THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF ARCHITECTURE

AUTISMTECTURE: THE INFLUENCE OF ARCHITECTURE ON THE DEVELOPMENT OF CHILDREN WITH AUTISM

DOMINIQUE D. DOBERNECK
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Reviewed and approved* by the following:

Jawaid Haider
Professor
Thesis Supervisor

Scott Wing
Associate Professor
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

AUTISMtecture:

the influence of architecture on the development of children with autism

An Architectural Thesis | Dominique D. Doberneck

ABSTRACT

In 1990, Congress passed the Americans with Disabilities Act, prohibiting the discrimination against people with disabilities. ADA is a constant factor in architectural designs; the code provides very specific regulations for accommodating people with physical disabilities. More difficult to codify, however, are design guidelines for people with non-physical disabilities.

People diagnosed with Autism Spectrum Disorder (ASD) are affected in vastly different ways. Though each person has different eccentricities, the Triad of Impairments has been used to diagnose the disorder, and thus can be identified in all people with ASD: impairments of social interaction, social language and communication, and flexibility of thought and imagination. A fourth impairment is often included: of sensory processing and motor skills.

Designing for autism is an emerging specialty in architecture. There are many techniques that can be employed to ease the learning process of children with ASD and aid in their social development, allowing for eventual social competency in a world unforgiving to non-physical disabilities.

Many of the design techniques that would enhance learning and development in children with autism can also be applied to children without autism. Concepts such as daylighting, acoustical isolation, and wayfinding are all incredibly important when applied to children with autism because of their impairments. The same concepts, however, do not hinder mainstream children, but would actually enhance their learning experiences, as well.

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"Every touching experience of architecture is multi-sensory; qualities of matter, space, and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton and muscle. Architecture involves seven realms of sensory experience which interact and infuse each other."

- Juhani Palasmaa

THESIS STATEMENT

Powerful design addresses all senses, recognizing their importance in understanding architecture as a whole. This concept is especially applicable to individuals diagnosed with an Autism Spectrum Disorder.

This thesis explores architectural methods which enhance the sensory experience of children with ASD in an educational and therapeutic setting.

RESEARCH AND DOCUMENTATION 1

1.1 Area of Focus Summary
1.2 Findings from Literature Review
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1.4 Architectural Issues
1.5 Architectural Precedents

1.1 AREA OF FOCUS SUMMARY

RESEARCH AND DOCUMENTATION

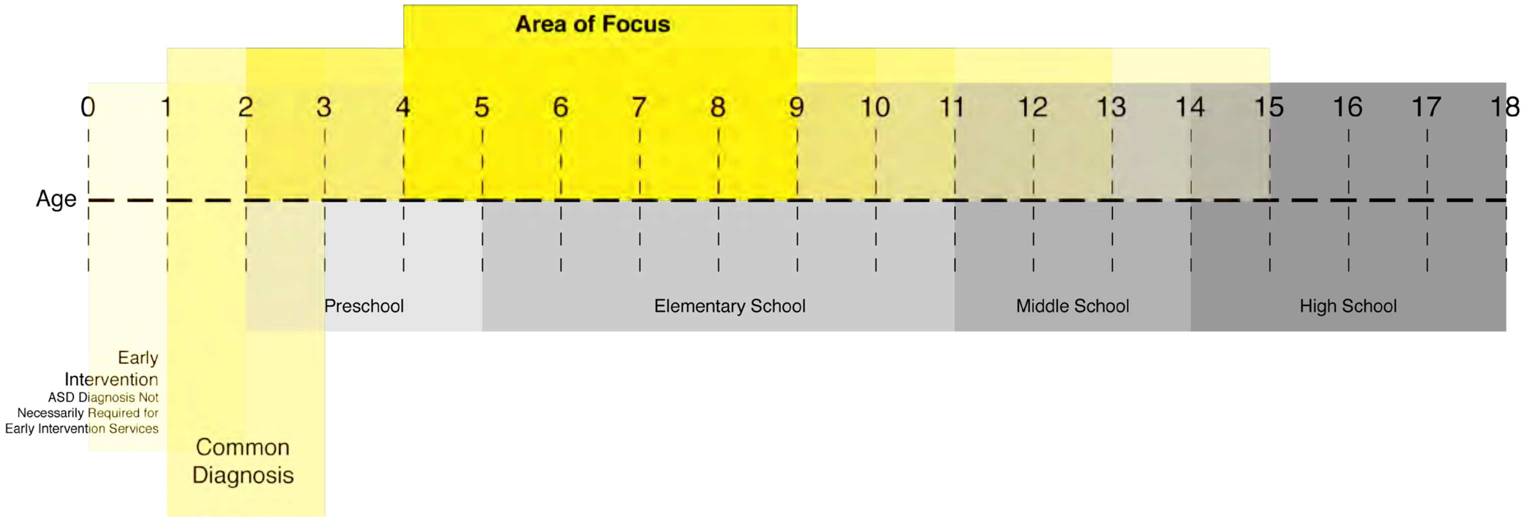
“Autism is described as a disorder in which there are markedly abnormal or impaired social and communication skills, and restricted interests and activities.” (White 6)

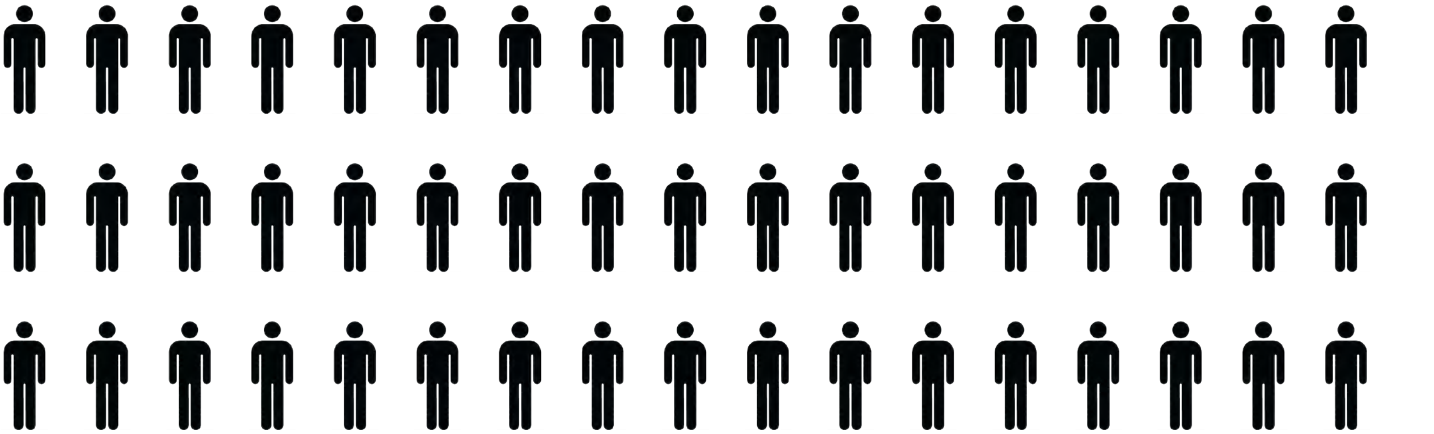
Research relating to autism has increased drastically since the 1970s. More and more studies are being done to determine more about the disorder: its characteristics, its causes, possible treatments, etc. However, little research has been done to determine the effectiveness of architectural design techniques on the development of the child. Research in this field of architectural specialization is becoming more important as the number of cases of ASD rises.

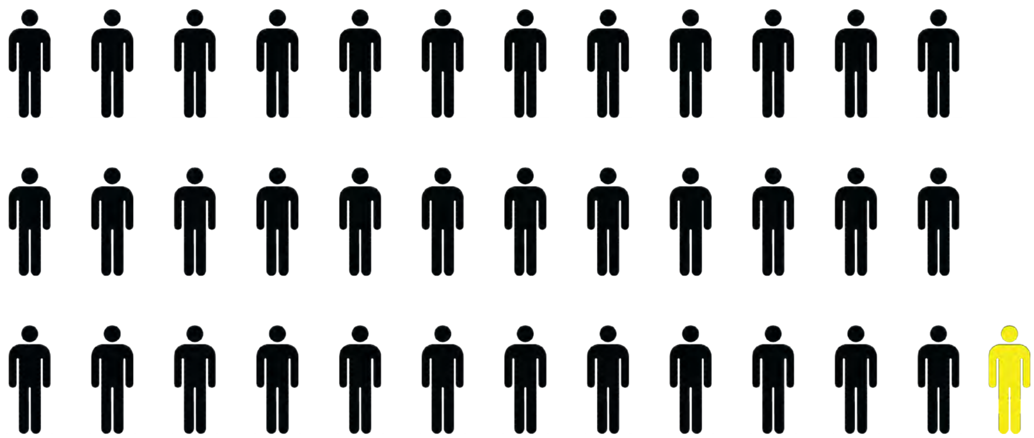
According to the Center for Disease Control and Prevention, 1 in 88 individuals were diagnosed with ASD in 2008, a prevalence much higher than the 1 in 150 individuals in 2000. As more children are diagnosed with ASD, measures must be taken to accommodate them, and their special needs must be taken into consideration. Reusing out-of-date spaces that are inadequate even for mainstream educational use is not acceptable.

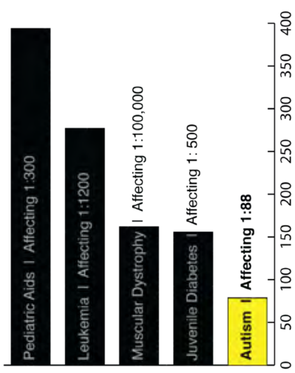
The graph to the right shows that, even though autism is vastly more prevalent than other childhood diseases, funding for research in treatment options is much less than that for other, less common childhood diseases. In addition to the private funding shown, the National Institutes of Health dedicates only .6% of their $30.5 billion budget, approximately $169 million, to research in autism.

The diagrams below and to the right indicate in yellow the age groups and severity of autism on which this thesis will focus.





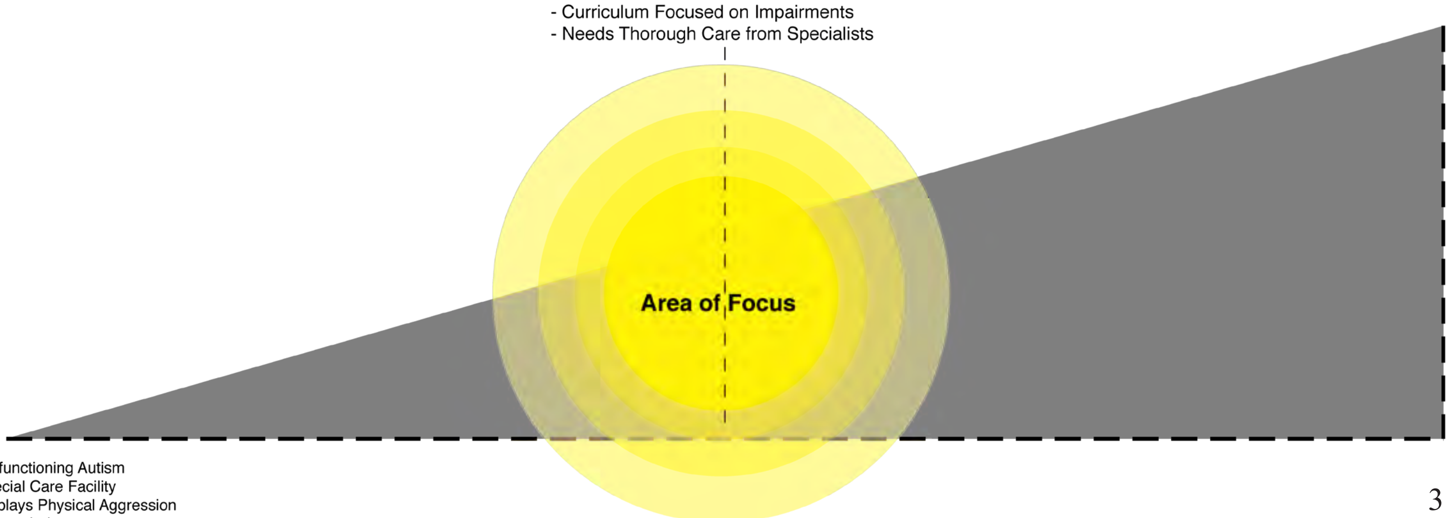




Distribution of Private Funding for Research in Childhood Diseases (millions of dollars)

Mid-Range Autism
- Split Days Between Special Care Facility and Mainstream School
- Able to Benefit from Academic Rigor at Mainstream School
- Curriculum Focused on Impairments
- Needs Thorough Care from Specialists

High-Functioning Autism
- Asperger's Syndrome
- Mainstream Schools
- Good Memory and IQ
- No Response to Social Cues



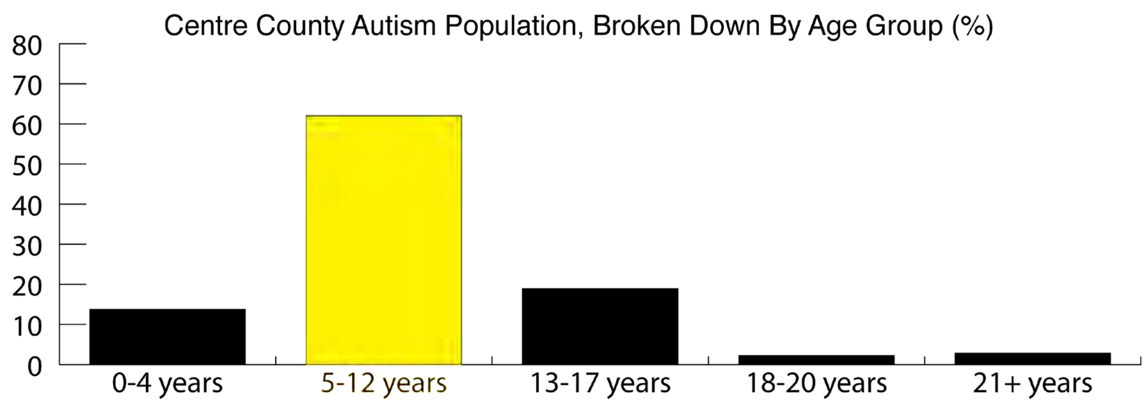
Low-functioning Autism
- Special Care Facility
- Displays Physical Aggression
- Non-verbal

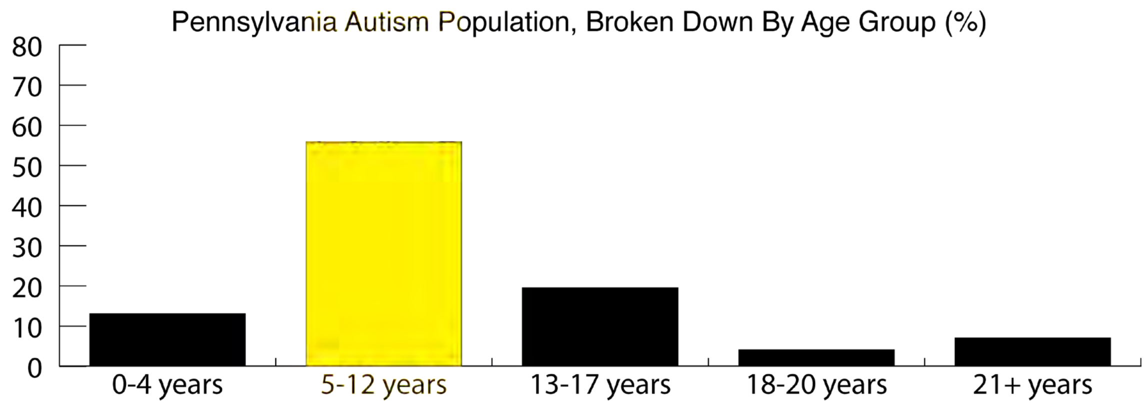
Pennsylvania Census Autism Project: Final Report

This report was published in 2009 based on data collected in 2005. Because of several limiting factors, the Pennsylvania Department of Public Welfare admits that “the estimate is likely a dramatic under count of the number of Pennsylvanians with ASD.” (p1) The greatest limitation of the report was that only those actually receiving services in 2005 were able to be counted.

The report found that in 2005 there were approximately 174 individuals in Centre County diagnosed with autism. Of these individuals, over 62% were between the ages of 5 and 12 years old. In fact, the distribution for Centre County is typical across all counties in Pennsylvania.

Dr. Sarah Douglass, an assistant professor of Special Education at Penn State, speculated that the reason for the large percentage of autistic cases in children is probably due to the fact that, through human services, these children learn to cope with their disability and eventually are taken out of “the system”.





Autism and the Built Environment

Researchers in Spain summarized the findings and design criteria outlined by several architects. From these lists, Sanchez, Vazquez, and Serrano came up with five categories in which architecture may aid students with autism.

1. Imagination - difficulty constructing a mental image of what may next be encountered

2. Communication - visual communication is more effective than verbal communication and information processing

3. Social Interaction - more sensitive proxemics

4. Sensory Difficulties - difficulty processing sensory stimuli

5. Behavior and Safety - aggressive conduct could harm students and the environment

Christopher Beaver, GA Architects

Through his experience designing facilities, both educational and residential, for individuals with autism, Beaver has identified five major architectural issues to address.

1. Circulating and Wayfinding - multifunctional circulation spaces, wayfinding system, such as color coding

2. Acoustics - acoustic materials and finishes that "manage" sound

3. Lighting - indirect, glowing light, recessed ceiling lights, dimmers

4. Heating - underfloor or ceiling radiant heating avoids burns and small places for vandalism

5. Color - bright colors to welcome students into the building, neutral colors for focus in the classroom

“The senses intercommunicate by opening on to the structure of the thing... One sees the springiness of steel, the ductility of red-hot steel, the hardness of a plane blade, the softness of shavings. The form of objects is not their geometrical shape: it stands in a certain relation to their specific nature, and appeals to all our other senses as well as sight.”

- Maurice Merleau-Ponty

Phenomenology of Perception

Merleau-Ponty emphasizes the connection between all the senses, indicating that sight is not the main way we experience space. In fact, without the other senses, our visual experiences would mean less. Through our eyes we are able to imagine how objects feel, smell, sound, and taste.

Christopher N. Henry, Autism Consultants

Henry’s series of articles for ArchDaily cover several aspects of design for individuals with autism. He defines the difference between sensory-sensitive design and neuro-typical design.

Sensory-sensitive design uses techniques like “limit[ing] daylight and exterior views, keep[ing] ceiling heights low and spatial volumes small, us[ing] restrained details, subdued colors, and reduc[ing] acoustical levels.” Neuro-typical design “mimic[s] all the colors, sounds, lighting, and spatial volumes” of spaces individuals would occupy in the typical world.

Interestingly, Henry also indicates that evaluating the effectiveness of these design techniques will be a long process. Despite the efforts of some (Henry, Magda Mostafa) to begin the research process, their studies are so fraught with inaccuracies that they are essentially inadmissible.

Simon Humphreys, Architect

Simon Humphreys has used his experiences with his autistic brother to design several facilities catering to children with autism. In one lecture on the subject he discussed the art of containment. He pointed out three requirements for spaces for play:

1. The child must be "contained" for safety
2. The child must feel that he is able to wander free
3. The carer must be comfortable that the child can wander safely

Humphreys cites zen gardens and natural containing forms as ways to accomplish these goals.

"If they are subtle, natural but secure it will allow possibilities for the person to wander at ease and also allow staff and carers to be more relaxed when this happens. Freedom of movement can be extremely liberating."

RESEARCH AND DOCUMENTATION

"Play is assimilation of reality to the ego, as distinct from 'serious' thought, in which the assimilating process is in equilibrium with accommodation to other persons and things."

- Jean Piaget

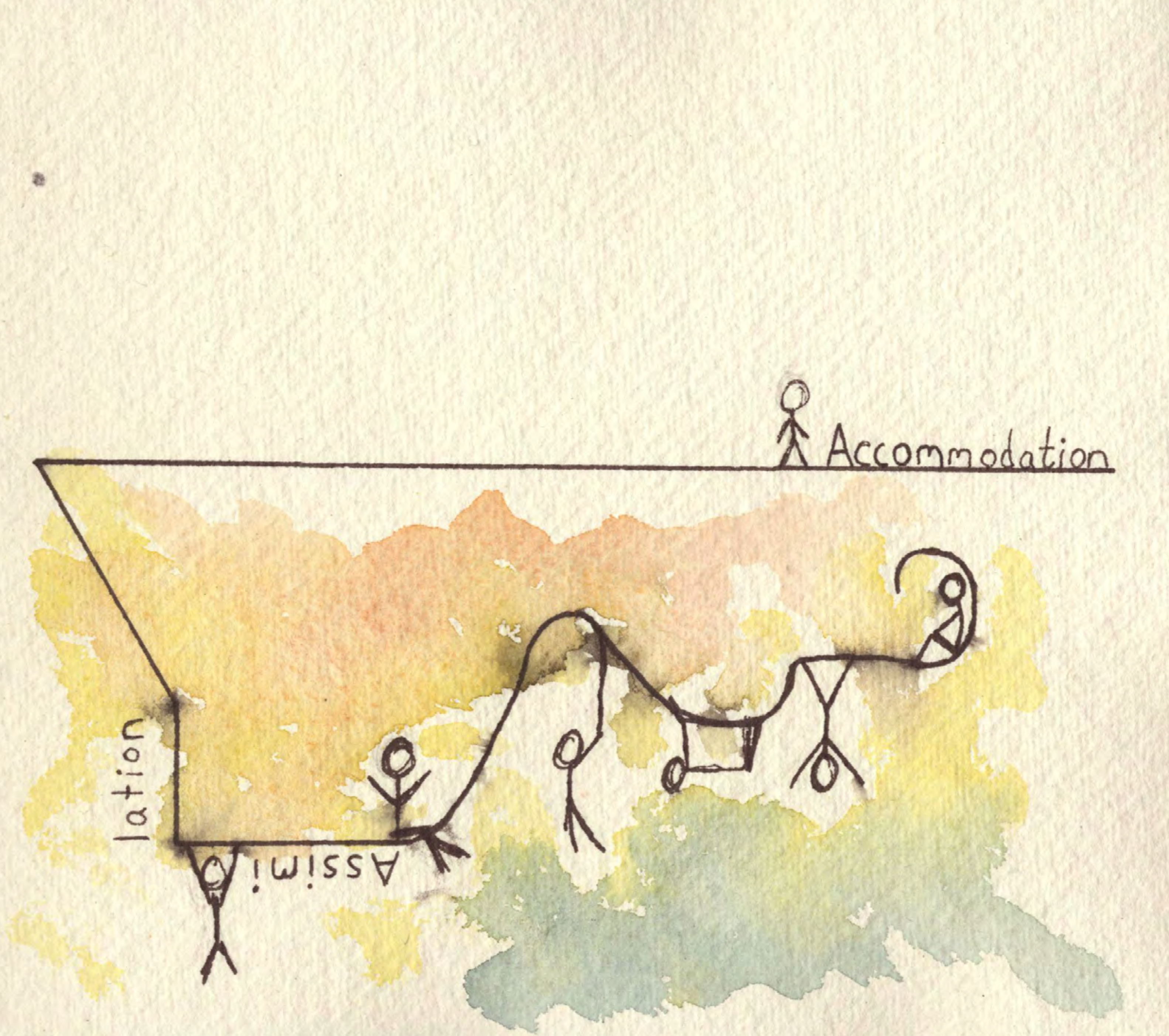
Play, Dreams and Imitation

Jean Piaget, a Swiss developmental psychologist, defines play as a combination of assimilation and accommodation. He recognizes assimilation as the alteration of reality to fit the ego, whereas accommodation is the opposite: the alteration of oneself to fit reality. He lists several criteria for defining play, all of which inherently express his idea of assimilation versus accommodation.

The idea that play is inherently unorganized, as opposed to "serious thought", which is naturally directed, is an example of the application of Piaget's theory. It is clear to Piaget that play is inherently unorganized "because reality is being assimilated to the whims of the ego instead of being thought in accordance with rules."

Piaget goes on to identify play as the base of learning. He presents an infant, learning basic motor skills. As the infant learns to suck, grasp, and shake, "each object is assimilated as something 'to be sucked,' 'to be grasped,' 'to be shaken,' etc., and is at first that and nothing more." The infant is altering reality to better fit his ego, in the fact that the only possible meaning for a rattle is that it should be shaken.

Once the infant has learned the skill, however, he does not put down the rattle. Instead, he keeps shaking it, "not in any further effort to learn or to investigate, but for the mere joy of mastering it and showing off to himself his power of subduing reality."


Accommodation
Assimilation

1.3 QUESTIONS/THEORETICAL ISSUES RAISED

RESEARCH AND DOCUMENTATION

How do children play with architecture? That is, how do children assimilate the reality of their built environment to their ego?

How do children accommodate themselves to architecture?

Can architecture improve the quality of education for all children, especially as applied to children with autism?

How can this architecture lend itself to research, so the effects of architectural interventions may be studied and measured?

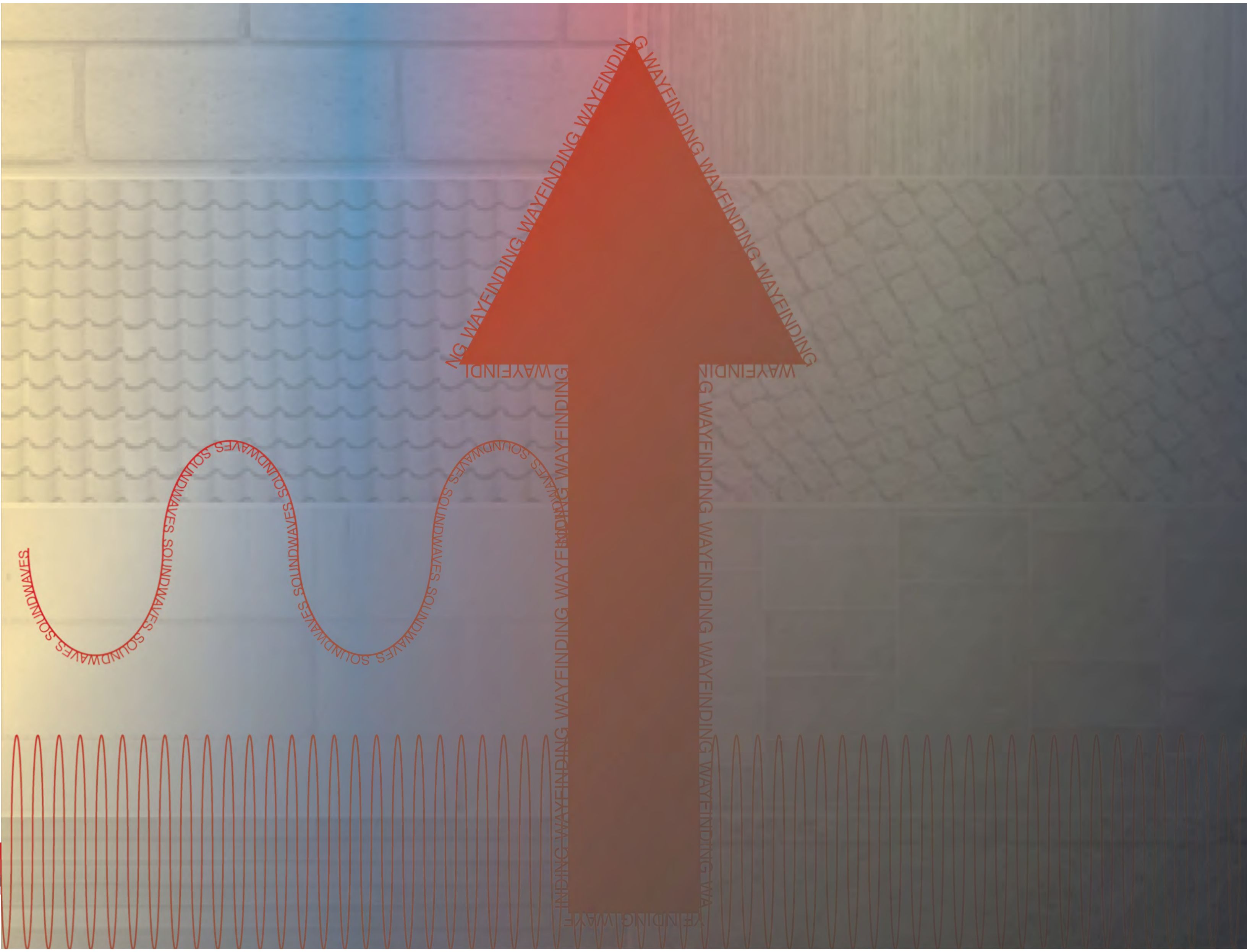
RESEARCH AND DOCUMENTATION

The research discussed in Section 3.2 indicates that architectural elements affect the behavior and development of children with autism. The environmental aspects that have the largest capacity for impacting the effectiveness of teaching techniques are:

1. Circulation and Wayfinding
2. Lighting
3. Acoustics

Secondary aspects to be considered in the design are:

1. Space Conditioning
2. Material choice (textures)
3. Color Theory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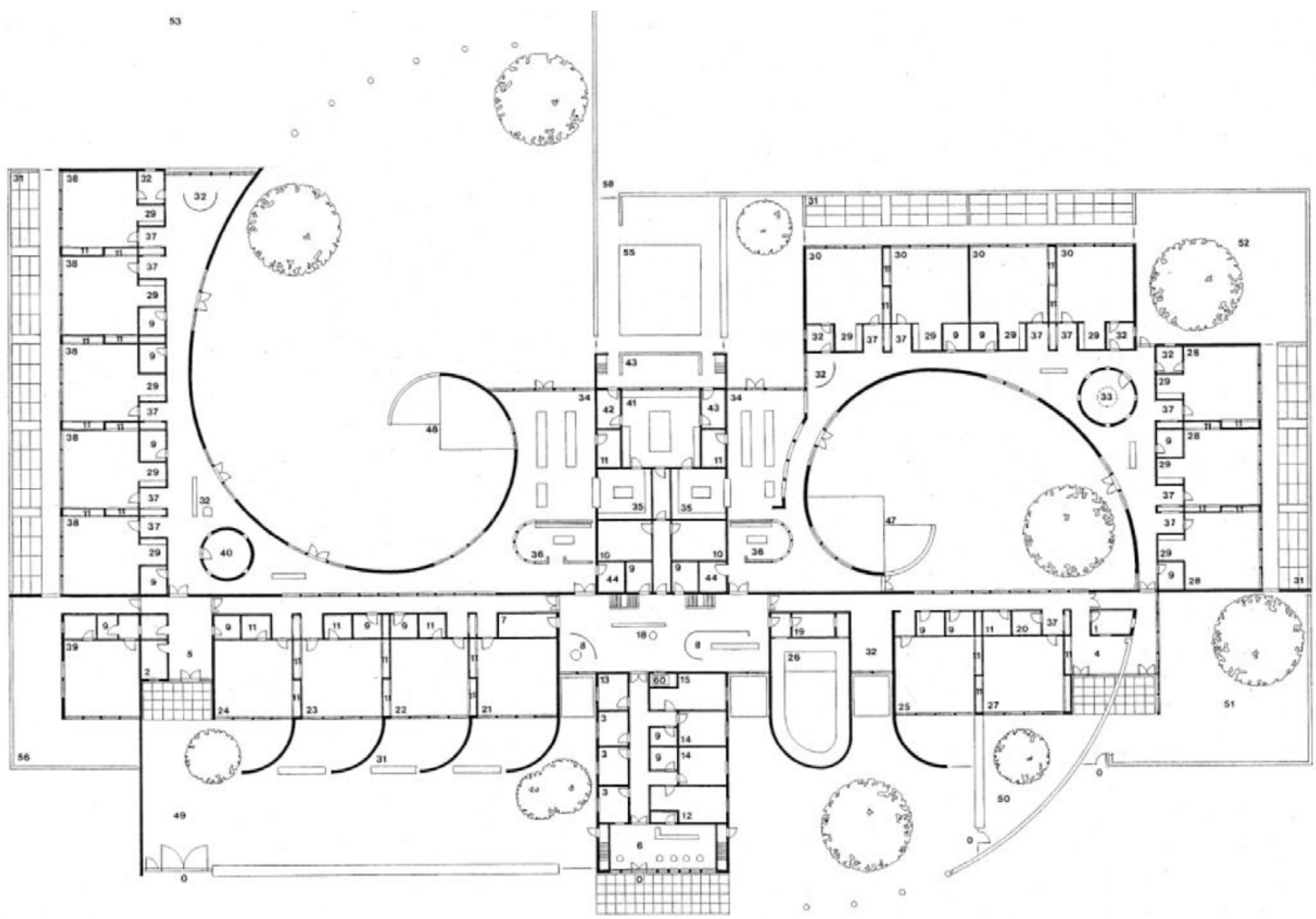
Newcastle School: Simon Humphreys

The circulation spaces used here are not typical of mainstream schools. Usually long corridors extend between classrooms and congregational spaces. In an autism school this can lead to a tendency to run and a sense of disorientation.

By arranging the program around a central spiral courtyard in both the junior and senior high school, Humphreys eliminated the disorienting corridor and enhanced wayfinding. Upon leaving any of the spaces arranged around the spiral, one always knows where in the building he is. This wayfinding tactic helps create a sense of peace and order.



Sunfield Residential School: GA Architects

GA Architects have been designing facilities for individuals with autism since 1989 in London, England.

The Sunfield Residential School is another example of non-traditional circulation spaces. By breaking down the halls, GA Architects provided places for children to play and congregate. Giving the circulation spaces another function helps to focus the children and help them make sense of the space.

Another consideration here was natural light. Fluorescent lights produce a buzz and a flicker that greatly affect individuals with autism. Generally, natural light is prefered. However, it is important that the light be diffused to avoid harsh shadows and glare. GA Architects placed clerestory windows in a setback of each bedroom, causing the light to bounce off of the internal light shelf produced and onto the ceiling and wall.

Netley Primary School Autistic Unit & Kentish Town Autistic Resource Base: Haverstock Associates

Natural lighting has many benefits, but is controversial in autistic design. Fluorescent lighting has the obvious drawbacks of humming and flickering that can be distracting. However, some professionals believe that the inconsistency of daylighting and the views afforded by large windows can be just as bad as fluorescent lights for a child's concentration.

Haverstock Associates first designed the Netley Primary school to allow for maximum daylight by separating a courtyard space from the main classroom with a glass wall. Though the daylighting was excellent, the students were too distracted by the enticing outdoors to be productive indoors. The teachers resorted to taping paper in the windows, inhibiting the daylighting purposes of the window wall.

Later, at the Kentish Town School, Haverstock Associates allowed some spaces to have grand window features, but minimized fenestration in classrooms.

Netley Primary School Autistic Unit

Kentish Town Autistic Resource Base

RESEARCH AND DOCUMENTATION

North Brother Island School for Autistic Children: Ian M. Ellis & Frances Peterson

This project addresses the issue of variance within the autistic spectrum. The designers recognize that each individual has different sensory disabilities. While one child with autism may be hypersensitive to sensory stimuli, another may be hyposensitive, while another still may respond to sensory input with relative ease.

As is clear in the plan to the right, the three courtyards were designed to be quite different. The left most is designed for children in the middle of the spectrum: the design is free yet controlled. The central courtyard is the most protected and most clearly designed, allowing children with hypersensitivity to play in a space they can understand clearly. The last courtyard is for those with hyposensitivities. Its unusual design allows them many opportunities to explore and test themselves.

This method gives students at any point on the spectrum a space in which they can feel comfortable and free to play.

HYPO GARDEN

HYPER GARDEN


original coastline

SITE AND CONTEXT INFORMATION

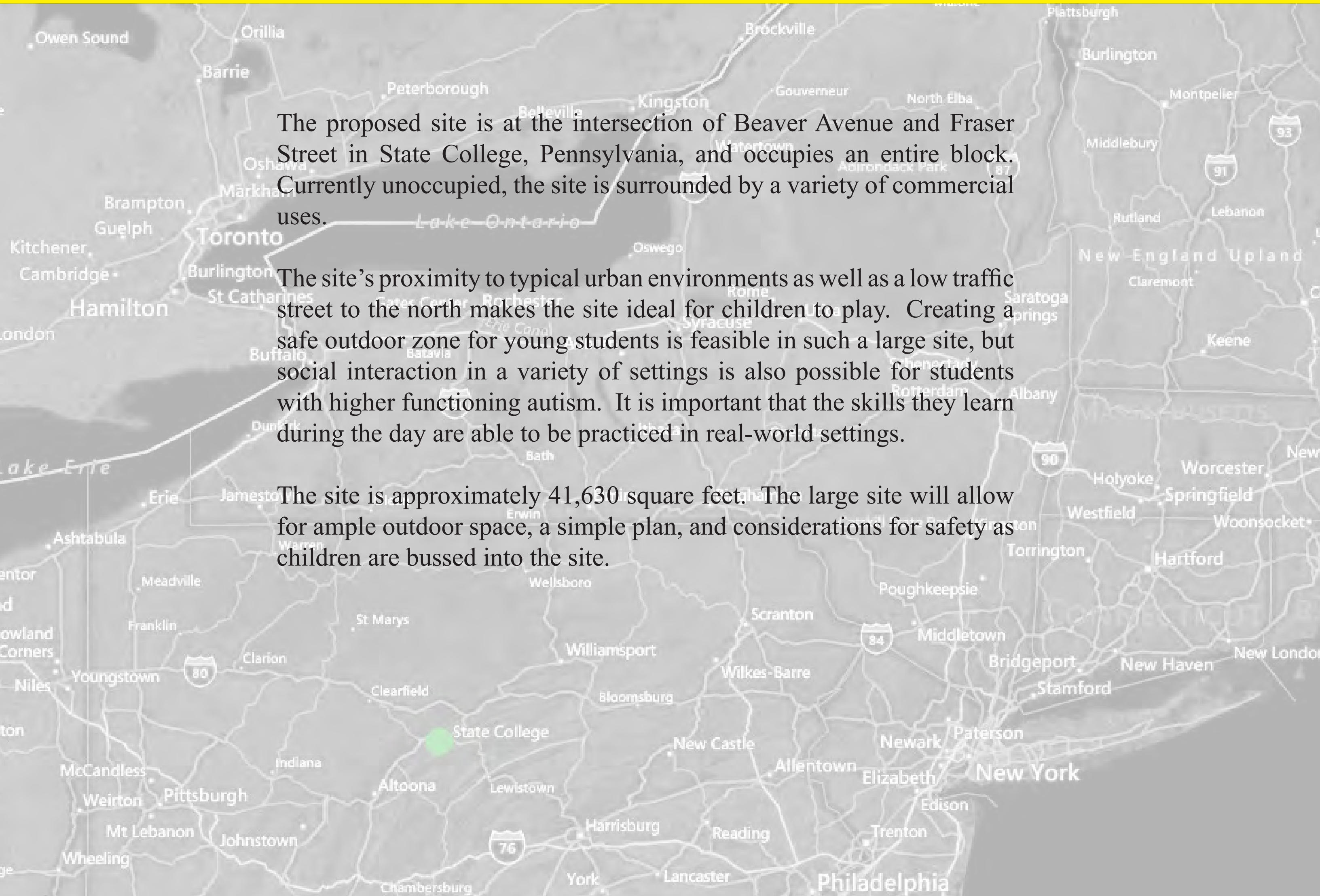
2.1 AERIAL PHOTOS/MAPS

SITE AND CONTEXT INFORMATION

The proposed site is at the intersection of Beaver Avenue and Fraser Street in State College, Pennsylvania, and occupies an entire block. Currently unoccupied, the site is surrounded by a variety of commercial uses.

The site's proximity to typical urban environments as well as a low traffic street to the north makes the site ideal for children to play. Creating a safe outdoor zone for young students is feasible in such a large site, but social interaction in a variety of settings is also possible for students with higher functioning autism. It is important that the skills they learn during the day are able to be practiced in real-world settings.

The site is approximately 41,630 square feet. The large site will allow for ample outdoor space, a simple plan, and considerations for safety as children are bussed into the site.

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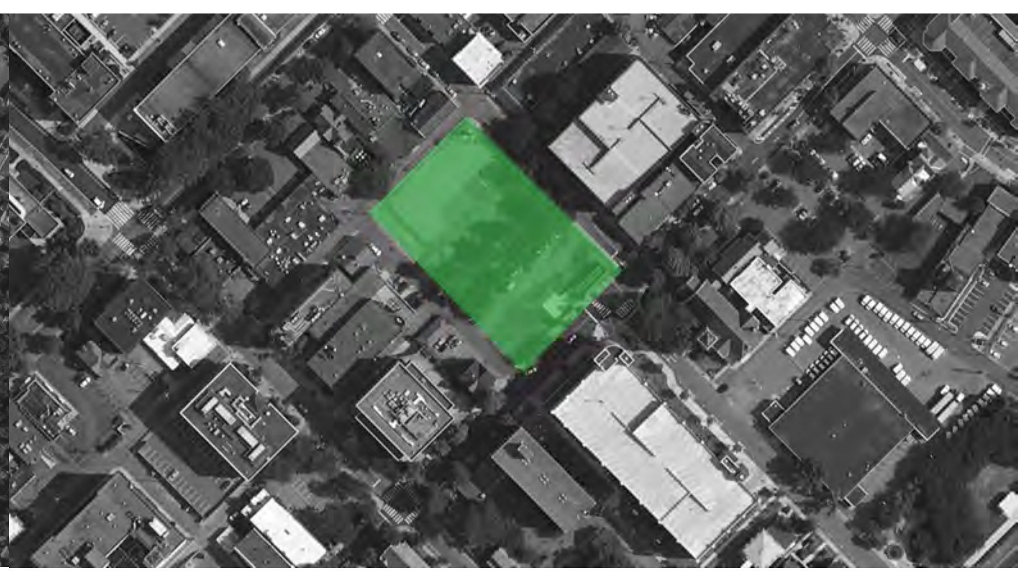
Belfast
Augusta
Lewiston
Brunswick
Portland
Laconia
Biddeford
Dover
Portsmouth
Manchester
Lowell
Boston
Brockton
Cape
Cod Bay
Providence
New Bedford
Nantucket


COLLEGE
AVENUE
STREET
ALLEY
NEW
ALLEY
CRESSON
MILLER
KELLY
STREET
WEST
BEAVER
AVENUE
ATHERTON
BURROWES
FRASER
ALLEN
HIGHLAND
ALLEY
BLOCK
SOUTH
W. FOSTER AVE.
CENTRAL PARKLET
ALLEN ST PARKING LOT
STATE COLLEGE, PA
REAL ESTATE
REGISTRY
SHEET 15



2.2 SITE DOCUMENTATION

SITE AND CONTEXT INFORMATION

Currently the site is used primarily for public parking. The north end of the site is fenced off, deterring the public from walking on the overgrown, rubble-laden ground. In the heart of downtown State College, this wasted space is unappealing, unsafe, and unacceptable.

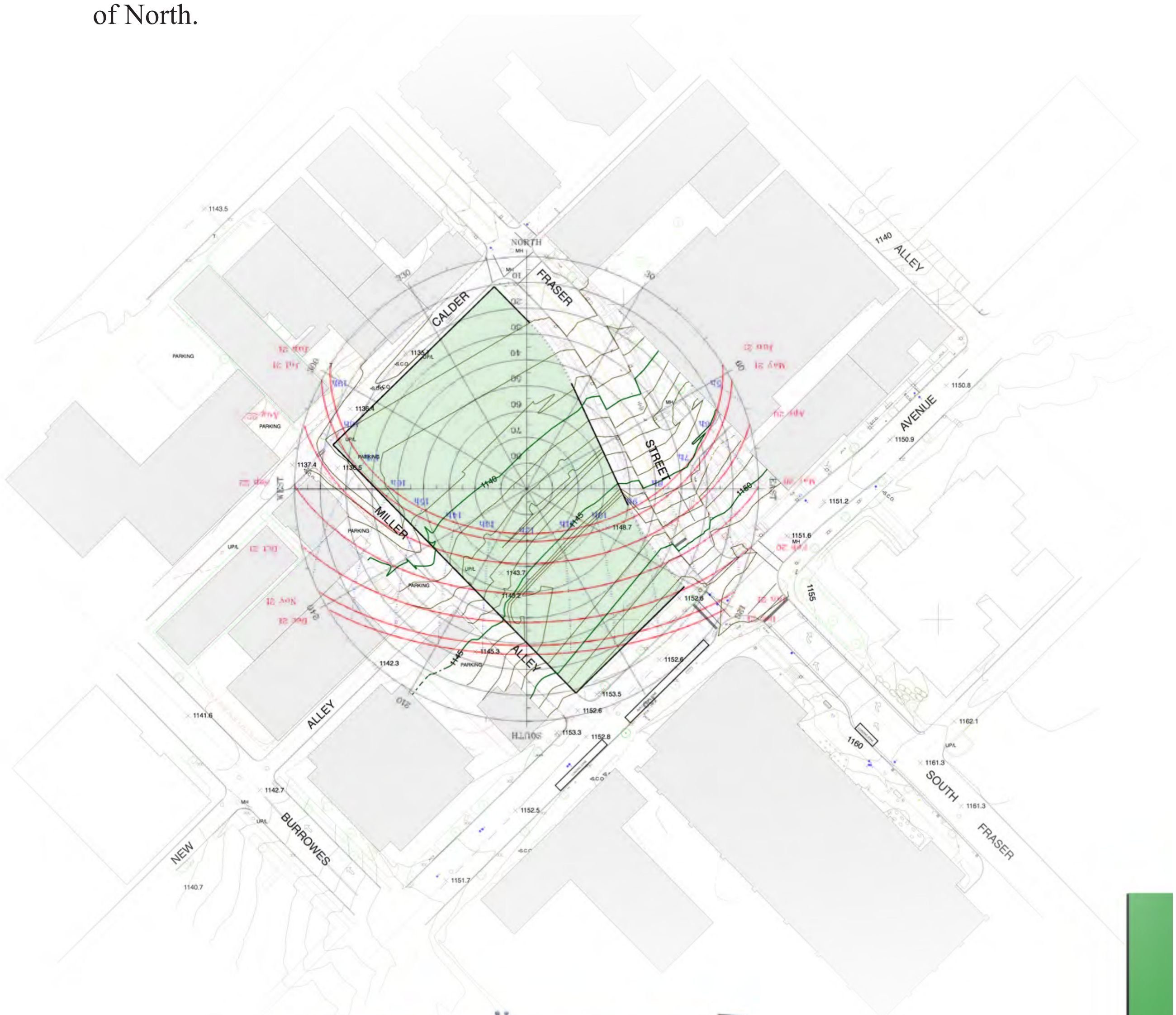
Panorama View: from southwest corner of site

View: from northeast corner of site

View: from northwest corner of site

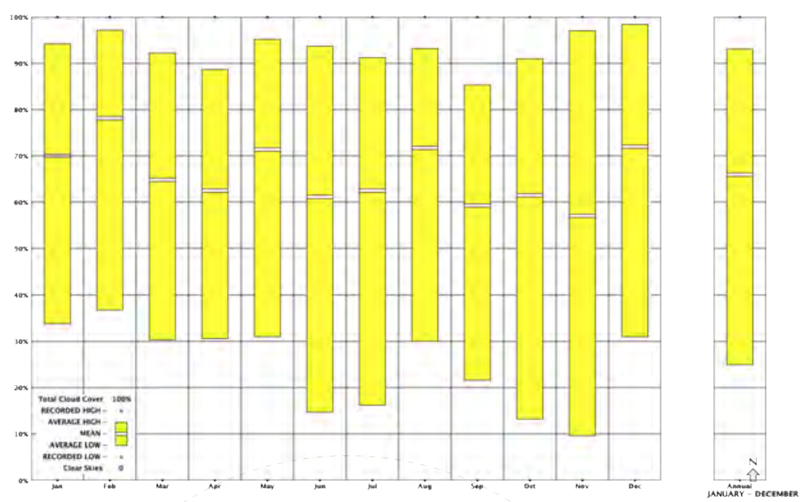
SITE AND CONTEXT INFORMATION

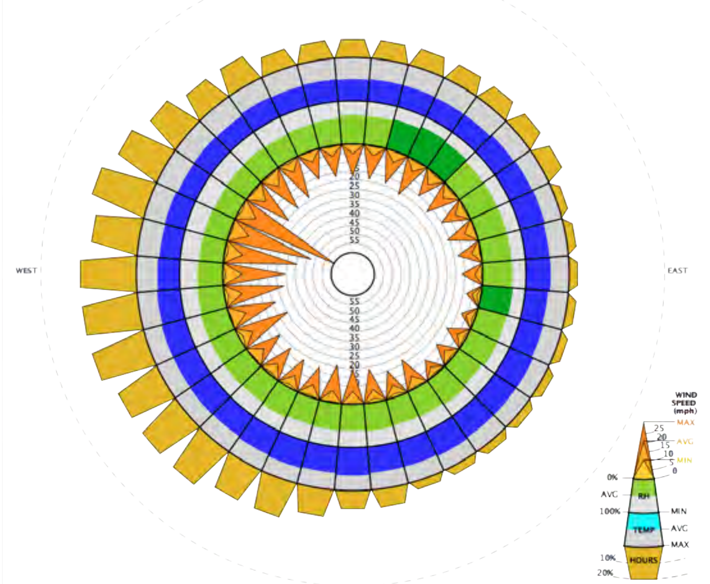
The Fraser Street lot is approximately 41,630 square feet, approximately 280’ X 137’, and rises by 17’ to the south, toward Beaver Avenue. The site is oriented approximately 45º off of North.

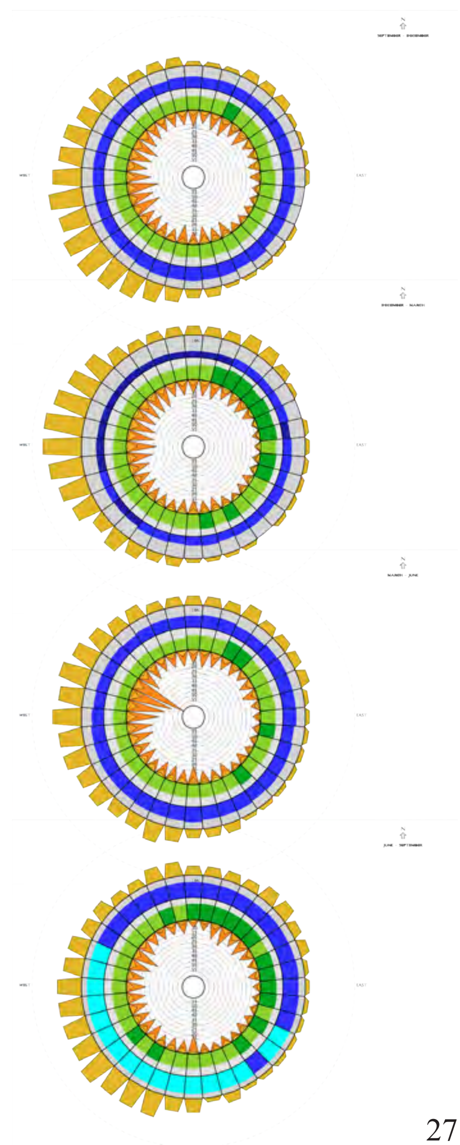


State College lies on 40.88 N, 77.84 W. Environmental considerations will be taken into account to ensure that natural resources are taken advantage of. Wind roses are shown below, representing the typical wind patterns for the entire year (bottom left) and different seasons (right). Wind will be an important consideration in siting the building. The harsh winter winds must be blocked, while the summer breezes should be taken advantage of for ventilation.

Another environment issue to consider is the quality of light avaliable in State College. Shown below is a graph of cloud cover in the area. The average annual cloud coverage is about 65%. This means that, especially during the school year, many days are overcast, giving a softer light inside buildings. Given its northern location, snowfall is another contributor to lighting conditions. What will happen to the light inside the building when sunlight bounces off surrounding snow?







SITE AND CONTEXT INFORMATION

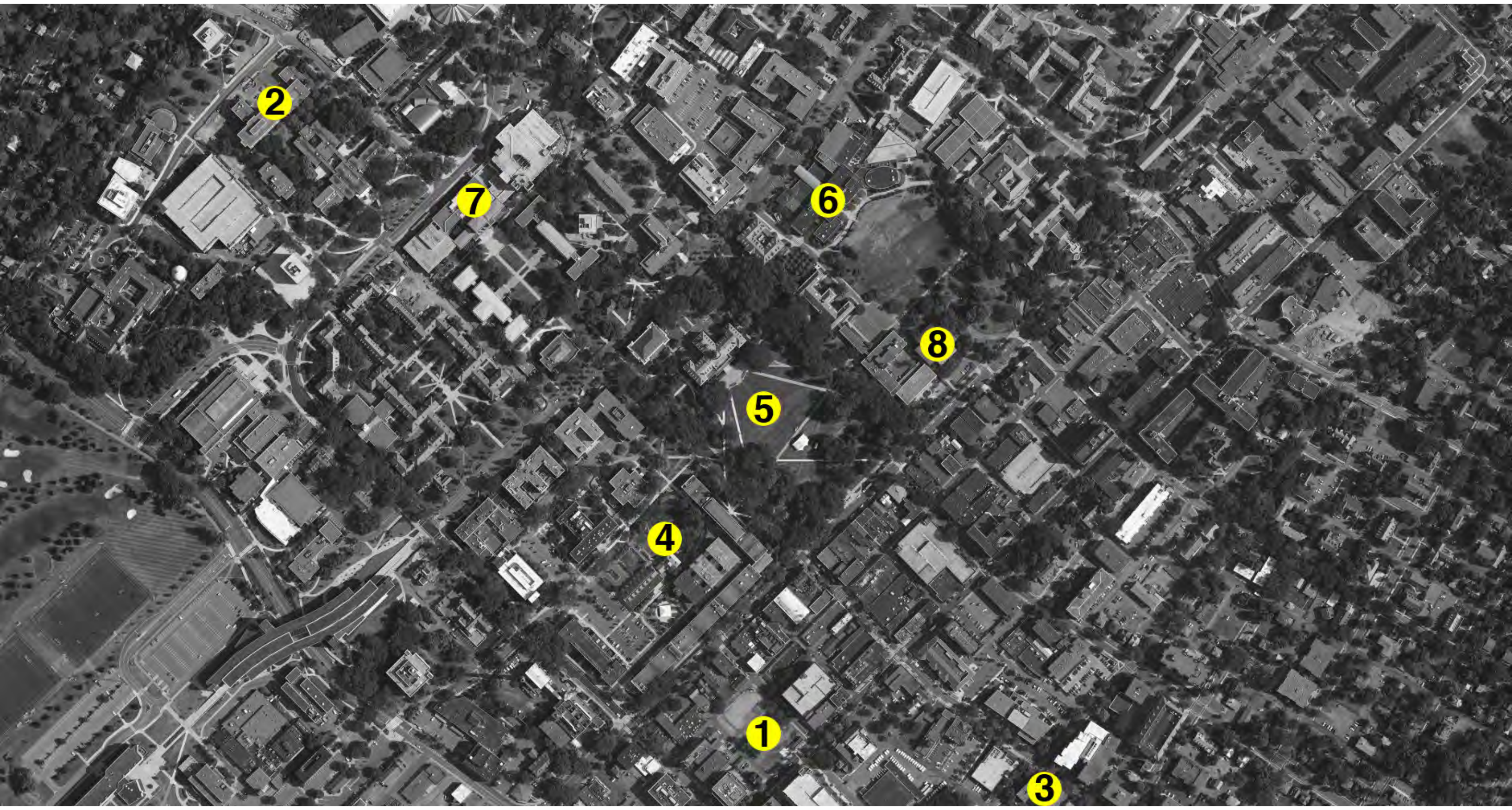
University Proximity

The National Autism Conference is held at The Pennsylvania State University every summer. During the conference, it would benefit research in the field if outside professionals were able to visit the facility and observe the children interacting with their environment.

In addition to the conference, Penn State's Special Education Department has many professors whose expertise lies within the field of autism, as well as many students wishing to work with children with autism. Including these professors and students in the development of the children attending the school would help to advance research in architecture for autism, as well as benefit the children in the school and the students from the university. Siting the school close to Penn State creates a symbiotic relationship between children receiving services and the people best suited to offer them.

The campus map on the bottom right shows that the University has already begun expansion into the downtown area. The map on the top right points out programmatically relevant campus buildings and areas.

1. Site
2. Department of Special Education: Cedar Building
3. Department of Special Education: 224 S Allen Street
   (while Cedar Building is under construction)
4. Alumni Garden
5. Old Main Lawn
6. Hetzel Union Building (HUB)
7. Pattee and Paterno Libraries
8. Health and Human Development Building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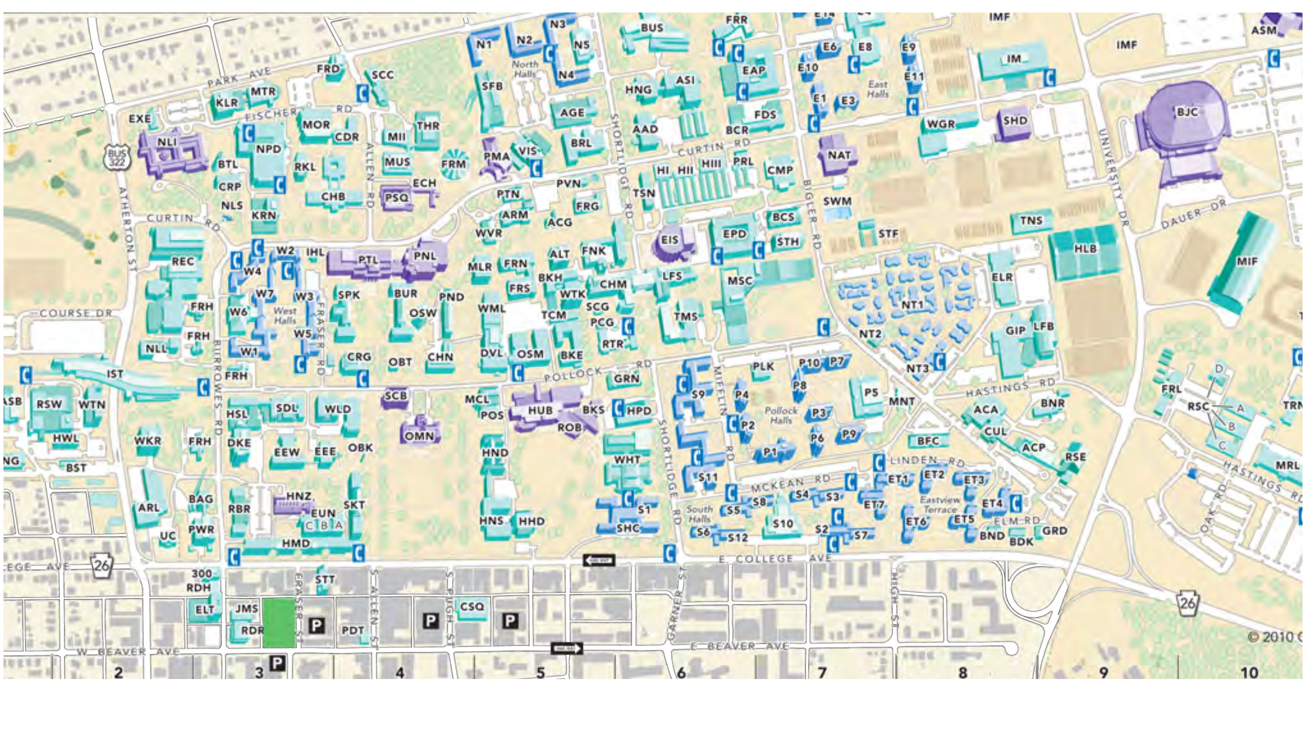
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South Halls
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SITE AND CONTEXT INFORMATION

Proximity to Social Opportunities

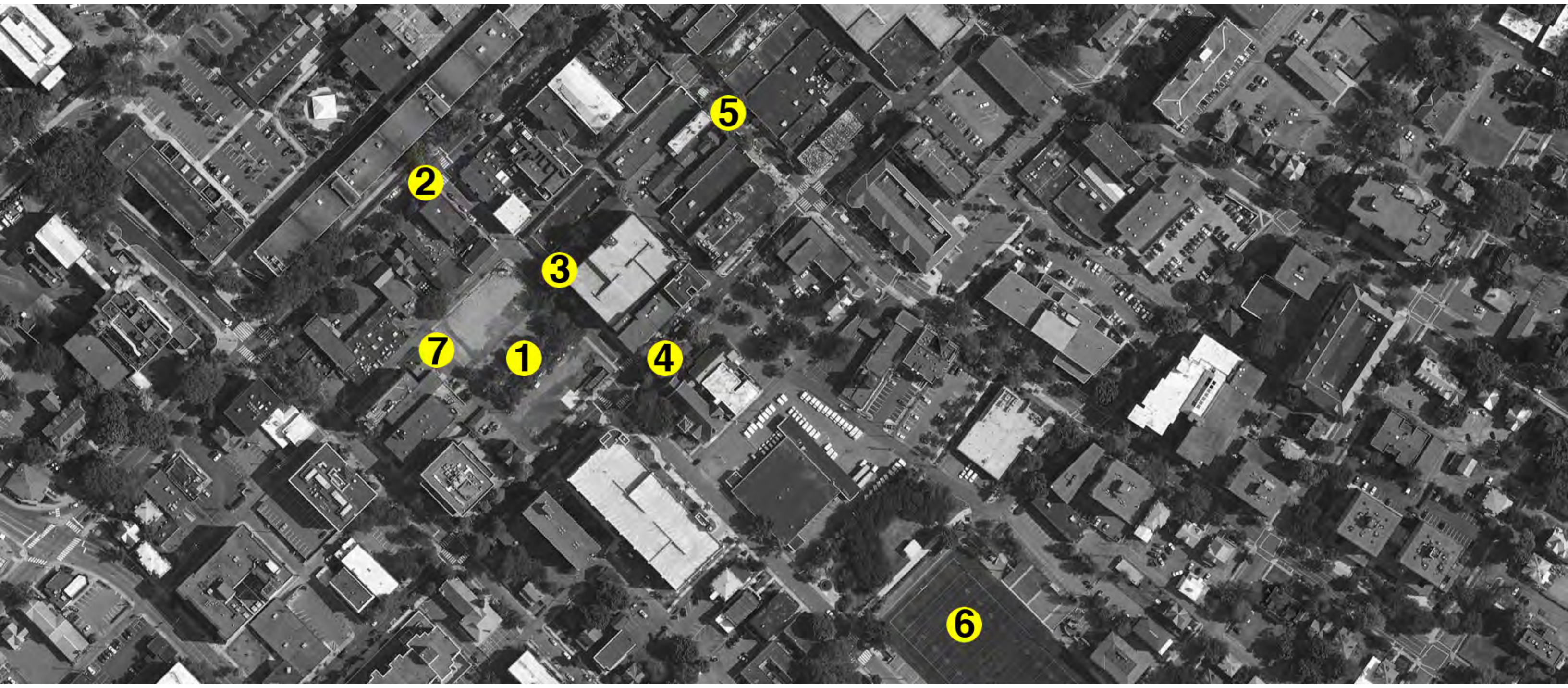
After the students are taught social skills in the specialized setting of the school, they will need to learn to generalize these skills in order for them to be successful in real-world situations. The variety of social opportunities surrounding the site is ideal for different levels of students. One student may be ready to handle a busy atmosphere like the hub, whereas another student may only be ready to explore a calm setting like a cafe. All the site located on the map directly to the right are within a block from the site, ideal for taking a quick venture into the world.

1. Site
2. Dunkin' Donuts, 2000 Degrees (Paint-Your-Own-Pottery), Comic Swap
3. Fraser Street Mini-Mall: PA Centre County Orchestra, Signature Engraving
4. Green Bowl, Saint's Cafe
5. Allen Street: The Corner Room, Panera Bread, Rapid Transit, Freeze-Thaw Cycles, McLanahan's
6. Memorial Field
7. Agape Coffee House and Sweet Tooth Bakery

Proximity to Local Mainstream Schools
State College School District

Some students will need both the services offered at a special care facility and the academic advantages of a mainstream school. Other children will benefit from the services so much that they will be able to spend most of their days at mainstream schools. The availability of nearby schools is important so that children can effectively split their time between institutions. Each yellow circle on the map directly to the right represents 1-mile radii increments from the chosen site, located at number 1.

1. Site
2. State College High School
3. Easterly Parkway Elementary School
4. Corl Street Elementary School
5. NHS Autism School



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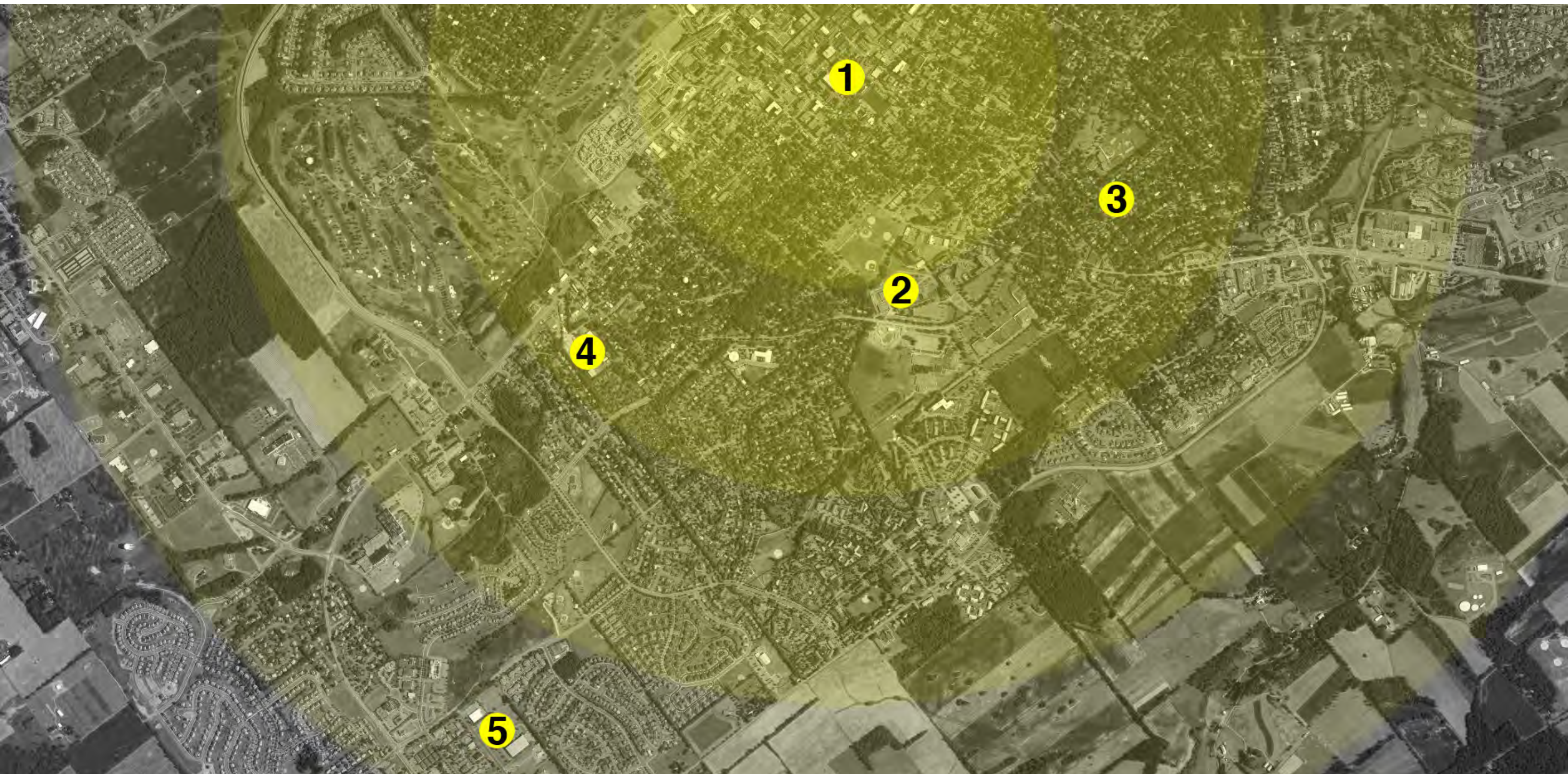


1
3
2
4
5

2.4 SITE PARAMETERS

SITE AND CONTEXT INFORMATION

The Fraser Street lot is located in the Commercial Incentive District (CID) and is surrounded by Commercial (C) zones.

Zoning Requirements
Borough of State College Commercial Incentive District

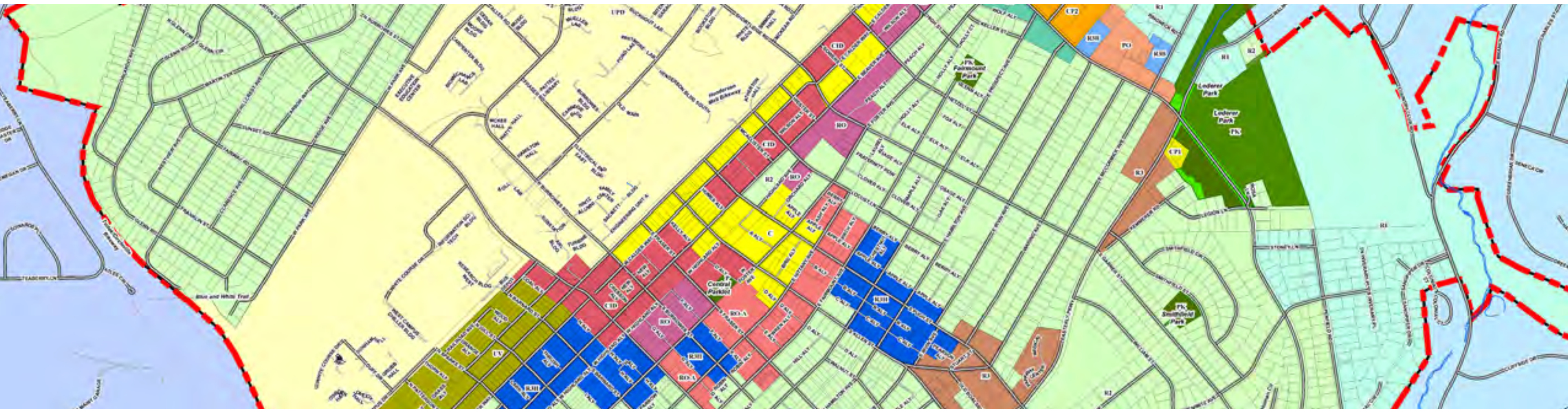
FAR and Building Height
Section 1803.f.2.a states that the FAR for the chosen site and use will be 2.5. The maximum allowed building height is 65 feet, as stated by Section 1852 Building Height. Incentives are shown in the chart to the right.

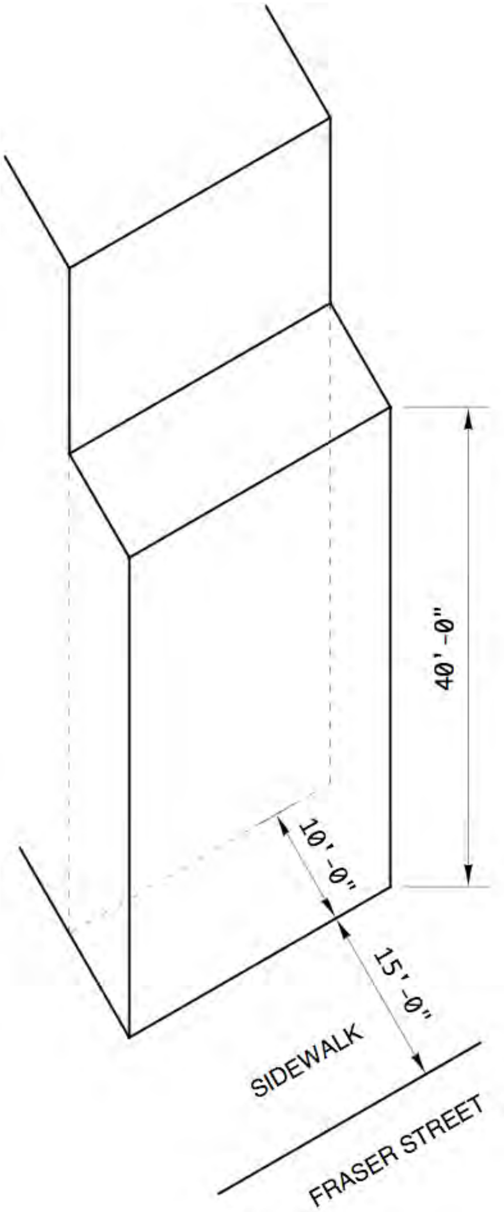
Parking
According to Section 2403.c Number of Spaces Required in Off-Street Parking, the proposed structure will provide 1 parking space per 500 square feet of gross floor area. The code also states that area allotted for off-street parking will not be used in FAR calculations. Incentives for reduction in parking are given in the chart to the right.

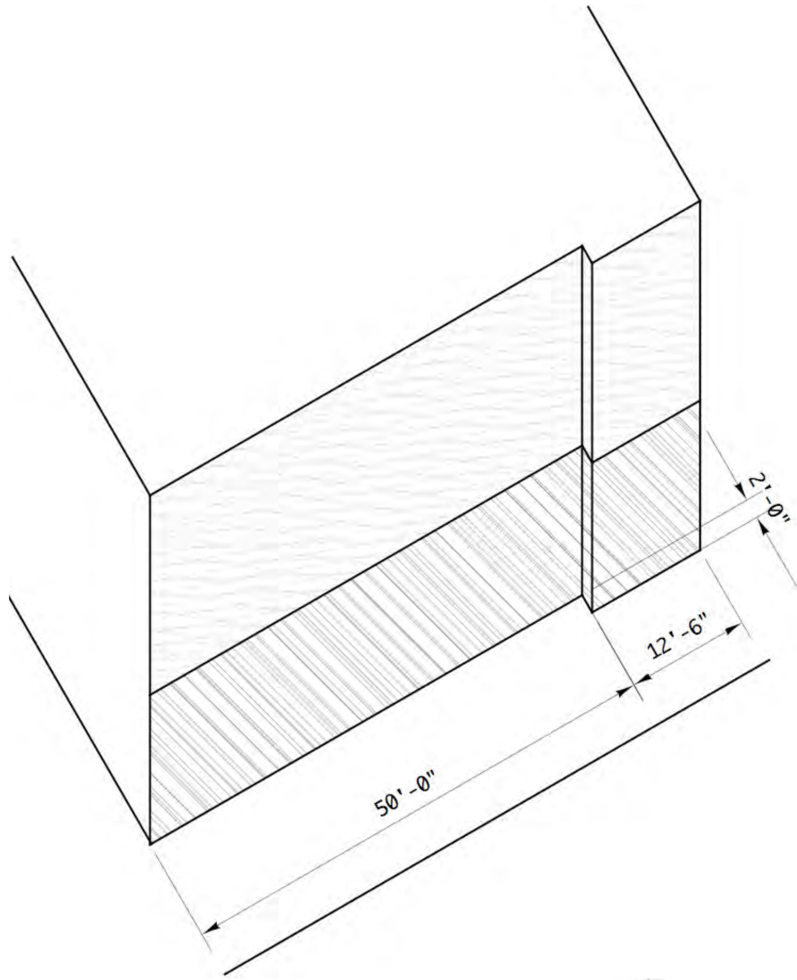
Yard and Facade Requirements
The figures to the right portray the yard requirements as outlined by Section 1851 of the State College Codification of Ordinances. The diagram to the far right shows the requirements outlined by 1853.a Building Facade Offsets.

A maximum of 50 continuous feet is allowed without interruption. However, a minimum of 25% of the total facade length must be offset, forward or backward, a minimum of 2 feet. The offset length may be cumulative.

Additionally, the ground floor must have distinct architectural features, such as an arcade, totalling at least 60% of the facade's length.

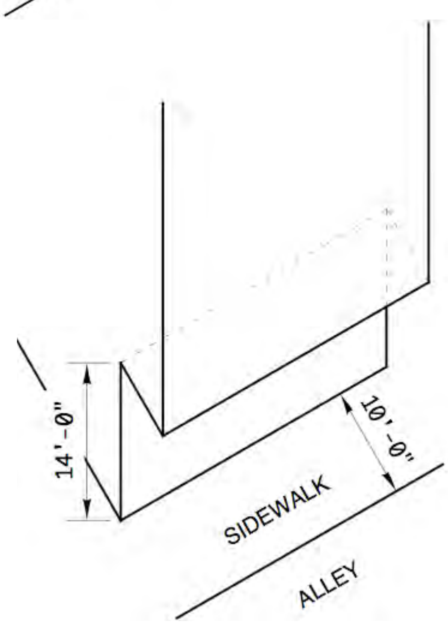






Incentives/Bonus Schedule
(Each Incentive shall be eligible to Earn One or More Bonuses)

Incentives (Building)	**Bonus – Increase in Building Height**	**Bonus – Increase in Floor Area Ratio (FAR) for Residential Use**	**Bonus – Reduction in Required Parking**
Front Building Setback = 25 feet or more	1 story (not to exceed 10 additional feet)		20%
Green Certified	1 story (not to exceed 10 additional feet)		***10% - 20%***
Underground Parking	1 story (not to exceed 10 additional feet)		Each underground parking space = 1.5 spaces in a surface lot or above grade structure
Incentives (Uses)			
Owner Occupied	Up to 2 stories (not to exceed 20 additional feet)	1.0	30%
Street Level Commercial where not required	1 story (not to exceed 10 additional feet)		20%
Retail/office (mixed use)	Up to 3 stories (not to exceed 10 additional feet per story)		



PROGRAM

3.1 PROGRAM TYPE, DESCRIPTION, AND GRAPHIC REPRESENTATION

Education, Therapy, Research

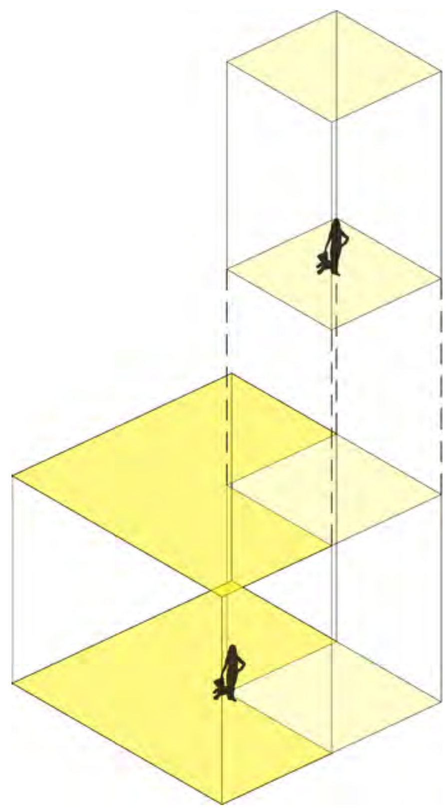
According to local school districts, there are currently 60 students with autism enrolled in the special education departments in grades K-5, and an additional 31 students in grades 6-9.

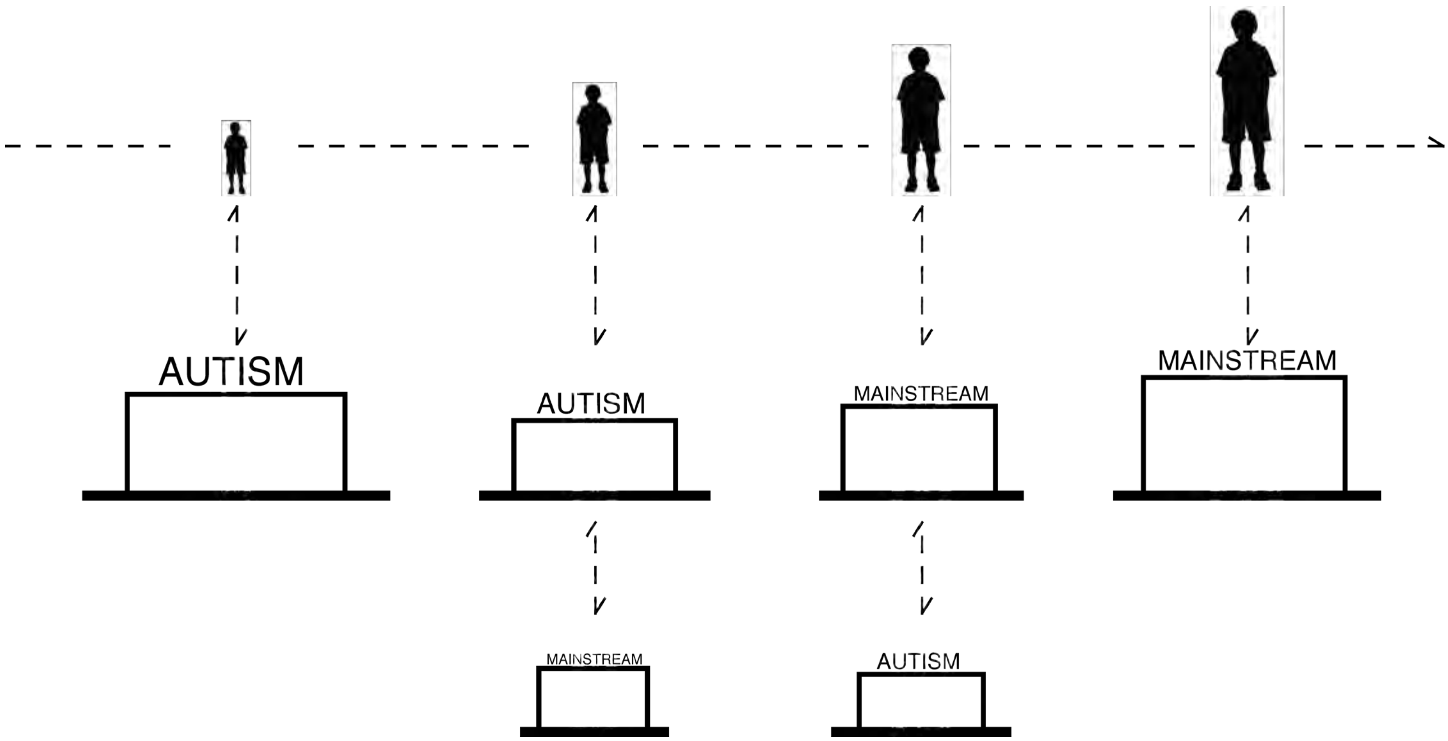
This education center will accommodate approximately 60 students in grades Pre-K - 9 with low- to moderate-functioning autism. The educational model is described in the diagram to the immediate right. Though a child may begin services with the need to spend all of his time at a school for autism, as he develops and learns to cope with his sensitivities he should begin to split his time between the school for autism and a mainstream school. Eventually, the goal is that the student should spend all day at a mainstream school. The purpose of curriculum at the school for autism is to provide the necessary services and therapies to help each child progress to the point where he no longer needs such intensive services.

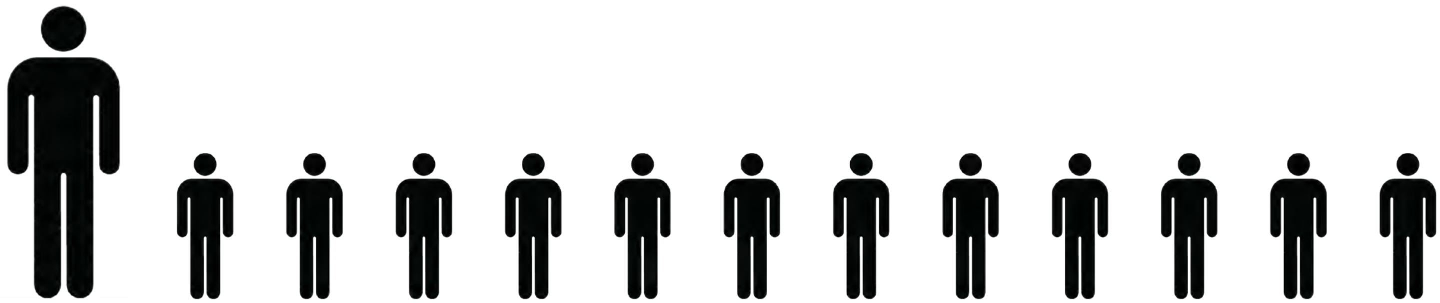
In addition to the education and therapy related program required for children with autism, the facility will also incorporate spaces designed for the observation and evaluation of students' progress. These spaces will allow professors and students from Penn State to conduct research both on autism itself and on the effects of architecture on the development of children with autism.

In a typical school setting, each child is allotted approximately 50 square feet. Because of the intricate spatial needs for children with autism, however, this number must increase. In her Master's Thesis entitled "Architecture of Autism," Maria Valdez determined that the appropriate spatial allowance for children with autism is approximately 250 square feet.

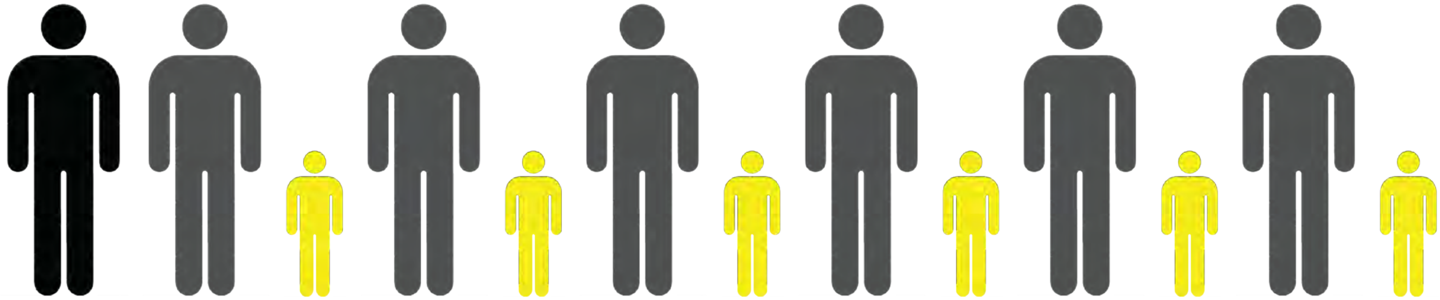
There are many reasons for this increase. First, children with autism require more "stuff" - more materials per child for their different types of therapies than children without autism. Second, the ratio of classroom aid to student for children with autism is 1:1 in addition to the general teacher, drastically different from the typical 1:12 (or lower) ratio seen in typical elementary schools. Third, children with autism often have a larger definition of "personal space."







Typical Classroom Distribution



Autism Classroom Distribution

3.1 PROGRAM TYPE, DESCRIPTION, AND GRAPHIC REPRESENTATION

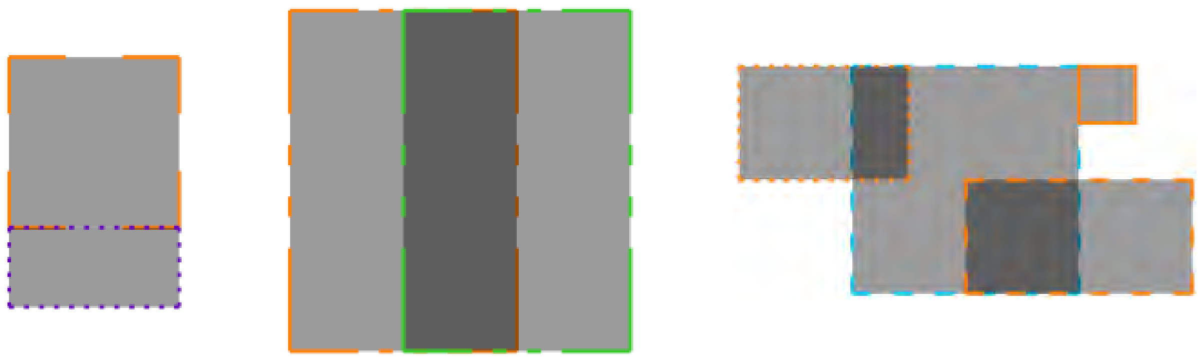
PROGRAM

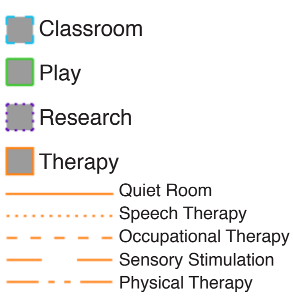
Because of the nature of some therapies, certain adjacencies would be possible, recommended, or even required, as displayed below.

Each classroom should include a quiet room. Speech and occupational therapies may be included as secondary functions to the classroom.

Physical therapy requires the use of large equipment, such as swings and trampolines. This type of therapy is often most enjoyed and can be associated with play.

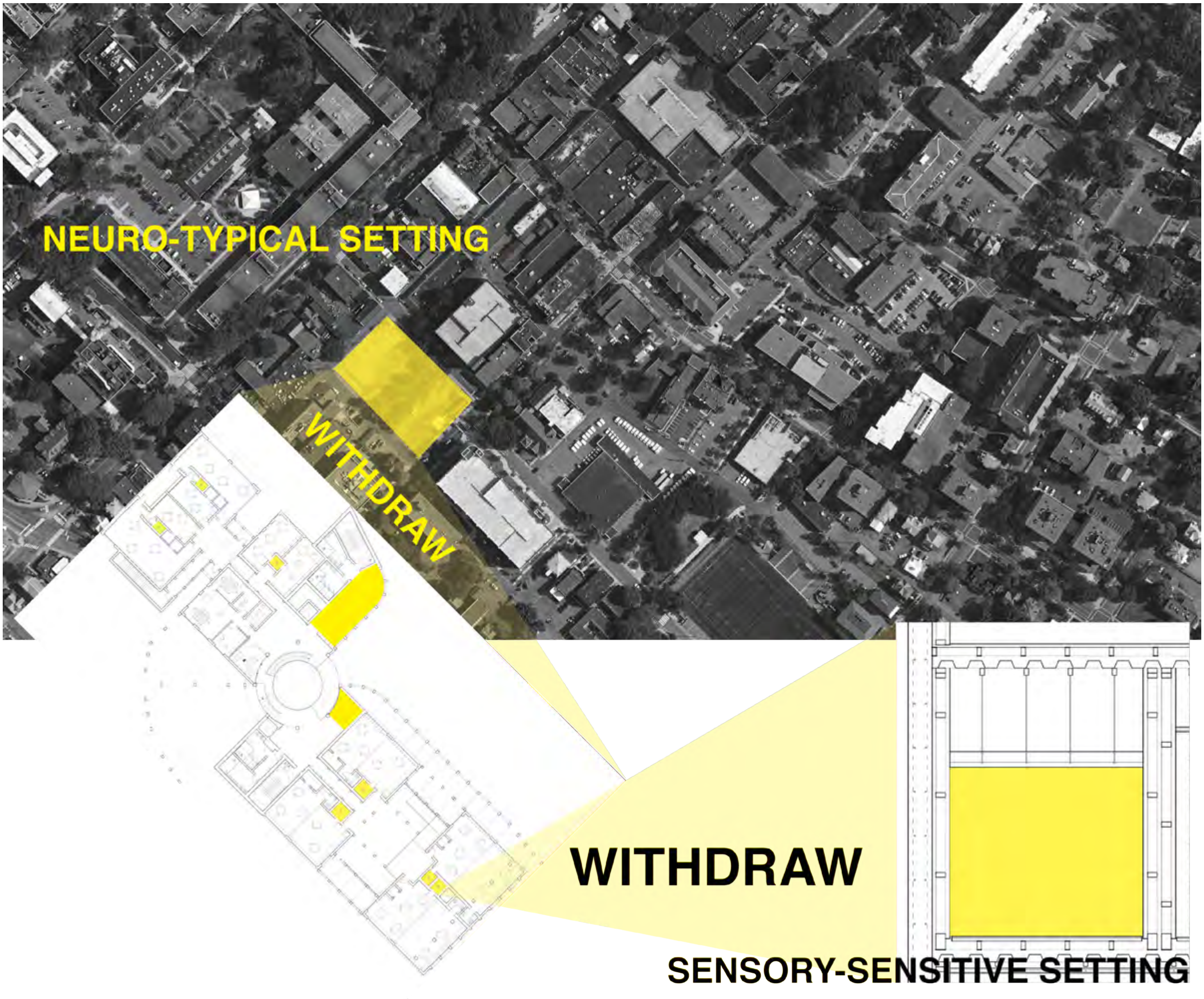
The sensory stimulation room should not be adjacent to classrooms. Here, the children will be exposed to sensory stimuli that push their comfort zones, and could therefore cause bad behavior. Because of this risk, it would be advantageous to prevent negative associations with other, more common activities.





The building will function as a safe-zone within the larger context of the site. Children will learn to cope with their sensitivities within the school, which is sited in a neuro-typical urban context. The design of the school itself is a mix of neuro-typical and sensory-sensitive design. Within the school are small, highly adaptable spaces. These rooms or zones are designed to be highly sensory-sensitive. The image to the right indicates the hierarchy of design from neuro-typical to sensory-sensitive and how that hierarchy relates to the scales of the project. As the scale of the spaces gets smaller, the design gets more sensory sensitive.

As a child experiences the site, he knows that the school is nearby if he needs a safe place to withdraw. Similarly, while in the school, he knows that there are multiple, comfortable spaces into which he can withdraw when the therapies and courses become overwhelming.


NEURO-TYPICAL SETTING
WITHDRAW
WITHDRAW
SENSORY-SENSITIVE SETTING

3.2 PROGRAMMATIC ELEMENTS

PROGRAM

Therapies can be conducted as group activities or on an individual basis. Because each child is different, decisions about the ideal mix of therapies must be decided for each student. When therapies can take place within the class setting, the classroom can be used. For this reason, class room space must be highly adaptable.

When students must undergo therapy in a smaller group or in a one-on-one setting, however, a separate space will be required.

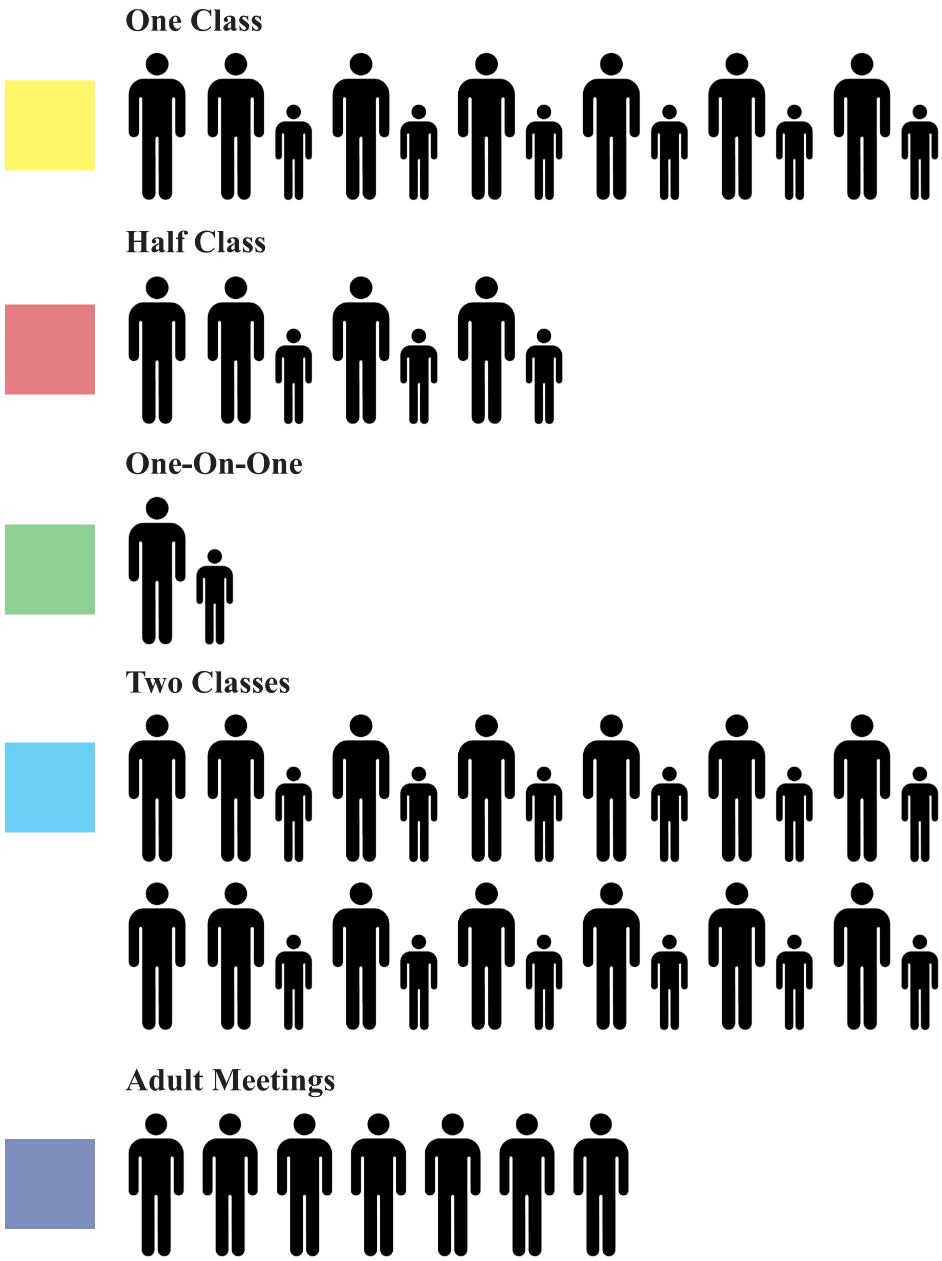
Some therapies require equipment. Occupational therapy helps to develop fine motor skills, including activities where students work with their hands. Physical therapy addresses gross motor skills and often requires equipment like trampolines, swings, and other gym equipment.

The sensory stimulation room would be used for desensitizing students to everyday stimuli that they may encounter. Students will work with different textures, smells, or lighting situations. Adaptable work stations and material storage areas will be required within this space.

Additional exterior program will include a loading dock for the cafeteria and accommodation for busses and parents transporting children into the school.

Program Areas	**Total Available Area: 104,075 SF**
Education:	
10 Classrooms	10,590 SF
1 Cafeteria	1,080 SF
1 Multifunctional Space	1,790 SF
1 Office Suite	1,090 SF
1 Indoor Play Space	1,270 SF
1 Outdoor Play Space	4,000 SF
	Total Interior Education: *15,820 SF*
Therapy:	
5 Speech Therapy	1,560 SF
3 Occupational Therapy	1,930 SF
1 Physical Therapy	1,040 SF
10 Quiet Rooms	700 SF
1 Sensory Stimulation Room	1,170 SF
	Total Therapy: *6,400 SF*
Research:	
2 Viewing Rooms	2 X 100 = 330 SF
	Total Research: *330 SF*

Total Program: *22,550 SF*



Education

- 10 Classrooms
- 1 Cafeteria
- 1 Multifunctional Space
- 1 Office Suite
- 1 Indoor Play Space
- 1 Outdoor Play Space

Therapy

- 5 Speech Therapy
- 3 Occupational Therapy
- 1 Physical Therapy
- 10 Quiet Rooms
- 1 Sensory Stimulation Room

Research

- 2 Viewing Rooms

Circulation (40%) = .4 X 22,550 = *9,020 SF*

Total Area: ***27,780 SF***

DESIGN PROJECT

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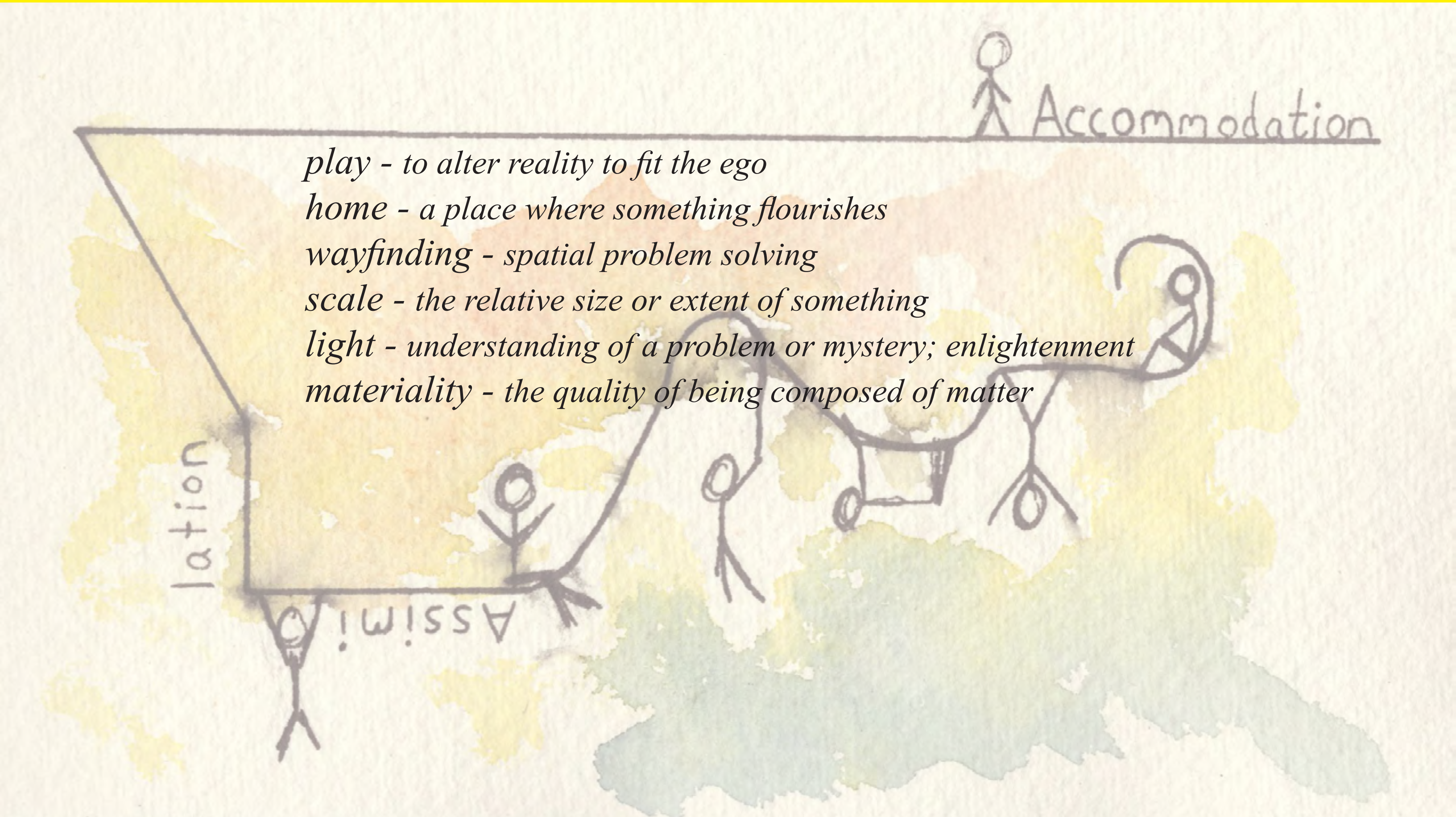
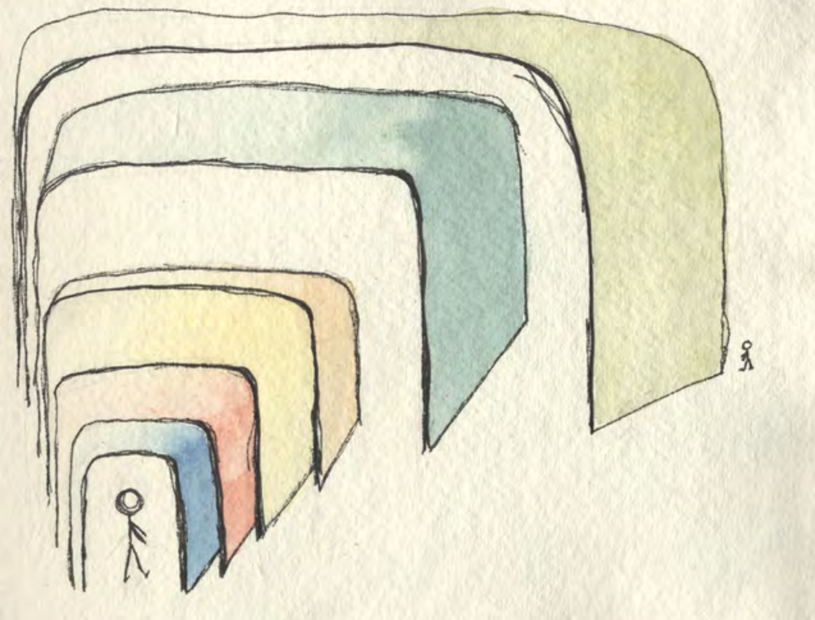
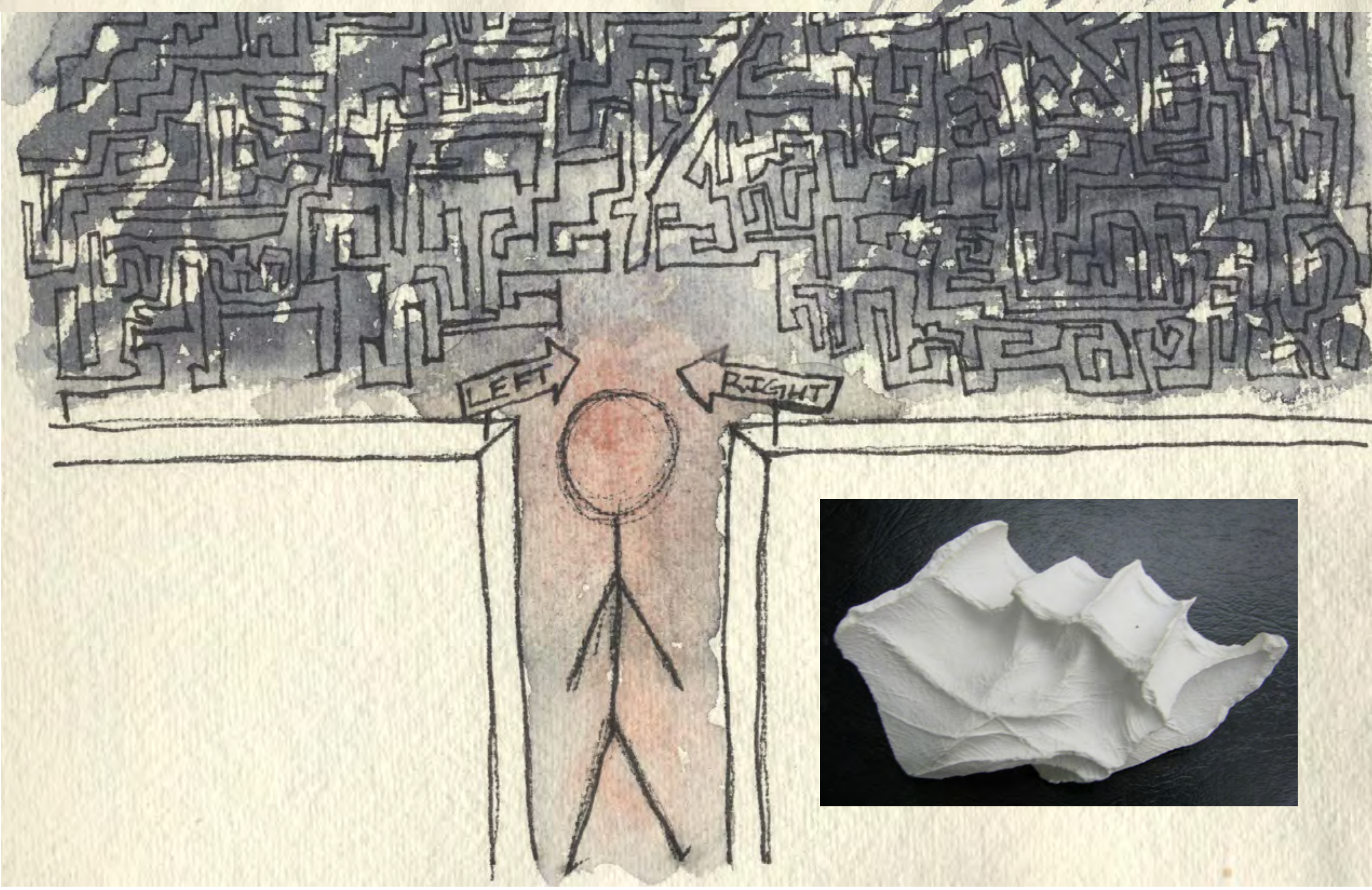
DESIGN PROJECT



play - *to alter reality to fit the ego*
home - *a place where something flourishes*
wayfinding - *spatial problem solving*
scale - *the relative size or extent of something*
light - *understanding of a problem or mystery; enlightenment*
materiality - *the quality of being composed of matter*




LEFT
RIGHT

4.2 SITE

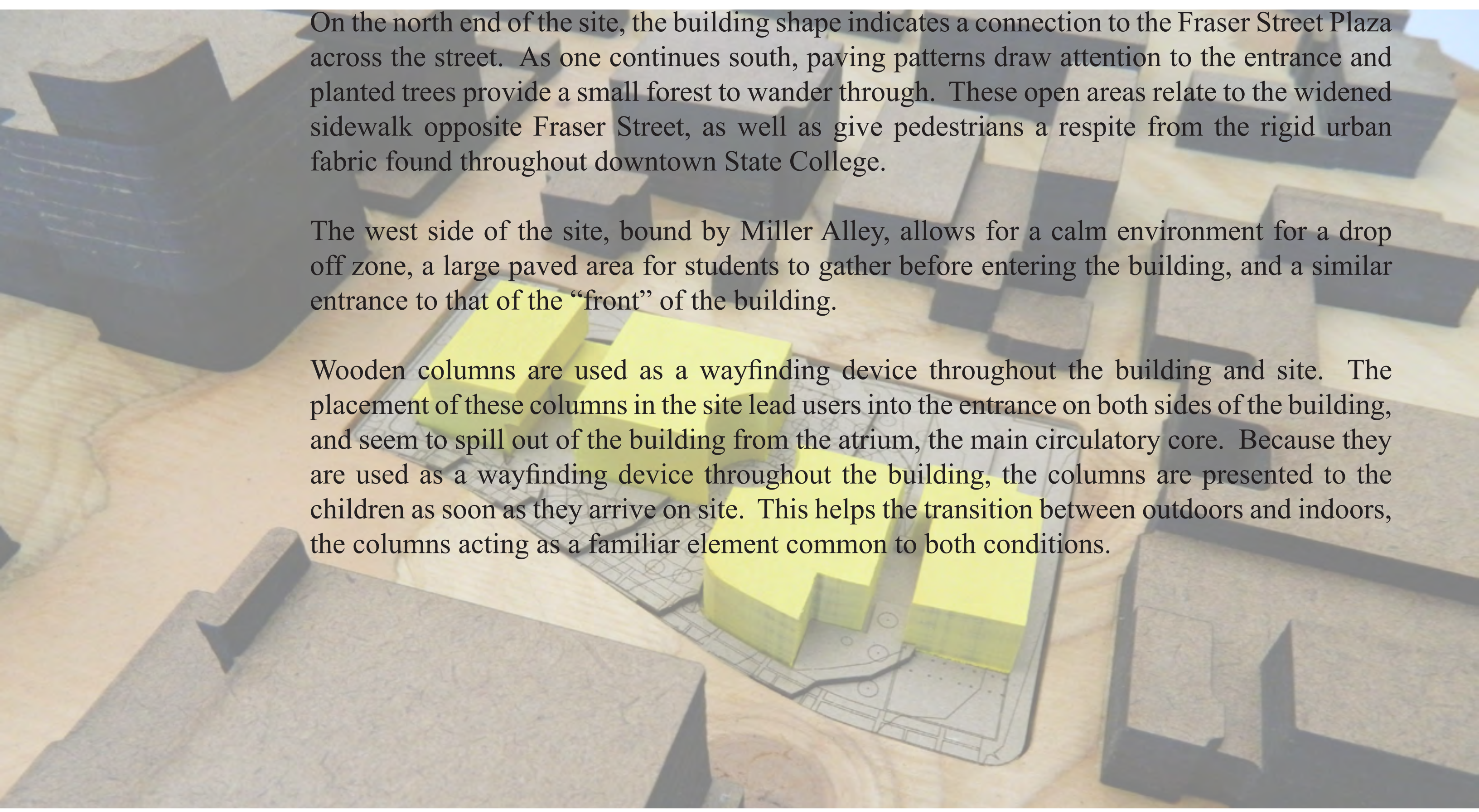
DESIGN PROJECT

4.2.1 Site Plan with Massing

Many considerations were taken into account while siting the building. Much of the determining factors relate to traffic around the entire block.

Bound by Calder Way to the north and Beaver Avenue to the south, the site represents a gradient of traffic. Because Calder Way gets little traffic throughout the entire day, functions that require a more calm atmosphere have been sited toward the north. These include therapies and an outdoor playground area. Beaver Avenue can be quite busy at certain times of day, and so the building has been pulled back slightly from the street. The classrooms are located on the southern side of the site because the activities done in the classroom tend to require less acoustical isolation than the therapies that occur in the northern part of the site.

For security purposed, the public will not be allowed access into the building. Rather than isolating the public from the entire city block, the front yard, facing Fraser Street, is used as public space. This give the site an identity within the public urban fabric. Having the public occupy outdoor areas of the site will also benefit the students. Integration into the public is the goal of the therapies that occur in the building, so it follows that the public should be integrated into the site.



On the north end of the site, the building shape indicates a connection to the Fraser Street Plaza across the street. As one continues south, paving patterns draw attention to the entrance and planted trees provide a small forest to wander through. These open areas relate to the widened sidewalk opposite Fraser Street, as well as give pedestrians a respite from the rigid urban fabric found throughout downtown State College.

The west side of the site, bound by Miller Alley, allows for a calm environment for a drop off zone, a large paved area for students to gather before entering the building, and a similar entrance to that of the "front" of the building.

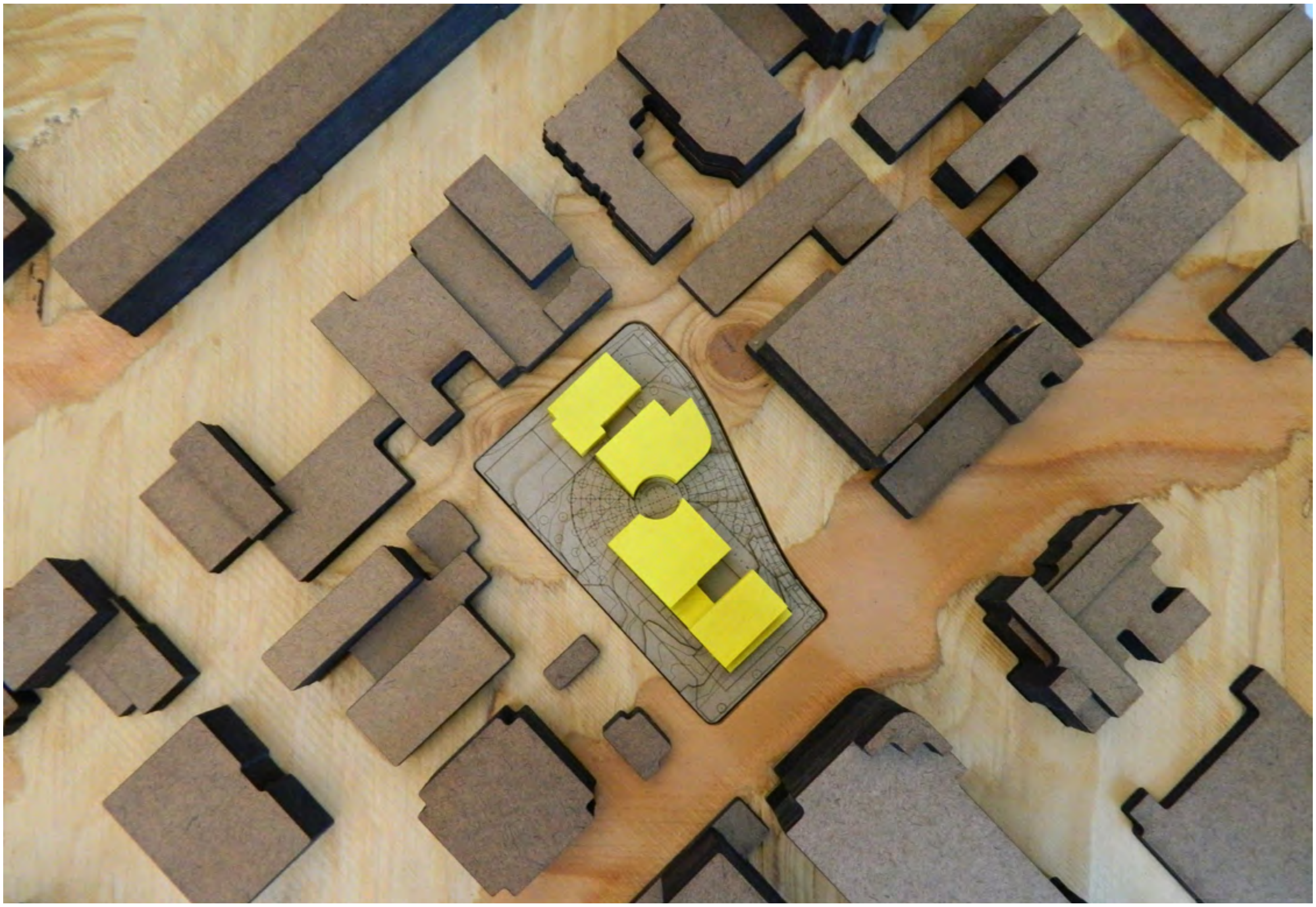
Wooden columns are used as a wayfinding device throughout the building and site. The placement of these columns in the site lead users into the entrance on both sides of the building, and seem to spill out of the building from the atrium, the main circulatory core. Because they are used as a wayfinding device throughout the building, the columns are presented to the children as soon as they arrive on site. This helps the transition between outdoors and indoors, the columns acting as a familiar element common to both conditions.


CALDER
FRASER
STREET
MILLER
ALLEY
ALLEY
PARKING
PARKING
PARKING
PARKING
MH
MH
MH
1143.5
1137.4
1140
1150
1151.2
1151.6
1155
1160
1145
1145.3
1142.3
1152.6
1153.3
1152.8
UP/L
S.C.O

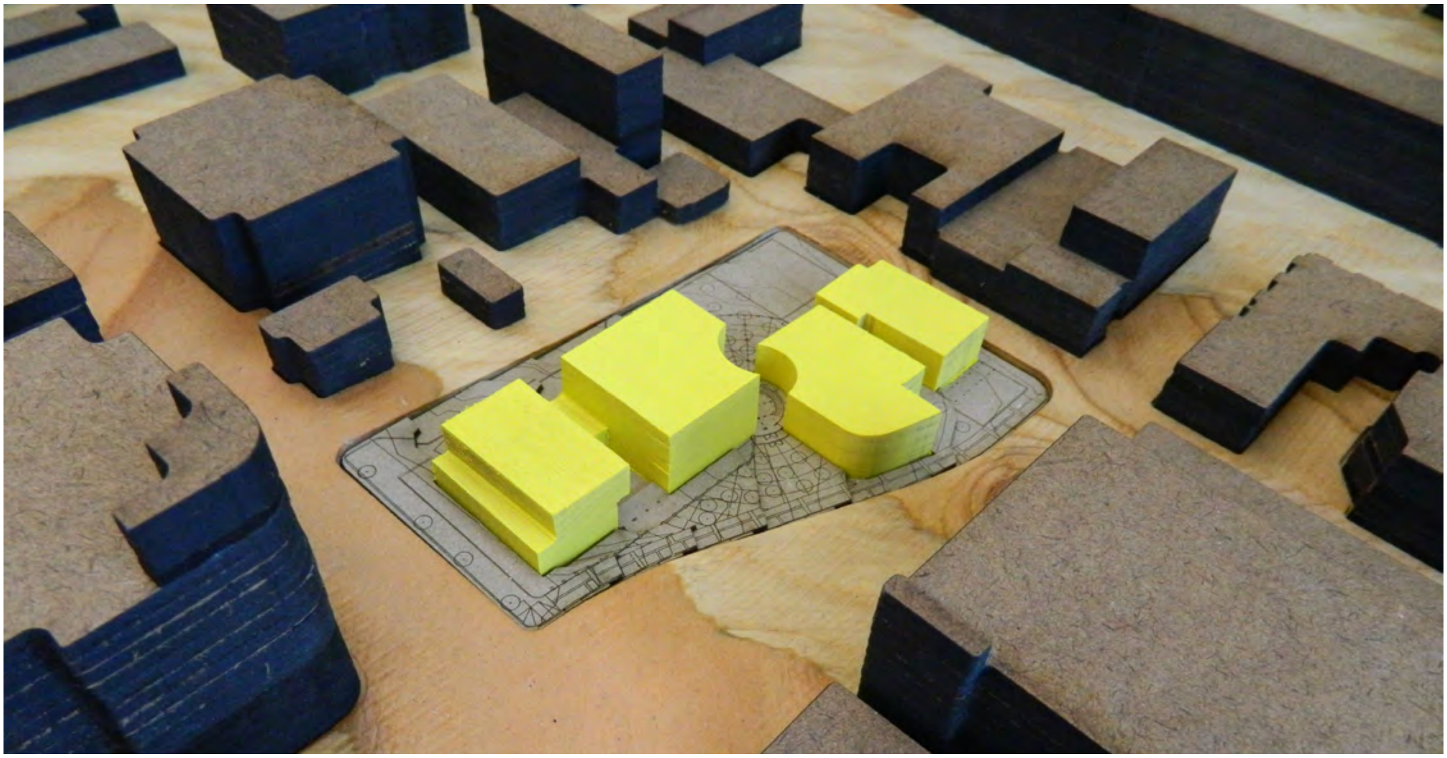
Site Plan

DESIGN PROJECT

4.2.2 Site Section with Massing
4.2.3 Site Model with Massing



Site Section with building mass



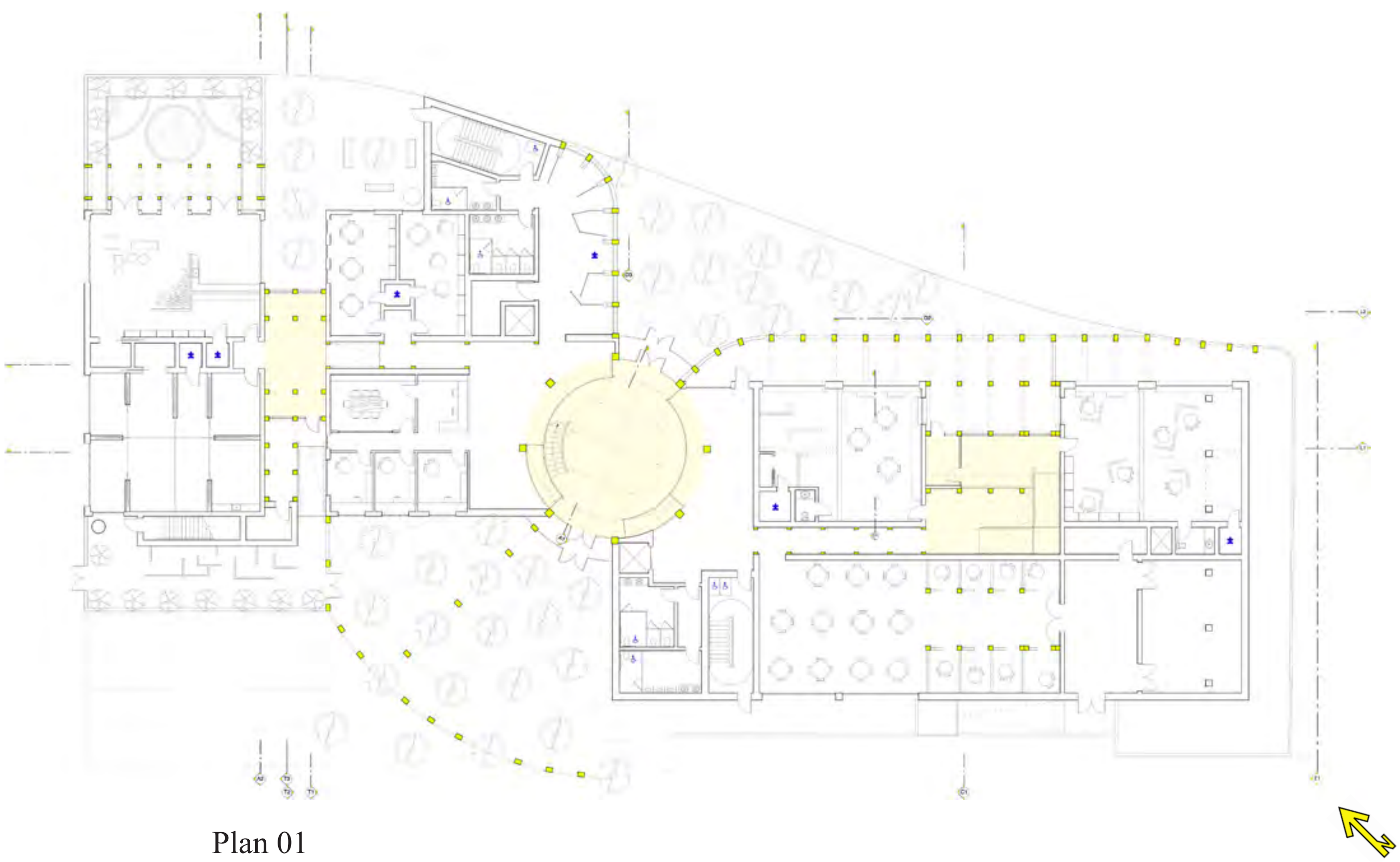
DESIGN PROJECT

In considering the ideals that emerged during the research portion of the project, most emphasis was placed on creating a circulation pattern that is intuitive to navigate.

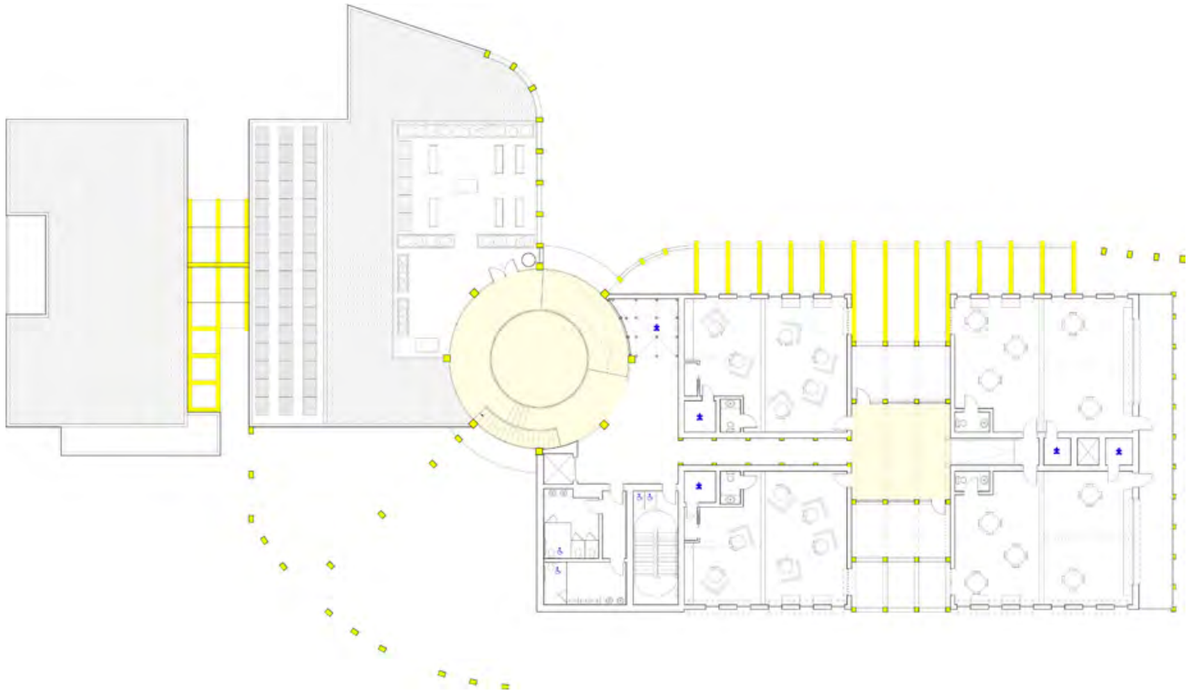
When a child enters the building, he is confronted openly with the vertical circulation of the building. As soon as he enters the space, he is aware of how to get to any floor of the building because he can see quite easily how the stairs and ramps connect the different levels.

In plan, circulation options are limited. Each space is serviced by one hall which leads to a "destination." Natural light guides children through a short hall to the area where a decision must be made. Choices are limited, however, and will be differentiated by color based on their function.

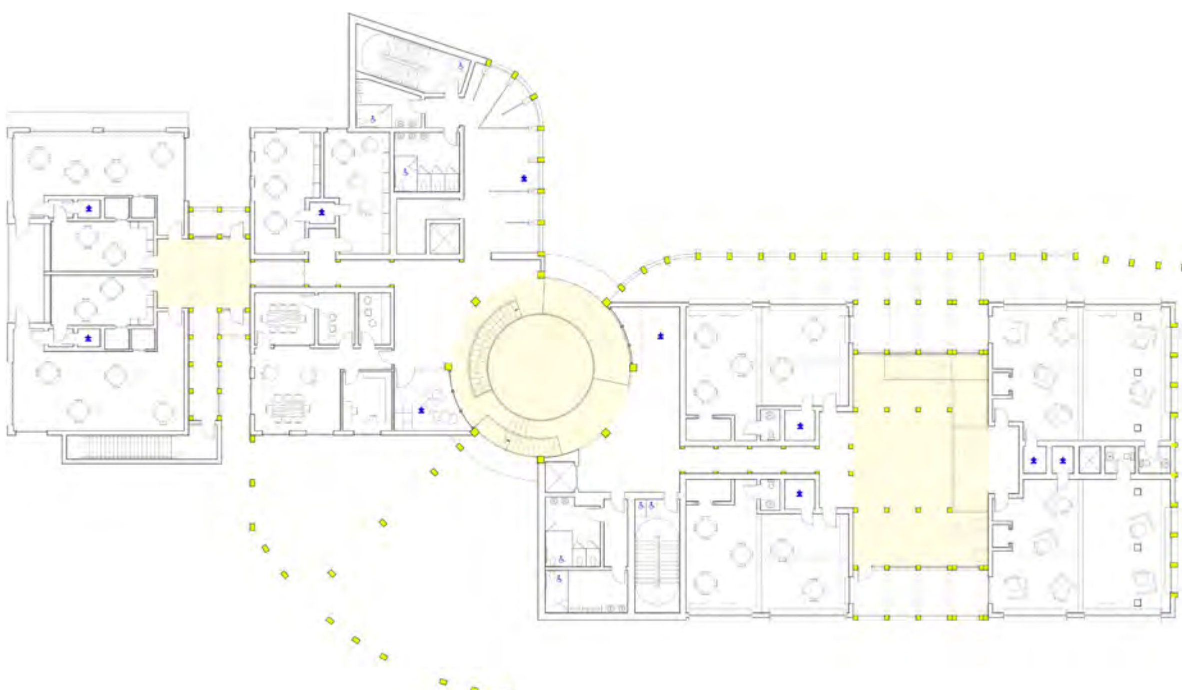
Circulation space is ample and provides many pockets to gather and play throughout the day. The variety of different types of spaces - based on shape, quality of light, scale, and materiality - allows for gentle exposure to similar types of spaces which would be encountered in every day life, while still allowing for individuals and their aids to choose which area is ideal for their present level of development. Children may linger in the spaces which make them feel most comfortable and pass quickly through spaces which do not.



Plan 01



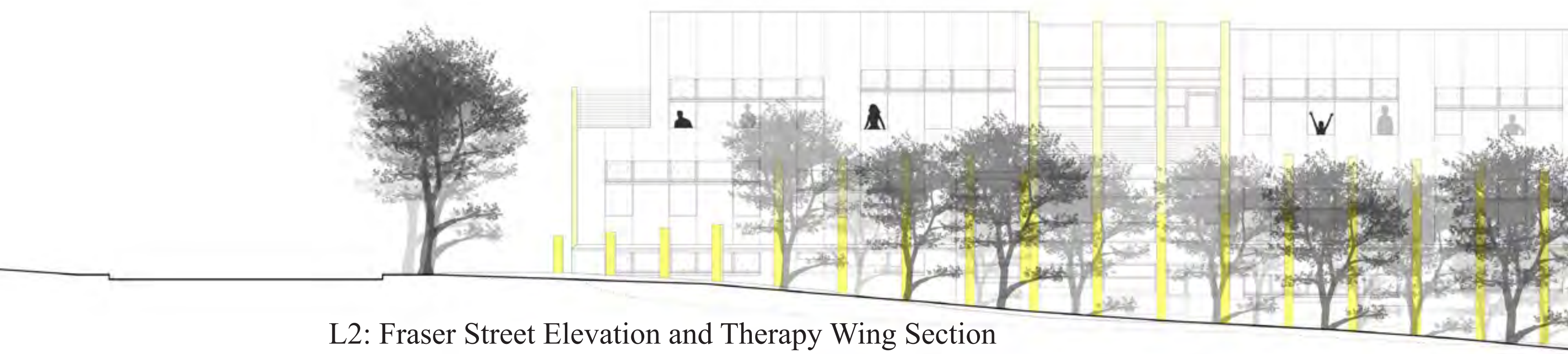
Plan 03



Plan 02

DESIGN PROJECT

Shown below are the elevations which face the most public sides of the site. Beaver Avenue (bottom) has a variety of scales at the street, but the buildings directly adjacent to the site are low, two story buildings. The Autism Center is three stories at this location on the site, but the first floor is sunk mostly underground to match the scale of the surrounding street. The circulatory columns on this southeast facade are attached to the building and extend above floor level, creating a barrier for the balcony accessible by the third floor classrooms. This treatment is echoed further north on the site, seen below in section as the facade for the circulatory playspace and occupiable roofspace.

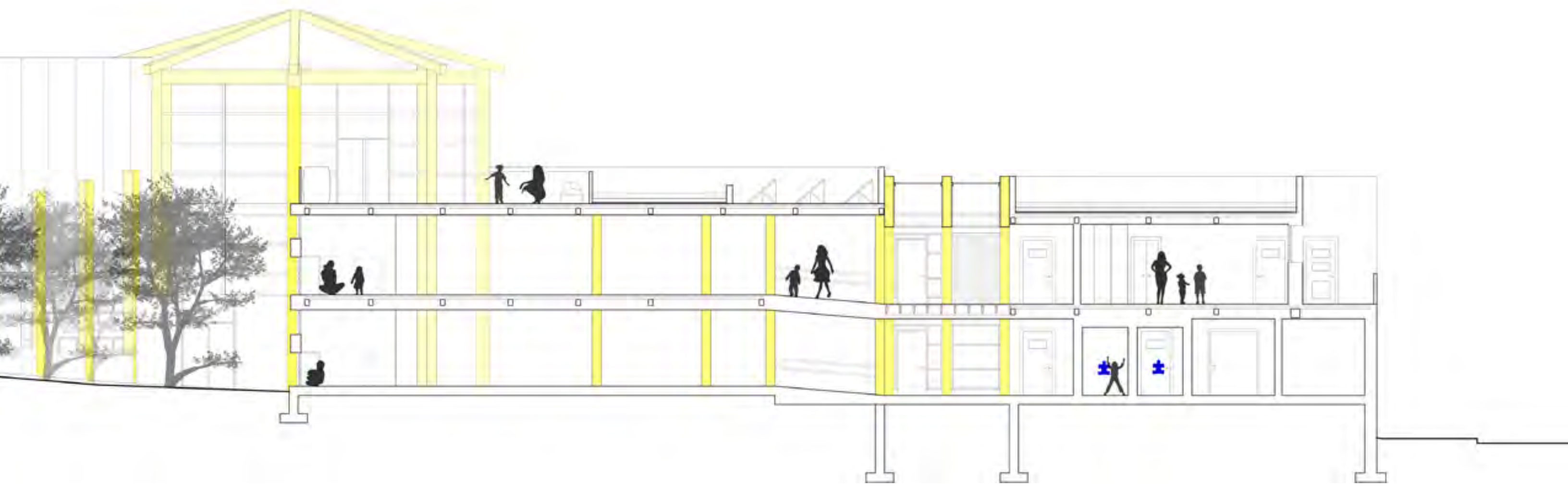


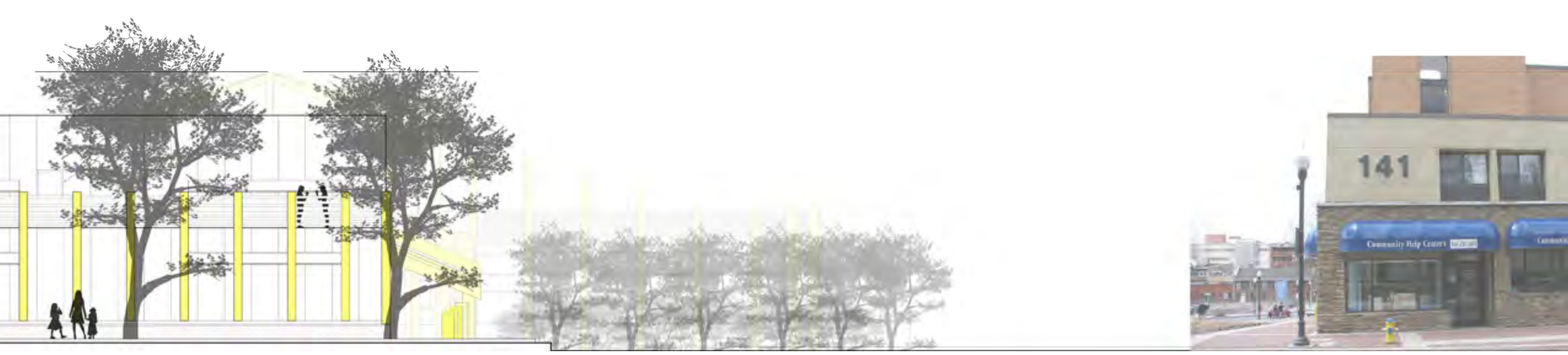
L2: Fraser Street Elevation and Therapy Wing Section

E1: Beaver Avenue Elevation

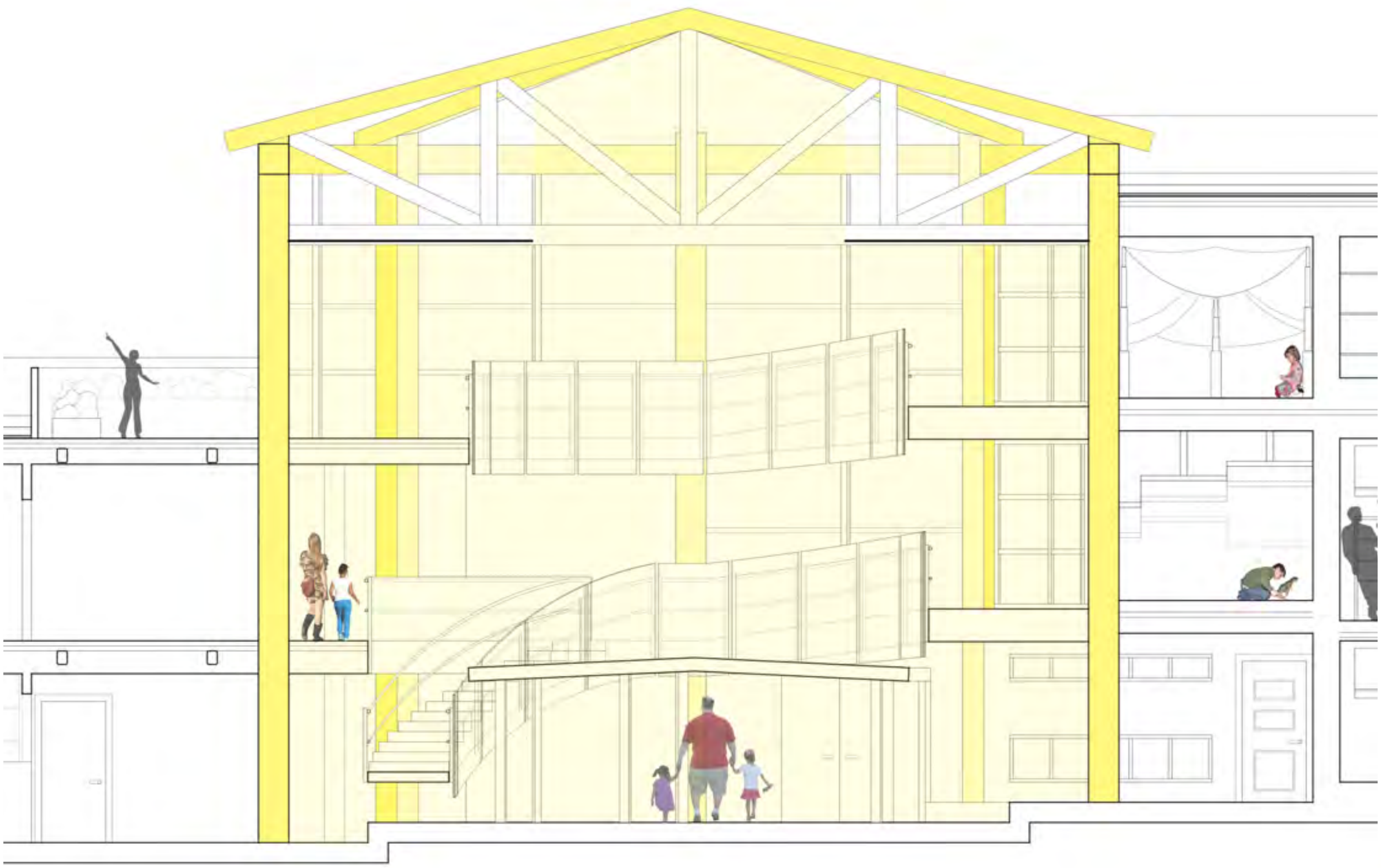
The Fraser Street facade also features the circulatory columns. In this case they frame a brick wall which secures an exterior walkway adjacent to the classroom wing. These columns are integrated into the truss system which characterizes the circulation node in the classroom wing, drawing the indoors outside.

These columns wind their way through the exterior of the site, circulatory atrium, hallways, and end with the circulation nodes in both the classroom wing (shown in elevation) and therapy wing (shown in section).

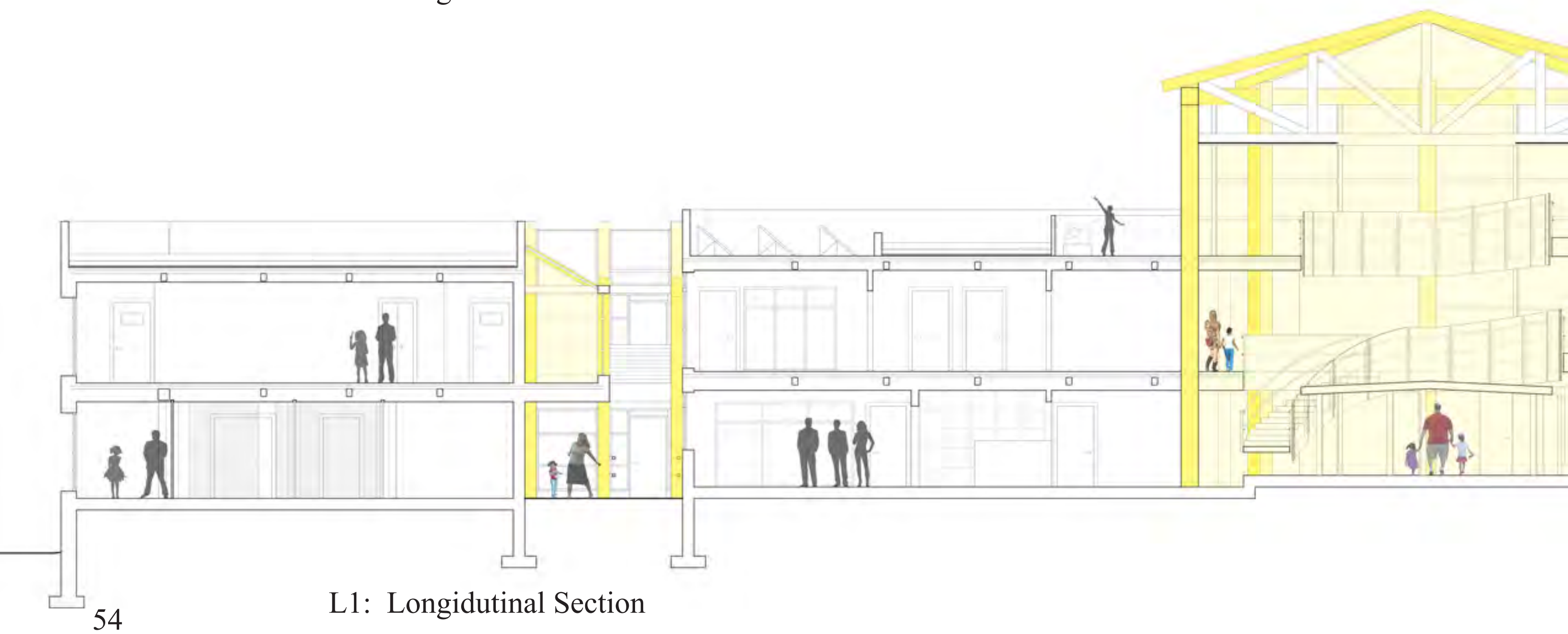




DESIGN PROJECT

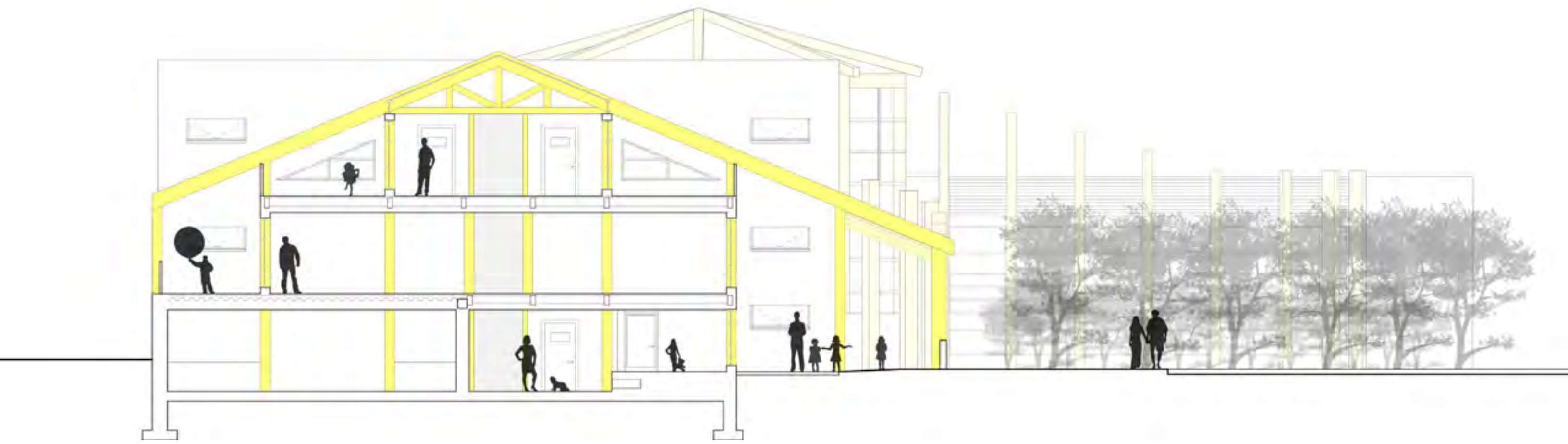


L1: Longidutinal Section: Circulation Core: Atrium



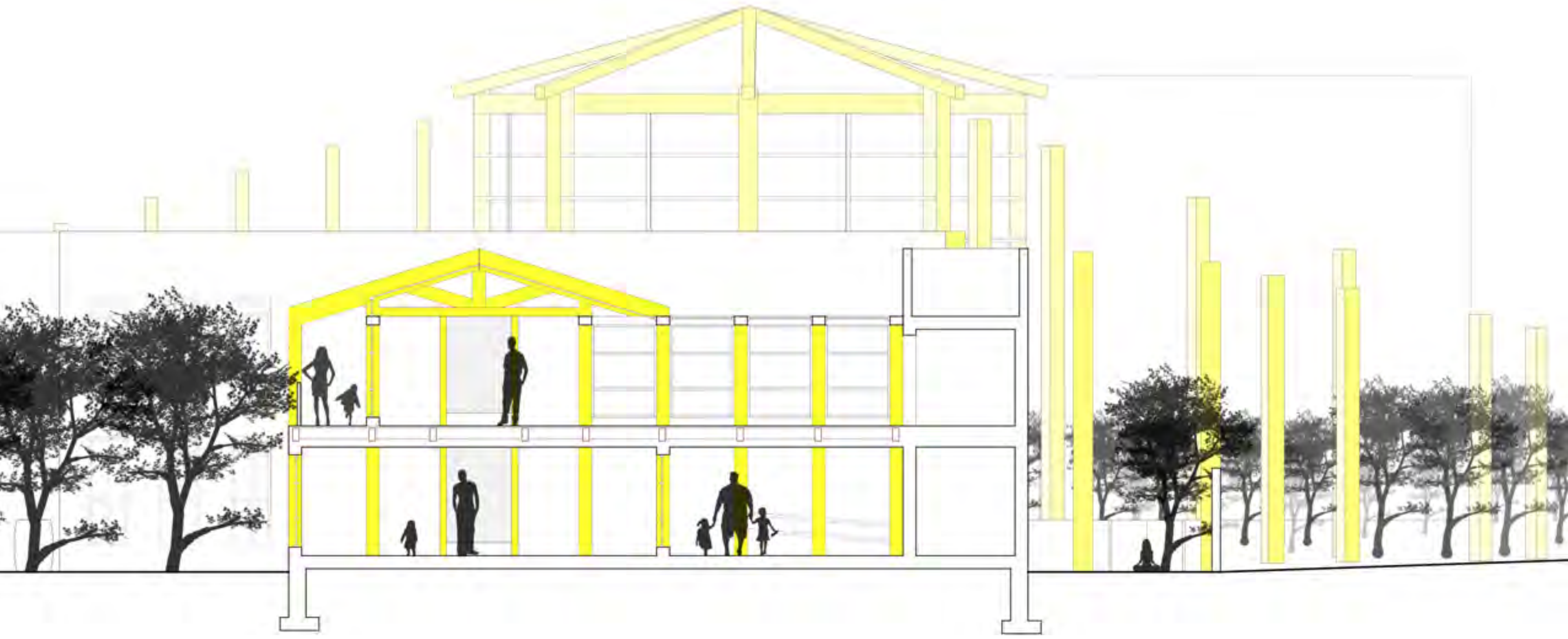
L1: Longidutinal Section

Because the large, open space of the atrium can be intimidating for children with autism, measures have been taken within the space to reduce the scale. Railings, for example, extend further than usual above and below the floor plate to minimize direct views throughout the space. A canopy makes the ground floor space a single story height. The radius of the opening is reduced as one ascends the building, causing a pinching visual effect as one gazes upward toward the massive wooden trusses. The circulation nodes in the classroom and therapy wing mimic the spatial qualities of the atrium by use of similar construction techniques: the use of glass and wood, as well as the sloped roof and truss system, is reserved for the circulation nodes in the building.

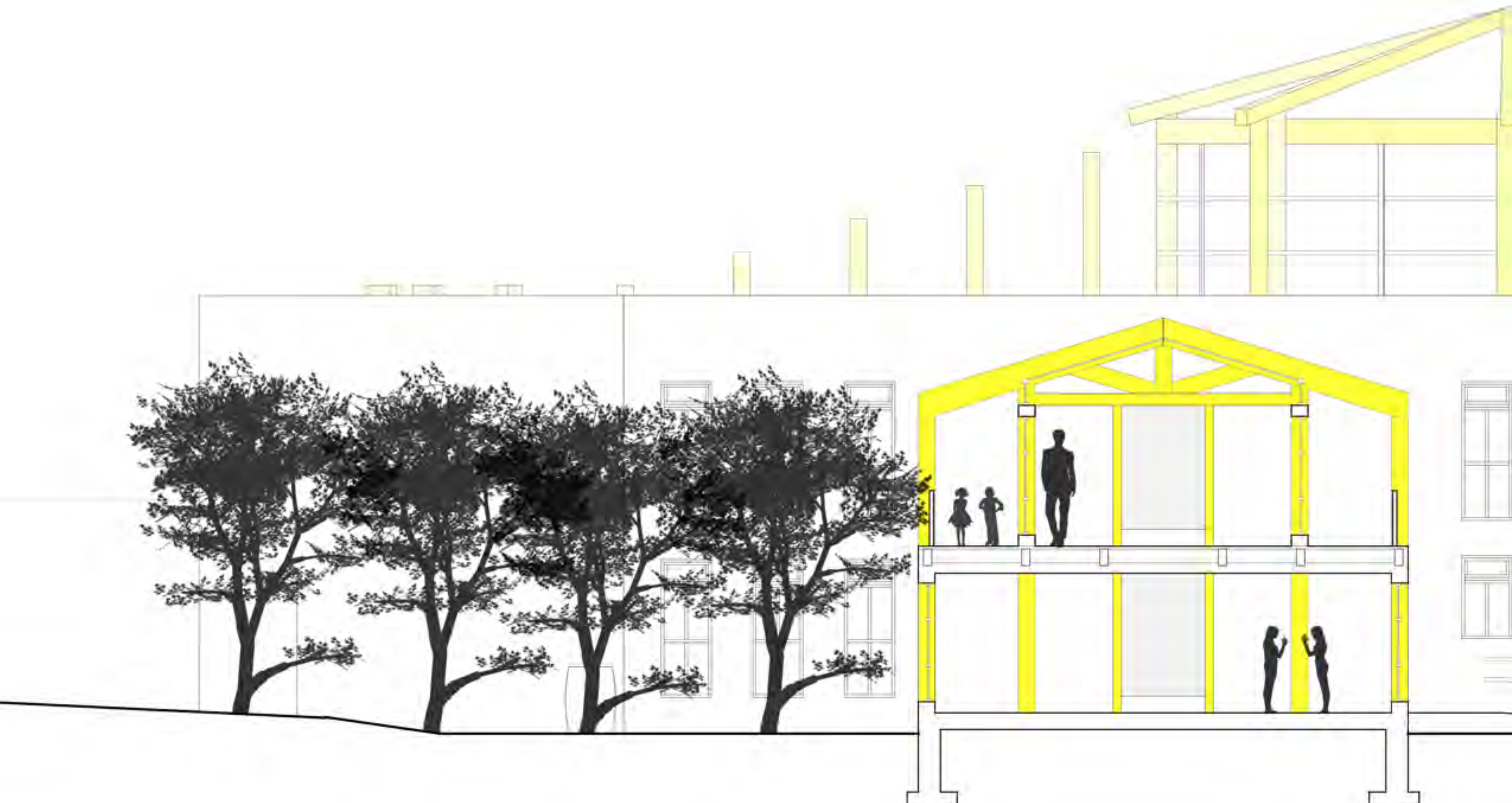


C1: Classroom Wing Circulation Node Transverse Section

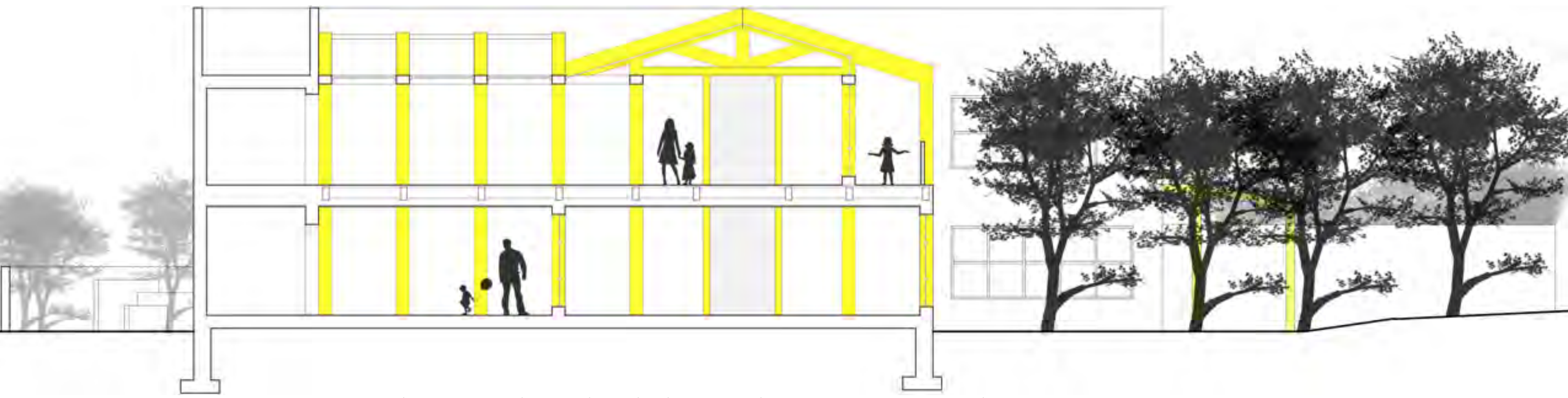
DESIGN PROJECT



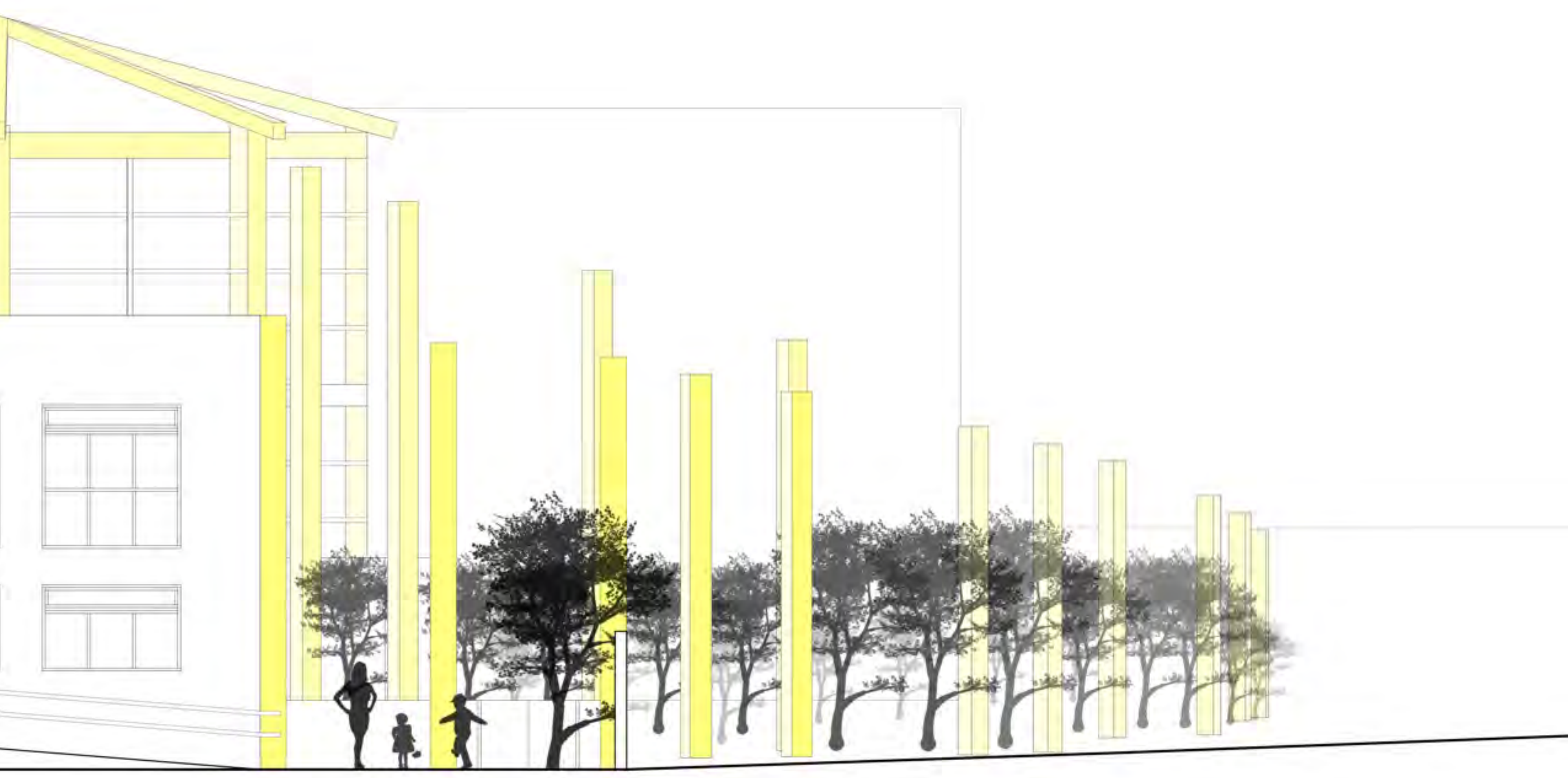
T2: Therapy Wing Circulation Node Transverse Section



T1: Therapy Wing Circulation Node Transverse Section



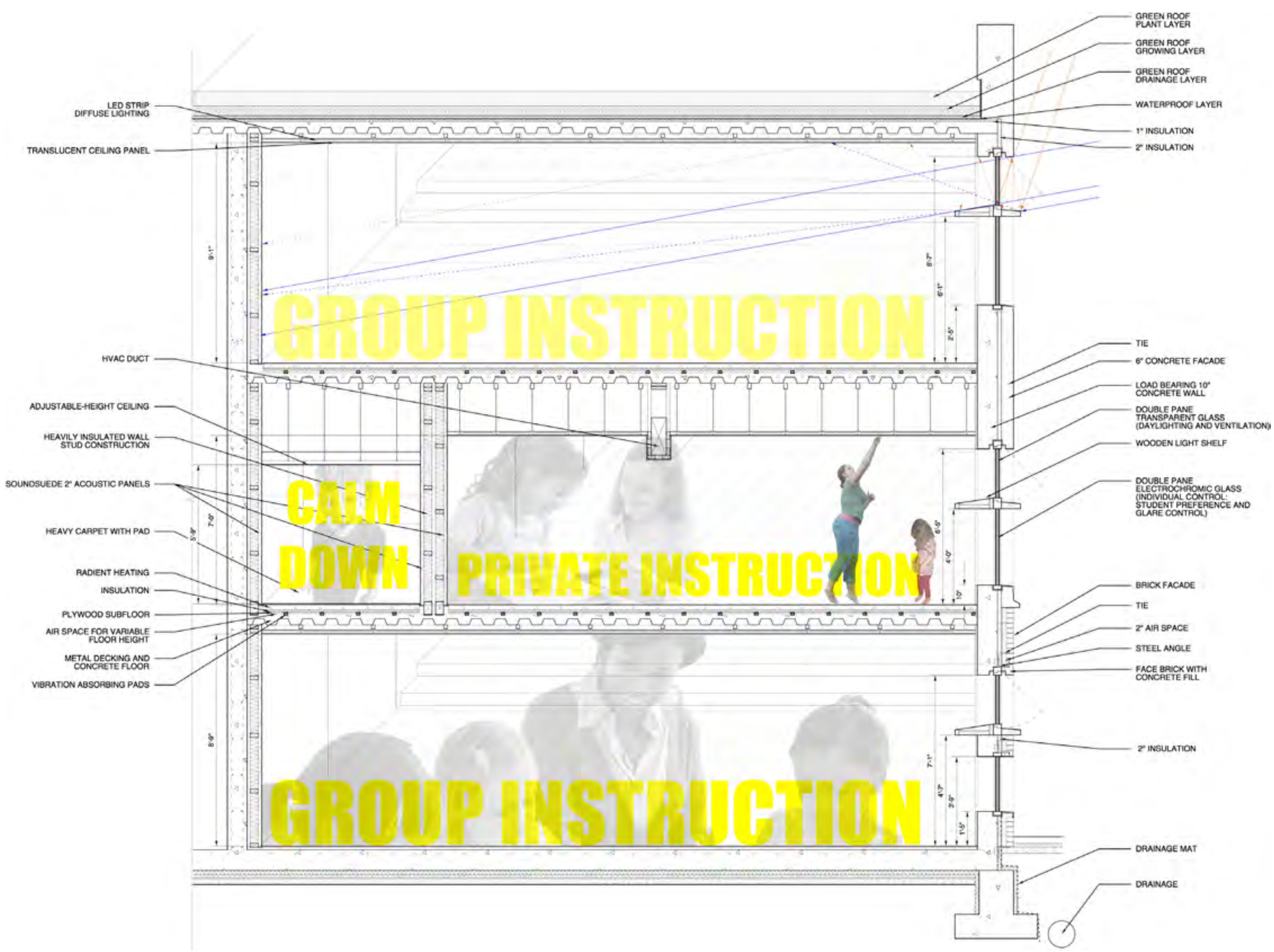
T3: Therapy Wing Circulation Node Transverse Section



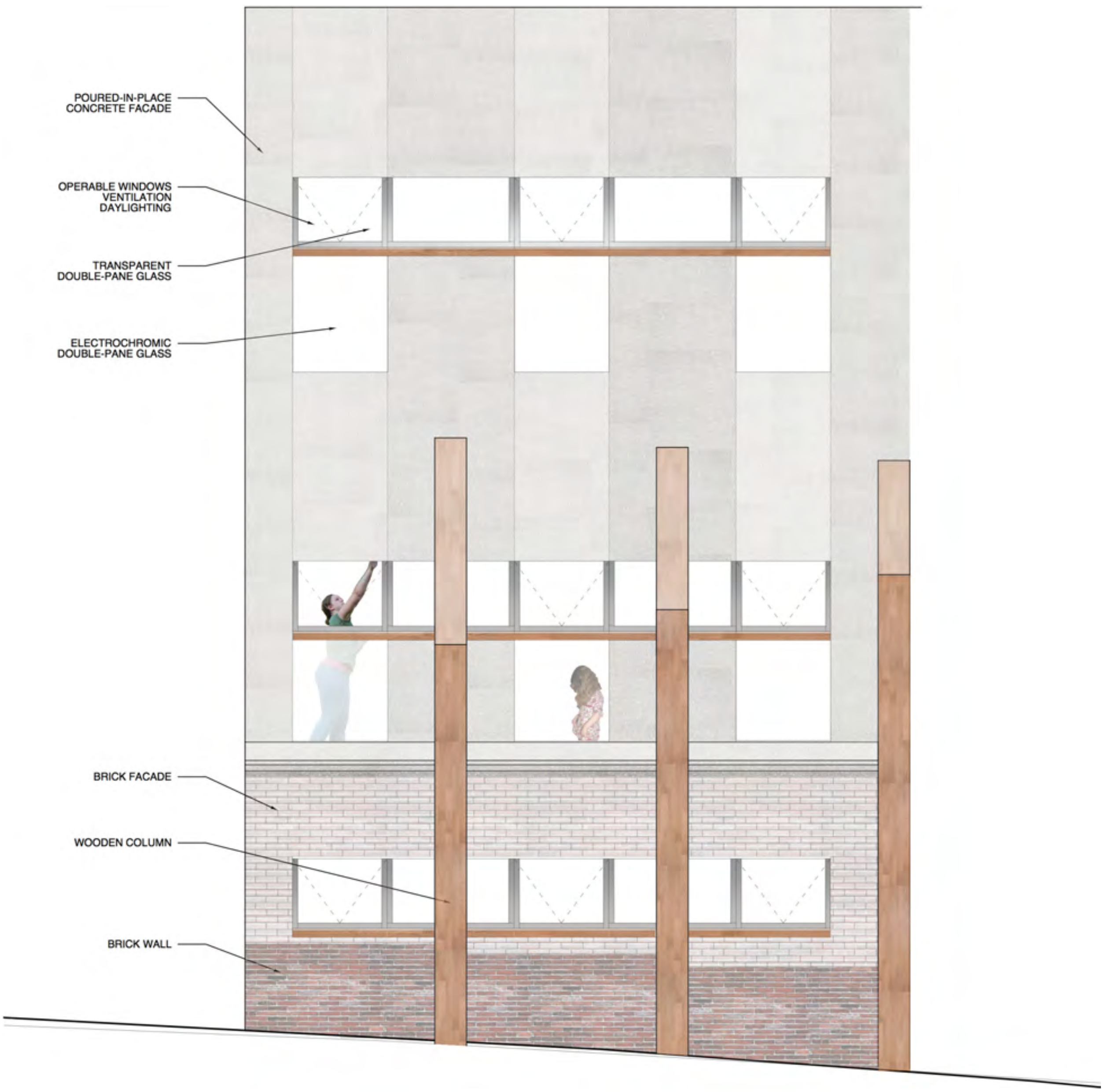
4.5 WALL SECTION AND FACADE STUDY

DESIGN PROJECT

The detail below and corresponding elevation to the right show the structure and materiality of the facade. Brick, concrete, and wood are materials that are used often in architecture that the students would have certainly encountered in their daily lives. These materials have an inherent comprehensibility that make them well suited materials for use by children with autism. Brick and concrete are heavy, massive materials which put forth the notion of stability and security, while wood is understood to be a lighter, soaring material which expresses the lightness and freedom which the circulatory spaces represent.



D1: Detail Section

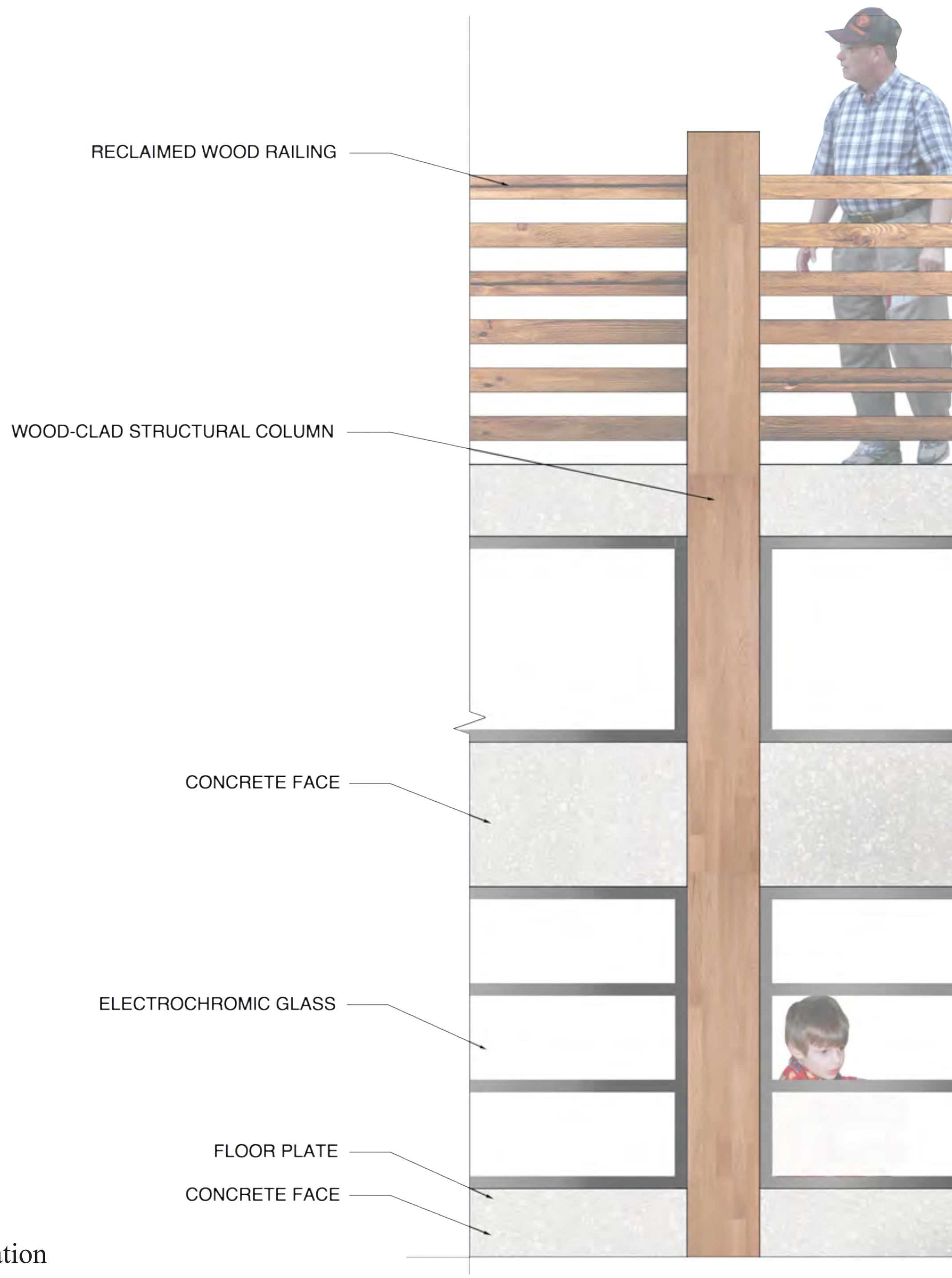


D2: Detail Elevation

4.5 WALL SECTION AND FACADE STUDY

DESIGN PROJECT

This facade detail shows how scale is reduced to the scale of a child by use of mullion patterns. The electrochromic glass used in the lower lights will be controllable by the child, so he may reduce or expand his view of the public plaza below as he desires.

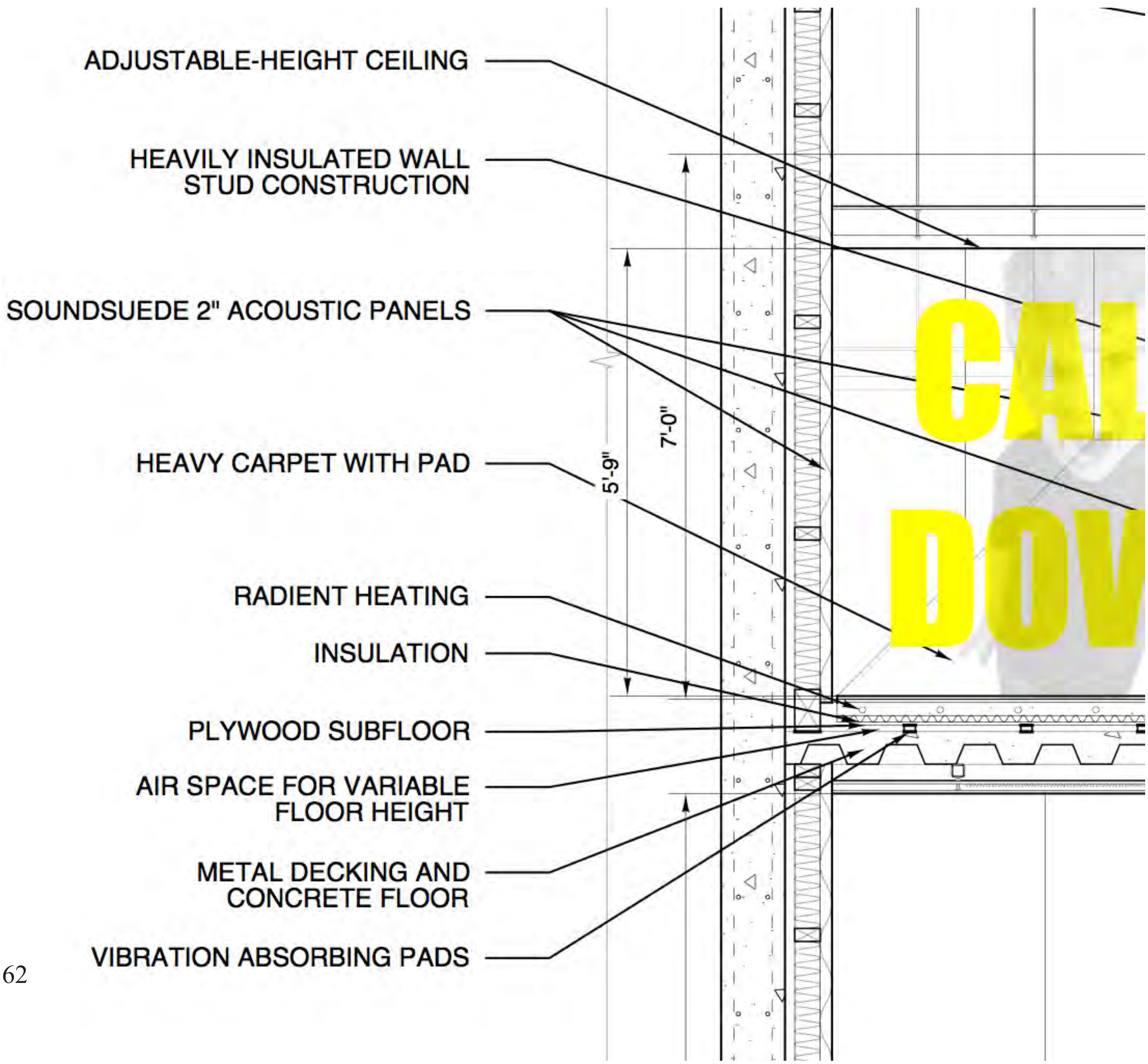


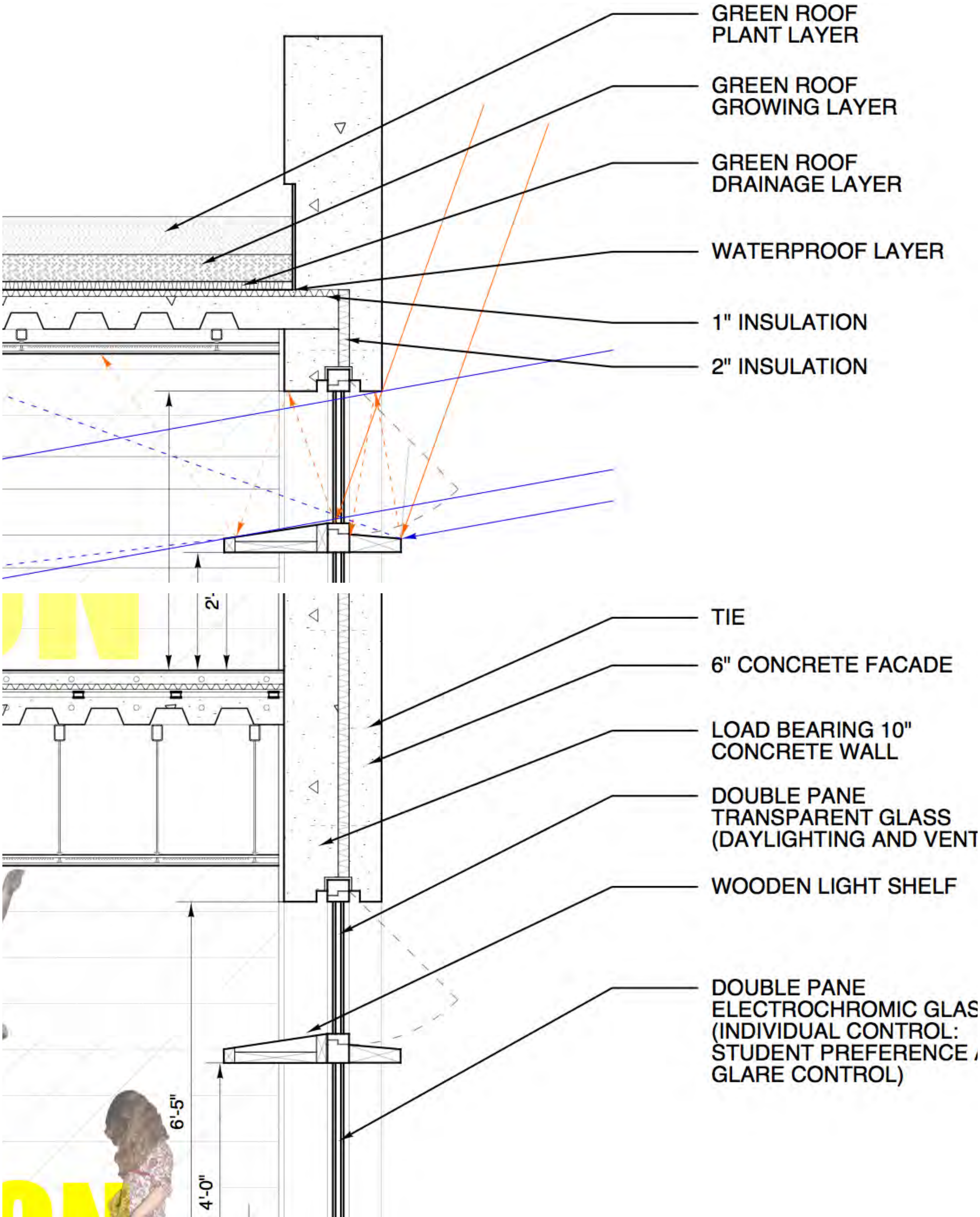
The detail also shows the railing of the occupiable roof space, which is taller than a typical railing but still visually penetrable.

DESIGN PROJECT

The structure of the building is comprised of a metal decking with concrete flooring system which connects to a concrete bearing wall facade faced with an additional concrete slab on the upper stories. The ground floor is faced with a brick facade. Because the floor height is so variable within the building (see Section L1) the floor is raised slightly to accommodate these changes. Radiant heating flows through a second concrete slab on which either carpet, cork, or hardwood floors rest. The risers are surrounded by vibration absorbing pads to aid in structure-borne acoustical isolation.

D1: Detail Section




GREEN ROOF
PLANT LAYER
GREEN ROOF
GROWING LAYER
GREEN ROOF
DRAINAGE LAYER
WATERPROOF LAYER
1" INSULATION
2" INSULATION
TIE
6" CONCRETE FACADE
LOAD BEARING 10"
CONCRETE WALL
DOUBLE PANE
TRANSPARENT GLASS
(DAYLIGHTING AND VENT
WOODEN LIGHT SHELF
DOUBLE PANE
ELECTROCHROMIC GLAS
(INDIVIDUAL CONTROL:
STUDENT PREFERENCE
GLARE CONTROL)
2'
6'-5"
4'-0"

DESIGN PROJECT

Acoustics have a great effect on the concentration of children with autism. Ambient noise can be very distracting, causing inattention and negative behaviors.

The building's organization lends itself to acoustic isolation from site sounds. Therapy spaces, where it is most important that ambient sounds are minimized, are located on the northern side of the site, away from the busy Beaver Avenue. A walled playground separates the building from Fraser Street, serving as a buffer between the therapies and the traffic noise. All quiet rooms are located on the interior of the building, away from any exterior walls.

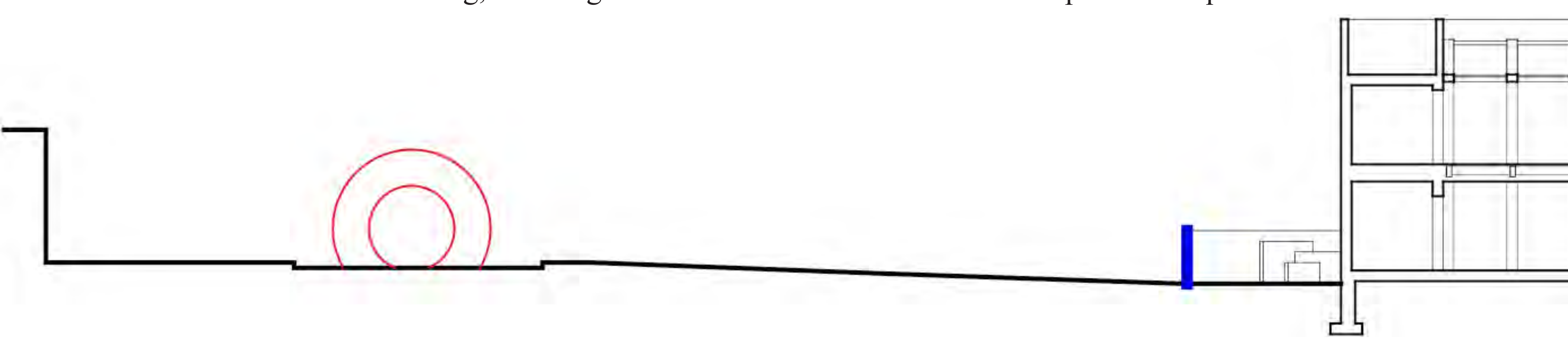
All mechanical spaces and vertical circulation shafts will be intensely insulated, and all equipment will be raised on vibration-absorbing pads and springs. This will help to isolate sound before it leaves the mechanical spaces.

Dead Room: Quiet Room
Quiet rooms are found throughout the building and are approximately 5'x 5' with adjustable ceiling heights. For sound absorption coefficients, the ceiling height has been chosen at 6'.

Because these rooms are used to settle down children who are having extreme difficulty coping with sensory issues, which can lead to intense fits of physical and auditory commotion, the quiet rooms must be acoustically isolated as well as safe for the child inside. Soft acoustic panels and thick, insulated walls serve to keep sound from entering or exiting the room while providing a soft surface to prevent the child from harming himself on the walls. A detail section (D1) can be found on page 62.

Medium Room: Classroom
While noise in the classrooms still must be controlled, it is acceptable for the room to reflect more sound in this space. This will allow the space to be more similar to typical classroom settings while still being sensitive to auditory hypo-sensitivities.

The same panels as are found in the quiet room will line the walls which face the interior of the building, isolating ambient noise from the circulation spaces and quiet rooms. Because



T3: Therapy Wing Circulation Node Transverse Section circulation spaces double as play spaces, it is important that they are kept acoustically isolated.

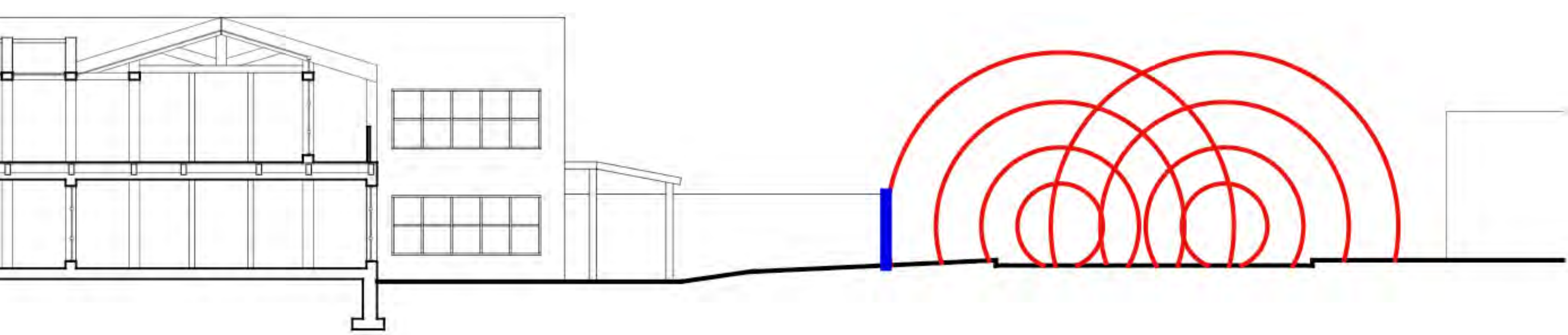
Noise Control: Traffic and Siting

Because therapy spaces must have a higher degree of acoustic isolation, they are located on the northern side of the site where there is the least traffic. The building is set back from Fraser Street. The buffer zone between the street and building consists of a high wall and a row of trees. These barriers serve to deflect sound away from the building.

The children's entry to the building is on the west side of the site, away from either high-traffic road. This allows the building to act as a sound buffer from the street noise while they are transitioning from bus to outside to inside.

Quiet Room									
Material	NRC 250hz	NRC 500hz	NRC 1000hz	NRC 2000hz	NRC total	Surface	Square Footage	Sabins	Room NRC
SoundSuede 2" Fabric Wrapped Wall Panels	0.81	1.24	1.3	1.21	1.14	Walls	120	136.8	
Heavy Carpet on Pad	0.24	0.57	0.69	0.71	0.5525	Floor	25	13.8125	
3/4" Fissured Tile	0.6	0.65	0.83	0.94	0.755	Ceiling	25	18.875	
						Totals:	**170**	**169.4875**	**0.9970**

Classroom									
Material	NRC 250hz	NRC 500hz	NRC 1000hz	NRC 2000hz	NRC total	Surface	Square Footage	Sabins	Room NRC
SoundSuede 2" Fabric Wrapped Wall Panels	0.81	1.24	1.3	1.21	1.14	Walls	626	713.64	
1/2" Gypsum Board	0.1	0.05	0.04	0.07	0.065	Walls	438	28.47	
Plastic Light Diffuser	0.22	0.17	0.1	0.1	0.1475	Ceiling	855	126.1125	
Cork Flooring	0.03	0.03	0.03	0.03	0.03	Floor	855	25.65	
						Totals:	**2774**	**893.8725**	**0.3222**



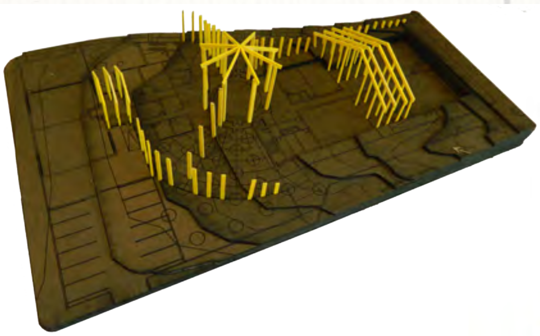
4.8.1 Wayfinding

An important concept for all people, wayfinding is especially important for children with ASD because they often have difficulty imagining that which they do not see.

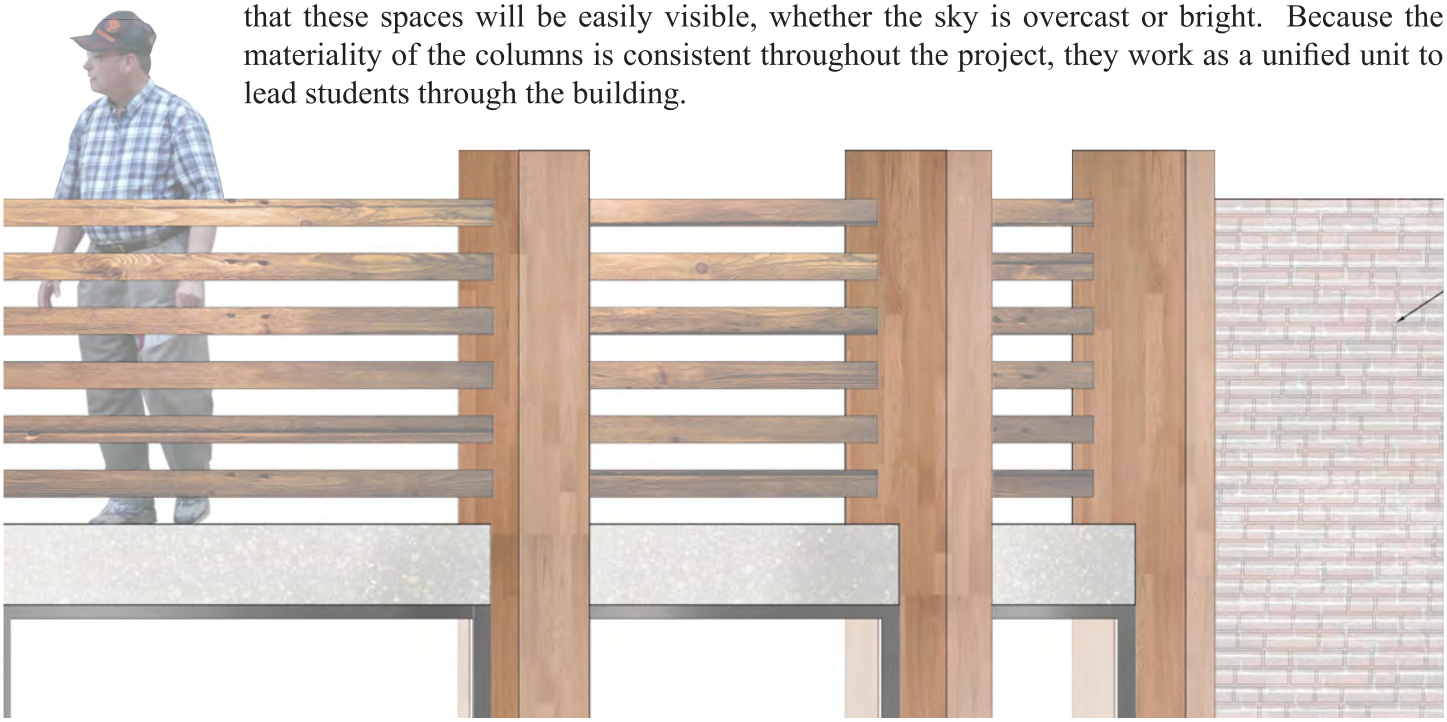
Being able to find your way through a building is the most fundamental level of understanding the built environment. Because of this importance, wayfinding is highly emphasized in this school. Not knowing where he is in relationship to the space around him can be stressful for anyone. If this stress is eliminated in the school, the children will have more energy to focus on their therapies.

The columns which are emphasized in the drawings above serve as the major wayfinding device. Because they are present both outside and inside the building, they ease the transition of going from the outside world into a more controlled, sensory-sensitive environment. These columns, made of the same reclaimed wood throughout the project, lead the way from node to node.

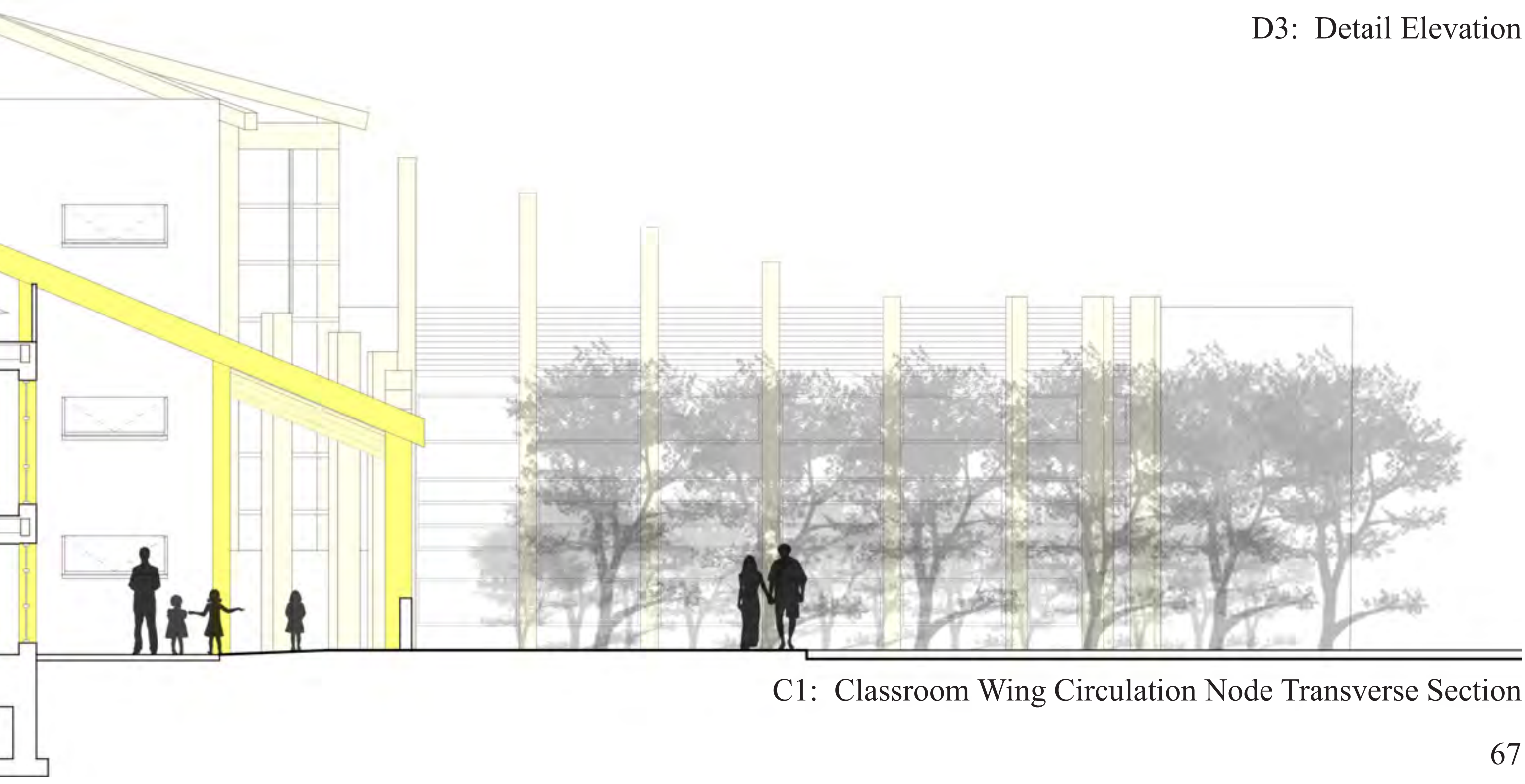
Scale, light, and materiality also contribute to wayfinding. Scale diminishes as students find their way to more intimate spaces: the circulatory atrium is the largest space, where most people will congregate at one time; the halls and circulatory nodes on either side of the building are smaller and more intimate; classrooms and therapy rooms are smaller, for groups of up to six children and their aids; the quiet rooms are the smallest, meant only for one child at a time.



Light guides students from circulation node to circulation node. Each node is made simply of wooden structural elements which frame glass walls and roofs. The hallways are short enough that these spaces will be easily visible, whether the sky is overcast or bright. Because the materiality of the columns is consistent throughout the project, they work as a unified unit to lead students through the building.



D3: Detail Elevation



C1: Classroom Wing Circulation Node Transverse Section

4.8.2 Scale

Because this building will function for people of multiple age groups, each space must be designed with careful consideration of scale.

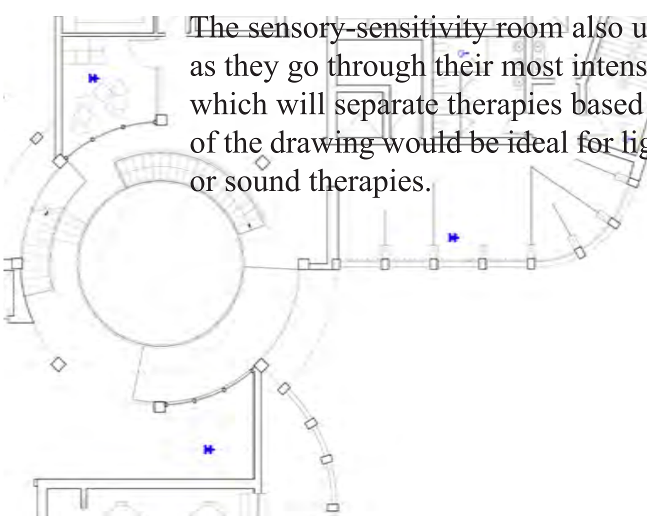
As mentioned above, the scale of the space diminishes as the uses become more intimate. This concept applies to the project as a whole, given the functions of the atrium, the largest space, down to the quiet rooms, the smallest, but also in individual spaces.

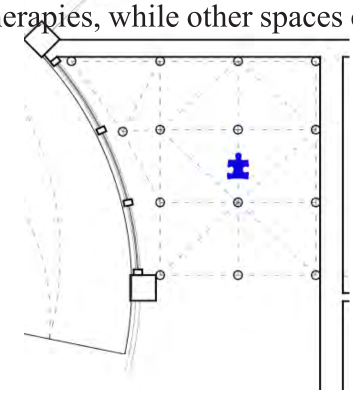
The classrooms, for example, are each divided into two zones: one for group work and one for individual instruction. The area for the group work is given a higher ceiling, allowing the space to feel more open despite the increased number of students. Conversely, the area for the individual instruction is slightly raised and the ceiling is slightly lowered. By compressing the space, the student and their aid can work in a more intimate setting. Furthermore, the shelving within each classroom creates small nooks in which the students may sit if they feel the need for further compression of space.

The smallest rooms in the building are the quiet rooms. These rooms function as places for withdrawal when a student is feeling overwhelmed by sensory input. The room is very small, and the ceiling may be lowered if the student feels that he would be more comfortable in an even smaller space. In one of these rooms, the child can calm down without worrying about sensory input. The rooms are highly insulated so that sound can neither escape nor enter the space, eliminating distractions caused by either the distressed child or the children still undergoing class outside the room.

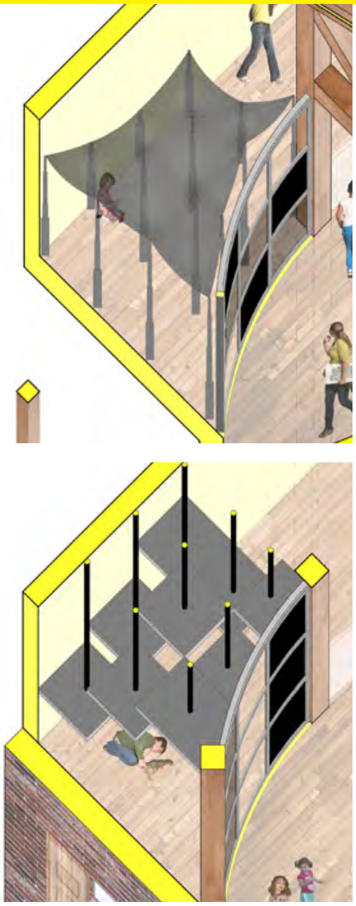
Adaptable zones are found throughout the building which function in a similar way. They are found near the circulatory atrium. Each space can be adapted in different ways. Some spaces will be better suited for some children. Each of these zones is contained behind a wall of electrochromic glass, which the child can alter to control the level of light in the space.

The sensory-sensitivity room also uses adaptable scaling to aid in the comfort of the students as they go through their most intense therapies. Moveable walls allow for a division of space which will separate therapies based on function. For example, the room at the top left corner of the drawing would be ideal for light therapies, while other spaces could be used for textural or sound therapies.

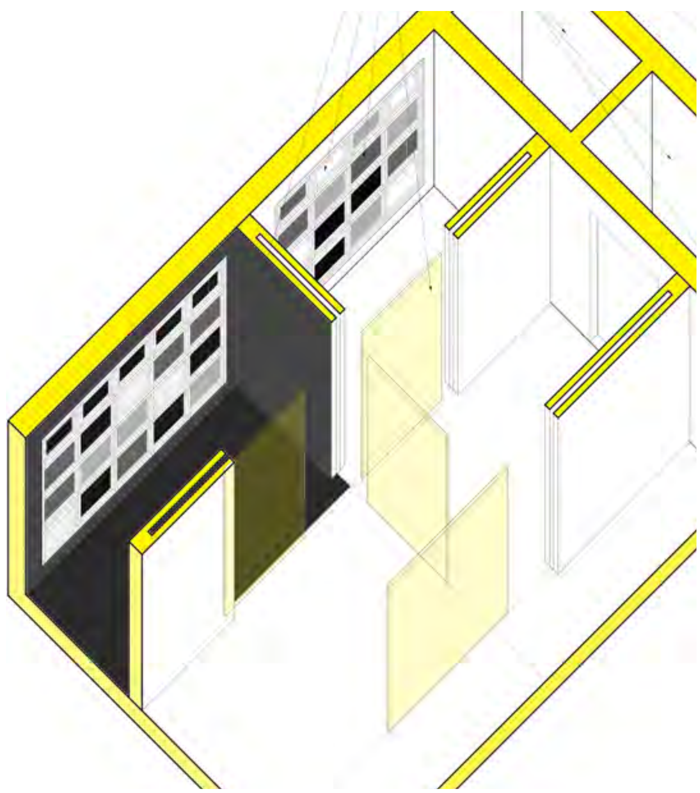




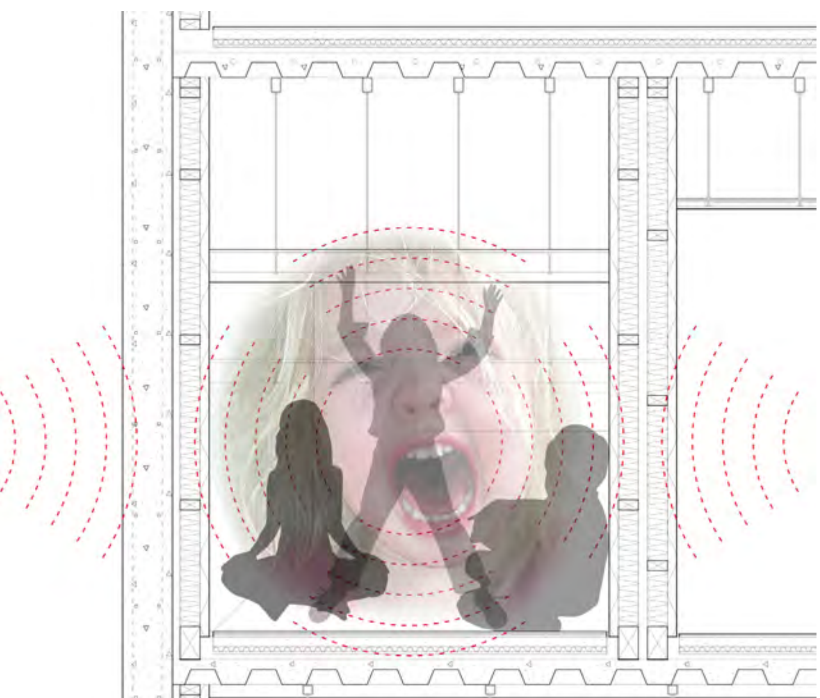
Classroom View



A1: Axonometric Section: Adaptable Zones



A2: Axonometric Section: Sensory Sensitivity Room



D1: Detail Section

4.8.3 Light

Natural light, though slightly controversial as applied to design for individuals with ASD, is accepted to have beneficial effects on learning and well-being.

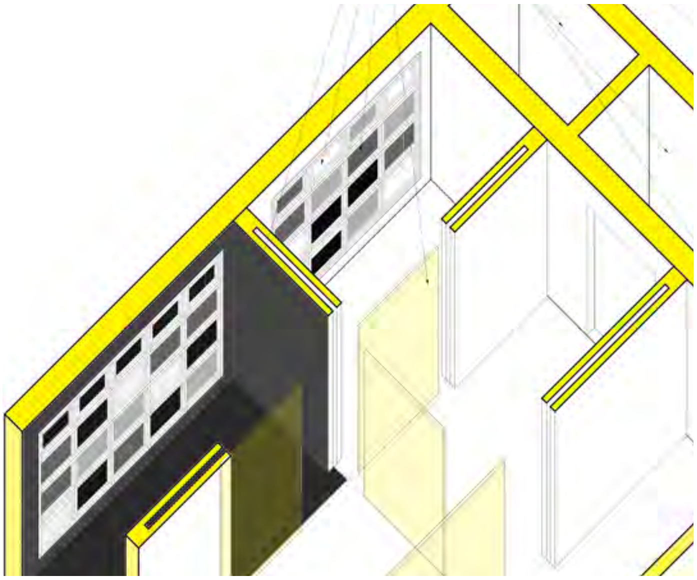
Sensitivity to light is common in children with ASD. A major problem with the lighting in facilities currently used for children with autism is that fluorescent lights are widely used. These lights buzz and flicker and can be extremely distracting and distressing in some cases.

This design employs natural light in all spaces. An issues with daylighting, however, is that it is unpredictable and can vary tremendously throughout the day. These variations can cause just as much distraction as fluorescent lighting. For this reason, daylighting is mostly used in the circulation nodes. Within the program spaces, daylighting windows are placed high in the space and use a light shelf to scatter the light, reflecting it off of several surfaces to achieve a more diffuse light than would occur with direct sunlight. In several spaces, fenestration with electrochromic glass is included for more control over the daylight. By turning the glass on or off, its opacity is altered and more or less light can enter the space. This allows the child or aid to determine what level of natural light is appropriate for the child, based on his individual sensitivity needs and the quality of light due to cloud coverage that day. This is depicted in the elevation details below and to the right.

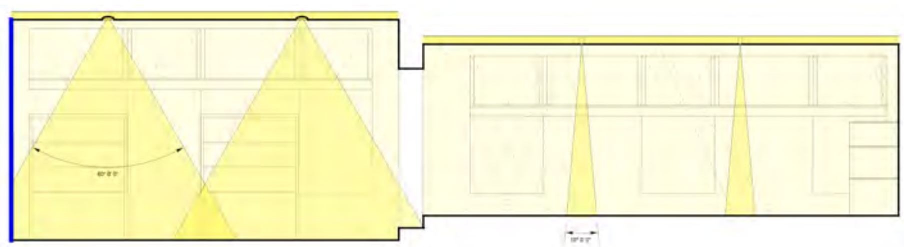
The daylighting is supplemented by an electrical lighting scheme which employs LED lights in various ways. First, strip LEDs are hidden in the ceiling, producing a even, direct diffuse light throughout the room. Second, recessed LED lamps produce a stronger, direct task light in areas of group work. Third, LED track lights produce a focused, direct light for individual instruction areas. All lights are controlled in zones and are dimmable, giving the opportunity for very specific lighting options to be used. A general lighting combination will be set as standard, and each variable can be controlled from this base setting. This scheme is shown to the right.

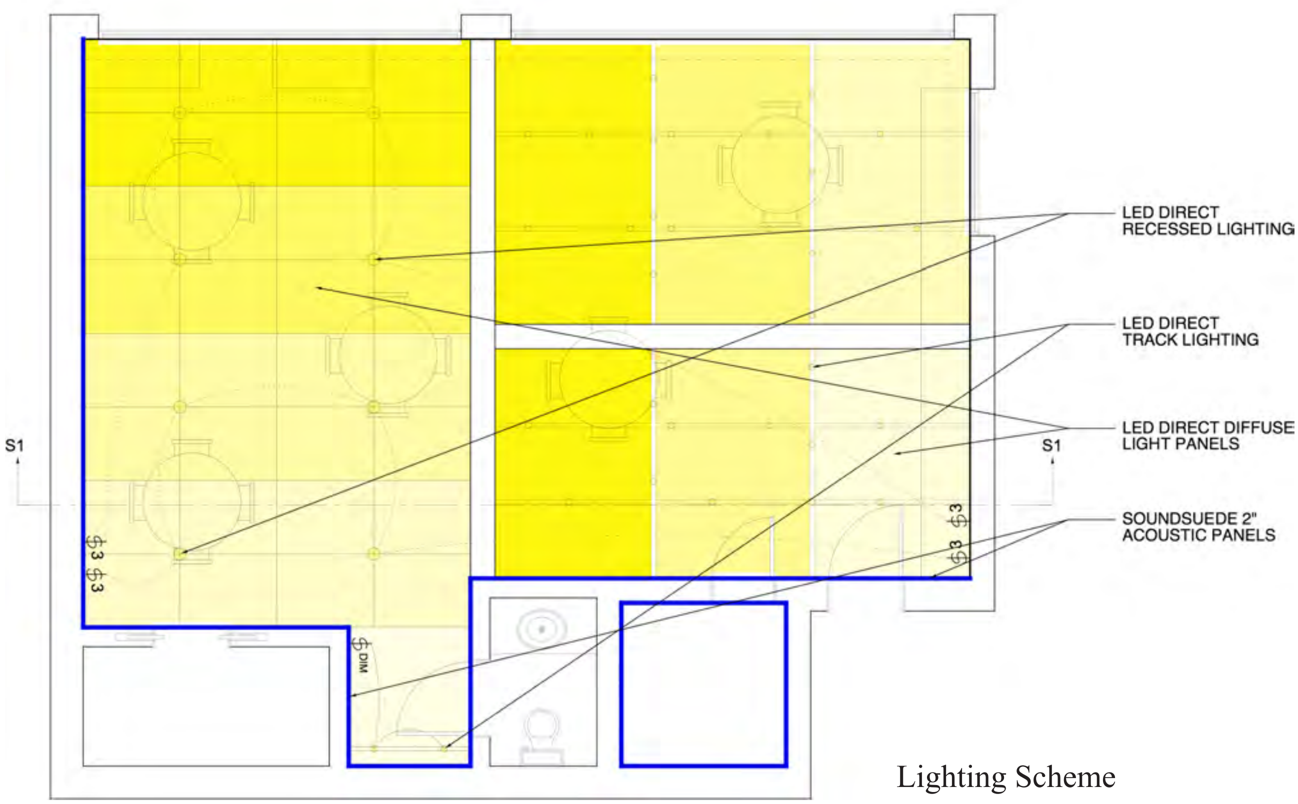
D3: Detail Elevation

Electrochromic glass is also found in the therapy wing. The northern walls of the sensory sensitivity room have a grid of these windows which can be manipulated by the students and their aids as part of a therapy for sensitivity to light.



A2: Axonometric Section: Sensory Sensitivity Room





4.8.4 Materiality

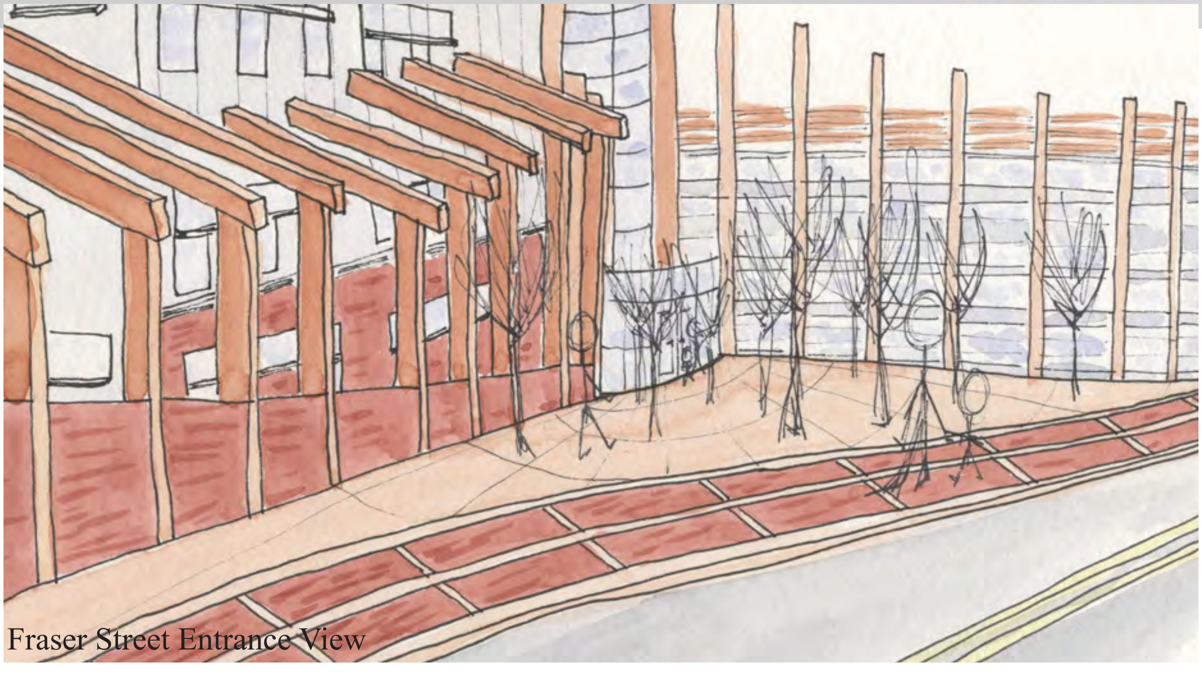
The connection between body and material can affect a person's experience of a building. Children with ASD often have issues with texture, and so a highly textured material may be very distracting in a classroom or therapeutic setting.

The materials used in the building are experientially typical. Being familiar with the material elements around them will make the children more comfortable in the environment.

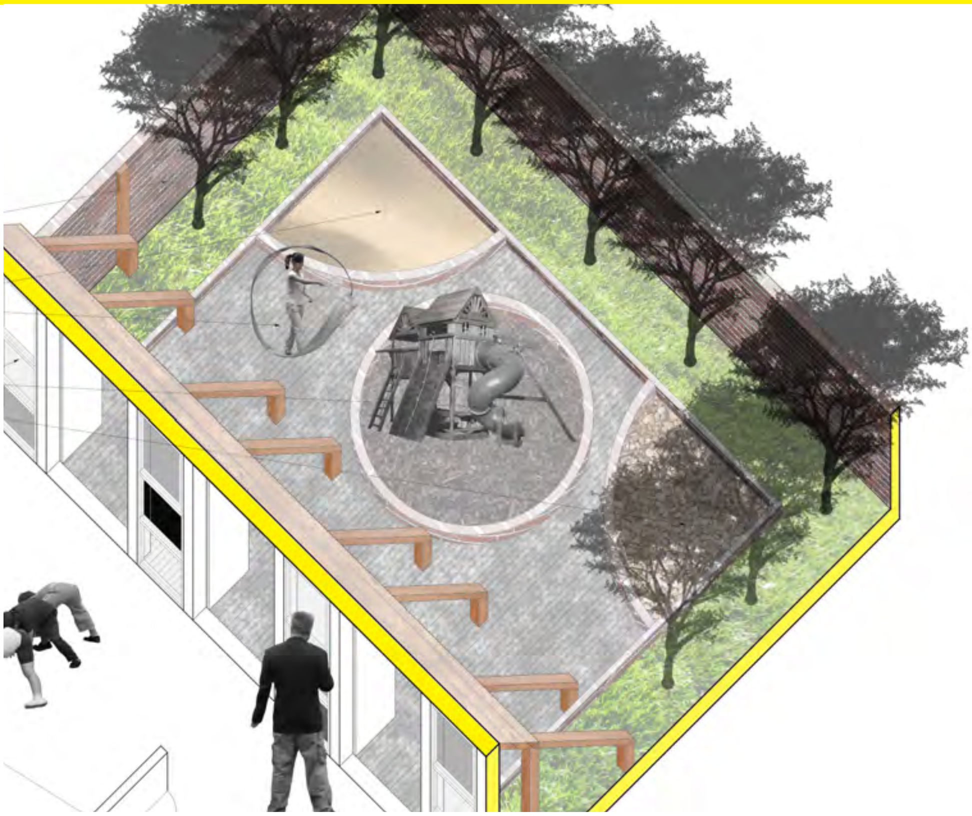
From the outside, the children will approach the building next to a brick facade on the ground floor, above which the facade switches to a smooth, light concrete. The children will subconsciously understand these materials, especially the brick, as massive and load bearing, materials that *should* comprise a sturdy, safe building.

Inside, wood serves as a wayfinding device, leading from the outside to the classrooms, laid over typical drywall surfaces painted with calm neutral colors. Lining walls between circulatory spaces and classrooms or therapy rooms, as well as within the quiet rooms, will be Soundsuede panels. These soft panels will create an acoustical barrier between spaces that need to be quiet and those which may not, as well as provide soft wall surfaces. This is a safety feature which will prevent over-stimulated children with violent tendencies from causing injuries by hitting themselves or others into walls.

Minimalist detailing allows for a simple backdrop in which the children can focus on their therapies. The electrochromic windows in the classrooms, for example, appear to extend straight into the concrete wall, while the daylighting windows show only vertical mullions between lights.

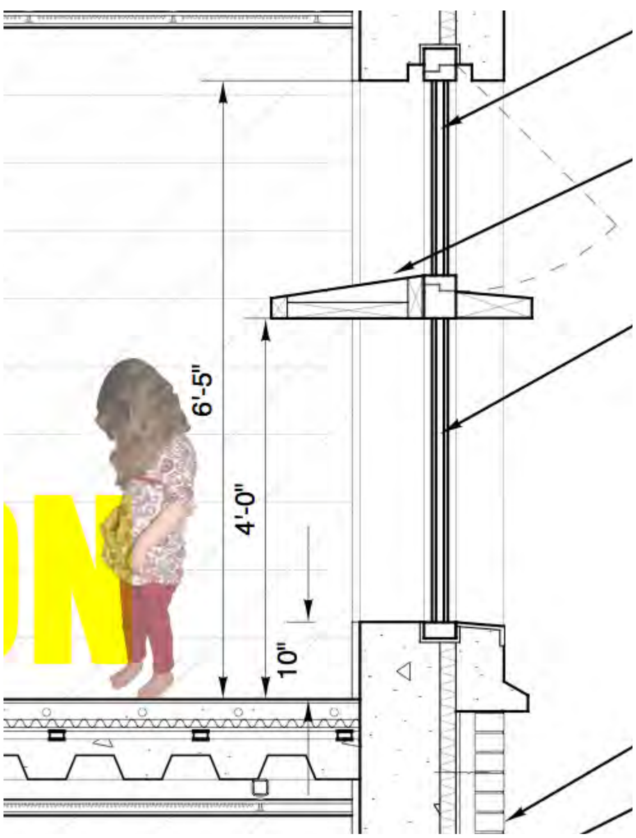


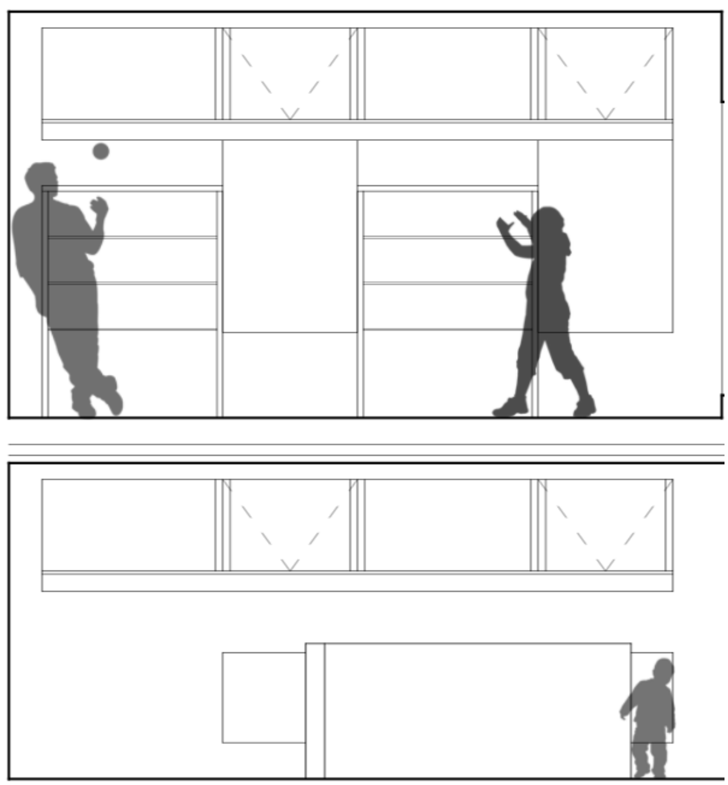
Fraser Street Entrance View



The playspace adjacent to the physical therapy room contains a variety of textures. Rubber pavers, mulch, sand, pebbles, grass, trees, and brick allow for children to play with and experience textures with which they are comfortable, or explore textures with which they are not.

A2: Axonometric Section:
Textural Playspace





D1: Detail Section

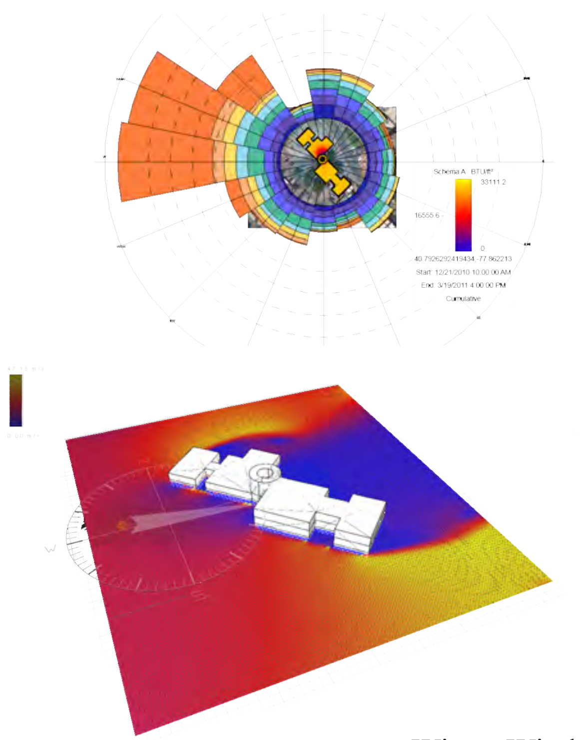
L1: Longitudinal Section

4.9.1 Sustainable Design Features Assessment

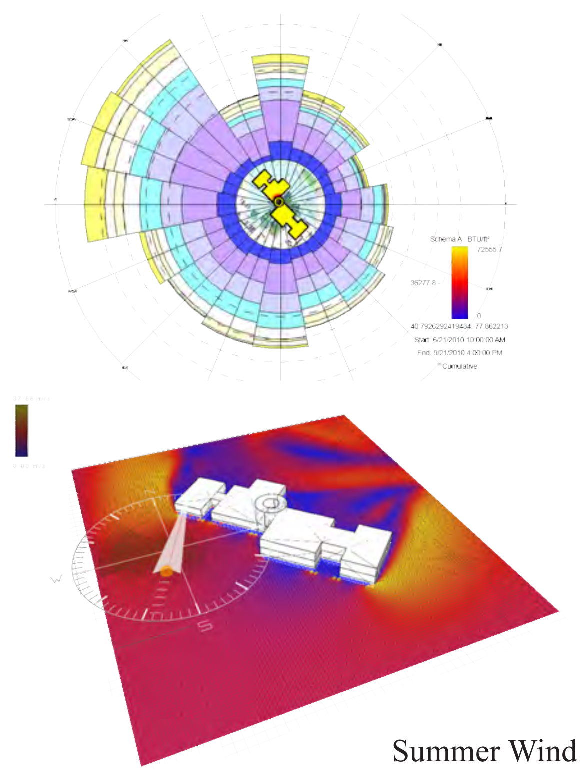
Architects have a responsibility to design buildings that serve nature. Conversely, nature serves humanity, and many aspects can be used as healing methods. Students with ASD who are sensitive to textures may benefit from therapies involving plant material and water. Students with specific interests in science may be interested in learning about photovoltaics. It is important that as many sustainability feature as possible are visible, yet unobtrusive to the design. If this is accomplished, nature and humanity will best serve each other.

Water Control
Water control is one aspect of sustainability that can easily be made visible and interactive. Children will be able to learn about how nature deals with water by observation and interaction. Points of water collection are placed around the site in areas where the children and/or the public can view the collection method. On the roof of the northern wing, rainwater from the atrium roof will be harvested and used in therapies and in growing projects on the garden portion of the roof.

Wind
As the excerpts from the Vasari Wind Tunnel models show, there are areas of low wind pressure created by the form of the building. These areas occur in the "hyphens" at either end of the site, and are marked in the site plan with a (-). These areas will allow individual rooms the opportunity to cross ventilate. A more comprehensive ventilation system will utilize the atrium as a stack, serving the circulation spaces. Cool air will be drawn in from the "hyphens",



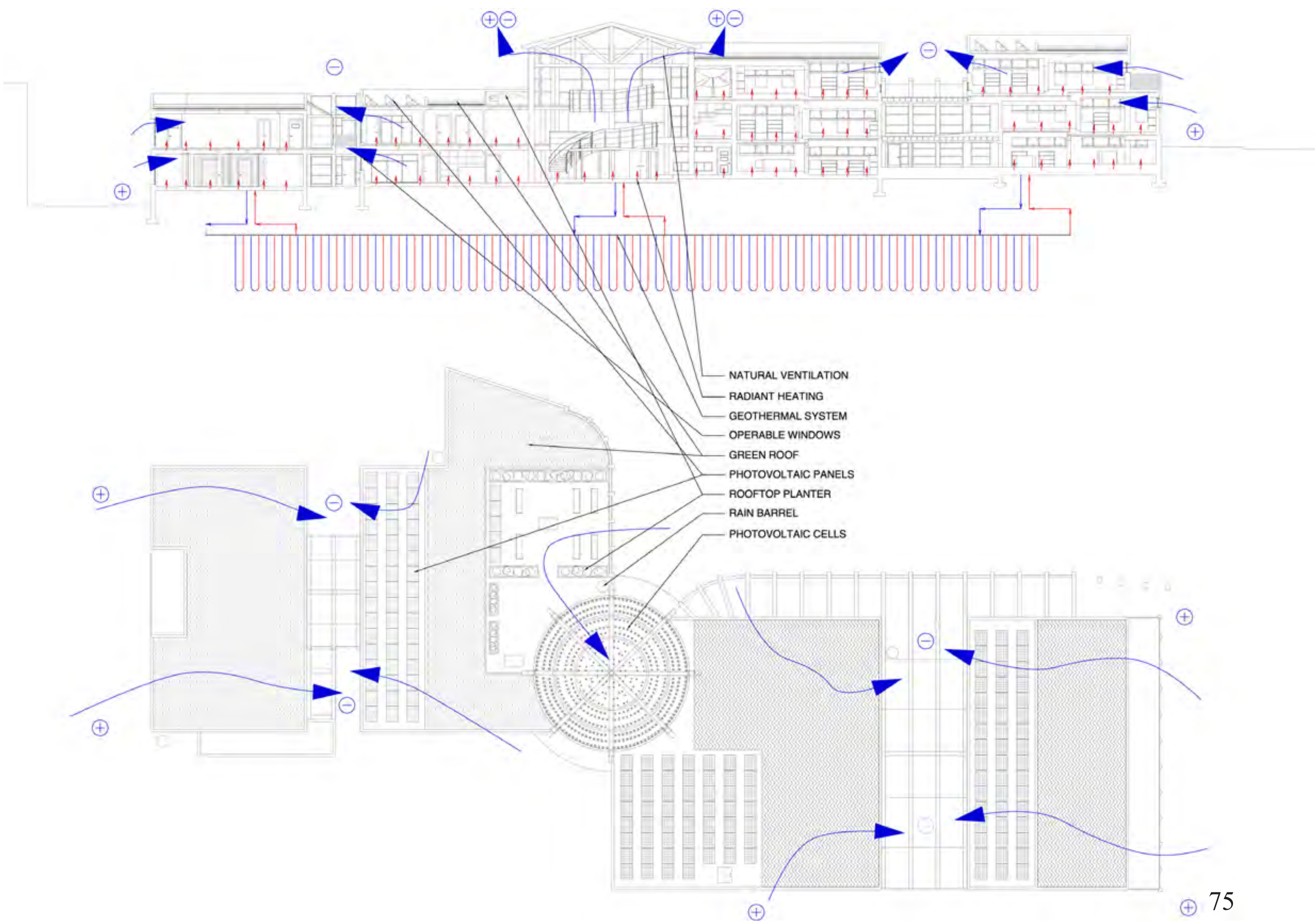
Winter Wind



Summer Wind

responding to the lack of pressure created by the heated air and updraft within the atrium. Because summer winds are relatively unpredictable, and the atrium is round, release openings will be placed all around the perimeter. A mechanical system will sense which windows are appropriate to be opened, and adjust the system accordingly.

As shown in the winter wind rose, the majority of the cold winter wind comes from the west. According to Vasari Wind Tunnel models, the eastern side of the building will typically have a relatively low intensity of wind. To protect the building from the western winter wind, two methods will be employed on the western side of the site. First, a walled playground will help to break the wind from the ground level before it reaches the building. Second, a planned forest of trees leading to the entrance will help break ground-level wind, as well as higher wind, preventing it from entering the building's main entrance.



4.9.1 Sustainable Design Features Assessment

Sun

The drawing below depicts how the window details allow sunlight to enter the space at different times of year. The orange lines represent the sun on the summer solstice, while the blue lines represent the winter solstice. Throughout the year, an interior light shelf will bounce light deep into the space, allowing for an even distribution of light. The light shelf also distances students from the window, diminishing their view to the outside, which can be very distracting.

As shown in the Vasari Solar Radiation models to the right, there is much opportunity to harvest solar energy. A large portion of the roof is given to standard photovoltaic arrays, set at a 41º angle to best capture the sun's radiation at all times of the year. In addition to the arrays on the flat roofs, the atrium roof will be covered in a sporadic pattern of photovoltaic cells of different sizes, helping to minimize the harsh shadows of the sun inside the large space.

Geothermal

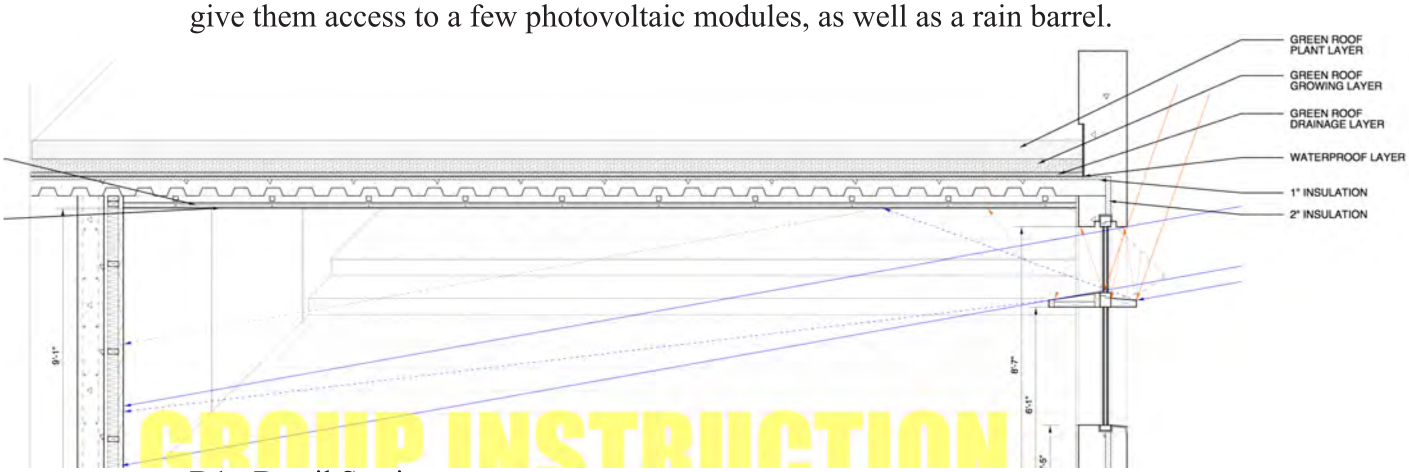
Because of the urban site, the geothermal system must be kept relatively small. Because of this size restriction, a vertical fluid system would best serve the building.

Using the geothermal system for radiant heating in the floors will minimize the need for a noisy HVAC system. The hums and sounds created by HVAC systems are very distracting for children with ASD, and should be avoided where possible.

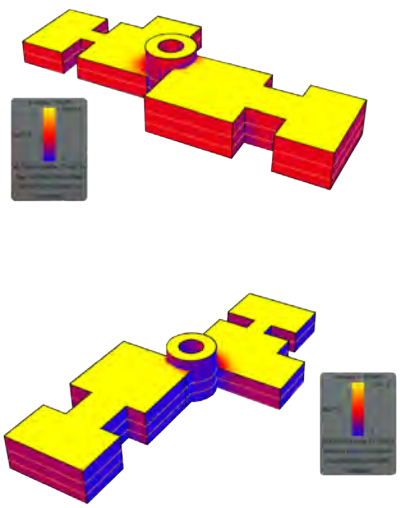
Green Roof

The green roof system chosen is described in the diagram below.

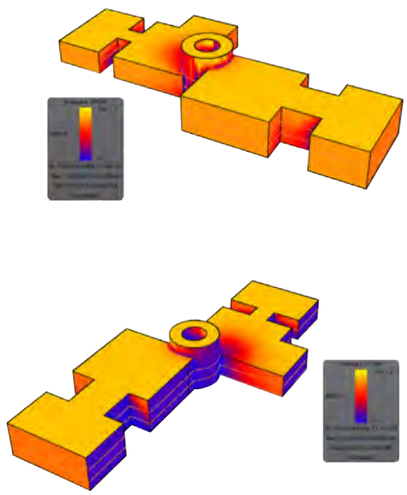
As part of their education, students who are ready to use nature and growth as a part of their therapies will be allowed access to the educational green roof area on the northern part of the roof. From here, they will be able to view the functional green roof on the other side of the wall, as well as plant their own plants and watch them grow. This portion of the roof will also give them access to a few photovoltaic modules, as well as a rain barrel.



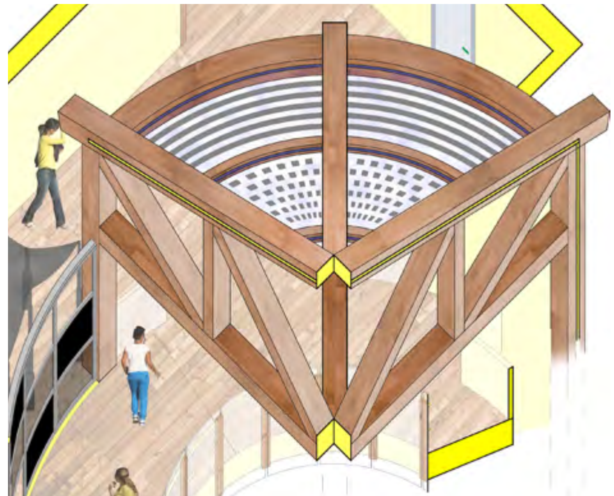
D1: Detail Section



Summer Solar Radiation



Winter Solar Radiation

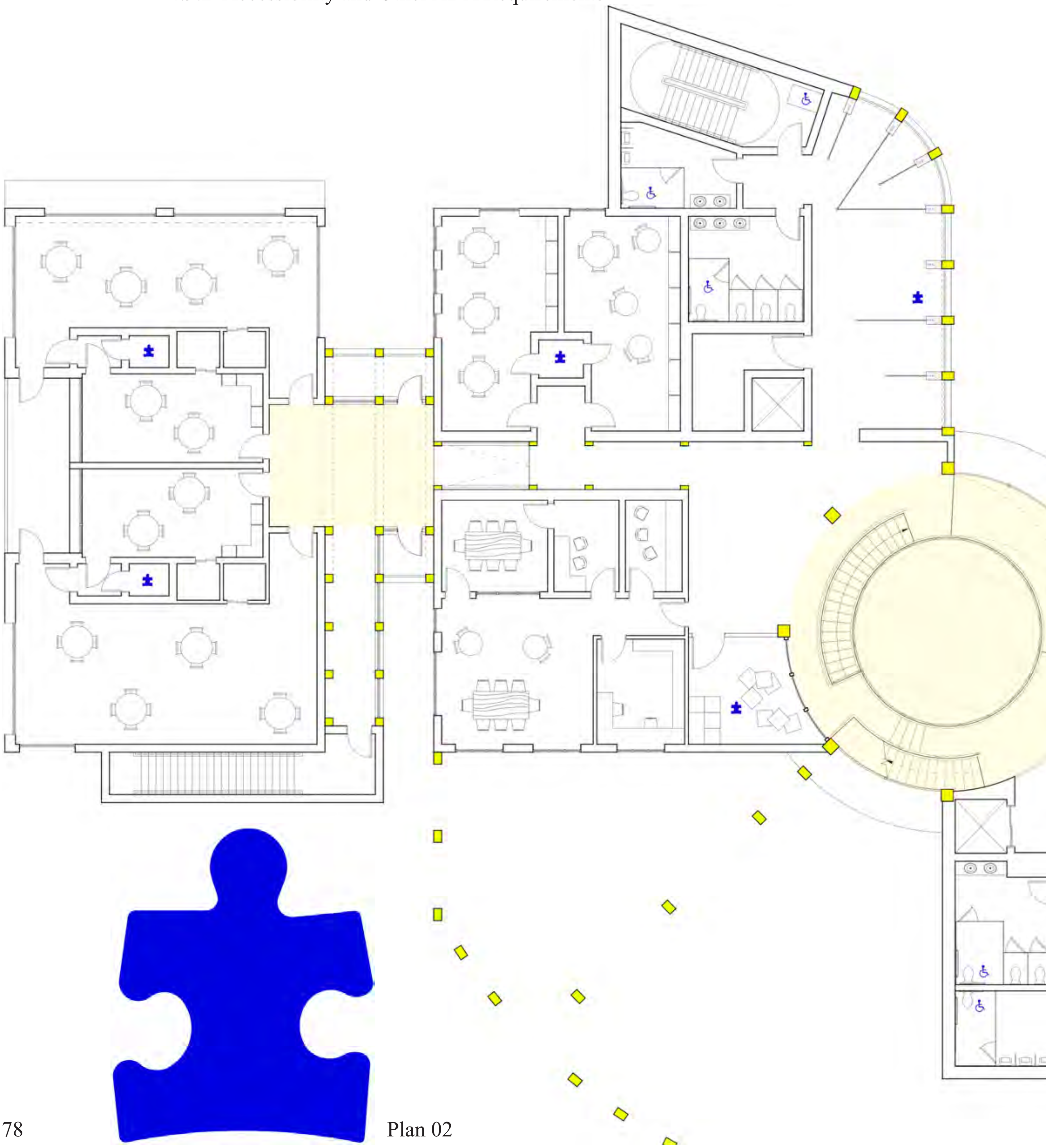


A1: Axonometric Section:
Atrium Roof PV cells

Occupiable Roofspace

DESIGN PROJECT

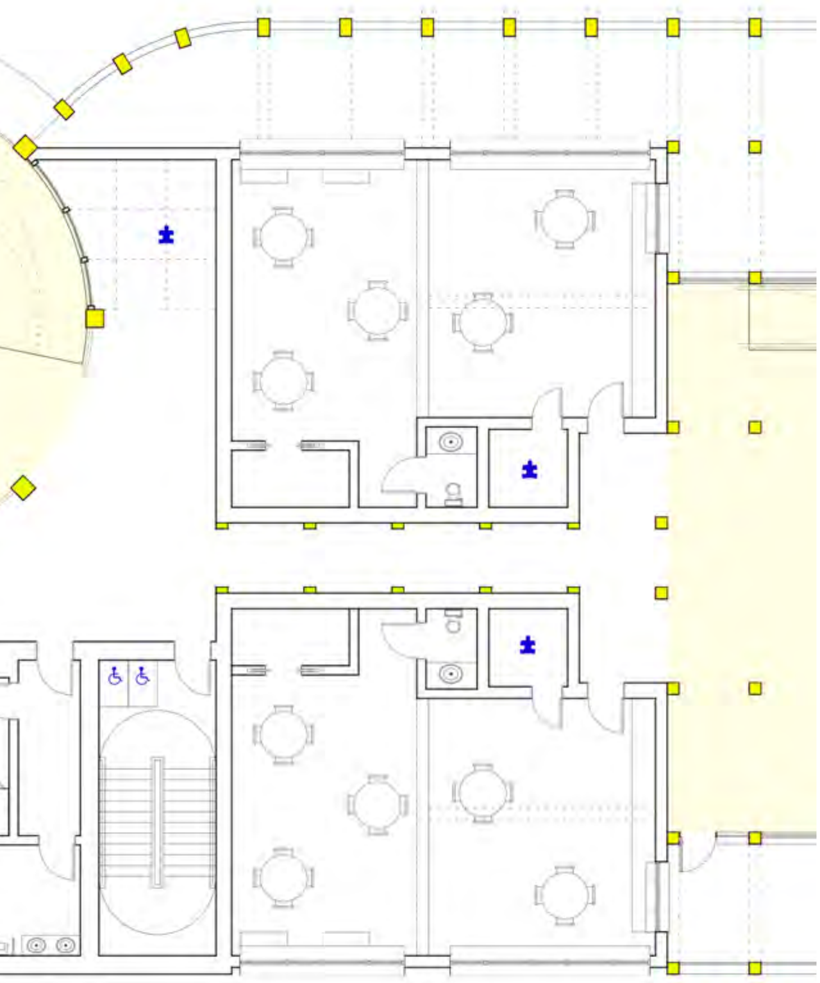
4.9.2 Accessibility and Other ADA Requirements

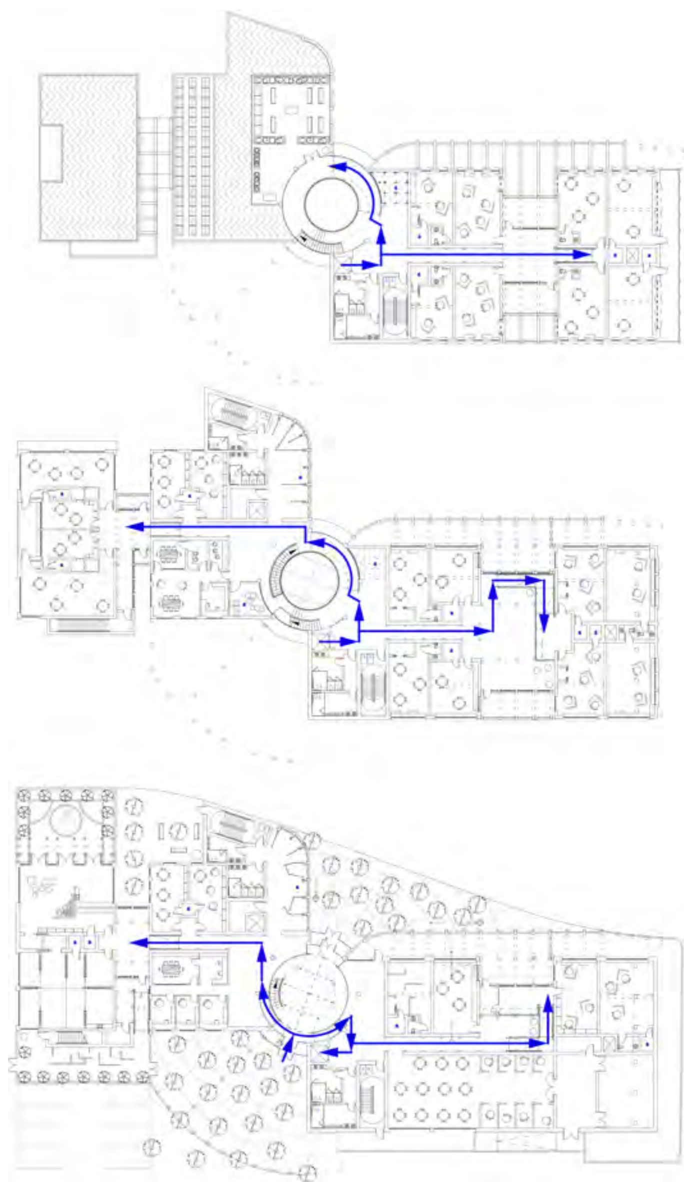


Plan 02

The building complies with ADA code, outlining ramps slopes and widths, railing heights, and wheelchair turning radii in restrooms. An accessible path exists to every space in the building.

In addition to this code, however, considerations for sensory sensitivities were taken into account, considering the function of the building. Areas in the plan which are specifically designed to accommodate sensory sensitivities are indicated in plan with the puzzle piece symbol. This is the symbol of the Autism Speaks organization, and represents the mystery and complexity of autism.





Accessible Path Diagrams

4.9.3 Code Analysis

With any building, the architect's main responsibility is keeping the users of his design safe. While a building must protect its occupants from the elements, it must not become a cage in which occupants are trapped during emergencies.

Often, egress routes are cold, uninviting, and intimidating. This type of treatment could cause additional panic to children with autism, whose senses will be over-stimulated in the case of an emergency. In an attempt to advert as much panic as possible and allow the children to escape the building with limited inhibitions, egress must be carefully considered.

Multiple options for egress must be available from all spaces so that a variety of choices is available for each student. These exits will vary in scale and materiality, allowing for each aid to escort their student through an exit appropriate to their individual needs and perceptive inhibitions.

OCCUPANCY GROUP | EDUCATIONAL GROUP E | IBC Section 305
Educational Group E is characterized by the use of "six or more people for classes up to the 12th grade." This group also includes spaces with the use of day care for more than five children over the age of 2.5 years.

OCCUPANT LOAD | GROUP E | IBC Section 1000
Occupant Load = Net sq ft / 35 sq ft
1st & 2nd Floor = 189
3rd Floor = 138
Because of the nature of the program, all floors will at maximum support only 70 occupants total.

REQUIRED EGRESS WIDTHS | GROUP E | IBC Section 1005
Doors: 189 X .2" = 37.8", not to be less than 32" clear width.
Stairs: 189 X .3" = 56.7", not to be less than 44"* clear width.
*(Section 1009.1)

EGRESS DISTANCE | GROUP E | IBC Section 1016
Because the entire building is sprinkled, the allowable egress distance is 250'.

ATRIUM | GROUP E | IBC Section 404
The proposed atrium opens to 3 floors, as allowed by code. A smoke control system will be installed at the top of the atrium, designed to accommodate both the atrium space and the adjacent spaces on each floor. The entire building must be sprinkled.

SPRINKLER SYSTEM | GROUP E | IBC Section 404
The entire building will be sprinkled, with particular consideration around the atrium. A deluge system will be installed to separate the open volume of the atrium from the circulatory paths within.

CONSTRUCTION TYPE | GROUP E | IBC Sections 503 and 602
The tables to the right show the chosen construction types and their required fire rating.

The core of the structure will be of reinforced concrete with metal decking and concrete slab for flooring. Exposed columns will have a wooden surround, relating the structural elements to the heavy timber construction of the circulatory "hyphens."

GROUP	HEIGHT (feet)	TYPE OF CONSTRUCTION TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV HT	TYPE V A	TYPE V B
		UL	160	65	55	65	55	65	50	40
			STORIES(S) AREA (A)							
A-1	S A	UL UL	5 UL	3 15,500	2 8,500	3 14,000	2 8,500	3 15,000	2 11,500	1 5,500
A-2	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-3	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-4	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A-5	S A	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL
B	S A	UL UL	11 UL	5 37,500	3 23,000	5 28,500	3 19,000	5 36,000	3 18,000	2 9,000
E	S A	UL UL	5 UL	3 26,500	2 14,500	3 23,500	2 14,500	3 25,500	1 18,500	1 9,500
F-1	S A	UL UL	11 UL	4 25,000	2 15,500	3 19,000	2 12,000	4 33,500	2 14,000	1 8,500
F-2	S A	UL UL	11 UL	5 37,500	3 23,000	4 28,500	3 18,000	5 50,500	3 21,000	2 13,000
H-1	S A	1 21,000	1 16,500	1 11,000	1 7,000	1 9,500	1 7,000	1 10,500	1 7,500	NP NP
H-2[d]	S A	UL 21,000	3 16,500	2 11,000	1 7,000	2 9,500	1 7,000	2 10,500	1 7,500	1 3,000

TABLE 601 FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I A	TYPE I B	TYPE II A^d	TYPE II B	TYPE III A^d	TYPE III B	TYPE IV HT	TYPE V A^d	TYPE V B
Primary structural frame[g] (see Section 202)	3^a	2^a	1	0	1	0	HT	1	0
Bearing Walls									
Exterior[f,g]	3	2	1	0	2	2	2	1	0
Interior	3^a	2^a	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and secondary members (see Section 202)	$1^1/2^b$	$1^{b,c}$	$1^{b,c}$	0^c	$1^{b,c}$	0	HT	$1^{b,c}$	0

DESIGN PROJECT

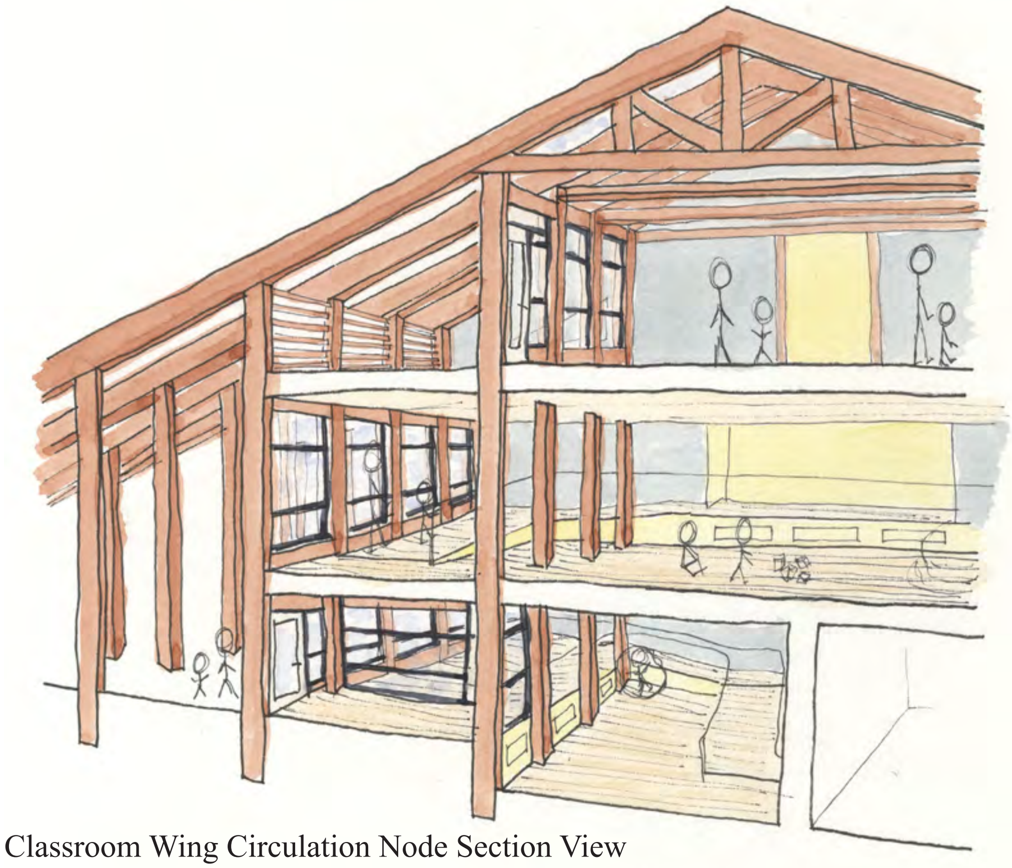
Fraser Street Entrance View

Classroom View

Occupiable Roofspace View

West Outdoor Playspace View: Hidden Containment

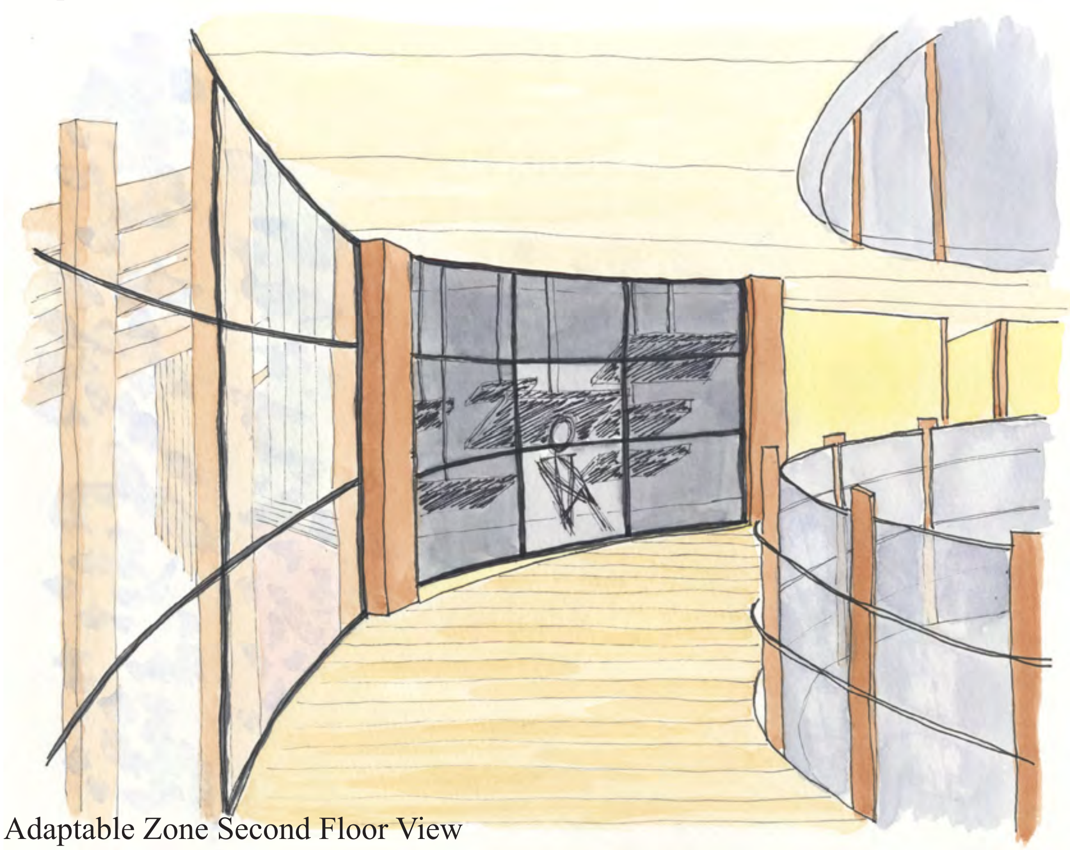
DESIGN PROJECT



Classroom Wing Circulation Node Section View

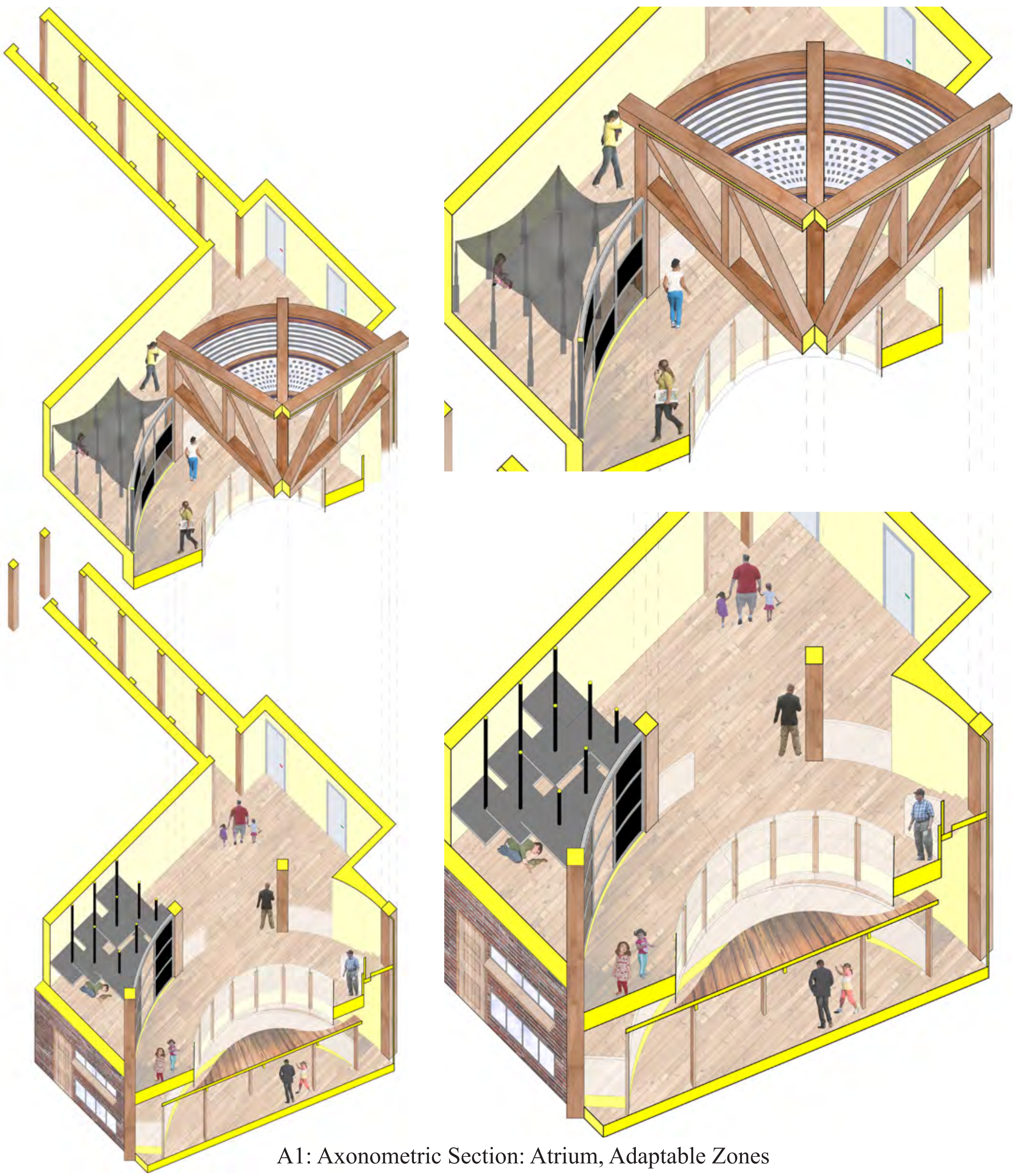
Classroom Wing Circulation Node Third Floor View

Adaptable Zone Third Floor View

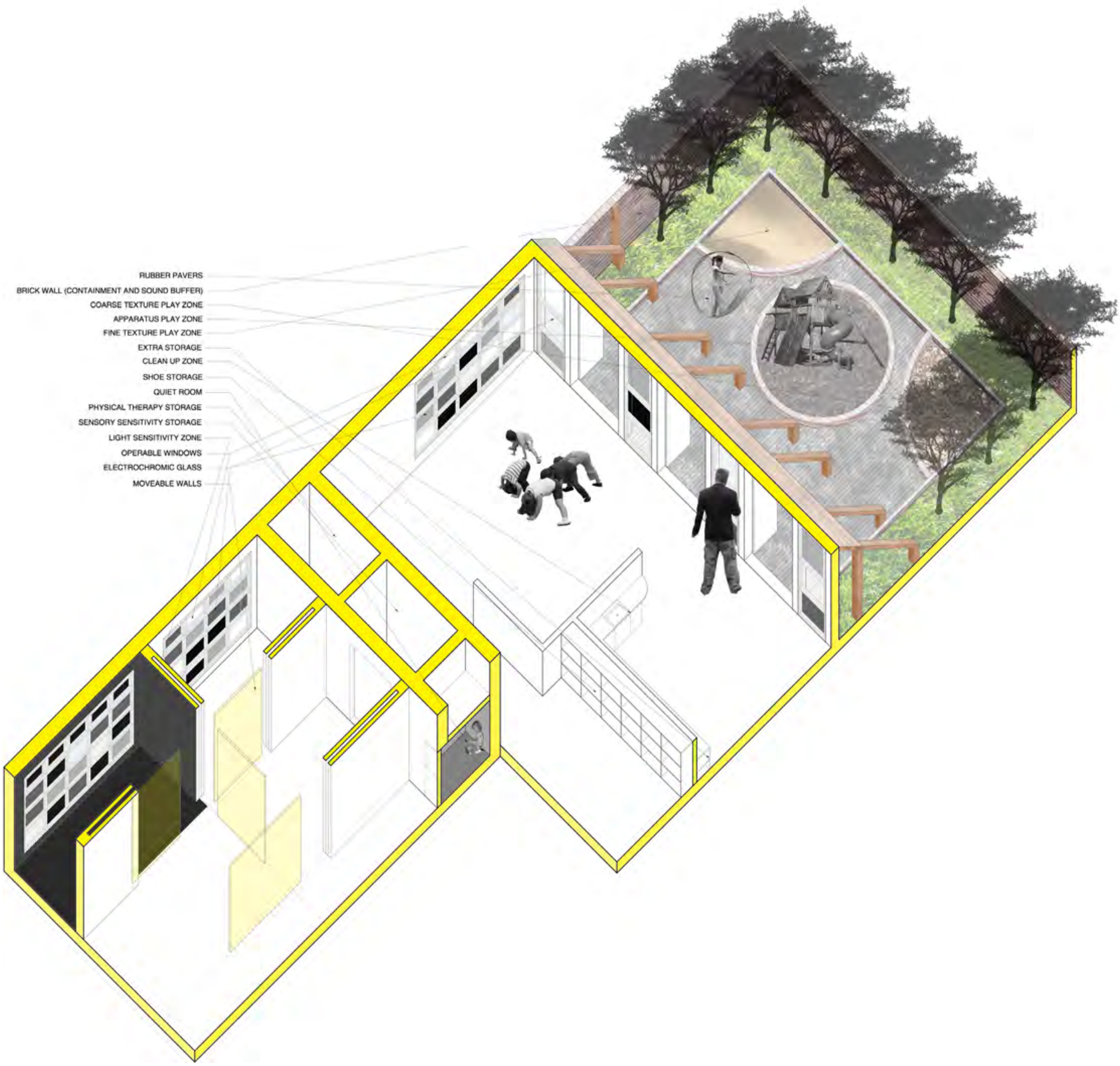


Adaptable Zone Second Floor View

DESIGN PROJECT



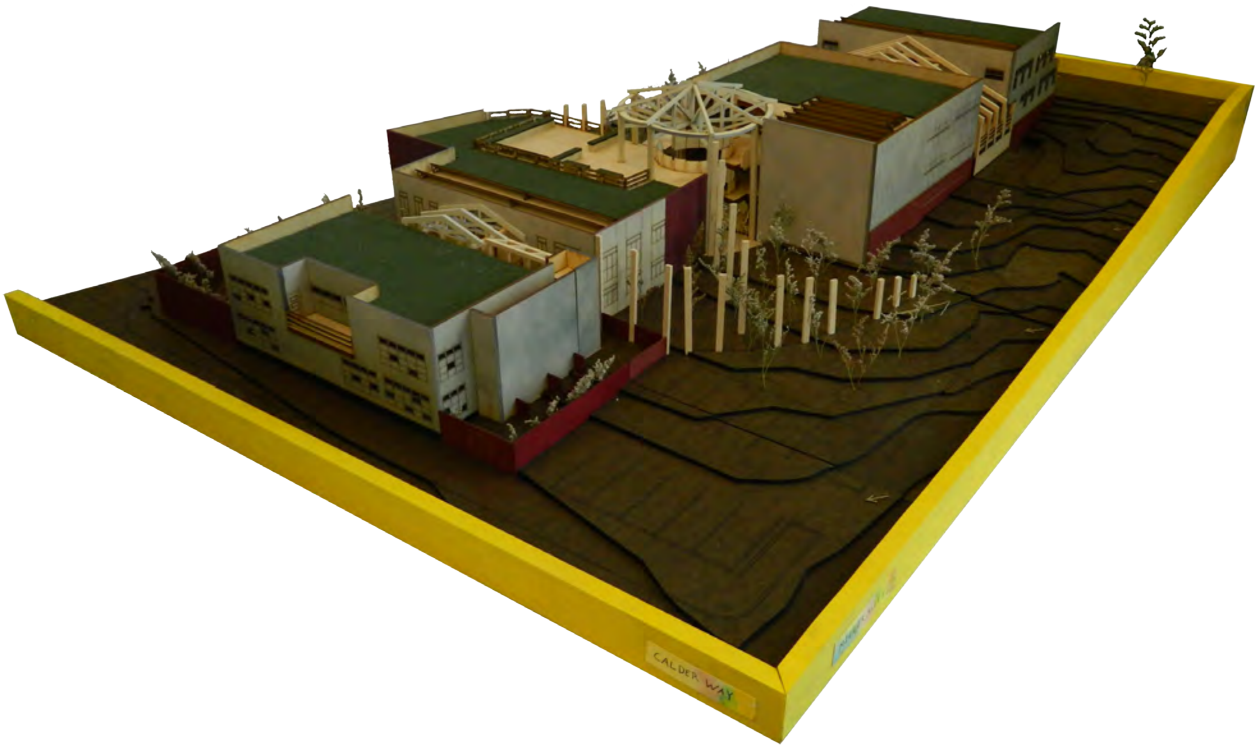
A1: Axonometric Section: Atrium, Adaptable Zones

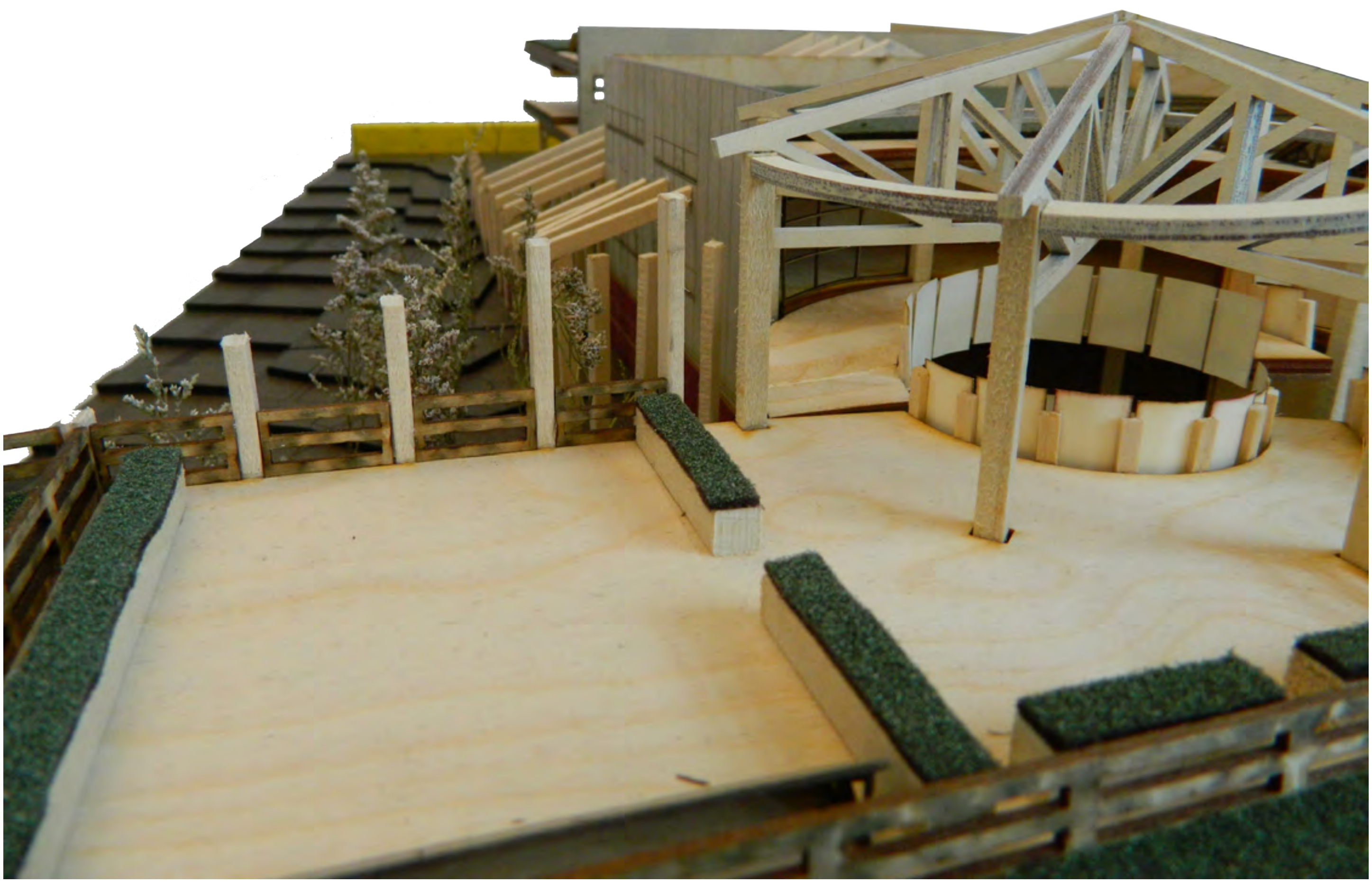


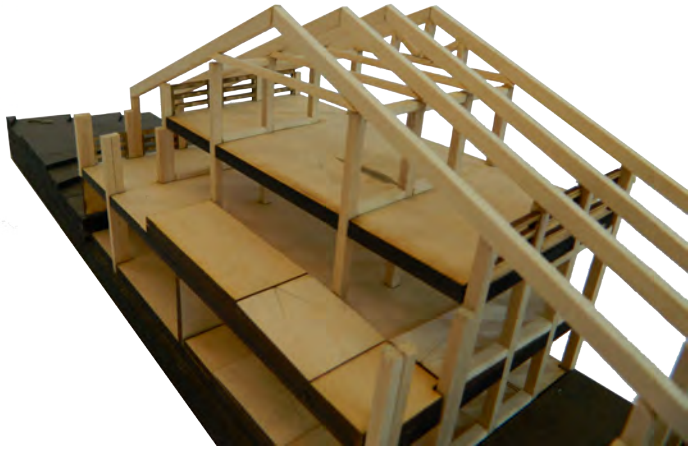
A2: Axonometric Section: Sensory Sensitivity Room, Physical Therapy Room, Physical Therapy Playground

4.10 PROJECT IMAGES

DESIGN PROJECT







CONCLUSIONS

Powerful design addresses all senses, recognizing their importance in understanding architecture as a whole. This concept is especially applicable to individuals diagnosed with an Autism Spectrum Disorder. This thesis explores architectural methods which enhance the sensory experience of children with ASD in an educational and therapeutic setting.

The main focus of this project was to balance wayfinding, scale, light, and materiality within the project to create an environment conducive to helping children with autism develop the skills necessary to cope with life in a world which does not understand their impairments.

By creating simple, legible circulation spaces, wayfinding is made easy. The entry atrium, surrounded by stairs and ramps, puts forth the vertical circulation of the building upon entering. In this space, the child can see the exact destination of each staircase, and therefore can easily visualize how to get from one floor to the other. Once on the level he needs, there is only one circulatory option, a hall leading to a well-day-lit destination node. This node is framed to be reminiscent of the atrium, the main circulatory core of the building. Once in this node, the entrances to each individual room will be color-coded, making wayfinding decisions easy for the children.

Scale acts in the building as a secondary, subliminal wayfinding device. The entry, where initial wayfinding decisions must be made, is open, airy, and transparent. As the decisions become more precise, the spaces get smaller. The main circulatory "lobby" of each floor is wide and open, and is infiltrated by the airiness of the atrium, but lower ceiling heights make the space more intimate. The final wayfinding decision – which room to enter – is made in a smaller space, feeling room-like, but with the open element of copious natural light.

Altering the scale of the individual rooms within the building serves to delineate different functions. Specifically, which functions of the room are carried out in large groups, small groups, or one-on-one instruction. The classrooms, for example, alter in floor height and ceiling height, producing a threshold between the larger volume (for group instruction) and the smaller volume (for one-on-one instruction). Quiet rooms, the most intimate spaces in the building, are located within the one-on-one instruction area. This place is a safe-zone for children to retreat and de-stress when they cannot cope with the stimuli surrounding them.

Light within the building must be treated with care. The glass and wood construction of the circulation nodes creates bright, open spaces which connect to the exterior both visually and physically, through balconies. Within the classrooms, however, fenestration is more precisely designed. Daylighting windows are placed high in the spaces and use light shelves to reflect light deep into the space. These windows are placed above the line of sight of children so that their views are pointed upward toward the sky, rather than toward a busy street which may cause distractions. The quality of light in the space can be controlled on an individual basis via electrochromic glass windows located below the light shelves.

Materiality is kept typical and comprehensible, and detailing is minimized. Being surrounded by familiar construction materials allows the children to feel comfortable in the spaces. Minimalist detailing reduces distractions, reducing the complexity of material connections which can be unnecessarily distracting in a therapeutic setting.

Allowing the scale and light to be highly adaptable in most space of the building creates a setting which can be made ideal for each student or class to learn to cope with their sensitivities. Teachers and aids can determine what type of environment works best for each child and help them develop the skills they need to function in neuro-typical settings. Reducing unnecessary stressors from difficult wayfinding, foreign materials, and complex detailing produces a neutral backdrop for this complex curriculum, allowing the children to focus on important tasks rather than extraneous stimuli.

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Personal Interviews:

Dr. Karen G. Doberneck, BCBA-B

Dr. Sarah Douglas, Assistant Professor, Department of Special Education, The Pennsylvania State University

Dr. Sarah Kollat, Senior Instructor, Human Development and Family Studies, The Pennsylvania State University

Dr. Richard Kubina, Associate Professor of Education, Department of Special Education, The Pennsylvania State University

Jonathan Redding, BCBA

Dr. Jonte Taylor, Assistant Professor of Education, Department of Special Education, The Pennsylvania State University

ACADEMIC VITA

DOMINIQUE D. DOBERNECK

EDUCATION

2008-2013 **The Pennsylvania State University, Schreyer Honors College**
University Park
Bachelor of Architecture
Minors: Spanish, International Studies

2012 **The Pantheon Institute: Sede di Roma**
Semester Abroad
Rome, Italy
Focus: Architecture

2011 **Iberoamericana**
Summer Session Abroad
Puebla, Mexico
Focus: Spanish Language and Mexican Culture

2004-2008 **Lewistown Area High School**
Salutatorian
National Honor Society

RESEARCH

2012-2013 **AUTISMtecture: the influence of architecture on the development of children with autism**
Honors Thesis
Adviser: Jawaid Haider

2011-2013 **Heliodon: A Hands-On Daylighting Educational Tool**
Presented at SOLAR 2013, Ignite Format
Collaboration with Ms. Kara Knechtel

AWARDS

2011-2013	Joseph L. and Vivian E. Steele Fund Scholarship
2012	Schreyer Ambassador Travel Grant: Rome
2011-2012	Grant Recipient: Heliodon: A Hands-On Daylighting Educational Tool
2011	Schreyer Ambassador Travel Grand: Puebla
2010	Alma Heinz and August Louis Pohland Scholarship
2004-2008	Excellence in Math Award
2007-2008	Scholar Athlete (Volleyball)
2007-2008	Senior Athlete (Volleyball)
2006-2007	Panther Pride Award (Volleyball)