

= Construction of the World Trade Center =

The construction of the first World Trade Center was conceived as an urban renewal project , spearheaded by David Rockefeller , to help revitalize Lower Manhattan . The project was developed by the Port Authority of New York and New Jersey , which hired architect Minoru Yamasaki who came up with the specific idea for twin towers . After extensive negotiations , the New Jersey and New York state governments , which oversee the Port Authority , agreed to support the World Trade Center project at the Radio Row site on the Lower West Side of Manhattan , New York City . To make the agreement acceptable to New Jersey , the Port Authority agreed to take over the bankrupt Hudson & Manhattan Railroad , which brought commuters from New Jersey to the Lower Manhattan site and , upon the Port Authority 's takeover of the railroad , was renamed Port Authority Trans @-@ Hudson (now known as PATH) .

The towers were designed as framed tube structures , which provided tenants with open floor plans , uninterrupted by columns or walls . This was accomplished using numerous closely spaced perimeter columns to provide much of the strength to the structure , along with gravity load shared with the core columns . The elevator system , which made use of sky lobbies and a system of express and local elevators , allowed substantial floor space to be freed up for use as office space by making the structural core smaller . The design and construction of the World Trade Center , most centrally its twin towers , involved many other innovative techniques , such as the slurry wall for digging the foundation , and wind tunnel experiments . Construction of the World Trade Center 's North Tower began in August 1968 , and the South Tower in 1969 . Extensive use of prefabricated components helped to speed up the construction process . The first tenants moved into the North Tower in December 1970 and into the South Tower in January 1972 . Four other low @-@ level buildings were constructed as part of the World Trade Center in the 1970s , and a seventh building was constructed in the mid @-@ 1980s .

= = Planning = =

In 1942 , Austin J. Tobin became the Executive Director of the Port Authority , beginning a 30 @-@ year career during which he oversaw the planning and development of the World Trade Center . The concept of establishing a " world trade center " was conceived during the post ? World War II period , when the United States thrived economically and international trade was increasing . In 1946 , the New York State Legislature passed a bill that called for a " world trade center " to be established . The World Trade Corporation was founded , and a board was appointed by New York Governor Thomas E. Dewey to develop plans for the project . Architect John Eberson and his son Drew devised a plan that included 21 buildings over a ten @-@ block area , at an estimated cost of \$ 150 million . In 1949 , the World Trade Corporation was dissolved by the New York State Legislature , and plans for a " world trade center " were put on hold .

= = = Original plans = = =

During the post @-@ war period , economic growth was concentrated in Midtown Manhattan , in part stimulated by the Rockefeller Center , which was developed in the 1930s . Meanwhile , Lower Manhattan was left out of the economic boom . One exception was the construction of One Chase Manhattan Plaza in the Financial District by David Rockefeller , who led urban renewal efforts in Lower Manhattan . In 1958 , Rockefeller established the Downtown @-@ Lower Manhattan Association (DLMA) , which commissioned Skidmore , Owings and Merrill to draw up plans for revitalizing Lower Manhattan . The plans , made public in late June 1960 , called for a World Trade Center to be built on a 13 @-@ acre (53 @,@ 000 m²) site along the East River , from Old Slip to Fulton Street and between Water Street and South Street . The complex would include a 900 @-@ foot (275 m) long exhibition hall , and a 50 ? 70 story building , with some of its upper floors used as a hotel . Other amenities would include a theater , shops , and restaurants . The plan also called for a new securities exchange building , which the Downtown @-@ Lower Manhattan Association

hoped would house the New York Stock Exchange .

David Rockefeller suggested that the Port Authority would be a logical choice for taking on the project , and argued that the Trade Center would provide great benefits in facilitating and increasing volume of international commerce coming through the Port of New York . Given the importance of New York City in global commerce , Port Authority director Austin J. Tobin remarked that the proposed project should be the World Trade Center , and not just a " world trade center . " After a year @-@ long review of the proposal , the Port Authority formally backed the project on March 11 , 1961 .

= = = Agreement = = =

The States of New York and New Jersey also needed to approve the project , given their control and oversight role of the Port Authority . Objections to the plan came from New Jersey Governor Robert B. Meyner , who resented that New York would be getting this \$ 335 million project . Meanwhile , ridership on New Jersey 's Hudson and Manhattan Railroad (H & M) had declined substantially from a high of 113 million riders in 1927 to 26 million in 1958 , after new automobile tunnels and bridges opened across the Hudson River . Toward the end of 1961 , negotiations with outgoing New Jersey Governor Meyner regarding the World Trade Center project reached a stalemate . In December 1961 , Tobin met with newly elected New Jersey Governor Richard J. Hughes , and made a proposal to shift the World Trade Center project to a west side site where the Hudson Terminal was located . In acquiring the Hudson & Manhattan Railroad , the Port Authority would also acquire the Hudson Terminal and other buildings which were deemed obsolete . On January 22 , 1962 , the two states reached an agreement to allow the Port Authority to take over the railroad and to build the World Trade Center on Manhattan 's lower west side . The shift in location for the World Trade Center to a site more convenient to New Jersey , together with Port Authority acquisition of the H & M Railroad , brought New Jersey to agreement in support of the World Trade Center project .

= = = Controversy = = =

Even once the agreement between the states of New Jersey , New York , and the Port Authority was finalized , the World Trade Center plan faced continued controversy . The site for the World Trade Center was the location of Radio Row , which was home to hundreds of commercial and industrial tenants , property owners , small businesses , and approximately 100 residents . The World Trade Center plans involved evicting these business owners , some of whom fiercely protested the forced relocation . In June 1962 , a group representing approximately 325 shops and 1 @,@ 000 other affected small businesses filed an injunction , challenging the Port Authority 's power of eminent domain . The dispute with local business owners worked its way through the court system , up to the New York State Court of Appeals , which in April 1963 upheld the Port Authority 's right of eminent domain , saying that the project had a " public purpose . " On November 12 , 1963 , the United States Supreme Court refused to accept the case . Under the state law , the Port Authority was required to assist business owners in relocating , though many business owners regarded what the Port Authority offered as inadequate . Questions continued while the World Trade Center was constructed , as to whether the Port Authority really ought to take on the project , described by some as a " mistaken social priority . "

By 1964 , by which time the intended scale of the Yamasaki designed scheme had been made public with plans for the twin 110 @-@ story towers , private real estate developers and members of the Real Estate Board of New York also expressed concerns about this much " subsidized " office space going on the open market , competing with the private sector when there was already a glut of vacancies . An especially vocal critic was Lawrence A. Wien , owner of the Empire State Building , which would lose its title of tallest building in the world . Wien organized a group of builders into a group called the " Committee for a Reasonable World Trade Center " to demand that the project be scaled down .

In January 1964 , the Port Authority inked a deal with the State of New York to locate government offices at the World Trade Center . The Port Authority began signing commercial tenants in the spring and summer of 1964 , including several banks . In 1965 , the Port Authority signed the United States Customs Service as a tenant .

A final obstacle for the Port Authority was getting approval from New York City Mayor John Lindsay and the New York City Council , who raised concerns about the limited extent that the Port Authority involved the city in the negotiations and deliberations . Negotiations between The City of New York and the Port Authority were centered on tax issues . A final agreement was made on August 3 , 1966 , that the Port Authority would make annual payments to the City , in lieu of taxes , for the portion of the World Trade Center leased to private tenants . In subsequent years , the payments would rise as the real estate tax rate increased .

= = Design = =

= = = Design announced = = =

On September 20 , 1962 , the Port Authority announced the selection of Minoru Yamasaki as lead architect , and Emery Roth & Sons as associate architects . Originally , Yamasaki submitted to the Port Authority a concept incorporating twin towers , but with each building only 80 stories tall . Yamasaki remarked that the " obvious alternative , a group of several large buildings , would have looked like a housing project . " Yamasaki 's design for the World Trade Center was unveiled to the public on January 18 , 1964 , with an eight @-@ foot model . The towers had a square plan , approximately 207 feet (63 m) in dimension on each side . The buildings were designed with narrow office windows , only 18 inches (45 cm) wide , which reflected on Yamasaki 's fear of heights and desire to make building occupants feel secure . Yamasaki 's design called for the building facades to be sheathed in aluminum @-@ alloy .

To meet the Port Authority 's requirement to build 10 million square feet (930 @,@ 000 m ²) of office space , the buildings would each need to be 110 stories tall . A major limiting factor in building heights is elevators ; the taller the building , the more elevators are needed to service the building , requiring more space @-@ consuming elevator banks . Yamasaki and the engineers decided to use a new system that included sky lobbies , which are floors where people can switch from a large @-@ capacity express elevator , which goes only to the sky lobbies , to a local elevator that goes to each floor in a section (the local elevators can be stacked within the same elevator shaft) . Located on the 44th and 78th floors of each tower , the sky lobbies enabled the elevators to be used efficiently , while also increasing the amount of usable space on each floor from 62 to 75 percent by reducing the number of required elevator shafts . The World Trade Center towers were the second supertall buildings to use sky lobbies , after the John Hancock Center in Chicago . This system was inspired by the New York City Subway system , whose lines include local stations where local trains stop and express stations where all trains stop .

Yamasaki , who had previously designed Saudi Arabia 's Dhahran International Airport with the Saudi Binladin Group , incorporated features of Arabic architecture into the design of the World Trade Center . The plaza was modelled after Mecca , incorporating features such as a vast delineated square , a fountain , and a radial circular pattern . Yamasaki described the plaza as " a mecca , a great relief from the narrow streets and sidewalks of the Wall Street area . " He also incorporated other features of Arabic architecture into the building design , including pointed arches , interweaving tracery of prefabricated concrete , a minaret like flight tower , and arabesque patterns .

The World Trade Center design brought criticism of its aesthetics from the American Institute of Architects and other groups . Lewis Mumford , author of *The City in History* and other works on urban planning , criticized the project and described it and other new skyscrapers as " just glass @-@ and @-@ metal filing cabinets . " Television broadcasters raised concerns that the World Trade Center twin towers would cause interference in television reception for viewers in the New

York City area . In response to these concerns , the Port Authority offered to provide new television transmission facilities at the World Trade Center . The Linnaean Society of the American Museum of Natural History also opposed the Trade Center project , citing hazards the buildings would impose on migrating birds .

The structural engineering firm Worthington , Skilling , Helle & Jackson worked to implement Yamasaki 's design , developing the tube @-@ frame structural system used in the buildings . The Port Authority 's Engineering Department served as foundation engineers , Joseph R. Loring & Associates as electrical engineers , and Jaros , Baum & Bolles as mechanical engineers . Tishman Realty & Construction Company was the general contractor on the World Trade Center project . Guy F. Tozzoli , director of the World Trade Department at the Port Authority , and the Port Authority 's Chief Engineer , Rino M. Monti , oversaw the project .

= = = Structural design = = =

As an interstate agency , the Port Authority was not subject to local laws and regulations of the City of New York , including building codes . Nonetheless , the Port Authority required architects and structural engineers to follow the New York City building codes . At the time when the World Trade Center was planned , new building codes were being devised to replace the 1938 version that was still in place . The structural engineers ended up following draft versions of the new 1968 building codes , which incorporated " advanced techniques " in building design .

The World Trade Center towers included many structural engineering innovations in skyscraper design and construction , which allowed the buildings to reach new heights and become the tallest in the world . Traditionally , skyscrapers used a skeleton of columns distributed throughout the interior to support building loads , with interior columns disrupting the floor space . The tube @-@ frame concept , earlier introduced by Fazlur Khan , was a major innovation , allowing open floor plans and more space to rent . The buildings used high @-@ strength , load @-@ bearing perimeter steel columns called Vierendeel trusses that were spaced closely together to form a strong , rigid wall structure . There were 60 perimeter columns , narrowly spaced , on each side of the buildings . In all , the perimeter walls of the towers were 210 feet (64 m) on each side , and the corners were beveled . The perimeter columns were designed to provide support for virtually all lateral loads (such as wind loads) and to share the gravity loads with the core columns . Structural analysis of major portions of the World Trade Center were computed on an IBM 1620 .

The perimeter structure was constructed with extensive use of prefabricated modular pieces , which consisted of three columns , three stories tall , connected by spandrel plates . The perimeter columns had a square cross section , 14 inches (36 cm) on a side , and were constructed of welded steel plate . The thickness of the plates and grade of structural steel varied over the height of the tower , ranging from 36 @, @ 000 to 100 @, @ 000 pounds per square inch (260 to 670 MPa) . The strength of the steel and thickness of the steel plates decreased with height because they were required to support lesser amounts of building mass on higher floors . The tube @-@ frame design required 40 percent less structural steel than conventional building designs . From the 7th floor to the ground level , and down to the foundation , the columns were spaced 10 feet (3 m) apart . All columns were placed on bedrock , which , unlike that in Midtown Manhattan , where the bedrock is shallow , is at 65 ? 85 feet (20 ? 26 m) below the surface .

The spandrel plates were welded to the columns to create the modular pieces off @-@ site at the fabrication shop . The modular pieces were typically 52 inches (1 @. @ 3 m) deep , and extended for two full floors and half of two more floors . Adjacent modules were bolted together , with the splices occurring at mid @-@ span of the columns and spandrels . The spandrel plates were located at each floor , transmitting shear stress between columns , allowing them to work together in resisting lateral loads . The joints between modules were staggered vertically , so the column splices between adjacent modules were not at the same floor .

The building 's core housed the elevator and utility shafts , restrooms , three stairwells , and other support spaces . The core of each tower was a rectangular area 87 by 135 feet (27 by 41 m) , and contained 47 steel columns running from the bedrock to the top of the tower . The columns tapered

after the 66th floor , and consisted of welded box @-@ sections at lower floors and rolled wide @-@ flange sections at upper floors . The structural core in 1 WTC was oriented with the long axis east to west , while that of 2 WTC was oriented north to south . All elevators were located in the core . Each building had three stairwells , also in the core , except on the mechanical floors where the two outside stairwells temporarily left the core in order to avoid the express elevator machine rooms , and then rejoined the core by means of a transfer corridor . It was this arrangement that allowed Stairwell A of 2 WTC to remain passable after the aircraft impact on September 11 , 2001 .

The large , column @-@ free space between the perimeter and core was bridged by prefabricated floor trusses . The floors supported their own weight , as well as live loads , provided lateral stability to the exterior walls , and distributed wind loads among the exterior walls . The floors consisted of 4 @-@ inch (10 cm) thick lightweight concrete slabs laid on a fluted steel deck with shear connections for composite action . A grid of lightweight bridging trusses and main trusses supported the floors . The trusses had a span of 60 feet (18 m) in the long @-@ span areas and 35 feet (11 m) in the short span area . The trusses connected to the perimeter at alternate columns , and were on 6 @-@ foot @-@ 8 @-@ inch (2 @-@ 03 m) centers . The top chords of the trusses were bolted to seats welded to the spandrels on the exterior side and a channel welded to the core columns on the interior side . The floors were connected to the perimeter spandrel plates with viscoelastic dampers , which helped reduce the amount of sway felt by building occupants .

Hat trusses (or " outrigger truss ") located from the 107th floor to the top of the buildings were designed to support a tall communication antenna on top of each building . Only 1 WTC (north tower) actually had an antenna fitted , which was added in 1978 . The truss system consisted of six trusses along the long axis of the core and four along the short axis . This truss system allowed some load redistribution between the perimeter and core columns and supported the transmission tower .

= = = Wind effects = = =

The tube frame design using steel core and perimeter columns protected with sprayed @-@ on fire resistant material created a relatively lightweight structure that would sway more in response to the wind , compared to traditional structures such as the Empire State Building that have thick , heavy masonry for fireproofing of steel structural elements . During the design process , wind tunnel tests were done at Colorado State University and at the National Physical Laboratory in the United Kingdom to establish design wind pressures that the World Trade Center towers could be subjected to and structural response to those forces . Experiments were also done to evaluate how much sway occupants could tolerate . Subjects were recruited for " free eye exams , " while the real purpose of the experiment was to subject them to simulated building sway and find out how much they could comfortably tolerate . Many subjects did not respond well , experiencing dizziness and other ill effects . One of the chief engineers Leslie Robertson worked with Canadian engineer Alan G. Davenport to develop viscoelastic dampers to absorb some of the sway . These viscoelastic dampers , used throughout the structures at the joints between floor trusses and perimeter columns , along with some other structural modifications reduced the building sway to an acceptable level .

= = = Aircraft impact = = =

The structural engineers on the project also considered the possibility that an aircraft could crash into the building . In July 1945 , a B @-@ 25 bomber that was lost in the fog had crashed into the 78th and 79th floors of the Empire State Building . A year later , another airplane nearly crashed into the 40 Wall Street building , and there was another close call at the Empire State Building . In designing the World Trade Center , Leslie Robertson considered the scenario of the impact of a jet airliner , the Boeing 707 , which might be lost in the fog , seeking to land at JFK or at Newark airports . The National Institute of Standards and Technology (NIST) found a three @-@ page white paper that mentioned another aircraft impact analysis , involving impact of a jet at 600 mph (970 km / h) , was indeed considered , but NIST could not locate the documentary evidence of the

aircraft impact analysis .

== Fire protection ==

Sprayed @-@ fire resistant materials (SFRMs) were used to protect some structural steel elements in the towers , including all floor trusses and beams . Gypsum wallboard in combination with SFRMs , or in some cases gypsum wallboard alone , was used to protect core columns . Vermiculite plaster was used on the interior @-@ side and SFRMs on the other three sides of the perimeter columns for fire protection . The 1968 New York City building codes were more lenient in some aspects of fire protection , such as allowing three exit stairwells in the World Trade Center towers , instead of six as required under older building codes .

In April 1970 , the New York City Department of Air Resources ordered contractors building the World Trade Center to stop the spraying of asbestos as an insulating material .

More fireproofing was added after a fire in February 1975 that spread to six floors before being extinguished . After the 1993 bombing , inspections found fireproofing to be deficient . The Port Authority was in the process of replacing it , but replacement had been completed on only 18 floors in WTC 1 , including all the floors affected by the aircraft impact and fires on September 11 , and on 13 floors in WTC 2 , although only three of these floors (77 , 78 , and 85) were directly affected by the aircraft impact .

The 1968 New York City building codes did not require sprinklers for high @-@ rise buildings , except for underground spaces . In accordance with building codes , sprinklers were originally installed only in the underground parking structures of the World Trade Center . Following a major fire in February 1975 , the Port Authority decided to start installing sprinklers throughout the buildings . By 1993 , nearly all of 2 WTC and 85 percent of 1 WTC had sprinklers installed , and the entire complex was retrofitted by 2001 .

== Construction ==

In March 1965 , the Port Authority began acquiring property at the World Trade Center site . The Ajax Wrecking and Lumber Corporation was hired for the demolition work , which began on March 21 , 1966 to clear the site for construction of the World Trade Center .

== Twin Towers ==

Groundbreaking was on August 5 , 1966 , marking the beginning of construction of the World Trade Center 's foundations . The site of the World Trade Center was located on landfill , with the bedrock located 65 feet (20 m) below grade . In order to construct the World Trade Center , it was necessary to build " The Bathtub " , with the slurry wall along the West Street side of the site , to keep water from the Hudson River out . This method was used in place of conventional dewatering methods because lowering the groundwater table would cause large settlements of nearby buildings not built on deep foundations . The slurry method involves digging a trench , and as excavation proceeds , filling the space with a " slurry " mixture , composed of bentonite which plugs holes and keeps water out . When the trench was dug out , a steel cage was inserted , with concrete poured in , forcing the " slurry " out . The " slurry " method was devised by Port Authority chief engineer John M. Kyle Jr . Towards the end of 1966 , work began on building the slurry wall , led by Montreal @-@ based Icada , a subsidiary of an Italian engineering firm , Impresa Costruzioni Opere Specializzate (I.C.O.S.) . It took fourteen months for the slurry wall to be completed , which was necessary before excavation of material from the interior of the site could begin . The original Hudson Tubes , which carried PATH trains into Hudson Terminal , remained in service as elevated tunnels until 1971 when a new PATH station was built .

Construction work began on the North Tower in August 1968 with construction beginning on the South Tower by January 1969 . In January 1967 , \$ 74 million in contracts were awarded to the Pacific Car and Foundry Company , Laclede Steel Company , Granite City Steel Company , and

Karl Koch Erecting Company to supply steel for the project . The Port Authority chose to use many different steel suppliers , bidding on smaller portions of steel , rather than buy larger amounts from a single source such as Bethlehem Steel or U.S. Steel as a cost @-@ saving measure . Karl Koch was also hired to do all the work of erecting the steel , and a contract for work on the aluminum facade was awarded to the Aluminum Company of America . Tishman Realty & Construction was hired in February 1967 to oversee construction of the project .

Extensive use of prefabricated parts for the perimeter framing and floor truss systems helped speed up the construction process and reduce costs , while providing greater quality control . Steel components were freighted into a Penn Central yard in Jersey City . From there , they were brought in early morning hours through the Holland Tunnel to the construction site , and lifted into place by a crane . Larger pieces were brought to the construction site by tugboats . A special type of crane , suitable for constructing such tall buildings , that used hydraulics to lift components and provided its own power was used in construction of the World Trade Center . The Favco Standard 2700 Crane , manufactured by Favelle Mort Ltd. of New South Wales , Australia was informally called a " kangaroo crane . "

In 1970 , tugboat workers went on strike , halting the transport of material to the construction site . The Port Authority attempted other means of transporting material , including via helicopter . When this method was tried , the helicopter lost its load of steel into the Kill Van Kull . Some other mishaps occurred during the construction process , including disruption of telephone service in Lower Manhattan when telephone cables were crushed by pile drivers . On March 16 , 1970 , an explosion injured six workers when a truck hit a propane tank . In all , 60 workers were killed in construction accidents while the World Trade Center was being built .

The topping out ceremony of 1 WTC (North Tower) took place on December 23 , 1970 , with 2 WTC 's ceremony (South Tower) occurring later on July 19 , 1971 . The first tenants moved into the North Tower on December 15 , 1970 , and into the South Tower in January 1972 . The buildings were dedicated on April 4 , 1973 ; Tobin , who had resigned the year before , was absent from the ceremonies .

Building the World Trade Center involved excavating 1 @, @ 200 @, @ 000 cubic yards (920 @, @ 000 m3) of material . Rather than transporting this material at great costs out to sea or to landfills in New Jersey , the fill material was used to expand the Manhattan shoreline across West Street . Work to demolish the piers began on January 5 , 1967 , including Pier 7 to Pier 11 which were all constructed around 1910 . The demolition work moved forward , despite conflicts between David Rockefeller , Governor Nelson Rockefeller , and Mayor John Lindsay regarding plans for Battery Park City . Landfill material from the World Trade Center was used to add land , and a cellular cofferdam was constructed to retain the material . The result was a 700 @-@ foot (210 m) extension into the Hudson River , running six blocks or 1 @, @ 484 feet (452 m) . This land was a " gift " to New York City , allowing more tax @-@ generating developments in Battery Park City .

The original estimates put forth by the Port Authority had the costs for construction of the World Trade Center at \$ 350 million ? an optimistic figure . In December 1966 , the Port Authority announced increased cost estimates , bringing the estimated total to \$ 575 million . This announcement brought criticism of the project from private real estate developers , The New York Times , and others in New York City . The critics charged that the Port Authority figure was an unrealistically low estimate , and they estimated the project would end up costing \$ 750 million . When the World Trade Center twin towers were completed , the total costs to the Port Authority had reached \$ 900 million . The project was financed through tax @-@ exempt bonds issued by the Port Authority .

= = = Other buildings = = =

The World Trade Center complex included four other smaller buildings constructed during the 1970s . 3 World Trade Center was a 22 @-@ story building , which was home to the Marriott World Trade Center . It was designed by Skidmore , Owings and Merrill in 1978 ? 79 . 4 World Trade Center , 5 World Trade Center , and 6 World Trade Center were all 8 ? 9 story buildings that were

designed by the same team as the Twin Towers , including Minoru Yamasaki , Emery Roth & Sons , and Skilling , Helle , Christiansen , Robertson . 7 World Trade Center was built in the mid @-@ 1980s , just north of the main World Trade Center site . The 47 @-@ story building was designed by Emery , Roth & Sons , and constructed on top of a Con Edison power substation .

= = Modifications = =

Over time , numerous structural modifications were made to suit the needs of tenants in the Twin Towers . Modifications were made in accordance with the Port Authority 's Tenant Alteration Review Manual and were reviewed by the Port Authority to ensure the changes did not compromise structural integrity of the buildings . In many instances , openings were cut in the floors to accommodate new stairways to connect tenant floors . Some steel beams in the core were reinforced and strengthened to accommodate heavy live loads , such as large amounts of heavy files that tenants had on their floors .

Repairs to structural elements on the lower levels of 1 WTC were made following the 1993 bombing . The greatest damage occurred on levels B1 and B2 , with significant structural damage also on level B3 . Primary structural columns were not damaged , but secondary steel members experienced some damage . Floors that were blown out needed to be repaired to restore the structural support they provided to columns . The slurry wall was in peril following the bombing and loss of the floor slabs which provided lateral support to counteract pressure from Hudson River water on the other side . The refrigeration plant on sublevel B5 , which provided air conditioning to the entire World Trade Center complex , was heavily damaged and replaced with a temporary system for the summer of 1993 . The fire alarm system for the entire complex needed to be replaced , after critical wiring and signaling in the original system was destroyed in the 1993 bombing . Installation of the new system took years to complete , and replacement of some components was still underway in September 2001 .