Architecture or Sculpture? Case Study of the Roof and Skylight Replacement on the Everson Museum of Art, Syracuse, NY

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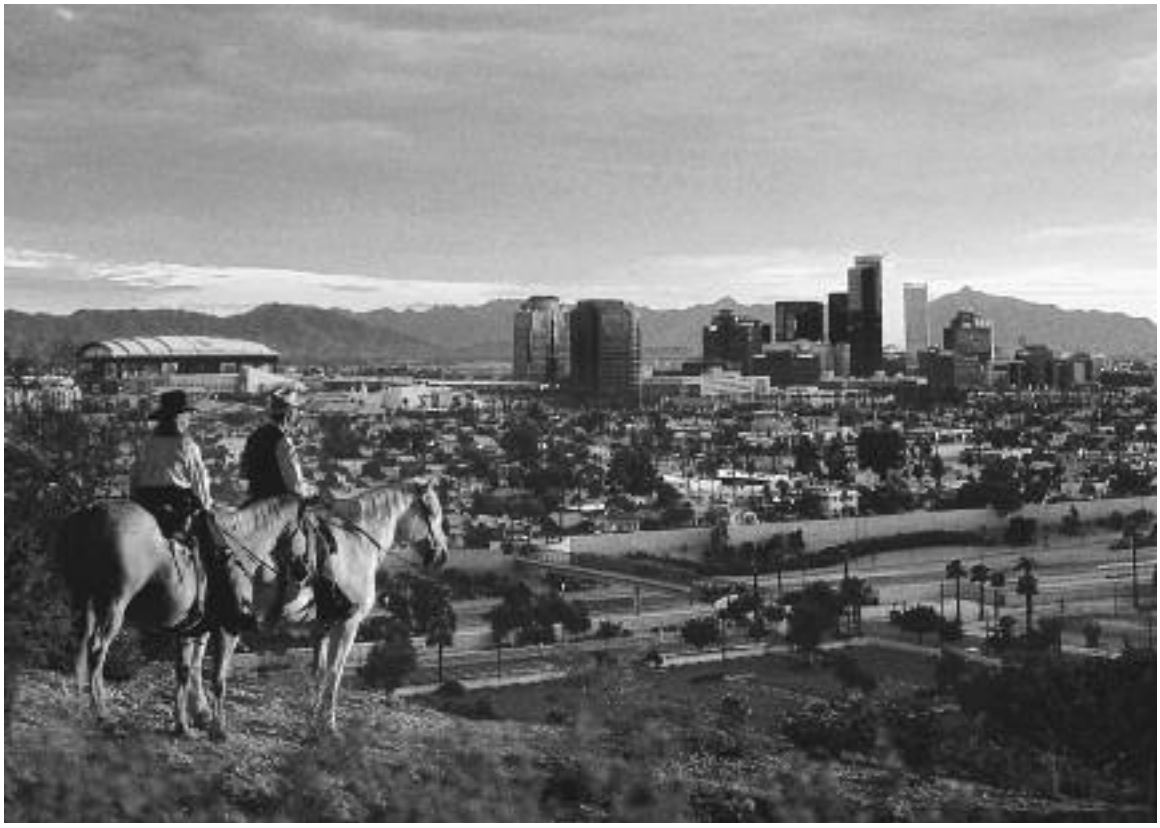

Roof Consultants Institute

ABSTRACT

The Everson Museum of Art was designed by I.M. Pei in 1965 and occupied in 1968. When it opened it was (and still is) considered a work of art in itself. It is perceived as a piece of sculpture placed on a podium that one walks around. Indeed, one of the comments often heard is that it's difficult to find the entrance – almost forcing visitors to walk around it to experience the structure. (*Architectural Forum* - June 1969.)

By 2002, the museum had a long history of water infiltration. Bell & Spina was retained to design the replacement of the roofing and skylight systems. What we thought would be a rather straightforward project turned into a two-year study to "do the right thing" for this landmark building, the museum, and its collection. This is a case study of the technical exploration to solve a number of waterproofing issues, along with the aesthetic concerns that presented themselves. It is also a study of the process and the discussions of the various strongly-held points of view, and of the compromises made to solve both aesthetics and waterproofing issues.

SPEAKER

DENNIS SPINA is principal in charge of the project and senior roof consultant for Bell & Spina. He has spent a year with the building committee exploring options and facilitating the discussion on what the right thing is for the museum, its collection, its mission and the long-term integrity of the building's structure and the desire to retain the original design esthetic.

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INTRODUCTION

The Everson Museum of Art was designed by I.M. Pei in 1965 and occupied in 1968. When it opened it was (and still is) considered a work of art in itself. It is perceived as a piece of sculpture placed on a podium that one walks around. Indeed, one of the comments often heard is that it is difficult to find the entrance – almost forcing visitors to walk around it to experience the structure. (*Architectural Forum* – June 1969.)

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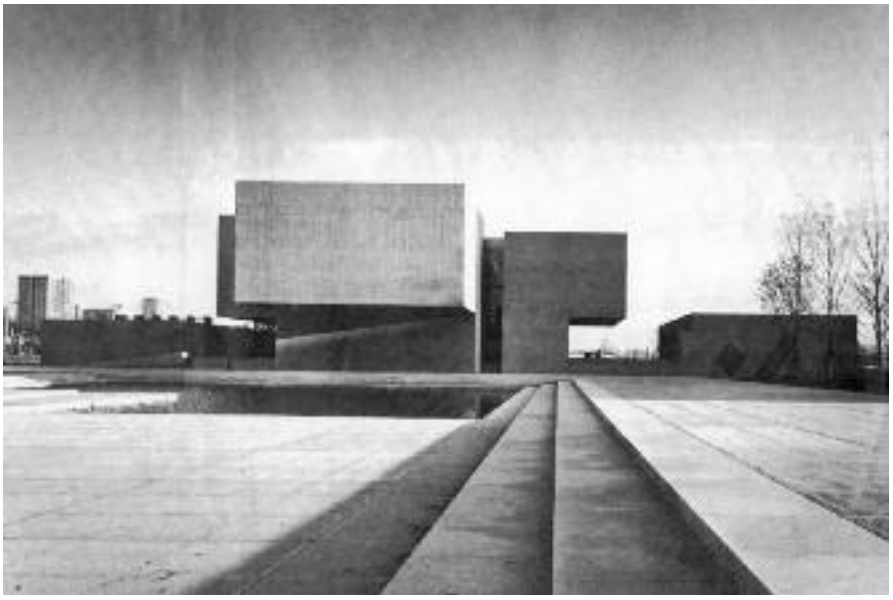
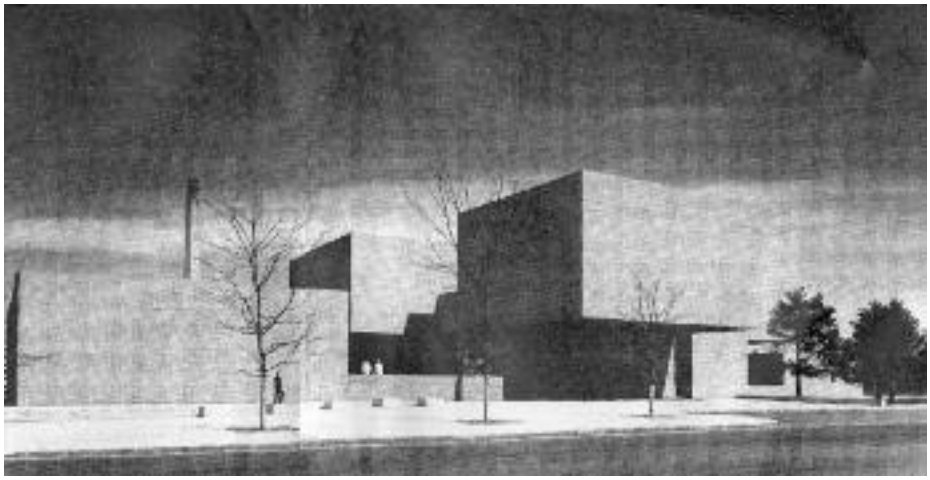




Photos by Ezra Stoller.

SETTING THE STAGE

Existing Conditions

There are ten separate roof areas, four galleries, a central sculpture court, an administrative wing, the auditorium, separate stair tower, and two canopies. There are five skylights – two at the sculpture court and three on the administration wing. Each presented a different design challenge.

The existing roof membrane was a fully adhered EPDM, which was installed over tapered insulation on top of the original coal tar, built-up membrane, which was installed directly to a reinforced concrete structural deck.

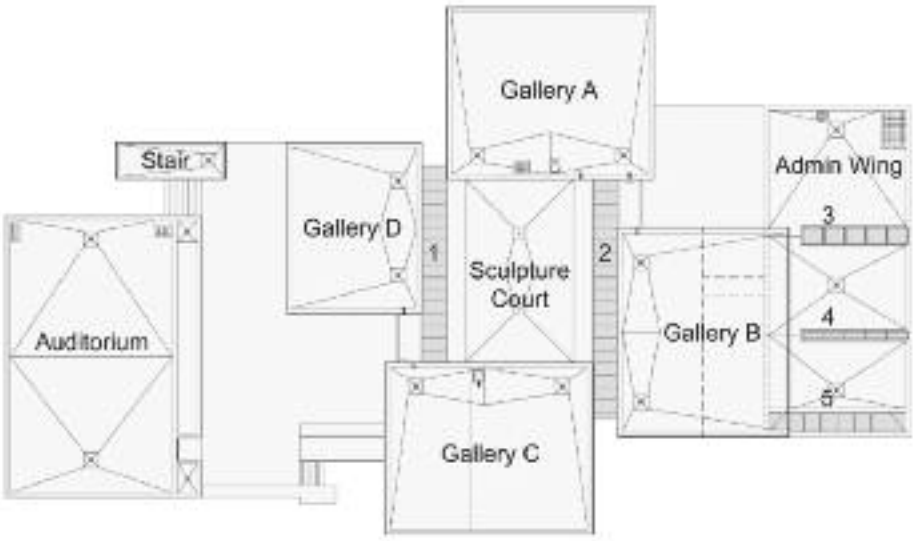
The skylights are divided by mullions at 40 inches on center. This skylight mullion grid matches the building's structural grid, which is designed on a ten-foot module subdivided into 40-inch increments.

All of the building's HVAC air intakes and exhausts are at roof level.

The Building Committee

The museum had established a building committee of 14 people. Like a typical committee, the make-up consisted of representatives from the museum, the museum's board, and the community. It included the museum's director, finance and facilities staff, six architects, two engineers, a contractor, a developer, and the chairman:

- Mark Robbins, dean of the School of Architecture at Syracuse University
- Toby Nadel, AIA, a roof consultant
- Manny Barbas, AIA, The deputy commissioner of facilities for Onondaga County
- Cal Bowne, AIA, principal of the firm that was the associated architect during the original construction.
- David Nutting, AIA, principal of VIP Structures, a large design/build firm.
- Bob Haley, AIA, Ashley-McGraw Architects
- Ravi Raman, PE, an electrical engineer and principal of Ram Tech Engineers, a large engineering firm.
- Edgar Galson PE, a mechanical engineer and the retired principal of Galson Engineers, a large engineering firm.
- Jim Taylor, president of J.D. Taylor Construction Co.
- Gary Pickard, president of a development company
- Ed Kochain, chairman of the committee and also the deputy county executive of Onondaga County.



In the initial meeting, October 30, 2002, the building committee directed that we make the building watertight while respecting the original design intent. We also consciously imposed constraints upon ourselves not to impact the original design.

Design Intent

The first thing we did was to review the existing conditions and original construction documents. The integration of the mechanical systems with the structure is impressive, and the systems are well hidden. The detailing on the skylights is also unique. To keep the pure geometric form of the design, the skylights have minimal slope. For example, skylights over the sculpture court are detailed at a slope of 1/2 inch over a distance of 6'-8", or about 1/16" per foot. Detailing on the original contract documents indicate no mullions were intended. The triangular skylights in the administration wing (skylight #3) are the only skylights without mullions and appear to closely conform to the contract documents. With the skylights having such minimal slope, the caps block the flow of water. The skylight glass would have to be cleaned five to six times a year, as dirt and algae would accumulate.

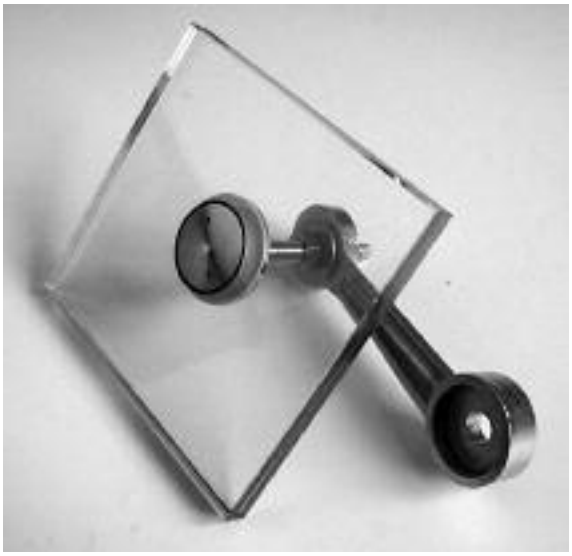
Existing configurations and details of the skylights match the shop drawings.

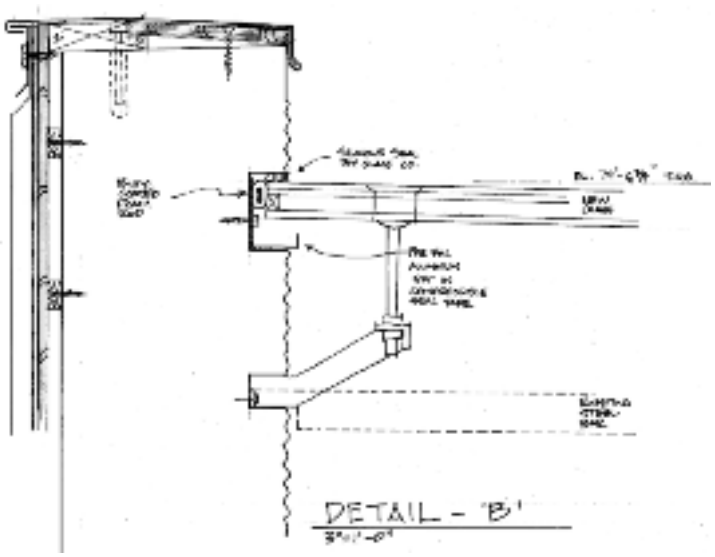
Design Conditions

Weather conditions in upstate New York can be extreme. It snows a lot. Last year (season), Syracuse received 181 inches of snow, which was not a record. It is also cold, with a low design temperature of minus 10 degrees F in winter; and for the summer, 90 degrees F, for a delta T of 100 degrees. The freeze/thaw cycles are many over the course of a single season. The American Association of Museums' recommendation for interior climate conditions is 75 degrees F and 50% relative humidity. These interior conditions are set to protect paintings and are a requirement in order to receive some traveling exhibits.

PROCESS

Our analysis of existing conditions found challenges that revolved around the lack of height to adequately flash and counter flash the roof membrane and the skylights. The single glazed skylights had the potential for condensation. All of the galleries and the sculpture court lacked overflow protection. It was obvious that the key design element was





Point load glazing examples.

the skylights. Solve those issues and the rest should fall into place.

We started to brainstorm ideas to provide the original design intent - i.e., a transparent, weather-tight separation between galleries. Our research lead us to contacting several glass manufacturers. We settled on a point load glazing system for the following reasons:

- Insulated laminated glass was able to be provided.
- Provided allowance for movement. (Glass moves independent of frame system.)
- Proven track record.
- Single point responsibility.
- Ten-year watertight warrantee.

Schematic design proceeded with concept sketches and analysis. We applied for and were awarded a grant through SATOP, the NASA-sponsored "Space Alliance Technology Outreach Program," to enlist the help of Syracuse University to determine the potential for condensation of the point-loaded frame system and glass under design conditions. We found that the heat transfer through the concrete mass would keep the frame system from condensating. We also found numerous thermal shorts at the galleries that were outside our project scope to correct as it would require renovating the interior. Our $1.2 million budget was approved and we proceeded to design development.

A week after we presented the design development (DD) report, there was another meeting at which the committee voiced its concerns over a system that would be custom designed for the museum by a firm from outside the country. Their concerns included that the museum may have difficulty getting timely response for replacement of broken glass or repair to any leaks or to problems with the system. The primary concern was a great hesitancy to rely on gaskets and sealant as a primary watertight component.

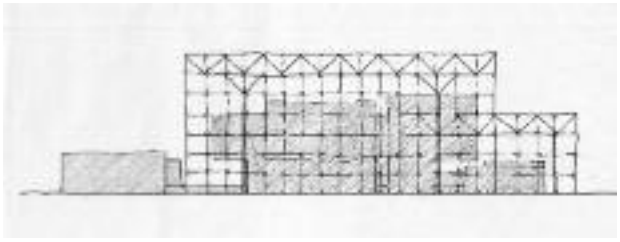
CONSTRAINTS LIFTED

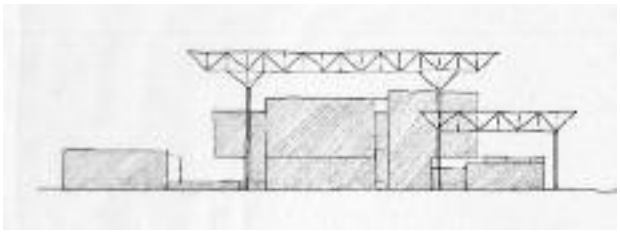
Our office expressed confidence in the design while sharing the concerns of the committee. We also stated that given the constraints it was a viable solution. The committee then decided to give us latitude to solve the design problem without any constraints.

Back to the drawing board. We came up with two possible solutions:

Option 1

Hayden Planetarium in New York City gave us an idea that on the sur-





Space elevations.

face may seem extreme, but when analyzed, is actually a good solution. Placing a glass structure around the Everson would give the museum its original design intent of a clear void between galleries, the bonus of additional exhibit space, and a strong fresh visual presence. After all, why not put a "sculpture" in its own museum?

At $25 to $30 million, the committee passed on this solution.

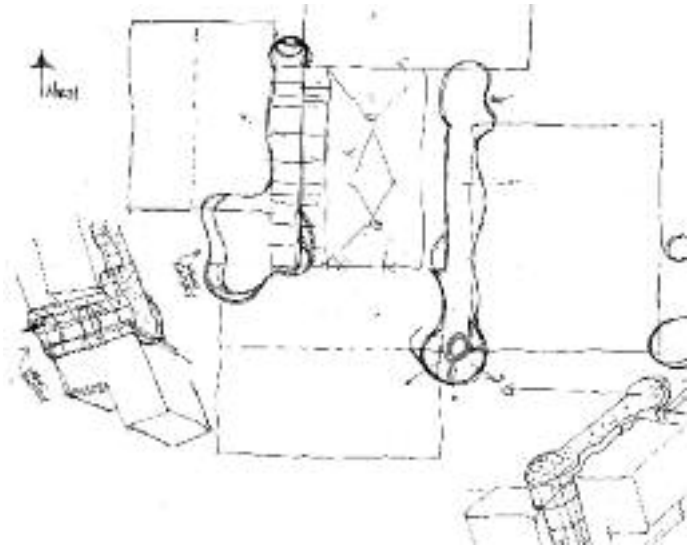
Option 2

Our second exploration involved the elimination of all horizontal glazing by turning the skylights into clerestories. Placement of clerestories extenuated the original design. The concept focused attention on the entrance and would make the building more visible at night. It also had no pretense of being part of the original design. However, the existing skylight over the director's office is not visible from the exterior. Placing a clerestory at the director's office would not extenuate an original design element, but add one. The proposal, therefore, was to eliminate that skylight and create a faux skylight inside with lighting.

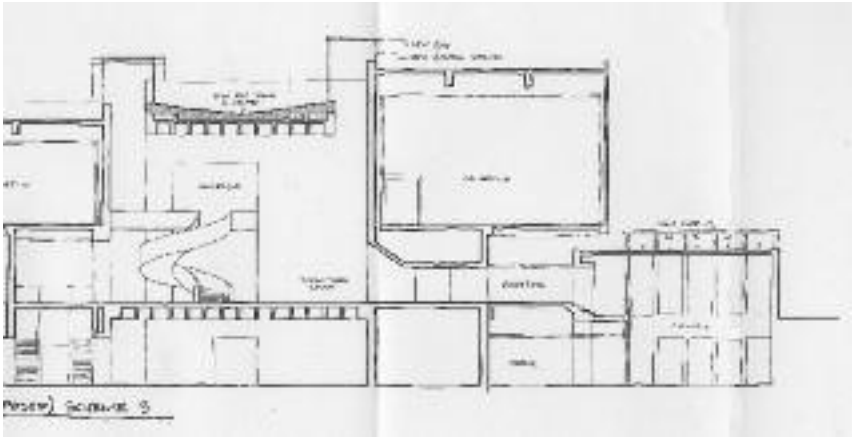
Half of the committee liked the concept; the other half were concerned that it was too much of a departure.

SUCCESS REDEFINED

The "Mission" of any museum is to: "house, protect, preserve, and present to the current and future generations."



Option 2 concept.



The discussion was wide-ranging, but boiled down to the fact that:

- Interior design conditions cannot be obtained (i.e., humidity of 50% without additional renovations and even then the humidity level may have to modulate with the exterior temperature so as not to condensate), limiting the shows that the museum can exhibit.
- The skylights have leaked since the building opened.
- The concerns identified need to be addressed, or conditions will continue to be detrimental to the art and the building.

All the above led to the discussion that the museum is not able to fulfill its mission if the building cannot be made watertight. Criteria established by the museum building committee, in order of priority:

1. Watertight integrity of the building.
2. Concern of aesthetics.

Other criteria:

1. Utilize a "standard" manufactured skylight system.
2. Installer should be local, within a 100-mile radius, with the ability to provide and install replacement glass.

Standard Manufactured Skylights

A "standard" skylight from most manufacturers has a minimum slope of 17 to 18 degrees. Using the minimal slope, we established some heights and presented the results, which our office and all members of the committee felt were not acceptable.

One manufacturer (Naturalite) offers a low-pitch skylight with a minimum slope requirement of 1/2-inch per foot. This system also could be integrated with a curtain wall system. Computer-generated elevations indicating

the visual impact were presented. All thought the visual impact was acceptable. This solution was proposed to and approved by the State Historic Preservation Office (SHPO) as required by one of the grant sources.

With the skylight manufacturer selected, we proceeded to tackle the details of integrating the roof system.

Exploring options: low pitch skylight.

DESIGN

Asbestos Abatement

The residual asphalt mastic on the parapets and the insulation on some of the roof drainage piping had to be abated.

Drains

The location of the existing drains did not present a logical solution using tapered insulation board. We proposed to use an insulated, lightweight concrete system to provide slope to drain. This system also allowed us to abandon the four scupper drains on the center sculpture court. Debris plugs scupper drains more easily than standard roof drains. Indeed, on one site investigation visit we found six inches of standing water on the sculpture court roof. The need for overflow protection was apparent. The gallery parapets varied in height from 16 to 60 inches. Overflow protection on the galleries was provided by core drilling through the walls, and on the sculpture court, with overflow drains. Scupper drains on the canopies were retrofitted.

Access

There are two roof access hatches – one in gallery "B" and one in gallery "C." A ladder to the center sculpture court roof was available from gallery "C." Gallery "D" was accessed by walking across the skylight or placing a sheet of plywood across the skylight. Access to Gallery "B" was by plywood over the skylight and then by ladder. We designed fixed ladders that swing into position to provide access across the skylights. All other roof sections, stair, auditorium, administration wing, and canopies are available only by ladder from the ground.

Membrane

The ten roof areas were each small enough to typically be made watertight in a day. However, the lightweight system used to provide slope to drain would have residual moisture. Therefore, a PVC membrane using the 2001 System that allows drying out over time was chosen. The system also had the advantage of hurricane wind ratings of 120 mph – extra insurance for the museum, even though winds of that speed are not experienced in the area. In

Below: cracks.

the future, when the membrane needs to be replaced, other options for a membrane will be available to be placed over the dry, lightweight fill.

Skylights 1 and 2

There were no real waterproofing compromises made in the detailing of the sculpture court skylights. Minimum flashing heights and counter flashing were able to be achieved and allowances for movement provided.

All the above sailed through the committee. Committee membership changed and the new members started asking the same questions we had asked ourselves months earlier. Answering their concerns resulted in the committee revisiting the following issues.

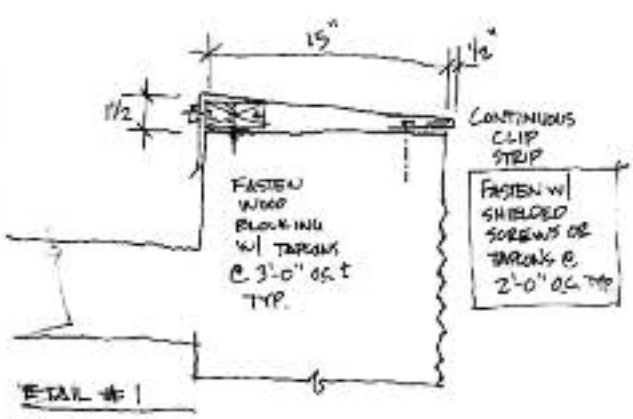
Parapet/Edge Detail

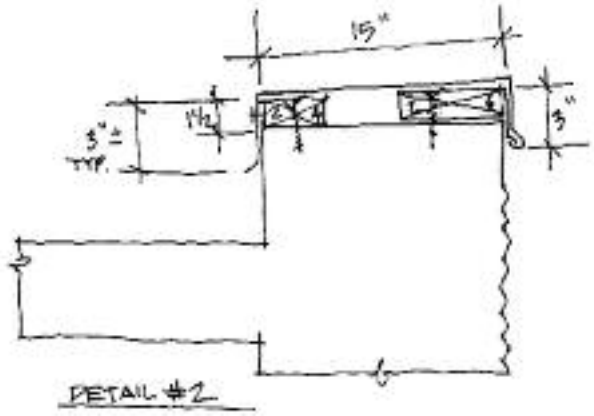
There was much debate over the need to cover the building's concrete parapet coping and the visual impact it would create. Multiple options were explored, such as use of a coating and cutting a reglet into the top of the parapet. In addition, five coping samples were made in stainless steel, freedom grey, black, and bronze. These samples were then placed on the upper and lower parapets and viewed by the committee members from street level. Surprisingly, all the samples placed on the upper sections appeared the same and disappeared against the overcast sky. In the end, the committee voted.

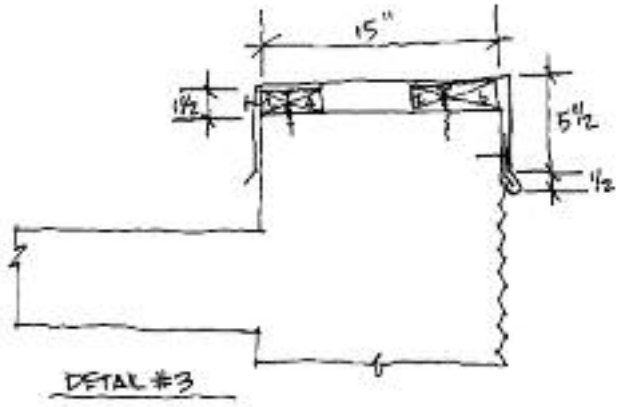
There were three edge details proposed: coping mock-up #1, which did not break the edge and relied on sealant for protection; coping mock-up #5, which had been previously approved; and a variation called 5A that had a straight rather than 45-degree drip, intended to present less of a shadow line.

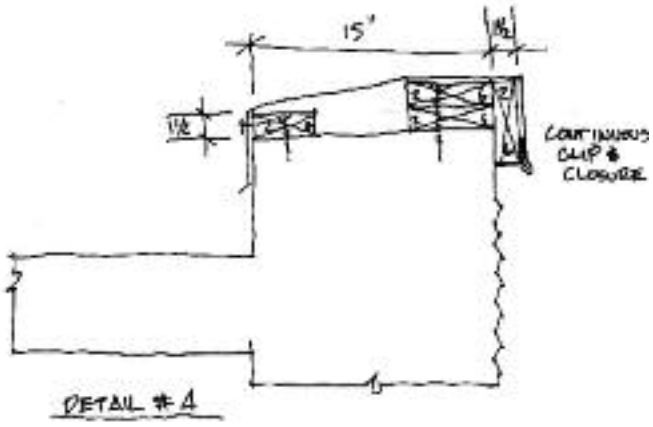
Each committee member voted and explained his reasoning:

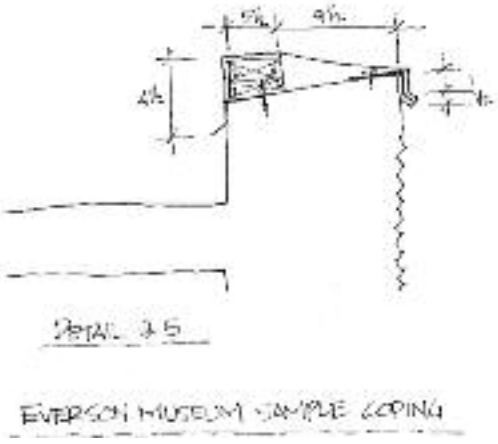
- We must cover the edge - 5A











- Agree likes - 5A
- Coping #1 needs maintenance, therefore 5A
- The criteria established by the commitee was watertighness first; the second was aesthetics. Coping #1 flips the order of that criteria; therefore - 5A.
- The drip edge is a better solution - 5
- There is a need to inspect every year; therefore, I suggest a compromise of the lower sections using detail #1 and in the upper gallery sections, use 5 or 5A.
- Any metal added to the building is a detriment to the aesthetics of this building. I do not believe any coping cap is required on the upper gallery roofs. The lower areas need a cap but should be zero visibility #1 or earlier proposed modified detail with a reglet.
- Prefers nothing but is of the opinion that we will lose the lower parapet walls; therefore, detail 5A.
- Would like to see nothing on the walls but does not want to rely on fool-proof maintenance; therefore, 5A.

Total vote: six for detail #5A; two for detail #1, one for detail #5.

Administration Wing Skylights

Options for the disposition of Skylights #3, 4, and 5 were previously agreed to and followed the clerestory proposal option 2.

Skylight 3

The issue with this skylight was that the curb had to be raised to accommodate the lightweight fill and to properly counter flash the membrane. The glass had to be an insulating type. Keeping the existing glazing slot location would require enlargement and a reduction of the light well width to accommodate sill to roof counterflashing. Raising the skylight and keeping the same slope would result in the peak of the triangular skylight being above the concrete fins. In the end, we raised the skylight, lowered the slope, and provided insulated glazing in a frame system.

Skylight 4

The difficulty here was lack of slope and height to flash. Also, this skylight had a vertical glazing component that was installed in a slot in the concrete. The glass had to be installed from the top. At only 20 inches wide, it did not make sense to make it a triangular skylight. The committee desired not to change this design element and voted to keep this skylight in its current configuration with the recognition that it will be below the manufacturer's minimum slope requirements and would not be guaranteed watertight.

Skylight 5

This skylight was similar to skylight 4, with a lack of slope and height to flash. It had previously been agreed that the director's office skylight would be eliminated. The committee desired to keep this design element and voted to keep it with the recognition that it would be below the manufacturer's minimum slope requirements and would not be guaranteed watertight.

FINAL THOUGHTS

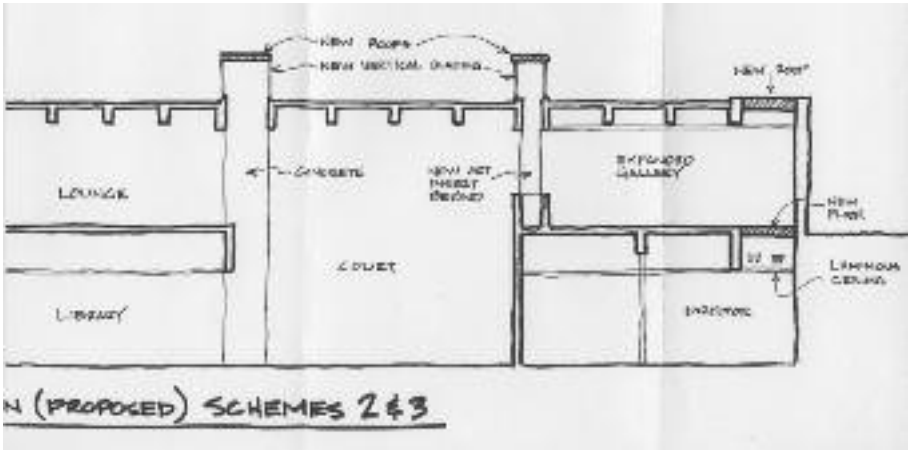
Next month it will be three and a half years since we started this project. What have we learned that we can pass on?

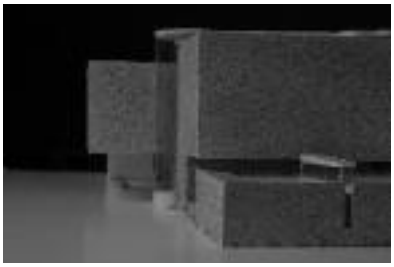
- In order to have water run downhill, you must provide the hill. (Positive slope is a requirement.)
- Do not rely on sealant as your primary line of defense against water infiltration. (You should flash and counter flash.)
- Involvement of your client is a good thing. (This committee was engaged and

helped define success.)

- There is no such thing as only one solution. (We explored many solutions.)
- Beauty is in the eye of the beholder. (Solutions that bothered some aesthetically were embraced by others.)

In the end, we collectively endeavored to preserve this landmark building, the museum's mission, and its art collection.





Skylight 5 was completely covered over. The light well became more gallery space.