Technological Benefits of Green Roof Tray and Built Up Systems

By James Lenhart and Timothy Nash. 2011

This comparison is based on general features of type of technology and not specific to any one technology as there are, in many cases, substantial differences within each technology. This comparison is not intended to demonstrate the one technology is better than the other, rather to demonstrate that each one has advantages over the other and should be used where appropriate. In fact, in many case combinations of trays and built up system provide the best solution.

Category	Tray	Built Up
Stormwater Management	Trays can be designed to address specific stormwater management issues. As regulations increase to encompass Low Impact Development (LID) techniques, green roofs as a component of site stormwater management will become more important.	Tend to be more passive in managing stormwater runoff.
Retention	Trays can retain more water due to the physical barrier which prevents or restricts later flow thereby reducing annual runoff volume and irrigation demand.	Retain mostly gravitational water. Water retention on sloped roofs is reduced since there is no barrier to prevent lateral flow.
Detention	Can be designed to detain runoff to reduce peak flows as part of an LID component.	Reduces peak flow on more of a passive scale by freely draining at field capacity
Evapotranspiration	More a function of the planting and soil media. However gas transfer from underneath and along the sides can increase water vapor transport however trays can restrict moisture transfer from one tray to the next.	More of a function of the planting provides for a more uniform soil moisture distribution. In many cases lack of free water storage will decrease available water and increase the need for irrigation.
Slope	On sloped roofs prevent lateral flow to increase retained water. Often increased resistance to sliding or sloughing.	Sloped roofs will cause lateral flow thus reducing retained water and detained water. Also susceptibility to sloughing and

		sliding.
Category	**Tray**	**Built Up**
Cost (assuming a comparable media depth)	Cost is variable depending on method of installation and the depth of the system. Sometimes more expensive than an equivalent built up system and sometimes less.	Generally perceived as less expensive. However this may be because of reduced depth of media.
Design Flexibility	Less flexible on the design depth of the system and requires a hybrid approach with a built up systems to accommodate nooks, crannies and curves. Depending on planting methods, some trays allow for "artistic" shapes and patterns of the planting	More variation in planting depth, albeit (sometimes leads to thin low cost profiles that can quickly fail) Easily cut to accommodate curves, nooks and crannies. Depending on planting methods allows for "artistic" shapes and patterns of the planting.
Ease of Layout		
Irrigation	Some provide anchoring points to fix irrigation lines. Reduces snagging and wind impacts	Irrigation lines typically placed over surface without substantive anchoring.
Wind	Wind uplift can be an issue unless trays are anchored individually, interlocking or surcharged with soil and plants	Generally thought to be OK except be cautious of edge effects which can unravel a continuous section. Uplift becomes blanket like.
Fire	More of a function of the material from which the tray is made, the soil and plant type	More of a function of the material from which the layers are made from, the soil and plant type
Weights	Can be lighter weight than the Built up alternative, depends on the type of tray. However the biggest influence on weight is the media, moisture content and plant density	Can be lighter weight than the tray alternative, depends on the type of tray and built up profile. However the biggest influence on weight is the media, moisture content and plant density
Roof Longevity	Depending on design offers a "hard interface" with the roof membrane to allow for free drainage and reduced moisture contact. The hard interface also helps mitigate membrane penetrations as compared to the softer built up layers.	Depending on the design, may increase the presence of direct soil contact and prolonged or permanent moisture contact
Roof Depressions	Can provide a "bridge" to elevate the soil media out of depressions which pond water and cause	Can sag into depressions leaving the growing media in saturated conditions causing anaerobic

	anaerobic conditions.	conditions. Depends on the depth of the drainage layer.
Category	**Tray**	**Built Up**
Anchoring	Trays work well with metal edging to tie and anchor the tray system into the roof by a mechanical connection between the edging and the side of the tray	Anchoring is not mechanical but rather the built up system is "tucked" underneath the edging overhang
Point of Manufacturing	Molded trays can be manufactured most anywhere by shipping the mold only, to reduce shipping costs and carbon foot print	Geotextiles generally manufactured in large single point facilities requiring long distance shipping
Shipping	Stackable trays are highly space efficient and reduce shipping costs. Trays on pallets are easy to transport.	Rolls of higher porous material are light weight but bulky and may increase volume and thus shipping costs. Rolls are sometimes difficult to handle.
Installation	There are many variations on installation methods which greatly impact cost. Least expensive is place empty trays, fill, and plant on the roof. Most expensive is pre-grown trays. Sometimes the trays are directional and need care in correct orientation to the roof slope.	There are many variations on installation methods which greatly impact cost. Lower cost methods depend on shipping distances.
Pre-Grown	Trays are planted with material and grown to maturity. Provides an instant roof. High cost due to capitalization of trays, shipping, and installation.Trays are reasonably light and meet OSHA weight restrictions on lifting.	Pre-grown rolls are planted with material and grown to maturity. Provides an instant roof. High cost to capitalization, shipping and lifting.
Pre-planted Tiles	Trays are set empty on the roof, partially filled with soil and "Tiles" are placed in the tray.	Drainage layer, filter layer and retention layer are installed in a cross directional fashion. The vegetated tiles are laid on the graded growing media.
Cuttings	Trays are placed empty, filled with growing media. Cuttings are applied and watered in. Inexpensive method but requires time to establish.	Drainage layer, filter layer and retention layer are installed in a cross directional. The growing media is placed. Cuttings are applied and watered in. Inexpensive method but requires time to establish.

Category	Tray	Built Up
Plugs	Trays can be placed, blown with soil and then plugged, or prefilled, plugged and then placed. Trays can be placed in sequence to eliminate or minimize walking on the soil surfaces while transporting and placing plugs.	Drainage layer, filter layer and retention layer are installed in a plywood fashion. The soil layer is blown in. Plugs are applied and watered in. Inexpensive method but requires time to establish. Sometimes difficult due the intensive labor which can disturbs and compressed soil.
Maintenance	Walkable. Some trays offer portable walks to minimize disturbance of plants. Others may have issues with walking on the tray edge. Some trays have exposed edges which can cause burning of plants along the margins while others are overfilled and the tray edges are not exposed. Easy to dig out material from tray in the event of insect or weed infestation, dead plants, etc.	Walkable. Avoid damage to the retention and filer layer if soil digging is required to remove weed, insect infestation or dead plant removal.
Repairs	Individual trays can be removed and replaced without any change in the structural integrity of the system.	Cutting or the geotextiles is needed and interrupts the integrity of the built up system
Proprietary vs. Non Proprietary	Sometimes viewed as a sole source product relative to built up systems. However, depending on the method of installation, soils and plants, and installation costs are not sole sourced and are very competitive. The cost of the tray is a smaller fraction of the entire. Sole source systems seem to have more accountability for the success of the product.	Typical specifications call for specific geotextiles products. Soil and plants not always specified to be provided by a specific source. Multiple sourced components can lead to a lack of accountability for system performance.

	Stormwater Management		Design					Installation				Features		Maintenance	
Product	Retention	Detention	Min height	Max height	Min weight	Shaping	Anchoring	Pre-grown	Tiles	Cuttings	Plugs	Irrigation	Trim	Routine	Repairs
AVRS Tray	+++	+++	++	+++ +	++	+	+++	$	+	+++	+++	+++	+++	+++	+++
Multilayer High Profile	++	++	+++	+++	++	++	++		+	+++	+	+	+	+++	+
Multilayer Low Profile	+	+	++++	++	+++	++	++		+	+++	+	+	+	++	++
Hybrid	++++	++++	++	+++	++	+++	++	$	+	+++	++	+++	++	++	++