McBRIDE
ARCHITECTURE PC

OSU OAK CREEK EXTERIOR RESTORATION AND REROOFING PROJECT REPORT

JANUARY 19, 2023

Presented By
McBride Architecture PC

INTRODUCTION

The Oak Creek Building is located on the Oregon State University campus at SW Western Boulevard and SW 30th Street in Corvallis, Oregon. For the purpose of this report, it consists of four separate but connected buildings termed Roof Area A, B, C and D Buildings. The Oak Creek Building is not part of the OSU National Historic District. The buildings were constructed in two phases. Roof Area A, B and C Buildings were part of the original 1956 project with the Roof Area D Building added in 1967. The original purpose of the complex was to support research and development relating to Oregon's timber industry. The original design was intended to demonstrate the current wood technology of the time and, as a result, a unique glue laminated structural system was used and exposed in the basic structure of three of the four buildings. The Roof Area A and B Buildings provide primarily workshop and laboratory space. The Roof Area C Building is an office building. The Roof Area D Building D provides laboratory space.

This report addresses roof conditions and the structural failures at the south elevation of the Roof Area C Building, the office wing, and gives an outline of the proposed roofing and

3115 NE SANDY BOULEVARD, SUITE 224, PORTLAND, OR 97232 ■ PO BOX 12574, PORTLAND, OR 97212
PHONE 503/916/1808 ■ E-MAIL: mac@mcbridearchitecture.com

window systems. A roof plan for general reference illustrating existing conditions and the nomenclature used in this report is included.

Roof Areas and structural SF areas are:

Roof Area A	16,622 SF
Roof Area B	11,484 SF
Roof Area C	8,013 SF
Roof Area D	6,210 SF
Links & Entrances	1,528 SF
TOTAL AREA	43,857 SF

DESIGN TEAM

The following Design Team members have contributed to this report:

- Richard (Mac) McBride, Architect, McBride Architecture PC
- Nate Carter, Architect, McBride Architecture PC
- John McDonald, PE, SE, Catena Consulting Engineers
- Adam Boyd, PE, ColeBreit Engineering

SOUTH WALL STRUCTURE (Estimated Cost $550,000 - $750,000)

The south face of the Oak Creek Roof Area C Building (design drawings dated 1956) has a colonnade of ten exposed, painted glulam columns. Portions of each column have dry-rot deterioration. These two-story columns support a wood framed second floor and roof. At these two levels a glulam beam is connected to the deteriorated column. The second-floor glulam is recessed into a notch within the column, and a barrel nut connection ties the beam to the column. At the roof level, the glulam beam sits atop and extends over the column.

In order to replace the columns, the second floor and roof framing require shoring. The intent is to replace the deteriorated columns with similar, if not identical glulam columns.

SOUTH WALL REPLACEMENT ALTERNATIVES

The façade scope of this project pertains only to the second level south exterior wall, windows, and full height of the exterior glulam columns at Roof Area C Building.

The south wall of the Roof Area C Building contains the original wood construction and single-pane windows. According to the 1956 drawings, the wall structure consists of 2x6 tongue and groove cedar applied vertically making up the siding and wall frame; this is

backed with building paper and ¼" plywood toward the interior. The interior side appears to have had gypsum board installed after the original construction. The floor framing is 2x12 spanning between glulam beams with 1x6 ship lap floor deck and ¼" marine plywood for the soffit board. The floor cavity has 2" batt insulation, there does not appear to be any insulation in the exterior walls.

Significant portions of siding exhibit dry rot. Recently upgraded mechanical and electrical systems are surface mounted to the interior face of the wall. The exterior wall and cantilevered floor do not meet the current energy code for insulation value and will need to be upgraded. Incorporating the existing exterior wall construction into a new wall/window system was briefly considered. Given the existing siding conditions, the deficiencies of the original design and other factors, these options have not been given further consideration. The following is recommended:

Replace with new wood framed construction with window openings:
This approach would involve demolition of the existing wall and window system and replacing it with a conventionally wood framed insulated wall with new windows. The existing mechanical system would require removal for reinstallation on the new wall. The electrical systems would be concealed in the new wall construction. Store front windows would not be part of this solution. This type of construction would allow for more freedom of selection with the window replacement.

Soffit Insulation:
The soffit insulation is under the energy code requirement and will require replacement, however, there is enough room to install insulation without the need for additional framing. The soffit board may be salvageable for re-installation, or it will need to be replaced as part of the process.

SOUTH WINDOW REPLACEMENT

The existing windows are approximately 5'-7" in height and 4'-0" in width. Each window has a larger fixed upper pane and an operable awning style lower pane providing the required ventilation. Each structural bay has four window units; bringing the total number of windows to forty along the façade in this scope.

The current windows are not in compliance with the current energy code and are believed to be past their useful life, as some of the windows no longer operate and they leak.

Fiberglass frame with insulated glazing:

Fiberglass frames are more susceptible to fading from sunlight making periodic painting a maintenance item. Their frames are more stable to temperature fluctuations leading to better thermal value, far less expansion and contraction, and longer lasting air seals. Fiberglass frames tend to be thinner and more attractive than vinyl windows. Fiberglass windows have a longer useful life than vinyl windows.

ROOF STRUCTURE

The existing roof structure at Roof Area A and B Buildings (east and west wing buildings) consists of 2x6 tongue and groove decking spanning between solid sawn 6x10 purlins at 7 feet on center. The purlins span between continuous, rigid glulam arches with a 7 x 24 3/8 beam section and 7 x 12-26-inch column section that are spaced at 16-foot intervals along the length of the building. The Roof Area C Building existing roof structure also consists of tongue and groove decking spanning between glulam 3 ¼ x 8 purlins at 7 feet on center. The purlins span between glulam 5 ¼ x 14 ½ roof beams that connect to columns at the north and south face of the building. At the Roof Area D Building, 5/8” plywood roof sheathing exists over solid sawn 3x14 rafters at 2 feet on center.

At the time of design and construction of the buildings (1950-60s), the required snow design loads in the Uniform Building Code were substantially lower than current requirements. However, when alterations are made to a building, existing roof member capacities must be verified using the most current loading requirements, including snow. There is minimal reserve capacity in the existing roof framing. Therefore, new roof loading during the reroofing and restoration project should be minimized. New roof loading to be minimized includes any new mechanical equipment, fall protection elements, insulation, and roofing.

REROOFING (Estimated Cost $2,300,000 - $2,800,000)

ROOF AREAS AT ROOF AREA A BUILDING

Roof Area A consists of the following existing roofing components:

- 2x6 tongue and groove decking running with slope of the roof
- Nailed base sheet #15 felt (OSU to test)
- 2 layers of 5/8 inch wood fiber board, nailed
- 3 ply BUR with an aluminized coating
- Nailed base sheet
- 2 ply SBS with granule surface (Siplast)

The roof samples revealed that the original roof and one over-roof exist which means that the entire existing assembly must be replaced when it is roofed for the third time. The wood

decking is exposed to the interior. The glue laminated arches, purlins and decking dominate the interior architecture of the building. Areas of rotted decking are expected but are not defined. The existing roof slopes are verified at 2 inches in 12 inches. This roof is visible to the public from the ground level. Existing drains are along the low edge of the roof and water ponds between them. Overflow is over the edge. Fall protection does not exist. Access is provided through a roof access hatch by a vertical ladder from the ground floor. The roof deck is very lightly insulated. The building functions primarily as a workshop.

Reroofing Roof Area A This involves replacing the existing roofing system, including preparing the wood decking for an approved mechanically attached R36, 2 layer polyisocyanurate rigid insulation system with cover board and a fully adhered 60 mil or 90 mil EPDM membrane. The flashing and counterflashing systems would be replaced to accommodate the increased insulation thickness. The reroofing project would also include, painting, providing for overflow drainage, reconfigured roof drainage, safety improvements, a new ladder to access the Building C roof, replacement of a clerestory window and related wall finish, re-detailing at the roman brick chimney and various other improvements described in this report.

- Maintenance/Repair/Life: 30 years which would require a repair project at about 15 years. OSU finds EPDM to be more maintainable than other types of roofing. Electronic leak detection is not effective on EPDM roofing systems.
- Risk/Benefit: Black EPDM material has good life expectancy. Single ply membranes lack the redundancy of multiple ply roofing systems. EPDM is susceptible to cutting and puncture. EPDM and single ply materials can be slippery when wet and coated with algae or frost.

ROOF AREAS AT ROOF AREA B BUILDING

Roof Area B consists of the following existing roofing components:

- 2x6 tongue and groove decking running with slope of the roof
- Nailed base sheet #15 felt (OSU to test)
- 2 layers of 5/8 inch wood fiber board, nailed
- 3 ply BUR with an aluminized coating
- Nailed base sheet
- 2 ply SBS with granule surface (Siplast)

The roof samples revealed that the original roof and one over-roof exist which means that the entire existing assembly must be replaced when it is roofed for the third time. The wood decking is exposed to the interior. The glue laminated arches, purlins and decking dominate the interior architecture of the building. Areas of rotted decking are expected but are not defined. The existing roof slopes are verified at 2 inches in 12 inches. This roof is visible to the public from the ground level. Existing drains are along the low edge of the roof and water ponds between them. Overflow is over the edge. Fall protection does not exist. Access is

provided through a roof access hatch from an interior mezzanine. A large wood framed platform exists. The platform is in deteriorated condition. It will need to be removed in order to reroof the building. The roof deck is very lightly insulated. The building functions primarily as a workshop.

Reroofing Roof Area B This involves replacing the existing roofing system, including preparing the wood decking for an approved mechanically attached R36, 2 layer polyisocyanurate rigid insulation system with cover board and a fully adhered 60 mil or 90 mil EPDM membrane. The flashing and counterflashing systems would be replaced to accommodate the increased insulation thickness. The reroofing project would also include, painting, providing for overflow drainage, reconfigured roof drainage, safety improvements, possible replacement of the wood platform and various other improvements described in this report.

- Maintenance/Repair/Life: 30 years which would require a repair project at about 15 years. OSU finds EPDM to be more maintainable than other types of roofing. Electronic leak detection is not effective on EPDM roofing systems.
- Risk/Benefit: Black EPDM material has good life expectancy. Single ply membranes lack the redundancy of multiple ply roofing systems. EPDM is susceptible to cutting and puncture. EPDM and single ply materials can be slippery when wet and coated with algae or frost.

Reroofing Roof Area B Reduced R Value Alternative involves a reduction in insulation thickness relating to the interior function of the building, in this case, workshops. The Oregon Structural Specialty Code allows an R value reduction for this kind of use. First cost savings can be realized in not only the insulation but in the various details affected by insulation thickness.

ROOF AREAS AT ROOF AREA C BUILDING

Roof Area C consists of the following existing roofing components:

- 2x6 tongue and groove decking running with slope of the roof
- A heavy steel strap at a purlin
- Metal electrical conduit for interior light fixtures located at top of roof deck
- 2 inch thick fiberglass faced polyisocyanurate rigid insulation
- ½ inch thick wood fiberboard mechanically fastened through insulation
- 2 Ply SBS roofing system strapped, hot mopped to wood fiberboard (Siplast 20/30)
- Original granule surface coated (likely snow coat)

The roof samples revealed a single insulated roofing system with crickets between drains. Electrical conduit powering interior light fixtures is located on the roof deck, complicating a tear-off. Consider locating and documenting conduits and straps utilizing GPR or other technology. The wood decking is exposed to the interior. The glue laminated arches, purlins

and decking dominate the interior architecture of the building. Areas of rotted decking are expected but are not defined. This roof deck interfaces with the south wall and window replacement part of the project. The existing roof slopes are low slope verified at ¼ inch per foot with crickets to promote drainage. The roof has areas of ponding. Consider an improved tapered insulation system. This roof is not visible to the public from the ground level. Existing drains are along the two long edges of the roof and water ponds between them. The south edge has 2 roof drains with exposed piping. The north edge has 2 scupper type drains with exposed downspouts. Overflow is at the edge. Fall protection does not exist. Three skylights exist. Access is provided through a roof access hatch located on Roof Area D, accessible by a vertical ladder from the ground floor. The building functions primarily as an office building.

Reroofing Roof Area C This involves replacing the existing roofing system, including preparing the wood decking for an approved mechanically attached tapered R36 minimum, 2 layer minimum polyisocyanurate rigid insulation system with cover board and a fully adhered 60 mil or 90 mil EPDM membrane. The tapered insulation and cricket system could produce roof slopes exceeding the existing 1/4 inch per foot. The flashing and counterflashing systems would be replaced to accommodate the increased insulation thickness. The reroofing project would also include, painting, providing for overflow, drainage, reconfigured roof drainage, safety improvements, and various other improvements described in this report.

- Maintenance/Repair/Life: 30 years which would require a repair project at about 15 years. OSU finds EPDM to be more maintainable than other types of roofing. Electronic leak detection is not effective on EPDM roofing systems.
- Risk/Benefit: Black EPDM material has good life expectancy. Single ply membranes lack the redundancy of multiple ply roofing systems. EPDM is susceptible to cutting and puncture. EPDM and single ply materials can be slippery when wet and coated with algae or frost.

ROOF AREAS AT ROOF AREA D BUILDING

Roof Area D consists of the following existing roofing components:

- 2 layers of ½ inch thick plywood
- Nailed base sheet #15 felt (OSU to test)
- One layer 5/8 inch thick wood fiber board nailed
- Hot mopped base sheet + 2 plies SBS granule surfaced (Siplast) strapped

The roof sample revealed a single uninsulated roofing system. This building was designed with an attic where the building insulation is located in the attic at the plane of the ceiling. The existing roofing system consists of an SBS modified bitumen strapped roofing system mechanically attached to the plywood deck. The existing roof slopes are verified at 2 inches in 12 inches. This roof is visible to the public from the ground level. Existing drains are along

the low edge of the roof and water ponds between them. Overflow is over the edge. Fall protection does not exist. Access is provided through a roof access hatch, accessible by a vertical ladder from the ground floor. The building functions primarily as a laboratory building.

Reroofing Roof Area D This involves replacing the existing roofing system, including preparing the wood decking for an approved mechanically attached uninsulated, 2 layer polyisocyanurate rigid insulation system with cover board and a fully adhered 60 mil or 90 mil EPDM membrane. The flashing and counterflashing systems may be replaced to accommodate revisions to drainage and the interface with Building C. The reroofing project would also include, painting, providing for overflow drainage, reconfigured roof drainage, safety improvements and various other improvements described in this report.

- Maintenance/Repair/Life: 30 years which would require a repair project at about 15 years. OSU finds EPDM to be more maintainable than other types of roofing. Electronic leak detection is not effective on EPDM roofing systems.
- Risk/Benefit: Black EPDM material has good life expectancy. Single ply membranes lack the redundancy of multiple ply roofing systems. EPDM is susceptible to cutting and puncture. EPDM and single ply materials can be slippery when wet and coated with algae or frost.

Roof Areas A-1, B-1, B-2, D-1 & D-2 are small independent areas covering links between buildings, the main entrance, an asphalt shingle covered shaft roof and a small metal roof interface. These areas will be developed in the next phase of design work.

DRAINAGE AND OVERFLOWS

The existing roof drainage system on all four buildings consists of roof drains or, in the case of Roof Area C, scuppers spaced along the low edge of each roof plane. The increased insulation depth could be used in the design to improve roof drainage utilizing crickets between the roof drains. Changing the drainage system to a gutter system is also an option. The existing drain piping is exposed and could be used as gutter downspouts.

SAFETY

FALL PROTECTION

Structural Limitations:
As noted above, the existing wood framed roofs do not have an abundance of reserve

structural capacity. Therefore, fall protection anchors will need to be strategically located so that extensive and invasive strengthening can be avoided. Fall protection anchors should be limited to the flush, or low mounted D-ring type tie-off elements. Stanchions that extend vertically 18” above the roof surface cannot be adequately supported to the existing roof structures without extensive structural strengthening.

> **Fall Protection Options** and combinations include warning lines, guard rails at certain equipment requiring service, fall protection anchors with cable at the ridge, stanchions at access hatches, cleaning gutters and/or drains from a lift.

HOOD EXHAUSTS

Consider implications of the laboratory exhaust hood exhausts on design and construction during the design process.

ROOF ACCESS **(Estimated Cost $25,000)**

The roof access hatches serving Roof Areas A and B will need to be raised or replaced to accommodate the increase in insulation thickness on these roofs. The roof access hatch on Roof Area D will not need to be replaced.

Replace two existing roof hatches with new counter balanced roof hatches with safety rails.

Modify the Roof Area D roof hatch to improve safety.

Landscaping interferes with access to the gutter drainage option for cleaning. OSU will confirm the ability of their lifts to reach across or through these areas around the building.

LADDERS

Add an exterior ladder between Building A and Building C to improve overall access to Roof Area C.

HAZARDOUS MATERIALS TESTING, LEAD PAINT, ASBESTOS

OSU will test existing roofing materials for asbestos.

HRC

Not applicable on this project.

ABANDONED EQUIPMENT/VENTS

An attached roof plan indicates equipment items that have been identified by the Design Team as potentially abandoned equipment that could be removed as part of the reroofing project. OSU will verify and comment.

INSULATION/ENERGY (Estimated Cost $35,000)

OSU requires that their roofs be insulated to Code minimum plus 20%:
Rigid roof insulation R36
Attic insulation R60

Roof Area D attic insulation consists of existing blown in fiber; evaluate current R value and replace or increase to current code.

Roof Areas A, B and C insulation is considered as part of the roofing system and referenced in each area's assembly.

Replacement exterior walls will be insulated to meet current code requirements:

Replacement windows will be designed to meet current code requirements for air infiltration, R value and related energy factors.

BUILDING FUNCTION RELATED TO ROOF DESIGN

Laboratories are located in the Roof Area D Building. OSU will help identify special considerations relating to safety and construction activity.

BUDGET

A Direct Construction Budget of $3,610,000 is estimated to account for the maximum combination of project options itemized in this report.

ATTACHMENTS

Roof Plan showing roof designations

South Elevation showing scope of window, wall, and glulam work

END OF REPORT

3115 NE SANDY BOULEVARD, SUITE 224, PORTLAND, OR 97232 ■ PO BOX 12574, PORTLAND, OR 97212
PHONE 503/916/1808 ■ E-MAIL: mac@mcbridearchitecture.com