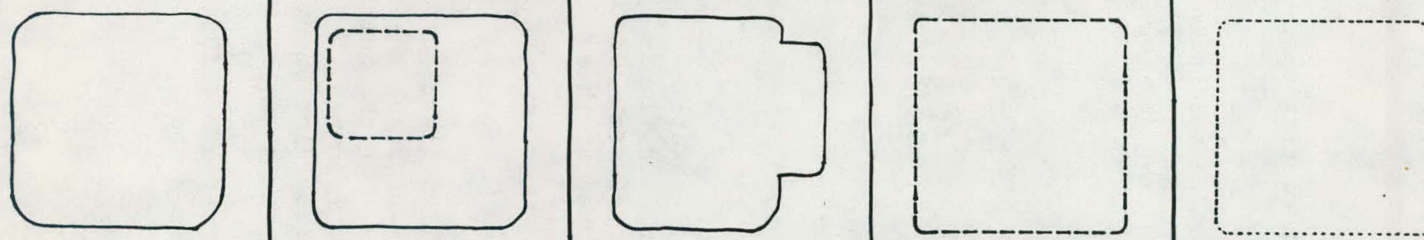
Using file cards, building activities and functions were pinned onto the matrix following discussion about the kind of facilities that might accommodate them.

DISCUSSION

Committee members were generally given to a large shared enclosed meeting room with the ability to expand, with a separate large enclosed firehall. The children's room and kitchen could be small alcoves off of the meeting room with varying degrees of sharing. A mudroom could be small and shared with another function such as a greenhouse or airlock. The volleyball court would be a separate partially enclosed space.

DECISION

Out of this matrix grew the building and site program identifying activities accommodated by the community center. The building program became: a large enclosed room of about 900 square feet capable of sharing within a variety of public activities, separate children's room and fire equipment; and a group of small rooms (kitchen, mudroom, etc.) that could share space with other functions; a large partially enclosed room for volleyball that could also acquire other public functions; plus outdoor spaces for parking, children, and recreation.



	ENCLOSED		DEFINED AREA WITHIN		ALCOVE OFF OF		PARTIALLY ENCLOSED		OPEN	
	SHARED	SEPARATE	SHARED	SEPARATE	SHARED	SEPARATE	SHARED	SEPARATE	SHARED	SEPARATE
SMALL (HALLWAY: ART & OTHER DISPLAYS, BULLETIN BOARD, CHATTING)	OFFICE SLEEPING QUIET ROOM; FOOD PREP. & PROC. FOOD CO-OP STORAGE REFR.; MUD ROOM ENTERING COATS	TOILETS ★	CLEANING EQUIP STORAGE WITH TOILETS.		FOOD ★ PREPARATION & PROCESSING; FOOD CO-OP			RECYCLING	PARKING 20-30 CARS; BOOKMOBILE PARKING	
LARGE	MAIN ROOM MOVIES MUSIC EATING VOLLEYBALL PLAYS	CHILDREN'S ACTIVITIES; FIRE EQUIPMENT STORAGE; EMERGENCY MEDICAL CARE				CHILDREN'S ACTIVITIES	MAIN ROOM MOVIES/ EATING VOLLEYBALL PLAYS.; FAIRS		CHILDREN'S ACTIVITIES	

Sizes of Spaces, Degree of Enclosure, Degree of Sharing August 14, 1979

MEETING TWO: AUGUST 31, 1979
Willamette Community Design Center, Eugene, Oregon

INTRODUCTION

The design team had requested at the first meeting that the community collect the following data:

1. a legal description of the site and its relationship to Deadwood Creek Road or any easements
2. a topographic survey of site
3. soil characteristics and suitability
4. groundwater location, quality, etc.
5. flood records
6. vegetation survey
7. climate/weather
8. demography
9. land ownership
10. valley vegetation pattern

By this meeting the design team was able to establish preliminary site boundaries, well location, and floodplain. Extensive county septic requirements were beginning to seriously restrict site use even at this very preliminary stage.

INTENT

The intention of this meeting is to establish distribution of building program elements on the site, establish their relationship to the site and to each other. At the building scale this meeting would establish the form and character of the meeting room as well as its relationship to other rooms.

The design team prepared a site analysis, three matracies, a site model and preliminary building volumes modes to make those decisions.

Meeting No 2

August 31, 1979.

DISTRIBUTION OF ELEMENTS AT SITE SCALE: AUGUST 31, 1979

INTENT

The intention of this matrix is to determine an overall strategy for site use and to place the community center spaces within that.

VARIABLES

This matrix identified four possible landuses to be accommodated on the site; parking, building(s), green space, and septic drain field. Primary variables in this decision involved parking; was it one large lot or several smaller ones, and the building(s); was it one building or a cluster of buildings on one part of the site, or more than one building on more than one site. Secondary variables were whether the parking was next to or apart from the building(s) and whether building sites were along the road, along the creek or both along the road and along the creek.

DESIGN ISSUES

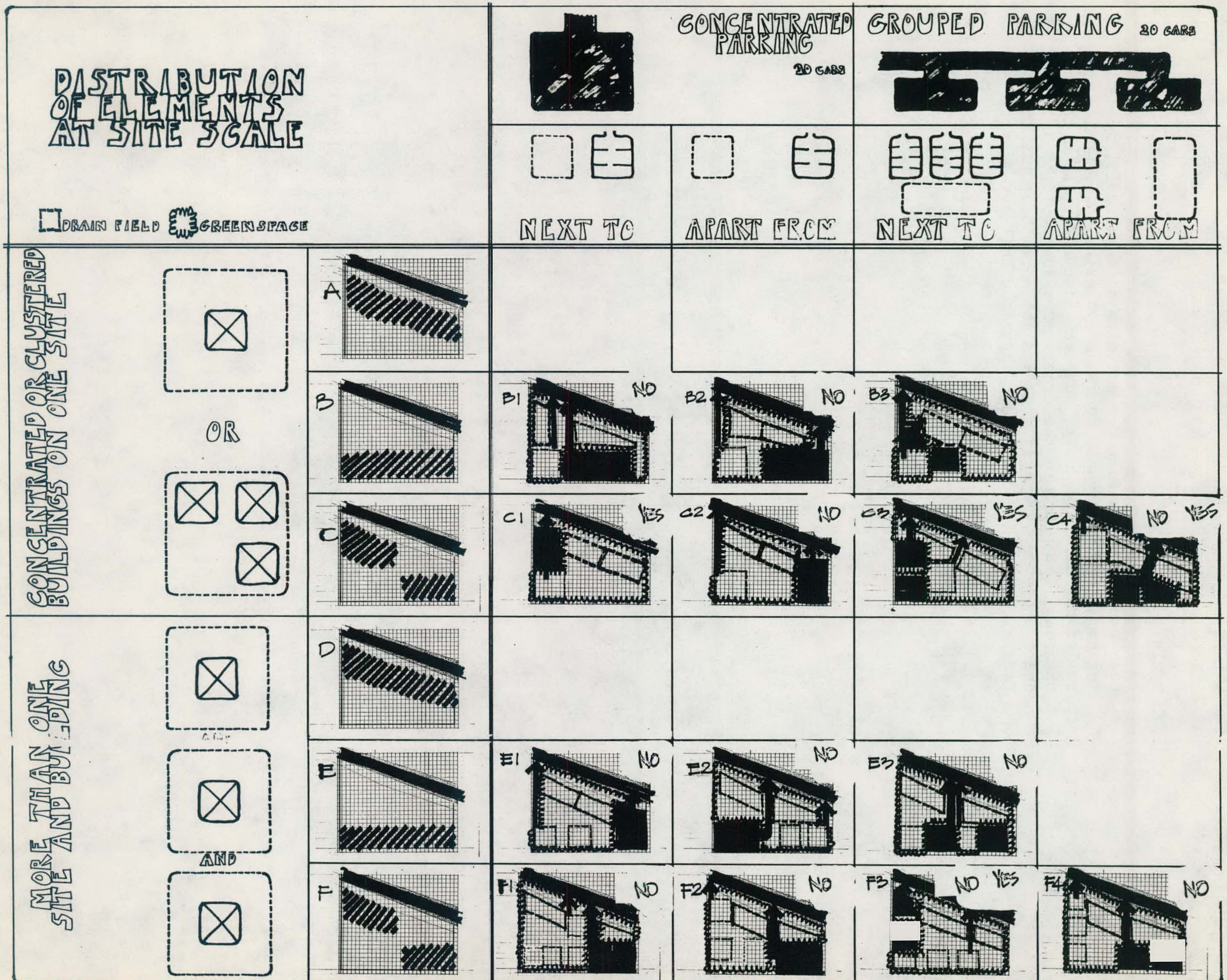
The design team identified that decision to be primarily influenced by attitudes toward optimum solar orientation for building, visual relationship and access to the road, and visual relationship and access to Deadwood Creek. Other design issues included attitudes toward amount of impermeable surface created on site, usefulness of green-space location, septic drainage and future building expansion.

METHOD

This information was portrayed on scale site diagrams illustrating the givens of site configuration, septic field area and green space. A model of the site with moveable firehall, meeting room, volleyball pavilion, and small rooms was used to elaborate particular alternatives.

DISCUSSION

In order to maximize unobstructed south exposure the decision was made to generally concentrate building near the north property line, within the limits of septic drain-field requirements. The firehall should be the building element nearest the road in order to facilitate emergency vehicle access and egress. Parking was not an important requirement but should be screened, between the buildings and the north property line. Generally, buildings should be more strongly related to the road than to the creek, although the volleyball pavilion may be more creek related. Expansion would probably occur by purchasing additional land to the west of the site.



Distribution of Elements at Site Scale August 31, 1979

DECISIONS

Consensus was to make three buildings: a firehall, meeting hall, and volleyball court on two sites. Two would be located along the north property line and related to the road, the third to the creek. Parking would be in one lot between the buildings and the north property line. Matrix cells C-1 and C-3 best expressed that agreement.

BUILDING ELEMENTS: THEIR RELATIONSHIP TO THE SITE AND TO EACH OTHER: AUGUST 31, 1979

INTENT

The intention of this matrix is to arrive at a configuration or cluster of buildings with the desired relationship to each other and the site. Building elements to be defined were: the main meeting space, the volleyball court, and the firehall.

VARIABLES

This matrix identified the four built program elements as two big spaces, volleyball, and a group of smaller spaces. Primary variables under consideration were six ways to arrange those parts with reference to the volleyball pavilion (end 'T', end, either end, next to, between, side 'T') and more generally, would there be one, two, or three buildings. A secondary variable was the position of the smaller rooms with respect to the larger building elements (next to or between). Another variable was the location and direction of the firehall exit.

DESIGN ISSUES

The design team identified that this decision would be influenced by attitudes toward achievements of optimum solar orientation for spaces that would benefit from it, the amount of solar collection area produced, the ability of inside spaces to move outside seasonally or with overflow, functional distances between spaces and future expansion.

METHOD

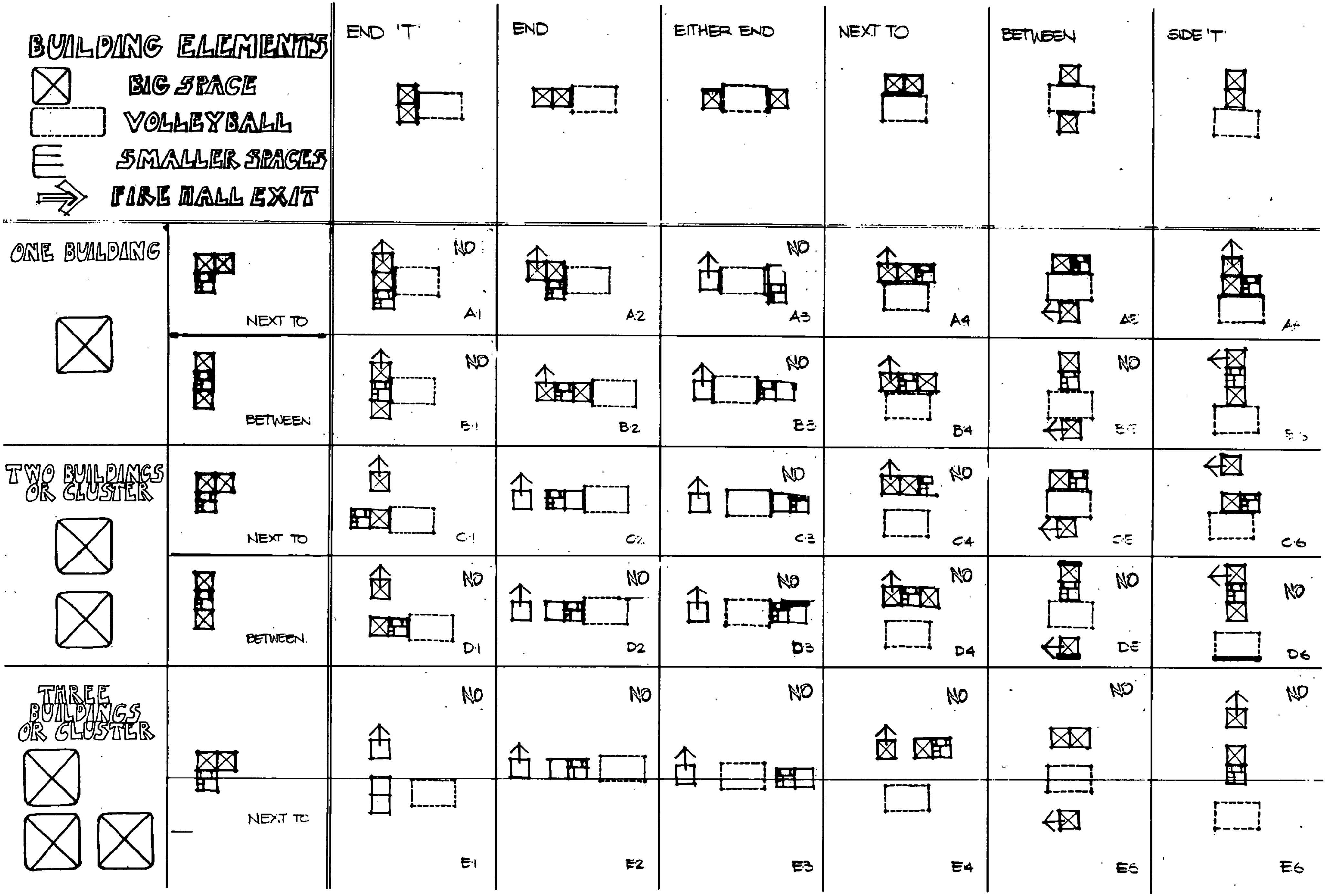
Diagrams illustrating those configuration alternatives were presented. A model of approximate room volumes that could explore spatial, solar, and formal implications was used to evaluate alternatives.

DISCUSSION

The firehall could be either attached or detached, and need not consider expansion. The main meeting space should be adjacent to the covered volleyball court and share supporting rooms.

DECISIONS

No single matrix cell resolved the issues to the satisfaction of everyone. Several alternatives, however, came under consideration at least in part. From those, the following agreements were reached. Two or three buildings would be made. The meeting hall would be to the south and adjacent to the covered volleyball court. Supporting rooms should serve both. A decision on the firehall was not necessary at this time and would be made later.



Building Elements: Relationship to Site and to Each Other

August 31, 1979

FORM OF MEETING ROOM AND RELATIONSHIP TO OTHER ROOMS
AUGUST 31, 1979

INTENT

The intention of this matrix was to determine a configuration for the main meeting room and resolve its relationship with the smaller rooms.

VARIABLES

This matrix identified six possible meeting room configurations (square, rectangle, circle, 'L', 'T', cross) and four possible ways to relate the meeting room to the smaller rooms (rooms off rooms, side corridor, end corridor, outside corridor).

DESIGN ISSUES

Issues seen to affect that decision: amount of solar exposure now and with future additions, ability to expand, ability to be built in phases, degree of spatial definition, shelter provided, and access to outside spaces.

METHOD

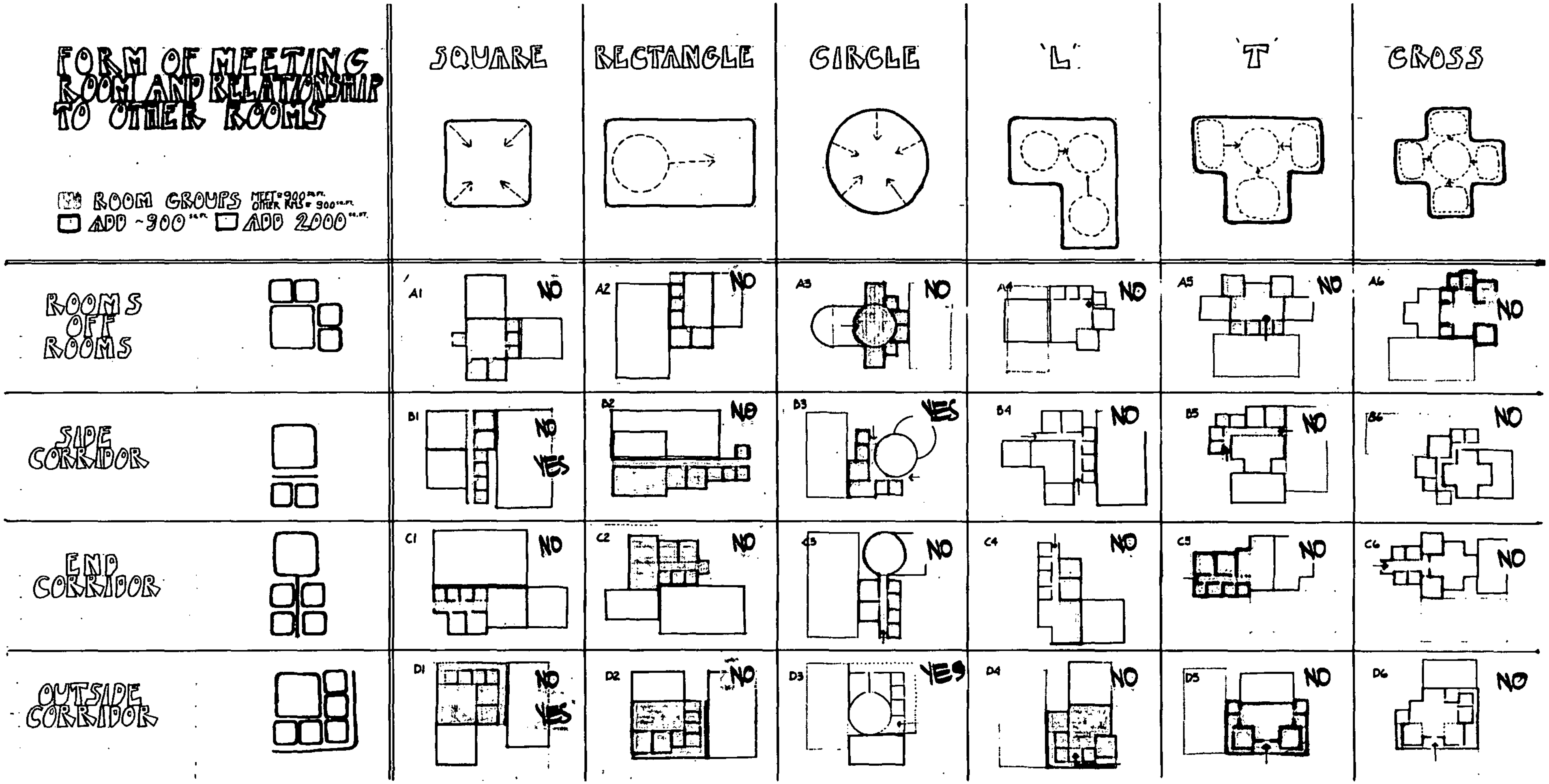
Alternatives were expressed on the matrix as schematic possibilities combining a particular meeting room shape with a patricular room arrangement. Schemes were presented in order to suggest the architectural potential of this decision for the building as a whole. Models were used to test specific alternatives.

DISCUSSION

It was consistently felt that the meeting room configuration should express the community's non-hierarchical organization. Spaces that implied a central rather than directional focus were clearly preferred (circle, hexagons, octagons, or squares). The meeting room should be a symmetrical space, and unlike those already found in Deadwood.

It was also felt that a roof for this space may be of a more simple geometry. Perhaps it could be more directional and related to a non-symetrical environment, particularly the southern exposure given the meeting room.

Corridor and adjacent spaces could open onto the meeting room provided they could also be closed off. Most interest was expressed in alternatives that wrap the meeting room with smaller rooms and/or a corridor.

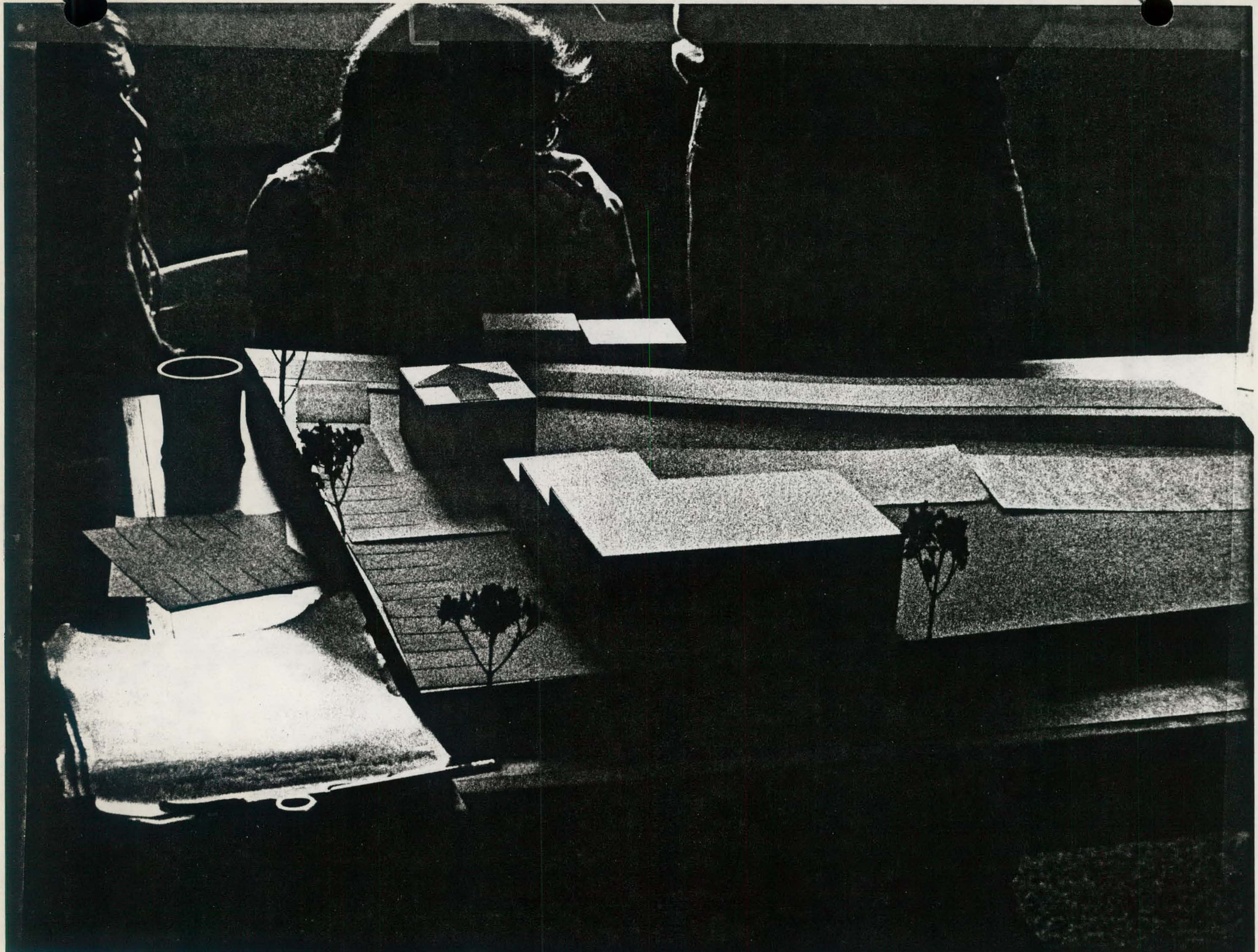


Form of Meeting Room and Relationship to Other Rooms

August 31, 1973.

DECISIONS

While no alternative was completely acceptable, it was resolved that the meeting room would be round, hexagonal, octagonal, or square. Interest was expressed in schemes that surround the meeting room on two sides with smaller rooms. It was agreed that another matrix would be prepared to make a more definite decision.



Meeting N°2: August 31, 1979.

MEETING THREE: SEPTEMBER 14, 1979
Willamette Community Design Center, Eugene, Oregon

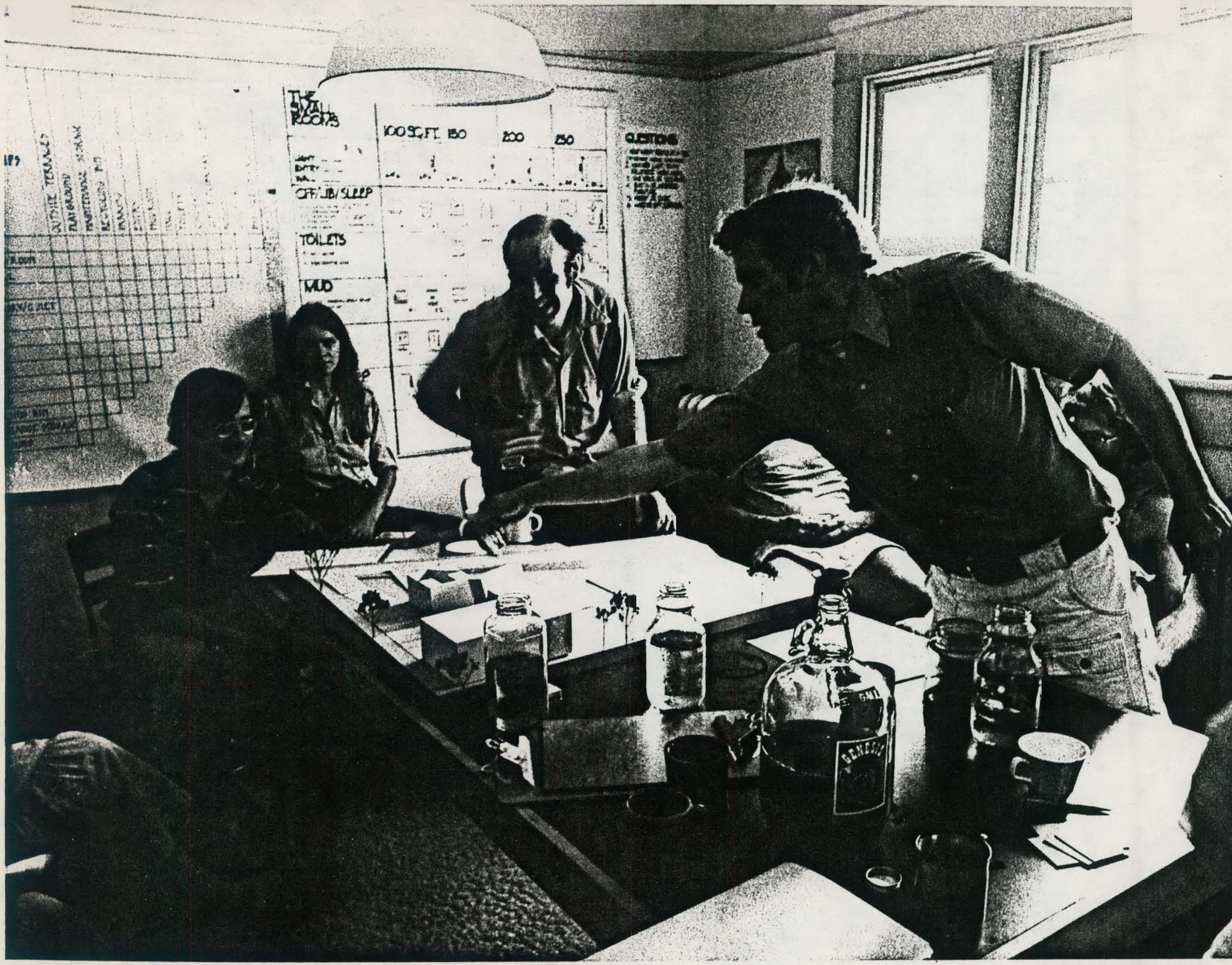
INTRODUCTION

This meeting follows clarification of county septic field requirements. The design team had by now received topographic information, accurate location of property lines, and had established the 100 year floodplain of Deadwood Creek.

INTENT

The purpose of this meeting refines earlier decisions about site use and meeting room configuration, establishe requirements for small rooms and verifies programmatic room relationships.

The design team prepared a survey of room relationships, three matricies,, and a more specific set of architectural models.



Meeting No 3 September 14, 1979.

<u>ROOM RELATIONSHIPS: SEPTEMBER 14, 1979</u>

INTENT

The intention of this work was to determine the degree to which rooms or functions needed to be related to other rooms and functions. This was a programming step necessary to verify the direction of design decisions.

VARIABLES

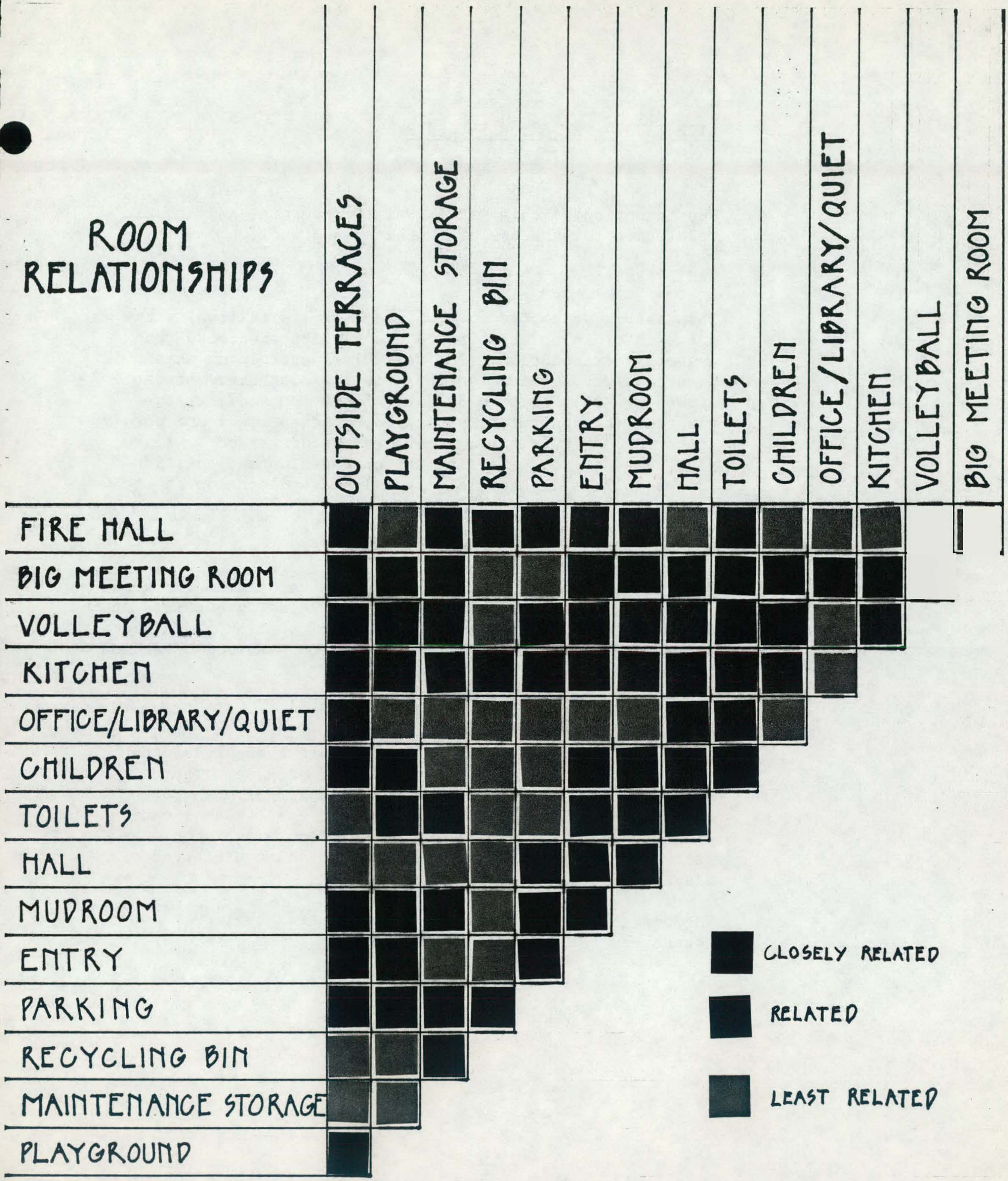
The design team identified fourteen rooms or functions present or possible in the scheme so far. These could be either closely related, related, or slightly related to other rooms or functions.

METHOD

Community members were asked to numerically score the degree of relationship on a matrix. The results were tabulated and distributed over three categories of relationships.

DECISIONS

Decisions are best read from the accompanying photograph.



Room Relationships September 14, 1979

SITE USES: SEPTEMBER 14, 1979

INTENT

The intention of this matrix was to determine a schematic resolution for the use of the site as a whole.

VARIABLES

This matrix attempted to combine several site level variables in order to establish a design direction more than a specific resolution. The variables determining that direction were seen to be the existing blackberry border around the site (retained, partial, or removed); tree planting (concentrated, clustered, or dispersed) and open space character (single, clustered, or dispersed). It was also necessary to determine the orientation and position of the volleyball pavilion as well as the location of the firehall.

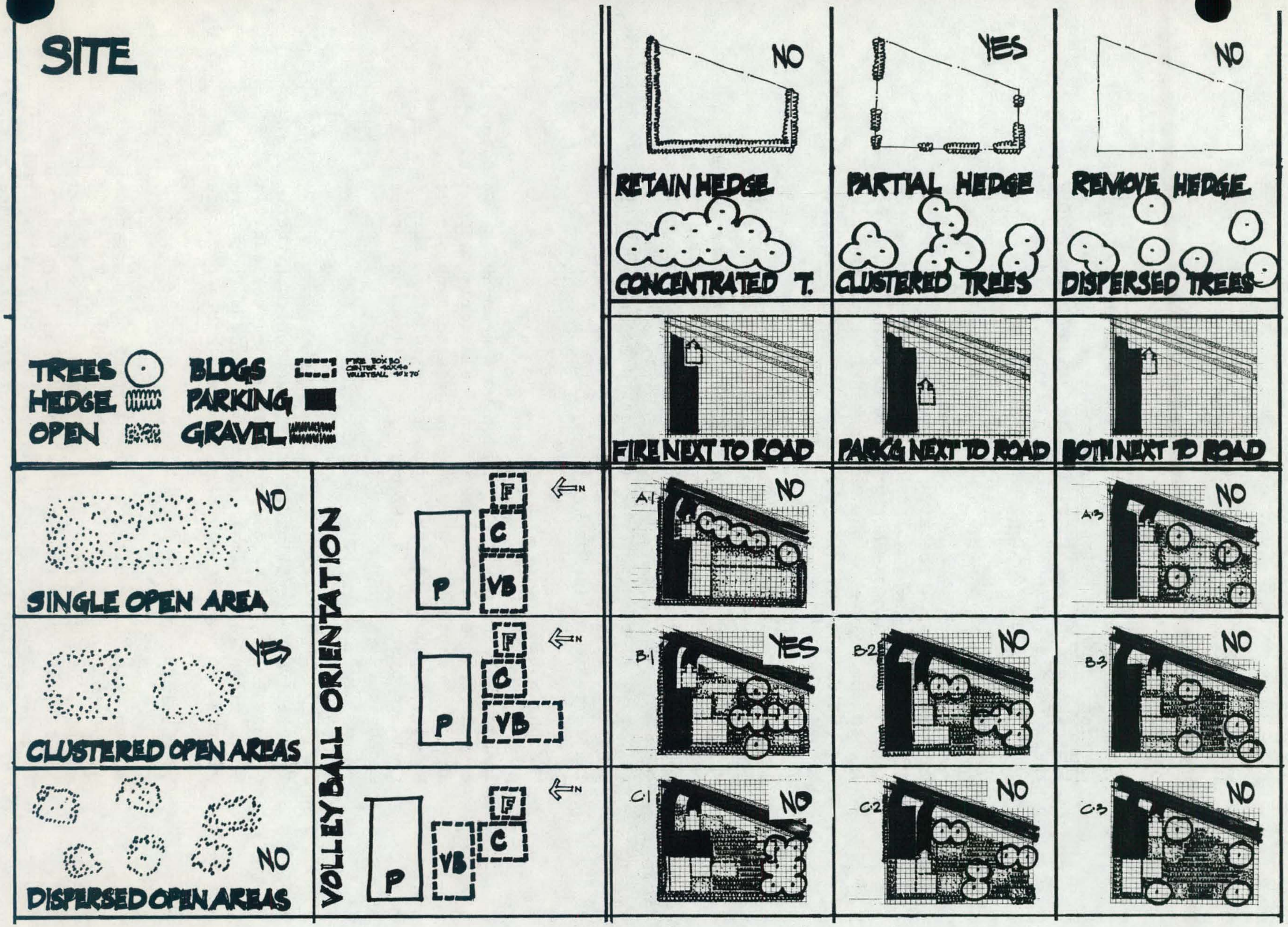
DESIGN ISSUE

This decision was influenced by issues related to the kinds of activities that might take place outside, views into and views out of the site, exposure and orientation of outside spaces to sun, wind, and rain, access to Deadwood Creek and future expansion.

DECISION

Agreement was reached to pursue a scheme that placed the firehall right at the road in front of parking. There should be several open spaces with one larger area to the south. The volleyball pavilion should open to that outside area and to the creek. The existing hedge should be partially removed and new trees planted in a clustered or dispersed pattern.

The design alternative expressed by matrix cell B-1 most accurately reflected that agreement.



Site Uses

September 14, 1979.

MEETING ROOM FORM AND BUILDING CONFIGURATION: SEPTEMBER 14, 1979

INTENT

This matrix develops the decisions made in the Form of Meeting Room and Relationship to Other Rooms matrix from the second meeting. Its intention is to decide the form and expression of the meeting room as it combines with the wrapping smaller rooms.

VARIABLES

In this decision, there is one group of alternatives pertaining to the small rooms as they connect to the meeting room and another group of alternatives pertaining to the volume of the meeting as it combines with the building mass.

Primary variables for the meeting room were single roof forms for the building that made the meeting room an undifferentiated element within, and combined roof forms which made the meeting room an expressed element in the overall form of the building. Secondarily, was that roof form a gable, a shed, a saw tooth, or some composite?

Primary variables for the smaller rooms were corridor position, inside or outside, and relationship with meeting room, in a line or wrapping 'L'.

DESIGN ISSUES

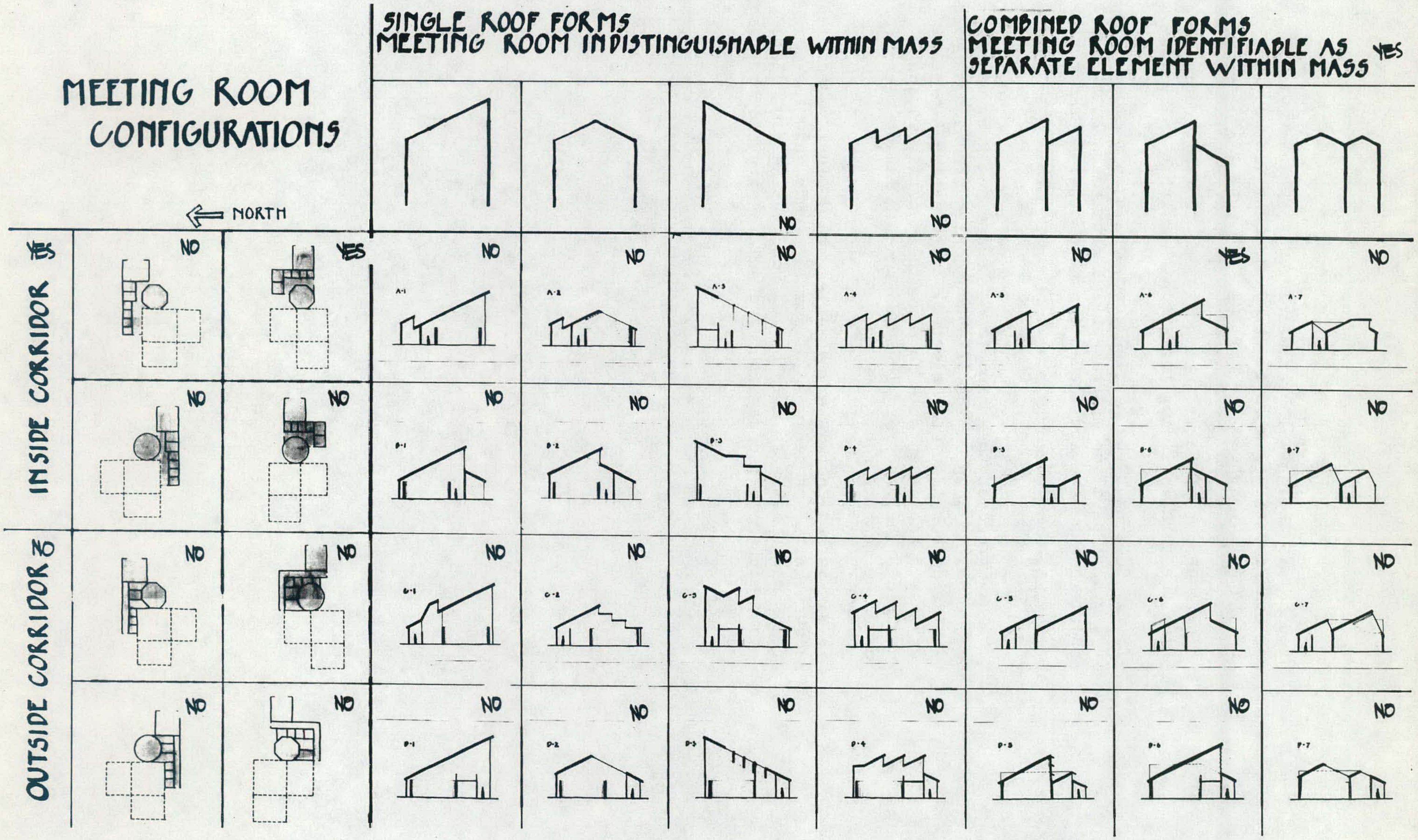
Issues influencing this decision were seen to be attitudes toward the overall building form, solar orientation and amount of south aperture, amount of skin area produced, ability of rooms to move outdoors seasonally, ability of rooms to overflow, functional proximities and future expansion.

METHOD

Alternatives were illustrated in section to directly address solar and volumetric design implications. A model illustrating small rooms and various roof forms was used to explore some alternatives more specifically.

DISCUSSION

It was generally felt that the meeting room warranted expression on the outside of the building. This might be accomplished with roof shape or perhaps an exception to the roof shape of the whole. There was also preference for utilizing the corridor as a lobby or overflow space for the meeting room as well as for the informal meetings



Meeting Room Configuration and Building Form: September 14, 1979.

typical following a larger meeting. Consequently all alternatives that employed an outside corridor or did not formally express the meeting room were rejected. There was also strong reaction against saw-tooth and single shed roof forms, primarily due to their conflict with the rural building forms typical within the valley.

It was felt that the meeting room, children's room and volleyball pavilion most urgently required unobstructed southern exposure and access to the southern outdoor area.

DECISIONS

It was agreed at this time that the meeting room was best octagonal in shape. The 'L'-shaped plan arrangement with an inside corridor was selected. Alternative A-6 best expressed the acceptable form and plan configuration desired. The roof form includes a south facing clerestory over the meeting room.

It was agreed that later matracies would clarify decisions about the 'L'-shaped wrap of smaller rooms, how the corridor might serve as a lobby and how meeting room clerestory might provide daylight and solar energy to the rooms beyond.

Meeting No 3

September 14, 1979.

THE SMALL ROOMS: SEPTEMBER 14, 1979

INTENT

This matrix was a more detailed programming step that elaborated on program information gained from the community survey and the discussion at previous meetings. Specifically it was intended to identify sizes, configuration and programmatic peculiarities for smaller rooms.

VARIABLES

Primary variables were size in square feet and configuration as a square or rectangular room.

Secondary variables were built-ins and furniture that might be provided in the room, size and position of entry and openings, and degree of enclosure by walls.

DESIGN ISSUES

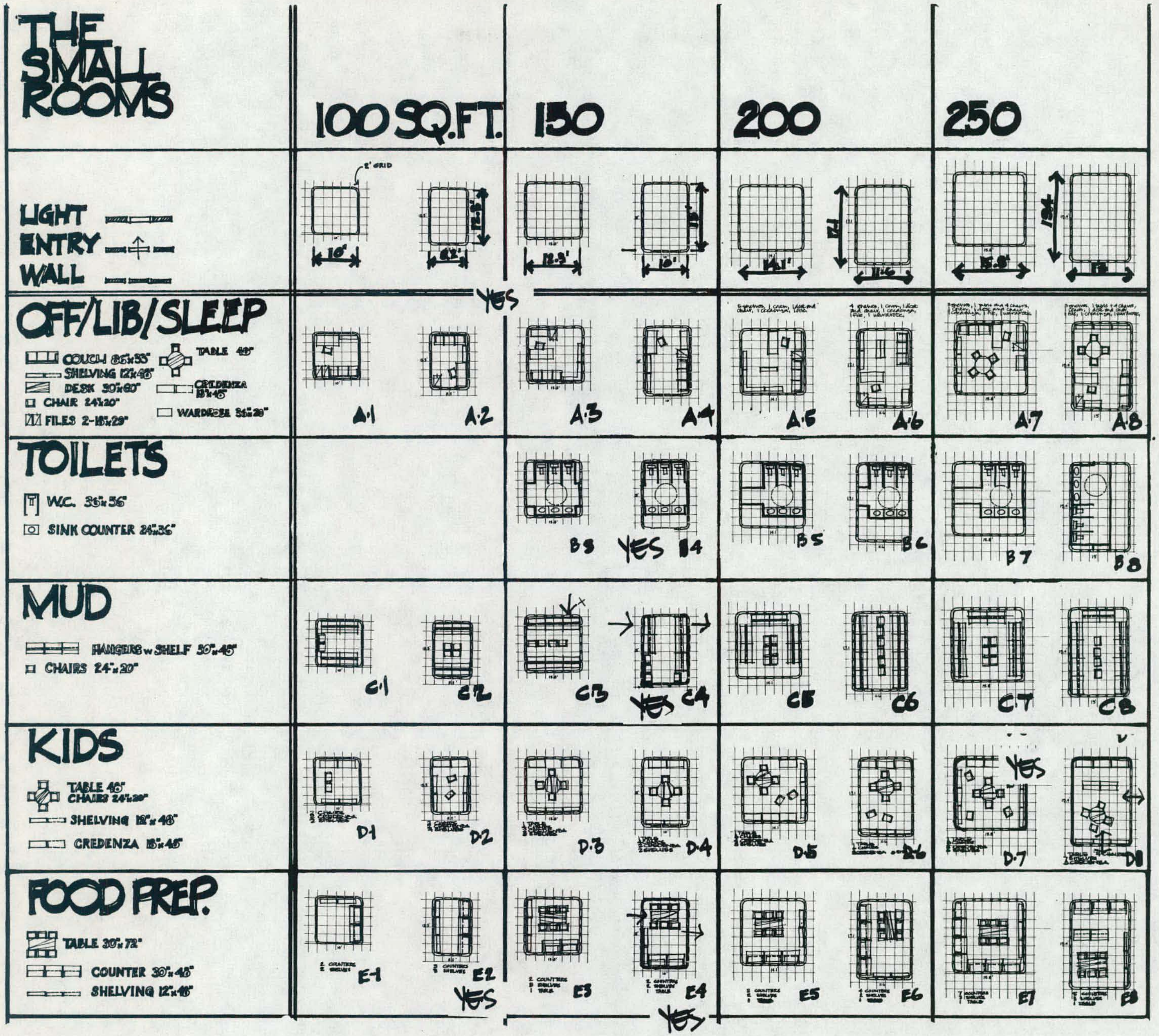
Issues affecting these decisions were: relationship of daylight and entry to work areas, numbers of people usually, at the most, and sometimes; one space or subspaces; built-in or movable furniture; hard or soft surfaces.

METHOD

Alternatives were presented as various sized room plans of square or rectangular configuration. Within each alternative was a suggested furniture layout that would accommodate that room's activity. Scale - people performing a variety of activities could be pinned to the matrix to test the adequacy of a particular layout. Wall location was indicated with an open broken line that was darkened or left open to indicate ideal locations for entry, daylight, and solid wall.

DISCUSSION

While no definitive decisions were reached with this matrix, strong direction was given through discussion of alternatives. It was agreed that the majority of small rooms should be as small as functionally possible. The exception to that is the children's room which should be large, with an unobstructed south exposure and convenient to both the outdoors and overflow spaces in response to its primarily daytime use.



The Small Rooms

September 14, 1979.

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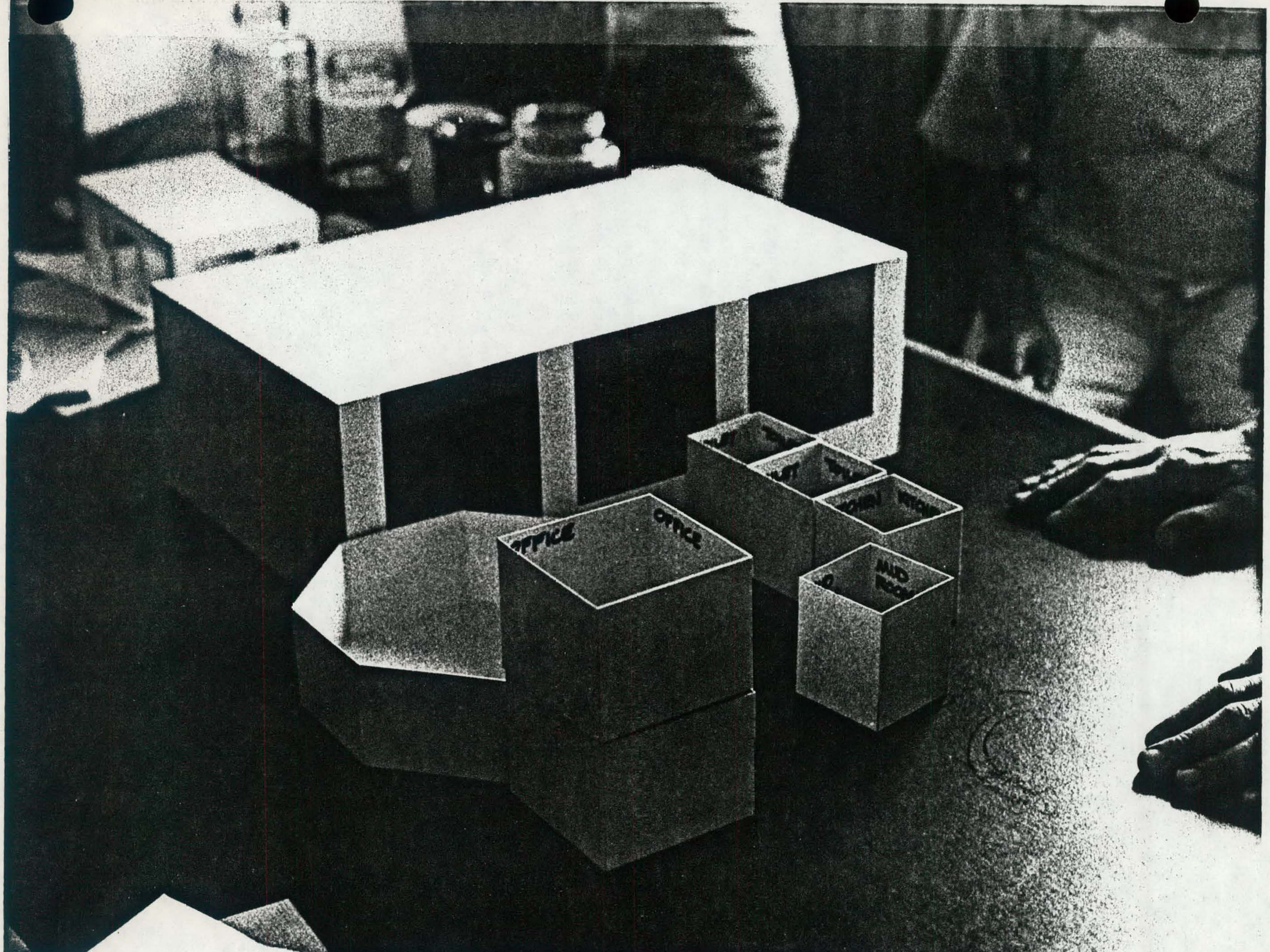


Meeting No 3

September 14, 1979.

MEETING FOUR: OCTOBER 11, 1979
Willamette Community Design Center, Eugene, Oregon

INTRODUCTION

Over the course of the past few meetings it became apparent that the amount of site area available to support the built parts of the program had dwindled considerably with setbacks and septic field allocattions. The preferred scheme, three buildings aligned along the north edge of the site, was uncomfortably tight. The community decided to pursue acquisition of additional land to the west, between the site and the creek. At this meeting, it was reported there there was an excellent chance of acquiring at least legal use of that land from a neighboring farmer. With this firm possibility, the design team assumed the additional space and presented revised site data.

The overlapping content of this meeting was such that it became appropriate to present and discuss each matrix without actually making a decision. Each decision was debated and assessed in the context of the other decisions made that day, prior to committing the design to one alternative.

INTENT

The intention of this meeting was to make design decisions concerning solar heating alternatives, overall building form and working entry.

The design team prepared three matricies, a series of study models and preliminary performance analyses of the principal solar heating alternatives.

Meeting N°4

October 11, 1979.

SOLAR HEATING: OCTOBER 11, 1979

INTENT

This matrix develops decisions made in the meeting room form and building configuration matrix of the third meeting. It is intended to integrate ideas about sectional building form and plan configuration with a solar heating method for the meeting hall.

Another decision regarding solar heating in the firehall was included on this matrix.

VARIABLES

Primary variables in this matrix were methods of acquiring solar energy (three roof forms; bent shed, double shed, shed) and methods of storing and utilizing that energy (direct gain, trombe, sunspace).

Second variables were the length of the clerestory and position of mass in the building.

DESIGN ISSUES

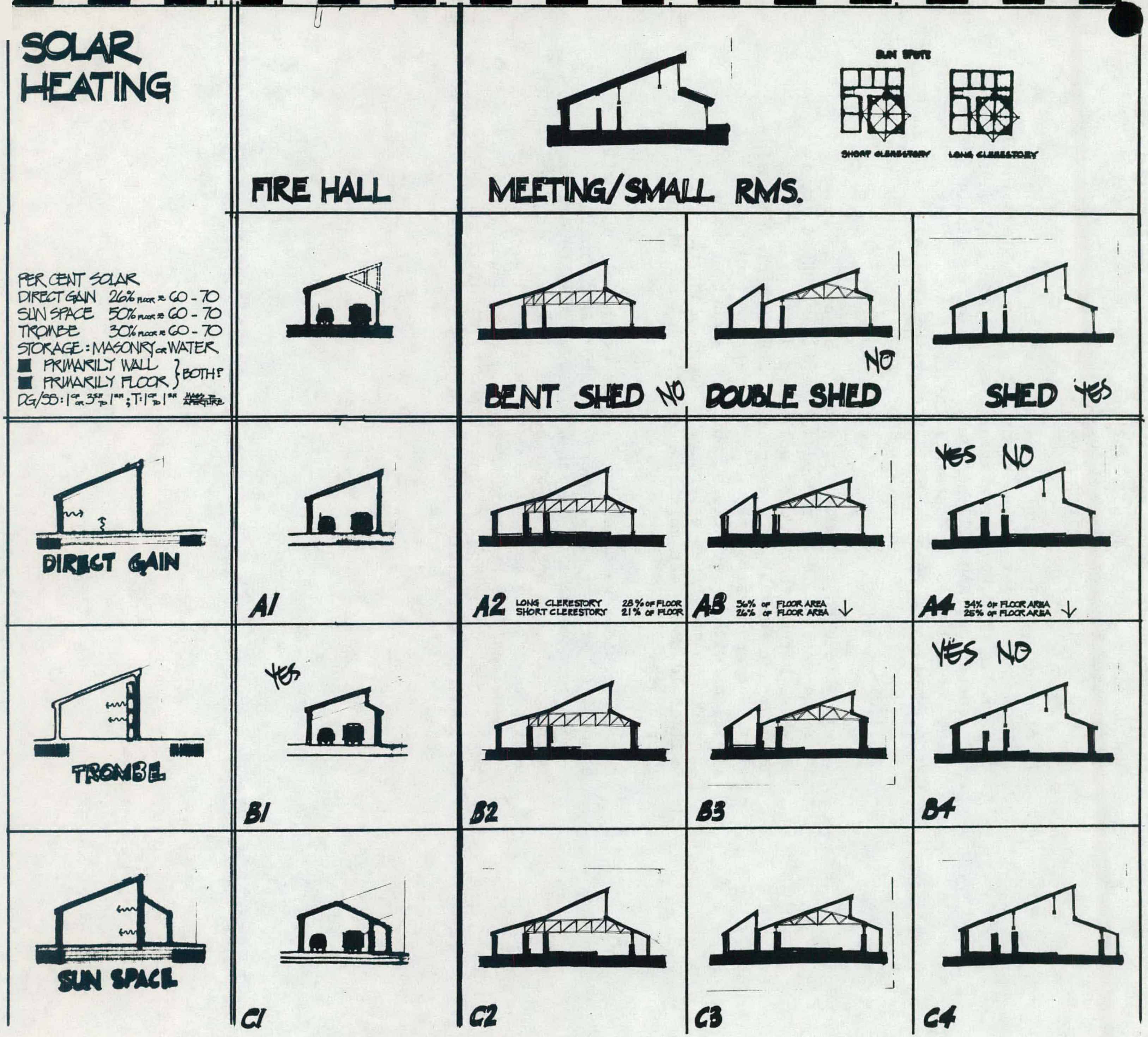
This decision was resolved in conjunction with decisions about the building form. Consequently many of the obvious design issues regarding visual and volumetric ideas overlap. More specific to the question of solar energy, influencing issues were: percentage of energy load that should be supplied by solar energy, number and character of thermal zones produced, type and amount of backup heat required, presence of thermal mass as an interior space, changeability of interior spaces; quality, intensity, and location of daylight.

METHOD

Alternatives were presented as building sections identifying the way sunlight would enter the building as well as where thermal mass would be located. Rules of thumb for estimating aperture and mass given a desired thermal performance were presented. Each alternative could be assessed with an estimate of thermal performance and an awareness of its architectural implications.

DISCUSSION

Generally, all alternatives that did not comply with building form objectives as defined by a previous matrix were rejected. Discussion regarding applicability of solar heating methods for the program identified that some alternatives were better suited to specific parts of the building



Solar Heating: October 11, 1979.

than others. It became apparent that no one method would adequately support the needs of the service rooms, children's room and meeting room due to their differing use pattern and light requirements.

It also became clear that wood flooring in both the meeting room and children's room was not a negotiable point. These rooms will be used a great deal for dancing, physical recreation, and will no doubt see a lot of sitting and lying on the floor. Hence all thermal mass in these rooms would have to be accommodated within walls.

DECISIONS

It was agreed that trombe walls would be used in rooms where no mass could be placed in the floor. However, it was also agreed that trombe walls could not present a blank black face along the entire south face of the building. Sun space alternatives seemed appropriate in those positions with reservations about the amount of mass required to make them effective. Rooms along the north wall could be direct gain spaces receiving sun through the clerestory.

These decisions represent the limits of the clients' willingness to utilize solar energy. While no definitive scheme or agreement was reached, it was understood that matrix cells B-4 and C-4 expressed a direction for the design team to follow. Once more detailed design and performance analysis had been prepared, those decisions would be reassessed in light of the community's initial objective to construct a building that was at least 50 percent solar heated.

BUILDING FORM: OCTOBER 11, 1979

INTENT

This matrix develops and extends previous design decisions made with the meeting room form and building configuration and site uses matricies of the third meeting. It is intended to identify the form of the volleyball court covering and firehall given two alternatives for the form of the meeting hall and their configuration on the site.

Significantly this design decision and the solar heating design decision were made together and mutually influenced the course and content of discussion.

VARIABLES

The variables in this matrix were quite simple. Two previously identified forms for the meeting hall were added to and compared with three forms for the firehall (gable, shed, or clerestory) and four forms for the volleyball pavilion (gabled, shed, clerestory, or saw-tooth).

DESIGN ISSUES

Issues influencing this decision were amount and location of solar aperature, view from the road, number of distinct or separate forms created, character of enclosed volume; and complexity of construction.

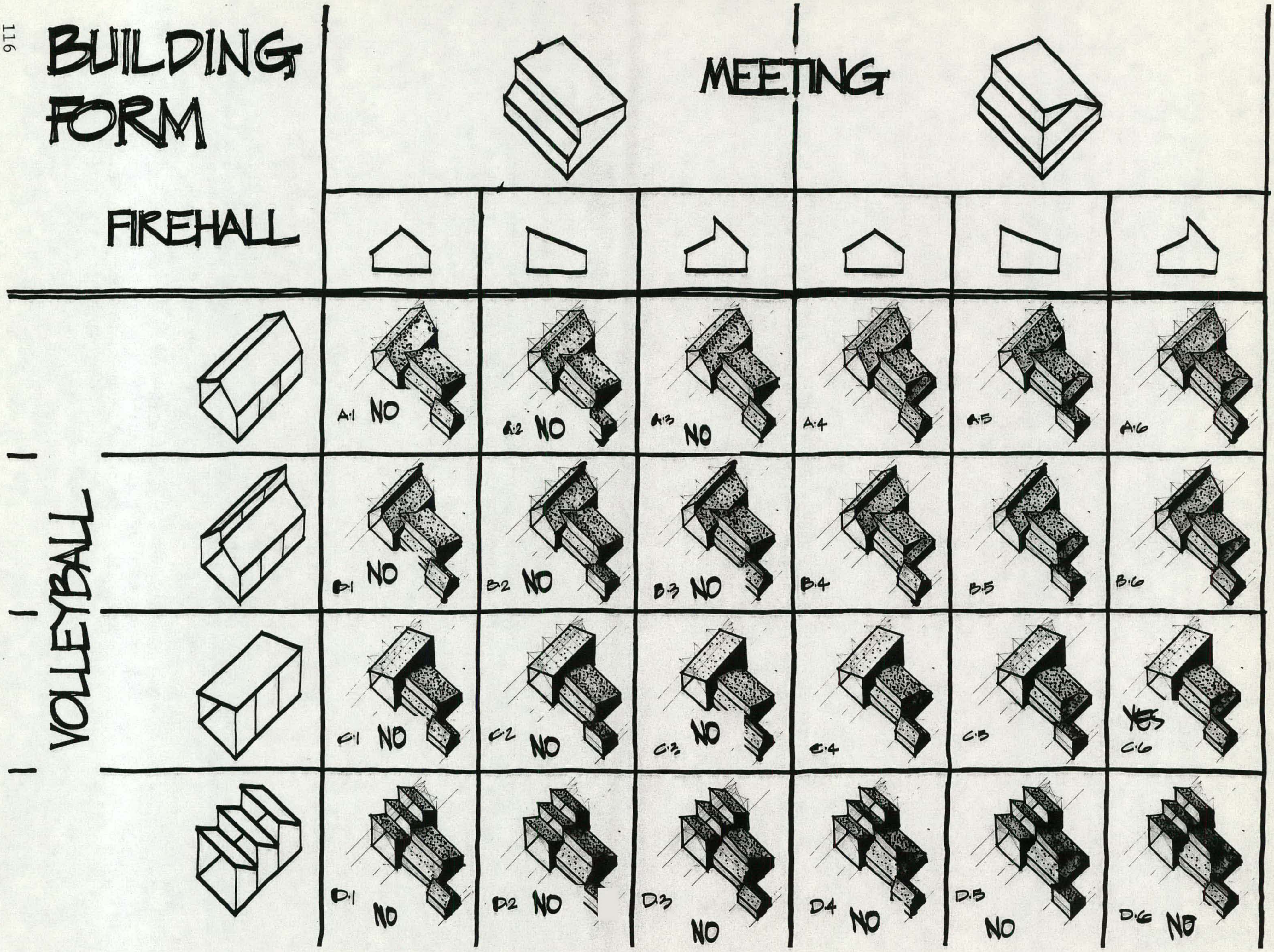
METHOD

This information was presented using plan oblique protections of the built form alternatives as viewed from the south. All alternatives could be mocked up in any combination on a site model. Consequently, the model was used to assess the formal and solar implication of various alternatives and the matrix was used as a way of keeping track.

DISCUSSION

Most of the discussion centered on the image and visual implications of this building for its rural, agricultural context. Continually there was a desire to soften the overall form and express a barn-like image and quality. Equally important was an awareness of the form requisite for passive solar energy, a need unexpressed by many of the rural architectural precedents in the area.

The community rejected all alternatives that did not reduce the sale of this tall building with a hipped lower roof. They also rejected all saw-tooth room forms because



Building Form. October [illegible] 1979.

of the urban industrial image which they carry. Clearly the rural barn form could be modified to accommodate an important solar response, but not to the point of domination by sun energy collecting forms.

DECISIONS

It was generally agreed that the meeting hall would be a form with a lower hipped roof wrapping its east and south sides. A south facing clerestory would rise out of that lower form. The volleyball pavilion should connect visually with the building height established by the clerestory. It should be a single shed that connects the scale of the clerestory to that of the lower roof with a single slope. That would accomplish an east facing clerestory for the pavilion which would prefer indirect light during afternoon periods of use and still visually relate to the meeting hall form.

The firehall should be of a form that reflects the meeting hall.

Matrix cell C-6 best represented that agreement.

WORKING ENTRY LOCATION: OCTOBER 11, 1979

INTENT

The intention of this matrix is to identify the location of the functional entrance to the meeting hall building, as well as a spatial character for the lobby surrounding the meeting room.

VARIABLES

Primary variables were seven alternatives for entry location (two end locations, two side locations, and three corner locations); the three alternatives for lobby edge configuration (straight, varied, and very varied).

DESIGN ISSUE

Issues influencing this decision were origin and direction of circulation within the building, relationship of entry places to interior circulation and exterior spaces, potential uses for resultant niches and alcove spaces.

METHOD

These alternatives were presented graphically only. Variables were expressed as schematic plan types locating entry points, circulation ways and resulting building zones. Alternatives were considered on the basis of entry location and lobby configuration. Using a large red arrow one could identify which particular entry in the scheme would be emphasized as a 'working' entry, through which the majority of daily traffic would pass.

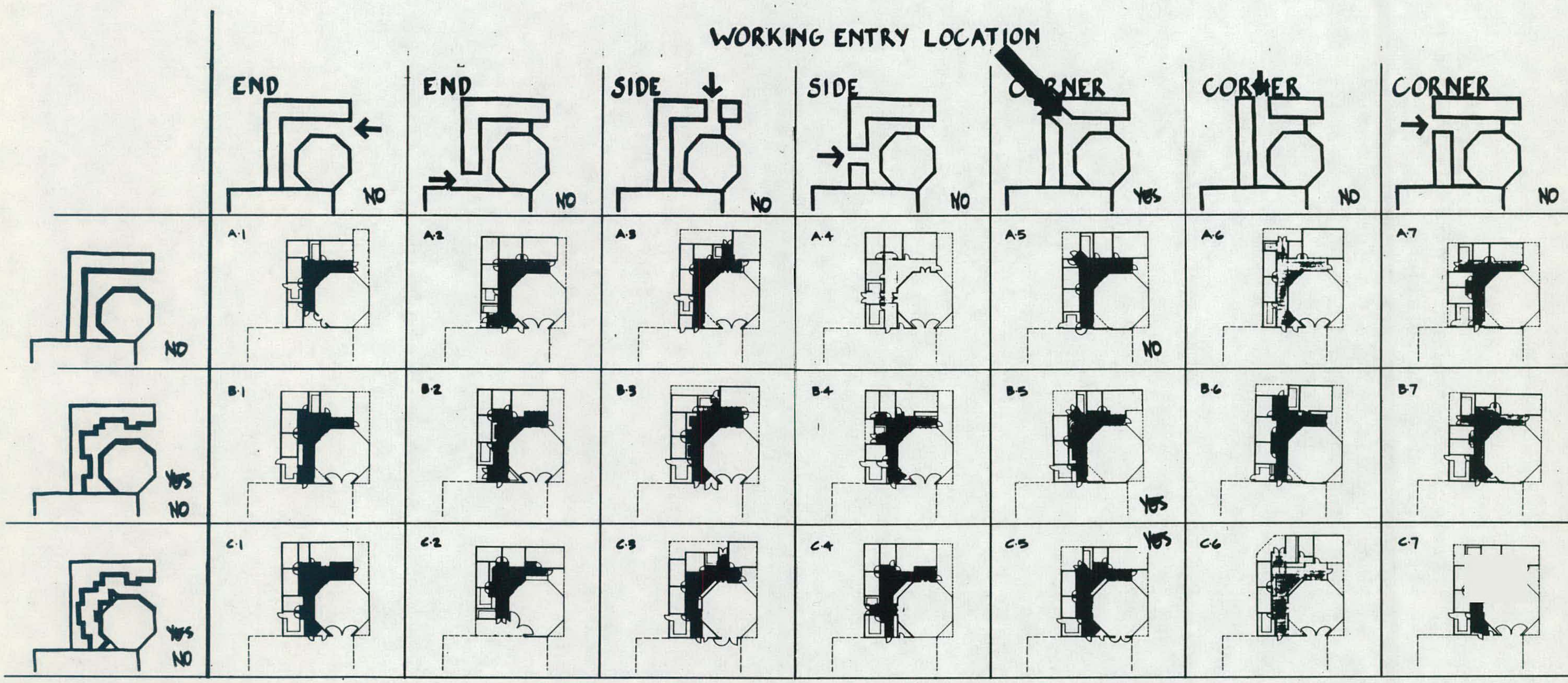
DISCUSSION

A clear preference was expressed for entries that placed people in a direct relationship with the octagonal meeting room. No one saw a need to differentiate between a working entry and a more ceremonial one. The main entry was desired at a point of dispersal, where one could elect to go to any of the three major zones of the community center; the kitchen, the meeting room, or the children's room and loft. This space was seen to have potential as a display area.

Clear access and connection to south outdoor areas was discussed as an important objective.

DECISIONS

Alternatives utilizing the corner entry location in a diagonal relationship with the meeting room were preferred. Thus the building became divided by circulation into three

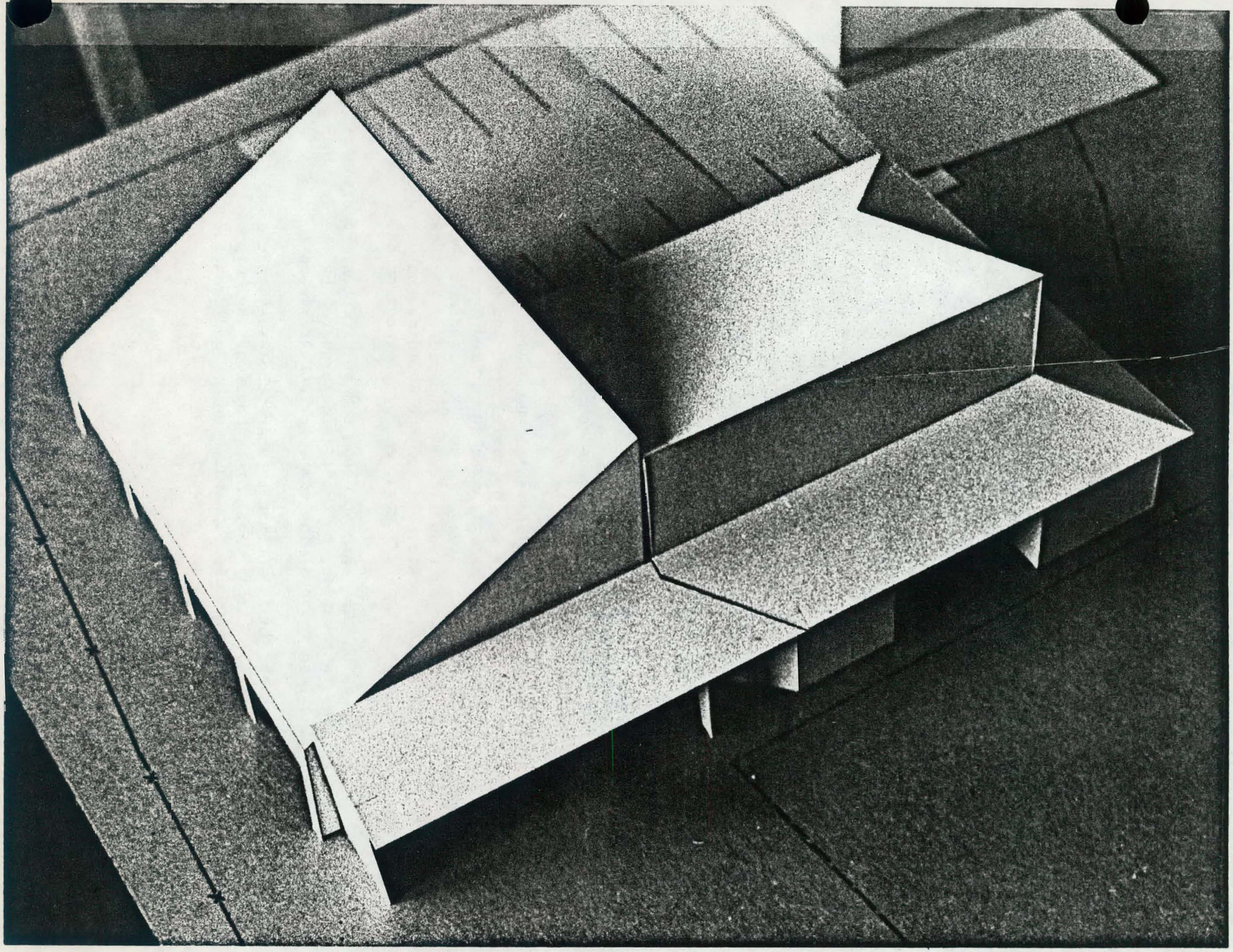


Working Entry Location

October 11, 1979.

more or less equal parts directly related to each other as well as to the outside.

Matrix cells B-5 and C-5 best expressed this agreement with the understanding that exact small room size and configuration remained to be decided.



Meeting No 4

October 11, 1979.

MEETING FIVE: NOVEMBER 17, 1979
Goertzen Residence, Deadwood, Oregon

INTRODUCTION

During the meeting of October 11, 1979 it was agreed that the time was appropriate to review progress of the design process with the Deadwood Community. This would be the first occasion the building project was to be presented in public.

Three important aspects of the project were to be presented. The first was to make the community aware of the content and character of the design as a process. The second was to present a model of the design as a place and an architectural form. The third was to review the budget and construction implications of the design decisions made thus far.

It was agreed that the meeting content should be presented as a shared effort by members of the design team as well as the building committee.

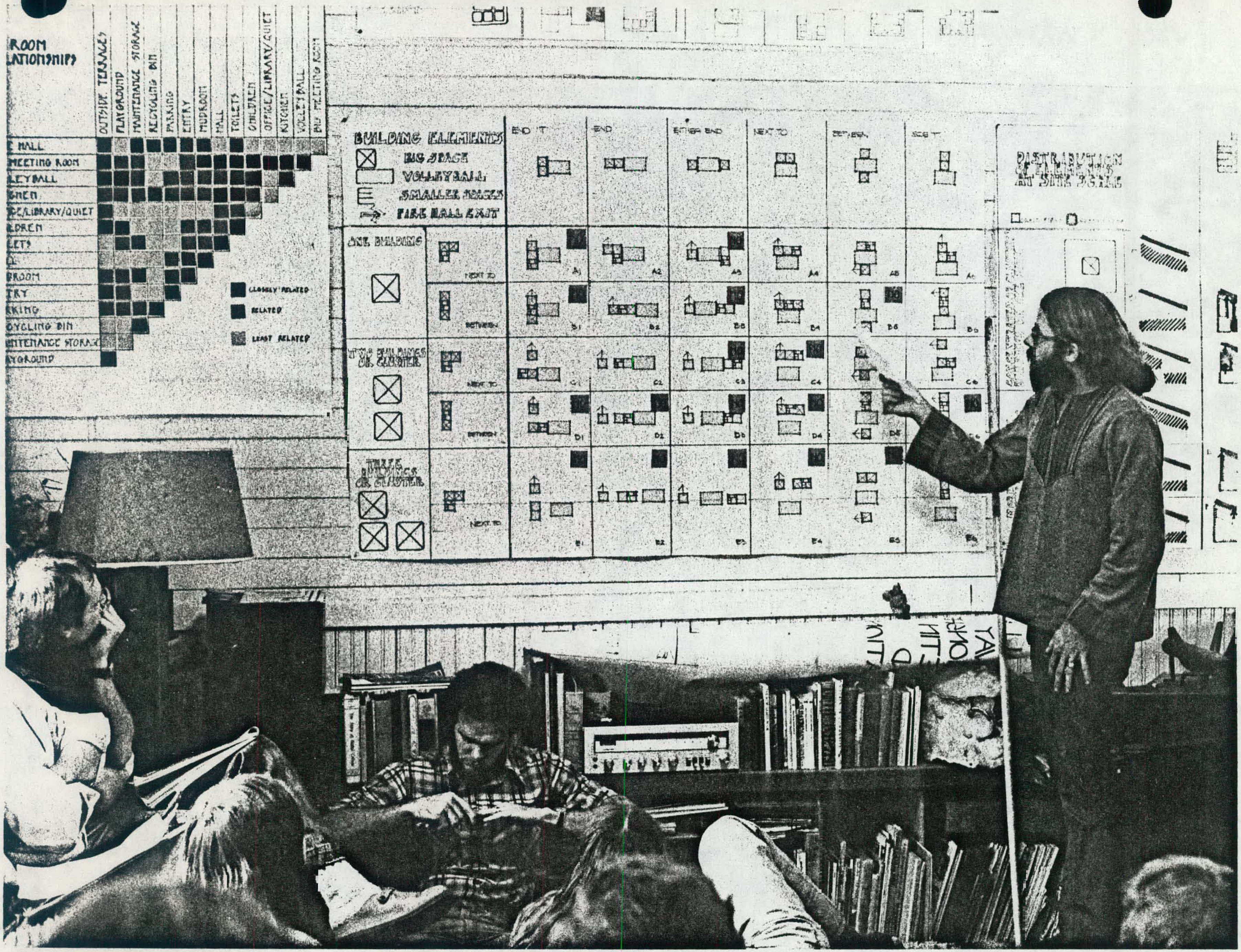
INTENT

The intention of this meeting was to review progress of the building project to the community at large and secure approval of the schematic design phase.

In order to accomplish this, the design process was presented by members of the design team and building committee. Each matrix was summarized and presented in terms of the design issues it raised and the design decisions which resulted. At the end of that presentation an 1/8" scale model of the building that grew from these decisions was unveiled for inspection and review.

Following the design process and architectural portion of the presentation, cost estimates prepared by the design team and the building committee were reviewed.

Further, in an attempt to share the experience of making design decisions with more members of the community, a sample design decision was prepared and debated using the building model and a matrix.

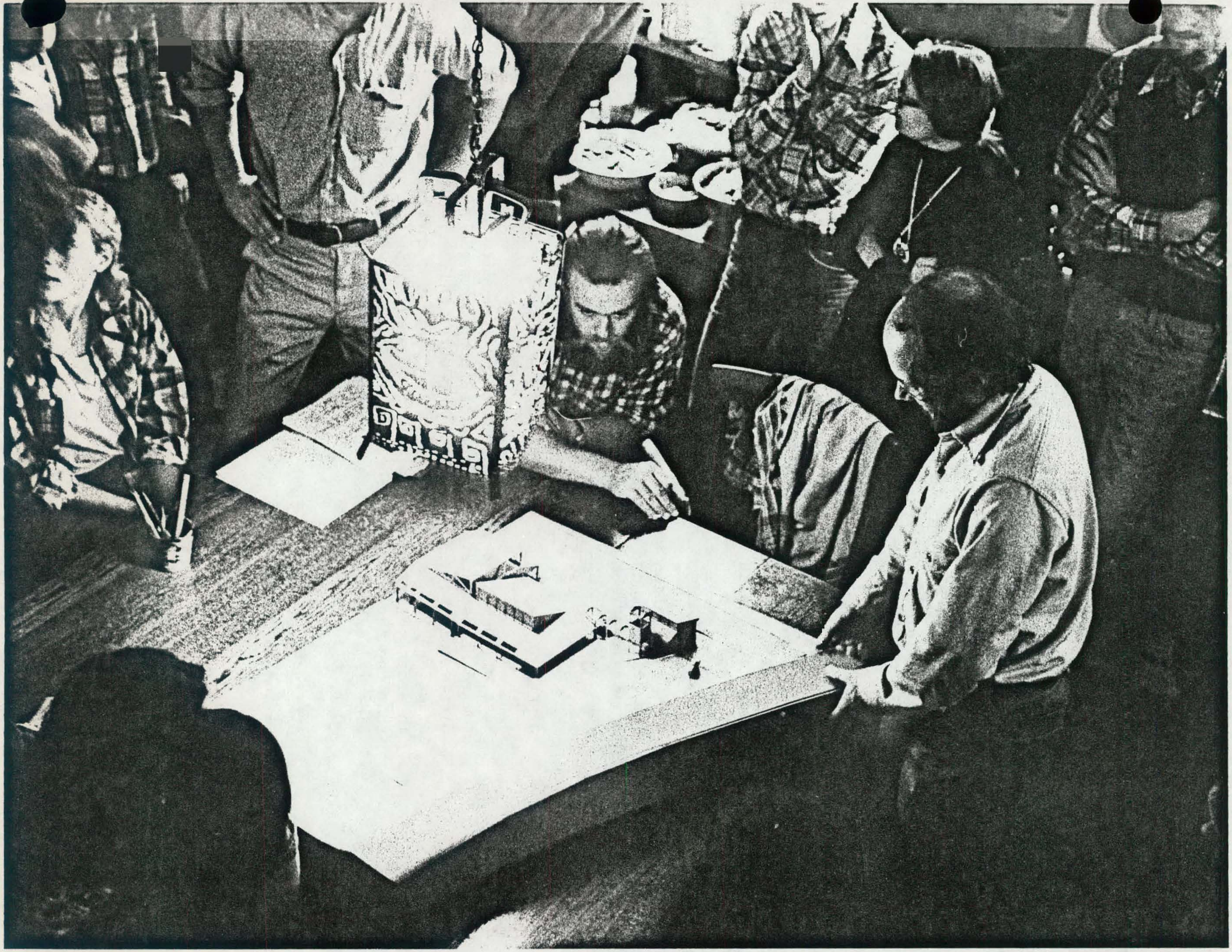


Meeting No 5

November 17, 1979.

Meeting No5

November 17, 1979,



Meeting No 5

November 17, 1979.

ENTRANCE DRIVE/BULLETIN BOARD LOCATION: NOVEMBER 17, 1979

INTENT

This matrix was primarily intended to amplify an explanation of the design process. Its presentation would serve as illustration to the concept and mechanics of a participatory design process. Members of the community not directly involved with the building committee were given an opportunity to make a design decision using a matrix. The focus of that was the relationships among the firehall, the parking lot entrance, and bulletin board at the northeast corner of the site.

VARIABLES

The variables in this matrix were kept deliberately simple. The driveway was either on the north or south side of the firehall. The bulletin board was either near the road or near the building entrance.

METHOD

This information was presented using diagrammtic plans of the buildings and entrance. Along one axis were two alternative locations for the driveway and along the other axis were two alternative locations for a bulletin board. All alternatives could be mocked-up on the presentation model.

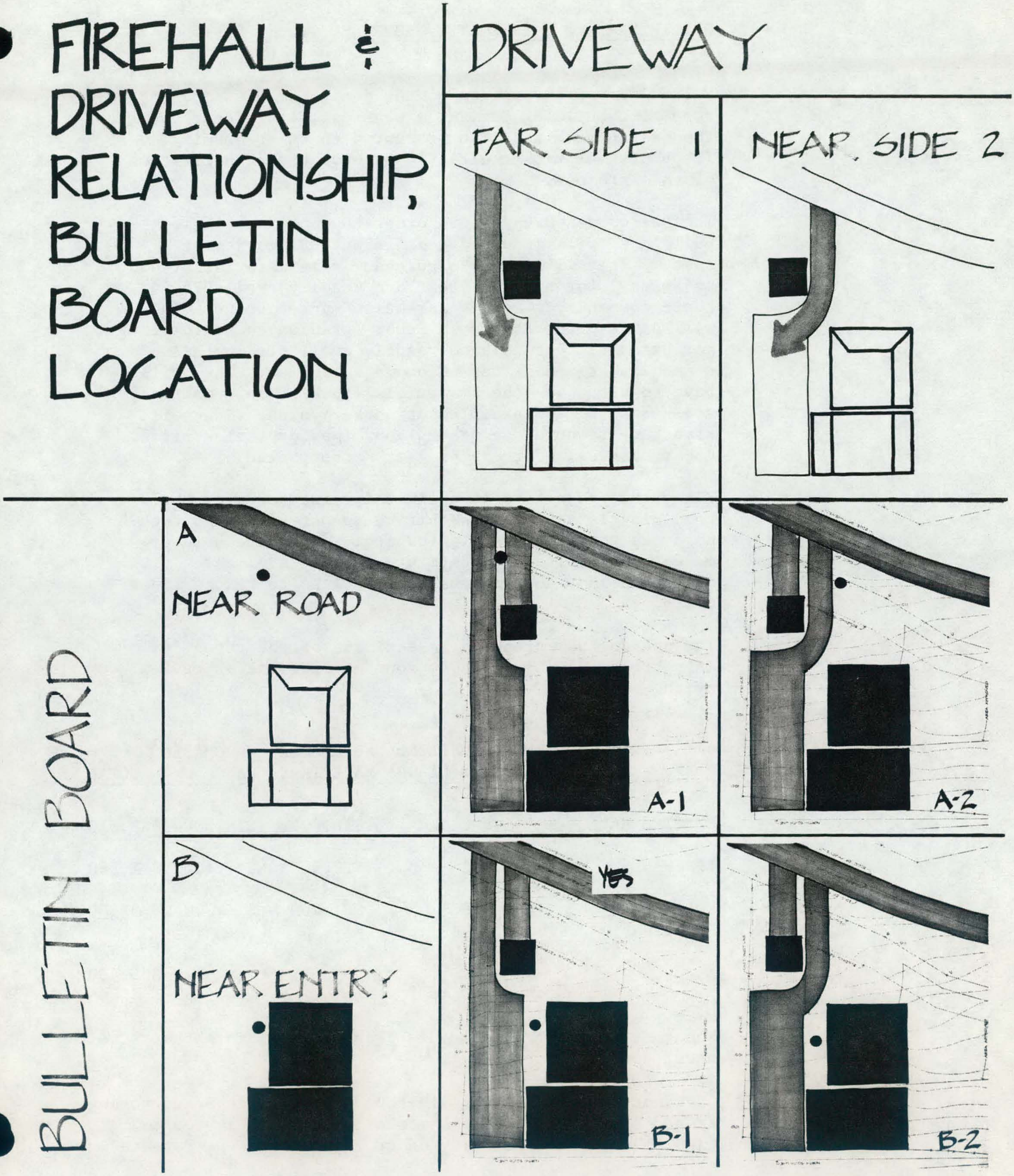
DISCUSSION

Most of the discussion concerned the community attitude toward the separation of cars and people on the site. Cars should be separated from potential children's play areas and it was very undesirable to cross the driveway in order to enter the building. Generally, it was agreed that the north side of the site is for cars and the south side is for people. That separation should be maintained in fact and in feeling.

Attitudes toward the bulletin board were not at all as clearly defined. However, it should not be a car-oriented element.

DECISIONS

The entrance drive to the parking lot will be on the north side of the firehall and the bulletin board will be generally near the building at an unspecified location.



Firehall and Driveway Relationship, Bulletin Board location.
November 17, 1979.

PRELIMINARY COST ESTIMATE: NOVEMBER 17, 1979

Following a presentation of the design process and a schematic building design, a cost estimate prepared by the design team was also presented to the community. It points out rather directly some of the peculiarities of this project.

The Deadwood Community, in order to construct these buildings, will incur four different categories of costs. They will have to purchase some materials (wood and glass, for example) that are readily available in their community at costs far below market value. They will have to purchase some labor (grading and carpentry, for example) that is also readily available in their community at a cost far below market value. They will have to purchase other materials (insulation, concrete, and hardware, for example) at market value. They will also have to purchase other labor (masonry, electrical, and mechanical, for example) at market value.

Since the project is on a limited, fixed budget, the community is very cost-sensitive to materials and technologies that require high capital. They are however more than willing to substitute locally available materials and labor-intensive practices to reduce those costs.

The design team prepared an estimate of the three buildings broken down into those four categories for review by the community.

	DEADWOOD-SUPPLIED MATERIALS & LABOR	PURCHASED MATERIALS	PURCHASED LABOR	TOTAL
MEETING HALL	$5,500	$16,770	$26,300	$48,510
FIREHALL	$1,260	$ 2,900	$ 7,400	$11,560
VOLLEYBALL PAVILION	$2,100	$ 700	$ 500	$ 3,300
				$63,430

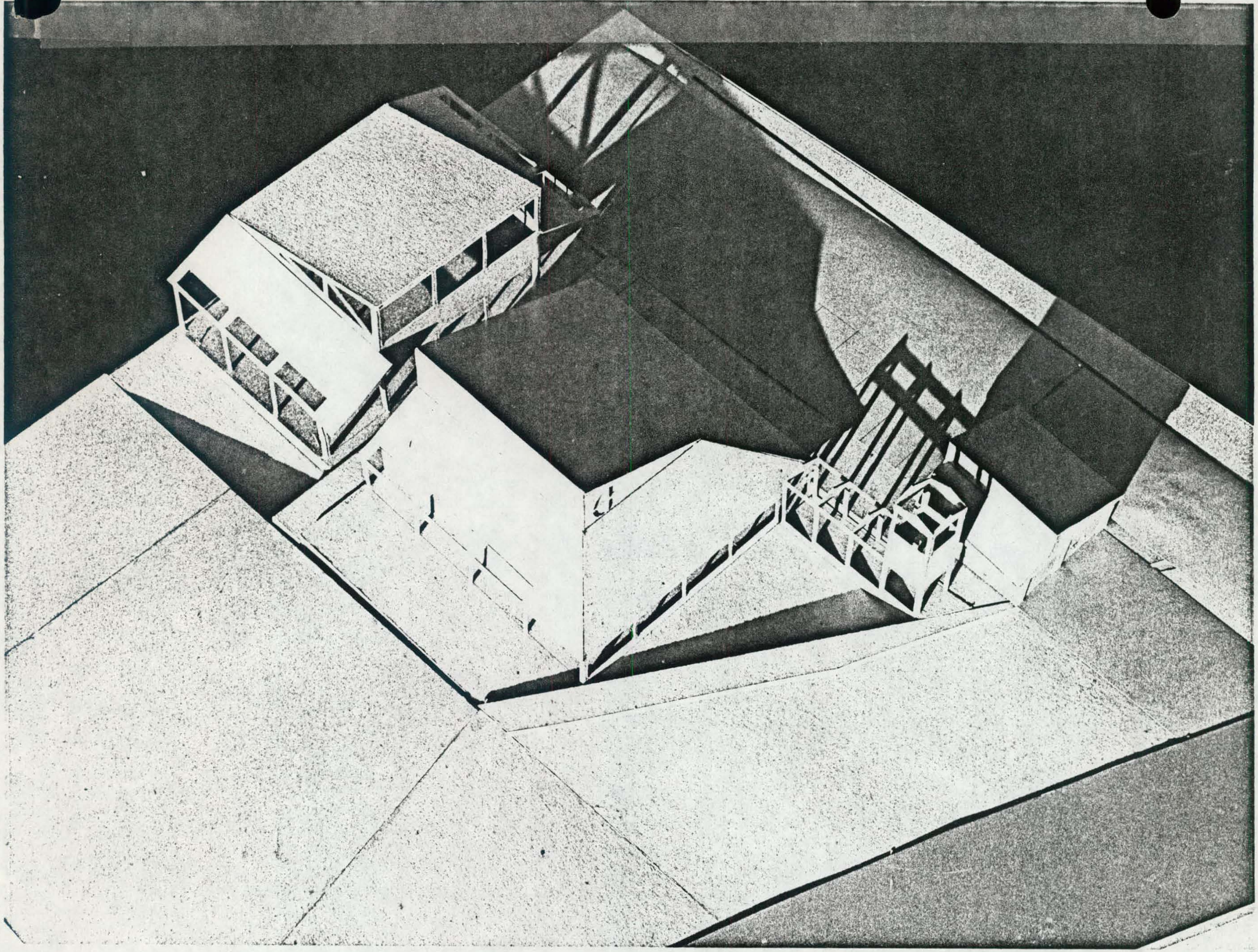
The cost estimate indicated a group of buildings that were about $30,000 over budget.

The community still approved the project as designed noting it had several specifically solar features that would likely qualify for subsidy under Phase II of the Passive

Meeting No5 November 17, 1979.

Solar Commercial Buildings Design Assistance and Demonstration Grant. They formulated the following strategy for further reducing capital costs.

It was recognized that reducing the size of the buildings would do little to reduce the cost since the highest cost area was mechanical and electrical which would not be significantly reduced with less area. The community agreed to attempt to supply all their own mechanical and electrical labor. They would also look for items eligible for funding under Phase II of the grant. The volleyball pavilion might be eliminated. Hand-split cedar shakes might replace purchased roofing material. It was also possible that additional money could be raised through donation or raffles, but that would only work once the site is under construction and a real need for the money can be identified for the community members not directly involved with planning the facility.



Meeting No 5

November 17, 1979.

MEETING SIX: NOVEMBER 29, 1979
Willamette Community Design Center, Eugene, Oregon

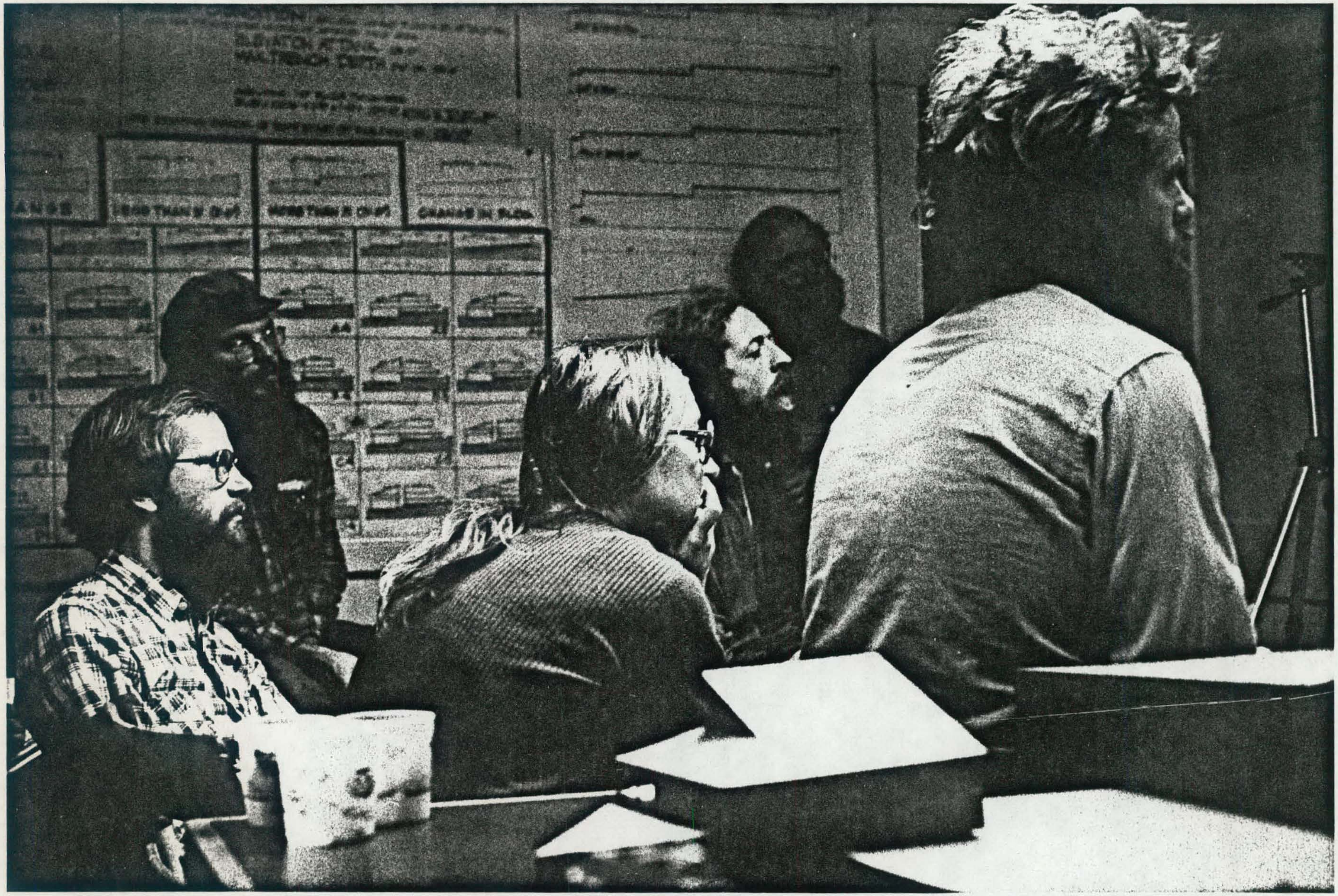
INTRODUCTION

Following community approval of a schematic design for the community center and firehall, both the design team and the building committee met to address its development and implementation. Issues regarding cost and construction scheduling were now felt to be pressing.

The building as designed exceeds the funds available for construction. However with all labor being volunteered by the people of Deadwood, substituting labor-intensive construction practices for capital-intensive ones, and a successful proposal for Phase II of the Department of Energy Grant, the buildings can be built. It was in that spirit that the design process continued into developmental phases beginning with this meeting.

INTENT:

The specific purpose of this meeting was to make design development decisions regarding outdoor spaces, grade changes, visual and functional relationships between the volleyball pavilion and the meeting building as well as selection of a structural system and construction schedule.



Meeting No6

November 29, 1979.

ARRANGEMENT OF SITE SPACES AND CIRCULATION: NOVEMBER 29, 1979

INTENT

The intention of this matrix was to identify how many different outside spaces are required and how they might be arranged on the site. The matrix was expected to establish a direction for further work rather than to determine a particular resolution of outside spaces for the site.

VARIABLES

This decision would be determined by two primary variables: the size and number of separate outdoor spaces to be provided (between 2 and 6) and ways of organizing them (in a linear, radial, branched, gridded, or looped pattern).

DESIGN ISSUES

Issues influencing that decision included: sizes and uses for outside spaces; their relationship to interior spaces; circulation around the site; views in, out, and across the site; exposure to sun, wind, and rain; and methods of defining outside spaces.

METHOD

This information was presented on site diagrams that illustrated different organizational strategies for outdoor spaces accommodating an increasing number of spaces.

DISCUSSION

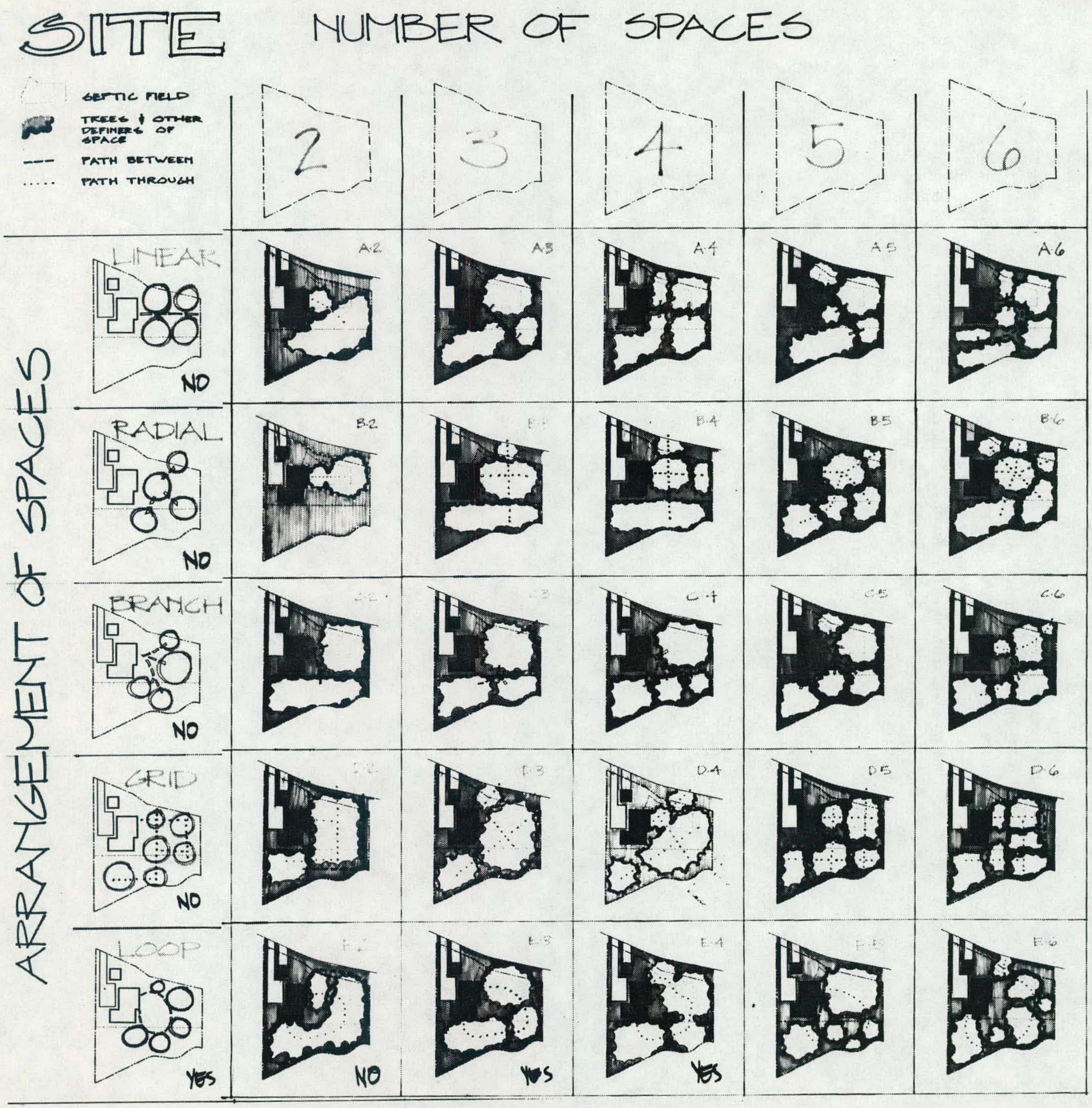
As expected, no matric cell expressed a satisfactory combination of outside spaces. However, the material presented served as a catalyst for some of the building committee's ideas and agreement was reached on a general direction.

From the discussion emerged a need to establish two main, but separate, kinds of outdoor spaces; one for active recreation and another for picnicking. Smaller spaces were also recognized to be necessary but would be better left to occur on their own.

Another discussion began concerning attitudes about planting. The need to shade both people and the building was recognized; planting should perform those roles in addition to becoming the major space definer outdoors.

Whatever outdoor spaces are to be provided should build on those already existing. For example, the open area

SITE



Arrangement of Site Spaces   November 29, 1979 near the stream already supports many of the activities discussed and the blackberries already make a good fence.

DECISION

Generally, a looped arrangement of spaces was preferred. The number provided has to be flexible but built from those spaces already defined. Two outside spaces for children (one for very young children and another for older children) should be immediately adjacent to the building. One larger open space should be adjacent to the pavilion.

POSITION OF THE MEETING ROOM RELATIONSHIP TO STAGE: NOVEMBER 29, 1979

INTENT

This matrix was intended to position the meeting room within the building shell and define its relationship to a stage. Integral with this decision was another matrix (grade change, relationship between meeting room and volleyball) that would determine an attitude toward regrading the site and establish a vertical distance between the meeting room and potential stage locations.

VARIABLES

Primary variables in this decision were four potential locations for the stage (south end of pavilion, north end of pavilion, adjacent to meeting room, or adjacent to corridor), two locations for the meeting room (adjacent to the west wall or completely surrounded by corridor), and two locations for the principal circulation between the meeting room, stage, and volleyball pavilion (at the meeting room or at the corridor).

Secondary variables explored the vertical relationship between the stage and the volleyball pavilion floor (greater than 3' or less than 3') and the position of a stair (inside or outside the building).

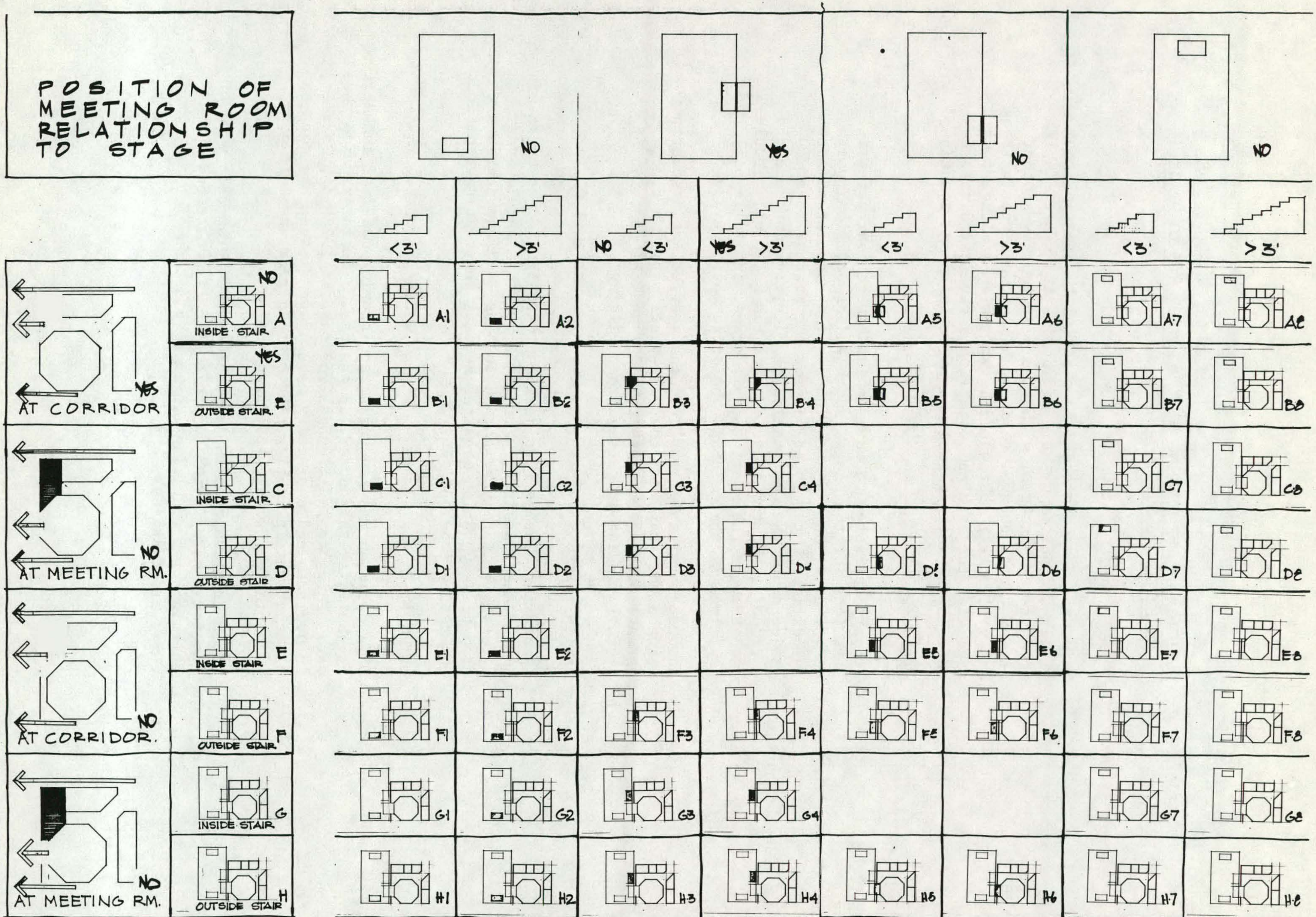
DESIGN ISSUES

Issues influencing this decision were the amount of inside/out movement desired, where and when that should occur, accessibility to handicapped persons, and the degree of acoustic separation required between the meeting room and the rest of the building.

METHOD

This decision was made using an interior model of the meeting building that described the design decisions made thus far. This particular model was made at 1/2"=1'-0" scale in order to address design development issues and mock-up alternatives in public. The meeting room was left as a moveable room within the structure.

The matrix isolated the variables as diagrammatic plan or section alternatives. Individual cells described the building plan resulting from a combination of those particular alternatives.



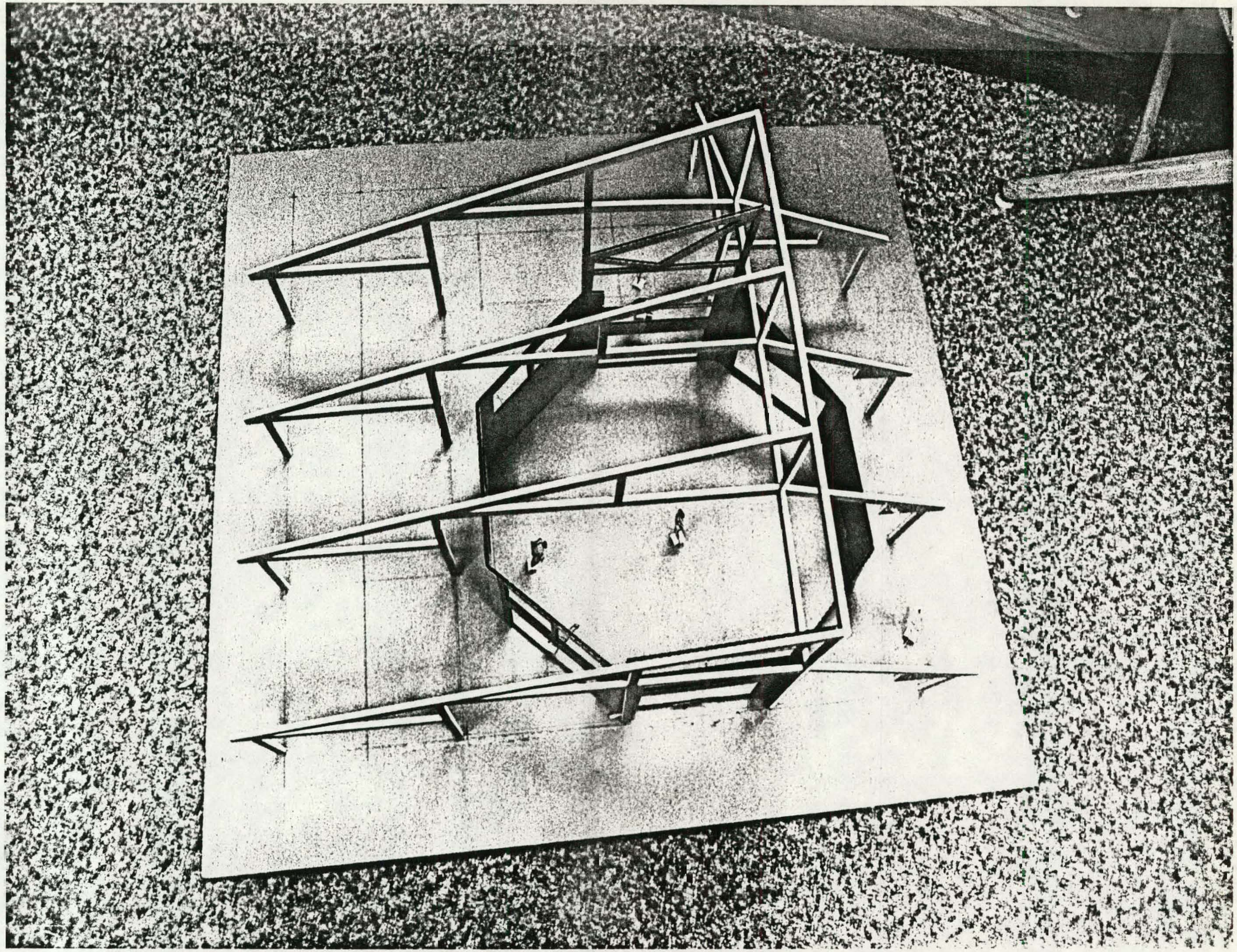
Position of Meeting Room: Relationship to Stage November 29, 1979

DISCUSSION

Soon after initial discussion of this decision, it became clear that the matter was too dependent on other grade-related issues to be resolved. It was decided that those grading decisions be made first with the meeting room and stage relationship in mind and the meeting would return to this matrix.

DECISIONS

Ultimately, the committee elected to locate the meeting room adjacent to the west wall of the building. The stage would be portable, located centrally in the pavilion connecting to the building at the end of the corridor with outside stairs.



Meeting No 6

November 29, 1979.

GRADE CHANGE: CONNECTION AT VOLLEYBALL AND MEETING BUILDING: NOVEMBER 29, 1979

INTENT

In order to more directly address the slope of the site, this matrix was used to determine the vertical relationships among the meeting building, the volleyball pavilion, and the site -- both visually and functionally. It was presented in conjunction with background information that reviewed the implications of grade-related decisions for site use, roof heights, and septic systems.

VARIABLES

Primary variables in this decision were the vertical distance between the floor of the meeting room and the floor of the volleyball pavilion (less than 3 feet or greater than 3 feet) and the visual relationship between their roofs (together or apart).

Secondary variables were whether the roofs were aligned or not aligned, and whether the grade change was achieved through cut, fill, or cut and fill.

DESIGN ISSUES

Outside issues influencing that decision were seen to be visual impact from Deadwood Creek Road, degree and frequency of inside/out movement, accessibility of south-facing outdoor spaces, potential uses for the space that might arise between the two buildings, construction sequence, and the degree of slope between toilet rooms and the septic field in order to feed the system by gravity.

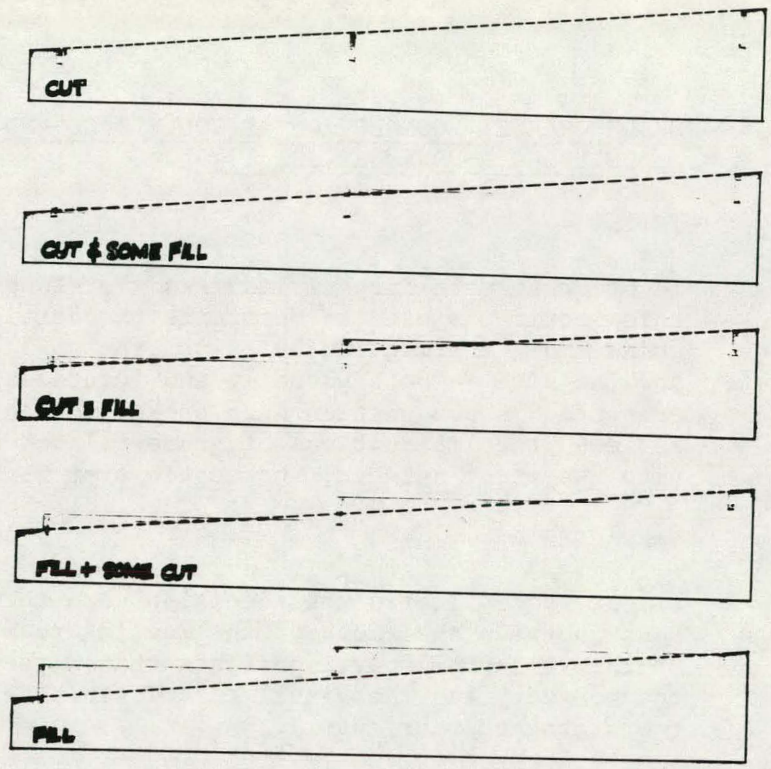
METHOD

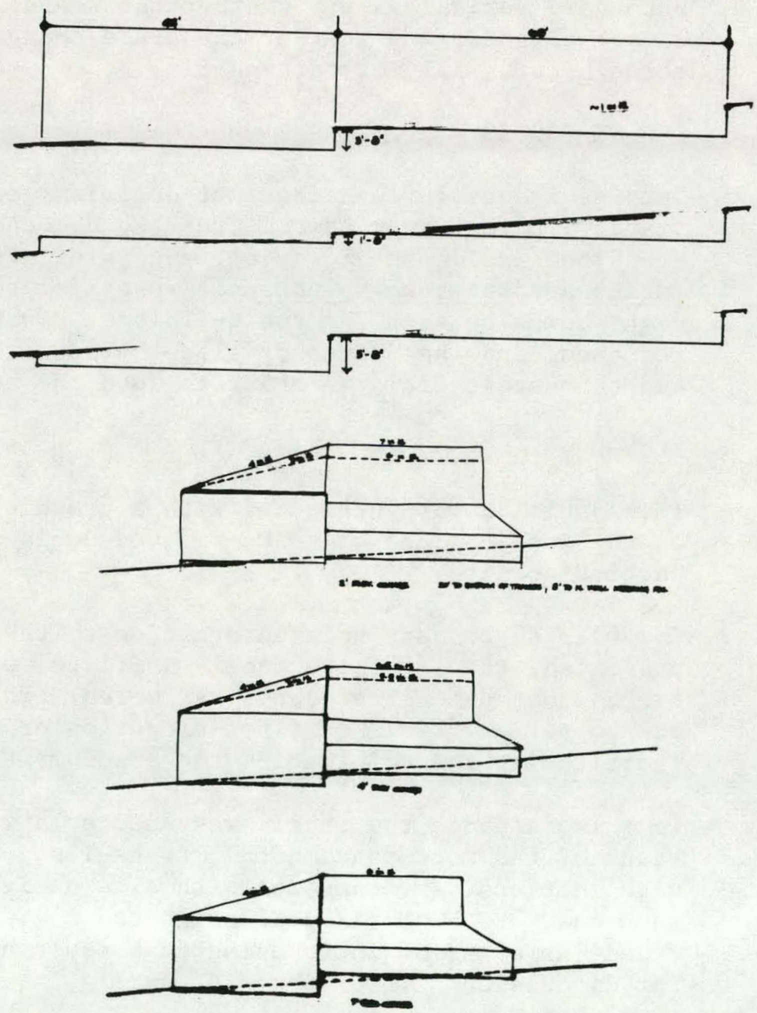
This decision was introduced with a graphic presentation on the implications of grade-related decisions for this particular site.

In order to connect this information to the alternatives presented, the 1/8" site model was fitted with some new pieces that demonstrated the variables. The model allowed one to set any finished floor elevation or any roof slope facilitating the combination and assessment of alternatives.

In this instance the matrix was used as a way of keeping track of the more fundamental strategies. Alternative site sections were compared with alternative building sections. Each matrix cell suggested a different building facade as a way of introducing that topic and exposing it for discussion.

FUN WITH GRADES





Background Information for: Grade Change: Relationship Between Meeting Room and Volley Ball November 29, 1979

ISSUES: SEPTIC

1. "WORST" CONDITION (REQUIRES HIGHEST FLOOR ELEV. AT TOILET RM)

ASSUMES FIELD IN EAST SECTION OF APPROVED FIELD AREA

ELEVATION AT TANK 107'-0"
MAX. TRENCH DEPTH 2'-6" OR ELEV 104'-6"
DIST. TOILETS TO TANK 60' AT 1/4" SLOPE PER FOOT = 1'-3" DROP

ASSUMING 1'-0" FLOOR THICKNESS
ELEV. 104'-6" + 1'-3" + 1'-0" = 106'-9" MINIMUM TOILET RM. FLOOR ELEVATION

2. "BEST" CONDITION (REQUIRES LOWEST FLOOR ELEV. AT TOILET RM.)

ASSUMES FIELD IN WEST SECTION OF APPROVED FIELD AREA.

ELEVATION AT TANK 105'-0"
MAX. TRENCH DEPTH 2'-6" OR 102'-6"

ASSUMING 1'-0" FLOOR THICKNESS
ELEV. 102'-6" + 1'-3" + 1'-0" = 104'-9" MINIMUM TOILET RM FLOOR ELEVATION

NOTE: EXISTING GRADE AT EAST EDGE OF BUILDING IS 106'-0"

ISSUES: GRADE

1. ROOF: IF ROOF HEIGHTS MATCH
EASIEST TO ACHIEVE WITH BIG ELEV. CHANGE: STILL REQUIRES DIFF. SLOPES

IF THEY DON'T
NO PROBLEM

2. MATERIAL MOVED: IF CUT = FILL
THE LEAST WITH 3'-8' CHANGE IN ELEVATION

3. RELATION TO EAST GRADE: IF CUT = FILL
MOST ELEV. CHANGE BETWEEN V.B. & MEET. =s FLOOR ELEV. CLOSEST TO EAST GRADE

IF CUT ≠ FILL
ANY GRADE POSSIBLE FOR MEETING

4. RETAINING WALL: ASSUMING NONE AT BLDG. EDGE
MOST WITH BIGGEST CHANGE AT CENTER.

ASSUMING ONE AT BLDG. EDGE
TOTAL THE SAME ALTHOUGH STILL HIGHEST WITH BIG CHANGE

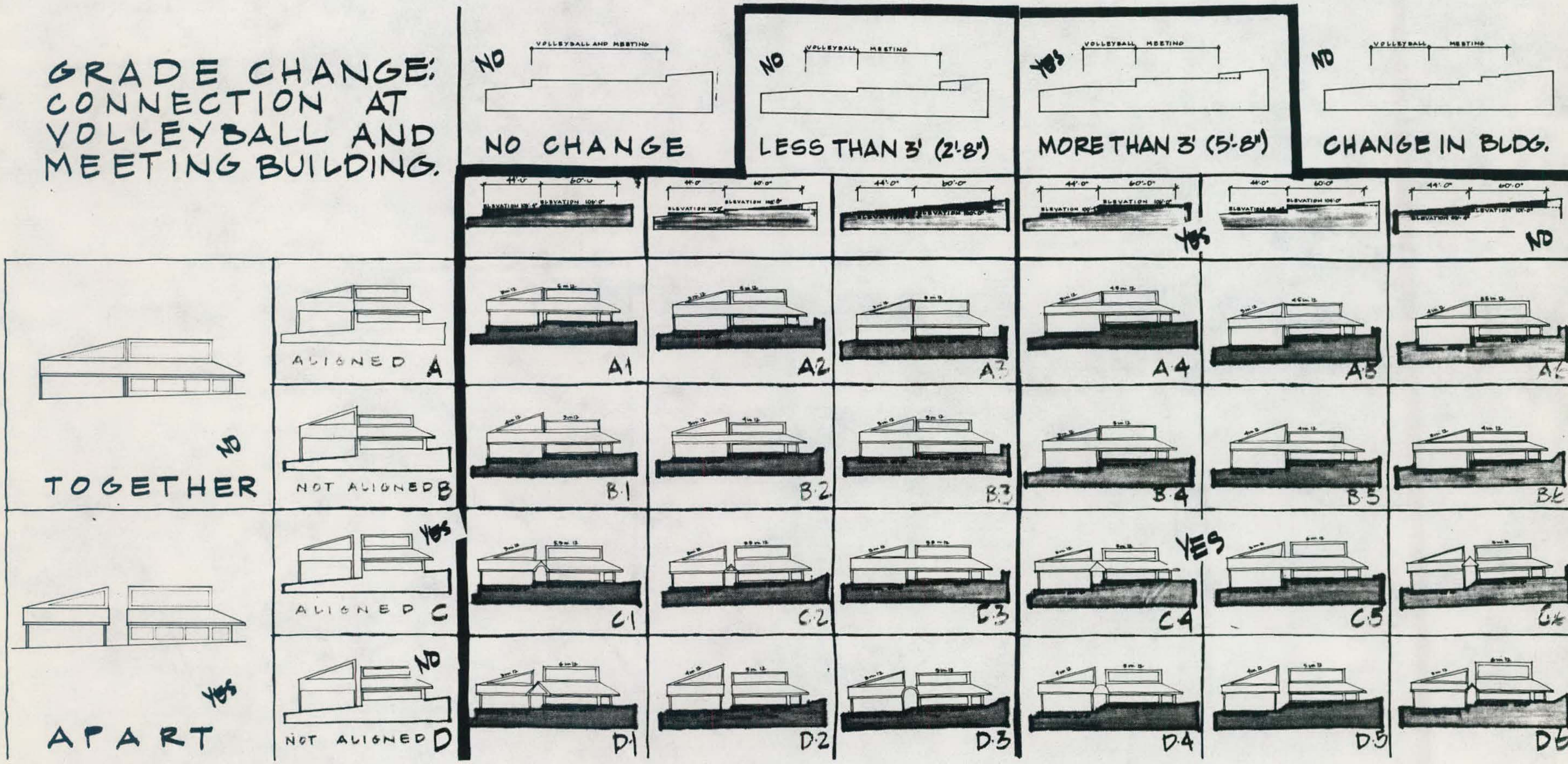
Background information from:
Grade Change: Relationship Between Meeting Room / Volleyball
November 29, 1979.

DISCUSSION

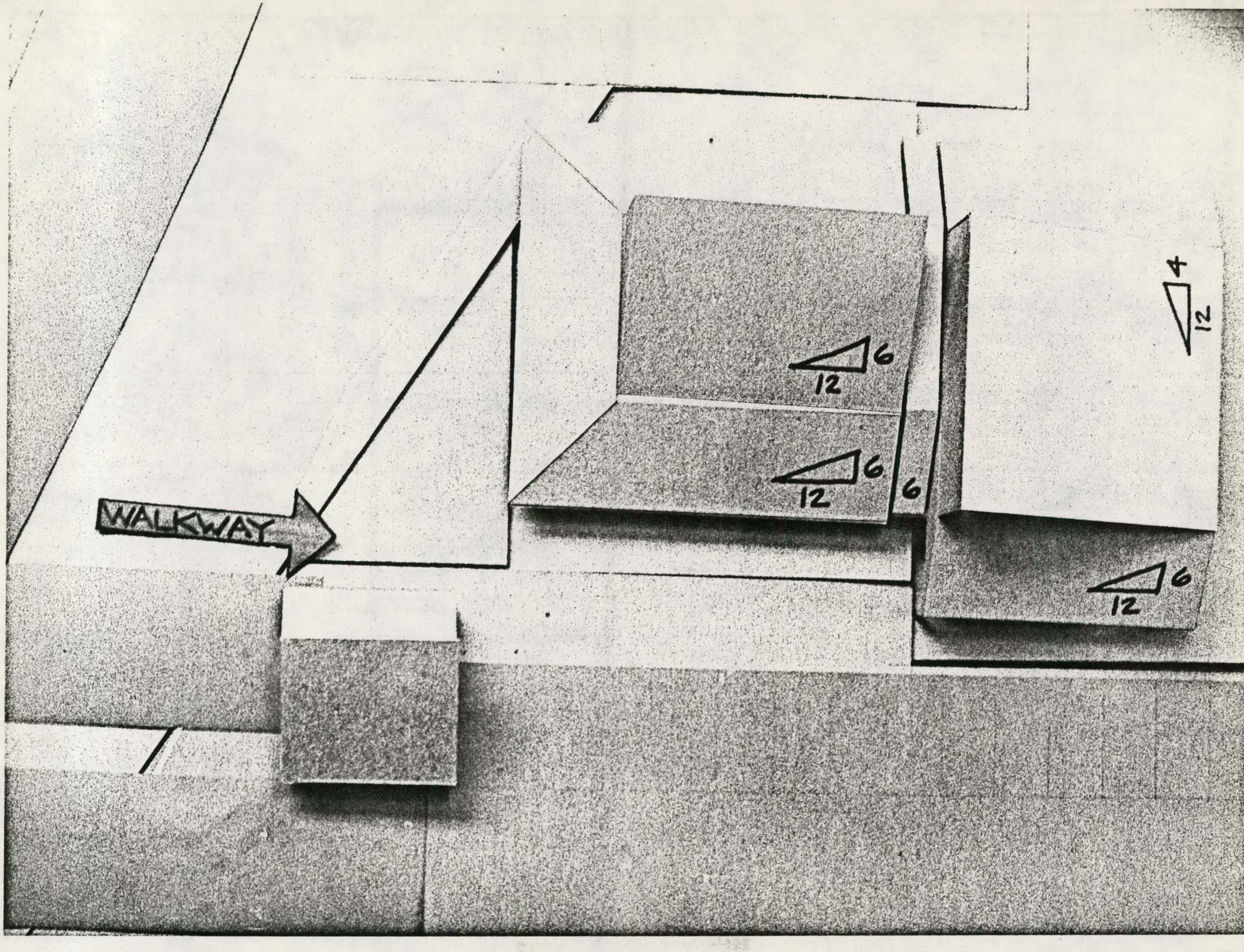
The committee eliminated any alternatives that emphasized either cut or fill because of potential drainage problems with cutting into the grade and the cost of fill. Preference was expressed for roof forms that gave the image of shelter, shedding water well. Equally important was the notion that each of the three buildings should establish a separate and distinct identity yet be brought together visually.

DECISION

It was decided to separate the buildings in order to start with individual and distinctive forms that are visually brought together. A vertical distance of 3'-5' between the meeting hall and pavilion was felt to be an appropriate degree of connection. Finished floor elevations of 105'-0" for the meeting hall and 101'-0" for the pavilion tended to balance the visual relationship among the three buildings on the site. The meeting hall and pavilion should be separated but their clerestory roofs should align and the lower roof should be a contiguous connecting element. The roof slope of the meeting building should be 6 in 12 to support the image of a shelter from the heavy rains of the valley. The pavilion roof should be 4 in 12 in order to align with the meeting building. The gap between the two could be at an intermediate elevation and would be used as a place to resolve the circulation problems brought about by the difference in floor elevations and to connect a portable stage.

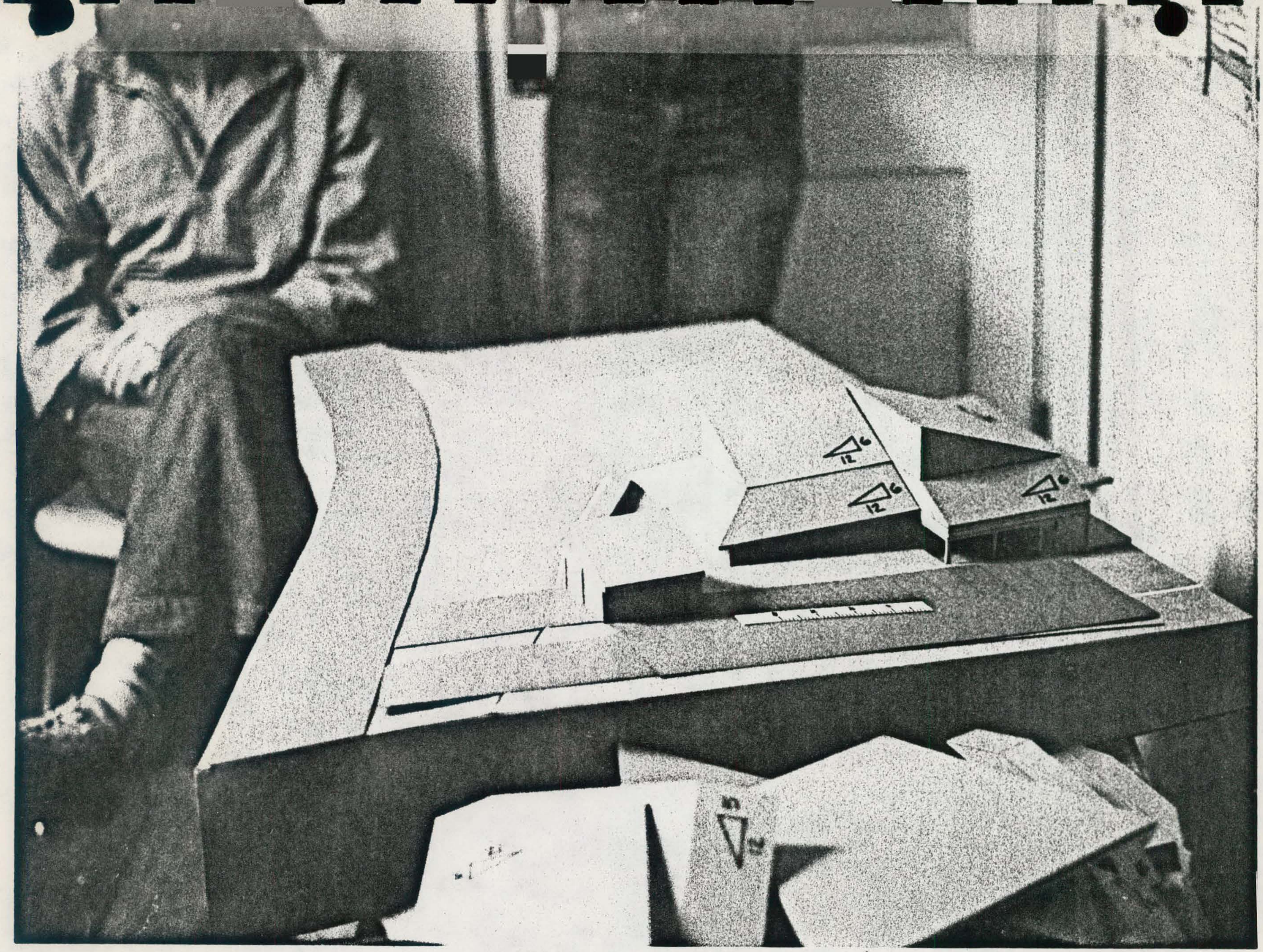


Grade Change: Relationship Between Meeting Room and Volleyball Pavilion
November 20, 1979.



Meeting Nº 6

Novembe[illegible]7, 1979.



Meeting Nº6

November 29, 1979.

ADJACENT SPACES: NOVEMBER 29, 1979

INTENT

This matrix was intended to produce additional program development information. Specifically, it was to determine the degree and character of connections between inside spaces and the outside. Consequently, decisions made were to establish direction rather than a specific resolution.

VARIABLES

Primary variables in this decision were access (no door, one door, french doors, sliding, or hatch), ground covering (lawn, planting, deck or paving), and roof coverings (open, trees, trellis, canvas, clear roof, or opaque roof).

DESIGN ISSUES

This decision was seen to be influenced by the desire to provide sheltered south-facing outdoor spaces immediately adjacent to the building without interfering with the collection of solar energy along the same wall.

METHOD

The matrix identified a range of relationships that an interior room can have with the outdoors. It compared methods of access with types of ground and roof coverings. Individual cells described the character of that alternative with a rendered plan. Cards with room names written on them were placed in the matrix cell that expressed the appropriate combination.

DECISIONS

Discussion of alternatives established the following direction:

Toilets: no door, paving or deck depending on state of outside circulation, solid roof.

Kitchen: one door, deck, some top light.

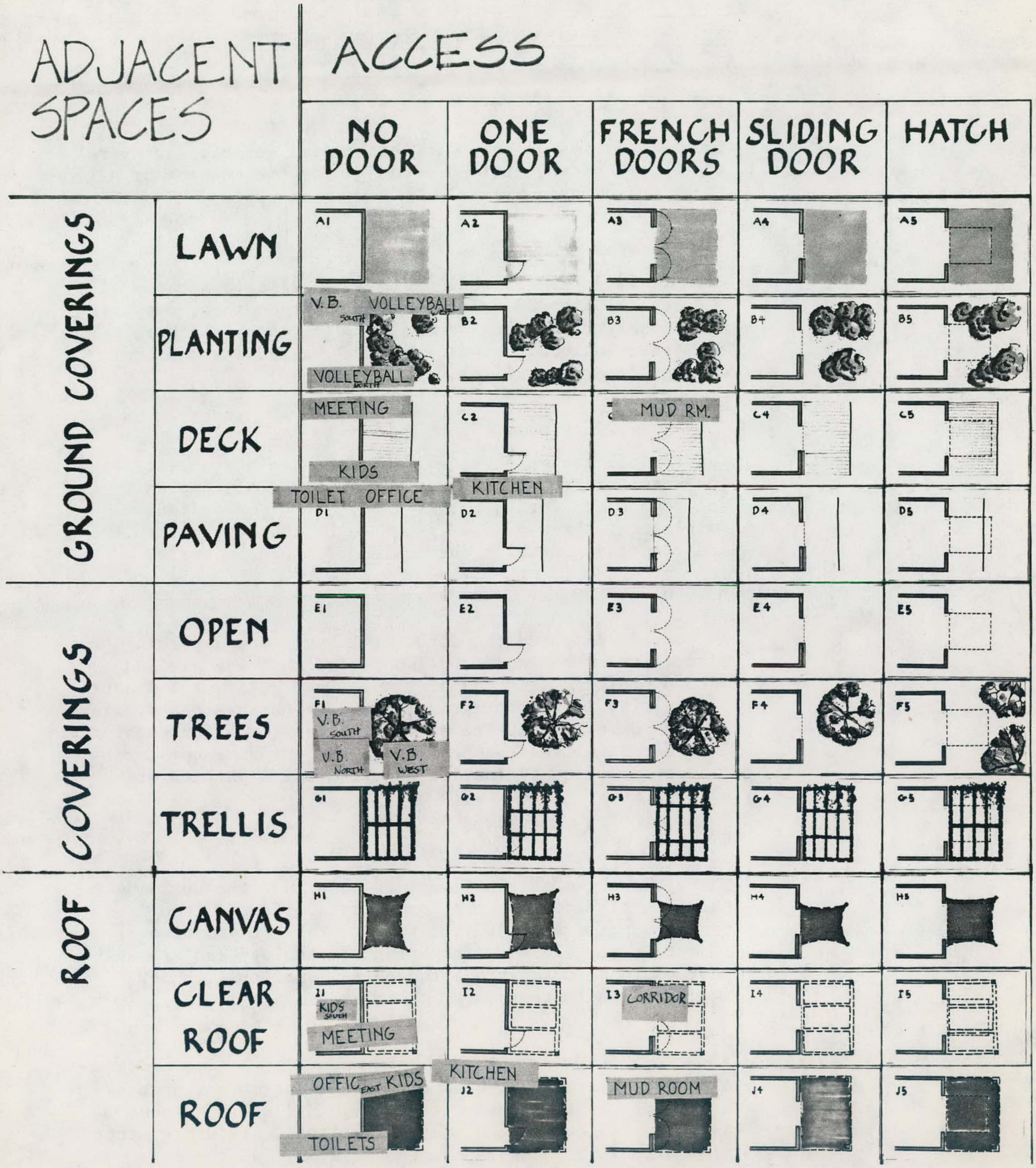
Office: no door, deck outside, solid roof.

Mud room: double doors, deck, solid roof.

Kids: no door, deck, east roof solid, south roof clear with louvres.

Meeting room: no door, deck, south roof with louvres.

Corridor: double doors, paving or deck, south roof clear with louvres.



Adjacent spaces

November 29, 1979.

STRUCTURAL SYSTEM AND CONSTRUCTION SEQUENCE: NOVEMBER 29, 1979

INTENT

This matrix was intended to determine a generic structural system and a construction strategy for the phasing of all three buildings.

VARIABLES

Primary variables in this decision were three methods of phasing (finish one building then start another, complete each construction task on one building after another, or start all buildings simultaneously), and two structural systems (bearing wall or column and beam).

DESIGN ISSUES

Issues influencing that decision included the ability of the structure to change over time, degree of complexity and technology for volunteer labor, level of design development that would be provided by the design team, and the order in which the buildings would be built.

METHOD

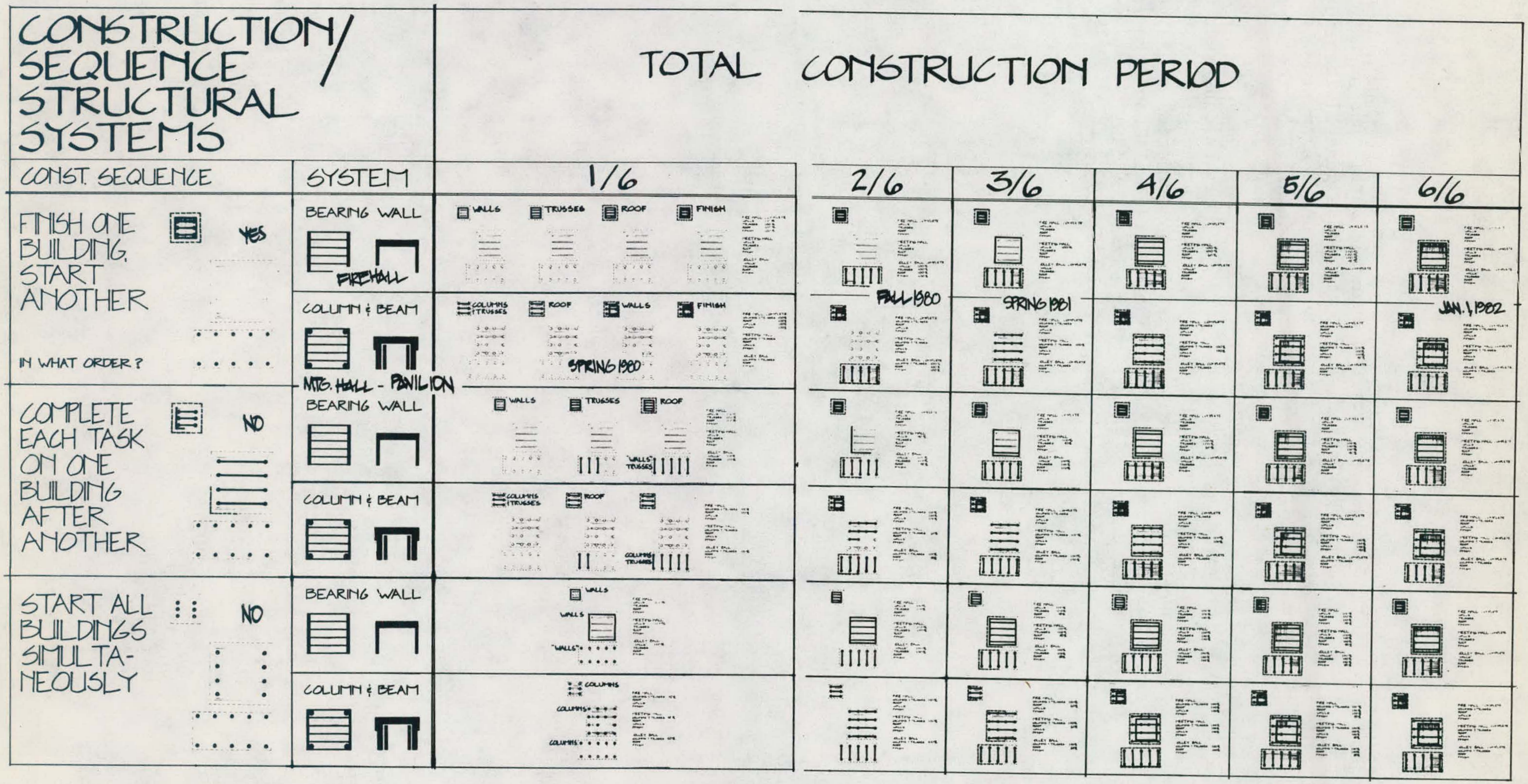
The matrix compared the structural systems and phasing strategies over a construction period that was divided into 6 arbitrary lengths of time. Each cell was a diagram of the site illustrating what would be built after similar lengths of time assuming an equal labor force for each. That format allowed one to assess the relative complexity and degree of co-ordination required for a particular alternative.

DISCUSSION

There was a general sentiment to construct the buildings one at a time so that the community could more readily identify goals and motivate volunteers. It was also important to select a "forgiving" technology and schedule that could be readily adapted to the availability of skills and volunteers.

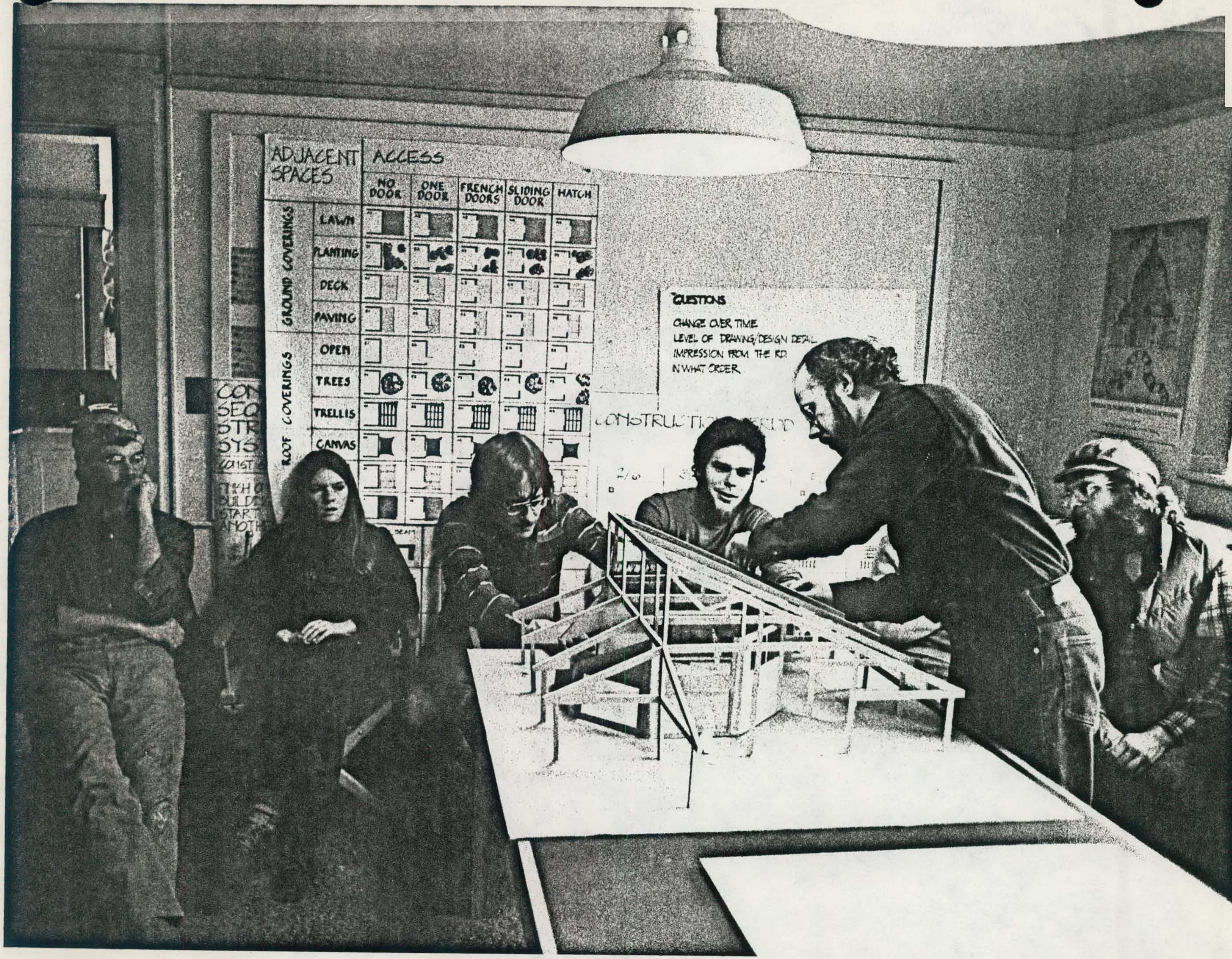
DECISIONS

Although a column and beam structural system was seen as a slightly more expensive technology, it was also seen as better suited to the timber available, allowed greater flexibility for on-site design decision, and could incorporate a wide range of skills and design ideas once a frame structure was completed. It was decided that



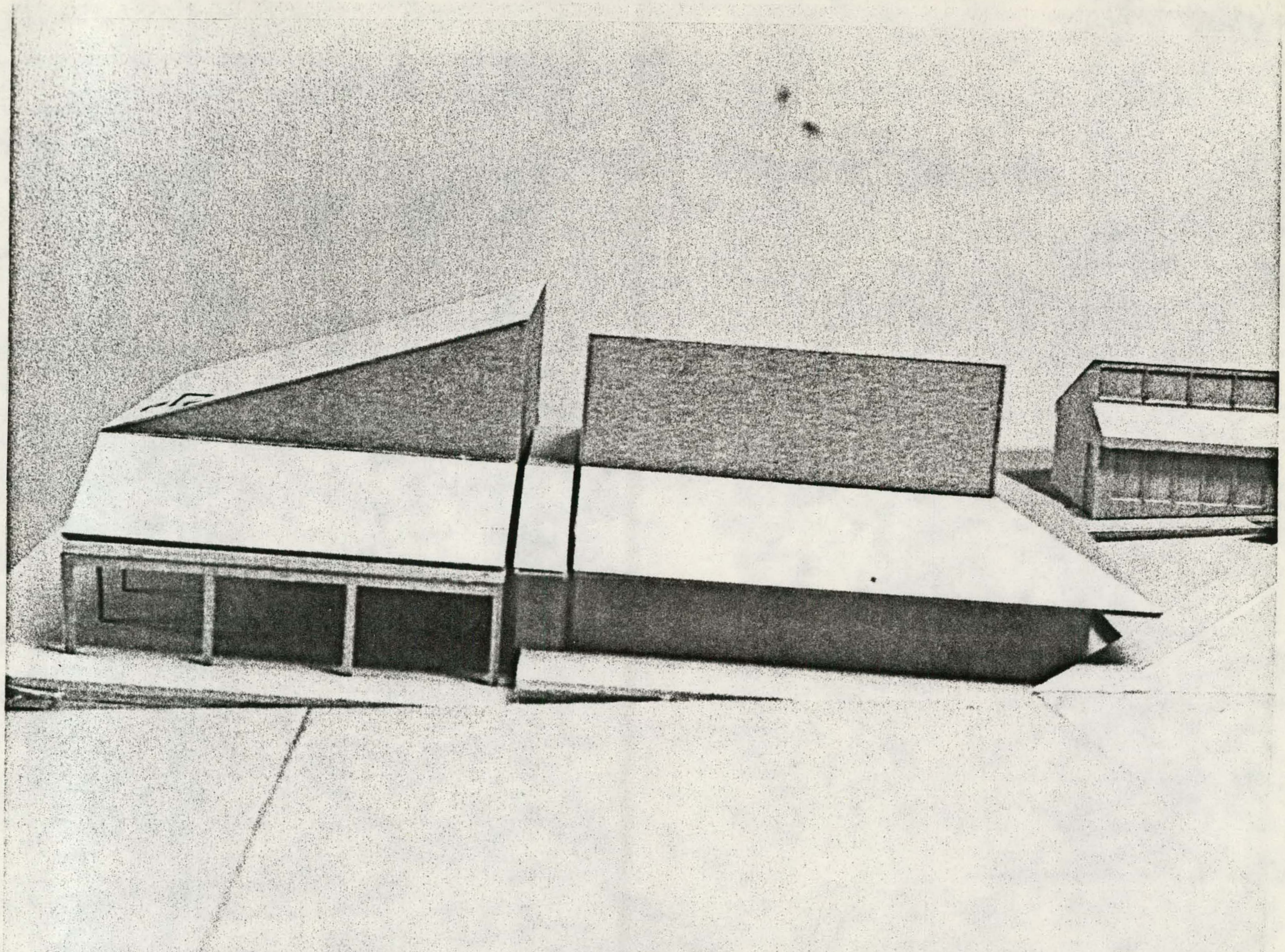
construction sequence / structural system November 29, 1979 the design team would design and detail the structural system. Performance criteria and a general location would be specified for non-structural elements which would, in turn, be designed and detailed by the community, on-site, within the shell of the whole building.

It was also decided that the firehall be constructed first as a gesture to the public nature of the project. The pavilion would be built next. Construction would begin in the summer of 1980. The meeting hall would go into construction with following summer in 1981.



Meeting N° 6

November 29, 1979.



Meeting No 6

November 20, 1979.

MEETING SEVEN: JANUARY 22, 1980

Willamette Community Design Center, Eugene, Oregon

INTRODUCTION

This meeting followed a month-long hiatus in the design process. In the interim, the design team had presented the design process and schematic design to the representatives of the Department of Energy as part of the Passive Solar Commercial Buildings Design Assistance and Demonstration Grant. That meeting offered some direction as to ways in which solar aspects of design development might proceed. In particular, more specific strategies for solar aperture and storage mass needed to be addressed.

With this background, the design team and the building committee met to consider the last group of design alternatives and proceed with design development.

INTENT

It was intended that the design process be brought to the point where the design team could begin the construction documents phase of the project following the meeting. In order to achieve that design decisions had to be made with respect to plan refinement, solar storage and controls, exterior circulation, the gap between the meeting hall and the pavilion, and the resulution of the structural system over the meeting room.

PLAN REFINEMENT: JANUARY 22, 1980

INTENT

This matrix was intended to finalize the exterior configuration of the building shell and place the rooms within that. It was anticipated that this decision would be made in conjunction with one that would select methods of solar collection and determine the configuration of the south wall.

VARIABLES

Two primary variables were involved in that decision. The first was methods of utilizing the south wall and the meeting room for solar collection (cutback, direct gain, or sun-spaces). The rest were several alternatives for placement and configuration of small rooms, meeting room entries, the wood stove, and stairs (toilets north, office east; toilets split, office north; kids' room and corridor separate; kids' room and corridor combined; location of meeting room entries and woodstove).

DISCUSSION

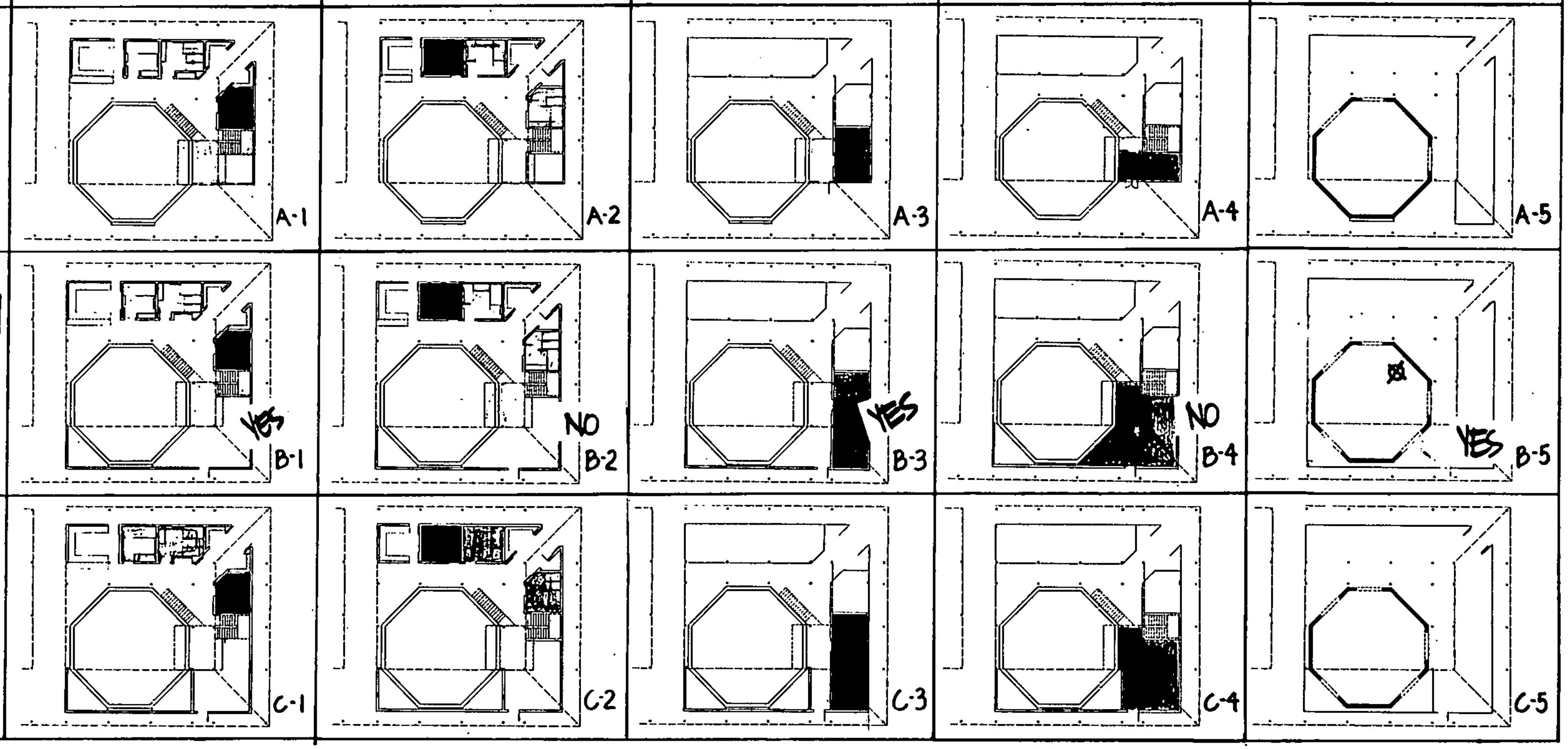
This design decision began with a lengthy discussion of solar heating implications and later turned to SOLAR COLLECTION AND STORAGE, METHODS OF SHUTTERING where attitudes towards solar storage and collection were voiced.

Other design alternatives were discussed and resolved rather readily once the relationship between the building configuration and passive solar heating systems was established, fixing the character and locations of major glazing and thermal mass.

DECISIONS

A decision was reached to maintain a continuous south configuration indicating an overall preference for direct gain systems. Toilets were clearly preferred on the cooler north side. The stair was preferred in a prominent central entry related location. The children's room should be separate from the corridor. Three entries are required into the meeting room: one related to the kitchen and the pavilion at the northwest, another related to the children's room and corridor to the southeast, and another related to the pavilion and the southern outdoor space at the southwest. There should be visual access between the children's room and the meeting room. The woodstove should be inside the meeting room at the northeast wall.

PLAN REFINEMENT



	TOILETS NORTH OFFICE EAST YES	TOILETS NORTH & EAST OFFICE NORTH NO	KIDS - CORRIDOR SEPARATE YES	KIDS-CORRIDOR COMBINED NO	MTG. RM. ENTRY WOODSTOVE
CUTBACK NO	A-1	A-2	A-3	A-4	A-5
DIRECTGAIN YES	YES B-1	NO B-2	YES B-3	NO B-4	YES B-5
SUNSPACES NO	C-1	C-2	C-3	C-4	C-5

157

Plan Refinement.

January 22, 1980

SOLAR COLLECTION AND STORAGE, METHODS OF SHUTTERING: JANUARY 22, 1979

INTENT

This matrix was intended to determine the methods of solar collection, storage and shuttering. Since this decision had a profound impact on the quantity and character of interior space available, it was made in conjunction with a group of plan refinement decisions previously discussed.

VARIABLES

Primary variables included three building configurations (cutback south wall, sunspaces, continuous south wall); methods of solar storage (mass floor, masonry walls; water storage at meeting room with wood floor in meeting room; wood floor and masonry walls in meeting room); and methods of shuttering (inside flaps, outside flaps, roll up or roll down). Information regarding the anticipated thermal swing of each alternative was presented on graphs.

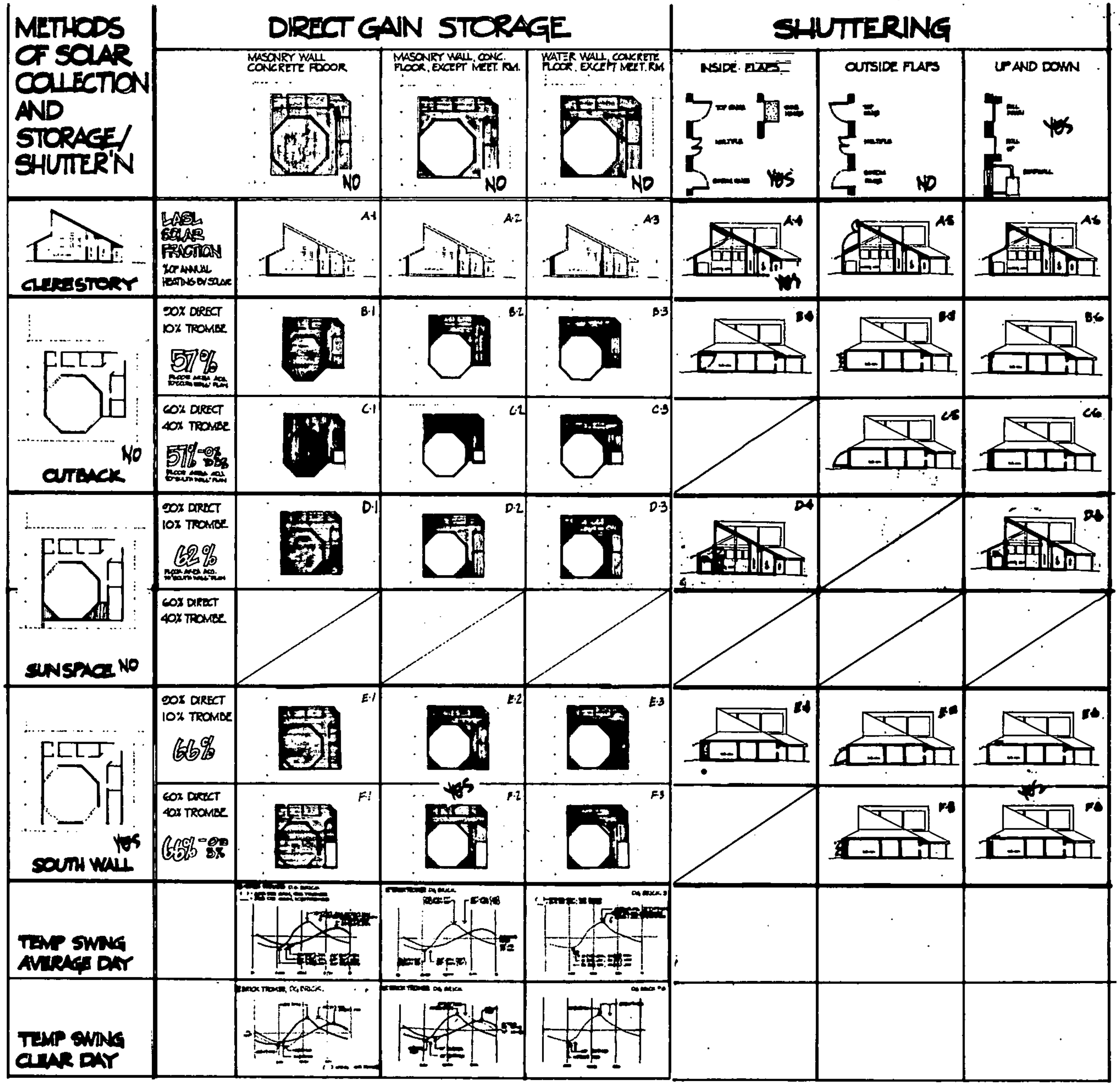
DESIGN ISSUES

Issues influencing these decisions were seen to be: impact on building area and plan configuration, position of hard thermal mass surfaces, implications of too hot or too cold inside temperatures, shading characteristics of shuttering, automatic or manual controls, amount of maintenance, fabrication or purchase of hardware, and relative ease of movement from the inside of the building to the outside through the south wall.

METHOD

In addition to comparing the design alternatives this decision involved an evaluation of a summary of thermal performance characteristics of the solar storage and shuttering systems under consideration. The solar systems were separated into two general categories, the clerestory and those along the lower south wall. Under discussion was the nature of that lower south wall as a solar collecting surface, method and location of thermal storage and methods and location of thermal shutters.

The matrix primarily presented potential mass locations as a plan issue and potential shuttering devices as a sectional issue. Individual cells simply described the implications of a particular solar alternative on the building plan and section. Along the bottom of the matrix were drawn graphs of anticipated temperature swings for each alternative. Graphs illustrated magnitude of that swing and the times at which maximum or minimum temperatures occur.



Methods of Solar Heating, Storage and Shuttering
January 22, 1980

DECISIONS

Sunspaces were questioned as an alternative since the community survey which initiated the design program for the project placed a very low priority on "greenhouses." A cutback scheme, while providing a convenient south-facing porch, also severely reduced the amount of interior building area available for the children's room.

The committee then selected a continuous south wall method of collection since it provided the most usable interior space. A wood floor was selected for the meeting room and the children's room because of its appearance and the anticipated physical activities it should support. Consequently required thermal mass would have to be accommodated in other locations. The walls of the meeting room could easily be masonry which would be of additional use in relating visually to the heavy timber structural system exposed in that room.

While a direct visual connection or functional connection to the outdoors was not important in the meeting room, it was a very significant issue in the children's room. As a result, it was decided to use a masonry trombe at the south wall of the meeting room and a transluscent water trombe in the children's room; direct gain and concrete floors would be acceptable in all other parts of the building. This strategy would also satisfy another important goal and demonstrate, for the benefit and education of building users, a variety of solar systems applied in different uses and conditions. It was agreed that the design team would take this direction and identify the cost, installation, and finish implications of various alternatives. They would be presented at the next meeting.

With respect to shuttering, a similar motivation was expressed. The intention was expressed to demonstrate a variety of shuttering strategies appropriate to their location and circumstance in the building.

At the clerestory, an automatic, low maintenance, inside flap such as "skylid" was preferred. At the children's room and the meeting room where flaps would present a conflict with uses, a roll-up, roll-down curtain was preferred. It was decided that beyond that more information was required with respect to operation, cost, installation, and an investigation into the technology of a community-fabricated shutter. It was agreed that the design team would investigate these options and present them at the next meeting.

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MEETING ROOM STRUCTURE: JANUARY 22, 1979

INTENT

This matrix was intended to identify the general appearance of the structural system inside the meeting hall. It was recognized that this decision could only establish a direction and would ultimately depend on an adequate resolution of a structural design.

VARIABLES

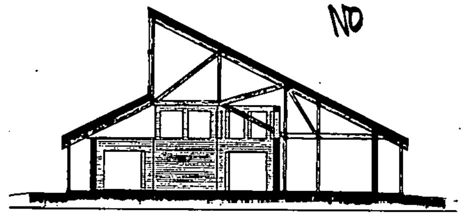
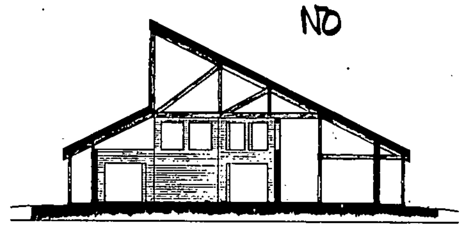
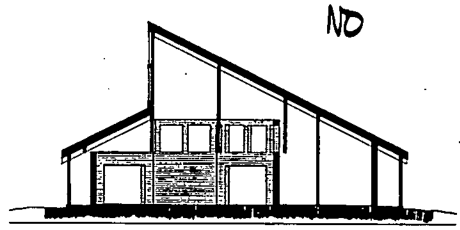
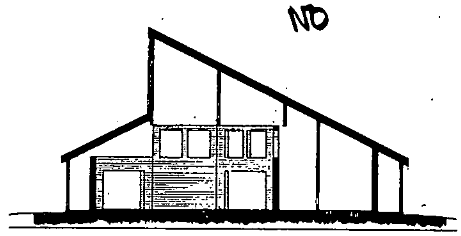
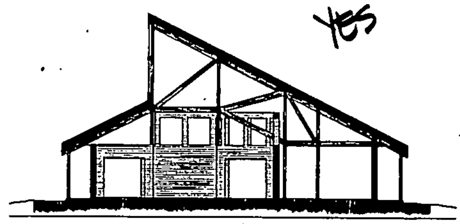
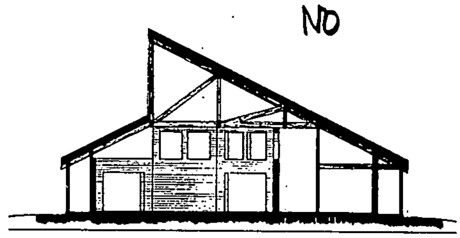
Primary variables in this decision were three methods of spanning trusses (parallel to the clerestory, perpendicular to the clerestory, both directions equally) and two methods of placing that structure over the meeting room (symmetrically or asymmetrically).

DESIGN ISSUES

Issues influencing that decision were seen to be quality of daylight entering through the clerestory and complications with methods of solar shuttering, methods of acoustically isolating the meeting room, and methods of electric lighting.

DECISIONS

Discussion of this decision was straightforward and identified a preference to accentuate the form and balance the meeting room. The structure would run in two directions placed symmetrically in the room.

STRUCTURE	SYMMETRIC TOP ON MEETING ROOM	ASYMMETRIC TOP ON MEETING ROOM
NORTH/SOUTH TRUSSES DOMINANT	NO  A1	NO  A2
EAST/WEST TRUSSES DOMINANT	NO  B1	NO  B2
TWO-WAY TRUSSES	YES  C1	NO  C2

<u>structure</u> January 22, 1980.

EXTERIOR CIRCULATION: JANUARY 22, 1980

INTENT

This matrix was intended to determine where site circulation should be provided and how it should be expressed.

VARIABLES

Primary variables in this decision were routes or points to connect (road, firehall, meeting room, volleyball; road, meeting room, volleyball; or firehall, meeting room, volleyball) and degree of architectural articulation (all, most, some, none). Secondary variables were a tower (which could be located anywhere or rejected) and amount of overhead covering.

DESIGN ISSUES

Issues influencing this decision were degree of shading on the firehall, view from the road, degree of pedestrian access maintained, and duplication of interior circulation.

DECISIONS

The committee indicated that the road, firehall, meeting hall, and volleyball pavilion should be connected by exterior circulation, the roof of which should be glazed or uncovered to admit light and solar energy. The firehall roof could extend to cover a walkway which would preferably be covered as far as the road. The walkway was preferred to be expressed with skylights in the roof plan around the perimeter of the building except on the east side. A tower was desired, and should be located at or near the entry corner, and might be used to resolve the change in roofs from walkway to the building.

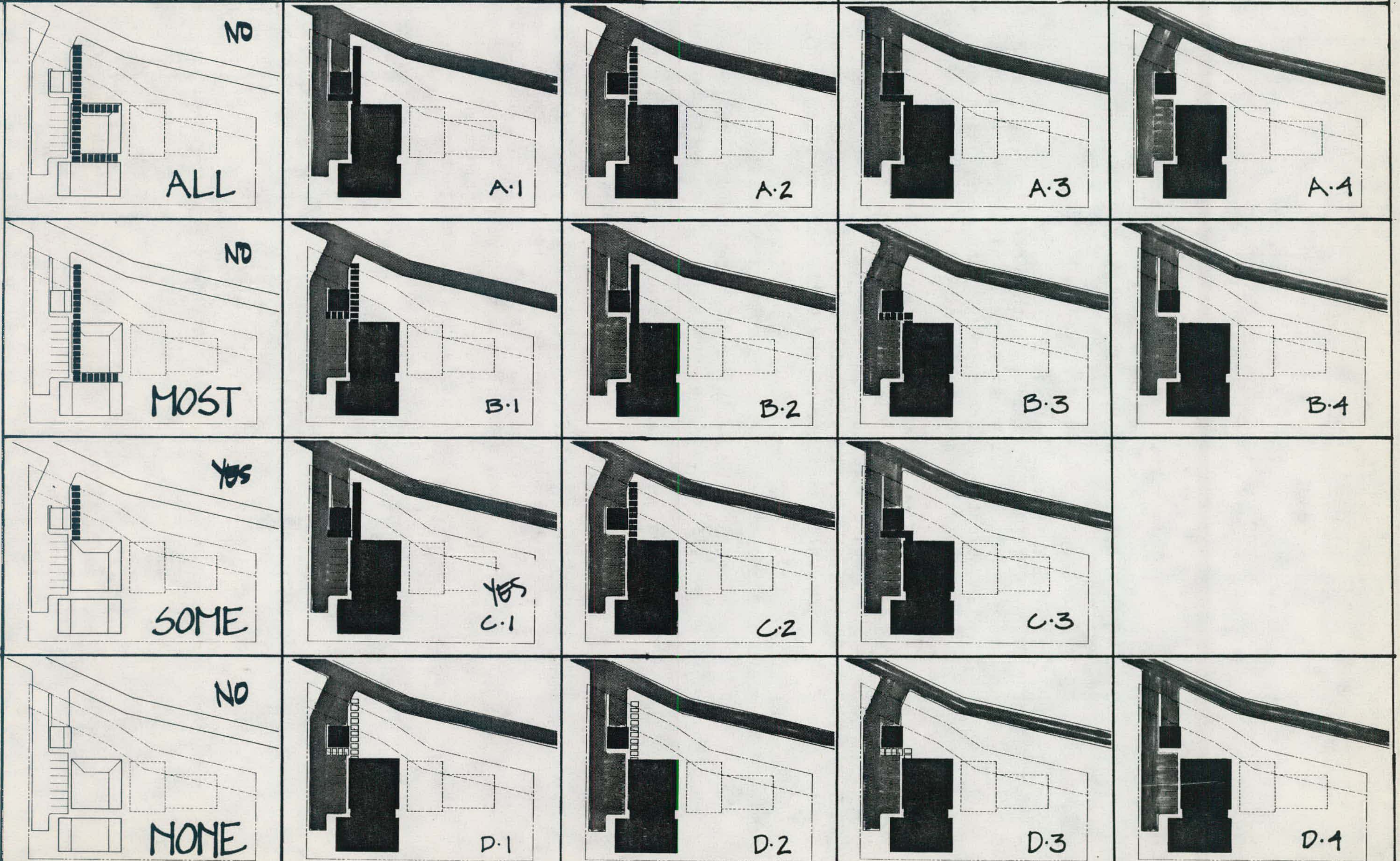
EXTERIOR CIRCULATION

	UNCOVERED	COVERED
ARTICULATED		
NONARTICULATED		

ROUTES – POINTS CONNECTED

ROAD FIRE HALL MEETING ROOM VOLLEYBALL	ROAD MEETING ROOM VOLLEYBALL	FIRE HALL MEETING ROOM VOLLEYBALL	MEETING ROOM VOLLEYBALL
YES	NO	NO	NO

DEGREE OF ARTICULATION



Exterior circulation

January 22, 1980

THE GAP: JANUARY 22, 1980

INTENT

This matrix was intended to determine the exterior appearance and function of the space between the meeting hall and the volleyball pavilion.

VARIABLES

Primary variables in this decision were three plans for the space (all walkway, half walkway, half seating, and a combination of ramp, stage, and stairs) and three roof types (simple shed, valley at center, gable at center).

DESIGN ISSUES

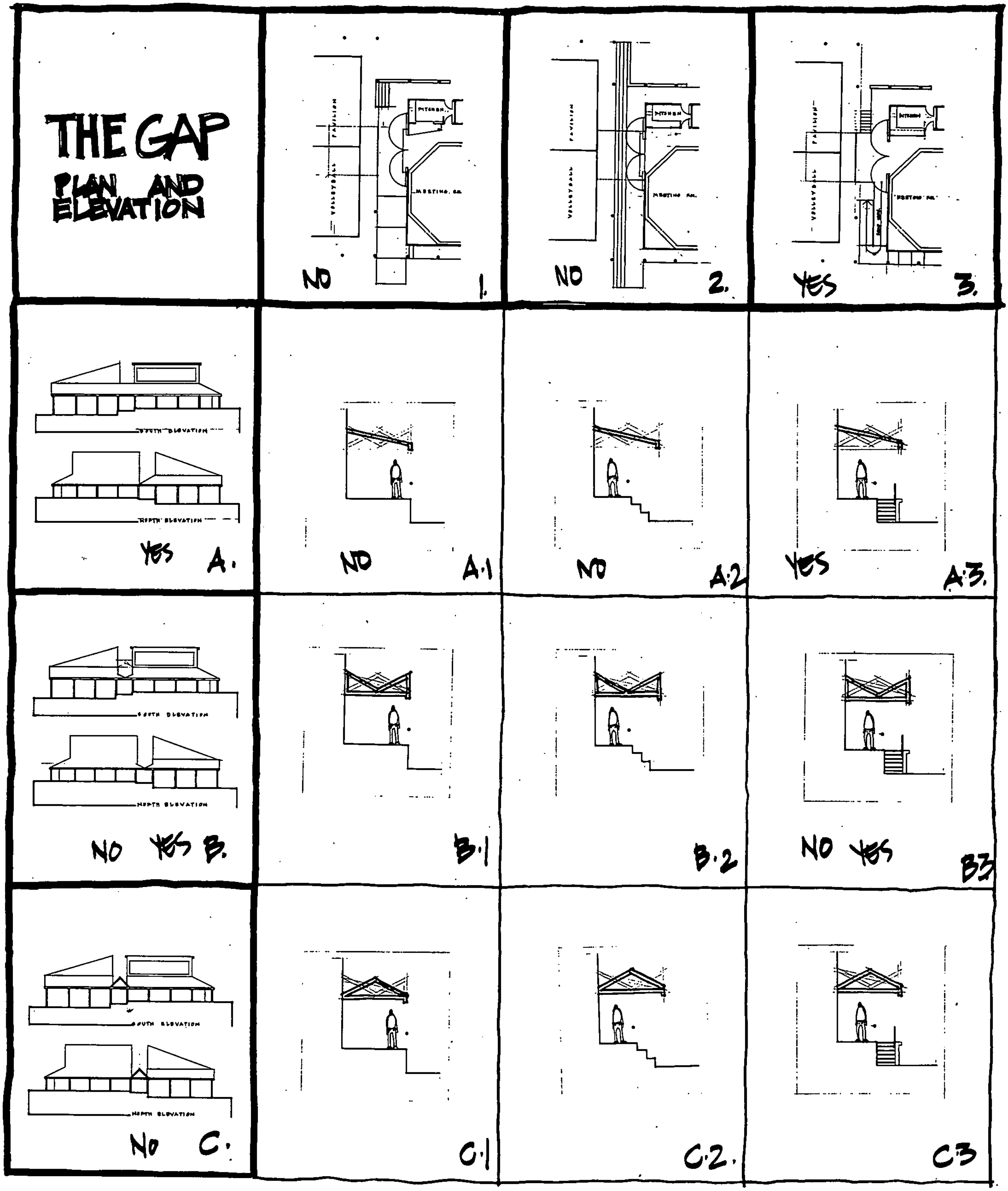
Issues influencing this decision were waterproofing, degee of visual separation or integration between buildings and accessibility of the volleyball pavilion to the handicapped.

METHOD

Since the decision was determined by the interaction of visual and functional issues, the matrix compared a plan of the gap with elevations of the building. Each individual cell was a sectional configuration for the gap.

DECISIONS

The committee selected a combination of ramp, stair, and stage although there was also preference for seating which might become incorporated with that. The simplest roofing solution possible was preferred. The south roof would continue uninterrupted, other options for the north end were to be explored by the design team.



The Gap

January 22, 1980

MEETING EIGHT: FEBRUARY 14, 1980

INTRODUCTION

Following the last meeting when the final round of design alternatives were presented, it was agreed that more specific information was required about thermal mass and shuttering. In particular, questions about cost, installation and finish were raised. Consequently a further group of alternatives were prepared for presentation. Also, drawings of the three buildings located on site were presented in order to identify that there were not further adjustments required before beginning detailed construction drawings.

INTENT

This meeting was intended to review progress and design development of the project. Detailed decisions needed to be made regarding structure, thermal mass and thermal shuttering alternatives. The schematic design drawings were presented for approval to proceed into construction documents. The design team also wanted to present a strategy for the preparation of construction drawings and specifications that would maximize the skills, knowledge, and creativity of the community's workers and craftspeople in construction.

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THERMAL MASS OPTIONS: MEETING HALL: FEBRUARY 14, 1980

This decision was intended to establish in detail the thermal mass in the meeting hall. This information was presented more simply than most design decisions on a chart. The chart compared several thermal storage alternatives for the meeting room and the children's room over the criteria of initial cost per square foot and architectural compatibility. They were discussed and evaluated with respect to those criteria. There was also expressed a desire to construct and demonstrate a range of methods of storing solar energy given the limitations of a volunteer labor force.

Typical installation details illustrated mass alternatives as they might be used in this particular building. For the meeting room walls this included ground concrete block filled with concrete and left exposed in stack bond, conventional concrete block filled with concrete and finished with ceramic tile on one side, and brick two sides filled with concrete. For the children's room the alternatives were Kalwall fiberglass water storage tubes or bottle water storage.

In the meeting room there was a preference expressed for brick as a finish surface but reservations about its cost. However, there also was the possibility of firing tile at a local kiln which would provide a finish surface on the cheaper concrete block alternatives.

Ultimately the building committee asked to postpone this decision while they continued to research the implications of using the masonry walls of the meeting room structurally, thereby reducing the amount of wood structure necessary and reducing the cost.

In the children's room, Kalwall was the clear choice since it would be more stable than a bottle wall and admit more light into the room through the south wall.

THERMAL MASS WALL OPTIONS MEETING HALL

WALL LOCATION	PRODUCT OPTION	APPROX COST/SF	DETAIL	SPEC.
MEETING ROOM	STACK BOND CONCRETE BLOCK FILLED WITH CONCR.	$1.55	SEE DWG M.1	
	CONVENTIONAL CONCR BLOCK FILLED WITH CONCR. TILE ONE SIDE	$3.00 W/TILE $1.32 W/O TILE	SEE DWG M.2	
	BRICK 2 SIDES FILLED WITH CONCRETE	$4.10	SEE DWG M.3	
KIDS ROOM	KALWALL FIBERGLASS WATER STORAGE	$6.90 PLUS SHIPPING	SEE DWG M.4	
	BOTTLE WATER STORAGE	?	SEE DWG M.5	

13 FEB. 1980

THERMAL SHUTTER OPTIONS MEETING HALL: FEBRUARY 14, 1989

This decision was intended to establish in detail the thermal shutter at every glazed opening in the building. This information was presented on a chart identifying each type of opening, the shutter type selected for it in a previous design matrix and project options for those design choices. Each product was compared over the criteria of initial cost per square foot and architectural compatibility.

Before alternatives were discussed it was made known that the building should demonstrate a variety of commercial and home-made shuttering devices. It was hoped that the community might develop some expertise in fabricating these materials and continue to do so into the future.

The following decisions were made in an opening by opening discussion of alternatives. The clerestory should have automatically operating devices due to the height above the floor. Sky lids, while expensive and appearing awkward architecturally, were preferred since they were highly visible in the most public room of the building and demonstrated an automatic device without using auxiliary energy.

Direct gain spaces at the lower level could use a community made Roman shade of canvas and Foylon or a commercial project like Insulating Shade. These openings were all highly visible, readily accessible for maintenance, and required many different sizes. The building committee preferred that the design team specify a range of R values and explore options for home-made products.

The water wall in the children's room should use an automatic rolldown curtain since it occurs in an inaccessible place and may have an irregular use pattern that would make maintenance and manual operation impractical.

The masonry trombe wall at the meeting hall was intentionally left undecided and would be resolved by the design team. The building committee felt it could be commercial, automated, home-made or even uninsulated.

THERMAL SHUTTER OPTIONS MEETING HALL

OPENING LOCATION	SHUTTER TYPE	PRODUCT OPTIONS	APPROX COST/S.F.	DETAIL	SPECIFICATION
CLERESTORY	INSIDE FLAP	SKYLID	$12.00 PLUS SHIPPING	SEE DWG S.1	
	UP AND DOWN	MOTORIZED CURTAIN WALL	$6.15 INCL. HARDWARE PLUS SHIPPING	SEE DWG S.2	
TROMBE WALLS	UP AND DOWN	MOTORIZED CURTAIN WALL	$6.15 INCL HARDWARE PLUS SHIPPING	SEE DWG S.3	
DIRECT GAIN WINDOWS	UP AND DOWN	INSULATING SHADE	$4.00 PLUS SHIPPING	SIM. TO S.4	
		HANDMADE SHADE	$1.00 NOT INCL HARDW.	SIM TO S.5	
TYPICAL WINDOWS OTHER WALLS	UP AND DOWN	INSULATING SHADE	$4.00 PLUS SHIPPING	SEE DWG S.4	
		HANDMADE SHADE	$1.00 NOT INCL. HARDW.	SEE DWG S.5	
GLAZED DOORS	UP AND DOWN	INSULATING SHADE	$4.00 PLUS SHIPPING		
		HANDMADE SHADE	$1.00 NOT INCL HARDW		

13 FEB. 1980

THERMAL SHUTTER OPTIONS FIRE HALL

OPENING LOCATION	SHUTTER TYPE	PRODUCT OPTIONS	APPROX COST /S.F.	DETAIL	SPEC.
CLERESTORY	INSIDE FLAP	SKYLID	$12.00 PLUS SHIPPING	SIM. TO S.1	
	UP AND DOWN	MOTORIZED CURTAIN WALL	$6.15 INCL HARDWARE PLUS SHIPPING	SIM TO S.2	
TROMBE WALL	UP AND DOWN	MOTORIZED CURTAIN WALL	$6.15 INCL HARDWARE PLUS SHIPPING	SEE DWG S.5	

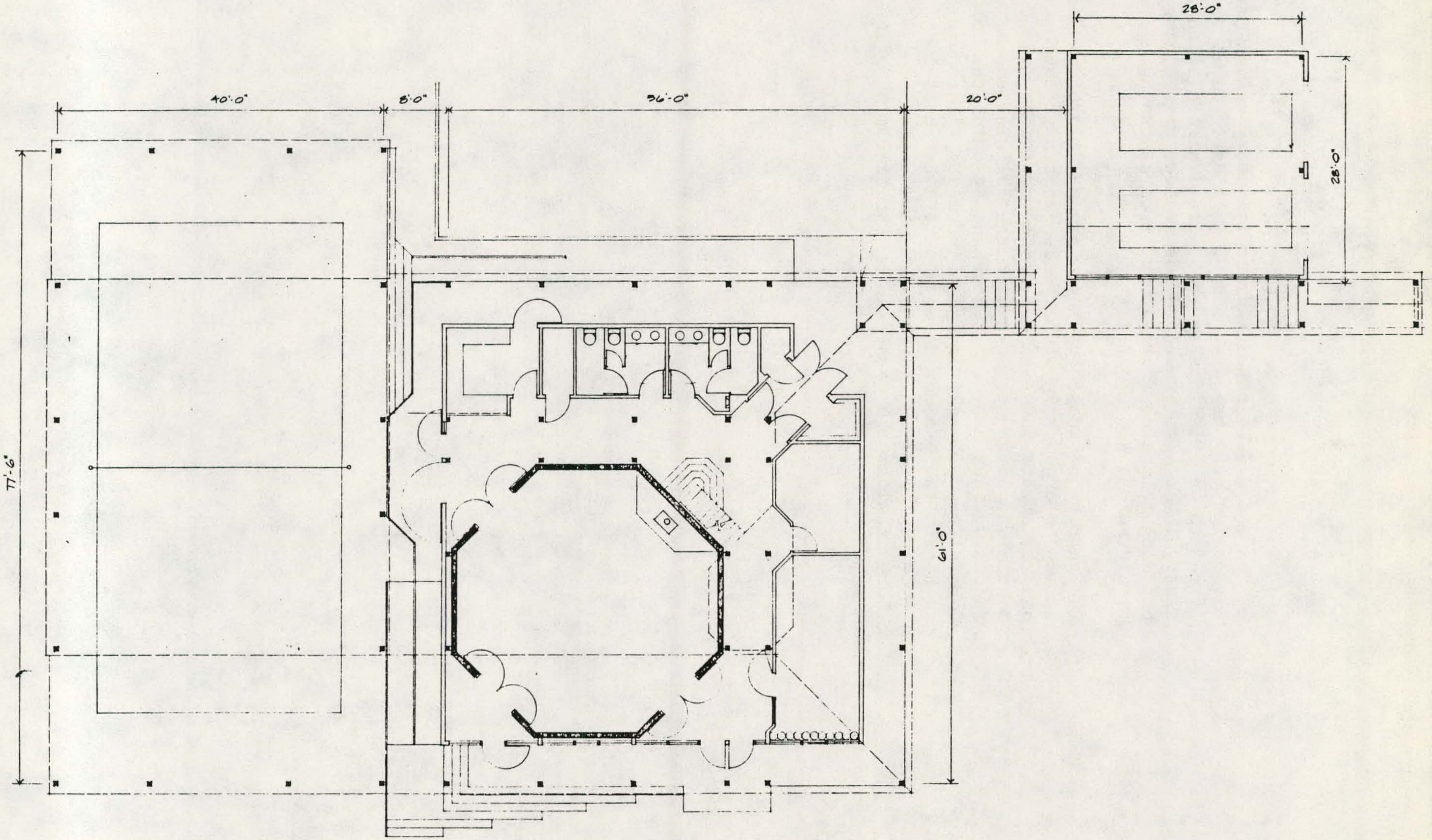
13 FEB 1980

SCHEMATIC DESIGN DRAWINGS: FEBRUARY 14, 1980

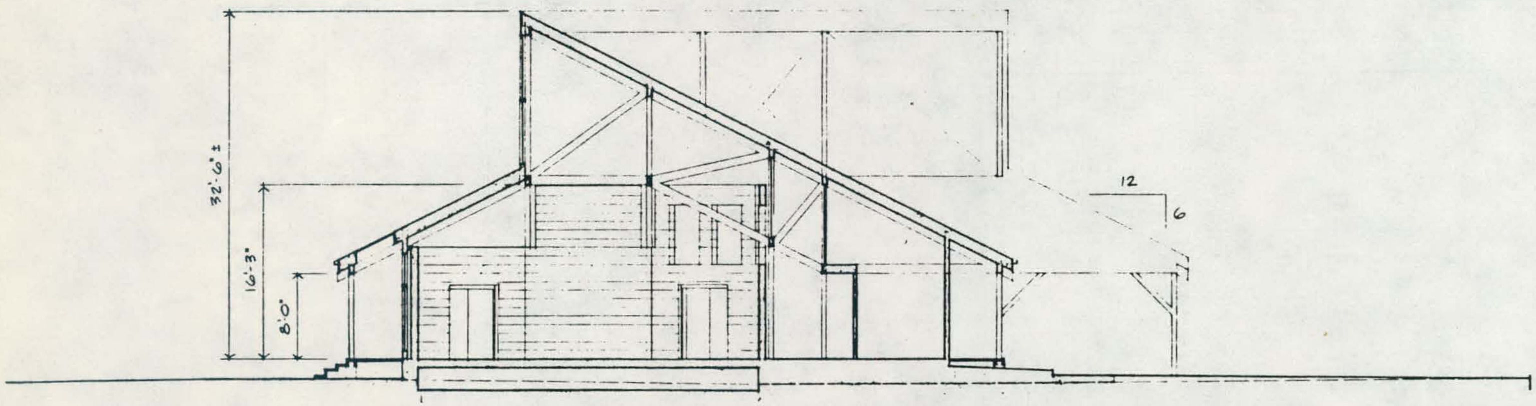
At the end of the scheduled participatory design meetings, the design team prepared plans, sections, and elevations of the three buildings as they were designed by that process. These were presented for review, fine tuning, and building committee approval prior to beginning construction drawings and specifications.

The purpose of these drawings then was twofold. First, it was an opportunity for the design team to summarize in one set of drawings all the design decisions made over six months of design meetings with the building committee. Secondly, they became the document by which the Deadwood Community would make design adjustments, if required, and authorize the project to move into construction drawings.

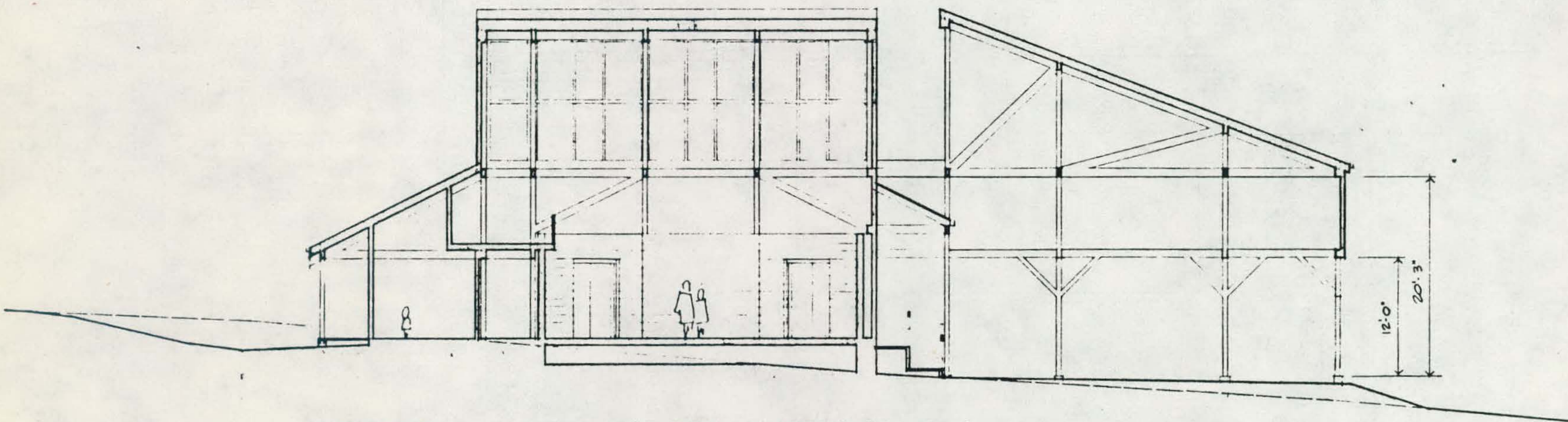
Those drawings are presented on the following pages.



PLAN ◦ DEADWOOD CREEK COMMUNITY CENTER ◦ 2·14·80 ◦ 1/8" = 1'-0"

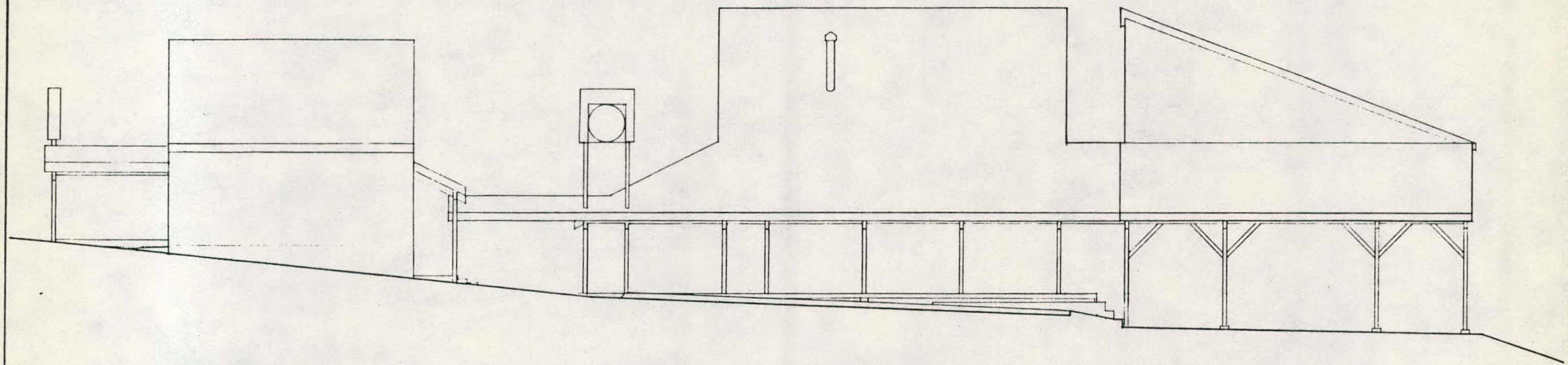


SECTION THROUGH CENTER OF MEETING ROOM

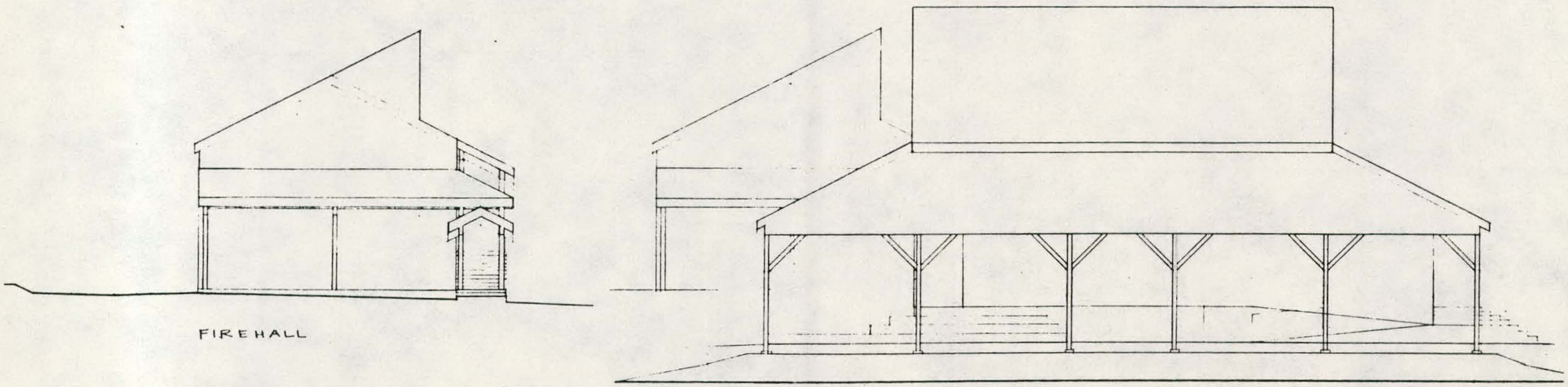


SECTION JUST INSIDE CLERESTORY

DEADWOOD COMMUNITY CENTER • 2·14·80 • 1/8" = 1'-0"

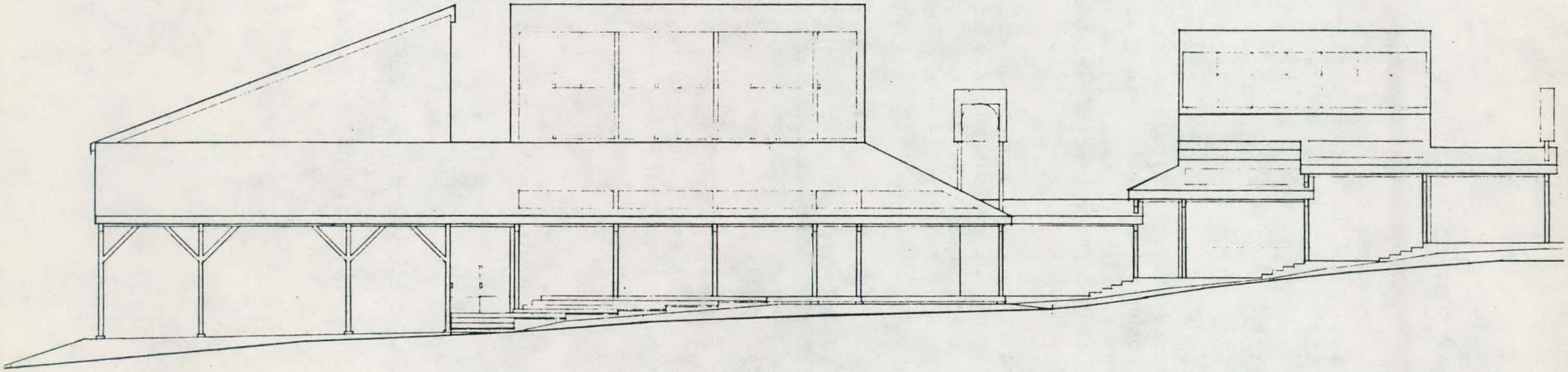


NORTH ELEVATION

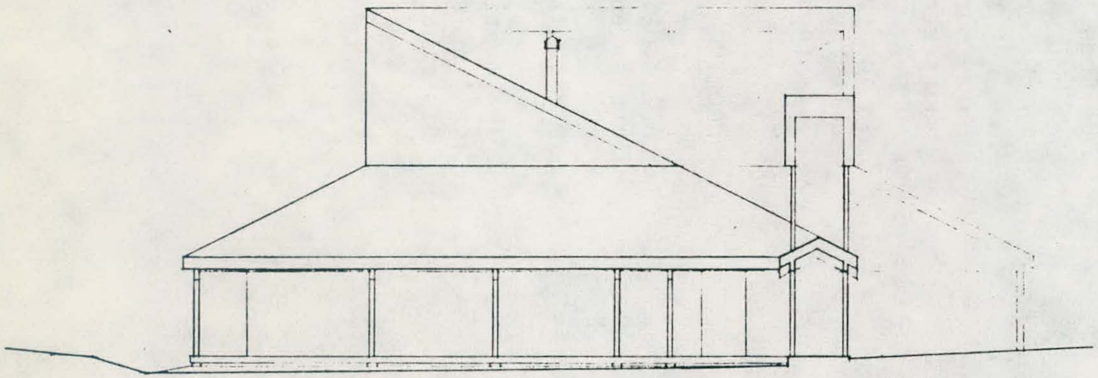


WEST ELEVATION

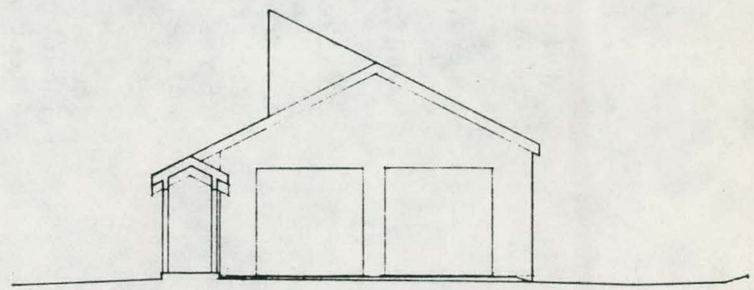
DEADWOOD CREEK COMMUNITY CENTER · 2·14·80 ∘ 1/8" = 1'-0"



SOUTH ELEVATION



EAST ELEVATION



FIREHALL

DEADWOOD CREEK COMMUNITY CENTER 2·14·80 1/8" = 1'-0"

II D.-5 SUMMARY OF PASSIVE SOLAR ENERGY SYSTEMS

A relatively broad range of passive solar energy systems are utilized in two of the three buildings of the community center. Their selection and design was largely determined by the clients' desire to demonstrate a variety of energy technologies to the users of the buildings and the community at large.

HEATING

The firehall where temperature stability was not critical demonstrates a simple unshuttered direct gain system. It receives solar energy through a totally glazed south wall and clerestory storing it in a concrete slab and water filled emergency vehicles.

The meeting hall demonstrates three systems in different locations. The majority of the building is a shuttered direct gain system receiving energy through part of the south wall and the clerestory storing it in a concrete slab floor and the concrete filled masonry wall that defines the meeting room.

In the meeting room itself where a concrete slab floor was not acceptable and view to the outdoors not desireable, part of that same masonry wall demonstrates a shuttered thermal storage wall.

In the children's room a concrete slab was also unacceptable but light and view to the south was desireable. This room demonstrates a shuttered water thermal storage wall.

COOLING

All cooling for both buildings is handled through natural cross-ventilation.

DAYLIGHTING

The meeting hall utilizes a clerestory, a reflective ceiling and glazed portions of interior partitions to distribute light throughout the depth of the building.

CONSTRUCTION DRAWINGS AND SPECIFICATIONS: FEBRUARY 14, 1980

Consistent with the active community involvement and interest in this project through programming and design decisions, an equally active role in construction process was desired. The design team decided to derive a method by which the participation of the community could continue in the same spirit.

Over the course of the design meetings, it became apparent that the Deadwood Community has some very special skills and materials. In addition to framers, material suppliers, and finish carpenters, there are a great number of crafts people who work with wood, clay, paint, fabric, etc... In sum, there was in Deadwood a range of talent and capability in construction and specialties that far exceeded that of the design team.

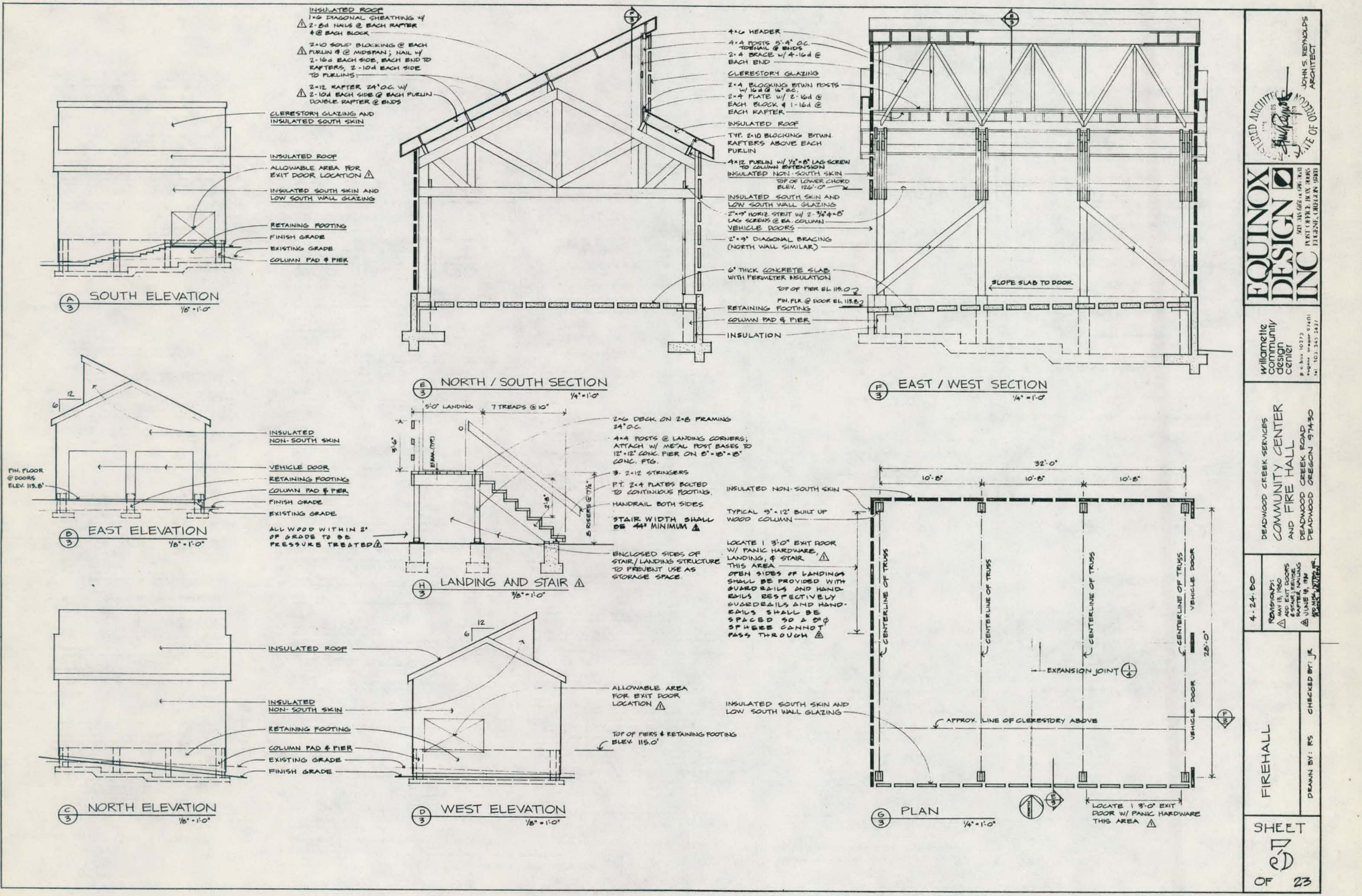
It is also true that some design decisions are better made in the field than on the drawing board. The building in effect becomes a full scale working model with which to assess construction and design decisions. It was the opinion of the community and the design team that in many instances higher quality design decisions can be made in the field. There is a long standing architectural heritage of crafts people making design decisions. It seemed that a volunteer labor force made this possibility even more appealing. Consequently the design team devised two methods of describing the building.

Some things in these buildings had to be prescribed very specifically and subject to no interpretation. Things described in that way are foundations, major structural frame, secondary structural framing, the roof, and the floor.

Other things could be described by a limit method which specifies a range of acceptable performance for building elements. These might be interpreted in many ways provided they satisfy the performance criteria. Things that are described in that way are non-bearing partitions, openings and finishes. A limit method allows some decisions to be made in the field in order to take advantage of a special skill, labor source, or material availability. This attitude and method profoundly affects the content of construction drawings and specifications as well as the way they are prepared.

In this project, drawings precisely locate the prescribed elements in a conventional manner with detailed measurements and specifications. Other elements are only generally located and are intended to offer some flexibility in location and configuration.

The specifications have been re-arranged from a conventional construction trade oriented format to one that describes a sequential order of construction tasks more supportive of a primarily non-professional labor force. These specifications describe the building code and thermal criteria to which the building element or assembly must comply. A good example of this would be the exterior non-south facing walls which are non-bearing partitions occurring within a general defined zone on the plan and conforming to both Uniform Building Code Standards and a thermal performance described by the design team to meet a calculated solar energy performance. Issues such as thermal transmission, ventilation, openings, wind loading, and fire protection are approached in this specification.



Firehall Construction Drawing

ril 24, 1980.

1. GENERAL CONDITIONS

A. Deadwood Creek Services shall lay out the building in accordance with the drawings and shall be responsible for its accurate location on site.

B. All work shall be executed in accordance with the Uniform Building Code 1976 Oregon edition.

C. All product installations shall be made in accordance with manufacturer's specifications.

D. Deadwood Creek Services shall be responsible for construction procedures and methods, supervision and direction of the work and compliance with drawings and specifications. Architect's occasional supervision shall not relieve Deadwood Creek Services of these responsibilities.

2. PREPARING THE SITE

A. SITE GRADING

1. Existing conditions survey: topographic and boundary as performed by owner.
2. Staking: slopes and grades to be set by owner, in accordance with site drawing.
3. Rough grades shall be set to allow for thickness of finish material.
4. Final grade elevations indicated on drawings are finish grades.
5. Fill in planting areas shall be clean soil, reasonably free of vegetable matter and rock. Gravel fill may be used in non-planting areas.
6. Fill to be placed in paving areas shall be spread in layers not to exceed 8" in thickness and compacted with either roller or hand tamp. For fill under concrete slabs refer to Section 3-B.
7. Maximum grade deviation allowable on drainage swales and finish asphalt shall be ± 1".
8. Where cut exceeds 1 in 2 or fill exceeds 1 in 3 slopes must be stabilized to prevent erosion.

B. EXCAVATION

1. Excavation for column footings shall be made to a minimum depth of 2'-0" below existing grade.
2. All excavation shall be carried to solid bearing. If undesirable materials are encountered below depth shown, such materials shall be removed and replaced with concrete. No reinforcement or concrete shall be placed until excavations are inspected and approved.
3. Excavated portions of the work shall be kept free of water at all times until all concrete work and backfilling is completed.
4. Shore and brace excavations where necessary to prevent cave-ins, or to prevent any settlement of adjoining structures.

3. POURING THE FOUNDATION

A. SOILS

1. Design soil bearing pressure 1500 psf. Existing soil is sandy gravel.

B. FILL

1. Subgrade fill shall be a non-expansive soil or rock soil mixture which is free from vegetable matter or other deleterious substances, containing no rocks or lumps over 2½" in greatest dimension.
2. Cover subgrade fill with a 4" layer of crushed rock and a 2" top layer of sand.
3. Strip and scarify the existing subgrade soils of areas under concrete slabs to a depth of at least 6" or deeper where necessary to remove all soft spots, roots, organic material and other deleterious matter. Fill material shall be placed and uniformly compacted in layers not to exceed 8" to a minimum dry density equal to 90 percent of the maximum dry density in accordance with AASHO designation T 191 or equivalent. After compaction is completed, soil control tests may be required to verify compliance with these specifications.

C. BACKFILLING

1. Backfill utility trenches and against building foundation walls with gravel.
2. All footings, walls, etc., against which backfill will be placed shall be adequately spaced, shored to prevent displacement or damage while backfill is being placed.

D. COLUMN FOOTINGS

1. Place footings on undisturbed earth. Fill any excess cuts under footings with concrete. Minimum footing depth shall be 2'-0" below natural firm ground.
2. Concrete pads shall be 2500 psi reinforced with #4 bars at 12" O.C. each way.
3. Concrete piers shall be 2500 psi and reinforced as shown on drawings.
4. Metal column anchors to be placed in concrete as shown on details.
5. No concrete shall be placed until reinforcement is inspected and approved.

E. RETAINING FOOTINGS

1. Place footings on undisturbed earth. Fill any excess cuts under footings with concrete.
2. Concrete pads shall be 2500 psi reinforced as shown on drawings.
3. Concrete retaining walls shall be 2500 psi reinforced as detailed in structural drawings.
4. Insulate stem walls with 3" rigid insulation to depth of top of footing pad. Insulation shall be impermeable to water.
5. No concrete shall be placed until reinforcement is inspected and approved.
6. Reinforcing shall be intermediate grade deformed bars ASTM A.615 Grade 40. Lap minimum 36 diameter at splices, bend minimum 12 diameter welded wire fabric shall conform to ASTM A.185.

F. CONCRETE SLABS

1. Compact gravel fill before pouring floor slabs. See Section 3-B.
2. Install continuous 6 mil polyethylene vapor barrier before pouring slab.
3. Concrete slab shall be 2500 psi poured to a depth of 6" and reinforced as shown on drawings.
4. Concrete to be formed true and level to elevations shown on drawings.
5. Insulate slab with 3" rigid insulation up to 2'-0" horizontally from slab perimeter. Insulation shall be impermeable to water.
6. No concrete shall be placed until reinforcement is inspected and approved.
7. Score slab for crack control at intervals of 4' or less within firehall.
8. Expansion joint detail and reinforcing as shown on drawings.

4. ERECTING THE STRUCTURE

A. LUMBER GRADES

△ 1. All lumber shall be clearly labeled by an approved grading agency.
2. All structural lumber shall be No. 2 or better Douglas Fir cut 1/4" over sizes shown on drawings.
3. No checks, splits, etc. longer than the narrow face of beam shall be allowed. No knots shall be permitted within 24" of connections.
4. Moisture content of lumber shall not exceed 19% at time of fabrication.

B. HARDWARE

1. Bolts shall be unfinished machine bolts conforming to ASTM-307. Holes shall be 1/16" greater than bolt diameter. Retighten bolts at 6 months intervals until moisture equilibrium is reached.
2. Lag screws shall conform to ASTM-A 307. The lead hole for the threaded portion of shank shall be equal to 75% of the shank diameter. Lag screws shall be inserted with a wrench. Retighten lag screws at 6 months intervals following erection until moisture equilibrium is reached.
3. Shear plates shall conform to SAE-1010 specifications sized as noted on drawings.
4. Steel plates shall conform to ASTM A-36, sized as noted on drawings.
5. All bolts with shear plates shall have a round wrought iron washer of 2" minimum diameter or a cast or malleable iron washer of 3" minimum diameter installed between the wood and bolt head and between the wood and nut.

C. FABRICATION

1. All structure shall be braced until all connections, roof and lateral supporting elements are securely in place.
2. Built-up columns shall be bolted as shown on drawings.
3. Bolt holes shall be 1/16" larger in diameter than bolt diameter specified.
4. All nailing shall conform to table 25-P of UBC, unless otherwise noted.
5. Trusses and columns shall be inspected during fabrication.
6. All connections shall meet minimum requirements of the Uniform Building Code unless otherwise noted.

5. CONSTRUCTING THE EXTERIOR ENVELOPE

A. INSULATED ROOF

1. Framing lumber shall be 2" x 12" actual dimension Douglas Fir Grade No. 2 or better.
2. Sheathing shall be minimum 1" x 6" actual dimension Douglas Fir, Grade No. 2 or better, laid up diagonally. Wood shake roof covering requires that tongue and groove sheathing be used. △
3. △ Roof covering shall be Class C assembly of either asphalt shingles or wood shakes on 15# asbestos felt base sheet. Asphalt shingles shall be fastened with not less than 4 nails per each strip shingle not more than nominal 36" wide and 2 nails per each individual shingle not more than 18" wide. Wood shakes shall be laid with a side lap of not less than 1-1/2" between joints in adjacent courses. Spacing between shakes shall be not less than 3/8" or more than 5/8". Shakes shall be fastened to sheathing with 2 nails only, positioned approximately 1" from each edge and approximately 2" above the exposure line. Starter course at the eaves shall be doubled. Shakes shall be laid with no less than 18" wide strips of 15# asbestos felt shingled between each course in such a manner that no felt is exposed to the weather below the shake butts. Shakes shall be labeled No. 1 Cedar shakes.
4. Nailing. Diaphragm shall be nailed with 2 - 8d nails per board per rafter and 2 - 8d at each end. Butt splice only over rafter or block.
5. Insulation shall be 12" fiberglass batts (R-38).
6. Vapor barrier shall be a continuous film of 6 mil polyethylene.
7. Ventilation. Continuous cross ventilation shall be provided between sheathing and insulation, within each rafter space.

   Upper roof: Provide a continuous 3/4" wide gap between sheathing underside and the top of fascia, both at upper and lower edges of roof.

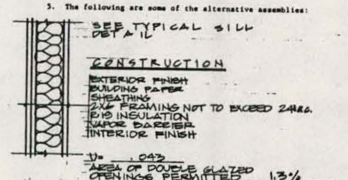
   Lower roof at clerestory: Provide a continuous 1/2" wide gap between sheathing underside and the top of fascia, at lower edge. At bottom of clerestory, see alternative clerestory glazing details.

B. UNINSULATED ROOF

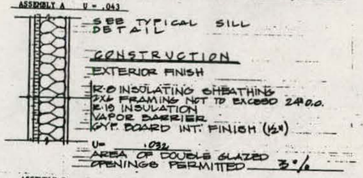
1. Framing lumber shall be 2" x 12" actual dimension Douglas Fir, Grade No. 2 or better.
2. Sheathing shall be minimum 1" x 6" actual dimension Douglas Fir, laid up diagonally.
3. Roof covering shall be either asphalt shingles or wood shakes on 15# underlayment. See section 5-A paragraph 3 for fastening specification.
4. Nailing. Diaphragm shall be nailed with 2 - 8d nails per board per rafter and 2 - 8d at each end. Butt splice only over rafter or block.

C. INSULATED NON-SOUTH SKIN

1. This assembly is indicated on architectural drawings as 'NON-SOUTH SKIN'.
2. Sheathing shall be 1" x 6" minimum. Siding shall be a minimum thickness of 3/8" backed with a water proof building paper.
3. Assembly shall have an average coefficient of heat transfer (u) of .05.
4. △ At firehall, provide operable ventilation openings along north side near floor. Covers should be insulated and weatherstripped. Total area should be approximately 48 sq. ft.
5. The following are some of the alternative assemblies:



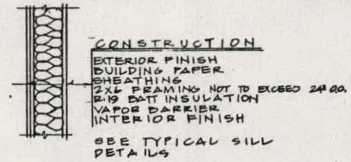
ASSEMBLY A U = .043



ASSEMBLY B U = .032

D. INSULATED SOUTH SKIN

1. This assembly is indicated on architectural drawings as 'INSULATED SOUTH SKIN'.
2. Sheathing shall be 1" x 6" minimum. Siding shall be a minimum thickness of 3/8" and backed with a waterproof building paper.
3. Assembly shall have an average coefficient of heat transfer (u) of .045.
4. The following are some of the alternative assemblies:



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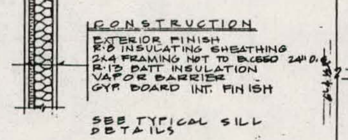

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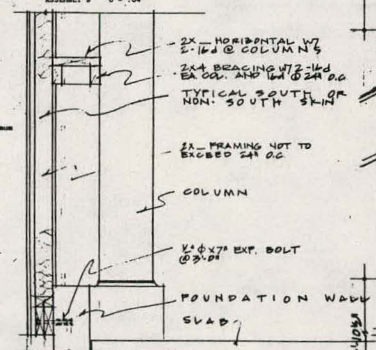
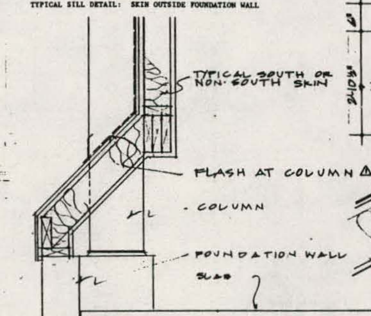


TYPICAL SILL DETAIL: SKIN OUTSIDE FOUNDATION WALL

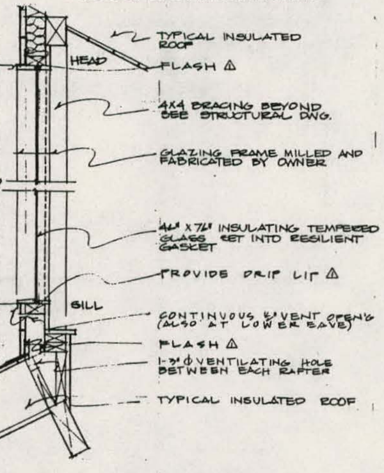


TYPICAL SILL DETAIL: SKIN INSIDE COLUMN

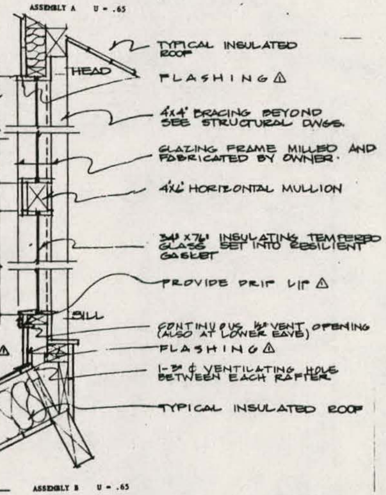
6. MAKING OPENINGS IN EXTERIOR ENVELOPE

A. Clerestory

1. This assembly is indicated on architectural drawings as 'CLERESTORY GLAZING'.
2. Assembly shall have an average coefficient of heat transfer (u) of .65 and use lights with a maximum area of 25 square feet each, and an approximate total area of 175 square foot.
3. Assembly shall use tempered glass with a minimum thickness of 1/8" and resist a wind load of 25 pounds per square foot.
4. Frame shall lap over glass a minimum of 5/16".
5. Glass edge shall have a minimum clearance of 3/16" set into a resilient setting material and secured in place on all four edges with a continuous glazing rabbet and glass retainer.
6. △ At firehall provide approximately 48 sq. ft. of operable glazing distributed over length of clerestory. Opening portions shall be weatherstripped.
7. Clerestory shall be shaded. See Section 7.
8. The following are some of the alternative assemblies:



ASSEMBLY A U = .65



ASSEMBLY B U = .65

EQUINOX DESIGN INC

DEADWOOD CREEK SERVICES
COMMUNITY CENTER AND FIREHALL
DEADWOOD CREEK ROAD
DEADWOOD, OREGON, 97430

4 24 80
REVISIONS: △ JUNE 5, 1980

FIREHALL AND PAVILION SPECIFICATIONS

SHEET S1 OF 23

Firehall Specifications

April 24, 1980

II - E. SUMMARY OF ENERGY ISSUES IN DESIGN PROCESS.

1) INTRODUCTION

Energy for the community of Deadwood and the design team is an issue intergral with economic, social, and political issues which all come equally to bear on the way they design. The meeting summaries document in some detail the compatibility of the architectural design with the values and program of the client but do not present a very ordered view of their meaning from an energy point of view.

It is difficult to isolate energy as a singular motivating attitude in the design process. Energy has nonetheless played a significant generative role in design and with some effort can be traced throughout this participatory process.

In order to do that it is necessary to reorganize the content of those design decisions independent of the time at which they happened. By discarding a sequential linear view of the design process energy based decisions can be made more clear.

Important design strategies are typically formulated at three scales of complexity; the site, the building, and the component. Within those three scales of decision making, it is possible to discuss the design strategies for passive solar heating, cooling and daylighting as they were derived with respect to both qualitative and quantitative aspects of performance and economic criteria. This portion of the report will also address information and design tools used or unavailable in making those decisions. Other sections of the report will address economic considerations in the selection of alternatives and the incremental costs of design time associated with passive solar systems.

E.-2. ENERGY ISSUES PRESENT AT SITE SCALE DESIGN

A) TASK OVERVIEW

Site level design decisions directly affecting passive solar heating, cooling, and daylighting were made at three different public meetings using five separate matrices. Site level design decisions occur primarily in early schematic design stages only. Energy consumption was seen to be influenced by design strategies concerning amount and location of buildings, their orientation to sun and wind as well as the overall mass they present on the site.

At a very preliminary stage, the design team and the building committee saw this task as minimizing the amount of thermally maintained indoor space and maximizing the potential utilization of sun and wind for heating and cooling of that which needs to be thermally maintained.

The first design strategy was addressed at the very first meeting of the design team and the building committee with a matrix intended to determine how much construction was actually required and what degree of enclosure was necessary to support the program. The matrix "Sizes of Spaces, Degree of Enclosure, Degree of Sharing" asks programmatic questions about how compact can these buildings become and how much infiltration-controlled space need be provided. This was accomplished by categorizing community center and firehall activities within a range of spatial alternatives. This step identified three separate parts to be dealt with on the site, a large enclosed meeting room that could be shared with other spaces, a large separate enclosed firehall and a large partially enclosed volleyball court. This information allowed the design team to formulate a further series of alternatives for arranging those pieces on the site based on their ability to use sun and wind to reduce energy consumption through heating, cooling, and lighting.

The next site level design strategy involved determination of a specific site or sites for these components given a land parcel elongated in a north-south direction. Site analysis data describing patterns of wind, sun, and flooding particular to this site was presented. A conceptual site use strategy was derived using the matrix "Distribution of Elements at Site Scale" which depicted diagrammatic alternative site plans which could be visually examined with a changeable site massing model. This process facilitated qualitative comparisons of site planning strategies with respect to maximum unobstructed south sun, free wind movement for ventilation and minimum site disturbance.

At a later more specific level of design, the configurations of those somewhat abstract geometric shapes located on the site began to gain dimension and proportion and be related to each other. In the matrix "Building Elements, Their Relationship to the Site and to Each Other" the design team presented to the building committee 30 different diagrammatic site and room arrangements ranging from one consolidated building to three separate buildings. Models of the three basic program volumes (the firehall, the meeting hall and the volleyball pavilion) were used to approximate the performance and appearance of the various arrangement alternatives. Those alternatives were compared qualitatively on the basis of their ability to provide unobstructed solar energy to the rooms that would best be able to use it. Alternative strategies were also assessed in terms of how much south facing skin area they could easily generate. Any scheme that provided a high percentage of south facing wall also presented a good orientation to the wind, facilitating summer cooling of the building and wind shading for adjacent south-facing outdoor spaces.

Having established an overall site design strategy that confined building to the north edge of the site extending in an east west direction from the road edge toward the creek, parking would occur to the north of the buildings and the septic drain fields to the southern end.

The matrix "Site Uses" seeks to establish a more definite placement and orientation for the program parts on the site.

Again, diagrammatic site plans and a changeable site model were used to specifically determine the orientation of the volleyball pavilion and location of the firehall. These were determined by how readily the firehall could have access to both sun and Deadwood Creek Road and how evenly the volleyball pavilion could be naturally lit when typically used in the afternoon, as well as the degree of protection it could offer to storms from the south and southwest.

Generally, site scale design decisions affecting energy consumption were confined to very early design stages and made qualitatively. The design team knew that solar energy, light, and wind were available on this site unobstructed, year round; the issue was how to utilize them. Design tools and techniques were selected on the basis of their ability to compare alternatives and assist decision making in public. These included the diagrams, matrices and models more thoroughly described and documented in the preceding design process description.

B) UNAVAILABLE INFORMATION

Much of the climate data, legal boundaries, soils and flooding characteristics particular to this site was by necessity gathered through the recollections and experience of valley residents. This was especially true of wind information where a long term average of wind speed and direction would have been of some assistance in planning for sheltered outdoor spaces.

Rules of thumb were used with respect to the amount of south-facing glass required. Generally stated this was achieving one-fourth the floor area in south facing glass in order to reduce heating energy consumption by 50 percent. This generalization is typical of buildings this size in this part of Oregon and was derived from S. Baker "Passive Solar Heating."

C) PERFORMANCE DESIGN INDICATORS

At the site scale, design strategies were formulated to address a heating energy problem. The initial goal was at least 50 percent of the total annual load. This was assumed to be achievable with siting strategies that produced unobstructed south facing glass roughly equal to one-fourth the enclosed floor area of the program.

D) ECONOMIC DESIGN INDICATORS

In this area of the design process no economic indicators were generated to complement the performance indicators. The unconventional nature of the financing and construction process for this project made it virtually impossible to formulate economic indicators.

ENERGY ISSUES PRESENT AT BUILDING SCALE DESIGN

A) TASK OVERVIEW

Building level design decisions affecting passive solar heating, cooling, and daylighting were made at six different meetings using nine separate matrices. They are by far the most extensively documented decisions with respect to energy.

The community had come to the design team wanting to build a solar heated building. Pre design tasks had identified that heating would be the dominant energy load in these buildings.

The design team and the building committee together defined this task as accommodating at least 50 percent of the building's annual heating load with solar energy. More was desired if possible, subject to an analysis of the impact on the architectural program. The goal would be renegotiated following some initial design studies into the scope and complexity of the problem.

In preliminary building level design decisions, the design was influenced by generalizations about an overall orientation and shape that would easily utilize passive solar energy. The designers offered some recommendations such as elongating buildings along an east west axis. It soon became clear that there was not sufficient site area to accommodate the program in a building of that shape. At that point a south facing clerestory was added to bring light and sun further into two almost square buildings.

Design tools facilitating that process had to include the participation of all members of the design team and the building committee in public meetings. As a result many of the alternatives were presented on matrices as sectional diagrams emphasizing orientation and potential aperture location, or models with moveable components that would demonstrate the volumetric and performance implications of an alternative under consideration.

A later design meeting began to attach some sizing data to design alternatives. Specifically three solar heating strategies were tested on a very schematic building design as derived from the previous meeting. The annual percentage of the heating load was assumed to be between 60 percent and 70 percent for each alternative. The rules of thumb for sizing the mass and aperture for each system were derived for the Oregon climate by Baker in "Passive Solar Heating." Diagrams described the size and location of aperture and mass with building sections and color codes (refer to solar heating, October 11, 1979).

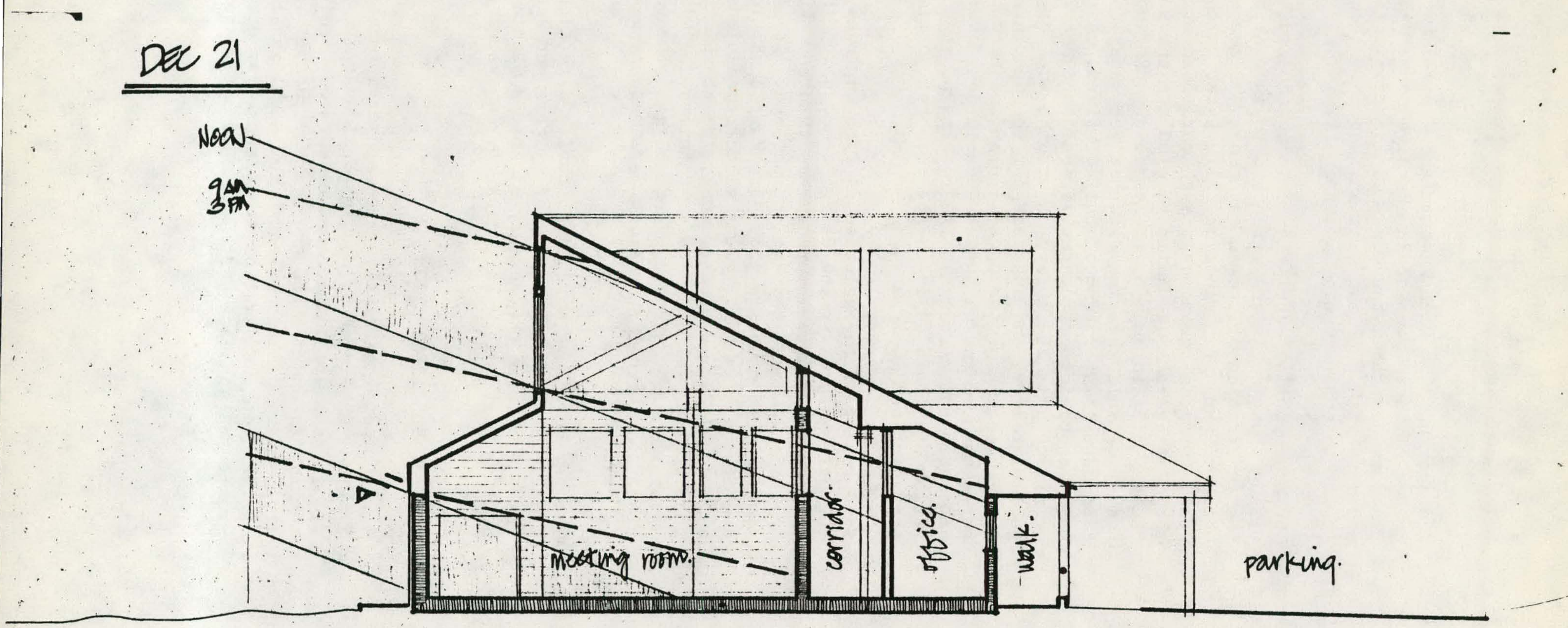
The accompanying schematic building sections summarizing those decisions were used to initially assess the penetration of the sun at noon on December 12, October/February 21, and June 21. Later in the design process a one-half inch cardboard model of the meeting hall was built to simulate the sun in the building throughout the year. By this point the number of solar heating alternatives under consideration were greatly reduced but not fixed. A trombe wall was preferred for the firehall and a combination of direct gain clerestory and trombe wall or direct gain clerestory and sunspace for the meeting hall. Annual heating performance simulations were prepared for shuttered and unshuttered variations over a range of thermostat settings. The results of that investigation are included in the performance portion of this section.

Fine tuning of the selected designs included detailed thermal analyses by the design team, using the TEANET program for hourly interior temperatures. When this analysis revealed that an unshuttered, direct gain system would maintain above freezing conditions in the firehall in cold, clear winter conditions (as well as milder, overcast ones), the trombe wall in the firehall was discarded. Detailed decisions as to aperture size and placement, thermal storage location, and thermal shuttering were made at meetings 6, 7 and 8.

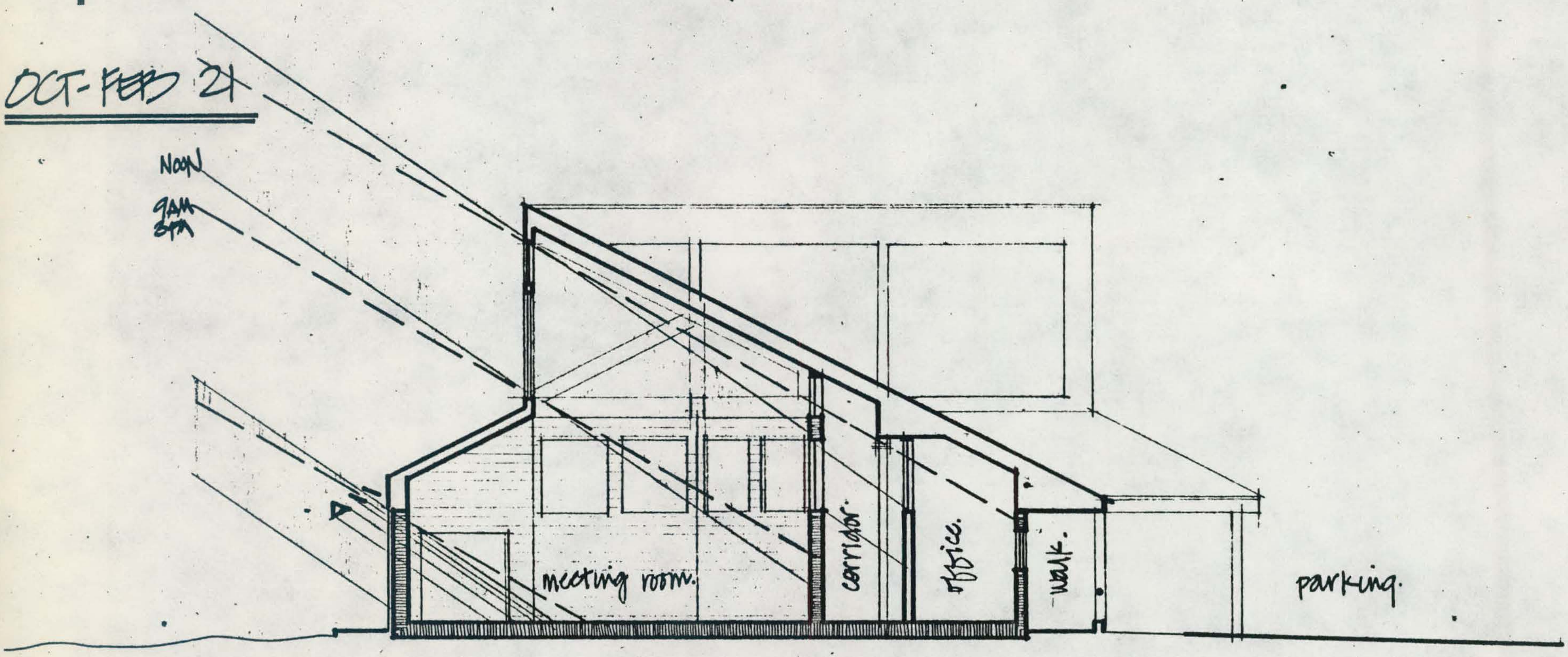
The two buildings moved in opposite directions in finalization; more variety of systems and shuttering methods serving the variety of spaces within the meeting hall; a simpler, unshuttered system in the firehall.

B) UNAVAILABLE INFORMATION

The community initially expressed an interest in the "thermal envelope" or double shell system. The design team had no performance data or prediction technique, and doubted the storage capabilities of this scheme. Rules of thumb for double-shell systems, in the same format as those for direct gain, trombe and sunspace systems, would have been useful.



schematic south · north section dec. 10, 1979
MEETING HALL



schematic south · north section dec. 10, 1979
MEETING HALL

Checking the Schematic Design with a Sunpeg — December 1970.

Testing the Schematic Design with a Sunpeg. December 1979.

During alternatives study, a somewhat more detailed rule-of-thumb procedure that included more precise ranges of percent solar, and internal temperatures to be expected (and their swings) would have been useful. (Balcolm's Passive Solar Design Handbook now provides this data.)

Testing of alternatives was somewhat limited by PASCALC's inability to include more than three passive systems within one building. A program on the TI59 that allows for four or five systems would be helpful.

Selection of the final design would be aided by an analysis technique for internal temperature swings that is more detailed than simply graphs as are found in Mazria's Passive Solar Energy Book, but considerably less tedious than the TEANET program for TI59 calculators. This could indicate the approximate times and temperatures of expected highs and lows, without yielding intermediate hourly data.

Development of the final design of the meeting hall was somewhat hampered because we were limited to an internal temperature program that has but seven nodes. In a building with several passive systems and storage mass types and locations, seven nodes is inadequate. A TI59 program that allows for more variety is needed.

C) PERFORMANCE

The goal of at least 50 percent solar heating was a joint decision of the community and the design team. "The more the better" was understood, with wide temperature swings made less threatening by a wood stove back-up system (rapid heat-up) and consistently cool exterior air (rapid cool-off). Operable windows and a central wood-stove location were thus early design strategies.

The investigation of basic solar alternatives is best described in the matrix summary for Solar Heating (meeting 4). The most obvious trade-offs involved a rejection of multiple clerestories that the sawtooth roof scheme would provide, and the added thermal mass that a concrete floor would give to the highly solar heated spaces of the meeting room and the kid's room.

Testing of the alternatives is described in the matrix summaries for Methods of Solar Heating, Storage, and Shuttering (Meeting 7) and Thermal Storage Options and Thermal Shuttering Options (Meeting 8).

The numerical analysis consisted mainly of PASCALC simulations for variations on both the meeting hall and firehall basic designs. A limitation of PASCALC is that only three separate passive systems can be examined simultaneously. The meeting hall utilizes four: clerestory direct gain; lower direct gain windows; masonry trombe; water trombe.

Thus, to examine impacts of shuttering each of four systems, we ran six alternatives:

A. Shuttered clerestory and lower direct gain windows

   1. unshuttered masonry and water trombe
   2. shuttered water trombe, unshuttered masonry trombe
   3. shutters everywhere

B. All trombe walls assumed to be water walls

   1. clerestory shuttered; all else unshuttered
   2. all shuttered except lower direct gain windows
   3. shutters everywhere.

A close correspondence between A1 and B1, as well as between A3 and B3, is expected; they differ only because the A group distinguishes between masonry and water trombes.

For the firehall, the alternatives were more distinct: All direct gain compared to half direct gain and half trombe wall; shuttered or unshuttered; and interior set temperature, which could safely go as low as 40°F.

A. Half direct gain, half trombe wall.

B. All direct gain.

COMPARISON OF ALTERNATIVES USING PASCALC.

ALTERNATIVE NUMBER	MAJOR VARIABLES	MINOR VARIABLES	Tset °F	AIR CHANGES PER HR.	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	SOLAR / AUX. ENERGY
A	DIRECT GAIN SYSTEMS COMBINED & ASSUMED TO BE SHUTTERED. TROMBES ISOLATED	1. UNSHUTTERED EVERYWHERE	65°	1.5	.27	.48	.58	.71	.89	—	—	.84	.43	.26	48% – SOLAR
					23.03	11.95	9.47	4.55	.94	—	—	1.81	12.43	21.2	85.38 – AUX. ENERGY
		2. SHUTTER WATERWALL UNSHUTTERED TROMBE	65°	1.0	.38	.64	.74	.86	.97	—	—	.95	.59	.36	60%
					14.2	5.82	4.17	1.58	.13	—	—	.39	6.24	13.07	45.58
		3. SHUTTERED EVERYWHERE	65°	.5	.61	.87	.93	.98	—	—	—	—	.83	.60	79%
					6.38	1.26	.68	.08	—	—	—	—	1.45	4.92	13.77
B.	TROMBES COMBINED DIRECT GAIN CLERESTORY ISOLATED	1. SHUTTERED CLERESTORY UNSHUTTERED ELSEWHERE	65°	1.5.	.26	.45	.55	.68	.87	—	—	.82	.41	.25	46%
					23.71	12.7	10.25	5.04	1.08	—	—	2.05	13.07	21.82	89.72
		2. SHUTTERED CLERESTORY SHUTTERED WATERWALL	65°	1.0	.37	.63	.73	.85	.98	—	—	.95	.58	.36	60%
					14.5	6.09	4.30	1.60	.10	—	—	.37	6.51	13.35	46.88
		3. SHUTTERED THROUGHOUT	65°	.5	.64	.89	.95	.99	—	—	—	—	.86	.63	81%
					4.67	.95	.47	.03	—	—	—	—	1.11	4.26	11.48

MEETING HALL PASCALC SUMMARY 4 MARCH 1980

SUMMARY OF RESULTS OF MEETING HALL ALTERNATIVE ANALYSIS

ONLY CLERESTORY SHUTTERED (B-1)
46% solar heated; 85.4 MBTU auxiliary needed

ONLY LOWER DIRECT GAIN UNSHUTTERED (B-2)
60% solar heated, 46.9 MBTU auxiliary needed

ALL SYSTEMS SHUTTERED (A-3)
79% solar heated; 13.8 MBTU auxiliary needed

Thermal shuttering throughout all passive systems results in a significant decrease in wood needed for auxiliary heating.

Removing shuttering from either lower direct gain glass, or from trombe walls, results in an approximately threefold increase in auxiliary heat, over the fully shuttered condition.

DEADWOOD COMMUNITY CENTER: FIREHALL — 4 MARCH 1980

Alternative Number	Major Variables	Minor Variables	Tset °F	Air Change per Hr	January	February	March	April	May	June	July–October	November	Dec	Total
A 40°	40° Tset, 2 passive solar systems D-G and block-trombe	1. No shuttering	40°	2	.96	–	–	–	–	–	–	–	–	96%
					.05	–	–	–	–	–	–	–	–	.05
		2. Clerestory shuttered	40°	1.5	.98	–	–	–	–	–	–	–	–	98%
					.02	–	–	–	–	–	–	–	–	.02
		3. All shuttered	40°	1.0	–	–	–	–	–	–	–	–	–	100%
					–	–	–	–	–	–	–	–	–	.00
A 50°	50° T-set, two systems direct gain + block-trombe	1. No shuttering	50°	2.0	.40	.77	.85	–	–	–	–	.77	.43	58%
					3.94	.70	.44	–	–	–	–	.60	3.12	8.80
		2. Clerestory shuttered	50°	1.5	.51	.87	.92	–	–	–	–	.87	.54	68%
					2.53	.33	.19	–	–	–	–	.28	1.98	5.30
		3. All shuttered	50°	1.0	.69	.97	.99	–	–	–	–	.97	.72	82%
					1.21	.05	.01	–	–	–	–	.05	.91	2.23
A 60°	60° T-set, two systems direct gain + blk-trombe	1. No shuttering	60°	2.0	.23	.41	.49	.61	.84	–	.77	.37	.23	41%
					9.26	5.10	4.35	2.17	.42	–	.92	5.10	8.43	35.75
		2. Clerestory shuttered	60°	1.5	.29	.49	.57	.70	.90	–	.84	.45	.29	48%
					6.72	3.46	2.84	1.32	.20	–	.79	3.51	6.13	24.68
		3. All shuttered	60°	1.0	.43	.69	.78	.89	.99	–	.97	.65	.42	65%
					4.05	1.56	1.09	.37	.02	–	.07	1.69	3.74	12.59
B 40°	40° T-set, all direct gain	1. No shuttering	40°	2.0	.99	–	–	–	–	–	–	–	–	99%
					.01	–	–	–	–	–	–	–	–	.01
		2. Clerestory shuttered	40°	1.5	1.00	–	–	–	–	–	–	–	–	100%
					00	–	–	–	–	–	–	–	–	.00
		3. ~~AB~~ All shuttered	40°	1.0	1.00	–	–	–	–	–	–	–	–	100%
					00	–	–	–	–	–	–	–	–	.00
B 50°	50° T-set, all direct gain	1. No shuttering	50°	2.0	.47	.85	.92	–	–	–	–	.85	.49	64%
					3.72	.50	.27	–	–	–	–	.43	2.92	7.84
		2. Clerestory shuttered	50°	1.5	.58	.93	.97	–	–	–	–	.93	.60	74%
					2.36	.18	.07	–	–	–	–	.16	1.82	4.60
		3. All shuttered	50°	1.0	.73	.99	1.00	–	–	–	–	.99	.76	85%
					1.12	.03	–	–	–	–	–	.02	.83	2.00
B 60°	60° T-set, all direct gain	1. No shuttering	60°	2.0	.27	.47	.56	.69	.91	~~.84~~	.84	.43	.26	46%
					9.30	4.82	3.96	1.83	.26	~~.66~~	.66	4.83	8.49	34.22
		2. Clerestory shuttered	60°	1.5	.34	.58	.68	.80	.96	–	.92	.53	.33	55%
					6.75	3.06	2.01	.92	.08	–	.25	3.20	6.18	22.75
		3. All shuttered	60°	1.0	.45	.73	.82	.92	–	–	.98	.69	.44	67%
					4.15	1.44	.94	.28	–	–	.04	1.60	3.84	12.29

SUMMARY OF FIREHALL PASCALC RUNS

SUMMARY OF RESULTS OF FIREHALL ALTERNATIVE ANALYSIS

At 40°F set temperature, the two passive alternatives, with no shuttering, were essentially 100% solar heated, requiring less than 1 MBTU of auxiliary heat annually.

A later design meeting came to refine those earlier decisions and more accurately assess the amount of aperture, mass and shuttering required to maintain 60% - 70% of the yearly heating load with solar energy (refer to solar collection and storage methods of shuttering, January 22, 1980). At this point the buildings as designed were examined for potential locations of sufficient thermal mass in the floors and walls as well as for alternative solar collection methods and south wall configurations. Each alternative was tested for its annual solar performance and approximate thermal swing characteristics on an average and a clear day. Thermal swings were graphed for a variety of mass types based on Mazria "Passive Solar Energy Book."

Once thermal mass alternatives were selected, a TEANET analysis was prepared to confirm the estimates made with more approximate graphic methods.

THERMAL SWING INVESTIGATION MEETING HALL

A representative clear January day was selected from among the past 12 years of Eugene climatic data. On this day, a low of 22° and high of 56° occurred. Two successive such days were assumed.

A 7-node network (TEANET) was set up for the meeting room and contiguous spaces (direct gain with small water wall), excluding the kids' room. A separate 3-node (TEANET AUTOMATRIX) network was set up for the kids' room (water wall). No heat exchange was assumed between these networks. Thermal shutters were assumed for both networks.

Internal gains were assumed as follows:

	Meeting room	Kids' room
Midnight-7AM	0.1 watts/sf	0.1 watts/sf
7 AM-4 PM	1.0 watts/sf	10 kids (= 5.4 watts/sf)
4 PM-Midnight	1.0 watts/sf	0.1 watts/sf

No auxiliary energy was assumed nor any venting in response to overheating. Beginning at 65° for all nodes, the results were as follows:

	Meeting room		Kids' room	
First day	Air temp.	Mass surface temp.	Air temp.	Water wall temp.
low:	51.5° at 9 AM	59.5° at 8 AM	55.4°	62.2° both at 8 AM
high:	69° at 9 PM	98° at 3 PM	81.1°	84° both at 5 PM
Second day				
low	55.8° at 9 AM	65.5° at 8 AM	64°	75.4° both at 8 AM
high:	72.7° at 8 PM	103.6° at 3 PM	87.5°	94° both at 5 PM

INTERPRETATION:

Overheating does not appear to be a serious problem in the meeting room/contiguous spaces; at the time the mass surface temperature was almost 104°, the air temperature was 68° (this, on the second successive clear day). The temperature outside at this hour was 55.4°.

Overheating does occur in the kids room; yet during the overheated period, a reservoir of much cooler air is available from the adjacent meeting room/contiguous space area. This suggests that provision be made to allow hot air to leave the upper area of the kids' room, to enter the higher meeting room space, while cooler meeting room air be admitted low in the kids' room.

	Meeting room air t.	Kids' room air t.	Exterior t.
1st day			
4 PM	64.9°	80.5°	53.7°
5 PM	64.3°	81.1°	51°
9 PM	69°	76°	34.6°
2nd day			
Noon	59.9°	76.1°	53.7°
2 PM	65.6°	83.1°	56°
4 PM	68.4°	87.2°	53.7°
6 PM	70.6°	86.3°	47.5°
8 PM	72.7°	83.8°	39°
10 PM	72.1°	81°	30.5°

THERMAL SWING INVESTIGATIONS, FIREHALL

The primary purpose here was to compare the lowest internal temperature expected (under rather extreme conditions) in the all-direct-gain alternative and the half direct gain-half trombe alternative.

A particularly cold, clear January day was selected from among the past 12 years of Eugene climatic data. On this day, a low of 17°F and a high of 33°F occurred. Two successive such days were assumed.

A 5-node network (TEANET, Automatic) was set up. No internal gains were assumed, no thermal shutters were assumed, nor any venting in response to overheating. Beginning at 55°F for all nodes, the results were as follows:

	Half direct gain Half masonry trombe	All direct gain
First day		
low:	34° at 8 AM	36° at 8 AM
high:	69° at 4 PM	82° at 3 PM
Second day		
low:	33.7° at 8 AM	38° at 7 AM
high:	70° at 4 PM	85° at 3 PM

INTERPRETATION

The all-direct gain alternative stays somewhat further above freezing than the half-masonry-trombe alternative, and overheating is not a factor in an unoccupied firehall.

Given the cheaper cost of the all-direct-gain alternative, the added daylighting (for occasional maintenance) in the firehall, and especially the display potential of the fire equipment inside the lower clear glazing, the all-direct gain alternative became the clear choice.

THERMAL SHADES SHUTTERS

Thermal shutters had been assumed to be required all through the design process. The clients were very interested in reducing auxiliary energy consumption to the lowest level possible given their selection of solar aperture and thermal mass strategies. Shuttered building designs for the meeting hall reduced auxiliary energy consumption to approximately 1/8 that of an unshuttered design, improving the solar load ratio by approximately 25 percent.

Based on PASCALC simulations of the firehall, it was possible to maintain the desired solar performance and auxiliary energy consumption without the use of any shuttering devices at all. Consequently, they were eliminated from the design.

SHADING

Protection from summer sun at south glass can be provided either by fixed devices of by seasonally installed devices that admit April sun, but exclude August sun. While seasonally installed methods are clearly preferable, our performance analysis assumed fixed devices for all lower glass (due to covered exterior walkways) and seasonally installed shading on clerestories. This was presented to the community as being either roll-down screens or deciduous vegetation (see Matrix Seventeen, adjacent spaces).

COOLING

Cross ventilation will be used to cool the building, with at least the UBC minimum of 5 percent of floor area in operable glass assumed to be adequate, especially when combined with night ventilation of thermal mass during hottest weather.

DAYLIGHTING

Daylighting for most spaces is assumed to be minimally adequate by providing UBC minimum of 10 percent floor area in glazing. The clerestory and south glazing increase this minimal daylight substantially.

From a performance viewpoint, design selection and development was guided largely by the use of the TEANET program for TI59 calculators.

The most significant development that resulted was the elimination of the trombe wall in the firehall, when an unshuttered direct gain system, utilizing the concrete floor as its only thermal mass, was predicted to remain above freezing under cold, clear winter conditions.

The community was pleased that the final design gave them, in comparison to more conventional schemes, buildings that were more brightly daylit, spatially unique, and were more able to display internal activities to those outside such as the view of the fire truck through south glazing.

E) ARCHITECTURAL COMPATIBILITY

The first solar option to be discarded was the thermal envelope, or double shell, scheme; while the designers' unfamiliarity was a large factor, so also was the community's relatively low priority for a "greenhouse," as indicated by an early survey (see Meeting One).

An early indicator of potential solar compatibility problems were the community's design for rural-character exteriors, for which large expanses of south glass are distinctly atypical.

The design alternatives that became the casual ty of incompatibility were all those involving "sawtooth" roofs, which offered the somewhat square meeting room plan, and the north-south elongated volleyball pavilion, ample south glass in clerestories. The sawtooth was unanimously and repeatedly rejected by the community, as being representative of urban industrial buildings, therefore distinctly incompatible with their rural environment.

A single, large clerestory, on the other hand, was welcomed as not only identifying the meeting room from the exterior, but also providing the unique interior space that the community desired for its meeting room. (See summaries for Form of Meeting Room and Relationship to Other Rooms, Meeting 2, and Meeting Room Form and Building Configuration, Meeting 3).

During testing of the alternatives, further modification to building form were made, sometimes reducing solar aperature in favor of overall building form relationships. Again, sawtooth possibilities were rejected; even the main clerestory was reduced in length to allow for increased compatibility with rural building forms. See the matrix summaries for Building Form, and for Solar Heating, Meeting 4.

In the process of selecting a final design, a continuous south wall was favored for the meeting hall, despite its variety of passive systems. These decisions are detailed in the matrix summary for Plan Refinement and Solar Collection and Storage, Methods of Shuttering, Meeting 7. Thus, while a variety of systems was desired both from a functional (zoning) and a community-educational viewpoint, the expression of that variety on the exterior became incompatible with the relatively simple exterior appearance that was desired.

Thermal mass and shuttering were the focus of decisions made in the development of the final design. The community wanted a variety of storage and shuttering methods, again for educational purposes, but also because locally produced thermal shutter or shade devices promised a potential cottage-industry development. Both automatic and manual shutter operations were ultimately accepted. A more complete discussion appears in the matrix summary thermal shutter option and thermal mass options, meeting 8. Again, wooden floors were insisted upon, functionally, for meeting room and kids room, despite the need for thermal mass in both spaces.

The community expressed willingness to manually operate some shutters, while relying on automatic devices for critical areas such as the main clerestory, and lower trombe walls. In addition, the labor-intensive wood stove back-up heating system was reaffirmed for the meeting hall both as an indigenous and renewable source, and as a way to achieve conservation (no fire = cold building when unused). (For extreme cold weather back-up, very small electric baseboard heaters with low-set thermostats will be installed both in the firehall and in meeting hall rooms containing plumbing.) A solar domestic hot water system, using active drain-down collectors, is also detailed.

The community's response is discussed both in the summary for meeting 5 (at the site) and in the strategy for construction drawings and specifications (meeting 8).

ENERGY ISSUES PRESENT AT COMPONENT SCALE DESIGN

A) TASK OVERVIEW

Component level design decisions directly affecting passive solar heating, cooling and daylighting were made at two different public meetings using three separate matrices and were later developed in more detail by the design team outside of the public meeting format. Energy consumption was seen to be affected by the relative efficiency of the component to block or admit sun, store and release solar energy, reduce or increase heat loss, and be supplied or fabricated at a local or regional scale.

The design team and the building committee saw this task as developing the components necessary to meet a solar energy utilization goal of 60-70 percent, demonstrate a variety of solar technologies to the public and express the more particular needs of the program parts or their location. Development of a unified hardware identity for the buildings was not an issue. To a certain extent, component choice and design were also a part of a group of design decisions that were thought to be better addressed in the field, with the buildings under construction and the volunteer labor force more able to assess the technology and level of finish appropriate to the spaces they have just built. Consequently most energy related components were discussed, evaluated and specified in terms of a performance level they have to meet in order to allow the building as a whole to comply with solar and architectural criteria. Energy related component scale decisions then had to be made for thermal shuttering, shading, thermal mass and domestic hot water heating.

SHUTTERING

The amount of mass, aperture, and skin area determined at the building scale required that at least the meeting hall be mostly shuttered and summer shaded in order to maintain an acceptable level of comfort as an assembly space reliant on natural systems. A matrix "Solar Collection and Storage, Methods of Shuttering" was the means by which shuttering and storage strategies were formulated. That matrix identified three operational different means of shuttering the building. They were all assumed to be of relatively equal thermal characteristics and were evaluated qualitatively on the basis of their ability to be effectively applied to the architectural, maintenance, and construction criteria of the building committee.

On the basis of that discussion the following strategies were proposed: The clerestory would use an inside flap in order to regulate the amount and quality of daylight entering through its large glazed area from the interior. And, other openings were to use roll down curtains since they represent the most flexibility and potential for demonstration of alternatives and community fabrication. They also presented the greatest range of insulating ability within a fairly simple technology.

Outside flaps, while presenting the opportunity of reflector enchancement of solar systems, were eliminated because of their maintenance problems and susceptibility to damage in a public building. Similarly, inside flaps were also rejected in areas with high public contact where they might come in conflict with building uses.

Later, those initial strategies were further refined with thermal shutter options, a chart which compared materials, product options and installation details. These very specific alternatives were discussed on a location by location basis with respect to their ability to admit or block sun and light, work manually or automatically and demonstrate an insulating principle or technology of community interest.

The following products were selected. The clerestory would be shuttered by 'Skylid' by Zomeworks. This responds to a need for an automatic device situated high above the floor. The location is probably the most publicly visible place in the building and its demonstration of a simple technology to open and close automatically was a significant issue in its selection. 'Skylid' could also be used to modify the amount, quality, and direction of daylight entering the building from above.

Trombe walls would be automatic roll-up roll-down curtains. 'Insulating Curtain Wall' by Thermal Technology Corporation was selected for the children's room and the meeting room. This choice responded to a need for an automatic device in a location with limited accessibility. Since these were installed 'outside' the room, level of finish and their ability to modify daylight was much less of an issue.

All other openings would be shuttered with a range of simple curtain type shutters. It was preferred that these be a locally fabricated product. The design team would specify an insulating value for the assembly and investigate options for local fabrication.

In the firehall, shuttering was considered and then ultimately eliminated. The building as designed had a sufficient aperture and mass to maintain an acceptable temperature without insulating shutters. This was mostly because extreme thermal swings were not a significant design issue due to its sole function of storing emergency vehicles.

THERMAL MASS

The location and amount of mass available for thermal storage had been determined using the matrix "Solar Collection and Storage." There would be concrete slab everywhere but the children's room and meeting room. The meeting room would have a masonry trombe and the children's room a water trombe. Unresolved at this point was the material character and finish at these mass locations.

These more detailed decisions were made with 'Thermal Mass Option' a chart which compared material or product options with approximate cost and installation details. Options were assumed to be of similar performance ability.

These very specific alternatives were discussed and evaluated with respect to their initial cost and architectural compatibility. There was also expressed a desire to construct and demonstrate a range of methods of storing solar energy within the limitations of the volunteer labor force.

In the meeting room the building committee asked to postpone this decision while they continued to research the implications of using the masonry walls structurally in the children's room. Kalwall storage tubes were selected since they are more stable than bottles and can admit light as well as store energy.

SHADING

Decisions about shading components were made a least in part in a design meeting using the matrix 'Adjacent Spaces.' That matrix identified the nature and character of roof coverings adjacent to the buildings. At that time, roof coverings outside the children's room and the meeting room were to be clear with louvres. The clerestory of both buildings was left undecided pending further investigation of alternatives by the design team.

Ultimately it was decided that easily accessible sharing components be seasonally variable. At the meeting hall this became canvas shades suspended from the walkway roof during overheating months. Louvres were also designed for these south walls but would only be installed should the simpler canvas shades prove unsatisfactory.

The clerestory will be shaded by fixed louvres, 'Skylid' shutters or adjustable bamboo blinds. This decision was one of many to be made by the community during construction as material, economic and labor resources are better defined.

The lower portion of the firehall will be seasonally shaded by deciduous vines along the arbor walkway from the road. Louvres were also designed for this wall and would be installed should the vines and arbor not provide satisfactory shading. The clerestory, like that of the meeting hall will be shaded by adjustable bamboo blinds or fixed louvres as determined by the community during construction.

DOMESTIC HOT WATER

The amount of hot water required in the building is very slight. An active solar draindown system was selected for the building primarily to demonstrate that technology to the community and users of the building. This component system was selected because it can be locally built from a kit, designed, tested, and produced for Oregon.

B) UNAVAILABLE INFORMATION

Virtually all the information required to make these component selections was reasonably accessible through publications or by telephone. Some in-place evaluation and examination of a few products such as 'Skylid' or 'Curtain Wall' would have been of some benefit.

PART III: DOCUMENTATION AND EVALUATION OF THE FINAL DESIGN

III-A INCREMENTAL PASSIVE DESIGN COST BREAKDOWN

INTRODUCTION AND OVERVIEW

The project incurred additional costs as a result of the passive solar design. Most of these costs were in staff design time not expenses or consultant fees. Of the total time spent on the project, approximately 19 percent of it can be allocated to the passive solar design. Because of the "learning curve" we estimate that future solar projects will have 12 percent more design time than that required for a conventional building.

III-A. INCREMENTAL PASSIVE DESIGN COST BREAKDOWN

	Labor (hrs)	Miscellaneous Expenses		Special Expenses	
PRELIMINARY DESIGN PHASE					
Preliminary Design (energy needs/site potential)	80	Oct.	$154.76		
Design Program (design indicators)	40	½ Nov.	118.07		
Information Seminar	48#				
	168				
DESIGN ALTERNATIVES					
Design Development (schematic alternatives)	65	½ Nov.	118.07		
Design Alternatives# (schematic alternatives)	40	Dec.	75.67	Alternative Review	$301
Evaluation# (design selection	48	Jan.	35.23	TI-59 cards	$205
		Feb.	41.00	TI-59	$465
Detailed Analysis (performance testing)	48				
	201				

	Labor (hrs)	Miscellaneous Expenses		Special Expenses	
FINAL DESIGN					
"Proposal"#	48	Mar.	29.36		
Final Review#	24	Apr.	71.00	Daylight Protractors	$ 46.44
Construction Documents (design development)	85	May	0 (out of $)		
Construction Supervision	30				
	187				

	Typical for Future Passive Design Efforts	Dedicated to staff learning time Information collection, etc.
Preliminary Design	120/168 = 70%	48/168 = 30%
Design Development	113/201 = 55%	45%
Final Design	115/187 60%	72/187 = 40%

Dedicated to learning time, information collection, etc.

III B. FINAL PERFORMANCE ANALYSIS

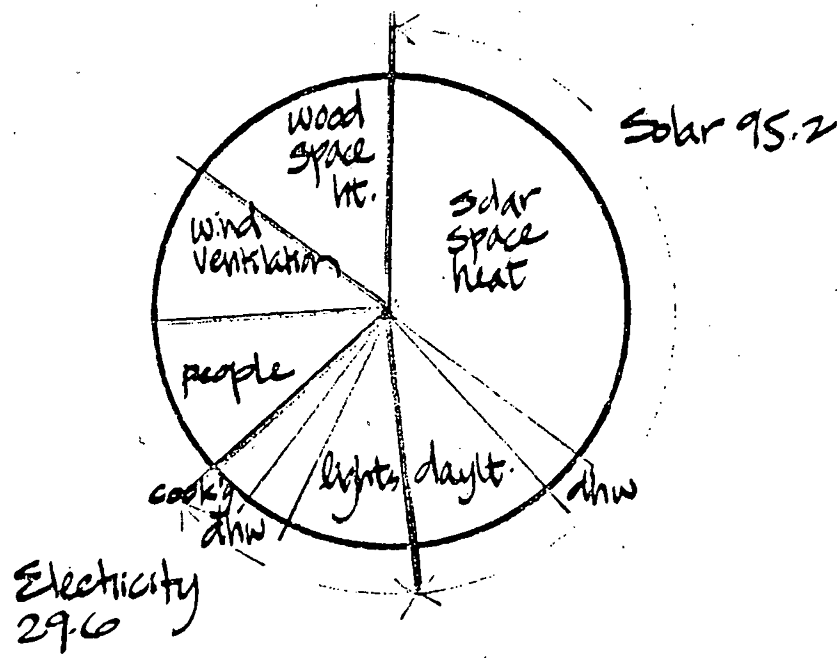
The following graph is based upon calculations for the meeting hall building as designed, assuming full use of thermal shutters.

A comparison between the preliminary view and the final calculations indicates similar performance, as would be expected from the similarities between this project and the commercial project (as adjusted) used as a guide to the preliminary calculations. Certain differences are also evident: we underestimated the heat contributed by people, and overestimated the need for electric lighting. The earlier project had a larger ratio of windows to floor area, so our final design needed much less space heating per square foot floor area.

MEETING HALL FINAL DESIGN

TOTAL ENERGY NEEDS: 76,500 Btu/sf-yr.

FLOOR AREA: 2,555 SF

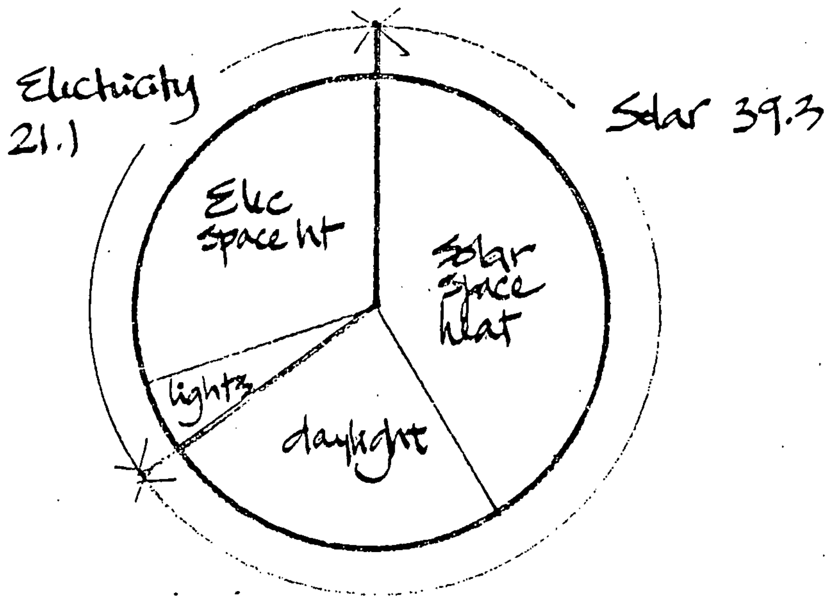


SOLAR SPACE HEAT
WOOD STOVE SPACE HEAT
DAYLIGHT
ELECTRIC LIGHT
WIND VENTILATION
SOLAR DHW
ELECTRIC DHW
ELECTRIC RANGE

FIREHALL FINAL DESIGN

TOTAL ENERGY NEEDS: 63,600 Btu/sf-yr.

FLOOR AREA: 950 SF



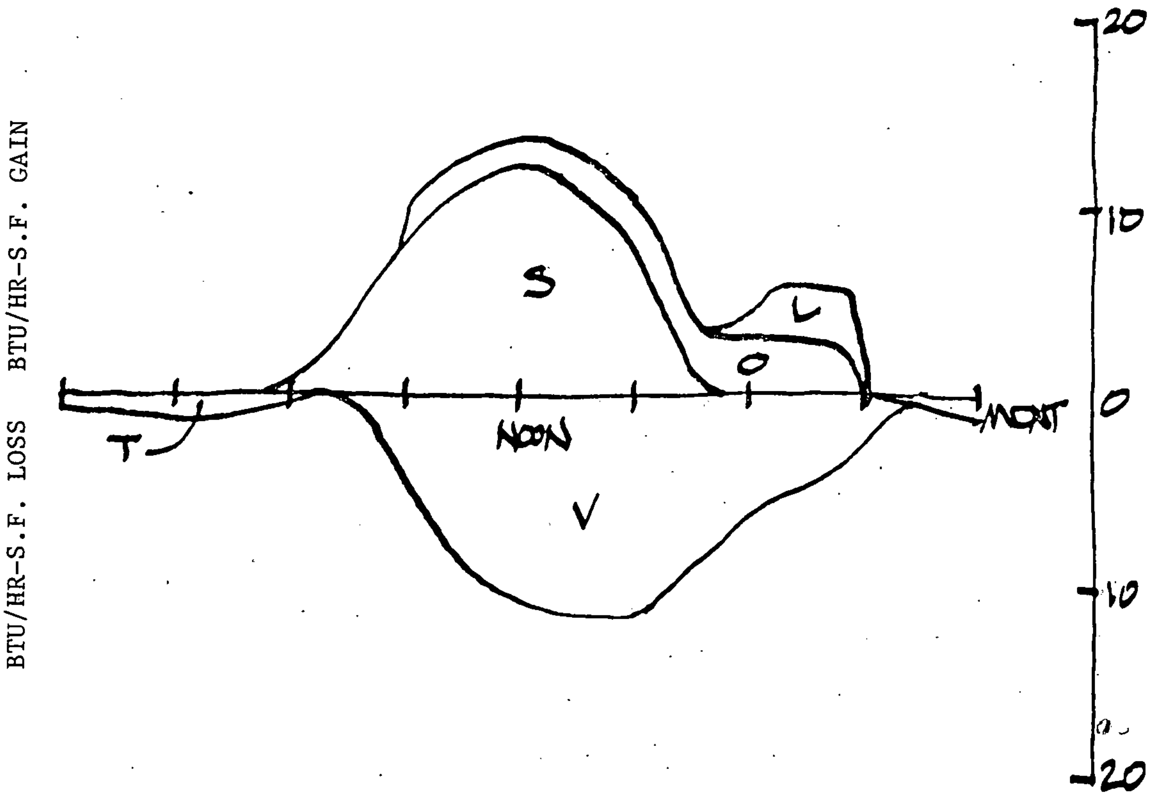
SOLAR SPACE HEAT
ELECTRIC RESISTANCE SPACE HEAT
DAYLIGHT
ELECTRIC LIGHT

The firehall's energy needs, based upon calculations as designed, indicated more energy consumption per square foot than we had estimated. This is primarily due to the users' decision not to utilize shutters on their direct gain, low internal temperature building.

DAILY LOAD PROFILES

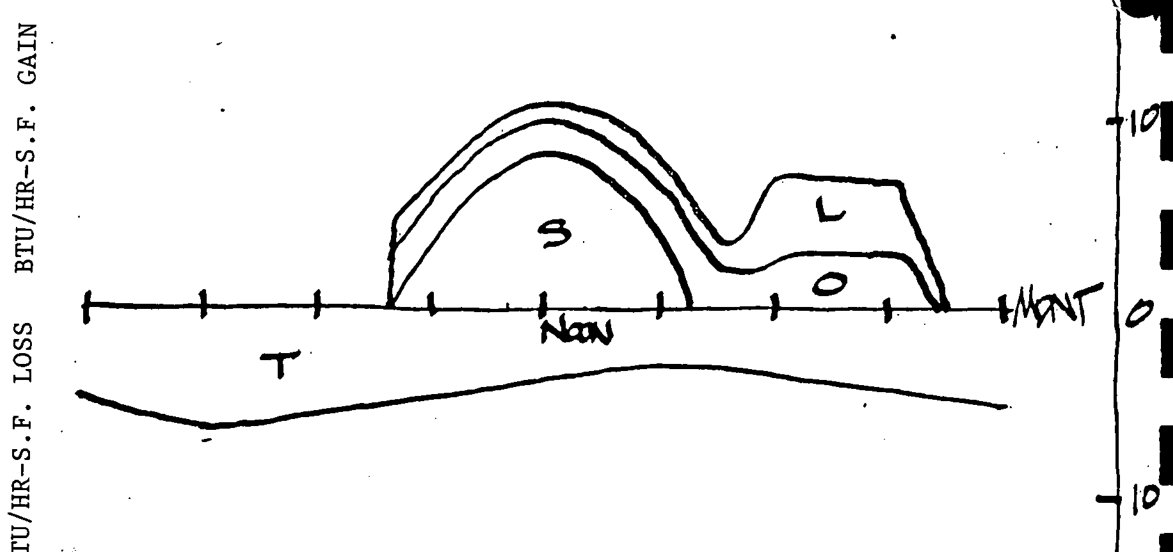
The daily load profiles were derived from the PASCALC (Solar Fraction) analysis, with a simplified heat gain analysis used for summer performance. The transfer of information from monthly data to an hourly graph was somewhat time consuming, and yields only approximately accurate results.

MEETING HALL
AVERAGE SUMMER DAY



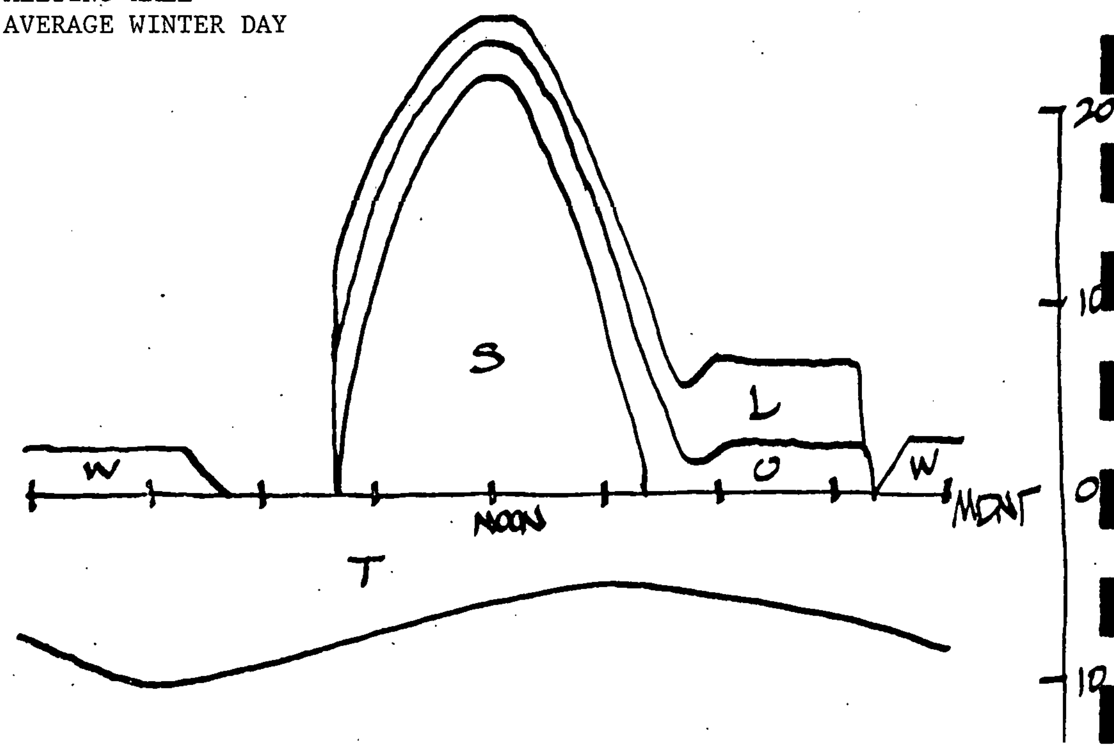
NOTE: Cross ventilation is provided to keep interior temperature within 3°F of exterior conditions. Under average Oregon conditions, this internal temperature is acceptable. Evenings present a special problem of lighting and people gains in addition to solar gain; cool evening exterior temperatures are available to keep cross ventilation effective.

MEETING HALL
AVERAGE FALL DAY



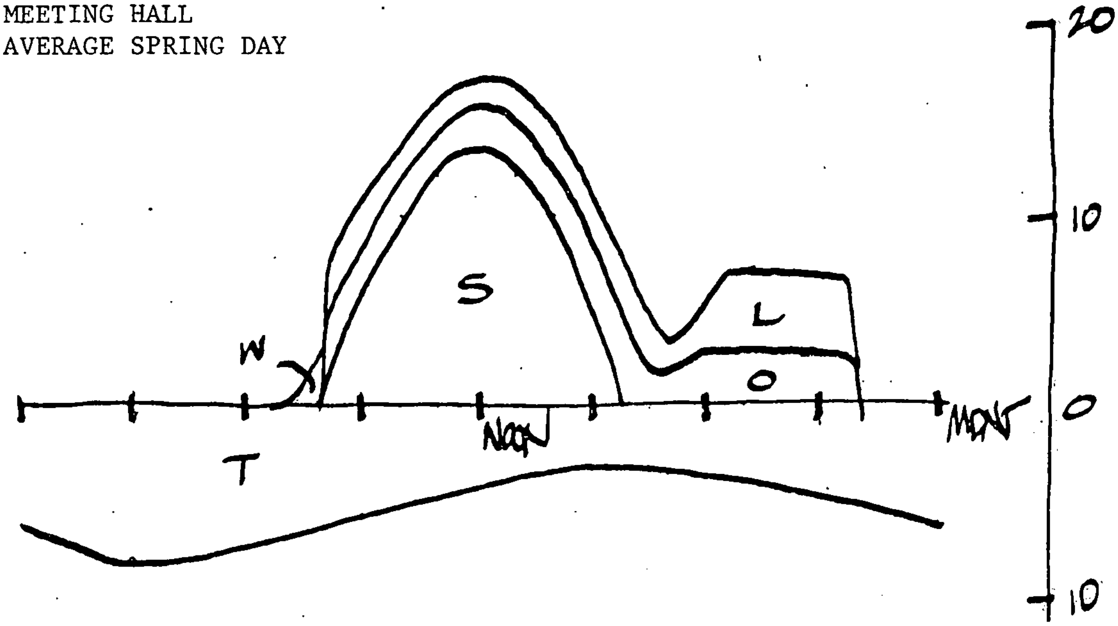
NOTE: Solar energy is somewhat more than adequate to supply space heating needs, necessitating a small degree of shading (or ventilation, not shown). Evening gains from people and lights, combined with solar gains, are stored to balance nighttime heat gains.

MEETING HALL
AVERAGE WINTER DAY



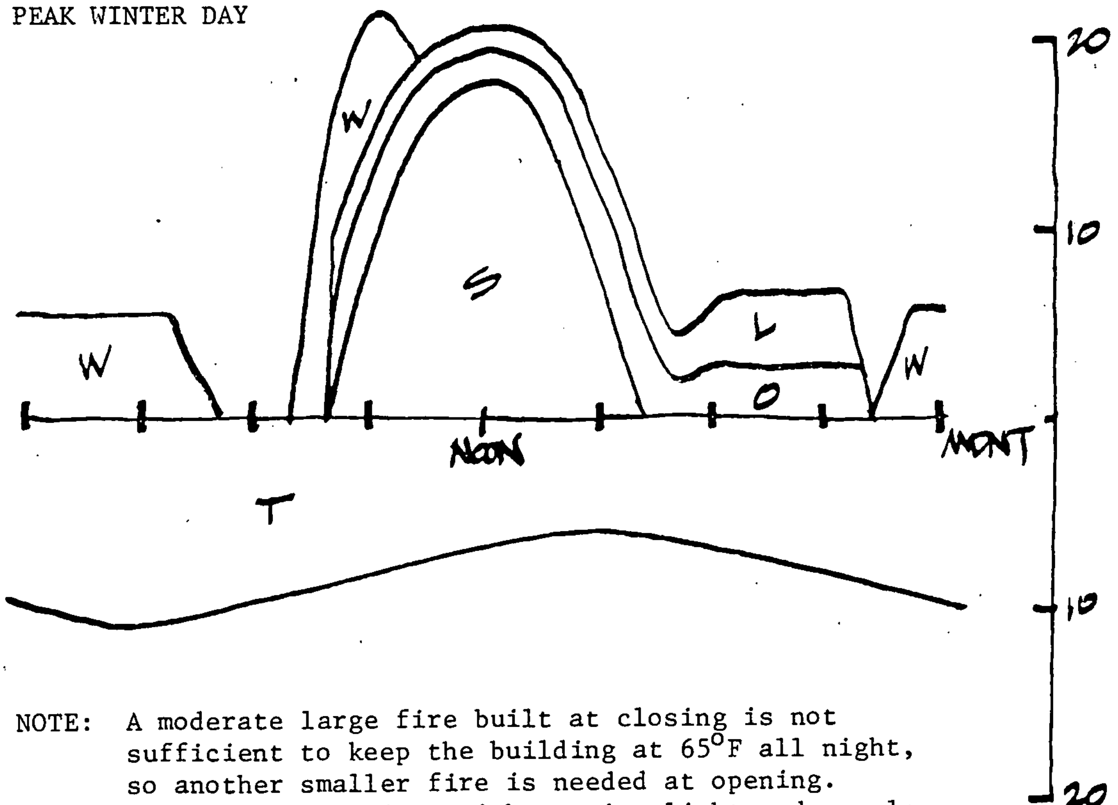
NOTE: Wood back-up combined with thermal storage allows a fire to be built at closing time in late evening, keeping the building warm enough for comfort upon opening.

MEETING HALL
AVERAGE SPRING DAY



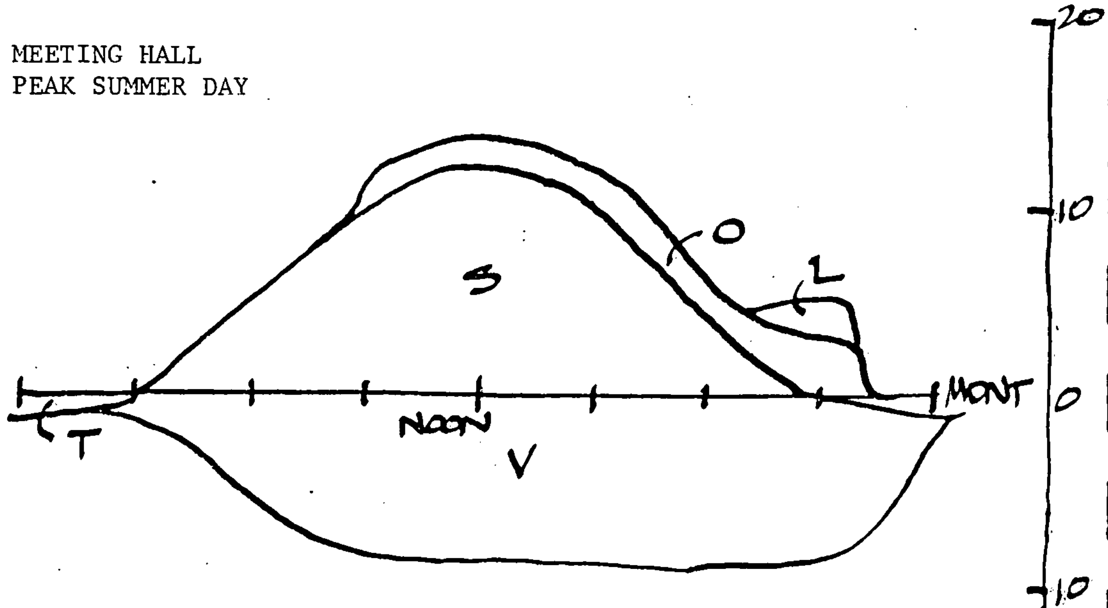
NOTE: Stored solar and evening internal gains are nearly adequate to hold building at 65°F all night; a very small fire built upon opening will quickly bring building up to a comfortable temperature.

MEETING HALL
PEAK WINTER DAY



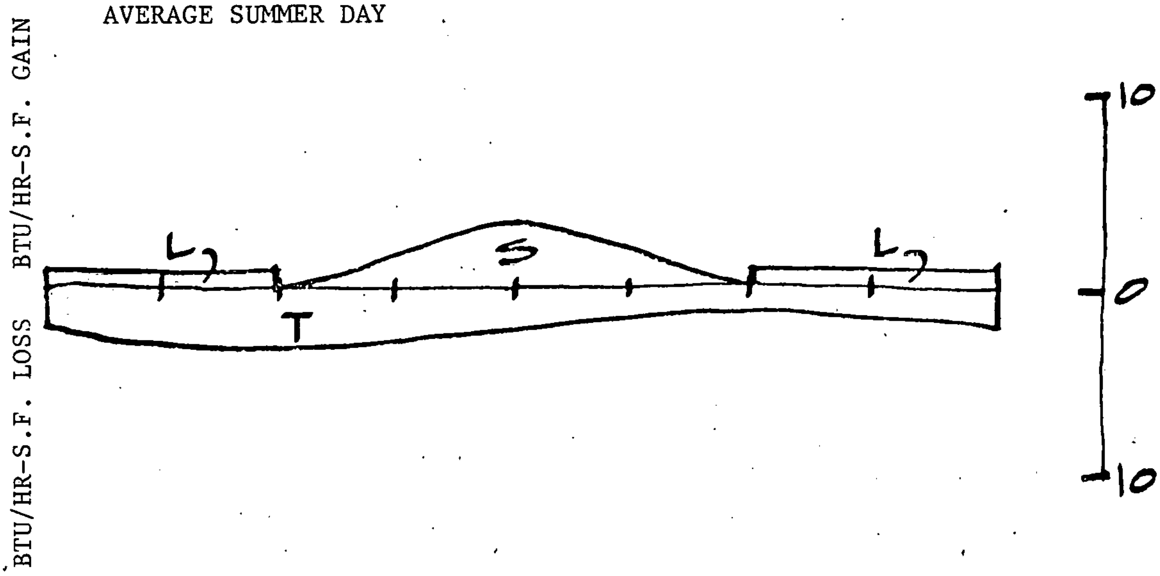
NOTE: A moderate large fire built at closing is not sufficient to keep the building at 65°F all night, so another smaller fire is needed at opening. Daytime solar gains, with evening light and people gains, make evening internal temperatures warm, but short of overheating (see more detailed TEANET analysis).

MEETING HALL
PEAK SUMMER DAY

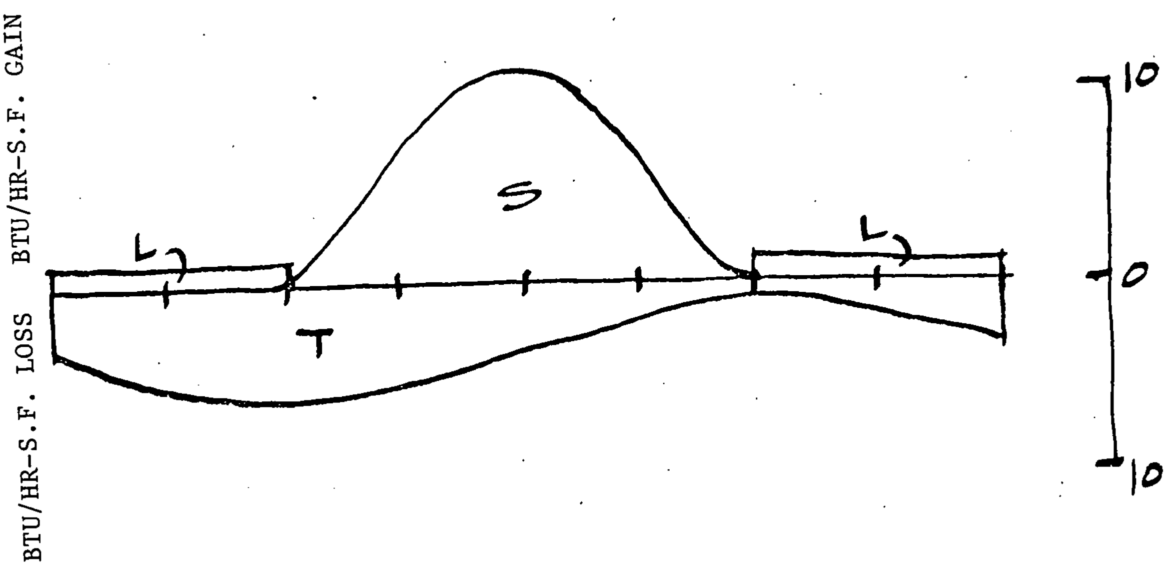


NOTE: Cross ventilation at hottest time of day would overheat interior, so night ventilation is also employed, to lower mass temperature and thus aid in maintaining comfortable interior temperatures by day. In extreme conditions, an exhaust fan can be used to bring in cooler evening air, in addition to that provided by cross ventilation.

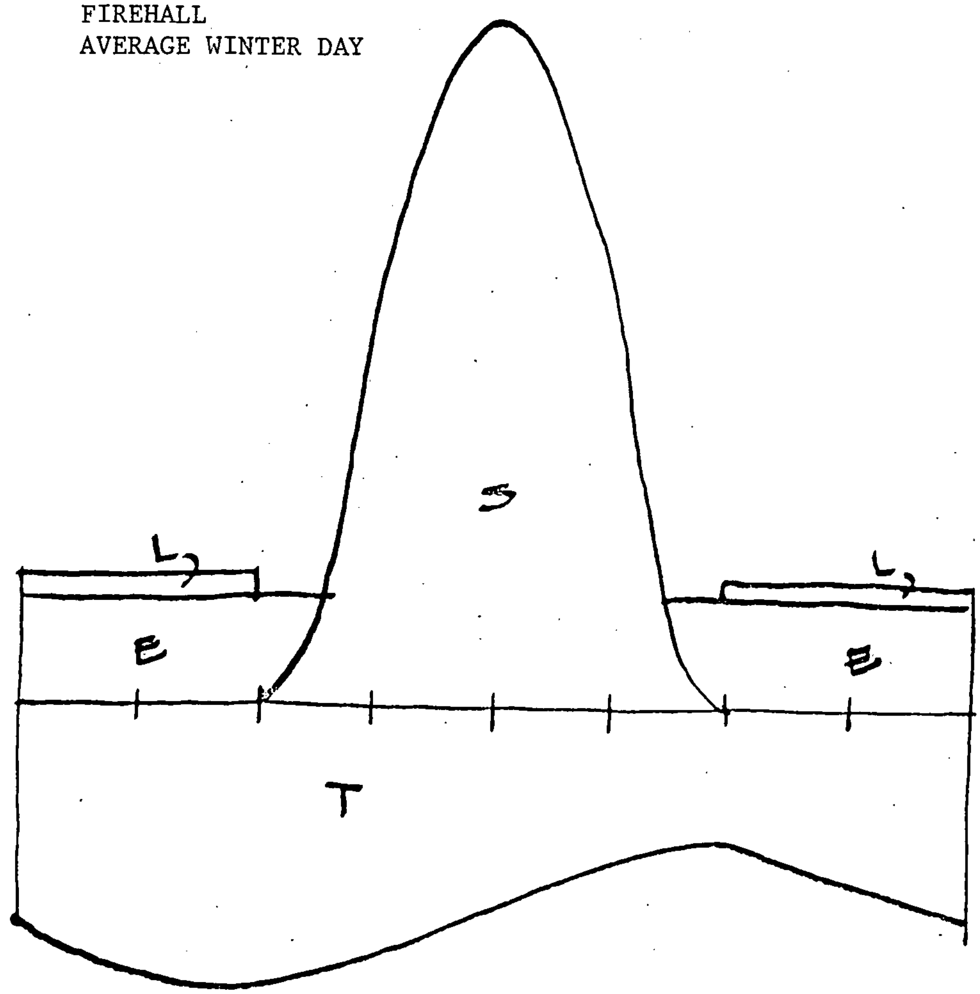
FIREHALL
AVERAGE SUMMER DAY



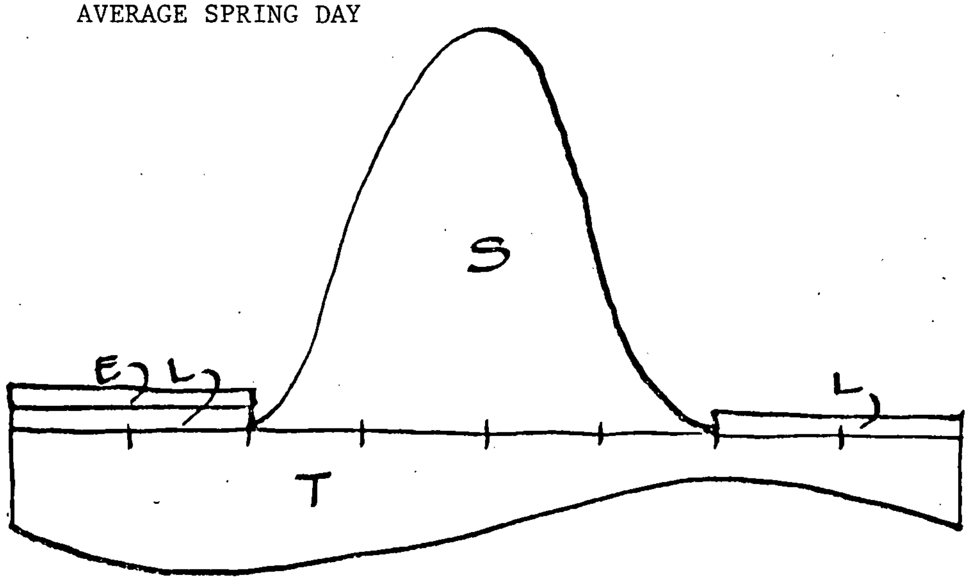
FIREHALL
AVERAGE FALL DAY



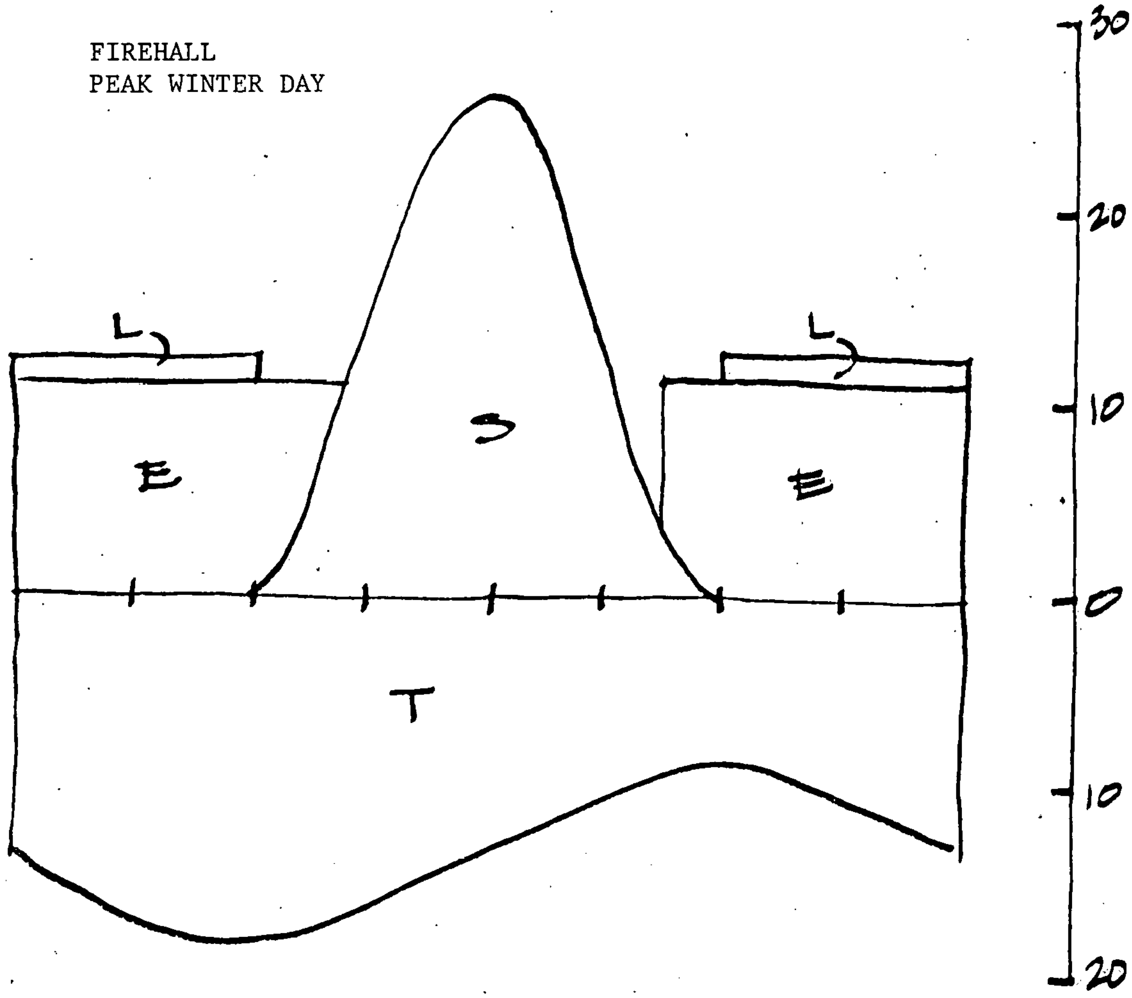
FIREHALL
AVERAGE WINTER DAY



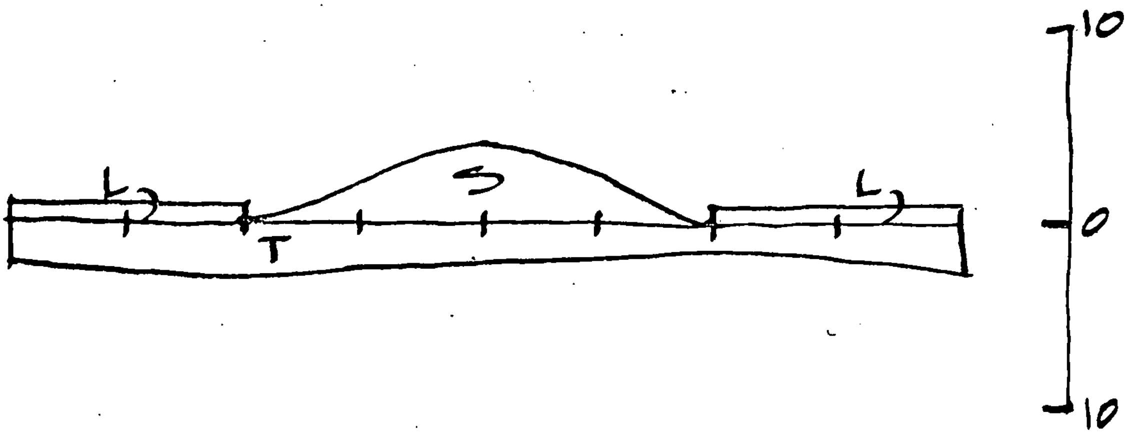
FIREHALL
AVERAGE SPRING DAY



FIREHALL
PEAK WINTER DAY



FIREHALL
PEAK SUMMER DAY



III-C FINAL ECONOMIC ANALYSIS

The economic analysis was done in two separate pieces -- the firehall and the meeting hall. The pavilion was not considered because it does not have an operating energy use. The two piece analysis is reasonable from a performance standpoint because the two buildings have different solar construction costs, and differing performance criteria. From a financial standpoint, it may be more meaningful to combine the two buildings.

The costs used in this analysis are based on a "systems" cost analysis conducted at a preliminary design stage. Costs of solar related components were determined by comparing the designed buildings to hypothetical conventional buildings. For example, if a clerestory was required for solar gain in the building as designed, but not required in the conventional building, the clerestory was considered an incremental solar cost.

The major elements of the incremental solar cost for the firehall are: southwall glazing, clerestory glazing, clerestory louvre, clerestory wall, clerestory structure, walkway roof, and insulation. These elements had a cost of $763 for discounted materials, $1,923 for materials at market values, and $3,077 for market value materials and labor.

The major elements of the incremental solar cost for the meeting hall are: concrete slab floor, masonry walls, thermal storage containers, southwall glazing, shutters, clerestory, glass roof overhand, insulation, woodstove, and solar domestic hot water. These elements had a cost of $14,848 for discounted materials $18,707 for market value materials, and $23,776 for market value materials plus labor.

MEETING HALL:

ITEM	BUILDING AS DESIGNED (AD)	CONVENTIONAL BUILDING (CB)
1. Floor	poured concrete slab	all wood
2. Octagon walls	masonry + glass	all wood
3. Water thermal storage walls	reinforced fiberglass containers	not required
4. South wall	glass (sun and lighting	reduced glass area opaque wood wall assembly
5. Shutters	skylid, rolldown, panels, etc.	not required
6. Clerestory	structure + roofing	structure + roofing covering reduced in size and area
7. Roof overhang	glass (lighting and sun)	wood
8. Shading	movable canvas, louvers	not required
9. Mech. heating	wood stove/elec. resistance	elec. resistance
10. Non-south glazing	daylight, ventilation	elec. light - incand., mechanical
11. Insulation	R38 roof av. u = .026 R19 walls av. u = .05	roof u = wall av. u = none
12. DHW	solar	elec. resistance

MEETING HALL

	BLDG. AS DESIGNED			CONVENTIONAL BLDG.			diff. $
item	area	unit $	total $	area	unit $	total $	(AD-CB)
1. Floor	1900 S.F.	1.28	2432	1900	.351 SF	$667	$1765*
2. Octagon walls	1670 S.F.	-	material + labor	1670	.776 S.F.	1296	$3192
3. Foundation walls	120 l.f.	-	4488 labor 1517			1517	0
4. Lintels	-	-	labor 380	not required		0	$380
5. Thermal storage at kid's room	7 tubes 18"x10' +	90.00 200 ship.	830	not required			$830
6. South wall lower glazing	trombe & kids only 8 sheets	25.00	200	approx 168 S.F.	wood assembly	131	$ 69*
7. Clerestory glazing	20 sheets	25.00	500	not required		0	$500*
8. Clerestory louvers	240 b.f.	.117 BF	28	not required		0	$ 28*
9. Clerestory	98 SF	.78 SF	76	not required		0	$ 76*

MEETING HALL

item	BLDG. AS DESIGNED area	unit $	total $	CONVENTIONAL BLDG. area	unit $	total $	diff. (AD-CB)
10. Structure	-	-	allowance 100	not required		0	$100*
11. Roof overhang glazing + canvas	48x6 288 S.F.	1.10 SF	317	shingles + sheathing disregarded because of low glazing costs		0	$317
12. Shutters-thermal storage wall	100 S.F.	6.15 SF	no shipping $615	not required		0	$615**
13. Shutters clerestory	252 SF	12 SF	no shipping 3024	not required		0	$3024**
14. Shutters kids	100	6.15	no shipping 615	not required		0	$615**
15. Shutters others	145	4	no shipping 580	not required		0	$580**
16. Wood stove	-	-	1000	not required		0	$1000**
17. solar DHW	-	-	1200	not required		0	$1200**
18. Insulation	20% in excess of code 3700 S.F.	.15	555	base at code		0	$555**
does not include increases in elec. light or mech. vent.				INCREASED COST DUE TO SOLAR			$14.848

* materials only.
** excluding labor for installation.

MEETING HALL COSTS
ADJUSTED TO MARKET VALUE FOR MATERIALS

- cost of items which have below market value material prices	$ 2,538
- increased to market value - based on calculations for Firehall (increase 250%)	6,397
- cost of meeting hall @ mat. market value $14,484 - $2,538 = $12,310 + $6,397	$18,707

MEETING HALL COST
ADJUSTED TO MARKET VALUE FOR LABOR

$ 6,397 + 60% for labor	$3,839 + $6,397	=	$10,235
$12,310 + 10% for labor	$1,231 + 12,310	=	13,541

COST OF MEETING HALL AT FAIR MARKET VALUE FOR MATERIALS AND LABOR	$23,776

FIREHALL

ITEM	BUILDING AS DESIGNED(AD)	'CONVENTIONAL' BUILDING (CB)
1. South wall	insulated glass	reduced glass area and opaque wood wall
2. Clerestory	louvers, glass, additional wall and structure	no glazing, reduced structure
3. Walkway roof	Wired glass	wood and roofing
4. Insulation	roof av. U = .026 wall av. U = .05	av. U = .032 code av. U = none

	AS DESIGNED			CONVENTIONAL BLDG.			
Item	Material Quantity	Unit cost	Total Cost	Quantity	Unit Cost	Total Cost	Difference (AD-CB)
1. South wall	glazing 6 sheets	25	150	wd. only 126 SF	.78SF	98	$52*
2. Clerestory a)	glazing 6 sheets	25	150	not required 0	-	-	$150*
b)	louvers approx 132 B.F.	.117 B.F.	15	0	-	0	$15*
c)	wall 64 S.F.	.78 S.F.	50	0	-	0	$50*
c)	structure	-	allowance 25	0	-	0	$25*

Item	AS DESIGNED Material Quality	Unit Cost	Total Cost	CONVENTIONAL BLDG. Quality	Unit Cost	Total Cost	Difference (AD-CB)
3. Walkway roof	30' x 6' glass 180 S.F.	1 S.F.	180	shingles + sheathing disrgarded because of low glass cost 0			180*
4. Insulation	20% in ecesss of code 1940 S.F.	.15	291	base established by code 0	-		219*
				INCREASED COST DUE TO SOLAR			$763

*material only.

FIREHALL

FIREHALL COST
ADJUSTED TO MARKET VALUE FOR MATERIALS

lumber @ $.117 b.f. is .40 to .50 below market
glass @ 1.00 SF is $3 to $6 below market
wall @ $1.75 SF is at market value

AT MARKET VALUE

item	1.	$380
"	2.a)	600
"	b)	80
"	c)	112
"	d)	100
"	3.	360
"	4.	291
INCREASED COST DUE TO SOLAR AT MARKET PRICE		$1,923

FIREHALL COST
ADJUSTED TO MARKET VALUE FOR LABOR

labor @ .6 of materials at market value	$1,154
TOTAL increased cost due to solar (market value materials + labor)	$3,077

Life cycle cost analysis was done using PASCALC Economics by TEA on the

TI59. The following assumptions are made:

length of mortgage	1 year
term of economic analysis	45 years
appreciation rate	4%
system resale value	0
depreciation	-
effective income tax bracket	0
extra property tax	0
insurance and maintenance	1% of system cost
down payment	0
discount rate	7%
mortgage interest rate	8%
general inflation rate	3%
fuel inflation rate	10%
first year full cost	$5.6/MBtu

Firehall:

non-solar building heat load	48.4 MBtu
solar building annual load	18.12 MBtu

Meeting hall;

non-solar annual building load	97.9 MBtu
solar building annual load	33.75 MBtu

The conventional building was assumed to have a heat loss equal to that of the designed meeting hall building. The conventional firehall was assumed to meet ASHRAE 90-75. Electrical lighting was treated as a contribution to space heating in the conventional building.

The following life cycle savings were realized

	discounted materials	market value materials	market value materials and labor
FIREHALL	$13,038	$11,629	$10,228
MEETING HALL	$11,554	$ 6,868	$ 712

These life cycle savings are sensitive to assumptions about general and fuel inflation rates, and fuel costs. These are particularly difficult to predict. Fuel costs, for example, are stated for a 30% increase next year. Even so, the fuel cost will still be one-fourth that of the Northeast. Using Northeast fuel costs dramatically increases the solar savings.

The first cost of the firehall is $763 (discounted materials), $1,923 (materials at market value), $3,077 (materials and labor higher than the conventional firehall assumption). The annual operating costs for energy are $169 less for the solar heated firehall.

The first cost of the meeting hall is $14,848 (discounted materials), $18,707 (materials at market value), $23,776 (materials at market value and labor) higher than the conventional meeting hall assumptions. The annual operating cost is $380 less for the solar heated meeting hall. This project will not be conventionally financed.

III-D EXTENDED CLIENT INVOLVEMENT

USER PARTICIPATION AND MAINTENANCE

1. Automatic devices (which may need occasional maintenance)
   a. Skylids @ meeting room clerestory
   b. Thermal storage wall insulating curtains.
   c. Electric resistance heaters with very low thermal setting.
   d. Shading louvres protecting clerestories from overheating.

2. Seasonally necessary actions (typically requiring attention twice a year)
   a. Skylid tie-down (of lower 2/3 only)(June), and release (Oct.).
   b. Canvas shade outside south lower direct gain windows (up in June, down in Oct.).
   c. Clean flue of woodstove.
   d. Release tie-down devices on upper meeting hall vent openings, to allow daily operation (release in July, tie-down again in Sept.).
   e. Open transoms over north and south doors to meeting hall and clerestory windows of firehall (open in June, close in Oct.).

3. Infrequent events (rarely necessary, but available if needed)
   a. Exhaust fan 6,000 CFM, for rapid hot air ventilation from the meeting hall (a fan also is provided for the firehall).
   b. Occasional fire in woodstove on suddenly cool nights or mornings in summer.

4. Frequent events (typically done on a daily basis)
   a. Thermal shades on lower windows at all orientations (October through April).
   b. Wood fire built in stove upon closing the building at night (Nov.-Feb.).
   c. Wood fire built in stove again upon opening the building in the morning (Dec.-Jan., cold weather periods).
   d. Open and close doors and windows to increase ventilation (overheated periods, June through Sept.).

CLIENT FEELINGS AND OPINIONS

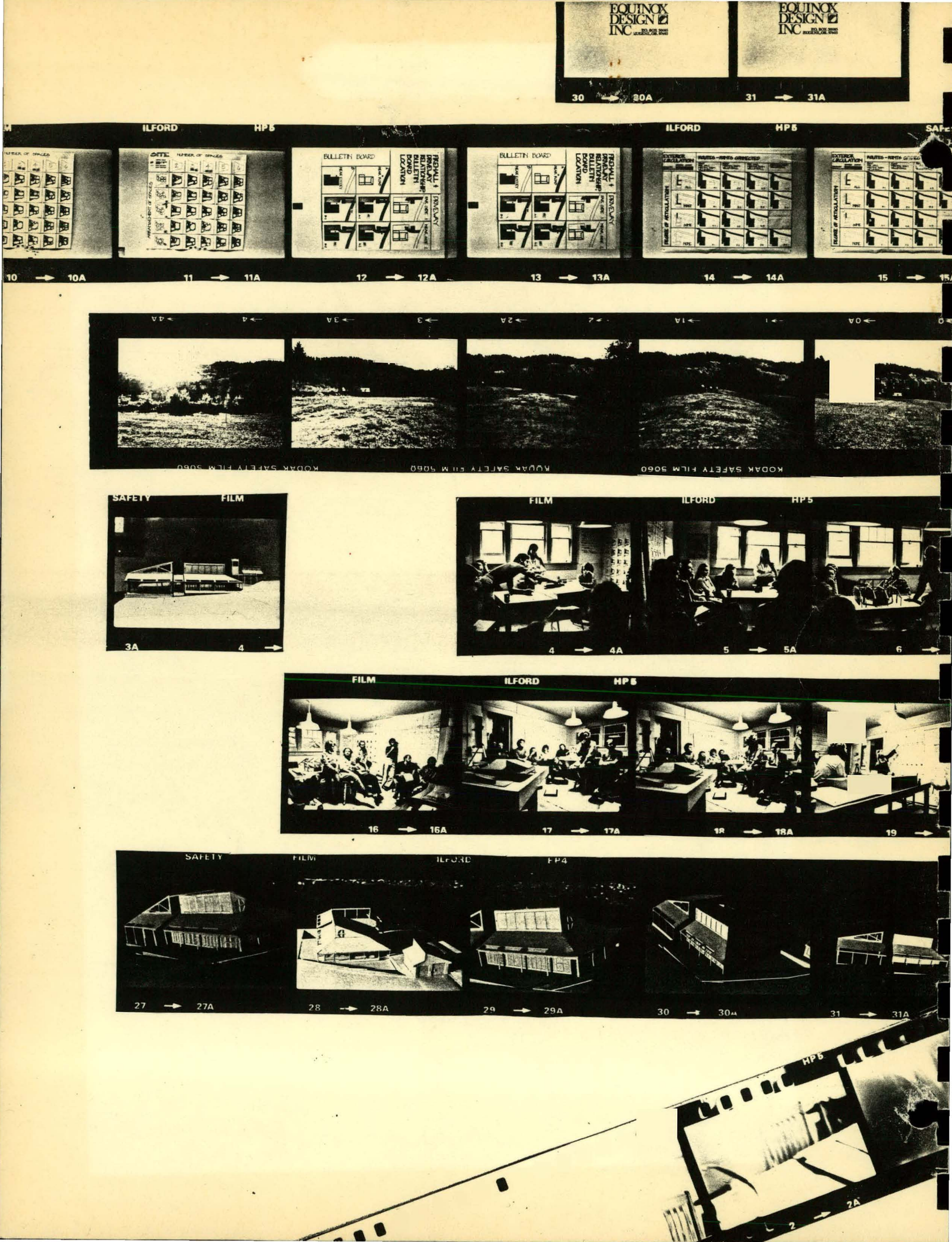
With respect to the final design and energy saving features of the community center buildings, the clients continue to be very enthusiastic about solar and wood as local and renewable energy sources. In fact, the clients enthusiasm has probably increased with an expanded knowledge of passive solar energy systems and their application through use of a participatory design process.

The community is quite accustomed to working together and see wood-gathering as another potential community activity.

With respect to the buildings as they relate to the community, the clients are sensitive to the interaction of three form generative ideas. These are the first public buildings for the community of Deadwood and their unusual size and clustered relationship to their site mark them as special within the community. The simple dominant roof forms mark the buildings as rural and very much Deadwood in character. The prominent clerestories, south facing glass and shading devices mark the adaptation of those forms to recognize use of the sun as an energy source.

At the same time, the clients are interested in demonstrating that electricity is only minimally necessary. They have preferred to utilize electrical energy only if no others seem reasonable. Electric resistance heat while typical for buildings in this region was only used as a backup with thermostats set as low as possible. Whenever automatic devices were required to maintain passive solar heating systems, their clear preference was for those of simple passive technology (such as 'Skylid').

As for other maintenance and controls for the building, the clients were somewhat skeptical of automatic devices such as 'Curtain Wall' because of their use of electricity and potential maintenance problems. They were almost equally skeptical of their own ability to manually operate devices such as thermal shades and shutters on a daily basis.


EQUINOX DESIGN INC
30 → 30A
31 → 31A
ILFORD HP5
BULLETIN BOARD
10 → 10A
11 → 11A
12 → 12A
13 → 13A
14 → 14A
KODAK SAFETY FILM 5060
SAFETY FILM
3A 4 →
FILM ILFORD HP5
4 → 4A
5 → 5A
16 → 16A
17 → 17A
18 → 18A
SAFETY FILM ILFORD FP4
27 → 27A
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30 → 30A
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HP5
2 → 2A