ESCSI Information Sheet 3650.41
March 2006

Expanded Shale, Clay and Slate Institute
Rotary Kiln Structural Lightweight Aggregate

Whole Building Energy Savings Analysis for LEED® Credit – Big Box Buildings with Concrete and Concrete Masonry Wall Systems

February 6, 2006

ESCSI
Salt Lake City, Utah

RE: LEED Comparison - Project 0350000800.201

Gentlemen,

Per your request, HEI has evaluated the energy cost savings of the "SmartWall" concrete masonry wall system in comparison with a Heavy Weight concrete masonry wall and an Insulated Concrete Sandwich Panel wall system. The same 200,000 square foot "big box" retail type building was used as the basis of design. The building is rectangular with approximately 45,000 square foot of exterior wall surface area and is of typical current construction. The Trace 700 program was utilized to determine the heat loss/gain of the building located both in Omaha, NE and Raleigh, NC. This program runs an hour by hour analysis of heat gain/loss through all components of a building for an indicated climate zone, while taking into account thermal lagging due to construction.

The wall density and the R-value of the wall were varied for the different wall constructions; all other variables were held constant. An energy cost study was done to determine an approximate annual energy (operating) savings associated with the systems studied.

The SmartWall CMU and Heavy Weight CMU walls are each composed of single wythe 12" concrete masonry units reinforced 48" on center vertically with grout and rebar. The other cores of the block are filled with Poly foam insulation. The SmartWall CMU utilizes a lightweight concrete masonry unit. The Insulated Concrete Sandwich Panel has 2" extruded polystyrene insulation between 3” normal weight concrete interior and exterior segments joined with metal ties.

Client provided R-values of 10.15 (hr)(ft^2)(°F)/Btu, 6.4 (hr)(ft^2)(°F)/Btu and 3.6 (hr)(ft^2)(°F)/Btu for the Insulated Concrete Sandwich Panel, SmartWall CMU and Heavy Weight CMU were used respectively. Trace allows the user to select material type and from this the program determines material density and thus thermal lagging. Lightweight concrete was used for the SmartWall CMU and normal weight concrete was used for the Insulated Concrete Sandwich Panel and the Heavy Weight CMU. The R-value alone indicates that the heat transfer through the Insulted Concrete Sandwich Panel and the SmartWall CMU will be significantly less than the Heavy Weight CMU. The impact the wall type will have on the overall building load will vary dependant on the percentage of wall surface area and its relation to other factors including roof load, internal load and geographic location.

For this study, we looked at a comparison of the wall peak load versus the overall peak building load in both heating and cooling. The results can be seen on the attached Figure (“Sheet 3” Heat Gain/Loss by Wall Type). Although the buildings were run in areas with substantially different climates and the peak heat load is much higher in Omaha, the percentage of overall wall heating peak load reduction for the buildings with the Insulated Concrete Sandwich Panel and SmartWall CMU remain similar. It is important to note that these results reflect peak load savings, which determines the size of equipment needed for the building, not the (annual) energy savings of the building. For this building, the Insulated Concrete Sandwich Panel saved 7 tons out of roughly 230 tons at peak load in Omaha and 6 tons out of 230 in Raleigh in comparison to the Heavy Weight CMU. This equates to an equipment savings between $4,500 and $5,000 depending on the complexity of the rooftop units. The SmartWall CMU saved 5 tons out of roughly 230 tons at peak load in Omaha and 4 tons out of 230 tons at peak load in Raleigh in comparison to the Heavy Weight CMU. This equates to an equipment savings around $4,000 depending on the complexity of the rooftop units. While this is a benefit to the owner, it does not obtain a LEED credit point on its own.

The table below represents what percentage of the heat gain/ loss comes from each building component for the building in Omaha.

Building Component Peak Load Analysis - Omaha. NE	Insulated Concrete Sandwich Panel			SmartWall CMU			Heavy Weight CMU		
	R-Value (hr)(ft^2)(°F)/Btu	% Heating Load	% Cooling Load	R-Value (hr)(ft^2)(°F)/Btu	% Heating Load	% Cooling Load	R-Value (hr)(ft^2)(°F) /Btu	`% Heating Load	Cooling Load
Roof	18.6	36.2	25.3	18.6	33.4	25.3	18.6	29	24.6
Wall	10.15	13.5	1.5	6.4	19.7	1.9	3.6	30.3	3.8
Glass	.93	0	0	.93	0	0	.93	0	0
Lights		0	14.8		0	14.8		0	14.5
People		0	24		0	23.9		0	23.4
Misc. (equip)		0	7.5		0	7.5		0	7.4
Outside Air		50.3	26.9		46.9	26.6		40.7	26.3

As you can see, the wall load is a relatively small portion of the overall building load for this particular building type. Other types of builing will will have different percentages, it is therefore not realistic to set a definitive percentage of building heat gain/loss based on wall type alone. To maximize the overall heat gain/ loss by varying only wall type, the building must have a large wall-load to building-load ratio. This would happen where the roof load, ventilation load and internal load of the building is minimized with the impact of wall maximized.

It is also difficult to say exactly how often a building will be in the heating mode versus the cooling mode. Varying factors such as location, climate and building occupancy largely impact heating and cooling. Generally speaking, a building is cooling during the summer months and heating during the winter months. A building can be cooling in the winter months if it is high in occupancy or has large internal equipment loads. During the summer there can be a small amount of reheat to bring the space to desired set point. The attached graphs are representative of the amount of heating (kBtu) shown in pink and cooling (kWh) shown in blue, used each month of the year for each of site studied and each alternate. As expected, Duluth is heating for a greater portion of the year while Raleigh is cooling more of the year and Omaha falls in between the two.

The US Green Building Council has established a Leadership in Energy and Environmental Design, or LEED, rating system as a way to certify buildings as being environmentally friendly, sustainable and efficient. Credit EA 1 of the LEED New Construction 2.2 rating system is intended to "achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental impacts associated with excessive energy use." The credit is broken down into 10 savings categories for new buildings, starting at 1 point for 10.5% savings and culminating with 10 points for 42% savings. To show that a building meets the energy savings, a summary printout from an energy analysis program must show the design energy cost is less than energy cost budget as defined by the Energy Cost Budget Method of AS I RAE 90.1 2004. The Energy Cost Budget Method compares the base building with the improved building to see how much energy savings there will be. It allows designers and building owners to make trade-offs in building construction, lighting, and heating and cooling elements, as long as the resultant building is more efficient than the original building. For this study, we were trying to determine if utilizing either the Insulated Concrete Sandwich Panel or SmartWall CMU in lieu of the Heavy Weight CMU could help in achieving points toward this credit. The percentage of savings needed to achieve LEED points is reduced from earlier work performed under LEED NC 2.1 and called for 15% savings to achieve the first point. This is due to the more stringent requirements of meeting ASHRAE 90.1 2004 in lieu of the previously required standard of ASHRAE 90.1 2001.

Several programs are available to illustrate compliance with ASHRAE 90.1 2004; our office utilizes COMCheck and has typically found this acceptable to code officials and authorities having jurisdiction nationwide. Since this study is evaluating wall type alone, COM Check is beneficial in that it allows the user to check compliance of envelope, lighting and mechanical systems independently. COMCheck asks the user to enter basic design information about the building such as square footage, gross area, location, and construction type. The building

construction can either be picked from a list of wall assemblies within COM Check or the user may enter a unique wall assembly. For this application, a unique wall assembly was entered for each wall type using the previously stated R-values. COM Check outputs for the three wall types in Omaha and Raleigh are attached to the back of this report. All wall types for Raleigh and both the Insulated Concrete Sandwich Panel and SmartWall CMU in Omaha show compliance where the Heavy Weight CMU in Omaha does not comply. While this envelope study shows that the Heavy Weight CMU envelope alone does not comply in Omaha, the building as a whole does pass the Energy Cost Budget Method. The Energy Cost Budget Method evaluates the performance of a building in its entirety, taking into account how various components interact and allows the user to apply trade-offs amongst building components.

To approximate annual energy savings, system types and utility rates must be plugged into the Trace 700 energy analysis program. The building was run with gas fired heating and direct expansion cooling rooftop units, common for this type of building. Direct expansion cooling uses electricity as the utility source. For the purpose of this study, flat utility rates of $.45/therm and $.065 kWh were utilized. These rates were held constant from earlier work done (for ESCSI) in the winter of 2003; although they are lower than current rates they will not affect the percent savings for LEED as they are consistent for all wall types and locations. Continually changing rates and local utilities offering peak and off-peak rates will result in varying energy savings. However, the flat rate load will give a good approximation of the type of energy savings that can be achieved by comparison of the two sites. In addition, equipment first cost and interest rates were left out to place the emphasis on annual operating savings.

The results of the energy cost analysis, which is what LEED utilizes, are shown in attached "TRACE 700 Economic Summary Reports" and summarized in the attached table "Yearly Utility and Cooling Capacity Savings by Wall Type." The study, which was run for Omaha and Raleigh, showed the greatest energy savings during the coldest months and in the colder climates. To emphasize the impact colder climates have on the energy savings, the same study was run in Duluth, MN. As expected, the energy savings were greatest at this location.

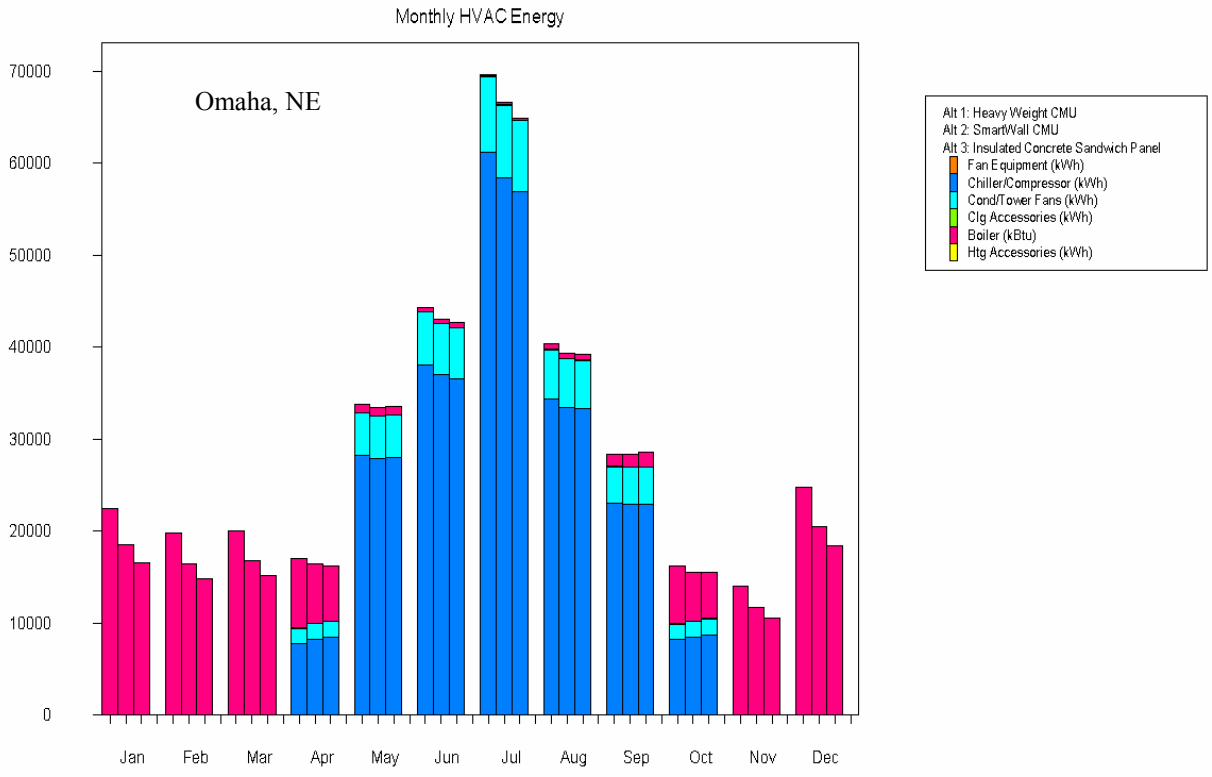
Based on the above information, the percent annual energy savings that can be achieved solely from substituting wall types are substantially less than the peak capacity savings. This is due to several factors; mainly that the building is seldom running at peak capacity. Some portions of the year the building is in economizer mode (economizer is a function that enables the building to be conditioned by utilizing outside air thus reducing the demand for mechanical cooling) and some portions of the year very little heating and cooling will be needed.

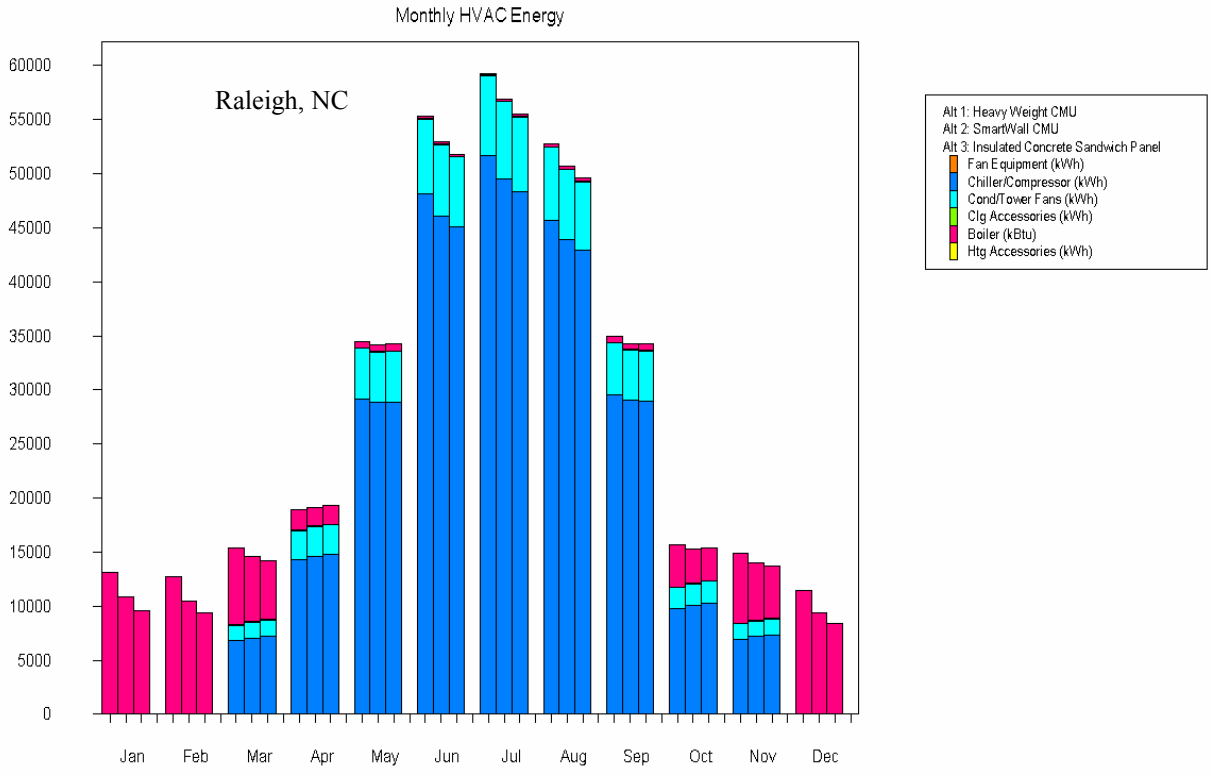
If you have any questions or comments please do not hesitate to call.

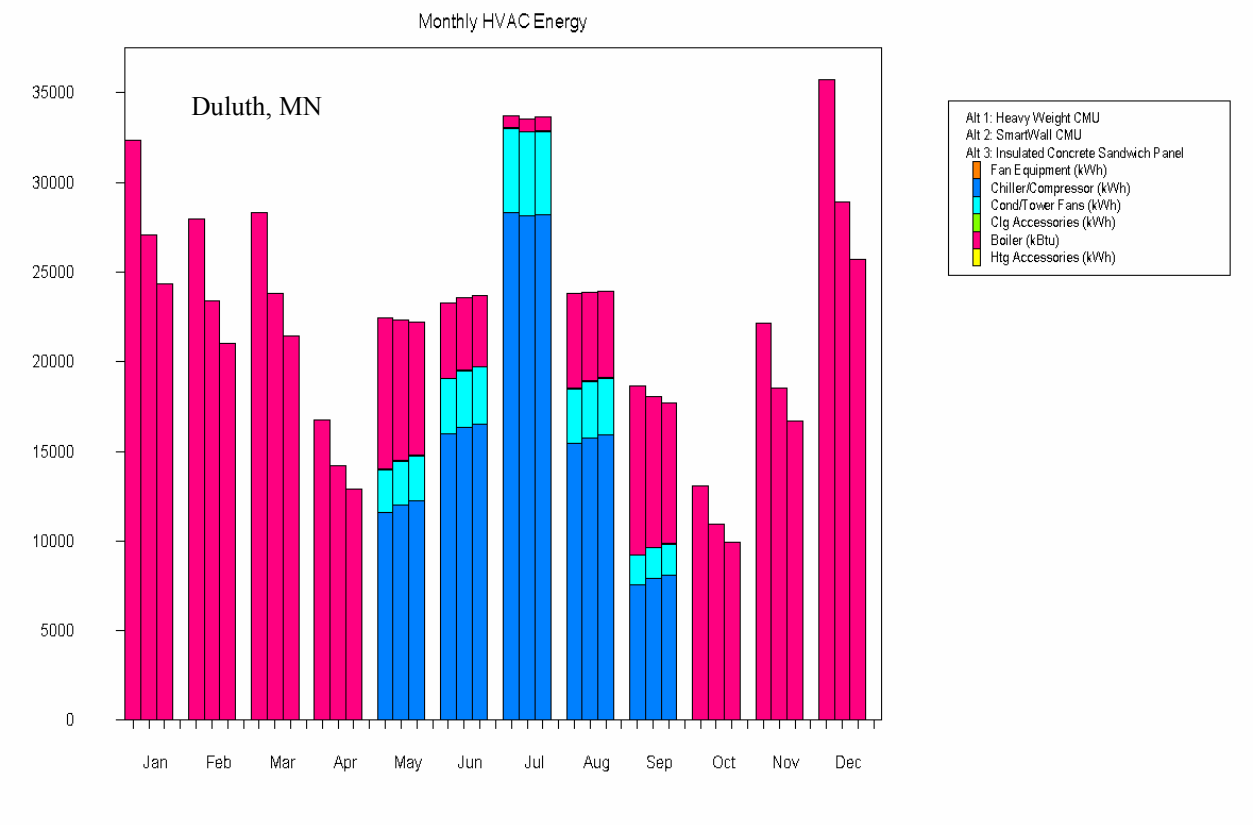
Sincerely,

HENDERSON ENGINEERS

This report was prepared for ESCSI by Henderson Engineers, Lenexa, KS. The original report has been edited for readability, but none of the facutal results have been changed. All original tables, figures, and attachments are included are presented unchanged.


Monthly HVAC Energy
Omaha, NE
70000
60000
50000
40000
30000
20000
10000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Alt 1: Heavy Weight CMU
Alt 2: SmartWall CMU
Alt 3: Insulated Concrete Sandwich Panel
Fan Equipment (kWh)
Chiller/Compressor (kWh)
Cond/Tower Fans (kWh)
Clg Accessories (kWh)
Boiler (kBtu)
Htg Accessories (kWh)


Monthly HVAC Energy
Raleigh, NC
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Alt 1: Heavy Weight CMU
Alt 2: SmartWall CMU
Alt 3: Insulated Concrete Sandwich Panel
Fan Equipment (kWh)
Chiller/Compressor (kWh)
Cond/Tower Fans (kWh)
Clg Accessories (kWh)
Boiler (kBtu)
Htg Accessories (kWh)


Monthly HVAC Energy
Duluth, MN
35000
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Alt 1: Heavy Weight CMU
Alt 2: SmartWall CMU
Alt 3: Insulated Concrete Sandwich Panel
Fan Equipment (kWh)
Chiller/Compressor (kWh)
Cond/Tower Fans (kWh)
Clg Accessories (kWh)
Boiler (kBtu)
Htg Accessories (kWh)

Yearly Utility and Cooling Capacity Savings by Wall Type

Omaha

Wall Type	First Year Utility Cost	Percent Savings Over Heavy Weight CMU	Building Tonnage	Tonnage Percent Savings
Heavy Weight CMU	$ 119,152.54		237.4	
SmartWall CMU	$ 116,345.69	2.4%	232	2.3%
Insulated Concrete Sandwich Panel	$ 115,035.12	3.5%	230.3	3.0%

Raleigh

Wall Type	First Year Utility Cost	Percent Savings Over Heavy Weight CMU	Building Tonnage	Tonnage Percent Savings
Heavy Weight CMU	$ 114,395.11		237.1	
SmartWall CMU	$ 112,685.78	1.5%	232.9	1.8%
Insulated Concrete Sandwich Panel	$ 111,920.05	2.2%	231.5	2.4%

Duluth

Wall Type	First Year Utility Cost	Percent Savings Over Heavy Weight CMU	Building Tonnage	Tonnage Percent Savings
Heavy Weight CMU	$ 121,507.03		207.7	
SmartWall CMU	$ 117,439.26	3.3%	204.2	1.7%
Insulated Concrete Sandwich Panel	$ 115,388.96	5.0%	203.8	1.9%

HEAT GAIN / LOSS BY WALL TYPE

OMAHA

HEATING PEAK LOADS

Wall (Btu/hr)			Total Building (Btu/hr)		
Heavy Weight CMU	SmartWall CMU	Insulated Concrete Sandwich Panel	Heavy Weight CMU	SmartWall CMU	Insulated Concrete Sandwich Panel
753,837	426,083	269,329	2,487,515	2,161,569	2,000,496
	Percent Savings over Heavy Weight CMU			Percent Savings over Heavy Weight CMU	
	SmartWall CMU	Insulated Concrete Sandwich Panel		SmartWall CMU	Insulated Concrete Sandwich Panel
	43.5%	64.3%		13.1%	19.6%

COOLING PEAK LOADS

Wall (Btu/hr)			Total Building (Btu/hr)		
Heavy Weight CMU	SmartWall CMU	Insulated Concrete Sandwich Panel	Heavy Weight CMU	SmartWall CMU	Insulated Concrete Sandwich Panel
107,151	51,194	41,286	2,849,317	2,784,299	2,763,210
	Percent Savings over Heavy Weight CMU			Percent Savings over Heavy Weight CMU	
	SmartWall CMU	Insulated Concrete Sandwich Panel		SmartWall CMU	Insulated Concrete Sandwich Panel
	52.2%	61.5%		2.3%	3.0%

RALEIGH

HEATING PEAK LOADS

Wall (Btu/hr)			Total Building (Btu/hr)		
Heavy Weight CMU	SmartWall CMU	Insulated Concrete Sandwich Panel	Heavy Weight CMU	SmartWall CMU	Insulated Concrete Sandwich Panel
516,192	291,761	184,424	1,669,485	1,441,051	1,334,359
	Percent Savings over Heavy Weight CMU			Percent Savings over Heavy Weight CMU	
	SmartWall CMU	Insulated Concrete Sandwich Panel		SmartWall CMU	Insulated Concrete Sandwich Panel
	43.5%	64.3%		13.7%	20.1%

COOLING PEAK LOADS

Wall (Btu/hr)			Total Building (Btu/hr)		
Heavy Weight CMU	SmartWall CMU	Insualted Concrete Sandwich Panel	Heavy Weight CMU	SmartWall CMU	Insulated Concrete Sandwich Panel
131,829	66,007	51,144	2,844,872	2,795,037	2,777,403
	Percent Savings over Heavy Weight CMU			Percent Savings over Heavy Weight CMU	
	SmartWall CMU	Insualted Concrete Sandwich Panel		SmartWall CMU	Insulated Concrete Sandwich Panel
	49.9%	61.2%		1.8%	2.4%

TRACE® 700 Economic Summary

By Henderson Engineers, Inc.

Project Information

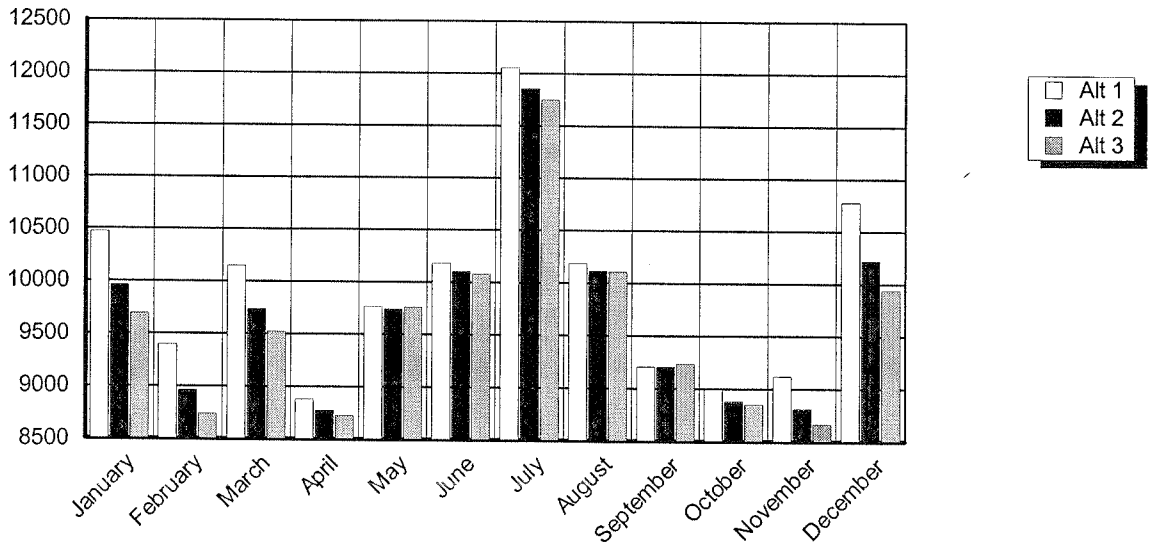
Weather file	Omaha, Nebraska
Project Name	ESCSI LEED Comparison
Location	Omaha, NE
Building Owner	
User	ES
Company	Henderson Engineers
Comments	

Alternative 1 - - Heavy Weight CMU
Alternative 2 - - SmartWall CMU
Alternative 3 - - Insulated Concrete Sandwich Panel

Economic Summary

	First Year Util. Cost
	119,152.54
	116,345.69
	115,035.12

Monthly Utility Costs



TRACE® 700 Economic Summary

By Henderson Engineers, Inc.

Project Information

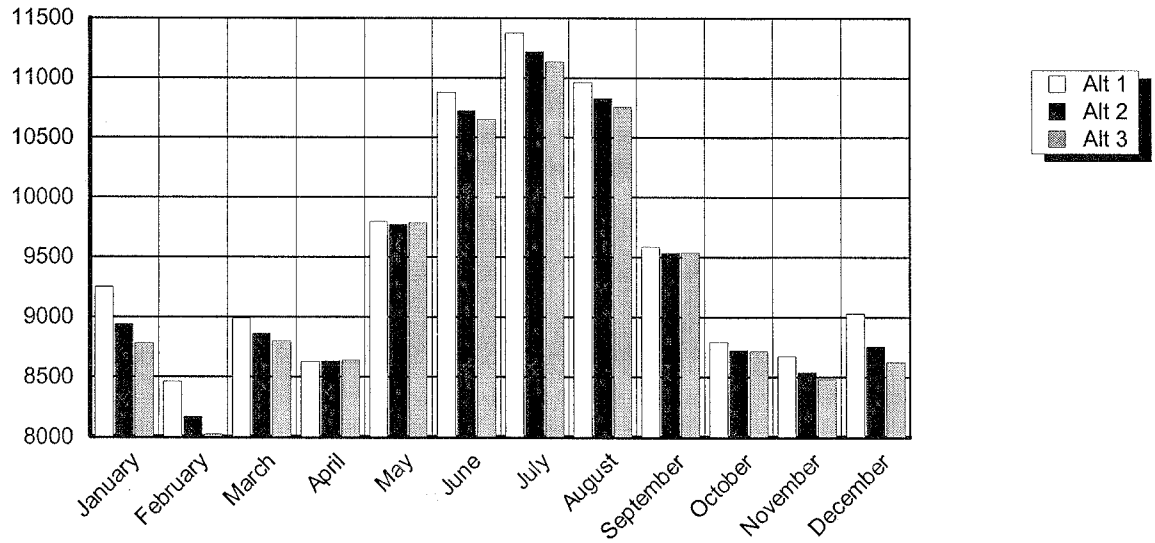
Weather file	Raleigh, North Carolina
Project Name	ESCSI LEED Comparison
Location	Raleigh, NC
Building Owner	
User	ES
Company	Henderson Engineers
Comments	

Alternative 1 - - Heavy Weight CMU
Alternative 2 - - SmartWall CMU
Alternative 3 - - Insulated Concrete Sandwich Panel

Economic Summary

	First Year Util. Cost
	114,395.11
	112,685.78
	111,920.05

Monthly Utility Costs



TRACE® 700 Economic Summary

By Henderson Engineers, Inc.

Project Information

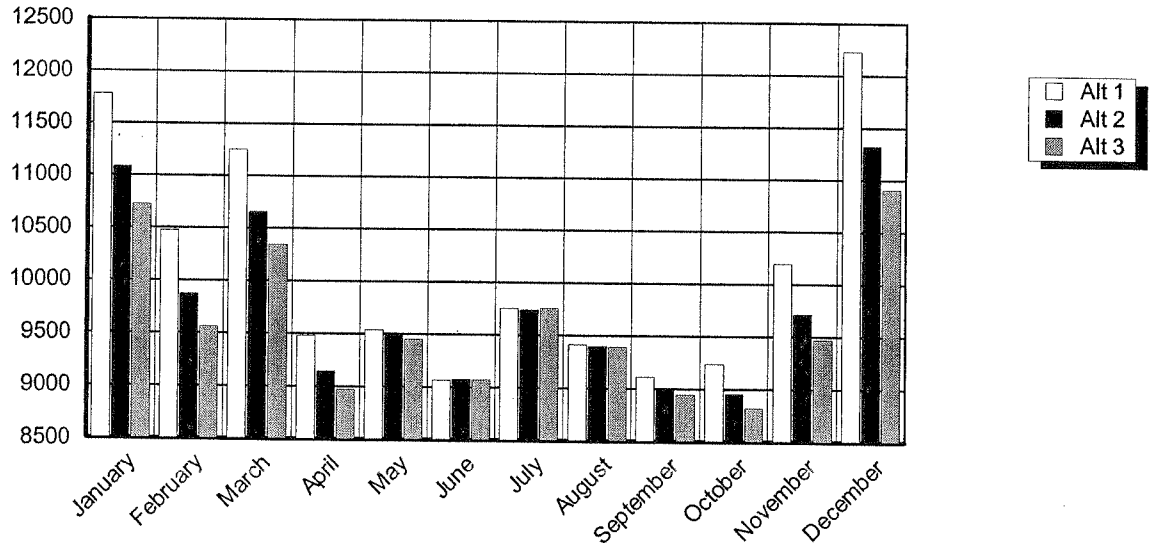
Weather file	Duluth, Minnesota
Project Name	ESCSI LEED Comparison
Location	Duluth, MN
Building Owner	
User	ES
Company	Henderson Engineers
Comments	

Alternative 1 - - Heavy Weight CMU
Alternative 2 - - SmartWall CMU
Alternative 3 - - Insulated Concrete Sandwich Panel

Economic Summary

	First Year Util. Cost
	121,507.03
	117,439.26
	115,388.96

Monthly Utility Costs



Permit #
Permit Date

COMcheck Software Version 3.1 Release 1

Envelope Compliance Certificate

Standard 90.1-2004

Report Date: 12/22/05

Data filename: G:\2003\0350000800 Buildex LEED Energy Comparison\201\comcheck\2004\Omaha heavyweight.cck

Section 1: Project Information

Project Title: Omaha Heavy Weight CMU

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Omaha, Nebraska**
Heating Degree Days (base 65 degrees F):	**6300**
Cooling Degree Days (base 50 degrees F):	**3398**
Building Type for Envelope Requirements:	**Non-Residential**
Project Type:	**New Construction**
Glazing Area Percentage:	**0%**

Building Type	Floor Area
Retail Sales, Wholesale Showroom	198000

Section 3: Requirements Checklist

Envelope FAILS: Design 9% worse than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Metal Building, Standing Seam	198000	0.0	19.0	0.051	0.065
Exterior Wall 1: Heavy Weight CMU, HC 14.0	50320	---	---	0.278	0.089
Door 1: Insulated Metal, Swinging	388	---	---	0.143	0.700
Floor 1: Slab-On-Grade:Unheated	2139	---	---	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ☐ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ☐ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ☐ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- ☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ☐ 5. All exterior insulation is covered with protective material.
- ☐ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ☐ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ☐ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- ☐ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled

using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

- ☐ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- ☐ 11. Windows, doors, and skylights certified as meeting leakage requirements.
- ☐ 12. Component R-values & U-factors labeled as certified.
- ☐ 13. Building entrance doors have a vestibule and equipped with closing devices.

Exceptions:

Buildings less than four stories above grade. Building entrances with revolving doors. Doors that open directly from a space less than 3000 sq. ft. in area.

Permit #
Permit Date

COM*check* Software Version 3.1 Release 1

Envelope Compliance Certificate

Standard 90.1-2004

Report Date: 12/22/05

Data filename: G:\2003\0350000800 Buildex LEED Energy Comparison\201\comcheck\2004\Omaha smartwall.cck

Section 1: Project Information

Project Title: Omaha SmartWall CMU

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Omaha, Nebraska**
Heating Degree Days (base 65 degrees F):	**6300**
Cooling Degree Days (base 50 degrees F):	**3398**
Building Type for Envelope Requirements:	**Non-Residential**
Project Type:	**New Construction**
Glazing Area Percentage:	**0%**

Building Type	Floor Area
Retail Sales, Wholesale Showroom	198000

Section 3: Requirements Checklist

Envelope PASSES: Design 6% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Metal Building, Standing Seam	198000	0.0	19.0	0.051	0.065
Exterior Wall 1: SmartWall CMU, HC 11.0	50320	---	---	0.156	0.089
Door 1: Insulated Metal, Swinging	388	---	---	0.143	0.700
Floor 1: Slab-On-Grade:Unheated	2139	---	---	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ☐ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ☐ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ☐ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- ☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ☐ 5. All exterior insulation is covered with protective material.
- ☐ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ☐ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ☐ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- ☐ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled

using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

- ☐ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- ☐ 11. Windows, doors, and skylights certified as meeting leakage requirements.
- ☐ 12. Component R-values & U-factors labeled as certified.
- ☐ 13. Building entrance doors have a vestibule and equipped with closing devices.
  Exceptions:
  Buildings less than four stories above grade. Building entrances with revolving doors.
  Doors that open directly from a space less than 3000 sq. ft. in area.

Section 4: Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the Standard 90.1-2004 requirements in COM*check* Version 3.1 Release 1 and to comply with the mandatory requirements in the Requirements Checklist.

Principal Envelope Designer-Name	Signature	Date

Permit #
Permit Date

COM*check* Software Version 3.1 Release 1

Envelope Compliance Certificate

Standard 90.1-2004

Report Date: 12/22/05

Data filename: G:\2003\0350000800 Buildex LEED Energy Comparison\201\comcheck\2004\Omaha smartwall revised.cck

Section 1: Project Information

Project Title: Omaha Insulated Concrete Sandwich Panel

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Omaha, Nebraska**
Heating Degree Days (base 65 degrees F):	**6300**
Cooling Degree Days (base 50 degrees F):	**3398**
Building Type for Envelope Requirements:	**Non-Residential**
Project Type:	**New Construction**
Glazing Area Percentage:	**0%**

Building Type	Floor Area
Retail Sales, Wholesale Showroom	198000

Section 3: Requirements Checklist

Envelope PASSES: Design 13% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Metal Building, Standing Seam	198000	0.0	19.0	0.051	0.065
Exterior Wall 1: Insulated Concrete Sandwich Panel, HC 15.0	50320	---	---	0.099	0.089
Door 1: Insulated Metal, Swinging	388	---	---	0.143	0.700
Floor 1: Slab-On-Grade:Unheated	2139	---	---	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ☐ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ☐ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ☐ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- ☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ☐ 5. All exterior insulation is covered with protective material.
- ☐ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ☐ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ☐ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- ☐ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled

using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

- ☐ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- ☐ 11. Windows, doors, and skylights certified as meeting leakage requirements.
- ☐ 12. Component R-values & U-factors labeled as certified.
- ☐ 13. Building entrance doors have a vestibule and equipped with closing devices.

Exceptions:

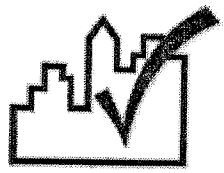
Buildings less than four stories above grade. Building entrances with revolving doors.
Doors that open directly from a space less than 3000 sq. ft. in area.

Section 4: Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the Standard 90.1-2004 requirements in COM*check* Version 3.1 Release 1 and to comply with the mandatory requirements in the Requirements Checklist.

Principal Envelope Designer-Name	Signature	Date

Permit #
Permit Date



COM*check* Software Version 3.1 Release 1

Envelope Compliance Certificate

Standard 90.1-2004

Report Date: 12/22/05

Data filename: G:\2003\0350000800 Buildex LEED Energy Comparison\201\comcheck\2004\Raleigh heavyweight.cck

Section 1: Project Information

Project Title: Raleigh Heavy Weight CMU

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Raleigh, North Carolina**
Heating Degree Days (base 65 degrees F):	**3397**
Cooling Degree Days (base 50 degrees F):	**4612**
Building Type for Envelope Requirements:	**Non-Residential**
Project Type:	**New Construction**
Glazing Area Percentage:	**0%**

Building Type	Floor Area
Retail Sales, Wholesale Showroom	198000

Section 3: Requirements Checklist

Envelope PASSES: Design 2% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Metal Building, Standing Seam	198000	0.0	19.0	0.051	0.065
Exterior Wall 1: Heavy Weight CMU, HC 14.0	50320	---	---	0.278	0.089
Door 1: Insulated Metal, Swinging	388	---	---	0.143	0.700
Floor 1: Slab-On-Grade:Unheated	2139	---	---	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ☐ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ☐ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ☐ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- ☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ☐ 5. All exterior insulation is covered with protective material.
- ☐ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ☐ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ☐ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- ☐ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled

using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

- ☐ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- ☐ 11. Windows, doors, and skylights certified as meeting leakage requirements.
- ☐ 12. Component R-values & U-factors labeled as certified.
- ☐ 13. Building entrance doors have a vestibule and equipped with closing devices.
  Exceptions:
  Buildings less than four stories above grade. Building entrances with revolving doors.
  Doors that open directly from a space less than 3000 sq. ft. in area.

Section 4: Compliance Statement

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Principal Envelope Designer-Name	Signature	Date

Permit #
Permit Date

COM*check* Software Version 3.1 Release 1

Envelope Compliance Certificate

Standard 90.1-2004

Report Date: 12/22/05

Data filename: G:\2003\0350000800 Buildex LEED Energy Comparison\201\comcheck\2004\Raleigh smartwall.cck

Section 1: Project Information

Project Title: Raleigh SmartWall CMU

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Raleigh, North Carolina**
Heating Degree Days (base 65 degrees F):	**3397**
Cooling Degree Days (base 50 degrees F):	**4612**
Building Type for Envelope Requirements:	**Non-Residential**
Project Type:	**New Construction**
Glazing Area Percentage:	**0%**

Building Type	Floor Area
Retail Sales, Wholesale Showroom	198000

Section 3: Requirements Checklist

Envelope PASSES: Design 11% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Metal Building, Standing Seam	198000	0.0	19.0	0.051	0.065
Exterior Wall 1: Smart Wall CMU, HC 11.0	50320	---	---	0.156	0.089
Door 1: Insulated Metal, Swinging	388	---	---	0.143	0.700
Floor 1: Slab-On-Grade:Unheated	2139	---	---	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ☐ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ☐ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ☐ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- ☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ☐ 5. All exterior insulation is covered with protective material.
- ☐ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ☐ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ☐ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- ☐ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled

using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

- ☐ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- ☐ 11. Windows, doors, and skylights certified as meeting leakage requirements.
- ☐ 12. Component R-values & U-factors labeled as certified.
- ☐ 13. Building entrance doors have a vestibule and equipped with closing devices.
  Exceptions:
  Buildings less than four stories above grade. Building entrances with revolving doors.
  Doors that open directly from a space less than 3000 sq. ft. in area.

Section 4: Compliance Statement

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Principal Envelope Designer-Name	Signature	Date

Permit #
Permit Date

COM*check* Software Version 3.1 Release 1

Envelope Compliance Certificate

Standard 90.1-2004

Report Date: 12/22/05

Data filename: G:\2003\0350000800 Buildex LEED Energy Comparison\201\comcheck\2004\Raleigh smartwall revised.cck

Section 1: Project Information

Project Title: Raleigh Insulated Concrete Sandwich Panel

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Raleigh, North Carolina**
Heating Degree Days (base 65 degrees F):	**3397**
Cooling Degree Days (base 50 degrees F):	**4612**
Building Type for Envelope Requirements:	**Non-Residential**
Project Type:	**New Construction**
Glazing Area Percentage:	**0%**

Building Type	Floor Area
Retail Sales, Wholesale Showroom	198000

Section 3: Requirements Checklist

Envelope PASSES: Design 15% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Metal Building, Standing Seam	198000	0.0	19.0	0.051	0.065
Exterior Wall 1: Insulated Concrete Sandwich Panel, HC 15.0	50320	---	---	0.099	0.089
Door 1: Insulated Metal, Swinging	388	---	---	0.143	0.700
Floor 1: Slab-On-Grade:Unheated	2139	---	---	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Insulation:

- ☐ 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- ☐ 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- ☐ 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- ☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- ☐ 5. All exterior insulation is covered with protective material.
- ☐ 6. Cargo and loading dock doors are equipped with weather seals.

Fenestration and Doors:

- ☐ 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- ☐ 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- ☐ 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled

using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

Air Leakage and Component Certification:

- ☐ 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- ☐ 11. Windows, doors, and skylights certified as meeting leakage requirements.
- ☐ 12. Component R-values & U-factors labeled as certified.
- ☐ 13. Building entrance doors have a vestibule and equipped with closing devices.

Exceptions:

Buildings less than four stories above grade. Building entrances with revolving doors.
Doors that open directly from a space less than 3000 sq. ft. in area.

Section 4: Compliance Statement

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Principal Envelope Designer-Name	Signature	Date