

Building Science Advisor

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BSA objective

 Assist in reducing or mitigating the impact that moisture plays on the buildings industry.



 The Housing Act of 1949 calls for "a decent home and suitable living environment for every American family..." (42 U.S. Code § 1441).



Builder's perspective





Builder's reaction...



Moisture performance of energy efficient walls

Moisture performance of energy efficient attics

System/whole-house integration when transition' to more energy effic homes Long-term effectiveness of insulation materials &systems Window installation solutions in walls w/more insulation Details for integration of exterior insulation w/other materials



*Total of 14 issues and challenges presented to respondents



Building scientist's perspective





What building scientists think...





What building scientists think...

"Fascinating! I wonder which hygrothermal transport mechanism led to this Stachybotrys colonization?!"



Homeowner's perspective





What homeowners are thinking...





What homeowners are thinking...





What homeowners are thinking (in **Swedish)**...





CAK RIDGE

What is the magnitude of the problem?

- In 2018, home repairs due to leaks and mold cost \$32B and were more acute for lowincome families (Federal Reserve Bank).
- New code and proposed retrofit requirements take builders out of their "tried and true" comfort range.
- Building science required to reduce risk associated with modern building envelope and retrofit strategies.





The Building Science Advisor



Io get stated select Assessment or Pre-Assessment mode. Assessment mode is designed for users trainitiar with residential wall construction. Pre Assessment mode has guidance and resources specifically tailored for those users with little or no background/experience in the design of residential vall constructions. Pre-Assessment mode will walk users through the design process from the selection of the exterior climate to individual components that make up the building envelope. These modes apply to new and retrofit constructions.

New construction - BSA enables experts and novices to evaluate the moisture durability of wall designs based on user inputs. If the user is not familiar with residential wall materials and construction, they can select "Guide to New Wall Construction" under resources for guidance regarding material selection. In addition to the wall construction, the guide provides information regarding the selection of climate zones. Otherwise, the user can select the assessment mode and go directly to the wall construction section. Guidance is also available as drop-down menus in the Wall Construction page for each of the component selections.

Retrofit construction – For the case of energy improvements in the form of envelope energy upgrades, BSA compares the performance of the existing wall to the retrofit solution. For this to work, the user needs to be familiar with the existing construction. If the user is new to energy retrofits, the pre-assessment path will provide guidance with respect to issues concerning the existing construction as well as construction of the energy retrofit.



Building Science Advisor (BSA) is a website that provides expert advice on building envelope system performance from industry's best researchers and building scientists. This knowledge tool promotes better-informed decisions regarding energy efficient and moisture durable building envelope solutions for new and retrofit constructions. BSA communicates uncertainty associated with moisture durability in a simplified manner. Please refer to the Security & Privacy Notice before using Building Science Advisor.

- Provides user with sources of information to consider prior to performing an energy retrofit.
- User defines wall he wants to construct or existing assembly.
- Tool rates its energy and moisture performance.
- Tool makes recommendations regarding improvements.
- bsa-new.ornl.gov



Building Science Advisor does not replace:





Select Climate Zone

Climate Zone * 4A - Mix

4A - Mixed-Humid 💙





Select Wall Assembly Components:

Wall Name *

Enter name for wall construction

- Exterior Cladding
- ► Air Space
- Continuous Insulation
- Continuous Insulation Thickness
- Water Resistive Barrier
- Exterior Sheathing
- ▶ Wall Structure
- Cavity Insulation
- Interior Vapor Retarder
- Interior Finish

Vinyl/Metal Siding	~
Drained/Ventilated	~
Expanded Polystyrene	~
1 in.	~
Housewrap/Building Paper (>= 10 perm)	~
Plywood/OSB/Fiberboard/Wood Plank	~
2 x 4 16 inch o.c. Wood Frame	~
Fiberglass/Cellulose/Open Cell Foam (R-	~
Polyethylene Sheet/Aluminum Foil	~
Drywall/Latex Paint	~





Select Analysis (new or retrofit)





O New Construction

• Exterior Retrofit





O Interior Retrofit

O Gut Retrofit



Retrofit assessment and recommendations

Home	Pre-Assessments	Assessments	Resources	Case Studies
rionic	i i c i ibbebbilietteb	rissessifientes	nesources	cube ordanes

Recommendations

The table below contains all the components in the gut retrofit apart from the framing material. Starting from left to right (exterior to interior) the table lists the **cladding, air space, continuous insulation, insulation thickness, water resistive barrier, exterior sheathing, cavity insulation, vapor retarder and interior finish.** Using the drop-down menus, you can select your preference of materials or no preference. Once the selection is complete a list of recommendations will be updated by order of performance based on insulation and durability values. For more detailed information on the performance of a specific retrofit wall assembly select the radio button adjacent to the recommendation and then select Next to go to the results page.

Preferences:

	Cladding		Air Space	Cont. Insulation		Insulation T	hickness	Water Resistive Barrier	Exterior Sheathing
ID	Brick/Stone	~	Drained/Ventilated ~	None	*	None	~	No Preference 🗸 🗸	Plywood/OSB/Fiberbc ~
• 128621	Brick/Stone		Drained/Ventilated	None		None		Impermeable Coating/Membrane (< 1 Perm)	Plywood/OSB/Fiberboard/Wo Plank
		_			_	_	-	1 2004	

Showing 1 to 1 of 1 results

*Please select a recommendation above.



BSA output screen - Retrofit

Exte

- Information on moisture durability and energy efficiency summarized along with recommendations to improve performance.
- Provide users confidence in new energy efficient designs and retrofits?

	Existing Wall	New Wall
ior Cladding	Acrylic Stucco/Trealed Brick	Brick/Stone
pace	None	Drained/Ventilated
nuove insulation	None	Foil Faced Polyiss
ation Thickness	None	1m
Air Barrier	Housewrap;Building Paper (>= 10 petril)	Housewhap/Building Paper (>= 10 perm)
ior Sheathing	Prywoos/OS8 /Fiberboard/Wood Plank	Plywood/OSB/Fiberboard/Wood Plank
Dructure	2 x 4 16 inch a.c. Wood Frame	
y Insulation	None	Fiberglass/Celluloss/Open Cell Foam (R-13/R-21)
or Continuous Itian	Norm	
or Continuous ation Thickness	None	
or Vapor Retarder	None	
or Finish	Cirywoll/Latex Paint	





Thermal Performance the code complete word depicted above is derived from the 2016 International Energy Conservation Code (ECC) using the precipitive path option



Vinyl wallpaper "cold side VR" retrofit



Retrofit Performance

The indicators below show the thermal performance and moisture durability of the new construction. Areas in green indicate good thermal performance (R-value above code and mold index of 2 or less). Poor thermal and moisture performance are reflected in the red and orange regions respectively.

Vinyl wall paper in hot-humid climate

	Existing Wall	New Wall
Exterior Cladding	Brick/Stone	Brick/Stone
Air Space	Dramed/Ventifated	Dramed WetsWeed
Continuous Insulation	Hane	Nane
Insulation Thickness	hone	Nora
WRB Air Barrier	Housewrap/Building Paper (>= 10 perm)	Impermeable Coating/Membrane (< 1.Perm)
Exterior Sheathing	Fliwood/GSS/Ficercoard/Mood Flahir	Piywodo/GVI/Fiberboard/Wodo Flank
Wall Structure	2 v 4 15 inch eic. Wood Frame	
Cavity Insulation	Elberglass (R-N(R-19)	Filoerglass (R-1) R-19
Interior Continuous Insulation	Hanè	Money
Interior Continuous Insulation Thickness	tione	Nota
Interior Vapor Retarder	Rona	Nong.
Interior Finish	Enywal/Gir Rantól/ n/ Waliosper	Drywall/Later 64 m







The code comptant level depicted above is derived from the 2018 International Energy Conservation Code (IECC) using the prescriptive path option



Add CI and drainage - 2x6 R19 retrofit

Retrofit Performance

The indicators below show the thermal performance and moisture durability of the new construction. Areas in green indicate good thermal performance (R-value above code and mold index of 2 or less). Poor thermal and moisture performance are reflected in the red and orange regions respectively.

Add Continuous Insulation

	Existing Wall	New Wall
Exterior Cladding	Mineral Stucco	Mineral Stucco
Air Space	None	Drained/Ventilated
Continuous Insulation	None	Extruded Polystyrene
Insulation Thickness	None	1 in.
WRB Air Barrier	Permeable Coating/Membrane (>= 1 perm)	Permeable Coating/Membrane (> = 1 perm)
Exterior Sheathing	Plywood/OSB/Fiberboard/Wood Plank	Plywood/OSB/Fiberboard/Wood Plank
Wall Structure	2 x 6 24 inch o.c. Wood Frame	
Cavity Insulation	Fiberglass (R-11/R-19)	Fiberglass (R-11/R-19)
Interior Continuous Insulation	None	
Interior Continuous Insulation Thickness	None	
Interior Vapor Retarder	Kraft Paper	
Interior Finish	Drywall/Latex Paint	





- Cent



No CI 2x6 R19 w/drainage - New



New - 6a. R19 2x6, no CI, w/drainage, kraft

Climate Zone: 6A - Cold

	New Wall Construction	
Exterior Cladding	Vinyt/Metal Siding	
Air Space	Drained/Ventilated	
Continuous Insulation	None	
Insulation Thickness	None	
WRB Air Barrier	Housewrap/Building Paper (>= 10 perm)	
Exterior Sheathing	Plywood/QSB/Fiberboard/Wood Plank	
Wall Structure	2 x 6 16 inch o.c. Wood Frame	
Cavity Insulation	Fiberglass/Cellulose/Open Cell Foam (R-13/R-21)	
Interior Vapor Retarder	Kraft Paper	
Interior Finish	Drywall/Latex Paint	











R5 CI 2x6 R19 w/drainage - New

New - 6A R19 2x6, R5 CI with drainage, Kraft

Climate Zone: 6A - Cold

	New Wall Construction	
Exterior Cladding	Vinyl/Metal Siding	
Air Space	Drained/Ventilated	
Continuous Insulation	Extruded Polystyrene	
Insulation Thickness	1 m.	
WRB Air Barrier	Housewrap/Building Paper (>= 10 perm)	
Exterior Sheathing	Plywood/OSB/Fiberboard/Wood Plank	
Wall Structure	2 x 6 16 inch o.c. Wood Frame	
Cavity Insulation	Fiberglass/Cellulose/Open Cell Foam (R-13/R-21)	
Interior Vapor Retarder	Kraft Paper	
Interior Finish	Drywall/Latex Paint	







New Construction Wall R-Value:

R-22.8

Thermal Performance®

The code compliant level depicted above is derived from the 2018 International Energy Conservation Code (IECC) using the prescriptive path option.



BSA "best practice" via BASC

Provides advice to further reduce risk:

- Drainage & ventilated cavities "drain the rain"
- Water resistive barriers (WRBs) "w/or w/o Cl"
- Vapor retarders "know your IECC perm"
- Insulation (CI and cavity installed correctly)
- Correct workmanship by all trades





Campers call to Action: Your feedback!

- What are the value propositions for using BSA?
- How can BSA benefit your clients and other users?
- BSA training opportunities suggestions?
- BSA versions suggestions?
 - User functional useability
 - Wall assembly options
 - New enhancements
 - Other





Building science boogie band: ROCK BSA

Verse 1: Rotting walls in the city, rotting walls in your hometown Beat up siding hiding mold, is what we've found.

Chorus: No rotting walls in the USA. Go Hygrothermal wild with the BSA. Please won't you check it out today. Cause we want to know what you gotra say, about the BSA

Verse 2: Learn your perm per the ICC No mushy was-wood walls w/OSB Build a dumb wall and you got to pay Or build a smart wall and use Joe's way

Chorus: Repeats

Verse 3: Choose your city, or TMY town Mold free walls that don't fall down. CI means less dew-point around Low perm in Miami, no mold found

Chorus: Ends

CAK RIDGE National Laboratory

Building science boogie band: "BS Biz"

You get up in the morning, you drive your car to Logan, take a 747 to a meeting. You make a lot of money, & people think you're funny, and the crowd really takes a beating. You have great lines and like to drink fine wine cost more than your sports car you say. If you clients get annoyed, you will be self employed, an aspen vacation let's play! BSB Joe's way, BSB, what did he say;

Drain the rain on the plane Save some cash, you better flash No overhang, no yin just yang Build it tight, test it on site Ventilate right, test it on site No virgin poly, a Canadian folly, It don't rot & fall, that's Joes perfect wall, No perimeter drain, Joe goes insane Know your perm, and you will learn Don't do stupid things, or Joe goes ching ching

BSB Joes way, BSB, It's what the BSA say!



Questions?

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