DESIGN/DEVELOPING/CONSTRUCTION: A Case Study in Comprehensive Services

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SUBMITTED IN
PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE
DEGREE OF BACHELOR OF ARCHITECTURE

at the

MASSACHUSETTS INSTITUTE OF
TECHNOLOGY
June, 1971

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Department of Architecture
May 25, 1971

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ABSTRACT

Title: DESIGN/DEVELOPING/CONSTRUCTION: A Case Study in Comprehensive Services

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Submitted to the Department of Architecture on May 25, 1971, in partial fulfillment of the requirements for the degree of Bachelor of Architecture.

This thesis is an experiment in the value of applying the skills and tools of architectural design to the building process as well as to the design process. In the light of a discussion of the professional and ethical issues involved, it proposes to explore the advantages of designing and building as two interdependent elements of the same process.

The experiment involves the design and construction of twenty housing units in central New Hampshire. The thesis documents include a discussion of the motivation for the experiment, an evaluation of the advantages of such a process, complete documentation of a design solution, an explanation of the process of building and samples from a "building book" which describes each task involved in the construction of the building and its relevance to the whole process.

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INTRODUCTION

"Comprehensive Services" - Definition and Discussion

While the term "comprehensive services" has come into vogue in the architectural journals and professional dialogue as an identifiable concept only within the last decade, the notion is as old as architects and, in fact, has served as the conceptual basis for their traditional reputation as "master builders." The term officially has no one meaning but rather refers to a practice currently gaining favor among architects and other professionals whereby design, consulting and management services formerly available to a client only through discrete entities are now being offered from one source. There is no particular set of services which may be considered "comprehensive" in architectural practice. Rather, the definition depends upon the view of the client and the scope of his needs. Rigorously defined, any service not directly related to the site planning, design concept, design development, contract document production and contract performance supervision could be considered comprehensive or outside the narrow limitations of his officially defined responsibilities.

Architects have always pretended to be generalists (as well as specialists in the particular skill of building design) and as such have promoted themselves as the most likely candidates to oversee the entire operation of producing a building or group of buildings. In representing themselves in this light, architects have frequently undertaken responsibilities far outside the scope of their primary responsibility. They have taken on the roles of engineers (admittedly this is a difficult distinction to draw), sociologists, anthropologists, historians, real estate advisors, management consultants, construction managers, geographers, political analysts and so on. In the past when these other related fields were relatively unsophisticated and the technical problems involved in construction and material science were simple, the architect could, with experience and the benefit of the best humanistic education, undertake these roles much as he can today in house design and other small building projects. It is only now in the twentieth century when the complexity and scale of the problems confronting the architect overwhelm his ability to understand and confound his ability to perform that he has sought first to narrowly define his professional role and then later, to propose to expand his role to cover those services he used to provide before the world became complex.

The Current Situation in the Architectural Profession

The force which has brought on the current interest in "comprehensive services" among architects is simply competition. The profession finds itself confronted on all sides with other "professionals" who are providing overtly or indirectly almost all of the services which architects consider their special domain. At the simplest and apparently most aggravating level (though far from the most dangerous to the profession) are the design-build companies, or "package dealers," which have outgrown the tract developments of single houses and are now producing factories, apartments, office buildings and even government buildings at a price and of a quality that makes them more attractive to developers and corporations than the traditional architect and contractor team.

Many of the related consulting professions which normally provide ansillory design services to the architect, like engineers and landscape architects, have recently determined that their disciplines were more fundamental to both the function and the form of the building (this applies particularly to structural and mechanical engineers) and that primary control should rest in their hands. As a result, architectural engineering firms have grown in which the project is attacked as a basic engineering problem and the "aesthetics" are applied by an in-house architect.

Similarly, landscape architects have taken the lead in developing skills and reputations (and, interestingly enough, school curriculum control) in urban design and large scale planning and are handing down, to the architect, sets of planning parameters that have virtually designed the building before the architect is engaged.

This same problem is even more severe with respect to developers and real estate specialists. This new breed of consultants and entrepreneurs along with many other specialists, the most important of which is the construction manager, are entering the picture well before the architect and are advising the client on such matters as site selection, project desirability, project feasability, project size, use pattern, use mix, building height, structural system, material selection, construction timing and so on. On many of the most fundamental levels of design, the architect is literally irrelevant.

The real threat to professional architects comes not from within his accustomed universe, but from the "think tanks" - the highly competent and creative research and development teams that have grown up around large and freely financed industrial efforts, notably the aerospace industry. These interdisciplinary teams have expanded their scope of interest into many areas and promise to capture the one logical growth area for architects - environmental research and complex planning - while the package dealers, developers, engineers and construction managers continue to erode present architectural business.

The reasons why the architectural profession is in such a bad competitive position at present are many and are not usefully over-simplified. In general, they can be laid, however, to a refusal to take advantage of current management and production techniques. Except for the few large, multi-disciplinary offices which have employed computers for at least a decade for specification writing, space planning and engineering calculations, almost no use has been made of the readily available systems hardware commonly in use in the simplest manufacturing, financial, scientific, legal or medical operation. Architects have tenaciously held onto their traditional role as generalists in the sense of their imagined (and occasionally realized) ability to synthesize successful solutions from their experience and educated intuition, but have, as a rule, resisted employing the coldly logical, hardnosed, "systems" thinking which the new professional consultants use to advantage in gaining the client's trust.

Similarly, architects have resisted the self-discipline of standard modern office management procedures and rarely know their own financial and operational situation so that they are in no position to offer responsible management services to a client. Only very recently have some offices recognized this failure and undertaken reorganization along the lines of other businesses.

Most firms now provide some form of what they consider to be "comprehensive services." At the simplest level, they provide pre-design consulting on feasibility, location and basic space use. Many offices can provide competent master planning, structural and mechanical engineering, interior design, and landscaping services. Most specialize in one or several building types and have a depth of expertise in problems related with that building type. Others have decided to develope skills in construction planning and management. Whether or not to provide comprehensive services is always a relative question and rests, in the final analysis, upon the inclination of the architect and the major, moral issues of law and ethics which it raises.

Ethical Considerations

The real impediment to the improvement of the architect's competitive position, by the expansion of his services to related areas of responsibilities lies in the special code of ethics which guides his behavior. The architect has traditionally had a particular obligation to serve the client and to represent him in all matters concerned with his project. It has been this special moral responsibility which has elevated the architect above the other consultants and made him most useful to the client. In the process of convincing prospective clients of his sincere, unwavering allegiance to the clients' interests, the architect has developed a public role for himself, reinforced by a written code, that now prevents him from remedying his present malady. That code, before it was revised in 1970, declared that an "architect shall not have financial or personal interests which might tend to compromise his obligation to his client" (American Institute of Architects 1967, 2). Specifically, and very much to the point with respect to his competition which remains free from moral ėncumberances, the "architect shall not engage in building contracting,....shall not guarantee the final cost (of the building),....(and) shall not offer his services in a competition except as provided in the Competition Code of The American Institute of Architects." (American Institute of Architects 1967, 2).

The code was clearly written tȯ promote the architect as a person worthy of the very significant financial and legal trust a client must place in him as well as to protect the architects from overly competitive practices amongst each other. The client market, however, is shifting away from the individual or company which only rarely built a building and needed firm, reliable fatherly advice from the experienced architect, to a highly diversified and competent organization with its own financial and engineering sections which needs expert, efficient, inexpensive, reliable assistance in achieving its objectives. Clients do not want to trust their money to an architect whose product is unknown, whose business acumen is in question and who is enjoined against guaranteeing the price and quality of his building.

The newly revised code of ethics (American Institute of Architects

1970) no longer specifically prohibits the architect from engaging in contracting or indeed from any other activity as long as the scope of his responsibility and the possible areas of conflict of interest are made perfectly clear to the client and as long as it would "reasonably appear that such activity, employment, interest or contribution (does not) compromise his professional judgment or prevent him from serving the best interests of his client or employer" (American Institute of Architects 1970, 2).

The central ethical issue surrounds the problem of the architect becoming involved in the construction of a building he has designed for the client and the conflict is obvious. While the architect is trying to get the most for the client for his money, the builder is trying to maximize his profit by performing as little work as possible for the most money the client is willing to spend. The problems raised by this conflict appeared to be insurmountable, but in light of the market reaction to package dealers and a closer reevaluation of the numerous areas of conflict of interest inherent in the most conservative architect/client relationship, even the American Institute of Architects has decided to throw out a specific prohibition of building by architects. That decision was based primarily upon a desire to survive in the building industry, but recognized the many areas in which an architect already jeopardizes his relationship with his client through self-interest. Clearly the same motives which drive a builder to enhance his profit on a job drive an architect to recommend the feasibility of a project if it means a job for him, use all of the clients funds available since his commission is a percentage of the project, and design more for his own gratification and objectives since his professional reputation depends upon the apparent result. Many architects realized that their relationship with clients was in fact not unlike many other professions or even businesses and that there were many opportunities to be dishonest or honest as one chose. Placing outdated restrictions upon themselves merely removed them from the opportunities to perform the ethically and qualitatively superior services they felt they could perform.

APOLOGIA

Why Architects Should Design, Develop and Build

There is no mystery surrounding the advantages of designing and building from a single point of control. Certainly the main advantages have to do with the elimination of the counterproductive adversary relationship that normally exists between the designer and the builder. This shroud of suspicion and distrust forces each to expend great amounts of effort (and the clients money) to establish legal insulation from one another. For the architect it means that the bulk of his commission and hence effort goes not into design and research, but into the production of wholly complete and foolproof construction documents (usually working drawings and specifications) and into the expensive supervision of the construction in order that the documents are lived up to. The contractor, on the other hand, must assume that he will be forced to live up to the letter of the contract in every possible detail and must allow, therefor, for expensive inconsistencies and inefficiencies. Moreover, his ability to make savings by on-site redesign or effective short-cut methods is precluded.

Because of the critical importance of current material costs, shipping problems and labor prices, experts in construction management frequently make the preliminary decisions which dictate the building design from that point on. The client is wise to begin with that information, but foolish not to have the designer's input at that stage. Those issues are as critical as design criteria as are the client's space needs, the users' psychological needs, the site conditions, the climatic conditions, the cultural setting, the geographical location, the movement patterns and all of the other criteria normally employed by the architect. Even more important, however, is the knowledge of how and when the building will be put together. Decisions relating to the process of building should begin with the first decisions about siting, size and materials. Design should not begin and cannot responsibly proceed without consideration of how the building should be built and the dialogue between "what to build" and "how to build" should flow back and forth each effecting the other.

The direct economic reasons for having the designer and the builder be the same are obvious. First, the number of overhead and profit expenses are reduced and the savings passed directly to the client. In the elimination of the need for extraneous documentation of contract requirements a large savings is made for the designer which can be passed on to the client. Similarly, the administrative streamlining of design changes and additions makes a significant reduction in the cost of the building. Supervision expenses are reduced. Construction time (and hence finance costs) is reduced because construction may begin without a complete set of building documents. Moreover, having responsibility for the construction of a building forces the designer to keep in close touch with current costs at every level of detail and minimizes the chance that he will be unaware of the harsh realities of the market place.

The list of financial savings could go on into finer levels of detail and become ever more convincing. These are accounting issues, however, and beg the fundamental question involved which is <u>quality</u>.

Before proceeding with a discussion of the advantages of the design/build process which is the basic subject of this thesis, it is important to make a few remarks about developing as related to the practice of architecture. In a sense it is a side issue since it does not involve the same ethical questions with respect to a client since the designer is his own client. What ethical questions can be raised revolve around the same issues that apply to all developers. While the developer cannot cheat himself, he can produce a poor product and deceive the public. The same opportunity is available to the architect, but again, it is only his sense of morality that prohibits his "cheating" of the public in his normal role so that the danger of his malpractice is not altered but only somewhat intensified.

The chances of his providing a better product to the public are greatly intensified, however. With the architect really in the driver's seat, there is a chance that he can achieve some of his design objectives and a very good chance that the small but critical decisions of detail will be made in favor of quality rather than simply profit. This assumption does not depend upon the naive belief that architects are better and more humane people than developers or that they are any less affected by the urge for profit. It is based upon an opportunity for the architect which is not available in any other relationship except those rare cases of infinitely generous and benevolent patrons. If the architect stands to make the developer's profit (and especially if he is building the project as well), he can afford the luxury of careful and protracted design efforts and has only himself to convince of the marketing advantages of high design quality.

The logic of this argument is simple but compelling. If the architect is not a man of integrity, then the project is no worse than if an equally unprincipled developer was the client and only the general reputation of the "profession" has been tarnished in some obscure way. If, on the other hand, he is a man of principle and some professional competence, it is very likely that a building representing more extensive and sincere design effort will be available to the public at the same or probably at a reduced cost than the building produced by discrete developers, architects and builders each needing to cover his own risks and profit desires. If the architect/developer is a man with unusual social conviction and understanding, the opportunity to do a very good building at low cost but with fair compensation for him exists.

Of course, developing is a special skill and not one most architects find easy or interesting. The issue is not to give up design in favor of finance, but to find a way to gain the developer's control and profit as effective ways to increase the amount and quality of design effort in a building. Whether that is accomplished by hiring in-house expertise, associating with competent developers or joining in an equity arrangement is only a matter of degree and style.

Before passing on to a discussion of the particular objectives of the thesis effort, it is important to note a few of the major objections to the assumption of total control by the architect. The main objection certainly would be that no one person should have total control, particularly of large housing projects. The present process is needlessly expencive and counterproductive, but it does have many levels of checks and balances and inputs from many sources which give a very desirable diversity. Similarly, mistakes in concept and detail are discovered quickly under the constant suspicious scrutiny. On the level of ethics, there is perhaps a greater chance of dishonesty going unchecked, though again, that is debatable.

Why a Design/Build Experiment as a Thesis

For many of the same reasons that practicing architects find themselves in a poor competitive position in the building industry and now in many respects, in the design industry as well, students prefer not to become part of a professional process that is markedly undistinguished in solving the problems it recognizes and, until very recently, unwillingly to change to discover new ways to arrive at solutions. There are many areas that are ripe for change and many promising possibilities for new professional relationships, new experiments in group design, new methods of educating the public, new ways to use computer technology, new areas of research in the study of form.

We have chosen as an area of investigation and future commitment for ourselves in this thesis and in the next few years, the study of the potential of design and prediction skills not only in the design of a building, but in its construction as well. We have come to believe that design is not something that occurs only on envelopes, in working drawings and in scale models, but involves design decisions and planning at many levels of detail. For the reasons already discussed above with respect to "comprehensive services", it is apparent that the economies and efficiencies are very real, but it is rather the necessity of carrying through building design to completion in order to understand the significance of decisions along the way that compels us to work this experiment.

To our understanding, the most valuable experience at this stage in our development in architectural design is to become totally serious and thorough about a particular project. At one level, it is a test - a final exam if you will - of our competence as designers, as planners, as organizers, as predictors. Experience within the normal process of schooling has convinced us that only the most absurd and unusual self-discipline would make the customary hypothetical design problem an effective vehicle for a detailed exploration of the value of designing construction process as a part of the building design.

The reason for choosing to undertake a real project is not only that it forces the designer to genuinely confront every issue rather than avoid it with the customary academic agility, but also that it affords an opportunity to test ideas and beliefs in a context that gives immediate and multi-level feedback as well as theoretical interpretations of successes and failures. Along the same lines, it is an opportunity to begin to discover the ways in which a designer can work and indicates those areas where previous academic preparation has been inadequate or even deceitful. In a very real sense, it serves as a transition exercise as it is both an experiment in a way of providing real professional services and a critique of the training that was to prepare us for that service.

THE PROJECT

The Program

The particular opportunity which serves as the vehicle for this experiment was a competition for twenty condominium units to be built as second homes in a valley near the Waterville Valley Ski Area in middle New Hampshire. The competition program called for twenty three-bedroom units of approximately 1000 square feet each to be built at a cost to the owner of about $16 per square foot.

The client was a partnership of two young men each with large families who had limited experience in developing housing projects in Boston suburbs, but who had firm ideas about what would be marketable as family ski homes. Their program insisted upon a plan for the unit which included a very large master bedroom, a medium sized bedroom and a third sleeping area which might be a loft or study. They wanted an open, flexible living area that was not disconnected form the kitchen space.

It was predetermined for economic reasons that all of the services were to be electric including heat and that the kitchen must have all of the conveniences including dishwasher and disposal. Their reading of the market told them that the woman's decision was the critical one so that there was great emphasis placed upon the size and convenience of the kitchen and the necessity for a bath and a half.

While there were no restrictions placed by them upon site planning, they did insist that the units be arranged so that there was a strong sense of community which would encourage the inhabitants to look after one another's family and property. Both of the owners intended to live in the project themselves and thus had a strong stake in this latter criteria.

The Site

The site was a 20.9 acre tract (see PLATE I) of relatively flat land in a valley surrounded by mountains on all sides. The shape of the property was roughly rectangular with the long dimension running north/south and the access off an old road which was adjacent to the northern edge. The entire northern half of the site was loam and clay and considered unbuildable for reasons of drainage. The middle section was heavily wooded with a stream running through the center which floods in the spring and turns the land to swamp for fifty feet on either side in April and May.

The back portion of the site was cleared and under a foot of topsoil, was coarse gravel for at least ten feet so that it was perfect for almost any foundation type or sanitation system. Views appeared to be almost equally desirable in any direction so that orientation with respect to the sun and wind became the major siting considerations.

Access to the back of the site where the buildings would have to be placed was accomplished along an old farm road along the eastern edge of the site.

The Constraints

The local zoning ordinance required that only one unit per acre could be built on the site. The units could be clustered in groups of up to ten units but any cluster of more than four had to be at least 200 feet from any other building. There were no building codes to meet other than a new state requirement that all wiring had to be done in compliance with the Federal Safety Standards.

A local fire ordinance prohibited the erection of any structure over 36 feet (the length of their longest ladder) above the ground. While there were no fire ordinances that required fire separation between the buildings even though they would be adjoining wood frame buildings, investigation uncovered the likelihood that the units could not be legally sold as condominium units unless there were such separation.

As condominium law is not developed in New Hampshire, there were no official requirements to meet although good advice warned that the maximum discreteness possible would assure their qualification should more sophisticated laws be passed in the interim.

The only serious constraints were posed by the State Water Pollution Control Board, but because of the excellent soil conditions, their restrictions did not become design considerations.

THE DESIGN SOLUTION

Site Planning and the Cluster Concept

Because of the uniformly excellent soil conditions in the back section of the site, the complete privacy in every corner of that section and the unusually pleasant views in almost every direction, there were no over-poweringly salient site conditions which dictated any particular set of solutions from the outset. Rather, we took advantage of the relative freedom to grapple with the theoretical problem posed by the client and reinforced by our own sentiments. Certainly one of the primary impulses for buying a house in New Hampshire is privacy and the desire to participate, even as an observor, in the unmolested landscape. One of the primary requirements would have to be accoustically isolated units with a primary outlooking orientation over undisturbed fields and woods.

The other side of the coin told the opposite story. One of the major requirements of the client was a strong sense of community - a sense of unity in the grouping that would encourage a feeling of mutual responsibility upon which the random use of the units and the specific legal arrangement of condominium living both depend. This requirement was backed up by our experience with skiers and skiing and the kind of use the units were likely to get. While the opportunity for quiet and privacy was vital as a choice, so too was the opportunity for gregarious interaction with friends and neighbors.

From this fundamental dichotomy, the "open stockade" plan emerged as a concept. As the unit plan was being developed simultaneously, a very clear attitude began to develop. While it was never articicluated as such, the early New England stockade parallel is a good one. The total form of the complex of ten units is very singular and unified from the outside, particularly from a distance. From that aspect, the exterior wall surfaces are relatively unmodulated (see PLATES II, VII, and XX through XXIII) and the roof planes all slope toward the ground so that the effect is not unlike a large, New Hampshire barn.

The inside of the cluster is entirely different (see PLATES II, X, and XI), reflecting the vitality of movement and arrival and suggesting the activity of living inside the units. Whereas the form is simple and protective from the ouside, the enclosed common space is surrounded by relatively complex and active roof and wall planes, sheltered entrances, public walkways and private decks assembled of smaller pieces in a vocabulary which suggests a different kind of use than the building envelopes.

Like a stockade, there are special gates of arrival to the common space and winding stairs to the towers that let you get high and look out in all directions. The entrances, the walks, the decks, the towers and the protruding staircase are intentional gestures which help to claim the common space for inhabitation. The common space is the public arena for arrival, unloading cars, meeting neighbors, overseeing children, sunbathing, appearing, moving.

Fortunately, the process of design is not a prosaic as the process of describing what you have designed after the fact. The problem was straightforward and the solution is appropriately straightforward.- there is an inside and an outside and gateways of arrival and living spaces in transition, in between.

The arrival to the clusters from the main road was an aggravating problem as there appeared to be an unresolvable conflict. The logical access was along the existing farm road along the east side of the site such that the road would inevitably approach the units from the northeast while the clusters were opened to the southwest in order to permit the sun to shine in the common space and on all of the decks from late morning through the rest of the day when the space would be most active. The site was indeed planned that way (see PLATE I) in the initial competition drawings, but a more careful study of the soil conditions and contours on the front part of the site permitted the shifting of the road to the western edge of the site such that the road does not have to pass by the private side of the units.

The shifting of the access road improved relationship between the two clusters by controlling the arrival sequence very carefully. From the main road, the access is down a hill and across a field into the woods. The first contact with a building is a sudden, close-up disclosure just as the car leaves the woods. The car passes very quickly before total comprehension of the cluster is realized and is again enclosed in a small pine grove. Emerging from that restricted space, the arrival suddenly has a clear view of the second cluster several hundred feet off and this time has time to fully investigate and understand it as he approaches directly toward it.

While the clusters are identical in plan (a preliminary decision based on an assumption about repetition that proved unnecessary), they are related by the arrival sequence, and very similar orientations. They are differentiated by the siting of one in the relatively open fields along a border of trees and the other fairly tightly in the forest, a device that allows for both tastes.

Unit Design

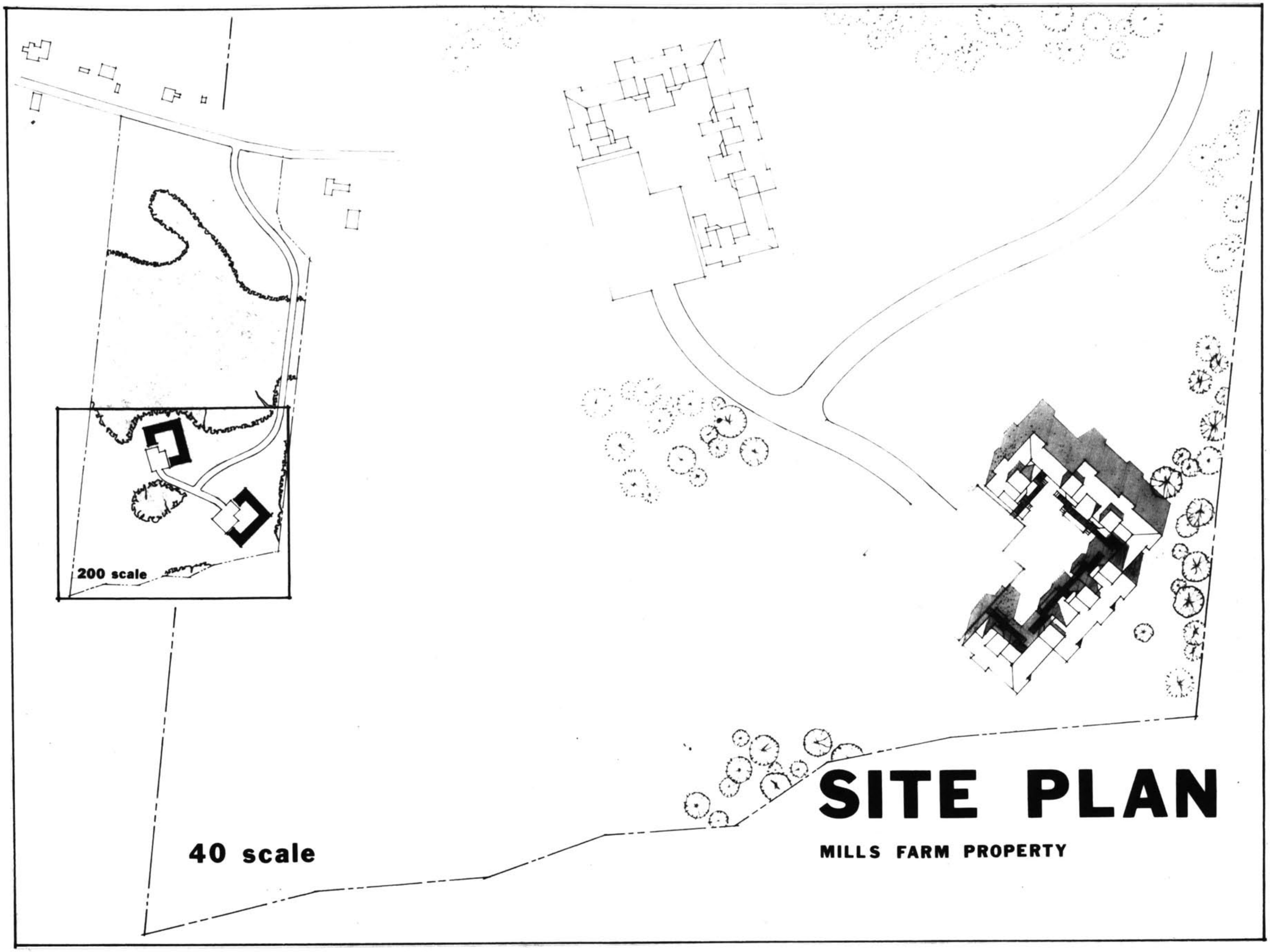
The design of the units occurred simultaneously with the design of the cluster and each contributed to the development of the other. The unit design thinking began with several basic conceptions which later proved to have varying degrees of validity. The size was predetermined by program requirements and in conjunction with the obvious thoughts about minimizing exterior surfaces for purposes of material and heating cost economies, it was very quickly determined that the best solution would be a square plan of about 20 feet on a side (in order to get interior spans in the right range for wood framing) in two floors with a loft. The decision coincided with the rough programatic requirements for space allocation so that the two major bed rooms and full bath with related storage and laundry facilities would be about the same size as the living spaces.

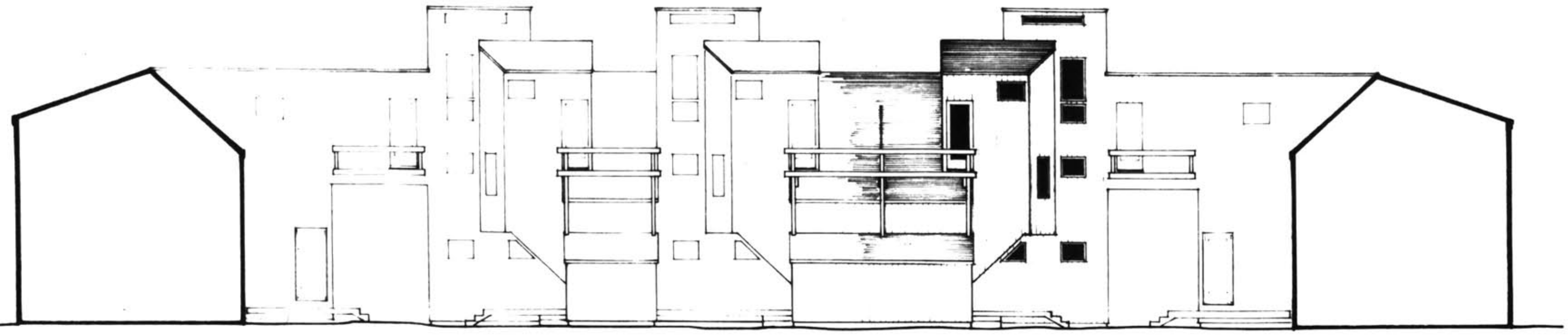
The decison was made equally early, to have the living spaces on the upper level to take advantage of the quality of the spaces beneath the rooves and to enhance the views by getting up over surrounding trees. This choice was assisted by a half level entry which allowed entry from an elevated walkway.

The plan of the ground floor is straightforward and needs no amplification. The living level (see PLATE XII) is the major space and is a continuous volume from the entry level to the loft which sits over the kitchen area and further subdefines the kitchen as a space within a space. The large living space is a single large area or can be subdivided into smaller spaces depending upon the arrangement of furniture in the space.

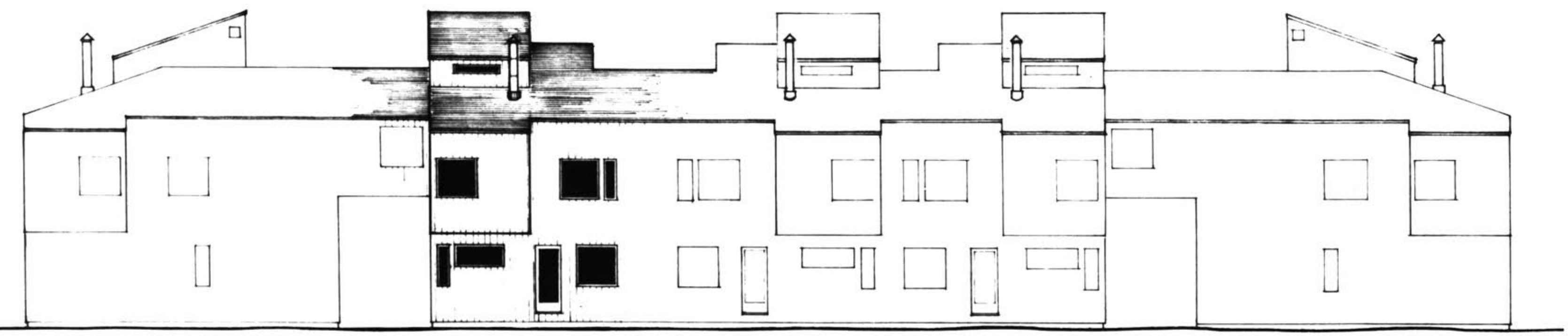
Questions concerning the structural system and the way the units were to be built were included in design discussions from the beginning. They will be discussed in the section of this paper dealing with the construction process and documents.

PLATE I





INNER ELEVATION

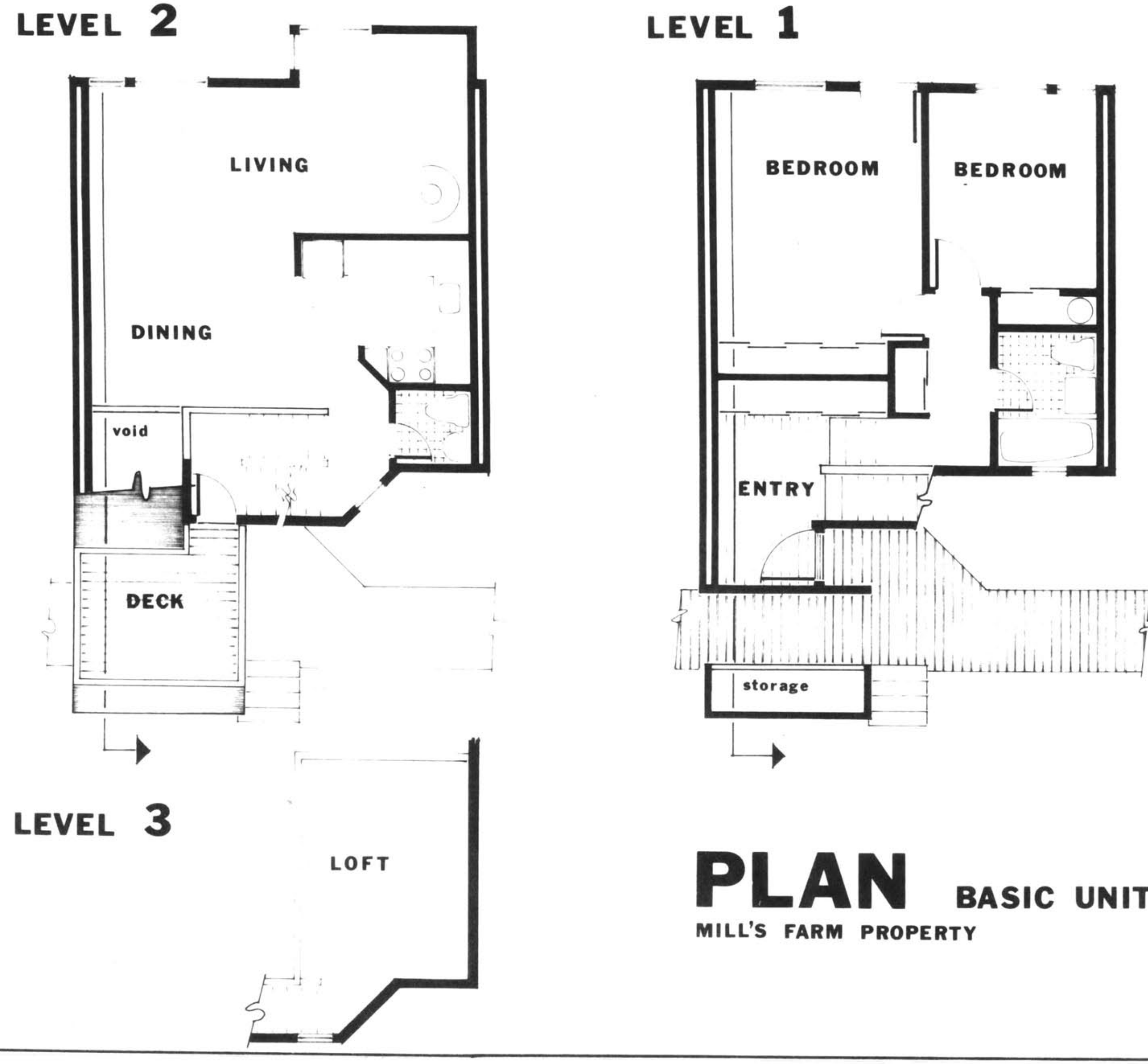


OUTER ELEVATION

ELEVATIONS

MILL'S FARM PROPERTY

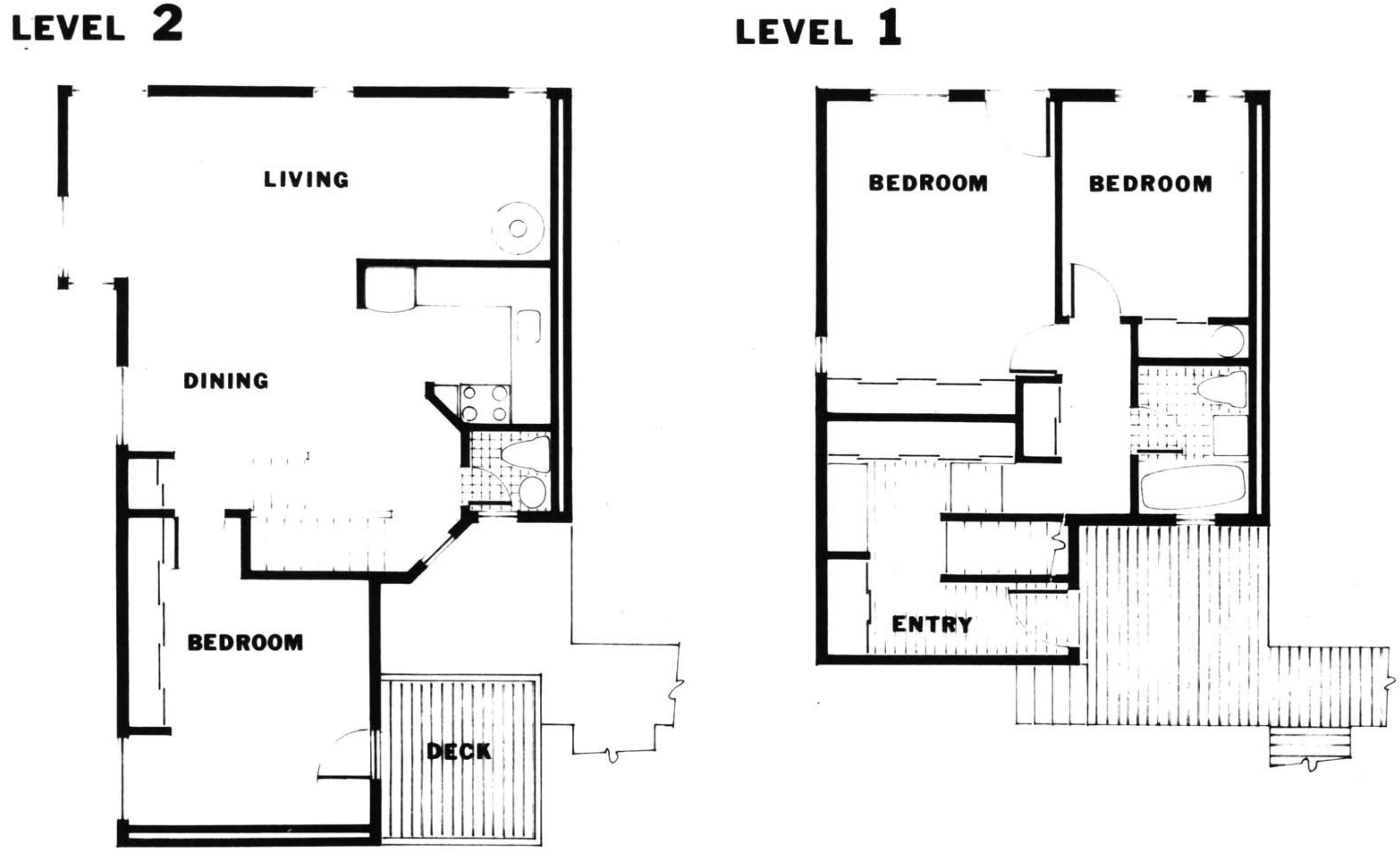
PLATE III



PLAN BASIC UNIT

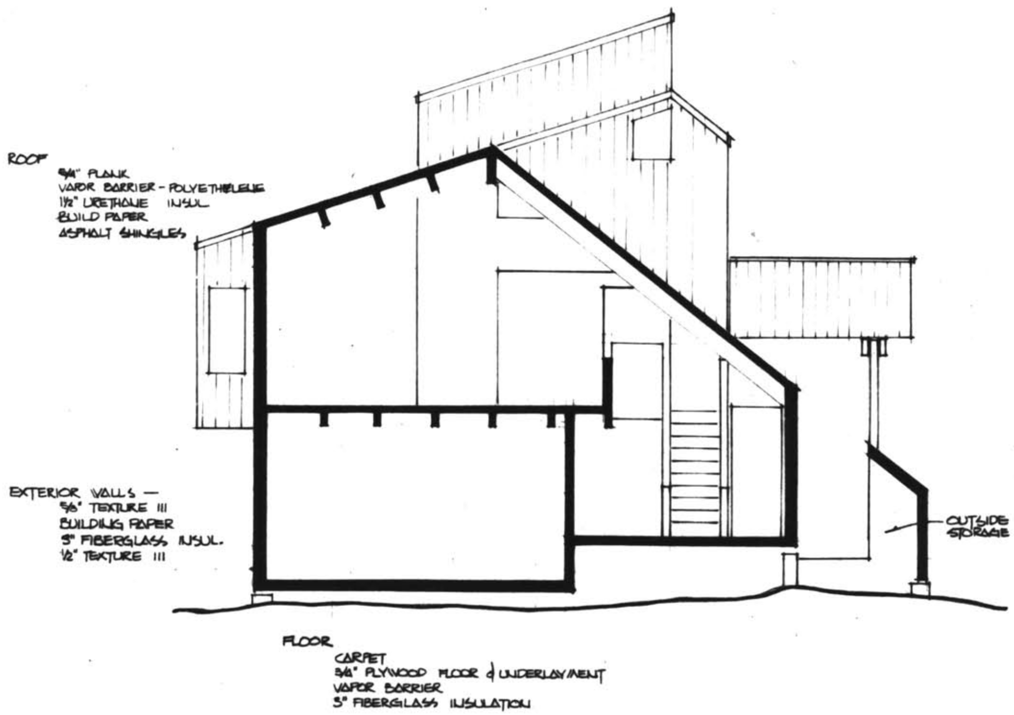
MILL'S FARM PROPERTY

PLATE IV



PLAN CORNER UNIT

MILL'S FARM PROPERTY

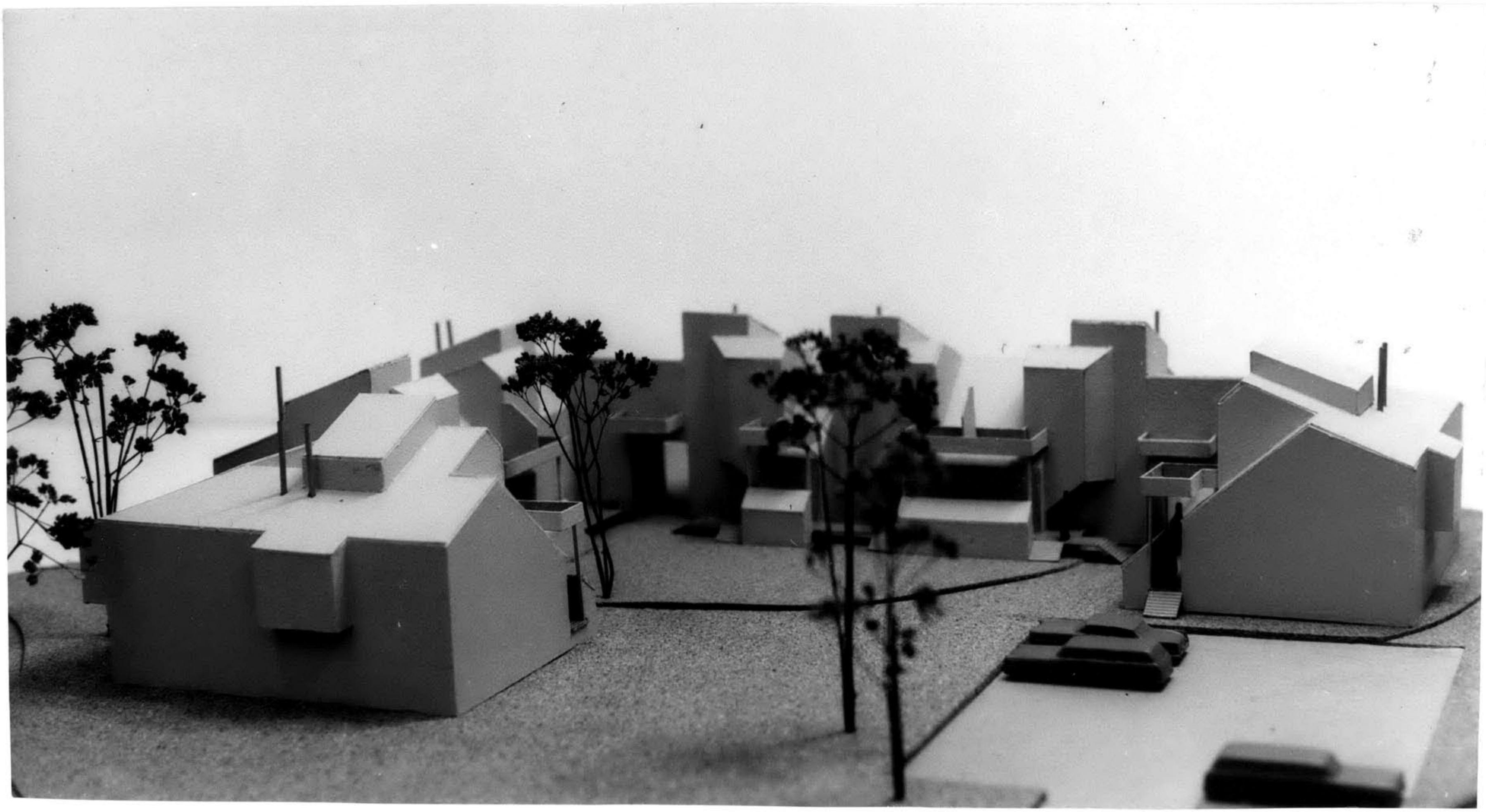

ROOF
3/4" PLANK
VAPOR BARRIER - POLYETHELENE
1½" URETHANE INSUL
BUILD PAPER
ASPHALT SHINGLES
EXTERIOR WALLS —
5/8" TEXTURE 111
BUILDING PAPER
3" FIBERGLASS INSUL.
½" TEXTURE 111
OUTSIDE STORAGE
FLOOR
CARPET
3/4" PLYWOOD FLOOR & UNDERLAYMENT
VAPOR BARRIER
3" FIBERGLASS INSULATION

1/4" = 1'-0" — SCALE


NORTH
EAST
SOUTH
WEST
WATERVILLE
SCALE ⅛" 1'
BRADLEY ROCHLIN
PETTIGREW WOOD

PLATE VI

PLATE VII



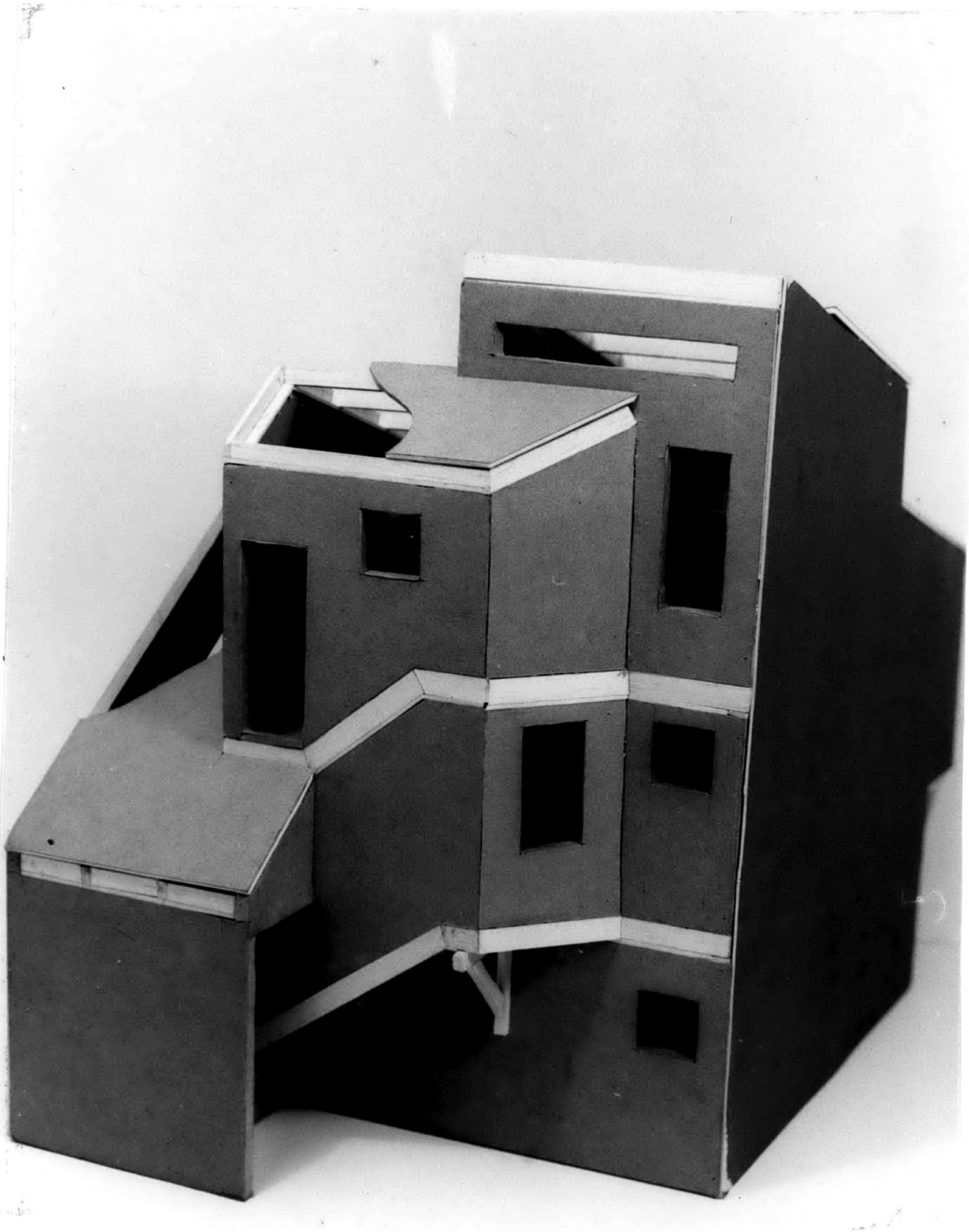


PLATE VIII

PLATE IX

PLATE X

PLATE XI

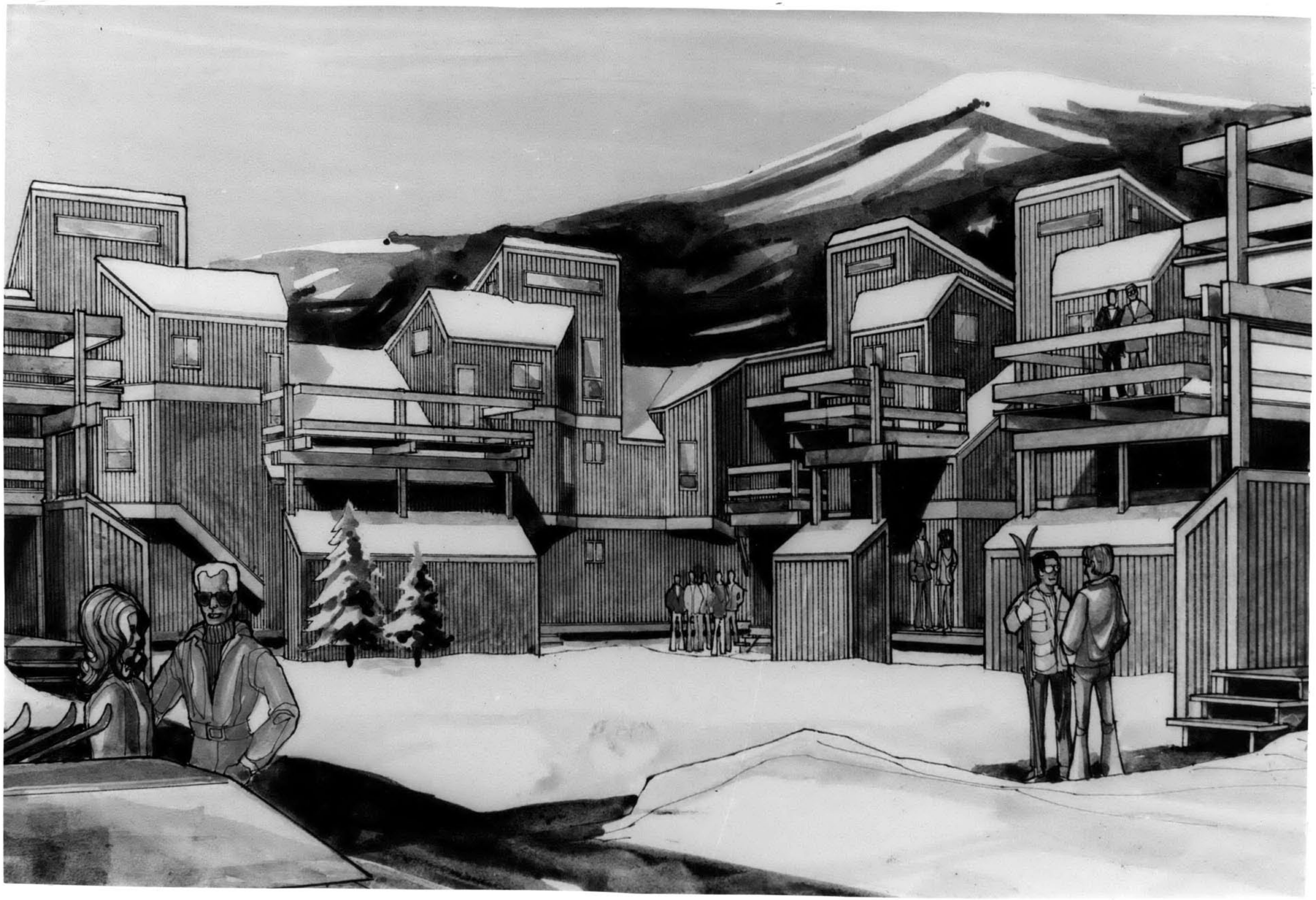
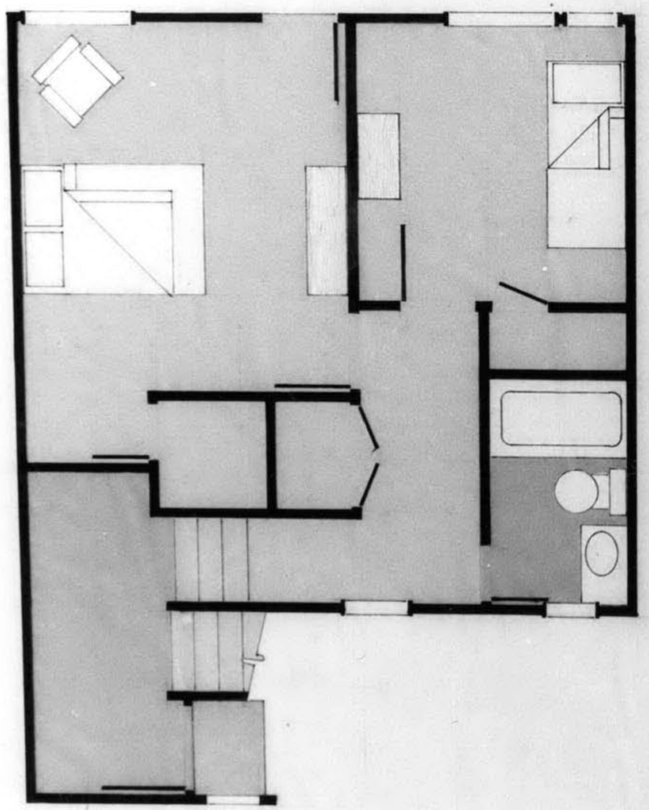


PLATE XII

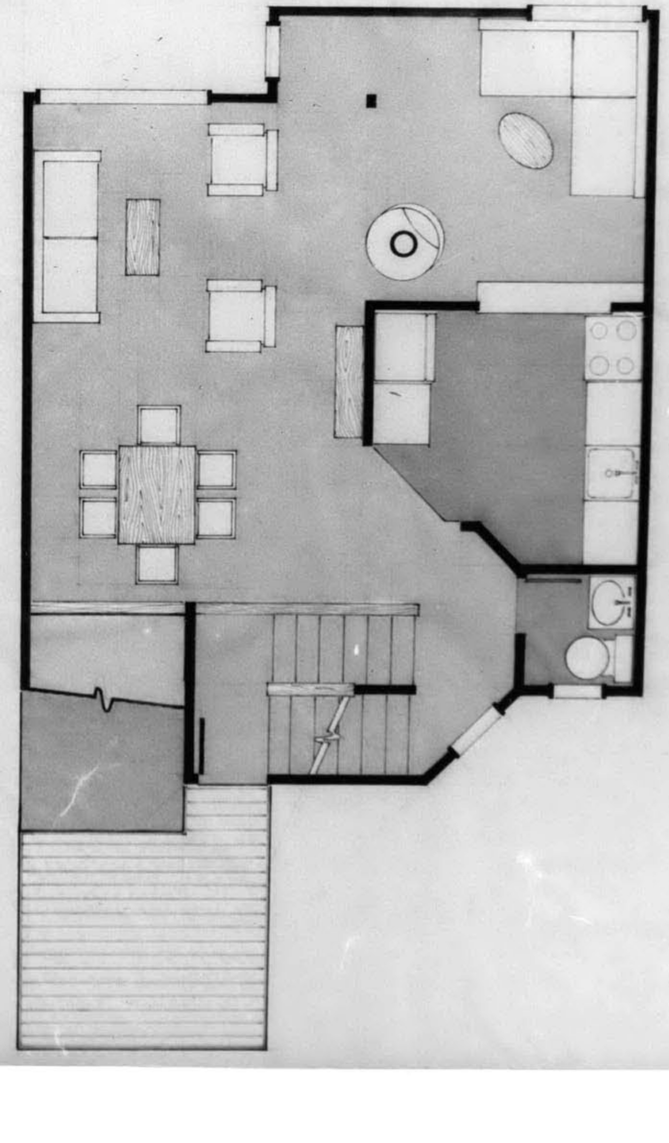
LOWER LEVEL

WATERVILLE ACRES



UPPER LEVEL

WATERVILLE ACRES



CONTRACT DOCUMENTS

The Contract Drawings (PLATES XIII through XXVIII)

One of the tasks that can be avoided when the designer is also the contractor is the exhausting chore of producing extensive working drawings. Ironically, the responsibility still remains for producing a set of documents that makes it entirely clear to the client what he is buying and establishes an unchallengable basis for resolving differences that might arise between the client and the designer/builder as to the quality or completeness of the building, although that set of documents is clearly simpler than functioning working drawings. Happily, such a set of drawings is precisely the design tool needed by the designer to clarify his intentions to himself.

Such was the case in this instance. Because this was a first attempt at designing and building at a scale that required more than notes and tracings, the medium of dimensioned "working" drawings was used as a design tool along with sketches and both mass and structural models because working drawings are a familiar medium. In this case, however, because the detail required to transmit complete instructions to the maker was to appear elsewhere, the drawings could be clear and legible even to a layman.

The one serious drawback to such a set of drawings is that they become the contract and commit the designer to a set of decisions long before such committment should be necessary. In that sense, they stultify the development of the design process although they can be altered at some administrative expense. That problem could be avoided in the future by the establishemnt and acceptance, by the client, of a set of performance standards based upon real, comparable examples which can be demonstrated to the client.

The Specifications (PLATES XXIX, XXX and XXXI)

The specifications are included to assist in describing the units, the structure and the level of detail involved in the design. Like all carefully researched specifications, they represent only the head of the iceberg above the mass of evaluation and rejection that goes into product selection.

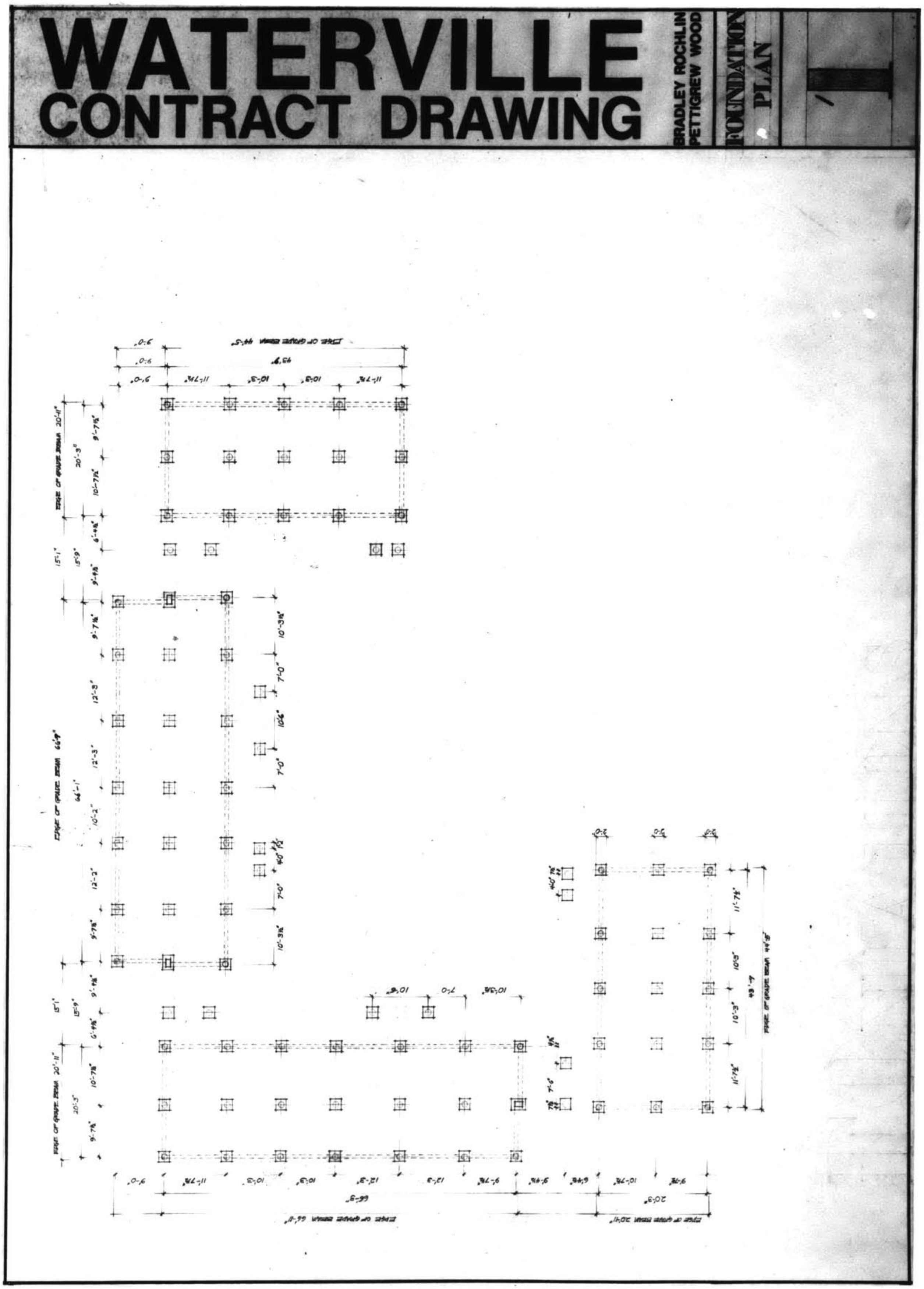
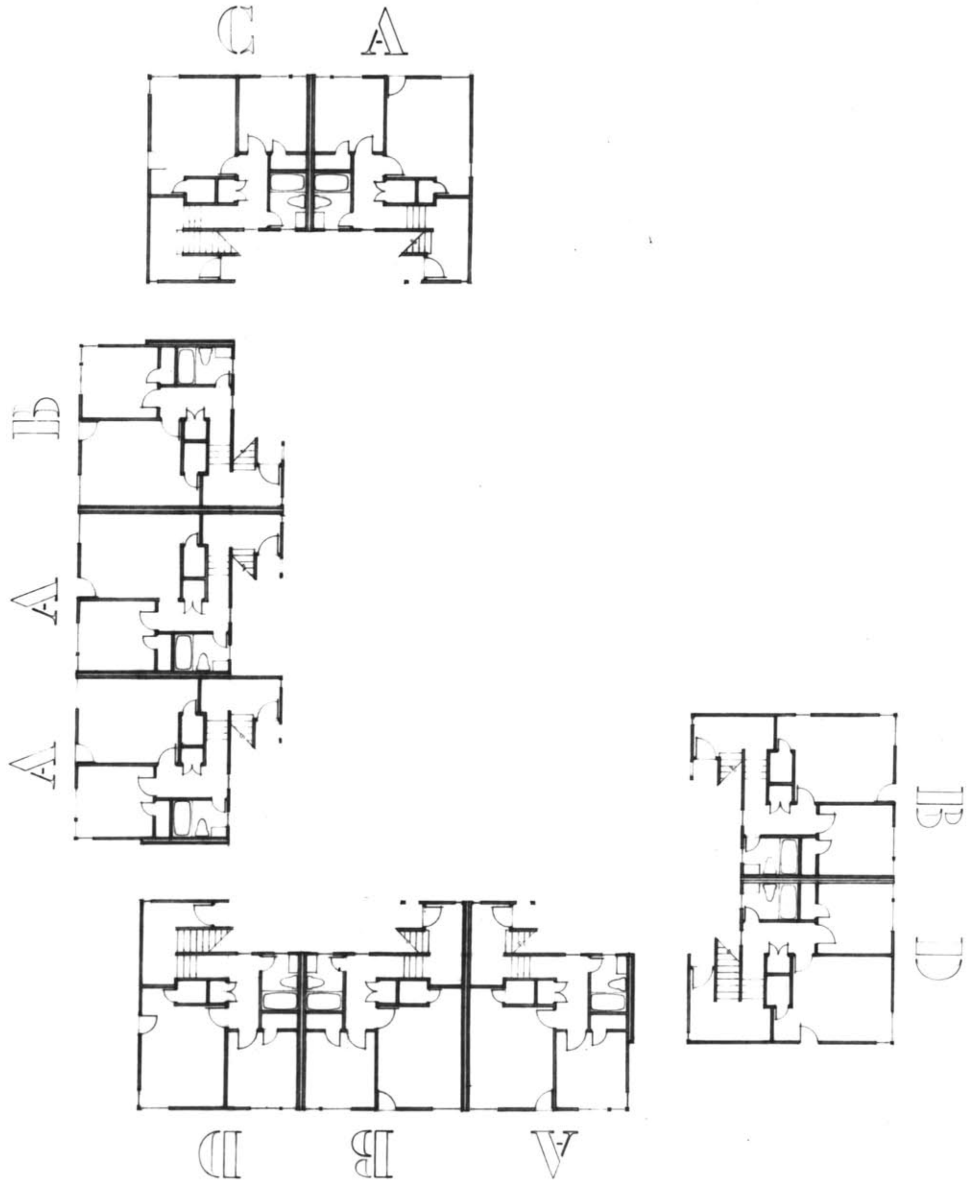

WATERVILLE
CONTRACT DRAWING
BRADLEY ROCHLIN
PETTIGREW WOOD
FOUNDATION
PLAN
1

PLATE XIII

WATERVILLE
CONTRACT DRAWING

BRADLEY ROCHLIN
PETTIGREW WOOD

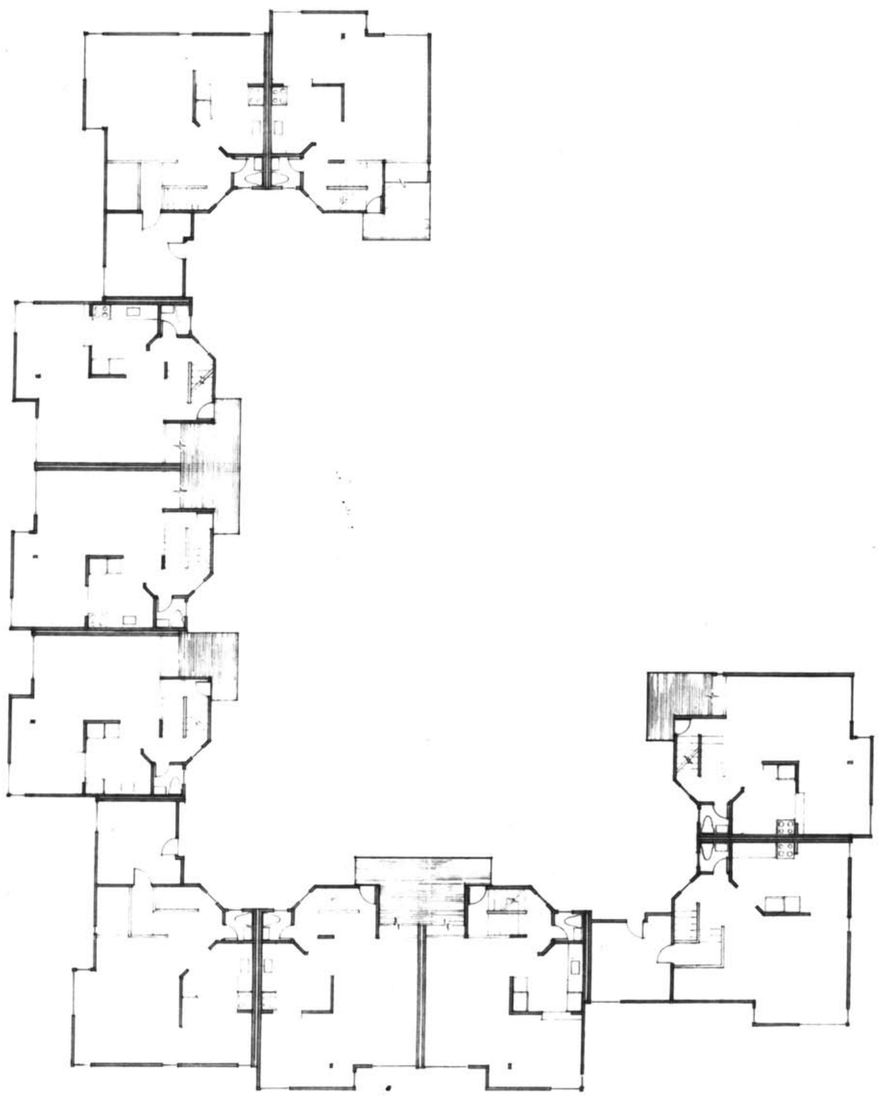
GRADE LEVEL 2



WATERVILLE
CONTRACT DRAWING

BRADLEY ROCHLIN
PETTIGREW WOOD

LIVING
- LEVEL



WATERVILLE
CONTRACT DRAWING

BRADLEY ROCHLIN
PETTIGREW WOOD

LOFT - LEVEL

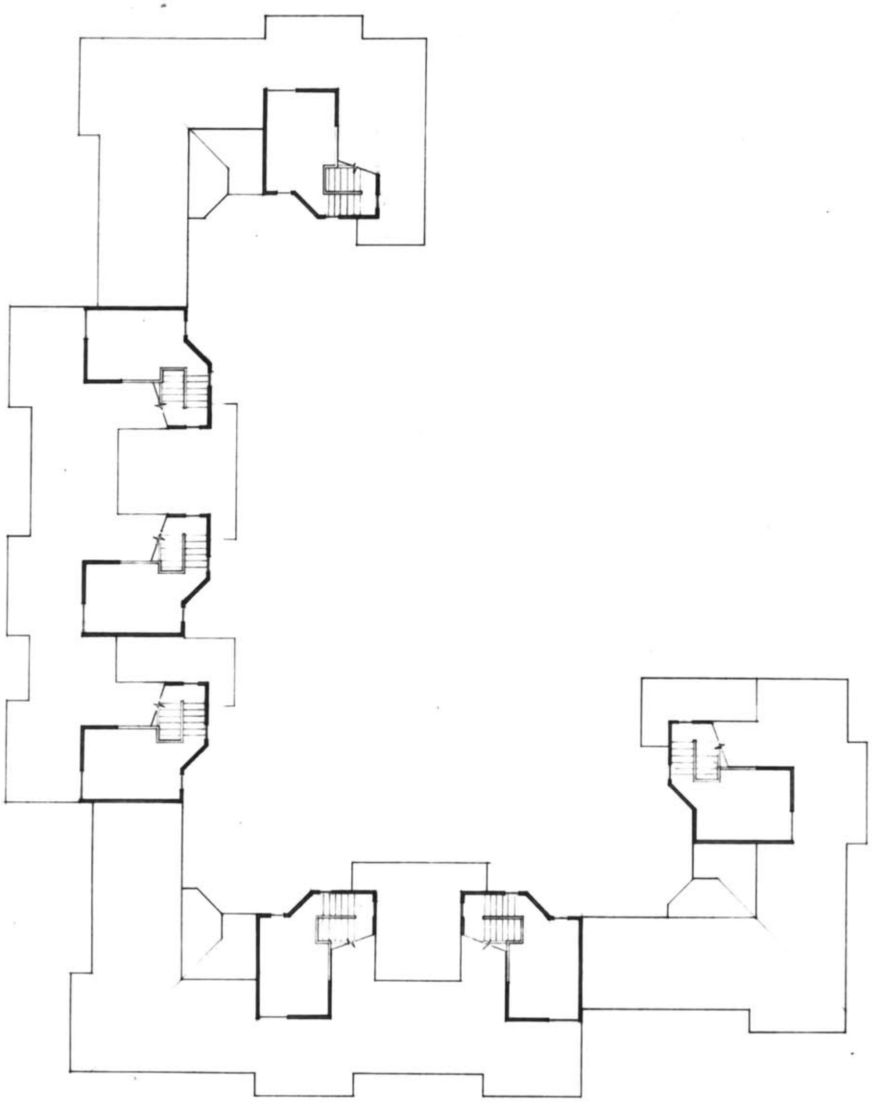


PLATE XVI

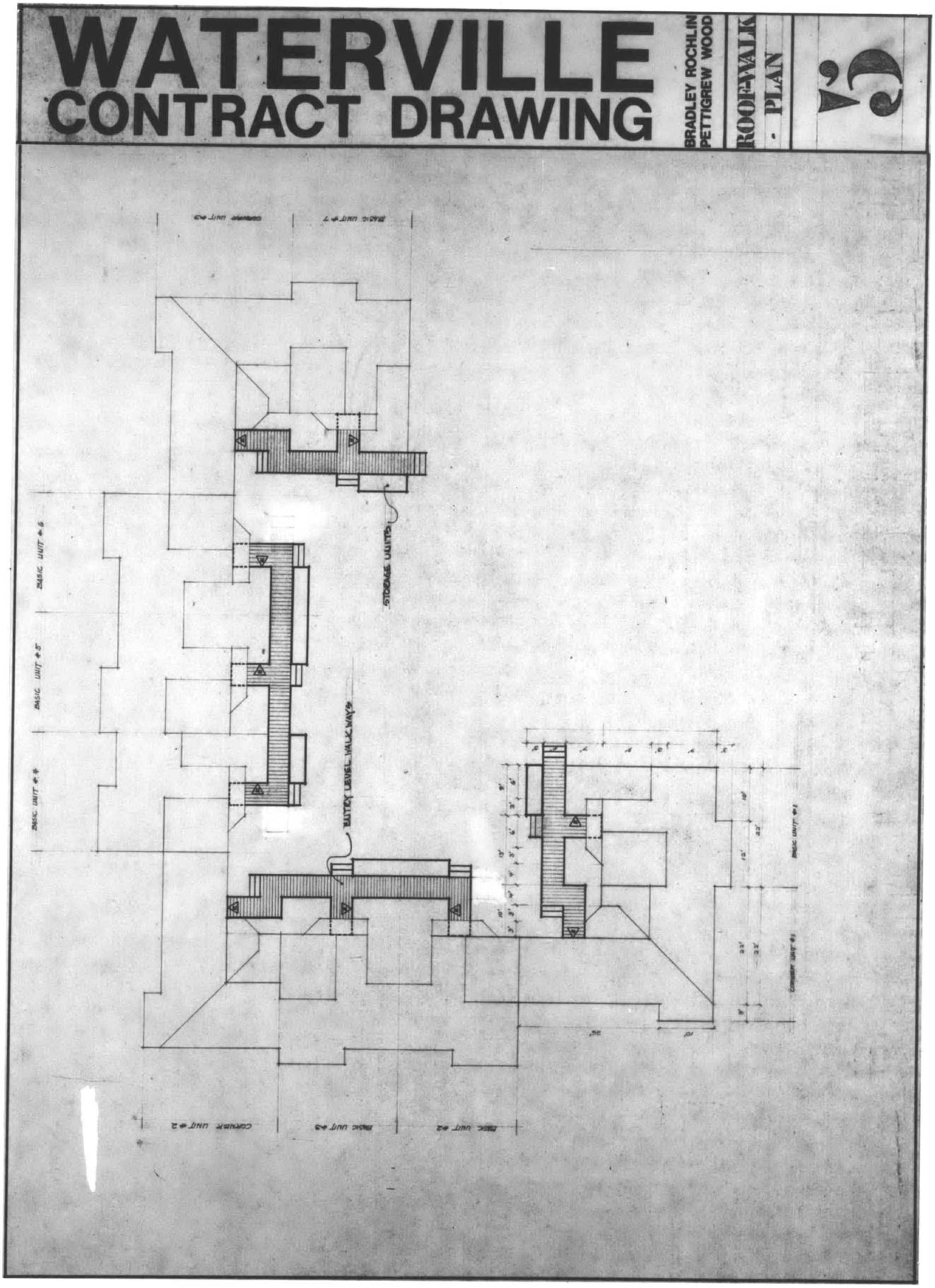
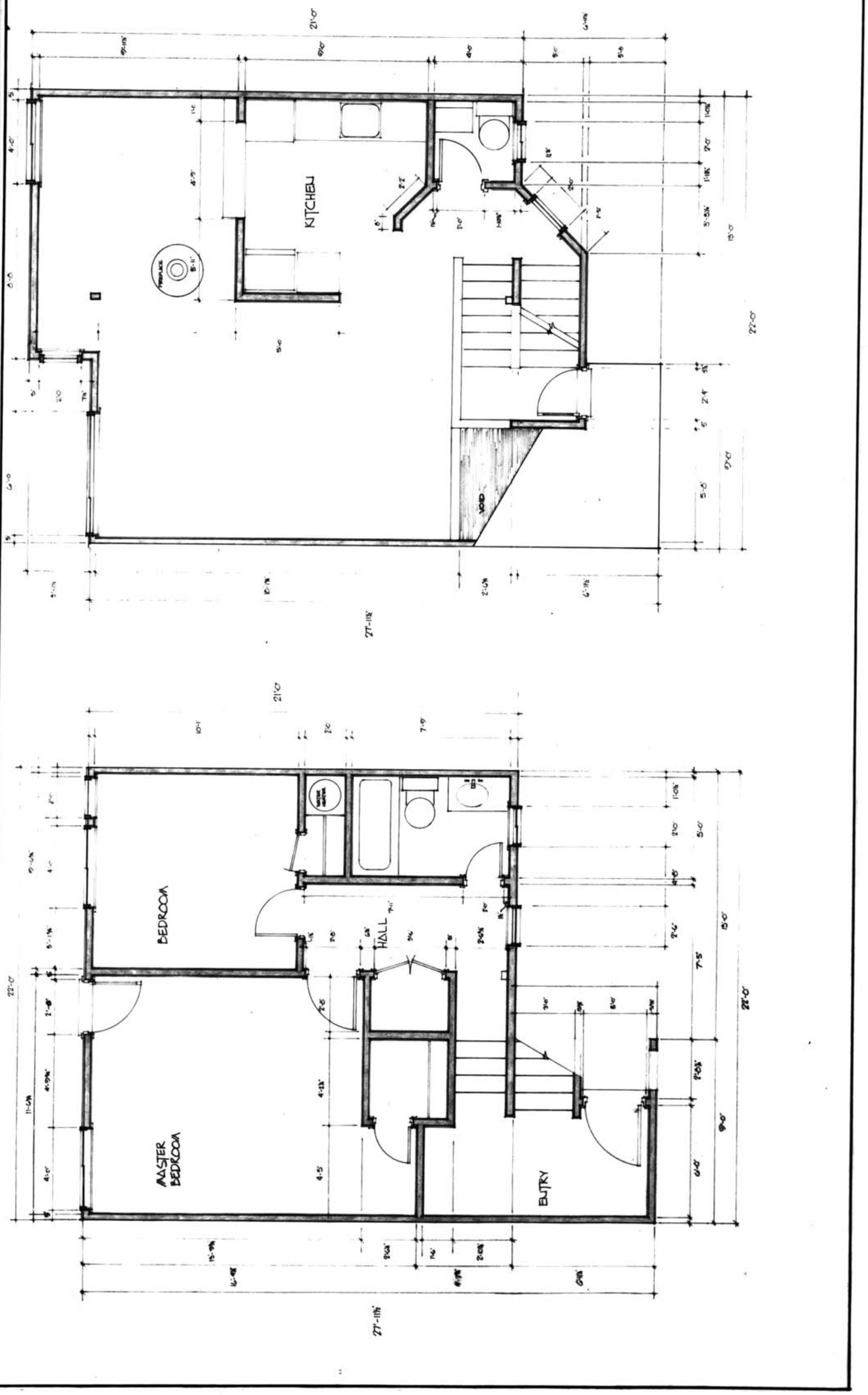

WATERVILLE
CONTRACT DRAWING
BRADLEY ROCHLIN
PETTIGREW WOOD
ROOF-WALK
PLAN
STORAGE UNITS
BASIC UNIT #4
BASIC UNIT #5
BASIC UNIT #6

PLATE XVII

WATERVILLE
CONTRACT DRAWING

BRADLEY ROCHLIN
PETTIGREW WOOD

BASIC UNIT
- PLAN



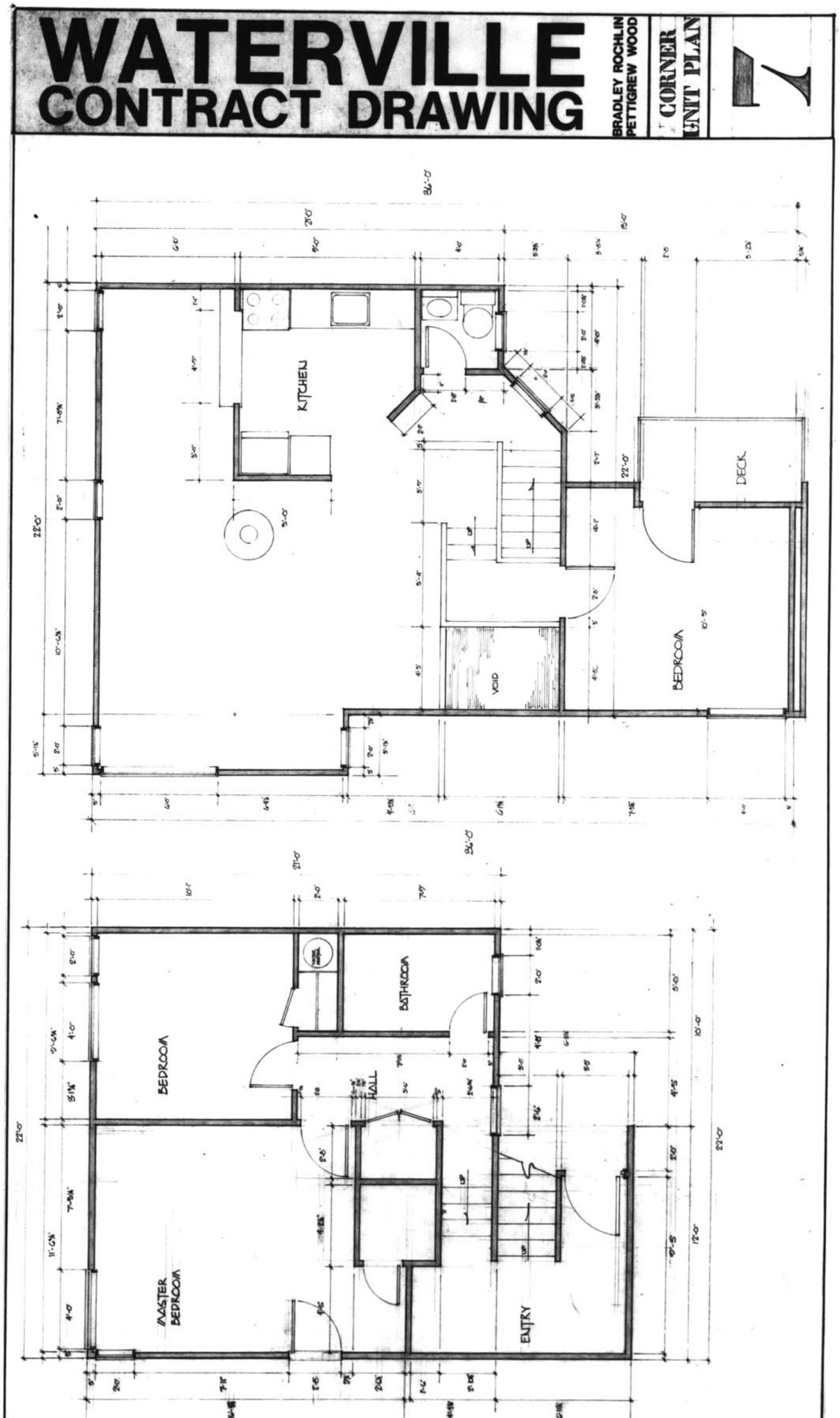
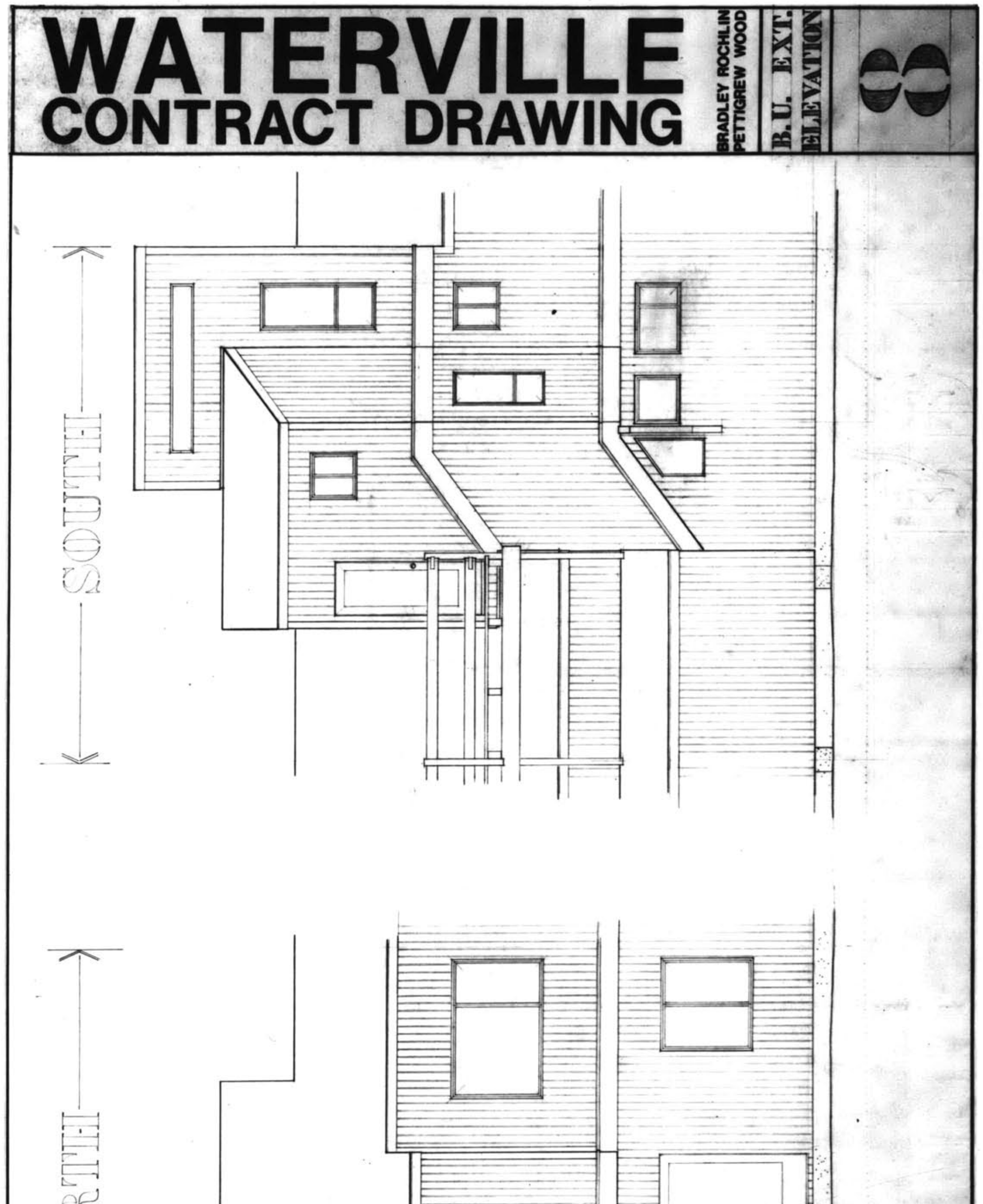

WATERVILLE
CONTRACT DRAWING
BRADLEY ROCHLIN
PETTIGREW WOOD
CORNER
UNIT PLAN
7
KITCHEN
DECK
BEDROOM
VOID
BATHROOM
HALL
BEDROOM
MASTER BEDROOM
ENTRY

PLATE XIX


WATERVILLE
CONTRACT DRAWING
BRADLEY ROCHLIN
PETTIGREW WOOD
B.U. EXT.
ELEVATION
SOUTH
NORTH

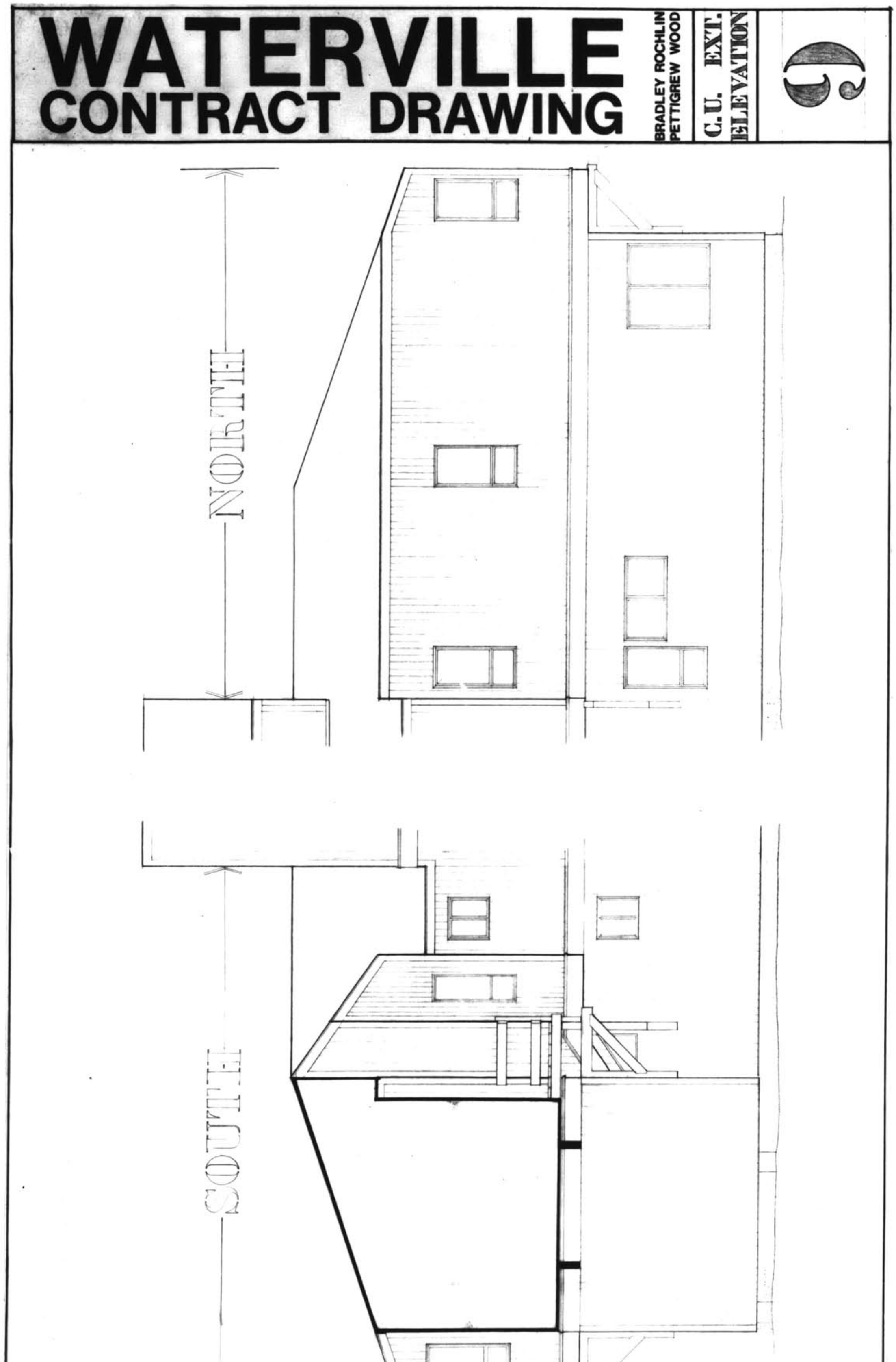

WATERVILLE
CONTRACT DRAWING
BRADLEY ROCHLIN
PETTIGREW WOOD
C.U. EXT.
ELEVATION
9
NORTH
SOUTH

PLATE XXI

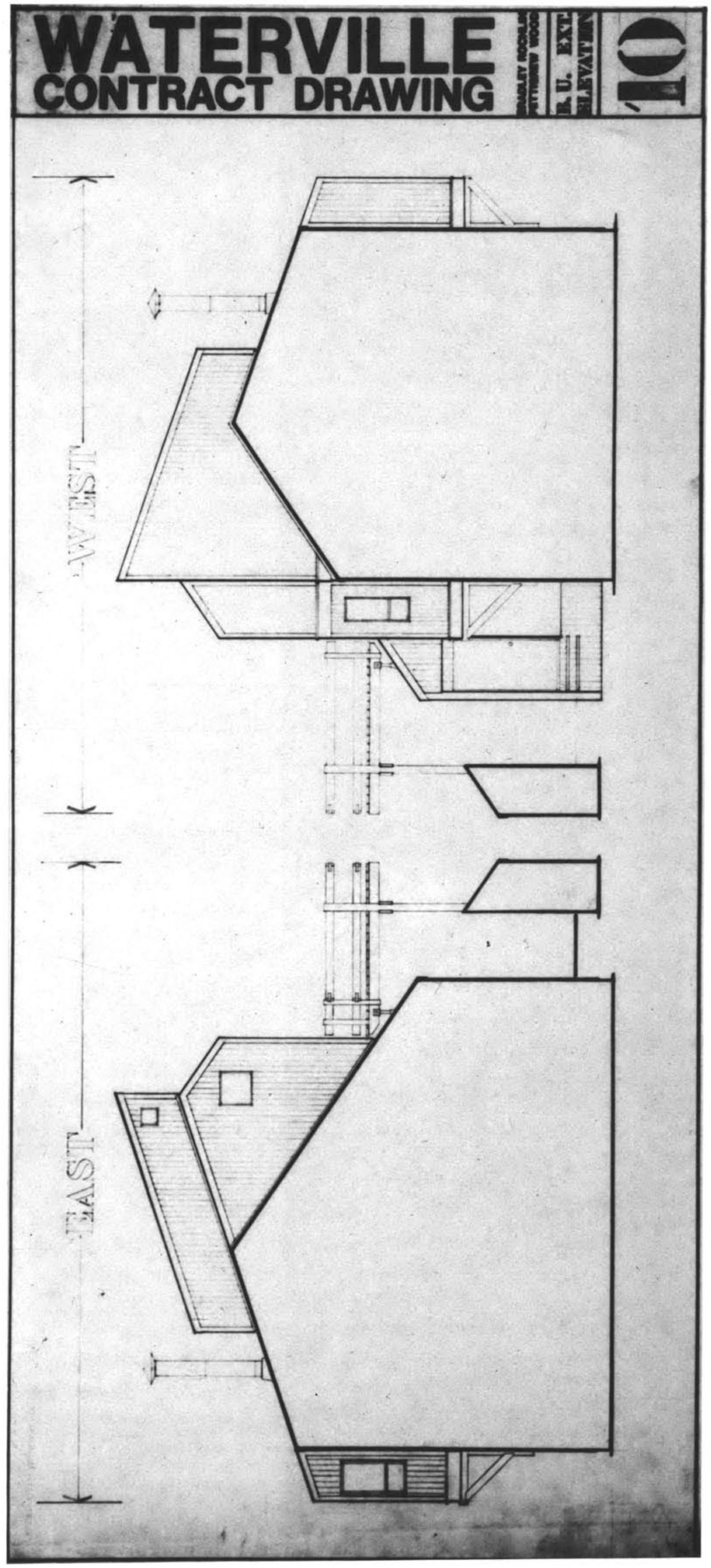
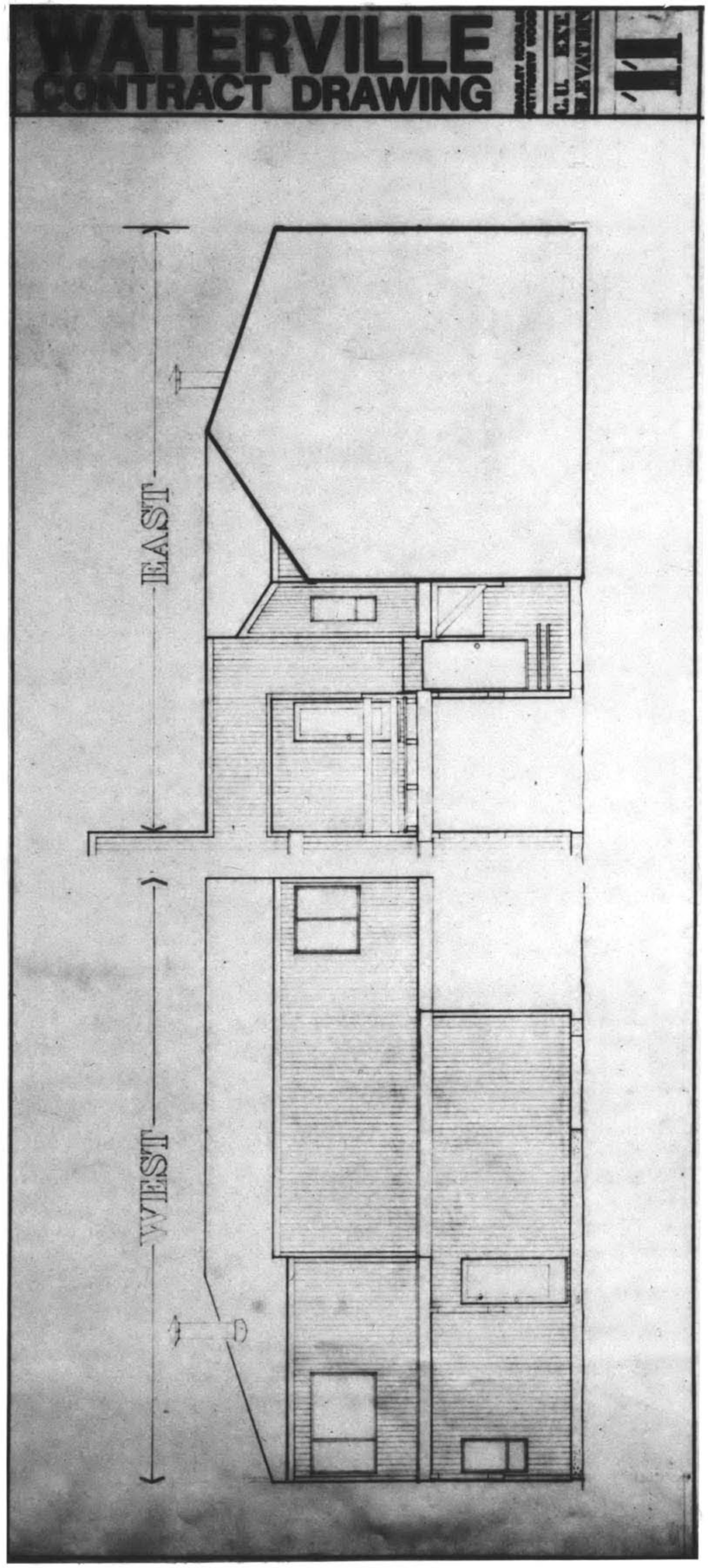
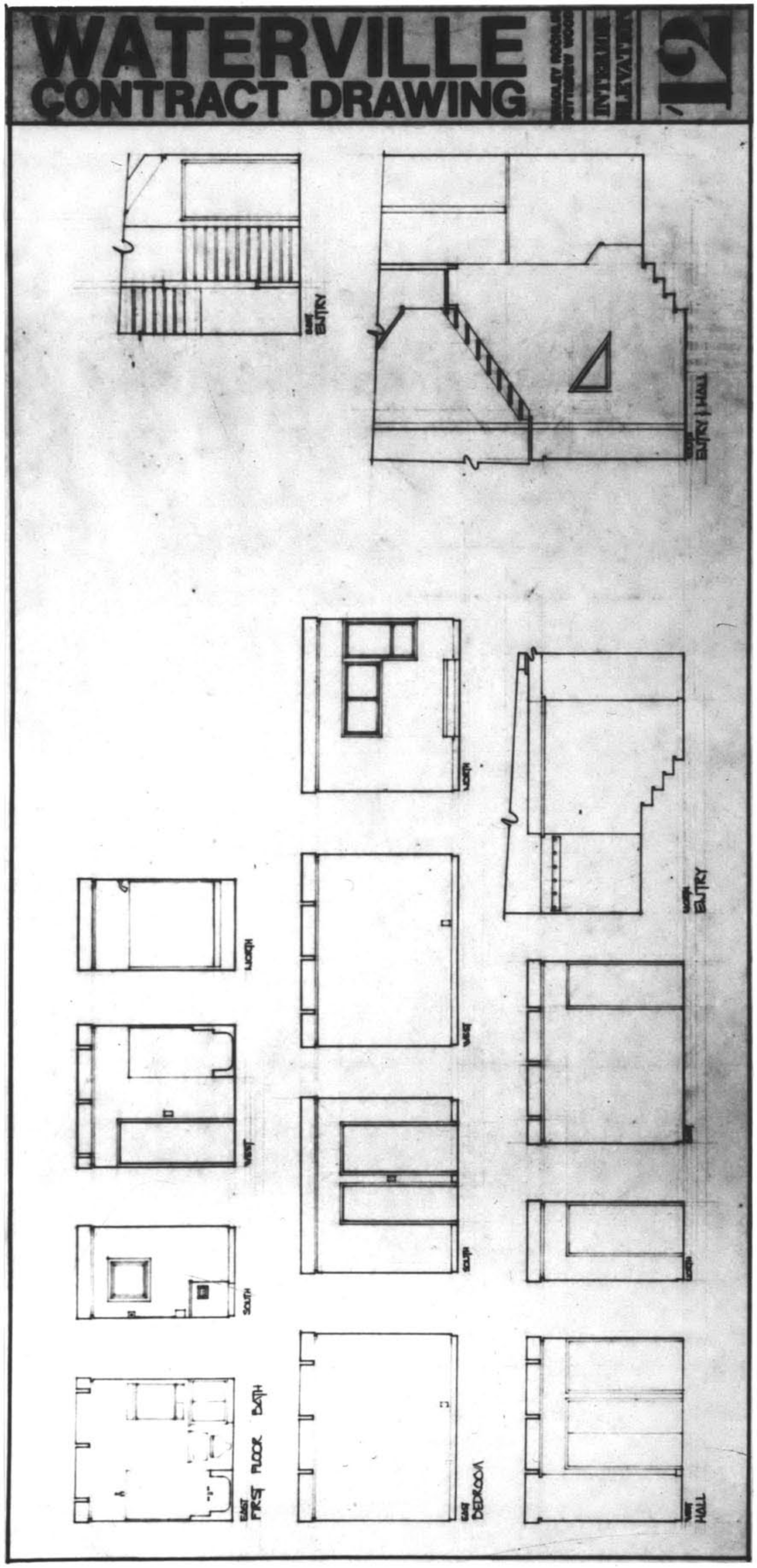


PLATE XXII


WATERVILLE
CONTRACT DRAWING
EAST
WEST


WATERVILLE
CONTRACT DRAWING
12
FIRST FLOOR BATH
SOUTH
WEST
NORTH
BEDROOM
HALL
ENTRY
ENTRY / HALL

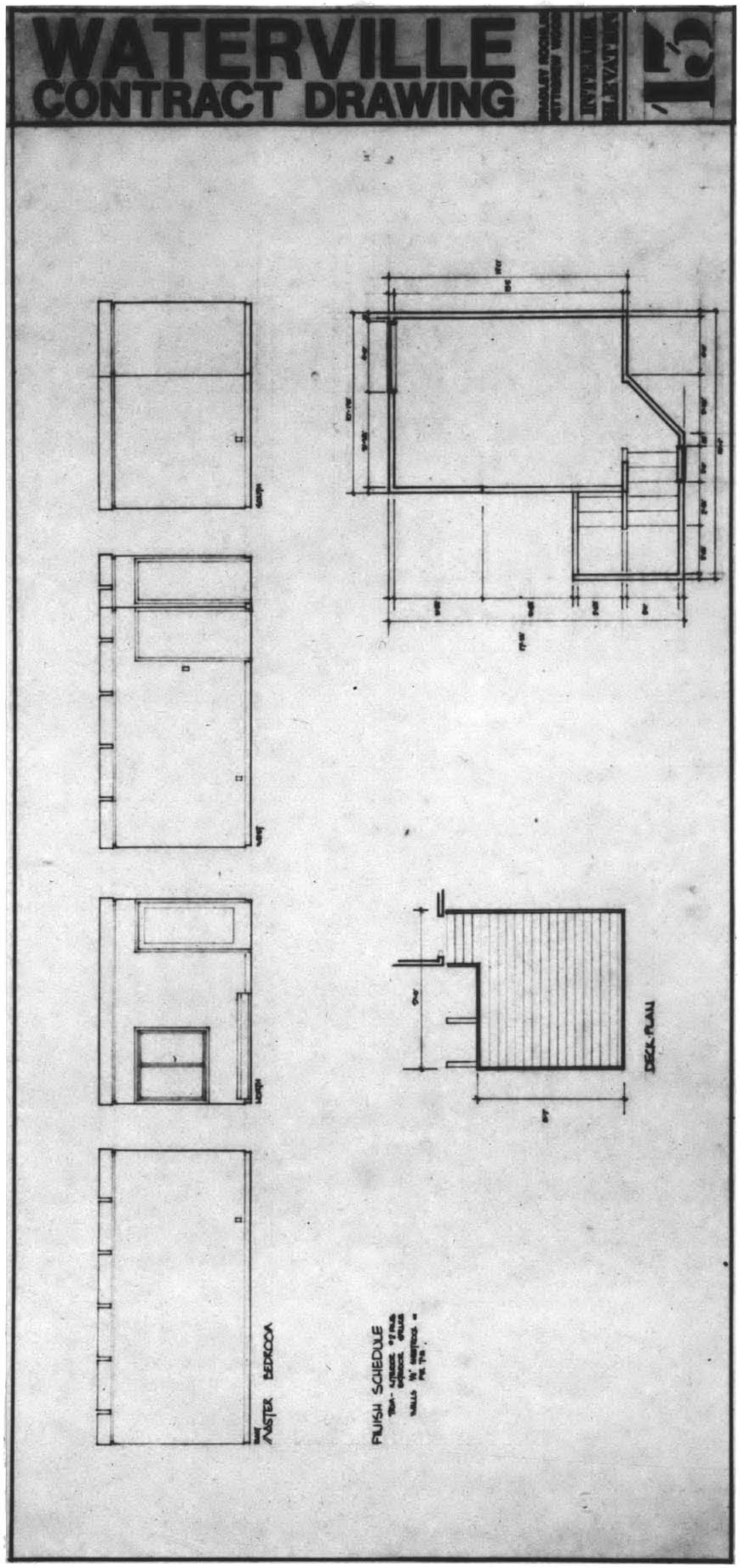
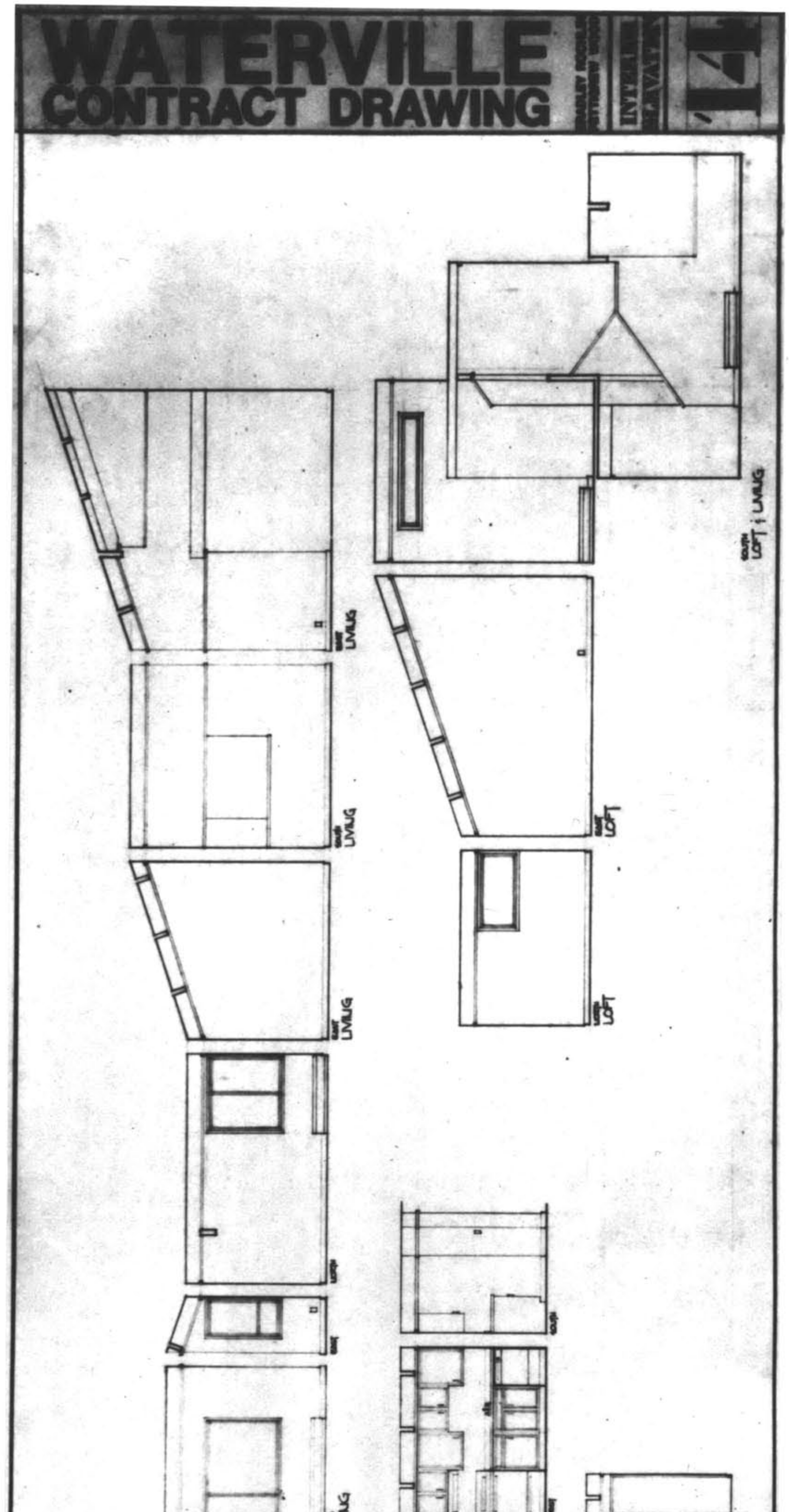
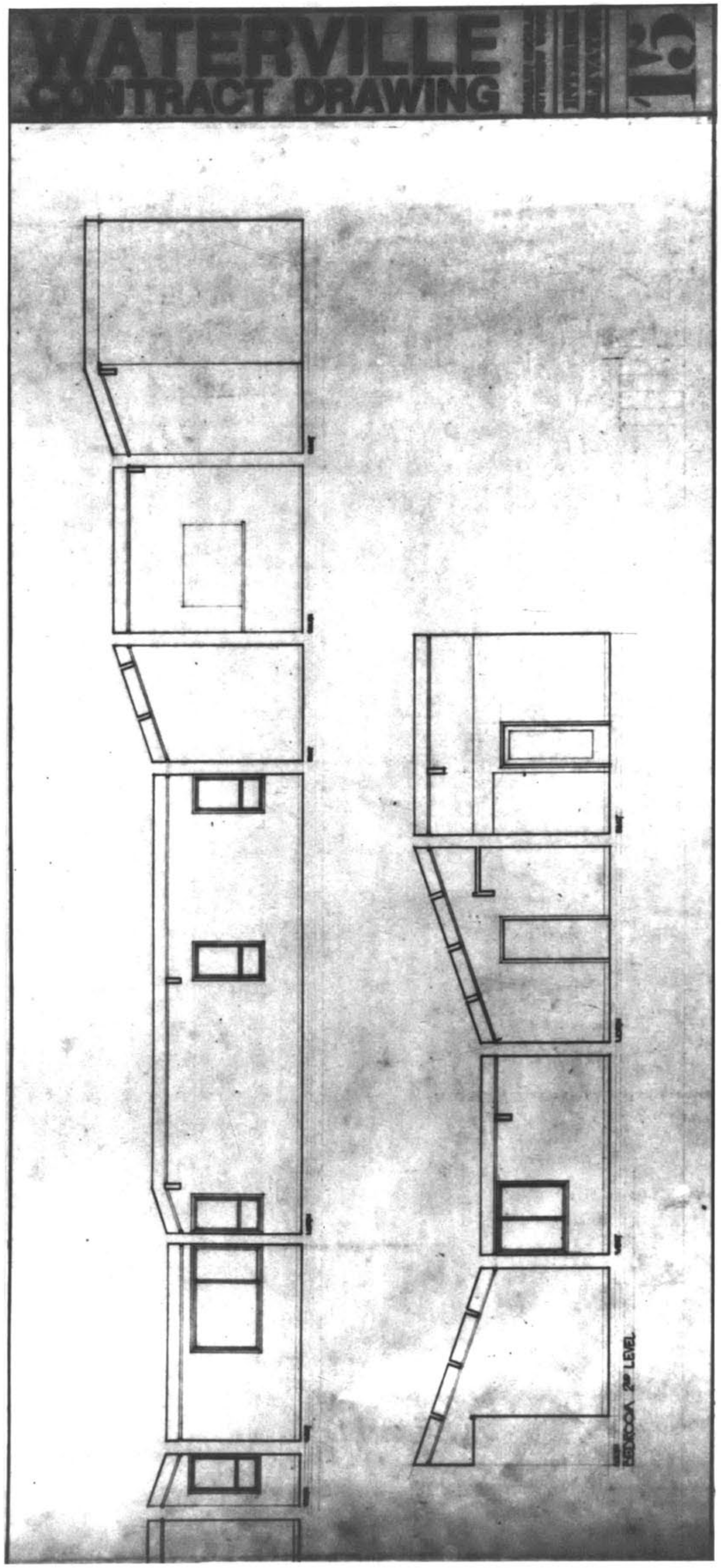
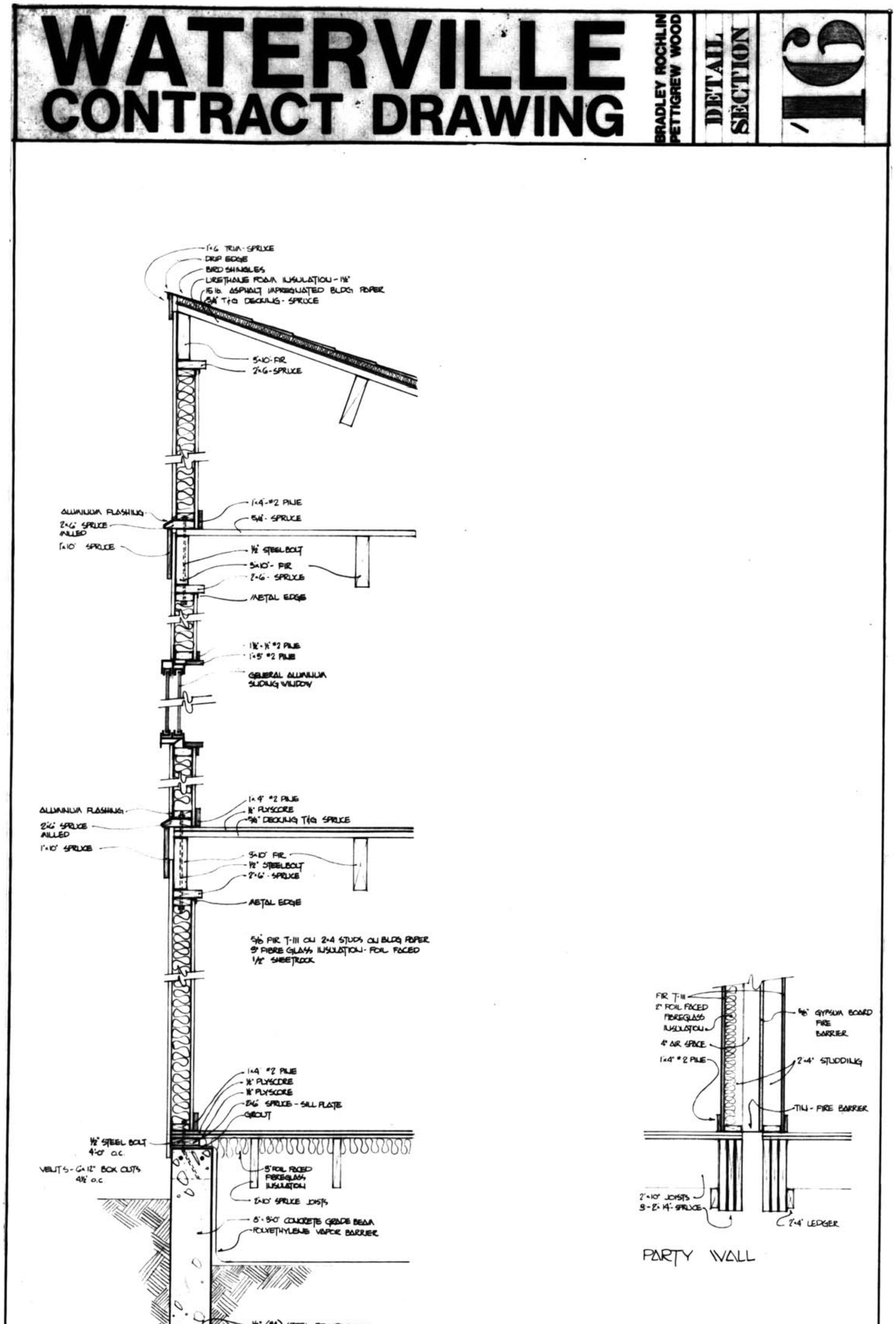

WATERVILLE
CONTRACT DRAWING
15
MASTER BEDROOM
FINISH SCHEDULE
DECK PLAN

PLATE XXV


WATERVILLE
CONTRACT DRAWING
LIVING
LOFT


WATERVILLE
CONTRACT DRAWING
15
BEDROOM 2nd LEVEL


WATERVILLE
CONTRACT DRAWING
BRADLEY ROCHLIN
PETTIGREW WOOD
DETAIL
SECTION
16
1×6 TRIM - SPRUCE
DRIP EDGE
BIRD SHINGLES
URETHANE FOAM INSULATION - 1½"
15 lb. ASPHALT IMPREGNATED BLDG PAPER
3/4" T&G DECKING - SPRUCE
3×10 - FIR
2×6 - SPRUCE
ALUMINUM FLASHING
2×6" SPRUCE MILLED
1×10" SPRUCE
1×4" - #2 PINE
5/4" - SPRUCE
½" STEEL BOLT
3×10" - FIR
2×6 - SPRUCE
METAL EDGE
1⅛ - ½" #2 PINE
1×5" #2 PINE
GENERAL ALUMINUM SLIDING WINDOW
ALUMINUM FLASHING
2×6" SPRUCE MILLED
1"×10" SPRUCE
1×4" #2 PINE
⅛" PLYSCORE
5/4" DECKING T&G SPRUCE
3×10" FIR
½" STEEL BOLT
2"×6" - SPRUCE
METAL EDGE
5/8 FIR T-111 ON 2×4 STUDS ON BLDG PAPER
3" FIBRE GLASS INSULATION - FOIL FACED
½" SHEETROCK
1×4" #2 PINE
⅛" PLYSCORE
⅛" PLYSCORE
2×6" SPRUCE - SILL PLATE
GROUT
½" STEEL BOLT
4'-0" O.C.
VENTS - 6×12" BOX CUTS
4½' O.C.
3" FOIL FACED FIBREGLASS INSULATION
2×10" SPRUCE JOISTS
8"×3'-0" CONCRETE GRADE BEAM
POLYETHYLENE VAPOR BARRIER
½" (#4) STEEL REINFORCING
FIR T-111
2" FOIL FACED FIBREGLASS INSULATION
4" AIR SPACE
1×4" #2 PINE
5/8" GYPSUM BOARD FIRE BARRIER
2×4" STUDDING
T111 - FIRE BARRIER
2"×10" JOISTS
3 - 2×14" - SPRUCE
2×4" LEDGER
PARTY WALL

FOUNDATIONS	2' by 2' poured concrete footings carrying 1' diameter poured concrete piers. 8" thick perimeter enclosure grade beams of reinforced conrete with rough plank textured finish.
GIRDERS	6x14 inch combination beams of hemlock and/or spruce
LOWER PLATFORM	2x8 and 2x10 inch joists in hemlock and /or spruce 16 inches on centre with subfloor of 1/2 inch plyscore.
STRUCTURAL WALLS	2x4 inch hemlock and/or spruce sills, plates and studs. Party wall shall be separate and distinct as per plan
STRUCTURAL TIMBERS	Second level structural beams of 3x10 inch natural fir 36 inches on centre. Roof girders of 4x10,4x16 and 4x12 or equivalent natural fir as per plan. Purlins of 3x10 and 3x6 natural fir 36 inches on centre as per plan.
PLANKING	5/4 inch tongue and groove natural spruce in both living level deck and roof structure.
EXTERIOR SIDING	5/8 inch fir textured 1-11, 4 inch o.c. grooving.
EXTERIOR TRIM	1x6 and 1x10 inch spruce trim boards as per plan. 1x4 corner boards, as per plan.
ROOFING	Bird wind seal shingles with self sealing mastic, or equal.
FLASHING	Aluminum flashing and drip edge as required.
PAPER	Roof--- 15 lb asphalt impregnated felt. Exterior wall vapor barrier--- asphalt impregnated building paper. Lower platform--- Polyethylene vapor barrier placed up to grade beams
INSULATION	Roof--- $1^1/_2$ inch polyurethane on roof planking. Exterior walls--- 3 inch foil faced fibre glass. Lower platform floor--- 2 inch foil faced fibre glass. Party wall--- 2 inch fibre glass blanket between units.
FIRESTOPPING	Wet wall closure--- zinc strip or equal. Between units--- 5/8 sheetrock.
GLASS WINDOWS	General Aluminum Corp. horizontal sliding sash, double and single slide dimensioned as per plan, glazed with 1/2 inch insulated glass including screens where required.

EXTERIOR DOORS	Entry--- Exterior solid core $1^3/_4$ inch thick dimensioned as per plan with oak step and fully weatherstripped. Deck and rear bedroom---Exterior wood frame with weld glass panel dimensioned as per plan and fully weatherstripped.
EXTERIOR DECK	Supported with steel shoe supports on roof deck, carrying 3x8 inch natural fir beams and 2x6 or 8 fir planking as per plan. Corner unit deck as per plan.
ENTRY PLATFORM	Structure per plan with 2x6 or 8 inch fir planking.

INTERIOR FINISH

WALL FINISH	As per finish schedule.
FLOORING	Kithen and bathroom---Armstrong Montina vinyl tile or equal Lower level--- 1/2 inch plyscore underlayment ready for carpet by others. Living Level--- 1/2 inch plyscore underlayment on planking ready for carpet by others. Loft--- structural planking.
INTERIOR DOORS	Dimensioned per plan and elevations, flush panel mahogany hollow coredoor stained and sealed with finish detail as per plan.
HARDWARE	Exterior doors--- brushed aluminum finish key in knob lockset. Bedrooms--- brushed aluminum finish with privacy lockset. Closets--- brushed aluminum finish with key in knob lockset. Bathroom--- brushed chrome plate finish on bath side and brushed aluminum finish on other.
KITCHEN CABINETS	Kitchen Kompact, Glenwood, dimensioned as per plan. Formica brand counter tops as per plan.
KITCHEN EQUIPTMENT	All Hotpoint RB525 30" electric range CTA12C1 11.6 cu.ft. two door refrigerator GHDA310ANP Dishwasher GHMA300A Disposal RVN2300 hood If unavailable appliances shall be Westinghouse products of equal rating.

PLUMBING FIXTURES	White Crane waterclosets wall hung as per plan. Rexmont 3-171 model Counter top mounted Ovette 1-990-S oval lavatory by Crane Fiber glass bath/shower, Chateau 2-810 model If unavailable these items shall be Universal Rundle products of equal rating. 30 inch single compartment stainless steel kitchen sink.
PLUMBING STOCK	PVC soil pipe system throughout ans PVC hot and cold supply system to all bathrooms and kitchens. Brass valves and fittings where required.
HEATING	Electric baseboard heating system thermostatically controlled in each bedroom and also in the main living space.
ELECTRICAL	100 amp or better service with switches and receptacles as per plan.
LIGHTING FIXTURE	See schedule as per plan.
FIREPLACE	Heatilator Mark 4106 Flatte Black.
MISC. FINISH	Bathroom vanity by Kitchen Kompact, Glenwood dimension as per plan. Bathroom mirror, light and cabinet combo,,Miami-Carey 639 with 436 light

CONSTRUCTION DOCUMENTS.

Objectives

The main thrust of the design effort and a major element of this thesis was the careful planning and analysis of the process by which these buildings are to be built. From the earliest stages, the nature of the structural system and the most logical ways to assemble it were major considerations of the design itself.

The experiment is to see whether the foresight and planning skills of people trained in architectural design and equipped with some of the design tools of architecture can use those skills to advantage in anticipating material, labor and equipment needs; avoiding costly errors and oversights; predicting problem areas and conflicts between systems; utilizing the full potential of available labor; and documenting the building process so that errors can lead to learning. In a very real sense, the experiment involves a series of dry-runs on paper of the entire building process and analyses of each task in the process in an effort to predict and avoid trouble.

The effect of this continuous mental simulation of the actual building process is to test the consistency and validity of the building design from an early stage and to clarify and simplify both the design itself and the physical parts and elements used in realizing the form and spaces. The process keeps the design in the proper perspective with the resources at hand always letting the designer know if what he is designing can be built intelligently and economically or whether he has crossed into the familiar architectural realm of pipedreaming. Of course the process feeds back the other way as well such that the design concepts of value can alter the plan of construction. Just as having a clear design intent indicates some better ways of building, it becomes clearer how to design once the idea of how to build begins to develop.

Perhaps one of the most important ways in which a heavy dose of planning and prediction can make themselves felt is in the effective utilization of available labor. Since it was apparent from the outset that the bulk of the labor force that would be involved in the construction of these buildings would be relatively unskilled college summer labor, it seemed vitally important to carefully think through the process so that it included only tasks that they could be expected to perform and that those tasks be presented to them in a way that they could understand. This intent sprung primarily from a desire to see the building successfully and economically completed, but was based upon a sincere respect for the individual makers who would be putting the building together.

It seemed very important to us to present the building and the building process to the makers in such a way that they understood not only the task they were to perform at any given moment and knew very clearly how to do that task, but also that they have a clear picture of the overall concept of the design and the relevance of the particular task within the whole. It was for this simple purpose that the "building book" was designed.

Mental simulation is an inexpensive way to experiment with building technology. The "building book" and the fully detailed model that will be built from it are somewhat more expensive in terms of time committed, but both an invaluable for their saving and teaching value.

The System and the "Building Book"

The structure as it finally appears is adequately described in the Specifications (PLATES XXIX through XXXI). It is a simple system reflecting both the low budget and the casual nature of the use of a ski house. It is not, in fact, a building system at all but rather the outcome of a carefully planned system of building.

The system of building is by no means revolutionary, but rather responsible and appropriate. The foundations are formed and poured in the most traditional way requiring only two men and taking place before the main labor force and materials arrive on the site. The grade level platform is similarly fashioned in a very standard "stick built" fashion because the accuracy of its dimensions and levelness are of acute importance to the success of the rest of the building.

The wall sections are assembled from full scale patterns on a table in a covered factory in the middle of the site. They are fabricated from precut lumber and factory-cut sheathing panels, have windows and electrical boxes installed and are stained and sealed before they are stored for erection. The intermediate floor and the roof are site-framed in heavy timeber and planked and roofed in the traditional way.

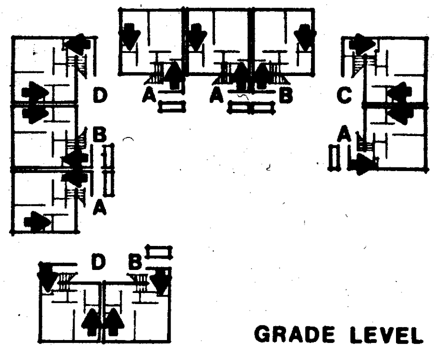
The party walls which are totally discrete with gypsum fire and sound insulation, are sheathed and prefinished on the inside and the exterior walls on the outside. Interior walls are factory finished on one side and then site wired and finished on the inside with either paneling of gypsum board detailed to eliminate messy and expensive finish work.

The major problem areas involve exterior detailing and correction of accumulating errors - both questions of tolerances. The use of 4x8 sheets of textured plywood simplify the sheathing and siding process but are apparently intended for absolutely simple, planar surfaces dimensioned in multiples of 4 feet. For those areas where it was important to articulate the walls more, careful consideration had to be given to the joining of panels.

Greatly more critical was the question of structural tolerances. The four and six inch air spaces between each unit allow passage for the plumbing and assist in the accoustical insulation, but they are absolutely vital in taking up errors so they do not accumulate along the full 140 foot dimension of the building. An adjustable panel over the doorways is another area where mistakes can be corrected as is the wide trim board that covers the panel joints in the verticle direction.

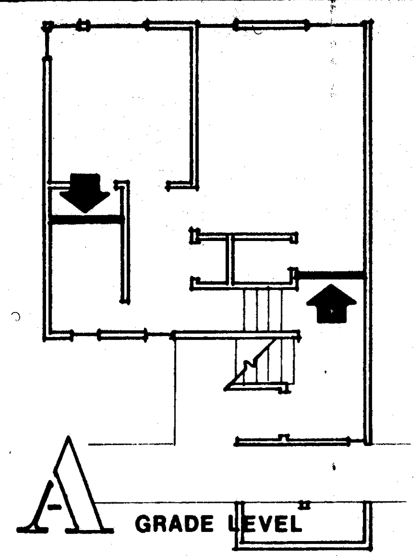
The "Building Book" (PLATES XXXII on) is a nearly self explanatory effort. There is a page for each of the panels which is to be built and a "how to" page for each operation. Each page describes verbally and pictorally what the task is, what parts are required, where the parts can be found, where the part is located in the cluster, where the part is located in the unit, what related work has to be performed with respect to the task and what likely problems will be encountered. The book will eventually be overforty pages long and will be bound into an 11x17 inch format which will be distributed to each laborer.

The book is an experiment in communicating the making process to the maker, in this case taking advantage of his literary and reasoning skills which are more developed than his construction skills. It is intended to be a thorough and complete reference, but is probably as valuable to us for having taken the care to make it as it will be to the laborers who will use it. It is both a plan to build from and a record of our own planning.



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

INTERIOR PANEL PREFAB.

LOCATION

ALL UNITS, ENTRY

ALL UNITS, TUB WALL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	48	10	
PLATES	1		10	
STUDS	4	93.5	40	

PANELS REQUIRED

10 AS SHOWN
0 REVERSED

SHEATHING INSTRUCTIONS

SHEATHING STOCK:
3/8 INTERIOR T1-11

1	48x66.5	10	

PARTS REQUIRED

SILLS	1	60	10	
PLATES	1		10	
STUDS	5	93.5	50	

PANELS REQUIRED

10 AS SHOWN
0 REVERSED

SHEATHING INSTRUCTIONS

SHEATHING STOCK:
3/8 COMPOSITION BOARD

PARTS REQUIRED R-L

1	48x96	10	
1	12x96	10	

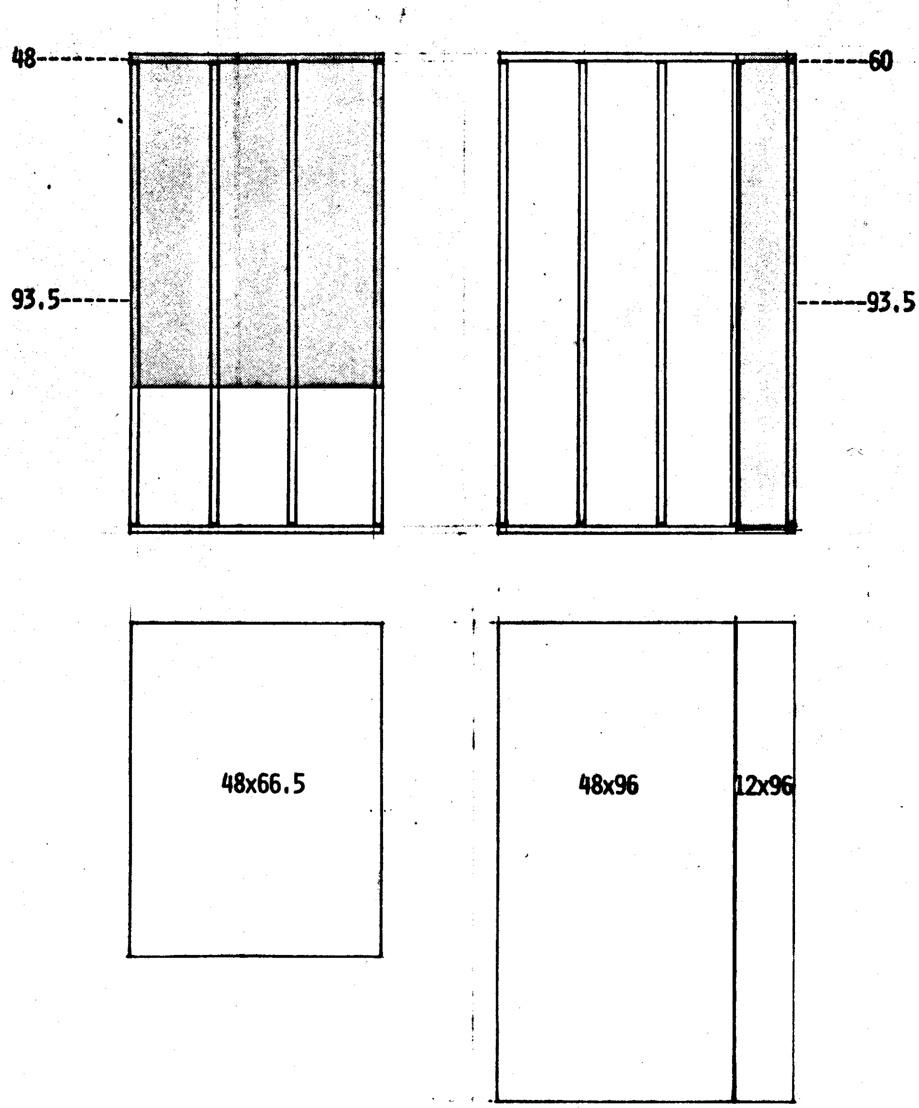
NAILING: D FINISH

FINISHING INFORMATION

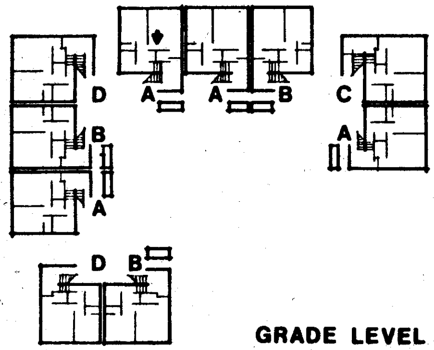
FIELD PAINTED

STORAGE INFORMATION

STUDDED PANEL
SHEATHED PANEL

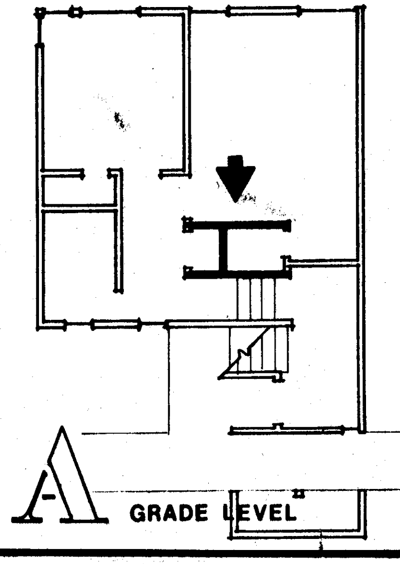


PANELS



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

INTERIOR PANELS

LOCATION

ALL UNITS, MASTERBED CLOSET AND END WALL

FRAMING INSTRUCTIONS

FABRICATION STOCK
2x4

PARTS REQUIRED

SILLS	1	94.25	20
PLATES	1		20
STUDS	8	93.5	160

PANELS REQUIRED

10 AS SHOWN
10 REVERSED

SHEATHING INSTRUCTIONS

SHEATHING STOCK
3/8COMPOSITION BOARD

PARTS REQUIRED L-R

1	48x96	20	
1	46.25x96	20	

FABRICATION STOCK
2x4

PARTS REQUIRED

SILLS	1	42.5	10
PLATES	1		10
STUDS	4	93.5	40

PANELS REQUIRED

10 AS SHOWN, SHEATHED BOTH SIDES

SHEATHING INSTRUCTIONS

SHEATHING STOCK
3/8 COMPOSITION BOARD

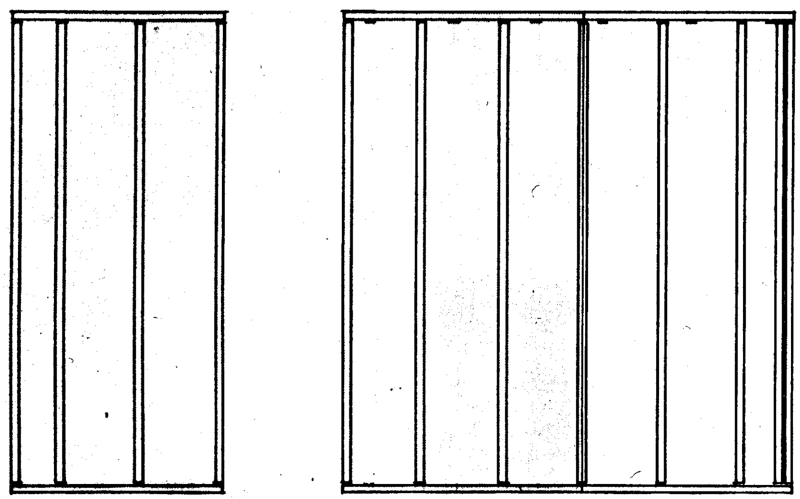
PARTS REQUIRED

1	42.5	20	

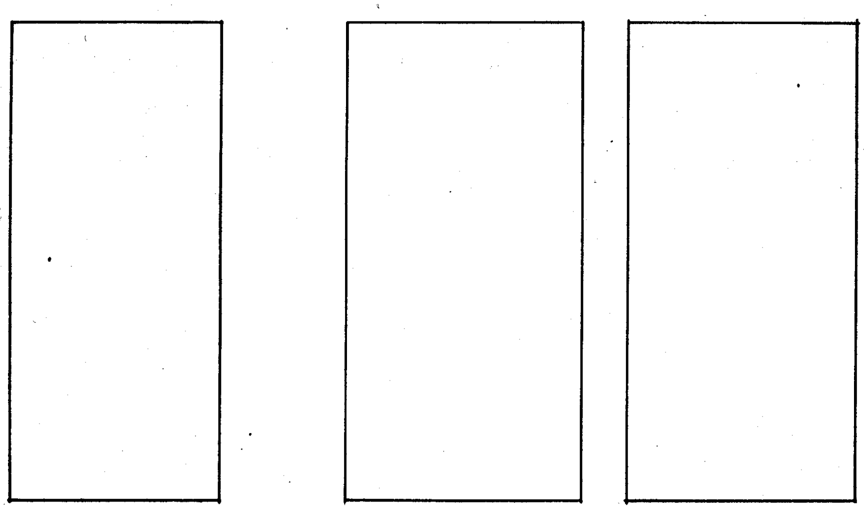
NAILING: 8 D FINISH

STORAGE INFORMATION

STUDDED PANEL
SHEATHED PANEL



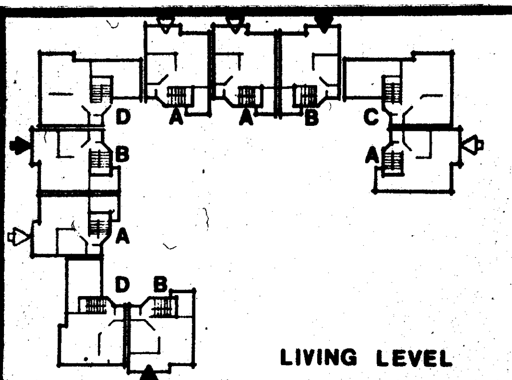
PANEL BOTH SIDES



11

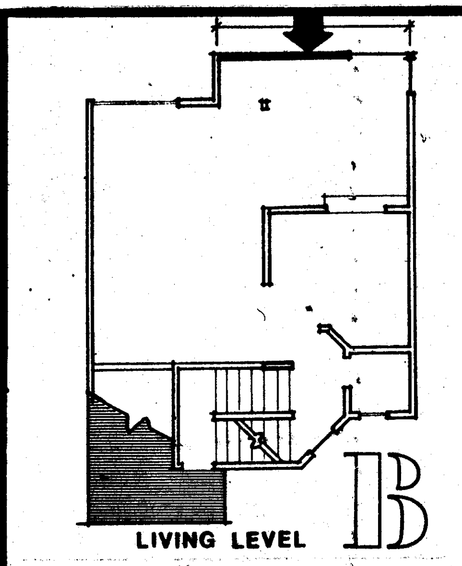
12

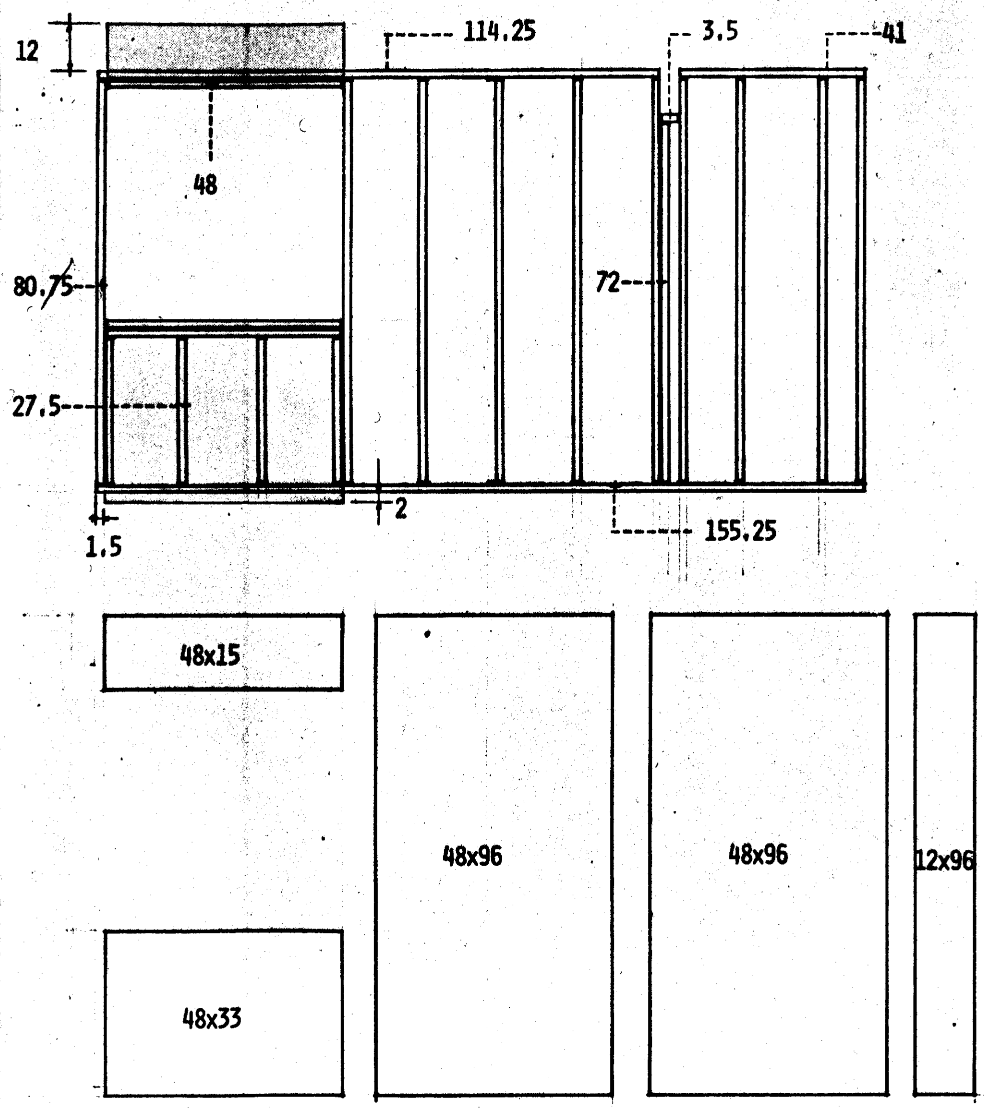
PLATE XXXIII



LOCATION IN CLUSTER

LOCATION IN UNIT





JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

BASIC UNIT, REAR
LIVING LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	155.25	7	
PLATES	1	114.75	7	
	1	3.5	7	
	1	41	7	
STUDS	10	80.75	70	
	1	72	7	
	4	27.5	28	
HEADER	3	48	21	

PANELS REQUIRED

3 AS SHOWN
4 REVERSED

VAPOR BARRIER

POLYETHYLENE

WINDOW INSTALLATION

1 4x4 SLIDER

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11

PARTS REQUIRED L-R

1	48x15	7	
1	48x33	7	
2	48x96	14	
1	12x96	7	

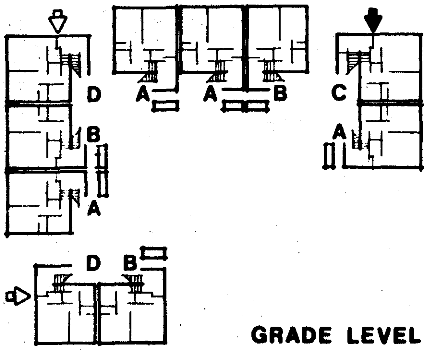
FINISHING INFORMATION

WINDOW CAULKING
SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

STORAGE INFORMATION

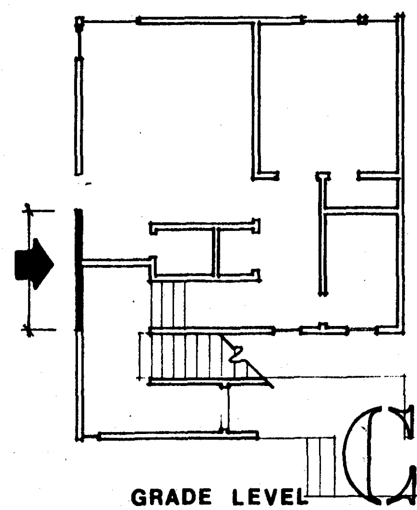
STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL

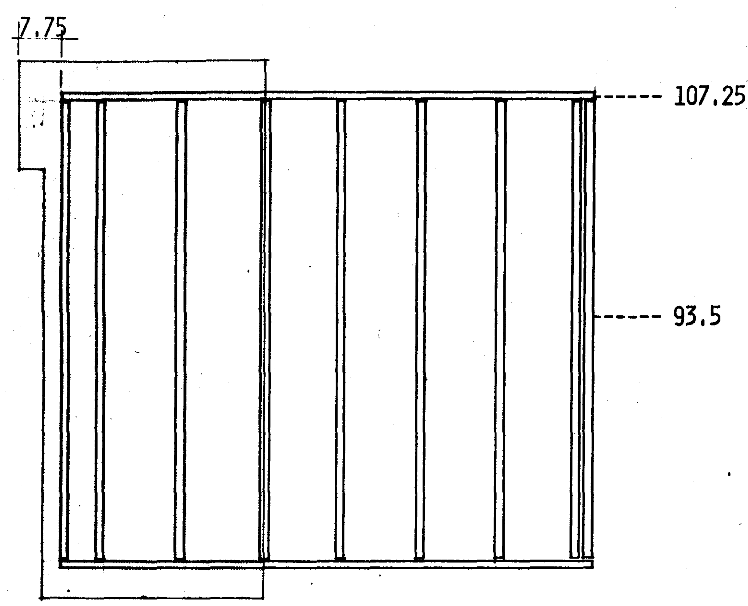
PANELS

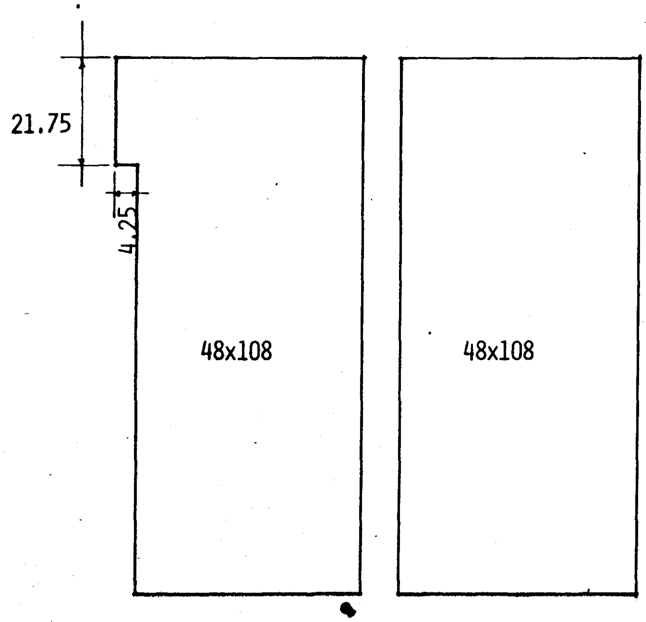


LOCATION IN CLUSTER

LOCATION IN UNIT







JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

CORNER UNIT, SIDE BEDROOM LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	107.25	3	
PLATES	1	107.25	3	
STUDS	9	93.5	27	

PANELS REQUIRED

1 AS SHOWN
2 REVERSED

VAPOR BARRIER

POLYETHYLENE

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11
PARTS REQUIRED L-R

2	48x108	6	

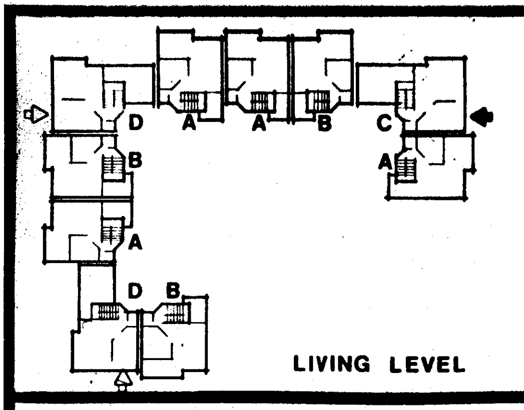
FINISHING INFORMATION

SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

STORAGE INFORMATION

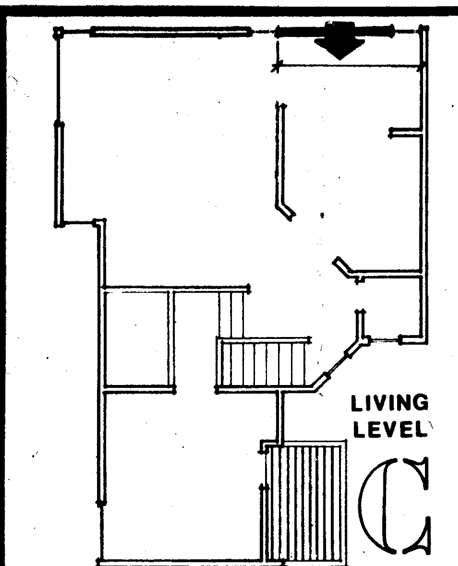
STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL

PANELS



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

CORNER UNIT, REAR LIVING LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	138.75	
PLATES	1	135.75	
STUDS	2	85.5	
	9	93.5	
	2	27.5	
	2	12	
HEADER	4	24	

PANELS REQUIRED

1 AS SHOWN
2 REVERSED

VAPOR BARRIER

POLYETHYLENE

WINDOW INSTALLATION

1 2x4 VERT SLIDER

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11

PARTS REQUIRED R-L

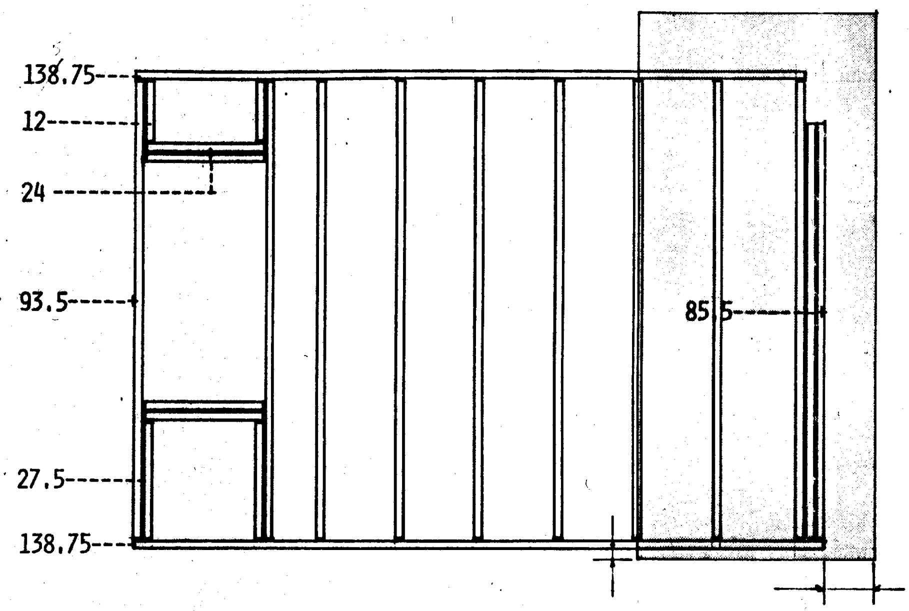
3	48x108	

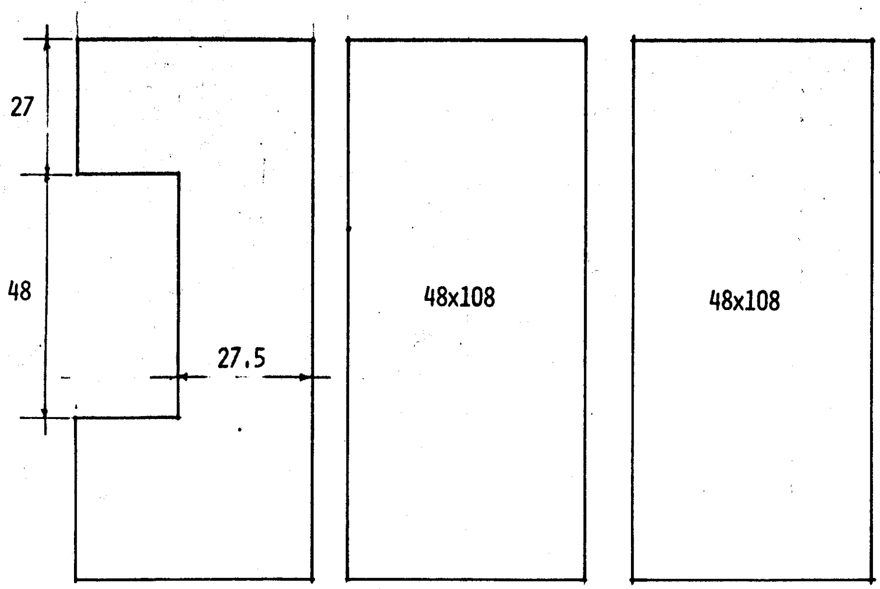
FINISHING INFORMATION

WINDOW CAULKING
SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

STORAGE INFORMATION

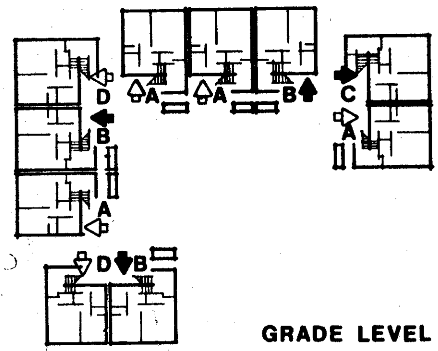
STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL





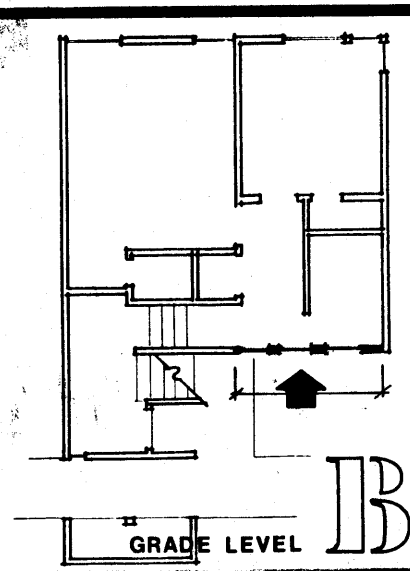
PANELS

PLATE XXXVI



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

BASIC UNIT, FRONT BEDROOM LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	114.75	10
PLATES	1	114.75	10
STUDS	9	93.5	90
	6	57.5	60
	6	6	60
	2	47.5	20
max	*1	7.25	10
max	*1	20.5	10
*54°	CUT AT ONE END		
HEADER	4	36	40
	4	24	40
	2	19.75	20
max	*2	26.75	20
54°	CUT AT BOTH ENDS		

PANELS REQUIRED

4 AS SHOWN

6 REVERSED

VAPOR BARRIER

POLYETHYLENE

WINDOW INSTALLATION

1 3x2 SLIDER

1 2x2 SLIDER

1 FIXED TRAPAZOID

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11

PARTS REQUIRED R-L

1	48x108	10	
1	*24x108	10	
1	48x108	10	

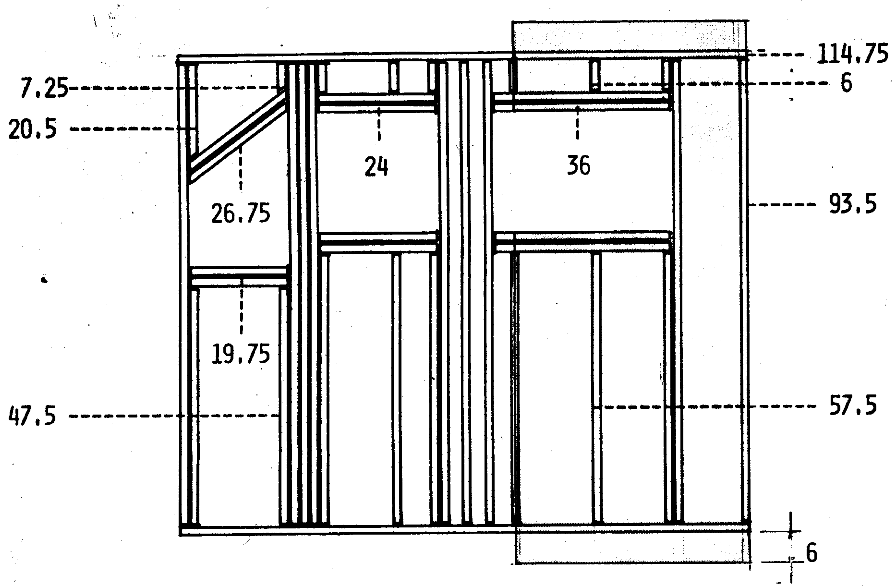
* ADD 3/8 REROUTED EXT.

FINISHING INFORMATION

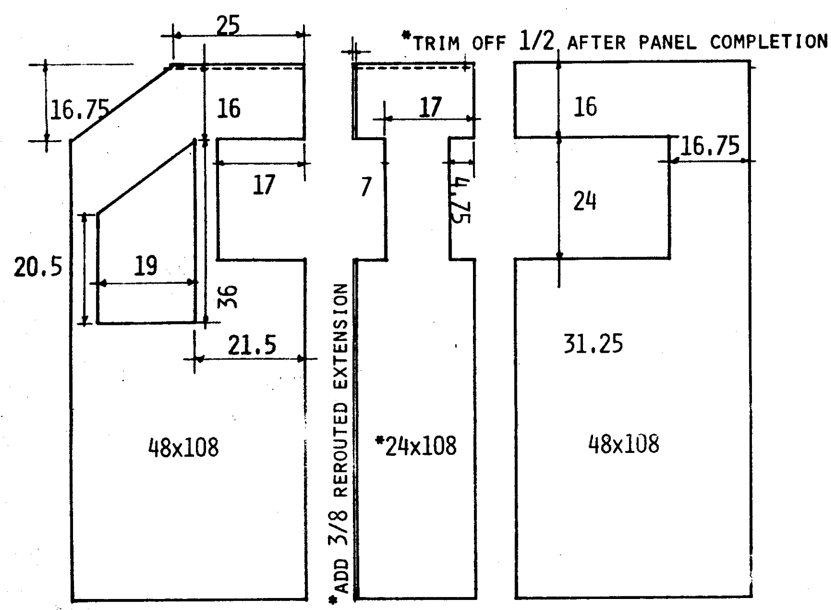
WINDOW CAULKING
SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

STORAGE INFORMATION

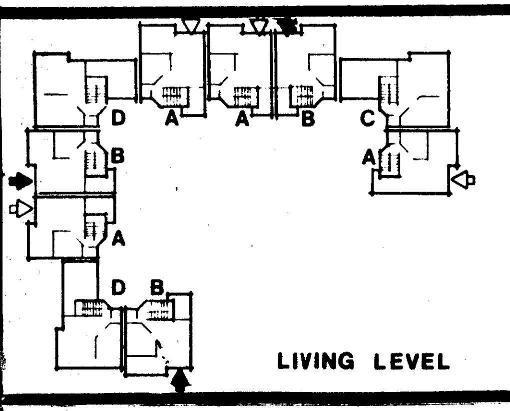
STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL



*TRIM OFF 1/2 AFTER PANEL COMPLETION

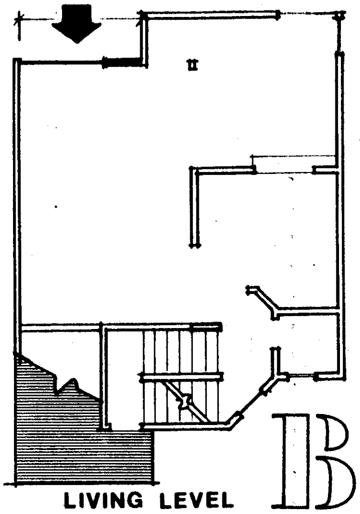


PANELS



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

BASIC UNIT, REAR
LIVING LEVEL.

FRAMING INSTRUCTIONS

FABRICATION STOCK:
2x4 KD

PARTS REQUIRED

SILLS	1	98.25	7	
PLATES	1	98.25	7	
STUDS	4	93.5	28	
	6	27.5	42	
	6	12	42	
HEADER	4	72	28	

PANELS REQUIRED

3 AS SHOWN
4 REVERSED

VAPOR BARRIER

POLYETHYLENE

WINDOW INSTALLATION

1 4x6 SLIDER

SHEATHING INSTRUCTIONS

SHEATHING STOCK
FIR TI-II
PARTS REQUIRED R-L

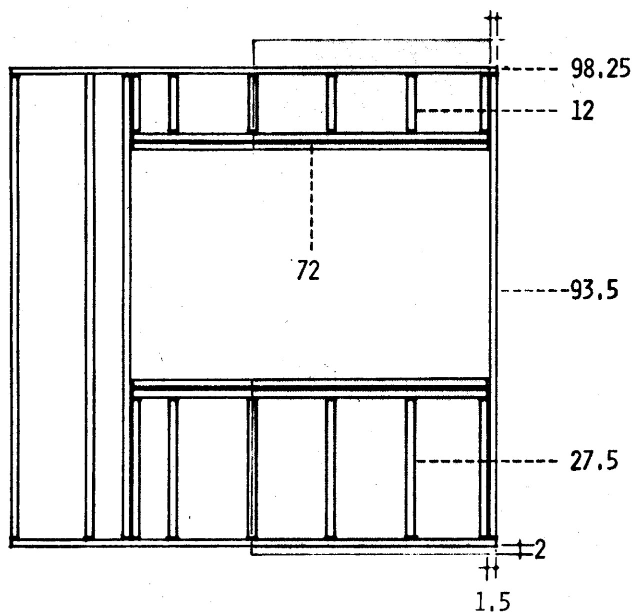
1	48x27	7	
1	48x33	7	
1	48x108	7	

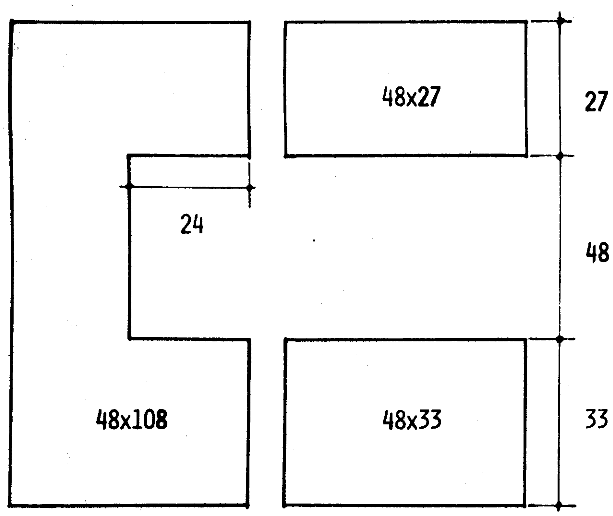
FINISHING INFORMATION

WINDOW CAULKING
SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

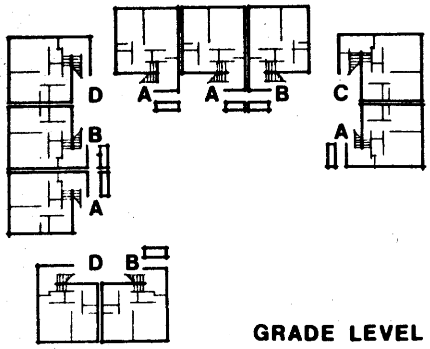
STORAGE INFORMATION

STUDDED PANEL
SHEATHED PANEL



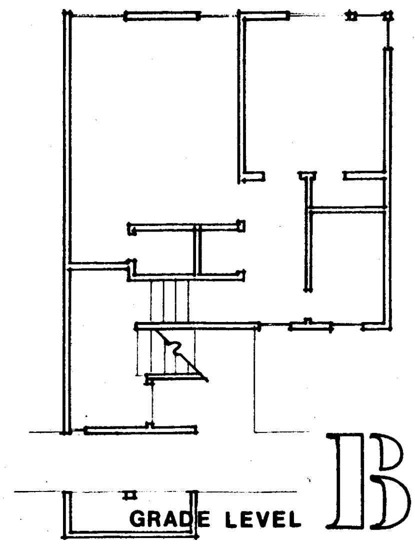


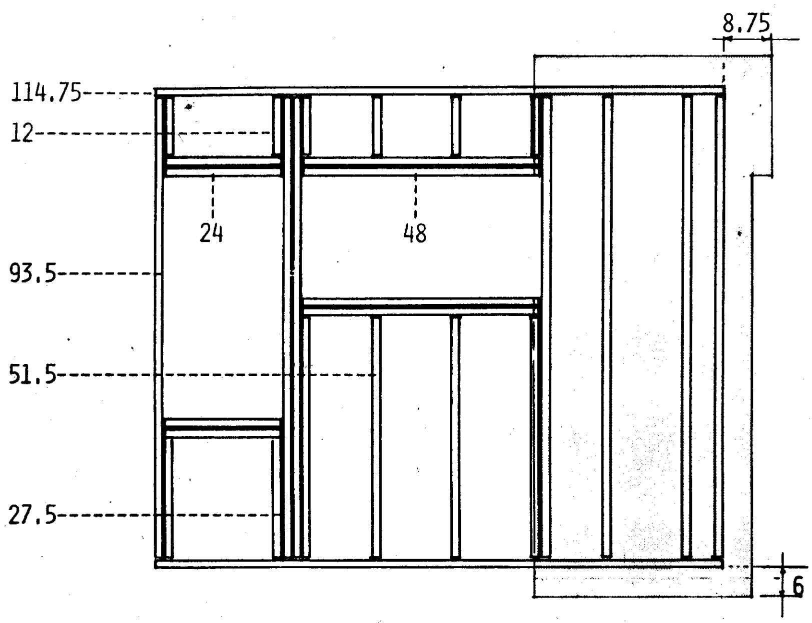
PANELS

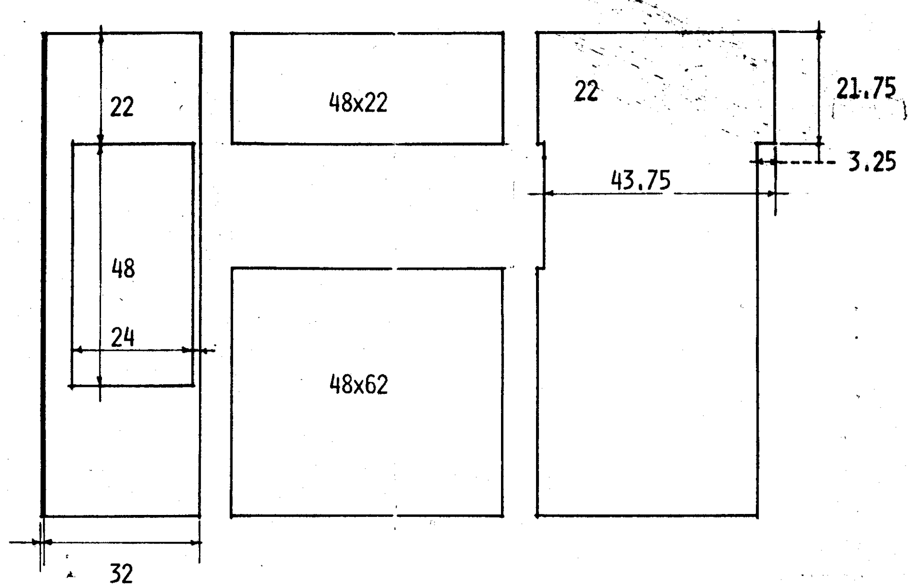


LOCATION IN CLUSTER

LOCATION IN UNIT







JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

BASIC UNIT, REAR BEDROOM LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	114.75	10
PLATES	1	114.75	10
STUDS	7	93.5	70
	4	51.5	40
	2	27.5	20
	6	12	60
HEADER	4	48	40
	4	24	40

PANELS REQUIRED

4 AS SHOWN
6 REVERSED

VAPOR BARRIER

POLYETHYLENE

WINDOW INSTALLATION

1 4x2 SLIDER
1 2x4 VERTICAL SLIDER

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11

PARTS REQUIRED R-L

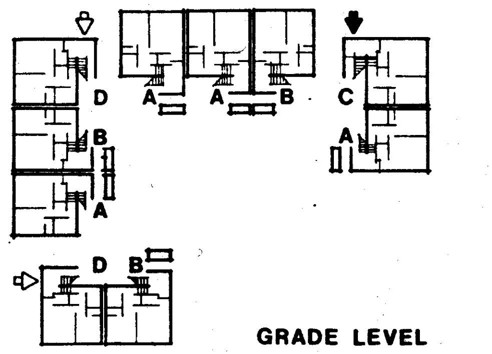
1	48x108	10	
1	48x22	10	
1	48x62	10	
1	32x108	10	

FINISHING INFORMATION

WINDOW CAULKING
SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

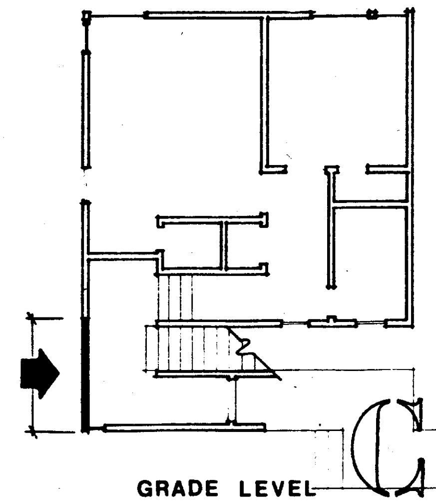
STORAGE INFORMATION

STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

CORNER UNIT , REAR
SIDE ENTRY

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	84.5	3	
PLATES	1	84.5	3	
STUDS	8	64.25	24	

PANELS REQUIRED

1 AS SHOWN
2 REVERSED
7 STUDS ONLY

VAPOR BARRIER

POLYETHYLENE FIELD APPLIED

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11
FIELD APPLIED

PARTS REQUIRED L-R

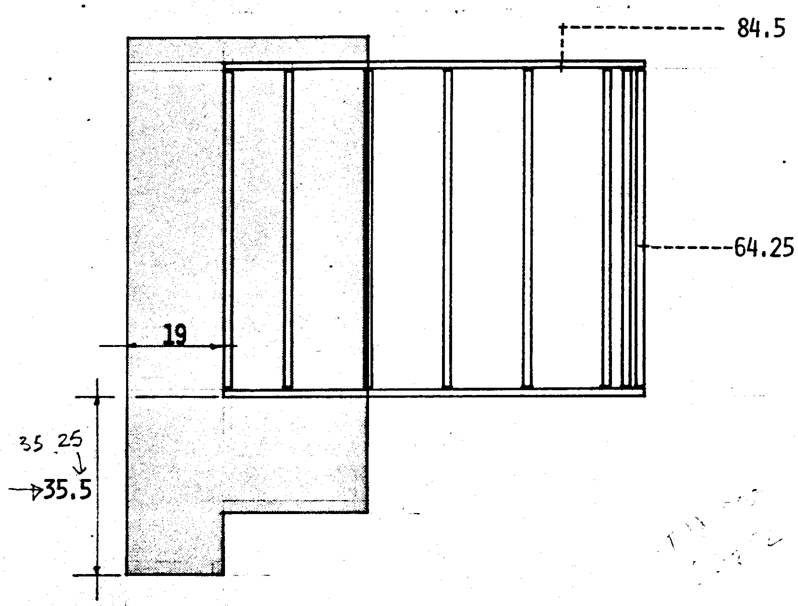
1	48x108	3	
1	48x96	3	
1	7.25x96	3	

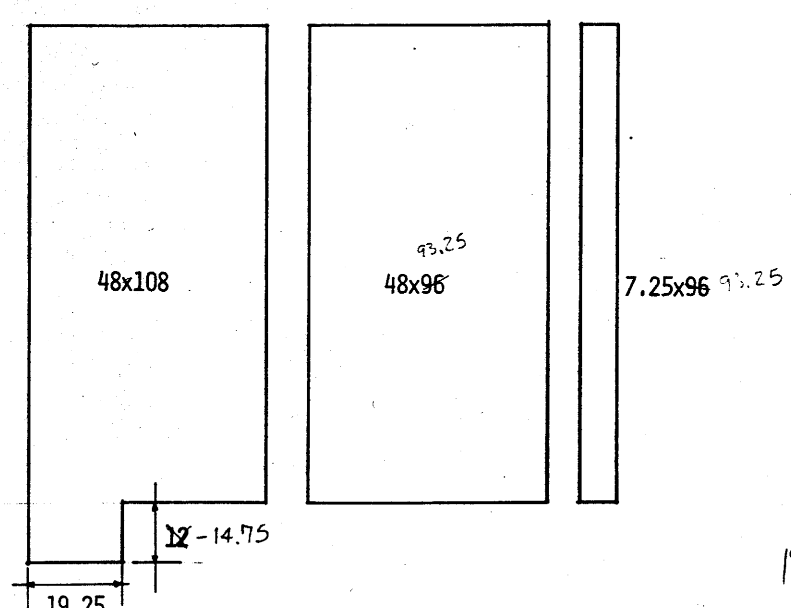
FINISHING INFORMATION

SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

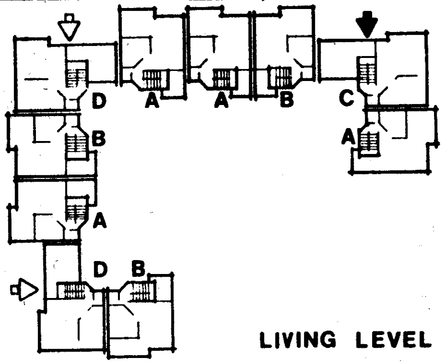
STORAGE INFORMATION

STUDDED PANEL
UNASSEMBLED SHEATHING
PAINTED SHEATHING



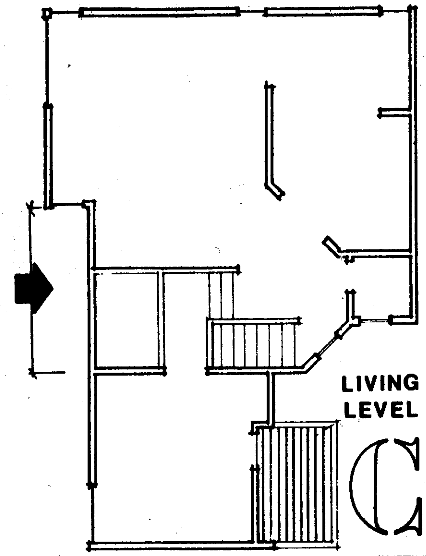


PANELS



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

CORNER UNIT, SIDE
LIVING LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

SILLS	1	144.75	3
PLATES	1	144.75	3
STUDS	14	93.5	42

PANELS REQUIRED

1 AS SHOWN
2 REVERSED

VAPOR BARRIER

POLYETHYLENE

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11

PARTS REQUIRED L-R

1	*39.25x108	3
2	48x108	6

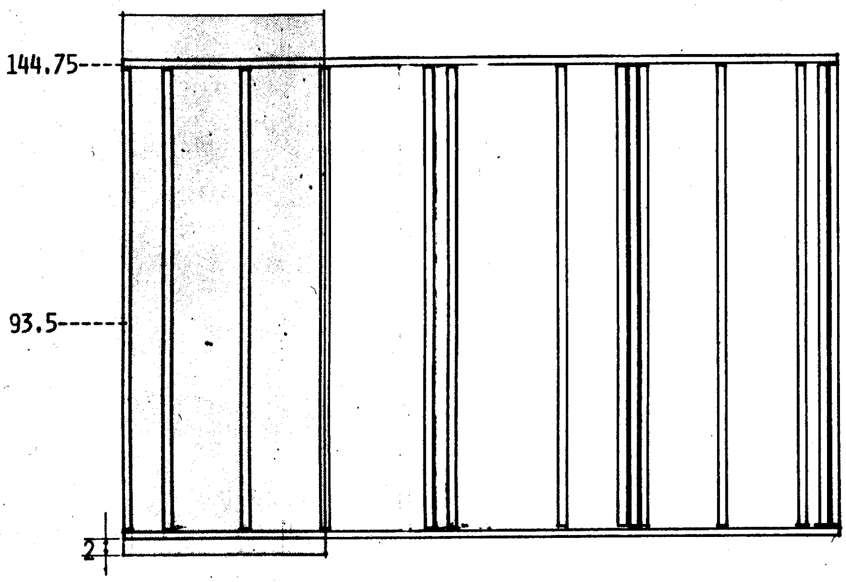
NB *REMOVE 8.75 FROM L

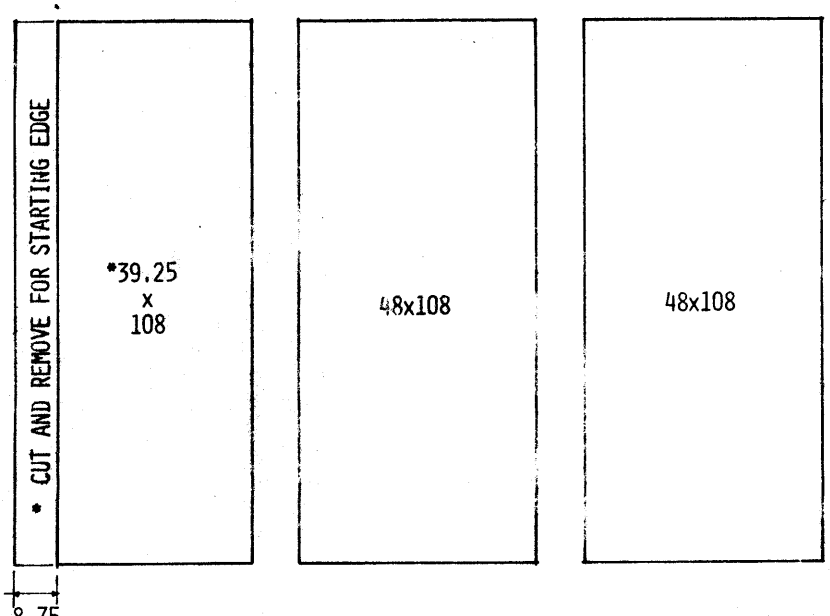
FINISHING INFORMATION

SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

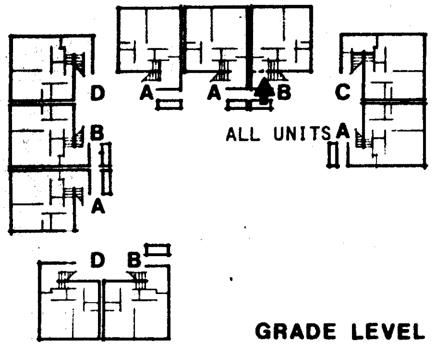
STORAGE INFORMATION

STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL



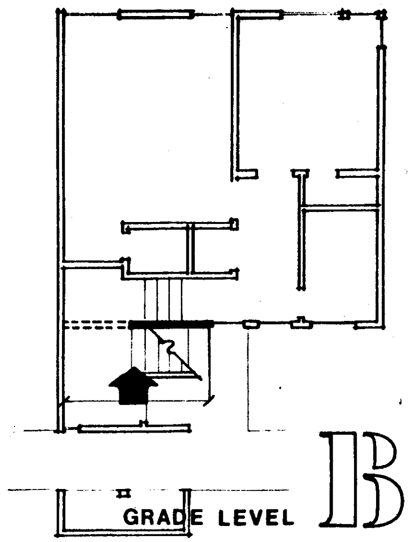


PANELS



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

BASIC UNIT, FRONT
BEDROOM LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	70.25	10	
PLATES	*1	31	10	
	**1	50.75	10	
* 36° CUT AT LEFT END				
STUDS	4	93.5	40	
	***1	80.25	10	
	***1	68.75	10	
	***1	66	10	

**36° TOP CUT 54° LOWER
***54° CUT AT TOP

PANELS REQUIRED

4 AS SHOWN
6 REVERSED

VAPOR BARRIER

POLYETHYLENE

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11

PARTS REQUIRED R-L

1	48x91.25	10	
1	*24x 56.75	10	

* ADD 3/8 REROUTED EXT.

PARTS REQUIRED

SILLS	1	72	10	
PLATES	1	72	10	
STUDS	7	17.75	70	

PANELS REQUIRED

4 AS SHOWN
6 REVERSED

VAPOR BARRIER

POLYETHYLENE

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1-11

PARTS REQUIRED

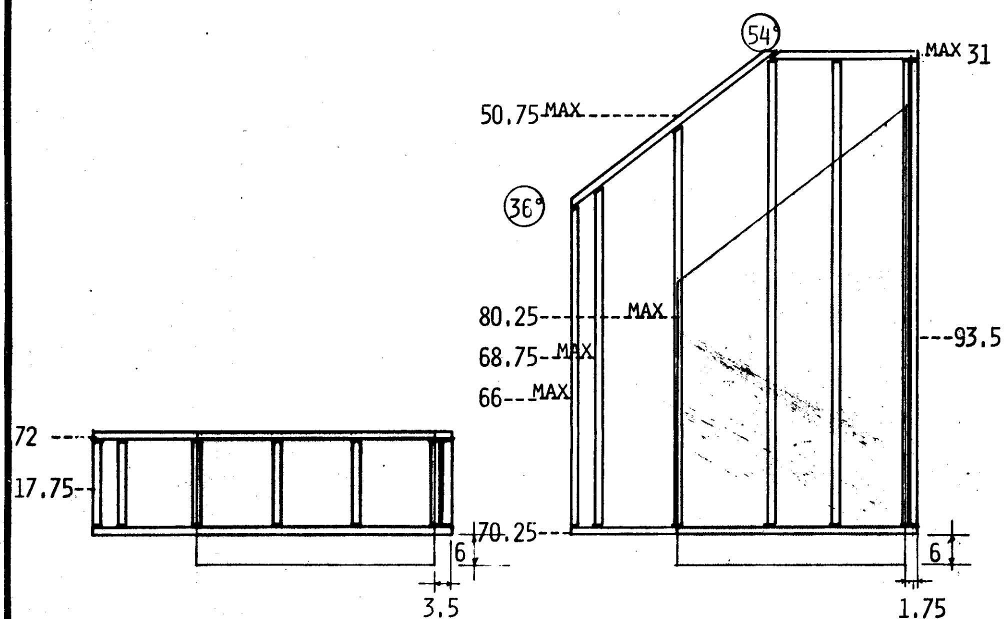
1	48x26.75	10	
1	20.25x26.75	10	

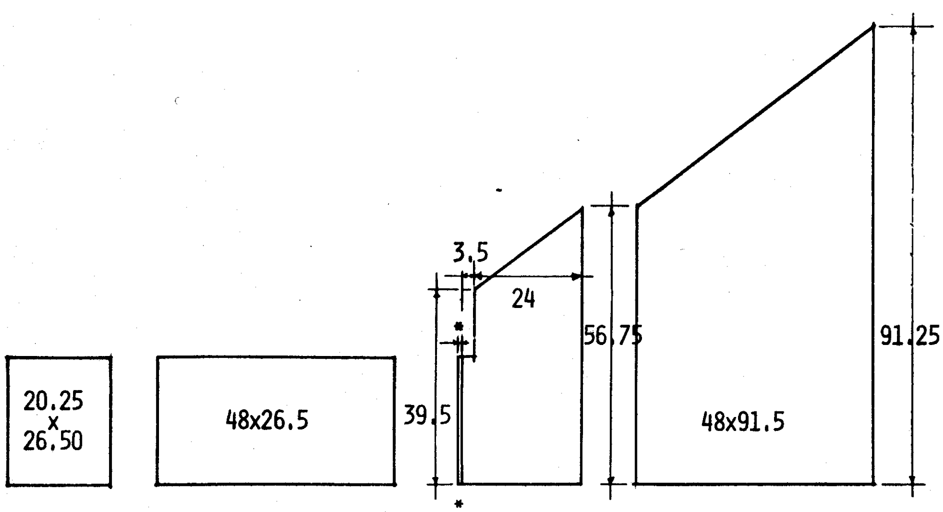
FINISHING INFORMATION

SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

STORAGE INFORMATION

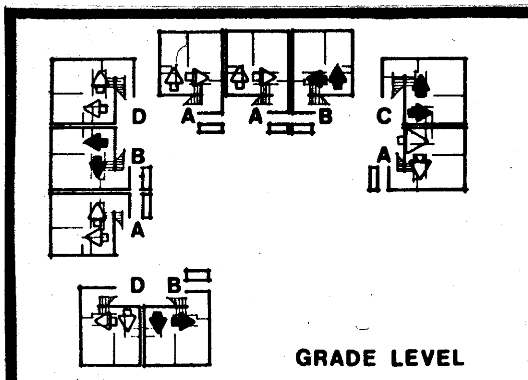
STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL





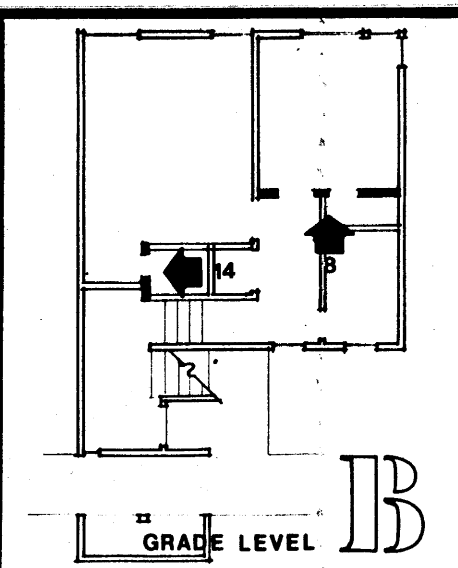
* ADD 3/8 REROUTED EXTENSION

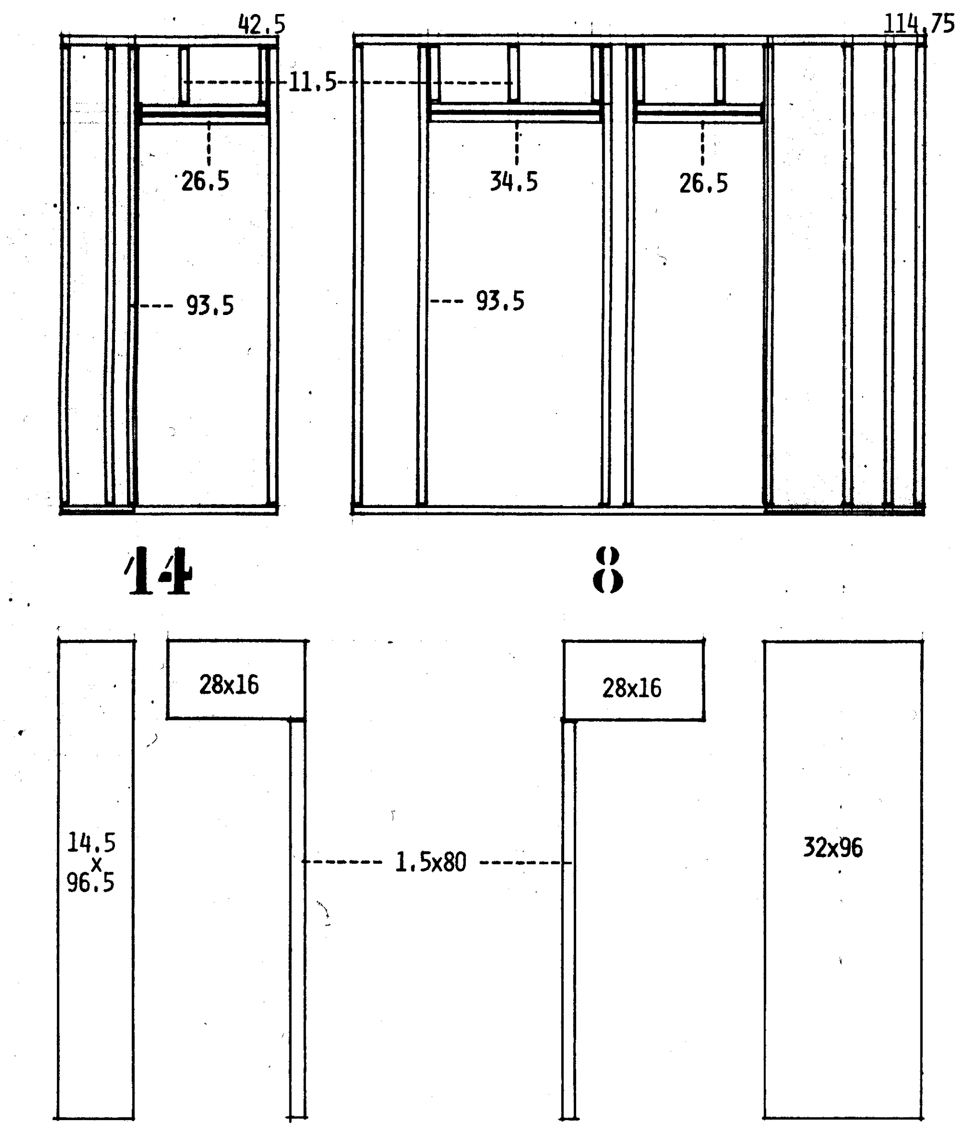
PLATE XLII



LOCATION IN CLUSTER

LOCATION IN UNIT





PANELS 8 & 14

JOB DESCRIPTION

INTERIOR PANEL PREFAB.

LOCATION

14 ALL UNITS
CLOSET WALL
MASTERBEDRM

8 ALL UNITS
ENTRY WALL
2ND BEDROOM

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

8 PARTS REQUIRED

SILLS	1	114.75	10	
PLATES	1	114.75	10	
STUDS	8	93.5	80	
	5	11.5	50	
HEADER	2	26.5	20	
	2	34.5	20	

PANELS REQUIRED

4 AS SHOWN
6 REVERSED

SHEATHING INSTRUCTIONS

SHEATHING STOCK:
3/8 COMPOSITION BOARD

PARTS REQUIRED R-L

1	32x96	10	
1	28x16	10	

NAILING: 8 D FINISH

14 PARTS REQUIRED

SILLS	1	42.5	10	
PLATES	1		10	
STUDS	4	93.5	40	
	2	11.5	20	
HEADER	2	26.5	20	

PANELS REQUIRED

4 AS SHOWN
6 REVERSED

SHEATHING INSTRUCTIONS

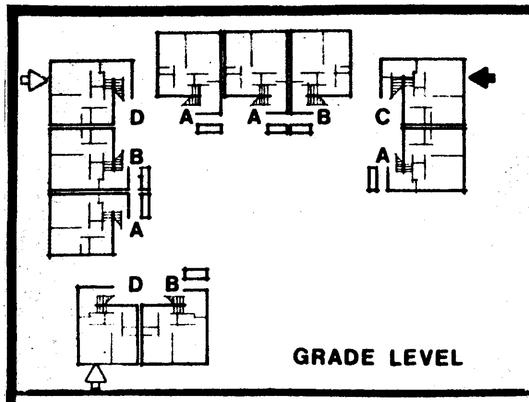
SHEATHING STOCK:
3/8 COMPOSITION BOARD

PARTS REQUIRED L-R

1	42.5 x96.5	10	
1	28x16	10	
1	1.5 x80	10	

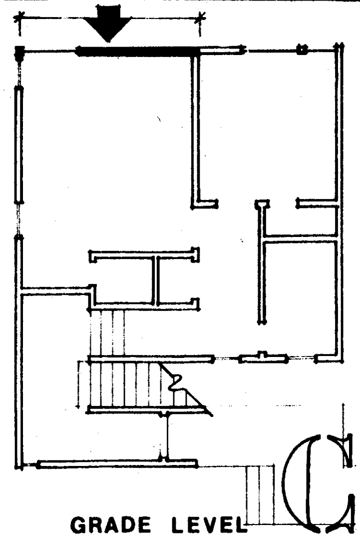
STORAGE INFORMATION

STUDDED PANEL
SHEATHED PANEL



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

EXTERIOR PANEL PREFAB.

LOCATION

CORNER UNIT, REAR BEDROOM LEVEL

FRAMING INSTRUCTIONS

FABRICATION STOCK: 2x4

PARTS REQUIRED

SILLS	1	138.75	3	
PLATES	1		3	
STUDS	9	93.5	27	
	4	27.25	12	
	4	12	12	
HEADER	4	48	12	

PANELS REQUIRED

1 AS SHOWN
2 REVERSED

VAPOR BARRIER

POLYETHYLENE

WINDOW INSTALLATION

1 4x4 SLIDER

SHEATHING INSTRUCTIONS

SHEATHING STOCK: T1 11

PARTS REQUIRED R-L

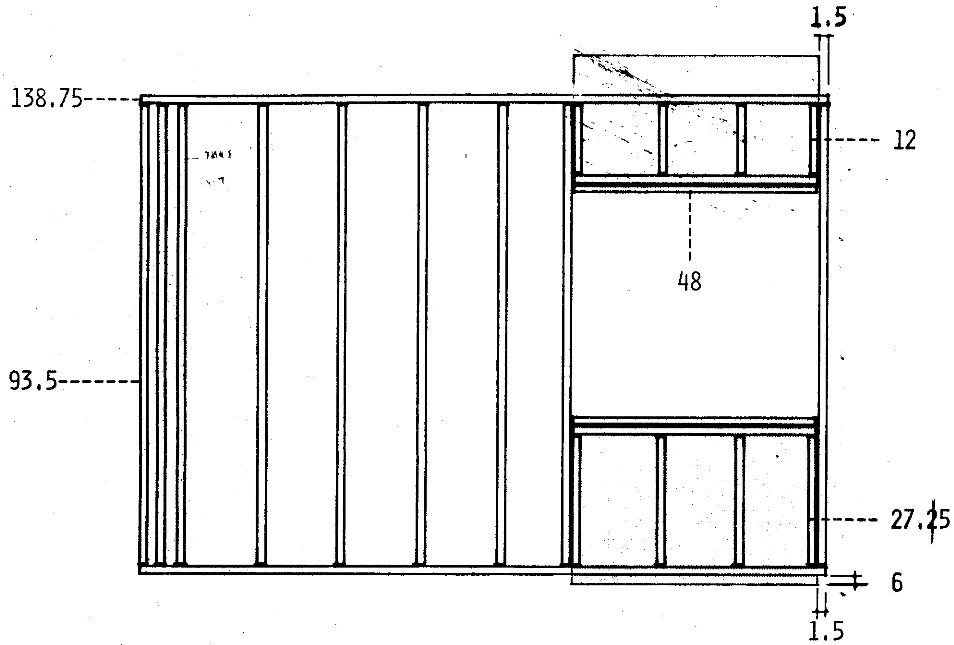
1	48x22	3	
1	48x38	3	
1	48x108	3	
1	36x108	3	

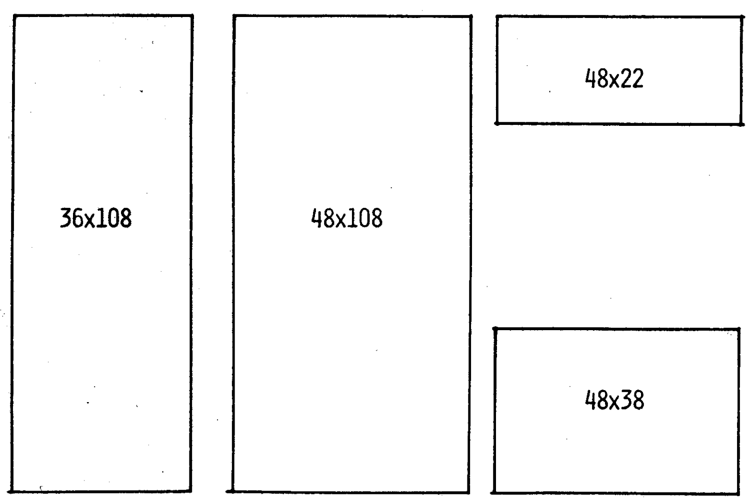
FINISHING INFORMATION

WINDOW CAULKING
SHEATHING STAIN
SHEATHING SEAL
PAINT FINISH

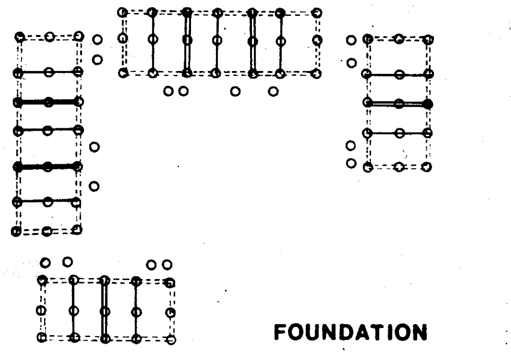
STORAGE INFORMATION

STUDDED PANEL
SHEATHED PANEL
PAINTED PANEL



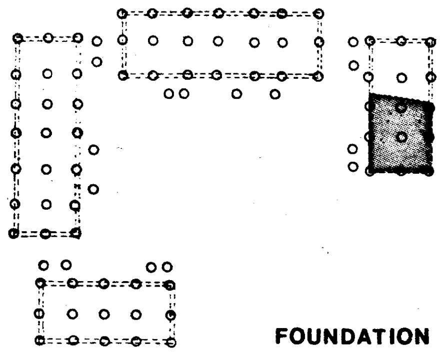


PANELS



LOCATION IN CLUSTER

LOCATION IN UNIT



JOB DESCRIPTION

PLATFORM STRUCTURE

LOCATION

ALL UNITS, BASE PLATFORM

FRAMING INSTRUCTIONS GIRDERS:

FABRICATION STOCK: 2x14

PARTS REQUIRED FOR COMBINATION GIRDER

2	84	from 14'	44	
2	158	from 14'	44	
1	115	from 10'	22	
1	127	from 12'	22	

GIRDERS REQUIRED

22 6x14's COMB LNGS 242"

JOISTS:

FABRICATION STOCK: 2x10
2x8

PARTS REQUIRED

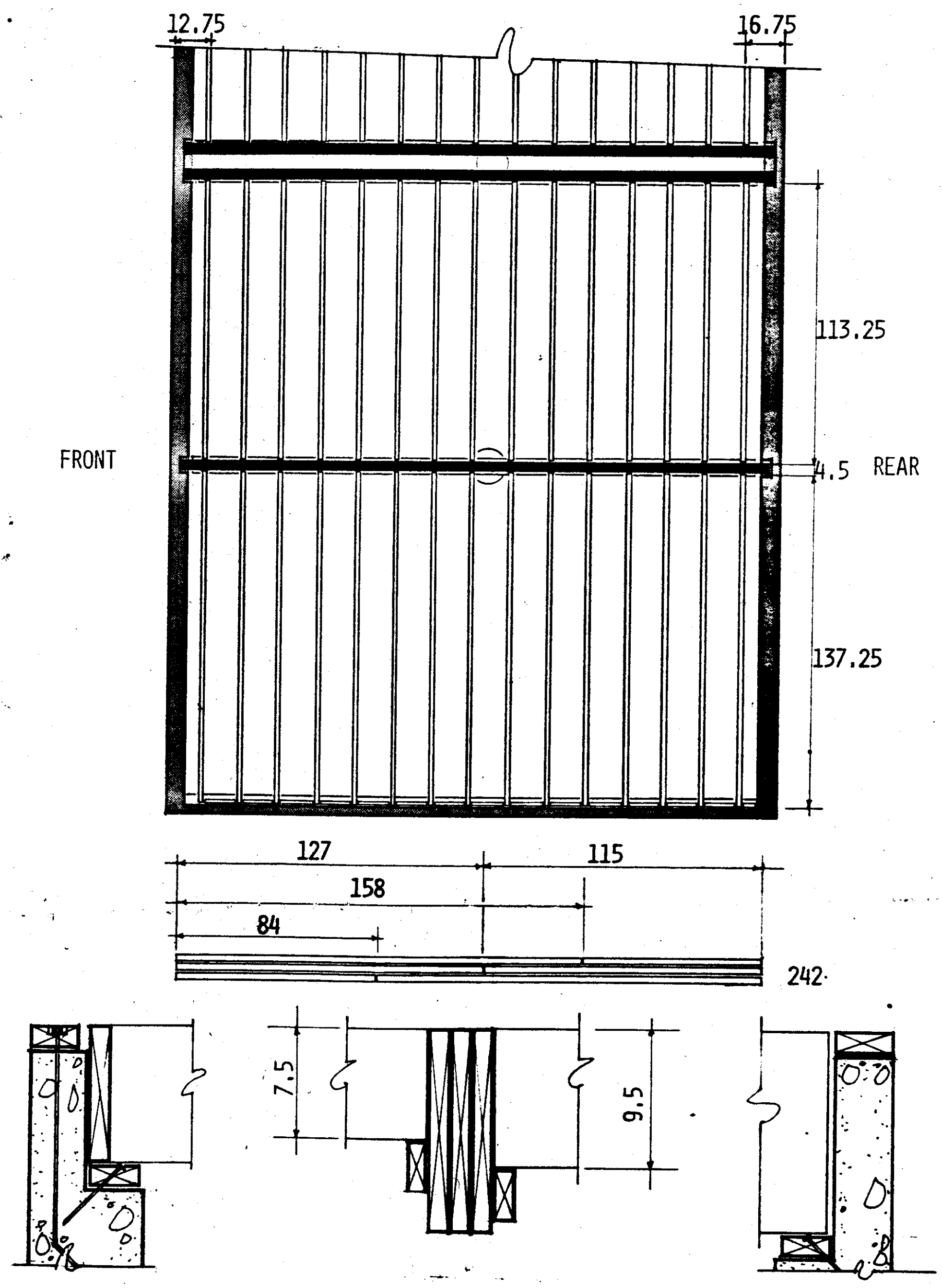
15	113.25	2x8	150	
15	137.25	2x10	150	

SILLS

FABRICATION STOCK: 2x6
12' CONTINUOUSLY PLACED
ANCHORED TO GRADE BEAM

BRIDGING

STEEL BRIDGING STRAPS
STAPLED CENTRE SPANS



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