CASE STUDY

Offices of The Architectural Group, Inc. - Grandville, Michigan

When The Architectural Group, Inc., (TAG) set out to design their new Grandville, Michigan office building, priority number one was sustainability. The team at TAG was determined to create the most eco-friendly office building possible. Since their organization in 1978, the design professionals at TAG have been proponents of sustainable construction practices, and that mindset is carried into the architectural design and master planning services they provide for public and private projects that include schools, churches, office buildings, health care facilities, and national chain stores. Accordingly, TAG's own offices would be built with sustainability and environmental stewardship in mind.

The architects at TAG designed their new facility to incorporate native landscaping, natural daylighting, and water-efficient plumbing fixtures. Each of these features helped them earn credits toward the United States Green Building Council's® (USGBC) Leadership in Energy and Environmental Design® (LEED®) program. LEED provides third-party certification that a building was designed and built using strategies aimed at saving energy and water, reducing CO_2 emissions, improving indoor environmental quality, and minimizing the environmental impact of both the project and the facility.

The architects at TAG elected to install a Carlisle SynTec Systems roof on their building. TAG knew from experience that Carlisle would provide them with the highest-quality materials, best technical support, and unparalleled customer service. Since energy efficiency was a priority on this project, Carlisle worked with TAG to develop a Roof$ense Life Cycle Savings Report. Roof$ense is an energy/cost analysis tool that helps determine which roofing system is most suitable for a facility, based on geography and historical weathering data. Roof$ense analyses pull data from leading energy sources[1] to generate a report which illustrates the energy and cost savings that are possible if proper insulation levels and roof color are utilized. In addition, Roof$ense compares a variety of roof systems and surfaces in regards to reduction of carbon dioxide, methane, and nitrous oxide. It also equates the reduced carbon emissions to the number of vehicles taken off the road or trees planted.

JOB PROFILE

PROJECT LOCATION:
Grandville, Michigan

LEED SILVER PROJECT

SQUARE FOOTAGE:
4300 SF

START DATE:
March 2010

COMPLETION DATE:
November 2010

ROOFING SYSTEM:
60 mil ballasted and 60 mil adhered black EPDM

ROOFER:
Great Lakes Systems

GENERAL CONTRACTOR:
JWK Construction

ARCHITECT:
The Architectural Group, Inc.

CARLISLE SYNTEC SYSTEMS

OFFICES OF THE ARCHITECTURAL GROUP, INC.

CASE STUDY

"The design and construction strategies used on our corporate office will reduce the building's environmental impact and improve our employees' comfort and productivity."

Since TAG's office is in a cool, northern climate, the Roof$ense report determined that a dark-colored EPDM roof would be the most energy-efficient choice, and would save TAG money on their winter heating bills. In cool climates, where heating costs are generally five times higher than air conditioning costs, a dark-colored EPDM roof that absorbs heat from the sun is often the ideal choice. Dan Bode, Chief Operating Officer for TAG, stated, "The energy / cost analysis provided by Carlisle showed that a black roof was more energy- and cost-effective than a white roof in our climate." **The Roof$ense report was submitted to the USGBC and ultimately earned TAG another LEED credit for utilizing the most energy-efficient insulation levels and roof color for their climate.[2]**

A ballasted EPDM system over an acoustical deck was selected for TAG's central, open office area. This system was chosen to provide sound insulation from rain noise. In addition to sound insulation, ballasted roofs provide excellent hail protection and wind uplift resistance, and all their components can be reused, repurposed, or recycled at the end of the roof's service life. As an added bonus, the ballast's thermal mass acts like an extra layer of insulation that reduces heat gain and loss through the roof, which can lead to increased energy bills. Once again, the focus was on sustainability.

The roofing contractor, Great Lakes Systems, installed two layers of three-inch Polyisocyanurate with an R-value of 36 over the steel roof deck. To prevent thermal bridging, they staggered the joints to avert possible heat loss or moisture infiltration. The roof's layout had several intersecting roof planes, so tapered Polyiso panels leading to centralized roof drains were used. Some of the architect's flashing details provided a challenge, but the skilled authorized applicators from Great Lakes Systems were able to meet or exceed all of TAG's and Carlisle's high standards.

Upon completion, the roof was carefully inspected by Carlisle and passed easily due to the quality of Great Lakes Systems' workmanship. TAG selected a fifteen-year warranty for their roof, one of Carlisle's many industry-leading warranty options. Carlisle's variety of warranties cover the repair of leaks from a range of causes, including hail up to two inches and wind of up to 120 miles per hour, and offer terms of up to 30 years. Therefore, TAG can have complete confidence and peace of mind in their roofing investment.

When the project was completed, it was awarded LEED Silver certification, partly due to the Roof$ense report which proved that black EPDM was the most energy-efficient roof in their cool, Northern climate. Bode concluded, "This project was driven by our desire to create a state-of-the-art, functional, and ecologically sustainable facility for our personnel. The design and construction strategies used on our corporate office will reduce the building's environmental impact and improve our employees' comfort and productivity."

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[1] The Roof$ense energy savings model is based on the LC4 Life Cycle cost analysis tool developed by Pat Downey of Merik Professional Roofing Services in the late 1990's. The LC4 energy calculations and formulas are taken from the 1989 ASHRAE Fundamentals Handbook". Also used was the "Guide for Estimating Difference in Building Heating and Cooling Energy due to Change in Solar Reflectance of a Low-Sloped Roof", Oak Ridge National Laboratory publication ORNL-6527 and the "NRCA Energy Manual" third edition, National Roofing Contractors Association, Chicago, IL. Adjustments to the formula and reflectance have been made as a result of a benchmarking study completed using Carrier's "Hourly Analysis Program" (HAP) and ASHRAE's standards on building simulation. Carrier's HAP is approved by the government for studies done for the Tax Policy Act of 2005. Historic energy cost data, when used, has been obtained from the Energy Information Agency (EIA) www.eia.doe.gov.

See the attached Roof$ense report for TAG.

[2] Visit *http://goo.gl/4pL8nT* to learn more about obtaining a LEED credit for dark-colored membrane roofing assemblies.

OFFICES OF THE ARCHITECTURAL GROUP, INC.

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CARLISLE SYNTEC SYSTEMS

RoofSense Life Cycle Savings Report

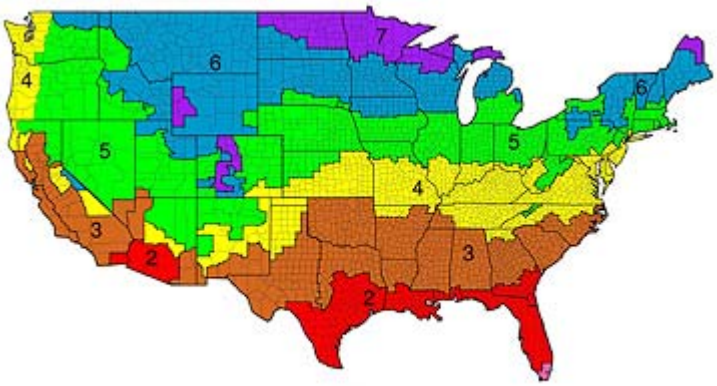
Project: The Architectural Group Inc.
Scenario: Black Membrane vs. White Membrane
Prepared By: Kevin Pollock

Roof Project Summary

Project Information

Location:	GRANDVILLE, MI
Term of Analysis:	10 Years
Roof Area:	4294 sq. ft.
Facility Type:	Office/Bank

Regional Weather Summary
AHRAE Station: GRAND RAPIDS
Heating Degree Days: 6927
Cooling Degree Days: 570



Roof$ense Weather Data

Regional weather data, Heating Degree Days (HDD) and Cooling Degree Days (CDD) are based on 30 year historical data from National Oceanic and Atmospheric Administration (NOAA). http://cdo.ncdc,noaa.gov/CDO/cdo

The map shown here shows ASHRAE U.S. Climate Zones, for the United States. Climate Zones are based on ASHRAE standard 90.1-2004 with zone 1 being the hottest zone and zone 8 being the coldest zone.

Roof Details

Roof Assembly
The following items were included in the roof assembly structure as a part of the life cycle cost comparison. The R-Values are shown for each included component of the assembly. Components in the assembly are present in the baseline roof as well as the proposed roof.

Assembly Item	R Value
Outside Air	0.17
Membrane	0.33
Cover Board	0
Roof Insulation	36
Vapor Retarder	0
Base Board	0
Deck	0
Air Space	0.94
Batt Insulation	0
Ceiling Tile	0
Inside Air	0.61
Total Assembly R:	38.05

What is R-Value?

R-Value is a measure of apparent thermal conductivity, and thus describes the rate that heat energy is transferred through a material or assembly item, regardless of the heat source.

Higher R-Value indicates a higher resistance to heat transfer. R-Values provided are from manufacturer specification or provided as scientific constants unless otherwise noted.

Roof Membrane and Insulation:
The following section details the roof membrane and insulation for the baseline and proposed roof systems being observed in the life cycle cost comparison.

Baseline Roof A:	Baseline Roof B:
Sure-White EPDM or TPO	Sure-Seal EPDM (black)
Roof Surface Type: Sure-White	Roof Surface Type: Sure-Seal
Existing Assembly Insulation R: 36	Existing Assembly Insulation R: 36
Insulation R to be Added: 0 Layer 1: n/a Layer 2: n/a	Insulation R to be Added: 0 Layer 1: n/a Layer 2: n/a
Total Insulation R: 36	Total Insulation R: 36

Energy Cost Summary

Heating and Cooling Data:
The heating and cooling load is referred to as the cost to heat and cool the facility. Following are the details of the buildings system efficiency, fuel type and associated cost used in the energy load calculation.

Cooling Data	Heating Data
Fuel Type: Electricity System Efficiency: 10 S.E.E.R or E.E.R	Fuel Type: Natural Gas System Efficiency: 75%
Fuel Cost: $0.09 /Kwh Fuel Inflation Rate: 2.1% per yr	Fuel Cost: $10.75 /1000 CF Fuel Inflation Rate: 2.4% per yr

Estimated Energy Cost:
The energy model within Roof$ense compares the estimated energy cost of two roof systems over the term of analysis. Fuel cost and inflation, interior temperature, climate, roof surface type and color, and the amount of insulation utilized are included in the energy cost formulas. The following are estimated energy costs.

A Sure-White EPDM or TPO	B Sure-Seal EPDM (black)
Estimated Energy Cost:	**Estimated Energy Cost:**
Cooling: $275.35	Cooling: $431.65
Heating: $3,471.39	Heating: $3,155.81
Total: $3,746.74	**Total: $3,587.46**

Energy Cost Reduction: **$159.28** (4.25%)

Environmental Emissions:		Environmental Emissions:	
CO2 Carbon Dioxide	69.22 Tons	CO2 Carbon Dioxide	64.38 Tons
CH4 Methane	1.28 LBS	CH4 Methane	1.19 LBS
N2O Nitrous Oxide	2.19 LBS	N2O Nitrous Oxide	2.04 LBS

Carbon Reduction: **4.8** Tons (7.00%)

Savings Equivalent To:	
Trees Planted	19
Airplane Miles	7416
Less Cars on Road	1

Energy Savings Notes:
The Roof$ense energy savings model is based on the LC4 Life Cycle cost analysis tool developed by Pat Downey of Merik Professional Roofing Services in the late 1990's. The LC4 energy calculations and formulas are taken from the "1989 ASHRAE Fundamentals Handbook". Also used was the "Guide for Estimating Difference in Building Heating and Cooling Energy due to Change in Solar Reflectance of a Low-Sloped Roof", Oak Ridge National Laboratory publication ORNL-6527 and the "NRCA Energy Manual" third edition, National Roofing Contractors Association, Chicago, IL. Adjustments to the formula and reflectance have been made as a result of a benchmarking study completed using Carrier's "Hourly Analysis Program" (HAP) and ASHRAE's standards on building simulation. Carrier's HAP is approved by the government for studies done for the Tax Policy Act of 2005. Historic energy cost data, when used, has been obtained from the Energy Information Agency (EIA) www.eia.doe.gov.