FOOTPRINTS IN THE CITY

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ABSTRACT

Footprints in the City
by Kenneth A. Stecklein

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This thesis analyzes the process of making physical connections of form, size and use in the context of Salem, Massachusetts. Through this analysis an intuitive design methodology becomes graphically explicit. As the process is clearly understood, it becomes useful as a mechanism for generating design in other contexts.

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To my wife, Hilary...for being near me when my light was low;

To my parents...for their support and encouragement in every endeavor;

To my thesis advisor, Tremie...for making me question it all;

To Michael Underhill...for introducing me to design;

To my fellow students...for their special friendship and countless hours of helpful criticism.
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When an architecture is genuinely appropriate to its environment it gives a pleasing sensation of harmony and is profoundly moving.¹

The architectural urban environment presents a particularly complex problem. The proximity of buildings in a city forces them to be viewed as series of relationships rather than singular examples of architecture. As such, each building is part of an assemblage. Groups of buildings are assemblages distinguished by their common or different characteristics. The city is an associated group of assemblages strengthened by the particular qualities of each assemblage. Sections of a city stand out as regions identifying associative territories within the city.

City form is a spacial field defined by regional differences. A continuous field is one where regions interweave and strengthen each other. The city becomes a map or fabric of differences and continuities understood by its inhabitants.² The fabric serves both as an organizer of form and a definer of associative territories.

Ancient European cities are prime examples of this
concept. Built over a long period of time and within strict geographic boundaries, they had to deal with every possible physical relationship. Issues of balance, continuity and integration were involved at all levels. Any new construction recognized and respected these issues and so became an integral part of the existing fabric. This contrasts with the prevailing piecemeal attitudes of American architecture.

Drawing form connections between ancient European and modern America is difficult. The architectural richness of Europe makes it useful, but its buildings are distant from the cultural and sociological context of the modern world. More directly useful to this thesis are recent projects which deal with the issues of organization and design of today.

Some modern projects attempt to make physical connections of form in an urban context. Although minimal and scarce, they serve as case studies for this thesis. They identify physical contextual relationships useful in making design decisions. Documented in Appendix A, they are referred to throughout this thesis.

These relationships are then applied to a speculative situation. An urban development site in Salem, Massachusetts, clarifies the implications of physical organization relationships in a design process. Partial design of the project clarifies the understanding of the methodology acquired through observation of the case studies. Through this process, an intuitive design methodology becomes graphically specific. This thesis is essentially a step-by-step documentation of this process.
It is clear that an urban planner can recognize the general relationships of city regions and organize them, and an architect can integrate a single building into a given environment. However, few urban designers can make form decisions which connect these two levels of design. For urban design to be meaningful and useful, it must include qualities of both. Only when the one process informs the other do the resulting buildings actually share physical qualities of both.

Modern architecture categorized this process as 'urban design'. It is not purely design in its initial stages. It is instead an organizational decision-making process which deal on a virtual level with design and on a real level with issues of organization. When organization connects with physical issues, design begins.

One implication of this process is that it begins to eliminate vague diagrams from the design. The process becomes more real and more direct. It deals with the physical design world of architecture and makes connections of form to the organizing issues of planning.
Understanding these concepts comes with an understanding of the specific urban relationships of a problem. Metaphorically, it means recognizing a city pattern instead or arbitrarily applying a grid and observing that it works. This point is crucial to understanding a process, although it may be a minor part of the actual execution.

These organizational issues involve not just immediate site issues, but include more inclusive relationships of the urban structure. The overall structure of the urban fabric must be recognized and understood before specific design decisions can be made. Otherwise the relationship of building to context is imaginary.

Recognizing specific qualities of an urban fabric is really a question of understanding design processes at several different scales. The scales are difficult to understand because they involve more inclusive sets of relationships than "normal" design. Aldo Van Eyck understood these relationships. He applied them directly in the design of his children's home in Amsterdam. He wrote,

A small world in a large world.
A large world in a small world.
A house like a city.
A city like a house. 3

The children's home uses as its organizer an urban street. Circulation within the home is articulated like the street of a city. Rooms within the home become homes within the city. This is an ideal example of understanding and using a specific set of relationships at more than one scale. Equally, this principle applies to all levels of design. It is part of an inclusive design process. Identifying positive relationships within a house can be associated with identifying positive relationships between
parts of an urban fabric. These positive relationships link actual buildings and reinforce the continuity of the fabric.

If an inhabitant perceives this continuity at more than one scale, then it is truly meaningful. When it works at an urban scale it projects a clear picture of city organization. When it works at local scale it identifies particular associated buildings within the larger organization. Consistent use of the process makes these two scales relate to each other as well. Identifying and strengthening this relationship strengthens the overall continuity of a city.

A strong (read continuous) city fabric can exist at almost any level of completion. Adding to a partial assemblage is possible since the process is inclusive in nature. This is inherent in the definition of an assemblage. Therefore it is all the more important that the organizational process include specific decisions as a means of determining qualities of the actual assemblage.

The problem of maintaining continuity between inclusive large scale decisions and human scale design is eased if the designer begins to suggest final physical qualities early in the design process. The object is to increase the information that the field organization can tell you about actual design. The proposition is that such information is useful in reinforcing the collective relationships of the final design.

The hypothesis is to work with design decision-making tools which deal with the organizational issues and, taking the user into account, establish some relative size decisions early in the working process.
These tools establish link, order and continuity in specific urban situations. They provide the link between organization and design, between large/inclusive and small/specific decisions. The process becomes more integrated.

Even though these tools clearly relate to the urban context, the unresolved issue is their derivation: exactly what elements of the urban landscape promote continuity.

There are modern examples of urban spatial form. The case studies of Appendix A recognize the range of sizes and patterns of use that define their respective environments. These are tools for design. The resulting buildings integrate spatially into the townscape, becoming reasonable links between sections of cities.

Different programs, different sites and different design attitudes distinguish these case studies. Yet, in all cases there are generic processes at work which yield mutually supportive designs. The final designs are identifiably different, but the processes share common qualities. The final designs reflect actual physical qualities of this process.

Understanding these qualities, and their implications in a design process, leads to a better understanding of any design methodology. Specific relationships between these processes and a given methodology define the method in more general terms. Once the method is understood it can be applied directly as a design tool, as it is used in the design phase of this thesis.
SITE INTRODUCTION

The site of a mixed-use development in Salem, Massachusetts serves as the basis for this thesis. Salem is a town of 40,000 people located north of Boston. The town suffered economically when the 128 beltway was completed around Boston. Much of the commercial traffic of Salem was diverted out of the city to nearby Peabody, to strip shopping centers bordering Route 128.

In the past few years Salem has enjoyed urban rebirth. Its rich heritage, a large influx of federal money and strong local interest in drawing people back into the town makes Salem a growing part of New England. It presents the relevant problem of how to build in a physically rich urban environment without imitating the heritage itself.

Understanding the specific of this project requires at least a minimal understanding of the general urban character of Salem. Since a complete urban planning study is not the purpose of this thesis, nor possible within its limited scope, only a basic review of the city planning program is possible.

The site for this project is part of an area demolished
in the late 1960's. It sits at the edge of the central business district offering readily buildable land and easy access to shopping and transportation. In addition, the probable construction of a new commuter rail terminal adjacent to the site makes it desirable for development. Architects and developers have spoken of this site as part of a town within a town, with all conveniences within walking distance.  

In 1974, builders recognized Salem's unexploited potential as an outlet housing market for metropolitan Boston. Since that time Salem has experienced an unprecedented surge of housing starts, with multi-family housing the main commodity. Salem's rich heritage, combined with relatively easy access to Route 128 and rail commuter lines to Boston, makes it a pleasant place to live.

The Salem Redevelopment Authority has already established a program outline for this site. They project mult-family housing organized around a "greenway" connecting Church Street to the church on the north edge of the site. Beyond this definition the program is vague.

The program for this thesis comes loosely from the SRA proposal. It comes more directly from an explicit architectural understanding of the specific needs and opportunities of the site. It consists basically of the housing proposed by the SRA, with a substantial amount of owner-occupied commercial space injected as a way of connecting the site to the downtown environment. Other public facilities are also added as a way to make the site identifiable as a specific neighborhood within the city.
The actual space allocations break down this way:

<table>
<thead>
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<th>Description</th>
<th>Units</th>
<th>Sq. Ft.</th>
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</thead>
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<tr>
<td>HOUSING:</td>
<td>ELDERLY (studios-1BR)</td>
<td>30 units</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>LARGE FAMILY (3-4BR)</td>
<td>20 units</td>
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<td></td>
<td>RENTAL UNITS (1-2BR)</td>
<td>40 units</td>
<td>1000</td>
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<td>COMMERCIAL:</td>
<td>SHOPS</td>
<td></td>
<td>9000</td>
</tr>
<tr>
<td></td>
<td>THEATER</td>
<td></td>
<td>3000</td>
</tr>
<tr>
<td>SERVICE:</td>
<td>COMMUNITY CENTER</td>
<td></td>
<td>3000</td>
</tr>
<tr>
<td>TRAIN TERMINAL:</td>
<td></td>
<td></td>
<td>12000</td>
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<tr>
<td>PARKING:</td>
<td>RESIDENTIAL</td>
<td>90 spaces</td>
<td>18000</td>
</tr>
<tr>
<td></td>
<td>GUEST</td>
<td>30 spaces</td>
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</tr>
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Issues of subsidy, development and specific economic mixes are not dealt with in the program.
SITE ANALYSIS

Site analysis begins with understanding Salem's basic networks of distribution and the related regional boundaries. Each network is a specific pattern of distribution. Networks establish the basic organization of a city, often defining associative regions within a city. Regions sometimes cross ethnic or cultural borders and represent physical/use territories within a city. For example, a residential territory may include an Irish neighborhood and a German neighborhood but would exclude an adjoining commercial district.

Jose Luis Sert's design for Holyoke Center in Cambridge, Massachusetts, uses the established pedestrian networks of the area to organize the circulation of the center. The connection between Harvard Yard and Harvard dormitories is defined by the physical organization of the center. Design of the center happens within this organizing framework, both supporting and being supported by it. The commercial fabric of the block makes a continuity through the framework. (see Appendix A).

The boundaries of downtown Salem are defined by three major barriers: to the west, Route 114; to the north, the North River; to the east and south, Route 1A, as shown in figure 1.
These roads are major thruways which divert most vehicular traffic away from the center of town. Washington Street is the main street of town and operates as a connecting route for these thruways. Traffic on Washington Street is lighter than it normally would be because of this traffic pattern.

The other major street on the edge of the central business district is Bridge Street which carries traffic from Peabody in the Northwest to Beverly in the northeast. This street is also a "boundary" for the site. This is perhaps the most difficult discontinuity in the Salem area. The juxtaposition of the North River and Bridge Street make direct association with the river difficult. It is therefore reasonable and necessary to use the rail terminal to establish a continuity across Bridge Street and link Salem (site/downtown) back to the river. The exact method will be defined later in this thesis.
The downtown area has a clear pattern of vehicular networks within the boundaries of 114 and 1A. Washington Street is the one major north-south street which carries traffic through the area. Perpendicular to Washington Street are minor distribution roads which carry local traffic: Front Street, Federal Street, Church Street, and others.

This vehicular network changes where it involves residential sections of Salem. This is at some distance from the boundaries of the site, and represents a more idealized condition. It does suggest some network differences for the area around the New England Telephone building. As the site extends to include this region, the renovation of the NET building is suggested to fit better with the networks of the region.

The vehicular network is the first organizational tool for the site. Extension of this network into the site establishes the basic organization of streets. At the intersection of Washington and Bridge Streets, the network responds differently by defining it as a larger unit, not a part of the basic network.

Ash Street remains as part of the residential organization. It is far enough from the corner of Washington and Bridge Streets to exist. North Court does not reinforce this organization. It is eliminated, replaced by a more useful alley leading north from Federal Street. The resulting composite vehicular network is the first direct clue that the site lies at the border of several territories which make up the subsections of Salem.

The second network identifiable in the area deals with
pedestrian movement. Most pedestrian traffic moves along sidewalks bordering these street. The intensity of movement corresponds directly to the vehicular network intensity. This pattern makes up most of the movement system of Salem.

Paralleling Washington Street and connecting the perpendicular streets are local pedestrian intra-block paths. These paths connect between streets on a relatively straight line, but they never cross streets directly. At the actual street edge they shift in response to local physical constraints, creating nodes or places in the path. These paths are known and used by the local residents only. Residents understand and use these paths as specific connecting routes, although the Salem authorities describe them as general organizing features of the Salem area. They eventually lead from the North River to the Derby waterfront, but are only idealistically perceived as this complete path.

Pedestrian movement through the site seeks to strengthen the urban fabric in the same way that Sert strengthened the pedestrian organization of Harvard Square. Strengthening occurs by two methods. On method is to intervene in the particular character of the given networks and create order out of difference. The second is obviously to reinforce the existing networks in a direct physical way.

It is unnecessary here to intervene further into the pedestrian character of Salem. A major intervention was produced when Essex Street was converted into a main street pedestrian mall. Reinforcing the existing spacial order will strengthen this desirable network organization. Further intervention would only weaken the identified paths
and confuse the basic network relationships. If there had been no singularly identifiable pedestrian pattern, then intervention would have been appropriate to distinguish physically between the different movement systems. These particular movement systems are still free to move vertically and probably will, although determination of this comes later in the process, at a more specific design level.

Extension of these two main pedestrian networks into and through the site strengthens its link to the city. The street edge movement then takes on two different "images". One is that of an urban street edge with all its particular building/sidewalk relationships. The other is a residential sidewalk image, where street-sidewalk-house have a more discontinuous, dimensionally loose relationship.

The second pedestrian network, the intra-block paths,
extend into the site at a more subtle level. It remains a locally identifiable path, not a thundering "greenway" tearing the city fabric, as projected by the city planners.

This pathway is a partial intervention into the existing network. As such it exists without disturbing the network. To impart too great an emphasis on this system divides the project both physically and figuratively. This path will extend through the site, but only as a residentially understood route. All of these networks operate as partially complete paths. Their completion exists at a direct associative level.

Locating the rail terminal on the north side of Bridge Street links Salem physically with the river, as previously stated. It is a public place defining the terminus of Salem and the ongoing continuity of the rail line. Appropriately located adjacent to the river, it becomes a 'link' on another level if the North River is dredged and a marina built on this edge, a potential scenario supplied by the Salem Planning Board. The rail terminal marks an end to Salem as one approaches up Washington Street. It defines a physical limit where none presently exists. This is a case where the argument for redefining the street edge is secondary to the stated issues for placing the terminal at this juncture.

These networks, and their associated levels of physical definition are the first stage in this design process. They establish a large scale organization which informs the succeeding stages. At this stage, the process yields enough information at an inclusive urban scale to be useful. The operating characteristics work within large enough boundaries to make sense at this scale. The relative information changes
appropriate to the scale change.

Extension of these networks into the site exists as a composite of literal extension and design intervention. Where the patterns are clear, as in this case, architectural judgement can distinguish between positive and negative network relationships. The positive is reinforced, the negative is replaced. The product is a design which makes reasonable urban scale decisions and suggests succeeding questions, as shown in figure 2. This clarifies the process to a degree that it can be understood not just as yielding a single product, but as a methodology.

Identification of these networks, as they influence the site, leads to a different organizational issue. Just as Fumihiko Maki establishes certain use relationships in his Hillside Terrace Apartments, it is helpful to develop an attitude toward these functional relationships in this project. Maki's recognition of the commercial nature of this character are parts of a positive design process. They inform direct design and suggest applicable qualitative values, without directly constraining the product.

In the strong character of Salem, it is appropriate to try and integrate actual use of the site into the surrounding fabric. Extension of the use fabric suggests a basic disposition of elements of the program, as shown in figure 3. Commercial activity is extended along Church Street, reinforcing the nature of that street and making a direct link between old and new. Washington Street, where it borders the site, also becomes an extension of this commercial fabric.
2. NETWORK DIAGRAM

VEHICULAR

Major

Minor

PEDESTRIAN

Major

Minor

Intra-block

NORTH RIVER

SALEM COMMON

NORTH
Ash Street and Federal Street are characterized as "residential" streets. It is desirable to have the residentially associated values of street and house, house and yard, yard and neighborhood. All of these relationships have associated values identified as residential in nature. If these values remain, identification of "residence" is clear even if the specific identification of "house" is not.

It should be noted here that the distinction between "house" as exists in Salem at present, and "residence" as referred to in this design is crucial to understanding this thesis. This process does not seek to imitate architectural forms and functions. Rather, it tries to make design which exists in harmony with context. To accomplish this, these issues of direct relationships must be dealt with, for the product to be appropriate to Salem. The design itself introduces contemporary values, structural constraints and social relationships germane to the actual site, not generic to historic Salem.
3. USE DIAGRAM

COMMERCIAL

RESIDENTIAL

PUBLIC/INDUSTRIAL

NORTH RIVER

SALEM COMMON
Massing establishes the basic volumetric relationships of the site. These are useful towards understanding urban contextual qualities. One example is Maki's Consolidated Office Building in Japan. There, the building's mass presses up against the street facade until it creates a balance between corresponding street edges. This balance is a physical recognition of relationships which reinforce the connection of project to context. (see Appendix A). Identifying these massing relationships adds information to the design process.

Washington Street is a vehicular route through Salem. As such it carries larger amounts of traffic at moderate speeds and with considerable noise. This edge of the site, and the adjacent rail terminal should be built strong enough in mass to act as a noise barrier and continuous enough in form to have recognizable characteristics from passing cars. Building up this edge in density and height eases program constraints on the remainder of the site. This mass serves as an exclamation point, marking the end of Salem and of the site. It reinforces the identification of this area as a terminus and of the site as a distinct region within the larger city context.
The city of Salem is made up of such identifiable regions. The integration of these regions, and their articulated features, form the city fabric. This site is large enough, and located in an appropriate position to be a region, identifiable in itself. People passing through Salem would see this site as a place, a place with connections to the city, yet with its own vitality and life.

Other critical massing regions in the site are along Church Street and opposite the New England Telephone building. Massing along Church Street is designed to establish a balance between the two sides of the street. This balance is difficult to achieve adjacent to the parking garage and the historic church because of their non-associative qualities. In these cases massing moves back from the urban edge. One might visualize the buildings as emitters of energy. More massive buildings emit more energy. Opposing buildings of equal mass would emit equal energy and establish a "neutral field" over the street. When one building has unusually high energy, other buildings create conflict unless they are set back where they allow the excess energy to diffuse.

The same massing principle applies to the New England Telephone Building. Its monolithic nature sets it apart from its environment. Therefore this area is designed with this building renovated as part of the project. Modification of the physical form of this building allows it to be part of the developing organization rather than existing as an anomaly in the middle of the region. This modification avoids altering the major mechanical equipment in the basement of the building.

In contrast, the jail located on the northeast corner
of the site is just as large in size but not nearly as massive in form. It exists as part of the continuity; massing can be balanced between the site and the jail. The resulting form diagram establishes volumetric constraints both specifically and generally. The axonometric of figure 4 shows this massing.

4. SITE MASSING
INCLUSIVE PHYSICAL CONSTRAINTS:

Salem building ordinances allow a maximum of four stories in any new construction. In an urban scale project this restricts design decisions unreasonably. The proposal in this thesis is to respect the four story limit as a flexible envelope. Buildings can exceed this limit in specific situations as long as they compensate in other ways.

Compensation can occur in different ways. One way is to give the lower stories of a taller building over to public functions, in effect to return them to public domain. The public becomes an active participant in use of the building. The second way is to involve the public in use of the unbuilt. Salem has no open green spaces other than private yards and the Common. There is an opportunity to design some intermediate-size land for community use. This, again, returns parts of the design to the public domain, giving back to the context.

Urban densities also suggest the inclusion of open space. Too often buildings totally dominate the townscape and create visual chaos. Creating open areas within a highly built fabric establishes a sense of rhythm and order as well as clarifying the public-private relationship. Aldo Van Eyck's children's home does it exceptionally. Rooms are organized around both the real street edge and an internal courtyard. Circulation makes the physical connection between these two.

'Public space + connection + private space' sets the framework for collective organization. These spaces make
both pieces of the public realm (plazas) and the private realm (courtyards). In both cases they strengthen the collective organization of the development.

Within the organization of Salem, there is a pattern where public open spaces reinforce connecting pathways through the city. This pattern establishes the position of several open areas along the intra-block path through the site and at the edge of the street crossings. There they support and are supported by both networks. Other plazas are defined opposite the object buildings of the site: adjacent to the churches and opposite the parking garage. This placement strengthens the distinction of continuity versus object in the landscape.

Where plazas create public links to context, they are further strengthened by having public buildings located adjacent. This leads to the placement, very positively, of the theater and community center where they maximize this relationship, as shown in figure 5.

The theater and community center are the first physical elements of the development. As such they are anchoring points between the development and the contextual fabric; landmarks which identify particular places within the development itself. Since these elements are very specifically identified, their design precedes, and sometimes excludes, general design methods.
CRITICAL AREAS. figure 5.

Defined edges

Open spaces

Placed buildings:
C - Community Center
T - Theater

NORTH RIVER

WASHINGTON STREET

ESSEX STREET

BRIDGE STREET

Salem Common

↑ NORTH
The other specific, physical quantity known at this point in the process is the large parking requirement of the program, about 130 cars for the full development.

People prefer to park close to where they live. The massing diagram establishes a general disposition of cars based on this organizing device. Within this general distribution two relationships organize at a local level. The first is a "typical" garage arrangement where cars are massed together. It serves the densely occupied parts of the site to the northwest and northeast. These garages raise the inhabited levels of the project above the traffic level of Bridge Street. They also eliminate potential sun issues on the ground level north side of the site. This edge becomes solely inhabited by cars, as shown in figure 6.

The second local parking-living relationship applies to the less dense residential sections of the site. Here a "traditional" relationship between house and car is altered slightly to accommodate the denser-than-traditional population of cars. Cars are aggregated into groups of two to four. Groups of cars define collective groups of housing of about quadraplex size. The relationship of house-car-street remains roughly the same though amplified in size.

The other useful aspect of parking is in further defining points of access. Since the garages should not open directly onto main streets, they open onto Federal Street and St. Peters Street. This strengthens the internal organization of streets.

Once the relationship of house-car-street has been identified as a useful organizational tool, then the tool can be used to generate more inclusive decisions. Donlyn Lyndon's dormitories at Brown University are good examples of
this concept. The dormitories deal with the two very different site edge conditions. The commercial edge includes physical qualities of the existing commercial fabric. The buildings build up to the sidewalk edge and then rise straight up for several stories. In contrast, the residential edge responds to the physical organization of that edge. The dormitories are set back some twenty feet from the sidewalk and rise more gently to their roofs. Through this process the edges of the building are defined without unduly constraining internal decisions.

The process is specific: to deal only with those issues understandable at the operative working size. This method leads to identification of several inclusive physical relationships. They are house-street, shop-street, shop-house and house-private outdoor space. Certain dimensions, changes in level, and quality of edge definition distinguish between the various relationships. These definitions, shown in figure 9, begin to make real the diagrammatic decisions of the earlier parts of the process.

The shop-street definition follows the decisions implicit in Lyndon's dormitories. The edge is characteristically identified and strengthened. Set back and height, derived partially from the massing diagram, reinforce the continuity.

The same process works for the house-street relationship. The image of 'house', and having a 'yard' between the house and the street, are collaged with the contextual house forms of Salem to achieve a partial design of this street edge. Dimension and sun lines play a significant part in establishing this edge definition.
The house-shop and house-outdoor private space are simply more inclusive, less explicit parts of this stage of design. Just as sections identify particulars of the external edges, they also should identify what is implied at the internal edges. Two specific architectural suggestions, which are overlayed on the fabric, make this identification. The designation of an owner-occupied commercial base implies, rather explicitly, a direct connection between most commercial frontage and adjacent housing. A half level change between commercial and residential accommodates this transition more directly.

This split-level diagram suggests the next relationship: that private outdoor space be raised a half level above ground level to relate more directly to the residential part of the project. Within the framework of these two decisions, actually all four of these decisions, further design can occur. These decisions focus the process. Through each change in scale, parts of each stage of design overlap. These level changes may not be exactly half-level in the final design, but the physical relationships are established at this scale.

At this point other issues are overlayed onto the process. The strength of the edge definition is further defined by issues of sun orientation. Passive solar gain makes southeastern exposure desirable while northern exposure is minimized. This works favorably in some instances, less favorably in others.

Passive solar design only becomes a substantial issue at the final design stage. At this point more general features of closure and orientation can only be suggested. They determine step-down heights and setbacks on buildings
facing the courtyards and street edges. The result is another "form envelope" which relates to the preceding edge decisions, ultimately becoming another collage of information at a more specific design scale. Applicable sun data is shown in Appendix B.

Another piece of information input into the process is the egress requirement requirement of Salem, related directly to the "high rise" portions of the development. A requirement of stairs every 100 feet establishes a "unit size" within these taller masses, as shown in figure 8.

The issue of individual access organizes other parts of the site as well. Although these areas are not constrained like the high-rise, they do have their own access requirements. The major organizational tool is developing a relationship between parking and entry. Entrances are placed near parking areas. Part of this decision stems from an implicit social understanding of the identification of house with car. In any other cultural context this might not be true.

So far no explicit size decisions have been made in plan beyond these decisions of access, parking, and edge definition as shown in figure 7. However these decisions help make the transition to the next, more specific level of definition.
SUB-REGION DESIGN

SOCIAL

So far, the product is a complex overlay of pieces of information. However it is just a valueless pile of thoughts and notions. It is only meaningful as a design method when architectural attitudes and decisions about social relationships are involved. Design is a matter of making value decisions at this stage. In this project definition of useful sizes and communal relationships direct these decisions.

Again, Lyndon's dormitories are very successful at this. Lyndon determined a "social size" of six rooms organized around common facilities, and a second larger size of eighteen rooms organized around a common entry and stair system. This larger size is the organizing dimensional piece throughout his site. This size also corresponds roughly to the size of the adjacent Pembroke House, in a sense the original reference for the dormitories. (see Appendix A).

The first qualitative decision determines the extent of collectivization of building functions. Some decisions
come implicitly from the massing diagrams and the program size. High rise buildings have high rise constraints. Other buildings require the application of their own criteria.

Images are useful mechanisms for identifying physical differences. The image of a "quadraplex" makes a positive reference to house given these circumstances. The image of Essex Street makes a useful reference for developing the urban form of Church Street. This is not to say that the resulting development looks like these references, but the images allow the designer to identify characteristics. These images reinforce the continuity of the fabric by being contextually supportive.

These images also carry implicit connotations of size and form which help inform the design process. The image of house in Salem as represented by the homes on Federal Street west of Washington Street is clearly too small to accommodate the program of the site. But an image of two of these houses juxtaposed into a single building does fit the constraints. It also forms a contextual basis, in form, for relating new residential construction to existing construction. Although the social conditions are slightly altered, there is still enough continuity for the relationships to be mutually supportive.
Collectivization of units combined with the process of edge definition distinguishes public to private relationships. The street edge defines particular public domains, while internal edges make qualitative distinctions between individual and collective privacies. All of these decisions operate within the established constraints of the inclusive physical organization. Succeeding decisions build upon this framework to become physical design.

Drawings show little of these diagrammatic notions. The method of the process suggests physical representations of these collective relationships. In a meaningful/physical way, parts of the development become more clearly defined, while other parts still carry diagrammatic qualities. The areas which are better defined take on general dimensions, primarily by generic use associations. They become "building blocks" which make connections of size within the development fabric.
A quadraplex under construction in this area of Salem reinforces this size definition. The amount of built in proportion to unbuilt strengthens the regional organization. It should be noted again that this size is roughly equivalent to two of the larger Federal Street houses. These images are useful tools at this scale of design as well as later scales. They reinforce the "appropriateness" of the "block" size as well as begin to imply qualities of the final product. Their relationship to the project begins with common characteristics of general size and use, and continues until it involves specific size, form, structure and spacial qualities. These issues are dealt with later in the process.

The same method of direct form associations works with the comparable images of Church Street and Essex Street. An association is made beginning with the basic use characteristics of Church Street. The commercial nature of both streets suggests further, more specific comparison.

Essex Street is an anomaly in one way. Its pedestrian mall makes an exception to the defined urban fabric. This definition allows very specific relationships to be drawn between these two streets without confusing purposes.

Essex Street is a typical small New England commercial street in that its continuous red brick facade is made by the juxtaposition of many single pieces of architecture. Sometimes these buildings have common attributes, sometimes they do not. They do have distinguishing qualities which are mutually supporting and identifiable as part of an urban landscape.
Understanding these qualities in the context of Essex Street can help in understanding the corresponding qualities of Church Street. The same qualities do not apply; just the system for understanding them, as defined in the case studies.

Church Street is not the main street of town. It cannot support the density of commercial activity that Essex Street supports. As the density decreases, so too the actual amount of continuous facade decreases. Each building remains part of an assemblage, adding together to strengthen the street edge definition, but it is more discontinuous than that of Essex Street. Instead of the block being one continuous facade, it is broken into different size pieces, as befits its density.

The result is a partial design which begins to make decisions about actual inhabitation. Specific relationships
are being established which distinguish between actual private yards and public sidewalks. The ultimate forms are not yet determined, but the physical relationships are clear, and helping to determine those forms.

A quadraplex size residence, a communal private courtyard and a portion of a commercial facade piece are one "unit size" within the larger definition of the site organization, as shown in figure 10. This form, as it repeats and is interwoven, defines sub-regional territories within the larger region of this site, as shown in figure 11. Each of these sub-regions is, in a sense, self supporting. It contains a mix of spacial qualities and uses which support each other. As two of these sub-regions come together this mix makes continuities between the particular sub-regions, and clarifies the connection to the larger network decisions.
Sub-regional definition approaches the realm of actual physical design. Specific user-needs and associated design decisions can almost be made. Yet the inclusive nature of this process still supports an organizational system which accommodates more than a single design decision. Making decisions based on operating scale qualities applies at this scale of design as well. These issues are examined in part of one sub-regional form only; the process will work for the entire sub-region.

The nature of edges, entries, degrees of openness and closure, and generative level changes are determined first at this scale, with some contextual bases. Overlayed on these determinations are specific, physical user-defined design decisions. The result is a complex, closely connected, partially physical organization: a "trace" of these particular qualities. This trace is more physical than not. It helps inform actual physical design decisions, yet it can be altered to fit different constraints on different parts of the site.

Just as social decisions informed the design process at the sub-regional scale, so too do the contextual social
organizations inform this level of design. In a lecture given by Martin Steinmann at M.I.T. on May 2, 1979, he refers to this concept when talking about adaptation of a building to its environment:

That means that the adaptation cannot be led by abstract criteria if it is to create a rational relation between the new design and the buildings forming its environs, or maybe I should say traces of man instead of buildings, for the notion of environs...includes all these traces in an area. Traces in this sense are: e.g. a street as well as a legend with which man may connect a particular point of the street: both give the area sociocultural meaning.6

The primary importance of this trace is as a tool for developing direct social organizations. Secondarily it operates as a physical, imagable form which generates design information. In terms of this process, these two components are integrated into a single methodology. The introduction of new elements integrates into a given setting through this mechanism.

Steinmann goes on to identify the buildings as a collage of these sociocultural traces. This collage brings together some of the stronger elements of the context and identifies them through their juxtaposition. What he does not explicitly mention is that the trace is also a physically related contextual component. The culture is directly identified by its physical environment. Through design which includes physical relationships, elements of culture and society can be conveyed as well.

The paintings of Paul Klee identify both the objects being painted and the field created by the juxtaposition of
these objects. Both components coexist, yet they retain their discrete identities as well as adding another level of physical meaning to the context of the painting. This type of collage integrates field (or continuity) with element (idealized form) while retaining, and in fact strengthening, their specific differences. The trace attempts to make this integration explicitly.

The notion that ideal forms can exist as fragments, 'collaged' into an empirical environment (and adjusted to context) has largely eluded the modern architect.7

Thomas Schumacker wrote this in an article on contextualism. He alludes to a concept of a trace; a design component which introduces 'ideal'forms into a contextual vocabulary. What he calls a fragment is similar to what is referred to here as a trace. The only possible misconception of 'fragment' lies in perceiving it as a semi-disintegrated element rather than a partially assembled one. The trace is defined as including more qualities not excluding certain ones. It aims to establish a partial framework to which actual individual design is added.

The framework is based on the developing patterns of built, unbuilt, environmental, social, cultural, economic, et cetera as they apply to this particular context. These patterns come from the decisions of the regional and sub-regional steps of this process. They are simply large traces in a more abstract way of thinking. More will be said about this abstraction in the concluding remarks.

The trace, or physical form image, of the commercial component of one sub-region is explored here. But, again,
the process of defining this trace also works for the other sub-regional components of this site. This commercial component, situated on Church Street, is in a position where direct contextual association should be recognizable. It has already been relatively well defined at the sub-regional level of design. Therefore the process should read fairly continuously to this next stage.

Some parts of the design are still more physically defined than other parts. Those decisions which were generated at the sub-regional scale take on real physical dimensions at this scale. This includes a common residential entry off the main street edge, half level changes within the building, strong definition of closure on the commercial facade, and fairly strong closure on the northern facade.

The focus of commercial space is on the existing street. The focus of residential space is primarily away from the street and secondarily towards the commercial space. This was established at the sub-regional scale. The organization stands with commerce on the ground level at the street edge and residences beginning one-half level up from ground, oriented towards the courtyard, and moving up over the commercial. The size accommodates four to six units, again seeking to reinforce the continuity of the site by maintaining a moderate urban density throughout.

So far these qualitative decisions have no dimensional constraints beyond the general images of the sub-regional size. If qualitative associations can be made between existing relationships within the Salem fabric and the desired relationships of the design, then actual physical characteristics of the existing fabric can be used to
generate physical decisions in the design. In this case, the sub-regional organization associates positive qualities with the nearby old firehouse and office building at the west end of the site, shown in the following sketch.

These buildings, also fronting Church Street, have commercial space at the ground level, and office or residential space above—uses similar to those projected for the sub-region. The space between these buildings and the open space at the rear are similar in sensation, image and dimension to the common entry and courtyard of the sub-region. The actual dimensions of those buildings fit roughly within the dimensions of the commercial edge of the sub-region.

Since general characteristics relate the old buildings to the new design... specific characteristics, when related, strengthen this connection. The desire for strengthening
continuity within the fabric remains the key design generator. The trace, derived from these sub-regional qualities and physical features of the old buildings, establishes the framework for this continuity.

The actual uses within the trace are still the first physical determinants. The location of entry and level change comes first from the sub-regional diagram and second from adjustments to context. Actual dimensions drawn from the old buildings do not apply until the definition of the sub-regional diagram is as complete as it can be.

The first direct reference to context deals with street edge definition. The street facade is twenty-eight feet high where it begins to slope to its peak in both of the old buildings. The organization of the site demands three to four stories of usable space on this space. To reinforce this contextual association, the fourth story of the Church Street edge will be set back from the facade line, as shown in figure 12. In this manner, contextual form relationships are made. On the interior edge on this trace, the quality and size of courtyard definition is the only link possible between trace and context. This continuity is not identifiable within the Salem fabric. Therefore little contextual association can be made. In a sense, the courtyard now stands on its own merits, just as the entire design must eventually.
Figure 12: Sub-Region Image

Scale: 5 ft = 10 ft = 20 ft...

Dimensions: 0 ft, 10 ft, 40 ft
Direct design decisions apply when contextual associations are not useful for determining physical qualities. Beginning with the plan of the two old buildings, and attempting to jam housing inside them, simulates an infill operation. While it is possible, the buildings do not support these attempts. Particularly, they do not support the introduction of a housing stock. The dimensions of the buildings are such that they are neither 'ideal' house dimensions having a maximum southern exposure, nor are they row house dimensions with their particular organization. They exist somewhere inbetween, and as such they must be adjusted towards the desired use.

This adjustment is difficult to make, partly because of the different spacial requirements of the commercial and residential uses. An organization which allows greater southern exposure is desirable for obvious reasons. This organization works well for the commercial space on the ground level. Yet the effect on the residential space is to make spaces larger than occupiable. Some kind of structural transition is needed which both maintains this southern orientation and establishes useful residential dimensions.

Further definition of actual uses is made within this organization. While the commercial use can be readily organized towards the street edge, the residential use must deal with all four edges. The between building entries permit the actual unit entry to occur near the center of the unit. From there it is possible to orient public parts (kitchen, living, dining) of the unit to the south and private parts (bedrooms, baths, workareas) to the north. This orientation strengthens the private nature of the courtyards and reinforces the street edge as a positive side of the
residential organization.

The trace begins to develop. At this stage it is a blend of particular uses and contextual forms: edges, entries, associative heights, associative size frameworks. Now it is important to introduce structure into the process. At earlier stages, parking was a structuring device. Here an actual structural system must be developed. This structure organizes these bits of information into coherent physical relationships.

The appropriate structural system is a composite of masonry bearing walls and column supports. This system has contextual origins in Salem: many houses are built of brick walls with interior columns. It can accommodate both residential and commercial use, and is therefore appropriate to this trace. The masonry walls make particularly strong spacial separation, while the columns make spacial connection. The columns define a connectedness appropriate to the commercial use, the walls a privacy applicable to residential use.

The structural bay dimensions are partially derived through contextual association. The spacial quality of the ground floor of the old firehouse is directly appropriate to the commercial use of this trace. The archway which forms this edge is a common element in Salem. Making a physical connection between these two components strengthens this quality. A sixteen foot dimension defined solely by the column makes this connection. Spacial quality is strengthened, not imitated.

This bay dimension is the first significant structural
trace component. Since this size is generated from the street edge by commercial use constraints, another bay dimension is introduced which supports the residential size constraints. This smaller bay makes the larger bay more recognizable as an edge related component, rather than having been randomly selected.

The edge of the trace which faces the courtyard also faces due north. Structure near this edge is laid out to imply, rather explicitly, the option of orienting this edge 45° off the orthogonal, as shown in figure 14. This will allow more spacial connection between courtyard and house as well as some variation in sunlight, rather than pure indirect north light. Giving the orthogonal nature of Salem's buildings, it seems more reasonable to suggest this geometry rather than turn the structure to create it directly.

In addition to this definition, the structure attempts to use a girder span which is repeatable. This leads to a twenty-two foot span between columns in most instances. This structure is both the real and sociological framework which organizes the trace.

This structure, when combined with the other information, becomes the basis for making actual design tests. These tests strengthen the spacial quality of the trace based on structure and organization. Through these tests, specific physical relationships develop out of the spacial qualities. The trace begins to take form.

The common entry is again a starting point. It defines a strong separation between public and private. This suggests
the use of masonry walls to make this separation. The same separation exists between any adjacent traces. In contrast, the separation between house and courtyard is not as strong. There the more open column supplies enough definition. This essentially determines the bearing wall determining and the normal beam direction.

Structuring the street edge is particularly complicated. The physical definition is different between the ground floor and the upper stories. This points out the reason that any trace must be thought of in true three dimensional form. It is a real assemblage of spacial relationships. The definition at the ground floor is columnar to accommodate the public exposure desired by commerce. However, on the upper floors the need for privacy suggests masonry definition.

Use establishes the next structural component. Masonry cores within the residential units operate both as passive heat storage systems and vertical flues. These cores are arranged so that they fit with the structure and create two different spaces within the unit. First they define an "inglenook", a private sitting area in close proximity with the fireplace. Second, on the opposite side, they are the first definers of a larger space—perhaps a formal living room.

These cores must be oriented so that they receive maximum southern exposure in order to act as passive heat vessels. This dictates their placement within the southern third, in plan, of the trace. The desire to use an extension of the core to define part of the actual entry specifically places it within each unit, as shown in figure 14. This
sets up a spacial relationship where entry happens past a masonry defined private area, opening onto the more public part of the house.

Plumbing stacks operate in similar fashion on the other side of the entry. The bathrooms defined by these stacks make privacies which further articulate the entry. The spacial definition exists without complete physical containment. Physical connection of these elements together begins to integrate the trace, also shown in figure 14.

Getting multiple definitions from a single form adds to the value of that form. Placing the entry in the interior of the trace also orients the internal circulation towards the middle of each unit. This frees the edges for actual inhabitation.

The trace combines all of these aspects into one integrated form. The spacial relationships of several units and two distinct uses are defined within a single organizational tool. As all of these components physically connect, the trace becomes an imagable part of the site. It has a physical form which begins to fasten it to particular social decisions of the sub-regional definition. As it works directly with the previous scale, it also points towards the next scale: actual design.

The actual trace is really simple in concept, although it looks complicated in form. Physical images of use, street-edge definition, solar orientation and structure are integrated together into one spacial element, as shown in figure 13. This trace is now the beginning point of actual design. It can be inhabited almost directly, as in figure 15, or it can
be developed into a different building with different features. Yet within the given sub-regional context, it can accommodate, and in fact support, the definition of many different spacial conditions.
The last part of this thesis tests this process by putting it together in two projected facade designs: the final integration of context, component, and continuity into a single recognizable form. Again, the use of this area on Church Street allows further comparison to be made between existing forms and the new design.

It still goes back to the opening quote by Le Corbusier; a harmonious environment is desirable. Within any environment, harmony does not imply mimicry. Cahen's infill building and Van Eyck's housing project, both in Amsterdam, (see Appendix A), remain the bellwethers of this concept.

Drawn from the context at this level are attitudes towards articulation of structure and spacial form relationships. In Salem, most buildings operate in a fairly straight forward manner. The structure of a building in understandable upon observation. Bearing walls support to the ground. Small openings in their surfaces make windows. Where large openings do occur, the masonry wall is arched to visually transfer the load.

Building in this fashion is absurd given modern economic
constraints and improved technology. Yet a structuralist system can deal with these modern issues and still operate in the visual language of the Salem environment. Not only can structure be articulated in terms of a 'grammatical' relationship, but components of the new can share scale relationships with the old as part of the vocabulary that makes up that grammar. Cahen's building does this in terms of structure, openness and physical size. Those same characteristics apply here.

At the ground level, the columns of the trace are articulated into actual doubled columns with haunches. These haunches accentuate the physical connection of beam to column much like the brick work at the corners of the firehouse's arches. The beams themselves span sixteen feet, slightly longer than the firehouse arch. This allows more commercial frontage. Between the doubled columns a smaller spacial definition humanizes the scale of the beams, as was down in the firehouse facade.

A continous surface vocabulary occurs above the beams are fronting the residential units. The columns are simpler but they continue to be accentuated, now by strip windows on both sides. This column does the simply job of supporting girders where they penetrate the facade.

These columns, and their associated openings, add together to define larger sections of building within the sub-regional organization. It becomes possible to identify a 'size' which correlates with the dimensions of the firehouse itself. This is not a discrete building size, but still a partial definition within the complete trace. It makes another visual connection to the context.
The larger definition of 'top' has also been partially defined in the trace. Where this building exceeds three stories, or twenty-eight feet, it steps back from the street edge before continuing upward. Terraces are created where this occurs. These terraces allow outdoor use of the southern exposure. The set-back of these terraces only begins to make this definition of top. The completing element is a pitched roof over the public stair of the trace. This roof extends to make the last connection between the two parts of the trace, like the stitching of two pieces of cloth.

In between the ground floor and the top, walls and windows make the completing connections of form. Columns and their associated windows are one set of components for this part of the facade. They link the middle to the ground level in terms of vocabulary. Another set of components is needed to link the middle to other middles in the Salem context.

Building on the characteristics of the firehouse, large masonry surfaces with four-foot holes punched through regularly, components are designed which fulfill the trace's housing requirements and still refer to the context. Openings are made in multiples of four by eight feet. This size is the beginning dimension for making a scale connection. These openings are placed as objects within the surface. A rhythm of open, to solid, to structure, is made by establishing certain regulating lines which maintain this relationship. This rhythm is recognizable as having a basis in the regular window placements of the buildings of Salem. It makes a geometrical relationship explicit through a connection to structure.
The connection of window in surface, to window and structure, to structure above and structure below, makes the entire facade read as a field organization with understandable contextual physical relationships. The process comes full circle, and now connects back to the initial concept of trace— that of a design tool with meaningful, physical, imagable implications.
CONCLUSIONS

Webster's dictionary defines a trace as "a mark, track, sign, et cetera left by a person, animal or thing." In this thesis the trace is made of tracks of culture, society and physical environment. Like a footprint in the ground the trace is a physical recognition of what was there before-the context. Traces define the context within which design occurs, thus the title *Footprints in the City*. Footprints lead to the trace, which in turn facilitates design.

In an abstract way a trace is at work at all levels of design, as referred to earlier. Just as here the trace is used to make a physical organization real at a direct design scale, so too does it work to make the organization real at an urban scale. The decisions which were made about plazas, parking and edges as they relate to use are really no different than those decisions which dealt with courtyard, entry and residential definition. The scales may differ but the relationships of the issues do not.

In the same sense that it is useful to connect these two levels of design through a methodology, it makes sense to connect them in physical form. The entire project then reads as a continuous spacial field understandable by the inhabitants. If one can understand the process as yielding an integrated
design, then the site networks have direct implications towards actual unit design.

Again, while it may seem abstract, it is not. To make physical connections between scales completely integrates the design process. The project becomes understandable at every scale. In making this connection complete, forms have meanings across scales. The appropriateness of the relationships developed in the edge definition of figure 5. have a direct relationship to the design of the actual trace, as shown in this sketch.
The form continuity was not understood at the beginning of this thesis. In a future project, this information would be used directly to fully integrate the design process. Although it may result in simple geometric relationships, it has its foundation in this concept of physical-use continuity. Ultimately, it could work at both ends of the range shown in the cover drawing.

This form relationship never preempts actual design decisions. Its foundation in use and context must always remain the true form determinants. Walter Netsch's grid systems neglect this basis in use. They are purely abstract forms.

The continuous trace is never built as drawn. It is a trace, with physical implications, but too incomplete to be a final design. It must be added to, to make real physical relationships. Where it fits with the context, little information need by added to make it complete. However, it must be modified to reinforce its specific use where it does not fit.

A good example would be the design of the high-rise portion of this site. It has special characteristics unlike those of any other part of the site. The trace designed in this thesis would be inappropriate to use here. However, it is geometric, spacial basis in form could generate another branchtrace which does integrate into the particular requirements of high-rise apartments. The trace is context bound, yet the method for deriving spacial relationships applies throughout the context.

The process is integrated. The problems of turning bubble diagrams into design are eliminated. Physical form
decisions generate design in an inclusive methodology. Each step is more specific than the previous step, always headed methodically towards the final design. Each step informs the next step, and is in turn informed by the previous. When the process is full integrated, the connection will be understood between the first step (network organizations) and the last step (facade design).

The process is not limited to the environment of Salem. Salem has such a clear organization—from fabric organization down to building details—that the traces can be clearly identified. In another context they may not be so clear. Application of this process should clarify the situation and identify the appropriate traces. They will most certainly never lead to the same results obtained here,—and should not. A different context must generate different forms. These differences identify contextual spatial continuities.

Salem is a clear but complex environment. Rich to begin with, the fabric simply needs strengthening. Another city might not be so vital. Richness may have to be introduced as a way of ordering the urban fabric. Here the clarity of the context helped generate the process. In a more confused situation, the process would help organize the context, and generate the design. The process can and should be used consistently.

The ability for other designers to use this process is one aspect not explored in this thesis. It should be possible for another designer to take a trace and design harmoniously with the original designer since the process results in physical, imagable form. He would have to be sympathetic to the goals of the original designer. Given this person,
there are enough physical implications designed into the trace that mutually responsive designs would result. This is more like a complex form of collaborative design rather than the setting of design controls.

Finally, the process must be put in perspective. It is a tool which directs, organizes and informs design. There is no magic to this process, nor any mysterious powers to the notion of trace. They are simply components of an observational design process. The trace is the integration of physical, observed design elements into highly useful tools for design.

Design builds from, and with, the context in all situations. In the landscape the context is the land. In the townscape the context is the urban fabric. The context is the beginning, the trace is the tool, and design creates the end.
FOOTNOTES


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There are modern examples of urban spacial form. These examples are physical recognition of the range of size and patterns of use which make up their specific environments. These designs have qualities and characteristics which strengthen their relationship to context and support the evolution of a harmonious environment. They are true parts of an urban townscape.

These examples cut across culture, involve several distinct functions, and use many construction systems. They represent such different architects as Jose Luis Sert, Fumihiko Maki and Dolf Schnebli. These architects have at least one trait in common: they all design by observing the specific spacial qualities around a site, and make their design decisions with reference—though not deference—to those qualities.

The actual design process involves recognizing those contextual qualities and making qualitative architectural judgements based on them. These judgements reinforce continuities within the urban fabric and make specific physical connections of form.
When J.L. Sert became involved with Le Corbusier in the redesign of Barcelona (1933), he recognized the need for continuity in an urban fabric. In contrast to some philosophies of the period, he argued that:

the slum areas were to be restored to health without destroying the character of the city, that original scale be maintained by rehabilitating old structures and relating new construction to them. ¹

The concept of scale and form relationships between old and new construction was a continuing theme for Sert throughout his career. As biographer Bastlund noted, "(Sert's) northern and Mediterranean buildings have one characteristic in common, and that is the intent of bringing urban design factors into the plans whenever possible. Consequently they are designed as parts of a larger growing complex."²

To simply define an intent is not enough. The physical relationship must be clear and real. Sert describes the planning of the Peabody Terrace graduate housing at Harvard University on a contextual form basis. Yet the buildings reflect little of his reference. While the basic diagram of the housing bears some resemblance to the organization of other Harvard housing along the Charles River, the relationships of the towers to the courtyards and the external circulation patterns are the antithesis of the actual form reference. This is in sharp contrast to the nearby Holyoke Center, also designed by Sert in the mid 1960's.

Holyoke Center responds more directly to the urban pressures around it and creates an identifiable order out of a chaotic urban setting. ³ Working with the university's
open space network of quadrangles and pedestrian paths, Sert strengthens this organization and links it physically with the existing spacial configurations of Cambridge.\textsuperscript{4} He does so systematically. He recognizes the paths as part of a series of movement systems which, to be stronger, need an organization which usefully supports both the existing and the new.

The pedestrian arcade through the ground floor of Holyoke Center reinforces the existing networks. It makes real the connection between Harvard Yard and the dormitories. It also brings the external life of Harvard Square into the building itself. This process of identifying movement systems is the first significant tool for understanding an urban fabric. The arcade becomes an animated street off the regular circulation system.\textsuperscript{5}
The program for Holyoke Center could have resulted in a single tower about eighteen stories tall. Instead it responds at an appropriate physical level to its surroundings. Its height at the street edge corresponds roughly to the height of its neighbors. Taller sections of the center are set back from the facade on all edges. This helps it to be viewed as a series of elements in the townscape rather than a single monumental building, further strengthening the continuity between it and the built environment.\(^6\)

This form relationship carries through to the human dimension associative level. At the facade edge there is a correlation between the window-to-wall ratio of Holyoke Center and the adjoining buildings. Where the juxtaposition is real, the relationships are real; in the taller section of the center the walls are opened up to allow more light into the interior. At this direct level of association the relationships have to be very real to be identifiable.

As in many of the 'modern' examples, Holyoke Center remains an example of an organization which takes minimal cues from its context. For a building to successfully integrate itself into an urban fabric it must apply all possible form references. The fear here is that if this organization were to be extended, that it would continue in the same form. Instead it should respond differently to the next specific set of contextual references. It is never the case of an idealized form being applied repeatedly. It is truly using form and use references as mechanisms for design.

Fumihiko Maki is another architect who has recognized the
importance of regional cues. He has designed several projects which take these issues into account. Two of those projects are detailed here.

In Japan, Maki's design of the Hillside Terrace Apartments is a useful example of a single urban organization used in three different building stages. Each of the stages deals with different program requirements and uses different structural systems. However, they all begin with the same basic organization.

The beginning is a recognition of the street as a strong urban edge, an edge which can be strengthened by building up to it and making it more identifiable as an urban element. Establishing one edge of the building as a built urban edge frees the architect to open the other faces of the building to the environment. A continuing pattern of these urban organizations is that one edge always reaches into its surroundings. This interlocking edge is never right on the street, rather it opens up away from the street, towards the sun, or unbuilt space, or quieter edges.

Sert used this same diagram in Holyoke Center. At the ground level he built the urban facade on the two main street edges and allowed the building to open up on the other two sides. At the upper levels this diagram is actually built and takes the form of a dogbone. This diagram accessed more light and ventilation to the offices than a monolithic square would have accessed. It is significant that this diagram is not on all floors of the center. It must change and respond to use as local conditions dictate.
The other major similarity between Holyoke Center and Hillside Terrace Apartments is the attitude towards circulation. Maki recognizes the potential for introducing another pedestrian path into the urban fabric. This path begins at the edge of the site but moves quickly away from it and through the building. Establishing this new path seems to ease the potential conflict between program and context. The edge of the building is able to respond directly to contextual cues while the program requirements develop from the interior of the building outward.

It is clear that Maki understood these relationships, because he used them to design stages two and three of the project as well. The actual buildings are not similar to the building of stage one, but there is a specific organizational continuity carried through all three phases of the projects.

Phase two of this project recognizes and reinforces many of the decisions begun in phase one. The urban edge becomes a continuity, as well continuing the pathway through the complex.
Movement is accessed from the edge into the heart of the building where it meets with the circulation of phase one, reinforcing that pathway and ordering the organization of the phase two building. In this case the intersection of these two circulation systems becomes the organizing element of the building. The courtyard where they intersect becomes a reference point which establishes the internal circulation pattern of the building. This internal pattern is different than those of phase one, recognizing a different use. Yet the organization of phase one is clearly the basis for their organization.

This pattern moves in section as well, when it moves back from the street edge. In phase one the pedestrian path moves down and then up as it crosses the site. In phase two it moves back and up as it intersects with the main path. This is a recognition of the need to differentiate between circulation at the street edge and the new circulation.

Phase three takes this process of organization and applies it once more. The building is not just a repetition of phase two, rather it responds to its individual program requirements. It makes form decisions based on its own specific needs. It builds on the organizational continuity established in the first two phases.

5-Hillside Terrace Apartments
Phase III
Plan
From Private Photograph
Circulation moves from the street edge back and up into the complex. Commercial activity strengthens the street edge, giving it life. Residential use is oriented to the south, away from the street.

In each of these three phases, Maki demonstrates a clearer and clearer understanding of the appropriate methodology. Circulation, organization and form are more clearly identifiable in phase three than they were in phase one. The continuity of the method is explicitly understood through the completed design. The inhabitants, at least sub-consciously, recognize this continuity and how it helps define the general organization of the complex.

Hillside Terrace Apartments exhibits qualities of organization and form which demonstrate a clear understanding of design as part of an ongoing process of growth. This project is a particularly good example because it was designed to be built in partial stages, each able to exist on its own as well as a part of the total development.

As if to prove his understanding is not a fluke, Maki's design of the Consolidated Office Building in Yokohama demonstrates his ability to recognize contextual spacial relationships in a much more specific physical manner.

Building in an area of monolithic office buildings, Maki makes a building with several qualities of collective urban form, while creating a reasonable addition to the environment. Perhaps the most significant aspect of this building is that it does not repeat the urban organization pattern of the Hillside Terrace project. It uses the same analysis process to create distinct yet contextually related
There is a clear recognition of public and private domains. The public domain is defined as an area bordering the street of a dimension larger than the actual sidewalk. The private territory is created, in part, by building against the public/urban edge and opening the building to face a plaza on the interior of the site. This plaza is an island in the urban sea. It, and the adjoining park, create a node of calm which focuses the building.
This points out another significant aspect of collective urban form. It is important that projects give something tangible back to their surroundings in order to strengthen the connection to its context. In this case the project "donates" the plaza and theater to its environment, establishing shared territory which helps identify it as part of a region.

Part of the success of Holyoke Center is attributable to the space given over to public use. The plaza off Harvard Square, though rather barren, is heavily used. It makes a real connection between the Center and people in the Square. The commercial activity on the ground level makes an enclosed connection. The plaza makes an open connection.

The Consolidated Office building recognizes another facet of urban growth form. The internal circulation moves upward away from the street edge, similar to Hillside Terrace Apartments. This can only occur because of the high density of actual sidewalk use. There is enough traffic to warrant the establishment of a new circulation system. This also frees the urban facade to respond directly to contextual pressures. Here the building responds literally to the scale and organization of its environment, maintaining its contextual relationship.

Scale and organization are perhaps the clearest identifiers of buildings based on contextual associations. These organizational tools make the difference between the office building as a collective form assemblage and any other building in the area. The building would be a simple mimic of its neighbors were it not for the introduction of these patterns. They distinguish the building from its context.
They also relate it to its context. The facade strengthens the connection by repeating literal forms of its neighbors. In a better method they could have made the connection through scale rather than actual form.

The student hostel in Amsterdam designed by Hermann Hertzberger has a facade where the elements respond to the context without mimicking their literal form. Qualities of scale and proportions relate the hostel's facade to its neighbors. Continuity of building height, street edge, orientation, and window scale strengthen the hostel's ties to the fabric. After the connection is established, the building can change to accomodate other program forms.

Hertzberger uses these relationships to organize much of the detail of the hostel. This is a good example of qualitative references being applied in a design.
actual form associations pass the diagram stage. They are real parts of the designed building. Harry Cahen's infill building, also in Amsterdam, makes these associations as well. It is not the actual repeated detail that makes the association, it is the scale and complexity of the detail.

In Providence, Rhode Island, Donlyn Lyndon's Pembroke dormitories identify these same organization issues. The dormitories are set in an urban context which lends itself to regional definition and specific form relationships. The architect understands the value in selecting form references which reinforce the fabric without mimicing their actual form.

The dormitories are a clear case of recognition of edge conditions. They respond to two different edges in two different manners. Most interestingly they respond using the same structure in both conditions. The structure operates at a constructional level. There is also a larger organization which establishes the form of the courtyard
and fits the project into the larger urban context. These two organizers, when interwoven, enrich the final design.

The larger organization, in the form of an L, reinforces specific characteristics of the site. On the east edge of the site the buildings continue and strengthen the commercial nature of that street. Shops are located on the ground floor of the dormitories and, in a somewhat heavy handed fashion, green glazed bricks identify this extension graphically. The new includes specific physical qualities of the old, but not the actual form.

On the north edge a different situation occurs, but the same methodology applies. The north street edge is largely residential and the dormitory form respects that identity. Here the buildings are set back from the edge and the edge is defined by a courtyard wall. This form is a derivative of existing forms and makes the dormitories part of the ongoing continuity of that street. It should be noted that this is accomplished at the cost of a loss of usable ground.
on the site. These yards seem to be the least useful part of the project, but still contextually appropriate.

These two edges, and their specific characteristics, help organize the project at an inclusive scale. The next layer of information, dimension and massing, is determined partially by the architect's superimposed social organization and partially by local spacial conditions of corner or edge recognized as having different qualities. All of this information is layered together and forms the basis for the structural unit design. This is the first example of a form diagram operating at two levels of design in the same project.

The structural unit operates within the framework of the inclusive organization. It is designed to correlate with the size of the adjacent Pembroke House. This size is the "building block" which adds together to make the larger organization. This form is flexible enough to accommodate both the residential and commercial uses. It has real physical qualities, like the earlier organization. It is not a vague diagram of intensions, rather it is a meaningful building tool with real physical implications. In fact, in this case it is an actual building system which is applied.
Other specific elements are included in this framework. Actual window dimensions correlate with window in Pembroke House. Bay windows are built into the dormitories in recognition of that vocabulary in the surroundings.

On the interior of the site, another world appears. Details of the exterior are brought inside but form relationships between the urban face and the interior do not occur. The interior is a world of red-glazed brick and steel-sculpted spaces. This dichotomy is the weakest part of the project. A fuller application of form continuity would have strengthened the work.

The Schnebli-Anselevicious-Montgomery design of the Law School at Washington University is perhaps the most useful example of understanding and using tools of form in a specific situation. The keys are the size/form relationships between the project and the existing school. These relationships work at multiple levels of organization like the Pembroke dormitories.
A clear form organization is drawn from the existing science center courtyard organization and used to organize the law school. This U-shaped form organizes the law school at a large scale. It has the qualities of interlocking form that were identified in the earlier projects and physically connects the new project to the old. It is the first tool for making a real connection.

The second tool is a module drawn from the basic form of the adjacent center. Although simple in itself, it has the property of becoming richer as it is multiplied, resulting in a richness approaching that of the original dormitory. The design is not a mimicry of the existing form, rather it uses physical form as "patterns" or "traces" for the new design. It makes a virtual connection where the association is strong although the actual connection is weak.
These traces are the tools which inform the actual design about organizational decisions. They strengthen the continuity between design and the existing fabric. They do not serve as random references, drawn at will. Rather they are mechanisms of continuity. The final design may bear minimal resemblance to the original reference yet a real physical relationship exists. This relationship strengthens the urban field, adding to the richness of the city.

Generally, definition of these reference tools depends on their proximity to parts of the urban field, the strength of the existing fabric, potential use-sizes, size of the program and a direct correlation to the developing field organization.

These organizational tools were generated in response to specific site and project issues. They were generated through
similar methods in several projects. Therefore they have a usefulness which is both specific (site) and general (organic) at the same time. They are methods for understanding specific issues of an urban fabric. While the application of these methods serves only to provide tools for organizing a project, they promote general contextual relationships between project and environment.

Four specific methods were identified in these studies at an organizing scale. They were:

1. analysis of circulation patterns
2. quality of edge conditions
3. specific relationship of programmed social values to context
4. relationships of actual uses and their extension into the project

At a fairly inclusive scale, organization can be generated based on these definable working methods. Direct association uses, program implications or sociological interventions apply where these methods are unspecific. Using these methods reinforces the urban field and clarifies the field organization. These decisions establish public paths, private zones, high and low density regions, circulation elements, and specific edge conditions.

The methodology becomes more specific as the scale becomes more specific. Ultimately it involves direct physical characteristics such as those described in the Pembroke Dormitories and the Washington University Law School. These characteristics extend from the fabric to strengthen the continuity of the fabric. They make the connection between organization and local physical qualities of the environment. This part of the method is much more specific than the
organization of the larger scale, but it still has identifiable features. These features include:

1. qualities of interlocking relationships and additive richness
2. associations of height, width, depth and massing
3. actual component relationships; "extension of material fabric".

These characteristics finally inform the actual design process. They link all levels of the process to concrete building methods. They are no end in or of themselves.

All of the stages of these design methods involve making transitions from one scale to the next scale as directly as possible. This directness, when cued by context makes the process understandable as a methodology. Consistent application of the methodology, though not necessarily the same design techniques, ultimately allows a theoretical basis for design to be developed. This theory formulates a more complete and coherent picture of the actual process.

Architectural design is then an integrated working process with clearly identifiable pieces, understandable in any one of the multitude of ways that work might be perceived. Distinguished are particular continuities and physical connections within a given context. The product is described as collective /continuous urban form.
FOOTNOTES


4. Ibid. p 55

5. Ibid. p 55

6. Ibid. p 55
APPENDIX B

SALEM
sun angles:

Sun rise
set

JUNE 22
DEC. 22
72°
24°
31°
33°
Developer's proposal for this site: