



# Tennessee Office of the State Architect



## **Tennessee High Performance Building Requirements: Overview and Implementation**

By: Peter Heimbach and Eric Sheffer

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# Best Practice



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# Best Practice



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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



# Course Summary



This presentation serves to introduce the Tennessee High Performance Building Requirements to the audience, particularly the AEC community in this region. The presentation material will cover a brief history and strategy behind the development of the HPBr, and addressing the issues that the HPBR attempts to solve. Performance of state buildings is a driving factor for design and operational decisions, and the HPBr provides guidance for performance analysis. Furthermore, this presentation will provide an overview of the implementation approach and components of the HPBr.

# Learning Objectives



1. History and development of the Tennessee High Performance Building Requirements (TN HPBr)
2. Application of the TN HPBr to various types of projects
3. Description of component documents within the TN HPBr: Manual, Scorecard, OPR
4. Key factors for analysis and Return on Investment (ROI) for state facilities

# History



- **Reduce operating costs, improve value, increase performance and sustainability** of the State of Tennessee facility portfolio
- Sustainable Design Guidelines (SDG) had limited success – the HPBr will enhance process for efficient and sustainable buildings
- Improve and expand upon the foundation of the SDG

# History



- Expand accountability for state projects
- Expand application to all project types. HPBr is mandatory tool for SBC projects.
- Incorporate greater flexibility for application of performance criteria

# Location



<http://www.tn.gov/finance/article/fa-osa-capital-projects>

Capital Projects - TN.Gov



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## Capital Projects

Annual Project Lists

Designer Information

Construction Information

Technical Standards

Per the provisions of TCA 4-15-104, the Commission is authorized to prescribe standards for the construction of State buildings. Additionally, the Commission is encouraged to prescribe high performance building requirements and other standards to ensure all State Buildings perform in an energy efficient manner.

[Building Information Modeling Standards \(BIMs\)](#)

Sustainability Design Guidelines (SDG)

High Performance Building Requirements (HPBr)

- [HPBr Manual \(version 1.01\)](#)
- [Owner Project Requirements \(OPR\)](#)
- [Checklist/Tracking Form](#)

Standard Forms and Documents

- [Membrane Roof Warranty](#)

Designer Manuals:

- [STREAM](#)
- [TBR](#)
- [UT](#)

# Structure



- Checklist / Tracking Form
- Owner's Project Requirements
- HPBr Manual

High Performance Building Requirements v1.01 CHECKLIST / TRACKING FORM				
Phase	Targeted Points	SBC Number	Project Name	
Applicable	0		Date	
Minimum	0		Project Type	
Not Applicable	0		Project Phase	
Programming	0	Category from	Category C	
SD	0	Applicability Tree		
CD	0			
Closeout	0			
				Checklist Total
22 Points			Land Management	LM Total:
Possible Points	Credit ID	Applicable to Building/Site Scope?	Description	Level:
1	LM1.1		Site Selection - Re-use Existing Buildings	Priority 2
1	LM1.2		Site Selection - Show preference for building on developed sites. Preserve farmland/habitat, wetlands, floodplains, public parkland	Priority 1
1	LM1.3		Site Selection - Brownfield Redevelopment - Remediate and Restore contaminated sites when possible	Priority 2
1	LM1.4		Site Selection - Urban Development - Locate building within existing infrastructure	Priority 1
1	LM2.1		Site Disturbance - Sediment and Erosion control during construction	Required
1	LM2.2		Site Disturbance - Limit site disturbance during construction to minimum development footprint	Priority 1

PROJECT NAME: \_\_\_\_\_  
 OPR AUTHOR: \_\_\_\_\_  
 SBC #: \_\_\_\_\_  
 ASSET #: \_\_\_\_\_  
 AGENCY #: \_\_\_\_\_  
 BUILDING #: \_\_\_\_\_

Tennessee  
 High  
 Performance  
 Building  
 Requirements:  
 OPR

October 22

2015

The OPR is a deliverable of the High Performance Building requirements and is completed for State of Tennessee Projects. This document shall be completed for all State of Tennessee projects, it is adaptable to individual project objectives and scope.

Owner Project  
 Requirements

Tennessee High  
 Performance  
 Building  
 Requirements:  
 Manual

December 18

2015

The HPBr Manual is the main reference guide for the High Performance Building Requirements. All State of Tennessee projects will comply with the credits detailed in this document. It is adaptable to individual project objectives and scope.

HPBr  
 Manual  
 Version 1.01

# Owner's Project Requirements



- Complete as early as possible – preferably while the owner is planning the project
- Identify any and all project objectives used to define the success of the project
- Project-specific, living document to be updated throughout with input from design team

# Owner's Project Requirements



- High Performance Building Goals

#### 4. High Performance Building Goals

- A. High performance building criteria will be implemented to improve the following, based on the building/site scope:
  - a. Land Management
  - b. Water Efficiency
  - c. Energy Efficiency
  - d. Material and Resource Use
  - e. Indoor Environmental Quality
  - f. Innovation in Design and Construction
- B. The HPBr Checklist includes a summary of the Owner's high performance design requirements and has been attached to this document.
  - a. In addition to the credits found in the Project Information Table, the following credits will be "Required" except where they do not apply to the building/site scope of the project:
    - LM 2.1 Site Disturbance – Erosion Control
    - LM 4.2 Landscape Design
    - LM 6.4 Stormwater Design
    - WE 1.1 Water Efficient Landscaping
    - WE 3.1 Water Use Reduction
    - EE 2.1 Energy Efficient Purchasing Policy
    - MR 1.1 Recycling Storage and Collection
    - MR 3.1 Sustainable Materials
    - EQ 1.1 Tobacco Smoke Control
    - EQ 2.1 Minimum Ventilation
    - EQ 6.1 through EQ 6.5 Material VOC Limits
    - EQ 7.2 Pollutant Control – Hazardous material storage
    - EQ 8.1 Thermal Comfort

# Owner's Project Requirements



- Building Information Table
  - Project Applicability Notes
  - System Notes
  - Commissioning Requirements
  - Operational Schedules

### 3. Project Information Table

Project Classification					
Project Type		<input type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Renovation / Maintenance			
Project MACC Budget (Maximum Allowable Construction Cost)		<input type="checkbox"/> Standard and Major (Greater than \$3M) <input type="checkbox"/> Minor (\$3M or less)			
Replacement or Additions to Existing HVAC Systems		<i>[Yes or No, short description]</i>			
Project Requirements on Applicability Tree (Refer to the figure above) The credits under the selected option shall be "Required"		<input type="checkbox"/> A EE1.2 EE3.1 EE5.1 EE6.1 EE7.1	<input type="checkbox"/> B EE1.1* EE3.1 EE7.1	<input type="checkbox"/> C EE1.1* EE3.1	<input type="checkbox"/> One-Time HPBr Completion Form
Choose Basic or Advanced Commissioning* (Owner to de-select systems not to be commissioned in "Commissioning" section below)		<input type="checkbox"/> EE1.1 Basic Commissioning <input type="checkbox"/> EE1.2 Advanced Commissioning <input type="checkbox"/> Not applicable based on building/site scope			

\*When Basic Commissioning is required based on project application, Advanced Commissioning may still be chosen at the Owner's discretion.

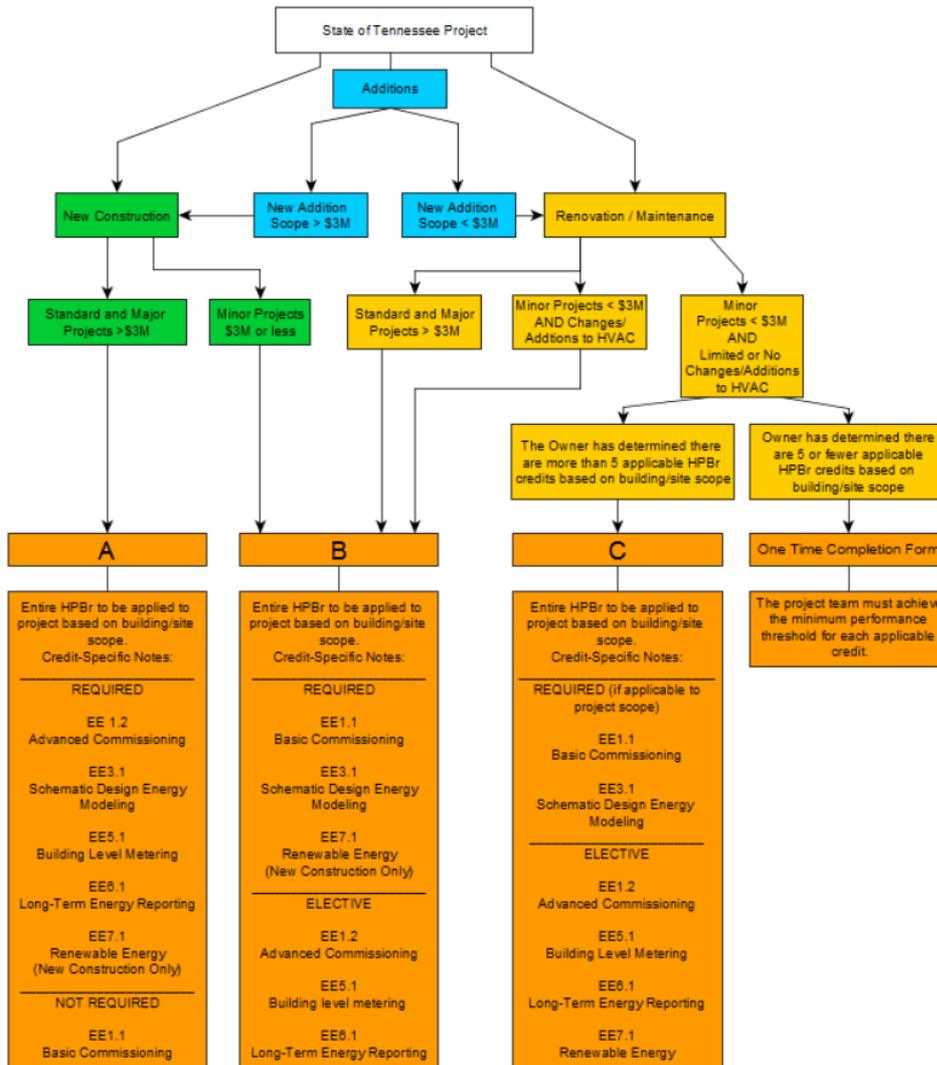
General Operation Schedules	
Lighting	Weekday: <i>[Example: 7 AM to 9 PM]</i> Saturday: <i>[Example: 8 AM to 12 PM]</i> Sunday: <i>[Example: Off]</i> Holiday: <i>[Example: Off]</i>
HVAC	Weekday: <i>[Example: 7 AM to 9 PM]</i> Saturday: <i>[Example: 8 AM to 12 PM]</i> Sunday: <i>[Example: Off]</i> Holiday: <i>[Example: Off]</i>
After-hour overrides	<i>[Example: Allow a 2 hour occupant override of lighting on each floor]</i>

# Project Applicability



- New construction, additions, major renovations, and capital maintenance projects
- Greater focus on life-cycle costs, energy efficiency, and performance monitoring
- The Owner has the responsibility to initially fit a project within the HPBr applicability tree

# Project Applicability



PROJECT NAME: \_\_\_\_\_  
 OPR AUTHOR: \_\_\_\_\_  
 SBC #: \_\_\_\_\_  
 ASSET #: \_\_\_\_\_  
 AGENCY #: \_\_\_\_\_  
 BUILDING #: \_\_\_\_\_

## Tennessee High Performance Building Requirements: OPR

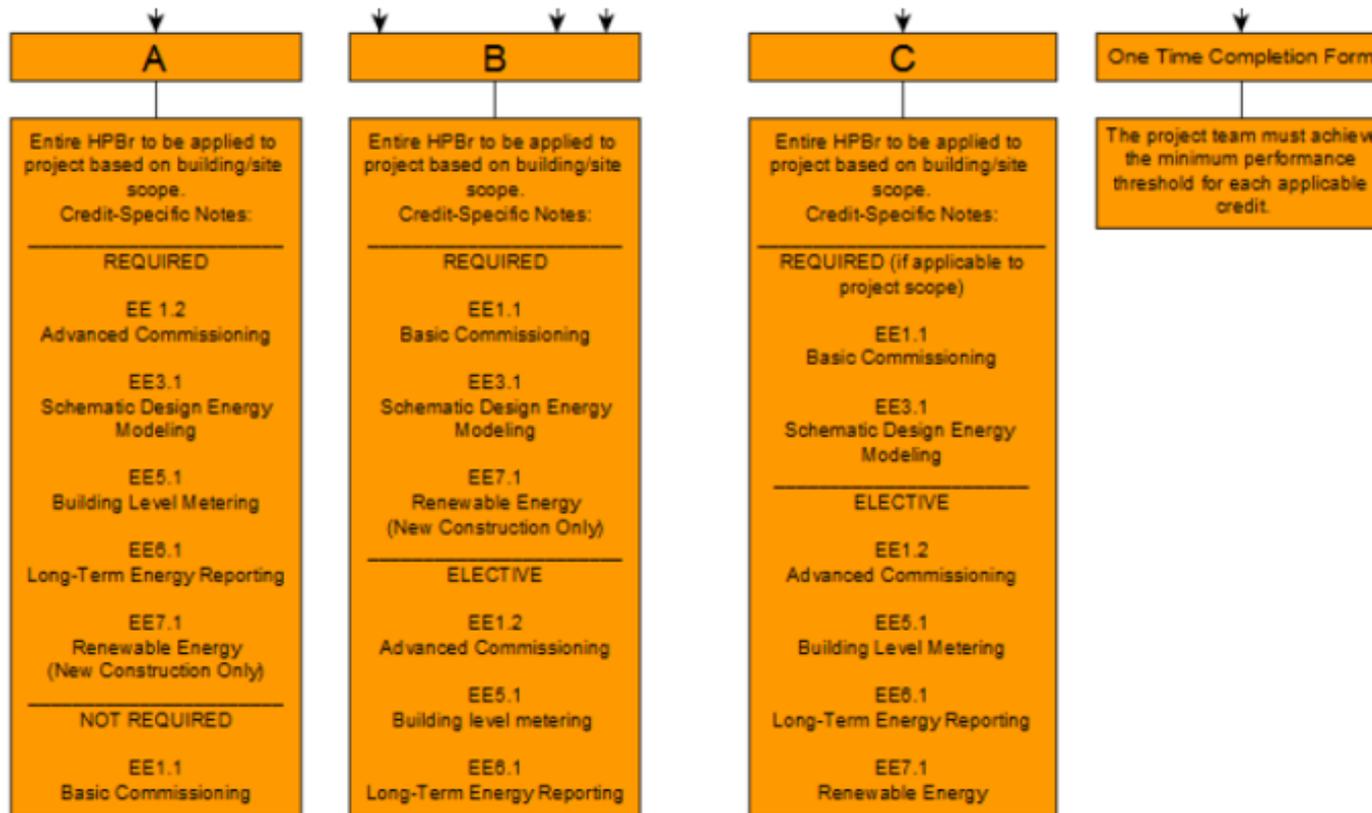
October 22

2015

The OPR is a deliverable of the High Performance Building requirements and is completed for State of Tennessee Projects. This document shall be completed for all State of Tennessee projects; it is adaptable to individual project objectives and scope.

Owner Project Requirements

# Project Applicability



# Checklist/Tracking Form



## High Performance Building Requirements v1.01

### CHECKLIST / TRACKING FORM

Phase	Targeted Points
Applicable	0
Minimum	0
Not Applicable	0
Programming	0
SD	0
DD	0
CD	0
Closeout	0

**\*\* MINIMUM INCLUDES REQUIRED CREDIT POINTS**

SBC Number:

Category from Applicability Tree: **Category C**

				Checklist Total
22 Points			Land Management	LM Total:
Possible Points	Credit ID	Applicable to Building/Site Scope?	Description	Level:
1	LM1.1		Site Selection - Reuse Existing Buildings	Priority 2
1	LM1.2		Site Selection - Show preference for building on developed sites: Preserve farmland/habitat, wetlands, floodplains, public parkland	Priority 1
1	LM1.3		Site Selection - Brownfield Redevelopment - Remediate and Restore contaminated sites when possible	Priority 2
1	LM1.4		Site Selection - Urban Development - Locate building within existing infrastructure	Priority 1
1	LM2.1		Site Disturbance - Sediment and Erosion control during construction	<b>Required</b>
1	LM2.2		Site Disturbance - Limit site disturbance during construction to minimum development footprint	Priority 1

# Checklist/Tracking Form



## Project Team Representatives

## Initials

O	-	Owner	
C	-	Contractor	
ME	-	Mechanical Engineer	
EE	-	Electrical Engineer	
CE	-	Civil Engineer	
A	-	Architect	
Other	-	Other	

## Programming SD DD CD Closeout

0	0	104	0	0	104	0	0	104	0	0	104	0	0	104
---	---	-----	---	---	-----	---	---	-----	---	---	-----	---	---	-----

0	0	22	0	0	22	0	0	22	0	0	22	0	0	22
---	---	----	---	---	----	---	---	----	---	---	----	---	---	----

## Primary Credit Responsibility

Yes	Maybe	No												
		1			1			1			1			1
		1			1			1			1			1
		1			1			1			1			1
		1			1			1			1			1
		1			1			1			1			1
		1			1			1			1			1

**Comment:** Describe implementation approach for each pursued credit. If credits are not pursued, provide justification.

## Role

## Initials

O	0
O	0
O	0
O	0
C	0
CE	0
-	-

# Checklist/Tracking Form



- Credit Verification Form
- One-Time Completion Form
- Materials and Resources (MR)-Calculator
- Daylight(DL)-Calculator

# Credit Verification Form



## Credit Verification Form

Phase:

### TN High Performance Building Requirements

In accordance with the State Architect's office, a copy of this form must be submitted at the end of each project phase and accompany required Project Closeout documents. Acceptance by the State Project Manager is required upon review of completed Credit Verification Form.

HPBr Points Required

0

HPBr Points Achieved

0

Designated Project Team Member	Initials	Team Member Name	Date	
Owner:	0	[sign/type team member name as verification that initialed credits are COMPLETE]		
Contractor:	0	[sign/type team member name as verification that initialed credits are COMPLETE]		
Mech. Eng.:	0	[sign/type team member name as verification that initialed credits are COMPLETE]		
Elec. Eng.:	0	[sign/type team member name as verification that initialed credits are COMPLETE]		
Civil Eng.:	0	[sign/type team member name as verification that initialed credits are COMPLETE]		
Architect:	0	[sign/type team member name as verification that initialed credits are COMPLETE]		
Other:	0	[sign/type team member name as verification that initialed credits are COMPLETE]		
0 Land Management				
# Points	Credit ID	Description	Credit Level:	Sign-Off (linked from HPBr Checklist)
0	LM1.1	Site Selection - Reuse Existing Buildings	Priority 2	N/A
0	LM1.2	Site Selection - Show preference for building on developed sites: Preserve farmland/habitat, wetlands, floodplains, public parkland	Priority 1	N/A
0	LM1.3	Site Selection - Brownfield Redevelopment - Remediate and Restore contaminated sites when possible	Priority 2	N/A
0	LM1.4	Site Selection - Urban Development - Locate building within existing infrastructure	Priority 1	N/A
0	LM2.1	Site Disturbance - Sediment and Erosion control during construction	Required	N/A

# One-Time Completion Form



## One-Time Completion Form TN High Performance Building Requirements

\*\*If a project has 5 (five) or fewer credits applicable to the project scope, this form may be used, signed, and filed (for future audit) by the Owner at the end of the Programming Phase. No further Credit Verification forms will need to be submitted.

<b>Owner's Organization:</b>		<b>Input Project and Owner Details</b>
<b>Owner Name:</b>		
<b>Date:</b>		
<b>SBC Number:</b>		
<b>Project Name:</b>		
<b>Project Scope/Description:</b>		
<b>Number of Applicable Credits:</b> (If there are no applicable credits, use Statement B)		
<b>Statement A:</b>		<p>After a complete and thorough review of the Tennessee High Performance Building Requirements Manual and Checklist, and in accordance with the Tennessee Code Annotated (TCA), the Owner has determined that there are between 5 (five) and 1 (one) Credits applicable to the scope of the examined project.</p> <p>The Project Team hereby commits to incorporating these selected Credits throughout the design and construction process and delivering a final product that is in full compliance with their requirements.</p>
<b>Credit Reference Number and Name</b>		
<b>List Applicable Credits:</b>	1	<b>List out applicable credits (there will be no more than 5).</b>
	2	
	3	
	4	
	5	

# One-Time Completion Form



List Applicable Credits:	3	
	4	
	5	
<b>Statement B:</b>		After a complete and thorough review of the Tennessee High Performance Building Requirements Manual and Checklist, and in accordance with the Tennessee Code Annotated (TCA), The Owner has determined that there are <del>0 (zero)</del> credits applicable to the scope of the examined project.
<b>Commit to Statement A or B: (Indicate which option is applicable)</b>		
Owner's Signature: (Required for A and B)		Date:
Designer's Signature: (Required for A only)		Date:
Contractor's Signature: (Required for A only)		Date:

- In the rare case that a project does not have any applicable credits – the owner shall sign the form
- Both Options are required to have a signature to complete the form

# MR-Calculator



## Materials and Resources Calculator

TN HPBr Appendix B

### Instructions

Complete the table below with construction materials items, their associated costs, and percent by weight or volume of recycled content (pre and post)

### Materials Table

Auto-calculates based on the input cost of any Rapidly Renewable material

Auto-calculates based on all entered percentages

Description of Material	Total Construction Cost	Labor Cost	Equipment Cost	Material Cost (Less Labor & Equipment)	Resource Reuse (MR3.6)	(MR3.1 & MR3.4)			Rapidly Renewable Materials (MR3.7)
						Post-Consumer	Pre-Consumer	Net Value	
	[\$]	[\$]	[\$]	[\$]	[\$]	[%] by weight	[%] by weight	[\$]	[\$]
Division 03 CONCRETE				0	0			0	
List Material	Input costs for each listed material.							0	
Division 04 MASONRY				0				0	
List Material	This should be actual cost							0	
Division 05 METALS				0				0	
List Material								0	
Division 06 WOOD, PLASTICS & COMPOSITES				0				0	
List Material								0	
Division 07 THERMAL / MOISTURE PROTECTION				0				0	
List Material								0	

Enter Manf. Provided % recycled content

# MR-Calculator



post-consumer).

Input cost of Enterprise of TN that needs Regional requirements each requirement

Regional Materials (MR3.5)		Tennessee Produced Materials						
Regional Materials	Value	Non-wood Materials (MR3.3)				Wood Materials (MR3.4)		
		Non-wood Materials	Harvested AND Manuf. in TN	Harvested OR Manuf. in TN	Value	Harvested AND Manuf. in TN	Harvested OR Manuf. in TN	Value
[%]	[\$]	[%]	[%]	[%]	[\$]	[%]	[%]	[\$]
	0				0			0
	0				0			0
	0				0			0
	0				0			0
	0				0			0
	0				0			0

Scroll Over



# MR-Calculator



## Materials and Resources Calculator

TN HPBr Appendix B

### Instructions

Complete the table below with construction materials items, their associated costs, and percent by weight or volume of recycled content (pre and post)

### Materials Table

Description of Material	Total Construction Cost	Labor Cost	Equipment Cost	Material Cost (Less Labor & Equipment)	Resource Reuse (MR3.6)	Recycled Content (MR3.1& MR3.2)			Rapidly Renewable Materials (MR3.7)
						Post-Consumer	Pre-Consumer	Net Value	
						[%] by weight	[%] by weight	[\$]	
Division	[\$]	[\$]	[\$]	[\$]	[\$]	[%] by weight	[%] by weight	[\$]	[\$]
03 CONCRETE				0	0			0	
04 MASONRY				0				0	
05 METALS				0				0	
06 WOOD, PLASTICS & COMPOSITES				0				0	
07 THERMAL / MOISTURE PROTECTION				0				0	

Scroll Down



# MR-Calculator



08	DOORS & WINDOWS (OPENINGS)					0				0
09	FINISHES					0				0
10	SPECIALTIES					0				0
	TOTAL	\$0	\$0	\$0	\$0	\$0			\$0	\$0

	Points
Percentage of Recycled Content (MR3.1 & MR3.2)	0%
Percentage of Tennessee Non-wood Materials (MR3.3)	0%
Percentage of Tennessee Wood Materials (MR3.4)	0%
Percentage of Regional Materials (MR3.5)	0%
Resource Reuse Percentage (MR3.6)	0%
Rapidly Renewable Materials Percentage (MR3.7)	0%

- Percentages calculate automatically based on inputs above

# DL - Calculator



## Daylight and Views Calculator

### TN HPBr Appendix B

Glare Control Chart				Window Geometry Table			
Type	Description	Window Type	Geometry Factor	Minimum Tvis	Height Factor	Best Practice Glare Control	
1	Fixed exterior shading devices		Sidelighting <b>Daylight</b> Glazing	0.1	0.7	1.4	Adjustable Blinds Interior light shelves Fixed translucent exterior shading devices
2	Light shelf, exterior						
3	Light shelf, interior		Sidelighting <b>Vision</b> Glazing	0.1	0.4	0.8	Adjustable Blinds Exterior shading devices
4	Interior blinds						
5	Pull-down shades		Toplighting <b>Vertical</b> Monitor	0.2	0.4	1.0	Fixed interior Adjustable exterior blinds
6	Fritted glazing						
7	Drapes		Toplighting <b>Sawtooth</b> Monitor	0.33	0.4	1.0	Fixed interior Exterior louvers
8	Electronic black-out glazing						
			Toplighting <b>Horizontal</b> Skylights	0.5	0.4	1.0	Interior fins Exterior fins Louvers

## Daylighting and Views Calculator

Room	Floor Area [SF]	Glazing Area [SF]	Window Geometry		Transmittance (T <sub>vis</sub> )		Window Height Factor	Daylight Factor		Daylit Area [SF]	Views [SF]	Glare Control
			Type	Factor	Actual	Min		Each	Room			
1		0	Horizontal	0.5		0.4	1.0	0.0%	0.0%	0		
			Horizontal	0.5		0.4	1.0	0.0%	0.0%			
			Horizontal	0.5		0.4	1.0	0.0%	0.0%			
2		0	horizontal	0.5		0.4	1.0	0.0%	0.0%	0		
			horizontal	0.5		0.4	1.0	0.0%	0.0%			
			horizontal	0.5		0.4	1.0	0.0%	0.0%			



- Intent, background, procedures, roles/responsibilities, key definitions
- Supports the Scorecard and OPR
  - Context and overall process
  - Specific requirements to comply with each credit



- Credit categories:
  - Land Management
  - Water Efficiency
  - Energy Efficiency
  - Materials and Resources
  - Indoor Environmental Quality
  - Innovation in Design and Construction

# Notable Credits



- Energy Efficiency
  - New Credit: EE2.1 – Energy Efficient Purchasing Policy
    - Per TCA, purchase and install ENERGY STAR equipment for all eligible equipment types
  - EE 3.1: Energy modeling now required for new construction and existing building projects with >\$3 million budget and scope impacting the HVAC system
    - Should be used as a decision making and goal-tracking tool throughout design
    - Based on ASHRAE 90.1-2010

# Notable Credits



- EE 3.2 Energy Efficiency: LCCA
  - Complete system LCCA prior to end of SD phase
    - Coupled with the schematic phase Design Energy Model
  - Evaluate at least (2) building design or ECM options investigated in the energy model
  - Use BLCC5 software by NIST (free)
  - Specific parameters of analysis required

# Notable Credits



- Materials and Resources
  - Three new credits to incentivize the use of regional and Tennessee produced building products
    - Tennessee Produced Materials (non-wood) (MRc3.3)
      - 10% harvested and manufactured within TN
    - Tennessee Produced Wood Products (MRc3.4)
      - 50% harvested and manufactured within TN
    - Regional Materials (MRc3.5)
      - 20% harvested and manufactured within 500 miles

# Notable Credits



- Project Innovation
  - Tennessee Advancement
  - Watershed Restoration
  - High Performance Operations Initiatives
  - Construction Site Energy Efficiency
    - Biofuels for construction equipment
    - Site lighting



# Questions / Discussion

# Contacts



*If you have any additional questions please feel free to contact us:*

**Peter L. Heimbach, Jr, AIA, NCARB, LEED AP**  
**State Architect**  
**Peter.L.Heimbach@tn.gov**

**Eric Sheffer, LEED AP BD+C, O+M, ISSP-SA**  
**Principal**  
**615.514.6132**  
**esheffer@ssr-inc.com**