ELEVATING THE COMMUTER EXPERIENCE

Public Transportation Facilities – Subway Design Guidelines

By

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A thesis

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In fulfillment of the

Thesis requirement for a Diploma in Architecture

Toronto, Ontario, Canada, December 2011

Author's Declaration

I hereby declare that I am the sole author of this thesis.

Acknowledgements

This thesis represents a significant milestone in my life. I enrolled in the RAIC Syllabus program in the fall of 1990. The program quickly became an integral part of my life. It wasn't long after enrolling, when family and friends realized the time and demand of the program and were always there to provide support.

The RAIC Syllabus program provided me with flexibility, and the necessary life, work, and educational balance required accommodate a mature students lifestyle. Without a program like this, I could never have become an architect and achieved what I have today.

I could not have achieved the goal of completing this thesis, and the many design levels that preceded it without the help and support of the many. I'm very grateful for the mentors that attend the studios on a weekly basis and have given their time, energy, and support throughout the duration of my time in the program.

I'm very grateful to Mariusz Gontarz, John Tassiopoulos, and Mohamad Mamiche for the direction and guidance and the most special commodity, their time.

In addition, many others helped me in this endeavor; Debbie Deller, Marek Zawadzki, Dr. Nina Marie Lister, Dr. D.J. Armin, Paul Stevens, Bill Curran, Marcelo Graca and Jeanne Fox.

Most importantly, I am thankful to family. My parents provided me with the values to always complete what we start and the drive to succeed. And lastly, my wife Sheri, and boys Austin and Spencer, for providing their sustained patience, throughout the many years of continued learning.

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Chapter 1

D9A - Initial Thesis Proposal

INTRODUCTION

December 15, 2008

INTRODUCTION

This thesis looks at the theoretical proposition that there is a correlation between good design and increased use of a facility.

The notion of creating a well-designed public transit building in response to a commission for a client and site-specific use is not new. However, the proposition that the creation of a well-designed public transit building is capable of increasing use in direct relation to its design is new. This approach questions whether a design theory or formula can be developed and used as a mechanism to measure use related to design.

This thesis will research the architectural design attributes related to public transit facilities and determine the relationship between increased use and the key design elements identified. Research will seek to understand and examine why significant numbers of people do not like using public transit and whether there exists a relationship to transit facility design.

> *"Commuters younger than 25 used a vehicle to get to work — either as a driver or a passenger — 57.2 per cent of the time. Those age 25-34 commuted by car 66.1 per cent of the time, and those 35 and over drove or were driven 75.8 per cent of the time."* -1

Toronto, like many cities that surround the Greater Golden Horseshoe Area (GGHA) has experienced significant population growth over the last 30 years. The scope of this growth can lead to increased commuter traffic. One factor that will impact traffic congestion within the city is the expansion of the public transportation system.

To deal with this expansion, public transit facilities in many cities across North America, and specifically the GGHA will have need of a new approach to their design. This proposal envisions an approach that will accommodate the projected population growth and the trend towards urban growth within city centers by providing well designed public transit facilities that attract and encourage more public use.

Population and Projected Population for the City of Toronto – 2	Population and Projected Population for the Greater Golden Horseshoe Area - 2
2001 – 2,590,000	2001 – 7,790,000
2011 – 2,760,000	2011 – 9,090,000
2021 – 2,930,000	2021 – 10,330,000
2031 – 3,080,000	2031 – 11,508,000

1 – Article – Public transit, walking favored by younger Toronto commuters, The Canadian Press, http://www.cbc.ca/canada/toronto/story/2008/04/02/census-commute.html

2 – Publication – Places To Grow, Growth Plan for the Greater Golden Horseshoe, Ministry of public Infrastructure Renewal, Ontario

This thesis proposes that a new approach to the design of public transit facilities is required to meet the expanded needs and to redefine the function of public transit facilities in such a way as to encourage increased use.

The area of study will be the city of Toronto, however the goal of this thesis is to develop a prototypical model than can be used in other growing urban areas within North America.

Key Issues

The city of Toronto's public transportation system has an existing network of major and minor public transit stations. This goal of this thesis is to show the relationship between well-designed public transit facilities and the volume of passengers that use them.

This thesis will focus on the design of public transit facilities in an effort to clearly define what constitutes the successful design of public transit station. These design attributes will then lead to a prototypical solution that can be implemented across the GGHA.

The main issues to be analyzed are:

1 Community - Transit stations designed as public spaces that facilitate community interaction.

2 Places - Transit station design that creates interesting public places for people and is not viewed as a service corridor such as a water pipe or electrical conduit.

3 Technology - Transit station design that integrates all aspects inherent in the technology required making the transit systems work while at the same time creating appealing and functional facilities.

4 *Multi -Use* – Transit facility design that contributes to the expands the use of these facilities to a wider group of commuters?

5 Safety – Ensuring the public is offered a crime free facility is paramount to increased use. Designing a facility that provides the comfort of personal safety in both perception and reality can increase the likelihood that ridership is maintained and increased.

6 Speed – Transit station design that provides commuters with rapid movement in and out of the facility as well as easy access to alternative modes of transportation within one location

The success and expanded use of transit facilities of the twenty first century will require that they take their architectural form and place within the city as a direct response to these key issues. Designing successful transit stations will require attention be provided to numerous issues together rather than individually.

Premise

Continued expansion of the city's boundaries outward into Greenfield areas is a declining option as the *Places To Grow Act, 2005* is enforced. As a result, the city of Toronto is now required by law to expand inward and maximize the use of existing infrastructure in the spaces between the city and the suburbs.

The continued increase in population in the GGHA is likely to negatively impact the environment with an increase in automobile use. Designing public transit stations that the public is motivated to use can significantly reduce the impact of population growth on the environment.

This thesis is not an urban planning study, although urban planning issues will be examined in order to place the architectural problem in context. Once an understanding of the urban issues is understood, development of an architectural program and solution will be possible.

Statement

There is a direct relationship between the successful and increased use of public transit facilities and their design.

Public transit facilities that address the key design issues identified will ensure the sustained base of commuter ridership and can even precipitate an increase in use. This increase is measurable and is one of the many considerations necessary to the successful provision of alternatives to automobile use and a reduction in negative environmental impact.

Research Focus

Research will focus on understanding why more people do not use public transit within Toronto and the correlation between that and the design of public transit facilities. There will be an additional focus on existing cities where public transit is widely used to identify the reasons for these variances in an effort to develop a programme of goals and objectives for a new transit facility.

Research Method

An analysis of existing public transit facilities throughout the Toronto area will be conducted. These facilities will be categorized into groups based on a number of criteria such as; size, location, use, etc. In addition, I will extend my research in two main categories of information gathering that can be defined as theoretical and statistical.

Theoretical research will be obtained from reading relevant studies and theories related to transit station planning that are not built or are planning studies.

Statistical data will be obtained through personal interviews, review of statistical data available through government agencies, current books and case studies, architectural/transportation periodicals, and utilize the Internet as a source.

The research findings will direct conclusions and determine the relationship between good design and the use of public transit facilities. A summary of the findings will be tabled and outline the areas of design focus for the demonstration portion of the project.

A set of criteria will be suggested that will form the basis for a new prototypical public transit facility. The next phase of this thesis (9B) will be to select a suitable site and design a public transit facility that responds to the research and issues identified.

Chapter 2

D9A - Thesis Research Submission

INTRODUCTION

November 23, 2009

INTRODUCTION

This thesis began with the theoretical proposition that there is a correlation between good design and increased use of a facility (refer to appendix A). The intention was to determine a set of architectural design criteria that will improve the travel experience for commuters when using public transit as many of the public transit facilities in Toronto, Ontario fail to provide commuters with a dignified travel experience.

The notion of creating a well-designed public transit building in response to a commission for a client and site-specific use is not new. However, the proposition that the creation of a well-designed public transit building is capable of dignifying the travel experience in Toronto, Ontario is new.

This thesis will research the architectural design attributes related to subway transit facilities and determine the aspects of design that improve a commuters travel experience. Research will seek to understand and examine why significant numbers of people do not like using public transit and whether there is a relationship to subway facility design.

There are many factors that influence the increased use of a facility although many of these factors are not under the control of the architect and the design. Accordingly, the focus of this thesis has shifted to search for design elements that will elevate the commuters experience when using subway transit stations. This will allow for a criteria and standard to be developed that can assist in achieving a higher level of design for these facilities. A well designed subway station that provides commuters with the comfort, services, quality, and convenience is expected to draw more commuters to use the facility.

Toronto, like many cities that surround the Greater Golden Horseshoe Area (GGHA) has experienced significant population growth over the last 30 years. The scope of this growth can lead to increased commuter traffic. One factor that will impact traffic congestion within the city is the expansion of the public transportation system.

To deal with this expansion, public transit facilities in many cities across North America, and specifically the GGHA will have need of a new approach to their design. This proposal envisions an approach that will accommodate the projected population growth and the trend towards urban growth within city centers by providing well-designed public transit facilities that attract and encourage more public use.

"Commuters younger than 25 used a vehicle to get to work — either as a driver or a passenger — 57.2 per cent of the time. Those age 25-34 commuted by car 66.1 per cent of the time, and those 35 and over drove or were driven 75.8 per cent of the time." -1

1 – Article – Public transit, walking favored by younger Toronto commuters, The Canadian Press, http://www.cbc.ca/canada/toronto/story/2008/04/02/census-commute.html

INTRODUCTION (con't)

Population and Projected Population for the City of Toronto – 2

2001 – 2,590,000
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Population and Projected Population for the Greater Golden Horseshoe Area - 2

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This thesis proposes a new approach to the design of public transit facilities is required to meet the expanded needs and to redefine the function of public transit facilities in such as way as to encourage increased use.

The area of study will be the city of Toronto, Vancouver, and selected cities around the world that have extensive public transportation systems. The goal of this thesis is to develop a prototypical model that can be used in growing urban areas within North America.

PREMISE

Continued expansion of the city's boundaries outward into Greenfield areas is a declining option as the Places To Grow Act, 2005 is enforced. As a result, the city of Toronto is now required by law to expand inward and maximize the use of existing infrastructure in the spaces between the city and the suburbs.

The continued increase in population in the GGHA is likely to negatively impact the environment with an increase in automobile use. Designing public transit stations that the public is motivated to use can significantly reduce the impact of population growth on the environment. This thesis is not an urban planning study, although urban planning issues will be examined in order to place the architectural problem in context. Once an understanding of the urban issues is understood, development of an architectural program and solution will be possible.

KEY ISSUES

The city of Toronto's public transportation system has an existing network of major and minor public transit stations. This thesis will focus on the design of subway transit facilities in an effort to clearly define what constitutes the successful design of subway transit stations. These design attributes will then lead to a prototypical solution that can be implemented across the GGHA.

2 – Publication – Places To Grow, Growth Plan for the Greater Golden Horseshoe, Ministry of public Infrastructure Renewal, Ontario

INTRODUCTION (con't)

The main issues to be analyzed are:

Community – Subway transit stations designed as public spaces that facilitate community interaction.

Sense of Place – Subway transit station design that creates interesting public places for people and is not viewed as a service corridor such as a water pipe or electrical conduit.

Technology – Subway transit station design that integrates all aspects inherent in the technology required making the transit systems work while at the same time creating appealing and functional facilities.

Multi -Use – Subway transit facility design that contributes to expanding the use of these facilities to a wider group of commuters?

Safety – Ensuring the public is offered a crime free facility is paramount within subway transit facilities. Designing a facility that provides the comfort of personal safety in both perception and reality can increase the likelihood that rider ship is maintained and increased.

Speed – Subway transit station design that provides commuters with rapid movement in and out of the facility as well as easy access to alternative modes of transportation within one location

The success and expanded use of subway transit facilities of the twenty first century will require that they take their architectural form and place within the city as a direct response to these key issues. Designing successful transit stations will require attention be provided to numerous issues together rather than individually.

In addition to the factors identified above, there are many additional factors that are not under the control of the architectural design solution, however these factors have a significant influence on the success of a facility. These include the cost, the location, urban planning allowances and restrictions, etc. For the purpose of the thesis, the only factors that are under the control of the architect and influence of architectural design are considered.

Good Design vs. Bad Design

What is the definition of good design? An essay by **Eberhard H. Zeilder**, Design and the Urban Environment, offers some insight. In this essay, Mr. Zeilder states that design cannot be isolated to a single element such as a single building, chair, or painting, but it fulfills the idea of *Gesamtkunstwerk* (total art work). Mr. Zeilder goes on in the essay to talk about an example of the Anglican Church in Toronto and it's surrounding development and the loss of the sense of place because the city did not recognize the importance of the concept when the church was built and it's connection with the city would be lost after development of the surround lands.

INTRODUCTION (con't)

Mr. Zeilder also describes the theory of design being able to influence our life expectancy and the research of Roger S. Ulrich on this topic, *"Based on medical records, he investigated the results of a surgical ward in a hospital over a ten (10) year period on the healing results of patients. He reestablished, with everything being equal, severity of operations, medical and nursing staff etc., that patients located in rooms with a pleasing view (a delightful landscape) showed a thirty percent less use of analgesic drugs than those who were in rooms with a boring view (brick wall)." -3*

A quote by **Frank Lloyd Wright** about design and it's importance in our lives, *"The longer I live the more beautiful life becomes. If you foolishly ignore beauty, you will soon find yourself without it. Your life will be impoverished. But if you invest in beauty, it will remain with you all the days of your life." - 4*

Le Corbusier has a similar feeling, in that good design is as fundamental to life as food and sleep, *"Space and light and order. Those are the things that men need just as much as they need bread or a place to sleep." - 5*

Charles Eames offers his point, that the details are the most important aspect of design, "*The details are details. They make the product. The connections, the connections, the connections. It will in the end be these details that give the product its life. " - 6*

So what is it that makes good design?

Good design simply stated is a design that is a response to the environment in which the object is placed. The design must speak to the environment to which it is placed while incorporating the needs of the program it requires. The ***"beauty"*** in the design *(Frank Lloyd Wright)* or the ***"Space, Light, and Order"*** *(Le Corbusier)*, or the ***"details"*** *(Charles Eames),* all appreciated by the critical eye of the public.

Good design is an elusive definition to establish as it ranges from the smallest detail to an overall design scheme. The ultimate goal is to understand what makes a successful subway transit facility and identify the key factors required to achieve a higher level of design.

STATEMENT

The modern subway transit station is a unique building type and is more than a pure functional node that transfers passengers from one point to another. The design of transit facilities provides an opportunity to enhance commuters travel experience through architecture that embodies the spirit and life of the city .

Subway transit facilities that address the key design issues identified will ensure a sustained base of current commuter rider ship while elevating and dignifying the commuter experience.

3/4/5/6 – Publication, Design does Matter, An anthology of Essays, Toronto, 2nd Edition, Teknion, 2005

INTRODUCTION (con't)

RESEARCH FOCUS

Research examines why more people do not use public transit within Toronto and Vancouver in an effort to establish a correlation between public concerns and the design of subway transit facilities. Model transit systems if different cities were selected to compare where public transit is widely used and identify the reasons for these variances in an effort to develop a program of goals and objectives for a new subway transit facility.

RESEARCH METHOD

An analysis of existing subway transit facilities throughout the Toronto and Vancouver area has been conducted. Case studies of Vancouver's Millennium and Canadian Line as well as Toronto's Subway System were visited and documented. The case studies examine each subway facility and compare the design; platform depth, public spaces, transition of spaces, natural light, security, etc.. The study examines facilities to arrive at a possible conclusion as to why rider ship is significantly higher per capita in some cities, than in Toronto, Ontario. Theoretical research will be obtained from reading relevant studies and theories related to transit station planning that are not built or are planning studies.

In addition, third party design reports and similar studies have been examined as well as undertaking public surveys to determine likes and dislikes commuters have about using public transportation.

The research findings have made it possible to summarize the observations, approach and design direction that will lead a design demonstration project of s subway transit facility. A summary of the findings has been tabled identifying the social, economical, and environmental impact of each key design issue and outline the areas of design focus for the demonstration portion of the project. The next phase of this thesis (9B) will be to select a suitable site and design a public transit facility that responds to the research and issues identified.

This goal of this thesis is to understand how excellence in design, using contemporary program requirements, will establish a new form and order of train station architecture with a return to the excitement and monumentality of transportation buildings.

Chapter 3

HISTORY OF TRAIN STATION ARCHITECTURE

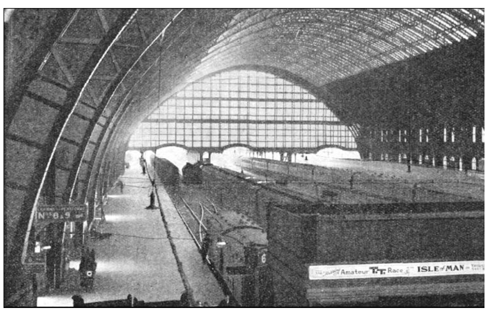
HISTORY

Historical Background of The Building Type

The development of passenger train systems in England, the United States and around the world are products of the industrial revolution. The building and invention boom during the early 1800's created s need to move transport people, goods, and services, from place to place, over large distances. This change resulted in the creation of a new building type that had never before been required.

This new building type would accommodate passengers coming and going during their travel, to the steam engine trains themselves, baggage for the passengers, and as travel increased, hotels, and places for eating, etc. were integrated within the new building type.

The first modern public transit station(s) in the world were constructed in parallel in both Europe and the United States of America. They were the Liverpool and Manchester Station in England, and the Baltimore and Ohio Railroad station in United States of America both were completed in 1830.



Liverpool, Manchester, UK, 1830 - 7

Baltimore and Ohio, USA, 1830 -8

HISTORY (con't)

Train station design became representative of national and historical pride as well as corporate ambition. Stations became monuments of independence, such as Helsinki's great terminal of 1904. It was the first real expression of Finnish independence as well as Milan Central station as a monument to Mussolini's fascist hegemony.

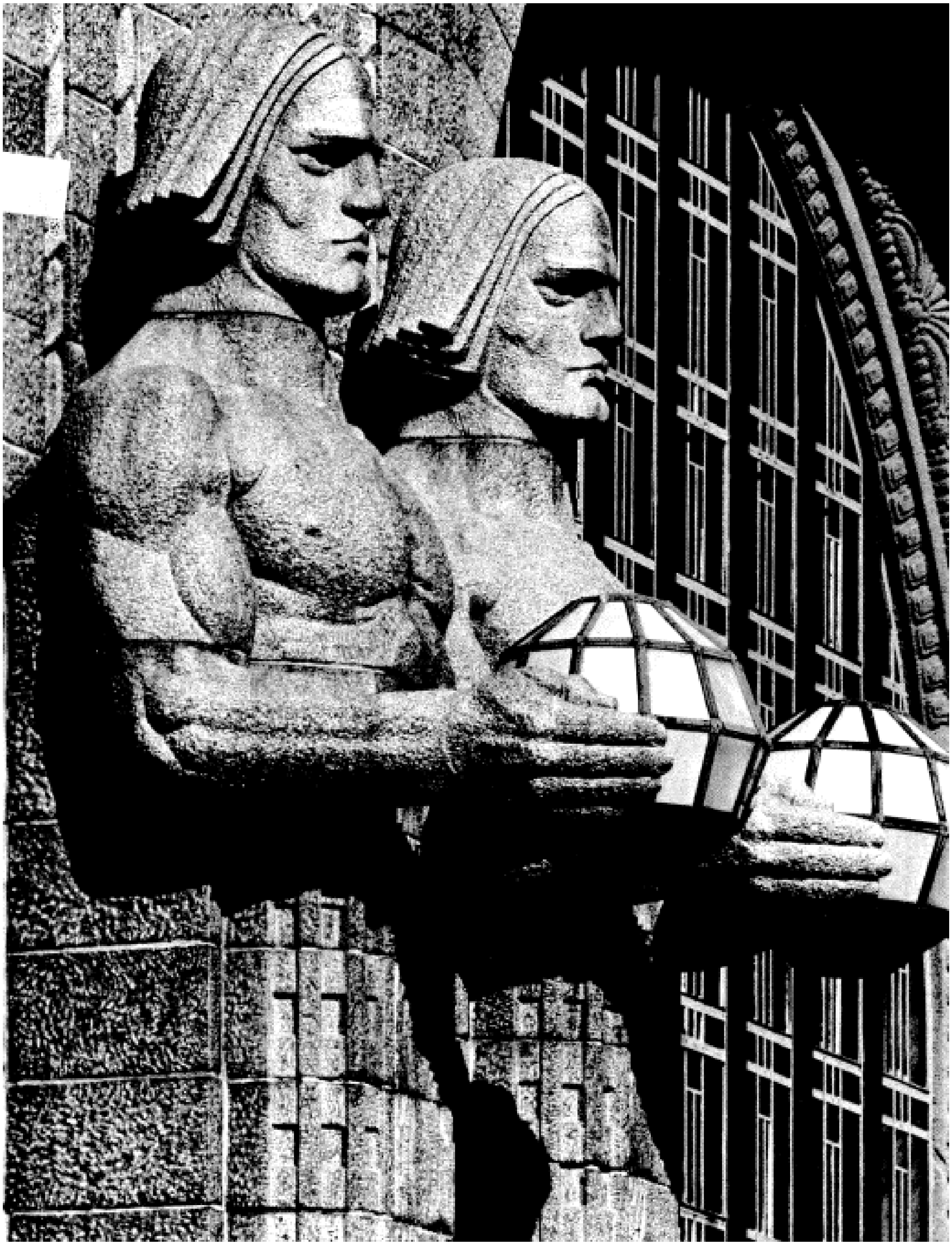
The terminal was also a place that served dual purposes during war times. The station was both a distribution centre for troops and war materials as well as a gathering point for families to see loved ones off. In Paris, Gare de l'Est was the principal centre for troop distribution in the wars against Germany in 1870, 1914-1918 and 1939-1940. Given their importance during wartime, they soon became war monuments with the addition of victory arches, statues of fallen soldiers, etc.

Stations around the world recorded the arrival and departure of many famous and influential men and women in history. The deceased bodies of Queen Victoria, king Edward VII and King George V all passed through Brunels Paddington station as well as Franklin D Roosevelt's body brought through Washington's Union Station. Lenin's arrival from Stockholm in St. Petersburg on April 16, 1917 was said to have been apart of the beginning of the Russian Revolution.

The station design was new to public buildings, although it was to become one of the most prominent building types of the industrial age. The railway terminal was often the centre of the planning or re-planning of towns and city centers. There was no precedent to follow, so its form was derived from its function, to shelter passengers from the elements when departing to and from the train to the station. This function soon took the form and symbol of a city gate with a large arch that were used to span the tracks and cover the platforms.

Helsinki Station, Helsinki, Finland, 1904, Eliel Sarrien – 9

9 – Steven Parissien, Station to Station, page 171, London, Phaidon Press Limited



Detail – Helsinki Station, Helsinki, Finland, 1904, Eliel Sarrien – 10

10 – Steven Parissien, Station to Station, page 170, London, Phaidon Press Limited

Pennsylvania Station, New York, 1910, McKim Mead and White - 11

11 – Steven Parissien, Station to Station, page 154, London, Phaidon Press Limited

HISTORY (con’t)

The Baltimore and Liverpool station was a basic building, required only to serve as a point of entry to identify a stop, a point of relay. There was no shed for the trains, and no cover for the passengers outside of the station when awaiting arrivals.

Early train stations were finding their way in terms of design and planning. There were four main types of station plan:

1 - The Head Type, this type has arrival and departure in a single building that spans across the end of the tracks.

2 – The Two Sided or Twin Type, with arrival and departure handled on opposite sides of the tracks.

3 – The ‘L’ type, with arrivals at the end of the tracks and departure at one side or vice versa.

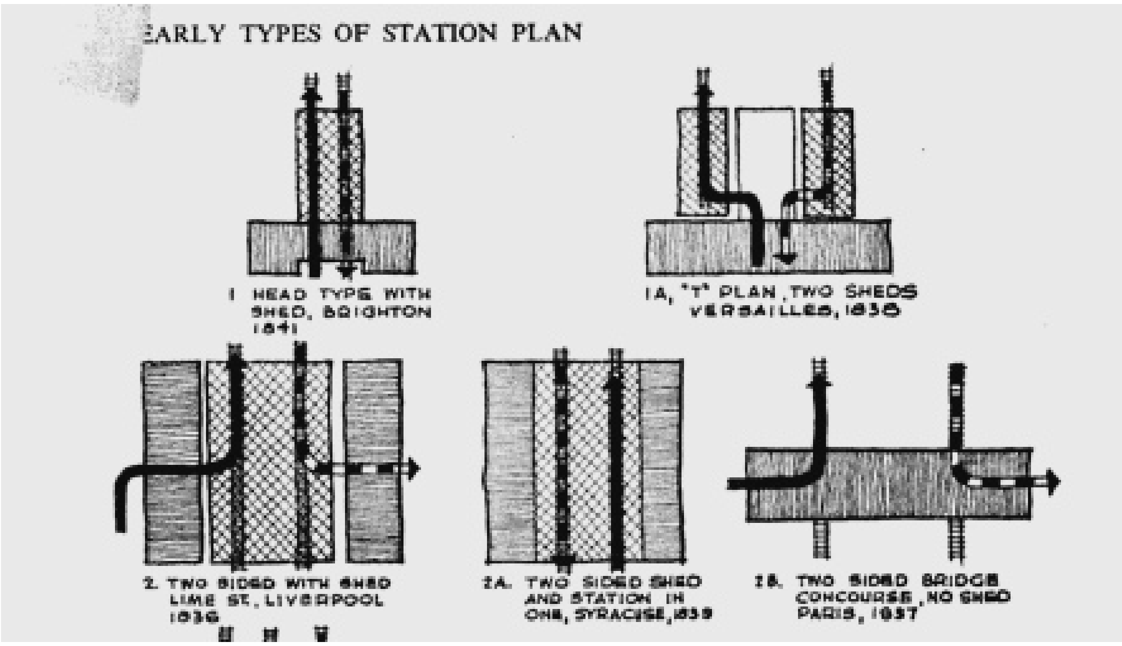
4 – One sided combination type, with arrival and departure on one side of the tracks

Station planning was logical and organized. The two main elements of the train shed were vestibules and barriers. The vestibules were the holding areas for passengers such as waiting rooms, restaurants, ticketing lobbies, etc. The barriers were the areas that were sued to direct circulations such as the colonnades, platforms, and were sued to separate arriving and departing passengers.

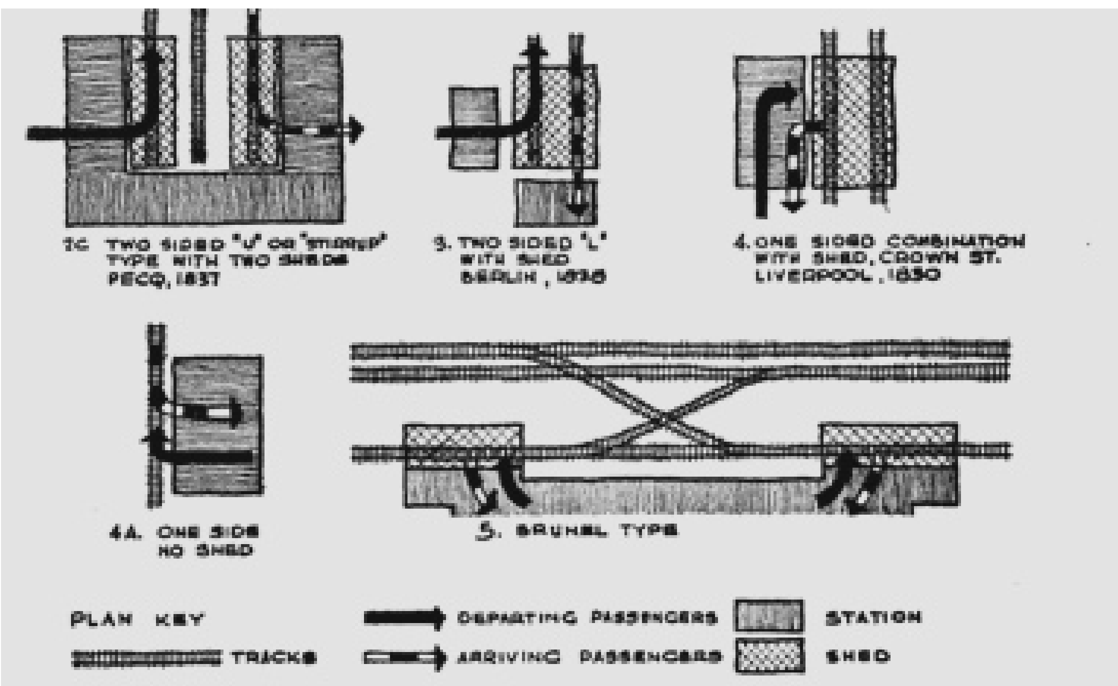
Early train station design was planned with the administrative building on one side (4 - One Sided) of the tracks allowing arriving and departing passengers to mix. Another type of station design is the dual sided (2 - Two Sided) station having platforms on both sides of the tracks allowing the arriving and departing passengers to be separated and improve the passenger circulation during peak periods of travel. A third type is the head Type (1-Head Type) where the main administrative building is centralized between the tracks and serves both arrival and departing passengers. This plan requires the main administrative building to span over the tracks for access to the platforms.

The One Sided combination type, the original style use in both Mount Clare in Baltimore and Crown Street in Liverpool, became the most commonly used. This was the most efficient and economical for the wide variety of passenger volumes and allowed for only one principal building to accommodate both arrivals and departures.

HISTORY (con't)



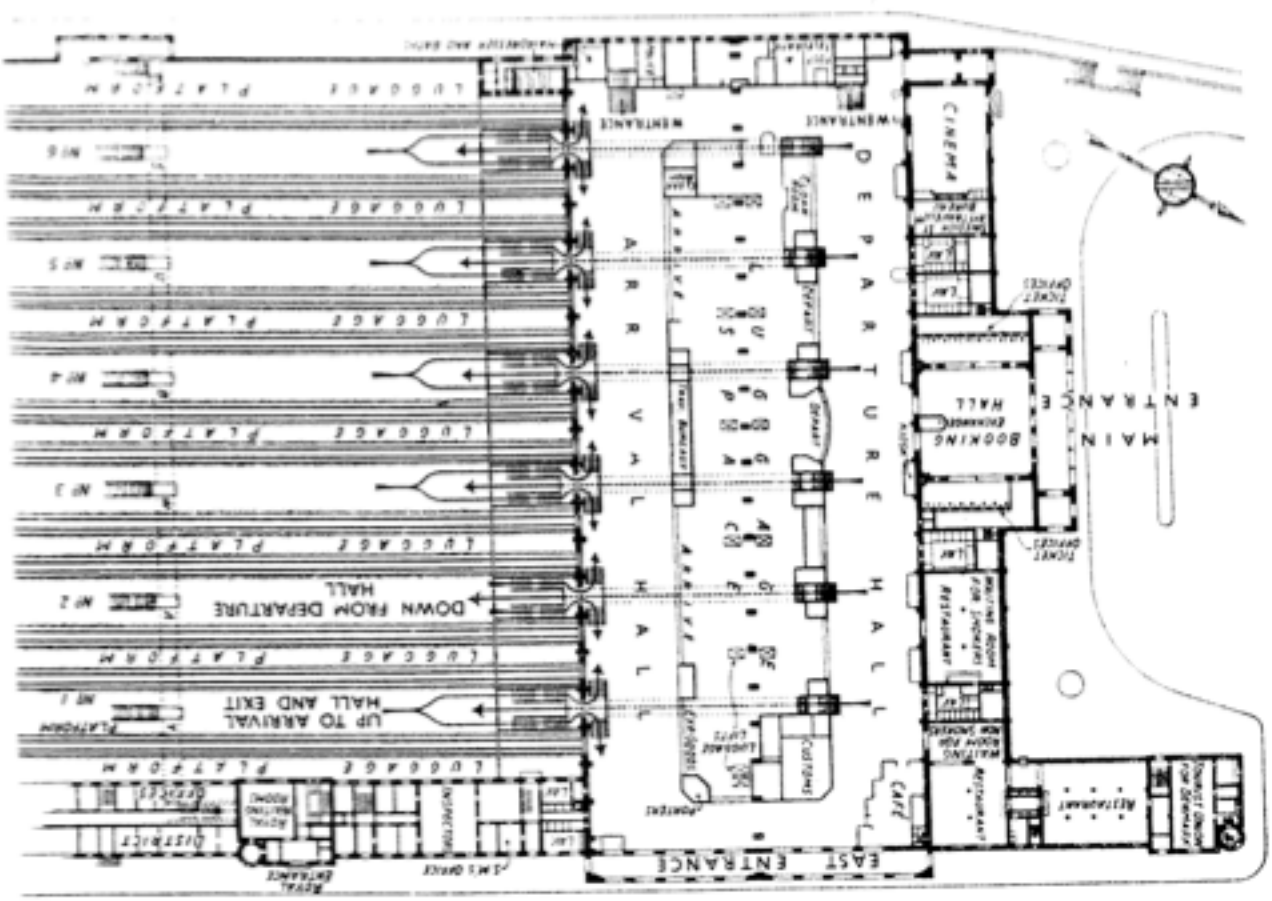
Detail – Track & Platform configuration - 12



Detail – Track & Platform configuration - 13

12/13 - Carroll L.V.Meeks, <u>The Railroad Station, page 30</u> : <u>An Architectural History</u>. New York: Dover Publications Inc., 1956

HISTORY (con't)



Plan – Head type configuration – platform – arrivals and departure, Copenhagen Central Station, 1906-11 by H.E.C. Wenck - 14

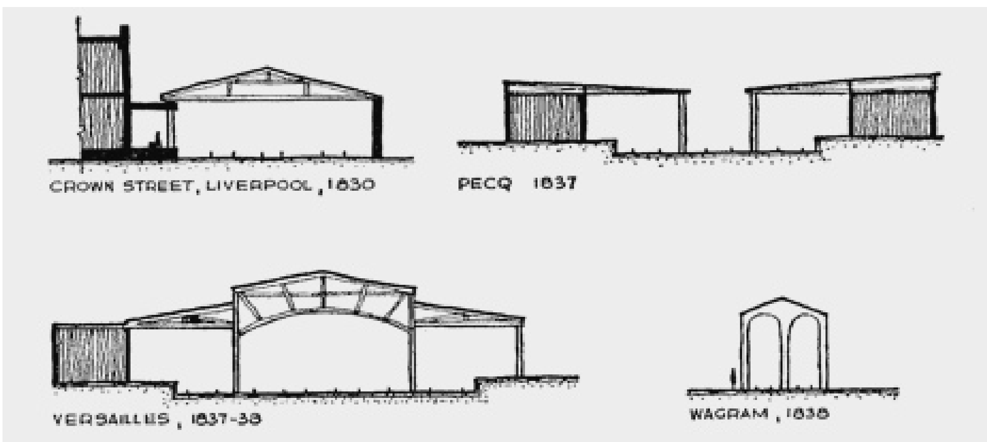
14- Carroll L.V.Meeks, The Railroad Station, illustrations : An Architectural History. New York: Dover Publications Inc., 1956

HISTORY (con't)

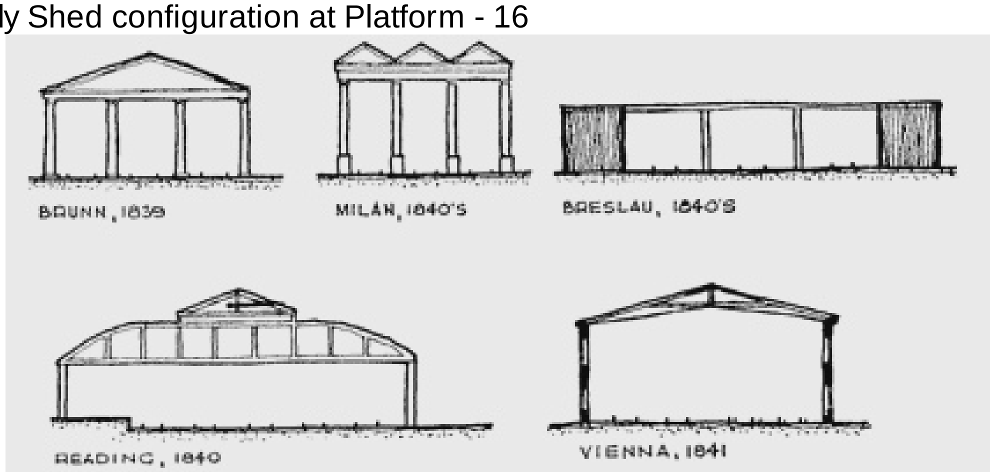
The invention of the passenger train at the beginning of the nineteenth century resulted in a massive requirement for new buildings around the world and a building type that had not existed until the emergence of this new technology. The design requirements were both architectural and engineering where the architect would undertake the principal station, and the structural engineer would undertake the platforms and the shed for the trains.

As the stations became more complex, larger, and incorporated inns, and larger spaces for gathering, there became a competition among architects and engineering teams to see who could achieve the larger spans with uninterrupted spaces and volumes.

"Toward the end of the century, engineers rivaled one another with wider and more daring spans. The railroad companies took pride in their colossal halls and lavished their funds upon them, presumably motivated by considerations of publicity and prestige." - 15



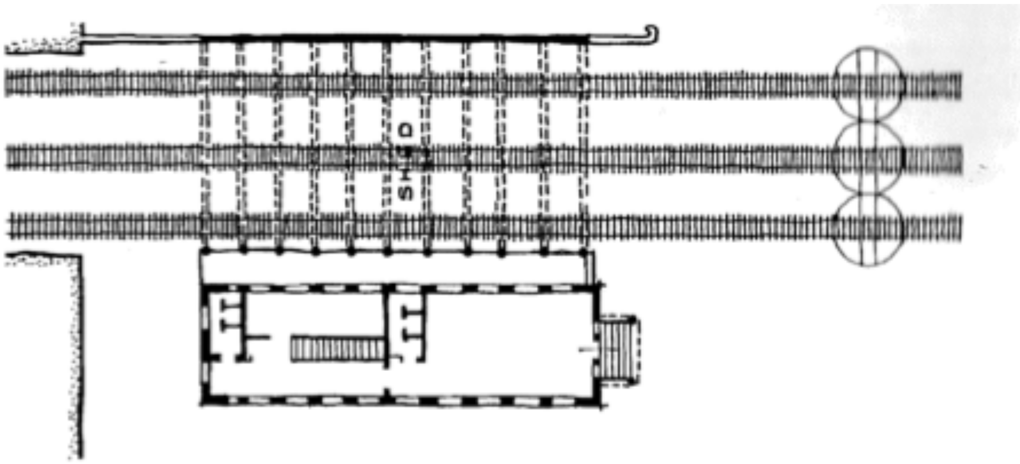
Detail – Early Shed configuration at Platform - 16



Detail – Early Shed configuration at Platform - 17

15- Carroll L.V.Meeks, The Railroad Station, page 35 : An Architectural History. New York: Dover Publications Inc., 1956
16/17- Carroll L.V.Meeks, The Railroad Station, illustrations : An Architectural History. New York: Dover Publications Inc., 1956

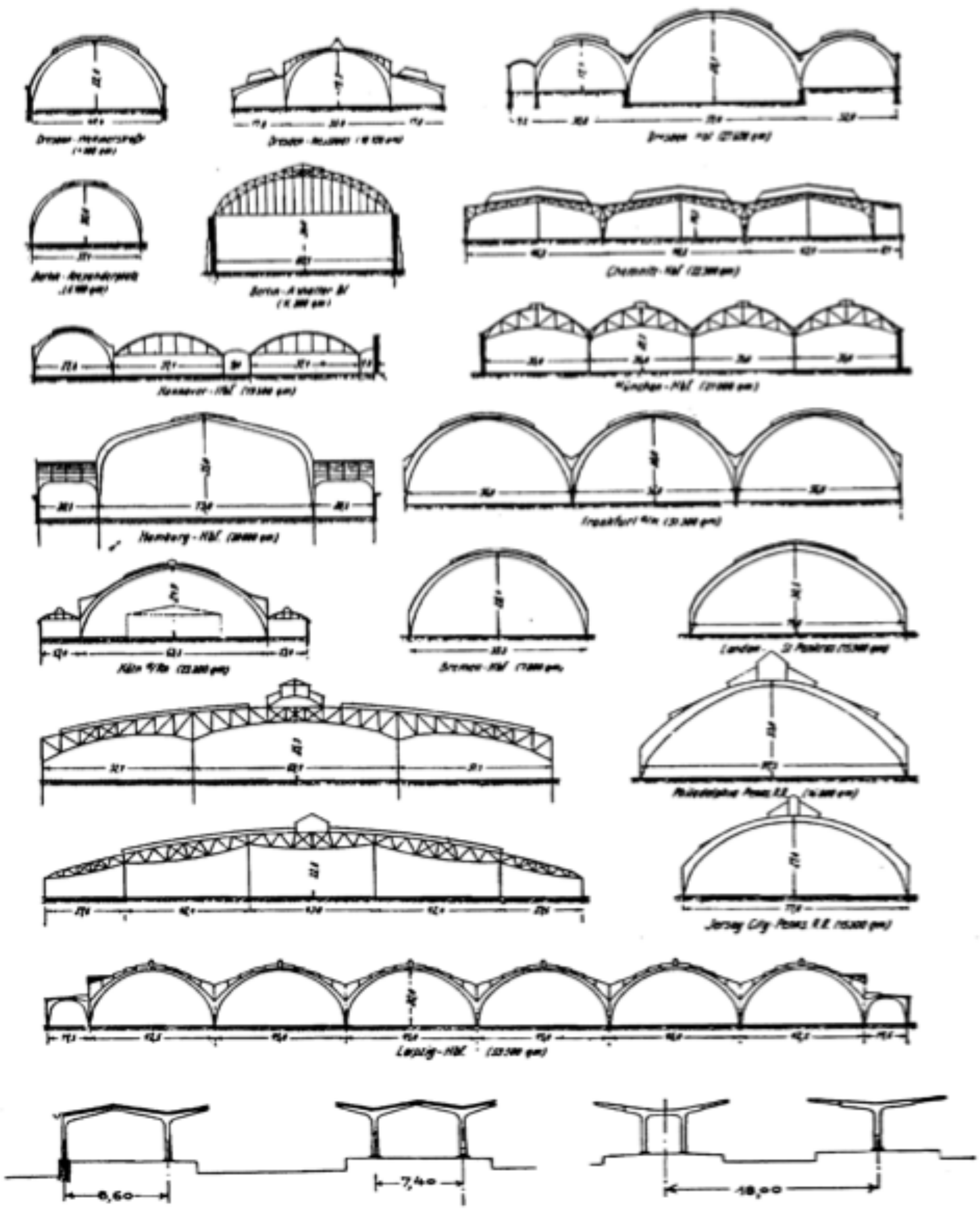
HISTORY (con't)



Plan and photo of head type with Shed addition at tracks, Liverpool Crown Street Station, 1830, Architect, John Foster II - 18

18- Carroll L.V.Meeks, The Railroad Station, page 35 : An Architectural History. New York: Dover Publications Inc., 1956

HISTORY (con't)



Detail – Shed configuration – Arch - 19

19- Carroll L.V.Meeks, The Railroad Station, Illustrations : An Architectural History. New York: Dover Publications Inc., 1956

HISTORY (con't)

Structural Span

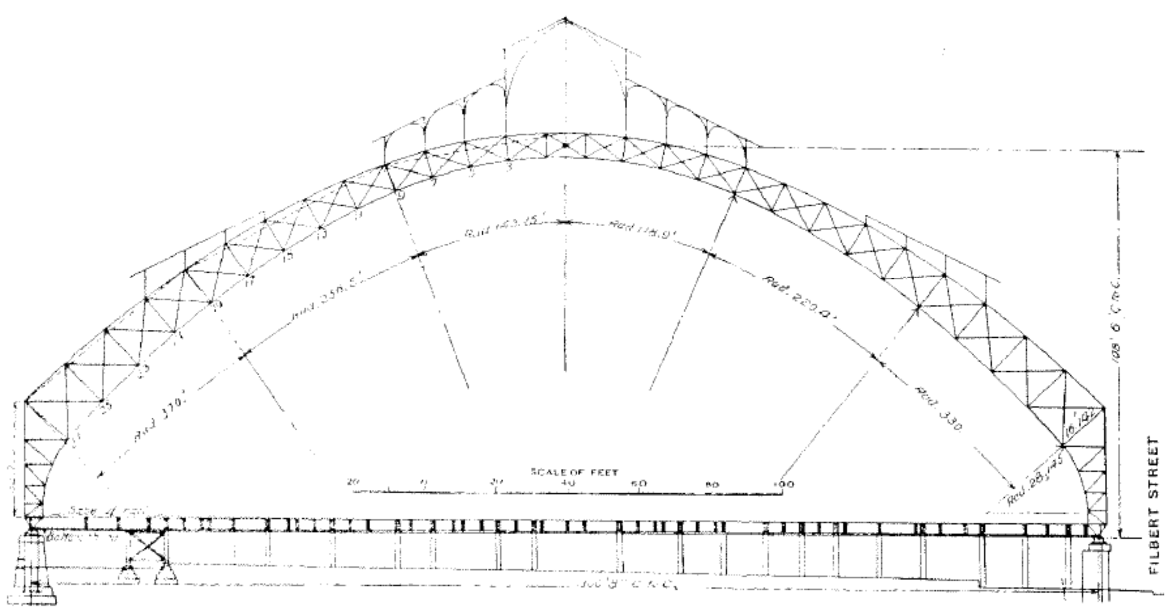
By 1846, achieving a clear span of 100 feet became fairly commonplace.

"Masonry spans of this width had been occurred a few times: the widest vaulted span erected in the Middle Ages is that at Gerona of 73 feet; the nave of St. Peter's in Rome equaled the widest Roman span of 84 feet; the width of the domed nave of Hagia Sophia is 107 feet." - 20

New materials such as iron and steel were emerging and allowed architects and engineers to achieve spans of 211 feet at the New Street Station in Birmingham in 1854 and 238 feet at the Paddington Station in London, England.

The structural framework that continued was advancing after the 1850's using metal for trusses and arches with wood frame becoming obsolete. The wood truss systems were susceptible to the sulphur within the steam and caused rapid deterioration.

104. Philadelphia, Broad Street Station. Wilson Bros. and Co., engineers and architects, 1892-93. Section through train-shed. (See also Figs. 126, 127.)

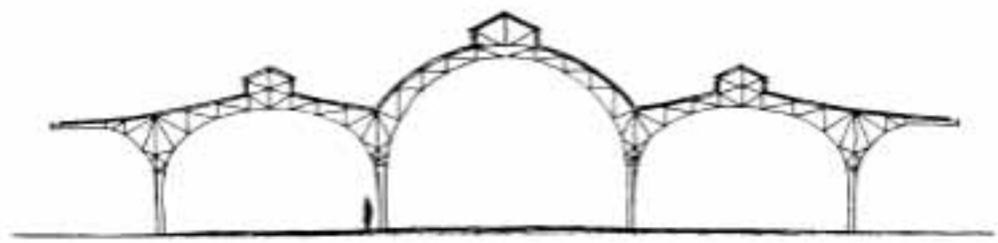


Train Shed Section across tracks – Broad Street Station, Philadelphia, Wilson Bros. and Co. engineers and architects, 1892-93 – 21

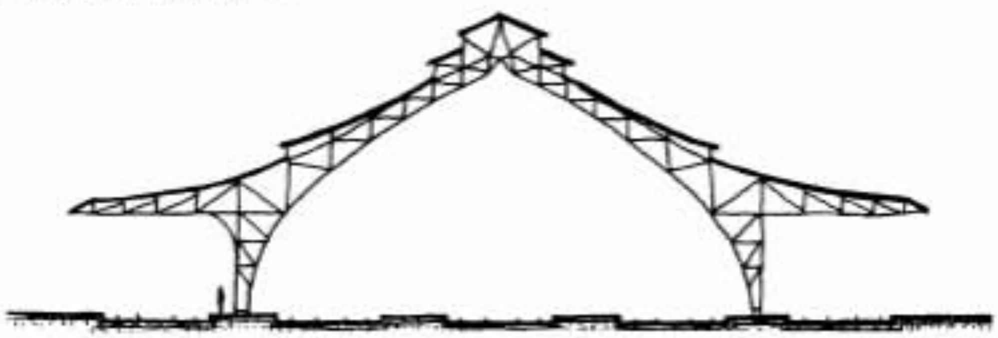
20- Carroll L.V.Meeks, <u>The Railroad Station, Illustrations</u> : <u>An Architectural History</u>. New York: Dover Publications Inc., 1956
21- Carroll L.V.Meeks, <u>The Railroad Station, Page 36</u> : <u>An Architectural History</u>. New York: Dover Publications Inc., 1956

HISTORY (con't)

105. New Orleans, Illinois Central Station. Section through train-shed. (See also Fig. 33.)



106. Chicago, Illinois Central Station. Bradford L. Gilbert, architect, and J. F. Wallace, engineer, 1892-93. Section through train-shed.



Detail – Section profile at track and platform - 22

22- Carroll L.V.Meeks, The Railroad Station, Illustrations : An Architectural History. New York: Dover Publications Inc., 195

HISTORY (con't)

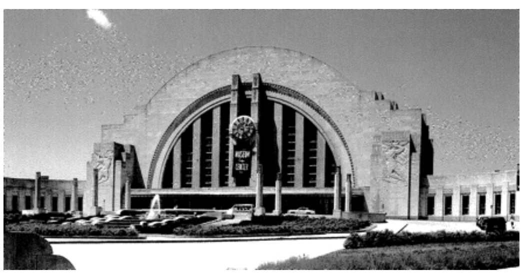
Early Train Station Architecture - Key Architectural Design Elements

Four key design elements begin to characterize early train station architecture. They were the shed, the arch, the clock tower, and the colonnade.

The Arch

The arch appeared singly and in multiples. This design element marks the entry to a point of significance, and marked the railway as a gesture towards a gateway of the city. You can see examples of the arch in many exemplary designs for train stations such as the Gare de l'est in Paris, 1847.

From the exterior the arch could display glazing and transmit natural light upon the interior spaces. It could also be representative of the location of the tracts within the shed and define interior space. The arch was a symbol of achievement for both the architect and the engineer, a point at which their expertise crossed paths.



Union Station, Cincinnati, Ohio, 1924, Roland Wank - 23

Helsinki Station, Helsinki, Finland, 1904, Eliel Sarrien - 24

23/24 – Steven Parissien, Station to Station, page 174 & 190, London, Phaidon Press Limited

HISTORY (con't)

Paddington Station, London, England, 1854, K. Brunei and M.D. Wyatt - 25

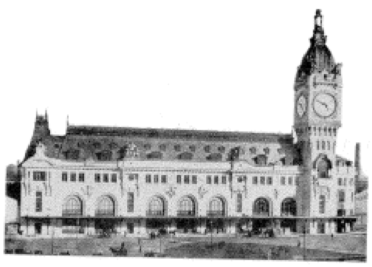
25 – Steven Parissien, Station to Station, page 48, London, Phaidon Press Limited

HISTORY (con't)

Early Train Station Architecture - Key Architectural Design Elements
The Clock Tower

Towards the close of the nineteenth century, another design element was introduced and helped to distinguish the train station from the urban landscape. The clock tower became a significant element to signify the building's location, similar to a minaret of a mosque or a tower for a cathedral.

The tower also helped to break up a continuous and sometimes monotonous facade and horizontality of the stations principal elevation. The clock tower also added to break the well-assigned symmetry of the train stations main elevations. The use of the clock tower is much more prevalent in North American and European examples than Latin examples. This may be due to the strictness of being on time as an aspect of cultural discipline.



Gare de Lyon, Paris, France, architect Marius Toudiere, 1897 - 26

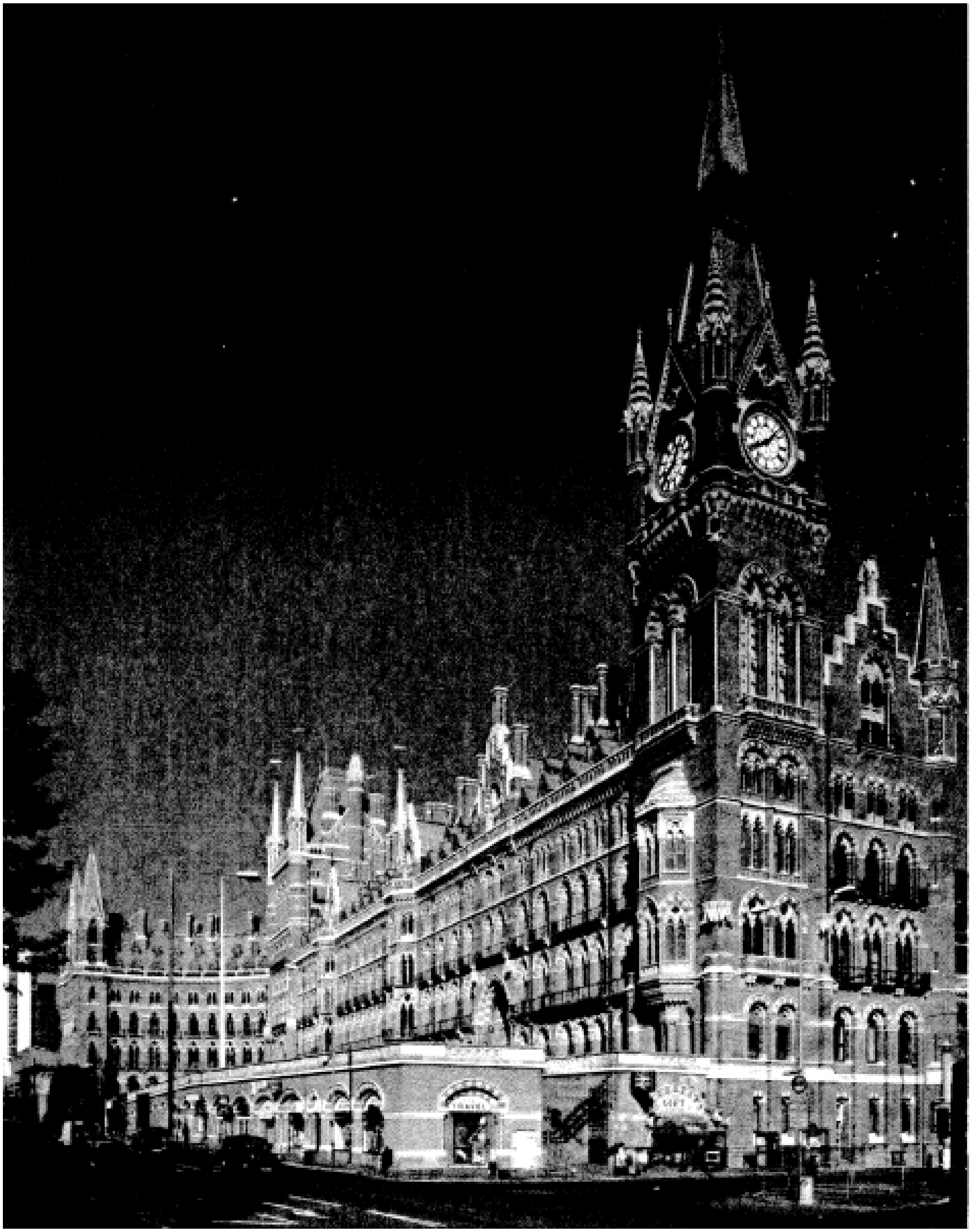
"The prevalence of station clock towers in the Northern Hemisphere was not, according to Dethier, entirely coincidental. In Europe, he argues, station Towers are most rare in the Latin countries, where the notion of time is less strict, whereas they abound in countries renowned for their social discipline." 27

Union Passenger Terminal, Los Angeles, California, Architect Donald and John Parkinson, 1939 - 28

27 - Carroll L.V.Meeks, The Railroad Station, page 37 : An Architectural History. New York: Dover Publications Inc., 1956

26 & 28 - Carroll L.V.Meeks, The Railroad Station, Illustrations : An Architectural History. New York: Dover Publications Inc., 1956

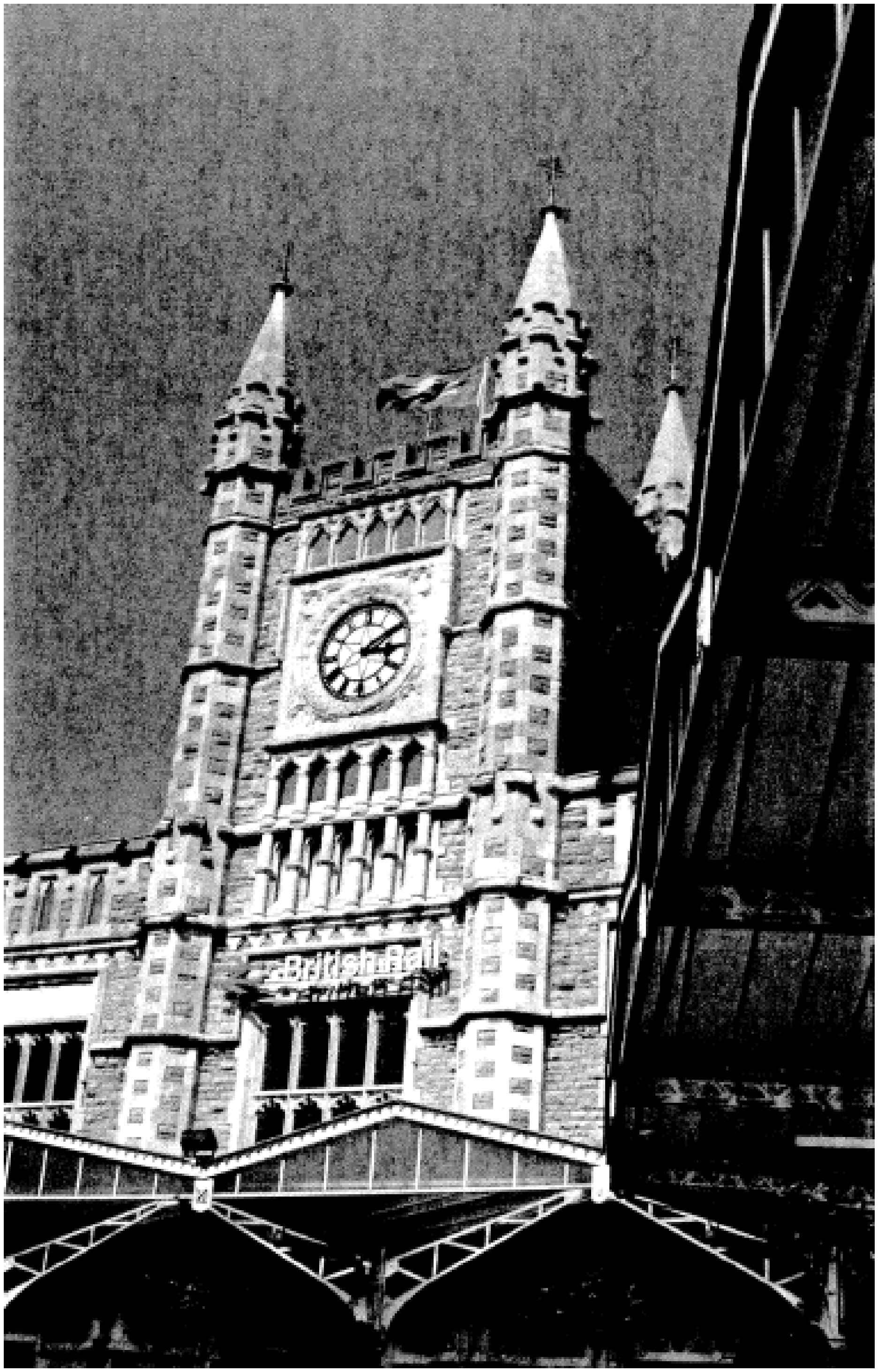
HISTORY (con't)



Pancras Station, London England, 1873, George Gilbert Scot - 29

29 – Steven Parissien, Station to Station, page 57 London, Phaidon Press Limited

HISTORY (con't)



Temple Meads Station, Bristol, England, 1878 – 30

30 – Steven Parissien, Station to Station, page 45 London, Phaidon Press Limited

HISTORY (con't)

Train Station Style

In the early 19th century, and the development of this new building type, the question was, "*Which station has the right look?" -31*

"*There was an idea that the station was to the modern city what the city gate was to the ancient city." - 32*

A new building type was emerging and there were many different approaches. Which one was the best? As the stations grew to meet the demands of increased use, they became more complex. Which element should dominate, and how were the four original elements (arch, shed, colonnade, and clock tower) of the passenger train stations to be included within the design if at all.

As a result of the growing need for a vast number of stations to be built as economical as possible, and easily designed, the 19th train station developed several styles in which derivative elements were subordinated to the original traits.

First, the Italian villa style that is presumed to have been a source as a result of the backgrounds in paintings of by Raphael, Claude, and Poussin. Another source of inspiration, often mixed with the Italian villa was pre-gothic styles. These styles were often combined, and the boundaries between them loosely regarded. The styles offered a method for easily designed, impressive scale, and without rules. The addition of a bell to announce arrivals, and a clock tower, and surround these elements with the train shed.

The English architecture of early train station design tended to adopt many different styles such as roman, Greek, Italian, etc. Columned porticos were attached to many of the stations designed in the 19th century, defining an entry or gateway to the city or in someway claiming that they were as monumental as museums.

French architects incorporated their experiences with other new 19th century challenges such as the need for other large public building that required large spans and complexity such as libraries, market places, and department stores.

31/32 - Carroll L.V.Meeks, The Railroad Station, page 39: An Architectural History. New York: Dover Publications Inc., 1956

HISTORY (con't)

Train Station Style

"*French architects successfully integrated their station complexes just as they also solved other new, 19th century problems such as the library (Bibliotheque St. Genevieve), the market (Les Halles), the opera, and the department store (Le Bon Marche')." - 33*

The French believed that the architecture of a monumental building should express its purpose. The French used the key elements of the station (the clock tower, the arch, colonnade, and the shed) as the principal characteristics of the architectural design, where as the English would use a primary component of the program such as a hotel form the building and principal elevation.

Euston Station, London, England, 1846 - 34

33 - Carroll L.V.Meeks, The Railroad Station, page 42: An Architectural History. New York: Dover Publications Inc., 1956

34 - Carroll L.V.Meeks, The Railroad Station, Illustrations: An Architectural History. New York: Dover Publications Inc., 1956

Chapter 4

HISTORY OF SUBWAY TRANSIT ARCHITECTURE

HISTORY - Subway

The first urban subway system in the world was developed in London, England. The principal supporter behind this initiative was the City Solicitor, Charles Pearson. He began the push for this innovative approach to movement within the city after the opening of the pedestrian tunnel that passes under the Thames River. Engineering for the tunnel was design was by Isambard kingdom Brunnel in 1853.

The world's first underground subway system was a quarter mile link between Paddington Station and Farrington Station. This quarter mile length was serviced by steam locomotives and opened to the public on January 10, 1863. The construction method used was called the cut and over method, where a trench was created, the tracks laid, and then the tunnel formed and the earth was replaced with the street and landscape above being replaced.

Paddington Station – London, England - 35

Farrington Station – London, England - 35

The first line (The Metropolitan) was an immediate success and had nine million passengers in its first year. The Metropolitan remained the only subway in the world for thirty years. In 1890, London opened its second underground line, called the Tube. The construction method used for the Tube tunnel was by boring a tunnel underneath the city. The Tube line used electric cars instead of the steam-powered version that was used on the Metropolitan.

HISTORY - Subway

The first subway in the United States was in Boston, Ma., open to the public September 1, 1897. The new subway line traveled above ground for a portion of its route and then went underground parallel to Tremont Street as it approached the busy downtown area adjacent to the historic Boston Commons area. The subway was said to be a cure of a disease according to George C. Cocker, Chairman of the Boston Transit Commission,

"The streets in the heart of our city….have for many years been seriously congested. The cars on that length (Tremont Street), dragged their slow length along the mournful processions and at the hours of greatest traffic, especially between five and six o'clock in the afternoon, it was not unusual for cars to take fifteen minutes to go half a mile, an sometimes they were even longer than that. Such was the disease." - 36

Scollay Square Station, Boston, 1900 - 37

36 – Brian J. Cudahy, Cash Tokens and Transfers, page 87: A History of Mass Transit in North America. New York: Fordham University Press., 1982
37– Brian J. Cudahy, Cash Tokens and Transfers, page 85: A History of Mass Transit in North America. New York: Fordham University Press., 1982

HISTORY - Subway

The New York subway system began operation in 1904. The subway line ran from downtown Manhattann to the Grand Central Terminal in Midtown Manhattan, then west to Times Square.Additional lines were continually added extending the subway system to 145th and then 180th streets in the Bronx. In 1908 the subway was extended to Brooklyn.

Street Kiosk Entry to subway, New York, 1906 - 38

The subway system was an immediate success and additional lines were being added throughout the city as well as a link under the Hudson River in 1908 that would connect Manhattan and New Jersey.

Entry to Hudson subway, New York, 1912 - 39

38 – Brian J. Cudahy, Cash Tokens and Transfers, page 120: A History of Mass Transit in North America. New York: Fordham University Press., 1982
39– Brian J. Cudahy, Cash Tokens and Transfers, page 121: A History of Mass Transit in North America. New York: Fordham University Press., 1982

HISTORY – Subway

Subway systems began to be constructed all over the world as an efficient means to move around the city underground and avoid the increasing traffic congestion. In 1896, Budapest opened the first subway on the European continent. Paris, France opened the Metro in 1900 line that was 6 miles long.

The Metropolitan as it was named, initially connected Porte de Vincennes to Porte Maillot. The subway system continued to expand and is now comprised of 131 miles of track on 14 separate lines. One key feature of the layout of the network of lines throughout the city is that you are always within a 500 meter walk of a Metro station from any building in Paris.

The design of the stations begins with unique and interesting entrances to the subway from the street through art nouveau portals.

Subway station entry - Abbesses Station, Paris France - 40

40 – "Top Ten Metro Stations in Paris", May 31, 2009, Travel Work Life, www.travelnetwork.net

HISTORY – Subway

The stations themselves are like museums with marble lined walls, exhibits, and replica art work for the passenger to enjoy.

Subway Platform – Varenne Station, Paris France - 41

The most extensive subway system in the world remains to be London, England with 252 miles of track and 279 stations. New York's system has 230 Miles of track and 462 stations. Paris has 105 miles of track with 270 stations.

Subway transit development continued to expand in cities around the world as an effective and efficient means of travel and controlling urban sprawl. In addition to subway travel, light rail transit became popular as an alternative to the high costs attributed to underground rail systems and the infrastructure required for these rail networks.

41 – "Top Ten Metro Stations in Paris", May 31, 2009, Travel Work Life, www.travelnetwork.net

Chapter 5

CASE STUDIES - TORONTO AND VANCOUVER

INTRODUCTION

WHY TORONTO AND VANCOUVER?

The following case studies analyze the current status of public transit facilities in Toronto, Ontario and Vancouver, British Columbia. These cities were selected as they represent two of Canada's largest cities that have existing public transit infrastructure. Both systems have many similarities and distinct differences. The main difference relevant to this study is that Vancouver's rider ship is almost double to Toronto when adjusted to suit the population differences. This thesis endeavors to understand why transit use in Vancouver is dramatically higher than many other major cities including Toronto, Ontario.

RELATING THE KEY ISSUES TO ARCHITECTURAL DESIGN

As stated in the introduction, the key issues to be analyzed in this study are; sense of place, community, technology, multi-use, safety, and speed. This thesis examines the architectural design to determine if the key issues are supported or neglected and what aspects of the building design contribute to the success or shortfall of project.

SENSE OF PLACE AND COMMUNITY

The first two key issues (Sense of Place and Community) occur in architecture, to various degrees of success, by default. That is, a simple construct of a wall encloses space, and can be described as architecture. Does this constitute good design, and create a Sense of Place or Community?

A quote by Christian Norberg-Schulz helps define this condition, *"Collective dwelling, thus, is not a mere coming together, but a being in the world somewhere as somebody. It is the somewhere, the place, which makes life visible. It fixes or keeps life, in the sense of a record or image which remains, explains or invites." - 41*

SENSE OF PLACE

Christian Norberg -Schulz defines sense of place as *"The Place, therefore, unites a group of human beings, it is something which gives them a common identity and hence is a basis for fellowship or society." – 42*

Creating a sense of place is important to architecture in that an individual's personal connection to a place will provide meaning to our lives; provide a sense of belonging and identification with a particular location. The choices we make as architects in the design of buildings determine the quality of the place, and the ability to become memorable.

41/42 - Christian Norberg-Schulz, The Concept of Dwelling, page 51: On the way to figurative architecture. New York: Rizzoli International Publications Inc., 1985

INTRODUCTION

COMMUNITY

Communities in architecture are collective places where learning about the world of others in the community occurs. Christian Norberg-Schulz quotes Louis Khan's words: *"A city is a place where a small boy, as he walks through it, may see something that will tell him what he wants to do his whole life". -43*

The community is part of the city, and it is the place where meeting takes place. The architectural design of public transit station need to respond to this obligation to the city and community. Providing architecture that offers the means to connect, exchange ideas, products and experience life with fellow man.

SAFETY AND TECHNOLOGY

Safety and technology are also key issues that affect the architectural design of public transit facilities and influencing the amount a commuter chooses to use a facility. A well design facility that embodies excellence in providing space, form, and order cannot be created in today's environment without dealing with new technologies and personal security. Technology and security are issues that have been imposed on the practice of architecture similar to the many of the requirements defined in local building codes or designing for accessibility.

The architectural solution will be inform the design, although design requirements for safety and technology should not lead the design.

SAFETY

The relationship of personal safety in architectural design is a perceived emotion. With the increase in a cities population, comes a corresponding amount of crime depending upon local conditions (economic, and social). Architecture is capable to respond to the public's perception of feeling insecure in public transit facilities through the design, form, lighting, feeling of enclosure, views to the exterior, etc. Safety is an issue of public concern and the perception of safety can enhance the commuters travel experience.

Although there are low amounts of reported incidents in public transit facilities, related to worldwide cities of a similar size and nature to Toronto and Vancouver, security remains high on the list of key issues when determining choices for urban commuting. There are two aspects to the issue of safety. The first is designing for personal safety as it relates to individuals being assaulted, crime, and the exposure to the elements of urban society. The second is personal safety that relates to accidental personal injury incurred as a result of the station design.

43 - Christian Norberg-Schulz, The Concept of Dwelling, page 51: On the Way to Figurative Architecture. New York: Rizzoli International Publications Inc., 1985

INTRODUCTION

SAFETY (continued)

Public safety is one of the most important aspects of the public transit facility design. Public transit facilities manage extremely large volumes of passengers each day and the architectural design must accommodate this requirement and ensure that public safety is built into each design element.

Architectural design elements that impact personal security are:

- Lighting, exterior and interior, natural lighting, etc.
- Clear lines of sight through platforms, stairways, etc.
- Use of technology, panic buttons, cameras etc.
- Adequate platform depth to accommodate large passenger volumes during peak periods
- Clear fire exit plans, visual aids to communicate emergency plans to passengers

TECHNOLOGY

Expressing technology architecturally will define a point in time that a building is conceived.

Technology can be expressed architecturally in many ways. It can be the span of the structure, the fabrication of the materials, the electronic devices used to communicate the arrivals and departures, as well as the speed of the train between transfer points. Technology affects every element within the transit facility and is constantly changing. Utilizing the latest technology in the design of transit facilities is capable of influencing the many choices passengers have today for transportation.

MULTI-USE

Multi-use transportation facilities are centralized buildings that provide various modes of transportation for commuters as well as services.

Multi-use facilities provide an opportunity for unique combinations of architectural program and choice for commuters. These combinations of program could result in the development of interesting architectural building types and forms. In addition, the combining of multiple modes of transportation create efficiencies in the construction of these large facilities and also create opportunities for improving commuter satisfaction by allowing increased access and improved frequency of connections.

Multi-use facilities have the ability to influence use by making the commuters transfer from transportation type (i.e. bus to subway) much more efficient. Architecturally, public transit stations that have centralized and frequent access points could encourage increased use.

INTRODUCTION

SPEED

The nature of today's society demands speed. Technology has significantly increased our expectations on how fast and efficient we can get where we want to go. Architecture could reflect the expectation of the passengers of the twenty first century. In the nineteenth century, passenger train use was the only means of traveling long distances. Once the industrial revolution began, there became many more choices and today we have the option of air, personal automobile, segway, subway, regional train, etc.

PASSENGER CIRCULATION

Architectural design would influence the speed a passenger can get where they want to go by having a clearly defined circulation path, adequate space for retail that does not conflict with large crowds of moving passengers, as well as ample platform space, and frequency of trains and type of trains moving in and out of transit stations.

CASE STUDIES - TTC – TORONTO, ONTARIO

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO
BUILDING TYPE, SENSE OF PLACE, COMMUNITY

TRANSIT STATION ARCHITECTURE - TORONTO

Architecturally, subway transit stations in Toronto have changed very little over the last 60 years. Subway stations designed in the 1950's such as Queen, King, and Dundas stations on the Yonge line, or the Museum station, St. George station on the University Street line are no different from newer stations designed and constructed in 2003 along the Sheppard subway line in Toronto, Ontario.

The architectural form and recognition of the building as a distinct type has been lost. The building form could represent a library, or a car dealership. The train station form and development as a building type since it's inception has characteristics that are unique to train transportation, such as the arch and the clock tower that are not used in modern day designs to the extent that they were in the past. The interior spaces have no natural light at the platform level, limited visual interest by way of design elements, with platform spaces that do not permit seating for fear of loitering.

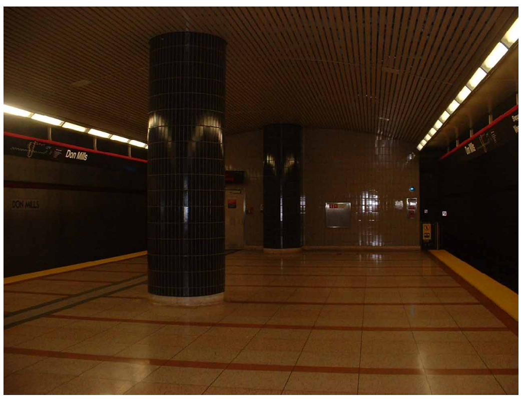


Photo - Platform - Bayview and Sheppard Subway Station
Toronto, Ontario - Constructed 2003

Photo - Exterior - Bayview and Sheppard Subway Station
Toronto, Ontario - Constructed 2003

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO
NATURAL LIGHT, SPEED AND SAFETY

The Yonge and Davisville subway station has improved natural light on the above grade platform, although the platform is exposed to the elements. The platforms are very shallow and do not allow for large volumes of commuters during busy travel periods.

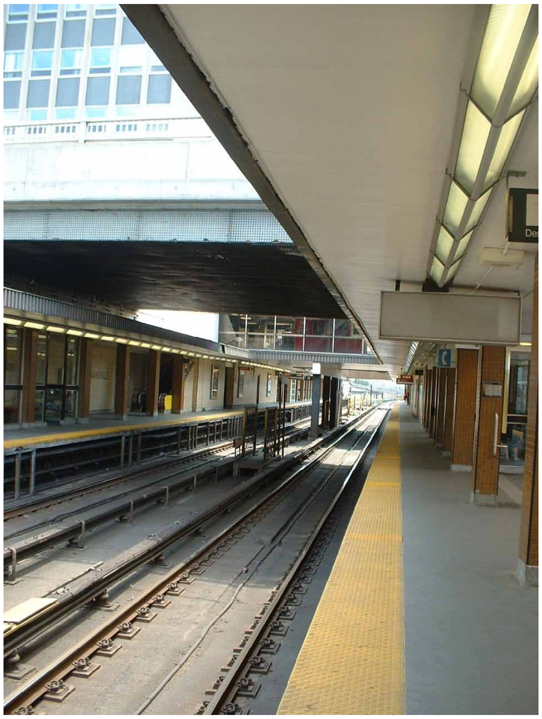


Photo - Platform - Subway Station - Yonge & Davisville,
Toronto, Ontario - Constructed 1954

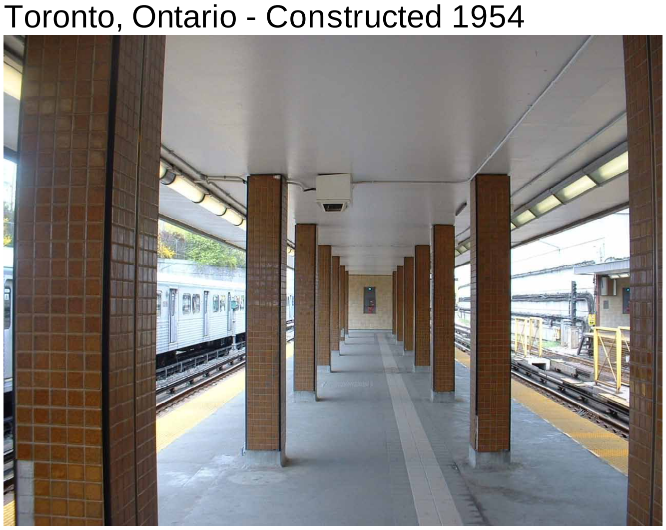


Photo - Platform - Subway Station - Yonge & Davisville,
Toronto, Ontario - Constructed 1954

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO

NATURAL LIGHT, SPEED AND SAFETY

Public safety is at risk with narrow platforms at busy stations. Kiosks block circulation path for the passengers, etc. Some attempts have been made to modify older transit stations to have access to natural light, although, similar attempts for adding retail and other aspects of new program to these facilities have work against each other.

Photo - Concourse - Subway Station - Yonge & Davisville, Toronto, Ontario - Constructed 1954

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO
SENSE OF PLACE, SECURITY, AND COMMUNITY

Photo - Ticketing and Entry - Subway Station - Yonge & Sheppard,
Toronto, Ontario - Constructed 1974

The lighting levels within this subway station are unevenly distributed throughout the space making it difficult to identify the circulation path, and the priority of what the commuter observes. There isn't any natural light making it difficult to know what time it is during the day, orientate yourself, and feel secure. Stainless steel turnstiles act as a visual barrier rather than welcome customers onto the trains. This also station lacks any reference point to the city it is located.

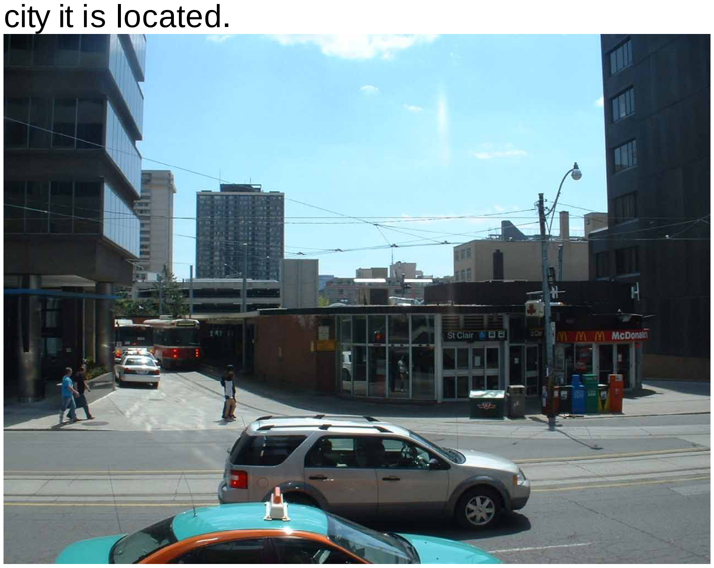


Photo - Exterior - Subway Station - Yonge & St. Clair
Toronto, Ontario - Constructed 1974

This prominent transit hub location at Yonge and St. Clair does not present itself with any memorable architectural design that would relate its design to that of a public transportation building type.

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO
NOW AND THEN, SENSE OF PLACE, AND COMMUNITY

Dundas Square offers hope for a new direction in the planning of these facilities. The Dundas square transit station exhibits a connection within the urban landscape and a connection to the life of the city and the busy intersection that is it’s home.

This transit station offers an extended canopy and place for seating and views to the bandstand and city square beyond. The Dundas square station below grade remains the original design from 1954, and closely resembles the design of many of the newest subway lines along the new Sheppard Avenue line in north Toronto.

Photo - Exterior - Subway Station - Yonge & Dundas
Toronto, Ontario - Constructed 2003

Photo - Interior - Subway Station - Yonge & Dundas
Toronto, Ontario - Constructed 2003

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO
NATURAL LIGHT, SECURITY, AND MULTI-USE

In 1974, a new north-south subway line was added to connecting the east-west Bloor line north to Downsview. This new group of subway stations between Eglinton and Finch constructed in the early 1970's has incorporated much more natural light than any previously designed.

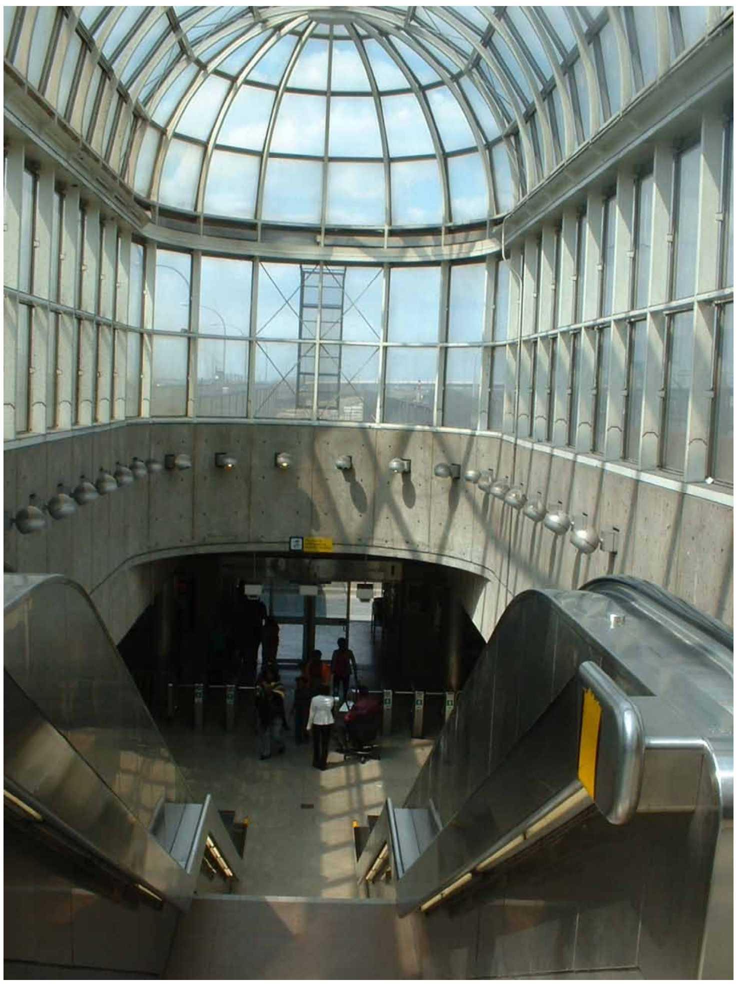


Photo - Interior - Subway Station - Yorkdale Mall
Toronto, Ontario - Constructed 1974

Escalators transfer passengers easily to lower platforms to service bus and mall access.

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO
NATURAL LIGHT, SECURITY, AND MULTI-USE


Photo - Interior - Subway Station - Yorkdale Mall
Toronto, Ontario - Constructed 1974

Deep (length) of subway platforms with minimal visual interference provide passengers with perceived security allowing clear view of the platform from one end to the other.

Platform width is approximately 12’-0” from the centre line of columns to the outer warning strip edge.

This is a multi-use facility that connects to adjacent shopping mall as well as links to Go Transit (regional train), TTC (local bus), and subway systems.

Clear vision lines along train platforms as well as an abundance of natural light for passengers. Time of day and sense of where you are is provided with the access to natural light along platforms.

CASE STUDIES – SUMMARY – TTC - TORONTO, ONTARIO
SYSTEM MAP

Population – 2,500,000
Paid individual trips per year - 459 million
Paid trips per person/year – 183.6

Toronto's transit subway system tends to follow the road system with few deviations. There is little opportunity for changing your travel route if there are problems on the subway tracks. In addition, 75% of the system runs underground and has little access to natural light for the passengers.

CASE STUDIES – SKY TRAIN – VANCOUVER, B.C.

CASE STUDIES – SUMMARY – VANCOUVER, B.C.
SENSE OF PLACE & MULTI-USE

Transit Station Architecture – Vancouver, B.C.

The Vancouver Regional Transit System has been is operated by a private company, Translink. The system services a population of 1,400,000 with approximately 1000 buses and trolley buses, 150 Skytrain cars and 2 Sea Bus Ferries.

The light rapid train system is the longest, driverless system in the world and is comprised of three main lines; the expo and Millennium lines that connect Vancouver to Burnaby, New Westminster, and Surrey and the newly constructed Canadian line, that will connect downtown Vancouver to the Vancouver International Airport.

What is interesting about the state of Vancouver's design of transit stations is the amount of natural light that penetrates into most stations, new and old. This is partially due perhaps to the climate and the lack of sunlight for many months of the year. Also, the ability for the city to take advantage of the light rapid transit system to the extent that they have is also supported by a warmer climate year around.

Photo - Pacific Station (exterior) – The starting point for the Sea Bus, millennium and Expo Lines, as well as the new Canadian Line.

CASE STUDIES – SUMMARY – VANCOUVER, B.C.
SENSE OF PLACE & MULTI-USE

Photo – Pacific Station (interior)

In contrast to Toronto's Union Station, that has a similar age and program, the Pacific Station has been fully restored, includes retail, restaurant, outdoor café's, etc. that support the needs of the commuters.

Photo - Millennium Line - Vancouver, B.C., Platform
At Pacific Station

CASE STUDIES – SUMMARY – VANCOUVER, B.C.

NATURAL LIGHT & SECURITY

Photo - Millennium Line - Vancouver, B.C., Typical Platform
Natural light is apart of each station and platform design.

Most of the train platforms along the Millennium Line are flooded with natural light. Stations are enclosed partially from the elements with perforated metal that provide some protection from the elements, and allow a significant amount of natural light to enter the transit platforms.

The perception of security is provided with sight to the platform from street level through the perforated metal enclosure as well as along the length of the platforms. Clear sight lines are provided for the full length of the platforms as well as visual connections from the street at the lower level. Station and platforms are only partially enclosed providing an audible connection outside of the transit station to signal danger or threatening conditions if required.

Photo - Millennium Line - Vancouver, B.C. View of
Elevated rail lines from street.

CASE STUDIES – SUMMARY – VANCOUVER, B.C.
NATURAL LIGHT & SECURITY

Photo - Millennium Line - Vancouver, B.C., View of platform from street level.

CASE STUDY – VANCOUVER, B.C.
NATURAL LIGHT & SECURITY

Vancouver's Millennium line and Expo lines are raised above grade, and are able to take advantage of natural light from all sides of the platform.

This configuration also minimizes disruption and costs to the existing city infrastructure during construction. All of the transit stations along the Millennium line are based standard design criteria and look. This standardization has created an identifiable building type for the Skytrain. The new Canadian line, in contrast has individual station designed to suit the specific requirements and needs of their location.

Vancouver's warm climate also provides an opportunity to have open-air stations. The access to natural light provides commuters with an increased perception of security and view of the city to minimize the frustration that monotonous waiting can cause. Platform depth is approximately 12'-0" from the centre column to the outer edge. This amount of area during busy periods is tight given the amount of use.

Photo - Exterior - Typical Skytrain Station Vancouver, British Columbia

Photo - Interior - Typical Skytrain Platform Vancouver, British Columbia

CASE STUDY – VANCOUVER, B.C.
NATURAL LIGHT & SECURITY

Exterior - Holdom Station, Vancouver, British Columbia -44

The Holdom station is quoted to be *“the lines most functional, according to both riders and maintenance crews: a simple easy to clean, open ended box, that among the stations, offers the only full protection from the elements.”*

The public was involved early on in the design stages and was able to create a team for community involvement with a list of aspirations for all stakeholders, such as:

- Visibility for safety
- The use of wood to create a sense of regional warmth
- Ambient night lighting to ensure public security and become identifiable as neighborhood beacons.

The goal of the design process was *“ to create civic rooms, all different, but all of the Millennium Line”.*

44 - “Millennium Line, Canada” By Randy Gragg, Architectural Review, page 136, August 2003

CASE STUDY – VANCOUVER, B.C.
NATURAL LIGHT & SECURITY


Exterior - Lake City Station, Vancouver, British Columbia - 45

The Lake City station is was a targeted as a Landmark station and its form identifies a place of significance with its elevated entry and mass of concrete, scale and presence. A futuristic form, which shapes the station and encloses the platform. The strength of steel and glass together express the entry and monumentality at this transit station location.


Exterior - Brentwood Station, Vancouver, British Columbia - 46

45/46 - "Millennium Line, Canada" By Randy Gragg, Architectural Review, page 135, Aug.2003

CASE STUDY – VANCOUVER, B.C.
NATURAL LIGHT & SECURITY

Exterior - Gilmore Station, Vancouver, British Columbia - 47

Exterior - Gilmore Station, Vancouver, British Columbia - 48

Busby and Associates designed both the Gilmore Station and the Brentwood stations shown here. Both designs offer extensive transparency, views, and access to natural light and both stations have been individually designed and detailed to suit their specific locations.

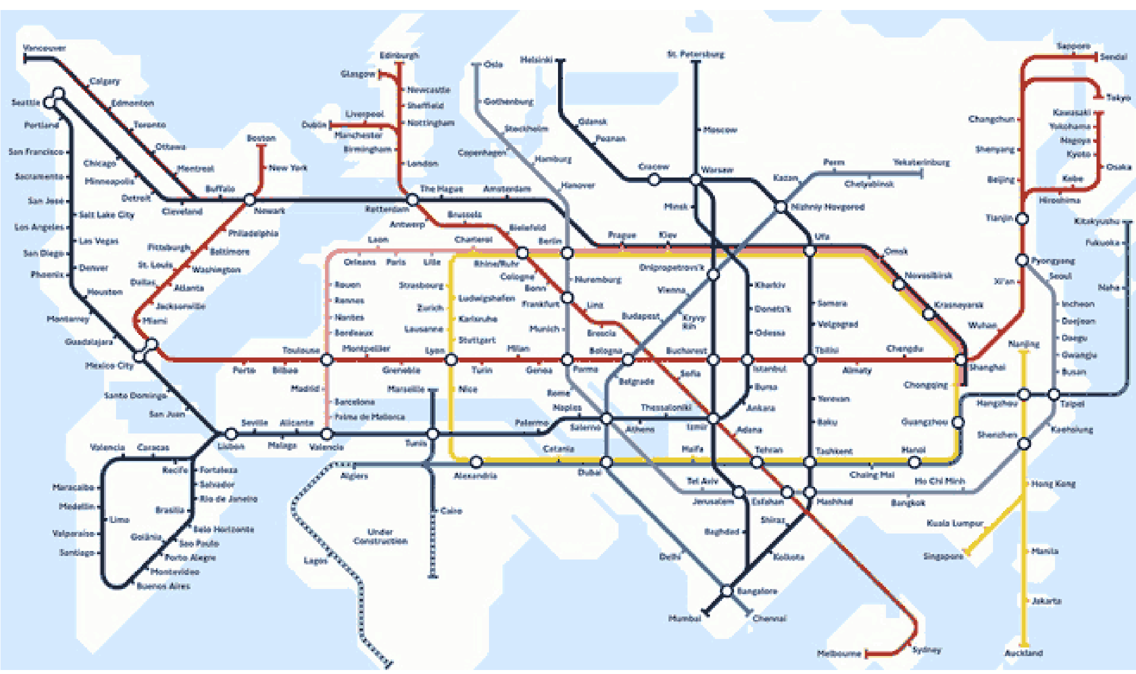
The Gilmore Station uses a straight forward planning, with window wall, and a sectional roof membrane that undulates perpendicular to the circulation of the pedestrians and train travel. The Brentwood Station is designed along a sensuous curve, enhanced with the curved glass enclosure creating a unique volume and form for this transit stop.

48 - "Millennium Line, Canada" By Randy Gragg, Architectural Review, page 132, Aug.2003

CASE STUDY – VANCOUVER, B.C.
NATURAL LIGHT & SECURITY

Photo – Granville Street, Vancouver, British Columbia

Vancouver's newest addition to public transit is the Canada Line that will connect the downtown core to the Vancouver International Airport. This new line is submerged underneath the downtown core as a subway system and travels above ground once leaving the downtown area connecting to the airport. The latest technology is utilized in all aspects of this design saving commuters valuable time to travel within the city as well as to the airport.



49 - Map - Vancouver, B.C., Skytrain System Map

CASE STUDIES – MISCELLANEOUS WORLWIDE EXAMPLES

CASE STUDY – O’HARE INTERNATIONAL AIRPORT, CHICAGO, IL
NATURAL LIGHT & TECHNOLOGY

Interior - Underground Connection Below Runway
O’Hare Airport, Chicago, Illinois - 50

Interior - Underground Connection Below Runway
O’Hare Airport, Chicago, Illinois - 51

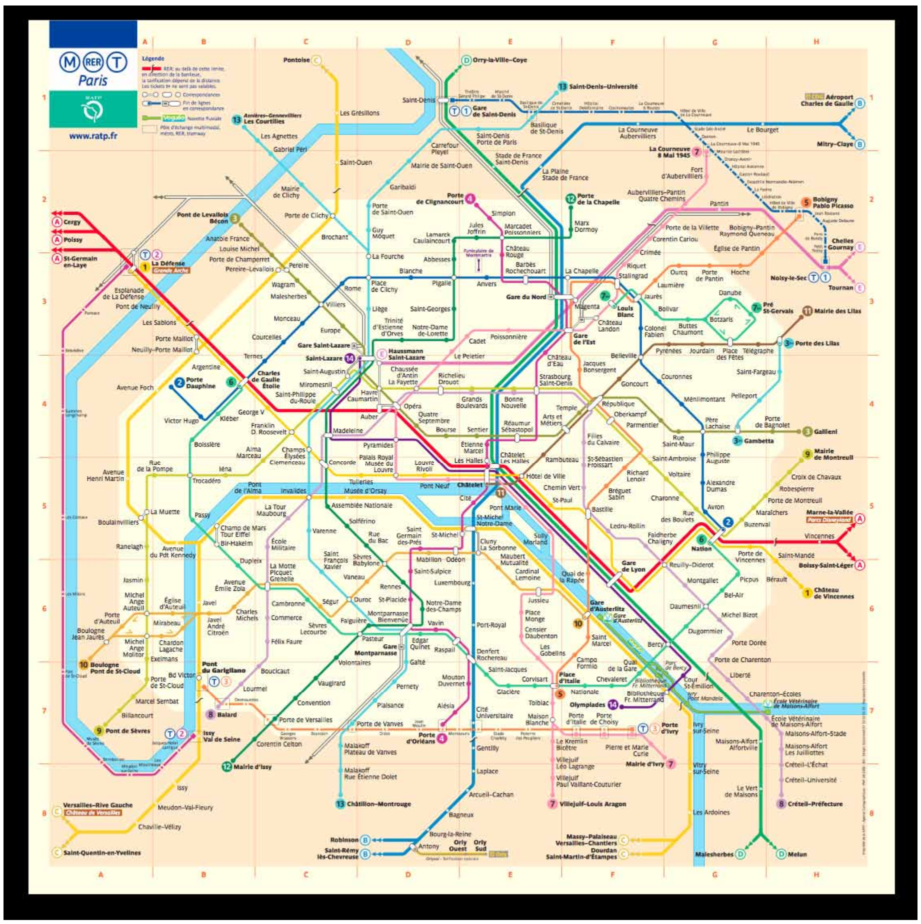
Chicago O’Hare airport uses many interesting aspects of design. The airport is flooded with natural light and views to the exterior. The connection between secure and non-secure areas within the terminal are connected under the runway with a link that offers no natural light, although there is a unique display of bright colored neon that is visually interesting and keeps the travelers alert along this long connection.

CASE STUDY – PARIS, FRANCE
SPEED

The circulation pattern in Paris, France is similar in configuration to the Vancouver, British Columbia system in that subway system trains do not necessarily only follow the routing of roads.

Trains bisect the travel path of the roads above and provide commuters with opportunity for a variety of alternatives to travel to their destination.

Also, the geographical area and population of the city relative to the number of kilometers of train is relatively small, also providing commuters with additional frequency of train access.



Metro Subway System Map, Paris, France - 52

Population – 2,200,000
Paid individual trips per year - 1.388 billion
Paid trips per person/year - 631

CASE STUDY – NEW YORK CITY, NEW YORK
SPEED

The circulation pattern in New York City, New York reaches into the neighborhoods and city business districts. Rider ship is quite low given the city’s population in relation to the cities selected for comparison.

Due to the geographical compact nature of the city, and the finite number of roads, the transit system is used out of necessity.

System Map, New York City, New York - 53

Population – 11,500,000
Paid individual trips per year - 1.563 billion
Paid trips per person/year – 135

CASE STUDY – Shanghai, China
SPEED, TECHNOLOGY, SENSE OF PLACE, COMMUNITY

The Yangpu District was until (2003) recently a thriving manufacturing neighborhood. Many factories moved out towards the countryside in search of less expansive land to conduct their business. Coincidentally, at around the same period of time, Shanghai was in the midst of constructing new roadways, to interconnect different districts.

This area of the Yangpu District was a very popular gathering space and as a result of the new roadways being constructed directly above deteriorated as a public space. This goal of this project was to activate the space and reunite to two sides of the square that were bisected by the new highway and subway line. “The idea was to bring is back to the way it was - a place of pedestrian movement and pedestrian activities”.

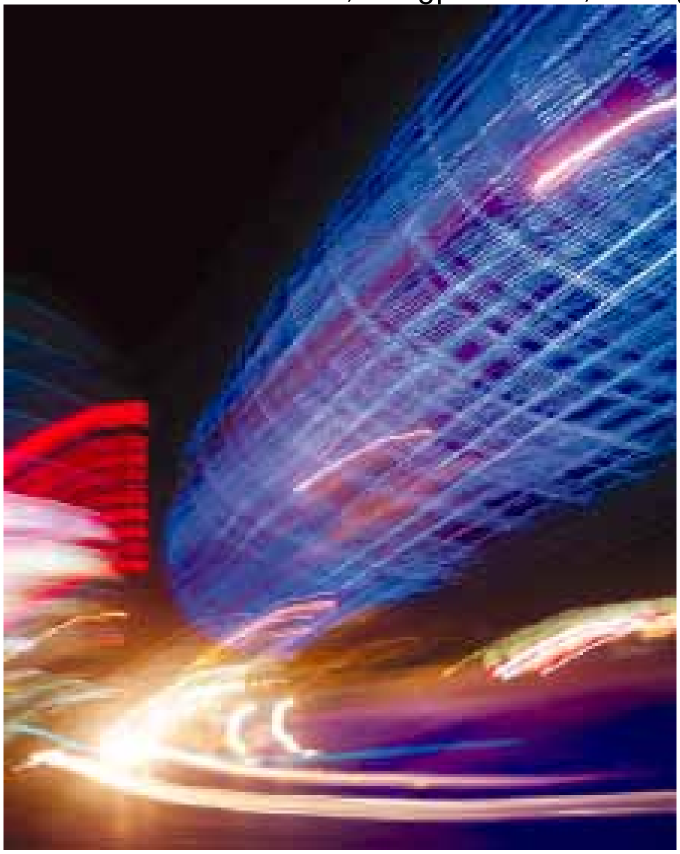
The five (5) highways and subway are concealed in one (1) 348 foot long by 157 foot wide overpass clad in steel and aluminum frame that changes colour depending on the day lighting.

Daytime Exterior - Wu Jiao Plaza,
Yangpu District, Shanghai, China – 54

54 - “Designs that move bodies and imaginations” By Randy Gragg, Architectural Review, page 170, Aug.2007

CASE STUDY – Shanghai, China
SPEED, TECHNOLOGY, SENSE OF PLACE, COMMUNITY

Exterior - Wu Jiao Plaza, Yangpu District, Shanghai, China - 55



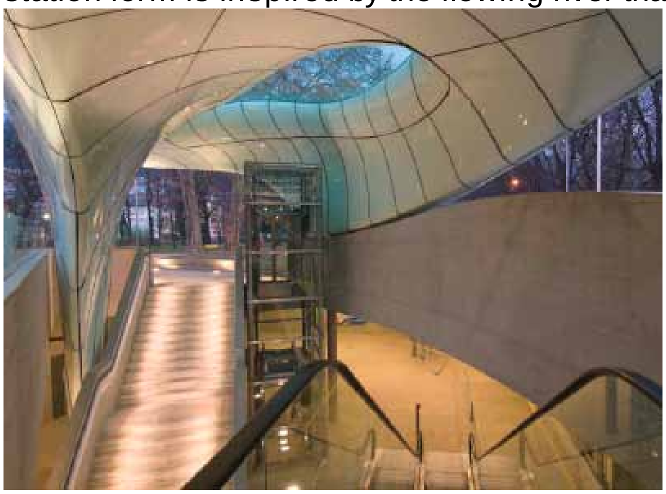
Animated night view exterior - Wu Jiao Plaza, Yangpu District, Shanghai, China - 56

55-56 - “Designs that move bodies and imaginations” By Andrew Yang, Architectural Review, page 170, Aug.2007

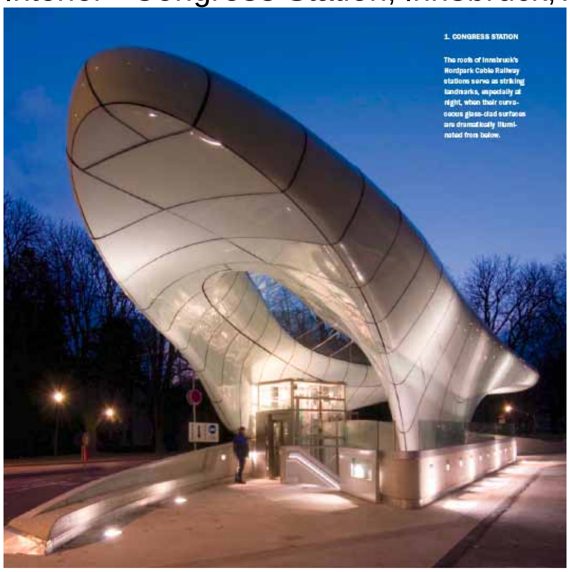
CASE STUDY – Innsbruck, Austria
SENSE OF PLACE, NATURAL LIGHT, TECHNOLGY

Zaha Hadid recently completed a commission for the design of four (4) transit stations that transfer skiers, hikers, snow boarders, and local residents from Innsbruck to Hungerburg. The route is about one (1) mile in length, and is one piece of a larger plan and project to replace antiquated lifts that interconnect the city and the summit of the Nordkette Mountain range.

Zaha Hadid says that the inspiration for the form comes from the natural history of Innsbruck and the individual sites natural surroundings. The Congress Station entry roof is shaped relate to the traffic that move around the adjacent roads. In a similar way, the Loewenhaus station form is inspired by the flowing river that runs along its side.



Interior - Congress Station, Innsbruck, Austria - 57



Exterior - Congress Station, Innsbruck, Austria - 58

57-58 - “Nordpark Cable railway” By Joann Gonchar, Architectural Review, page 186, May 2008

CASE STUDY – Innsbruck, Austria
SENSE OF PLACE, NATURAL LIGHT, TECHNOLGY

Exterior - Hungerburg Station, Innsbruck, Austria - 59


Exterior - Loewenhaus Station, Innsbruck, Austria - 60

59-60 - "Nordpark Cable railway" By Joann Gonchar, Architectural Review, page 186, May 2008

Chapter 6

FINDINGS

FINDINGS – SUMMARY OF RESULTS

So, what is it that commuters are looking for in a public transit facility? To answer this question, and understand if architectural design can influence use; research was undertaken of this area of interest in an effort to quantify what constitutes good design.

Defining good design is a challenging topic as the answer will be different for everyone depending upon individual influence and interest. For example, each of these buildings serves the same functional requirement, although there is no historical connection to the four design elements traditionally used to identify the transit station such as the clock, the arch, the shed, or the colonnade. The sense of place, and the building type is no longer memorable.

Photo - Subway station entry -
Sheppard and Leslie, Toronto, Ontario
Constructed 2003

The goal of this thesis is to define a formula or a list of design criteria that will provide architects with a program for improving public transit station design while respecting the commuter as the most important element in the process.

The findings of the research undertaken was obtained using the following methods:

1 –Site visits to various public transit facilities in Toronto and Vancouver
2 – Historical analysis of train station architecture and its evolution to public transit stations design
1 – Comparative summary of the key design issues and their impact social, environmental and economical impact
2 – A public survey to determine the likes and dislike of the current transportation facilities in Toronto and Vancouver

FINDINGS – SUMMARY OF RESULTS (continued)

Photo - Subway station entry - Lawrence & Allen Road, Toronto, Ontario
Constructed 1974

Photo - Subway station entry - Canadian Line, Vancouver, B.C.
Constructed 2009

FINDINGS – POPULATION TO USE COMPARISON

Statistics - Population Related to Public Transit Use

The following chart represents a comparison of the cities researched in the case studies, their population, and use of public transit.

City	**Toronto**	**Vancouver**	**Tokyo**	**Paris**	**New York**
Population	2500000	615000	12000000	2200000	8500000
Number of Paid Individual Trips per Year	459000000	302000000	2916000000	1400000000	1563000000
Paid trips per year per person based on population	183.60	491.06	243.00	636.36	183.88
* poulation used is the greater metropolitan area					
** statistics for use and population taken from www.en.wikpedia.org					

Based upon the statistics noted above, Vancouver has one of the highest trips per person based among the five (5) selected cities above.

The research focus was to analyze the factors that influence the variations in use, and to understand if the architectural design of the transit system plays a direct role in the commuter choice to use public transit.

FINDINGS – OPINION

The following tables quantifies the social, economic and environmental impact of the six key design issues analyzed; Safety, Access, Technology, Multi-Use, Community and Sense of Place. Each of these design issues has been selected to act as a tool to measure design impact as suggestive, strong, and conclusive impact as related to the social, economical and environment.

	SOCIAL IMPACT	ECONOMIC IMPACT	ENVIRONMENTAL IMPACT
DESIGN ISSUE			
COMMUNITY			
Heritage preservation	**		*
Proximity to Neighborhoods	**	**	***
Space for interaction; café, newspaper, public art, etc.	*	**	
Fecognizable building form	*	**	
Local materials	**	**	**
Scale	*	**	**
SENSE OF PLACE			
Character, identity, responding to local needs	**	*	
Clearly defined enclosed spaces	*	*	*
Clearly efined public spaces	*	*	*
Recognizable building forms	**	**	
Connection to the urban fabric	**	**	
Sense of permanence	**	**	*
Clear circulation path, directional		**	
Sense of arrival and departure	*	**	

	SOCIAL IMPACT	ECONOMIC IMPACT	ENVIRONMENTAL IMPACT
TECHNOLOGY			
Visible updates of arrival/departure schedules	*	**	
Use of materials representative of the 21st century			
Lighting	*	***	**
Exterior and Interior Surfacing	*	*	*
Glazing systems	*	**	**
MULTI - USE			
Expandable to multiple modes of transportation			
Bus	*	**	***
Streetcar	*	**	***
Air		***	
Ferry	*	***	***
SAFETY			
Spaces that visually interact with each other	**		
Clear lines of sight throughout	**	**	
Access to natural light	*	**	***
Retail, public activity throughout the day during non peak travel times	**	***	*
Location	**	**	**
LOCATION			
Access to multple modes of transportation	**	**	***
Access to services	**	**	***

FINDINGS – FACTS – SURVEY RESULTS

Public Survey - Toronto

A public survey was carried out in order to quantify what aspects about using public transit would influence their frequency of use. The following are the questions and the results.

Question
Do you have access to public transit (TTC, GO, VIA, etc.) within a fifteen (15) minute walk or a five (5) minute drive from your home? If yes, please describe which type (TTC, GO, VIA, etc.) is within this distance.

Results
100% of the respondents have access to public transit within a fifteen (15) minute walk or a five (5) minute drive.

This would tell me that the distance from resident homes is not a reason for low use in Toronto and has not negatively impacted use of the transit system.

Question
Do you own a car?

Results
85% of respondents own cars.

This indicates that the respondents have alternatives for transportation other than public transit.

Question
For those respondents that own a car, how often do they use it for travel?

A - 100% of the time (All Travel)
B - 75% of the time (perhaps you would use for work commuting and casual travel locally)
C - 50% of the time (work only)
D - Less than 50% of the time

Results
Responses were with 100% of the time or 50% of the time for use of their personal automobiles when they have one to use.

23% said they use their automobiles 50% of the time.

46% said they use their automobile 100% of the time.

FINDINGS – FACTS – SURVEY RESULTS (continued)

Question
If public transit was provided free of charge would you use it?

Results
60% of respondents stated that they would use public transit if it was free.

This indicates the cost influences use.

Question
If you use public transit, what is it you like or dislike most about it?

Results
30% of respondents indicated that they feel crowded when using public transit. 20% indicated that they feel tied to schedule. 10% indicated that the train stations are dirty.

Architecture can respond to the feeling that commuters have of being crowded, although all other responses would not be rectified by an architectural design solution.

Question
If your local transit station had any of the following services, would this increase your use of public transit?

A - Dry Cleaners
B - LCBO
C - Vegetables, milk, and quick meal options
D - Variety store, candy, newspaper and coffee services
E – Café, seating area for lunch, coffee, etc.
F - Car Rental
G - Other - Specify

Results
80% of respondents indicated that none of these selections would impact their decision to use public transit. This clearly indicates that the use of transit is out of necessity and not influenced by adding features along the way such as retail, cafe’s, etc.

FINDINGS – FACTS – SURVEY RESULTS (continued)

Question
Would any architectural design elements influence your comfort when using public transit, such as:

A - Natural Light
B - Interconnecting spaces; retail, public, platform, arts, etc.
C - Wide platforms that are visible from many other areas, indoors and outdoors
D - Interior volumes
E - Public assembly space, cafe's
F - Other - specify

Results
70% of respondents indicated natural light is a key architectural design element that would influence their comfort when using public transit.

40% indicated that wider platforms are also important.

Question
Would any of the following item(s) listed below influence your choice to use public transit?

A - Design of the facility
B - Cost per trip
C - Access to services (groceries, personal care (Shoppers Drug Mart), dry cleaning, etc.)
D - Improved personal security
E - Distance to home and work
F - Other - specify

Results
60% stated that the cost per trip is an influence to determining their use of public transit, while 50% identified the distance to home and work as a key factor. 40% also identified the frequency of service as a key factor.

FINDINGS – FACTS – SURVEY RESULTS (continued)

Question
Of the three images (stations) shown, what attributes are appealing or not? Add notes below please. The images shown 1A/1B go together as well as 2A/2B, and 3A/3C. Consider the contrast to emphasize the differences

Image 1A

Photo - Go Transit Platform - Toronto, Ontario

What I like about this image?
Comments such as natural light, sight lines to train, functional, clean and simple

What I dislike about this image?
40% stated it is too open to the elements, and narrow platforms.

Commuter rail – Zurich, Switzerland

What I like about this image?
20% stated that it looks futuristic, enclosed, protected from weather, and architecturally interesting.

What I dislike about this image?
Too cold, bland, over designed.

FINDINGS – FACTS – SURVEY RESULTS (continued)

Image 2A

Subway – Moscow, Russia

What I like about this image?
Sense of grandeur, warm, benches, high ceilings, scale, detail and direction.

What I dislike about this image?
No natural light, nationalistic ambition depicted, looks expansive and too grand for subway.

Image 2B

Union Station – Toronto, Ontario

What I like about this image?
Retail and services, openness, access to train schedule on displays.

What I dislike about this image?
Many stated they like nothing, bland and non-monumental.

FINDINGS – FACTS – SURVEY RESULTS (continued)

Image 3A

Subway Platform – Moscow, Russia

What I like about this image?
Arches, warm lighting, sense of permanence

What I dislike about this image?
Too opulent for a subway and too traditional.

Image 3B

Photo - VIA and GO Transit – Toronto, Ontario

What I like about this image?
Nothing, celebration of industrial age, simple, screen with train destinations.

What I dislike about this image?
Drab, no seating, very industrial, no view.

Chapter 7

OBSERVATIONS

OBSERVATIONS

Architectural design is one of many factors that contributes to elevating subway transit travel to a respected, supported and socially acceptable mode of transportation within our cities. There are many other non-architecturally related factors that will influence the positive or negative aspects of a commuters experience while using public subway transit, although these factors are not part of this study.

Commuters require subway facilities that are a proud representation of the city and the aspiration of its population using the architectural design as a mechanism to communicate their ambitions. The four main factors that the research indicates impact architectural design are:

1 – Building Form
2 – Sense of Place and Community
3 – Natural Light
4 - Safety

1 – Building Form

My research indicate that subway facilities that have dynamic, identifiable, and interesting spaces that utilize the building form to express the use and function, will improve the commuter experience. Evidence of this observation is found in results of the public survey and in the analysis of transit station design within the case studies documented.

To achieve this, I believe there are three areas of subway transit facility design that require improvement using the building form. These are, using the building form to express interior use of the subway, defining gathering spaces for the commuters, as well as providing a strong connection with the site and the context to which the building has been placed.

The design of transit stations in the late twentieth century and early nineteenth century provided building types that were markers or beacons within the city centre. The transit station provided an entry and departure point to destinations afar and could be identified with the clock tower, shed and the colonnade. These motifs remain to be important, although not as a specific to reference the past as in the early years of transit station design. In the researched case studies, the range of expression of building form goes from glass box (Vancouver's Holdom Station) to sculpted organic shapes with Zaha Hadid's station design for Innsbruck, Austria.

The Clock Tower, Arch-Shed, and the Colonnade,

These forms have less relevance in today's architecture for transit station than they did previously when used on regional train stations. However, there is a need for a return to an architectural design for transit stations that provide a recognizable form, consistent with nature, location and use of the facility.

OBSERVATIONS (con't)

Modern subway transit facilities have different program requirements in modern time and subsequently require the building form to reflect this reality.

"These features not only fulfilled a practical function, denoting the stations main point of entry, but also served to reflect the train shed behind (thus providing a simple but potent and easily recognizable symbol of the building's function), to advertise the importance of the station in the city, and to underline the stations ancestry from the triumphal entrance gateways of the Classical world via the gate in the city wall." - 61

2 - Sense of place

This aspect of architectural design has been lost in many of the recent examples researched. The monumentality of public transit station design of the nineteenth century and the recognizable forms of the arch, the clock tower, etc. have disappeared. Architectural design of subway transit has been reduced to a formula of standardization. Older transit stations along the Millennium line in Vancouver, British Columbia as well as the platform layout and configuration of the subway system in Toronto, Ontario are designed based upon outdated standard design criteria used at the inception of subway transit in Canada in 1950.

Zaha Hadid's recently completed group of four stations is an excellent example of architectural forms that reflect the individuality of the station and its place. In addition, the transit stations along the new Canada Line, such as the Holdom Station and the Lake City Station reflect evidence of a marking the building type with monumentality, and marking the location for a specific use.

"Neighborhood stations (like Renfrew and Rupert) were intended to be modest, finer-grained responses to community context and history." - 62

The issue of identification was mentioned as a concern in the survey responses in Question 9, with commuters indicating the bland and non-monumental designs. The building scale, form, and order of the early transit station designs provided a recognizable building type that was seen from city to city and country to country. A new building form representative of the modern age, personal security, natural light, and technology needs to be created. Creating places that commuters can be proud of using because the subway building represents a superior technology, a symbol of innovation, or a simple, pure response to the specific needs of a particular place can achieve this requirement and improve the commuter experience.

61 - Steven Parissien, Station to Station, London, Phaidon Press Ltd., 1997, page 35
62 – "Millennium Line, Canada", By Randy Gragg, Architectural Review, August 2003

OBSERVATIONS (con’t)

3 - Access to Natural Light

The survey responses clearly indicated that access to natural light was an important design element that would influence their choice to use public transit. Vancouver’s public transit use is nearly twice that of the Toronto system, and the majority of their stations are raised above grade with ample access to natural light indicating that this feature influences use. In addition, survey responses indicated that the lack of natural light was a common dislike of the photographs shown and personal experiences.

Question 7 of the public survey indicates that 53% of respondents feel that natural light influence commuter comfort when using public transit. Also, in question 9 of the survey, natural light is stated numerous times as a key element in the positive feeling of commuters as it relates to comfort, security, and enclosure.

The challenges that occur in design to overcome this issue are the potential costs of large glazed areas and light wells to underground platforms and circulation corridors. Placement of transit stations on the site in relation to the amount of natural light and exposure during the seasons will impact rider ship and use.

My research indicates that designs that incorporate natural light to many areas of transit facilities provide opportunities for expressing the pure function of these facilities to the city by using the architectural expression of building form and scale.

4 - Safety

In all aspects of my research, safety is always at the top of the list as a key issue for commuters when using public transit. Designing facilities that are safe, and perceived to be safe by commuters is the challenge that architects must overcome in order to increase use. Architectural design factors that impacts personal safety has been broken down into two categories;

- Crime
- Accidental

Design factors that impact the perception of personal safety **(crime related):**

Transparency

The architectural form should respond to the need for clear sight lines and transparency. Achieving a high degree of transparency will minimize concerns about personal safety.

OBSERVATIONS (con't)

The typical design of public transit stations places them below grade and subsequently require large columns to support the loads creating blind corners, and views throughout the station, platforms, etc. This aspect of the design should be understood and overcome. Secondly the placement of the station above and below grade should be considered to provide adequate views for passengers to the exterior and allow the public to easily see the business and activities of the interior of the transit stations.

It is also evident in the recent community involvement with the new designs for the transit stations along the Canadian Line in Vancouver, British Columbia. Public security within the stations staircases and platforms was managed in the design process to include fully transparent glazing and abundant nighttime lighting in these areas.

"VIA achieved the public's desire for security and nighttime appeal with plenty of glass-around entrances, stairways, elevators, platforms-in short, where people move and where they wait." - 63

Program - Design factors that impact the perception of personal safety (crime related):

My research indicated that commuters would not increase their use of public transit if additional retail kiosks, cafe's and restaurants were available. However, the need to have ongoing daily activities and movement along the corridors and platforms is necessary to reduce crime.

Most train stations have significant breaks between peak periods of passenger use, and during these periods is when passengers feel insecure about their personal safety. Adding retail activities that have direct vision and access to all interior spaces. Therefore, personal security will be improved by ensuring that the program use of the transit station includes spaces that will have activities during all hours of the day.

Platform - Design factors that impact the perception of personal safety (accidental):

There are numerous design factors that have an impact on the personal safety of commuters that are related to accidents, most are covered in design codes administered by Authorities Having Jurisdiction. The surveys conducted indicate that platform depth and design of the platforms is a concern for passengers due to the large volume of passengers in close proximity of the trains arriving and departing the terminals.

Adequate space for passengers needs to be provided and be in balance with the need to provide a space that is not cavernous and underutilized.

63 - "Millennium Line, Canada" By Randy Gragg, Architectural Review, Aug.2003

OBSERVATIONS (con't)

SUMMARY

The design of public transit facilities should elevate the commuter experience and find their place among public buildings in high regard. Commuters should not have the feeling that they are reduced socially because they are using an efficient and environmental mode of transportation.

The design professional has ability and the responsibility to inspire commuters to use public transit facilities. Utilizing their expertise to transform the sundry task of transporting huge amounts of people back and forth throughout each day to an enjoyable experience.

Chapter 8

DESIGN DIRECTION

DESIGN DIRECTION

Summary:

The four (4) main factors that influence a commuter's decision to use public transit facilities determined through research are:

1 - Safety
2 - Natural Light
3 - Sense of Place and Community
4 - Form

A successful design solution for a new prototypical station will require more than providing a building with ample natural light, security guards at every corner, etc. The final design will take will take these factors into consideration in all aspects of the design, however I believe that the energy and excitement that has been lost with public transit station design can be inspired and influenced by the architectural design.

Secondly, the ability to have a major new subway or rapid transit line added in one stage would provide an opportunity to provide a new face to public transit with a large impact and chance to change public opinion quickly. Vancouver's recent two (2) billion dollar investment in public transit infrastructure with the Canada Line has already begun to show the results.

Prototype – Subway Transit Facility - Toronto, Ontario

The design demonstration will result in an architectural design solution for a prototypical design of a subway transit facility within Toronto, Ontario at a major intersection that will connect to the existing system. The final site will be determined during D9B.

Chapter 9

D9B - Program & Design Development

INTRODUCTION

October 1, 2010

1.0 Introduction – Program Outline

The architectural program is based upon the research carried out in D9A as well as the continuation of related research into D9B with the goal of developing a set of design guidelines or criteria for new public transit facilities. These design guidelines will establish a framework for new public transit facilities that are below grade (refer to modified design direction dated December 23, 2009).

The architectural program is based upon my research findings and analysis of existing subway transit systems in Canada and Europe. In Canada, Toronto, Ontario and Vancouver, British Columbia have been selected as they both are experiencing significant expansion in the urban population. In addition the subway systems in, London, England and Paris, France have been studied as examples of existing systems in cities that have already undergone the population expansion and provided two very different responses to the city commuter.

The foundation for this theoretical proposition is as follows:

1 – Toronto is embarking on an ambitious expansion of our transit system that could see as much as 62 km of new track under the Transit City plan by the year 2020 - 1.

2 – The current design model is outdated and requires a new approach that celebrates the transit typology as a unique facility and expresses this type through the architectural design.

3 – Create facilities for transit users that ensure a dignified experience by attending to the architectural design requirements of:

- Natural light
- Building form
- Passenger security

1 – TTC Web Site, www3.ttc.ca

1.1 Program Content

The program has been based upon the evidence obtained in the site analysis of existing subway transit facilities in North America and Europe. The data obtained has been organized into a macro and micro summary.

1.1.1 Program Basis – Macro Level

After visiting numerous subway stations in a variety of cities, it became clear that a greater emphasis is placed upon the design of subway stations that are located in prominent locations with the city. However, if public subway travel is to be considered a viable alternative mode of transportation to the automobile, then we need to establish a minimum standard of architectural design.

This study is focused on metropolitan commuter travel on subway systems and light rail transit and does not consider regional travel. The three main design elements that differentiate the design of successful transit facilities are natural light, building form and public security.

1 – Natural Light – The requirement for natural light to fulfill all parts of the public spaces within the transit facility.

Designing spaces that have adequate natural light goes without saying. However, in the example sites visited, 90% have limited access to natural light. So, as a requirement of the program, new facilities must have direct access to natural light.

"Technological and other advances of modern life have provided dramatic changes in convenience and comfort in all phases of our lives. However, I have become increasingly aware of the psychological and physical problems accruing from changes which ignore the natural order and biological rhythms of the human mind and body." - 2

Platform

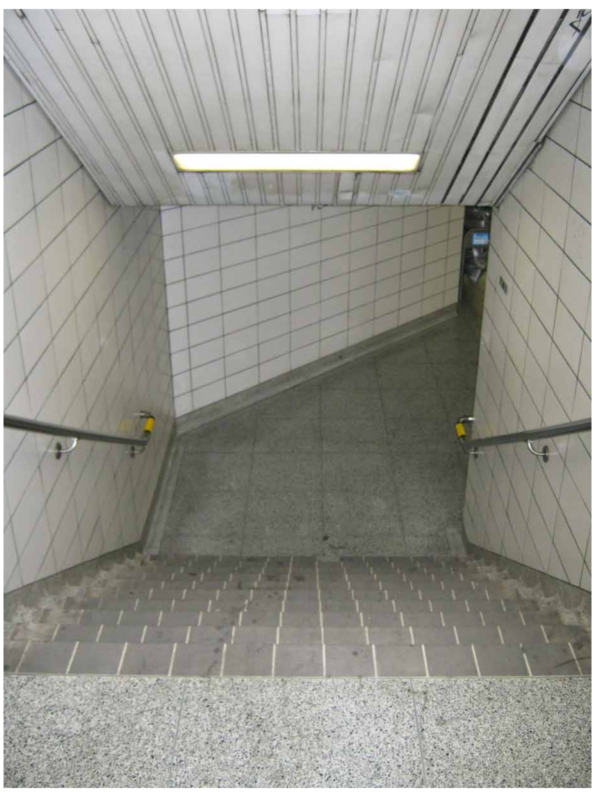
Natural light through the use of light wells will be transmitted to the platform levels of subway transit stations. A typical platform configuration and would have a length of approximately 200 linear feet.

Minimum targets will be established for natural light at the platform level. Access to direct and indirect lighting at the platform level and through the travel from the street will be established.

2 – Article, www.bettyphillipspsycology, Light Up Your Life, Betty W. Phillips, Ph.D., Psychology

1 – TTC - Subway Station – Bloor & Coxwell – Interior view at street level

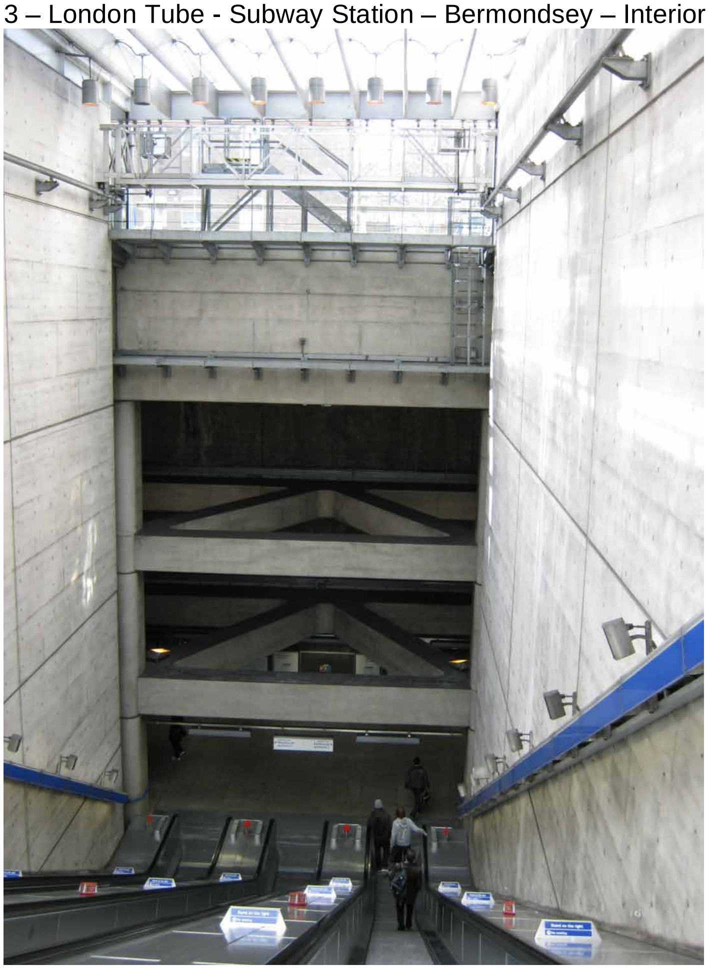
The street level at the Bloor and Coxwell (1) subway station provides the main entry, ticketing and a waiting area for pick-up and drop off as well as bus access. This location is one of the better subway stations at street level for access to natural light, however it stops here. In the photo below (2), no attempt is made to transfer light to the concourse level or to the platform levels through the addition of skylights or light wells.



2 – TTC - Subway Station – Bloor & Coxwell – Interior stairs concourse to platform

In contrast to the TTC stations, the Jubilee line, in London England, utilize an abundance of natural light at street level and platform levels. Natural light is transferred through glass ceilings (3), walls, and using the structural elements that allow light to be transferred as much as 80 feet below grade to the subway platform (4).

3 – London Tube - Subway Station – Bermondsey – Interior view at street level



4 – London Tube - Subway Station – Bermondsey – Interior escalator, street level to platform

2 – Building Form – The building form must generate an identifiable building type unique to subway transit facilities.

The building form above and below grade must celebrate the building use through its architectural excellence and should not be a simple by product of transferring passengers from point to point. All transit facilities must meet some minimum design standards such as:

- A minimum building area (sf/sm) at street level
- A minimum size of interior spatial volumes (m3) for public waiting areas (height & width)
- An alternating interior spatial forms (m3) at the intersection of public circulation path that identify change in direction

The goal is to avoid seeing architectural solutions for corridors like the TTC - LRT station at Ellesmere and McCowan Road in Toronto. Providing design guidelines with minimum requirements on the size and variety of exterior and interior spatial volumes aims to avoid this type of solution.

5 - LRT Station – Ellesmere – Interior corridor

3 – Public Security – The public using these transit facilities must feel safe and secure or it will not be used and will not support the idea of providing a dignified mode of transportation. Architecture plays a significant role in the sense of security patrons feel when using these facilities through passive design elements.

Passive security design may be provided by providing clear sight lines within all areas of the transit station. Eliminating blind or hidden corners by using transparent or reflective materials

Natural light will also assist in enhancing public security using the concept of borrowed light. Borrowed light is a design approach used in the design of correctional facilities, allowing natural light to penetrate open spaces, and the prison cells.

“Within two years of a correctional facility’s construction, staff and inmate attitudes have soared; construction and operational costs have been reduced; security and conditions of confinement have improved; and the facilities presence has improved area property values, boosted local business and become a symbol of community pride.” - 3

1.1.2 Detailed Program – Micro Level

The micro elements within the program contribute to the detailed spatial requirements within the public transit facilities. These items relate to the depth, height, and overall sizes of interior and exterior spaces.

Train Station Entry – Waiting Area

Statistics from the TTC indicated that the average daily passenger volume can be calculated at 7200 passengers. It has been assumed that this passenger load is spread across the three peak periods:

Morning – Peak Period 1 – 7:00am to 9:00pm – 25% of the daily load or 2,160 passengers

Lunch Hour – Peak Period 2 – 11:30am to 1:00pm – 15% of the daily load or 1,080 passengers

Evening – Peak Period 3 – 4:30pm to 6:00pm – 25% of the daily load or 2,160 passengers.

Using the daily peak period of 2,160 passengers at 1.5m2 per person, we get a requirement for 3,240 m2 as a minimum area for the entry assuming all passengers arrive and depart at the same time. For the purposes of this thesis, it has been assumed that 50% of the passengers would arrive at any one point as the peak load or 1,610 m2.

Ticketing

This area cannot impede the circulation of passenger movement within the station. A wicket can see as many as 20 customers awaiting ticket purchase at peak periods. Space for this area can be calculated at 20 persons @ 1.5 m2 per person or 30m2.

Train Station Platform

A similar criteria has been used to calculate the area for platforms as was used for train Station Entry areas.

However, it is also necessary to assume that a transit car could stop during a peak period for emergency conditions. Each car carries approximately 250 passengers and it is assumed that each subway carries ten (10) cars or 2500 passengers when fully loaded.

2500 * 1.5m2 per person = 3,750m2

In addition to the area required for the public full disembarking from the trains, we must also allow for the passengers during peak periods 1 & 3. Assume that 50% are waiting during a peak period or an additional 1610m2.

Total single platform size = 5360m2

Ticket Office/Cash Vault

The ticket office needs to accommodate one ticketing agent, a counter, and access to an adjacent ticket office. The space required for the ticket wicket is 10m2 plus and additional 10m2 for the office. The cash vault will be located within the manager’s office.

Lunch Room – Meeting Room

Space to be provided for five (5) staff, fridge, microwave oven, and a couch. The area is calculated to 35m2.

Men's & Ladies Lockers - Change Area

This space to be adjacent to the staff lunch room and is required to accommodate up to twenty full size lockers and change area complete with one (1) barrier free shower.
Provide 20m2 per sex.

Staff Washrooms

It is assumed that the maximum occupant load for staff will not exceed five (5) staff at any one time. The Ontario Building Code permits one (1) fixture per sex given these loading conditions. Provide one (1) barrier free washroom for men's and women's washrooms. These facilities should be adjacent to the Men's and ladies Lockers – Change Area.

Public Washrooms

The requirement for public washroom facilities will be a function of the occupant load based upon area calculation used for the final space and design outcome. For the purposes of the preliminary program, it has been assumed that seven (7) fixtures will be allocated per sex, complete with barrier free access.

1.2 Program Summary

Train Station Entry – Waiting Area - 1610m2

Ticketing – 30m2

Train Station Platform – 5360m2

Ticket Office/Cash Vault – 20m2

Lunch Room – Meeting Room – 35m2

Men's & Ladies Lockers - Change Area – 20m2 (per change room)

Staff Washrooms – as per OBC

Public Washrooms – as per OBC

Storage – 10m2

Janitorial Room – 6m2

Garbage Room – 10m2

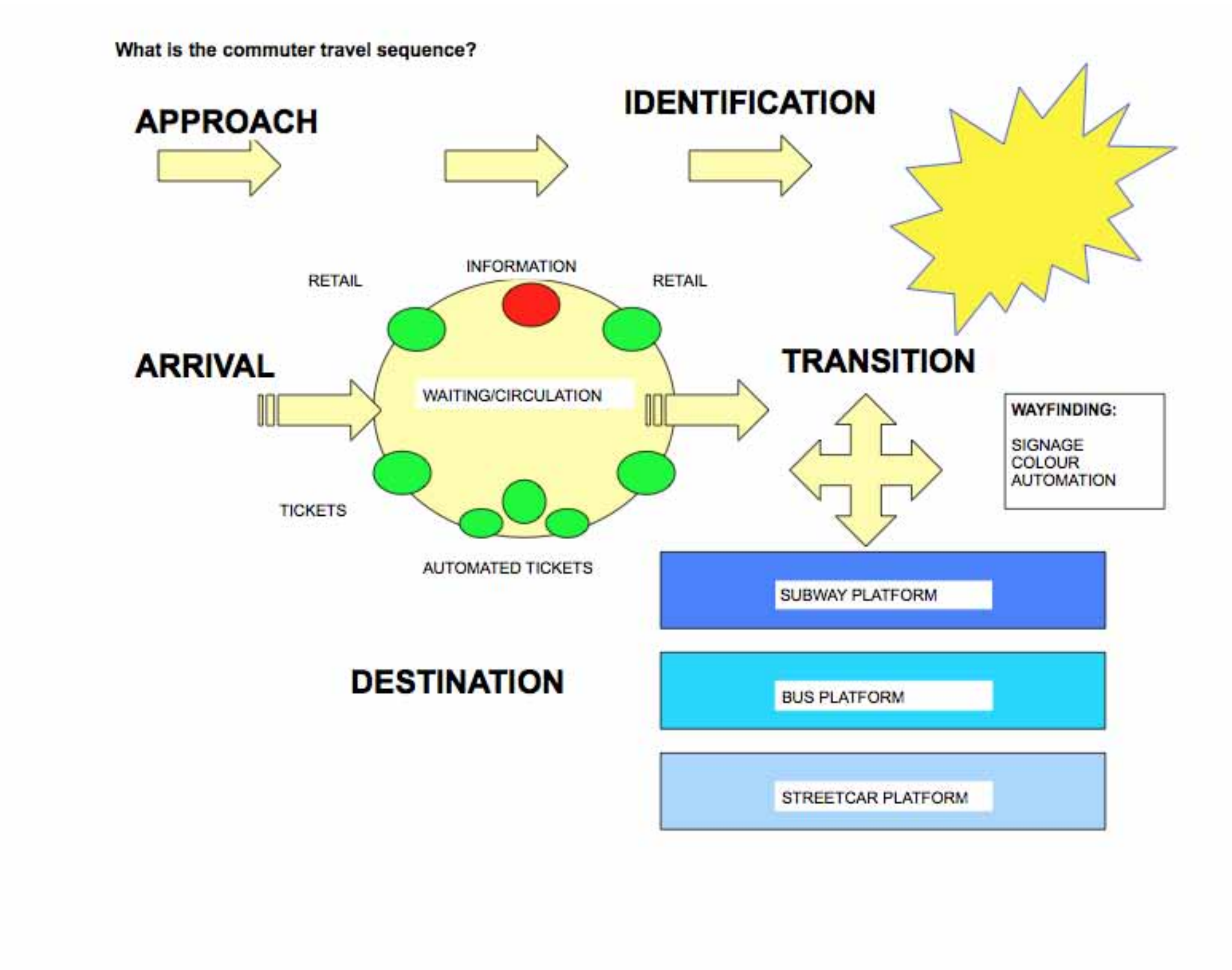
Public Washrooms – as per OBC

1.3 Commuter Travel Sequence

The five (5) main stages of a commuter travel experience have been categorized as the approach, identification, arrival, transition, and destination. Each of these stages link together to provide commuters with an enjoyable experience during their travel sequence. My research has shown that the most important design issues that must be integrated into this sequence include natural light, building form, way finding and personal security.

Approach

Commuters arrive in a variety of modes of transportation such as taxi, walking, car, connecting subway, LRT and bus service lines. The experience along the approach to the building, platform, etc. cannot necessarily be connected to the program of the train station itself as this element is outside the realm of the design of the facility.



Identification

Identify the location of the building with a recognizable architectural form to provide a sense of arrival and scale related to the use and function of the space.

Arrival

Arrival provides a space for waiting, information, direction, ticketing and retail options with connections to other important modes of transportation.

Transition

A transition space takes commuters to different modes of transportation such as the subway, light rail transit, streetcar, taxi, bus services, etc. This area accommodates changes in elevation above and below grade.

Destination

The destination in a dignified transit station is the arrival at the platform level awaiting the mode of transportation to allow the commuter to connect and depart.

1.4 Research Verification Process

The research presented in D9A, was extended, and challenged as part of the beginning of program development and design concept. This exercise was carried out by visiting a large number of public transit facilities in major cities and to document through the use of sequence photograph, the commuter experience.

The cities used for this research were:

1 – Toronto, Ontario (TTC)
2 – London, England (Tube)
3 – Paris, France (Metro)

1.5 Research Verification Goal

The goal of this extension of the research process was to create a model that expresses the commuter experience as they pass through the subway transit facility. That is, document what the commuter will see and feel as it is possible through the eyes of the researcher, and a camera. The goal is to identify the good and the bad elements within each public subway transit facility.

1.6 Site Selection & Analysis

The site selected for the architectural demonstration is located at Yonge & St. Clair in Toronto, Ontario. This site was selected for the following reasons:

Centrally located within the City of Toronto

The site is in an urban location, central to the City of Toronto, Ontario, on the south-east corner of Yonge and St. Clair. This area of the city is on the fringe of the downtown core, adjacent to residential uses, as well as the loop station for the new streetcar extension on St. Clair Avenue.

Passenger use is average at 33,600 trips per week

This site was also selected as it was at the median for daily trips during the week by commuters at 33,600 trips per week. Other sites to compare are St. George & Bloor at 116,840 trips per week, and Yorkdale at 23, 280 per week.

Multi-Model Transit Access

This site has many options for commuters using public transit; bus, streetcar and subway. The interest in selecting a site with multiple modes of transportation comes in the challenge and diversity of programmatic elements that will drive the building form.

Street Appeal and Identity

This site is deficient of any architectural identity that speaks to the community to which it belongs. It appears to be one of the original structures in the area, as the city was expanding. A pioneer in location as one of the first subway system buildings, dating back to 1954 as the Yonge Street line first opened its doors.

Additional options are available for design of this site with it’s interconnections below grade to a number of the office towers in the immediate area.

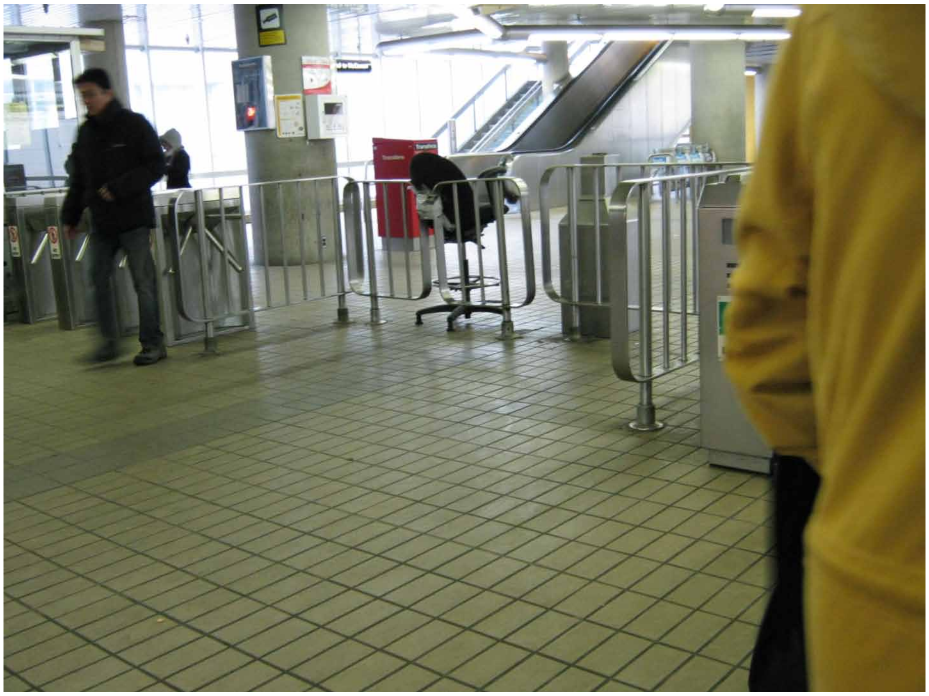
Chapter 10

SITE ANALYSIS

Site 1 – TTC – Light Rail Transit – Scarborough Town Centre, Toronto, Ontario

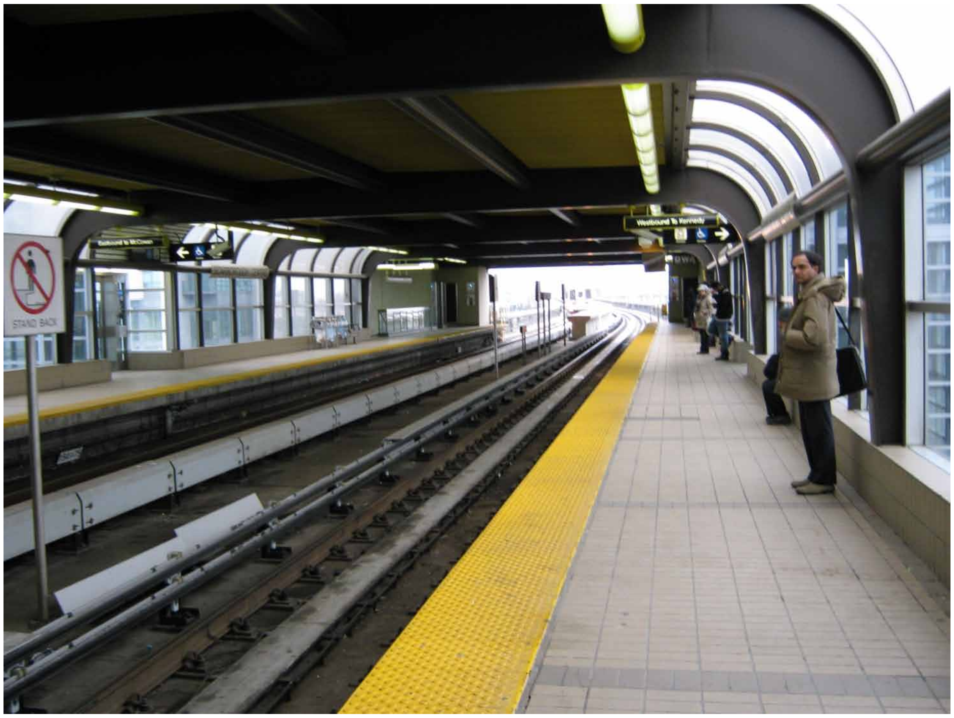
Positive Attributes

- Above ground with access to natural light from platform and most public space
- Clear sight lines within facility
- Connected to shopping mall and City Centre



Negative Attributes

- Dirty
- No public seating visible ion platforms
- Shallow platform
- No architectural identity



Site 2 – TTC – Light Rail Transit – Ellesmere Station, Toronto, Ontario

Positive Attributes

- Above ground with access to natural light from platform and most public space

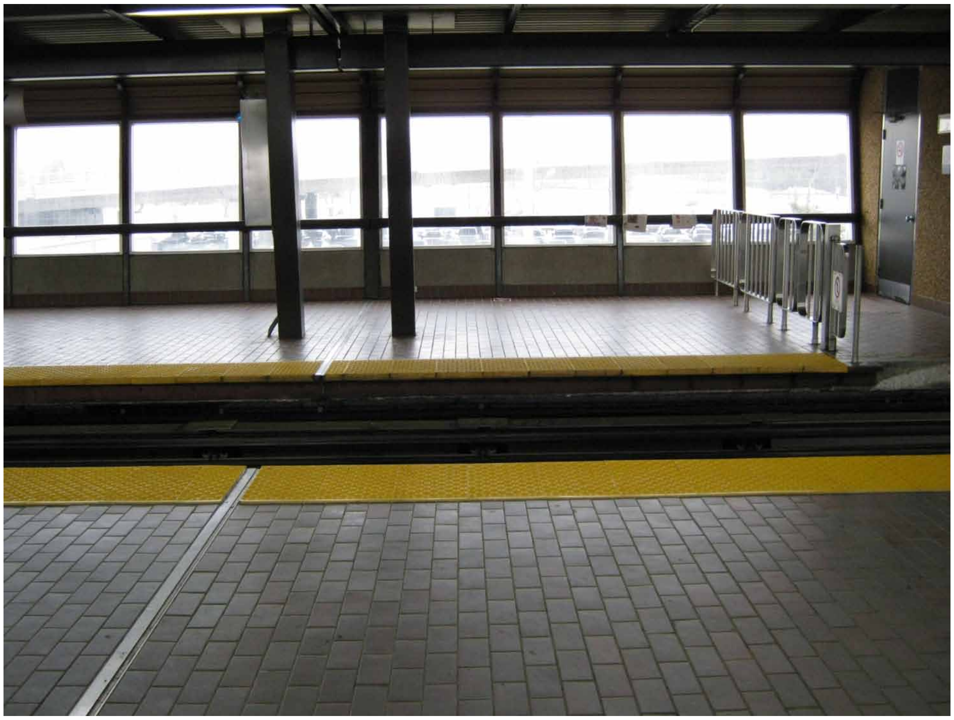
Negative Attributes

- No architectural identity
- Limited signage or way finding
- Corridors that connect spaces are made from concrete forms used for rain water management
- Limited lighting

Site 3 – TTC – Light rail Transit – Kennedy Station, Toronto, Ontario

Positive Attributes

- Above ground with access to natural light from platform and most public space
- Connection to subway system and community centre



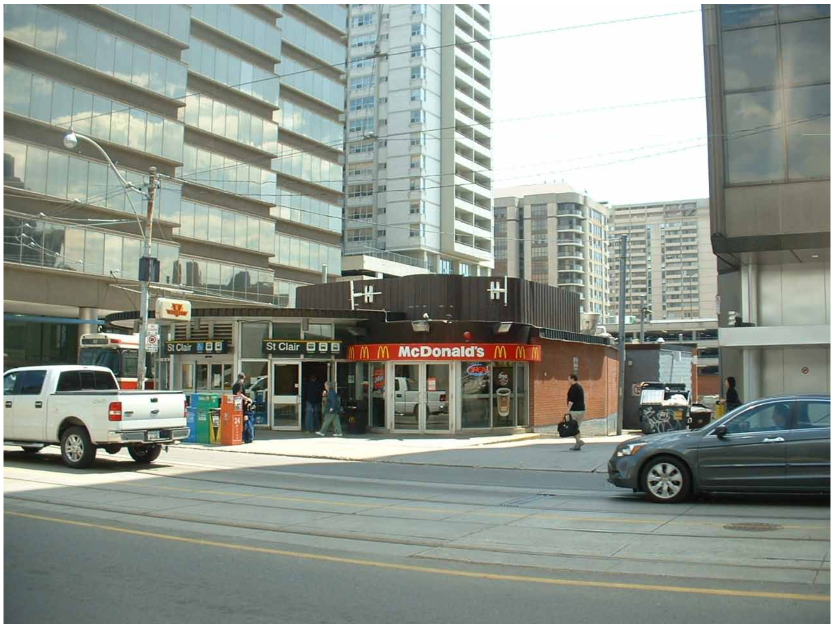
Negative Attributes

- No architectural identity
- Long corridors without any form or sense of arrival to important transition spaces
- Subway levels do not have any access to natural light
- Exterior platform is exposed to weather

Site 4 – TTC – Subway – Yonge & St. Clair, Toronto, Ontario

Positive Attributes

- Located within city downtown edge, connecting high density residential and commercial developments
- Connections to streetcar, subway, and bus systems
- Some natural light is provided at the street level for bus and streetcar access



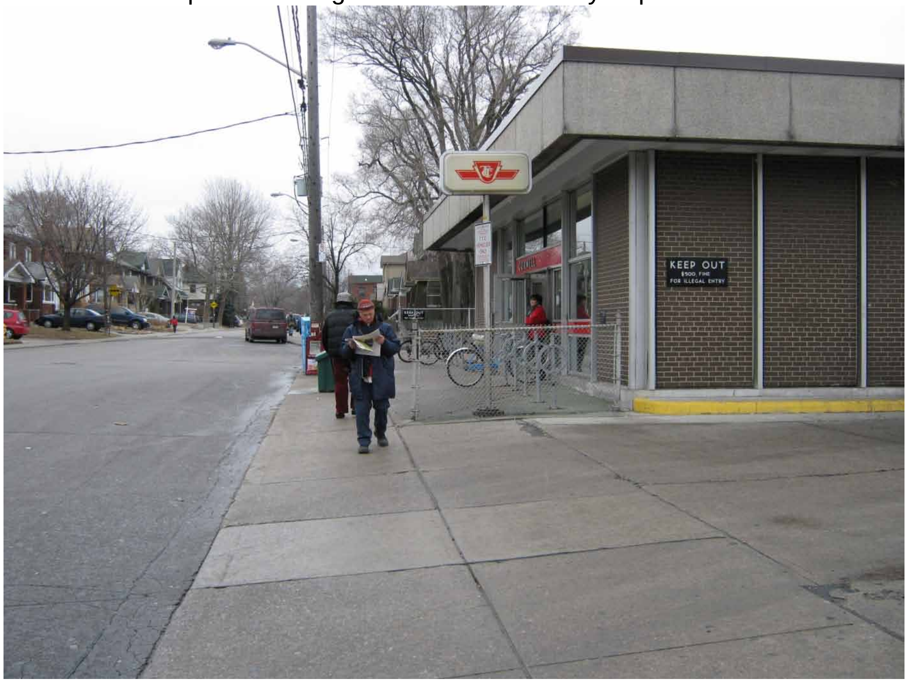
Negative Attributes

- No architectural identity
- No identifiable interior forms at major connections between interior spaces, such as; ticketing, access to subway lower levels from main level, entry to bus and streetcar platforms
- Poor signage & way finding
- Poor lighting

Site 5 – TTC – Subway – Coxwell and Bloor, Toronto, Ontario

Positive Attributes

- Identifiable form, station typology
- Neighborhood setting
- Ample natural light at street level entry to platforms



Negative Attributes

- No seating
- Poor signage & way finding
- Narrow platforms
- Dark interior spaces

Site 6 – TTC – Subway – Pape and Bloor, Toronto, Ontario

Positive Attributes

- Nothing notable

Negative Attributes

- No architectural identity
- Dark interior spaces
- Shallow platforms
- Poor signage & way finding

Site 7 – Metro Subway – Barbe’s Rochechouart - Paris, France

Positive Attributes

- Reflective materials used on the ceiling and walls help with lighting the space
- Identifiable entry from street level
- Ample lighting at platform level

Negative Attributes

- No above grade building to receive passengers and identify the building
- Dirty
- Shallow platform depth
- Poor signage and way finding
- Long interior corridors with little architectural interest

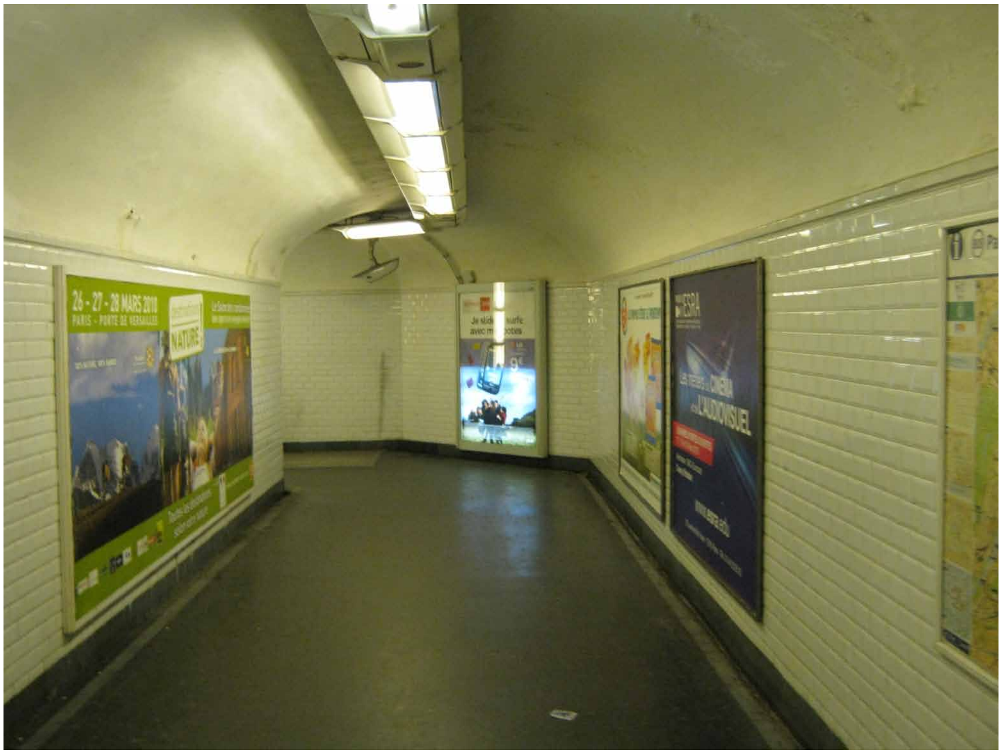
Site 8 – Metro Subway – Gare de Nord - Paris, France

Positive Attributes

- Connected to main hub regional transit station
- Natural light in ticketing area of main building
- Lots of amenities available to commuters

Negative Attributes

- Long corridors with no architectural form or interest
- Contrast in level of design and space as you leave regional transit area to subway



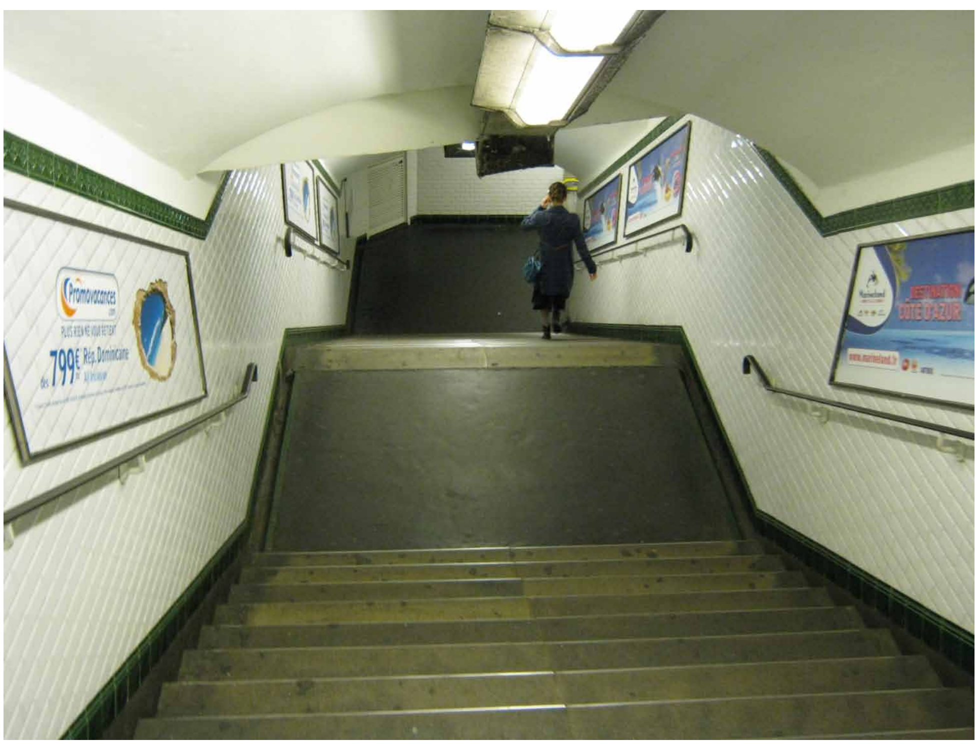
Site 9 – Metro Subway – Gare de l'est - Paris, France

Positive Attributes

- Well lit platform levels
- Unique identification at street level
- Some use of floor patterns to break monotony and provide some sense of rhythm

Negative Attributes

- Long corridors from street level to platforms with little architectural identity
- No natural light once below grade



Site 10 – Metro Subway – Bastile- Paris, France

Positive Attributes

- Unique street identity

Negative attributes

- Long corridors to platform
- No natural light below grade
- Poor lighting in corridors

Site 11 – Tube – Subway – Oxford Circle Station – London, England

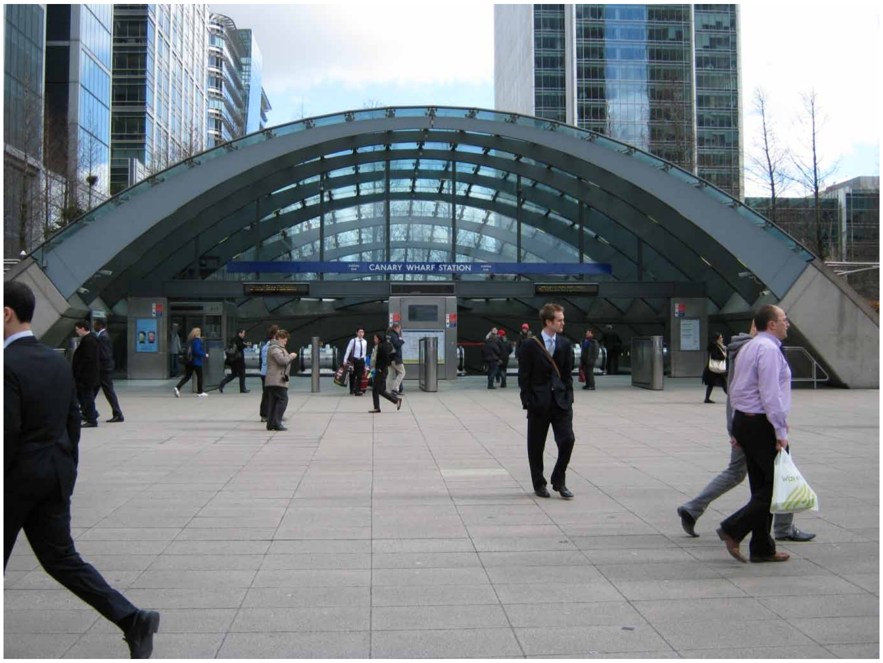
Positive Attributes
- Detailed street identity
- Excellent lighting below grade
- Consistent interior form of the "tube" at platform space
- Clear signage & way finding
- Contrasting colors and materials

Negative Attributes
- No natural light below grade
- Station is located very deep below grade
- Long walk from entry to station to reach the platform levels

Site 12 – Tube – Subway – Canary Wharf Station – London, England

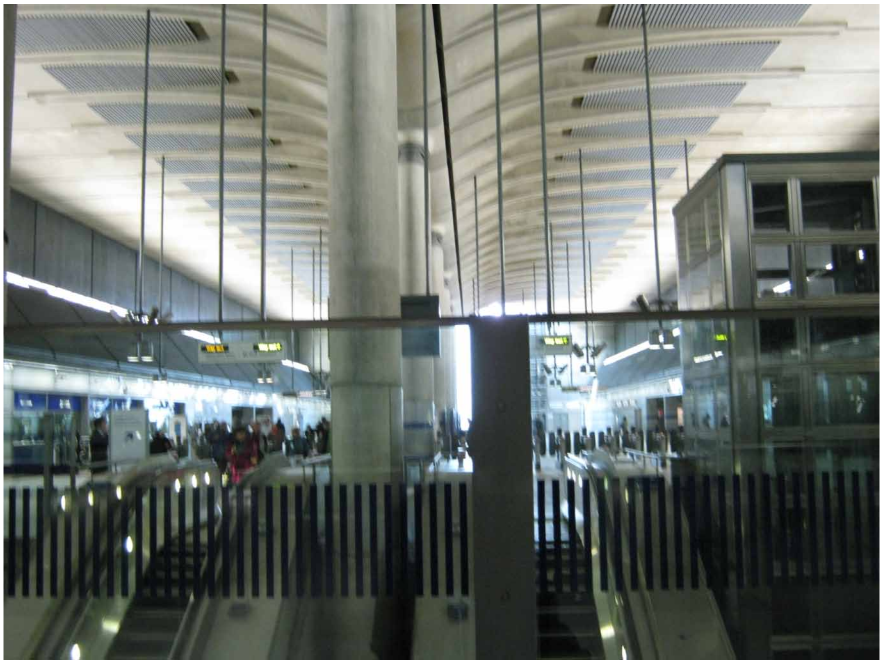
Positive Attributes

- Ample natural light at all levels of the transit station
- Identifiable building form at grade level for the main entry to the station
- Deep platforms
- Interesting visual experience as passenger travels through the transit stations; views, materials, spatial volumes, etc.



Negative Attributes

- Long travel path from street level to platform level



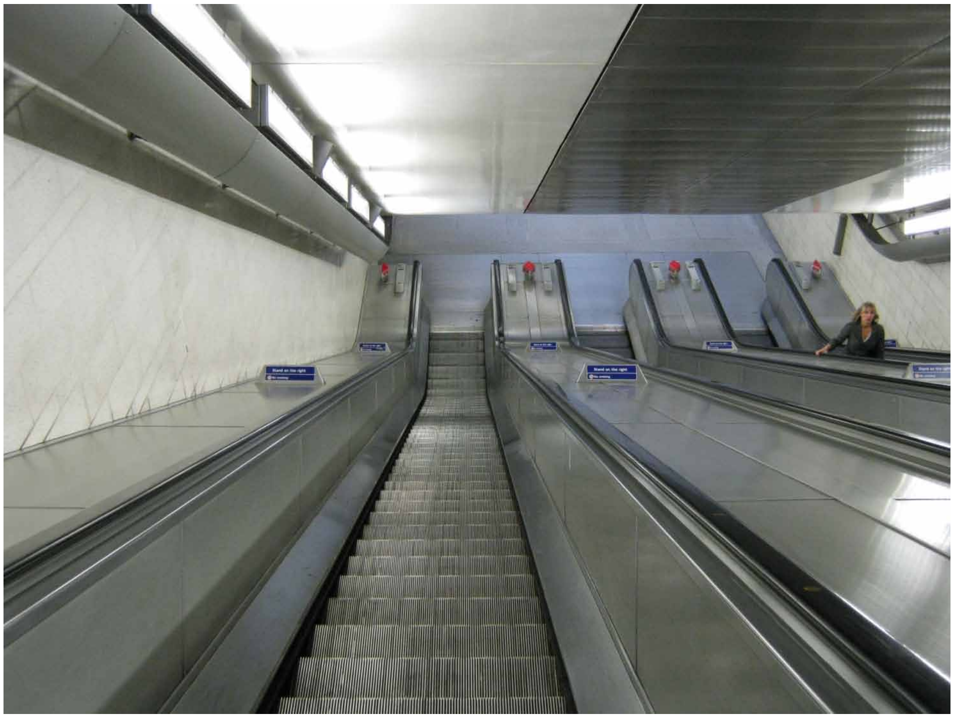
Site 12 – Tube – Subway – Southwark Station – London, England

Positive Attributes

- Ample natural light at all levels of the transit station
- Identifiable building form at grade level for the main entry to the station
- Deep platforms
- Unique seating detail at platforms
- Unique design feature to create feeling of natural light below grade
- Interesting visual experience as passenger travels through the transit stations; views, materials, spatial volumes, etc.

Negative Attributes

- Long travel path from street level to platform level



Chapter 11

Commuter Sequence Analysis

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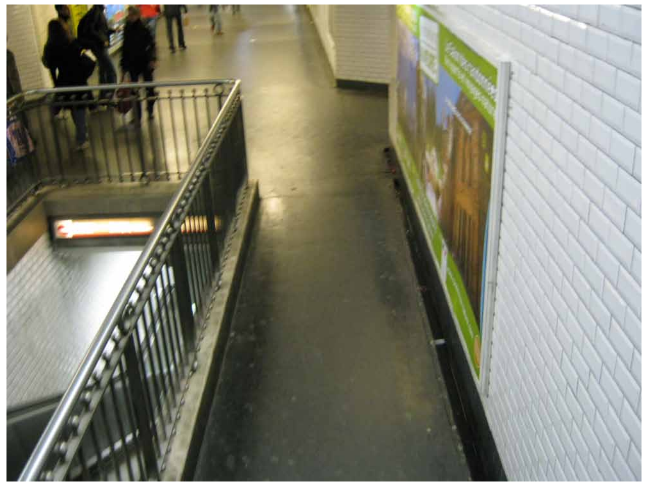

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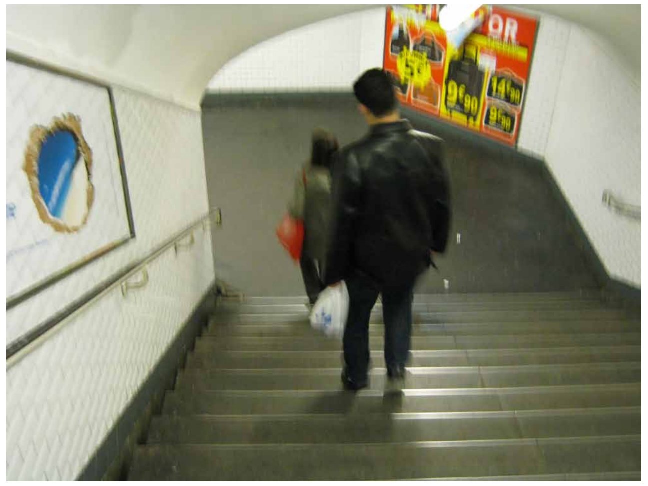

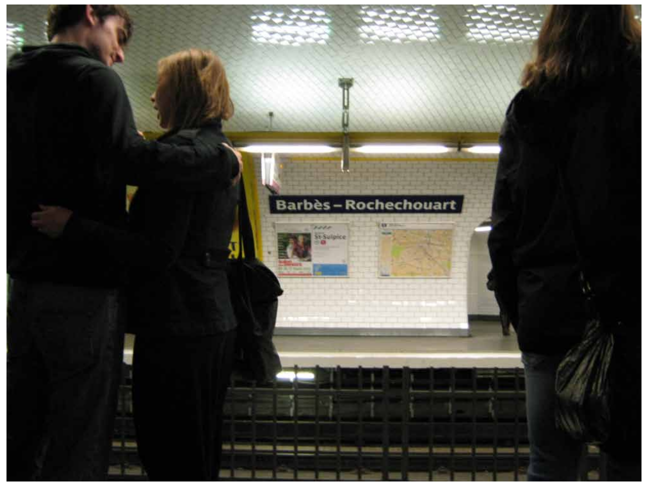

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Barbe's Rochechouart Station – Paris, France

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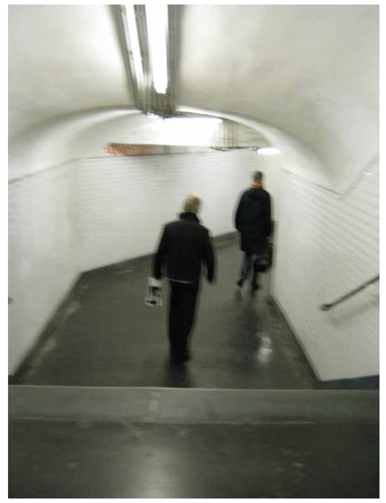

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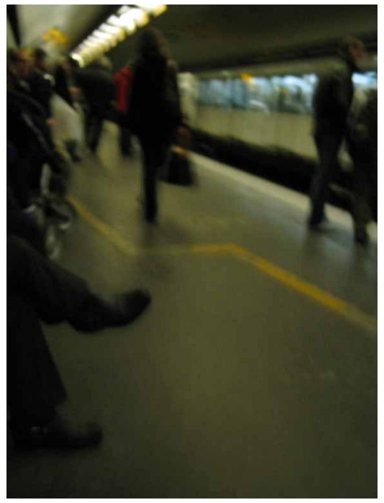

Bastile Station – Paris, France

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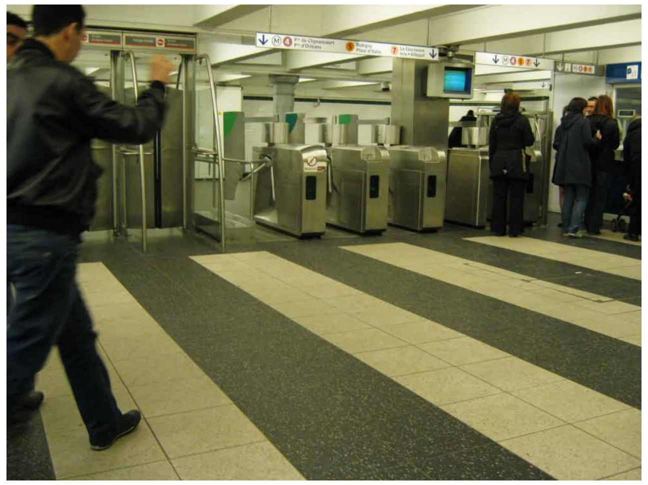

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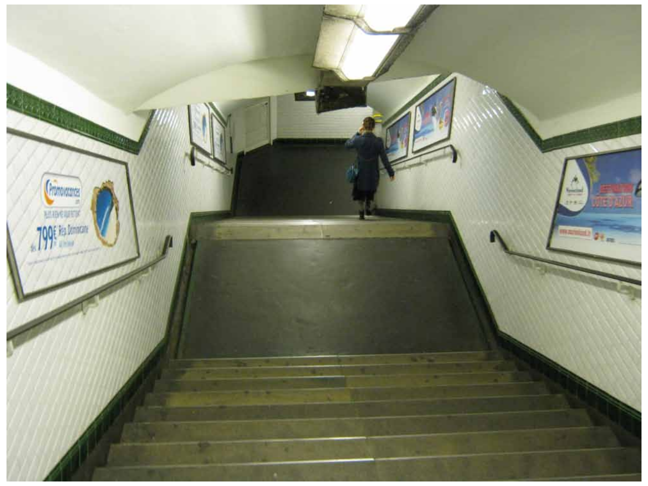

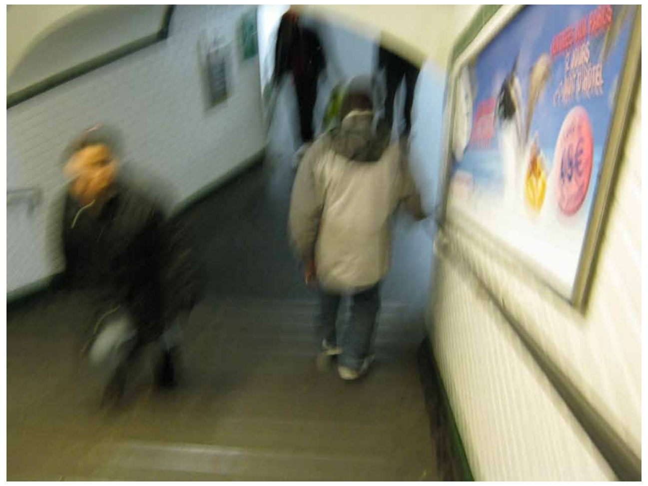

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Gare de L'est Station – Paris, France


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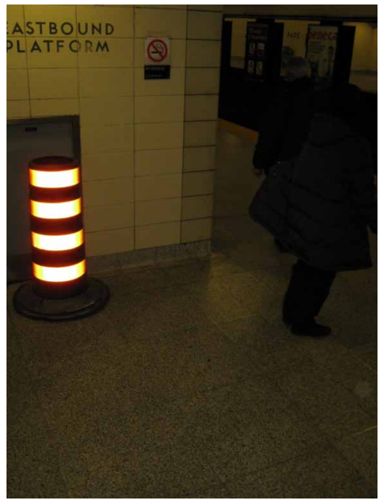
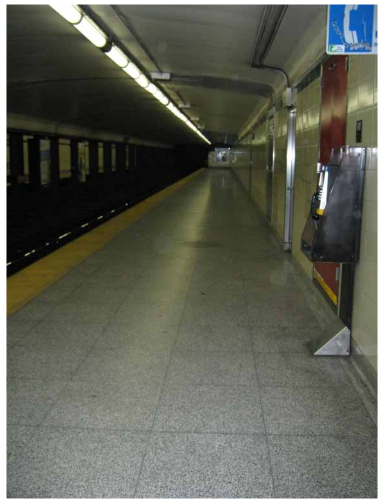

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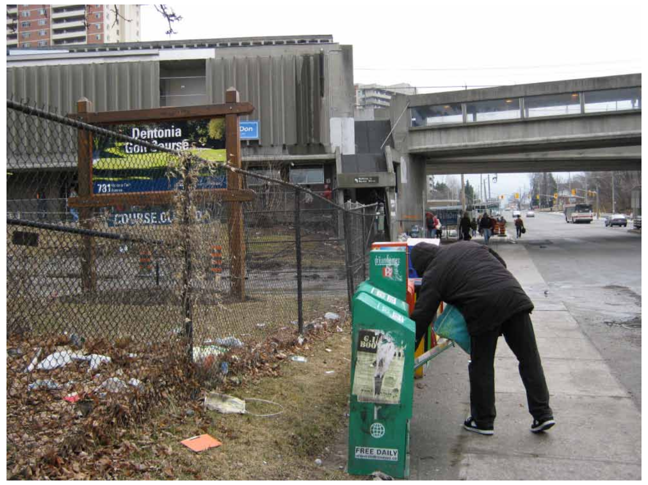
Bloor – Pape Station – Toronto, Ontario



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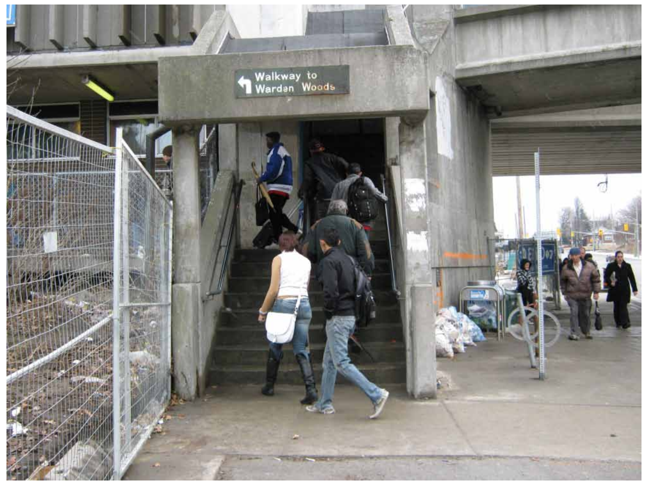

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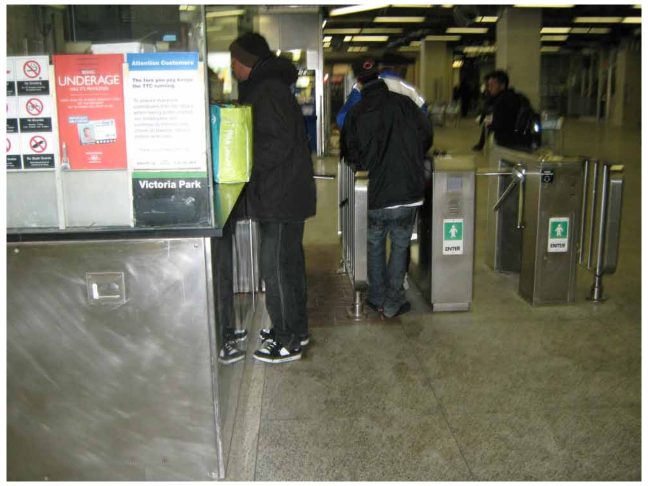

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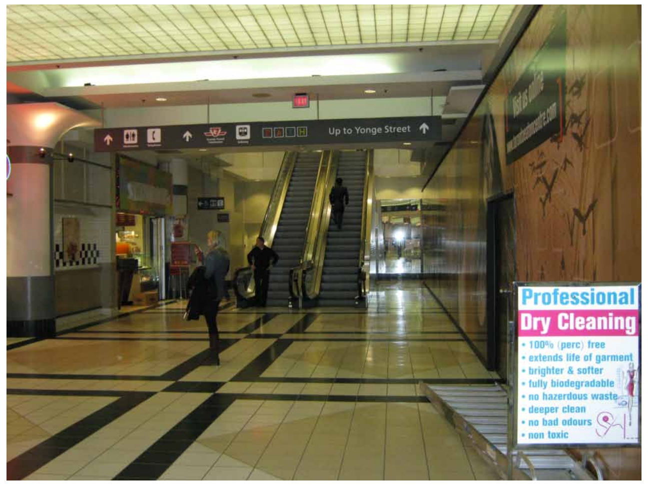

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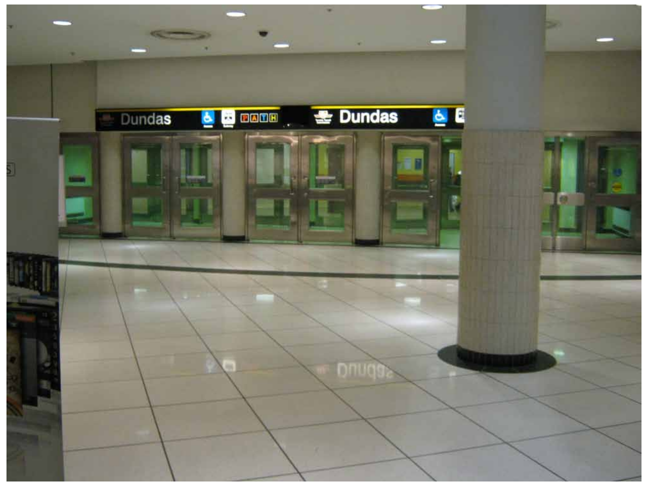

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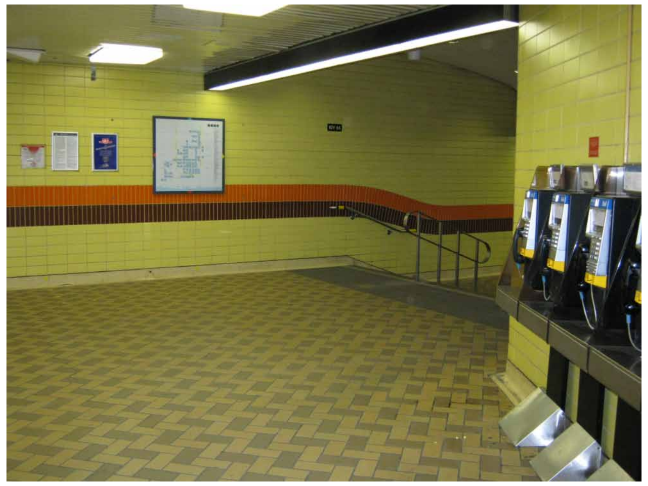

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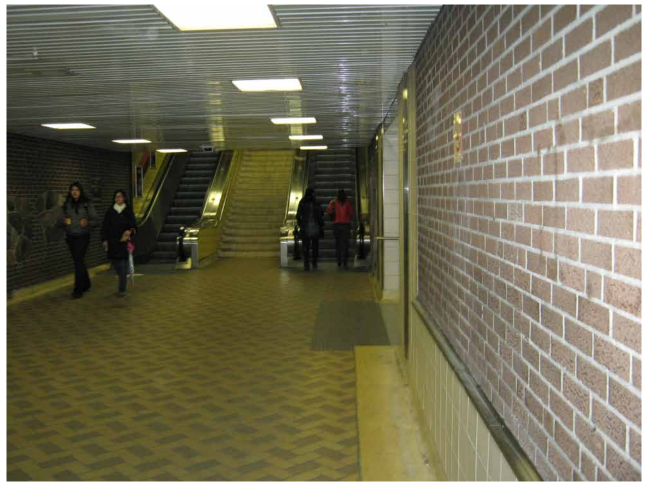

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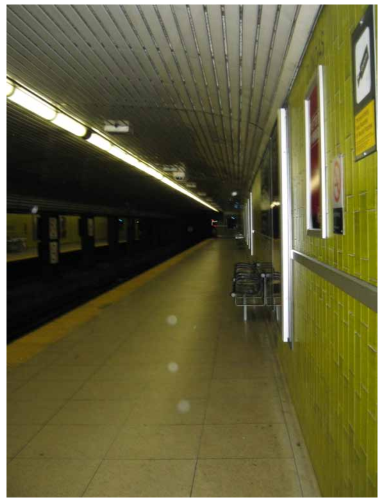

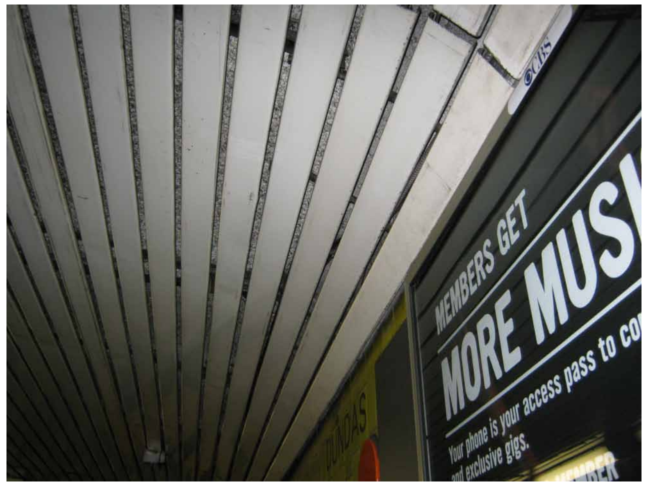

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Yonge Dundas Station – Toronto, Ontario

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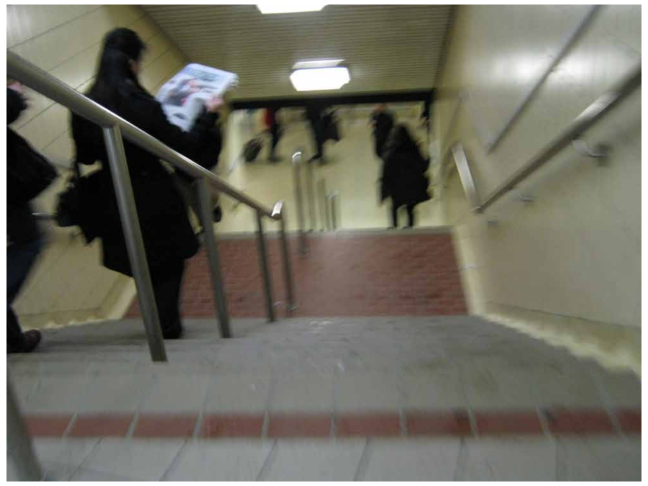

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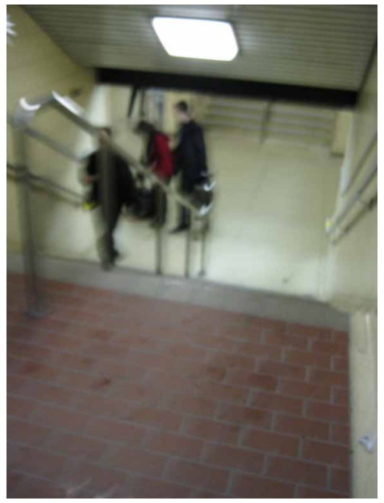

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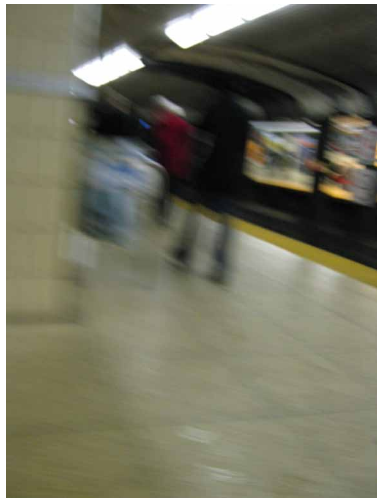
Yonge & St. Clair, Toronto, Ontario



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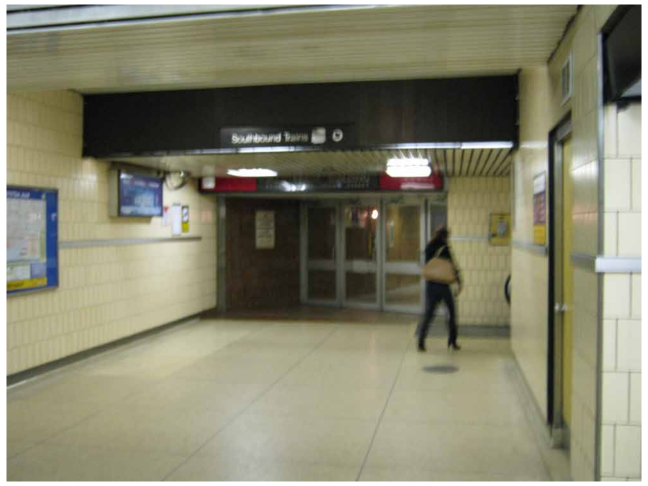

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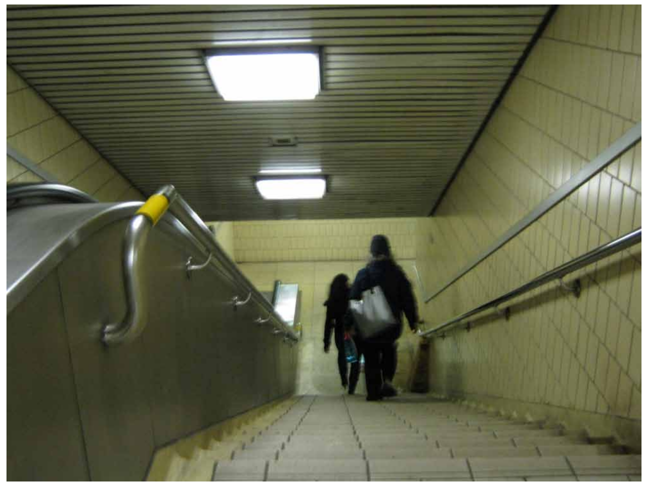

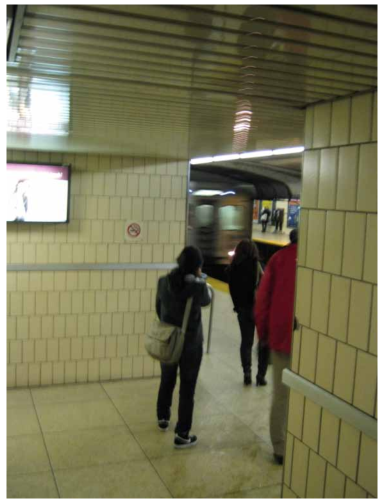

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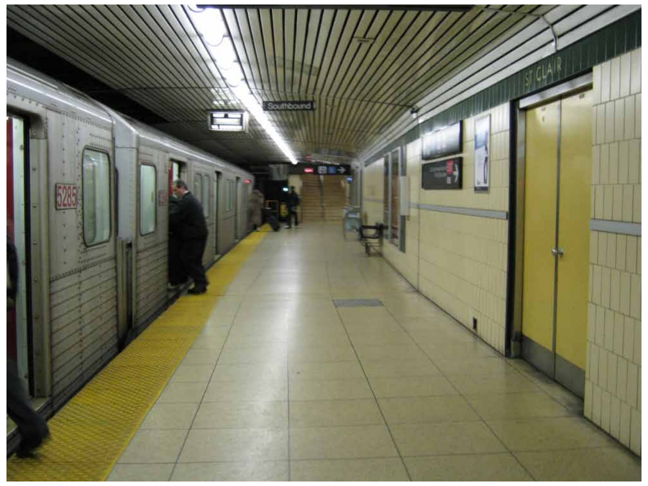

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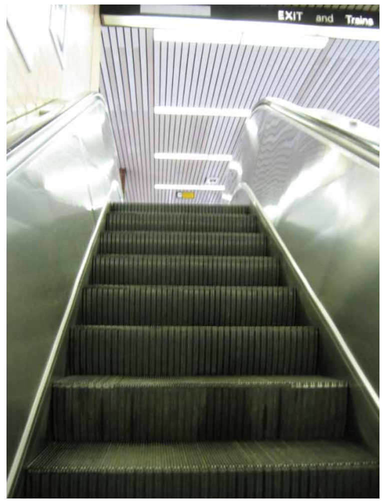

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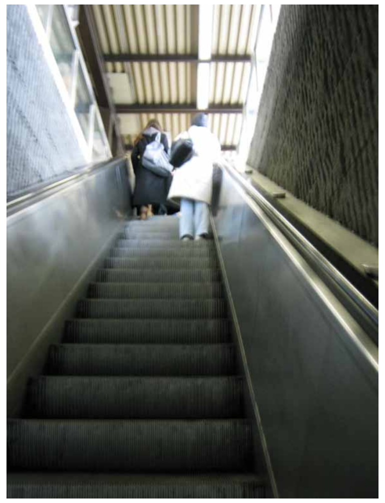

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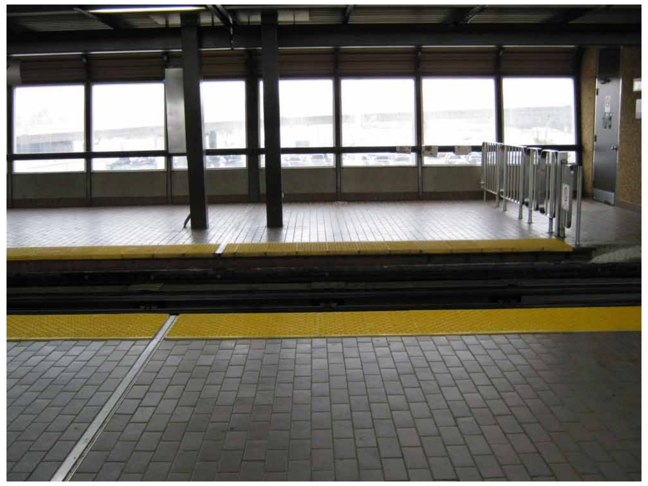


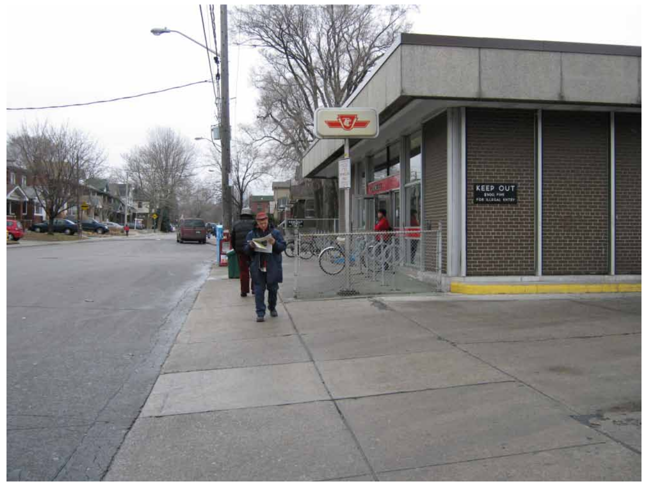
Bloor – Kennedy Station – Toronto, Ontario

APPROACH

APPROACH

APPROACH

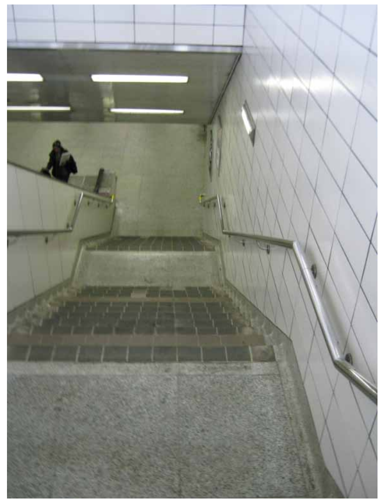
IDENTIFICATION



IDENTIFICATION

ARRIVAL

TRANSITION



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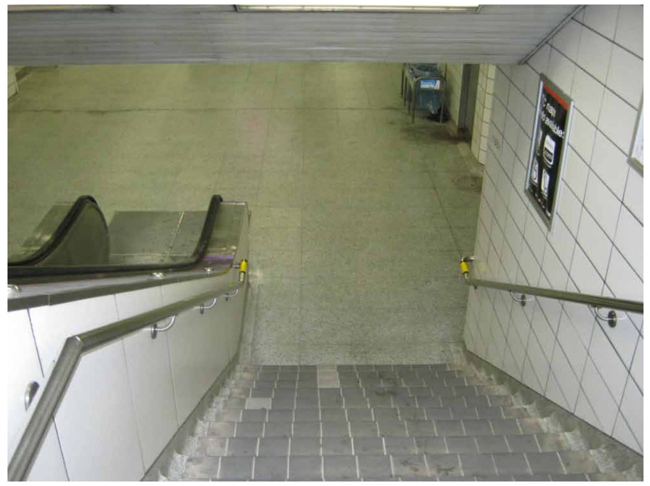

TRANSITION

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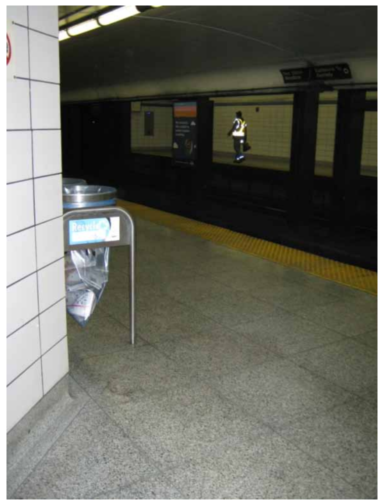

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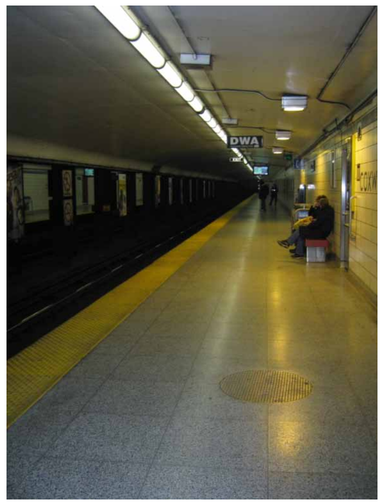
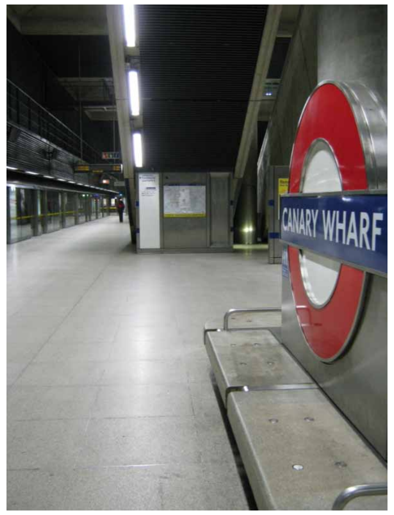


Bloor & Coxwell Station, Toronto, Ontario



DESTINATION

TRANSITION

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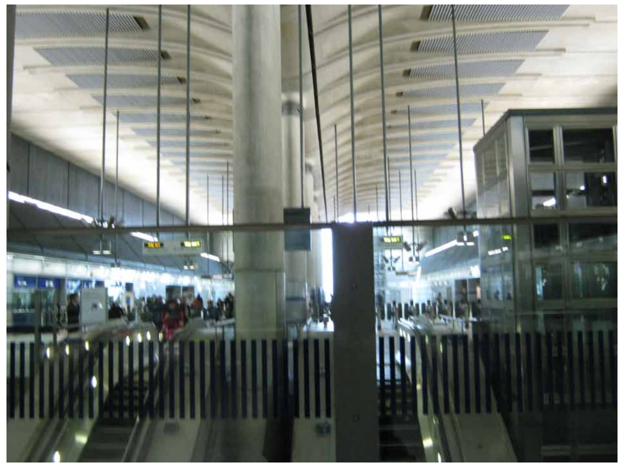

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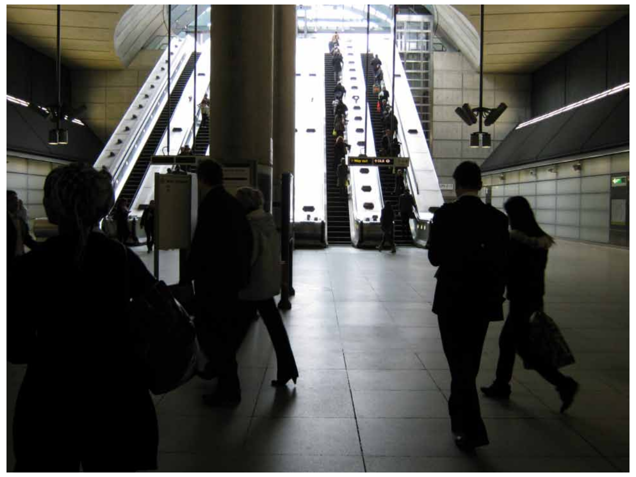
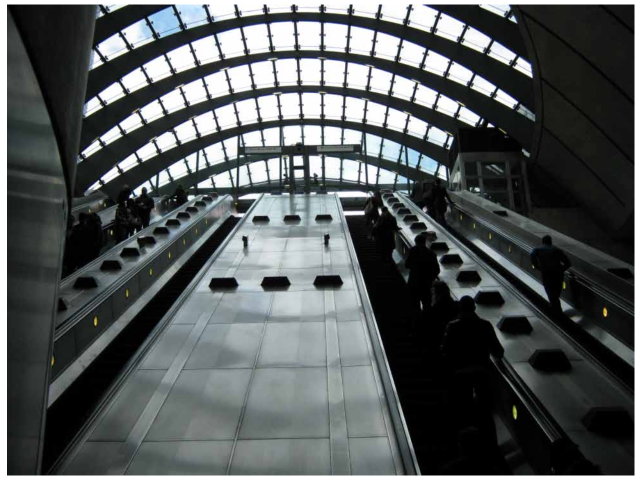
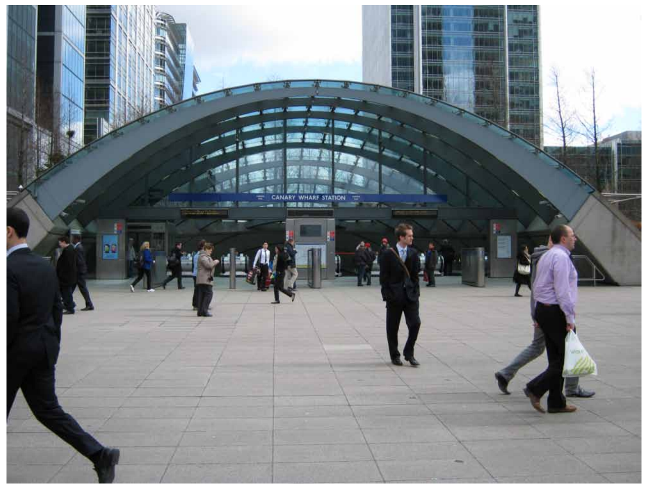




APPROACH



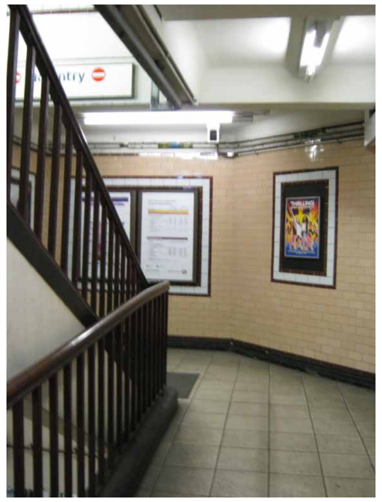
APPROACH

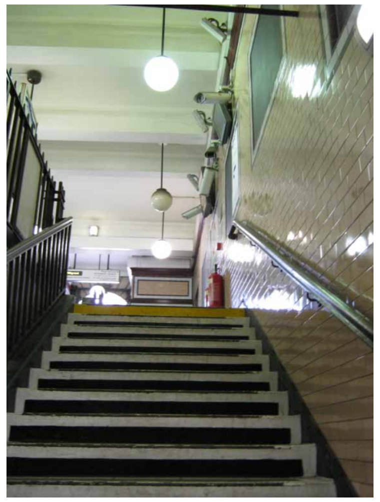
Canary Wharf Station – London, England

DESTINATION

TRANSITION

TRANSITION





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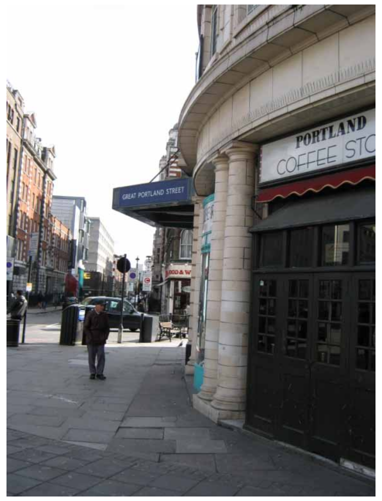
ARRIVAL

APPROACH



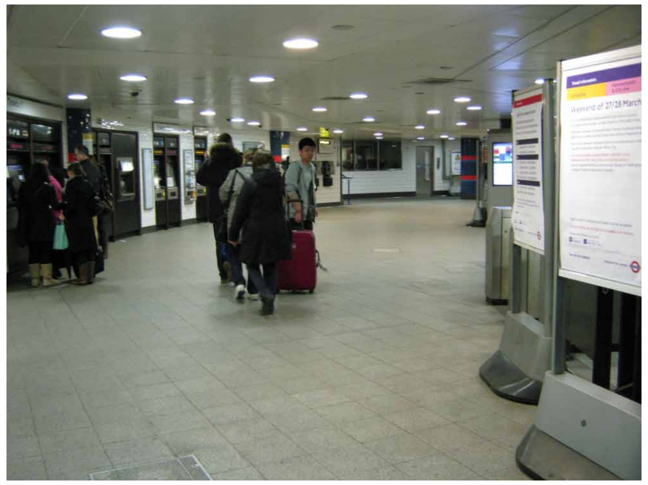
IDENTIFICATION

Old Portland Street – London, England

APPROACH – IDENTIFICATION

TRANSITION

ARRIVAL



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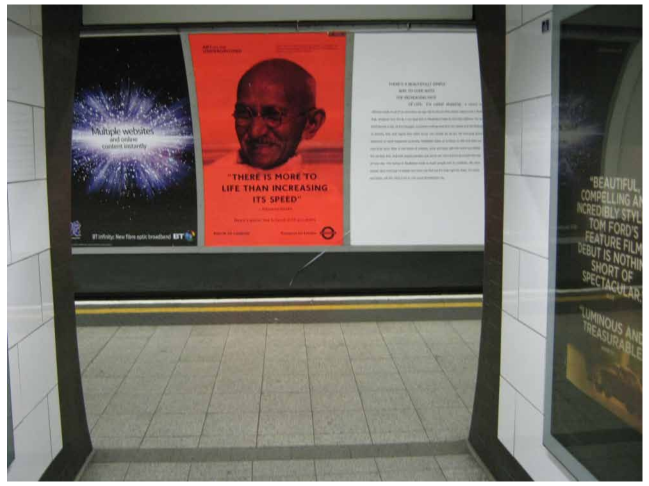


DESTINATION



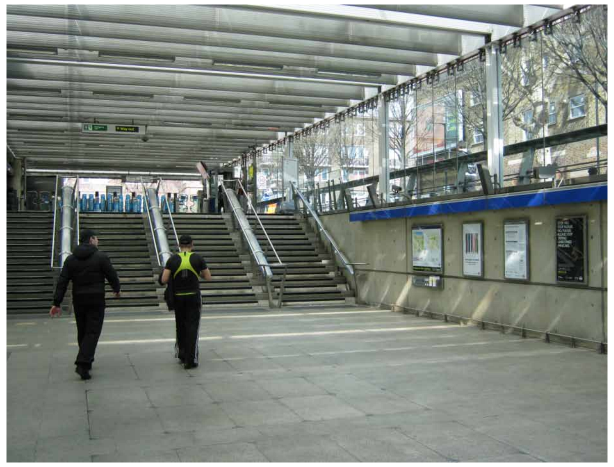
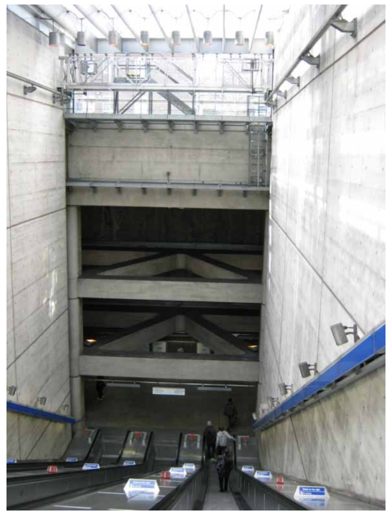


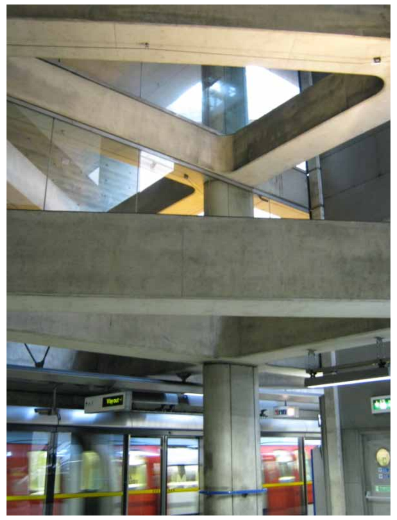
APPROACH

ARRIVAL

TRANSITION

TRANSITION


TRANSITION

DESTINATION

DESTINATION

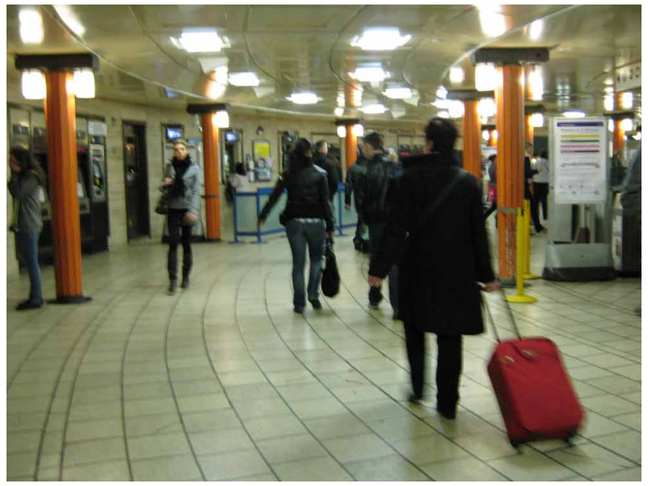
Bermondsey Station – London, England

APPROACH

IDENTIFICATION

TRANSITION

TRANSITION



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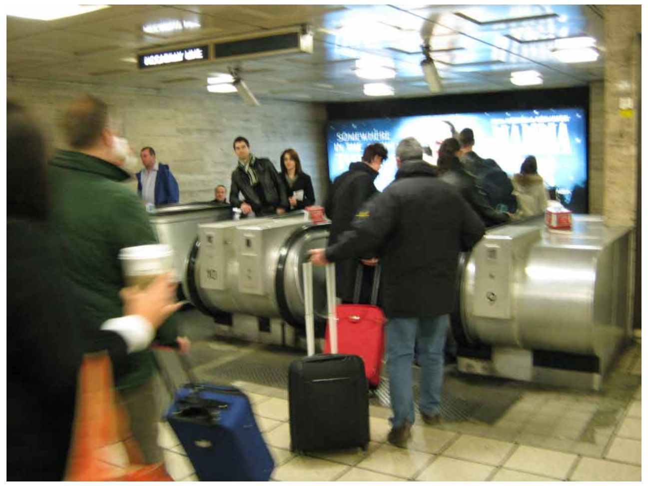
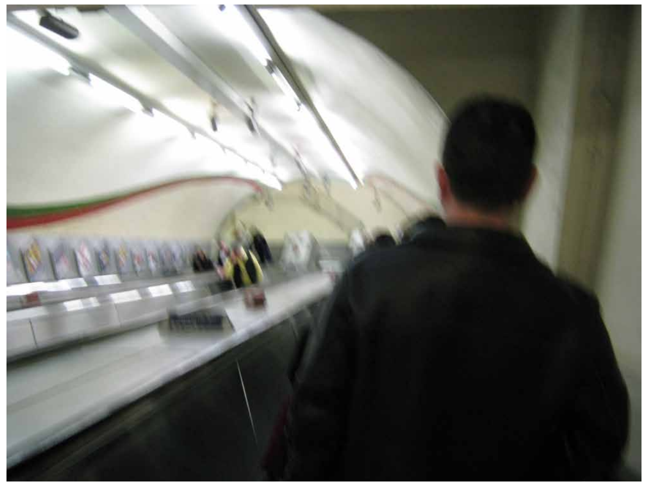
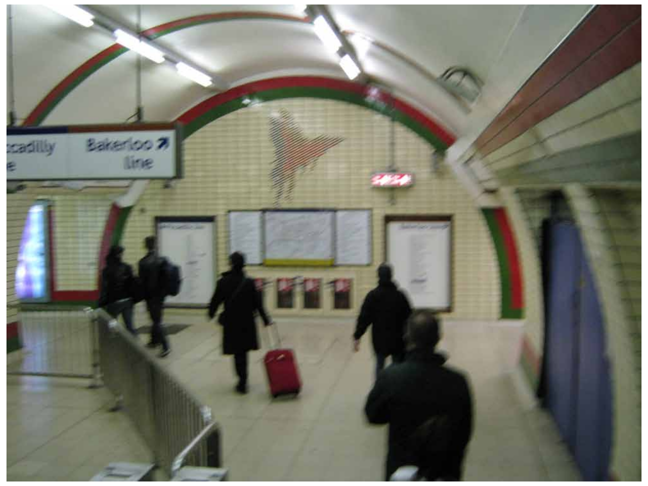
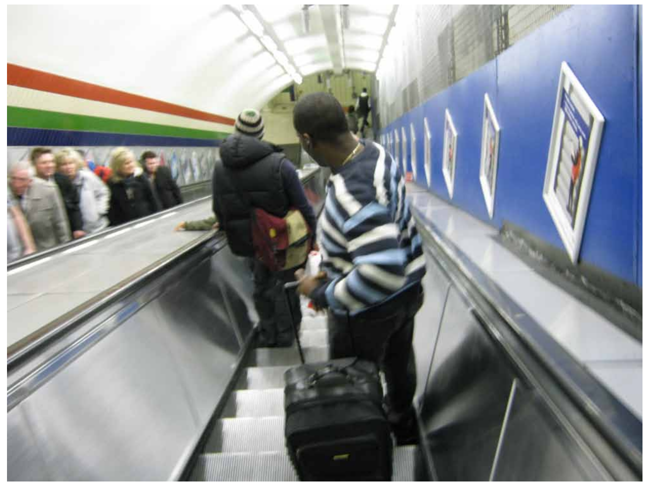




TRANSITION

Picadilly Station– London, England





TRANSITION

TRANSITION

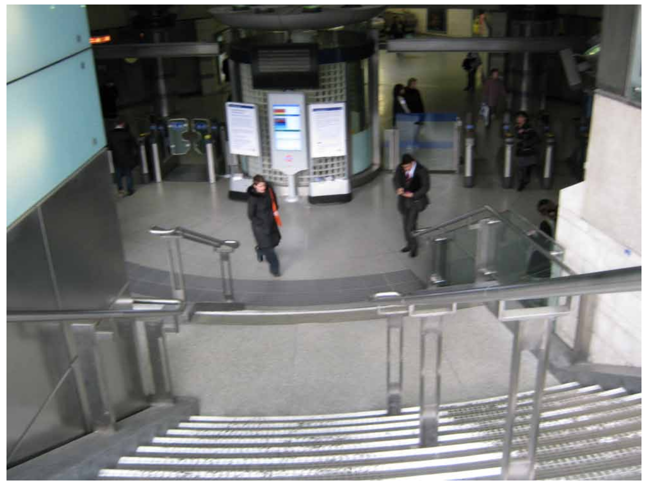
TRANSITION

DESTINATION

Picadilly Station– London, England

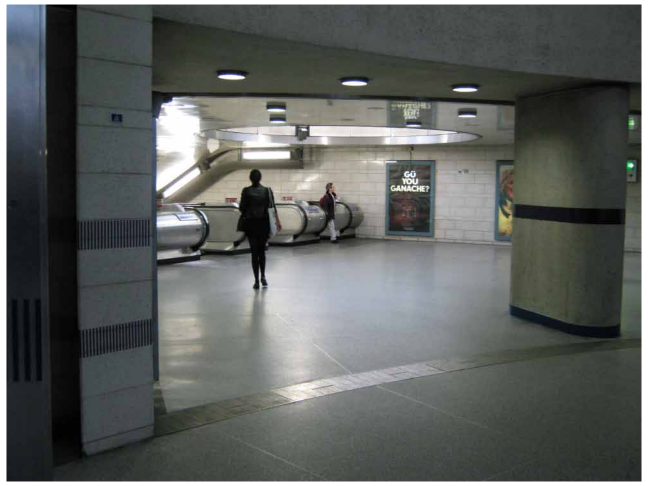
APPROACH

IDENTITY



ARRIVAL

TRANSITION



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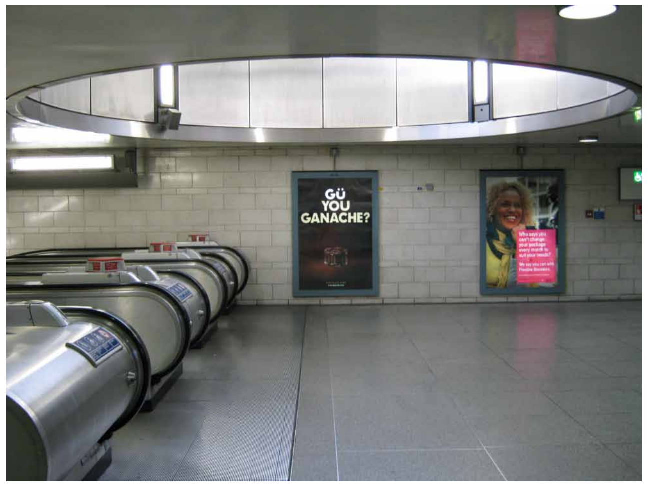

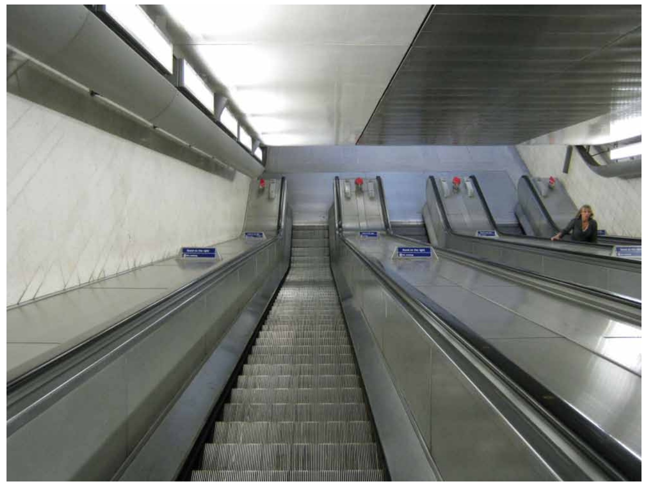

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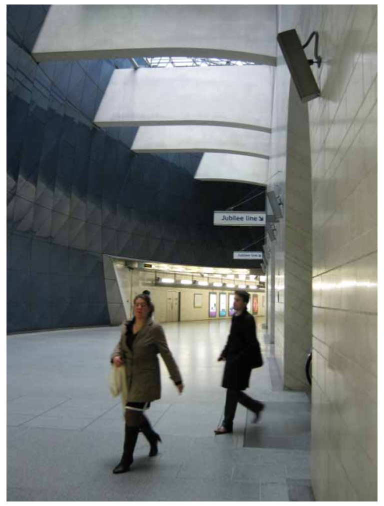
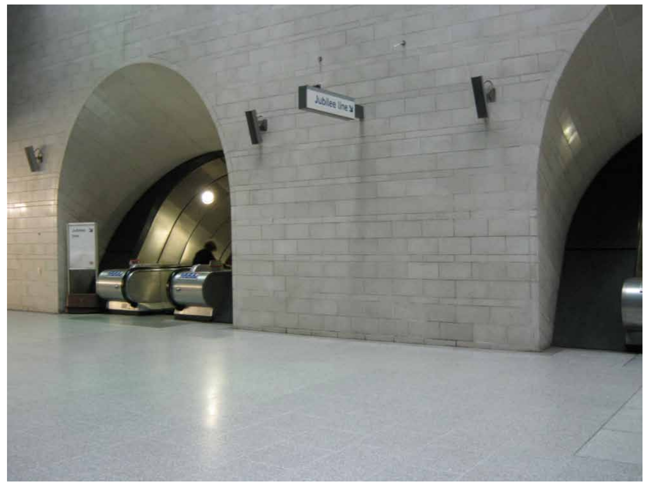




Southwark Station – London, England





TRANSITION


DESTINATION

Southwark Station – London, England

Chapter 12

Thesis Demonstration Presentation – D9B

INTRODUCTION

1.0 Elevating the Commuter Experience

2.0 Points of Reference

3.0 Design Guideline Structure

1.0 Elevating the Commuter Experience

The goal of this thesis is to establish a set of design guidelines that elevate the commuter experience when using public transit facilities. Extensive research of subway public transit facilities around the world has provided the basis for establishing design criteria for major design elements within these public spaces. In addition to site research, review of various periodicals, essays, and data on pedestrian movement and requirements for comfortable travel have also been analyzed.

Architectural design plays a significant role in establishing the framework for a pleasurable commuter experience. The role of architectural design, and the influence it has on commuter's use of these facilities, is the basis for this thesis topic. The result of this research, is a set of design guidelines.

Research indicates that there are no known publications that exist to provide designers with a consolidated set of design guidelines for subway transit facilities. This thesis aims to fill that void by providing a set of design guidelines for both the primary spaces within and built form relationship outside the public transit facility.

2.0 Points of Reference

The design guidelines provided are a result of findings and observations determined in the research portion of this thesis (D9A Research document dated December 15, 2010).

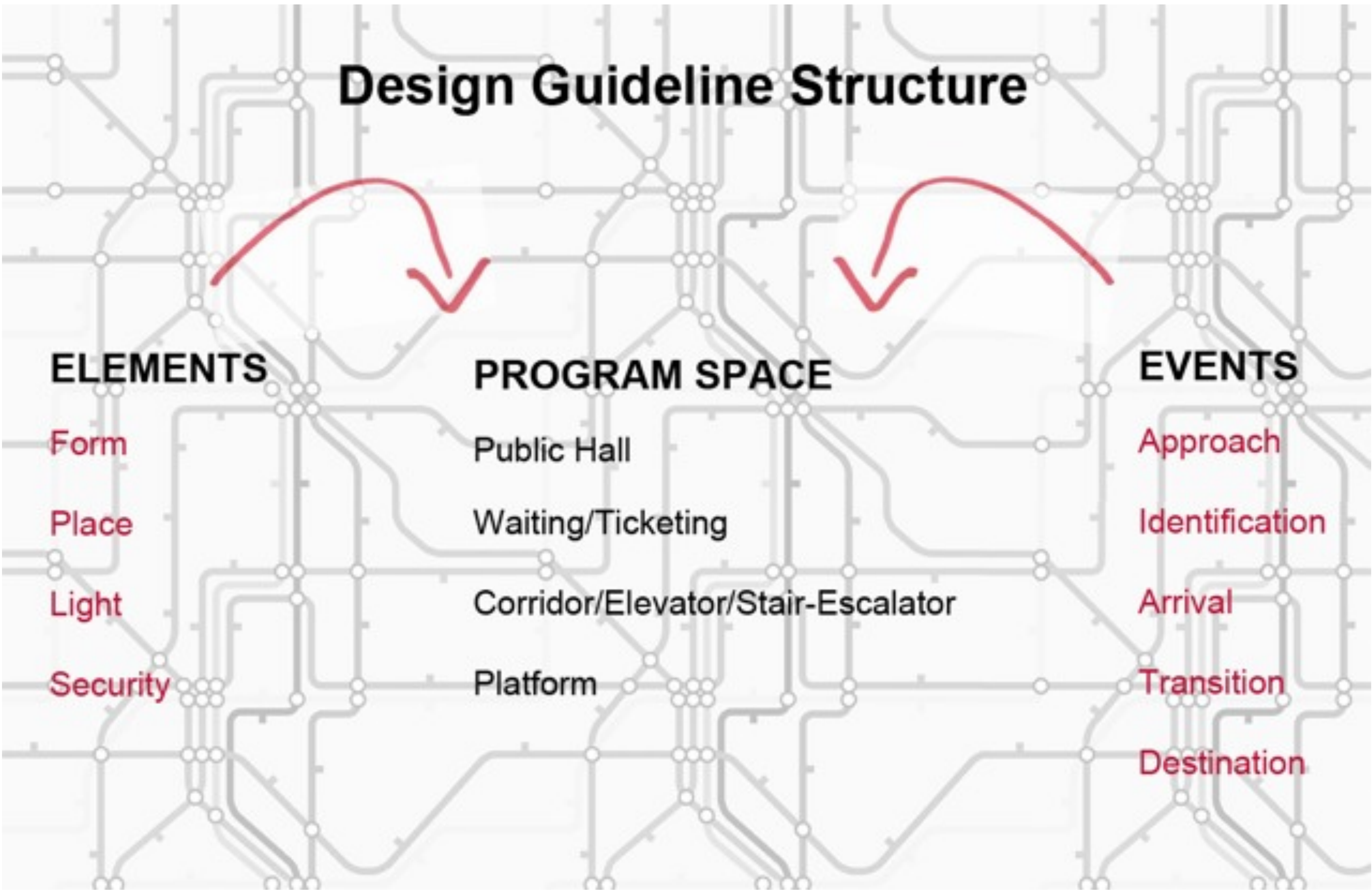
The ultimate success of designing a pedestrian space, such as a subway facility, depends on it's ability to adjust to the daily demands of traffic volume and traffic patterns, while also providing essential programatic requirements to meet the needs of commuters. Each subway site requires specific data to be collected by the designer in order to ensure the best solution or approach for the design problem. Design issues such as:

- Land use of adjacent and surrounding area
- Projected passenger volume per site
- Location within city (urban/sub-urban)
- Services required to support (taxi/bus/light rail/street-car)

This demonstration provides a set of design criteria for program areas within subway facilities as well as an architectural illustration of the design guidelines using St. Clair subway station site located at Yonge Street & St. Clair Avenue in Toronto, Ontario.

3.0 Design Guideline Structure

My research concluded three main points that these design guidelines are based upon. Firstly, that the four main architectural elements that influence a passengers enjoyment when travelling within subway facilities are **Form, Place, Light, and Security**. Second, that while passing through the subway facility, passengers main experiences or events can be defined as **Approach, Identification, Arrival, Transition, and Destination**. Last is the ensuing space required for human comfort and locomotion, so that large numbers of commuters can be accommodated during peak travel periods and overcrowding is not a problem.



Chapter 13

Thesis Demonstration Presentation – D9B

DESIGN BASIS

B-DESIGN BASIS

Photo - Example - Form

Photo - Example - Light

This design guideline is based upon the findings and conclusions carried out during the research portion of the thesis in D9A. The three main categories of conclusions that were identified are the elements, events, and human spatial requirements.

The architectural elements**,** that have the most significant impact on the commuter travel experience. The commuter events broken down into four (4) main categories. And lastly, the commuters spatial requirements, and how the data used for calculating space within these facilities requires updating.

1.0 - The main architectural elements that impact the commuter experience are:

1.1 Form

1.2 Place

1.3 Light

1.4 Security

Photo - Example - Security

B-DESIGN BASIS

2.0 - The main events that occur during a commuters travel through a subway transit facility are:

2.1 Approach/Identification

2.2 Arrival

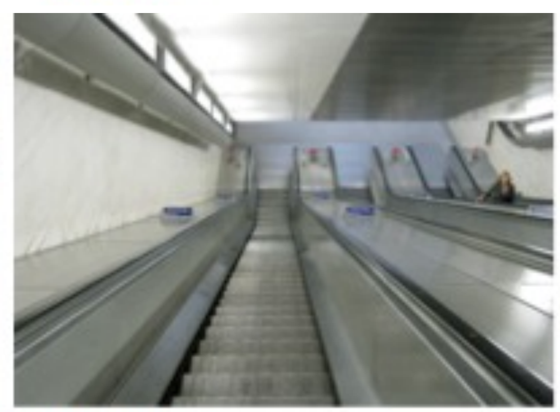
2.3 Transition

2.4 Destination




APPROACH IDENTITY ARRIVAL TRANSITION





TRANSITION TRANSITION

Commuter Travel Experience - Southwark, London, England

3.0- Current up to date data for human spatial requirements within subway transit facilities must be considered.

Spatial design criteria that accommodates comfortable pedestrian movement during peak travel periods has been examined. A new criteria has been developed based on a survey of typical pedestrian sizes and the space required around to maximize comfort while walkling through subway facilities.

B-DESIGN BASIS

Photo - Example of Building Form
Nordpak Railway - Innsbruck, Austria

Photo - Example of Building Place
Spiral Cafe - Birmingham, England

1.0 Introduction - Elements

The main design elements that have been concluded as having a significant impact to elevating the commuter travel experience within subway transit facilities are form, place, light, and security. These four elements have the ability to inform the building architecturally and respond to the commuters concerns identified in my research.

1.1 Form

The building form must express its use and function while defining an important public space within the city. The hierarchy of internal spaces must be clearly defined within the building's massing. The scale of individual spaces such as main entry, secondary entry, drop off locations, etc. must be considered each by there own specific requirements and their location within the building and should be designed accordingly.

Commuter circulation will be given priority and integrated within the movement of all subway transit facility traffic such as buses, cars, streetcars, and taxi.

Although each subway transit facility stands alone, at an individual location, they are part of an overall urban landscape and are important streetscape forms. The form used from one facility to the next need not be the same, however the building design should communicate the character and identity of the community while defining the subway transit facility as an important public building.

My research concluded that the majority of existing subway facilities visited do not play a significant role in being an identifiable component within the city's urban fabric. My goal, through the application of these design guidelines is to address this deficiency using building form as a one of the key ingredients to elevating the commuter experience.

1.2 Place

Subway transit facilities are buildings that move vast numbers of passengers in and out each day, however most passengers have little on their mind except to get to their destination. These facilities play an important role in defining social spaces within our community. By social space I mean, a building that provides places for social interaction aside from the busy hustle and movement that are typical to subway transit facilities. These buildings require attention to be paid to place making, and providing for spaces to touch down, such as cafe's, benches with a view, retail outlets, etc.

Designing with the intent of providing a place for commuters to meet one another, and wait for their friends, and view the city as it move along, all contribute to a higher quality building and place making within our community.

Image - Example using Light features at Platform Level

Photo - Example - Security - Crowded Platform

1.3 Light

Providing light to spaces within transit facilities must exceed the building code requirements and be used to enhance the building form, and add interest and excitement to spaces at all levels within subway transit facilities.

Innovative use of light may be in the form of a light wall, illuminated panels, lighting that take the form of public art and be updated over time.

The use of natural or manmade light can be used to illuminate the overall structure and enhance the building form. Access to lighting can also provide a passive heat source to large public spaces during the winter seasons. Current technology available will allow designers with numerous options to achieve getting natural light to the lowest levels within the building, including the platform, thereby improving the quality of these spaces while commuters travel through the subway facility on their daily journey.

1.4 Security

During the research, personal security was identified as one of the most important considerations highlighted by commuters as when using subway facilities. The architectural design must achieve the highest level of passive security possible by making conscious choices related to blind corners, choice of materials, views for the passengers from one space to another, views from one level to another, interior-exterior views, etc..

Perceived personal security is not something one can measure or provide a tangible result other than looking at improved commuter ridership, or through personal interviews. Many passengers often do not have a choice in their use of the subway to travel to and from their destination, therefore designing facilities with personal security in mind will help to improve the commuter travel experience.

2.0 - Introduction - Events

Five (5) main commuter events have been identified to have a significant impact on the commuters travel experience within subway transit facilities. These are approach, identification, arrival, transition, and destination.

The events are the method used to break down the commuter experience while travelling through subway transit facilities. For the purpose of this study, the starting point for the travel process is the approach and identification to the building. The destination is defined as the platform.

Passengers can start the process in reverse, from the destination as they arrive from the train and exit at the platform, however to get to this point, the commuter would already have had to enter a subway transit facility somewhere in the system and start. So, for the purpose of this study, the starting point is the exterior of the building and the end of the experience is the platform.

2.1 Approach

The approach is defined for the purpose of this thesis as the event in the commuters travel experience when moving towards the facility as a whole. The facility is in sight as a whole, however the individual access point the commuter is moving towards has not been isolated visually.

2.2 Identification

Identification is defined as the visual connection with the specific point the commuter is going to access for their travel. It could be the front door of the transit facility, or the automobile drop off/pick up point, or the entry point to the subway portal from the street.

2.2 Arrival

Arrival is defined as the space within the subway station such as the waiting areas, ticketing, or the public hall. Arrival spaces could contain retail and ancillary services for passengers to gather at and provide an activity prior to their next move or transition.

2.3 Transition

Transition spaces are where we spend most of our time while moving from one event to another within the subway facility. Transition spaces connect all the spaces internally. These spaces can be stairs, escalators, corridors, etc. and should be designed with the equal importance and attention as all other events within the commuters travel

2.4 Destination

The destination is the platform for the purpose of these design guidelines. The platform is where the commuter wants to go on his or her journey. The journey may be work or play, although the commuter must pass through the previous three (3) events in order to get to the destination.

2.0 - Introduction - Events (continued)

IDENTIFICATION

ARRIVAL

DESTINATION

TRANSITION

Body Data				
Name	Width	Depth	Height	Age
John Tanfield	22	14	5'-9"	43
Phil Notley	28	18	6'-2"	44
Sheri Tanfield	18	13		43
Cam McCiver	32	28	6'-4"	40
Gary Deller	32	30	6'-2"	55
Tim So	20	14	5'-8"	29
Alisha Williams	20	13	5'-8"	
Avril Darson	19	12	5'-4"	32
Debbie Deller	22	18	5'-2"	55
Austin Tanfield	18	12	5'-0"	13
Spencer Tanfield	16	11	4'-6"	11
Jeff Broad	23	22	5'-8"	49
Valentin Gaina	24	23	5'-10"	47
Beth Tanfield	24	18	5'-2"	80
Bob Jewell	24	20	5'-8"	76
Greg Dennis	30	28	6'-1"	
	372	294		
Average width	28.6153846153			
Average depth	22.615384615			

Table - Body Data Research

3.0 Introduction - Spatial Requirements

The design of all public spaces within subway transit facilities in this thesis is also based upon the requirements and comfort levels of the commuter. Studies by both the Transportation Research Board, National Research Council, and by Dr. John J. Fruin were referenced in defining comfort levels for pedestrians in different spatial categories.

3.1 Fruin Study

The body ellipse is defined as a sphere of 24" (600mm) x 18" (450mm) for the area (3.0 SF) per person.

The personal comfort distance for men is stated by Fruin as an area of 43" (1100 mm)" around the individual and 30" (750 mm) for women.

3.2 Tanfield Research

The design criteria stated by Fruin did not seem to be adequate for the design of subway transit facilities. The area defined for one person was tested against measuring individuals and verifying if the area of 3.0 SF per person was adequate. My study, taking a sample range of individuals by size and age (see Table - Body Data Research), revealed that a more realistic value would be 4.9 SF person based upon dimensions indicated (See Diagram - Tanfield Body Ellipse).

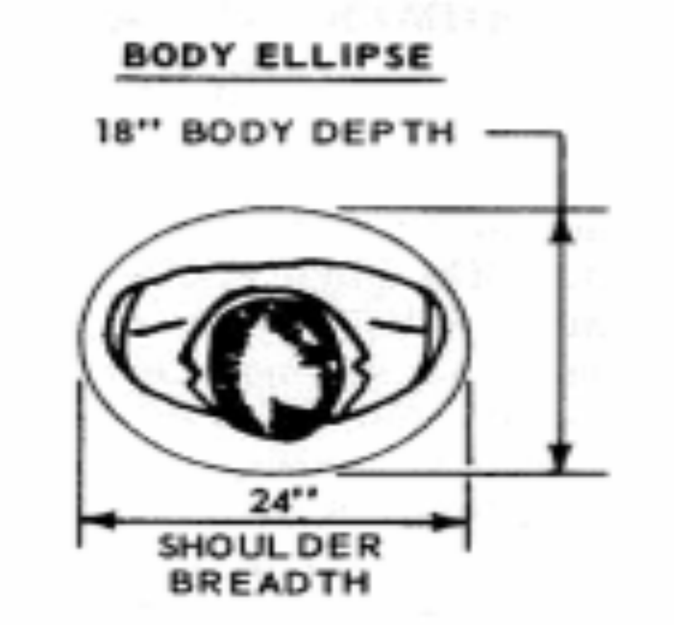


Diagram - Fruin - Body Ellipse

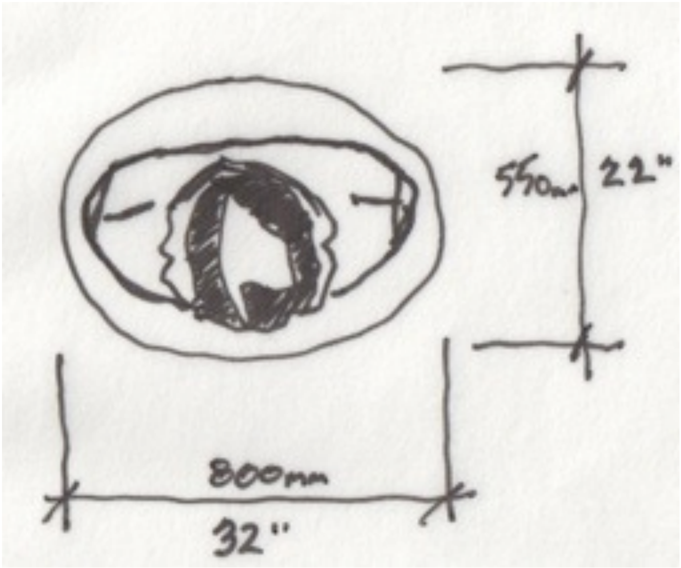


Diagram - Tanfield - Body Ellipse

Property Data Map - Yonge Street and St. Clair Avenue, Toronto, Ontario

Aerial View - Yonge Street and St. Clair Avenue, Toronto, Ontario

4.0 Architectural Illustration - Site Selection

The site selected to architecturally illustrate the subway transit facility design guidelines is located just east of the intersection of Yonge Street and St. Clair Avenue, Toronto, Ontario. This site was selected as it provides the opportunity to display a number of design scenarios that will occur in typical subway transit facilities, and provided a good basis for applying design guideline standards.

The demonstration, subway transit facility design, illustrates one way in which a subway transit facility may be developed and provides design solutions that can be used as starting points for the design of these facilities at multiple locations and scenarios. The demonstration illustrates the design guidelines developed as part of this thesis.

Some of the key attributes of this location were its urban location; located centrally in a major Canadian city. Secondly, this location provides a site with access to two (2) streets; St. Clair Avenue on the north side of the site, provides a city street, with a dense office tower typology, and Pleasant Avenue to the south, that is primarily residential with a lower density. This site also has a medium level of passenger usage per day, for TTC subway locations and has multiple modes of transportation access such as subway, street car, bus and taxi. Some facts about this location that were used to begin my calculations and assumptions are as follows:

Yonge Street and St. Clair Avenue Station - Daily Use

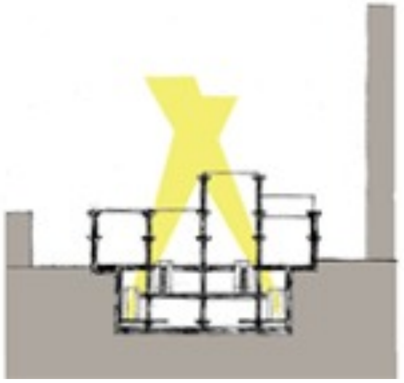
Daily Average subway passenger volume for Yonge & St. Clair station is 7200 and divided over three peak periods.

7:00am to 9:00am = 2160 passengers
11:30am to 1:00pm = 1080 passengers
5:00pm to 6:00pm = 2160 passengers
Total = 7200 passengers

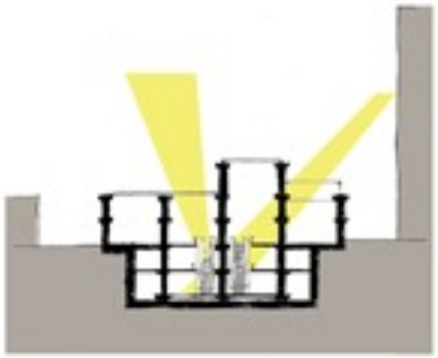
Case Study Transit Facility Size Requirement

The maximum commuter usage that this facility would be required to accommodate is 2160 passengers.

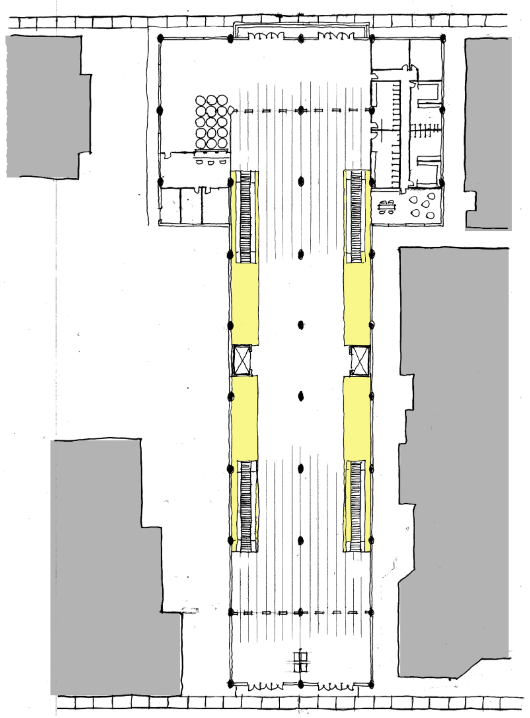
2160 x 1.21 m2/passenger = 2613 m2
Add space for future capacity due to better commuter experience and growth, and additional peak loads of 25%. The following estimated space requirement would be:
2613 x 1.25 = 3266 m2



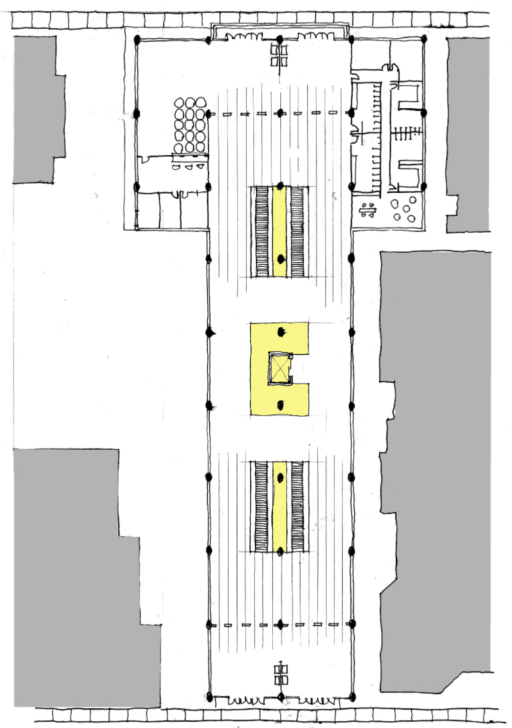
Drawing - Section - Outer Stair Design



Drawing - Section - Inner Stair Design



Drawing - Plan - Outer Stair Design



Drawing - Plan - Inner - Stair Design

Rendering - Outer Stair Design

5.0 - Moving Between Elements and Events

Program spaces that occur between Elements and Events.

It is important to acknowledge that the program spaces that occurs between the events must also be given design consideration. The designer must ensure that the design standard for one element and event is coordinated with the adjacent element and event. Two (2) examples of design consideration are provided:

- Arrival - Transition - Destination
- Form /Arrival & Form/Waiting Area-Ticketing

5.1 - Arrival - Transition - Destination

Consideration must be given to the type of light and security solution for the concourse level, and what the site will permit (natural or man made lighting).

For example, the design guidelines state that light wells within the concourse level (Transition) be positioned within the column and niche spaces, whereas on the platform level this may not be possible depending on the design scenario and site specific conditions.

Utilizing the vertical penetrations of the elevator, stairs, and escalators will all have a design impact on the type of design solution proposed for the concourse and platform (see Drawing - Section - Plan - Renderings, this page).

In the example shown, light wells are utilized to transfer light from the Public Hall level to the lower levels, such as the Concourse and Platform. The elements of Light and Security work to connect the events of Arrival, Transition, and Destination. Spaces are also visually connected between levels providing an enhanced passive level of personal security for commuters.

Rendering - Ticketing

Rendering - Public Hall

5.2 - Form /Arrival & Form/Ticketing

In this example shown, (see Rendering - Ticketing, this page), the rendering illustrates the connection between the Event/Element of Form/Arrival and the Event/ Element of Form/Waiting-Ticketing. Coordinating the design requirements established in the guideline between these two spaces is illustrated between these two (2) spaces. The Waiting area is to be in an area with a smaller scale than the Public Hall, and in the example within the design guideline a clear interior height of 4.5 m, where the Public Hall in the design guideline has no maximum height defined.

5.3 - Summary

The **four (4) architectural elements (Form-Place-Light-Security) combined with the five (5) commuter events (Approach-Identification-Arrival-Transition-Destination)** provide the framework by which these guidelines were developed and illustrate the conclusions reached during D9A. These are the primary elements and events that impact the program space within the design guidelines for subway transit facilities.

Chapter 14

Thesis Demonstration Presentation – D9B

DESIGN GUIDELINES FOR SUBWAY TRANSIT FACILITIES

1.0 Approach
- 1.1 Introduction
- 1.2 Design Objective
- 1.3 Main Entrance
- 1.4 Street Portal Entrance

2.0 Identification
- 2.1 Introduction
- 2.2 Design Objective
- 2.3 Main Entrance
- 2.4 Secondary Entrance
- 2.5 Taxi Stand
- 2.6 Bus Pick Up Area

3.0 Arrival
- 3.1 Introduction
- 3.2 Design Objective
- 3.3 Waiting Area
- 3.4 Public Hall
- 3.5 Ticketing
- 3.6 Cafe and retail spaces

4.0 Transition
- 4.1 Introduction
- 4.2 Design Objective
- 4.3 Stairs and Escalators
- 4.4 Corridors
- 4.5 Elevators

5.0 Destination
- 5.1 Introduction
- 5.2 Design Objective
- 5.3 Platform
- 5.5 Designated Waiting Area

1.0 A P P R O A C H

Photo - TTC - Bayview and Sheppard -
Example of poor approach design to form

Photo - TTC - Yonge and St. Clair -
Example of poor identification Form

C - DESIGN GUIDELINE - APPROACH - IDENTIFICATION

1.0 EVENT - APPROACH

1.1 introduction

Approach is the event experienced by the commuter as he or she is identifies the overall building. The first of the five (5) main elements that require attention when designing subway transit facilities is the building form. There are many architectural methods to achieve a dominant and recognizable building form that will act as a beacon to remember and ensure identification with the subway station.

Subway transit facilities reside in many locations throughout the city such as dense urban locations (Toronto - Yonge Street & St. Clair Avenue) and suburban locations (Toronto - Sheppard & Bayview). The building form selected must address the many conditions that occur within a city while ensuring buildings of the highest architectural quality.

Subway stations in Toronto, Ontario had an average passenger use of 950,000 rides per day in 2010. This high level of activity and use within our city demands buildings that strive for the highest architectural design and quality. In addition, these buildings are necessary for the movement and business within the cities daily life so they must also be pedestrian friendly and work well within the existing street scape and site to which they belong.

1.2 Design Objective

- Subway stations should act as a beacon, and have a dominant form from one station to the next in order to become an identifiable building form over time.

- Massing should enhance glazed openings, large areas of similar materials, etc.

- Establish the buildings importance as pubic spaces and have a significant presence along the main street elevation. The use of the facility should be clear and identifiable as a public transit facility.

- Canopies and signage should be integrated

Photo - Jubilee Line - Canary Wharf -
Example of good identification Form

Photo - Jubilee Line - Canary Wharf -
Example of good identification Form

Rendering - Yonge & St. Clair -
Design illustration of good identification Form

1.3 DESIGN GUIDELINE

EVENT = APPROACH
ELEMENT - FORM & PLACE
LOCATION - URBAN - BUILDING SCENARIO

Design Guideline - Main Entrances

- Provide an identifiable entry location within the street landscape to which the subway station entrance is located
- Where Possible, set back the entry 6-8m from the street edge to accommodate queuing
- Provide an overhang over the entry extending out to the sidewalk or street edge as possible to establish a strong pedestrian scale
- Utilize transparent materials for enclosure
- Set back from sidewalk to ensure queuing space is adequate for location
- Where stairs are required, they should be recessed under a recessed canopy

Design Guideline - Overall Massing - Roofs - etc.

- Overall form should be bold and inspiring, unique to the site requirements and respond to the building program
- Provide a form that increases in volume from the main entrance to the centre of the facility
- Utilize a high amount of transparent materials for enclosure to allow natural light to access all public areas within the facility
- Architectural details should be consistent on all elevations to reinforce the dominant building form selected by the designer

Architectural Illustration - Example

The model used as an architectural illustration to demonstrate design the criteria while traveling on the subway introduces the use of a dominant form. This illustration uses the arch as an example of how to achieve identification within the architectural form.

- The dominant form has been selected as the arch
- Scale at the street level is pedestrian friendly
- Transparent materials used throughout the entrance

1.0 A P P R O A C H

Photo - London Tube Portal


Photo - Paris Metro Portal


Photo - Barcelona Portal


Photo - Chicago Metro Portal

1.4 DESIGN GUIDELINE

EVENT = APPROACH
ELEMENT - FORM & PLACE
LOCATION - STREET PORTAL

1.5 Design Objective

- Subway stations should act as a beacon, and have a dominant form from one station to the next in order to become an identifiable building form over time.
- Provide protection from the elements
- Avoid interference with sidewalk circulation

Design guideline - Street Portal Entrances

- Provide an identifiable entry form within the street landscape to which the subway station entrance is located
- Provide a scale that is not greater than 6m above grade at entry
- Utilize transparent materials and non-staining materials for enclosure
- Incorporate the subway station name and branding where possible
- Lighting to be incorporated within the overall design of the portal and when illuminated enhance the overall form of the portal
- Maintain 6m clearance from inside edge of portal and building face where possible
- Align street edge of portal along curb with no more than 12" clearance from road where possible
- No doors to be provided at the street entry to the portal where climate conditions permit to allow free entry and egress during high volume use

Design Guideline - Overall Massing - Roofs - etc.

- Provide a recognizable form that decreases in volume as the commuter descends below grade
- Design theme or type to be consistent with the identifiable form selected for the main subway station
- Ensure no spaces for loitering on or around the enclosure are available.
- Scale of the portal to be consistent with adjacent architecture and work with overall massing of the neighborhood

2.0 I D E N T I F I C A T I O N

Photo - TTC - Bloor & Lansdowne Station
Example of poor design form - Identification

Photo - TTC - Bloor & Islington Station
Example of poor design form - Identification

C - DESIGN GUIDELINE - IDENTIFICATION

2.0 EVENT - IDENTIFICATION

2.1 Introduction

Identification is the event experienced by the commuter as he or she arrives at the entry point to the building. These spaces are located on the exterior of the building and can include spaces such as the main and secondary entry access points to the building, the passenger drop off and pick up points, etc.

2.2 Design Objective

These space must be clearly identifiable to the commuter upon approach. That is, the commuter needs to understand where they are within the facility. Are they at the main entry or he secondary entry? Is this a drop off entry for automobiles, or are you at the taxi stand? Defining spaces on the exterior of the building within the using massing, scale, lighting, and use of materials to defined the hierarchy will measure the success of the design.

- Similar to the approach, subway stations should act as a beacon, and have a dominant form from one station to the next in order to become an identifiable building form over time.

- Massing should enhance glazed openings, large areas of similar materials, etc.

- Establish the buildings significance as pubic spaces and have a significant presence along the main street elevation. The use of the facility should be clear and identifiable as a public transit facility

- The scale of the element (entry, drop off, etc.) will reinforce its place in the overall building program, i.e main entry will have a more significant scale that a secondary entry

Photo - Canada Line, Vancouver, B.C

Photo - Main Entry - Rail Geelong, Melbourne, Australia

2.3 DESIGN GUIDELINE - PRIMARY BUILDING ENTRANCE

EVENT = IDENTIFICATION
ELEMENT - FORM & PLACE
LOCATION - EXTERIOR BUILDING ENTRY

Design guideline

- Provide an identifiable entry form within the street landscape to which the subway station entrance is located
- Provide a scale that is not greater than 6m above grade at entry
- Material and colour selection should be robust and highlight entry within overall massing
- Overall massing will highlight entry within as the primary location to enter the building
- Lighting to emphasize the dominant form and highlight the entry
- Provide a roof overhang as protection (min. 2 meters deep) from the elements
- Set back from street edge by a minimum of 4 meters to accommodate queuing during peak traffic periods
- Provide adjacent seating with covered protection for waiting
- Integrate bicycle storage rack within overall massing and design of entry
- Integrate all trash and recycling requirements within overall massing and design of entry
- Entry doors leafs to be a minimum 1.2m (4’-0”) wide
- Entry turnstiles should not be used
- Entry vestibules should not be used

Photo - Main Entry - Peter Minot Plaza, South Ferry Station
New York, New York

Photo - Secondary Entry - Peter Minot Plaza, South Ferry Station
New York, New York

2.3 DESIGN GUIDELINE - SECONDARY BUILDING ENTRY

EVENT = IDENTIFICATION
ELEMENT - FORM & PLACE
LOCATION - EXTERIOR BUILDING ENTRY

Design guideline

- Provide an identifiable entry form within the street landscape to which the subway station entrance is located
- Provide a scale that is less prominent than the main entrance
- Material and colour selection will highlight entry within overall massing
- Overall massing will highlight entry as a location to enter the building
- Lighting to emphasize this point along the elevation as a point of entry to the building
- Provide a roof overhang as protection (min. 2 meters deep) from the elements
- Set back from street edge by a minimum of 4 meters to accommodate queuing during peak traffic periods
- Provide adjacent seating with covered protection for waiting
- Integrate bicycle storage rack within overall massing and design of entry
- Integrate all trash and recycling requirements within overall massing and design of entry
- Entry doors leafs to be a minimum 1.2m (4'-0") wide
- Entry turnstiles should not be used
- Entry vestibules should not be used

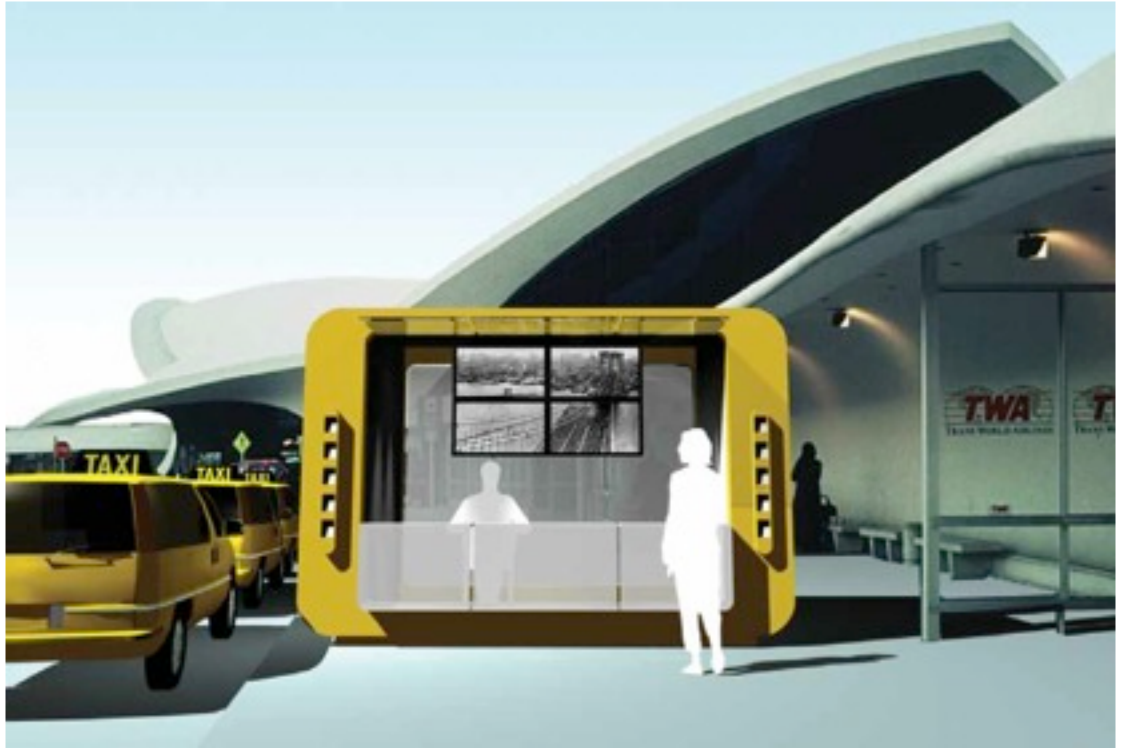


Image - Taxi stand with attendant

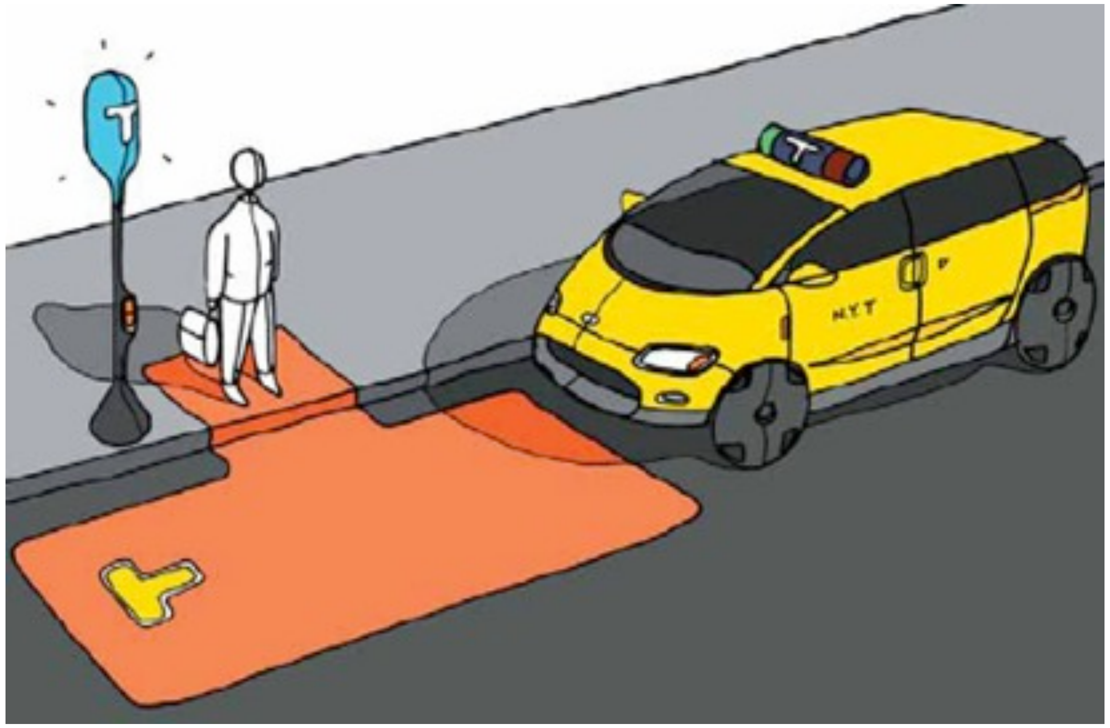


Image - Taxi stand without attendant

2.3 DESIGN GUIDELINE - TAXI STAND

EVENT = IDENTIFICATION
ELEMENT - FORM & PLACE
LOCATION - EXTERIOR TAXI STAND

Design guideline

- Provide an identifiable entry form within the street landscape that will differentiate the taxi from the main or secondary entry points to the building
- Exterior elevation material for the taxi stand area will highlight taxi stand within overall massing of the elevation
- Provide a change in surface paving materials to indicate that the use of this space has a different use from adjacent spaces
- Where possible provide a roof overhang as protection (min. 3 meters deep) from the elements
- In busier transit facilities provide space to accommodate orderly pedestrian queuing. Use stantions and utilize pavement material changes to indicate waiting areas.
- Provide seating with covered protection for waiting
- Provide taxi queuing space for four (4) taxi's. Taxi queuing and waiting area to be set back from pedestrian pick up area.
- Taxi drop off area to be in close proximity to the main or secondary entry
- Integrate all trash and recycling requirements within overall massing and design of entry

2.0 I D E N T I F I C A T I O N

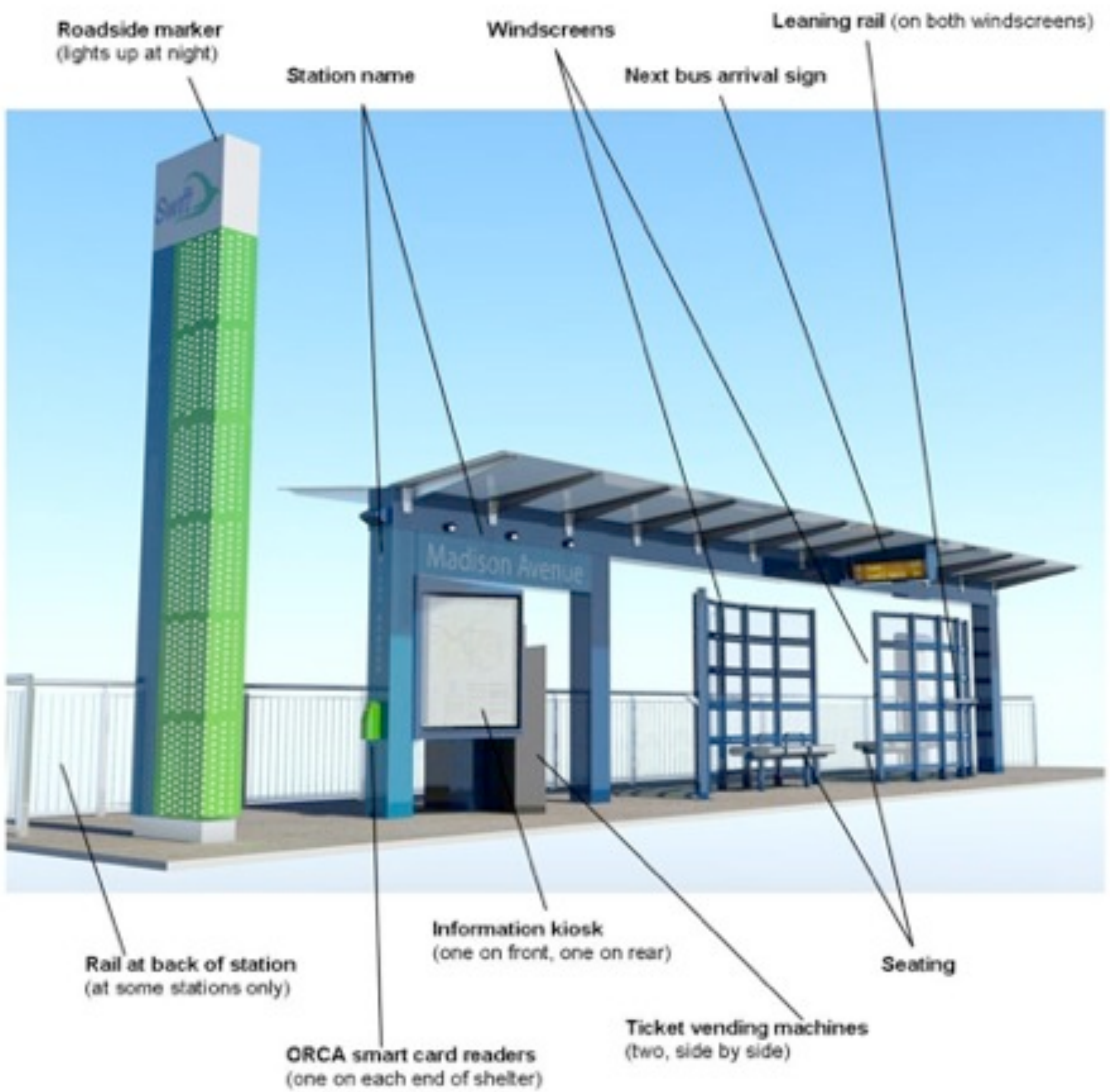


Image -Swift Rapid Transit Bus Pick-up Kiosk
Seattle Washington

2.3 DESIGN GUIDELINE - BUS DROP OFF

EVENT = IDENTIFICATION
ELEMENT - FORM & PLACE
LOCATION - EXTERIOR BUS DROP OFF

Design guideline

- Provide an identifiable entry form within the street landscape that will differentiate the bus drop off from from the main or secondary entry points to the building
- Utilize materials, form, scale, lighting, etc to differentiate bus drop off area from other modes of transportation such as taxi and streetcar,
- Exterior elevation material for the taxi stand area will highlight entry within overall massing
- Provide a change in surface paving materials to indicate that the use of this space has a different use from adjacent spaces
- Where possible provide a roof overhang as protection (min. 3 meters deep) from the elements
- In busier transit facilities provide space to accommodate orderly pedestrian queuing. Use stantions and utilize pavement material changes to indicate waiting areas.
- Provide seating with covered protection for waiting
- Integrate signage within overall building form
- Provide taxi queuing space for four (4) taxi's. Taxi queuing and waiting area to be set back from pedestrian pick up area.
- Taxi drop off area to be in close proximity to the main or secondary entry
- Integrate all trash and recycling requirements within overall massing and design of entry

3.0 A R R I V A L

Photo -TTC - Waiting - Poor example of Arrival

Photo -TTC - Poor example of Arrival

C - DESIGN GUIDELINE - ARRIVAL

3.0 EVENT - ARRIVAL

The third of the five main elements is Arrival. The point in the commuter travel experience where one feels they have arrived at either the final point or one of main points along their travel route. The main design components of the Arrival event are the waiting areas and ticketing.

3.1 Introduction

Waiting areas are to be distributed throughout the facility. These areas are to be provided for the comfort of commuters during there time awaiting transfers between modes of transportation such as bus, taxi, subway. Waiting areas are to be to located within the public hall and platform spaces within the facility. Waiting areas should not impede commuter circulation and provide minimum clearance between the seating and the opposite wall or edge.

These important public spaces must go beyond utilitarian functionality and represent the form and function of a significant public institution.

3.2 Design Objective

- Provide a clear view of the building form from the arrival area
- Provide adequate space to accommodate daily passenger volume of 7200 passengers using the personal No Touch Zone of 56” (1400mm) x 46” (1350mm) or 1.61 m2.
- Provide a large interior space that increases in volume as you travel closer to the centre of the building

3.0 A R R I V A L

Image - Waiting Area - Good example of Arrival space

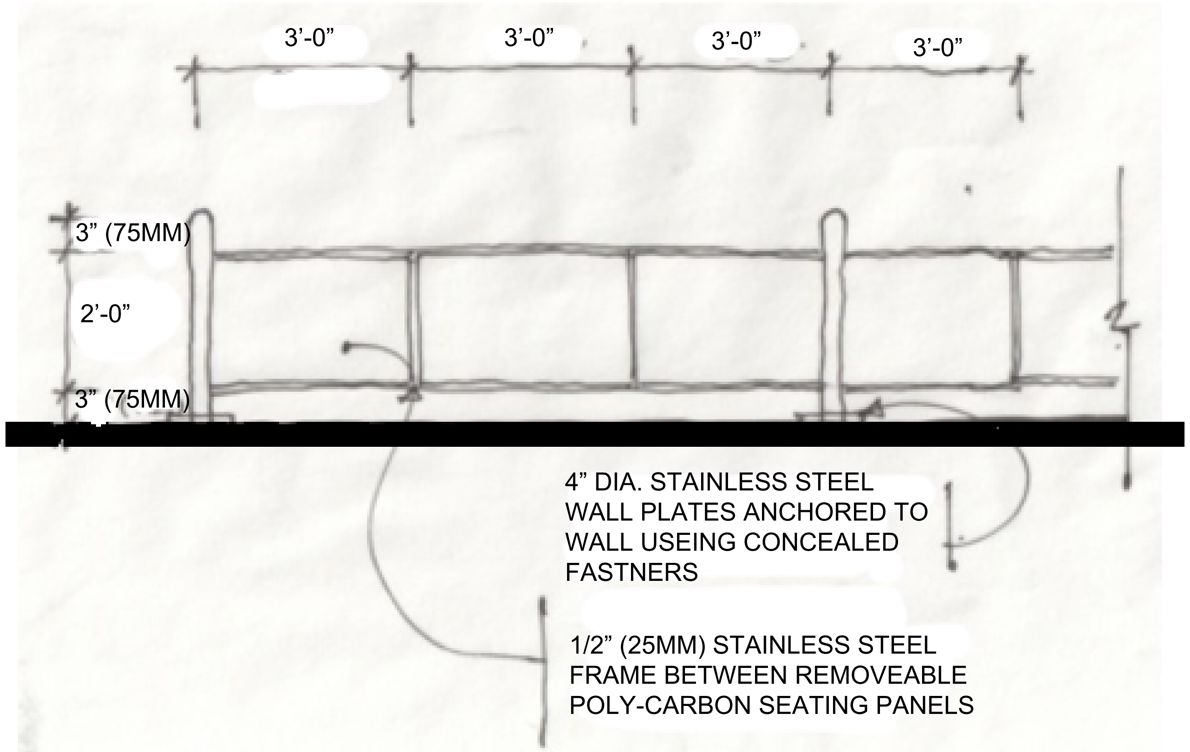
Image - Waiting Area - Good example of Arrival space

3.3 Design Guideline - Form - Waiting Area(s)

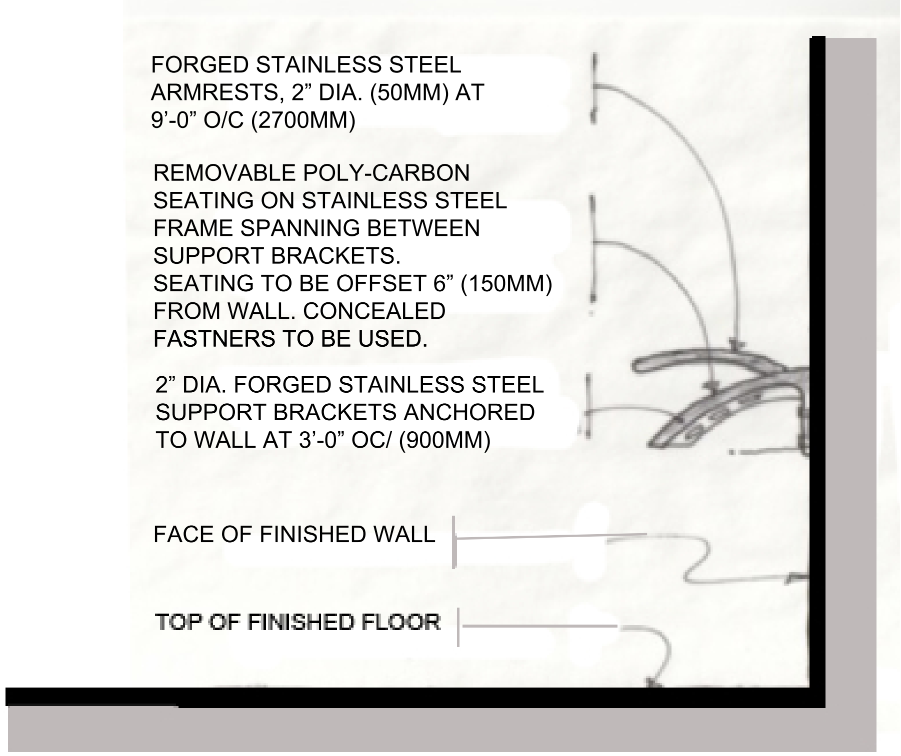
EVENT = ARRIVAL
ELEMENT - FORM
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

Design Guideline

- Provide an interior space that has a lower scale than that of the public hall
- Locate adjacent to the public hall
- Allow adequate space for queuing at ticketing spaces
- Provide adequate seating with clearance in front with a minimum of 4.0 m (13’-2”) from Ticketing line up or public circulation within the Public Hall
- Minimum interior clear height at 4.5m (15’-0”)
- Locate with direct views to the exterior
- Direct view to main entry/exit of to facility
- Locate throughout the main public hall, adjacent to escalator and stair openings where possible
- Provide views to video monitors



Drawing - Plan at commuter bench - Design Illustration for Place



Drawing - Plan at commuter bench - Design Illustration for Place

3.3.1 Design Guideline - Place - Waiting

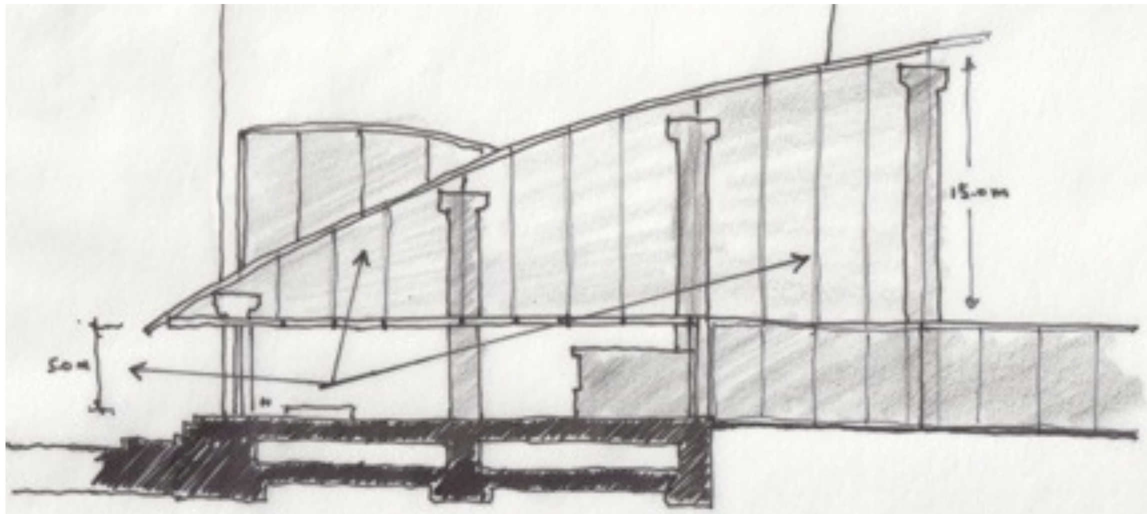
EVENT = ARRIVAL
ELEMENT - PLACE
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

Design Objective

- Incorporate seating design into arrival space
- Provide in locations that provide views to the interior and exterior of the building
- Provide seating design that offers temporary rest space and does not encourage loitering

Design Guideline

- Provide seating in locations that are adjacent to cafe's, retail, etc.
- Provide views to the major interior spaces such as the public hall
- Provide seating in 915mm (3'-0") increments, defined spaces for individual passengers
- Fabricate seating from materials that have resilient surface finishes
- Adequate space for groups of six (6) or more commuters in one location
- Wall hung seating where possible, clear of flooring below



Drawing - Section at Yonge & St. Clair (Pleasant Avenue entry) - Design illustration for Light & Security

Rendering - Public Hall at Yonge & St. Clair Station - Design illustration for Light & Security

3.3.2 Design Guideline - Light & Security - Waiting

EVENT = ARRIVAL
ELEMENT - LIGHT & SECURITY
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

Design Objective

- All waiting areas should have direct access to natural light or where not possible, indirect access to natural light and sufficient man made lighting architectural features.
- Lighting should highlight the seating area from within the transit facility as well as the circulation route.
- Superior architectural lighting should be provided to enhance the overall architectural form of the transit facility.

Design Guideline

- Lighting to enhance the seating location within the transit facility
- Illumination of the waiting and seating areas should be clearly visible from the exterior of the building upon approach
- Architectural features (column, building form, etc.) should be illuminated and visible from the arrival spaces
- 50% of the overall public seating to be located within 20.0m (65’-0”) of the main entry.
- Provide transparent balustrades where seating is adjacent to stairs and escalators
- Clear unobstructed views of the entire transit facility
- Clear views to the exterior; bus and taxi stands

Photo - TTC - Ticketing Poor example of Light - Public Hall

Photo -London Tube - Good example of Light - Public Hall

Rendering -London Tube - Design illustration of a good use of Light - Public Hall

3.4 Design Guideline - Light - Public Hall

EVENT = ARRIVAL
ELEMENT - LIGHT
LOCATION - PUBLIC HALL

Design Objective

To provide bright interior spaces at all times of the day and throughout the variations of the seasons. Utilize the architectural features within the selected architectural form enhance the main public hall with abundant lighting, natural or artificial.

Design Guideline

- Provide a glazed enclosure, walls and ceilings where possible
- Enclosures within such as security entry, stair guards, elevators, etc. the public hall to be designed using transparent materials where possible
- Utilize reflective materials for floors, and walls to increase the passive effect of lighting during the day
- Lighting should be incorporated within the architectural design of the public hall to illuminate the overall architectural form during evening hours
- Lighting should be used to define circulation at changes in elevation; stairs, escalators, elevators, etc.
- Provide a minmum light level of 70fc

Case Study - Example

The model used (Case Study) demonstrates the design of the Public Hall with a fully glazed enclosure, reflective materials, and ample views to the exterior. Key design guidelines represented are:

- Clear identification of the dominant architectural form
- Architectural form and light working together to define clear circulation and interior sight lines throughout the public spaces
- Transparent materials used throughout the entrance

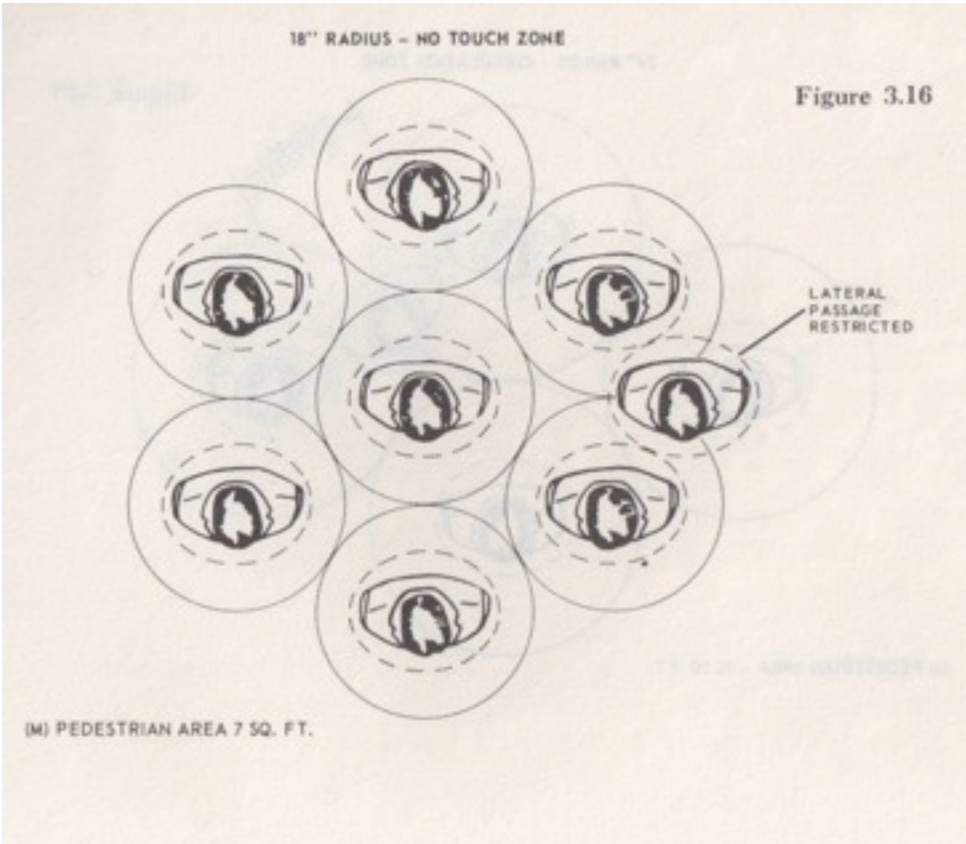


Diagram - J. Fruin No Touch Zone

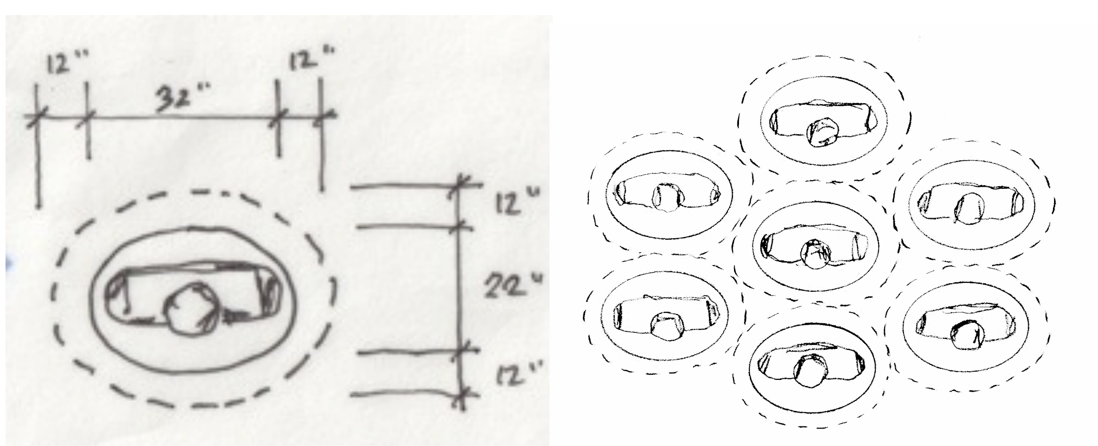


Diagram - Space between commuters is 24” (600mm) using Tanfield No Touch Zone.

3.5 Design Guideline - Ticketing

Introduction

The design of ticketing spaces is again based upon the spatial requirements for commuter’s to move freely, while providing enough room for movement and level of comfort. Ticketing is a type of queuing, or holding space for commuter’s while awaiting their turn to place an order. The queuing space allocated at a ticketing kiosk is different from platform design as it is a linear type pattern and has different spatial requirements for commuters as their movement is limited and they may have baggage, or parcels with them as they stand in line and await service.

Since there are no known building code requirements or design standards available for this type of space, J. Fruin’s model is used as a benchmark for establishing a design guideline for commuter queuing in ticketing spaces.

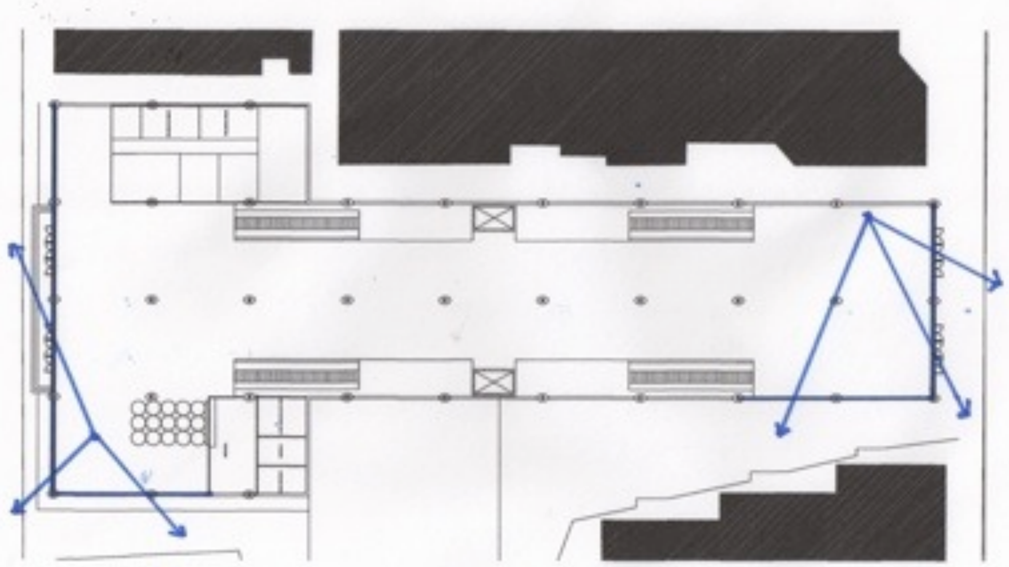
In Fruin’s model, space requirements for linear queuing is defined by providing different spatial requirements related to what Fruin calls “touch” and “no touch” zones. For this design guideline, we use “no touch” zones as the preferred design scenario for these spaces. Below is a comparison of the model prepared by J. Fruin, and the model offered as a solution for this thesis.

The Fruin model is based upon the body ellipse, using the average human body dimensions of 24” (600mm) x 18” (450mm). Using the “no touch” zone of 18” radius, this provides a design area of 60” (1500mm) x 4’-6” (1350mm). Using 18” (450mm) radius spacing provides a person to person “no touch” area of 3’-0” (900mm).

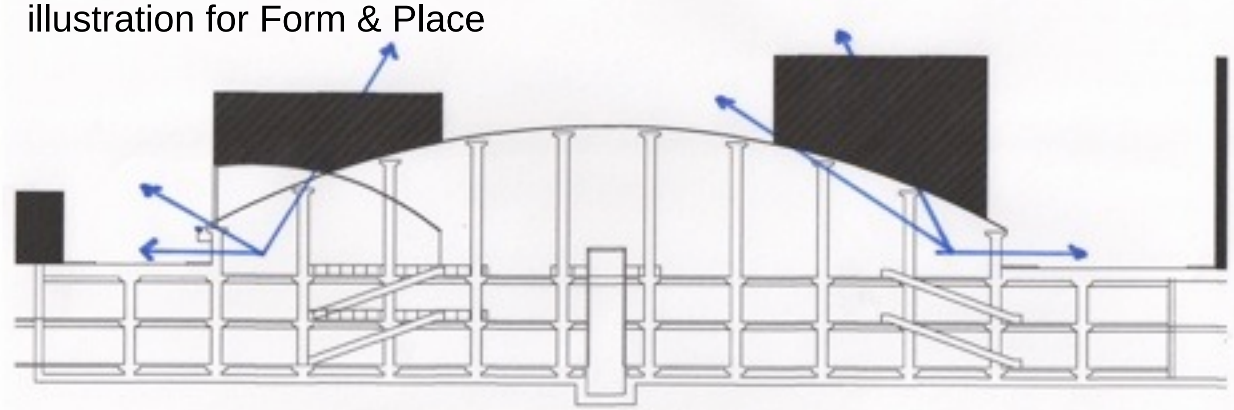
After taking measurements of a number of family and friends that represent a wide range of ages and body sizes, it was identified that my model for the body ellipse is significantly larger than documented by Fruin. Also, the no touch zone, described by Fruin seems to be excessive at 3’-0” (900mm), and unrealistic in al large city with peak demand periods.

Using a larger body ellipse of 32” (800mm) x 22” (550mm), and a smaller “no touch” zone of 12” (300mm), this provides a design area of 56” (1400mm) x 46” (1150mm). Also, the “no touch” zone has been reduced to a 12” (300mm) radius around each passenger, providing a clear area of 24” (600mm) between commuter’s.

Rendering - Ticketing at Yonge & St. Clair Station - Design illustration for Form & Place



Drawing - Public Hall at Yonge & St. Clair Station - Design illustration for Form & Place



Drawing - Public Hall at Yonge & St. Clair Station - Design illustration for Form & Place

3.5.1 Design Guideline - Form & Place - Ticketing

EVENT = ARRIVAL
ELEMENT - FORM & PLACE
LOCATION - TICKETING

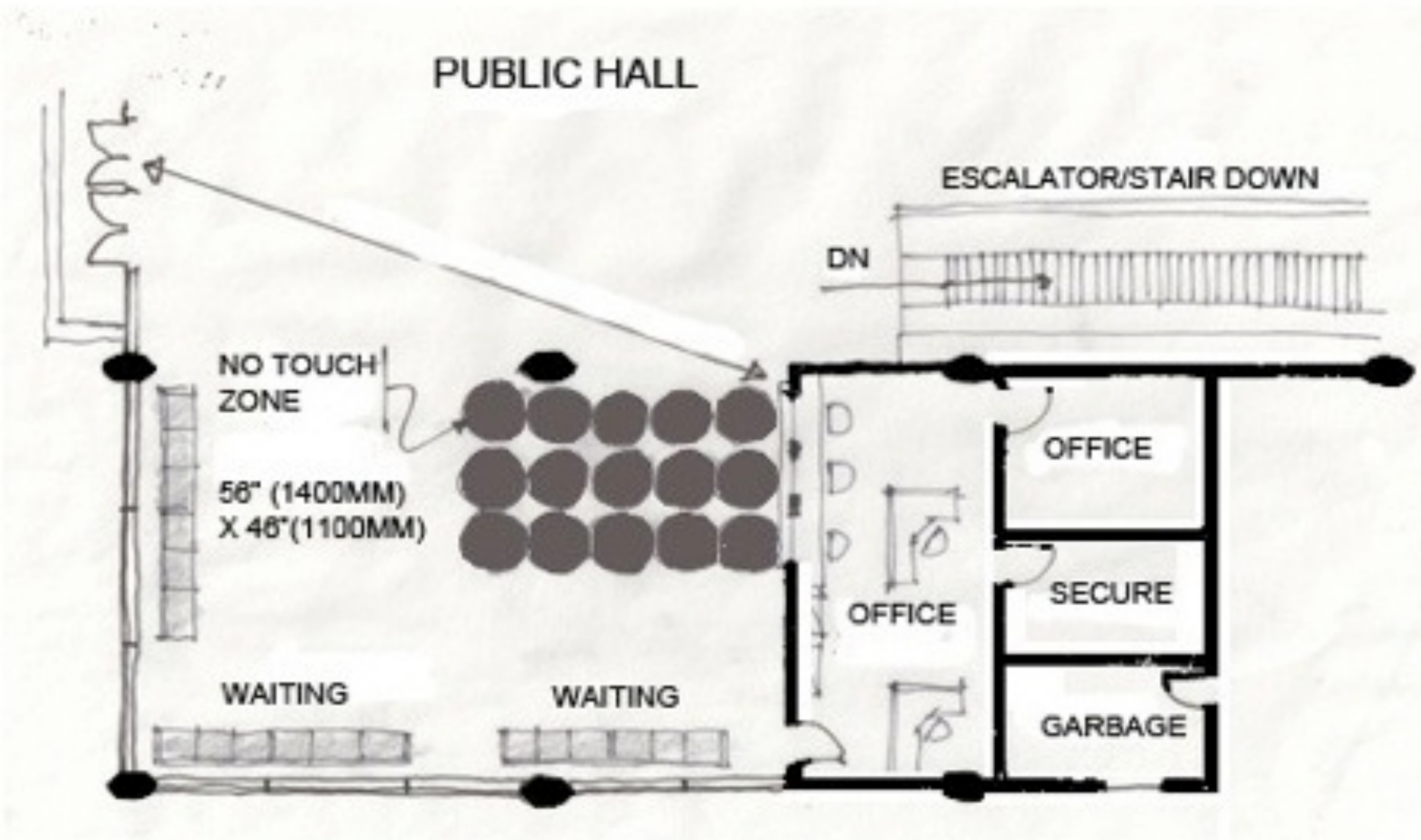
Design Objective

- Ticketing spaces should be in large open spaces, where the commuter is able to see the volume of the building form.
- The ticketing kiosks should provide ample space for the employees, also with clear vision to the overall interior and exterior spaces.
- Transparency between the ticketing office, sales wickets, and open public space should be provided where possible and does not compromise security of the ticketing office.

Design Guideline

- Provide a minimum area per employee of 250 sf
- Provide a minimum counter area per employee of 25sf
- Locate public side of ticketing under skylights where possible
- Provide lower scale space adjacent to public hall
- Provide clear views of overall building form and interior spaces
- Locate adjacent to main entry, escalators, and seated waiting areas

3.0 A R R I V A L



Drawing - Ticketing at Yonge & St. Clair Station - Design illustration for Security

Design Guideline

- Provide one (1) wicket per commuter load of 150 commuters/hour
- Provide queuing space for ten (10) commuters per wicket
- Provide a minimum area per commuter of 56” (1400mm) x 46” (1150mm), no touch zone
- Provide visual connection to overall public hall
- Provide visual connection to building design idea, form, type, etc.

3.5.2 Design Guideline - Security - Ticketing

EVENT = ARRIVAL
ELEMENT - SECURITY
LOCATION - TICKETING

Design Objective

- Integrate Ticketing spaces within the overall facility, adjacent to the entry, and large open spaces
- Higher volume locations require larger space for queuing, etc.
- For the purpose of this study, assume 70% of passengers will arrive by foot, and of that 70%, assume 20% will require to purchase a ticket.

Morning Peak Period

- 7:00am to 9:00am = 2160 passengers
- 2160 at 70% = 1512 passengers enter through the St. Clair Avenue entry
- 1512 at 20% = 302 passengers buying a ticket during the peak period
- 302 passengers over 2hours (120 minutes) = 2.5 passengers per minute

This holding space is ideal for communication of the building space, idea, and history of subway train travel. Adequate space for each commuter in line should be provided for linear queuing of fifteen (15) passengers per wicket per one hundred and fifty (150) commuters per hour.

Photo - Cafe - Rome Terminal
Rome, Italy

image - Cafe - Location unknown

3.6 Design Guideline - Place - Cafe/Retail

EVENT = ARRIVAL
ELEMENT - PLACE
LOCATION - CAFE/RETAIL

Design Objective

- Cafe and retail spaces are to be provided throughout the public hall and concourse levels.
- Locate adjacent to waiting areas, pick up locations for taxi, bus and etc.
- Provide in locations that are visible from multiple levels to increase perceived visual access and security

Design Guideline

- Location to allow commuters to view other modes of transportation, incoming and outgoing
- Allow for loose public seating
- Allow for minimum space allocation of 500 sf
- Ensure placement of kiosk does not impede commuter circulation
- Provide a minimum lighting level of 50 fc
- Use a change in floor, wall, ceiling, and lighting to allow locations to be clearly identifiable within overall public hall or concourse spaces
- In larger stations provide along main circulation route with views to the exterior
- Provide in areas with large spatial volumes

4.0 T R A N S I T I O N

Photo - TTC - Corridor - Kennedy Station - Example of poor use of form for Transition

Photo - Paris Metro - Stair - Example of poor use of form for Transition

4.0 EVENT - TRANSITION

4.1 Introduction

For the purpose of this study, transition spaces within transit facilities include public halls, corridors, stairs, elevators and escalators. We spend most of our travel commute time within transit facilities within transition spaces in order to get from the exterior of the building (Arrival), to travel to the platform (Destination).

The design of transition spaces should consider the four (4) main issues; form, place, light, and security. In addition to these issues, passenger volume must be considered as it relates to a typical pedestrian walking speed.

That is, what volume of commuter can make its way through a space, given the daily typical passenger volume during peak periods during.Transition spaces are where we spend the majority of our time when travelling to and from our destination within public transit facilities. Therefore, transition spaces require the highest level of architectural quality and are to be representative of the overall building design and idea.

The dominant building form should be clearly seen from all areas in the public hall and the lower concourse level. Each site will have specific spatial requirements that is determined by the program and peak commuter volumes, so variations will occur from site to site. In addition, these spaces are required to be designed and influenced by the characteristics of the commuter, and the needs for comfort and movement as they pass through facilities.

Examples of poor transit transition spaces are shown here to make the point that transition spaces are more than a conduit to transfer commuters from one point to another. Transition spaces provide the opportunity to communicate a message about the city they belong through the architectural form.

Introduction (con't)

The average walking speed for humans is 250 ft/minute, at a typical speed of three (3) miles per hour. Using the human comfort space allocation defined as a diameter of 43", then one lane for one person is rounded to 5'-0" (1500mm)x 5'-0" (1500mm), or 25sf/person, then you have:

250 - Average speed/25 - average area per person = 10 commuters per foot width of walkway, per minute. In other words, ten (10) commuters will pass through one linear foot of walkway, with a comfort zone of twenty five (25) square feet per person at an average pace of two hundred and fifty (250) feet per minute.

If we imagine a pedestrian lane for walking through a facility is divided into a series of 4'-0" (1220mm) walkways, then we could calculate the level of capacity, time and distance between commuters as they pass through the facility.

If we have 4'-0" lanes in our facility, then that would give a commuter density of forty (40) commuters, per minute, using the comfort space of twenty five (25) square feet per person at an average pace of two hundred and fifty (250) feet per minute.

From this point on, all calculations will be converted to imperial, due to data collection method for pedestrian movement.

Public Hall - Calculations for prototypical subway transit facility:

Ground floor area:
20m wide = 65'-0"
90m deep = 295'-0"

Area = 65'-0" x 295'-0" = 19175 ft2

If we divide our prototypical facility into 4'-0" wide lanes along the length:
65/4 = 16 lanes at 4'-0" wide

If we multiply each lane by the commuter density, that incorporates the level of comfort space per commuter of twenty five (25) square feet, as well as the average pace per person at two hundred and fifty feet per minute, we get:

16 (lanes) x 40 (commuters/minute/5x5 area of comfort at 250 ft/minute = 640 = commuter/minute/ft

The prototypical facility is 295'-0" in length:

295 x 640 = 18800 maximum commuter density at any one time can comfortably be contained
within the public hall of the facility.

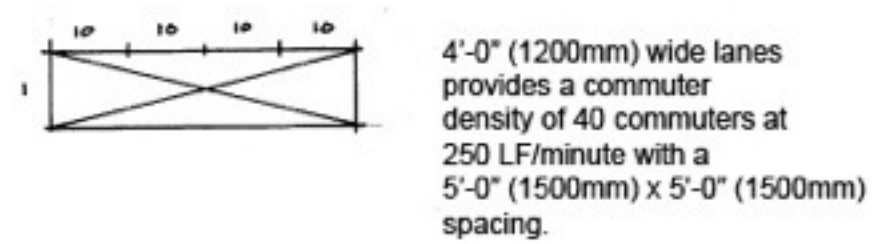
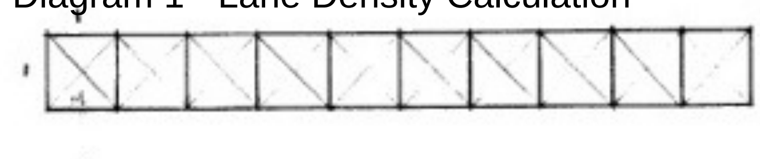


Diagram 1 - Lane Density Calculation



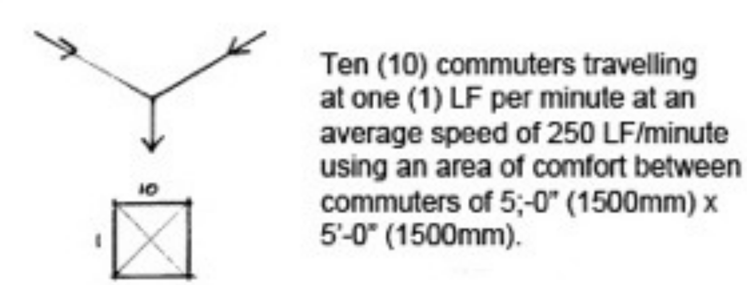


Diagram 2 - Lane Density Calculation

4.0 T R A N S I T I O N

Photo - London Tube - Jubilee Line - Good example of Form and Place - Transition

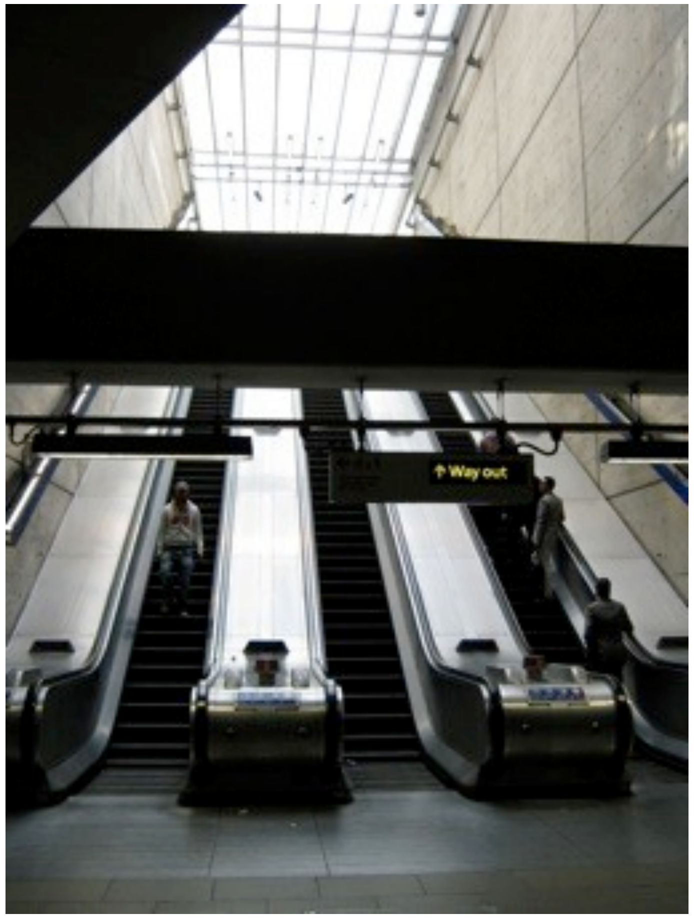


Photo - London Tube - Jubilee Line - Good example of Form and Place - Transition

4.2 Design Objectives - Form & Place - Stairs and Escalators

- Create spaces that are interesting to pass through
- Incorporate changes in volumes and commuters transcend through the spaces
- Provide consistent levels of lighting along the transition path

EVENT = TRANSITION
ELEMENT - FORM & PLACE
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

4.3 Design Guideline

- Interior Scale to be significant, and utilize dominant form, to be visible while travelling throughout transition spaces
- Dominant form to be visible from multiple locations along transition space
- Transparent to adjacent interior spaces, function and use
- Materials to be reflective and durable such as stone, glass, and stainless steel
- Visual connection to various levels within the facility
- Visual horizontal/vertical breaks along large escalator or stairways providing a sense of scale and rhythm as well as a measure of the distance travelled
- Provide change in floor material & spatial volume to indicate change in direction at landings
- The minimum stair width is 3960mm (13’-0”), with railings at 1500mm (5’-0”) horizontally. The minimum stair depth should be 300mm (12) clear (including nosing), at a maximum angle of 27 degrees.
- Provide opening to the floor above for the entire length of the stair
- Minimum distance from entry – 20.0m (65’-0”)
- Minimum distance between stairs – 18.20m (60’-0”)

Photo - London Tube - Jubilee Line - Good example of Light & Security - Transition

Photo - London Tube - Jubilee Line - Good example of Light & Security - Transition

4.3.1 Design Objectives - Light & Security - Stairs and Escalators

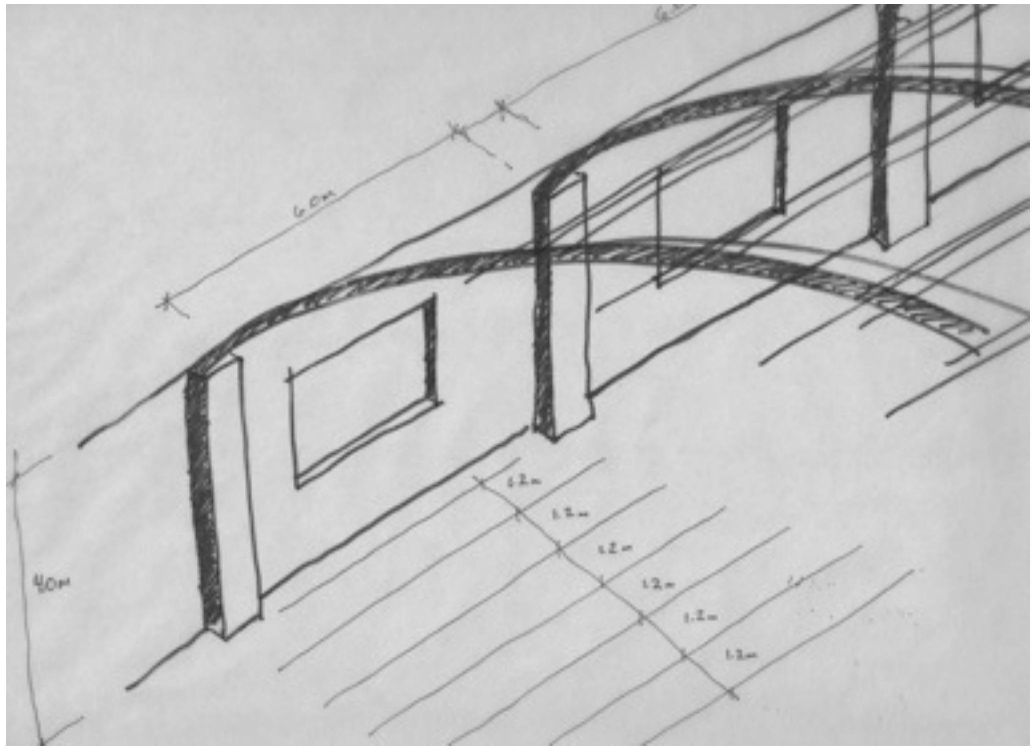
- Consistent level of lighting throughout the space
- Commuter can clearly identify path direction and anticipate changes in floor levels

EVENT = TRANSITION
ELEMENT - LIGHT & SECURITY
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

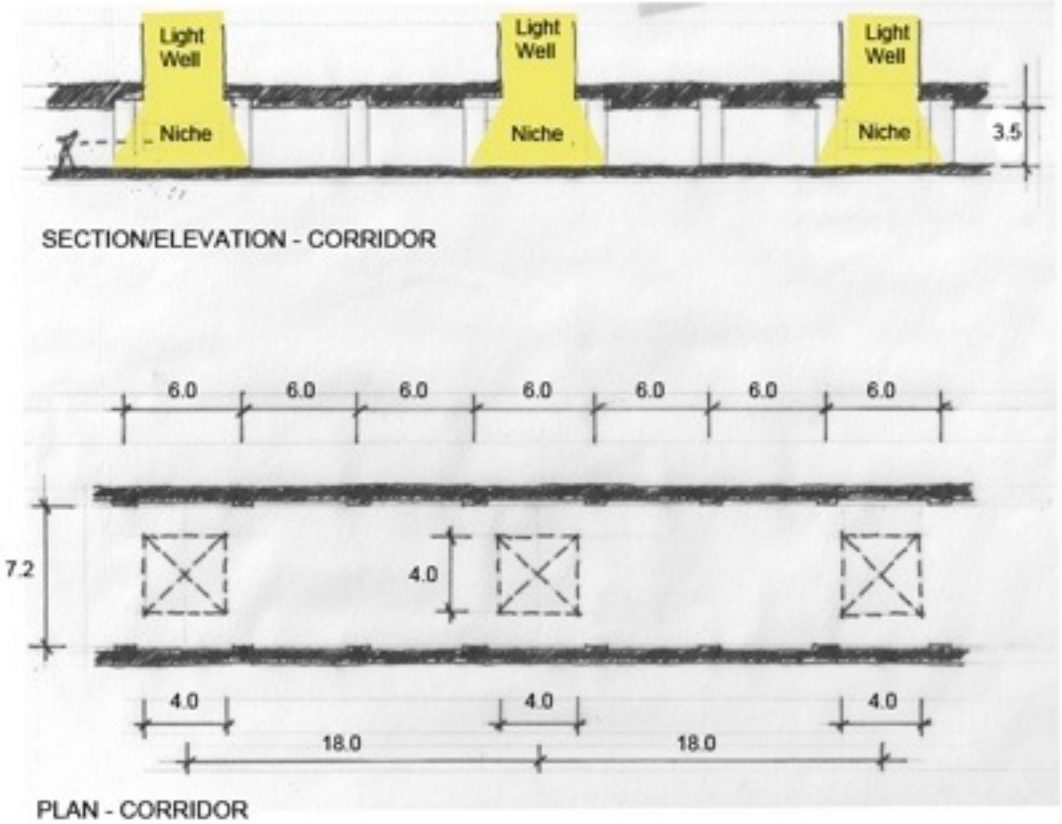
Design Guideline

- Reflective materials to be used on the floor wall, and ceiling surfaces
- Utilize light wells at changes in direction where possible
- Clear sight lines between interior spaces, interior levels, etc.
- Minimum interior clear height of 4m
- Incorporate light panels in marketing and signage displays along circulation route
- Textured changes in floor finishes at changes in direction, change in elevation, or indication of caution
- Natural or manmade light panels to illuminate surfaces along the transition path
- Minimum lighting levels of 70fc

Photo - Location Unknown - Good example of Light & Security - Transition



Drawing - Corridor - Design illustration for Transition - Form



Drawing - Corridor - Design illustration for Transition - Light & Security

4.4 Design Objectives - Form - Corridors

Corridors are necessary within the design of transit facilities and require equal attention to design excellence as larger program spaces.

- incorporate a sense of scale and rhythm along the length of the travel.
- Achieve an architectural rhythm using ribs, columns, niches, etc. to modulate space and provide a measure of distance and time

EVENT = TRANSITION
ELEMENT - FORM
LOCATION - CONCOURSE LEVELS

Design Guideline

- Interior hight to be a minimum of 4m clear
- Provide wall niche at regular intervals along the corridor length
- Incorporate column and ceiling ribs at regular intervals along the length of the corridor
- Incorporate floor pattern with overall wall niche, column, and ceiling rib intervals

4.4.1 Design Objectives - Light & Security- Corridors

- Use light (natural and manmade) along corridors at intervals to achieve a regular rhythm within the architectural design

EVENT = TRANSITION
ELEMENT - LIGHT AND SECURITY
LOCATION - CONCOURSE LEVELS

Design Guideline

- Integrate light wells within wall niche and column intervals
- Natural or manmade light panels to illuminate surfaces along the transition path
- Ensure clear sight lines along the full length of corridors
- Utilize reflective floor and wall finishes

Photo - London Tube - Jubilee Line - Good example of Light & Security - Elevator - Transition

4.5 Design Guideline - Elevators

Introduction

Elevator design capacity is based upon the a comfortable area required for commuters. The number of passengers that will comfortably fit within the elevator using the two calculations for commuter space will be the Tanfield Body Ellipse and the Tanfield No Touch Zone. The elevator used in the prototypical design is a Kone Mono Space with a Visual SPace Kit, with dimensions of 6’-6” deep (2000 mm), and 7’-10” (2400 mm) wide. Below are the calculations for the maximum capacity as an example using these specifications.

Using the Tanfield Body Ellipse

Area required per person using Tanfield Body Ellipse = 1’83’ x 2.63’ = 4.81’/person
Elevator Area = 7.87’ x 6.56’ = 51.63 SF
Maximum number of passengers = 51.63’/4.81’ = 10.73

Using the Tanfield No. Touch Zone

Area required per person using Tanfield No Touch Zone = 4.63’ x 4.0’ = 18.52’/person
Elevator Area = 7.87’ x 6.56’ = 51.63 SF
Maximum number of passengers = 51.63’/18.52’ = 2.78

Using the Fruin Body Ellipse

Area required per person using Fruin Body Ellipse = 1.5’ x 2.0’ = 3.0’/person
Elevator Area = 7.87’ x 6.56’ = 51.63’
Maximum number of passengers = 51.63’/3.0’ = 17.21

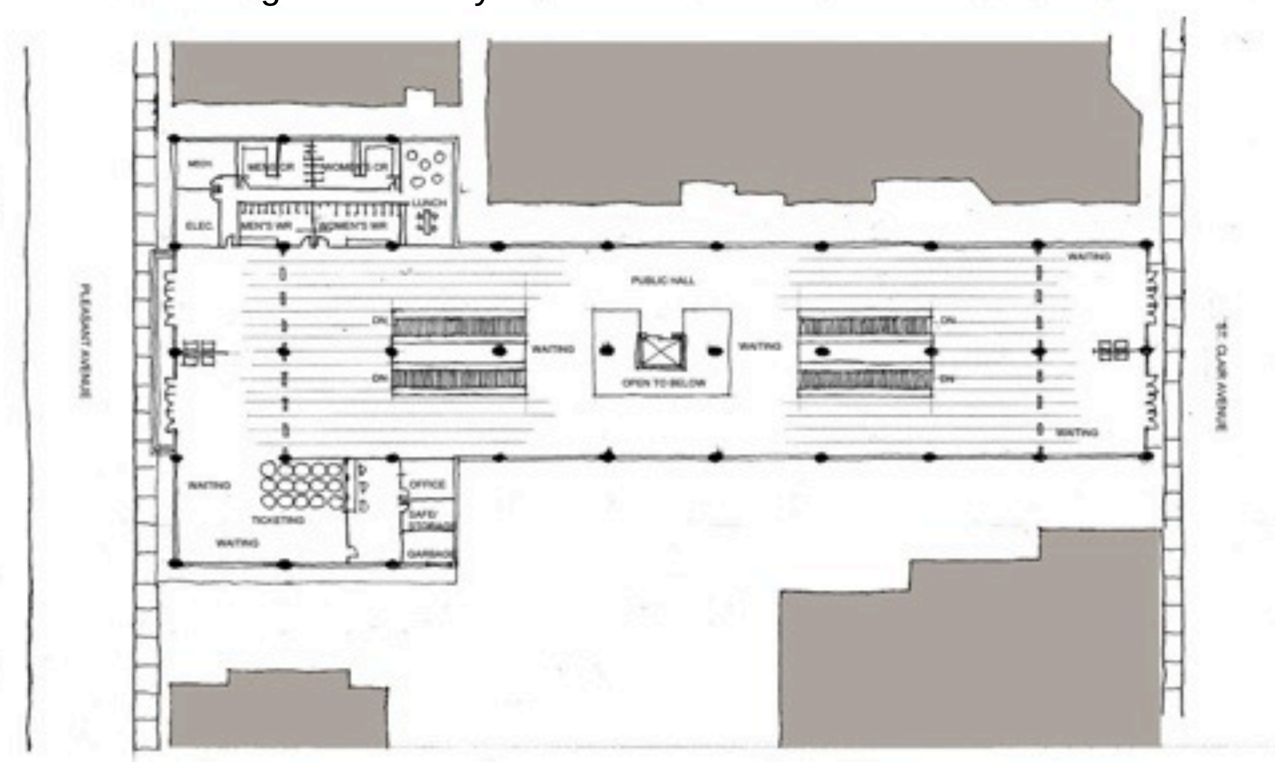
Using Fruin No Touch Zone

Area required per person using Fruin No Touch Zone = 5.0’ x 4.5’ = 22.5’/person
Elevator Area = 7.87’ x 6.56’ = 51.63 SF

Maximum number of passengers = 51.63’/22.5’ = 2.29 passengers

It is unrealistic to expect commuters to only load elevators to correspond with the body ellipse or the no touch zones described, however understand the comfortable area required for passengers is useful in the design of these spaces. According the Fruin, unavoidable contact between standing passengers occurs at 2 3/4 sf/person. If we cannot control the density of passenger elevators, we can post signage to indicate the maximum capacity an elevator can comfortably accommodate based upon spatial limits.

Rendering - Public Hall at Yonge & St. Clair Station - Design illustration for Light & Security - Transition



PLAN - STREET LEVEL

Drawing- Public Hall at Yonge & St. Clair Station - Design illustration for Light & Security

4.5.1 Design Objective - Form - Light - Security - Elevator

The majority of elevators use is by commuters that require assistance with their mobility such as the elderly, or physically handicapped as well as parents with strollers or travelling with large packages.

Elevators must be able large enough to accommodate the passenger as well as the packages or device they are using for mobility such as a wheelchair. The elevator must not impede the circulation path on the level to which it is placed. This is a significant design challenge when locating within a facility at the platform level.

EVENT = TRANSITION
ELEMENT - LIGHT AND SECURITY
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

Design Guideline

- Provide glass on all four sides of elevator cab where possible
- Glass ceiling where possible to provide light well to lower levels
- Reflective materials to be used on all surfaces where possible
- Minimum size 7’-6” x 6’-6”’
- Visible upon entry to the transit facility
- Double sided doors for ease of access
- Minimum clearance between elevator and adjacent wall or obstruction is 3m
- Provide adequate space for queuing without compromising circulation on public hall, concourse, or platform levels
- Centrally located within the transit facility
- Views within the facility and to the exterior where possible

5.0 Design Guideline - Form - Subway Platform

5.1 Introduction

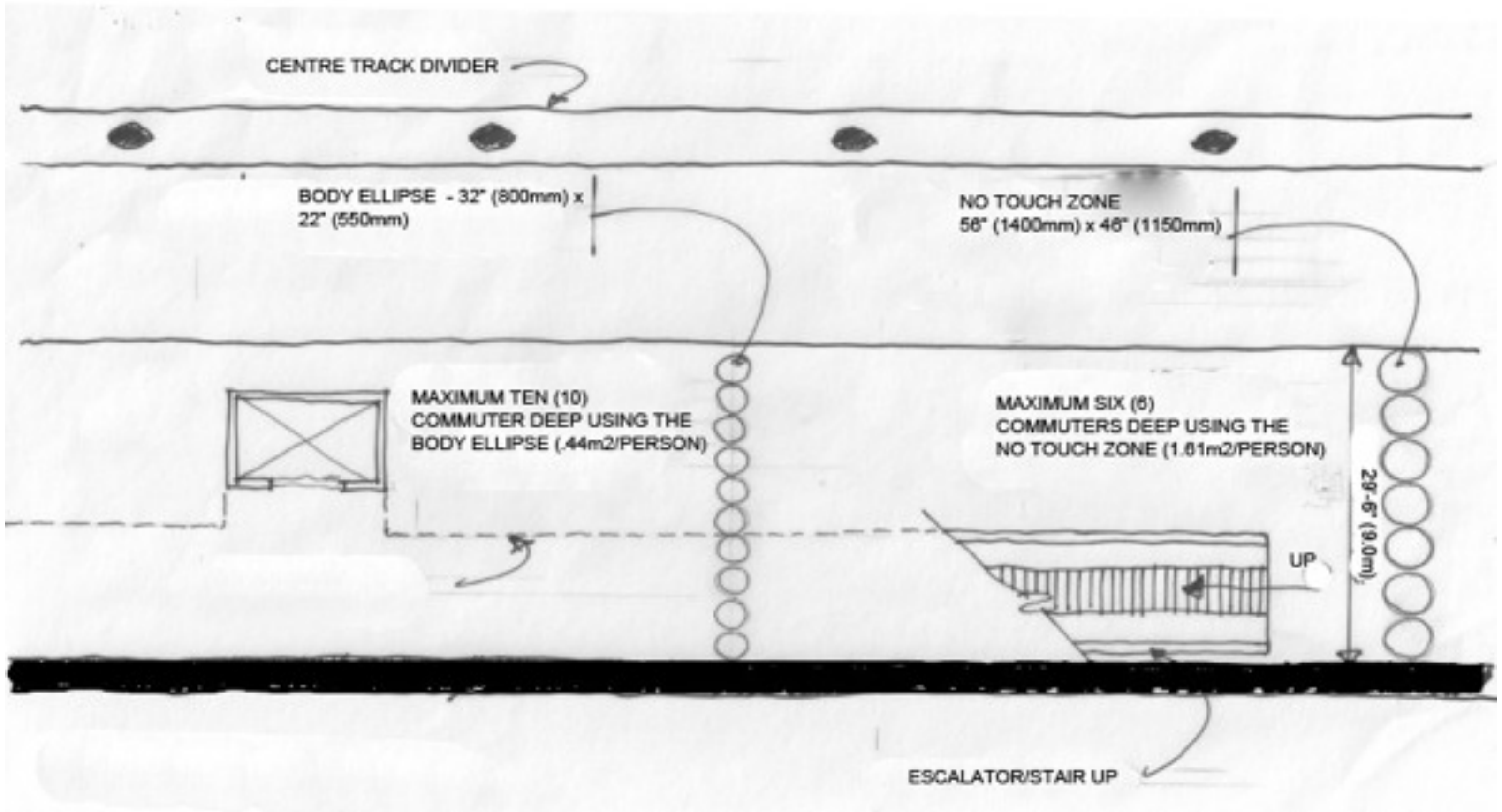
The subway platform design criteria is based upon a number of fixed elements required to serve the service requirements such as the capacity of each subway car, number of cars in a link, etc.

Each subway car has a maximum rated capacity of 180 passengers. A maximum chain of subway cars is six (6).

180 x 6 = 1080 passengers per subway (maximum)

Each train is 22.86 m in length, therefore using six (6) subway cars in tandem requires a minimum platform length of 137 m.

For the purposes of this study and demonstration, I have applied a platform length of 150 meters in length and 9.0 meters in depth.



Single Loaded Platform Criteria

No touch Zone - Tanfield Capacity - 56” (1400mm) x 46” (1150mm) = 1.61 m2/person

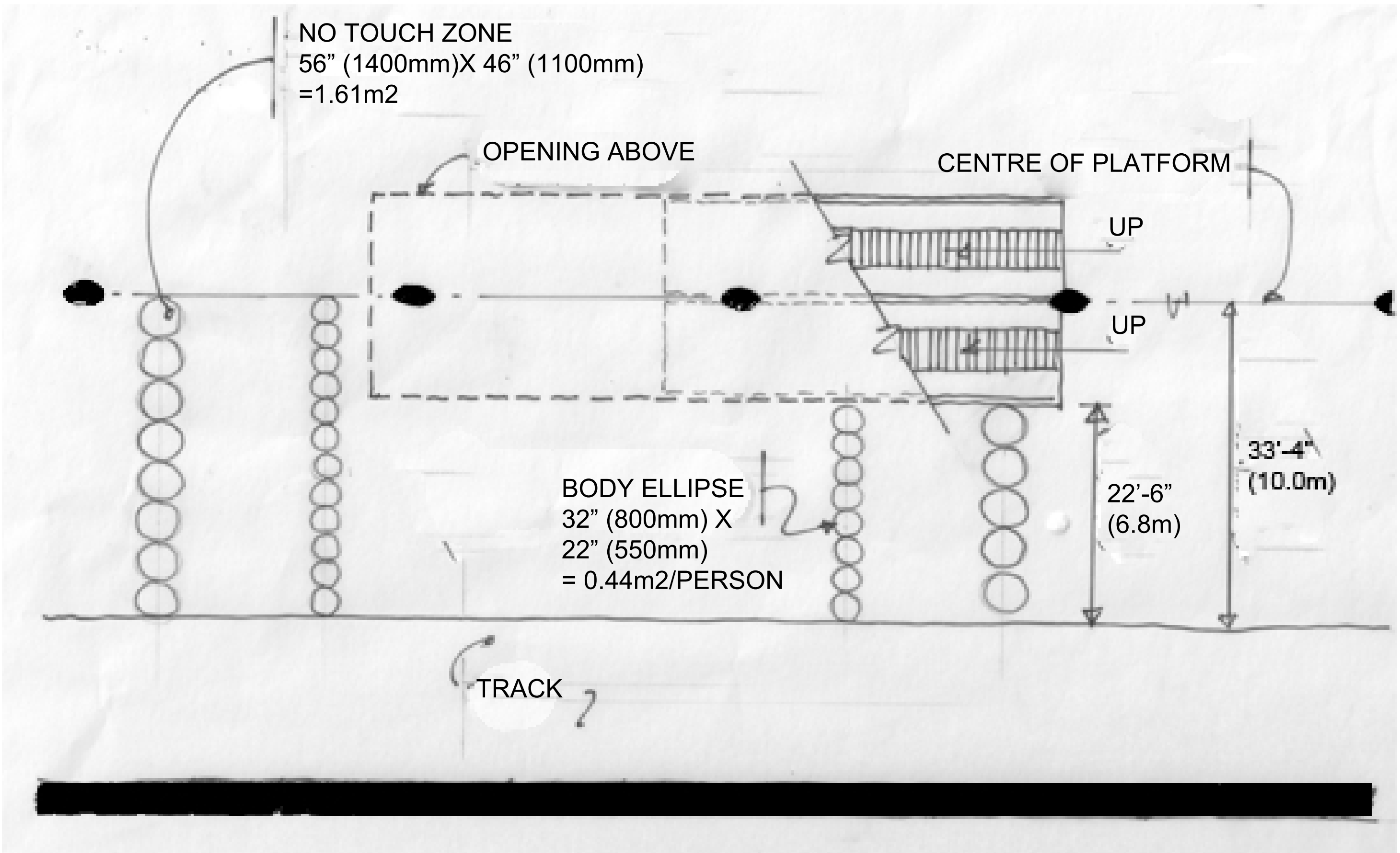
Area of Each Platform = 150- m x 9 m = 1350 m2
Maximum platform capacity = 1350 m2 /1.61 m2/ person = 830 passengers

Body Ellipse - Tanfield Capacity - 32” (800mm) x 22” (550mm) = .44m2/person

Area of Each Platform = 150- m x 6.5 m = 1350 m2
Maximum platform capacity = 1350 m2 /.44 m2/ person = 3060 passengers

Drawing - Partial Plan - Single Loaded Platform - Design illustration for Destination

5.0 D E S T I N A T I O N



Drawing - Partial Plan - Double Loaded Platform - Design illustration for Destination

Double Loaded Platform Design

No touch Zone - Tanfield Capacity - 56” (1400mm) x 46” (1150mm) = 1.61 m2/person

Area of Each Platform = 150- m x 20 m = 3000 m2
Maximum platform capacity = 3000 m2 /1.61 m2/ person = 1863 passengers

Body Ellipse - Tanfield Capacity - 32” (800mm) x 22” (550mm) = .44m2/person

Area of Each Platform = 150- m x 6.5 m = 975 m2
Maximum platform capacity = 300 m2 /.44 m2/ person = 6818 passengers

Drawing - Overall Partial Plan - Platform Level
Drawing - Enlarged Partial Plan - Platform Level - Single Sided Commuter Density

Photo - London Tube - Jubilee Line - Good example of Single Loaded Platform - Form - Destination

Photo - Bilbao Metro - Barakaldo Station - Good example of Platform Form - Destination

5.2 Design Objective - Form - Subway Platform

The column grid used for the example site was based upon a module of 10m. The structure is designed as a concrete, and utilizes offset columns at 5m to provide a column free platform level.

Offsetting the columns on the platform level allow for deep uninterrupted platform spaces,with ample space for commuters. The offset columns also provide the main structural support at the platform level. Using arched buttress, at a 10m spacing, also provide rhythm to the long platform interior spaces

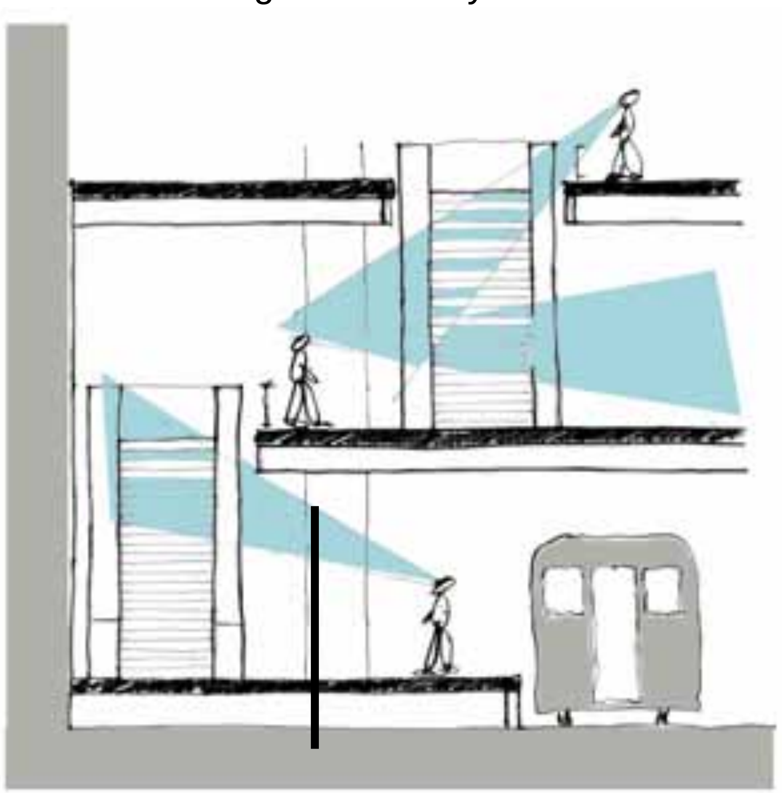
Lastly, the ceiling height at the concourse level and platform level is established as a minimum of 5.2 m. This provides 900 mm for HVAC, lighting, and horizontal service requirements as well an additional 200mm for the structure.

EVENT = DESTINATION
ELEMENT - FORM
LOCATION - PLATFORM

5.3 Design Guideline

- Platform depth to be a minimum of 6.5m at Stair/Escalator
- Platform depth to be a minimum 9m without stair/escalator
- Minimum clear interior height to be 4m
- Structural design of tunnel to be reflected in design of platform volume
- Provide wall niches at regular intervals along length of platform creating wall niche spaces
- Form of platform volume to incorporate dominant form of overall facility design
- Seating to be wall hung and designed to provide temporary rest for commuters
- Seating to be incorporated within wall niche space at regular intervals along the entire length of platform
- Incorporate waste receptacles, etc. within wall niche spaces along platform

Rendering - Platform at Yonge & St. Clair Station - Design illustration for Light & Security - Destination



Drawing - Platform at Yonge & St. Clair Station - Design illustration for Light & Security - Destination

5.3.1 Design Objective - Light & Security - Subway Platform

Both the single and double platform designs provide significant additional light at the platform levels as a result of light wells. Research has shown that the commuter's enjoyment of subway travel is significantly higher when there is access to natural light. The time of day, weather conditions, and visual connection to the outdoors reduce commuter stress while awaiting the next train.

EVENT = DESTINATION
ELEMENT - LIGHT
LOCATION - PLATFORM

Design Guideline

- Utilize openings for elevator, stairs, and escalators as light wells allowing light to penetrate to platform levels
- Where natural light cannot be accessed at the platform level, provide illuminated light features along the length of the platform
- Provide transparent balustrades to provide clear interior views between floors
- Use reflective wall, floor and ceiling finishes where possible
- Design to provide clear sight lines for the full length of the platform
- Textured floor finish to be provided at platform edge and changes in circulation direction
- Sliding door to be provided at platform edge for train arrival
- Provide clear sight lines to opposite platform when train not in position
- Ensure minimum lighting levels of 70fc for all platform spaces
- Minimize door openings to service rooms along the length of the platform

Image - Security - Interior Platform at Vaughan Corporate Centre TTC - Toronto, Ontario

5.3.1 Design Objective - Security - Designated Waiting Area - Subway Platform

Providing the pubic with a perceived sense of security can be achieved by including designated waiting areas at the platform level. These spaces provide commuters with a monitored seating area adjacent to the subway platform.

EVENT = DESTINATION
ELEMENT - SECURITY
LOCATION - PLATFORM

Design Guideline

- Define the designated waiting area using a change of wall and floor materials that are different from the overall platform.
- The designated waiting area should be clearly identifiable and stand out within the overall platform
- Provide seating for up to twenty (20) passengers
- Use reflective wall, floor and ceiling finishes where possible
- Design to provide clear sight lines for the full length of the platform
- Textured floor finish to be provided at platform edge and changes in circulation direction
- Provide clear sight lines to opposite platform when train not in position
- Ensure minimum lighting levels of 70fc for all platform spaces
- Locate adjacent to stair, escalator or elevator openings to take advantage of natural light penetrating from above where possible

Chapter 15

Thesis Demonstration Presentation – D9B

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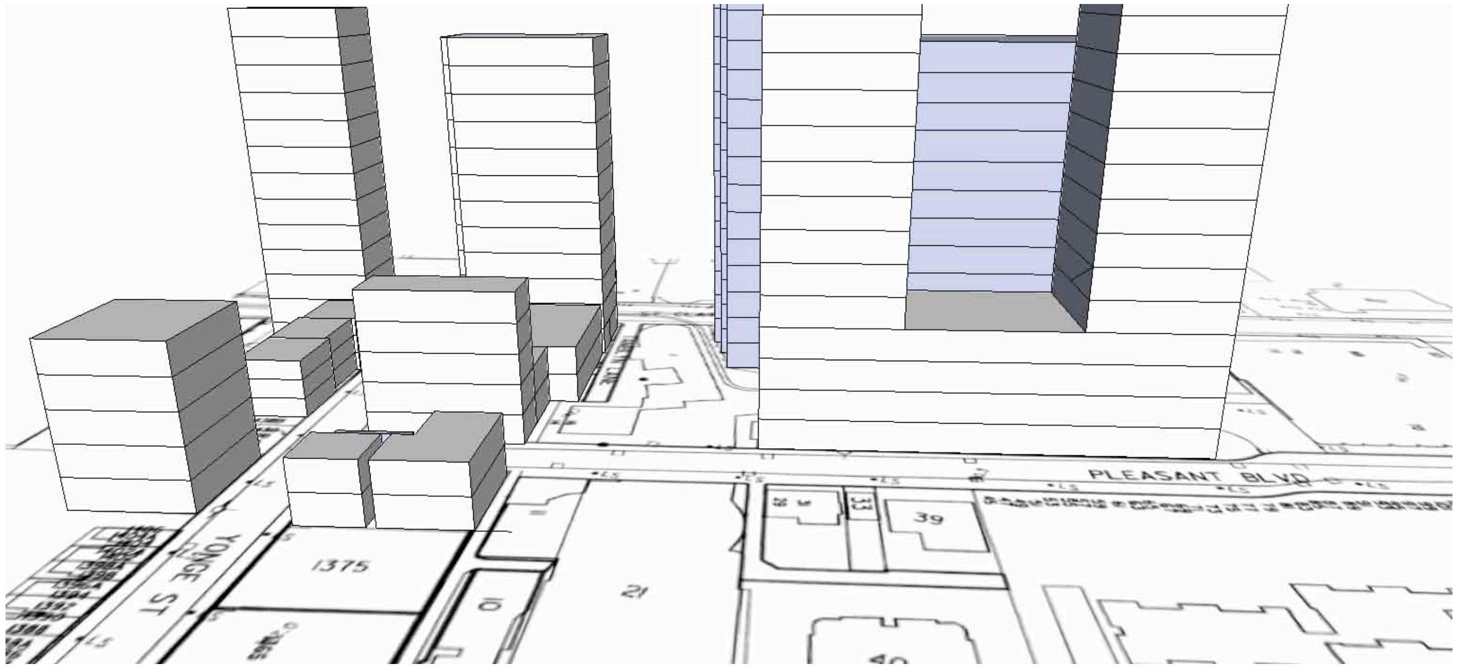
Chapter 16 - Appendix A

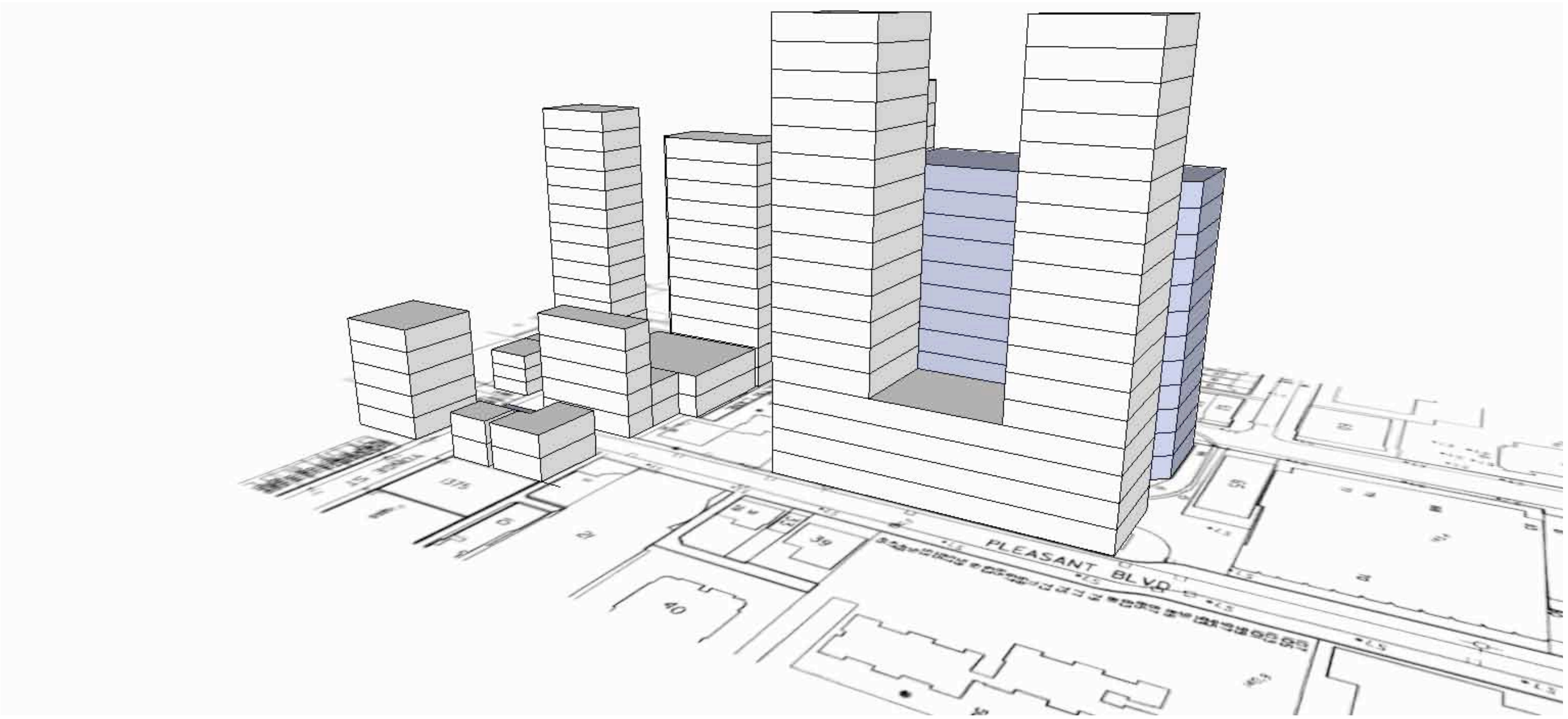
Thesis Demonstration Presentation – D9B

Appendix

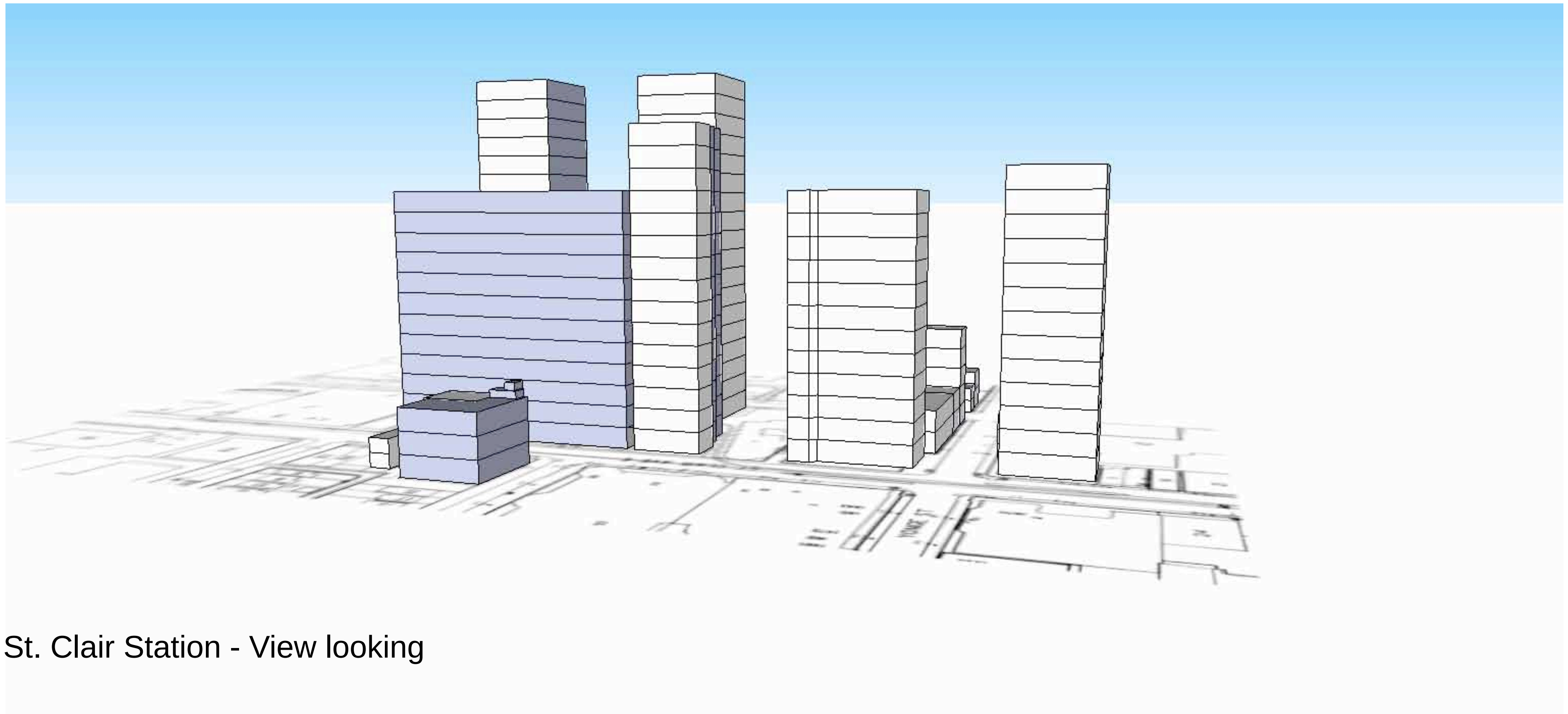
Architectural Illustration - Site Massing Models



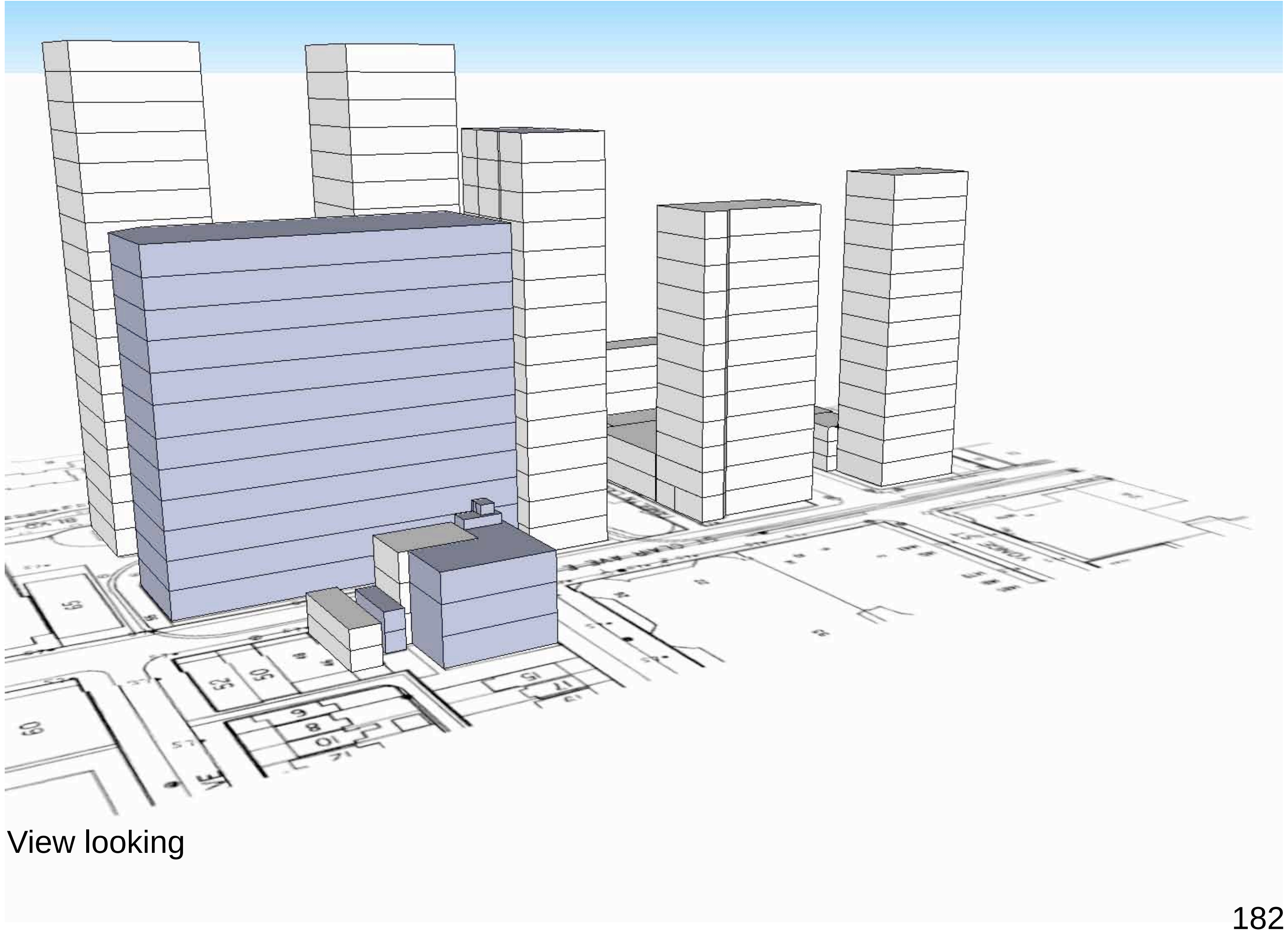
Sketch up model - Yonge Street & St. Clair Station - View looking
north from Pleasant Avenue



Sketch up model - Yonge Street & St. Clair Station - View looking
north-west from Pleasant Avenue



Sketch up model - Yonge Street & St. Clair Station - View looking south from St. Clair Avenue



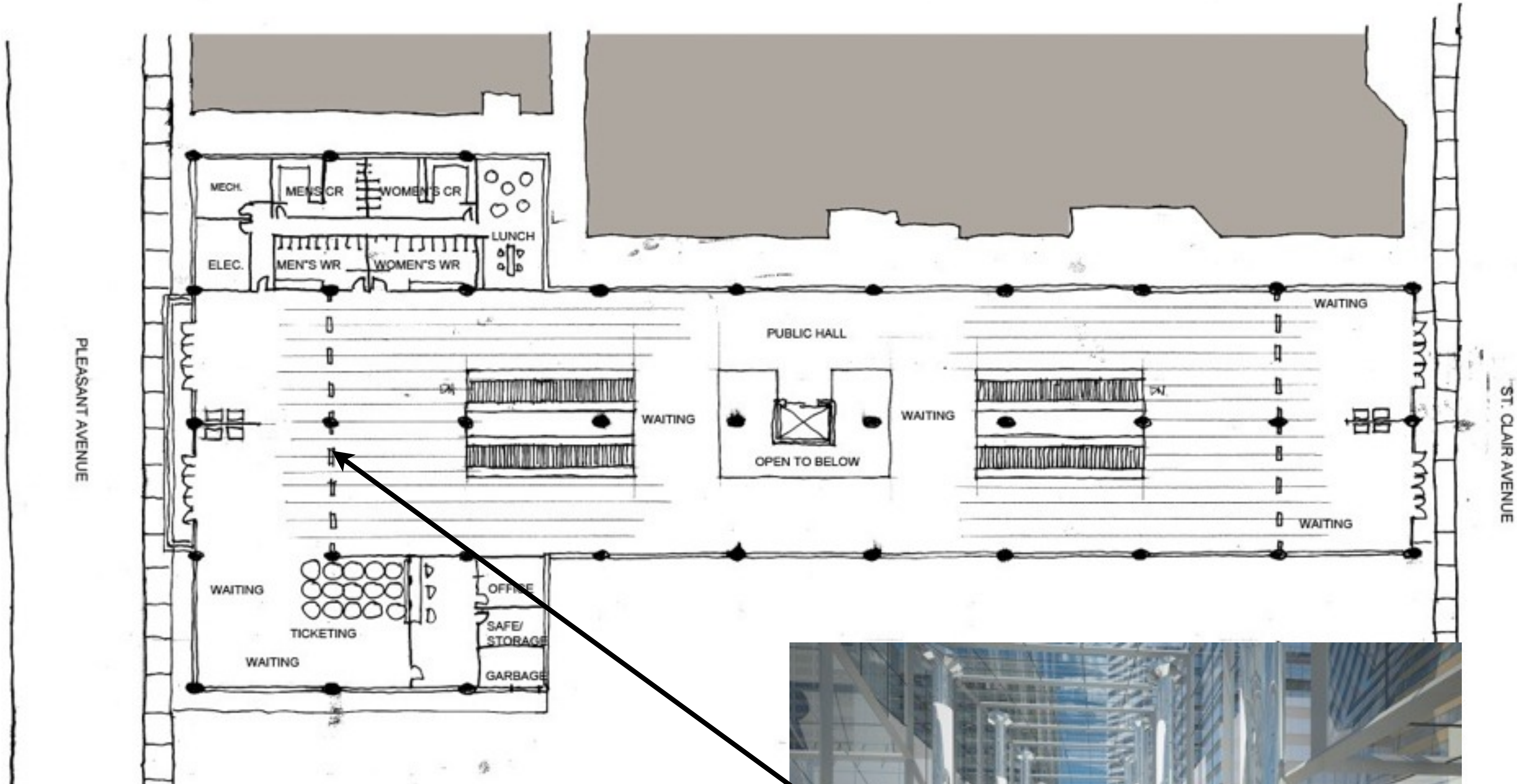
Sketch up model - Yonge Street & St. Clair Station - View looking south west from St. Clair Avenue

Chapter 16 - Appendix A

Thesis Demonstration Presentation – D9B

Appendix

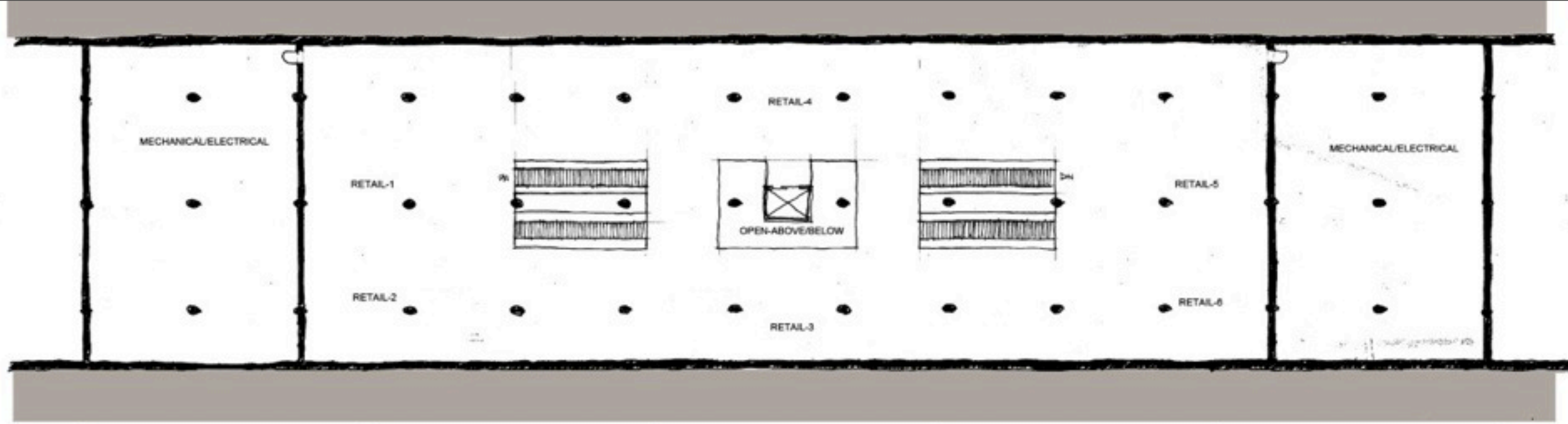
Architectural Illustration - Inner Stair Design



PLAN - STREET LEVEL

NTS

LIGHT _ Rendering - Interior View - Public Hall - Yonge & St. Clair Station



PLAN - CONCOURSE LEVEL

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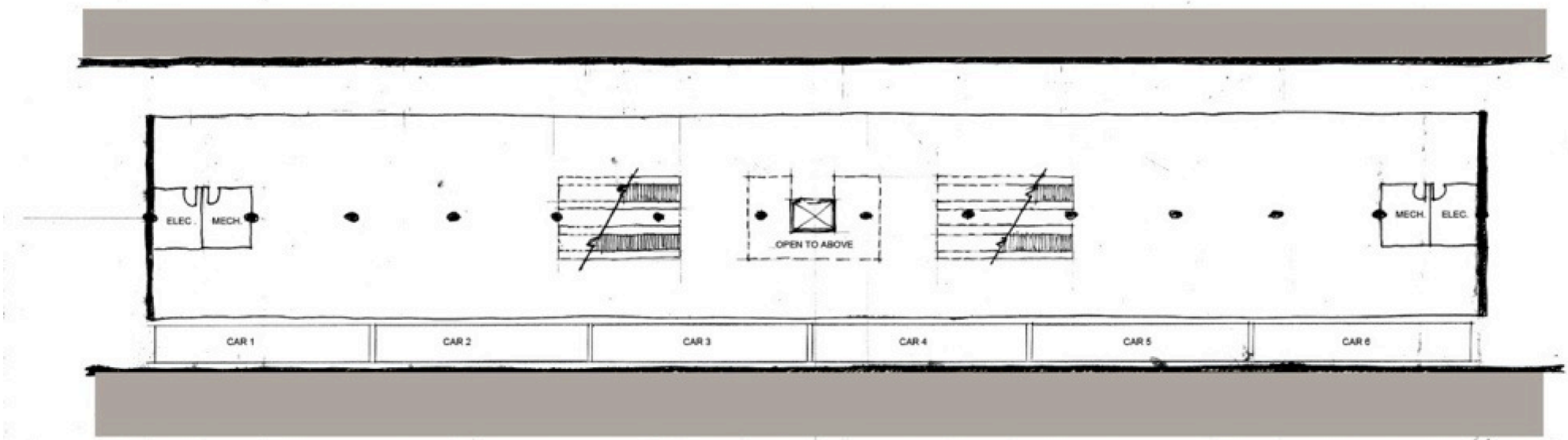
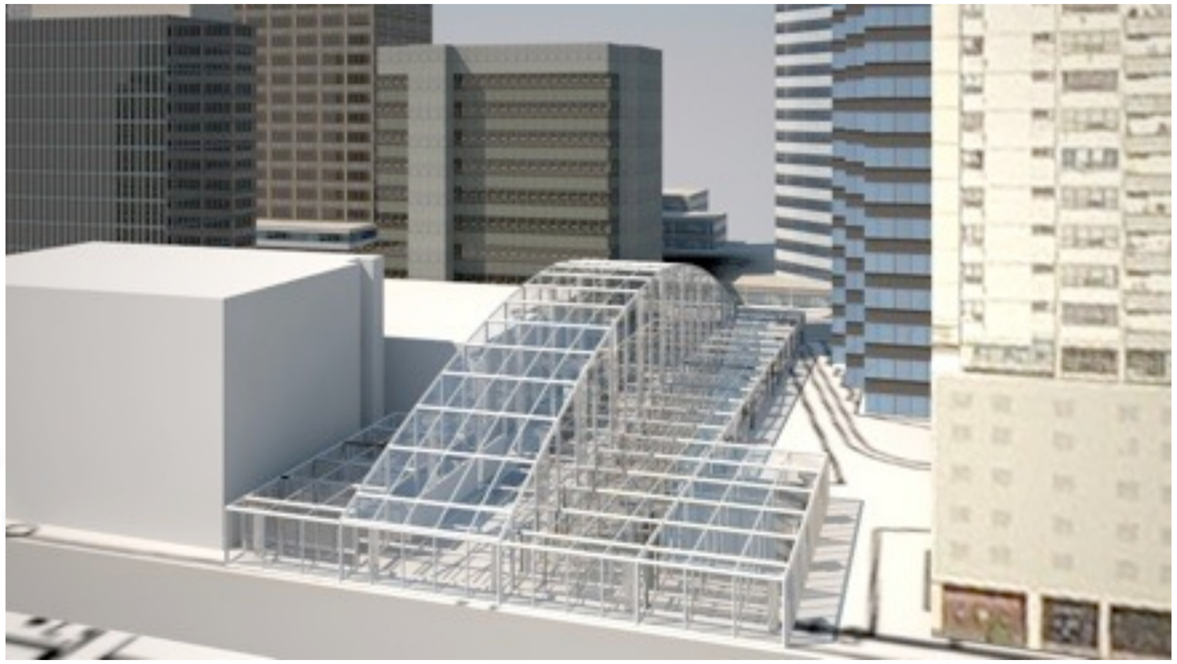
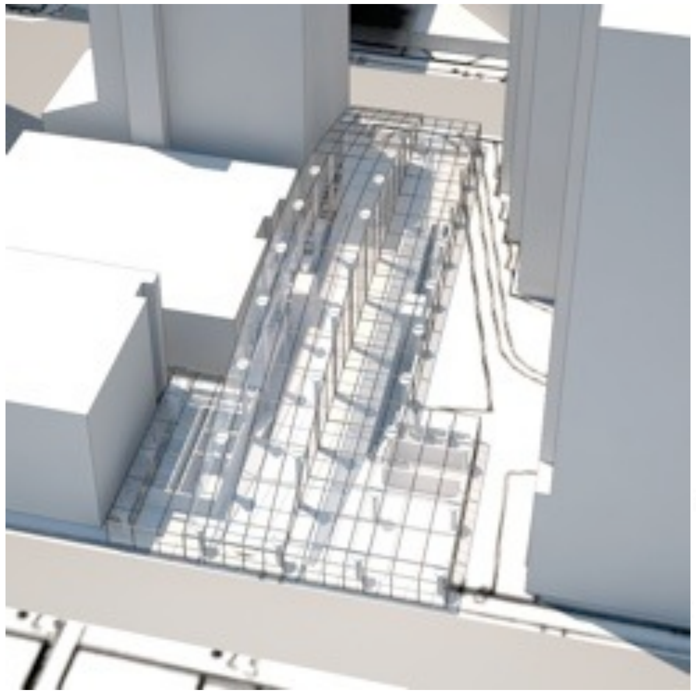


PLAN - PLATFORM LEVEL

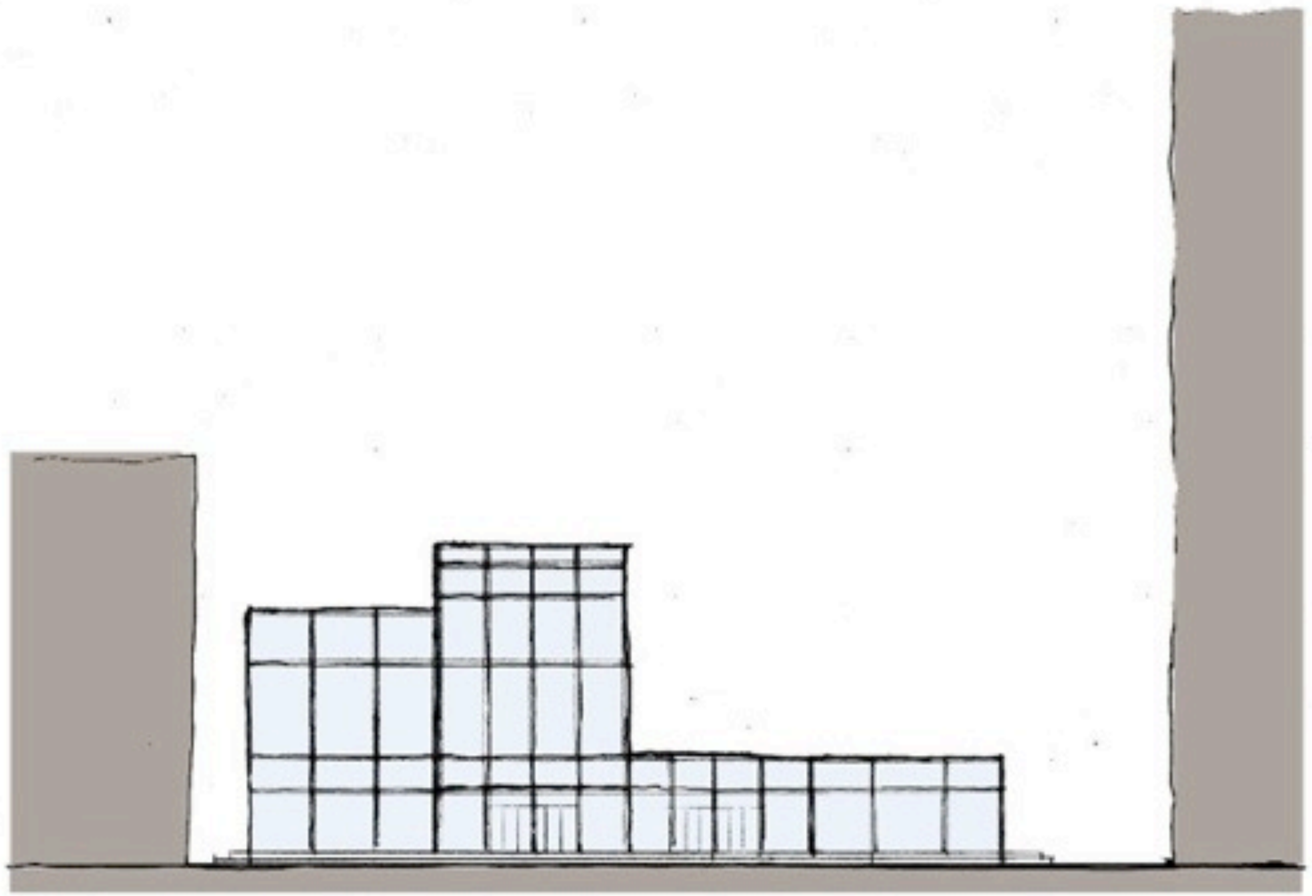
NTS



FORM _ Rendering - View looking North from Pleasant Avenue Yonge & St. Clair Station

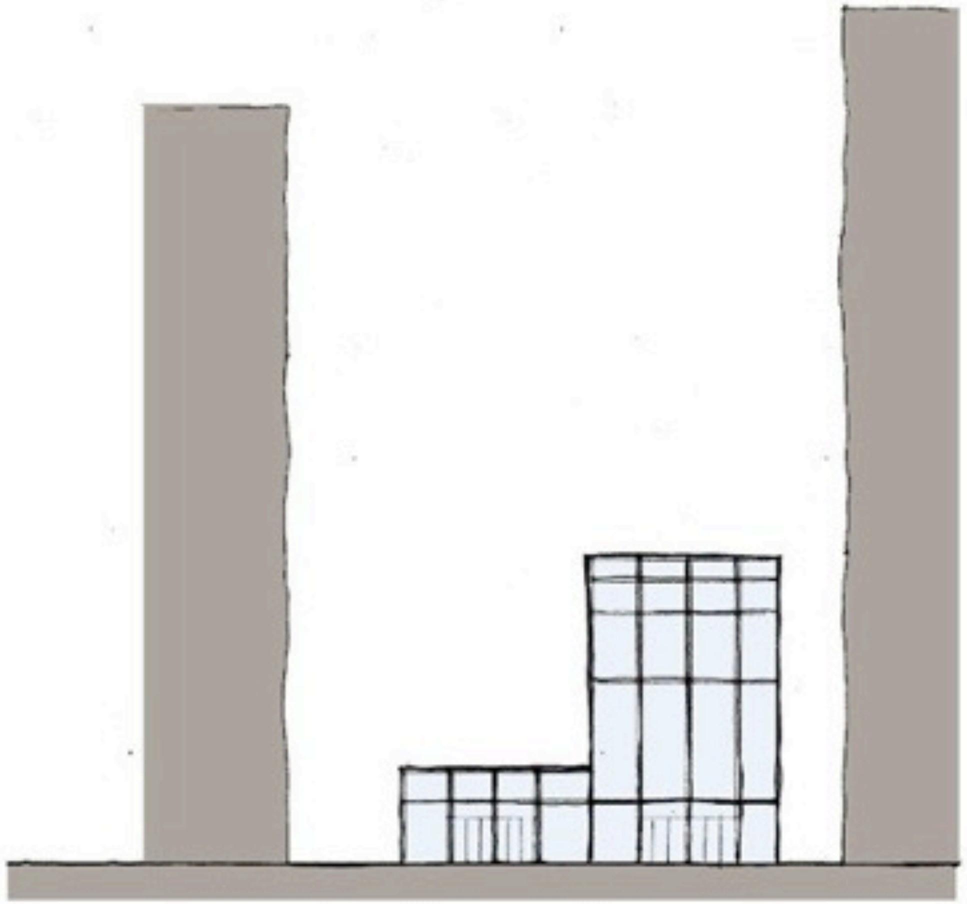


FORM - Rendering - View looking North from Pleasant Avenue Yonge & St. Clair Station



ELEVATION - PLEASANT AVENUE

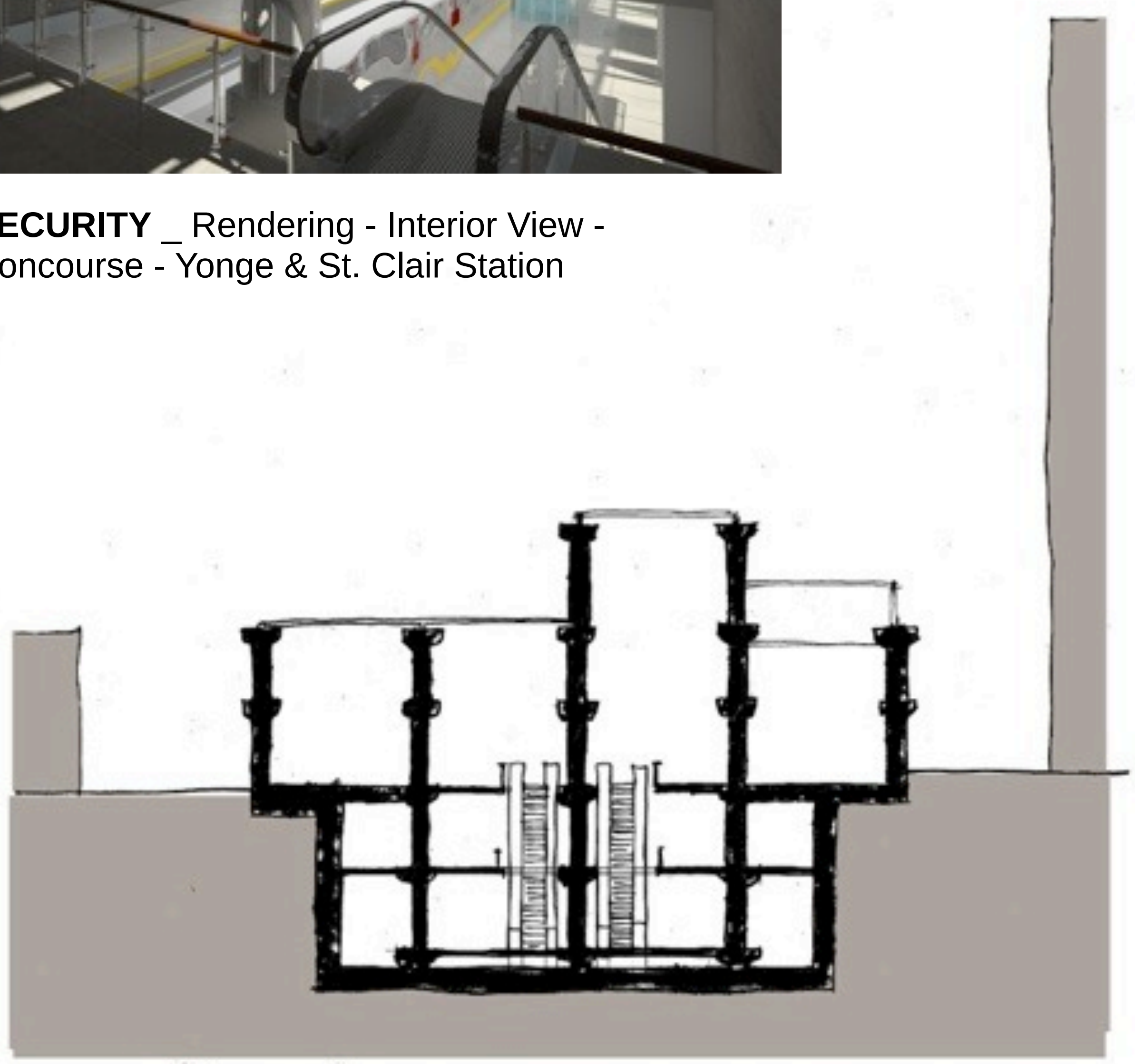
NTS



ELEVATION - ST. CLAIR AVENUE

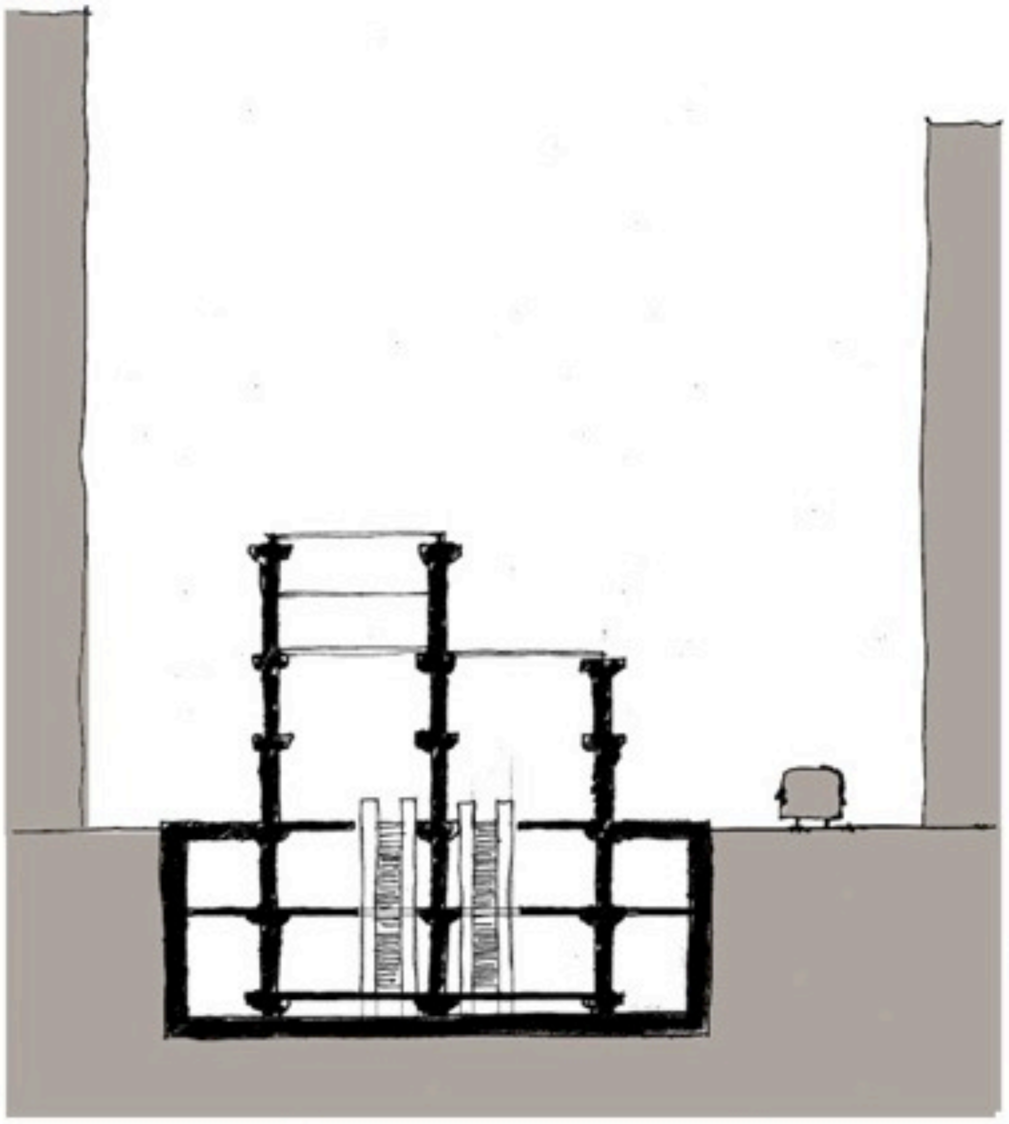
NTS

SECURITY _ Rendering - Interior View - Concourse - Yonge & St. Clair Station



SECTION - A

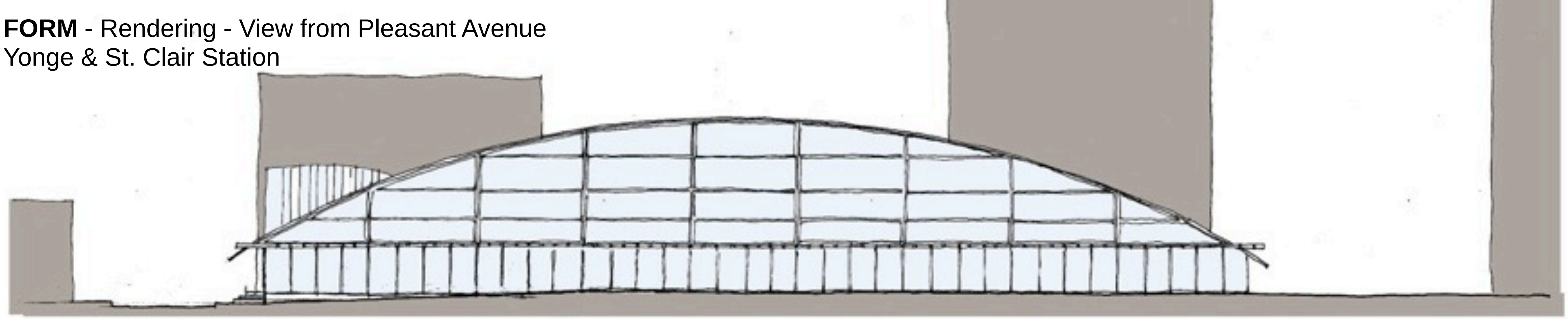
NTS



SECTION - B

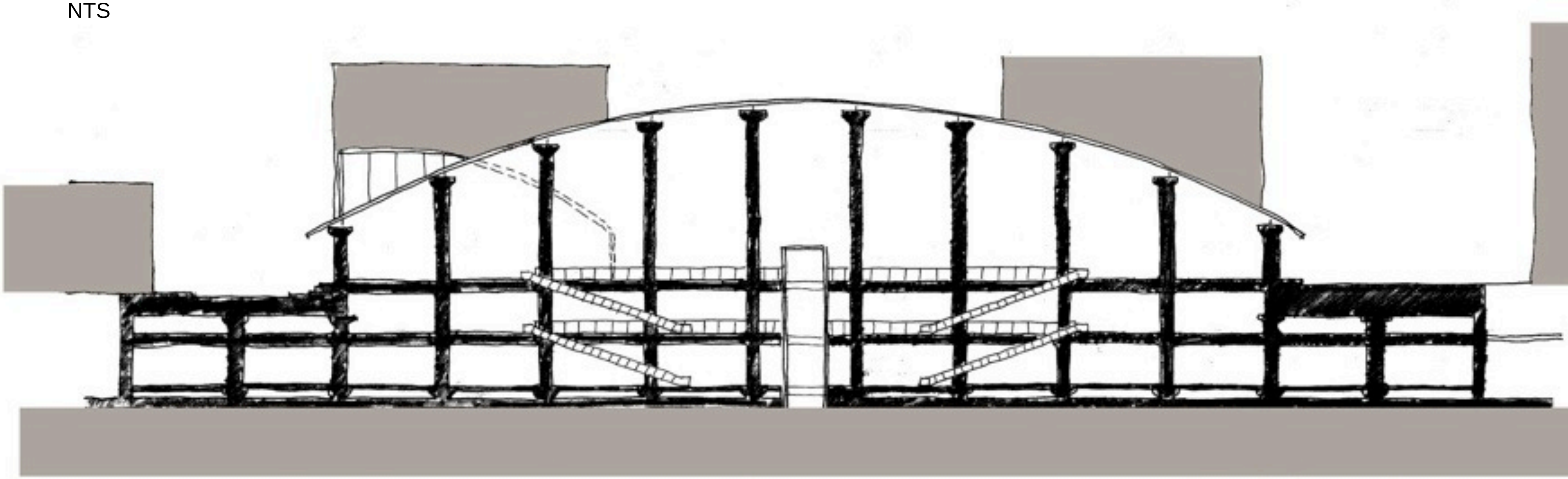
NTS

FORM - Rendering - View from Pleasant Avenue
Yonge & St. Clair Station



ELEVATION - EAST

NTS



SECTION - NORTH/SOUTH

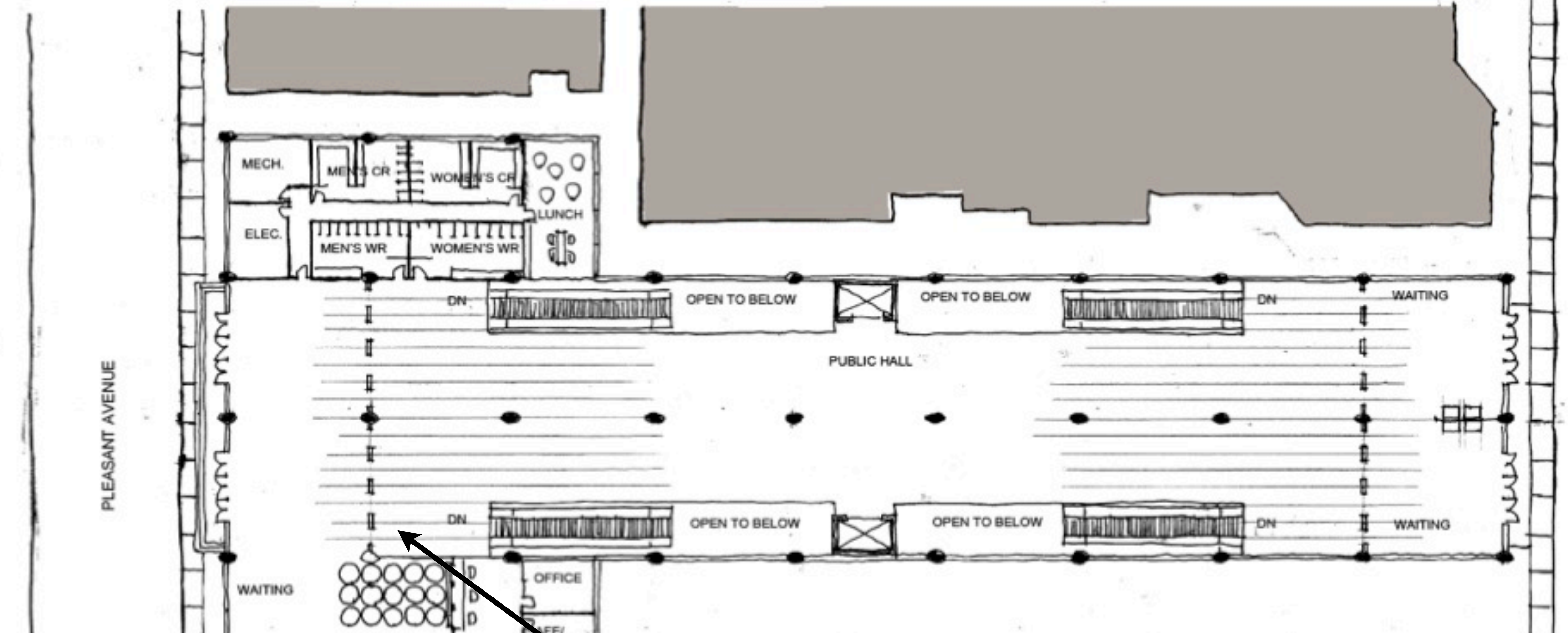
NTS

Chapter 16 - Appendix A

Thesis Demonstration Presentation – D9B

Appendix

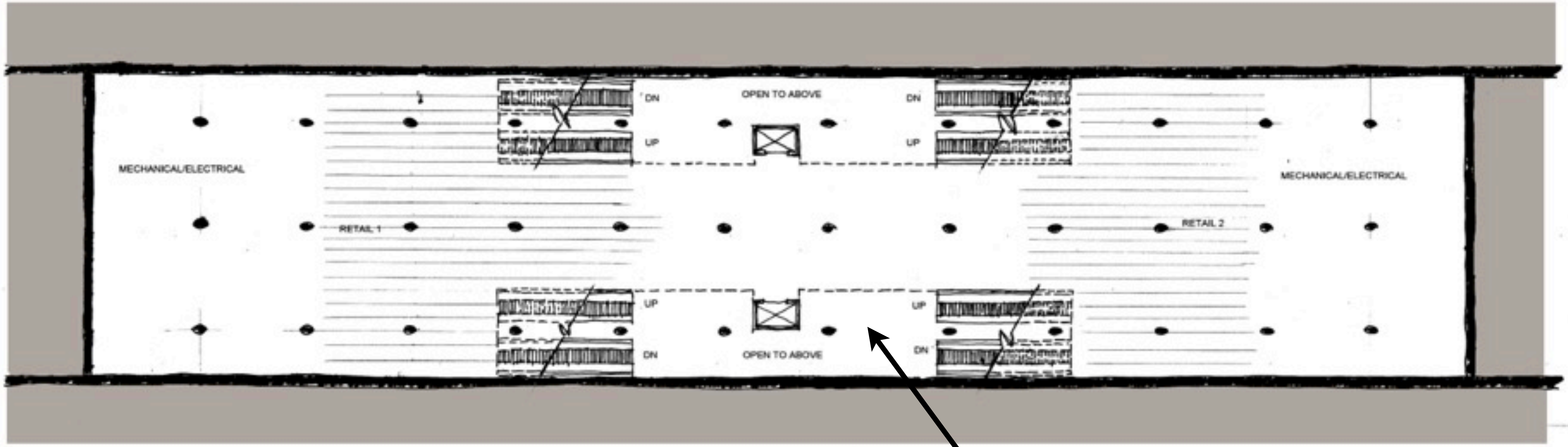
Architectural Illustration - Outer Stair design



PLAN - STREET LEVEL

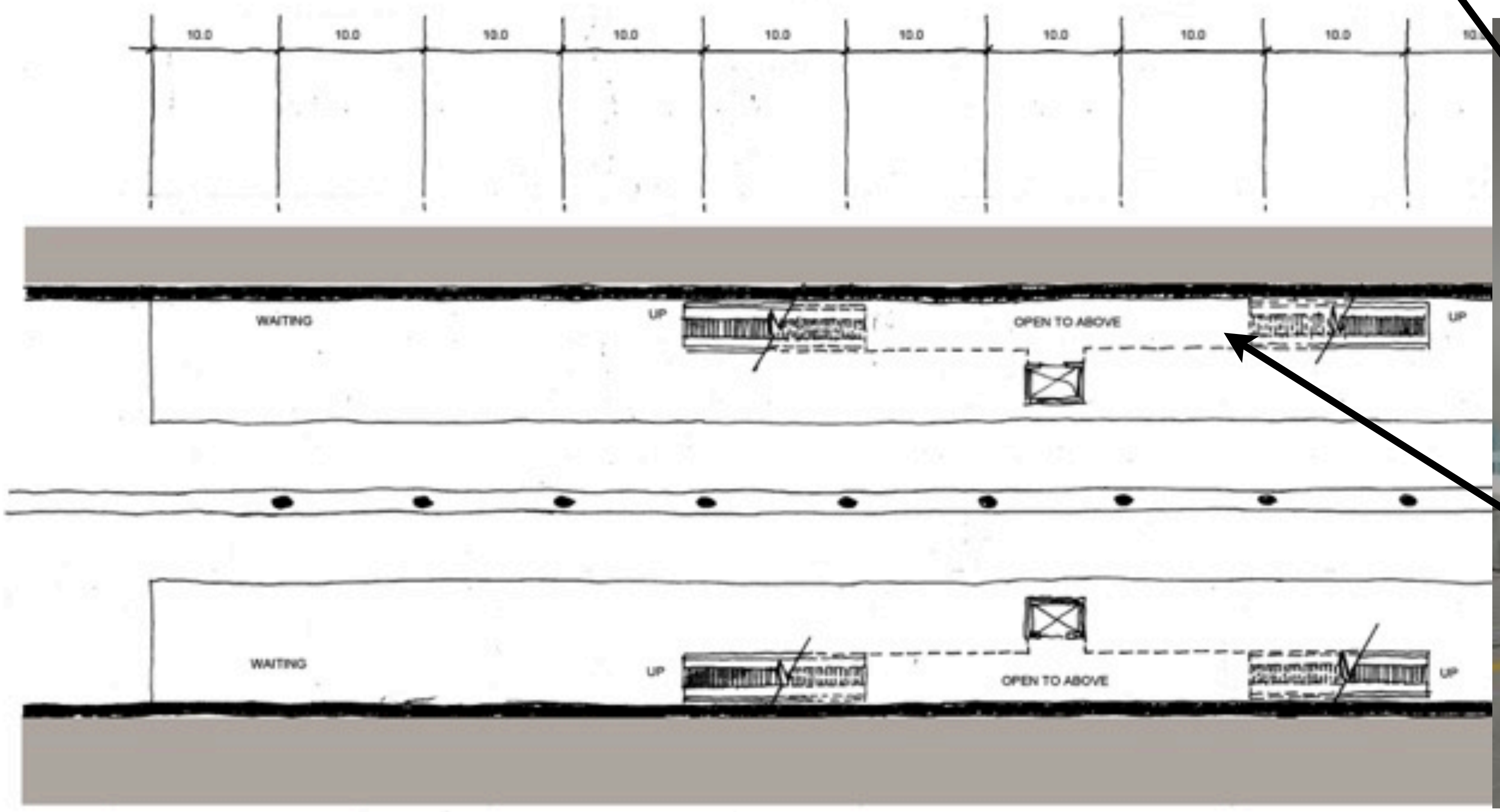
NTS

PLACE - SECURITY - Rendering - Interior View - Public Hall - Yonge & St. Clair Station



PLAN - CONCOURSE LEVEL

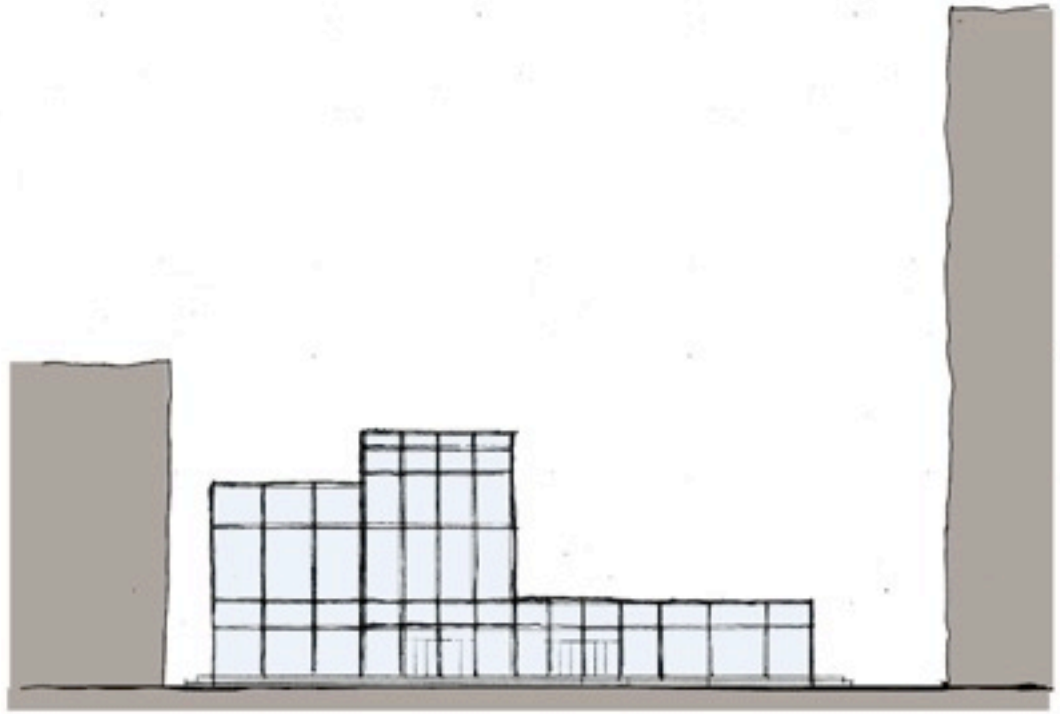
NTS



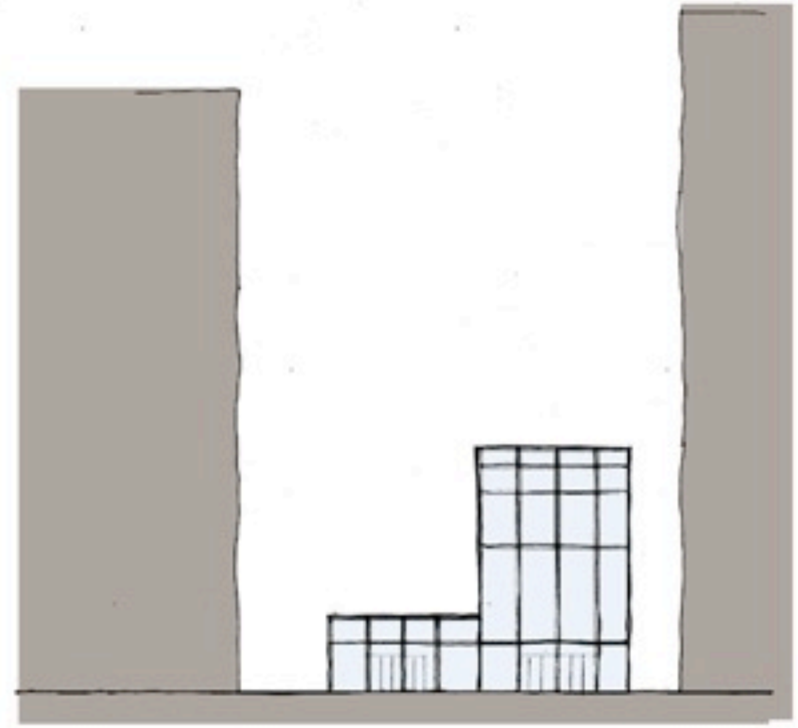
SECURITY - LIGHT - Rendering - Interior View - Platform - Yonge & St. Clair Station

PLAN - PLATFORM LEVEL

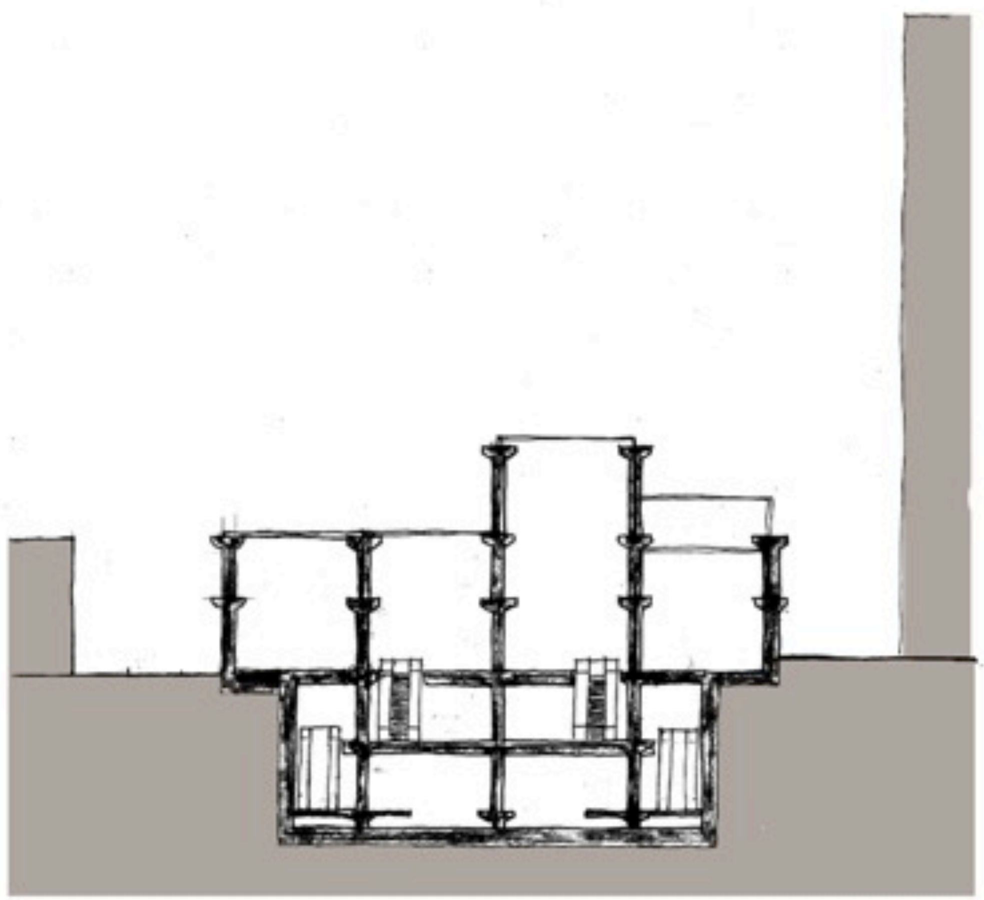
NTS



ELEVATION - SOUTH (Pleasant Avenue)

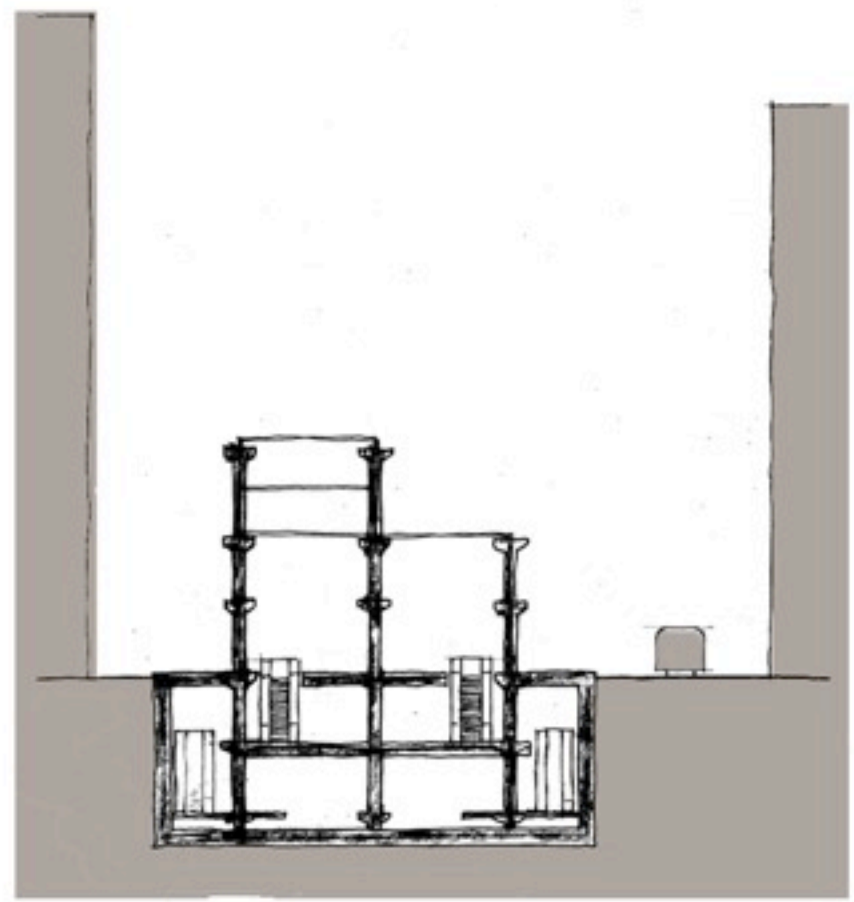


ELEVATION - NORTH (St. Clair Avenue)



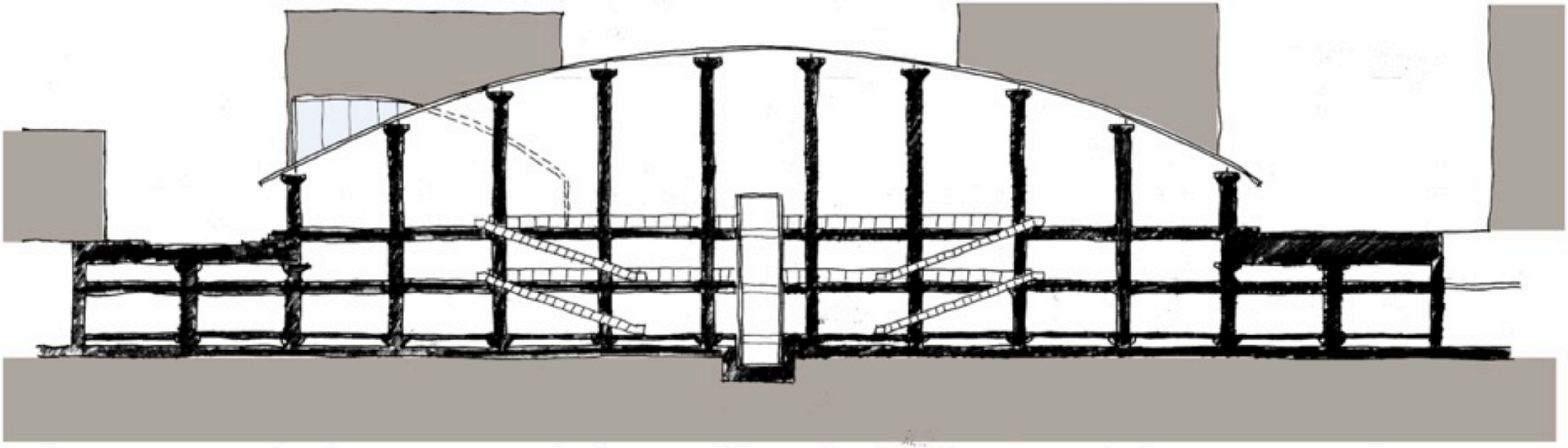
SECTION - B - EAST/WEST

NTS



SECTION - C - EAST WEST

NTS



SECTION - A (NORTH/SOUTH)

NTS

FORM - PLACE - Rendering - View from St. Clair Avenue Yonge & St. Clair Station

FORM - Rendering - Birds Eye View Yonge & St. Clair Station

Chapter 17 - Appendix B

Thesis Demonstration Presentation – D9B

Appendix

Slide Show Presentation Content - December 10, 2011

Elevating The Commuter Experience
Public Transit Facilities - Subway Design Guidelines

John Tanfield - ON900041
December 10, 2011

My area of interest for this thesis is Public Transit Facilities

My specific topic is:

Elevating the commuter experience within Subway Transit Facilities.

How:

This is achieved through establishing a set of design guidelines.

Why I selected this topic?

- I believe that there is a place for Architects in the design of subway transit facilities. Commuters and the city deserve dignified spaces for subway travel.

- Over 62km of new Subway track will be added to the existing subway system by 2020.

- The existing subway system is used by over 1,000,000 passengers each day.

- The existing subway facilities lack identity within the urban landscape as important public buildings.

We can no longer accept subway facilities like this....dark, narrow platforms & lack of identity.

We want to establish a higher standard for these facilities.

A design guideline that takes into consideration the key architectural elements and commuter events.

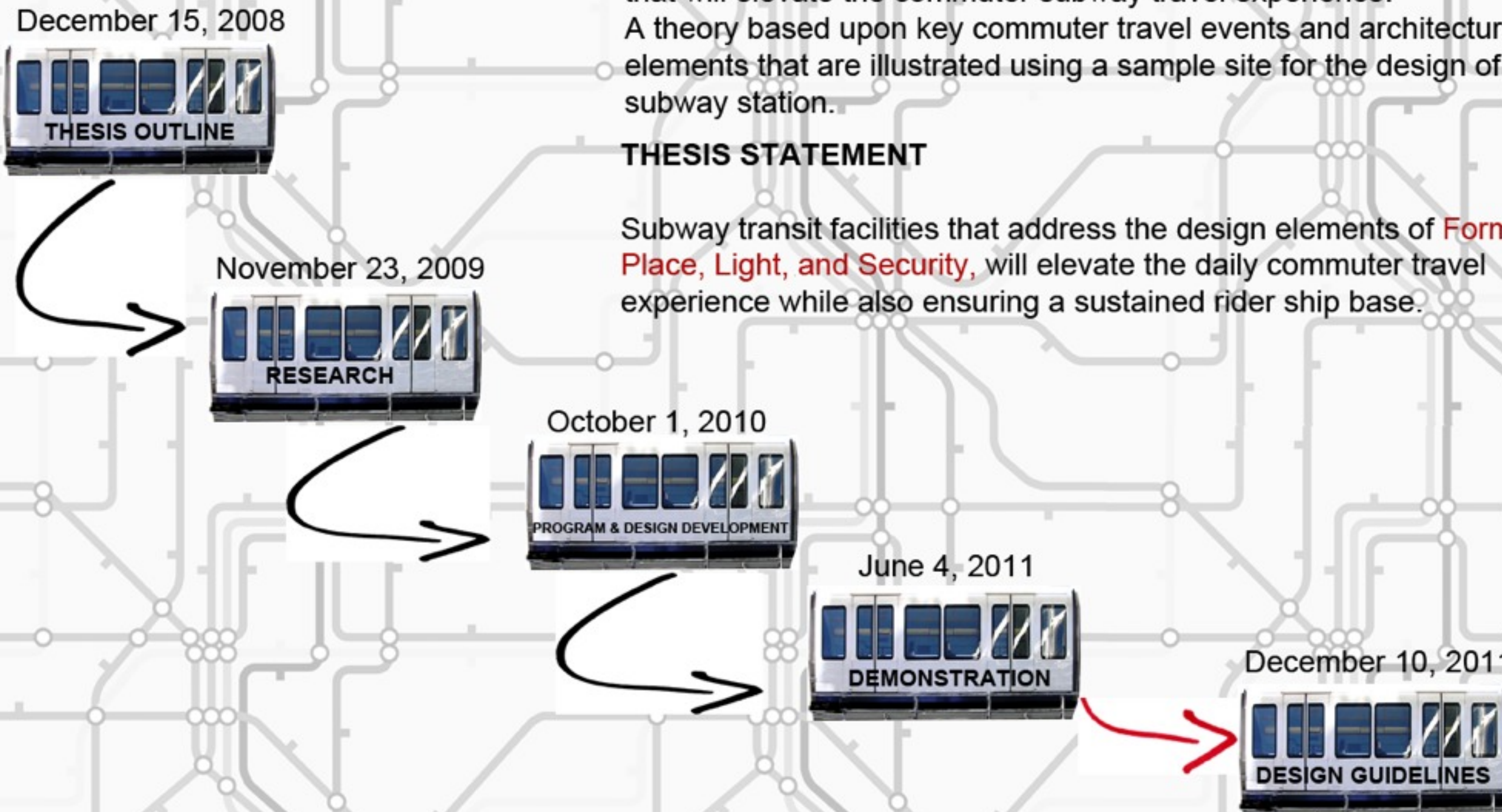
My thesis process.....

INTRODUCTION

The goal of this thesis set out to establish a set of design guidelines that will elevate the commuter subway travel experience.
A theory based upon key commuter travel events and architectural elements that are illustrated using a sample site for the design of a subway station.

THESIS STATEMENT

Subway transit facilities that address the design elements of Form, Place, Light, and Security, will elevate the daily commuter travel experience while also ensuring a sustained rider ship base.



Presentation Outline:

To begin, I would like to outline the main points of my research and conclusions, that form the basis for the development of the design guidelines.

Next, I will provide examples of the design guidelines for each of the main categories.

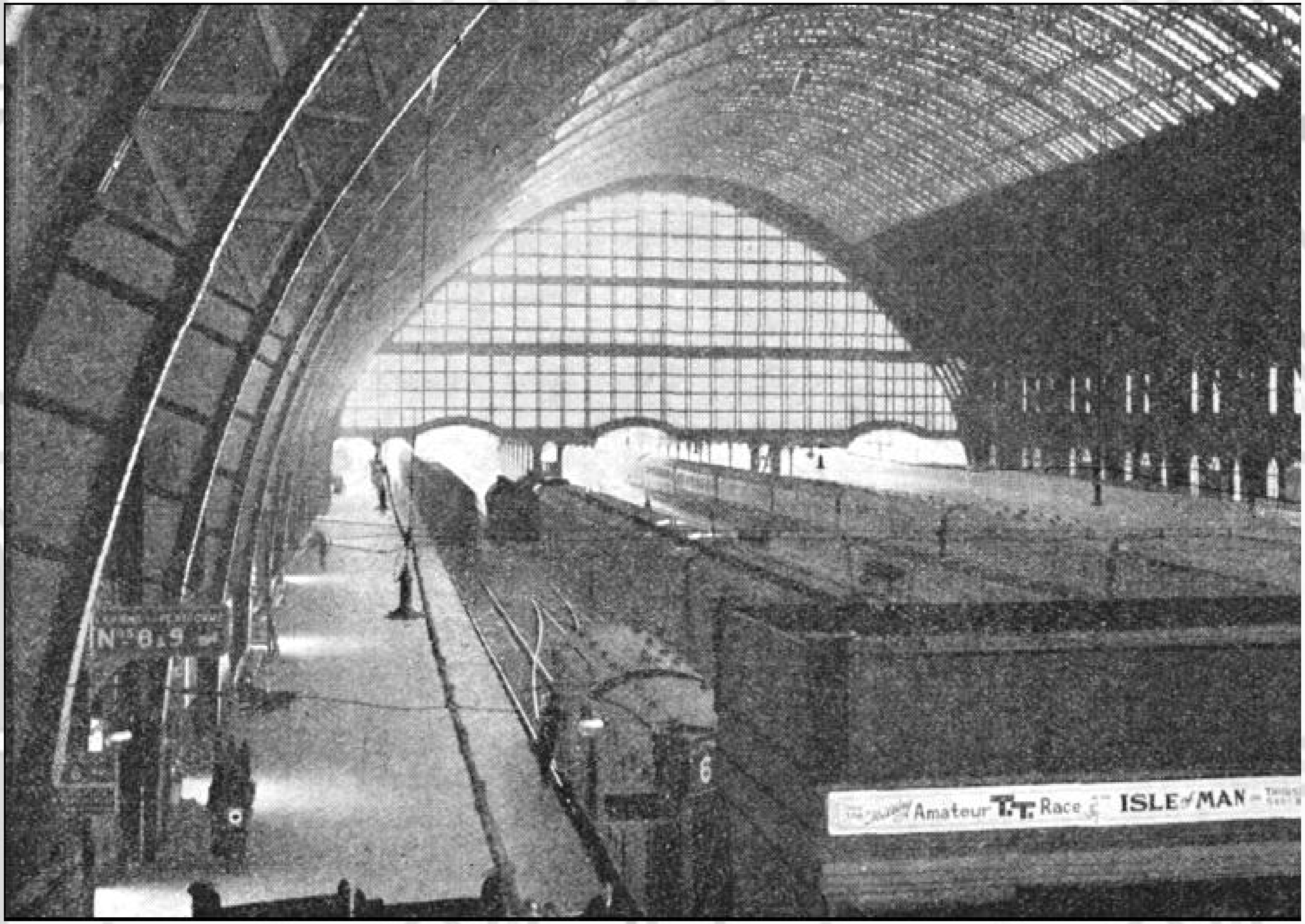
This thesis addresses the architectural elements and commuter events identified during my research as the most significant to subway facility design.

This thesis does not cover engineering and non-architectural issues.

Research

The development of passenger train systems in England, the United states and around the world are products of the industrial revolution.

The building and invention boom during the early 1800's created the need to transport people, goods and services over large distances.



Research

My Research started with the history of trains used for passenger travel.

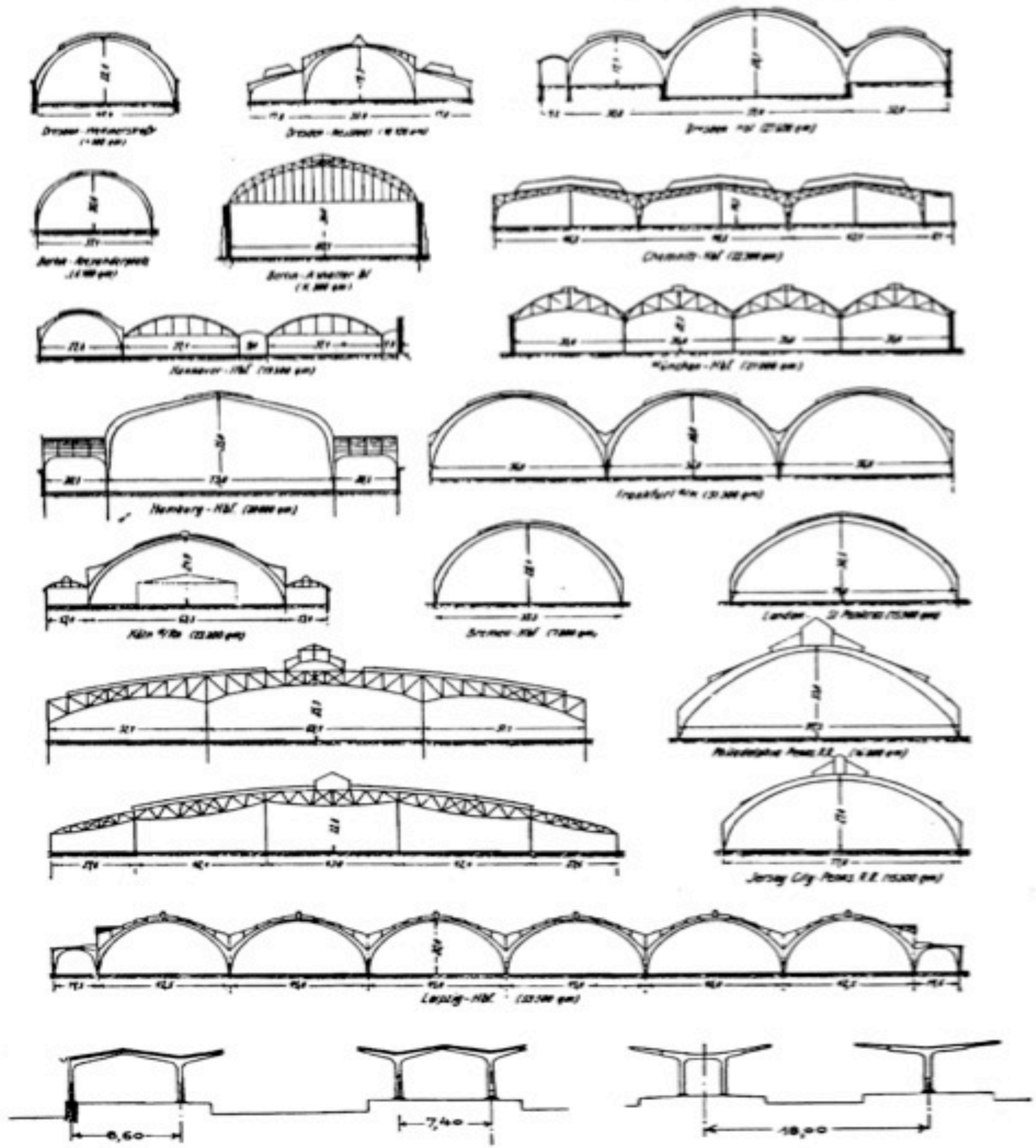
The first known passenger train station being the Baltimore & Ohio station, Baltimore, Maryland, 1830.

In parallel, was a second passenger train facility, Liverpool Station, Manchester, England.

Research

As the stations became more, complex, larger, and incorporated inns, and larger spaces for gathering, there became a competition of sort among architects and engineers to see who could achieve larger spans without uninterrupted spaces and volumes.

Various different track configurations required different architectural approaches to solving this new building type.



Research

My Research moved from regional transit facilities to urban transit facilities, including subway.

I started with the first known subway facilities.

The first know subway in the United states was in Boston, Ma, open to the public September 1, 1897.

New York had it's first subway in operation in 1904, running from downtown Manhattan to Grand Central Station

Research

My focus continued to narrow. I visited a number of transit facilities, in a variety of cities such as:

Toronto, Ontario
Vancouver, British Columbia
Chicago, Illinois
London, England
Paris, France

Research

It became clear that the train station architecture of the past has not continued into present day design solutions for these facilities.

Train station architecture today lacks identity, orientation and legibility within the urban landscape.

My research analyzed attributes of public transit facilities in an effort to find common elements that could form the basis for improved design in the future.

Research

The four (4) main architectural elements that were concluded to have the most impact on the design and the commuter experience were:

Form

Light

Place

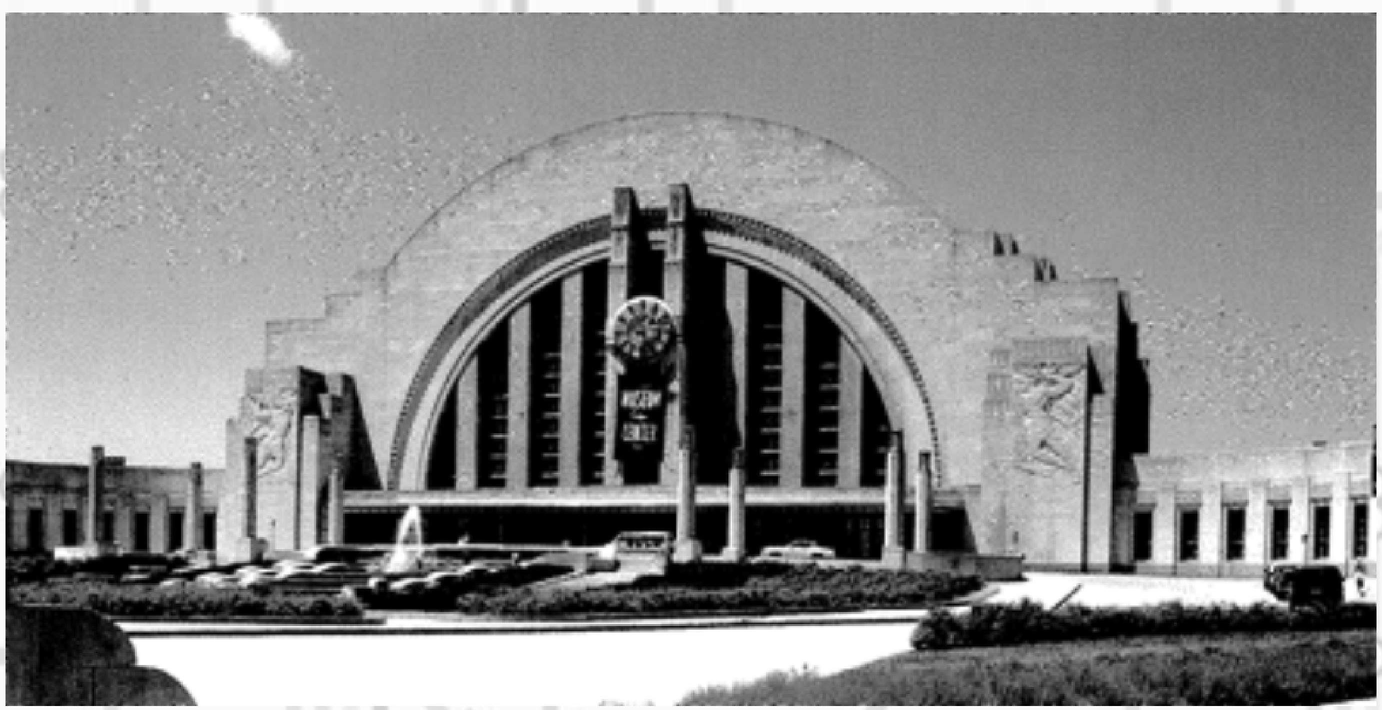
Security

These elements are not stated or positioned in any particular order, all are equally important. Each design solution may change the hierarchy of the elements to suit each individual scenario.

Research (con’t)

Form

Subway stations have lost their identity as a building type. The use of the arch and the clock tower as a recognizable form in the late 19th century created the building type that is lost in today’s stations.



Research (con't)

So many of the transit stations I visited lack an identity that is true to their use, any historical connection, or a recognizable building type.

Research (con't)

Place

Subway facilities were once constructed as a instrument of national pride, a symbol that represented wealth, craftsmanship, and superior technology.

Red Line - Chicago, Illinois

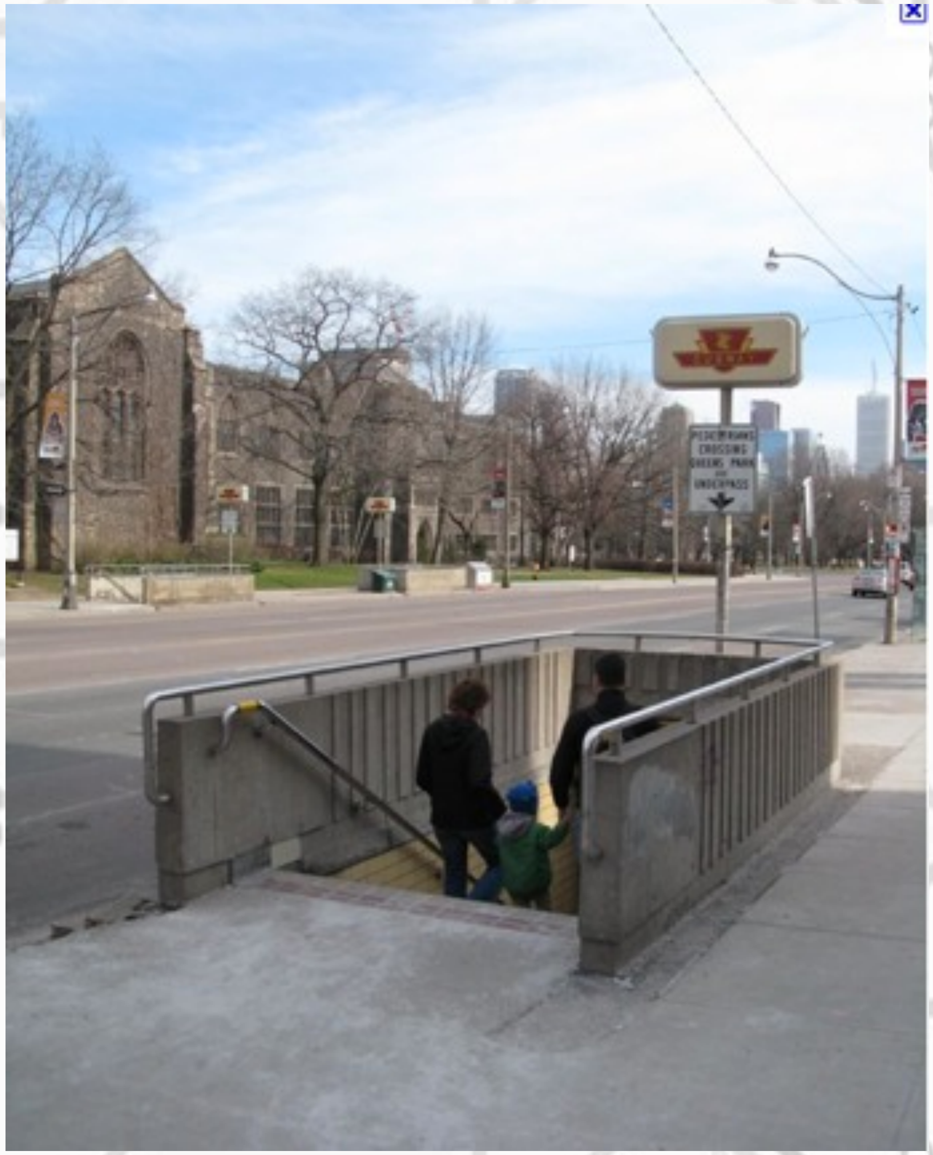
Subway - Moscow, Russia

Metro - Paris, France

Research (con't)

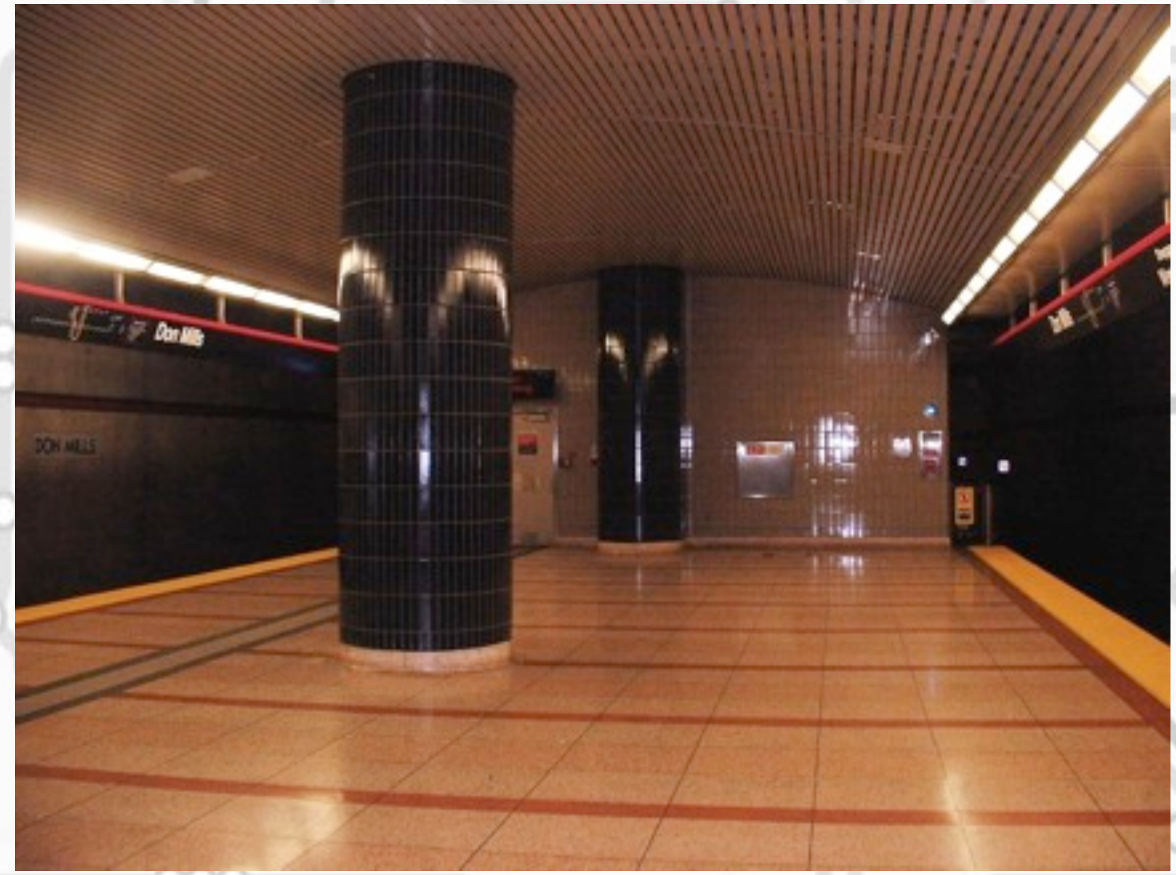
Place

In Toronto, and in many locations where subway transit has expanded in the last fifty years, this is not the case.



Research (con't)

Many of the recent subway stations in Toronto follow the same design that was used in 1953 when the subway was first started in Toronto, Ontario.



TTC - Sheppard - Don Mills Station - 2002

TTC - Yonge & Dundas Station 1954

Research (con’t)

Light

Subway facilities are by definition underground. The human body needs a certain amount of light to feel at ease, especially with a facility that is underground that we use as necessity for travel within the city. My site visits and surveys identified light as a major factor that influences commuters comfort while using these facilities.

Tube - Jubilee Line - Bermondsey Station

Tube - Jubilee Line - Canary Wharf Station

Research (con’t)

Light

Today, even in a location where we have an opportunity to access light through a design feature, it is obstructed.

Having a design guideline in place for these facilities will provide a necessary tool to inform these design and planning decisions.

Research (con't)

Security

Personal security is also a major concern identified in my research as it relates to use and architectural design. Subway stations in Toronto, Ontario handle up to 1,000,000 passengers each day and require adequate space for commuters.

Outdated spatial design requirements need to be reviewed as part of any design guideline.

Security is also enhanced by providing clear sight lines, and reflective materials to improve commuters awareness of their surroundings.

Tube - Jubilee Line - Southwark Station

Summary of Conclusions (Part 1):

The Elements Are......

Form

Space

Light

Security

Now the Sequence of Travel for the Commuter......

The Events (Part 2)

The Commuter Travel Sequence

The Events

The five (5) main stages of commuter travel experience have been categorized by me as; Approach, Identification, Arrival, Transition, and Destination.

Each of these stages link together to define the individual commuter with their own personal experience.

My research has shown that the most important architectural elements that must be integrated within these stages include; form, place, light, and security.

The Events

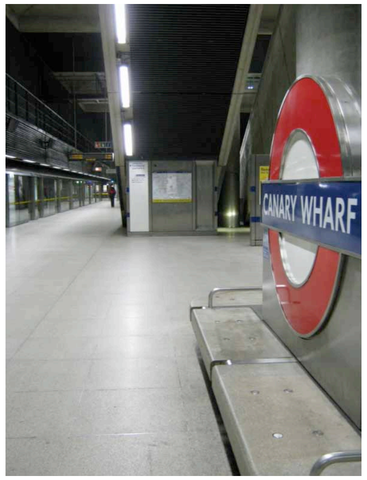
Approach - Approach is defined as the event in the commuters travel experience as they are moving towards the facility as a whole. The facility is in sight, however the individual access point the commuter is moving towards has not been isolated visually.

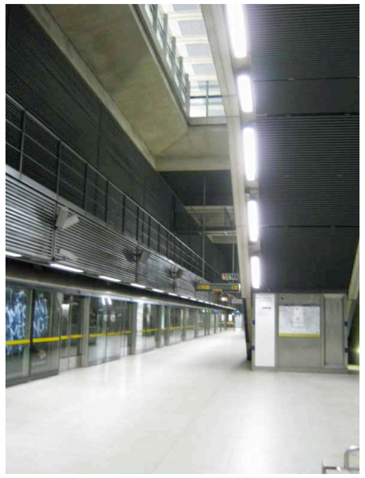
Identification - Identification is defined as the visual connection with the specific point the commuter is going to access for their travel. It could be the front door of the transit facility, or the automobile drop off/pick up point, or the entry point to the subway portal from the street.

Arrival - Arrival is defined as the space within the subway station such as the waiting areas, ticketing, or the public hall. Arrival spaces could contain retail and ancillary services for passengers to gather at and provide an activity prior to their next move or transition.

Transition - Transition spaces are where we spend most of our time while moving from one event to another within the subway facility. Transition spaces connect all the spaces internally. These spaces can be stairs, escalators, corridors, etc. and should be designed with the equal importance and attention as all other events within the commuters travel

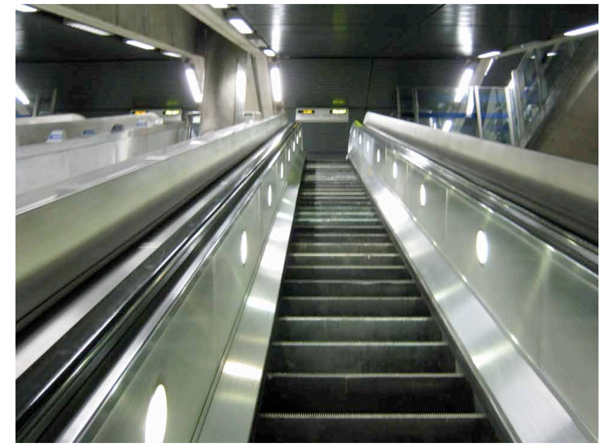
Destination - The destination is the platform for the purpose of these design guidelines. The platform is where the commuter wants to go on his or her journey. The journey may be work or play, although the commuter must pass through the previous four (4) events in order to get to the destination.





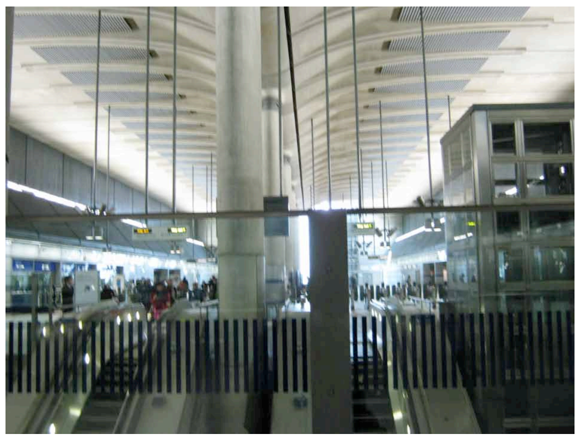
DESTINATION

TRANSITION



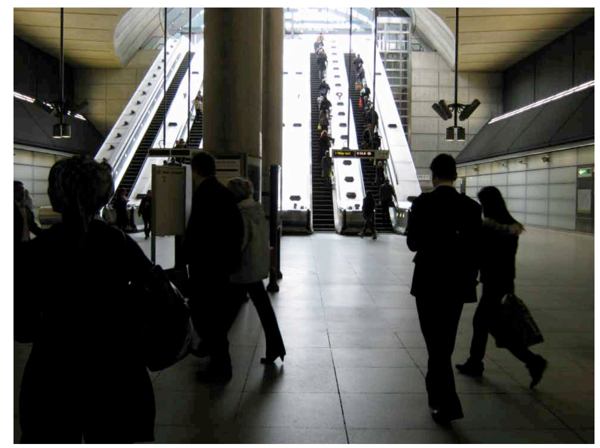
TRANSITION

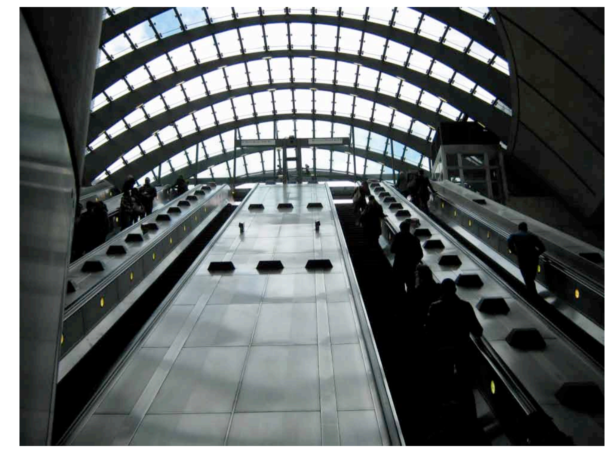
ARRIVAL



TRANSITION

TRANSITION

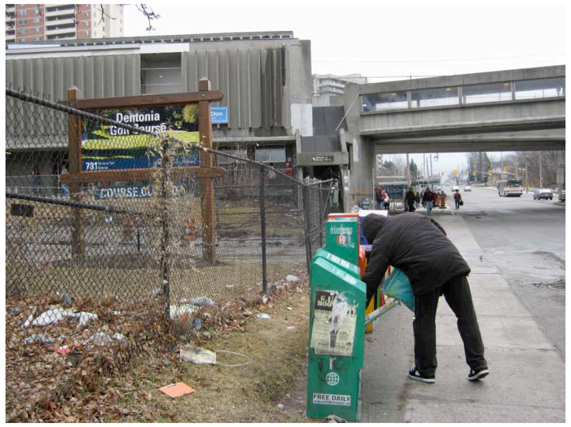




APPROACH

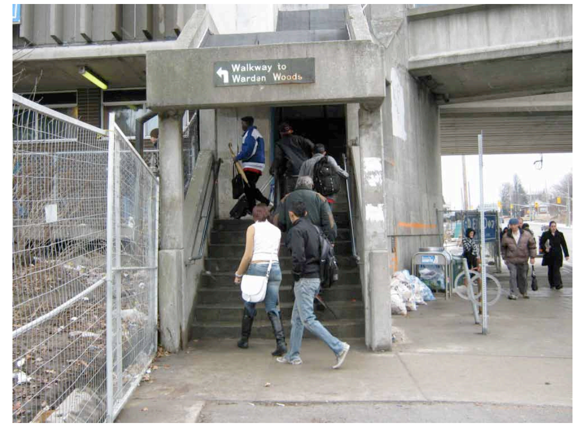
APPROACH

Event Sequence - Canary Wharf - London, England



APPROACH

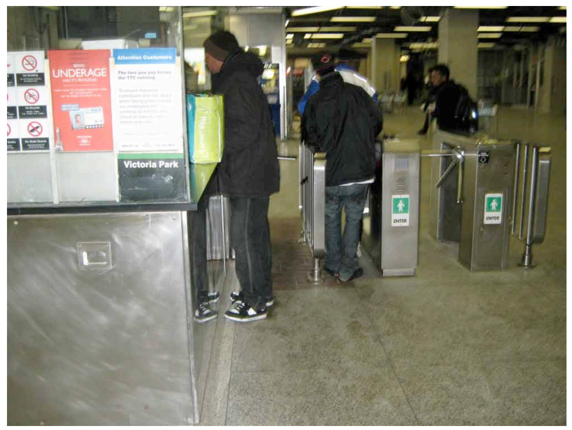
APPROACH



IDENTIFICATION

TRANSITION

TRANSITION



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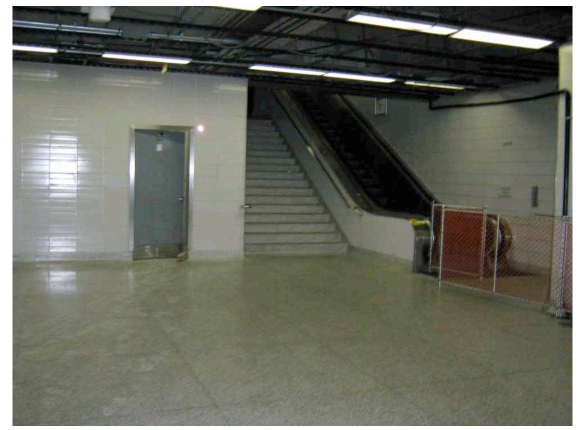

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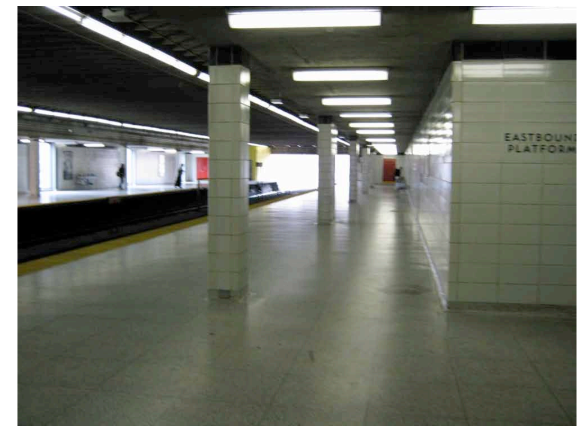
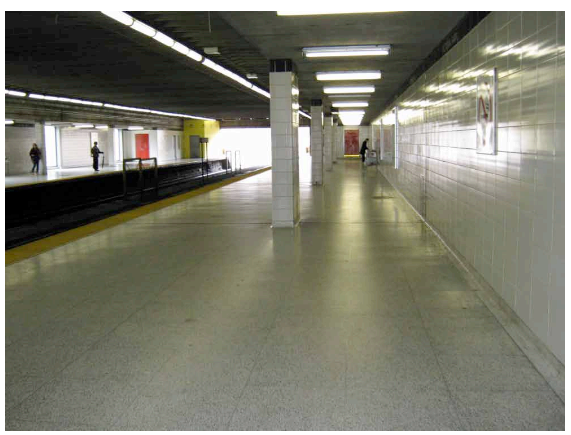
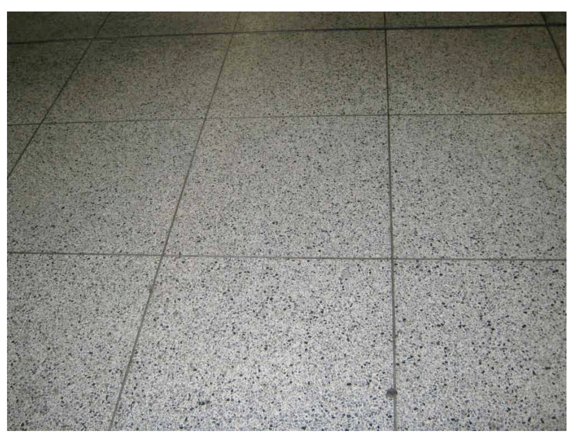


DESTINATION





DESTINATION

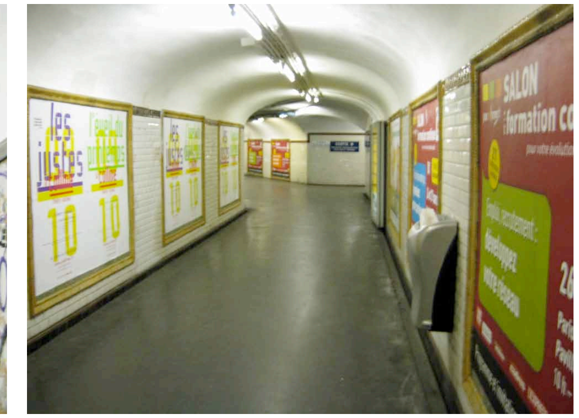
Event Sequence - Victoria park - Toronto, Ontario


IDENTIFICATION


TRANSITION


TRANSITION


TRANSITION




TRANSITION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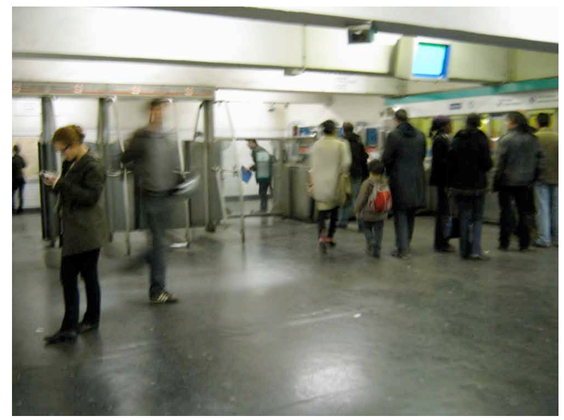
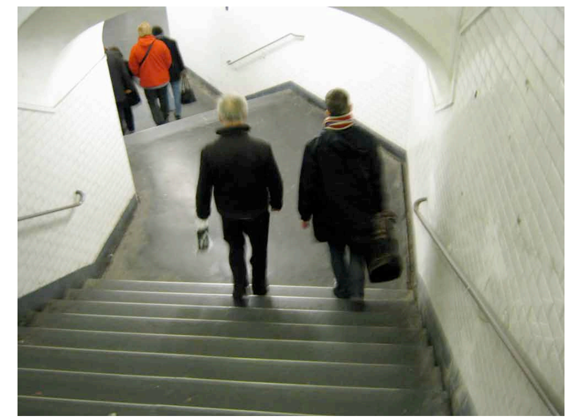

ARRIVAL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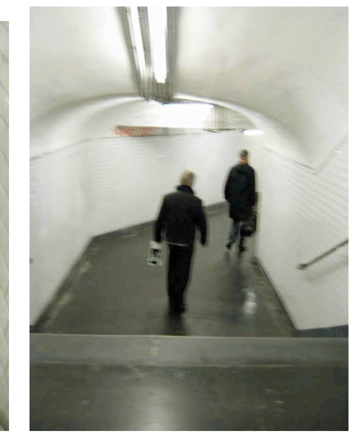
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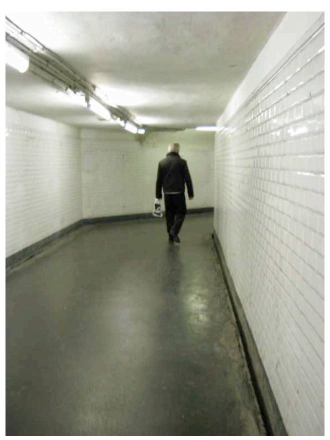
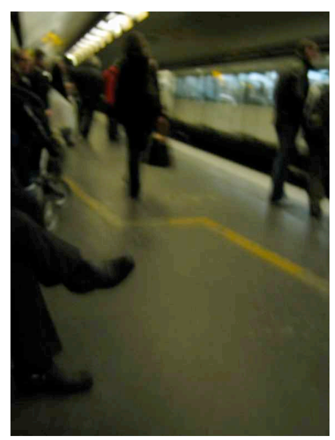

TRANSITION


DESTINATION



Event Sequence - Bastile - Paris, France

Summary of Conclusions (Part 2):

The Events.......

Approach

Identification

Arrival

Transition

Destination

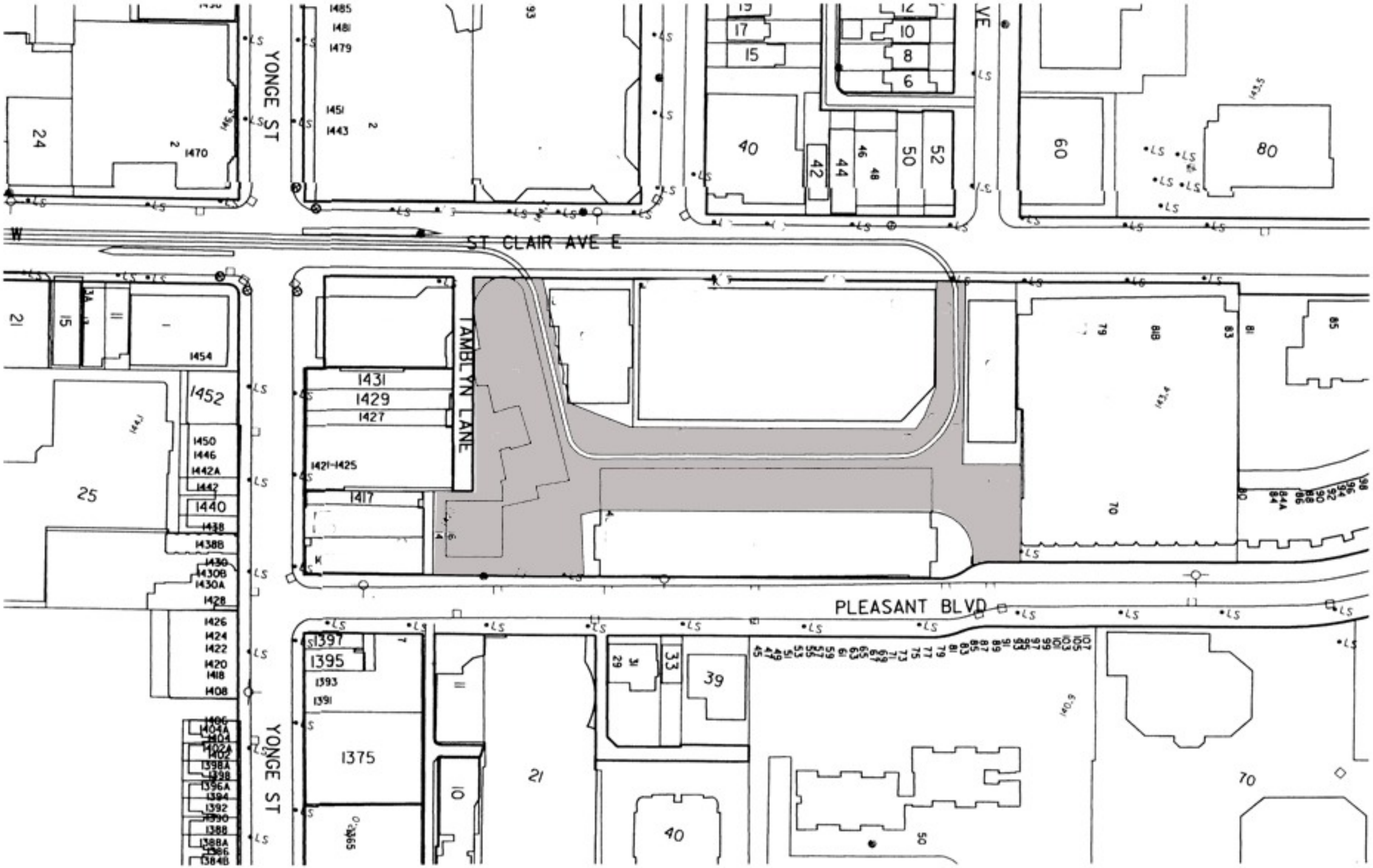
Design Guideline Structure

ELEMENTS	PROGRAM SPACE	EVENTS
Form	Public Hall	Approach
Place	Waiting/Ticketing	Identification
Light	Corridor/Elevator/Stair-Escalator	Arrival
Security	Platform	Transition
		Destination

My next step was to illustrate how the Elements and Events come together architecturally to inform the design guidelines.

Due to the variety of site conditions, a single approach/solution is not possible. The illustration shown here is to be used as a reference point for the application of the guideline.

Architectural Illustration - Site Selection



Architectural Illustration - Site Selection:

Yonge Street. & St. Clair Avenue

- 35,000 subway commuters/day

- Connects to two streets, St. Clair to the north & Pleasant Avenue to the south

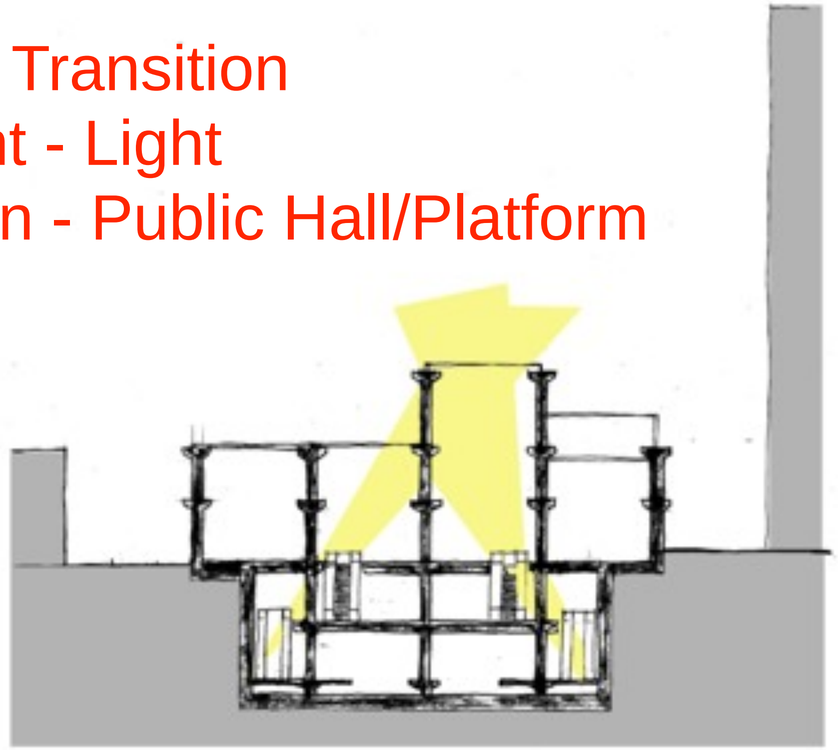
- Multiple modes of transit use; subway, bus, & streetcar

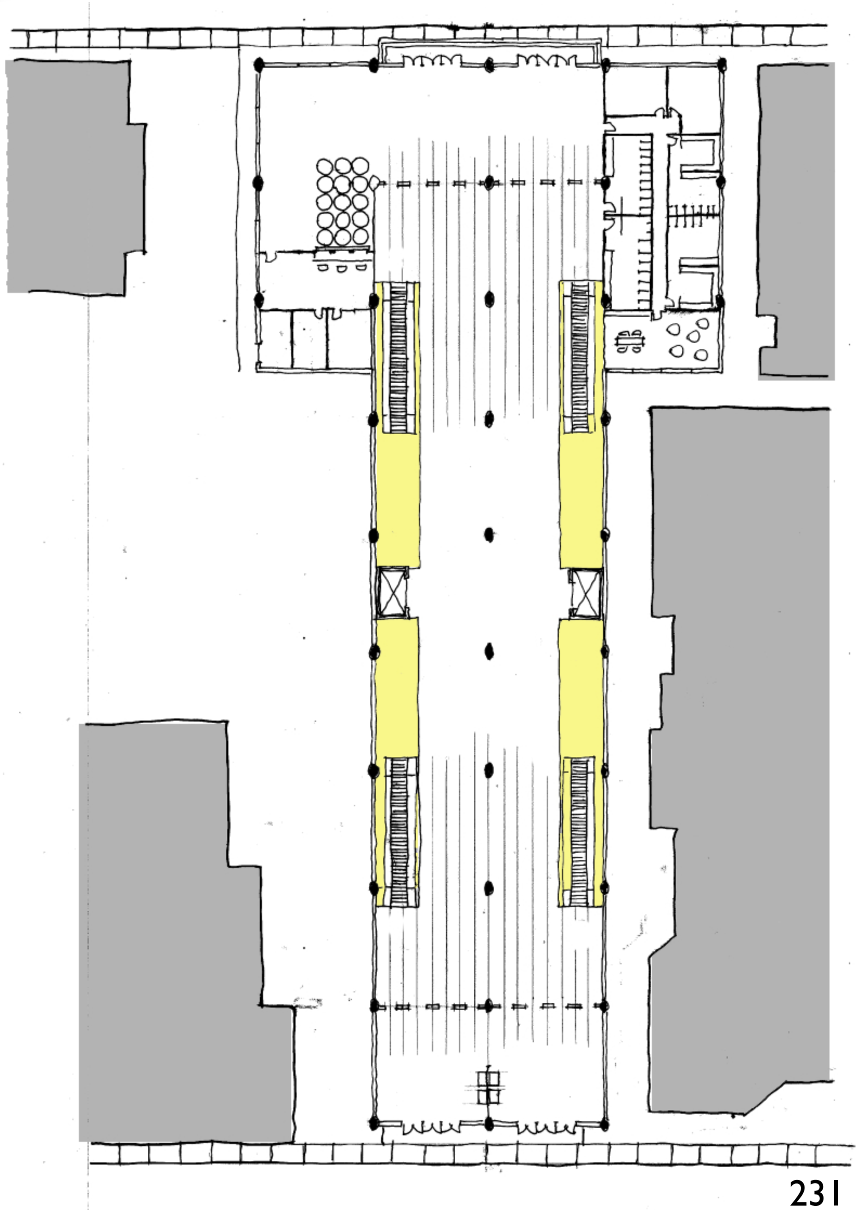
Architectural Illustration:

Event - Transition
Element - Light
Location - Public Hall/Platform

Two design scenario's were used to develop and illustrate the guidelines related to the four (4) Elements.

An inner and outer stair circulation plan.



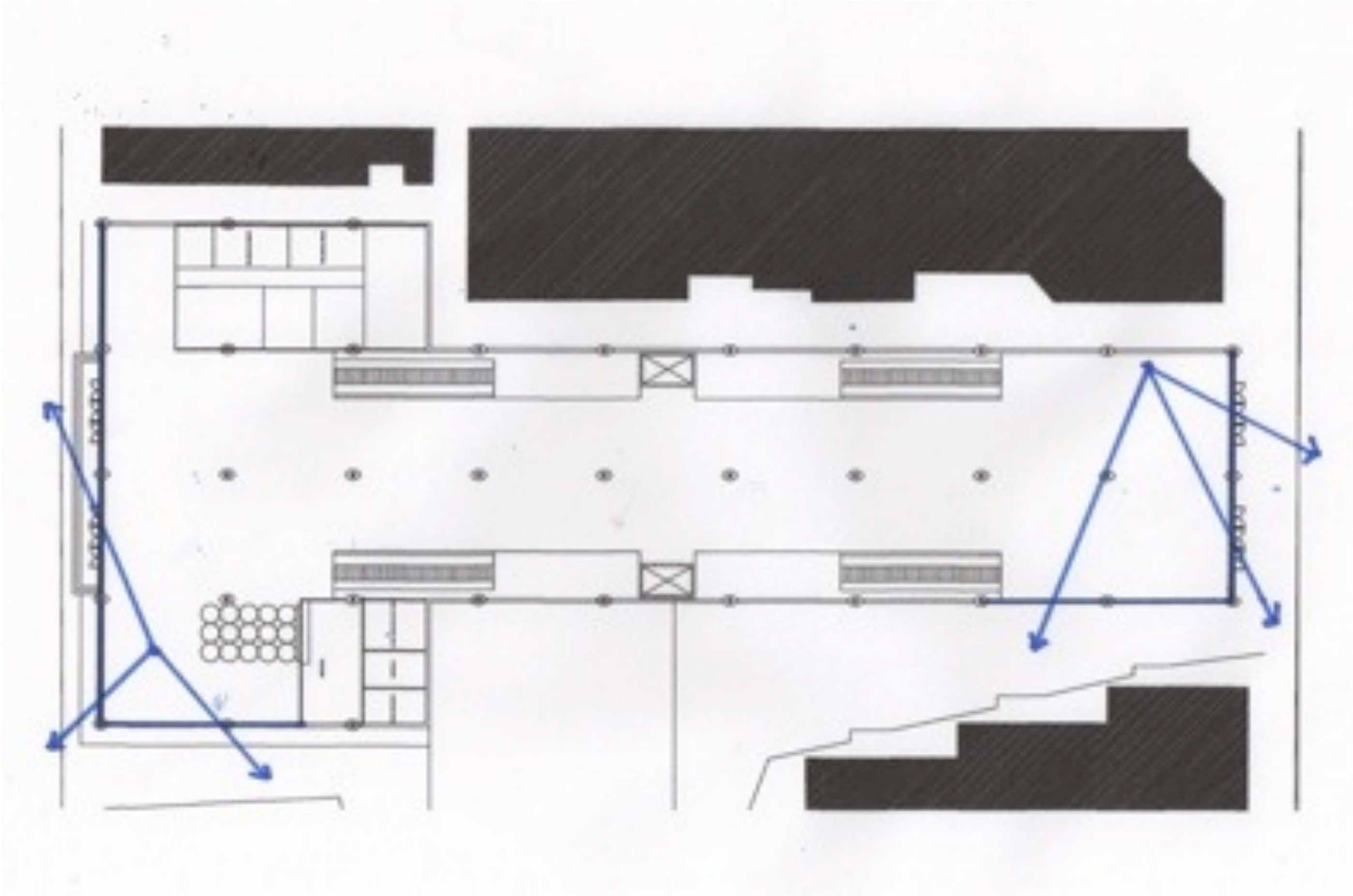


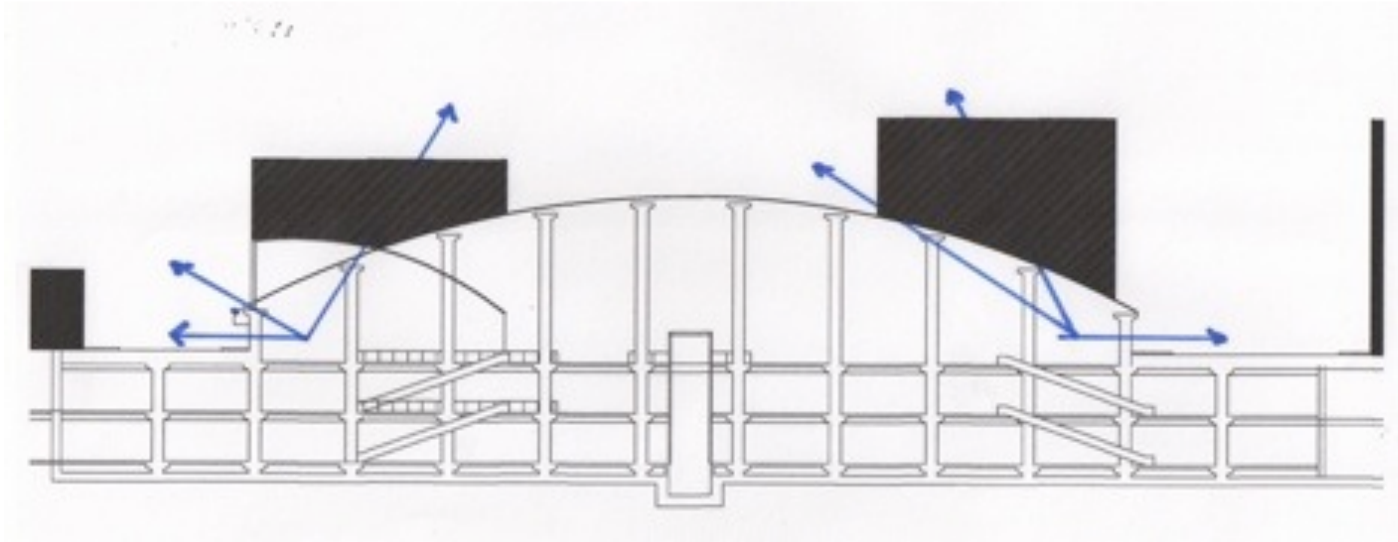
Architectural Illustration:

Event - Arrival
Element - Form/Place
Location - Ticketing

For example:

Looking at the Event of Arrival as it relates to Form and Place in the Ticketing Area





Design Guideline Structure

ELEMENTS

Form

Place

Light

Security

PROGRAM SPACE

Public Hall

Waiting/Ticketing

Corridor/Elevator/Stair-Escalator

Platform

EVENTS

Approach

Identification

Arrival

Transition

Destination

Design Guideline Structure & the table of contents

Each of the five (5) sections (Events) in the design guideline is comprised of three (3) parts:

- Introduction

- Design Objective

- Design Guideline

Event = Approach
Introduction & Design Objective

1.0 A P P R O A C H

Photo - TTC - Bayview and Sheppard -
Example of poor approach design to form

Photo - TTC - Yonge and St. Clair -
Example of poor identification Form

C - DESIGN GUIDELINE - APPROACH - IDENTIFICATION

1.0 EVENT - APPROACH

1.1 introduction

Approach is the event experienced by the commuter as he or she is identifies the overall building. The first of the five (5) main elements that require attention when designing subway transit facilities is the building form. There are many architectural methods to achieve a dominant and recognizable building form that will act as a beacon to remember and ensure identification with the subway station.

Subway transit facilities reside in many locations throughout the city such as dense urban locations (Toronto - Yonge Street & St. Clair Avenue) and suburban locations (Toronto - Sheppard & Bayview). The building form selected must address the many conditions that occur within a city while ensuring buildings of the highest architectural quality.

Subway stations in Toronto, Ontario had an average passenger use of 950,000 rides per day in 2010. This high level of activity and use within our city demands buildings that strive for the highest architectural design and quality. In addition, these buildings are necessary for the movement and business within the cities daily life so they must also be pedestrian friendly and work well within the existing street scape and site to which they belong.

1.2 Design Objective

- Subway stations should act as a beacon, and have a dominant form from one station to the next in order to become an identifiable building form over time.
- Massing should enhance glazed openings, large areas of similar materials, etc.
- Establish the buildings importance as pubic spaces and have a significant presence along the main street elevation. The use of the facility should be clear and identifiable as a public transit facility.
- Canopies and signage should be integrated

Design Guideline Example No. 1

Event = Approach
Element - Form & Place
Location - Urban - Building Scenario

1.0 A P P R O A C H

Photo - Jubilee Line - Canary Wharf -
Example of good identification Form

Photo - Jubilee Line - Canary Wharf -
Example of good identification Form

Rendering - Yonge & St. Clair -
Design illustration of good identification Form

1.3 DESIGN GUIDELINE

EVENT = APPROACH
ELEMENT - FORM & PLACE
LOCATION - URBAN - BUILDING SCENARIO

Design Guideline - Main Entrances

- Provide an identifiable entry location within the street landscape to which the subway station entrance is located
- Where Possible, set back the entry 6-8m from the street edge to accommodate queuing
- Provide an overhang over the entry extending out to the sidewalk or street edge as possible to establish a strong pedestrian scale
- Utilize transparent materials for enclosure
- Set back from sidewalk to ensure queuing space is adequate for location
- Where stairs are required, they should be recessed under a recessed canopy

Design Guideline - Overall Massing - Roofs - etc.

- Overall form should be bold and inspiring, unique to the site requirements and respond to the building program
- Provide a form that increases in volume from the main entrance to the centre of the facility
- Utilize a high amount of transparent materials for enclosure to allow natural light to access all public areas within the facility
- Architectural details should be consistent on all elevations to reinforce the dominant building form selected by the designer

Architectural Illustration - Example

The model used as an architectural illustration to demonstrate design the criteria while traveling on the subway introduces the use of a dominant form. This illustration uses the arch as an example of how to achieve identification within the architectural form.

- The dominant form has been selected as the arch
- Scale at the street level is pedestrian friendly
- Transparent materials used throughout the entrance

Design Guideline Example No. 2

Event = Approach
Element - Form & Place
Location - Street Portal

1.0 A P P R O A C H

Photo - London Tube Portal

Photo - Paris Metro Portal

Photo - Barcelona Portal

Photo - Chicago Metro Portal

1.4 DESIGN GUIDELINE

EVENT = APPROACH
ELEMENT - FORM & PLACE
LOCATION - STREET PORTAL

1.5 Design Objective

- Subway stations should act as a beacon, and have a dominant form from one station to the next in order to become an identifiable building form over time.
- Provide protection from the elements
- Avoid interference with sidewalk circulation

Design guideline - Street Portal Entrances

- Provide an identifiable entry form within the street landscape to which the subway station entrance is located
- Provide a scale that is not greater than 6m above grade at entry
- Utilize transparent materials and non-staining materials for enclosure
- Incorporate the subway station name and branding where possible
- Lighting to be incorporated within the overall design of the portal and when illuminated enhance the overall form of the portal
- Maintain 6m clearance from inside edge of portal and building face where possible
- Align street edge of portal along curb with no more than 12” clearance from road where possible
- No doors to be provided at the street entry to the portal where climate conditions permit to allow free entry and egress during high volume use

Design Guideline - Overall Massing - Roofs - etc.

- Provide a recognizable form that decreases in volume as the commuter descends below grade
- Design theme or type to be consistent with the identifiable form selected for the main subway station
- Ensure no spaces for loitering on or around the enclosure are available.
- Scale of the portal to be consistent with adjacent architecture and work with overall massing of the neighborhood

Event = Identification
Introduction & Design Objective

2.0 I D E N T I F I C A T I O N

Photo - TTC - Bloor & Lansdowne Station
Example of poor design form - Identification

Photo - TTC - Bloor & Islington Station
Example of poor design form - Identification

C - DESIGN GUIDELINE - IDENTIFICATION

2.0 EVENT - IDENTIFICATION

2.1 Introduction

Identification is the event experienced by the commuter as he or she arrives at the entry point to the building. These spaces are located on the exterior of the building and can include spaces such as the main and secondary entry access points to the building, the passenger drop off and pick up points, etc.

2.2 Design Objective

These space must be clearly identifiable to the commuter upon approach. That is, the commuter needs to understand where they are within the facility. Are they at the main entry or he secondary entry? Is this a drop off entry for automobiles, or are you at the taxi stand? Defining spaces on the exterior of the building within the using massing, scale, lighting, and use of materials to defined the hierarchy will measure the success of the design.

- Similar to the approach, subway stations should act as a beacon, and have a dominant form from one station to the next in order to become an identifiable building form over time.
- Massing should enhance glazed openings, large areas of similar materials, etc.
- Establish the buildings significance as pubic spaces and have a significant presence along the main street elevation. The use of the facility should be clear and identifiable as a public transit facility
- The scale of the element (entry, drop off, etc.) will reinforce its place in the overall building program, i.e main entry will have a more significant scale that a secondary entry

Design Guideline Example No. 3

Event = Identification
Element - Form & Place
Location - Exterior Building Entry

Photo - Canada Line, Vancouver, B.C

Photo - Main Entry - Rail Geelong, Melbourne, Australia

2.3 DESIGN GUIDELINE - PRIMARY BUILDING ENTRANCE

EVENT = IDENTIFICATION
ELEMENT - FORM & PLACE
LOCATION - EXTERIOR BUILDING ENTRY

Design guideline

- Provide an identifiable entry form within the street landscape to which the subway station entrance is located
- Provide a scale that is not greater than 6m above grade at entry
- Material and colour selection should be robust and highlight entry within overall massing
- Overall massing will highlight entry within as the primary location to enter the building
- Lighting to emphasize the dominant form and highlight the entry
- Provide a roof overhang as protection (min. 2 meters deep) from the elements
- Set back from street edge by a minimum of 4 meters to accommodate queuing during peak traffic periods
- Provide adjacent seating with covered protection for waiting
- Integrate bicycle storage rack within overall massing and design of entry
- Integrate all trash and recycling requirements within overall massing and design of entry
- Entry doors leafs to be a minimum 1.2m (4'-0") wide
- Entry turnstiles should not be used
- Entry vestibules should not be used

The design guideline includes a number of additional examples of Identification:

- Taxi Stand
- Secondary Entry
- Bus Pick Up Area

Event = Arrival
Introduction & Design Objective

Photo -TTC - Waiting - Poor example of Arrival

Photo -TTC - Poor example of Arrival

C - DESIGN GUIDELINE - ARRIVAL

3.0 EVENT - ARRIVAL

The third of the five main elements is Arrival. The point in the commuter travel experience where one feels they have arrived at either the final point or one of main points along their travel route. The main design components of the Arrival event are the waiting areas and ticketing.

3.1 Introduction

Waiting areas are to be distributed throughout the facility. These areas are to be provided for the comfort of commuters during there time awaiting transfers between modes of transportation such as bus, taxi, subway. Waiting areas are to be to located within the public hall and platform spaces within the facility. Waiting areas should not impede commuter circulation and provide minimum clearance between the seating and the opposite wall or edge.

These important public spaces must go beyond utilitarian functionality and represent the form and function of a significant public institution.

3.2 Design Objective

- Provide a clear view of the building form from the arrival area
- Provide adequate space to accommodate daily passenger volume of 7200 passengers using the personal No Touch Zone of 56” (1400mm) x 46” (1350mm) or 1.61 m2.
- Provide a large interior space that increases in volume as you travel closer to the centre of the building

Design Guideline Example No. 4

Event = Arrival
Element - Form & Place
Location - Exterior Building Entry

3.0 A R R I V A L

Image - Waiting Area - Good example of Arrival space

Image - Waiting Area - Good example of Arrival space

3.3 Design Guideline - Form - Waiting Area(s)

EVENT = ARRIVAL
ELEMENT - FORM
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

Design Guideline

- Provide an interior space that has a lower scale than that of the public hall
- Locate adjacent to the public hall
- Allow adequate space for queuing at ticketing spaces
- Provide adequate seating with clearance in front with a minimum of 4.0 m (13’-2”) from Ticketing line up or public circulation within the Public Hall
- Minimum interior clear height at 4.5m (15’-0”)
- Locate with direct views to the exterior
- Direct view to main entry/exit of to facility
- Locate throughout the main public hall, adjacent to escalator and stair openings where possible
- Provide views to video monitors

The design guideline includes a number of additional examples of Arrival:

- Public Hall
- Concourse
- Ticketing
- Waiting
- Cafe/Retail

Event = Transition
Introduction & Design Objective

4.0 T R A N S I T I O N

Photo - TTC - Corridor - Kennedy Station - Example of poor use of form for Transition

Photo - Paris Metro - Stair - Example of poor use of form for Transition

4.0 EVENT - TRANSITION

4.1 Introduction

For the purpose of this study, transition spaces within transit facilities include public halls, corridors, stairs, elevators and escalators. We spend most of our travel commute time within transit facilities within transition spaces in order to get from the exterior of the building (Arrival), to travel to the platform (Destination).

The design of transition spaces should consider the four (4) main issues; form, place, light, and security. In addition to these issues, passenger volume must be considered as it relates to a typical pedestrian walking speed.

That is, what volume of commuter can make its way through a space, given the daily typical passenger volume during peak periods during.Transition spaces are where we spend the majority of our time when travelling to and from our destination within public transit facilities. Therefore, transition spaces require the highest level of architectural quality and are to be representative of the overall building design and idea.

The dominant building form should be clearly seen from all areas in the public hall and the lower concourse level. Each site will have specific spatial requirements that is determined by the program and peak commuter volumes, so variations will occur from site to site. In addition, these spaces are required to be designed and influenced by the characteristics of the commuter, and the needs for comfort and movement as they pass through facilities.

Examples of poor transit transition spaces are shown here to make the point that transition spaces are more than a conduit to transfer commuters from one point to another. Transition spaces provide the opportunity to communicate a message about the city they belong through the architectural form.

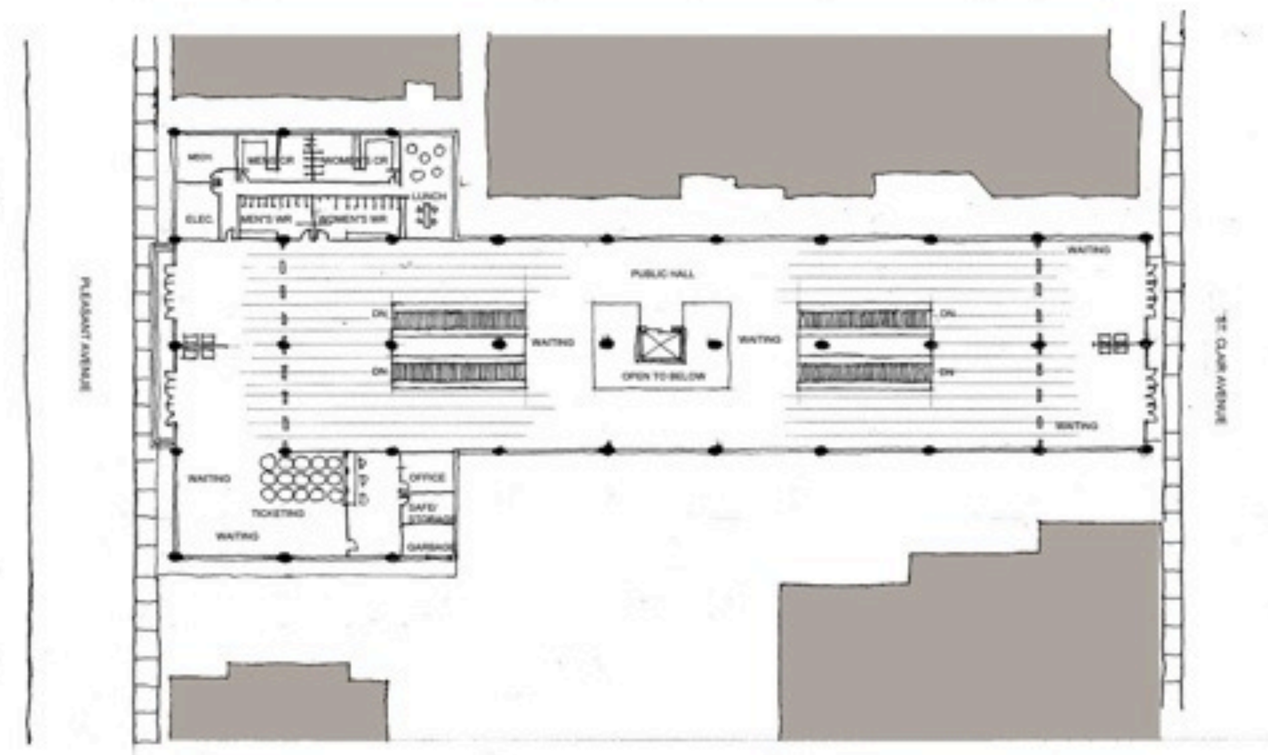
Design Guideline Example No. 5

Event = Transition

Element - Light and Security

Location - Public Hall and Concourse

Rendering - Public Hall at Yonge & St. Clair Station - Design illustration for Light & Security - Transition



PLAN - STREET LEVEL

Drawing- Public Hall at Yonge & St. Clair Station - Design illustration for Light & Security

4.5.1 Design Objective - Form - Light - Security - Elevator

The majority of elevators use is by commuters that require assistance with their mobility such as the elderly, or physically handicapped as well as parents with strollers or travelling with large packages.

Elevators must be able large enough to accommodate the passenger as well as the packages or device they are using for mobility such as a wheelchair. The elevator must not impede the circulation path on the level to which it is placed. This is a significant design challenge when locating within a facility at the platform level.

EVENT = TRANSITION
ELEMENT - LIGHT AND SECURITY
LOCATION - PUBLIC HALL, CONCOURSE, AND PLATFORM

Design Guideline

- Provide glass on all four sides of elevator cab where possible
- Glass ceiling where possible to provide light well to lower levels
- Reflective materials to be used on all surfaces where possible
- Minimum size 7’-6” x 6’-6”’
- Visible upon entry to the transit facility
- Double sided doors for ease of access
- Minimum clearance between elevator and adjacent wall or obstruction is 3m
- Provide adequate space for queuing without compromising circulation on public hall, concourse, or platform levels
- Centrally located within the transit facility
- Views within the facility and to the exterior where possible

The design guideline includes a number of additional examples of Transition:

- Stairs and escalators
- Corridors
- Elevators

Event = Destination
Introduction & Design Objective

5.0 Design Guideline - Form - Subway Platform

5.1 Introduction

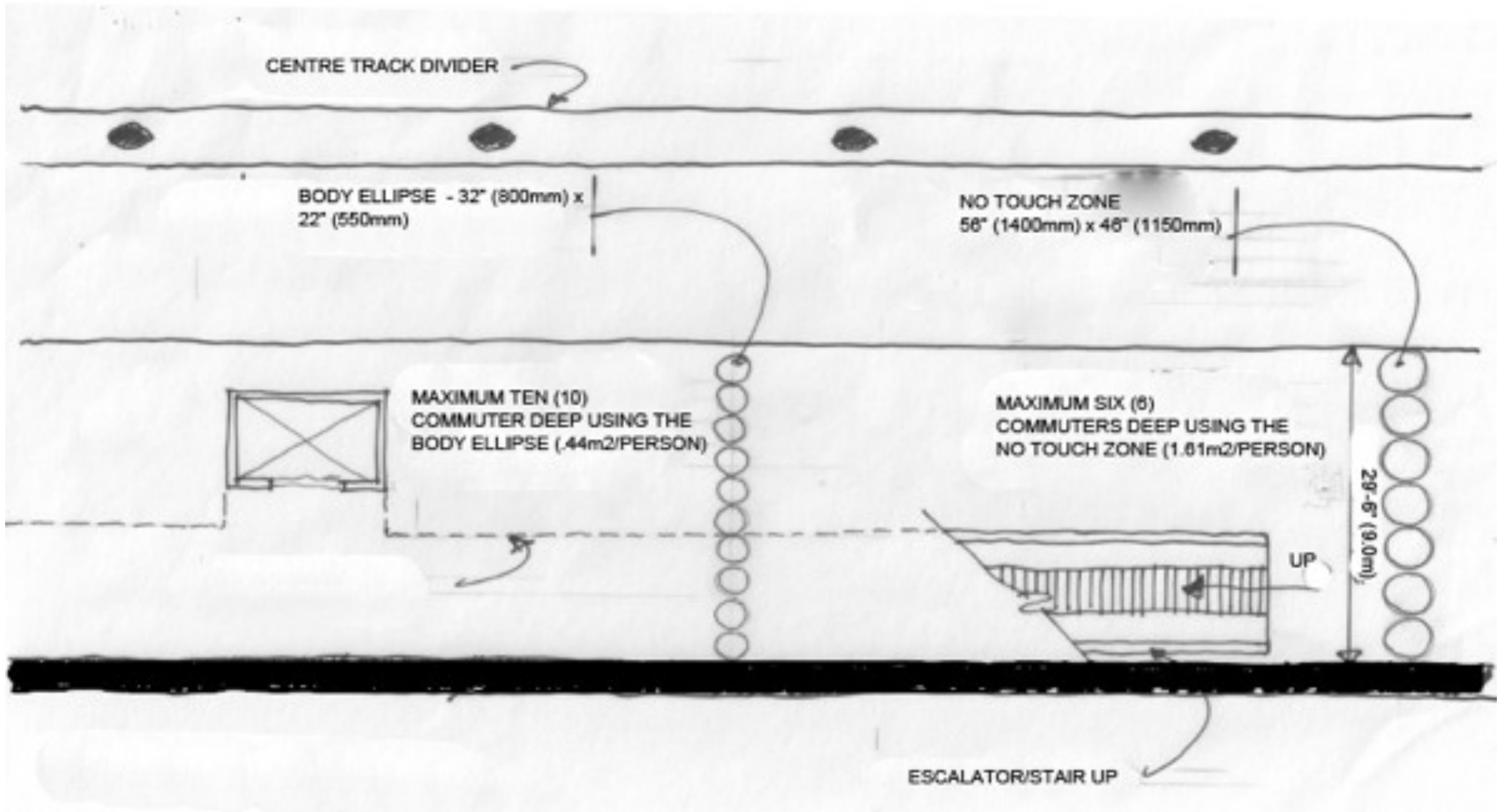
The subway platform design criteria is based upon a number of fixed elements required to serve the service requirements such as the capacity of each subway car, number of cars in a link, etc.

Each subway car has a maximum rated capacity of 180 passengers. A maximum chain of subway cars is six (6).

180 x 6 = 1080 passengers per subway (maximum)

Each train is 22.86 m in length, therefore using six (6) subway cars in tandem requires a minimum platform length of 137 m.

For the purposes of this study and demonstration, I have applied a platform length of 150 meters in length and 9.0 meters in depth.



Single Loaded Platform Criteria

No touch Zone - Tanfield Capacity - 56" (1400mm) x 46" (1150mm) = 1.61 m2/person

Area of Each Platform = 150- m x 9 m = 1350 m2
Maximum platform capacity = 1350 m2 /1.61 m2/ person = 830 passengers

Body Ellipse - Tanfield Capacity - 32" (800mm) x 22" (550mm) = .44m2/person

Area of Each Platform = 150- m x 6.5 m = 1350 m2
Maximum platform capacity = 1350 m2 /.44 m2/ person = 3060 passengers

Drawing - Partial Plan - Single Loaded Platform - Design illustration for Destination

Design Guideline Example No. 6

Event = Destination

Element - Form

Location - Platform

Photo - London Tube - Jubilee Line - Good example of Single Loaded Platform - Form - Destination

Photo - Bilbao Metro - Barakaldo Station - Good example of Platform Form - Destination

5.2 Design Objective - Form - Subway Platform

The column grid used for the example site was based upon a module of 10m. The structure is designed as a concrete, and utilizes offset columns at 5m to provide a column free platform level.

Offsetting the columns on the platform level allow for deep uninterrupted platform spaces,with ample space for commuters. The offset columns also provide the main structural support at the platform level. Using arched buttress, at a 10m spacing, also provide rhythm to the long platform interior spaces

Lastly, the ceiling height at the concourse level and platform level is established as a minimum of 5.2 m. This provides 900 mm for HVAC, lighting, and horizontal service requirements as well an additional 200mm for the structure.

EVENT = DESTINATION
ELEMENT - FORM
LOCATION - PLATFORM

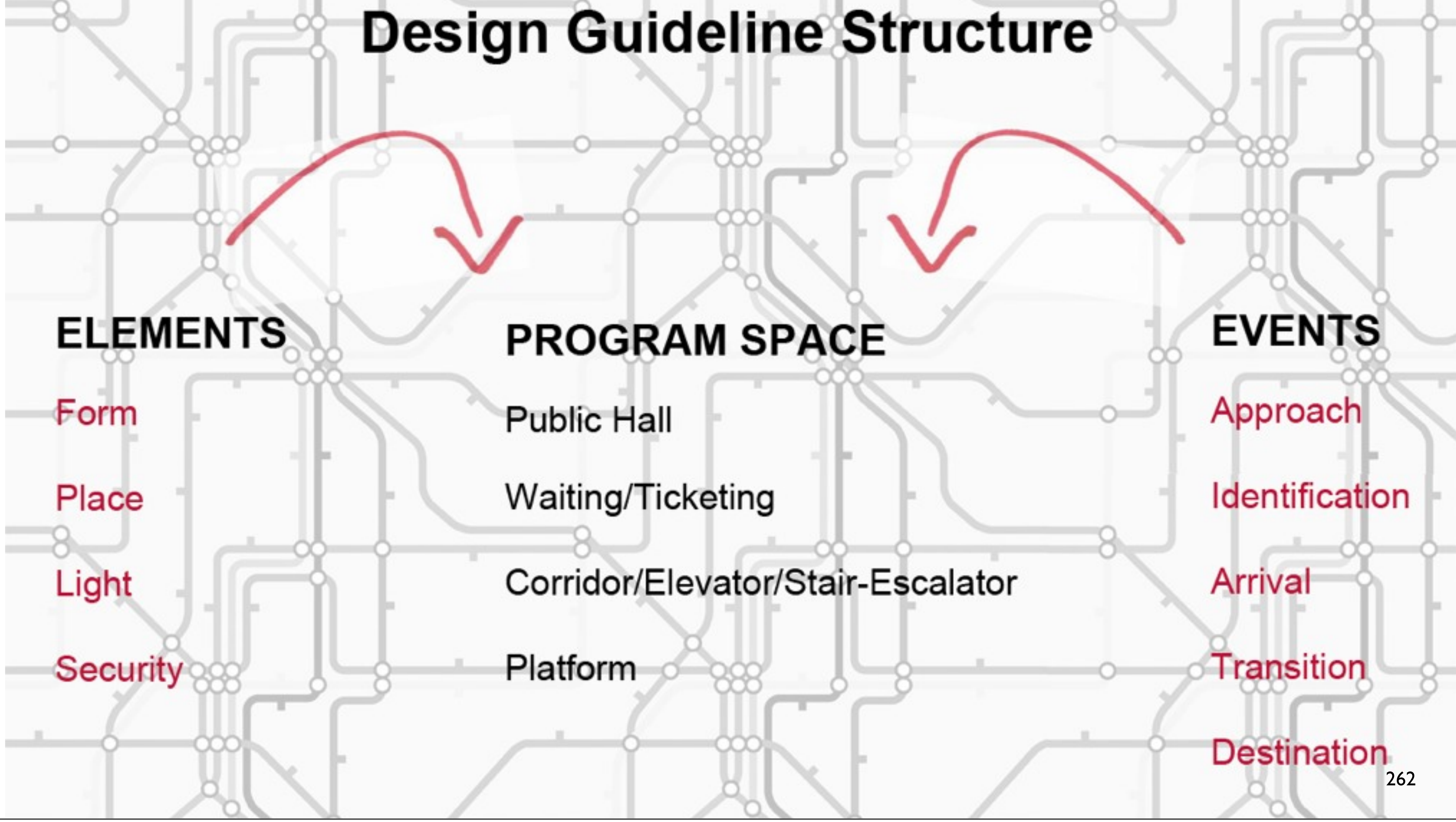
5.3 Design Guideline

- Platform depth to be a minimum of 6.5m at Stair/Escalator
- Platform depth to be a minimum 9m without stair/escalator
- Minimum clear interior height to be 4m
- Structural design of tunnel to be reflected in design of platform volume
- Provide wall niches at regular intervals along length of platform creating wall niche spaces
- Form of platform volume to incorporate dominant form of overall facility design
- Seating to be wall hung and designed to provide temporary rest for commuters
- Seating to be incorporated within wall niche space at regular intervals along the entire length of platform
- Incorporate waste receptacles, etc. within wall niche spaces along platform

The design guideline includes an additional example of Destination:

- Designated Waiting Area

In closing, the design guideline structure is based upon the Elements and Events to inform the architectural space than makes up subway transit facilities.



The End