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A Salad from the Roof

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GREEN ROOFS REDUCE THE HEAT ESCAPING THRU THE ROOF

As with many of the new “green” innovations like collecting water off your roof, does anyone remember the cistern that sits in the basement of most century homes or the Roman method of pooling water on a roof for a hot water supply, the use of a roof and its benefits are now coming to the forefront. Properly positioned and angled roof assemblies can greatly assist in solar PV and hot water systems and their efficiency.

Green Roof Technology is one of the more recent environmental applications that are now being considered. In fact, utilizing a roof goes back to the 7th century. The hanging garden of Babylon was a structure built by the King of Babylon. It is widely known the sod roofs of Europe, specifically in Scandinavia were used to insulate their homes. These buildings were commonly built of hand drawn timbers that were able to bear this enormous weight. In fact there is a UNESCO Heritage site in Newfoundland that has a sod roof. The use of green roof technology entered a long phase where only a few “green folks” utilized the limited technology, mainly by the use of potted plants or garden boxes. A few buildings did try the green roof concept, the Rockefeller Centre was built in 1937 and this building utilized an idea similar to the Babylon Gardens. The first major step forward was in Germany when in the '70's they began work on lightweight applications of sod roof coverings. This coincided with the introduction of heavy rubber membranes for roof coverings; the first major project was the O'Hare Airport in Chicago in the 60's. Coincidentally, Chicago also has the largest number of green roof buildings in

the USA. The Germans continued to move forward on developing this technology to the point where today they have over 13 million square meters of roofs covered in plants and gardens.

So why the sudden interest in green roof technology in Canada? In one sentence: green roofs reduce the heat escaping thru the roof which reduces the level of energy needed for heating and cooling the building. The vast majority of urban buildings can benefit from shading the roof; this translates into considerable energy savings. There are other benefits too, like improving the air quality in a city, the “concrete jungle” of most cities can capture heat, known as the urban heat island effect and in most cases this can add up to an air temperature that is 5 degrees C greater than in the country. This adds considerably to the cost of air conditioning a city building. A green roof can actually extend the life span of the rubber membrane under the gardens by protecting it from the UV rays of the sun. Discharge of rain water from the roof is greatly reduced and what does come off the roof is a lot



cleaner. This dramatically reduces the volume of water entering the storm drains which could in time help reduce some localized flooding.

A lot of large metropolitan regions all across

NATIVE GRASS AND SHRUBS

North America are taking a hard look at what has gone on in Chicago and the fact the European Cities are at least ten years ahead of us in this technology. Closer to home the City of Toronto has seen the green roof light and after January 30th, 2010 every building over six stories must have at least 50% of its roof in a green covering. This is the first North American city to introduce a bylaw for green roof technology. The city of Toronto is leading the way however, they plan to unveil a green roof on city hall by October of this year. The developers in **Toronto are seeing red...not green and the green they are facing is called dollars.** It is estimated that a green roof costs anywhere from 20-30.00 per square foot plus the annual maintenance. Installing a green roof requires planning, in some cases the actual building structure must be strengthened to allow the complex system of waterproofing and drainage along with the soil base that goes with this technology. The plus side is there are hundreds of these buildings already in use all over the world, mainly in Germany where their climate is not much different than ours.

There are different types of green roofs that range from a grass covering to a roof top park with social infrastructure. One **development in Toronto that's being built by Liberty is the Thornhill City Complex.** The roof on this condominium building will hold barbeque areas and herb gardens for the condo-owners. For the near future this type of green roof will be rare however, the cost is prohibitive. The majority will be native grass and shrubs that will require little or no ongoing maintenance.

One area that has not been mentioned is the use of a green roof as a habitat for ground nesting birds. One project in Vancouver found that goose had set up a nest colony on the green roof. This can serve as a safe habitat for some birds, away from their four-legged predators. In time as the idea of a roof garden

catches hold we will find as they have in Europe that a green roof has multiple benefits. Hospitals could use this as a quiet area for recovering patients, open space for day care or meetings and the potential for rooftop vegetable gardens, that salad may not be as far fetched as you think!

Next week in this three part series we will look into the different kinds of green roof installations and the last part will take us on site with a green roof owner as they describe the effort they put into their green roof.

GREEN ROOFS 101

Less than a month ago in Minneapolis Minnesota they began the 5th largest green roof in North America. The city owned Target Center roof covers two and half acres. This roof will utilize over 900 rolls of pre-grown vegetation matt's, over 540 cubic yards of soil which is being pumped up over 120 feet in the air by a blower truck, over 11,000 miles of irrigation pipe and they are attempting to complete this green roof by using almost 100% recycled materials. It includes a leak detection system called the Electra Field Mapping System. This 113,000 square foot roof is expected have a dramatic effect on the sheer volume of storm water that casts off this roof uncontrollably into the nearby Mississippi River. You have to congratulate the city for this kind of progressive thinking.

Last week we looked at some background in the development of green roofs. This week we look at the possibility of installing one. The first myth to dispel is a green roof does not have to be a flat roof. I am aware of one company that has a clip system to hold the trays or growing medium in place that can be installed on a roof with a 7/12 pitch/slope. There are hundreds of green roofs on houses all over Europe that are low pitch



“EXTENSIVE” OR “INTENSIVE” SYSTEMS

gable style. In fact with continuing development of waterproof membranes I have to wonder why we build anything today with a pitched roof. One of the better web sites I discovered as we researched this series is www.roofscapes.com. They go into simple explanations of the different kinds of actual green roof assemblies and offer a selection of ideas for roof coverings.



The first thing to consider is **“why are you looking at a green roof?”** They are not cheap and if you intend to install one on an existing building I strongly recommend you have a civil engineer give your building a structural review. Most people look at a green roof as an **“out on the edge”** environmental installation when in fact it's far from it. **Storm water management and collection**, improved air quality, decreased noise levels and habitat for birds and insects are a few benefits. The reduction in heating and cooling costs for a building are substantial and the life span of a rubber membrane roof can be increased at least 50%. One study I read said it could conceivably double the average life span of a membrane roof. As with most things to do with the environment you must look past the initial cost and look at the extended value cost of lifespan and annual operation, then add in the GHG reduction values you have attained.

There are two generally accepted types of green roof systems. They are known as **“extensive”** or **“intensive”** systems. The extensive green roof is probably the most widely used as it can often be established on a roof without any additional structural improvements. This is the type used for any roof with a slope. Once the roof vegetation is established, generally after the first year, they require little or no maintenance and have a **long life span**. They usually **don't require irrigation and drainage** is often present in an existing building. You can leave the vegetation to grow naturally which keeps the maintenance and initial costs down to a reasonable level. The soil depth is anywhere from an inch to no more than six inches. This **“soil”** is actually different layers of sand/gravel/leca/peat/organic matter and some soil, usually dictated by the plants to be used. Depending upon the soil depth this can add from 15-50 pounds per square foot to your roof load. The plant selection is limited to native grasses and some local plants and small shrubs if you go to the thicker soil levels. This type of roof can handle

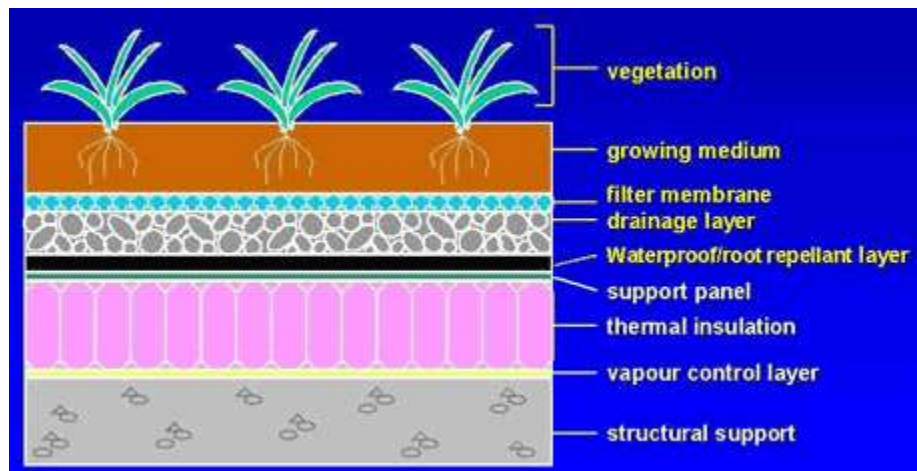
most weather conditions, especially high winds. Average costs for this type of roof if designed in with a new building is in the 20.00-30.00 per square foot range.

The intensive green roof is just that, intensive. It is however the most pleasing to the eye, often blended with other features like sitting areas or a patio section and commonly have a greater diversity of plants and shrubs. It has the best insulation properties of the two systems, mainly due to the design and level of soils which can range from 6 inches to nearly two feet. Greater energy efficiency and higher storm water retention are other benefits along with longer membrane life. This type of roof creates a garden, one that is secure from outsiders and beyond four legged predators. While the extensive roof is plain and not useable by the building owner, the intensive roof does come with additional costs. Few existing buildings are capable of this



weight load. Installation of irrigation systems and proper drainage are a must. There will be higher maintenance costs, watering and plant replacement. If you are considering this type of roof I suggest you sit down with a reputable landscape architect to discuss the design and plant selection. Installation costs here often reach over \$50.00 per square foot and one condominium building in Chicago spent over a \$100.00 per square foot.

The vast majority of green roofs are based upon the extensive green roof concept. The energy savings are substantial, the cost of roof replacement is extended well past the time when an open roof needs to be replaced and tests have shown a roof with a 5 inch soil base can drop the exterior sound levels dramatically. One European study I read noted that there was even reduced fire spread due to the fact a green roof is damp. Next week we report on our trek to visit a couple of existing green roof installations.



NOW ELEVEN YEARS OLD AND THRIVING

GRASS ROOTS IN THE SKY!!

This is the third in our series on Green Roofs and this week we venture into the backwoods of Frontenac County and the Urban Jungle of Toronto. Located south of Westport Ontario is a unique building that has been assembled within the past couple of years by Dr Rena Uptis and her platinum cast of Directors who have opened a self sustaining lodge for development of environmental education and the studio arts.



When I arrived at Wintergreen Studios to meet Dr Rena Uptis and inspect their roof I was impressed by the tranquility of the setting. Rena sat down and described the efforts they have put into this relatively new roof. The main building is **timber frame with straw bale infill. The actual rafters are sawn 4" x 8" timbers equally spaced and covered in 2" x 6" butt faced planking.** The roof was assembled at a 1/12 pitch, arriving at an estimated 70 lb sq ft load rating. A metal drip edge was then installed. Then they laid a complete rubber membrane covering over the entire roof. Rena commented that they bought the heaviest artificial pond liner they could find and sealed it to the roof. Next, the foam insulation board designed to protect the rubber membrane was installed. PVC pipe was cut in half and forms drainage from the stone layer poured over a 6 mill plastic liner, then they secured a product called colbond. This is a recycled product manufactured as a drainage layer that helps bond the roof soils and vegetation. On top of this they began with straw and nine inches of soil of which they packed 3 ½ inches and loose filled 5 ½ inches of soil.

We then took a visit onto the green roof as Rena continued to describe the effort that they put into the actual planting, which was nothing! This is a unique method, they have allowed the natural growth found in the soil and the wind cast seed to become the growth cover of this roof. There are still open areas but considering the roof is barely over a year old it has done remarkably well. Rena walked all over the roof and it was clearly in a compacted state with very little evidence of wind effect erosion, considering its age and cover. This lodge is a remark-

able structure with numerous eco-conscious features. We are going to return and do a feature on the Wintergreen building.

Our next stop is the green roof at Mountain Equipment Co-op on King Street in Toronto. This is one of the oldest commercial green roof installations in Canada. We were met by David Robinson, the Sustainability Co-ordinator for the Co-op. David took a few minutes to describe their building and how they built it with the environment in mind, in downtown Toronto no less! This building was assembled in 1998 using 55% recycled materials. The wood frame for the skylight came from the former Marconi Building in Montreal, the walls and roof are insulated with 50% recycled rockwool, the interior stairs are recycled steel and the concrete pillars contain slag from the mines in Sudbury. Their latest store in Montreal has a 95% recycled content.

David then took us to the second floor and a ladder to the roof. When you set foot on the roof, the sheer size of the 10,000 square foot green roof is impressive. It was developed with a prairie environment theme to make it an extensive green roof system, all be it a mature one. They laid a green roof **underlayment called the "Sopranature" system and then planted** the entire roof with indigenous meadow plants, flowers and grasses that require limited watering. If you want more information go to www.soprema.ca. They estimate that the green roof captures 75% of the rain and the balance was allowed to drain off until recently when they installed a rainwater recovery system that now returns this water to the roof for mist irrigation. This mist system operates for 20 minutes at 5:00 AM to get maximum value from the water.

David then showed us a smaller green roof that they are **evaluating. Called the "Xeroflor" system, it is an answer to** anyone with limitations to their structure. This thin system allows low growth plants to mesh with this drain material. David told us one of their staff members had a sunroom that was either too hot or too cold to use on a constant basis. They installed this lightweight precultivated moss-sedum vegetation blanket and it balanced the temperature in the room dramatically. The actual depth of this type of green roof with the water and drain layer can start at just over 2 inches. If you go to www.xeroflor.ca this is an excellent web site describing the materials used on this sample green roof.



The main green roof is now eleven years old and thriving with minimal maintenance. David stated that not only does this

roof help offset the CO2 generation, it helps reduce their heating bills too. This building was awarded a Certificate in Environmental Excellence in 2005 by BOMA Toronto.

I would like to express my "Thanks" to Rena Upitis at Wintergreen and David Robinson from Mountain Equipment Co-op for taking their valuable time to explain and show us their green roof installations. The 3 million members of this Co-op are to be congratulated for having the foresight over ten years ago to build a store with eco-responsible ideas that are now becoming a popular building innovation. One quote I got from Wintergreen by John Muir was timely

When one tugs at a single thing in nature, he finds it attached to the rest of the world

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