ABSTRACT

Title of Thesis: SCHOOL DEVELOPMENT IN URBANIZING AREAS
Pranjali Rai, Master of Architecture 2016

Thesis Directed By: Prof. Emeritus, Ralph Bennett, Architecture

Good schools are essential for building thriving urban areas. They are important for preparing the future human resource and directly contribute to social and economic development of a place. They not only act as magnets for prospective residents, but also are necessary for retaining current population.

As public infrastructure, schools mirror their neighborhood. “Their location, design and physical condition are important determinants of neighborhood quality, regional growth and change, and quality of life.” They impact housing development and utility requirements among many things. Hence, planning for schools along with other infrastructure in an area is essential.

Schools are very challenging to plan, especially in urbanizing areas with changing demographic dynamics, where the development market and housing development can shift drastically a number of times. In such places projecting the

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future school enrollments is very difficult and in case of large population influx, school development can be unable to catch up with population growth which results in overcrowding.

Typical is the case of Arlington County VA. In the past two decades the County has changed dramatically from a collection of bedroom communities in Washington DC Metro Region to a thriving urban area. Its metro accessible urban corridors are among most desired locations for development in the region. However, converting single family neighborhoods into high density areas has put a lot of pressure on its school facilities and has resulted in overcrowded schools. Its public school enrollment has grown by 19% from 2009 to 2014. While the percentage of population under 5 years age has increased in last 10 years, those in the 5-19 age group have decreased. Hence, there is more pressure on the elementary school facilities than others in the County.

Design-wise, elementary schools, due to their size, can be imagined as a community component. There are a number of strategies that can be used to develop elementary school in urbanizing areas as a part of the neighborhood. Experimenting with space planning and building on partnership and mixed-use opportunities can help produce better designs for new schools in future.

This thesis is an attempt to develop elementary school models for urbanizing areas of Arlington County. The school models will be designed keeping in mind the shifting

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nature of population and resulting student enrollments in these areas. They will also aim to be efficient and sustainable, and lead to the next generation design for elementary school education. The overall purpose of the project is to address barriers to elementary school development in urbanizing areas through creative design and planning strategies.

To test above mentioned ideas for elementary schools, the Joint-Use School typology of housing +school design has been identified for elementary school development in urbanizing areas in this thesis project. The development is based the Arlington Public School’s Program guidelines (catering to 600 students). The site selected for this project is Clarendon West (part of Red Top Cab Properties) in Clarendon, Arlington County VA.
SCHOOL DEVELOPMENT IN URBANIZING AREAS

by

Pranjali Rai

Thesis submitted to the Faculty of the Graduate School of the University of Maryland, College Park, in partial fulfillment of the requirements for the degree of Architecture
2016

Advisory Committee:
Prof. Ralph Bennett, Chair, Professor Emeritus, Architecture Program
Prof. James Tilghman, Lecturer, Architecture Program
Prof. Brian Kelly, Professor and Director, Architecture Program
Dr. James Cohen, Professor and Director, Urban Studies & Planning Program
Dedication

To all the parents and their kids who had to leave cities and live in suburbs due to overcrowded schools in urban areas.
Acknowledgements

I would like to thank my Thesis Committee, especially my Thesis Chair, Prof. Ralph Bennett for his support, patience, encouragement and guidance during the entire process. I thank Prof. James Tilghman for his valuable feedbacks, Prof. Brian Kelly and Dr. James Cohen for their assistance and encouragement in development of this thesis.

My special thanks to Mr. Andrew D'huyvetter, Urban Planner, Arlington County, Community Planning Housing and Development Department for the time he spent on discussing inspirational ideas related to the school situation in Arlington County and design proposal for this thesis. Also, I thank the Urban Design and Research Division at Arlington County CPHD Department for their time and feedback on this project.

I thank my peers in Architecture Thesis Cohort for critiquing ideas related to development and presentation of my thought process for this thesis. I would also like to thank my roommate Diane Bickel for emotional support.

Last but not the least, I thank my husband Abhishek for his endless patience and support throughout my masters education. I also thank my family for their encouragement, helping me to successfully culminate masters education at University of Maryland.
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Chapter 1: Elementary Schools in Context

*Elementary School – a community component*

While high schools and middle schools are specialized buildings due to the nature of education, elementary schools can be imagined as community facilities. Elementary schools tend to serve smaller districts especially in dense areas due to high enrollment because of young families who tend to prefer living close to diverse work opportunities in these areas and enforced low capacity on these type of schools. Therefore due to its smaller size and smaller service area, an elementary school can be imagined more like a neighborhood facility than, for example, a much larger high or middle school.

This unique nature of elementary school is an opportunity to develop different morphologies to best suit the neighborhood community. They can be imagined as not only educational buildings, but also as a common resource for the neighborhood. They can exist in shared sites for schools and other public buildings. They can also exist in mixed-use environments in tandem with other structures in high density areas. It is important to note that elementary schools are opportunities to build partnerships and to develop better living work and play environments for densely populated areas.

*Elementary Schools in Urbanizing Contexts*

Architect Susana Torre – (Jury member New Schools for NY)- "A school can play an important role in forming a child’s –especially an urban child’s view of nature."

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Urbanizing contexts chosen for this project are areas that are continuously densifying or are changing their development character. This shifting nature of urbanizing areas results in demographic shifts and population increase or loss. This leads to a fluctuating school enrollments. Planning and designing for this change is quite a challenge which will be addressed by this project.

To understand the implication on school buildings in changing contexts, The Urban Transect model from New Urbanism theory has been used (Fig1). An urbanizing context can look like anything from T4 to T6. Hence, developing strategies for these areas would be the goal for this project. Understanding the morphology of elementary schools found in these zones of The Transect will help in pinpointing the variables in design. Further study on the relationship of these variables with the context will help clarify the issues.

![Urban Transect](image)

Figure 1 Urban Transect

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Another key difference to understand is in the requirements for elementary schools for each of these zones. The code requirements for development will be different in all zones. Determining how much is the change as a result of requirements in higher density construction can be a factor when developing school models for these zones.
Figure 3 Characteristics of Elementary Schools.

Relocatable Classrooms – A stackable concept

Figure 4 Redefining the Relocatable Classroom: Future Proofing Schools
http://www.australiandesignreview.com/event/redefining-the-relocatable-classroom
One key difference is the value of land in different contexts. The development cost per acre in suburban areas is lower than per acre development cost in urban areas. The high development cost tends to result in smaller school sites in urban areas than suburban areas. The limitation of land results in more floors in schools in urban areas. While the schools in suburban areas tend to be low especially for elementary schools. The smaller size of school sites in cities allow it to be more a part of the neighborhood than suburban schools where schools are more like a special zone on their own. This shows that the city context can be a great opportunity and a challenge for the architecture of schools.

In urbanizing areas belonging to T3-T5, planners and designers sometimes try to apply suburban school models, but such schools can cost a lot and therefore are not a good fit financially. Such models usually face investment problems and therefore take a long time to get done.

The urbanizing areas of Arlington County are suffering from a similar problem. The schools are not able to keep up with the changing development around them. The increase in school enrollment has resulted in overcrowding. To accommodate new student population The Public School Board has proposed building above the existing suburban school models. On one hand, building above existing structure saves money, but on the other it is often not the most effective given the dynamic nature of population. The nature of problem requires further investigation of strategies for schools in such urbanizing areas, especially in its corridor developments.

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Chapter 2: Elementary School Program

*Elementary School Building Configuration- a Comparison by Context*

The following elementary school projects belong to different contexts ranging from T2-T6. The difference in programming and space planning for these schools will showcase the variance in strategies for school development in different contexts. The key purpose of this exercise is to identify ideal elementary school programs using precedents and building codes when building in an urbanizing context. The precedent analysis will also help disclose the current trend and important strategies for elementary schools.

![Figure 5 Quantitative analysis of school projects in urbanizing contexts (Authors Diagram)](image)

![Figure 5 Schools in different urbanizing contexts (multiple sources)](image)
Project information as per context (Table 1) (Full case study table refer Appendix 1)

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<thead>
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<th>PROJECT INFORMATION</th>
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<th>T4</th>
<th>T5</th>
<th>T6</th>
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<td>60,097</td>
<td>79,656</td>
<td>76,046</td>
<td>99,232</td>
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<tr>
<td>Avg. Project Area/</td>
<td>123</td>
<td>119</td>
<td>146</td>
<td>146</td>
</tr>
<tr>
<td>student</td>
<td></td>
<td></td>
<td></td>
<td>Chesterton is an exception</td>
</tr>
<tr>
<td>Avg. Land Area</td>
<td>10.85</td>
<td>8.28</td>
<td>4.12</td>
<td>2.16</td>
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<tr>
<td>Avg. Land Area/</td>
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<td>836</td>
<td>314</td>
<td>180</td>
</tr>
<tr>
<td>student</td>
<td></td>
<td></td>
<td></td>
<td>Chesterton is an exception</td>
</tr>
<tr>
<td>Avg. Project Cost</td>
<td>$41,330,000</td>
<td>$39,725,667</td>
<td>$43,149,000</td>
<td>$69,966,667</td>
</tr>
<tr>
<td>Avg. Project Cost/</td>
<td>$65,603</td>
<td>$54,066</td>
<td>$83,067</td>
<td>$106,745</td>
</tr>
<tr>
<td>Student</td>
<td>Chesterton, London not included built in 1963, no cost avail for Patwin, Rogers, Boston Renn and Sandy Hook</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. No. of stories</td>
<td>1.5</td>
<td>2.5</td>
<td>4</td>
<td>5.7</td>
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If in between two transect contexts, project is included in both contexts
Avg. Value per child is calculated by averaging Value/student for all cases

Figure 6: Scale Comparison: (All images are at same scale)
Boston Renaissance Charter Public School, Boston (T4)

Marie Reed Elementary School, Washington DC (T6)

8 Spruce Street School, Beekman Tower, NY (T6)

Discovery Elementary School, Arlington VA (T3-T4)

Chesterton Primary School, London U.K. (T6)

Patwin Elementary School, Davis CA (T3-T4)

Rogers Elementary School, Victoria Canada (T3-T4)

New Sandy Hook School, Newton CT (T3)
Conclusions

- Average $/ student for projects in T3 and T4 contexts is about $20,000-$30,000 lower than T5 and T6 context.
- Average built area Sq ft / student is more for T5 and T6 projects (by about 20 sq ft) than T3 and T4 projects,
- Average land area Sq.ft/ child decreases drastically from T4 projects to T5 projects (by about 500 sq.ft). Generally, it reduces from T3 projects to T6 projects.
- Average number of floors increase from T3 projects to T6 projects (by about 1-2 floors between contexts).
- Multilevel schools with more than 4 floors or underground functions were from T5 and T6 contexts.

Figure 7: Multi-level Schools


In school projects for all contexts there is a tendency of sharing school gym, auditorium and sports facilities with the general community. Hence these facilities are generally located near main access points and parking.
Most new urban (T4-T6) schools have land area constraints and require renovation or demolish of existing structure and expansion of current facility. In such cases class room relocations are built into the phasing of the project.

Figure 9: Construction Phasing
Phasing of Lafayette Elementary School involved “Swing Space” planning since the design proposed demolishing a part of the old school DC Dept. Of General Services. Lafayette Elementary School Project

- Urban schools in T4-T6 contexts are more likely to include adaptive re-use and mixed use than suburban (T3-T4) schools.
- While suburban schools tend to allocate space for future expansion, urban schools don’t.
Roger’s Elementary School (T3-T4) was planned for a growing community and involves future expansion (Author’s Diagram).

Patwin Elementary School (T3-T4) also has space assigned to relocatable classrooms in its Flexible Zone to accommodate excess enrollment (Author’s Diagram).

- Most new elementary schools in all contexts involve green building strategies.
Efficient circulation is an important design goal in all contexts, especially in urban (T4-T6) contexts.
- Separation of grades through design and space planning is an important feature in elementary schools in T3 to T4 contexts.
Interaction with outdoor green spaces was found in mostly suburban schools (T3-T4) than Urban (T5-T6) schools. However, good designs and site opportunities make it possible even in urban schools (Eg: Horace Mann Elementary School, Washington DC)

Figure 15: Access to outdoor space in Horace Mann Elementary School (T5) (Author’s Diagram)
In mixed-use urban schools (T6) like Spruce Street School, separate identity for
the school was achieved through massing, exterior finish and separate access.
• Dedicated surface parking was common for suburban (T3-T4) contexts. Urban schools (T4-T6) did not have a lot of surface parking. Schools in T6 context had no surface parking at all.

• An effective classroom is an important module for elementary schools in all contexts since it holds the main function and is replicated in learning areas of the school. Some new elementary schools also indicate importance of collaborative learning spaces just outside the classrooms that are flexible in function. They occur in T3, T4 and some T5 projects but not in T6 projects. Chesterton Primary School in London was an exception and it was built in 1960s.

• Depth of classrooms is important for proper interior daylighting. Shallow depths are required to achieve this.
In all projects kindergarten classrooms and daycare facilities are located near access points and drop-off areas on ground level. The kindergarten classes also have attached toilets.

**Joint-Use School⁹ in Urbanizing Contexts**

Mixed-use developments can prove to be the answer for overcrowding schools in urbanizing areas. In current economic scenario, public private partnership is the most viable funding solution. Also, integrating schools with other developments, especially residential, might create more opportunities to use the school as a community resource through shared spaces.

In New York a number of private developers are including schools in their developments. This has not only opened a number of City owned sites for private development but has also helped to resolve financial implications of developing new

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⁹ Joint Use School Partnerships in California: Strategies to Enhance Schools and Communities accessed May 17th 2016
http://citiesandschools.berkeley.edu/reports/CC&S_PHLP_2008_joint_use_with_appendices.pdf
schools. Not surprisingly, a number of developers are using schools as tools for negotiating approvals from the city for their developments.

Following are some examples:

- **Spruce Street School, NY (Beekman Tower)**

  Also discussed in previous section, the first five floors of this 76 story tower is dedicated to PS 397 also known as Spruce Street School. The development was a result of a partnership between the city’s School Construction Authority (SCA) of Department of Education and a private developer Forest City Ratner. The shell of the school was constructed by the private developer, while the interiors were done by SCA. In return the Forest City got $190 million tax exempt bonds to also help finance the project.

  The development has a number of 3 bed room apartments with children who attend school downstairs. There are no rent or enrollment implications of adding a school to this building.

  Table 2: Mix of Uses for Spruce Street School-

<table>
<thead>
<tr>
<th>Function</th>
<th>Area</th>
<th>No. of Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>100,000 sq ft (648 students)</td>
<td>5</td>
</tr>
<tr>
<td>Apartments</td>
<td>903 units (500-1000 sq ft each)</td>
<td>71</td>
</tr>
<tr>
<td>Hospital (ambulatory care)</td>
<td>25,000 sq ft</td>
<td>1-2</td>
</tr>
<tr>
<td>Retail</td>
<td>2,500 sq ft</td>
<td>Ground level</td>
</tr>
<tr>
<td>Public Space</td>
<td>22,000 sq ft</td>
<td>Ground Level</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1,000,000 sq ft</td>
<td>76</td>
</tr>
</tbody>
</table>

- **Windward School, Manhattan**

  The school is planned to be housed in the first five floors of a rental residential tower at 205 East 92nd Street. It is a private school dedicated to
language learning. The project did not receive any tax credits or incentives for this addition. The project is a partnership between Windward Private School and a private developer Related Companies.

Table 3: Mix of Uses for Windward School-

<table>
<thead>
<tr>
<th>Function</th>
<th>Area</th>
<th>No. of Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>60,000 sq ft (350 students)</td>
<td>5</td>
</tr>
<tr>
<td>Apartments</td>
<td>250 units</td>
<td>30</td>
</tr>
<tr>
<td>Open Space</td>
<td>12,000 sq ft</td>
<td>Ground Level</td>
</tr>
<tr>
<td>TOTAL</td>
<td>- sq ft</td>
<td>35</td>
</tr>
</tbody>
</table>

Figure 19: Windward Manhattan school campus, Tour the Manhattan Campus, Accesses Dec 11 2015
http://www.thewindwardschool.org/windward-manhattan

- Dock Street Dumbo Project

The Middle School is housed in the base of a condo building. This project was a partnership between NYC’s School Construction Authority (SCA) and a private developer Two Trees. The developer constructed the core and shell of the school building.

Table 4: Mix of Uses for Dock Street Dumbo School-

<table>
<thead>
<tr>
<th>Function</th>
<th>Area</th>
<th>No. of Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>50,000 sq ft (300 students)</td>
<td>4-5</td>
</tr>
<tr>
<td>Apartments</td>
<td>290 units</td>
<td>12</td>
</tr>
<tr>
<td>TOTAL</td>
<td>- sq ft</td>
<td>17</td>
</tr>
</tbody>
</table>
Riverside Center School

The Pre K to 8th grade school is included in a new residential building in Upper West Side of NYC. The building is a part of a massive Riverside Center project. It is public school housed in Riverside Parcel 2 building. The whole center comprises of 5 residential buildings.

The project is a result of partnership between SCA and a private developer Extell. According to their agreement the developer is required to construct core and shell and install mechanical systems for the school while the SCA takes care of the interiors.

Table 5: Mix of Uses for Riverside Center School-

<table>
<thead>
<tr>
<th>Function</th>
<th>Area</th>
<th>No. of Stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>100,000 sq ft (488 students)</td>
<td>4</td>
</tr>
<tr>
<td>Apartments</td>
<td>616 units</td>
<td>36</td>
</tr>
<tr>
<td>TOTAL</td>
<td>- sq ft</td>
<td>43</td>
</tr>
</tbody>
</table>
A joint-use school in Arlington, VA

A joint-use school development scenario can also be imagined for the upcoming and urbanizing parts of Arlington County, where the development market for housing can help finance schools for these areas. A developer could aim for density bonus or height and parking exceptions from zoning ordinance provided by the county for meeting certain conditions (that could include exceptions for incentivizing school development) for a Mixed-Use project.\textsuperscript{10}

Currently, Arlington County doesn’t have an impact fee on developers for development of new schools, also it doesn’t include school development in its conditions for providing density bonus or height and parking exceptions from zoning.

ordinance. However, it does have a “Special Incentives” program that could be used to mobilize a mixed-use school projects in Arlington VA. The incentives can be negotiated between the county and private developers under “Special Exception” from zoning ordinance through their “Site Plan Review Process”\textsuperscript{11}.

\textit{Elementary School Program and Guideline Comparison}

A general list of elementary school program was obtained from Virginia State Elementary School prototype and Arlington Public School guidelines. Following is the list of program spaces. The final square footage is exclusive of outdoor programs which have been mentioned separately.

In order to come up with an appropriate Elementary School Program the Virginia State, Arlington Public School and Montgomery County guidelines were compared. Later, the guidelines were also related with Discovery Elementary School program that uses APS guidelines\textsuperscript{12}. This gave an idea of the level of implementation of APS guidelines, and the ways they could be customized.


Table 6: School Program Comparison

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-School + in-built store &amp; toilet</td>
<td>1</td>
<td>945</td>
<td>1040</td>
<td>975</td>
<td>1070</td>
<td>1300</td>
</tr>
<tr>
<td>Montessori + in-built store &amp; toilet</td>
<td>3</td>
<td>2835</td>
<td>3120</td>
<td>2925</td>
<td>1070</td>
<td>_</td>
</tr>
<tr>
<td>Kindergarten + in-built store &amp; toilet</td>
<td>4</td>
<td>3780</td>
<td>4180</td>
<td>3900</td>
<td>4280</td>
<td>3900</td>
</tr>
<tr>
<td>First Grade + in-built store &amp; toilet</td>
<td>4</td>
<td>3780</td>
<td>3480</td>
<td>3900</td>
<td>4160</td>
<td>_</td>
</tr>
<tr>
<td>Second Grade</td>
<td>4</td>
<td>3780</td>
<td>3300</td>
<td>3200</td>
<td>3540</td>
<td>_</td>
</tr>
<tr>
<td>Third Grade</td>
<td>4</td>
<td>3780</td>
<td>3300</td>
<td>3200</td>
<td>3440</td>
<td>12600</td>
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<tr>
<td>Fourth Grade</td>
<td>3</td>
<td>2835</td>
<td>2475</td>
<td>2400</td>
<td>3440</td>
<td>_</td>
</tr>
<tr>
<td>Fifth Grade</td>
<td>3</td>
<td>2835</td>
<td>2475</td>
<td>2400</td>
<td>3300</td>
<td>_</td>
</tr>
<tr>
<td>Reading Classroom</td>
<td>1</td>
<td>_</td>
<td>420</td>
<td>_</td>
<td>855</td>
<td>650</td>
</tr>
<tr>
<td>Reading Recovery/ Clinical</td>
<td>1</td>
<td>_</td>
<td>400</td>
<td>_</td>
<td>1075</td>
<td>_</td>
</tr>
<tr>
<td>Flex Space Classroom</td>
<td>_</td>
<td>_</td>
<td>825</td>
<td>_</td>
<td>_</td>
<td>5125</td>
</tr>
</tbody>
</table>

<p>| Art Classroom                              | 1      | 1200          | 1730                    | 1200                            | 2810                                                      | 1050                                                          |
| Music Vocal Classroom + Storage             | 1      | 945           | 1150                    | 1000                            | 1990                                                      | 1050                                                          |
| Music Instrumental Classroom + Storage     | 1      | 945           | 1025                    | 500                             | 895                                                       | _                                                             |</p>
<table>
<thead>
<tr>
<th>Other resource Classroom + Storage</th>
<th>1</th>
<th>945</th>
<th>500</th>
<th>_</th>
<th>_</th>
<th>_</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Room</td>
<td>1</td>
<td>1800</td>
<td>2800</td>
<td>1870</td>
<td>2475</td>
<td>2000</td>
</tr>
<tr>
<td>Multi-use AV tech Area</td>
<td>1</td>
<td>420</td>
<td>300</td>
<td>120</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Computer class + Tech office</td>
<td>1</td>
<td>945</td>
<td>945</td>
<td>900</td>
<td>120</td>
<td>1000</td>
</tr>
<tr>
<td>Library Admin+ Backrooms</td>
<td>1</td>
<td>540</td>
<td>300</td>
<td>300</td>
<td>335</td>
<td>500</td>
</tr>
<tr>
<td>Conference Room</td>
<td>1</td>
<td>–</td>
<td>150</td>
<td>–</td>
<td>245</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>1</td>
<td>–</td>
<td>150</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>AV Storage</td>
<td>1</td>
<td>–</td>
<td>200</td>
<td>150</td>
<td>410</td>
<td>450</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>1</td>
<td>3150</td>
<td>4100</td>
<td>3150</td>
<td>6075</td>
<td></td>
</tr>
<tr>
<td>PE Toilet</td>
<td>1</td>
<td>300</td>
<td>150</td>
<td>300</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>PE Office/ Toilet</td>
<td>1</td>
<td>250</td>
<td>100</td>
<td>250</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>PE Storage</td>
<td>1</td>
<td>300</td>
<td>150</td>
<td>–</td>
<td>155</td>
<td></td>
</tr>
<tr>
<td>Team room</td>
<td>4</td>
<td>1600</td>
<td>–</td>
<td>300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------</td>
<td>---------------</td>
<td>-------------------------</td>
<td>----------------------------------</td>
<td>---------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Dining Area</td>
<td>1</td>
<td>2660</td>
<td>3500</td>
<td>2040</td>
<td>2850</td>
<td>-</td>
</tr>
<tr>
<td>Kitchen + Food storage</td>
<td>1</td>
<td>1655</td>
<td>1200</td>
<td>1590</td>
<td>2020</td>
<td>1000</td>
</tr>
<tr>
<td>Multipurpose Area</td>
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<td>2400</td>
<td>-</td>
<td>-</td>
<td>2400</td>
<td>-</td>
</tr>
<tr>
<td>Storage Furniture</td>
<td>1</td>
<td>1220.5</td>
<td>200</td>
<td>500</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>Stage</td>
<td>1</td>
<td>1770</td>
<td>450</td>
<td>1700</td>
<td>450</td>
<td>-</td>
</tr>
</tbody>
</table>

Concentrations and Gifted Students

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>ESOL</td>
<td>1</td>
<td>420</td>
<td></td>
<td>400</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HILT</td>
<td>1</td>
<td>825</td>
<td></td>
<td>-</td>
<td>1465</td>
<td>-</td>
</tr>
<tr>
<td>Project Go</td>
<td>1</td>
<td>420</td>
<td></td>
<td>-</td>
<td>1465</td>
<td>-</td>
</tr>
<tr>
<td>Title 1</td>
<td>1</td>
<td>400</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Gifted Classroom</td>
<td>1</td>
<td>420</td>
<td></td>
<td>545</td>
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## Special Education

<table>
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</thead>
<tbody>
<tr>
<td>Resource</td>
<td>1</td>
<td>420</td>
<td>420</td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Pre School Disabled</td>
<td>1</td>
<td>825</td>
<td>825</td>
<td></td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>SC Small Classroom</td>
<td>1</td>
<td>500</td>
<td>500</td>
<td></td>
<td>2800</td>
<td></td>
</tr>
<tr>
<td>Interlude</td>
<td>1</td>
<td>825</td>
<td>825</td>
<td></td>
<td>3855</td>
<td></td>
</tr>
<tr>
<td>Transitional</td>
<td>1</td>
<td>825</td>
<td>825</td>
<td></td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>SE Small Classroom</td>
<td>1</td>
<td>400</td>
<td>400</td>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Toilet</td>
<td>1</td>
<td>40</td>
<td>40</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
## Administration

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception/Clerical</td>
<td>1</td>
<td></td>
<td>500</td>
<td>250</td>
<td>775</td>
<td>675</td>
</tr>
<tr>
<td>Principal's Office</td>
<td>1</td>
<td></td>
<td>200</td>
<td>200</td>
<td>195</td>
<td>250</td>
</tr>
<tr>
<td>Principal's Assistant</td>
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<td></td>
<td>100</td>
<td>100</td>
<td>165</td>
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</tr>
<tr>
<td>Assistant Principal's Office</td>
<td>1</td>
<td></td>
<td>120</td>
<td>_</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>Conference Room</td>
<td>1</td>
<td></td>
<td>250</td>
<td>200</td>
<td>245</td>
<td>300</td>
</tr>
<tr>
<td>Work Room</td>
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<td></td>
<td>250</td>
<td>100</td>
<td>445</td>
<td>300</td>
</tr>
<tr>
<td>Book Storage</td>
<td>1</td>
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<td>400</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Record Storage</td>
<td>1</td>
<td></td>
<td>300</td>
<td>300</td>
<td>90</td>
<td>350</td>
</tr>
<tr>
<td>Clinic with Toilet</td>
<td>1</td>
<td></td>
<td>600</td>
<td>250</td>
<td>550</td>
<td>400</td>
</tr>
<tr>
<td>Staff toilets</td>
<td>2</td>
<td></td>
<td>65</td>
<td>100</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Speech</td>
<td>1</td>
<td></td>
<td>200</td>
<td>_</td>
<td>435</td>
<td>250</td>
</tr>
<tr>
<td>Social Worker/Psychologist</td>
<td>1</td>
<td></td>
<td>120</td>
<td>_</td>
<td>240</td>
<td>250</td>
</tr>
<tr>
<td>Testing/Conference</td>
<td>1</td>
<td></td>
<td>150</td>
<td>200</td>
<td>205</td>
<td>150</td>
</tr>
<tr>
<td>Counselor</td>
<td>1</td>
<td></td>
<td>450</td>
<td>100</td>
<td>490</td>
<td>250</td>
</tr>
<tr>
<td>Occupational/Physical Therapy</td>
<td>1</td>
<td></td>
<td>420</td>
<td>_</td>
<td>435</td>
<td></td>
</tr>
<tr>
<td>Gifted/Visiting Teachers</td>
<td>1</td>
<td></td>
<td>120</td>
<td>_</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lounge with toilet</td>
<td>1</td>
<td></td>
<td>600</td>
<td>200</td>
<td>1115</td>
<td>850</td>
</tr>
<tr>
<td>Teacher work areas</td>
<td>1</td>
<td></td>
<td>300</td>
<td>250</td>
<td>335</td>
<td>150</td>
</tr>
<tr>
<td>Storage Furniture</td>
<td>1</td>
<td></td>
<td>150</td>
<td>_</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Distributed on all levels and no fixed proportions*
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended Day (Storage/ office)</td>
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<td>-</td>
<td></td>
<td></td>
<td>740</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playground</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Outdoor Play area</td>
<td>1</td>
<td>8000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC and circulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16142</td>
<td>33893</td>
</tr>
<tr>
<td>Total (exclusive of outdoor spaces and circulation space)</td>
<td>54256.5</td>
<td>55130</td>
<td>44720</td>
<td>63810</td>
<td>42825</td>
<td></td>
</tr>
</tbody>
</table>

For the capacity of about 600 students
Chapter 3: Design Approach

*Design Issues*

The precedents and building guidelines revealed important issues that can define the design of a new age elementary school in urbanizing areas. While certain issues were radical others were more secondary, but had the ability to enhance the user experience of a school facility.

<table>
<thead>
<tr>
<th>Radical Issues</th>
<th>Critical Design Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Efficient Circulation</td>
<td>- Daylighting</td>
</tr>
<tr>
<td>- Future Expansion and Reuse</td>
<td>- Connection to Outdoor Spaces</td>
</tr>
<tr>
<td>- Collaborative Learning</td>
<td>- Multiple Floors</td>
</tr>
<tr>
<td>- Shared Community Facility</td>
<td></td>
</tr>
<tr>
<td>- Separation of Grades</td>
<td></td>
</tr>
<tr>
<td>- Small Footprint</td>
<td></td>
</tr>
</tbody>
</table>

The test program described in the previous chapter has been used to come up with a morphology of school buildings for densely populated contexts. Schemes have been developed keeping each of the secondary issues as the main idea. It is however understood that a school design can be a solution for more than one or even all these issues. In order to study the difference in form and space interactions, only one issue has been undertaken as the core design problem, but all schemes include the radical issues related to sustainable school design.
Issue 1- Daylighting

A room depth of 30’ has been followed throughout the school program to ensure proper delighting from one side. Some classrooms also require exclusive storage and Bathrooms. These ancillary spaces have been used to increase daylight penetration and also cross-ventilation, if weather permits.


Figure 23: Classroom Depth- 30’ depth considered for daylighting in classrooms and other learning areas. (Author’s Diagram)
Scheme 1.1 Linear Bay
Remark:

- Linear design requires special large or linear parcels.
- The scheme has very efficient circulation.
- The shape is viable to have other programs for mixed use on top floors, but will require a different entrance lobby area.
- Integrating functions in a structure adjoining this building will be tricky.
- The programs are separated and the scheme has few opportunities for a vibrant common space that has different activities around it.
- The scheme allows separate access to public areas.
Scheme 1.2 Perpendicular Bays
Figure 25: The Perpendicular Bay Scheme (Author’s Diagram)
Remarks:

• The Perpendicular Bay shape can fit on most sites but requires more circulation space than linear scheme.

• A sloping site will allow multiple levels of exit discharge, allowing PK, K, 1 and special education to be arranged on multiple levels.

• The shape is viable to have other programs for mixed use on top floors, but will require a different entrance lobby area.

• Functions in a structure adjoining this building can be connected from dining facilities and Multi-function space area.

• Allows more mixing of programs.

• The Public area can have same or separate access.

• The private learning spaces branch off from the public spaces.

Issue 2- Connection to Outdoor Space

In precedent analysis schools with programs arranged around courts revealed greater opportunity of interaction with outdoor space. This is not only true for interaction with outdoor space at ground level but also at upper levels by using green roofs and terraces.

Scheme 2.1 Courtyard
Figure 26: The Courtyard Scheme (Author’s Diagram)
Remarks:

- More isolated programs but more interaction with outdoor play areas.
- Opportunity to expand programs on terraces
- Classrooms around the court create a unique environment.
- If the courtyard is covered it can be used in a mixed-use scenario but will require different entrance lobby space on ground floor
- The placement of courts results in different building proportion and may be decided as per the site.
- Both courts can have different level and nature of interaction depending on the type of activities around them.

Issue 3- Multi-level

Most of the mixed-use school scenarios noted in precedent analysis have multi-level (more than 3 stories) schools that allows for ample open space even in relatively small urban sites. The following scheme is more compatible for mixed-use scenario and can have the same lobby and core.

Scheme 3.1 Common Core and Lobby
Remarks:

- PK- 1 are housed on 2 levels resulting in smaller footprint
- Possibility of a central social space.
- roof (86’ x 100’) can be used for playground
- Small footprint
- Stacking of similar programs like Dining and Special Education can help have dedicated access in case these programs need to function independently

Scheme 3.2 Common Core and Lobby, and shared facilities
Remarks:

This scheme has gymnasium on level 5 which will allow shared use with residential floors above the school in a mixed-use scenario. This option still allows for 86’ x 100’ playground on the roof
Chapter 4: Site Analysis

Site Selection

The site selection for schools is an important activity that has a great impact on the learning environment. Most school boards have certain site requirements for a project to qualify for school development. These requirements are usually related to lot sizes, accessibility, appropriate surrounding environment and other physical conditions. Following are the criteria for an appropriate school site:

- Lot Size: Usually the school boards prescribe a minimum lot size for school development. It is generally high for rural and suburban (T1-T3) contexts and low for urban (T5-T6) contexts. The lot size also varies as per expected enrollment and related future expansion plans. It also changes with the requirements for outdoor programs on school site. Arlington County considers a min. site area of 3.5 acre for school development. Since this thesis is specifically looking at school development in urbanizing areas and emphasizes on shared facilities, determination of outdoor programs and the resulting lot size will depend on opportunities around the sites being considered. One of the main issues considered in previous sections is reduced building footprint which will also affect the required lot size.

---


• Accessibility: Walkability is an important variable for site selection of elementary schools. Most of the elementary schools have a service area of \( \frac{3}{4} \) to 1 mile around the school site. Also, a central location is usually preferred for school sites. School accessibility also depends on the travel time of students from home to school and the quality of their travel route. For elementary schools a travel time of less than 30 mins\(^{15} \) is considered appropriate. Safe travel paths are an important consideration for selecting school sites.

![Diagram of home to school travel paths](source: Candill, W. W., Space for Teaching.)

Figure 28: Appropriate travel path from home to school, School Site Selection Historic PAS Report Series American Planning Association, accessed Dec12 2015, [https://www.planning.org/pas/at60/report175.htm](https://www.planning.org/pas/at60/report175.htm)

• Surrounding Environment and Site Physical Conditions:

For an appropriate school site the surrounding environment conditions should safe and pleasant. The site should not have any activities causing disturbance in learning environment of the school. Usually zoning takes care of these

---

\(^{15}\) School Site Selection Historic PAS Report Series American Planning Association, accessed Dec12 2015, [https://www.planning.org/pas/at60/report175.htm](https://www.planning.org/pas/at60/report175.htm)
issues, but development sites considered in this thesis will go beyond zoning recommendations for school sites. Hence it is important to check for any disturbances that cannot be mitigated.

The site and its surrounding should not expose students to any toxic substances. Physical conditions like topography and soils have programming and financial implications on school projects. The school sites should allow proper drainage and preferably not be a part of flood plains. As discussed in previous section, a sloping site can have multiple levels of egress discharge, which will allow programming of lower elementary grade classrooms at 2 levels which will result in a smaller building footprint.

Arlington County: Regional Setting and Main Features:

Arlington County VA is located in Northern Virginia on the west bank of Potomac River. The county’s planning is known for focusing high density development along its major transportation corridors while retaining lower density in its residential neighborhoods. There are three primary planning corridors in the county- The Rosslyn- Ballston corridor, The Jefferson- Davis Corridor and the Columbia Pike corridor\(^\text{16}\). Out of these the R-B and J-D corridors are along metro transit lines.

Figure 29: Arlington County Major Planning Corridors (Author’s Diagram)
Sites Considered:

Following attributes were used to come up with sites for elementary school development in urbanizing areas of Arlington County.

- Sites proposed for mixed use or housing development in Metro Corridors
- Sites considered for school development in Public Land for Public Good Study\(^{17}\)
- Sites considered for affordable housing developments in Public Land for Public Good Study.\(^{18}\)

A Transit Corridor Mixed-Use School in Arlington, VA:

The sites being considered (refer figure 28) are in County’s high density metro corridors. The county has been considering new schools in these areas, however no sites have been recommended yet. Since these sites are closer to metro stations, it is possible to imagine a Transit Corridor School. The service area of this school could stretch along one of the metro corridors where, like in DC and New York, students could travel by metro rail. The travel time will be less than 30 minutes which is considered appropriate for elementary schools. The school itself can be supported with safe access to metro station. Along with metro rail, the sites considered are also served by Metro and ART buses.


A corridor school along the R-B and J-D corridor can help relieve pressure on existing elementary schools serving these areas. It will have a significant impact on Oakridge, Ashlawn, Long Branch, Key and Glebe Elementary Schools that are projected to be at more than 110% capacity utilization by year 2024 (Fig. 29).
Figure 31: Elementary School Capacity Utilization projection for year 2024, (Author's Diagram, basemap CIP)

Possible sites:

In order to select the most appropriate site for a Transit Corridor Elementary School, all considered places discussed earlier were studied for the following desired attributes:

- Proper transit – ART or Metro bus and rail services for transportation
- Located centrally in the county
- Suitable for mixed-use school development.
- Safe access
- Possibility of having shared community facilities
- Proper site proportion - tested using the schemes generated in previous chapter

- Lot size not more than 3 acres, which was found feasible for schools in urban areas in precedent analysis. The min. lot size considered for schools by the county is 3.5 acres.

- Under consideration for future development.

- Preferably a sloping site allowing two levels of egress discharge.

To select a site for a Joint-Use school in Arlington County, the above listed attributes were weighted. The most desired attributes had higher weights than other attributes.

<table>
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<tr>
<th>Attribute</th>
<th>Weight</th>
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<tr>
<td>Lot Depth</td>
<td>2.0</td>
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<tr>
<td>Metro Access</td>
<td>2.0</td>
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<td>Considered for Mixed-Use Development</td>
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<tr>
<td>Centrally Located</td>
<td>1.5</td>
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</table>

Figure 32: Site Attribute Weightage, (Author's Diagram)

The sites were ranked as per this weighting criteria to find the most suitable location for a joint-use school. Please refer Appendix 2 for the analysis.

Following sites ranked high in the analysis for site selection:

- Courthouse Sq
- Clarendon West
- Carpool Restaurant
- Mazda Site
The above listed sites are located in the R-B corridor. The Courthouse Sq site is very close to the existing Key elementary school. Hence, Clarendon West site was selected as the site for Joint-Use school development for this thesis.

Figure 33: Site Ranking, (Author's Diagram, base map: Tableau Public)

**Site Analysis**

Clarendon West- Site Attributes:

The following images give a better idea of preferred characteristics on Clarendon West site:
Figure 34: Clarendon West Site Attributes (Author’s Diagram over base maps from Arlington GIS Center and Arlington County Projects and Planning Image Gallery, accessed May 15 2016 http://projects.arlingtonva.us/projects/clarendon-west-red-top-cab/)
Clarendon West- Possible School Service Area:

A school on Clarendon West site will serve elementary school aged kids in ½ mile radius of the site\(^\text{19}\). The service area can also extend along the orange line metro till Ballston.

![Service Area Diagram (Author's Diagram)](image)

Clarendon West- Existing Conditions:

The site is currently occupied as Red Top Cab parking area. It is also a part of a proposed commercial and housing development. A historic commercial block is located towards the Clarendon core. The site has housing and commercial developments, The Beacon and The Hudson, adjacent to it.

Towards N-W the site fronts the suburban community of Lyon Village. The

\(^{19}\) Figure 26: Appropriate travel path from home to school, School Site Selection Historic PAS Report Series American Planning Association, accessed Dec12 2015, [https://www.planning.org/pas/at60/report175.htm](https://www.planning.org/pas/at60/report175.htm)
context around the site drastically changes from a T6 Urban Core, Clarendon Core to T3 Suburban Lyon Village Community.
The site is an edge condition site with tapering height regulations ranging from 76’ over the commercial block to 110’ in the center and 55 ‘ towards the suburban Lyon Village community, as per the Clarendon Sector Plan\textsuperscript{20}.

The site offered 2 options for subdivision based on extension of existing secondary streets serving the adjacent developments.

\begin{itemize}
  \item Max. FAR: 3.0
  \item Use Mix: Residential, Commercial, Hotel, or Mixed Use
  \item Façade preservation: preserve the first 10 feet
  \item “additional density may be approved by the County Board in exchange for extraordinary community benefits”
  \item “the total maximum height limit (in feet) cannot be exceeded”
  \item Parking: One space per unit for residential uses and one space per 580 square feet of commercial use
  \item Exemptions from parking requirements for those uses within 1,000 feet of a Metro entrance. (Sites is within 600 ft. walking distance from metro entrance)
\end{itemize}

Figure 39: Site Regulations (Author’s Diagram)

Figure 40: Site Section Existing (Author’s Diagram)
Chapter 5: Design Options

Zoning of School & Housing in Joint-School Development:

The subdivision of the site and varying context on both sides allowed various options for zoning and massing of school and housing uses. Options were generated using The Design Issue studies (conducted in Chapter 3) and manipulating them for Clarendon West site. The options also consider different levels of school and housing use overlap.

![Figure 41: School & Housing Zoning Options (Author’s Diagram)](image)

![Figure 41: School & Housing Zoning Options (Author’s Diagram)](image)
The above described massing studies were also considered for separation and overlapping of school and housing circulation.

- **The Courtyard School**: The school is zoned facing the Lyon Village community. The housing and school uses have less overlap. Consequently, the circulations for school and housing is largely separated.

- **The Multi-level Urban School**: The school is zoned towards the Clarendon Core and over the existing historic commercial block. The housing and school uses overlap considerably. Consequently, the circulation for school and housing also overlap at a numer of places.
Chapter 6: Design Proposal

The Courtyard School Option:

The design proposed in this thesis for Joint-Use school on Clarendon West site in Arlington VA is developed from The Courtyard School option discussed in the previous chapter. The Courtyard School option offered better connection with the surrounding residential community. It had potential to address the critical design issues of daylighting and connection with open spaces in a better way. It also provided an option of fully conserving the existing historic commercial block. The design proposal claims bonus height incentive for development of school on this site. Additional 5 floors have been added resulting in a height of 192’. This is approximately equal to the maximum height of 200’ (Olmstead Building) in Clarendon Core.

Figure 42: Base Case as per Regulations, (Author’s Diagram)
Figure 43: Claiming bonus height incentive, (Author's Diagram)

Number of units = 380

Figure 44: Commercial Block Preservation, (Author's Diagram)

Historic commercial block fully conserved number of units = 323
Site Plan:

Figure 45: Site Plan (Author’s Diagram)
Site Axon:

Height limit achieved by adding more stories for consistent street environment
View along 13th St:
Relating to the Suburban Context

![View along 13th Street (Author's Illustration)](image)

View from the Clarendon Metro Station:
Relating to the Urban Context

![View from Clarendon Metro (Author's Illustration)](image)
Sectional Perspective:

Figure 49: Proposed Development Sectional Perspective (Author’s Diagram)
Floor Plans:

Figure 50: G-1 floor plan (Author's Diagram)

Figure 50: First (Ground) floor plan (Author's Diagram)
Figure 50: Second floor plan (Author’s Diagram)

Figure 50 Third floor plan (Author’s Diagram)

Figure 50 Fourth floor plan (Author’s Diagram)
Figure 50 Fifth floor plan (Author’s Diagram)

Figure 50 Sixth floor plan (Author’s Diagram)

Figure 50 Seventh-Sixteenth floor plan (Author’s Diagram)
Approach View from Lyon Village Community: A Community Oriented School

Figure 51: View from Community (Author’s Illustration)

Figure 62: G-1 level Access, Circulation & Shared Spaces (Author’s Diagram)
Approach View from Clarendon Central Park: Contributing to Pedestrian Oriented Clarendon Core.

Figure 53: View from Clarendon Core (Author’s Illustration)
Drop-Off View: Lively and Safe Environment

Figure 54: Drop-Off view (Author’s Illustration)

Figure 55: First Floor Access, Circulation & Shared Spaces (Author’s Diagram)
The Courtyard:
Interaction with outdoor green space and the center of life in school

First Floor Plan (Author's Diag)

Figure 56: Courtyard View from Central Staircase (Author's Illustration)
The Courtyard: 
A Multipurpose Assembly Space for school and community

G-1 Floor Plan (Author's Diag)

Figure 57: Courtyard View from Loggia (Author's Illustration)
Table 7: The School Program: (Area in Sq Ft)

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<th>Number</th>
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<td>HVAC and circulation</td>
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**Total (exclusive of outdoor spaces and circulation space)** 67212.5
Figure 58: School Learning Space Program (Section looking N-W) (Author’s Diagram)

Figure 58: School Learning Space Program (Author’s Diagram)

Figure 59: Daylighting of Learning Spaces (Author’s Diagram)
Figure 60: N-E classrooms at 11 am (Author’s Illustration)

Figure 61: S-W classrooms at 2 pm (Author’s Illustration)
Collaboration Pods: Maximizing Interaction

Figure 62: Collaboration Pods (Author’s Illustration)

Soccer Field: Unique provisions for play areas and green spaces

Sixth Floor Plan (Author’s Diag)
Figure 63: Looking into Soccer Field from Housing (Author’s Illustration)

Flexible Classroom Space:

School Section Looking N-W (Author’s Diag)

Figure 64: Flexible Classroom Space on Fifth Floor (Author's Diagram)
Conclusion:

The design proposal clearly shows that a Joint-Use School model can be successfully used to intensify and develop elementary schools in urbanizing areas of Arlington County VA. In case of Clarendon West, the regulations for edge sites of metro corridors played an important role in shaping the joint-use development.

Additionally, this thesis demonstrates that it is possible to achieve effective learning environments even on constrained sites in high density areas. Both site selection and design have an important role to play in development of such sustainable school models for urbanizing areas.
Appendices

Appendix 1:

<table>
<thead>
<tr>
<th>Project Information</th>
<th>Discovery Elementary School</th>
<th>Battery Park City School</th>
<th>8 Spruce Street School, Beekman Tower</th>
<th>Patwin Elementary School</th>
<th>Rogers Elementary School</th>
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<td>Victoria, BC, Canada</td>
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<td>5241 36th St N, Arlington, VA 22207</td>
<td>55 Battery Pl, New York, NY 10004</td>
<td>8 Spruce Street School Manhattan, New York City 10038</td>
<td>2222 Shasta Dr, Davis, CA 95616</td>
<td>765 Rogers Ave, Victoria, BC V8X 5K6</td>
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