Vertical School:
A New Typology for the City

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Abstract

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As Seattle continues to increase in density, so has the demand for schools. Traditionally designed in a horizontal, dispersed fashion, schools are meant to provide the space to promote learning and growth. However, as the population within the city increases, land becomes scarce, and fostering a learning environment becomes an ever increasing challenge.

This thesis examines the current city density and explores the advantages of a downtown school. The Thesis is a proposal for a Vertical School, combining Elementary School, Middle School and High School to improve the existing school system within the greater Seattle to maximize the student's' experience at school.

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Figure 1 - Vertical School within downtown fabric

As Seattle continues to increase in density, so has the demand for schools. Traditionally designed in a horizontal, dispersed fashion, schools are meant to provide the space to promote learning and growth. However, as the population within the city increases, land becomes scarce, and fostering a learning environment becomes an ever increasing challenge.

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1.1 Introduction

In the past fifty years there has been a major shift in educational systems in the United States. Since the 1950s school design has been based on a "cells and bells" model, where students occupy cell-like classrooms with long corridors, their movements dictated by the sound of school bells (figure 1). But this traditional model is no longer applicable to the 21st century learning environment. Architect Bruce Jilk observes that the basic concepts of educational design "have been structured around a very narrow interpretation of 'school.'" He argues that "it is possible… to design settings for education that do indeed expand opportunities for learning." (Children's Space, 31) Evidence to support the connection between learning environments and the education has increased in recent years. The transition into today's "information era" calls for a new type of flexible educational space to enable a wider variety of learning strategies. Designers must challenge the design intents of traditional school facilities that are increasingly un-supportive of learning.

A new design approach is necessary to support adequate learning environments for children. As Ann Taylor writes in her Linking Architecture and Education, "the environment itself and the objects within it becomes a teaching tool or "three-dimensional textbook." (Linking Architecture and Education, 30)

Cities like Seattle that are undergoing rapid change offer the chance to explore the possibilities of architecture itself becoming a learning tool. Designers have a unique opportunity to expand on traditional school systems (physical and curriculum) to begin shaping the city for the future generations.
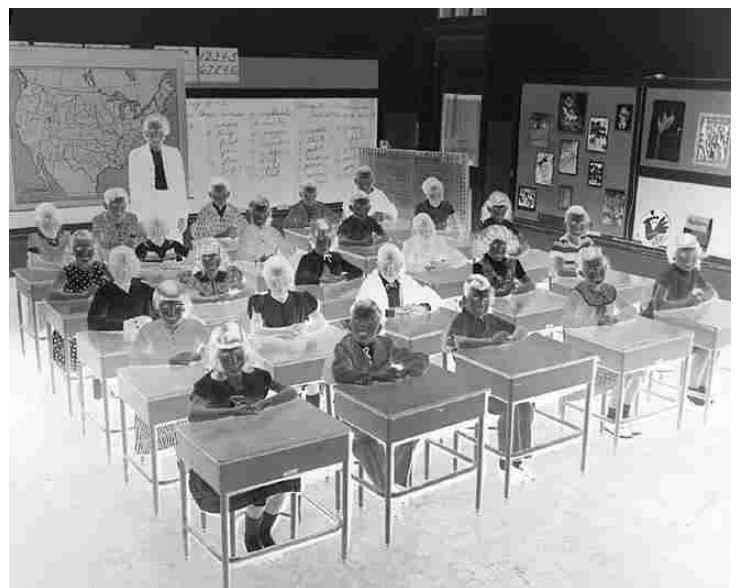
Figure 2 - Cells and Bells Model

2.1 Learning

Childhood is a critical stage in the development of human intelligence and character.   Mark Dudek, a researcher and architect Mark Dudek describes the unique neurological state of children that makes them able to absorb …… knowledge more quickly during early years than at any other time in life. "Children's environment must be conceived of as a 'world within a world'; it should be a special place with all the aspects that make the environment a rich landscape for exploration and play" (Children's Spaces, Intro) The learning environment in which they spend a majority of their time are especially important to their growth.

As Dudek argues successful learning environments can expand children's experiences in this critical formative stage. He states, "The best form of learning takes place within an integrated environment of architecture, technology, and teaching." (Children's Space, Intro) Specialists in education from Maria Montessori to Sal Khan have also emphasized the role of integrated learning spaces. Active learning experiences can reinforce the social development and learning experiences of children who are engaged in the world around them.

The traditional educational system needs to be re-evaluated and modified in order to to support the changing demands of the 21st century. Educational Progress data reveals a declining trend in the traditional U.S educational system since the 1950's. National Assessment of Educational Progress (NAEP) data states that, "80% of high school graduation rate in U.S, however, only 30% of those graduates could read well enough to understand an d use information found in technical materials, literary essays, historical documents, and college-level texts" (Blue Print, 30) The evidence indicates that this decline is in part due to the gap between changes in learning and the physical environment of educational facilities. This lack of physical environment to support education is alarming to many parents and others, because lack of educational support is pushing unprepared children into the real world to solve increasingly complex issues. A new approach to learning architecture is needed to to support children in their learning for the future.

2.2 Obsolescence of Traditional Education

British educationalist Ken Robinson has recognizes the obsolescence of the traditional U.S school system. "The whole process of public education came about primarily to meet the needs of the Industrial Revolution in the 18th and 19th centuries." (The Third Teacher, 56) He argues that the traditional education structure focuses on a strong sense of conformity. 'Teacher-Centered Learning' is a conventional model where a teacher teaches students at a given time frame and test the students on taught material. This system places a teacher in the front of the confined space of a classroom and the students as spectators in rows. This past conventional model dictates a physical environment that is fixed and ordered in a set pattern.

In contrast to this 1950's model, 21st century education has evolved to embrace a more flexible innovative, and cross-disciplinary thinking. (figure 3) Sal Kahn, educator and founder of Khan Academy supports 'Student-Centered Learning'. He argues that, "Learning environment should be geared towards the student, individualized, allowing children to explore and learn at their own pace to master the material." (Let's Teach for Mastery - not test scores. Ted Live Nov 2015) This core concept of 'Student-Centered' learning has been proposed before. Mario Montessori, best known for her philosophy on education in the late 1800s also agrees with 'Student-Centered Learning'.

Figure 4 - Transitioning from 'Industrial Era' to 'Information Era'

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She writes, "Children do not learn by obeying rules and reproducing behavior, but by discovering and exercising their own strengths and abilities in an environment suited to that self-determination." (The Third Teacher, 14) 'Student-Centered' learning provides a platform for students to actively participate a deeper understanding of material, allowing "project-based learning, personalized learning and socio-emotional learning." This paradigm allows students to direct their learning, maximize their own personal potential, and develop the skills to apply theoretical knowledge to solve real-life problems." (Blue Print, 5) This kind of self-determination is believed to allow children to actually absorb the materials and master the knowledge individually. This approach will bring dynamic interaction within the learning environment taking ownership of their learning. Khan suggests that encouraging students to take ownership of their learning through creative teaching will focus on creative classes will lead to opportunities that will produce future researchers, and entrepreneurs.

2.3 Re-Imagining the Physical Space

The mandate for education of children to encourage progressive thinking requires a functioning and supportive physical learning infrastructure. Over $12 billion dollars are being invested as school facilities every year, making it the largest educational investment in US history. However, many traditional school buildings are average 40 years in age with falling far short against goal of 21st century educational demand. Educational consultant, Prakash Nair argues that this failure, "is not surprising, because older school buildings were not designed to facilitate modern methods of teaching and learning." (Blue Print, 1) Typical physical classrooms are designed to be 'Teacher-Centered Learning' environments with double loaded corridors reinforcing isolation from other classes. Conformity is encouraged in a classroom layout where the teacher is positioned in a fixed position in front of a group of students. Educational designer Bruce Jilk argues environments should mirror the learning they are designed to support. "To be sustainable we must simultaneously design for greater longevity and increased flexibility of use." (Children's Space, 33) Student –Centered Learning design calls for a new approach that provides greater flexibility of use. An emerging approach to classroom is based on contingency, meaning conditions not yet established.

Jilk observes, "in learning, one formulates thoughts in the mind that did not exist there before. Learning is a creative action." (Children's Space, 32) In order to raise the quality of learning for children, more flexible and creative learning spaces are need.

The obsolescence of traditional school facilities has been documented by engineers as well. The American Society of civil Engineer's 2107 report card on America's infrastructure gave schools a grade D, citing aging, outdated, and overcrowded facilities, estimating that 75 percent of the buildings were not meeting student requirements. (Linking Architecture and Education, 8)

2.4 Benefits

New school typology will bring benefits to the city. New school typology will be more sustainable, improve school systems and utilize existing Seattle urban infrastructures.

High density design approach will present an opportunity to be Sustainable. As the design disperses the program vertically, school facility will require less foot print on the ground floor. This is important because the world urban population is in rapid increase. The current pop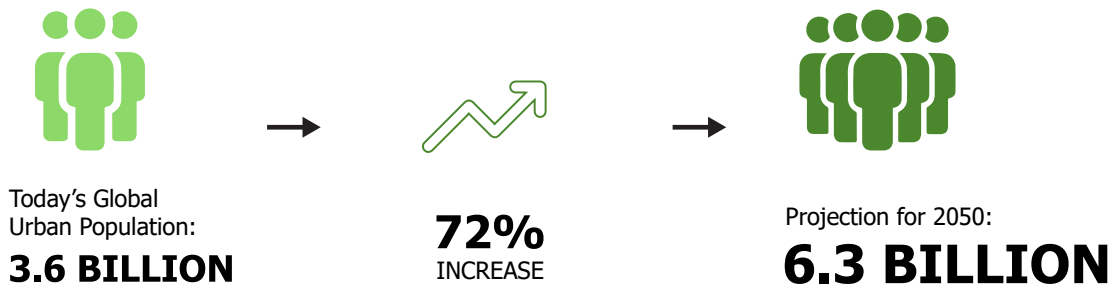ulation of 3.6 billion is projected to grow by 72% by the end of 2050. (figure 6) This is more than tripling from the urban population in 1970s. The demand for urban schools for children will only increase as urban densifies through population increase. To provide proper learning environments for the 21st century and beyond, a more creative solution to the need for a new type of educational model. "The economic status of individuals and countries will greatly depend on their levels of education." (Global Trends 2030: US National Intelligence Council) Sustainable design strategies will reduce operation cost and provide better learning environments for the students.

WE CAN REDUCE
$14 Billion
U.S Public School
Annual Maintenance & Operation Cost

Figure 5 - Reduction of

Today's Global
Urban Population:

3.6 BILLION

72%
INCREASE

Projection for 2050:

6.3 BILLION
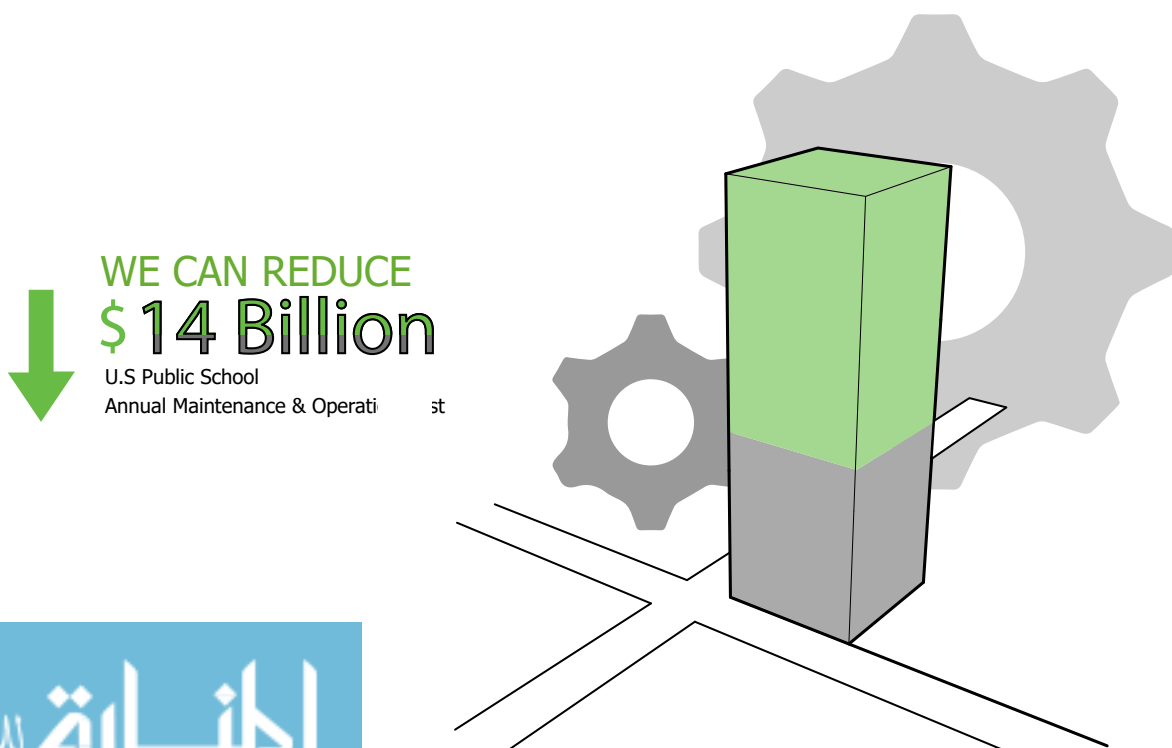
Rate of Urbanization
(% of the Population Living in Cities)

10%

30%

50%

60%
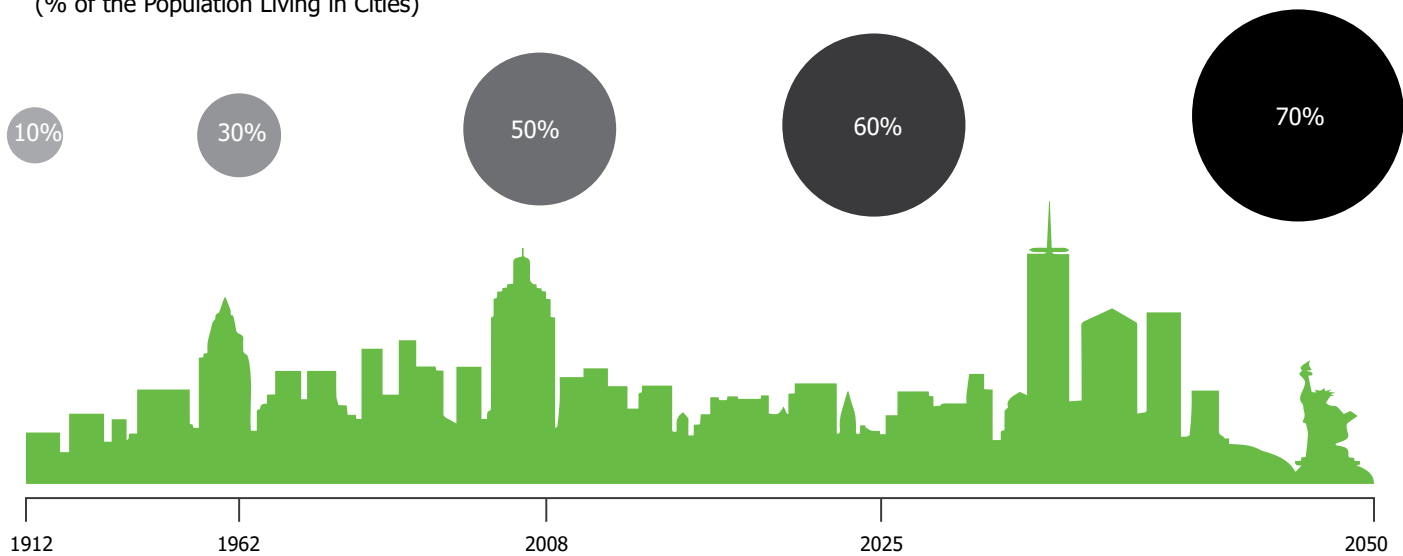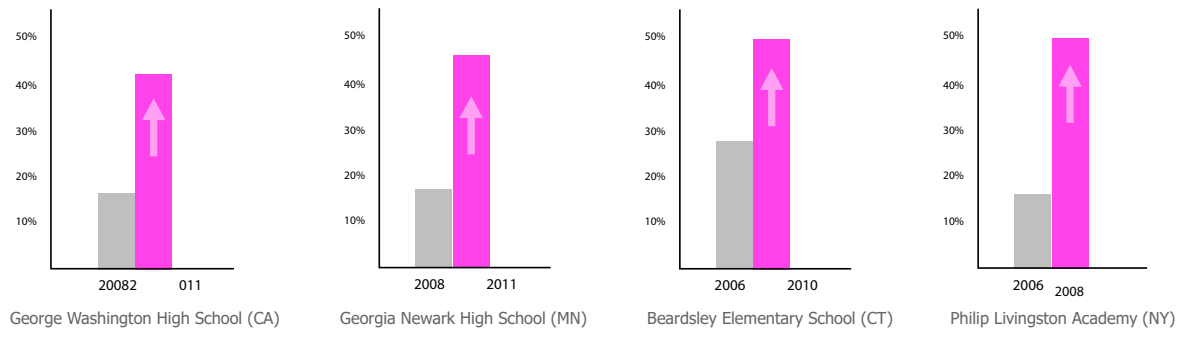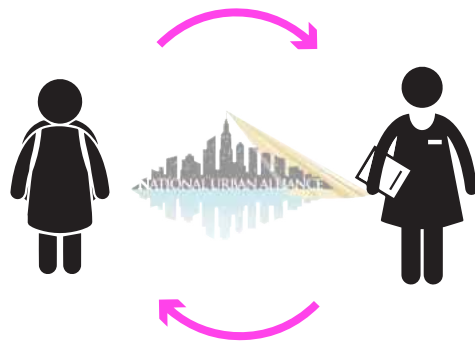
70%

| 1912 | 1962 | 2008 | 2025 | 2050 |

Figure 6 - Urban Population growth around the world

High density design increases student interactions. High interaction between students creates a platform for students to learn from each other and develop social skills. In addition to the social development, the new urban school typology improves the public school system by implementing cutting edge school programs like Effective Education Program. National Urban Alliance is an organization that works with urban school districts to improve test scores by encouraging students to create mock lessons where students teaches the teachers and teachers in training programs. This exercise creates a dialogue between the school and the students by discussing what works and what does not. It also provides additional information for the school to make assessments on student's and the materials they learn. There are proven urban studies (figure 7) across United States from LA to New York where schools in urban setting have improved their education qualities by 20%.

| George Washington High School (CA) | Georgia Newark High School (MN) | Beardsley Elementary School (CT) | Philip Livingston Academy (NY) |

Improved State Test Scores after **Effective Education program**

Figure 7 - National Urban Alliance

There are existing urban infrastructures in downtown Seattle available for the school to utilize. This is very unique to the urban schools compare to the schools in the suburban schools.

There are unique partnership opportunities for the vertical school. (figure 8) Opportunities within downtown allows for students experience in the field they are interested in or would like to learn more. The wide ranges of opportunities are available from Arts at the Arts Institute to Neuroscience at Paul Allen Institute at South Lake Union. The unique urban setting also provides students with access to Seattle landmarks for the students to engage with the school context that is very different than the suburban schools.

Lastly, there are existing public transportation that is accessible for the school occupants and provides an opportunity for the school to serve the broader Seattle for the future. The public transportation commute will support students to be more active and make connection with the urban context.

Figure 8 - Partnership Opportunities

2.5 Need for A New School Typology

The 2010 economic boom has changed the downtown cityscape in the city of Seattle forever. In addition to a record pace of new construction projects downtown (downtownseattle.com PDF, 2), an additional 18, 896 residential units will be built by 2019 to meet the growing demand for housing.   Downtown Demographics Report in 2016 by the Downtown Seattle Association recorded a 72% population increase since 1990 (figure 9).   In particular, "Downtown Seattle's Uptown and South Lake Union/Denny Triangle neighborhoods grew 103 and 305 percent." (downtownseattle. com PDF, 3) Increasing number of young families moving into the city has driven the number of school aged children higher. The Seattle School District recorded an 50% increase of school age children between 2010 to 2016. Tracy Libros, the district's student enrollment manager confirms the growing number of elementary school age children within downtown Seattle. "The district no longer sees a drop in the number of students in… elementary school, and middle school." (Seattle Times. May 28, 2014)
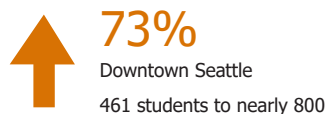
The recent population growth in the downtown area has challenged the city's educational infrastructure. Unprecedented population growth has outpaced capacity of existing and influx of traffic has limited community spaces for children. Local resident, Michael George commented, "right now having a family with kids downtown is difficult because ... there isn't a place to create a community around. What a school would do is help kids and parents from throughout downtown connect around something." (http://www.sightline.org) Architect Lisa Galen observes that schools are in an ambiguous relationship to the public realm. She emphasizes on the importance of community values in creating a safe environment for children. "Children are the most private part of a family, even when they are out of the home and in a school." (Sustainable School Architecture, 58) The growing demand for an educational facility and safe community space within the downtown area calls for a new approach to the design of a school. This thesis proposes a new school typology that will serve local students and their families and reinforce the sense of community in the downtown area.

Increasing Demand

Rise in births in Downtown Families (2007 - 2016)

↑ 103%
Downtown Seattle

Seattle Public School Enrollment

↑ 73%
Downtown Seattle
461 students to nearly 800

Legend:
- More than 50%
- 40% - 50%
- 30% - 40%
- 20% - 30%
- 10% - 20%
- 0% - 10%
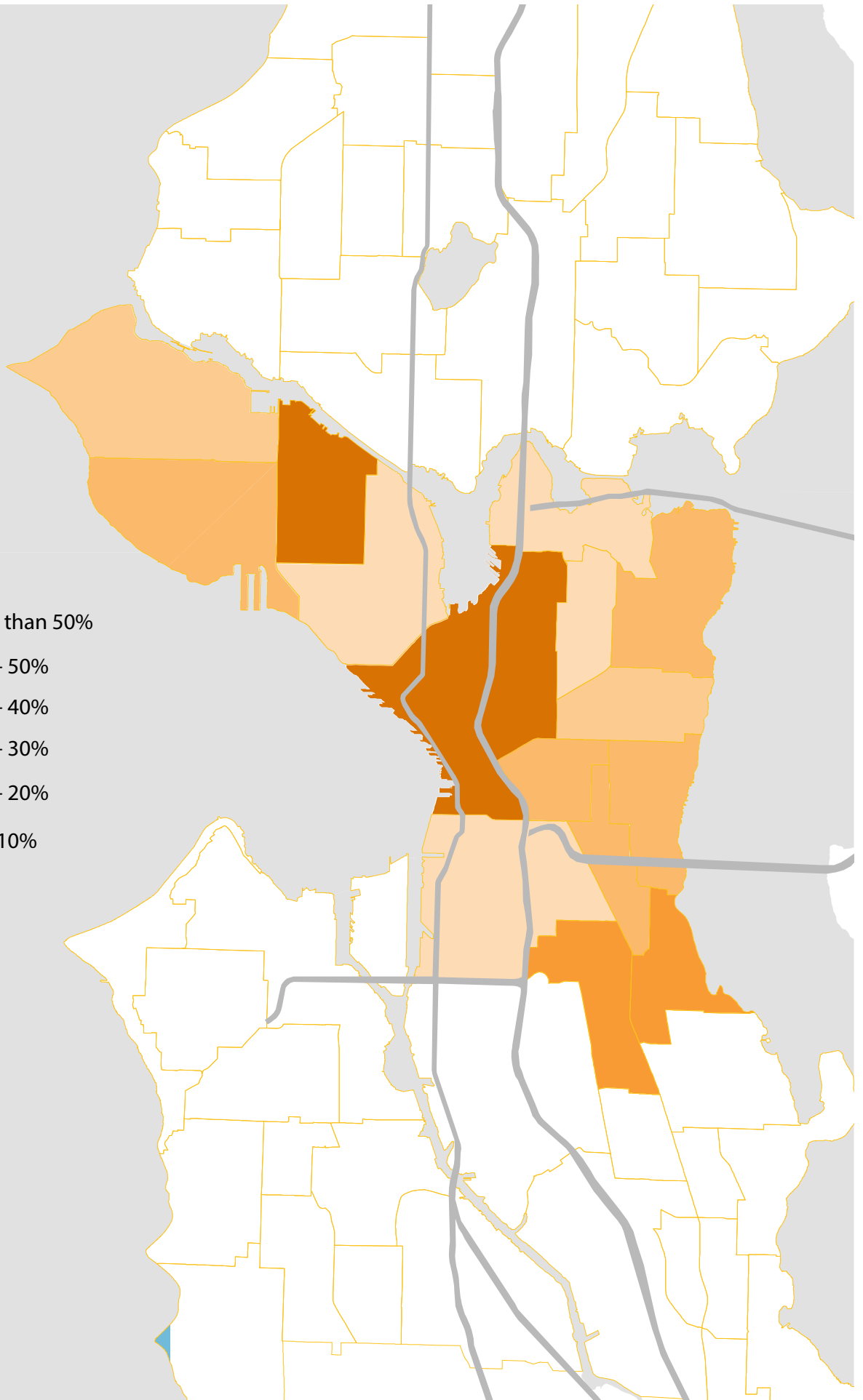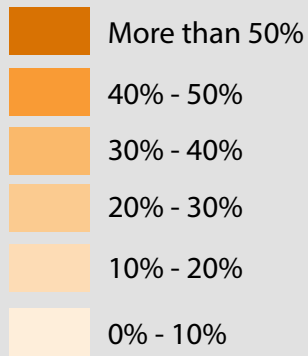
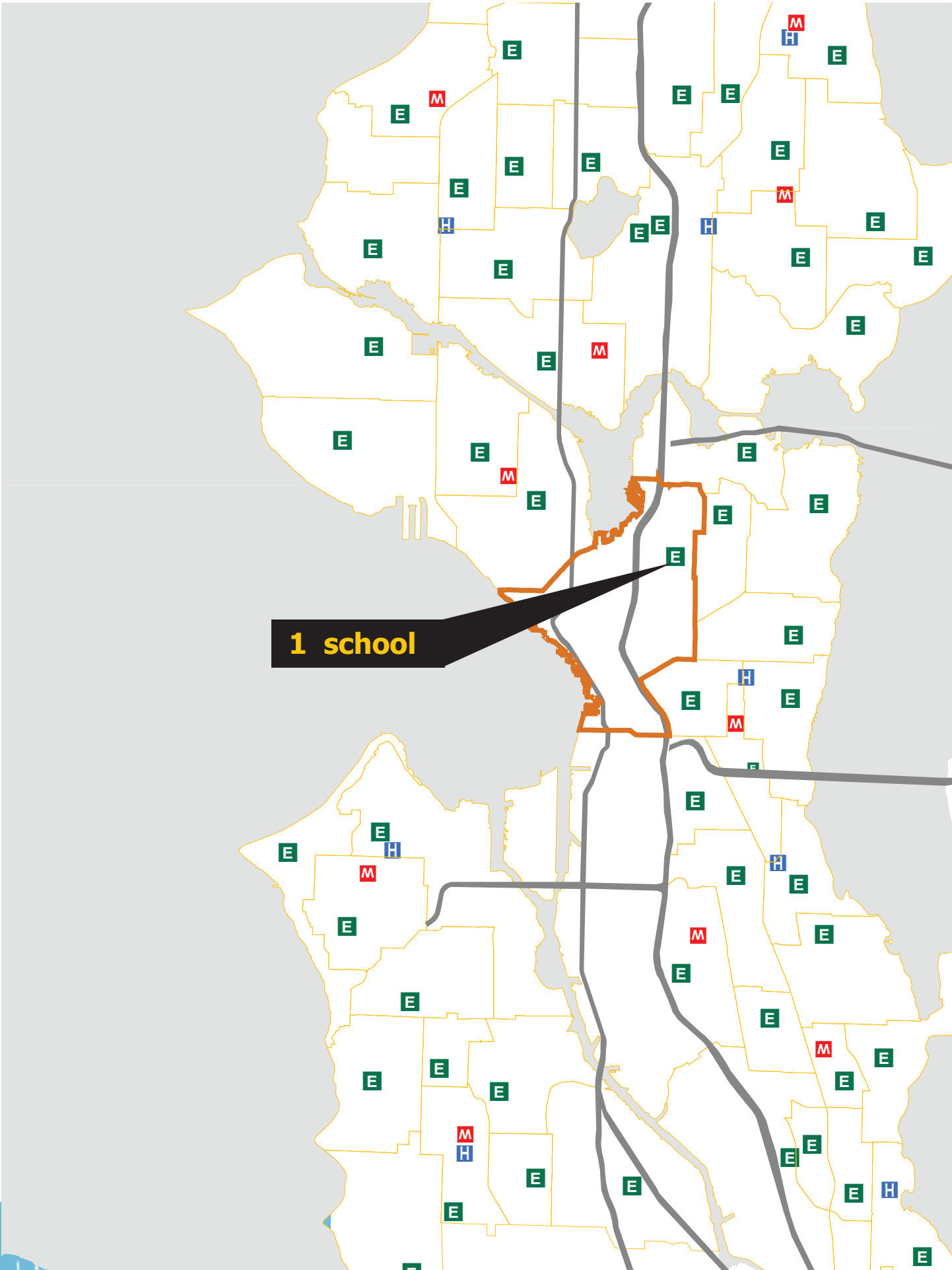Figure 9 - Seattle Density Diagram

1 school

Figure 10 - One Elementary School serving downtown Seattle students

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2.6 Vertical Campus

Since the 1950s the conventional "Teacher-Centered Learning" school model has taken the form of low-rise cubic structures. The concept of Vertical School Campus has emerges as a solution to offer a new type of learning environment in dense urban conditions. The authors of "The Future of the City" state, "a turning point in urban education is the "vertical campus" where a single tall structure contains one of multiple schools. The vertical campus reinforces the urban nature of educational institutions and gives cities a new identity." (The Future of the City: Tall Buildings and Urban Design, 58) Al-Kodmany and M.M.Ali view vertical buildings as a solution to the scarcity of land in high-density areas. (figure 11) Vertical structures can "provoke urban inspirations and emphasizing the centrality of education to city and business." (The Future of the City, 60) This thesis argues that a well-integrated vertical schools can help to redefine the image of traditional schools and become part of the community. After school activities functions as an extension from its community to its neighboring cities. The analysis of case studies of recent examples will demonstrate how vertical schools can be successfully integrated into the surrounding urban fabric and the community.

Figure 11 - Vertical School in Downtown

2.7 Case Studies

Case Studies One: Singapore International School-Hong Kong

The school exemplifies an idea of vertical school by designing adaptive re-use and rebuilding the existing urban school at Aberdeen, Hong Kong. The project is commissioned to revive a 20-year old utilitarian public school into a new learning environment that's suitable for the 21st Century students. One of the biggest challenges is to create an integrated campus within the small foot print of the existing facility (0.4Ha). "The new secondary school wing is not to be seen as a standalone facility, but an integral part of a larger complex" (www.mkp.sg) to blend in with its surrounding nature and accommodate 800 students. This unique constrains of the site offers an opportunity to apply new strategies for a vertical school in the city. "The vertical stacking of program and spaces form the main thrust of the design." (www.mkp.sg) (figure 12)

Figure 12 - Singapore International School (Exterior)

The addition MKP designs the vertical facility through articulating series of smaller volumes. The design strategy achieves transparency, appropriate scale and compatible massing. The transformation enriches the learning experiential qualities. The interlocking of the smaller masses creates an open atrium around the central circulation. The design strategy allows natural lighting into the atrium, natural ventilation and promotes interaction. The Sports Hall is positioned at the top, forming a canopy over this all-weather social space. (figure 13)

Figure 13 - Singapore International School Atrium (Interior)

Case Studies Two: William Jones College Preparatory School

The school project demonstrates a new school typology by designing a vertical school. Perkins+Will designers approached the project with a focus on school programs and functions. Seven occupied floors allow school functions to disperse vertically. "Classroom spaces are located at the center of the school (4th and 5th) to provide optimum proximity to the shared curriculum spaces above and below." (ArchDaily. 02 Jan. 2014)   Perkin+Will's stacked design process creates outdoor space opportunities for students. Different scale of terraces allow students to explore distinctive parts of the facility. School programs on each floor are carefully designed. First and second floor are public for the occupants to enter. Third through sixth are semi-private with classrooms for the students to circulate. Seventh floor is the most private space occupied by a gym and swimming pool where privacy is needed.

Figure 14 - William Jones Preparatory School Section

Figure 15 - William Jones Preparatory School with Context

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Above two examples responds to different urban challenges through design. Vertical school creates opportunities to engage public as a social learning environment. School also redefines the image of a traditional academic facility through aesthetics. Both vertical school designs have unique solutions to population growth and high densities in metropolitan cities. Seattle, a city with a characteristics of a growing metropolitan will benefit by implementing vertical school.

As the educational system has changed, so must school design. The traditional low-rise model cannot support current approaches that emphasize interactive Student Centered Learning. This thesis argues for the integration of vertical schools into downtown Seattle in begin to address issues of population growth and increased density in the city. We should continue to explore and learn from the leaders in designing vertical campus to begin providing different learning configurations to meet the infinite imaginations of our children.

3.0 Site Selection

The intent of this thesis is to design a vertical school for downtown Seattle that responds to the growth of the city and changes in educational curriculum. By 2019, 42% of the new condo construction will be developed in Belltown. The selection of the site for the new Vertical School is driven by lack of existing education network in the city.   The criteria also address issues of neighborhood growth including traffic flow and residents safety.

The chosen site is in Belltown, intersection of 3rd and Bell street. (figure 16) The site is located in close proximity to residential fabric and to existing community resources.   The proposed Vertical School will serve 2000 students from Elementary School to High School.

Proposed Site

Figure 16. Proposed Site; 3rd Avenue & Bell Street
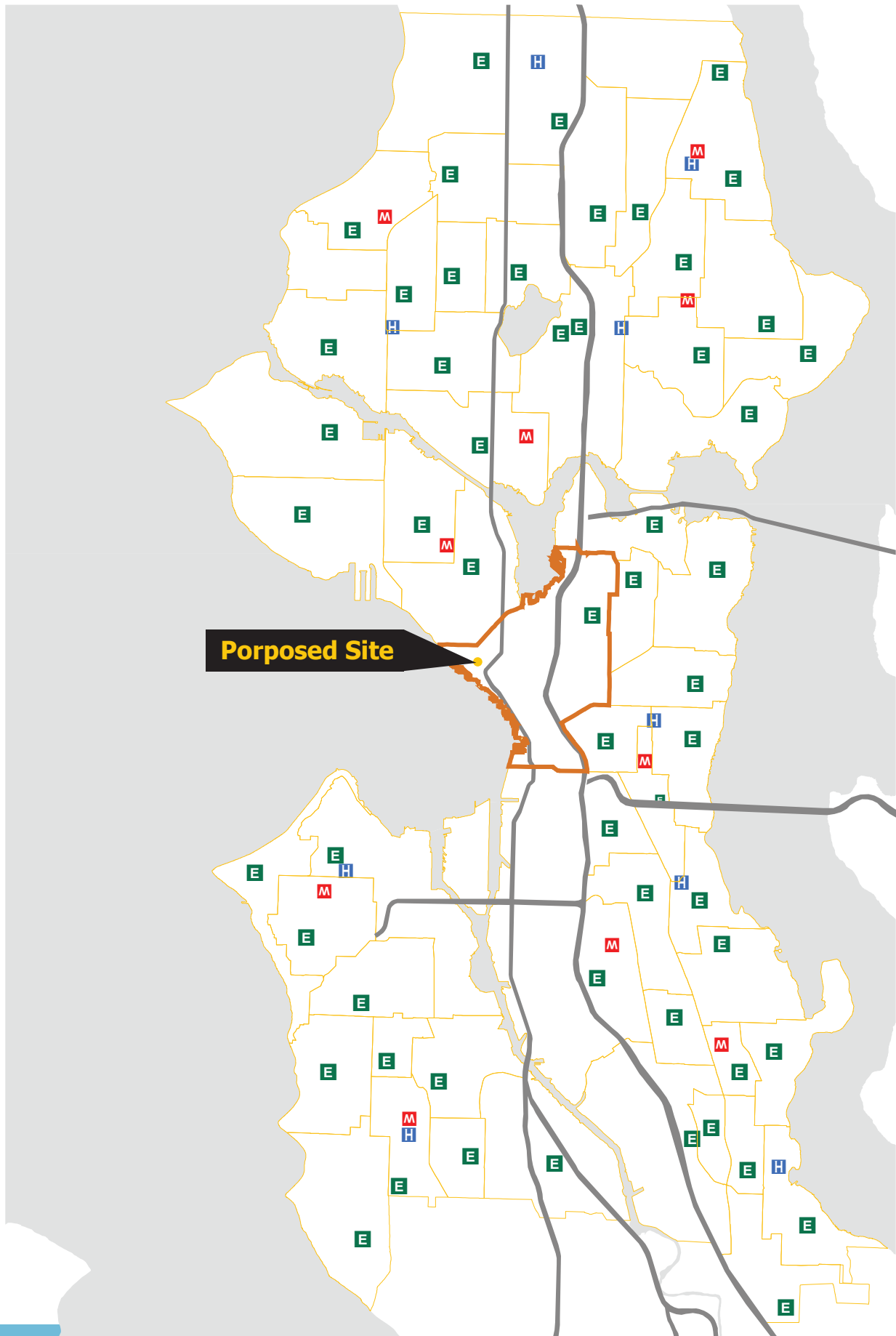
Porposed Site

Figure 17. Proposed Site within downtown district

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Existing school resources supporting elementary, middle, and high school in downtown Seattle is basically non-existent. Figure 10 indicates the nearest elementary school offered in downtown is Lowell Elementary School in Capitol Hill, Seattle. The addition of the proposed public school will greatly benefit the immediate communities like downtown, Belltown, Lower Queen Anne and Capitol Hill by serving the local community of growing number of school aged children.

Belltown, located just to the north of the downtown area, is said to be the most densely packed neighborhood in the city. Once a low rent, semi industrial area, the area has transformed into a neighborhood of high rise apartments and condos. According to city data, there has been a 40% increase in residents between the age of 6 and 18 in last 10 years. Belltown, an area establishing itself as an area of high-rise condos (figure 18) and apartments will be an appropriate location for the proposed vertical school. The vertical school will serve to maximize the use of the plot and to distinguish the presence of the school among the surrounding high rise structures. Residence will become the guardians of the students during school hours, creating a sense of safety and stronger community bond.

Proposed Site

PROPOSED SITE
(E) RESIDENTIAL TOWERS
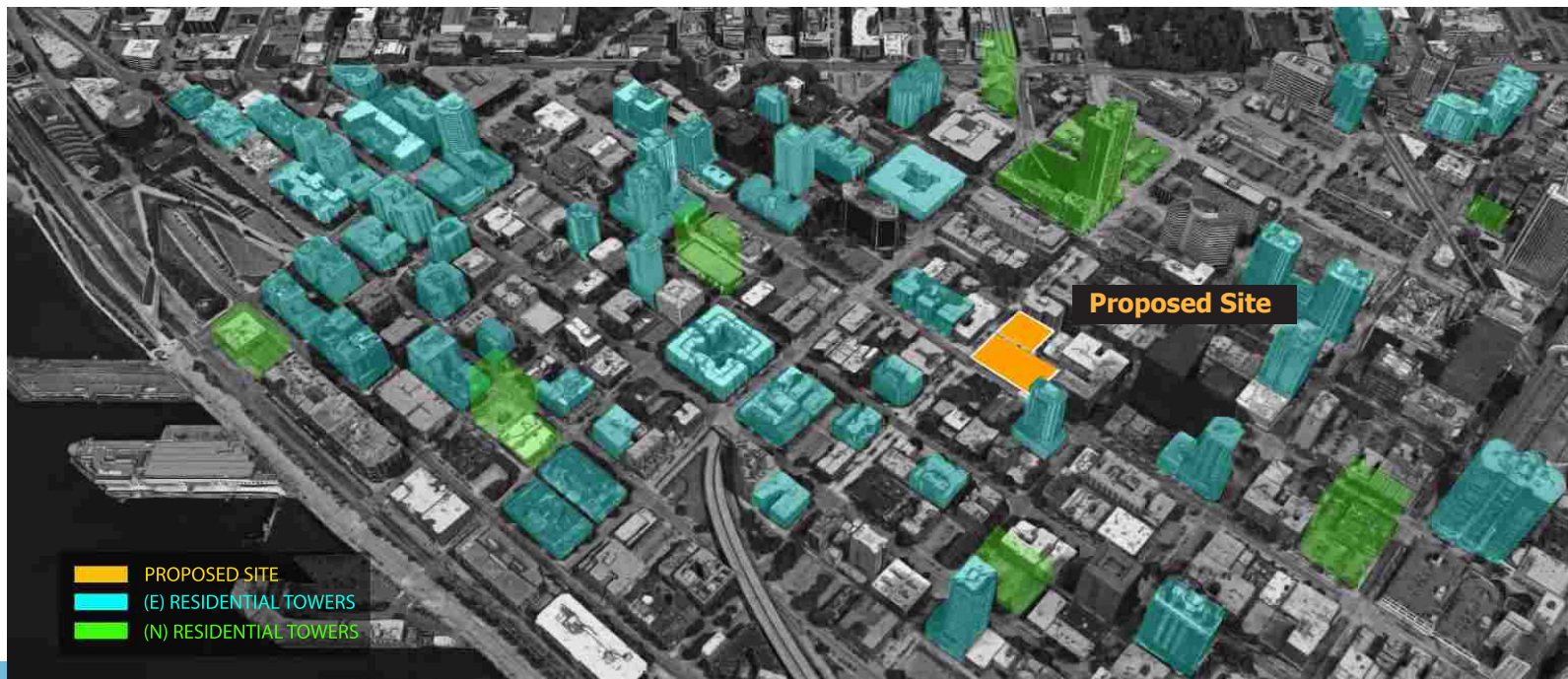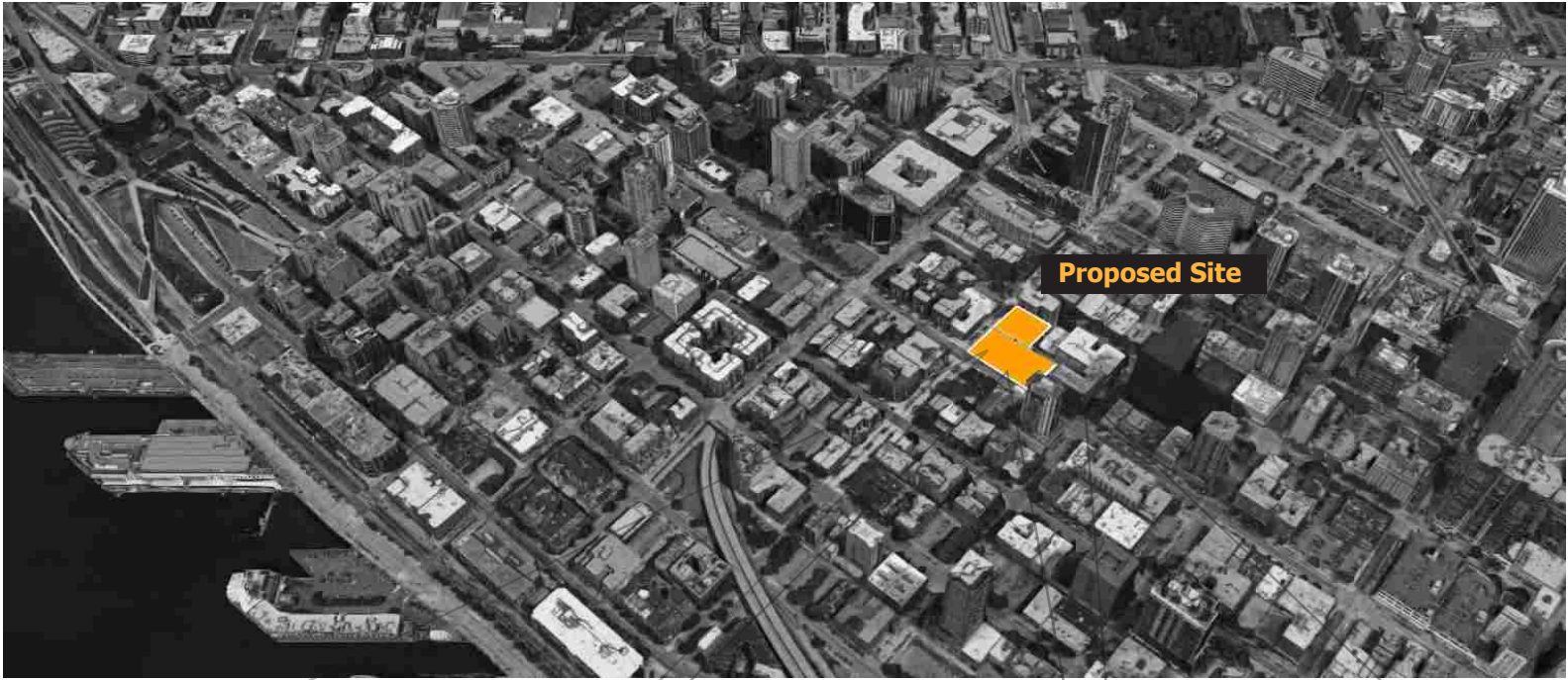(N) RESIDENTIAL TOWERS

Figure 18. Residential Development in Belltown

Figure 19. Site Context

NE of the Site   Existing Parking Lot at the Site   South of the Site

Figure 19. Proposed Site Context

500,000 ft.2 proposed site shown in Figure 14 has a height restriction at 250ft. The site encompass an empty parking lot, a small low rise, and an existing 12 story residential building to the East. An existing 9 story residential building to the south of the site.

OLYMPIC SCULPTURE PARK

DENNY PARK

BELLSTREET PARK

Proposed Site

BELLTOWN COTTAGE PARK

REGRADE PARK

PROPOSED SITE
PARKS

Figure 20. Existing Parks around the proposed site

Lack of parks and amenities in Belltown creates an opportunity for the design to solve and engage the community.

4.0 Program Organization

The school serves 2000 elementary to high school students in downtown Seattle. This school primarily serves the downtown residents rather than neighborhoods in the periphery of Seattle. Figure 9 indicates the proposed perimeter serviced by the school, based on Seattle School District's data.

In contrast to the traditional model of classrooms horizontally arranged along corridors, this new school typology takes advantage of the vertical form without compromising space for quality. It addresses a new type of learning environment through program rearrangements.   The proposed school emphasizes integration, way-finding, and performance.   The design principles organizes three main components of the programs: interaction, collaboration, and security. Dispersed vertically, more flexible and interactive spaces for student-centered learning are created.
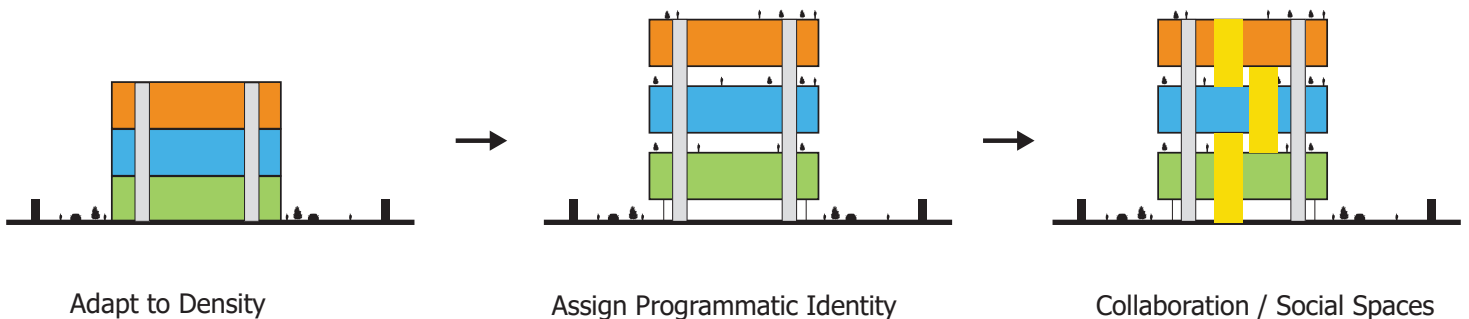

Adapt to Density   Assign Programmatic Identity   Collaboration / Social Spaces

Figure 21. Program Organization

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5.0 Design Guidelines

Based on the analyses of case studies and theories on education and architecture, the Vertical School focuses on interaction, collaboration, and security. Interaction is a core principle of the Vertical School's design. The design addresses interaction through responding to its context and internal program layouts. It begins with a community space within the site that engages immediately with its surrounding environment. Additional amenities such as gyms and playgrounds presents an opportunity to engage the community beyond school hour.

In addition, the idea of interaction includes strong program layouts. The distribution of auditoriums and cafeterias at interstitial levels integrates students from all grades to congregate in the shared areas.

Collaboration as a design guideline emphasizes the core of the school (figure 21), establishing vertical and horizontal circulation, as well as interactive spaces around the atrium.

As an urban school, controlling access is a challenge. This design guideline focuses on controlling private and public accessibility and establishing a safe environment for all students.
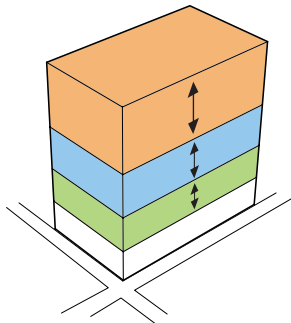
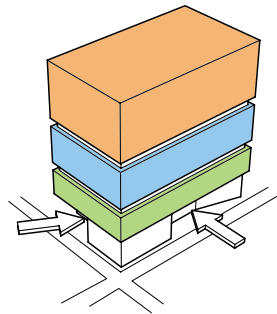# 6.0 Design Responses

Programmatic Organization and Massing

The Vertical School design demonstrates optimal spatial and circulatory organization in a high density design that results in better learning environment for the 21st-century students. The design approach emphasizes on the schematic-level design of the entire school with greater detail focusing on entries, security, classrooms, and auditorium. The general layout of the schools respond to specific needs of each schools with individualized circulations.
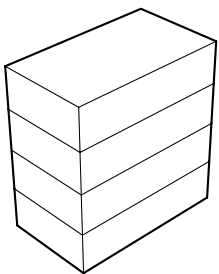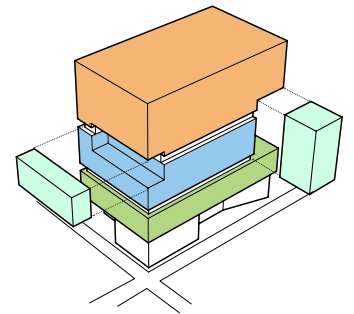
| Respond to Urban Condition | Massing Adjustments | Establish Entries | Green Spaces |

Figure 22. Program Massing Adjustments

Designated elevators for each of the schools allow students to move through the facility efficiently (figure 24). In addition, interstitial spaces such as auditorium and cafeteria promote social interaction between schools.

The amenity facility located at the corner of 2nd and Bell Street contains the administration offices, gyms and lockers for students during school hours. The space then becomes a community center for the immediate neighborhood after hours.
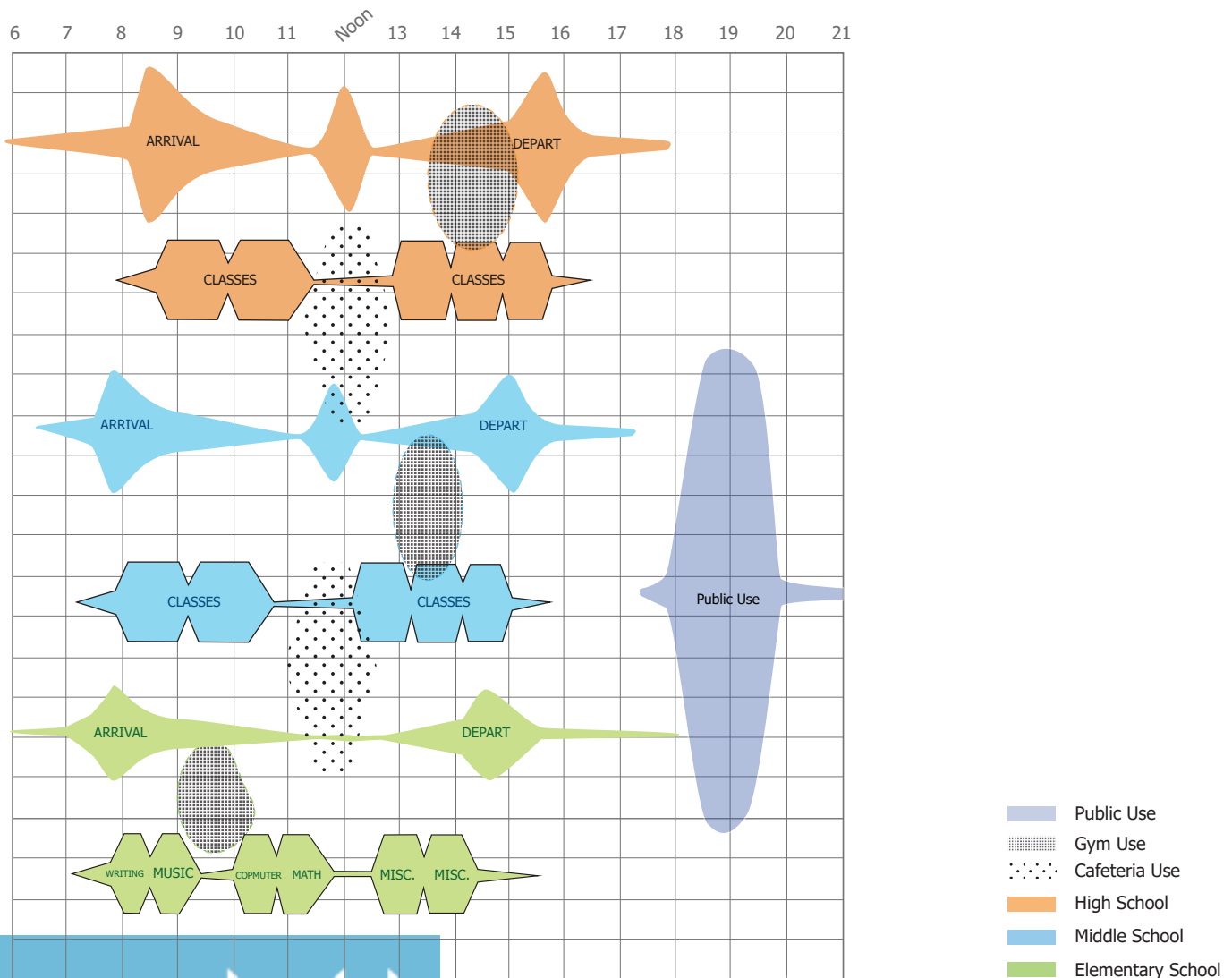

Figure 23. Time Table - Influx of Traffic

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The design encompasses two volumes, shown in figure 24. The first volume is the school located at the corner of 3rd Avenue and Bell Street. The second is the amenity facility located at the corner of 2nd Avenue and Bell street. The orientation of the school takes advantage of the southern exposure.
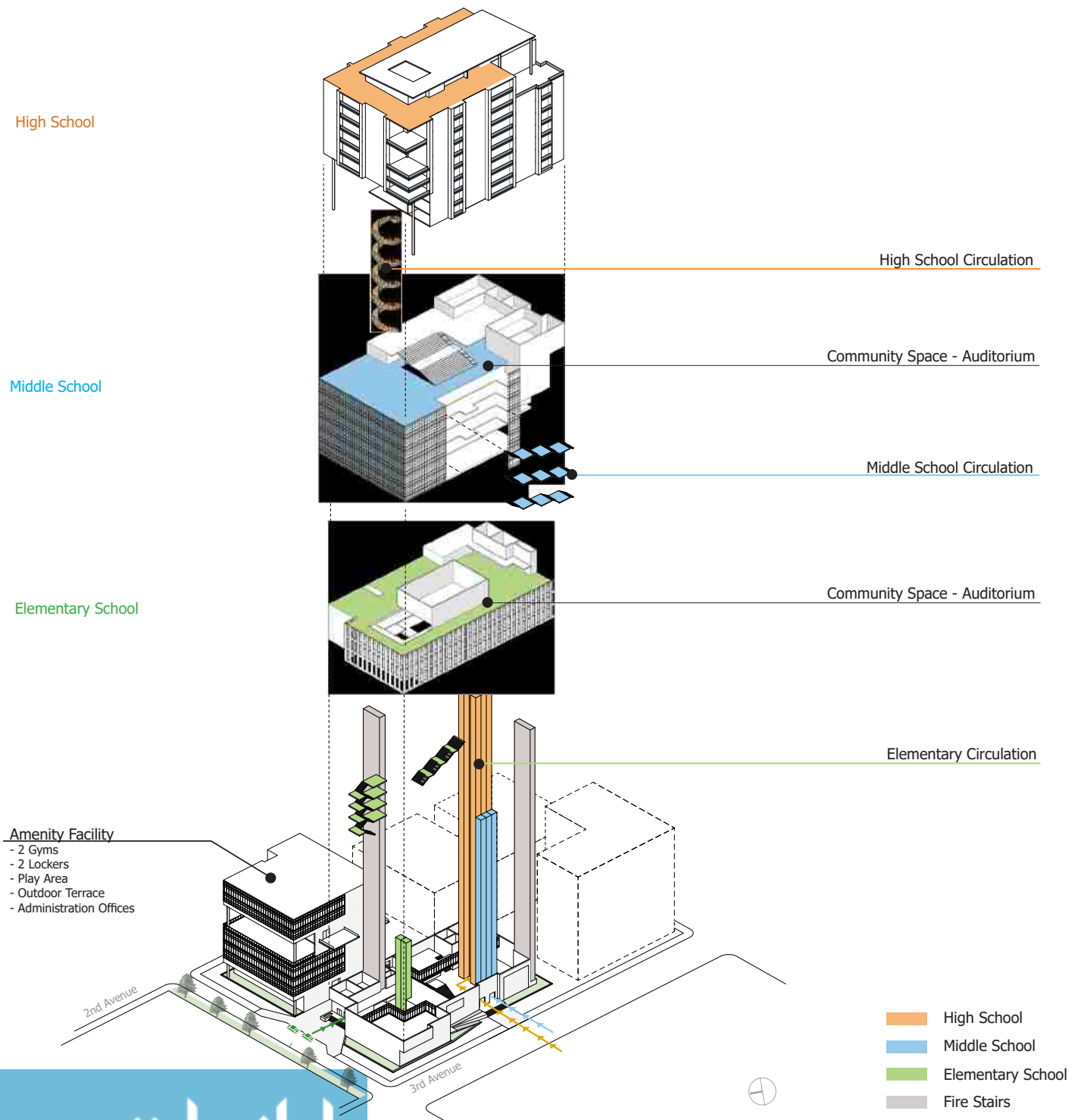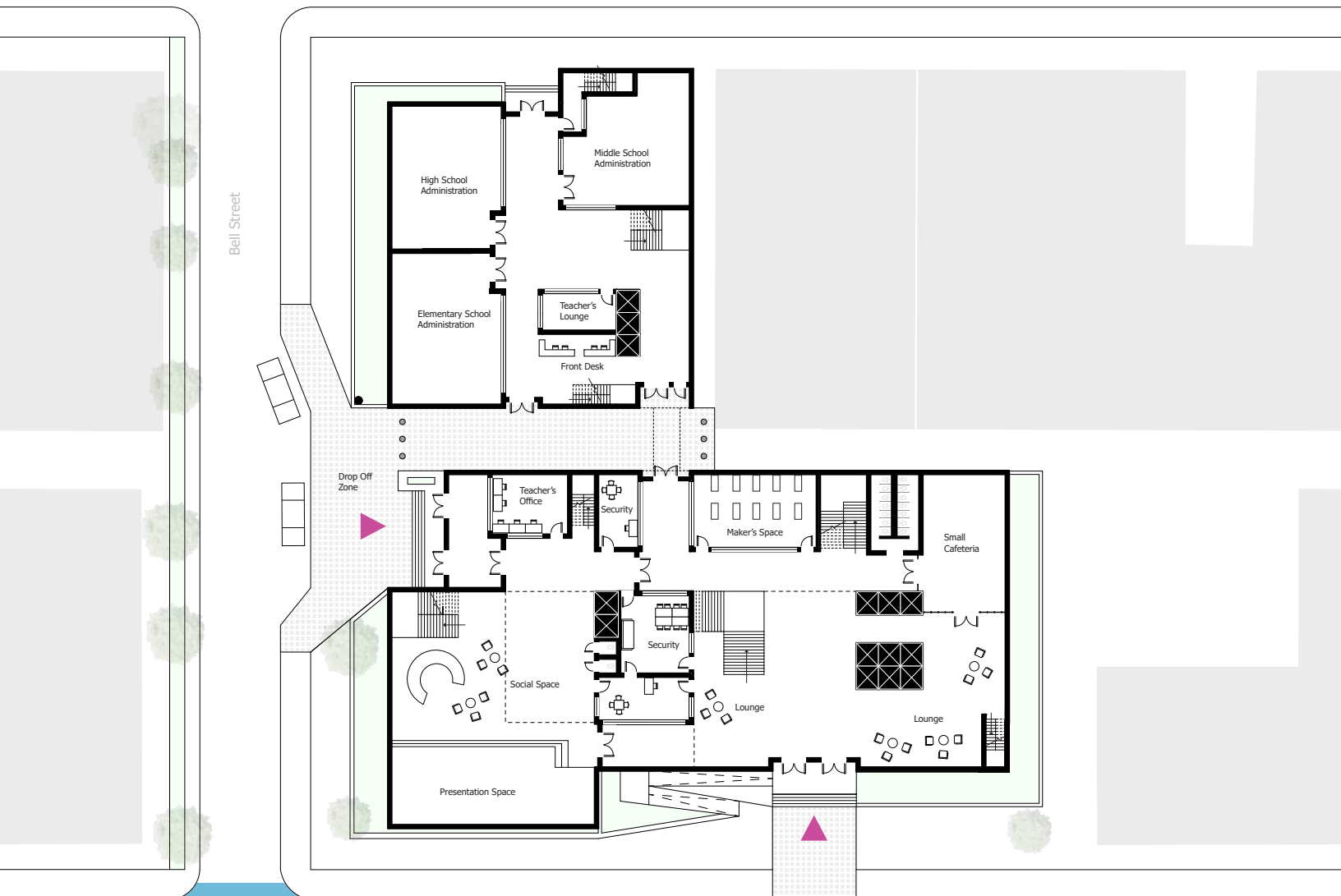

High School

High School Circulation

Community Space - Auditorium

Middle School

Middle School Circulation

Elementary School

Community Space - Auditorium

Elementary Circulation

Amenity Facility
- 2 Gyms
- 2 Lockers
- Play Area
- Outdoor Terrace
- Administration Offices

2nd Avenue

3rd Avenue

High School
Middle School
Elementary School
Fire Stairs

Figure 24. Circulation Diagram

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Entries

The street level of the school is the main access from the outside into the school. Because of this, controlled security, foot traffic, and public access are primary concerns.

To address access, there are two main entries that accommodate the students' arrival into school. The first is the northern entry. The northern entrance is designed with a drop-off zone on Bell Street for younger students arriving with parents. The second is the eastern entry, designed for older students arriving through walking or public transportation at 3rd and Blanchard.

Bell Street

Middle School Administration

High School Administration

Elementary School Administration

Teacher's Lounge

Front Desk

Drop Off Zone

Teacher's Office

Security

Maker's Space

Small Cafeteria

Security

Social Space

Lounge

Lounge

Presentation Space

3rd Avenue

Figure 25. Street Level Floor Plan - Entries

Street Level Plan

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These controlled and designated entry points provide a safe environment where teachers and security officers are regulating public access in order for the students to enter into a safe learning environment.
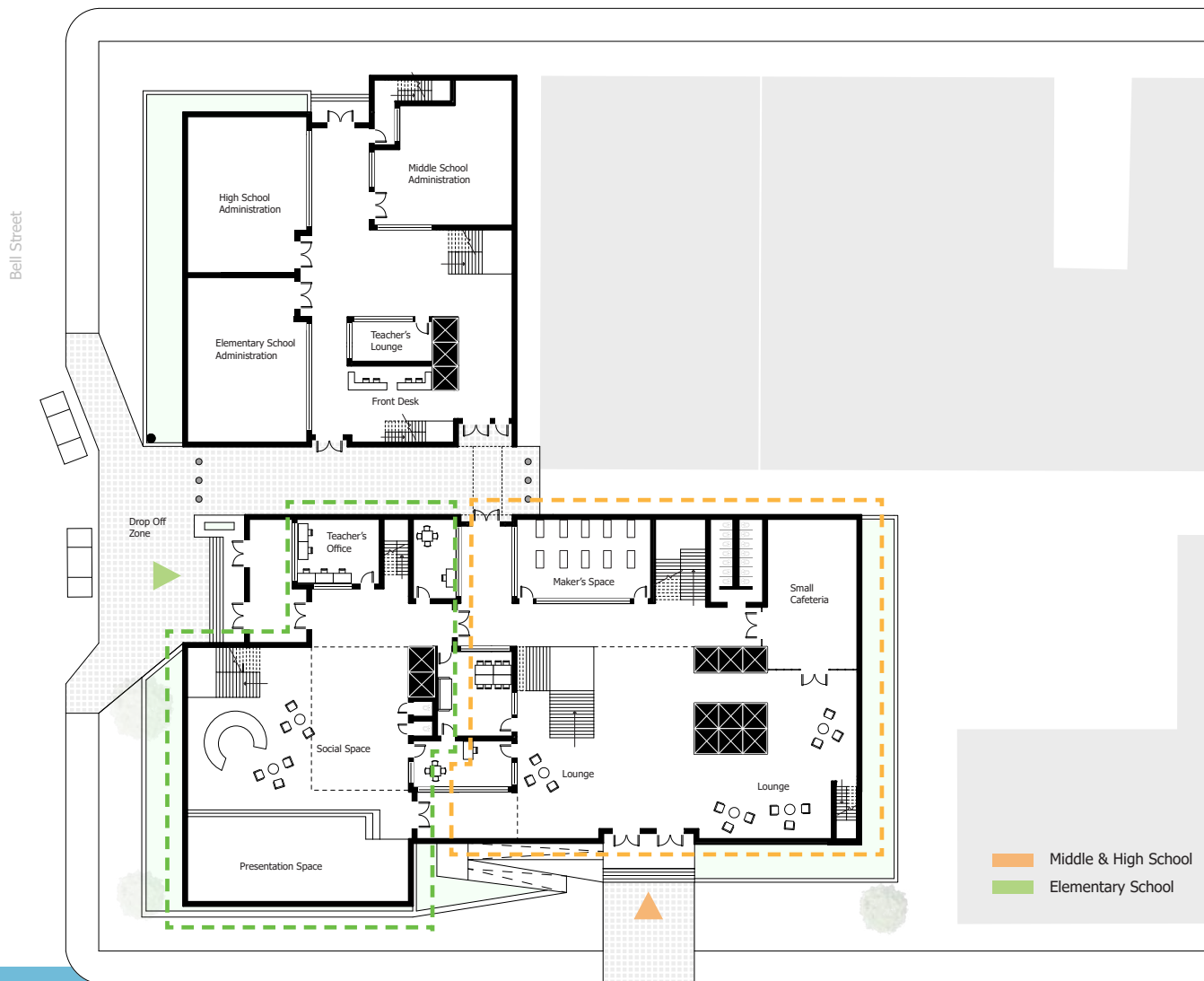

Figure 26. Street Level Floor Plan - Security

The open first floor is designed specifically to maximize ease of navigation. The northern part of the school, shown in green, is elementary school, and southern part of the school (shown in oranges) is occupied by middle & high school.
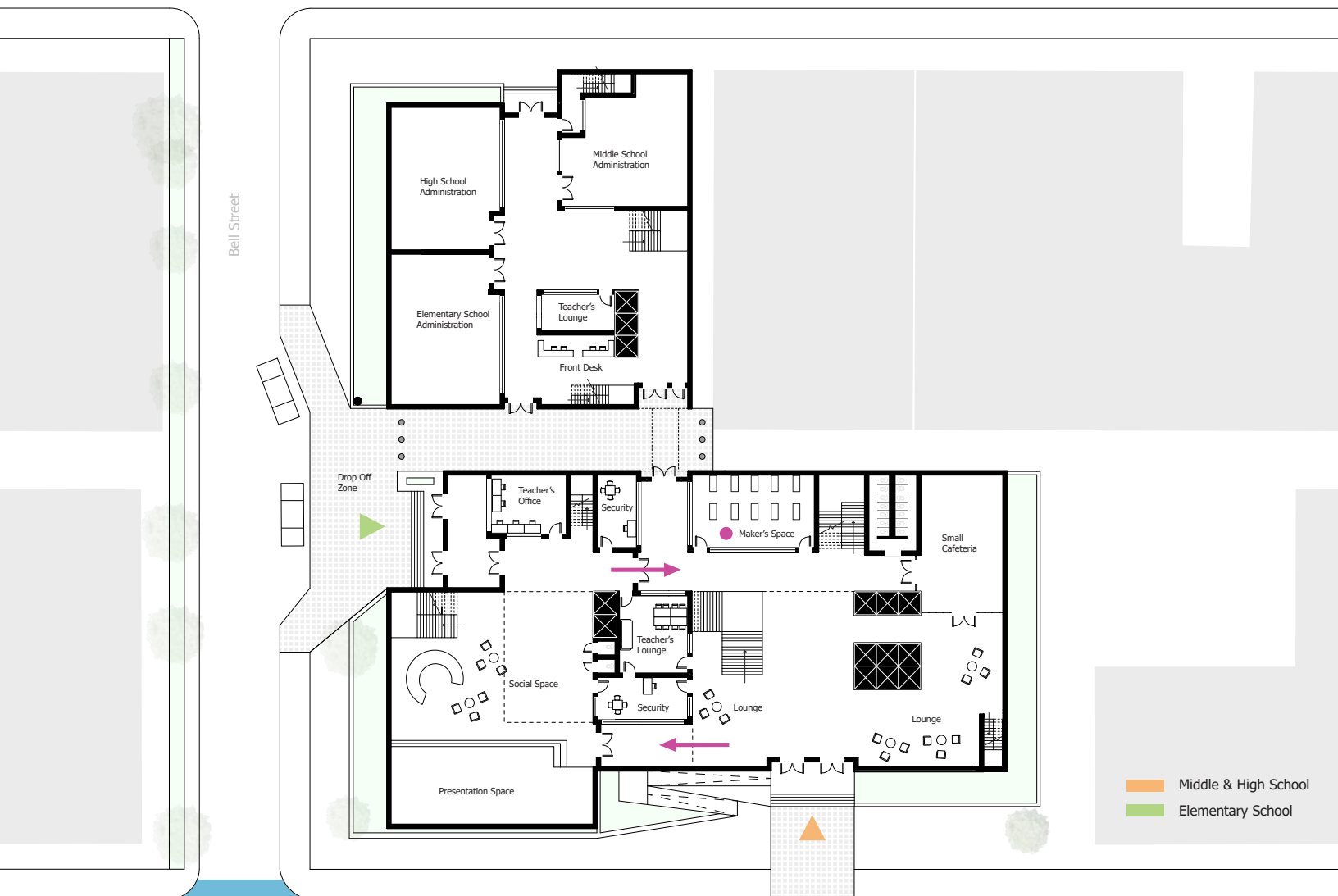

Figure 27. Street Level Floor Plan - Occupancy

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While the plan facilitates intentional navigation, it still permits the flexibility for students to openly access other areas of the school such as the maker's space by the younger students under school's supervision. Doors that separates the schools controls the accessibility.

Figure 28. Street Level Floor Plan - Space Flexibility

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Most of the elementary school students enter through the controlled northern entrance. Playfulness of the student tile arts on the pavement and the vegetation creates a warm and welcoming entrance. During the student arrival rush-hour, presence of the parents and teachers secures the zone as a safe place for the young students to freely walk into the school.
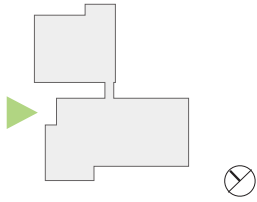

Figure 29 Rendering of Northern Entry

Elementary School Accessibility

Once inside the building, students can proceed to the social space or they can ascend to the upper floors using the stairs or elevators. The idea here is to create an open entry plan so children can freely move around and engage socially. The social space also functions as a lobby or waiting area for students to wait for their parents.
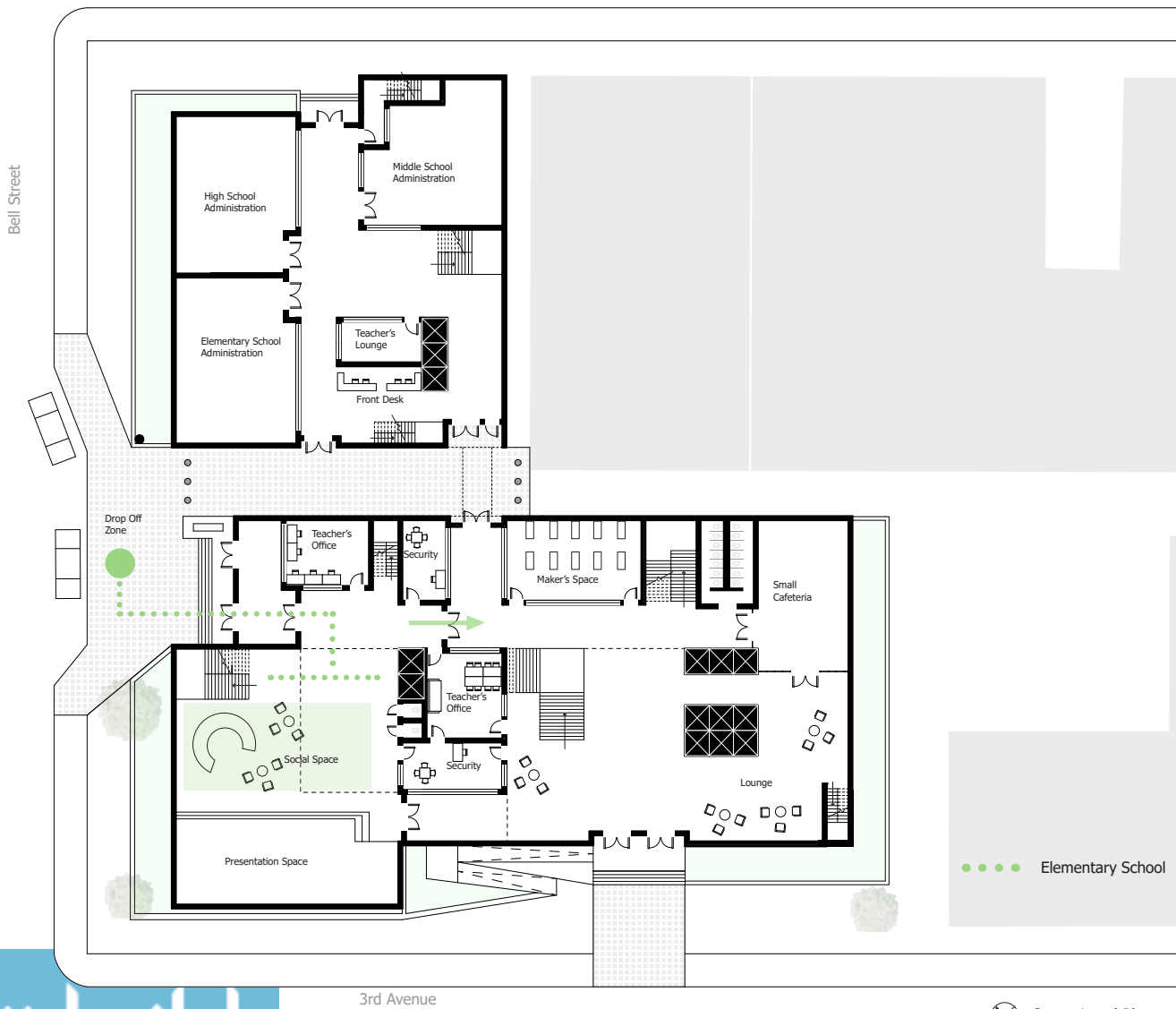

Bell Street

Middle School Administration

High School Administration

Elementary School Administration

Teacher's Lounge

Front Desk

Drop Off Zone

Teacher's Office

Security

Maker's Space

Small Cafeteria

Teacher's Office

Social Space

Security

Lounge

Presentation Space

3rd Avenue

Elementary School

Street Level Plan

Figure 30. Street Level Floor Plan - Elementary School Accessibility

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The southern entrance located on 3rd avenue directs students to the upper levels of the building upon entry. A larger area for entrance shown in figure 31 is intended to accommodate a higher traffic flow from the bus along 3rd Avenue. The lobby then functions as a transition space for students to grab a quick bite at the cafeteria near the elevators, then ascend to the upper floors.

Figure 31. Street Level Floor Plan - Middle School & High School Accessibility

Bell Street

High School Administration

Middle School Administration

Elementary School Administration

Teacher's Lounge

Front Desk

Drop Off Zone

Teacher's Office

Security

Maker's Space

Small Cafeteria

Social Space

Teacher's Office

Security

Lounge

Presentation Space

3rd Avenue

High School
Middle School

Street Level Plan

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The second floor is designed to promote social interaction. The commons at the center of the plan at figure 32, is a bridge that looks into both school entries on the first floor. The space can be used as a presentation space, or a path connection the school to the amenity facility. The library and lab are accessible to all students during school hours.
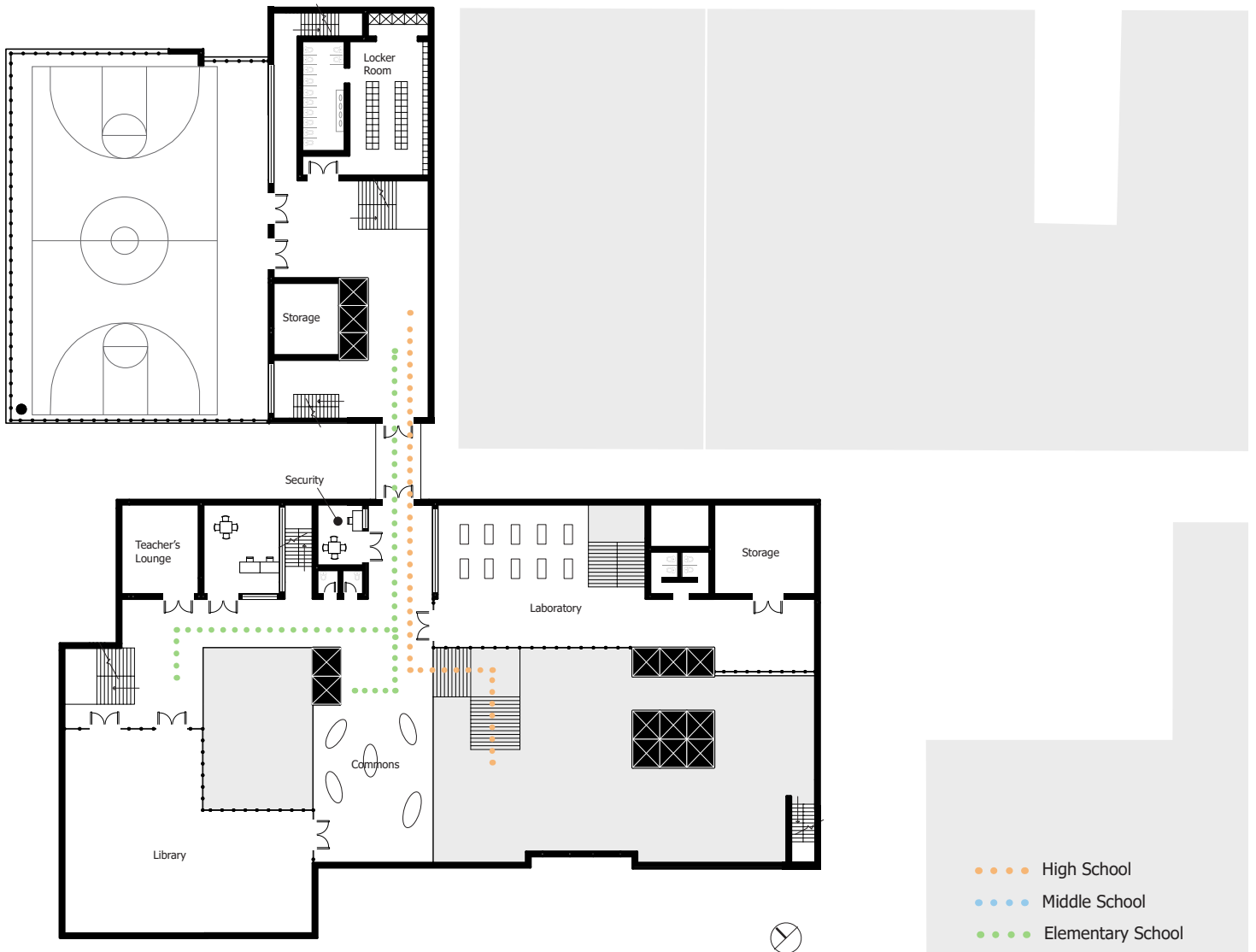

Figure 32. Second Floor Plan

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The typical elementary school is designed with classrooms on the perimeter of a central atrium space. The design goal is to utilize the existing Seattle Public School's design guidelines with flexibility. Each floor houses satellite administration, teacher lounges and class rooms. The design provides various scale of learning environments, provides central stairways at atrium to support movement, and creates interactive spaces near atrium for the students. In combination with the open central atrium and the southeast outdoor terrace establishes a dynamic elementary school learning environment.
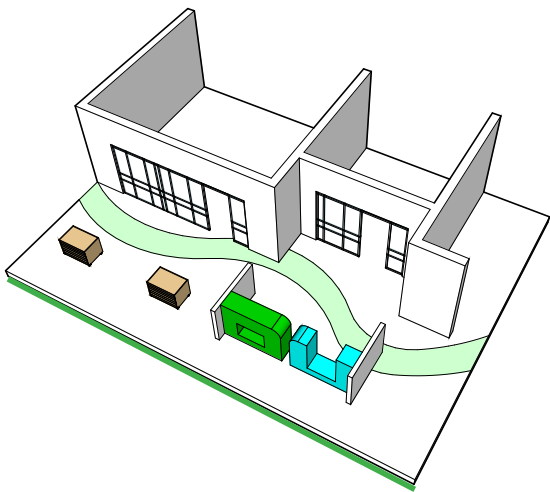

Figure 33 Typical Elementary School Classroom Diagram + Floor Plan

The designed middle school classrooms can be larger than the existing design guide line to accommodate the variety of flexible layouts. Learning pods adjacent from the classrooms (shown in blue arrows) can be occupied as classrooms. This flexibility creates an opportunity for students to break into smaller groups within the class with the gain of an additional 600 ft of study space.   The Lounge area near the South stair activates the space to promote social interaction.
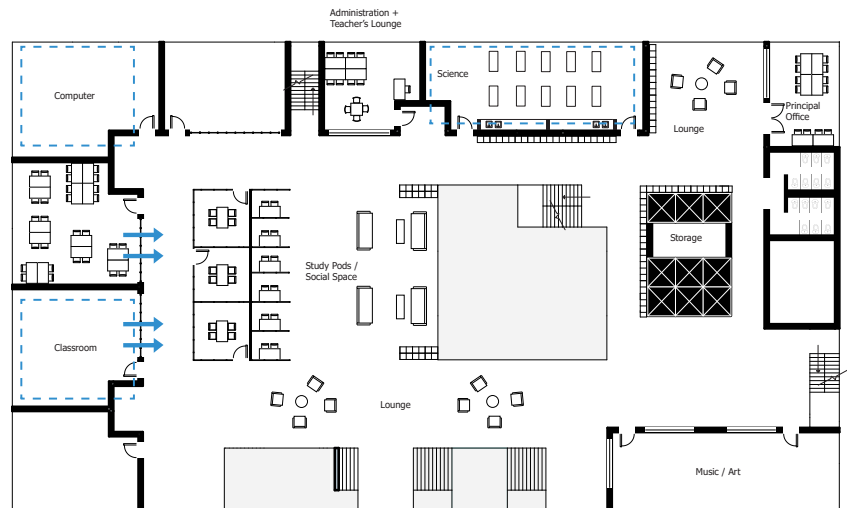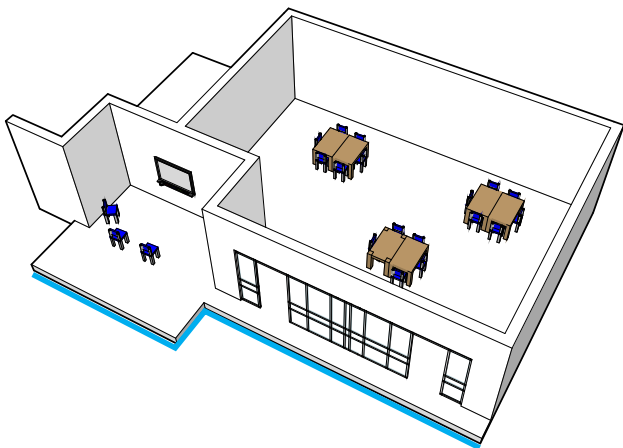

Figure 34 Typical Middle School Classroom Diagram + Floor Plan

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Modular classroom design, repeating in size with smaller classrooms attached, allows flexibility for rearrangement to accommodate different teaching approaches. Integration of technology, such as the white board and Internet in classrooms assist 21st century learning for the high school students.
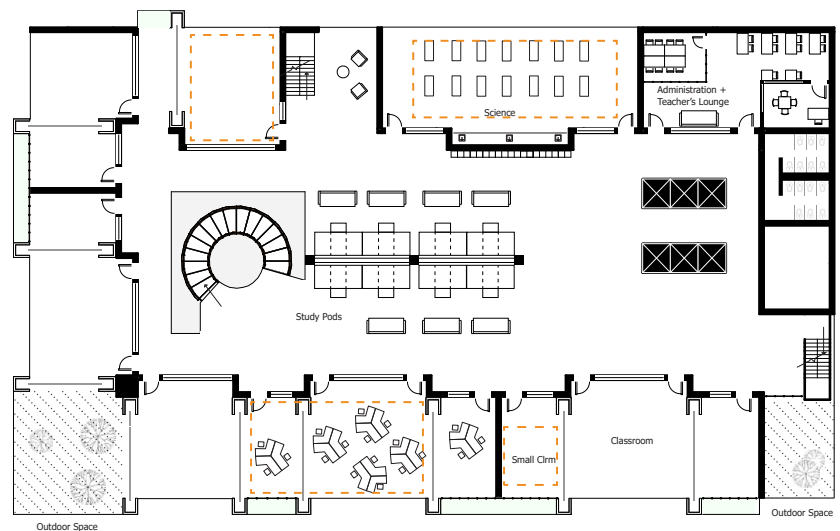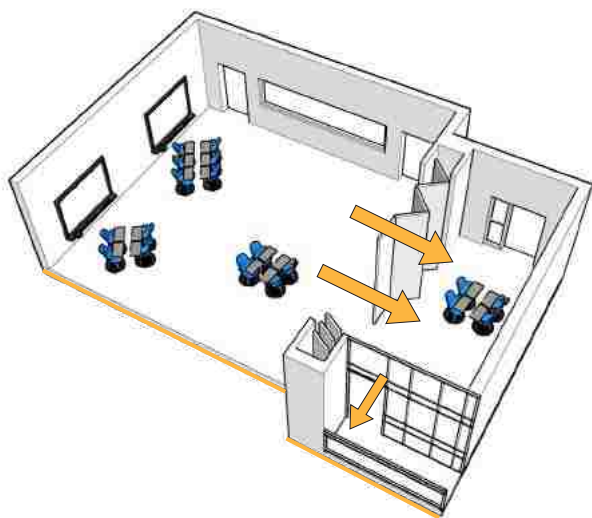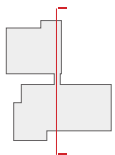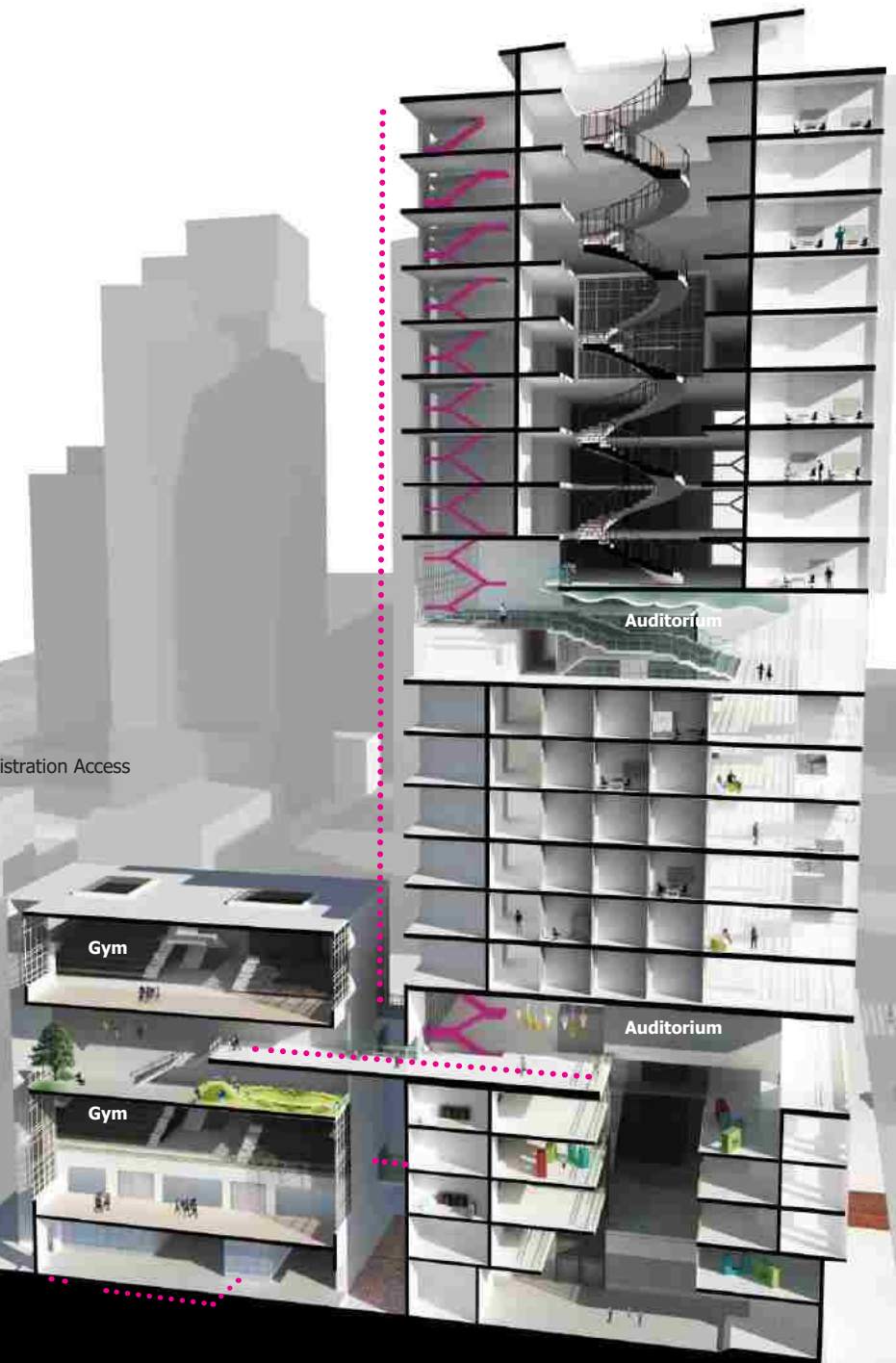

Figure 35 Typical High School Classroom Diagram + Floor Plan
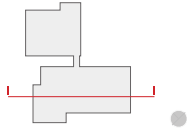
Auditorium

Gym / Administration Access

Gym

Gym

Auditorium

Figure 36 Section Perspective - Relationship between School and Amenity Facility

Figure 36 demonstrates the relationship between the school and the amenity facility on 2nd Avenue.

There are three controlled access points into the amenity that regulates public access. School gyms and playgrounds can be accessed through the street level from 2nd Avenue, where the administration offices at the location regulates and secures this entry point. The second entry is a bridge accessible from the interstitial floor between elementary and middle school. This bridge also functions as an exit to safety from the larger fire stair case nearby.

Study Lounges

Auditorium
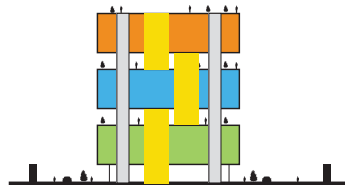
Study Lounges

Auditorium

Commons

Bell Street

Figure 37 Section Perspective - Atrium as Collaboration and Social Spaces

Central atrium activates the core of the building as a place to gather and collaborate. Study pods and lounges near the atrium enhance students' learning experience and promote interaction within the vertical school. Various sizes of social interaction spaces engages and support all students.

Central circulation at each of the schools engage the students differently to support movement. Central circulation at the elementary school is visible from all corners on every floor.

Middle school circulation takes advantage of the southern exposure. Southern exposure and wider stairs engage the students to travel in different group sizes. This design strategy promotes groups of varying sizes.

The internal circulation of high school at the atrium provides a unique type of migration experience. The internal spiral staircases visually and experientially engage the students as they navigate within the space. The visual connection to the outdoor terrace creates additional enhanced experience. With the atrium as a focal point within the space, the natural lighting cascading through the skylight above as students ascend or descend the spiral staircases enhances the social experience within the school.
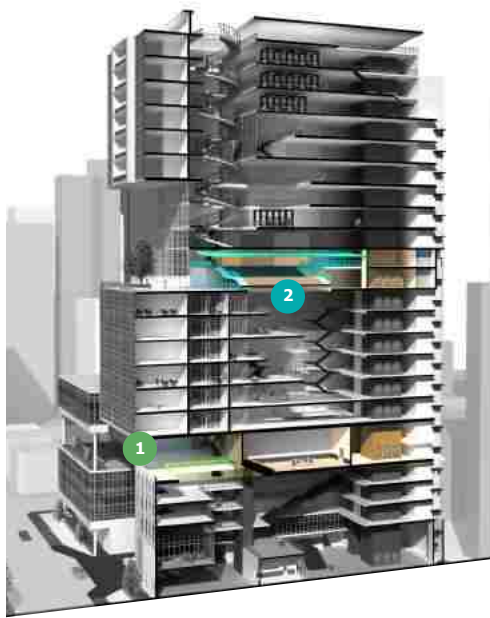
The auditoriums and cafeterias in the interstitial spaces are intended to be occupied by different age groups as a space for collaboration. There are often times high foot traffic in the auditoriums and cafeterias during mass gatherings and lunch time. For this reason, it is important to design an open floor plan with paths that are clearly indicated to support ease of navigation. The combination of these two programs at the interstitial spaces between schools thus promote interaction and integration.

The lower interstitial space plays an important role. Through combining the cafeteria and auditorium, the open floor plan creates a platform where students can choose to congregate or migrate through. (figure 39) It is a connection to the amenity facility, but also a communal area for the schools.

Figure 38 Section Perspective - Interstitial Spaces

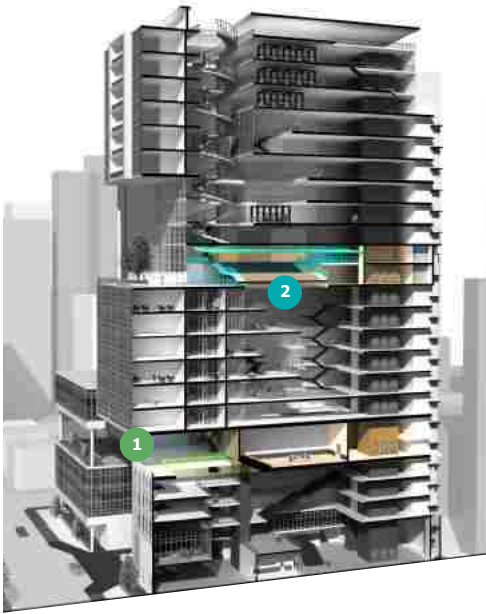Figure 39 Rendering of Lower Interstitial Space

Figure 40 Section Perspective - Interstitial Spaces

The upper interstitial place houses a larger cafeteria and auditorium to accommodate the larger number of middle school and high school students. Playfulness of the acoustic ceiling tiles (figure 41) enhance the space both visually and acoustically. A range of seating options cater to the variety of group sizes and meet their spatial needs. North of the auditorium are large windows that display the outdoor terrace and beyond. The vegetation and courtyard-like design at the outdoor terrace shared amongst students promotes interaction between schools.

Figure 41 Rendering of Upper Auditorium

Green Spaces

Outdoor
Terrace

Outdoor
Terrace

Outdoor
Terrace

Outdoor
Terrace

Outdoor
Terrace

Bell Street
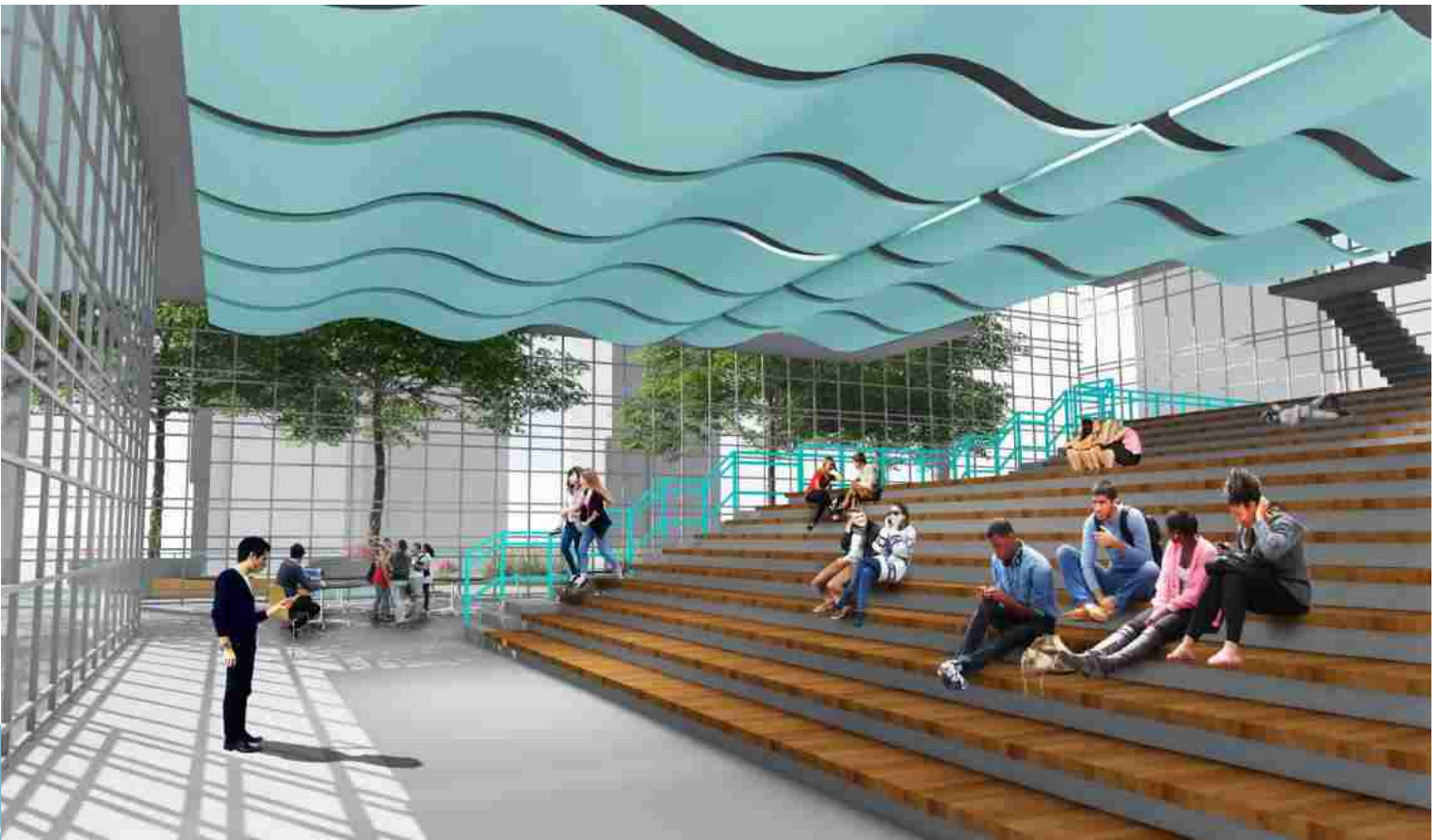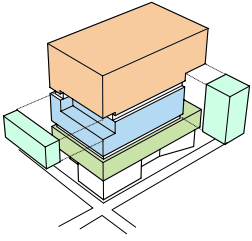
Figure 42 Section Perspective - Outdoor Terraces

The series of outdoor terraces off of the auditoriums provide an outdoor amenity and also breaks down the mass of the building.

These outdoor terraces encourage movement outward for fresh air and a chance to visually engage the school's urban context with a view not accessible in traditional horizontal schools. Each outdoor terrace includes places to sit and are decorated with greenery of various scales. Larger outdoor terraces at the interstitial spaces can even accommodate an entire classroom outdoors. The dynamic learning conditions provide stimulation that enhances students' learning experience beyond traditional classrooms.

The physical relationship of the Vertical School and surrounding community establishes a visual and social connection, creating the sense of community.

7.0 Conclusion

The Vertical School is a result of the changing the 21st century education system in the growing urban context. The high density design approach as a new typology re-imagines the traditional school form. The large scale and complexity of this thesis is a schematic design proposal that focuses on schematic massing study, with emphasis on outdoor terraces, and typical school plans with more developed circulation ideas. These plans include internal atrium, flexible classrooms, satellite administration offices and circulations.

Given the strategy, there are opportunities to develop the project further and beyond. The rigorous application of the existing school district's requirements could further develop the thesis. While the focus of the design development is primarily inward looking, the thesis has the potential to further develop the building by designing the facades.

To support successful learning for all students, designers should prioritize understanding the relationship between students and the space they occupy. Elementary, middle and high schools require very different spatial needs. To combine all three schools into one site, it is imperative then to understand the various spatial qualities that promote interaction as well as daylighting strategies and circulation to facilitate the needs for the 21st student in their journey through education.

Figure 43 Section Perspective   Figure 44 Section Perspective

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