Pataphysical Prosthesis:
Bringing the 3D Printing Industry from Detroit, MI to the World

Pataphysical Prosthesis: Bringing the 3D Printing Industry from Detroit, MI to the World

A Design Thesis Submitted to the
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by

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Thesis Abstract

Modern architectural theory criticizes the use of computers in architectural design for producing cold, inhuman environments. How then should we use the fascinating technology at our fingertips if we are told that doing so will result in meaningless architecture? Historically, man has been driven to push technology forward. Technology plays a crucial role in the way that humans perceive and experience the world. and the innate calling to advance technology has become a construct of our identity as a species and a culture. However, we stand at risk to lose control of technology, and in doing so would lose a rich architectural environment based in symbolism and contextual ground.

This thesis proposes an architectural solution that embraces future technology while remaining grounded in the broader reality of the cultural context. The project takes shape as an industrial complex for the storing and manufacturing of 3D-printed architectural components, housed within the ruins of an abandoned industrial giant: the Packard Plant in Detroit, MI. The site simultaneously holds the weight of its historical significance and its current state of abandonment and perceived irrelevance. The introduction of one of man's newest technological discoveries to the forgotten Motor City could potentially revitalize its cultural identity and redefine its place in the continuum of our current history as the home of the newest leading technology.

The Narrative of the Theoretical Aspect of the Thesis

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Let us take a look at a place where a blind acceleration toward technology resulted in one of our nation's greatest urban failures: Detroit, MI, U.S.A. Detroit began as a French settlement dealing in trapping and agriculture. Its turn toward industry really began with the completion of the Erie Canal in 1825. This new transportation route brought travelers by the thousands to the "Paris of the West" where iron from the Mesabi Range was turned into stoves, railcars, and eventually cars by the millions. Opportunities in Detroit enticed businessmen, European immigrants, and, largely, escaped slaves and free African Americans from the rural South. Tensions during the Civil War created deep racial schisms that deeply affect Detroit today. As more and more black people moved into the city center, more and more white people built out and moved to the suburbs. Blacks and whites refused to work side by side in the automotive factories that had taken over the economic industry of Detroit. At the peak of its mid-century heyday one in six American jobs were connected to the auto industry. The big three: Ford, General Motors, and Chrysler, had their home in the city center. And the city relied on that single industry, riding its rollercoaster into destruction. As workers began to protest, the auto companies built branches in the suburbs and neighboring cities as backup. The core of the city was beginning to fall in on itself. As the industry began to experiment with automation, tens of thousands of jobs were lost and people began to flee in mass numbers. As auto jobs moved out of the city, Detroit's labor costs increased significantly, leaving many in poverty. Detroit suffered its intense downfall because it didn't diversify. People were left as the byproducts of an accelerating technological industry. The population has fallen by 60% from its peak as the fourth largest city in the country at 2.8 million to only 714,000. Less than a third of employable people are working and the per capita income in 2009 was just $15,310, just over half the national average of $27,041.

Detroit is left as a hollowed-out core of a societal infrastructure that failed to keep up with its own acceleration. What it needs is a slow nurturing back of human desire, interest, and welfare. It needs to be designed for the human that wants to stay there, to build a home and identity there, which was never done throughout its history. Detroit was a machine driven by industry, technology, and economy. When humans were no longer efficient, it drove them out with automation and relocation. What the people of Detroit need is a city that will no longer treat them as a cog in the machine, but the controller of the machine. This thesis proposes to do this by introducing one of the world's newest technologies currently in the infancy of its own industry. We are at the pivotal moment to define the industry of 3D-printing technology. 3D printers are becoming more and more accessible to the public and the first fully 3D-printed house is being conceptualized and materialized in Amsterdam. What makes it quite relevant to this discussion is that the software primarily used to produce it is based in parametrics, which essentially eliminates human decision from the equation of design. Parametric architecture is a design response defined by a set of given parameters. These parameters are set into an algorithmic equation and the mathematical giant: the Packard Plant in Detroit, MI. product is the architectural solution. This concept is on the fast track of acceleration, propelled by autonomous technology. By placing the major manufacturers of this industry in Detroit, we could make the decision as a society to insert human interaction and decision into the very framework of the mode of production. With humans at the helm rather than machines, we could potentially slow down and analyze the acceleration of technology and begin to relate it more directly to the people that are essentially dependent on it. This concept would be embodied architecturally by an industrial complex for the storing and manufacturing of 3D-printed architectural components, housed within the ruins of an abandoned industrial giant: the Packard Plant in Detroit, MI.

The Packard Plant was once the king of automotive production. At its peak it housed four million square feet of factory space and employed up to 40,000 workers. The factories contained multistory automated assembly lines and bridges connected different regions of the campus. There were offices, drafting rooms, and parking garages as well as a grand lobby and a penthouse. It was a state-of-the-art technological dream in its prime. As the dream and industry were ushered out of Detroit, the plant lost its economic and technological relevance. Advancing technology rendered the plant obsolete. According to the philosopher Marshall McLuhan, what is obsolesced by the morphology of media is turned into a visible cliché. A cliché is a medium that is now dead but was once living. "Our visible world, for McLuhan as for Heidegger, seems to be filled 'with petrified statues, with things that have the mere semblance of life'" (Harman, 187). This is especially apparent in Detroit where photographers can be observed documenting the abandoned landscape of 'ruin porn'. The Packard Plant is a particular modern ruin that holds societal and emotional importance for the many citizens that worked there and drove past its iconic assembly line bridge every day. What has become obsolesced has become increasingly visible.

Today, the site lies abandoned and ravaged by scrappers. Floors are falling in on one another and wildlife permeates the framework. It stands as a great symbol of the suffering that the people of Detroit have endured as their lives and contributions became irrelevant in the eyes of the technological machine. The site is tied to the human condition of the present and retains memories of a collective past that situates the area's cultural identity. The careful revitalization of this iconic structure could potentially establish a precedent for the rebirth of Detroit as a city built by and for its inhabitants that calls upon the past to situate itself within the present and to effectively point beyond itself toward the future.
So we must ask,

How can architecture embrace future technology while remaining grounded in the broader reality of the cultural context?

Modern architectural theory criticizes the use of computers in architectural design for producing cold, inhuman environments. Juhani Pallasmaa said that "computer imaging tends to flatten our magnificent, multi-sensory, simultaneous and synchronic capacities of imagination by turning the design process into a passive visual manipulation, a retinal journey" (Pallasmaa, 12). And Alberto Pérez-Gómez claims that architecture as variables and functions has failed to come to terms with the essential question of meaning in architecture. How then should we use the fascinating technology at our fingertips if we are told that doing so will result in meaningless architecture?

In the beginning, the machine was a mysterious and divine figure. Vitruvius explained that machines are moved by revolutions of circles, which depend on the order disclosed in the "revolutions of the universe" as "all machinery is generated by Nature". The circle is a paradoxical figure: one line with no beginning and no end, at once concave and convex. "When moving, it resolves two contrary motions, a geometric manifestation of coincidentia oppositorum" (Olshavsky, 184). In an Aristotelian text, the author describes geometrical machines as "instruments which make possible a reversal of power such as that which is metis (magic) – which enable the smaller and weaker to dominate the bigger and stronger" (Olshavsky, 184). Medieval machines overturned the natural order of things and kept the cause immanifest. This sparked wonder in man, and wonder sparked philosophizing. In the Middle Ages, machines were highly regarded in a biblical sense. Saint Augustine asked the Divine: "By what means did you make heaven and earth" and "What tool did you use for this vast work?" He likely imagined a crane as in the theoretical device deus ex machina (god and machine) in which a crane lowers a god into a scene to resolve conflict. Thus we can observe that "the primary purpose of medieval machines was not to understand the cosmos as an objective entity but to demonstrate the wondrous workings of the Nature that God had created" (Olshavsky, 188).

The Greek term techne once referred to these wondrous effects. In Homer techne is the know-how of metalsmithing, carpentry and weaving. It is not differentiated from magic. It taps the power of the gods and creates wondrous objects or magical effects. This technical action depends upon the same kind of intelligence as metis (magic). For two thousand years architects depended on "ritual, the original mimesis, to insure the effectiveness of their architecture as cosmic place, founded on a belief in the cosmos as the source of the transcendental order of formal relationships" (Pérez-Gómez, 49). We can see the progression of the term techne through Plato when he distinguished techne from poiesis. Techne was understood as a purely human activity, while poiesis was the artistic creation of the poet. This techne was the technique of Vitruvius and of architecture in the Western tradition, and it held a propensity for mathematics and instrumentalization. "After Plato's techne, the craftsman's (and the architect's) original technique becomes a doxa (opinion), as opposed to true science, episteme (knowledge). It is seen to participate in true knowledge only in so far as its operations are guided by weight, measure or calculation" (Pérez-Gómez, 49).

Descartes took this even further when he considered false everything that was not clearly proven true by mathematics and reason. With the dawn of Cartesian theory and Galilean science, the sacred machine was stripped of its symbolic significance. Galileo and Newton explained all mysterious phenomena (including machines) with science and Descartes discredited human senses and consciousness in an effort to separate the mind and the body. The interpretive space between the worldly activities of man and the celestial activities of the gods collapsed and flattened. Worldly experiences were no longer sacred and individualized; the celestial and physical realms had become homogenized. With the French Revolution and the execution of Louis XVI, the order of social taboos and natural social groups had officially disappeared. This environment gave rise to what we know today as modern technology. This modern technology, according to Heidegger, demands that nature be orderable as standing-reserve. It challenges-forth the energies of nature to be unlocked, transformed, stored, distributed, and switched about in a constant line of production. Modern man is under the illusion that he controls standing-reserve, but the new factor of technique is that it has become autonomous. Man is no longer making the decisions in favor of the best technique; the machine can effect the same operation. In this way, man has become entrapped by technology.

It is obvious that we are at a breaking point. Technology is moving forward so quickly that we feel powerless to harness and control it. However, we confuse speed with acceleration. It is easy to associate capitalism with acceleration. "The essential metabolism of capitalism demands economic growth, with competition between individual capitalist entities setting in motion increasing technological developments in an attempt to achieve competitive advantage, all accompanied by increasing social dislocation" (Williams, 5). The philosopher Nick Land proposed that "…capitalist speed alone could generate a global transition towards unparalleled technological singularity" (Williams, 5). But this confusion between speed and acceleration is important. We are experiencing only increasing speed in a horizontal direction, restricted by a set of capitalist parameters. Accelerationists "seek(s) to preserve the gains of late capitalism while going further than its value system, governance structures, and mass pathologies will allow" (Williams, 8). "Rather than a world of space travel, future shock, and revolutionary technological potential, we exist in a time where the only thing which develops is marginally better consumer gadgetry. Relentless iterations of the same basic product sustain marginal consumer demand at the expense of human acceleration" (Williams, 9).

According to the Accelerate Manifesto, we must align our efforts with those of the Enlightenment to understand ourselves and our world better. In doing so, we can come to rule ourselves. However, unlike the original Enlightenment we must not seek a politics of maximal mastery over society. Rather "…it must include recovering the dreams which transfixed many from the middle of the Nineteenth century until the dawn of the neoliberal era, of the quest of Homo Sapiens towards expansion beyond the limitations of the earth and our immediate bodily forms. These visions are today viewed as relics of a more innocent moment" (Williams, 16-17). We must shift "towards an era of all-encompassing change […] towards a completion of the Enlightenment project of self-criticism and self-

mastery, rather than its elimination (Williams, 17).
This Accelerationist view glorifies technology as the answer to all of our problems. It puts all of the power in the hands of this accelerating machine. However, if we look to the past, particularly in Detroit, it is easy to see that the acceleration and automatization of technology pushes man out of its way. Effectively, humans would become cogs in the machine of technological progress. Labor would become obsolete. Our society is so fixated on progress that it is hard to imagine ever halting the immense kinetic potential of modern intelligence as it hurdles toward a world in which everything is rationally defined, quantified, and technologically mediated. The problem with such a world is that everything within it becomes technology. Technology controls society, economics, politics, the marketplace… We have become cybernetic organisms dependent upon our cellphones, our headsets, our mediated environments, so that if technology fails we are defenseless. Accelerationists speak of a utopia in which no one has to work, we find love through our phones and social media, technology takes care of everything. But a machine lacks an important human quality that it can never obtain: practical wisdom. It can build upon more and more information, it remembers everything, but it can never forget. It cannot recall some forgotten knowledge that has since matured and ripened, and it cannot contextualize or build upon past experience. A world controlled by technology would in effect not contain any knowledge, but only information. This potential future is not a place designed for human inhabitance. It mirrors the abandoned core of Detroit where life has been driven out by a hurtling technological machine.

How then can we change this path? "The first step forward is to get out of either/or language about technology. So much discussion either sees it as panacea or curse" (Wark, 13). It is both and it is everything in between. "A technology is not what it does, it is also what it might do" (Wark, 13). The ability to change its direction lies in no hands but our own.
In order to do this, I think we must take a look at Alfred Jarry's pataphysical machines and the history of daidala. Daidala, or art objects, derive their name from the mythical architect Daedalus, who inherited metis from his father. This became a fundamental aspect of his personality and work. Daidala can appear to be what they are not, they seem to possess mysterious powers, and they are luminous – they reveal the reality they represent. "The principle value of daidala is that of enabling inanimate matter to become magically alive" (Pérez-Gómez, 50). Many years later, at the end of the nineteenth century, Jarry's machines were a response to the modern dichotomy of aesthetics and function in the machine, prompted by the schisms of Descartes. Modern physics deals with appearances and quantifiable phenomena. Metaphysics gets lost in abstractions that neglect the concrete and historical. "Pataphysics targets precisely where we live. This includes dreams, hallucinations, and other outpourings of the imagination that modern science does not regard as 'real'" (Olshavsky, 199). Jarry's pataphysical machines countered the egocentric demand of technology, which he personified with the character Ubu. Ubu is all things grotesque, the fat being, the science of machines in all its sinister frenzy. By contrast, Jarry's

"'improbable' contrivances are governed neither by mere mechanics nor by conventional utility. It also makes little difference whether they are materially feasible. By suspending the functional aim of mechanics, these contentious pataphysical machines may seem 'useless', but instead present 'the semblance of machinery, of the kind seen in dreams, at the theater, at the cinema.' This allies them more closely to their earlier architectural heritage of wondrous and imaginative contrivances in search of meaning" (Olshavsky, 199).

Not only do these machines establish connections to the mystery and wonder of medieval machines, but also to the excitement and optimism that was present during the space race, when our dreams were transfixed on the quest beyond our earthly and bodily limitations. "The aim of Jarry's machinations, like his writing, is to 'suggest rather than to state', to display what is essentially singular and to reveal 'laws governing exceptions'" (Olshavsky, 200-201). The accuracy of these machines is measured by the discovery of similarities, metaphors, metonymy, and mimesis. Effectively, they begin to rebuild the interpretive space between man and the machine. With a distance created between technology and man we can begin to participate, to play, to imagine. We can fill the gaps between what is presented to us and its deeper, metaphysical meaning.

I intend to do this through my architecture. My proposal is an industrial complex for the storing and manufacturing of 3D-printed architectural components, housed within the ruins of the Packard Plant in Detroit, MI. This typology is in anticipation of a future in which we have harnessed the potential of parametric and 3D-printing technology to contribute to a better world. This building will utilize technology in a way that remains grounded in context. Perhaps this will be through the use of pataphysical machines or pataphysical design, in which there is an interpretive space between parametric architecture and the humans who encounter it. It will need to invite participation between man and machine, man and architecture. The public will be invited to interact with the building in a way that brings wonder back into man's idea of technology, in a way that will inspire us to bring forth and reveal the poetic capabilities of technology. The workers within the factory will play a key role in the way the product is manufactured and the designers of the products will use their practical wisdom to enhance and contextualize their creations in a way that could never be done with a machine alone. It is my goal that this project will bring an important new industry to the city of Detroit in a way that has never before been done. It will open the doors for human creativity and participation, it will create jobs and interest in the city, and hopefully, it will catalyze the reconstruction of our relationship with technology.

PROGRAM

an industrial complex for the storing and manufacturing of
3D-printed architectural components

Major Project Elements

Storage warehouses
Factory space [including multistory automated assembly lines]
Offices
Design Studios
Grand Lobby and Showroom
Public Viewpoints
Giftshop
Café

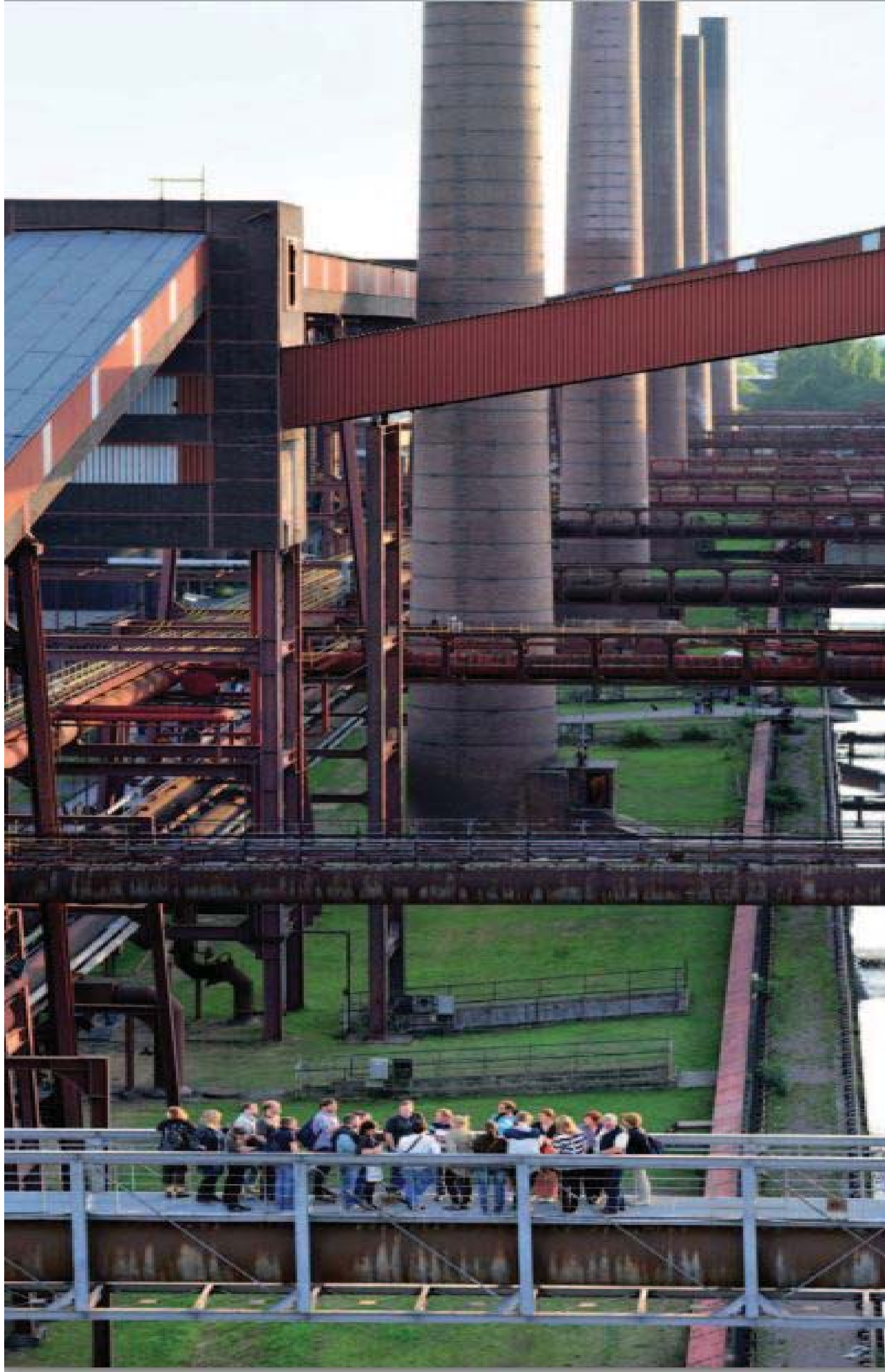
User/Client Description

The project will be designed for a major 3D-printing production company that produces large-scale architectural components.
The building will be owned by the company
and will be utilized by
Architects - Peak time: 9-5 Parking requirements: 20+
Designers - Peak time: 9-5 Parking requirements: 20+
Production Workers - Peak time: 24h Parking requirements: 500-1000
Public - Peak time: 10-7 Parking requirements: 50-100

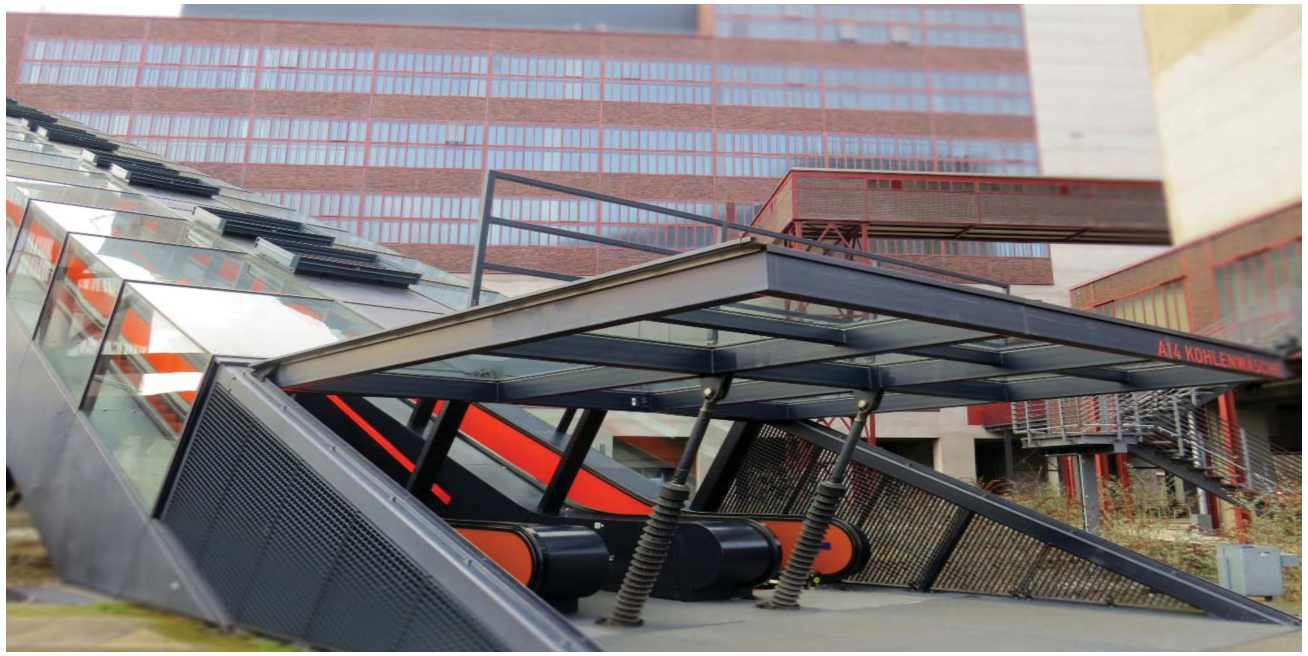
Special consideration will need to be made for the medical and mental health of the workers as production cannot be halted once initiated. The factory will need to be staffed 24/7 and should provide a comfortable environment for all workers.

CASE STUDY
ZOLLVEREIN

Project Type	Industrial Complex Preservation/Renovation
Location	Essen, Germany
Size	100 hectares, distributed over the central shaft facilities of Zollverein XII, the Shafts 1/2/8 and the coking plant premises.
Program	Museum/Gallery
Characteristics	UNESCO World Heritage Site Zollverein Coal Mine Industrial Complex has been preserved through conversion into a cultural center honoring the natural and cultural heritage of mankind.



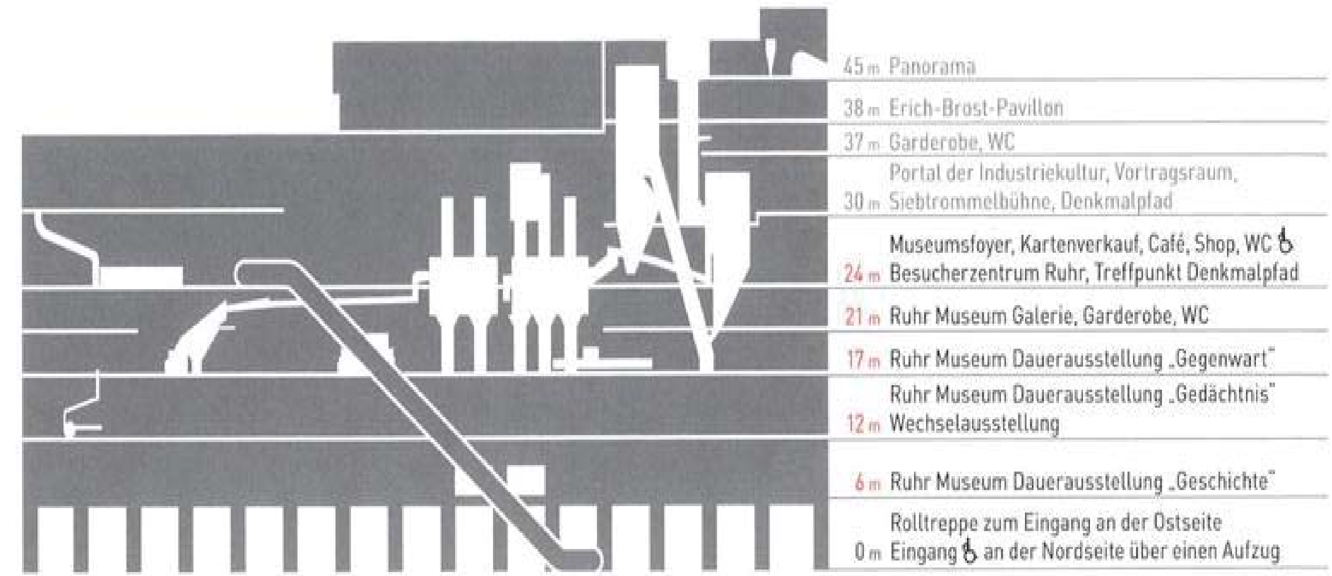
[1]
Coking plant, Zollverein Coal Mine Industrial Complex.



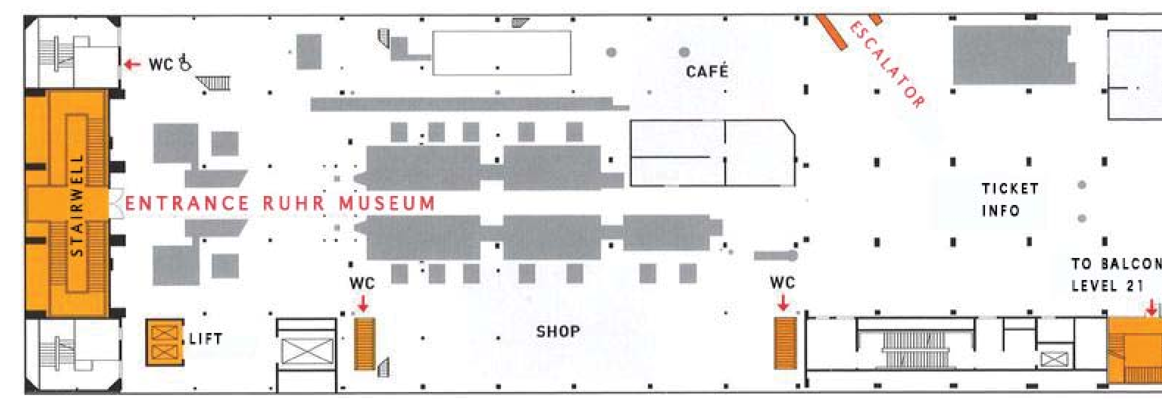
[2] Rem Koolhaas' iconic escalator entrance introduces visitors to the building through a tunnel of molten coal orange.

Zollverein is an example of industrial architecture defining the cultural identity of the region in which it is situated. The Zollverein Coking Plant is located in the largely industrial Ruhr region of southeastern Germany. Upon commencement of coal production in 1932 it was the the largest coal mine of its time. Architects Fritz Schupp and Martin Kremmer designed a technical masterpiece in the modern Bauhaus style with a daily output of 12,000 net tons of pure hard coal. When the plant was decomissioned in 1993, it was clear that the campus should be preserved. However, it was unclear what was to be done wih it. In 2001 The Zollverein Shaft Sites XII and 1/2/8 as well as the Zollverein Coking Plant were declared a UNESCO World Heritage Site in coordination with a master and management plan designed by Rem Koolhaas, which was initiated later that year. This case study focuses on the site's most impressive building: the Kohlenwäsche, a former factory for sorting coals.

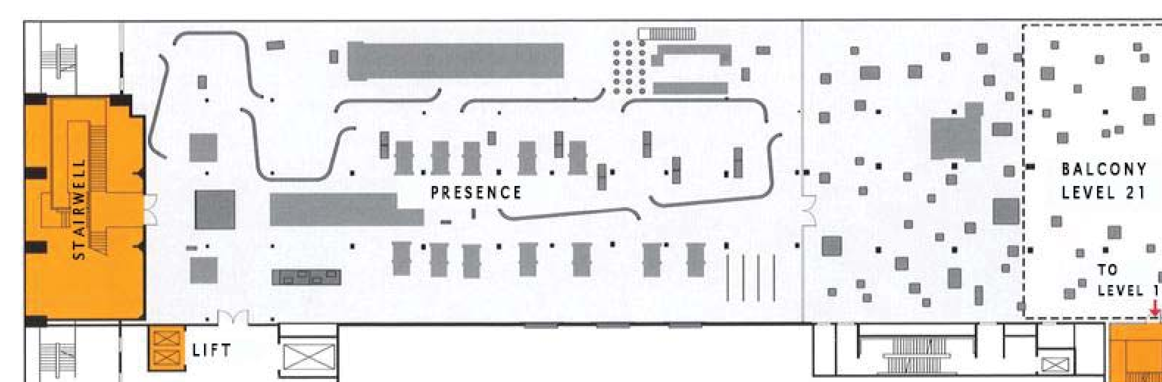
The building was renovated to its current condition as a museum for the Ruhr region by Koolhaas himself. The new program was designed around the existing machines that dominate the building. The visitor center, the Ruhr Museum, the Portal of Industrial Heritage, and the Monument Path ZOLLVEREIN exist over three levels. Today, the building displays the history of the role of industry in the Ruhr area and stands as a symbol for the cultural identity of the region.



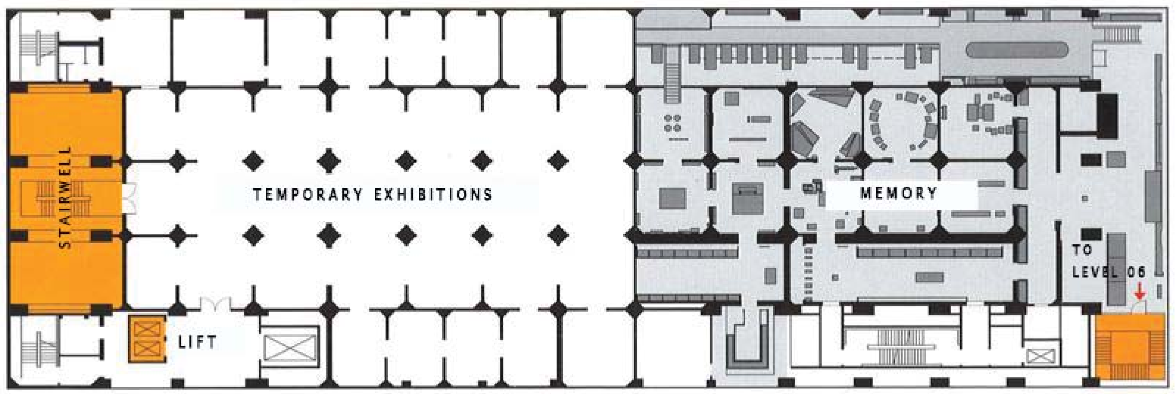
[3] Building section.



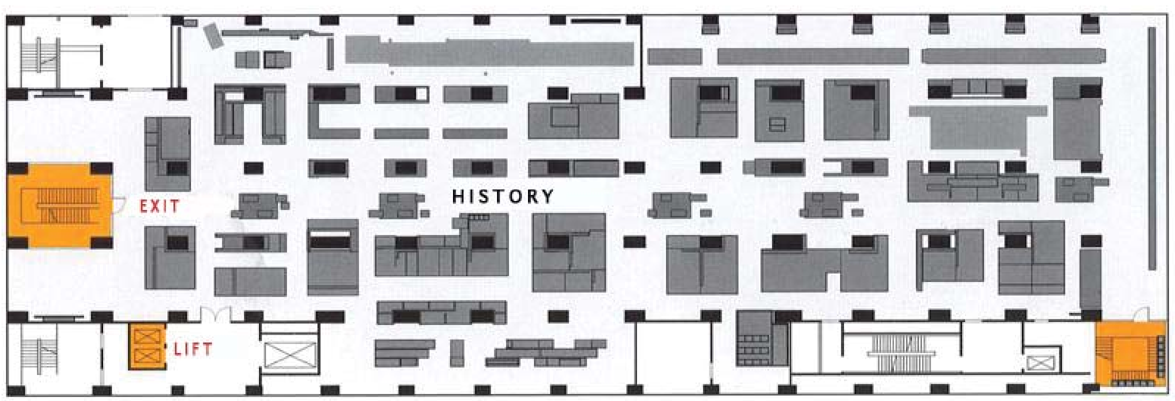
[4] Level 24m.



[5] Level 17m.



[6] Level 12m.



[7] Level 6m.

Plan to section

Because a new program has been applied to the existing building, emphasis has been made to create a distinction between the grid-like spacing implied by structure and new envisioned spaces. Each floor represents a different phase in the history of the Ruhr region and thus has a different essense, which is apparent in the analysis of plan. The history level (6m) is strongly defined by existing machinery and has adpated a linear progression of spaces. Level 12m is defined by the large open space provided by lack of machinery. This floor is open to interpretation for temporary exhibitions. The memory level (21m) looks down upon this level through a scattered mix of machinery. On the presence level (17m) Koolhaas implemented an inversion of the linear progression of structure with curvalinear elements directing fluid movement. The entrance to the museum occurs on level 24m where the escalator positions visitors to enter the building at an oblique angle. This is also an inverse of the grid-like language laid out in historical plan, section, and elevation. Movement then tends to take a zig-zag pattern through the cafe, shop, and ticket office.

Geometry

The perimetrical geometry of the Kohlenwäsche in plan displays a 3:1 proportion. Within the confines of this simple rectangular geomtery, a consistent gridwork of columns repeats, leaving the original construction open and optimal for industrial factory work. This homogenized space has been altered somewhat by Koolhaas' design intervention. However, the museum remains rather open to the wanderings of visitors.

Circulation

Circulation of people follows the circulation of coal as it entered the building from the top and worked its way down. The exterior escalator entry condition positions visitors at an angle to the linear floor plan. Inside the building, Koolhaas has placed primary circulation for the museum at the extreme west end, effectively creating a simultaneous start and end point for each descending floor. Visitors are released from the stairwell at its center point and are left to construct a path to the opposite end of the building. They then must turn back and revisit the length of the floor before exiting.

Repetitive to Unique

Unique instances of fluorescent orange lighting repeat throughout the vertical elements of the building. Rem Koolhaas' iconcic orange escalator ushers visitors up and into the building in a tube of throbbing color. Later, stairwells lit in bright orange connecting levels of the Ruhr museum call back to the initial ascent. These design elements mimic the hot orange color of molten coal as it made its journey through the building during the industrial era.

[8] Stairwell.

Structure, Massing, Hierarchy, and Natural Light

The Kohlenwäsche rests upon concrete structural legs. The framework of the building is set by a rectilinear grid system of steel beams and columns and a facade of red brick. The language of the design is simple, straightforward, and unadorned. All of the buildings that comprise the coking plant were constructed with the same tectonic language as Shaft XII, the iconic "Eiffel Tower" of the Ruhr region. Its vocabulary of grand, symmetrical gestures is the product of industrial efficiency. This was translated to the coking plant buildings through large, cubic, symmetrical massing. Linear, angled chutes protruding from the buildings contrast their stoic rectilinear attitudes. Architecture on the site builds from wide solid bases to smaller iterations of the base shape at the peak. Geometry contrasting the rectilinear language of the buildings such as tubes, chimneys, and chutes are given visual hierarchy. Natural light is let into the open floor plan through large bands of refurbished windows that span the length of the building.

[9] (Previous spread) An aerial view of the Zollverein Coal Mine Industrial Complex demonstrates connections within the campus and outward toward the region.
[10] (Above) The Kohlenwäsche today.

The Zollverein case study acts as an example for multiple aspects of this thesis project. It demonstrates the careful preservation of culturally significant industrial architecture through conversion. This conversion of typology preserves the heritage and identity of the Ruhr region through culture-focused programmatic elements including museums, galleries, restaurants, exhibit spaces, event spaces, etc.
The Kohlenwäsche has been updated to re-engage interest through Rem Koolhaas' modern, contrasting interventions that open one's eye to the events of the past. However, the preservation of much of the machinery and the essential structure of the building truly makes the project successful in its attempt to become a "memory and shop window of the Ruhr Metropolis"(Schacht, 6). I will be applying the design decisions made at Zollverein to my preservation and restoration work at the Packard Plant where the cultural identity of Detroit, MI is strongly symbolized. My work must recall the past while inviting a participation with present human culture. The careful marriage of existing infrastructure and engaging modern elements defines the succes of Zollverein and is essential to the success of this project.

[11] (Above) Shaft XII, the "Eiffel Tower" of the Ruhr region, sparked the iconic architectural language of subsequent bulidings including the Kohlenwäsche.
[12] (Right) Visitors are able to see the historic process of coal-making through interaction with existing machinery and infrastructure.

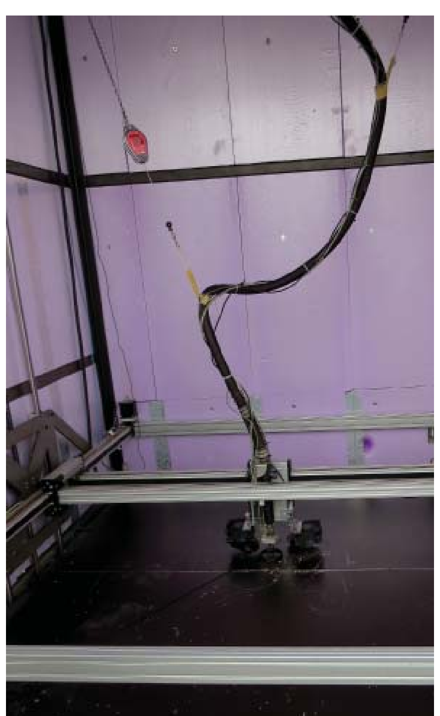
CASE STUDY
3D PRINT CANAL HOUSE

Project Type	Expo-site for the world's first 3D Printed Canal House
Location	Amsterdam, Netherlands
Size	50,400 sq ft canal-size plot
Program	Building, innovation and exhibition ground
Characteristics	DUS Architects is collaborating with scientists, engineerings, and designers to demonstrate the potential for 3D-printing technology to revolutionize construction by increasing efficiency, reducing pollution, and offering low-cost housing solutions worldwide. Proposed completion of the 3D Print Canal House is 2017.

[13] The site is an open forum for the public to receive guided tours and participate in discussion.

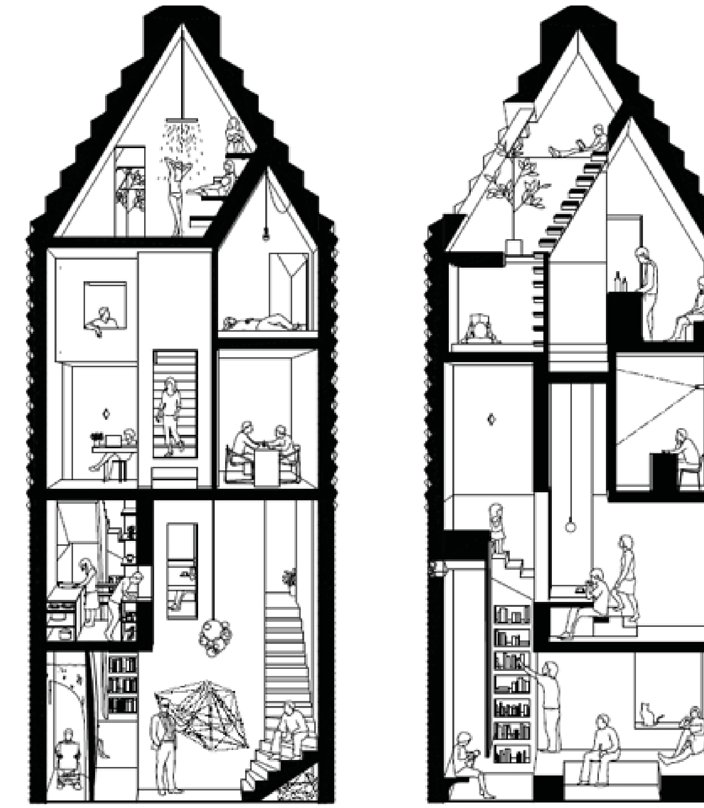
3D Print Canal House

is not a traditional architectural case study interested in precedents of form and function. Rather, it is a model for innovative solutions to questions existing and unasked.

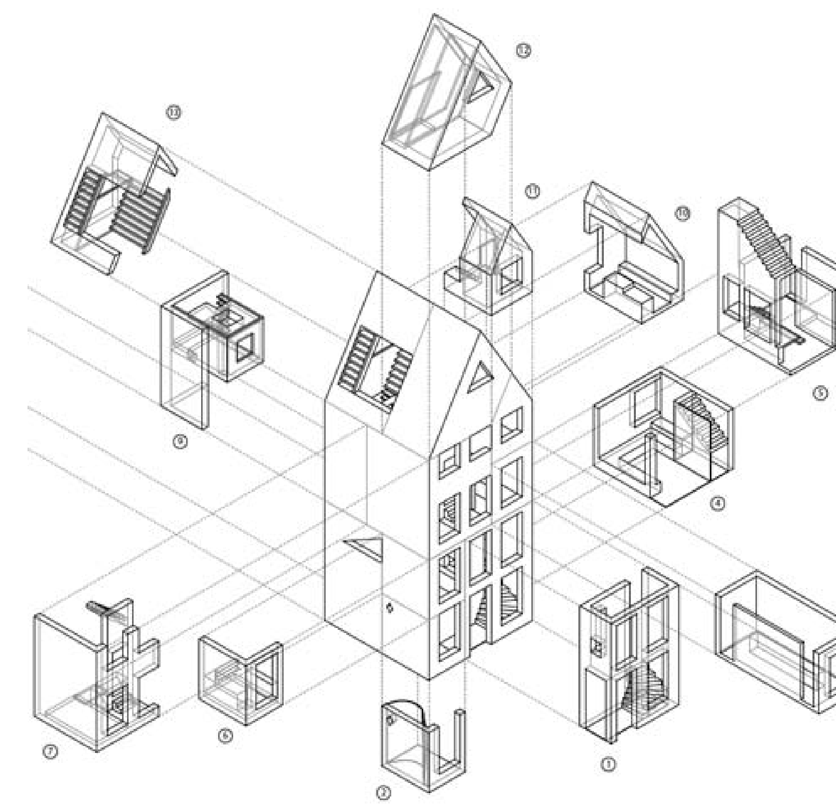


DUS Architects has been granted three years on their canal-side site in Amsterdam to conduct research, experiment with construction techniques and materials, and to collaborate with their partners and the public on anything and everything that can be contributed to their goal: "to revolutionize the building industry and offer new tailor made housing solutions worldwide". The firm has developed a design for a canal house that will be entirely constructed of 3D-printed material on site using a gigantic 3D printer of their own development: the Kamermaker, which can print elements of 2 x 2 x 3.5 meters. Technically, it can print any material that melts and then hardens again, as long as the melting temperature isn't too high. Currently, they are using a type of industrial glue (80% of which is composed of vegetable oil) called Hotmelt, developed by leading partner Henkel. They are also experimenting with other sustainable materials: bamboo, recycled plastics, even the leftover potato starch from a french fry company. Different materials produce results with qualities optimal for different applications. Through experimentation and collaboration they hope to develop a "renewable, sustainable, strong, tactile and beautiful material that can compete with current building techniques". The problem that arises when applying this technology to architecture is the product's ability to comply with current building regulations. When a facade is constructed in the Kamermaker its layers are printed at once, meaning the 3D-printed wall is at once an exterior and interior component. It must have qualities that handle the questions of insulation, fireproofing, wind loads, and foundations.

[14] (Far left) The Kamermaker produces experimental building components on-site.
[15] The stepgable of the canal house boasts the most ornamentation, which actually generates more strength within the increasing surface area of the folds.



[16] Each room showcases a research update in shape, structure and material.



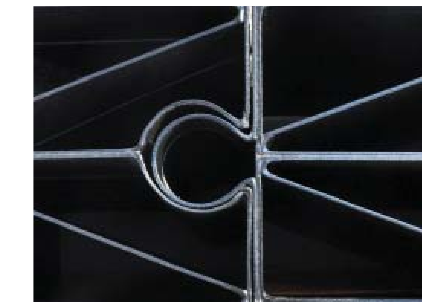
[17] Individually printed components will be pieced together to form a traditional 13-room 4-storey Dutch canal house.

[18] (Above) The site of the 3D Print Canal House acts as a construction site, museum, research facility, and exhibition ground.
[19] (Right) Eco-concrete fill connects elements of the building while providing structural support and insulation.
[20] (Opposite) One of the rooms showcases the click system of construction. Components are clicked together like giant Legos and are unable to be pulled apart again.

Together with Henkel, DUS has developed a lightweight foaming eco-concrete that will fill hollow diagonal shafts scripted into the design of the wall. These large structural crosses will connect separately printed elements and provide strength and stability for the entire structure. Additionally, the substantial air inside the concrete acts as insulation. As little concrete as possible is used in order to maximze strength while keeping the canal house lightweight, economic, and sustainable. The inclined shafts used for structural stability are used similarly elsewhere for cables, pipes, communication technique, wiring etc. Because they are scripted into the design, dimensions and angles can be changed on an individual basis for each instance of each project. In this way, 3D printing technology opens up the possibilities for using a high level of variation and customization. It will no longer be more expensive or labor intensive to add detail or unique objects to a design.

ANALYSIS

The research being conducted at the 3D Print Canal House is essential to the discussion of this thesis proposal. The mode in which 3D-printed material is designed and manufactured is based in parametrics. Design parameters (such as solar angle, climate, structure, economy, sustainability, comfort, style, etc.) are entered into design software that then applies the data to an algorithmic equation. The result is an optimized design that is then coded to the Kamermaker and printed. DUS Architects are conducting their experiments by changing the variables within their parameters and evaluating the results. This is a very mathematical and scientific approach to design. The technology is fascinating and has enormous potential. However, it must be tested against measures other than the parameters that are calculable by a computer. We must question if this kind of design work can stand up against the cultural and historical anatomy of the real world. How will 3D-printed architecture respond to the contextual reality of the site on which it is located? 3D-printing technology will give us the ability to send designs digitally to a printer on site. This will eliminate transportation costs and middle men. It will no longer be cheaper to have things produced across the globe. It will be possible to print everything locally. Waste will be reduced as the raw material transforms directly into the final product. These advantages are exciting, but have the risk of becoming reductive means of design. Alberto Pérez-Gómez claims that architecture as variables and functions has failed to come to terms with the essential question of meaning in architecture. As 3D-printing technology begins to develop from its infancy we stand at a critical point in the projection of its inevitable industrialization. We have the power now to determine how this technology can be applied to the building industry and the profession of architecture. What is important to take away from this case study is its emphasis on research, discovery, and modification. The entire process is open to the public for input and exposure on daily tours and demonstrations. This approach to the development of the 3D-printing industry has a unique social and anthropological quality. It is essential to continue to push beyond what has already been discovered in order to realize the potential of technology. “A technology is not what it does, it is also what it might do” (Wark, 13).



Conclusion

Upon moving forward with the proposal of an industrial complex for the storing and manufacturing of 3D-printed architectural components, the developments of this case study will set a standard for the requirements of the thesis program. Spatial organization and function will be informed by the demands of the progressing construction of the 3D Print Canal House. Additionally, this thesis project will be influenced by the forward-thinking quality of research and experimentation being conducted by DUS Architects and partners. An essential question of this thesis is in regard to the potential of technology. It seeks to propose a way in which the relationship between humans and technology can be reconstructed to incorporate a space of interpretation and meaning.

CASE STUDY

Aimer Fashion Factory

Project Type	Fashion production complex
Location	Shunyi District, Beijing, China
Size	49,000 sqm
Program	Production line, distribution center, storage facility, research and development department, offices
Characteristics	The factory houses various functions of the Beijing Aimer Lingerie Co.,Ltd under one roof. In order to promote interaction and a sense of community for the workers, a platform connecting the different parts of the factory is set at level +13 m, creating an inner landscape and recreation center for employees.

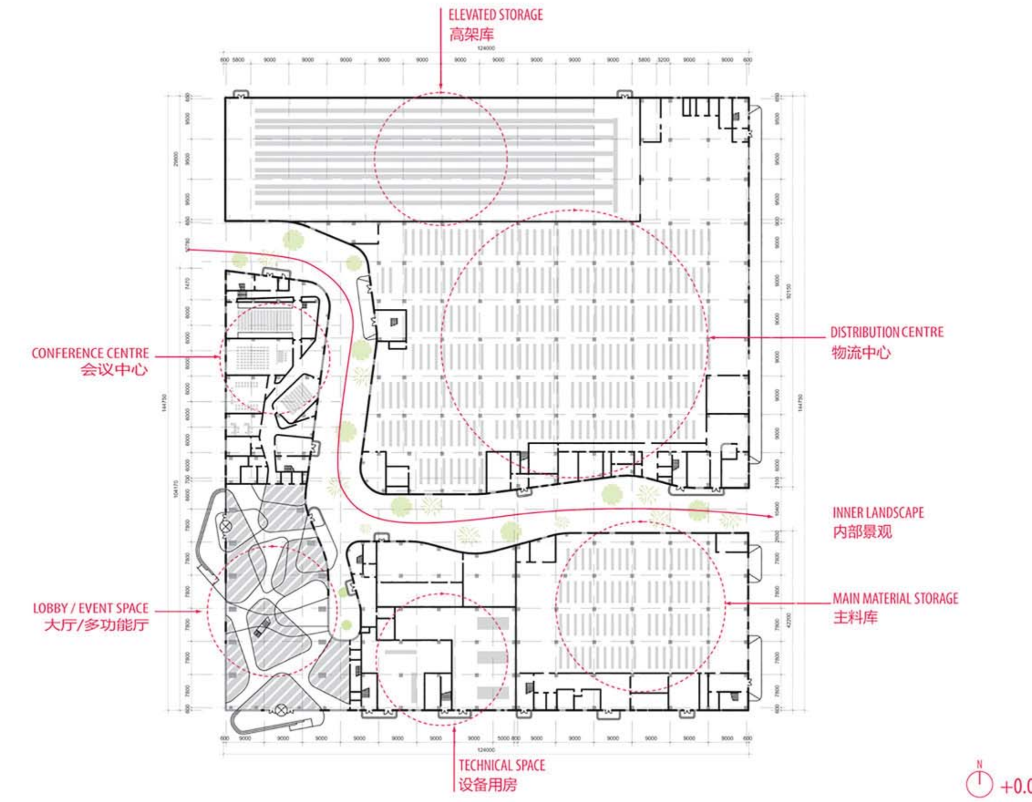
[21] The catwalk-like grand staircase is veiled and revealed by slender, seductive columns.

This case study demonstrates the design attributes of an industrial factory conceived and constructed in the current context. It focuses on the differences in form, spacial layout, and detail in comparison to the industrial era designs of the Packard Plant and Zollverein. The Aimer Fashion Factory was completed in August 2014.

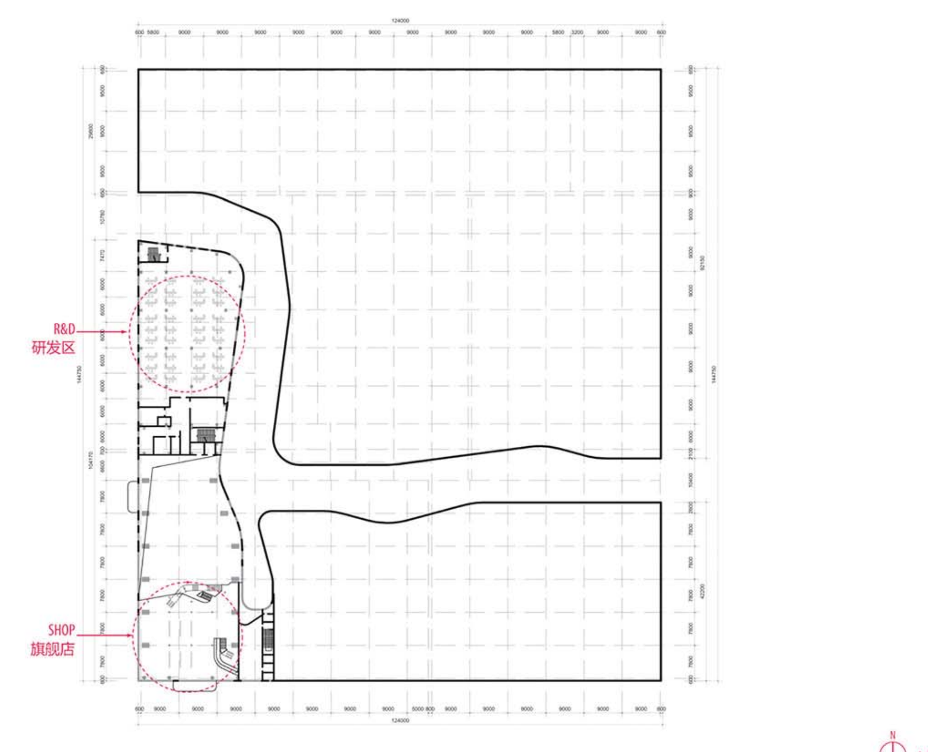
Aimer Fashion Factory

The program of the Aimer Fashion Factory positions designers, administration employees, and production workers within the same building. In an effort to foster a community within the factory, a void has been cut through the center of the building and bridged by a communal deck at level +13m. This outdoor space breaks the mold of conventional restrictive factory design and allows for communication and a collective breath for all workers. The factory has also been designed for events, showcasing, and industry conferences. This public aspect of design is something new to the identity of factories as well. The grand staircase in the lobby winds around slanted columns that obstruct the eye of the viewer standing at ground level. Models are able to descend the staircase as if it were a catwalk, gradually becoming visible to the audience below. The seductive slender columns also veil the shop and museum beyond the lobby.
This language of coverage and transparency is echoed throughout the building in curved and quadrilateral patterns of lighting, walkways and voids, which were extracted abstractly from selections of lace. The facade of the building transitions from industrial galvanized aluminum to moments of transparent glazing where different levels of lighting are required. The interior finish of pre-fabricated concrete panels contribute a warm and tactile element to a traditionally cold and mechanized typology.

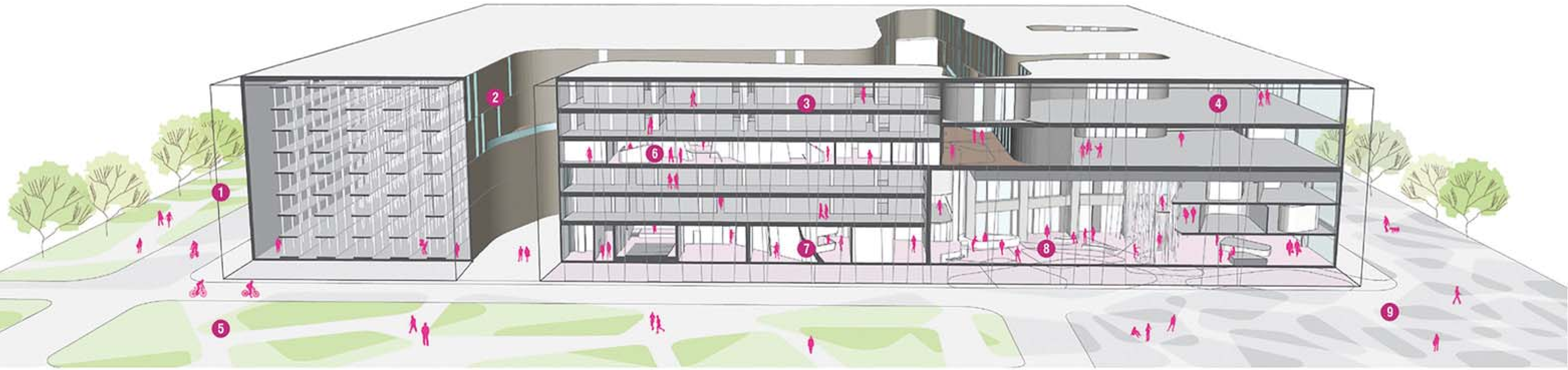
[22] (Previous spread) A timbered bridge connects workers and separated portions of the building across the void.
[23] (Above) The theatrical lobby space embodies the covering and revealing qualities of lingerie. Spaces like this allow large public gatherings and glamorous showcasing events to take place within the same building as production lines and workshops.



[24] Level +0.00m



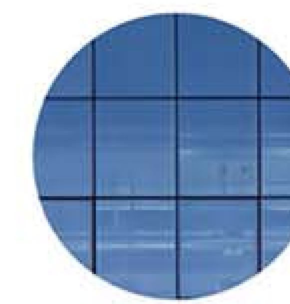
[25] Level +5.30m



1
Facade / Storage
幕墙/厂区

2
Facade / Inner Street
幕墙/内街

3
Facade / Office
幕墙/办公区



4
Facade / Public
幕墙/公共区

5
Green Area
绿地

6
Office
办公区

7
Conference Center
会议中心

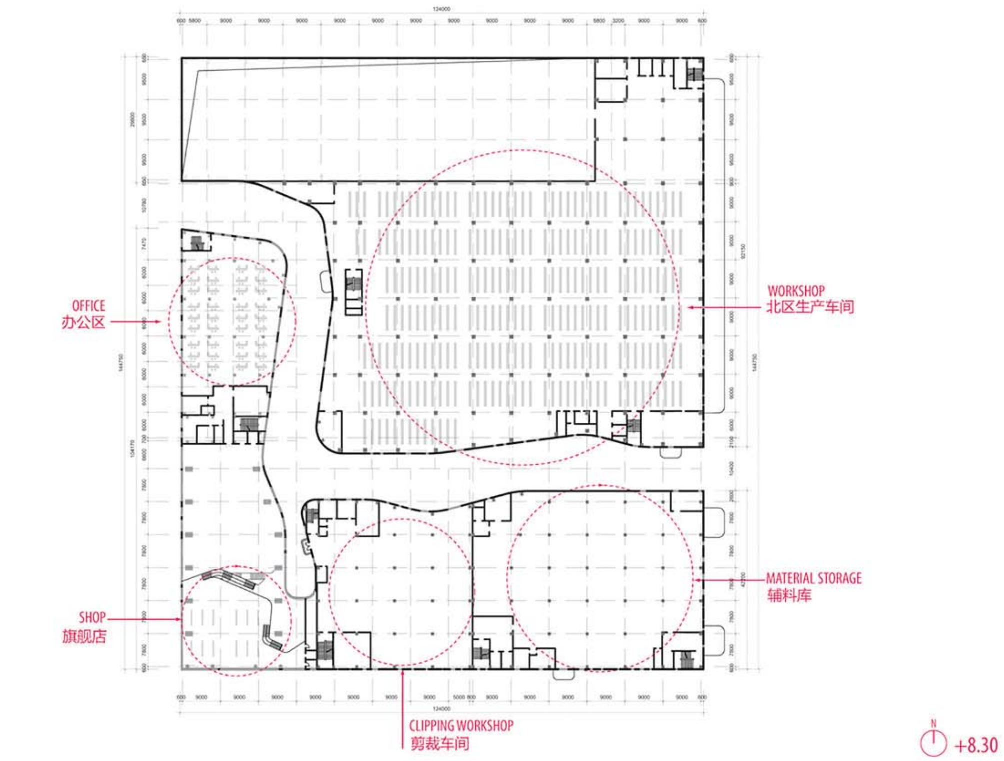
8
Lobby
大堂

9
Plaza / Pattern
广场/图案

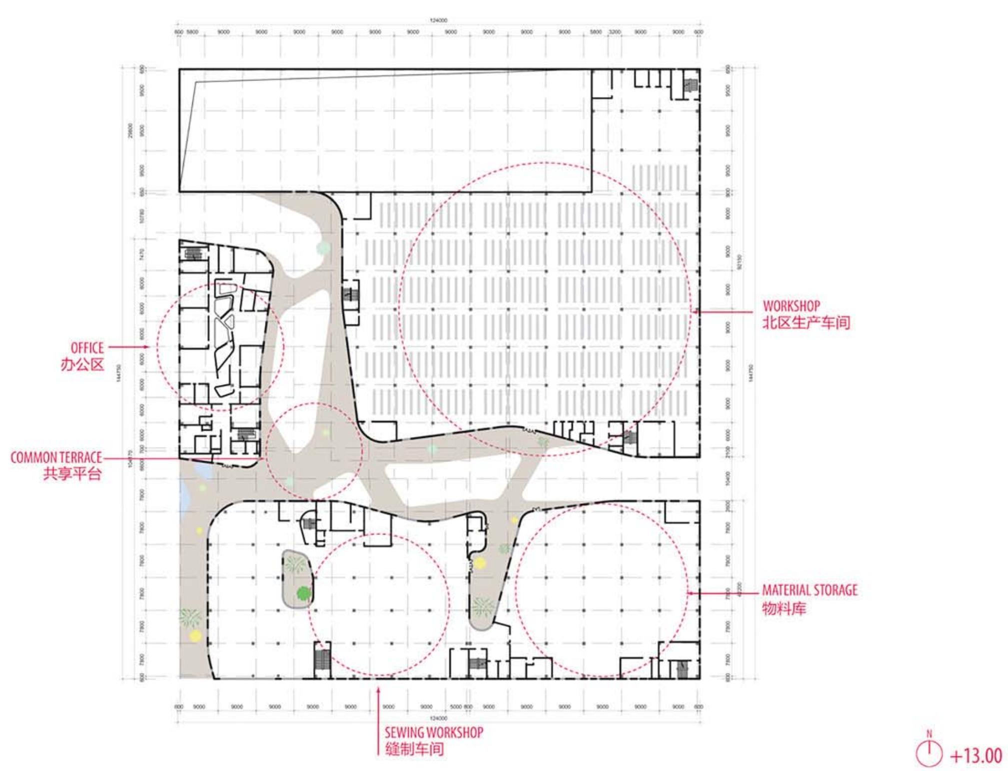
Plan to section analysis, geometry, subtraction, and circulation

There is a proportional relationship between plan and section. Because the plan forms a rectangle that is nearly square, a section taken anywhere in the building is an increment of the area of the plan. The rectilinear geometry of the plan and structural grid system is typical of traditional factory design. What sets this factory apart from the traditional is the curved edge conditions generated by a subtracted void. The curves of this void that cut through the otherwise systematic layout of the building add interest and an organic quality. They define the transitions between spaces and establish a “linear” configuration of circulation although the shape is organic. All sections of the building share an edge with this corridor and bleed together in the outdoor space of the void. Office walls are laid out in a rectilinear fashion as a response to the the location of columns and large workshops grow out of large open spaces. The monotony that could ensue from such a configuration is broken up by the intervention of the curved walls and casework. This brings the large factory environment down to a human scale.

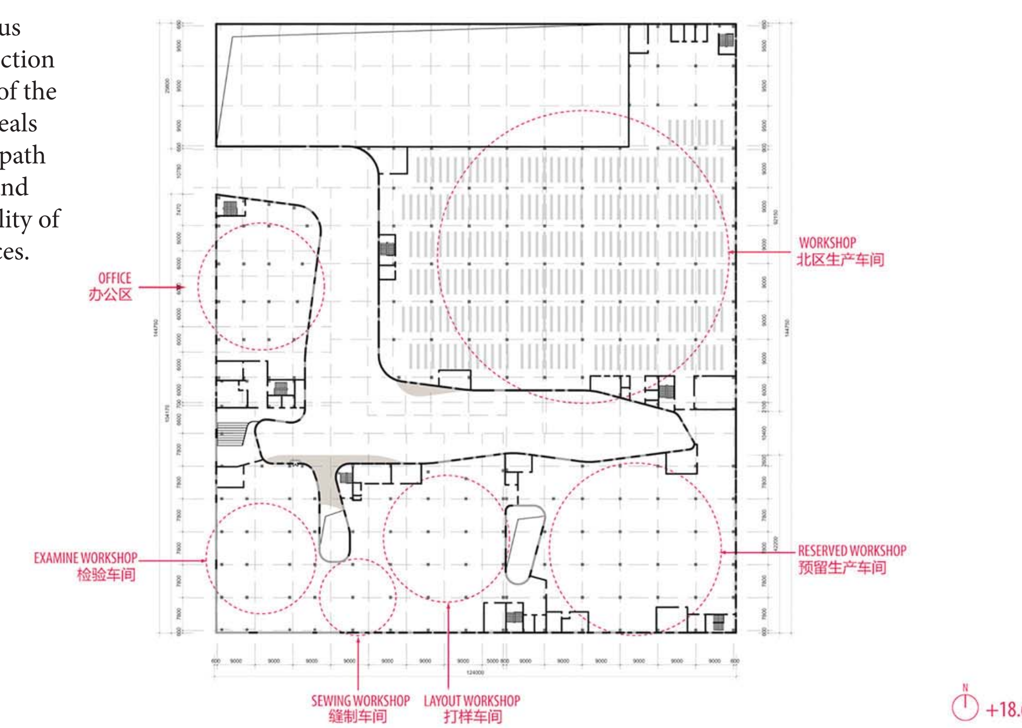
[26] (Previous spread) A section perspective of the building reveals the snaking path of the void and ensuing quality of interior spaces.



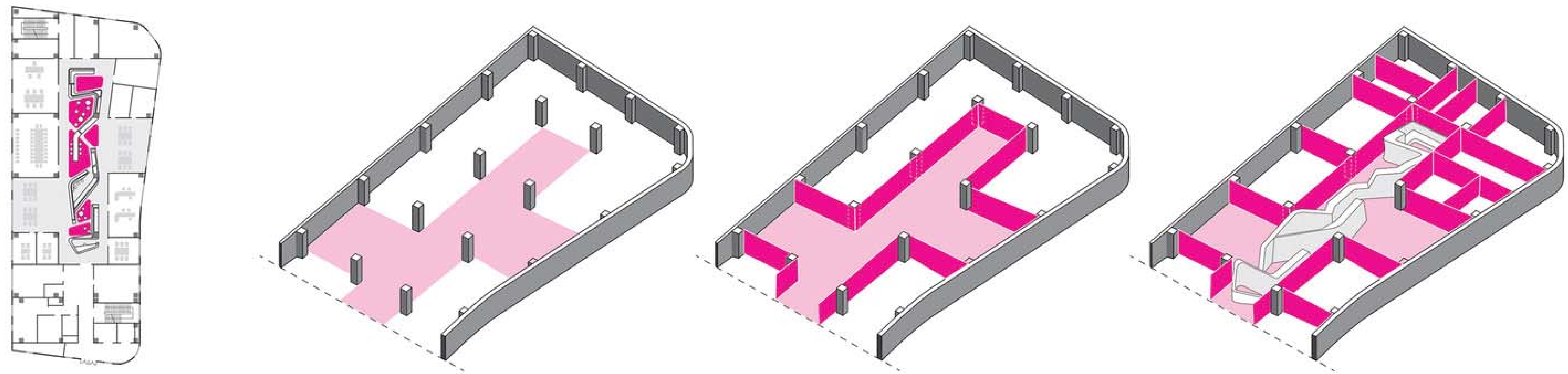
[27] Level +8.30m



[28] Level +13.00m



[29] Level +18.60m



[30] An otherwise daunting expanse of space has been broken up by a nested set of rectilinear and organic boundaries.

Structure, Massing, Hierarchy, and Natural Light

The industrial nature of the building is addressed with the application of concrete columns and loadbearing walls. The columns imply a division of space in vast open areas such as the workshops. On office levels, these columns are overshadowed by organic island interventions. The slim, slanted columns present in the lobby contribute to aesthetic goals rather than structural. This mix of gridded and organic space is an iteration of the massing scheme of the building on a smaller scale. The massing of the tectonic forms on a holistic scale is a play on the the juxtaposition of the highly mechanized nature of industrialization and the organic nature of the landscaped outdoor space composed within the center of the building's boxy shell. In this environment, shapes unfamiliar to the typological function are given hierarchy. The eye is drawn to organic shapes that interrupt the order of a grid system that attempts to establish control. Glimpses of this dynamic can be seen from the outside through strips of glazing and the enticing entrance of the void. Natural light is also let in through the strips of glazing, which are placed in accordance with the changing lighting requirements in product-centered vs. human-centered areas.

This case study contributes modern life-quality values and factory work standards to the premise of the thesis proposal. Because the primary aspect of this thesis proposal is the development of an indsutrial complex for the storing and manufacturing of 3D printed architectural components, the most current regulations for workplace efficiency, safety, and welfare must be met. The Aimer Fashion Factory goes beyond those standards in an attempt to foster a community for the building's inhabitants. It has also been designed for the engagement of the public and the branding and growth of the company. These concepts will be important aspects for the design of this thesis as well. What will make the project successful will be the careful introduction of of 3D printing technology the public eye. The building will invite the public to envision the possibilities and potential of technology through tours, exhibitions, and museums.

Typological Summary
of the Case Study Series

[31] Shells of Packards rode the assembly line across the bridge spanning E Grand Boulevard in the early 20th century. Today, many Detroit natives recognize the bridge as iconic.

The preceding case studies act together to frame the theoretical premise of this thesis project. The unification of various aspects from each case study can be seen in the development of the program: an industrial complex for the storing and manufacturing of 3D-printed architectural components, housed within the ruins of an abandoned industrial giant: the Packard Plant in Detroit, MI.

Zollverein is the most direct comparison to this thesis project as far as cultural, political, conceptual, and restorative goals. The restoration and conversion of the Kohlenwäsche was done in a way that retained the historical significance and value of the original architecture. Rem Koolhaas kept the majority of the machinery in place and added only limited architectural interventions. However, these interventions play a vital role in the successful integration of the building into the modern cultural context. The building has a wonderful quality of continuity. It not only teaches the public about the region's past through the program of museums and galleries, but it actually connects them to the past through the architecture. Guests experience the building as it was in the peak of its production, moving through spaces in the same sequence as coal did in the past. In this way, they are given the story through physical movement as well as through language and visual ais. Collective stories and memories of workers, builders, and citizens are present in the very bones of the building. Tours are given in the words of those who witnessed the performance of the building during the industrial era. Standing within the site of the Kohlenwäsche, humans can situate themselves within the continuum of time. Connections can be drawn between current conditions and those of the past. In this way, the architecture derives its meaning. It has the ability to provide understanding for modern man in regard to his own life and the collective lives of humankind. The preservation and conversion of the Packard Plant will achieve cultural and contextual meaning through similar conceptual applications.

The 3D Print Canal House builds upon the development of the typology. It is obvious from the findings at Zollverein that the Packard Plant should be preserved through conversion in order to revitalize its cultural relevance. The study of the 3D Print Canal House provided the answer to the question of converted typology. The Packard Plant once symbolized the exciting potential of technology and the dreams of the citizens of Detroit. Today, it lies in ruin..The careful revitalization of this iconic structure could potentially establish a precedent for the rebirth of Detroit as a city built by and for its inhabitants that calls upon the past to situate itself within the present and to effectively point beyond itself toward the future. This could be done by placing the hub of the budding 3D printing industry in the former hub of the automotive industy. Effectively, this would give the city the power to shape the way in which the 3D printing industry develops and is presented to the public.

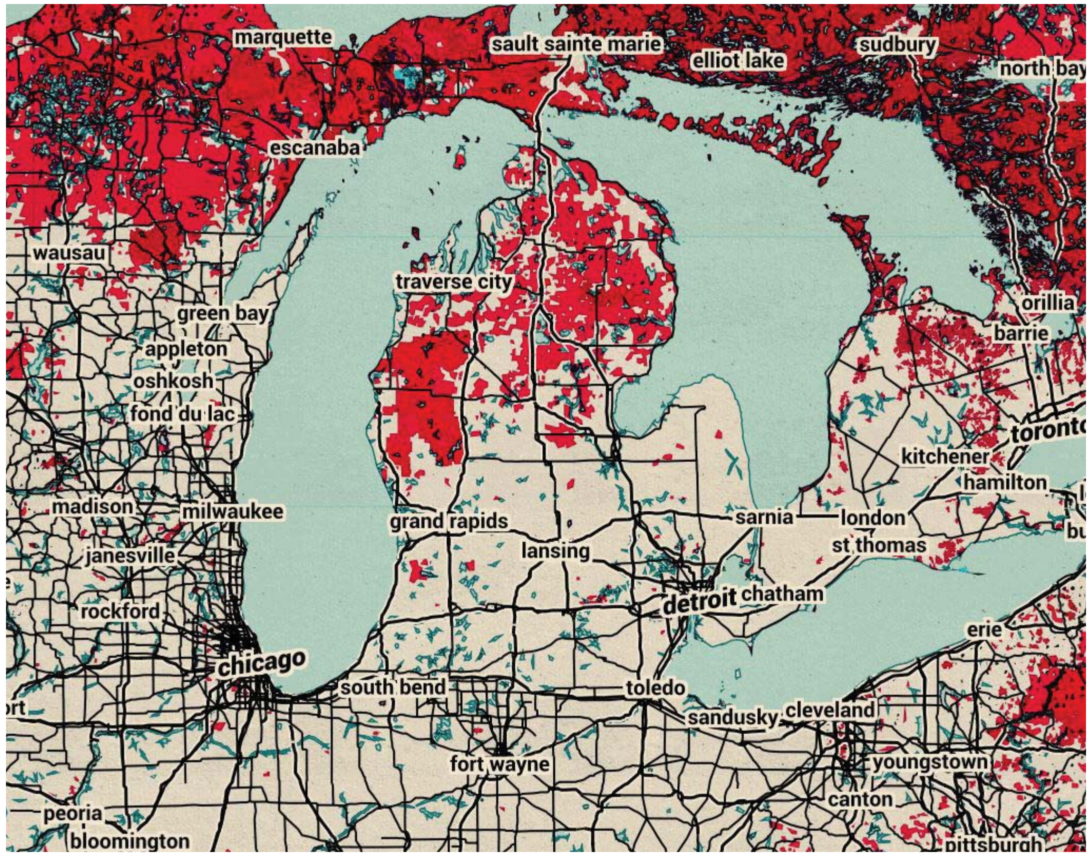
Aimer Fashion Factory is the final piece of the puzzle. Once the typology was established as industrial, the functional, spatial, and technical issues of the thesis could be informed through the study of a modern factory. The Aimer Fashion Factory is an especially relevant case because it is a human-focused project that is designed for the well-being of employees as well as for the education, entertainment, and integration of visitors. The design of the factory applies theatrics to what is traditionally a mundane, mechanical typology. This theatricality initiates the public's desire to experience the building. This is an important aspect to incorporate into an industrial building that acts additionally as a museum and exhibition site. It is also important to note the function of spatial arrangements, interior qualities, and technical regulations that must be applied to the construction of a modern day factory. The synthesis of these three case studies directs this proposal.

SITE

[32]

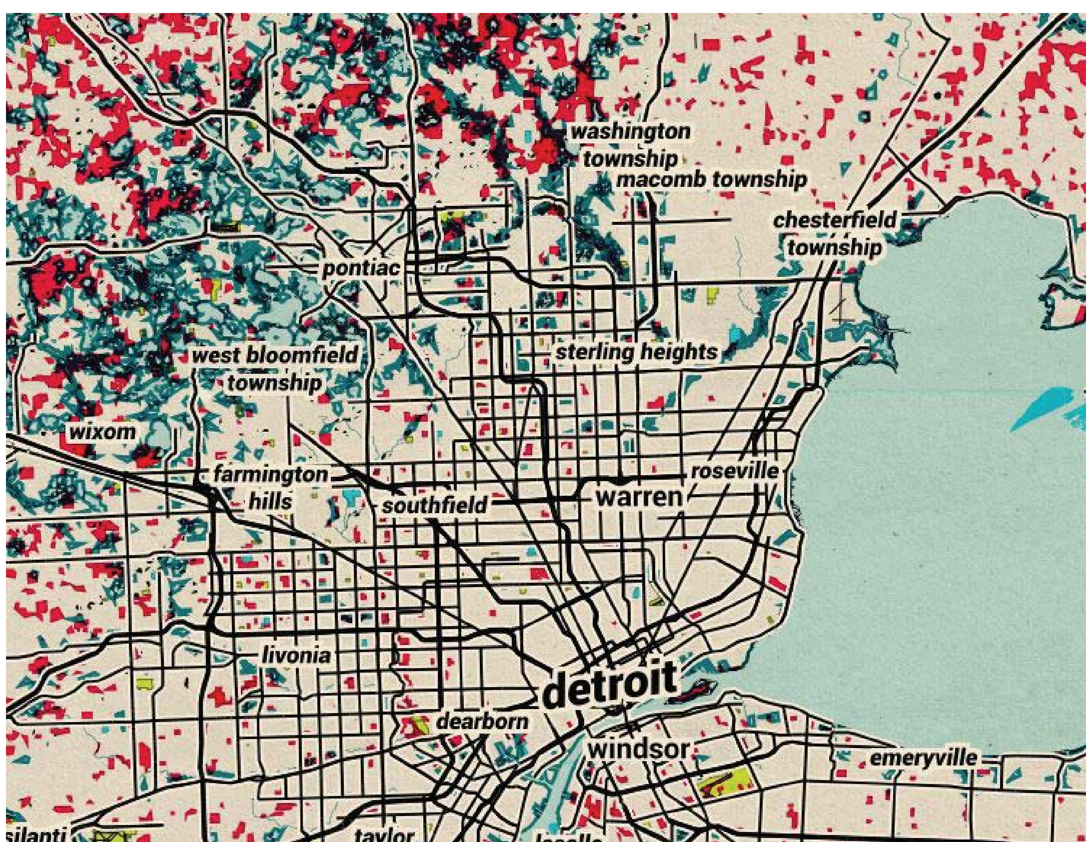
The Packard Plant was once an iconic landmark for Detroit, MI. It was symbolic of the industrial and technological power of the city. Today it lies in ruin, projecting the city's current image of abandonment and failure. The revitalization of this important site has the potential to re-situate Detroit as a leader in technological innovation and to restore its cultural identity. It has the power to explain the human condition through references, memory, imagination and integration.

REGION



[33]

CITY

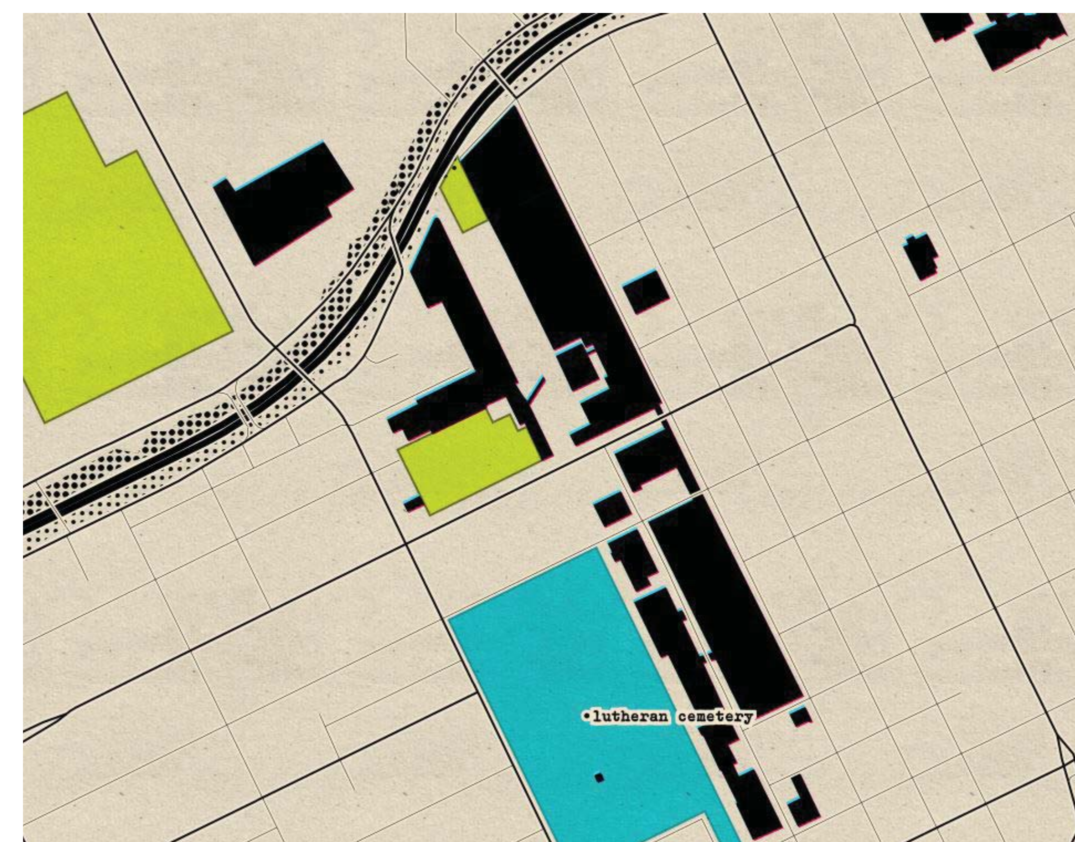


[34]

DISTRICT

[35]

SITE



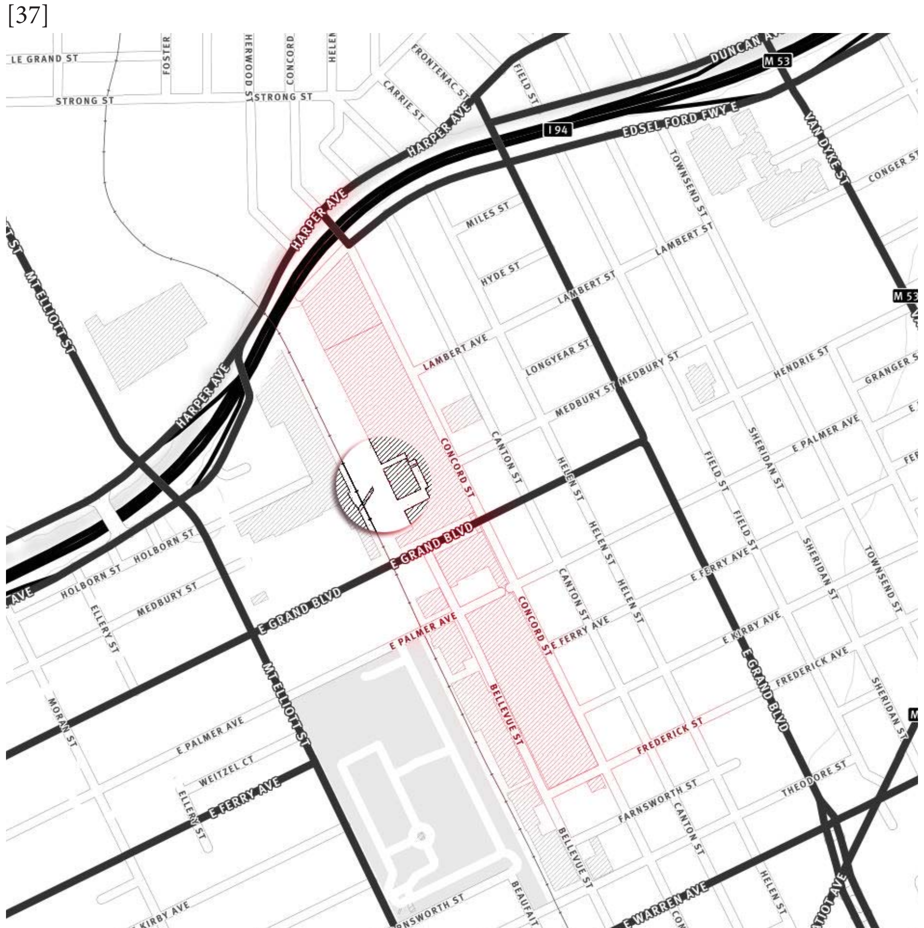
[36]

STREETS AND BOUNDARIES

The Packard Plant is bounded by I94 to the North, Concord St. to the East, Frederick St. to the South, and a rail line to the West. The site is intersected by E Grand Boulevard and Palmer Ave.

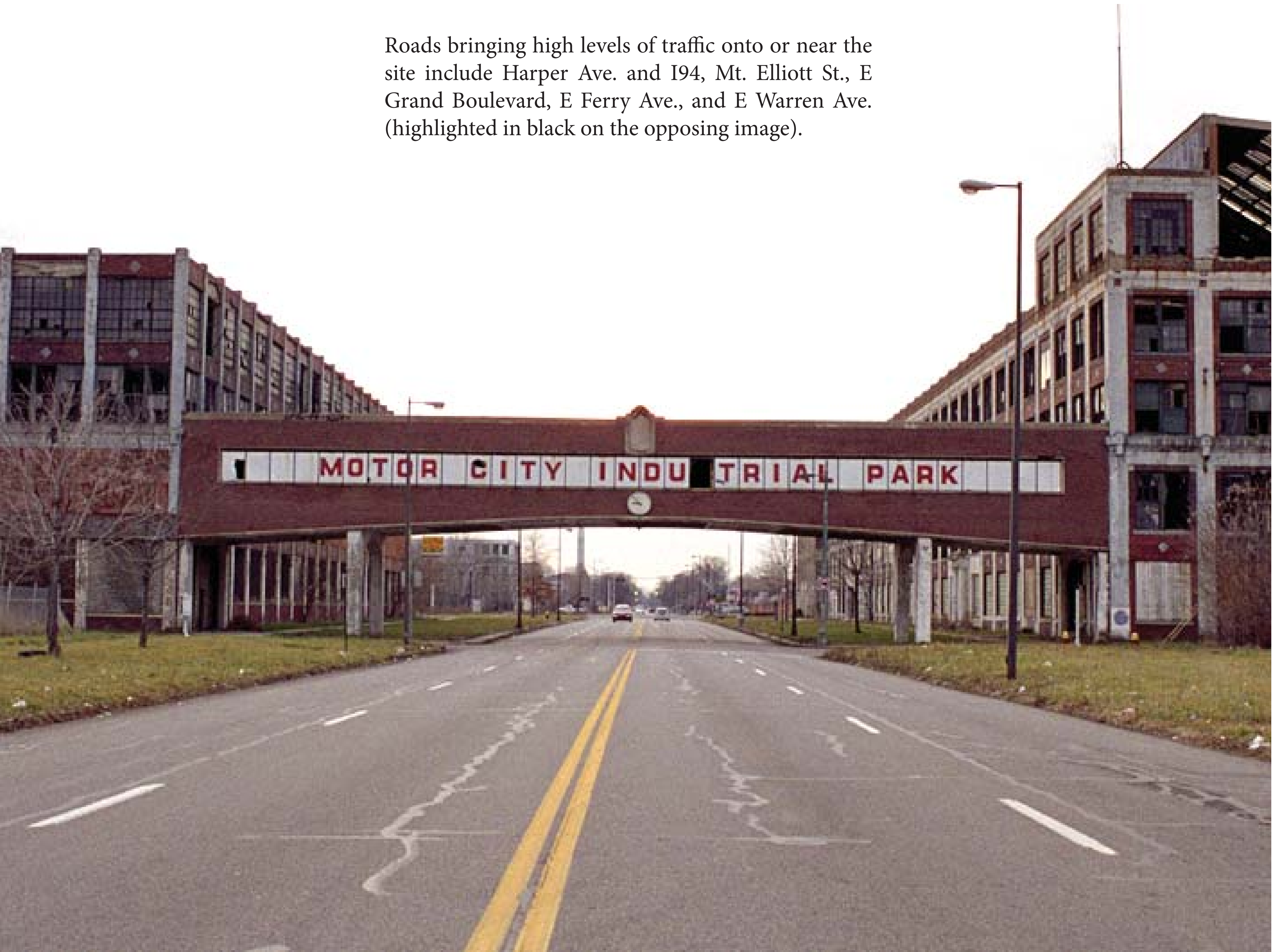
[38] (Right) A bridge crosses a ravine and tracks to connect the primary west facade to another building on the complex.

[37]



TRANSPORTATION LINKS

Roads bringing high levels of traffic onto or near the site include Harper Ave. and I94, Mt. Elliott St., E Grand Boulevard, E Ferry Ave., and E Warren Ave. (highlighted in black on the opposing image).



[39]

AREA

Complex: 39 buildings over 3.5 million sqaure feet

[40] (Left) The iconic bridge crossing E Grand Boulevard once carried cars on a multi-story assembly line.

MAJOR LANDMARKS

Major landmarks around the site include the Cadillac Assembly Plant to the Northeast, I94 to the North, and the Lutheran Cemetery to the Southwest.

[42] (Left) Pedestrian bridges once linked buildings within the complex.

[41]

[43]

PROJECT EMPHASIS

The project, first and foremost, focuses on the construction of an industrial complex for 3D-printed architectural components. It should function fully as a manufacturing plant and warehouse. In addition, it should educate and excite the public about advances in technology and possibilities for the future of architecture. Tours and exhibits will provide the public with an inside look at the process of 3D-printing, the products being produced, and techniques for assembly.

Secondly, the project has a distinct adaptive re-use quality. What can be preserved of the complex will be renovated, with special attention paid to iconic portions including the bridge over E Grand Boulevard and the water tower at the south end of the site. Tectonic language of the Packard Plant should be apparent in new construction and the final design should point beyond itself through references, memory, imagination, and integration in order to be relevant within the broader continuum of human culture and knowledge.

In its essence, this project is a marriage of old and new. It seeks to produce a solution for the use of computer-age architectural technology that remains relevant to history and the human condition.

GOALS

The Academic

With this project I strive to push myself academically by grounding my design in theoretical knowledge. By reading and applying the works of Plato, Aristotle, Nietzsche, Maurice Merleau-Ponty, Heidegger, Alberto Pérez-Gómez, etc. I will have the knowledge to design architecture rich with historical and cultural relevance. Juhani Pallasmaa said the task of great architecture is "to make visible how the world touches us" (Pallasmaa, 46), to "fuse our image of self with our experience of the world" (Pallasmaa, 11). My goal is to produce architecture that is a positive contribution to the human experience. It should enhance the lives of those that encounter it. Beyond all else, it should stand the test of time as meaningful and relevant art/ poesis/symbolism.

Simultaneously I would like to pursue the exploration of Grasshopper and Rhino softwares in an effort to understand the capabilites of parametric design. I would like to attempt my own parametric design and begin to experiment with 3D-printing in order to better understand the product that my architecture will be endorsing. I will be contacting DUS architects, the firm spearheading the 3D Print Canal House project in Amsterdam. There, they are testing materials and methods of assembly at differing scales in order to produce the most renewable, sustainable, strong, tactile, and beautiful end result possible. By learning more about this technology and mastering the software programs that are used to produce it, I can become a valuable asset to the profession. During the final year of my education, I am striving to learn as much as I can about parametric design and how to utilize it to its full capabilities.

The Professional

I intend to produce a thesis project that is backed by thorough investigation and research. It will pose questions and solutions that are relevant to issues in today's culture and resonant with theoretical questions that have been posed throughout history. It is my goal to create a project that will be referenced for years to come by others students as well as by faculty and professionals. I am attempting to create architecture that will be used in the future by clients in a time when this building program will be universally required by the industry. I am anticipating the needs of our world and producing a solution for that demand.

It is my intent to propose a thesis project that will garner the attention of professionals that are interested in the development of 3D-printed technology as well as critics of the parametric. I wish to open up a dialogue about the imminent future of design. With computers driving the profession in a technological direction at breakneck speed, we must make a decision now about the role that architects will play in the design process. It is my goal to discuss a future in which architects harness the power of technology to produce wonderful, relevant, contextual architecture rather than a vast environment of meaningless parametric forms.

The Personal

I would like to use this thesis project as a vehicle for my own growth as an architectural designer as well as for the growth of my knowledge of human history. The project that I am proposing has deep historical roots, not only within the site itself, but within the discussion of the relation between humans, technology, and machines. The texts that I will need to read in order to fully understand this issue will broaden my knowledge of philosophy and theory and will surely change the way in which I view the world. I feel that it is essential to know about the past in order to understand the present, and in turn, as an architect, design the future. I am excited to take advantage of this project to gain that knowledge. Within my personal life I will have the pleasure to meet intelligent and influential people. It is my goal to be able to contribute to conversations about such topics and continue to learn through discussions with my comtemporaries.

Plan for Proceeding

The Design Methodology applied to the development of the design solution of this thesis is based on Stephen Alexander Wischer's

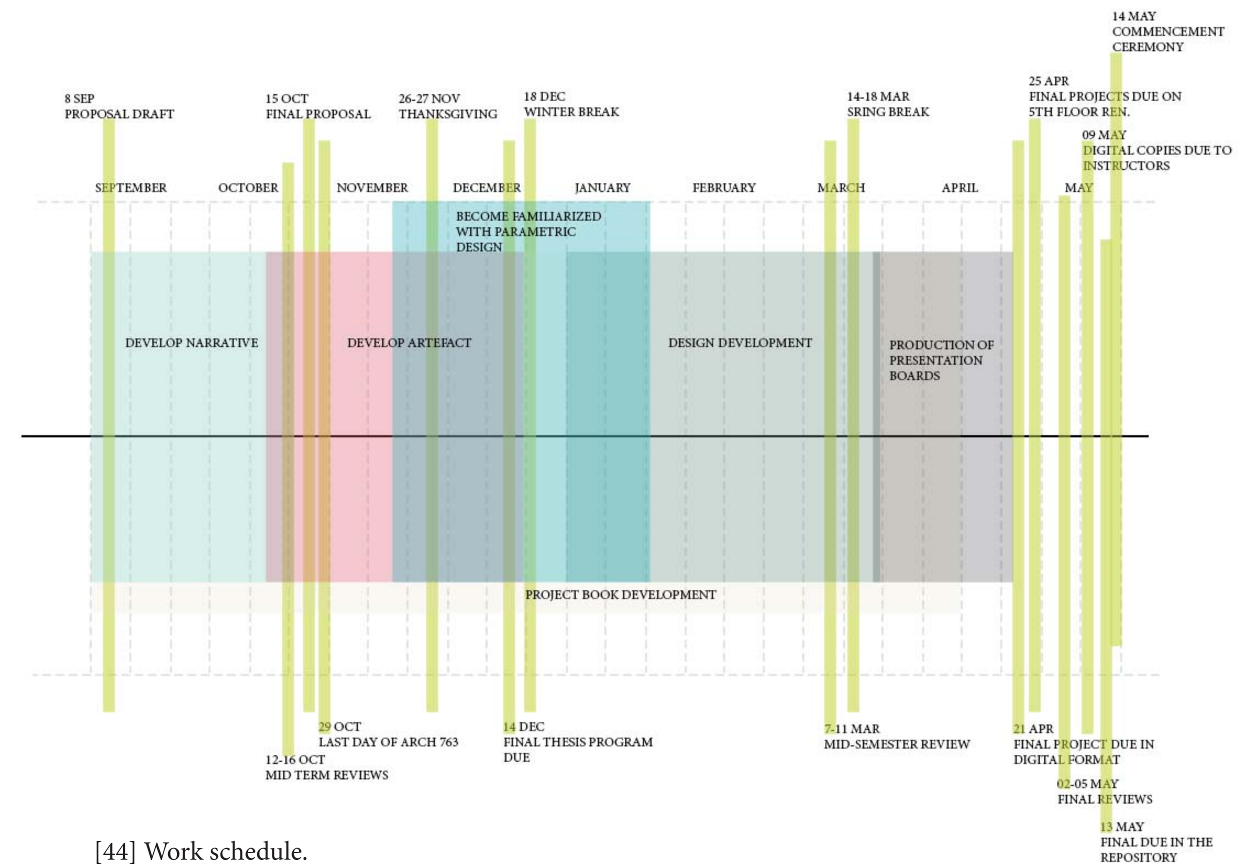
Narrative Transformations and the Architectural Artefact

The development of the narrative will involve extensive research within the following areas: the theoretical premise/unifying idea, project typology, historical context, site analysis, and programmatic requirements. The resulting narrative will communicate the ideas behind the proposal in a particular way. Because we constitute our current situation based on past experience, the narrative will present something "old" or relatable in an enigmatic and provocative "new" way. A position between the ideas of the thesis and past knowledge will be articulated so that the project can relate to ideas, experiences, and knowledge larger than itself.

Upon completion of the narrative, an architectural artefact will be designed to present the ideas of the narrative in physical, tangible reality. The artefact will work obliquely as a means through which to translate ideas into architectural representation. It will spark a conversation amongst those who encounter it, as thinking and doing are intertwined.

The completed artefact remains a very important piece of the final presentation as connections will be drawn between it and the design solution. The representation of this solution will be layered so that the idea can be read across varying platforms. Deliverables of the following mediums will be produced:

Physical context model
Physical building model
Artefact
Digital design boards
Comprehensive printed project book*
Comprehensive digital project book*



[44] Work schedule.

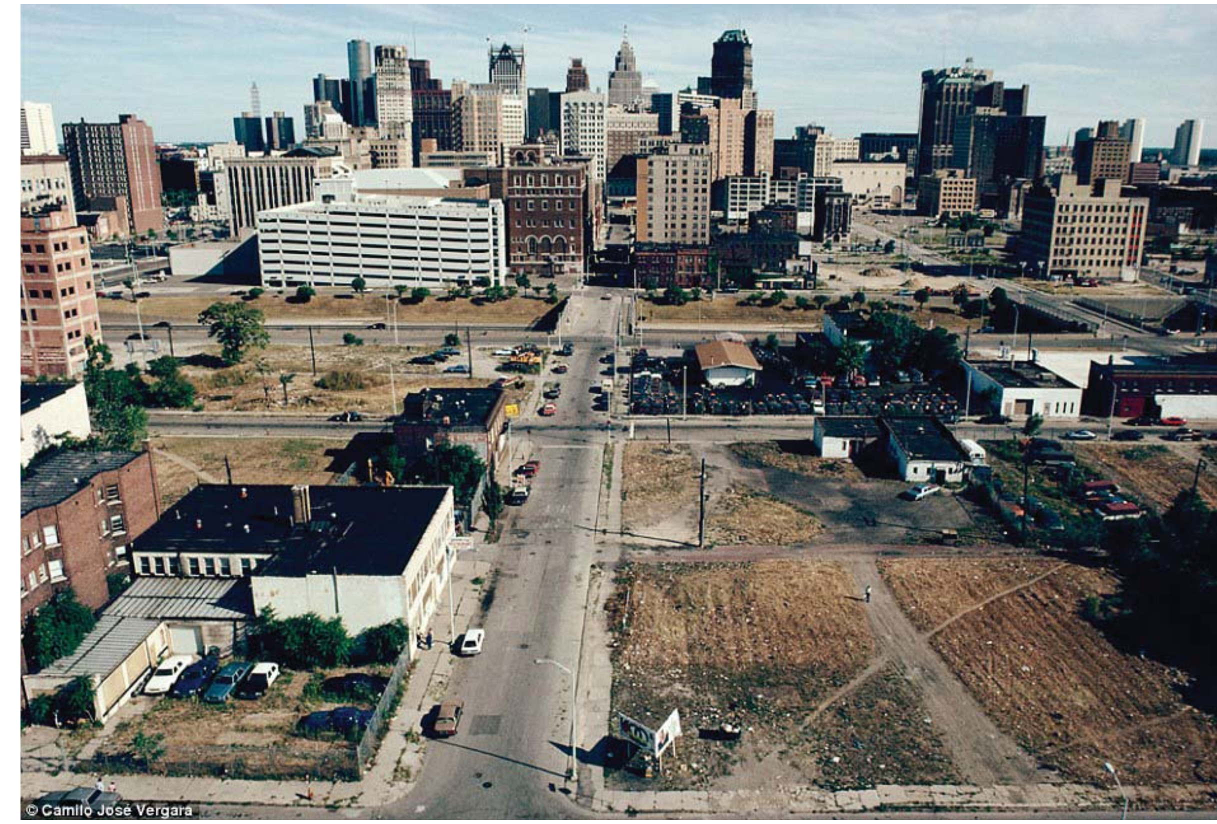
*The project book will be compiled as a trade book with the Adobe InDesign Plug-In for Blurb Publishing Company. It will be printed and saved as a physical copy in the Architectural Stacks of the Klai Juba Architectural Library at NDSU for future reference. Additionally, it will be submitted to the North Dakota State University Institutional Repository available as reference to professionals and students worldwide.

Results of Research for the

Narrative of the Theoretical Aspect of the Thesis

This thesis project is the product of my personal taste and interests, current social and economic circumstances, and larger historical and philosophical questions. The research behind the Narrative of the Theoretical Aspect of the Thesis has been broken down here into its constituent parts:

[1] The Urban Failure of Detroit, MI, U.S.A
[2] The Packard Plant as Modern Ruin
[3] 3D-Printing Technology
[4] Medieval Machines
[5] The Scientific Revolution
[6] Critique of the Modern Paradigm
[7] The Pataphysical



[45] Downtown Detroit.

THE URBAN FAILURE OF DETROIT MI, U.S.A.

Detroit's intense downfall was the result of a lack of diversification. The city began to turn toward industry with the completion of the Erie Canal in 1825. Thousands traveled the new route to get their piece of the iron industry that was turning out stoves, railcars, and eventually cars by the millions. The population boomed with immigrants, businessmen, escaped slaves, and free African Americans. Racial tensions from the Civil War escalated and deep schisms were created that still affect Detroit today. Suburbs were born as the white middle class attempted to preserve their way of life away from the insurgance of the black population; the city center was occupied largely byAfrican American automotive workers. The big three: Ford, General Motors, and Chrysler built their home there and the expansion spread until one in six American jobs were connected to the auto industry. It was doing so well that Detroit officials didn't see a need to do anything differently. The city relied on that single industry, and rode its roller coaster into destruction. Black and white workers were forced to work side by side, but the racial divide had become so great that productive work became impossible. Protests and riots were destroying the efficiency of the factories in the city, so the companies began to build factories in the suburbs as backup. The core of the city was beginning to fall in on itself. As the auto industry began to experiment with automation, tens of thousands of human employees were replaced with machines, and people began to flee in mass numbers. Today, Detroit is left as a hollowed-out core of societal infrastructure that failed to keep up with its own acceleration. The population has fallen by 60% from its peak as the fourth largest city in the country at 2.8 million to only 714,000. Less than a third of employable people are working and the per capita income in 2009 was just $15,310, just over half the national average of $27,041. The abandonment of thousands of houses has destroyed the structure of neighborhoods and left Detroit as a city without a human identity.

THE PACKARD PLANT AS MODERN RUIN

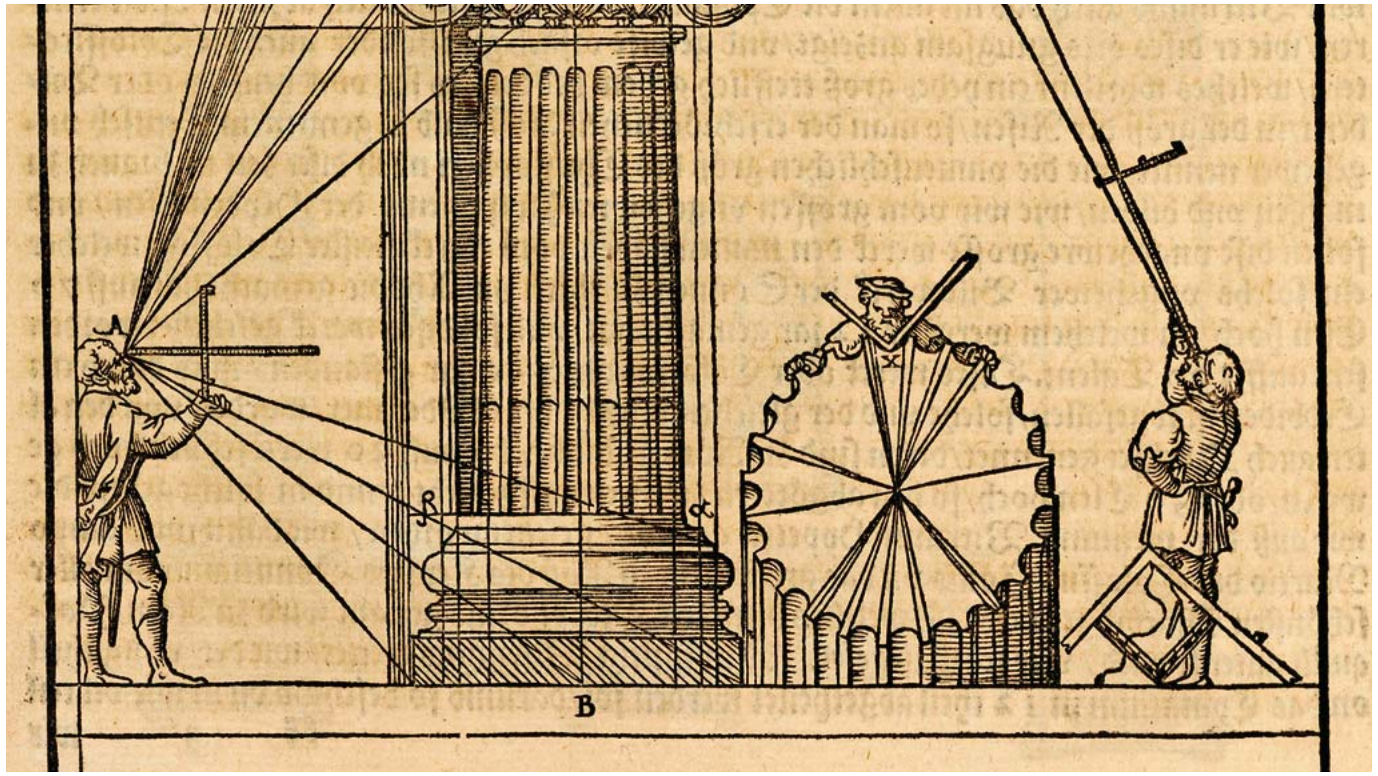
Before he gained notoriety as the architect for Henry Ford, Albert Kahn designed the Packard Plant for the president of the Packard Automotive Company as its headquarters moved from Warren, Ohio to Detroit in 1903. The plant was designed with large windows for lighting and ventilation, large open spaces for comfort and productivity, and Kahn's famed reinforced concrete system allowed for larger loads over longer spans. It was a masterpiece of industrial architecture. At its peak the complex housed four million square feet of factory space and employed up to 40,000 workers. Automated assembly lines ran the length of the plant and a system of overhead bridges and underground tunnels carried workers across the campus. The plant remained crucial to American industry throughout both World Wars with the manufacture of Rolls Royce aircraft engines and naval engines for the United States and its allies occuring on its assembly lines. However, by the 1950s advancing technology rendered the plant obsolete. It held various tenants after the Packard Automotive Company moved out in 1956, but consistently struggled until the final tenant left the site in 2010. According to the philosopher Marshall Mcluhan, what is obsolesced by the morphology of media is turned into a visible cliché that is now dead but was once living. "Our visible world, for McLuhan as for Heidegger, seems to be filled 'with petrified statues, with things that have the mere semblance of life'" (Harman, 187). The Packard Plant is a particular modern ruin that holds societal and emotional importance in the cultural context which it inhabits. What has become obsolesced has become increasingly visible.

[46] Abandoned elevator shaft.

3D PRINTING TECHNOLOGY

3D printing is arguably one of the most cutting-edge technologies of our time and it is rapidly being applied to the field of architecture. Building components are produced by the process of additive manufacturing in which layers of material are added one on top of the other by the printer until the final form is achieved. In Amsterdam, DUS Architects is experimenting with plant-based materials to develop structural webbing which is then filled with an eco-concrete. This technique allows the product to be completely manufactured on-site. Other companies such as ContourCrafting in California and Shanghai WinSun Decoration Design Engineering Co. have developed concrete-based materials that are extruded out of larger 3D-printers off site and then assembled on location. This technique is behind the groundbreaking headlines boasting 3D-printed houses and apartments. In Switzerland, architect/programmers Michael Hansmeyer and Benjamin Dillenburger have designed the first 3D-printed room: Digital Grotesque. This artistic masterpiece was developed from computational design that orders a folding algorithm which produces complex, multifaceted geometries. The marriage of this type of design with the additive manufacturing of sandstone allows the design to be stunningly embodied physically. The result is a beautiful composition of intricately detailed localities existing within an organic whole. The hierarchy, volumetric depth, and ornament present in classical architecture are rediscovered here in the manipulation of a parametric design.

[47] Digital Grotesque.



[48] An overturning of power.

MEDIEVAL MACHINES

The machines of today are so closely associated with mathematics and technology that is nearly impossible to distinguish amongst the three. It was not always like this. In the beginning, the machine was a mysterious and divine figure. Vitruvius explained that machines are moved by revolutions of circles, which depend on the order disclosed in the "revolutions of the universe" as "all machinery is generated by Nature". The circle is a paradoxical figure: one line with no beginning and no end, at once concave and convex. "When moving, it resolves two contrary motions, a geometric manifestation of *coincidentia oppositorum*" (Olshavsky, 184). In an Aristotelian text, the author describes geometrical machines as "instruments which make possible a reversal of power such as that which is *metis* (magic) – which enable the smaller and weaker to dominate the bigger and stronger" (Olshavsky, 184). Medieval machines overturned the natural order of things and kept the cause immanifest. This sparked wonder in man, and wonder sparked philosophizing. In the Middle Ages, machines were highly regarded in a biblical sense. Saint Augustine ased the Divine: "By what means did you make heaven and earth" and "What tool did you use for this vast work?" He likely imagined a crane as in the theoretical device *deus ex machina* (god and machine) in which a crane lowers a god into a scene to resolve conflict. Thus we can observe that "the primary purpose of medieval machines was not to understand the cosmos as an objective entity but to demonstrate the wondrous workings of the Nature that God had created" (Olshavsky, 188). "Ancient machines belonged to a concept of nature (*physis*) as a living force with generative power. Consequently, ancient technique was not reducible to instrumental operations imposed on dead matter (i.e., technology). This would only come much later" (Olshavsky, 186).

THE SCIENTIFIC REVOLUTION

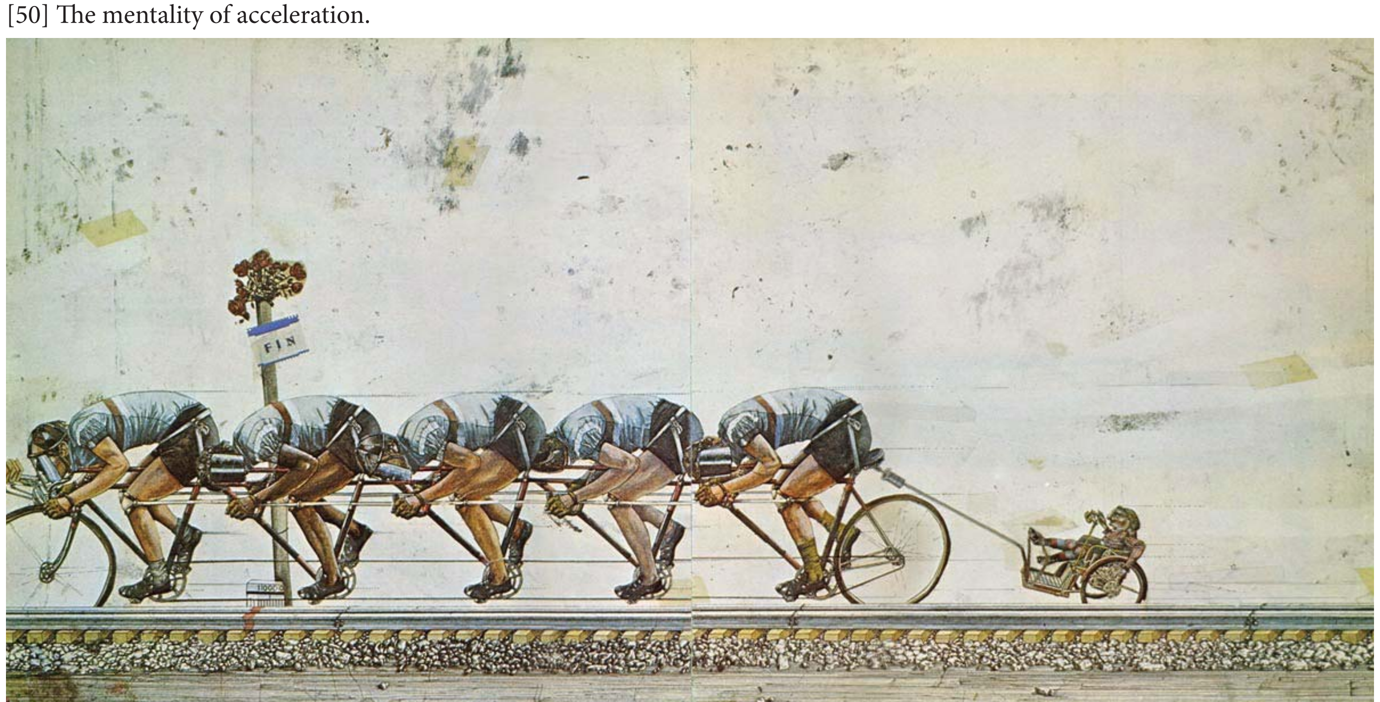
The Greek term *techne* once referred to the wondrous effects of medieval machines. Its definition began to change with the Platonic division of mind and perception. Plato referred to *techne* as a purely human activity and associated the divine and artistic creation of the poet with what he called *poeisis*. Plato's *techne* was the technique of Vitruvius and of architecture in the Western tradition, and it held a propensity for mathematics and instrumentalization. "After Plato's *techne*, the craftsman's (and the architect's) original technique becomes a *doxa* (opinion), as opposed to true science, *episteme* (knowledge). It is seen to participate in true knowledge only in so far as its operations are guided by weight, measure or calculation" (Pérez-Gómez, 49). Descartes took this even further when he considered false everything that was not clearly proven true by mathematics and reason. He discredited human senses and consciousness in an effort to separate the mind and body, leading to his application of the machine metaphor to a body ruled by shape, size, quantity and motion. At the same time, Galileo "...formulated clearly the problem of statics and strength of materials as part of the geometrization of human space..." (Olshavsky, 192). "Although this development was assumed to be divinely sanctioned, it required tremendous faith in the human ability to step into divine shoes" (Olshavsky, 194). This new understanding of human power led to the natural philosophy of Isaac Newton. "Through observation, he discovered mathematical principles in worldly situations, stripped of symbolic significance and their individual nature. They operated in an infinite and abstract void of homogeneous space and time, defined entirely by number" (Olshavsky, 194). This environment gave rise to what we know today as modern technology.

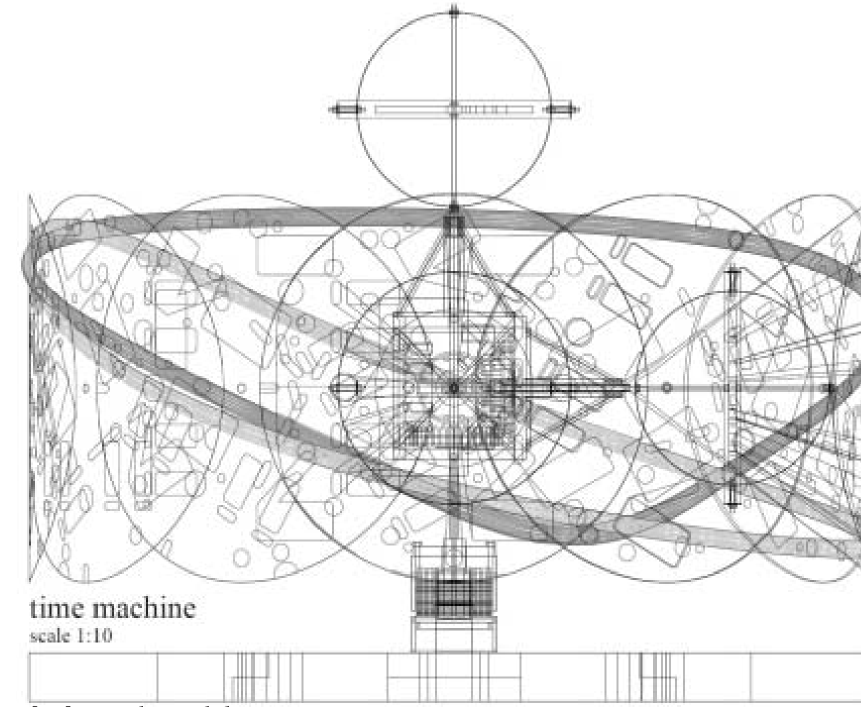
[49] Hevelius' telescope.

CRITIQUE OF THE MODERN PARADIGM

This modern technology that we speak of has a new characteristic that sets it apart from its medieval ancestors. It has become autonomous, accelerating so quickly that humans are powerless to harness and control it. "...We exist in a time where the only thing which develops is marginally better consumer gadgetry. Relentless iterations of the same basic product sustain marginal consumer demand at the expense of human acceleration" (Williams, 9). However we are under the illusion that we are accelerating because the concept is so closely related to our capitalist environment. "The essential metabolism of capitalism demands economic growth, with competition between individual capitalist entities setting in motion increasing technological developments in an attempt to achieve competitive advantage, all accompanied by increasing social dislocation" (Williams, 5). The leaders of Accelerationist Politics propose that we "...preserve the gains of late capitalism while going further than its value system, governance structures, and mass pathologies will allow" (Williams, 8). They believe in an ultra-modernity that "...must include recovering the dreams which transfixed many from the middle of the Nineteenth century until the dawn of the neoliberal era, of the quest of Homo Sapiens towards expansion beyond the limitations of the earth and our immediate bodily forms." (Williams, 16-17). In effect by increasing the amount of technology in our environment with an Accelerationist Politics, we could begin to control it. Contrarily, Hans-Georg Gadamer warns of the society in which everything has become technology in his book *The Enigma of Health*. He identifies the difference between information and knowledge, emphasizing the importance of human practical wisdom. Specialized technological fields have eliminated the concept of holistic experiential knowledge in favor of individualized, unrelated studies in pursuit of a quanitifed and rational discovery. Without a practical knowledge of the world in which we live, we become increasingly reliant on the technology that we have created.

[50] The mentality of acceleration.





[51] Pataphysical diagram.

THE PATAPHYSICAL

In the late nineteenth century, French Symbolist writer Alfred Jarry conceived of a new science that took a critical stance against the Cartesian deductions of the machine into a dichotomy of aesthetics and function. He named it pataphysics. In *Gestes et opinions du Docteur Faustroll, pataphysicien* (1911), he explains that "... pataphysics will be, above all, the science of the particular, despite common opinion that the only science is that of the general". "Modern physics is based on the world of appearances and quantifiable phenomena, while metaphysics is lost in abstractions that neglect the concrete and historical. Pataphysics targets precisely where we live. This includes dreams, hallucinations, and other outpourings of the imagination" (Olshavsky, 199). Jarry wrote of a series of machines that would playfully twist the role of technology in pursuit of significance. These "'impropobable' contrivances are governed neither by mere mechanics nor by conventional utility. It also makes little difference whether they are materially feasible. By suspending the functional aim of mechanics, these contentious pataphysical machines may seem 'useless', but instead present 'the semblance of machinery, of the kind seen in dreams, at the theater, at the cinema.' This allies them more closely to their earlier architectural heritage of wondrous and imaginative contrivances in search of meaning" (Olshavsky, 199). "The aim of Jarry's machinations, like his writing, is to 'suggest rather than to state', to dis*play* what is essentially singular and to reveal 'laws governing exceptions'" (Olshavsky, 200-201). The accuracy of these machines is measured by the discovery of similarities, metaphors, metonymy, and mimesis. They begin to establish connections to the mystery and wonder of medieval machines while countering "the reductive and mechanistic premises of the Newtonian void" (Olshavsky, 203).

Summary of the Research

[52] View of downtown Detroit from the Packard Plant.

The breakdown of the Research for the Narrative of the Theoretical Aspect of the Thesis indicates a chronology of investigation. The intial premise of the thesis proposal was developed prior to any investigation as a product of my personal interests and recent European travels. My decisions regarding the location of the Packard Plant in Detroit, MI and the typology of an industrial complex for the storing and manufacturing of 3D-printed architectural components were determined in the summer before formal investigation. Thus, these areas of research were conducted first. Subsequently, the cultural and historical context of my thesis proposal was supplemented with broader questions raised by theoretical and philosophical texts that I encountered through my fall seminar and studio courses. The final four areas of research - Medieval Machines, The Scientific Revolution, Critique of the Modern Paradigm, and The Pataphysical - subsequently followed.

The pairing of the progressive 3D-printing industry with the abandoned shell of a once prominent automotive plant creates an opposing drama within the project. My research has only underscored this relationship. The Packard Plant was once the most state-of-the-art building of its kind and housed the largest industry in the country. It defined the way of life, the mode of thinking, and the style of design for Detroit, and the entire country. Today 3D-printing technology stands to develop into the automotive industry of the 21st century. It has the potential to completely revolutionize the way that our products and cities are designed and built. It will undoubtedly have a huge effect on the job market and economy of the entire world. By placing one of the major manufacturers of this industry within the ruins of Detroit's beloved Packard Plant, a strong historical and cultural connection can be drawn between the mistakes of the past and the potential of a renewed future. The careful revitalization of one of Detroit's iconic industrial factories could potentially establish a precedent for the rebirth of Detroit as a city built by and for its people, driven by the cultivation of the 3D-printing industry. The application of historical, philosophical, and theoretical research to this topic has provided a groundwork for progression into broader contextualization and the particulars of design quality. By looking back to the history of machines and the evolution of technology, we can better understand our current situation.
The scientific revolution framed the environment of industrialization and modern technology, which contributed to Detroit's failure. With the dawn of Cartesian theory and Galilean science, a world that was once grounded in human experience and divine sanctions transitioned into a homogenized and abstract void. The wondrous effects of machines disappeared as everything was systematically explained by mathematics and reason, leaving the human experience irrelevant. This mindset evolved into the business model of the automotive industry, driven by the competitive demands of capitalism. Economic and technological growth overruled human quality of life, setting in motion increasing social dislocation. When humans were no longer efficient, they were driven out with automation and relocation. Understanding the contributing factors to the urban failure of Detroit is essential for the progression of its future. Research into various politicians', theorists', and philosophers' reactions to the crsis of capitalism and modern technology has provided insight into the embodiment of a solution. Most responses to the situation follow one of two directions: the development of a 'technitopia' in which we increase our endeavors into the evolution of technology (Accelerationist Politics), or a return to the pre-modern understanding of the world (Antiquarian Historical View). Alfred Jarry's pataphysics lies somewhere in between. His new science was meant to regard the particular rather than the general. Jarry's machines were not interested in functionality but in the discovery of similarities, metaphors, metonymy, and mimesis. These playful contrivances established connections to the mystery and wonder present in medieval machines. This approach to design opens a distance between the creation and the viewer, allowing humans to fill the gaps with imagination and deeper, metaphysical meaning.

PROJECT JUSTIFICATION

It is obvious that the acceleration of technology is coming to a breaking point. As the application of autonomous technology begins to infiltrate the workplace, the public and social realms, and the built environment, we are rapidly becoming aware that we have lost an anthropological quality to our way of life. In the field of architecture, parametric and generative designs are producing glistening, hyper-realistic models that function in a meaningless void of homogeneous space. Rather than dismissing it, this thesis project attempts to embrace the fascinating technology at our fingertips in a way that remains grounded in the broader reality of the cultural context. By providing an industrial complex for 3D-printed architectural components that is designed with a pataphysical dimension of participation, play, and imagination, I hope to invite the public to learn about this technology with a renewed sense of wonder and inspiration. This complex will inhabit the ruins of the abandoned Packard Plant in Detroit, MI where the acceleration of technology ultimately led to the city's failure. This project has the potential to reinvigorate the social and cultural identity of Detroit by setting a precedent for its rebirth as a city that embraces the reconstruction of our relationship with technology to once again involve human involvement and experience.

[53] Packard Plant September, 2015.

HISTORICAL, SOCIAL, & CULTURAL

Context of the Thesis

[54] Packard Plant 1950s.

HISTORICAL

The Rise and Fall of Detroit

1763 Detroit was a farming and trapping settlement established and controlled by the French until the Treaty of Paris delegated control to the British.

1825 The opening of the Erie Canal provided a direct route from New York. Immigrants flooded in and the iron industry flourished.

1863 Tensions from the Civil War were high as newly freed African Americans and escaped slaves fled to the North for a better way of life.

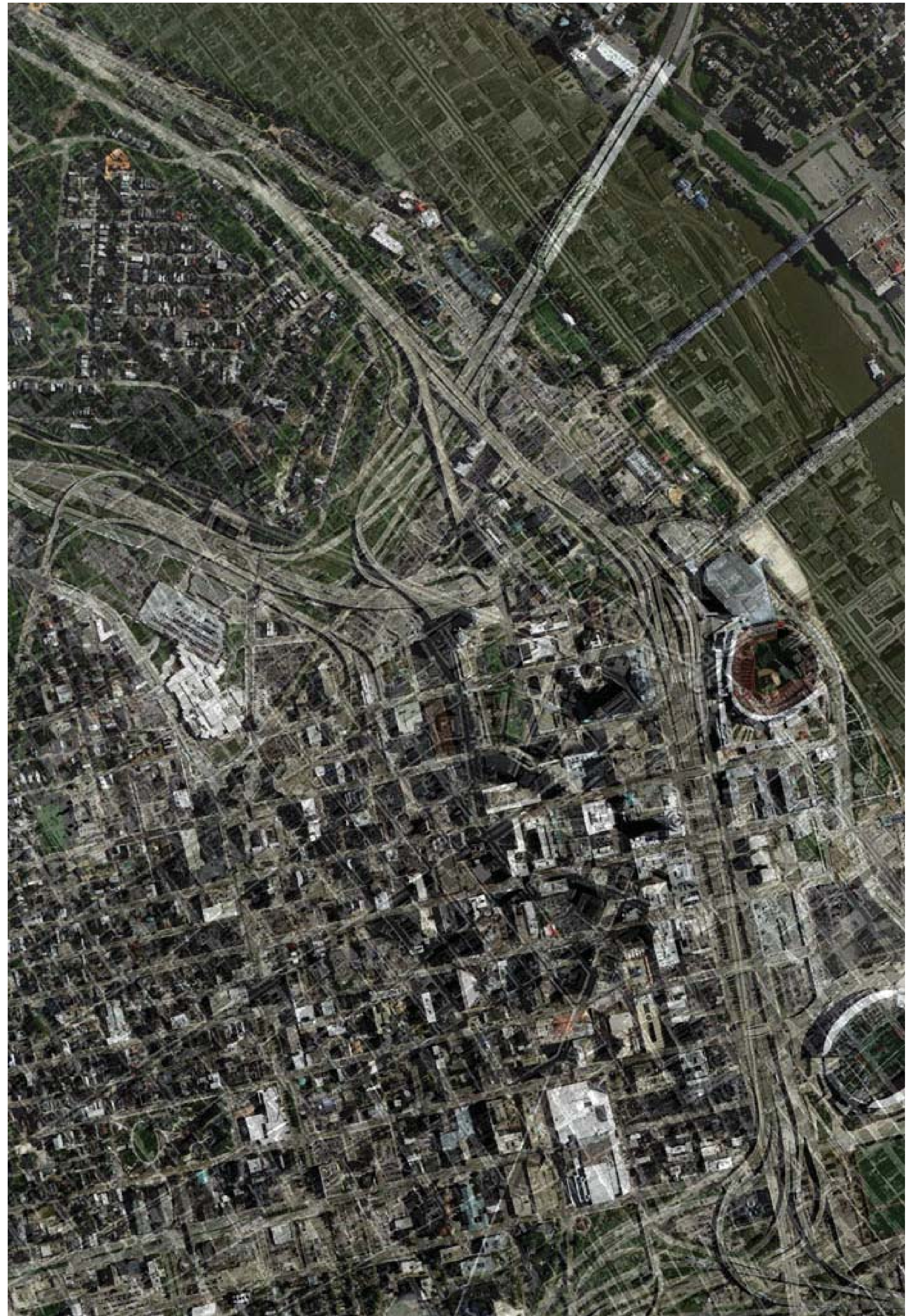
1896 A young entrepreneur named Henry Ford rode a wooden wagon powered by a four-cylinder engine around Detroit in the early morning darkness.

1902 The creative and entrepreneural vibe of the city caught fire. The Packard brothers moved their young luxury car company from Ohio to Detroit.

1913 With the invention of the production line, Ford doubled car production each year from 1909-1919. Quality of life for his workers was terrible.

1920 Of Detroit's one million people, only 250,000 were native Michigan residents. The rapid influx exacerbated racial tensions and housing issues.

1931 Detroit was a one-industry town. Ford laid off tens of thousands of workers during the Great Depression. There were no other jobs to turn to.



[55] Downtown Detroit then and now.

1937 The United Auto Workers union forced the Big Three to improve wages and working conditions, but not without strong resistance from Ford.

1941 The auto industry recovered during World War II while producing equipment and supplies for the war. Inadequate housing remained unchanged.

1943 The 1943 Riot erupted as a result of black migration out of the slums. 34 people were killed and 433 were injured, with $2 million in damages.

1944 After the war, the Big Three returned solely to auto production. Meanwhile, Congress distributed critical industries throughout the country.

1961 The Big Three saw the expensive cost of doing business with the UAW in Detroit as a hindrance. As they decentralized, people lef t the city.

1967 Frustration boiled over in black neighborhoods. The 1967 Riot saw five days of arson and murder; 2,000 buildings burned and 43 people died.

1973 The Arab Oil Embargo changed the way consumers bought cars; Coleman A. Young would be the black mayor for a black city for 20 years.

1982 The only business left in Detroit was the drug trade. Young people chose the thug life over the grueling factory life of their parents.

2000 By 2000, anyone who had the economic means to leave Murder City, did. There were astronomical crime rates and no prospect of development.

2008 During the Great Recession, average home prices dropped from $97,847 in 2003 to $12,439 in 2008. Half of Detroit drove to the suburbs for work.

2011 Today, urban farming provides affordable access to food and strengthens neighborhood cohesion, but will do nothing to counter the economic collapse.

HISTORICAL
The Rise and Fall of Detroit

There is a significant difference between a neighborhood of the working poor and a neighborhood of people who can't find work. The latter communities tend to lack the kind of social cohesion that offers a buffer against crime and blight. It's not a function of selection by the residents. Few people choose to be poor, to be undereducated, to be socially and economically isolated, to live in places where violence and hunger are endemic. Such neighborhoods - which account for much of Detroit - are what's left when the rest of society breaks down. When jobs move out of neighborhoods, whether they are well-paying union factory jobs or minimum wage janitorial work, those financially capable of moving go with them, or at least go somewhere else to find new work.

Left behind are the financially isolated and immobile - the uneducated and undereducated and those with pressing medical, psychological, or drug problems. Without access to reliable transportation, they also lose access to suburban jobs. In Detroit, the problem is compounded by the spread of its geography and an inadequate public transportation system. It can take a coupe of hours in each direction, depending on the bus lines, to get from parts of Detroit to different suburban sites. Given the option of a minimum wage job in the suburb where they feel unwelcome, and that involves adding a four-hour round-trip commute to an eight- or nine-hour workday, most people choose not to work (and the hurdle is even higher for workers with children).

- Scott Martelle, *Detroit: A Biography*

[56] Current dilapidation.

HISTORICAL

The Evolution of the Factory

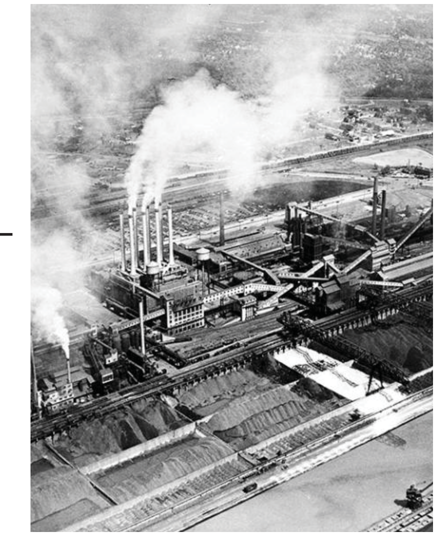
1783

Richard Arkwright ushered in modernity when he built his Masson Mill near Derby, England - a birthplace of the Industrial Revolution. For the first time, powered machinery was placed inside the factory, which was decorated in a Palladian villa style to distract from the horrible working conditions inside. This fashionable choice popped up across Europe on many other early factories. Cities that housed these factories were burdened with poisonous air, blackened skies and faces, injuries and fatalities for their citizens, while the mill owners garnered concentrated wealth.

1903

A little over a century later, Albert Kahn revolutionized modern life in the United States with his many automotive factories, beginning with the Packard Plant. The efficient and economic demands of industry had made quick work of decorative facades of the past. Kahn's futuristic pared down design showcased the structural frame of the building. His patented re-bar system allowed for longer spanning distances between columns, opening up spaces for large windows that brought in natural light and ventilation. Long, open areas increased productivity and safety. Working conditions had improved immensely.

1931



In 1913, Ford introduced his mass production line that churned out a new car every one hour and 33 minutes. Compared to the previous rate of 12 hours and 28 minutes, this industrial novelty became a requisite for competitive business. The vertical building became obsolete. Kahn was enlisted to build a low, sprawling metropolis of an industrial complex: The Ford Motor Company's River Rouge. At the peak of production in the 1930s the plant's steel-framed buildings covered two square miles, housed 100,000 workers, and produced 4,000 cars per day. However, work was tedious and monotonous.

2005

Unfortunately, the production line's properties of efficiency, rationalism, and technological advance were mirrored in countries across the globe as the craze to Americanise infiltrated the Asian and European markets. Imitations of the factory were present in the designs of houses, schools, and hospitals. The speed of production sped up the worker, quickly defining a human as a constituent of productive parts. The Cankun Factory in Zhangshou is a warehouse of monotony and inhuman scale representative of China's mega-production.

2014

Recently, strides have been made by some companies to provide a better working environment for their employees. Many of these new precedents feature open courtyards, sensuous materials and lighting, and quality finishes. Construction decisions are still driven by the most economical means and interior spaces are left bare for maximum productivity, but moments of human scale provide a reprieve from the often monotonous work of factory employees. As previously highlighted, the Aimer Fashion Factory has succeeded in their efforts to provide a warm and communal environment for all.

SOCIAL & CULTURAL
Life for the Citizens of Detroit

[62] Aerial view of downtown Detroit.

Neighborhoods are somewhat nonexistent in Detroit. The abandonment of the city has led to physical gaps in the rows of houses lining residential streets. These lots have been left to return to the fields. Discarded belongings have been overgrown with tall prairie grasses in 'urban' locations that one would never expect to see wild vegetation. The homes that remain standing exist in isolation. Many are boarded up and vacant. Those that are inhabitated are dilapidated. There is no sense of a neighborhood community structure. Traditionally this would be established by the connections of local schools, convenience shopping, social activities and recreational uses shared by neighbors. This structure is missing from the post-recession network of residential Detroit. Sadly, this absence cannot be solely attributed to the city's intense 2008 downfall. The neighborhoods of Detroit have never really been defined. Pete Saunders, an urban planner from Detroit, testifies "... ask a Detroiter where they're from, and they will likely tell you East Side or West Side; if pressed, they might note a key intersection." Unlike other major U.S. cities, Detroit has always had a bit of an identity crisis.

The public realm is an important factor for the quality of city life. It is the space of human interaction and experience; it is largely influenced by the built infrastructure and dedicated economic stimulation of the city's center. Detroit's downtown was never treated as a priority, resulting in a weak, unengaging core. It was designed to support the advertising, legal and financial offices of the automotive industry. It was a strong retail and commercial center through much of the 20th century, but the automotive factories were not the only entities that began to expand into neighboring suburbs in the 60s. Homeowners and office workers followed, and the development of strip malls brought retail out of the downtown area. It was left to struggle with an identity as a center for retail that could not compete with the enticing suburbian strip mall utopia. Today, the streetscape of Detroit is barren and outdated. Anonymous single-story buildings line the crumbling streets. There is a stark lack of signage, decorative lighting, and architectural variety. The condemnation of this modern day ghost town is underscored by the bankrupt city's inability to repair damage or maintain landscaping.

The transit network in Detroit has always been singularly autocentric. It was designed to support the industry on which Detroit was built. This city's immense freeway system dwarves those of similarly sized American cities. The development of Detroit's mass public transit was influenced heavily by General Motors lobbyists who encouraged the use of the city's extensive freeway system. Buses built by GM could provide much greater flexibility to meet shifting travel demands than the city's existing streetcar network. The diesel-fueled buses were also a less expensive alternative. GM won and the last streetcar route was completed in 1956. This story is by no means exclusive to Detroit. Many other American cities - New York, Philadelphia, Boston, etc. - also converted to bus transit. However, those cities had other systems like subways and rail lines in place as backup that connected the outer regions of the metro to the center. Once again, Detroit's lack of diversification contributed to its detriment. Today, Detroit's citizens are left without a reliable and comprehensive system of transit to get them around the city. As a result the developing and poverty-stricken areas remain disconnected.

Constraint imposed by the scattered expanses of factory complexes within the city limits the growth of Detroit's urban fabric. The unique feature of Detroit's landscape was the sheer magnitude of the automotive industry whose physical presence was placed in the middle of the city. Rather than being clustered in an industrial zone, they were allowed to expand in all directions in the Automobile Capital of the World. These complexes were serviced by the completion of the Detroit Terminal Railroad in 1911. This third rail line drew an outer belt around the city that connected the city's two existing major lines to each other and the river, effectively drawing an industrial wall that constricted the growth of the dense urban core. Within that core, sprawling expances of industrial and manufacturing land created gaps in the structure of the metropolitan web. Today, those gaps create instances of intense abandonment with daunting amounts of work required for redevelopment. As a result, small neighborhoods surrounding these abandoned industrial sites suffer the same attributes of isolation and dilapidation. The center of the city has been cemented as a modern ruin.

SITE ANALYSIS

NARRATIVE
of the Qualitative Aspect of the Thesis

[64] The main path along the edge of the complex covers an underground circulation system.

The Packard Plant is a sprawling industrial complex consisting of two halves: the north building and the south building. The former runs for six blocks north of E Grand Boulevard and the latter stretches four blocks south of E Grand Boulevard. They were connected by the iconic Packard bridge in 1939. The bridge features a thin band of glazing in the middle of fading red brick that once showcased shells of Packards rolling across the elevated assembly line inside. At the center of the bridge below the glass opening lies the minimal face of a clock. The bridge itself remains square at the top and arches gently at the bottom, allowing cars to pass underneath. E Grand Boulevard continues past the Packard Plant to curve southward into a residential neighborhood whose houses look to be in just as poor of conditions as the plant. Most windows have been salvaged by scrappers. Some are boarded up by cardboard; others remain open, leaving the interior at the mercy of the elements. The lawns and boulevards of the area have grown over to invade the sidewalk and the houses themselves. The floors of many of the homes have fallen in, leaving structure to support only the air. However, the neighborhood has not been completely abandoned. Young people likely involved in the drug trade can be seen sitting on the stoops of the desolate houses, where they may spend the entirety of their day. Returning to the plant, stoopers can be seen occupying the yard directly south of E Grand Boulevard. But, the building itself is monitored by security. The entire complex was purchased by Fernando Palazuelo in 2013 and is slated to undergo $420 million worth of renovations, beginning with the portion of the north building nearest to E Grand Boulevard. As a result, the north building is in the process of being cleared of the large amounts of debris that have accumulated over the last decade. A small portion of the plant located at the enclave nearest E Grand Boulevard was demolished when the city had ownership at the turn of the century. A pile of crushed CMU, brick, and re-bar lies unmoved in the gap. The rest of the plant houses a similar landscape of dismantled building components on every surface of floor space. All of the window frames have been salvaged by scrappers; glass pieces glistening in the sun lie on the floor at the base of each opening. This continues for blocks and blocks as the building consists of seemingly never-ending open space framed by a colonnade of concrete pillars. The long main hall branches off at regular intervals to rectangular rooms at the west. The east facade remains flush for the entirety of the complex. Floor textures vary from room to room as specialized activities occured in each. The main hall is lain with a somewhat cushioned brick developed by Kahn for the comfort of the factory workers. One of the far north rooms transitions abruptly from this brick to slender, diagonally placed wooden planks. A horizontal configuration of the same flooring appears again in the offices and drafting rooms. At the northern-most point of the complex, the building transitions into showroom space. A ramp that once serviced completed Packards follows descending windows down the height of the building. The concrete columns found here are topped with a decorative mushroom cap. Views from the roof showcase a breathtaking view of downtown Detroit to the southwest. Heading back toward E Grand Boulevard, the main hall takes its only turn (a slight one to the east) to line up with the assembly line bridge. A centralized column splits the hall in two before it enters the bridge. To the west of the bridge, the wooden frames of offices still stand. Views from these offices look back to the expanse of the north building and across E Grand Boulevard to the south complex. The building's grand staircase leads down to the main entrance where teal light streams through glass blocks.

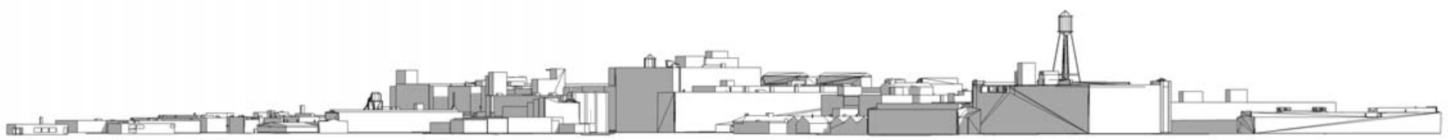
[65] The bridge spanning E Grand Boulevard is a widely recognized symbol of Detroit.

[66] The main hall that once housed an assembly line full of Packard shells seems to go on into a dark infinity.

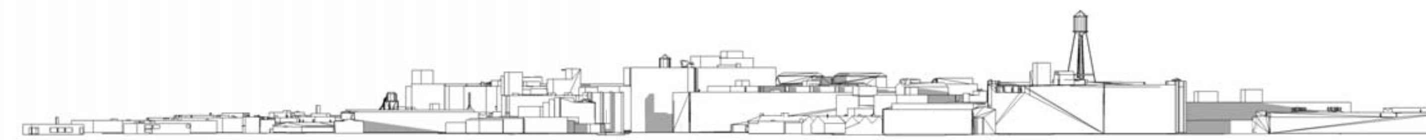
[67] A ramp at the end of the north building brought completed Packards to the street. Today it leads up to a prairie-like rooftop view of downtown Detroit.
[68] (Opposite) Wooden frames sketch out the office space layout on the second floor.
[69] (Next spread) An interior view of the E Grand Boulevard bridge reveals a large sun-spewing gap and encroaching vegetation.

VIEWS

[70] Materials and textures.



[71] Winter Solstice 9:00am Section.



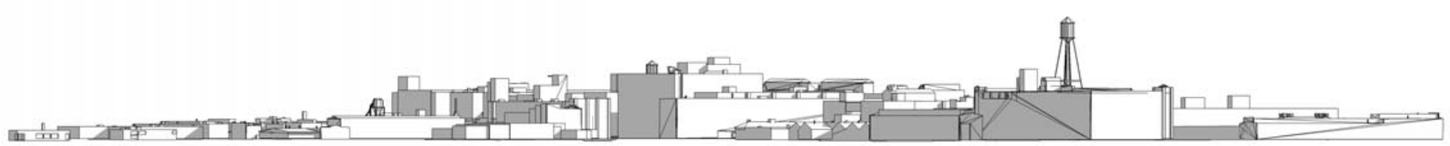
[73] Winter Solstice 3:00pm Section.

[72] Winter Solstice 9:00am Plan.

[74] Winter Solstice 3:00pm Plan.

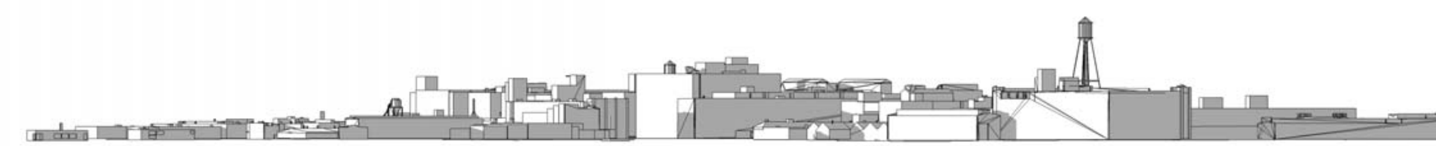
VIEWS

The site in plan consists of a rectilinear grid set up by intersections of streets and avenues which have been offset to form the edges of buildings on the complex. A series of U-shaped enclaves produce portals of sunlight over midday and cause the complex to cast shadows upon itself at sunrise and sunset. This creates a moving painting of the complex in shadow upon its own walls in the evening. Low industrial buildings to the west of the site have little effect on the daylight received through the large windows of the four-to six-story Packard Plant. Most belong to the complex and remain abandoned. The topography continues evenly across the site, dipping only slightly at the freeway.



[75] Summer Solstice 7:00am Section.

[76] Summer Solstice 7:00am Plan.



[77] Summer Solstice 6:30pm Section.

[78] Summer Solstice 6:30pm Plan.

NATURAL LIGHT WATER & VEGETATION

The Midwestern sunlight is soft and clear, only growing harsh for about half an hour at dusk when it takes on a beautiful orange tint. Currently, light flows freely between open air and building as all windows have been removed. However, this was one of Albert Kahn's original goals and, with the current window selection, this quality of light should continue throughout the building after the openings have been refurbished. This will create banks of bright natural light followed by banks of deep shadow, repeating throughout the linear expanse of the building. Vegetation on the site consists of wild grasses, shrubs, and light tree cover to the west. To the east, a maintained lawn boasts a landscaped arrangement of darker and more densely leafy trees. Two of these types of trees also appear on the boulevard between the nroth building and E Grand Boulevard, framing a potential main entrance condition. Currenty, each floor of the building also acts as groundwork for wild vegetation, but this will cease to continue after renovation. There are no occurences of still or running bodies of water on or around the site. Depressions in the uneven concrete terrain may hold rainwater after large amounts of precipitation.

[79] The Packard Plant on a clear September afternoon.

[80] At times, entire floor slabs cave in, revealing resistent structure.

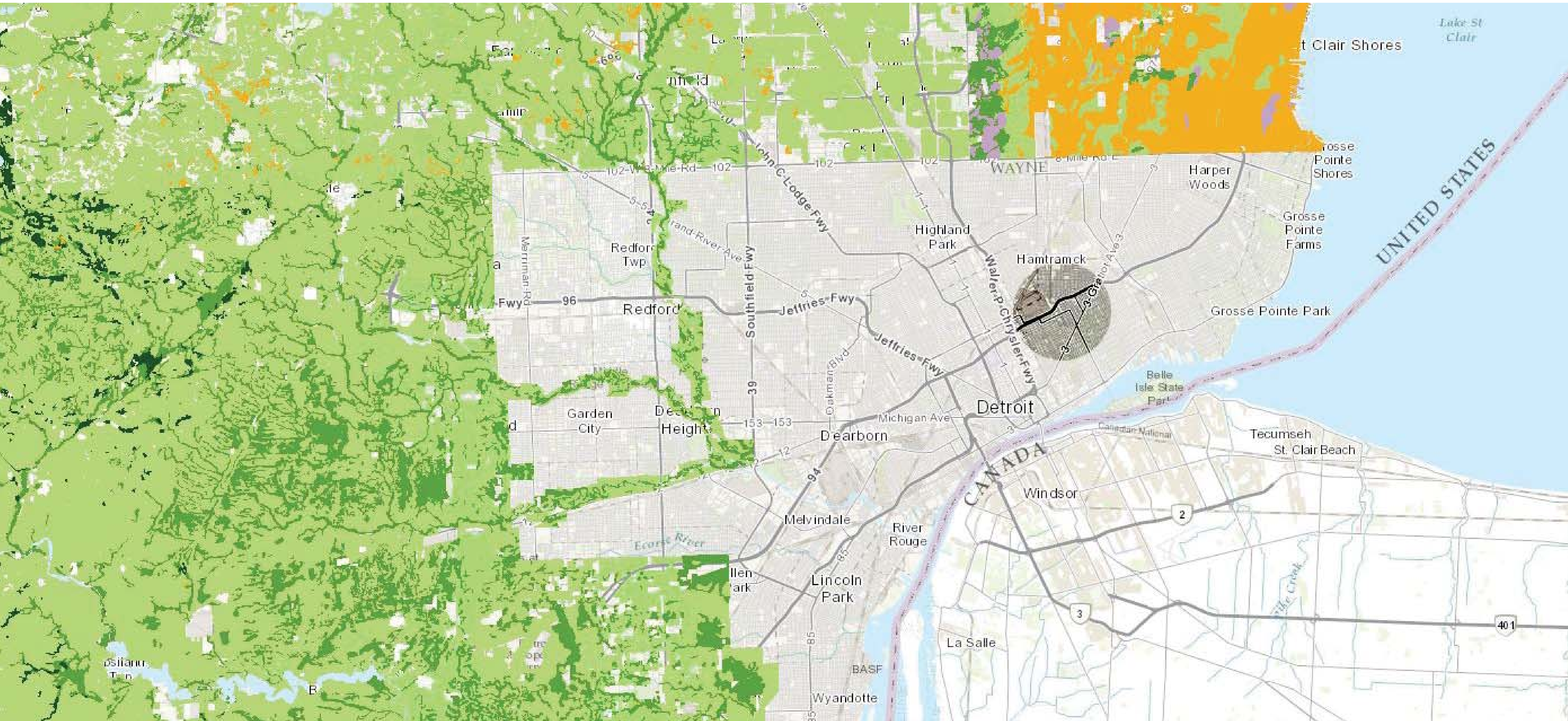
The site shows considerable amounts of distress specific to the micro system of the plant itself, but also characteristic of the surrounding neighborhood and most of Detroit. Interrupted demolition has left a large amount of rubble to lay dormant within the building and on the ground surrounding the site. Wild plant life has taken root through many of the floors of the building and grows freely in the complex's courtyards. The micro system that has developed as a result will disappear once major construction and human inhabitance commences. Most of the north building has remained structurally stable with the exception of some upper floor implosion near the end of one of the central wings of the complex. The south building has suffered far more distress to its structural integrity, but will not be built upon for this phase of the project. The plant's state of destruction is largely due to the salvage work of scrappers who took anything of value while destroying the surroundings in the process. Anything worth scrapping has now been taken, leaving the building much quieter and more desolate. Traces of a homeless population presence can be found in the form of sleeping bags, shoes, and clothing. However, now that the building has been purchased, security guards do their best to keep the building free from unwelcome human activity. Restoration workers have now begun cleanup work, which is noticable at the southern-most end of the north building where the bare concrete floor makes its only appearance. Fairly regularly, film crews, potential leasers, and field researchers are given guided tours through the building during daylight hours. Unguided trespassers are prosecuted by security.

HUMAN CHARACTERISTICS & DISTRESS

SOILS

- Alfisols, Urban land-Thetford complex, 0-3% slopes
- Entisols, Tedrow loamy fine sand, 0-2% slopes
- Mollisols, Granby loamy fine sand
- Inceptisols, Lenawee clay foam
- Spodosols, Au Gres sand, 0-6% slopes

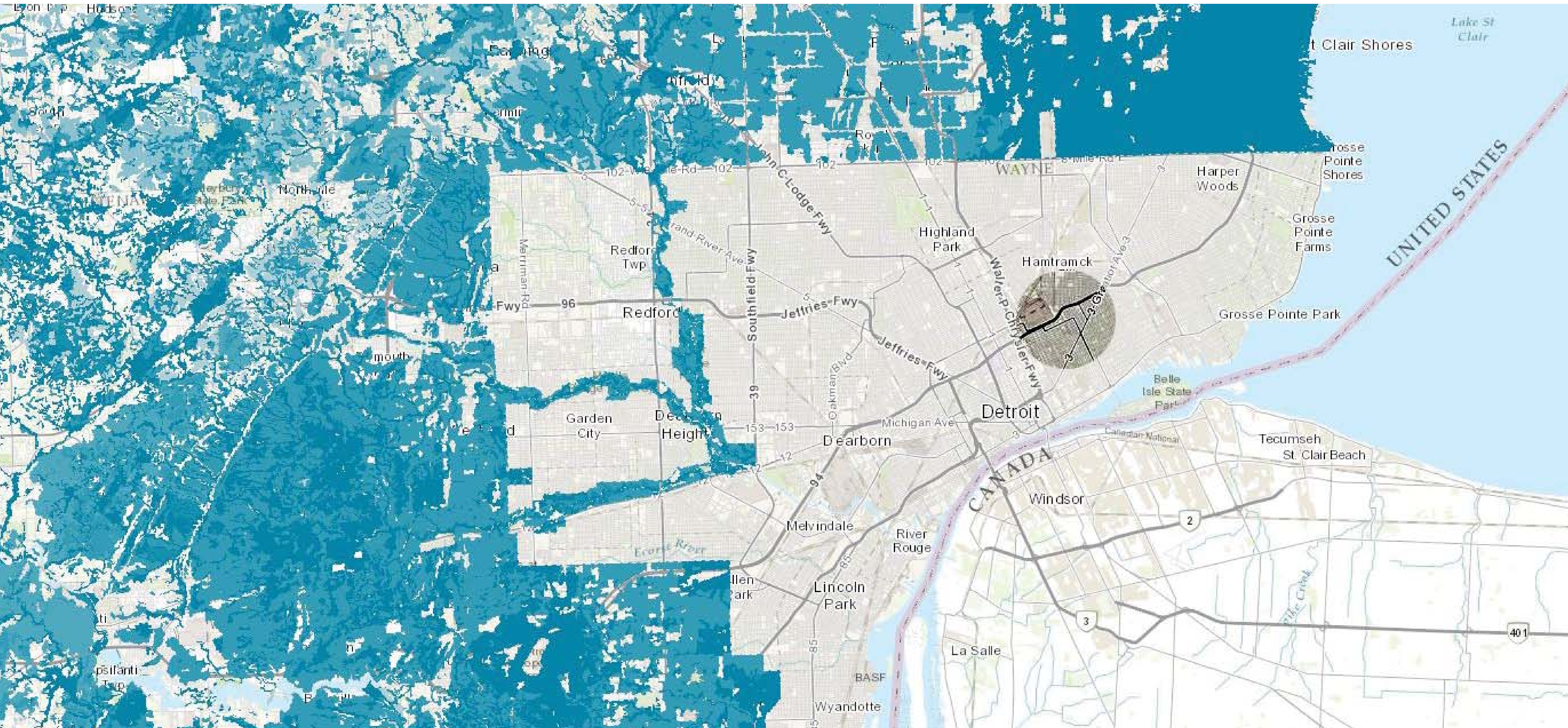
Because Detroit was so developed in housing and industry at the time of the most recent Natural Resources Conservation Service soil survey, a detailed map of the area was not practical. Thus, soil analysis must be made as a conjecture based on surrounding conditions. It is likely that the region of Hamtramck contains a mixture of the soil types present on the map below. We can predict that the majority of soil in this area is composed of loamy clay and sand. The soil has supported the six floors of the Packard Plant and considerable industrial loads for the past 110 years. However, because of this history, the site is a brownfield condition and will require extensive redevelopment



WATER TABLE

0 cm 60 cm 281 cm

Because Detroit was so developed in housing and industry at the time of the most recent Natural Resources Conservation Service water table survey, a detailed map of the area was not practical. Thus, water table analysis must be made as a conjecture based on surrounding conditions. It is likely that the water table under the region of Hamtramck is considerably low considering its proximity to Lake St. Clair. In the areas directly north of Hamtrack the shallowest depth to the water table at any time of the year is 0 cm. In combination with the presence of clayey sand and the toxic nature of the soils beneath the Packard Plant, this poses a critical subsurface issue.



INFRASTRUCTURE

Vehicular Traffic Density | Viable Pedestrian Route | Node | Packard Plant | Industrial Building

The Packard Plant forms the eastern-most edge of a heavily industrial region. Interstate-94 brings heavy traffic to the north and Gratiot Ave to the east provides a direct link to downtown Detroit. However, commerical activity around the site is very limited. Nodes on the above map indicate the only instances of functioning services in the area. A gridwork of heavily abandoned residential blocks exist to the east and west of the industrial strip. Sidewalks are only walkable at the instances highlighted above.

The complex borders a ravine to the west that houses light tree cover and brush as well as an old rail bed. Beneath the ravine lies a tunnel system through which workers once navigated from building to building. To the east, a lot with dense tree cover and a maintained yard of lush grass provides some shade for portions of the plant near the E Grand Boulevard bridge. In the surrounding area, neighborhood parks are dispersed fairly evenly. The Luthern Cemetery to the southwest provides the most density of tree cover for the neighborhood as well as a nice field of grass. The area completely lacks water features, still or flowing.

LAND FEATURES

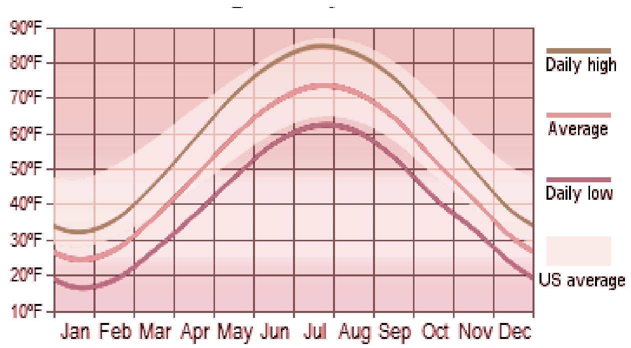
- General Vegetative Cover
- Large Tree
- Packard Plant
- Industrial Building

SITE RECONAISSANCE

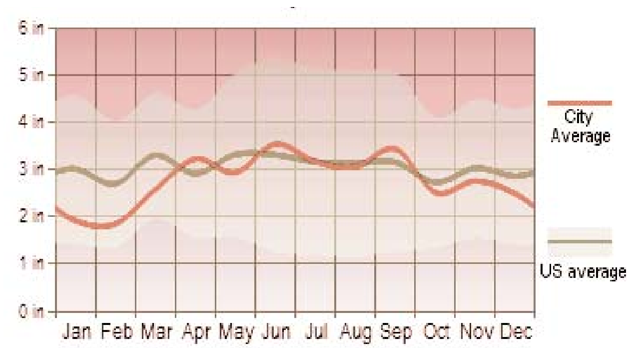
[North]
[East]

[South]
[West]

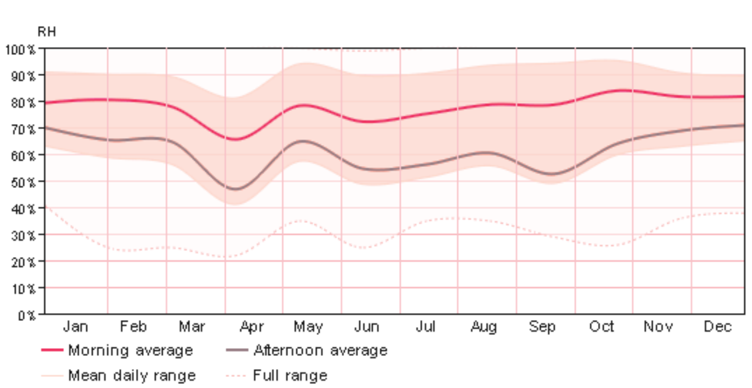
CLIMATE DATA



[85] Average temperatures.



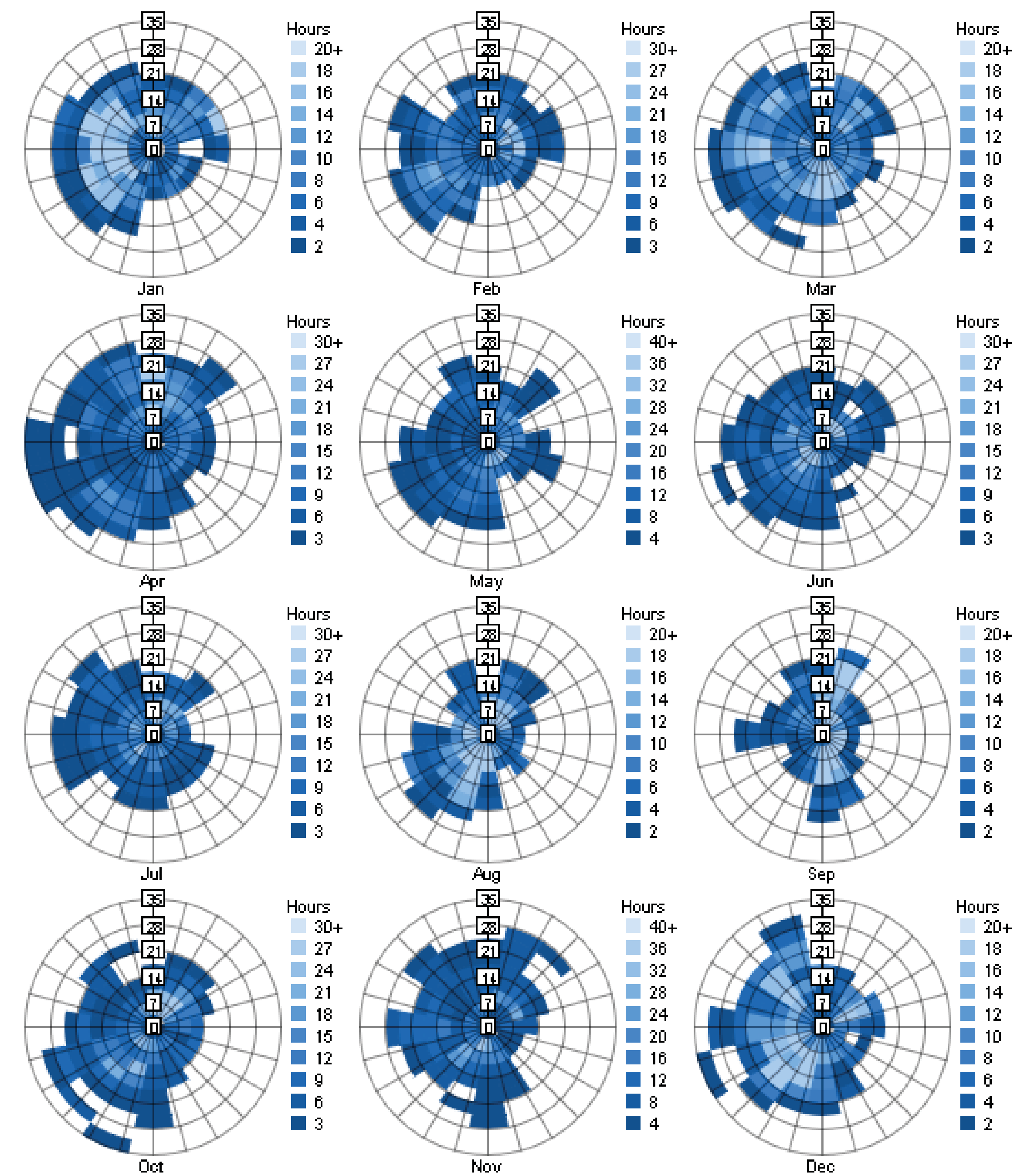
[87] Precipitation.



[86] Rekative humidity.

Detroit exhibits a wide range of temperatures, dipping well below the national average in the winter months and reaching relatively high summer temperatures. The buildinge envelope will need to be very secure for the cold months, but should allow relief for workers in the heat of the summer. Precipitation remains minimal throughout the year, meaning runoff control and drainage will need to be implemented, but will not require advanced methods. Relative humidity levels are rather high, producing sticky summer heat that will require mediation within the building.

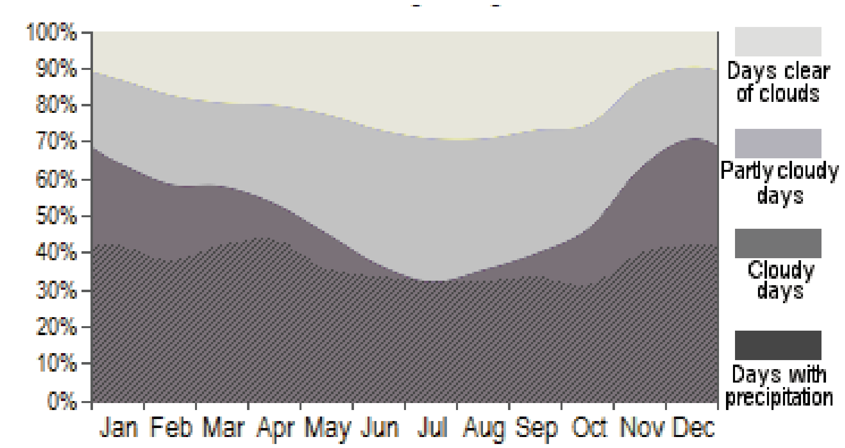
The strongest winter winds typically come from west during March and April. A consistent lighter western wind accompanies the rest of the season. In the summer, light breezes can be detected with similar consistencies from each direction. Fall brings moderate winds from the northeast and southwest. The western facade of the Packard Plant displays a pattern of U-shaped enclaves that have the tendency to accelerate and channel cold winter winds around corners and along the face of the building. Future renovation should protect against this climate condition.



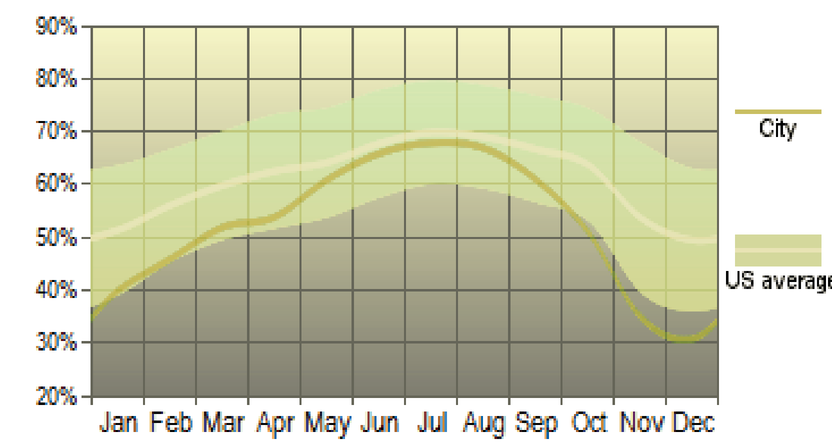
[88] Monthly wind roses.

SUN STUDY

[89] Sun path.



[90] Cloudy days.



[91] Sunshine.

The slope of the site is very flat, making conditions favorable for factory work, but not ideal for solar gain. The design of U-shaped enclaves has increased the surface area of south facades, allowing warm summer sunlight to flood into these areas in the late morning and over the noon hour. Afternoon and evening light creates deep shadows to the east of the building and within the enclaves. On average, Detroit receives less sunlight than the rest of the nation. This is escalated in early winter when the city can receive as little as 30% sunlight. This is a result of increased air pollution caused by heavy industrial work.

SPATIAL PLANNING

Space Allocation in Square Feet

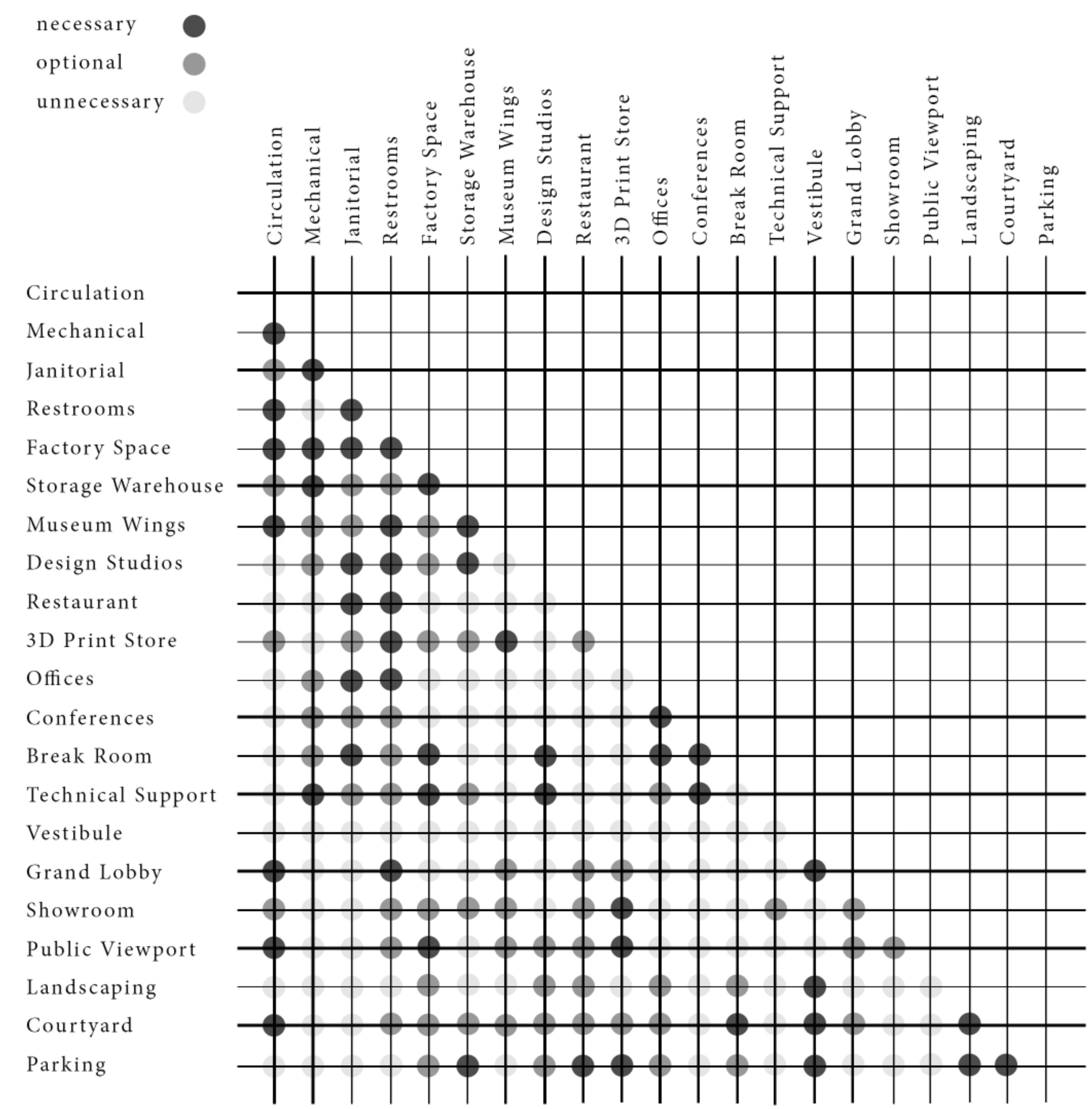
Supporting - [100000+]
- Circulation
- Mechanical
- Janitorial
- Restrooms

Factory Space - [150000+]
Storage Warehouse - [90000+]
Museum Wings - [80000+]
Design Studios - [19500+]
Restaurant - [15000+]
3D Print Store - [19500+]

Administration - [30000+]
- Offices
- Conference
- Break Room
- Technical Support

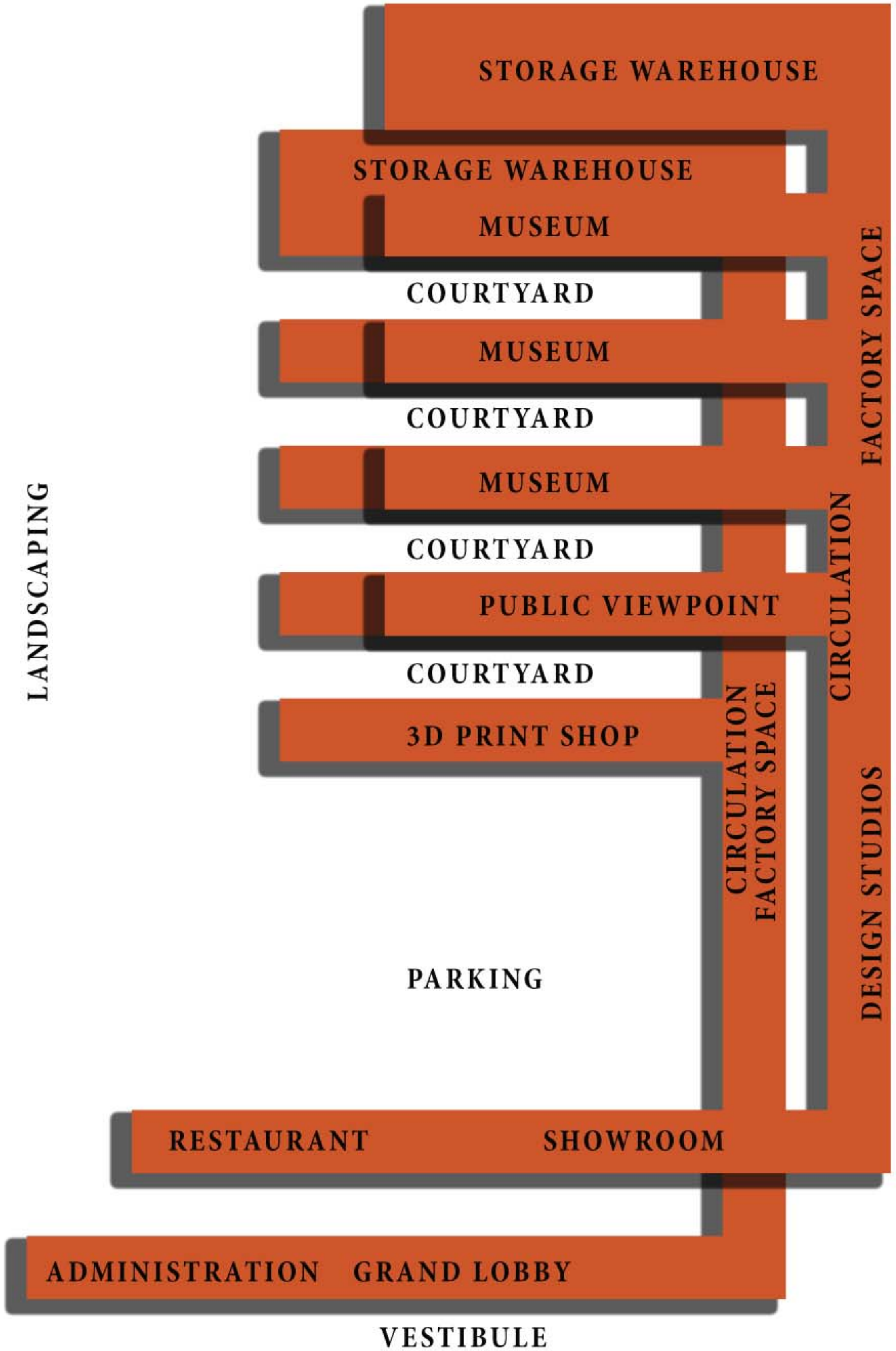
Entrance - [30000+]
- Vestibule
- Grand Lobby
- Showroom
- Public Viewpoint

Exterior - [360000+]
- Landscaping
- Courtyard
- Parking



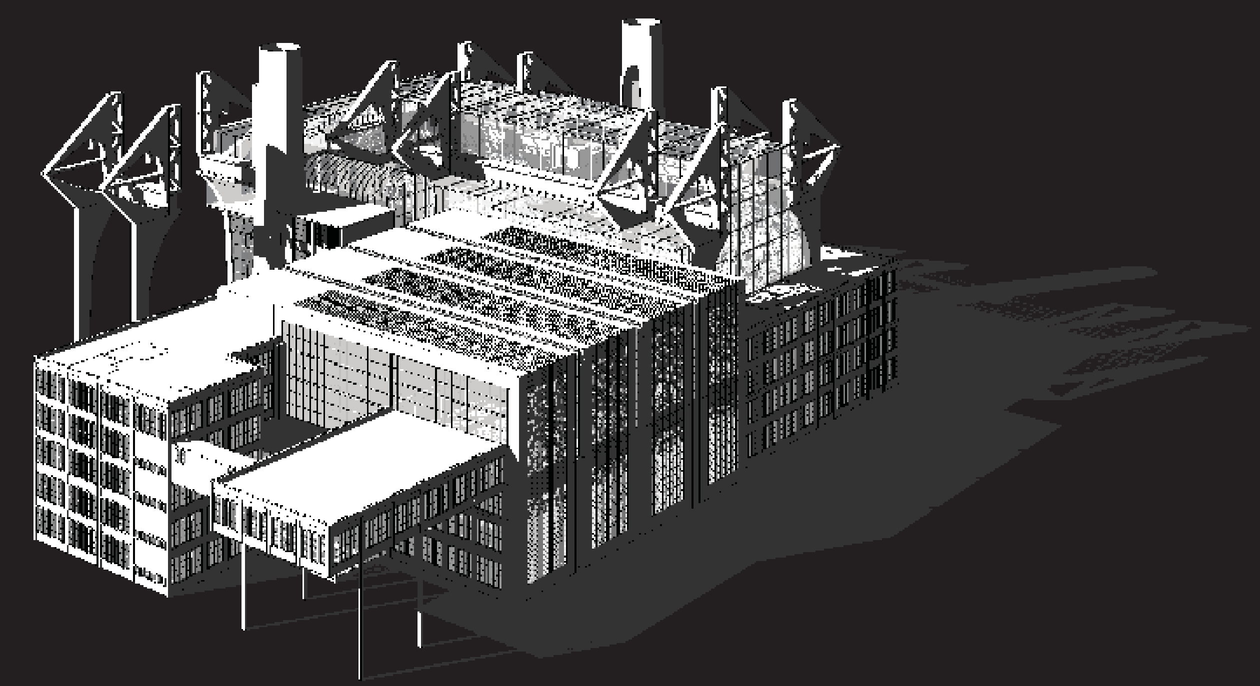
[92] Interaction matrix.

SCHEMATIC DESIGN



[93] Interaction net.

DESIGN SOLUTION



[94] Axonometric model.

PROCESS DOCUMENTATION

The Artefact

In *The Technological Society*, French philosopher Jacques Ellul explains that “our modern worship of technique derives from man’s ancestral worship of the mysterious and marvelous character of his own handiwork” (Ellul, 24). We are still intrigued and fascinated by modern technology because it is indeed a human discovery. However, modern technology has been detached from tradition. It has become a game of mechanical reproduction, in which copies upon copies lose their “aura”, as Walter Benjamin puts it, to the absence of context, ritual, and wonder. What is fabricated in a production plant, and the goal of this labor, is outside of the question of its design.

[95] Artefact installation for presentation.

[96] Repetitive organization implies continuous forward movement.

[97] (Right) Mutation detail.

This wall adorned with prosthetic hands questions the value of the reproduction line. When ordered in a mathematical grid system, the nuances of each hand are highlighted. These differences were created either by a direct human interference or the serendipitous mistakes of the technology. What is interesting is that the 3D printer did not know when it made these mistakes. It was only by the practical wisdom of the human overseeing the project that each difference is recognized and labeled. The variations that I have saved are what give rise to the pataphysical act of play between the creation and ourselves as the humans who encounter it.

In Timaeus, Plato spoke of the world and our bodies as the products of a creator which mimicked parts of itself. The plastic forms of the world take on geometrical shapes that are imposed upon them. The collisions of these shapes produce the variety of sensations, textures, and objects that make up the world around us. Architectural design creates an order resonant with the body's own. Our body's experience of the world is projected back to us through the architectural creation and a distance of interpretation is constructed. Here, it is impossible not to relate the form of these 3D printed hands to that of our own, to project the slices and mutations of these hands onto ours. It is through anatomical cutting that we have come to know our bodies by the rational means of today's medical field. A similar system of cutting and layering defines the order of operations for a 3D printer. The analytical ordering of these hands through cuts and classifications is an ironic play on the rationalized, efficient means of production that my architecture is trying to avoid. By contrast, this investigation is not interested in functionality, but in the expressive potential of this technology. The unique exceptions to the ordered copying of the hand provide a pataphysical distance which we fill with our own connections and meanings.

PROCESS DOCUMENTATION

Precedent Study

[98] The most iconic image from the film depicts Pink's screaming face protruding from the wall.

Pink Floyd's *The Wall* as a Work of Fiction

In "The Function of Fiction in Shaping Reality" Paul Ricoeur speaks of the distance between the new image and its original as forming a space of fiction. "Fictions are merely complex ideas whose components are derived from previous experience" (Ricoeur, 125). New combinations of these ideas generate new images through which predicative relations can be read. "In the measure to which image gives a body, a contour, a shape to meaning, it is not confined to a role of accompaniment, of illustration, but participates in the invention of meaning" (Ricoeur, 129). To see meanings alluded to in pictorial or linguistic metaphors is to affirm the emergence of a new meaning derived from a relation in a new world constructed by the imagination at work. Rather than referring to an idea or an image that is merely absent, this new combination "…has no reference in a previous original to which the image would be the copy" (Ricoeur, 126). It refers to the unreal, a neutralized atmosphere, a space of non-engagement and suspended meaning: fiction. Through fiction, we are able to find new ways of being-in-the-world. "Thus mimesis is not simply reduplication but creative reconstruction by means of the mediation of fiction" (Ricoeur, 140).

Pink Floyd's *The Wall* works within the dimension of fiction to "leave in sketch an alternative to the present situation" (reality). The historical context leading up to the creation of the work is largely dominated by Britain's struggle to realize an ideal national identity after the destruction of World War II. The pride of the British Empire had diminished substantially and the post-war dream of a just and peaceful home for soldiers and their families was replaced by the dominating capitalist socio-economics of the United States. However, both the album and the film place stress on the personal-national identitary dimension rather than the socio-economic base which constitutes the work's material ground. Our protagonist, Pink Floyd, is an obvious autobiographical reference to band member Roger Waters, who composed the majority of the concept album. The film opens up to him sitting alone in a dark room in a state of retrosWWWWpection. The following montage of counterpoint scenes establishes a crucial parallelism amongst the past battle of Anzio to which he lost his young father (fighter planes drop bombs

[99] Pink encounters the past in his armchair.

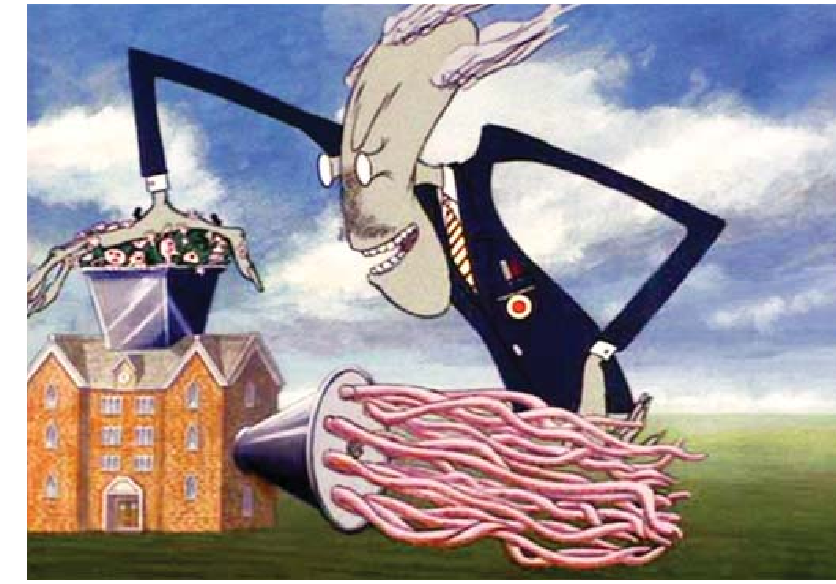
in the trenches), the present reality of an impending concert with his band in the United States (a screaming mob of crazed fans), and an imaginary re-elaboration of Pink's own encounter with the audience attending the concert (in which he personifies a fascist totalitarian leader). This construct of past, present, and non-time dimensions constitutes the temporal structure of the work through which Pink identifies a reality and builds the wall.

The absence of the father is a symbol that frames not only the personal historical context of the work, but stands for the overlying issue that generated the entire attitude of a disillusioned post-war Britain. After the war, Britain's socio-economic national ideal was "…passed on as a legacy to the post-war generations" (Romero, 45). "By interweaving the individual with the collective history, the film records how this legacy soon started to undergo a fatal process of erosion and was brought to an end in the present dimension from which the story is told" (Romero, 48). The betrayal and eventual destruction of the 'national ideal' as symbolized by the death of the protagonist's father gave way to "…a present that is totally dominated by an evil capitalist system, brutally dehumanized and viciously destructive" (Romero, 50). As Pink envisions the battle of Anzio in his hotel room hours before his expected appearance on stage, he "becomes aware that he is nothing but a piece in an implacable, dark, voracious, irrational and monstrous machinery" (Romero, 51). "The place of the father has been taken over by that unbridled and unstoppable machinery that dissolves all traces of socially binding affection and transforms individuals into simple producers and consumers" (Romero, 52). The image of a giant meat grinder in a factory-like school building churning out robotic, faceless children underscores this linguistic metaphor. Waters' lyric /Daddy's flown across the ocean/ refers not only to the personal void of Pink's father, but the nation's loss of the symbolic father: a set of social rules and values that were killed by the Western capitalist structure. The present reality of Britain in the fictional world of the work "…no longer returns love in exchange for repression and obedience" (Romero, 55).

"The consequence of this is 'the wall': that is, discontent, frustration, materialist fetishism, isolation, narcissistic introversion, disorientation, vacuous hedonism and irrational (self-) aggression" (Romero, 52). Pink builds up his wall to protect him from the pain associated with the events of his past and the possible pain of similar encounters in the future. In his drug-induced reverie he envisions an open field with a

rugby post as a space of possible pasts, inviting his father and his friends to join him in a game structured by tradition and the national ideal. "Instead, the field is invaded by all the spectral figures of the real past that lie at the root of the present discontent" (Romero, 53): the ghost of his dead father, the explosions of the battle, a repressive and violent education system, and a protective mother that lays the seed of his distrust in women. Pink's journey through this morphing field is a metaphor for Britain's post-war course through history. The hallucinatory montage is finally broken by the barging in of Pink's doctor and crew who inject him with a stimulant that will allow him to complacently perform his duty as a rock star, as a cog in the machine of the "excessive and incessant movement of dominant capitalism". This leads to the work's temporal dimension of non-time in which an astonishingly Hitler-like Pink performs in front a fictional British crowd, enlisting them to back his totalitarian-paramilitary solution. The crowd morphs into a violent mob of racist radicals. The combination of the montage of images in the film and lyrics of the three corresponding tracks from the

[100] The efficient institution.



album warn against this sort of ultranationalist, imperialist solution to the work's construct of reality.

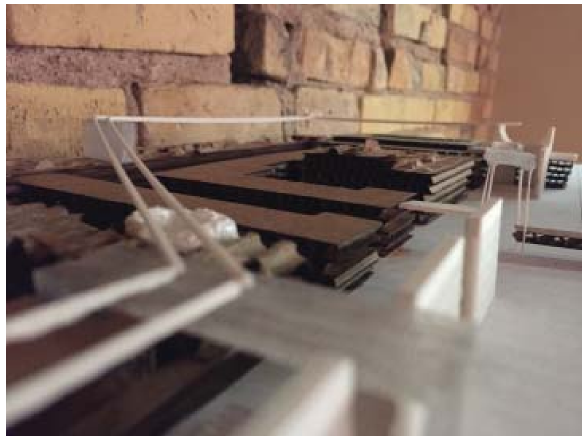
The building pressure of the wall finally comes to a breaking point as the film transitions back from non-time to present reality as a depleted Pink is carried to the hospital, symbolically disintegrating into a pile of worms. Transitioning again to an animated scene, the story culminates in Pink's hour of judgment. Cowering with guilt behind the wall that has grown to obscure him, Pink is put on trial before the Judge and the Crown. These traditional British entities have been "…rescued from the past to incarnate and serve as the Nation's rebirth out of the ruins of present day chaos" (Romero, 56). In a paradoxical twist, Pink's liberation from the wall is achieved through his condemnation at trial. He is found guilty of "showing feelings of an almost human nature" and is sentenced "to be exposed before/ [His] peers". "Tear down the wall" the grotesque figures chant, leaving Pink alone in an empty abyss without the wall that at once protected and alienated him completely.

The Wall as a symbol is the combination of socio-economic, national, and individual contexts; past events, present situations, and future trajectories. The Packard Plant acts similarly as a symbol in the context of Detroit, MI. In the past it stood as the image of progress and the ideals of the Motor City. Today in its state of obsolesced ruin, it reflects the present reality of a city that is struggling to redefine itself and offers a critique of the mistakes of the past. Detroit was left to rebuild itself when the sole industry on which it was based abandoned it in favor of globalization and automation. The investment in a technology and an industry that eventually turned its back on human prosperity has left Detroit cynical and defeated. The architecture that I have created within this functioning symbol for Detroit's reality produces an environment of pataphysical fiction in which references to previous experiences and understandings are juxtaposed against the present situation and futuristic suggestions.

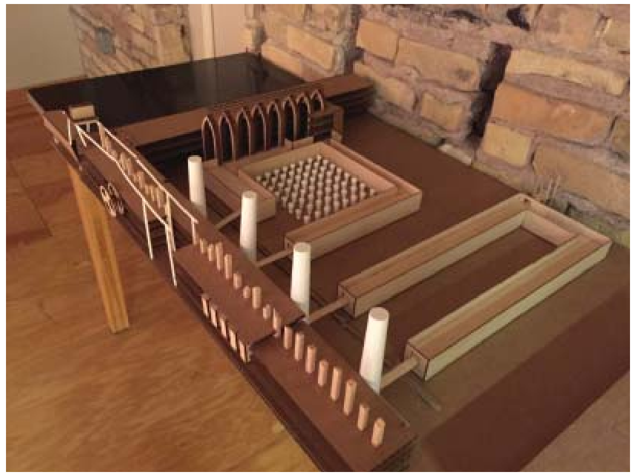
[101] The abandoned Packard Plant falls back into nature.

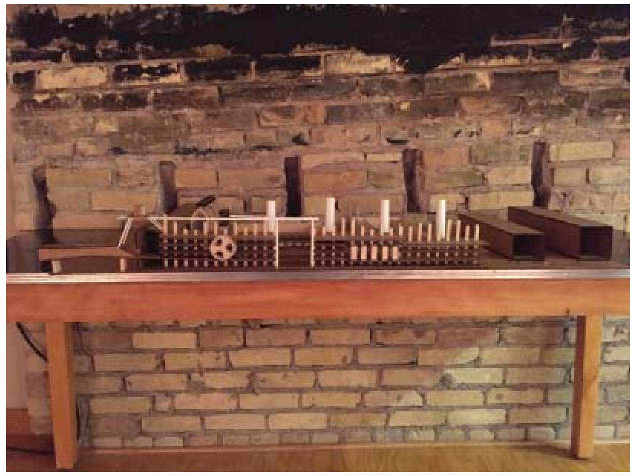
PROCESS DOCUMENTATION

Physical Models



[102] Model 01.





[103] Model 02.

PROCESS DOCUMENTATION

3D Printing Experimentation

[104] Gap installation 01.

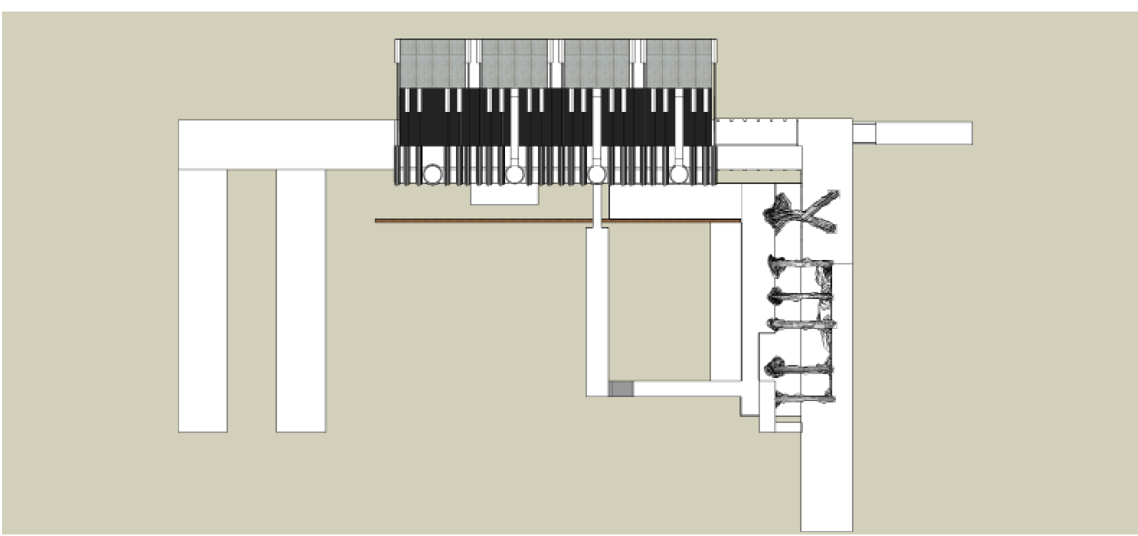
[105] Gap installation 02.

[106] Gap installation 03.

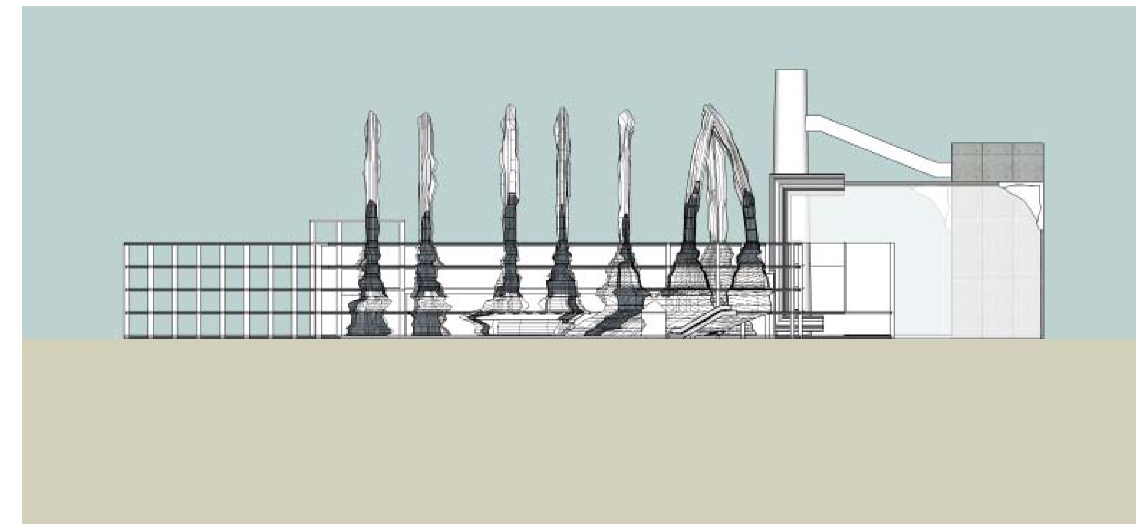
[107] Gap installation 03 detail.

PROCESS DOCUMENTATION

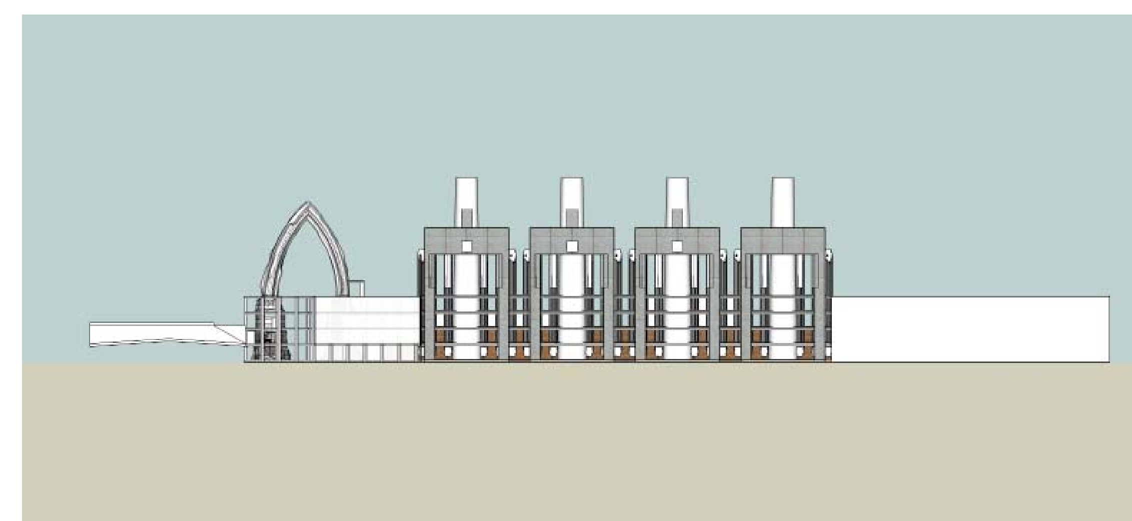
Midterm Review



[108] Aerial view.



[109] Museum section.



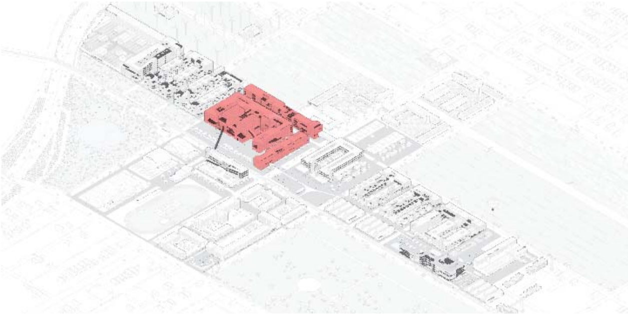
[110] Factory section.

FINAL SOLUTION DOCUMENTATION

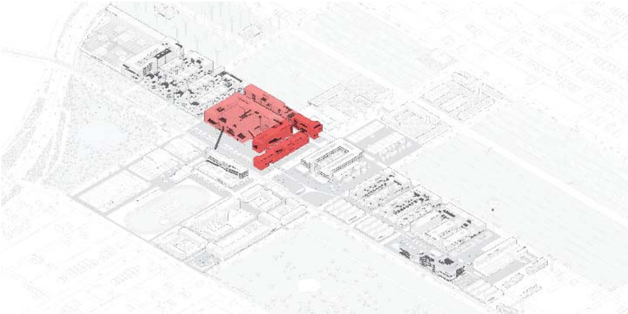
Presentation

My architectural solution takes shape as the first phase of a 3D-printing factory and warehouse that will point the trajectory of the industry toward its expressive, contextualized and intrinsically beautiful potential. I have isolated one block of the expansive Packard Plant complex as the home for the completed factory. This block lines popular E Grand Ave with the Packard's most decorated façade and is connected to the second story assembly line bridge which has become an iconic symbol for the people of Detroit. Phase one operates within the eastern-most portion of the block where restoration efforts are currently underway. The introduction of phase one as an "ethical swarm" of digitally fabricated architecture counters the uninhabitable and uncontextualized quality of parametric swarms. Rather, this architectural prosthetic breathes new life into the rich historical and cultural framework of the existing building. It has been designed to function within this particular environment, offering a critique of today's rationalized and efficient mode of production. This swarm is intended to act as a working model for further expansion of the factory, revitalization of the entire complex, the city of Detroit, and the world. It is meant to showcase the potential of 3D printing technology to clients that will ultimately develop the global built environment of the future.

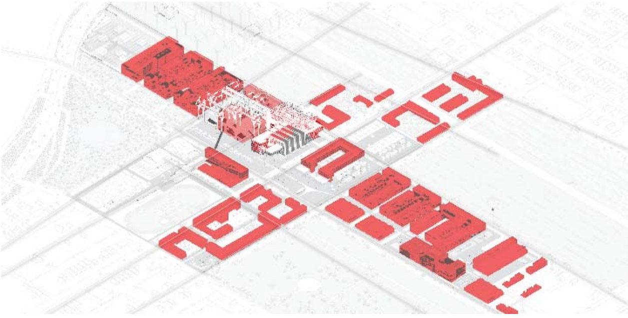
[111] Packard Plant complex.



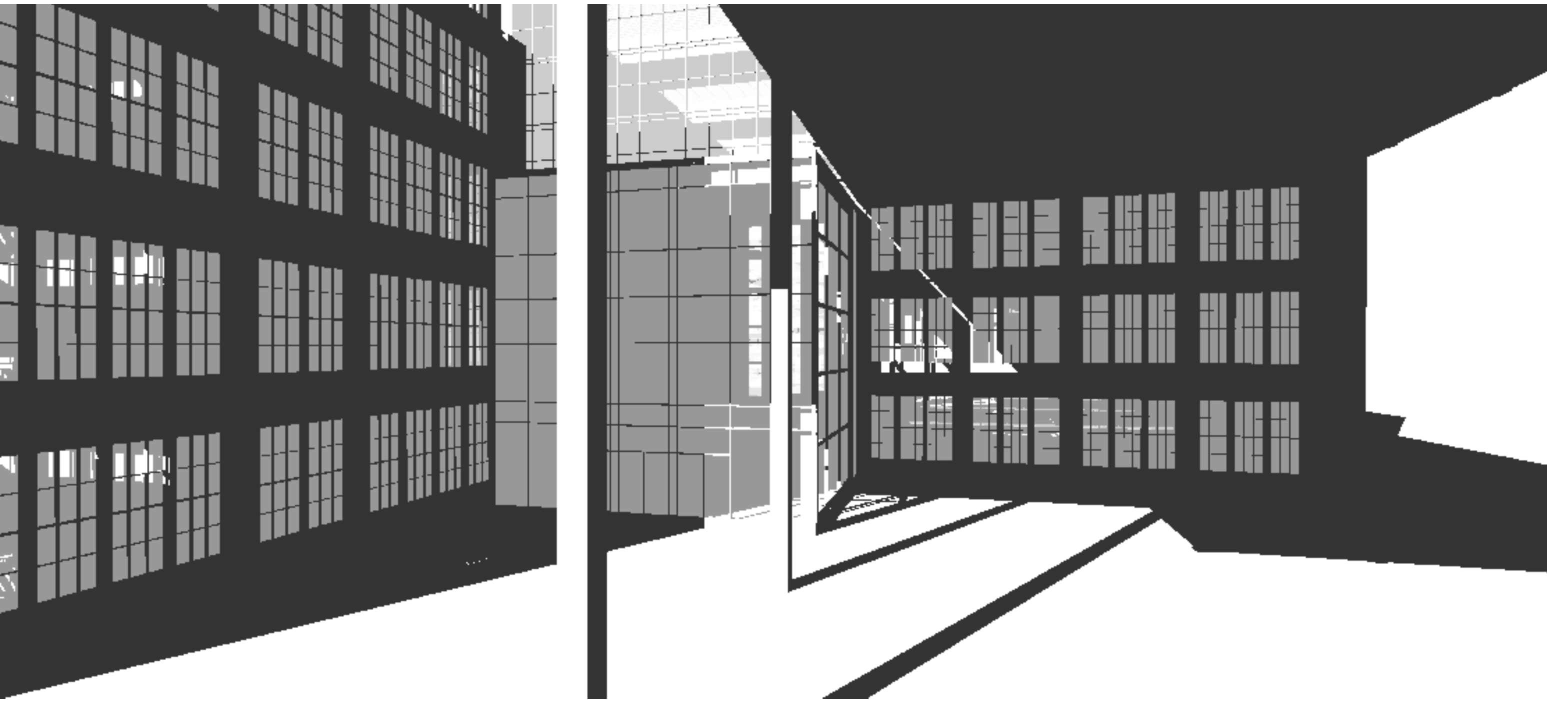
[112] Revitalization block plan.



[113] Ethical swarm phase 01



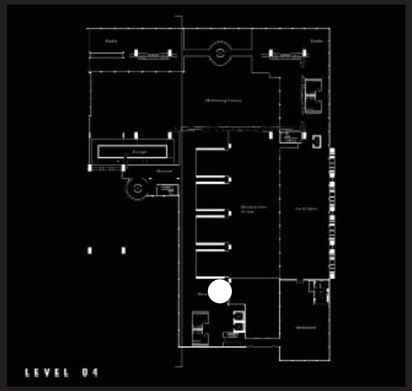
[114] Ethical swarm impact.



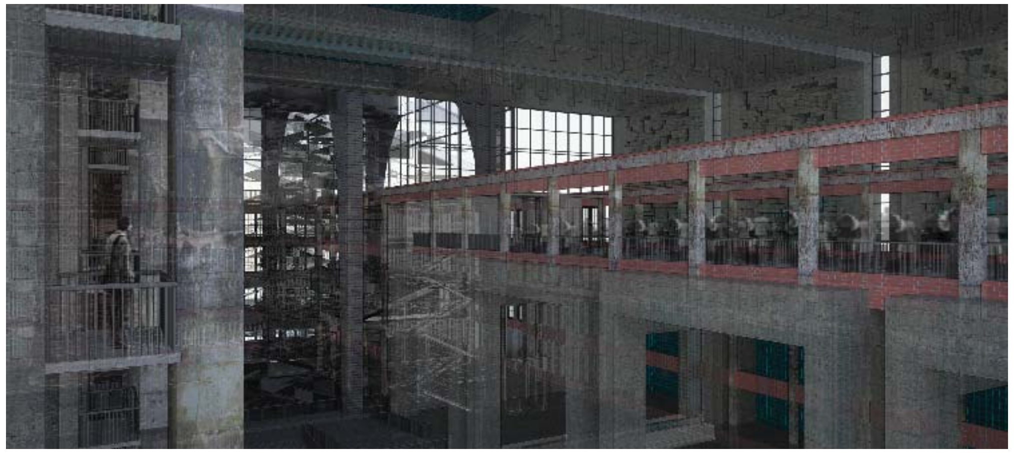
[115] Entry perspective.

The major prosthetic applications that service the revitalization of the Packard Plant work within the gaps between endless repetitions of columns, windows, banks, and wings. This monotony of efficient and economic construction can be redefined by the potential for 3D-printed components to be highly detailed and entirely individualized with little to no extra cost or labor.

[116] The main entrance opens into the “Obsolescence Gallery”.



[117] Display case components.



[118] Existing floor reveal.

[119] Event space framed by the old.

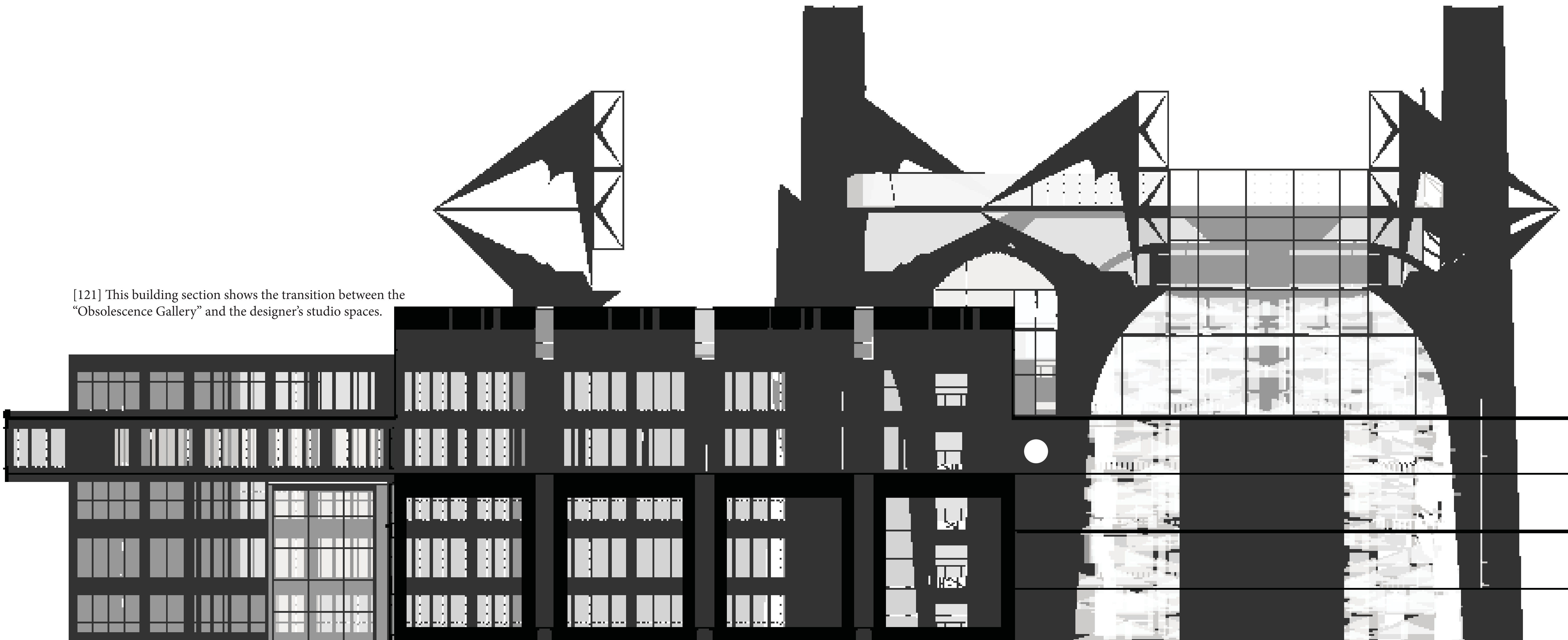
[120] The opposing side of the "Obsolescence Gallery" showcases the old.

The "Obsolescence Gallery" showcases the most cutting edge examples of 3D-printed applications with a bit of a critical overtone. Installations are showcased in display cases fabricated from a cement polymer based from concrete rubble that has been salvaged from the site. The exterior panels of the obsolescence pieces are scripted with light wells that are fitted with structural 3D-printed glass blocking printed from abundant shattered glass on-site. The teal blocks bring light into the space in the same way similar glass blocking did in decades past. Between each of the four modules, a glass reveal highlights the existing concrete floor five feet below. The entire component supports what was once the fourth and top-most floor of the Packard Plant. The existing window lintels, columns, and parapet provide a framework through which those inhabiting the event space view the gallery from the other side.

This side of the obsolescence frame displays machinery from the Packard's prime hung within the confines of four outdated 3D printers that have become obsolete within only the past few years. The new display cases on the other side of the gallery are simply replicas of the shells that you see here. In this space, new references old, old may be confused as new. As soon as a new product is introduced to the obsolescence gallery the layers densify and recycle. Here, our understanding of progress and the acceleration of technology is put into question.

Down the hall lies one of the designer's studio spaces. Here, passers-by encounter a parametric wall that cuts through the entire building to act as a partition between introspective design space and active production-based design and 3D-printing. The openings in this wall were developed through a give and take between man and machine. The desirable scale, shape, and location of openings were scripted into a parametric equation, calculated, modeled, and tested. After tweaking the algorithmic solution manually to reflect contextually specific necessities and personal preferences, the wall was sent digitally to a printer on-site and fabricated locally.

[121] This building section shows the transition between the "Obsolescence Gallery" and the designer's studio spaces.

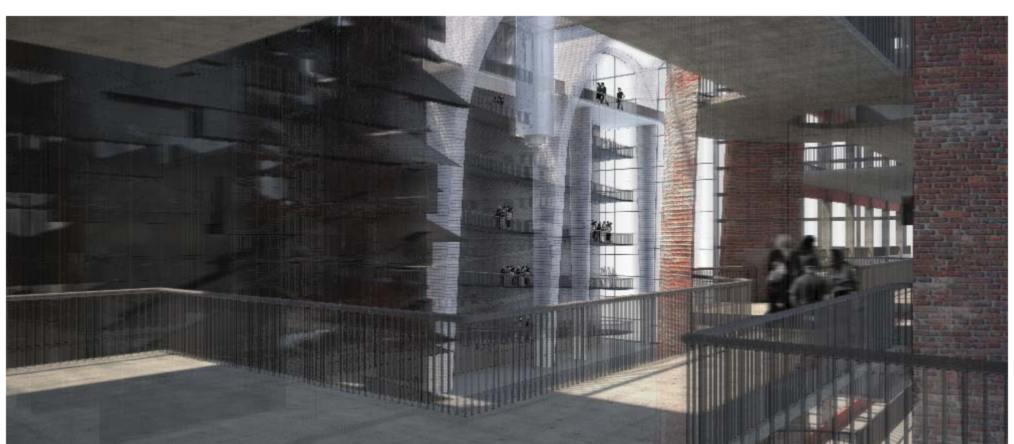


[122] Passing through an opening in the parametric wall leads to the factory space.

Once inside the factory space, we are met with a guarded platform for the designers' direct observation and collaboration. They are able to assess the printing situation in real time, either making changes on control panels set up within the printing arena or returning to the drawing table on the other side of the permeable wall in the studio environment.

[123] The large-scale 3D-printer operates within a 50'x 115' platform.

[124] Another parametric partition defines the transition between factory space and "Obsolescence Gallery".



[125] Complex 3D-printed structure inspires creative vision.

[126] Visitors scale the ascending ramp system of the museum.

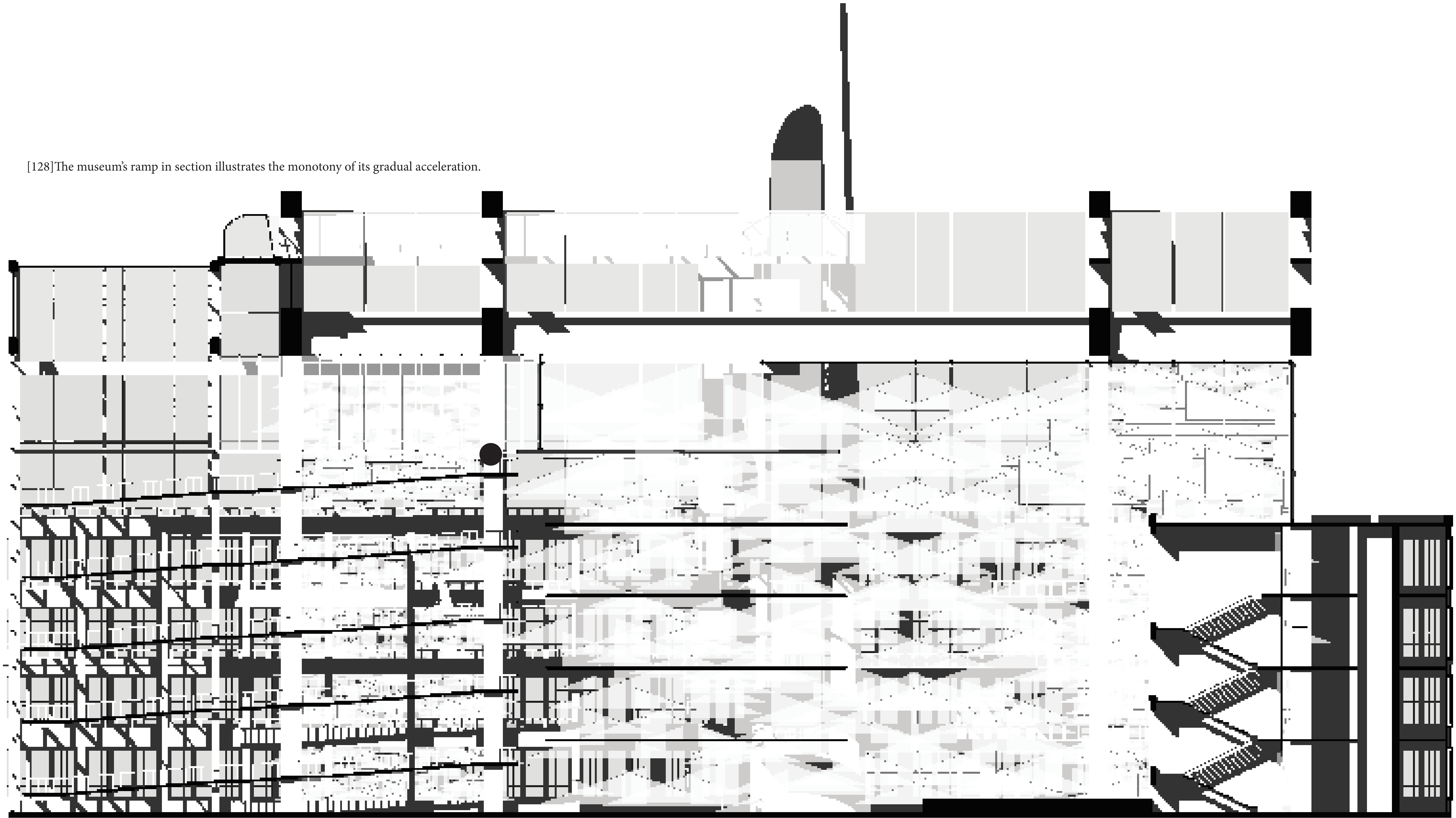
The large-scale 3D-printer operates within a 50'x 115' platform. It is capable of fabricating entire building components such as curved cladding panels or complex structural columns in one continuous print. Much of the work done here involves the production of a series of interlocking modules that will require post-production assembly. Test assembly and free experimentation are a vital step in the process of the exchange between humans and the machine. What is considered completed must be tested in a physical environment against contextual models and a bodily wisdom that is intrinsically human. This step assures the ethical dimension of parametric architecture created in this factory. This give and take is performed in the open printing space when the robotic arm returns to its home base at the far end of the building.

The perimeter of the platform is defined by another parametric wall to our left, on the other side of which, we remember, lays the Obsolescence Gallery. Where the wall breaks away, the factory's structural system is revealed. These complex columns were fabricated through the additive process of the successive layering of concrete via a robotic arm. What would once have taken weeks to realize, now can easily be produced in a matter of hours. This means that we can begin to physically fabricate whatever we see in our dreams. If we can imagine it, we can print it, and we can inhabit it. Rather than continuing the current stagnant state of 3D-printing practice, here clients are asked to tap into the realm of their fantasies, to a space of fiction that invokes wonder and awe. That space can bleed into physical reality through the thoughtful and creative application of digital fabrication technology.

Behind the screen of structure, we can observe figures slowly ascending back and forth along a ramp system that envelopes a large gallery wall. This is a crucial part of phase one construction: the museum. The progression along this winding path takes our guests through a brief history of technology and the machine. It frames our species' relationship with modern technology through the lens of history as a once poetic techne transforms through the scientific revolution into what we recognize today as a mathematically rationalized understanding of the world. The gradually additive motion of the museum is positioned alongside the Cartesian movement of the 3D-printer to ironically call attention to the monotonously repetitive character of this mode of production.

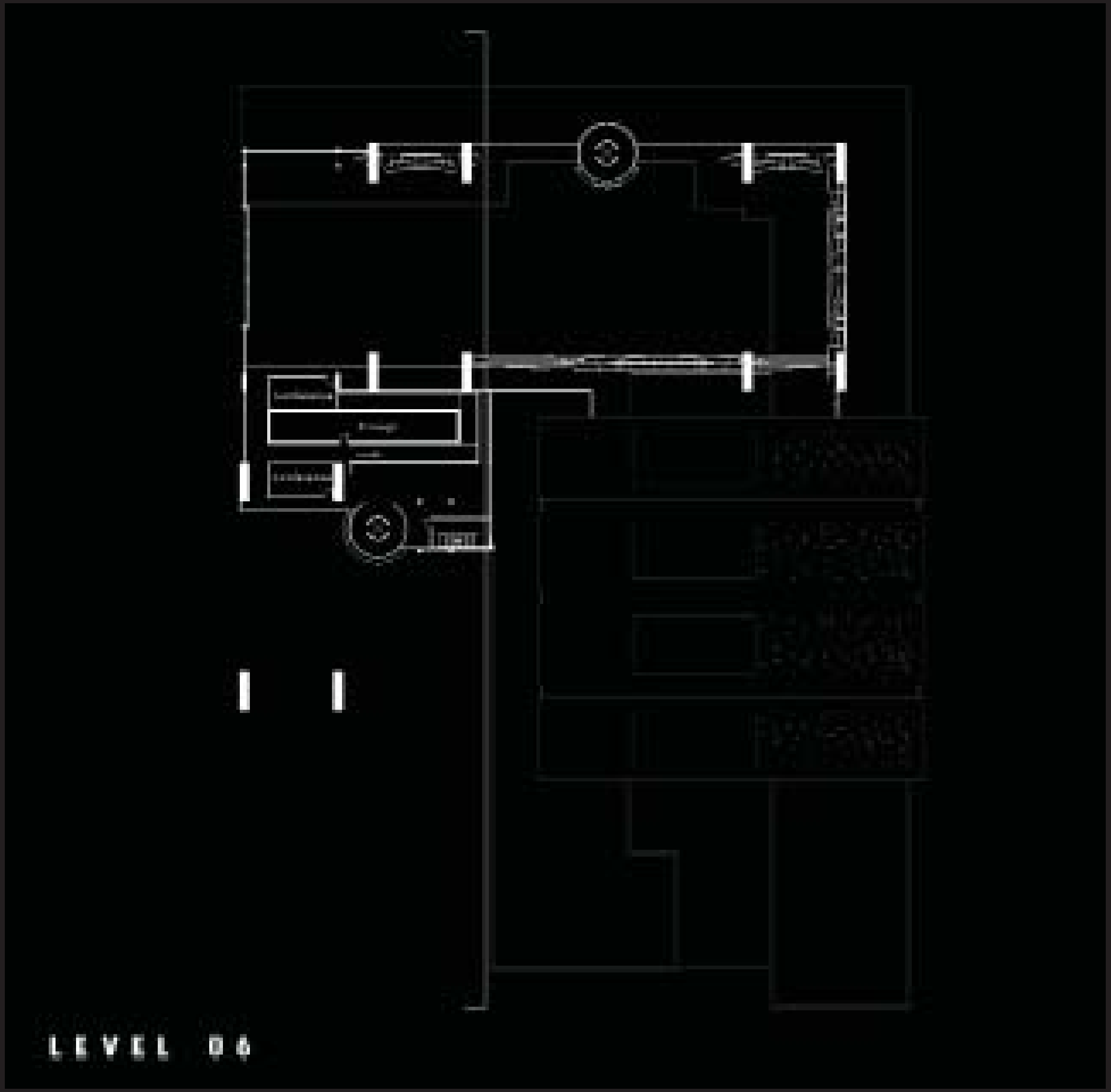
[127]Taking a shortcut across the 3D-printing platform brings one to the ground level of the museum.

[128]The museum's ramp in section illustrates the monotony of its gradual acceleration.

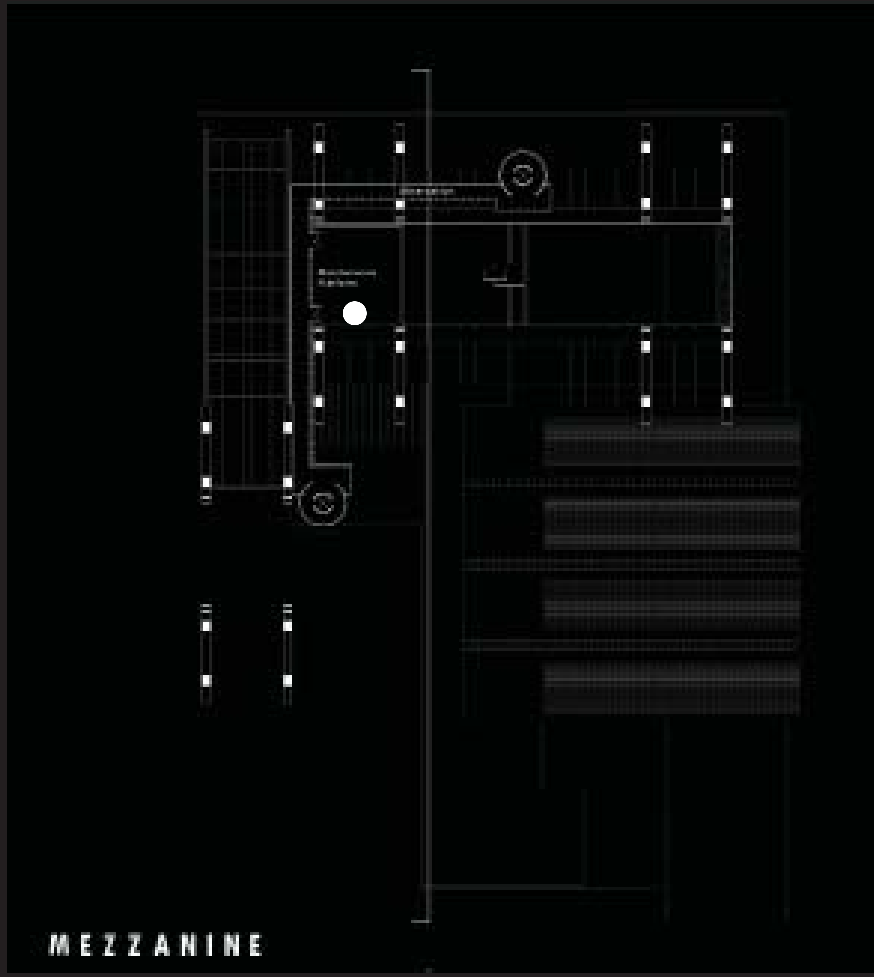


[129] View of the factory from the educated eye of the museum.

The ramp system commences on the sixth floor where we are slightly elevated and set akimbo from the main productive action. From this vantage point, Albert Kahn's repetitive banks of industrial wasteland come into focus as they are superimposed by 3D-printed architecture that simultaneously mimics and critiques its surroundings. This simulated environment connects old and new elements through a constant overlapping of past, present, and a dreamlike non-time dimension. This dimension offers a critical preview of what could be, at times warning against a return to the failures of an automated mode of production, and at times inspiring visions of a highly varied, contextualized, and intrinsically beautiful built environment. The transitions between these temporal dimensions are constantly circulating and evolving within the building to the point that they exist at once as a pataphysical hyperspace. It is here where clients discuss their ideas with the designers, where they can dream, where they can play.



[130] Elevated surveillance network.

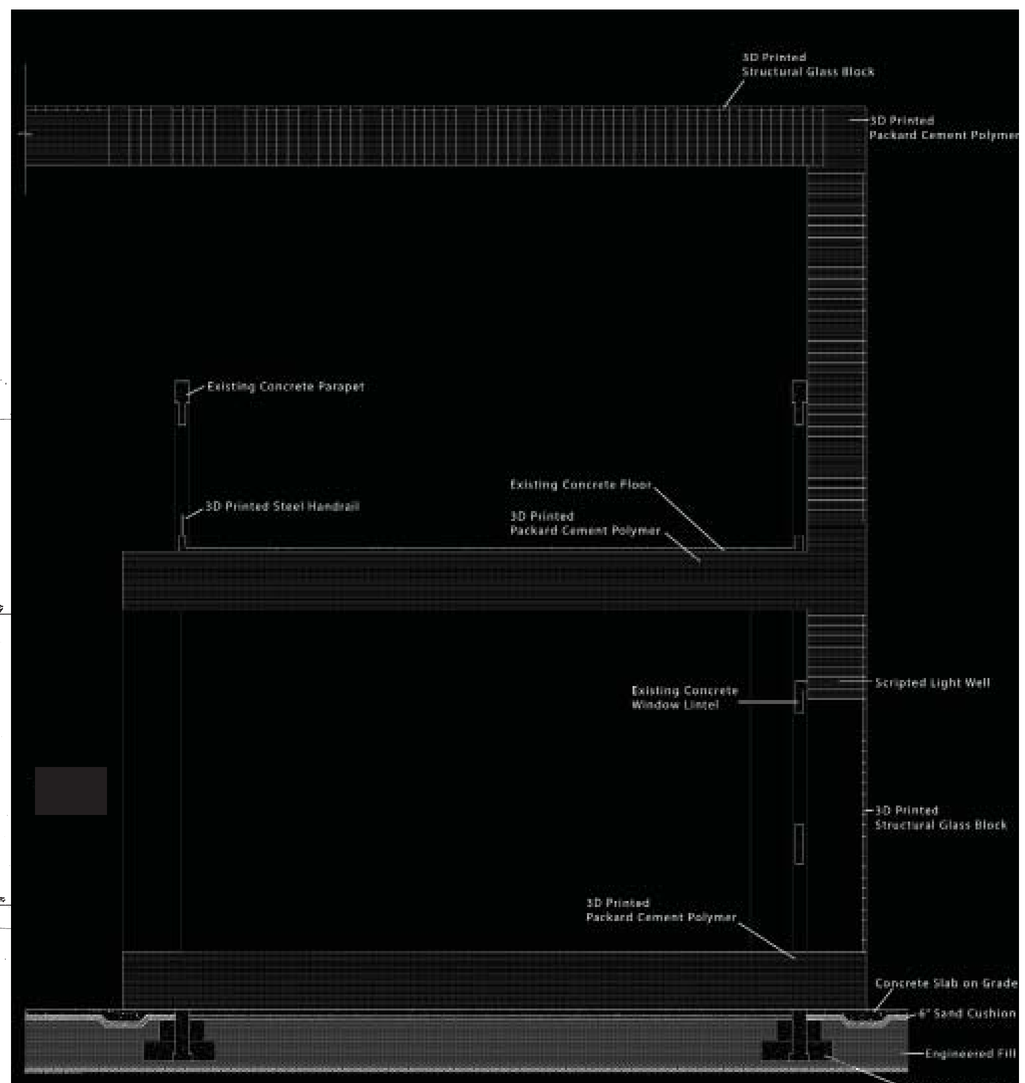


The elevated surveillance network provides a final experience before exiting. It is here that humans sit above the machines at the control panel. A covered catwalk connects the building's two vertical circulation towers, offering a shortcut for designers as they make their way around the factory. From a symbolic stance of wisdom, we are encouraged to look down upon the movements of the machine and the people interacting with it. It is from this seat that we are able to make observations and interventions in what would otherwise be an autonomous process for the machine. It is here that we are finally given a holistic understanding of the building and a position of hierarchy above technology.

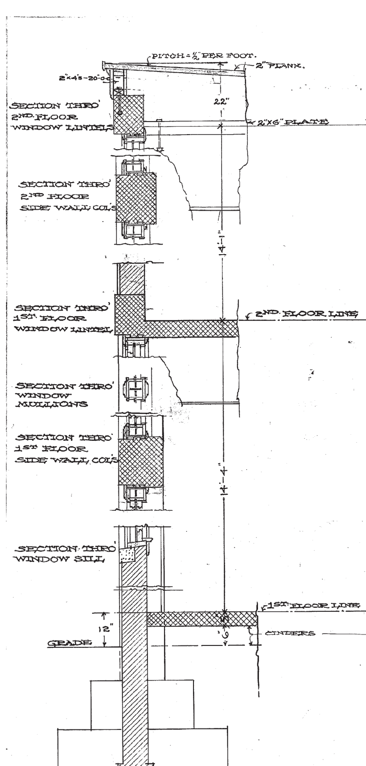
FINAL SOLUTION DOCUMENTATION

Wall Sections

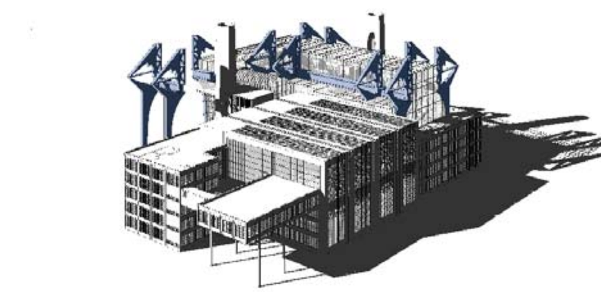
[131] Obsolescence wall detail.



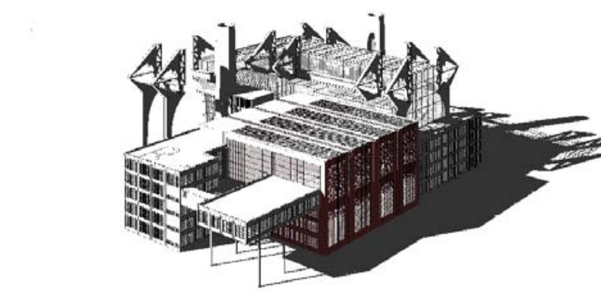
[132] Original Albert Kahn wall detail.



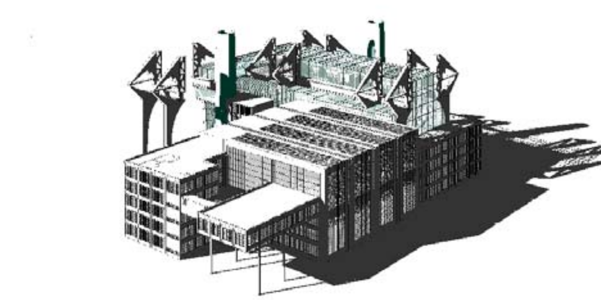
Prosthetic Applications



[133] Structural framework.

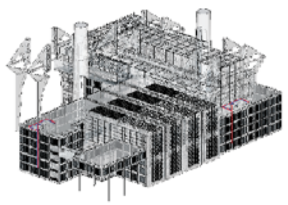


[134] Obsolescence Gallery.

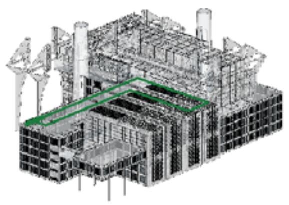


[135] Elevated surveillance network.

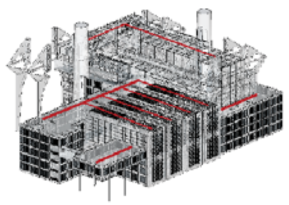
Systems



[136] Plumbing system.

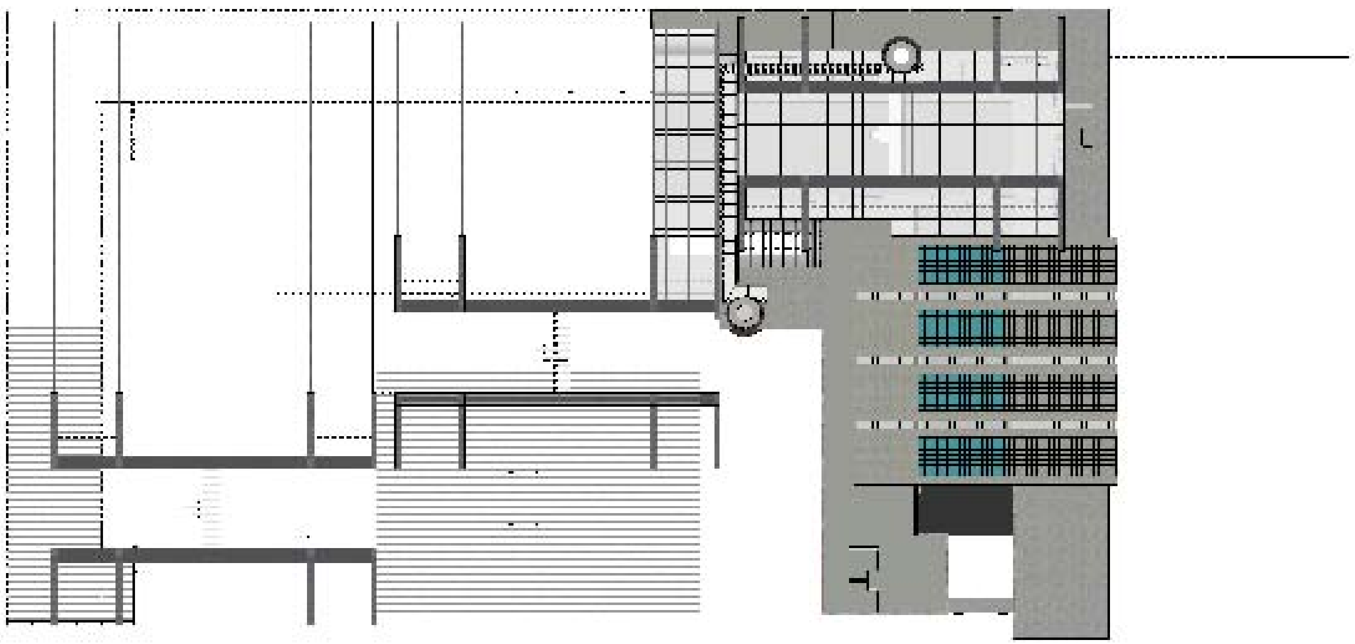


[137] Primary and Secondary Variable-Speed HVAC System.



[138] Sprinkler system.

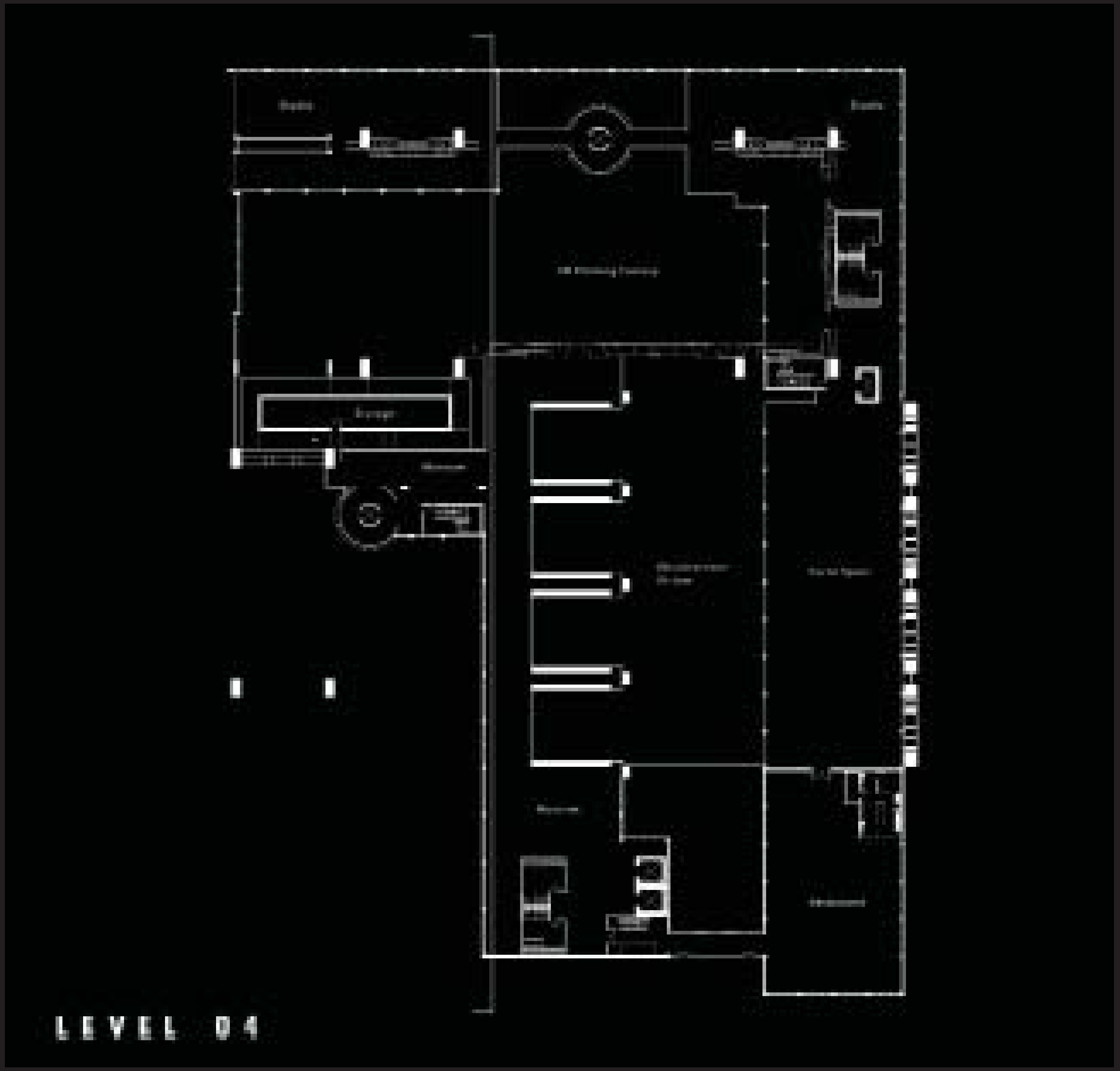
Phase 01 Plan

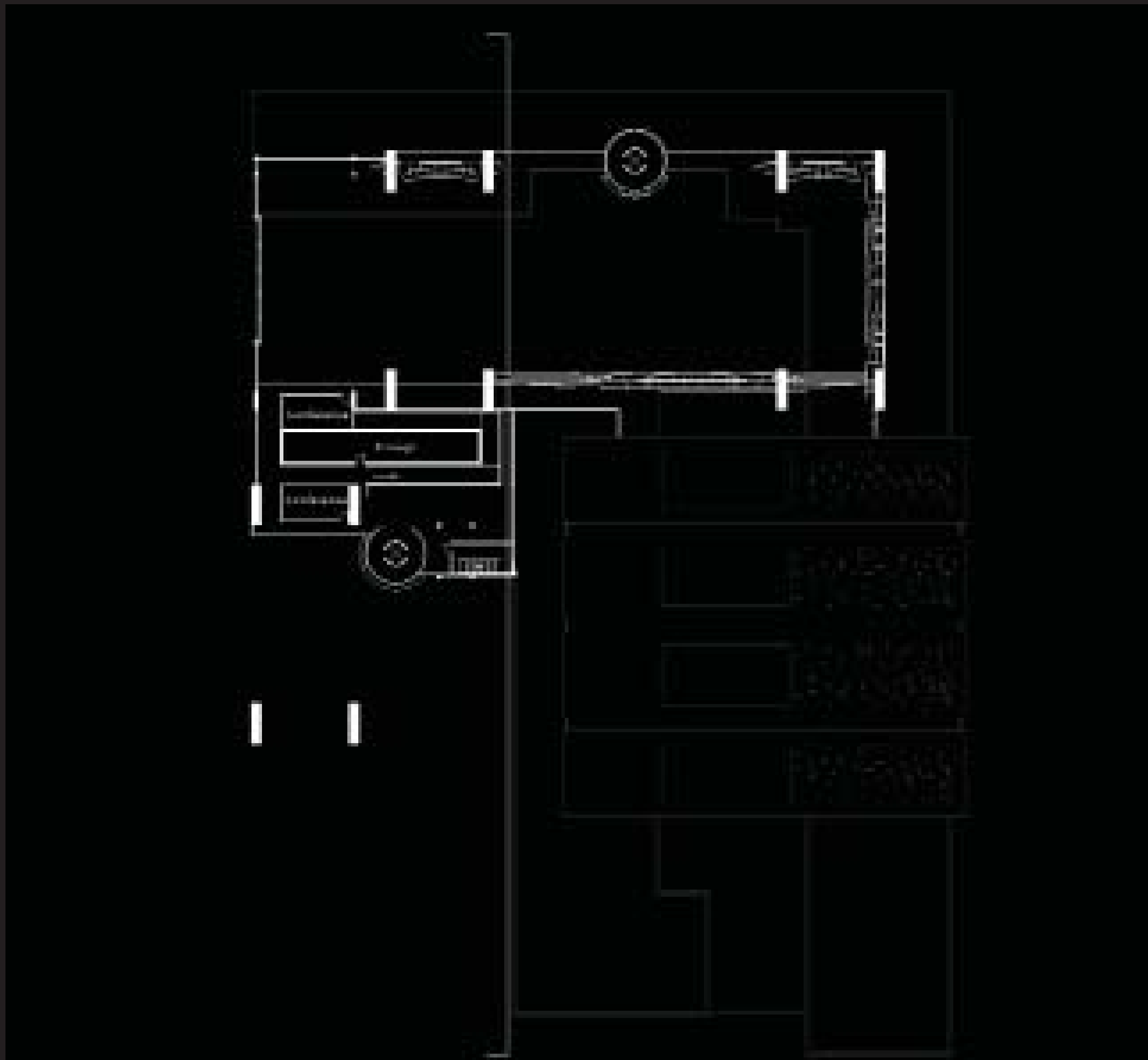


[138] Phase 01 will include construction of the final solution as well as a structural framework for the future implementation of two additional 3D printers and access/motility routes.

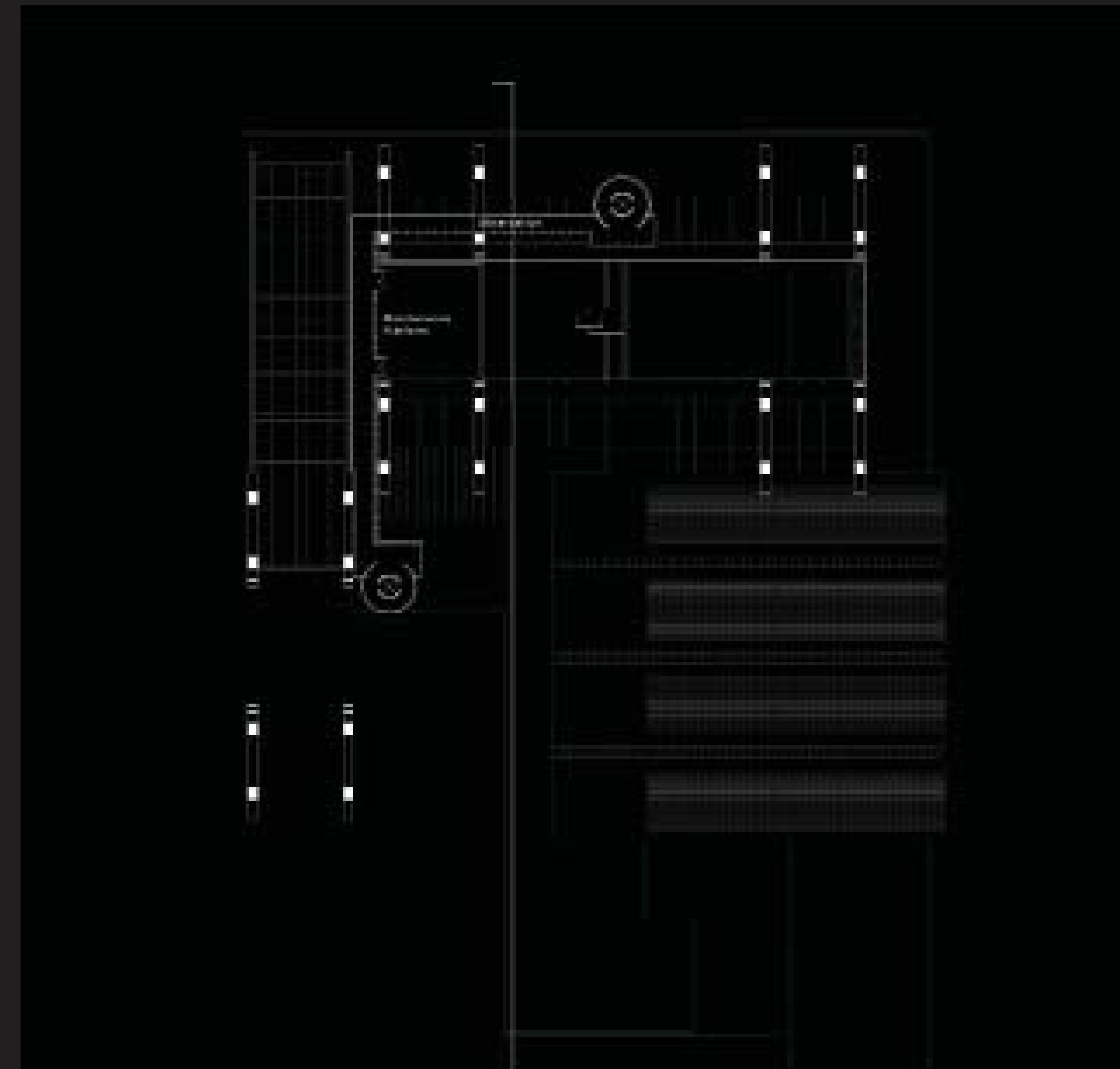
Floor Plans


LEVEL 02


LEVEL 04



LEVEL 06



MEZZANINE

[140] Project installation.

FINAL SOLUTION DOCUMENTATION

Project Installation

5th floor Renaissance Hall, Fargo, ND

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PREVIOUS STUDIO EXPERIENCE

	Fall	Spring
2nd Year	Fall 2012	Spring 2013
	Darryl Booker	Stephen Wischer
	Teahouse, Boathouse	Twin house, Performance Center
3rd Year	Fall 2013	Spring 2014
	Steven Martens	David Crutchfield
	Wildlife Center, Wellness Spa	STAR Institute, Youth Center
4th Year	Fall 2014	Spring 2014
	Don Faulkner	Paul Gleye
	High Rise	Inter-Beton Urban Intervention

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