

**[RE]Investing in Education:
Enhancing Education Through Design**

A Thesis

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Reinvesting in Education

Enhancing Education Through Design



PART 1 - WRITTEN THESIS
ABSTRACT
PAPER

PART 2 - DESIGN THESIS
SITE ANALYSIS
FINAL DESIGN

PART 3 - COMMENTARY

TABLE OF CONTENTS

[RE]Investing in Education: Enhancing Education Through Design

ABSTRACT

Education, much like architecture, has the power to shape the ways in which we live and how we interact with the world around us. Through thoughtful architectural design, is it possible to design an environment that strengthens the learning processes of children in grades K-12?

This paper investigates how an environment can enhance the education of students by creating spaces that facilitate a collaborative and creative environment. Can architecture respond to the diverse ways that help children learn, and engage with each other and their environment? Through case studies that analyze school design since the early 2000s, what aspects of the school can be reconsidered due to change in student learning outcome and the evolving challenges due to advancements in technology that require changes in students' skill set? This paper investigates different styles of learn, the school as a social system and the architectural response required to successfully produce a supportive environment that is conducive to the children's learning processes.

This paper will also investigate the problems Chicago is facing with its public education system and explore how design can improve the established system. Many of Chicago's predominantly low-income African-American and Latino neighborhoods are most often the areas affected first when the city begins looking to make budget cuts. Low test scores and overall performance are often the driving force ultimately leading to the closure of many facilities. I believe this paper is relevant to both architecture and education; educational spaces should be created to enhance students' learning processes.

[RE]Investing in Education: Enhancing Education Through Design

INTRODUCTION

Chicago has been facing an economic crisis; in the 2000s Chicago unemployment rate hit all-time highs at 12%, forcing many of those who could not find jobs to turn to crime. Many Chicago public schools are beginning to become greatly underfunded and underutilized. The city holds over \$20 billion in pension debts, forcing teaching strikes, cuts to vital programs such as music and art programs, and even total shut downs of schools. Chicago Public Schools has marked 129 elementary schools for closure or consolidation based on their utilization, performance and community feedback¹. A total of 45,145 students will be affected by these closing and reallocations. Many of the schools facing shutdown are in predominantly black, low income neighborhoods.

There are various architects doing interesting working in schools of late. HMFMA architects in Connecticut are creating elementary schools that implement a learning corridor that decentralizes the classroom and creates a fluid environment for learning. I will also be researching Summerhill in the United Kingdom. Summerhill is a boarding school that has no formal schedule for students. If a student does not want to go to class and rather spend their days outside or in the room, they are totally free to do so. I am not sure how this environment will foster learning, but I believe it is worth a look.

A Brief Synopsis of Public Education in the United States

The American culture has always valued education. The Founding Fathers believed that learning promoted liberty. Settlers constructed schools, so their children could become educated. Large areas of land were set aside to create one of the finest systems of

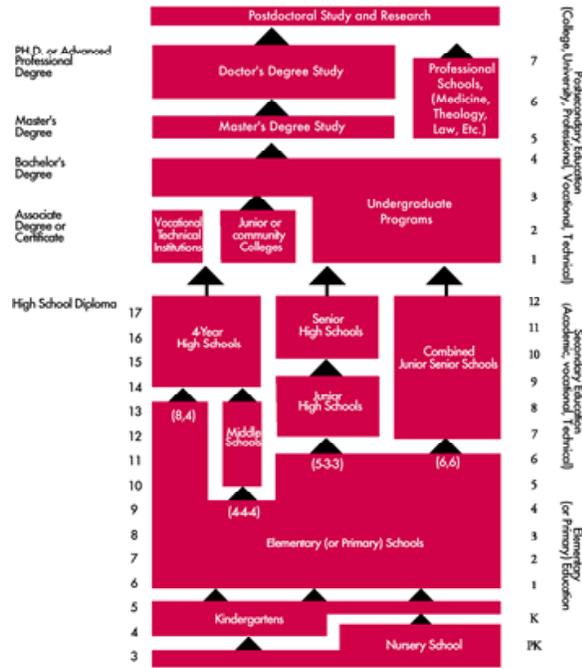


Figure 1 - EDUCATION SYSTEM STRUCTRE

education in the world. The decentralized nature of U.S. education has its origins in the early history of the United States. In the 17th and early 18th centuries, what was to become the United States began as separate colonies established by settlers from several European countries. In the thirteen British colonies that formed the original United States, the colonial governments and local communities were responsible for education. It was usual for each locality to establish and their own schools and to educate their own children per their own values and needs. This system of local overseeing helps to explain why state and local governments today retain primary responsibility for administering elementary and secondary education in the U.S.²

THE SCHOOL AS A SOCIAL SYSTEM

A social system is the system generated by any process of interaction on the sociocultural level between two or actors. The actor is either

an individual or a collective. In a social system, behavioral factors such as power, trust, conflict, and communication come in to play. Education depends on communication between teacher and student as well as communication between student and student. A classroom can be thought of as a facilitator for socialization. This motivating factor drives communication between the actors, in this case, student to student, student to teacher, teacher to student as well as teacher to the class as a collective³. Initially it may seem that the collective of students are just a group of individuals grouped together in a particular room. It is difficult to imagine that classroom as a system. What is common to all these usages is the idea of a pattern of interdependent relationships. ⁴ Much like the internet is not thought of as a million physical servers, but rather a web of interconnectedness that allows us to communicate at the speed of light. "The solar system is not merely an aggregate of heavenly bodies; it represents bodies interacting in regular ways, on the basis of certain principles of relationship".

HOW THE MIND LEARNS

Since learning is just storing information in our brain for later recollection, we must understand the mechanism in which we store information, or memory. There are three stages of memory processing. The first being encode. Encoding is the process in which a new memory is written. This process involves two principles, elaboration and organization. The original theory on memory conceived by Hermann Ebbinghaus was that we ingrain a memory by rehearsal; like repeating a name or piece of information, otherwise known as maintain rehearsal. This process does work as long as we are not interrupting while trying to memorize the information. In most cases the information we are trying to memorize is forgotten shortly after the need for recall has ended. Instead what is needed to solidify the encoding of information is elaborative rehearsal, which is making associations of what we are trying to learn with what we already know. An example of this principle is using mnemonics to create associations that help the recalling of these memories.

We learn best when we learn progressively, building new information upon old information. It is also true that the more energy or attention will result in a deeper memory. "A recent study by Connor Diemand-Yauman and his colleagues at Princeton (2010) showed that presenting text in an unfamiliar font, such as Comic Sans, which is relatively hard to read, led to better memory for text contents compared to a more familiar font, such as Arial. The more effort you expend, the better you'll remember -- provided that it's not just rote rehearsal". The elaboration principle is supported by the organization principle. If we can form a relationship between two separate bits of information, or see how those pieces fit together. Therefore, grouping things into categories or finding linking between them allows for quicker retention than memorization alone. The elaboration principle deals with "item-specific" processing, while the organizational principle must do with "inter-item" processing. But the essential principle is the same: we learn things best when we attend to how they relate to other things ⁵.

Encoding is what we use to store information and knowledge. The retrieval of this stored information is mostly dependent on cues. The accessibility of how easily that information can be recalled is based on what type of value is placed on the information. For instance, it is easier to recall the address of your childhood home, than it is to remember the color of the car you parked next to in the parking, because of the value placed on the memory of your childhood home, {think of better example}. Memory is more easily recalled if the information used to encode it matches with the information used to retrieve it. Retrieval and encoding aren't entirely separate and independent; they interact with each other in various ways. For example, there can be a negative relationship between encoding and retrieval. Having numerous retrieval cues may make for poor storage at the time of encoding.

The encoding and retrieving can be simplified by using a library as a metaphor. The books in the library are the information and memories we store. The books are categorized by the Dewey Decimal System, which to our brains are the cue in which we can more easily recall the information. When we need to recall the

4 [RE]INVESTING IN EDUCATION

information, we use the cues like index numbers and can find the book many times quicker than trying to recall what the book looked like and where we may have possibly placed it.

DESIGNING A SCHOOL FOR THE FUTURE

The current education system in the United States is preparing children for a world that no longer exists. To become a chef, a lawyer, a philosopher or an engineer, has been a matter of learning what these professionals do, how and why they do it; as well as some set of general facts that describes our world and ourselves. Children start in kindergarten, proceed through elementary school into high school. From high school into college and from college into graduate school; while the whole journey learning how to do something and then spending the rest of their lives doing said task. They learn and then after they do. They go from school to work like some sort of prescribed dogma, there is not much for discovery. Many voluntary school's programs facilitate a type of discovery but are often at the mercy of school budgets and outside factors. The school itself should be a space of discovery.

Waldorf education is based on Rudolf Steiner's ideas about education. Rudolf Steiner, the founder of anthroposophy, a philosophy that hypothesizes the existence of an objective, intellectually comprehensible spiritual world that is accessible by direct experience through inner development. More specifically, it aims to develop faculties of perceptive imagination, inspiration and intuition through the cultivation of a form of thinking independent of sensory experience, and to present the results thus derived in a manner subject to rational verification.⁶ There is extensive controversy on how to place his contribution in relation to other philosophers and theorists of learning. This interest increasingly acknowledges Steiner as an original thinker who nonetheless shared ideas in common with other original thinkers and school reformers of the twentieth century.⁷ A major point in Steiner's educational teaching was that Waldorf education, contrary to the traditional school system of the time, was not about "head-learning" but "limb-learning". The emphasis in Waldorf education

on experience, the senses, and the concern for children as individuals, engaging with the material world, emphasizing the importance of richness, and value of an experience as a source of knowledge. According to Steiner, learning consists of an element of will, which is closely tied to the body and the senses, as well as of emotion and cognition. A core principle in Waldorf education is Steiner's idea that thoughts are, so to speak, brought out from the artefacts of the experienced world.

THE IMPORTANCE OF CHICAGO

Chicago is the global gateway for Midwest America and for better or for worse the capitol of the Midwest. During the 2000s, Chicago experienced a bit of a two-track performance. Parts of city's Loop continued to grow energetically, fueled by the real estate bubble and perhaps the greatest urban condo building boom in America. This directly affected

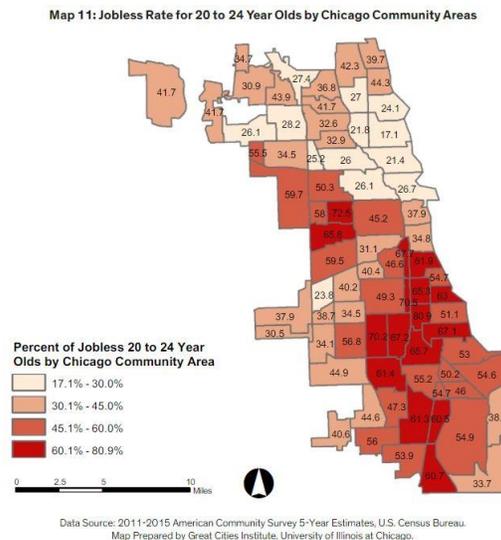


Figure 2 Chicago Jobless Map

cultural, and other scenes in Chicago to grow and improve. Yet, while there was a solid core of growth at the city's core, the outlying neighborhoods and greater Chicagoland faltered badly with overall statistics that were awful in most respects.⁸

Chicagoans lost a total of 323,000 jobs during the 2000s, most of which hit heavily during the Great Depression. By 2015, the

nonworking/not-in-school figure for that age range had dropped among all groups except white men, where it held about constant, and Latino men, where it rose about eight percent. Among young black men, the joblessness figure more than doubled, skyrocketing from 22.3 percent to 45.8 percent before dipping back down in 2015 to 42.8 percent. Joblessness and poverty in Chicago have become more concentrated. That at least partially explains, why just five neighborhoods - Austin, Englewood, New City, West Englewood and Grand Crossing -accounted for a third of the homicides citywide in 2016. Jobless rates among teens in those neighborhoods ranged from 79 percent to 91 percent. In a report about joblessness among Chicago's youth by the University of Illinois at Chicago Director of sociology Dr. Terasa Cordova states that "joblessness among young people is tied to the emptying out of jobs from neighborhoods. In contrast, jobs are being centralized in Chicago's downtown areas where whites are employed in professional and related services."⁹

Dr. Cordova and her colleagues at UIC listened to young Chicagoans at annual hearing for youth employment sponsored by the Alternative Schools Network at the Chicago Urban League. Young people at the event where asked to speak based on their experiences and knowledge about their community. Many of the participants strongly believe there is a connection between joblessness and crime in their neighborhoods. While not everyone who is without a job engages in violence, these statements suggest that of those who do, economic reasons are often a motivating factor. Further, they suggest that providing jobs will deter those jobless from seeking economic solutions that may involve them in illegal activities. While rampant joblessness may not completely explain violence, Dr. Cordova learned from young people that it is no doubt a contributing factor and conversely, providing a job can mitigate the conditions that lead to criminal activities.

"...jobs solve violence. If you are busy working, you don't have time for violence.

"There are so many people who don't have a job, and they get into the wrong things."

"Bring youth employment... everyone wants drugs and violence to stop, well then...get us off these streets and get us in some work clothes and you will see the change."

"We need these jobs out here; it's real bad out here. If you want to save lives, you want to see a difference, give these teens jobs." - except of statements made by community members at "More Jobs, Less Violence: Connecting Youth to a Brighter Future" hearing at the Chicago Urban League, January 30, 2017.¹⁰ Improving Education to Improve Life of Chicago's Youth.

The change from industrialization to globalization has left Chicago war-torn. Many of Chicago's population in less advantaged neighborhoods are often the first feel the despair or economic downturn. The unskilled jobs that once were plentiful are no longer available. The residents who resided in these neighborhoods are often less education and as a result have more difficulty obtaining higher income employment and therefor turn to a job that is amply available, crime. What is needed in these communities is a serious of paradigm shifts that will change how they live their lives. What is needed is a change in their education at the most fundamental levels. A change in the most fundamental level of education - elementary school- can cause a chain-reaction in the way the view themselves and their community. If a child develops a passion learning they will never be satisfied with the "the cards they have been dealt" in life. Students who enjoy learning are more likely to perform better, stay in school longer, and pursue higher levels of education and ultimately hold higher paying jobs. The same jobs that Chicago's despite youth at looking for.

CASE STUDIES

The first school, Christa McAuliffe is an elementary school that was constructed in 2013 as a replacement for two schools that were in dire need of replacement. The community had a strong attached to the character of the original two schools, so the architects incorporated salvaged elements such as the granite to define the entrance to the school. During planning the architects chose to keep the school in the current downtown

neighborhood and used the existing four-story foot print for the new two-story building¹¹.



Figure 3- McAuliffe School Exterior

McAuliffe School exterior looks like any other contemporary elementary school built in the early 2000s. It isn't until you enter the school when the uniqueness of the design begins to show. The library was decentralized and pulled throughout the school as a learning corridor. This learning corridor creates an environment that supports a variety of learning. It offers space for full class work, presentations, small group work and nooks for individual work. These spaces are to enable learning at anytime and anywhere.

A second design featured implemented in the school is the use of windows in the corridors and double height spaces to create a sense of transparency within the space. Students and teachers are able to see from one space to another. This transparency is to allow for students to have more freedom while still allowing teachers and adults to always be able to see them. It allows for there be a certain level of safety while still give the children some form autonomy, which could be beneficially to developing responsible and general collaboration second design featured implemented in the school is the use of windows in the corridors and double height spaces to create a sense of transparency within the space. Students and

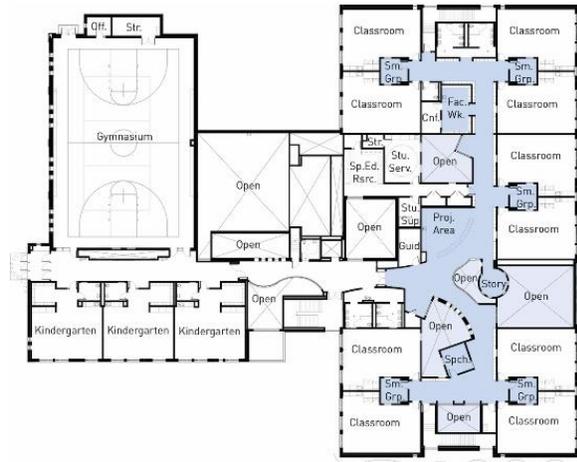


Figure 4 - Learning Corridor – HMFH Architects

teachers are able to see from one space to another. This transparency is to allow for students to have more freedom while still allowing teachers and adults to always be able to see them. It allows for there be a certain level of safety while still give the children some form autonomy, which could be beneficially to developing responsible and general collaboration.

VICTORY PRIMARY SCHOOL DUBAI

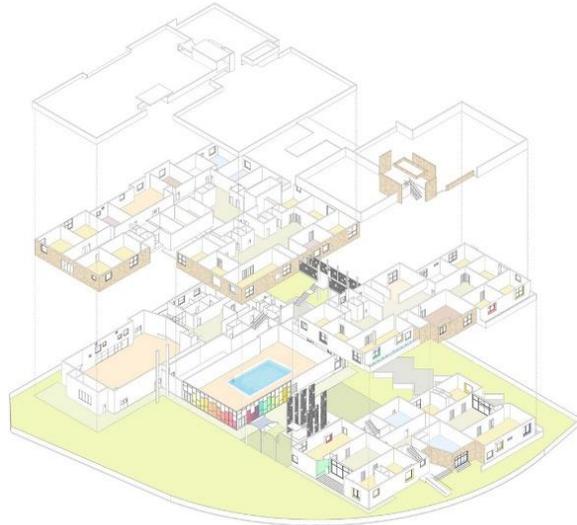


Figure 5 - Victory Primary School Axonometric

The second school that was analyzed was Victory Primary School in Dubai. Victory School is intended to be a space that is conducive to the evolutionary development of the child. The

space compels the child to act, explore, and be curious. R+D architects designed the program pieces of the school to clusters that are almost like a village. The corridors connect the clusters together like roads connects town together. The primary school and kindergarten wings of the building branch off from a central courtyard that is meant to be where both groups of students meet for interaction¹². The harsh environment of Dubai causes the design to have a closed off feel. The façade is design such that it respects the context of the local vernacular. The only aspect that indicated that it is a school are the large swatches of bold primary colors on the exterior windows. The color moves from the windows to the interior to provide a sense of playfulness with the firm architecture. The clusters are slightly stacked to offer great deals of natural daylight through the roof. When comparing both schools, it can easily be seen the cultural difference between each. The Victory Primary School separates the students into clusters and the only interaction that is offered is either on the "road" to their next class or thought the forced interaction in the central courtyard. Whereas at McAuliffe, the students have more autonomy and visual stimuli. McAuliffe School is seemly more avant-garde, where Victory could be more traditional in since of the comparing the school and its design and function to a standard American elementary school.

ENDNOTES

¹ Olson, Jeanee. "45,146 students will be affected by school closings." *School Cuts*. Accessed April 07, 2017. <http://www.schoolcuts.org/?locale=en>.

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³ Talcott Parson, "The School Class as a Social System: Some of Its Functions in American Society," *Harvard Educational Review* 29, no. 4 (1959): , accessed March 14, 2017, <http://varenne.tc.columbia.edu/bib/texts/parsntalc59schoclas.pdf>

⁴ Pat D. Hutcheon, "The Classroom as a Social System." *The Classroom as a Social System*. Accessed March 15, 2017. <http://www.humanists.net/pdhutcheon/Books/classrm.htm>.

⁵ John F. Kihlstrom, "Ow Students Learn - and How We Can Help Them" (lecture, Teaching and Technology, University of California, Berkeley), April 23, 2013, accessed March 13, 2017, http://socrates.berkeley.edu/~kihlstrm/GSI_2011.htm

⁶ Rudolf Steiner and Robert A. McDermott, *The essential Steiner: basic writings of Rudolf Steiner* (San Francisco: Harper & Row, 1984).

⁷ Schieren, J. (2012). The concept of learning in Waldorf education. *Research on Steiner Education*, 3 (1), 63-74. Retrieved April 17, 2013, from <http://www.rosejournal.com/index.php/rose/article/viewFile/99/124>

⁸ Renn, Aaron. "State of Chicago: The New Century Struggle." *Urbanophile*. July 2, 2012. Accessed June 26, 2017. <http://www.urbanophile.com/2012/07/02/>

[state-of-chicago-the-new-century-struggle/](http://www.urbanophile.com/2012/07/02/state-of-chicago-the-new-century-struggle/).

⁹ Cordova, Teresa L., and Matthew D. Wilson. *Abandoned in their Neighborhoods: Youth Joblessness amidst the Flight of Industry and Opportunity*. Report. Economics, University of Illinois Chicago. January 2017. Accessed June 2017. https://www.scribd.com/document/337737625/Report#from_embed.

¹⁰ Cordova, Teresa L., and Matthew D. Wilson. *Abandoned in their Neighborhoods: Youth Joblessness amidst the Flight of Industry and Opportunity*. Report. Economics, University of Illinois Chicago. January 2017. Accessed June 2017. https://www.scribd.com/document/337737625/Report#from_embed.

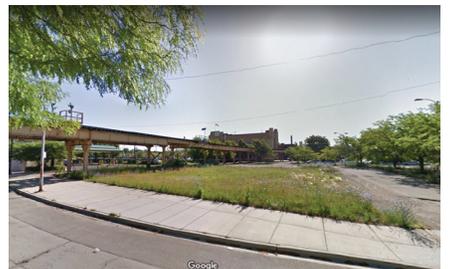
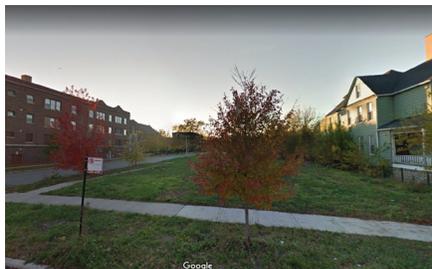
¹¹ HMFH Architects. "Not Old School: Architecture in Support of Learning" – Filmed, Youtube 10:40 [Nov 2012]. <https://youtu.be/JRB95p7hKkQ>

¹² "Victory Heights Primary School / R D Studio." *ArchDaily*. February 10, 2016. Accessed March 08, 2017. <http://www.archdaily.com/781622/victory-heights-primary-heights-r-plus-d-studio>.

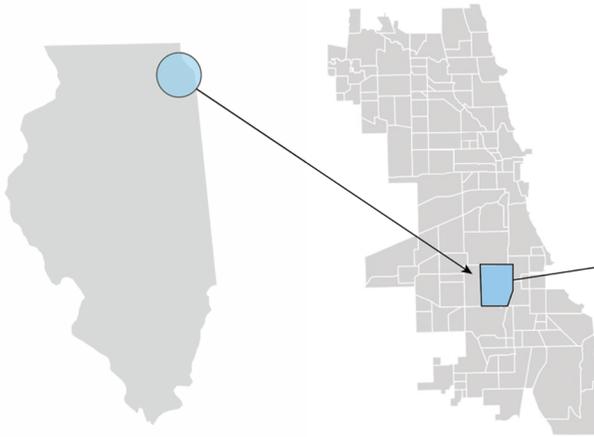
SITE AERIAL



SITE CONTEXT



SITE ANALYSIS



ENGLEWOOD, CHICAGO, IL

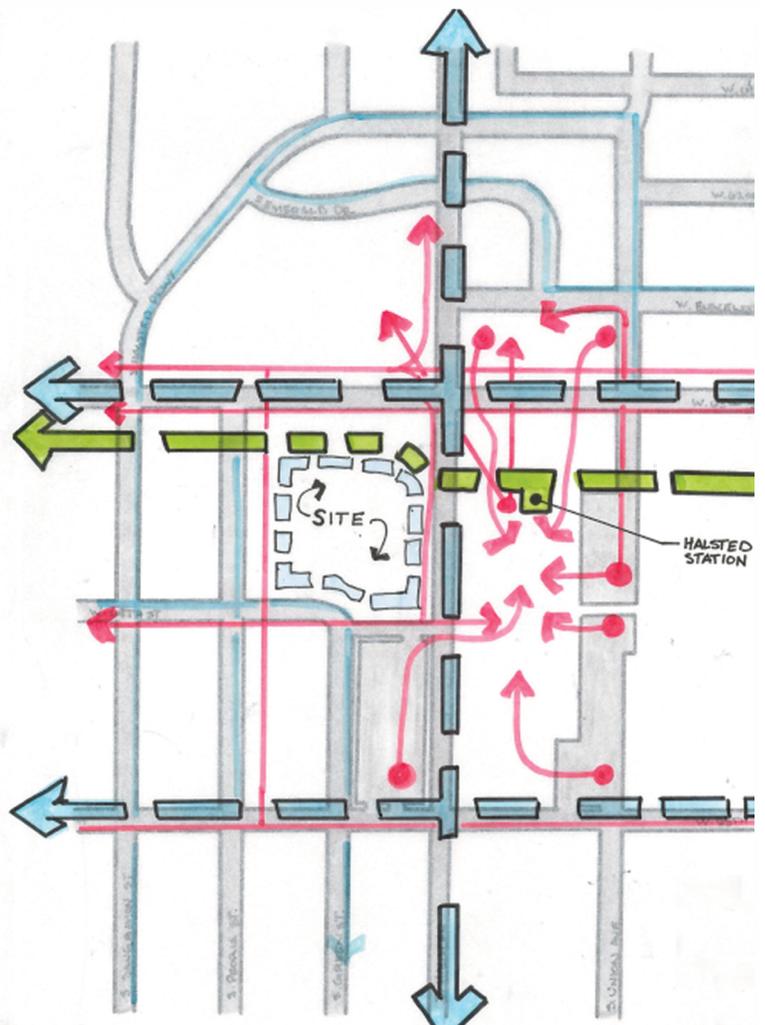


SITE ANALYSIS

FIGURE GROUND

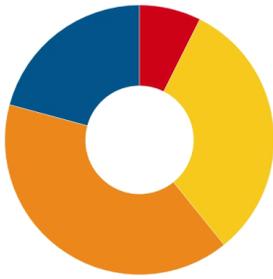


PUBLIC TRANSPORTATION



SITE CIRCULATION

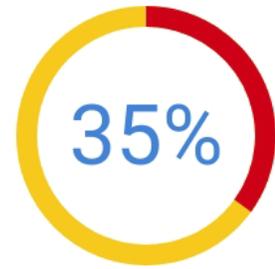
DEMOGRAPHICS



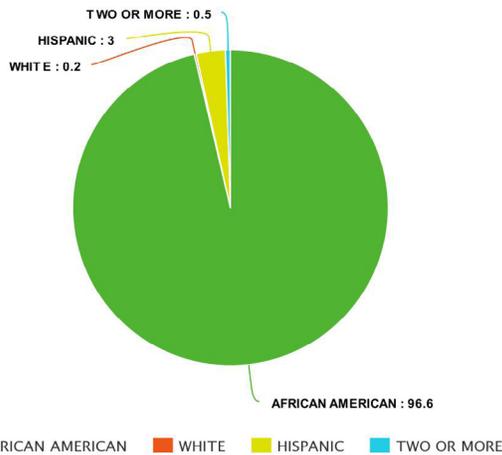
NO HIGH SCHOOL 7.4 SOME HIGH SCHOOL 31.8
SOME COLLEGE 40 COLLEGE 20.8



48%
OF HOUSEHOLDS UNDER
POVERTY LINE



35%
DECLINE IN ENROLLMENT
IN NEIGHBORHOOD
SCHOOLS



AFRICAN AMERICAN WHITE HISPANIC TWO OR MORE

NEIGHBORHOOD WATCH

Crime reports in Englewood from June 28 to July 28, 2017

Englewood, a Chicago neighborhood, covers 3 square miles and within the first six months of 2017 recorded **318** violent crimes.

70 Violent crimes
Robbery, battery, assault, homicide, sexual assault

137 Property crimes
Theft, burglary, motor vehicle theft, arson

80 Quality-of-life crimes
Criminal damage, narcotics, prostitution

CHICAGO ZONING ORDINANCE

ENGLEWOOD ZONED - RT4 - RESIDENTIAL TOWN HOME
TOTAL LOT AREA - 6.13 ACRES (266,275 SQ. FT.)
BUILDING SITE AREA 3.065 ACRES (133,137.5 SQ. FT.)
SETBACKS - 15 FEET
MAXIMUM BUILDING - UNLIMITED
PARKING SPACES REQ'D - GROUP E - 33.24 ~ 34 SPACES

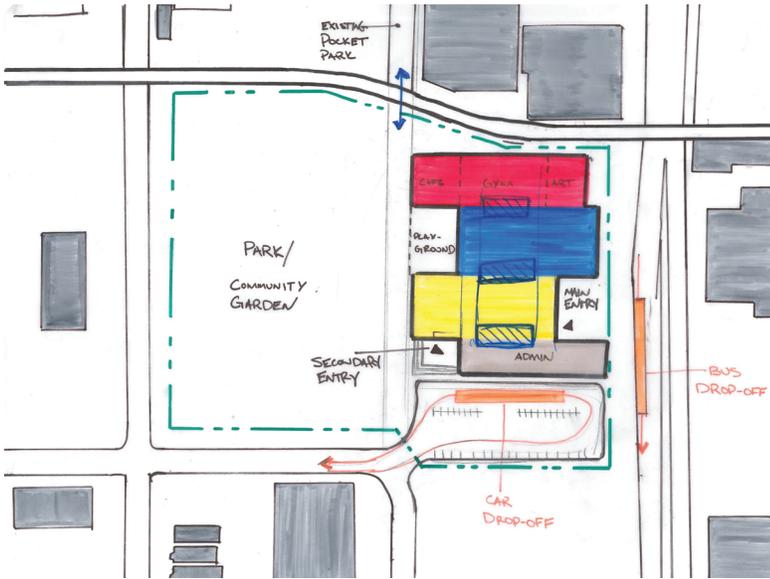
FLOOR AREA RATIO - 1.5
BONUS FAR KICKBACK FRO PARK .73
TOTAL FAR 2.23

PROGRAMING

ESTIMATED NUMBER OF STUDENTS - 300

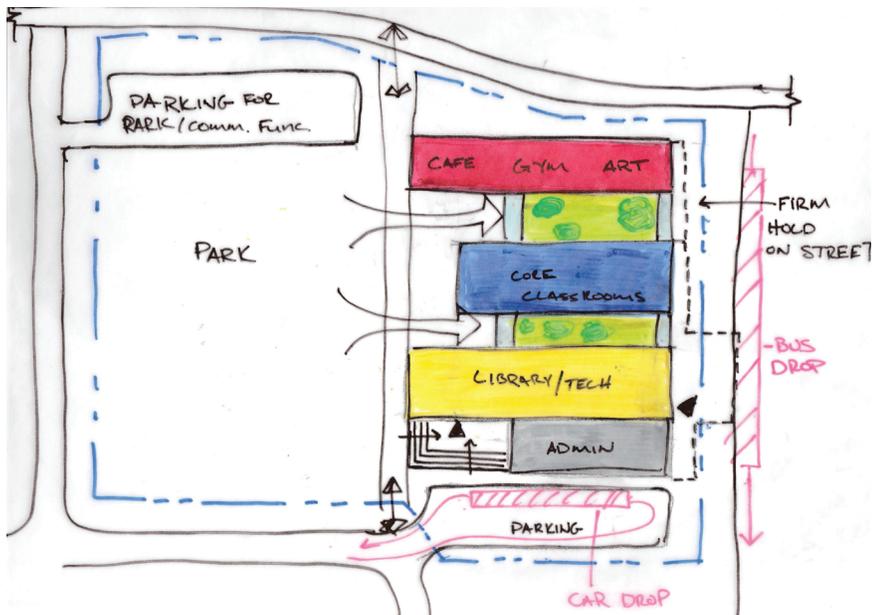
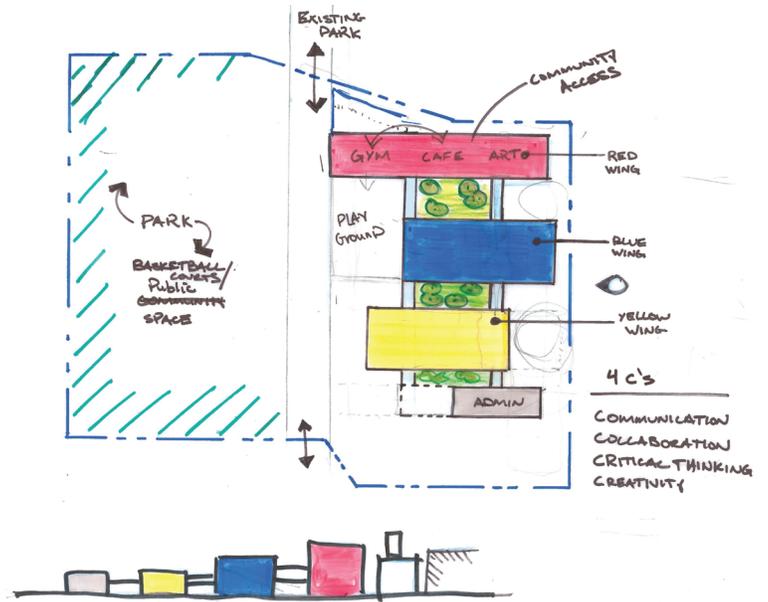
CLASSROOMS - 20 SQ.FT. PER STUDENT
600 SQ. FT. MIN.

CAFETERIA 3,000 SQ. FT.
GYM. 40' X 70' X 20' - 2,800 SQ. FT.
LIBRARY 1,350 SQ. FT.
SUPPORT 2,000 SQ. FT.
ART STUDIO 2,000 SQ. FT.
TECH. LABS 1,200 SQ. FT.
MUSIC ROOM 2,000 SQ. FT.
SCI. LABS 1,200 SQ. FT.

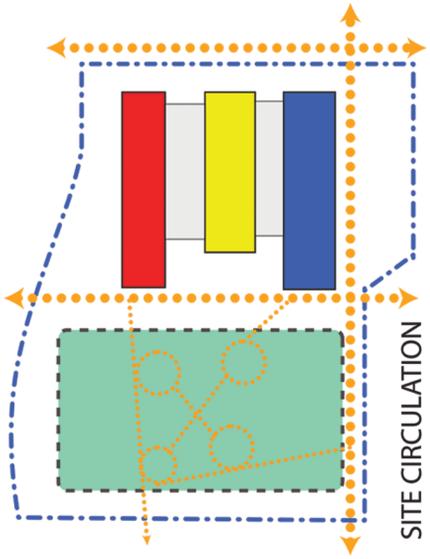
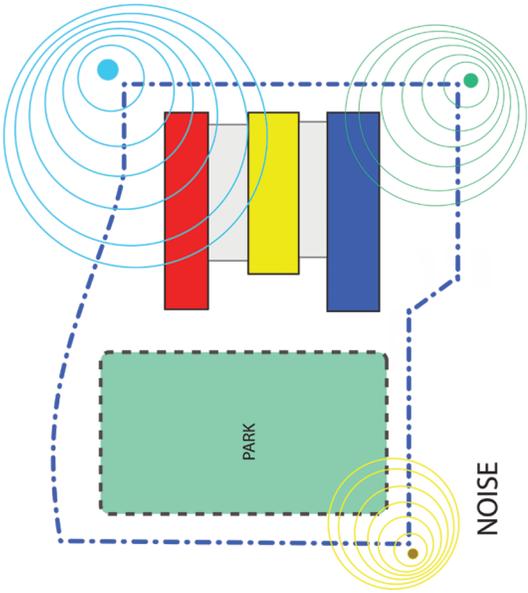
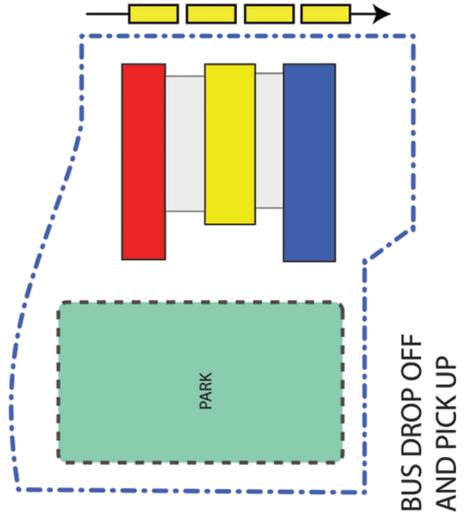
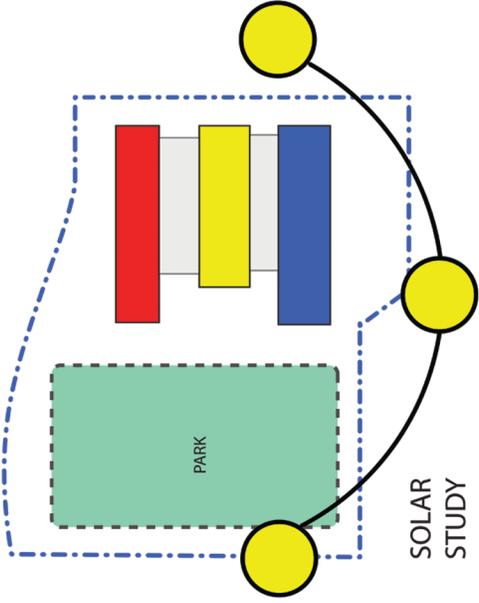
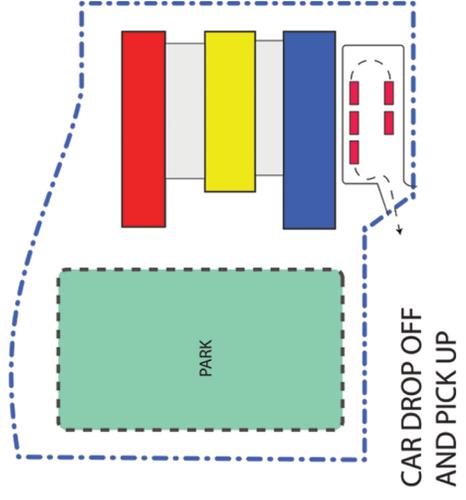
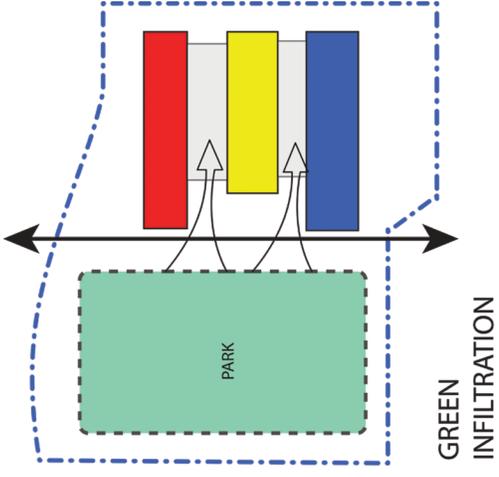


SCHEME 1

SCHEME 2



SCHEME 3





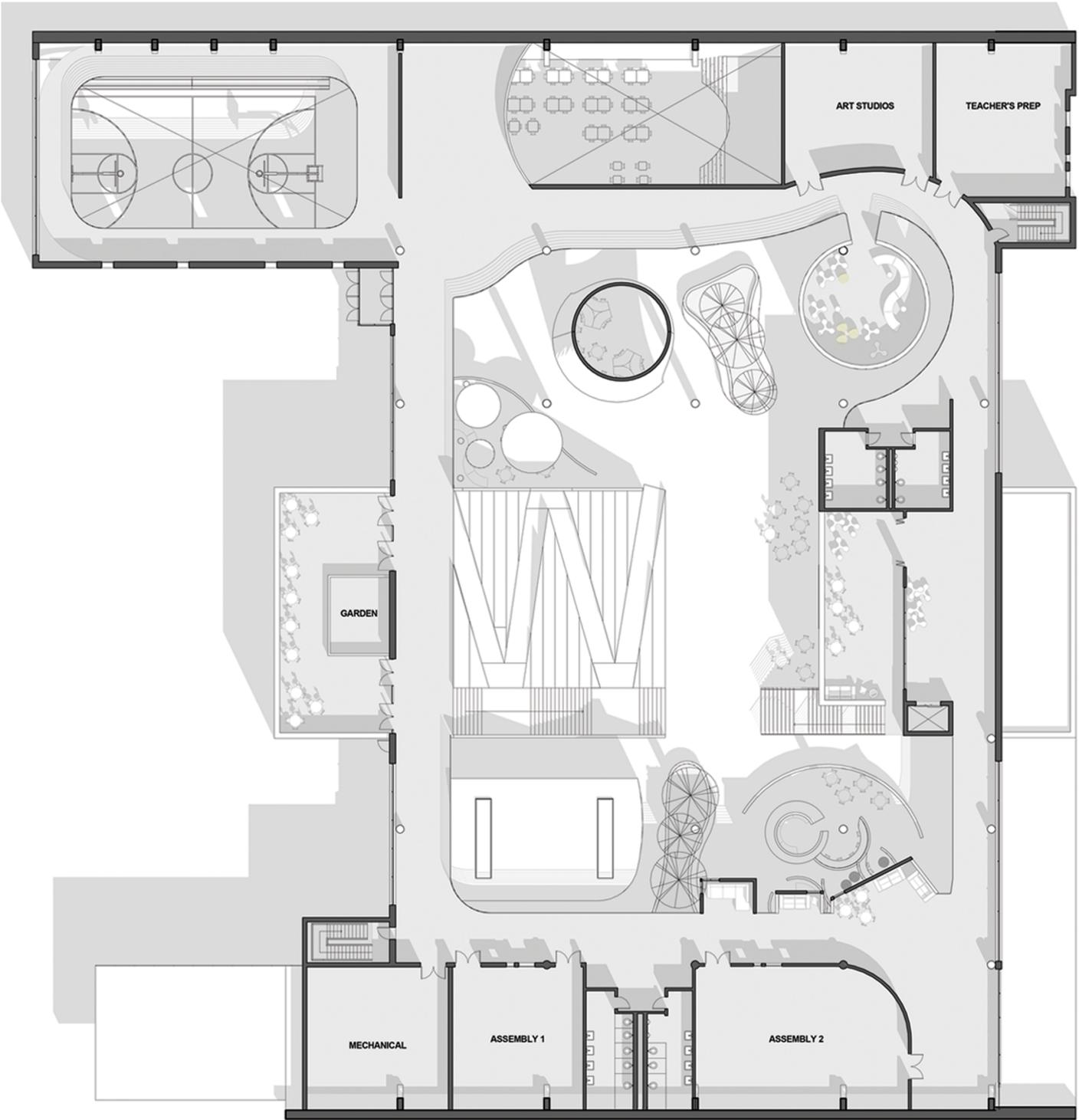
SITE PLAN
KEY CONCEPTS





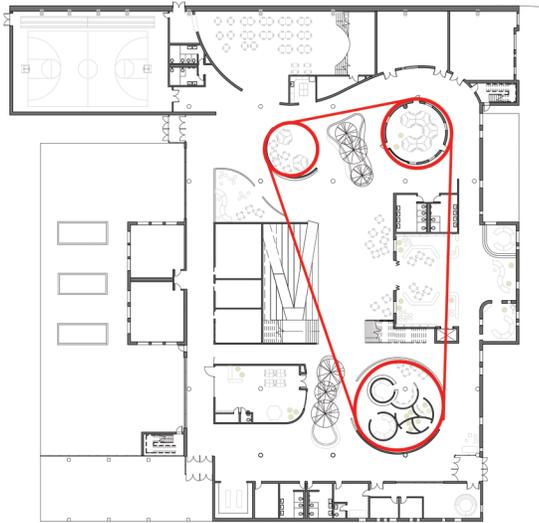
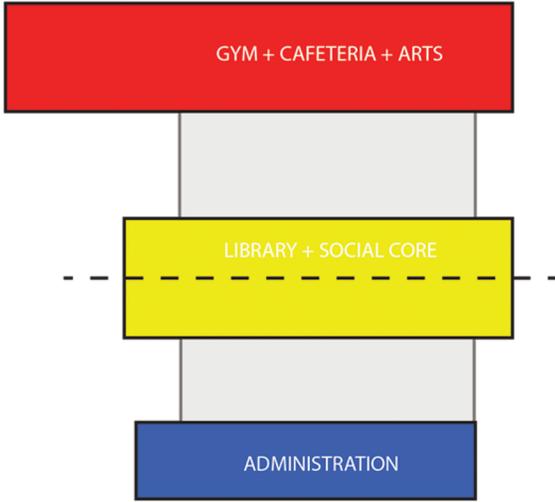
FIRST FLOOR PLAN





SECOND FLOOR PLAN

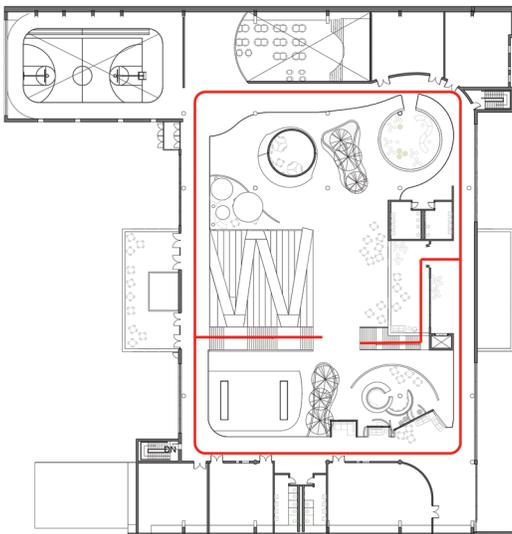




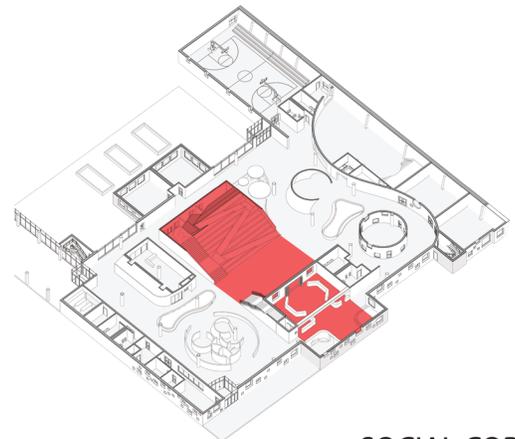
STATION LEGEND

- AGES 5-6 A
- AGES 5-6 B
- AGES 6-7 A
- AGES 6-7 B
- AGES 7-8 A
- AGES 7-8 B
- AGES 8-9 A
- AGES 8-9 B
- AGES 9-10 A
- AGES 9-10 B

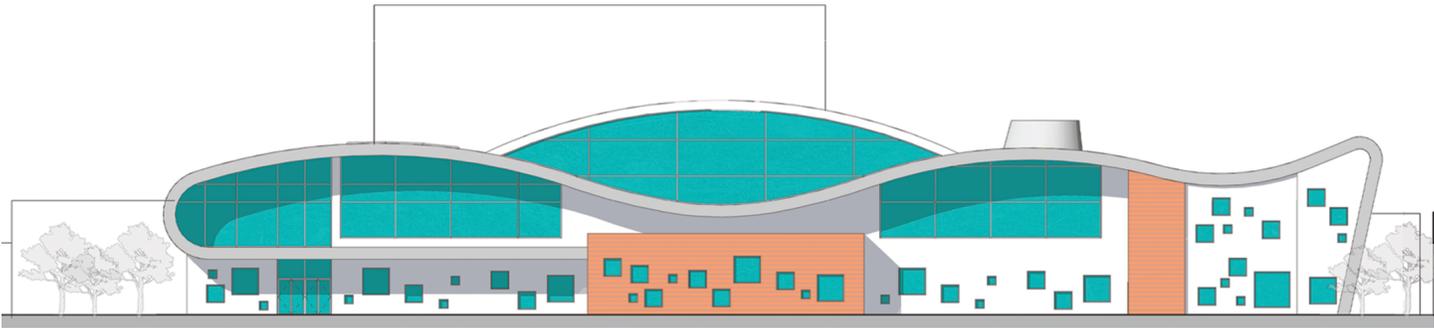
JUMP START STATIONS



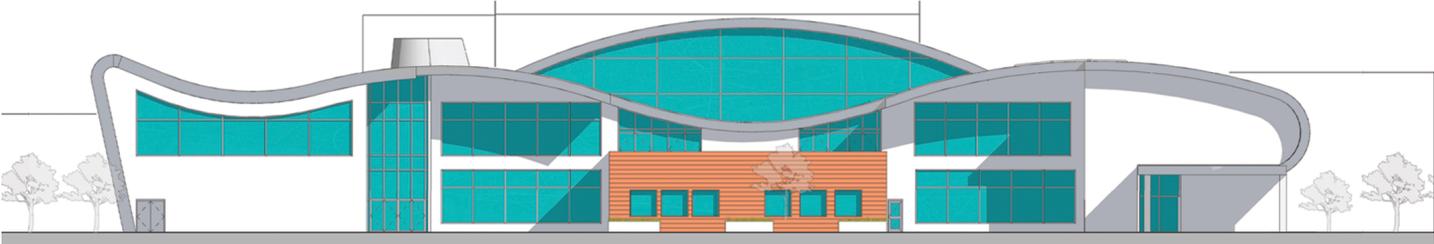
CIRCULATION



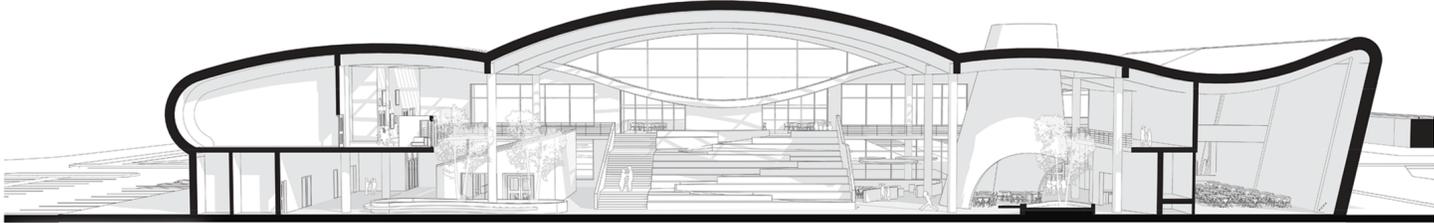
SOCIAL CORE



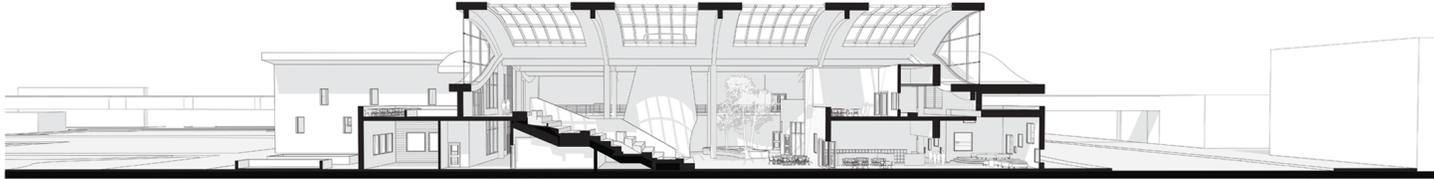
EAST ELEVATION



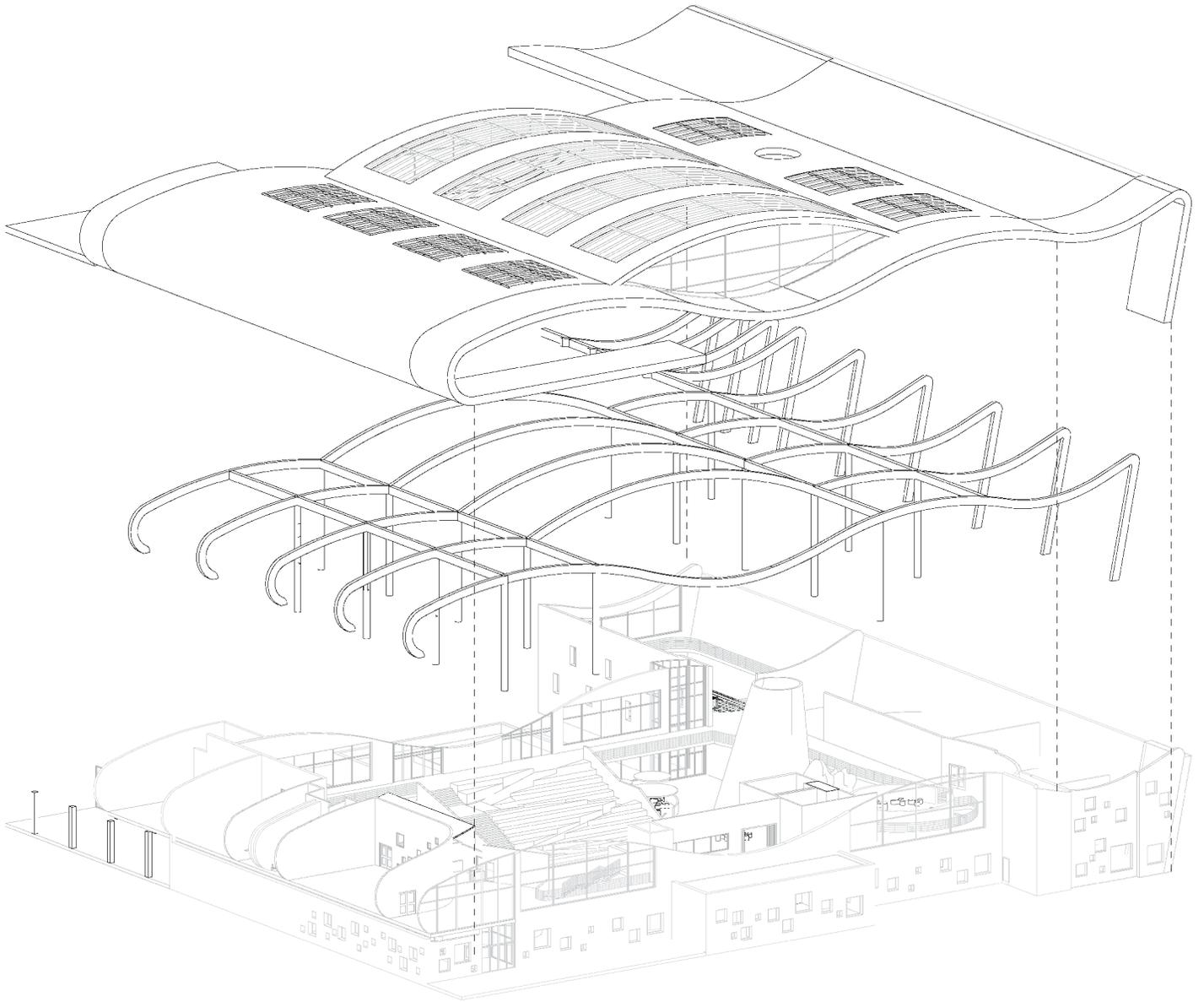
WEST ELEVATION



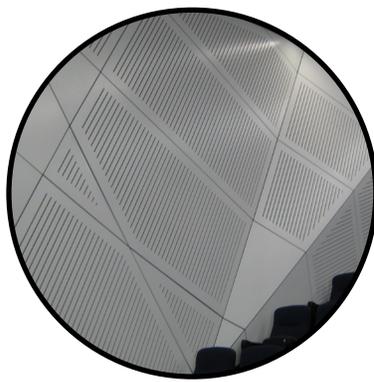
LATITUDINAL SECTION



LONGITUDE SECTION



ETFE ROOF MEMBRANE

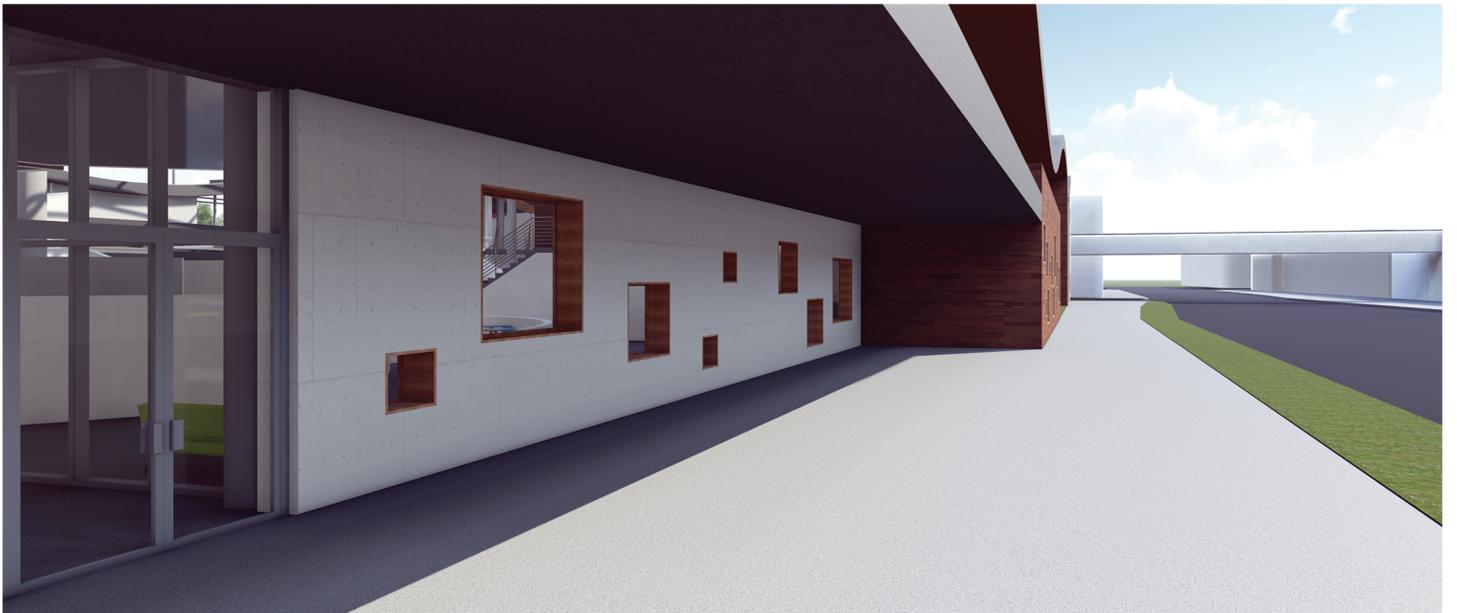


PERFORATED METAL
SOUND PANELS



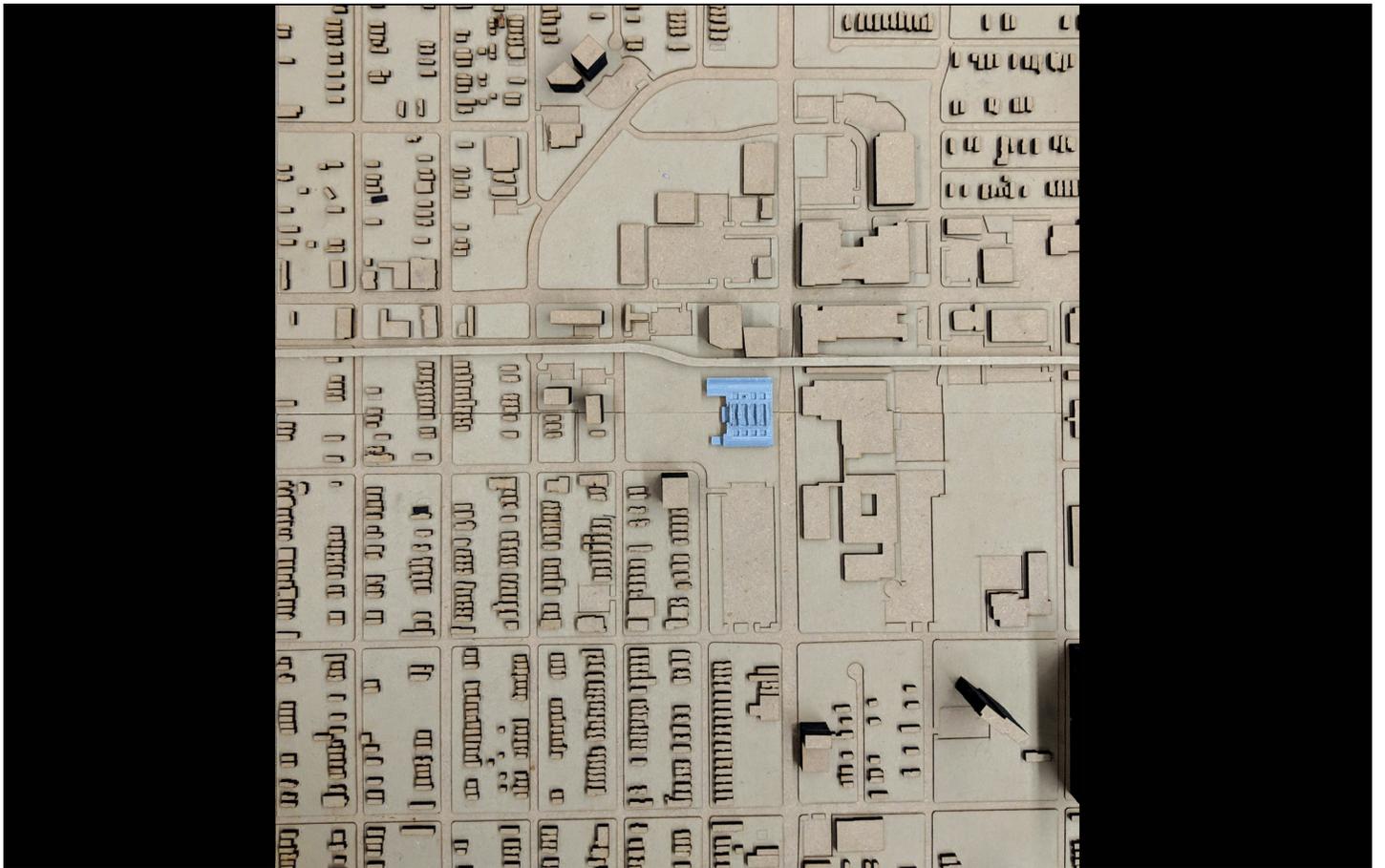
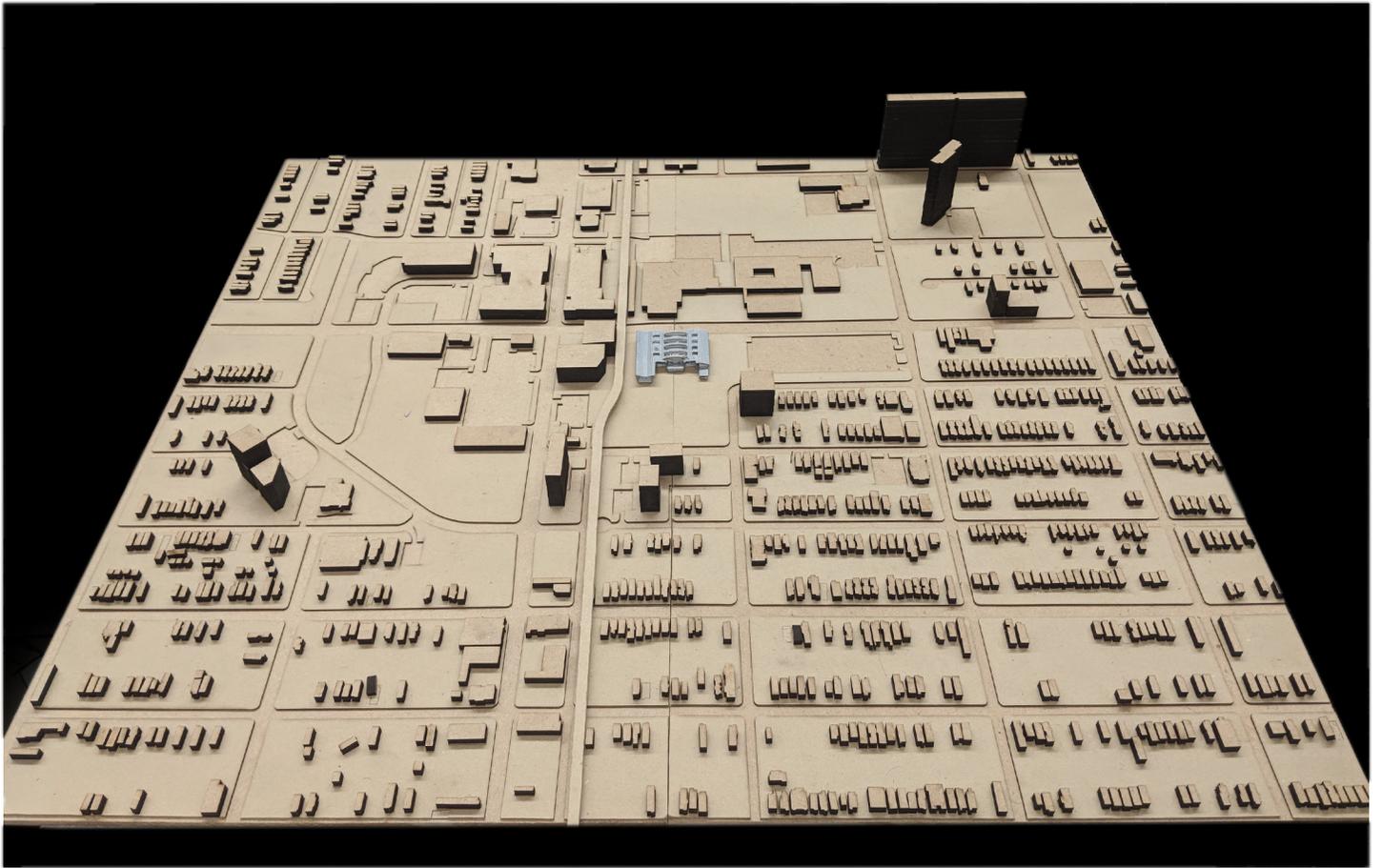
GLULAM STRUCTURE

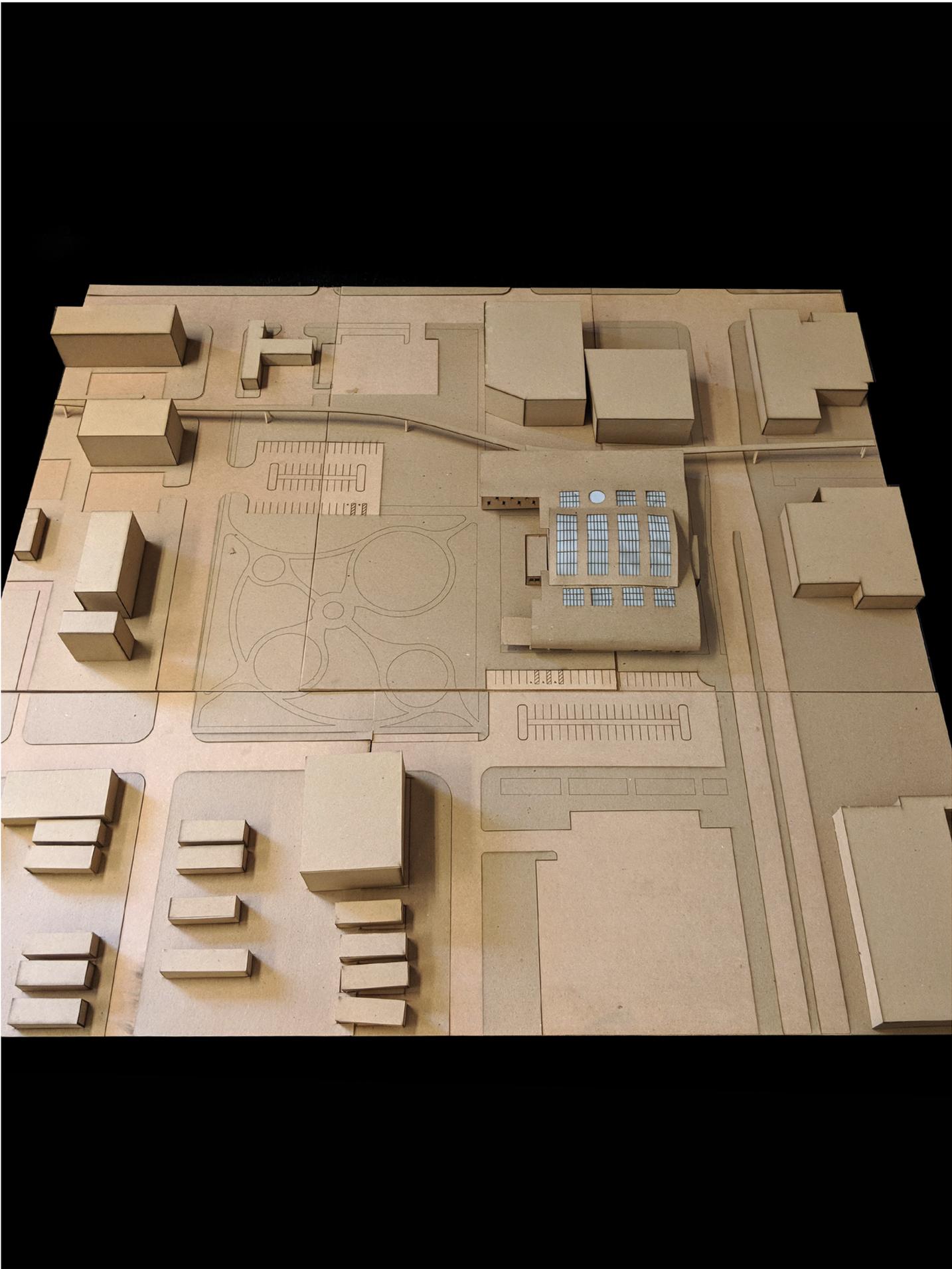


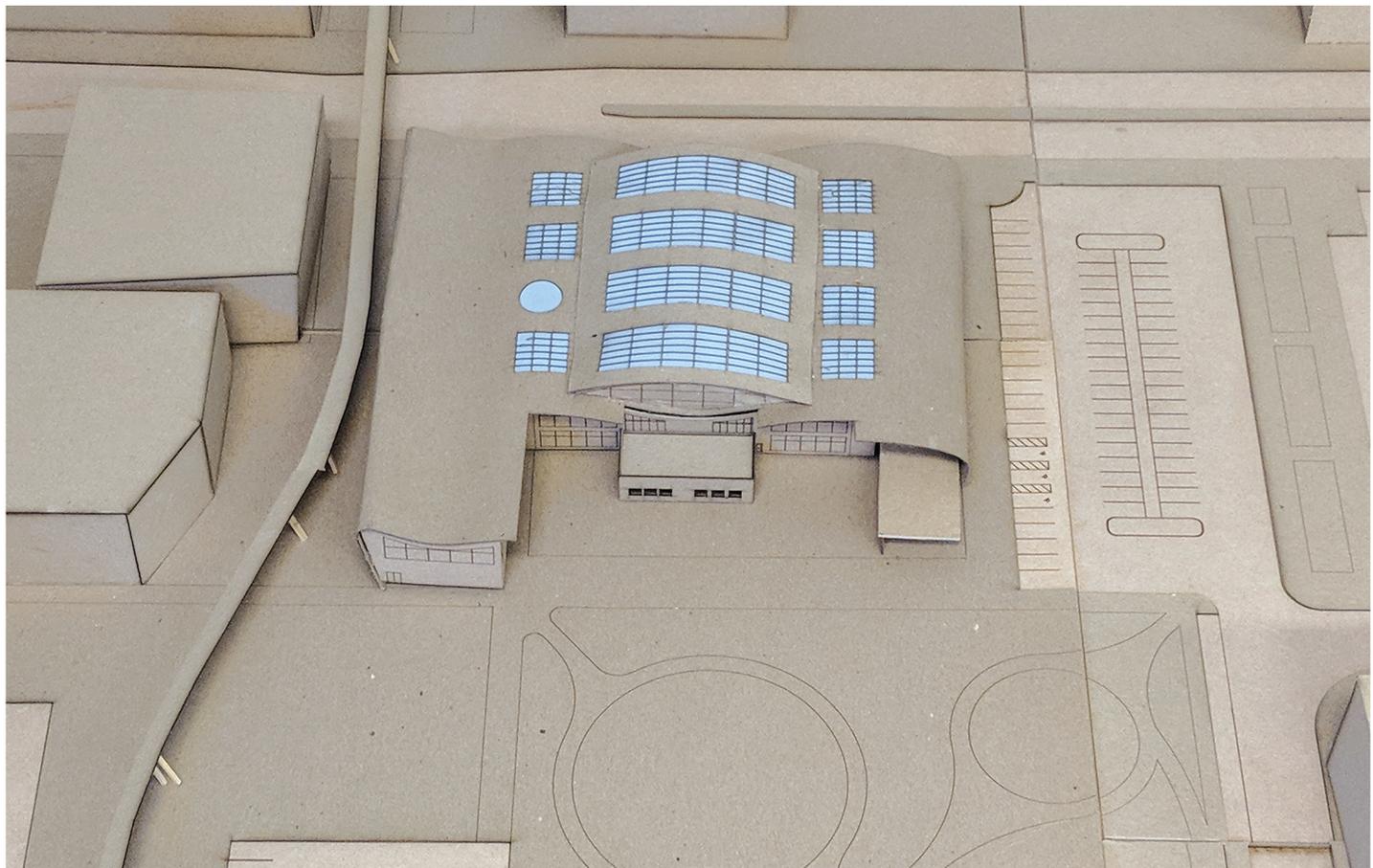
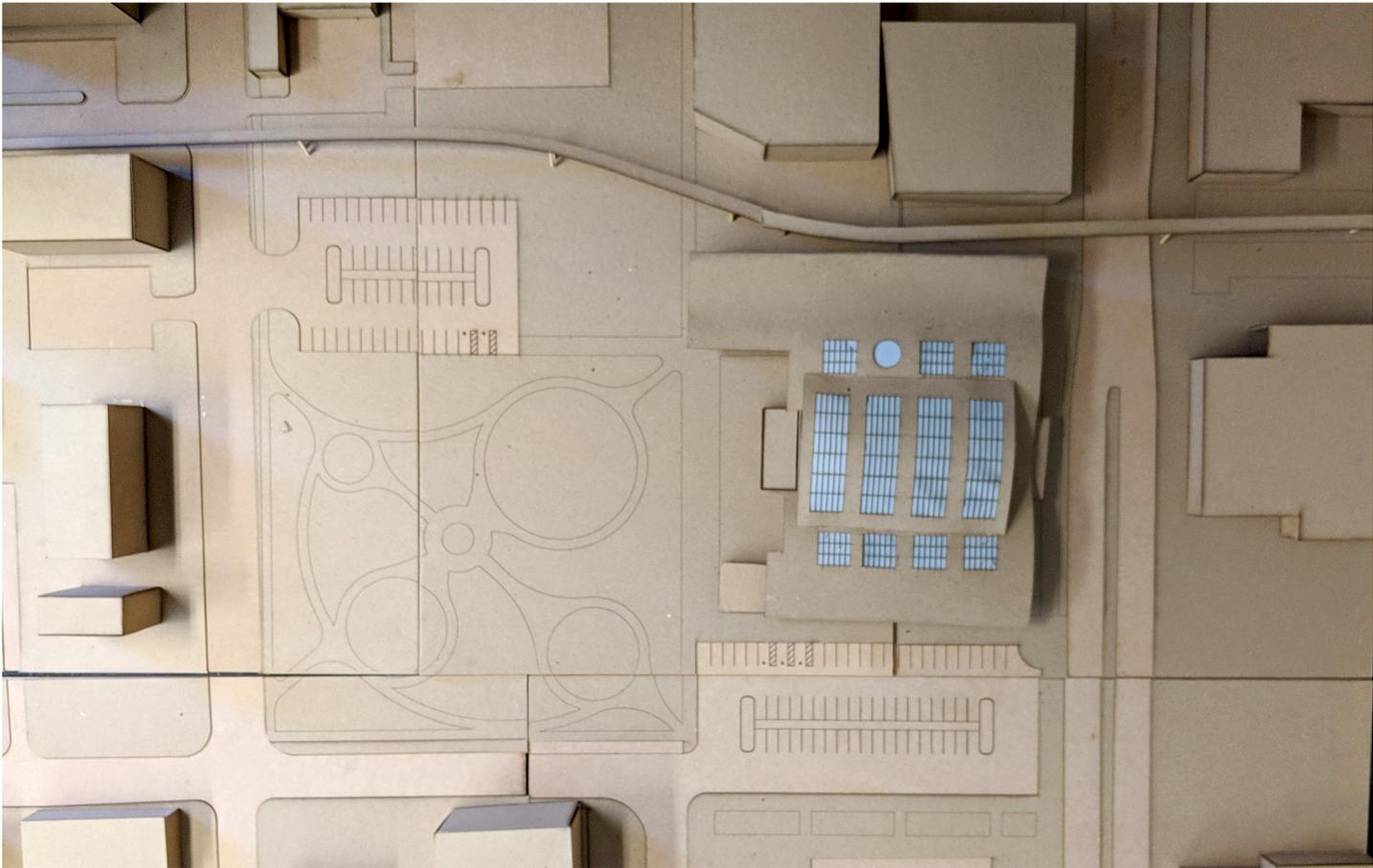


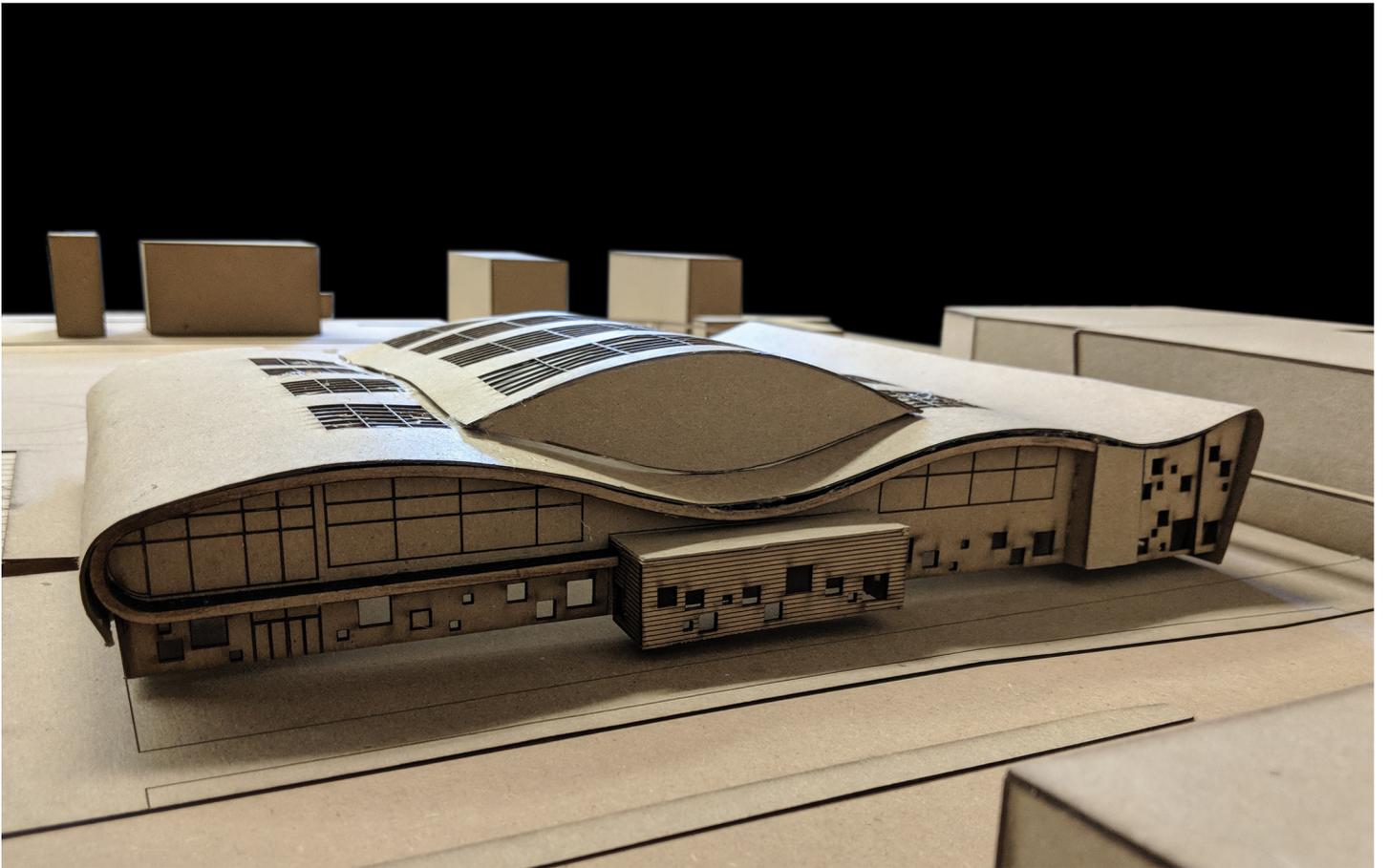












While the written portion of this thesis addressed the school as a system, how children learn, and a plausible curriculum system that may be a viable starting point for a new way of educating, the design process of this thesis explored putting the concepts these concepts into a K-5 elementary school, in the deeply troubled southside Chicago neighborhood of Englewood.

Throughout the design process, many aspects of the design had changed. The original intention of designing a K-5 elementary school with a Waldorf based curriculum reformed rather early in the design process to a Montessori based curriculum. This changed was made mainly because the initial design curriculum would not be suitable or implantable in the Englewood neighborhood. Instead, a Montessori STEAM (Science, Technology, Engineering, Arts, and Math) curriculum was selected because the way in which students are taught in vertical classrooms based on skill level and not by age would be more congruent in an environment that fosters a collaborative and creative environment.

The program elements of the thesis design were placed in way which allowed the element that typically produces much most noise to be placed to the north end of the site to act as a sound buffer from the continuous traffic for the elevated train tracks. This process allows for the school to be divided by its central axis, with the louder program at to the north and quiet program to the south. The program was broken down further into three parts, or bars, with the gymnasium, art studio, and maker lab in the north-most area. The library and social space form the middle bar. The library spills out into the social area, creating a large gathering space. The third and south-most bar housing the administration and school support.

Within the three programmatic elements, the interstitial space between these elements serves as "break-out" like spaces. Small intimate circular "cubbies" allow for learning to happen on a small scale. These "cubbies" vary in size from one or two student areas to spaces large enough to contain a 15-student class and teacher. In the north interstitial space contains elements that serve as both gathering and learning spaces. One of these elements, "the drum" is an occupiable light well that

provides enough space for larger classes and group learning to happen. The light well construction dampens some of the noise produced by a larger gathering of children. The social core is the real heart and organizing principle of the entire school. This multi-use space services as vertical circulation, ADA circulation, and an amphitheater. The design of this school is composed of social interactions with spaces and place for withdrawal and repose. Every aspect of the design is around social events.

I would thank my thesis committee, John Weigand, Patrizio Martinelli and John Blake for their continued support and pushing me and this project to a delightful outcome. I would also like to thank John Becker for his help and guidance in laying a strong foundation to design this project from.