

MANHATTAN FUTURE GATEWAY  
**NEW PORT AUTHORITY BUS TERMINAL**

FINAL RESEARCH REPORT

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COMPLEX PROJECTS  
GRADUATION 2020 - NEW YORK MIDTOWN

Evolution of City Mobility & Infrastructure

New mobility and future transportation hub in NYC

Research

New York City is the most cosmopolitan city with great influence in the world, but the transportation problem has always been its urgent task. Mobility and infrastructure facilities are the aspects with the most contradictory and most prominent problem concentrated. This situation is even severer in the site of Transitional Yards, where the entrance of the most congested tunnel in NYC, Lincoln tunnel placed, also the busiest train station and the largest bus terminal located.

In some ways, Transitional Yards is very well connected. With the major interstate and upstate railway lines converging here, hopping on a train to New Jersey or upstate New York couldn't be easier. Similarly, with many important subway lines crossing through Transitional Yards, taking the subway to other parts of Manhattan and the other boroughs is also very easy. However, when it comes to mobility within the site as well as vehicular traffic, Transitional Yards is very inadequately equipped. Regarding mobility within the site, the 7-line extension has had a huge positive impact on the accessibility of the waterfront region, but this still leaves the south-western part of the site inaccessible. While bus networks and even bike-sharing hubs do exist, the subway is by far the most used mode of transportation due to its comfort of use and travel speed.

Now the transportation efficiency in the site is greatly reduced because the infrastructure facilities connecting Lincoln Tunnel are operated beyond capacity. The site's vehicular traffic system is completely outdated. With the Port Authority Bus Terminal, the parking and bus infrastructure it requires, and the systems of ramps feeding into the Lincoln Tunnel, the whole northern part of Transitional Yards is dominated by these unsightly structures. Nowadays the growing pressure on urban passenger transport systems has increased the demand for new and innovative solutions to increase its efficiency. With the Dyer corridor, Lincoln Tunnel and the Westside Highway forming bottlenecks at their access points, the congestion in Transitional Yards is so severe that traffic often simply comes to a standstill, not just during rush hour.

How can a bus terminal in NY Midtown meet the existing need and adapt to changes of new mobilities that may arise in the future? My graduation project ambition is to reorganize regional transportation in Transitional Yards to improve transport efficiency and cater for the future development of new mobilities. The final purpose of this design topic is to provide a possibility to the current and potential future problems in metropolitans as NYC: the mismatch of the infrastructure buildings' design and the new citywide mobility.

I try to review and synthesize the existing knowledge, the development of the transportation in NYC, and also explore more general issues about the existing situations or problems, even anticipate the future trends and create new design goals.

Transportation History in NYC

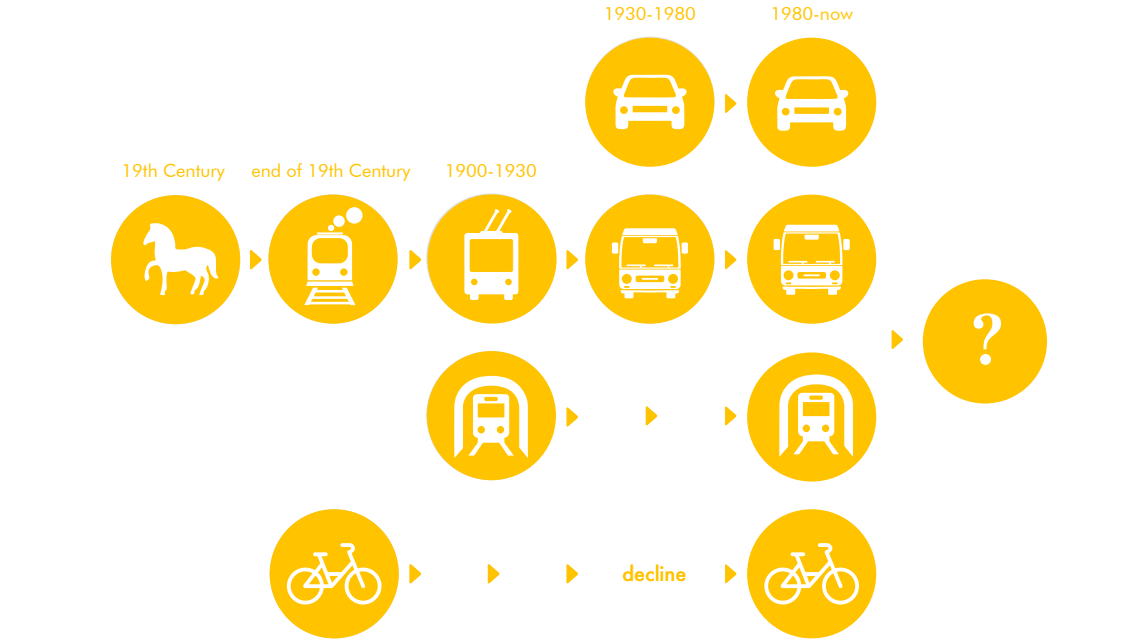
Before the 19th Century, the main mode of people's transport is horse-drawn carriage, which lasted for a hundred years until the steampunk era. At that time people had not yet established the awareness of building a terminal to centralize vehicles at the same place or making stopping point to improve efficiency. They just stopped anywhere passengers asked them to stop.

At the end of the 19th Century, steam-powered cable cars appeared. Before long, the already crowded streets of Manhattan were made more chaotic thanks to the horse-cars, cable cars, and subsequent elevated rail lines that began to define city living.

After 1904 the first subway line in NYC opened, establishing a terminal space became a requirement. That is when people start to design and build terminal buildings. A typical design was the Williamsburg Bridge Terminal built-in 1908, combining trolley terminal with a subway station, also constructed with balloon loops for turning around streetcars after they crossed over the Williamsburg Bridge to send them back to Brooklyn. Although streetcars are no longer the main way people travel over time, the terminal gradually abandoned in the mid-19th Century, the idea of building a comprehensive transportation center influenced the later infrastructure history.

Then with the rapid development of automotive technology, private automobiles boomed, motor buses and subway became the main public transportation. People are increasingly pursuing more convenient and efficient travel modes. In this case, the bus terminals become the main interchange point, such as Pennsylvania Greyhound Terminal and the largest Port Authority Bus Terminal.

Nowadays, private cars, subways, buses, and bikes become the main city-wide travel mode. Besides, there are new mobilities emerged and changed people's life. For-hire vehicles such as Uber and Lyft rapidly grew in the past 5 years, while the usage of the traditional taxi has decreased. Apart from FHV, New York Citi Bikes also started operating in 2013 and experienced rapid growth during the recent years. New mobility increased both challenges and opportunities for the design of infrastructure buildings.



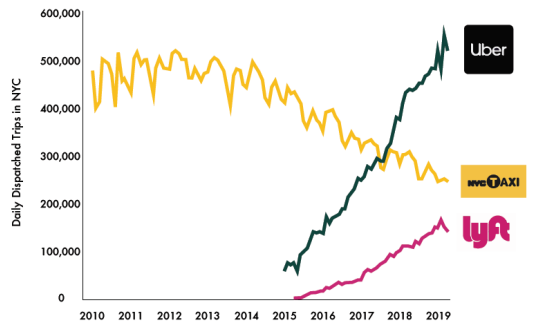
Evolution of mobility in NYC from 19th Century to now



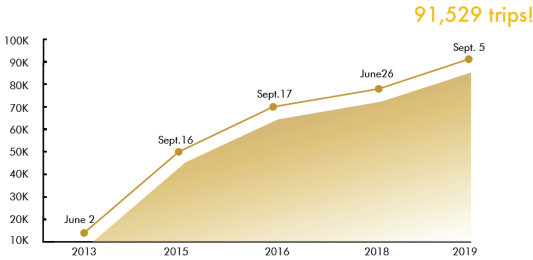
FHV's now make up nearly 30% of all traffic in Manhattan\*



Citibike bike sharing program in NYC\*



Taxis & FHV (for-hire vehicles) change from 2010-2019



CitiBike (NYC) Daily Ridership Record, 2019

History of Port Authority Bus Terminal

The Port Authority Bus Terminal is located in a very crucial area. In the east, it is next to the Times Square and Bryant Park, with the high-rises surrounding them form the central business district of Midtown, while in the west, it is not far from the super-large-scale new area like Hudson Yards and Javits Center. With such an important location, it should provide better services and make more convenience to the public. However, now the terrible situation of the bus terminal shows its prominent conflict with society. The city’s mobility is changing rapidly, but the typology the infrastructure building has been maintained for decades. This becomes a problem that architects need to care about.

The Port Authority Bus Terminal was opened in 1950, near the mouth of Lincoln Tunnel, greatly relieving traffic pressure from New Jersey. It is directly connected to the Lincoln Tunnel with the ramps from different levels and has a rooftop parking lot. These became its characteristics, which greatly improved transportation efficiency and mobility experience at that time. In 1979, it renovated and added another half block to enlarge its capacity. The façade is also changed into the fashion style at that time and remained until now. Actually, from the time it was built, the space usage of the terminal didn’t change much. The interior waiting area, the way people boarding on buses and even how they transfer to other inner-city transportation didn’t change much. Now the terminal carries about 8,000 bus trips with 225,000 passengers per day, but it remains the way how it worked 70 years ago. People say, “It’s a mid-20th century bus terminal trying to meet mid-21st century needs.” Problems accumulated over the years, although there are a lot of small renovation keep going in the building now, which means that Port Authority of NY and NJ has already taken some measures, there are still a lot problems that cannot be solved without reconstruction, including the ramp system which no longer adapted to the current environment. We should be aware of the seriousness of the problems and the necessity of summing them up and finding solutions.

Challenges of the Building

For the current Port Authority Bus Terminal, I summarized the following 3 challenges: operating beyond capacity, new mobility trends cannot be facilitated and technological development cannot be implemented.

Firstly, the bus volumes from New Jersey are over six times greater than other parts of the region and among all Trans-Hudson facilities, Lincoln Tunnel and PABT undertake nearly half of the transportation, so the infrastructure facilities reach their limits.

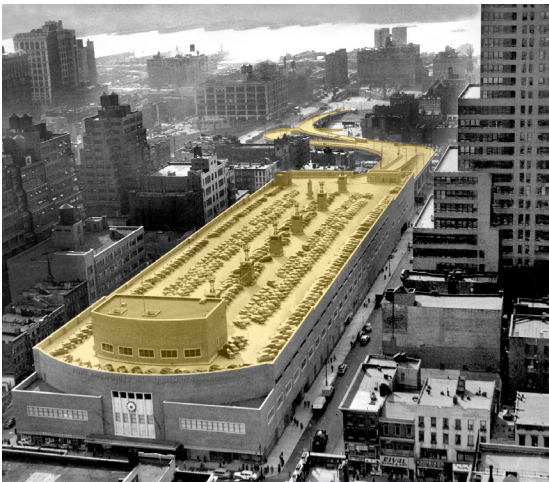
Secondly, the mobility trend has changed. For-hire vehicles such as Uber and Lyft rapidly grew in the past 5 years, while the usage of the traditional taxi has decreased. Now in Manhattan, FHV’s make up nearly 30% of all traffic. Comparing to other areas in NYC, Midtown also has the most proportion of Taxi and FHV which has already made up over half of the total vehicles in the site. Apart from FHV, New York Citi Bikes also started operating in 2013 and experienced rapid growth during the recent years. However, the present bus terminal doesn’t provide any suitable spaces for these vehicles. There is no transfer space inside the building for autos to pick up or drop off passengers. Not to mention e-bikes or other modes that may appear in the future.

Thirdly, technological development cannot be implemented. Some modern equipment such as online tickets, real-time information boards, turnstiles, and smart parking facilities still could not be found in the Port Authority Bus Terminal.

In the future, as mobility keeps changing, the situation will be more different. There is also a new concept of Mobility as a Service (MaaS), which means buying mobility services based on consumer’s needs instead of buying the vehicles. It will decrease the need to own a car and help the automobility system more sustainably. Now many companies are planning to carry out this notion into reality. Under this circumstance that is highly likely to happen in the future, there must be a new definition of transportation terminals.



Port Authority Bus Terminal is located in a very crucial area



Opened in 1950 with rooftop parking plots\*



Directly connected to Lincoln Tunnel with the ramps from different levels\*



Current Situation of the Bus Terminal

The building is in “L” shape, with the bus terminal in the bottom and the top 2 floors with the roof are parking areas. The function of the building is divided into 3 parts: bus terminal, parking, and support functions. Each part is facing different challenges.

For the bus terminal, first because of the few renovations, the gates look differently on different layers and wings, which always makes people confused. Congestion of people is also a problem, it even causes the accumulation of criminals and homeless people. What’s more, inappropriate functional distribution causes a waste of space. For example, they have overlarge ticket areas that are always empty. What we need to improve, is making a simple, clear and unified boarding way, larger area of circulation and public space and new functional distribution.

As for the rooftop parking, firstly, is the bus layover parking. There is no area in the building so they occupied a lot of parking space outside. Secondly is the ramp system. The long-circulated ramps occupy a lot of properties, which is a waste of public space. Thirdly, the drivers using the parking area in the building have no separate flow. They use the same elevator as other bus terminal passengers. Fourthly is the measure of dealing with the different density on weekdays and weekends. Finally, it is a super expensive parking fee. You have to pay 52 dollars for 24 hours. However, the still overcrowded parking area on weekdays means that the parking lots in this area are in high demand. Therefore, for the new terminal, we need to add a bus storage area, to consider demolishing the ramp system, to divide the flow of passengers and car drivers and to deal with the problem of the vacancy of parking on weekend.

For support functions, they have a bowling lounge, small art galleries, piano and stage in the entrance hall now. But these facilities are not in good use. Seldom people spend time and enjoy them. Apart from the inner space, there are really good views of both Hudson Yards and Times Square day and night on the top of the building, but the rooftop is only used as a parking lot now. It’s a waste of resources. And because the terminal is located in the business district, with a lot of white-collar workers passing by or taking buses home from here, but there is no place for them to relax such as cafeteria or music bar. The bus terminal didn’t do what a public building should do, to serve the public. Therefore, the new bus terminal needs to improve the quality of public space, add a rooftop viewing platform and add entertainment places for workers.

All of these problems are long-term issues left over by history and need to be well solved. Improving these as well as other points of (human) congestion at big transportation hubs will make Transitional Yards a lot more functional, enjoyable and livable.



Port Authority Bus Terminal from the Times Square side

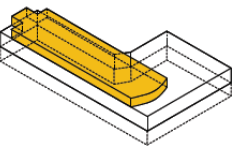


The waiting area and gates in the terminal

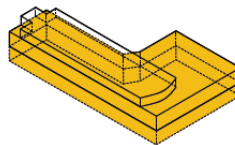


The rooftop parking on the north wing

Parking - 5F/6F/7F



Bus Terminal



4F



3F



2F



1F



-1F



-2F

Functions and axonometric plans of current PABT\*



Challenge: Bus gates’ congestion



Challenge: Inappropriate functional distribution (empty ticketing area)



Challenge: No parking lot for buses



Challenge: PABT is becoming the corridor of criminals\*



New Port Authority Bus Terminal

Manhattan Future Gateway

Design Brief

Redesign Competition

The unbalanced accessibility across the site, as well as the badly designed and outdated road infrastructure around Port Authority Bus Terminal, are both challenges that need to be addressed. Since the building has faced these challenges for a long time, the owner, Port Authority of NY & NJ already did something to change it. In 2016, they invited a number of teams to propose ideas for the replacement of the existing bus terminal. The International Design and Deliverability Competition challenged architects to reimagine the current terminal building, for the demands of modern-day ridership. Among the final 5 proposals, there is only one proposal remain in the current site. But it demolished all the infrastructure facilities above the ground and hide the whole bus terminal underground. The upper space was left for several high-rises. Another three proposals changed the location to the same site, just at the exit of the Lincoln Tunnel. They also have the same strategy that concentrating all the infrastructure facilities in the terminal and building new high-rises in the previous site. The last proposal was quite radical that it moved the bus terminal under the Javits Center by Hudson River.

According to the comments of the 5 proposals, some people love the idea of moving the terminal underground and think putting several towers on top would be a great way to utilize the space and finance the terminal. But some people hate most of the proposals because they tear down some self-owned buildings in the area. However, most people understand why they want to rebuild the terminal and even want to move the location, which makes sense to connect PA, Penn Station, Hudson Yards and Javits, and utilize the “no-man’s-land” between them.

In conclusion, we know that the ramp system really wastes urban space. It’s better to move it underground or in the building. Then the resource above the ground could be better used. That also means the movement of location might be a new opportunity for the new bus terminal.

Site analysis

The GFA of the current site is 140,000 sqm, a large site on the border of Theater District, Garment District and Clinton. These three districts are more well-developed than the dyer corridor, which is an area filled with ramps and open spaces next to the bus terminal. Actually, among all the properties owned by Port Authority of NY & NJ, only the site of PABT is occupied with building, others like Galvin and Dyer are still under development. According to the analysis before, the large spread of the massive ramp system on Dyer Avenue leaves a huge void in the urban fabric and makes the property of Port Authority a “no-man’s-land”. Therefore, if we connect the bus terminal and Lincoln Tunnel directly and confine the ramp system to a much smaller area, we could free more urban space, minimize the negative impact of tunnel traffic and improve the street network. Also, with more immediate and direct ramp access, buses will not traverse

or interact with the local network. Last but not least, the original land would have opportunities to build profitable high-rises.

The following site analysis will also support the idea of moving the location of the bus terminal.

1. After checking the max FAR of all the land owned by PANYNJ, we can find out the best usage of this land. The original terminal site is the only land having the largest commercial FAR, 15, while others are only 2, so it will make more profit if the current site transformed into high-rises.

2. According to mobility analysis, after the future development of Metro Line 7, there will be a new metro station next to the Dyer corridor. The future bus terminal could directly connect the terminal to the future Line 7 subway station at 41st street.

3. The new site is also in the center area of a large number of scattered parking lots and could concentrate all the public parking space.

4. After moving into the new site, the bus terminal will also become an important connection in our group strategy. It will connect the midtown business district and the new business district of Hudson Yards. On a larger scale, it will connect the Times Square area, Penn Station & Herald Square area, and Hudson Yards area.

Therefore, we need to reconsider the ramp system on the new site. The roads above the ground are to be demolished. They connect the current Bus Terminal and the Lincoln Tunnel directly. Buses and private vehicles are using different ramps to get to different layers. In the new bus terminal, these ramps could all be reorganized in the building. The ramps underground are going to be kept.

Then is the pedestrian connectivity. Most people come to the bus terminal by foot and subway, so the connection to the metro station and pedestrian way is important.

I made 12 massing models considering all the site analysis above. They are divided into 4 categories, cube, scattered bulk, centrally concentrated volume and buildings with base. Among these models, I come to some urban rules.

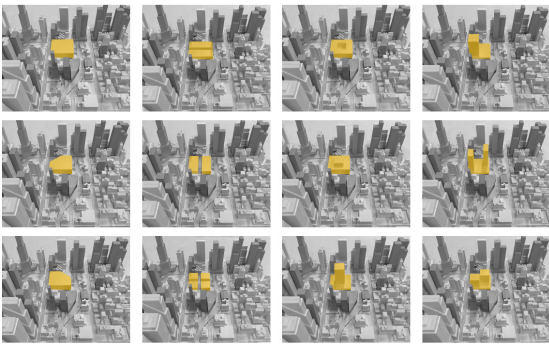
1. The building needs to react to the square on the northwest.
2. The building needs to make the city road in the middle passable.
3. The building is better centrally concentrated, probably with a courtyard.
4. There should be no tall towers on the site.



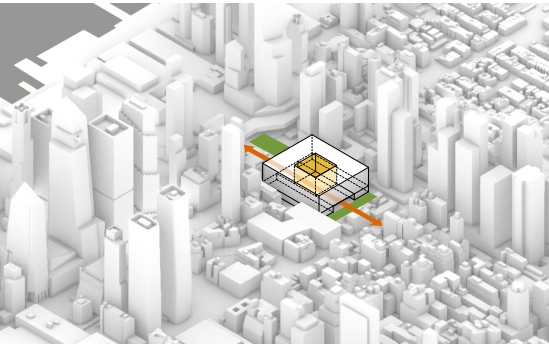
Challenge: In a larger scale, the new site will connect Times Square area, Penn Station & Herald Square area and Hudson Yards area districts



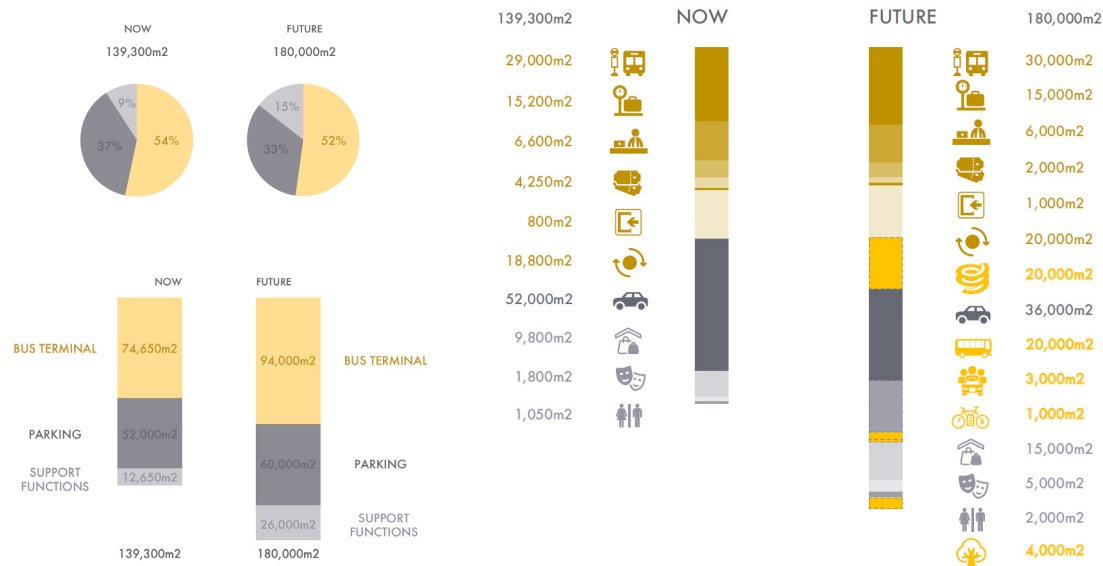
Ramps above the ground (grey) are to be demolished



Massing study according to site analysis



A possible massing model



Program comparison

## Program

For the program, I have 3 references.

First is the bus terminal design guideline. From here we know that circulation and pedestrian plaza is always a large proportion among the whole area. Increasing layover time leads to increased bus parking area requirements. From the functional requirement, we know the demand for bus bay, structure parking and amenities for both passengers and staff.

The second reference is the official documents form PA. It tells us the peak hour forecast of the bus terminal, the future mobility trend prediction and the requirement of the ramp system, etc.

The most important reference is the current PABT. The functions are divided into 3 parts, bus terminal, parking, and support functions. The bus terminal occupies the largest proportion, which is over 70,000 sqm large, including bus bay and gates, ticketing and offices, foyer and the circulation area. The parking area is over 50,000 sqm, only for rechargeable private vehicles' parking. The smallest part is the support functions, over 10,000 sqm, including retail and entertainment areas. The new functions I decide to add are ramp system connecting Lincoln Tunnel, bus storage area, sharing car parking area with charging points, e-bike parking area, and rooftop garden. Therefore, the future bus terminal will be around 180,000 sqm. The most added part is support functions.

## Design ambition

The future bus terminal will be an important connection point in the Hudson Yards area, not only as a transportation hub, but also a space providing public services for people. Therefore, it has to be an iconic and impressive architecture that could be recognizable in the business district.

For materials, because of its huge volume, the façade should not have a heavy look to reduce the visual impact on the city. Bricks, limestones or concrete would be better not used for the exterior finish layer. Glass, plastic, metal or other new lightweight materials would give the façade a lighter and modern characteristic. The color would also be better in white or other light colors.

As the college shows, the future bus terminal's exterior would be modern, green accessible and passible on the ground floor. The interior will be spacious with all the functions visible at any location. The circulation of bus bays, parking lots and retail areas should be well-organized and people can easily know where to go. And the rooftop with a garden would be open and lively, with a great view of the new business district, Hudson Yards and all the pedestrians could get onto the garden easily.

1. Joseph Brennan, "Williamsburg Bridge Railway terminal."
2. Anthony & Chris, "Vanished New York City Art Deco: The Pennsylvania & Capitol Greyhound Terminals."
3. Todd W. Schneider, "NYC Daily Trips: Yellow Taxi, Uber, Lyft."
4. DOT New York City, "New Daily Ridership Record! - 91,529"
5. OneNYC 2050, "Efficient Mobility."
6. Regional Plan Association, "Crossing the Hudson."
7. Patrick Lynch, "5 Teams Shortlisted for Redesign of New York City's Port Authority Bus Terminal."
8. SGArchitects, "Bus Terminal Design Guideline."
9. Port Authority of NY & NJ, "PABT Design Appendix A: The Emerging Design + Deliverability Brief."



Collages of the exterior, interior and rooftop