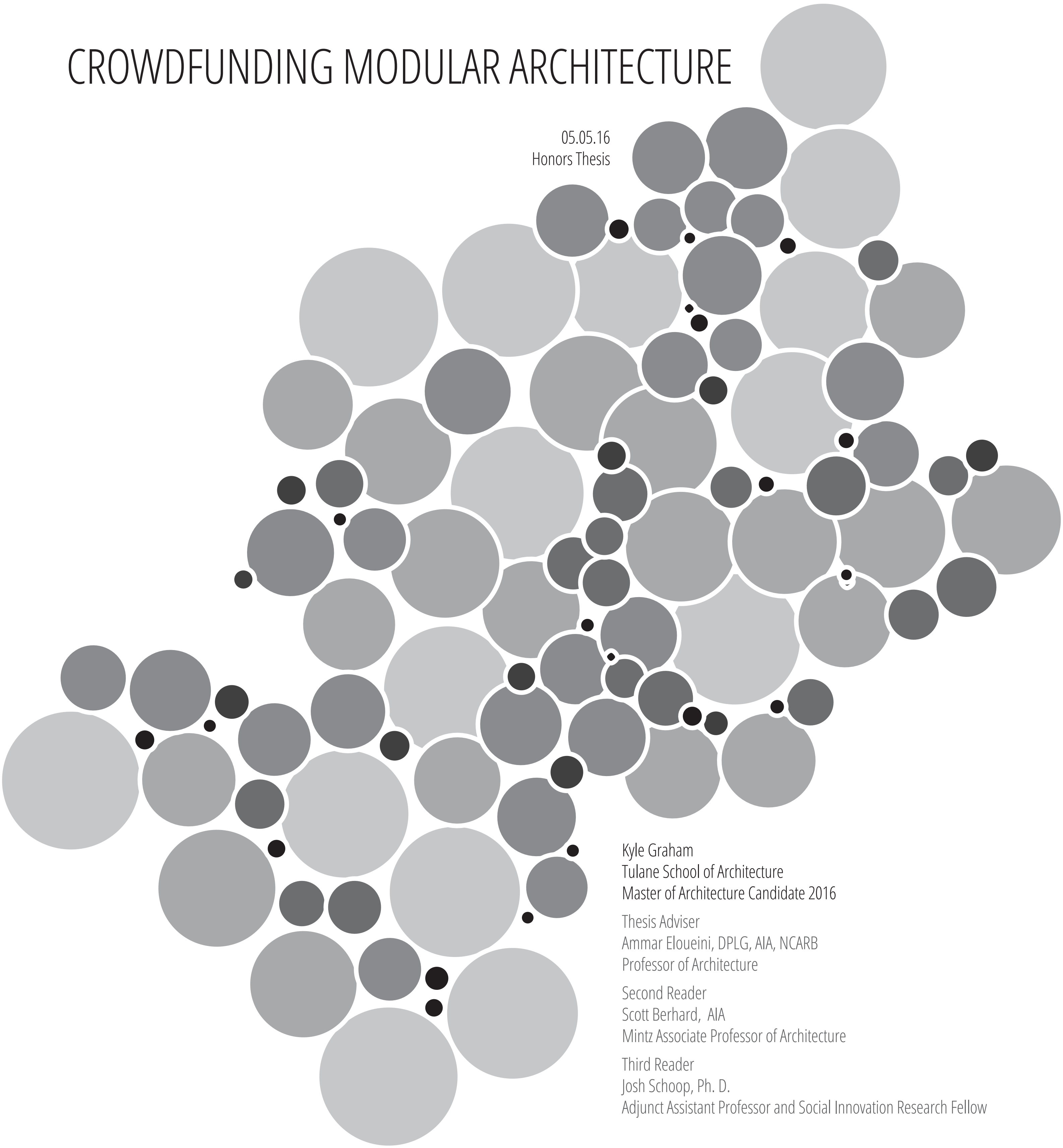
CROWDFUNDING MODULAR ARCHITECTURE

05.05.16
Honors Thesis

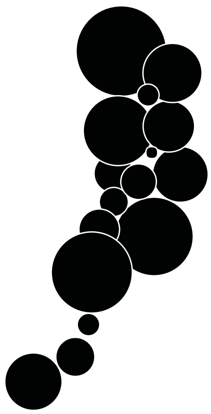


Kyle Graham
Tulane School of Architecture
Master of Architecture Candidate 2016

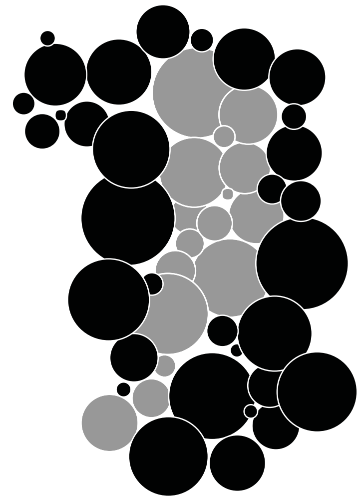
Thesis Adviser
Ammar Eloueini, DPLG, AIA, NCARB
Professor of Architecture

Second Reader
Scott Berhard, AIA
Mintz Associate Professor of Architecture

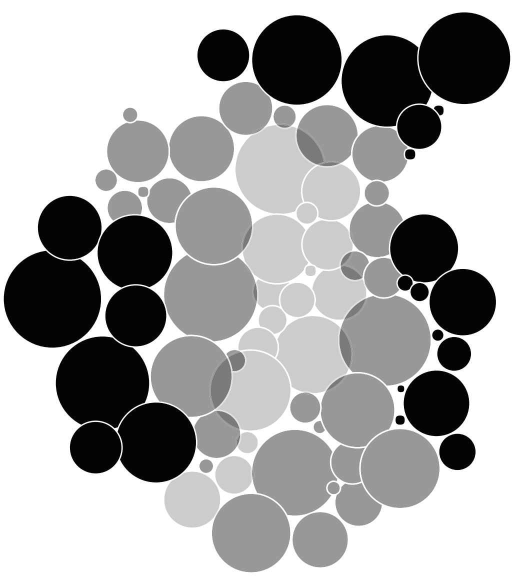
Third Reader
Josh Schoop, Ph. D.
Adjunct Assistant Professor and Social Innovation Research Fellow



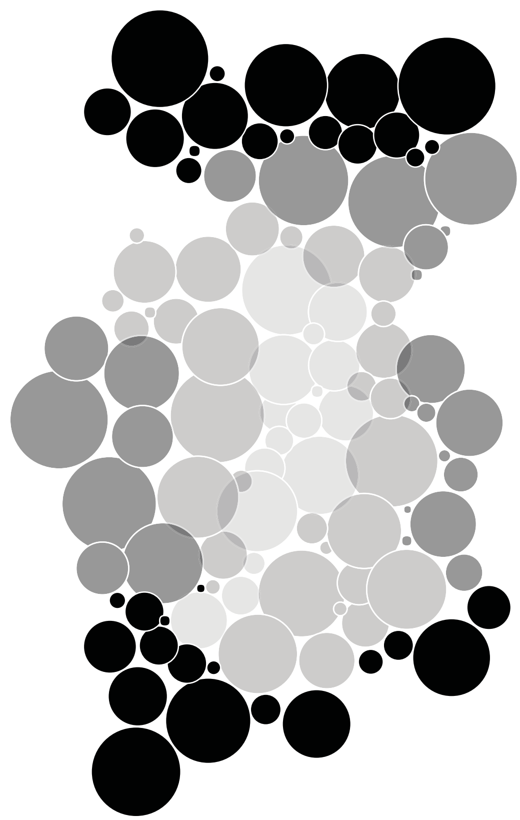
x



x + 1

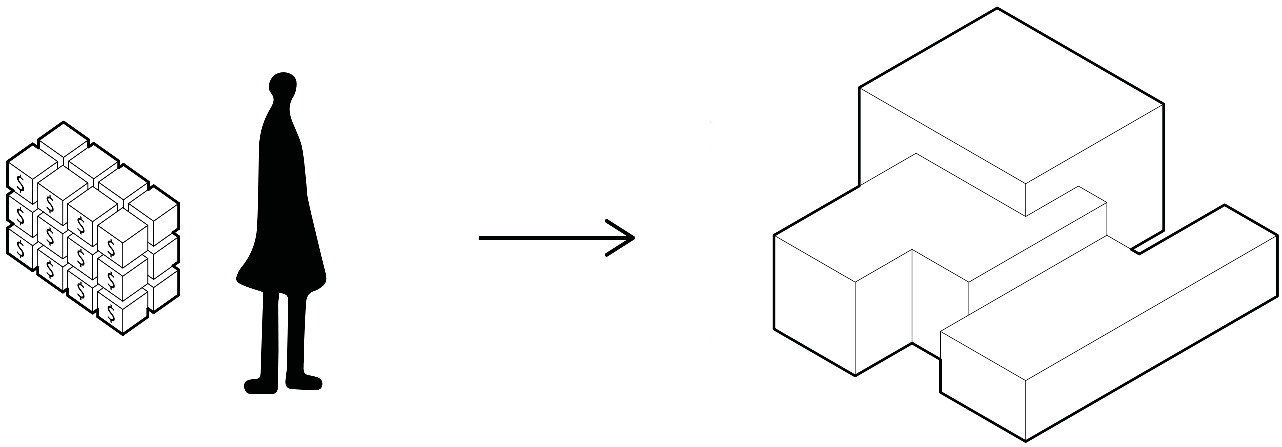


x + 2

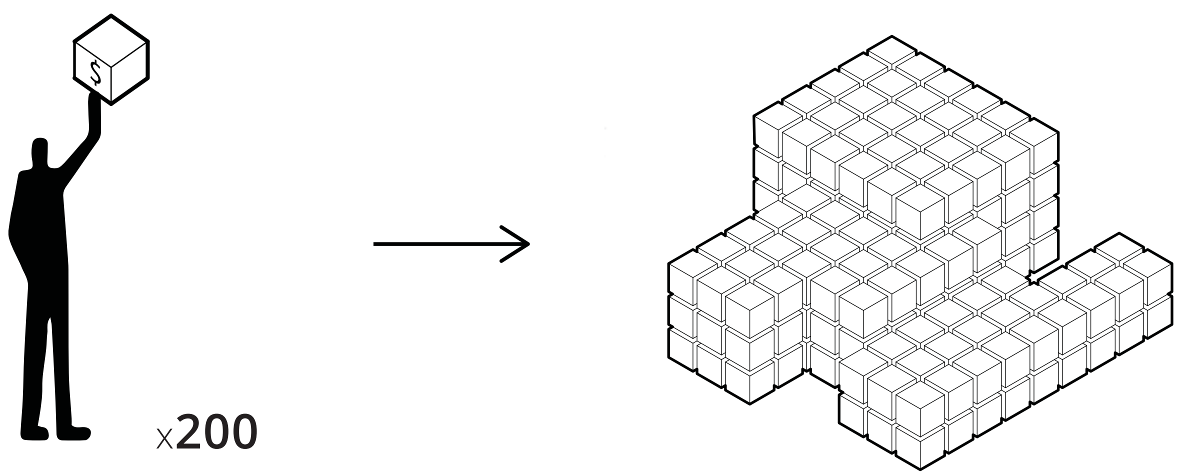


x + 3

TABLE OF CONTENTS



2



THESIS STATEMENT

A mode of designing specific to crowdfunded buildings can be created that is more representative of and beneficial to the crowdfunding model.

ABSTRACT

To the average American citizen, the thought of constructing a public building is completely unachievable. With price points in the millions of dollars (Building Journal), average citizens rely upon the government, wealthy individuals, or corporations to construct the communities they live in. However, the contemporary landscape of financing buildings has provided an alternative: crowdfunding. Crowdfunding, or the pooling of money from a large number of individuals in order to collectively reach a larger funding goal (Davies), injects a democratic system into the traditional construction process, allowing individuals to vote on projects they support by either choosing to fund or not to fund the project. At this time, buildings that use crowdfunding strategies are designed in the same manner as those funded from traditional sources. However, this reliance on traditional design methods is proving to be detrimental to crowdfunded projects with 70% of all projects failing. By divorcing crowdfunded buildings from the design methodologies that are used to design traditional buildings, a new mode of design can be created that is more beneficial to crowdfunded projects.

This new mode of design will capitalize on the differences in how these types of projects and traditional projects are funded. Crowdfunded projects are formed through the accumulation of resources over a length of time whereas traditional projects are given all of their resources at once. In order to take advantage of this rate of accumulation, crowdfunded projects should be defined by the aggregation of individual parts which can be funded independently. As parts are funded, they are added to a growing whole. While the final form will be unknown to the advocates of the project and the project designer, they will be responsible for designing the elements that will amount to the building and composing the strategy for how the elements will be organized. This process will allow the project to adapt the resources at hand and the desires of the community, generating a manifestation of the project's support by the community in real time.

ESSAY

CROWDFUNDING

A NEW MODEL

During the economic recession in the late 2000s, many small creative companies began to look for alternative methods to fund their projects. Many of these companies found success by utilizing fledgling crowdfunding systems, or methods that would allow these companies to solicit financial contributions from a large number of people. This system opened up a new type of venture financing that was available to the average person as opposed to small groups of wealthy individuals. Now, individuals with no previous venture financing experience could view a multitude of projects that are seeking funding, and contribute their money to the projects that they would like to see become a reality. For the companies seeking funds, they now had the opportunity to pitch prototypes and new ideas to a potential market of consumers and gauge interest in the project based on the number of contributions they received. This allows companies to experiment with products more freely and spend time developing projects that garner genuine interest from the community. Currently, crowdfunding is utilized by a wide range of industries from art to real estate[1]. In addition to the vast new range of project types, the amount of money raised by crowdfunding sources

FIGURE 1 - *Example crowdfunding platforms*

1- *Companies such as Prodigy Network are currently funding commercial realestate through crowdfunding methods. This is accomplished through a sub-category of crowdfunding known as crowdfund investing where shares of a building are distributed to a wide array of people and can be bought and sold like stock. The end goal for most users of this system is not to support a specific project but to find a project that will generate the highest dividend.*

has risen to $5.1 billion per year (Massolution 2013), allowing more projects to be funded each year with even larger funding goals.

The contemporary success of crowdfunding is largely attributed to rise of social media and online payment systems (Davies 36). Modern social media systems allow for the creation of communities based around various interests that are not limited by geographic proximity. This has allowed groups of likeminded individuals to find products keyed to their interests, and team up to fund them on crowdfunding platforms such as Kickstarter and Indiegogo. These crowdfunding platforms have made the critical development of displaying the members of the community that have already contributed to the project, allowing for each individual to be keenly aware of the fact they are acting collectively to achieve a common goal. At the same time, the ease of online payment presented by contemporary systems such as Paypal has simplified the act of contributing to a few key strokes. Now, the only thing limiting an individual from contributing to a project was their own available funds and their desire to be a part of making the project become a reality.

CROWDFUNDING IN ARCHITECTURE

The success of the crowdfunding methodology has also carried over into the built environment. According to Chris Gourlay, a founder of Spacehive, a British crowdfunding platform specializing in community spaces, the rise of crowdfunding has allowed the average citizen to get involved in the creation of public space. This is going against the traditional systems of community planning which "are determinedly shutting off any approaches by local people and businesses to get involved in making things work better for local people" (Gourlay 2015). This traditional system has created a disconnect between the users of space and those crafting it, leading to spaces being created that are unwanted while the desires of the community are being neglected. The crowdfunding system unites those with ideas for community spaces and individuals with the desire to see those spaces created. These ideas are aggregated within a common marketplace where the best ideas can be selected and funded by community members. On top of this, crowdfunding platforms specializing in the creation of public space have begun to fill the need for investment into communities that have neglected during the recent recession (Gourlay). This has been accomplished by crowdfunders recieving private money to put towards a selection of public projects that would onormally be produced by public monies. Both of these aspects have contributed to a system that Gourlay considers to be an optimization of creating public spaces because community members have selected and funded the space themselves, allowing the space to be uniquely owned by the communities.

American design groups such as Ideo have also found that involving communities from the beginning of the design process for public spaces enhances the quality of the space as well as how enthusiastically it will be accepted by the individuals within the community. "By starting with [communities] and their hopes, fears, and needs, we quickly uncover what is most desirable (Ideo 15)." In this manner, crowdfunding gets communities involved at the beginning of the design process and allows them to select which projects they would like to be constructed. This selection is manifested through their financial support for the project and the projects that generate the most financial support are considered to be representative of the desires and needs of the community. Projects that are unable to generate the adequate amount of financial support are less likely to have been viable within the community and may have been rejected by the community entirely. Because of this, the crowdfunding process has the potential to create buildings that best meet community needs and desires while avoiding the potential to generate spaces that are not best suited for the area.


TUESDAY, AUGUST 11, 1885—WITH SUPPLEMENT.

ONE HUNDRED THOUSAND DOLLARS!

TRIUMPHANT COMPLETION OF THE WORLD'S FUND FOR THE LIBERTY PEDESTAL.

FIGURE 2 - *Clipping from the Aug. 21 1885 edition of the New York World newspaper showing the completion of the Statue of Liberty crowdfunding campaign*
Image Source: aboutjosephpulitzer.weebly.com

HISTORIC EVIDENCE

Historically, crowdfunding has been used with great success to collectively fund large public works of architecture. The most prominent of these efforts is undoubtedly the campaign to construct the pedestal for the Statue of Liberty led by Joseph Pulitzer. In 1885, the French government constructed the colossal statue at its own expense as a gift to the people of the United States. However, the United States government refused to pay for the $100,000 price (roughly $2.3 million in today's currency) of the pedestal for the statue. Upon hearing of this, Pulitzer launched his own effort to raise the money through his newspaper, The New York World (Davies 32). Pulitzer's campaign established a precedent for many elements that now define contemporary crowdfunding efforts. Foremost, The New York World's office acted as the historical equivalent to a modern online crowdfunding platform, a single point where donations could be collected and put towards the project. On top of this, Pulitzer published the names of every person to donate to the project, no matter how small the donation. This accomplished two things that are each critical to the success of modern crowdfunding campaigns. Firstly it created a community knowledgeable that they were working collectively towards a greater goal. Furthermore, the prospect of having one's name published in a nationally circulated newspaper encouraged further donations, establishing a precedent for reward systems in crowdfunding campaigns. In the end, Pulitzer was able to raise the necessary funds from over 160,000 individuals with an average donation of only $0.63 (Davies 33).

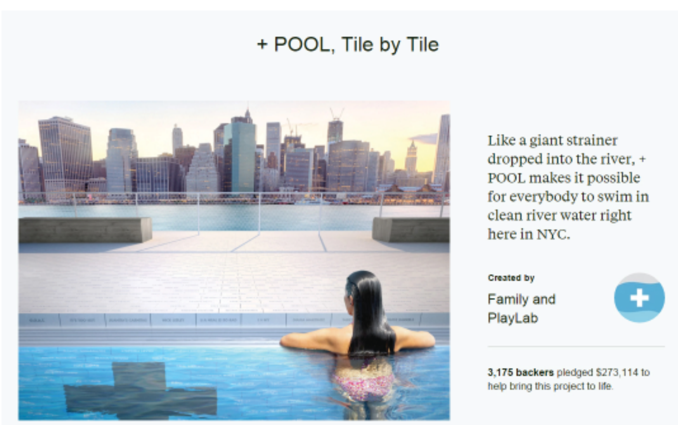
MISSED POTENTIAL

At the current moment, it is much more common for crowdfunding to be utilized to generate funding for consumer goods than grand public works such as the Statue of Liberty, with architectural projects making up less than 1% of all crowdfunded projects started yearly (Davies 45). This can largely be attributed to the fact that constructed works do not directly complement the innovations that have led to the rise of contemporary crowdfunding. Unlike crowdfunded consumer goods which can be shipped to donors around the globe, architectural projects are fundamentally tied to a location and the donors will have to have ready access to the area in order to benefit from the project. Pulitzer's campaign was able to overcome this through appealing to the national pride of his readers and their desire to be recognized for their patriotism. By publishing the names of the contributors in a nationally distributed newspaper, Pulitzer was able to provide a benefit that was transferable to people who were not going to be directly affected by the construction of the statue. However, many contemporary architectural crowdfunding campaigns do not have the lofty ambitions or patriotic ideals of his campaign nor the ability to provide a reward that carries as much weight as Pulitzer's offering. Rather, many campaigns for architectural projects are limited in the number of people they will benefit and thusly, the quantity of individuals that will donate to their project. In order to compensate for this, many campaigns become even smaller and more community specific in order to best appeal to a specific group of people. This has led the prototypical crowdfunded architectural project to become a small public amenity or an urban intervention within areas that are traditionally underserved by public investment (Davies 46). A common manifestation of this is small urban gardens that can be used to grow fresh food or parks within blight stricken neighborhoods. Both of these common projects can be constructed with minimal investment, but in turn create only marginal benefit for the community (Davies 42).

FIGURE 3- *Promotional image from Boleyn Road Community Garden*

When projects of a larger scale are proposed within crowdfunding systems, they are subject to fairly grim chances of success. Out of all the projects proposed on platforms such as Spacehive, only about 40% are successful and those that do succeed only raise approximately $44,000 on average (Spacehive 2015)1. With the average communal building in the United States costing over $2 million (calculated against national average for new construction size (19,000 sqft.) on BuildingJournal.com), the low success rate of these platforms begins to be understandable. At the same time, Kickstarter, a crowdfunding platform that supports a wide range project types, has seen unequaled success in funding of community space projects. Out of over 350 community space projects that have been started on the platform, 80% of them have been successful with multiple projects such as

1- *Many of the most successful projects on Spacehive utilize the crowdfunding platform for only a percentage of their total budget with significant contributions coming from Non-profit organizations and government matching grants.*



TOP - FIGURE 4, *Jennings Hotel Crowdfunding Campaign*
BOTTOM - FIGURE 5, +*POOL Crowdfunding Campaign*
Image Source - Kickstarter

hotel in Oregon (Jennings Hotel, Kickstarter) and a pool in New York City's East River (+Pool, Kickstarter) raising well over $100,000. The Kickstarter platform has two notable parameters that set it apart from other crowdfunding systems. Namely, Kickstarter forces projects to set a minimum funding goal. If this goal is not reached within a set amount of time, the funds are not given to the project. This generates a sense of urgency that encourages interested individuals to act immediately rather than remaining a passive supporter. Secondly, Kickstarter encourages projects to set donor rewards which individuals can receive for contributing certain amounts of funding. This encourages projects to establish a series of reward benchmarks that have a mass appeal in order to attract the widest array of donors who may contribute in order to receive a specific reward.

ACCESSING ARCHITECTURAL POTENTIAL

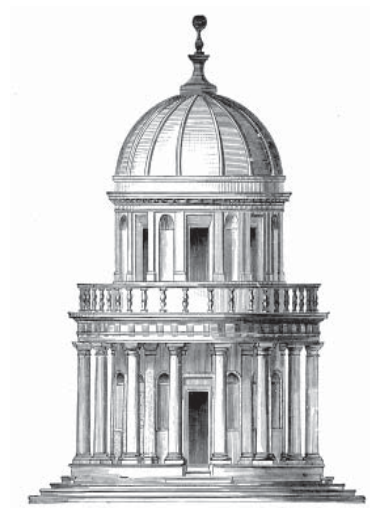
A NEW TYPOLOGY

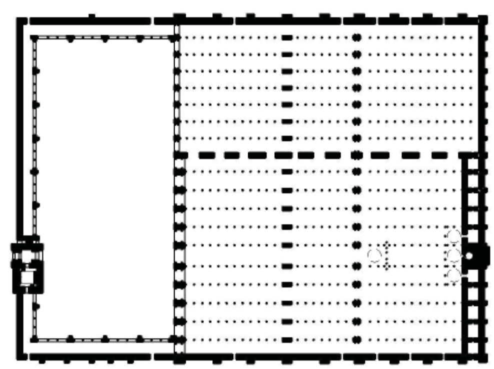
For crowdfunding, the question begins to be posed whether the way projects are designed and constructed can be used to create a more successful project. This new mode of design would give primacy to elements that complement the advantages of crowdfunding while diminishing its limitations. By doing this the success rate of projects may be increased while opening the possibility for more ambitious and unique crowdfunding projects. In order to accomplish this, the design process would need to outline a strategy for the organization of building elements as they are funded so the building may be functional at any stage of the campaign. On top of this, the typology must be adaptable to a variety of programs and uses while still being able to adapt to a highly variable size of financial contributions from project to project.

ORGANIZING SYSTEMS

PARTS ARE SIMPLY PARTS

Since Antiquity, many architects have strived to design perfectly proportioned structures that follow the Aristotelian adage “the whole is the sum of the parts” (Aristotle). Under this notion, the design that is manifest as built form must be whole upon completion. Because of this, the form that is wrought is the optimal configuration of elements and thus greater than the elements alone. During the Renaissance, Leon Battista Alberti went further stating, “Beauty is the adjustment of all parts proportionally so that one cannot add or subtract or change without impairing the harmony of the whole,” (Alberti) This was supported by many architectural exercises in formal proportion during





TOP - FIGURE 6, *Bramante’s Tempietto. 1502, Rome, Italy*
Image Source: Wikimedia Commons
BOTTOM - FIGURE 8, *Great Mosque-Cathedral of Cordoba. 784-1523, Cordoba, Spain (addressed on next page)*
Image Source: Archnet

that time such as Bramante's Tempietto (Figure 6). These approaches are perfectly valid for buildings utilizing traditional financing methods as a few large sums of money given at one time are directly translated into a cohesive whole.

On the other hand, crowdfunding campaigns for architectural projects are defined by their accumulation of parts. If the design of a crowdfunded building is beholden to the doctrine displayed by Aristotle and Alberti, the building would only be successful if it achieves its loftiest funding goal and converts those resources into the only valid iteration of the design. With 70% of crowdfunded architectural projects failing to achieve their funding goals, this is not a viable model. Instead, crowdfunded projects should embrace their origins as aggregated systems which come together to form occupiable structures. Such an approach is shown within the +POOL crowdfunding campaign[1]. Within this project, the creators divided the entire form into 70,000 pieces, each of which is purchasable by a crowdfund campaign donor (+POOL, 2015). However, these pieces cannot operate independent of each other and, because of this, are not truly parts but fractions of the designed whole. The pool cannot be completed without having all of the pieces in place, and will fail if all 70,000 pieces are not purchased.

The delineation between fraction and part is expressed at the theoretical level within Gilles Deleuze and Felix Guattari's 1980 text, *A Thousand Plateaus*. According to the authors, parts, addressed by the authors as rhizomes (Figure 7), are critical in the formation of a state of matter known as assemblages rather that wholes. An assemblage, in an architectural sense, is a jumbling together of discrete building elements that produce a number of distinct forms and functionalities (Deleuze and Guattari 28). This haphazard jumbling is diametrically opposed to the development of the whole. The whole is drawn from beginning to end with the goal of producing one dominant form or function.

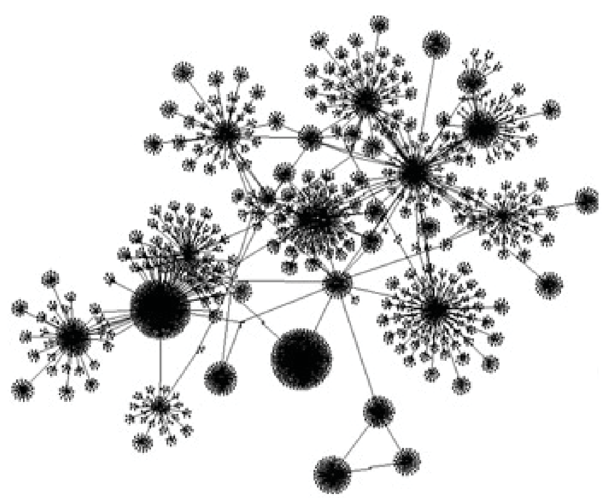


FIGURE 7, *Diagram of a rhizomatic assemblage. The network is defined by a network of individual elements that can readily be reorganized into different configurations Image Source: Creativity and Innovation in Education*

1- *For more information on the +POOL project, see the case study section of this document.*

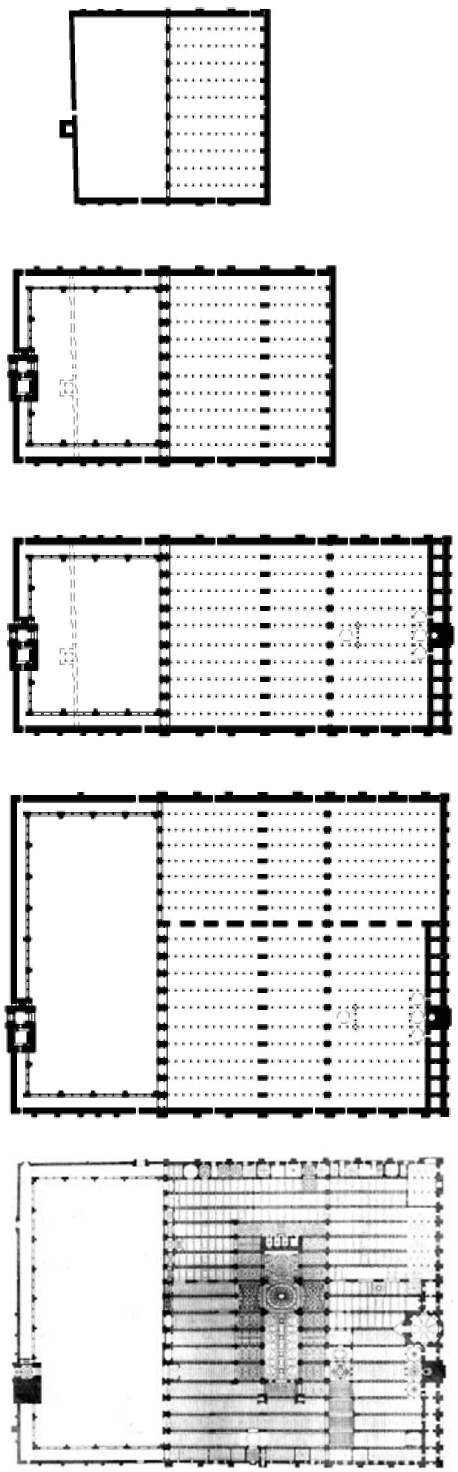
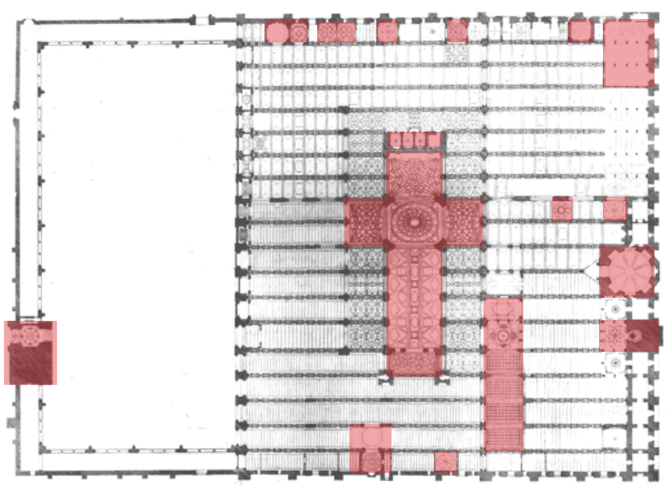


FIGURE 9, *Development of the Great Mosque-Cathedral of Cordoba. 784-1523*
Image Source: Archnet

On the other hand, an assemblage is in constant flux and can only be given a determined form or function through the organization of its network of parts. This organization allows an assemblage to achieve an equilibrium and, in the case of a building, create a space that could satisfy the needs of a user. When this equilibrium is disrupted by the addition of more parts, the system can be reorganized in order to welcome these new elements into the network.

The usage of a network of parts in architecture is illustrated historically within the Great Mosque/Cathedral of Cordoba, Spain[1] (Figure 8). Originally constructed in 784 CE by the Moorish Caliphate, the building was continually expanded and added onto over the course of 800 years in order to compensate for additional size, programmatic demands, and opulence (Figure 8) (Catedral Cordoba). This pattern of continual expansion would be impossible to accomplish with the belief that architectural form is whole upon completion. Rather, during the Moorish period a repeatable part was identified, the structural bay (Figure 10). By repeating this part and supplementing it will specialized programmatic components (Figure 11), a system could be established where “parts are not fragments of wholes, but simply parts” (Allen 94) which could be used pragmatically, rather than to assert a dominant reading of the space. These parts

1- *For more information on the Great Mosque/Cathedral of Cordoba, see the case study section of this document.*



TOP - FIGURE 10, *Structural bays at the Great Mosque-Cathedral of Cordoba*
Image Source: Famouswonders.com
BOTTOM - FIGURE 11, *Diagram showing unique program components within organizing grid within the Great Mosque-Cathedral of Cordoba. Plan View*
Image Source: Archnet.org, overlay by author

and components could be arranged in a number of variable configurations to best fit programs. As resources became available, more parts were added and then complemented by additional components in order to increase the function of the building while filling the desires of the community.

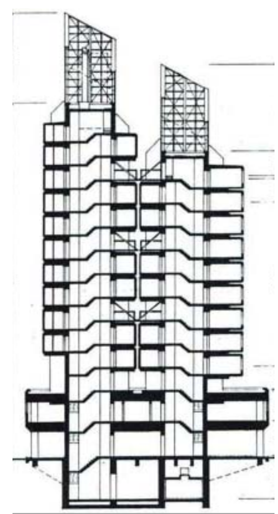
FIELD ORGANIZATION

The Great Mosque of Cordoba serves as an important precedent that can be reapplied to crowdfunded buildings not only because of how it determined a language of parts that could be expanded as resources were added but also because of how it defined a logic of expansion. When analyzing the building in his 1999 text, *Points + Lines*, Stan Allen notes that the initial phase of the building follows the traditional mosque typology: ten parallel walls oriented towards Mecca punctured by a system of arches at a regular interval. At the intersection of the two systems, a column is placed, acting as a visual indicator of the field that is generated by the walls and their punctures. When more parts were added to the building, they were organized upon this pre-established field. If the building needs to expand further, more columns are added to the system in accordance to the field organization logic.

For crowdfunded buildings, it is possible that parts will be continually added to the system as funds are raised. In order to properly account for this, the designer must create an organizing field that is prepared to accept parts as they are made available. This field “is a space of propagation, of effects. It contains no matter or material points, rather functions, vectors, and speeds,” (Kwinter 1986 qtd. in Allen 92) which can serve as the informing logic driving the placement of objects as they are accumulated.

METABOLISM AND GROWING SYSTEMS

In the 1960’s, avant garde Japanese architects such as Kenzo Tange and Kisho Kurokawa began exploring architectural spaces that are redefined over time. According to Kurokawa, many of the architects of this period were fascinated by the dramatic change in the relationship between urban fabric and the landscape after a disaster. Following World War II, many Japanese cities were completely destroyed, eradicating their urban fabric. Yet, the landscape and the organizing elements of the urban system such as roads retained their character. As the urban fabric regrew, it filled in the voids that had been left in the landscape by the destruction of the previous built environment. Their new design methodology, Metabolism, sought to establish a similar relationship between a permanent organizational structure and temporary programmatic components (Kurokawa 28). While presenting the ideals of the movement in 1959, Kiyonori Kikutake described this relationship akin to the relationship between a tree and its leaves (Lin 26). In a Metabolist building, a permanent core could be developed like the trunk of a tree. As architectural functions are needed, branches grow out from the core and are populated with leaves in the same way programmatic components could cluster around a circulation element. These programmatic components could be removed and updated similar to a tree shedding its leaves and growing new ones.



LEFT- FIGURE 12, *Kisho Kurokawa’s Nakagin Capsule Tower. 1970, Tokyo, Japan*
Image Source: Wikimedia Commons
RIGHT - FIGURE 13, *Sectional diagram showing “tree and leaves” relationship of parts”*
Image Source: Archnet.com, overlay by author

The Metabolist methodology is illustrated clearly within Kurokawa's 1972 Nakagin Capsule Tower (Figure 12, 13). This building is defined by a structural element that is analogous to a tree trunk and is to remain largely unchanged throughout the lifespan of the building. This element is then be surrounded by programmatic components that are plugged into the structural frame of the building. These elements are analogous to the semi-permanent leaves that are fixed upon the branches reaching out from the trunk of the tree. As these programmatic elements become obsolete or are no longer needed, they can be removed and new units can be added to the structural core (Kurokawa 102).

Following the Metabolist philosophy of designing systems that can be adjusted in size based upon the needs of the users is critical for the development of crowdfunded buildings. As a crowdfunded project garners support, a system such as this can accommodate a growth in scale alongside an increase in financial support. When the project begins to fail to generate additional community support, the project can be halted and constructed in a way that represents the amount of support it has garnered. This system has been implemented successfully within Moshe Safdie's Habitat 67 project in Montreal, Canada (Figure 14). The project was originally intended to be constructed with 2000 identical prefabricated concrete units, yielding 1000 apartments (Sharp Twentieth Century Architecture: a Visual History p.281). However, during the construction phase, the project was scaled back to only 158 units. Due to the dexterity of the aggregative system, the project was able to be easily altered to meet the new demands of the program.

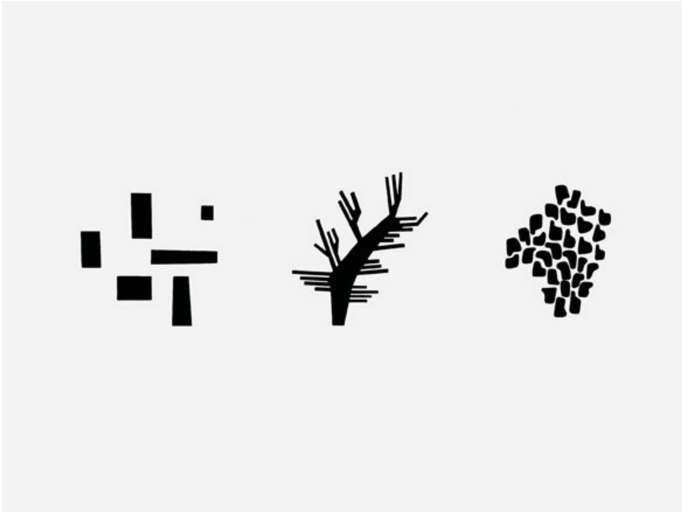
COLLECTIVE FORM

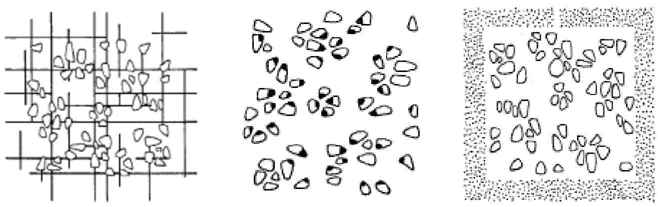
Unfortunately due to the large initial investment required to fund a super structural element that can support all the other systems of a building, the methodology described by Kurokawa within

FIGURE 14, *Moshe Safdie's Habitat 67. 1967 Montreal, Canada*
Image Source: Dezeen

the Nakagin Capsule Tower and many other early Metabolist designs is not feasible for a crowdfunded system. However, later contributors to the Metabolist movement such as Fumihiko Maki began to move away from the primacy of the structural skeleton element and instead began to focus on the relationship between the smaller programmatic structures. Maki referred to this new focus as collective form, or form that is derived through the aggregation of human scale elements through a generative logic.

The generative logic that Maki outlines draws immediate comparisons to the field organization systems described by Allen and Kwinter; however, Maki's efforts are focused on describing the objects that are placed within the system rather than the system itself. In his 1964 article "Investigations in Group Form," Maki highlights a series of techniques that preserve the cohesion of an architectural system with multiple unique components (Maki 29, Figure 15). First among these techniques, or linkages as Maki refers to them, is the consistent usage of similar materials and forms with slight variations between unique elements. This establishes a visual continuity throughout the system that can be immediately understood by an observer while not creating identical spaces. This visual linkage can be supplemented by a mediating system or a physical connection between units through

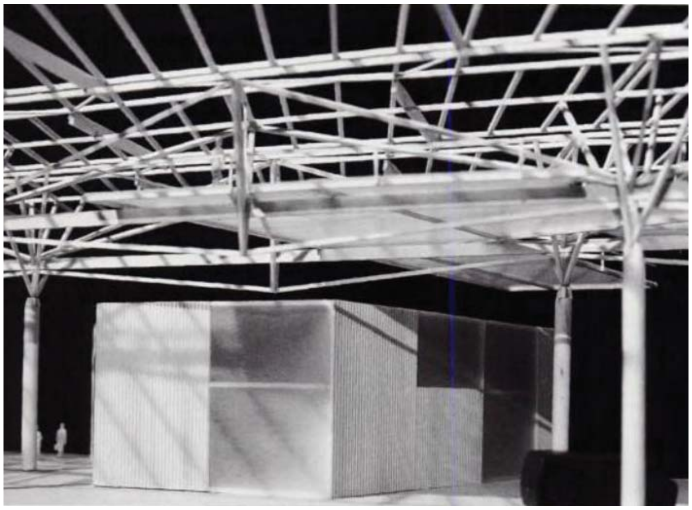


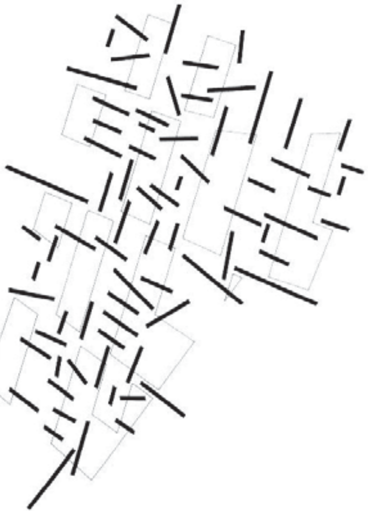


TOP - FIGURE 15, *Types of group form: Compositional, Mega, and Collective*
Image Source: Investigations in Collective Form, Maki 6
BOTTOM - FIGURE 16, *Types of collective form linkages: Mediation, Repetition, and Selection*
Image Source: Investigations in Collective Form, Maki 25

a separate material or experience. According to Maki, this can be accomplished with shading structures, composed open space, and prescribed pathways (Maki 37). Finally, Maki argues that a collective form can be identified through a process described as selection, or an independent system encompassing a group of individual units, thereby giving them all a shared characteristic. This can be accomplished through structures such as large continuous shading devices or plinths that differentiate certain units from units that are selected by the structure (Figure 16).

Each of Maki's group form linkage techniques are utilized within Stan Allen's 1996 entry for the Barcelona Logistical Activities Zone Competition (Allen 73, Figure 17). Within this project, Allen organizes a series of programmatic boxes made of channel glass underneath a large shading canopy. Immediately, it is easy for the visitor to distinguish that the project is a collection of a single forms as the boxes are topologically related to one another and each utilizes a similar material palette. From here, Allen highlights a collection of mediating elements that stitch the individual components together along circulation paths (Figure 18). Finally, the entire project in covered with a single continuous roof, showcasing Maki's concept of selection by uniting all the individual units beneath a single shading structure.





TOP - FIGURE 17, *Barcelona Logistical Activities Zone. Competition, 1996*
Image Source: Points + Lines, Allen 72
BOTTOM - FIGURE 18, *Diagram illustrating linkages between disparate building elements*
Image Source: Points + Lines, Allen 83

By serving as a logic to unite unique elements or parts, Maki's theories on collective form lend themselves to the design of crowdfunded buildings. A mediating system can unite each independent part into a single collective form despite being added to the system separately. This is critical to crowdfunded buildings as individual parts will be funded and added to the system at different times. Even if there is already an established logic for the placement of parts, they will not be truly united without utilizing a linking system outlined by Maki.

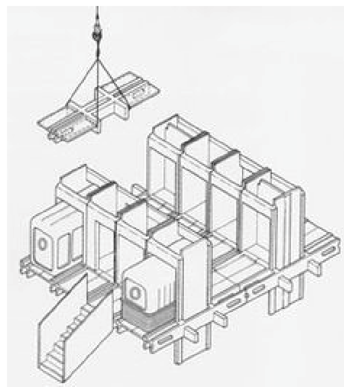


FIGURE 19 *Axonometric View Prefabricated Apartments Image Source: Kenzo Tange and the Metabolist Movement*

ADAPTABLE PROGRAMMATIC STRUCTURES

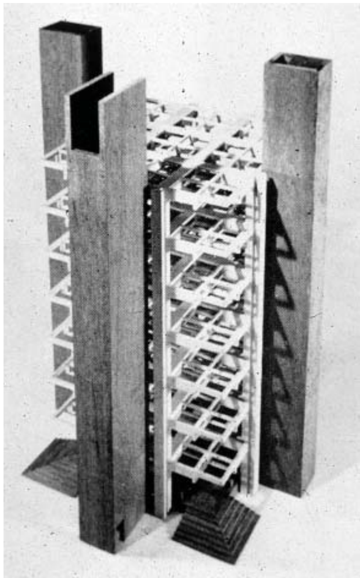
AGGREGATING FUNCTION

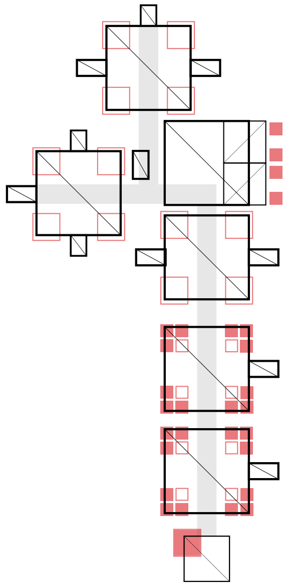
Throughout the Modernist movement in architecture, the program of a building and its form were inseparably intertwined. As Louis Sullivan famously stated, "form follows function," and in keeping with this credo, a building must be designed to house a specific use or fill a particular need. However, as the Great Mosque of Cordoba has highlighted earlier, the programmatic needs of a building may shift over time, requiring the form to adapt to the new desires of the user. This is expressed through the transformation of the structure from a mosque to a church following the Spanish Reconquista (Figure 9, p. 12). By inserting a nave and the other trappings of a church, the function of the space has been altered, while the formal logic of the building is preserved.

During the 1960's, Metabolist designers such as Kisho Kurokawa also challenged the primacy of function in the design of architectural form and insisted that buildings would never contain fixed uses. Instead, the functions of spaces would change as technology and demand changed (Kurokawa 42). Within this new paradigm, programmatic components would be refreshed and replaced as more advanced iterations could be developed.

This is best illustrated within Kurokawa's 1962 proposal for a prefabricated apartment building (Figure 19). Within this project, Kurokawa defines a core living unit such as a living room or a bedroom. He then surrounds the core unit with a series of variable, plugin service units to support the living unit. According to Kurokawa, it is more likely that these service units will need to be updated, while the usage of the living core would remain constant. Whenever a user needs a new service component for their home, the existing one can be detached and a new one added in its place. At the same time, if the building must expand in order to meet the needs of more people, more living units can be added to the system.

These theories are derived from the earlier works of Louis Kahn and exemplified through projects such as his 1957 Richards Medical Center in Philadelphia[1] (Figure 19). Within this project, Kahn defines a single structural unit that can either be wrapped in a brick enclosure or have a programmatic unit such as a stairwell or an office plugged into it (Figure 20). Unlike the tree-like super structure that would come to define the designs of many Metabolist architects,





TOP - FIGURE 20, *Richards Medical Center, 1955*
Image Source: http://www.greatbuildings.com/buildings/Richards_Medical_Center.html
BOTTOM LEFT - FIGURE 21, *Diagram illustrating usage of structural unit*
Image Source: GreatBuildings online
BOTTOM RIGHT - FIGURE 22, *Diagram illustrating implementation of stuctural unit in project. Each bay shown with large square, plug-in units shown in red.*
Image Source: author

1- *For more information on Kahn's Richards Medical Center project, see the case study section of this document.*

Kahn's structural unit is also a repeated part of a larger assemblage. As illustrated in Figure 21, Kahn strategically places this structural unit in stacks in order to group certain programmatic elements together and create mechanical efficiency for the air exchange towers servicing the building's labs. Because of this, similar structural units can be exploited within assemblages or networks of parts such as the systems described by Allen and Kwinter. Within these networks, these structural units act as specialized parts that allow for the creation of further organizing systems within the original assemblage. This can prove critical to crowdfunded buildings as these structural units can act as programmatic nodes that hold space within the system for the development of finer and more specialized programs that have yet to be funded and added to the project.

STRINGS OF PROGRAM

Following the design theories of Kahn and the Metabolist architects, Christopher Alexander; an Austrian architect and professor at University of California, Berkeley; makes an effort to further delineate programmatic components of buildings in his 1979 text, *A Timeless way of Building*. In this text, Alexander goes beyond the spacial dichotomies proposed by Kahn and the Metabolists (service

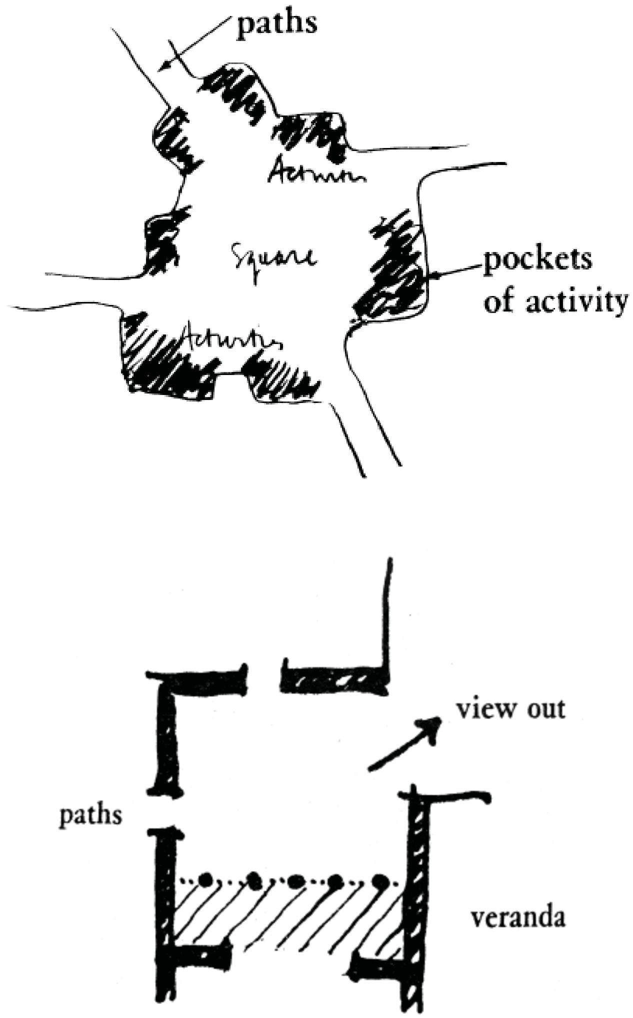


FIGURE 23, *Examples of spacial patterns*
Image Source: A Pattern Language, Alexander 602

versus served, structure versus program) by dividing buildings into interwoven strings of experiences known as patterns (Figure 23). These patterns contain a core characteristic or function that seperates one pattern from another, similar to the compartmentalization of space made by Metabolist architects (Alexander 92). However, Alexander also accounts for complex relationships that are formed between these experiences that are required when designing a network of building elements. For example, within a prototypical cathedral, there is a nave, side aisles, transept, and altar. Each of these elements has a defined event and relationship to other elements intrinsic to its character as a pattern. A nave must be flanked by side aisles, a transept must intersect the nave, and an altar must be placed at the intersection of the transept and nave. Without these relationships, the character of the pattern is compromised and it is no longer the element its name implies (Alexander 90) Thusly, in order for a pattern to remain true to its intended experience and function, its relationship to other patterns must be preserved.

Within the context of crowdfunded buildings, Alexander's patterns present a potential solution to dividing a building into specific configurations of parts that can be funded independently. Each pattern determines the programs and events that intertwined

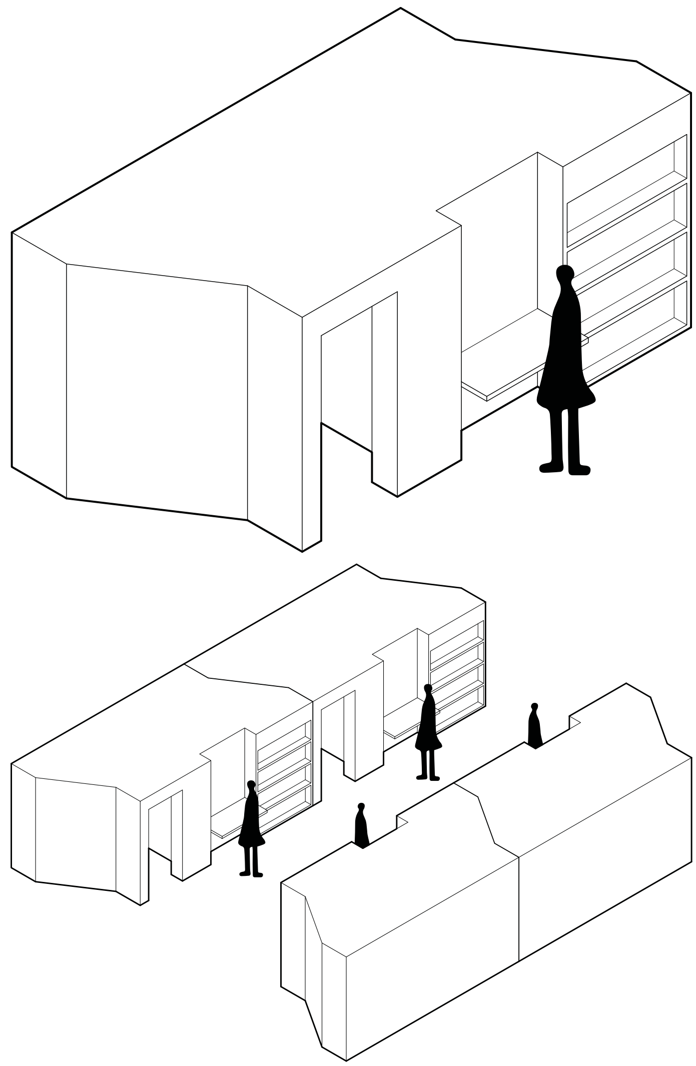
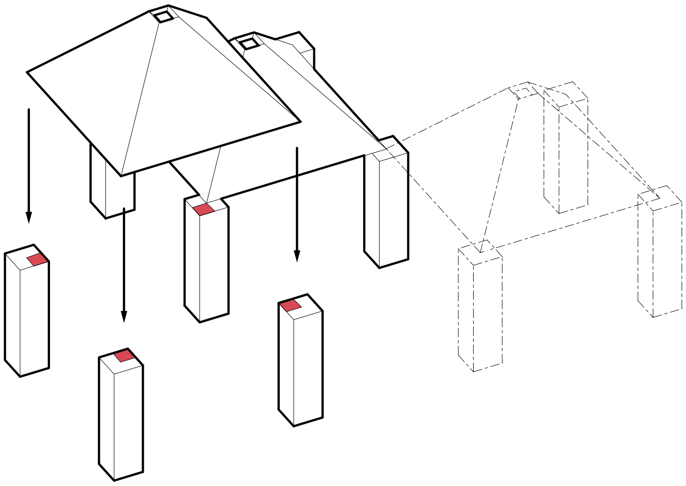


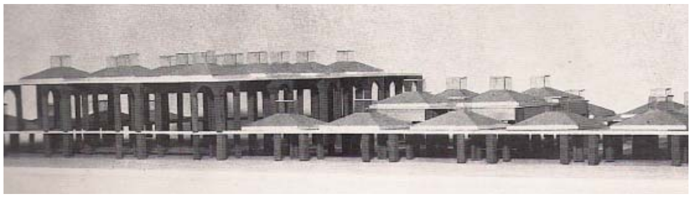
FIGURE 24, *Diagram showing a single programmatic string, or pattern, being aggregated over time. This particular string is a work station for a single person. As more of these strings are added, the space becomes more functional as more people are able to utilize the function of the space.*

and cannot function properly without its supporting parts. By allowing parts of the building to be aggregated pattern by pattern, the designer can ensure that each part has a role within a system already present within the project rather than a part being added that is not ready to be fully utilized by the system. In other words, a function or use will not be added to the building before the other elements that make it possible to be used have been added. As parts and patterns are added, the relationships between the events and functions become more intertwined, allowing each of the disparate systems to come together and function as a cohesive whole once the project achieves its funding goal.

ANTICIPATING THE FUTURE

However, Alexander's analysis of patterns presupposes that they will only occur within whole buildings where all the patterns come into being concurrently. However, if a pattern language is to be utilized within crowdfunded architectures, singular patterns must be able to expect the addition of future patterns as the network is built up over time. In other words, when the first pattern or set of parts is added to the project it will operate alone without a network of other parts around it. However, coded within that first set of parts must be the ability to interact with the network of





TOP - FIGURE 25, *Trenton Bath House*
Image Source: Wikimedia Commons
MIDDLE - FIGURE 26, *Diagram showing the interaction between the roofs and columns within the Trenton Bath House. Plan View*
Image Source: Greatbuildings Online, overlay by author
BOTTOM - FIGURE 27, *Proposed Jewish Community Center, Unbuilt - 1955*
Image Source: Archidialogue.com

parts that are still to be added to the project. Stan Allen defines this intrinsic coding as formal “anticipation” (Allen 86). By designing elements with anticipation, the designer instills the ability for an object to facilitate the growth of a network in a controlled fashion.

A designer instilling their building elements with anticipation is easily seen within Louis Kahn’s 1955 Trenton Bath House (Figure 25). Within this project, Kahn utilizes two primary building elements: a square roof and a large square column that supports it. The columns are oversized in such a way that when the roofs are positioned on top of them, they only occupy a corner of the column (Figure 26). This allows one column to support multiple roof pieces, expanding the system in an orderly fashion around the column nodes. In the case of the Trenton Bath House, Kahn utilized this system to account for the potential of the project being expanded into a larger community center (Figure 27). By adding additional columns and roofs, the system that was designed for the bath house could have easily been scaled up to produce a larger building without changing the design methodology.

Each of the systems outlined earlier lend an important element to the development of a better crowdfunded project. Metabolist architects such as Kisho Kurokawa stress the ability for programmatic components to be delineated into specific functions that can be plugged into existing spaces in order to increase functionality. Kahn’s work on the Richard’s Medical Center outlines a strategy for designing a core building unit that can organize disparate programmatic elements into a single building form as they are added to the project. Alexander begins to describe how programmatic elements should be divided along strings of a single person’s experience rather than aspects of programmatic requirements. This allows a building to have full functionality while also allowing the project to grow by adding onto the scale of that functionality as opposed to being partially functional at full scale. Finally, Allen describes the quality of anticipation which can be designed into building components in order to facilitate the controlled expansion of the project. Each one of these aspects is critical for crafting the pieces that will be funded by the crowdfunding campaign so that the project can be successful.

VARIABLE PART SIZES

SYSTEMS WITH CHANGNING INPUTS

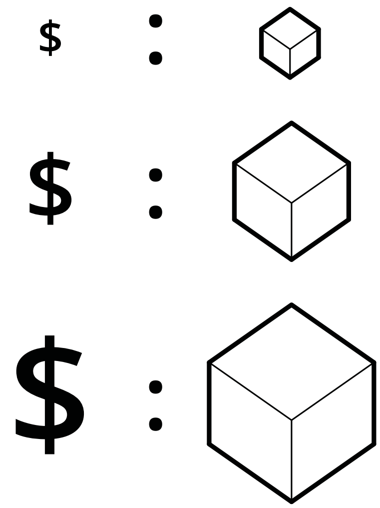
In order to properly take advantage of the crowdfunding methodology, architects must embrace the nature of crowdfunding as accumulating capital towards a larger goal in small increments. In the same

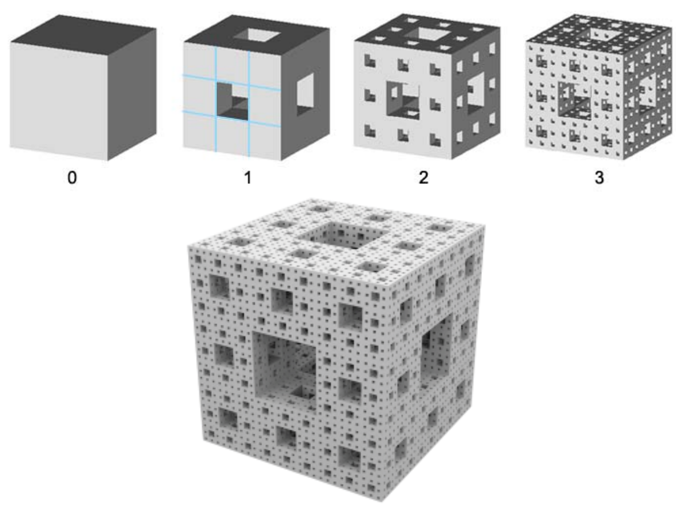
way, buildings following a crowdfunding methodology cannot be formed by large, singular formal moves, but rather through the aggregation of parts to form larger wholes. At the same time, a crowdfunding campaign will be characterized by contributions of wildly varying scales. Most of these will be small, and will be analogous to an individual contributing a single building unit such as a brick or concrete masonry unit to a project. However, crowdfunding platforms such as Spacehive have found that individual donations rarely make up the entirety of a crowdfunding campaign. In many cases, such as in the case of the Glyncoch Community Center (Figure 28), portions of the project were funded by large group donations (Spacehive, Glyncoch Community Center). These larger donations make up a substantial portion of the collective goal and can be used to fund larger components such as a structural bay or an entire string of program. Smaller contributions of single individuals will eventually grow to be equally important to the campaign as these larger parts. Each of these scales of contributions can be articulated within the project as building components that are representative of their contribution to the project. This is critical because the contributor being able to visualize financial support being made manifest into a building component is one of the incentives that is provided to potential supporters of the project. In order to maximize this incentive and draw the most support, a project must overtly display the transformation from financial support into building form within the design of the building.

FIGURE 28, *Glyncoch Community Center, 2013*
Image Source: Spacehive.com

SELF SIMILARITY

One of the ways that a project can express the transformation of financial support into building form is by having an established rate of exchange between financial contributions and building components (Figure 29). In other words, the designer of the project can create a building component that is equivalent to a specific size of contribution. In order to preserve this relationship between these two elements, the building component must be able to scale alongside the financial contribution. Rather than a large contribution being used to purchase multiple building components, it is much more advantageous for visualizing the translation if the larger contribution is used to purchase a single component that is scaled up to match it. This will preserve the self similarity of elements which, as Maki states earlier, lends to the cohesion of the collective form (Maki 27). With all the units being of the same proportion expressed at different magnitudes, they will resemble a mathematical phenomenon known as fractal geometries (Figure 30). Fractals are objects "that display self-similarity on all scales," (Wolfram 2002). In other words, as the contribution is divided or multiplied in scale, it will produce geometry that is identical in proportion to the original object, but volumetrically related to the scale of the contribution. Such systems are utilized within built form by Aranda-Lasch and their application is clearly illustrated within their 2010 Primitives Exhibition for Design Miami (Figure 31). Within this project, a singular primitive is determined and aggregated at varying scales in order to define space. Each scale of the primitive has a defined purpose: the large objects serve as foundations for smaller pieces to aggregate around while the smaller pieces refine the shape of the form by filling gaps left by larger pieces. The multiple scales working in tandem





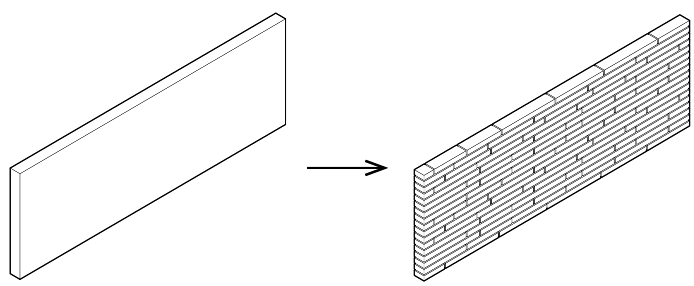
TOP - FIGURE 29, *Diagram illustrating the exchange rate of financial support into building component*
Image Source: author
BOTTOM - FIGURE 30, *Menger Sponge, an example of self similar fractal geometry*
Image Source: https://pbmo.files.wordpress.com/2012/03/menger-sponge.png

are able to achieve forms that a primitive of a single scale would not be able to articulate. A crowdfunded project following this logic would work in a similar manner, first defining the scalable primitive and then aggregating the element into the form that will define the project.

UNITIZATION OF LARGER ELEMENTS

Within crowdfunding campaigns it is not feasible for the project to rely solely upon the larger contributors in order to fund larger building elements. Rather, large building elements must be able to be broken down into smaller parts that can be funded on an individual basis. This difference is shown clearly when contrasting a brick wall against a poured in place concrete wall (Figure 32). The concrete wall is a continuous, indivisible form that is made in a single process. Within a crowdfunded project, it is advantageous to minimize such forms as they would need a large amount of funding at one time. On the other hand, a brick wall still accomplishes the formal goal of the wall yet it is composed of a divisible system. Such a strategy is more advantageous for a crowdfunded project as it allows the wall to be funded piece by piece as support is garnered for the project.

By employing the strategies of designing a building



TOP- FIGURE 31, *Aranda-Lasch's Primitive Installations, Design Miami 2010.*
Image Source: Arandalasch.com
BOTTOM - FIGURE 32, *Diagram illustrating the unitization of larger building elements*
Image Source: author

that encompasses the minimum required elements of success at all stages of funding, programmatic elements that can be plugged into the minimum building form, and individual construction units that can aggregate into larger structures of a similar language, designers can craft buildings that are better suited for the methodology of crowdfunding. In turn, this will allow community members the best opportunity to take charge of what is built in their neighborhoods. These two forces working in tandem can create better crafted communities formed of structures that are the physical manifestation of the support that the community members have for them.

ANNOTATED BIBLIOGRAPHY

"About +POOL." +POOL. Friends of +POOL, n.d. Web. 07 Sept. 2015.

The Friends of +POOL, a non-for-profit organization that supports the +POOL funding effort, describe the crowdfunding process for a prospective pool in New York City's East River and the critical elements that have led to the project's inception as well as the problems encountered by the team. This project serves as a test case for future crowdfunding development through its implementation of phased crowdfunding campaigns, unitization of the building form into fundable pieces, and generation of public support through a successful marketing campaign. The +POOL is still in the early stages of development, but the project is serving as a vanguard for crowdfunded architecture and is encountering problems and developing solutions for the methodology for the first time.

Alexander, Christopher. The Timeless Way of Building. New York: Oxford UP, 1979. Print.

In his 1979 text, Christopher Alexander outlines a new paradigm for design that relies on the repition of design patterns within buildings. These patterns have been generated by Alexander through a series of quantative and qualatative analyses of spaces in an effort to distill the characteristics that make up the best buildings. Alexander argues that by designing with these specific patterns within new projects, the qualities of space that are experienced within these optimal conditions can be replicated, enhancing the new space. These patterns divide buildings into smaller component parts which can recombined with other elements to generate optimal spaces that meet other functional requirements.

Allen, Stan. Points Lines: Diagrams and Projects for the City. New York: Princeton Architectural, 1999. Print.

Allen describes an architecture that is comprised of different component parts that are then organized in accordance to the inherent properties of the project site. These inherent properties are determined by a rigourous documentation of various qualities present within the site. When all of these qualities are displayed graphically, it reveals the charged field present within the site which the architect can use as a tool for designing a project that is specifically suited to serve the site on which it is placed.

Lin, Zhongjie. Kenzo Tange and the Metabolist Movement: Urban Utopias of Modern Japan. New York: Routledge, 2010. Print.

An outline of the development of the Metabolist movement in Japanese architecture. Lin describes the philosophical goals of the movement and how they were achieved by several of the movement's prominent architects as well as the failings of the movement and its inability to achieve its lofty goals. On top of this, Lin describes the influence that Louis Kahn had on the movement and how his designs can be reinterpretted in the context of Metabolism.

Davies, Rodrigo. "Civic Crowdfunding: Participatory Communities, Entrepreneurs and the Political Economy of Place." Thesis. Massachusetts Institute of Technology, 2014. Print.

Rodrigo Davies explores crowdfunding and its potential to impact the built environment through the lens of scholarly inquiry, a perspective, he states, is missing from the current analysis of crowdfunding. In his text, Davies focuses on the phenomenon of civic crowdfunding, or crowdfunding for community oriented projects and its particular implications on communities and politics. From here, he describes the dynamics of a crowdfunded project and the potential for future projects in the field. According to Davies, crowdfunded buildings have a unique potential to secure investment from all economic sectors, public; private; and civic, and thusly could be a more optimal way of creating community spaces that are best received by the entire populous. On top of this, Davies outlines a plethora of data on a multitude of crowdfunded projects including what has been successful in the past which can serve as a point of reference for future projects in the field.

Maki, Fumihiko. Investigations in Collective Form. St. Louis: School of Architecture, Washington U, 1964. Print.

Maki offers an alternative to the standard paradigms of design known as collective form, an aggregative design methodology that is focused on human scale elements. On top of this, he outlines specific methods in which this the design paradigm can be utilized and how architects can enhance their collective designs through the implementation of linking elements. These linking elements ensure that the project reads as a single building despite being made up of smaller units.

CASE STUDIES

CHILDREN'S HOME

ALDO VAN EYCK *AMSTERDAM - 1960*

Built on the outskirts of Amsterdam, the Children's Home was intended to be a small urban environment which would contain all the functions necessary to house an orphanage. In order to accomplish this, Van Eyck designed a single building unit and aggregated it into a spiraling manner around a sequence of outdoor public spaces while tightly constraining the building to a grid created by the building unit. For communal spaces, multiple units were grouped together to form larger units that rose above the normal unit, creating a visual heirarchy that was evident within the massing of the building.

The building units themselves are composed of four round concrete columns supporting concrete lintels which in turn support a flat dome roof. The joints between each unit are clearly articulated which allows the building to be visually decomposed into its component parts by a viewer moving through a building. The walls are kept seperate from the rigid unit, allowing for Van Eyck to keep the space fluid underneath an orderly canopy and allow the residents ample access to the outdoors.

FROM: http://www.archdaily.com/151566/ad-classics-amsterdam-orphanage-aldo-van-eyck
FIGURE 1 - *First Floor Plan*
FIGURE 2 - *Section through communal space*
FIGURE 4 - *Aerial View*
FROM: https://thesleepofrigour.wordpress.com/2013/01/06/the-orphanage-amsterdam-1960-aldo-van-eyck/
FIGURE 3 - *Courtyard View*

FIGURE 1

FIGURE 2

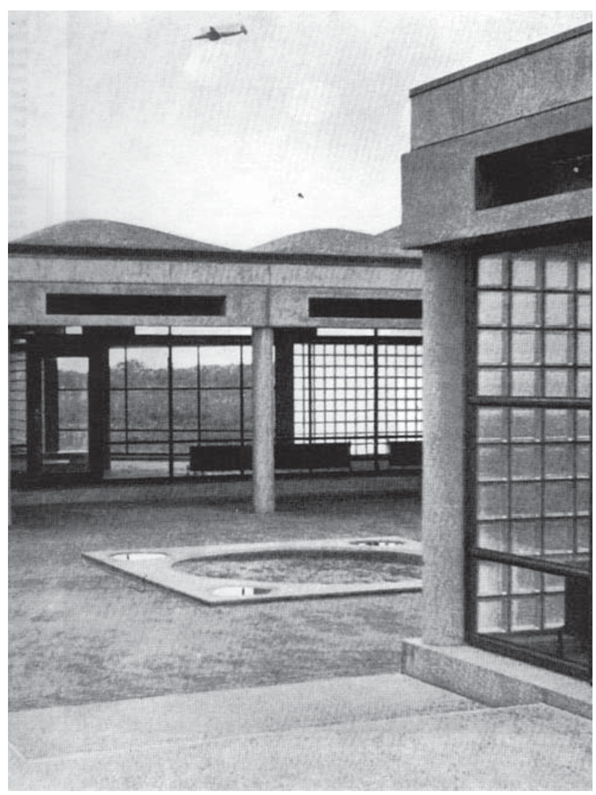


FIGURE 3

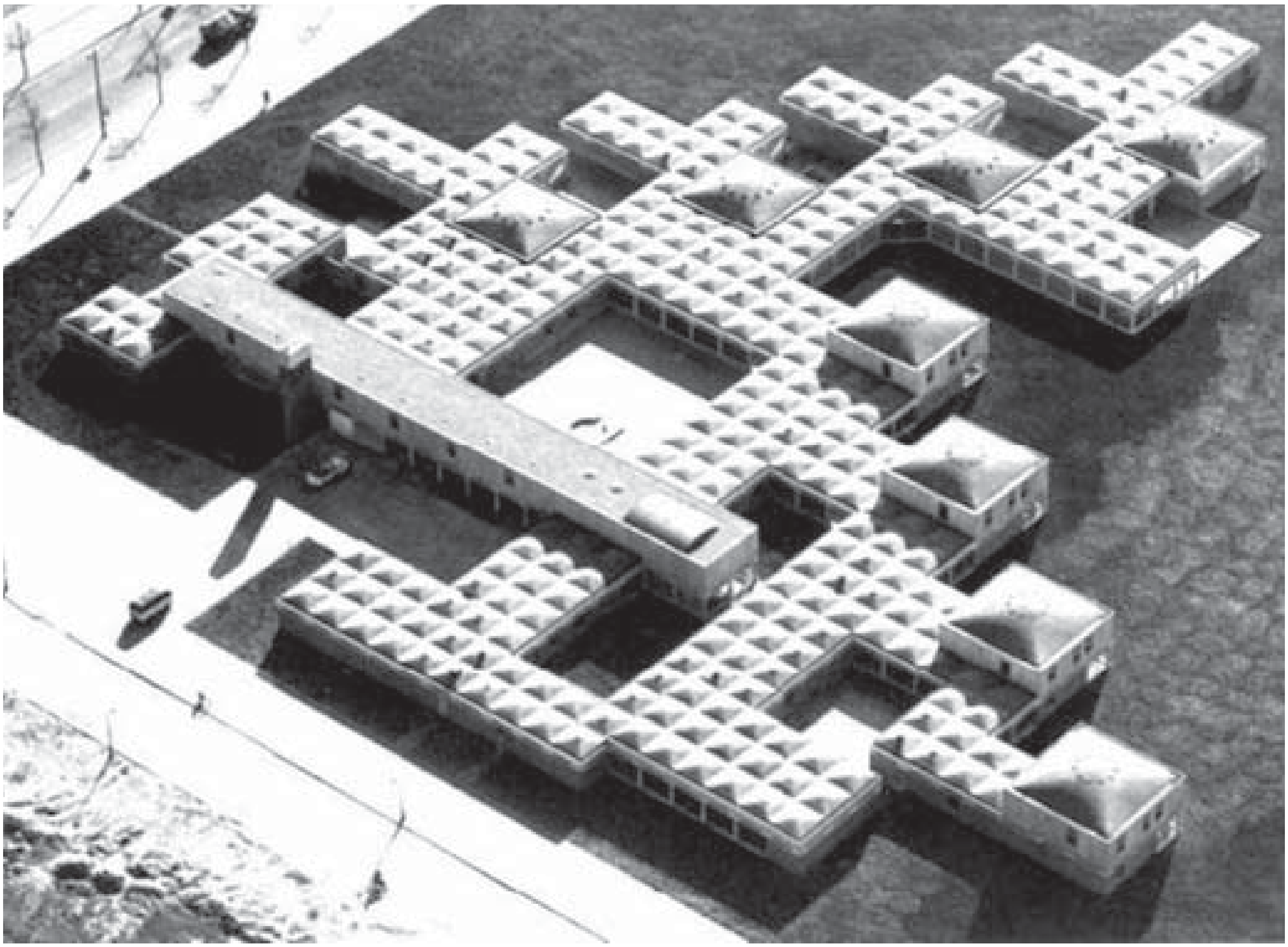


FIGURE 4

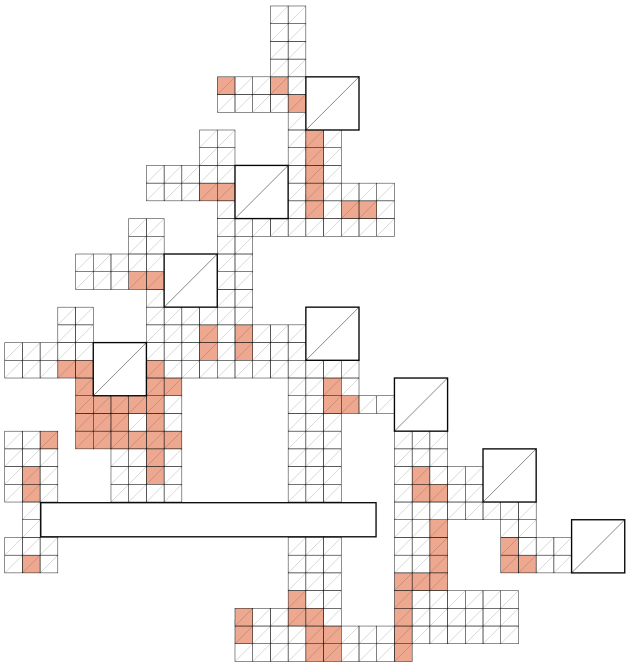


DIAGRAM 1

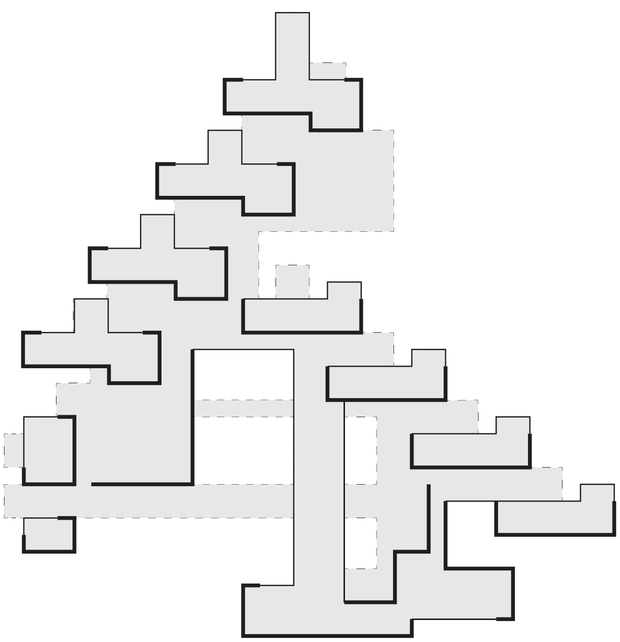


DIAGRAM 2

The rigor of the geometry within Van Eyck's design is clearly expressed within **Diagram 1**. Each standard component is articulated by a small square which are used to to make up most of the buildings form. The exceptions to this component are the larger communal component pieces and a large administrative bar that unites the two spiraling arms together while also defining a central court. The standard unit is periodically cycled out for a skylight unit of the same size in order to provide daylight to the corridors. These skylight units are highlighted in red.

The walls used by Van Eyck to define programmatic boundaries are evident within **Diagram 2**. Concrete walls are expressed through a thick line, glass is shown with a thin line, and paved space by the dotted boundary. In this diagram, Van Eyck's intention to create a small scale urban-like space is clear through the articulation of independent elements united through flowing corridors that act as roads.

TOP - DIAGRAM 1 - *Geometric Divisions*
Image by author
BOTTOM - DIAGRAM 2 - *Programmatic Divisions*
Image by author

Diagram 3 shows the continuity of the geometry into the section of the buildiing where the larger communal spaces are elevated above the smaller standard units, which are half a unit smaller in height. Also shown in this diagram is the replacing of standard units with skylight units shown in red.

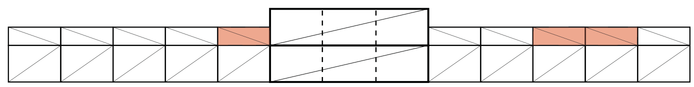


DIAGRAM 3

Diagram 4 shows a single building unit as used within the Children's House. The unit is composed of a single kit of parts that is repeated from unit to unit.

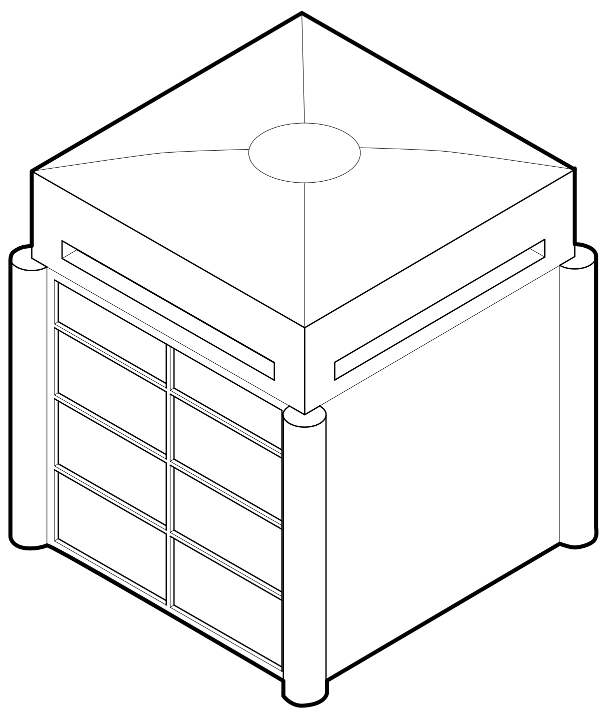


DIAGRAM 4

TOP - FIGURE 2 - *http://www.archdaily.com/151566/ad-classics-amsterdam-orphanage-aldo-van-eyck*
MIDDLE - DIAGRAM 3 - *Geometric Divisions, Section*
Image by author
BOTTOM - DIAGRAM 4 - *Building Unit*
Image by author

HABITAT 67

MOSHE SAFDIE *MONTREAL - 1967*

Designed as an experimental solution to a growing housing crisis in Canada, Safdie's proposal outlined the use of prefabricated housing units aggregated into a growing building form. Unlike previous similar systems, Safdie choose to aggregate the units irregularly, creating large gaps between units. These gaps then became private outdoor for each one of the units, an ammenity that was rare within public housing systems. On top of this, the single unit utilized within the building could be easily manipulated into a variety of housing forms without changing the pieces being used. The end result is a building where each housing unit has a distinct identity seperate from the whole, yet is made from the same components as each of the other housing units.

On top of this, the original plan by Safdie called for the construction of 2000 prefabricated elements to produce 1000 units of housing. However, the project was scaled back to only consist of 158 units, illustrating the capabilities for a aggregated system to easily adapt to the needs and desires of the client.

FROM: http://www.dezeen.com/2014/09/11/brutalist-buildings-habitat-67-montreal-moshe-safdie/

FIGURE 1 - *View from Entrance Court*

FIGURE 2 - *Construction Photo*

FIGURE 3 - *Unit assembly diagram*

FIGURE 4 - *Exterior View*

FIGURE 1

FIGURE 2

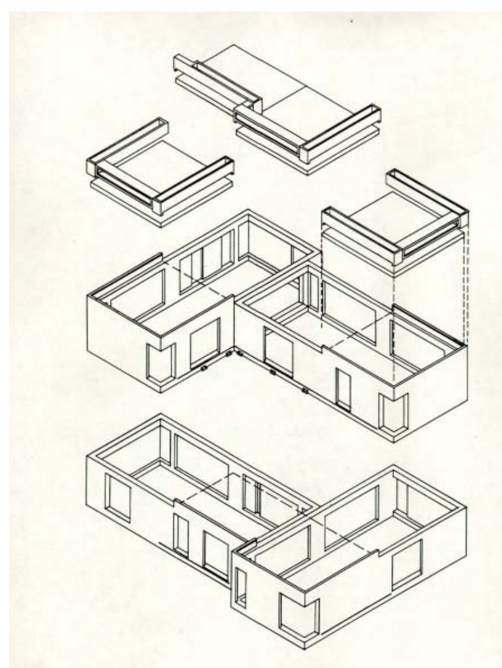


FIGURE 3

FIGURE 4,

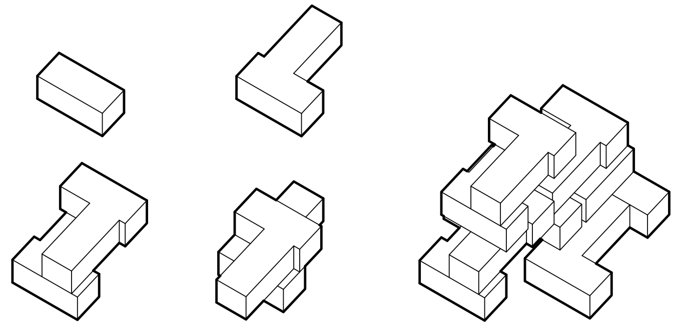


DIAGRAM 1

Diagram 1 shows the process for aggregating the individual units into a complete whole. By exploiting overlaps created by how units were combined as well as possibilities present when rotating the units, a branching form can be created that results in the unique form of Habitat 67.

Diagram 2 shows the multitude of arrangements that were capable from the standard unit present within Habitat 67. The various relationships between the unique indoor spaces and their resulting outdoor spaces are shown in red.

Diagram 3 shows the final aggregation of the building form, with each arrangment variation keyed with a different shade of green.

TOP - DIAGRAM 1 - *Aggregation Strategy*
Image by author
BOTTOM - DIAGRAM 2 - *Arrangement Strategy*
Overlay by author, underlay by Dezeen
RIGHT - DIAGRAM 3 - *Final Arrangement of units*
Image by moremorexless.blogspot.com

DIAGRAM 2

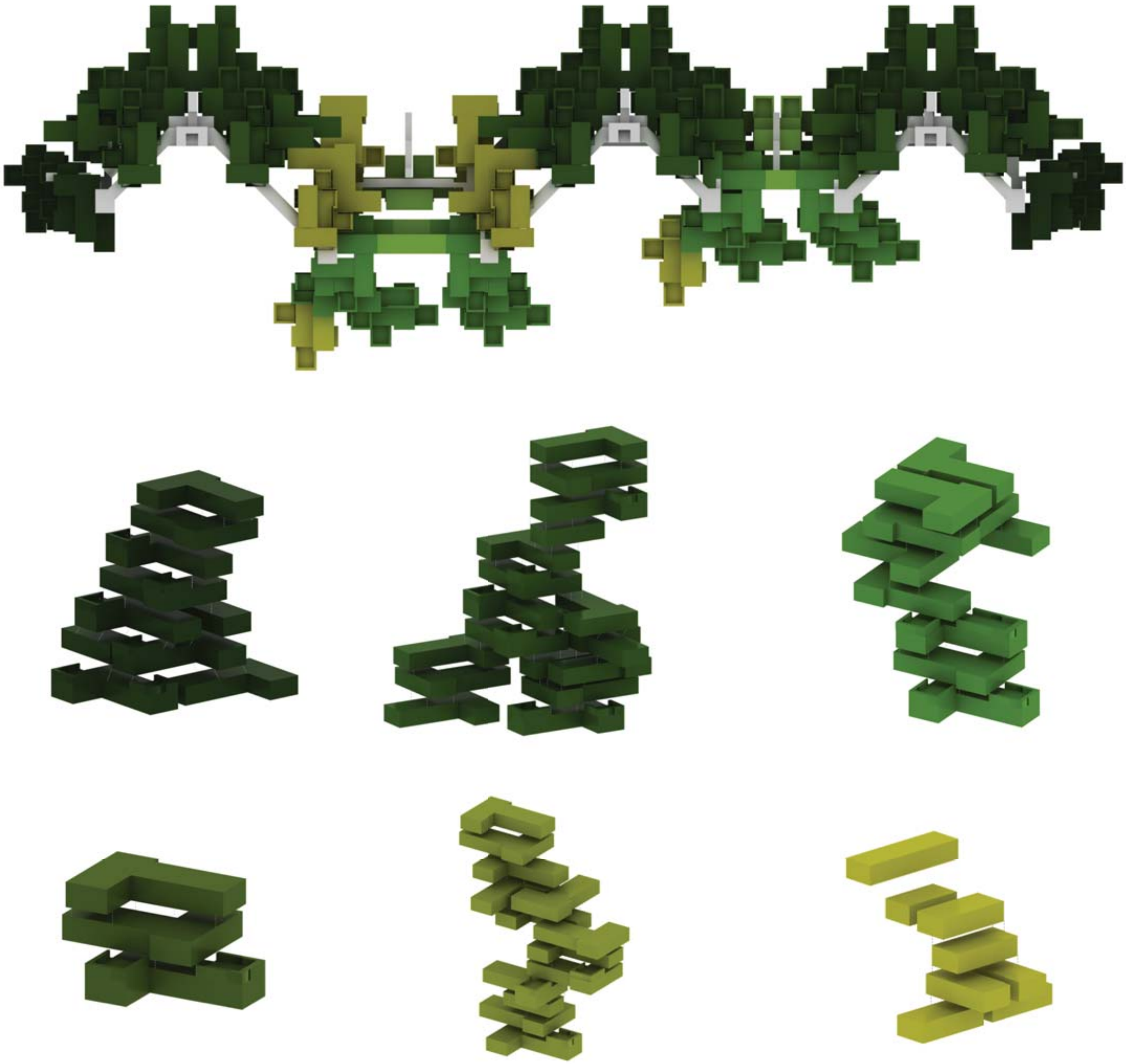


DIAGRAM 3

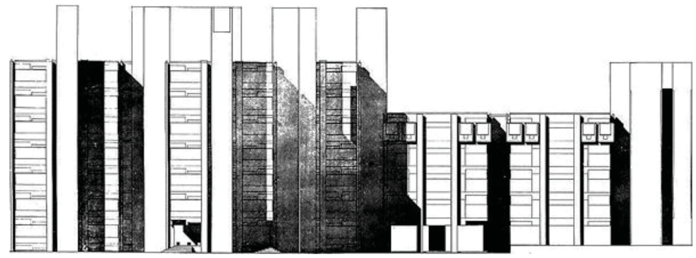


FIGURE 1

RICHARDS MEDICAL CENTER

LOUIS KAHN PHILADELPHIA - 1957

In order to solve the complexities surrounding a demanding labratory program, Kahn sought to isolate the labs in stacks and then provide them with ample light and ait with services selectively plugged in around the perimeter. This resulted in six moderately sized square towers loosely linked by a single corridor with large windows at the corners. In the centers of the towers, tall, slender service towers were attached to provide ventilation and vertical circulation. In addition to these, offices and specialized labs were also plugged into the corners of the towers, giving these more human elements of the program access to natural light and ventilation.

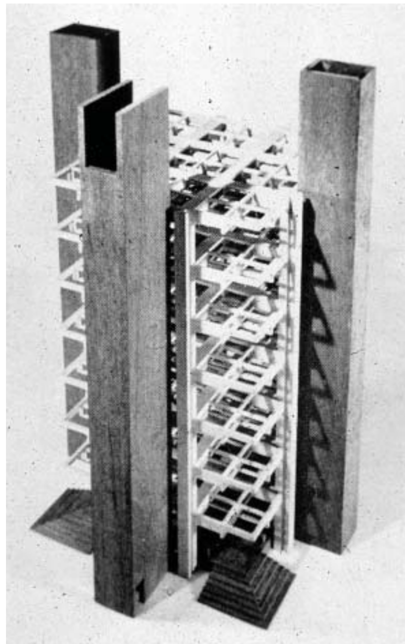


FIGURE 2

Central to the success of this scheme is an adaptable square floor plate further divided into nine smaller squares. As programmatic elements are needed, Kahn either replaces one of the smaller squares with the new element or attaches a new element to the perimeter of the floor plate. Once a floor plate has reached capacity, a new one is added on top of it or another tower is added adjacent to it and the two are linked by a short corridor.

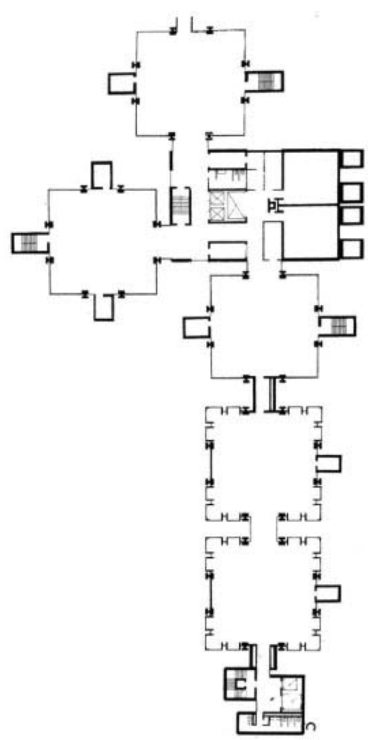


FIGURE 3

FROM: http://www.greatbuildings.com/buildings/Richards_Medical_Center.html

FIGURE 1 - *Elevation View*

FIGURE 3 - *Plan View*

FIGURE 4 - *Exterior View*

FROM: http://www.studyblue.com

FIGURE 2 - *Structural Model*

FIGURE 4

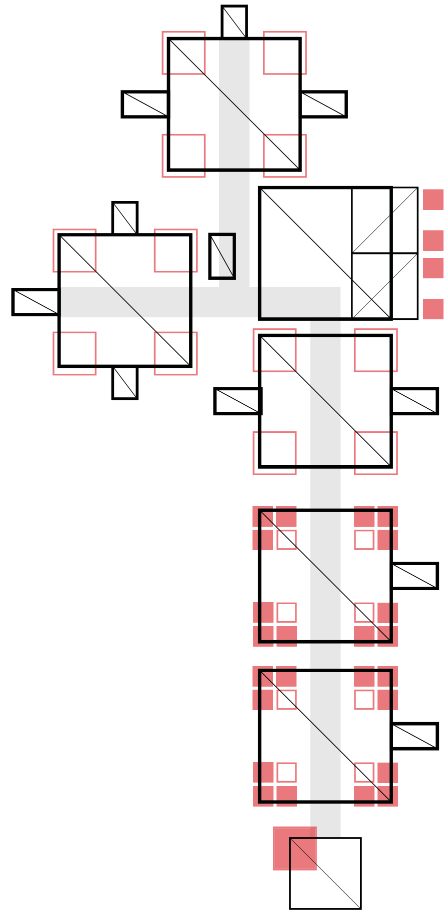


Diagram 1 shows the different elements that are plugged into the base floor plate. Different specialized programs such as labs and offices are indicated in red whle vertical cores flank the initial square floorplates.

Diagram 2 shows the structure of the building in plan. In order to make the corners of the building flexible, the structural columns are moved towards the center of the floor plate (dashed line). From here, the columns act as the physical signifiers of the nine square grid division that Kahn uses to organize the interior spaces. The structure is also supplemented by the vertical cores which are depicted by rectangles with a heavy stroke

Diagram 3 shows the division of the building in elevation. The plug in elements are shown in red

DIAGRAM 1

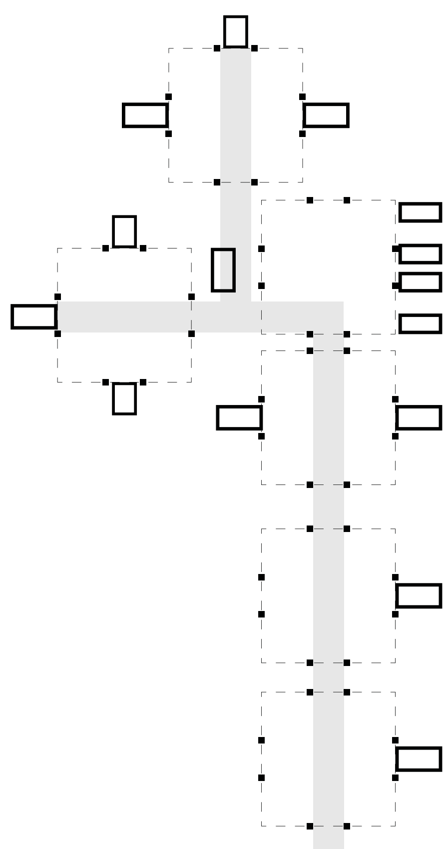


DIAGRAM 2

TOP - DIAGRAM 1 - *Plug-in Elements*
Image by author
BOTTOM - DIAGRAM 2 - *Structure*
Image by author
RIGHT - DIAGRAM 3 - *Geometric Division in Elevation*
Overlay by author, underlay by Great Buildings Online

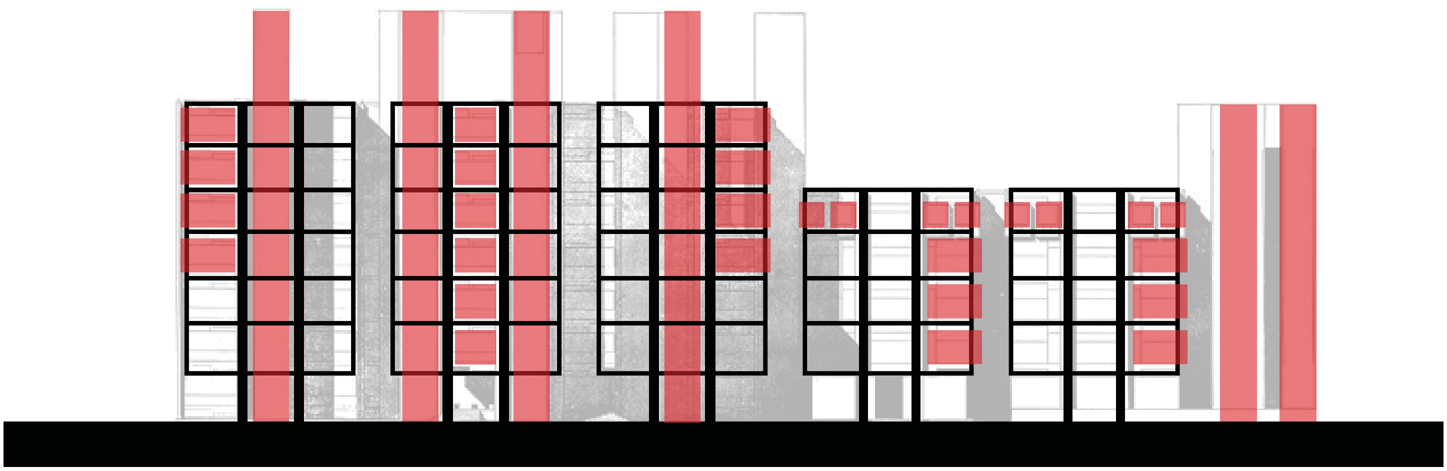


DIAGRAM 3

INSPIRATIONS

+POOL

FRIENDS OF +POOL *NEW YORK - UNBUILT*

Still within its early development stages, +POOL is an effort to create a crowdfunded urban pool on New York City's East River. Early crowdfunding efforts of this project have been successful due to the large population of people who would benefit from a new pool in New York and a large viral marketing campaign. At the architectural level, the +POOL has divided its exterior into 70,000 affordable units which are sold to a large number individuals who wish to see the project be successful. Because of this, the financial burden of such a project is distributed over a large population with no one person holding a large stake in the project. This collective burden is further expressed within the final form of the building through the labeling of each individual unit with a personalized note from the person who funded it.

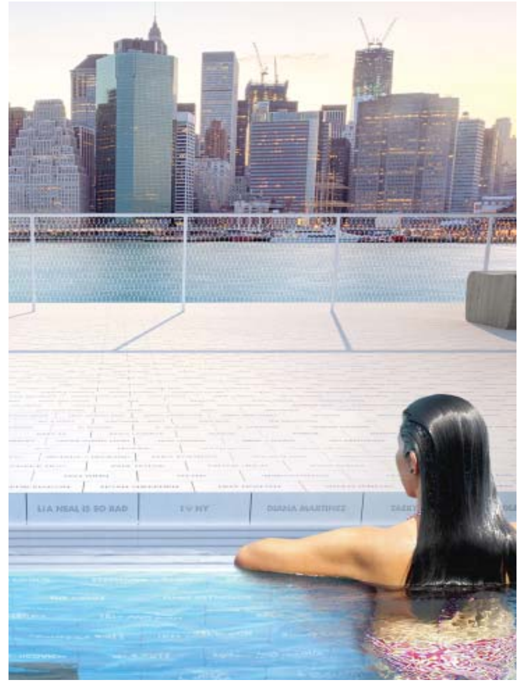


FIGURE 1

FIGURE 2

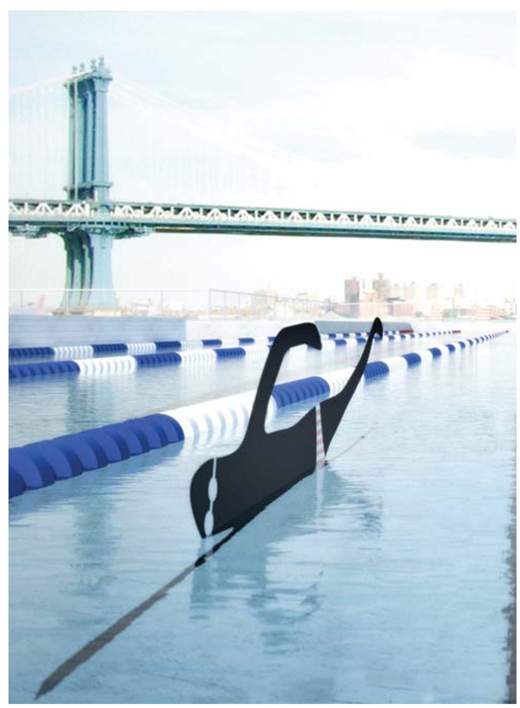


FIGURE 3

FROM: http://www.pluspool.org
FIGURE 1 - *Rendering in context*
FIGURE 2 - *Axonometric View*
FIGURE 3 - *Rendering in context*

MOSQUE-CATHEDRAL OF CORDOBA

VARIOUS *CORDOBA - 784 CE-1523 CE*

Developed continuously over the course of almost 800 years, the Great Mosque-Cathedral of Corrdoba, Spain serves as a model for part based design schemes. This is because of the system's identification of a repeatable element that could inform a pattern of expansion as additional space was needed for the growing program. On top of this, the program identified several programmatic patterns that could be placed within the part network. These patterns informed the required experience for the space, but could be elaborated upon as spaces grew.

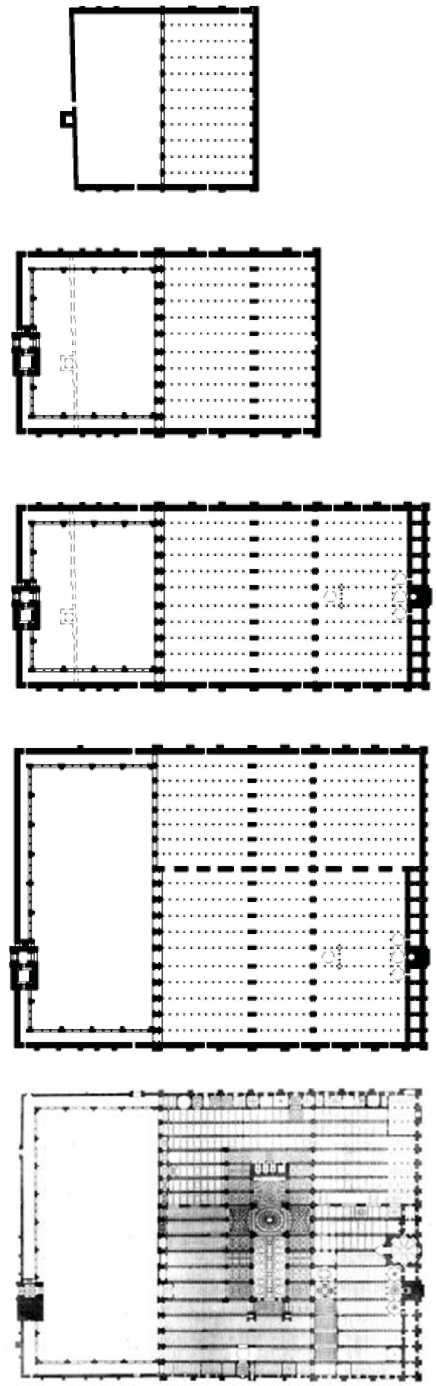


FIGURE 1

FIGURE 2

FROM:https://www.khanacademy.org/humanities/art-islam/islamic-art-early/a/the-great-mosque-of-cordoba

FIGURE 1 - *Plan development*

FIGURE 2 - *Interior View*

TRENTON BATH HOUSE

LOUIS KAHN *EWING - 1955*

Among Louis Kahn's first major works, the Trenton Bath House is designed as a support building for a community pool in Ewing, New Jersey. The building is designed with two primary components, a square pitched roof and an oversized brick column, which are organized in a grid formation. This system designed by Kahn can be readily expanded in order to meet additional requirements of the space through the addition of more columns and roof components. This is critical to this design due to the fact that the scope of the project initially unknown and a large community center following the same design logic was proposed. Because of the proposed system's versatility, the design was able to be easily adapted to the smaller program while preserving the initial design intent.

FIGURE 1

FIGURE 2

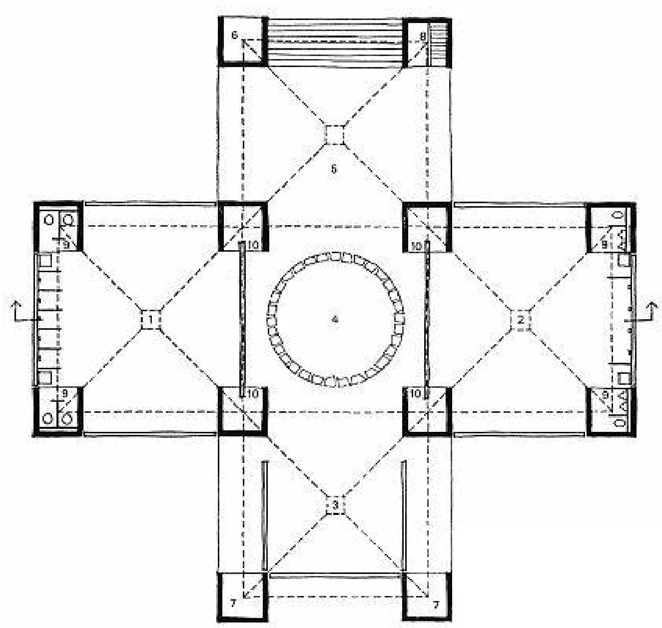


FIGURE 3

FROM: http://www.wikimediacommons.org

FIGURE 1 - *View from courtyard*

FIGURE 2 - *Exterior View*

FIGURE 3 - *Plan View*

FIGURE 1

RULES OF SIX

ARANDA LASCH MOMA EXHIBITION - 2008

The Rules of Six Exhibition for The Museum of Modern Art by Aranda-Lasch showcases the versatility of fractal systems in design contexts. The designers began by generating a geometric primitive which could be controlled and altered through a series of six variables. According to the designers, this allowed the system to display incalculable levels of variety from iteration to iteration, giving the designers a large degree of control over a malleable system.

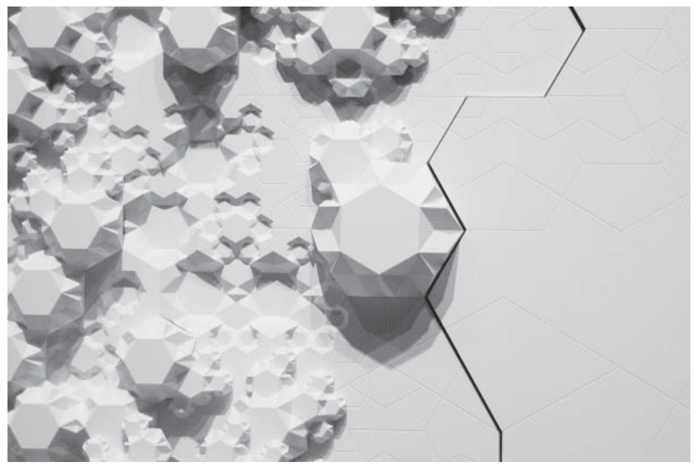


FIGURE 2

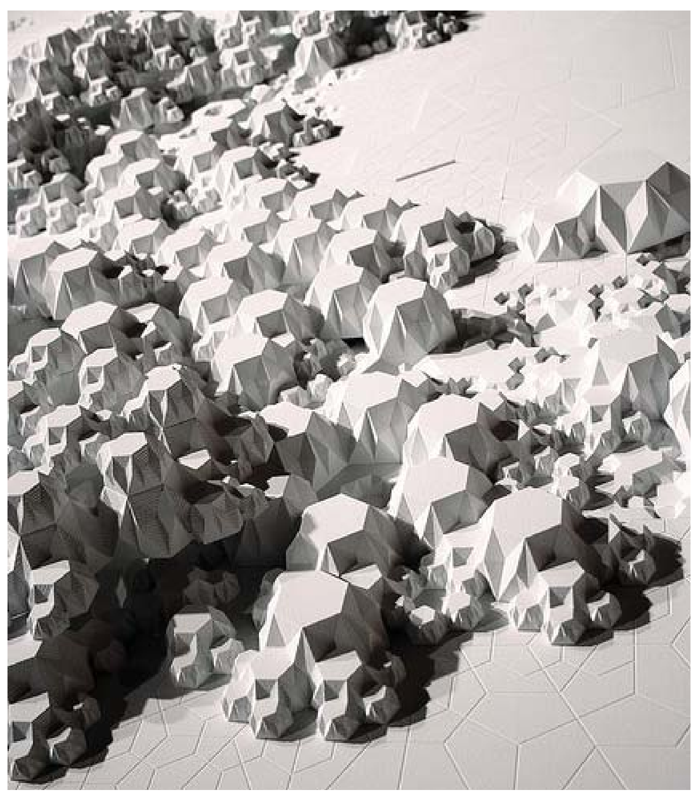


FIGURE 3

FROM: http://www.http://arandalasch.com/works/rules-of-six/

FIGURE 1 - *Exhibition View*

FIGURE 2 - *Hexagonal Aggregation, Detail View*

FIGURE 3 - *Hexagonal Aggregation, Detail View*

PROGRAM

BENEFIT CORPORATIONS

During an analysis of the contemporary field of civic crowdfunding, Rodrigo Davies cites two primary characteristics which are present within successful crowdfunding campaigns: a strong linkage to the community surrounding the proposed project site and a marketable appeal to a mass audience. The local linkage grants a project a strong core of supporters that will generate attention and enthusiasm for the project whereas the mass appeal will ensure that the project reaches enough supporters in order to raise adequate funding. This combination of local support and mass appeal can be readily found within a classification of businesses known as benefit corporations. Benefit corporations are unique types of business that focus on the creation of public good alongside traditional business goals. In the case crowdfunding, benefit corporations immediately present a strong connection to a local community through the public good that they are creating. On top of this, their traditional business elements allow the benefit corporations to generate mass appeal through the provision of goods or services to a wide array of clients that are not limited to a small area.

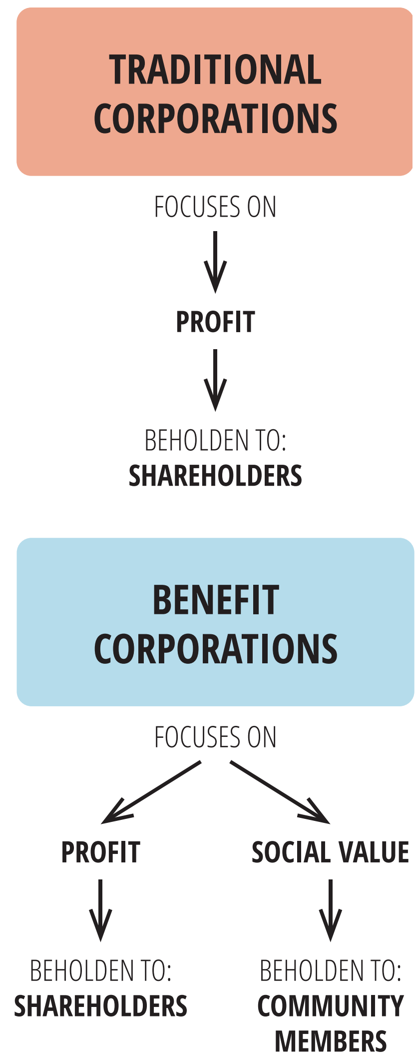


FIGURE 1 - *Benefit Corporations vs. Traditional Corporations*
Image Source: Author

UNCOMMON CONSTRUCTION

For this thesis, an existing prototypical benefit corporation, Uncommon Construction, has been selected to serve as the hypothetical group proposing a crowdfunding campaign to finance a new facility. Uncommon Construction is a New Orleans based benefit corporation that provides skilled labor training to young adults through the construction of houses within the greater New Orleans community. In this manner, it is providing a local, public good through teaching individuals the skills they need to acquire jobs while also providing a construction service to a much larger community. For the purposes of this exercise, Uncommon Construction is seeking to improve both the public good it creates while also producing a good that can appeal to an even larger market. In order to accomplish this, the company is seeking a centralized location from which it can operate its workforce development program alongside a new space for the creation of prefabricated construction components. This new space will allow the skills development program to take place within a controlled environment while also producing material that can be used to supplement the existing residential construction work the group is already doing while opening up the possibility for the group to sell the construction components to third parties.

FIGURE 2 - *Uncommon Construction*
Image Source: http://www.uncommonconstruction.org/

RHIZOMATIC GROWTH

As addressed earlier in this thesis, within their 1980 text, Gilles Deleuze and Felix Guattari describe a type of collective form, known as an assemblage, in which the parts of the collective generate further collective parts in a process referred to as rhizomatic growth (Figure 3). If a crowdfunding campaign is run by profit generating organization such as benefit corporation, the organization can invest its profits back into the crowdfunding campaign. Because of this, the profit generating parts of the building may be used to generate further parts. By selecting a program for investigation that produces building components, it gives this project the opportunity to explore this phenomenon more directly. As the manufacturing facility generates parts, they can be taken applied to the building in order to construct more areas the generate parts. Such a system is more beneficial for crowdfunding projects as it will reduce their reliance on generating financial support, and instead allow the the project to become more self sustaining over time.

FIGURE 3 - *Rhizomatic growth is described by Deleuze and Guattari as systems that resemble the growth of grass. Grass sends out roots that generate new nodes that can , in turn, grow more grass. In this project, there are spaces that generate the building components that are necessary to build more spaces.*
Image Source: University of Toronto

PROGRAM DISTRIBUTION

Space	sf	qt	total sf
Building Entry			
Lobby	300	1	300
Reception Space	1200	1	1200
Production			
Wood Shop	8000	2	16000
Metal Shop	8000	1	8000
Concrete Shop	8000	1	8000
Flexible Work Space	2000	3	6000
Production Support			
Equipment Storage	1000	1	1000
Maintenance shop	1000	1	1000
Server Room	600	1	600
Materials Storage	1600	1	1600
Lockers, Shower	300	2	600
Waste	200	1	200
Workforce Development			
Conference Room	400	2	800
Classroom	600	10	6000
Auditorium	3600	1	3600
Common Work Area	1400	1	1400
Individual Workstation	60	20	1200
Development Support			
Lockers	300	1	300
Development Office	600	1	600
Storage	100	5	500
Archive	200	1	200
Distribution			
Loading	800	1	800
Garage	4000	1	4000
Covered Product Storage	1200	1	1200
Exterior Product Storage	5600	1	5600

Administration			
Office Suite	950	1	950
Individual Offices	150	4	600
Security	200	1	200
Common Room	400	1	400
Commercial			
Sales Floor	800	1	800
Storage	250	1	250
Showroom	1500	1	1500
SUBTOTAL (sf)			75400
Parking			
45 Spaces	162	45	7290
Mechanical			
Generic Mechanical	1300	1	1300
Electrical Room	600	1	600
Circulation			
30% of Subtotal			22620
TOTAL (sf)			**107210**

The final distribution of space provides a blend of skills development space as well as the necessary areas for operating a production facility. By relating these spaces directly, Uncommon Construction can foster eductational interactions between those individuals who are learning within class rooms and those who are getting hands on experience on the manufacturing floor.

PROGRAM CASE STUDIES

SOUTH BRONX STARTUP BOX

ENNEAD LAB 2012

A proposed startup incubator space in the South Bronx neighborhood of New York City, the Startup Box proivides a space for facilitating an intersection of traditional education and entrepreneurial thought.By blending these two elements, the space will be able to harness the potential of opportunity youth within this neighborhood by exposing them to new educational and job opportunities that can facilitate their entry into New York's growing startup sector.

The space itself is designed as a large flexible space that is flanked by a series of specialized support programs that can facilitate additional uses. This allows the large main space to be continually rearranged as the needs of the users change, expanding the functional utility of the the otherwise limited space. On top of this, the space presents itself as a highly visible beacon along the street, with large expanses of clear glass covering the street facade.

FIGURE 1

FROM: http://www.enneadlab.org/projects/

FIGURE 1 - *Sectional Rendering*

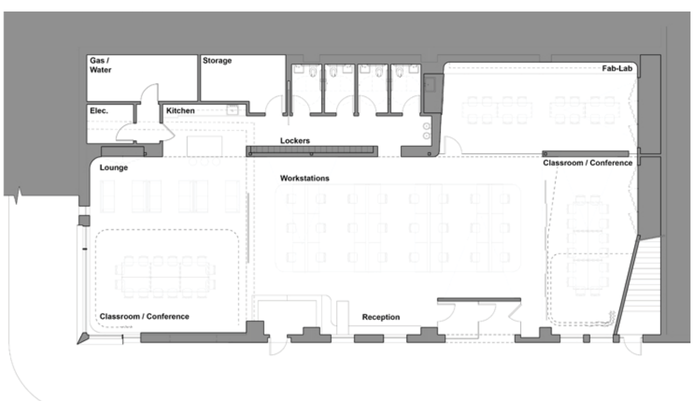
FIGURE 2 - *Rendering of primary flex space*

FIGURE 3 - *First Floor Plan*

OVERLAY BY AUTHOR:

FIGURE 4 - *Diagram of Spacial Compartmentalization*

FIGURE 2



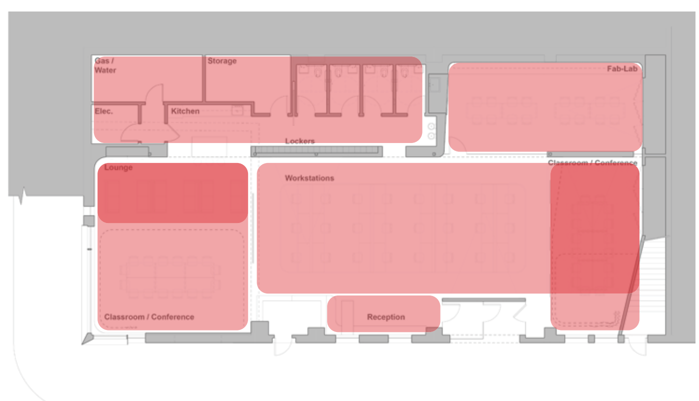


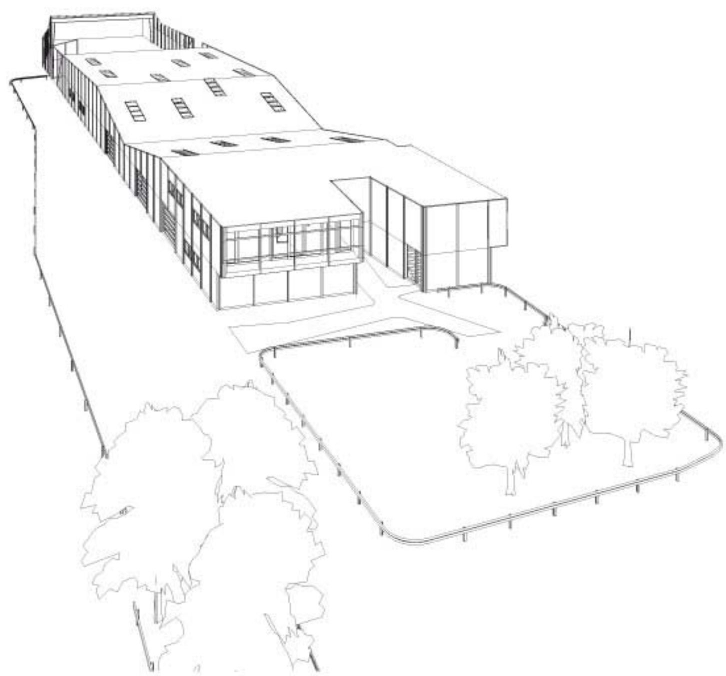
FIGURE 3

FIGURE 4

SCHOTEN WORKSHOP BUILDING

LOOS ARCHITECTS 2006

A manufacturing facility for a small canal hardware company in Schoten, Belgium. The space contains a consolidated area for the administative functions of the company in the front of the building in order to provide ample space for production and distribution in the back. Structural bays of the building are periodically punctured to allow for the addition of large garage doors in order to facilitate access to the manufacturing floor by large machinery.



COMPONENTS

Manufacturing Floor - 2400 sf x 2
Distribution Area - 2400 sf
Garage - 4000 sf
Storage Area - 3000 sf
Administrative Area - 4800 sf

FIGURE 1

FROM: http://www.archdaily.com/153579/schoten-workshop-building-loos-architects
FIGURE 1 - *Perspective VIew*
FIGURE 2 - *Exterior View*
OVERLAY BY AUTHOR
FIGURE 3 - *First Floor Plan Spacial Compartmentalization*
FIGURE 4 - *Sectional Spacial Compartmentalization*

FIGURE 2

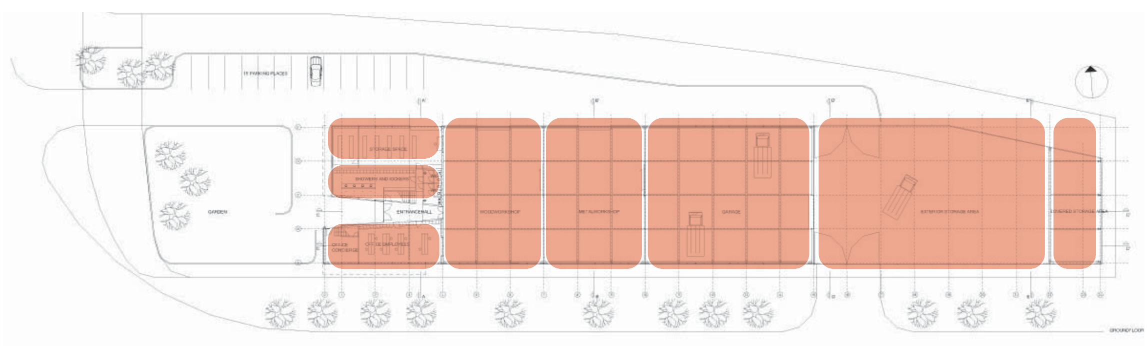


FIGURE 3

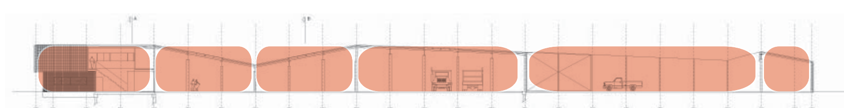


FIGURE 4

PAYKAY BONYAN PANEL FACTORY

ARAD 2006

A large manufacturing facility for a regional prefabricated building component company in Tehran, Iran. The building is defined by the repitition of large bay structure which is sloped in order to allow for natural light. At one end of the building, these spaces contain all of the more public functions of the company such as a sales office and administrative functions. On the other side of the structurem ample open space is given for production and distribution of building components. These two primary functions of the building are seperated by a bay containing mechanical and storage functions, clearly delineating the two different zones of program.

COMPONENTS

Manufacturing Floor - 32000 sf
Distribution Area (exterior, uncovered) - 2000 sf
Storage Area - 1600 sf
Administrative Area - 1800 sf
Showroom - 850 sf
Mechanical - 2500 sf

FIGURE 1

FROM: http://www.archdaily.com/7456/paykar-bonyan-panel-factory-arad-architectural-research-and-design
FIGURE 1 - *Facade View*
FIGURE 2 - *Interior View*
OVERLAY BY AUTHOR
FIGURE 3 - *First Floor Plan Spacial Compartmentalization*

FIGURE 2

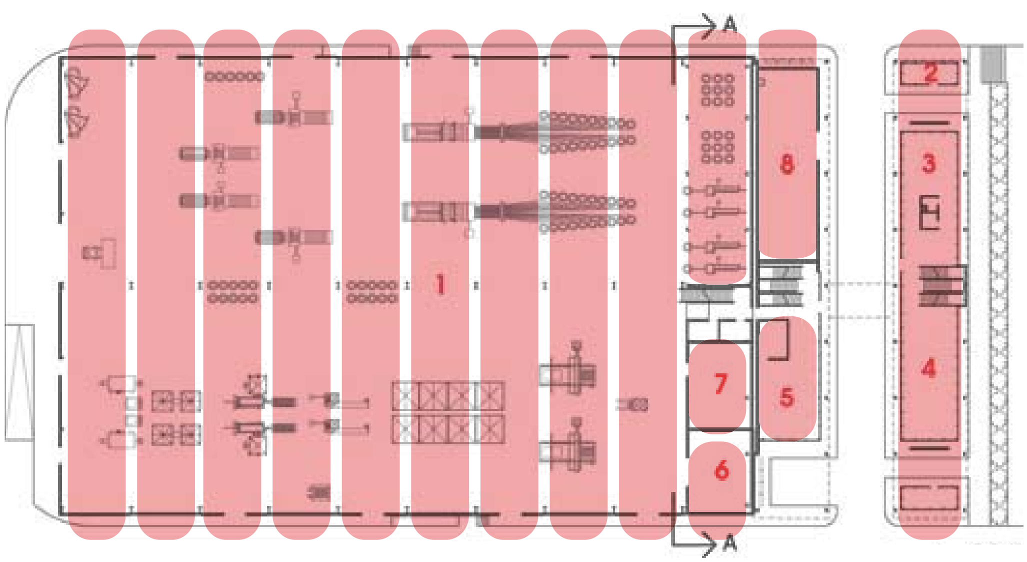


FIGURE 3

SITE

1228 ORETHA CASTLE HALEY BLVD.

The site on which a crowdfunded project is placed offers a unique opportunity for public institutions to get involved in this new system of generating community space. Within many cities across the United States, local governments operate institutions known as land banks, or public owned entities that are created with the purpose of acquiring and managing vacant and blighted properties (U.S. Dept. of Housing and Urban Development 2). Unlike the process of foreclosing on these properties and selling them to private interests for substantially less than their value, land banks give governments the opportunities to distribute land on the basis of what would best serve the community. Because of this, it is feasible for a group that is generating public good such as a benefit corporation to be eligible for a property grant from a land bank. Within New Orleans, LA, the municipal government operates a land bank program known as the New Orleans Redevelopment Authority (NORA) which is tasked with the revitalization of now blighted historic commercial cores. This mission offers NORA the unique position to serve as the source of a site for a crowdfunded building.

In order to properly fit within the needs of the program's mission for generating public benefit and satisfy NORA's mission to revitalize blighted commercial cores, the project site needs to fulfill certain qualities:

1. Site must be within walking distance to a neighborhood that has a demonstrated need for the public benefit provided
2. Site must be within a historic commercial core that is being redeveloped
3. Site must be a blighted property that can feasibly be controlled by NORA

Several sites within New Orleans meet all of these qualifications, but none of them as substantially as 1228 Oretha Castle Hayley Boulevard (Figure 1). Located within the Oretha Castle Hayley Historic District, the area surrounding the site has already hosted multiple successful NORA land bank projects. On top of this, the site is in close proximity to impoverished neighborhood (U.S. Census 2012) that historically has displayed very high unemployment figures (U.S. Dept. of Housing and Urban Development 1996). Finally, the site is an aggregation of several blighted or vacant properties, all of which could conceivably be acquired and managed by NORA. In addition to all of these qualifications, the location chosen is also in close proximity to the NORA headquarters and several community development NGOs[1]. By being in the vicinity of these complementary institutions, a work force development center such as the one proposed will gain a substantial competitive advantage that will ensure its long term success.

2000 ft

FIGURE 1 - *1228 Oretha Castle Hayley highlighed in red*

1- *Non-Governmental Orgainzations*

FIGURE 2 - *Major Locations and Green Space surrounding project site.*

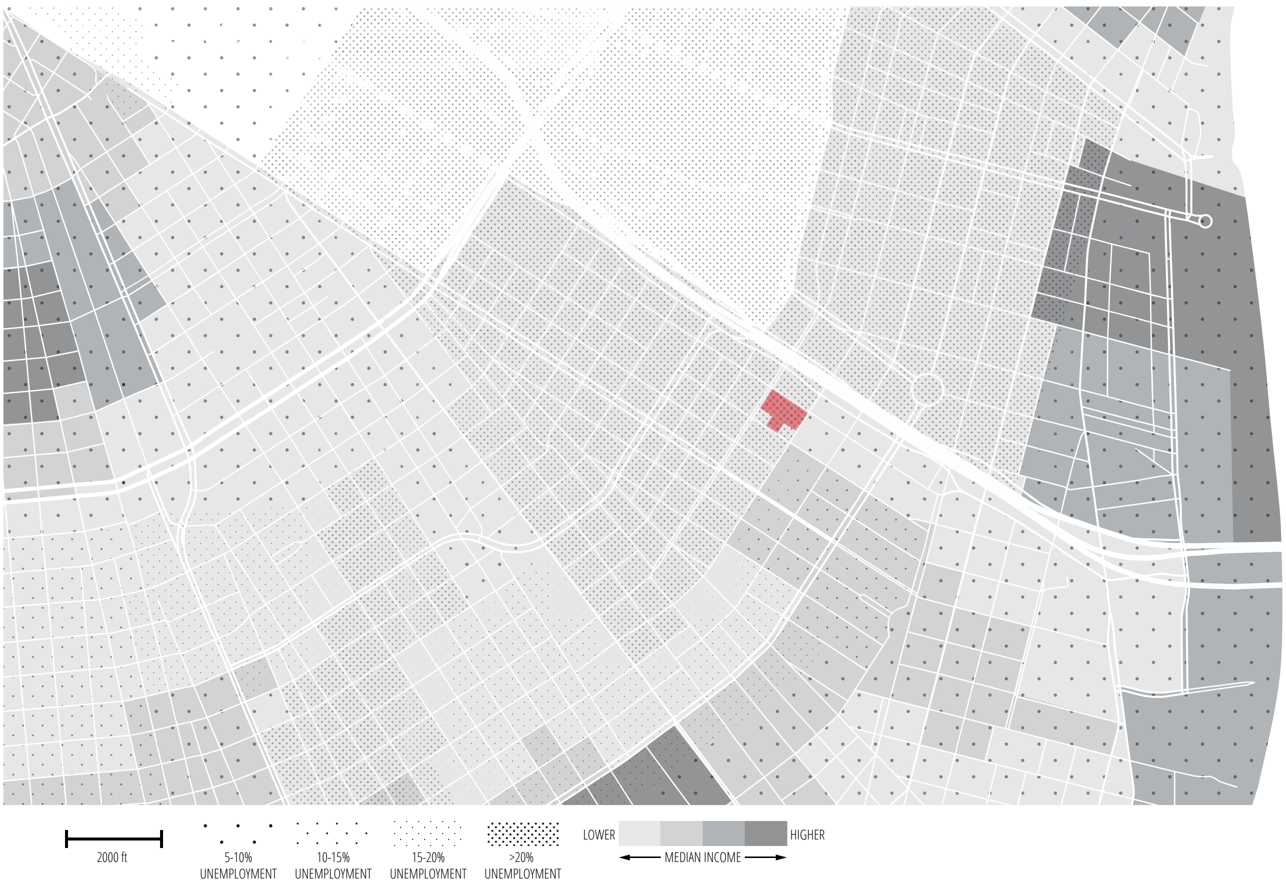


FIGURE 3 - *Relative median income and unemployment levels in the neighborhoods surrounding the site. The high unemployment and low median income demonstrates a potential desire for the public good that is generated through a workforce development center.*

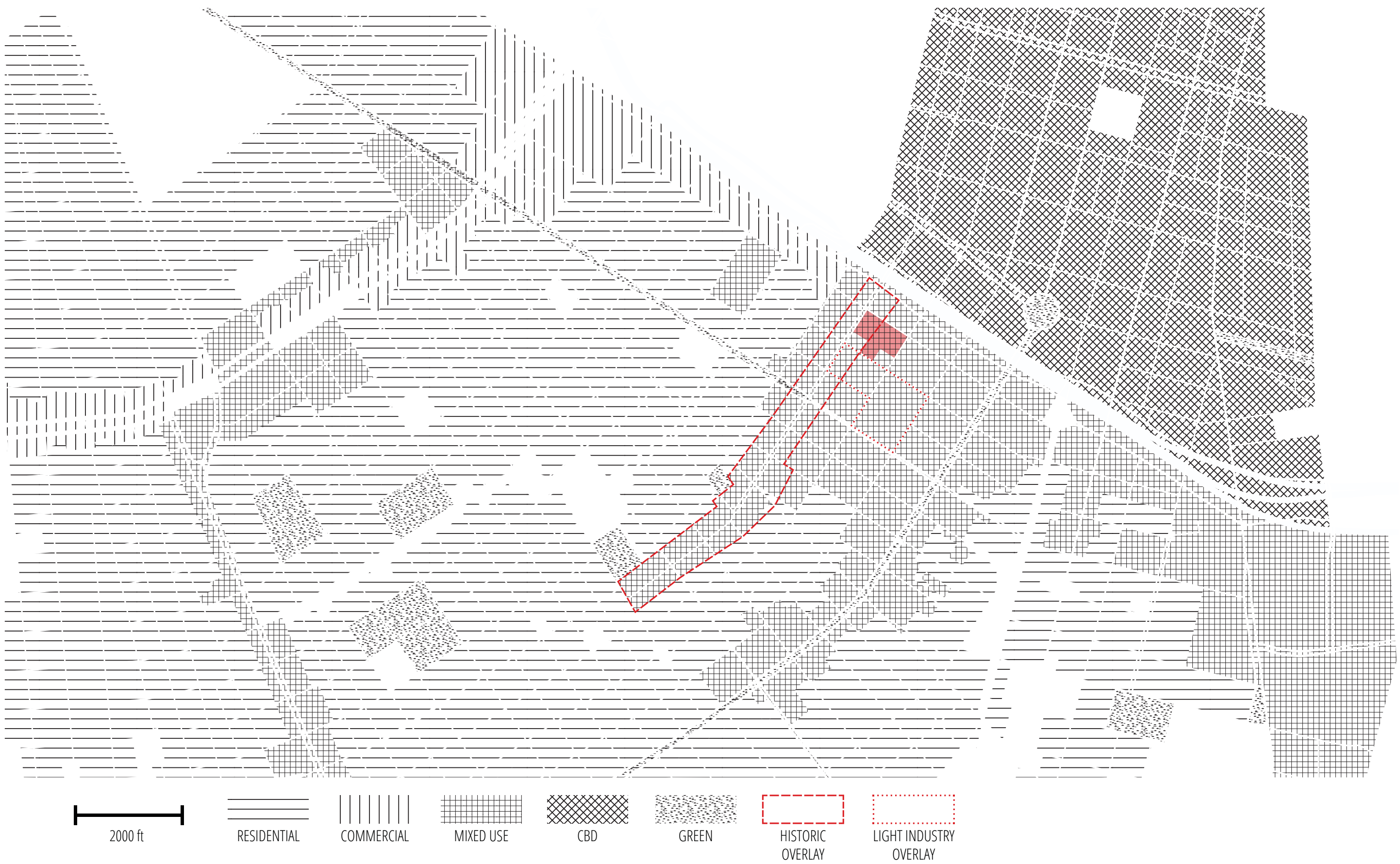


FIGURE 4 - *Zoning conditions surrounding project site. The site is located within a high density mixed use zone and is subject to additional review as part of the O.C. Hayley Historic Commerical District. On top of this, the site is adjacent to a light industrial usage overlay, increasing the likelihood that such a location could be used for the manufacturing component of the program.*

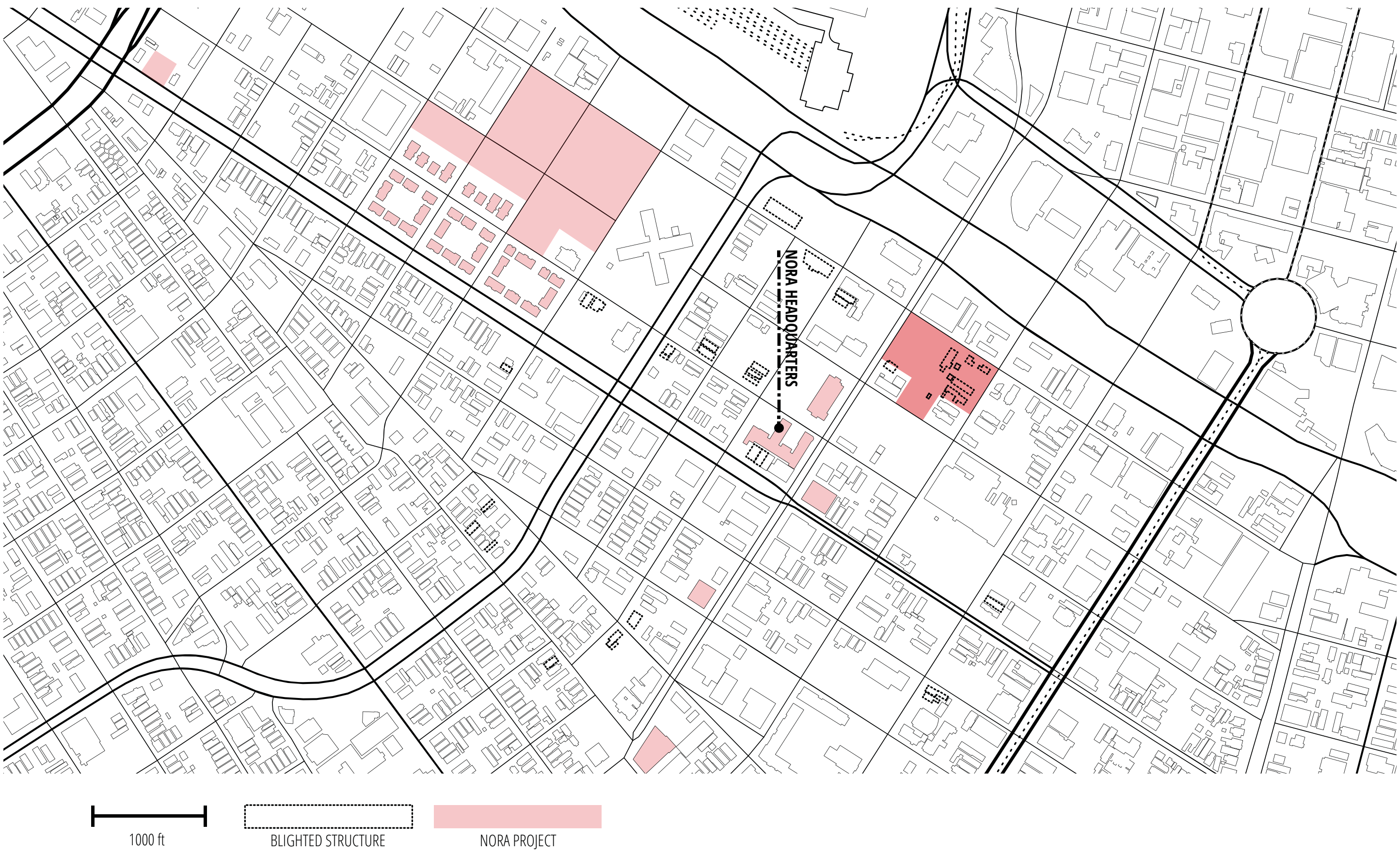


FIGURE 5 - *Blighted Properties and NORA revitilzation sites around the project site. Being composed of primarily blighted properties, the project site could feasibly be owned by NORA through its landbank program. On top of this, the proximity between the NORA headquarters and the site could present a competitive advantage for the chosen program as they will most likely work alongside NORA are future revitilzation and construction projects.*

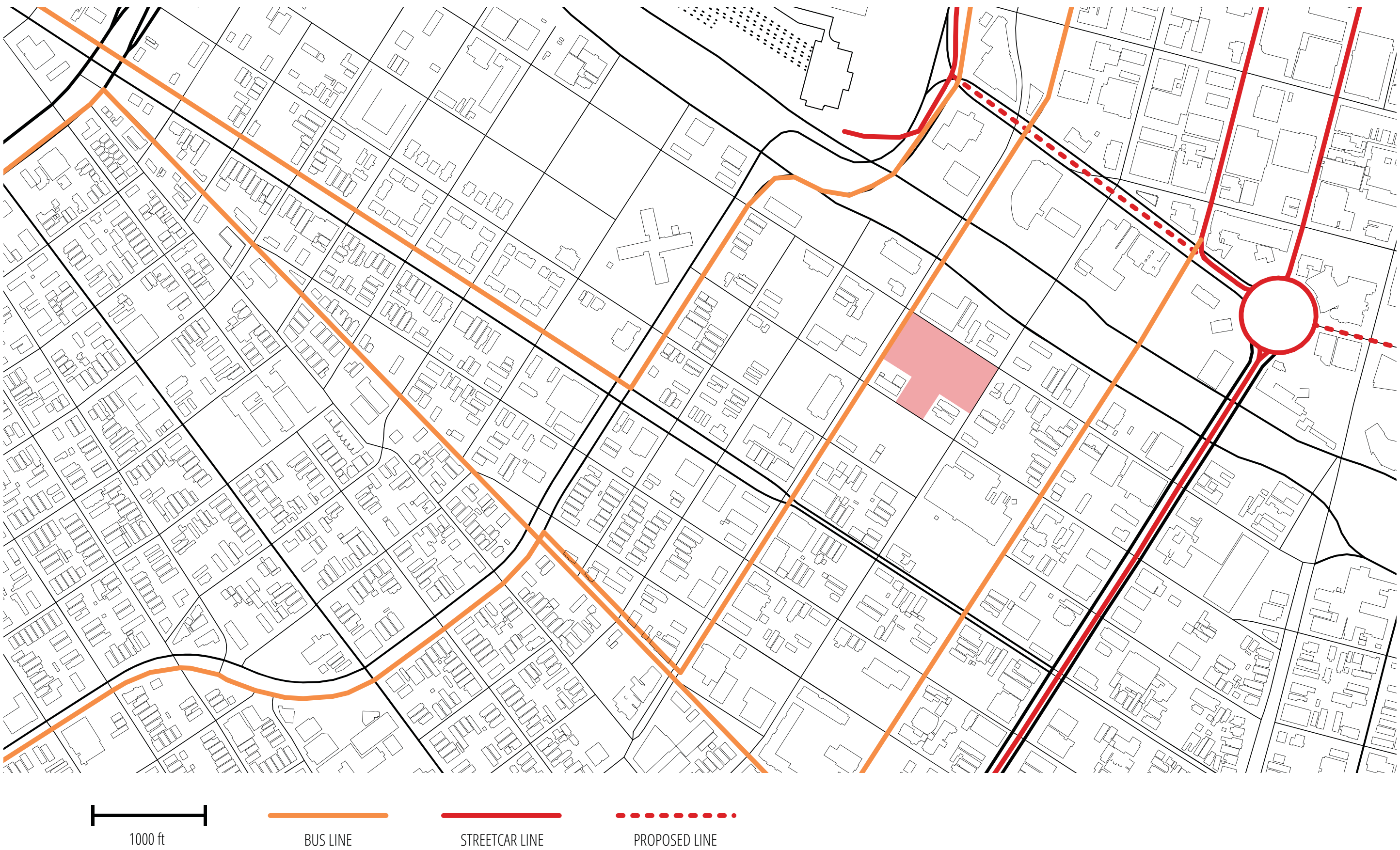


FIGURE 6 - *Public Transportation and site access. The site is readily accessible through a variety of transportation methods, allowing it to service a large area of the city.*

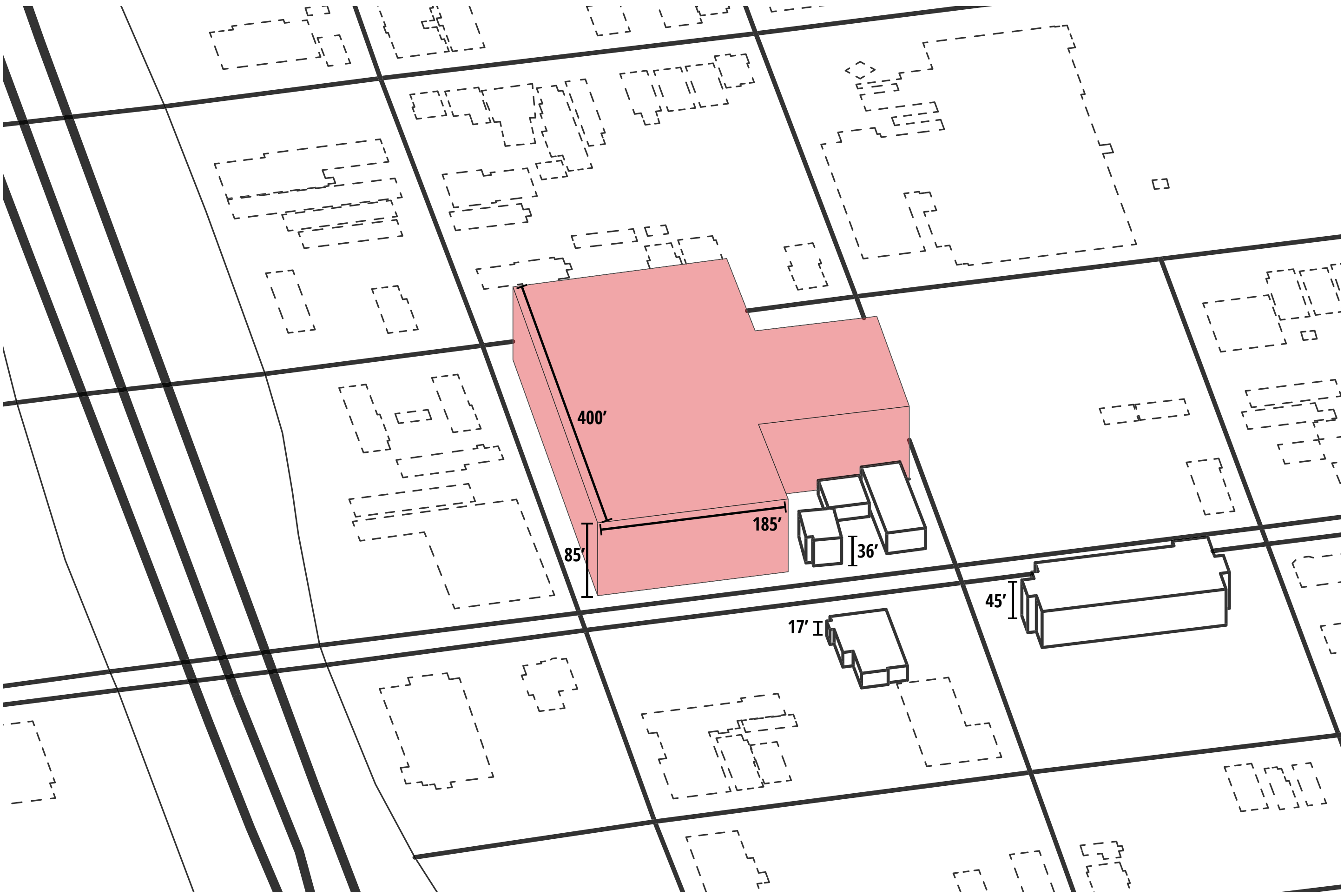


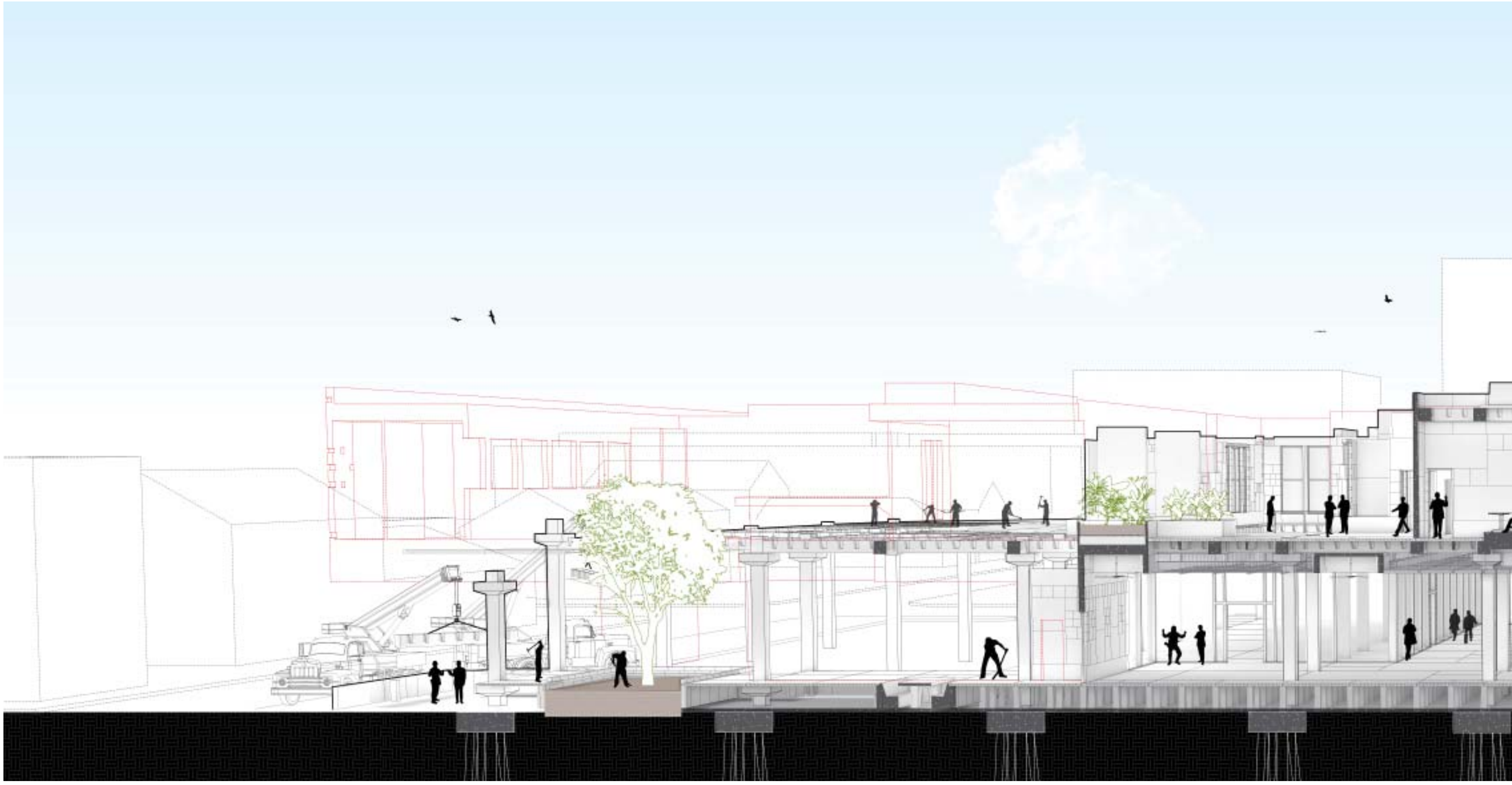
FIGURE 7 - *Zoning envelope present on site. Located within an MU-2 district, the site has a maximum building height of 85' and a maximum FAR of 5. The site itself is 99,000 sf, leaving ample room for the required space of the program.*

PROJECT DEVELOPMENT

A CROWDFUNDED INTERVENTION

The project developed to accompany this thesis is designed to showcase the primary improvable elements of crowdfunded architecture that have been highlighted in this document's research. This project also utilizes existing technologies and materials that can be easily reimplemented in similar projects seeking to accomplish the same goals. By following the example of this proposed design, it is hoped that more projects can begin to address the desires of communities through the implementation of crowdfunding strategies.

The project was designed as a series of programmatic components elevated from the ground, leaving the ground floor open for public activity and the workshop floor (Figure 1). The programmatic components were left independent of one another so they could be funded independently and added to the finished structure as they achieved functionality (Figure 4). The project was also designed in such a way where the development of the project could be paused at a series of checkpoints (Figure 3) where the needs and desires of the community could be reassessed and the crowdfunding campaign could be altered to account for these changes.



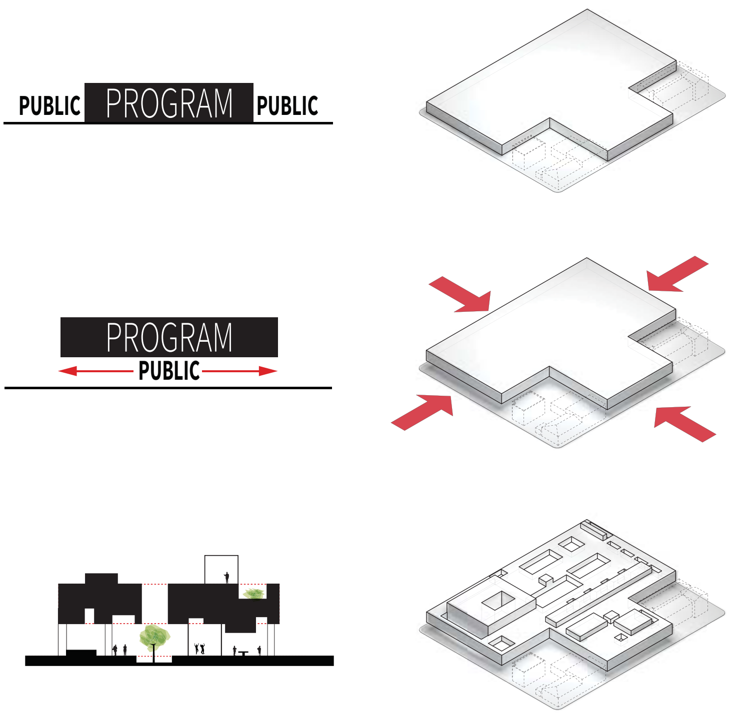


FIGURE 1 - *Formal Development*

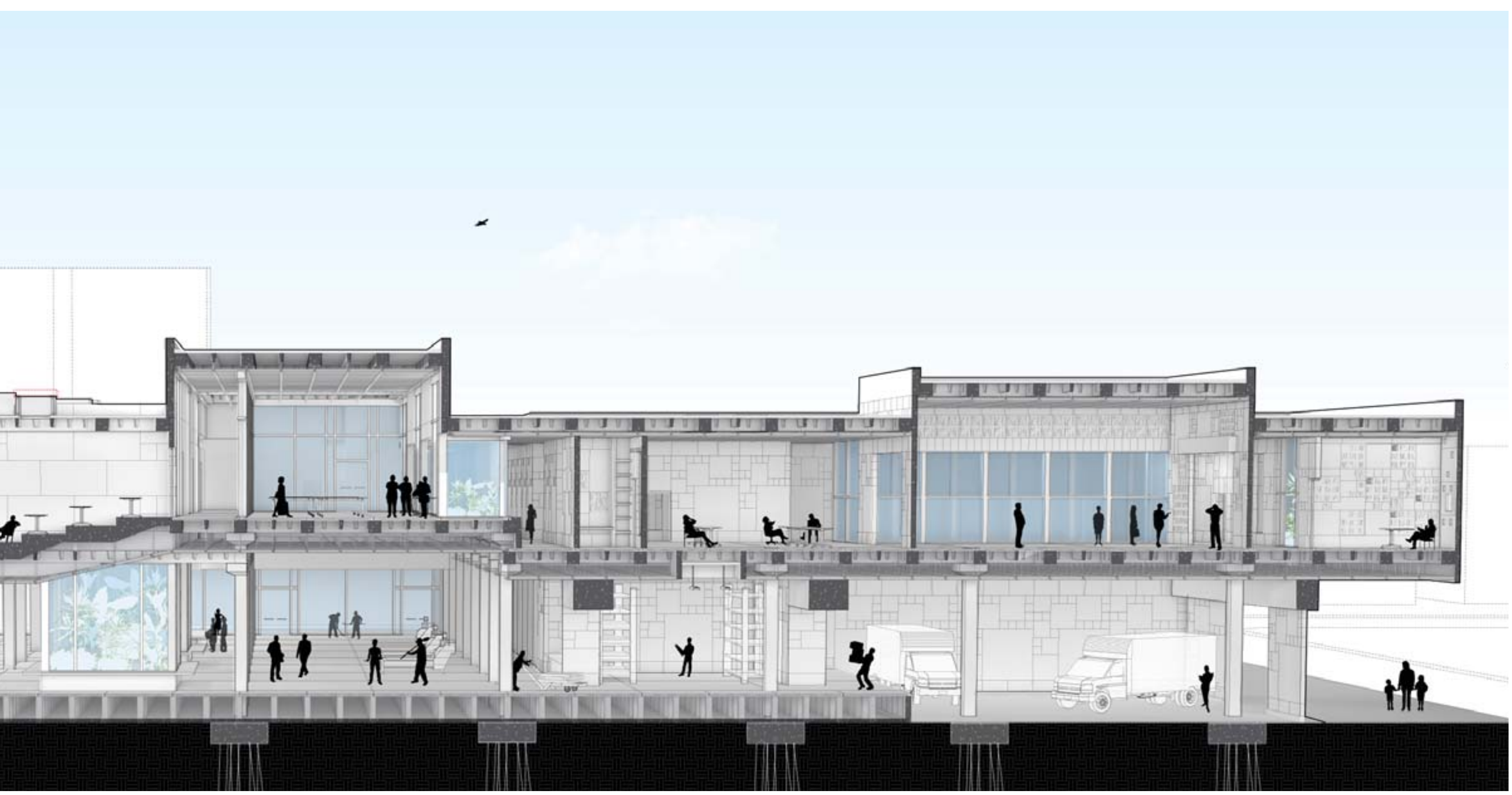


FIGURE 2 - *Timelapse Section*

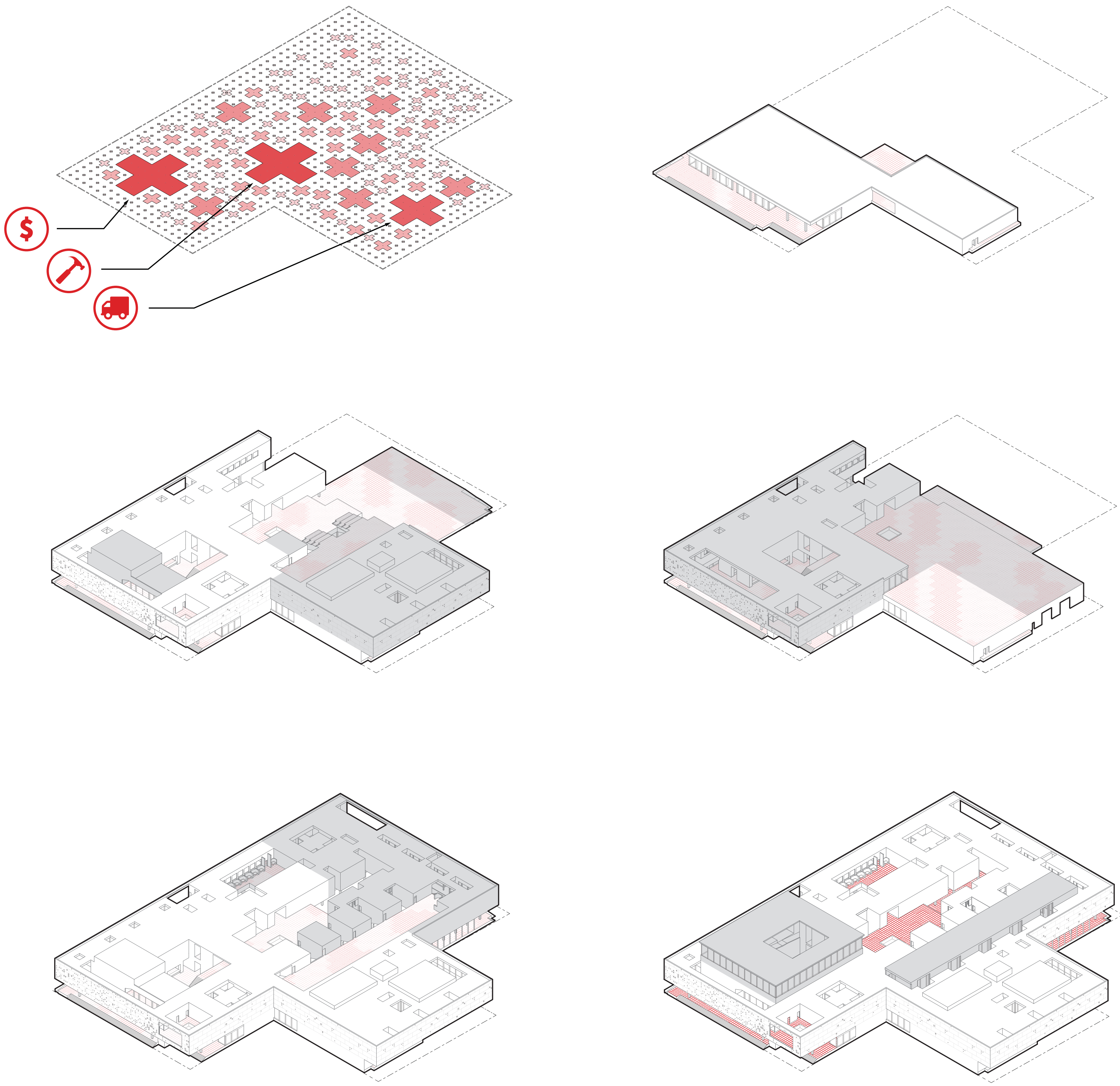


FIGURE 3 - *Development Checkpoints*

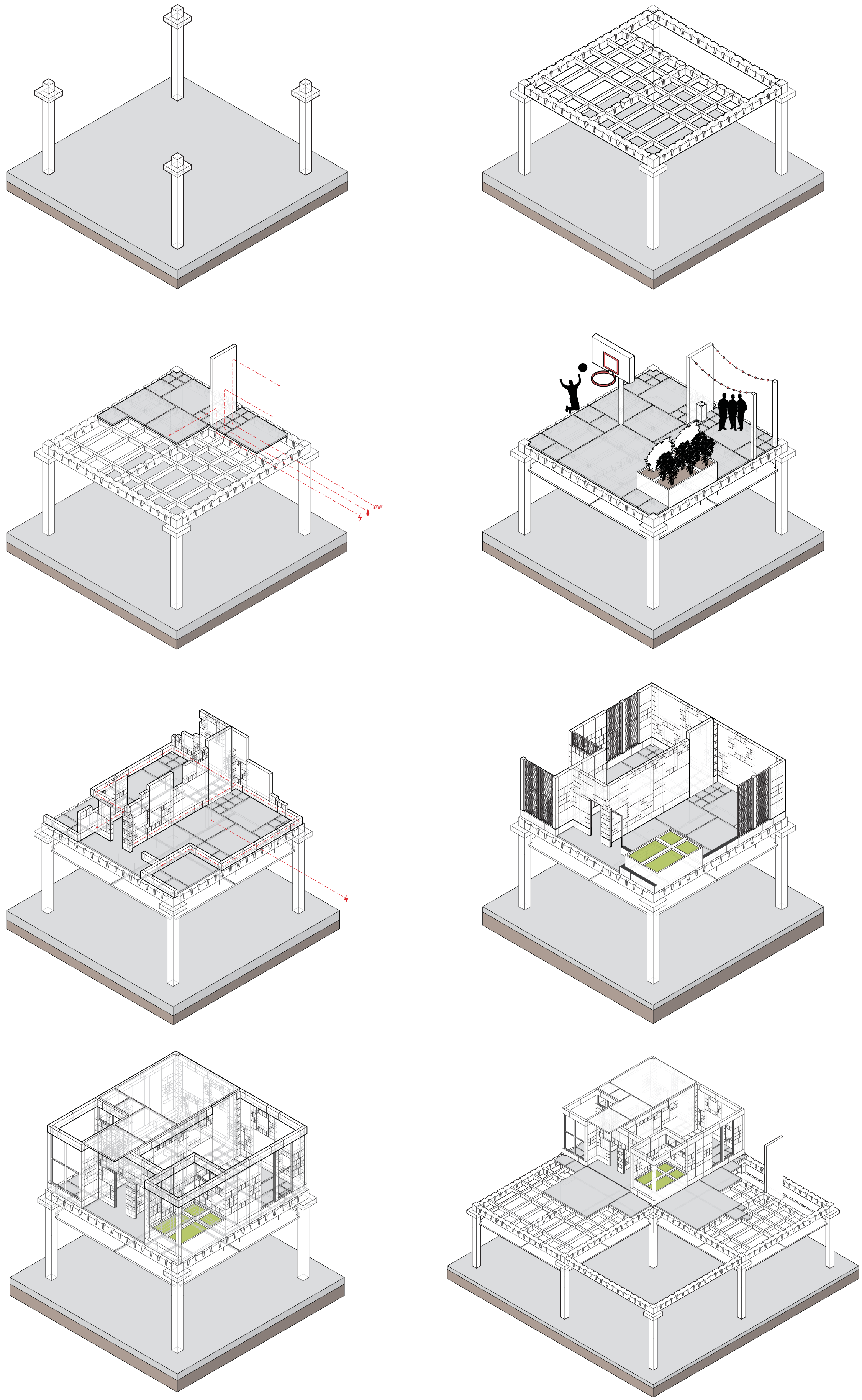


FIGURE 4 - *Component Development*

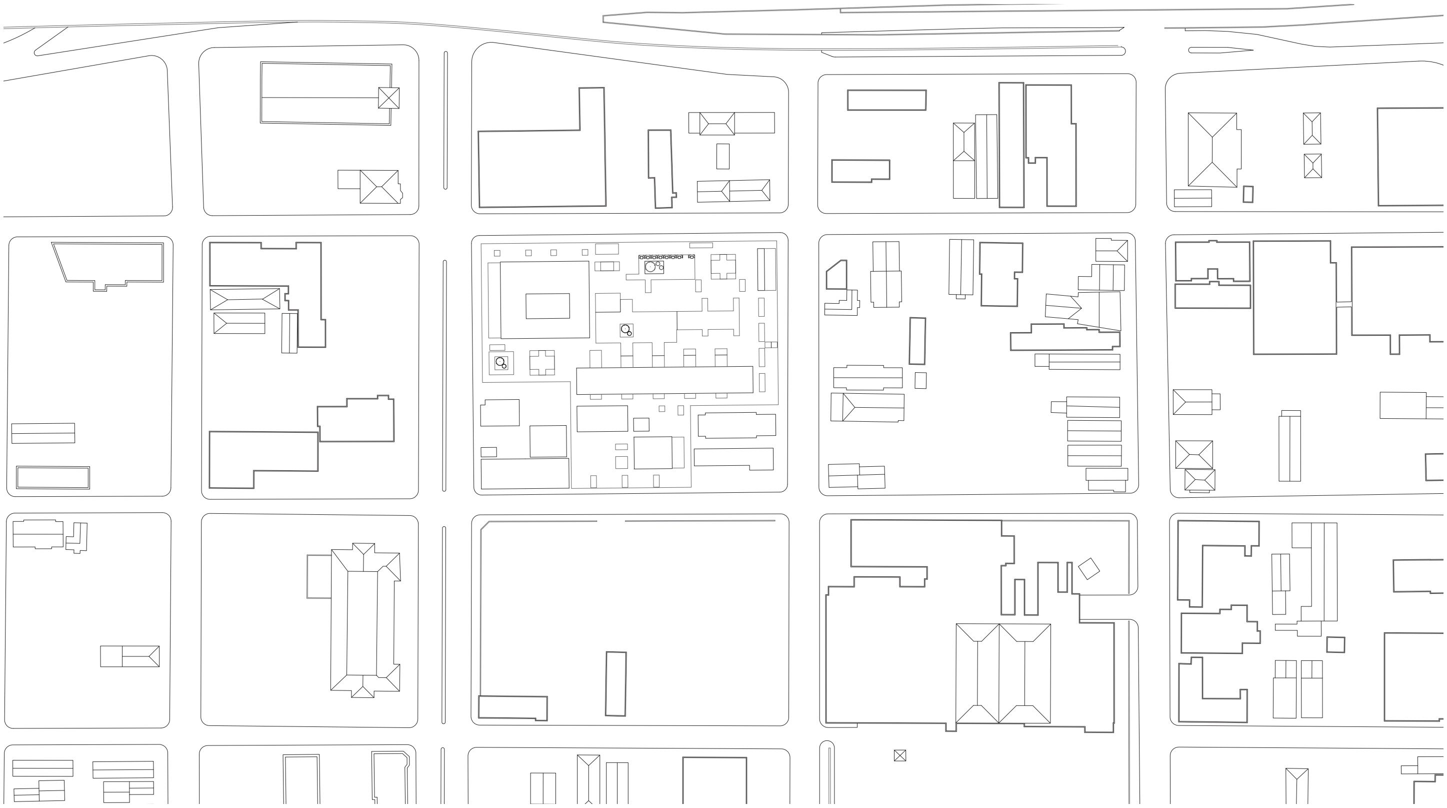


FIGURE 5 - *Site Plan*

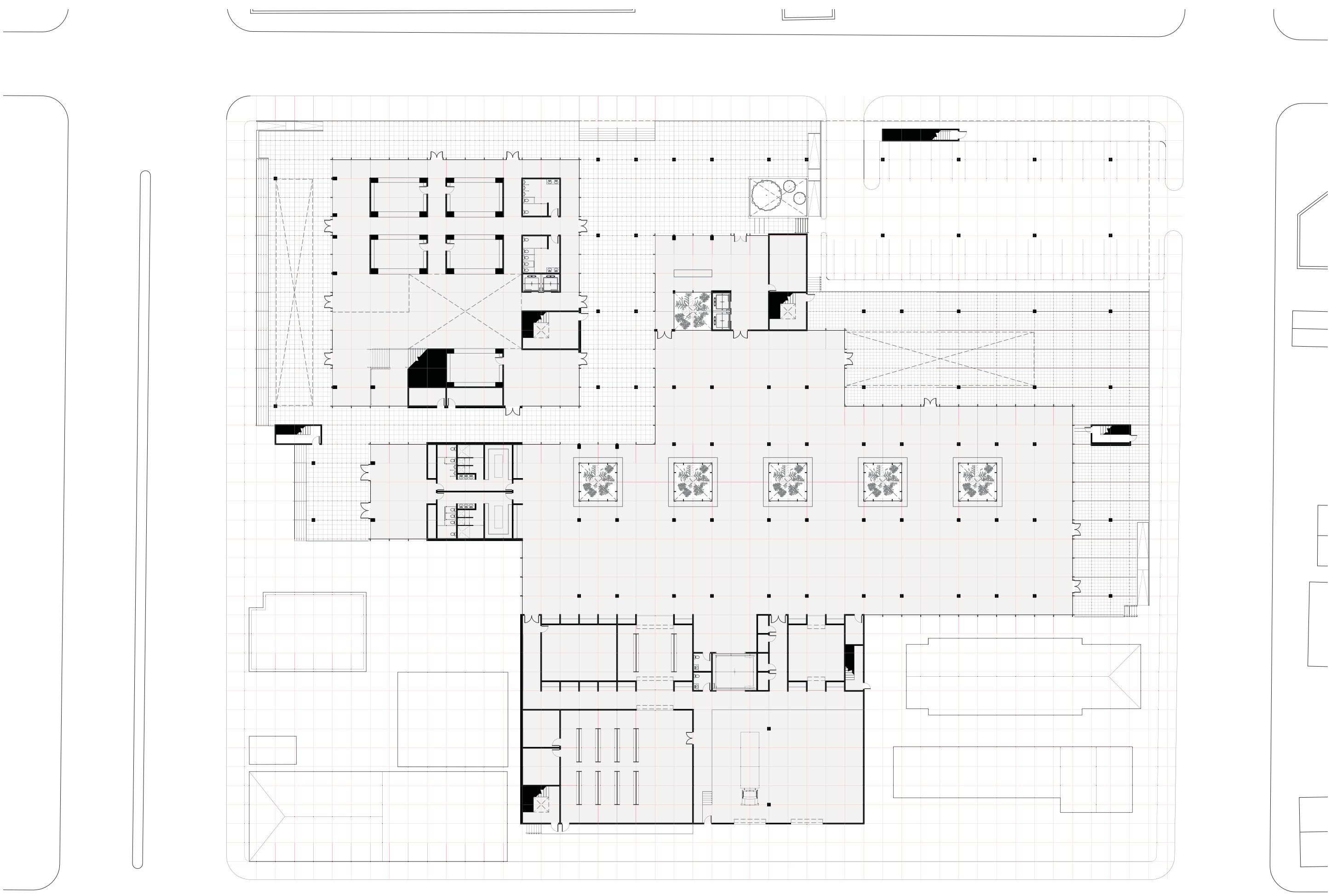


FIGURE 6 - *First Floor Plan*

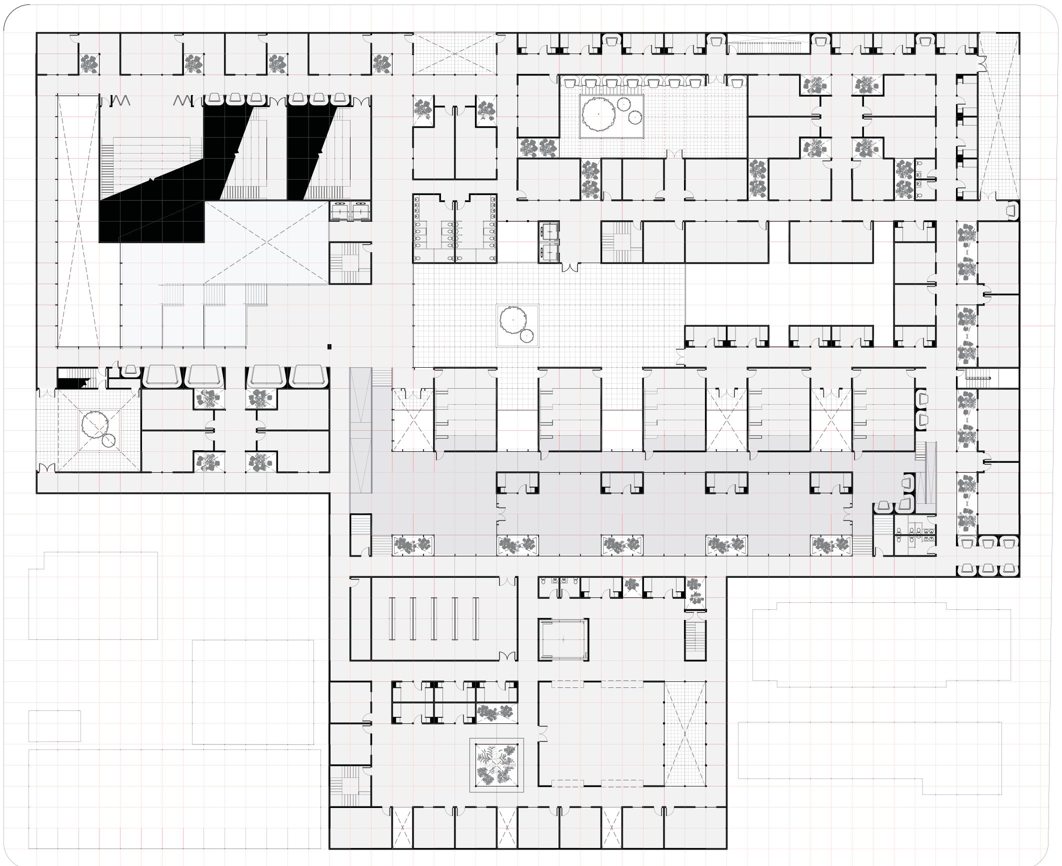


FIGURE 7 - *Second Floor Plan*

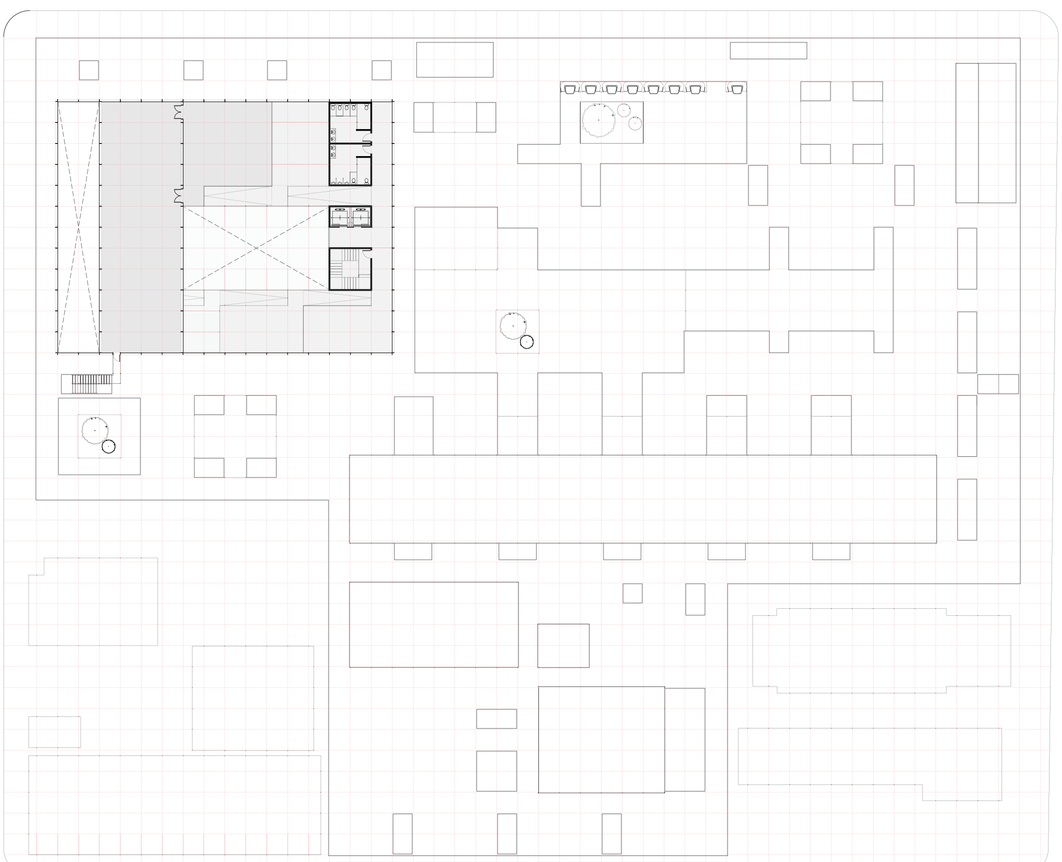


FIGURE 8 - *Third Floor Plan*

FIGURE 9 - *Atrium Section*

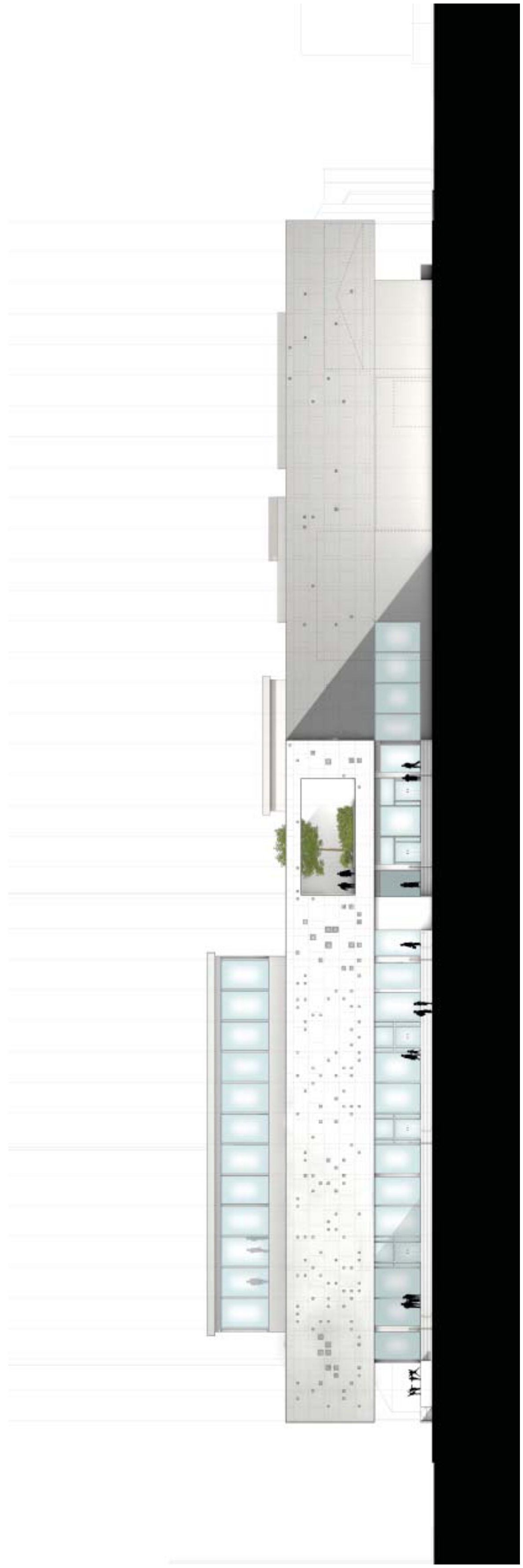


FIGURE 10 - *Oretha Castle Haley Blvd Elevation*

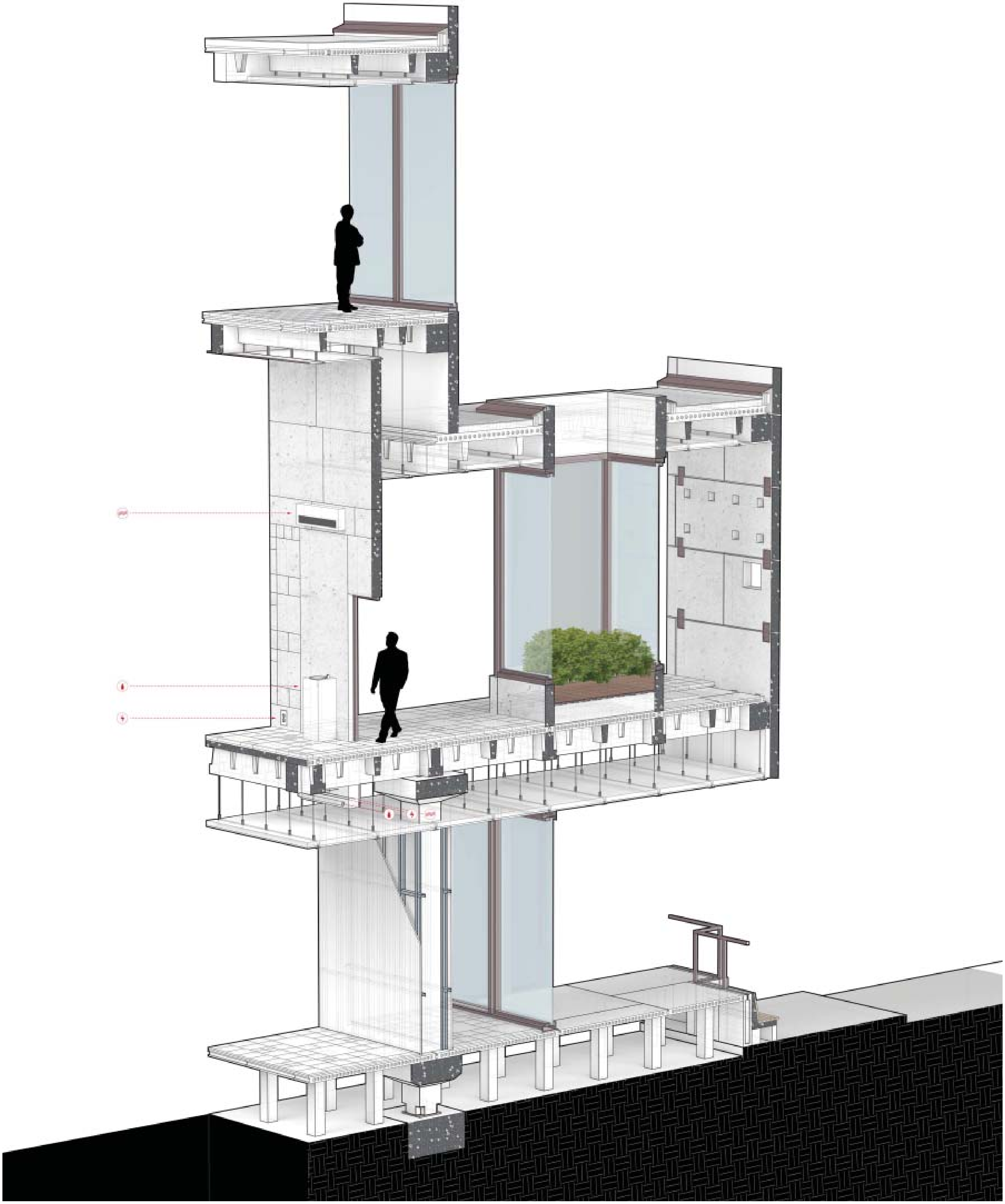


FIGURE 11 - *Wall Section Detail*

END NOTES

WORKS CITED

"About." The Bath House. Trenton Jewish Community Center, n.d. Web. 20 Nov. 2015.

Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. A Pattern Language: Towns, Buildings, Construction. New York: Oxford UP, 1977. Print.

Allen, Stan. Points Lines: Diagrams and Projects for the City. New York: Princeton Architectural, 1999. Print.

"ArandaLasch." ArandaLasch. N.p., n.d. Web. 20 Nov. 2015.

"Banks and Banking: What Is a Bank?" Michigan Law Review 5.7 (2007): 574-81. United States Dept. of Housing and Urban Development. Web. 20 Nov. 2015.

Davies, Rodrigo, *Civic Crowdfunding: Participatory Communities, Entrepreneurs and the Political Economy of Place* (May 9, 2014). Available at SSRN: http://ssrn.com/abstract=2434615 or http://dx.doi.org/10.2139/ssrn.2434615

Deleuze, Gilles, and Félix Guattari. A Thousand Plateaus: Capitalism and Schizophrenia. Minneapolis: U of Minnesota, 1987. Print.

Elkington, John, and Pamela Hartigan. The Power of Unreasonable People: How Social Entrepreneurs Create Markets That Change the World. Boston, MA: Harvard Business School, 2008. Print.

"Ennead Lab | Home." Ennead Lab. N.p., n.d. Web. 20 Nov. 2015.

The Field Guide to Human-centered Design: Design Kit. San Francisco: IDEO, 2015. Print.

"Fractal." -- from Wolfram MathWorld. N.p., n.d. Web. 20 Nov. 2015.

"Free Online Construction Cost Calculator." Building Journal. N.p., n.d. Web. 20 Nov. 2015.

Frumin, Aaron. "About." UnCommon Construction. N.p., n.d. Web. 20 Nov. 2015.

"Glyncoch Community Centre." Glyncoch Community Centre. N.p., n.d. Web. 20 Nov. 2015.

"Kickstarter." Kickstarter. N.p., n.d. Web. 20 Nov. 2015.

Kurokawa, Kisho. Metabolism in Architecture. Boulder, CO: Westview, 1977. Print.

Lin, Zhongjie. Kenzo Tange and the Metabolist Movement: Urban Utopias of Modern Japan. New York: Routledge, 2010. Print.

Maki, Fumihiko. Investigations in Collective Form. St. Louis: School of Architecture, Washington U, 1964. Print.

"Massolution." Massolution. N.p., n.d. Web. 20 Nov. 2015.

Mirmobiny, Shadieh. "Great Mosque-Cathedral of Cordoba." Khan Academy. N.p., n.d. Web. 20 Nov. 2015.

"New Orleans Redevelopment Authority." New Orleans Redevelopment Authority. N.p., n.d. Web. 20 Nov. 2015.

"Paykar Bonyan Panel Factory / ARAD (Architectural Research And Design)." ArchDaily. N.p., 13 Oct. 2008. Web. 20 Nov. 2015.

"Richards Medical Center by Louis I. Kahn at GreatBuildings." GreatBuildings. N.p., n.d. Web. 20 Nov. 2015.

"Schoten Workshop Building / Loos Architects." ArchDaily. N.p., 25 July 2011. Web. 20 Nov. 2015.

Sharp, Dennis. Twentieth-century Architecture: A Visual History. Mulgrave, Victoria: Images Pub., 2002. Print.

Wicks, Simon. "Hive Mind: An Interview with Chris Gourlay." The Planner. N.p., 19 June 2015. Web. 20 Nov. 2015.

Wong, Dong Ping, and Archie Lee Coates. "+ POOL, Tile by Tile." Kickstarter. Friends of +Pool, 27 Oct. 2015. Web. 20 Nov. 2015.