



2013 Residential Roof Measures

June 10, 2011



Roof Measure Agenda

- Summary of current code requirements
- Research Results
- Roof Deck insulation
- ACM Calculations for Roofs, Attics and Ceilings
- New Proposed Roof/Attic Prescriptive Insulation Requirement
 - Roof Deck Insulation Options
 - Life Cycle Costs and Energy Savings
 - Steep Slope Roof Prescriptive Solar Reflectance
- Changes to Performance Compliance Options



Current Cool Roof Requirements

- 2008 Title 24 – Low-Rise Residential
 - Prescriptive approach – steep-sloped roofs weighing more than 5 lbs/sf
 - Concrete & clay tile, some metal roofs
 - minimum *aged* solar reflectance of 0.15, thermal emittance of 0.75
 - All climate zones 1-16
 - Steep-sloped roofs weighing <5 lbs/sf
 - asphalt shingle, some metal roofs
 - minimum *aged* solar reflectance of 0.2, thermal emittance of 0.75
 - Only climate zones 10-15 (inland valleys)



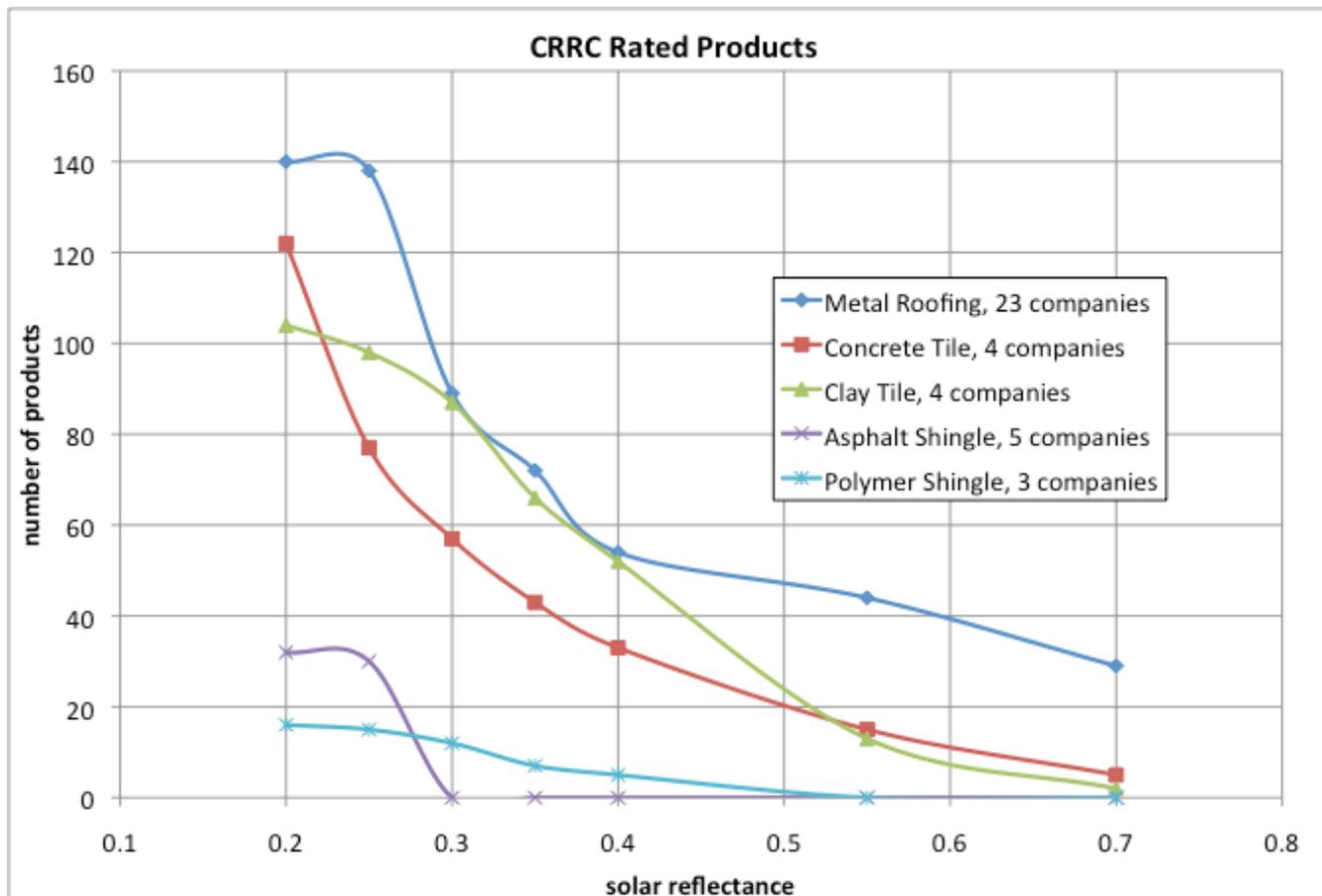
2008 Standards Ceiling/Attic Requirements

- **Ceiling Insulation:**
 - R30 in CTZ 2-10,
 - R38 in CTZ 1 & 11-16
- **Radiant Barrier/Attic Ventilation:**
 - Radiant barrier and enhanced ventilation in CTZ 2, 4, 8-15
 - Performance compliance credit available
 - Unvented attics may be approved on an exceptional basis
- **Raised Heel Truss:**
 - not required and no credit for them
- **Roof Deck Insulation:**
 - not required, but performance compliance credit is available



Cool Roofs: Initial Findings

Higher reflectance roof materials do exist





Roof Tile Solar Reflectance

- Cool roof products with reflectance to 0.35 to 0.40 have zero to marginal markup (\$0-6/square) relative to tile that meets minimum Standard requirements
- Cool roof tile with reflectance of 0.40 is cost effective in all climates

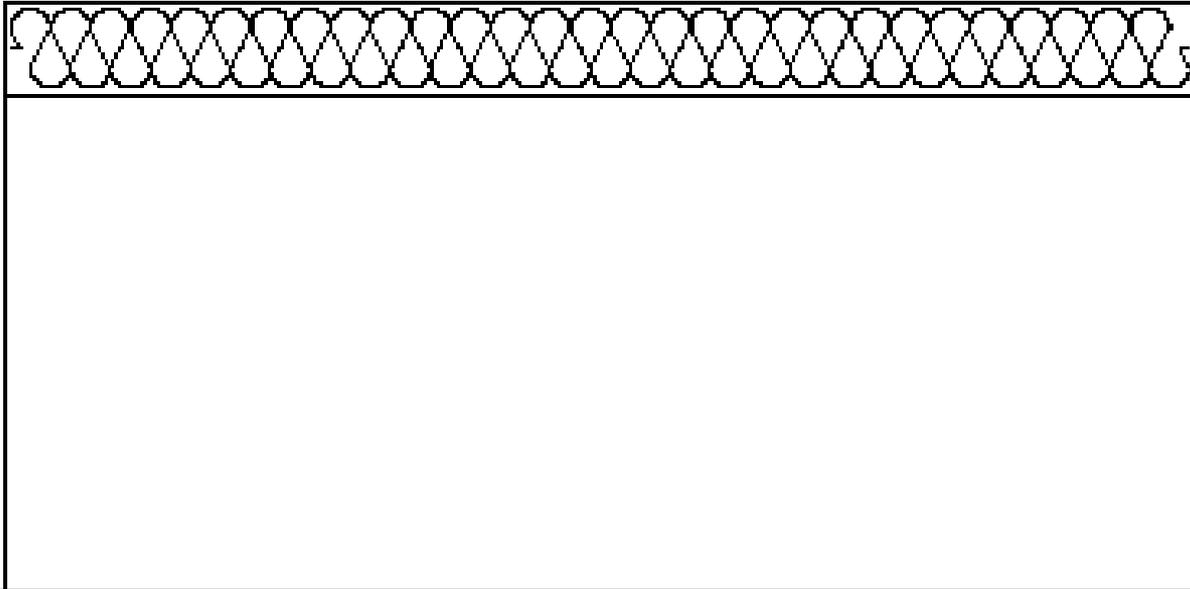


Roof Deck Insulation Options

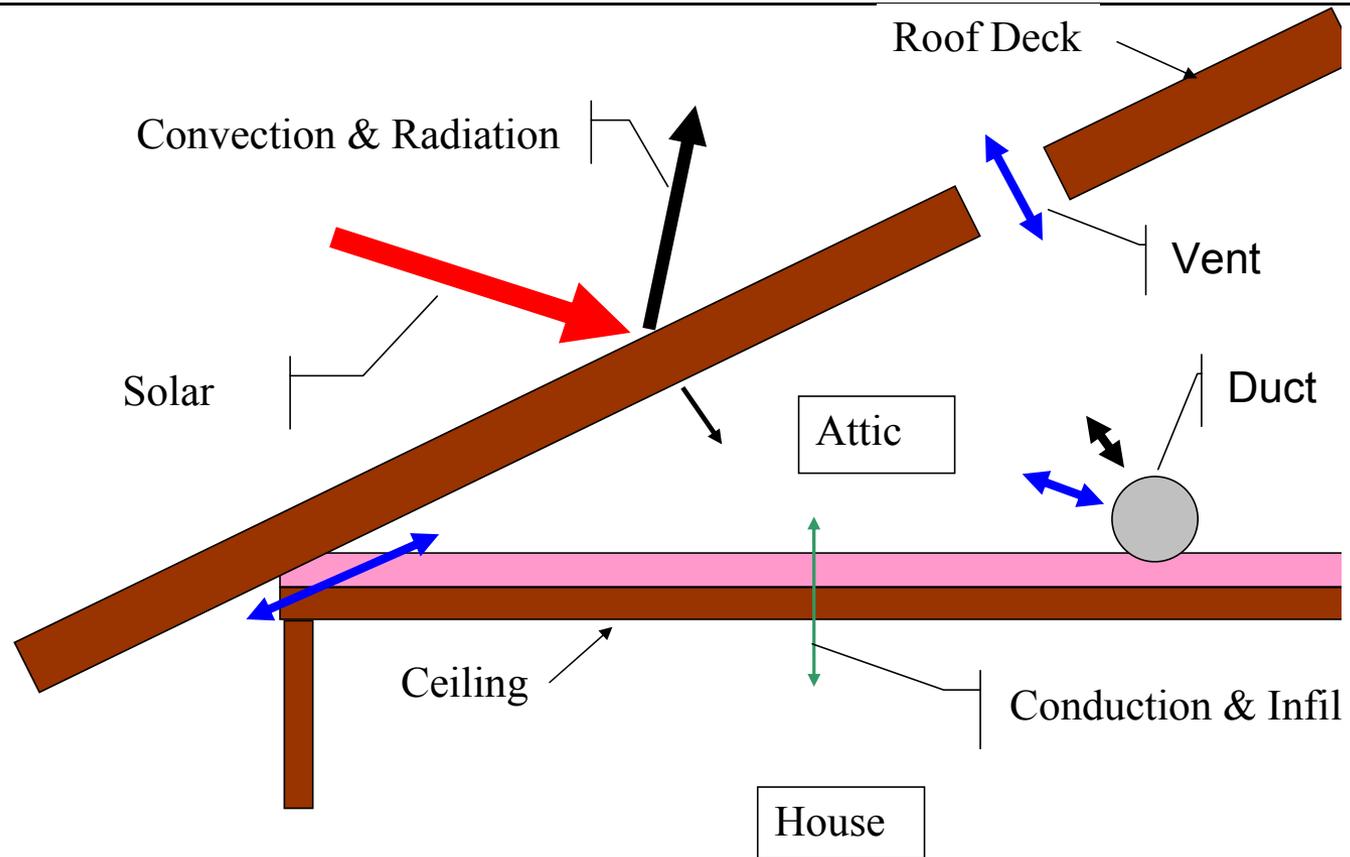
- Above deck insulation
 - An effective option, but asphalt shingles require a nailable base, adding cost
 - Continuous thermal barrier at roof deck
- Below deck insulation
 - Install closed-cell spray foam or fiberglass batts between trusses



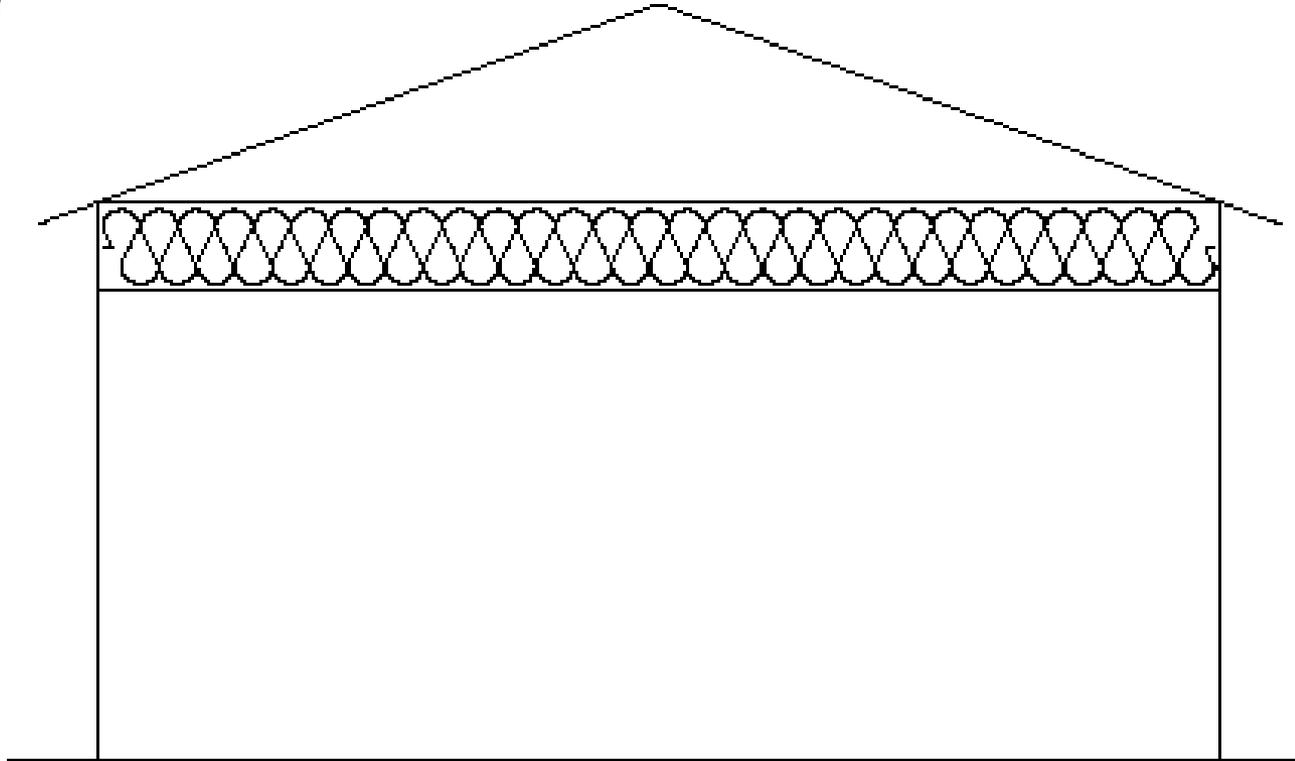
Background: ACM Calculations



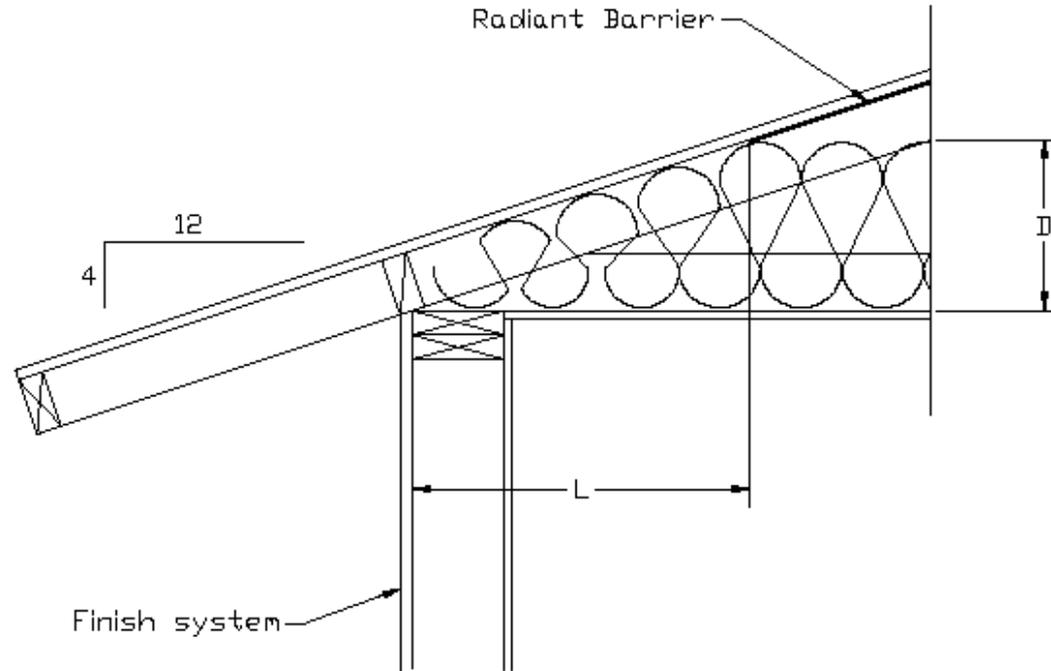
In 2005 and earlier standards the ACM model simply had a flat roof with the JA4 U-value



2008 Standards added UZM to model interactive heat transfer processes in the attic

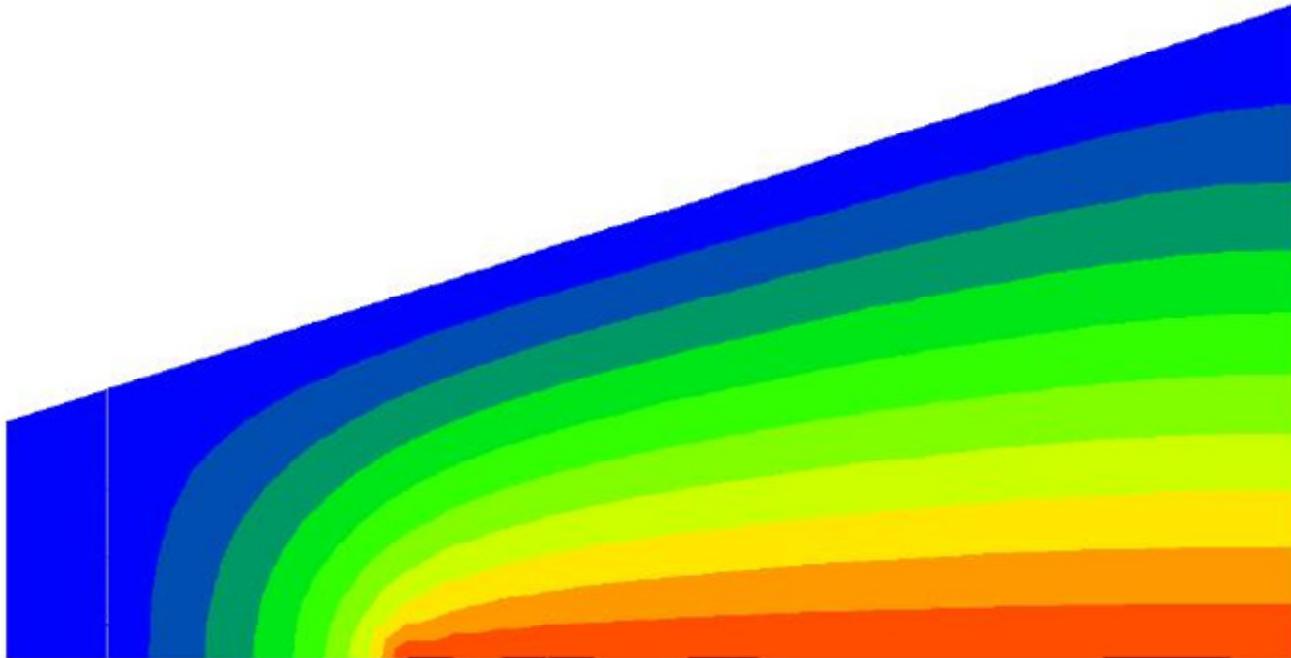


But even with 2008 UZM, the ceiling insulation is a flat construction and heat flow is vertical

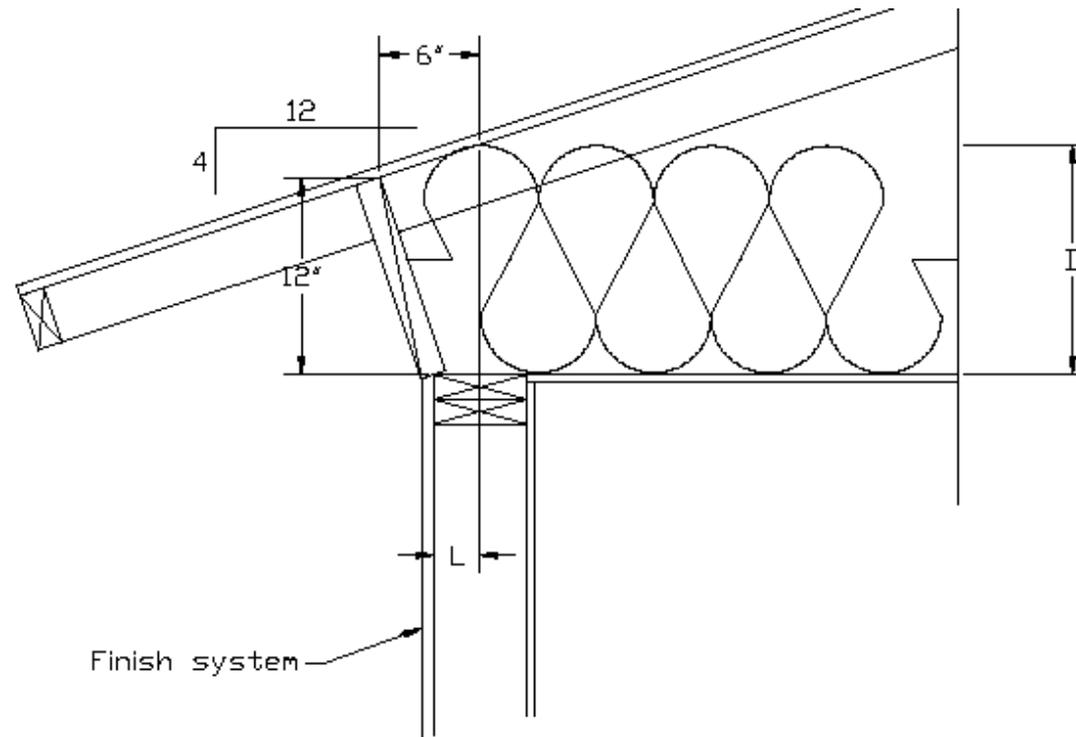


STANDARD TRUSS

In reality, with a standard truss the attic space tapers to ~4" high at the edge and there isn't room for the rated insulation depth. In addition, the defined ceiling area extends to the outside face of the wall studs.



We used a 2D finite element heat transfer program to model the heat flow in the insulation and framing of alternate systems at the roof edge.



RAISED-HEEL TRUSS

A Raised Heel Truss provides more height for insulation out to the edge of the wall. Actual U-value is close to 2008 standard assumption.



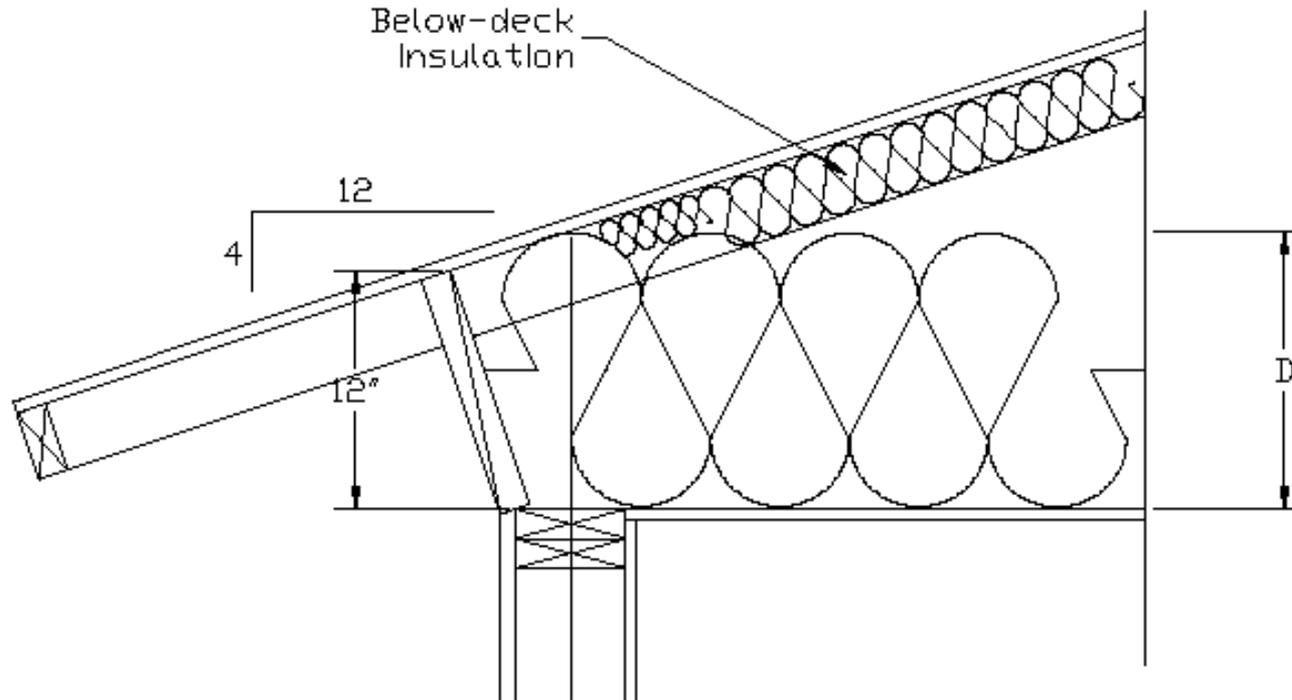
New Ceiling/Attic U-factors

Ceiling Insulation R	2008 JA Table 4.2.1	Overall Standard	Raised	Raised Savings
30	0.0320	0.0321	0.0309	4%
38	0.0260	0.0270	0.0252	7%
49	0.0220	0.0230	0.0207	10%
60	0.0170	0.0207	0.0176	15%

Include heat flow at the edge based on the 2700 ft² Prototype House. Used in the roof life cycle cost analysis/



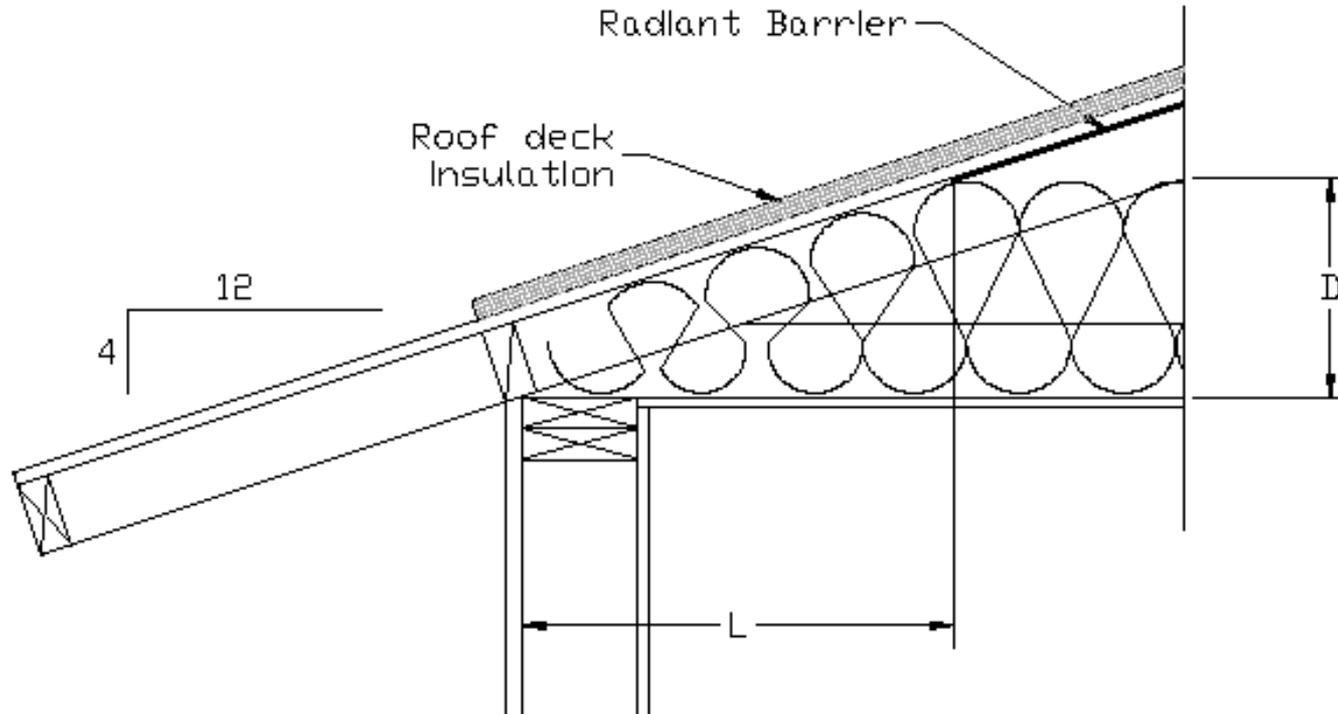
Roof Deck Insulation



Below deck insulation can't extend the full width of the roof due to lack of space at the eave, particularly an issue with standard trusses



Roof Deck Insulation



Above deck insulation extends over the roof edge, reducing the effect of standard truss insulation depth. Also allows for a radiant barrier.



New Effective Below Deck R Values

Insulation R & Truss	Below Deck Insulation	Effective R
30 Std	13	7.8
30 Raised	13	13.0
38 Std	13	6.8
38 Raised	13	12.5

Include heat flow at the edge based on the 2700 ft² Prototype House. Used in the roof life cycle cost analysis.



Roof Deck Insulation Options

- Batts below deck
 - R13 installed with wire support, cost to home buyer = \$.72/ft² of roof
 - Potential moisture problems in some climate zones (detailed study under way)
- Foam above deck
 - R8 installed (with nailbase for shingles) over roof sheathing for \$1.17/ft² (less expensive with tile roofs).
 - No moisture issues
- Radiant Barrier
 - On roof sheathing for \$0.13/ft² of roof
- R13 batt below deck ~ equal to R8 foam above deck with radiant barrier



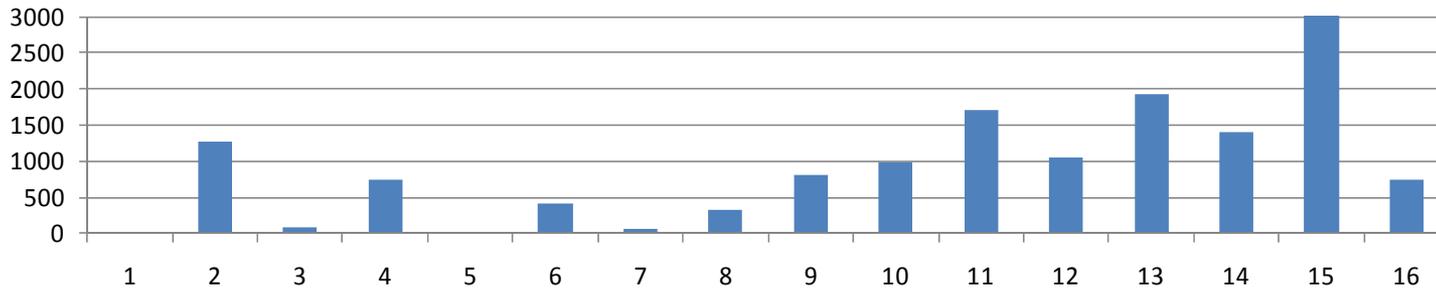
New Proposed Roof/Attic Prescriptive Insulation Requirement

Zone	Ceiling & Truss	Roof Deck Insulation	Radiant Barrier
1	R38 Std	None	No
2	R30 Std	R13 Below	No
3	R30 Std	R13 Below	No
4	R30 Std	R13 Below	No
5	R30 Std	None	No
6	R30 Std	R13 Below	No
7	R30 Std	R13 Below	No
8	R30 Std	R13 Below	No
9	R30 Std	R13 Below	No
10	R30 Std	R13 Below	No
11	R38 Std	R8 Above	Radiant Barrier
12	R38 Std	R8 Above	Radiant Barrier
13	R38 Std	R8 Above	Radiant Barrier
14	R38 Std	R13 Below	No
15	R38 Std	R8 Above	Radiant Barrier
16	R38 Std	R8 Above	Radiant Barrier

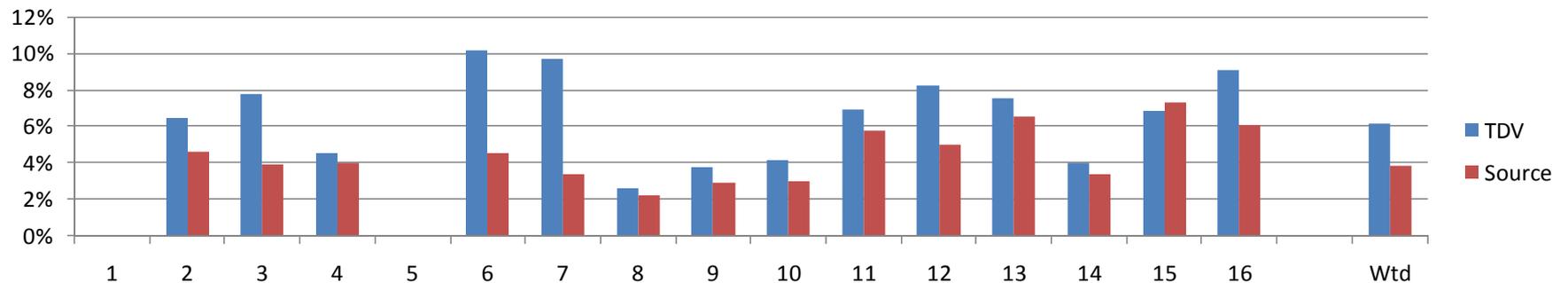


Roof/Attic Prescriptive Insulation Savings

Roof Proposal LCC Savings



Roof Proposal Energy Savings





Steep Slope Roof Prescriptive Solar Reflectance

- All roofing products minimum aged solar reflectance of 0.20.
- Exception: Asphalt roofing products in Zones 1-9 and 16.



Changes to Performance Compliance Options

- Attic Ventilation
 - Minimum ventilation 1/300 assumed
 - No credit for enhanced attic ventilation
- Unvented Attics
 - Needs further software development
 - Need eligibility criteria and testing and verification rules



2013 Standards Update

Send related comments by July 8, 2011 to:

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