green. environmentally friendly.healthier living.

building green
starts with NUDURA

USE OF NUDURA® ON PROJECTS EMPLOYING THE LEED® GREEN BUILDING RATING SYSTEM™

Since its introduction in 1998, the Leadership in Energy and Environmental Design (LEED®) Green Building Rating System™ Program as administered by the U.S. and Canada Green Building Councils (USGBC, CaGBC) has rapidly become the nationally accepted benchmark for the design, construction, and operation of high performance green buildings world -wide. Most design professionals are already aware that LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health- these being:

1. SS Sustainable Sites
2. WE Water Efficiency
3. EA Energy & Atmosphere
4. MR Materials &Resources
5. EQ Indoor Environmental Quality

Though NUDURA Corporation acknowledges that only PROJECTS (not building materials) qualify for certification by LEED, designers should be made aware that the NUDURA® Integrated Building Technology System CAN contribute towards LEED Architectural Design Teams effecting positive achievement of points under select credit areas of the LEED Project Checklist. The objective of this document, therefore is to identify those area of the LEED Rating System where points can be positively improved or influenced directly by use of the NUDURA Wall system and secondly, to provide (wherever possible) the quantitative data which LEED professional designers require for accurate assessment of the NUDURA Wall system in completion of the project certification documentation required for each project.

As a building envelope material, specification of the NUDURA wall system provides potential contribution to selected categories and credits of LEED Assessment under the New Construction & Major Renovation Assessment Checklists for each Country. The summary contained in this document assesses NUDURA's contributions to credit categories for the following LEED Green Building Rating Systems:

- USGBC LEED® NC-2.2
- CaGBC LEED® NC-Canada 1.0

GreenSpec® LISTED 2005
NUDURA ICFs

U.S. GREEN BUILDING COUNCIL MEMBER

NUDURA®
INTEGRATED BUILDING TECHNOLOGY
Building Value

Building Has Evolved™

The potential points attainable under each of the checklists are summarized as follows:

Category Code	Assessment or Element Name	Credit Designation	Possible Points in Category
EA	**Energy & Atmosphere**		
	• Optimize Energy Performance	Credit 1	10
MR	**Materials & Resources**		
	• Construction Waste Management - Divert 50%	Credit 2.1	1
	• Construction Waste Management - Divert 75%	Credit 2.2	1
	Recycled Content,		
	• 10% USA/7.5%CAN(post-consumer + ½ post-industrial)	Credit 4.1	1
	• 20% USA/15% CAN(post-consumer + ½ post-industrial)	Credit 4.2	1
	Durable Building	Credit 8	1
EQ	**Indoor Environmental Air Quality**		
	• Thermal Comfort - Design	Credit 7.1	1

Supporting Information

EA	**Energy & Atmosphere**		
	• Optimize Energy Performance	Credit 1	10 pts (max)

Although the NUDURA Wall assembly itself boasts a calculated R-Value of R 22.4 (RSI 3.94) (U-Factor 0.0447 Btu/hr ft^2 °F (0.2538 W/m^2K)), studies conducted by the Portland Cement Association have confirmed that the effect of thermal mass provided by ICF wall assemblies enables the wall to achieve insulation performances well beyond the basic calculated amount depending upon climatic zone location of the project. In some instances, the effect of thermal mass can improve wall insulation capabilities by as much as 60% over what is typically achieved by more conventional construction methods that are installed to minimum code standards in building structures of comparable building and occupancy type. This attribute is one of the main product features that led to the selection of NUDURA® Integrated Building Technology as the primary structural and building envelope material of one of Canada's first projects to target as its design goal- a LEED® Platinum rating (>52 points) – West Village Student Condominium in Hamilton, Ontario. The exact point achievement in this category will of course depend upon the architect's co-selection of other envelope materials as well as lighting and mechanical systems that contribute in the same fashion to reduction of the energy consumption to the same degree as demonstrated by the NUDURA wall system.

West Villiage Project - Hamilton - ON

MR	**Materials & Resources**		
	• Construction Waste Management - Divert 50%	Credit 2.1	1 pt.
	• Construction Waste Management - Divert 75%	Credit 2.2	1 pt.

A 1994 study referenced in the CaGBC LEED Rating System Reference Package pegs the construction waste composition for a variety of common construction materials in terms of percent of construction waste composition relative to the volume of building material (of that type) shipped to the site. According to this study, up to 35% of the total wood products (exterior and interior wall framing) shipped to a site will typically be designated as waste (due to shrinkage, damage, cut-offs, etc). Similarly, up to 12% of masonry products designated for exterior or interior wall construction will become waste.

It has been consistently demonstrated that projects that have been planned to utilize the NUDURA Insulated Concrete Form System combined with employment of an experienced NUDURA trained and managed installation team will typically result in *less than 1% of the total volume of NUDURA product shipped to a construction site ending up as waste.* This is because of several innovative features within the form itself that enable cut-off segments as small as 8 inches in length to be utilized within the wall assembly without having to be designated as waste in the first place. These features include:

- The fact that NUDURA is shipped and shrink wrapped to site folded flat (preventing product waste due to damage)
- NUDURA features large sturdy EPS interlocks (again minimizing damage)
- NUDURA features a 4-way reversible interlock (this feature enables the form to be interconnected with itself in a variety of ways that enable cut-off segments to be utilized in twice as many scenarios as a non-reversible form can- thus eliminating this material from going to waste
- NUDURA features a dual cross tie connecting web system (in conjunction with the reversible interlock, this feature permits horizontal half form cut-offs to be fully utilized in either the top or bottom of a wall build).
- 100% of any web materials (high density polypropylene/polystyrene) that may be left over as part of the waste can be collected and recycled for re-use.

In addition, unlike frame or block materials, the concrete that is placed in the wall need only be supplied in the quantity required- again diverting significant volumes of debris from going to landfill and thus enabling the architect to better achieve both points available in this area of analysis .

MR Materials & Resources

- Recycled Content,
- 10%USA/7.5%CAN(post-consumer + ½ post-industrial) Credit 4.1 1 pt.
- 20% USA/15% CAN(post-consumer + ½ post-industrial) Credit 4.2 1 pt.

Although 100% of NUDURA's EPS foam is virgin material, more than 57% of the form unit weight is composed of the polypropylene/polystyrene web materials that make up its structure. This is true for the full range of form widths offered in the NUDURA system as displayed on the following chart:

SUMMARY OF COMPONENT WEIGHTS OF STANDARD NUDURA® FORMS

METRIC WEIGHTS IN GRAMS

Form	Total Form Weight	Panel Weight	No. of Panels	Web/FS Type	Web/FS Weight	No. Webs	FS Weight	No. FS	Total Panel Weight	%. Tot	Total Web/FS Weight	% Tot.
4 Inch	6598	1403	2	Hinged	316	12	0	0	2806	42.5	3792	57.5
6 Inch	6754	1403	2	Hinged	329	12	0	0	2806	41.5	3948	58.5
8 Inch	6886	1403	2	Hinged	340	12	0	0	2806	40.7	4080	59.3
10 Inch	7534	1403	2	Hinged	394	12	0	0	2806	37.2	4728	62.8
12 Inch	7438	1403	2	Insert	116	12	135	24	2806	37.7	4632	62.3

IMPERIAL WEIGHTS IN LBS.

Form	Total Form Weight	Panel Weight	No. of Panels	Web/FS Type	Web/FS Weight	No. Webs	FS Weight	No. FS	Total Panel Weight	%. Tot	Total Web/FS Weight	% Tot.
4 Inch	14.546	3.093	2	Hinged	0.697	12	0	0	6.186	42.5	8.360	57.5
6 Inch	14.890	3.093	2	Hinged	0.725	12	0	0	6.186	41.5	8.704	58.5
8 Inch	15.181	3.093	2	Hinged	0.750	12	0	0	6.186	40.7	8.995	59.3
10 Inch	16.610	3.093	2	Hinged	0.869	12	0	0	6.186	37.2	10.423	62.8
12 Inch	16.398	3.093	2	Insert	0.256	12	.298	24	6.186	37.7	10.212	62.3

More importantly, 100% of the polypropylene and polystyrene materials used in the manufacture of NUDURA webs and fastening strips is *recycled material.* NUDURA's polypropylene and polystyrene resin suppliers are among the very few in the industry to be able to verify the following composition of their materials:

- Not less than 30% of the material is traceable to post-consumer sources.
- Not more than 70% of the material is traceable to post-industrial sources.

This data can be used by the LEED design team to most effectively target towards attaining both of the points in this area of the LEED analysis, WHENEVER NUDURA is specified for a project.

MR Materials & Resources

- Durable Building — Credit 8 — 1pt.

Unlike many comparable external exterior building envelope material options, such as metal or wood framing, or concrete block walls constructed using the NUDURA system consist exclusively of materials that are not susceptible to damage from:

- Moisture/Condensation
- Mold and Mildew
- Reduction in insulation thermal resistance over time
- Dry Rot
- Corrosion
- Core Impact Failure resulting from strikes from windborne materials

NUDURA walls are composed ONLY of Expanded Polystyrene Foam (EPS) insulation, high density polypropylene or polystyrene, concrete and reinforcing steel. In the final installed condition, NONE of these materials are susceptible to any of the above types of damage that can occur with other more traditional exterior building envelope materials. In addition, NUDURA as an insulating concrete form, provides one of the most inert substrates currently in existence for application of acrylic based architectural coatings. All of these attributes serve to support LEED design professionals in targeting the end objective of attaining a building structure where its "Predicted Service Life" exceeds the "Design Service Life" established by the Guideline on Durability in Buildings (CSA S478-95(R2001). NUDURA backs this assertion by provision of a 30 year warranty with respect to its R-Value and STC Classifications for the assembly.

EQ Indoor Environmental Air Quality

- Thermal Comfort - Design — Credit 7.1 — 1

In supporting the LEED design professional's requirement to meet the thermal conditions set forth in ASHRAE 55-2004, the use of the NUDURA Wall System in any building design supports this objective by way of the following attributes of the system:

- Independent analysis if the NUDURA Wall System by CTL Engineering of Skokie Illinois verifies that when installed with concrete as per installation specifications, the NUDURA Wall System prevents air penetration to a rate not greater than 0.023 cfm/ft^2 (0.1168 l/s/m^2) This assures the designer that the wall assembly will significantly support the building design in meeting the design goal of eliminating unplanned and undesir able air flows.
- The thermal mass of the core of the wall assembly assures more stable interior wall temperature thus minim ing stack effect and drafts from being created along the wall surface for the complete perimeter of the structure
- Analysis of the wall system by Intertek Testing Services of Coquitlam BC verifies that the product itself (independent of the concrete core) inhibits vapor flow to a maximum of .624 perm (36 Ng/Pa.s.m2) thus qualifying it as a vapor retarder or barrier, and therefore enabling the wall to prevent uncontrolled humidification of any interior space enclosed by the wall system or condensation from occurring within the building shell.

In conjunction with appropriate design of the mechanical systems for the facility, use of the NUDURA Wall System enables the designer much tighter control of the interior environment towards attaining points under this credit.

Summary

Assessment of EACH of the potential categories for point attainment under the LEED Rating Systems may reveal opportunities for synergy of use of the NUDURA Wall System with other components of the building design to affect greater point achievement. This could include examination of the use of concrete that is specified to LEED requirements utilizing recycled or reclaimed aggregates or examining other opportunities to dovetail with other building systems and design elements under the credit opportunities outlined under the Innovation in Design section of the LEED checklist. However, NUDURA has elected to present herein, ONLY data pertinent to those categories which it is confident can positively contribute towards maximum point attainment for the LEED Design Professional. NUDURA's technical support team and distributors are ready to provide any other assistance to LEED design teams as may be required for documentation submissions for any potential LEED project. You can contact our technical support team through your local NUDURA distributor or via E-mail directly at:

techsupport@nudura.com
