Torres Rojas, Genara FOI#12659

From: bkabak@gmail.com
Sent: Tuesday, October 04, 2011 9:38 AM
To: Duffy, Daniel
Cc: Torres Rojas, Genara; Van Duyne, Sheree
Subject: Freedom of Information Online Request Form

Information:

First Name: Benjamin
Last Name: Kabak
Company: Second Ave. Sagas
Mailing Address 1: 86 7th Ave. Apt. 2
Mailing Address 2:
City: Brooklyn
State: NY
Zip Code: 11217
Email Address: bkabak@gmail.com
Phone: 646-894-0980
Required copies of the records: Yes

List of specific record(s):
A current financial record displaying a cost breakdown of the elements of the new Calatrava-designed World Trade Center PATH terminal.

THE PORT AUTHORITY OF NY & NJ

Daniel D. Duffy
FOI Administrator

January 25, 2012

Mr. Benjamin Kabak
Second Avenue Sagas
86 7th Avenue, Apt. 2
Brooklyn, NJ 11217

Re: Freedom of Information Reference No. 12659

Dear Mr. Kabak:

This is a response to your October 4, 2011 request, which has been processed under the Port Authority's Freedom of Information Policy for the current cost breakdown for the new Calatrava-designed at the World Trade Center PATH Terminal.

Material responsive to your request and available under the Policy, which consists of 72 pages, will be forwarded to your attention upon receipt of a photocopying fee of $18 (25¢ per page). Payment should be made in cash, certified check, company check or money order payable to "The Port Authority of New York & New Jersey" and should be sent to my attention at 225 Park Avenue South, 17th Floor, New York, NY 10003.

Please refer to the above FOI reference number in any future correspondence relating to your request.

Sincerely,

Daniel D. Duffy
FOI Administrator

Enclosure

225 Park Avenue South
New York, , NY 10003
T: 212 435 3642 F: 212 435 7555

DOWNTOWN RESTORATION PROGRAM – WORLD TRADE CENTER (WTC) TRANSPORTATION HUB PROJECT – PROJECT RE-AUTHORIZATION – WTC COMMERCIAL INFRASTRUCTURE – PROJECT AUTHORIZATION

It was recommended that the Board: (1) re-authorize the project to design and construct the World Trade Center Transportation Hub (WTC Hub), at an estimated total project cost of $3.44 billion, inclusive of payments to contractors and consultants, allowances for extra work, insurance, engineering, project contingency, financial expense and other project costs; and (2) authorize a project for commercial infrastructure at the World Trade Center (WTC) site, at an estimated total project cost of $151 million.

In June 2008, at the request of the Governor of New York, staff conducted an assessment of the rebuilding effort at the WTC site that covered all facets of the WTC Redevelopment Program and included input from multiple WTC site stakeholders. In October 2008, the Port Authority issued a post-assessment report, entitled *World Trade Center Report: A Roadmap Forward*, which provided a revised forecast for the WTC Hub Project, at an estimated total project cost of $3.26 billion, and called for revisions to the project scope, including streamlining the Oculus design, a deck-over solution for the PATH Hall roof (which prioritizes completion of the Memorial Plaza by September 11, 2011), and top-down construction of Greenwich Street/#1 subway line station, to permanently underpin the box enclosing the New York City Transit #1 subway line lying directly below.

To accommodate the recent increase in costs, primarily associated with various WTC Hub Project trade contracts, including those for mechanical, electrical and plumbing work and Oculus steel, which exceeded budget, and the Owners Controlled Insurance Program, project re-authorization was requested, at an increase of $180 million over the presently authorized project amount.

In addition, authorization was requested for a project, at an estimated total cost of $151 million, for commercial infrastructure, including such items as Tower 2 and 3 workarounds, including installation of street-level temporary ventilation and emergency power facilities which would be relocated later in Towers 2 and 3, respectively, being performed by various projects. Other project items would include East Bathtub excavation and acceleration to meet commitments to Silverstein Properties, Inc., which are part of the WTC Site – Eastside Development Plan authorized by the Board at its meeting of August 26, 2010.

Pursuant to the foregoing report, the following resolution was adopted with Commissioners Bauer, Coscia, Grayson, Holmes, Moerdler, Pocino, Sartor, Silverman and Steiner voting in favor; none against; Commissioner Samson recused:

RESOLVED, that a project to design and construct the World Trade Center Transportation Hub, at an estimated total cost of $3.44 billion, be and it hereby is re-authorized; and it is further

RESOLVED, that a project for certain commercial infrastructure at the World Trade Center site, at an estimated total project cost of $151 million, be and it hereby is authorized; and it is further

RESOLVED, that the Executive Director be and he hereby is authorized, for and on behalf of the Port Authority, to take action with respect to construction contracts, contracts for professional and advisory services and such other contracts and agreements as may be necessary to effectuate the foregoing projects, pursuant to authority granted in the By-Laws or other resolution adopted by the Board; and it is further

RESOLVED, that the form of all contracts and agreements in connection with the foregoing projects shall be subject to the approval of General Counsel or his authorized representative.

World Trade Center Report:

A Roadmap Forward

October 2, 2008

THE PORT AUTHORITY OF NY & NJ

TABLE OF CONTENTS

I. Letter from Chris Ward, Executive Director, Port Authority of NY & NJ

II. Schedules and Budgets

III. 15 Issues Resolved

IV. Moving Forward

V. Graphics

INTRODUCTION

October 2, 2008

The Honorable David A. Paterson
Governor of the State of New York
State Capitol
Albany, New York 12224

Dear Governor Paterson:

It has been three months since we first reported on the status of rebuilding at the World Trade Center site. At the time, the rebuilding effort stood at a crossroads. If we were to achieve a fully rebuilt site on an acceptable schedule within an acceptable budget, a new way of doing business was required: a set of aggressive yet realistic schedules and budgets; intermediate milestones to which the public could hold us accountable; resolutions to fundamental issues that had gone unresolved for too long; and, an efficient, inclusive decision-making structure to coordinate this incredibly complex program.

Today, I believe we have each of these essential elements in place. While we still face many challenges ahead, we believe we have created a level of certainty and control over this project that has been missing since its inception. With the major issues resolved, this effort can finally be managed like a construction project – a complex construction project unlike any other in the world, but a construction project nonetheless. That is the kind of certainty that you and the Port Authority's Board of Commissioners have demanded and that the public deserves.

Three months ago, our June assessment defined four central questions that, candidly, we could not answer with confidence: what we were building; who was building it; when it would be built; and for how much. Our June assessment then outlined 15 issues that had to be resolved before we could answer these questions with certainty. In the last three months, at your direction, and together with the Port Authority Board of Commissioners and our project partners, we have undertaken an intensive effort to resolve.

In order to bring coherence to this complex set of issues, we needed a functional governance model to address them. So we established a World Trade Center (WTC) Steering Committee with representatives from the key WTC stakeholders: the Port Authority of New York and New Jersey and its Board of Commissioners (Port Authority); the Federal Transit Administration (FTA); the City of New York; the National September 11 Memorial & Museum (Memorial Foundation); Silverstein Properties, Inc. (SPI); the Metropolitan Transportation Authority (MTA); the New York State Department of Transportation (NYSDOT); and the Lower Manhattan Development Corporation (LMDC).

Three main principles guided this effort:

First and foremost, to get the rebuilding program to a level of certainty and control so that schedules and budgets reflect the construction reality on the ground instead of politically- or emotionally-driven promises.

Second, to approach this effort with the same clear-eyed perspective that produced our initial assessment – to put all options on the table, to question previous assumptions and to be honest about what we can and cannot do.

Third, the absolute necessity to make tough but practical decisions to drive this program forward.

The efforts of the past three months have produced the following results, which are critical to getting this rebuilding program on track:

1. **A simplified design of the World Trade Center Transportation Hub that retains architect Santiago Calatrava's iconic vision and, at the same time, delivers schedule and cost savings, increased transportation capacity, reduced construction risk and reliable delivery of other projects on the WTC site.**

   Working with architect Santiago Calatrava, the Downtown Design Partnership and the Steering Committee, we have developed a range of design approaches that will significantly simplify the construction of the World Trade Center Transportation Hub (Transportation Hub or Hub) (see "15 Issues Resolved" for a full description of the redesign). Through the strategic placement of columns and other conventional elements, we have been able to save time and money and reduce risk. Importantly, we have been able to do all of this while retaining the core Calatrava design, which will significantly increase transportation capacity downtown and make this Transportation Hub one of the world's great public spaces. Plus, we have been able to do this without forcing a massive redesign process that could have delayed the project even further. Because of this certainty, we will begin to procure Hub steel as early as next month.

2. **A construction solution that will allow the Memorial to open on the tenth anniversary of the September 11th attacks.**

   Over the past three months, we have developed a construction solution – a deckover approach – that literally builds the roof of the Hub's PATH Mezzanine first, which will serve as the floor of the Memorial Plaza. By building the roof first, we have prioritized the completion of the Memorial and decoupled its construction from the Hub's platform work below, thereby ensuring the Memorial Plaza's completion by September 11, 2011.

3. **A strategy to construct Greenwich Street – the front door for Towers 2, 3 and 4 and a key access point to the Memorial – years before we anticipated in our June assessment.**

   This strategy consists of several resolutions described in detail later in the report, the main one being a new, more efficient approach to the permanent underpinning of the MTA's #1 subway line, which must be completed before Greenwich Street is built on top of it.

4. **A series of agreements that will give the Port Authority greater control over delivery of the Vehicle Security Center, which will serve as a key access point to all of the commercial development on the WTC site.**

   These agreements include: settling a seven-year old land claim that delayed the VSC's construction; acquiring full control over the VSC's design, procurement and construction based on the FTA's tentative agreement, subject to your requesting such action, to reallocate federal funding from the VSC to the Hub, thus removing a layer of federal requirements off of the project; and a police and security agreement with the City of New York for the World Trade Center area that will give greater certainty over how the VSC will interact with the rest of the site's security plan.

These main results were made possible by resolving all 15 fundamental issues that had gone unresolved prior to our June assessment. (All 15 resolutions are described in detail in the "15 Issues Resolved" chapter.) As a result, we can now say with certainty what we're building, who's building it, when it will be built and for how much. That is not to say there won't be challenges ahead or new obstacles to overcome, but we have come a very long way since June.

As our initial assessment put plainly, to forecast completion dates and costs before these fundamental issues had been resolved would only create a new set of unrealistic commitments and expectations. But because of these resolutions, we can now present with confidence schedules and budgets with interim milestones so the public can track our progress and hold the Port Authority and our project partners accountable.

I realize these new schedules and budgets will be met with a degree of skepticism. After all, schedules and budgets have been released before. But it's important to understand that these schedules and budgets are markedly different from past ones. Here's why:

First, they reflect the construction realities on the ground that had not been fully understood until now, given the infancy and complexity of the project.

Second, they reflect a level of built-in risk – through the application of what is called a "probabilistic analysis" or risk analysis – that had not been applied to past schedules. (This concept is explained later in the "Schedules and Budgets" chapter of the report.)

Third, they include interim milestones so the public can hold us accountable. This is critical. I cannot promise that we will meet every single milestone every step of the way; after all, this is the most complex construction program in the region's history and some setbacks are inevitable. But what I can promise is that we will have full transparency. Now, when we miss a milestone, we will not only let the public know – we will tell them why we missed it and how we plan to fix the problem.

Completion Dates	Target Date	Probabilistic Date	Budget Estimate
Transportation Hub	4Q 2013	2Q 2014	$3.2 billion
Memorial*			
Interim Plaza Turnover (80% deck complete)	4Q 2010	1Q 2011	
Complete Plaza Turnover (100% deck complete)	3Q 2011	4Q 2011	
Museum Completion	1Q 2013	2Q 2013	
One World Trade Center, Freedom Tower	2Q 2013	4Q 2013	$3.1 billion
Greenwich Street	2Q 2012	4Q 2012	$281 million**
Vehicle Security Center	1Q 2012	3Q 2012	$633 million

* Memorial Foundation is in control of this budget

** The budget for Greenwich Street is part of the Hub's overall $3.2 billion budget.

As you can see from our revised schedules and budgets, no panaceas emerged over the last three months. As I said in our initial assessment, "there should be no illusion that future mitigation efforts will dramatically scale back schedule and cost to the point of meeting those dates and costs originally projected, which, as this report makes clear, are not realistic."

Sure enough, we found no rewind button that could take us back in time or reverse the trajectory of the last seven years. With projects already underway, billions of dollars already committed and foundations already built, it is impossible and impractical to turn back the clock and reimagine the World Trade Center landscape in radically different terms.

But what we did find were creative, innovative and practical solutions to major unresolved issues, creating a clear path toward meeting key milestones – like the tenth anniversary of the September 11th attacks and others critical to the commercial viability of the site – that we did not have before. Substantial progress toward those key milestones is already underway:

In just the last three months since our June assessment, we have begun erecting steel for the Memorial; nearly completed bidding out the contracts for One World Trade Center, The Freedom Tower; installed all 47 steel arches that form the underground East-West passageway for the Transportation Hub; and have all but finished the excavation for Towers 2, 3 and 4. This is important progress that we must build on.

Moreover, in addition to making permanent a centralized decision-making structure – the WTC Steering Committee – which has proven critical over the past three months, this report also recommends the establishment of a new Office of Program Logistics to be housed in the Port Authority – a command and control structure to efficiently manage the enormously complex construction logistics on and around the 16-acre WTC site.

The residents and business of Lower Manhattan are understandably frustrated. They live and work in a 24/7 construction zone and we must do a better job of communicating with them. But the fact is, as this report makes clear, the current construction activity at the World Trade Center site pales in comparison to what the site will look like over the next five years. Thus, it is essential that we have a

mechanism in place – this new Office of Program Logistics – to communicate regularly and openly with the residents, businesses and public officials of Lower Manhattan, and work together to mitigate what will inevitably be necessary inconveniences due to the reality of how much we are building in such a small, congested area of the City.

Finally, while much progress has been made, this remains an enormously difficult undertaking. While this report will bring far greater certainty than we had before, it has not solved every problem. From a construction and logistics perspective; from a community coordination perspective; and, combined with a rapidly deteriorating economy, from a real estate market perspective, the years ahead will undoubtedly bring a new series of challenges. But, as I hope this report shows, we will confront these challenges with the same urgency, candor and pragmatism that we have brought to this process to date.

I want to personally thank the Port Authority Board of Commissioners and all of our project partners for their efforts over the past three months. This was not an easy process. There were few easy conversations and even fewer easy choices. But each partner exhibited a level of leadership, cooperation and patience without which we could not have gotten this far.

Most importantly, I want to thank the Port Authority staff, and all of our project partners' staffs, for working around the clock to resolve these issues in an environment that offers constant demands and little relief. There is an enormous amount of work reflected in the pages that follow, and it is because of this work that we can stand behind our conclusions with confidence.

With this new level of certainty and control, and with our continued commitment to be open, honest and accountable, I am confident that we can deliver on the promise of a rebuilt World Trade Center and a renewed Lower Manhattan.

Sincerely,

Chris Ward
Executive Director
Port Authority of New York & New Jersey

Cc: Governor Jon Corzine
Anthony R. Coscia, Chairman, Port Authority of NY & NJ
Henry R. Silverman, Vice-Chairman, Port Authority of NY & NJ
Port Authority Board of Commissioners
Mayor Michael Bloomberg
Assembly Speaker Sheldon Silver
Senate Majority Leader Dean Skelos
Assembly Minority Leader James Tedisco
Senate Minority Leader Malcolm Smith
Council Speaker Christine Quinn
Council Member Alan Gerson
Manhattan Borough President Scott Stringer
Senator Charles Schumer
Senator Hillary Clinton
Congressman Jerrold Nadler

Schedules and Budgets

Listed below are the updated schedules and budgets for each of the major public projects on the World Trade Center site. We have also included a brief narrative to give these numbers some context.

Each schedule includes a completion date, and, perhaps most important, interim milestones so the public can track our progress and hold us accountable. This is a new element of the Port Authority's published schedules and one we believe is critical. This way, the public will know if we've missed a key milestone and, most importantly for the management of the project, why we missed it so we can fix the problem.

We have also built in risk to the schedules for the Transportation Hub, the Memorial and Greenwich Street. This too is a new element of the Port Authority's published schedules and one we believe is just as critical. We recognize that projects this complex inevitably involve risk and, while we believe we can meet our target dates, the risk-ranging process (one that the FTA and LMCCC have done in the past) will allow us both to manage public expectations and pinpoint where the most significant risks lie so we can develop a risk mitigation plan to address them.

Here's how the process worked:

Our scheduling team, working with engineering and construction experts and, most importantly, our contractors charged with executing the design in the field, first developed a set of "target schedules" that our architects, engineers and contractors all agreed could be achieved with careful management and oversight. These target schedules were developed after detailed planning sessions to determine a logical sequence of activities each with assigned construction durations based on industry-standard productivity rates, as well as factoring in our experience to date with the WTC site and all of its logistical constraints. In the past, our scheduling process would have stopped here. But we wanted greater certainty, so we took the process to the next level.

Once we had these target schedules, our team engaged in a series of risk workshops. During these sessions, risks from minimum to maximum and most-likely duration were assigned to each activity that made up the program's overall schedule, taking into consideration the best- and worst-case scenarios for the design, material fabrication, construction and logistical risks of each activity.

A computer simulation then took these combinations and "built" the project 10,000 different times, randomly assigning these risked durations to each activity within the best- and worst-case scenarios to generate the probabilistic schedules we have today.

What's more is that, in the process, the computer simulation created a risk profile for each project, pinpointing the areas of the rebuilding program that contain the greatest risk, so we can use our time most efficiently to develop a risk mitigation plan to address them.

Schedules and Budgets Summary (see Graphic 1 for individual milestones)

Completion Dates	Target Date	Probabilistic Date	Budget Estimate
Transportation Hub	4Q 2013	2Q 2014	$3.2 billion
Memorial*			
Interim Plaza Turnover (80% deck complete)	4Q 2010	1Q 2011	
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Vehicle Security Center	1Q 2012	3Q 2012	$633 million

* Memorial Foundation is in control of this budget

** The budget for Greenwich Street is part of the Hub's overall $3.2 billion budget.

In addition to meeting these schedule deadlines and milestones, this report acknowledges the reality that the costs of all of these projects have increased. We take seriously our responsibility for getting all of these projects complete and want to leave no doubt that, working with our project partners, the funding will be identified to meet this commitment and see these projects through.

Before explaining the cost and schedule increases specific to each project, it's important to note that all of these projects are experiencing intense upward pressure from soaring construction and commodity prices independent of factors under our direct control.

Driven by increasing costs for essential building materials, crude oil and a weakened dollar, U.S. construction prices have skyrocketed since 2003, when the World Trade Center Master Plan was conceived. These factors, along with a limited supply of contractors in New York City, have driven the cost of construction to unprecedented heights.

From 2004 to 2007, construction costs in New York City rose 1% per month, a rate that is expected to continue through the rest of the decade. To put this in perspective, presently high-rise office building construction cost in New York City exceeds $400 per square foot (psf) exclusive of soft costs, land costs and developer profits, compared to a $230 psf average price in 2003.

Commodity prices for steel, concrete and other essential building materials have been among the major contributors to the price escalation. For example, the Associated General Contractors Construction Inflation Alert issued in March 2008 reported that steel mill prices have increased 63% between 2003 and 2007. As diesel fuel prices are closely linked to steel prices, recent increases in the price of oil have driven the five year price increase of steel to 150% in the first half of 2008.

Schedules and Budgets Explained

WTC Transportation Hub

The cost of the Transportation Hub has increased substantially since the last estimate of $2.5 billion. Construction and commodity price escalations are partially to blame, as was the lack of a complete design up until now. But it's also clear that the original cost estimate was too low to begin with if we were to achieve our project goals. If you consider how much value this money is buying, it begins to put the cost in perspective. Consider what this project must accomplish:

- When complete, the 800,000 square foot Transportation Hub will serve 250,000 people and more than 200,000 commuters per day. Far more than "simply a PATH station," it will be a Grand Central Station for Lower Manhattan – the third-largest transportation hub in New York City – and serve commuters via the subway, PATH, and ferries from two states and all five boroughs;
- Even before completing the permanent Hub, two different temporary PATH stations must be built and deconstructed at a cost of more than $400 million, almost $100 million of which is included in the project's overall budget;
- $75 million extra for the loss of Hub construction productivity and additional construction for the deck directly attributable to delivering the Memorial Plaza on September 11, 2011;
- $591 million worth of security infrastructure and hardening, given that the Hub and the WTC retail space are the only facilities on site that are completely accessible to the public;
- $281 million to build a permanent support structure ("underpinning") for the #1 subway line;
- To increase transportation capacity for future regional growth consistent with the scope in the FTA's grant of $2.2 billion, construction of three extended 10-car platforms in addition to a brand new platform that will increase capacity from three platforms to four (previous platforms accommodated only 8-cars), and five tracks that are fully ADA-compliant;
- Approximately 500,000 square feet of first-class retail and restaurant space to help revitalize the Lower Manhattan economy (larger than the retail contained in the Time Warner Center), representing the largest concentration of new retail space developed in New York in decades; and,
- The most integrated network of underground pedestrian connections in all of New York City (all served by world-class retail space), which will seamlessly link PATH service, 13 different subway lines and the Battery Park City Ferry Terminal, as well as other locations on and around the WTC site, including the WTC Memorial, Towers 1, 2, 3 and 4, and the World Financial Center (WFC). Specifically, connections will be built:
  - From the Lower Concourse, connections will be available to PATH trains to Newark, Hoboken, and Journal Square; northbound and southbound R/W lines; northbound and southbound 1 line; and the MTA's Fulton Street Transit Center, allowing separate connections to the 4/5, J/M/Z, A/C, and 2/3 lines.
  - From the Upper Concourse, direct connections will be available to the southbound R/W line, the northbound 1 line, the E, A/C, and 2/3 lines, and the MTA's Fulton Street Transit Center, allowing separate connections to the 4/5, J/M/Z, A/C. and 2/3 lines.

- North/South Connections: Sub-grade pedestrian connectors will extend north from the Transit Hall to provide access to Vesey Street, a separate connection to the E, A/C, and 2/3 lines and Tower 2. Sub-grade pedestrian connectors will extend south from the Transit Hall to provide access to Cortlandt Way, the corner of Liberty and Church Streets, separate connections to the southbound R/W and northbound #1 lines, and Towers 3 and 4.
- East/West Connections: The east-west pedestrian corridor will offer a safer, faster and traffic-free way to and from work for those who travel via the 2/3, 4/5, and J/M/Z subway lines to Fulton Street and then head for destinations west of Broadway. From the west end of the concourse extending from the Transit Hall, direct access will be provided to One World Trade Center, The Freedom Tower and other components of the WTC complex, and continuing west to the World Financial Center and Battery Park City. For PATH commuters working at the WFC or in Battery Park City, this connector will eliminate the current need to double back along Vesey Street or Liberty Street.

Still, given the scope and expense of this project, it's worth spending some time on a question some people have reasonably asked: why build such a station in the first place? Why not simply scrap the current design and make the current temporary PATH station permanent?

These are fair questions to ask, so we took a hard look at what this would really mean. It turns out that it is not as simple or easy as it sounds. In fact, while it may be a less-expensive, short-term answer to the challenges on the site, it is an impractical and risky long-term solution. Here's why we decided not to go that route:

- Would buy us only a fraction of what was listed above;
- Would not increase transportation capacity – the next generation infrastructure – necessary for anticipated regional growth (e.g., could not accommodate new 10-car PATH trains – current station can handle only 8-car trains, which are becoming functionally obsolete; could also not accommodate an additional platform, which will allow us to expand platform capacity from three platforms to four.
- Significant changes to the scope of the Terminal would be inconsistent with the $2.2 billion in Federal Transit Administration funding;
- Would squander a significant portion of the $1.35 billion in investment that has already been spent on construction of the Hub;
- Would not meet desired life cycle and performance requirements over the next several decades and would result in increased repairs, replacement, and maintenance costs, as well as service disruptions (e.g., the existing station platforms, designed as part of the original 1970's construction, were never designed for the next fifty years, much less the next hundred). Thus, had the attacks on September 11, 2001 never happened, the Port Authority still would have had to rebuild the train station;
- Would not include approximately 500,000 square feet of prime retail and restaurant space to help revitalize the economy and quality of life of Lower Manhattan;
- The existing station must be rebuilt anyway because it sits on the northern end of where Greenwich Street will be built and is on the future site of the Performing Arts Center, as well as

on one of the entrances to the Vehicle Security Center. Other features that the current station conflicts with include: Hub emergency egress; #1 subway street access/egress; #1 subway platform; Retail space; Car parking space; Street Utilities; 20" water main and hydrant; 16" high pressure gas main; 12" storm sewer and manhole; PAC back of house space; Access road serving One World Trade Center, The Freedom Tower;

- Would have to revise the Environmental Impact Statement, which could take more than a year to complete;
- Would not meet updated security, life-safety and regulatory requirements; and,
- Would require a complete redesign of all mechanical, electric and plumbing systems (MEP), including all fan plants, outside air intake/exhaust shafts, air distribution, piping, etc. This would require significant coordination with adjacent stakeholders – a process that has been ongoing already for two-plus years to reach the final design now on the table.

Thus, in the end, the choice was clear. We now have a redesign that considerably simplifies the original design, one our builders know how to build, one that delivers priority projects within acceptable timeframes, one that fulfills the goal of significantly increasing transportation capacity, and one that creates certainty going forward given that we have a completed design and can go to the market for steel as early as next month.

National September 11 Memorial & Museum

As discussed later in the report, we have made significant changes to the rebuilding program to ensure that the Memorial is open on the tenth anniversary of September 11, 2001. This is a significant difference from our June assessment, which showed the Memorial Plaza completion in 2013 or 2014, and it is a credit to the Port Authority staff, the Memorial Foundation, the City of New York and all of our project partners who worked intensively over the past three months to pull this date back.

To give the public some perspective, we have attached a rendering of what the Memorial will look like when every last piece is in place, including the two waterfalls, the parapets, the 500-plus trees, the Museum Visitor's Center, etc (see Graphic 2). While the Port Authority can commit to much of this picture, and will continue to work closely with the Memorial Foundation and the City of New York to get even more, given that the area will continue to be a construction site, parts of the final Memorial fit-out, such as the landscaping, as well as the Museum Visitor's Center, will not be fully complete and will be phased in over time.

Given the importance of this date, we have included several milestones below so the public understands what to expect.

The first milestone – 4th Quarter 2010 – is an interim turnover of what amounts to approximately 80% of the Memorial Plaza floor. This date is important because it will allow continued construction on the two signature waterfalls that fill the voids left by the Twin Towers, as well as the parapets where the names will be inscribed of those killed at the World Trade Center on September 11, 2001 and February 26, 1993. As of this interim date, construction work will continue in the Northeast corner of the Memorial Plaza, which makes up the remaining 20%.

The second milestone – 3rd Quarter 2011 (before 9/11/11) – marks the turnover of the complete floor of the Memorial Plaza – when 100% of the plaza floor will be complete. At this point, we will have completed 100% of the Memorial Plaza's floor, the two signature waterfalls, the parapets where the names will be inscribed, some landscaping and the early-stage structure of the Museum Visitor's Center – though some of these commitments are dependent on certain deliverables from the Memorial Foundation. Given the importance of this milestone, subject to Board approval, the Port Authority will make a financial commitment to meet it.

While we have come a very long way since our June assessment, it should be noted that, even though the Memorial will open on September 11, 2011, the WTC site will still be a construction site. In fact, construction work on the overall program will be peaking during the second half of 2011. The largest office tower in the country will be under construction less than 50 feet from the north end of the Memorial, as will three other major office buildings, the Vehicle Security Center, and the below- and above-grade work on the third-largest transportation hub in the City.

As a result, we must work closely with the Memorial Foundation, the City of New York and the other stakeholders to develop an operations strategy to ensure safe, controlled access to the Memorial after September 11, 2011, when construction will still be ongoing.

One World Trade Center, The Freedom Tower

One World Trade Center, The Freedom Tower was originally budgeted at $2.9 billion when the Port Authority took over the project from Silverstein Properties in November 2006. Despite substantial construction and commodity price escalation since that time (price escalation specifically on mechanical, engineering and plumbing trades have increased 25% in the last two years – representing approximately $93 million of the increase), the Port Authority now estimates that the project will be completed for $3.1 billion, within 7% of our original budget estimate.

The project's original completion date of fourth Quarter 2012 has been pushed back until 2nd Quarter 2013 due to the ongoing complexity of building on the site of an active railroad system, PATH, that requires certain below-grade foundation be completed only during track shutdowns, as well as certain scope changes (MEP system adjustments, security enhancements and program modifications).

Greenwich Street

One of the real success stories of the last three months was the development of a strategy to address three projects along the Greenwich Street Corridor that are critical to delivering Greenwich Street – the front door for Towers 2, 3 and 4 and a key access point to the Memorial – while at the same time preserving the important program space located below the subway line.

As explained later in the report, millions of dollars and several years will be saved on the construction of Greenwich Street as a result of this new strategy.

Vehicular Security Center and Tour Bus Parking Facility (VSC)

The VSC's original 2005 budget was $478 million. However, this budget reflected a project with a significantly reduced scope than the one we are building today. For example, the original budget did not include the build-out necessary to take on the capacity for cars. Nor did it include the common infrastructure connections for electrical power and air conditioning or the increased hardening, and columns and structural spans added to the roadway configuration to meet increased security standards, which are now part of the current design. With these scope changes, as well as with construction and commodity price escalation factored in, the current budget estimate of the VSC is $633 million.

The original schedule for the VSC set in 2005 envisioned project completion in the first Quarter of 2011. Because of the increased scope discussed above, the previously-unresolved land claim issue with St. Nicholas Greek Orthodox Church, and the lack of a security agreement with the City of New York – all issues that are now resolved – the completion date has been pushed back to 1st Quarter 2012.

15 Issues Resolved

As we stated in June, an examination of the overall World Trade Center rebuilding program made clear that project schedules and budgets were significantly out of line with earlier projections. There were many reasons for this. Five in particular stuck out:

First, the original schedules and budgets were unrealistic to begin with. Had the rebuilding program gone without a hitch, those dates and costs could never have been met because they were established at a time before the construction reality on the ground was fully understood and before the designs of most of the projects were completed.

Second, the uniquely complex engineering and constructability challenges throughout the 16-acre WTC site (see Graphic 3, 4, and 5 to orient you to the site map). The WTC rebuilding program attempts to fit within the size of just a few city blocks:

- Five major skyscrapers, which will house Class A office space comparable to all of downtown Atlanta;
- One of the world's most significant memorials and museums;
- The third-largest transportation hub in New York City;
- A world-class retail venue serving all of Lower Manhattan;
- A major performing arts center;
- A state-of-the-art vehicle security center;
- Two brand-new city streets (Greenwich and Fulton) and two brand-new pedestrian ways (Cortlandt and Dey); and,
- All of the critical infrastructure to support these projects (chiller plant, utility and communication networks, etc).

And all of this is happening within the confines of a transportation corridor that moves 150,000 commuters a day through an active construction site via the MTA #1 subway line, which literally cuts through the center of the site, and the WTC PATH trains, which run beneath the site.

Add to this challenge the fact that there are 19 public agencies, two private developers, 101 different contractors and sub-contractors and 33 different designers, architects and consulting firms all in charge of one element of the project or another, and you have a construction challenge that is as complex as any in the world.

Third, beyond the unprecedented size and complexity of the program, what has become increasingly apparent in the two years, since the major phase of rebuilding commenced, is that nearly all components of the WTC program are interdependent (see Graphic 6 for an illustration of the interdependencies of the Transportation Hub project). Put another way, it is not as if each project is being built in a vacuum or on an isolated "Greenfield" site; rather, the reality is more akin to a game of pick-up sticks, where if you move one stick, it is nearly impossible not to move all of the others. As a result, delays and challenges associated with any one project whose design and construction, in some cases, may reside with stakeholders other than the Port Authority, can have ripple effects on all other projects, further complicating construction.

Fourth, the significant cost escalations in commodity and construction prices. As the Bureau of Labor Statistics reports, the construction material price index has increased over 30% from December 2003, when the conceptual planning phase of the program was ongoing.

But perhaps the most critical observation from our June assessment, because it informs how this project will be managed going forward, and is something directly within our control (as opposed to the price of steel), was the fact that certain key issues that are fundamental drivers of schedules and budgets still needed to be resolved for the project to move forward. These 15 key issues provided the roadmap for getting the rebuilding effort on track.

Immediately following the release of the June assessment, the World Trade Center Steering Committee organized the list of unresolved issues into logical categories. Then, Working Groups consisting of representatives from each of the Steering Committee members were established to focus on each issue – both to fully understand the problem and to define a set of options to solve them. Working groups targeted key areas of the rebuilding program, including: Transportation Hub Design Alternatives; the Greenwich Street Corridor; the Vehicle Security Center; and the Memorial. In addition, an internal Port Authority group was established to focus on Contracting Performance and Efficiencies.

Three main principles guided these groups:

First and foremost, to get the rebuilding program to a level of certainty and control so that schedules and budgets reflect the construction reality on the ground instead of politically- or emotionally-driven promises.

Second, to approach this effort with the same clear-eyed perspective that produced our initial assessment – to put all options on the table, to question previous assumptions and to be honest about what we can and cannot do.

Third, the absolute necessity to make tough but practical decisions to drive this program forward.

Supporting each Working Group, in addition to staff from the Port Authority construction and engineering departments, were teams of construction, engineering and scheduling professionals from a variety of world-class firms, including Parsons Brinkerhoff, URS, Turner Construction and The LiRo Group, as well as from the construction contractors on the WTC site, including Phoenix Constructors (the joint venture of Skanska, Fluor, Granite Construction Inc., and Bovis Lend Lease), which is building the Transportation Hub; Tishman Construction, which is the construction manager for One World Trade Center, The Freedom Tower, Towers 3 and 4; Turner Construction, the construction manager for Tower 2; and Westfield, the Port Authority's designated retail developer. Our team of experts helped analyze each project for schedule, cost and risk, and were critical to developing and validating the resolutions throughout this report.

What follows is an explanation of how we resolved each of the 15 previously unresolved issues. For each issue, we describe what needed to be resolved and why, and the resolution that was reached.

15 ISSUES RESOLVED

15 Issues

Transportation Hub Design

- World Trade Center Transportation Hub Design Alternatives
- Final Design/Engineering on the NE Corner of the Memorial Quadrant

Greenwich Corridor

- Construction of a Permanent Underpinning for the MTA's #1 Subway Line
- Temporary PATH Station Reconfiguration
- Cortlandt Street Subway Station – Design and Schedule Issues

Vehicle Security Center

- Construction Sequencing and Funding of the Vehicular Security Center
- St. Nicholas Greek Orthodox Church – Land Rights Claim
- 130 Liberty Street Abatement and Demolition
- World Trade Center Police and Security Plans

Contracting Performance and Efficiencies

- Contracting Strategy for the World Trade Center Transit Hub
- Procurement and Contracting Inefficiencies
- Owner/Builder Management Coordination for Memorial and Museum

Other Significant Issues [1] [2]

- Route 9A/West Side Highway Staging and Funding
- Below-Grade Engineering at the Performing Arts Center Site
- Site Logistics

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[1] These issues were not explicitly raised in our June assessment, but was added after further analysis revealed challenges that needed to be addressed.

[2] In our June assessment, one of the 15 issues identified was the "Potential Redesign of Tower 3 to Accommodate Merrill Lynch Lease Requirements." At the time of the June assessment, discussions were ongoing with Silverstein Properties Inc. and Merrill Lynch to secure Merrill Lynch as the tenant for 3 World Trade Center. The potential tenant lease would have required redesign of some elements of the building, including sub-grade areas that impact the WTC Transportation Hub, retail elements, VSC and shared infrastructure. In July, Merrill Lynch informed the Port Authority and Silverstein Properties Inc. that it was no longer planning to move out of its current locations at the World Financial Center. At that time, any need to redesign Tower 3 ceased.

1

World Trade Center Transportation Hub Design Alternatives

Context

Designed to serve approximately 250,000 people per day, the World Trade Center Transportation Hub is one of the most important projects on the 16-acre WTC site. It will significantly expand transportation capacity – as the City's third-largest transportation hub – and, together with WTC retail space, will serve as an anchor for the economic revitalization and quality of life of Lower Manhattan.

In addition, perhaps no other project interfaces more with every other project on the site than the Transportation Hub (see Graphic 6). Think of it as the spoke of a wheel. As a result, in order to gain certainty and control over schedules and budgets for every other project, we had to gain greater certainty and control over this project.

To do that, the Port Authority decided to make changes to the design with the following goals in mind:

1. *Reduce construction risk through simplification:* The original design for the Transportation Hub by architect Santiago Calatrava and the Downtown Design Partnership of STV and DMJM+Harris offered an iconic and highly functional structure that would instantly stand alongside the great train halls of the world. The start-from-scratch moment following the attacks on September 11, 2001 provided a once-in-a-century opportunity to significantly increase transportation capacity while simultaneously building a great public work in Lower Manhattan as opposed to something like the current Penn Station.

   However, with that iconic design came construction and engineering complexity that increased schedule, cost and constructability risk. Any redesign alternative considered had to simplify construction – primarily around the support for the arched roof of the PATH Mezzanine, which, unlike conventional structures, relied on very long cantilevered Vierendeel trusses[3] anchored at either end, rather than on traditional columns placed at intervals along the span.

2. *Increase transportation benefits:* At its core, besides the retail components and significant public space, the Transportation Hub is just that: a critical transportation center that will connect two different states and all five boroughs of New York City. After bringing together PATH and the MTA, we agreed that any redesign must enhance the transportation benefits of the Hub.

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[3]A Vieriendeel Truss is a frame truss named after the Belgian engineer Arthur Vierendeel. It is an atypical type truss in that it does not contain any triangulated, diagonal members. Contrary to a conventional truss structure, whose members are designed to resist tension and compression only, members of a Vierendeel Truss are subject to bending as well as axial compression and axial tension. This frame action is accomplished through rigid nodal connections, as opposed pinned connections which permit the connected members to rotate in relation to each other. Vierendeel trusses are less efficient than conventional trusses, and are typically used where diagonal members would disrupt the functional space of an area. In this case, the Architect has chosen a Vierendeel truss for aesthetic reasons rather than functional reasons.

3. *Improve project delivery of the Memorial, Greenwich Street and WTC Retail Space:* Because of the complexity of the original design and the means and methods of construction, legitimate questions were raised as to the impact on schedules of other projects on the 16-acre site, most particularly the Memorial Plaza, the northeast corner of which sits effectively on the roof of the Hub's PATH Mezzanine. The longer it takes to build the Hub's roof, the longer it takes to build the Memorial Plaza. Another concern was the impact on the construction of Greenwich Street, which will serve as the front door of Towers 2, 3 and 4. Any redesign had to speed up the delivery dates of both projects. Finally, the synergistic relationship between the Transportation Hub and WTC retail space had to be maintained. Any delay in the completion of the Hub would delay the opening of the retail space, which provides much-needed services to the individuals who work, live and visit Lower Manhattan.

4. *Build now:* Besides the complexity of design, more than anything else, this project has suffered from a lack of decision-making and certainty. Uncertainty is expensive – both in terms of hard dollars given the explosion of construction and commodity prices, and in terms of schedule with the risk associated with a design process that never ends. Whatever combination of redesign approaches were chosen, we needed to be in a position to quickly go from the drawing board to the construction site.

Analysis

To meet these four goals, the Port Authority and Steering Committee developed and analyzed a number of alternative approaches, including:

- A variety of different methods to reduce construction risk at the primary point of complexity: the very long-span (150 foot) arched roof structure that was originally supposed to be supported by two Vierendeel Trusses and a complex bearing system supported by the North-South shear walls and super columns to the East. The primary method of simplification examined were dropping columns and plate girders to help support the arched roof structure conventionally instead of more unconventionally through Vierendeel Trusses;
- Introducing bolted connections instead of fracture-critical welded connections, which would simplify constructability given that a bolted connection is much easier and faster to install;
- Deckover approaches to "build the roof first," which would require decking over the western portion of the Hub – the PATH Mezzanine – in order to deliver the Memorial Plaza sooner;
- Reuse of the current "temporary" PATH platforms, columns and mezzanine, making them "permanent" instead of rebuilding them;
- Simplify the above-grade Oculus in a variety of ways;
- Numerous different methods of construction phasing to improve project delivery;
- Various scenarios of outages to the PATH system and the #1 Subway Line;
- Redesigns to more centrally locate the subway entrances;
- Different methods of supporting the #1 Line where the Hub corridor passes under it (e.g., using trusses, arches and/or columns); and,
- Scrap the current design altogether and start over.

Resolution

- Design simplified, while retaining iconic vision
- The use of columns and other conventional elements saves time, money and reduces risk associated with constructability and schedule
- Deckover solution delivers Memorial Plaza for 9/11/11
- Improves transportation benefits
- Design process is complete (3,700 drawings have been completed) – can finally just build.

After considering numerous alternative approaches, Santiago Calatrava and the DDP team incorporated a combination of many components discussed above – the main ones being: (1) simplification and conventional design elements; (2) deckover solution (i.e., "build the roof first"); and, (3) transportation improvements. The following description summarizes each component:

Simplification and Conventional Design Elements (see Graphic 7)

Columns in PATH Mezzanine

The redesign replaces both Vierendeel Trusses on either side of the Mezzanine with two standard steel plate girders spanning East to West and supported by 4 columns in strategic locations where construction and engineering risk was greatest, thus providing additional support to the roof structure (see Graphic 8). The benefits of this change are substantial:

- Introduces new, conventional supports to roof structure, thus eliminating substantial risk associated with the original design, which depended on more complex Vierendeel Trusses;
- Both plate girders are fully bolted (conventional connections) with no field welds (more unconventional connections) associated with the Vierendeel Trusses, thereby eliminating the fracture-critical welds;
- Reduces steel tonnage by 1,500 tons or 15%;
- Makes fabrication and erection easier because the pieces of the roof are smaller and more conventional, given that they no longer have to span the full length of the structure and can be supported separately by columns;
- Eliminates a significant step in the original construction sequence for the installation of the Memorial Plaza trees because the columns create independent support elements for the roof, which previously relied on the interaction of the concrete and steel to create the same support, saving time;
- Reduces risk associated with the engineering of the shoring towers because the number of towers will be reduced, making it a more conventional build;
- Provides greater flexibility and reduces the need for tower cranes, allowing for greater mobility for laborers and equipment, thus simplifying construction;
- Reduces the number of PATH track outages because the support structures are smaller and can be fabricated and installed more rapidly;

- Reduces cambering and fit challenges during construction because the roof is now on a permanent, rigid support structure as opposed to a roof constructed on temporary shoring which required "jacking down" (i.e., lowering) the structure after all roof elements, including the Memorial planters, were installed in the original design – thus saving significant amounts of time;
- Enables the existing PATH roof to remain in place while constructing the new Mezzanine roof, which reduces construction risk and allows for the protection of the public without having to construct a special shield; and,
- Changed from marble to stone flooring.

Simplified Structural Support for #1 Subway Line

- Replaces original support structure of #1 line box from a completely-welded truss to a bolted tied-arch construction with far fewer weld points (eliminates 70% of welding on #1 line support structure – from 1,400 ft of welds to 400 ft) (see Graphic 9);
- Replaces welding connections with bolted connections in concealed locations in both East and West Bathtubs;
- Accommodates MTA's NYS Building Code compliance as basis of design to eliminate the need to construct an extra ventilation structure over #1 line box, saving time and money (see Graphic 10); and,
- Incorporates the permanent underpinning approach to the #1 subway line, which is explained later in the "15 Issues Resolved" section.

Oculus Roof Simplification *(see Graphic 11)*

- Roof wings no longer open and close (see Graphic 12)
- Cuts back length of wings on Tower 3 side
- Reduces number of purlins from 5 to 1 (purlins are the structural connections between wing elements)

Deckover Solution

Before this redesign effort, the original design called for the Transportation Hub to be constructed from the bottom up, with the roof being completed in stages and the final roof closure toward the end of the platform construction process instead of the at beginning. The main reason was to allow the contractor access from above to feed the construction site. This staged completion meant that the roof and platform construction would be completed together. Unfortunately, this meant that the Memorial Plaza would not have been completed until some time in 2013.

To solve this problem, the deckover approach incorporated into the new design means that we will build the roof first, thus prioritizing the completion of the Memorial Plaza and decoupling the station platform work below (see Graphic 13). This construction solution is made possible, in part, by the new permanent columns that are being utilized to support the roof structure instead of temporary shoring towers, therefore reducing the waiting time previously required to lower the roof. The

permanent columns, in conjunction with the new plate girder supports, have been strategically placed to allow for roof concrete and planter construction to begin immediately upon installation of the station arches.

As a result, our Hub contractor will utilize two main points of access for construction: (1) from the West, from Fulton Street through East-West Connector; (2) from the East, from Church Street over temporary bridge structure to complete this work. Additionally, alternate access for the completion of the platforms and station below will now be done through deck openings on the North side of Fulton Street and scheduled deliveries of equipment and materials via work trains from PATH yards in New Jersey.

In addition, the redesign incorporates a new construction phasing approach that will erect the Hub from West to East instead of East to West, again in an effort to prioritize the Memorial Plaza and get Greenwich Street up and running sooner.

It is worth noting that the deckover solution will cost the Port Authority $75 million extra for the loss of Hub construction productivity and additional construction for the deck directly attributable to the prioritization of the delivery of the Memorial Plaza on September 11, 2011.

Transportation Improvements

The redesign also changes the entrance positions for the #1 Line and the R and W lines – from locations that were on the side of the Transit Hall and less prominently exposed to the public, to central locations within the Hall, making it easier and faster for commuters to get to and from the subways (see Graphics 14 and 15). The redesign also increases the size of the fare collection zone to make it more convenient for commuters.

2

Final Design/Engineering on the NE Corner of Memorial Quadrant

Context

Because the roof of the Hub's PATH Mezzanine serves as the floor of the Memorial Plaza, coordination between the two designs is essential. However, the Memorial Foundation and Port Authority had been negotiating for months over the final design details of each and could not reach agreement on the number of trees that could be accommodated on the northeast corner of the Memorial quadrant. While this may sound like a relatively trivial design element in the scheme of things, given that each tree – with the tree itself, soil and planter – weighs 150 tons, that means that approximately 7,500 tons (50-60 trees to be placed on the NE corner of the Plaza) had to be factored into the design of the Hub's roof support – approximately the equivalent weight of 180 fully loaded tractor trailers or half the weight of the Brooklyn bridge. The delay in reaching an agreement has compounded delays on the final design of the Transportation Hub.

Resolution

On July 16, 2008, the Port Authority, the Memorial Foundation and the Mayor's Office of City Planning agreed to a final plan to place additional trees on the NE Quadrant. The design of the Transportation Hub and the roof design above the PATH mezzanine have been modified to accommodate this agreement. As a result, combined with the redesign decisions discussed in the previous section, all critical-path elements of the Hub design have been finalized – adding certainty to schedules and budgets.

3

Construction of a Permanent Underpinning for the MTA's #1 Subway Line

Context

Next to the final design of the Transportation Hub, the projects within the Greenwich Corridor represented the other major opportunity to control schedule and cost overruns.

We looked at a series of issues relating to the projects that directly influence the schedule and cost escalations of the construction of Greenwich Street, which include: (1) the permanent underpinning of the MTA's #1 subway line, which sits directly beneath the future Greenwich Street; (2) the reconfiguration of the Temporary PATH Station, which is located directly in the path where the northern portion of Greenwich Street will eventually be located; (3) the design and construction of the Cortlandt Street Subway Station, which will eventually be the station that accesses the #1 line beneath the future Greenwich Street. (Graphic 16 identifies each project within the Greenwich Corridor.)

This section deals with the resolution reached on the permanent underpinning of the MTA's #1 subway line. By "underpinning," we mean the structural support for the subway that divides the East and West portions of the site. That subway, thanks to the remarkable efforts of the MTA, was up and running less than a year after the attacks on September 11, 2001. In fact, for the first time in history, a train structure unparalleled in length – over 1,000 feet long – is being suspended in the air by steel columns that then transfer the loads to the underpinning system. What's more is that the "box" that the subway moves through cannot be allowed to move more than two inches under the weight of the passing subway cars.

However, this support was designed to be temporary. Ultimately, the Port Authority must construct a permanent underpinning to support the full weight of the subway and Greenwich Street above it.

Because of an overly-complex design, the original cost estimate for the permanent underpinning was $325 million and was to be completed in September 2014, which meant Greenwich Street could not be completed until as late as 2015 or 2016. That would have impacted the overall operation of the WTC site, as well as, Towers 2, 3 and 4, which all face Greenwich Street.

Options

The Greenwich Corridor Working Group developed and validated four options that would have demonstrable benefits to schedule, budget and project delivery. The four alternatives are summarized below:

1. **Up/Down, Save the Subway Box**

The intent of this option is to provide a permanent structure for the box utilizing a caisson installation and structural invert slab that allows for refurbishment of the box and completion of Greenwich Street while simultaneously excavating and installing program space beneath the subway box structure.

Primary construction activities include:

- Drill caissons
- Construct invert structure
- Transfer load
- Enlarge the box
- Simultaneously begin excavation and install utilities, streets and sidewalks

This alternative would require up to three months of service shutdown of the #1 line during installation of the caissons. The overall construction cost of this option is estimated at $381 million. This alternative would deliver a completed by Greenwich street by second Quarter, 2012.

2. **Up/Down, Cut the Subway Box**

The intent of this option is the complete demolition and reconstruction of the subway box. While reconstructing the subway, the construction methodology allows for simultaneous construction of structural support and program space beneath the box.

Primary construction activities include:

- Demolish the subway box
- Drill caissons
- Insert invert structure
- Construct expanded subway box
- Simultaneously begin excavation and install utilities, streets and sidewalks

The overall construction cost of this option is estimated at $361 million, but would require a three year shutdown of the #1 line, an impact estimated to cost the MTA about $30 million per year in additional operating costs. This approach would deliver a completed Greenwich St. in mid-2012.

3. **Top-Down Construction Methodology, incorporating existing temporary support into permanent support structure** (see Graphic 17)

The intent of this option is to incorporate the existing mini-piles into the temporary and permanent structure, building each successive level from the underside of the box downward.

Primary construction activities include:

- Install the top level of bracing and structure
- Install the invert structure
- Add walls
- Partially excavate level
- Pour partial wall
- Complete excavation
- Pour structural slab
- Complete walls
- Repeat three times
- Transfer load
- Enlarge the box
- Install utilities, streets and sidewalks

This alternative proved to be the least expensive of the four approaches (total cost approximately $281 million), and would deliver a completed Greenwich St. in 4th Quarter 2012 (unlike the schedule estimates of the other three options, this schedule was risked and this date represents the probabilistic date). This alternative does not require the extensive service disruption needed for Option 2 and would not require the loss of program space described in Option 4.

4. **Bury the subway box, remove the program space underneath**

The intent of this option is to suspend excavation under the subway box, and replan the program space, limiting any further construction under the box and beginning a backfill operation.

Primary construction activities include:

- Construct temporary or permanent walls to contain refilled earth
- Install tension tie-rods
- Fill in earth below subway box
- Transfer load
- Begin box construction
- Install utilities, streets and sidewalk

This alternative would cost approximately $370 million (significantly more than Alternative 3) and would also force the relocation of 165,000 square feet of program space currently designed beneath the permanent #1 Line Box. This space, to be used for retail, bus and car parking and other facilities, could not be completely relocated within the overall WTC space. This alternative would deliver a completed Greenwich St. by mid-2011.

It's important to note that these figures incorporate the resolutions that are reflected in the following issues relating to the Temporary PATH Station and Cortlandt St. Station.

Resolution

When compared to the existing baseline design, all of the options identified will significantly improve schedule. However, as indicated above Option #3, the Top-Down Construction, presents the greatest cost savings, and nearly the greatest schedule savings, while significantly reducing the number of subway outages and other negative impacts that will be necessary to complete construction. The ability of our Greenwich Corridor Working Group to develop a more efficient construction approach to the #1 Line Underpinning has been a major accomplishment of the WTC Assessment process.

Going forward, logistics between the Greenwich Corridor projects and other projects directly adjacent remain a critical issue to the viability of any option and must be managed.

PATH and #1 Line Outages

It is important to make clear that all of this construction will necessitate future outages to the #1 line, terminating at Chamber Street station. In order to speed up construction, these outages would be necessary under any of the options we looked at. Currently, we are working closely with the MTA to devise an outage strategy for six weeks during the summer of 2010, with some potential outages as necessary in 2009. These outages will be used strategically to complete the work supporting the (1) #1 line permanent underpinning; (2) the MTA Cortlandt St. Station; and, (3) the construction of the Hub passageway between the Path Mezzanine and the Oculus Hall.

Is also is important to make clear that the WTC PATH line will be impacted by weekend closures starting during the summer of 2009 and continuing approximately forty out of fifty-two weeks of the year for approximately three years. These weekend closures are necessary for the construction of the Hub and, under any scenario, would have had to be effectuated at some point to take full advantage of schedule savings on the overall rebuilding program.

The Port Authority will work closely with the MTA and PATH to mitigate the impact of the service interruptions on riders.

4

Temporary PATH Station Reconfiguration

Context

One of the most significant challenges with getting Greenwich Street up and running – which will serve as the front door to Towers 2, 3 and 4, as well as an access point to the Memorial – is the fact that the existing temporary PATH station is located directly where the northern portion of Greenwich Street will eventually be located (see Graphic 16).

The Temporary PATH station is currently the only means of entering and exiting the PATH World Trade Center station. This is the second location for the temporary station. The first was opened in November 2003, restoring PATH service to the Lower Manhattan. That station is now being demolished. The current temporary station opened in March 2008.

The Port Authority built the Temporary PATH station in its current location because, under previous schedules, the station would be torn down long before Greenwich Street was supposed to be built. Why? Because the permanent Transportation Hub was supposed to have already been built and fully operational by then, thus rendering the temporary station unnecessary. As we now know, the projected completion date for the Transportation Hub is later than the original date for the planned take-down of the temporary PATH station and the completion date for Greenwich Street.

Other critical issues related to the timing of the Temporary PATH station reconfiguration or removal include that it also blocks: construction of the #1 Line underpinning; the Cortlandt Street station reconstruction; installation of the primary water main servicing the site; and the below-grade roadway that eventually will connect the loading docks for One World Trade Center, The Freedom Tower, WTC retail space and the Performing Arts Center to the main VSC below-grade roadway.

Resolution

As a result of the original assessment, and the work of the past three months, this challenge will be successfully addressed by reconfiguring the current temporary station.

Port Authority engineers and construction professionals, working closely with the Greenwich Corridor Working Group, are developing several options for reconfiguring the temporary station in time to get out of the critical path of the construction of Greenwich Street. As such, all the good work that has been done to speed up the permanent underpinning of the #1 subway line, and thus the construction of Greenwich Street, will not be wasted. We will also continue to refine our methods to allow One World Trade Center, The Freedom Tower to begin operations as soon as the office building receives its certificate of occupancy.

5

Cortlandt Street Subway Station – Design and Schedule Issues

Context

The MTA is planning to rebuild the Cortlandt Street station, but there are design and construction issues that first needed to be coordinated and agreed upon between the MTA and the Port Authority. The issues to be resolved include, among others: (1) a variety of complex and time- and cost-intensive construction measures to meet regulatory National Fire Prevention Association (NFPA) 130 standards; (2) an agreement between the MTA and Port Authority on design and construction responsibilities so that the MTA station design concept can be incorporated in the #1 Line support strategy and a final design can be completed for the structure to grade.

Without resolution of these two issues, a day-for-day schedule loss is anticipated going forward and the interim Greenwich Street completion date will be compromised for the tenth anniversary of September 11, 2001.

Resolution

The Port Authority and MTA have reached resolutions on both issues:

First, the MTA Cortlandt Street Station reconstruction will be redesigned to comply with NYS Building Code requirements including emergency egress and fire protection, in lieu of NFPA130 (all of the MTA stations currently follow the NYS Building Code requirements). Six months and approximately $60 million in savings can be attributed to this one change, mainly due to the fact that the roof on the subway box does not have to be deconstructed and then built all over again to accommodate mechanical requirements. (see Graphic 10).

Second, the Port Authority and the MTA are working on an MOU under which the MTA will pay the Port Authority to reconstruct the Cortlandt Street Station as part of its overall Hub construction contract. Given the extent of construction coordination required between the Hub and Cortlandt Street station projects, it makes more sense for one contractor to combine these efforts – improving construction efficiency and reducing schedule and budget risks.

6

Construction Sequencing and Funding of the Vehicle Security Center

Context

The World Trade Center Vehicle Security Center and Tour Bus Parking Facility (VSC) will provide as part of the comprehensive WTC area police and security plan for screening of buses, trucks, and cars entering the WTC site and its facilities (see Graphic 18).

Importantly, during the rebuilding phase, the VSC will serve as the critical passageway for the delivery of construction fit-out material to the commercial towers, retail space, Memorial Museum, and other facilities. That is why it is critical that the VSC gets built as soon as possible. Otherwise, it could delay other projects on the site.

Resolution

Over the past three months, as described in the next several sections, we have taken several important steps to reducing schedule and cost overruns and gaining greater certainty and control of the VSC project. This particular section focuses on two of those steps:

First, we will begin accelerating certain portions of the VSC work that can facilitate certain aspects of the Memorial Plaza's completion. The construction of the southeastern portion of the VSC substructure is necessary to enable the Memorial Plaza to be completed in a timely manner. Additionally, construction of the VSC interior footings and foundations can be added to the existing South Bathtub Perimeter Wall contract to allow certain concurrent construction activities. This allows the Southeast section by Liberty and Greenwich streets – assuming 130 Liberty Street is demolished in time – to be completed sooner, which, in turn, allows access to the Memorial. Port Authority engineers will continue to examine ways to accelerate VSC construction where possible.

Second, the FTA has agreed in principle to cancel its VSC grant to the Port Authority and thru a grant amendment reallocate the unspent funds, roughly $450 million, to the WTC Transportation Hub, subject to the Governor's request for such action. This reallocation of funds will help speed up the VSC schedule by eliminating the Federal review process with respect to this project and by giving the Port Authority greater control and flexibility over design, procurement and construction as the comprehensive WTC area police and security plan is developed with the City of New York.

7

St. Nicholas Greek Orthodox Church – Land Rights Claim

Context

St. Nicholas Greek Orthodox Church (Church) was destroyed during the attacks on September 11, 2001. The World Trade Center Master Plan, approved in 2005 after several years of public discussion, calls for the land on which the structure once stood to be part of the VSC, which serves the entire WTC site. The Church agreed to accept land a short distance to the east, on the same block, for the construction of their new Church. However, the Church and the Port Authority needed to negotiate a compensation package to effectuate this concept and allow the Church to rebuild. Otherwise, the issue would have continued to delay the VSC. Negotiations had been ongoing on for some time, but no resolution could be reached

Without this property, the Port Authority could not proceed with the construction of the VSC, which not only increases the direct timeline and cost of the VSC, but affects those facilities like Towers 1, 2, 3 and 4 and the Memorial and Museum that depend on the VSC being open in time to service those facilities.

Resolution

The Port Authority and St. Nicholas Greek Orthodox Church have reached an agreement that will allow the 92-year-old church to be rebuilt near its former Cedar Street location – allowing for the VSC, a vital artery that will serve nearly every facility on the site, to begin construction immediately. This agreement on one of the linchpin issues for the site brings to a successful conclusion months of negotiations.

Under the agreement, the Church agreed to convey property at 155 Cedar Street -- where the church was located before it was destroyed on 9/11 – to the LMDC. LMDC, in turn, will transfer a portion of the parcel at 130 Liberty Street to the Church for its new building. LMDC will then transfer property at 155 Cedar Street, 140 Liberty Street and a portion of 130 Liberty Street to the Port Authority for construction of the South Bathtub, which will house the VSC.

The Church will receive up to $20 million to offset direct costs for the rebuilt church, including $10 million from the Port Authority to mitigate the impact on the cost of building the church over the VSC, and $10 million from a third party as part of a future development agreement for the Tower 5 site. The Port Authority will provide up to an additional $20 million to build the infrastructure needed to support the church on top of the VSC and for interim access and temporary use of the Church's property until the transfers take place.

As a result of resolution of this property issue and the elimination of federal funding involvement, the Port Authority was able to move forward with the award of the construction contract for building the slurry wall and basement area for the entire VSC complex, a major milestone in the VSC's construction.

8

130 Liberty Street Abatement and Demolition

Context

The former Deutsche Bank building at 130 Liberty Street was damaged in the attacks of September 11, 2001 and stood empty and idle for years after the attacks while Deutsche Bank and its insurers wrangled over its fate. After an arbitration process presided over by former Senator George Mitchell, the LMDC stepped in to acquire the building and decontaminate and deconstruct it in order to advance the progress of rebuilding. Because of those delays and the year-long process of obtaining regulatory approval of the original Deconstruction and Implementation plans for the project, the decontamination and deconstruction of the building did not begin until late 2006.

The former Deutsche Bank building at 130 Liberty Street must be demolished as part of the excavation of the "South Bathtub" of the WTC site, for the future VSC, Tower 5 and St. Nicholas Greek Orthodox Church. This bathtub system is to be constructed using "slurry walls." Unfortunately, the abatement and demolition have incurred significant delays.

Resolution

For over a year, LMDC/LMCCC, the Port Authority, City DOT, State DOT and Silverstein Properties have been meeting to coordinate the plans for the VSC, and the attendant slurry walls, as well as to address and coordinate other issues necessary to allow the Port Authority to begin construction on the slurry walls and to accommodate the site needs of the Port Authority contractor Cruz/Nicholson. These efforts have included re-alignment of the sidewalk protection, additional supports at Liberty Park for the Liberty Street Bridge, and the identification and leasing of property that will allow the removal of trailers and other construction equipment off the 130 Liberty Street side to accommodate the mobilization of the Port Authority contractors.

Although plans for the VSC are not yet complete, the plans for the slurry wall intended to allow for the future design and construction of the VSC would not change and call for portions of the slurry wall to be built in areas now occupied by the remaining structure of the Deutsche Bank building. Accordingly, the deconstruction of 130 Liberty Street must be coordinated with the schedule for the construction of the slurry walls. The Port Authority has already awarded the slurry wall contract and the contractor is expected to reach the portion of the site under 130 Liberty Street next summer – around the time the 130 Liberty Street building will be completely demolished.

LMDC's current schedule indicates that decontamination of the Deutsche Bank building will be completed during January 2009, and that deconstruction will be complete by August 2009. The 130 Liberty Street project is being run using a CPM Schedule and Risk Analysis.

There are approximately 450 abatement and other workers in the building each day over the course of three shifts, 24 hours a day, six days a week, and those numbers should increase to more than 500 a day over the next few weeks. Since abatement recommenced this spring, these workers have cleaned (and Federal, City and State regulators have cleared) floors 14 through 19. Floors 12 and 13 are expected to be cleared by next week and floor 10 and 11 by the end of this month.

There are three phases remaining to reach completion:

1. *Completion of decontamination:* Each floor must be completely demolished, all demolished debris such as carpet tile, sheetrock, ceiling tile, etc., treated as asbestos containing material and removed in "containment". This means that the entire acre floor must be enclosed with an air tight plastic barrier, negative air pressure maintained within the floor, worker access to the floor limited to a shower and air lock system, and all workers on the floor, as well as supervisors, inspectors, etc., wear hazardous material suits with full face respirators at all times. It takes approximately one month of work to demolish and remove the materials from the floor and then another month to clean the steel and concrete floors of all fireproofing and other debris. After this is done, a group of regulators examines the floor and must sign off before it is cleared.

2. *Facade of the building and internal stairways:* After the floors are cleaned, the facade of the building must be removed and the interior stairways that were required to be installed and rebuilt after the August 2007 fire, must be cleaned and removed. This work is expected to be completed several weeks after abatement.

3. *Demolition/deconstruction:* The deconstruction and decontamination of the building is subject to the regulatory oversight of numerous federal, City and State regulatory agencies, and the plan governing the deconstruction must be approved by these regulatory agencies. The final Deconstruction Plan and Contractor's Implementation Plan is currently in development. The Deconstruction Plan specifies Code, regulatory, City Department of Building and other requirements for the deconstruction of the building and then the contractor describes its means and methods to accomplishing the work in the Implementation Plan. Since the abatement and deconstruction of the building have been decoupled, and the building will be entirely clean prior to deconstruction, the latter phase of the work is expected to proceed under more routine demolition protocols. As noted above, the work is expected to be complete by August 2009.

9

World Trade Center Police and Security Plans

Context

Before a comprehensive security plan could be developed and implemented at the World Trade Center site and the surrounding area, the City of New York and the Port Authority had to reach agreement on jurisdictional questions for policing the site, taking into account the new City streets that will traverse the site itself, and the security needs of the office, retail, public transportation, Memorial & Museum, and cultural facilities, as they fit into the overall WTC area. Because the plan will have impacts throughout the site and the surrounding area, it was important that an agreement be reached as soon as possible in order to complete the implementation of nearly every project at the site. Unfortunately, agreement could not be reached after months of negotiation.

Resolution

In July, after many months of negotiation, the City of New York and the Port Authority entered into a Memorandum of Understanding envisioning that the Port Authority Police Department (PAPD) and New York City Police Department (NYPD) will jointly police and secure the World Trade Center area. To provide for seamless law enforcement activities, this agreement creates a framework for the PAPD and NYPD to work together, fostering a security environment that is coordinated, cooperative and certain, and one that ensures a vibrant 24/7 community in Lower Manhattan.

The agreement provides a clear delineation of responsibility. The City will form a dedicated police and security unit (WTC Unit) for the World Trade Center Area on a schedule to be established by the NYPD as part of a security plan for the World Trade Center Area to be developed by NYPD, with the concurrence of the Port Authority (the Security Plan). The Security Plan will also provide for the WTC Unit's management of the security operations control center and oversight of security operations, personnel and technologies, including screening procedures and vehicular access, at the World Trade Center, as well as the interface with the Port Authority with respect to the Port Authority's law enforcement and security activities at the World Trade Center, to be implemented through a Port Authority World Trade Center Command Center at the site.

The Port Authority will have primary responsibility for all law enforcement and security activities at the World Trade Center Transportation Hub, will exercise command and control over Port Authority police personnel at the World Trade Center Transportation Hub, will participate in and conduct police and security operations with respect to all office towers, and memorial and cultural facilities at the World Trade Center in accordance with the Security Plan, and will directly or through its tenants be responsible for, and bear the costs of, the installation and maintenance of all security equipment at the World Trade Center.

15 ISSUES RESOLVED

As part of the agreement, the Port Authority and the City will establish a World Trade Center Area security advisory committee. The committee will meet on a regular basis to review any and all relevant reports and consider law enforcement and security related matters pertaining to the World Trade Center Area and coordinate interagency cooperation with respect to such matters. The committee will consist of a representative of the City, the Port Authority, the Governor of New York and the Governor of New Jersey.

10 & 11

Contracting Strategy for the World Trade Center Transit Hub & Procurement and Contracting Inefficiencies

Context

As discussed, one of the four central questions raised in our June assessment – other than what we are building, when it will be built and for how much – was, "who is going to build it." The "who" question had been answered for all of the major projects on the site, but there had been lingering uncertainty as to whether the current builders of the Transportation Hub – the Phoenix Joint Venture consisting of Skanska, Fluor, Granite Construction Inc. and Bovis Lend Lease – would stay on to complete the bulk of the work left on the Hub.

This uncertainty arose from the fact that in the urgency to rebuild the Port Authority established a less-then-ideal Construction Management/General Contractor contract with Phoenix. The contract was developed and institutionalized before the Port Authority was able to finalize key design decisions on the project and without the proper incentive structure that is typical of large-scale construction contracts. Specifically, because the Transportation Hub design had not been finalized at the time the Phoenix contract was executed, much of the early Hub construction work was individually negotiated and in the interest of getting the work started often resulted in the initial use of a "time and materials" contract, which was later converted to lump sum. This arrangement does not provide the level of cost certainty and scope control needed on such a complex project.

Moreover, there have been some issues over Phoenix's compliance with the terms of the contract. Some of these stem from the combination of procurement and contract administration requirements imposed by the Port Authority and the FTA which imposed unanticipated burdens on both the Phoenix Joint Venture and the Port Authority. Some were from the Port's management approach and some were from Phoenix's failure to meet key contractual terms in a timely manner. Together these inefficiencies have contributed to schedule delays and cost escalations on the project.

Resolution

In the interest of bringing greater certainty to the rebuilding effort and reducing cost, schedule and constructability risk, we have decided to retain the Phoenix Joint Venture under a modified relationship that provides the right incentives to control schedule, cost and risk. The reasons for this decision are as follows:

1. *Reformed contracting relationship:* In consultation with the Phoenix team, the Port Authority has initiated a number of process improvements that will create a more effective working relationship with the Joint Venture. Moreover, where possible certain conflicts between Port Authority standard contractual requirements and FTA protocols are being resolved in order to

create more efficient contract administration. The issue of contracting inefficiencies was one of the key 15 decision points raised in the June WTC Assessment, and a Port Authority working group is implementing changes that will speed payments for work performed, improve cost accounting and project controls, and better align the Port Authority's contractual structure with Phoenix to FTA reporting requirements.

2. *From time and materials basis to lump sum, fixed price:* Now that the scope and final design of the Hub project has been finalized, it will be possible for Phoenix to commit to remaining Hub work on a lump sum, fixed price basis. This will result in cost certainty on the project, better budget control, and will also create improved incentives for the Phoenix team to perform efficiently.

3. *Benefits of market competition without the schedule risk of new bidding process:* One potential argument for considering an open bid process for remaining Hub work as opposed to retaining Phoenix is increased competition and potentially lower costs. However, for much of the remaining work on the Hub, such as the purchase of steel and mechanical/electrical work, competition will be achieved through sub-contractor bidding processes that will be fully open and transparent. Moreover, we will avoid the lengthy delay and uncertainty of a whole new bidding process. The FTA shared our concern that an open bid process would add schedule risk to the project without clear evidence that a lower cost could be achieved or that a new general contractor would improve performance.

4. *Continuity with builders who know the site and project:* The extended knowledge that the Phoenix team has developed on the WTC site over the last several years will reduce project risk and help the Port Authority meet the new schedule milestones of the project. An open bid process would only increase project risk through the uncertainty of contracting resources in the marketplace at this time, and the challenge of coordinating many different contractors who are new to the site and the project. In contrast, we now have a single point of accountability in the Joint Venture and a partner that knows more about the construction reality at the World Trade Center site than any other contractor in New York.

12

Owner/Builder Management Coordination for Memorial and Museum

Context

Prior to resolution, the responsibility for the design and construction management of the Memorial Foundation was split between the Memorial Foundation, which as owner of the National September 11 Memorial & Museum oversees the implementation of the design, and the Port Authority, which as builder oversees the construction. In order to make coordination as efficient as possible, the two parties needed to define a set of guidelines for working together. Without a clear definition of roles and responsibilities, as well as a concise list of steps that can be taken to achieve greater project efficiencies at the staff level, the Memorial and Museum will be vulnerable to schedule delays and cost escalations.

Resolution

There have been extensive discussions between the Port Authority, the Memorial Foundation management and Bovis Lend Lease (the Memorial's builder) to clarify roles and responsibilities. The Port Authority is finalizing an agreement to act as the sole construction manager, with oversight and direction of Bovis Lend Lease. The Memorial Foundation acknowledges that construction direction should come only from the Port Authority, while the Memorial Foundation reserves the right to participate in all the construction meetings. The Memorial Foundation is responsible for the management of their design professionals and delivering a set of coordinated construction plans at an agreed upon schedule. With these responsibilities clarified, design and construction can more forward more efficiently.

13

Route 9A/West Side Highway Staging and Funding

Context

The Port Authority has ongoing projects that require coordination with the New York State Department of Transportation (NYSDOT) Route 9A (West Side Highway) project. NYSDOT is realigning a segment of Route 9A and installing underground utilities adjacent to the WTC site. At the same time, the Port Authority is constructing major project elements that parallel Route 9A, including One World Trade Center, The Freedom Tower, Vehicle Security Center, Memorial and Museum, and the WTC Transportation Hub.

Without an agreement between NYSDOT and the Port Authority to fund cost impacts to the route 9A project, further schedule delays and further escalated costs to the following projects will continue: the Vehicle Security Center; the Memorial and Museum; the WTC Transportation Hub, One World Trade Center, The Freedom Tower, and Route 9A.

The sequencing and staging of construction are important for the following reasons: As Graphic 19 illustrates, NYSDOT, under their original schedule, was potentially going to finish their 9A project at the end of 2009 – before the Port Authority would have the chance to utilize the below-grade space beneath 9A for its own projects on the WTC site. Unless NYSDOT and the Port Authority could agree on a restaging plan for the project, the Port Authority would have to rip up the completed 9A, which includes pavement and up to seven feet of additional fill beyond exiting grade, in order to get necessary access for Port Authority project work. The Port Authority would be required to deconstruct a significant portion of the new northbound roadway between Liberty and Vesey Street in order to access below grade construction areas in support of the VSC, Memorial, One World Trade Center, The Freedom Tower and the WTC Transportation Hub projects.

Resolution

The Port Authority has worked with NYSDOT on a restaging sequence for the 9A project that will advance the construction of the WTC projects with minimal schedule impacts to the PA. The original sequence, which would have meant the loss of access to the VSC, Memorial, Transportation Hub Concourse, and One World Trade Center, The Freedom Tower projects, would have delayed these individual projects between six and fifteen months (see Graphic 20, which shows how the Port Authority will now have time to complete its work and not have to come back and rip up an already-completed 9A section).

This plan accelerates installation of utilities and raising of grades, to support planned access to the Memorial and other projects. Upon completion of the Port Authority construction and use of the 9A ROW for access and staging, NYSDOT's contractor will complete the remaining 9A work.

In order to facilitate this coordinated approach, in July 2008 the Port Authority advanced $16 million to NYSDOT so that their contractor could proceed with necessary WTC infrastructure work. The Port Authority is in further discussions with NYSDOT so that NYSDOT's 9A contractor can build additional infrastructure for the WTC program as part of ongoing 9A work. Moreover, as part of the Port Authority's Office of Program Logistics function, the Port Authority will continue to closely coordinate work with NYSDOT along the 9A corridor.

14

Below-Grade Engineering at the Performing Arts Center Site

Context

The WTC master plan proposes that the Performing Arts Center (PAC) be built where the existing Temporary PATH Station is located. In order to ensure that a world-class facility can be built on this site, the design and engineering of the below-grade areas should be coordinated with the many other uses that need to be accommodated at this site. Other uses include: Hub ventilation and egress, #1 Line Cortlandt Street Station access and egress, retail, parking and parking access (vehicle helix), access roads, and utilities. At the same time, design of the below-grade elements of the future PAC has to be coordinated with the final design of the Transportation Hub.

Final design and engineering of the many uses at the site cannot be completed without a complete understanding of what the below-grade needs of the PAC will be.

Resolution

The Port Authority has met with City officials and reached agreement to proceed with the design of the below-grade elements that will support the parking helix and the Performing Arts Center. This agreement will allow the Port Authority to advance the construction of the Hub project per its new schedule, while providing the needed infrastructure for the future PAC.

15

Site Logistics

Context

As has been discussed, the WTC rebuilding program attempts to fit within the size of just a few city blocks:

- Five major skyscrapers, which will house Class A office space comparable to all of downtown Atlanta;
- One of the world's most significant memorials and museums;
- The third-largest transportation hub in New York City;
- A world-class retail venue serving all of Lower Manhattan;
- A major performing arts center;
- A state-of-the-art vehicle security center;
- Two brand-new city streets (Greenwich and Fulton) and two brand-new pedestrian ways (Cortlandt and Dey); and,
- All of the critical infrastructure to support these projects (chiller plant, utility and communication networks, etc).

The result of all of this construction – unless there is a clear plan in place – is a potential logistics nightmare in what is already one of the most congested areas of New York City. Graphic 21 shows that the number of workers on site will more than quadruple over the next three years, and the number of trucks going in and out of the site will more than double. With so many major projects being built at the same time, space for construction staging, lay-down areas, truck queuing, etc. will be vital.

Unless there is a single command and control structure to coordinate with City DOT and all the stakeholders all of the moving pieces in this confined space, every project on the site risks schedule delays and cost escalations. Moreover, there must be a single point of contact so the residents and businesses of Lower Manhattan understand in real time what the impacts are of the construction activity around them.

Resolution

To address this logistics challenge, the Port Authority has established a new Office of Program Logistics, which will zero in on the following issues:

- *Planning/Analysis:* Develop and maintain a proactive approach to the identification and resolution of challenges by designing short- and long-term plans to overcome critical path obstacles. Logistics planning will be tailored in phases: first, to address the current conditions on

the ground; second, to address the challenges as certain key milestones are achieved and the site transitions from a pure construction site to a live operation, such as on the tenth anniversary of the September 11th attacks; third, when construction is finally complete and the site is fully operational.

- *Liaison:* Maintain an active network of internal and external WTC stakeholder groups to collaboratively address time-sensitive schedules for construction, with a goal of maximizing safety and minimizing financial implications as well as public inconvenience.

- *Communication:* Provide a central information source for stakeholders, agencies, and the general public regarding WTC program logistics and ongoing processes.

To accomplish its goals, the Office of Program Logistics has established an organizational structure and administrative protocol. Staff has been dedicated to specific issues such as transportation, working with City agencies on permitting, and information dissemination, as well as scheduling and coordination transparency.

Through the Office of Program Logistics, projects – both internal and external to the site – will be advanced in a sensible and integrated manner, while allowing for the successful execution of individual designs and construction. Stakeholders, agencies, and the public will be better coordinated and informed as to realistic schedules and impacts. The Office will be the single entity to coordinate the moving pieces of every project, avoiding unnecessary schedule delays and cost escalations.

Moving Forward

The efforts of the last three months have given the Port Authority a level of certainty and control over the rebuilding program that we have not had before. We now have schedules and budgets that reflect the construction reality on the ground and, because of tough but practical decisions, we have resolved the major unresolved issues facing this rebuilding program.

However, we still face many challenges ahead. That is why it is all the more important that, moving forward, we make permanent what has worked so well over the past three months.

1. A functional decision-making model – the WTC Steering Committee – that is inclusive and can efficiently address problems that arise throughout the rebuilding effort. The stakeholder group we established in June is working. We have seen a level of cooperation, coordination and information sharing that we've simply never had before. The dividends are already paying off in the form of the creative and practical solutions that are described throughout this report. Going forward, the WTC Steering Committee will continue to meet to ensure that stakeholders on the site are working together and resolving challenges as quickly as they arise to prevent slippage in schedules and escalation in costs.

2. The strong partnership we have established with the FTA, which is our critical funding partner for the WTC Transportation Hub. Like our Board of Commissioners, the FTA has long called for greater project controls and a candid and on-going assessment of where this project stands. We look forward to working closely in partnership with them.

3. A continued effort to be upfront with the public. Over the years, there has been too little public communication about the rebuilding effort and the challenges we face. As a result, the public does not fully understand what is actually being constructed, why it will necessitate public inconveniences at times (street closures, train outages, traffic congestion, etc.), and has little confidence in the ability of all the WTC stakeholders involved to get the job done.

Going forward, we intend to do things differently. We will establish clear construction milestones and will report openly and often about our progress in reaching them. And, if we don't hit a target, we will provide a clear explanation of why and a detailed plan to fix the problem. That is what our Board of Commissioners and the public have demanded and deserve.

We cannot promise that the path forward will be smooth or simple, but we can promise that the public will know about our progress, as well as our challenges, as we work every single day to rebuild the World Trade Center.

GRAPHIC 1

WTC Program
Major Milestones

Quarter	WTC Transportation Hub	Memorial	Vehicle Security Center	One World Trade Center, Freedom Tower	Greenwich Street	Quarter
Q4-08	·Final Construction Documents to Phoenix Constructors ·Begin Procurement of Structural Steel ·Start South Mezzanine Steel ·Turnover Tower 2 Core and Tower 4 "sliver"	·Sector 2 Steel Complete ·Pavilion Structural Design Complete (by NS11MM)	·Contractor Mobilization	·Foundations Complete ·Complete South Core Shear Walls to Grade		Q4-08
Q1-09	·Steel Fabrication Package Award ·Complete South Mezzanine Steel ·Complete Pavilion/Spot Network Footings	·Temporary Ramp Removed ·Pavilion Cladding Design Complete (by NS11MM)	·Start West St. Slurry Wall	·Begin Fulton Street Deck	·Top Down Underpinning Design Complete	Q1-09
Q2-09	·Begin 9A Underpass Excavation for East-West Corridor	·Pavilion Interior Design Complete (by NS11MM)			·Phase 1 Excavation & Bracing complete	Q2-09
Q3-09	·Platform Column Foundations Begin ·Fulton Street Slab Available for Access		·130 Liberty St. Deconstruction Complete (by LMOC)	·Concrete Slabs to Grade substantially complete		Q3-09
Q4-09	·Begin Construction of Underpass Supercolumns ·Complete Steel Erection at South Mezzanine & Pavilion Transfer Structure			·Start Erection of Tower Steel	·Begin Construction of Underpass Supercolumns	Q4-09
Q1-10	·First Roof Steel to Site					Q1-10
Q2-10	·PATH Hall Arch Installation Begins	·Plaza to Grade ·Pavilion Steel Erection Begins	·Start Excavation	·Start Spray Fireproofing	·East and West Truss Installation	Q2-10
Q3-10		·Plaza Finishes Begin	·Start Tie-back Installation	·Start Curtainwall Installation	·Cortlandt Street Station Structure	Q3-10
Q4-10	·25' Walkway at North Pool Available to Memorial (i.e., 80% of the Memorial Plaza floor)					Q4-10
Q1-11		·Museum Design Complete (byNS11MM) ·Museum Construction Begins	·Perimeter Wall Substantial Completion ·Start Ramp Structure Foundations			Q1-11
Q2-11	·Platform A Construction Complete	·Start Pavilion Curtainwall	·Start Ramp Structure Steel Erection	·Complete Installation of Podium Glass	·Begin Cortlandt Street Station Finishes	Q2-11
Q3-11	·Platform B Construction Starts ·PATH Mezzanine Roof Complete (deckover)	·NE Quadrant Finishes begin ·Memorial Plaza floor (100%), Fountains, Parapets/Names Complete		Complete Core Shear Walls to 93rd Floor	·Greenwich Street Partially Complete for Memorial Access	Q3-11
Q4-11		·Pavilion Shell Complete		·Complete Tower Steel Erection to Roof		Q4-11
Q1-12			·Ramp available for Tower Fitout	·Complete Spray Fireproofing		Q1-12
Q2-12						Q2-12
Q3-12	·Oculus Construction Begins ·Platform B Construction Complete		·VSC Operational	Complete Curtainwall (excluding Hoist Area)		Q3-12
Q4-12	·Platforms C & D Construction Starts				·Greenwich Street Complete	Q4-12
Q1-13						Q1-13
Q2-13	·Oculus Wings Complete	·Memorial and Museum Complete				Q2-13
Q3-13						Q3-13
Q4-13				·Building Complete		Q4-13
Q1-14	·Platforms C & D Construction Complete					Q1-14
Q2-14	·Oculus Construction Complete (minus punch list) ·PATH Hall Complete (minus punch list)					Q2-14
Q3-14						Q3-14
Q4-14						Q4-14

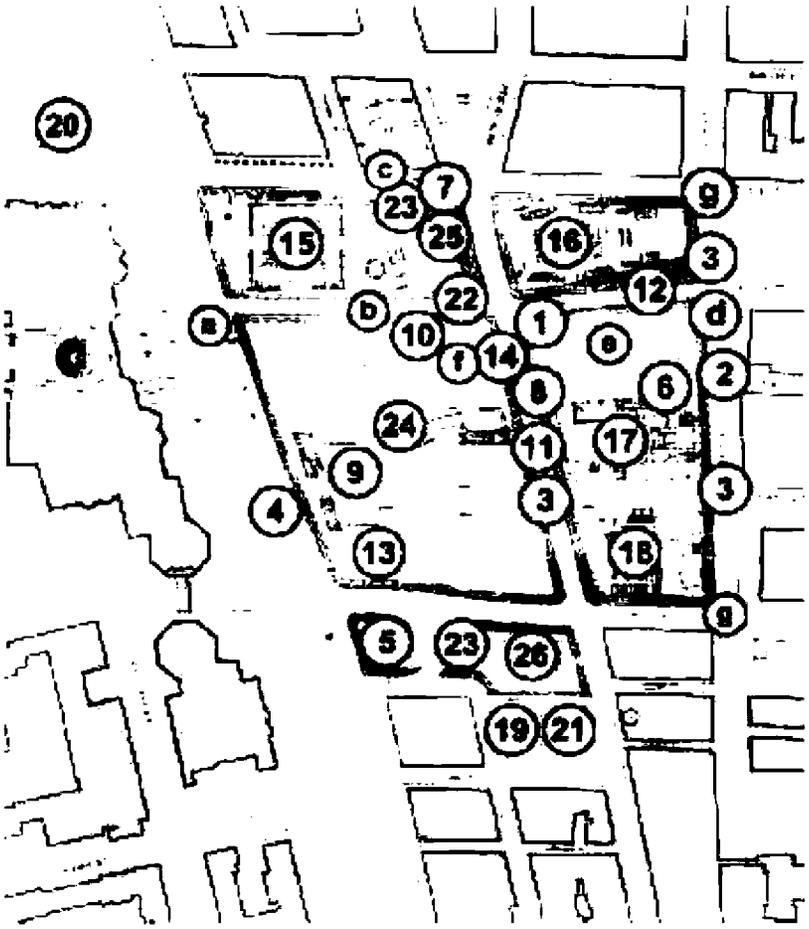
Rendering of Memorial Plaza

Source: National September 11 Memorial & Museum

GRAPHIC 3

Goldman Sachs Hqs.
Tower 1
WTC Memorial
7 WTC
Performing Arts Center
Visitor Center
Tower 2
Tower 3
Tower 4
Transportation Hub
Church St.

GRAPHIC 4



WTC Redevelopment Major Projects

Transportation Projects

1. Transportation Hub
   a. WFC Underpass
   b. East West Connector (below Fulton Street)
   c. North Temporary Access
   d. Utility work at Church Street
   e. Oculus
   f. PATH Facility
   g. Eastside North and South Connectors
2. Dey Street Passageway and Fulton Street Transit Center
3. Subway Stations (FTA funded)
4. Route 9a Realignment

Infrastructure Projects

5. VSC Phase 1-Vehicular Security Center and Tour Bus Parking Facility
6. VSC Phase 2 – Eastside Tour Bus Parking Facility
7. VSC 3 – West Bathtub Vehicular Access (helix)
8. Street, Utilities and Related Infrastructure
9. Central Chiller Plant and River Water System
10. Common Electrical System (PDC/SN and Emergency Generator Plant)
11. Common Infrastructure – Underpinning of 1 Subway
12. Site-wide Security/Operations Center (to be located)
13. Master Manager Facility

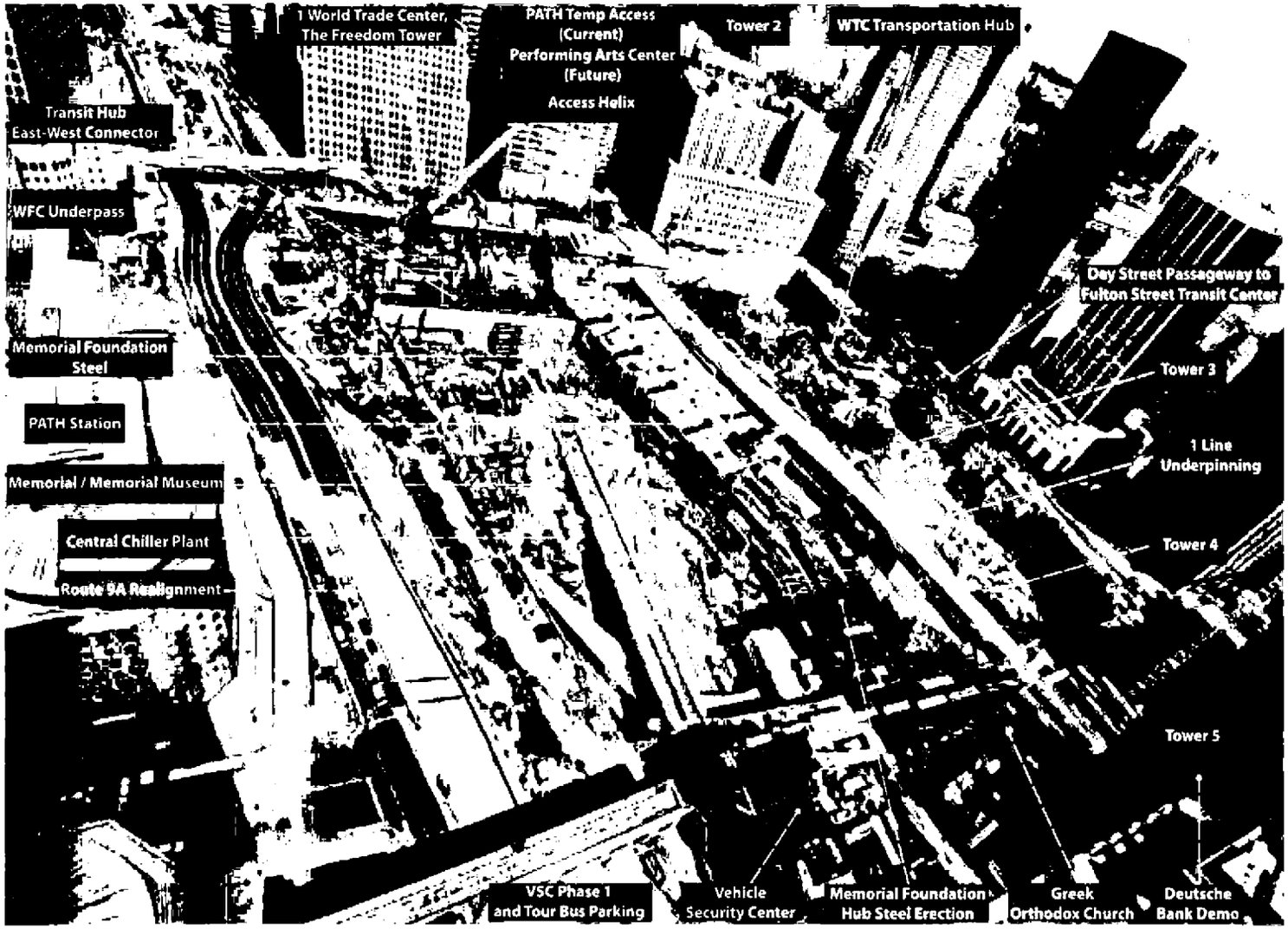
Commercial Projects

14. Commercial Infrastructure – East Bathtub Incremental Construction (accelerated turnover and 240 elevation work)
15. 1 World Trade Center, The Freedom Tower
16. Tower 2
17. Tower 3
18. Tower 4
19. Tower 5
20. Goldman Sachs World Headquarters
21. Deutsche Bank Building Deconstruction
22. Retail Development
23. Commercial Infrastructure (Parking)

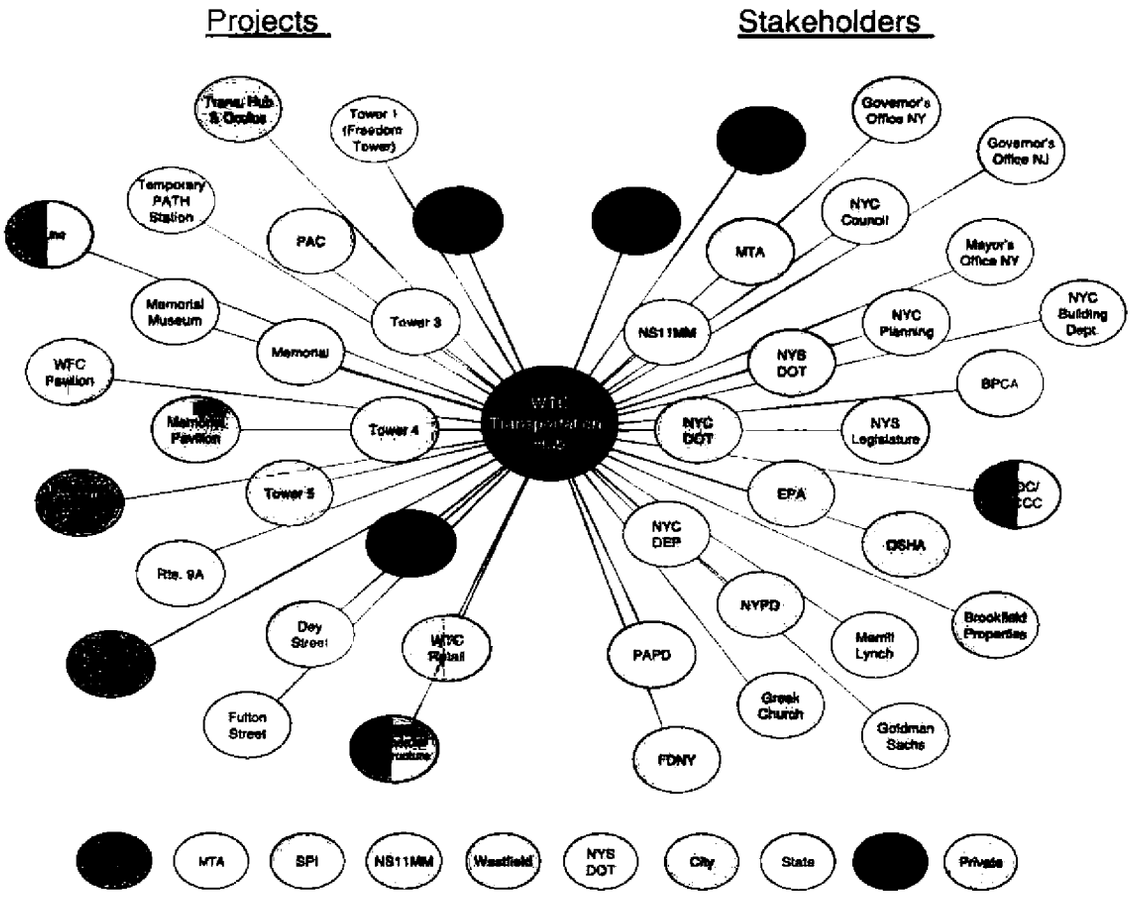
Cultural Projects

24. Memorial/Memorial Museum and Memorial Pavilion
25. Performing Arts Center
26. St. Nicholas Greek Orthodox Church

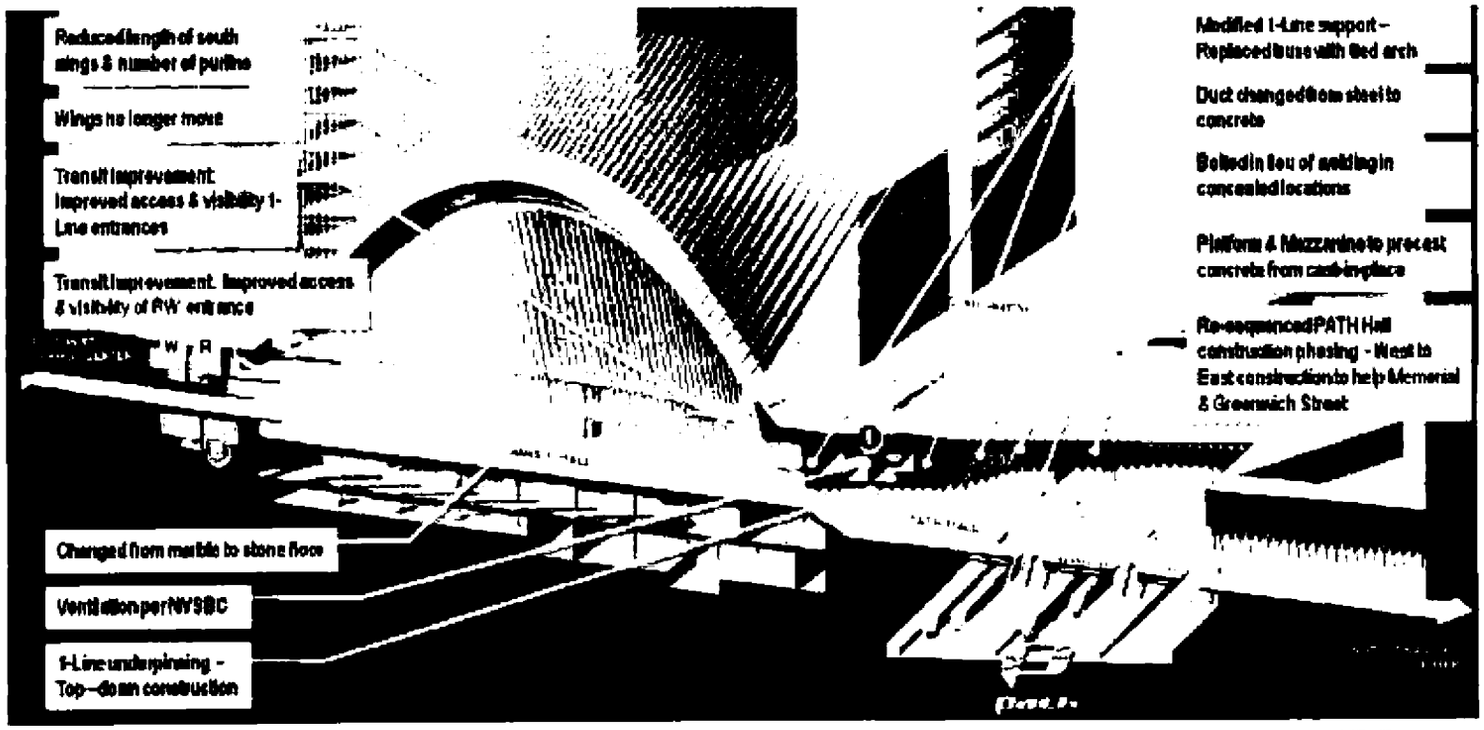
GRAPHIC 5


1 World Trade Center, The Freedom Tower
PATH Temp Access (Current)
Performing Arts Center (Future)
Access Helix
Tower 2
WTC Transportation Hub
Transit Hub East-West Connector
WFC Underpass
Memorial Foundation Steel
PATH Station
Memorial / Memorial Museum
Central Chiller Plant
Route 9A Realignment
Day Street Passageway to Fulton Street Transit Center
Tower 3
1 Line Underpinning
Tower 4
Tower 5
VSC Phase 1 and Tour Bus Parking
Vehicle Security Center
Memorial Foundation Hub Steel Erection
Greek Orthodox Church
Deutsche Bank Demo

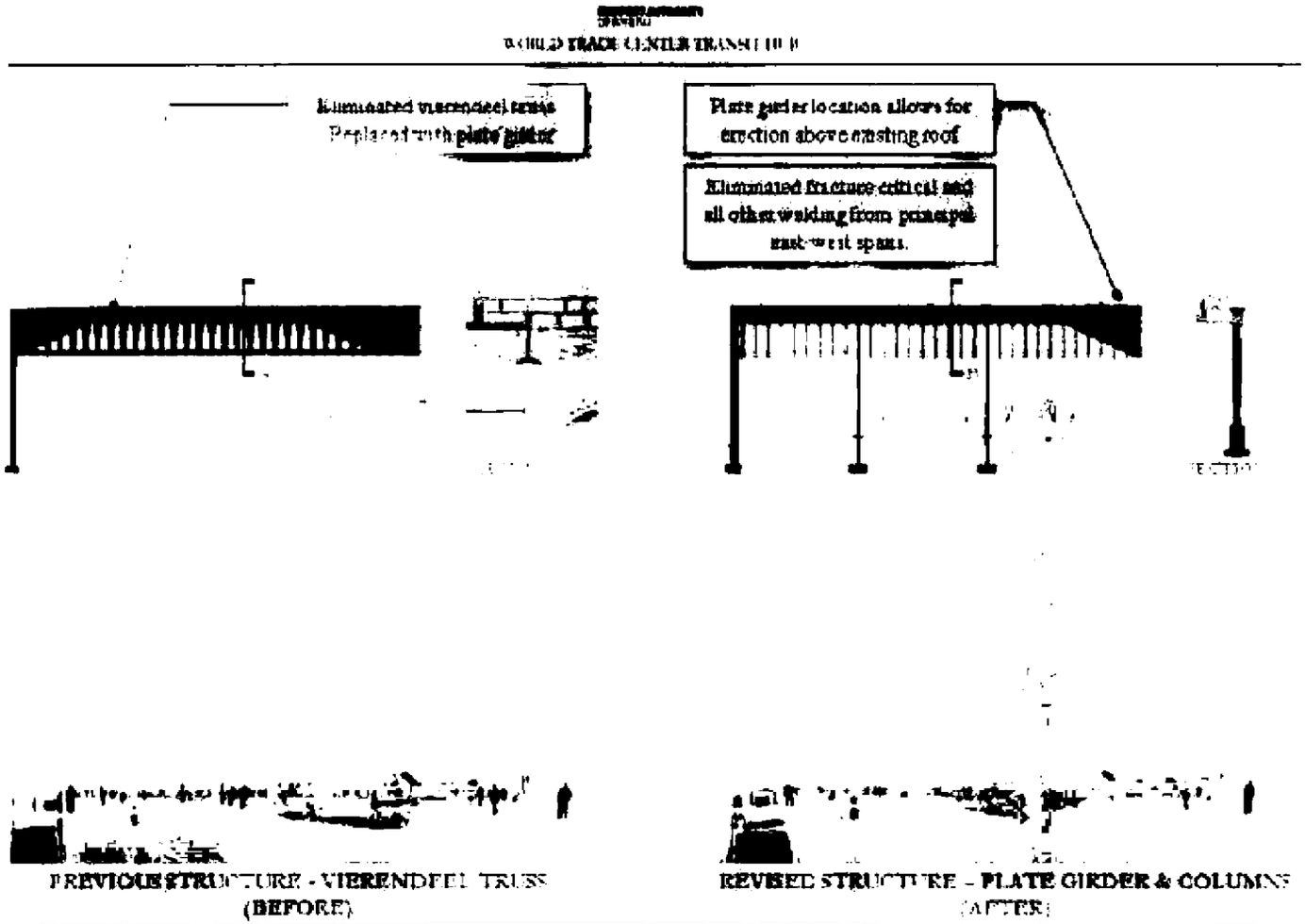
GRAPHIC 6


Projects
Stakeholders
Tower 1 (Freedom Tower)
Temporary PATH Station
PAC
Memorial Museum
Memorial
Tower 3
WFC Pavilion
Tower 4
Tower 5
Rte. 9A
Dey Street
Fulton Street
Governor's Office NY
Governor's Office NJ
NYC Council
MTA
Mayor's Office NY
NYC Building Dept
NYC Planning
NS11MM
NYS DOT
BPCA
NYC DOT
NYS Legislature
EPA
OSHA
NYC DEP
NYPD
Brookfield Properties
Merrill Lynch
PAPD
Greek Church
Goldman Sachs
FDNY
MTA
SPI
NS11MM
Westfield
NYS DOT
City
State
Private

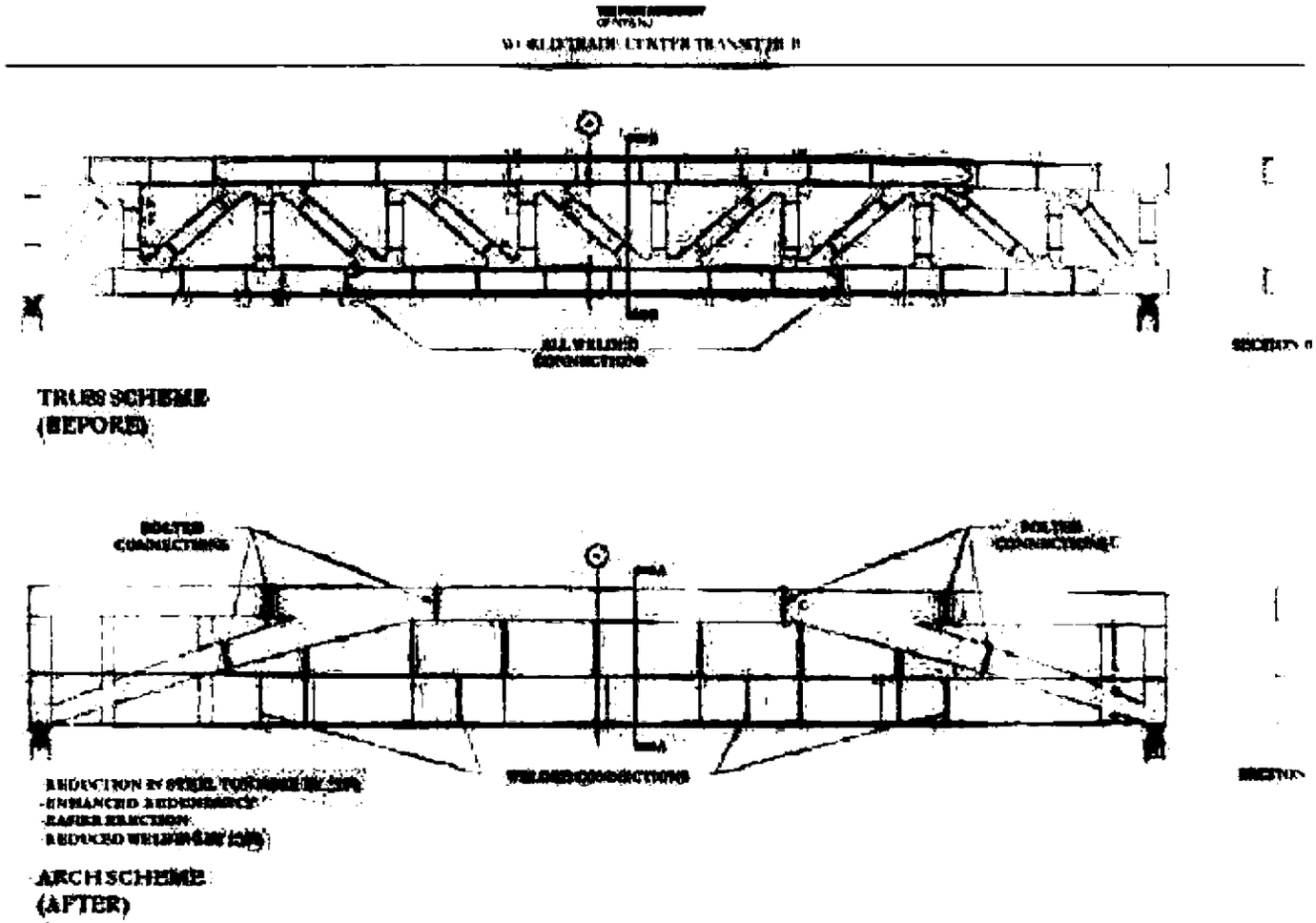
GRAPHIC 7


Reduced length of south wings & number of purlins
Wings no longer move
Transit improvement: Improved access & visibility 1-Line entrances
Transit improvement: Improved access & visibility of PW entrance
Changed from marble to stone floor
Ventilation per NYSBC
1-Line underpinning - Top-down construction
Modified 1-Line support - Replaced truss with tied arch
Duct changed from steel to concrete
Bolted in lieu of welding in concealed locations
Platform & Mezzanine to precast concrete from cast-in-place
Re-sequenced PATH Hall construction phasing - West to East construction to help Memorial & Greenwich Street

GRAPHIC 8



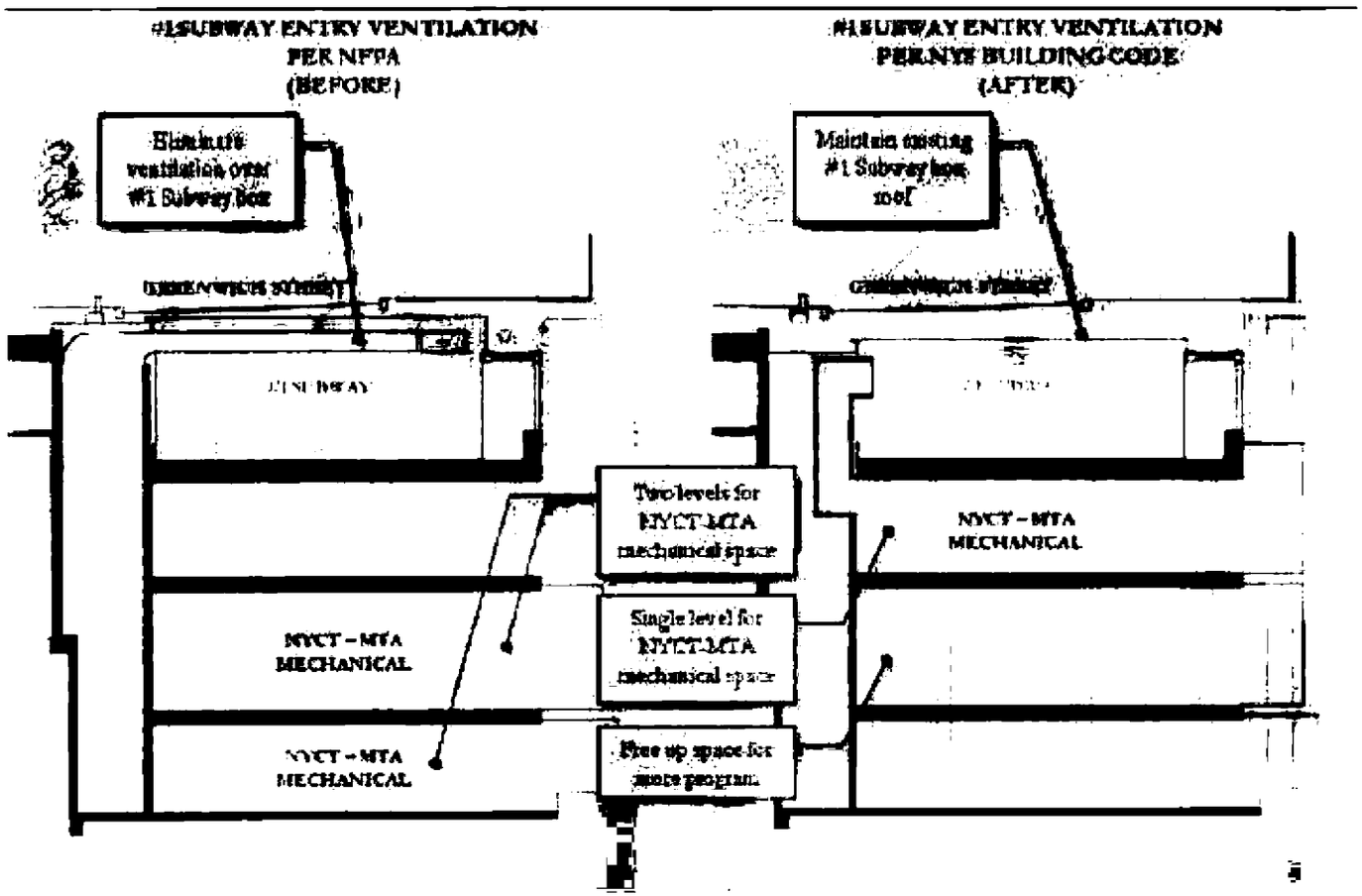
PATH HALL ROOF STRUCTURE



SANTIAGO CALATRAVA

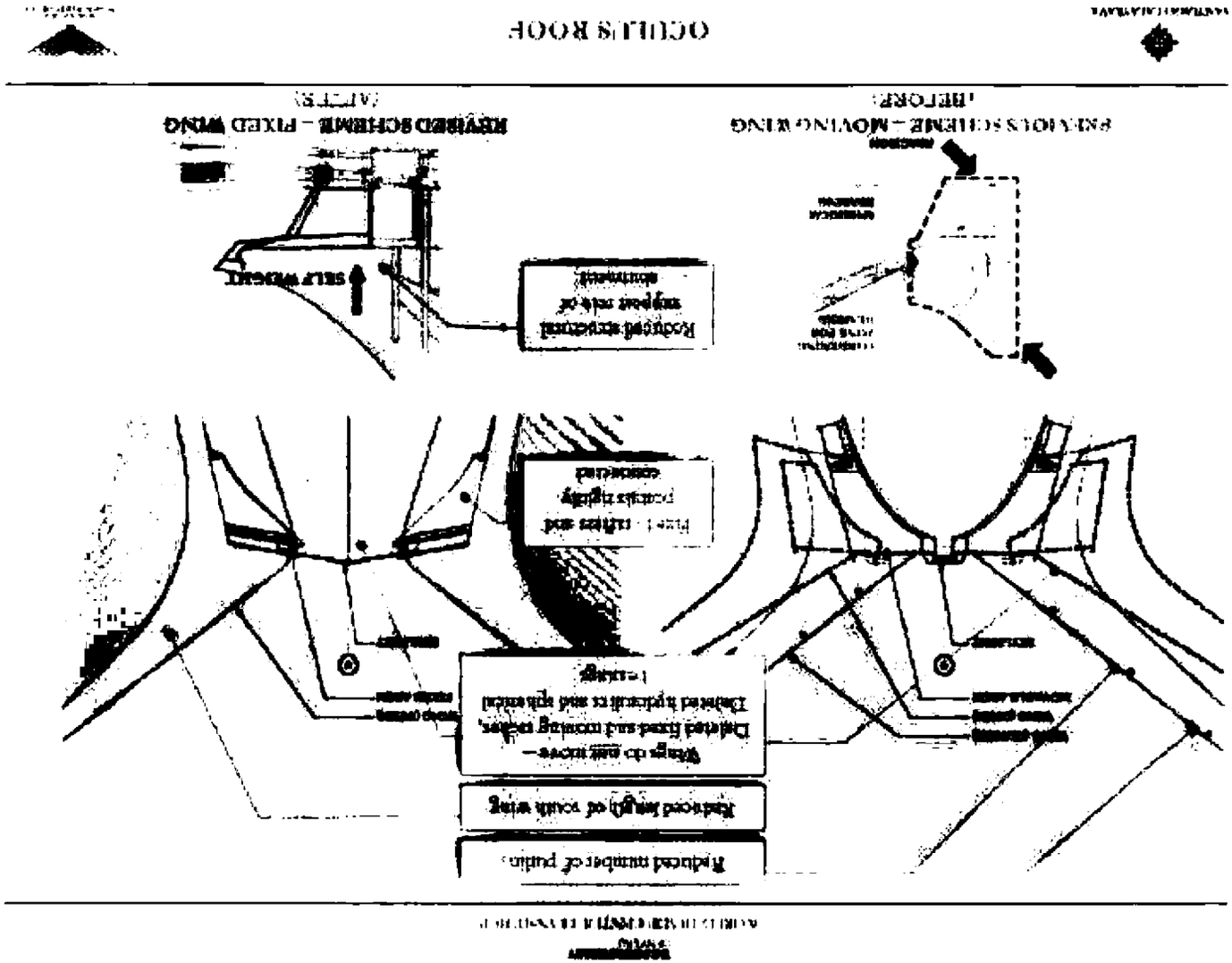
NYCT #1 SUBWAY BOX SUPPORT

GRAPHIC 10

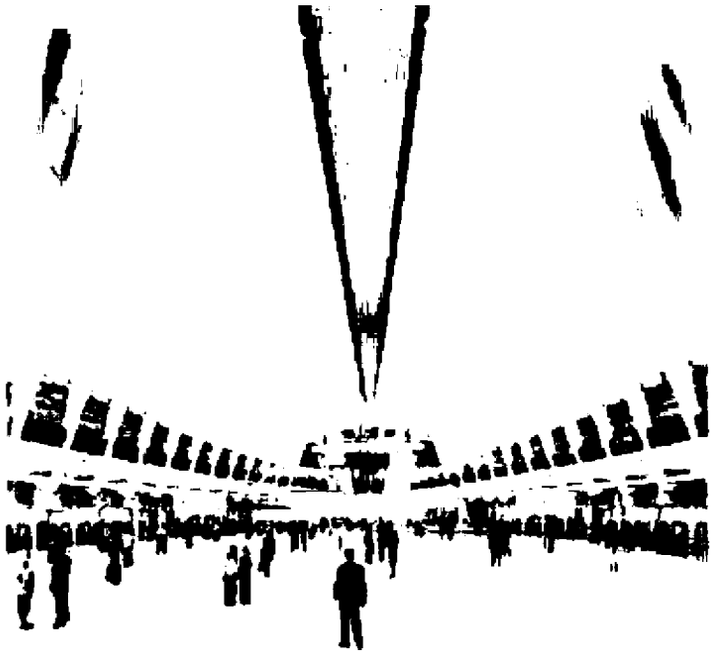


NYCT #1 SUBWAY CONSTRUCTION SIMPLIFICATION

GRAPHIC 11

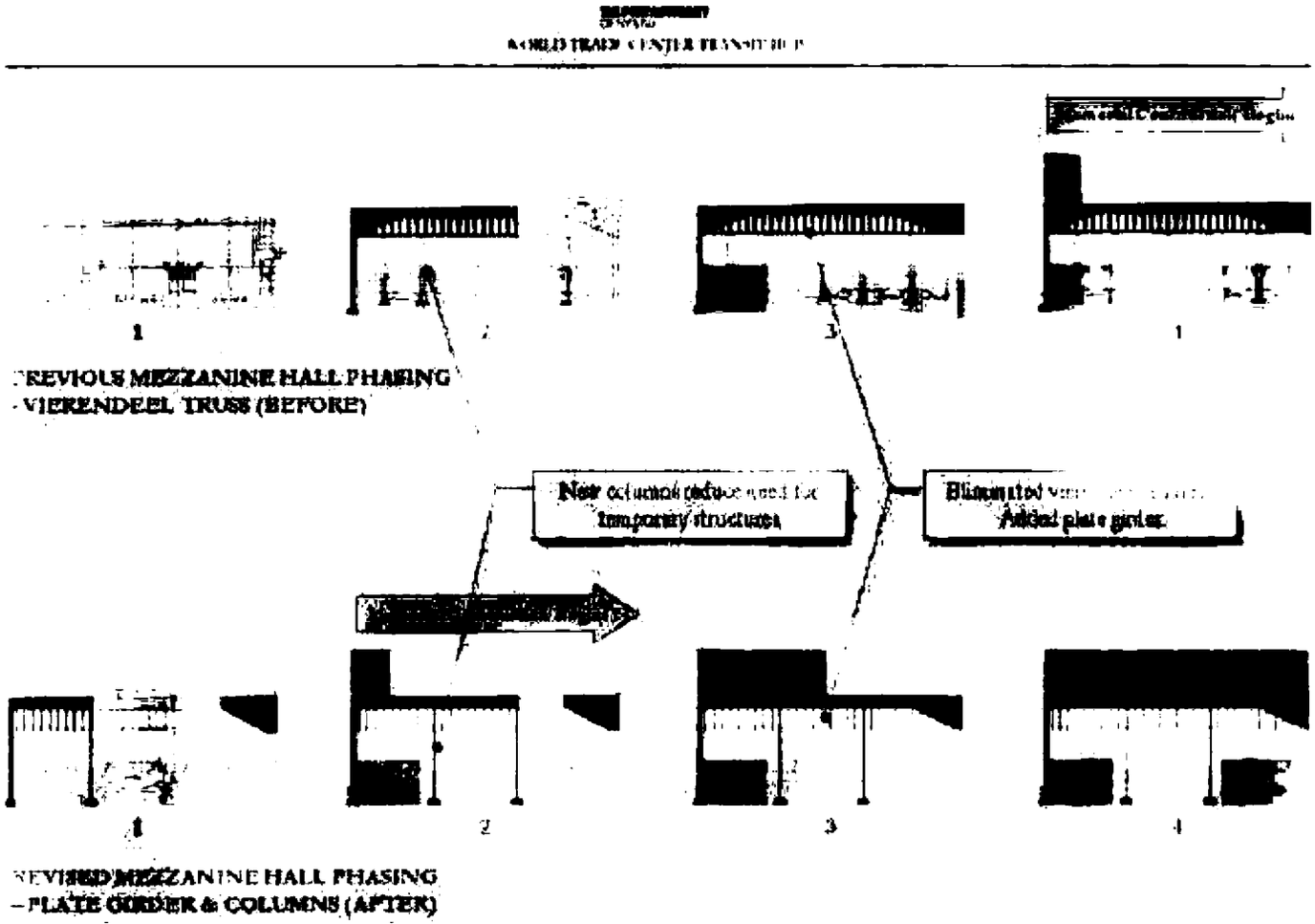

SUMMIT CONSTRUCTION
OCULUS ROOF
SUMMIT CONSTRUCTION
Reduced number of pulins
Reduced length of south wing
Wings do not move –
Tilted floor and moving trusses,
Tilted hydraulics and splitted
beams
Floor 1 – tilters and
pivots rigidly
connected
SUMMARY SCHEME – MOVING WING
(BEFORE)
Roofed structural
support rods of
aluminum
SELF WEIGHT
REVISED SCHEME – FIXED WING
(AFTER)

GRAPHIC 12



MOVING ROOF SCHEME

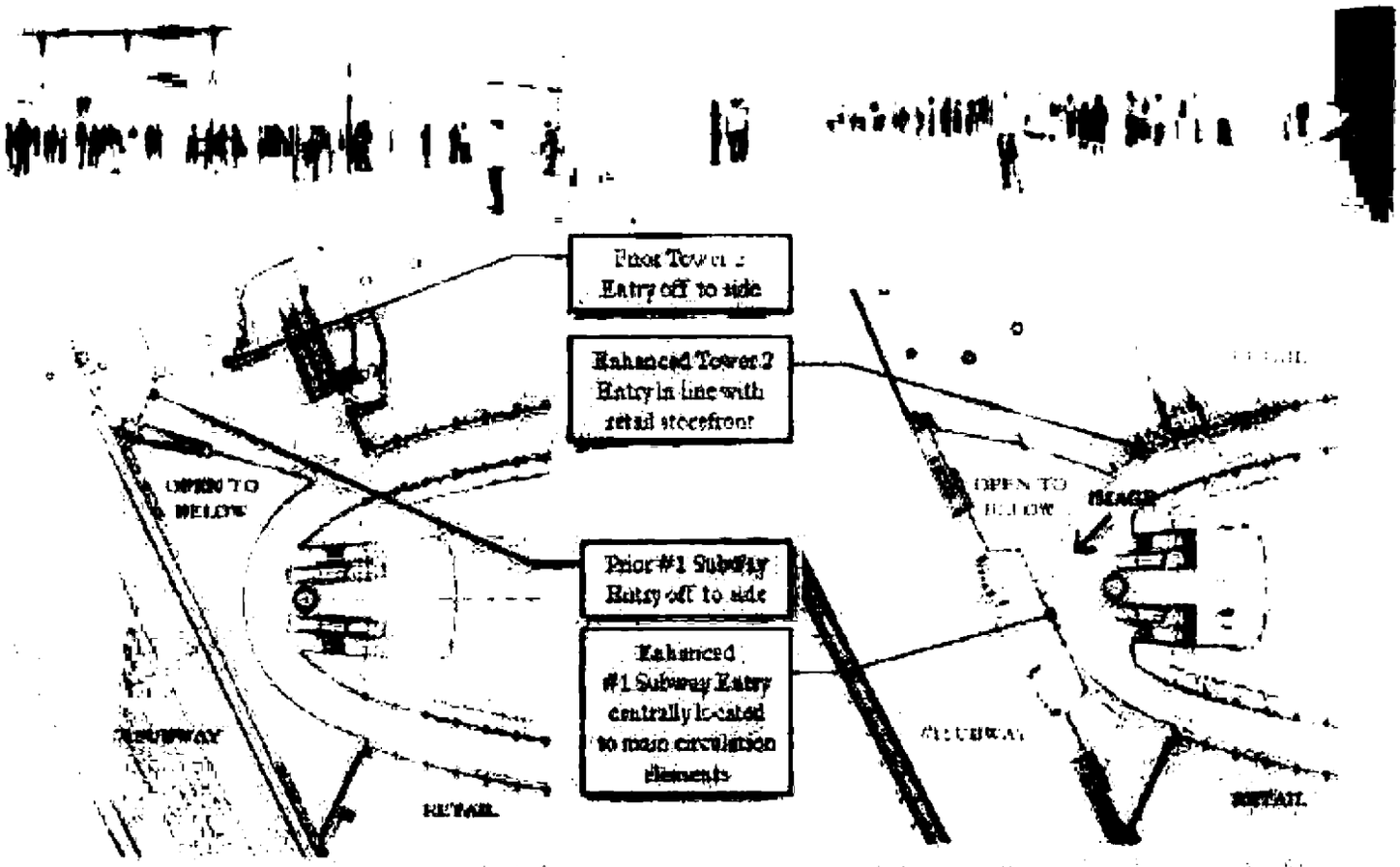
SKYLIGHT SCHEME



PATH HALL ROOF STRUCTURE SEQUENCE

GRAPHIC 14

WORLD TRADE CENTER TRANSIT HUB



PRIOR ENTRY FROM TRANSIT HALL
(BEFORE)

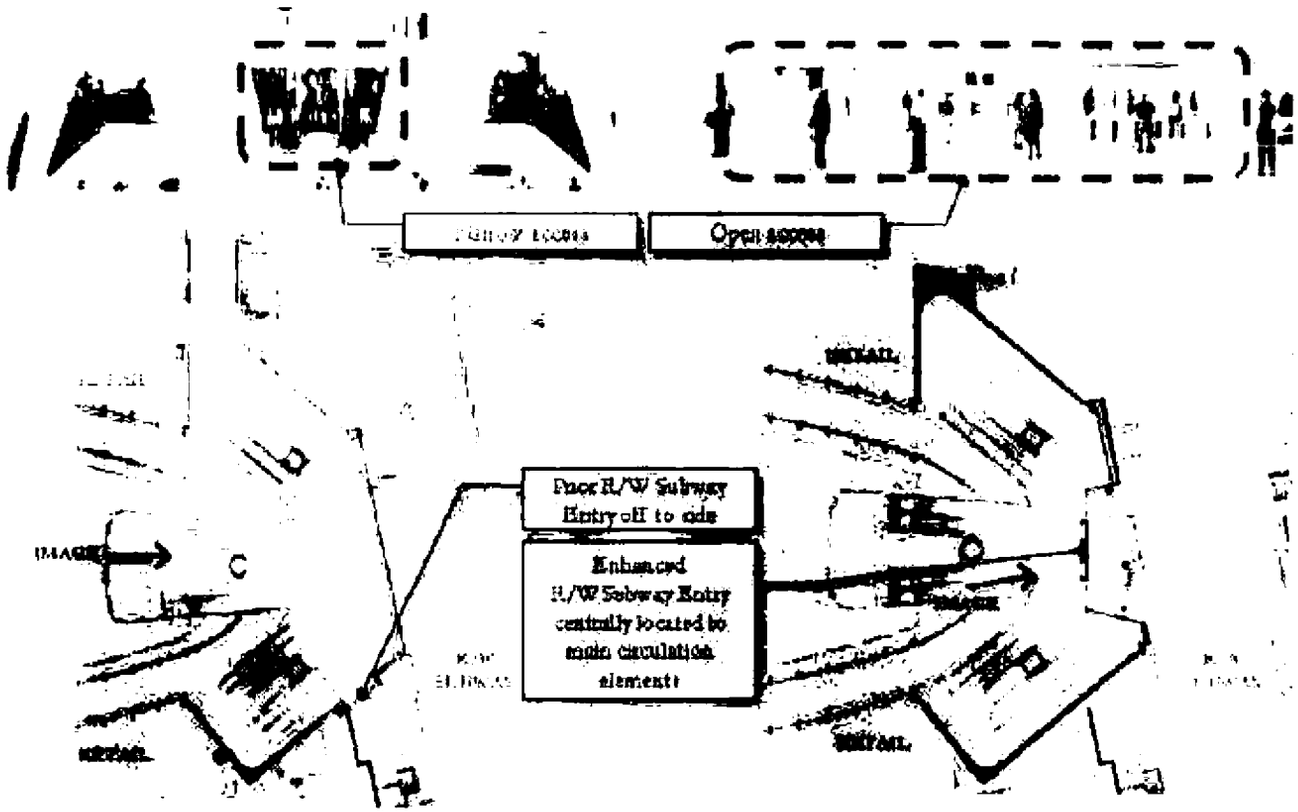
ENHANCED ENTRY FROM TRANSIT HALL
(AFTER)

SANTIAGO CALATRAVA

NYCT #1 SUBWAY STATION ENTRY ENHANCEMENT

[redacted]

WORLD TRADE CENTER TRANSIT HUB



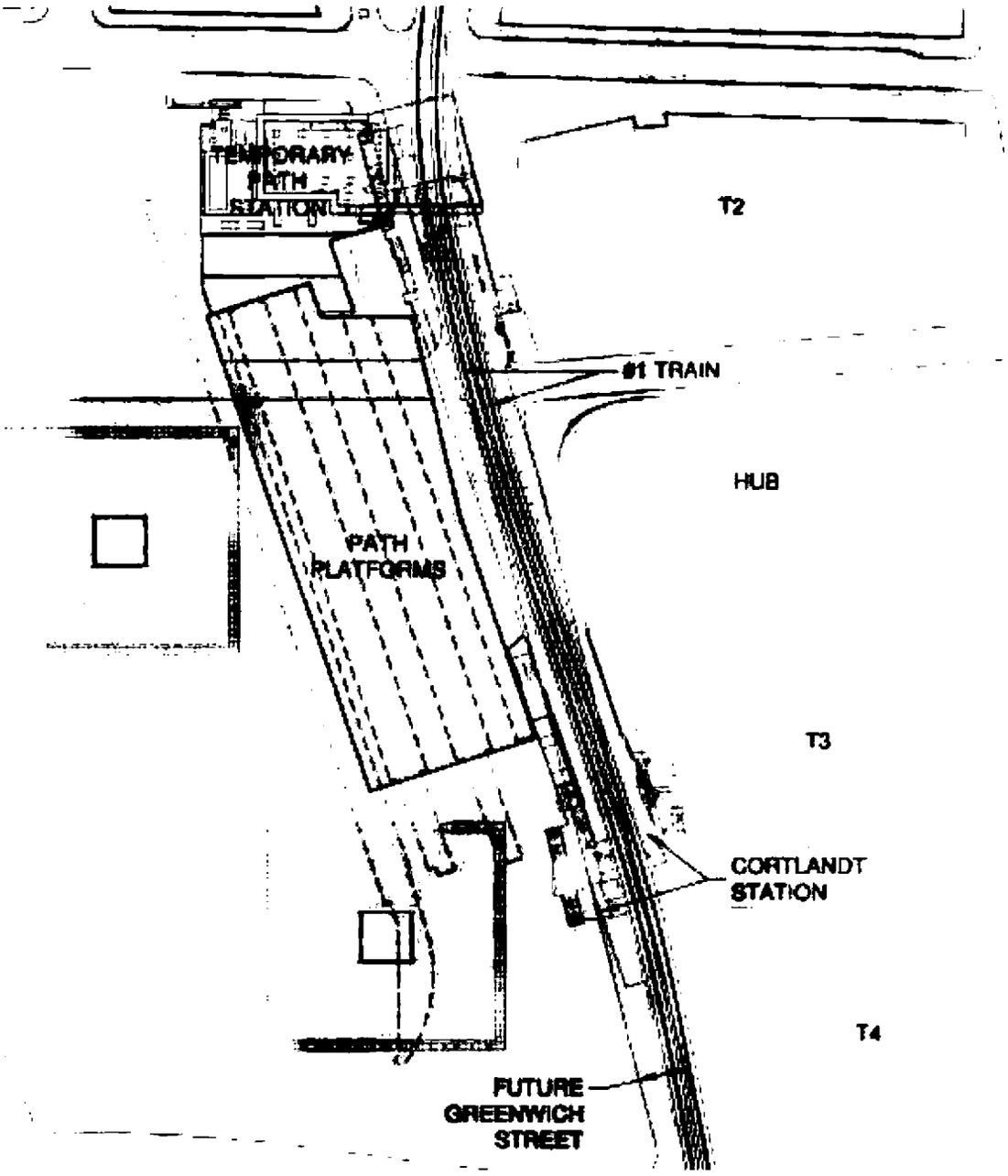
PRIOR ENTRY FROM TRANSIT HALL (BEFORE)

ENHANCED ENTRY FROM TRANSIT HALL (AFTER)

SANTIAGO CALATRAVA

NYCT R/W SUBWAY STATION ENTRY ENHANCEMENT

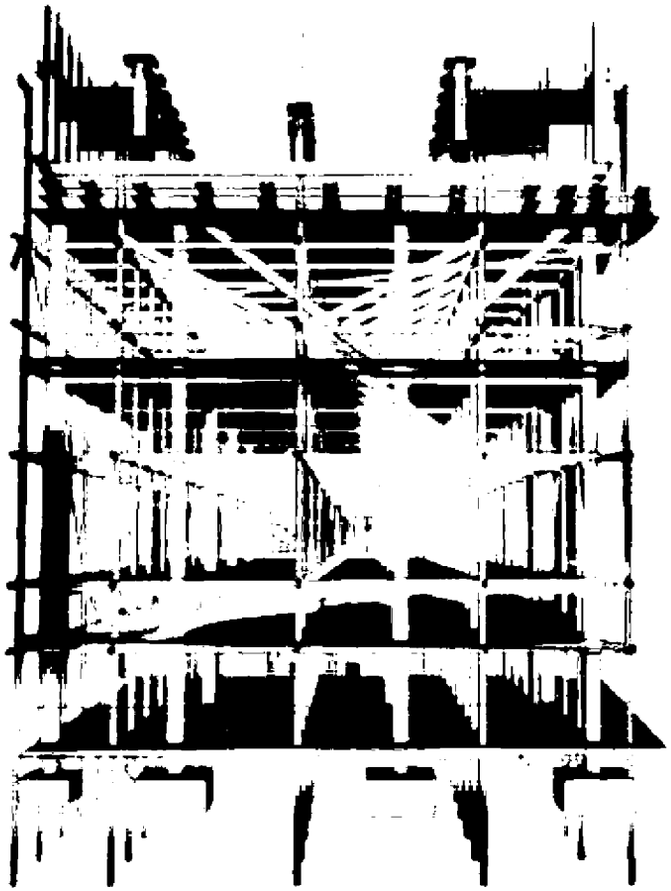
GRAPHIC 16


TEMPORARY
PATH
STATION
T2
#1 TRAIN
HUB
PATH
PLATFORMS
T3
CORTLANDT
STATION
T4
FUTURE
GREENWICH
STREET

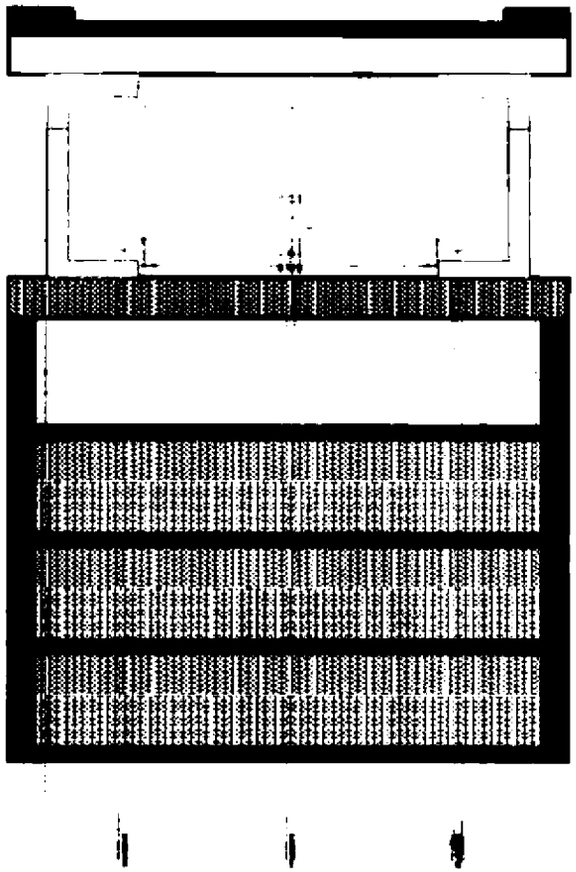
GRAPHIC 17

Underpinning of the #1 Line

Before: Original Underpinning Design

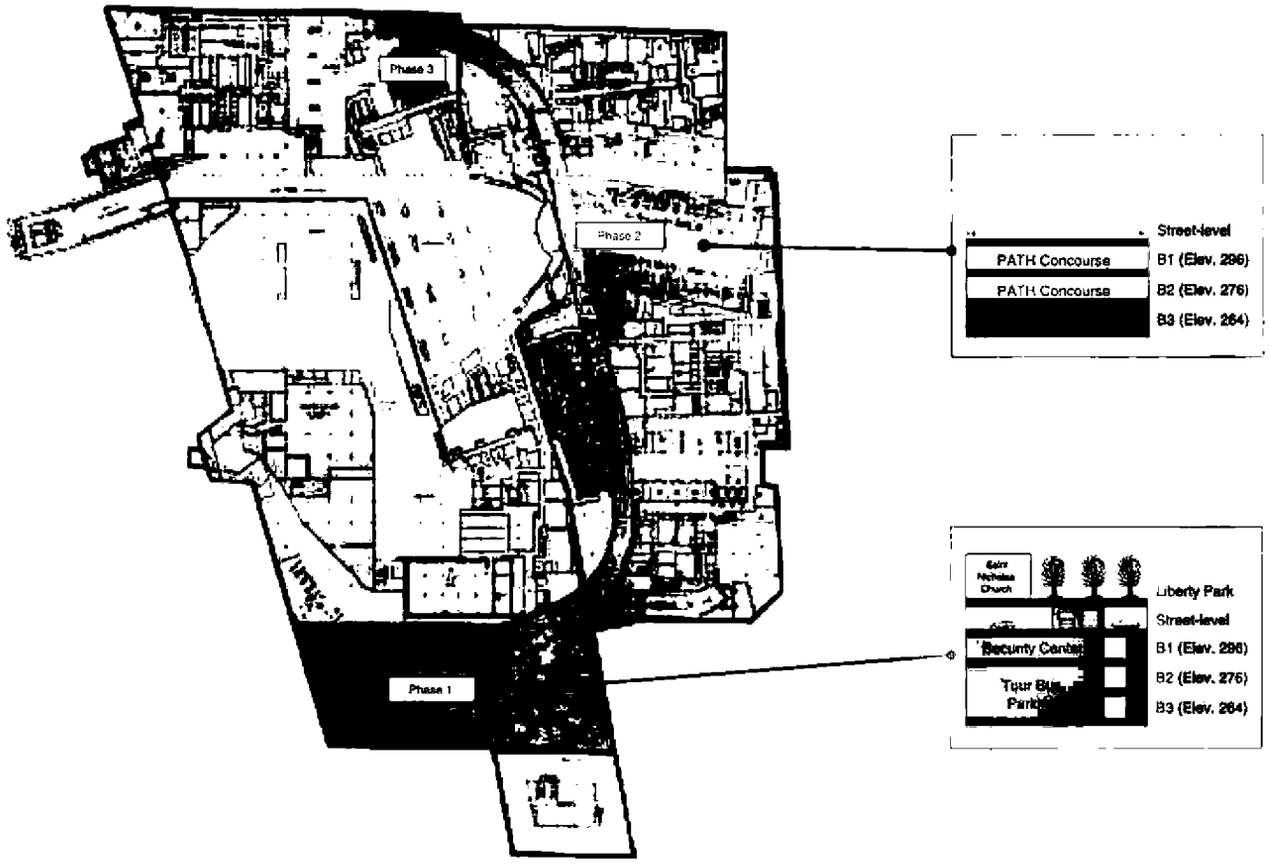


After: Top Down Construction

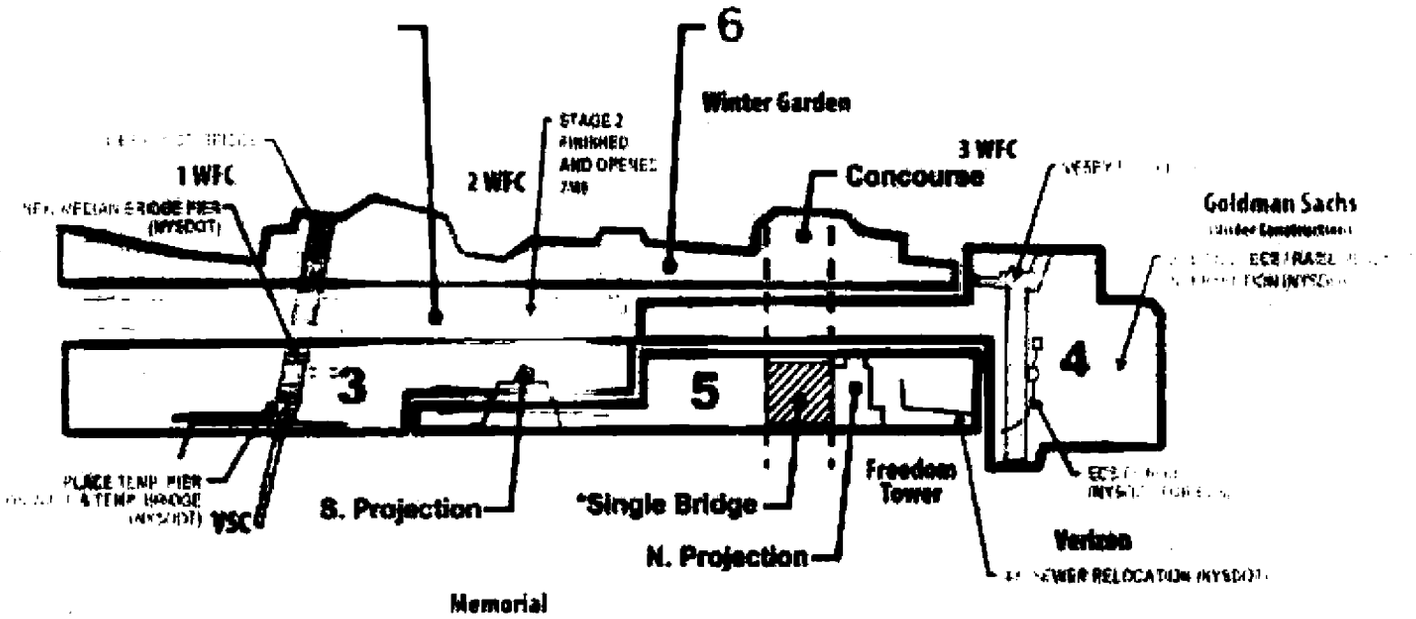


GRAPHIC 18

Vehicle Security Center (Phase I, II and III)



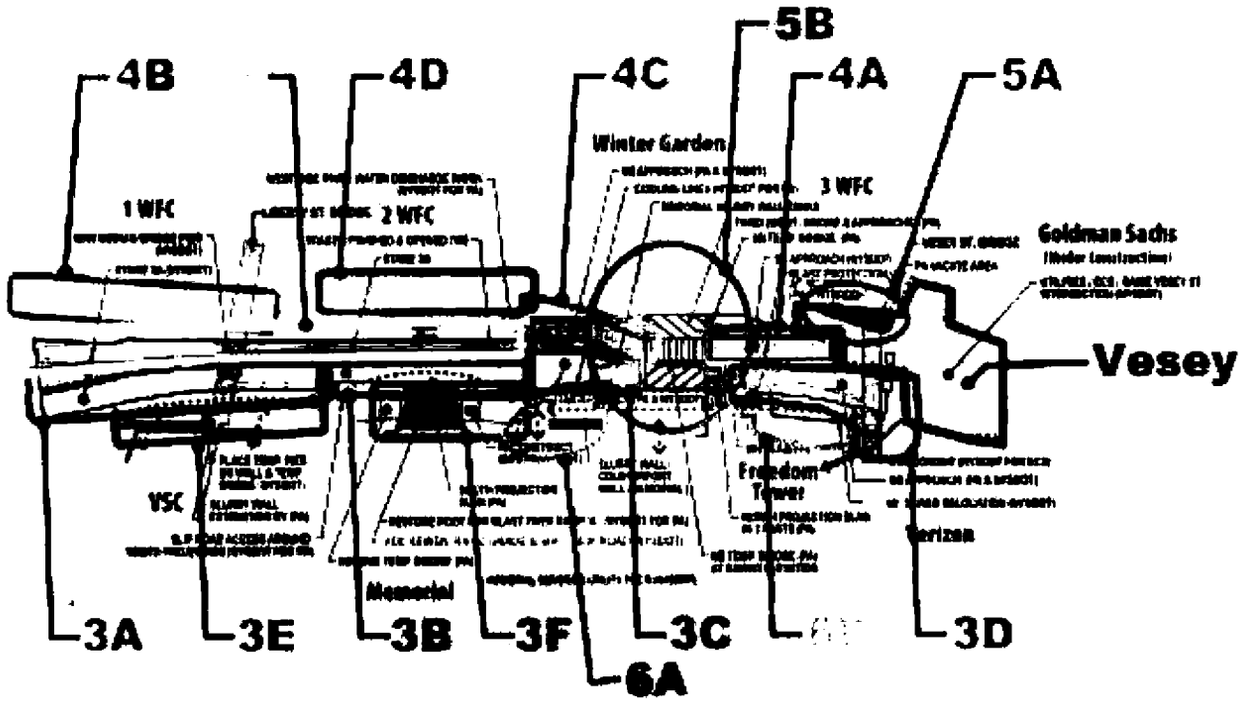
ORIGINAL West Side Highway Staging Plan



YEAR	STAGE
2008	2, 3
2009	4, 5, 6

*Original PANY&NJ plan included one temporary bridge over the Concourse construction with new West Side Highway (NY 9A) utilities staged around the bridge

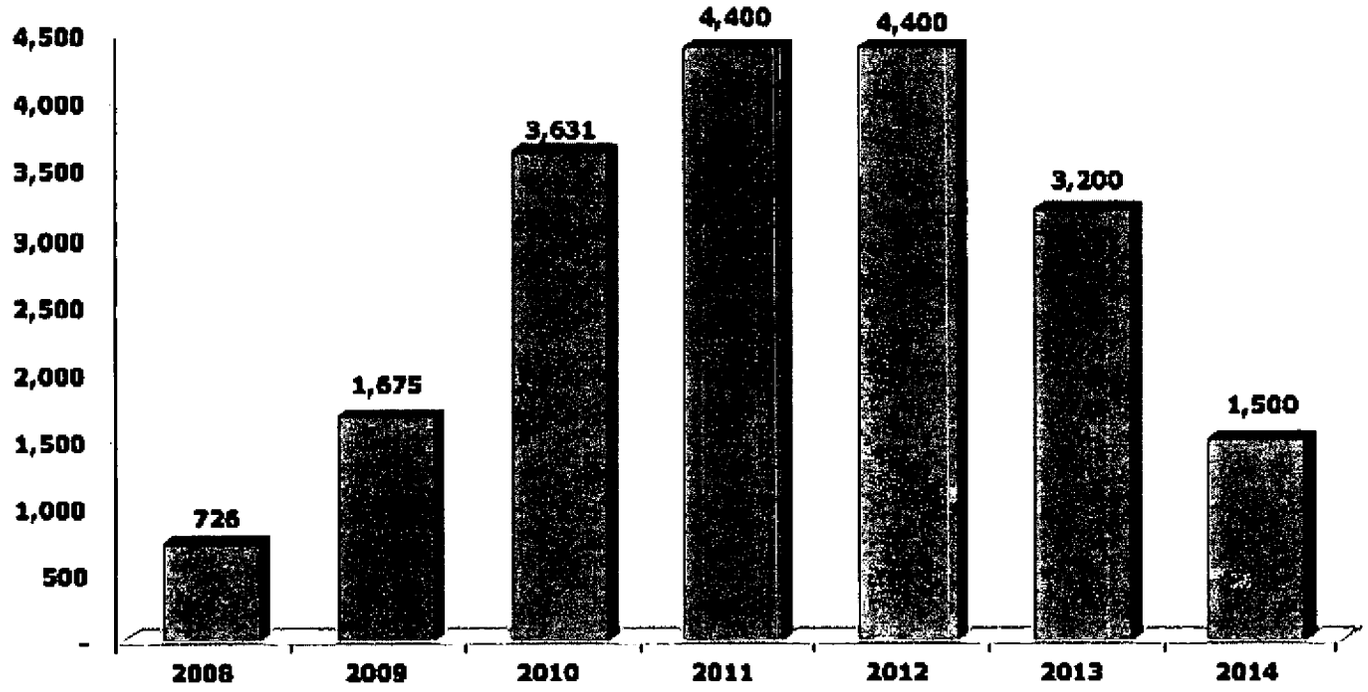
Revised West Side Highway Construction Staging Plan



YEAR	STAGE
2006	2, Vesey, 3A, 3B, 3C, 3D & 3E
2009	3E, 3F, 4A, 4B
2010 - 11	Memorial Frontage
After 2011	[illegible]

The Port Authority of NY & NJ

WTC Peak Manpower Year-to-Year



GRAPHIC 21