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PLANNING AND ARCHITECTURE

The Future of High-Rise Buildings

George Schipporeit

For anyone interested in the relationship of urban issues and tall buildings, there is no greater challenge than this 6th World Congress theme of "Cities and the Third Millennium." The last few decades leading up to this threshold of time have demonstrated an unprecedented acceleration of transformation and change. Because there has been no long-term learning curve, the marketplace has become the judge of success and cities have been expected to just absorb the growth.

Yet, the future of high-rise buildings when viewed from their origins, and albeit brief history, do hold lessons to be learned and assessments that can be made. However, it should also be noted that from the famous Home Insurance Building, by William Le Baron Jenny, in 1885, through the beginning of the Great Depression, and from post-World War II through the year 2000, there are generally two 50-year increments, or a mere 100 years of development. Well intentioned perceptions must be expected to compensate for the luxury of an extended period of architectural history. Even with these limitations it is still necessary to look back before projecting forward.

It seems so natural now to understand how Chicago was destined to become the culture that produced the first tall buildings and the powerful verbal image skyscraper. The reconstruction of the city after the Great Fire was well under way, there was a vibrant creative architectural community that had been drawn to this construction cycle and there was a surge of commercial growth that motivated the investment in increased rentable floor area. But even more important was the resource of technology. The skeleton structural frame of the Home Insurance Building benefited from the first steel available from the adjacent mills, electric elevators had replaced the original steam lifts by E. G. Otis and, to compensate for the low-bearing capacity soils, new foundation systems were engineered from steel and concrete.

These three technologies, and the practical considerations of investment, became the drivers of an architecture known as the Chicago School. It was based on the form developing from a functional plan. Each building came down to the property line to include a street edge of retail. If the site were large, the narrow office configuration required for natural ventilation formed interior courts with the vertical plumbing, stairs and elevators given this inner orientation. But what was most evident was a fierce determination to develop an ornamentation that broke away from historical tradition to find its own appropriate architectural expression.

The vitality of this period continued into the turn of the century and also produced buildings in other surrounding cities, including Sullivan's Wainwright Building, St. Louis, in 1890, and Guaranty Building, Buffalo, New York, in 1895. But perhaps the most significant architecture of this time is the Reliance Building in Chicago, by Burnham & Root, in1895, with the profound lightness of its glass and terracotta skin drawing in as much natural light as possible with the undulating bay windows.

Figure 1 Reliance Building, Chicago: Burnham and Company 1894 (Courtesy: Chicago Historical Society).

Then with the construction of Burnham's twentytwo story Flat Iron Building, New York, in 1903, the momentum shifted east. By shear numbers, this domination continued during the balance of this first phase of high-rise construction. However, the East Coast architects were more heavily influenced by the European Beaux-Arts traditions and their tall buildings now expressed an historical eclecticism. And, as the engineering confidence in steel developed, the investor motivation of rentable area was reinforced with the identity of an individual building's domination of height. Zoning now became the only limitation.

Figure 2 Empire State Building, New York Shreve Lamb and Harmon, 1931 (Courtesy: Empire State Building).

Some of the crowning achievements of a mature architecture were designed during the final building boom of the late 20's and early 30's. Chicago and New York, along with many other U.S. cities, were unified with the rich expression of Art Deco and the search to create a modern style. New simplified vertical forms and massing replaced the dependence on historical ornamentation. In one dynamic shift, an exciting collaboration of architects, painters and sculptors enriched the exterior detailing, street edge scale storefronts and majestic lobbies with the luxury of a beautiful, artistic craftsmanship of stone and metal.

In Chicago, two exceptional tower examples were the Palmolive Building, in 1929, and the Chicago Board of Trade in 1930, both by Holabird and Root. However, it was New York that seemed to express this spirit best with three projects which have that unique quality of being both the best of an ideal and the end of a period.

The Chrysler Building, by William van Alen, in 1930, literally topped off the ultimate expression of Art Deco. It ended up being number two in the race for height at 1046 feet. Number one for over 40 years at 1250 feet, and still the best architecture of a tower on a base, is the Empire State Building, by Shreve, Lamb & Harmon. Opening on May 1, 1931, a little over one year after the start of construction, it set a standard yet unequaled for logical construction and contractor coordination.

The end of the era produced this century's finest example of an urban vision. Rockefeller Center, by Raymond Hood, collaborating with an architectural team that included Andrew Reinhard and Wallace K. Harrison, clustered fourteen buildings around the central axis of an arcade and sunken plaza, a concourse of retail shops and a double height lobby that connects Fifth Avenue with the Sixth Avenue subway. The RCA Building and Radio City Music Hall opened in 1932, with the construction of the remaining buildings struggling through the 1930's.

Figure 3 Rockefeller Center, New York Hood with Reinhard and Harrison, 1932–1939 (Courtesy: Rockefeller Center).

Even though economics were a constant concern, the plaza areas and lower rooftops were landscaped as elegant formal gardens with the skating rink added in 1936. Sculpture and extensive murals embellish the outdoor and indoor spaces, high speed elevators and one of the first applications of central air-conditioning established the quality level of Rockefeller Center in the marketplace. But it is the lofty formal massing and the intimacy of the outdoor spaces that still gives anyone coming off Fifth Avenue an unforgettable urban experience.

By the late 1940's, the post-war economy of the U.S. had made the transition from wartime industry to the expanded production required to meet the pent-up civilian demands. The last of the office space that had remained vacant since the Depression was rented and a building boom began with a construction volume unprecedented in history. New York was the first city to recover and shake off the gloom of office building investment. Most of these initial buildings were generic with wedding cake profiles filling out the maximum allowable zoning. While the exteriors generally reflected that which had been done twenty years before, there were major new contributions of technology. The market had changed to larger floor areas that were made possible by fluorescent lighting that was cooler and more efficient, central air-conditioning to provide comfort levels for both interior and exterior zones and faster automatic elevators.

During the intervening years, the architectural climate had also changed. Historical styles no longer seemed appropriate. There was a post-war optimism at all levels of society and the issue was not looking to the past but, once again, searching for the new. Modernism was an idea whose time had come and the architectural leadership was about to shift back to Chicago.

The creative forms and embellishment of Art Deco in the 1920's had grown out of an earlier arts and craft movement. With an almost parallel development, Modernism had its origins in the Bauhaus and the belief that technology was the spirit of the time. When Mies van der Rohe came to Chicago in 1938, to become director of the architectural program at what is now Illinois Institute of Technology, he was recognized as its leading practitioner. This stature was based on a few very visionary drawings, his role at the Bauhaus, furniture design and three modern low-rise structures. Chicago would provide the first opportunity to do high-rise buildings.

It is possible to review the dynamics of change through the development of the residential and office prototypes in Mies' office. Promontory Apartments, Chicago, 1949, was a 22 story reinforced concrete structure representing pre-war construction technology. The floor was a pan forming system with a plaster suspended ceiling, partitions were plaster on masonry units and the exterior was the exposed concrete skeleton with brick spandrels and infill. 860-880 Lake Shore Drive, Chicago, 1951, was a 26 story steel structure with a steel and glass skin that became the icon of Mies' influence. Sited along the shore of Lake Michigan and surrounded by vacant land with surface parking, the glass lobbies were recessed and the buildings were expressed as free-standing towers.

Commonwealth Promenade and 900 Lake Shore Drive, Chicago 1956, were two buildings that made the transition to flat slab construction and at 28 stories were the world's tallest reinforced concrete structures. The underside of the concrete slab was now the ceiling and the partition system was a combination drywall with a single coat of wet plaster. Air-conditioning had not been included in 860 and 880 because the lenders believed the additional costs were not financially feasible. These two projects now became the first residential buildings to have central air-conditioning. The exterior skin was a custom curtain wall of aluminum extrusions fabricated into a grid and glazed with tinted glass. The cycle of new construction technology was completed in 1958 when drywall systems completely replaced all wet plaster.

Figure 4 860–880 North Lake Shore Drive, Chicago Mies van der Rohe, 1951 (Courtesy: Chicago Historical Society).

All of the previous studies and issues of proportion were brought together with the opportunity to do the Seagram Building, 1958. The entire building with its special hardware, light fixtures, perimeter air diffusers, partition systems and all of the other new products were designed to convey a unified feeling of quality. This was to be Mies' first and only office building in New York. Understated with its curtain wall of extruded bronze and tinted glass, the tall slender 38 story massing set back from Park Avenue became the ultimate tower on a plaza.

Figure 5 Seagram Building, New York Mies van der Rohe, 1958 (Courtesy: J. A. Seagram).

This image, along with the growing momentum of the U.S. economy, positioned corporate identity towers as the dominant architecture for the next twenty years. Where zoning would permit, every major city was growing its own skyline of tall buildings. Along the way, the developer began to be the client and the corporate name was the marketing lure for a large block of office space. During the 1980's, this architecture truly became international. First in

Europe for more scaled down high-rise banking and office market requirements, and then for the balance of the century, in Asia and the Pacific rim countries to establish their status. For the developed cities, the high-rise buildings solidified their economic strength in the region. For the developing countries, the high-rise buildings attempted to establish credibility to attract foreign investment.

Looking back now over this very brief summary that represents 100 years of history, it is easy to give an unqualified answer, "Yes, there is a future for high-rise buildings." However, this is not a clarion call to Utopia.

The most glaring error is that high-rise apartment blocks must not warehouse low income subsidized families. While they may have been built with at least the good intentions of providing new, clean housing and the illusion of urban renewal, their failure has finally been accepted. Through the years the social programs increased the isolation, dependency and poverty. In spite of the politicians who have feared losing control of their constituency, virtually all of these remaining apartment buildings in Chicago will be demolished in the next few years. Buildings do not solve social problems.

There are also the issues of urban fabric and infrastructure. During the first 50 years, all of the office buildings were built out to the property line and maintained a sidewalk edge of retail shops. Even Rockefeller Center lined its inward arcade and sunken plaza with shopping, and the Empire State Building sets the example of retaining the street edge urban scale with a tower on a base. New assessments must be made.

Every city might welcome a dignified tower on a plaza. Open spaces also have an urban value. What did not work were the zoning changes that provided bonuses for ground floor set backs. When implemented, this completely destroyed the life-giving street edges of the city. Moreover, it also affected the architecture. It seemed that most high-rise buildings were being designed with presentation drawings and constructed as stand-alone objects expressing more of the architect's pastiche rather than their role in the urban setting. What began as a positive search for diversity has the danger of becoming an end unto itself. It is a fundamental dichotomy that high-rise buildings have achieved a confident sophistication of architecture and technology, but there is still much to learn about how to enrich the city with their development. One lesson is to look back again to the 1920's.

Returning from a trip to New York, Frank Lloyd Wright did a series of drawings titled, "Skyscraper Regulation," in 1926. His basic concept was to accept the grid and plan several city blocks at one time. Parking was to be below grade or above the second floor within the complex. The street level was maintained for services and automobile access with the streets widened for landscaped medians. The second level was pedestrian with sidewalks that bridged over the streets. Horizontal surfaces were landscaped gardens and terraces with some connecting pedestrian walkways also spanning the streets. All of the services including parking, retail, commercial and restaurants, were planned within the horizontal infrastructure of the base with the towers given their own open orientation into the natural setting of the roof level parks. The beauty and the logic of these theoretical drawings were Wright's last attempt to make sense out of the city before his dictum that it should spread out.

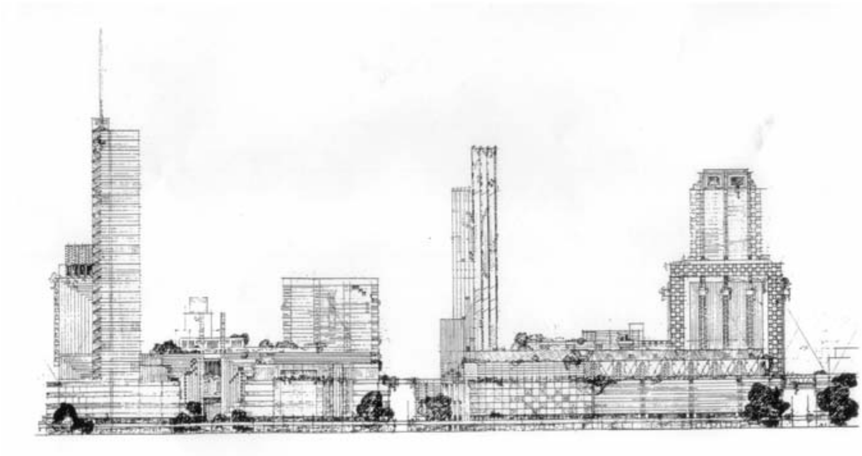

Figure 6 Skyscraper Regulation, New York Frank Lloyd Wright, 1926 (Courtesy: Copyright 2000 The Frank Lloyd Wright Foundation).

Some 40 years later, the graphics had changed to master plans that could address larger segments of a city. Incorporating the new terminology of urban design, these new images could represent streets with vistas and landscaped edges framing an attractive mix of high-rise buildings. However, when examined more closely, they were usually just identifying parcels of land for separate development without any provisions for integrating the buildings together with a cohesive infrastructure. It is a significant commentary on the present urban reality to note that even with the timeless message of Rockefeller Center, cities have continued to be built with stand-alone icons.

One significant exception is Embarcadero Center, in San Francisco, by John Portman, 1976-1981. This 8.5 acre site has a wedge-shaped atrium hotel on the east end near the Bay and extends west five city blocks with three additional blocks added in a second phase. All parking is below grade with the street level and two additional pedestrian circulation levels forming a three-story base for the towers. An existing east-west street through the center of the project was closed to vehicular traffic to form a three-level pedestrian spine. Bridging over streets and connecting the Golden Gateway housing on the west with Justin Herman Plaza at the Bay end, it becomes a wide landscaped multilevel access to the retail shops, restaurants and building lobbies. These three levels of public spaces are really people places with generous seating, trees, fountains and art work. If the provisions for financing to build out a complete complex at one time can be achieved, the potential of including similar quality amenities only enhance the success and secure the investment of the venture. The lesson here is not just assembling several square blocks for an urban development, the architecture must also produce a sense of place.

Figure 7 Embarcadero Center, East View, San Francisco, John Portman, 1976–1981 (Courtesy: John Portman and Associates).

All of these issues became the premise for a joint research project at the College of Architecture, Illinois Institute of Technology (IIT), that was supported by the resources of, and funded by, Hyundai Engineering and Construction (HDEC), of Seoul, Korea. Previous publications from the Council on Tall Buildings and Urban Habitat, including most recently Chapter 2 of the 1995 Architecture of Tall Buildings, have documented IIT's historic and current role in the development of high-rise buildings. In general, it has been the tradition that students at the Graduate and Doctorate level use the design studio as a research process to combine faculty from the academy with professionals from practice to form a unique study environment. This same format was used to assemble a research team of several graduate students, key professional consultants, along with full-time representatives of architecture, structural and mechanical engineering from HDEC that were all coordinated by IIT faculty.

The initial proposal was the research and design services to consolidate the globalization of communication and electronic industries with a 340,000 M^2 (3,650,000 sq ft) ultra-tall office building with a 600 room hotel in a planned area of Seoul, to be named The Hankang City Project. Including a Business Center and an Electronics Exhibition and market, the total area was programmed at 490,000 sq M (5,250,000 sq ft) with approximately 4,600 cars. During October 1996, four different architectural options, including their structural systems, for a 502 M (1,650 ft) tower with 134 floors on a four-level base, were presented to ownership. The selection process for the final tower to be designed in more detail during a Phase II of research also revealed some major problems. It became obvious that it would be virtually impossible to build a project this large in a relatively undeveloped location in Seoul without the required supporting infrastructure. The decision was made to position the ultra-tall tower within the context of a completely planned Hankang City.

To resolve the growth and economic needs of Seoul as a world-class city, the City Planning Committee had designated five strategic major centers within the metropolitan area that had the potential for major urban development. This proposed site of approximately 685,000 M^2 included a U. S. military compound in the center, railroad property, and a low density residential district with few social constraints. The priority of urban issues were identified as: vehicular and pedestrian traffic flow; multilevel streets; large horizontal base building to include the various functions and the orientation of the tower to open and closed spaces.

Since 1993, the Seoul City Planning Committee has been preparing policies for development schedules, criteria for planning, financial control and developer selection. The primary goal of the Hankang City Program was to bring together an appropriate mix of investment real estate to assure financial feasibility:

Hankang City Transportation Center	180,000 M^2
Exhibition and Convention Center	220,000 M^2
Convention Hotels	400,000 M^2
Ultra-Tall Tower Complex	490,000 M^2
Four Tower Office Complex	500,000 M^2
Retail Shopping Center	300,000 M^2
Market Rate Residential	740,000 M^2
Public Service Facilities	60,000 M^2
	2,890,000 M^2
	(31,000,000 sq ft)
	Not including parking and service areas

The challenge was to unify these functions with a design concept that would be cutting edge for improving the living and working environment with a new urban quality of life. Most cities have a central office core with residential high-rise and low-rise options distributed within the metropolitan area. This separation of office and residential forces the major shift of a commuting population every working day. For urban areas with accelerated growth, an already inadequate transportation infrastructure becomes intolerable. By bringing all of these functions together, Hankang City has the opportunity to demonstrate a new form of urban architecture and construction to accommodate urban growth for the 21st Century.

The most immediate planning concern before any design level decisions were made was the flow of all traffic to and from the site. These considerations had to include the total mix of varied traffic requirements, including office, retail, shopping center, hotel, convention, electronic market and residential, along with access to the new Hankang City Transportation Center. There is a six lane east-west access road at the south edge of the site, along with another four lane access road at mid-point, that both connect with the Riverside Expressway on the north edge of the Han River. The elevation of these roads are +6 M with long ramps that bring all traffic down to grade. A north-south high speed expressway next to the east edge of the site is planned at −6 M with ramps bringing all traffic up to grade with an interchange for Hankang City and another for the Transportation Center. Internal circulation has been planned to minimize any traffic light constraints.

As was previously stated, one of the most critical issues of international urban development is that the transportation infrastructure invariably lags behind the exponential growth. Hankang City brings together one of the most sophisticated intermodel transportation systems ever consolidated into a single Transportation Center. Within the classical scale of a transportation hub space of approximately 1000 M^2 (10,760 sq ft) with a 38 M (125 ft) high vaulted roof of glass are the interfaces of a new high speed train station, a railroad station for surface trains along with express rail to the international airport, an existing subway system, commuter bus terminal and expressway vehicular traffic. Three levels of perimeter shops, restaurants and travel services surround the space to provide all appropriate travel amenities, along with direct connections to a 7,500 car parking garage. This hub, in turn, is linked to Hankang City with a loop transit system that has two shuttle trains with a continuous cycle. One train travels clockwise from the station and the other counterclockwise for optimum access to terminals adjacent to all buildings and functions.

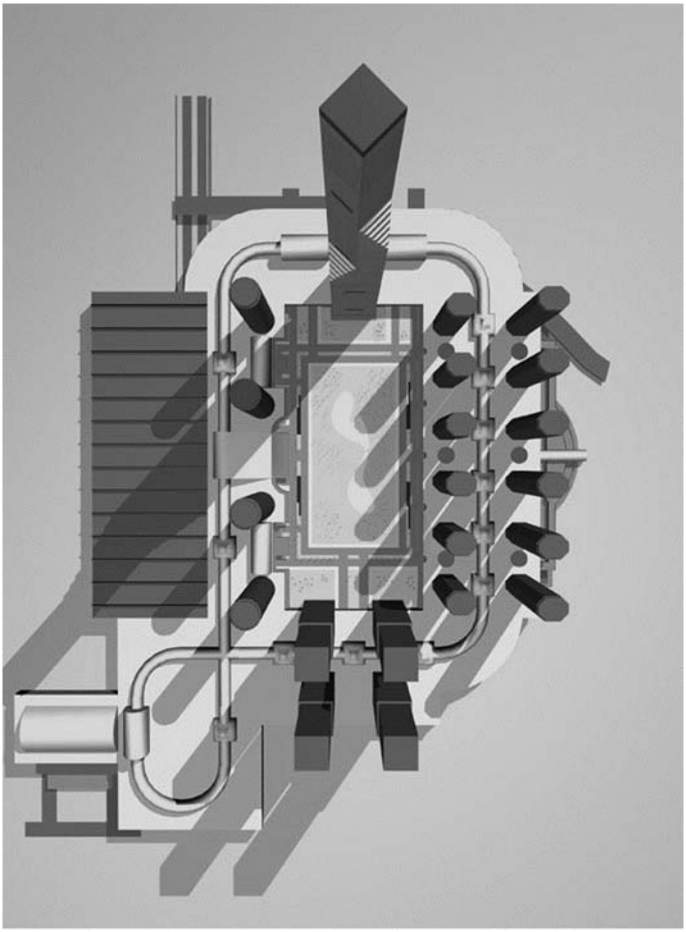

Figure 8 Hankang City, Plan View, Seoul, Korea IIT/Hyundai Joint Research, 1997 (Courtesy: Robert Krawczyk).

Two basic decisions established the design concept for Hankang City. The first was to simply raise the plaza level to a +12 M (40 ft) elevation. A single basement level permits automobile and pedestrian circulation under the grade level streets with typically four levels of parking above grade at 3 M floor to floor. This above grade structure for parking is not only more economical to build, it also becomes available for alternate functions during the evening and weekends i.e., office parking is also available for the Shopping Center and the Exhibition and Convention Center.

The other planning concept decision was to build the 100,000 M^2 (1,076,000 sq ft) exhibition building over the eight lane expressway to the east edge of the site. This recaptured site area becomes a Central Park with burmed landscaping, lakes and walking paths. The actual park is 134 M wide by 300 M long (10 acres), but when the landscaped open space is combined to include other landscaped areas, the open space is 215 M wide by 475 M long, or over 100,000 M^2 (25 acres). This Central Park landscaping and the scale of the open space balance the high density with nature.

The ultra-tall tower is located on the south end of Central Park and is complemented by a four office building complex on the north end. On both the east and west edges of this Plaza Level open space, the sidewalk is enriched with the scale of trees and the diversity of shops, restaurants and gathering places for outdoor dining and people-watching at both the sidewalk level and the outdoor Promenade at the Concourse Level. Also at this level is a continuous two story interior pedestrian arcade with a vaulted skylight of glass that encloses the shuttle trains.

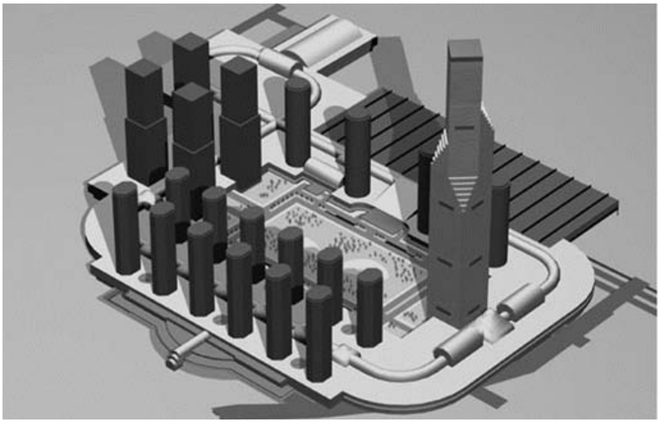

Figure 9 Hankang City, Southwest View, Seoul, Korea IIT/Hyundai Joint Research, 1997 (Courtesy: Robert Krawczyk).

To conveniently serve the needs of the Convention Center, two hotels have an exterior orientation to Central Park along with direct access to the Convention Arcade. Each has two 155 M, 50 story towers with 1,000 rooms each, or a total of 4,000 rooms. Meeting rooms and food services that are normally required to serve a convention facility are provided by the hotels. Basement unloading facilities are shared with the Convention Center. The large 95,000 M^2 exhibition space is divisible into smaller units, each with its own entrance from the +18 M Concourse Level. There is also a lower level interstitial space for services and smaller exhibitions at the +12 M Plaza Level.

Most of the 300,000 M^2 of retail is located in the Shopping Center on the west side of Central Park. The sidewalk edge and Concourse Level Promenade have an exterior exposure for a diversity of shops and restaurants. Two levels of shopping also line both sides of a continuous interior Arcade at the +18 M Concourse Level and the +24 M Shuttle Level. The west edge terraces down to grade level to link with the existing Seoul Electronics Market.

The Shopping Center Arcade becomes the Concourse Level main street and central circulation spine for pedestrian access to all of the residential towers. This city sidewalk edge has the shops, restaurants, cinemas, entertainment and support services, bringing the people places, color and sounds of a city together into a unique urban environment. At the axis with the residential buildings, there is the identity of a larger spatial intersection with smaller arcades leading to the secure lobbies of both buildings. The +12 M Plaza Level has lobby access for taxi and visitor parking. A 27 M diameter opening through the Shopping Center brings natural light down to this level. Six 122 M, 45 story residential towers have 500 units each, or a total of 3,000 units. On the west side of the Arcade there are six 152 M, 55 story towers that have 600 units each, or a total of 3,600 units. The roof over the Shopping Center is landscaped as a private park for the residents that would also include recreational facilities, community center, daycare centers and elementary schools. Hankang City makes it possible to have the convenience of both living and working within the diversity of this self-sufficient community.

At the north end of Central Park, four 245 M, 60 story office towers of 125,000 M^2 (1,350,000 sq ft) each are grouped around a common covered courtyard. The Plaza Level has the drop-off areas and the garage entrance for the cars and driver limousines. There is a single major shuttle train terminal with radiating arcade access through support retail to the individual lobbies at the Concourse Level. It would also be possible for the two towers on Central Park to each have small 200 room boutique hotels on the upper floors.

The ultra-tall tower is given the dominant position at the south end of Central Park with open views along the Han River to the east and west and across the river to the city views of Seoul. Observation levels and restaurants are located on the four top floors. The next twenty-two floors have the hotel sky lobby and 600 guest rooms with an additional seven floors of support services below the sky lobby. There are two floors of mechanical with the balance of the floors divided up into three office zones with mechanical floors between each zone. As each of the corners of the tower are dropped off to change the form to a rotated square, the stepped enclosure becomes a twelve story atrium planned as corporate community space. The lowest level would be landscaped as a terrace and gathering place with food service available throughout the day. The remaining floors could have private dining rooms, conference rooms and executive offices opening out to the space.

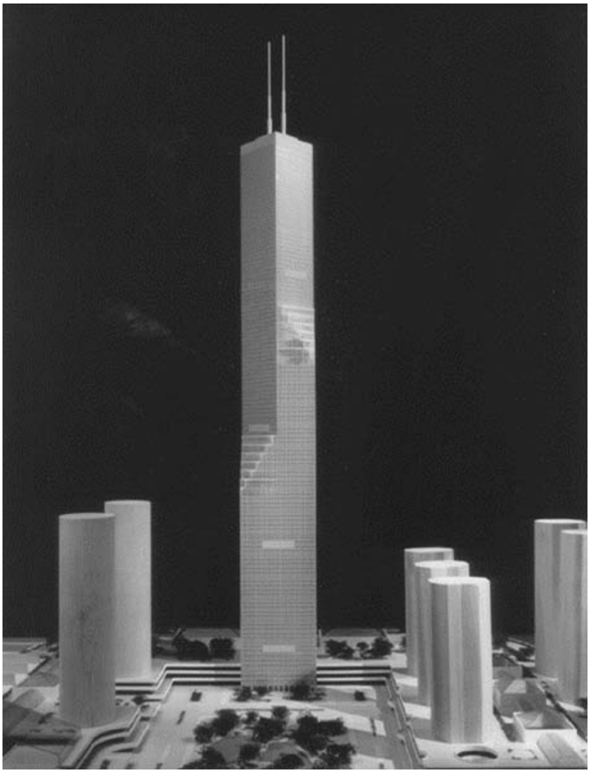

Figure 10 Hankang City, North View, Seoul, Korea IIT/Hyundai Joint Research, 1997 (Courtesy: Orlando Cabanban).

The horizontal structure is a very critical element of the project. It must accommodate a population of approximately 20,000 people, including the functions of the Business Center with its meeting rooms and auditorium, racquet club, the hotel banquet rooms and back-up services, the transportation node and support shopping center, lobby areas for the hotel and office portions of the tower and the circulation for the observation decks and sky restaurants. But perhaps its most important architectural significance is to provide a strong visual platform as a base for the ultra-tall tower.

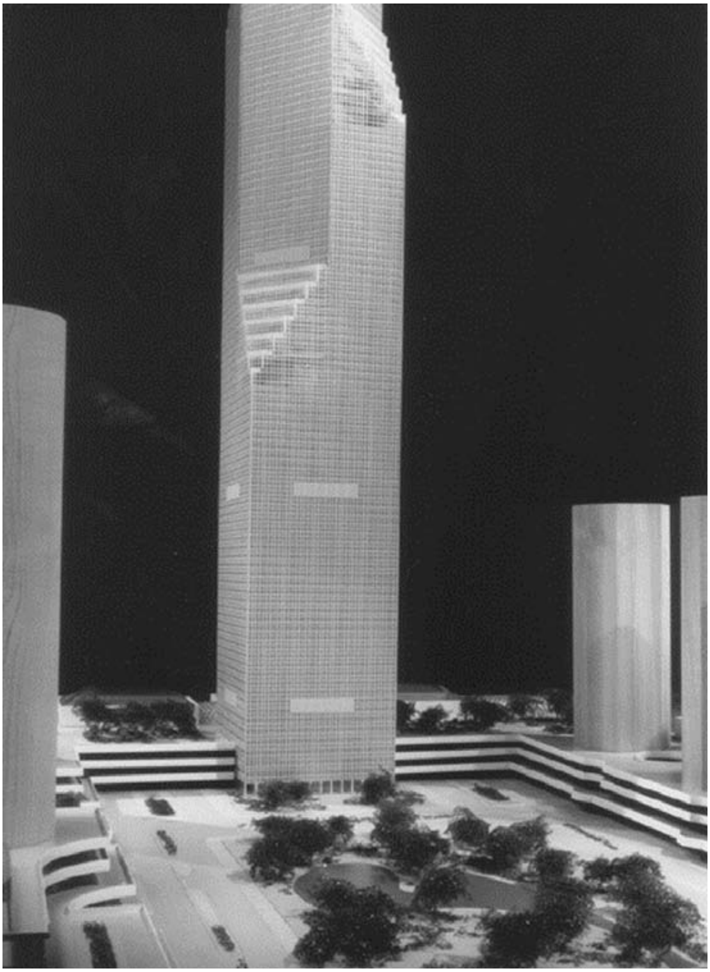

Figure 11 Hankang City, Northwest View, Seoul, Korea IIT/Hyundai Joint Research, 1997 (Courtesy: Orlando Cabanban).

The final presentation included a complete engineering analysis to confirm feasibility. Both lateral and gravity loads were resolved with a structural system that combines an exterior structural steel frame tube and an interior structural concrete core-wall which drops off below the upper third of the building. At the transition zones, the lateral loads are transferred through the sloped faces and there are belt trusses at all mechanical floors to reduce the rotational reactions. Large diameter concrete caissons would carry the loads to bedrock which is estimated to be –28 M below grade.

Based on computer simulations and economic analysis, a hybrid combined cycle cogeneration thermal energy storage plant was designed on a modular basis not only for the ultra-tall project but is also expanded to produce all of the energy requirements for Hankang City. In general, heat recovery through heat pipes and thermal-wheel for all ventilation air is used throughout the project.

Optimum energy efficiency is achieved by balancing all of the different residential, hotel, retail and office mechanical requirements with the ability to transfer and store energy. In addition to the electricity produced from cogeneration and the supply system of chilled and hot water, the Hankang Utilities also includes bringing incoming domestic water into storage tanks to be processed through a water purification plant. All sanitary waste goes through a treatment plant to produce availability of gray water with the overflow entering the city sewers. And, all of Hankang City would have optical fiber access with Internet always online and the most advanced telecommunication systems available, including the co-location storage of Internet carriers.

High-rise buildings will always have the logic of being the most energy efficient and practical way to resolve high density urban requirements. This project demonstrates a cohesive mix of functions that are interfaced with a horizontal infrastructure concept that also brings life to the city. What had not been thoroughly researched was the ultimate height of a high-rise building.

When the ultra-tall tower was designed, the height was intentionally programmed to exceed the Sears Tower's 443 M (1454 ft) by approximately 200 ft. Since then, there has been another determined escalation to achieve that temporal distinction, "World's Tallest Building." One of the earliest was Norman Foster's proposed 840 M (2,755 ft) Millennium Tower, in Tokyo. All of the architects and engineers involved with these boundaries of height have confidence in the potential of today's technology. However, very significant planning issues for both the vertical tower and the horizontal base must always be resolved. As a postscript to Hankang City, there has been an ongoing study for a Half-Mile High tower to compare the feasibility of this major change of scale with the more conventional high-rise buildings. The architectural objective has been to not just reach for height but rather to design a viable vertical city with all required services and amenities. The assumption was made to establish the gross area at approximately one-half the size of Hankang City, or a total of a 15 million sq ft tower on a base of parking and retail. When the magnitude of these traffic and circulation patterns were analyzed in more detail, the criteria replicated the services that had been planned for the ultra-tall tower site. With the assumption that additional basement floors of parking could be added, the Half-Mile High was also positioned at the south end of Central Park.

The base of the tower is 360 ft × 360 ft with a slightly tapering vertical profile. There are 90 ft × 90 ft structural tubes at each corner connected together with large Virendeel trusses on a vertical spaced module of squares. At two locations, the infill floors between these trusses are eliminated to allow a complete flow of air through the tower. The vertical sequence of functions has a large atrium above the Business Center and Exhibition lower floors that serves as the lobby and restaurant level for 2,000 convention hotel rooms. The next vertical function is five million sq ft of office space with the upper floors of the tower planned with approximately 3,600 units of market rate and luxury residential and a luxury hotel. The top four floors would also have observation decks and sky restaurants.

There are several conceptual issues that determine the feasibility. If a major portion of the residents can both live and work in the tower, the circulation requirements at the base of the building are significantly reduced. There are similar efficiencies if many of the residential amenities of retail shopping, restaurants, cinemas and entertainment are also included in the tower. It would then be possible for residents to literally live in the tower for several days at a time and, when they did leave, it would not be during peak periods. A vertical infrastructure is required to move these large segments of the building population and distribute building services.

The scale of the vertical express elevator cabs would be similar to the shuttle train cars and would move on a continuous cycle to transportation nodes in the tower. These three story high sky lobbies would be large landscaped atrium spaces with appropriate support amenities that would also sort out the passengers to conventional elevators to their selected floor. At the residential levels, these landscaped atriums could also include day care centers, elementary school or community services. The final phase of this study will include an economic analysis to compare the Half-Mile High with other Hankang City functions.

All of this research must still relate back to the 6th World Congress theme. Making projections into the Third Millennium is a daunting endeavor. With our most recent experiences, even the 21st Century may be difficult to comprehend. At the beginning of the 20th Century, the U.S. had an agricultural economy, but industry was growing. By 1980, the industrial economy dominated and the number of people employed in agriculture was insignificant. From roughly that point in history, computer technology and the Internet began to take over. By 2005, it is estimated that the percentage of workers employed in industry will be less than 20%. What is making this happen is software. Instead of physical capital, the economy is now based on ideas.

A company's survival is directly related to the potential of its creativity and innovation. It must not only attract the best and the brightest, it must also hold them with a corporate culture that builds a sense of community. These same market forces are beginning to reshape the city. In Chicago, the suburban office vacancy rates are increasing and downtown construction has started again. This talented workforce, along with a growing population that is rejecting suburbia want to live in the city. The resulting residential construction is generating high-rise buildings supporting the density of the core, along with more modest developments on all the surrounding infill. This same infusion of a vitality of life back into cities is occurring in almost every industrialized American and international city. A similar transformation is also taking place in this next wave of the global economy. Even developing countries are compressing the time frame by marketing favorable government policies, the required urban infrastructure and their resource of an educated workforce.

While technology will continue as the delivery system, humanism will define the future. Making our cities more livable is now the idea whose time has come.

Hankang City Research Team

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