Why the Atria at US Bank Plaza Need to Be Modified

At its last meeting, the Urban Design Commission's discussion of proposed modifications to US Bank Plaza focused on changes to the building's atria. The Commission asked for additional information on the atria, the problems caused by their design, and the alternatives we considered.

US Bank Plaza was designed in 1972 by Bruce Graham of Skidmore, Owings & Merrill. The architect's vision for the project was to create an "urban relationship of the (building's) exterior wall and its ability to define the public square and Wisconsin State Capitol." It was Graham's "dream that the entire Capitol Square be circumscribed by a gallery of glass which would serve as green space in the winter, and as public space in the summer." A transparent glass facade was designed to capture the stunning views of the Capitol Square and to bring the outside environment into the building. The atria were greenhouses that would let sunlight penetrate deep into the office floors. Graham stated that the building's design would save energy. Unfortunately, he was wrong.

US Bank Plaza opened in 1974, just as the OPEC oil embargo was underscoring the energy dependence of the United States. Since the first tenant moved in, the building has suffered from a number of serious problems.

The excessive amounts of energy consumed in an unsuccessful attempt to cool US Bank Plaza are driving operating costs almost two times higher than what a new building would experience. In its present condition, the building cannot deliver a comfortable environment for its tenants. Tenants who want Class A office space are moving out of the building.

Even as the building was under construction, a letter from SOM to its client indicated that the significant heat gain and comfort levels within the southwest-facing atria would be a major problem to the building occupants. The problem has proven to be so significant that the space contained within each atrium is effectively nonfunctional.

The three existing atria spaces at US Bank Plaza generate 11% of the building's total cooling load and make it impossible to create a comfortable, energy efficient building.

The glass in each atrium is single-pane polished plate glass with no solar shading or insulating value. A sophisticated energy analysis that was prepared by Environmental Systems Design (ESD) documents that the three existing atria spaces generate 11% of US Bank Plaza's total cooling load, even through they account for less than 2% of the total floor area.

The heat gain in the atria is so significant that on a sunny day in January when the outside temperature was below 20 degrees, the temperature was hot enough in Boardman Suhr's

main conference room (which is open to the atrium) that clients had to remove their suit coats and sweaters. On July 30, 2008 at 3:00 pm, a sunny summer day with an outside air temperature of 82 degrees, the temperature inside the Boardman Suhr atrium was 86 degrees. Extraordinary amounts of energy are being consumed and wasted in an unsuccessful attempt to cool the building

The ambient thermal comfort behind the plate glass (which is the temperature perceived by a person sitting directly in the sun's rays) is so problematic that floor space behind the plate glass is left unoccupied or used for files and storage. The few employees of US Bank who work in cubicles within the first floor Pinckney Street atrium put up overhead umbrellas and cardboard in an attempt to create shade. In its present condition, the building cannot deliver an interior office environment that is acceptable to its tenants. The space within each atrium is not functional.

The effect of solar radiation in the atrium areas and the problematic thermal comfort for employees was acknowledged by the original architects, Skidmore, Owings & Merrill (SOM). In a letter dated May 22, 1973 that is attached, SOM stated that

> "We have reviewed the effect of the sun radiation into the greenhouse areas and the resultant comfort level. Based upon the review, and the opportunity to visit the full size mock-up in Miami, **we definitely recommend that the glass in the sloped areas of the greenhouse(s) be changed to a reflective glass ...**"

This recommendation was ignored for reasons that were never documented, perhaps because a highly reflective or mirrored plate glass on the atria would have dramatically changed the buildings exterior appearance and conflicted with its intended transparency.

In an unsuccessful attempt to control glare and provide shade in the atria, dark shades were installed behind the sloping glass and down to 9 feet above the first floor level. Even with the shades, the glare from direct sunlight is so severe that the former President of US Bank could not see her computer screen during several hours of the day. The shades make the adjacent glass read as a dark mass that is a strong contrast to the transparency of the vertical building walls.

It is not possible to install insulated glass with appropriate solar shading on the existing curtain wall framing in the atria

We initially considered installing new insulated glass with appropriate solar shading on the atria. The vertical mullions in the curtain wall system on the existing atria are spaced 10 feet on center. The ten-foot length of the horizontal mullions will not support the weight or accommodate the thickness of insulated glass. The exterior walls in the main building were designed for insulated glass and have vertical mullions spaced 5 feet on center. Without the installation of new insulated glass that has a reasonable solar shading coefficient, it is impossible to reduce the heating and cooling loads to a level that would create an acceptable interior office environment.

The current atrium configuration has a significant adverse effect on the marketability of adjacent office space.

Looking through a vertical glass wall in addition to the sloping glass, dark blinds and angled mullions of an atrium has an extremely negative impact on views of the Capitol Square. As a result of impaired views, the third floor and sixth office space that is located behind the upper levels of the atria has experienced significant long term vacancy and reduced rents. Office tenants do not want to be in office space behind or adjacent to an atrium.

The impact on views of the Capitol Square is illustrated in the photograph we presented to the Urban Design Commission that shows the view from the third floor in space that was vacated by Smith Barney. Even though this space is a prime corner suite, it has been vacant for more than 15 months and we have no prospective occupants.

Our proposed modifications will maintain a two story volume on the main floor level of the atria and create landscaped roof terraces on the third and sixth floors as shown in the attached sections. Direct Capitol views and a usable roof terrace will create a singular amenity that will make office space on the third and sixth floors highly desirable. Reducing the heat gain and ambient thermal comfort on the main floor level of the atria will allow the interior space to function as Bruce Graham originally envisioned.

The sloped glazing creates significant problems

The sloped glazing in the atria is prone to leak. Mullion caps typically used in an exterior wall are designed to shed water vertically down the face of the glass and over the mullions. At US Bank, the protruding horizontal mullion caps on the sloped portions of the façade act like small dams interrupting water flow sheeting off the surface and have created numerous leaks. These leaks have been collected into tubing that drains water onto the floors of the atria.

In the winter the sloped glazing with its protruding mullion caps collects snow which, through daily freeze-thaw cycles, can melt and re-freeze as ice. The snow and/or ice eventually release from the sloped glazing and cascades down to sidewalk below. Along Pinckney Street, this falling snow and ice is dangerous to pedestrians. Orange safety cones and caution tape block major portions of the sidewalk every winter.

The expansion of the Webster Street floor plate

The wing of the building along Webster Street is only 60 feet wide and has two major vertical penetrations (for a stair and mechanical chase) that make it extremely difficult to use to meet the needs of tenants who need private outside offices. The building was

originally designed for Ray-O-Vac and First Wisconsin Bank, two large corporate users who accommodated the majority of their employees in open work stations. Today, almost every downtown office tenant demands private outside offices and conference rooms.

The limitations of the existing 60 foot wide floor plate are graphically demonstrated on the 4th floor where Boardman Suhr created offices with roofs that encroach more than 15 feet into the main floor of the atrium in order to create a usable floor plan.

To create functional office space and to solve the heat gain issues discussed above, we propose to remove the secondary atrium on the 4th floor and to construct a six story addition to the building. This addition will extend the floor plates 30 feet closer to the Capitol Square and will incorporate the white plastered south wall of the elevator core that currently stands out in striking contrast to the transparency of the balance of the building facade. Constructing this building addition will add more than 15,000 square feet of rentable area. The improved floor plate will provide far more functional space for large tenants and create space that can attract small and medium sized office tenants that are almost impossible to fit into the existing building. The new west façade of the building addition will be designed to fully match the existing building exterior and will have new energy efficient glass.

The proposed atria modifications are consistent with the original architectural concept and will improve the buildings exterior appearance.

Installing mirrored or very dark glass with adequate solar shading as SOM recommended in its May 22, 1973 letter would have made the sloped glass of the atria a stark contrast to the clear glass used on the vertical walls. Even if installing insulated glass on the sloped surfaces was possible, the glass would need to have a solar shading coefficient of 0.16 to approximate the energy savings of our proposed modifications. With this glass, the atria would appear either as a black mass or a mirror.

The proposed atrium modifications eliminate the problems discussed above yet retain the best of the building's architecture and central design concept. The proposed modifications respect the geometry, massing, and transparency of the original building design concept.

The squared forms and stepped massing of the building are reinforced. The existing module spacing of the mullions in the existing atria is repeated. In effect, although the shape of the atria has changed, the grid of the window mullions is the same. The footprint of the atria is identical to the existing. The exposed structural steel tubes in the new atria will match the details that presently exist.

Creating two additional landscaped roof terraces that generate outdoor life and activity will replicate and reinforce the main roof "garden" that was an important design element of the building.

We believe that our proposed atria modifications are consistent with the buildings design vocabulary and will create functional and attractive office space. The modifications we have proposed are far superior to the cheap and ineffective fix of installing a mirrored or reflective glass on the sloped surfaces that SOM recommended.

As part of our work, new energy efficient glass will be installed on the entire south and west walls of US Bank Plaza that have the greatest solar exposure. The new glass will be chosen carefully to maintain transparency and provide acceptable solar shading. Our proposed atria modifications will create functional space that will realize Bruce Graham's vision of a "gallery of glass which would serve as green space in the winter, and as public space in the summer."

Our proposed modifications will reestablish US Bank Plaza as a Class A office building. Without these improvements, the building will continue to deteriorate, its contribution to the City's tax base will decline and tenants seeking functional and attractive office space will continue to flee.

The proposed atria modifications will reduce energy consumption significantly and are important steps to achieving a LEED-EB Certification

Reducing energy consumption to the point where US Bank Plaza will be an example of responsible stewardship is a primary focus of our efforts. The cost of energy today is a major problem for all of us. Saving energy is important.

According to the US Green Building Council, existing buildings account for 39% of the total energy and 71% of the electricity consumed in the United States. US Bank Plaza consumes extraordinary amounts of energy in an unsuccessful attempt to heat and cool the building.

Our proposed changes to the Pinckney Street and main 4th floor atria will save 6.2 % of the buildings total current energy consumption. These savings are documented in the attached graph prepared by ESD summarizing data from the sophisticated building energy model that was used to analyze the impact of all of the options we considered. In addition to the exterior improvements that are discussed in this application, we intend to undertake HVAC improvements that include:

- Replacing existing chillers on the ninth floor with new equipment that will be relocated to the buildings ground floor. Moving the chillers allows existing mechanical space to be recaptured and reused for offices.
- The buildings existing cooling towers will be replaced and louvers will be added in the south wall of the ninth floor in order to increase the cooling capacity of the new equipment. The new cooling towers will not be visible from the street since they are located in an exterior recess on the ninth floor.

- The induction units that provide heat and cooling to the buildings perimeter will be repaired, and
- A state of the art building automation system that will effectively control HVAC equipment will be installed.

The building modifications we are proposing combined with major improvements to the buildings HVAC system will reduce US Bank Plaza's total energy consumption by 20% or more. We expect that these demonstrated savings will be the basis for LEED-EB certification of the US Bank Plaza.

A summary of Environmental Systems Design's energy analysis that discusses the buildings current problems and reviews the impact of our proposed modifications is attached for the Urban Design Commission's review.

Construction Timetable

Construction work on the 4th floor atrium modifications and building addition will begin in September after Concerts on the Square are complete. Construction work on the Pinckney Street atrium will begin in late fall in order to minimize the impact on pedestrian traffic on sidewalks adjacent to the building. Construction activity on the exterior modifications to US Bank Plaza will be complete nine months after construction begins.. The installation of the new cooling towers and chillers will be complete by March 2009 before the demands of the next cooling season are experienced.

Creating Life and Vitality at the Sidewalk Level

As a future phase of improvements to US Bank Plaza, we intend to construct a new entrance to the building lobby and to undertake improvements to the interior of the lobby that will recapture the grace and character of the ground floor that was originally envisioned. We intend to pursue the possibility of creating new sidewalk entrances into ground floor retail shops and restaurants in order to add more life and vitality at US Bank Plaza. Plans for new entrances into the ground floor spaces of the building will be submitted for review and approval as a separate phase of building renovation. New building signage will be developed and submitted to both US Bank and to the City of Madison for approval as part of the plans for future work.

Skidmore, Owings & Merrill ARCHITECTS / ENGINEERS

30 WEST MONROE STREET
CHICAGO, ILLINOIS 60603

GEORGE J. JARIK, P. E.
ASSOCIATE PARTNER

May 22, 1973

First Wisconsin National Bank of Madison
110 East Main Street
Tenney Building - Room 418
Madison, Wisconsin 53701

Attention: Mr. Dale Prindiville

Re: First Wisconsin Plaza
Madison, Wisconsin
Glass

Dear Mr. Prindiville:

We have reviewed the effect of the sun radiation into the greenhouse areas and the resultant comfort level.

Based upon the review, and the opportunity to visit the full size mock-up in Miami, we definitely recommend that the glass in the sloped areas of the greenhouse be changed to a reflective glass which will reduce the effect of the sun radiation.

The range of materials have been reviewed and the PPG material identified as LHR 140 clear is the glass that is compatible with the remainder of the building.

We are sending Mr. Pirrotta a copy of this letter and are thereby requesting him to advise your office and this office of any cost differences and the delivery date, so this issue can be resolved at an early date.

Very truly yours,

SKIDMORE, OWINGS & MERRRILL

George J. Jarik

/jz

cc: J. Turley
J. Pirrotta
B. Graham

ENVIRONMENTAL SYSTEMS DESIGN, INC.

ENGINEERING ■ CONSULTING ■ TECHNOLOGY

Kurt A. Karnatz, P.E
CEM, LEED® AP
Executive Vice President
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11 August 2008

Mr. Brad Binkowski
Urban Land Interests
10 East Doty Street
Suite 300
Madison, WI 53703

Re: US Bank Plaza – Madison, WI
Building Energy Model

Dear Brad,

At the request of Urban Land Interest, Environmental System Design, Inc. developed a comprehensive building energy model for the US Bank Building in Madison, WI. The energy model has been developed using Trane Trace Software and accurately estimates the buildings energy consumption and predicts thermal comfort acceptability based on the buildings actual construction features including installed mechanical HVAC systems and building envelope components.

At nearly 35 years old, the 340,000 sq. ft. facility contains aging mechanical systems that are outdated and energy intensive. Additionally, the thermal performance of the building envelope is significantly less than that of a modern building. Together, these inefficiencies result in building energy consumption of almost two times that of similar use buildings being built today.

The energy model studied various modifications, enhancements and upgrades to the mechanical systems as well as glazing upgrades with a focus on minimizing energy consumption and maximizing occupant thermal comfort. The results of the energy model calculations indicate that the existing southwest facing three atria at Pinckney, Washington and Webster Streets impose a disproportionately high cooling load on the building. The heat gain absorbed at the single pane glazed atria represents 11% of the total building cooling load while accounting for only 2% of the total building area (see attached graph 'Total Atria Cooling Loads').

Because of the existing single pane glazing and sloped wall configuration, the areas within the atria are generally unoccupiable due to the uncontrollable heat gain. In the summer months the extreme solar heat gain, is virtually impossible to overcome and cool effectively while in the winter the solar radiation results in indoor temperatures in the 85-90°F range. During the majority of the year the atria spaces are thermally unusable and waste energy.

The inability to control the solar load in the current atrium configuration also results in excessive glare further rendering the space unusable. Interestingly, the original building designers, SOM, also became aware of this situation and recommended to change the atria glass to reflective mirror during the construction of the building as documented in correspondence dated May 22, 1973.

To mitigate the effects of the atria solar radiation, several modifications were developed and analyzed using the energy model including replacement of the existing sloped atria glass and reconfiguring the atria with roofs. The energy model calculations indicate that proposed roofed atria with high performance glazing will result in thermally comfortable space and achieve over a 6.2% reduction in building energy consumption. By contrast, to achieve the same energy savings, thermal comfort and glare reduction the existing atria glass would need to be replaced with dual-glazed panels with a shading coefficient of 0.16 (see attached graph 'Total Energy Consumption'). A glazing shading coefficient of 0.16 can only be achieved using very heavily tinted or mirrored glass. Furthermore, it is our understanding that the existing atria wall system cannot support dual glazed thermal window elements.

The sustainability and marketability of Class A office buildings today requires highly optimized mechanical systems, superior thermal comfort and minimized energy consumption. The proposed mechanical system upgrades and building atria modifications will result in reducing the total US Bank building energy consumption by over 20% while significantly increasing the thermal comfort and overall building usability.

The proposed modifications will also be the foundation in achieving USGBC LEED-EB Certification for the building and clearly demonstrates responsible environmental stewardship on behalf of the building ownership and for the City of Madison.

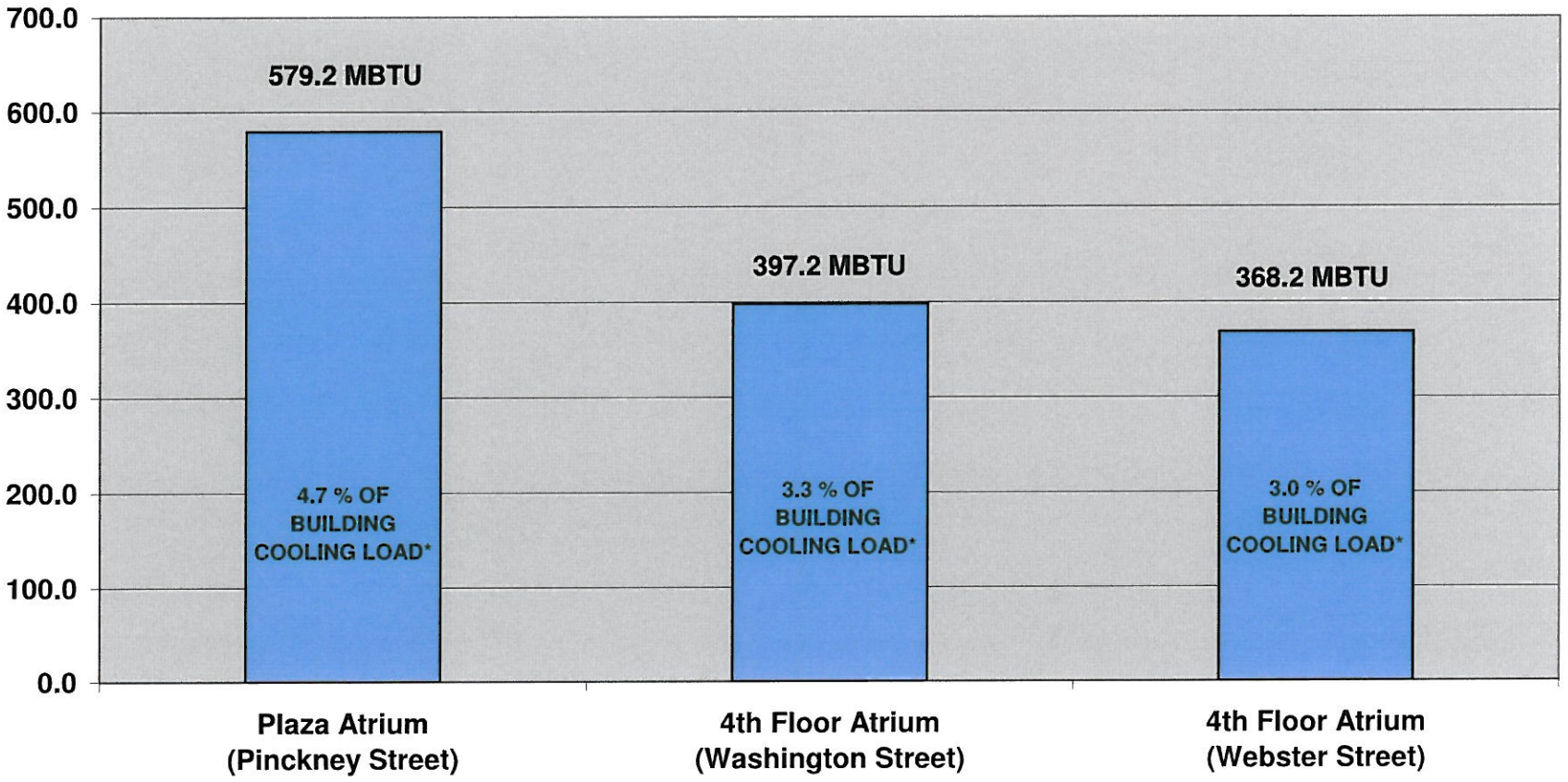
Sincerely,

Kurt A. Karnatz

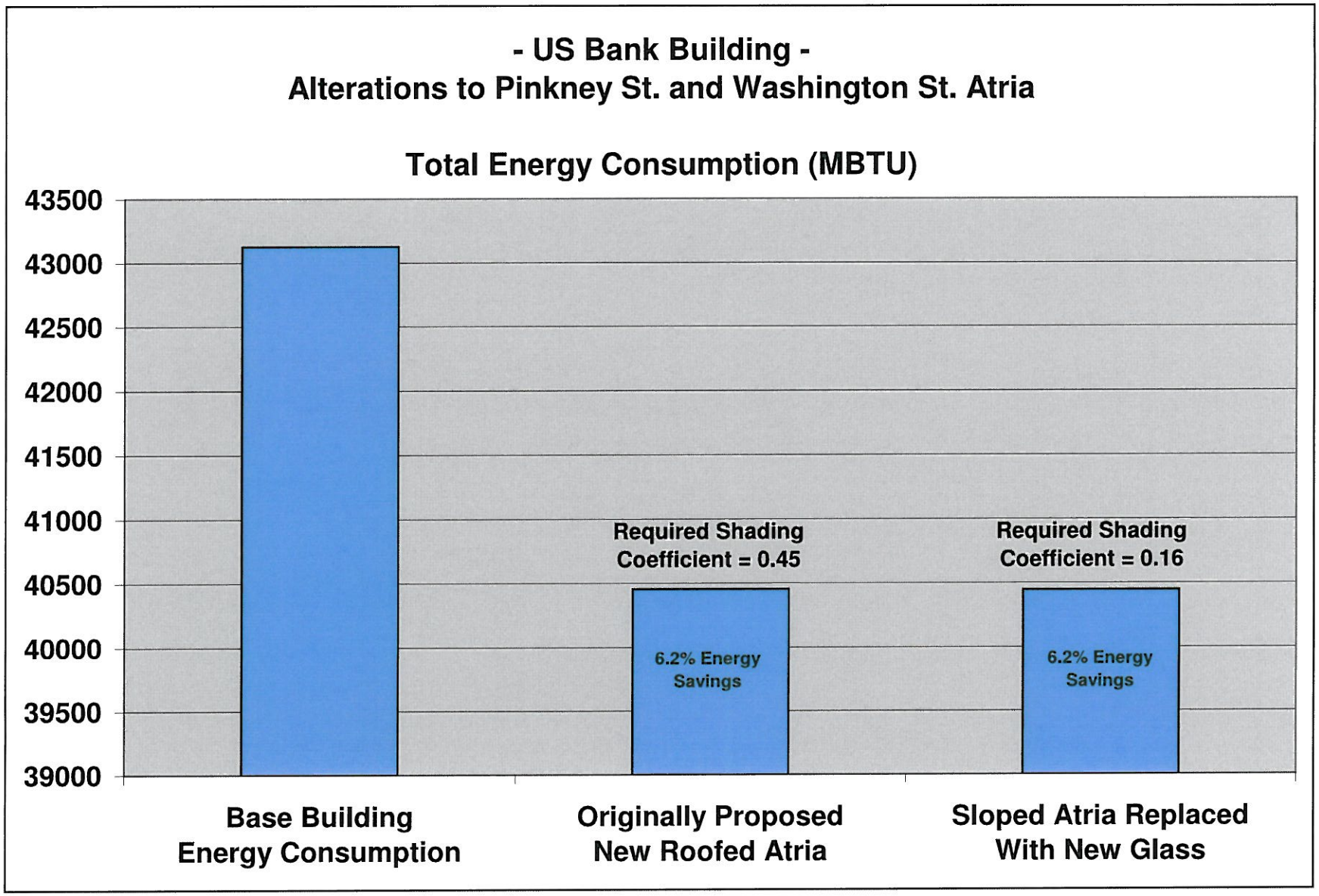
KAK/bao

- US Bank Building -

Total Atria Cooling Loads (MBTU)



*TOTAL BUILDING COOLING LOAD ~ 12,202.8 MBTU


- US Bank Building -
Alterations to Pinkney St. and Washington St. Atria
Total Energy Consumption (MBTU)
43500
43000
42500
42000
41500
41000
40500
40000
39500
39000
Required Shading Coefficient = 0.45
6.2% Energy Savings
Required Shading Coefficient = 0.16
6.2% Energy Savings
Base Building Energy Consumption
Originally Proposed New Roofed Atria
Sloped Atria Replaced With New Glass