



Greening History

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Types of Green Roofing



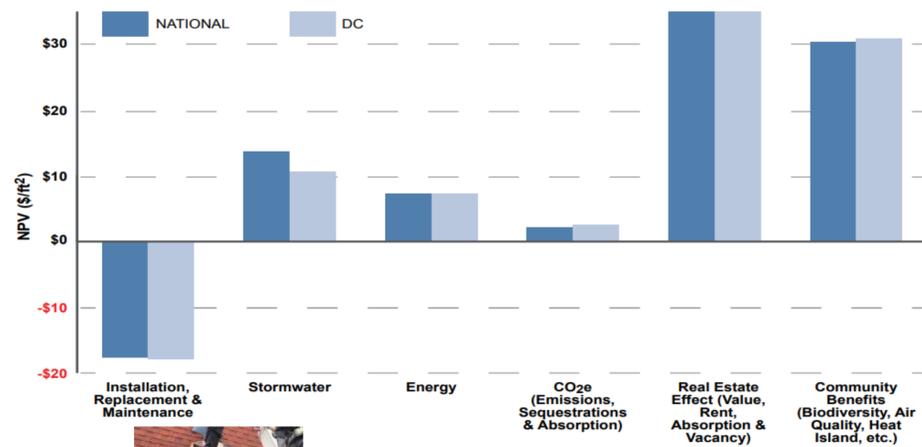
	SINGLE-COURSE EXTENSIVE	MULTI-COURSE EXTENSIVE	SEMI-INTENSIVE	INTENSIVE
THICKNESS	3-4 inches	4-6 inches ^(a)	6-12 inches ^(b)	over 12 inches
DRAINAGE LAYER	No discrete drainage layer.	Based on the growth media thickness, plants selected, local climatic conditions, and rooftop hydrologic conditions. Synthetic geocomposite are typical nationally. ^(c)	Discrete drainage layer.	Discrete drainage layer.
VEGETATION LAYER	Sedum or other succulents.	Sedum or other succulents. Potential for other plants as thickness increases or with permanent irrigation.	In the Mid-Atlantic and with irrigation, supports a variety of plants—meadow species, ornamental varieties, woody perennials, & turf grass.	Supports plant communities similar to ground-level landscapes (depending on thickness and exposure).
MEDIA TYPE	Coarse media over moisture-management layer.	Finer-grained growth media over discrete drainage layer.	Multi-course over discrete drainage layer.	Intensive growth media layer over discrete drainage layer. Topping media may be used (includes higher organic content, greater density, greater water holding capacity, and lower permeability).
IRRIGATION	Typically none.	Typically necessary in the first year to establish growth in Mid-Atlantic.	Required if turf grass is used.	Required.
PREVALENCE	Common internationally. Areas with sufficient precipitation is necessary.	Nationally the most common green roof type.	Common. Provides more variety in vegetation.	Less common than the other types. Structural capacity and maintenance are limiting factors (see Section 4.4.1 and 4.3)

Notes:
^(a) Typical total media thickness (growth media, plus granular mineral drainage layer) is 4–6 inches (assembles vary widely in thickness and complexity).
^(b) Pedestrian traffic (typically turf grass) requires a 10–12 inch thickness.
^(c) Common drainage layers are shown in Table 3.
^(d) Internationally, granular mineral media drain layers are more common and offer advantages in terms of costs and performance.



Research Design

This study was designed around applying a green roof the Historic Stanley Hotel, located in Estes Park, Colorado. Built in 1909 it is an iconic structure and the gateway to Rocky Mountain National Park. This study looks at removing the existing asphalt shingle and installing an extensive green roof in its' place. The historical preservation could still be achieved through use of red flowing plants throughout the new roof system.



United States Environmental Protection Agency Region 8 Headquarters located in Denver, Colorado; it provides an excellent real-world example of how the roof could look at The Stanley Hotel.



The Stanley Hotel Roof Repair Project (2018)



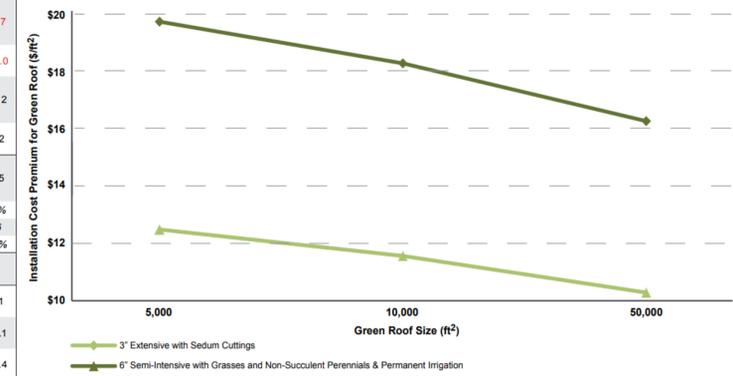
Results

The roof comprises asphalt shingles with a five-year lifespan in mountainous regions such as Estes Park. In fact, the Stanley Hotel has already begun to show signs of disrepair with pictures below from this article from 2018 by Elite Roofing, who performed a repair from a leak on this iconic structure. Therefore, The Stanley Hotel is an ideal candidate for a transformation on the roof. The current renovation plan seeks to improve the hotel by utilizing green roof environmental techniques. Due to its redness, there is a need to transform the hotel roof and promote more sustainable development to ensure that the building follows more sustainable structures. It would allow for an environmentally friendly update while maintaining its historical significance and look; the green roof would need to be made up of red in color plants.

Many costs would be allocated to purchasing the correct materials, to allocate costs for historic preservation permits, and engineering and labor costs. A considerable budget would also be needed to maintain the roof in superb condition. With The Stanley Hotel specifically being of such a large footprint, more than 10,000 square feet, the costs decrease, making this option more affordable. While the initial investment would be substantial the cost would more than recoup over the roof's lifetime.

NATIONAL LEVEL RESULTS	ROOF SIZE (ft²)		
	5,000	10,000	50,000
Impact on Owners/Occupants/Investors			
Initial Premium, \$/ft² of roof (extra cost of installing a green roof instead of a black roof)	-\$12.6	-\$11.4	-\$9.7
NPV of Installation, Replacement, & Maintenance, \$/ft² of roof	-\$18.2	-\$17.7	-\$17.0
NPV of Stormwater, \$/ft² of roof (savings from reduced infrastructure improvements and/or stormwater fees)	\$14.1	\$13.6	\$13.2
NPV of Energy, \$/ft² of roof (energy savings from cooling and heating)	\$6.6	\$6.8	\$8.2
Net Present Value (installation, replacement & maintenance + stormwater + energy NPV)	\$2.5	\$2.7	\$4.5
Internal Rate of Return (IRR)	5.0%	5.2%	5.9%
Payback, years	6.4	6.2	5.6
Return on Investment (ROI)	220%	224%	247%
Other Financial Impacts (less realizable)			
NPV of CO ₂ e, \$/ft² of roof (emissions, sequestration & absorption)	\$2.1	\$2.1	\$2.1
NPV of Real Estate Effect, \$/ft² of roof (value, rent, absorption & vacancy)	\$120.1	\$111.3	\$99.1
NPV of Community Benefits, \$/ft² of roof (biodiversity, air quality, heat island, etc.)	\$30.4	\$30.4	\$30.4

Cost-Benefit Analysis



Discussion and Conclusions

Installing a green roof will be a great incentive for this historic hotel because it would lower the temperatures of the entire building and the surrounding environment, increase the hotel's energy preservation efforts and be a significant increase to the biodiversity. Payback times are smaller than the lifecycle of green roofs in mature markets and needs with average beginning expenses. It would be a shining example of how one unique place could bring its history into the modern world with a significant environmental impact and statement while maintaining its historical significance.

Contact

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