Chapter 9 – Design Guides

9.17.1 ROOFING GUIDE

A. GENERAL

1. The OGS Roofing Quality Improvement Team (QIT) is available for assistance on roofing projects. Each Business Unit has a point-of-contact on the QIT, listed below, who should be contacted for assistance and coordination with the Business Unit’s respective client agencies.
   a. Business Unit’s “point-of-contact” to assist with the design and construction of roofing projects: (all contacts have 518 area code)
   b. BU 1: Ron Casso (486-2857), Tom Harrison (402-5660) and Nancy Lendrum (473-4827) (client agency: DCCS)
   c. BU 3: John Morelli (486-2021) and Bruce Wolford (486-1516), (primary client agencies: OGS, A&M, DOT)
   d. BU 4: Jason Phelan (474-0267), Greg McBride (473-9841) and Curt Wilkins (474-0237) (primary client agencies: OMH, MNA, DSP, SAS, CFS, OPWDD)

2. References:
   a. Very good and balanced information can be found at the following independent websites:
      1) NRCA (National Roofing Contractors Association) www.nrca.net
      2) RSI (Roofing Specifier Institute) http://www.rci-online.org
      3) SPRI (Single Ply Roofing Industry) www.spri.org
   b. Manufacturer’s representatives and their respective web sites are a resource for technical information. Below are a few websites:
      1) Carlisle: www.carlisle-syntec.com
      2) Firestone: www.firestonebpco.com
      3) GenFlex: www.genflex.com
      4) Johns Manville: www.jm.com
      5) MBCI: www.mbcicom
      6) Sarnafil: www.sarnafil.com
      7) Siplast: www.siplast.com
      8) Tremco: www.tremcoroofing.com

3. Types of Roofing:
   a. Roofs generally fall into 2 categories; low-slope (slopes at or less than 3:12) and steep-slope (slopes greater than 3:12).
      1) Steep Slope roofing materials are generally asphalt shingles, metal roof panels, clay & concrete tile, wood shakes & shingles, slate and synthetic.
      2) Low Slope roofing materials are generally built-up roofing, modified bitumen, metal panel systems, single ply membranes (such as EPDM, PVC, TPO), spray polyurethane foam (SPF) and liquid-applied systems.

4. Roof System:
   a. The roof system is a system in the true sense of the term:
1) Decks: The two most common decks in state-owned buildings are Concrete Decks and Steel Decks. Wood and Gypsum decks are also used, but to a lesser degree. Generally we adhere insulation and membranes to concrete decks, and we either adhere or mechanically fasten insulation to steel decks. It is important to consider U.L. Wind uplift requirements such as the fastener spacing of insulation on steel decks. Fire resistance ratings must be considered, especially on steel decks, and materials used must be tested in conjunction with the type of structural roof deck and roof slope applicable to the project and have achieved an Underwriters Laboratories Class A external fire resistance rating.

2) Vapor Retarders: Vapor Retarders can be classified into 2 categories: Bituminous vapor retarder membranes and non-bituminous vapor retarder membranes. Bituminous vapor retarders are the most commonly used type of vapor retarder. The most common is 2-ply glass-fiber sheets applied in hot steep asphalt. Non-bituminous vapor retarders are plastic sheets or kraft paper or laminates, but these are rarely used.

3) Insulation: The predominately used insulation in roofing is Isocyanurate rigid insulation (Iso). This is because it has a relatively stable LTTR R-value of 6 per inch – about the highest for any common rigid insulation, has good compressive strength and is easy to use. Iso also has good dimensional stability, good attachment capability, and is compatible with nearly all roofing systems. Iso can be adhesively or mechanically attached depending on the system, conditions and deck type. Other insulation types used to a lesser degree are Expanded Polystyrene insulation board, with an LTTR of around 4.25 per inch, and Extruded Polystyrene insulation board with a similar LTTR. Insulation should be installed in at least 2 layers (staggered) to avoid thermal loss through the joints of the boards. Tapered Insulation is utilized to accomplish slope for positive drainage when required.

4) Coverboard: Although some manufacturers don’t require coverboards, it is the office standard to use a coverboard over all insulations. It is also recommended by the National Roofing Contractor’s Association (NRCA) to use a coverboard over insulations. Materials most often used are ¼” or ½” glass mat-faced gypsum board panels (the office recommendation) and to a lesser degree ½” or ¾” wood fiberboard or glass fibrous boards.

5) Membrane: The choice of membranes is dictated after a number of criteria have been considered, including:
   a) client request
   b) type of roof deck and construction
   c) slope and drainage requirements
   d) anticipated rooftop traffic and impact resistance
   e) building height, configuration and location
   f) compatibility with existing materials
   g) odors, noise, dust which may impact building occupants or hvac systems.
B. SUSTAINABLE ROOFING GUIDELINES (also refer to Chapter 9.17.1.1 )

1. Although Executive Order 111 has been repealed, the principles of green design should be incorporated when possible. These measures may be based on LEED credits, such as reduction of heat island effect, optimizing energy performance, using recycled content and/or regional products, and recycling construction waste. Sustainable roofs fall under two categories: “cool” (or light-colored) roofs and vegetative roofs. Both have the ability to reduce energy consumption in buildings as well as reduce the urban heat island effect.

2. Cool Roofs: The benefits associated with cool roofs include reduced building heat gain and annual air-conditioning energy use; extended service life of roofs by reflecting ultraviolet and infrared radiation and modulating temperature differentials; improved thermal comfort when there is no air-conditioning; and reduced air pollution and greenhouse gas emissions.
   a. Existing Roofs: Since reflectance and emissivity are only surface properties, almost any existing roof type can be made cool by making the surface white or light-colored. To retrofit an existing roof to a cool system, ensure that the coating or membrane is compatible with the roofing and match its mechanical properties by checking with the manufacturer.
   b. New Roofs:
      1) Single-Ply Membrane Roofing is made of synthetic waterproof material with the color integral to the sheet. White and other colors are available to meet desirable SRI (Solar reflectance index) criteria.
      2) Metal Roofing: Uncoated metal roofing typically has high reflectance and low emittance. For a new roof select a color to meet the EPA Energy Star minimum reflectance values. Metal roofing with recycled content is readily available and preferable.
      3) White or reflective aggregate or granules on modified bitumen: Check SRI to meet LEED requirements for reflectance.

3. Vegetative Roofs: The two main types of vegetative roofs are extensive and intensive. The benefits associated vegetative roofs include:
   a) Control of rainfall runoff.
   b) Moderation of heat and cold transfer into a building.
   c) Improvement of air quality and combating heat island effect.
   d) Extending life of roof by protection of membrane.
   e) Longer life span than traditional roofs.
   f) Sound absorption

4. Recycling Old Roofs: It is possible to recycle insulation, ballast, metal trim and other roofing components within New York State. A common use for
recycled and scrap asphalt shingles is in hot-mix asphalt pavement. Empire State Development has a recycling markets database for locating recyclers by county, zip code or state. The database can be found at this website: http://appcenter1.esd.ny.gov/IESDRecyclingMarkets/

C. SPECIFICATIONS

1. Sections: Roofing specification sections can be found in Division 7 – Thermal and Moisture Protection. The following sections are the more commonly used sections and are found in DesignAndContruc/Common/MasterSpec04, or on the OGS website, Design and Construction Services/General Information/Master Specifications.
   a. 073113 Asphalt Shingle Roof System
   b. 074113 Preformed Metal Roofing System
   c. 075100 Built-Up Bituminous Roofing System
   d. 075216 SBS Modified Bitumen Roofing System
   e. 075323 Adhered EPDM Roofing System
   f. 075417 Adhered PVC Roofing System
   g. 076000 Flashing and Trim

2. Related Sections: Other sections commonly used in conjunction with a roof project include:
   a. 028213 Asbestos Abatement
   b. 061053 Wood Nailers and Blocking
   c. 079200 Joint Sealers
   d. 040121 Masonry Restoration (used when walls, copings and parapets may contribute to leaks and are in need of repair).

3. In many cases, the yellow highlighted text will advise as to what type of system or what manufacturers etc. can or should be used. Remember, when finished editing a section; DELETE all yellow highlighted text.

D. DRAWINGS

1. Roofing projects need to use the standard drawing layouts that are found in Chapter 5 of the OGS Design Procedures Manual.

2. Drawing titles should reflect the roofing system being used – for instance:
   a. Provide Adhered EPDM Roof System.
   b. Provide SBS Modified Bitumen Roof System.
   c. Provide Asphalt Shingle Roof.

3. Drawings generally include:
   b. Notes: Notes explaining the removal of the existing roof system (be aware of possible asbestos containing materials in existing built-up roofs, flashings and asphalt vapor barriers). Notes should also state special conditions and a
description of the roofing system being used. Be specific to thickness of insulation and type, coverboards, membranes, flashings, etc.

c. Details: AutoCad details can be found in: DesignAndContruc/Common/CaddDetails/07-Thermal. Under this section, details are broken into roofing type, such as EPDM, PVC, Built-Up, Shingle, Metal Roofing and Modified Bitumen Roofing.
   1) Edit details to accurately describe conditions found in your project.

d. It is very important to alert the contractor to special conditions such as:
   1) Height of building (especially high rises).
   2) Number of roof levels.
   3) Areas of asbestos containing material.
   4) Access to and around the building.
   5) Penetrations.

e. It is also a good idea to include digital photographs of existing conditions – especially difficult or unique conditions.

E. DESIGN PROCEDURE

1. Information:
   a. A large number of OGS projects are replacement of existing roofs. Exact procedures may vary between business units, but below is a typical guide.
   b. After a request for a project is received, retrieve all pertinent roofing and structural drawings from OGS Plan File on the 32ND floor of the Tower Building or look for existing drawings in the V Drive/Design and Construction/Plan File/Client/Facility. It is important to confirm if there is slope built into the deck or tapered insulation will be required.

2. Site Visit:
   a. Visit the site to ascertain existing conditions. Use the existing drawings to confirm or update current conditions. Bring a tape measure and a camera. OGS form BDC 45, Roofing Design Checklist should be used to document existing conditions. This form is found in DCNet/Forms/Division of Design Forms and on the OGS website, Design and Construction Services/General Information/Forms.
   b. If a roof appears to be in “good” condition, or is not that old (roughly less than 8-10 years for single plies and 12-15 years for built-up roofs; an infrared survey could be requested to determine if water penetrated the roof system and if the insulation is wet. Findings can dictate repair or replacement as options.
   c. On metal deck buildings, check the condition of the decking – especially if the roof has been identified as previously leaking.
   d. Check the general appearance of the roof. Look for signs of ponding, poor attachment, vegetation, thinning of the single ply membrane, bare spots on aggregate surface roofs, etc.
   e. Pay attention to the water tightness of copings, flashings, windows, staining of the masonry or interior surfaces, rusting, cracks, movement signs in the masonry (parapets, etc.).
   f. When replacing a roof, the existing roof system is generally removed down to the vapor retarder on concrete decks. This is due to the difficulty of removing it,
and then the vapor barrier is repaired. Test for asbestos in the vapor retarder and other suspect materials of the roof system. On steel and wood decks the existing vapor retarder is removed and replaced with an underlayment board. After the vapor barrier is repaired or replaced, insulation, coverboard, and a new membrane is added to become a system as stated previously. Some roofs can be repaired or coated to provide a longer life span (OGS does not usually do this – but it can be done). Metal roofs are one type of roof that can be prepared and coated with an elastomeric coating with good results. The coatings come in many colors, or to match the existing (i.e. – patina green for old copper roofs) and are found in specification section 075601. Built-up roofs can be repaired by cutting out wet insulation, providing membrane and flood coating – this procedure is found in specification section 070160. As stated above, we generally replace not repair roofs, but consider all options.

g. For roofing projects on occupied buildings, consider the impact of re-roofing activities and air intakes on building occupants regarding odors, fumes, noise and dust. Also consider the impact of fumes from exhaust fans on roofing contractors. Discuss this in advance with the client agency and the OGS Engineer-in-Charge.

h. Insulation requirements of current energy codes usually raise the height of the roof. It is important to determine if this will have an impact on existing flashings (usually required to be a minimum 8” above the roof) and existing weeps.

3. Codes:

a. NYS Building Code Requirements:

1) Structural Engineers must be involved early in the design process to determine structural requirements! All new buildings and all existing buildings where the loads might be different (such as adding more insulation) must have structural evaluations.

2) Designers must comply with the NYS Building Codes. Chapter 15, Roof Assemblies and Rooftop Structures, contains requirements such as performance requirements, fire classifications, materials, coverings, insulation, etc. Designers must also include requirements based on Chapter 16, Structural Design, such as: wind, snow, seismic, live and dead loads. Roof drawings need to include this Design Data table.
This data is required by code, and must be coordinated with the structural engineer. This form should be placed on the roof plan drawing. Delete the seismic data if not required by code, and as recommended by the structural engineer.
b. NYS Energy Conservation Construction Code requirements.
   1) To determine the appropriate R-Value for your project: Start with the 2010 NYS Energy Code Chapter 3 to determine County and Zone. For commercial construction use the tables in Chapter 5 to identify the R-Value.

c. Structural Requirements:
   1) **For new construction:** follow Structural requirements as outlined in the applicable chapters of the Building Code of NYS.
   2) **For reroofing projects:** follow Structural requirements of the Existing Building Code of NYS.

d. P1107 Secondary (Emergency) Roof Drains (New Construction):

   **§P1107.1 Secondary drainage required.** Secondary (emergency) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason.

   **§P1107.2 Separate systems required.** Secondary roof drain systems shall have the end point of discharge separate from the primary system. Discharge shall be above grade, in a location which would normally be observed by the building occupants or maintenance personnel.

   **§P1107.3 Sizing of secondary drains.** Secondary (emergency) roof drain systems shall be sized in accordance with Section 1106 based on the rainfall rate for which the primary system is sized in Tables 1106.2, 1106.3 and 1106.6 by two. Scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1101.7. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when sizing the secondary roof drain system.

e. Wind/Snow Loading Requirements: See structural engineer for evaluation.

f. Coordinate with OGS Team Leader for OGS D&C Code Bulletins.

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