

GREEN ROOFS

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History

1950's – replace destroyed landscape

1970's – oil embargo, energy efficiency (higher roof R factor)

1980's – Life cycle cost – roof replacement cost avoidance

1990's – Storm water control

2000's – Heat island – higher storm water temperatures ecological impact

Types of Systems

Intensive – heavy, thick (12" or so) soil needing structural support

Extensive – started in Germany (in 1970's FLL developed standards), thin (up to several inches), light, no soil

How to Apply

Tray

Roll Out

Modified Layer System

Local Projects

Older – Hubert Humphrey Institute and U of M Architect Building used 12" to 15" deep top soil, modified intensive system with goal of energy savings. Loading and leakage was an issue.

New – Minneapolis Library using an extensive system

Why?

- During the last century, the average temperature in Minneapolis increased from 43.9F to 44.9F, mostly since 1961
- The river and lake ice cover seasons has shortened by approximately two weeks
- Precipitation has increased in the state, including the Twin City metro area by 20%
- The larger rain events occur more often

EXTENSIVE SYTEMS

- 1 week rain event is an average of 1.25". The typical 2.5" green roof is designed to contain this. A storm water system is still needed for the greater than 1.25" rain event.
- Slower discharge into water systems, allows the storm water to be filtered and cooled
- Plants about 18" tall (Perennial type) – life expectancy of 50 to 100 years
- Minimal maintenance
 - o Cut grass
 - o Replace dead plants
 - o Remove tree seedlings
- Designed for 5 to 6 passes per year
- Roof loading
 - o Thinnest system about 9#/sq ft – gravel roof designs see 10#/sq ft minimum to 25#/sq ft
 - o For a typical system about \$1.0 to \$1.5 per sq ft additional structural costs
- 90F ambient day, gravel roof ranges from 120F to 140F, asphalt up to 170F – green roof about 94F
- Up to 1/3 pitch, but Peter like more of a 1/2 maximum pitch
- Irrigation needed for first 2 years to establish plant root system
 - o Small roofs – water systems
 - o Large roofs – integrated weep system (better option, promotes roots to “grow” towards water, deeper root system)
 - o Plants need 1" of water per week (June, July, August)
- Leakage detection
- Benefits
 - o Rain water containment
 - o Lower storm water temperatures
 - o Higher roof insulation factor
 - R19 versus R40
 - Reduce HVAC load by 35%, HVAC system size reduction by 30%
 - o Roof lasts longer – typical roof replaced 2 or 3 times before “green” roof replaced
 - o Sound insulation
 - o Improves air quality
 - o Aesthetic improvement
- Disadvantages
 - o Potentially higher construction costs
 - o Potentially higher initial maintenance costs

How To Pay For The Green Roof?

1. Building total construction costs
 - a. Lower roof insulation costs
 - b. Lower HVAC costs
2. Life cycle cost
 - a. Lower energy usage (lower kW draw from smaller HVAC system and better roof insulation)
3. Rebates/operating charges
 - a. Xcel rebate program
 - b. Local municipal – lower storm water charges