

ABSTRACT

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This thesis intends to rethink the role of Metro stations in the Washington Metropolitan Area. It considers Metro stations as more than infrastructure, but with potential to serve as neighborhood centers and vital physical elements in the city. It anticipates an organic relationship between the station and the neighborhood and explores the opportunity to animate the program of the stations by reexamining the relationships between Metro stations and their urban / suburban, socio-cultural, economic and physical contexts.

Design strategies are developed and tested in two neighborhoods: Farragut North and Silver Spring. Precedents of railway stations design are analyzed and compared to existing Metro stations as part of the research. This research supports the exploration of programming and design of the two Metro stations.

The goal of the thesis is to create more dynamic and contextually integrated architecture of Metro stations for the national capital, and thus to strengthen the urban centers as well as enhance the image of the neighborhoods in the Washington Metropolitan Area.

RETHINK DC METRO STATIONS

By

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Thesis submitted to the Faculty of the Graduate School of the
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2009

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Dedication

To those who love cities.

Acknowledgements

I want to thank my committee, especially Michael Ambrose as my chair, for the encouragement, contributions and advice that make this thesis possible.

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Chapter 1: Metro in the City

Network of Urban Nodes

The first metro system of the world, London Underground, was opened in 1863. It was built in order to solve the congestion problem of streets with pedestrian, horsemen and horse-drawn vehicles. It was also used as regeneration tool for the suburban slums by linking the redevelopment sites with the employment districts. Since then, hundreds and hundreds miles of underground railway have been built all around the world. Today, there are more than 150 subway systems worldwide with over 5000 miles of track length. This infrastructural network connects different neighborhoods in the urbanized areas and increases the mobility of urban living.

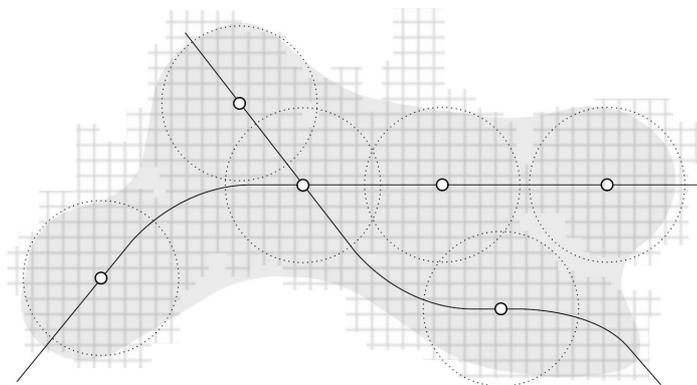


Fig 1.1 Network of Urban Nodes

In many large cities, metro stations are the hubs between this highly mobile layer and the ground surface of the city. They are points of concentration of various events as thousands of people access the stations daily. They are urban nodes, neighborhood centers, which have significant contribution to the image of the city. A main theme for this thesis is to explore how the design of metro stations in Washington Metropolitan Area can be informed by dynamic nature of the urban context.

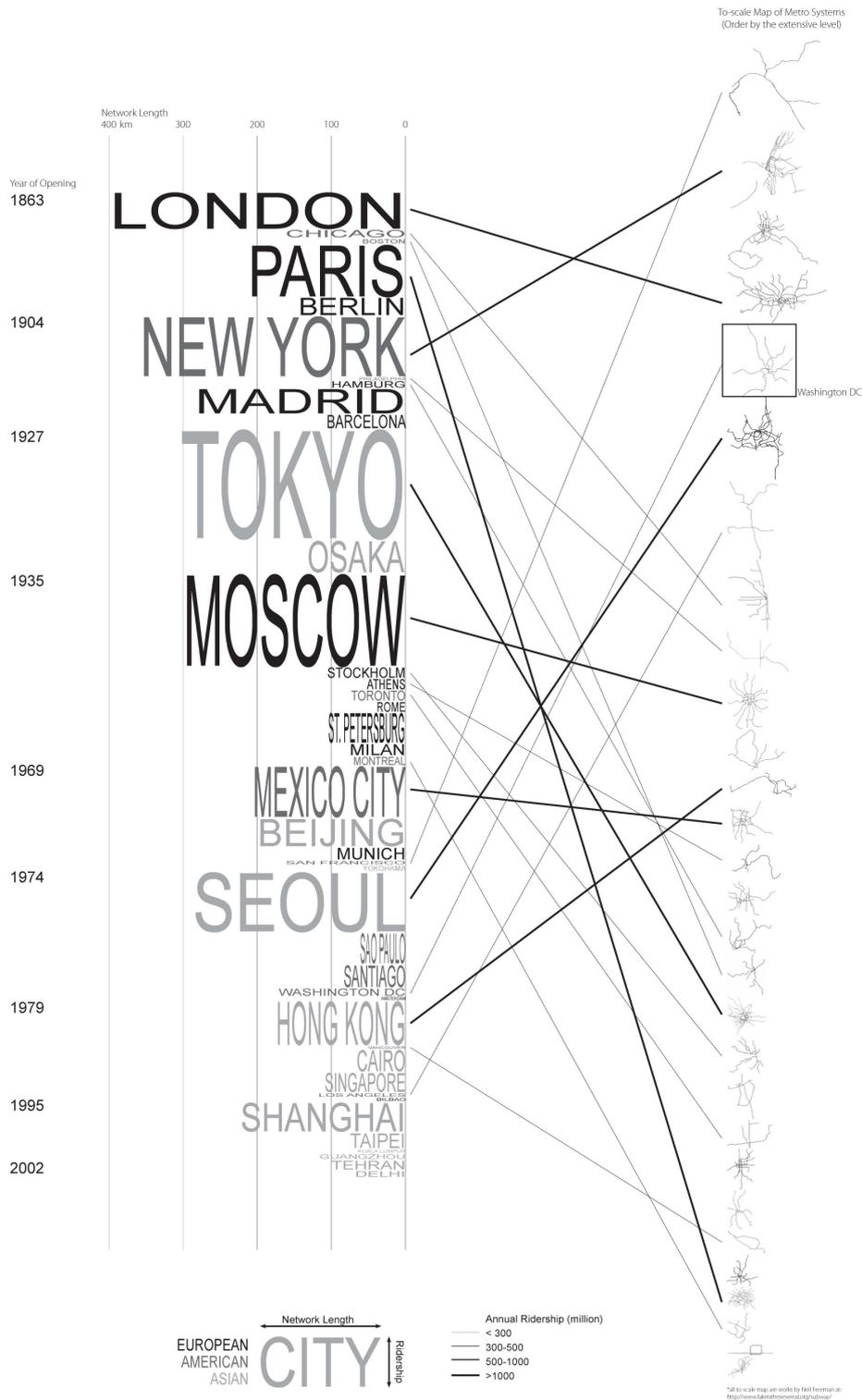


Fig 1.2 Comparison of the age, network length, annual ridership and the extent of major metro systems in the world

The above diagram compares major Metro systems in the world. It shows that Washington DC Metro is relatively young but it is the second largest system in America. It is also more spread out than other major systems in Europe and Asia. The charts below depict the phenomenon that there are fewer intersections in American metro systems when comparing to other systems of the world. It means that US metro systems usually have long lines, connecting the suburbs with the downtowns.

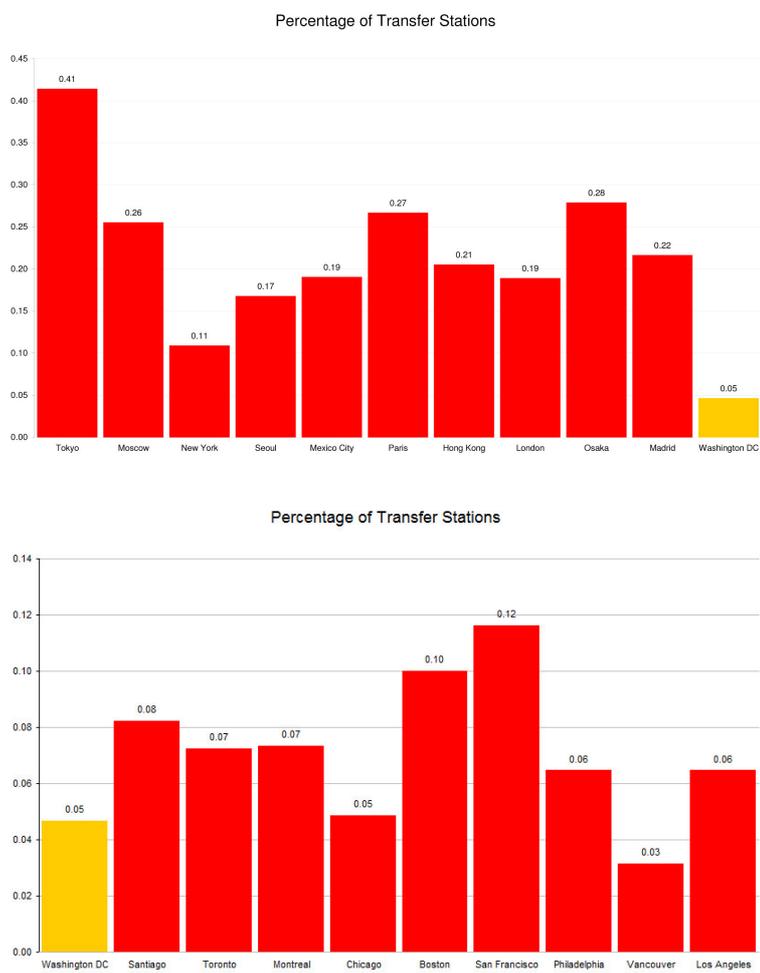


Fig 1.3 Percentage of the number of transfer stations in different metro systems

Metro System in Washington Metropolitan Area

Brief History of the Washington DC Metro System

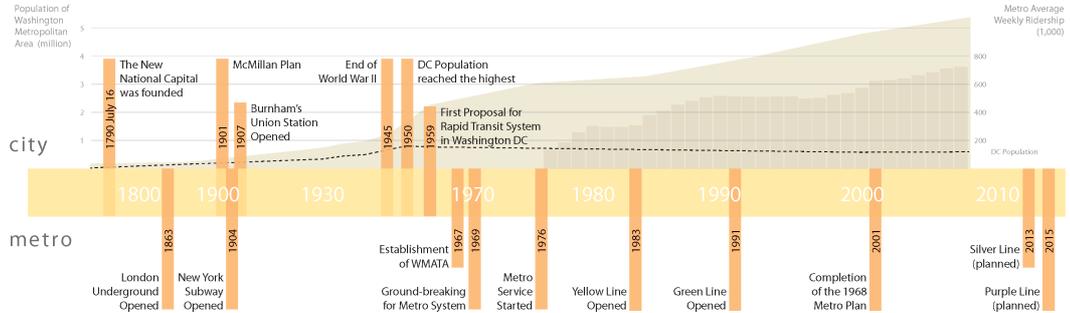


Fig 1.4 Brief History of the Metro System



Fig 1.5 Chronological Development of the Metro System

Opened in 1976, the DC Metro system was developed through decades. From the ground breaking for the system in 1969, it took 32 years to complete the original 98-mile Metro plan in 2001. The average weekday ridership has risen from 134,000 in 1977 to 726,000 in 2007.

Current Challenges

- a. Over-crowded cars and platform in several core stations

At rush hour, overcrowding of Orange line is reaching absurd levels. Passengers may need to wait for another train in order to get in. Boarding and alighting is taking longer and causing delays. Escalators between platforms in some transfer stations become bottlenecked . All these factors lengthen the time to take a metro trip, and thus prompting people to drive.

- b. Lack of intersections between the metro lines

There are 3 transfer stations in the system downtown core to connect all the 5 lines with each other. The capacity of these stations is reaching the saturation level as the ridership grows continuously. The Metro system will need more intersections between metro lines to reduce the pressure on existing transfer stations.

- c. Weak connections between suburban centers

The design of Metro system was intended to connect suburbs with downtown Washington DC. But since more suburbs are now developed into employment centers, the system is found to be ineffective in connecting these suburban neighborhoods. For example, passengers going to Rockville from Silver Spring have to travel through the downtown, which takes 30 minutes longer than driving.

- d. Require capital improvement to meet the demand

Because of the aging and limited infrastructure of the Metro system, WMATA cannot just simply run more trains to solve the overcrowding problem. For instance, traction power system needs to be upgraded in order to support more 8-

cars trains. Addition tunnel crossing the Potomac River is required to support more frequent service and the proposed Silver Line.

System Expansions

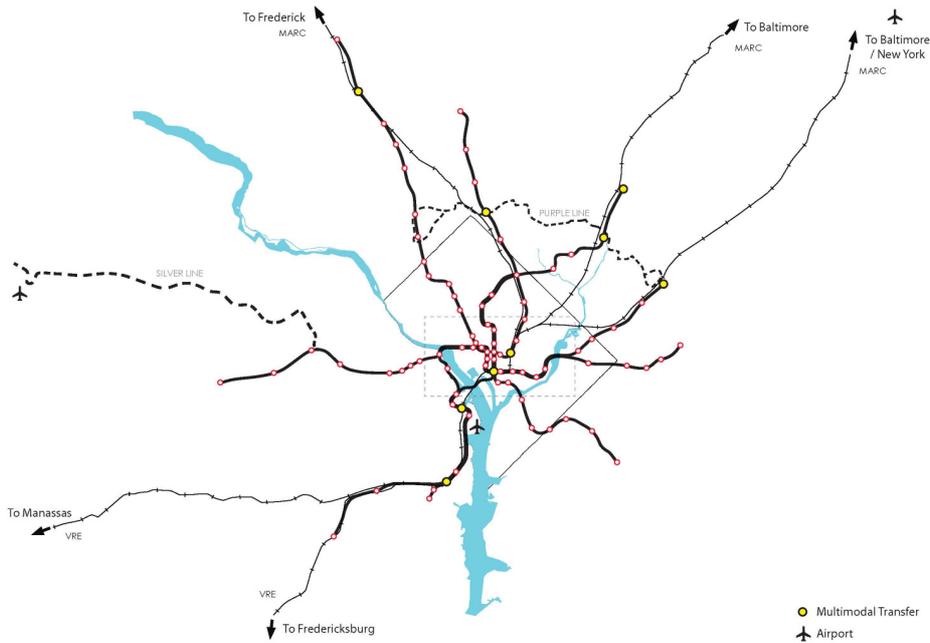


Fig 1.6 Existing System Lines and Planned Expansion

DC Metro system is continuously upgrading in response to the evolving challenges. WMATA presented a 10-year Capital Needs Inventory to address its performance needs. The \$11.3 billion capital improvement plan covers the upgrade of trains, track, traction power switchgear, IT and communication system, and maintenance etc.

Two new lines are also planned to open within 10 years. The construction of the Silver Line, which connects Dulles Airport to the downtown Washington DC, has already started. And the Purple Line, a light rail or bus rapid transit system connecting major suburban town centers at the fringe of the metro system, is going

through the public hearing process after the Draft Environmental Impact Study was released in October 2008.

There are also other planned projects to alleviate the capacity problem, such as rerouting Blue Line in rush hour, pedestrian walkwayway tunnel between Metro Center and Gallery Place, and pedestrian walkwayway tunnel between Farragut North and Farragut West.

Beyond 2030

A separate Blue Line is included in the Metro 2030 plan, in which the Blue Line will separate with Orange Line at Rosslyn station and run to Georgetown through a new tunnel across the Potomac River. It will then run along M Street and Massachusetts Ave corridors to meet with Orange Line again as shown in the map below. (This map represents the author's conjectural interpretation of the future Blue Line alignment.)

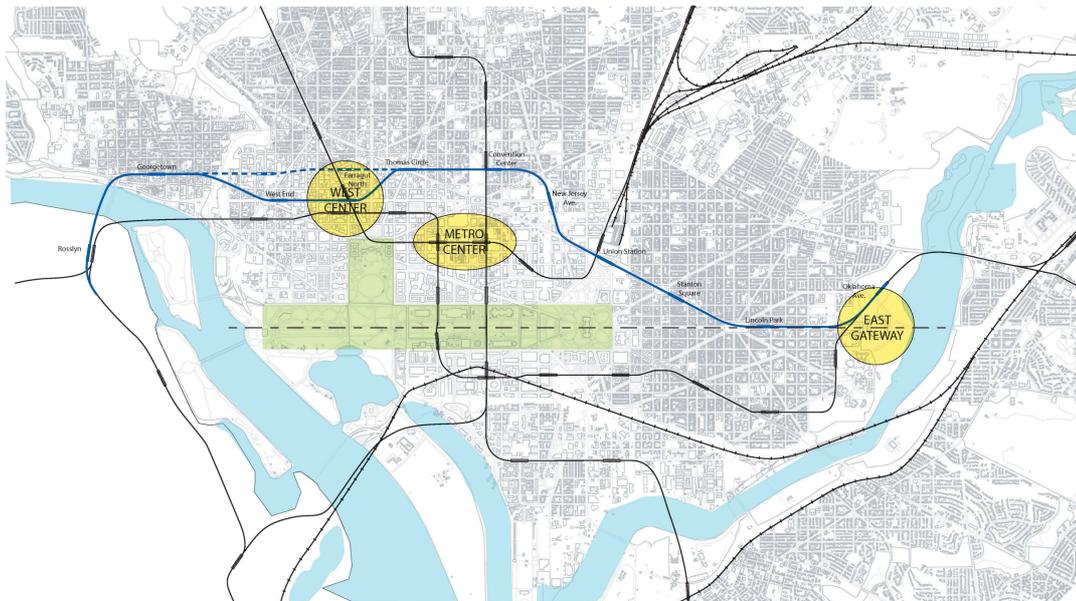


Fig 1.7 Potential Separated Blue Line

Adding a new line through the downtown DC will create tremendous potential for the development of the city. First of all, it can provide more access as the urban core expands northward. It will also further integrate Georgetown to the urban network. In addition, it will create five additional intersections in the metro system, improving the connectivity between metro lines around downtown DC. Furthermore, the new line can stimulate smart growth at the fringe of the city core. And last but not least, it will be an opportunity to consider new architectural expression for this new era of Metro system.

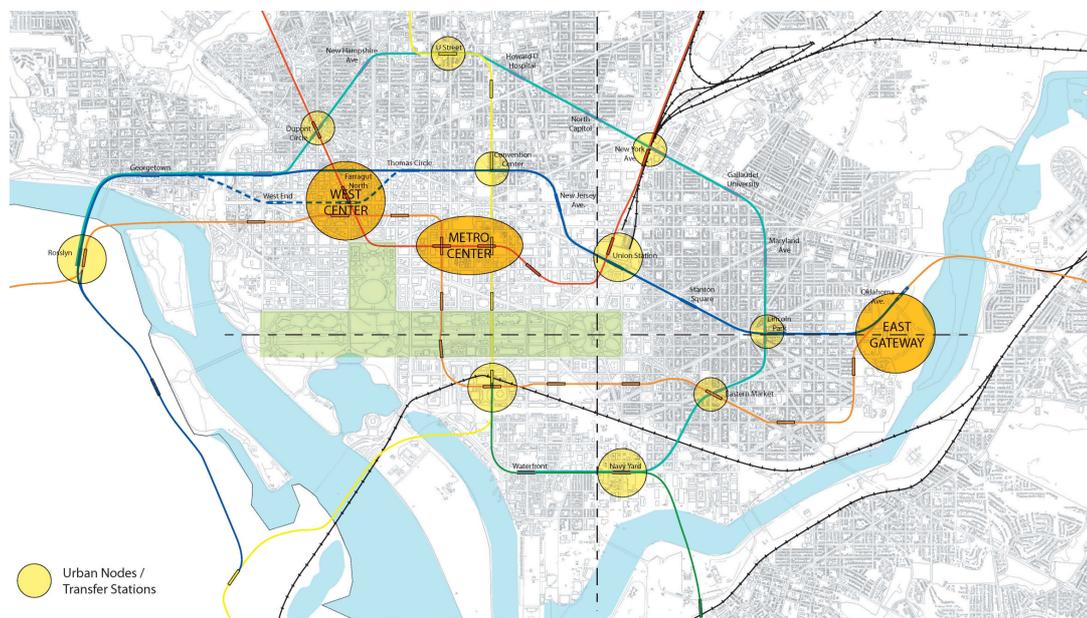


Fig 1.8 Metro 2050 Fantasy Plan

To push the imagination further, the map above speculates an additional line that runs further north from the downtown in 2050. It would operate almost like a ring that runs along the boundary of the L'Enfant Plan, connecting Rosslyn at the West, U Street at the North, Lincoln Park at the East and Navy Yard at the South. By that time the system would cover most of the L'Enfant Plan's area. And the metro service would be so effective that it would be not necessary for a family to own a car. Taking metro

would become part of everyday life. All the neighborhoods that are served by the Metro would become important urban nodes in the city, forming an integrated network of places for urban living. The environment would also be improved even though the density of the city would likely increase.

The Thesis Proposition

In this aspiration of urban living, this thesis tries to answer the following questions:

What should the architecture of Metro stations be in the future?

How can it give identity to the neighborhoods?

How can it be integrated to the urban environment?

It intends to rethink the role of Metro stations, to consider Metro stations as more than infrastructure, but also as neighborhood centers and vital physical elements in the city.

Chapter 2: Existing Stations of DC Metro System

Vault and Canopy

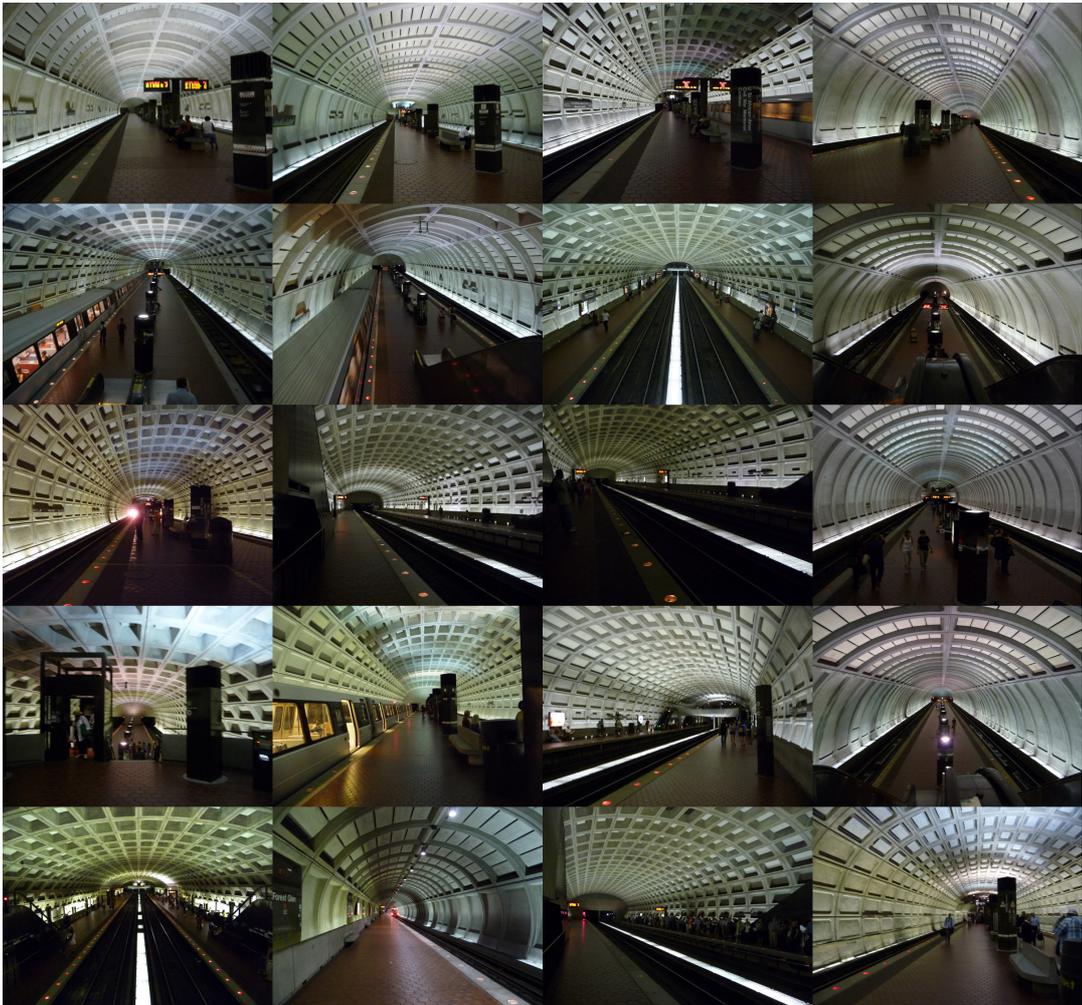


Fig 2.1 Platform View of Existing Underground Stations in Metro System

The Metro station in Washington DC is recognized as the grandest metro system in the United States. The underground stations employed vault design. The reinforced concrete waffle vault, designed by Harry Weese, provides a vast column-less space for the platform and has become a signature of the Metro system.

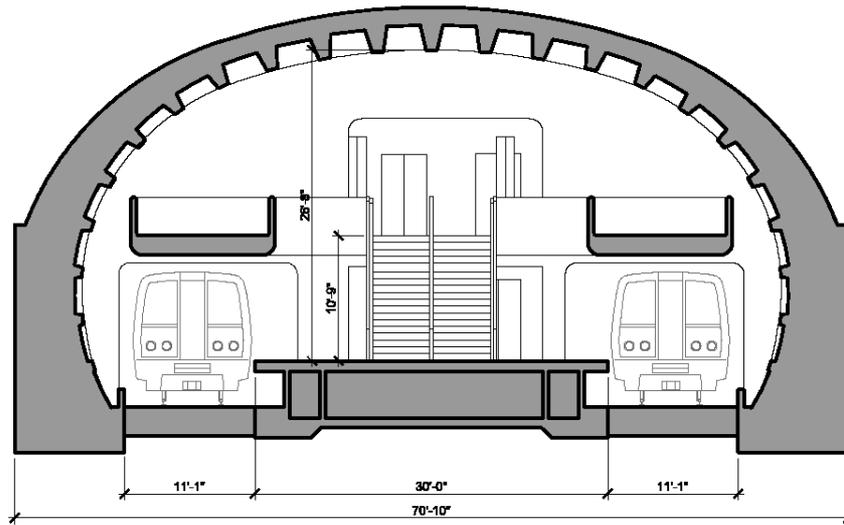


Fig 2.2 Typical Section of the Waffle Vault Station Design

Later stations were built with various vault designs. Concrete panels were used instead of cast-in-place concrete in order to reduce the construction cost. The size of the vaults also varies in different tunnel conditions. But concrete vault is still the general theme throughout the entire Metro system, including the above ground stations.



Fig 2.3 Concrete Vault Canopy in Takoma Park Station

While in few newly built above-ground stations such as New York Avenue and Largo Town Center, steel canopy is employed at the platform. In addition, a competition for entrance canopy design was held in 2001. The winning adaptable design of glass panels on steel frame also give a modern touch to the 32-year-old system.



Fig 2.4 Steel Canopy in New York Avenue Station



Fig 2.5 Entrance Canopy of Clarendon Station

Construction methods

There are several ways to construct an underground station. The simplest and cheapest method is open-cast construction method. It is suitable for stations that are just below ground. This method starts by digging the building trench that is secured by shuttering or bored-pile wall. After the shell structure is complete, the ground will be restored. Most stations in DC Metro system built in that way which are built right under the main street. However, this method has more disturbances to the ground and street-level activities during construction.

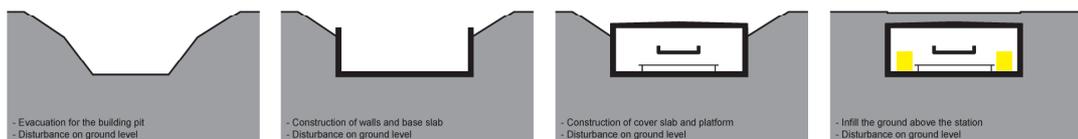


Fig 2.6 Open-Cast Construction Method

Diaphragm Wall and Cover-Slab Construction is employed when the station is a multi-story underground structure. Diaphragm walls are built first and then topped with a cover slab. Then the construction of the multi-stories underground can be done with minimum ground and street disturbance. But this method is rarely used in the existing system.

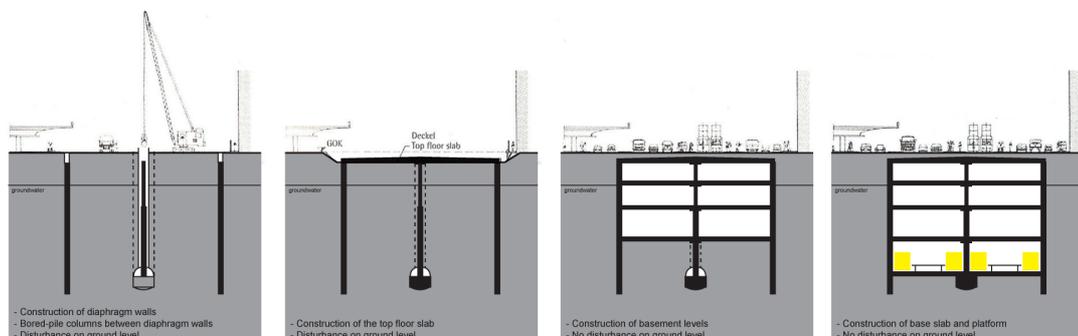


Fig 2.7 Diaphragm Wall / Bored-Pile and Cover-Slab Construction

Mine tunneling construction is used when the station is extremely deep in the ground. This kind of station usually consists of two tunnels with one platform and train track each. Tunnel Boring Machine (TBM) is used to construction the shield tunnel followed by the mining technology to expand the volume of the tunnel to form the station. Several metro stations employed this construction method such as Forrest Glen, which is 196 feet underground.

Universal theme and Locality

A critique to the existing metro station is that they lack locality. Architecturally, the stations employ standard designs that can be categorized as station types with very few exceptions. Stations are identical with the concrete vault theme that passenger may find it difficult to know where they are as they are traveling. The stations also express a modest gesture in the city even though their roles as neighborhood centers become more and more prominent nowadays.



Fig 2.8 Program of Existing Metro Stations

From the program point of view, the existing Metro stations are purely functional. All stations basically share the same program, which is dominated by the transportation use. The station is a space just for people to pass by, but not a place for events.

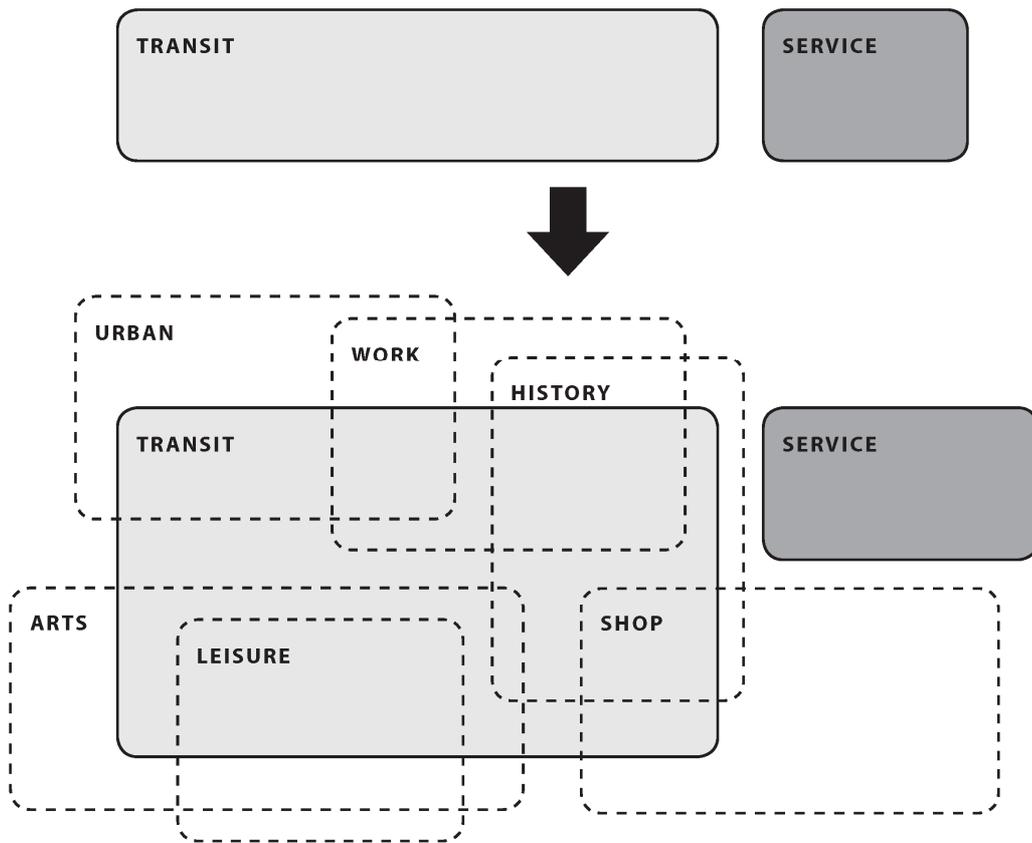


Fig 2.9 Animating the Transit Station with other Programs

This thesis proposes that the program of the metro stations should be animated by drawing references from the urban contexts. As each neighborhood has its own characters, the derived program for the station will be more unique and site specific. Therefore, the station will serve more than transportation by incorporating mixed uses into the program.



Fig 2.10 Different Movement Systems in Downtown DC Area

Another strategy to strengthen the role of the station is by integrating the metro networks with other movement systems in the city. In the past century, automobiles imposed a dominant influence to the design of American city. But under the trend of downtown living and Transit Oriented Development in Washington DC area, walking and cycling have been given a higher priority today in comparison with the automobile-oriented urban design decades ago. Rapid transit system has become a more popular alternative to driving. Therefore the notion of metro station as a transit hub becomes more significant. It is important to understand the movement systems of the site and incorporate them in to the design of contemporary metro station.

Case Study Sites

In order to test the proposition, three case study sites are selected for further investigation as testing grounds of the thesis. The selected stations are located in very different neighborhoods and have very different contexts. They also cover various types of stations in term of their relationship with the ground, and multimodal connections. The following analysis delineates the contexts and explores the potentials of each site.

Farragut North

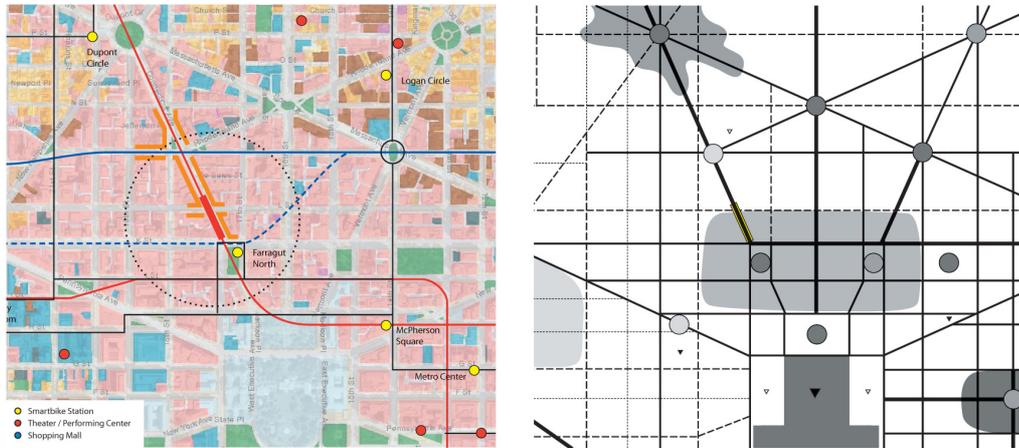


Fig 2.11.1 Land Use and Imageability Diagram of Farragut North Area

Farragut North is an underground station on the Red Line, located at Farragut Square. It is the heart of the Golden Triangle central business district, where there are hundreds of retail venues on street level and 30 million square feet of office space. WMATA Metrorail capacity study suggested that the existing station suffers with critical capacity constraint. Platform, escalators and stairways are overcrowded in peak time. The planned pedestrian pathway connecting Farragut North to Farragut West station is expected to add even more usage of the station.

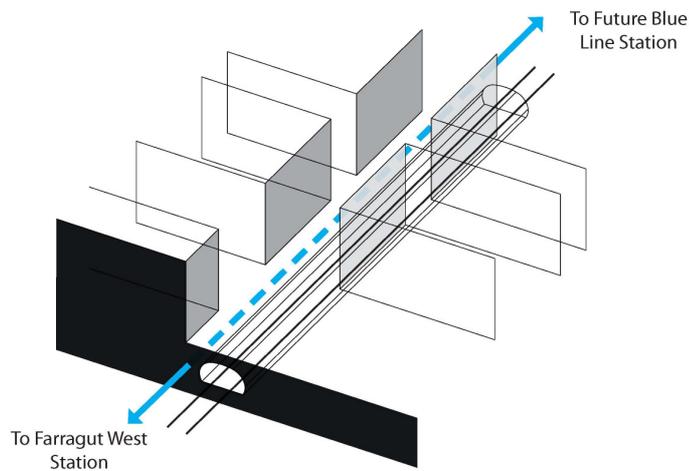


Fig 2.11.2 Isometric Diagram of Farragut North Station

The future separated Blue Line may also be connected to the existing Farragut North station. There is a potential of creating an underground networks to connect the future station, Farragut North and Farragut West. The underground nature of the station also creates the potential of developing a multi-layer ground for the DC downtown area.

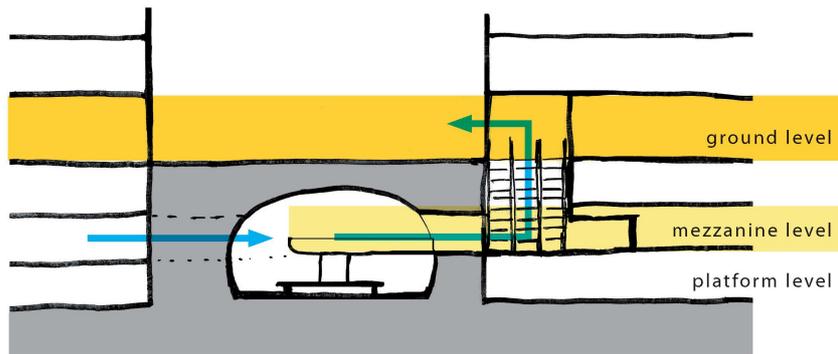


Fig 2.11.3 Section diagram of Farragut North Station

Silver Spring



Fig 2.12.1 Land Use and Imageability Diagram of Silver Spring Area

Silver Spring is an elevated station on the Red Line located at the Southwest edge of the downtown Silver Spring. The station is 1/4 mile away from the activity center

area and is surrounded by major office buildings. According to the proposed zoning plan for the downtown Silver Spring, Montgomery County will continue to transform the area into mixed-use development.

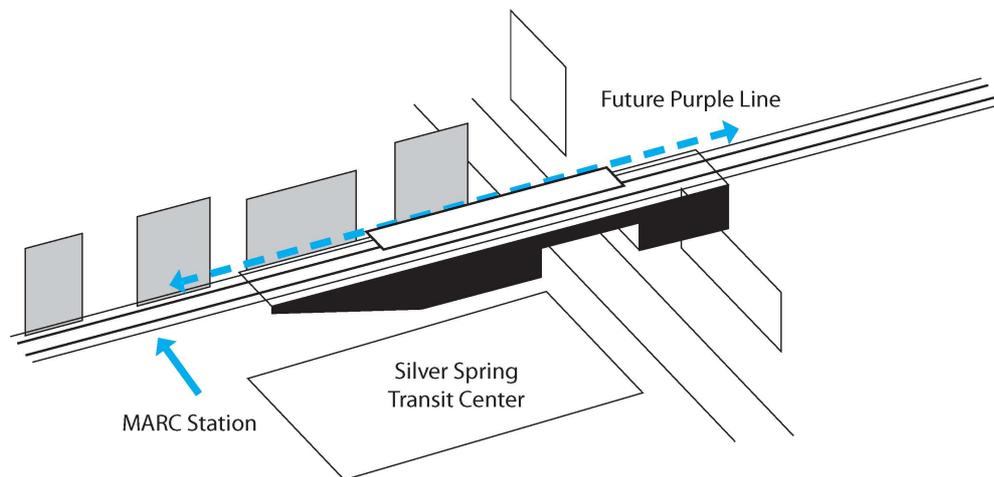


Fig 2.12.2 Isometric Diagram of Silver Spring Station

The location of the station is also a key interchanging point for multiple modes of transportation. There are more than 30 bus lines arriving Silver Spring. There is also a MARC station next to the metro station. It will also be a transfer between Metro and the future Purple Line. The Metropolitan Branch Bike Trail is planned to run along the metro lines to downtown DC area. The proposed Silver Spring Transit Center (SSTC), which is a 3-story concrete structure for bus, taxi & vehicle drop off, is now under construction as well.

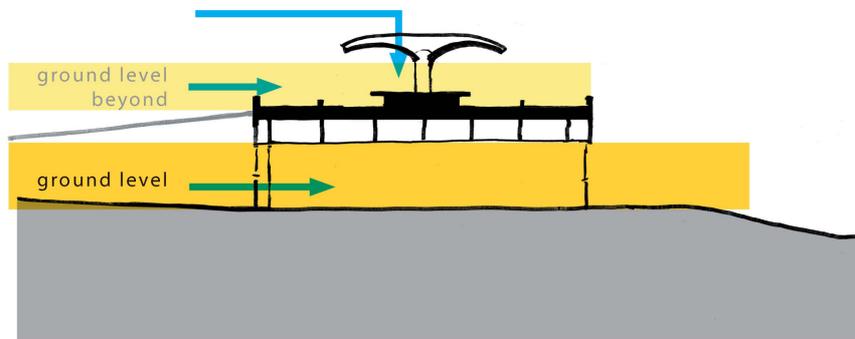


Fig 2.12.3 Section of Silver Spring Station

The existing station is elevated and spans across Colesville Road. Passengers enter the station from street level and go up to the platform by either escalator or elevators. The grading outside the station slopes up toward the Southeast side of the site. It creates an opportunity to access the train on grade as the current MARC station does.

New Carrollton



Fig 2.13.1 Land Use and Imageability Diagram of New Carrollton Area

New Carrollton is the eastern terminal station of the Orange Line. The station is also an interchange between Metro, Amtrak, MARC and the future Purple Line. There is a

Transit-Oriented Development planned for the site, which proposes a mix-used development of offices, hotels and high to mid-density residential around the station.

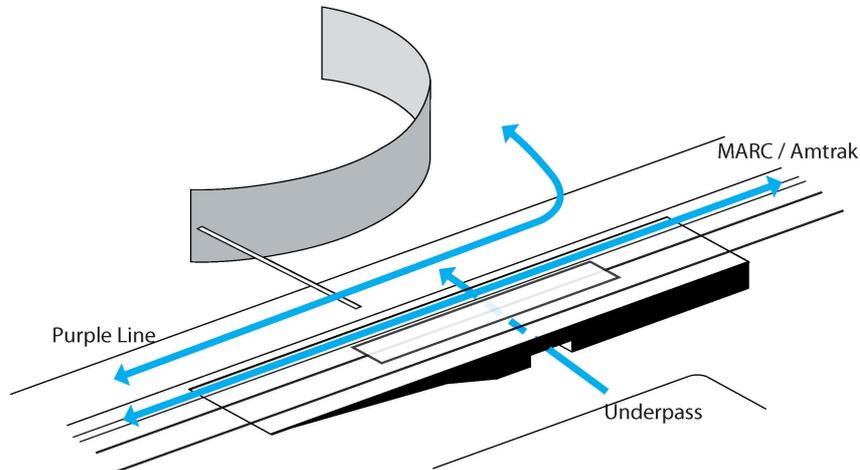


Fig 2.13.2 Isometric Diagram of New Carrollton Station

The existing surrounding of the station is mainly parking lots. The New Carrollton Federal Building for IRS is the major landmark in the site, which connects to the station with an elevated walkway. The current train track is a barrier between the North and South of the station. There are no vehicular connections between North and South within 2000 feet from the station. The station is elevated with an underpass to connect the lower-grade South side with the high-grade North side.

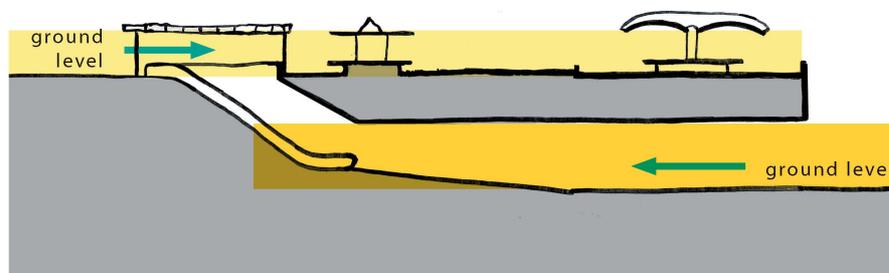


Fig 2.13.3 Section of New Carrollton Station

Chapter 3: Analysis of Precedent Station Designs

In order to have better understanding on the design approaches for metro stations, precedents of contemporary subway stations are studied and used to compare and contrast with existing DC Metro stations. This analysis studied the relationship of the stations with the ground plane, the physical presence of stations in its context, as well as the program of the stations.

Jubilee Line Extension

In considering the system expansion projects such as the Silver Line and the separated Blue Line, the most appropriate precedents for future metro stations are found to be the 1999 Jubilee Line Extension in London. The Jubilee Line Extension consists of 11 stations. Each of them is custom designed by selected architect. Some of the stations reflect the history of the site; some of them have mixed use program for the station. Architecturally, the stations are characterized by polished metal panels, glass and molded concrete walls and columns. Platform edge doors are also installed to improve airflow and prevent passengers from falling onto the train track. This precedents study includes three stations from the Jubilee Line Extension: Canary Wharf Station by Norman Foster, Canning Town Station and Southwark Station.

Other precedents projects included Bijlmer ArenA Station and South Cross Station by Grimshaw Architects; some design projects by Richard Rogers and UNStudio; and subway stations in Montreal and Hong Kong.

Relationship with the Ground Plane

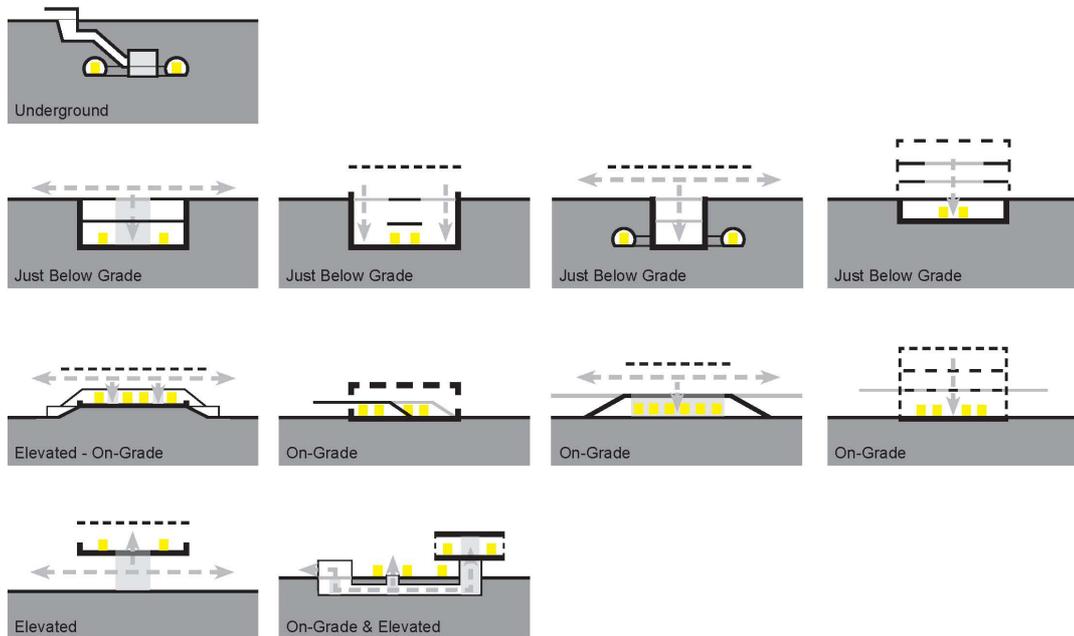


Fig 3.1 Relationship with the Ground Plane of Precedent Stations

Above are the diagrammatic sections of the precedents, and they are organized according to the relationship with the ground plane, from underground to elevated. One important challenge for contemporary metro station design is how to get sunlight to the underground station. This study shows that the opportunity to open up the ground plan for capturing sunlight is higher when the stations are just below grade. However, in most of the underground stations in the DC Metro system, stations are usually constructed underneath the arterial roads, which makes it impossible to open up the ground plane.

Physical presence of the stations

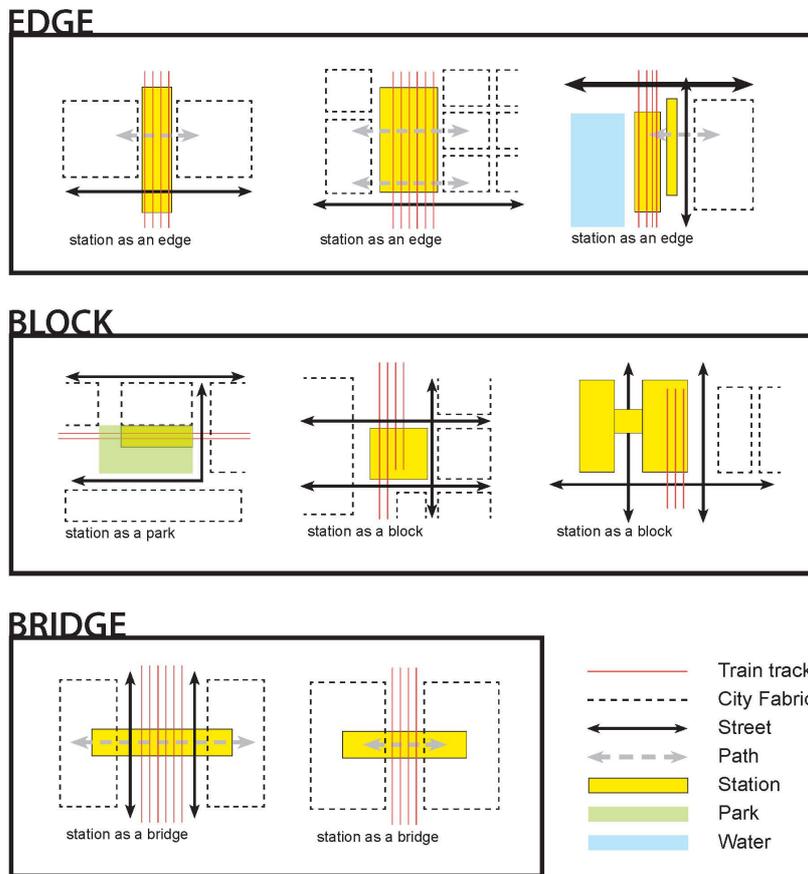


Fig 3.2 Physical Presence in the Immediate Urban Context of Precedent Stations

The diagram above tries to categorize the physical presence of some above ground stations into three forms: Edge, Block and Bridge. Edge means that the linear form of the stations run along with the train track. They become a seam in the city, which can be a barrier or a unifier depends on the design of the station. In DC, many above ground stations show the character of edge and unfortunately they usually act as a barrier in the site. Examples are New Carrollton, Greenbelt, New York Avenue, etc.

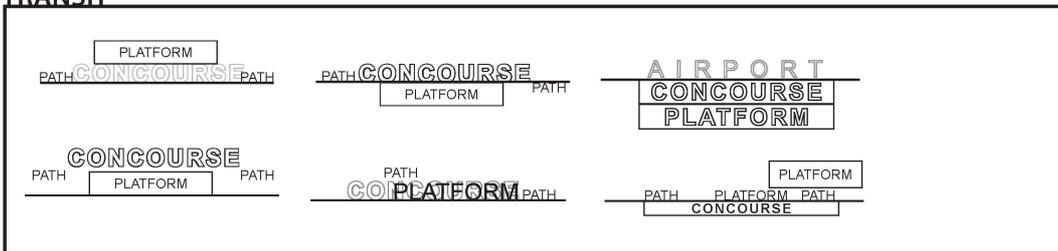
Block means that the stations occupy a block in the city, integrating into to context as a fabric of the city. Precedents such as South Cross Station, Hong Kong Station are

example of station as a block. The underground Canary Wharf Station is also categorized as block because its roof garden of the station is connected with the adjacent green space to form a unified public open space in the city. Station of this kind is rare in Washington DC. The only example is Union Station.

Bridge means that the aboveground stations have a linear form perpendicular to the on-grade train track. They serve as a bridge to connect the city fabric on both sides of the track. They also create a potential for multi-layer ground in the city by their elevated concourse and platform level. An example of bridge-like station in DC Metro system is Vienna, which bridges over I-66.

Program Analysis

TRANSIT



TRANSIT + MIX

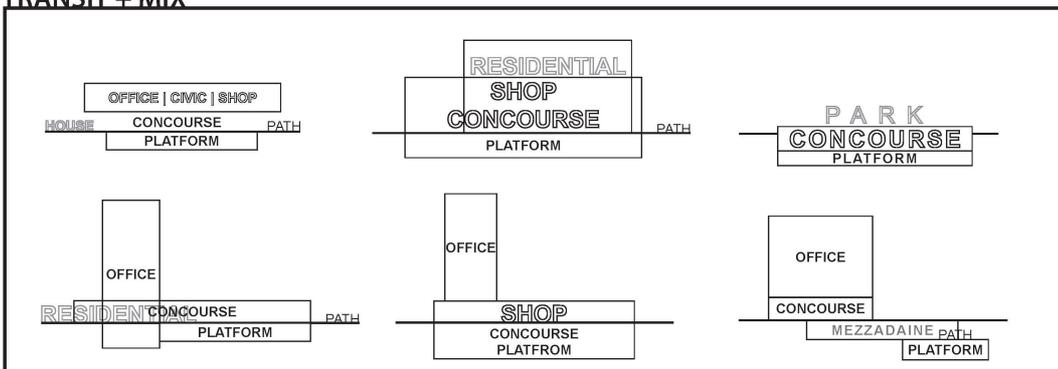


Fig 3.3 Program Diagram of Precedent Stations

The program analysis for the precedent stations found out that many contemporary station designs have program that is solely transportation. Those stations are usually found in residential zone of the city. Some of the precedents have program that is mixed-use, incorporating office, commercial, and other public program into the station. And they are usually located in business or mixed-use district. They have prominent physical presence in the city and some of them are mega-structure. In DC, however, there are very few stations have mixed-use program.

Implication on Design

To conclude the research section of the thesis, with the understanding of the challenges and potentials of the existing Metro system as well as the references of other contemporary station designs, this thesis proposes three design strategies for the future Metro stations:

- a. To animate the program of the stations;
- b. To integrate the station with other movement systems;
- c. To create unique architectural expression for each station.

Chapter 4: Design Proposals for the Case Study Sites

Site Selection

	Farragut North	Silver Spring	New Carrollton
Visibility	Poor	Excellent	Good
Layering	Good	Potential	Potential
Mixed-uses Context	Potential	Good	Poor
Walkable Streets	Good	Fair	Poor
Multimodal	Fair	Good	Good
Station Capacity	Need Improvement	Good	Good
System Expansion	Separated Blue Line	Purple Line	Purple Line

Fig 4.1 Site Evaluation Matrix

Base on the site study in Chapter 2, a site evaluation matrix is developed to compare the three case study sites. Although New Carrollton Station has a good visibility and multimodal nature, the site lacks context as the station is mainly surrounded by parking. And because developing a master plan for the site is not the primary purpose of this thesis, the design proposals will only focus on Farragut North and Silver Spring.

Farragut North

Design Challenges and Strategies

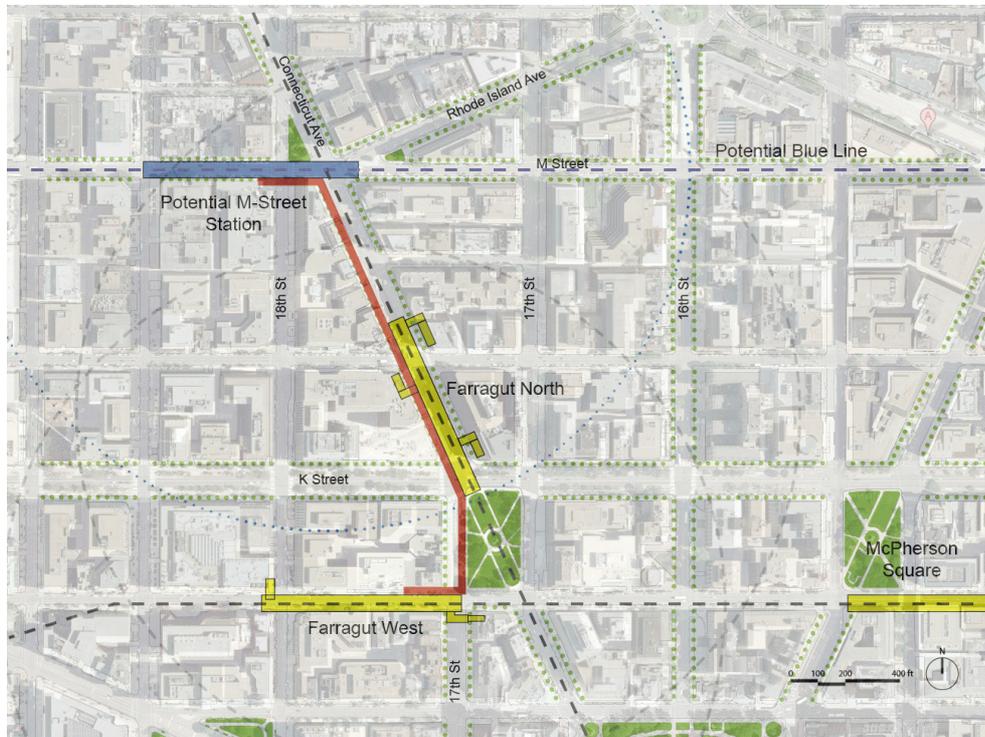


Fig 4.2.1 Existing Farragut North neighborhood

The existing Golden Triangle neighborhood is within the central business district of Washington DC. Connecticut Avenue is the arterial road that diagonally cut through the district, which also is a commercial street where the Red Line Metrorail runs underneath.

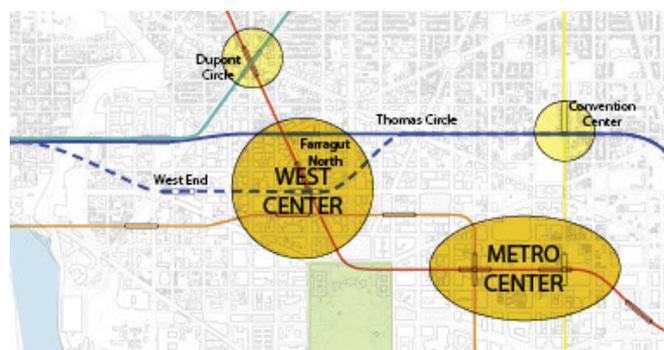


Fig 4.2.2 Farragut North neighborhood as West Center of Washington DC

The design strategy for this neighborhood is based on the speculation that there will be a new Blue Line as part of the Metro expansion plan. The Farragut North, Farragut West and the new Blue Line station will serve the Golden Triangle neighborhood that could be conceived as the future “West Center” of Washington DC.

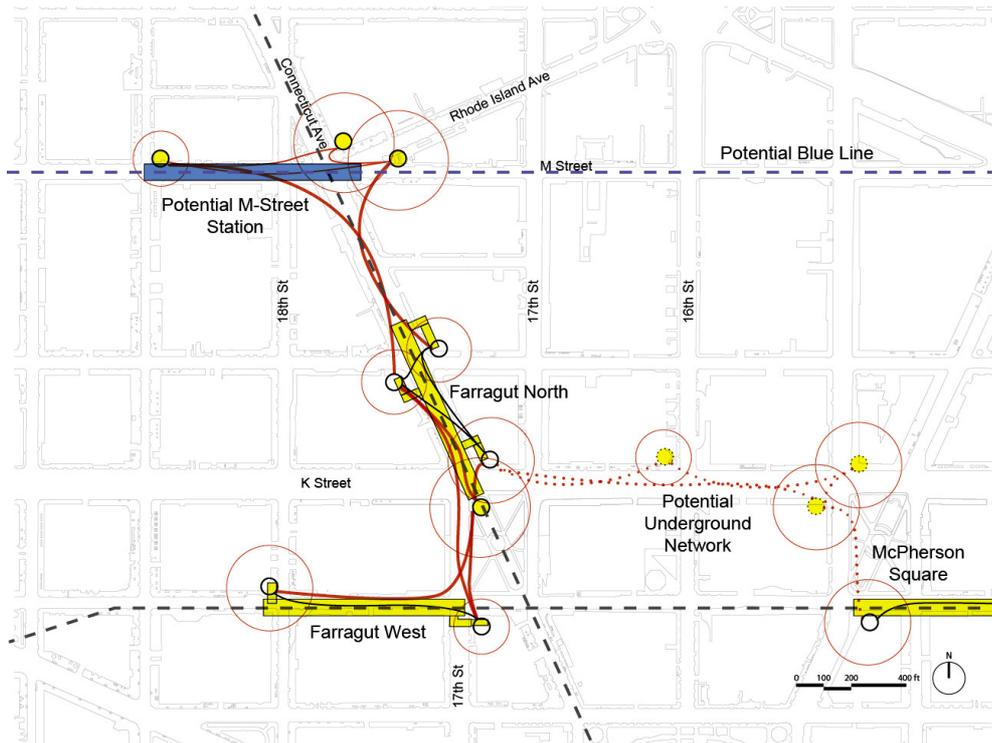


Fig 4.2.3 Design concept – Network of urban nodes

Given the proximity between these three stations, the design concept is to create an underground pedestrian linkage between them, so that the Red line, Blue line and Orange line will be knitted together. With each Metro entrance is conceived as a little node in the neighborhood, this thesis proposes a network of nodes for Farragut North neighborhood, which will become a bigger node in a broader context.

The main design challenge for an underground network is to make connections to the street level. The metro entrances need to be visible from the street level. It is also

important to bring sunlight down to the subterranean space to make more pleasant. It requires a reconfiguration between ground, streets, buildings, the Metro station and other underground spaces. Another challenge is the overcrowding platform. As the ridership of Metrorail continue to soar, future station design will need higher capacity.



Fig 4.2.4 Existing metro station entrance at the corner of a block



Fig 4.2.5 Overcrowding platform of Farragut North Station

Design Solutions

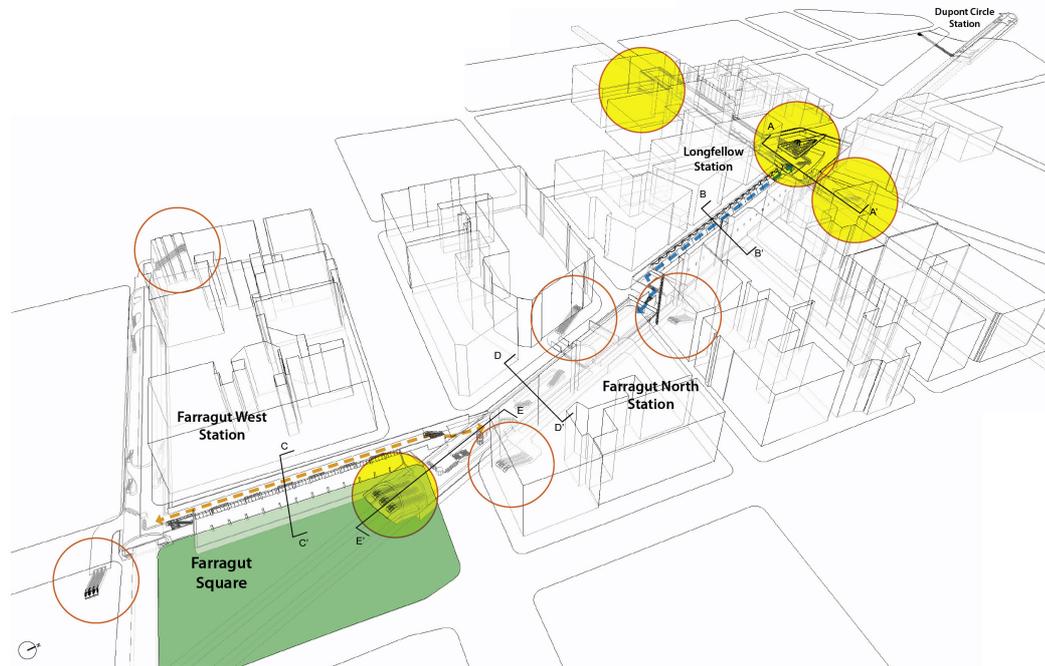


Fig 4.2.6 Design intervention at Farragut North neighborhood

The design intervention includes three parts:

- 1) Underground pedestrian retail walkway between Farragut West Station and Farragut North Station, with a new entrance of Farragut North Station at Farragut Square;
- 2) New Blue Line station on M Street at Longfellow Square;
- 3) Underground pedestrian retail walkway between Longfellow Station and Farragut North Station.

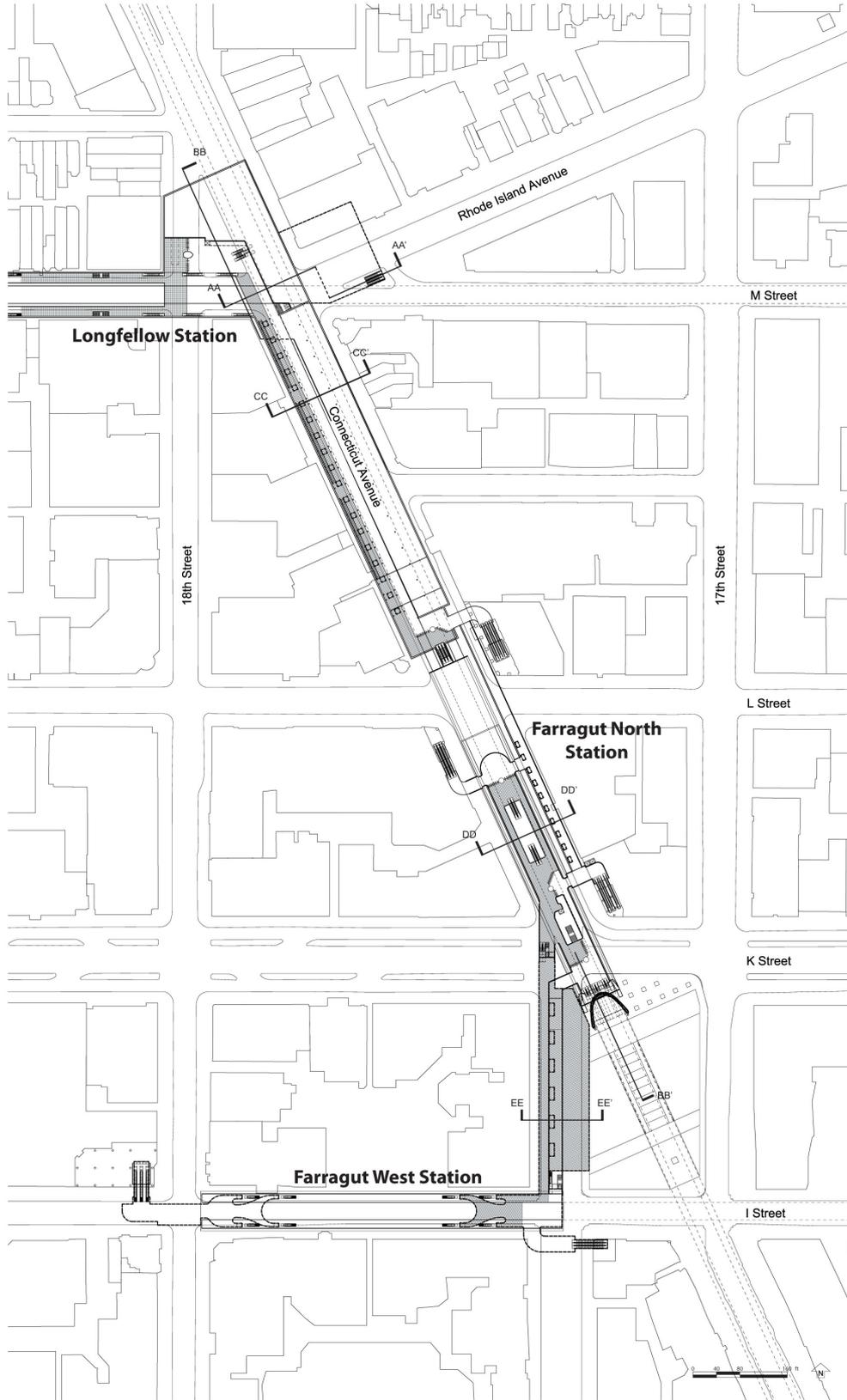


Fig 4.2.7 Site plan – network of Metro station



Fig 4.2.8 Model of Farragut North Station at 1"=40' scale

Farragut Square

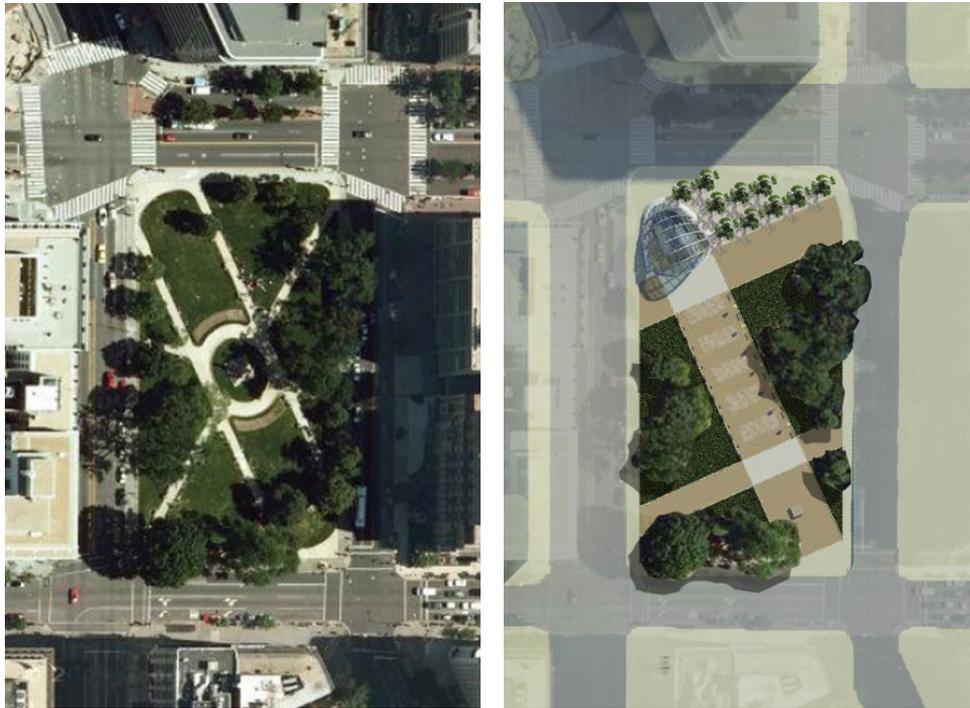


Fig 4.2.9 Before and After of Farragut Square

A new Metro entrance to the Farragut North Station is added at the Northwest corner of Farragut Square. The prominent canopy will be a landmark for the neighborhood, which will also become an icon terminating Connecticut Avenue.

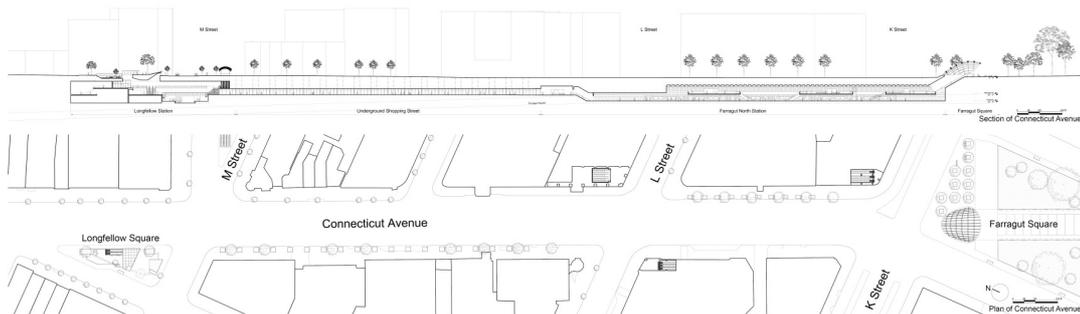


Fig. 4.2.10 Section and Plan along Connecticut Avenue

Sunlight will be brought down into the mezzanine of the station through the glass canopy, and provide a sense of direction for the underground station. Preserving most of the trees, the additional paving makes the square becomes more civic, creating a public open space that fosters the nature of the square as an urban node, allowing more variations of activities happen in the square.

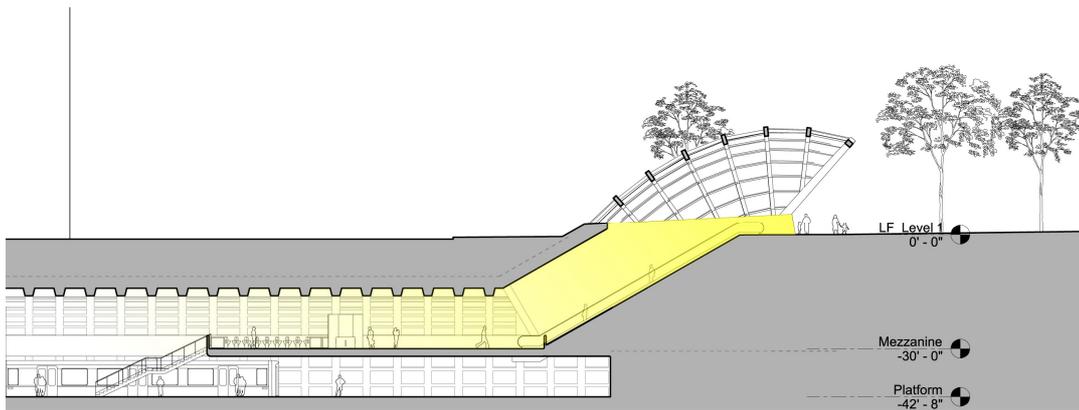


Fig 4.2.11 Section of the new Metro entrance at Farragut Square

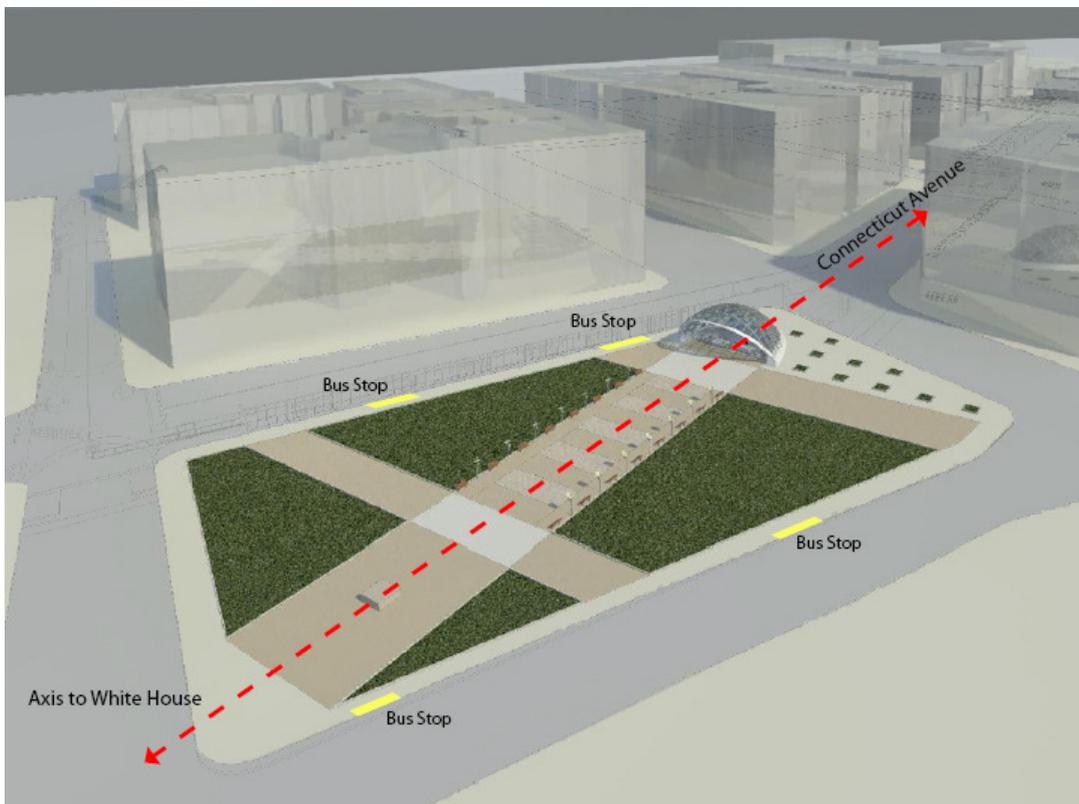


Fig 4.2.12 Aerial view of redesigned Farragut Square



Fig 4.2.13 Farragut Square as a civic plaza



Fig 4.2.14 Metro entrance canopy as a landmark

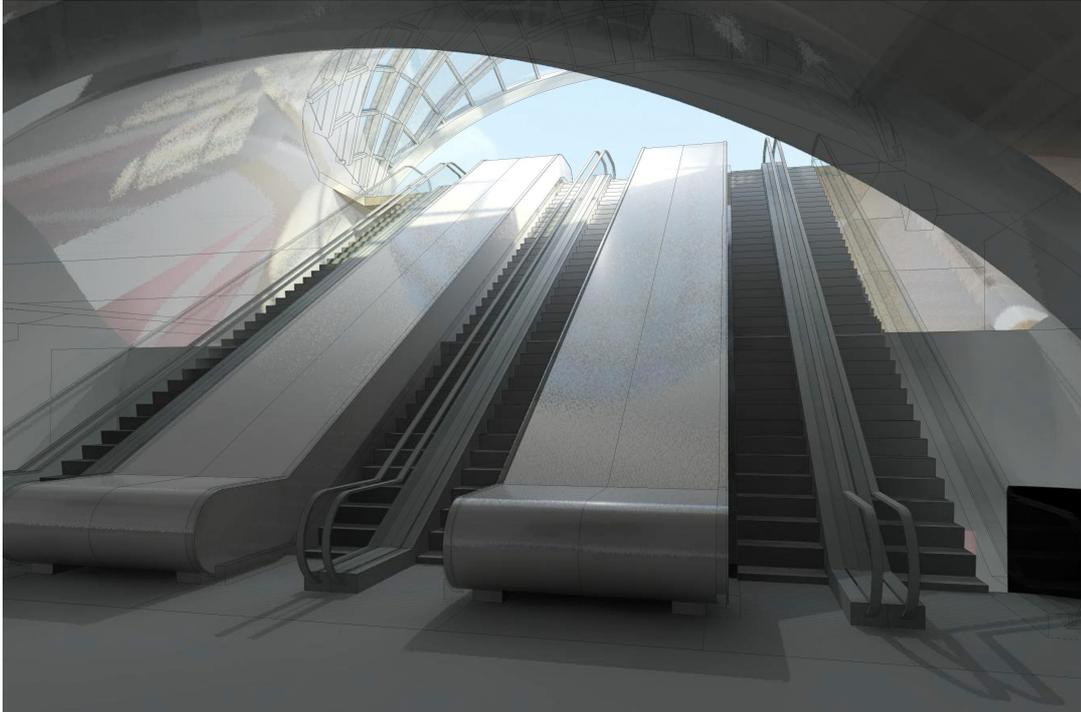


Fig 4.2.15 Metro entrance canopy as a landmark

Underground pedestrian retail walkway

By connecting the existing Farragut North Station of Red Line with Farragut West Station of Orange Line, these two stations become a new transfer between Red and Orange Line. It can relieve the overcrowding problem at Metro Center Station, which is currently the only transfer station between the two lines. Retail space is added to the tunnel to activate the space. The walkway also includes a non-ticket zone, which provides a weather-protected connection for people to use without entering the metro system.

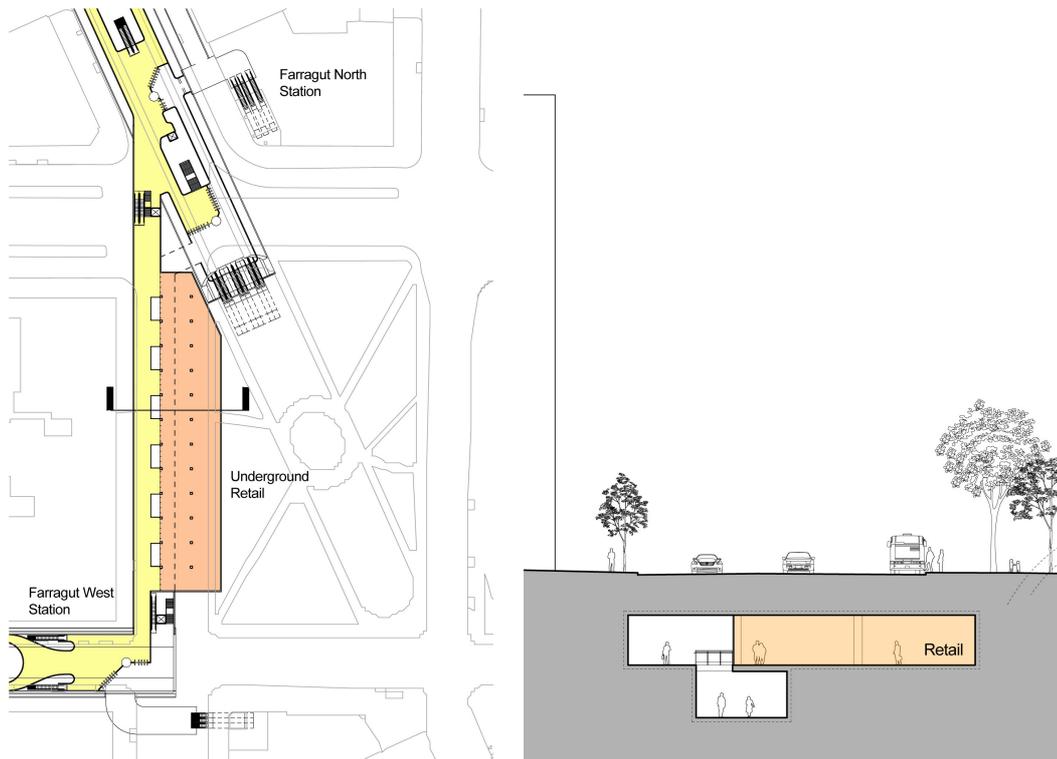


Fig 4.2.16 Underground retail walkway between Farragut North and Farragut West

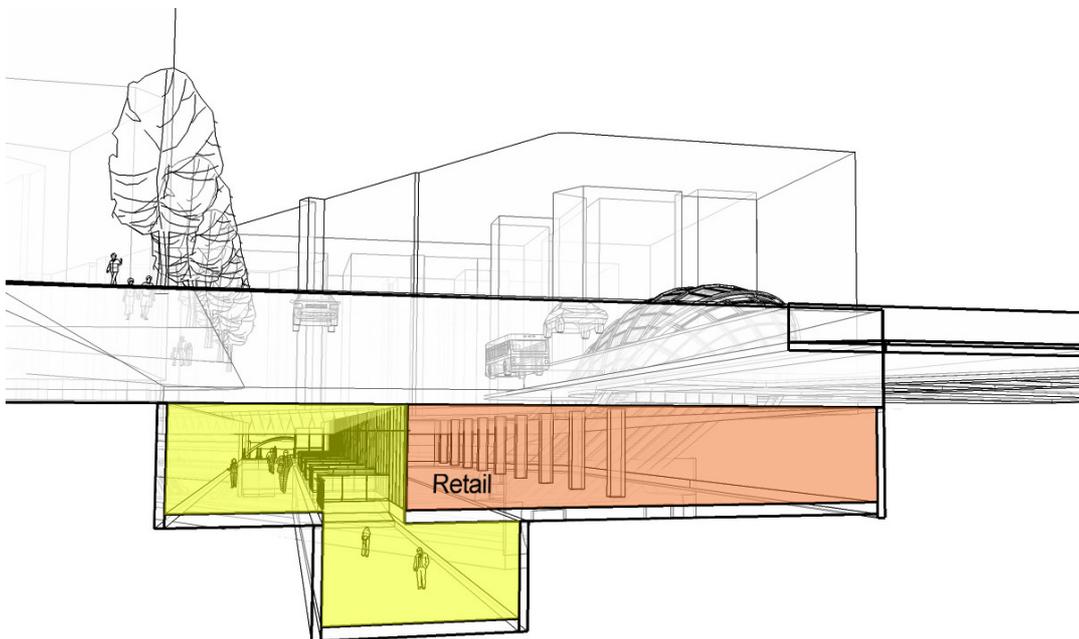


Fig 4.2.17 Separation between ticketed and non-ticketed walkway



Fig 4.2.18 Underground pedestrian walkway

Longfellow Station



Fig 4.2.19 Site context of Longfellow Station

This thesis proposes a new Blue Line station at the intersection of Connecticut Avenue and M Street. The main station entrance is located at the Longfellow Square that the triangular square has been redesigned. Skylight is introduced to allow

sunlight to penetrate to the underground station as well as the platform. It also increases the visibility of the Metro entrance.

The interior architecture of the station is unique in order to give identity to the neighborhood, as well as to help passengers to recognize which station they have arrived. The width and the length of the platform are increased in comparison to the existing station so that overcrowding could be reduced.



Fig 4.2.20 Before and After of Longfellow Square



Fig 4.2.21 Aerial view of Longfellow Square



Fig 4.2.22 Sunken Garden of Longfellow Square

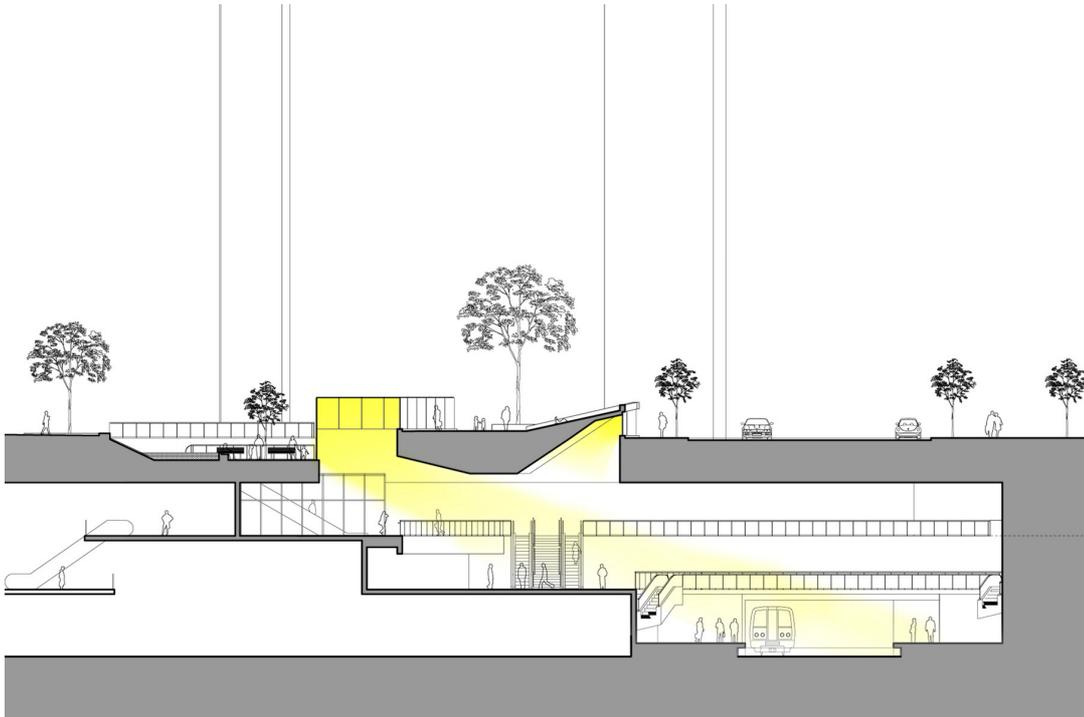


Fig 4.2.23 Section of Longfellow Station



Fig 4.2.24 Longfellow Station Lobby



Fig 4.2.25 Longfellow Station Lobby

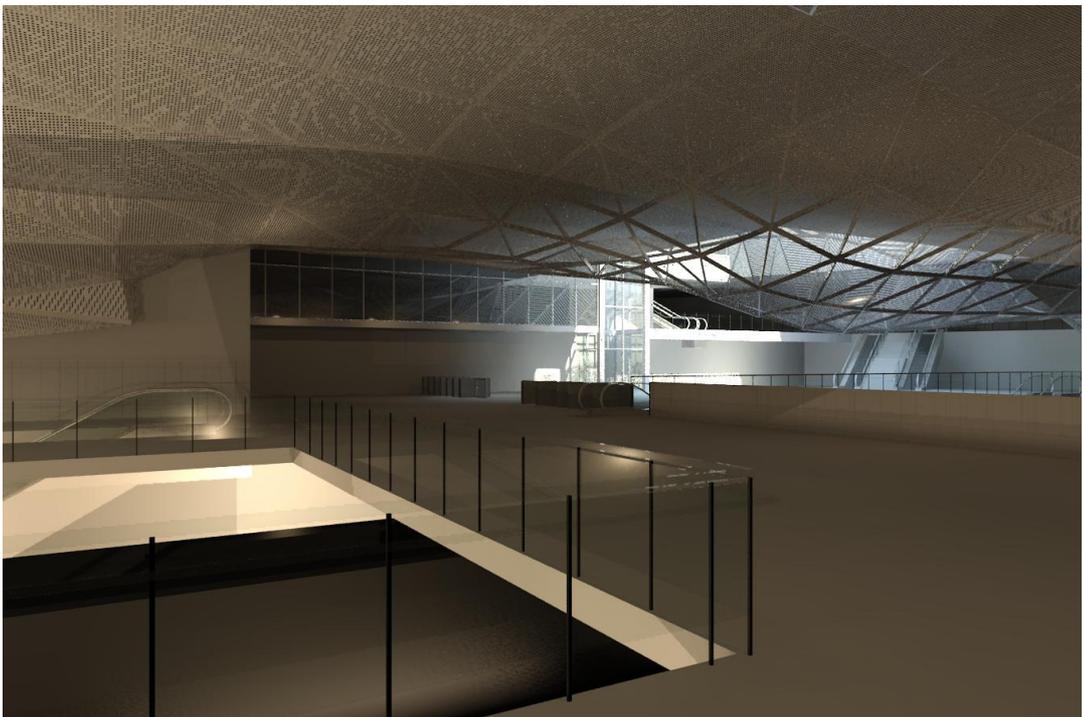


Fig 4.2.26 Longfellow Station Mezzanine

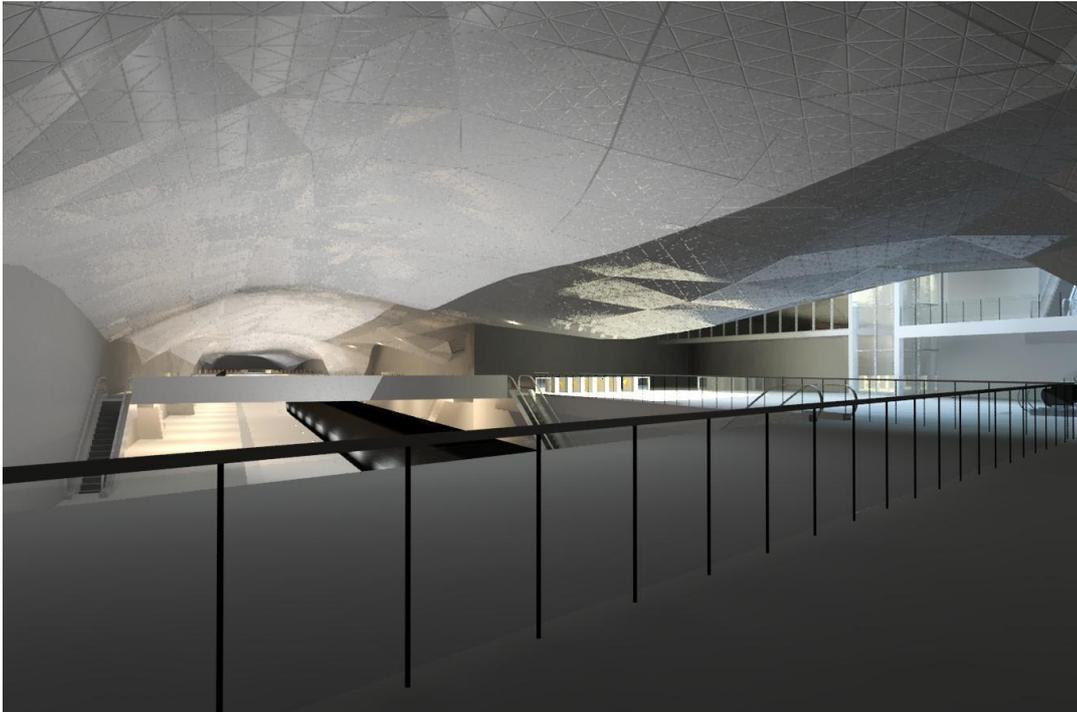


Fig 4.2.27 Longfellow Station Mezzanine

The Underground pedestrian network

Another underground pedestrian retail walkway is introduced to connect the new Longfellow Station with the Farragut North Station. It completes the overall underground network to allow people to walk from Farragut West Station at I Street to Longfellow Station at M Street. It connects Farragut Square and Longfellow Square with an additional layer of retail and public space. This part of design also explores the opportunity to get sunlight down to the underground pedestrian space, which involves redesigning the street at certain level.

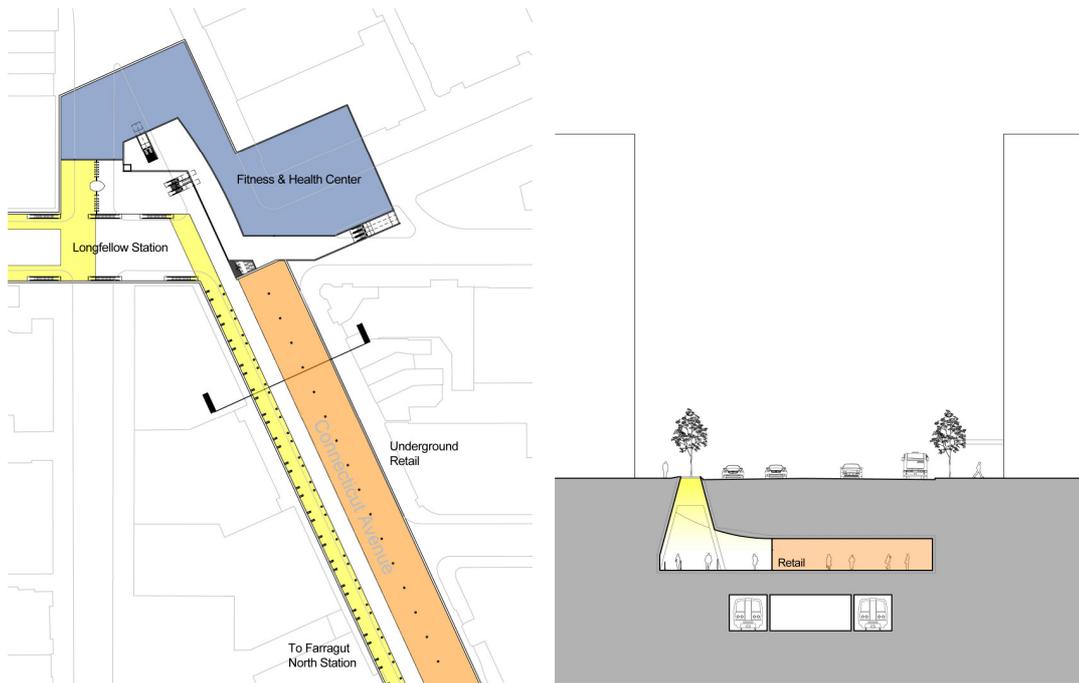


Fig 4.2.28 Underground retail walkway between Longfellow and Farragut North

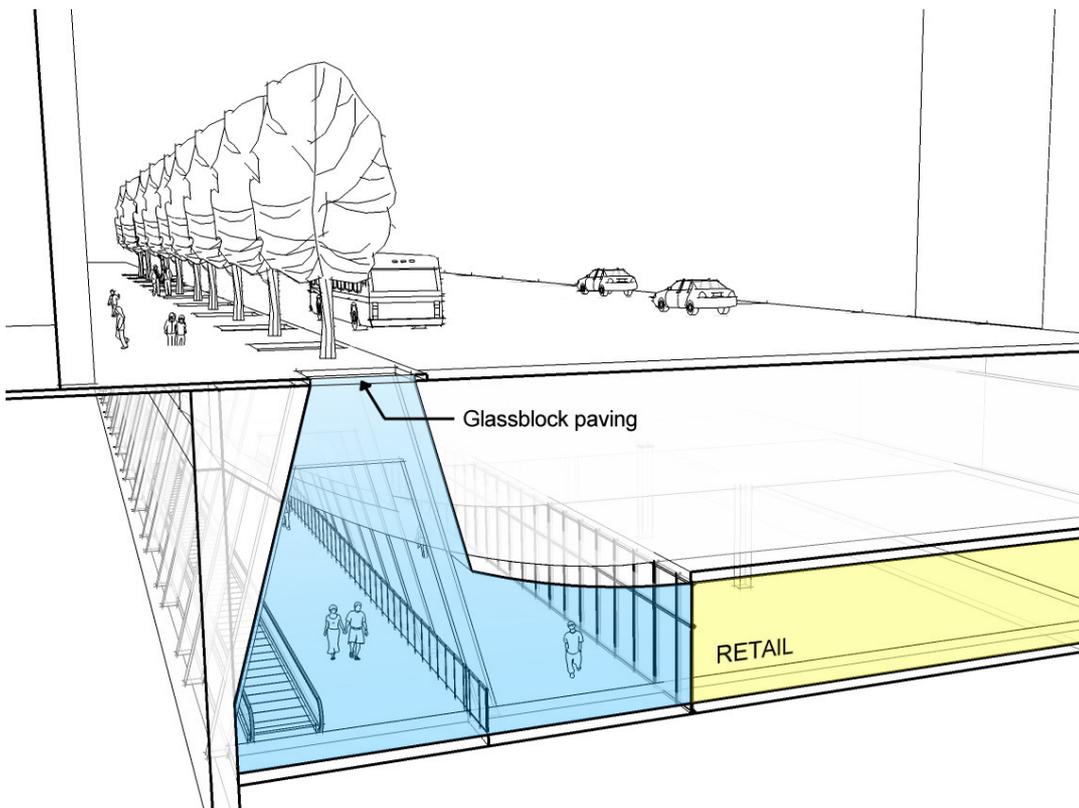


Fig 4.2.29 Underground retail walkway between Longfellow and Farragut North



Fig 4.2.30 Underground retail walkway between Longfellow and Farragut North

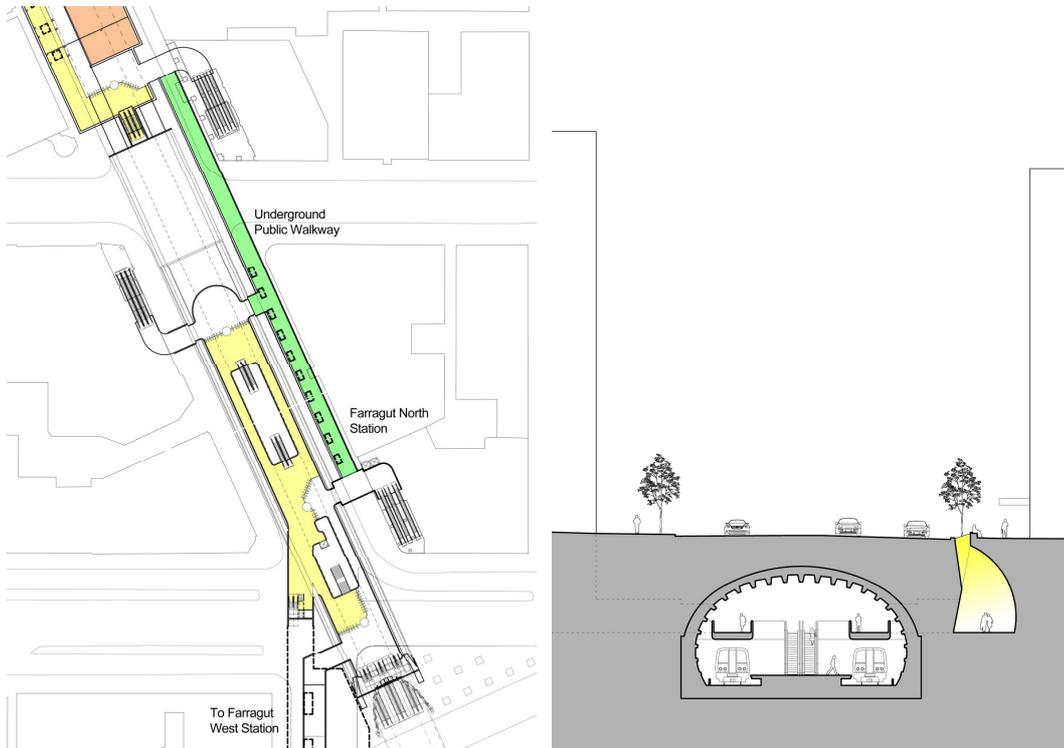


Fig 4.2.31 Underground walkway along Farragut North Station

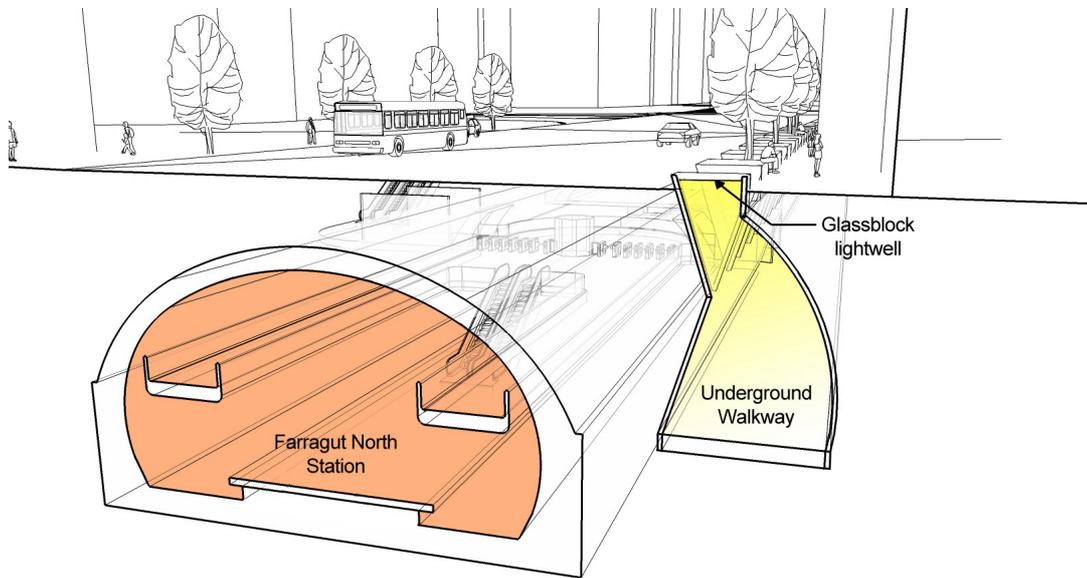


Fig 4.2.32 Underground walkway along Farragut North Station



Fig 4.2.33 Underground walkway along Farragut North Station

Silver Spring

Design Challenges and Strategies

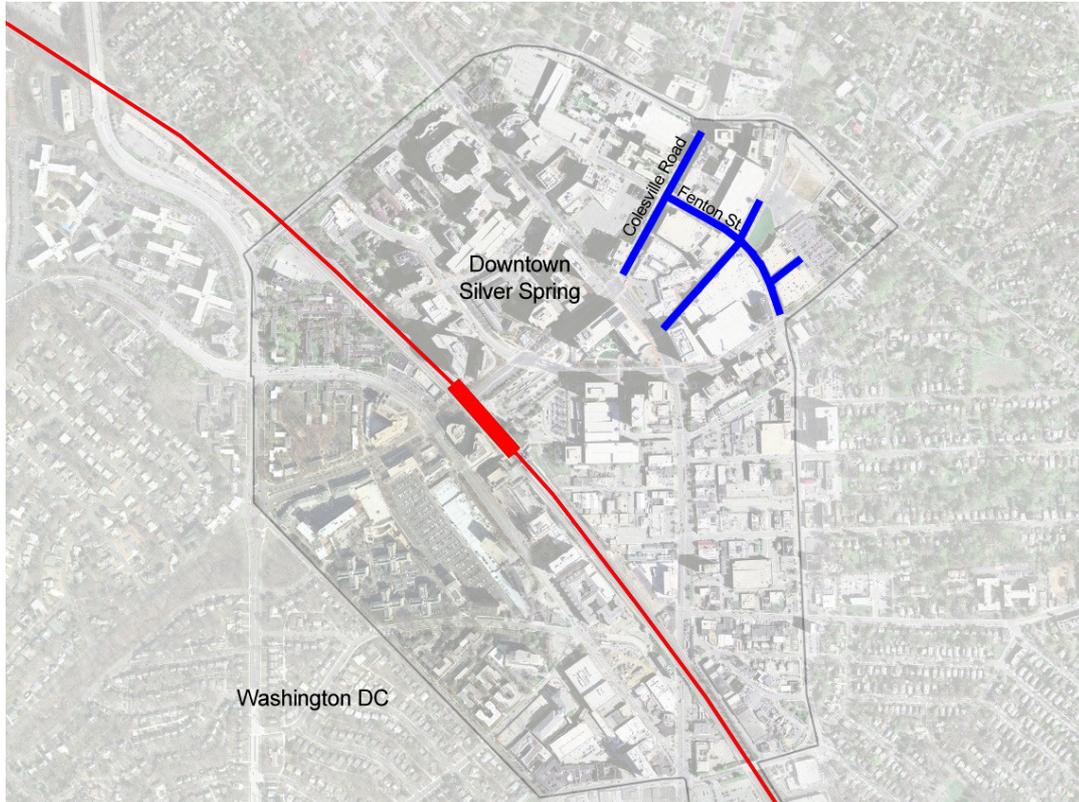


Fig 4.3.1 aerial map of downtown Silver Spring

Silver Spring is a suburban town center at the North of Washington DC. It is the first station outside Washington DC on the Eastern Red Line of the Metrorail. Silver Spring is characterized with many high-rise office buildings. Its vibrant activity center is near Fenton Street and Colesville Road, where theaters, restaurants, retails and supermarkets are located. However, Metro station is at the edge of the Silver Spring downtown area. It has weak connection with the activity center. So the design strategy is to establish more connections between the metro station and the surrounding fabric.

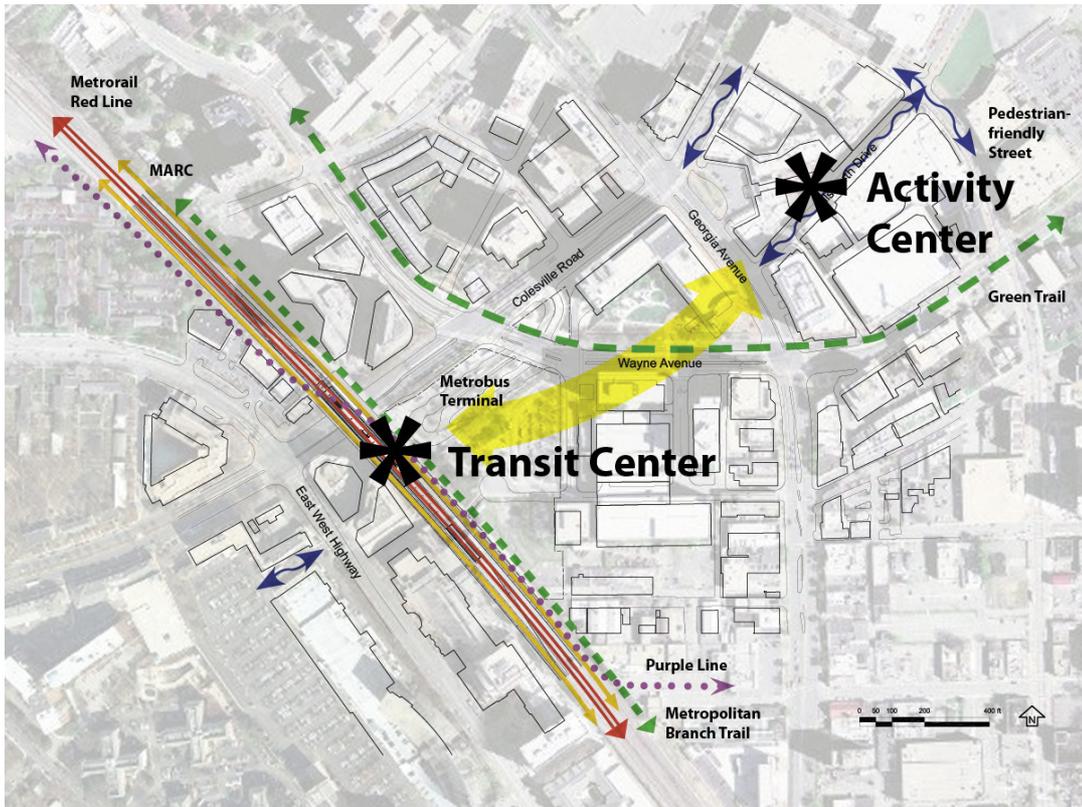


Fig 4.3.2 Design strategy for Silver Spring station

As discussed in chapter 2, Silver Spring is a multimodal transit center of the region, which connects the nearby suburban residential neighborhoods to the city. One challenge for the design is to create clear transfer between these different modes of transit. The existing scheme of the Silver Spring Transit Center (SSTC) is a good attempt in doing so. But it does not include the future Purple Line. And the architecture is rather disappointing with no sense of place and brutal form of the structure. This thesis tries to develop a design from the SSTC proposal in a way that will have a prominent architecture and a better sense of place.

Design Solutions

The design takes a holistic approach for Silver Spring Station which incorporating these three parts:

- 1) Integrating different mode of railway systems
- 2) Establishing pedestrian connections with the neighborhood
- 3) Creating sense of place by programming and the architecture

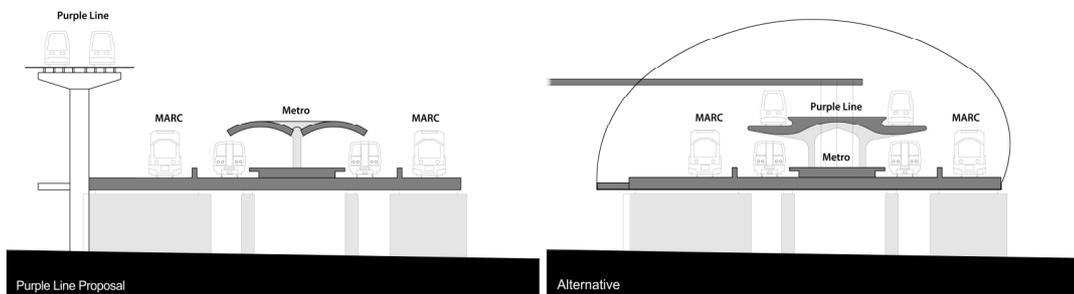


Fig 4.3.3 Section of the proposed metro station

The current plan for Purple Line is to create an elevated platform apart from the existing Metrorail, MARC train and the SSTC. This approach will create too many scattered structures in the city, making the urban environment looks intricated. This thesis suggests to incorporate the three modes of railway system. It allows easy transfer between the rails and provides an opportunity to create a bold architecture for the station. A new metro entrance is added to the top which will linked the Metro station with the Transit Center complex.

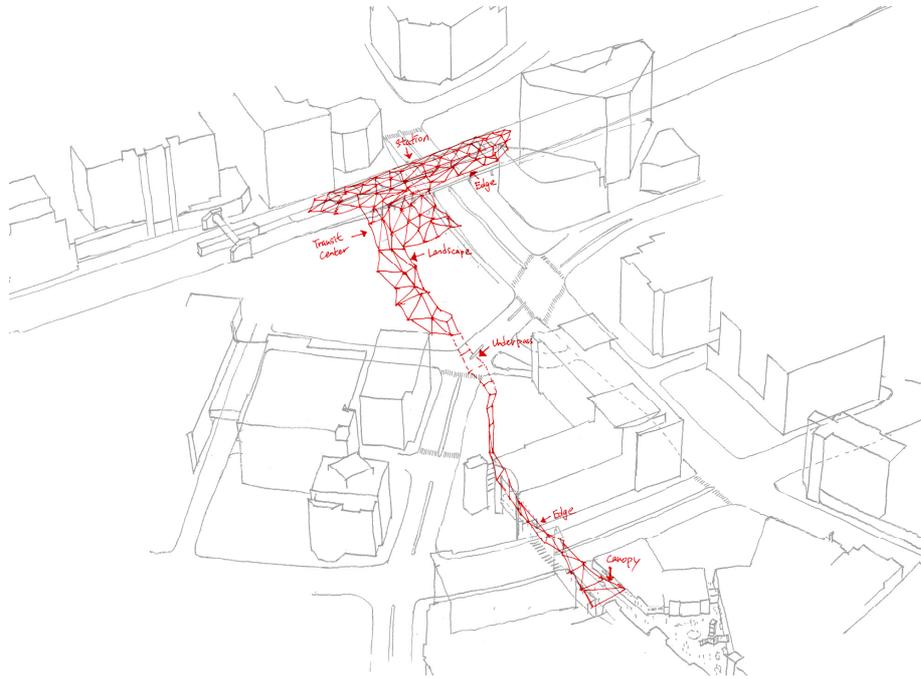


Fig 4.3.4 Conceptual diagram of the site strategy

The existing Metro station is elevated and very visible. It is perceived as an edge of the downtown Silver Spring area. One idea of the design is to pick up this nature of edge and extend it to the activity center of the city.

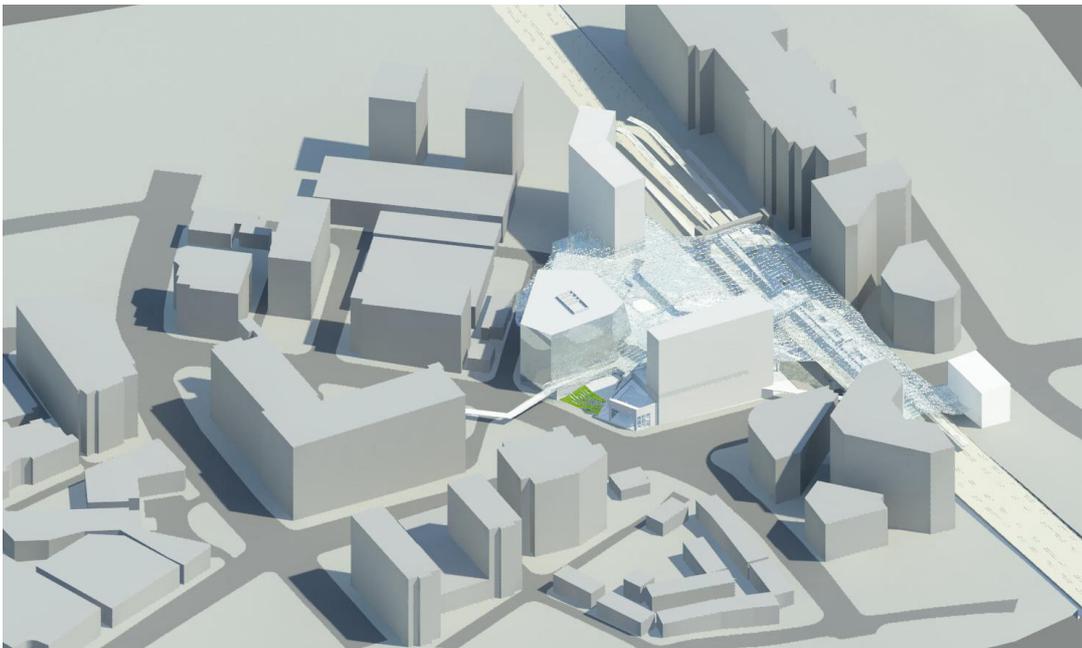


Fig 4.3.5 Aerial view of the reinvented Silver Spring Metro station

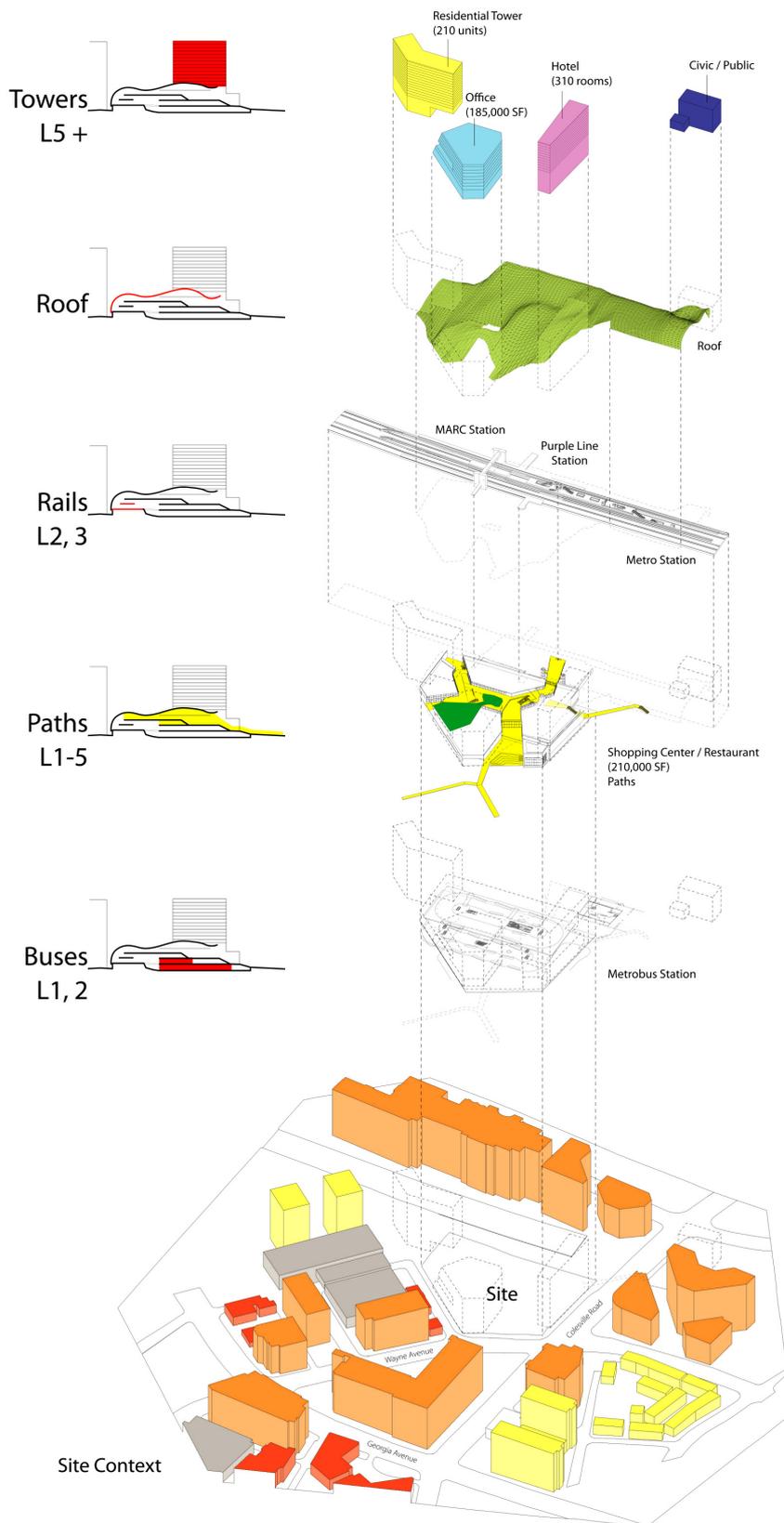
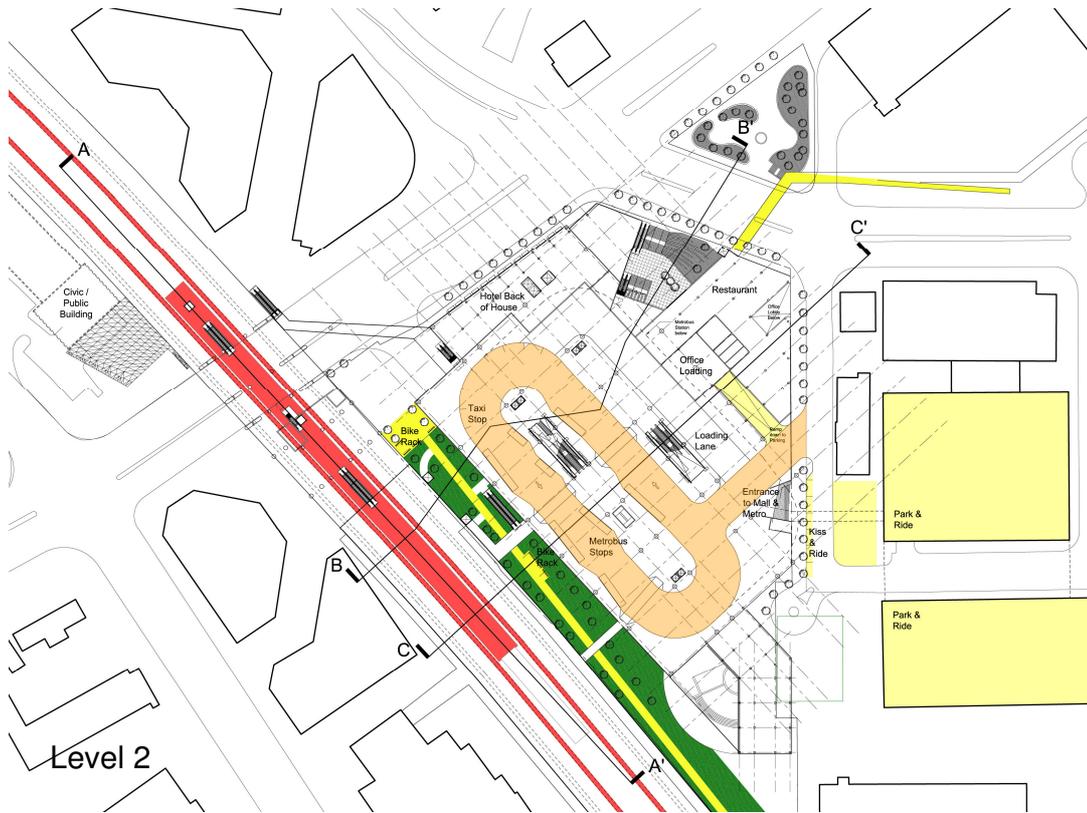
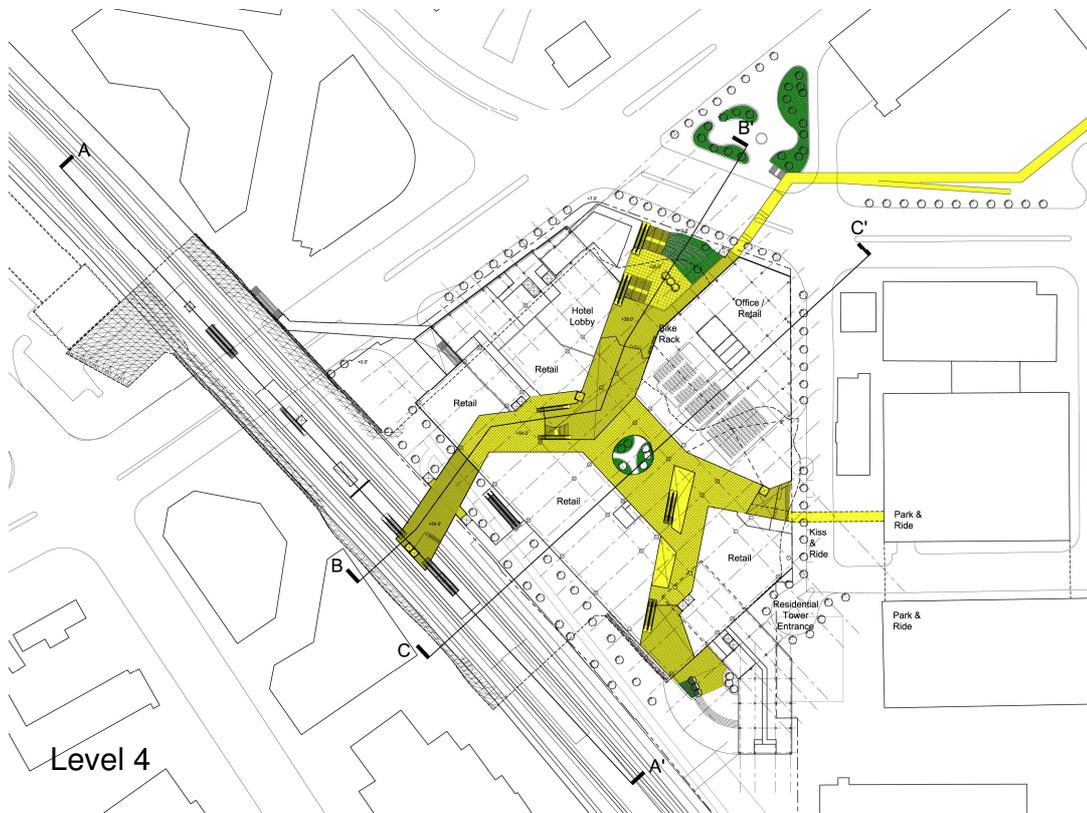


Fig 4.3.6 Exploded isometric diagram of Silver Spring Metro Station



Level 2



Level 4

Fig 4.3.7 Plan diagrams at Level 2 & 4

The Transit Center complex consists of retails, commercial, residential, office and hotel program, which build upon the SSTC proposal. The bus and taxi drop off are further compacted into the first and second level. Retails, commercial & hotel are placed at the upper levels and the street edges. There are three towers including office, residential and hotel. The elevated path is conceived as a public space, cutting through the complex in different directions to connect the Metro station with the neighborhood as delineated as the yellow path in the above diagram.

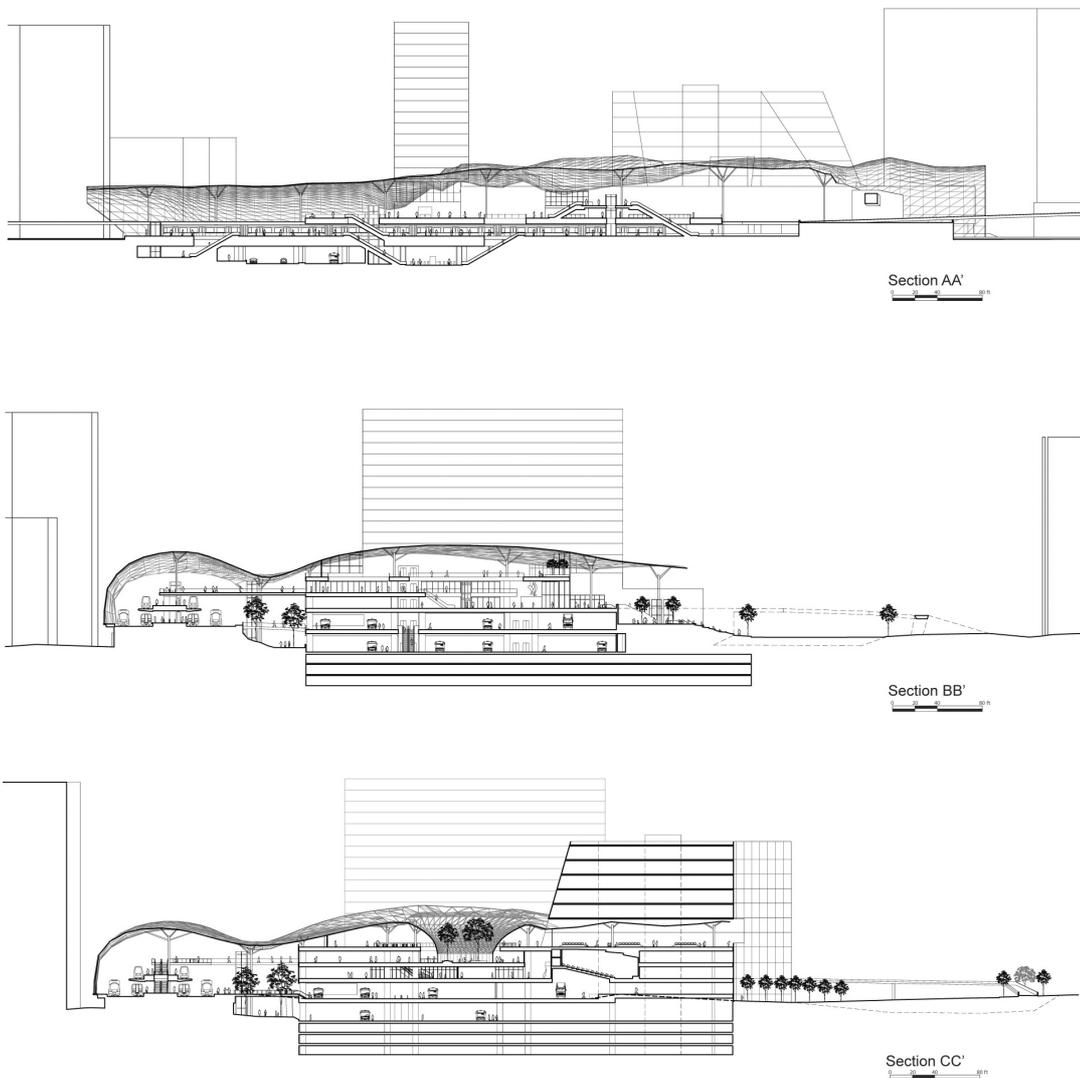


Fig 4.3.8 Sections of Silver Spring Metro Station



Fig 4.3.9 Exterior view of Silver Spring Transit Center complex



Fig 4.3.10 Terraced Plaza at the North of the site facing Wayne Avenue



Fig 4.3.11 Terraced Plaza at the North of the site facing Wayne Avenue

A terraced plaza is created at the North, which provides landscaped area for cafe, restaurant and other public uses. A bridge is also extended across Wayne Avenue at the North side of the site, and ramp down back on grade. Bike racks are provided near the Metro station and the terraced plaza.

The overall architecture is featured with a gridshell roof structure, which covers the Metro station as well as the transit center complex. The bold form gives a unique character to the building, creating a strong image about the identity of the place. The roof also helps defining the space of the paths that lead to the Metro station.

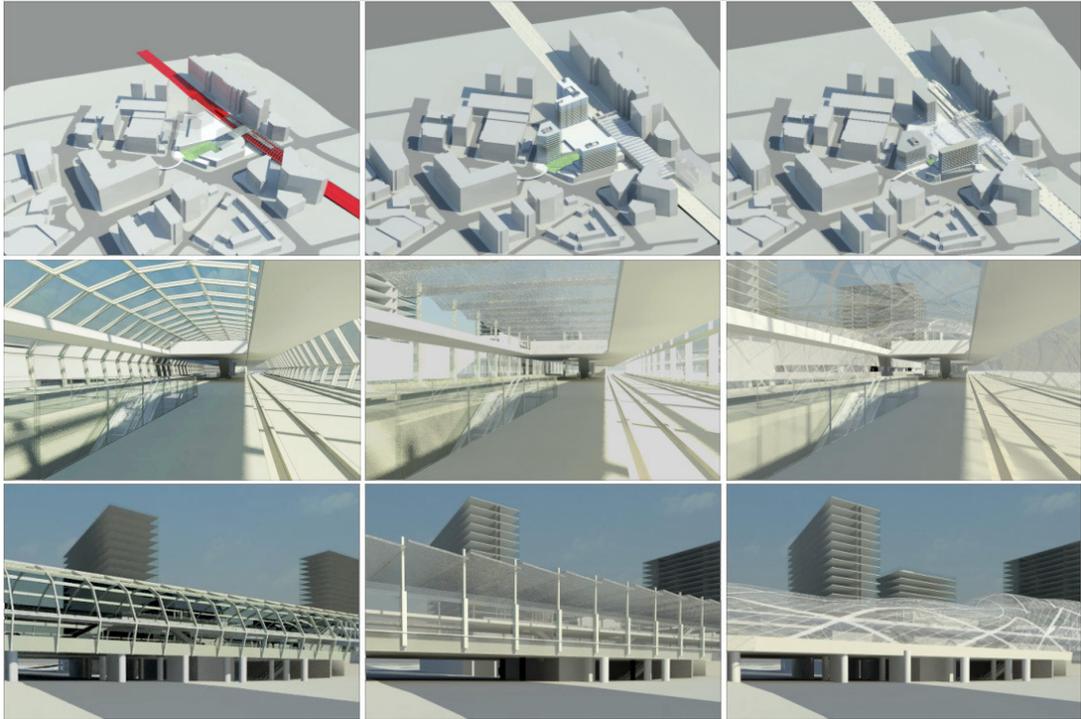


Fig 4.3.12 Study of the roof structure

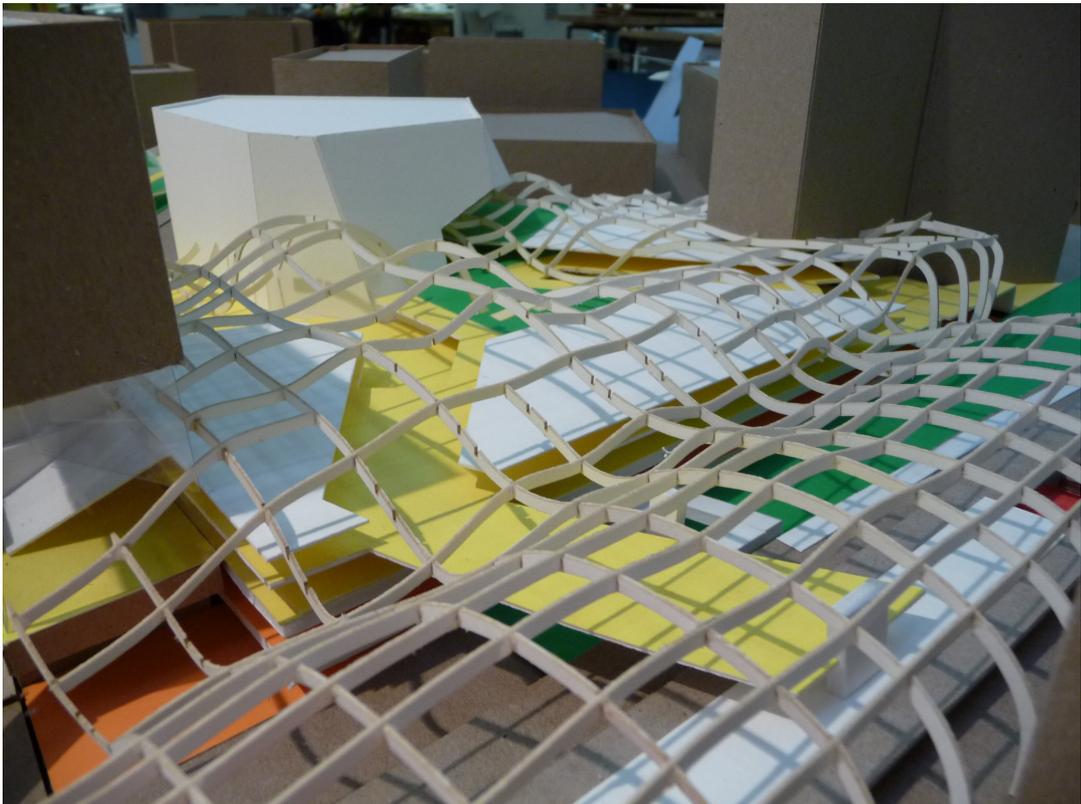


Fig 4.3.13 Model of Silver Spring Station at 1"=40' scale



Fig 4.3.14 Atrium space inside the Transit Center complex



Fig 4.3.15 Outdoor garden in the Transit Center complex



Fig 4.3.16 Bridge connecting the Metro station with Transit Center complex



Fig 4.3.17 Silver Spring Metro station platform

Chapter 5: Conclusion

Transit is an important part of urban living. This thesis explored the increasing role of Metro station in the Washington Metropolitan Area. It considered metro station as a place instead of merely infrastructure. The research studies discovered the design potentials and challenges of the stations in their unique urban settings. It developed three strategies to approach the designs for the two test sites.

- a. To animate the program of the stations;
- b. To integrate the station with other movement systems;
- c. To create unique architectural expression for each station.

The designs have explored many different urban design issues. In Farragut North, the design proposed to use Metro entrances to activate the federal squares. It transforms the existing parks into civic plaza. The thesis also examined the possibility of creating underground pedestrian network in downtown Washington DC, which also investigated the design of street in order to bring sunlight down to the underground space.

In Silver Spring, the design proposed an integration between the Metrorail, MARC train, Purple Line, buses, taxi, vehicles, bike and pedestrian movement. It also explored the idea of elevated public space that is connected the station to urban fabric of Silver Spring.

To conclude, the value of this thesis is more an urbanistic one. It challenges that Metro stations should gain more attention in designing the city. It imagines how Metro stations could be design. And it raises varies urban design questions that hopefully can inspire more theses in the future.

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