뉴욕시 공립학교에 나타난 배치 특성에 관한 연구 - 맨하튼 가로체계와 외부공간의 관계를 중심으로 -

A Study on the Layout Patterns of Public Schools in Manhattan - Focused on Relationship between Manhattan Grid Plan and Open Space -

김 필 수* 전 유 창**
Kim, Pil-Soo Jeon, You-Chang

Abstract

The purpose of this study is to analyze patterns of public school building layout types, open space and relationship with communities in the Manhattan grid plan. The study illustrates how building layout patterns of school facilities are influenced by societal demands in the urban grid environment. During the nineteenth century, the Island of Manhattan was transformed into a physical representation of the Cartesian coordinate system via the development of the grid street plan. In order to take advantage of streets as urban space, it is quite important to understand characteristics of communities and open space relationships between buildings and streets. Moreover, the strategic planning of schools' outdoor space vitalizes public streets as a critical community anchor. This research reviews 118 Manhattan public schools and categorizes them by (1) building layout type, (2) site type, (3) circulation and public open space, which are the biggest factors that determine the layout patterns of the public schools in Manhattan. As a result of analysis, the layout patterns are classified into seven types : “—”, “L”, “ㄱ”, “口”, “H”, “T” and “other” type. Of these, “—” type and “L” type occur most frequently, because these configurations most flexibly fit into the limited grid-locked blocks, the various types of site & topography, and adapt most dynamically to the open spaces created by using avenues and streets. The ultimate objective of this study is to provide a case study for future efforts to plan open spaces for campuses that effectively utilize the streets in proximity.

키워드 : SCA, 공용 공간, 맨하튼 공립학교, 배치유형, 대지유형, 블록유형, 가로체계

Keywords : SCA, Open Space, Manhattan Public School, Building Layout Type, Site Type, Block Type, Grid Plan

1. Preface

1.1 Background and Purpose

In general, educational facilities in urban settings tend to be thoroughly closed off from surrounding public space to secure the privacy needed for an educational environment. With their buildings enclosed from the urban landscape, campuses have been losing their meaning and

value as public space. When organically connected to the street, the open spaces of schools can serve in various capacities as public space. The relationship between streets and schools' open spaces can directly affect the layout of campus buildings. Therefore, properly understanding the relationship between streets and campus open space can help improve the efficiency of urban public spaces. As establishing spatial continuity between the campus and the streets can help further encourage exchange between the campus and the surrounding community, the relationship between streets and open space is an critical factor to consider when planning the

* Registered Architect, Mitchell Giurgola Architects, LLP.

** Associate Professor of Ajou University, Corresponding Author(ycjeon@ajou.ac.kr)

This paper is supported by the National Research Foundation of Korea. Project NO. 2011-0014326

layout for campuses. This study will make a theoretical examination of layout types based on education, school facilities, and local communities. It will then provide suggestions on how the layout of schools can meet the social demands of cityscapes with a street grid system. This study examined how the layouts of educational facilities can affect, or can be affected by, the characteristics of the open space and street by integrating the buildings into the urban landscape.

In particular, this study examined extant examples in Manhattan, where a grid of streets outlines various blocks that allow for different layouts of open spaces in each district. Through bibliographical research and on-site surveys, the study specifically categorized and analyzed the environmental layout and circulation of 118 public primary and secondary schools built in Manhattan under the guidance of the School Construction Authority(SCA)¹⁾. The analysis will help identify the types of relationships between the open campus space and the streets of Manhattan's grid plan.

The ultimate purpose of this study is to provide a case study for future efforts to plan open spaces for campuses that effectively utilize the streets in proximity.

1.2 Subject and Methodology

This study used spatial analysis to examine Manhattan public schools. The methodology used herein was as follows: first, refer to precedent literature for the characteristics of Manhattan's grid plan and the background behind the selection of the schools' locations, as well as any policies that underpinned such decisions; second, visit 118 of Manhattan's public schools to collect data on the status of public elementary schools' open spaces that utilize their streetside disposition or any plans to do so; and third, determine the characteristics of the surroundings and building site of the subject areas to categorize building layout types according to the topography, the

relationship between the building site and the street, the direction of the buildings and their main entrances, frontality of the buildings, outdoor space, and open space. Through such categorization, the study identified various manifestations of spatial continuity between the indoors and the outdoors of the buildings, and noted how each type integrates the open space with the surrounding streets. Lastly, the study highlighted several schools that prominently make use of the Manhattan grid plan in their layouts, and analyzed their correlations with the community school district, block types, topography, outdoor space, and elements related to the streets.

2. Manhattan'S Urban Characteristics and Grid Plan

2.1 The commissioner plan of 1811

In the early years of New York City, Manhattan's southernmost area formed the heart of the city, bustling with residential areas, warehouses, wharfs, churches, and government facilities. As fires were common during that era, many facilities gradually relocated northward. However, due to the lack of specific guidance on urban development, the new buildings were constructed in a disorderly array. This can be seen in the lower part of 14th Street where various grids and vertices overlap without any particular plan. Moreover, New York in the early 19th century experienced rapid growth in economy, population, and number of immigrants from Europe. Such conditions necessitated expansion of real estate and residential facilities, leading the State of New York to appoint a three-member council in 1807, declaring:

"laying out streets... in such a manner as to unite regularity and order with the public convenience and benefit and in particular to promote the health of the City...."

In 1811, the council published the Commissioner's Plan of 1811 upon the approval of the State and the City. The plan proposed 12 north-south avenues above Houston Street, with 155 streets crossing the avenues from east to

1) The School Construction Authority(SCA) was established by the New York State Legislature in December 1988 to build new public schools and manage the design, construction and renovation of capital projects in New York City's more than 1,200 public school buildings, half of which were constructed prior to 1949.

Figure 1. A modern redrawing of the 1807 version of the Commissioner's Grid plan for Manhattan, a few years before it was adopted in 1811. Central Park is absent.

west. As an exception, Broadway crosses the grid diagonally from northwest to southeast. Governor Morris explained the reasoning behind the grid system in the Commissioner's Plan, saying, "a city is to be composed principally of the habitations of men, and that straight-sided and right-angled houses are the most cheap to build and the most convenient to live in."

2.2 Role of the Grid Plan in Capitalism, Commerce, Population Increase, and Urban Expansion

The grid plan offered the possibility of maximizing real estate value while providing efficient and cheap residential space. Despite the high density of the city, the grid plan allowed for improved ventilation of the city with the two rivers hugging the land. Meanwhile, the high-density population helped promote the diversity and street culture of New York. The rather abstract concept of a grid deviated from the traditional perception of the city as a physical space, while the numbered streets and avenues provided a clear sense of orientation in the grid system. Such new concepts provided a comprehensively new perception of a city. Manhattan brought life to a banal, unsentimental, and two-dimensional grid system through its ethnic and cultural diversity, while also physically vitalizing the cityscape through its early zone regulation that helped three-dimensionally embellish the skyline with buildings of varying heights.

2.3 Manhattan Avenue and Street

The north-south avenues are numbered from 1 to 12, starting with the eastern most 1st Avenue and ending with the western most 12th Avenue. Each avenue is 30m wide, allowing for bidirectional vehicular traffic. As much of the commerce at the time occurred at the water front, the outermost avenues were set slightly narrower than the inner ones. The avenues in the center of the island were set to be 281m wide, while the waterfront avenues were set slightly closer at 240m. The length of four avenues is approximately 1.6km.

In contrast to the varying dimensions of the avenues, the streets form a regular grid of 20m-wide and 60m-long

blocks from 1st Street to 155th Street. In consideration of the heavy traffic across the eastern and western parts of the island, 14th, 23rd, 34th, 42nd, 57th, 72nd, 79th, 86th, 96th, 106th, 116th, 125th, 135th, 145th and 155th Streets were set to be wider than the remaining streets. The length of 20 blocks is approximately 1.6km(1 mi).

Figure 2. Block and Lots

2.4 Streets of Manhattan and Their Meaning

The streets of Manhattan serve as the host of social interaction comprising a wide range of ethnicities and events. Street activities occur when many pedestrians are able to use the streets in a variety of ways. A street not only connects one place to another, but is also a place in and of itself. In other words, a street can host urban activities as both the means of transit and as a place of its own.

In the street, local denizens directly express their culture and sentiments. The unique traits of a given street tend to result from the culmination of the cultural potential of the area, representing the spirit and culture of the area. As such, streets serve not only as channels of human and vehicular traffic, but also as providers of cultural index that greatly influence the look and feel of the buildings and cityscape of the area. Streets thus provide an important venue of experience crafted by the time people spend there.

Starting in the modern age, streets have mainly served as channels of vehicular traffic or pedestrian passage, rather than as functional spaces. However, the streets of Manhattan are most vibrant when “each person walking on the street comes into extensive contact between each

Figure 3. Extended Manhattan Grid as Open Space

streetside building,”²⁾ rather than functioning merely as a road. While it would be most desirable to have streets become venues for social activities, the form and function of the street will vary according to the values of the cultural group to which the users of the given street belong. Some schools in Manhattan have taken advantage of the potential of the street as a place of cultural exchange by effectively utilizing the traits and nature of adjacent streets to expand their open space into the grid. Exemplary cases may feature uninhibited entry into school grounds thanks to the lack of visible boundaries, streets that double as plazas, and sharing the streets with the local community to promote exchange between the school and the community.

3. Traits of Public Schools in Manhattan

3.1 Manhattan Public School System

Figure 4. School District Diagram

2) garrett eckbo, 도시조경계획, 동명사, 1975, p.17

There are 246 public schools in Manhattan, comprising 111 elementary schools, 44 middle schools, 76 high schools, and 15 special schools. As previously mentioned, Manhattan's grid system plays a noteworthy role in facilitating the social and cultural expansion of the city. Most small Manhattan schools are in close enough proximity to make full use of nearby public facilities, thus conserving valuable resources required for programs that can be served by the city facilities. For example, the campus of New York University is fully integrated within Manhattan, and the campus's vague boundaries make Manhattan itself the de facto campus area. Public schools in Manhattan make active use of city museums, libraries and parks in their curricula, providing the students with a more familiar learning environment within the urban community. Public schools also play an important role in the community life. They not only provide the functional benefit of facilities such as gyms, auditoriums, and libraries, but also offer the open spaces and recreational venues that flavor the otherwise starkly compact city grid filled with solids(architectural structures).

3.2 SCA Guidelines for the Public Schools of NYC

Since its establishment in December 1988, the School Construction Authority (SCA) has built and managed the designs of over 1,200 public school buildings in New York. The SCA's objectives are to improve the management of the construction process and to reduce school construction costs by providing a set of simplified design standards while also encouraging competition among contractors. The SCA provides a systematic set of design standards to provide guidance on every step of the design process from drafting to actual construction. Through such standardized management, the SCA strives to ensure efficiency and excellence in public school constructions in New York.

The location of the school and its relationship with the neighborhood becomes an important factor to consider when designing a school's layout, in addition to the functional considerations of school facilities. The building layout and designs are important not only in the context of the campus, but also in the context of the community.

Table 1. SCA Building Location and Orientation Guidelines

Locating the School Building on the Site	
1	Easy and Safe Accessibility - both pedestrian and vehicular traffic of students, parents, and staff members should be provided ease of access to the site and a safe path of travel
2	Traveling Direction of Student, Parents, and Faculty - Traveling in the local vicinity to attend the school
3	Local Mass Transportation - more of an influence on intermediate and high schools - impact main entrance design
4	Types of Vehicular Traffic and Traffic Flow of Adjoining Streets
5	Topography
6	Location of Available Utilities
7	Use of Surrounding Land and Buildings - safety(vehicular traffic), noise, light and air, security (accessible hidden areas)
8	Open Space - the first priority for non-built area is student recreation
9	Safety and Security - fencing, landscaping, security lighting to discourage vandalism and illegal entry, no hidden entrances and exits

This is because the school buildings mingle with the surrounding buildings, influencing the school's roles in the community, both educational and otherwise.

In addition, the SCA lays out three guidelines to maximize the learning experience of public schools:

1. *Creating dynamic and vibrant learning environments through the use of natural light, human scale, and color;*
2. *Creating facilities that are flexible and adaptable enough to meet the needs of the future; and*
3. *Designing buildings that are cost-effective, through the use of streamlined design standards and new technologies.*

The movement patterns and safety of the students and staff members are also important factors to consider. The SCA encourages extensive design meetings to best understand the unique traits and topographical limitations of each location and optimally meet the guideline requirements.

4. Types and Traits of Manhattan School Buildings

Building layouts of public schools in Manhattan generally

take one of the following shapes: “—”, “L”, “ㄷ”, “口”, “H”, or “T”. Those whose shape does not fall under one of these categories are considered to have an “irregular” shape. This study analyzes key examples of each layout type in terms of site proportion / relationship between site and driveway, main entrance location, and characteristics of open space.

4.1 “—” Type PS194

Table 2. PS194

Address: 244 WEST 144 STREET MANHATTAN, NY	
Building Layout Type	“—”
Site and Proportion	Rectangular, 1:2
Relationship between Site and Driveway(walkway)	2 driveways
Main Entrance	North
Open Space	Playground and sports facilities
Building Material	Stone Base/Brick/Punched Window

The site is located between the north and south blocks, and between clusters of buildings to the east and west. The “—” shaped building has its main entrance to the north, thereby maintaining frontality. The materials and surface pattern of the northern face of the building have been selected in consideration of the surrounding context. Meanwhile, the southern side of the building provides a bright and open outdoor space for the students and the community. The L-shaped outdoor space is maximally exposed southward, providing an ideal recreational space while providing maximum lighting to the south-facing classrooms. In addition, the L-shaped outdoor space visually connects the north and the south while providing recreational / athletic facilities to connect the communities to the north and south of the school. In effect, this type of outdoor space unites the communities of three blocks into a single unit. The “—” type layout creates relatively spacious and efficient outdoor space amidst the crowded blocks of Manhattan, providing open space for the community.

4.2 “L” Type JH113

Table 3. JH113

Address: 240 East 109th Street, New York, NY	
Building Layout Type	“L”
Site and Proportion	Rectangular, 1:2.5
Relationship between Site and Driveway(walkway)	4 driveways
Main Entrance	North
Open Space	Playground and sports facilities
Building Material	Brick and Curtain Wall System

The site of this layout type takes up an entire block, opening up all four sides of the site to the streets and allowing the school to become a community center for the eight adjacent blocks(including diagonally adjacent). The northern and eastern faces follow the surrounding context. The main entrance faces north to ensure the safety of students and staff members commuting via personal vehicles or school bus. The L-shaped building hugs the northeastern corner of the block, providing maximal sunlight and ventilation to the building while creating the ideal outdoor space. The outdoor space has three open sides, making it highly accessible to the community. In particular, by opening up an entire side to the avenue, the outdoor space becomes strongly cohesive with the community as the avenue forms an axis connecting the northern and southern communities. The heavy traffic in the avenue and the visual openness of the space make the school’s outdoor space highly approachable. The avenue side of the outdoor space hosts athletic and recreational structures for the community, while the more central portion of the outdoor space is designated for school usage. The “L” shaped entire-block configuration efficiently and effectively leverages the traits of the grid system, making it the most popular building type among Manhattan public schools.

4.3 “ㄷ” Type PS173

Table 4. PS173

Address: 306 Fort Washington Avenue, New York, NY	
Building Layout Type	“ㄷ”
Site and Proportion	Irregular
Relationship between Site and Driveway(walkway)	3 driveways
Main Entrance	West
Open Space	Playground and sports facilities
Building Material	Stone Base/Brick/Punched Window

The building is adjacent to the streets on three sides, which facilitates cohesion with surrounding blocks, but does not provide enough square area to independently accommodate all of the programs and outdoor space needed by the school. In addition, as the site does not fully cover the northern street, the main entrance is placed instead on the western side adjacent to the avenue.

One advantage of the irregular geometry of the site and the “ㄷ” shape of the building is that a buffer zone is naturally created to filter out streetside noise. While the open box shape strives to provide maximal lighting, ventilation, and circulation, the limited square area of the site leads to substantial differences in the lighting and ventilation among classrooms. The “T” shaped outdoor space displaced by the “ㄷ” shaped building can be small and isolated, potentially resulting in security issues. However, this school’s outdoor space is opened to the north and the south, creating a visual connection that resolves such safety concerns. The “ㄷ” type layout is the third most common type among Manhattan school buildings, selected for its flexibility in confined or irregular sites.

4.4 “ㄱ” Type MS247

The building site is bordered to the north and the south by streets, and to the east and the west by building clusters. The main entrance to the northern street maintains frontality and the light traffic of the northern street maximizes the safety of students getting on and off

Table 5. MS247

Address: 32 West 92nd Street, New York, NY	
Building Layout Type	“ㄱ”
Site and Proportion	Rectangular, 1:2
Relationship between Site and Driveway(walkway)	2 driveways
Main Entrance	North
Open Space	Playground and sports facilities
Building Material	Brick/Punched Window

the bus. Unlike PS194, this site is very confined. Thus, the “ㄱ” configuration has been selected to accommodate the building on a confined site. While the hollow box shape provides the benefit of unbroken circulation and an inner courtyard, the limited block size makes it difficult to create an outdoor space suitable for recreation, and the space may even feel congested. Furthermore, this configuration suffers from poor lighting and ventilation and is susceptible to external noise. However, a portion of the site is apportioned outside the box-shaped building so as to visually and spatially connect the northern and southern blocks. This outdoor space contains athletic and recreational facilities that help integrate the three community blocks.

4.5 “H” Type PS11

Table 6. PS11

Address: 320 West 21st Street, New York, NY	
Building Layout Type	“H”
Site and Proportion	Irregular
Relationship between Site and Driveway(walkway)	2 driveways
Main Entrance	North
Open Space	Playground and sports facilities
Building Material	Stone Base/Brick/Punched Window

The available space for this school is irregularly shaped like an “L”, and located between crowded residential

clusters. The building itself is shaped like an “H”, a common configuration for schools built in the late 18th century or the early 19th century. The “H” configuration is a historical school building layout from the early New York era. Frontality is established by placing the main entrance on the northern street where traffic is light. The two side wings blend well with the contextual masses, while opening up a central outdoor space to ensure circulation, lighting, and ventilation. The smaller courtyard to the north also provides sufficient space to facilitate the busy traffic of commuting students and staff, while the southern courtyard is left more spacious to maximize lighting and ventilation. However, the northern courtyard is the only outdoor space connected beyond the campus, limiting the school’s exposure to the surrounding blocks and the school’s role in the community.

4.6 “T” Type PS30

Table 7. PS30

Address: 144–176 East 128th Street, New York, NY	
Building Layout Type	“T”
Site and Proportion	Rectangular, 1:2.5
Relationship between Site and Driveway(walkway)	4 driveways
Main Entrance	North
Open Space	Playground and sports facilities
Building Material	Brick/Punched Windows

PS30 uses an entire block as its site. As all four sides of the site are exposed to the streets, the site serves as a community center for the eight surrounding blocks. This is the optimal school building configuration for the Manhattan grid system. Exposure to both avenues ensures sufficient pedestrian traffic for the school to be an important community space. The large school building is shaped like a “T”, with its main entrance to the north for frontality. Outdoor spaces are left in the southeastern and southwestern corners for maximum lighting and ventilation, while providing recreational or athletic facilities for the community. Access to both bordering avenues greatly

enhances the outdoor spaces, making the site valuable as a significant community recreation space.

4.7 “Other” Type PS33

Table 8. PS33

Address: 281 9th Avenue, New York, NY	
Building Layout Type	“X”
Site and Proportion	Irregular
Relationship between Site and Driveway(walkway)	2 driveways
Main Entrance	East
Open Space	Playground and sports facilities
Building Material	Brick/Punched Windows

The site is shaped like a “Z”, which is an irregular shape for a school site. The school facilities are interspersed around the apartment buildings on the block. PS33 is unlike other school sites in that, instead of adapting to the grid system, the building takes after the “X” shape of the adjacent apartment buildings. The “X” shape allows for balanced lighting and ventilation of the building and creates four triangular outdoor spaces between the building and the block perimeter. Frontality is westward, with the main entrance placed near the western avenue which allows for large volumes of traffic. The large open space in the northwest corner helps alleviate congestion during commuting hours. Athletic and recreational facilities are placed across the street from the northern block, providing an open space and a place of rest for the students and the community. The connection to the high-traffic avenue also helps vitalize the site as a social venue.

5. Analysis of Building Layouts and Streets

5.1 Building Layouts of Community School Districts(CSD)

Table 10 illustrates that the most common layout plans in CSD 1 were, in order, type “L”, type “□”, and

Table 9. Manhattan Community School District

Characteristics

CSD 1 is located near the southern end of Manhattan, along the East River. 10 of 15 researched schools in CSD 1 have an “a” block type and 5 of 15 researched schools have a “4” site type

CSD 2,

CSD 2 covers a large portion of Manhattan including the neighborhoods of the Upper East Side through the Financial District. 5 of 25 researched schools in CSD 2 have a “b” block type and 10 of 25 researched schools have a “4” site type.

CSD 3

CSD 3 is located on the west side of Manhattan, between Central Park and the Hudson River. 19 of 21 researched schools in CSD 3 have a “b” block type and 2 of 21 researched schools have a “4” site type.

CSD 4

CSD 4 is located on the upper east side of Manhattan and serves the neighborhood of East Harlem. 12 of 18 researched schools in CSD 4 have an “a” block type and 6 of 18 researched schools have a “4” site type.

CSD 5

CSD 5 is located in northern Manhattan. Neighborhoods within CSD 5 include Central Harlem and Manhattanville. 12 of 17 researched schools in CSD 5 have an “a” block type and 5 of 17 researched schools have a “4” site type.

CSD 6

CSD 6 is located at the northern end of Manhattan. Neighborhoods within CSD 6 include Hamilton Heights, Sugar Hill, Washington Heights, Fort George and Inwood. 12 of 22 researched schools in CSD 6 have an “a” block and 10 of 22 researched schools have a “4” site type.

Table 10. Building Layout Type Distribution Chart by CSD

		—	□	L	ㄣ	H	T	other
CSD 1	15	2	3	4	1	1	1	3
CSD 2	25	5	3	11	1	2	0	3
CSD 3	21	2	4	6	2	2	3	2
CSD 4	18	5	1	3	2	3	1	3
CSD 5	17	7	2	2	2	0	3	1
CSD 6	22	3	0	4	10	1	2	2
Total	118	24	13	30	18	9	10	15
		20%	11%	25%	15%	8%	9%	12%

the irregular type. In CSD 2, “L” type was most common, followed by type “—”. In CSD 3, “L” type was most common, followed by “□” type. In CSD 4, “—” type was most common, followed by “L” type, “H” type, and the irregular type. In CSD 5, “—” type was most common, followed by “T” type. In CSD 6, “ㄣ” type was most common, followed by “L” type. Overall, the surveyed Manhattan school building layout types were found to be in the following decreasing order: “L” > “—” > “ㄣ” > “other” > “□” > “T” > “H”.

5.2 Block Types and Building Layouts

According to the above table, 33% of Manhattan’s public schools are situated in type “a” blocks, 21% in type “b” blocks, and 46% in type “c” blocks. As the longest rectangular block type, type “a” blocks most often had an irregular layout, followed by types “—”, “ㄣ”, and “□”. The smaller rectangular blocks most commonly had type “L”, followed by type “□”. The irregularly shaped type “c” block also tended to have more “L” and “—” types of building layout.

Table 11. Manhattan Block Type

Manhattan Block Type	Characteristics
<p>a</p>	<p>“a” block type is located between 1st AVE and 5th AVE of Manhattan. The area of an “a” block type is about 8,280 sqM-11,700 sqM and consists of 34-48 lots. Each lot is 8m by 30m. Most schools in “a” block type have an area of half or 2/3 of a whole block.</p>
<p>b</p>	<p>“b” block type is located between 5th AVE and 12th AVE of Manhattan. The area of “b” block is about 16,000 sqM-18,400 sqM. Each block has 66 to 76 lots. Most schools in “b” block type have 1/3, 1/2 or 2/3 of a whole block.</p>
<p>c</p>	<p>There is an irregular type “c” created by the tilted axis of roads such as Broadway or by the shape of nature(rocks, elevation differences or waterfront) .</p>

Table 12. Building Layout Type Distribution Chart by Manhattan Block Type

		—	□	L	ㄷ	H	T	other
“a”	39	7	6	6	4	4	4	8
“b”	25	2	5	7	2	3	3	3
“c”	54	15	2	15	12	2	3	4
Total	118	24	13	30	18	9	10	15
		20%	11%	25%	15%	8%	9%	12%

5.3 Site Types and Building Layouts

According to the above table, of all public schools in Manhattan, 19% are located in type “1” sites surrounded by streets on all four sides, 30% in type “2” sites surrounded by streets on three sides, 34% in type “3” sites surrounded by two streets, and 16% in the irregular type “4” site. In type “1” sites, the most spacious type, irregular building layouts were found to be most common, followed by type “ㄷ”. In type “2” sites, “L” type buildings were most common, followed by type “ㄷ”. Type “3” sites also had “L” as the most common building layout, followed by type “□”. Type “4” sites also had “L” as the most common layout, followed by “—” and “other” types

Table 13. Site Type

Site Type	Characteristics
<p>1</p>	<p>“1” site type is surrounded by 8 blocks(north and south streets and east and west avenues), which is ideal for orientation, daylight, ventilation, accessibility, and openness.</p>
<p>2</p>	<p>“2” site type is surrounded by 5 blocks(north and south streets and east and west avenues). Most buildings with this layout type are located on the east or west side of the block. This block type is good for accessibility, daylight, ventilation and openness</p>
<p>3</p>	<p>“3” site type is only open to south and north streets. Usually, the north street is good for a main entrance and the south is suitable for open space for daylight but noise and daylight for classrooms are constrained by the surrounding buildings.</p>
<p>4</p>	<p>“4” site type has very limited access to daylight, accessibility, ventilation, and noise reduction.</p>

Table 14. Building Layout Type Distribution Chart by Site Type

		—	□	L	ㄷ	H	T	other
“1”	23	0	4	4	5	1	3	6
“2”	35	3	3	13	10	1	1	4
“3”	40	8	10	13	6	1	0	2
“4”	19	5	1	8	0	0	0	5
Total	118	16	18	38	21	3	4	17
		20%	11%	25%	15%	8%	9%	12%

5.4 Outdoor Space and Building Layouts

Due to the nature of Manhattan where buildings are placed very close to each other, outdoor space plays an important role in providing lighting, ventilation and space for recreation or athletics. Moreover, the type of outdoor space is determined by the combination of the site type and the block type. Site types 1 and 2 are surrounded by three or four roads, making it possible to provide outdoor space to neighboring blocks. On the other hand, the confined sites of type 3 and 4 lead to greater priority on the building layout, with the remaining space being used for outdoor activities.

Table 15. Building Layout Type

Building Layout Type		Characteristics
—		“—” is the simplest building layout type and is located on the north side of the site along the street. The shape of open space is determined by the location of the building on the site. Depending on the program requirements, “—” configuration is transformed to “L”, “ㄷ” or “ㄱ” building layout type which makes for more complicated outdoor spaces. As mentioned above, the Manhattan grid system doesn’t have enough width(30m) to develop a complicated building configuration or many useful outdoor spaces for students and the community at the same time.
L
ㄷ
ㄱ
H		Another typical location of the building types is in the middle of the site creating more than two open spaces. “ㄷ”, “ㄱ”, “H”, “X”, and “O” types are common building types. The downside of the complicated building shapes is that it is difficult to have ideal daylight, ventilation, noise, security and safety all together
T
other

6. Conclusion

There are seven building layout types of elementary and junior high schools in Manhattan: “—”, “L”, “ㄷ”, “ㄱ”, “H”, “T” and “other” type. Of these, “—” type and “L” type occur most frequently, because these configurations most flexibly fit into the grid-locked blocks, the various types of topography, and adapt most dynamically to the open spaces created by using avenues and streets. The biggest factors that determine the types of building layout are as follows.

First, the shape and size of blocks can influence the building layout type. The larger the block, the more ideally rectangular the site becomes, allowing more freedom in deciding the placement of buildings or open spaces. As the above table illustrates, “L” type is the most ideal layout, because it keeps the outdoor space contiguous, large, and connected to the street. Furthermore, if the site is wide enough, many variations of layouts can be attempted.

However, when the block is smaller or irregular, the size of the site can also shrink or become irregular in shape. In such conditions, the most simple types “—” and “L” can provide the most reasonable and effective way to create outdoor space on a spatially limited site. If placed on a confined site, a “L” shaped building may be extended into “ㄷ” and “ㄱ” configurations.

While the “L” type was most often found in the larger blocks, it can also be used flexibly on blocks of smaller shape. The “L” shape allows for optimal lighting, ventilation, and outdoor space even when the site is limited in size.

Secondly, the building layouts of Manhattan’s public schools are affected by the type of site and the number of sides touching the street. The most ideal type of site is one that uses the entire block, becoming surrounded by streets on all sides. Such layouts allow for more freedom in determining open space, which readily interacts with the nearby streets for frontality. However, the buildings are generally placed northward to maximize the outdoor space, ventilation, and lighting afforded by the southern part of the site. Moreover, the street sides of rectangular blocks are often selected as the spots for the main entrance due to the safety and approachability afforded to commuters and school busses. On blocks surrounded by streets on three sides, the “L” type was found to be most common, as it effectively filters out noise from surrounding buildings while creating an appropriate amount of outdoor space. The type 3 site also has its frontality and main entrance to the north. Type 3 sites and irregular blocks tend to be confined. When constructing buildings in such small spaces, the configuration may change from “L”, to “ㄷ”, to “ㄱ”, if increase in the demand for program necessitates building expansion. Although more complicated configurations may finally provide the layouts needed, they also face greater disadvantages with regard to lighting, ventilation, and placement of the open space, which are regarded to be less important than securing all the indoor space the school needs for its programs.

Lastly, building layout type also influences the size and shape of the outdoor space. The more complicated the

perimeter of the building and the more central the location of the building are, the more outdoor space is created. Although buildings on sites that use entire blocks may obstruct the appropriate outdoor space, it is far less economic for smaller sites to create complicated configurations which may only result in shadowy, hidden pockets of campus ground that can lead to security issues.

This study surveyed, analyzed, and outlined the characteristics of school building layout types of Manhattan's public schools. Although the study may provide a point of reference when planning school layouts conjoined with adjacent streets, one should remember that the cases referred to come from New York City, which has many different factors from Korean cities. Further study is warranted for the street-conjoined school layouts in the Korean context.

Bibliography

1. Eric Homberger and Alice Hudson , The Historical Atlas of New York City: A Visual Celebration of 400 Years of New York City's History, Holt Paperbacks, 2005
2. Eric W. Sanderson and Markery Boyer, Manhattan: A Natural History of New York City, Abrams, 2009
3. Hilary Ballon, The Greatest Grid: The Master Plan of Manhattan, 1811-2011 ,Columbia University Press, 2012
4. Peter C. Lippman, Evidence-Based Design of Elementary and Secondary Schools: A Responsive Approach to Creating Learning Environments, Wiley, 2010
5. Kim, Mi-Hyung Lee, Eul-Kyu Kim, Jun-Kyung, A Study on Layout Types of High Schools -Focused on High Schools Which Were Built from 2000 to 2004 in Gyeonggi Province, The Journal of Korean Institute of Educational Facilities v.12, n.4, July, 2005
6. Kim, Seung-Je, A Study of Exterior Space by Promotion Type in Elementary Schools, The Journal of Korean Institute of Educational Facilities v.16, n.6, Nov, 2009
7. Yang, Kum-Suek, A Study on the Layout and External Space of High School in Gyeongnam Area, The Journal of Korean Institute of Rural Architecture v.10, n.3, Aug, 2003
8. You-Jin Kim, "A Study on Revitalization of Elementary School Exterior Space to the Street."
9. New York City Public Schools Demographic and Enrollment Trends, 1990-2002(Manhattan)
10. http://en.wikipedia.org/wiki/Commissioners'_Plan_of_1811
11. <http://schools.nyc.gov/Offices/SCA/AboutUs/default.htm>

접수 2012. 12. 17
1차 심사완료 2013. 2. 3
게재확정 2013. 3. 8