

(RE)THINKING PUBLIC SCHOOL ARCHITECTURE  
AS A PEDAGOGICAL TOOL

by

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*“If we teach today’s students as we taught yesterday’s, we rob them of tomorrow.”*

- JOHN DEWEY

## ABSTRACT

This thesis aims to rethink elementary public-school architecture by exploring its ability to become an influential aspect of the pedagogical process in schools. As educational paradigms have historically responded to social, political, and cultural conditions, it appears that the development of educational paradigms has moved faster than the educational buildings of the 21st century. Paradoxically, the spatial conditions of educational architecture seem to be stuck in the 19th century. Although there are notable school buildings that emerged from the 20th and 21st century that challenge a conventional school model, the existence of a gap between school architecture and pedagogical paradigms is predominant in the North American context.

Beginning with an investigation of the current spatial conditions of educational architecture, specifically in North America, this thesis analyzes the relationship between school buildings and pedagogical paradigms that draw upon the history of education and its built institutions. As well, it examines the factors that prevent such correlation. Relevant building typologies were studied through orthographic drawings to create a visual comparison of school buildings from the 19th century to today. This allows us to observe the major spatial transformations that occurred between school models over time. Additionally, the analysis addresses how the social, economic, and political factors influence the relationship between the design of learning environments and the shift in educational paradigms, uncovering the principles of school designs and identifying clear discontinuities between the built forms and educational models. Undoubtedly, most of the contemporary educational buildings present in the North American context manifest spatial traditions that bear few relations to the current knowledge of the learning processes.

Considering the significant role of the learning environment in the support of critical thinking, discovery, and creativity, this thesis explores this potential to overcome century-old traditions of learning through memorization and subservience to the authority of the teacher. We use the context of Markham, Ontario, in the Greater Toronto Area, to create an elementary school based on the principles seen in Montessori’s, Reggio Emilia Schools, and Lab Ecole projects, which respond to the basis of the most actual theories of children education. The designs we see today of newly constructed school buildings within the suburban context tend to be an afterthought, prioritizing budget, and fast construction rates with little to no consideration to how the built environment can aid in the learning process. As a result, the suburbs provide an ideal setting to explore how the physical environment can aid in the learning process. Ultimately, using architecture as a pedagogical tool that prompts the physical environment to inspire, stimulate, and encourage exploration and investigation of new ideas while supporting collaboration and the development of connections beyond the typical school environment.

KEYWORDS: [*educational architecture / public school buildings / childhood pedagogy / educational paradigms / third teacher / learningscapes / suburbs / elementary schools*]

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*“Learning is far more complicated than once thought but also far simpler than commonly presumed.”*

- DAVID ORR

## INTRODUCTION | Existing Critiques of the Educational System and Built Environment

This thesis will focus on analyzing educational models of early childhood (children from thirteen months to age five) and elementary school children (age five to thirteen). Elementary schools in North America comprise of a series of generic classrooms, made up of four walls lined with rows of desks and chairs.<sup>1</sup> Conventionally, classrooms are considered as being the foundations of a school building, evidently seen in the early One-Room Schoolhouses where the classroom itself defines the building. Teachers would have the freedom to arrange and decorate the space as they see fit, lining the walls with works of the students or informative posters and quotes. However, considering deeper regard on the spatial qualities of classrooms, what distinguishes them apart from classrooms 50 years ago or 100 years ago?

Without a doubt, children spend a significant amount of their time in school classrooms, as a result, it creates “both a complex and demanding circumstance”<sup>2</sup> for children during their elementary school years. However, historically and in the

present day, classroom spaces reinforce a common presumption that learning can be done effectively in the same four walls, giving little to no considerations to the diverse learning styles or the subjects being taught. Recent studies prove that children “learn more deeply and retain knowledge longer when they have opportunities to engage actively with information experiences at hand”.<sup>3</sup> And that learning occurs more effectively when the student can move around.<sup>4</sup> In this regard, neutral classrooms that have no sense of identity, offering no variations of spatial experiences can be detrimental to the child’s learning capabilities. As a result, this sometimes places immense pressure solely on the teachers to “bridge the gap between the primary clients (the students) need and what the architects design”<sup>5</sup> and be creative and adaptive with otherwise simplistic and neutral learning environments into spaces appropriate for the teaching model.

According to Sir Ken Robinson, a British author, and educationalist, education within the current society separate children into different grades with the

<sup>1</sup> F. Henry Johnson, *A Brief History of Canadian Education* (McGraw-Hill Company of Canada Limited, 1968).

<sup>2</sup> Mark Dudek, “The Architecture of Schools: Valuing Play in the Learning Environment,” Mark Dudek Associates, n.d., <http://www.markdudek.com/the-architecture-of-schools-valuing-play-in-the-learning-environment/>.

<sup>3</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning* (New York, New York: Abrams, n.d.), 66.

<sup>4</sup> Pat Wolfe, *Brain Matters: Translating Research Into Classroom Practice* (ASCD, 2010).

<sup>5</sup> Anne Taylor, “Programming and Design of Public Schools Within the Context OfCommunity” (University of New Mexico, n.d.), <https://files.eric.ed.gov/fulltext/ED452685.pdf>.



FIGURE 01: Classroom 150 Years Ago

FIGURE 02: Classroom in the 21<sup>st</sup> Century

assumption that learning capabilities are distinguished solely by age;<sup>6</sup>

*Schools are still pretty much organized on factory lines, ringing bells, separate facilities, specialized into separate subjects. We still educate children by batches, you know, we put them through the system by age group. Why do we do that? Why is there this assumption that the most important thing kids have in common is how old they are?<sup>7</sup>*

Alternatively, Robinson believes that the development of creativity, innovation, and human resources should follow an organic system and not mechanical ones.<sup>8</sup> While Robinson critiques the education system at large, Canadian architect Bruce Mau and collaborators raise the question that the design of educational learning environments has not been fully examined or revisited since the 1950s. As a result, much of our technological, social, and educational advancements have been built on an obsolete foundation.<sup>9</sup> In a collaborative project between Bruce Mau's firm, Bruce Mau Designs, and two other design firms, Cannon Design, and VS Furniture, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching & Learning* is a book that compiles statistics, stories, interviews, and facts from varying individuals from different disciplines, which brings forth new perspectives to the design of educational environments and its interactions with the pedagogical processes. The book touches on topics such as the basic physiological needs of a child, the importance of health and play, activating the five senses, and sustainability all with the intention to "ignite a blaze of discussion and initiative about the environment as an essential element of learning" and to connect organizations, individuals, and ideas dedicated to these causes through a holistic approach.<sup>10</sup>

The thoughts brought forth from Robinson, and contributors of *The Third Teacher*, are a few of many ideas that indicate the need for change. The traditional model where "students gather in a physical facility, grouped by age and passively receiving

compartmentalized information" may be obsolete in the future of educational systems.<sup>11</sup> Moving forward, by challenging the traditional educational systems and built environments, presents an opportunity to design spaces that can resonate with the students, teachers, faculty, and community.

## Research Methodology

The buildings studied are limited to the boundaries of North America, beginning in the late 19th century up until the 21st century. The main phases of this research are divided into three stages.

The first stage consists of a theoretical investigation of educational paradigms in tandem with a historical investigation of school building models that allows a general understanding of the topic. Additionally, the analysis addresses briefly how the social, economic, and political factors influence the relationship between the design of learning environments and the shift in educational paradigms. Published in 1968, F. Henry Johnson's *A Brief History of Canadian Education* has provided valuable information for this study.

Stage two consists of a comparative analysis of relevant Canadian School building typologies and their major spatial transformations from the late 19th century to the current school models we see today. Through orthographic drawings, a visual comparison of school building typologies allows the visualization of differences and similarities between typologies. The analysis unveils the underlying principles of school designs and identifies clear discontinuities between the built forms and educational models. In addition, relevant case studies such as open-air schools, open plan schools, and Lab Ecole are examined to provide alternative examples that challenge the traditional notions of education and learning environments. Considering the gap between school building traditions and pedagogical approaches, the research prompts the question of whether it is possible to design a school building that is based on principles of education theory.

<sup>6</sup> Sir Ken Robinson, *Changing Education Paradigms*, TED Talk, 2010, [https://www.ted.com/talks/sir\\_ken\\_robinson\\_changing\\_education\\_paradigms](https://www.ted.com/talks/sir_ken_robinson_changing_education_paradigms).

<sup>7</sup> Ibid.

<sup>8</sup> "Sir Ken Robinson - The Official Website of Sir Ken Robinson," Sir Ken Robinson, n.d., <http://sirkenrobinson.com/>.

<sup>9</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*.

<sup>10</sup> Ibid.

<sup>11</sup> Bryan Goodwin et al., *The Future of Schooling: Educating America in 2020* (Solution Tree Press, 2011), 2.

The third and final stage addresses the questions raised in the previous stages by presenting a final architectural project that rethinks public school buildings in the suburban context of Markham, Ontario.

## Current Conditions of Elementary Education: Definitions and Critiques

In Canada, public education is not governed by a national curriculum, instead, each provincial government is responsible for establishing its own curriculum.<sup>12</sup> Generally, education is divided into four stages: preschool or early childhood education, primary or elementary education, secondary education, and post-secondary education. Based on the Ontario Ministry of Education, elementary education consists of the first eight years of education and includes four grade divisions usually determined by a child's age. This includes Kindergarten (Junior and Senior Kindergarten, Aged 4-5), Primary (Grades 1-3, Aged 6-8), Junior (Grades 4-6, Aged 9-11), and Intermediate (Grades 7-8, Aged 12-13).<sup>13</sup>

The focus for children during their kindergarten and other pre-elementary school stage is to “build strong foundations that are central to [the] child’s learning and growing.”<sup>14</sup> Typically, children at this stage are introduced to basic literacy and mathematics, the development of connections and relationships, self-regulation, and play-based learning.<sup>15</sup> By the time children enter elementary school, they are confined to their designated classrooms the majority of the time under the direction of only one instructor. And each individual teacher is required to meet the standard curriculum, that focuses on developing “strong literacy, math, science and social studies skills that build a base for all academic achievement.”<sup>16</sup>

As we know, young children tend to be very impressionable, and the first couple of years of a child’s life is a crucial time for fundamental development. Play is incredibly important for the development of children, during their early stages of life; it is a time when they can have ownership and have the freedom to explore their interests with the support of an educator.<sup>17</sup> That said, it is important to understand that each child is unique and develops at different rates, and the age of the child doesn’t necessarily define their abilities to learn. In fact, in 1983, Howard Gardner introduces his Theory of Multiple Intelligences in his book *Frames of Mind*, he suggested that there are eight types of intelligence everybody possesses at varying capacities and is not dictated by age.<sup>18</sup> These include Visual-Spatial, Linguistic-Verbal, Interpersonal, Intrapersonal, Logical-Mathematical, Musical, Bodily-Kinesthetic, and Naturalistic.<sup>19</sup> It is important to understand that Gardner’s theory is a broad classification of intellectual abilities and not necessarily the methods to disseminate knowledge.<sup>20</sup> That said, Gardner’s theory can be used in conjunction with a combination of teaching methodologies and the physical environment to foster critical thinkers. Similarly to Gardner’s idea, in Robinson’s 2006 TED Talk, *Do Schools Kill Creativity?*, one of the most popular TED Talks and viewed over 60 million times online by people in over 160 countries,<sup>21</sup> he emphasized that “intelligence is diverse, we think visually, in sound, in kinetics, in abstract terms, and in movement; it is dynamic... where creativity comes from interaction in different disciplinary ways of seeing things.”<sup>22</sup> Although Robinson criticizes the current educational systems and very broadly saying that education should incorporate more creativity and divergent thinking that is typically restricted by current educational models, he has been widely criticized for not suggesting alternative methods to address these issues raised.



FIGURE 03: Kindergarten Classroom 1950s



FIGURE 04: Kindergarten Classroom Now

<sup>12</sup> Government of Canada, *Education in Canada*, n.d., <https://www.canada.ca/en/immigration-refugees-citizenship/services/new-immigrants/new-life-canada/enrol-school.html>

<sup>13</sup> Ontario Ministry of Education, “Principles,” Ontario Ministry of Education (Government of Ontario, n.d.), <http://www.edu.gov.on.ca/childcare/oelf/principles/>.

<sup>14</sup> Ontario Ministry of Education, *Education in Ontario*, n.d., <https://www.ontario.ca/page/education-ontario>

<sup>15</sup> Ontario Ministry of Education, *The Kindergarten Program 2016*, 2016, <https://www.ontario.ca/document/kindergarten-program-2016/introduction>

<sup>16</sup> Ontario Ministry of Education, *Education in Ontario*.

<sup>17</sup> Wolfe, *Brain Matters*.

<sup>18</sup> “Multiple Intelligences: What Does the Research Say?,” Edutopia, accessed November 23, 2020, <https://www.edutopia.org/multiple-intelligences-research>.

<sup>19</sup> “Gardner’s Theory of Multiple Intelligences,” Verywell Mind, accessed November 23, 2020, <https://www.verywellmind.com/gardners-theory-of-multiple-intelligences-2795161>.

<sup>20</sup> “Multiple Intelligences.”

<sup>21</sup> “Sir Ken Robinson- The Official Website of Sir Ken Robinson.”

<sup>22</sup> Sir Ken Robinson, “Do Schools Kill Creativity?,” [https://www.youtube.com/watch?v=iG9CE55wbtY&ab\\_channel=TED](https://www.youtube.com/watch?v=iG9CE55wbtY&ab_channel=TED).

Montessori, Waldorf, and Emilia Reggio are some examples of alternative methods of education that address some of the issues that were mentioned by Robinson. The examples incorporate practical spaces that are designed to “allow [children] to use their bodies, their hands, their noses, their ears and sometimes even their tongues to explore their worlds”.<sup>23</sup> These examples demonstrate the potential for the physical learning environments to take part in the child’s learning experiences. When children are presented with irregular classrooms that incorporate niches, bays, and other indentations that are separate from the main spaces, it creates dynamic spaces that allow for imaginative play and learning to happen organically.<sup>24</sup> It is crucial to understand the unique talents and individuality each child possesses. As a result, architecture that supports individualized learning, in a space that is dedicated to the masses, creates a “powerful spatial resonance”<sup>25</sup> with the child that emphasizes the value of the users.

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<sup>23</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*, 167.

<sup>24</sup> Mark Dudek, “The Architecture of Schools: Valuing Play in the Learning Environment.”

<sup>25</sup> Mark Dudek, “How Architecture Learns from Children,” Roca Gallery, October 2019, <http://www.rocagallery.com/how-architecture-learns-from-children>.

“...the whole process of public education came about primarily to meet the needs of the industrial revolution in the 18th and 19th century, and the current system doesn't just represent the interests of the industrial model it embodies them.”

- SIR KEN ROBINSON

## CHAPTER 1 | From 19<sup>th</sup> Century to Modernity: A Brief Overview of Common Public School Typologies in Canada

During the late 19th century leading into the 20th century, society prized conformity and standardization and was reflected in both the teaching methods and architectural buildings.<sup>26</sup> However, people began to criticize traditional methods of teaching, once it was realized the limitations they posed. As a result, education began to undergo major changes that eventually led to a new era of public education, presenting new public-school building typologies.<sup>27</sup>

The following sections present common school models that were identified through historic research.<sup>28</sup> The evolution of common educational building typologies, from the one-room schoolhouse to the current school models, is shown through orthographic drawings that were produced for a Drawing Imagination Seminar assignment. This assignment provided an opportunity to carefully examine the spatial elements of each building typology and through the drawing process, it allowed for an understanding of similarities and

differences between these models. As well, the drawings provided an opportunity to examine the interactions between teachers, students, and their physical environments at a detailed level. In addition to these drawings, a collage was produced, referencing social, economic, and political contexts that may have influenced the physical forms of the buildings.

<sup>26</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*, 57.

<sup>27</sup> We have adopted the classification presented by author, F. Henry Johnson for the buildings one-room schoolhouse and common schoolhouse, while the term Factory Model School or Industrial School was borrowed from the Canadian Encyclopedia. While these terms bear are an afterthought construction by critics and historians, the term Residential School was explicitly part of the government policies. The term Current School Model was our own definition to describe conventional schools constructed after 1950s, that are inspired by functionalism, resulting in architecture as a response to minimum programmatic requirements.

<sup>28</sup> The orthographic drawings included were produced for Drawing Imagination Seminar- ARCH 5316, led by Professor Mark Baechler. Drawings were created based on research from the following documents: ( Gyure, Dale Allen. “The Transformation of the Schoolhouse: Modernizing School Architecture in the Nineteenth and Twentieth Centuries.” University of Virginia, 2016. <http://school-time.conference.mcgill.ca/Gyure.pdf>.; Johnson, F. Henry. *A Brief History of Canadian Education*. McGraw-Hill Company of Canada Limited, 1968.; Seaborne, Malcolm. *Primary School Design*. London, United Kingdom: Routledge & Kegan Paul Ltd, 1971.; Thomas, Gary. *Education: A Very Short Introduction*. Oxford, United Kingdom: Oxford University Press, 2013.). Orthographic drawings for the One-Room Schoolhouse, Common School Model, and Current School Model were done based on interpretation, the Factory School Model was based on Phoebe Street Elementary School, and the Residential School Model was based on Kuper Island Residential School.

## One-Room Schoolhouse



FIGURE 05: One-Room School Log Cabin, Michigan

The one-room schoolhouse was a very common school typology during the late 19th century and the beginning of the 20th century, especially in rural areas. Usually, these buildings were small log structures – sometimes heated by a fireplace – and simplistic in design.<sup>29</sup> Children ranging from age 5 to 16 would be taught in the same room by a single teacher. The youngest children sat at the front and older students sat at the back. At this point, education had yet to be governed by any universal curriculum, and as a result, grades fluctuated every year, and instruction was adjusted accordingly by the teachers.

<sup>29</sup> Johnson, *A Brief History of Canadian Education*, 130.

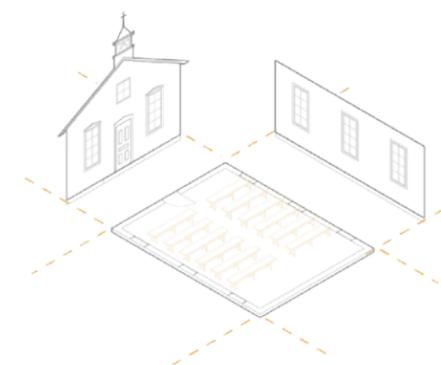


FIGURE 06: One-Room Schoolhouse Model

## Common Schoolhouse

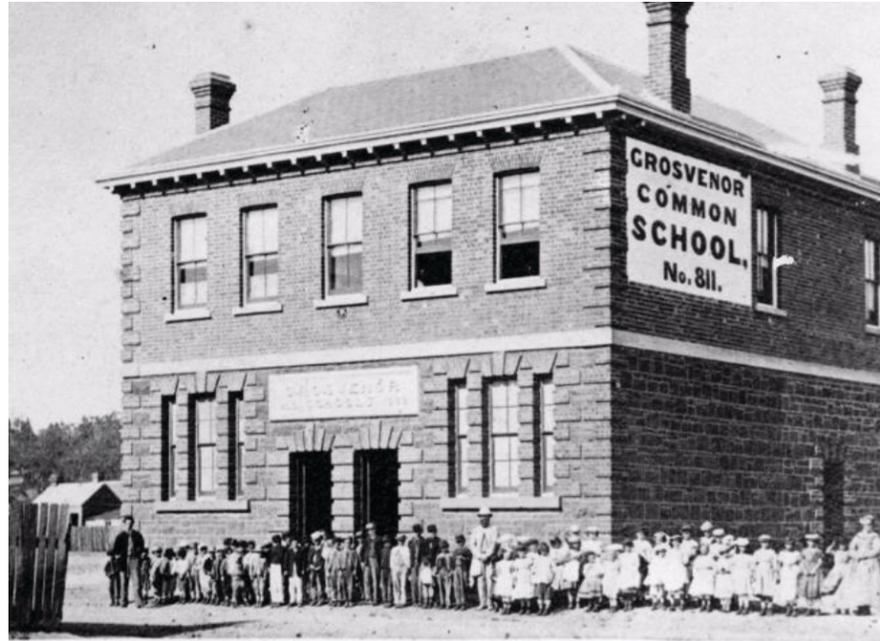


FIGURE 07: Grosvenor Common School, Abbotsford

In 1816, the first Common School Act was passed, which was the first major step in providing mass schooling for the “common” people and was funded by the local property taxes.<sup>30</sup> This legislation was based in many ways on values borrowed from the US System, which was influenced significantly by the Common School Movement that was started by American educator Horace Man.<sup>31</sup> Man believed that in a democratic society, education should be free and universal.<sup>32</sup> This was also the time of industrialization and compulsory education, as a result, enrollment increased at an unprecedented rate which created overcrowded facilities that lacked adequate lighting or air quality. As a result, the one-room schoolhouse was no longer sufficient in accommodating the increase in enrollment, and the Common Schoolhouse was introduced.

<sup>30</sup> Johnson, 24.

<sup>31</sup> “Common School Movement- Colonial and Republican Schooling, Changes in the Antebellum Era, The Rise of the Common School- StateUniversity.Com,” accessed November 28, 2020, <https://education.stateuniversity.com/pages/1871/Common-School-Movement.html>.

<sup>32</sup> Ibid.

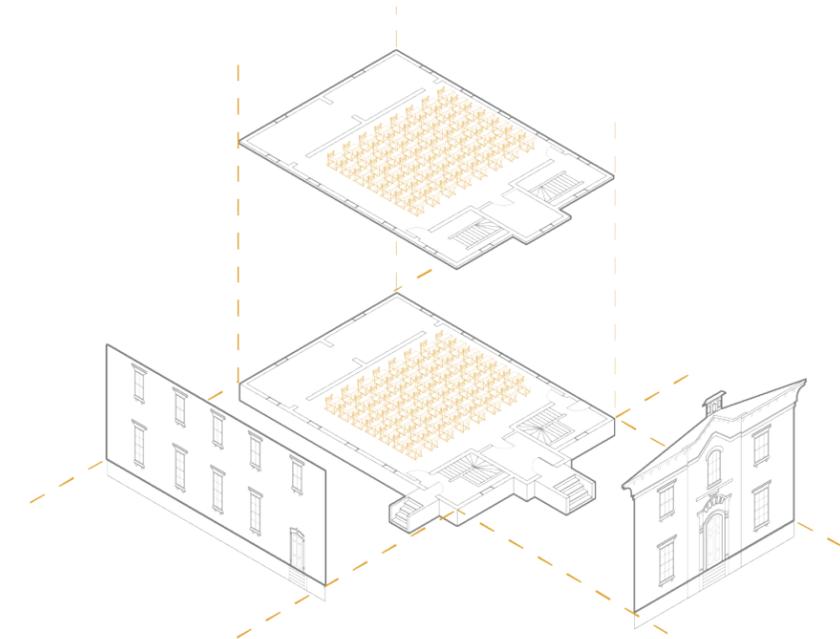


FIGURE 08: Common School Model

## Factory Model School



FIGURE 9: Phoebe Street Elementary School, Toronto, Ontario

The Factory School Model refers to its role in the industrial revolution model of education, where schools act as factories producing carbon-copy mentalities at a time when society prized conformity.<sup>33</sup> After the war, standardization and efficiency had become the new norm in education, effectively replacing any progressivism that occurred previously.<sup>34</sup> Again, school enrollment experienced dramatic growth. The main physical transformation between the common schools and factory schools, was the addition of corridors and numerous classrooms to accommodate the rise in enrollment. Overcrowding, curriculum lacking in child interest, discipline issues were common during this time – especially because at one point, the ratio between teachers to students was at 1 to 80.<sup>35</sup> Eventually, organizing a large number of students became the priority and persisted to influence the current schools of today.

<sup>33</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*, 32.

<sup>34</sup> Frank Peters, "School Systems | The Canadian Encyclopedia," The Canadian Encyclopedia, March 2015, <https://www.thecanadianencyclopedia.ca/en/article/school-systems>.

<sup>35</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*.

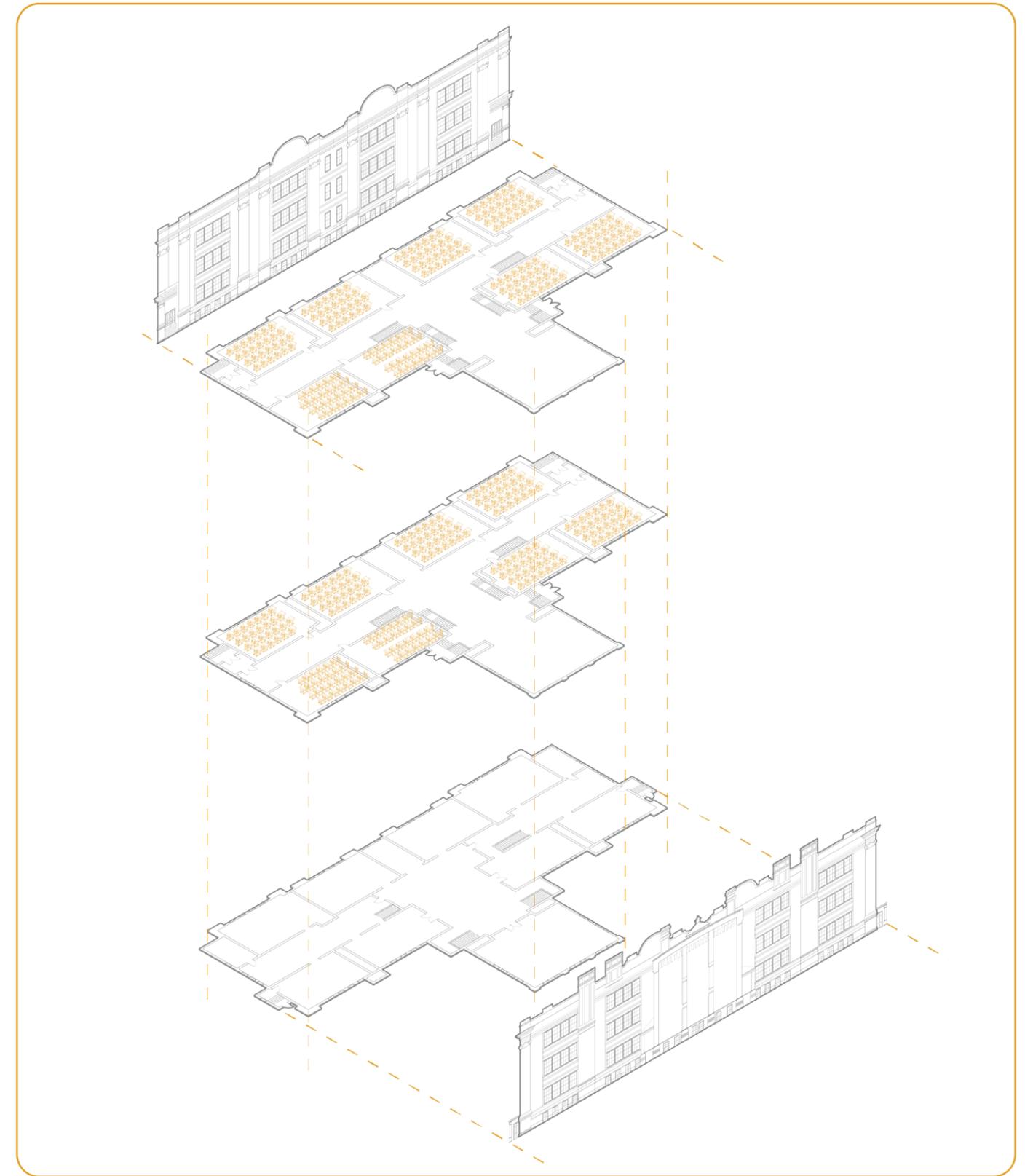


FIGURE 10: Factory Model School

## Residential School



FIGURE 11: Kuper Island Residential School, Kuper Island, British Columbia

In 1880, federal funding of schools began, commissioning architects to design schools that were solely used to assimilate Indigenous children into Canadian society. It “demonstrated [how] the government used architecture as a significant tool to enact its racist policies.”<sup>36</sup>

“The smaller on-reserve day schools, which were attended by children who continued to live at home, were often one or two classroom buildings similar to typical settler one-room schoolhouses.”<sup>37</sup> These were constructed by Indian Affairs, a department within the federal government, that was responsible “for holding reserve lands ‘in trust’”.<sup>38</sup>

Other larger industrial schools were built by the Department of Public Works, a government department that controlled larger federal architecture projects.<sup>39</sup> Initially, these ‘industrial schools’ were designed to facilitate “training in occupations such as trades and farming for boys and homemaking for

girls.”<sup>40</sup> However, by the 1910s, the design of the residential school slowly came into favour with efforts to provide better ventilation and space. Although, overcrowding and disease persisted<sup>41</sup> and the overall conditions of these spaces failed to adhere to the most basic human needs. Between 1910 and 1930, the majority of the residential schools were very simplistic and plain. Employing a prominent entranceway capped by a spire, high lighting the religious curriculum taught within.<sup>42</sup> Floorplans for all the schools were highly standardized and were typically configured in an H shape. Each institution is laid out with a similar series of classes, kitchens, dormitories, bathrooms, and so on. By the mid-1970s, most residential schools were closed or turned over to First Nations Communities and eventually the last federally funded residential school closed in 1996.<sup>43</sup> However, as we know today, these schools became symbolic representations of racism and segregation, which was “reflected in both the architectural evolution of these institutions and their educational models.”<sup>44</sup>

<sup>36</sup> Magdalena Miłosz, “From Instrument to Evidence,” *ARPA Journal*, no. 04 (May 2, 2016), <http://www.arpajournal.net/from-instrument-to-evidence/>.

<sup>37</sup> *Ibid.*

<sup>38</sup> “Federal Departments of Indigenous and Northern Affairs | The Canadian Encyclopedia,” accessed November 26, 2020, <https://www.thecanadianencyclopedia.ca/en/article/aboriginal-affairs-and-northern-development-canada>.

<sup>39</sup> Miłosz, “From Instrument to Evidence.”

<sup>40</sup> *Ibid.*

<sup>41</sup> Geoffrey Carr, “EDUCATING MEMORY: Regarding the Remnants of the Indian Residential School,” *JSSAC* 34, no. 2 (2009): 67–99.

<sup>42</sup> *Ibid.*

<sup>43</sup> J.R. Miller, “Residential Schools in Canada | The Canadian Encyclopedia,” *The Canadian Encyclopedia*, n.d., <https://www.thecanadianencyclopedia.ca/en/article/residential-schools>.

<sup>44</sup> Miłosz, “From Instrument to Evidence.”

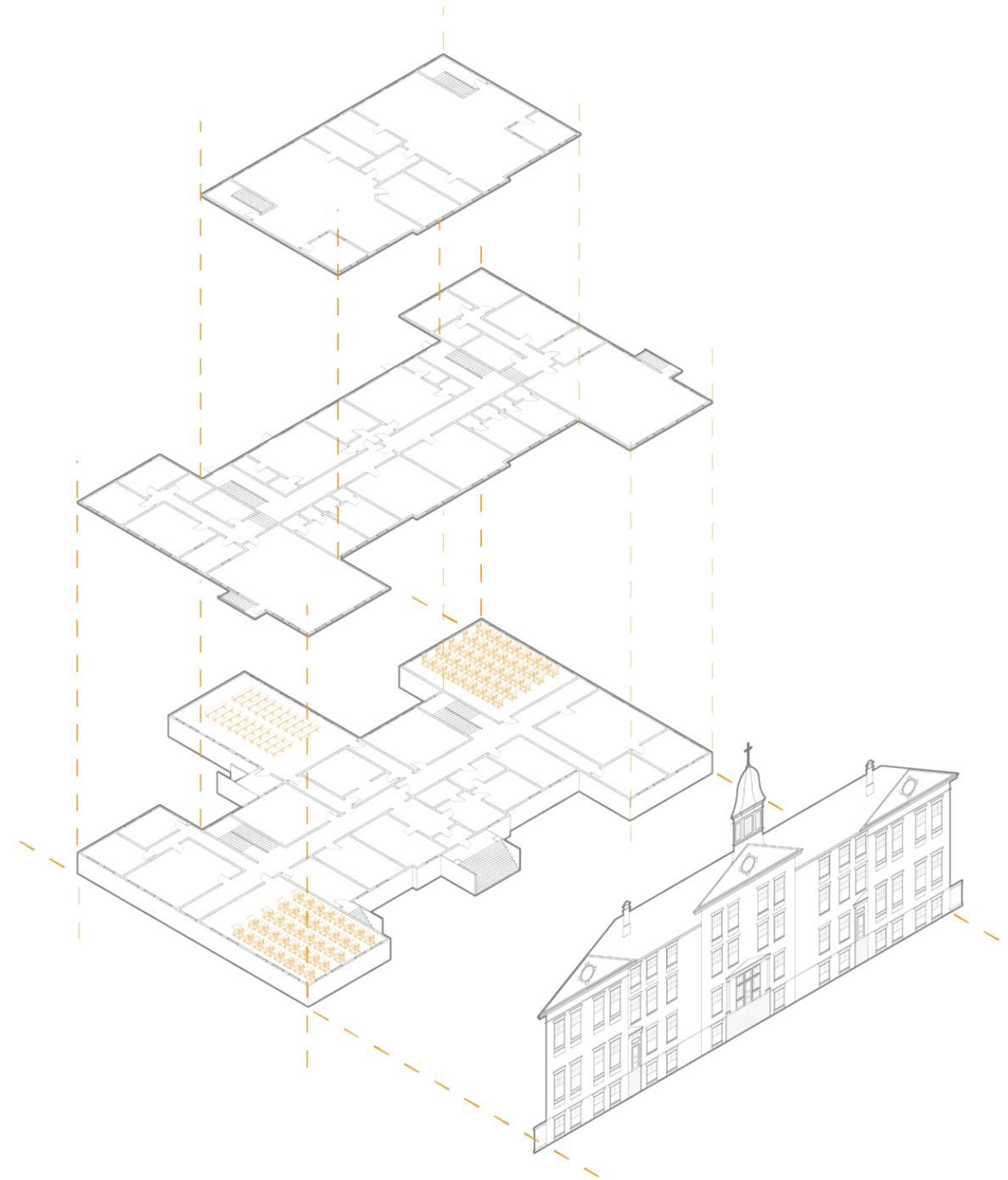


FIGURE 12: Residential School Model

## Current School Model



FIGURE 13: Wismer Public School, Markham, Ontario

The current school models have pretty much remained the same since the mid 20th century. Conformity and standardization can be seen as remnants of industrialization during the 19th and 20th centuries that significantly impacted the educational paradigms and building models we see today.<sup>45</sup> Considering deeper regard to the spatial configurations of this school typology, it consists of generic rectangular classrooms running along straight, sometimes narrow, hallways common in the “Factory School Model” that has persisted into today’s public-school models. As a result, these double-loaded corridors exemplify the idea that hallways serve only one purpose and that is to get users from one classroom into another.

With that said, what differentiates the schools we see today from previous typologies is the addition of specialized spaces intended to support learning opportunities outside the traditional classroom spaces. Some of these additions include gymnasiums and outdoor spaces intended for physical activities and gathering spaces, multi-purpose rooms that can be adapted for various needs as well as libraries and media centers that provide students and faculty access to resources. However, the schools we see today are

very much compartmentalized, clustering specialized spaces in one area and generic classrooms in another. As such, it prevents different programmatic spaces to intermingle and results in a missed opportunity to create a dynamic building.

Additionally, the school building typologies rarely anticipate the growth and needs of the future. For example, issues of overcrowded facilities, apparent in the Common Schoolhouse and Factory Model typologies, continue to be a present challenge. Portable classrooms are sometimes present to account for the increase in student enrollment due to constant housing developments, building up to the sad reality where “currently, nine percent or 173,000 Ontario students are in portables or ‘unofficial’ classrooms.”<sup>46</sup>

<sup>45</sup> There are numerous critiques on the uniformity and lack of architectural generosity seen in the most frequent type of schools built in North America: (Cannon Design, VS Furniture, and Bruce Mau Design. *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*. New York, New York: Abrams, n.d.; Goodwin, Bryan, Elizabeth Hubbell, Laura Lefkowitz, and Carolyn Woempner. *The Future of Schooling: Educating America in 2020*. Solution Tree Press, 2011.; Robinson, Sir Ken. *Changing Education Paradigms*. TED Talk, 2010. [https://www.ted.com/talks/sir\\_ken\\_robinson\\_changing\\_education\\_paradigms](https://www.ted.com/talks/sir_ken_robinson_changing_education_paradigms).)

<sup>46</sup> Ontario Ministry of Education, “Principles.”

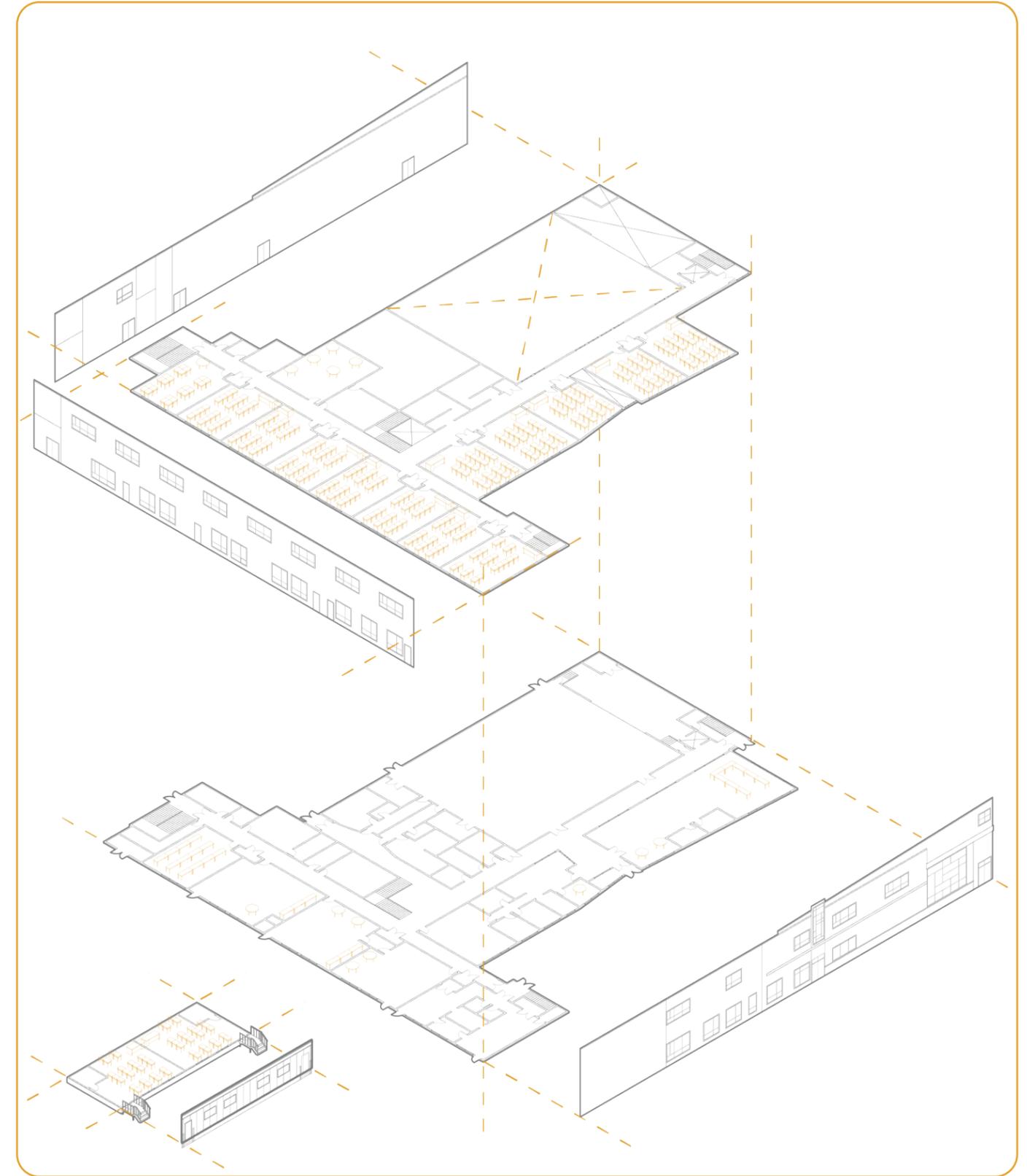


FIGURE 14: Current School Model



FIGURE 15: School Typology Comparison Chart

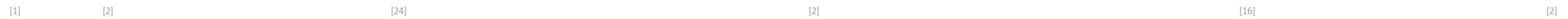
SYMMETRY



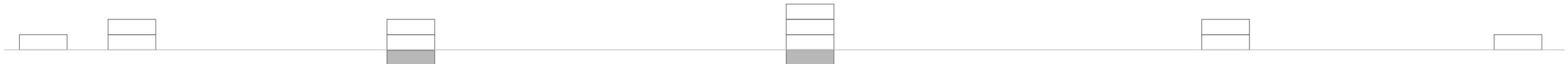
EXTERIOR ENTRANCES



GENERAL CLASSROOMS



LEVELS



AGE GROUP



UNIQUE CHARACTERISTICS



TYPICAL FACADE FINISHES





FIGURE 16: School Typology Elevations

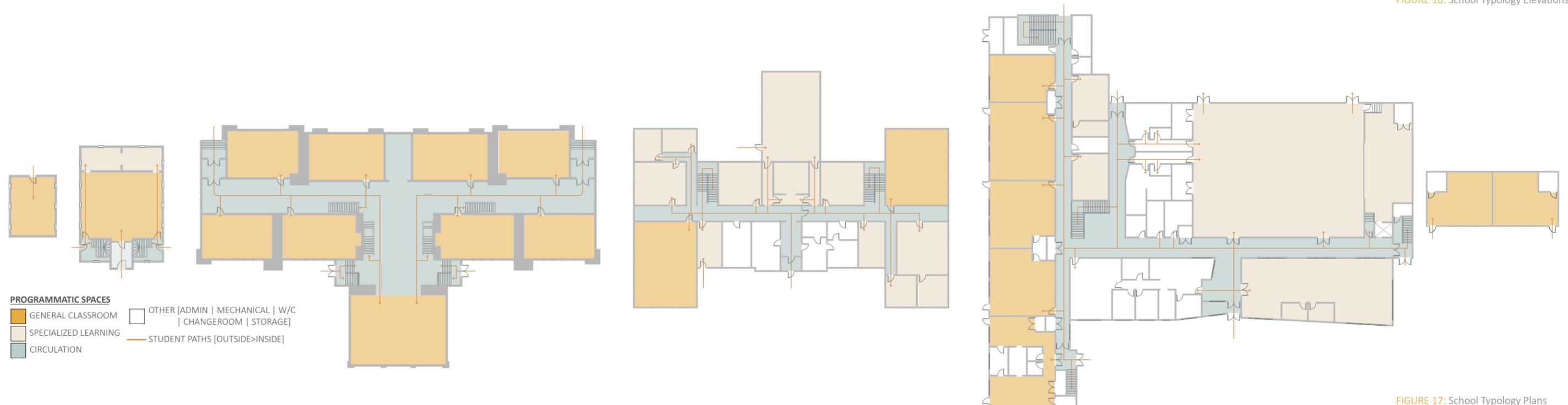


FIGURE 17: School Typology Plans

## Preliminary Observations

The different school buildings depicted in this study do not follow a linear transformation but appear simultaneously in different instances and times, which means that we cannot talk about the evolution of school buildings in the sense that it is a linear process. This short study shows how school buildings have responded to educational models and the sociopolitical conditions of their time, more particularly as a response to public federal politics such as the Common School Act. This act permitted districts to raise funds through property taxes that established free common schools for all children and eventually compulsory education.<sup>47</sup> As a result, this was one of the many factors that influenced the need for larger schools and classrooms to accommodate

the unprecedented increase in enrollment. Although the school buildings studied appear to be varied and increasingly bigger in size, a general observation points to the fact that none of the modifications made to the school typologies were done in anticipation of future needs. Generally, the changes in the typologies occurred as a way of responding to the current needs of their time. For example, the transition from the Common Schoolhouse to the larger Factory Model School conformed to the Industrialization of the Canadian economy, population growth, and the development of cities, while dealing with the issues of overcrowding and lack of adequate lighting and fresh air.

As designers, it is crucial to anticipate the future and design not only for today's needs but for tomorrow. Even though it would be very difficult to predict the future and know for certain what sociopolitical conditions would be like, anticipating the student's experiences, new teaching, and learning approaches through the inclusion of flexible elements that can be adapted would be a step towards designing a more sustainable environment.

<sup>47</sup> Johnson, *A Brief History of Canadian Education*, 39.

*“...the basics of school design such as air quality, daylighting and ergonomic issues of comfort, for example, are contributory to children’s outcomes at school...”*

- S.HIGGENS, E.HALL, K.WALL, P.WOOLNER  
The Impact of School Environments: A Literature Review

## CHAPTER 2 | 20<sup>th</sup> Century to Modernity: Experimental Designs in North American Schools

During the 20th century, societal changes had influenced a series of critiques of educational institutions. These critiques referred to the limitations of conformity and standardization within the ‘traditional’ educational paradigms at the time “were unresponsive to the real educational needs of the individual”.<sup>48</sup> This prompted educators to examine “issues of control within their traditional philosophy, notions of curricula, and protocols of teaching and learning”<sup>49</sup> and shifting that focus to pedagogies that valued children’s well-being. This movement for education reform leads to many experiments and exploration for alternative methods that facilitated those needs for change. Pedagogical changes associated with the “Progressive Era began to inspire new ideas about how children in an urbanizing democracy should learn [...] reformers like John Dewey [adopted] a more active mode of learning.”<sup>50</sup> People such as Maria Montessori, discussed later, started to develop “new and often controversial teaching methods that challenged the most basic assumptions of contemporary educational philosophy and practices”.<sup>51</sup> And shifting pedagogies focused on ‘textbook-centered curriculum’ to more active

methods of learning that incorporates the physical environment.<sup>52</sup>

<sup>48</sup> T. Hille, *Modern Schools: A Century of Design for Education* (John Wiley & Sons, 2012).

<sup>49</sup> “Open Classroom Schools,” *Education Encyclopedia*, accessed December 22, 2020, <https://education.stateuniversity.com/pages/2302/Open-Classroom-Schools.html>.

<sup>50</sup> “Why Don’t All Schools Look Like This One?,” *Bloomberg.Com*, October 9, 2015, <https://www.bloomberg.com/news/articles/2015-10-09/crow-island-school-why-don-t-all-schools-look-like-this>.

<sup>51</sup> Hille, *Modern Schools*.

<sup>52</sup> Bryan Perez, “Shifting School Design to the 21st Century: Challenges with Alternative Learning Environments” (University of Nebraska-Lincoln, 2017), <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1185&context=archthesis>.



FIGURE 18: Open-Air Classroom 1911

## Open Air Schools [1904]

Open-Air Schools first emerged in Europe in 1908, and eventually migrated to North America a couple of years later. The schools emphasized fresh air, improved light quality, and outdoor learning that met the physiological needs of children at a time when tuberculosis was prevalent.<sup>53</sup>

As seen in prior typologies, environments that were overcrowded and lacked the most basic humanistic needs of fresh air and light not only complicated the learning process but were places where tuberculosis flourished. In fact, “doctors and educators believed that the crowded classrooms [facilitated] the spread of the disease.”<sup>54</sup> And the Open Air Schools were used as a solution to tackle these issues. The first Open Air School in North America opened in Providence, Rhode Island in 1908, ridding of all windows, walls, and roofs. By the end of the first school year, students showed improvement in their overall health.<sup>55</sup> As a result of this success, the popularity of this movement

grew, and architects began to design permanent school buildings that “reflected the ideas and values of the movement.”<sup>56</sup> For example, the Corona Avenue Elementary School, designed by Richard Neutra in 1935 included glass facades that can slide open to outdoor class spaces, blurring the boundaries between inside and outside.<sup>57</sup> Even with the success, the Open-Air Movement was replaced with other concepts and typologies. Although, seen today all-around Canada, are Forest Schools, that have adapted similar ideologies of the open-air schools that eliminate the four walls of a building.

<sup>53</sup> Sarah Pruitt, “When American Students Attended School—Outside,” HISTORY, accessed December 22, 2020, <https://www.history.com/news/school-outside-tuberculosis>.

<sup>54</sup> Ibid.

<sup>55</sup> Ibid.

<sup>56</sup> Ibid.

<sup>57</sup> Ibid.

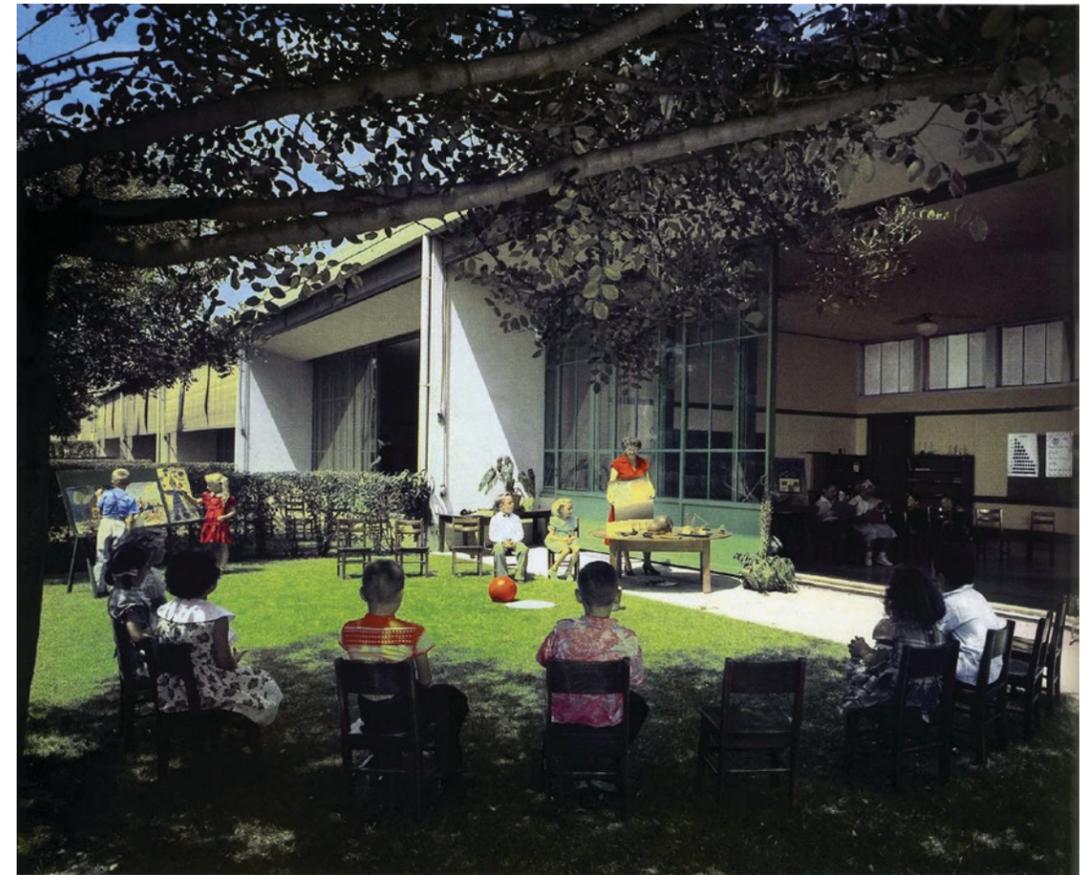


FIGURE 19: Corona Avenue Elementary School 1935



FIGURE 20: Corona Avenue Elementary School 1939



FIGURE 21: Crow Island Outdoor Classroom

## Finger Plan Schools [1940s]

In 1940, Perkins + Will and Eiel Saarinen designed Crow Island Elementary School located in the suburbs of Winnetka, Illinois. This school aimed to provide child-center learning through an experiential experience within a flexible, open, and child-scaled school design.<sup>58</sup> Crow Island was “recognized by Architectural Record, [an American Magazine,] as one of the most important buildings completed in America [in] the preceding 100 years”.<sup>59</sup> It was typically regarded as the first Modernist elementary school building in North America, marking the transition from the imposing scale to a school designed at the residential scale.<sup>60</sup> It served as an ‘ideal model’ in the post-war period, when suburban growth and the Baby Boom produced a tremendous demand for new and modern schools.<sup>61</sup>

The school was organized in the ‘Finger Plan’ method, where individual ‘L’ shaped classrooms ran along

a shared corridor. Classrooms were designed as a “self-contained village” with an entrance foyer that consisted of storage spaces, a bathroom, a kitchen space, and the main classroom framed by two glass walls and a semi-enclosed outdoor space.<sup>62</sup> After the debut of Crow Island, many schools began to imitate this model but only the most basic elements: “an asymmetrical single-story made of brick, with strong horizontal lines and large windows”.<sup>63</sup> And “school districts preferred standardization to Crow Island’s sense of exploration, play, and artistry.”<sup>64</sup> Elements of the finger plan school model, where classrooms run along either side of linear hallways, are key characteristics that exist in most public elementary schools within Canada.

<sup>58</sup> Perez, “Shifting School Design to the 21st Century: Challenges with Alternative Learning Environments.”

<sup>59</sup> Ibid.

<sup>60</sup> Ibid.

<sup>61</sup> Milnarik, “Crow Island School,” Text, SAH ARCHIPEDIA, July 16, 2018, <https://sah-archipedia.org/buildings/IL-01-031-0025>.

<sup>62</sup> “Why Don’t All Schools Look Like This One?”

<sup>63</sup> Ibid.

<sup>64</sup> Ibid.



FIGURE 22: Exterior View of Crow Island Elementary School



FIGURE 23: Crow Island Elementary School Classroom



FIGURE 24: Deerfield Elementary School, Open Plan Classroom

## Open Plan Schools [1960]

During the 1960s, the American Educational Facilities Laboratories developed the open plan concept based on the British primary schools, as a method that placed value in the interests of a child by focusing on the idea of “learning by doing”, mirroring the social, political, and cultural spirit of that time. Generally, the schools were configured with large pods of classrooms with no interior walls and using furniture to define the spaces. Children were not “assigned individual desk, [instead] they sat in cooperative small groups at tables.”<sup>65</sup> Students were encouraged to explore concepts that piqued their interest with the support of the teachers and the spaces that were thoughtfully defined by the teachers. Teachers would arrange flexible spaces dedicated for multi-age groups; the spatial compositions were remnants of the One-Room Schoolhouses.<sup>66</sup> With the openness and flexibility of these spaces, children had the freedom to move around without restrictions. However, like many other ‘progressive’ movements on education reform, the idea of Open Plan Schools eventually faded in the

mid-1970s.<sup>67</sup> Concerns about noise and distractions, as well, “with the economy stagnating and the nation deeply divided over the Vietnam War”,<sup>68</sup> and schools around the United States and Canada shifted gears back to more ‘traditional’ schools and returning ‘back to the basics’.

<sup>65</sup> “Open Classroom Schools.”

<sup>66</sup> Ibid.

<sup>67</sup> Steve Drummond, “‘Open Schools’ Made Noise In The ‘70s; Now They’re Just Noisy,” NPR ED, accessed May 6, 2021, <https://www.npr.org/sections/ed/2017/03/27/520953343/open-schools-made-noise-in-the-70s-now-theyre-just-noisy>.

<sup>68</sup> Education Next, “The Open Classroom,” Education Next (blog), July 6, 2006, <http://www.educationnext.org/theopenclassroom/>.



FIGURE 25: Fully Open Classrooms and Hallways



FIGURE 26: Semi-Open Classrooms and Hallways



FIGURE 27: Wilkes Elementary School

## Wilkes Elementary School [2012]

Wilkes Elementary School, designed by Mahlum Architects, located in Bainbridge Island, Washington, has taken a unique approach to interweaving educational and social spaces, based on the idea of play.<sup>69</sup> The design for Wilkes embraces visual and physical connections that support dynamic styles of teaching and learning.<sup>70</sup> Classrooms are arranged in clusters that form “four intimate learning communities” that foster collaboration and creates variation in scales of learning – from “multi-classroom gatherings, to intimate individual experiences.”<sup>71</sup> In addition, glazing is incorporated to provide seamless transitions between classroom spaces and other learning areas. “Through transparency, the needs of the whole child are addressed: physical limitations to educational opportunities are removed, a range of learning styles are supported, and lines between where learning or play can occur are blurred.”<sup>72</sup>

<sup>69</sup> “Wilkes Elementary School / Mahlum,” ArchDaily, February 10, 2015, <https://www.archdaily.com/596974/wilkes-elementary-school-mahlum>.

<sup>70</sup> “Wilkes Elementary School,” Architect, n.d., <https://www.architectmagazine.com/project-gallery/wilkes-elementary-school>.

<sup>71</sup> Ibid.

<sup>72</sup> “Wilkes Elementary School / Mahlum.”



FIGURE 28: Breakout Spaces



FIGURE 29: Breakout Spaces



FIGURE 30: Model of Lab École Projects

## Lab École [2017]

Lab École is an initiative launched in Quebec in 2017 and the organization is led by architect, Pierre Thibault, chef Ricardo Larrivé, and sportsman and lecturer Pierre Lavoie.<sup>73</sup> The initiative resulted in a competition that includes the design of six schools established across the province of Quebec, located in Maskinongé, Rimouski, Saguenay, Shefford, Quebec City, Montreal, and Gatineau.<sup>74</sup> This competition resulted in 160 proposals (available on the Catalog of Canadian Competitions) submitted by 135 architecture firms, where a multidisciplinary panel made up of school administrators, architects, and representatives of municipalities chose the final five winners. What is so unique about this project is that it includes individuals from different disciplines that bring new perspectives on learning and education. The main objective of this initiative was to design the schools of tomorrow that put physical activity, nutrition, and healthy habits to the forefront of education. Lab École aimed to identify courses of action that would

result in the possibility to adapt architecture to the school's educational processes, rather than limiting its possibilities.<sup>75</sup> As well, design schools that meet the needs and realities of the students and those who support them.<sup>76</sup> Incorporating the importance of not only the built environment, and the relationships between teachers, peers, and community but many of these schools emphasize the natural environment as being an important aspect of learning.

The competition projects present a set of themes that are followed, the classroom, transitional spaces, shared environment, and outdoor spaces, that possess unique spatial qualities and requirements that contribute to an overall successful design. For example, classrooms that are more complex in form, offering a variety of zones that foster various activities is best suited for younger students, versus classrooms that incorporate flexible furnishings that can be reconfigured by older students.<sup>77</sup> Transitional spaces,



FIGURE 31: Lab École - Maskinongé

such as corridors used for circulation are widened, fostering non-traditional learning environments that be used for informal learning opportunities. Incorporating spaces such as a dining hall contributes to the shared environments that support interactions between students of all age groups. Lastly, outdoor spaces that include generous courtyards that extend interior functions outwards, provide alternative learning environments that extend beyond traditional classroom layouts, demonstrating similar perspectives of the Montessori's, Reggio Emilia, and Waldorf schools. Lab École can be seen as a catalyst to rethink traditional notions of school environments by emphasizing the importance of healthy habits, nutrition, and physical activity. Important architectural concepts that emerged through this initiative includes, learning streets, that will later influence the final project design.



FIGURE 32: Lab École - Gatineau



FIGURE 33: Lab École - Quebec



FIGURE 34: Lab École - Saguenay

<sup>73</sup> The competition is fully documented at the Canadian Competitions Catalogue (<https://www.ccc.umontreal.ca/resultats.php?searchKeywords=lab+ecole&lang=fr>)

<sup>74</sup> Ibid.

<sup>75</sup> Natacha Jean et al., *Penser l'école de demain*, 2019, 18–19, <https://www.lab-ecole.com/wp-content/uploads/2019/04/Penser-ecole-demain-Lab-Ecole-2019-BR-2019.pdf>.

<sup>76</sup> Jean et al., 18–19.

<sup>77</sup> Ibid., 32–33.

### Results of Comparative Analysis

Eventually, the momentum for educational reform during the 20th century settled, and the need for standardization persisted both in the built school typologies and the educational paradigms we see today. Although, currently in the 21st century, it appears that there is an emerging effort to challenge the traditional conditions of education and the environments that facilitate learning. Nevertheless, the examples presented in the previous sections provide many effective spatial architectural elements that have proven to enhance the student's learning experiences and overall well-being. There is an active awareness to integrate fresh air, natural light, flexibility, and more opportunities for collaboration that prioritizes the physical and mental health of students and faculty. As well, these examples bring forth a new perspective to learning spaces that are not restricted to the four walls of a typical classroom but have the opportunity to expand into other programmatic spaces such as hallways, in turn, creating a more dynamic spatial system. These elements will later be explored in the architectural project for a public elementary school in Markham, Ontario.

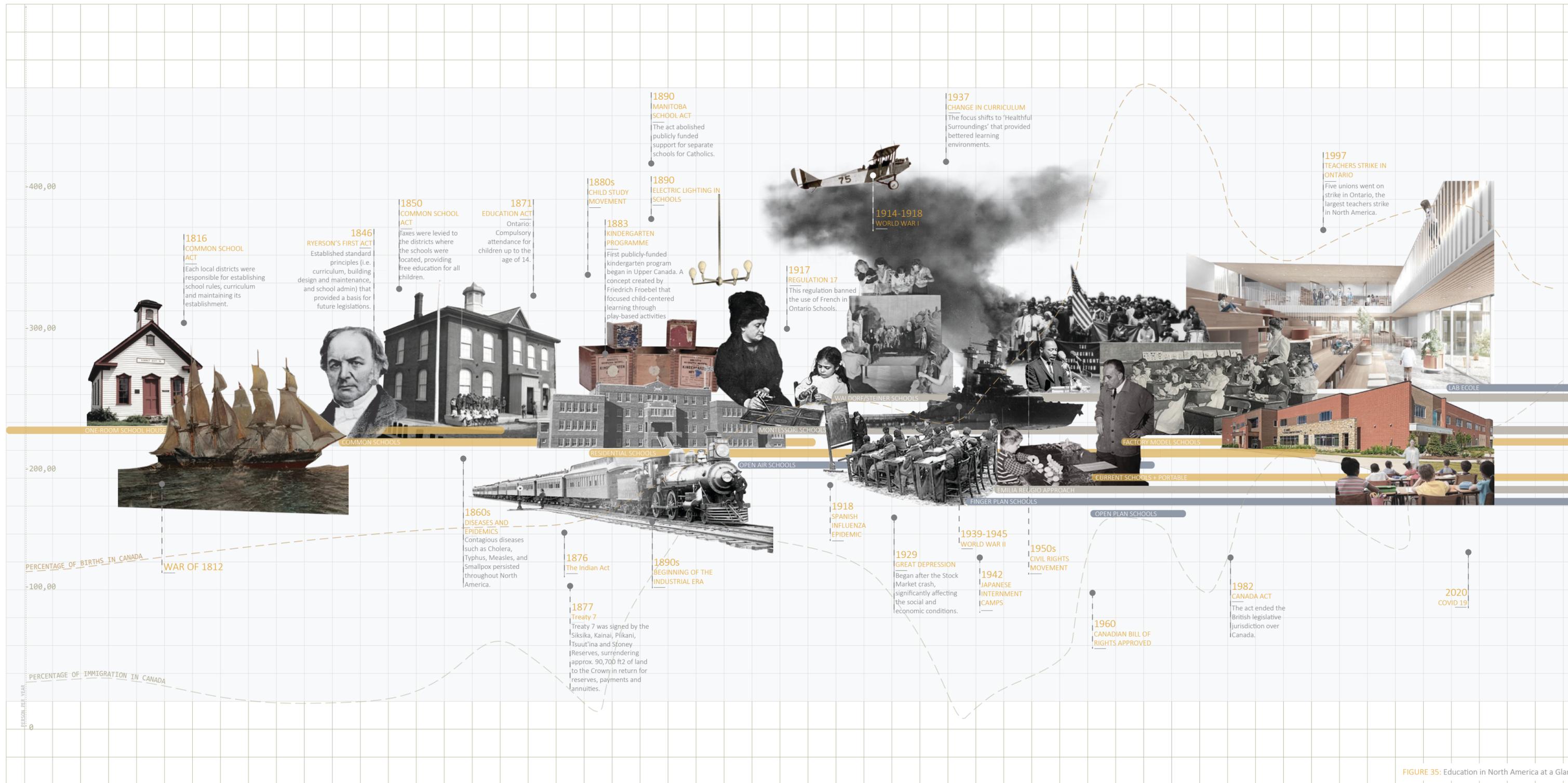


FIGURE 35: Education in North America at a Glance

*“In order to act as an educator for the child, the environment has to be flexible, it must undergo frequent modifications by the children and the teachers in order to remain up-to-date and responsive to their needs to be protagonists in constructing their knowledge.”*

- LELLA GANDINI  
The Hundred Languages of Children

## CHAPTER 3 | Alternative Methods of Education

Without a question, the design of the physical environment plays a significant role in the learning process of young children. What we experience as children oftentimes affects our behaviors and the way we function as adults and we should take “our natural impulse to nurture a student and extending that in a conscious way to every aspect of the physical environment that the child is learning in.”<sup>78</sup>

*Early childhood is the time to begin teaching these skills. By bringing children out of their childcare centers and classrooms into the built and natural spaces of their cities, and by involving children in naturalizing-built surroundings, urban environmental education contributes to cities where human constructions and natural processes can productively co-exist for all ages.<sup>79</sup>*

Raffi Cavoukian, the founder of the Raffi Foundation for Child Honouring, stated that “everything that a child is immersed in is a learning opportunity. It’s not just what you’re ‘teaching’ in a given moment.”<sup>80</sup> As such, schools such as Montessori, Waldorf/Steiner,

and Reggio Emilia are “three highly regarded early education methods”<sup>81</sup>, that bring new perspectives to the relationships between the student, teacher, and the learning environment.

<sup>78</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*, 32.

<sup>79</sup> Victoria Derr, Louise Chawla, and Illène Pevec, “Early Childhood (in Essays in Urban Environmental Education),” in *Essays in Urban Environmental Education*, 2016, 44–52.

<sup>80</sup> Cannon Design, VS Furniture, and Bruce Mau Design, *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching and Learning*, 32.

<sup>81</sup> “5 Facts about Montessori, Waldorf & Reggio Emilia Schools | PrivateSchoolReview.Com,” Private School Review, accessed November 28, 2020, <https://www.privateschoolreview.com/blog/5-facts-about-montessori-waldorf-reggio-emilia-schools>.



FIGURE 36: Montessori | Classroom 1937

## Students, Teachers and Physical Environment as One Area

Montessori Schools are considered one of the more popular approaches to teaching preschool and primary age children. This approach was developed by Dr. Maria Montessori in the early 1900s, who “believed that every educator should ‘follow the child’, recognizing the evolution needs and characteristics of each age, and building a favourable environment, both physical and spiritual, to respond to these needs.”<sup>82</sup> A great deal of consideration is put into designing with the child in mind. The environment is designed to be “proportional to children’s height and size, and it has low shelves and tables and chairs of different sizes where children can sit individually or in groups”.<sup>83</sup> The classroom is divided into theme areas where related materials are exposed on the shelves, promoting the child’s independence in the exploring and learning process. Teachers within this education model provide guidance and support for students to experiment with their desires and interests that “allows children to act, want, and think by themselves.”<sup>84</sup> As a result, it provides opportunities for the child to explore and

develop a sense of independence. Freedom and self-discipline make it possible for each child to find activities that respond to their evolutionary needs.<sup>85</sup>

Similar to Montessori’s principals, the Reggio Emilia Approach, which was developed by Italian psychologist Loris Malaguzzi, also emphasized the physical environment as having a significant impact on the learning processes of children. Malaguzzi argued that children learned through their interactions with not only their teachers and peers but, with the physical environment. The term ‘Third Teacher’ is derived from the Reggio Emilia Approach referencing the physical environment. By incorporating the environment as an educator, an approach prominent in the Reggio Emilia philosophy, we can notice its significant role to children’s learning. Malaguzzi coined the expression, “Hundred Languages of Children,” which refers to the principle that children can express themselves and their thinking in multiple ways. The learning is very hands-on and the school emphasis artistic expression



FIGURE 37: Reggio Emilia | Collaborative Work



FIGURE 38: Reggio Emilia | A Math Workshop 1966



FIGURE 39: Waldorf Steiner | Children Ring Dancing In Front of New Kindergarten Building 1994

providing students with endless opportunities to make their visions come to life through a range of multimedia and multi-sensory experiences. Projects that emerge from the classroom experience in Reggio Emilia follow a set curriculum based on the child’s passions, interests, and curiosities.

The importance of the physical environment seen in Montessori’s and Reggio Emilia Schools are also very evident in the Waldorf Steiner approach. The Waldorf/Steiner School was conceptualized by Rudolf Steiner in 1919 for the children of the workers and employees of the Waldorf-Astoria cigarette factory. Every aspect of the school – furniture, natural lighting, pastel colors, and outdoor spaces- was seen by Steiner as having an architectural and pedagogical significance.<sup>86</sup> The core curriculum is focused on the daily and weekly routines of an individual, as well, focuses on the child’s relationship to nature. The characteristics of this pedagogy are focused on children being taught

together equally and aim to train “the head, heart, and hand”. Though, unlike Montessori’s and Reggio Emilia schools, Waldorf schools emphasize art and learning through artistically embodied means in all aspects of the curriculum.<sup>87</sup> These means “include drawing, story, chant, and a choreographed series of body movements known collectively as ‘eurythmy’”.<sup>88</sup> Not only is this approach expressive in its teaching methods, typical Waldorf schools are known for their architecture that is referred to as “organic expressionism, where buildings were liberated from the constraints of the right angle.”<sup>89</sup> This was “in accordance with Steiner’s advice: avoid straight angles to stimulate those inside not to be ‘block heads’ but to think independently and creatively.”<sup>90</sup>

Nevertheless, the pedagogical approaches mentioned successfully illustrate the correlation between the physical environment and learning processes. In addition, they exemplify the impact of

<sup>82</sup> Translated by Author, “The Montessori Method,” FAMM, n.d., <https://www.fundacionmontessori.org//the-montessori-method.htm>.

<sup>83</sup> Ibid.

<sup>84</sup> Ibid.

<sup>85</sup> Ibid.

<sup>86</sup> Rena Upitis, “School Architecture and Complexity,” *Complicity: An International Journal of Complexity and Education* 1, no. 1 (n.d.): 24.

<sup>87</sup> Ibid.

<sup>88</sup> Ibid.

<sup>89</sup> Ibid.

<sup>90</sup> Ida Oberman, “Waldorf History: Case Study of Institutional Memory” (School of Education, Stanford University, 1997), 16, <https://files.eric.ed.gov/fulltext/ED409108.pdf>.

how architecture can act as a teaching tool. These principals and methods seen in early childhood learning approaches will later be implemented in an exploratory design for a public elementary school.

Each of these pedagogical approaches encourages children's exploration and nurtures their relationships between the teacher, peers, and the physical environment. These principals have been so successful, that even though they first emerged around the mid-20th century in Europe, these schools can be seen today scattered around North America and all around the world. Montessori, Waldorf / Steiner, and Reggio Emilia Schools provide opportunities for not only the child to take charge and develop a sense of independence, but also nurtures the child to develop skills from within and cannot necessarily be taught. As a result, creating a foundation for later in life.

## Alternative Approaches of Education in the Greater Toronto

As a method to ground the research, the following maps, indicate the locations of Reggio Emilia, Montessori, Waldorf/Steiner, and Public Schools in the Greater Toronto Area (GTA). As you can see, the density of public schools (funded by the government) is very prominent in the urban fabric, in comparison to other types. Typically, the latter is privately funded - meaning tuition fees are implemented and can range from 5,000-20,000 /year.



FIGURE 40: Map of Reggio Emilia Schools in the GTA



FIGURE 41: Map of Waldorf/Steiner Schools in the GTA

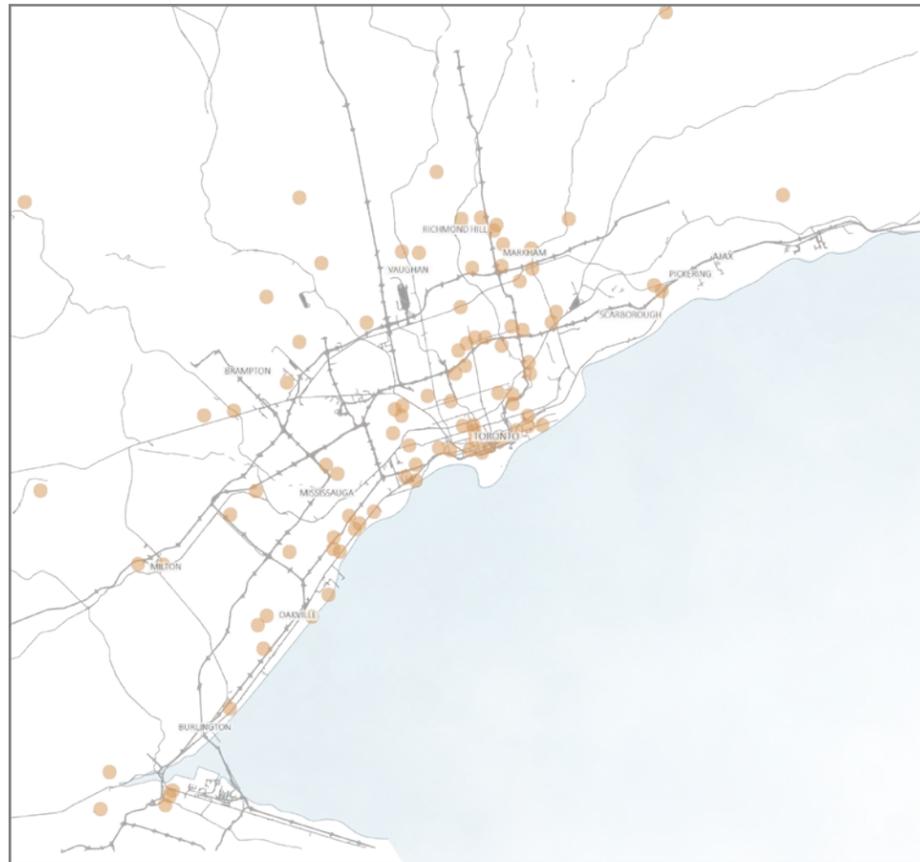


FIGURE 42: Map of Accredited Montessori Schools in the GTA

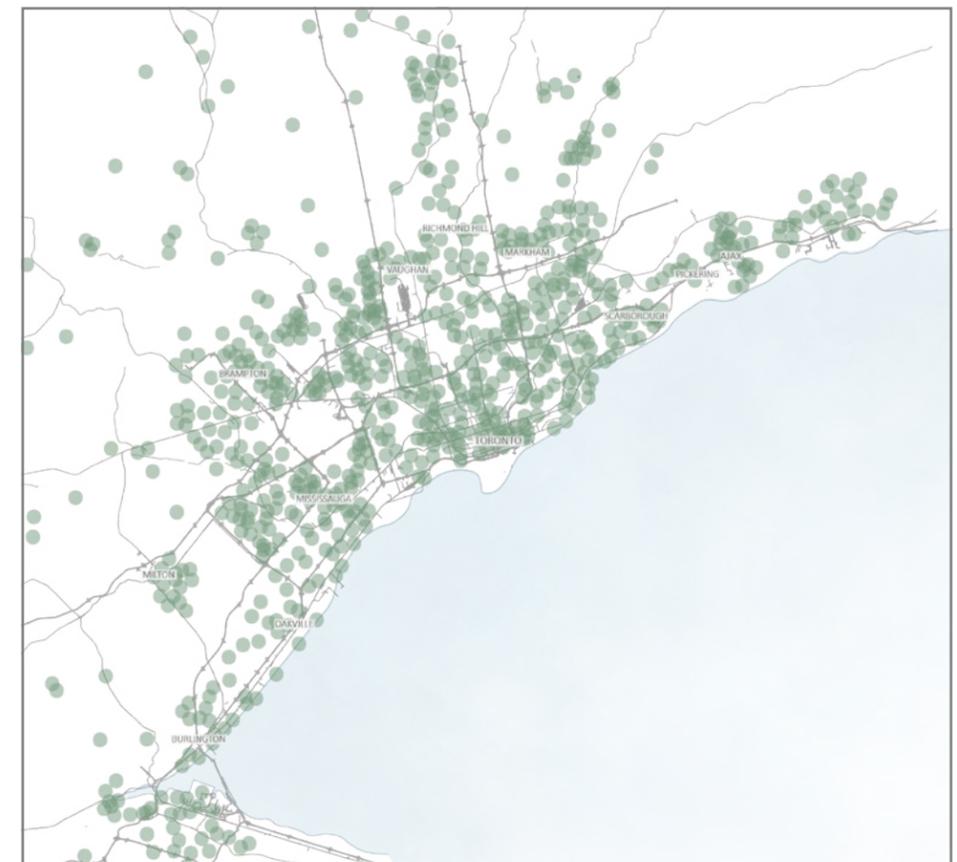


FIGURE 43: Map of Public Schools in the GTA

*“Tell me and I forget, teach me  
and I may remember, involve me  
and I learn.”*

- BENJAMIN FRANKLIN

## CHAPTER 4 | Site

The Greater Toronto Area<sup>91</sup> was chosen as the focus of study, more specifically, the York Region Area. According to Statistics Canada, York Region is predicted to have an increase in the population of 3.5% in 2031. As well, between 2005 and 2015 in the local municipalities: the largest increases in numbers of children aged 0 to 12 years living in low income occurred in The City of Markham with 17.9%, followed by Richmond Hill with 17.4% and Georgina with 13.8%. As a result, children who reside in these regions that are in the middle to lower-income section may not have as great of an opportunity or be able to financially afford specialized schoolings such as Montessori's, Waldorf Steiner Schools, and Reggio Emilia Schools. For this reason, the City of Markham was chosen as the site to develop a public-elementary school that draws on philosophies and practices seen in previous precedents studied that have proven to be beneficial in the overall learning processes.

<sup>91</sup> The Greater Toronto Area (GTA), is a metropolitan area made up of five regions, these include York Region, Halton, Peel, Durham, and the City of Toronto.

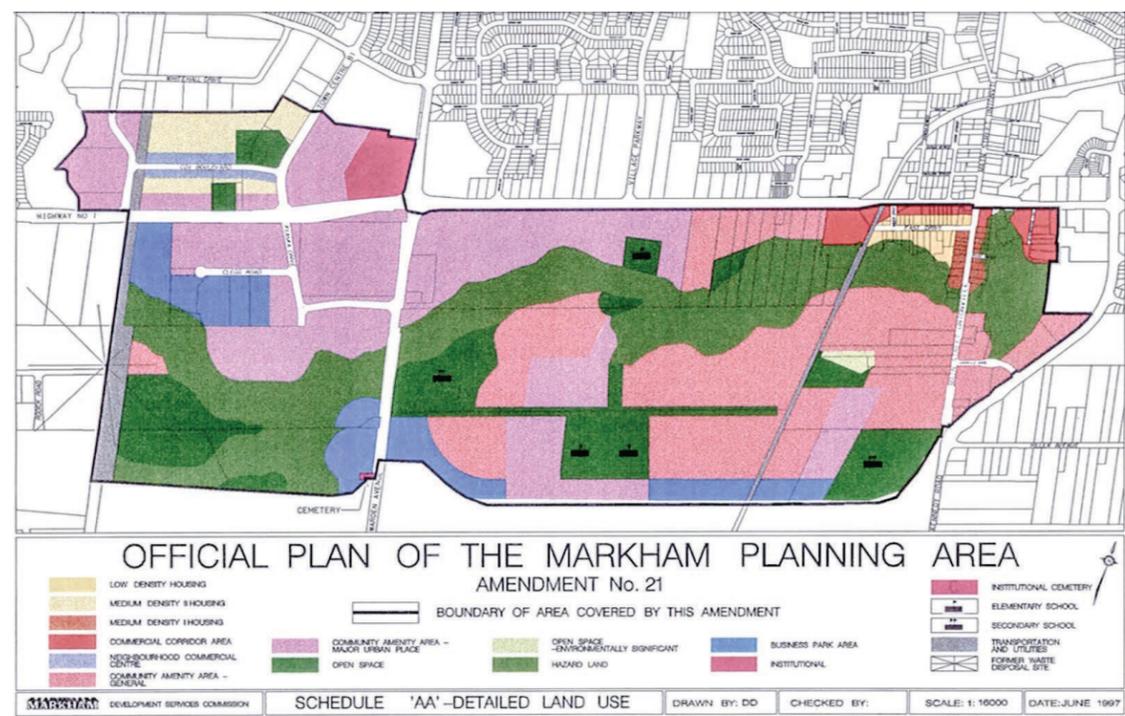


FIGURE 44: Markham Centre Conceptual Plan | 1992

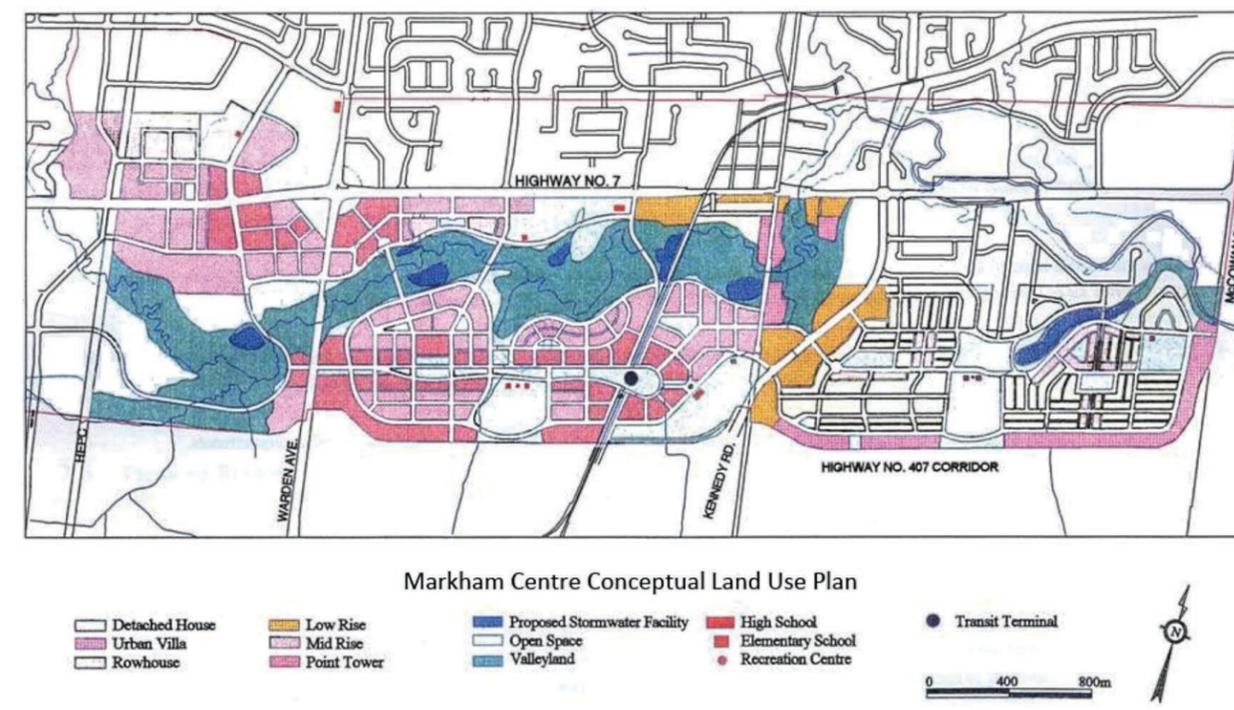


FIGURE 45: Markham Centre Secondary Plan | 1994-1997

## Markham

The City of Markham is the largest local municipality in the York Region Area, with an estimated population of 343,000. The city is one of the fastest-growing in Ontario and is forecasted to grow to 460,200 by 2031.<sup>92</sup> Founded in the 1790s, Markham has evolved into Canada's most ethnically diverse city with 59% of its population [being] foreign-born and this percentage is increasing.<sup>93</sup>

However, when driving through the city, one may not notice the diversity embedded throughout the community and the urban fabric. Markham, like many other suburban cities in the GTA, is highly suburbanized, with endless rows of cookie-cutter houses that hold no sense of identity or connection to its environment—prioritizing budget and fast construction rates over identity and placemaking. This kind of practice is also reflected in the school buildings built in these areas with almost identical brick facades that are essentially made up of varying configurations of rectangular boxes.

<sup>92</sup> City of Markham, "2019 Integrated Leisure Master Plan Update: 2019-2031," November 13, 2019.

<sup>93</sup> Ibid.

<sup>94</sup> Ibid.

<sup>95</sup> Ibid.

Markham is considered as one of the most progressive in adapting a 'new urbanist' approach to planning among the Greater Toronto Hamilton Area.<sup>94</sup> So, what is preventing the emerging public-school projects within the city from implementing ideologies from previous examples studied into their design?

## Markham Centre

Over the last decade, Markham's urban fabric has undergone some major transformations. Currently, Markham Centre is an area that is being developed with condos and mixed-use developments spanning over 243 acres "with hopes to create a denser city center; an alternative to the existing growth patterns of unsustainable urban sprawl."<sup>95</sup> Back in the 1990s, this area had been "frozen" for development by the province during the planning and construction of the Express Toll Highway 407 located on the southern part of the site. In fact, in 1992 a conceptual master plan was established based on the principles of

New Urbanism with the vision for Markham Centre to consist of residential, employment, commercial, recreational, cultural, and institutional used in a compact core.<sup>96</sup> The Markham Centre secondary plan was adopted by the Markham council in 1994 and approved by Ontario Municipal Board in 1997.<sup>97</sup> The Secondary Plan established a strong planning foundation for Markham Centre. Key elements include: protecting the natural environment, supporting public transit, promoting mixed-use, high quality, and compact urban form, providing for a range of parks, public spaces, and community amenities.<sup>98</sup> However, it wasn't until 2005 when construction started.

Even though it hasn't been fully developed yet, this neighborhood has been nominated as one of the country's largest mixed-use development, as well as North America's largest LEED registered mixed-use development. What is so unique about the site is that it not only includes vacant lands, which is very uncommon in Markham, there are natural woodland

<sup>96</sup> "MARKHAM CENTRE STORY," accessed January 14, 2021, <https://www.arcgis.com/apps/Cascade/index.html?appid=5abae9cd9814462a97f882672184973c>.

<sup>97</sup> Ibid.

<sup>98</sup> Ibid.

<sup>99</sup> Ian Merringer, "Canada's First National Urban Park," Text, Canadian Geographic, July 16, 2015, <https://www.canadiangeographic.ca/article/canadas-first-national-urban-park>.

areas and a natural river (Rouge River), that flows from Oak Ridges Moraine through the site into the eastern border of Toronto where Rouge Park is located, the only national park in Canada within a municipality.<sup>99</sup>

Currently, there is not an elementary school within the Markham Centre area that serves the children living in this area. Children who reside in this area are delegated to surrounding schools that have reached close to maximum capacity. As a result, the site chosen is one of two lots reserved by the York Region District School Board for future developments of an elementary school that serves the Markham Center Area. This provides an opportunity for my project to apply the 'new urbanist' mentality to the planning of the new public school typology within the unique context of Markham Centre. As well, harnessing the natural environment qualities and incorporating them into the built environments, again drawing from the philosophies and typologies such as Montessori's, Emilia Reggio, and Waldorf Steiner into the design.

## Brief History of Markham Centre

FIGURE 46: Markham Centre Transitions



### Pre-1980

Lands were primarily agricultural, with Rouge River running through the area. Major roads were limited to Highway 7 East, Warden Avenue, and Kennedy Road. The CP rail travels through the area in a north-south direction, as it does today functioning as the GO Station.<sup>100</sup>



### 1980 - 2006

During this time, it was a period of transition. Major developments, such as new transportation infrastructure including Highway 407, and reconfiguration of Kennedy Road, began to form around the site, shaping the area into what it is today. In 2006, the first Growth Plan for the Greater Golden Horseshoe was prepared and later updated in 2019, providing a framework for where and how growth occurred in the GGH to the year 2031.<sup>101</sup> Markham Centre was identified as one of several 'urban growth centers' in the GGH, that is planned as focal areas for: commercial, recreational, cultural and entertainment uses; high-density employment centers; and population and employment growth.<sup>102</sup>

<sup>101</sup> "MARKHAM CENTRE STORY."  
<sup>102</sup> Ibid.



### 2006 - 2011

Markham Centre's importance as a regional centre and hub gained momentum with two important transportation projects – VIVA Rapidway and the Mobility Hub Study.<sup>103</sup> In 2011, after Metrolinx identified Unionville Go Station as an "Anchor Mobility Hub", the city initiated concept design studies to determine the planning and design of a future Mobility Hub. The hub is an efficiently designed multi-modal transportation facility that seamlessly connects local transit with pedestrian and cycling routes and road networks. With a mixture of residences, offices, shops, and entertainment to create a unique place and destination.<sup>104</sup>

<sup>103</sup> "MARKHAM CENTRE STORY."  
<sup>104</sup> Ibid.



### 2011- Present

Markham Centre is identified as one of the "Regional Centres" in the City's Official Plan – to contain the highest concentration and greatest mix and intensity of uses and activities providing a range of housing, employment, live-work, investment, cultural, sports and entertainment.<sup>105</sup>

<sup>105</sup> "MARKHAM CENTRE STORY."

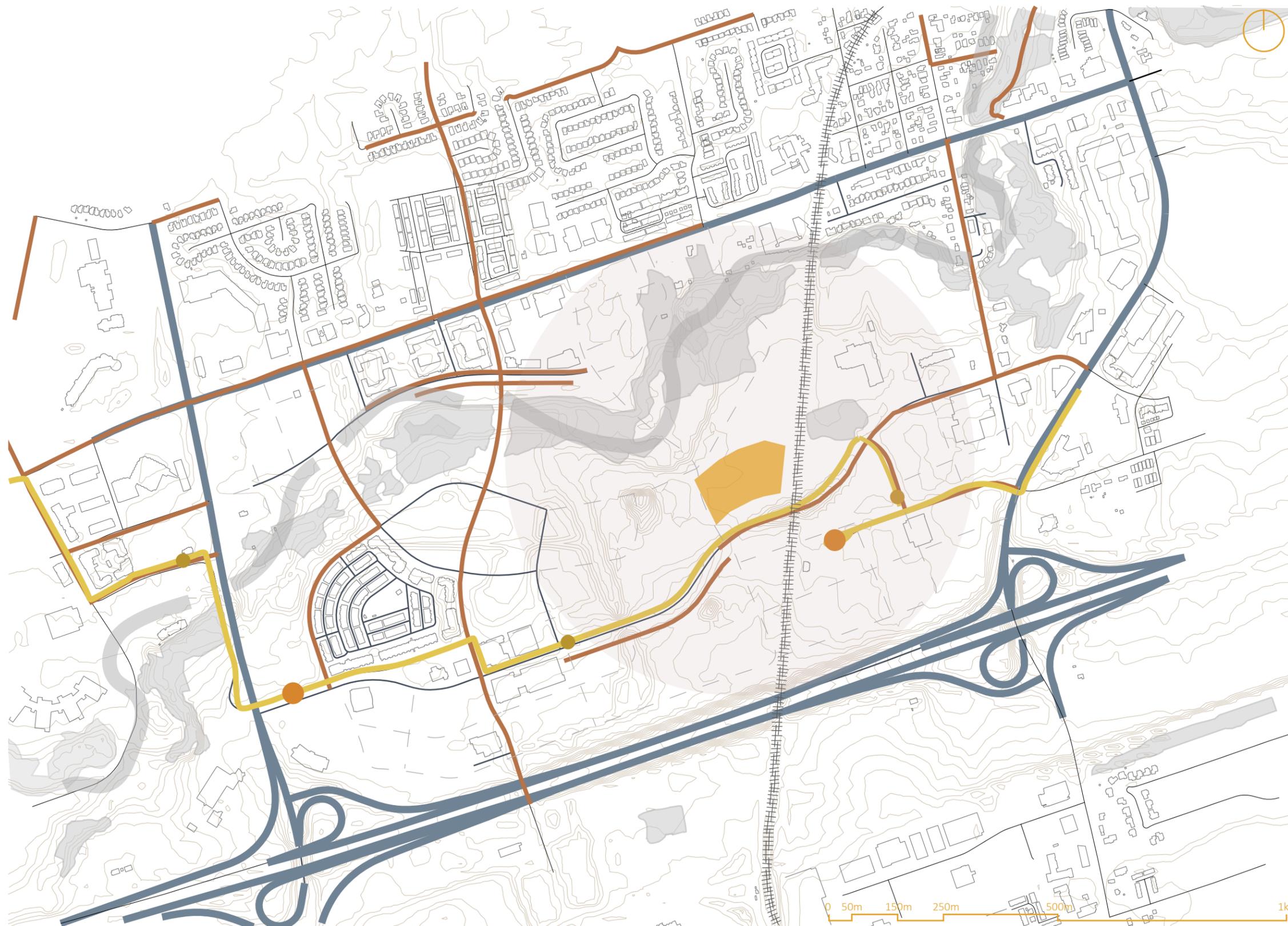


### Future

"Over the last twenty years, many planning and development projects have refined the community structure and neighborhood character of Markham Centre."<sup>106</sup> As the site continues to develop and grow with "the original vision for Markham Centre 'to create a complete and integrated community, containing a mix of uses suitable to a City Centre'" from the 1990s remain unchanged.<sup>107</sup>

<sup>106</sup> "MARKHAM CENTRE STORY."  
<sup>107</sup> Ibid.

<sup>100</sup> "MARKHAM CENTRE STORY."



### Site Analysis | Movement

The site chosen is centrally located in the Markham Centre Area and is easily accessible and convenient for residents to access. As a result of the site being underdeveloped, this provides an opportunity to implement new roads, that best suit the site and facilitating a pedestrian-friendly connection to the neighborhood, transit, and biking networks.



FIGURE 47: Map of Markham Centre | Movement

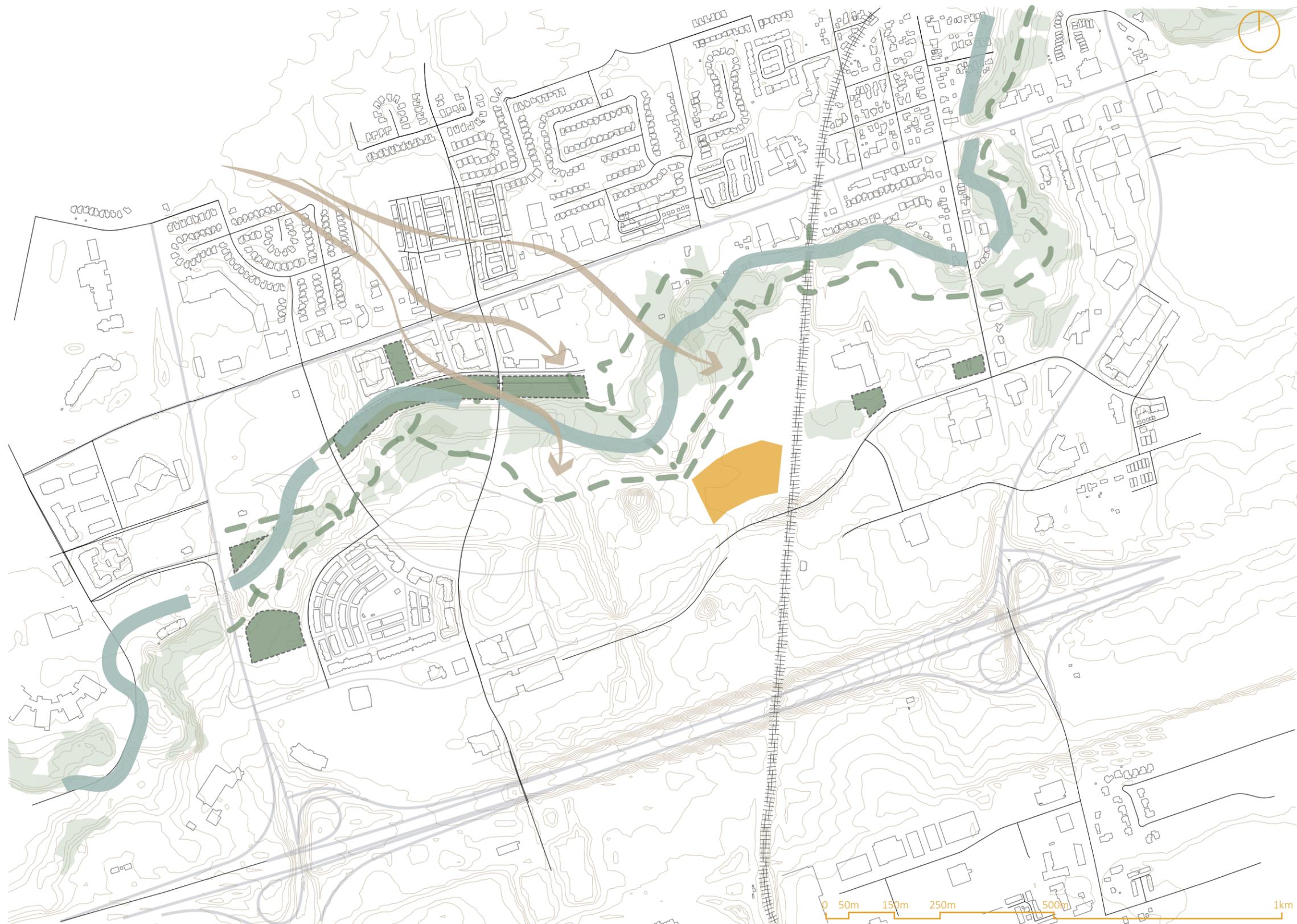


### Site Analysis | Built Environment

As mentioned earlier, Markham Centre continues to grow and become more developed with mixed-use developments consisting of commercial and residential spaces. Some major projects that have been approved and are projected to be complete within the next 5 years include the York University Markham Center Campus, and Gallery Square – a mixed-use development of 454 units and 15,000 sqft of retail spaces.

FIGURE 48: Map of Markham Centre | Built Environment

LEGEND	
	SINGLE DETACHED
	TOWNHOUSES
	CONDOS/APARTMENTS
	OFFICES
	COMMERCIAL
	EXISTING HIGH SCHOOL
	MIXED USE DEVELOPMENTS UNDERWAY
	SITE



### Site Analysis | Natural Environment

A major advantage to the site is its proximity to the Rouge River and the natural woodlands that pretty much haven't been touched since the 1980s. This provides an attractive natural backdrop, as well, creates endless opportunities for my design to interact with the natural site all while becoming a teaching opportunity that allows students to immerse themselves in a natural environment.

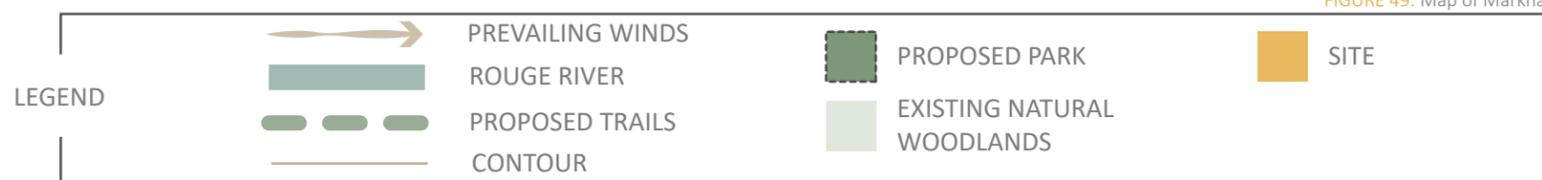
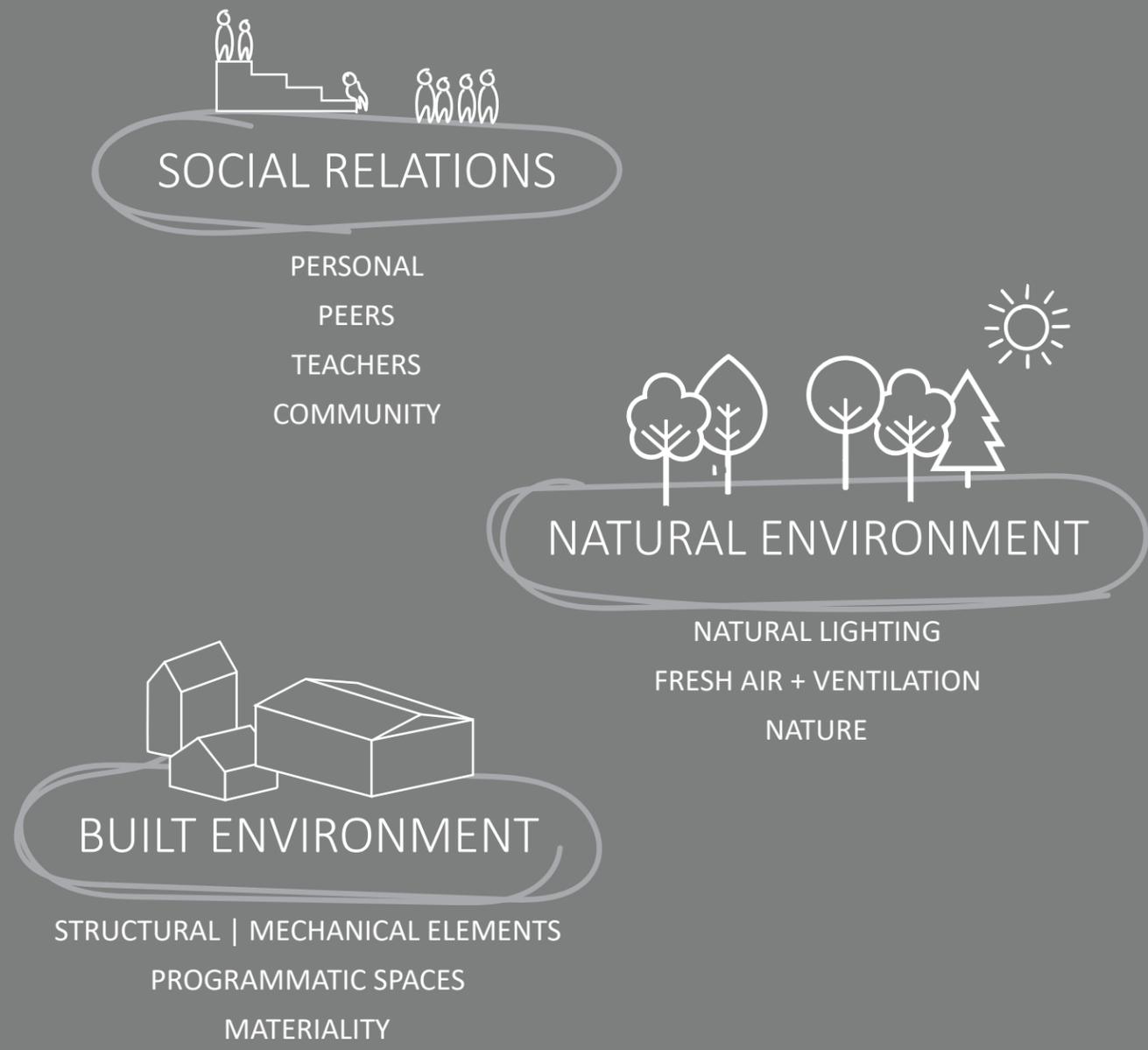


FIGURE 49: Map of Markham Centre | Natural Environment



## CHAPTER 5 | Rethinking Public-School Architecture in the Greater Toronto Area

This thesis proposes to use architecture as a pedagogical tool that aids in the learning and teaching processes at school that can foster connections between peers, teachers, and the community. Philosophies and ideas presented in previous examples, such as Montessori's, Reggio Emilia, and Lab Ecole, help set guiding parameters that frame the overall design intentions. As such, the three main pillars that ultimately drive this thesis are as follows;

building as a third teacher. This can be realized through multiple architectural strategies, such as exposing building components for pedagogical purposes.

These are key interrelated elements that work simultaneously creating a public elementary school typology that will promote collaboration and inspire individuals to investigate and explore new ideas.

**Social Relations** includes the learning that naturally occurs in either formal or informal interactions between the students, teachers, and community that takes place between individuals, small groups, larger groups, and lecture-based environments.

**Natural Environment** represents the fundamental pillars that support learning and the student's and teacher's well-being. This includes natural lighting, having fresh air, and ventilation, in addition to the physical and visual connections to the natural environment.

Lastly, the **Built Environment** is essentially architectonic, and this includes strategically designing and spaces that support a variety of interactions and explores the idea of the

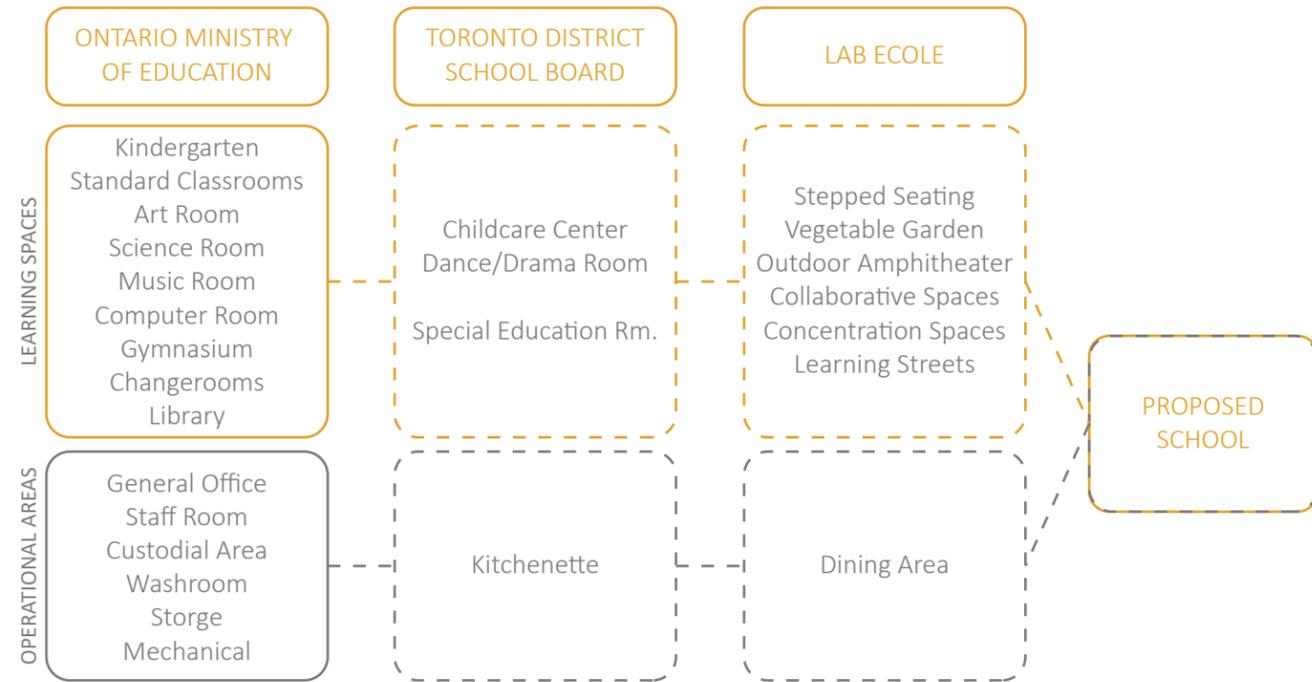


FIGURE 50: Programmatic Spaces Requirements

## Formulating the Program

Before the design phase, the programming of the spaces requires careful consideration. There are numerous factors to consider when defining the programmatic spaces as well as the total amount of space allocated for each. As a start, requirements set by the Ontario Ministry of Education were referenced to create a baseline. Afterward, unique elements prevalent in the precedents discussed earlier such as Lab Ecole, Montessori's, and Reggio Emilia schools were used to develop a new set of programmatic spaces that elevate traditional standards of learning environments seen within Markham. Even though this school would be under the York Region District School Board (YRDSB), as a result of limited access to YRDSB's set programming, the requirements set by the Toronto District School Board (TDSB) were used as a frame of reference for programmatic spaces required by a school board. The table (Figure 50) depicts the standard programmatic spaces required by the Ontario Ministry of Education, in addition to extra programs presented in the Lab Ecole projects such as the well-curated outdoor spaces like classrooms, amphitheater, gardens, and courtyards. This provides a great baseline to the minimum square footage typical in Public

Elementary Schools to build upon and elevate the traditional standards of learning environments seen within Markham.

Once this has been established, further micro-programming (Figure 51) was done to identify key elements that are crucial to the programmatic spaces, these include but are not limited to visual and physical connections to the built or natural forms, adjacency to other spaces, and atmospheric intentions. Through this exercise, it ensures that the functionality of these spaces is optimized and adheres to the design principles stated in the previous section.



FIGURE 51: Microprogramming

## Built Forms as Pedagogical Tools

With the guiding principles set and programmatic spaces formulated, the development of the final design intervention began to take shape. The overall form of the building was largely informed by the site and many environmental factors such as passive winds and sun direction (Figure 52). Once the general form was established, the building was separated into four primary categories: Classrooms, Specialized Learning Spaces, Learning Streets, and Support Spaces. Classrooms are re-imagined to be more than just a singular unit but a series of spaces that are strategically arranged to create a more effective learning environment. Specialized learning spaces include art, science, dance, gym, and music spaces that are woven between classroom clusters that challenge traditional notions of compartmentalizing subjects. Learning Streets is generally a circulation space that connects various programmatic elements such as the flex spaces and classrooms into one, but with the bonus of seamlessly fostering learning opportunities. And lastly, support spaces are crucial in a school environment: administration, faculty, caretakers, and even storage, mechanical, and washrooms are elements that allow the school

to function effectively. Nonetheless, deliberate design decisions were made based on the specific requirements of each category, but all include subcategories that work cohesively to create a dynamic design that meets the design parameters established. The following text describes these programmatic spaces further and highlights their role in forming an overall design that enriches the physical environment to inspire, stimulate, and encourage exploration and investigation of new ideas while promoting collaboration and the development of connections beyond the typical classroom environment.

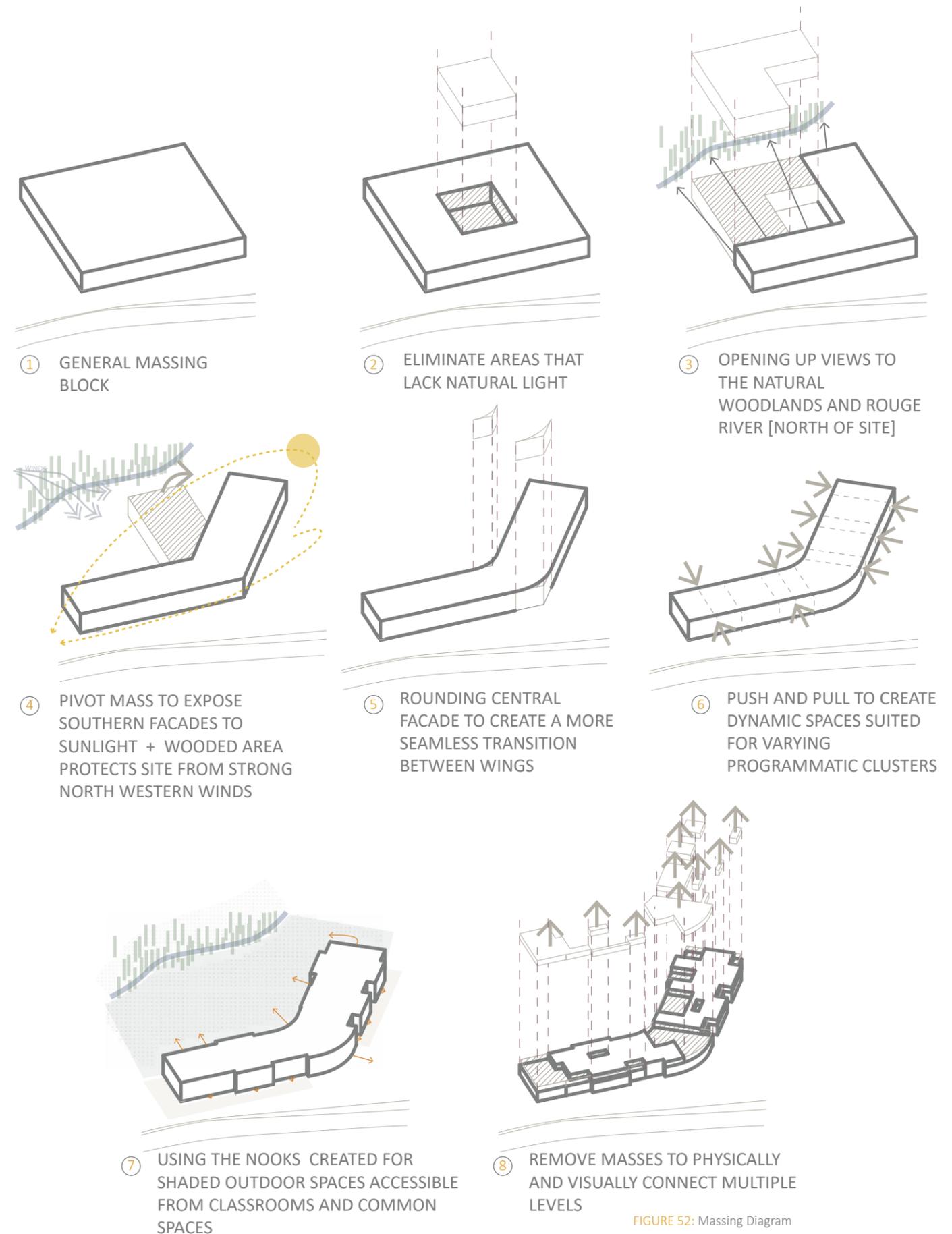


FIGURE 52: Massing Diagram

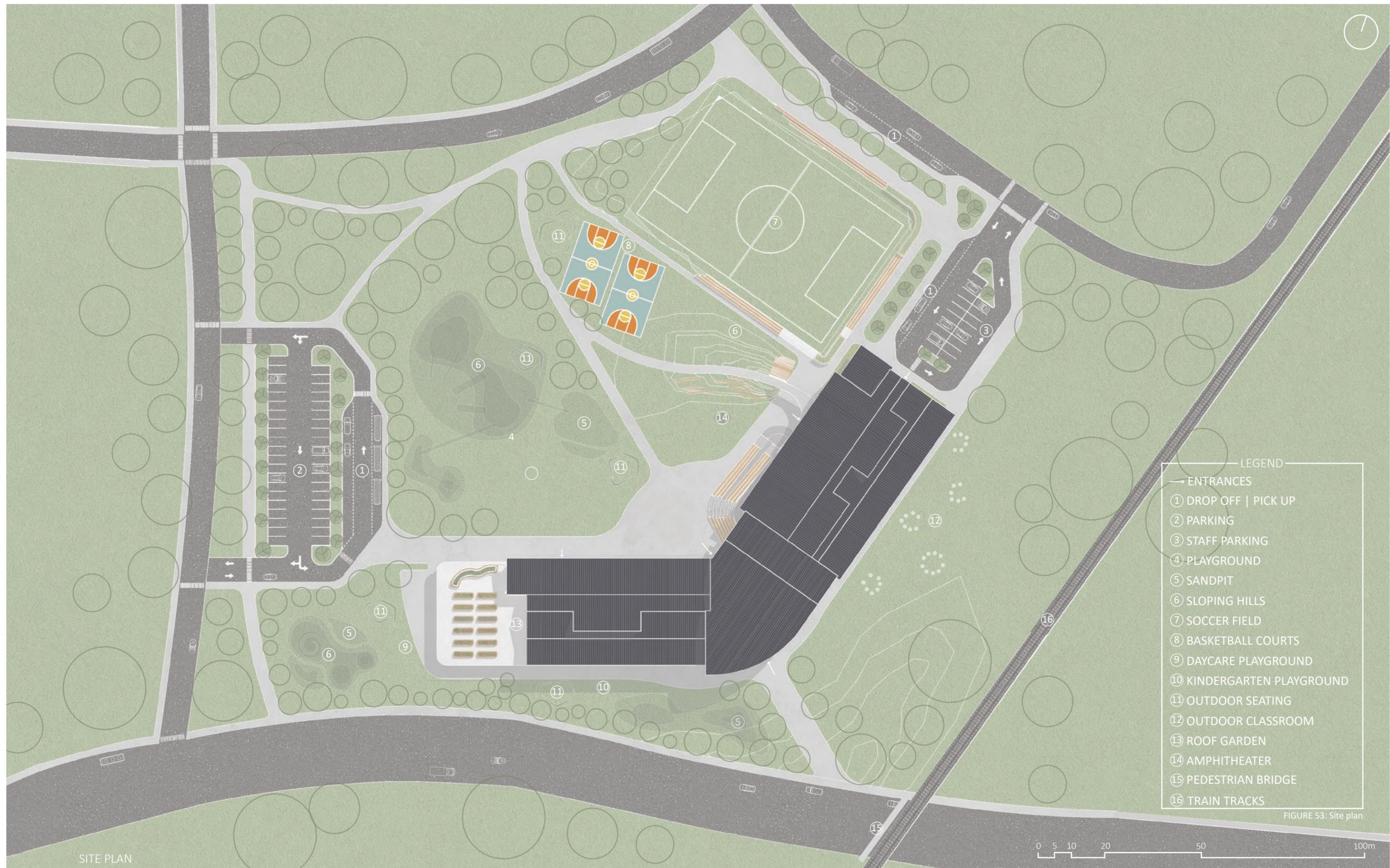


FIGURE 53: Site plan





LEGEND

① ENTRANCE	⑬ STORAGE	③① BALCONY
② ADMINISTRATION	⑭ STROLLER STORAGE	③② GARDEN
③ MAILROOM	⑮ WASHROOM	③③ OUTDOOR AMPITHEATER
④ MEDICAL ROOM		
⑤ MEETING ROOM		DAYCARE
⑥ OFFICES		PRIMARY
⑦ STAFF ROOM		JUNIOR
⑧ ELEVATOR		INTERMEDIATE
⑨ CARETAKER ROOM		SPECIALIZED LEARNING SPACES
⑩ MECHANICAL ROOM		LEARNING STREETS
⑪ CUBBIES		OTHER
⑫ LOCKERS		
⑬ STORAGE		
⑭ STROLLER STORAGE		
⑮ WASHROOM		
⑯ ART ROOM		
⑰ COMPUTER ROOM		
⑱ DANCE ROOM		
⑲ MUSIC ROOM		
⑳ SCIENCE ROOM		
㉑ BREAKOUT ROOM		
㉒ FLEX SPACE		
㉓ SOCIAL STAIRS		
㉔ RELAXATION ROOM		
㉕ GYM		
㉖ CHANGEROOM		
㉗ KITCHEN		
㉘ LIBRARY		
㉙ MULTIPURPOSE ROOM		
㉚ BEFORE/AFTER CARE		



FIGURE 55: Floorplan | Level 2



## Central Atrium

The main entrance is located centrally on the north side that feeds into the main atrium space. A significant element of this space is the incorporation of the social stairs that seamlessly flow from the inside to outside and outside to inside, signifying the dynamic language between the site and the building. As well, they allow for various functionalities, these include but are not limited to gathering spaces for individual or group work, school assemblies, or even public events serving as a cultural hub. Directly adjacent to the atrium space is the administration offices and a multipurpose room. The admin spaces, provide a security component, observing students, faculty, and visitors that enter the building, as well, it provides supervision for students using the social stairs. The multipurpose room consists of a sizable kitchen and storage space that again, is flexible and adaptable to various functions. Large sliding doors are incorporated to provide easier access and the ability to connect the multipurpose room and the atrium into a larger space when required. In addition to physical connections, the art classroom is directly visible when in the atrium space. The wall is fully glazed and lined with glass shelves that provide a space for students to proudly display their works of art, creating a sense of belonging.



FIGURE 56: Central Atrium



FIGURE 57: Level 2 Perspective of Atrium

## Learning Streets

Learning streets can be seen as the heart of this building typology that challenges existing public-school buildings in Markham. To move away from the double-loaded corridor model seen in many previous school typologies, where standard hallways only serve one purpose of getting users from one point to another, learning streets are used to foster informal learning opportunities that naturally occur at school. Flexible spaces complete this feature, acting as extensions of standard hallways.



FIGURE 58: Learning Street

## Flexible Spaces

Considering Robinson’s critique of grouping children based on their age, and the positive experiences of Montessori’s, the early One-Room Schoolhouse model, and the Open Plan Schools, multi-age interactions can be successful and must be encouraged. Human beings aren’t designed to exist or learn in single-age communities.<sup>108</sup> Every child possesses different abilities across a multitude of subjects and should not be contained to single-aged groupings. Research has shown that “learners from multi-age classrooms have both a better attitude towards school” and a better self-concept because the environment normalizes differences and provides opportunities to take on different roles to further learning.<sup>109</sup>

Although realistically, in the context of this project, designing a public elementary school within the York Region District School Board that adheres to the idea of multi-aged classrooms is a challenge because it requires the restructuring of the entire educational system. To navigate this, this thesis introduces flexible spaces (Figure 59), a new programmatic element that allows for this idea to be adopted. Similarly, to Montessori Schools, the idea behind this space is catered towards a multi-aged group setting, that allows older children to take leadership roles and for younger ones to observe older children. A mixture of primary, junior, and intermediate classes is arranged strategically to create a central collaborative space that seamlessly connects classrooms and learning streets. Ultimately blurring the standard boundaries of a classroom and eliminating teacher-student hierarchy by providing an alternative setting that fosters unique learning opportunities.



FIGURE 59: Flex Space

<sup>108</sup> Josh Hansen, “Why Does Age Determine the How, What, and With Whom of Learning?,” *Education Reimagined*, June 13, 2018, <https://education-reimagined.org/why-age/>.

<sup>109</sup> Ibid.

## Classrooms

The central component of schools, and essential environment for the student and teacher relation, classroom spaces can have a significant impact on children's learning experiences. Classroom spaces can be rigid or be adjusted to the child's desires and learning modalities. Some of the experimental schools of the 20th century studied in this thesis include classroom spaces that surpass traditional classrooms because they allow flexibility and freedom of movement. By allowing freedom of movement and diversity of activities, these classrooms facilitate learning by experiences. As such, the classroom spaces are adaptable to student's and teacher's needs.

The main collaborative space is used for structured and formal teachings required by the school curriculum. Between some classrooms are shared breakout rooms that provide a controlled setting with minimal noise and distractions for group work, collaboration between classes, and individual tasks. Sliding pivot doors were designed for a Fabrication Seminar that allowed us to explore the project's intentions through its manifestation to a smaller scaled architectural artifact. As a result, the design of this artifact relies heavily on the idea of versatility

so that it can adapt to different scenarios and needs of the students and teachers: providing a unique way to connect the classroom, flexible spaces, and learning streets through its combination of pivoting doors, glazing, partition wall, exploration, and play into one system (Figure 60). Functioning as a doorway when open or a partition wall when closed and can be rotated and pushed to the side. The door panels of this system also play an important role, they are finished with either corkboard, whiteboard, or pegboard materials. Corkboards can be used to display artworks and information. The whiteboard contributes to the collaborative processes seen in junior and intermediate levels. And the pegboards can be used as a storage and shelving aspect or used as a toy/playful piece for primary levels by having gears and tub attachments to create a path for a marble to run along. As a result, the design focuses on the needs of the students and teachers and allows for adaptability for everyone's unique learning modality (Figure 62). Lastly, classrooms are closely connected to outdoor spaces that provide an alternative learning environment- while optimizes ventilation and natural daylight.

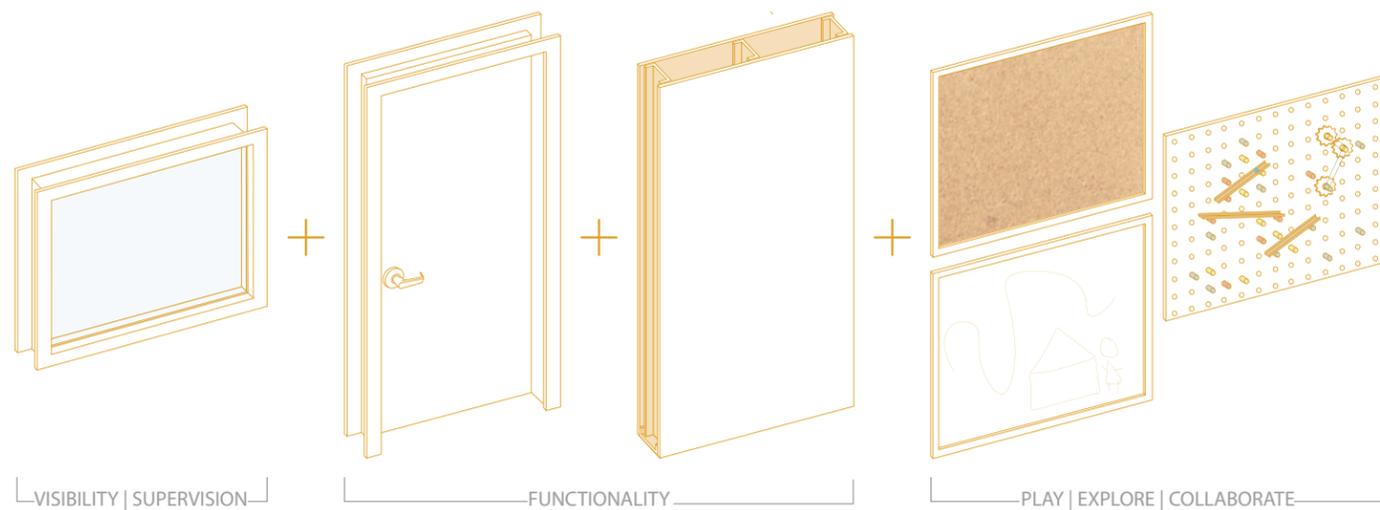


FIGURE 60: Artifact Design Principals



FIGURE 61: Art Room



FIGURE 62: Artifact Perspective



FIGURE 63: Gym



FIGURE 64: Multipurpose Room + Library



FIGURE 65: Main Entrance

## Diversity in Scales

The design of this elementary school was done with the child in mind [their scale, interpersonal relationships, how they learn] and understanding that the way an adult experiences space is different from the way children experience spaces. And even different age groups of children having their own unique architectural needs and wants, that respond to how the child learns. As a result, spaces that are dedicated to different age groups are designed to align the built forms with the different needs of each child.

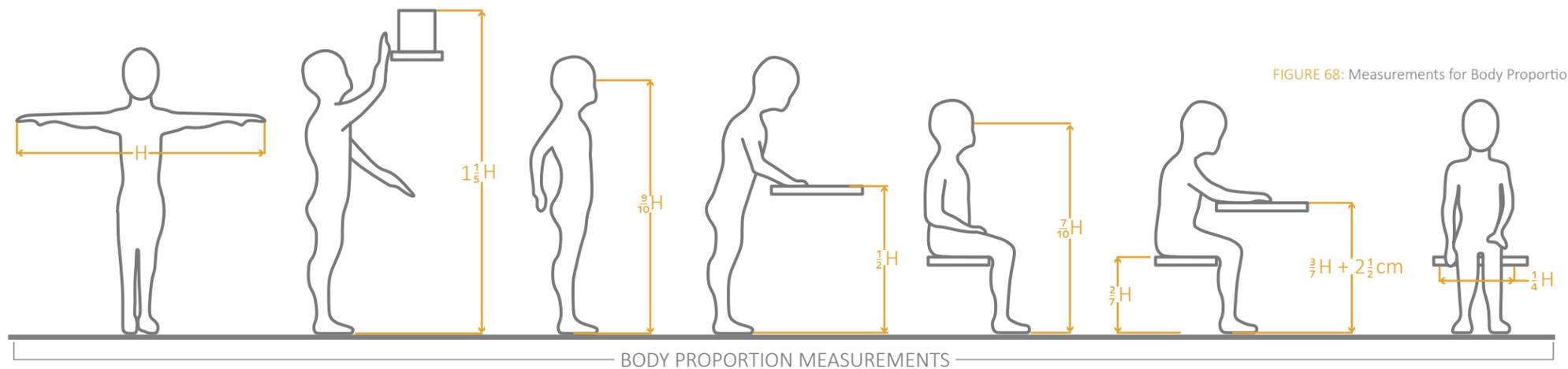
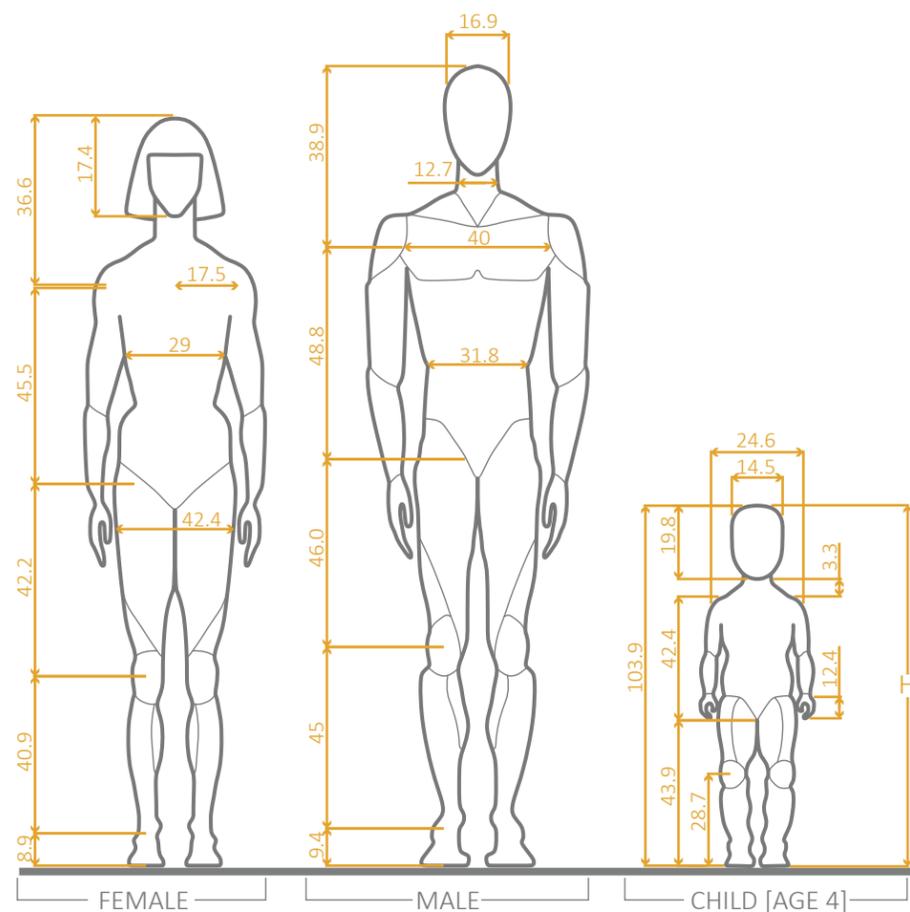


FIGURE 68: Measurements for Body Proportions

FIGURE 66: AVERAGE HEIGHT AND WEIGHT ACCORDING TO AGE

AGE [year]	MALE		FEMALE	
	HEIGHT [cm]	WEIGHT [kg]	HEIGHT [cm]	WEIGHT [kg]
6 months	67	8	66	7
1	76	10	74	9
2	88	12	87	12
3	96	14	95	14
4	103	16	103	16
5	110	18	109	18
6	116	21	115	20
7	122	23	121	22
8	127	25	127	25
9	133	28	133	28
10	138	31	139	32
11	143	35	145	26
12	149	39	152	42
13	156	45	157	47
14	163	51	160	51

FIGURE 67: SUGGESTED FURNITURE HEIGHT BY AGE GROUP

CHAIR HEIGHT	10"	12"	14"	16"	18"	HEIGHTS
TABLE HEIGHT	19"	22"	24"	27"	29"	

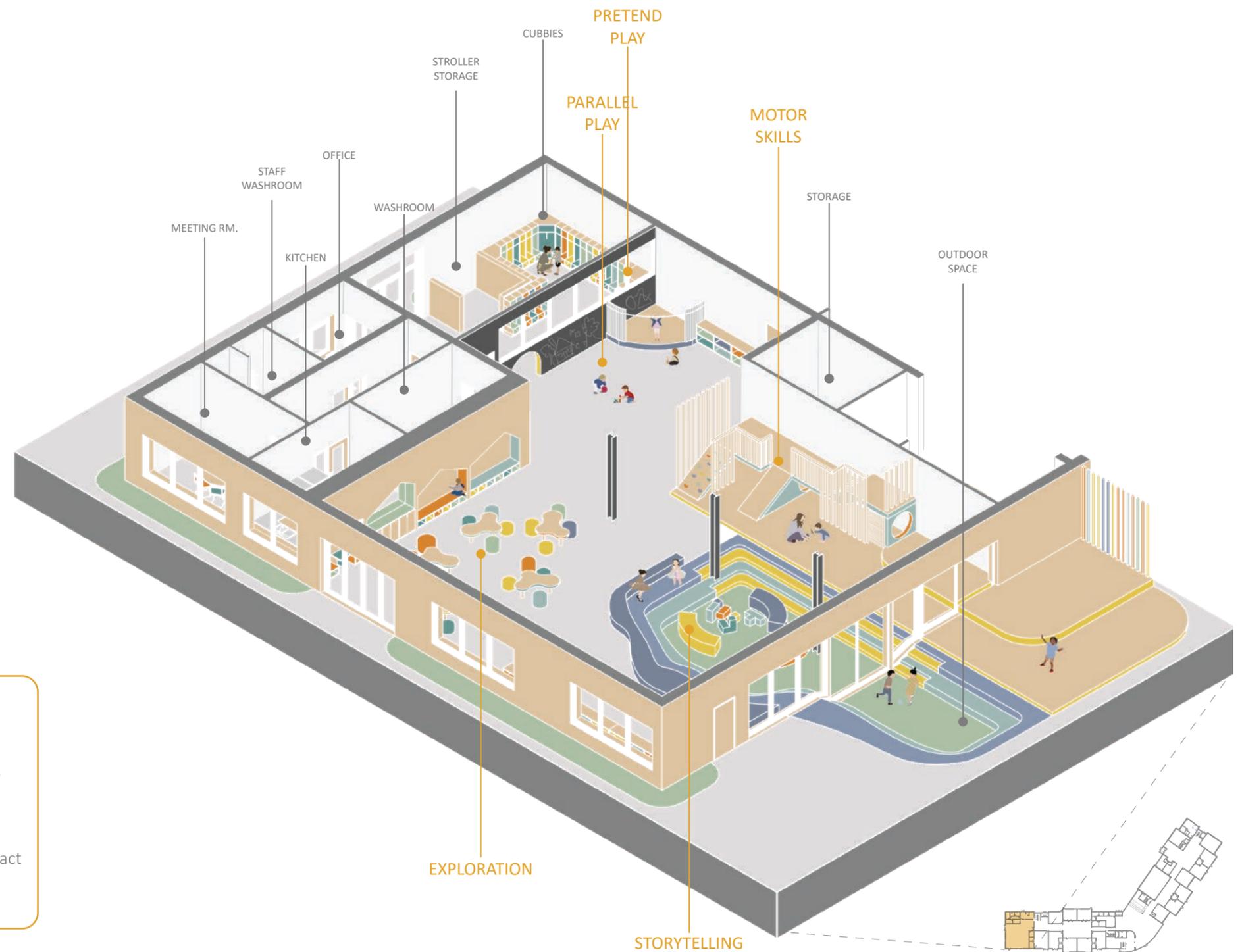
  

3-4 Years Old	50% ↔ 50%				% OF CLASS
KINDERGARTEN		50% ↔ 50%			
GRADE 1			100%		
GRADE 2			25% ↔ 75%		
GRADE 3-4				100%	
GRADE 5				50% ↔ 50%	
GRADE 6-8				100%	

## Learning Through Play

The Child Care Center was designed for toddlers and preschool-aged children. During the first three years of life, “a child’s brain absorbs more information from the environment than at any other part of [their] lifetime. Every sight, sound, touch, taste, and smell is taken in and processed.”<sup>110</sup> Play is how children make sense of the world and is an effective method of learning for young children, it is a time where ideas and skills become meaningful, tools for learning are practiced, and concepts are understood.<sup>111</sup>

Eventually, learning through imitation and exploration seen during the toddler stages evolves into pretend and imaginative play in the preschool age, which are very important during this stage of development.<sup>112</sup> As a result, it is very important to design a setting that nurtures the child’s desires to optimize learning opportunities and allow for different configurations that accommodate play, group activities, and quiet reading spaces (Figure 69).



### TODDLER [1-3 YEARS OLD]

- Ability to run, kick, jump and climb
- Short Attention Spans
- Super Energetic
- Importance of run, play and explore.
- Lack of judgment and self-control in comparison to motor skills
- Simple Words

TYPICAL MILESTONES

### PRESCHOOLERS [3-5 YEARS OLD]

- Super Inquisitive
- Clearer Sense of Time
- Basic Concepts (such as alphabets, counting, shapes, and sizes)
- Develop a sense of interests and talents
- Exploring Practical Ideas and Abstract Ideas (why is the sky blue?)
- Copies Adults

TYPICAL MILESTONES

<sup>110</sup> “NAMC Infant Toddler (0-3) Montessori Diploma Program- Teacher Training,” accessed December 18, 2020, <https://www.montessoritraining.net/diploma-programs/infant-toddler-0-3>.

<sup>111</sup> Ibid.

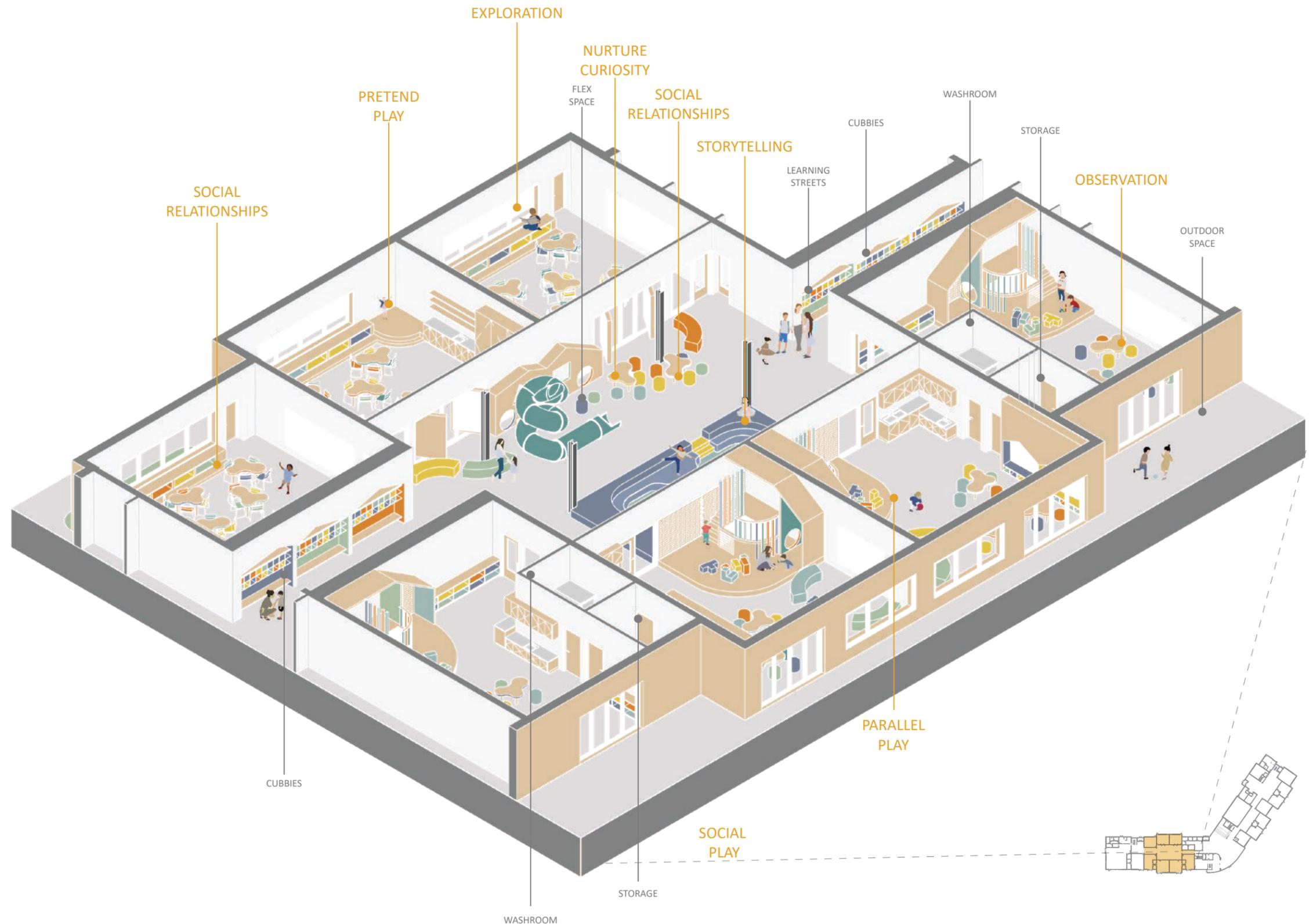
<sup>112</sup> “Ages & Stages,” HealthyChildren.org, accessed January 16, 2021, <https://www.healthychildren.org/English/ages-stages/Pages/default.aspx>.

FIGURE 69: Daycare Axonometric

## Learning Through Movement

As mentioned, pretend play is the primary mode of learning during the preschool years, but it continues to be an important element during the primary grades. “The joy of learning is more evident and effortless than perhaps at any other stage of life. Through natural curiosity, the child absorbs information, assimilates it with [their] senses, and constructs [their] own knowledge.”<sup>113</sup> So allowing for different configurations, to adapt to formal teaching to individual work, to group collaborations. And being flexible in the sense of curating spaces dedicated to free play, storytelling, indoor or outdoor activities, and quieter spaces for reading, individual work, and observation.

As mentioned, pretend play is the primary mode of learning during the preschool years, but it continues to be an important element during the primary grades. “The joy of learning is more evident and effortless than perhaps at any other stage of life. Through natural curiosity, the child absorbs information, assimilates it with [their] senses, and constructs [their] own knowledge.”<sup>114</sup> So allowing for different configurations, to adapt to formal teaching to individual work, to group collaborations. And being flexible in the sense of curating spaces dedicated to free play, storytelling, indoor or outdoor activities, and quieter spaces for reading, individual work, and observation.



### PRIMARY [5-8 YEARS OLD]

- Ability to understand basic abstract ideas and concepts
- Refinement of cognitive skills, personality, motivation, and interpersonal relationships
- Mimics adult behaviors
- Cooperates/Plays with others

TYPICAL MILESTONES

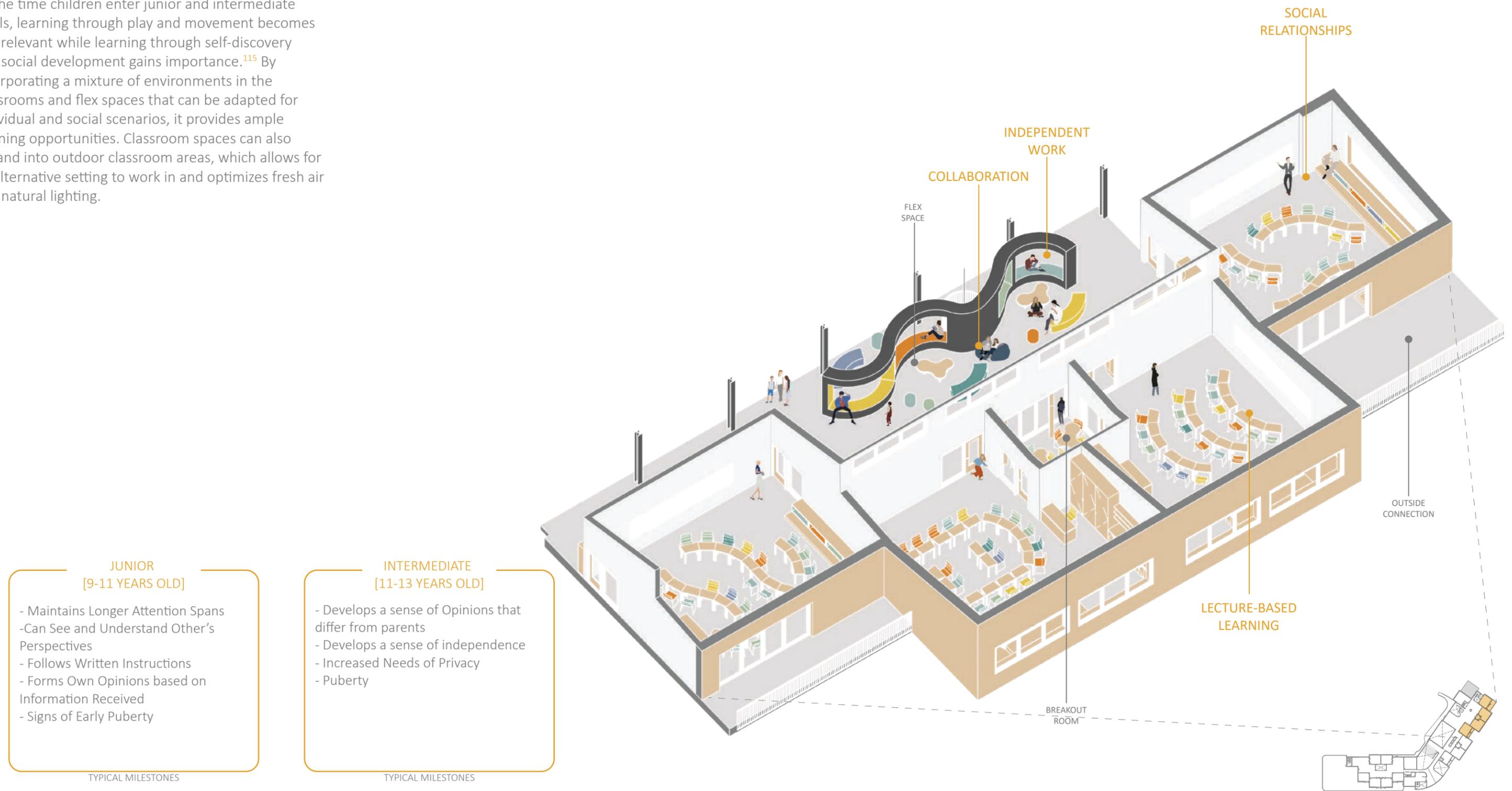
<sup>113</sup> Yenny Rojas, “The Stages of Child Development | Children’s Health Care,” Children’s Health Care Newburyport and Haverhill, MA, October 5, 2018, <https://www.chcmass.com/2018/10/05/the-stages-of-child-development/>.

<sup>114</sup> Rojas.

FIGURE 70: Primary and Kindergarten Axonometric

## Learning Through Self-Discovery and Social Development

By the time children enter junior and intermediate levels, learning through play and movement becomes less relevant while learning through self-discovery and social development gains importance.<sup>115</sup> By incorporating a mixture of environments in the classrooms and flex spaces that can be adapted for individual and social scenarios, it provides ample learning opportunities. Classroom spaces can also expand into outdoor classroom areas, which allows for an alternative setting to work in and optimizes fresh air and natural lighting.



115 Rojas.

FIGURE 71: Junior and Intermediate Axonometric

## Structure

The primary structure of the building is a hybrid structural system that is laid on a 10m x 5m grid, except for programmatic spaces that require large opening spans such as the gymnasium and central atrium space. This system is mainly composed of composite concrete CLT floor panels, steel columns, and girders with steel and glue-laminated (Glulam) structural supports and bracing.

The main level of the building sits on a concrete slab on a grade foundation, providing a platform for load-bearing walls, stairs, and elevator cores, which contribute to lateral stability. Composite concrete and CLT floor panels are used for the second level flooring system, with the CLT panels exposed on the underside, which contributes to the overall material expression where natural materials are left exposed for visual clarity and authenticity. Steel columns and girders are used to support these floor panels and allow for longer spans to create open floorplans. As well, it requires shallower structure depths, as a result, larger floor-to-ceiling heights can be achieved. Glue-laminated (Glulam) beams act as structural supports and bracing that provides an expressive contrast to the steel elements.

In the gymnasium, atrium, and flexible spaces, areas that require large spans, a series of scissor and inverted trusses were used to support the flat and butterfly roof forms. Specifically, in the central atrium space, the butterfly roof makes room for clerestory windows, optimizing the natural light into space. The butterfly roof and scissor trusses also contribute to the symbolic gestures around the theme of childhood. The structural elements are expressive and celebrated to create learning opportunities and stimulate curiosity.

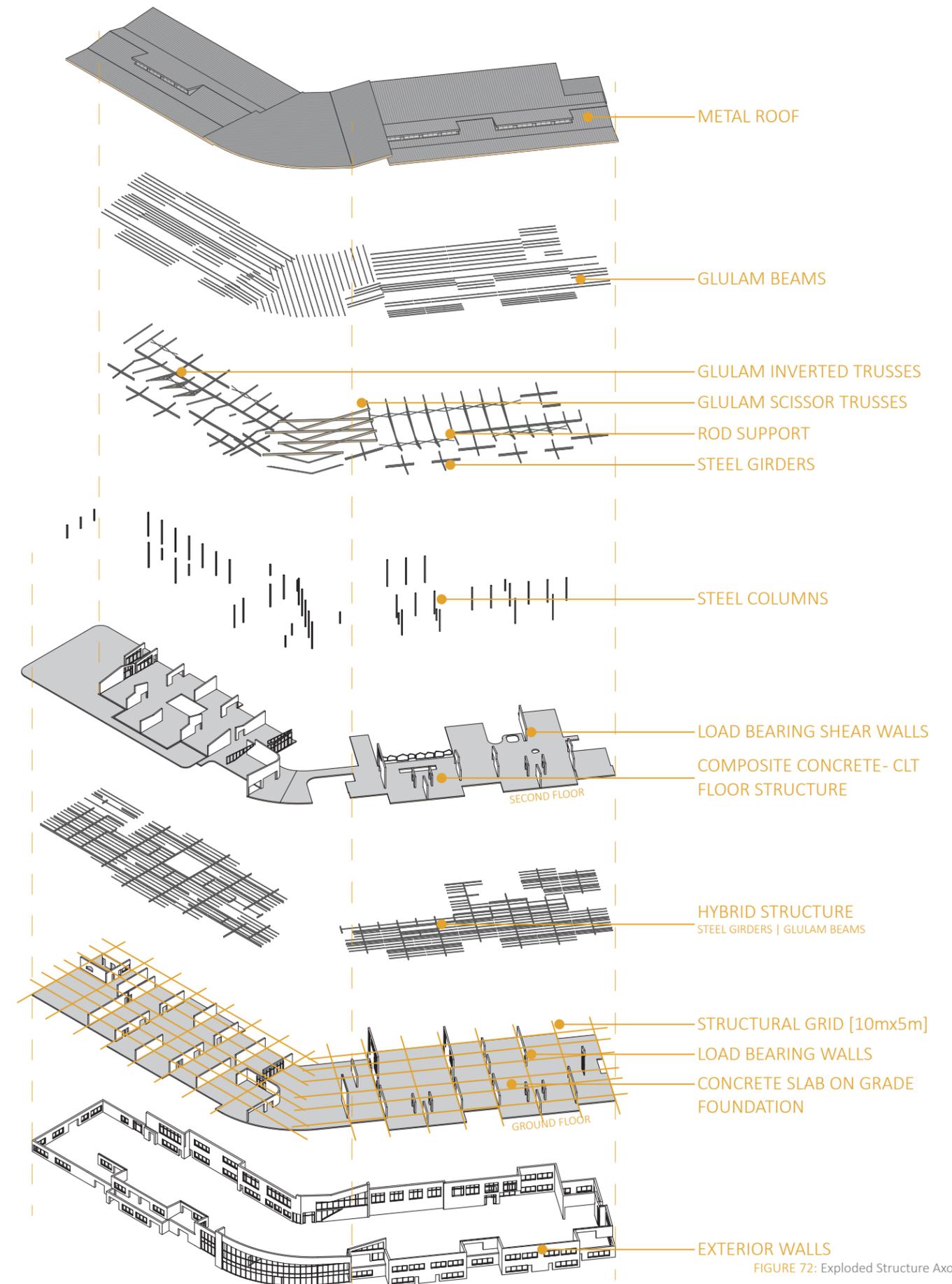


FIGURE 72: Exploded Structure Axo

### Passive Strategy

The building is oriented to maximize solar exposure. The location of various programmatic spaces, mainly classroom spaces, were strategically placed on the southern side of the building to optimize sun exposure. Overhangs prevent overheating during the warmer months but allow for optimal solar heat gain during the colder months when the sun is at a lower angle (Figure 74). Specialized learning spaces, such as the computer lab and art room, were placed on the north side which allows for indirect lighting and prevents harsh shadows and glares.

The butterfly roof structure also creates an ideal condition for natural ventilation. Having most of the prevailing winds come from the northeast side of the site, maximizing fresh air and natural cooling (Figure 73). Operable clerestory windows, oriented towards the south side allows for cross-ventilation through the building (Figure 75).

FIGURE 74: GREENHOUSE SUN + ROOF ANGLES  
TORONTO LATITUDE = 43.7°N (rounded to 44°)  
ROOF ANGLE = 90° - SUN ANGLE

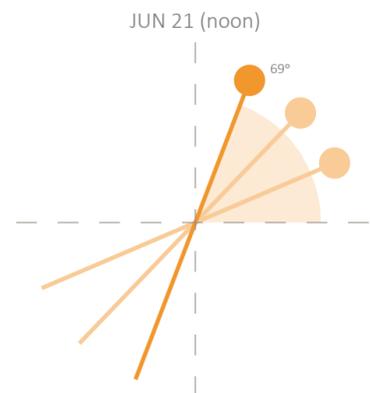
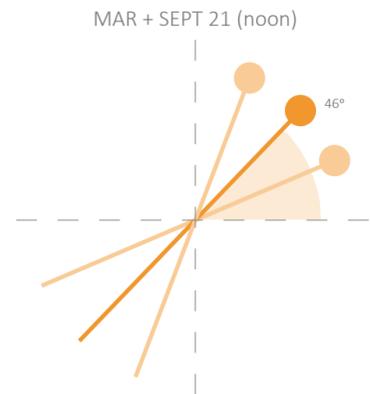
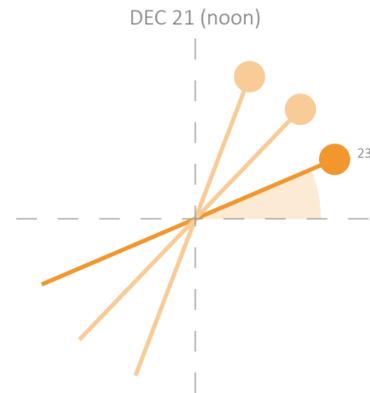


FIGURE 73: WIND ROSE FOR MARKHAM, ON

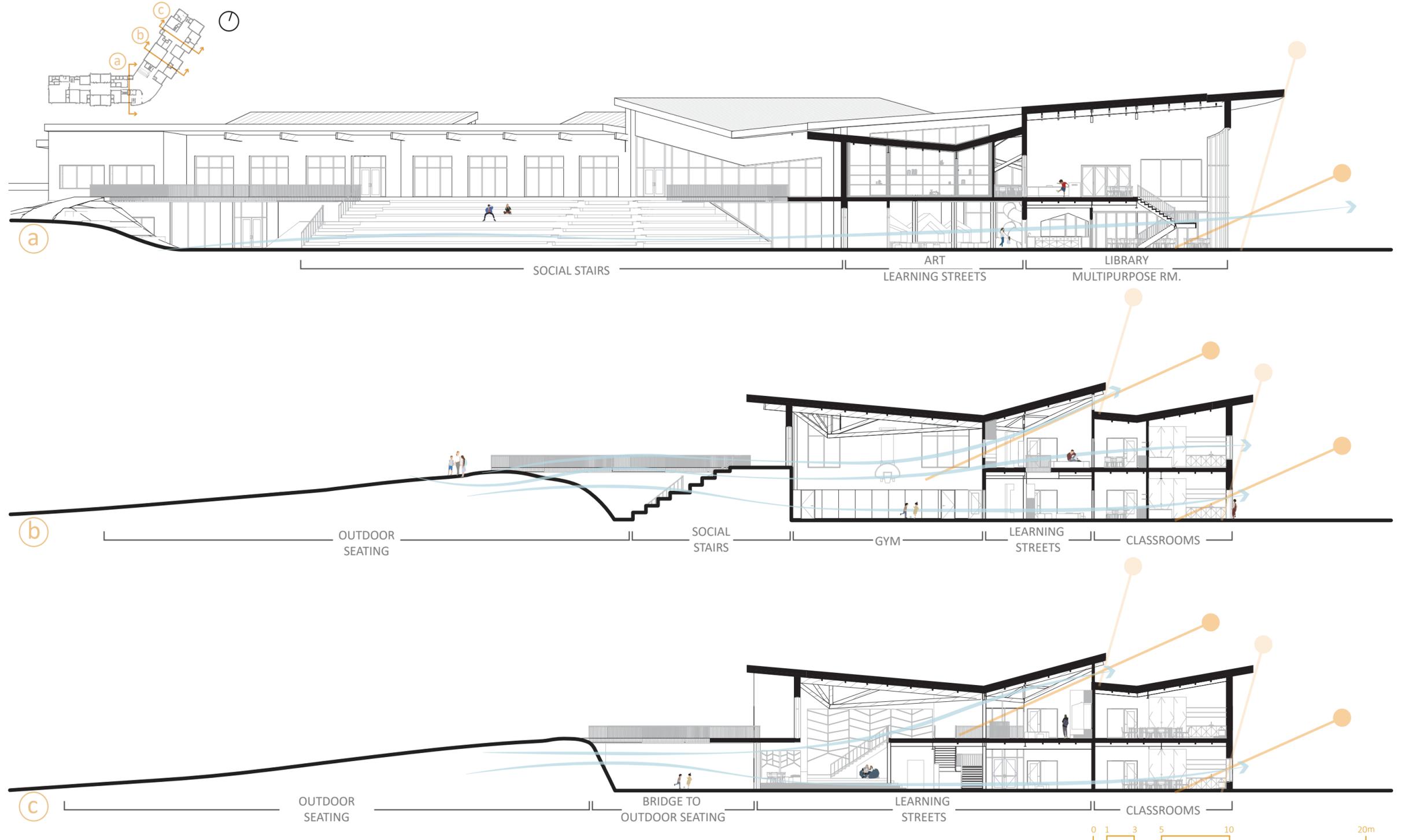
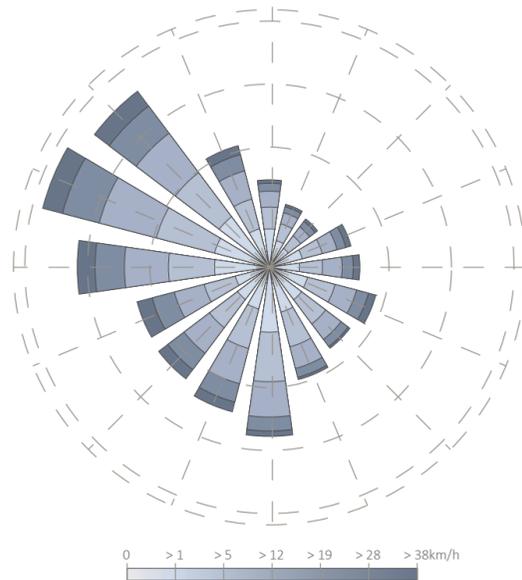
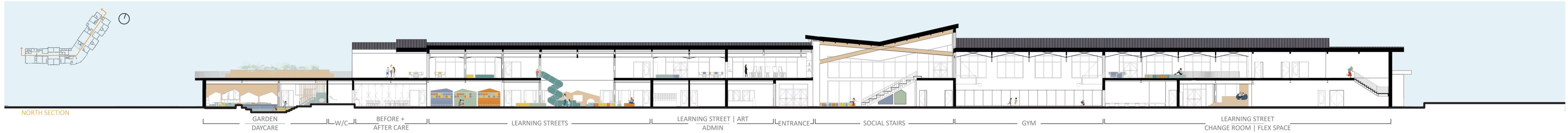


FIGURE 75: Passive Strategy Sections



0 1 3 5 10 20m  
 FIGURE 76: Sections and Elevations

# Playful Architectural Features

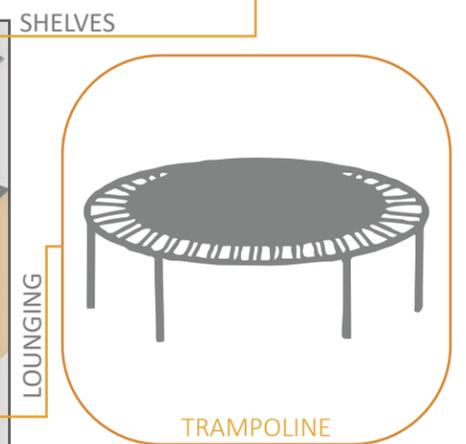
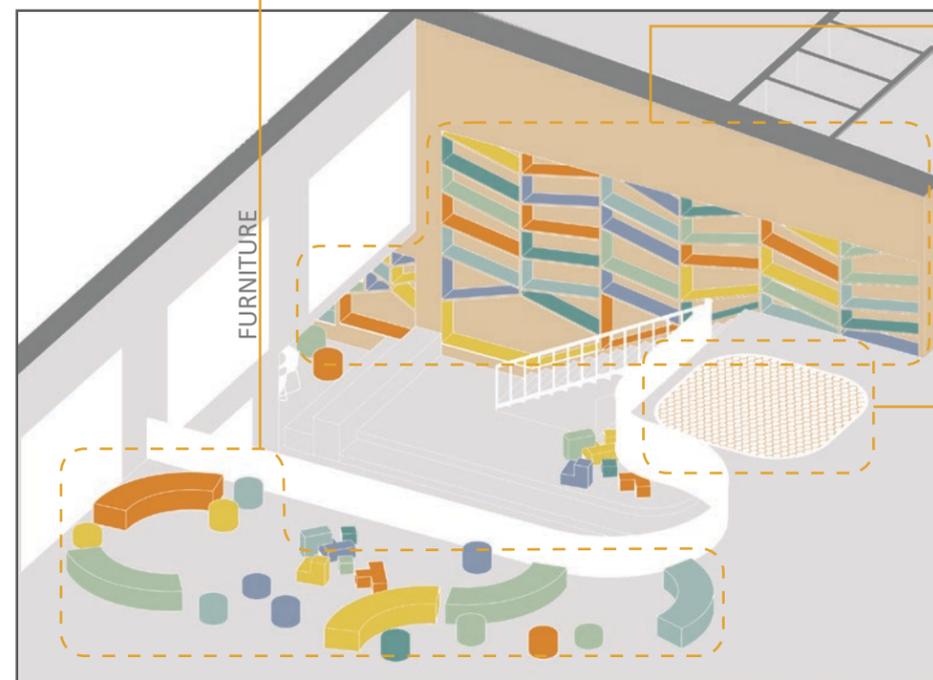
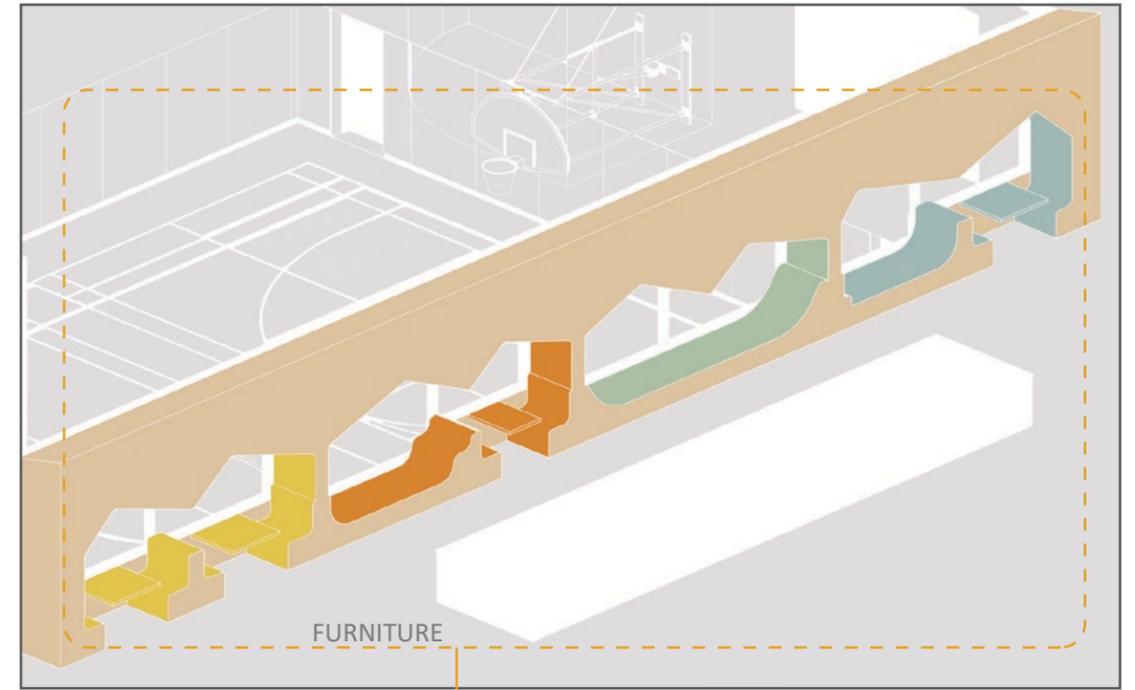
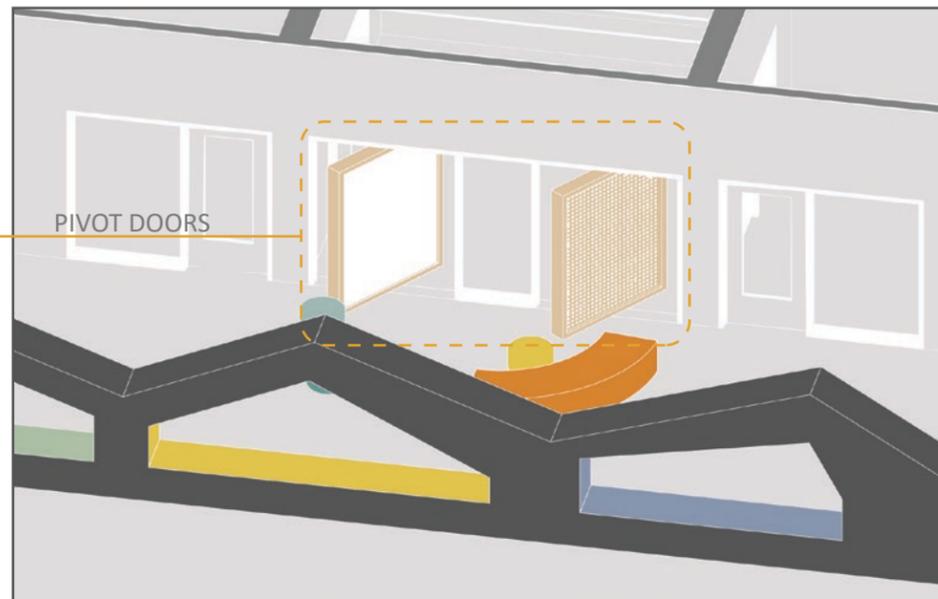
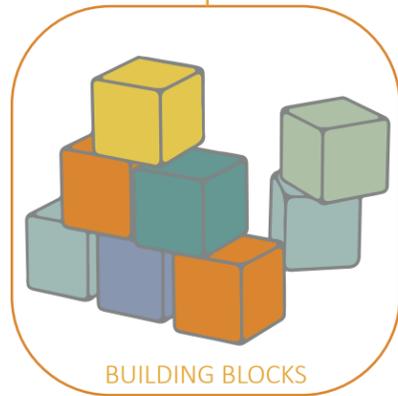
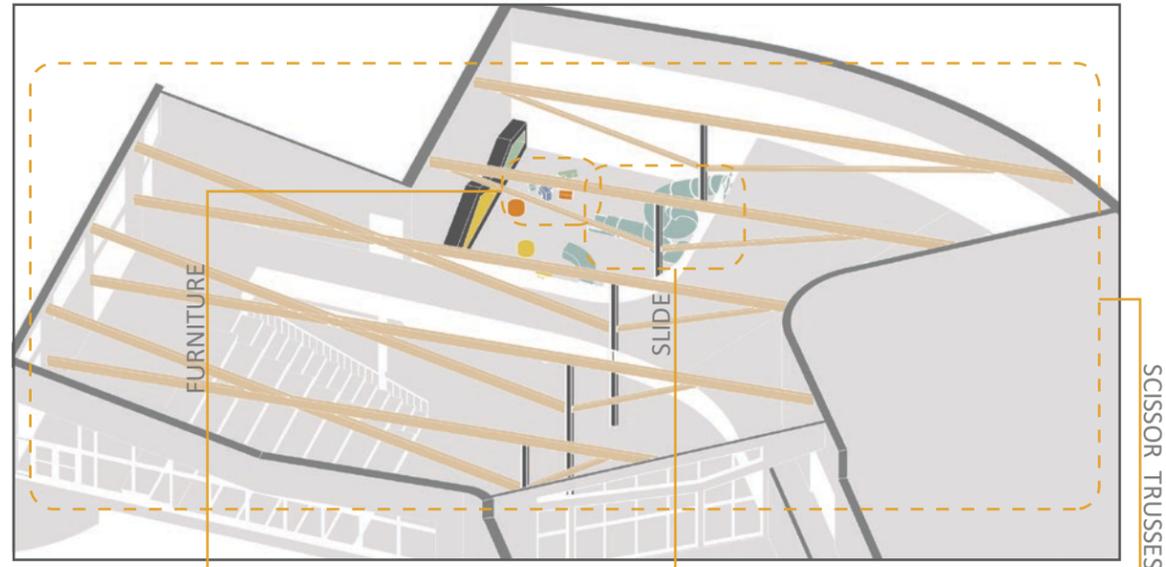


FIGURE 77: Architectural Features Inspired by Playful Elements



FIGURE 78: Flow of People Throughout the Day Diagram

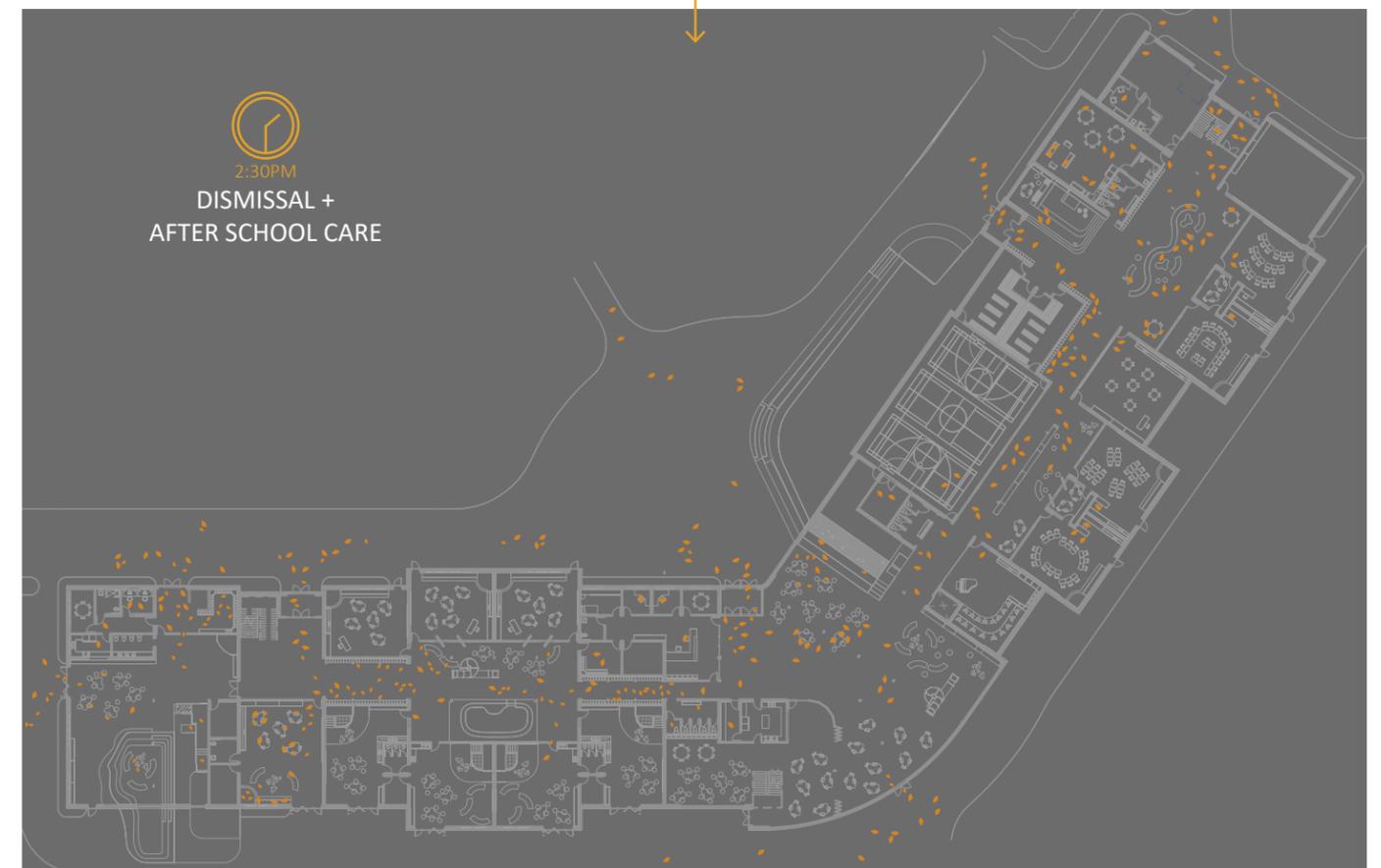


FIGURE 79: Flow of People Throughout the Day Diagram

## Conclusion | Rethinking Play, Movement and Social Development as Building Blocks for School Typologies

This thesis began by studying typical school buildings typologies, and various examples of early childhood pedagogical approaches, experimental design, and architectural precedents, which subsequently allowed the development of a set of design principles that are informed by a children-centered approach. This thesis presents a new school typology within the suburban setting of Markham, Ontario, that connects to its surrounding environment and community. More importantly, this architectural project bridges the spatial discontinuities between pedagogical methods and the design of educational buildings by acknowledging the importance of the physical and natural environment on social and learning experiences. By doing so, it re-imagines public-school architecture and celebrates a variety of learning experiences through specific strategies: the classroom space is redefined with its integration to flexible spaces, interior learning street, and outside spaces, that are catered towards different learning modalities. In addition, careful consideration has been given to the connections between interior and exterior spaces, common toys and everyday objects related to children has playfully influenced architectural features, and studies of how users experience spaces all while considering functionality and principals of sustainable architecture.

Although the future of educational buildings remains unpredictable, it is necessary to keep thinking about the users and their irrevocable interactions with the physical environment, as well as social interactions between users as key to sustainable design. Existing school buildings can be improved but they also bring many lessons when we recognize the good elements that are working. As designers, it is crucial to anticipate the future and design for today and tomorrow, while critically challenging standards practices that prioritize budget, fast construction, and curriculum. To push for change that prioritizes the users of the building, such as the inclusion of flexible elements that can be adapted by both the students and teachers, would be a step towards bettering learning environments and designing a more sustainable architectural typology. Ultimately, this thesis has contributed to understanding the significant role of the learning environment, and how it can inspire, stimulate, encourage exploration, support critical thinking and creativity while promoting collaboration and the development of connections beyond the typical classroom environment.

## APPENDIX

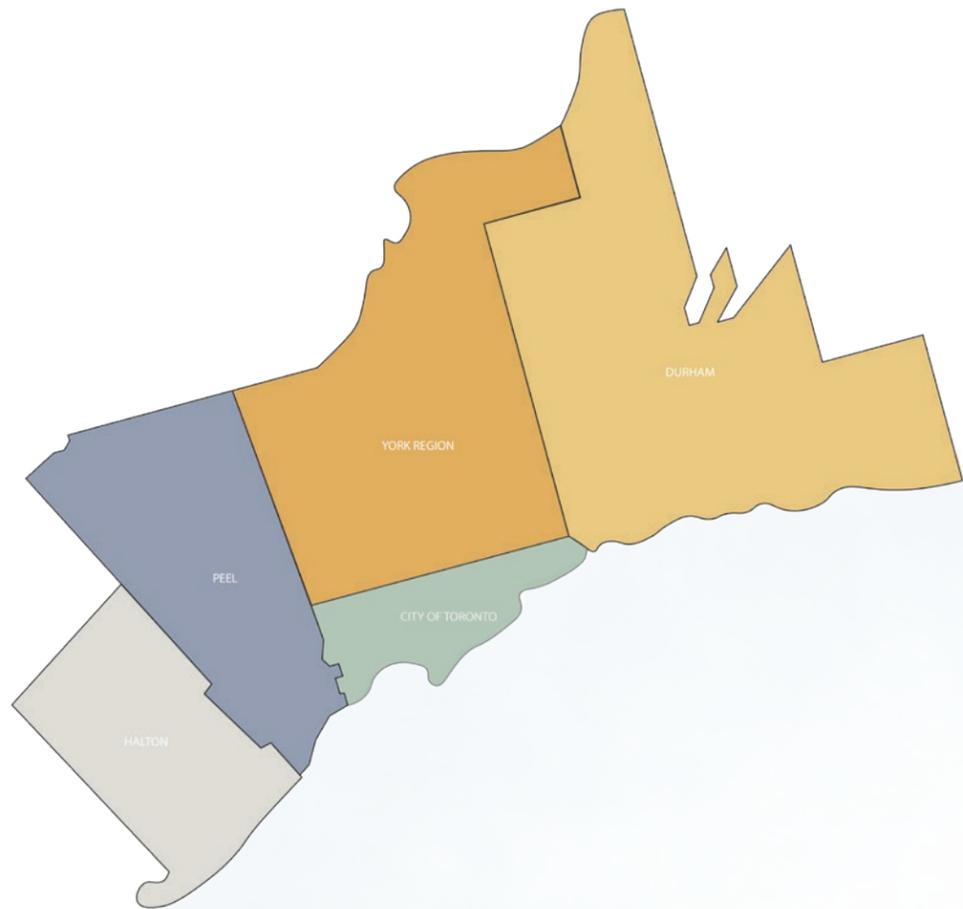


FIGURE 81: Map of Greater Toronto Area  
| Regional Municipalities

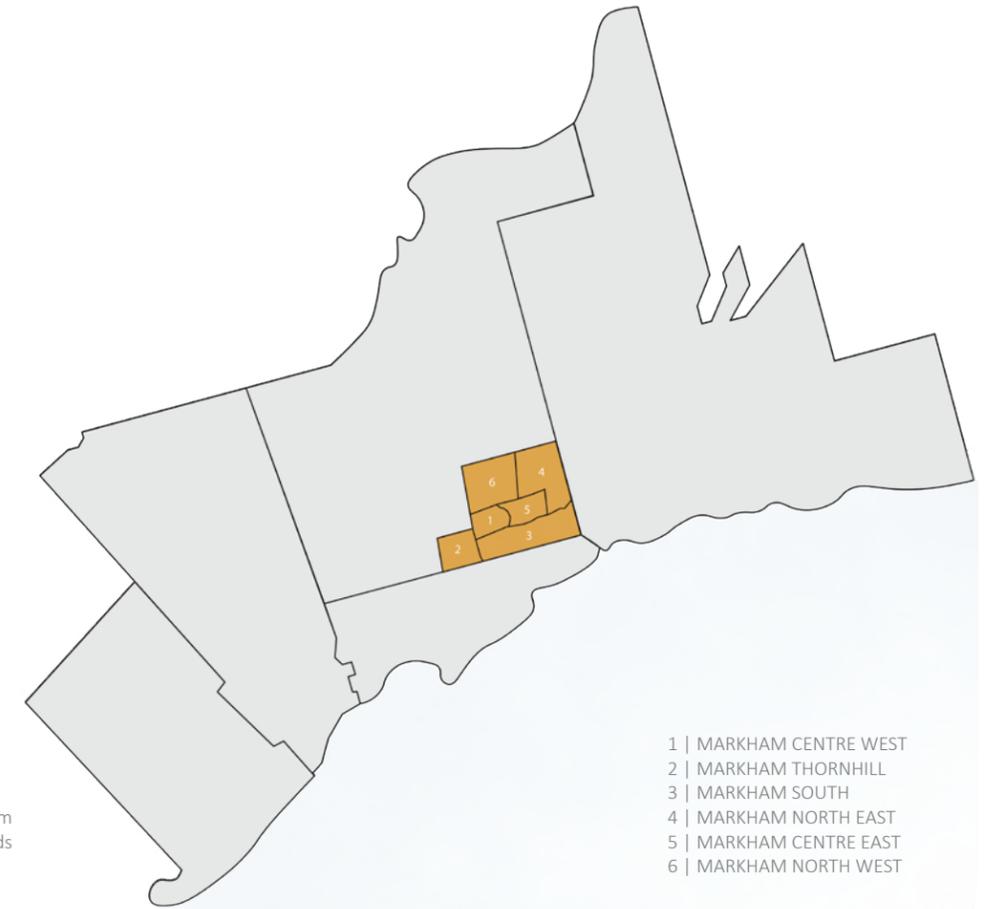


FIGURE 83: Map of Markham  
| Wards

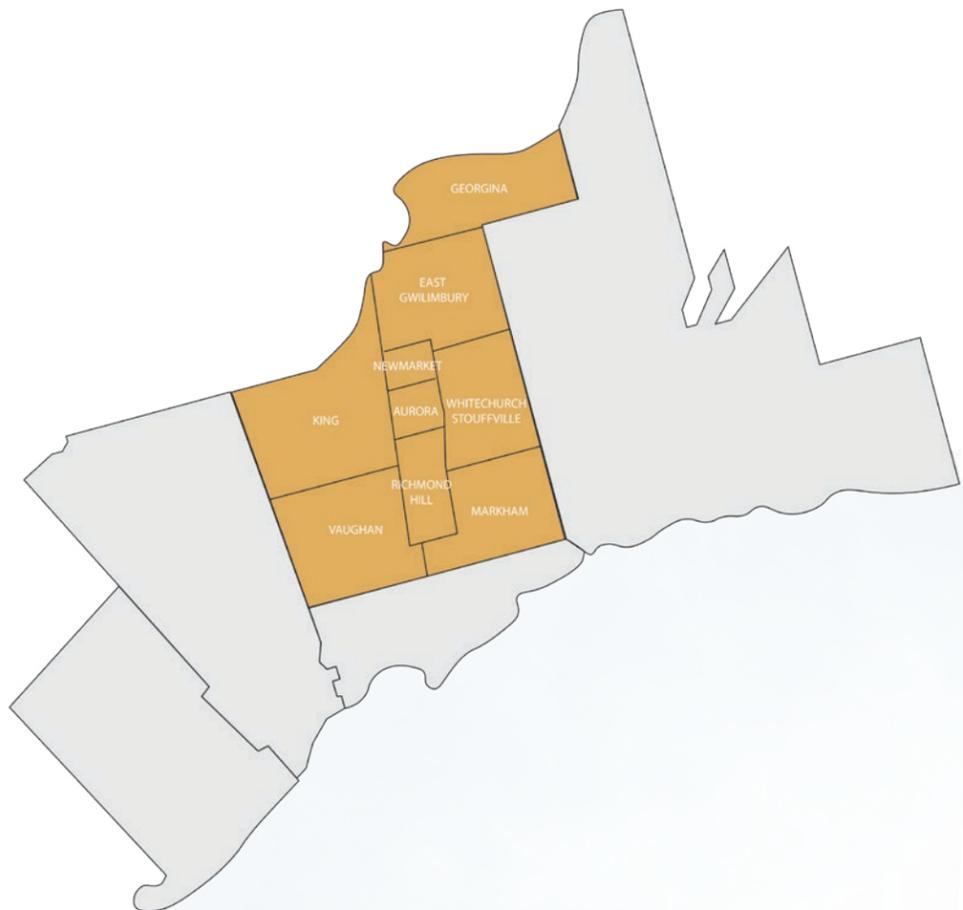


FIGURE 82: Map of York Region  
| Municipalities

FIGURE 84: POPULATION GROWTH / GREATER TORONTO AREA

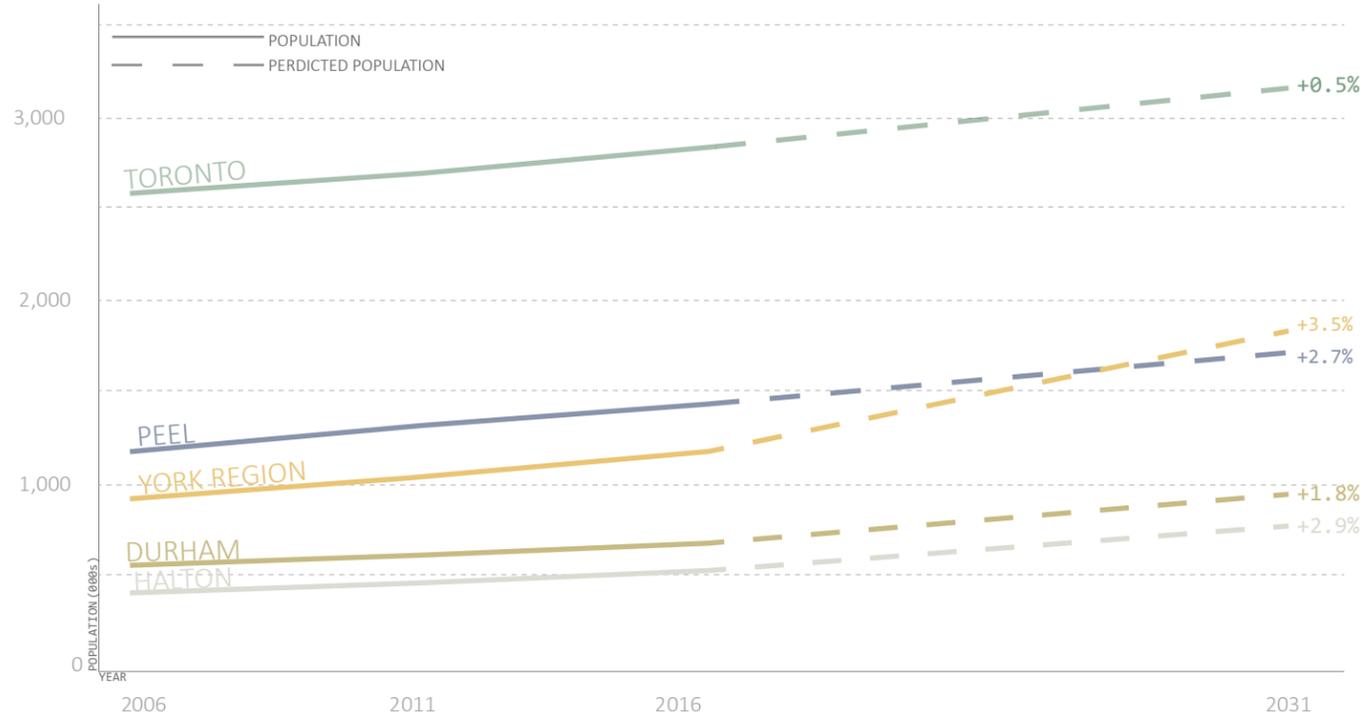


FIGURE 86: CHILDREN AGED 0-12 LIVING IN LOW INCOME / YORK REGION / 2015

	NUMBER(##) LIVING IN LOW INCOME, 2015	CHANGE IN NUMBER (##) FROM 2005-2015	PERCENTAGE(%) LIVING IN LOW INCOME, 2015	
			AGE 0-12	TOTAL POPULATION
VAUGHAN	5,005	1,100	10.2	8.8
MARKHAM	8,560	2,375	17.9	15.1
RICHMOND HILL	4,700	1,095	17.4	15.9
NEWMARKET	1,625	480	12.9	10.0
AURORA	985	350	11.9	8.9
WHITCHURCH -STOUFFVILLE	815	480	10.1	8.2
GEORGINA	890	-70	13.8	11.3
KING	335	125	8.9	7.5
EAST GWILLIMBURY	340	175	9.7	7.2

SOURCE: STATISTICS CANADA

FIGURE 85: POPULATION GROWTH BY AGE GROUP / MARKHAM

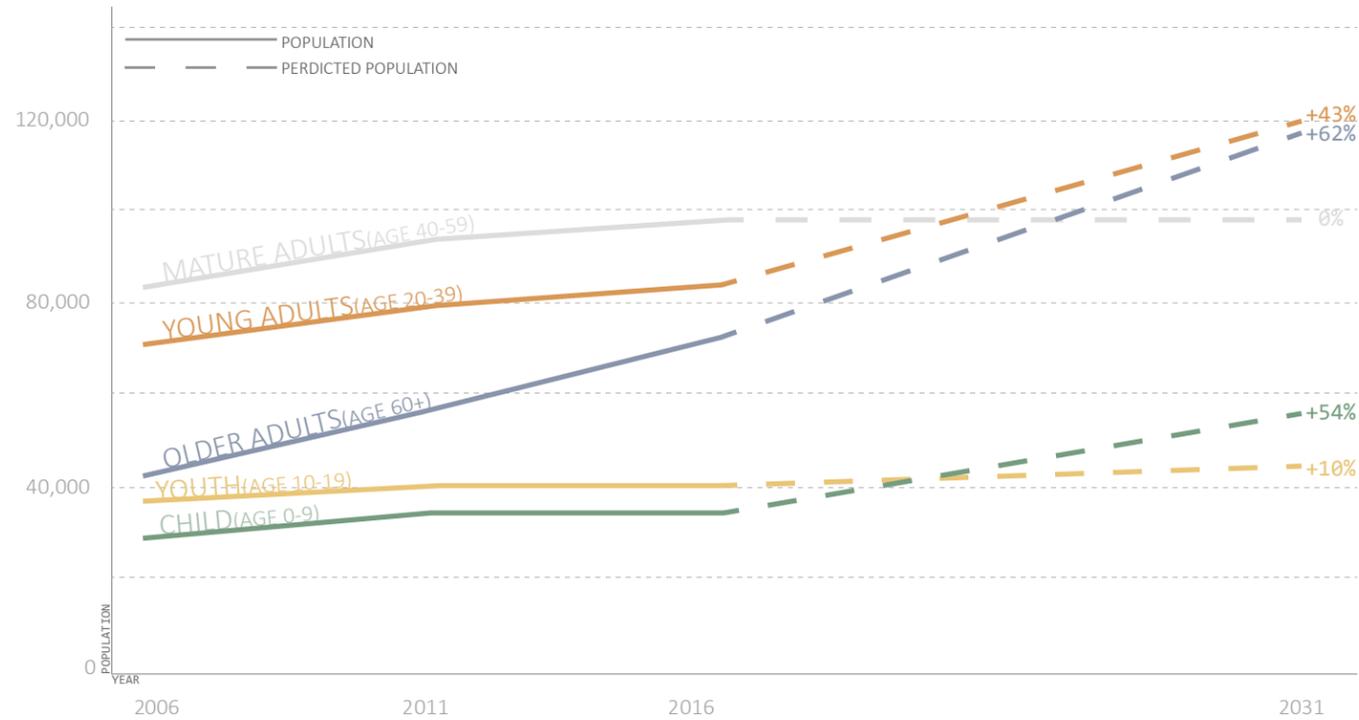


FIGURE 87: SHARE OF CHILDREN BY AGE / YORK REGION / 2016

	AGED 0 TO 6		AGED 6 TO 12		AGED 0 TO 12	
	NUMBER(##)	SHARE(%)	NUMBER(##)	SHARE(%)	NUMBER(##)	SHARE(%)
VAUGHAN	19,960	6.3	29,930	9.5	49,100	16.0
MARKHAM	20,660	6.5	26,995	8.2	47,650	14.5
RICHMOND HILL	10,635	6.3	16,510	8.5	27,145	13.9
NEWMARKET	5,260	5.5	7,280	8.6	12,545	14.9
AURORA	3,310	6.2	5,030	9.1	8,340	15.0
WHITCHURCH -STOUFFVILLE	3,855	6.0	4,320	9.4	8,180	17.8
GEORGINA	3,025	8.4	3,455	7.6	6,480	14.3
KING	1,545	6.3	2,235	9.1	3,785	15.4
EAST GWILLIMBURY	1,560	6.5	1,930	8.0	3,495	14.5

SOURCE: STATISTICS CANADA

FIGURE 88: PROJECTED UTILIZATION

	2019/20	2020/21	2022/22
1 MARKHAM CENTRE WEST	98%	95%	92%
2 MARKHAM THORNHILL	97%	95%	96%
3 MARKHAM SOUTH	89%	91%	91%
4 MARKHAM NORTH EAST	98%	100%	100%
5 MARKHAM CENTRE EAST	102%	101%	102%
6 MARKHAM NORTH WEST	100%	103%	103%

SOURCE: YORK REGION DISTRICT SCHOOL BOARD

FIGURE 89: MOTHER TONGUE (C2016)

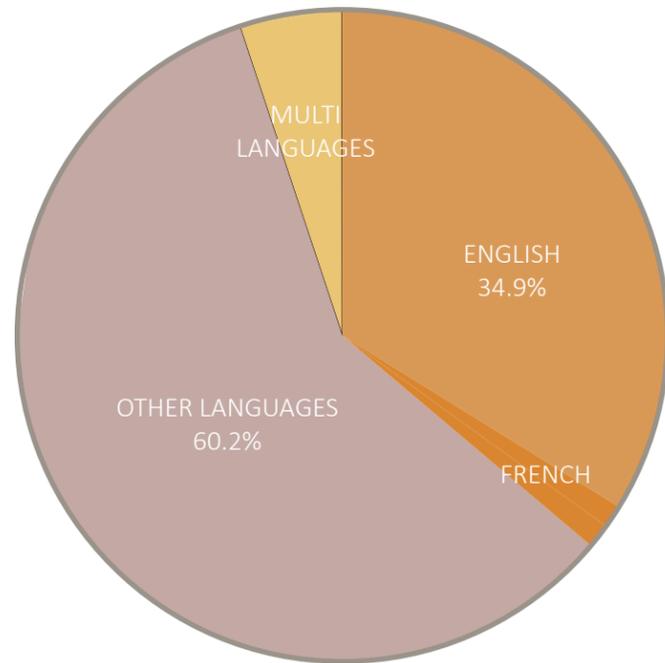
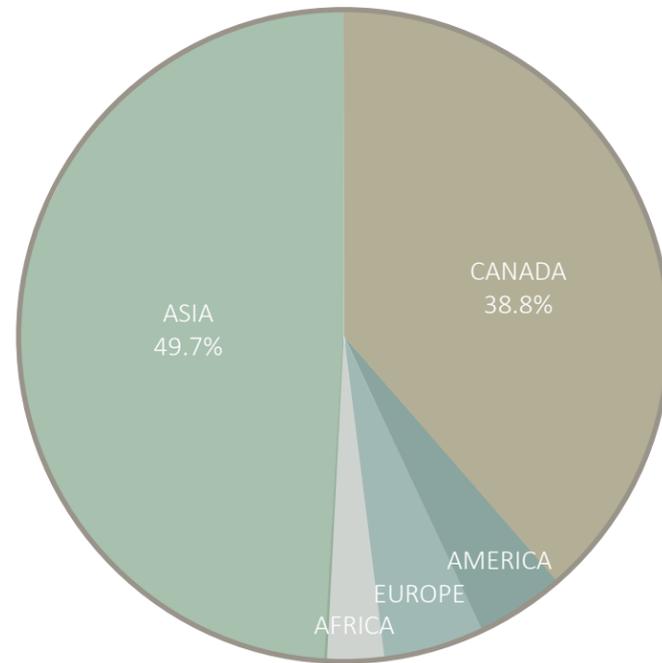


FIGURE 90: COUNTRY OF BIRTH (C2016)



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