# **Fate** of the **Houston Skyline:**

## **Strategies** adopted for **Rehabilitating Mid- Century Modern High-Rises**


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M.Arch II, Preservation
May 2014


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## Abstract

*Title:* **Fate** of the **Houston Skyline:**
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A recent report by Terrapin Bright Green "Mid-century (Un) Modern" discusses the desperate condition of mid-century modern high-rises in Manhattan. The article argues that it would be beneficial both economically and environmentally to demolish these buildings and build new ones with an assumed increase in FAR. To re-build, repair or re-skin are the questions Mid-century Modern High-rises (MMH) face today. This study focuses on Houston, Texas, which is very different from New York City both climatically and from a planning stand point. It is dreaded for its hot and humid climate and notorious for its consistent refusal to adopt any zoning. These high-rises in Houston represent the economic success of the city immediately after WWII. These buildings were constructed as the city transformed from the Bayou City to the Space city. In this study I have mapped the status of these high-rises and the strategies that were used to renovate them. The questions I further wish to address are how preservation or energy efficiency are addressed while renovating these buildings. Even preservationists might agree that all buildings are not equal and a new look would benefit some. The real challenge lies in resolving the grey areas, where one is not talking about a Seagram or a Lever House, but a well designed environmentally sensitive building.

**Thanks to…**

Dr.Michael Holleran
Ulrich Dangel
Dason Whitsett
Archivists at HMRC
Architects at Kirksey
Architects at Gensler
and **several others**…

## Contents

## Introduction

Often known as the energy capital of the world, Houston boasts the fourth largest skyline in the United States with over 400 high-rises ( buildings over 35m or 114 ft, which are buildings 12 storeys or higher). Notorious for tearing down mid-century high-rises like the Shamrock Hotel, Prudential Building, and the Houston Savings Building, Houston currently has around sixty two high-rises that were built during the 1950s and 1960s. While some of them stand abandoned waiting for a sympathetic developer to save them from demolition, several of them are still being used and have undergone successful rehabilitation. This study intends to map the changes and understand the strategies that are generally adopted to rehabilitate these buildings.

High-rises are symbols of economic prosperity and technological success, and the mid-century modern ones in Houston represent the economic success of the city immediately after WWII. This was a result of the increase in demand for oil during and after WWII , and the opening of the Manned Space Station by NASA in the 1960s. These buildings were constructed as the city transformed from the Bayou City to the Space city. I have mainly focused on buildings constructed between 1950 when the first modern high-rise was constructed in Houston, to 1971 when Shell One plaza was completed. With the completion of the One Shell Plaza in 1971 a new phase began in high-rise construction. The soil condition in Houston does not support very tall buildings and a different technology had to be used to reach the height of 50 stories. One Shell plaza was also one of the first high rises to be built by developers and not individual corporations. Therefore 1971 becomes the terminal point for my survey of high-rises in Houston. Today, the skyline of Houston is dominated by the post-modern buildings from the 1970s and 1980s, and these mid-century modern buildings are not prominent in the skyline anymore. None of these buildings are either local historic landmarks or are listed in the National Register, and have been subject to insensitive changes. There are also several measures taken to make these buildings more sustainable.

The primary research question for this study is: What are the strategies adopted for the rehabilitation of Mid-Century Modern High-Rises in Houston? Some secondary questions that follow are: Do they incorporate energy efficient measures or address preservation? How can these strategies be further developed, where needed, to better address preservation and energy efficiency? By contacting firms that have renovated these buildings, I intend to outline the changes in the building MEP systems, envelop and interiors.

## *Chapter 1:* **Mid-century Modern High-rises**:
Their **History, Preservation** and **Environmental Challenges**


*"Even on their best days, Boomer Buildings were not easy to love. They had substandard heating and air conditioning systems, poor lighting, minimal chase space, drafty exterior walls, asbestos and other toxic materials, crumbling concrete exposing rusting rebar, not to mention hostile urban manners, contextual indifference, and monumental invulnerability."* – Michael J. Crosbie

## 1.1 Significance and Development of the High-rise building

The high-rise or the tall building, a truly American invention, was a result of two technological developments. One was the steam powered passenger elevator that could safely transport people up and down in buildings. The other was structural framing in steel, a high strength, low density, non-combustible material, which eliminated the need for very thick load bearing masonry walls on the lower floors.[1] Further technological developments in foundation design, artificial lighting, and mechanical ventilation made this building typology more practical.[2] The typical characteristic of the tall building were the vertically stacked floors of habitable space. The high-rise has been constructed for various programmatic requirements like residential, commercial, healthcare, education etc, but it is most commonly associated with commercial office space as it reaps the highest rents.[3]

*"An office building's prime and only object is to earn the greatest possible return for its owners, which means that it must present the maximum of rentable space possible on the lot with every portion fully lit."*[4]

The high-rise became a commercial success as it increased the square footage potential of small lots. At the turn of the twentieth century, in developing cities like New York and Chicago, where space was limited this building type immediately became popular. For most part of the twentieth century all the tall office buildings were in New York and Chicago. These tall buildings were not just monuments but enabled these cities to grow economically. They became a symbol of technological and economic success.

The development of the high-rise is usually categorized into two broad categories. The first starts from the late 1800s and ends with the World War II. There was minimal construction going on during the late 1930s and 1940s until World War II ended. High-rise construction began again in the late 1950s which marks the second stage of its development. During the first stage the high-rises assumed different styles including historicist styles, and the art deco of the 1920s.[5] They varied from tall slender buildings to bulky ones with courtyards in the middle or u-shaped structures. The later part of this stage saw the wedding cake form developing due to height and zoning ordinances. The second stage saw a change in development of the high-rise design construction based on new building materials and engineering technologies that developed during the post-war period. The development of the high rise is usually further

divided into four distinct phases: (i) late 1800s to 1916[6] pre zoning phase (ii) 1916 – 1950 zoning and set back phase (iii) 1950 -1973 the mid-century modern buildings (iv) 1973 – present the post energy crisis stage. (See Appendix 1 for a time line on development of high-rises and the development of their form ) This study focuses on the post-World-War II high-rises, which were constructed between 1950 and 1973.

Fluorescent lighting and mechanical ventilation liberated the high-rise from its dependence on nature and site. [7] The modernist vision of an open plan and expansive space were realized in the high-rises of the post-war period. These buildings had an identical glass curtain wall on all fours sides, as mechanical ventilation and fluorescent lighting provided artificially controlled indoor environments, and the building was not required to respond to natural factors like heat and light.

*"The ceiling became a girded plane of light, in which acoustical material and ventilating equipment was also concealed. Since large windows were no longer necessary to illuminate interiors, ceiling heights could be reduced and more stories could be fit within the zoning envelop. The most visually striking change was the glass faced. Glass was transformed from window panes to curtail walls."*[8]

These characteristics were first realized in Mies van der Rohe's 860 Lake Shore Drive (Chicago, 1951) which was designed as residential apartments. Three buildings, which followed this, were the ones that actually served as a model for all future designers of high-rises. (See Fig 1.1,1.2,1.3 for description of their form). Raised on columns these buildings look as if they could be picked and planted anywhere in the world.[9] Each of these buildings have a distinct form that reflected the designers' rationale. Of these buildings Mies' Seagram building was the one that was duplicated and imitated by both designers and developers in every American downtown. His design gave the imagery required for corporate America. Efficiency, cleanliness, organization and standardization, was a perfect fit for big business in this country.[10]

While the prototype as an elegant tower with impeccable proportions and high-quality materials, its duplicates did not always have the same characteristics. (Fig.1.4) Built in an era with cheap energy, the curtain walls were poorly insulated and not very energy efficient. Several well known architects were responsible for modifying them to suit the context. The glass curtain wall was also modified with exposed concrete, stone veneer, porcelain enamel

panels and other materials. (Fig.1.5 & 1.6) Many of them have turned, or are turning 50 years old soon, and their preservation raises several issues which this study will further discuss. There are several preservation challenges that high-rises share with other building types of the post-war period. I will touch upon both the broader issues that professionals are concerned with while dealing with post-war heritage and more specifically the high-rises from that period.

***Description of Form:*** *Two Large expanses of gridded curtain walls were held between two blank walls. The horizontal slab was mostly expressed, which reflected the lines of movement. Mostly offices were organized along lines of corridors which ran parallel to these large curtain walls. The blank walls at the ends terminated these corridors giving the building its expressive quality. The structural system is only secondary.*

Fig 1.1. The United Nations Secretariat Building by Harrison and Abramovitz (New York, 1950) was based on Le Corbusier's (or Niemayer's) scheme for the same project.

***Description of Form:*** *A slab raised on columns with a rectangular tower rising from it. The horizontal slab was again expressed, but there were glass curtain walls on all four sides showing that space was undifferentiated and flexible.*

Fig.1.2. Lever House designed by Gordon Bunshaft of Skidmore, Owings and Merrill (New York, 1952).

***Description of Form:*** *A tower raised on columns in a plaza. The main concern was the expression of a spatial grid, and not the skeleton. The spatial grid was expressed in steel, a symbol of the technology of that time. The plan is a wide rectangle with a central service core. All four sides are similar which again showed that the space inside was undifferentiated and flexible.*

Fig.1.3.The Seagram Building designed by Mies van der Rohe (New York, 1958, with Philip Johnson).

Fig.1.4. View of Park Avenue looking south, with generic glass office towers.

**1.2 Challenges of Preserving Mid-century Modern High-rises:**

The post- World War II building stock is slowly being recognized as a significant part of the cultural landscape in the United States. It has recently started to obtain the attention of preservationists due to its widespread presence and the challenges it poses. More than 80% of the existing buildings in the United States have been constructed after World-War II.[11] Mike Jackson in his paper presented at the 1989 APT conference in Chicago[12], urges preservation professionals to look beyond the iconic examples of modern architecture, thereby encouraging the study of corporate buildings and franchise commercial buildings. The most compelling argument he makes is that history is directly proportionate to rate of change, and the pace of development today makes the buildings of the recent past historic. He also states that preserving buildings of the recent past blurs the boundaries between past and present, thus integrating preservation with everyday life. The preservation of high-rises covers a broad spectrum of buildings. At one end we have the iconic buildings built by master architects like Le Corbusier and Mies van der Rohe, and the other end the poorly duplicated glass office tower built by developers for purely financial gains. As Hubert Jan Henket says:

*"… as soon as building requirements start to change, the match between demand and utility will fade. Adapting the building fabric might result in an economically and functionally satisfactory solution. If not, the final verdict will be demolition. Yet, if the emotional or historic value of the building is sufficiently apparent, we must be prepared to temper our functional and economic desires. In which case it is the work of art we primarily want to keep, rather than its utility."*

Based on this perspective, the modern icons have been preserved by default; it is quite unimaginable to demolish the Seagram Building or the Lever House. The real threats are to those high-rises developed by lesser known architects. Since artistic quality is based on emotion there is never a common consensus to it, which leads to much debate on what to preserve. The

Fig.1.5. The exposed concrete façade of Boston University Law Tower was designed by Josep Lluis Sert between 1960 and 1965. Initially there were talks of demolishing this building, but was eventually rehabilitated.

utilitarian appearance of most of the post-war high-rises often results in a negative perception of the buildings from this period.

**1.2.1 Perception:** The 50 year provision in the National Register at the time it was formed in 1966 seemed very accommodating given that only a decade ago several buildings that were dated after 1830 were demolished in the Independence National Park in Philadelphia. [13] With technological and communication boom in the late 20th century, the pace or rate of change has exponentially increased. In a brief 20 year span between 1950 and 1970 a series of fifteen hundred McDonalds were built, of which very few remain today.[14] The 50 year mark prevents many buildings from the recent past from attaining historic status, and therefore appropriate protection. The sheer scale of high-rises makes demolition not an imminent threat to them, but their flexible interior spaces and the non structural curtain wall façade make them easily adaptable. This results in loss of original architectural character, details and construction from this particular phase in history.

Significance is usually attributed by aesthetics, personal taste, or emotion, and very rarely a careful, objective historic enquiry on the contribution of the particular building.[15] Such a limited insight prevents non-iconic mid-century modern high-rises from being given a historic listing even if they are fifty years old. Their form which often seems to be a duplication of the Seagram Building or a similar icon prevents them from having any architectural significance, which would encourage their preservation. Building codes and environmental standards have changed making these office spaces obsolete, which prevents them from being rented as 'Class

A' office space. As the economy has fluctuated over years these buildings have transferred ownership several times, and have succumbed to insensitive changes.

Fig.1.6. Staler Hilton in Dallas has been an endangered modern building for several years. The curtain wall has porcelain enamel panels.

**1.2.2 Modern Exteriors:** The abstract modern aesthetic is inextricably linked with the idea of industrial production. The buildings of this period with clean lines and minimalist detailing portrayed the precision of the machine and its ability to economically mass produce such products.[16] This age saw the development of several industrially produced building materials like stamped metal panels, extruded metal sash windows, fiber glass panels, reinforced concrete and several others. These materials do not age with the same grace as limestone or copper. The oxidation of copper from brown to green is acceptable but the gray oxidation of aluminum is often not acceptable.[17] Pitted aluminum or fiber-glass panels that have become yellow due to UV deterioration are not often considered beautiful.

Modern buildings see more material failures in a shorter time span than older buildings, as many of the materials were new, experimental, and their technology was at stage of infancy. Aluminum windows and curtain wall technology has developed since they were first manufactured, and it is more efficient to replace them with something newer, which might be identical in appearance but not in assembly and composition. It is easy to re-produce hand crafted wooden molding or mills that produced wooden shutters and clapboard, but it is difficult to manufacture 20 feet of extruded aluminum sections that have been out of production for several years.[18] Building codes keep changing and are becoming more stringent, which forces professionals to replace materials in modern buildings. [19] This raises issues of

authenticity when the building is iconic, (Fig.1.7) but for the more common buildings which were never meant to last for more than a couple of decades the interventions involve significant changes in the façade. This generally increases the market value of the building as it has a new look and up to date systems and finishes. Many of these buildings are not well documented and such insensitive changes results in a loss of early modern construction methods, detailing and finishes.

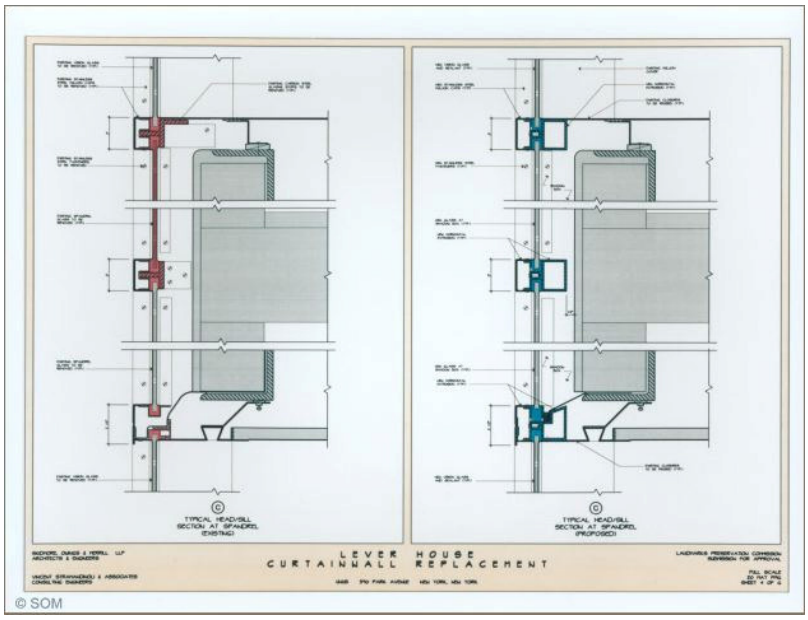


Fig.1.7. The Lever House was re-skinned with new materials but has retained the original appearance. The above drawing shows the original detail (left) and new detail (right). The glass is green-tinted and single-paned, as in the original, but now it is heat-strengthened instead of annealed. While parts of the underlying curtain-wall structure of carbon steel have been kept, a new aluminum receiver system was added.

**1.2.3 Modern Interiors:** One of the most significant attributes of modern architecture was to merge the boundaries of exterior and interior spaces. This ideal was achieved by large expanses of transparent glass curtain walls, which made the interior an integral part of the envelope. In New York several interiors of modern high-rises have achieved landmark status. (Fig.1.8) There are also several instances when the interior was not given a landmark status due to the owners' fear that it may not be commercially viable.[20] It is an important factor that forces owners, especially of commercial buildings, to constantly change or upgrade interiors. Stewart Brand considers interiors "flighty, fickle and inconstant- whether from caprice or wear and tear, or the irregular shifts of necessity."[21] He estimates that they change every 5-7 years, which results in loss of valuable interior details and character.

Fig.1.8. The interiors of Fours Seasons restaurant in the Seagram Building is a New York Landmark.

Similar to older buildings, modern architecture also tried to integrate paintings and sculpture with architecture. Artists collaborated with architects to produce objects that were an integral part of the building. There were several government supported initiatives to include artwork in public buildings,[22] which was also seen in privately owned buildings. In any significant renovation the interiors are the first to get changed and invariably these works of art are threatened. There are cases where they have been restored successfully and continue to occupy the place they were intended for, but there are also several instances when they are moved to a museum, destroyed or kept in storage. [23] Even when interiors are landmarked artwork is not landmarked as they are movable property. (Fig.1.9)

Fig.1.9. Picasso's Le Tricorne in the Four Seasons restaurant is threatened as the owner wants to move it. The interior is landmarked but the painted curtain is moveable and cannot be landmarked.

**1.3. Environmental Challenges:**

High-rises are often symbols of economic prosperity, and the mid-century buildings represent the post-war reconstruction efforts. Significant amounts of energy were invested in their construction, and it is important for any city to ensure that they are retained, protected and continuously used from both a preservation and sustainability perspective. Professionals while rehabilitating Mid-Century Modern High-rises face challenges similar to those of any modern building, except that the scale of the buildings increases the issues several times. The curtain wall, florescent lighting and mechanical ventilation, all modern developments that influenced the form of the modern high-rise now make them energy guzzlers, and less environmentally friendly. The high levels of toxic materials

found in them make material abatement or demolition very expensive. This results in many of them remaining abandoned for several years.

**1.3.1 Perception:** The concept of sustainability which became popular in the mid 1980s has benefitted the preservation of postwar heritage or the recent past considerably. The idea that " The greenest building is the one already existing" increased the scope of the field of preservation from only dealing with historically/culturally significant buildings to even mundane utilitarian buildings. The need to conserve material resources recognizes the advantage of rehabilitating existing buildings instead of building anew; as long as the structure is sound. While this approach has reduced the demolition of buildings from the recent past, it has still allowed them to be altered considerably, as the public and the real estate industry are yet to fully acknowledge their cultural significance.

*"… many buildings of the recent past are currently in a state of technical obsolescence - their exposed concrete is decaying or their curtain wall requires repair or re-placement - and appropriate, economically viable conservation solutions are not as obvious as for earlier heritage."*[24]

Another challenge is to market such rehabilitation which is both economically viable and architecturally respectful, as they are yet to offer the public the emotional attachment it seeks to more traditional architecture or environments.

**1.3.2 Building systems:** The low floor heights and deep floor plates prevent natural light from entering interior spaces, making them dependent on artificial lighting. With changing minimum floor height codes for commercial spaces, it is difficult to drop ceilings that cover ducts and pipes.[25] These early HVAC systems were generally oversized with control valves or thermostats at the users' end to moderate the temperature. This doubled the energy used as the air was cooled to a very low temperature at the source and again heated to the required temperature set by the thermostat. Today we have more efficient systems with sophisticated controls and variable speed pumps that take into consideration the constantly changing occupancy levels in a building. Most high-rises undergo an HVAC upgrade when they are rehabilitated.

**1.3.3 Curtain wall facade:** Curtain walls with low thermal mass and hermetically sealed environments make high-rises heavily dependent on mechanical ventilation.[26] They also do not satisfy current wind load codes.[27] The post-war buildings generally relied on lightweight aluminum frame curtain walls for their facades, which were a byproduct of wartime increase in aluminum production. These early systems were experiments in aluminum extrusion and glazing technology. Many factors like over dependence on sealants, poor detailing that resulted in interior moisture accumulation and penetration, insufficient bracing and the use of moisture sensitive materials resulted in early failure of the curtain wall system. Most of them were single glazed curtain walls and their frames did not have any thermal breaks resulting in poor insulation, which increased the load on HVAC systems. Just replacing the glazing is not possible as the frame of the single glazed curtain wall is not structurally designed to take the load of double or triple glazed panels.[28] A common solution is a total re-skinning with a newer and advanced curtain wall system that has double glazing, or some other materials that offer better insulation. Since curtain walls are not structural they are easy to disassemble and so replacing them is not difficult. This result in large amounts of glass, metal and other industrially manufactured material being directed towards landfills, which is not by any measure environmentally friendly. Another alternative that is becoming popular with high-rises is over cladding facades. This allows the building to be occupied during construction and saves demolition costs, and in turn provides better insulation.

**1.3.4 Interior Materials:** The modern movement saw a sudden increase in new materials that were a result of industrial processes. Materials like asbestos, lead, mercury, Pthalates and PCBs (polychlorinated biphenyls), which were considered benign miracle materials, are now considered health hazards.[29] Many of these materials off-gas and take several years to stabilize which reduces the indoor air quality. These materials are ubiquitous in modern buildings and can exacerbate the situation if exposed to temperature changes or are cut and tampered with. They are found in paints, tiles, grouts, fireproofing, concrete etc. During renovations these materials need to be carefully disposed making material abatement very expensive, which is another reason why many modern building remain vacant for several years or get demolished.

The ones that do get successfully renovated invariably have their interior gutted till the structure, resulting in a complete loss of original interior and character.

**1.3.5 Energy retrofits:** The above conditions forces developers to consider making a deep energy retrofit of these buildings. A 2013 study conducted by Terrapin Bright Green LLC in New York City proposed that a deep energy retrofit would reduce energy costs by a minimum of 40%. Whereas demolishing them, and building a high efficiency tower with 44% more square footage would reduce the source energy use by 5%. The cost of demolishing the old building and constructing a new one would be recovered in 15.8 to 28 years. While a deep energy retrofit would be recovered in 44 years. It assumes that the retrofitted building would only be 80% occupied and not rentable as a 'Class A' office building. While certain groups are more interested in demolishing these buildings and building new ones there are certain professionals at the opposite end who are interested in preserving the single glazed curtain wall. There are several in the middle interested in retrofitting the interior or exterior of the building to make it more energy efficient and also increase its market value. The study further focuses on the trends in preserving or rehabilitating mid-century modern High-rises in Houston.

## Illustration Credits:

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Fig 1.1 - http://wirednewyork.com/un.htm

Fig 1.2 - http://www.archdaily.com/61162/ad-classics-lever-house-skidmore-owings-merrill/

Fig 1.3 - http://www.crainsnewyork.com/article/20110914/REAL_ESTATE/110919949/no-takers-for-49-stake-in-famed-seagram-bldg

Fig 1.4 – modified from Google "Street View"

Fig 1.5 - http://en.wikipedia.org/wiki/File:BU_Law_Tower.JPG

Fig 1.6 - http://upload.wikimedia.org/wikipedia/commons/1/1f/Statler-Hilton-Block-Panora.jpg

Fig 1.7 - http://www.archdaily.com/61162/ad-classics-lever-house-skidmore-owings-merrill/som3/

Fig 1.8 - http://goodman-theatre.blogspot.com/2011/09/art-architecture-and-affluence-on-park.html

Fig 1.9 - Michael Appleton for The New York Times (http://www.nytimes.com/2014/02/09/nyregion/judge-temporarily-bars-removal-of-picasso-tapestry.html?_r=0

## End Notes :

[1] Stephen Fox, "*Scraping the Houston Sky: 1894-1976*," Cite Spring-Summer (1984): 10.
[2] ibid
[3] Carol Willis, *Form follows finance: skyscrapers and skylines* (New York and Chicago: Princeton Architectural Press, 1995), 8.
[4] Geroge Hill, "Wasted Opportunities, No.III," Architectural Record 3 (1893): 19.
[5] Carol Willis, *Form follows finance, 8.*
[6] The ending date is based on the zoning change in New York City. In Chicago it would be 1923 when the zoning requirement changed.
[7] In the 1930s the standard level of illumination was 25 foot candles, but by 1960s it was 100 footcandles. From: Carol Willis, *Form follows finance,* 133.
[8] Carol Willis, *Form follows finance,* 133.
[9]Cesar Pelli, "*Skyscrapers*" Perspecta: The Yale Architectural Journal 18 (1982): 6.
[10] Michael Quinlan, *"Living Where we Work: Exploring the Modern Office Tower's Potential for High-Rise Living,"* (Thesis: State University of New York), 2006, 15.
[11] Quoted from U.S department of Energy Commercial building Survey, 2003 in Jean Carroon, *Sustainable Preservation: Greening Existing Buildings* (Hoboken, N.J. : Wiley, 2010), 363.
[12] Mike Jackson, "*Preserving What's New*," APT Bulletin, 23: 2 (1991), 8.
[13] Richard Longstreth, "*The significance of the recent past*." APT Bulletin 23: 2 (1991): 12-24.
[14] Mike Jackson, "*Preserving What's New,9.*
[15] Richard Longstreth, "*The significance of the recent past," 12-24.*
[16] David Fixler*, "Appropriate Means to an Appropriate End,"* APT Bulletin 39: 4 (2008): 32.
[17] Mike Jackson, "*Preserving What's New," 9.*
[18] Michael F. Lynch, " *What Are We Going to Do with the Recent Past in the Not Too Distant Future?*," APT Bulletin 23:2 (1991), 6.
[19] In the case of Mies van der Rohe's Crown Hall at IIT, the large panels of ¼" thick glass were not code compliant, and had to be replaced with at minimum ½" thick glass. As the glass gets thicker it has a green tint due to the iron content. The team working on the project had difficulty in finding a manufacturer who could produce ½" glass with less iron content.

[20] The Manufacturer Hanover Bank branch in New York designed by Gordon Bunshaft of SOM was only given Landmark Status for the exterior and not the interior. Though this is not a high-rise similar issue do influence the listing of high-rises from this period.
[21] Stewart Brand, "*How buildings learn: What happens after they're built"* (Penguin, 1995), 12.
[22] In the United States "The Federal One Project" was initiated by President Franklin D Roosevelt; it employed artists for public beautification and educational projects during the depression of 1935. This program ended during the World War II. A similar program began in 1963 with President Kennedy's Ad Hoc Committee's "Guiding Principles for Federal Architecture."
[23] Tahinee M. Félix Marín, *Modern Architecture + Art: An Analysis of Preservation Strategies for Installed Art (Professional Report: University of Texas at Austin),(2011)*
[24] Susan D. Bronson and Thomas C. Jester, *"Conserving the Built Heritage of the Modern Era: Recent Developments and Ongoing Challenges,"* APT Bulletin 28:4 (1997),9.
[25] Current codes require a minimum of 9 feet between finished floor and dropped ceiling. Many of the buildings from the 1950s and 1960s have only 8 feet.
[26] "… tall buildings completed prior to the war had between 20% and 40% glazing within their fac¸ades (Fine Arts Building, Chicago, 1885: 40%; Equitable Building, New York, 1915: 25%; Chrysler Building, New York, 1930: 32%), 'third generation' buildings had a significantly higher ratio, between 50% and 75% (Lake Shore Drive Apartments, Chicago, 1951: 72%; Lever House, New York, 1952: 53%." From: Philip Oldfield , Dario Trabucco & Antony Wood, "*Five Energy Generations of Tall Buildings: An Historical Analysis of Energy Consumption in High-Rise Buildings*," The Journal of Architecture 14:5 (2009), 591-613.
[27] The code at that time required meeting wind loads of 30 lbs per square foot, whereas today it is understood that façades may experience loads above 70 lbs per square foot. Ibid.
[28] Bill Browning*, "Energy Analysis, Mid Century (Un) Modern: An environmental Analysis of the 1958-73 Manhattan Office Building*," a report by Terrapin Bright, 2013.
[29] Jean Carroon, "*Sustainable Preservation",*367.

## *Chapter 2:* **Mid-century Modern High-rises** in **Houston**:
Their **Status, Strategies** adopted for **Rehabilitation,** and **Significance**.

*"The industrial design aesthetic, the corporate commitment to public art , and even sometimes the social stresses related to the contemporary politics of communism played important roles in shaping buildings of this period." - Vincent.P.Hauser*

## 2.1 Houston History: Economic Development and High-rise Construction

The fourth largest city in the United States today was laid out in seven weeks with no mechanical instruments; the most far-sighted plans for it were the 80-100 feet wide streets and 12-1/2 feet lots.[1] Founded by Augustus and John Allen in 1836 they named it after their friend General Sam Houston, who won Texas' independence after defeating Mexico at San Jacinto on April 21, 1836. It began with the grandiose dreams of the Allen brothers who advertised a non-existent city, praising it for its maritime facilities, and rich land. They decided to create a town on a spot called Allen's Landing where White Oak and Buffalo Bayou intersect. They touted it as the "coming commercial capital when there was nothing but coastal grass and some canvas tents. Houston has never failed to live up to the Allen brother's dreams, even if they abandoned the town for other possibilities. [2] Known as the perennial "boom town" it has seen continuous growth since it was founded in the early part of the nineteenth century.

**2.1.1. The Bayou City (1836-1900):** Until the 1900s Houston had an agricultural economy centered on ranching, cotton, and timber. The advent of railways and improvement of the waterways supported the growth of Houston through the 1800s. Good business and wealth also attracted several bankers like T.W. House and Thomas Bagby. Yet at the end of nineteenth century Houston seemed like an "overgrown dirty village", with just a few tall buildings.[3] New York and Chicago were the first cities to start the race to build taller during the 1870s and 1880s. Houston was late in joining the race. In Texas, San Antonio and Dallas had already constructed few high-rises before the six storey Binz Building (demolished in 1951); the first high-rise in Houston constructed in 1895. Though it had a cast iron frame, its highly ornamental load bearing walls did not help it gain the status of being the first high-rise to completely use modern structural systems. The first steel framed high-rise in Houston was the First National Bank building built in 1905. (See Appendix 1 for timeline)

**2.1.2. The Oil Boom (1900-1950):** The Allen brothers' dreams were fully realized when oil was struck at Spindletop in 1901. The developed railroads and the completion of the Port of Houston in 1914 supported the growth of the oil industry, which created a real estate boom in

the 1920s. Houston city limits was only nine square miles around the 1890s, but expanded during the 1920s. There was a race to build the tallest building, and many of the high-rises that were built during this period continued to dominate the skyline through the 1950s. Several important high-rises were constructed during this period, and Houston became known as an important southern city .Some of these early high-rises built in different styles were; the 16 stories Carter Building (1910), 17 stories Rice Hotel(1913), 27 stories Esperson Building (1927), and the 37 stories Gulf Building (1929). They mostly followed the typology of the high-rises built in New York and Chicago as Houston has never had any zoning. The city sustained its economy through the depression and the World War II, and is often known as the "city the depression forgot". The demands of World War II actually supported Houston's oil industry. Many oil companies transformed from mere refineries to sophisticated producers of petrochemicals. Though the oil industry prospered high-rise construction slowed down with no significant building being added to the skyline.

**2.1.3 The Space City (1950 to 1973):** The post-war period saw a diversification of Houston industries into petroleum-processing and metals. This was a time that saw the rise of the suburbia and an increase in white collar jobs. The years following World War II were characterized by enormous urban growth and prosperity in Houston. City engineers laid plans for the construction of radial arterials and the "loop" system of freeways.[4] Many oil companies and banks began to build high-rises for their downtown offices. Construction in Houston downtown increased and several new high-rises joined the towers of the 1920s; these buildings only populated the skyline without making it taller. This period also saw the construction of the Prudential Building, the first high-rise tower outside downtown.

These early modern high-rises of Houston followed the model of the Lever House or the UN Secretariat. The first modern tower in downtown, The Melrose Building, tried to follow Corbusier's model for t he UN Secretariat, but the Medical Towers and Americana building were closer imitations of the UN secretariat building that was built. This typology changed during the late 1950s and 1960s when Houston saw another period of prosperity. The existing international airport was deemed insufficient and the George Bush Intercontinental Airport was

opened in the northern part of the city. This was followed by NASA opening its Manned Spacecraft Center in 1962, which brought more jobs to the city. Buildings of this period either occupied the entire block or adopted the typology of a tower in a plaza like Mies van der Rohe's Seagram building. Most of these buildings were 28 to 34 stories high with the Humble Building (now the Exxon Building built in 1963), which was 44 storeys high, being the tallest.

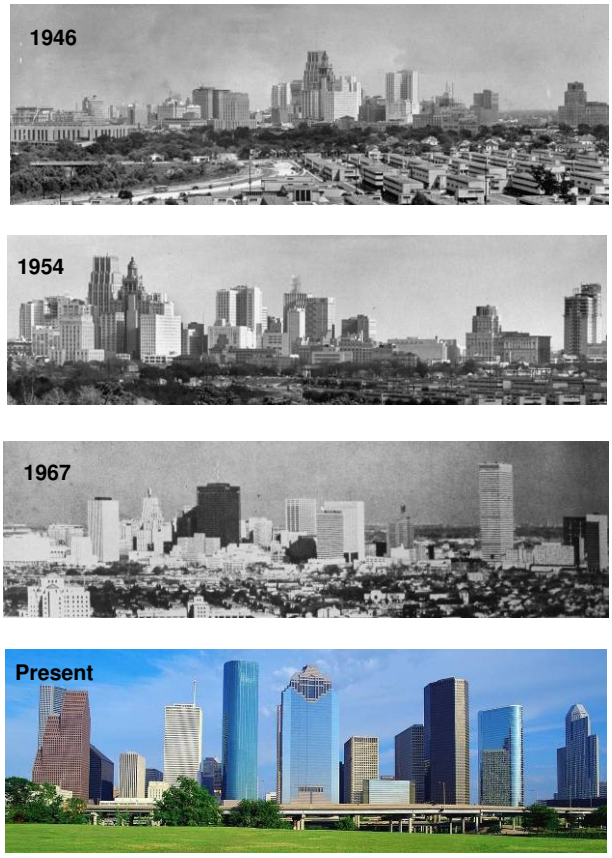


Fig.2.1. The images show the development of the Houston Skyline. The MCMH are not very tall and buildings from the 1920s dominate the skyline even in the late 1960s. Currently they are completely dominated by the building from the 1970s and 1980s.

**2.1.4 Post Oil Embargo (1973- present)**: With the completion of the One Shell Plaza in 1971 a new phase began in high-rise construction. The soil condition in Houston does not support very tall buildings and a different technology had to be used to reach the height of 50 stories. One Shell plaza was also one of the first high rises to be built by developers and not individual corporations. This was accompanied by another growth spurt in the 1980s, which had its seed in the early 1970s. With the 1973 oil embargo, and the Iraq- Iran war in 1979, there was an increase in oil prices and production in Texas. Houston saw enormous construction boom during this period with a densification of downtown and the development of the Galleria/uptown. Most of the high-rises built during this period, like the Bank of America Center, and JP Morgan Chase building continue to dominate the skyline of Houston today. (See Fig.2.1. for development of Houston's Skyline, and Fig.2.2 for number of high-rises constructed in each decade).

There was a huge economic slump at the end of 1980s, due to sudden fall in oil prices as other oil resources were found around the world. It was a major set back for a city that had seen unprecedented growth for around 80 years. Since then the city has slowly tried to

diversify its industries and stabilize its economy. The 1990s was an important decade for Preservation in Houston. The Preservation Ordinance was adopted by the city. Several high-rises changed ownership and underwent renovation during this decade. Recessions always seem to support Preservation.

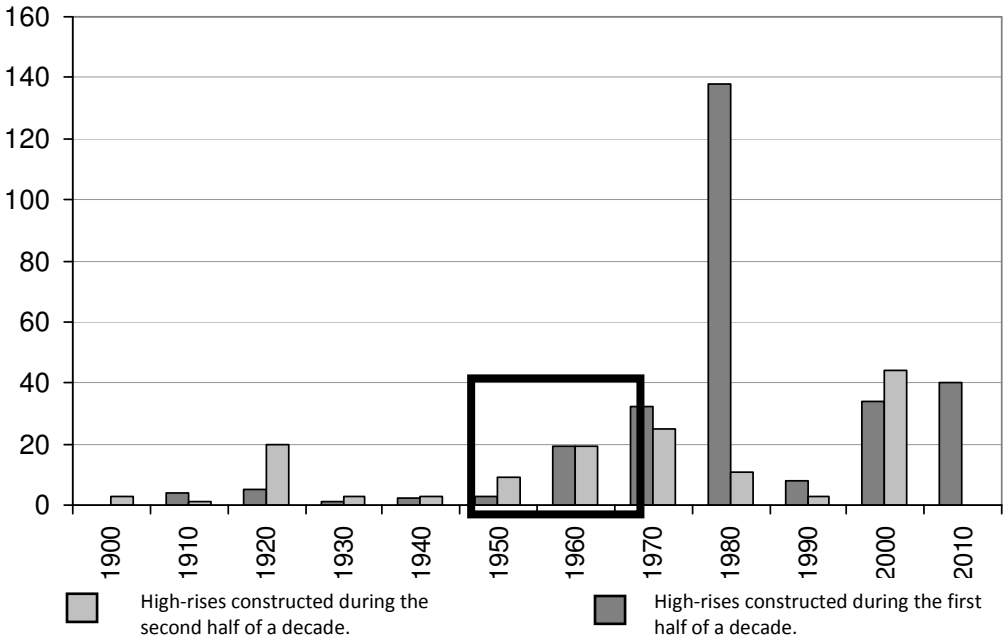


Fig.2.2 Graph show the number of high-rises constructed in each decade

## 2.2 Status of Mid century Modern High-rises in Houston

The post-war period in Houston saw an increase in high-rise construction. There are around 62 high-rises that were built between 1950 and 1971. Unlike Chicago and New York City where there is a concentration of high-rises in the downtown areas, Houston has them spread out between downtown, Texas Medical Center, and Galleria. Absence of zoning has allowed them to crop up wherever the owner thought it would be feasible to construct them. As the economy has fluctuated, these buildings have been subject to varying levels of

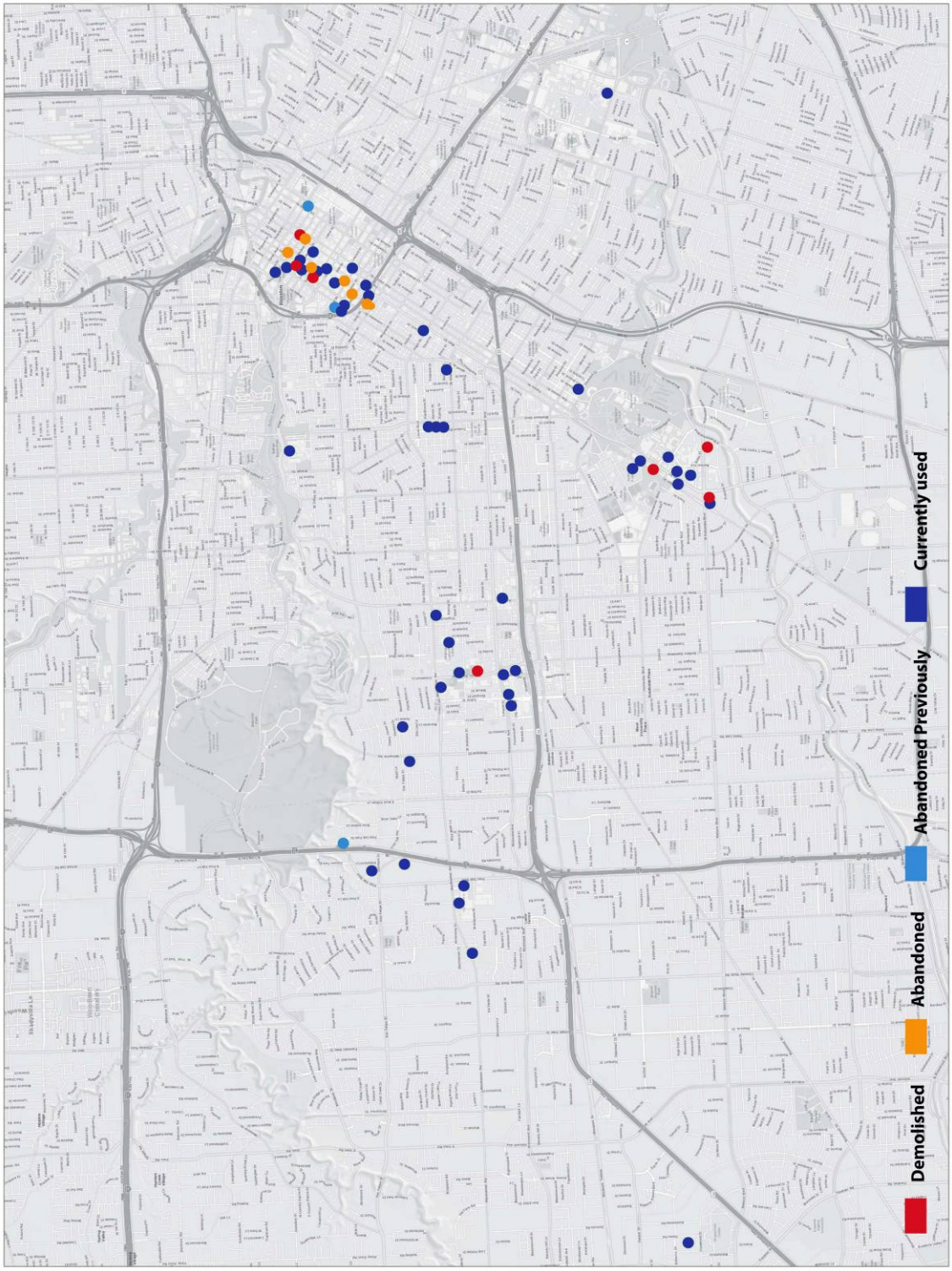


Fig.2.3. MCMH Status in Houston

change, starting from a service upgrade to demolition. Based on data collected from websites like “emporis.com” I have found that 7 of these high-rises have been demolished, 7 are vacant, 3 have been vacant previously, and the remaining buildings have been used continuously. (Fig.2.3)

Of these 62 buildings, 35 are office buildings, 16 are apartments or dorms (residential), 7 are hotels, and 5 are healthcare related buildings. In my study I found that offices and residential high-rises are less threatened than hotels, as the latter have more stringent utility requirements and smaller room divisions, which make them less adaptable. (Fig.2.4) High-rise residences usually have more flexibility than hotels as they have larger units with restrictions on the location of services only. Unlike post-war public housing, like the Pruit-Igoe, the residential high-rises in Houston are in relatively affluent neighborhoods and have rarely become completely vacant.

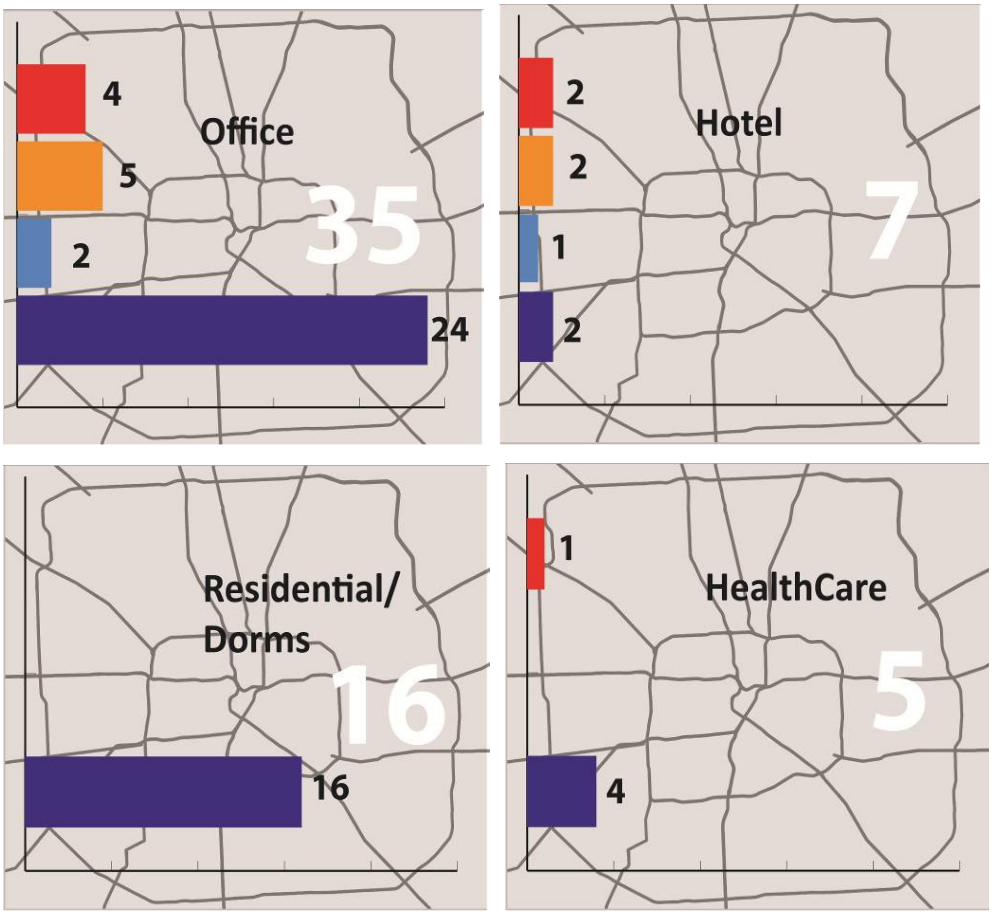


Fig.2.4. Building type and status.

Modern office buildings have the most adaptable form, yet the ones owned by individual owners or family run businesses do not withstand market fluctuations and tend to become vacant. Often the owner is unable to raise the money to maintain the building to safety codes.

Of the seven vacant high-rises two have become vacant in the past three years. [5] The others have been vacant for 10 or more years. In these cases the owners were either bankrupt, or in jail, or the building was caught in some family-feud, which led them to a state of disrepair and neglect. Developers have subsequently bought them with intentions of renovating them, but have never been able to gather sufficient funds to see the project to its end.

Of the 63 buildings, 7 buildings have been demolished of which only three have been re-placed with new buildings. Two of these are a part of the Texas Medical Center, and have been replaced by newer medical facilities. The third is closer to the Galleria , and has an apartment complex there. The most recent demolition, in 2012, was the Prudential Building, the owners ignored requests of preservationists as they felt it was not feasible to renovate the building.[6] The other three demolitions are in Houston downtown. Two office buildings were demolished with plans of building a new tower, which were never realized. One continues to be a big hole in the ground with water stagnating in parts, and the other has become a parking lot. The third was the Sheraton Lincoln hotel, which was partially demolished in 2011, after being vacant for 24 years.[7]

Though the high-rise building is meant to be adaptable it is also very expensive to maintain and renovate. It depends on large number of tenants or one really big one to maintain it and make it feasible. It is a huge commercial venture that is not always very successful, which is evident from the examples I have discussed above. My study further focuses on the more successful MCMH that have been continuously used. I have tried to study the type of physical changes these buildings undergone.

**2.3 Methodology:**

The purpose of my research was to find out how MCMH had changed during renovations and outline any energy efficient or preservation measures that had been undertaken. I had a set of questions for which I hoped to obtain reasonably accurate

information. (See Appendix 2 for questionnaire) Initially I started with face to face interviews, but realized that I could not obtain sufficient details, as these were old projects and the architects did not have all the details easily available. It was also not possible for me to locate the architect for every project and very often I had to go through the building management to obtain information from the concerned professionals. Given the circumstances I used a standard questionnaire that I emailed to obtain the information I was looking for. I contacted architects, maintenance people, engineers, and leasing agents to obtain the information I needed. I mainly focused on buildings in Houston downtown with few important ones from outside downtown. I was able to obtain information for 15 buildings, the results of which I have discussed below.

**2.4 Strategies adopted for renovation:**

Majority of the MCMH have been continuously used. The buildings from the 1950s and the 60s are known to be energy guzzlers. Since they have only recently become 50 years old, they are not perceived as historic buildings and are often subject to insensitive changes. These issues have motivated me to study the manner in which these buildings have changed and the steps that were taken to make them more energy efficient. In the process I wish to see if any effort was made to preserve these buildings.

**2.4.1 HVAC Changes:** Most of mid-century modern buildings relied heavily on forced air mechanical ventilating systems for indoor temperature control. These early Constant Air Volume systems (CAVs) were generally oversized with control valves or thermostats at the users' end to moderate the temperature. A given volume of air is cooled or heated to a particular temperature at the central system and then again heated to a temperature of the thermostat at individual outlet locations. This doubled the energy used as the air was cooled to a very low temperature at the source and again heated to the required temperature set by the thermostat. Today we have Variable Air Volume (VAV) systems where the temperature is adjusted by the amount of air that is let into the space. Since less air is used and the temperature is controlled at the source, less energy is consumed. This is a 1990s invention and

has replaced CAVs. Along with CAV systems Variable Frequency Drives (VFDS)[8] and electronically controlled Energy Management Systems (EMS) take into consideration the constantly changing occupancy levels in a building. It is expensive to change from a CAV to a VAV system and many buildings from the 1950s and the 1960s have CAV systems. The installation of a variable frequency drive (VFD) on both supply and return air fans in CAV systems can reduce airflow at night and on weekends.

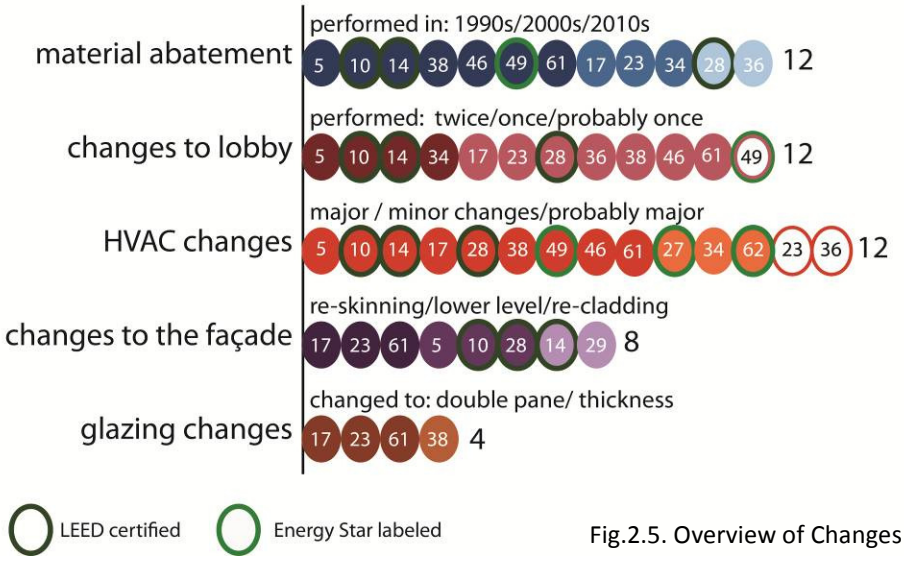


Fig.2.5. Overview of Changes

An HVAC system could be broadly divided into refrigeration, air-distribution, and zone controls. In the Overview diagram (Fig.2.5) major changes indicates a change in both the refrigeration and air-distribution system. A minor change would mean changes in only the refrigeration system or air-distribution system. This would mostly involve replacing or refurbishing existing parts like the chiller, air handling units, or introduction of EMS. Among the 15 buildings I have surveyed 9 of them have had major HVAC upgrades. Out of these, 4 of them have changed from a CAV to VAV system, and 7 of them have had VFDs added. Chiller upgrades are the most common changes, with 11 buildings having undergone those changes. (Fig.2.6) This involves replacement of the chiller, which is one of the important parts of a refrigeration plant, as it removes heat from the refrigerant that cools the distributed air. Two buildings have gained energy star labels by just including EMS and upgrading their chillers, besides upgrading

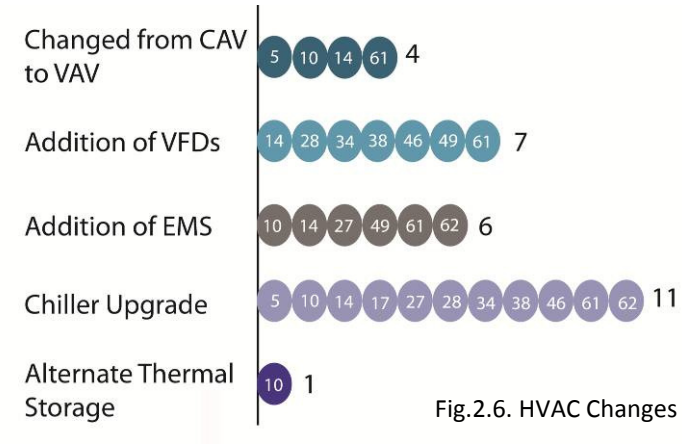


Fig.2.6. HVAC Changes

other building services. These HVAC upgrades are market standards, and no innovation like alternate thermal storage methods have been used except in the case of one building.[9]

**2.4.2 Façade Changes:** One of the most important characteristics of MCMH was the curtain wall façade. The aluminum framed single glazed curtain wall in buildings like UN Secretariat, Lever House and Seagram Building were the ultimate realization of the lightweight non-load-bearing external envelope. Modified versions of it are found in several MCMH with a more vertical, horizontal, or gridded expression with over hangs or recessed windows. Materials also vary from glass and mental panels to porcelain enamel panels and thin stone veneer. Amongst the buildings I have surveyed in Houston most of them have some shading elements, recessed windows, or deeply inset windows with very few having flat glass curtain wall surfaces. The facades also have different materials like brick and stone veneer, metal panels, glass, and pre-cast concrete panels. The early glass curtain walls are faced with issues like moisture infiltration due to failure of sealants and poor insulation resulting from the use of thin glass panes and metal frames. Contrastingly many of the Houston high-rises do not seem to have suffered from such issues as many of them still retain their original façade.

Of the 63 MCMH in Houston only three buildings have undergone a complete re-skinning. (Fig.2.5) All three of them were vacant for several years, and have undergone complete character change. The re-skinning was undertaken both due to material deterioration of the façade and to eliminate negative perception of the building and bring it to a Class A status office building. Of these only one building had a glass curtain wall. There are also cases where there has been failure of thin stone veneer. Two buildings which had marble cladding on their expressed concrete frames were re-clad due to deterioration of the marble, which was also posing to be a threat for pedestrians. One building was re-clad with granite and the other was re-clad with metal panels. Three other buildings have undergone minor façade changes at

the ground level as a way of improving their status in the market. The easiest way to give a face-lift to a high-rise is to make changes to the lobby façade. All these three buildings had changed ownership or had low occupancy levels, and the owner felt there was a need to upgrade the status of the building. (See Fig. 2.7 – 2.14 for details of individual examples).

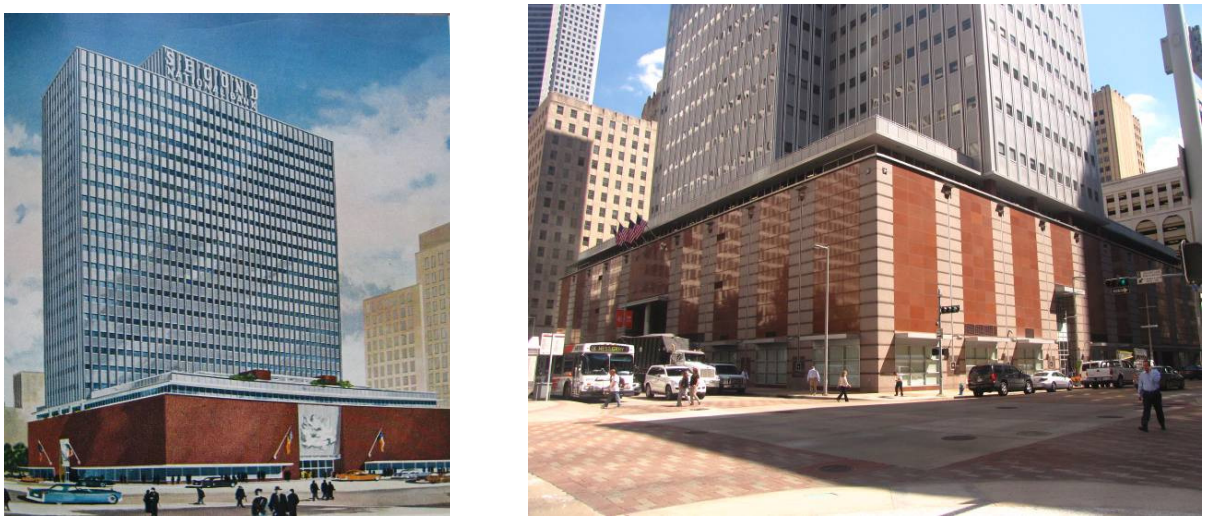

Fig.2.7. 919 Milam was initially owned by Bank One. Image on the left shows an early rendering of the building. Image on the right shows changes made to the podium. The completely red granite clad podium of 919 Milam was broken with vertical strips of grey granite that expressed the inner columns of the building. Here the red granite was removed and reused in place. The more post-modern modification of the faced is not considered authentic to the starker original modern façade.

Fig.2.8. The first five floors of the Travis Tower were re-skinned. The challenge here was to conduct the façade change while the tenant still occupied the spaces.

Fig.2.9. The Tenneco Building now the KinderMorgan Building underwent its first major renovation after 40 years. The Image on the left is before the renovation and the image on the left is after. The elevated lobby did not have a sufficient ground presence, and it was wrapped with a curved glass curtain wall.

Fig.2.10. One City Centre which was originally First City Bank, had marble cladding on the external skeleton, which had deteriorated and was falling. It was re-clad with granite which is less porous therefore more durable.

Fig.2.11. The ExxonMobil Building had marble cladding on the columns, which had deteriorated. The marble was replaced with Aluminum panels as that was easier to finish than stone.

Another issue with the post-war high-rises, which made them less energy efficient, was the use of ¼" thick glass in both curtain walls and windows. These thin sheets of glass caused internal spaces to experience vast heat losses in the winter, but also overheat them due to excess solar gain in the summer, which increased the load on the mechanical systems.[10] Many of them use dark tinted glass which also tends to absorb heat. [11] After the energy crisis of the 1970s new technology was developed with double glazing, low-e coatings and argon-filled cavities. Today we have triple glazing and advanced glass technology that allows for good light transmittance but provides reasonable insulation also. Among the buildings I have surveyed

only the ones which have undergone a complete re-skinning have double glazed windows. Only one building with the original façade has had a glazing thickness changed from 1/4" to 3/8".(Fig.3) The majority of the buildings continue to have ¼" single glazed windows.

Fig.2.12. Hotel Sonesta (image above) was vacant for 10 years before it was renovated and re-opended in 2001. There was a new faced added to this building that completely changed the character.


Fig.2.13. Park Towers was re-skinned after being vacant for ten years. It took on a new façade with a double glazed blue curtain wall. This was a real estate decision, as the new façade increase the floor area of the building and gave it a new appearance.

Improving the efficiency of the façade with thermally broken frames and insulated glazing is often not an easy fix. One needs to make sure the load of the new façade is something the existing structure can take. Also this involves complete replacement of the aluminum frame

which might work to be expensive. Re-skinning with a envelope of different character is an option in several projects where owner is able to reap benefits from it. In Houston amongst these buildings it does not seem to have been popular.

Fig.2.14. The World Trade Center (above) was vacant for several years and the curtain wall was in a bad state. Water had infiltrated and had caused severe damage. The tiles on the podium had also deteriorated and the building was completely re-skinned. It was rehabilitated to a hotel and has recently been bought by Westin.

**2.4.3 Interior Changes:** Interiors of MCMH change frequently, especially the upper floors which are tenant spaces. Every new tenant wants to change the interior to suit its specific needs. Mostly the lobby is under the owner or property manager's control and being the point of arrival it becomes associated with the character and image of the building. When compared to changing the façade, it is cheaper to change the lobby of the building to give it a more contemporary look. Among the buildings I surveyed, 4 of them have had two changes to their lobby, while 7 other have undergone at least one significant change. In all cases the lobby has undergone a significant change in character, and the purpose was to give the building a new look. This includes increasing the height of the lobby by breaking parts of the slab, converting parts of the windowless lobby to parking, and converting courtyards to atrium


Fig.2.15. Interior Changes

spaces that would become part of the lobby. Among the buildings I surveyed 4 of them have undergone such spatial changes. Nine of them have had their finishes completely changed. This would involve changes in lighting, ceiling, flooring and wall or partition finishes like the elevator walls. In two cases the marble on the elevator lobby and columns were retained, and those have been indicated with a partial color. Three responses addressed these changes as "opening up the lobby space" as they felt the interiors had a very dated appearance. (Fig.2.15) The is also an interior style developing for this buildings called the "Modern Revivalist".[12] (Fig.2.16) It is ironic to see designers try to open up modernist spaces, as one of the main tenants of modernism was to express "limitless space".

The interiors of MCMH have undergone significant changes and there has been particularly a loss of huge banking interiors. These bank lobbies in Houston were particularly large as in the 1950s and 1960s banks were not allowed to operate in more than one location to prevent them from using branches to siphon deposits out of rural communities. The economic success during the post-war period fostered the growth of these banks, and they were forced to have really large facilities to meet the needs of the economy. Several of these banks went out of business in the 1990s, and were sold to other owners or developers. While re-purposing the building to commercial office space these bank lobbies had to be extensively altered. There were 3 bank buildings that I surveyed where significant changes were to their interiors. There have also been some instances where there has been loss of art work during demolition or renovation. (Fig.2.17) Art works has played a significant role in modern buildings and MCMH in Houston have lost significant pieces during demolition or during renovation.

*Material Abatement:* Modern buildings have several hazardous materials, of which asbestos and lead abatement is often challenging as they are found in fire-proofing, paint and insulation that are more difficult to remove from the building when compared to PCBs which are usually found in . While it is possible to encapsulate these materials, care needs to be taken during renovations to see that it is not disturbed. Among the buildings I have studied several underwent abatement in the 1990s, apparently the cost of material abatement went down then.[13] (Fig.3) Since material abatement is performed by the owner, and is outside the architects' scope of work I do not have much details on it. Some responses did quote

abatement to be challenge, especially performing it when the building was occupied. Of the 15 buildings I have surveyed, 12 have undergone material abatement, and three others have not had any significant renovation since they were constructed. Material abetment is one of the main reasons for interiors being gutted in any rehabilitation or renovation project.

Fig.2.16. The original Houston House interiors (above) had a very dated and heavy appearance and was changed to a more something more open and contemporary (below), but still keeping some of the modern aesthetic. Some call it the "Modern Revival" style.

Fig.2.17. Bank One (above two) was a fine example of large banking halls in Houston designed by Knoll and Joseph Whited. It was renovated in the 1900s with colored aluminum cladding on columns and floor patterns that alluded to symbols from the 1950s. The lobby was huge and part of it was converted to parking. As in many renovations the painting Americas by Rufino Tamayo was moved from this building.

### 2.4.4 Outlining Purpose and Strategies:

Based on my survey three broad categories have emerged for the purpose of rehabilitation. (Many responses did not clearly state the purpose of rehabilitation but based on the description of changes I have defined the purpose of rehabilitation.) These categories are not exclusive of each other but form a series of nested circles. (Fig.2.18) While employing different strategies, they also determine the level of intervention in a building. The first is to improve energy efficiency, which would involve a minor HVAC upgrade like re-commissioning,

replacement of chiller, and introduction of an automated EMS. Lights and plumbing fixtures are also upgraded to more energy efficient ones. Few of these buildings have also obtained energy star rating.

The second one which is the most common was to increase the value and status of the building. This would involve a significant change in HVAC and other services that would improve the energy efficiency of the building, and result in cost savings. Interiors are changed considerably to give the building a new look, and in some cases some cosmetic changes are made to the lower level of the buildings.

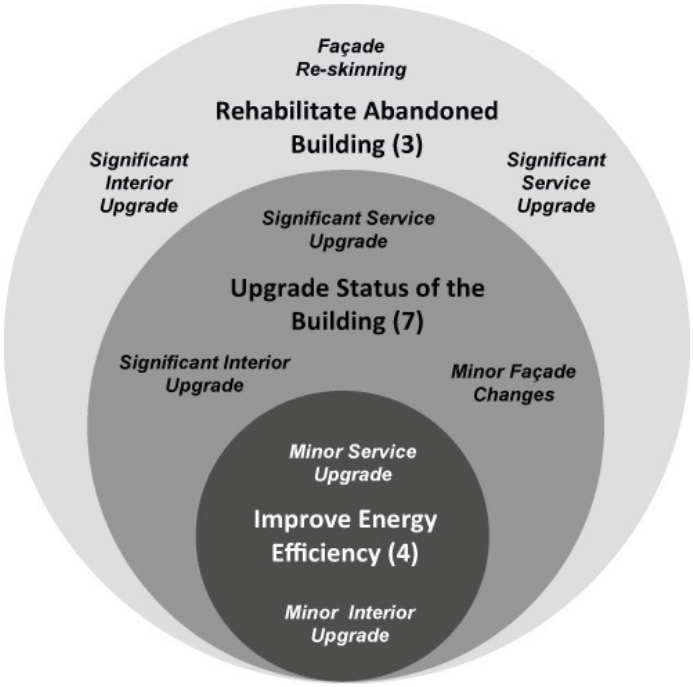


Fig.2.18. Summary of Strategies adopted for Renovation.

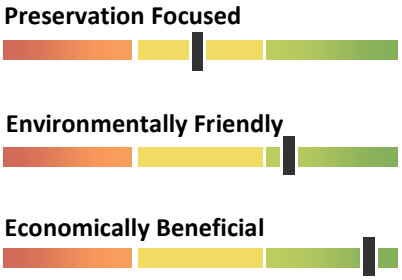


Fig.2.19. Sliders show the main focus of changes in high-rises

There is a significant change in interior character, which in some cases results in a loss of historic material from this period. Re-skinning could be used as a strategy to create a more positive perception of the building and in the process increase real estate value of the building. In the case of a high-rise it is an expensive endeavor, and has not been adopted by the cases I have focused on. In few buildings the façade cladding was changed from marble to granite or

metal panels due to severe deterioration of marble. Some buildings in this category have also achieved LEED certification.

The third category is to rehabilitate a vacant building. This involved strategies adopted for improving energy efficiency and real estate status of the building, and additionally it also involved re-skinning. Rehabilitating vacant building does not necessarily require a complete façade change, but in this case the buildings were vacant for almost a decade and their facades had deteriorated considerably due to deferred maintenance. The owner also perceived a need to change the appearance and have a new character, which would increase the real estate value and perception of the building.

Economics has been the main driving force behind all these projects. In some relatively recent projects LEED certification has also been an important consideration. Energy efficiency has always been important for high-rises as it results in cost savings, but LEED certification has a broader approach to sustainability by giving points for reducing the overall embodied energy of the changes. Most of the buildings that have achieved LEED certification are the ones that have been continuously occupied, and have undergone several successive renovations. Preservation has never been a consideration for any of these buildings. Several buildings have retained their original façade, but this does not imply that there has been a conscious effort to preserve these building. It is just more economical not to touch the façade. Since very few of them have complete glass curtain wall facades which are more prone to leaking there might not be an immediate need to change the façades. (Fig.2.19)

Many of these buildings have just recently become 50 years old, and do not have any historic designation. This often leads to extensive changes that alter the character of these buildings. This study further outlines the significance and the manner in which these buildings are perceived.

### 2.5 Significance and Perception:

The high-rises built between 1950 and 1971 represent the first generation of modern high-rises in Houston. Besides being the first they reflect a particular typology and form that draws inspiration from master architects like Le-Corbusier and Mies van der Rohe. Though most of

them were rarely the tallest buildings when they were constructed, these buildings ushered in the modern era in Houston high-rise construction. The new style suited the entrepreneurial spirit of Houston in the 1950s, and simultaneously pointed to a future in space technology that the city was looking forward to in the 1960s.[14] As already stated these buildings are not iconic and did not set any particular trend in high-rise design, though some of them have been published in national journals and have won awards at the both local and national levels. They are often cited for their deep set windows, horizontal shading elements and brise-soleils which seem environmentally responsive.[15] (Fig. 2.20, 2.21 & 2.22).

Fig. 2.20. Melrose Building, the first modern high-rise in Houston, built in 1952 by Lloyd Morgan and Jones.

Fig.2.21. The Wortham Tower known for its deep set windows and brise-soleil. Built in 1965 by Lloyd Morgan and Jones.

Fig.2.22. The ExxonMobil Building by Welton Becket and Associates, built in 1963. Has been sold and is going to be re-skinned.

Recognition by awards and publications is not sufficient for a building to get preserved. Whether professionals approve it or not buildings that appeal to the public gets preserved easily. I used the following website http://www.houstonarchitecture.com/ to map the public perception of these buildings. (See Appendix) This website is an open forum where people upload images and videos, share opinions, and discuss issues related to the built environment in Houston. This website has individual pages for some of the buildings I have focused on, and

members are allowed to like it on Facebook, or there is a tab for “praise it or raze it” which gives percentages
of people liking the building. Most of the buildings that are liked and have been published are the ones that have been occupied continuously with significant changes
to the interior and minor changes to the exterior. The vacant ones are generally not the very popular ones, and are not architecturally significant. Except the case of the Melrose building, in most cases the architect is also not known.

Houston has already lost some of its valuable mid-century modern interiors, while the exteriors have been mostly untouched. For a city that has voted out zoning several times and laid its faith completely on market forces to find appropriate use for land, historic preservation does seem a little farfetched. Since adopting the preservation ordinance in 1995, several landmarks like the Rice Hotel and Humble Oil Building have been innovatively restored and preserved. The city offers several tax incentives for renovating historic buildings. Certain locations have been recognized as protected historic districts, but none of the buildings that I have focused on fall in these historic districts. The city has also designated Houston downtown to be a TIRZ (Tax Increment Reinvestment Zone) district. They have several grants like the façade restoration grant which is focused on preservation. The list of buildings that have benefitted from this grant are usually pre-war buildings, and some how none of the MCMH have taken advantage of this program. The city claims that it is up to the owner to take the initiative and they show no preferences. When compared to New York City which even landmarks its interiors, Houston has a long way to come when it comes to recognizing the significance of its Mid-century Modern High-rises.

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Fig 2.1: (1954) - Courtesy http://www.skyscrapercity.com/showthread.php?t=757518

Fig 2.1: (1967) – Courtesy HMRC, Houston

Fig 2.1: (present) – City Data.com

Fig 2.2 – by author

Fig 2.3 – by author

Fig 2.4 – by author

Fig 2.5 – by author

Fig 2.6 – by author

Fig 2.7 (left) - courtesy HMRC, Houston

Fig 2.7 (right) - by Author

Fig 2.8 (left) - courtesy HMRC, Houston

Fig 2.8 (right) - courtesy Kirksey, Houston

Fig 2.9 (left) - courtesy Gensler, Houston

Fig 2.9 (right) - by Author

Fig 2.10 - http://www.houstonarchitecture.com/HAI/Images/Buildings/Downtown/1CityCentre-Jan08-004a.jpg

Fig 2.11 (left) - by Author

Fig 2.12 (left) - courtesy HMRC, Houston

Fig 2.12 (right) - by Author

Fig 2.13 (left) - http://www.tpmcrealty.com/properties/office/park-towers-houston Fig 2.13 (right) - http://www.tpmcrealty.com/properties/office/park-towers-houston

Fig 2.14 (left) - courtesy Kirksey, Houston

Fig 2.14 (right) - by Author

Fig 2.15 (left) - by Author

Fig 2.16 (left) - Slyworks Photography

Fig 2.16 (right) - http://content.uniquehomes.com/2011/11/historic-houston-house-gets-a-modern-makeover/

Fig 2.17 (left) - courtesy HMRC, Houston

Fig 2.17 (right) - http://www.vaughnconstruction.com/build/project-showcase/parking/commercial-parking-garage

Fig 2.18 - by Author

Fig 2.19 - by Author

Fig 2.20 - Courtesy Woodson Research Center, Rice University, Houston

Fig 2.21 - Ben Hill, HoustonMod website

Fig 2.22 – by Author

## End Notes :

[1] William Marlin, *Supergall,"* Forum, April (1972), 35.
[2] John died in 1838 due to climatic conditions. Augustus left the town in 1852 after he had a squabble over business investments with his wife Charlotte. He separated and went to Mexico never to return.
[3] ibid
[4] "Houston History," http://02db39d.netsolhost.com/legacy/history6o.htm (accessed 14th February 2014).
[5] Houston Club is scheduled for demolition and new designs have been developed for a new tower. The developer is waiting for a single big tenant to occupy majority of the space before commencing on the demolition.
[6] The Prudential Building later became a part of the M.D.Anderson facility and was called the Houston Main building. The new plans for this site are not known.
[7] In the late 1990s the building was cleared of asbestos, and there was talk of renovating it, but as usual plans fell through. In 2011 the building was bought by Brookfield Properties, which owned nearby properties, and demolished this building for providing better views of downtown. The lower levels of the building were kept and are used as a parking garage.
[8] It is an accessory to a motor which allows the speed (RPMs) of the motor to be varied. In HVAC, they may be used on AHU fans, pumps, and cooling towers to reduce energy used by those motors during times of off-peak loading
[9] In this case alternate thermal storage methods were introduced when there were incentives and were stopped when the incentives were withdrawn.
[10] Philip Oldfield , Dario Trabucco & Antony Wood, "*Five Energy Generations of Tall Buildings: An Historical Analysis of Energy Consumption in High-Rise Buildings*," The Journal of Architecture 14:5 (2009), 598.
[11] Philip Oldfield et al, "Five Energy Generations of Tall Buildings….", 591-613.
[12] Houston House was changed to a "Modern Revival" style that claimed to re-invent the modern character of interior spaces.
[13] Based on conversation with architects at Kirksey.
[14] Anna Mod, Building Modern Houston, Arcadia Publishing, South Carolina, 2012.
[15] Melrose and ExxonMobil Building have horizontal shades.

## Conclusion:

High-rises are huge commercial ventures, which make them different from other building types. The technology and services required to construct high-rises, make them more expensive than constructing the same square footage at a lower heights, and invariably maintenance of such tall buildings is equally expensive. [1] Hence any rehabilitation or renovation of tall buildings needs to be an economically viable option for the owner. It is not surprising that this study observes that in any renovation work the option that would involve minimum costs but would reap maximum benefits is sought. In the case of MCMH in Houston it means upgrading mechanical systems, and changing interiors, but not touching the façade. In general energy retrofits for post-war high-rises stop short of the façade. In Houston, only those buildings that have been vacant for several years have been re-skinned. While deferred maintenance might have caused severe deterioration compelling the owner to change the façade, perception was also an important factor in the decision making.

From a preservation perspective it is beneficial not to have many MCMH re-skinned or façade significantly modified, from an energy efficiency perspective it is not an advantage. The curtain wall technology of the post-war period was still new and its technology was still developing. They are known for problems like air infiltration, moisture penetration and poor insulation, and several are in need of an energy retrofit. A recent study in The New York Times revealed EPA's Energy Star score of several buildings in the city: Empire state – 80, Chrysler Building- 84, Seagram - 3, and Lever House-20 (after its façade restoration). For a building to be rated as Energy Star it needs to have a score of 75. This supports the idea that the single glazed curtain-wall is not very energy efficient. A common argument in favor of the glass walls in high-rises is that the internal heating is caused by lighting and other equipments used in an office, rather than heat transfer from the walls.[2] We are having more Energy Star rated gadgets and office equipment, and lighting has become more efficient with less heat being generated. The next step in energy savings then would be the façade design that effectively improves day lighting and reduces the use of artificial lights, and improving the insulation of the curtain walls to further reduce heat transfer.

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[1] Gordon Wittenburg, *" The Environemntal Impact of Tall building,"* Cite, Spring-Summer, 1984: 15.
[2] Witold Rybczynski, *"LEED Lies,"* On Culture and Architecture Blog, December 26, 2012, http://www.witoldrybczynski.com/architecture/leed-lies/

In such a scenario the dilemma that MCMH are faced with is to find an economical balance between making these buildings energy efficient, and preserving the architectural character of the building. Re-skinning with a more efficient curtain wall is not the only solution to improve the energy performance of the building. Installation of chilled beams, motorized interior screens, and thermal comfort screens could be used to reduce heat transfer.[3] Several MCMH were also environmentally responsive and many have shading elements like brise-soleils, and horizontal or vertical shading devices. Very often these environmentally responsive design gestures are not taken into consideration and a complete re-skin is proposed to increase the value of rentable space in a building. These new proposals do not allude to the existing façade or the period the building was built, which results in a loss of continuity in the urban fabric. Re-skinning becomes a challenge when one needs to adopt new technology, yet allude to the existing. Here the boundaries between preservation and architecture start to blur. ( See appendix 3 for a design exploration for the façade of the ExxonMobil Building in Houston, Texas)

[3] Nina Rappaport, *"Sustainability a Modern Movement"* in Van den Heuvel, Dirk, Maarten Mesman, Wido Quist, and Bert Lemmens, "*The Challenge of Change: Dealing with the Legacy of the Modern Movement,*" (2008): 337.

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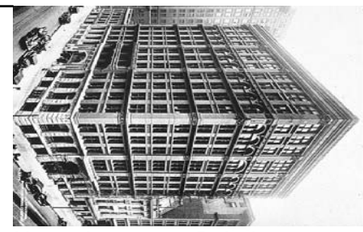
## *Appendix 1*: **Timeline**
A **comparison** of **high-rise** development

*The new buildings were based on what architects had learned from books and not on previous responses to similar problems. The skyscrapers of the thirties were forgotten and an answer for the type was sought in new terms. Tall buildings were seen as a special case of a general condition, as normal, low buildings that happened to have grown tall. The name skyscraper was abandoned and replaced with "high-rise" building – Cesar Pelli.*

1885 and later

1885



Home Insurance Building
Chicago

1890

World Pulitzer Building
NYC

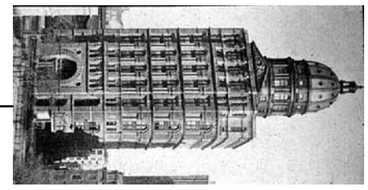
Wain Wright Building
Chicago

1890s

Binz Building
Houston

1894

1899



Park Row Building
NYC

1900s

First National  Bank
Houston

1905

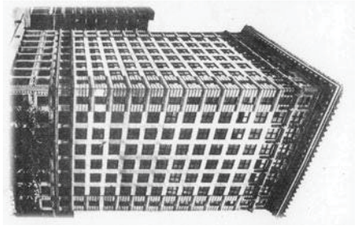
1907

Flatiron Building
NYC

1909

Metropolitan Life Tower
NYC

early 1910s



Carter Building
Houston

1910

Rice Hotel
Houston

1912

1913

Woolworth Building
NYC

1915 and later

1915

Equitabke Building
NYC

1920

Chrysler Building
NYC

1920s

Esperson Building
Houston

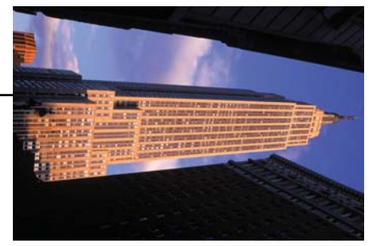
1927

Gulf Building
Houston

1929

1930s

1931



Empire State Building
NYC

early 1940s

1945 and later

1950s

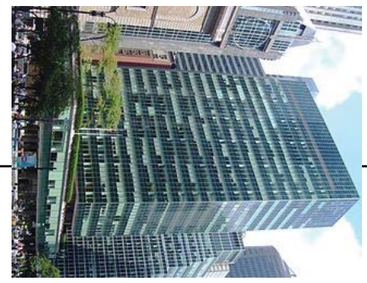
1960s

early 1970s


Melrose Building
Houston

1952

Prudential Building
Houston



1952

Lever House
NYC

United Nations Building
NYC

919 Milam
Houston

1956

Medical Towers
Houston

1958

Seagram Building
NYC

1960

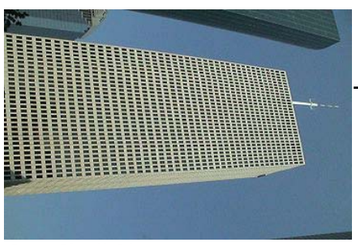
One City Center
Houston


Kinder Morgan Building
Houston

1963

ExxonMobil Building
Houston

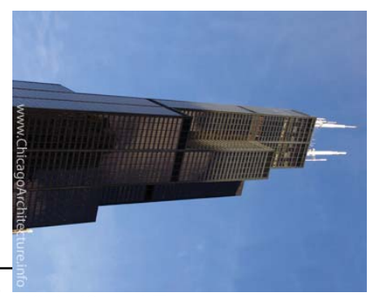
Twin Towers
NYC



1971

One Shell Plaza
Houston

1970




1974

Willis (Sears) Towers
Chicago

# Appendix 2: **Charts Inventory** and **Significance**

*"The skyscraper is a building type which, more than any other, epitomizes modern American architecture to the world."* - James Fitch, *American Building*

## INVENTORY OF MID-CENTURY MODERN HIGH-RISES IN HOUSTON

| No. | Building Name | Alternate Names | No. of Floors | Address | Zip | Construction End Date | Date vacant or demolished | Former Use | Current use | Architect |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Hermann Professional Building | n/a | 15 | 6410 Fannin Street | 77030 | 1948 | | medical | medical | Kenneth Franzheim |
| 2 | Melrose Building | n/a | 21 | 1121 Walker Street | 77002 | 1952 | 1980s | office | office | Lloyd and Morgan |
| 3 | Houston Main Building | Prudential Building | 21 | 1000 Holcombe Boulevard | 77030 | 1952 | 2012 | office | medical | Kenneth Franzheim |
| 4 | Houston Club Building | n/a | 18 | 811 Rusk Street | 77002 | 1955 | 2010 | office | office | Wyatt C. Hedrick & Co. |
| 5 | Travis Tower | Conoco Building, Texas National Bank Bldg. | 21 | 1300 Main Street | 77002 | 1955 | | office | office | Kenneth Franzheim |
| 6 | 3400 Montrose | n/a | 10 | 3400 Montrose | 77006 | 1956 | | office | office | |
| 7 | Central Square One | Century Building | 14 | 2100 Travis Street | 77002 | 1956 | 2000 | office | office | Lars Bang & Lucian T. Hood, Jr. |
| 8 | Amegy Bank Building | Renaissance Tower, Houston Citizens' Bank & Trust Co., Southwest Bank of Texas | 14 | 1801 Main Street | 77002 | 1956 | | office | office | Kenneth Franzheim & Pierce |
| 9 | Medical Towers | n/a | 18 | 1709 Dryden Street | 77030 | 1956 | | medical | medical | SOM, Goleman and Rofe |
| 10 | 919 Milam | Bank of the Southwest, Bank One Center | 24 | 910 Travis Street | 77002 | 1956 | | office | office | Kenneth Franzheim |
| 11 | M.D. Anderson Cancer Center | Anderson Mayfair Hotel | 15 | 1600 Holcombe Blvd. | 77030 | 1957 | 1991 | hotel | medical-rebuilt | Lloyd, Morgan and Jones |
| 12 | Methodist Hospital Diagnostic Clinical Center | Methodist Hospital West Pavilion Building | 15 | 6448 Fannin Street | 77030 | 1957 | 2006 | medical | medical-rebuilt | |
| 13 | 1400 Herman | n/a | 17 | 1400 Herman | 77004 | 1957 | | residential | residential | Wyatt C. Hedrick & Co. |
| 14 | One City Center | First City National Bank | 32 | 1021 Main Street | 77002 | 1960 | | office | office | SOM |
| 15 | Americana Tower | American Building | 15 | 811 Dallas Street | 77002 | 1961 | 2012 | office | office | Lloyd, Jones & Fillpot |
| 16 | Texaco Building Annex | Gibraltar Savings Bank | 12 | 701 Fanin Street | 77002 | 1962 | 2003 | office | office | Cameron Fairchild |
| 17 | Inn at Ballpark | Houston World Trade Center Building | 12 | 1520 Texas Avenue | 77002 | 1962 | | office | hotel | Wilson, Morris, Crain & Anderson |
| 18 | Bob Casey Federal Building | n/a | 13 | 515 Rusk Street | 77002 | 1962 | | office-gov | office-gov | Harvin Moore |
| 19 | Bank of America Building | Fannin Bank Building | 17 | 1020 Holcombe Boulevard | 77030 | 1962 | | office | office | Lloyd and Morgan |
| 20 | The River Oaks | n/a | 18 | 3435 Westheimer Road | 77027 | 1962 | | residential | residential | Cameron Fairchild |
| 21 | Sheraton Lincoln Hotel | n/a | 28 | 777 Polk Street | 77002 | 1962 | 2011 | hotel | hotel | Quinn Christiansen/ Leo A Daly |
| 22 | The Hallmark South | n/a | 10 | 4718 Hallmark Drive | 77056 | 1963 | | residential-senior | residential-senior | |
| 23 | Crowne Plaza - Cullen Center | The Whitehall, Hotel America, Hotel Sonesta | 12 | 1700 Smith Street | 77002 | 1963 | | hotel | hotel | Welton Becket and Associates |
| 24 | The Parc IV | Parc IV Apartments | 12 | 3614 Montrose Blvd | 77006 | 1963 | | residential | residential | Jenkins Hoff Oberg Saxe |
| 25 | Regency House | n/a | 13 | 2701 Westheimer Road | 77098 | 1963 | | residential | residential | Turner and Geyer |
| 26 | The Willowick | n/a | 15 | 2200 Willowick Road | 77027 | 1963 | | residential | residential | Neuhaus and Taylor |
| 27 | Jefferson Building-Cullen Center | Cullen Center | 20 | 500 Jefferson Street | 77002 | 1963 | | office | office | Welton Becket and Associates |
| 28 | Kinder Morgan Building | El Paso Energy Building, Tennoco Bldg | 33 | 1001 Louisiana Street | 77002 | 1963 | | office | office | SOM |
| 29 | Exxon Buildng | The Humble Building | 44 | 800 Bell Street | 77002 | 1963 | | office | office | Welton Becket and Associates |
| 30 | Central Square Two | Century National Bank | 12 | 2120 Travis Street | 77002 | 1964 | 2000 | office | office | Lars Bang & Lucian T. Hood, Jr. |
| 31 | SouthWest Tower | n/a | 21 | 707 McKinney Street | 77002 | 1964 | 1983 | office | office | Kenneth Bentsen |
| 32 | Executive House | Executive House Apartments | 10 | 230 W Alabama Street | 77006 | 1965 | | residential | residential | |
| 33 | Great Southern Life Insurance Building | n/a | 10 | 3121 Buffalo Speedway | 77098 | 1965 | 1997 | office | office-rebuilt | SOM |
| 34 | Houston Community College | Southwestern Bell Telephone Company | 12 | 3210 Main Street | 77002 | 1965 | | office | office-education | Wilson, Morris, Crain & Anderson |
| 35 | The Parc V | Parc V Apartments | 12 | 3600 Montrose Blvd | 77006 | 1965 | | residential | residential | Jenkins Hoff Oberg Saxe |
| 36 | Houston House | Houston House Apartments | 21 | 1617 Fannin Street | 77002 | 1965 | | residential | residential | Charles M. Goodman |
| 37 | Lamar Tower | n/a | 23 | 2929 Buffalo Speedway | 77098 | 1965 | | residential | residential | |
| 38 | Wortham Tower | American General Life Insurance Company | 25 | 2727 Allen Parkway | 77019 | 1965 | | office | office | Lloyd, Morgan and Jones |
| 39 | 2016 Main | n/a | 26 | 2016 Main Street | 77002 | 1965 | | residential | residential | Irving Klein |
| 40 | 3701 Kirby | n/a | 12 | 3701 Kirby | 77098 | 1966 | | office | office | |

## INVENTORY OF MID-CENTURY MODERN HIGH-RISES IN HOUSTON

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 41 | Laurence H. Favrot Tower Apartments | n/a | 13 | 6540 Bellows Lane | 77030 | 1966 | | residential - dorms | residential-dorms | |
| 42 | Sussex East & WestTower | Laurence Favrot Hall | 15 | 7510 Hornwood Drive | 77036 | 1966 | | residential - dorm | residential-dorm | Freeman, Van Ness & Mower |
| 43 | Savoy Field Hotel | n/a | 16 | 1616 Main Street | 77002 | 1966 | 1980s | hotel | hotel | |
| 44 | Inwood Manor | Sussex Tower 1 | 16 | 3711 San Felipe Street | 77027 | 1966 | | residential | residential | Neuhaus and Taylor |
| 45 | Prosperity Bank Building | First Capital Bank, Charter Bank | 12 | 5433 Westheimer Road | 77056 | 1967 | | office | office | Wilson, Morris, Crain & Anderson |
| 46 | Houston Police Department HQ | Houston Natural Gas Building | 28 | 1200 Travis Street | 77002 | 1967 | | office | office-gov | Lloyd, Jones & Fillpot |
| 47 | Fondren Brown Building | n/a | 12 | 6565 Fannin Street | 77030 | 1968 | | medical | medical | Lloyd, Morgan and Jones |
| 48 | The Cabochon at River Oaks | The Hermitage | 12 | 2828 Bammel Lane | 77098 | 1967 | | residential | residential | |
| 49 | Bob Lanier Public Works Building | Houston Lighting & Power Building | 27 | 611 Walker Street | 77002 | 1968 | | office-gov | office-gov | Wilson, Morris, Crain & Anderson |
| 50 | One Greenway Plaza | n/a | 11 | 3651 Richmond Avenue | 77046 | 1969 | | office | office | |
| 51 | Two Greenway Plaza | n/a | 11 | 3551 Richmond Avenue | 77046 | 1969 | | office | office | |
| 52 | Buffalo Tower | n/a | 12 | 3700 Buffalo Speedway | 77098 | 1970 | | office | office | Denny and Ray |
| 53 | Moody Towers North and South | Libbie Shearn Moody, W.L. Moody, Jr. Tower | 18 | 4401 Wheeler Street | 77004 | 1970 | | residential-dorms | residential-dorms | |
| 54 | Gallerai Tower II | Post Oak Tower | 21 | 5051 Westheimer Road | 77056 | 1970 | | office | office | |
| 55 | St.Lukes Episcopal Hospital | n/a | 26 | 6720 Bertner Avenue | 77030 | 1970 | | medical | medical | |
| 56 | Sid Richardson College | n/a | 14 | 6360 Main Street | 77005 | 1971 | | residential-dorms | residential-dorms | Neuhuas and taylor |
| 57 | Three Greenway Plaza | n/a | 21 | 3800 Greenway Plaza Dr | 77046 | 1971 | | office | office | |
| 58 | Westin Oaks | Houston Oaks Hotel | 21 | 5011 Westheimer Road | 77056 | 1971 | | hotel | hotel | |
| 59 | Control data Center | Control Data Corporation Building | 22 | 2000 West Loop South | 77027 | 1971 | | office | office | SOM |
| 60 | Holiday Inn Hotel | Heaven On Earth Inn Houston | 30 | 801 St. Joseph Parkway | 77002 | 1971 | 1998 | hotel | hotel | Henry C. Cooke |
| 61 | Park Towers | n/a | 18 | 1233 West Loop South | 77027 | 1971 | | office | office | |
| 62 | Continental Center II-Cullen Center | Cullen Center Bank & Trust Company Bld | 20 | 600 jeffferson | 77002 | 1971 | | office | office | Neuhaus and Taylor |

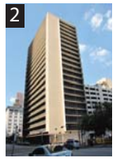
Demolished

Vacant

Previously Vacant

Continuously Used

# Significance vs Perception

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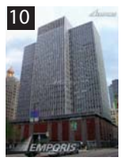


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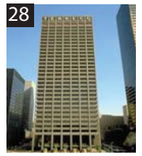


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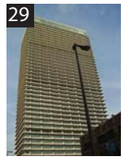


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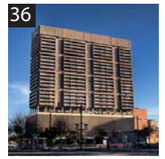


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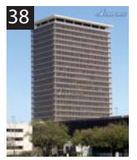


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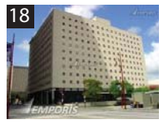


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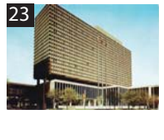


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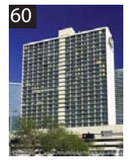


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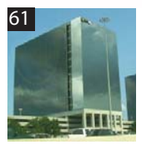



70%


60%

"Praise It" from houstonarchitecture.com

"Like It" on houstonarchitecture.com

AF Published in Architectural Forum

AR Published in Architectural Record

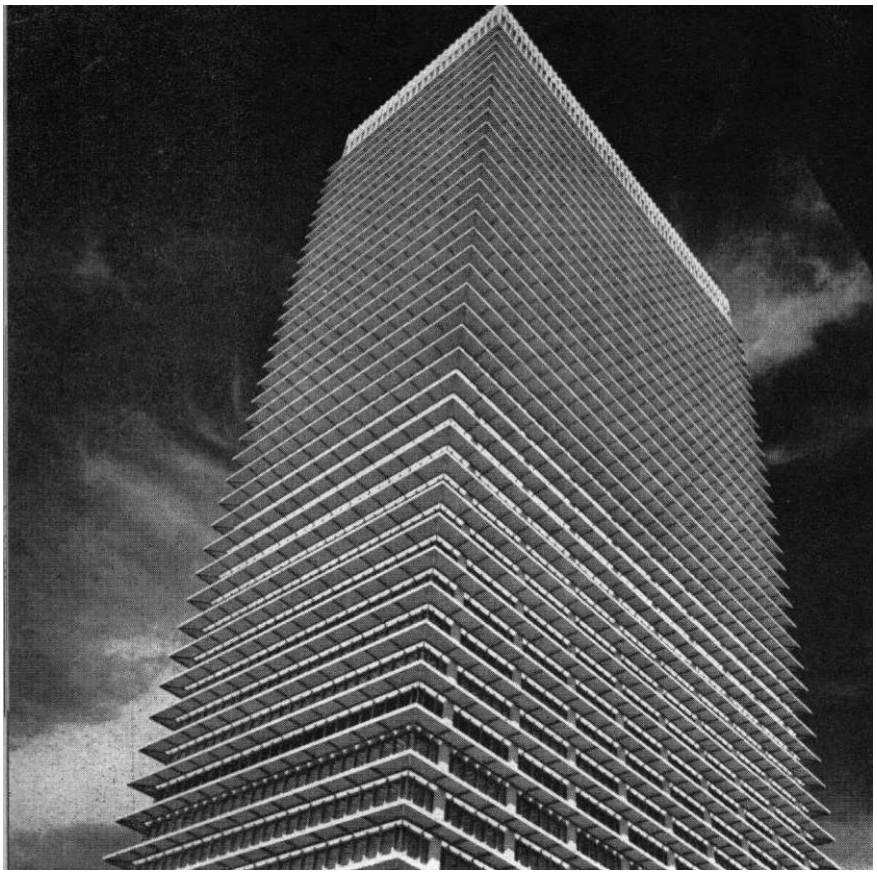
PA Published in Progressive Architecture

N Received AIA National Award

H Received AIA Houston Award

[The picture numbers refer to the numbbers in the inventory.]

## *Appendix 3:* The **ExxonMobil Building** Developing **Façade Options**



*"Design against Sun and Glare – the home office for the Humble Oil and Refining Company in Houston, Texas, designed by Welton Becket, has continuous horizontal sun shades on four exposures to reduce air conditioning costs".* – Architectural Record, October 1963

Fig A3.1 Existing

Re-skinning

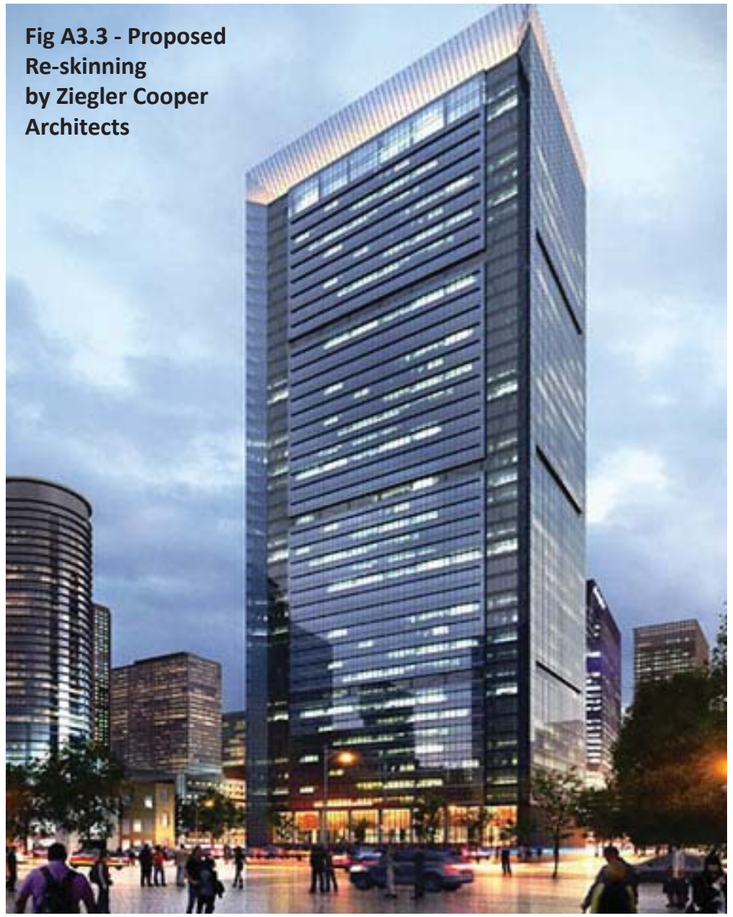


Fig A3.3 - Proposed Re-skinning by Ziegler Cooper Architects

Fig A3.2 - 7 feet deep shades

The Exxon Mobil Building on 800 Bell Street in Houston Downtown was constructed by Welton and Becket Associates in 1963. Initially built as the Humble Oil building, it was the tallest building west of the Mississippi. The most character defining feature of this building was the 7 feet sun shade which protected the building from the hot summer sun in Texas. Supported on Aluminum out-riggers the shades are made of porcelain enamel aluminum panels. The exposed columns are clad with marble, which was replaced in the 1990s with aluminum panels. An Architectural Record article from October 1963 discusses the manner in which these shades make the building energy efficient. The shades are held of the column, which allows airflow, and prevents any hot spots. The building has been recently bought over and there is a re-skinning proposed by Ziegler Cooper Archietcts. The details of the proposal are not available, but the 7 feet shades are going to be made into occupied office space. Of all the mid-century modern high-rises this is the most significant building (See Appendix 2), and it is 50 years old. This faces a fate similar to other mid-century modern high-rises that are not iconic. Often developers believe that re-skinning is necessary to improve the status of the building. I have performed some qualitative facade studies to evaluate different options for this building.

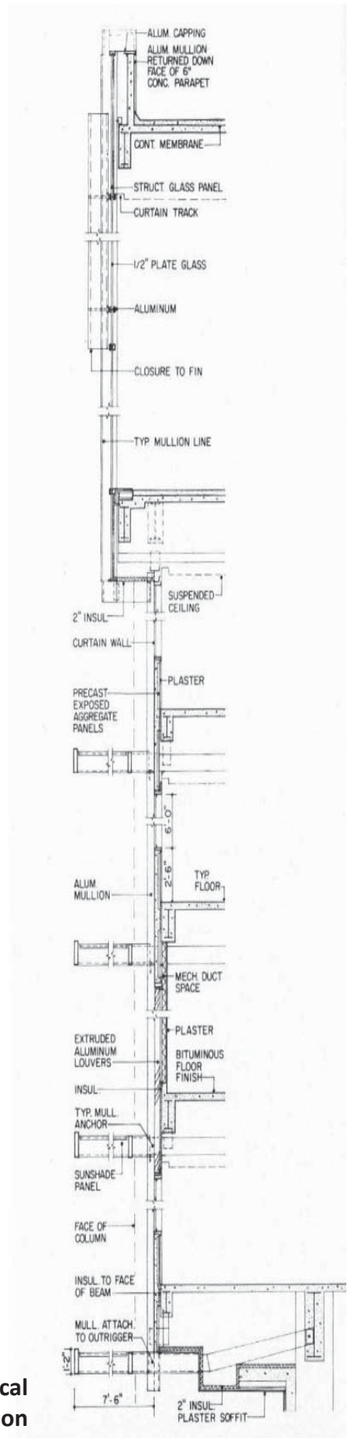
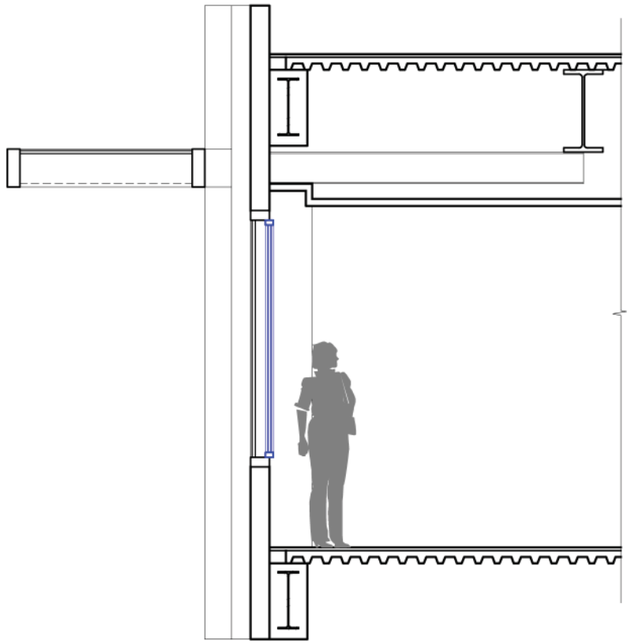
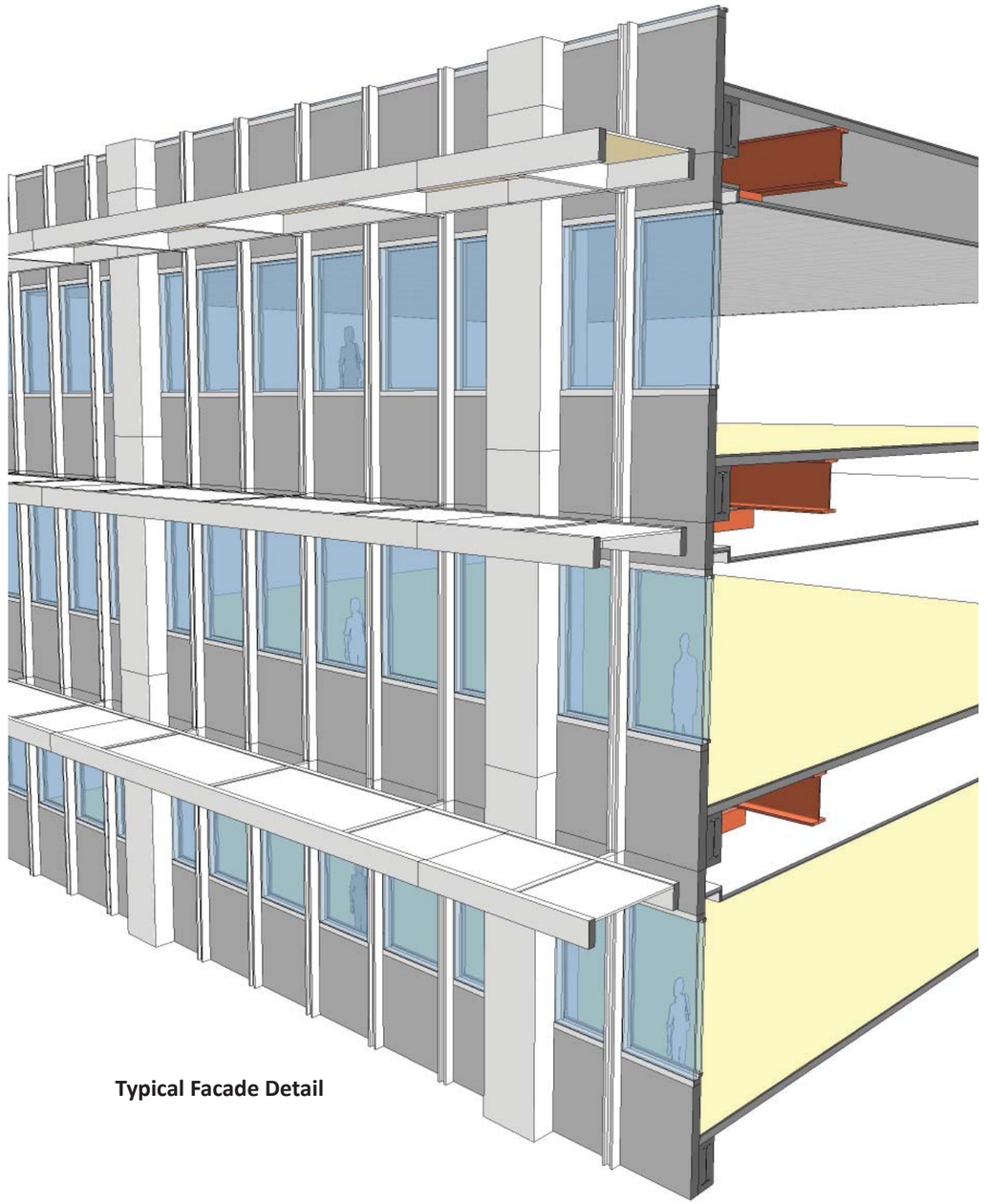



Fig A3.4 - Typical Wall-Section

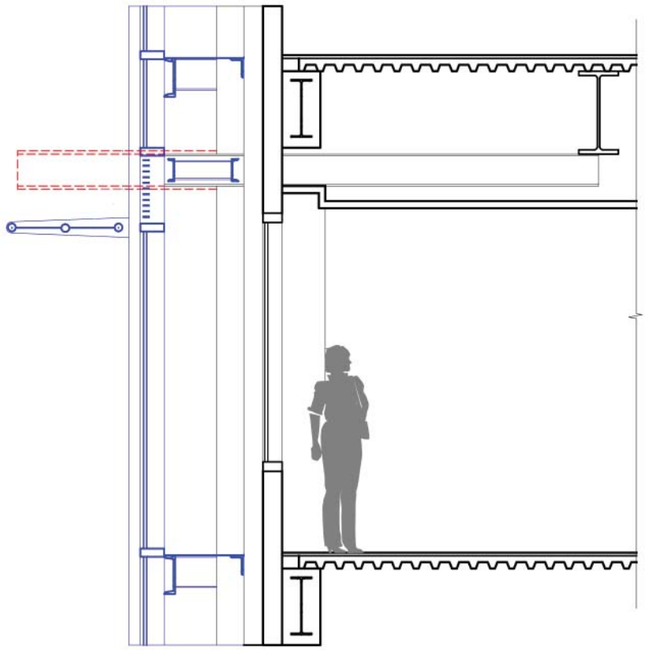


**Typical Wall Section**



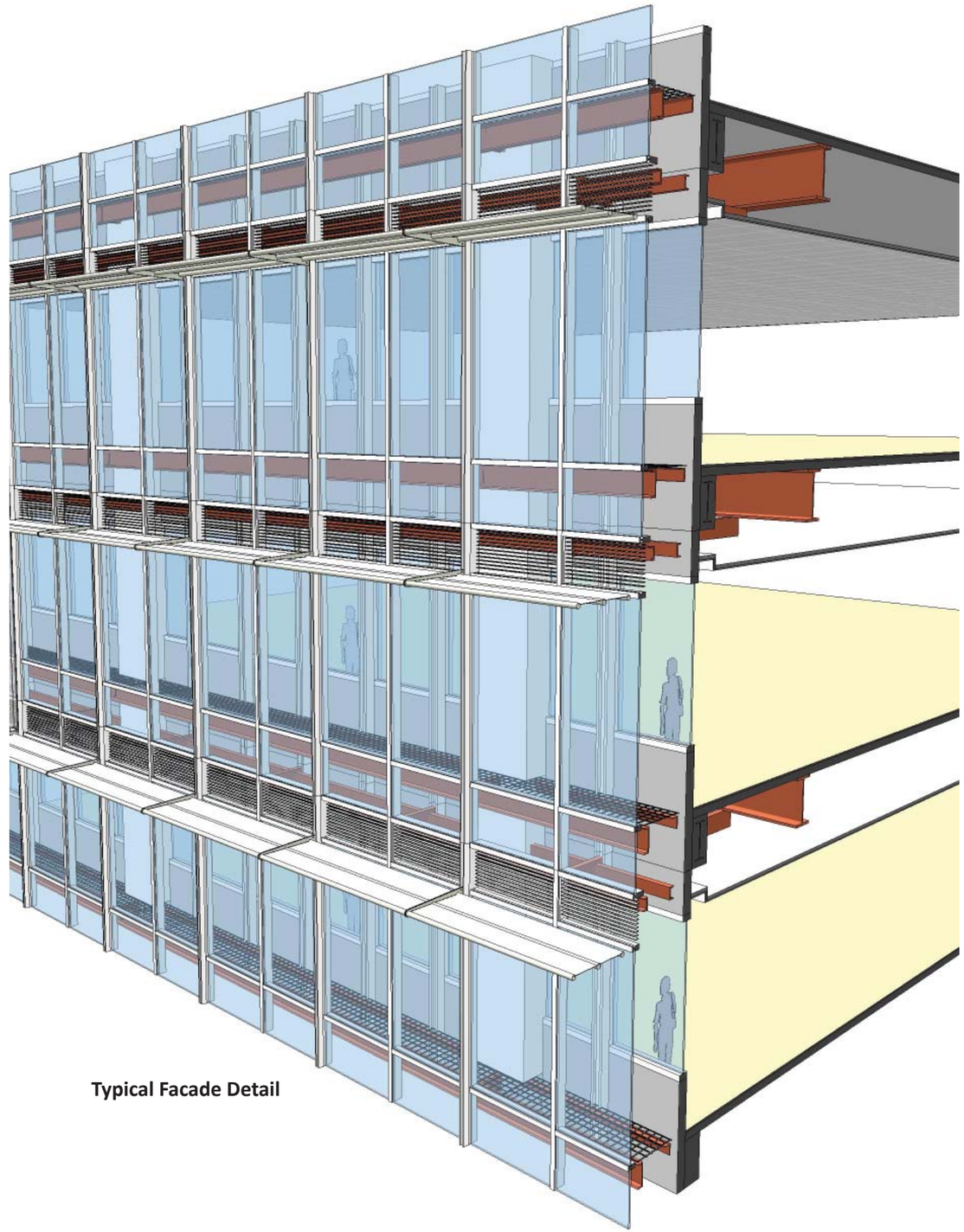
**Typical Facade Detail**

| **Option 1 - RESTORATION ( Instal Interior Storm Window)** | |
|---|---|
| ——— | Elements in the existing façade that are to be retained. They are the existing aluminum curtain wall mullions, aggregate concrete panels, ¼” thick glazing for windows, and porcelain enameled aluminum panels for shading. |
| ——— | Elements to be added. Double glazed low e coated windows to be added on the inside. |
| STRATEGY | To retain the integrity and character of the existing façade and make minimal interventions to improve its energy efficiency. |

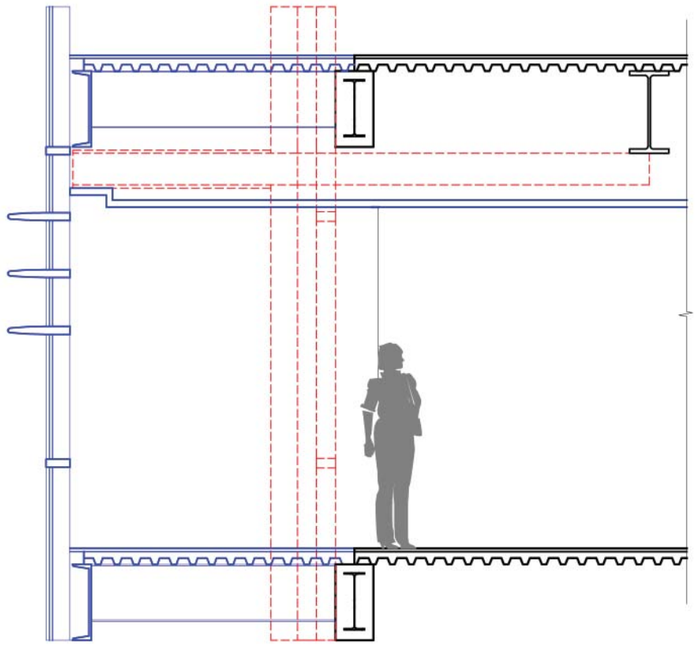


Typical Wall Section

| Option 2 – Over-cladding (Double Glazed Curtainwall) | |
|---|---|
| ——— | Elements in the existing façade that are to be retained. They are the existing aluminum curtain wall mullions, aggregate concrete panels, ¼” thick glazing for windows, and parts of the steel outriggers that support the aluminum shading element. |
| ——— | Elements to be added. Double glazed ventilated aluminum curtain wall with horizontal aluminum shading elements. |
| ——— | Elements to be removed. The existing shading devices are removed to make way for a second façade. New shading devices are added to this façade. |
| STRATEGY | To retain the original façade and add another skin over it. The existing steel outriggers that supported the shading devices were designed to resist wind loads. They will be used with additional bracing to support the new façade. New shading devices are added to protect the façade from the direct rays of the sun and to maintain the horizontal character of the building. |

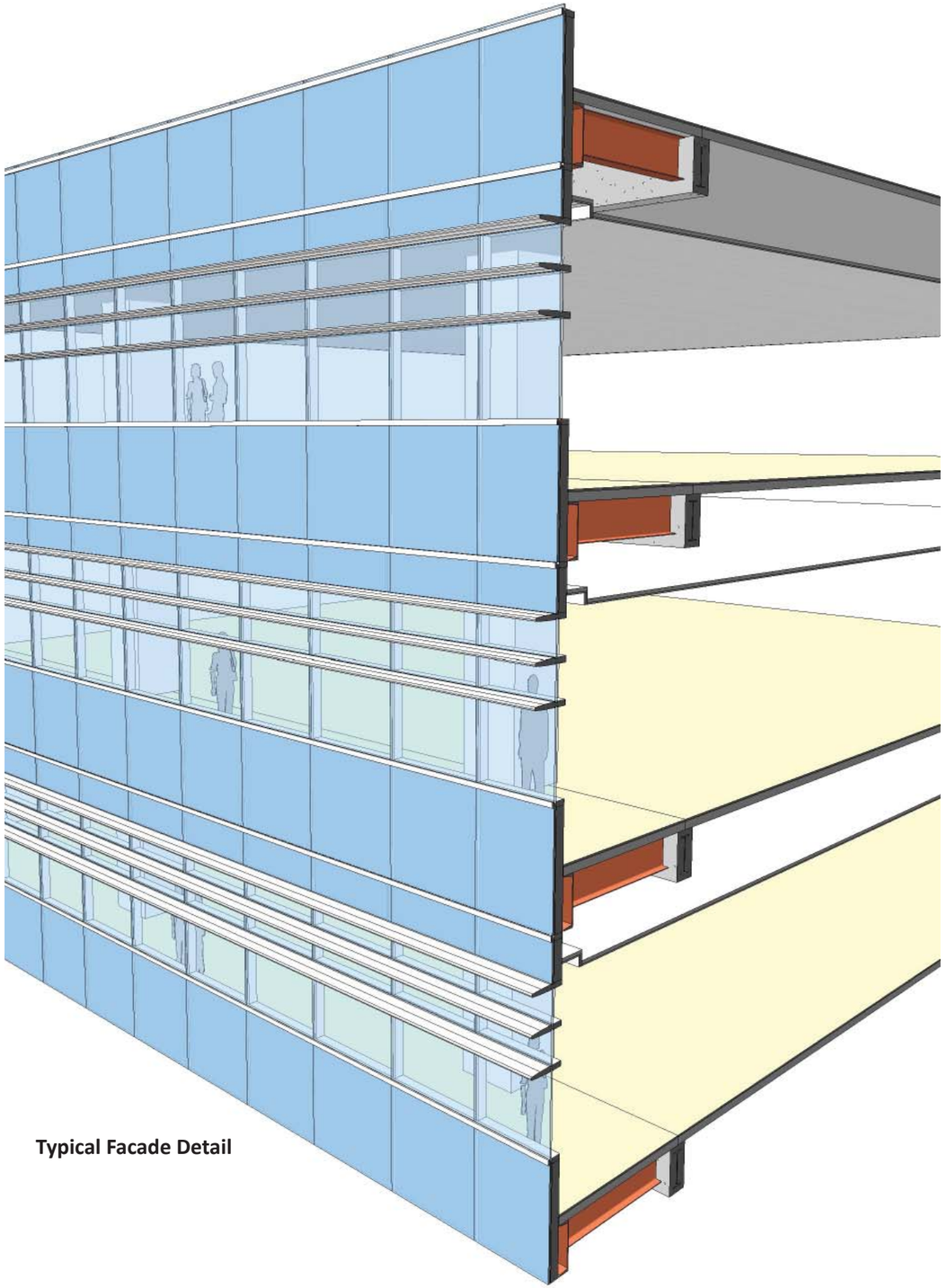


Typical Facade Detail

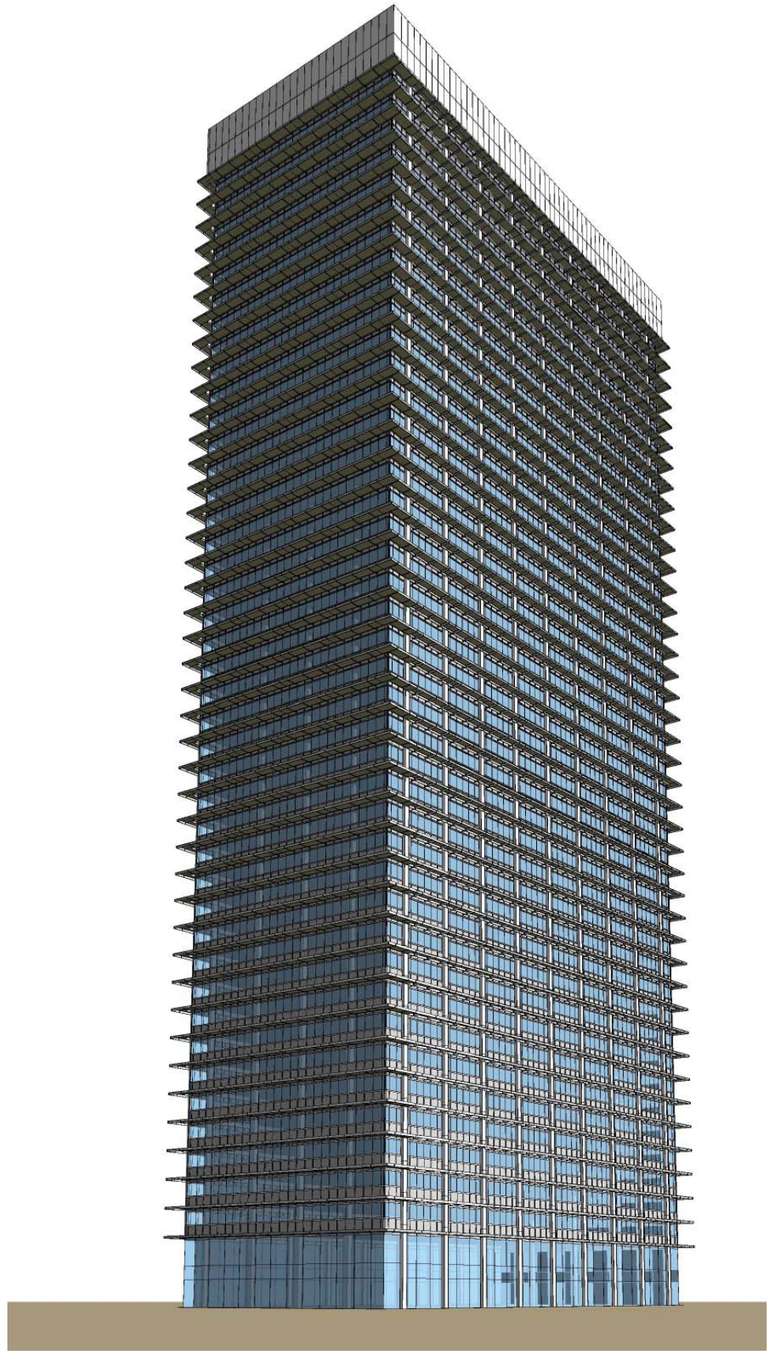


Typical Wall Section

| Option 3 – Re-skinning (Triple Glazed Curtainwall) | |
|---|---|
| ——— | Elements in the existing façade that are to be retained. They are the existing columns and the structural part of the floor. |
| ——— | Elements to be added. Low e coated, triple glazed, aluminum curtain wall with 1’ deep horizontal mullions. |
| ——— | Elements to be removed. The existing façade is completely removed. |
| STRATEGY | To remove the existing shading devices and increase the rentable square footage by making them occupiable space. This would involve adding structure and completely replacing the existing façade with a new one. |

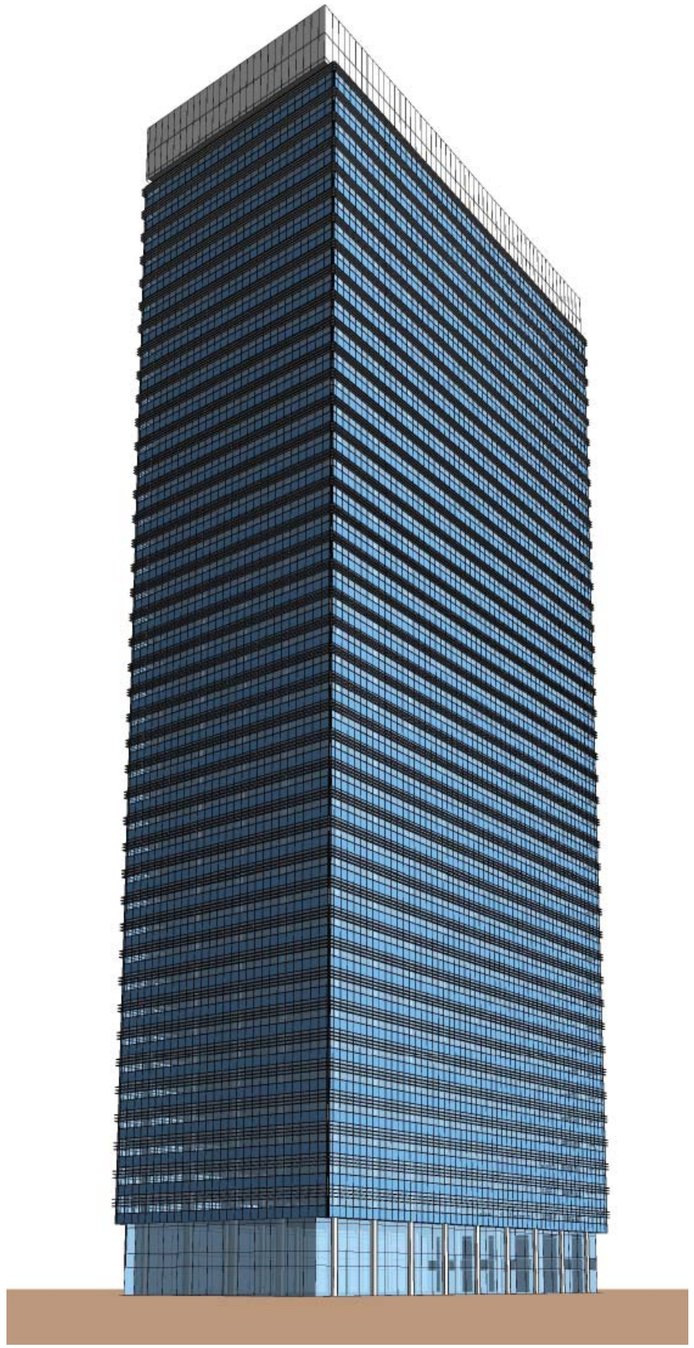


**Typical Facade Detail**

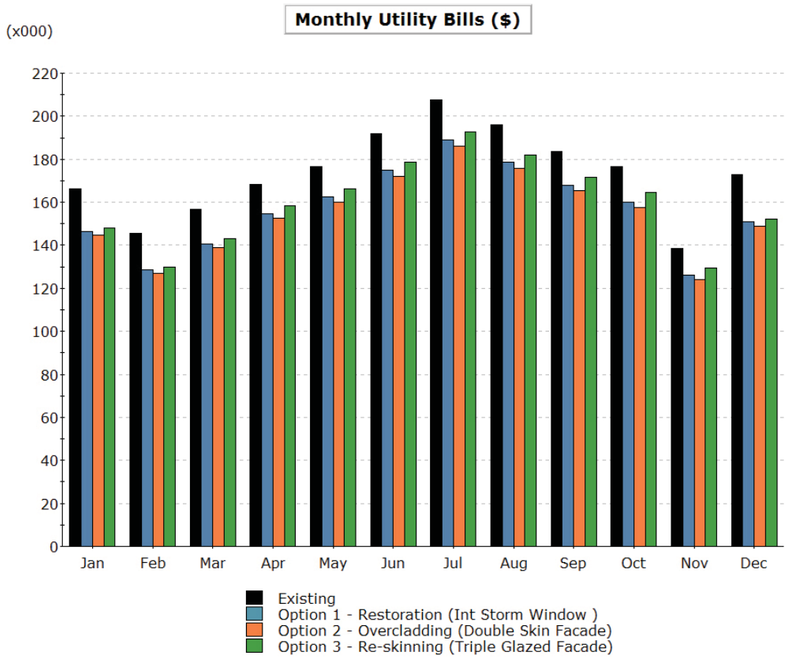


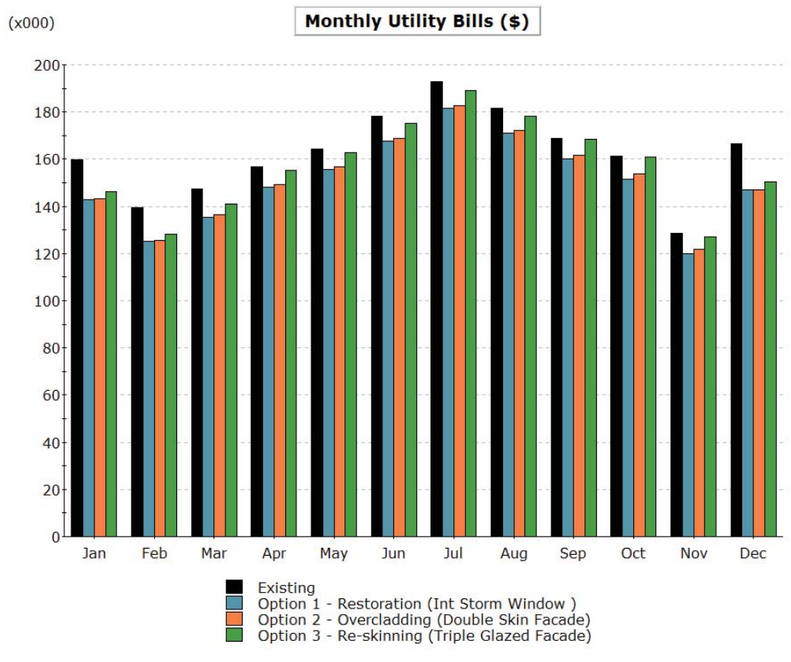
**Option 1 - Restoration**

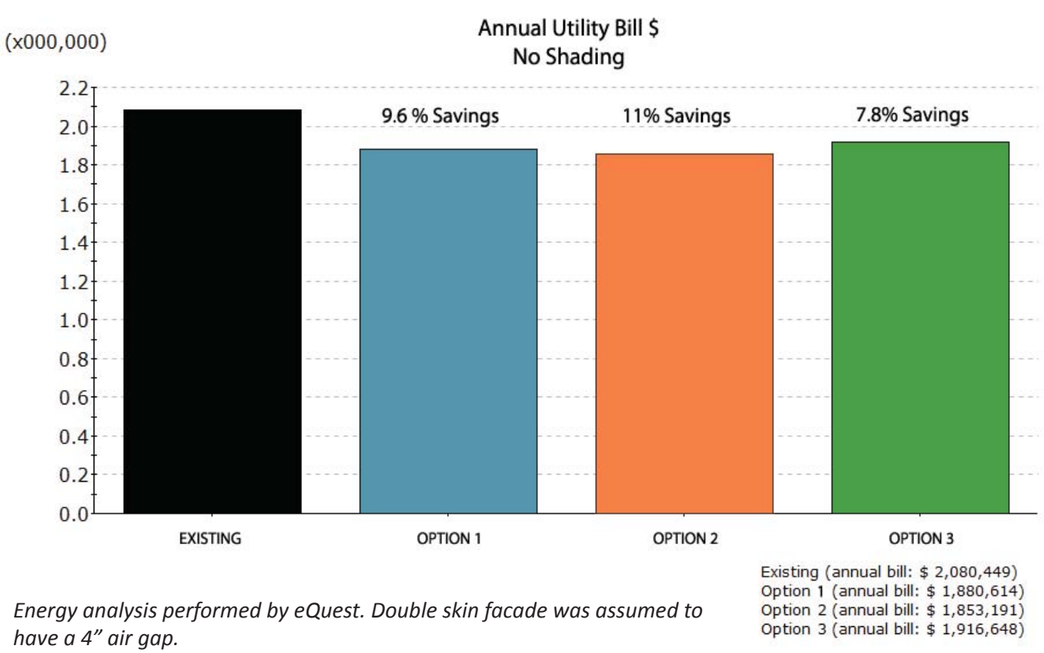
**Option 2 - Overcladding**

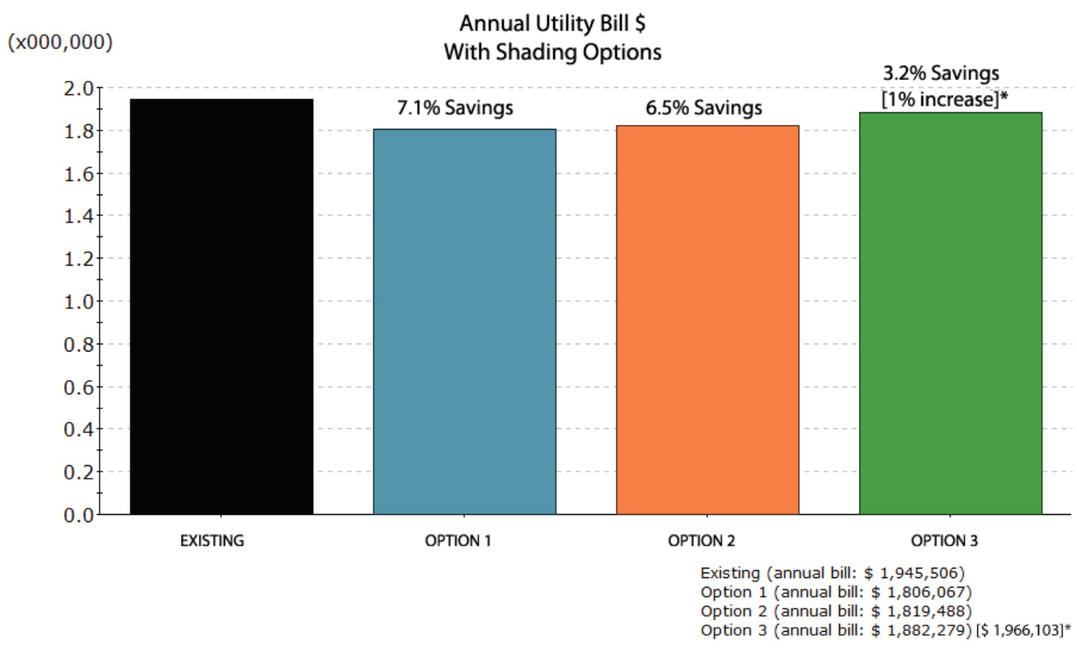


**Option 3 - Re-skinning**




*Energy analysis performed by eQuest. Double skin facade was assumed to have a 4" air gap.*

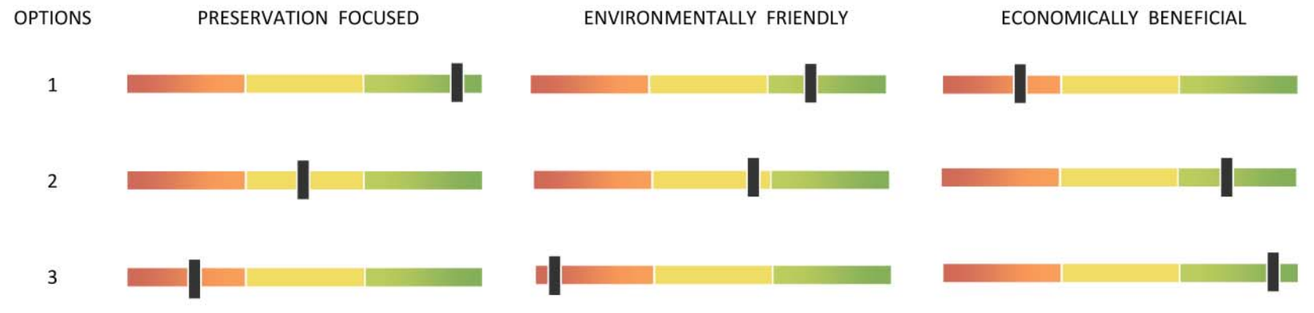
** The analysis did not add the additional floor space in Option 3, as a separate model was reuired for that. Its value is in brackets.*

I have used eQuest to compare the efficiency of the three façade options. For the double skin façade I assumed a four inch air gap, as it was beyond the scope of this project to simulate a vented double skin façade. Given that high-rises are internally loaded building the savings are very less, but it is interesting to note that when there is no shading the effective savings are greater when more energy efficient glazing is used. This shows the importance of the shading elements. The sun path diagrams also show the effectiveness of the existing shading diagrams. They protect the façade from the afternoon and evening sun during the summer months. Though option 1 is the most favorable from the analysis, in reality a double skin vented façade would be more energy efficient if modeled more accurately. It would remove hot spots and reduce the HVAC load.

Energy efficiency is not the only criteria that determine the feasibility of an option. In the analysis I have looked at the way preservation is weighed against energy efficiency and economic returns. Ideally this would require a detailed Life cycle Analysis. In this project the values are more speculative and in reality could shift considerable if values are actually entered in the tables. Looking at the overall qualitative analysis of the three options, there is no clear preference. One and two are better than the third, but given that there is a market bias for new looks, one would prefer over-cladding. Recently three federal high-rises have been overclad. From the perspective of preservation this seems as a reasonable compromise between old and new. It is not a technology popular in tropical climates and needs further exploration.

## Qualitative Analysis of the Three Facade Options

| | PRESERVATION CRITERIA | | | ENVIRONMENTAL CRITERIA | | | ECONOMICAL CRITERIA | | |
|---|---|---|---|---|---|---|---|---|---|
| OPTIONS | MATERIAL | PROPORTION | ARCHITECTURAL ELEMENTS | ENERGY USAGE | DEMOLITION WASTE | NEW MATERIALS | MARKET PRESENCE | HQ MATERIALS | RENTAL INCREASE |
| 1 | RETAIN MOST | RETAIN ALL | RETAIN ALL | MEDIUM | MINIMUM | MINMUM | AVERAGE | NO | MINIMUM |
| 2 | CHANGE SOME | RETAIN MOST | CHANGE SOME | MINIMUM | MEDIUM | MEDIUM | EXCELLENT | YES | MEDIUM |
| 3 | CHANGE ALL | RETAIN MOST | CHANGE ALL | MAXIMUM | MAXIMUM | MAXIMUM | EXCELLENT | YES | MAXIMUM |




## Sunpath Diagrams

100% shading of windows

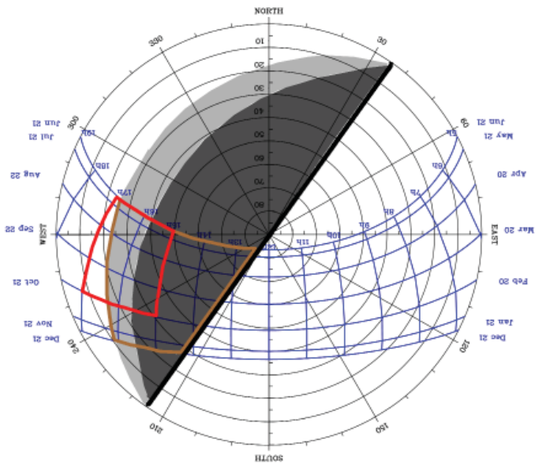
50% shading of windows

facade orientation

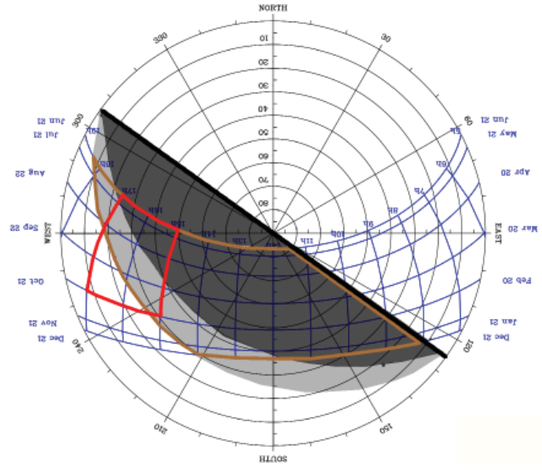
duration when temperature is maximum

duration when facade is shaded

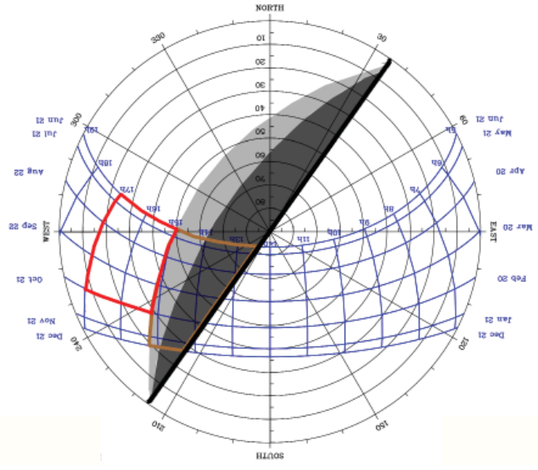
### Existing - North-West Facade



### Existing - South-West Facade



### Option 2 - North-West Facade



### Option 2 - South-West Facade