



Request for City Council Committee Action from the Department of Community Planning and Economic Development - CPED

Date: February 21, 2008
To: Council Member Scott Benson, Chair, Council Committee on Health, Energy & Environment
Subject: Target Center Green Roof Evaluation

Recommendation: Authorize staff to commence a cost bidding process with the green roof consultant team that prepared this cost-benefit analysis for four conventional and green roof options that do not require structural enhancement. Direct staff to return to this Committee with the results of that bidding process not later than October 16, 2008

Previous Directives: On January 7, 2008, CPED staff provided this committee an update on the status of a green roof lifecycle cost benefit analysis for the Target Center. The Committee directed staff to return with the completed analysis on February 21, 2008 and with a draft RFP for roofing options on March 24, 2008. On December 10, 2007, CPED staff reported to this committee that a green roof on the Target Center does not appear feasible given structural and operational constraints. The Committee directed staff to return January 7, 2008 with more detail on green roof options for the Target Center. On April 13, 2007, City Council approved the selection of AEG Facilities, Inc as the new operator and execution of an Arena Lease, Operating Management, Use and Assurances Agreement with AEG and consented to the assignment by Midwest Entertainment Group LLC and assumption by AEG of Target Center Arena agreements, assets and obligations and authorized proper MCDA officers execute these agreements and any related documents necessary to implement the transaction.

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Approved by: Charles T. Lutz, Deputy CPED Director _____

Mike D. Christenson, CPED Director _____

Presenters in Committee: Kristin Guild

Financial Impact

No financial impact
Action is within the Business Plan

Community Impact

Neighborhood Notification: N/A
City Goals: Enriched Environment; A Premier Destination

Sustainability Targets: Permeable Surface

Comprehensive Plan: 7.1 Minneapolis will manage the use of the city's environmental resources (including air, water and land) in order to meet present needs while considering future concerns. 7.9 Minneapolis will make buildings more energy efficient. 7.12 Minneapolis will play a leadership role in setting up examples and pilot projects.

Zoning Code: N/A

Living Wage/Business Subsidy Agreement
Job Linkage

Yes _____ No X
Yes _____ No X

Supporting Information

On December 11, 2007, this committee directed staff to analyze the pros and cons of a white conventional roof versus green roof options for the main event roof of the Target Center. Staff has worked with a consultant team including green roof expert Peter MacDonagh and Nathalie Hallyn of The Kestrel Design Group, sustainable design expert Rick Carter of LHB Architects, structural engineers Jim Roed of Ericksen Roed and Associates, Charles Ault and Peter Siessenbuettel of Leo A Daly, roof systems expert Gary Patrick with INSPEC, Inc., Leo A Daly architect Frank Anderson and AEG Operations Manager Tom Reller to conduct a lifecycle cost-benefit analysis of seven* roofing options:

- Conventional white PVC roof;
- 13.4 pound per square foot (psf) extensive green roof – 1.4 inch growing medium depth;
- 17.4 psf extensive green roof – 2 inch growing medium depth;
- 22 psf extensive green roof –2.5 inch growing medium depth;
- 39 psf extensive green roof –6 inch growing medium depth;
- White/green combination – conventional white roof with a 22 psf, approximately 19,000 sq ft, extensive green roof on the perimeter where the structure has greater structural support (the existing roof has pavers for ballast at this perimeter location and the building was designed with additional structural support here); and
- Green/green combination – a 17.4 psf extensive green roof with a deeper 22 psf 19,000 sq ft extensive green roof perimeter.

The options are described in detail on pp. 7-10 of the consultant report (attached) and summarized in the report's Executive Summary (pp. 2-4).

The analysis seeks to compare the advantages of a deeper green roof (more stormwater capture and greater plant diversity and vigor) against those of a shallower system (less weight and need for structural enhancement) and all green roof options against a conventional white (heat reflective) PVC roof. The cost-benefit model incorporates conservative cost estimates for each option. The team provided detailed parameters to manufacturers, contractors and estimators expert in both conventional and green roof systems and installation and structural enhancement. Structural enhancement cost estimates were prepared in consultation with Sowles Company, a

* Originally, the team assessed six roofing options. As the consultant team modeled the costs and benefits of these options, a seventh option combining two different depths of green roof seemed feasible enough to warrant analysis and was included in the study.

steel erector company with extensive experience with complex construction jobs. Sowles was the erector company engaged in constructing the Target Center in 1991.

The consultant report is attached. A summary of the costs, cost-benefit analysis findings, stormwater capture and consultant and staff recommendations is in table format as Attachment A at the end of this document. Also attached is a review memo of the methodology, findings and next steps by sustainable design expert Rick Carter of LHB Architects. Mr. Carter concurs with the findings and recommendations of the consultant team, which are summarized on p. 5 of the consultant report. The attached Kestrel report fully documents the analysis and the findings. A few key parameters, findings, and outstanding issues and considerations are noted below.

Parameters

1. Main event roof – The Target Center roof is comprised of 30 different discrete roofs, many small, on five different levels (Figures G-1 and G-3 of consultant report). At 18 years old, all roof sections have nearly reached their maximum useful life and require replacement. Only the 115,000 sq ft main event roof is sizable enough for a green roof to be potentially economically viable to install and maintain. That roof section is the subject of the green roof cost-benefit analysis.
2. Inputs to the cost-benefit analysis – The analysis assessed a number of parameters for comparison including capital installed cost, energy cost savings, stormwater fee savings (based on current City rates), lifespan, and the residual re-sale value of roofing components. A spreadsheet outlining all of the model inputs as well as the pros and cons of each system is on pages 18-20 of the consultant report. The inputs are described on pp. 10-17.
3. Roof weight – The existing roof weighs 13.4 pounds per square foot (psf). The team's structural engineers evaluated the building's roof structural capacity and assessed what type of structural enhancement, if any, the roofing options analyzed would require.
4. Rigging capacity – The building has a rigging capacity for hanging audio, video and other equipment for shows of 125,000 pounds at the center of the facility and south end (7th Street) and 40,000 pounds at the north end (6th Street). As the trend is for shows to have increasingly heavy audio, lighting, video and special effects equipment designed to be hung from structural supports, rigging capacity is an important element of the property's competitive position in the marketplace. The analysis assumed that the building's existing rigging capacity would be retained for any roof replacement option.
5. Acoustics – The Target Center was designed as a multi-use event center focused primarily on sports events, and the building's metal ceiling members are not ideally suited for audio quality. Bass reverberations that negatively effect sound quality could be fairly easily dampened with a lightweight fabric and fiberglass acoustical treatment, and staff is exploring system options. The installed weight of an installed acoustical system would be at most one pound per square foot. During the course of this analysis, the team determined that the

one pound per square foot could be accommodated in conjunction with any of the assessed green roof systems with some very minor adjustments to the growing medium depth. Therefore, to understand the feasibility of a green roof system in concert with potential acoustic enhancements, City staff requested that the models assume that a pound of roof capacity would be utilized for acoustic enhancements.

6. Study periods – Two study periods were modeled:
 - a) 16 years, coinciding with the 2025 expiration of the Team Operating Agreement, the management agreement with AEG, and the bond financing;
 - b) 20 years, based on a conservative estimate of the lifespan of a conventional PVC roof system. Most PVC roofs are warrantied for 20 years, though there are some new PVC roof systems warrantied for 25 to 30 years.

Key findings

1. Consultant recommendation – Based on the key findings of the analysis summarized here and described in the Kestrel report, the consultant team recommends a combination green/green roof as the most cost-effective re-roofing decision if the building is expected to remain in service at least 20 more years. This is due to the lifespan differential between a green roof and a conventional roof. Green roofs have been demonstrated to have a lifespan of 40-50 years, whereas conventional roofs of this type have a typical 20-year lifespan. There are, however, some conventional roof systems on the market now with warranties of 25-30 years. The green roof becomes more cost effective than a conventional roof at the point when the conventional roof must be replaced. If the building is not likely to be in operation at least another 20 years, the lifecycle cost-benefit analysis favors a conventional white roof. The consultant report notes several factors including the marketing value of a green roof and water quality benefits that are not quantified and captured in the model. The issue of the building's operational lifespan is addressed below in the "Outstanding issues and considerations" section, point 1.

If a green roof option is chosen, the Kestrel report recommends the green/green combination roof over the shallower 13.4 psf extensive green roof. At the 20-year analysis mark, the green/green option has a slightly less favorable Net Present Value (NPV) than the 13.4 psf roof, but the consultants contend that the benefits of capturing significantly more stormwater (0.8 inch rainfall versus 0.55 inch) and increasing the possible plant diversity and vigor warrant the additional investment cost. Moreover, with time the increased stormwater savings of the deeper green/green combination will close this gap in NPV (between the 16-year and 20-year analysis timeframes, the gap in NPV between the two options closes somewhat, illustrating this trendline).

2. Structural analysis – The team's structural engineers conducted a thorough structural assessment of the building to determine the additional roof weight the existing structural members could accommodate and what structural enhancements would be necessary for greater loads. Four green roof options would not require structural enhancements – 13.4 psf, 17.4 psf, the white/green

(22 psf perimeter) combination and the green/green.

The 22 psf and 39 psf options assessed would both require structural enhancements. The 22 psf option would require additional bracing of each of the secondary trusses. The estimated cost of that structural support is \$500,000 (reported both as part of the total installed cost and separated out on p. 19 of the report) The work could probably be scheduled around building events and would not likely require closure of the main arena space.

A 39 psf green roof would require modifications to the building's primary truss system as well. The structural enhancement materials and labor cost associated with this option is estimated at \$17,000,000 and incorporated into the cost-benefit model. To do this installation work without closing the event center would take an estimated 13 months, and would require sections to be closed for extended periods.

3. Net Present Value – The financial analysis output of the cost-benefit model is conveyed through a net present value (NPV) for each option on p. 20. The NPV is given for two different analysis periods (20 years and 16 years, coinciding with a typical conservative timespan for a conventional PVC roof and the Team Playing Agreement and bond financing expiration period, respectively). A positive net present value indicates that an investment adds financial value over the analysis period, whereas a negative NPV indicates that an investment would not add financial value. If no NPVs are positive, as in this case and the norm with capital outlays, the best financial option is the smallest negative NPV. If the analysis period is taken as 20 years, assuming that the conventional roof must again be replaced at that time, and the building has remaining useful life, the best financial choice according to the model is the 13.4 psf green roof, followed by the green/green combination roof. Kestrel recommends the green/green combination if a green roof is selected due to the increased cost savings from stormwater utility credits in the longer term, greater stormwater capture, and increased plant vigor. If the study period coincides with the Team Playing Agreement and bond expiration period of 16 years, the cost of replacing the white conventional roof is not calculated into the model and the negative NPV of that option is significantly smaller than that of any of the green roof options. Therefore, if the expected life of the building is less than the period within which a white conventional roof would have to be replaced, the cost-benefit analysis indicates that a white conventional roof is the more cost-effective investment.
4. Repayment period – The model calculates a repayment period as an additional measure of comparison between the green roof and conventional white roof options, evaluating the point at which the additional capital costs of a green roof would pay for themselves through cost savings. Several options do not have a defined repayment period because they would not pay for themselves, measured against the conventional white roof option, within the study period. The two green roofs that would require additional structural enhancement will not pay for themselves within the study period even taking into account the replacement costs of a conventional white roof due to the added capital investment. The

white/green combination will not pay for itself within the study period due to the cost of the white conventional portion. The green roofs that do not require additional structural enhancement (13.4 psf, 17.4 psf and green/green combination) have a repayment period of 20 years, meaning that the investment doesn't pay for itself until the conventional white roof would have to be replaced.

5. Warranty – Two companies, XeroFlor (supplier for the Ford Motor Company green roof in Dearborn, MI) and Zinco, have recently developed partnerships with roofing contractors to provide a 20 year single-source warranty for slim profile green roof systems. The green roof warranty would cover all roofing components including the roofing membrane, green roof layers, and plants. A conventional white roof warranty is typically a total system warranty from the roof manufacturer covering the full replacement value of the roof for problems as they arise. The model includes the cost of the warranty in the total installed capital cost within the model for all options.
6. Non-financial considerations – As with any investment decision, there are non-financial pros and cons that cannot be captured by an NPV model. These are articulated in the report on pp. 21-22. The difficult-to-quantify pros of a green roof include reduced heat island effect (also a pro of a white roof), reduced stormwater impact on Mississippi River water quality, air quality benefits and marketing value. The cons are largely captured in the cost benefit analysis and include higher design, installation, maintenance and replacement costs than a conventional roofing system.

Outstanding issues and considerations

1. Building useful life – While the Target Center building, constructed in 1991, was structurally designed to last indefinitely and has thus far proved adaptable to market trends, the building has already surpassed the 33.3-year median lifespan of an NBA sports venue (average age at demolition). The bond financing period, operating agreement and NBA contract all expire in 2025, 16 years from the expected roof construction year of 2009. While the building may be a rare example of an arena able to evolve and adapt to new market circumstances, there is a real possibility that the building could be deemed functionally obsolete beyond that timeframe. There may also be real estate development pressures on the property as the value of the land increases with redevelopment activities on Hennepin Avenue, the new Twins ballpark and the adjacent juncture of light and regional rail systems. The probable useful life of the building should be taken into account with any significant capital investment assessment.
2. Stormwater utility fee increases – The cost-benefit model uses the existing stormwater utility fee structure to calculate credits. The City of Minneapolis is likely to raise stormwater utility rates considerably in the coming years. If this happens, the stormwater credit savings from the green roof would also significantly increase.
3. Maintenance costs – Under the City's operating agreement with AEG, any net increase in maintenance costs is borne by the City. If a new maintenance

contract is required for green roof, the operator would negotiate and manage it, but the contract cost passes to the bottom line along with all the other operating expenses.

4. Sponsorship potential – Preliminary investigation indicates that there may be sponsorship potential to fund a capital cost differential between a green and conventional roof. However, bond financing constraints and proprietary rights granted to the team and operator may limit this potential. Preliminary investigations indicate that any sponsorship revenue paid to the City or allocated to the capital cost of the roof would be “private payments” under the IRS code. Private payments to the Target Center are strictly limited to a lifetime maximum of \$8,465,000 under the terms of the bond financing; approximately \$5 million of private payment capacity remains. Any revenues that might be considered private payments need to be evaluated by bond counsel on a case-by-case basis.

Recommended Next Steps

In the interest of obtaining cost figures accurate enough for comparative decision-making, this Committee requested that staff prepare a Request for Proposals (RFP) draft document for presentation on March 24, 2008. In order to obtain cost estimates through an RFP process for a construction project, an RFP would need to request costs for both designing and constructing the project (a design-build RFP). According to City Procurement staff and the City Attorney’s office, the City does not have authorization from the State to use design-build RFPs for construction projects. The alternative, and one likely to result in more accurate cost estimates for this complex project, is to engage in a formal bidding process for the project. Staff believes that the extensive cost estimating conducted for this analysis is accurate enough to select a few of the options assessed to put out to bid.

Based on the Net Present Values and capital costs given in the Kestrel report and the consultant recommendations, staff recommends that the Council authorize staff to commence a bidding process for three options (none requiring structural enhancement):

- a conventional, white PVC roof
- a 17.4 psf green roof
- a 22 psf perimeter green roof (for the white/green and green/green combination options)

This would provide cost estimate data bid in the marketplace for the conventional white roof, the conventional white/green combination, a 17.4 psf green roof, and a green/green combination. These main arena roof bid documents would be prepared in conjunction with bid documents for replacement of the Target Center’s other 29 roofs.

Since none of these options would require structural enhancement to the building, the bid documents would not need to include extensive engineering design work. The consultant team estimates that the roof design and bid packet could be completed within 3 ½ months after receiving a notice to proceed. The bids and review could be completed in another 2 to 2 ½ months (1 week in Procurement, 4 weeks bids solicited, 4 weeks for bid review).

Staff recommends returning to this committee no later than October 16, 2008 with the results of this bidding process. At that time, the Council would have real-market cost estimates for four roof options well in advance of the 2009 construction season when we anticipate the roof replacement will occur.

**Attachment 1
Target Center Green Roof Cost-Benefit Analysis
Summary of Findings February 12, 2008**

Option	Stormwater capture*	Structural reinforcement needed?	Installed capital cost (rounded)	Expected lifetime	Net Present Value (rounded)		Payback period**	Consultant recommendation on cost-benefit basis alone	Staff recommendation
					16 years	20 years			
Conventional white PVC	0	No	\$1.2 million	20 years	-\$959,000	-\$2.3 million	Not Applicable	if building used <20 years	Bid
13.4 psf (1.4") extensive green	0.55"	No	\$2.6 million	40 years	-\$2.1 million	-\$2.1 million	20 years		
17.4 psf (2") extensive green	0.76"	No	\$2.8 million	40 years	-\$2.2 million	-\$2.1 million	20 years		Bid
22 psf (2.5") extensive green	1.0"	Yes	\$3.3 million	40 years	-\$2.7 million	-\$2.6 million	None		
39 psf (6") extensive green	2.22"	Yes	\$20.1 million	40 years	-\$19 million	-\$19 million	None		
White/green combo (22 psf green perimeter)	1" only in green roof band	No	\$1.5 million	20 years	-\$1.2 million	-\$2.9 million	None		Bid
Green/green combo (17.4 psf with 22 psf perimeter)	0.8"	No	\$2.8 million	40 years	-\$2.2 million	-\$2.1 million	20 years	if building used >20 years	Bid

* 90% of all rain events in Minneapolis are 1" or less over a 24-hour period.

** Compared to conventional white roof