



U.S. Department of Energy
Energy Efficiency and Renewable Energy



Building Energy Codes

How to Use REScheck Energy Code Compliance Software

U.S. Department of Energy
Building Energy Codes Program

Presented by: Pam Cole, PNNL

www.energycodes.gov
techsupport@becp.pnl.gov



U.S. Department of Energy

Energy Efficiency and Renewable Energy *Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable*



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Building Energy Codes Program



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Code Analysis and Development

Implementation Tools



DOE's Building Energy Codes Program is an information resource on national model energy codes. We work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and help states adopt, implement, and enforce those codes.

The Program recognizes that energy codes maximize energy efficiency only when they are fully embraced by users and supported through education, implementation, and enforcement.

Free Software



REScheck

[REScheck](#), [REScheck-Web](#), [REScheck Package Generator](#)



COMcheck

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What Residential Code Compliance Tools does BECP offer?

Prescriptive Approach

- Simple, fast and easy
- Generally most stringent

- Requires minimum input
- Based on climate and WWR
- Uses a prototype building

1 Printed guides on www.energycodes.gov

or

2  REScheck™
Package Generator

Trade-off Approach

- Trade-off between components
- Provides design flexibility

- Requires area & U/R-factors
- Uses UA calculation (REScheck)

Free

1



Desktop Versions:

Windows
Mac

or

2



All REScheck tools available from www.energycodes.gov

Case Study – REScheck Software



Jones Residence, Bowman, SC

- PowerPoint presentations with faculty notes
- Case studies
- Online training
- Online videos

Building Energy Codes
ONLINE TRAINING

energycodes » REScheck101

You are logged in as Pam Cole (Logout)

| Administration | Topic outline | Topics |
|---|---|--|
| <ul style="list-style-type: none">Change password...Unenrol me from REScheck101... | <p>PNNL-SA-49263</p> <h3>REScheck 101 Training</h3> <p>Welcome to the Building Energy Code Program's new online training tool. This tool allows you to learn about using REScheck to comply with the 2003 International Energy Conservation Code at your own pace.</p> <p>Each section is designed to provide a basic overview of the requirements, and most sections have links that provide additional details on that section's topic as well as additional resources for more information if you are interested.</p> <p>Pilot Study: BECP is currently conducting a pilot study on this course to determine the amount of Continuing education credit that can be offered. The actual amount of AIA learning units/continuing education credits offered for this course will be determined based on the results of this pilot study.</p> <p>Participants who successfully complete the course and quiz and enter their AIA numbers will be submitted to AIA by BECP for the determined amount of credits following the conclusion of the pilot study. Certificates of completion will be emailed to all successful participants at the end of the pilot study.</p> | <p>1 2 3 4 5 6 7 8 9 10</p> <p>This course covers the basics of complying with the 2003 International Energy Conservation Code using REScheck. Each section is designed to provide a basic overview of the requirements, and most sections have links that provide additional details on that section's topic as well as additional resources for more information if you are interested.</p> <p>Topics:</p> <ol style="list-style-type: none">Scope of IECCGeneral Requirements for Building EnvelopeGeneral Requirements for Heating, Ventilation, and Air ConditioningGeneral Requirements for Service Water HeatingGeneral Requirements for Electrical |

Local intranet

Welcome to the Building Energy Codes Resource Center



This system has been developed to provide users with information about energy codes and beyond code technologies. You can SEARCH by keyword, or BROWSE the available topics. Start your research using the toolbar at the top of the page.

Resources are available in a variety of different media types, including Articles, Graphics, Online Tools, Presentations, and Videos. The BECP Resource Center gathers content not only from our own archives, but also provides links to energy code resources from around the web. [Learn more about the Resource Center.](#)

NEW MATERIALS

[Article #1529: Energy Policy Act 2005 and Tax Credits](#)

[Article #1533: Appropriate Use of Building Energy Simulation Software](#)

[Article #1484: Vestibule Case Study](#)

POPULAR RESOURCES

[Article #139: Insulating Suspended Ceilings](#)

[Building Energy Codes Glossary](#)

[Article #1420: Energy Code Climate Zones](#)

[Article #1469: How Do I Enter Non-Uniformly Insulated Basement Walls in REScheck?](#)

When does REScheck apply?

Residential New Construction and Additions

- 1-2 single family dwellings
- Multifamily dwellings: 3 or more attached dwelling units 3 stories or less

State Dependent

- Not all states have the same code, some states have state-specific energy codes
- Check to see what code is applicable in your state and if REScheck is accepted
- Status of State Codes
 - http://www.energycodes.gov/implement/state_codes/index.stm

Residential Requirements

- 1) Mandatory Requirements:
 - Moisture Control
 - Air Leakage - Recessed Lighting Fixtures
 - Infiltration Control
 - Solar Heat Gain Coefficient
 - Building Mechanical Systems and Equipment
 - Service Water Heating

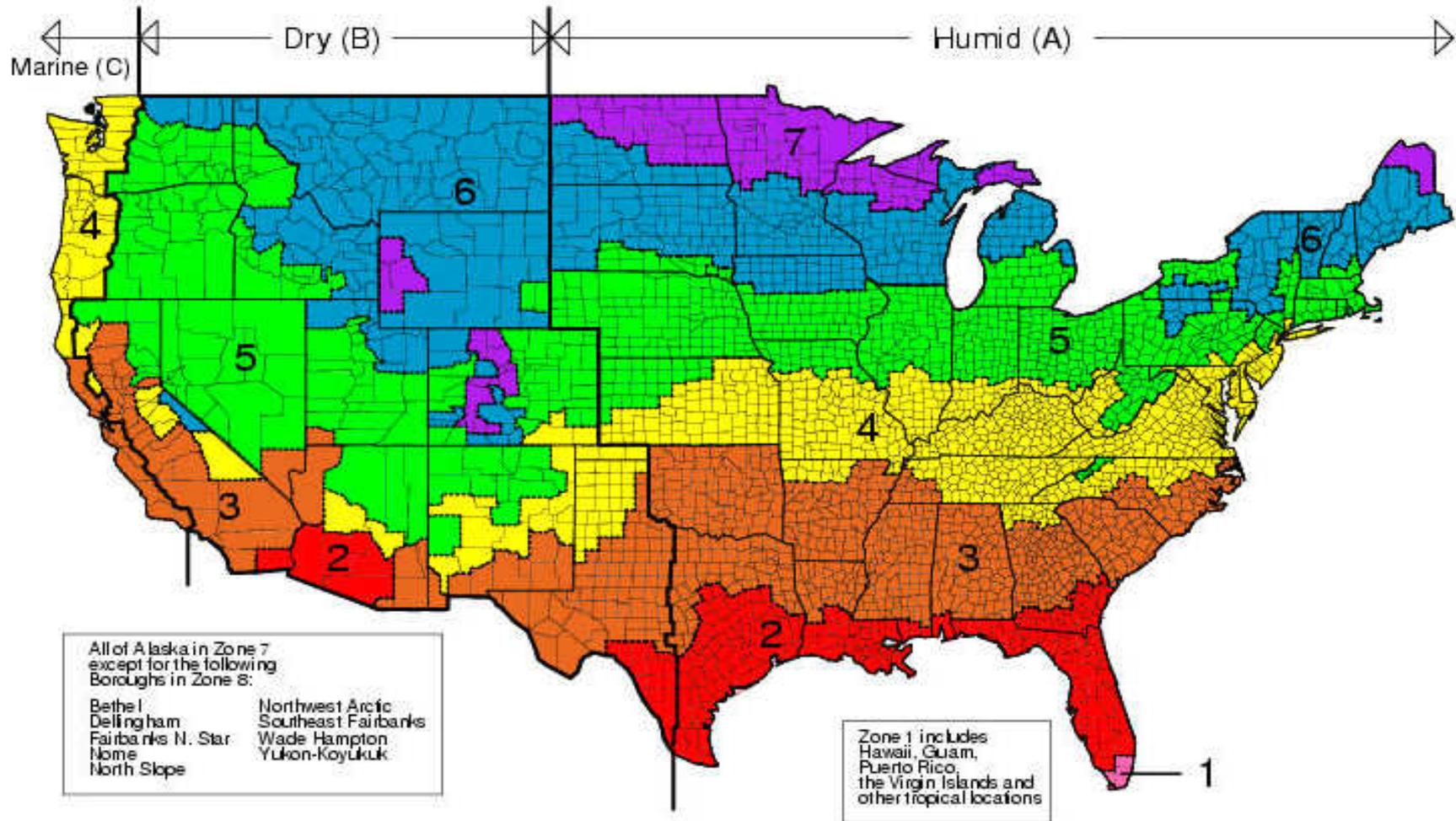
- 2) Climate Specific Requirements:
 - Foundations
 - Crawlspace
 - Slabs
 - Basements
 - Above Grade Walls
 - Skylights, Windows, and Doors
 - Roofs
 - Duct Insulation



What's New in REScheck for 2006 IECC

- Climate Zones
- Envelope Requirements
- Fenestration Hard Limits
- New Software Inputs
 - Conditioned Floor area
 - SHGC
- Panel Certificate
- Different Approach to HVAC Trade-offs

Climate Zones in 2006 IECC & REScheck



Insulation and Fenestration

Requirements by Climate Zone in 2006 IECC

**Table 402.1.1
Insulation and Fenestration Requirements by Component**

| CLIMATE ZONE | FENESTRATION U-FACTOR | SKYLIGHT U-FACTOR | GLAZED FENESTRATION SHGC | CEILING R-VALUE | WOOD FRAME WALL R-VALUE | MASS WALL R-VALUE | FLOOR R-VALUE | BASEMENT WALL R-VALUE | SLAB R-VALUE & DEPTH | CRAWL SPACE WALL R-VALUE |
|-----------------|-----------------------|-------------------|--------------------------|-----------------|-------------------------|-------------------|---------------|-----------------------|----------------------|--------------------------|
| 1 | 1.20 | 0.75 | 0.40 | 30 | 13 | 3 | 13 | 0 | 0 | 0 |
| 2 | 0.75 | 0.75 | 0.40 | 30 | 13 | 4 | 13 | 0 | 0 | 0 |
| 3 | 0.65 | 0.65 | 0.40 | 30 | 13 | 5 | 19 | 0 | 0 | 5 / 13 |
| 4 except Marine | 0.40 | 0.60 | NR | 38 | 13 | 5 | 19 | 10 / 13 | 10, 2ft | 10 / 13 |
| 5 and Marine 4 | 0.35 | 0.60 | NR | 38 | 19 or 13+5 | 13 | 30 | 10 / 13 | 10, 2 ft | 10 / 13 |
| 6 | 0.35 | 0.60 | NR | 49 | 19 or 13+5 | 15 | 30 | 10 / 13 | 10, 4 ft | 10 / 13 |
| 7 and 8 | 0.35 | 0.60 | NR | 49 | 21 | 19 | 30 | 10 / 13 | 10, 4 ft | 10 / 13 |

U-Factor Requirements

Requirements by Climate Zone in 2006 IECC and in REScheck

**Table 402.1.3
Equivalent U-Factors**

| CLIMATE ZONE | FENESTRATION U-FACTOR | SKYLIGHT U-FACTOR | CEILING U-FACTOR | FRAME WALL U-FACTOR | MASS WALL U-FACTOR | FLOOR U-FACTOR | BASEMENT WALL U-FACTOR | CRAWL SPACE WALL U-FACTOR |
|-----------------|-----------------------|-------------------|------------------|---------------------|--------------------|----------------|------------------------|---------------------------|
| 1 | 1.20 | 0.75 | 0.035 | 0.082 | 0.197 | 0.064 | 0.360 | 0.477 |
| 2 | 0.75 | 0.75 | 0.035 | 0.082 | 0.165 | 0.064 | 0.360 | 0.477 |
| 3 | 0.65 | 0.65 | 0.035 | 0.082 | 0.141 | 0.047 | 0.360 | 0.136 |
| 4 except Marine | 0.40 | 0.60 | 0.030 | 0.082 | 0.141 | 0.047 | 0.059 | 0.065 |
| 5 and Marine 4 | 0.35 | 0.60 | 0.030 | 0.060 | 0.082 | 0.033 | 0.059 | 0.065 |
| 6 | 0.35 | 0.60 | 0.026 | 0.060 | 0.06 | 0.033 | 0.059 | 0.065 |
| 7 and 8 | 0.35 | 0.60 | 0.026 | 0.057 | 0.057 | 0.033 | 0.059 | 0.065 |

2006 IECC Compliance Paths and REScheck Approach

- 2006 IECC (2 Main Paths)
 - Prescriptive
 - Sub paths (R-value computation, U-factor Alternative, and Total UA)
 - Performance
- REScheck Approach
 - Total UA Alternative (same as U-factor alternative but allows trade-offs across all envelope components)
 - Limited scope performance analysis for HVAC trade-offs

Fenestration – REScheck

- Area-weighted average U-factor and SHGC are subject to hard limits, even in trade-offs
- An area credit of 15 sq. ft. is applied to all fenestration
 - The software looks for the highest glazing U-factor and exempts up to 15 sq. ft. of it
 - REScheck eliminates this 15 sq. ft. in both the proposed UA and the required UA calculation
- One opaque door with the highest U-factor (poorest performing) entered in REScheck is exempted from the UA calculations
- Window replacement cannot be shown using REScheck



Windows – U-Factors

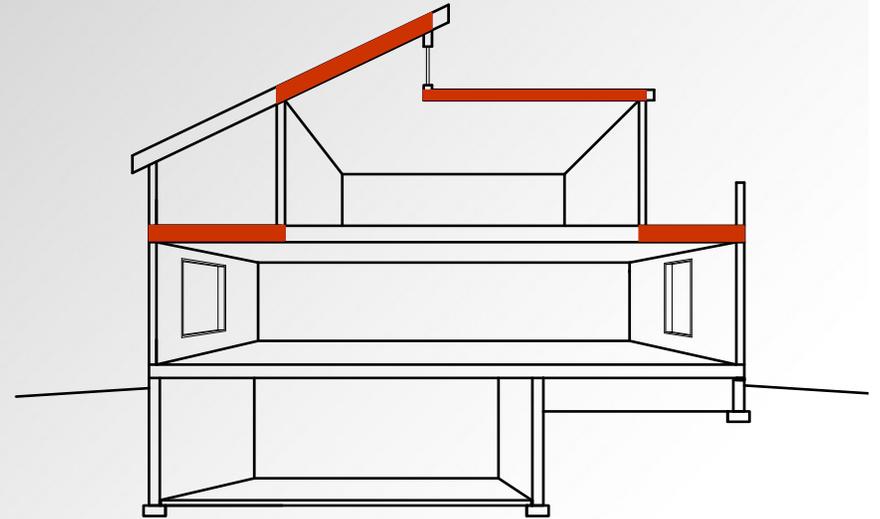
Requirements by Climate Zone in 2006 IECC and in REScheck

- Hard trade-off limits (cannot be exceeded even in trade-offs)
 - U-0.48 maximum in Zones 4 and 5
 - U-0.40 maximum in Zones 6-8
 - U-0.75 for skylights in Zones 4-8
 - These are based on building average; individual windows or skylights can be worse if the area-weighted average meets these requirements

Ceilings - Cathedral

Requirements by Climate Zone in 2006 IECC and in REScheck

- Special-case allowance
 - If insulation levels require above R-30,
 - 500 sf. can be based on lower limit and not penalized
 - Sf. > 500 is based on the higher requirement
 - for example - Climate zone 6 requires R-38

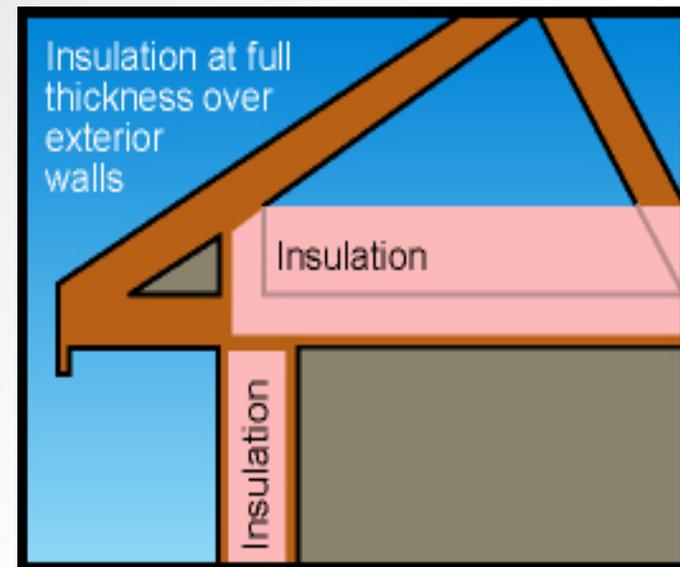


Raised Heel Truss

Requirements by Climate Zone in 2006 IECC and in REScheck

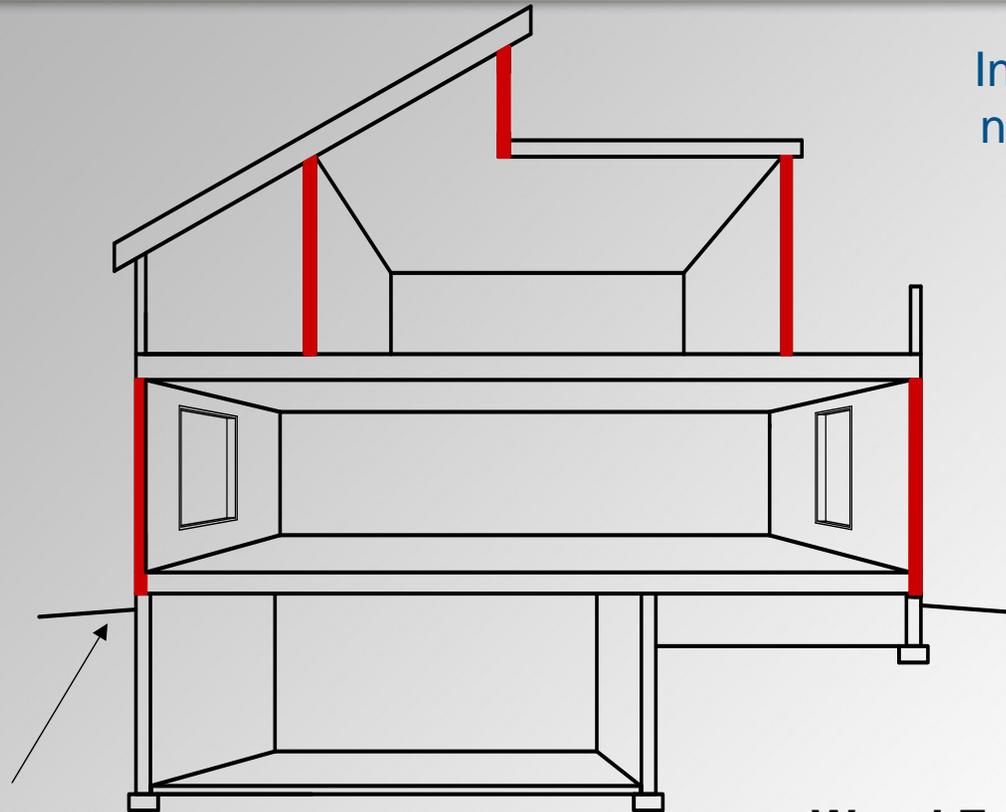


- Raised Heel/Energy Truss allowance if insulation is full height over exterior wall
 - R-30 instead of R-38
 - R-38 instead of R-49



Above Grade Walls

Insulate walls including those next to unconditioned spaces



Don't forget to insulate rim joists

Wood Frame Walls

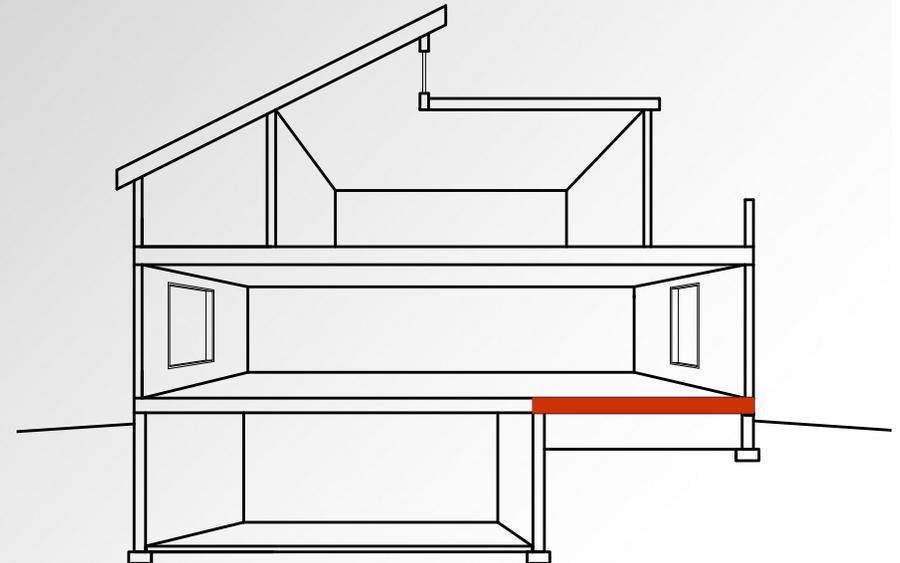
Climate Zones

- 1-4: R-13
- 4 marine and 5-8: R-19 or 13+5

Floors Over Unconditioned Space

Requirements by Climate Zone in 2006 IECC and in REScheck

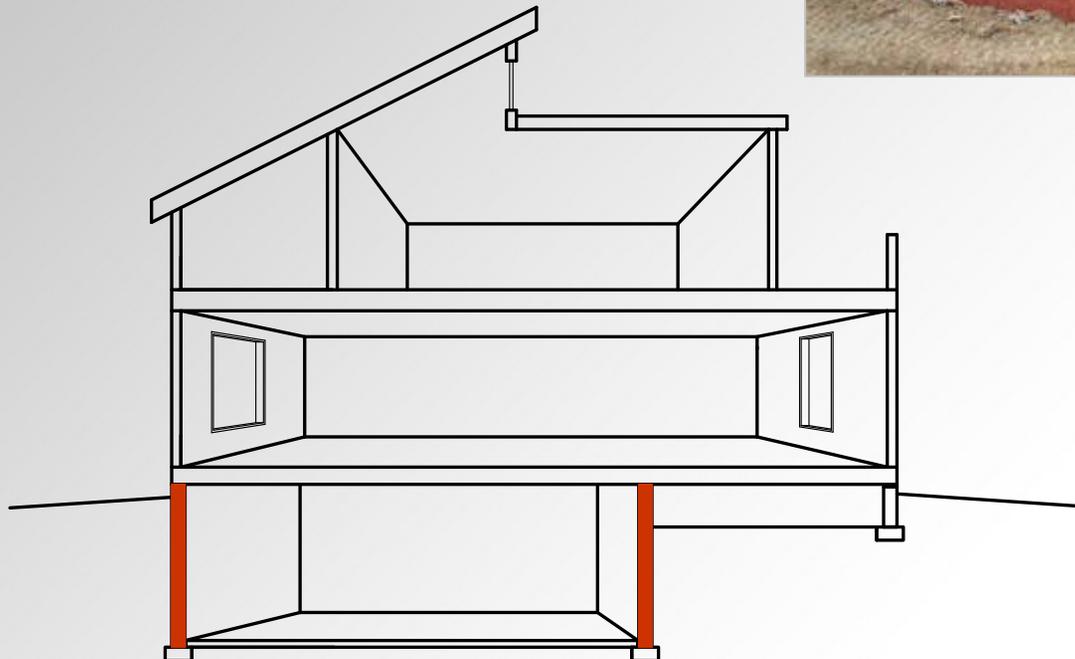
- Space can be unheated basement or a crawlspace or outdoor air
- Zones 1-2: R-13
- Zones 3-4AB: R-19
- Zones 4C-8: R-30



- If you don't meet these insulation levels, additional insulation of other envelope components is required to comply

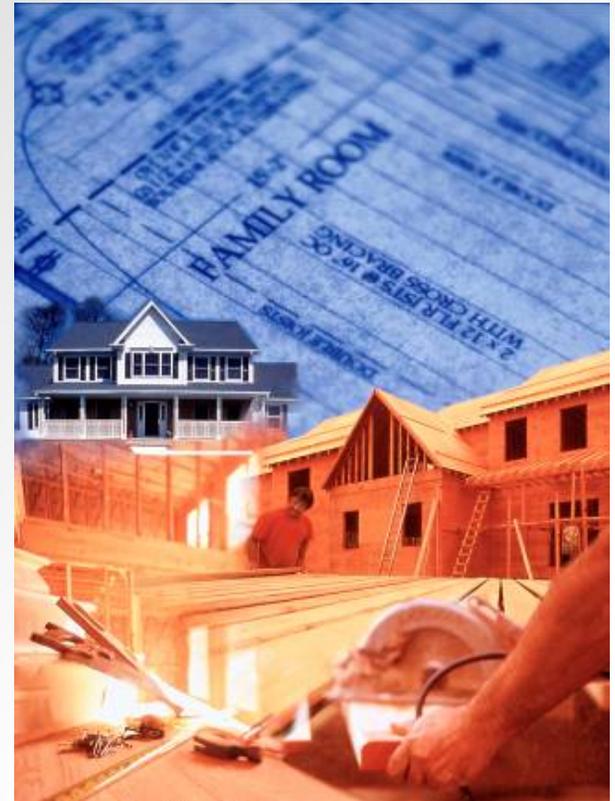
Below-Grade Walls

- > 50% below grade
- Zones 1-3: R-0
- Zones 4-8: R-10 (continuous) or R-13 (cavity)



Compliance/Documentation/ Inspections

- Code Official has final authority
- Electronic media can be used
 - Email compliance report
- Construction work for which a permit is required is subject to inspection
- Certificate is required



Certificate

- Permanently posted on the electrical distribution panel
- Shall include the following:
 - R-values of insulation installed for the thermal building envelope including ducts outside conditioned spaces
 - U-factors for fenestration
 - SHGC for fenestration
 - HVAC efficiencies
 - SWH equipment

|  2006 IECC Energy Efficiency Certificate | | | |
|---|--|-------------|------|
| Insulation Rating | | R-Value | |
| Ceiling / Roof | | 0.00 | |
| Wall | | 0.00 | |
| Floor / Foundation | | 0.00 | |
| Ductwork (unconditioned spaces): _____ | | | |
| Glass & Door Rating | | U-Factor | SHGC |
| Window | | | |
| Door | | | |
| Heating & Cooling Equipment | | Efficiency | |
| Water Heater: _____ | | | |
| Name: _____ | | Date: _____ | |
| Comments: _____ | | | |

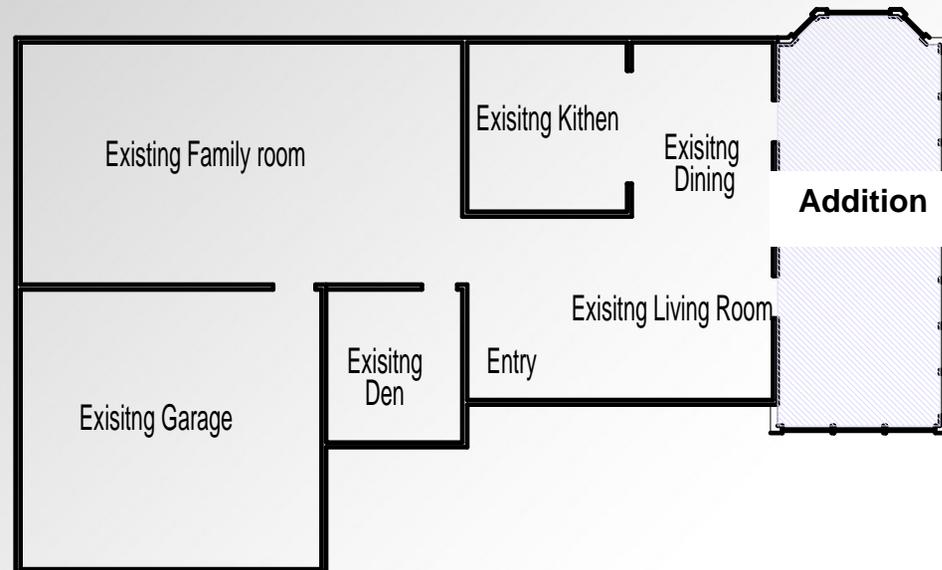
HVAC Trade-offs

- REScheck is a “limited scope” performance analysis tool as permitted under Section 404.6.2
- Performance analysis is attempted only when:
 - House fails by UA compliance
 - High Efficiency HVAC equipment has been specified
- How this impacts REScheck
 - Requires users to initiate compliance check
 - Requires entry of orientation and SHGC
 - Doesn't always improve compliance even if high-efficiency HVAC is specified

Additions

➤ Compliance options for additions

- Treat as a stand-alone building
- Bring entire building into compliance



Special Rules for Sunrooms

Sunroom addition defined:

- > 40% glazing of gross exterior wall and roof area
- Separate heating or cooling system or zone
- Must be thermally isolated and not used as a kitchen or sleeping quarters



REScheck cannot be used

Sunroom Requirements/2006 IECC

Minimum Insulation:

- ceiling R-19 for climate zones 1-4
- ceiling R-24 for climate zones 5-8
- walls R-13 for all climate zones

A new wall (or walls) separating a sunroom from a conditioned space shall meet the building thermal envelope requirements.

Fenestration:

0.50 U-factor in climate zones 4-8 is a maximum

Skylights:

0.75 U-factor in all climate zones

Any new windows and doors separating the sunroom from conditioned space shall meet the building envelope requirements.

Questions/Comments

- Help Desk – on-line electronic form

<http://www.energycodes.gov/support/helpdesk.php>

- Email

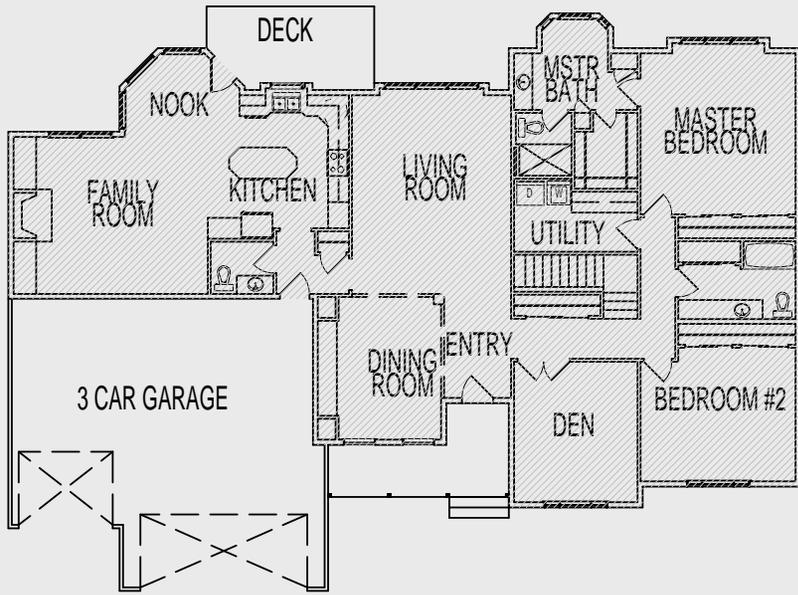
Techsupport@becp.pnl.gov

Case Study – REScheck Software

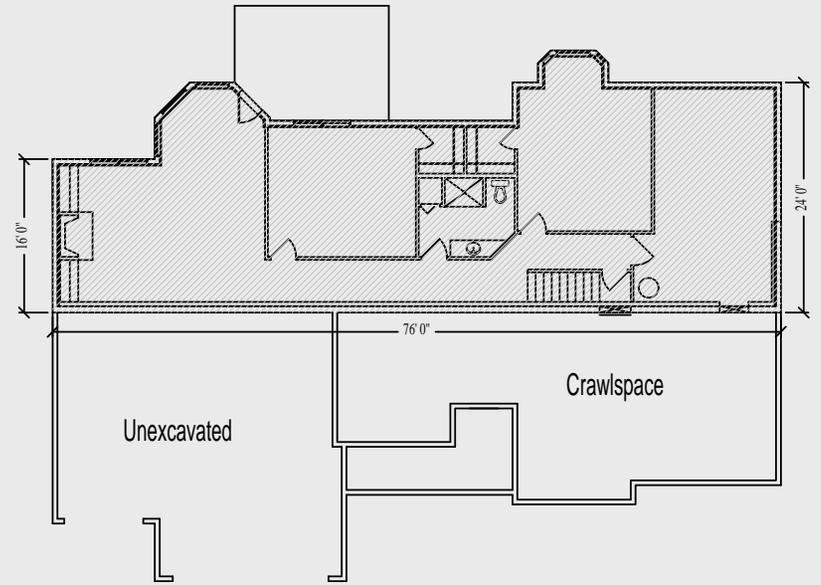


Jones Residence

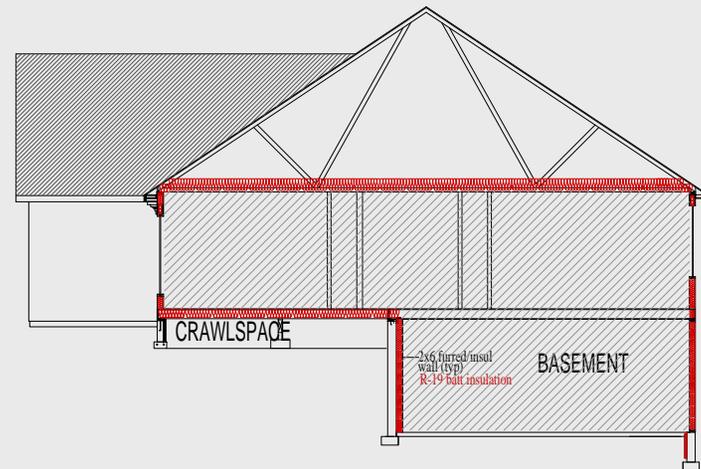
➤ Building Envelope



Conditioned Main Floor



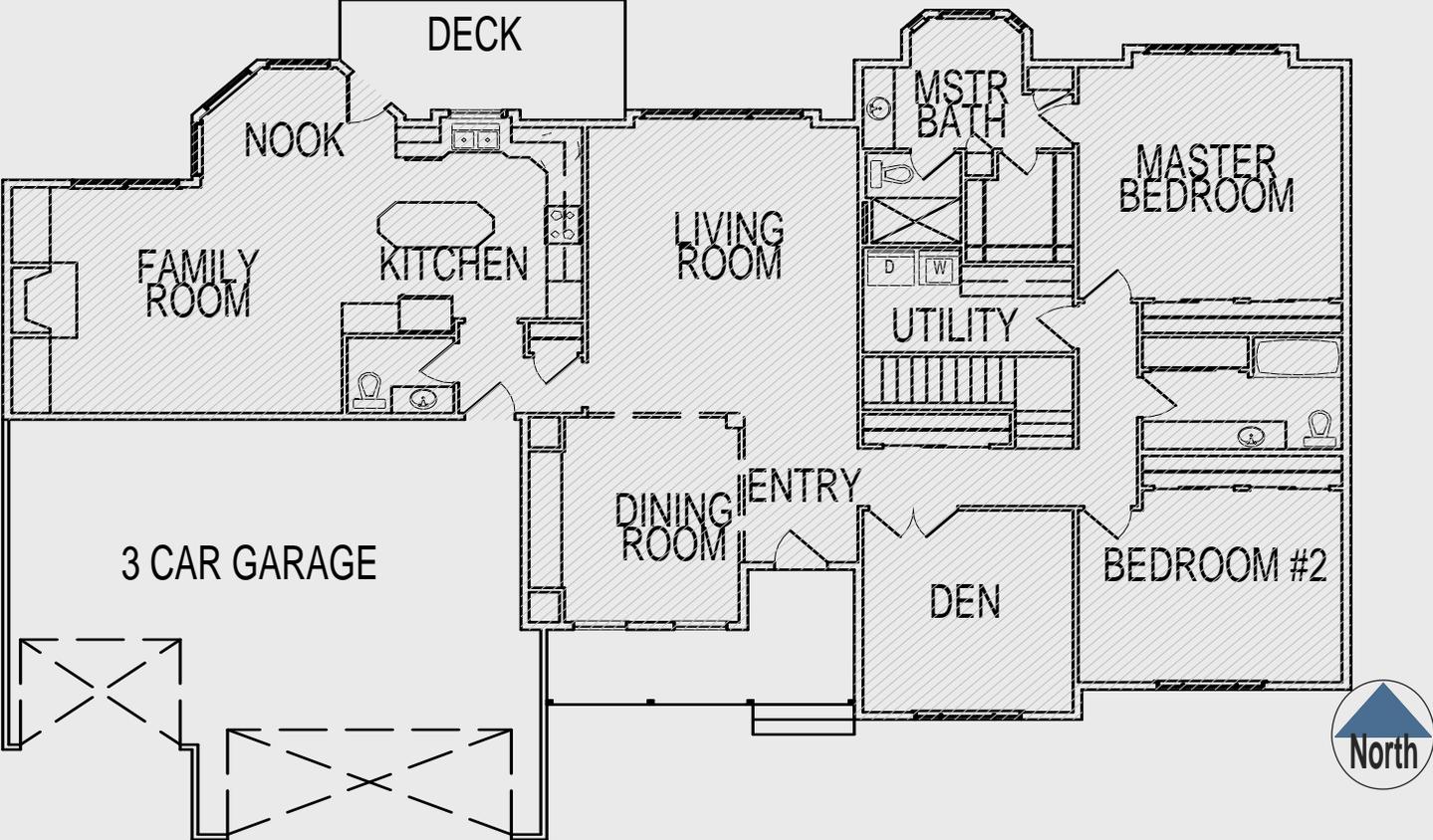
Conditioned Basement



Building Section

➤ Ceiling Area

Ceiling Area
2415 s.f.



➤ Exterior Wall Areas

12' Exterior Walls - 689 s.f.

North – 221 s.f.

South – 234 s.f.

East – 52 s.f.

West – 182 s.f.

9' Exterior Walls - 2180 s.f.

North – 690 s.f.

South – 600 s.f.

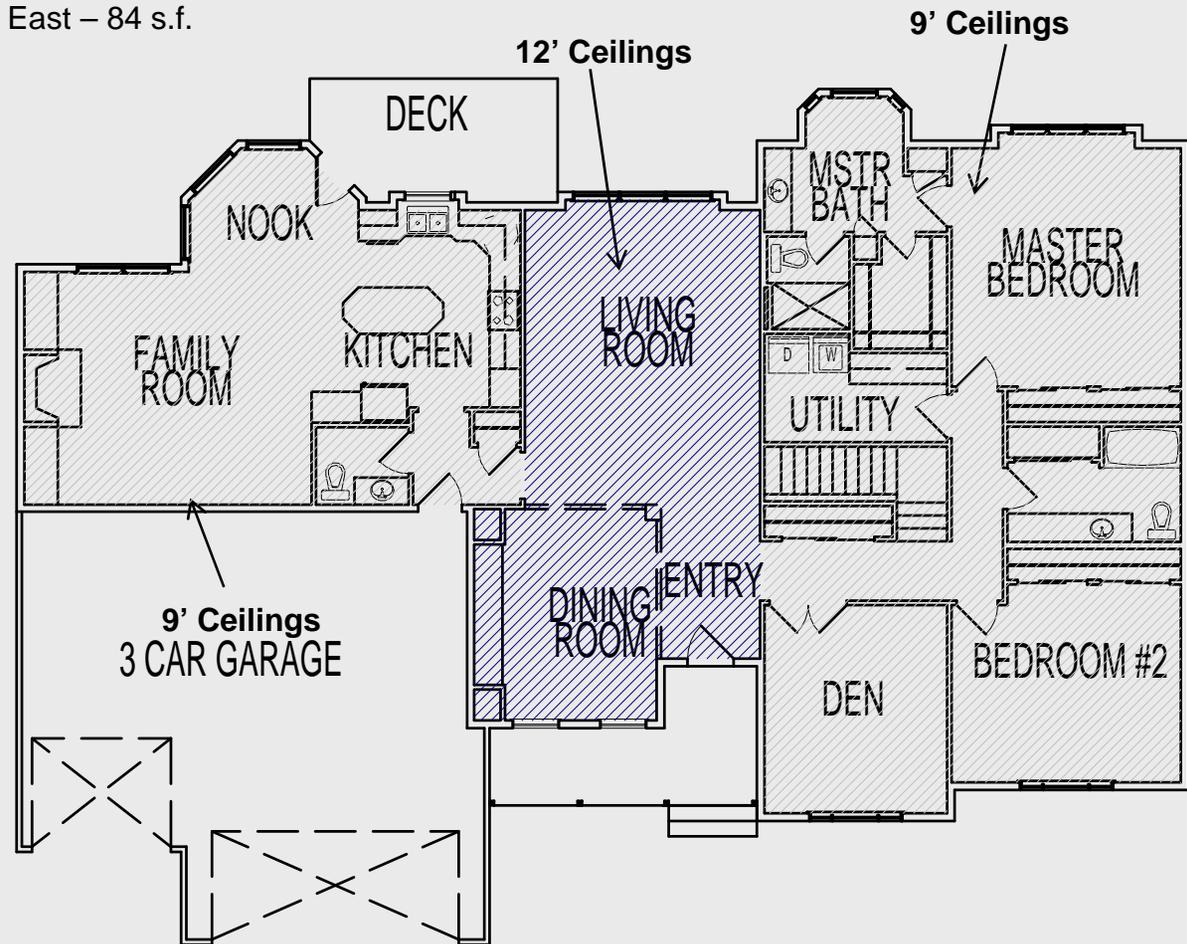
East – 440 s.f.

West – 450 s.f.

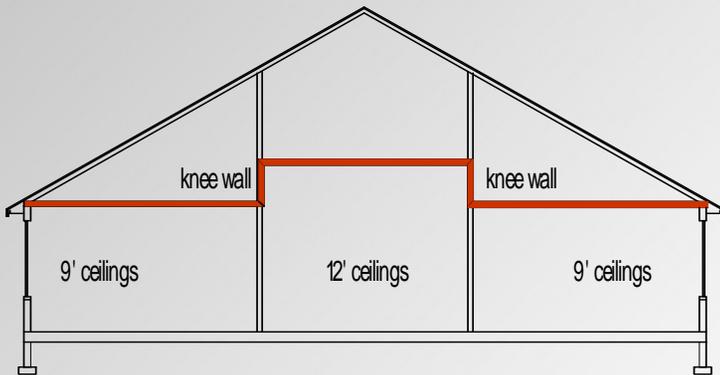
3' knee walls (between 9'&12' sections) – 153 s.f.

West – 69 s.f.

East – 84 s.f.



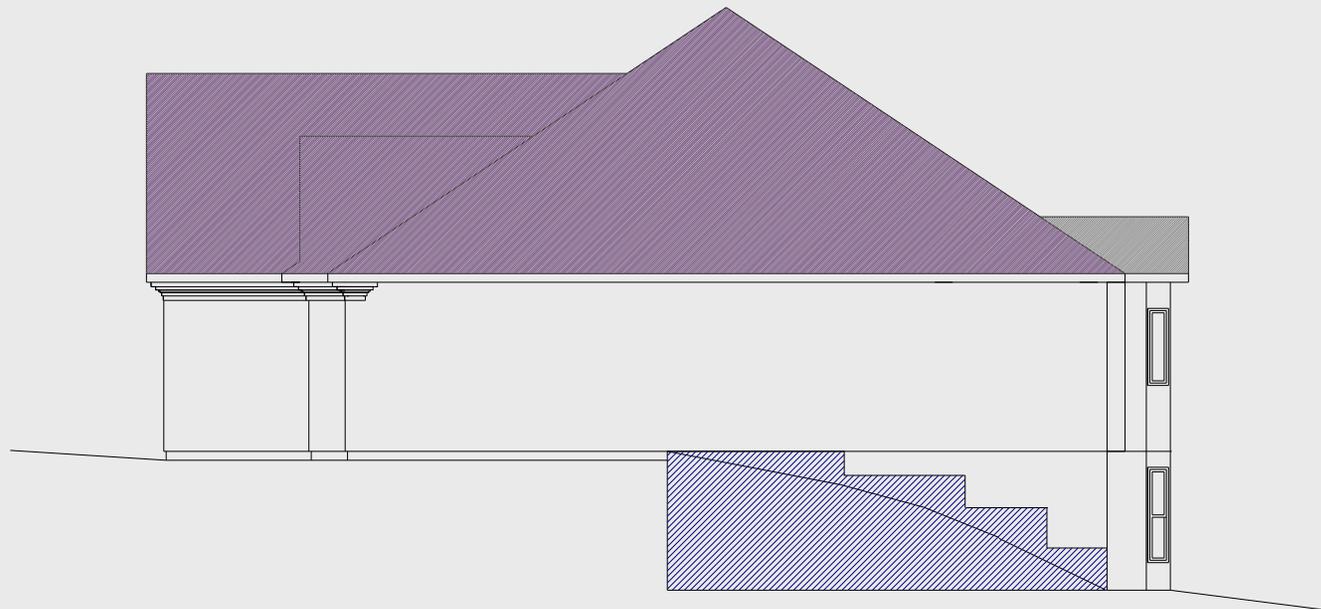
Knee Wall Insulation



No, No... Never cut the batts too short

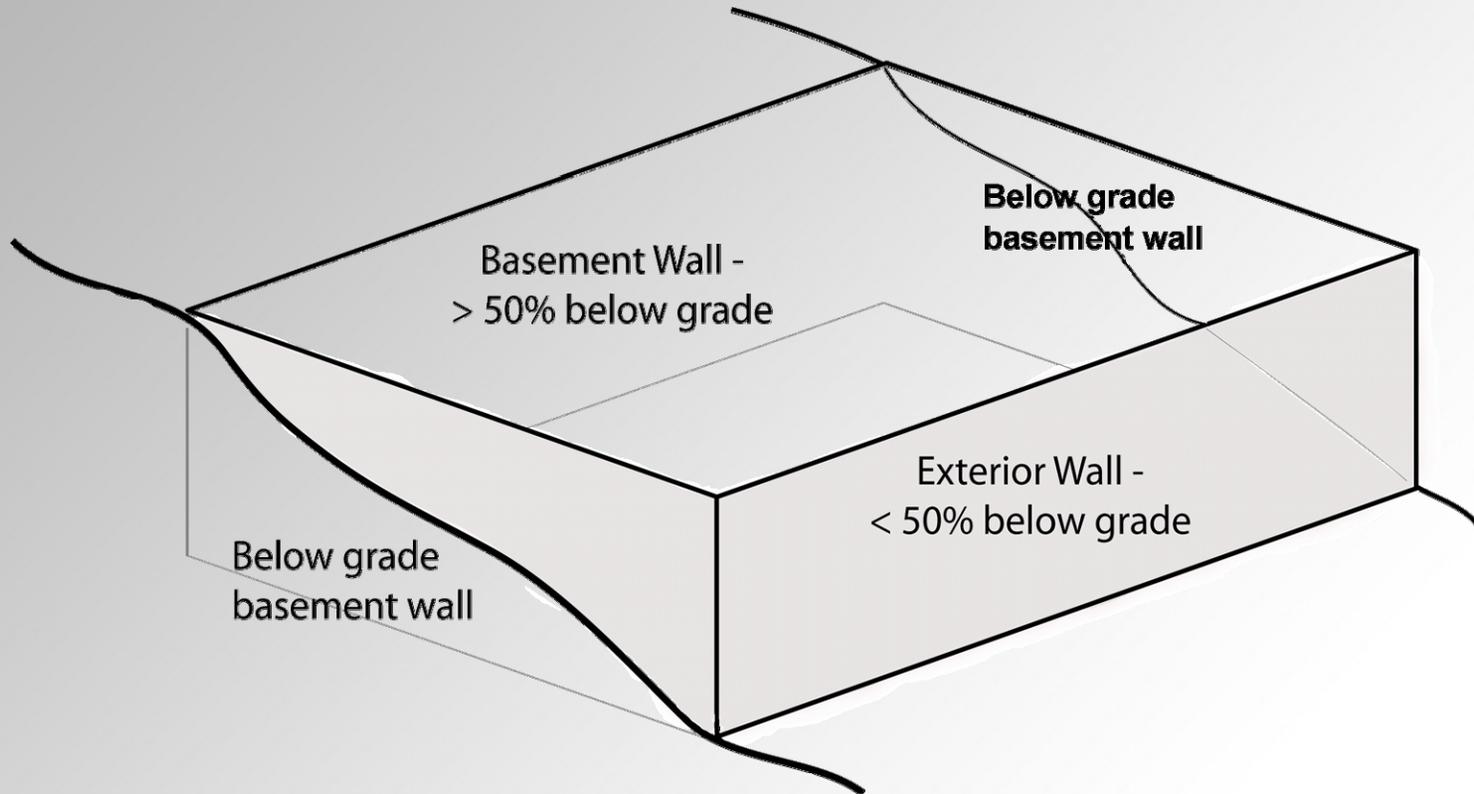
➤ Basement Walls -

- below grade



>50% below grade =
below grade concrete basement wall

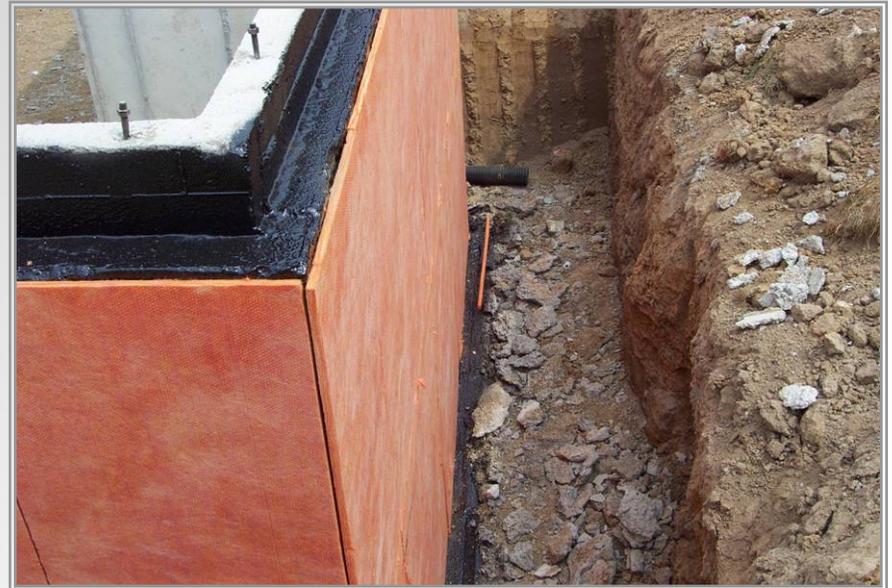
Defining Below-Grade Walls



Ways to Insulate Basement Walls

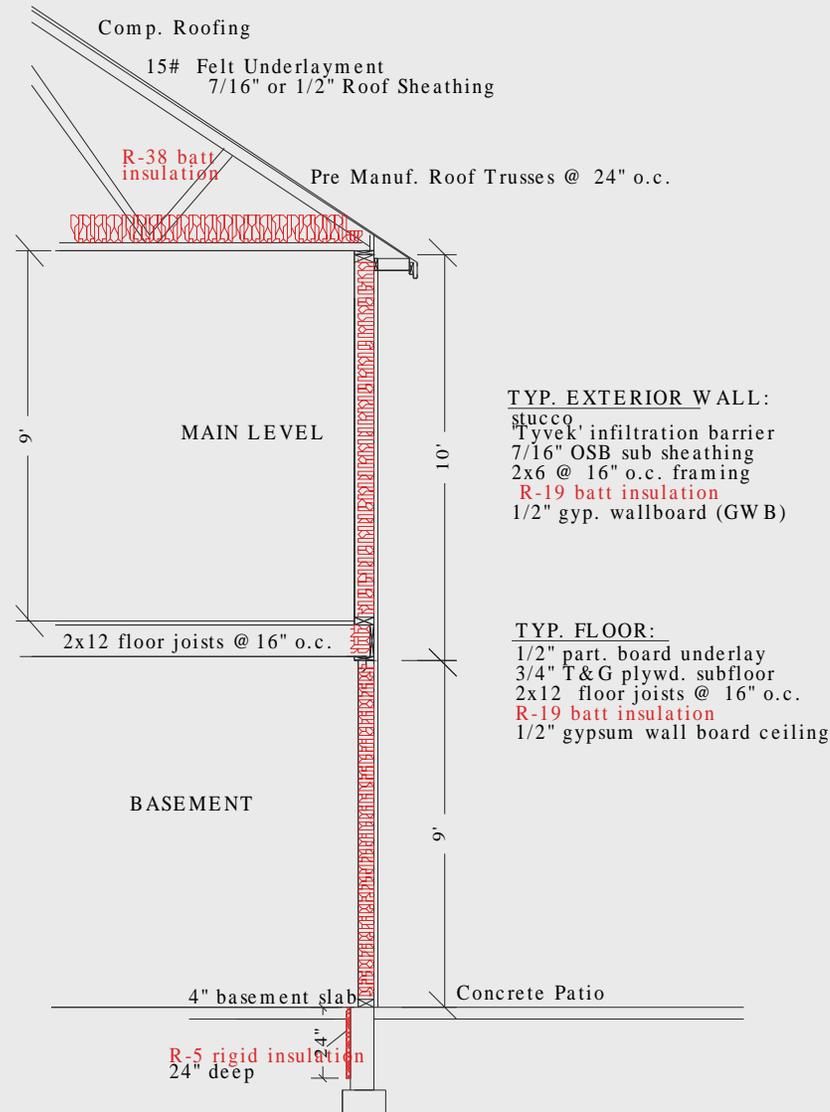


Interior Studs w/batts



Exterior Rigid Foam

➤ Including Rim Joists in the Exterior Wall Area



BASEMENT SECTION @ EXTERIOR WOOD WALL

➤ Basement Wall Areas

Above Grade Bsmt Walls (exterior wood) = 837 s.f. (93' x 9')
(entered as wood frame wall not a basement wall)

Below Grade Bsmt Walls = 1044 s.f.

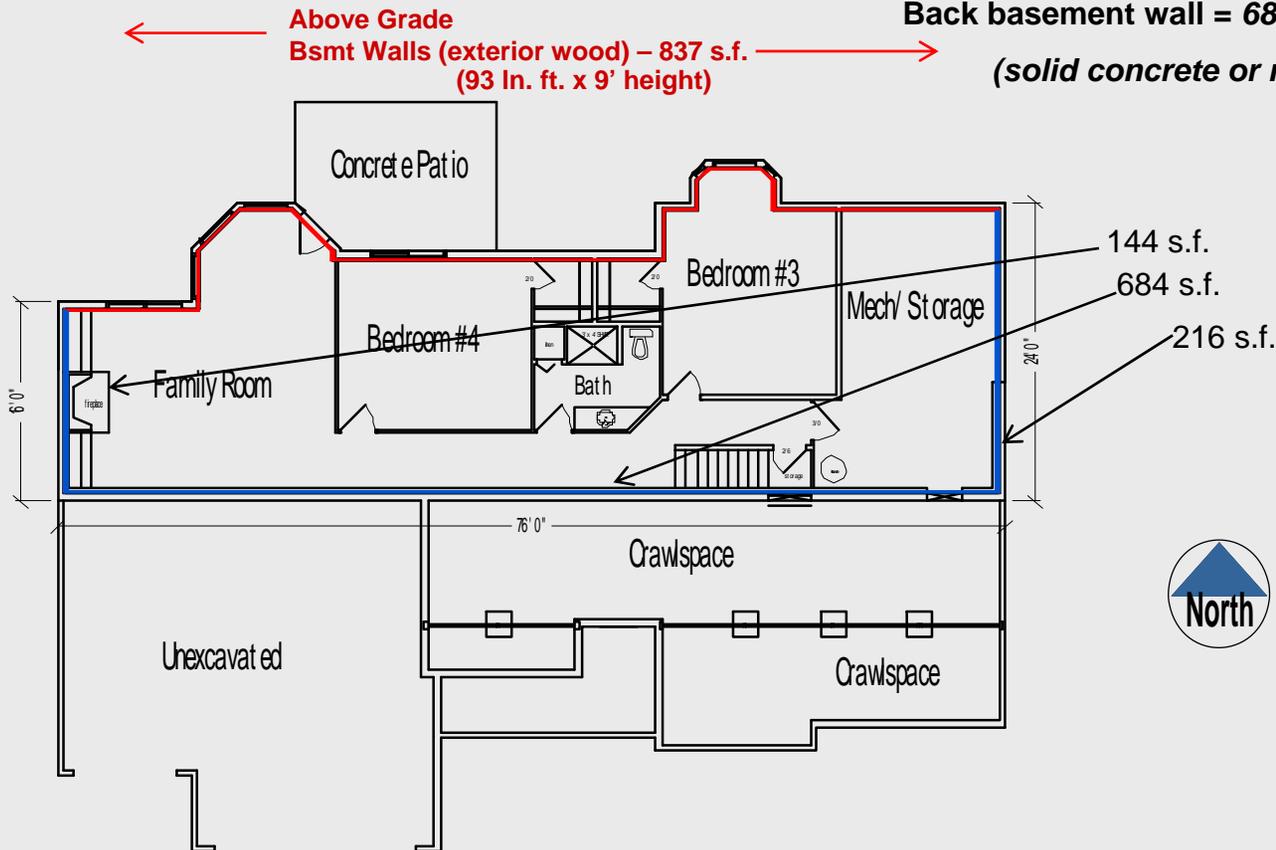
Side basement walls = 360 s.f.

•West Wall – 144 s.f

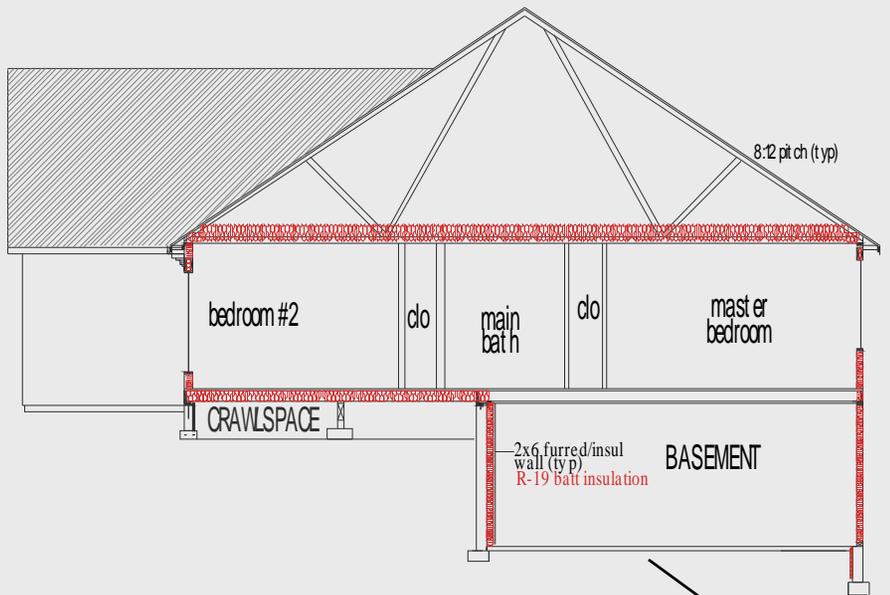
•East Wall – 216 s.f.

Back basement wall = 684 s.f. (76'x9')

(solid concrete or masonry)



➤ Basement Walls



“back” below grade basement wall
(entire back wall is adjacent to
crawl space)

Basement Walls ✕

Enter the specified dimensions in feet (not inches) in the boxes provided.
A basement wall less than 50% below grade is considered an above-grade wall
and must be entered using the Wall button.

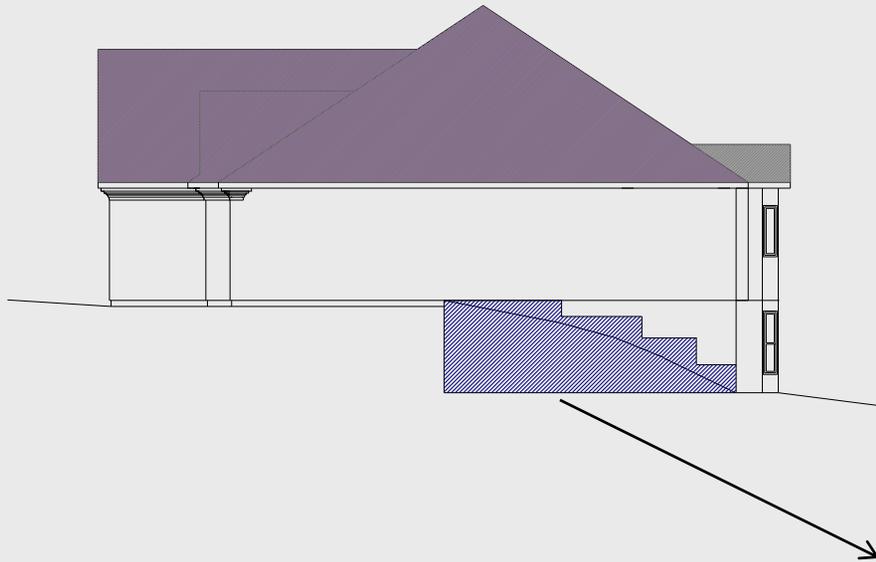
The diagram shows a cross-section of a basement wall. The wall is shown extending from the finished outside grade down to the basement floor. The wall height is measured from the top of the wall to the basement floor. The depth below grade is measured from the finished outside grade to the basement floor. The depth of insulation is measured from the top of the wall to where the insulation stops.

Wall Height (ft)
Measured from the top of the wall to the basement floor.

Depth Below Grade (ft)
Measured from the finished outside grade to the basement floor.

Depth of Insulation (ft)
Measured from the top of the wall to where the insulation stops.

➤ Basement Walls



“side” below grade basement walls

Basement Walls ✕

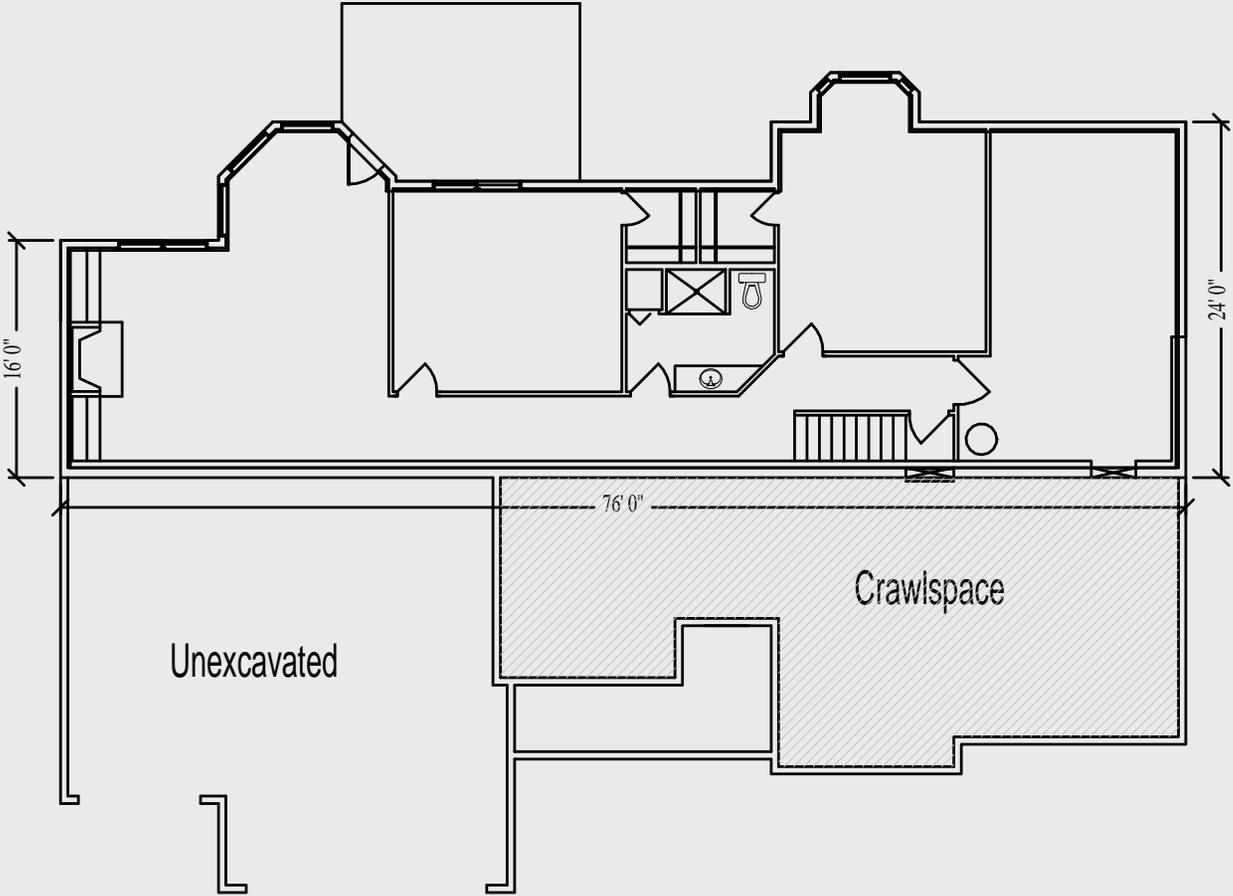
Enter the specified dimensions in feet (not inches) in the boxes provided.
A basement wall less than 50% below grade is considered an above-grade wall and must be entered using the Wall button.

The diagram shows a cross-section of a basement wall. The ground level is indicated by a blue line. The wall extends below the ground level. Three measurement points are marked with boxes containing '0.0':

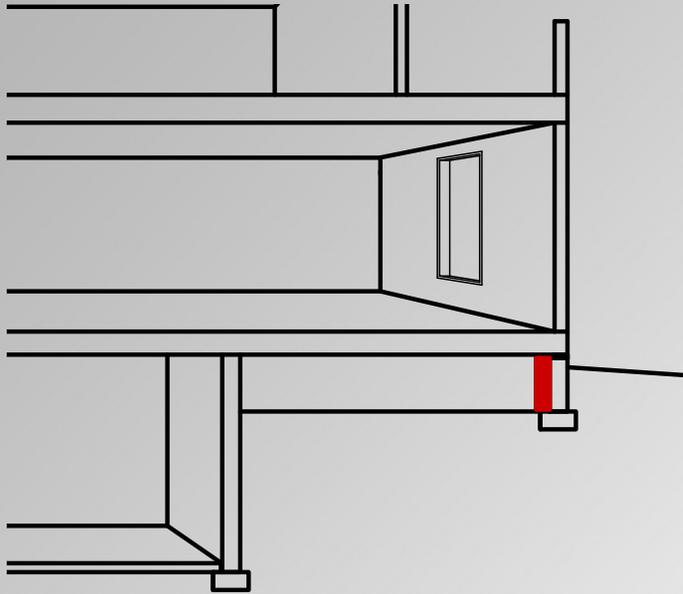
- Wall Height (ft)**: Measured from the top of the wall to the basement floor.
- Depth Below Grade (ft)**: Measured from the finished outside grade to the basement floor.
- Depth of Insulation (ft)**: Measured from the top of the wall to where the insulation stops.

➤ Floor Area

Crawlspace Area - 783 s.f.



Crawlspace Wall Insulation



Insulated crawlspace wall =

- no foundation vents
- + mechanically vented or conditioned



Crawlspace Walls in REScheck

| Project | | Envelope | | Mechanical | | | | | | | | | | | |
|-----------|----------|---------------------------|---|---------------------------|-------------------------------|----------|-----|------------------|------------------------|-------------------------------|-----------------------|-------|--|------------|--|
| Ceiling | | Skylight | | Wall | | Window | | Door | | Basement | | Floor | | Crawl Wall | |
| Component | Assembly | Gross Area | | Cavity Insulation R-Value | Continuous Insulation R-Value | U-Factor | UA | Wall Height (ft) | Depth Below Grade (ft) | Depth Below Inside Grade (ft) | Depth Insulation (ft) | | | | |
| Building | | | | | | | | | | | | | | | |
| 1 | Crawl 1 | Solid Concrete or Masonry | 0 | ft2 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | | | | |

Unventilated Crawl Space Walls

The crawl space wall option applies only to walls of unventilated crawl spaces. Enter the specified dimensions in feet (not inches) in the boxes provided.

The diagram illustrates a cross-section of a crawl space wall. The wall is shown as a vertical structure with a footing at the bottom. The top of the wall is connected to a floor slab. The diagram shows the following measurement points:

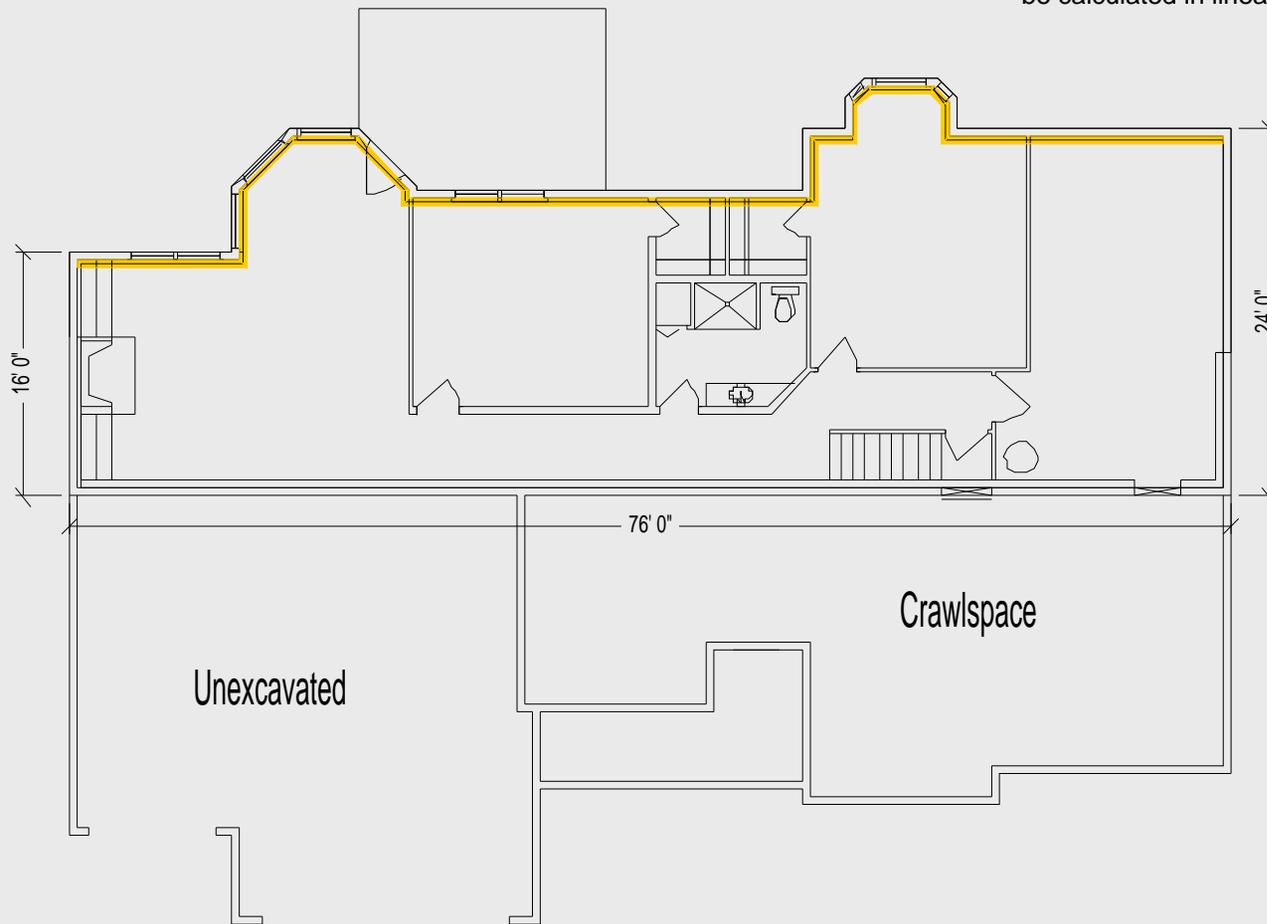
- Wall Height (ft):** Measured from the top of the wall to the top of the footing. The input box shows 0.0.
- Depth Below Grade (ft):** Measured from outside grade to the top of the footing. The input box shows 0.0.
- Depth Below Inside Grade (ft):** Measured from inside grade to the top of the footing. The input box shows 0.0.
- Depth of Insulation (ft):** Include the total vertical plus horizontal distance. The input box shows 0.0.

OK Cancel

➤ Slab Perimeter

← Slab Perimeter - 93 linear feet →

Line represents the slab edge to be calculated in linear feet.

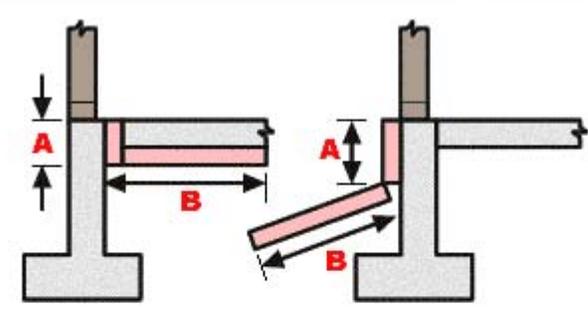


Slabs in REScheck

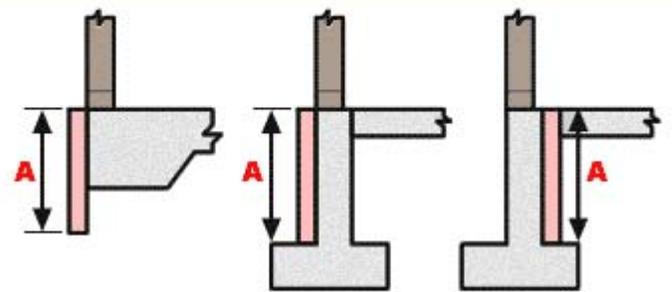
| Project | | Envelope | | Mechanical | | | | | | | |
|-----------|----------|------------------------------|---|------------|--|--------|--|------|--|----------|--|
| Ceiling | | Skylight | | Wall | | Window | | Door | | Basement | |
| Component | Assembly | Gross Area | | | | | | | | | |
| Building | | | | | | | | | | | |
| 1 | Floor 1 | Click here to select Asse... | 0 | ft2 | | | | | | | |
| | | All-Wood Joist/Truss | | | | | | | | | |
| | | Slab-On-Grade | | Unheated | | | | | | | |
| | | Structural Insulated Panels | | Heated | | | | | | | |
| | | Other | | | | | | | | | |

Slab-On-Grade Floors

Enter the depth of the insulation (ft.), including the total vertical and horizontal distance: ft.



Horizontal Insulation ($A + B = \text{Insulation Depth}$)



Vertical Insulation ($A = \text{Insulation Depth}$)

OK Cancel



• Depth of Insulation - Enter the depth (ft) of the insulation you intend to install as measured from the top of the slab to where the insulation stops. This distance should include the total vertical plus horizontal distance. Refer to the illustration below of acceptable configurations. If you enter a depth of 0, the program assumes no insulation is to be installed.

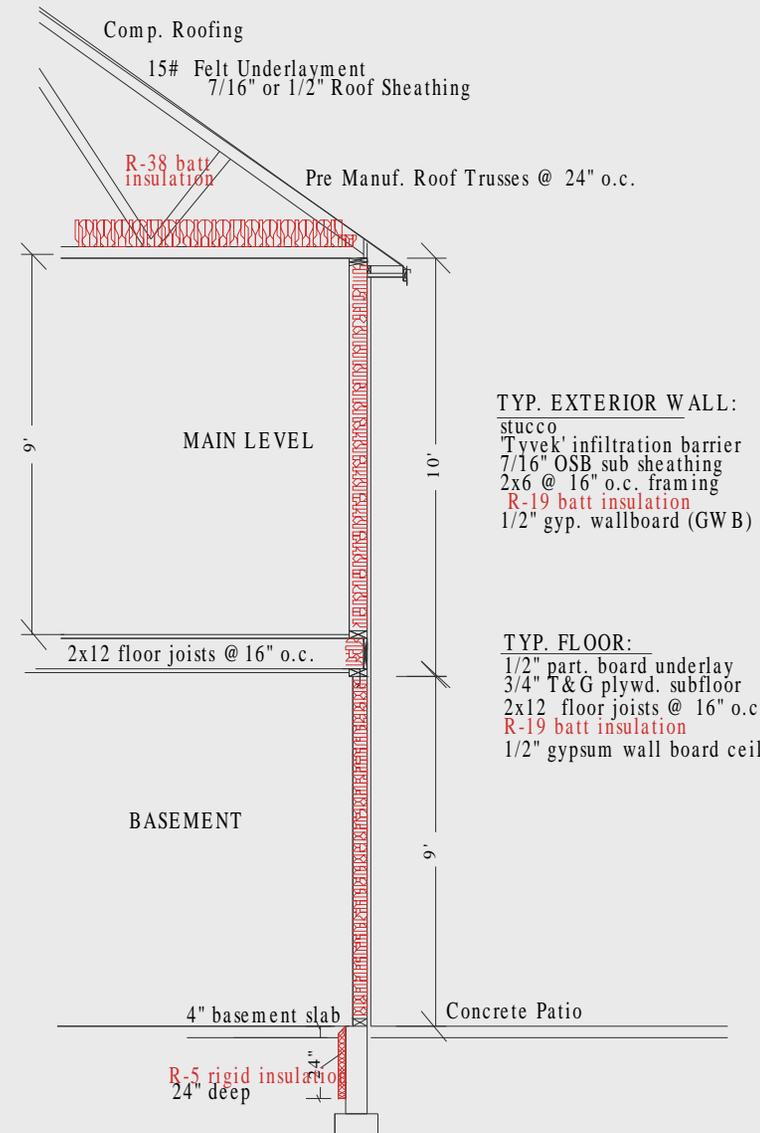
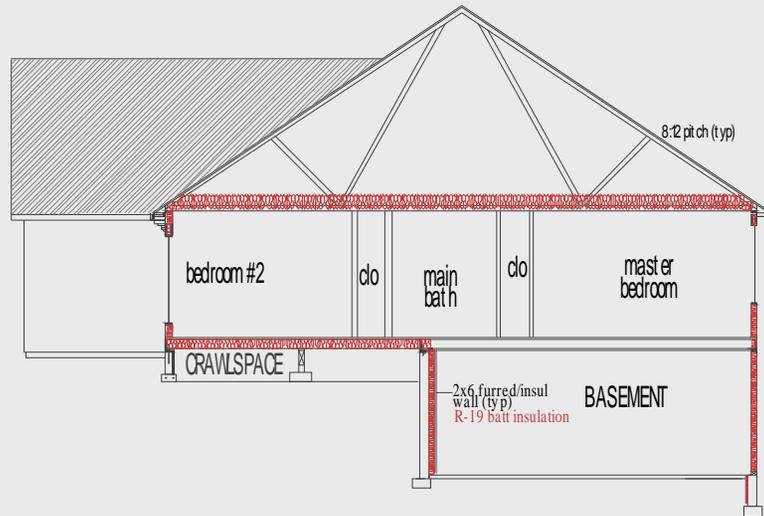
➤ Insulation Levels

Roof/Ceiling - R-38 batts

Wall - R-19 batts

Floor - R-30 batts

Slab - R-5 rigid (24" vertical)



➤ Window/ Door Area

Window Area - 533 s.f.;

U-value = 0.35 & SHGC .40

North – 369 s.f.

South – 149 s.f.

West – 15 s.f.

Glass Doors <50% glass - 40 s.f.; U-value = 0.50

North – 40 s.f.

Opaque Doors - 40 s.f.; U-value = 0.50

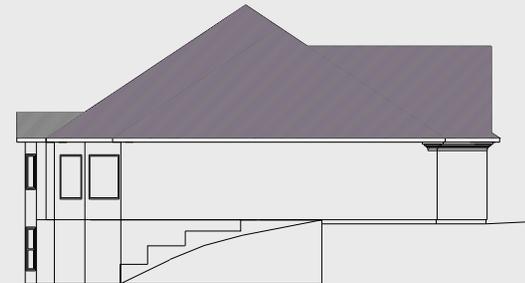
South – 40 s.f.



South



North



West



East