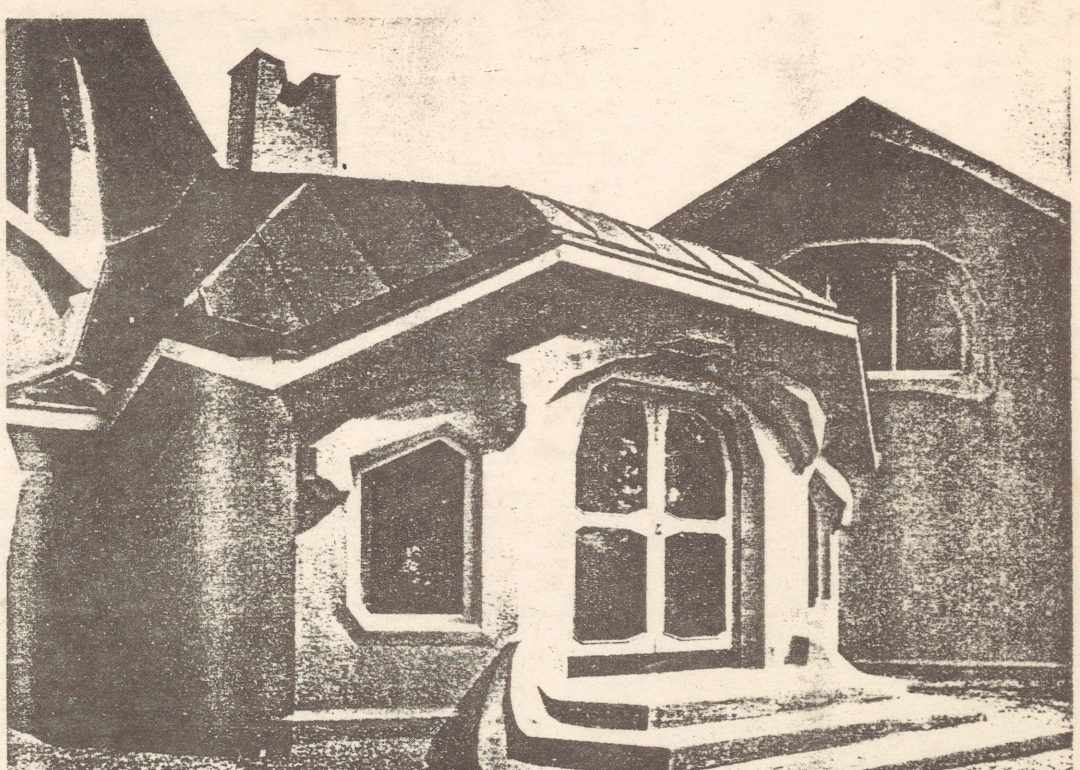

Character

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CHARACTER

by

BRADLEY T. GOSS

A professional paper submitted in partial fulfillment
of the requirements for the degree

of

BACHELOR OF ARCHITECTURE

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MONTANA STATE UNIVERSITY
Bozeman, Montana

June 8, 1980

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I dedicate this thesis to Mother and Father,
without whose unending help this
would not have been possible.

~~Arch.~~
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"A house with character grows more valuable as it grows older while a house in the prevailing mode, whatever the mode may be, is soon out of fashion, stale and unprofitable." [1]

Thesis Statement.

A skillful composition of design elements produces qualities which distinguish Architecture from mere building. Positive character is one of these qualities. An analysis of building images will give an insight into what is character.

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introduction

When trying to decide on what topic to do for my thesis I asked myself some questions. One of these questions was, what do I feel is missing in a lot of buildings today? I answered by saying: many buildings do not possess a positive character like many of the older buildings in the central core (original city core) of many cities. At first I wondered whether those buildings seemed to possess this character simply because they were old buildings and had that historical association or whether there was something else that contributed to this apparent visual character. Of course the kind of detailing or ornament on the buildings greatly contributed to this feeling. However, there are some examples of modern buildings that are not ornamented in the same way but which also possess this positive feeling which I refer to as character. Because some modern buildings also possess this special quality and

other modern buildings do not, I wanted to figure out, if possible, what it is that contributes to this special positive feeling. If in some way I could get a better understanding of what contributes toward the buildings evoking this pleasant positive feeling it might assist in the process of giving this special quality to new buildings.

To my way of thinking this positive character seems to be a valuable component which would help make daily life more enjoyable (seems like a worthwhile cause) which is the architect's underlying concern.

SPACE

"The reality of a room was to be found in the space enclosed by the roof and walls, not in the roof and walls themselves." [2]

Space is the basic element of architecture. It is that which architects try to define. In a certain sense, space cannot be created; it is something that already exists and must be defined by the mind and then physically defined by the tangible elements of construction. Space depends for its importance on its physical property of nothingness. To explain: space is important because it is not a solid, and usually not a liquid. For example, a jug carrying liquid receives its importance from the fact that it encloses space and thus is able to contain and ultimately carry that liquid. Analogously, the important value of a building is that it defines spaces in which activities can take place.

It is this pursuit which the architect is engaged in when providing spaces for living activity. Space can have many qualities depending on how it is given boundaries. Thus the architect gives character to space through its means of definition.

When space is given limits it takes on the aspect of being internal or external. The space defining limits can be referred to as the component parts of a building.

BUILDING COMPONENTS

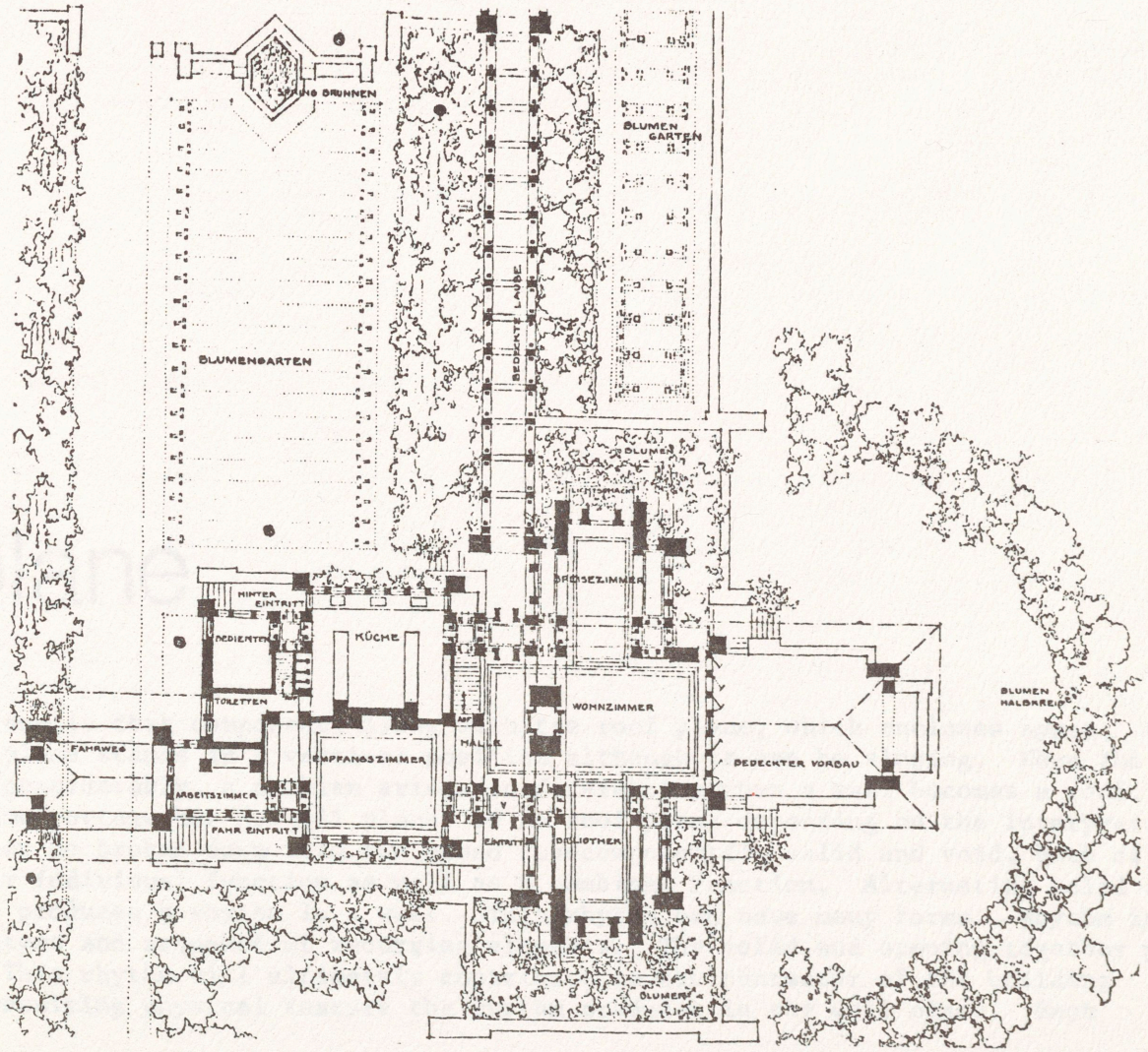
ground plane

The ground plane is the surface upon which the building rests. This surface can be manipulated in numerous ways and the building itself can meet this surface in many ways. The building can grow from the ground plane or it can be perched above this receiving surface and only touch-down at certain points. Each different way to connect the building to the site will have a specific purpose that will contribute to the overall character of the building.

A building that visually appears very light will give two different impressions if raised off the ground at one time and planted firmly within the ground at another. Visible structure that supports the building and transfers loads to the supporting ground plane will create a link between the building and its supporting ground plane.

Ground plane can be existing natural elements (both hard and soft) that are not altered or man-made constructions which facilitate the joining of the building and the ground surface (steps, level walks, terraces). The handling or detailing of this link will affect the character of the building as mentioned above. Landscaping can soften, accentuate the building theme, act as a guiding and direction-giving device, provide contrast to the building and many more functions.

The relationship between the built forms of the building and vegetation produces a definite impact on the overall visual image. The nature of this relationship contributes greatly to the response of the viewer which can be very diverse. In the work of Frank Lloyd Wright, the built forms and the natural environment are thought of as working together. Each component (built form and landscape elements) complements the other in producing the end result.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a

wall plane

The wall plane is that component, along with the roof plane, which encloses space. Generally the wall plane stands in a vertical position although it can be sloping. When the wall starts to slope considerably, a problem arises in determining when a wall becomes a roof. For example an a-frame cottage has no wall plane, or no roof plane depending on the interpretation. The wall plane can be broken down into two broad sub-components: solid and void, both of which serve their individual function as well as a combined function. Alternating solid and void in a series produces a rhythm in a wall. This rhythm can have many forms. Rhythm is dependent on pattern and sequence of recurring elements. The solid and opening together produce a rhythm. This rhythm will ultimately contribute to the character of the building because of the resulting physical texture the rhythm produces in the wall plane. Each

different rhythm will evoke a different emotional response to the image of the wall plane. The rhythm will ultimately affect the overall proportion of solid and opening in the wall surface and we will respond to the lightness or heaviness of the wall depending on these proportions.

When each of the individual sub-components of the wall plane are thought of individually, the result directly affects the building character.

The treatment of the glass, the frame of the opening and all aspects of how solid an opening are detailed will affect character.

The use of the word opening in a wall refers to windows, doors (solid and clear), and actual holes.

Walls that can be touched by the users become very important because the users can feel the tactile qualities of the materials that are used to construct the wall. By feeling a wall surface another dimension is added to the visual image of buildings. Now the users can associate a visual image and its sub-components to the physical textural qualities of the materials that make up the sub-components of the image.

The materials chosen for a wall will affect the feeling the viewer receives from this wall image and each material will convey a different feeling. These feelings are associated with physical tactile experiences as well as visual experiences like the grain in wood, which can not be felt.

roof plane

"In Japanese, the roof of a house is called yane, meaning literally house-root."

"A roof is the most essential part of a building. People have lived without walls, but never without roofs."

"It is the roof design that we find the first and also the most varied expression of form and material."[3]

When talking about the roof plane as a component, I mean that surface which shelters the

spaces below it, from elements of the environment. In order for the roof plane to be visible it is usually sloping, and it is the visible roof which can be a strong visual element.

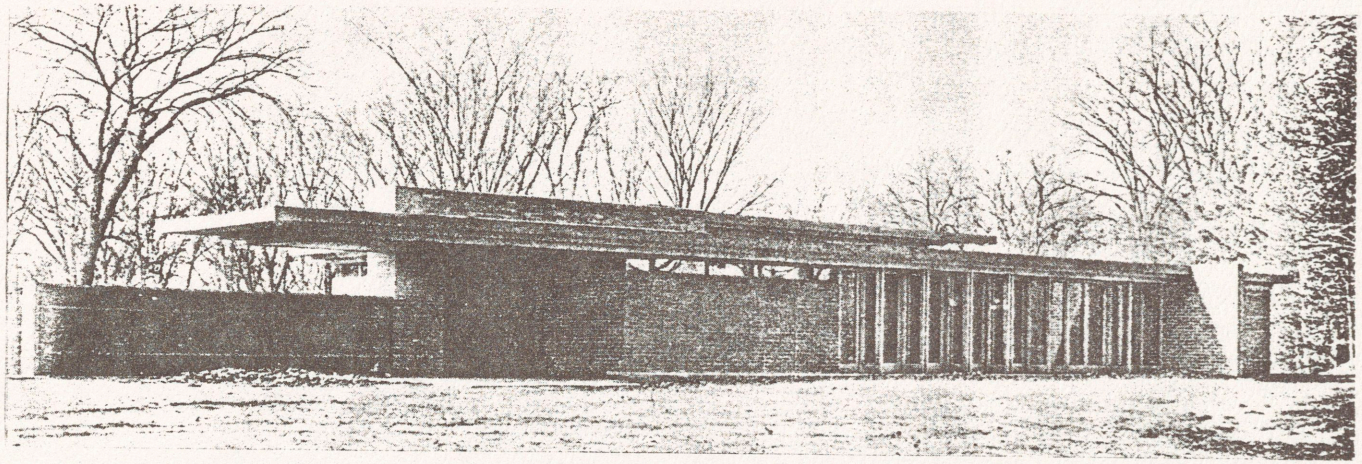
Throughout my investigations and research it became apparent that the roof plane plays a very strong role in the overall composition of the building. This roof plane therefore is a strong factor which can add to the character the building possesses. The presence of a visible roof plane gives the architect a major component, composed of sub-elements, to contribute to the building's character. The absence of a visible roof plane creates a totally different character for the building. Without the visible roof plane, a reduction in the complexity of composing the visual image is provided. Often the inclusion or deletion of a visible roof plane is more an economic and practical concern and the roof plane's importance is determined with all aspects of design in mind. By choosing not to work with a visible roof plane the number of building components is reduced and a stronger emphasis, in creating character, is placed on those remaining components.

The private residences designed by Frank Lloyd Wright, which have visible roof planes, possess a distinctly different character than his designs which do not have this visible roof plane.

For example, in the Robie House and the Goetsch Winkler house, the roof plane is a component which can give unity to the masses of the building and thus contribute to a coherent composition.

In many instances there is something very special about the roof plane which gives the viewer a very powerful feeling.

Often the roof plane is the dominant component of the building and this gives the roof a special importance and a key role in providing character. The other components of the building have been emphasized to a lesser degree to give the roof plane this dominant, powerful quality. The roof plane can be a very dynamic form and often sculptural and it is when the roof plane is allowed to be just that which gives it those special dynamic qualities.



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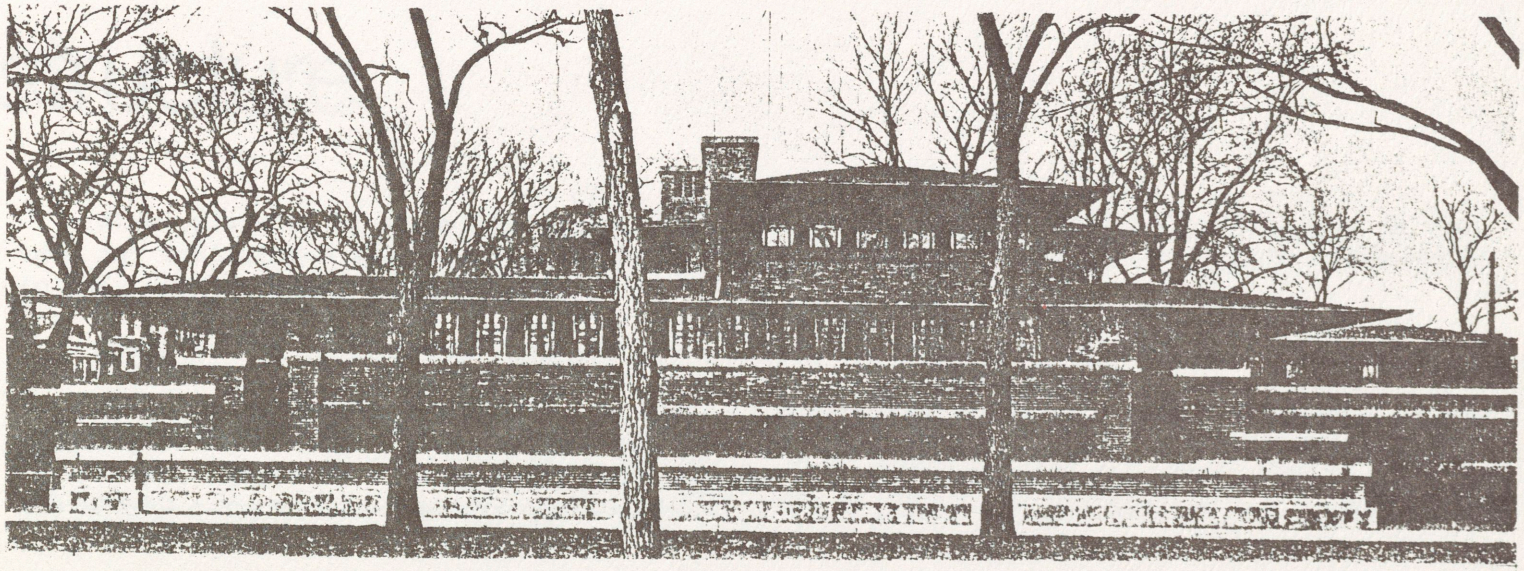

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structure

When referring to structure I mean those components which maintain the integrity of the wall and roof planes and make the building physically resist the force of gravity which wants to pull the building to the ground.

Structure is grouped into two general categories: integral and separate.

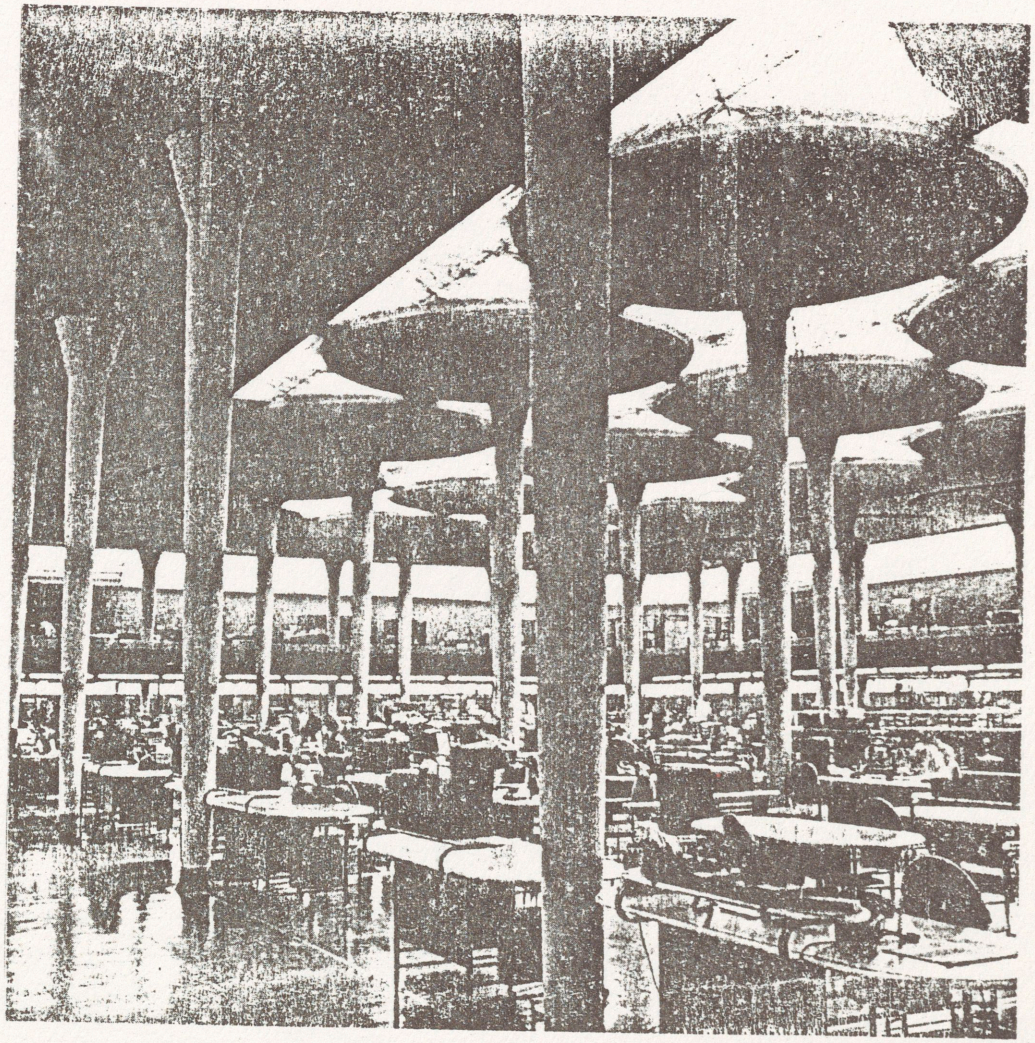
Integral structure means: the components which define space and those which hold up the components that define space, are one and the same. For example a load bearing masonry wall is integral structure. An example applicable to the roof plane, is the difference between the hidden structural beams and the suspended ceiling which visually defines the upper

boundary to the space, and the rough framing of a summer cottage ceiling. The ceiling of the summer cottage is integral structure.

The structural elements in the separate structure category become external, within, or internal to the space boundaries. External and internal structure require another skin to define boundaries of the building's outer limits and structure that is within the space boundaries involves infill between structural members. These qualities of skin or infill are qualities which will contribute to the character of the space defining elements.

There are also exceptions or special cases to what defines space. The structural columns that are visible on the interior space define subspaces that are recognizable and often fluid spaces that merge with adjacent space.

Structure on its own can be very expressive. The integral structure of Saarinen's TWA airport are examples of expressive integral structure as are Kenzo Tange's olympic buildings in Tokyo.



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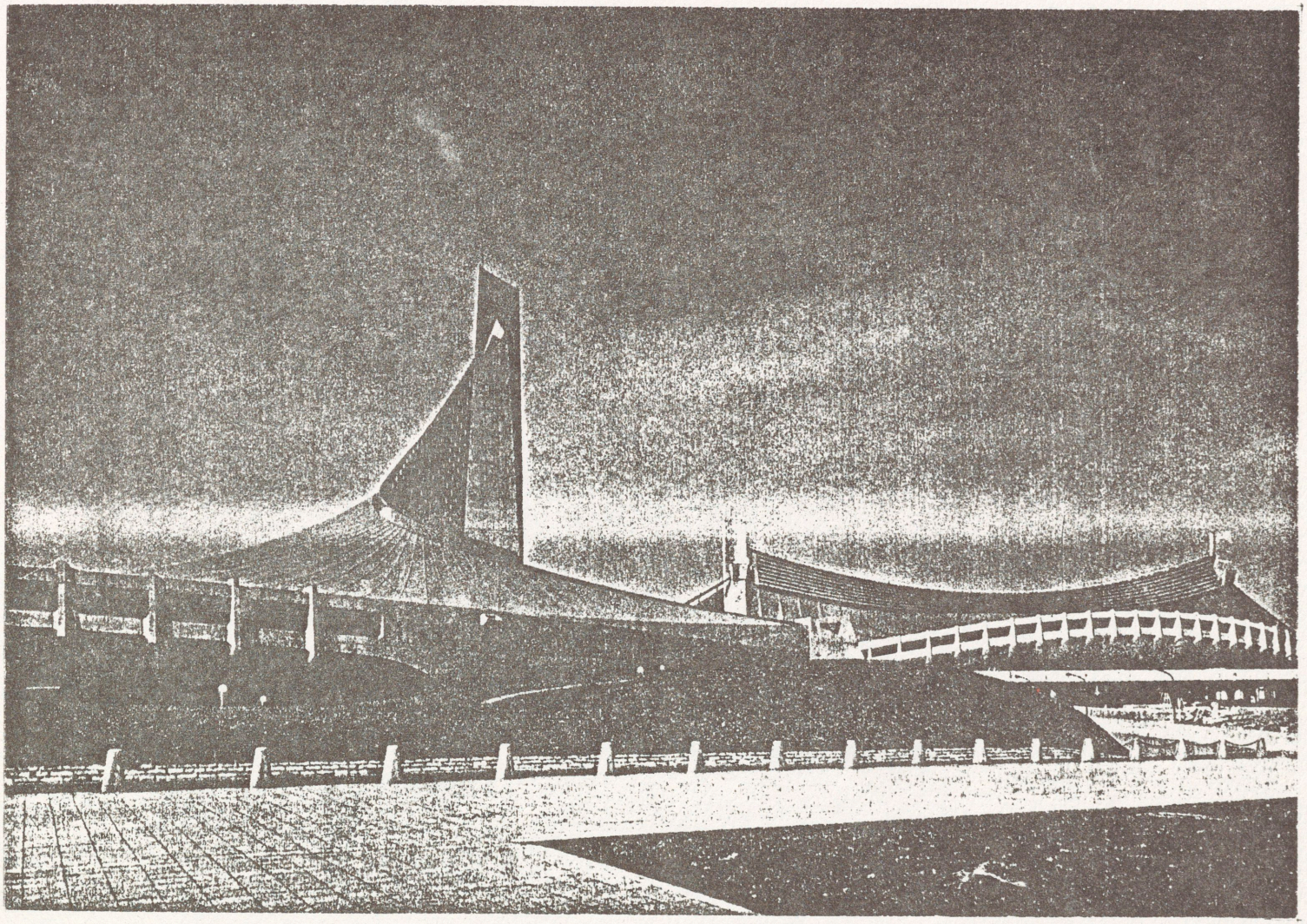

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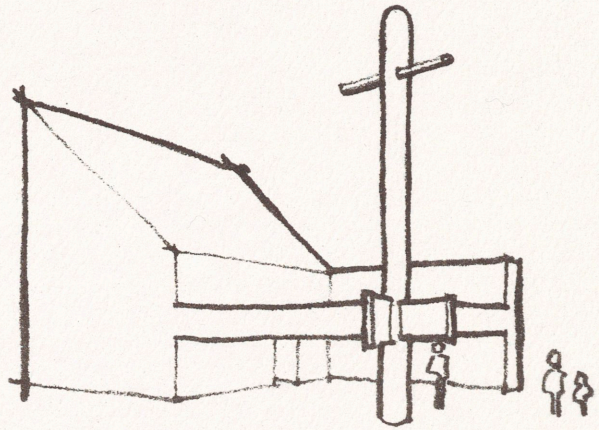


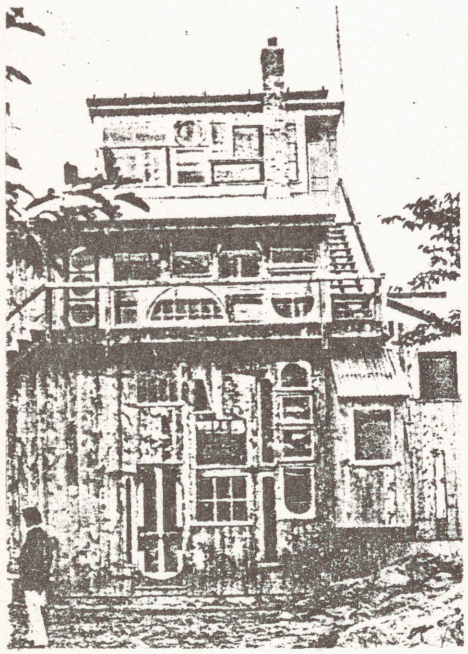
supporting elements

Supporting elements refers to components like stair and elevator towers, fireplaces and flues, lightwells and skylights, connections between two buildings, built elements that may or may not be physically connected to the building, but which do not act as built landscape elements, (for example a separated cross tower for a church.)

These supporting elements can often add a playful quality to the composition or, when vertical, can contrast with horizontal components. Contrast gives the building variety which adds interest to the composition and gives the viewer more visual stimuli.

When detailing these supporting elements it must be remembered that complexity in the

composition can produce chaos. This chaos may be good or bad depending on what the desired end result is. The designer must keep in mind what character he/she wants the building to have and what kind of treatment of these supporting elements will produce this desired character. Therefore the subtlety or blatancy of the detailing will affect the character and thus the feeling in the viewers.



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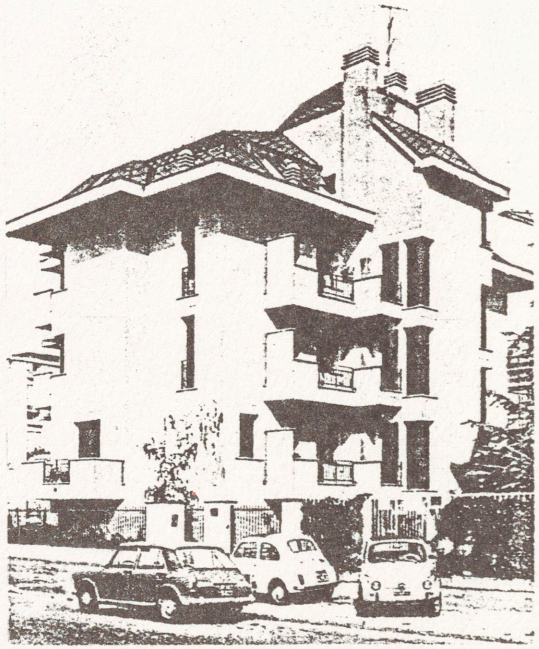

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DESIGN ELEMENTS

materials

The number of different materials available for the construction process is endless. The materials chosen to represent a mass can affect character, because each material possesses inherent emotional associations. The choice of materials, however, is not always solely aesthetic.

Materials can be grouped into two broad categories: natural and synthetic, of which the latter category consists of a larger number. There seems to be no end to the new materials that man can produce.

Materials are a very important aspect of architectural construction because they are used

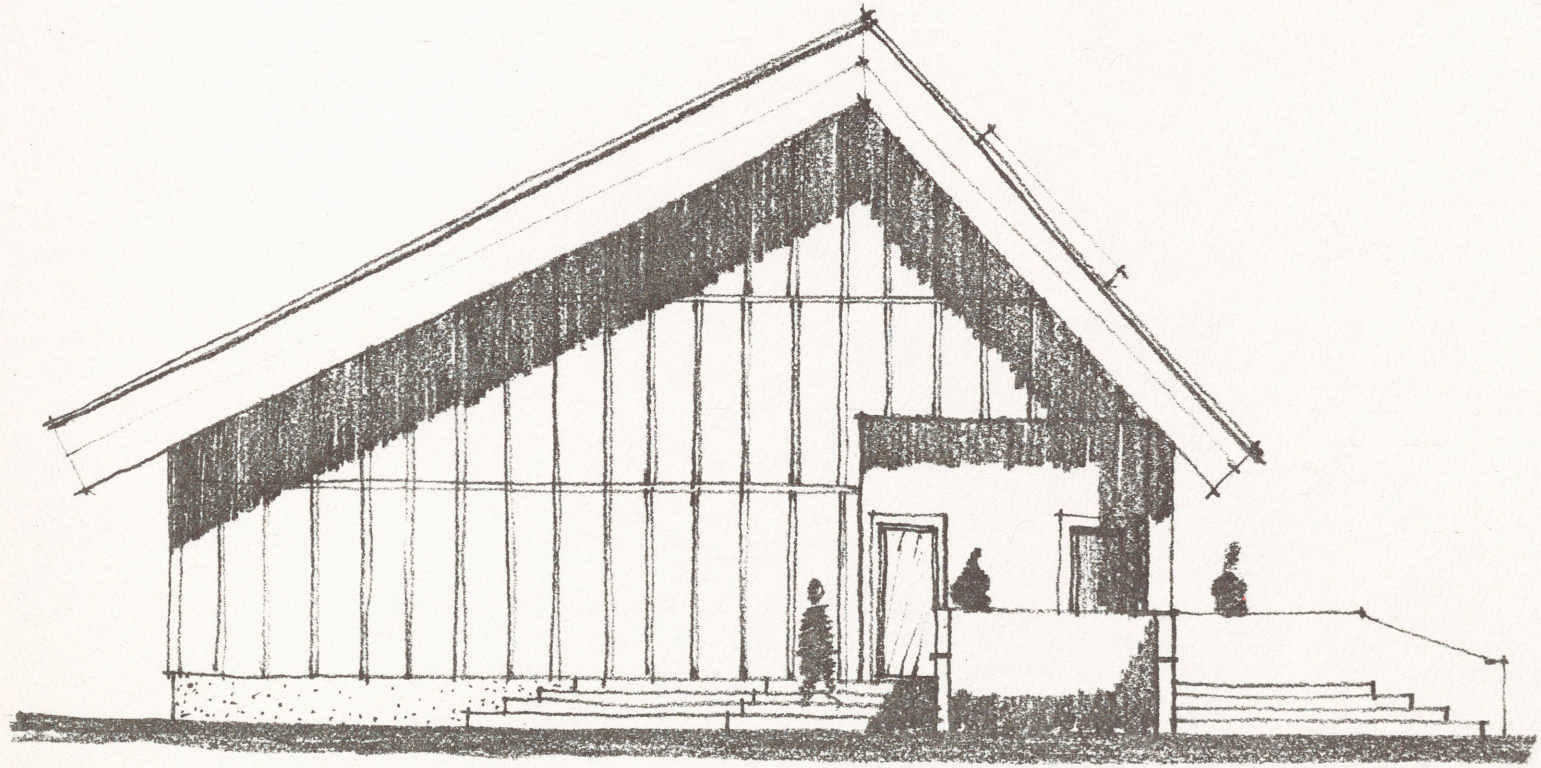
to construct the surfaces that form the images which we see.

Each material has individual properties both physical and aesthetic. The physical properties refer to how a material is made and what resulting properties the material will receive from the making. Properties of structure, (strength, shape adaptation) respond to activities performed on that material (i.e., cutting, polishing, planing, drilling, etc.) The way in which materials are put together can give the materials an added aesthetic quality. The aesthetic qualities of plaster as it exists in a bucket are very different from the aesthetic qualities after someone has applied that plaster to a surface in a certain way. Usually the application is done by hand although machines can also make the application by man's control of the machine. Very different effects result from these two applications.

The aesthetic properties of a material are a direct result of the nature of creating that material. Each material will have its own aesthetic quality and these individual qualities will create responses in the viewers of these materials. Again, the responses will vary among viewers.

Natural materials possess a special aesthetic quality (wood, stone, clay). Often they seem more pleasant than synthetic materials. I wonder whether this is partially because of the knowledge that less is done to natural materials than synthetic and they represent something of nature, which has an appealing quality in a plastic society. Over long periods of time certain materials change their appearance. Wood turns a silver gray, copper oxidizes and changes from its copper color to a dull pale green. These changes are a process of protection, the green color to the copper is a result of the copper and the oxygen in air and water interchanging elements to create a skin on the copper which will stop the copper from completely distintegrating. The same idea holds for the transformation that takes place in untreated wood. Wood responds individually to the individual elements of the environment and therefore the side of the building exposed to sunlight will transform differently than the side that is not directly exposed. The same is true for wind, rain and snow.

These materials that change their outward appearance over time will ultimately affect the character of the building. When the building is first constructed the materials may appear



new, i.e., the corners will be sharp, crisp and often angular. Through time the materials will soften, joints (corners) may round off, the materials may change color and as a result the total character of the building may change from what it was initially. Often this change in character is positive and appealing. However, often this change is negative and the impression is one of deterioration. Thus when choosing materials for a building we should anticipate what the building will look like after the elements have had a chance to act.

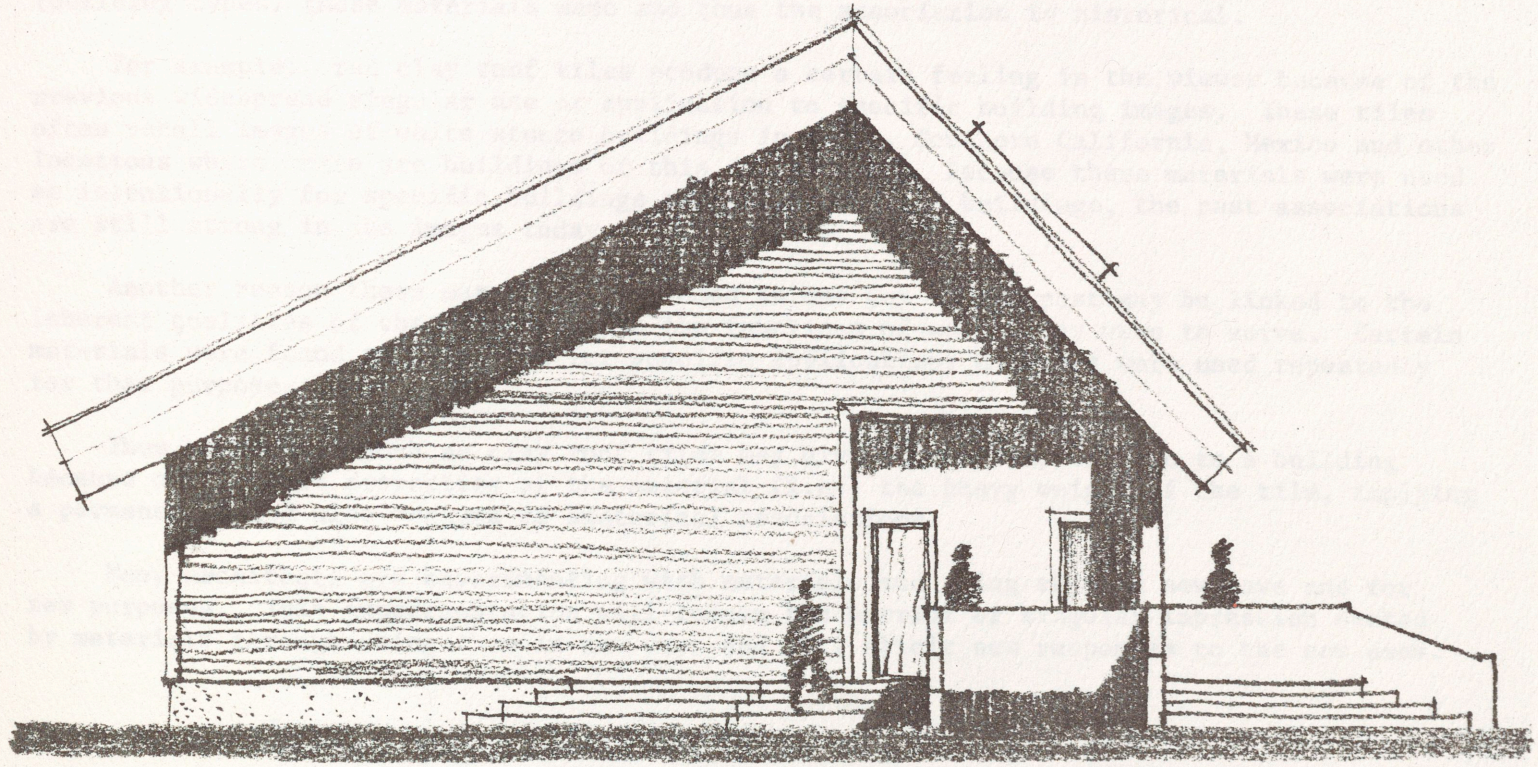
Stone has a heavy nature because of its composition. Visually stone makes the viewer aware or subconsciously feel the weight of the stone. Many of these visually associative properties are a direct result of physical experience, ex., the lifting of stone at some point in our lives. Wood has a lighter feeling associated with it because of its physical structure, and because of its color.

Unfortunately economics is often a strong controlling factor in the design process which may not allow the architect the opportunity to use materials in an appealing way and thus produce the feeling of pleasantness and appeal.

The color of materials is an element which can contribute to the feeling the building generates. Each building material has its own inherent color although often materials must be covered for protection.

The mechanical processes performed on materials can be varied and create a different result according to the individual property of the material. For example, if cut stone is going to be the exposed material on a wall the way the stone is cut can affect the texture of that finished surface, ex. is the cutting done with a circular motion or back and forth. The end result of the process may also be dependent on the nature of the process performed on the material and how it was related to any inherent properties of the material. For example if the material possesses a grain, the kind of process; let's say cutting, can come into play and also the direction the cutting takes place relative to the grain (with, against).

When choosing materials, texture and the employing of contrast can be used to produce character. Contrast is the result of different materials having different outward physical



properties. One material will be very rough and another material a very smooth polished surface. Contrast involves the placing of these materials with very different outward properties adjacent to one another to make more dominant the visible differences between their respective properties.

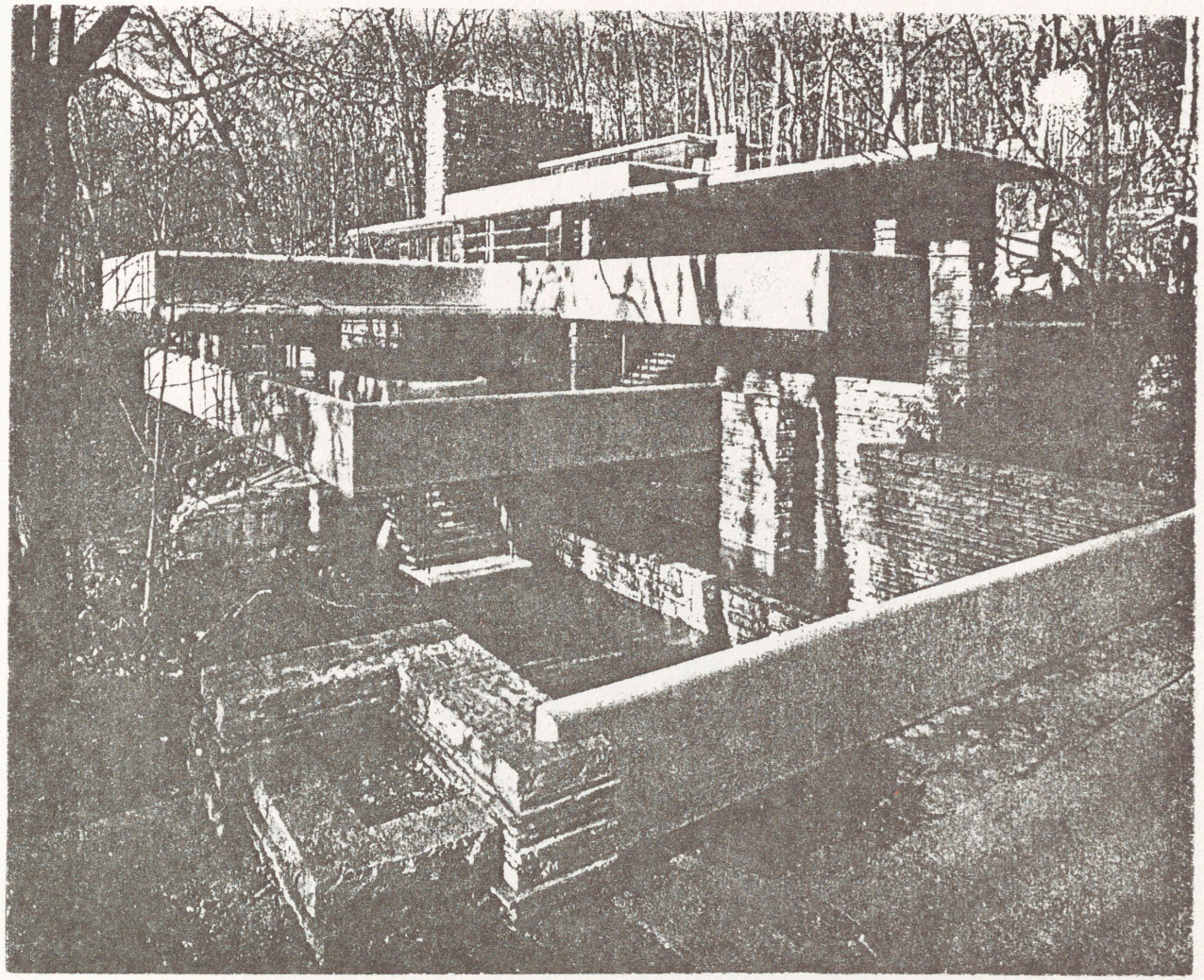
Materials have associated with them two sets of meanings or associations. Certain materials used during specific time periods carry specific associations because of the compositions (building types) these materials made and thus the association is historical.

For example: red clay roof tiles produce a certain feeling in the viewer because of the previous widespread singular use or application to specific building images. These tiles often recall images of white stucco buildings in Spain, Southern California, Mexico and other locations where there are buildings of this description. Because these materials were used so intentionally for specific buildings or applications to buildings, the past associations are still strong in the images today.

Another reason these materials were used in one way in the past may be linked to the inherent qualities of the materials and the functions of which they were to serve. Certain materials were found to work best for specific applications and thus were used repeatedly for that purpose.

Thus a material such as clay roof tiles may give a formal appearance to a building because of inherent properties of the material (i.e., the heavy weight of the tile, implying a permanence) and also because of historical associations.

Many architects are experimenting with materials and using them in new ways and for new purposes. This experimentation will loosen the barrier or singular impression evoked by materials through using them in new ways and will elicit new responses to the new uses.



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proportion

Basically proportion is a ratio. The ratio is a relationship between the parts and the part to the whole. This relationship between the part and the whole is intended to give order to a composition. This order or organization will make the overall composition comprehensible.

This underlying desire to produce order in a composition, was the intent of many of the theories of proportion that have been developed through the past. (Golden Section, The Orders, The Modular, The 'Ken').[4]

In the past, the proportions of the spaces between the columns were just as important as the proportions of the columns because they are interrelated. They both affect the overall result. If the spaces between the columns are too large the result makes the columns appear.

thinner, if the voids are too small, they visually increase the size of the columns. This is related to perception as each viewer will perceive the apparent diminishing or expanding, of the column size, in a different way and to a lesser or greater degree. This also applies to modern buildings in the relative proportions of wall planes composed of window and wall material (solid, partial void).

The proportion of a space directly affects the way we feel because of scale. Certain proportions are more pleasing than others because of the association we make with objects that are familiar to use.

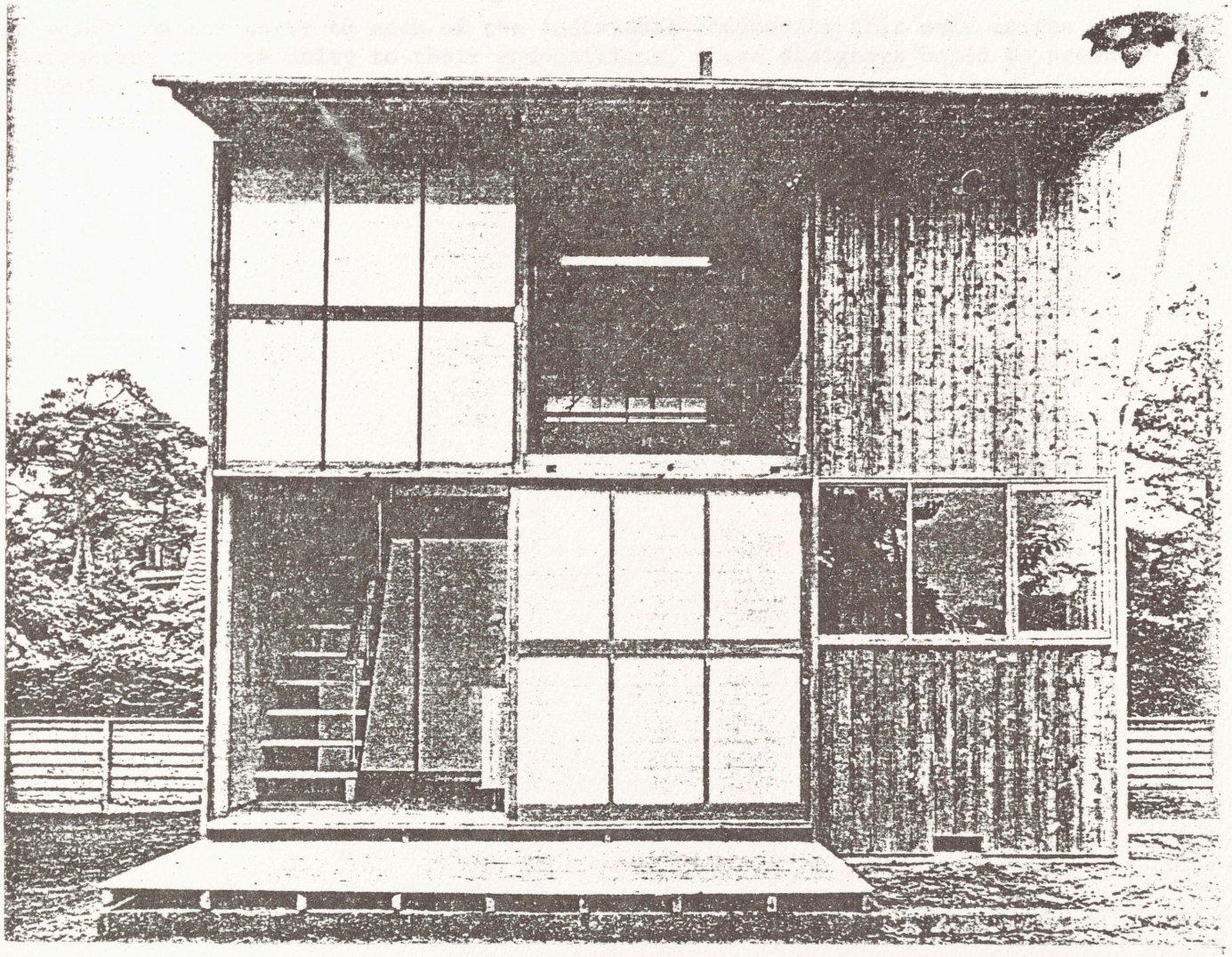
For example, when two spaces have the same physical height from floor to ceiling but the width of the space is different in each, the feeling received by the user will be different within each space. This feeling is related to the proportion of our own bodies and the amount of space each of us requires around ourselves in order to feel comfortable.

The sketches that follow help to explain these examples. If a space has a 9 foot ceiling and a width and depth of, say, 24 feet, the space might reasonably be a comfortable space. If however the width and depth were 100 feet with the same 9 feet high ceiling the space would probably not feel as comfortable as the former space. This feeling of comfort is therefore related to the relationship between the ceiling height and the width and breadth of the space and the user's reponse to this relationship.

Other spaces or proportions appear to be more comfortable because (some experts believe) they simulate more closely the proportions of our own bodies. This may partially be explained by the space being proportioned to the user because he/she is the one who ultimately uses the space. Thus the proportioning of the space to the user's proportions makes the using of the space easier and ultimately more pleasant.

> "Form in the mass of the building - form even in the smallest detail of ornament - depends for its beauty upon proportion."[5]

The search for a proportioning system in the past was a search to give unity to the whole



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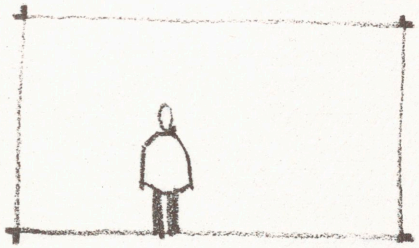
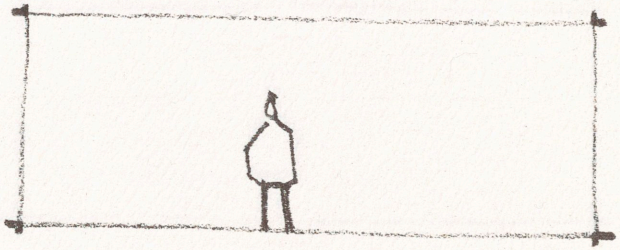
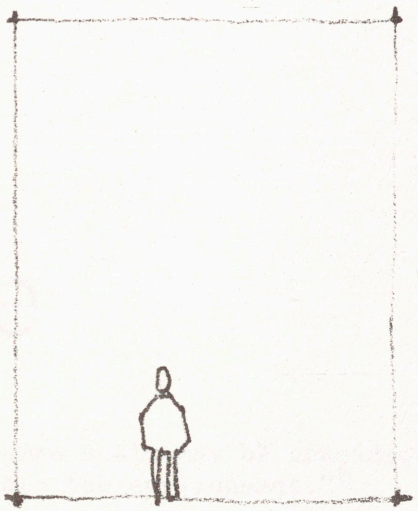
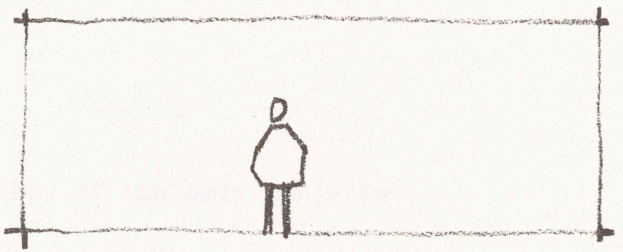
composition which implies unity to each of the individual components that make up the composition. In attempting to give unity to their compositions, these designers hoped to produce beautiful pleasing works of Architecture.









scale

"Human scale may be considered a metaphor of the body projected into the environment."[6]

Scale is a relative means of making a comparison of proportions between two separate entities. It is the relationship of the parts to a determined standard of measure. Scale and proportion are closely related. When the human body becomes the standard against which to measure or compare components as well as the total building we are dealing with human scale.

Scale is often referred to as being appropriate or not appropriate. This sense of appropriateness depends on what the purpose of the space is, i.e., the scale may be

appropriate for one function but not appropriate for another.

> "In a house trailer, a 2 foot door seems large, and 6 foot 6 inches is good for a ceiling, while it is hardly acceptable in a home."[7]

Another type of scale is called generic scale. This refers to, "the size of a building element relative to other forms in its context."[8] The size of building elements can thus be determined by their comparison to other elements which we may know the size of through experience. For example a concrete block wall can help us determine the length and height of a wall or the size of the window opening within it. A doorway is also a good element to make comparisons with and thus make a space understandable.

Buildings can have many different scales within the whole composition depending on the proportion of the parts at any given time.

Character enters the picture when we respond to the space and our understanding of it through scale comparisons.

unity

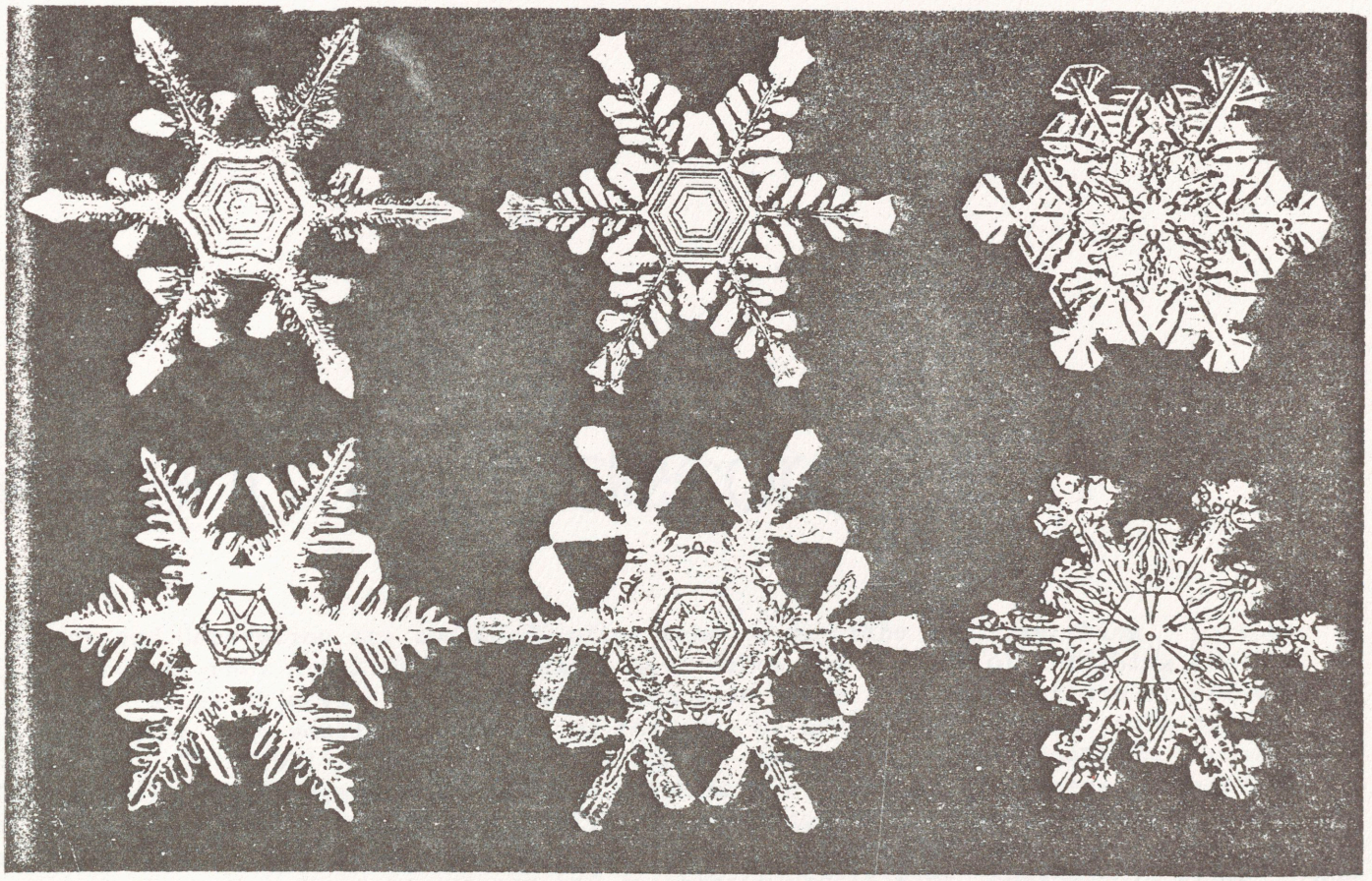
With so many individual design elements to compose, to make an end product, the designer must use restraint to ensure a unity exists in all aspects of the design. Each component can be a sub-entity and must possess unity itself in order to contribute unity to the overall composition.

"To possess unity a thing must be complete in itself."[9]

In order for a whole to possess unity the parts should have a definite relationship to each other as well as to the whole. Proportion is a key element which gives a strong relationship among parts if all are based on the same proportioning system.

This unity gives a composition a oneness. All elements convey an inner intent towards the whole.

Snow crystals exhibit this quality. Each fragment of a crystal can act as a unit on its own. When all fragments are viewed together the overall design possesses a unity composed of unified sub-components.



23,24. Snow crystals (W. A. Bentley and W. H. Humphreys, 1931). See pp.9,71,303 j

ornament and decoration

Ornament and decoration are two words often used to describe the same thing. In their correct use however they are different ideas. Both serve the purpose of enriching the essential shape of an object. They articulate and give scale to a wall surface by breaking the wall plane down into smaller portions and thus can be used to give human scale to a building facade. This quality of giving buildings a human scale is not always an ingredient in buildings built in the present day but one which most old buildings possess. Therefore ornament and decoration are elements that give old buildings their pleasing quality. The International Style has had a significant impact on the buildings of today. This movement made a very strong stand against ornament and decoration proclaiming "ornament is crime"[10] and the buildings built at that time were devoid of all ornament and decoration in the traditional

sense. Building elements which were previously not thought as ornamental or decorative features, became the only features which could be construed as ornament (standard pipe handrails, window frames, lettering and address numbers, doors.)

> "With more-than-candor they point out that the renunciation of decoration has led the modern architect to so manipulate his 'structural' forms that the entire building becomes a decoration."[11]

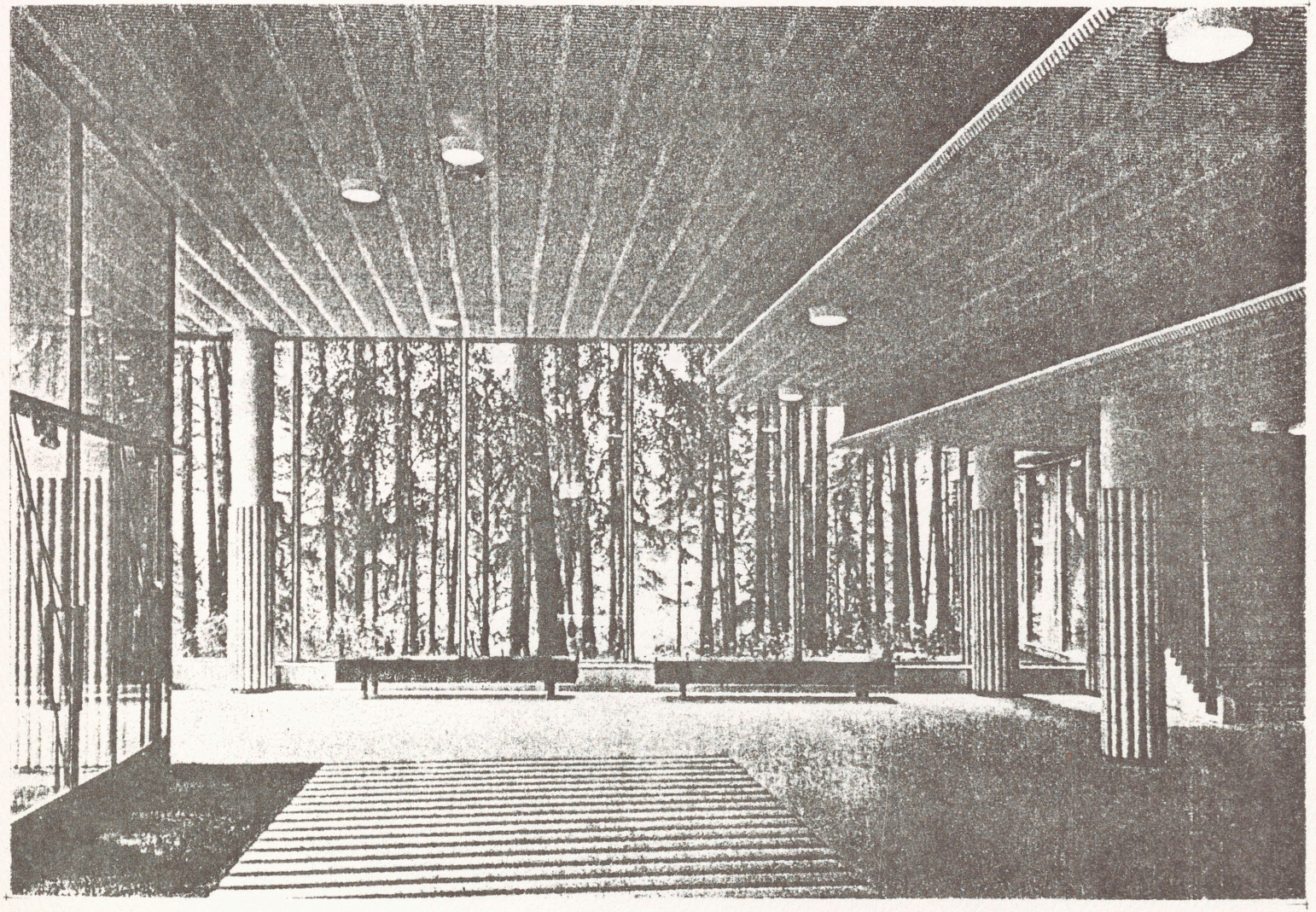
Ornament is inherent with the wall plane, whereas decoration is something that is applied to the wall surface. The ceramic tiles applied to the columns in many of Alvar Aalto's buildings are a good example of decoration. The tiles are not integral with the column but when applied, add a special quality; both visual and psychological.

> "There is, indeed, a functional reason why Aalto wrapped columns in textured tiles: the tiles protect them from wheeled carts and other abrasives. But the wrapping has another effect as well. It disassociates the columns from floor and ceiling - disassociates them from their identity as structural members and brings them down to our scale. It makes it seem as if the columns too are walking through the lobbies of his buildings along with us. Their nonrectilinear placement accentuates this feeling." [12]

An example of ornament is a cast in place concrete wall where the interior surface of the formwork is made of many wooden boards of varying depth. The final surface of the cured concrete wall will receive any grain of the wood as well as a surface with a varying pattern of in and out caused by the formwork.

Ornament and decoration affect the observer on both the conscious and subconscious levels. Through association past experiences can be recalled and triggered to stimulate a response to a new image.

As symbols they give meaning to the overall composition and also individually irrespective to the whole composition.



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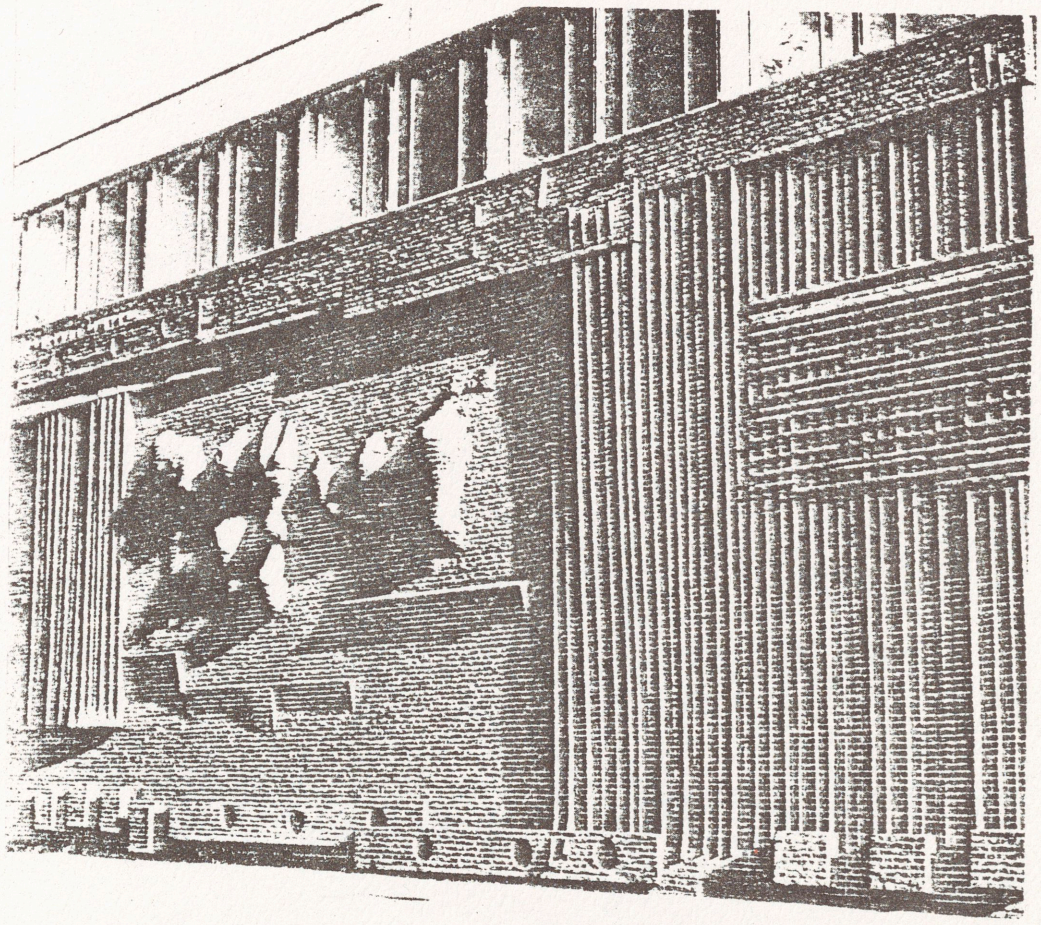
Color is an element which is either ornament or decoration. The color that is inherent in a building material will qualify as ornament in combination with the host material. Color that is applied, by whatever means, is a form of decoration. Buildings materials that change their color through time due to weathering, are a form of ornament. This starts to become a technicality but I have classified this type of color as ornament because the change, in color, is due to the inner properties of the material for its outward appearance. For example, the color that appears in glass and reflective surfaces is a form of ornament because the color is apparent because of the properties of the material.

In some new buildings today ornament and decoration are prevalent; not in the sense of the past but in response to the present day. Details are thought of in the way they perform the function required of them and also in the appealing quality they possess while being utilitarian. By combining these two aspects details become ornament and decoration and perform duties of providing scale and breaking the building planes into recognizable humanly scaled proportions.



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form

Space is a three-dimensional void. Form is visually a three-dimensional solid with space being contained within.

Form can be the expression of internal space. When this is the case the building composition receives a sense of legibility. That is, from the exterior the observer is able to make a connection between the functions that may take place within the building and the external form which is representing that internal space. This is what is referred to as Functional Character. The total of the forms produce a composition. The approach to creating this composition is one aspect of the whole which can contribute to character. The individual forms themselves each have their own character through association and proportion. Proportion is the main ingredient which contributes to forms having meaning through association. Are the

forms similar in their three dimensional qualities? ex., are they all cylinders?, tetrahedrons?, cubes?, etc.

A composition of three dimensional forms will possess a different character when all the forms are the same than when they are all different.

When we talk about the building's overall form we refer to basic geometric shapes and volumes. For example, to say the building form is in the shape of a cross we are three-dimensionalizing a two dimensional shape. The position of individual forms will affect the outcome of the overall building form.

Since the interior spaces possess a specific character and the external forms may represent the internal space, the external form is afforded the opportunity to express the character of the internal space. By making the internal spaces recognizable on the exterior the building becomes legible.

balance

Balance is a term used to describe or define what is stated below. Balance involves several concepts.

Balance is very much a principle which is associated with physical objects, gravity, the forms of objects and how these objects are supported. The most stable shape is the triangle. When a triangle is sitting on its base and the point is directed at the sky, the shape is in a state of equilibrium and will remain that way unless a great deal of force is exerted to upset the shape from its state of neutrality. When the point of the triangle is towards the ground and its opposite base is horizontal, one visually feels the image is not in balance and will fall to attain a neutral state with the point directed at the sky.

The other aspect of balance deals with images appearing equal and can be compared to a scale that measures weight. This aspect is a visual element very dependent on perception.

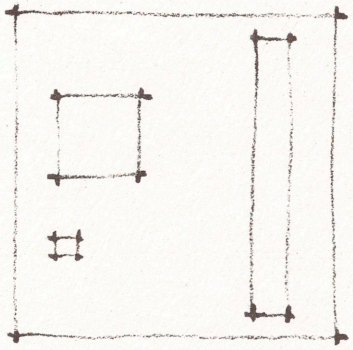
Visually the sizes of masses on different sides of an, often imaginary, central axis appear to equal each other and thus the whole composition will appear to possess balance. This can be the case with windows in a facade. The windows can be of various sizes and shapes, but will need to appear as though they equal each other in order to possess balance.

This is not simply a matter of making certain that the area of window on one side is equal to the area of window on the other regardless of all of their shapes. Other aspects come into play and the judgment as to whether balance does exist is based on visual perception and an inner feeling received by the person who is viewing the image.

The distance the windows are apart, the sizes of the windows, their proportions and shapes, their proportions to the remaining portion of wall and the resulting shapes, amounts, and proportions of the wall that is not window, all play a part in whether a two-dimensional facade will appear to have balance or not.

Because of the many factors that come into play, this is a complicated element to work with in composition and requires visual inspection to aid in the judging of success or failure.

If an elevational composition does not have balance a different kind of character will result in the overall feeling the building projects. A dynamic quality might be the result.



ASPECTS THAT AFFECT CHARACTER

perception

One aspect of perception that is probably impossible to deal with is that each individual has his/her own areas or subjects of interest. When dealing with visual appeal of architecture, one composition may be very pleasing to one individual and not very pleasing to another because of individual biases or preferences. Levels of association come into play, i.e., if one person has had some visually pleasant experience in his/her past which he/she is reminded of in a new visual experience that person may feel the same pleasure through association; the other person who may not have a similar pleasant past association upon which to associate this new experience may or may not receive a pleasurable feeling from the new experience. Therefore the same building may evoke both pleasurable and displeasurable feelings from different people. To this problem the architect can not accommodate both people directly by trying to conglomerate many elements that may or may not evoke pleasurable feelings in many

individuals.

Some people will respond differently to different handlings of the building's physical manipulations (manifestations) according to whether it is in accord with their beliefs or at odds. However the architect should provide something within the building which the viewer may find of interest or may remind the viewer of a particular past experience.

style

When talking about character it is important to distinguish the difference between style and character. If one were to say, "that building has style", then the meanings of style and character become very close. The above use of the word style is different than when we say, "that building belongs to a specific style". This second use of the word style is much easier to distinguish from the first. In the latter case, style refers to a particular way of building which can be distinguished from other ways. The specific approach or method that is used to detail and compose the individual design elements will collectively constitute the style. Therefore, style is determined by the way the designer composes the functions of a building. The resulting composition will belong to a specific style. The character of this resulting composition is related to the style. For each style or approach to a problem

a different character will result. Character is the received emotional impression from a building of whatever style. Buildings can be built in many different styles each of which will have a certain character.

Style is often associated with time periods. These time periods correspond to the people who produced the work of that style and how these people gave character to their compositions.

Time periods are defined by distinct occurrences which take place and thus contribute something new to the time interval. Once the new occurrence has been replaced again by something distinct and new the end of the old time period will be defined and thus signalling the beginning of the next period.

Buildings are often referred to as belonging to this or that style which illustrates the point of time periods. The distinct occurrences are the characteristics which distinguish one style from another. Thus the buildings built during a certain time period belong to the style of that period. Time periods, however, can overlap and thus differing styles can coexist.

The best way to explain the first use of the word style would be to say, a building can have style regardless of what time period (style) (i.e., Gothic, Queen Anne) it belongs to. Thus style is something special or unique about one Queen Anne building which four others of that same style do not possess.

When I think of the work of Frank Lloyd Wright I think of both character and style. His work can be recognized as belonging to a style of which he was responsible. His strong emphasis of the horizontal distinguishes many of his projects giving them character and a distinguishing feature of his style. The emphasis of the horizontal was an echoing within the building of what the site was as a whole. The roof form (of large projecting overhangs) is an element of that style and was initially intended to shelter the vertical walls of the building. The roof element, through its handling, gives character to many of his private residences. (If the overhangs had not been so large the roof elements would not appear so dominant and might not contribute to give character to the whole; the character would be of a

different nature.)

Each one of his plans is different to accommodate each new site, client and anything new and different about each project. Why then do many of his private residences look the same? This is because of a similar mental conception or attitude toward design, the purpose for which the individual elements are to serve and the best way to achieve that purpose. Each project was given character because of the way in which elements were handled. This way in which elements were handled may have often been the same between projects thus making each project belong to a similar style.

CHARACTER TYPES

functional

Functional character refers to the connection between the specific purpose of the building and the outward physical representation that the function acquires. In other words, the three dimensional representation (which is the building) will imply what function or activity the building was constructed for.

In order for the building to express the function for which it was built two things must occur. First, the manifestation of the building, through symbolism, must express the function in the physical elements that make up the building. For example, to express the function of a space of worship, the building must demonstrate in its physical make up, this is the activity that takes place within that space. This can be accomplished by many of the

individual design elements, (ex., the proportions of the space may create a subservient feeling in the observer because of its height relative to the user, or the mass of the building may be representative of an important religious symbol.)

The second requirement in order to successfully convey the purpose of the building is that of legibility. The outward symbolism, the physical elements of the building convey about the building's purpose must be recognizable and correctly associated by the viewer.

The forms that compose the building carry meaning. These meanings associated with forms are a result of association with past images which have been handed down through time and represent understood ideas. When an architect creates a new form that wants to express the old meaning, the tie or line of association does not exist and the meaning that wants to be conveyed is blocked. This is often a slow process of trying to have new forms expressive of the old meanings, accepted and understood by society. If the new forms are similar enough to the old forms, an association can possibly be made with the new forms and the old meanings. Many factors can contribute to making new forms appear similar to the old forms. (Proportions, materials used, the placement of the form in the whole composition, eg. the form within the landscape.)

Building forms that are used inappropriately may produce misleading ideas about the building's function and possibly an unpleasant character. Whether or not a form is interpreted as appropriate or not can be linked with whether the expressing of the function was performed with relative ease or not. If a complex manipulation is used to express the function the user may become lost and miss the connection that is intended.

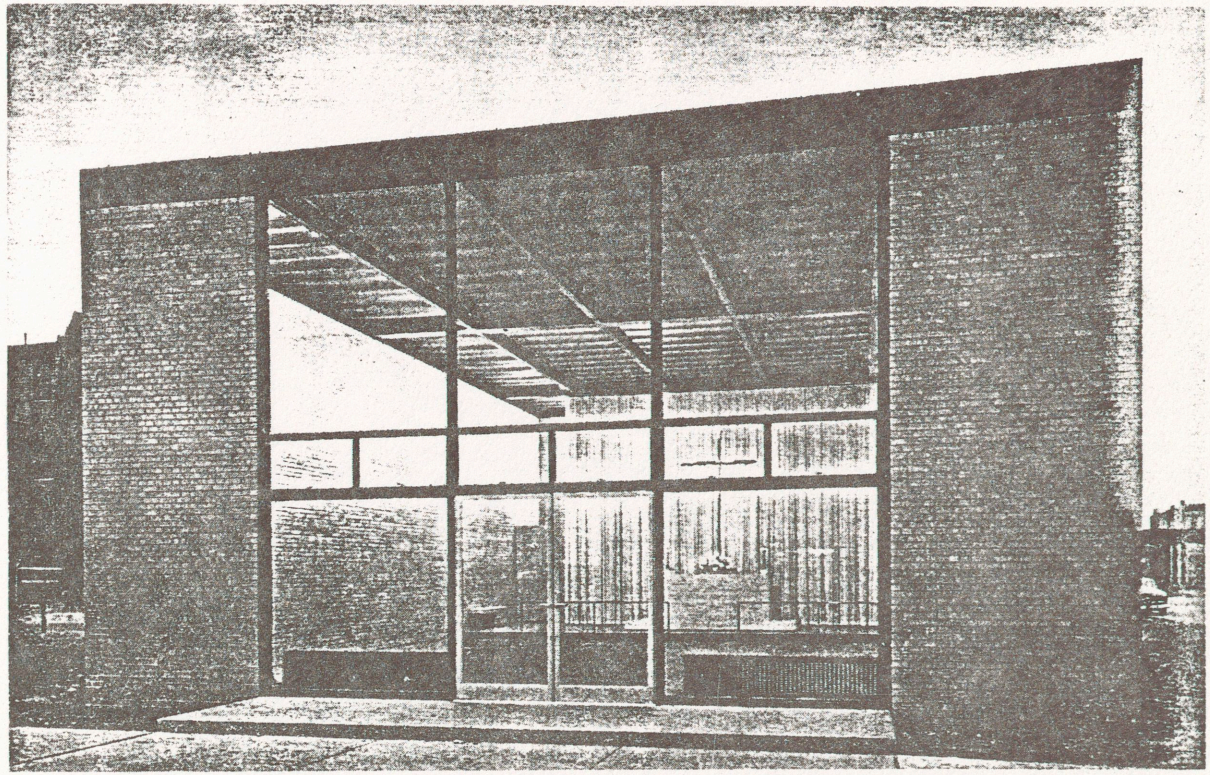
Expressing the building's function through symbolism seems to be an honest approach to making buildings recognizable in the built environment. Many of the buildings today seem to be anonymous in their expression of function through symbolism. This may be explainable by the increased use of actual lettering on or adjacent the building for the purpose of explicitly stating the building's function.

With the increased use of signage on buildings the forms that were formerly used to convey a building's function are being used less and less and thus the meanings that are

associated with those forms are slowly slipping from the architect's collection of forms with recognized and attached meanings associated.

One positive aspect of this (if architects would use forms to convey meaning without building signage) is that the meanings associated with the old forms are becoming freed from the forms which allow these old forms to take on new meanings. This separation also allows the meanings to link up and be associated with new forms that may be created.

The example of the IIT. Chapel is an example of an anonymous building. This is an example of a building with an outward form which does not give a clue to the activity which takes place within the building. From three sides of the building the form is anonymous. If the symbol of the cross were not evident, it would be difficult to determine the building's function. A cross is also created by the composition of window mullions; which, if not noticed and associated by the viewer would not help convey the building's function.



73. Illinois Institute of Technology, Chapel, 1952.

regional

A region refers to broad, distinctive, recognizable features that are unique to an area. Regional character refers to a building which looks as though it belongs where it is and also within its physical image conveys complementary ideas about that regional environment. The building makes the viewer recognize or associate the physical components of the landscape. One can look at the building and see or feel images of a region of Montana.

These features that contribute to a region's individuality include: geology, geomorphology, climate, vegetation and historical references. This type of character is by its definition sympathetic to the natural landscape. The forms of the buildings are derived from landforms, forms of vegetation, response to climate, the local materials that can be used for

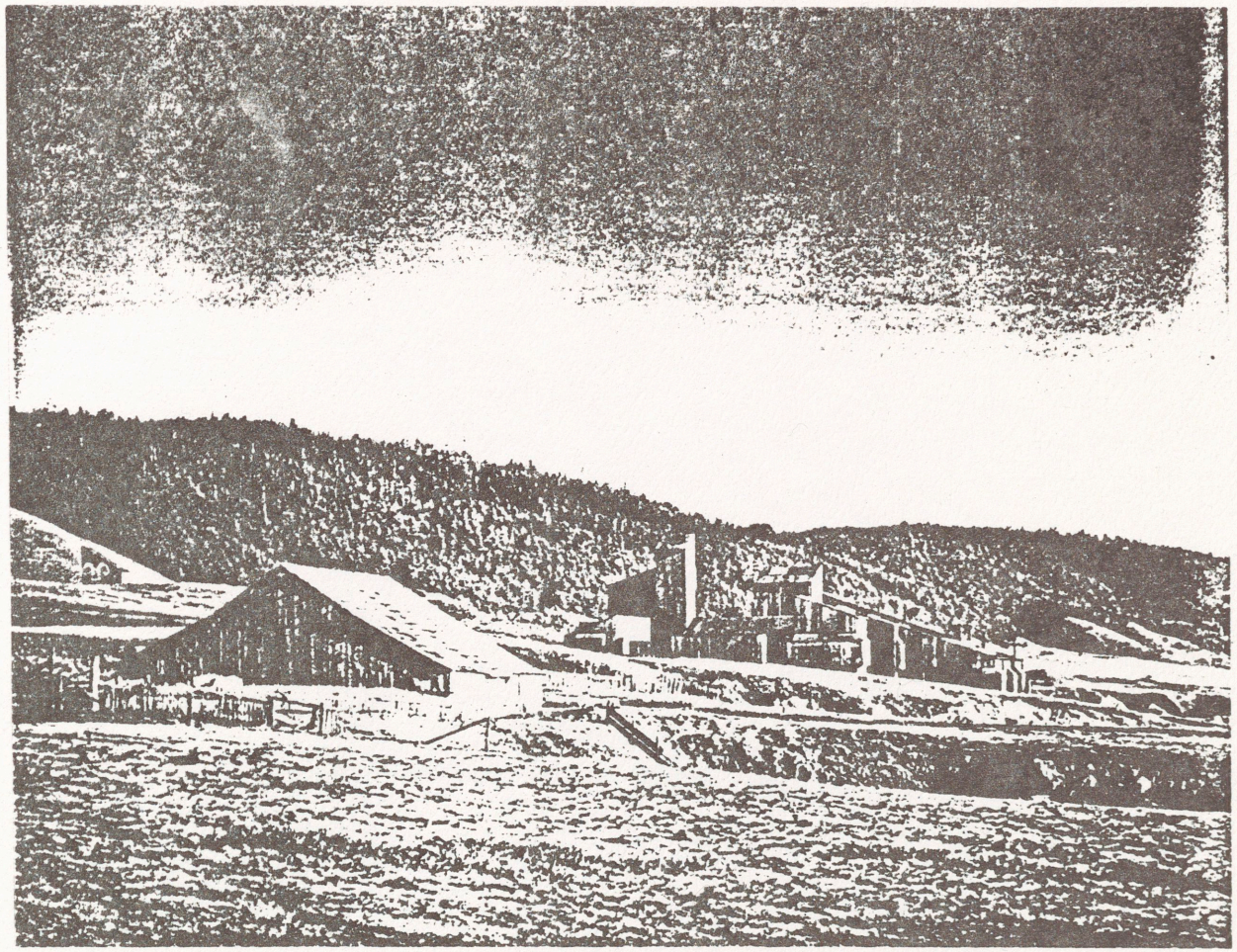
construction and any historical symbols that may be associated with a region.

> "Another aspect of site relationship, is the symbolic link certain objects and ideas have with particular places and regions. The ancient artifacts of a place, like the legends attached to it, can constitute valued evidence of the lives of previous inhabitants."[13]

The use of indigenous building materials creates a link between building and land and often gives the feeling that the building is actually growing from the landscape. Concrete has the ability to appear as though it grows from the landscape but only in terms of the forms it is molded into. Concrete forms will not totally appear as though they grow from the landscape because nowhere in nature does concrete occur in the state of which it is used. This is due to the fact that concrete is a composite building material. Adobe on the other hand is an organic building material because it exists in nature in the state of which it is employed in constructing buildings.

An example that comes to mind which represents regional character is the Sea Ranch Condominiums on the California coast.

Often the distinct features of a region are expressed by the inhabitants' attitudes towards these distinct entities; be they land forms, climatic factors, vegetation or whatever. Therefore Regional character is basically a sympathetic expression of people's response to the environment in which they live through the built forms in which they inhabit.



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contextural

Contextural character is somewhat like Regional character but refers more specifically to a micro-environment. By this I mean a much smaller physical area, for example a neighborhood, community or only a few blocks. This specific area is differentiated from other areas by distinct features which are not present in the areas immediately adjacent. These features can be many: roof pitch, colors, materials, and so on for many of the elements which have been talked about. Contextural character can involve cultural, economic, social and historical aspects. In most large cities composed of many ethnic groups, individual cultural neighborhoods are recognizable. Everyone has experienced the strong and distinctive Chinese, Italian or other cultural neighborhoods that possess their own individual character. The character is present in the built forms that the people inhabit more so than the places in

which they work, but also in the way they care for the environments in which they live. Often the eating places possess the character that is associated with their residential environment.

This contextural character of which I refer can be a factor when designing a project within an area that has a strong character.

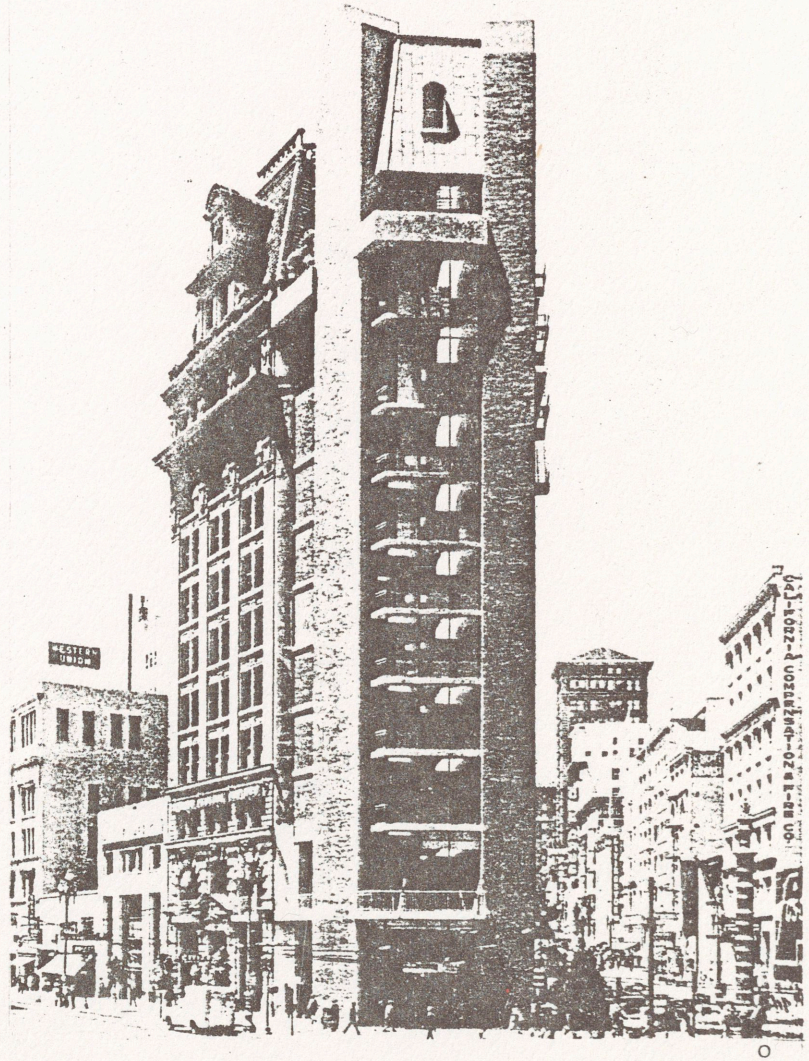
An individual building or neighborhood with a strong character can act as a point of reference much in the same way as a landmark. It can be an orientation device in a larger mental image much like Kevin Lynch's landmark.

For example, within Bozeman there are strongly recognizable individual characters within many of the neighborhoods. Some of the houses are much larger older homes, some areas have fewer trees, and the state of repair of many of the houses contributes to a specific area.

An example that comes to mind in terms of an individual, distinguishable element is the bay window on the Victorian Townhouses in San Francisco. It is an element which the designer can respond to.

Context also refers to time which leads to historical character. Character of different time periods is often associated with styles. Each decade of architects is influenced by the previous centuries of architectural thought as well as by the present day attitudes and notions. The economic, cultural and social climate that we design in has a tremendous influence on the design outcome and the approach which has brought about that result.

> "Change of place, though less drastically than destruction, also affects the permanence of an object. When an object changes context, it changes character. . . . and thereby loses some of its constant identity." 14


WESTERN UNION

spatial

Spatial Character can apply to two broad kinds, Internal and External.

The spatial character of St. Mary's Cathedral in San Francisco by Pietro Belluschi is significantly different from that of the houses of Frank Lloyd Wright.

The spaces of each are intended for a different reason and because of this they take on different qualities which contribute to the impression of character.

Usually when thinking about space we refer to internal spatial volumes that are defined by space defining elements. However space is also an external phenomena. It is what is left

over after space has been defined on the inside. It can be defined by the grouping of buildings, vegetation and other space defining elements.

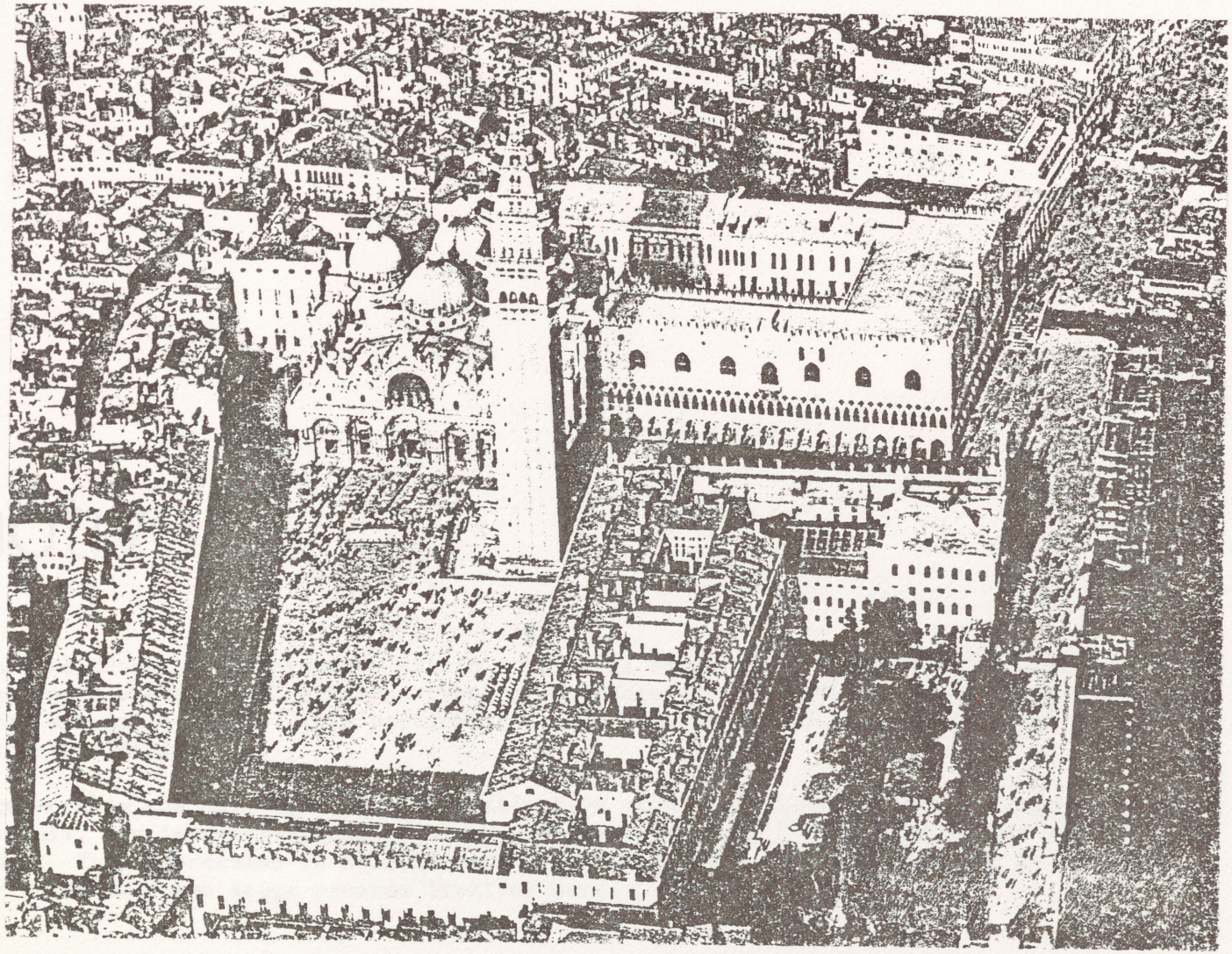
Space is the primary architectural element. It is that which we are trying to define, confine, enclose or provide for whatever purpose of activity.

A well known example of external space is the Palazzo de San Marco in Venice.

The proportions of the space play a major part. Associated or in conjunction with the physical spatial qualities of a space, go feelings (psychological) that the components (composition) of the design evoke within us (unmeasurable quality) which the participant experiences measurable in the sense that one space may evoke a horrendous pleasant response in a person and another space may evoke only a small pleasant response.

Similar to the link between the actual physical external form of the building and the feeling evoked because of association through imagery, towards that form, a similar link exists between the configuration of the internal space and the kind of response evoked in the viewer. Different spatial configurations evoke different emotional reactions to each configuration.

Since space depends on its boundaries for its existence, there is an interaction and interdependence on both elements. The physical composition or character of the space defining elements will have a large impact on the character the space receives. Since space has this dependence on the defining elements, the architect is the one in control in giving space character, by the way in which he/she manipulates the defining elements. Therefore the architect has at his use, the elements of design which were talked about previously.



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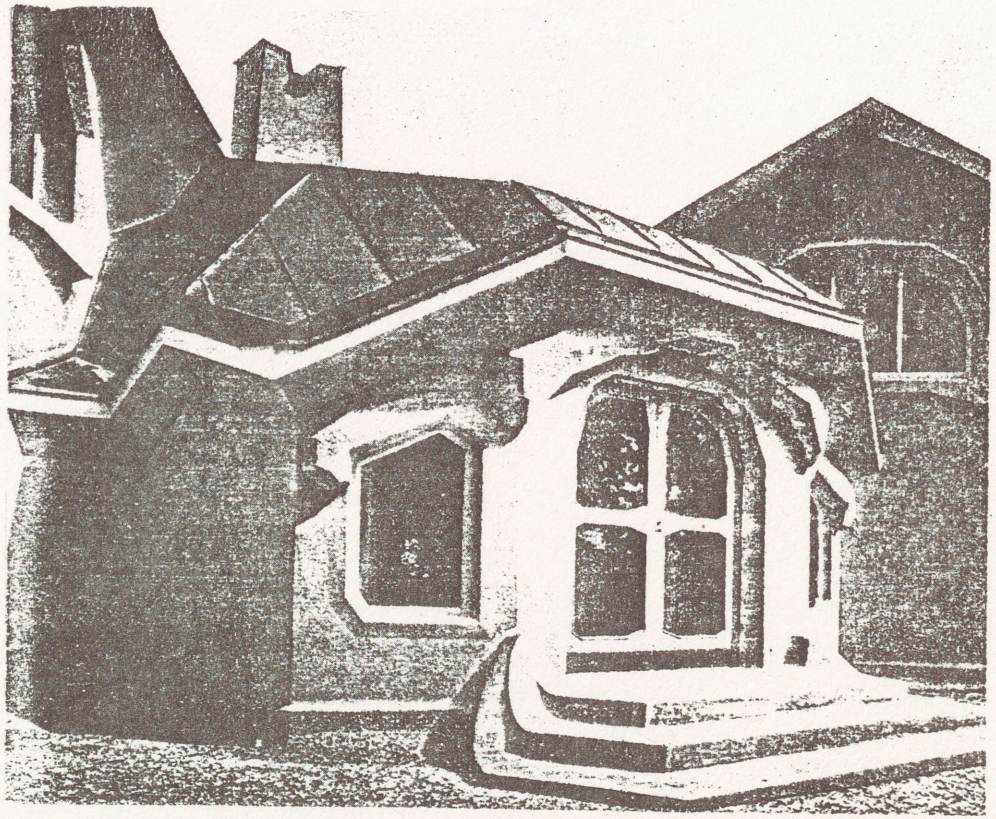
emotive

Emotive Character is presence within a building image which draws forth a pleasurable feeling from a viewer. All previous types of character which have been talked about can possess this special quality. This particular type of character can apply equally to objects other than buildings.

Presence is the existence of some distinctive atmosphere (aura) that is created by sensory stimuli. An impression, which is dependent on the aura, is received by the observer of the image. This impression is a feeling or sensation as opposed to perception and thought. However there is a two stage process involved here.



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First there is the initial sensation which the observer receives from the character and then there is a mental process which starts to make associations and judgments. This initial stage can be likened to the 'zap'[15] experience referred to by George Nelson when he talks about the creative act. This idea of sensation is also referred to by Arthur Koestler in his book, The Act of Creation.

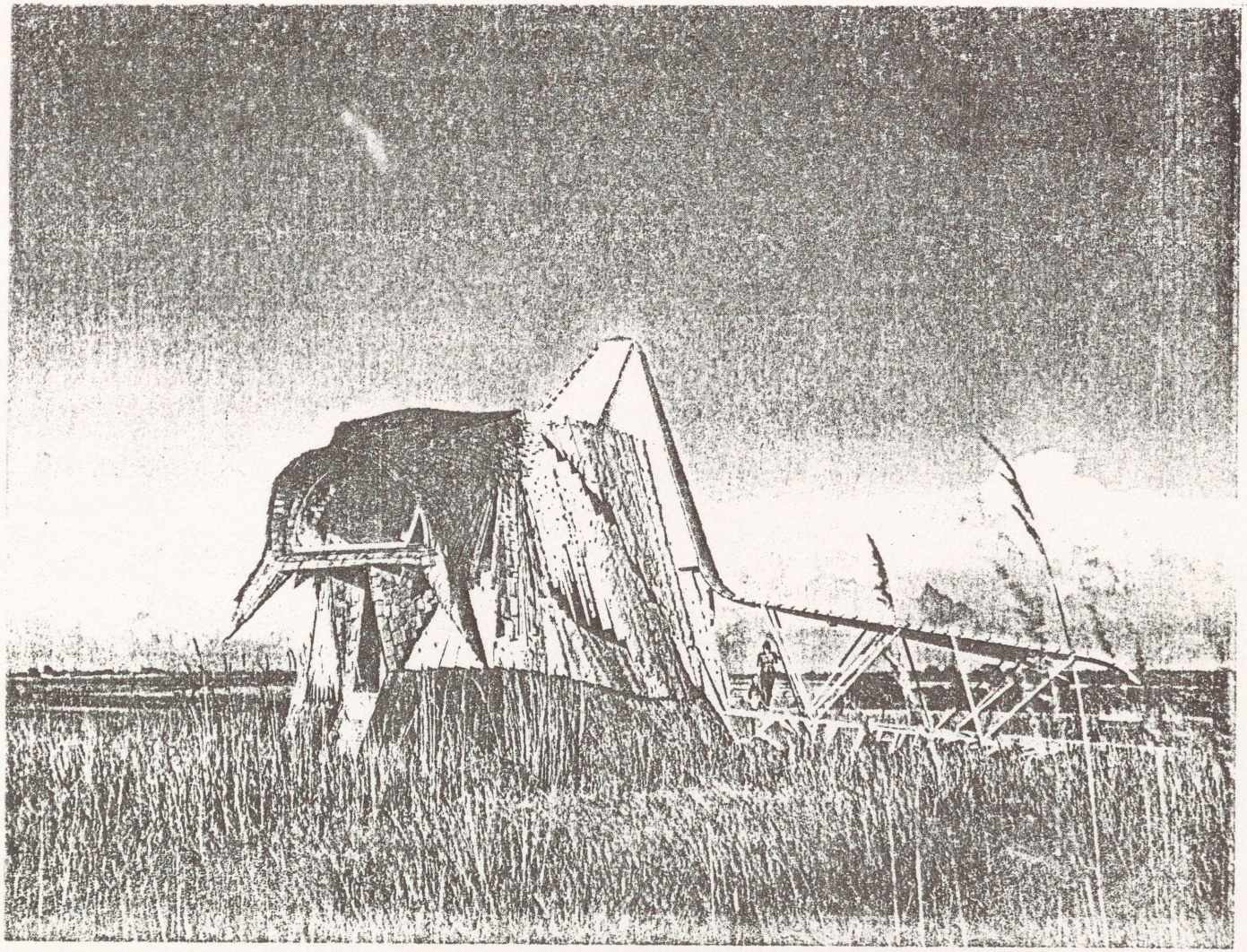
Character is a quality that is inherent within the building. It exists within that expression which we perceive as the building.

> "To distinguish this view of expression from those of other theorists, let me assert that the objects and events we perceive are not simply endowed by us subjectively with human qualities, as the theory of 'empathy' has it. Rather, the dynamic qualities come along with the percepts of objects and events, and characterize them as possessing in themselves some particular way of being or behaving."[16]

The reason why we at one time do not experience character within a building and then ten years later feel the same building does possess character (even though there has been no actual physical, visible change, other than time) can be explained by the value judgments we make at time phases in our lives. At one point in our lives we value certain possessions, ideals and physical manifestations. As we change through time the ideals and such which we now put value on, have changed. We assign value to a new series of importances. Nothing has actually changed within the object itself, except our perception of that object's importance. The new objects which take the place of our old importances will lose the inherent value which they have now acquired (been assigned).

The society we are living in now, sees the buildings which the previous societies lived in, the buildings that followed those, the buildings that are built today and now would like to have some of the qualities that those previous buildings had, in the buildings which we inhabit today.

This idea of value judgment explains why we are often shocked by something that is ahead of its time. For example, the work of Frank Lloyd Wright was very different from the work



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other people were doing at the same time. Often it is not until several years later that we realize the value in such work. When we finally make this new judgment we are understanding the thinking that went on to produce the new conception and thus will outwardly respond differently to the visual image. This is the second stage of the experiencing of character. The first stage is experienced exclusively externally; the sensation in us is produced from the external image.

Color evokes certain reactions. Likewise, architecture evokes variations of human response. The underlying elements produce the resultant image; the proportions, materials, colors, scale -- in short, the total composition creates the three-dimensional image and evokes human response.

The buildings and sketches of the architects of the Expressionist Movement in Europe, possess this last kind of character. Often the visual image of the building, stated outwardly, the function the building contained within; for example, Erich Mendelsohn's, Luckenwalde factory.

Generally, however, their buildings did not express ideas related to function, but simply expressed a feeling the architect could put into the building. For example, Mendelsohn's Einstein tower.

> "Steiner's architecture is really open sculpture; huge pieces of sculpture in which people move and have a new sense of being . . . It is not sculptural building in the sense that Mendelsohn or Le Corbusier referred to in their equation of architecture with the magnificent play of light on form. It is rather an environment above and around which the primary spaces are created to invoke response of the spirit in man."[17]

I think, Frank Lloyd Wright was the one who said, "Art is the evidence of joy in man's work." Character, therefore, is the evidence of spirit in an object. Spirit is that inner entity which gives life or excitement to a thing. Spirit is that which exists within something that has emotive character.

conclusion

Until now I have referred to design elements and their effect on the viewer's response to these elements, as visual clues. It must not be forgotten that these elements influence our other senses as well. Brief mention was made about the tactile qualities of materials which users may experience in a building. These felt textures give the building another area of appeal. Children experience the textures of building surfaces more than adults.

Society has changed its primary concern for buildings from design principles to construction costs; thus many of the other sensory effects (touch, sound, smell) which contribute to the overall mood of a building are no longer considered at the developing stages of building images.

The sound and feel of walking on polished granite are very different from a wooden boardwalk. Likewise the smell in a bakery or delicatessen contributes to the mood when buying rolls or sausage. However, because of the change of emphasis regarding building, the qualities of touch, sound and smell are not employed (as strongly as visual clues) to produce an eventual building image which is pleasurable to all of our bodily senses (taste not being intended to apply to buildings.)

Sight is the most used sense and thus when composing building images designers primarily think of how a building will appear, as differing manipulations are performed on the developing image.

All of the properties of materials should be incorporated into building compositions in order to create a complete desirable building character.

Throughout this thesis I have been talking primarily about aesthetic considerations. All other aspects of the design process must also be fulfilled (budget, code requirements, functioning of the building, etc.) to the best. As buildings have become more complex, building codes more restrictive, concern for human safety more dominant, there is little wonder architects have often found little time to think of buildings in terms of the character they possess.

However just as the unpleasantness of an incomprehensible floor plan makes for a confused mental recognition in a user, in contrast those buildings which evoke pleasant feelings in viewers make life more enjoyable to the people who come in contact with these pleasing buildings. As cities become larger and more congested than ever, there is a stronger need for Architecture to strive to be "an art that is concerned with creating beautiful objects, enhancing the quality and love of life, and exhilarating the human spirit."[18]

In writing this thesis I became aware of how interrelated many of the individual design elements are and that it is often hard to talk about them separately. One element will directly affect another and this one in turn interacts with another. For the first time the

knowledge of how complex this process of creating an image from which to build (which often occurs subconsciously) has struck me.

The elements of design or rules of composition, if you will, are not meant to precede any form giving (three dimensional manipulation) that may come from anything within the two dimensional organizing of spaces which is a result of functional requirements of the program, but go hand-in-hand and occur simultaneous to the organizing of two dimensional requirements.

From this simultaneous working (organizing) of two dimensional and three dimensional requirements the space will be given a physical character (something visually recognizable if not comprehensible) which hopefully should be pleasant.

The character that results will be at the control of the designer as to what he feels is appropriate and his ability in composing will determine whether the building receives a positive, pleasant character or a negative and unpleasant character.

Composing is the process by which something can be given character; a composition is that end product which has character. Character is that sum total of composed elements which produces distinct features within a building in such a way that a strong feeling is elicited in the viewers. It is that which is uniquely inherent within a composition.

PROJECT BACKGROUND

The City

The city of Calgary is a rapidly expanding urban centre situated in a gently undulating landscape centered on the Bow River Valley some 60 miles east of the Rocky Mountains.

The 1962 population was 269,000 and in 1979 the population reached 540,000 and is estimated to be 618,000 in 1986 and 778,000 in 1996. "The city is growing by 2,000 people a month. . . ."[19]

Approximately 30% of the work force is employed in the downtown area. The growth of the suburbs is expanding in the south, northwest through northeast and west. "Single-family homes make up 70 percent of the dwelling units in the suburbs."[20]



s

In the past the city has been able to maintain a level of new construction for major arterial roadways. The city has reached a size that construction of new freeways will not be able to keep pace with peripheral suburban expansion as well as maintenance required on existing expressways and minor roadways.

Another factor which plays a strong determining role in the introduction of a rapid transit system is the space for parking in the downtown core. As was mentioned earlier, a significant portion of the work force works in the downtown area. The existing downtown core is already inadequately equipped to accommodate vehicular parking and with the present trend of increased rapid construction of highrise office towers, the space for parking will be both, more in demand and without space for its adequate inclusion.

Away from the downtown, space is much more available and land costs are less. Park-and-ride stations incorporated with the L.R.T. system will solve many of these problems. Office tower construction can continue, vehicular traffic can be reduced in the downtown business and shopping district, people from the outlying communities have a place to park their cars, and transit to the city centre is provided for those people who work and shop there.

The LRT System

The initial track of the LRT system travels 16 km. from the downtown area to a terminal at Anderson Road which is the southernmost portion at this first stage of construction (maintenance, repair, storage facilities are incorporated into this terminus which will also double for buses).

The first phase consists of the following four sections: railway right-of-way, Cemetery Hill section, Victoria Park section, and Downtown section.

The railway right-of-way is the most southern portion of the line and is constructed within an "existing 32.8 metre right-of-way of the MacLeod Subdivision of Canadian Pacific

Ltd. (CP)."[21] Building within this existing R.O.W. will not involve relocating the existing track but requires the purchase of additional land at the stations. Grade separations will occur at major vehicular roadways and at some minor roads access will be closed. Lying to the east of the R.O.W. between Glenmore Trail and 34th Avenue is an area of light industrial development.

The alignment leaves the railway right-of-way at 42nd Avenue and at 34th Avenue the track enters a tunnel under MacLeod Trail where it travels between two cemeteries. The reason for tunneling at this point is because excessive grades would be involved to stay at grade and the available right-of-way is limited.

Between Cemetery Hill and Downtown, the line follows the east side of MacLeod Trail at grade and involves the purchasing of land to widen the roadway by 15 metres.

The Downtown section starts when the track turns west onto 7th Avenue and travels at grade on 7th Avenue until 10th Street Southwest which comprises the north terminus of the south line. L.R.T. vehicles, buses, and emergency vehicles are the only vehicles allowed access on 7th Avenue.

The Site

The site for the L.R.T. Station is on MacLeod Trail S.E. and between 14th and 17th Avenues Southeast (there is no 16th avenue between them).

The Calgary Exhibition and Stampede grounds compose the east edge of the project area. A new 200,000 sq. ft. Agricultural Convention Centre, the Stampede Corral (multi-purpose building for indoor rodeo, ice hockey, curling, major gymnastic competitions, etc.) and the Big Four Building (convention type building) constitute a year round convention centre for Calgary.

Thoroughbred and harness racing, trade shows, The Calgary Stampede, basketball

championships, auto and boat shows, team rodeo, wrestling, and rock concerts are some of the other activities that take place at the exhibition grounds to make it a facility used year round. The grounds received a total attendance from October 1, 1978 to September 30, 1979 of 3,149,284 visitors at 2,025 different events.[22] The stampede grounds has been continually expanding to accommodate the growth of the city and the need for convention facilities of all kinds.

The number of people the stampede grounds receives annually will directly affect the design of the LRT Station and in time, the station will have an effect on the attendance to the functions that take place at the exhibition grounds.

Immediately to the northeast of the project area is a residential neighborhood (Victoria Park) which consists of one and two storey, wood frame houses built in the 1940's.

The houses themselves are in a state of deterioration (in need of paint, structural revamping of many porches and balconies, replacement of siding and fence boards and general sprousing up) because of a lack of maintenance and personal upkeep over the years.

The people fall into an economic category of lower class and upper lower class which may be a contributing factor to the lack of upkeep to the dwellings. Another aspect which is probably a contributing factor to the lack of upkeep on the dwellings is the continual expansion of the exhibition grounds.

In the past parking was provided at the grounds. As expansion has taken place over the years, parking is no longer provided and just this past year (1979) the exhibition grounds has expanded to the north into Victoria Park, as this is one of the few directions where expansion is physically possible. The exhibition grounds is contained on the east and south by the Elbow River, the west by MacLeod Trail, leaving the only space and direction for direct expansion to the north, into Victoria Park.

Because of many involved factors and the nature of urban political structures, the community of Victoria Park will probably not be able to stop future development into their community. New building development is taking place in this area.

To the northwest is a residential area in the midst of a general commercial zone. The overall character of the neighborhood is much the same as Victoria Park; however the upkeep on many of the properties is somewhat better. The neighborhood is composed mainly of one and one and a half storey wood-frame or stucco houses, although there are a number of old brick houses and the odd apartment buildings.

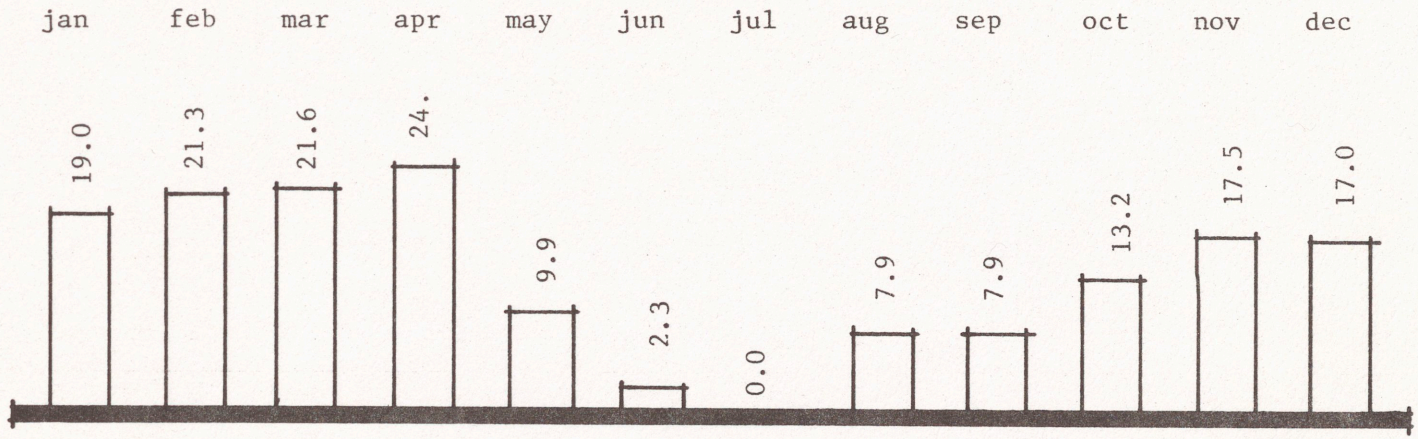
Like Victoria Park, this neighborhood is in transition and new infill apartment housing projects are being built as the older houses are brought up.

To the south and southwest is a general commercial zone. Again, this is an area of transition which was originally residential but has been infilled by small commercial development and many renovations have been done to convert houses for commercial use.

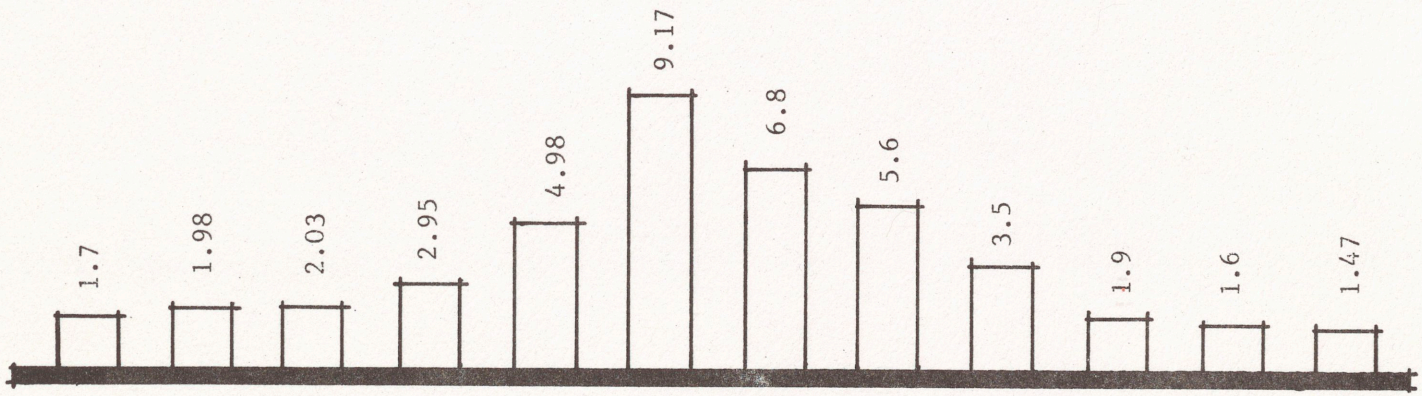
WIND DATA

Data is for 1978

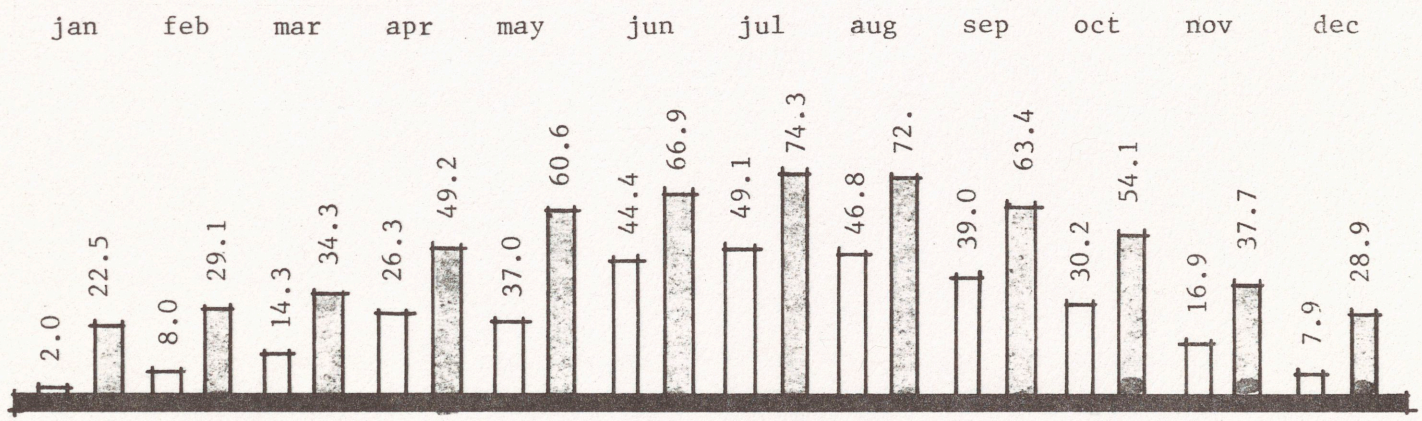
Month	Hours of Wind in month	Speed (km/hr.)	Prevailing Direction
November	720	20.	West
December	744	21.1	West
January	744	13.2	North
February	672	12.0	South
April	720	17.1	North N.W.
June	720	16.0	West
July	744	14.8	North N.W.
August	744	14.9	North N.W.
October	744	17.4	West



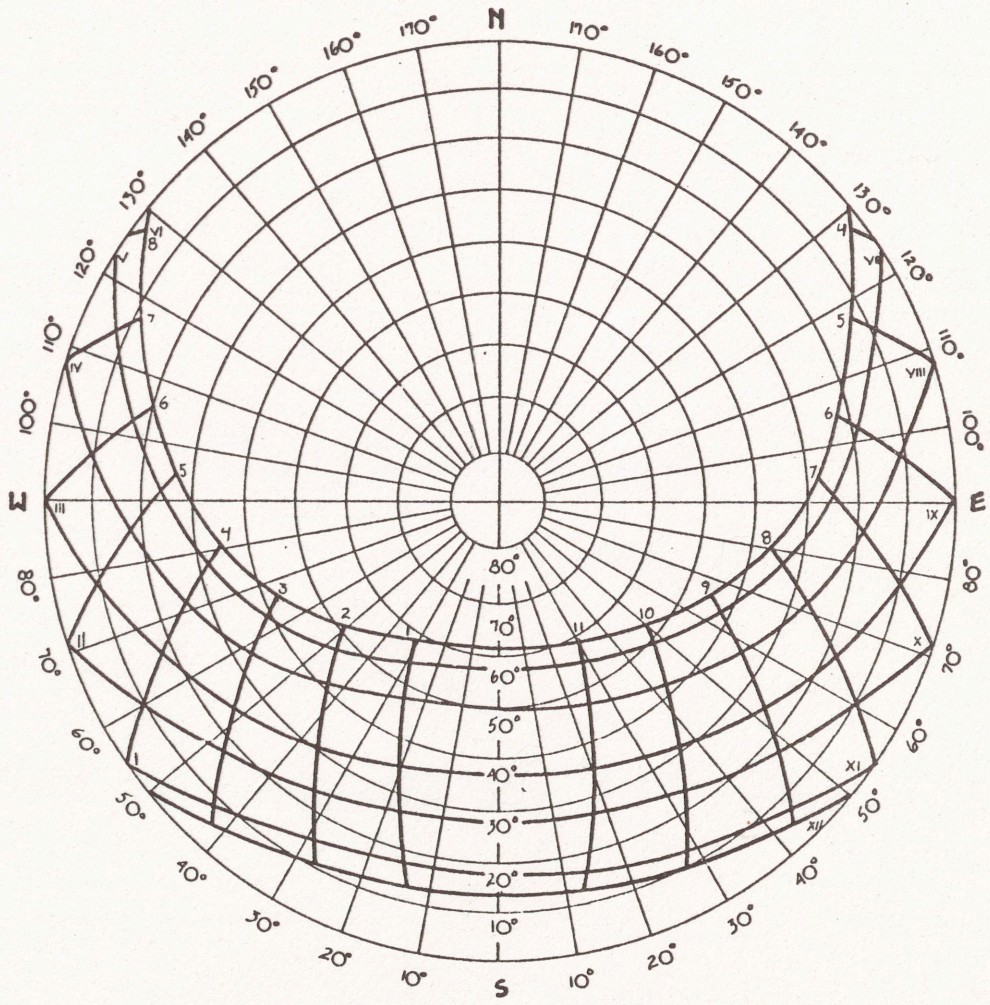
mean monthly snowfall cm.



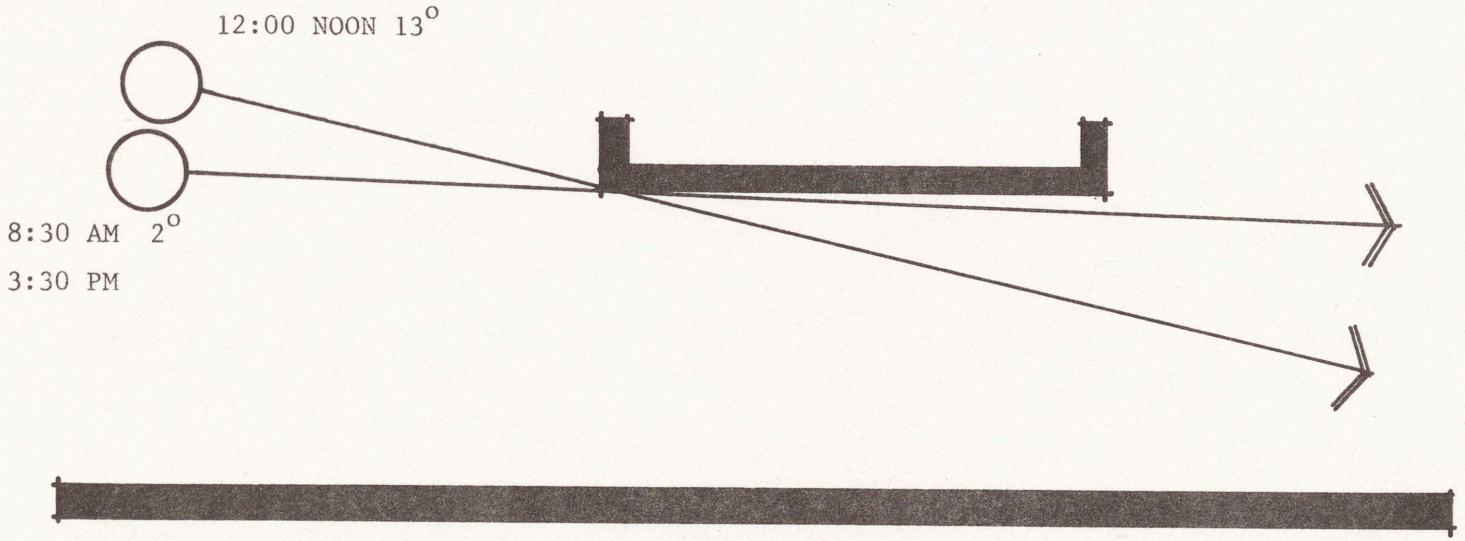
mean monthly total precip. cm.



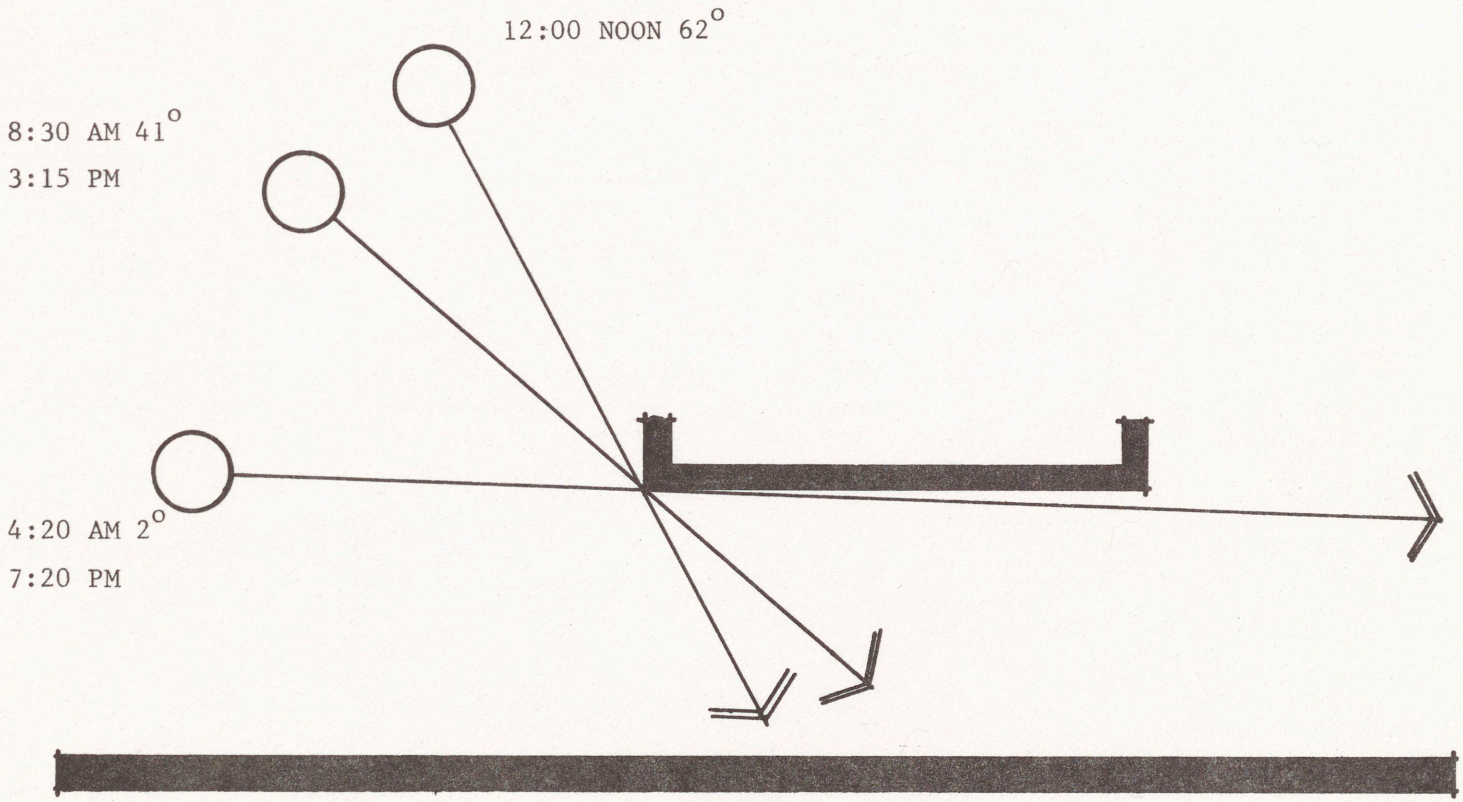
mean daily temp. min. & max. ^{o}F



Sunpath for 52° North Latitude



Sun Angles for December



Sun Angles for June

Programming

- Connection of station to adjacent land uses
- Connection to bus service (Optional, bus waiting area)
- Station sized to accommodate an initial 3 car consist with phase 2 expansion to handle 5 car consist

- Pre-control Area
  - 3 ticket vendors
  - change making machines (incorporated in ticket vendors)
  - decision area (where to go)
  - system explanation (procedures)
  - organizational explanation (maps) (routes and stops)

- Control Area
  - 3 ticket/transfer validators
  - 2 magnetic reader validators (for passengers with monthly passes) (must accommodate wheel chair access)

- Accommodation of two future processing channels

- Station processing area to be weather enclosed and heated

- Platforms to be enclosed with cover which spans platform, track and includes side screens

- Platform to contain shelters in addition to enclosure

- Control Area Attendant Space
  (provide assistance with machines out of order, deterrent to vandalism and theft)

- Escalators, stairs and elevator (wheel chair use)

- Adequate Signage and Explanatory Information

- Concessions (Optional) (vending machine only)

- Toilet Facilities (drinking fountain optional)

- Public Phones
- Garbage Receptacles
- Lighting
- Janitor Room
- Mechanical Space
- Electrical Space
- Emergency Power Source
- Public Address System
- Security Alarm System (intrusion alarm)
- Closed Circuit Television System (Optional)
  (connected communication network to other stations as well as police control rooms)
- Emergency Equipment (phone, fire extinguishers, first aid, fire alarm, standpipe and hoses)
- Ambulance Service Access
- Clock
- Bicycle Racks

guidelines

- 8 Sq. Ft (.744 m^2) of occupancy space per person for mass assembly crowds on platforms

- Provide a preferred space of 8 Ft. (2.44 m) between the edge of platform and obstructions such as stairs, escalators, or railings

- Distance from the end of platform to nearest point of exit should not exceed 200 Ft. (60.96 m) (this deals more with tunnels)

- Barrier must be provided throughout the system to deny unauthorized persons or vehicles access to operating areas

- Where the transit R.O.W. is crossed by a pedestrian walkway, the barrier should effectively prevent objects being dropped on the R.O.W. or on passing transit cars

- Noise in above-ground stations, platform level, trains entering and leaving 70-75 dBA

- Noise in underground stations, platform level, trains entering and leaving 80 dBA (130 dBA pain level)

- City Council has approved closure of 13th and 14th Avenues southeast, east of MacLeod Trail and 15th Avenues S.E., west of MacLeod Trail

- Vehicular Volumes anticipated to stay about the same for 17th Avenue south and increase for MacLeod Trail

- Electrical substations are provided separate to the stations for power supply for LRT vehicle

- Widening of MacLeod Trail by 4.572 m between River and 17th Avenue, to the west of MacLeod Trail to accommodate lane which LRT train will take up on MacLeod Trail

- 30-38 m. intervals of poles which carry overhead electrification wire

- 80 people/minute for single-bus unloading

Fare Processing Capacities 170 people/minute Entry and Exit
10 people/minute opposing

180 people/minute x 60 = 10,800 people/hour

Stairway Capacity 40 persons/minute/metre width
2400 persons/hour/metre width

Stairs should be designed in multiples of aisle widths of .55 m

Minimum stair should not be less than 2 aisles (1.10 m)

The maximum width between handrails should not exceed (2.2 m)

Train Headways are every 5 minutes during rush hours
15 - 20 minutes non-rush hour

Total Recommended Stair Widths (8 aisle requirements)
x .55 m

4.40 m

(Architect's Guidelines from above - $\frac{10,800}{2,400}$ = 4.5 m

Phase 1 Maximum design load/train/direction

164 people/car
x 3 cars

492 people/3 car train
x 2 directions

984 people/platform exiting onto platform

8 ft^2 (.744 m^2)/person on platform

984 people
x .744 m^2

731.1 m^2 Platform area

984 people/3 car train/5 minute rush hour interval
x 12 intervals

11,808 people/hour/3 car train

Capacity of 48 inch Escalator run at 90 feet/minute = 8,000 people/hour

11,808 people/hour = 1.47 total metre width (Escalator)
8,000 people/hour

Stairway Capacity, 2,400 people/hour/metre width

1.0 m stair = 2,400 people/hour
+ 1.0 m escalator = 8,000 people/hour

2.0 m (exit or entry width) = 10,400 people/hour
maximum people/hour = 11,808

Phase 2 Maximum design load/train/direction

164 people/car
x 5 cars

820 people
x 2 directions

1,640 people/5 minute (rush hour) interval
x 12

19,680 people/hour

2.0 - 2.0 m escalator width x 8,000 people/hour/metre width = 16,000 people/hour
2.2 - 2.2 m stairway width x 2,400 people/hour/metre width = 5,280 people/hour

Total exit or entrance capacity at given sized widths = 21,280 people/hour

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i.

j. Snow Crystals
The Sense of Order, E.H. Gombrich, plate 23.

k. University Entrance, Alvar Aalto
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l. Brick wall relief, Holland, Henry Moore
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m. I.I.T. Chapel, Ludwig mies van der Rohe
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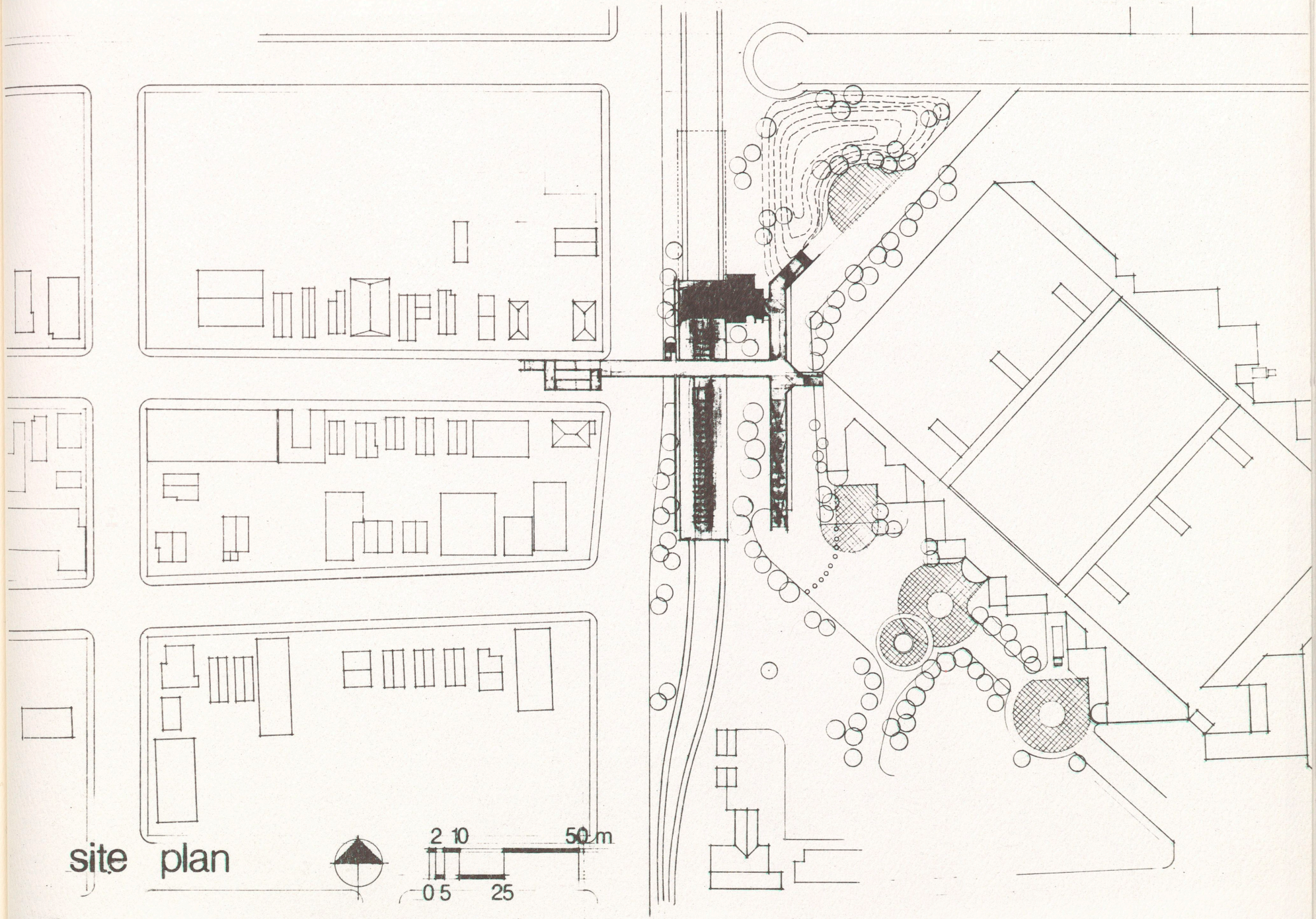
Design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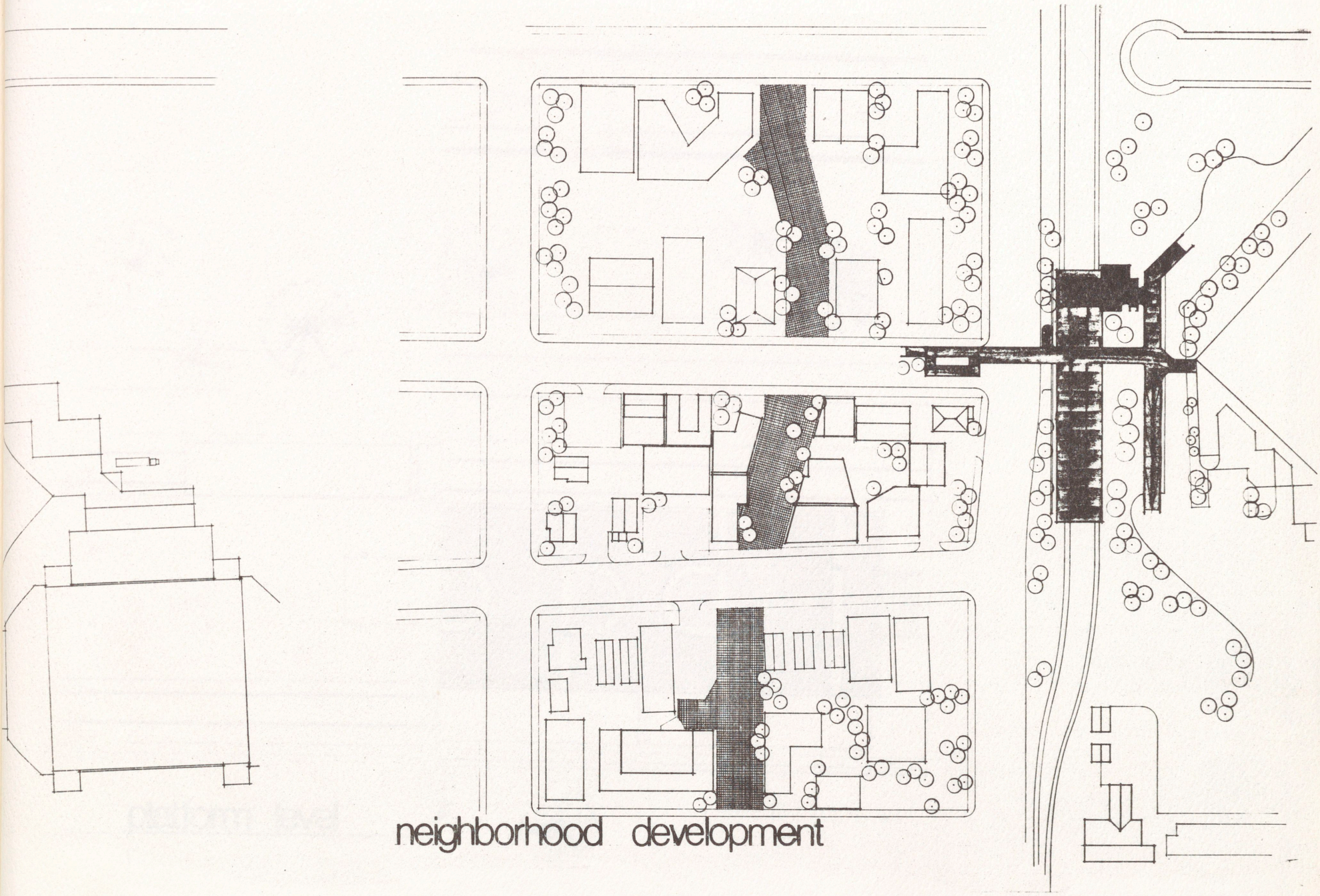
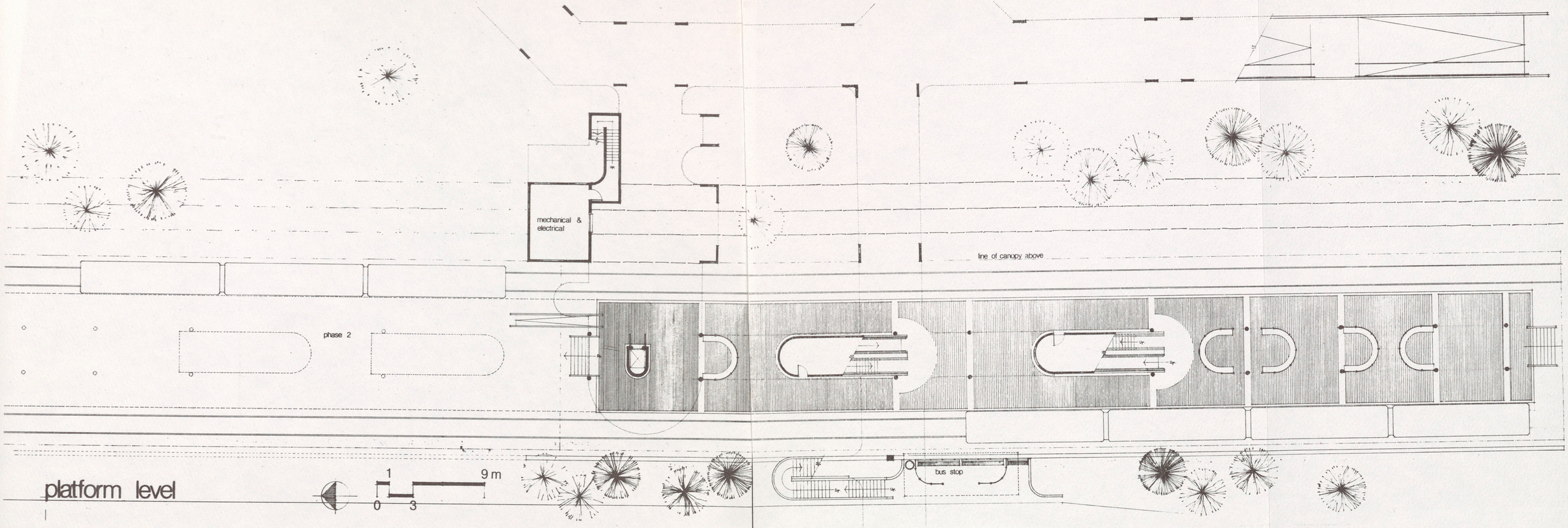


neighborhood development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bus stop
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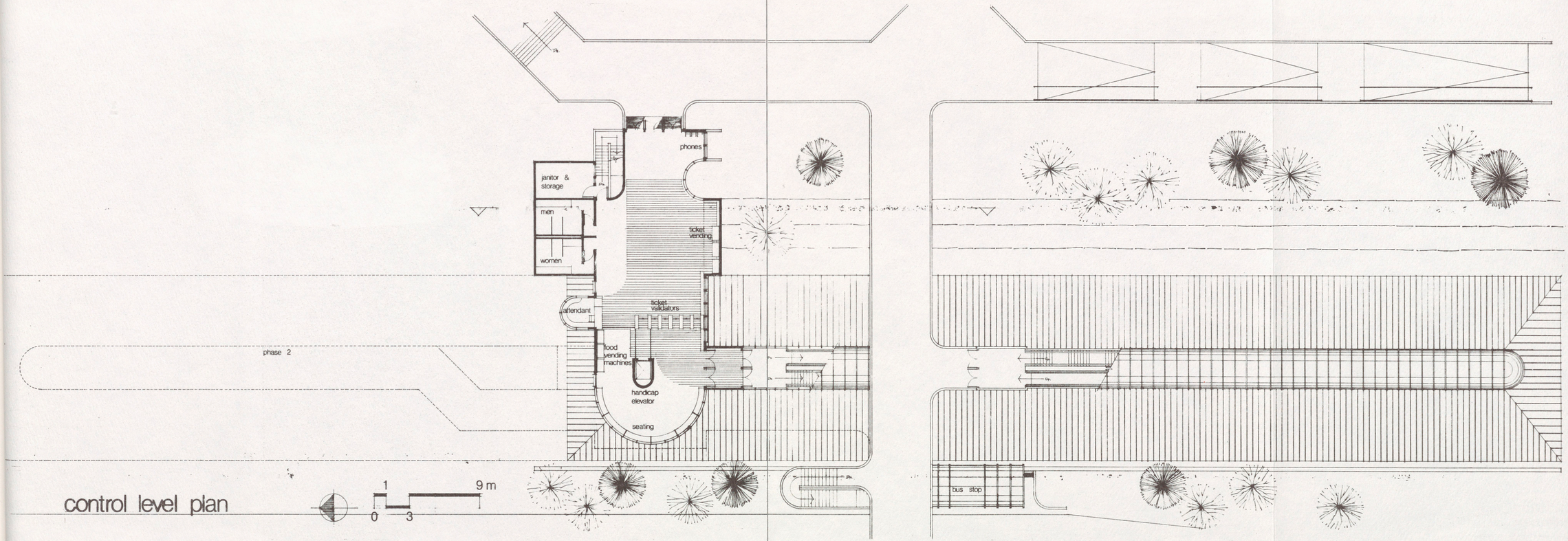

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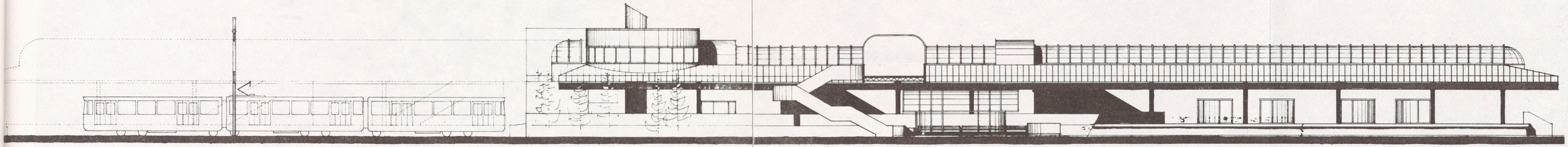

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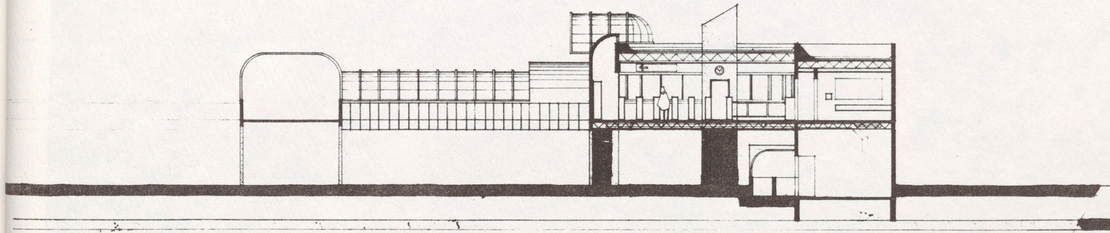

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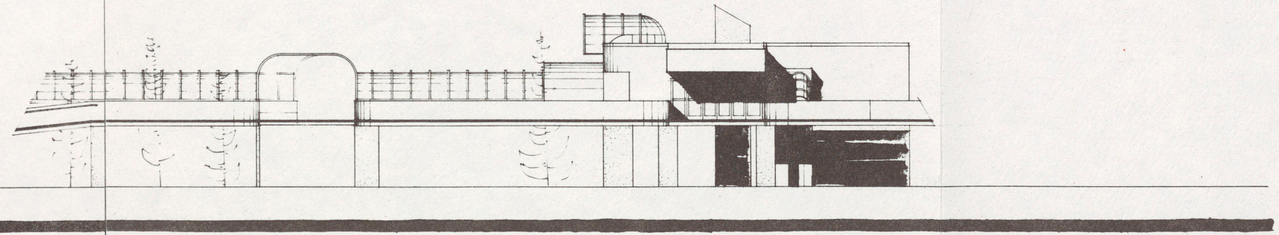

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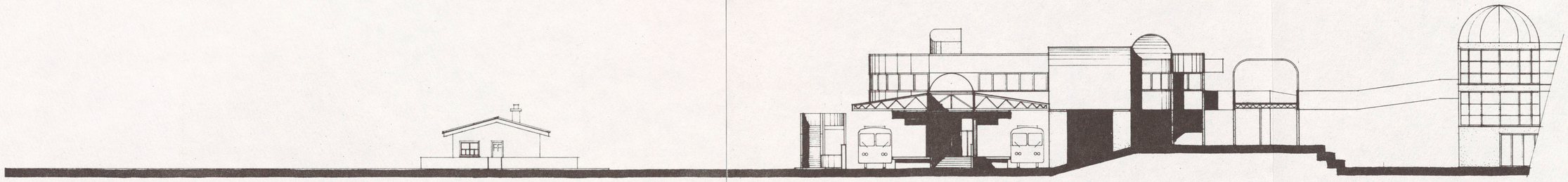

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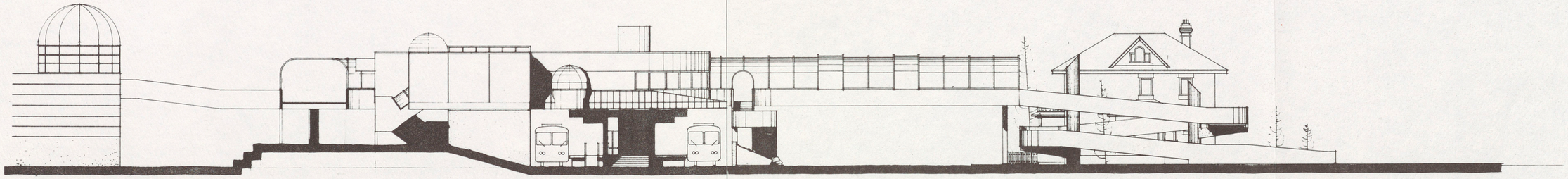

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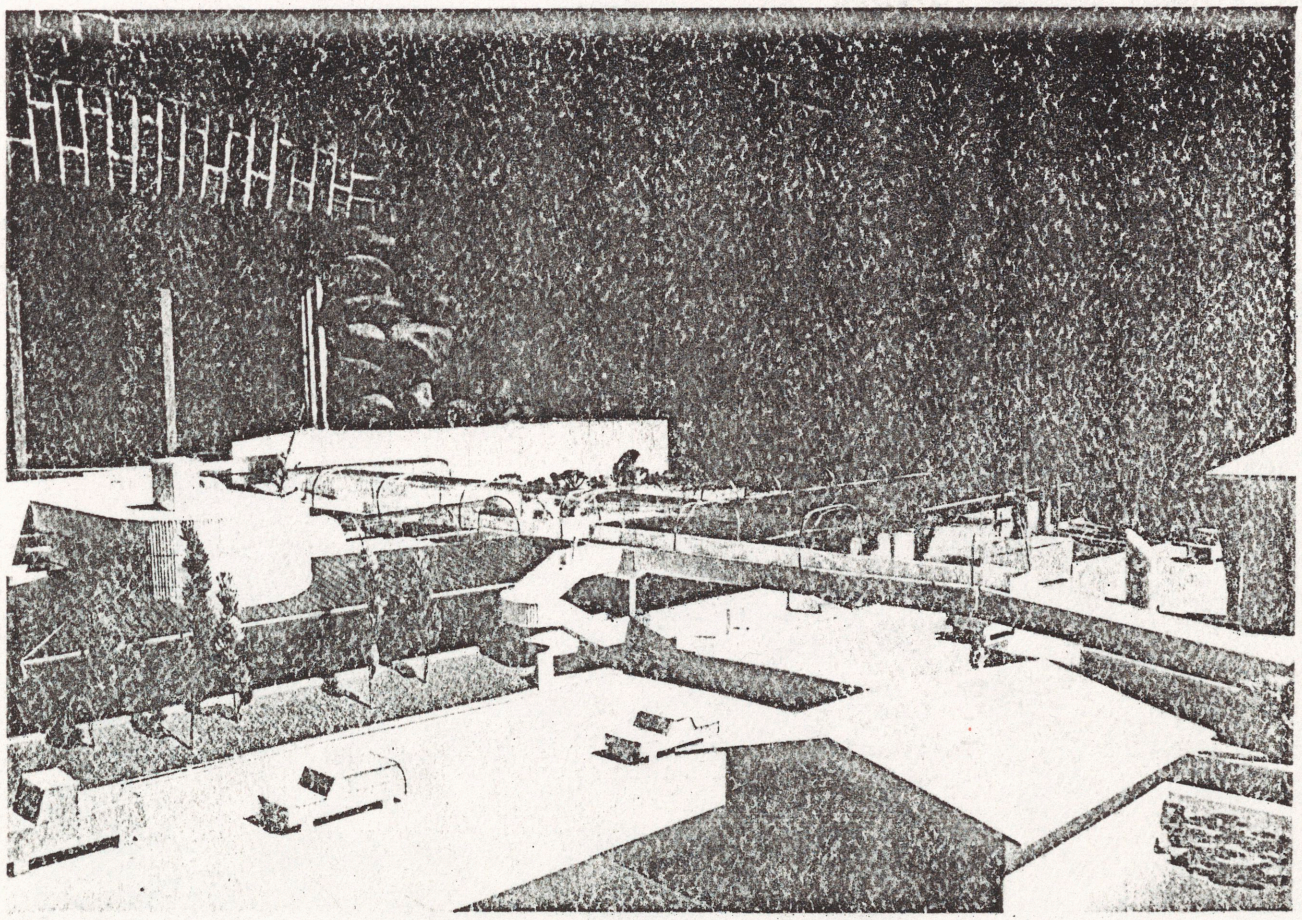

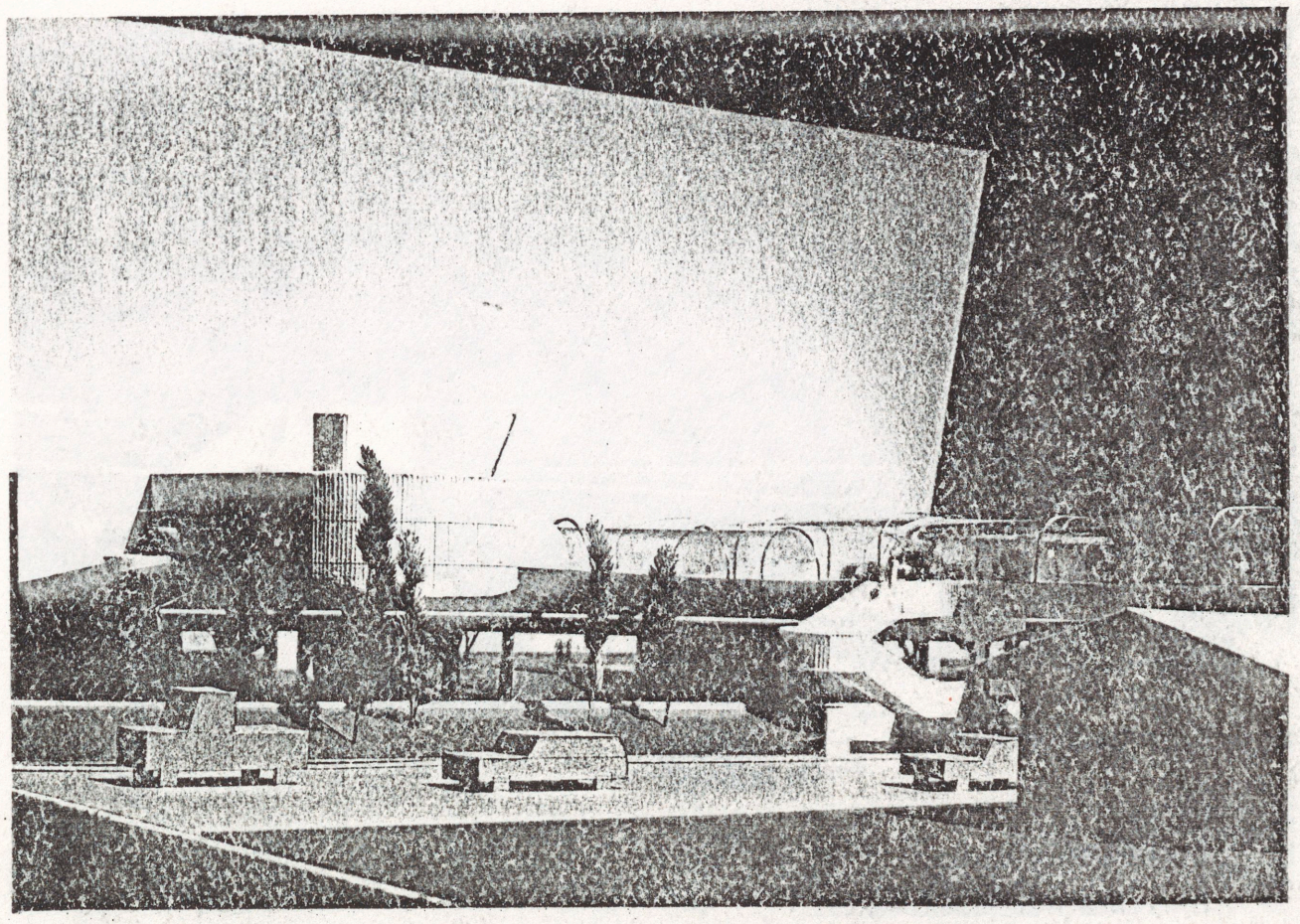

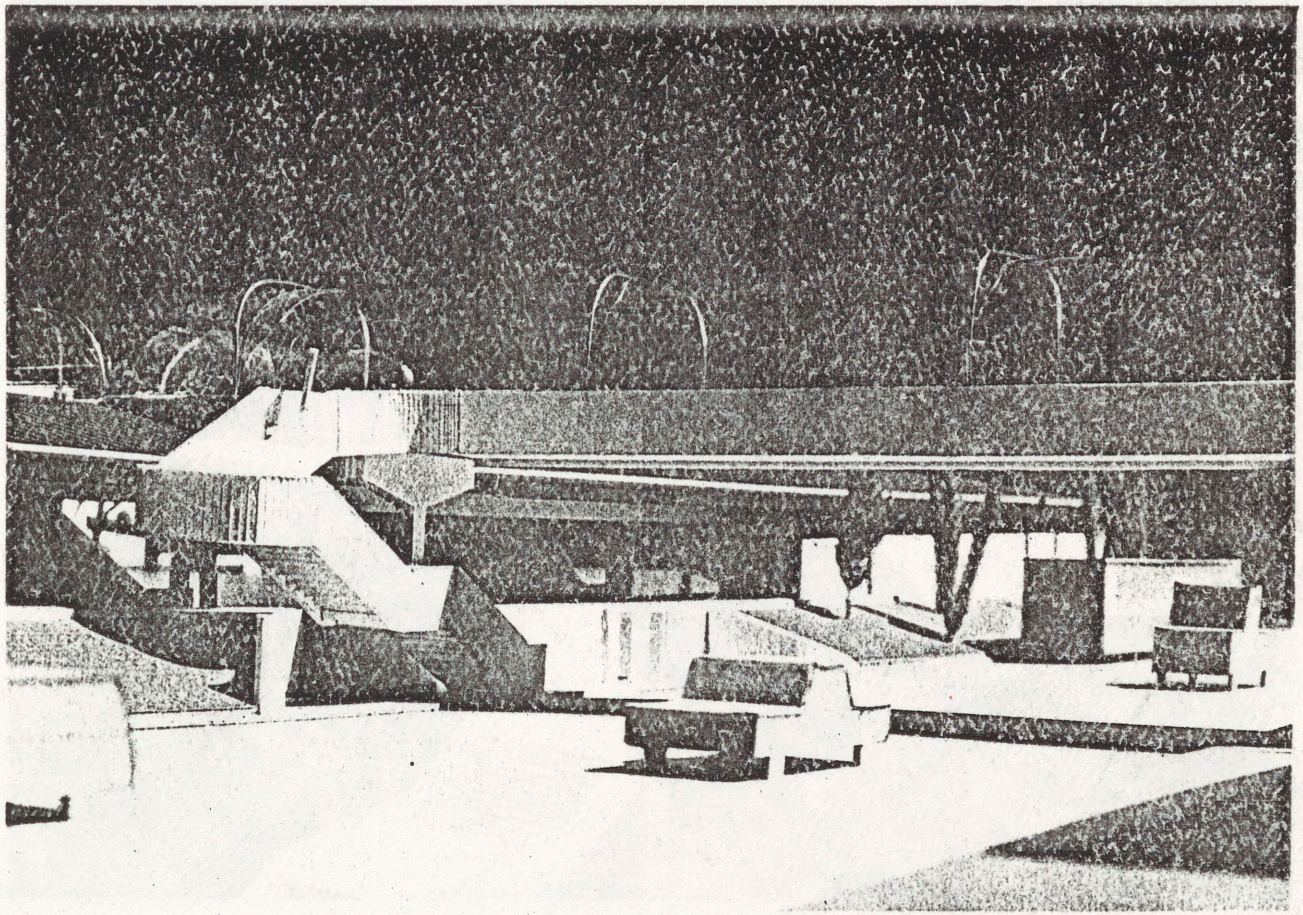

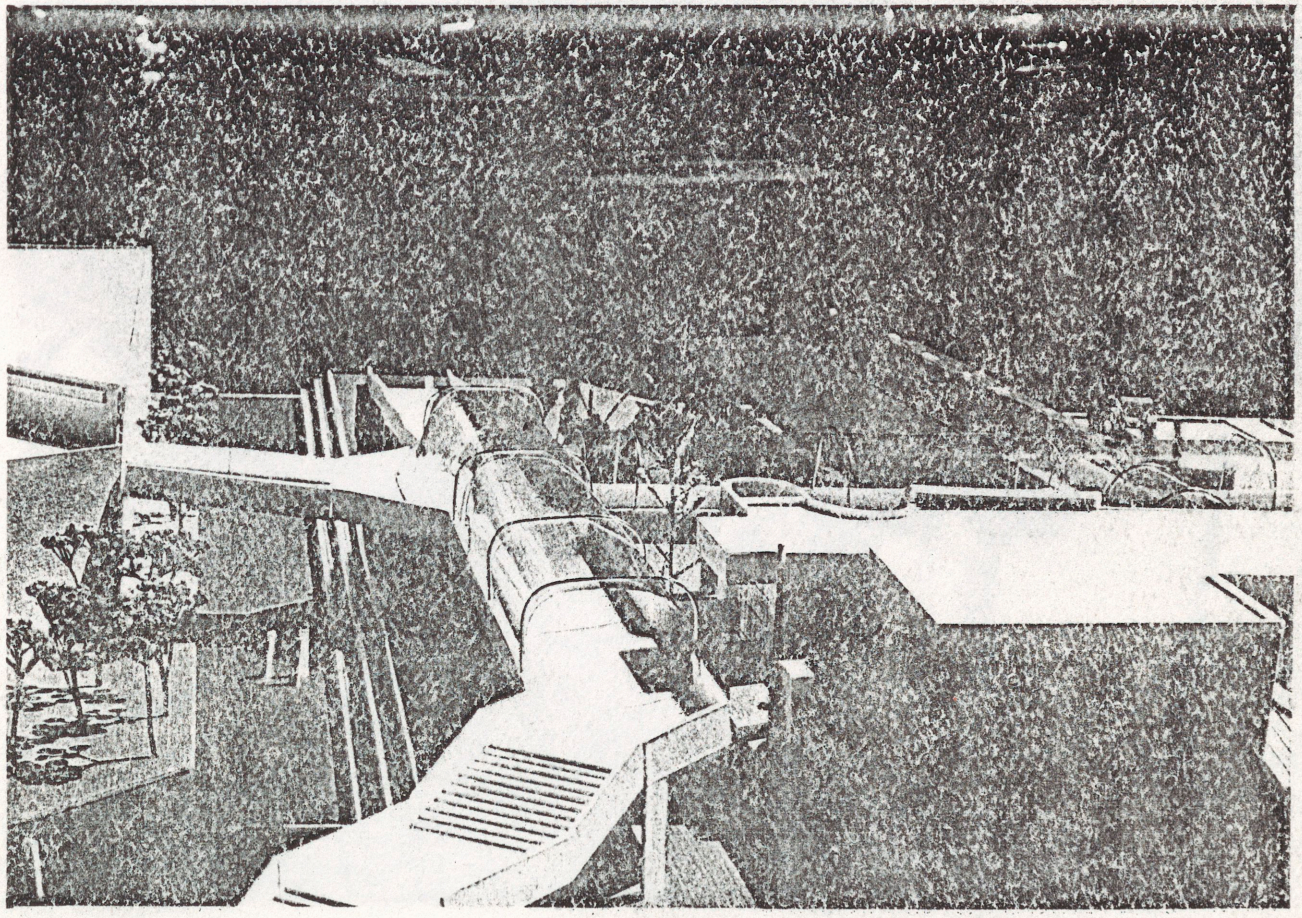

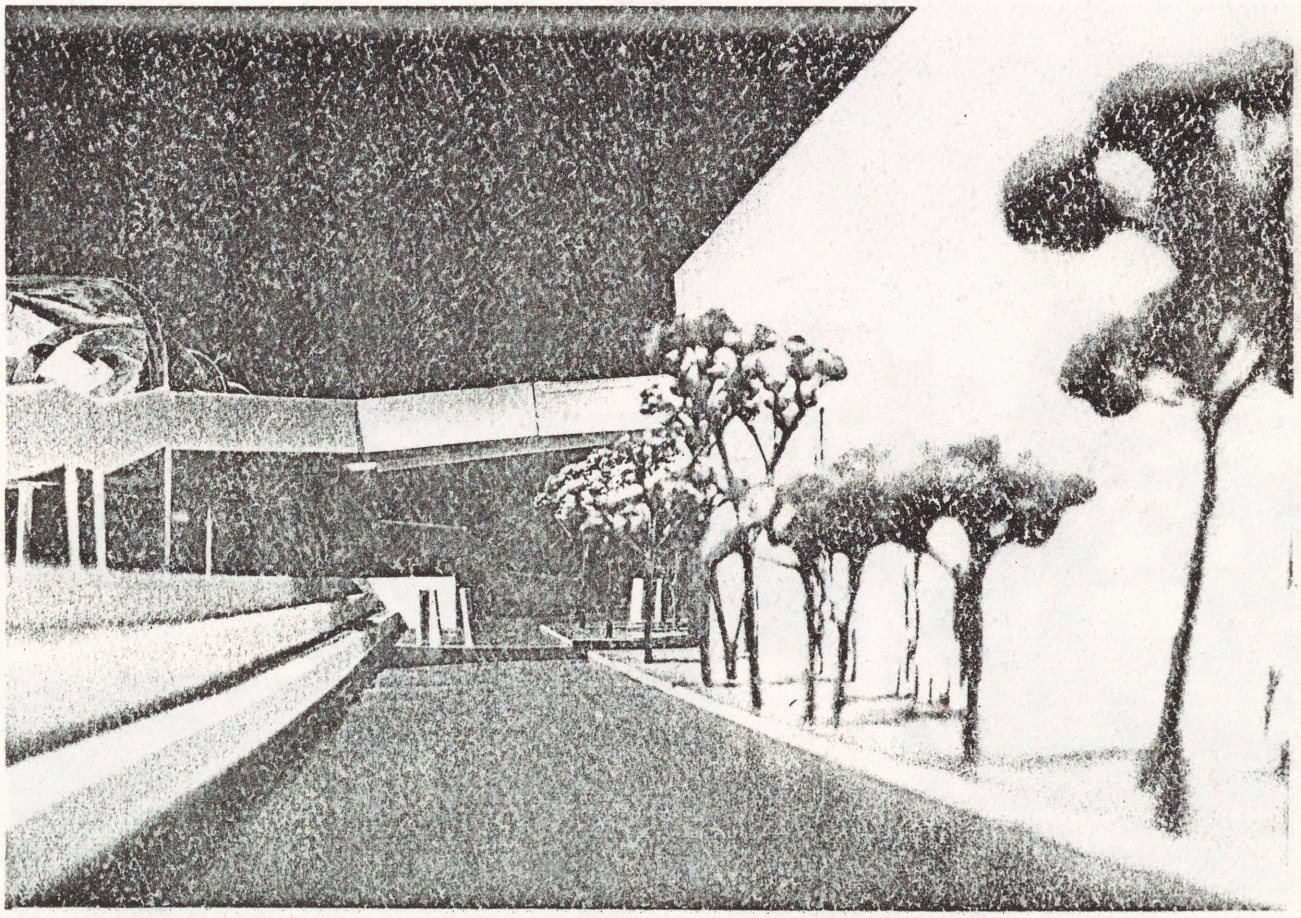

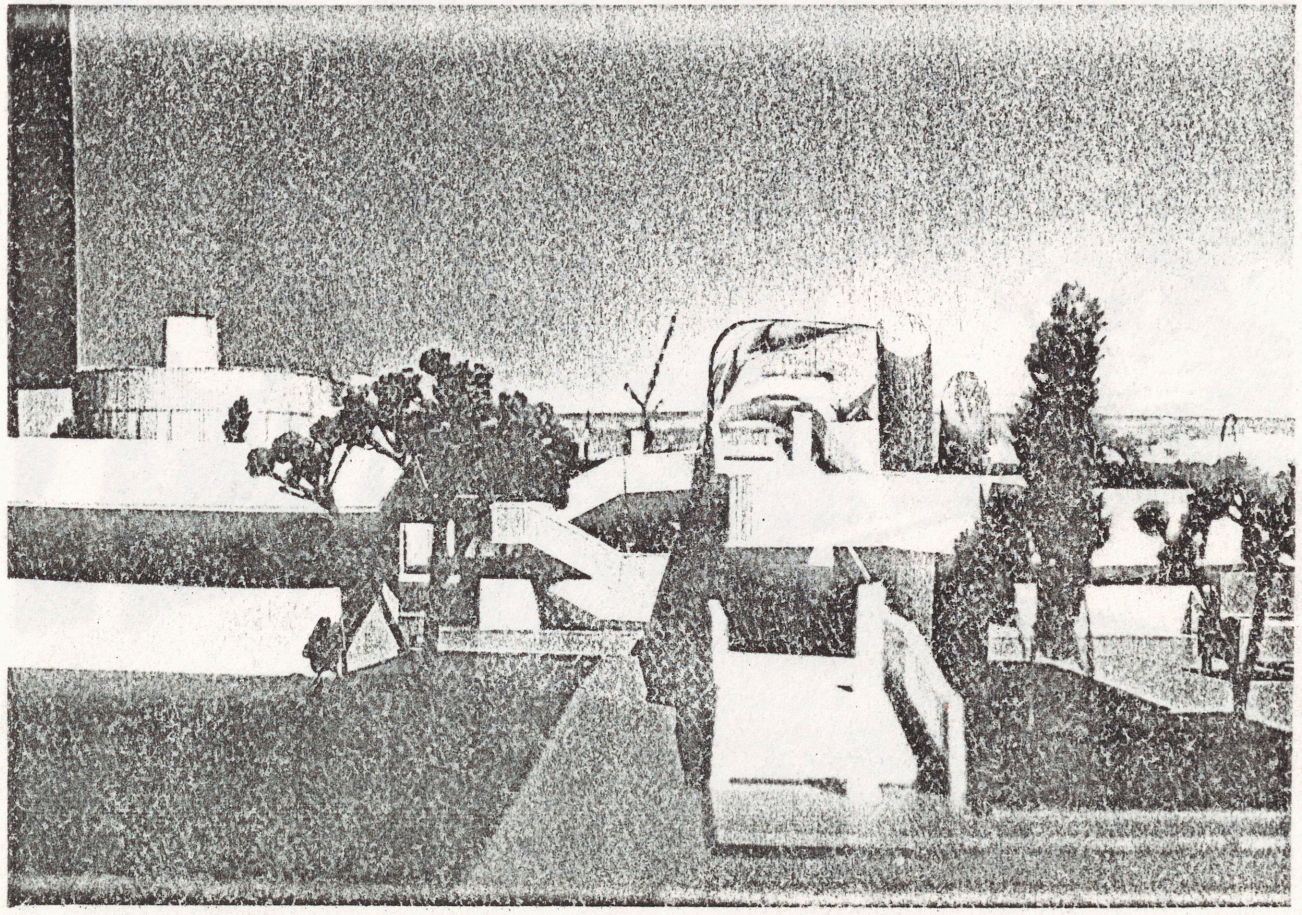

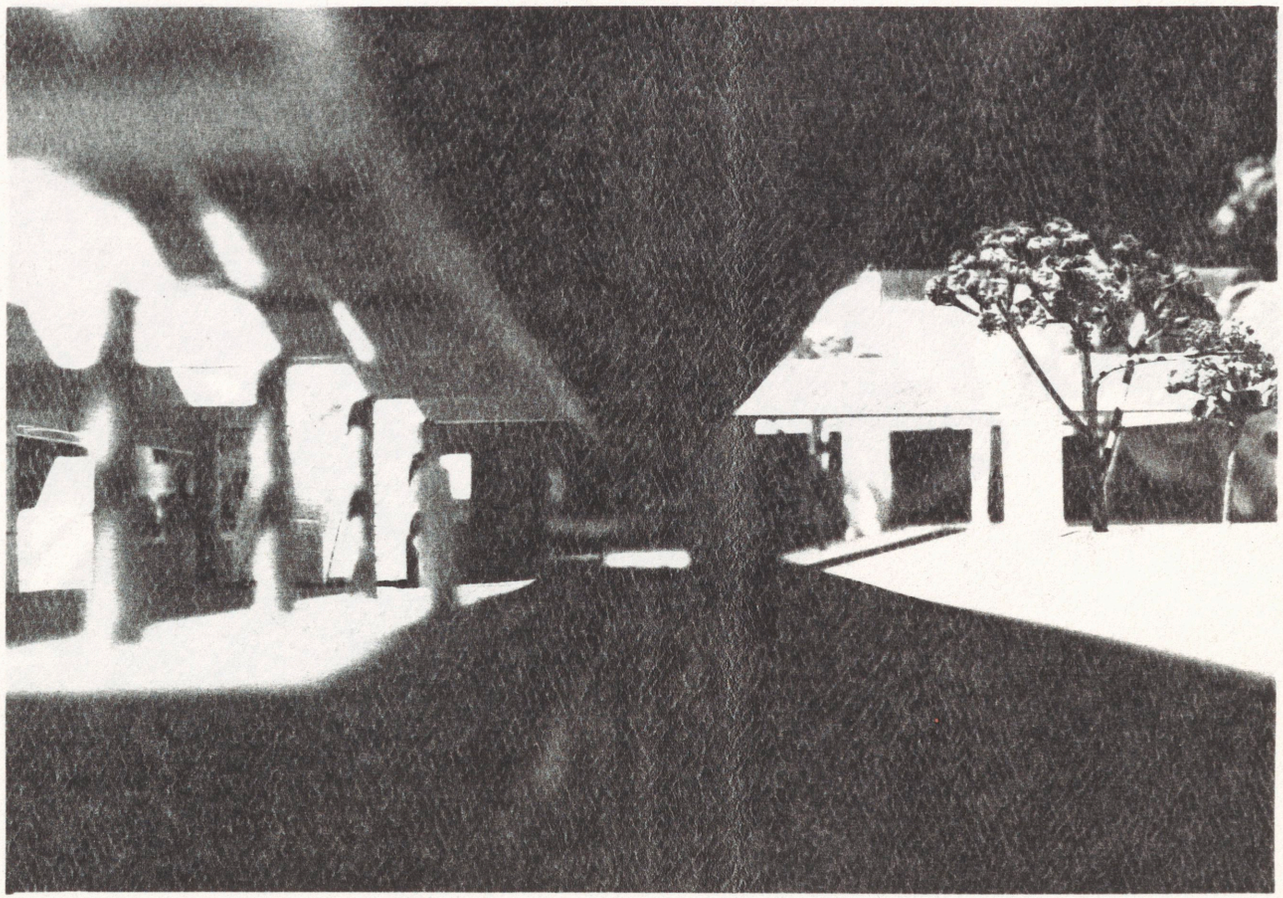

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