5th WALL
BUILDING DIAGNOSTICS CONSULTANTS

Brief synopsis of Green Roofs and Cool Roofs

Green Roofs

A green roof is one which is partially or completely covered with vegetation and a growing medium, which is installed over a waterproofing membrane. A green roof may also include additional items such as root barriers, insulation, and drainage mat or board, and irrigation systems. Green roofs serve a number of purposes with rainwater control (reduced stormwater runoff), energy reduction, and mitigation of "heat island effect" being of significant importance. Other purposes include increased insulation, creation of habitat for wildlife, filtration of pollutants, sound mitigation, and providing a more aesthetically pleasing landscape particularly for locations where a rooftop can be easily viewed.

There are two types of green roof systems - intensive and extensive as noted below.

Intensive

- typical growth media depths greater than 6 inches
- able support a wide variety of plants to include shrubs and trees – generally 75 to 150 pounds per square foot of vegetation
- sometimes accessible to the public
- heavy
- expensive to maintain – requires irrigation, feeding, and other maintenance
- less common type

Extensive

- typical growth media depths of 3 inches to 6 inches
- supports herbaceous groundcover plants with sedums and grasses being the most common – generally 10 to 25 pounds of vegetation per square foot
- generally not accessible to the public
- lighter
- requires less maintenance – generally designed to be virtually self-sustaining
- most common type

Both types are typically used on low slope (1/4" per foot) roofs. However, with appropriate modifications, roofs with steeper slopes can be utilized. Both types require suitable substrates for support.

<u>Cautions</u>

Although a green roof can provide a number of benefits, there are several items that must be addressed and/or taken into consideration

- Requires suitable structural capacity
  - ◊ A minimum of 60 lbs per square foot for intensive systems
  - ◊ 180 lbs or more per square foot for extensive systems depending on depth of growth media and types of plantings to be supported
- Requires moisture
- Must allow for evacuation of excess moisture
- Plant maintenance

Cost/Financial Benefit

Upfront costs can be expensive approaching $25 to $30 per square foot or more for an extensive system depending on types of components, allowances for drainage/water retention, and plant type. Intensive systems can exceed $200 per square foot. Structural modifications, if needed, can add significantly to upfront costs.

Green roofing can extend the life of the underlying membrane (waterproofing membrane) significantly – at least 200%. And, when replacement becomes necessary, the cost can be anticipated at approximately 1/3 of the initial installation cost as most of the original materials can be salvaged.

Reduction in energy usage can also be anticipated as green roofing aids in retention of heat during cooler months while absorbing and reflecting solar radiation during warmer months.

Note: Orange County does not currently have a green roof in place on any of its facilities.

Cool Roofs

A cool roof is one which incorporates materials that have high thermal emittance and solar reflectivity values, are generally light in color, and result in substantial reductions in energy usage when cooling loads are needed.

Primary advantages of cool roofs are reduced energy usage during warmer months, reduced air pollution, and mitigation of "heat island effect."

Nearly all roof types, including "tar and gravel" and shingles can be broadly classified as "cool" including conventional multiple ply built-up membrane. However, cool roofs are most commonly associated with single ply membrane systems generally found on low slope (1/4" per foot) roofs.

Common types of Cool Roof

- Conventional multiple ply built-up membrane
- Polymer modified bituminous membrane
- Single ply membrane

Composition of Cool Roof includes

- Surfacing
  - Conventional multiple ply built-up systems
    - Aggregate
    - Coatings
      - Fibered aluminum
      - Fluid-applied
    - Granules
  - Polymer modified bituminous membrane
    - Granules
    - Coatings
      - Fibered aluminum
      - Fluid-applied
  - Single ply membrane
    - None
- Insulation
- Suitable substrate

Cautions:

- Membrane degradation – good quality membranes are highly recommended
- Maintenance - cool roofs should occasionally be washed to maintain reflectivity
- Maintenance required to assure longest possible useful life

Cost/Financial Benefit

Upfront costs typically range from approximately $7 to $12 per square foot depending on types of components, method of attachment, thermal requirements, allowances for drainage, allowances for wind resistance, and perimeter restraint.

Cool roofs have a high solar reflectance compared to conventional, dark-colored roofs. Roofs with high solar reflectance reflect more solar radiation (ultraviolet, visible, and/or infrared) than conventional roofs and therefore stay significantly cooler. Because the surface temperature of a cool roof is lower than that of a conventional roof, less heat is transferred to the building below and to the surrounding areas. A building with a cool roof requires less energy for cooling in the summer but can require more energy for heating in the winter. Factors that minimize this heating penalty include less intense solar radiation during the winter due to lower sun position, shorter days, increased cloud coverage, the potential for winter snow coverage, and the fact that peak demand for heating occurs after the sun goes down, which is when conventional and cool roofs return to roughly the same temperature.

A primary benefit of a cool roof is substantially reduced energy cost for cooling in the warmer months. Cost savings can be significant (20% or more) depending on region, thermal requirements, and membrane reflectivity.

Note: Orange County has several cool roofs in place on its facilities.

Additional information on Green Roofs and Cool Roofs is available from a number of sources including

Cool Roofing Council	www.coolroof.org
US Green Building Council	www.usgbc.org
Energy Star	www.energystar.gov
National Roofing Contractors Association	www.nrca.net