



Policy Title: Directive 7-1 Roofing and Reroofing

Responsible Office: Design & Construction

Last Revised Date: September 2019

Summary

This Directive provides requirements for roofing and re-roofing used on Fund projects.

Overview

Projects must be designed using Campus preferences and standards for roofing, re-roofing, finish and other requirements. Design approach must provide for water and ice management that maximizes the design service life of roofing, considers the maintenance and operational needs of the Campus, and provides for reasonable accommodations for the inevitable future need to replace roofing. The design must comply with Directive [1B-1 Building Codes](#). Insulation design must comply with Directive [1B-2 Net Zero Carbon New Buildings and Deep Energy Retrofits of Existing Buildings](#).

Responsibility

The Consultant is responsible for complying with this Directive and the Campus standards. See Directive [1C-10 Coordination with Individual Campus Standards](#). Roofing system design shall be based upon recognized, non-proprietary roofing systems manufactured by firms with ten years' experience in the manufacture and supply of waterproof membranes and roofing materials. The Consultant must review the project specific design, drawings, specifications and warranty with the listed manufacturers prior to bidding as required in Directive [1C-2 Specification of Materials](#).

Procedures

- I. General requirements for all roofing projects (new construction and re-roofing):
 - A. During the Concept Phase, review system and material choice with the Campus.
 - 1) Determine the insulation thickness required by Directive [1B-1 Building Codes](#) and Directive [1B-2 Net Zero Carbon New Buildings and Deep Energy Retrofits of Existing Buildings](#).
 - 2) Consider the visual impact of the roofing from adjacent public vantage points including adjacent taller buildings. Provide options for colors and materials used for pavers, ballast, fascia and other materials exposed to view. See Directive 1C-3, [Material and Color Selections](#), for guidance on color selections.
 - B. Comply with the current recommendations, guidelines and other information published by the National Roofing Contractors Association (NRCA) in their Roofing and Waterproofing Manual and other publications.
 - C. Comply with the current recommendations, guidelines and other information published by the Sheet Metal & Air Conditioning Contractors' National Association (SMACNA) in their Architectural Sheet Metal Manual and other publications.
 - D. Comply with the current recommendations, guidelines and other information published by the International Institute of Building Enclosure Consultants (IIBEC) in their Manual of Practice and other publications.

- E. Where roofing meets masonry, comply with the current recommendations, guidelines and other information published by the Brick Industry Association (BIA) in their Technical Notes and other publications.
- F. For new construction or for renovation of vacated, non-occupied buildings, unless otherwise directed by the Fund, plan for and show temporary roofing, either at the roof level or at a level where it protects work being installed below and allows for sufficient time and environmental conditions for the proper drying out of work.
 - 1) If the temporary roofing will remain in place in the completed work, the Consultant's design, detailing and specifications for temporary roofing must comply with the requirements of this directive and must also be protected with suitable coverings to withstand reasonable loads, traffic and other activities that may occur during construction.
 - 2) If the temporary roofing will be removed in its entirety and not remain in the completed work, the design may be delegated to the Contractor, but the Consultant must specify all design parameters and performance requirements, including:
 - a) material durability for the environmental loads and conditions that may occur during the duration of the Project,
 - b) the minimum slope for positive drainage,
 - c) minimum height and securement of flashings at edges, penetrations, and other terminations,
 - d) sequencing work that penetrates temporary roofing with same day repairs to roofing,
 - e) leak detection or monitoring requirements,
 - f) timing and response requirements when corrective action or work is required to stop leaks, remove ponding, and/or perform other corrective work necessary to maintain a watertight temporary roof,
 - g) sequencing removal of temporary roof with the installation of the permanent roof to keep the structure watertight, and
 - h) Other requirements requested by the Fund.
- G. Use a design approach to water and ice management that maximizes the design service life of roofing. Review options with the Fund and Campus that provide for optimal drainage of water, mitigates the impact of ice and simplifies future maintenance work. Considerations include:
 - 1) All roof areas shall have positive drainage to internal roof drains.
 - a) Unless a greater slope is recommended by the roofing manufacturer or Code, design roofing to provide a minimum slope of 1/4" per foot on installed roofing systems, and increase the slope as needed to accommodate reasonable and customary construction tolerances.
 - b) If 1/4" per foot is not achievable due to existing conditions on the roof deck or substrate, shallower slopes may be used, but do not use a slope of less than 1/8" per foot without written approval of the Fund and Campus.

- c) Where tapered insulation will be used to achieve positive drainage, show the layout that provides for the optimal use of materials on the drawings submitted at Pre-Bid. Consult with a tapered insulation manufacturer prior to bidding as required to show a constructible insulation layout.
- 2) Roofs, copings, caps, canopies and other sloped building surfaces shall be oriented to drain water away from their edges that face towards the building exterior and to drain water towards internal drainage points.
- a) Unless otherwise approved by the Campus and the Fund, do not include sloped roofs and surfaces in the design that will drip water or shed snow onto the site adjacent to the building or courtyards.
 - 1. If sloped roofs that drip water or shed snow onto the adjacent site are approved by the Fund and Campus, the design must include snow retainage, gables, diverters and other components to redirect water away from occupied site surfaces (walks, entrances, recreational areas, site mounted equipment and systems, etc.), as required to reasonably prevent damage and injury from sliding snow, falling ice and/or ice creation on site due to freezing of falling water.
 - b) Where existing building surfaces or secondary drains already drain to the exterior, review options with the Campus for mitigating any issues with existing drainage.
 - c) Where existing roofs slope to shed snow onto surfaces below, consider the impacts of sliding snow and its accumulation on the surface below and consider the need to mitigate the impact of sliding snow with a snow retention system.
- 3) Where internal roofs, copings, caps, canopies and other horizontal building surfaces drain onto interior roof areas, consider the impact of falling water, ice and snow on the roof below.
- a) If used, design a snow retention system layout and type for anticipated snow fall, its maximum potential sliding force and the size and type of roof on which it is installed. Provide snow retention system on metal roofing systems that does not penetrate metal panels.
 - b) Where substantial water discharges onto a membrane, design a protective barrier, such as a pre-cast, freeze resistant, concrete splash block at the discharge point.
- 4) Design crickets in valleys between roof drains and at curbs and other obstructions in the flow of water as required to provide positive drainage of all roof areas. Design crickets with a minimum of $\frac{1}{4}$ " per foot net slope.

- 5) Internal roof drains shall have bottom outlets and shall be located above conditioned spaces and their leaders shall be within the conditioned envelope.
 - a) Do not use scuppers, parapet drains, external gutters, internal gutters, drains with 45- or 90-degree outlets, downspouts, exposed leaders or other components in areas where water may freeze.
 - b) Where new leaders are required, provide a 4" minimum leader size in new construction even if the Code permits using a 2" or 3" leader.
 - c) Unless contrary to campus standards, on existing buildings, where existing drains, gutters and leaders must remain and are exposed to freezing, install heat tracing or other means to maintain flow.
 - d) Membrane seams and system joints must be at least three (3) feet away from roof drains.
 - e) If roof scuppers are existing, verify condition and replace if needed. Where icing occurs, provide protective systems to safeguard areas below scuppers.
 - f) See Directive [15H-5. Refrigeration Systems](#), for cooling tower drain requirements.

- 6) Vapor retarders:
 - a) Vapor retarders may be needed at high humidity interior building conditions. Provide a model simulating transient hygrothermal behavior (WUFI® or equivalent) in the proposed assembly to determine if a vapor barrier is required or recommended.
 - b) Show remedial work on the existing roof deck, if any, recommended by the manufacturer to prepare the deck to receive the vapor retarder. Use adhesives, fasteners and/or fastening methods appropriate to substrate and required by uplift.
 - c) In the case of recovering an existing roof system, a well-adhered, asbestos-free existing vapor retarder may remain in place if it can be repaired. Ensure primers and adhesives used to adhere new systems are compatible with the existing systems to remain.
 - d) Design the overall system to avoid penetrating the vapor retarder with fasteners.
 - e) If the vapor retarder will serve as a temporary roof during construction, provide bi-level drains or a require a temporary means for positive drainage until the permanent roofing is installed.
 - f) If a vapor retarder is used and unless otherwise recommended by IIBEC, extend the vapor barrier up vertical surfaces in base terminations and curbs, onto horizontal surfaces of curbs, and link to the air/vapor barrier of the wall

system. For other vertical elements, turn up a minimum of 4", secure with metal clamps and termination bars, and seal with compatible sealant.

- 7) Design vertical terminations at walls, curbs, parapets and other elements for optimal longevity and future maintenance.
 - a) For existing roofs, consider impact to vertical terminations when considering the requirements of Directive [1B-2 Net Zero Carbon New Buildings and Deep Energy Retrofits of Existing Buildings](#).
 - b) Extend the roof flashing membrane up and over the edge, curb or parapet blocking. Install sheathing acceptable to the roofing manufacturer onto masonry prior to adhering membrane.
 - c) The height of base flashings at curbs for skylights, equipment or other work must be a minimum 12" above the installed roof membrane.
 1. Consider the thickness and taper of insulation when specifying the height of curbs. For example, to provide a minimum of 12" of base flashing when there is 8" of adjacent insulation, a 20" curb or next available taller size curb should be specified.
 2. For new construction, Use the manufacturer provided pre-molded boots for pipe and other items even when they are less than 12" high.
 3. Where existing conditions do not allow for 12" base flashings, review options for how to achieve optimal height of base flashing with the Fund and Campus prior to the Schematic submission. Do not block, conceal, or cover over existing weep holes in existing masonry.
 - d) Where sills of door and window openings are at roof level, provide a base flashing height of at least 8".
 - e) At structural penetrations, such as dunnage/supports/platforms for roof-mounted mechanical equipment, etc., provide 24" minimum clear height from underside of support beams to the top of the installed roof surface. An alternative clear height may be acceptable if it allows Campus staff reasonable access to the roof surface and all flashings under installed equipment.
 1. Support posts shall be formed from round structural tubing or pipe to provide optimal flashing termination conditions. Avoid use of non-round posts that require labor intensive flashing or sealant poured into flashing pans.
 2. Do not use wide flange steel members at locations that penetrate roofing and need flashing. If wide flange vertical support members already exist, provide structural closure plates for space between flanges, fabricated and welded in place per NRCA details. This will simplify flashing and be a less maintenance intensive assembly.

- f) Where multiple piping and/or conduit penetrate the membrane, use a SMACNA hood system with sealed penetrations in the vertical metal side of the hood in lieu of horizontal penetrations with pitch pockets in the membrane.
- g) Fascia / Copings:
 - 1. A pre-manufactured metal system tested for wind resistance is preferred.
 - a. For custom made units, comply with appropriate reference standards, i.e. SMACNA, for design requirements as minimum standard.
 - b. Select material, weight and profile to minimize oil canning.
 - 2. Stone / precast copings: Stone / precast copings are not preferred. If existing copings must be retained, consider installing metal thru-wall flashing with soldered joints and caps at dowel extensions. Follow SMACNA recommendations.
- h) Expansion Joints:
 - 1. As recommended by NRCA, install area divider curbs at critical changes in shape/size of roof areas or to separate maximum areas of open roofing.
 - 2. Install roof system expansion joints at building expansion joints.
 - 3. Use preformed expansion joints compatible with roofing system manufacturer.
- 8) Attachment of roofing system:
 - a) Wind design: Consider local Campus conditions and other special risks specific to existing building configurations.
 - b) Where allowed by Code or as permitted by existing conditions, use non-penetrating insulation attachment systems, such as adhesive, for securing insulation in lieu of mechanical fasteners. Select adhesive in consultation with the specified roofing manufacturers.
 - 1. Where fasteners are required, fasten at the lowest material layer that the roof manufacturer will accept (i.e., not exclude in their warranty) and use adhesive for subsequent layers. Inspect underside of existing decks and perform pull out tests as noted in Part II below.
 - c) Where low compressive strength insulation is exposed to foot traffic, protect insulation with an overlay of non-compressible material recommended by the membrane manufacturer prior to installation of the membrane.

- d) Ballasted roof systems are not recommended but may be considered if requested by the Campus.
 - 1. Provide a justification for not using a fully adhered system and obtain approval from the Campus and Fund.
 - 2. Consider anticipated wind velocities at the building location, height of roof surface above grade, exposure of building to prevailing winds and other factors that may cause ballast scour and blow off.
 - 3. Obtain ballast samples from local sources prior bidding to confirm that suitable ballast is available at reasonable cost.
 - 4. Roof edging, roof drain assemblies and scuppers should be designed accordingly (i.e. stone grades, etc.). Stone type and color should be considered at locations where roof top is visible from adjacent vantage points.
 - 5. Evaluate the existing structure to verify that it can support the weight of ballast during placement and in final coverage thickness.
- 9) Kitchen exhaust: provide protection of roofing at exhaust of grease-laden vapors, as recommended by the manufacturer.
- 10) Green Roof Systems are not recommended but may be considered if requested by the Campus.
 - a) Discuss with Campus and Fund the types of green roof systems available. System information to be reviewed shall include initial cost, maintenance, weight, planting mediums, etc. Planting maintenance by the Campus begins at substantial completion and is not part of the extended 2-year guarantee of the roof.
 - b) For existing buildings verify weight of desired green roofing system and ability of existing structure to accommodate increased loading, including added water retention. Modify the existing drainage system to reflect the green roofing system.
 - c) Coordinate Green roofing system with the proposed roofing type to verify compatibility and not to void warranty.
 - d) Consider Campus preference for an electronic leak detection system, electric field vector mapping or similar, beneath all green roof systems.
 - e) If desired by the Campus, enhance the warranty to include an “overburden” warranty in which the manufacturer is responsible for the removal and replacement of the green system due to leak investigation and/or repair
- H. Use the design approach that maximizes the Campus’ ability to properly maintain the roofing for its design service life. Review options with the Fund and Campus that provide for proper access by maintenance personnel.

- 1) Provide a permanent means to access to all roof levels not accessible by hatch, stair or door.
 - a) Where doors access a roof, provide a fixed step(s) / stair(s) where interior surfaces are more than 8" below the door sill elevation.
 - b) Roof ladders shall be wall mounted; do not support ladders from roof surfaces. Design adequate structural support in vertical surfaces at ladder anchoring points.
 - c) For existing buildings or low canopies in new construction, where the permanent or acceptable means of access does not exist to a roof level(s) or is impractical, review options with the Fund and Campus prior to Schematic submission for accessing the roof.
 - 2) Perimeter roof edge protection shall be reviewed with Campus to determine type of OSHA approved system to be used based on the Campus access needs.
 - a) When providing railings or parapets as roof edge protection, consider deck surface tolerances, insulation thicknesses and other factors that may reduce the effective minimum height of a railing or parapet. i.e., posts are mounted to a deck that varies from level and may result in some areas where the top of railing drops below the minimum height required above the top of the installed roof walking surface.
 - 3) When designing the roof walkway materials, consider the frequency, amount and natural desire lines of foot traffic across a roof and the potential for damage.
 - 4) Do not mount ducts, piping or conduit directly on the roof membrane.
 - 5) If elevated ducts, piping or conduit are routed above a roof such that they obstruct natural desire lines for foot traffic, provide a fixed ladder / bridge in the path of travel over the obstruction.
- I. Identify sole and single sources in the Design Manual submission and comply with Directive 1C-2 Specification of Materials.
 - J. Specify coordination conferences with the Contractor for pre-installation, pre-acceptance, post-occupancy inspections, and other coordination interface.
 - K. Warranty: Specify a 2-year contractor guarantee and a manufacturer's 20-year full system warranty. The suggested wording for this requirement shown below in Part III. Enhancements to this warranty may be proposed, subject to confirmation that it is desired by the Campus and the cost is within the available budget.
- II. Additional requirements for reroofing existing buildings
- A. Design Phase Investigation for Re-Roofing Projects is a prerequisite for the Schematic Phase submission. Work that may be required before field work includes:

- 1) Field Testing and Compensation: Unless included in the lump sum fee or the Schedule B of the Consultant's Agreement, the services and fees related to field sampling and testing, exposing concealed conditions, level survey, structural evaluation, roof core samples, construction probes, pullout tests, parapet and roof diaphragm analyses, drain and equipment testing, hiring contractors and surveyors, and other third party investigative efforts required in this Directive may be provided through extra compensation when approved by the Fund.
 - a) Exception: The Consultant's Design Phase Investigation effort to visually inspect, measure and create documents showing all exposed existing conditions is included in the basic design fee and is not extra compensation.
 - b) See Directive [1C-4 Extra Compensation Authorization](#) for more requirements.
 - c) After the orientation meeting with the Fund and Campus, develop and manage a plan to provide field investigation and testing, to evaluate the resulting data and to incorporate the required design solutions into the Schematic submission. See Directive [1A-2 Program Verification Phase](#) for more requirements.
 - 2) Obtain drawings, specifications and other information from the Campus for the original building construction, subsequent reroofing, and other work that may have modified the roof.
 - 3) If "as-built" roof drawings exist, they should be used as a starting point for the examination and documentation of field conditions. If drawings don't exist or cannot be located, measure and document the existing conditions.
 - 4) NOTE: If not already shown on the Campus drawings, the roof should be broken into sub-sections and labeled based on physical attributes such as area dividers, expansion joints, level changes, etc. The labeling system, such as Area "A", Area "B", etc., must be acceptable to the Campus.
 - 5) Determine whether existing roof system, deck and/or structural system varies at different areas of building. If so, the Existing Roof Conditions Investigation should be performed (repeated) at a representative location for each different system.
- B. Design Phase Investigation inspection, measurement and documentation includes:
- 1) As required to supplement the existing documentation provided by the Campus, field measure roof areas, locate penetrations and other equipment, and provide other measurements needed to create existing condition drawings.
 - a) Verify that elevations of existing curbs, counter flashing, cavity wall weeps, and vents will provide for the clearances above membrane listed in Part I above, especially where tapered insulation is to be installed.
 - b) Identify and measure overall dimensions of contract work area and sub-sections.

- c) Identify and measure all roof penetrations. Survey should include material identification, dimensions, diameters, heights, curb heights, etc. Measure and document vent pipes, roof drains, equipment curbs, exhaust fans, roof top HVAC units, skylights, structural supports, antennas, pitch pockets, electrical conduit, etc.
 - d) Identify and measure perimeter conditions at roof areas including variations of roof edge and/or parapet profiles.
 - e) Identify and measure conditions and profiles at any doorways to stair towers or penthouses and windows to occupied areas.
 - f) Identify and measure miscellaneous equipment, supports, mechanical piping, conduits, cabling, ladders, etc., mounted at vertical, horizontal or diagonal surfaces within the contract area.
 - g) Identify and measure wall elevations particularly if roof project includes building mounted equipment and/or masonry or exterior envelope repair/rebuilding.
 - h) Identify and measure locations of any control joints in masonry walls above roof and flashings/weepers in wall systems at roof level
- 2) If mechanical equipment must be removed and reinstalled/replaced to provide access to replace an existing roof system, investigate and consider raising their supports, using taller curbs and/or extending mechanical/electrical connections to provide the optimal flashing height required in this Directive.
 - 3) Document construction access paths and staging areas for dumpsters, insulation, roofing, etc. Note impact to Campus operations and constraints that contractor will have when utilizing such paths and staging areas. Identify and measure heights of roof areas relative to each other and to grade at likely staging area(s). See [Directive 1D-4 Construction Site Requirements](#) for construction staging and access policies.
 - a) Unless otherwise permitted by the Campus, the Consultant should plan for and show construction access paths that do not include use or access to any existing building entrances, stairs, elevators and/or hatches.
 - b) For worker and site representative access, show locations for temporary scaffold stairs that are erected by the Contractor prior to any roofing work and removed after the roofing work has been completed, or when directed by the Consultant.
 - c) For material and equipment deliveries, plan for and show adequate space for cranes, hoists, lifts or other means that may be utilized.
 - 4) Locate optimal areas or conditions for construction probes required in the Existing Roof Conditions Investigation section of this Directive and review proposed locations with the Campus.
 - 5) All existing conditions should be documented via photography.

- a) Provide overall images of roof areas and close-up images of specific assemblies. Quantity of photographs should be appropriate to size and complexity of project. Where possible, close-up images should be taken with a ruler or rigid measuring tape pictured within the field of view to document relative size of pictured components. Label files.
 - b) Using the email address or file transfer method provided by Coordinator, submit all images to Fund e-Builder Documents folder: 4.00 Design \ 4.09 Photos – Renderings.
- C. Structural review: evaluate the existing structure and structural drawings to determine if the existing roof structure can support the proposed roofing system. Determine live load limitations that will be shown on the Drawings.
- 1) Consider other Code requirements that may have a significant scope and budget impact, such as:
 - a) Bracing for existing unreinforced masonry parapets,
 - b) Existing roof diaphragm analysis and improvements in high wind locations,
 - c) Secondary drainage or new leaders where existing roof doesn't provide positive drainage.
- D. Plumbing review: Prior to submitting the Schematic, examine existing roof drains and leaders to determine their condition.
- 1) Evaluate the existing roof drainage for positive drainage, adequate capacity and remaining service life and review options with the Fund and Campus if there are inadequacies.
 - 2) Roof Drains: coordinate with Campus to have drains inspected and tested for flow capacity before the Contractor initiates work. Provide video inspection where feasible.
- E. Existing Roof Conditions Investigation: Prior to submitting a Schematic design and to minimize changes during construction, perform the following:
- 1) If portions of the roof are to remain, perform an infrared scan of the entire roof area to determine the extent of moisture in the system. Review the results with the Fund, Campus, and proposed roofing system manufacturers to confirm the acceptability of allowing portions of the roof to remain.
 - 2) Perform construction probes:
 - a) Probes penetrating roof to deck are made and patched by a roofer acceptable to the Campus.
 - b) Cut open the existing roofing assembly to determine its materials, thickness, and condition of the structural deck. Open at least one area large enough to

easily inspect the deck and additional smaller areas as needed to establish the range of existing conditions. Use roof cuts to:

1. Examine the roof deck to determine its condition and its ability to remain structurally sound during removal of existing roofing and installation of new roofing.
 2. If deck surface is gypsum, lightweight concrete or other poured fill over structure below, determine its thickness to substrate below. If tectum or other plank, determine plank thickness.
 3. Determine the levelness/slope of the existing structural deck. Where ponding of water is visible, provide a level survey to determine if there is a structural cause for the ponding. The level survey should be provided by a surveyor based on a grid layout provided by the Consultant. Spot elevations of top of membrane and top of deck will be taken at each grid point.
 4. Perform pullout tests at selected probe locations as further described below.
 5. Inspect the underside of the deck. If material is adhered to underside of deck, consider how they may be impacted during the work, including impacts due to changes in loads that cause flexing in deck.
- 3) If accurate construction details are not available, or if existing blocking will be retained, provide additional construction probes at representative section(s) of fascia, copings, flashings, etc. to determine type and condition of underlying blocking and other substrate materials.
 - 4) Consider additional construction probes to expose concealed masonry in parapets and other conditions to determine the type and quality of the masonry construction.
 - 5) Document results of the Existing Roof Conditions Investigation by showing the locations of probes on existing conditions (removal or demolition) drawings and providing written notes, survey data, graphics, photographs or other information suitable for communicating existing site conditions to the bidders.

F. Pullout Tests:

- 1) If the roofing system is to be mechanically attached to deck, perform pullout tests determine proper fastener specification.
 - a) If underside of deck is exposed in public areas below, consider the visual effect of exposed screws.
 - b) If underside of deck is covered by a suspended ceiling, review as-built documentation and examine the space above the ceiling in representative areas to determine if existing MEP systems, fireproofing, finishes or other materials might be damaged when fasteners are installed.

- c) If material is adhered to underside of deck, consider how they may be impacted by fasteners, including impacts due to changes in loads that cause flexing in deck.
 - 2) If existing roofing system is mechanically attached to deck, perform fastener removal tests determine the risks and feasibility of methods of removing fasteners.
- G. Asbestos and Hazardous Material Testing:
 - 1) Prior to submitting the Schematic Report, perform sampling and testing for asbestos in all existing roofing materials, including underlayment in multiple locations.
 - a) Coordinate sampling with the Existing Roof Conditions Investigation specified in this Directive to identify and test presumed asbestos materials that may be concealed by existing construction.
 - 1. Examine the underside of deck in several locations for overspray of beam fireproofing onto deck.
 - b) Identify and test presumed asbestos materials on the building interior, such as sprayed-on fireproofing, roof leader insulation, etc. that may be disturbed by new roofing work.
 - c) Refer to Directive [1D-6, Asbestos Abatement](#), for asbestos abatement policy.
 - 2) Perform sampling and testing for lead if painted surfaces or other presumed lead containing materials will be disturbed during the work.
 - a) Contact the Fund Coordinator for guidance on testing areas and materials downstream of lead surfaces.
 - b) Refer to Directive [1D-5, Lead Remediation](#), for lead remediation policy.
 - 3) Test existing caulks for PCB content. Contact the Fund Coordinator for guidance on handling PCB caulk.
- H. Field Verification of Existing Skylights, Rooftop Equipment and other Systems to remain.
 - 1) Prior to submitting the Schematic design, evaluate the remaining service life of skylights, hatches, vents, ventilators, exhaust fans, etc. and review options with the Fund and Campus if there is insufficient remaining service life.
 - 2) Test operability of existing air handling equipment, refrigerant based split systems and other mechanical and/or electrical systems at the roof top level. Testing should be done by the Campus or a Campus approved firm when done by extra compensation.
 - 3) If rooftop air handling equipment (air handling unit, exhaust fan) are to be removed and reinstalled, the equipment should have its air flow measured during the design process to establish a performance baseline to compare to when the equipment is

reinstalled. These measurements should be taken at the air inlets and outlets of the equipment.

- 4) If the rooftop equipment are refrigerant based split systems and are planned to be removed and reinstalled, provide a description of the existing system so that the contractor understands refrigerant gas will need to be removed and replaced.

I. Lightning Protection: Test system continuity and ground resistance. Perform a Code analysis to assist the Campus in determining if the system should be maintained. Review the replacement in kind with Campus and obtain its approval prior to including a replacement lightning protection system in the project.

J. Construction Impact Investigation

- 1) Provide representative photo documentation of spaces immediately below the roof deck, including concealed spaces, where materials or debris could be dislodged. Note existing interior water damage due to roof leaks.
 - a) Where required to protect the occupancy (kitchen, hospital spaces, etc.) below the roof work from dust and debris that may be dislodged during the work on the roof above, consider the need for temporary dust control barriers between the underside of deck and the work areas in the occupancy below. Discuss options for temporary dust control barriers with the Campus and include the agreed upon barriers in the design.
- 2) Locate nearby HVAC air intakes, operable windows, and other points where fumes from roofing operations may impact Campus operations.
- 3) Document other special conditions which could impact the re-roofing, such as noise limitations (required by the Campus and local ordinances, if any, where the project is adjacent to off Campus neighbors), quiet times, operating fume hoods, vibration limitations and other constraints required by Campus operations.

III. Other considerations.

A. Removal of existing roofing:

- 1) Normally all existing roofing materials are removed to the deck prior to re-roofing. Do not “encapsulate” asbestos-containing materials.
- 2) Unless verified prior to bidding by the Consultant as suitable for reuse, remove existing wood blocking, cants, and curbs and all associated accessories, hardware and fasteners.
- 3) Remove existing metal roof edges and copings. In historic buildings, metal work in good condition may be retained or carefully removed and re-installed. See [Directive 1C-9, Historic Preservation](#), for policies regarding work on buildings that are more than fifty (50) years old.

- 4) Consider requiring removal of all existing ballast/gravel prior to removing any of the roofing below the ballast. Do not allow stockpiling or temporary storage of ballast on the roof.

B. Specifications

- 1) Comply with Directive [1C-2 Specification of Materials](#).
- 2) Specifications Part 1
 - a) Specify proper storage and protection of roofing and insulation materials at the site and require that any materials exposed to water or snow in any way will be rejected and removed from the site. Any other damaged materials will also be rejected and removed.
 - b) State that unless approved by the Consultant, storage of removed or new materials on the roof shall not be permitted.
 - c) Specify pull out tests of fasteners installed in roof deck that must be submitted with the fastener submittals.
 - d) Specify or refer to other sections that specify temporary facilities and other work required prior to and during the work by this Directive.
 - e) Submittals: require all manufacturer recommended submittals. Require a field seam layout for use during installation. Where ballast or pavers may cover seams, require a field survey of as-built seams and add this survey to *General Requirements Section 01 71 23 Field Engineering*.
 - f) Pre-Roofing Conference: The following paragraph is to be included in the roofing specifications:
 1. "Prior to the beginning of the roofing work, a pre-roofing conference is to be held, attended by the Consultant, the Contractor, the Roofing Installer, a technical representative of the Roofing Manufacturer, the Mechanical Installer, the Campus, and the Fund Coordinator. The purpose of this conference is to review the specifications, drawings, details, application requirements, staging areas, crane set-up locations, storage areas, protection and safety precautions, and what work is to be completed before the roofing operation begins."
 2. The results of this conference are to be submitted in writing to the Fund Coordinator by the Consultant. See the Agenda in Directive 7-2.
 - g) The specification should define the qualifications and role of the manufacturer's technical representative:
 1. Manufacturer's Technical Representative: For each system installed and for each building that may be part of the work, provide on-site services of the manufacturer's technical representative (not a sales

representative who has at least five (5) years' experience with the manufacturer's products) to:

- a. Observe first two (2) days of installation, and
- b. Observe two (2) other non-sequential full days of installation selected by the Consultant; and
- c. If work of other trades may occur after roofing is installed, review the temporary protective coverings for compliance with manufacturer's recommendations, guidelines for best practices;
- d. Inspect completed installations and provide written acceptance for each completed installation; and
- e. Review the post completion infrared scan of the completed roof areas and make a written recommendation on the impact (if any) of the results on the Warranty.
- f. Inspect the work during the acceptance walk of this project with the Contractor, Installer, Campus, Consultant and the Fund.
- g. In addition, after an inspected portion of the system is worked upon in this Contract by other trades or otherwise exposed to damage from the work of other trades, the advisor shall inspect the system again, upon request of the Consultant.
- h. All the above inspections shall be performed and completed prior to issuing any Warranty.

3) Specifications Part 2

- a) Do not specify carbon steel for any exterior application unless it can be specially coated to prevent rust, such as by hot dip galvanizing after fabrication.
- b) Acceptable roofing system type and membrane thickness is subject to Campus approval.
 1. If the existing roof is sound and still covered by a manufacturer's warranty and the work involves modifications to the roof, then require that all materials shall be from / approved by the existing roof system manufacturer. Bind the warranty after the section.
- c) Insulation: Select roof insulation that is compatible with the roofing and structural deck. R-values for insulation calculations shall be industry-accepted standards for "aged" insulation. Insulation, both flat and tapered under an adhered membrane, shall have a minimum of 25 psi compressive strength unless protected with a non-compressible material recommended by the membrane manufacturer.
- d) Blocking: wood used for blocking, roof curbs, or edge conditions shall be selected based on the risk of decay due to moisture. Where risk is high, use pressure-treated lumber with any cuts made after treatment to be coated with the same treatment solution. Review the code requirements for use of wood and specify the code complaint materials required.

- e) Fasteners: All fasteners in pressure treated material shall be stainless steel to limit galvanic action. A separation sheet (ice and water shield) shall be used between any pressure treated blocking and metal decking. Specify compatible fasteners, i.e., copper fasteners to be used at all areas where copper flashings are used.
 - f) Cover Board: Comply with manufacturer and NRCA recommendations.
 - g) Pavers: coordinate with roof drain specification and include bi-level drainage. Do not conceal roof drains under pavers.
- 4) Specifications Part 3:
- a) Do not permit any more existing roofing to be removed than can be replaced and made watertight the same day. The building is not to be left "open" overnight.
 - 1. Require an emergency response plan that is reviewed at the pre-roofing conference.
 - b) Where there is either new deck or existing deck to remain, require a level survey of the top of deck or the vapor barrier/temporary roof installed over the deck.
 - 1. Modify *General Requirements Section 01 71 23 Field Engineering* to include a spot elevation survey. Specify the grid size, other spot elevations, and the timing of the deliverables from the surveyor.
 - 2. Deliverables must be submitted to the Consultant prior to the start of the permanent roofing work. Specify adequate time for the Consultant to review the survey results and, if needed, provide supplementary information showing additional work needed to fill low spots and achieve the minimum slope required by the design.
 - 3. If the Consultant recommends that the Fund provide the surveyor in lieu of the Contractor, the Consultant must prepare and manage a work plan that provides survey work that fits the construction time schedule. See Directive [1C-4 Extra Compensation Authorization](#) for more requirements.
 - c) Where existing roof drains may not provide positive drainage during removals and the Contractor is required to provide an alternative drainage method, require that the Contractor demonstrate that their alternative drainage method will manage the amount of water that may occur during the work period.
 - d) Noxious vapor control: Prior to installing roofing components that create significant odors, shut down ventilation systems adjacent to the work area and seal air intakes with 6-mil polyethylene sheet and battens to prevent intake of vapors.

1. The Consultant must coordinate shut down requirements with Campus personnel and add project specific restrictions to the General Requirements.
 - e) Roof insulation should always be specified to be applied in multiple layers. Specify staggered joints in each layer and the minimum acceptable stagger distance. When the insulation is to be mechanically fastened to the roof deck, explain the procedure for installing fasteners that penetrate decking, repair of any damage to existing work installed below the deck, and the aesthetic treatment of fasteners that will be exposed to view on the underside of the deck.
 - f) Fasteners: In consultation with the manufacturer's technical representative, consider the need to reduce the spacing of fasteners to allow for workmanship omissions that may occur and be concealed before corrective action can be ordered.
 - g) The documents shall state that no roofing work is to be done during inclement weather. Temperature shall be 40°F and rising. No roofing work will be done unless roof deck is completely dry, free from any water, dew, frost, ice or snow.
 - h) For re-roofing projects, specify cleaning of all clamping surfaces, drain bowls, and tailpieces of all existing roof drains. Replace missing or broken drain parts. Replace and lubricate all clamping bolts. Where replacement parts are not available, replace entire drain assembly.
 - i) Specify the flush out all drain lines with water. After completion of all work on roof, the contractor shall demonstrate to the Fund/College that the roof drains are functional.
 - j) In projects where the work of other trades is not under the direction of the roofing installer, specify a minimum level of protective covering at the work areas of the other trades and along the access routes to such work areas. Example:
 1. "After completion of the roofing work and prior to allowing the work of other trades to begin, install protective coverings at the work areas of the other trades and along the access routes to such work areas and extending at least five (5) feet beyond the outer limit of the work areas and access routes. Protective coverings shall be approved by the Consultant and meet the following performance requirements:
 - a. Be able to prevent penetration of the new roof i) by fasteners, metal debris and other hard materials when stepped on by workers; ii) by equipment or tools moved over the roof or dropped upon the roof, or iii) by other impacts caused by the means and methods employed during the work of other trades.

- b. Be able to prevent other damages that may be caused by the means and methods employed during the work of other trades, such as damage due to hot work, incompatible fluids or materials, etc.
 - c. Be continuous and without gaps, holes, seams or other openings that may allow penetrating materials or hazards an alternative route to the roofing work.
 - d. Be able to remain in place during anticipated environmental conditions, working conditions and other conditions that may cause the coverings to shift from their installed locations.”
- k) Consider limiting the amount of patching, which may be required due to damage from other trades after the roofing is installed or due to poor workmanship. Although patching may be watertight, it adds seams and more seams increases the risk of future leaks. See *Section 01 73 29, Cutting and Patching*, of the Fund’s boilerplate General Requirements and modify Part 3 of the roofing specifications to inform the roofing installer that significant roof patching shall be replaced with new work.
- l) Prior to the acceptance walk through with the Campus, require an infra-red inspection like that described in the Fund’s General Requirements *Section 01 32 33 30, Roof Inspection*.
- m) If desired by the Campus, consider adding a physical plaque on the roof memorializing the final roof warranty provided by the manufacturer. Example: Warranty Plaque: The manufacturer shall provide copies of the roof warranty plaque for mounting on the wall beside the roof access hatch. Plaque shall contain the name of the manufacturer, serial number of the warranty, date of issue, length of warranty. The plaque shall be laminated watertight and attached to the wall adjacent to each roof access point. Provide one plaque per roof access door and/or hatch.
- n) Review the need to specify post beneficial occupancy inspections with the Campus.
- 5) Specifications Part 4: The Contractor's Guarantee / Manufacturer's Warranty shown below shall be part of the roof membrane section of the specifications. To provide added emphasis, specify as Part 4 to the standard CSI format:
- 4.01 Guarantee: The Contractor shall guarantee the roof system for 2 years and provide a Manufacturer's 20-year full System Warranty, starting on or after the date of Owner's acceptance of the completed construction work. Guarantee and Warranty shall not be issued until all inspections have been witnessed and signed off by the Consultant. Include all warranty extensions specified in Section 01 78 36 Warranties.*

4.02 Contractor's Guarantee

1. *The Contractor guarantees that the total roofing installation, together with all related composition flashings, plastic flashings, metal flashings, roof insulation, cover boards, substrate boards, any vapor seal, cants, blocking, adhesives and seals installed in connection with same, will be watertight and free from defects as to materials, installation, and/or workmanship, for a period of two (2) years from the date of acceptance of the completed project. Except as otherwise expressly provided herein, provisions of Section 2.25 of Article II of the Agreement apply to this guarantee.*
2. *During the 2-year guarantee period, the Contractor agrees that within 24 hours of receipt of notice from the Fund, he will inspect and make immediate emergency repairs to defects or to leaks in roof system, and that within a reasonable time, he will restore the affected items to the standard of the original specifications.*
3. *All emergency and permanent work during the life of the Contractor's guarantee will be done without cost to the Fund, except in the event it is determined that such leaks were caused by abuse, lightning, hurricane, tornado, hail storm, other unusual climatic phenomena of the elements, or failure of adjacent or related work previously installed by others.*
4. *Any work completed under the contractor's guarantee period shall be coordinated with roofing system manufacturer warrantee so as not to void manufacturers warrantee.*

4.03 Manufacturer's Warranty

1. *In addition to the Contractor's guarantee, the Contractor shall provide the roofing manufacturer's continuous 20-year warranty that the roofing installation will be watertight and free from defects as to materials, installation, and/or workmanship. This warranty shall include vapor barriers, roof insulation, tapered insulation, crickets, substrate boards, cover boards mechanical fasteners, adhesives, roofing plies, mastic, membrane flashings, all metal flashings, wood blocking, cants, and edge strips provided under this Contract. The roofing and insulation shall withstand extended peak gust wind speed coverage up to 90 MPH. This warranty shall be for 20 years for all roofing work, with no requirements for renewal during the 20-year period. Manufacturer shall be required to inspect the roofing system at years 2 (two), 5 (five), ten (ten) and fifteen (15) of the warranty period, and report conditions to the Owner. Such warranty shall commence with the Fund's final acceptance of all work covered under the Contract or at such other date or dates as the Fund may specify in writing prior to that time. The warranty shall not be limited to any dollar value.*

2. *Four (4) copies of manufacturer's warranty shall be provided to the Fund at the time it accepts completion of the project. The form and content of such warranty shall be in accordance with the foregoing and shall be subject to the approval of the Fund. Prior issuing any warranty,*
3. *All field inspections must be completed and signed off in writing by the manufacturer's technical representative, and*
4. *The manufacturer's technical representative must inspect the work during the acceptance walk of this project with the Contractor, Installer, Campus, Consultant and the Fund.*

4.04 *Final Payment: Final Payment will not be made until receipt of properly executed and approved Manufacturer's Warranty.*

C. Drawings

- 1) Provide roof plans at not less than 1/8" per foot scale.
- 2) Show direction and rate of slope to roof drains. Show insulation thickness.
- 3) Show all rooftop-mounted equipment, penetrations, skylights, and other features that interrupt the roof membrane.
- 4) Include relative elevations of roof levels and ground level.
- 5) Show on roof or site plan where the Contractor is to access the roof. Show Contractor's Staging Area and Contract Limit Line.
- 6) Show overall dimensions of contract areas and of sub-sections.
- 7) Identify all roof penetrations and locations where flashing or roof specialties will be required. Include size and geometry info (i.e., plumbing vents, roof drains, equipment curbs, exhaust fans, roof top units, skylights, mechanical lines or conduit supports, antennas, etc.).
- 8) Show walkway pads at points of repeated traffic/wear. Among these, at doorways, around 3 open sides of roof scuttles, top and bottom of ladders between roof levels, pathways of repeated traffic, and around roof-level mechanical equipment requiring monthly (or more often) visits or heavy maintenance.
- 9) Provide complete details for flashings required at all locations of vertical intersections with the roofing system, such as exterior walls, parapet walls, roof edge fascia conditions, gravel stops, skylights, smoke vents, expansion joints, roof drains, and other unique conditions.
 - a) If applicable, details must show pavers, ballast, and other material placed on the membrane and consider their impact on drainage.

- 10) Detail drawings should show the above conditions in a scale not less than 1-1/2" = 1'-0", preferably 3" scale.
- 11) For reroofing projects, include separately drawn details of existing conditions showing extent of removals.
- 12) Show temporary roofing and details that provide for watertight closure. Do defer these details by considering them means and methods to be selected by the Contractor but establish the minimum acceptable temporary closure that reduces the risk of water damage.
 - a) For removals where new work is temporarily tied into existing work to remain, show a detail for the temporary nightly tie-ins between the new and existing roofing.
- 13) Indicate by detail or other means, fastening patterns, requirements and materials for blocking and/or board materials where applicable.

ROOF PROJECT CHECKLIST

Here is a short list of issues that the Consultant must to consider when reviewing the design submission and recommending it to the Fund for review as complete:

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| <ul style="list-style-type: none"> <input type="checkbox"/> Asbestos (use checklist) <input type="checkbox"/> PCB caulk <input type="checkbox"/> Lead coated copper <input type="checkbox"/> Lead paint on steel components <input type="checkbox"/> Code Review <input type="checkbox"/> Compliance with FCNYS chapter 14 <input type="checkbox"/> Fire Code / NFPA 241 <input type="checkbox"/> Core testing <input type="checkbox"/> Curbs and doorways <input type="checkbox"/> Davit Requirement (tie-back) <input type="checkbox"/> Drain capacity and condition <input type="checkbox"/> Do roof field conditions match existing plans? <input type="checkbox"/> Flashing <input type="checkbox"/> Guardrails (roof edge and skylights) <input type="checkbox"/> Height of mechanicals above roof <input type="checkbox"/> Height of roof above grade <input type="checkbox"/> Historic nature of roof <input type="checkbox"/> Lightning Protection (pre-/post- installation) <input type="checkbox"/> Load Capacity <input type="checkbox"/> Maintenance Pads <input type="checkbox"/> Metal Coping <input type="checkbox"/> No Flashing above Existing Weepholes <input type="checkbox"/> Parapet Repair and Reinforcement <input type="checkbox"/> PSI of insulation <input type="checkbox"/> Replacement of Roof Equipment <input type="checkbox"/> Roof Color <input type="checkbox"/> Roof Hatch Dimensions <input type="checkbox"/> Roof Type including green roof | <ul style="list-style-type: none"> <input type="checkbox"/> Seismic Bracing <input type="checkbox"/> Smells/Odors Mitigation <input type="checkbox"/> Staging and Access Areas <input type="checkbox"/> Temporary Covers <input type="checkbox"/> Time of Year <input type="checkbox"/> Underside of Deck Verification <ul style="list-style-type: none"> <input type="checkbox"/> -for fireproofing / overspray (asbestos) <input type="checkbox"/> -for paint (lead?) or other materials that may delaminate during the work <input type="checkbox"/> -for conduit and J-boxes that might be hit with screws <input type="checkbox"/> -for other existing conditions that might be damaged by work above. <input type="checkbox"/> -can occupants below remain in place during the work? <input type="checkbox"/> PESH / OSHA required rails / devices <input type="checkbox"/> Vapor Barrier presence / need <input type="checkbox"/> Presence/need for below roof deck ventilation <input type="checkbox"/> Deck - pull out test / venting <input type="checkbox"/> Structural slope / ponding 24 hours after last rain event? <input type="checkbox"/> Tapered insulation height impact <input type="checkbox"/> Local wind uplift conditions <input type="checkbox"/> Blocking securement <input type="checkbox"/> Energy Code R-Value <input type="checkbox"/> Roof top electrical conduit / fixtures <input type="checkbox"/> Assess MEP equipment conditions <input type="checkbox"/> Warrantee information |
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