Cannon Group, Inc.
Roof / Building Envelope & Structural Consultants

H.J. Cannon Group, Inc.
520 Fellowship Road
Suite A-111
Mt. Laurel, NJ 08054

856-914-0900
800-233-6986
Fax 856-914-0600
www.hjcannongroup.com

September 25, 2015

Wiley|Wilson
6600 West Broad Street, Suite 500
Richmond, Virginia 23230-1717

Attn: **Chris Garner, PE**
Project Manager
via email: cgarner@wileywilson.com

Subject: **Roof Inspection and Draft Report**
Repair Building 1001 and interior improvements for DAPS
Project No.: Qu1402M
HJCG No: 2015-089
Marine Corps Base, Quantico Virginia

Dear Mr. Garner,

The H.J. Cannon Group has been retained by Wiley|Wilson to perform a visual inspection of the roofs covering Building 1001 located within the Marine Corps Base in Quantico, Virginia, in order to determine their overall condition and to provide a report of our findings that would include recommendations, for replacement or repair as necessary.

On Wednesday September 2, 2015, Christopher Cifone RRO of the H.J. Cannon Group performed the visual inspection of the roofs covering the building.

Roofing material manufacture information was not provided prior to the survey, however, Roof Replacement drawings dated November 1993, prepared by Seal Engineering Inc, of Alexandria, Virginia were provided and reviewed.

All observations were visual in nature. This report is subject to revision pending review of any additional information, reports, or literature.

BACKGROUND

The original Quartermaster Depot Building was constructed in 1919. The roof encompasses approximately 28,300 square feet and is composed of two slightly sloped pitched gable roofs that drain onto low sloped areas at the center, and along the east and west roof edges. The building is surrounded by a low parapet wall along the east and western edges, while a stepped parapet wall was constructed towards the south, and a sloped parapet wall constructed at the north. All parapet walls are capped with copper copings that were found to be in generally good condition.

The drawings reviewed provided details for “Repair work” on the main roof area as well as “New” work on the lower roof areas; however, it appears that all of the proposed work was not performed, as shown and will be explained in detail within the report.

INTERIOR OBSERVATIONS

Building personnel indicated that leaks typically occur following a heavy rain at the centermost roof drain along the northern wall and at the northeast corner.

During the inspection, a spray foam adhesive appears to have been installed onto the underside of the existing decking. The thickness of the insulation is unknown, and the roof deck was not visible at the time of the inspection.

Photo 01: Overview of the underside of the roof deck. A sprayed in place polyurethane foam was sprayed to the underside of the roof deck and painted.

Photo 02: Detailed view of the spray foam applied to the deck and the drainpipe.

The roof leaks located at the northern most location was at the center of the building, adjacent to the centermost roof drain along the northern wall. The leaks occur following a heavy rain.

Photo 03: Overview of the leak location at the northern wall.

Photo 04: Detailed view of the spray foam applied at the drainpipe.

While the drain strainer was restricted, and it is likely that this area ponded water, it appears that the roof drain carries water from the roof, through interior piping. The stains on the wall indicate that the water infiltration may be coming from the abandoned exterior copper conductor. The exterior scupper box was found to be open and loose, allowing water to flow into the building.

Photo 05: Overview of the scupper from exterior ladder.

Photo 06: Detailed view of the loose conductor.

This condition was also noted at the northeast corner, with displaced masonry observed.

Photo 07: Overview of the northeast conductor box and exterior masonry conditions

Photo 08: Detailed view of the drain conductor.

GENERAL OBSERVATIONS

The main roof areas were found to be in generally poor condition, with numerous deficiencies observed that may allow water infiltration and interior damage if unaddressed.

Photo 09: Bing birds eye aerial photograph of NAVSEA Historic Headquarters Facility

The corrugated steep sloped roof panels extend 16' from peak to eave overlapping and draining onto the granular surfaced modified membrane. Numerous fasteners were found to be loose and missing, resulting in several overlapping panels found to be loose and open.

Photo 10: Overview of the roof area looking south from the north wall.

The roof areas covered by the granular surfaced membrane were found to be in generally poor condition, with numerous deficiencies observed that include clogged drain strainers open field seams and splits that coincided with loose plywood decking.

Photo 11: Overview of the granular surfaced membrane looking south from the north.

The 10’ areas along the eastern and western ends of the building are also covered with the granular surfaced membrane with similar crickets and deficiencies observed.

Photo 12: Overview of the membrane looking south from the north.

The lower roofs along the south were also inspected.

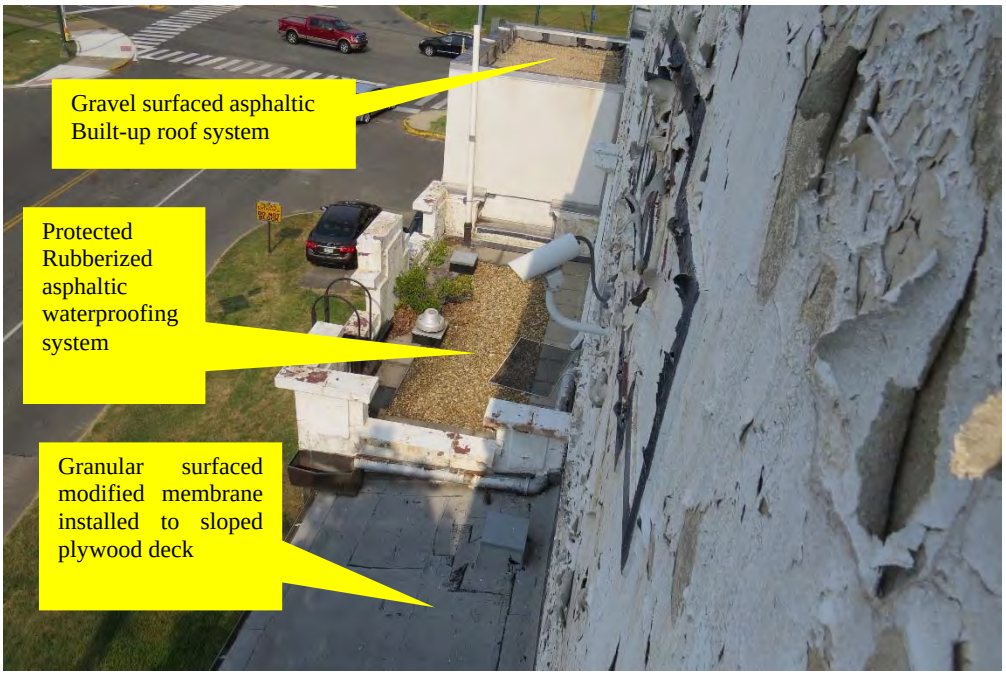

Photo 13: Overview of the membrane looking south from the north.

A gravel surfaced built-up roof covers the western roof area, while the rubberized waterproofing system is installed on the center roof area, and is installed as shown within the documents previously reviewed. The granular surfaced membrane is also installed to the wood deck of the one story addition to the east as shown on the drawings; however, the pipe enclosure was not installed as specified.

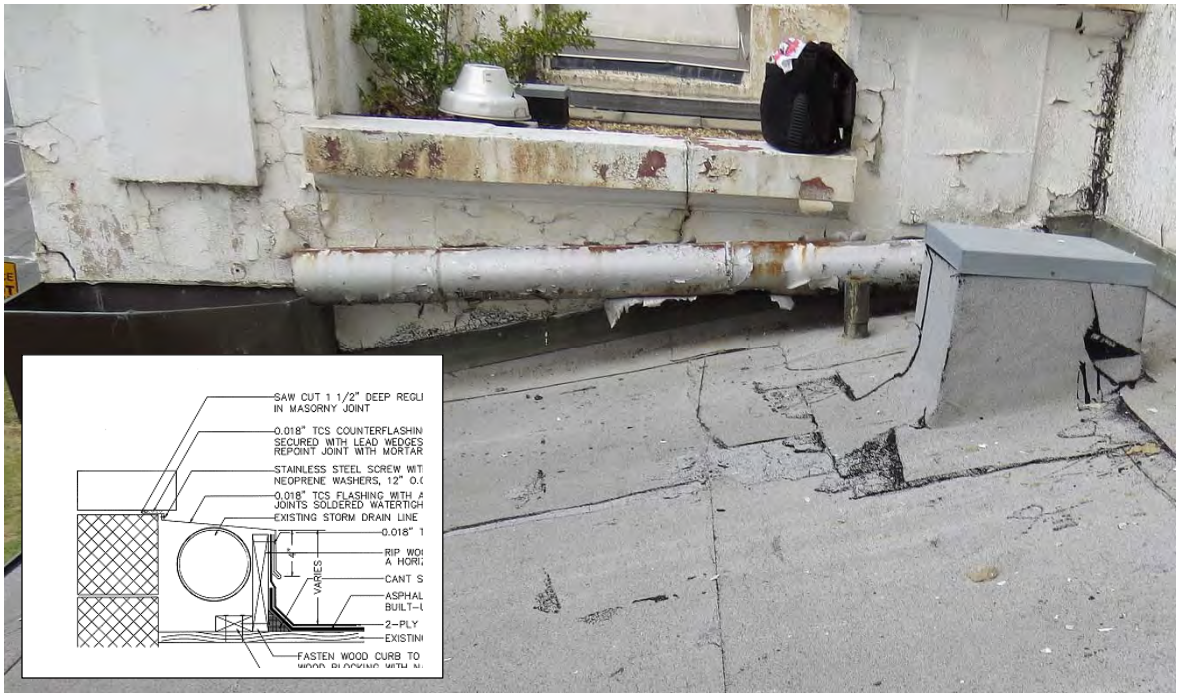

Photo 14: Overview of the pipe running across the roof surface of the eastern lower sloped roof.

Other smaller roofs were noted. Metal roof panels cover a doorway at the north wall and along the eastern loading dock.

Photo 15: Overview of rear shed metal roof.

Photo 16: Overview of metal panels covering the loading dock.

A small entry vestibule at the southern end, and a shingle overhang located above a doorway on the western wall were also noted.

Photo 17: Overview of front entryway.

Photo 18: View of shingles covering doorway,

Other exterior masonry concerns were also noted during the inspection of the roof areas and will be included towards the end of the report.

The following list of deficiencies represents our concerns with the roofs and related components.

The following conditions were observed at the time of inspection.

Main Steep Sloped Corrugated Roof Panels

Two steep sloped gabled roofs run parallel north to south and covered with 16’ long corrugated aluminum panels that are 4’ wide and secured to wood sleepers attached to the existing roof deck. The sides are overlapped approximately 4” and secured along the laps approximately 10-12”, with rows of horizontal fasteners spaced 4’ and secured approximately 10”-12”.

Photo 19: Overview of the metal panels

Photo 20: Overview of the wood sleepers below the corrugated metal panels.

The age of the existing corrugated roof could not be determined, and it appears that all of the work shown on drawings reviewed was not performed.

The following deficiencies were observed:

1. Loose and Missing Fasteners:

   During the inspection loose and missing fasteners were observed at numerous locations. Several areas of the corrugated aluminum roof panels were found loose and unsecured, potentially allowing wind driven rain or snow to enter below the metal panels.

The following photographs represent typical conditions observed:

Photo 21: Overview of loose metal roof panels.

Photo 22: Detailed view of loose metal roof panels.

Photo 23: Overview of missing fasteners and loose panels.

Photo 24: Overview of missing fasteners.

Photo 25: Detailed view of failed fasteners.

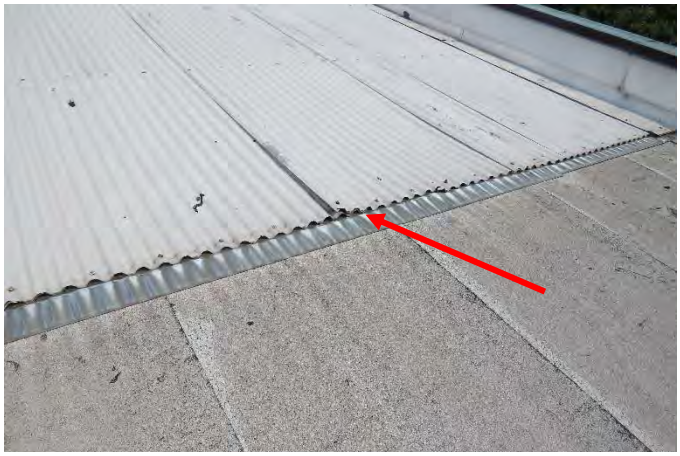

Photo 26: Overview of failed fasteners.

Photo 27: Overview of repaired metal panels and unsealed holes from previously installed failed fasteners.

Photo 28: Detailed view of repaired metal panels and unsealed holes from previously installed failed fasteners.

Photo 29: Overview of weathered ridge cap

Photo 30: Detailed view of unsecured ridge cap support.

2. Loose Panels:

During the inspection loose and unsecured corrugated aluminum roof panels were found along the gutter edge where areas of missing or loose fasteners were noted. These areas can potentially allow wind driven rain or snow to enter below the metal panels and into the building if left unaddressed.

The following photographs represent typical conditions observed:

Photo 31: Overview of loose metal roof panels.

Photo 32: Detailed view of loose metal roof panels.

Photo 33: Overview of loose metal roof panels.

Photo 34: Detailed view of the taut membrane along the western facing slope.

SBS Granular Surfaced Modified Membrane

The granular surfaced modified membrane is installed along the 10’ wide eastern and western edges, and a 20’ wide section runs between the two steep sloped gabled roofs, running north to south. The drawings reviewed indicated that a stainless steel gutter pan was to be installed where the corrugated metal panels are, but these areas are covered with the granular surfaced membrane.

Photo 35: Overview of the granular surfaced membrane looking south from the north.

Photo 36: Overview of the granular surfaced membrane looking north from the south.

1. Open Membrane Seams:

   Numerous splits and cracks were noted throughout the roof. The splits and cracks are at various stages, with some cracks completely through the membrane, and other cracks through the top layer into the reinforcement. These cracks will continue to allow water to enter the building.

The following photographs represent typical conditions observed:

Photo 37: Overview of open field seams.

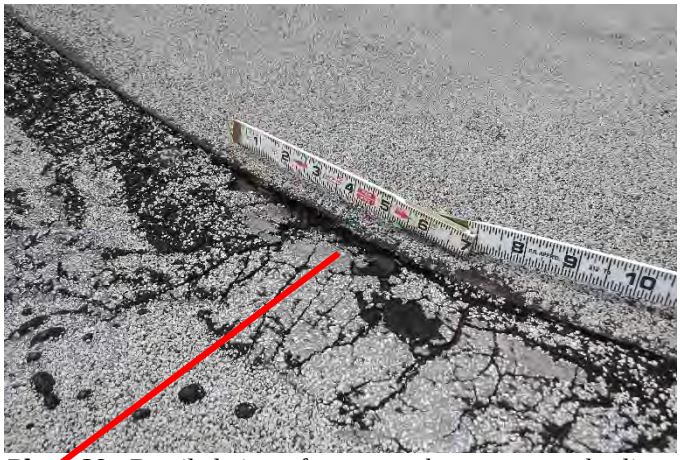

Photo 38: Detailed view of open membrane seam and split.

Photo 39: Detailed view of membrane splits. Note the fastener used in an attempt to secure the lap. The plywood was observed through the membrane splits at this

Photo 40: Detailed view of membrane split.

2. Open Flashing Seams:

   Numerous splits and cracks were noted throughout the roof. The splits and cracks are at various stages, with some cracks completely through the membrane, and other cracks through the top layer into the reinforcement. These cracks will allow water to enter the building.

The following photographs represent typical conditions observed:

Photo 41: Detailed view of membrane split.

Photo 42: Detailed view of membrane split.

Photo 43: Additional view of membrane split.

Photo 44: Detailed view of membrane split at a 90° angle.

3. Weathered and Deteriorated Lead Vent Flashing:

The lead flashings installed at the base of an existing plumbing vents were found to be weathered, split and open, providing a path for water to enter the building.

Photo 45: Overview of lead flashing.

Photo 46: Detailed view of Lead flashing at plumbing vent.

Photo 47: Additional view of membrane split.

Photo 48: Detailed view of membrane split at a 90° angle.

4. Damaged Membrane:

   The nails used to secure the plywood decking at several locations had backed out through the roof membrane as shown below

The following photographs represent typical conditions observed:

Photo 49: Overview of plywood deck fasteners backing out through the membrane

Photo 50: Detailed view of plywood deck fasteners backing out through the membrane

Photo 51: Detailed view of fasteners backing out through the membrane

Photo 52: Detailed view of fasteners backing out through the membrane

5. Clogged Drain Strainers:

   The drain strainers were found to be clogged, preventing the proper drainage of water. Although the overflows are installed above the drains, the flashing at the copper piping is unsealed, potentially allowing water into the building.

The following photographs represent typical conditions observed:

Photo 53: Overview of plywood deck fasteners backing out through the membrane.

Photo 54: Detailed view of plywood deck fasteners backing out through the membrane.

Photo 55: Detailed view of fasteners backing out through the membrane.

Photo 56: Detailed view of fasteners backing out through the membrane.

Photo 57: Detailed view of membrane split at a 90° angle.

Photo 58: Additional view of membrane split at a 90° angle.

Photo 59: Additional view of membrane split at a 90° angle.

Photo 60: Additional view of membrane split at a 90° angle.

Photo 61: Detailed view of membrane crack at seam.

Photo 62: Detailed view of membrane crack at seam.

Lower SBS Granular Surfaced Modified Membrane

The granular surfaced modified membrane installed onto the southern sloped shed roof is in generally fair condition with a weathered surface observed. Generally the roof membrane is functioning as intended; however, the rising wall conditions are suspect and are potential points of water entry into the building if unaddressed.

Photo 63: Overview of the lower southern granular surfaced membrane covering the sloped shed roof looking east from the west.

Photo 64: Overview of the granular surfaced membrane looking north from the south.

1. Rising Wall:

   Numerous masonry cracks were observed at the rising wall at various flashing transitions. These cracks, if unaddressed can allow water to enter the building.

The following photographs represent typical conditions observed:

Photo 65: Overview of rising wall conditions adjacent to the rising wall flashing.

Photo 66: Detailed view of rising wall conditions.

Photo 67: Overview of rising wall conditions.

Photo 68: Detailed view of rising wall conditions adjacent to the rising wall counterflashing.

Lower, Protected Waterproofing Membrane

The existing rubberized asphalt protected waterproofing system appears to be functioning as intended. The rubberized membrane is protected with a layer of extruded polystyrene insulation and covered with filter fabric and pea gravel. Rising wall conditions and plant growth on the existing roof are areas of concern.

Photo 69: Overview of the roof system. Note plant growth behind roof curb.

Photo 70: View of the exposed waterproofing flashing, insulation below the filter fabric and pea gravel protection

1. Rising Wall:

   Several masonry transitional points were found to be open and unprotected. The inside corner of the roof area and rising wall conditions are open allowing wind driven rain to enter the building.

The following photographs represent typical conditions observed:

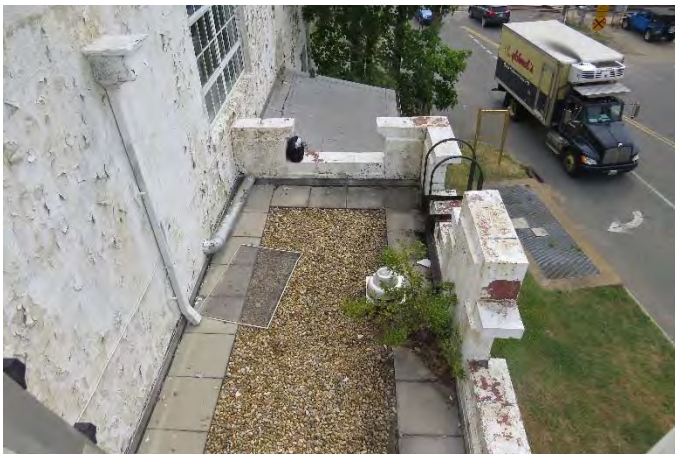

Photo 71: Overview of roof area from above.

Photo 72: View of metal used to seal transition at rising wall.

Photo 73: Overview of trim rising wall conditions.

Photo 74: View of open metal trim used to cover masonry transition.

Lower Gravel Surfaced Roofing System

The existing gravel surfaced asphaltic built-up roof (BUR) system towards the west appears to be functioning as intended. The BUR is covered with pea gravel, and membrane flashings are used at the perimeter. The rising walls and counterflashing observed continue to be areas of concern.

Photo 69: Overview of the upper gravel surfaced Built-up roof.

Photo 70: View of the scupper.

1. Rising Wall:

   The rising walls continue to be areas of concern, with cracks, broken mortar, loose and open counterflashing observed that will allow wind driven rain to enter the building if unaddressed.

The following photographs represent typical conditions observed:

Photo 71: Overview wall condition above counterflashing.

Photo 72: Detailed view wall condition above counterflashing.

Photo 73: Detailed view wall condition above counterflashing.

Photo 74: View of open counterflashing

Lower, Smooth Surfaced Roof at Front Vestibule

The existing smooth surfaced asphaltic built-up roof (BUR) system covering the southwestern vestibule appears to be functioning as intended draining to a small gutter secured to the eastern roof edge. The BUR is coated with a fibrated aluminum coating that continues to the base of the copper flashing towards the south, and covers the flashing at the rising wall. As previously noted, the rising walls and counterflashing observed continue to be areas of concern; with failed coatings and numerous sealant repair attempts observed.

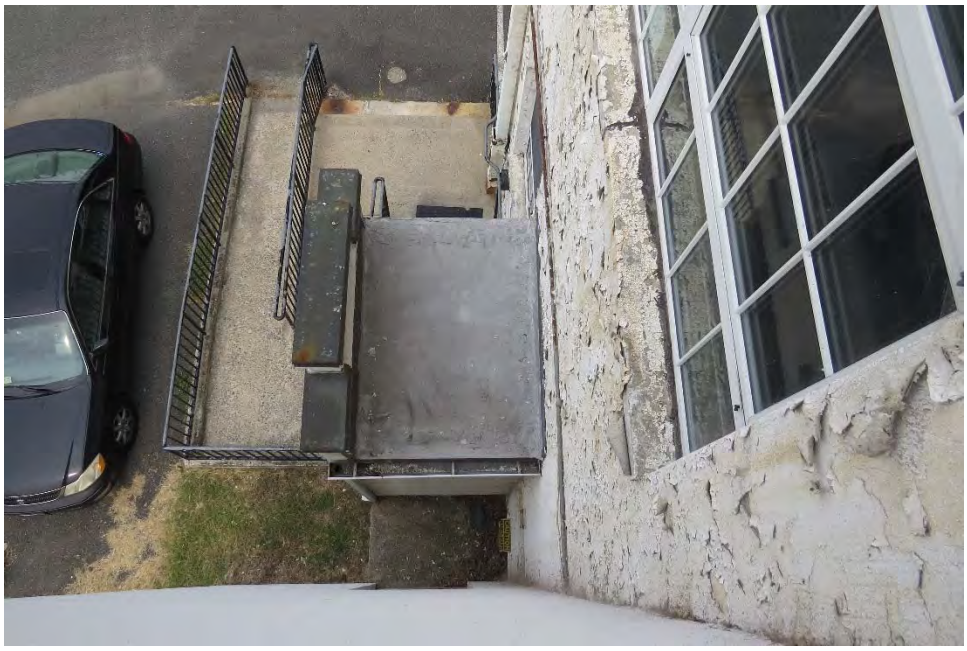

Photo 75: Overview of the Lower smooth surfaced Built-up roof at the front vestibule.

Photo 76: View of the membrane covering the front vestibule.

1. Rising Wall:

   The rising wall above the roof area continues to be an area of concern, with failed coatings and sealant repairs observed that will allow wind driven rain to enter the building if unaddressed.

The following photographs represent typical conditions observed:

Photo 77: View of the membrane covering the front vestibule.

Photo 78: View of the membrane counterflashing and copings covering the front vestibule.

Lower, Asphaltic Three-Tabbed Shingle Overhang

The existing shingles covering the western access door are functioning as intended. It appears that the wood framing supporting the shed type roof was secured to the existing wall without the appropriate counterflashing at the roof to wall transition.

Photo 79: Overview of the shingles covering the western access door.

Lower, Corrugated Metal Overhang

A metal shed type roof is installed against the northern elevation. Although the corrugated panels appear corroded, they are functioning as intended.

Photo 80: View of the shingle overhang at the western access door.

Lower, Metal Loading Dock Roof

The existing metal panels covering the loading dock along the eastern elevation is functioning as intended. The metal panels appeared to be sound, with no areas of distress noted.

Photo 81: View of the metal roof covering the loading dock

Photo 82: View of the metal roof covering the loading dock.

CONCLUSIONS

The numerous membrane and metal panel deficiencies noted are all contributing factors for the overall failure of the roofing systems covering the main roof. The perimeter masonry conditions also appear to contribute to water infiltration experienced. The deficiencies noted within the report are all contributing factors that collectively indicate that replacement is required.

As previously noted, the drawings reviewed, did not depict the actual conditions found on the main roof area, as noted earlier in Photograph 11and 12. The stainless steel gutter linings were not installed as shown on the details below that were part of the Roof Replacement drawings dated November 1993, prepared by Seal Engineering Inc, of Alexandria, Virginia.

The history of these alterations, or change of scope is unknown.

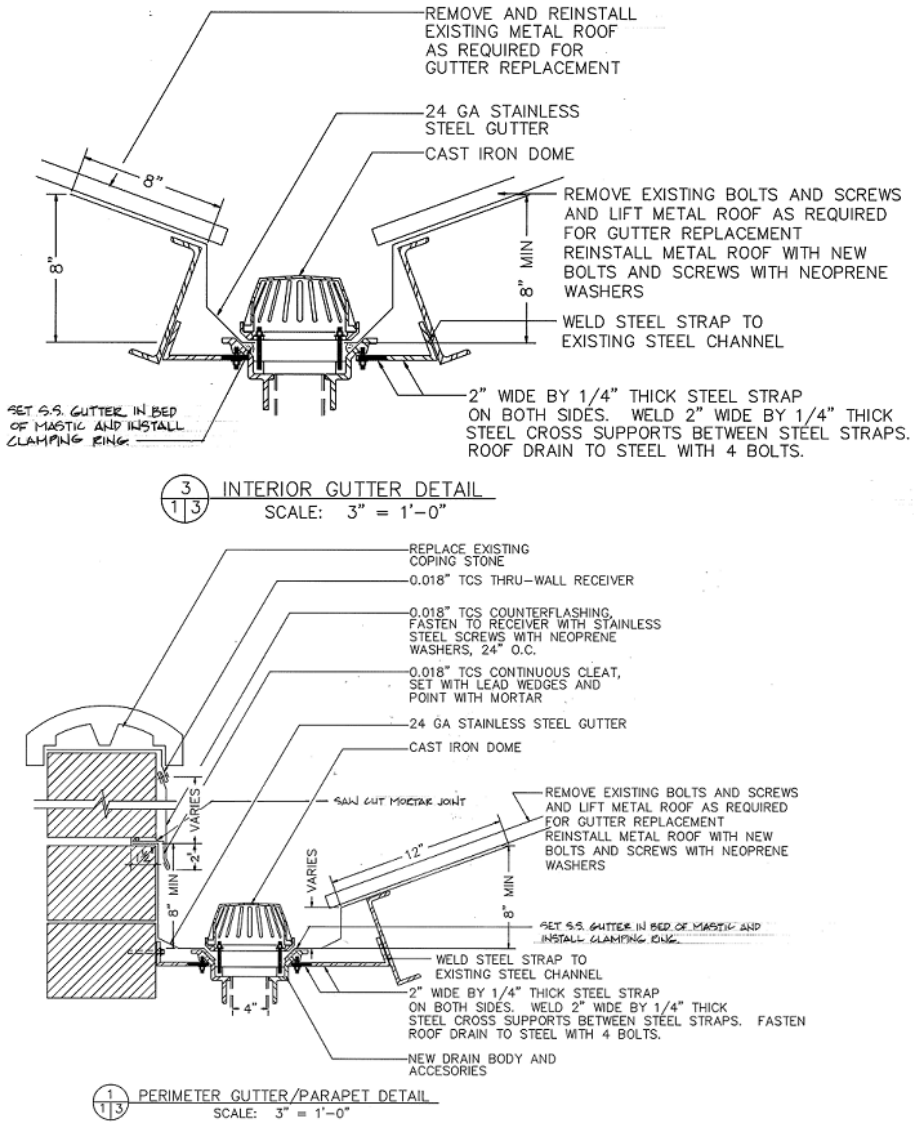

Plate 1: Details extracted from the Roof Replacement drawings dated November 1993, prepared by Seal Engineering Inc, of Alexandria, Virginia

As evident of the numerous photographs provided, the roofs have reached the end of their service life, and can no longer be expected to provide ***long-term watertight performance***.

RECOMMENDATIONS

It is our recommendation that the corrugated metal, and granular surfaced main roof areas be removed to the existing roof deck, and a new insulated roof system and all related metal flashing components be installed that includes a long-term (20-30 year) Manufacturer's labor and material warranty.

The roof areas on the lower areas should also be considered for replacement once the exterior masonry work has been completed.

If you have any questions, or require further assistance, please do not hesitate to contact our office.

Sincerely,
H.J. Cannon Group, Inc.

Christopher T. Cifone, RRO
Sr. Roof Consultant / Project Manager
H.J. Cannon Group, Inc.