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July 11, 2010 10:30 am | 4 Comments

# Green Roof in a Purple City

A look at the first green roof on a North American sports arena.

by Kyle Stack / @NYSportswriter

NBA free agents might avoid Minneapolis due to its harsh winters, but many others move there partly because of the city's determination to remain "green." Target Center, home of the Timberwolves, is an example of why that's the case.

The arena, which opened in downtown Minneapolis in 1990 and which sits across the street from the Twins' new palace, Target Field, unveiled its green roof in September 2009 to rave reviews. Target Center became the first sports arena in North America to have a green roof, which at the time was the fifth-largest extensive green roof in the U.S. (An extensive green roof means that it's there strictly for functional purposes.)

The \$5.3 million project, which was paid for by a city fund for capital improvements for buildings, gave Minneapolis another green roof to match the ones that sit atop City Hall, Central Public Library and The Green Institute.

A lot of people might wonder what purpose a green roof serves. The answer is there are a myriad of ways in which it can benefit a community; it just depends on what main environmental problems need to be solved. In Target Center's case, there were two overarching goals: 1) collect water from rain and snow that would otherwise eventually drain into the Mississippi River, and 2) mitigate the "heat island" effect of the 2.5 acre roof on surrounding areas. Several other factors came into play, such as replacing a worn-out roof and instituting a sound plant system. Let's look at the water issue first.



"What the city wanted to do is capture the equivalent of a 0.9 rainfall," said Frank Anderson, Project Manager for Leo A Daly, a world-wide architecture and engineering design firm with a Minneapolis office which led the project. "They wanted to try and hold 55 percent of the total annual precipitation — about 1 million gallons annually."

That's exactly the amount of storm water that the roof expects to hold annually thanks to a super-light soil (mostly expanded shale and bloated clay products) with large spaces between soil particles for water retention and a groundcover system based on sedums, whose fleshy leaves can hold a great deal of water.

Sedums don't comprise all the plant life on the roof. A host of Minnesota prairie plants, such as columbine, prairie coreopsis, lupine and wild strawberry dot the roof. The lupines even attract a federally-listed endangered butterfly called a Karner Blue which needs the plant to survive. A mixture of plant life was vital.

"One of the difficulties [of implementing only one plant] is you put something in to an extreme and it becomes the only thing there," said Peter MacDonagh, Director of Science and Design for Kestrel Design Group, a local sustainable landscape architecture firm which worked on the project. "We wanted to create resilience."

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Plant material are attached together with small ties on pre-grown mats. The mats, each of which is the size of a pallet, are erosion control blankets with plants growing through them. The plants are tied together to prevent them from blowing away, which can happen on a 160-foot high roof with a 120 mile per hour wind lift. Anderson correlated a wind lift with waves on an ocean.

"As long as the wind goes across it lifts up the water and creates a wave," Anderson said. "It does the same thing with roofing materials. It will lift [materials] on the roof so you have to hold roofs down."

MacDonagh conceded that although the roof's ability to capture 9/10ths of an inch of precipitation every 24 hours is important, he had his sights set higher. He wanted to capture one inch every 24 hours, which would've boosted the 1 million gallons of precipitation captured annually by 10 percent. Weight restrictions on the roof prevented that from becoming a reality.

Weight limitations weighed on the mind of everyone who worked on the project, including Angie Durham. She's the Green Roof Manager for TectaAmerica, an Illinois-based green-roofing company, who led the roof's reconstruction.

"This was the most challenging building in that it had a limit of 17.4 pounds dead load," Durham said in reference to the highest amount of weight each square foot of the roof could hold before failure. An extensive amount of testing was done to ensure 17.4 was the limit, although certain areas of the roof's perimeter were able to hold an additional five pounds dead load.

The concerns about weight didn't stop there. As was noted by Thomas Reller, Director of Operations for Target Center, "our biggest concern was weight. We didn't want it to have an ill effect on the building's ability to hang things from the inside and add more weight."

To fulfill that wish, Durham led nearly a full recycling effort of the roof's materials. The project's contract stated that at least 50 percent of the roof's materials would have to be recycled but Durham eventually discovered that 98 percent of the material was recyclable.

"We were able to re-use it somewhere else on the roof, recycle it or send it to someone else who could re-use it," Durham said.

The roof now is expected to last in its current capacity for 40 years, although Durham and her team will have to make periodic maintenance checks on it over the years. Yet the benefit of a refurbished roof is undeniable.

"You're investing in a long-term roof system that's going to be protected from UV rays every day," Durham explained.

That brings into play one of the most eye-opening accomplishments of the project. The roof was pounded with the sun's rays at all times of year and higher temperatures sped up damage on the roof's membrane.

MacDonagh noted temperature readings taken several years ago from a nearby green roof at the Central Public Library. On several 90 degree days a black bitumen surface averaged 170 degrees F, a gravel ballast (pea gravel) came in at 145 degrees F, a group of white reflective roof pavers measured 125 degrees F and the green roof portion of the building was just 92 degrees F.



Take into consideration the extreme temperatures during winter — MacDonagh noted a roof such as the Central Public Library's can dip to -30 degrees F regularly during winter — and Target Center's roof could have experienced 200 degree temperature swings during the year before the green roof was applied. That creates an unhealthy amount of stress on the roofing membrane, which is why this project was initiated in the first place.

That leads into the reduction in the "heat island" effect on surrounding buildings. Although it's difficult to quantify exactly what cooling effect Target Center's new roof has on its surroundings, MacDonagh noted several benefits.

Since the air surrounding the building is cooler, air conditioning units in nearby buildings take in cooler air from outside, which means they don't have to work as hard to cool their buildings. That translates into less overall stress on the city's grid system, especially the 2-5 p.m. time slot when manufacturing, residential and commercial buildings run their cooling systems. "It's a way to reduce the peak load," MacDonagh said of the Target Center roof's cooling effect.

That Target Center became the latest public building in Minneapolis to receive a green roof was perhaps inevitable. The city was named America's 11th-greenest city by *Popular Science* in 2008, one year after it distributed 20 \$1,000 mini-grants and five \$10,000 awards to city programs that included household power-consumption monitors and "block club talks" regarding global warming. The city has taken a lead role in building up enthusiasm among its residents over energy conservation.

"I think the governments at the city level need to lead by example," said Lisa Goodman, a member of the Minneapolis City Council who was one of the council's biggest proponents of initiating the Target Center

The Lower Merion years.

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project. "We're asking the private sector, private businesses, to do something about their energy consumption and storm water treatment. The city owns this arena and we felt like we should do the same."

She noted future Minneapolis projects, such as the country's largest bike-share program which began last month. Over 1,000 bicycles are available at 60 kiosks throughout the city in an effort to reduce vehicular traffic. It's all apart of the city's attitude toward treating the environment in a positive manner.

Even though Target Center's roof is suited only for functional purposes and won't have a garden or any type of community activity, its environmental benefits give the city another example of how best to maximize the usefulness of buildings which take up a large footprint.

While there won't be many visitors to the roof, people in adjacent buildings can enjoy the leaf-inspired design of the clay-fired terracotta roof pavers that represent the roof's firebreaks.

"We wanted to use something [for the design] that was iconic," MacDonagh said.

For any future NBA free agents who fly into Minneapolis, they'll get a new look at what the top of their potential future home arena looks like.

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**Dacre** Posted: Jul.11 at 10:56 am  
 My favourite part was this bit: "our biggest concern was weight. We didn't want it to have an ill effect on the building's ability to hang things from the inside and add more weight."... pffft Like what those NBA championship banners that you've invented in your mind?

**LDR4** Posted: Jul.11 at 11:40 am  
 Great article, I thoroughly enjoyed it. Hopefully the rest of the NBA teams will take note and follow suit. It would be a great thing if the NBA could implement a green roof initiative. I know that it really a matter of the owners of the arenas, be they cities or corporate, choosing to do so but with a push from the NBA and ownership this could greatly benefit eeach city.David Stern always likes positive PR and after the LeBron PR nightmare this week it could be just the ticket the league needs. A strong green plan is always a good thing. I'm glad that you brought my attention to this, I had no idea there was a green roof anywhere in the league.

**LDR4** Posted: Jul.11 at 11:43 am  
 @Darce No its more like if they plan on installing a larger jumbotron or more lights.

**olddirtyphil** Posted: Jul.11 at 6:05 pm  
 i think it looks cool

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