Insulation

Materials and Practice

Funding

Funding for this class was provided by the Alaska Housing Finance Corporation (AHFC).

This course is designed to empower homeowners with the knowledge to live in and maintain a safe, energy efficient home.

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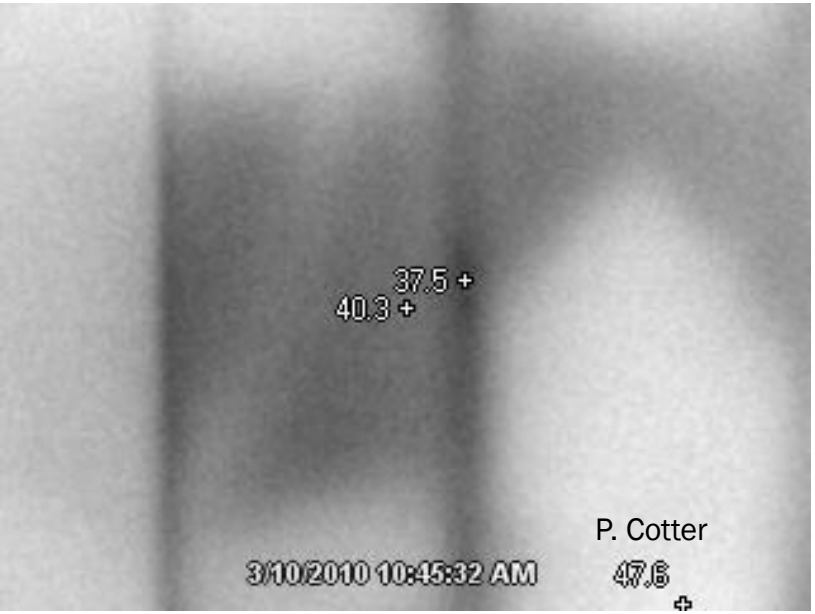
Topics for today:

- Building Science review
- Insulation materials
- Roofs
- Foundations
- Walls

AHFC Energy Efficiency Programs:

- Home Energy Rebate Program
- Weatherization Assistance Program
- New Home Rebate
- Second Mortgage for Energy Conservation
- Energy Efficiency Rate Reduction Mortgage
- www.ahfc.us

Insulation



3% gap = 30% reduction in thermal performance

Heat

Insulation minimizes heat loss in cold climates

Heat

- Transfer of energy

From

High temperature areas

TO

Low temperature areas

Heat is

transferred from high temp

regions to low temperature

regions

Heat Flow by…

1) Conduction - through solid objects
   - Reduce with Insulation

2) Convection - through air

3) Radiation - through space

Conduction

Compare

Measure insulation effectiveness with

- R-Value
  - Most common in U.S.

- U-factor
  - Used in U.S. for windows/doors

R-value vs. U-factor

- R-Value
  - Resistance – prevent heat transfer
  - Additive (Ex. 0.9 + 11 + 1.25 = 12.15)
  - Inverse of conductivity - R = I/U
- U-factor
  - Conductivity – amount of heat moving through a material
  - Not additive
  - Inverse of resistance - U = 1/R

Everything has an R-value

R-value of dirt ~ 1.5/Foot

The Good and the Bad

- Good conductors make great cookware
  - High U, low R
  - Aluminum, steel

- Bad conductors make great outhouse seats
  - Low U, High R
  - Foam, still air

Compare Conductivities

Aluminum Frames

Insulated Fiberglass Frames

R-value for building components

Table A402.1.1 Insulation and Glazing Minimum R-values by Component							
Climate Zone	Windows, Doors, & Skylights	Ceiling[a]	Exterior Wood Frame Wall	Floor	Below Grade Wall[b]	Slab and Depth[c]	Crawl space Wall[b]
6	3.33	54 or 43	25	38	15/19	15, 4ft	15/19
7	3.33	54 or 43	25	38	15/19	15, 4ft	15/19
8	4.5	59 or 48	30	38	15/19	15, 4ft	15/19
9	5	65 or 52	35	43	NR	NR	NR

It’s not just about R-value

- R-value
- Perm rating or relative Permeability
- Moisture sensitivity
- Fire performance
- Availability
- Limitations
- Cost

Permeability

- Ability to allow movement through it
- Air or Vapor
- High – easy movement
- Low – difficult movement
- Faced products (plastic, aluminum, paper) have lower permeability

High or low permeability?

Depends on the application

(Sorry)

Insulation Materials

Options, Properties, Practice

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Foam Products

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Polyisocyanurate

Always faced

~R7 new

Vapor impermeable

Expensive/sheet

½ - 2” thickness

Tape seams

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Polyurethane

Paper-faced

~R6

Low vapor perm

Commercial use

2- 4” typically

Uncommon in residential applications

Extruded Polystyrene (XPS)

Unfaced

~R5

Low vapor perm

Readily available

Reasonable price

1-2” typical

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Expanded Polystyrene (EPS)

Unfaced and Faced

~R4

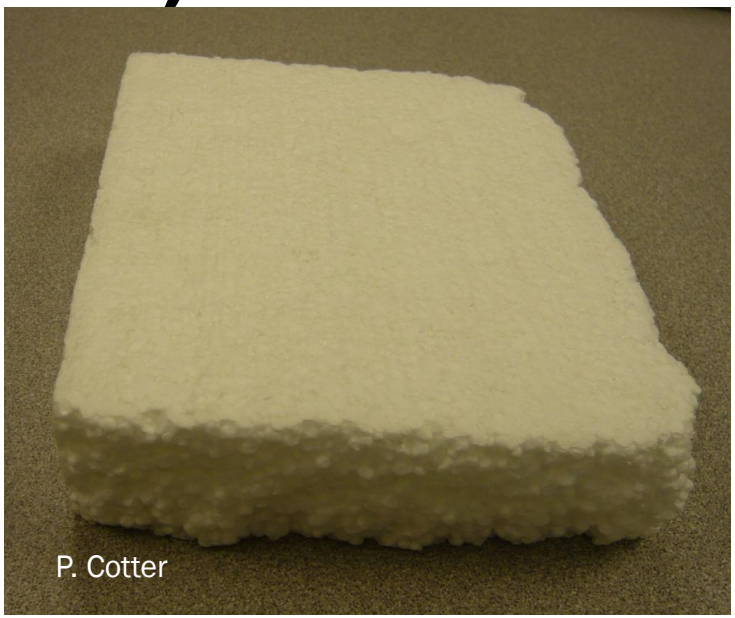
Vapor perm (unfaced)

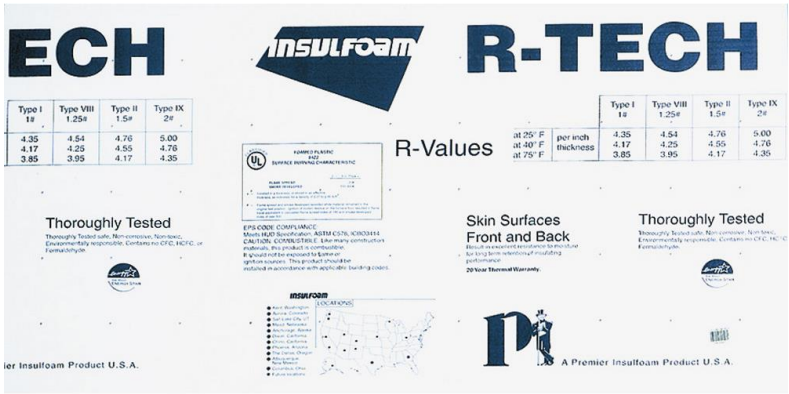
Readily available

Inexpensive

Any thickness

Made in Alaska





Fiberglass Board

Faced and unfaced

Few residential applications

~R4/in

Unfaced used for sound reduction

Spray Foam

Spray Foams (polyurethane)

One-part:

- Spray cans (e.g., Great Stuff)
- Spray guns with screw-on cans

Two-part:

- Portable 2-tank kits – small, medium, and large
- Truck-mounted rigs

One-Part Spray Foam

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- Many manufacturers
- Adjustable bead guns
- Reusable guns
- Cleaners available/necessary
- Keep gun/canister attached
- Gun cost ~ $25 - $100
- Better than disposable cans

One-Part Foam

ADVANTAGES

- Quick and easy for small holes and gaps
- Creates an effective seal for small holes
- Lightweight and portable
- Long shelf life opened or closed

DISADVANTAGES

- Set up time can exceed 2 hours
- Not cost effective for large jobs
- Freshly gunned product will not adhere on overhead surfaces

2-part polyurethane foam kit

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~ R7/in

~2.8 perm/in

Air Barrier

Many brands available

2-Part Foam

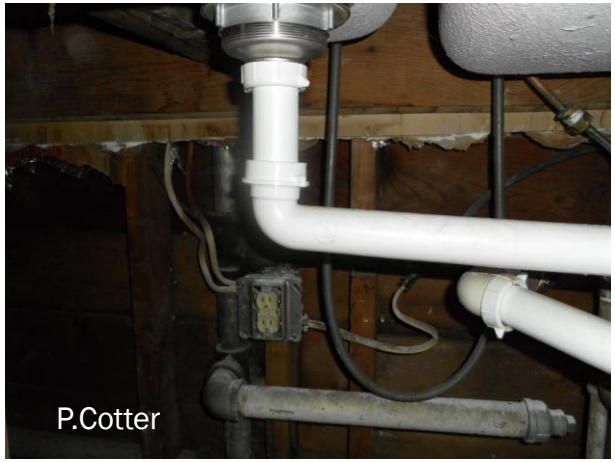
ADVANTAGES

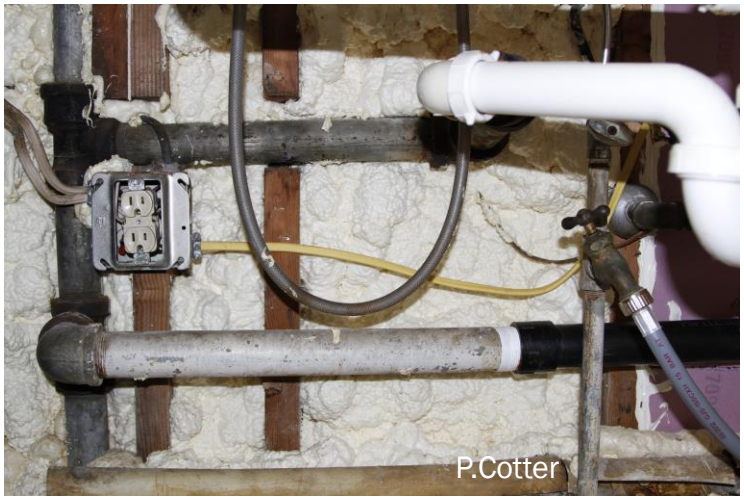
- Insulates and air seals
- Fast, easy application
- Quick setting (< 1 min)
- Forms strong, structural bond with many materials
- Different tips for different applications (fan v. round)

DISADVANTAGES

- Sensitive to temp & moisture during application
- Not cheap
- Shelf life/sensitive once opened
- Should ventilate when using

Good application for a foam kit





Fiberglass products

The good news

Not as itchy as it used to be!

Also, less airborne fibers

But always wear protective clothing and mask when working with fiberglass insulation

Batt Insulation

- Roll out panels
- Variety of thickness
  - Up to R-38
- Stackable

Faced Fiberglass Batt Insulation

- Face = insulation attached to paper or foil
- Face should always be on warm side
- Walls
- Attic floor/ceiling – first layer of insulation only
- Floors – Face should be against floor sheeting

Faced Fiberglass Batt Insulation

Not best practice

Note faced batt above cellulose insulation*

Unfaced Fiberglass Batt Insulation

- Many uses
- Difficult to install around wiring, etc.
- Inexpensive
- R11 – R38
- Stackable

Excellent installation by homeowner

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Mechanically secure on vertical surfaces

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Loose-fill Fiberglass

Cellulose

Loose fill cellulose in attic

Cellulose

Prepped for dense-pack cellulose

Pipe Insulation

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Insulating Building Assemblies

Some Tips

- Air barrier MUST be on warm side of insulation
- Vapor retarder MUST be on warm side of insulation

AK recommended levels

Table R-A402.1.1 Nominal Insulation and Glazing Minimum R-values by Component							
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Best tool in the box! (the facemask)

Insulating attics

Insulating attics - Caution

Unless specified for insulation contact (IC), electrical fixtures and combustion appliance flues must not be in contact with insulation

Recommended minimum attic R-value

Climate Zone	Attic R-value
6	54 or 43
7	54 or 43
8	59 or 48
9	65 or 52

Alaska Amendments, April 3, 2013.

Cold attic options

Fiberglass batt

Blown-in fiberglass or cellulose

“Flash coat” of spray foam then…

...additional “cheap” R-value

Hot roof options

Polyurethane spray foam professionally applied

Exterior foam on roof

Exterior foam on roof

Exterior foam on roof

Exterior foam on roof

Exterior foam on roof

Insulating Floors

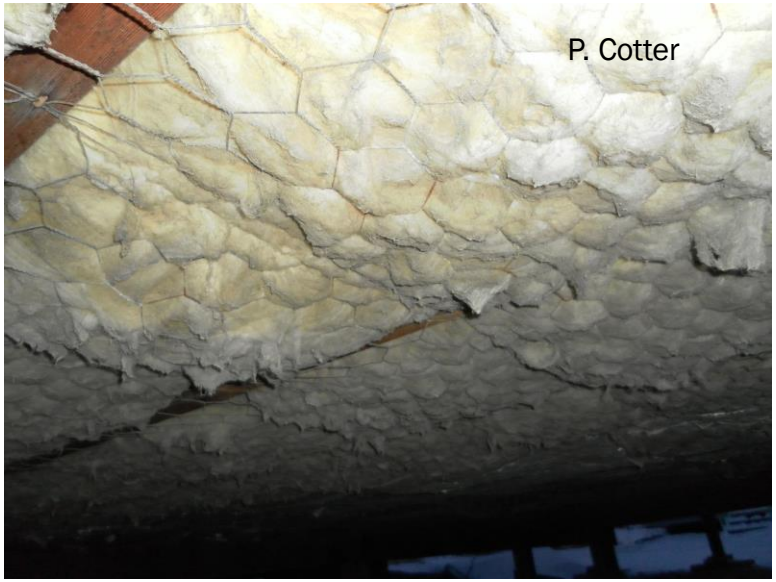
- Facing material MUST be against floor
  - Do not use facing as a fastening flange
- Secure insulation
- Protect from wind, weather, pests
  - Permeable covering and/or skirting

Poorly installed floor insulation

Recommended minimum floor R-value

Climate Zone	Floor
6	38
7	38
8	38
9	43

Secured and protected



Insulating foundations/crawlspaces

- If plumbing is in crawlspace, insulate crawlspace walls
  - Inside or outside
  - Inside insulation can be foam or batt
  - Do not install “vapor barrier” on walls
- Insulated skirting can be effective
- Slab foundations should be insulated
- Rim joists should be airsealed and insulated

Exterior insulation of foundation

Rim joist air filter!

Rim joists - Insulated and Sealed


ACHP


ACHP


LOCTITE
FOAMBOARD
ACHP

Crawlspace wall insulation - Interior

Check local codes before insulating interior crawlspace walls

Crawlspace fiberglass insulation

ACHP


ACHP


ACHP


ACHP


ACHP

Skirt insulation

Insulation must be covered with weather resistant barrier

Moisture management before insulating


ACHP

Recommended wall R-values

Climate Zone	Exterior Wood Frame Wall
6	25
7	25
8	30
9	35

Foam on the exterior of walls

- Outside Insulation Technique (OIT) or REMOTE wall
- Often recommended by energy raters
- Can be an effective efficiency improvement
- Best practices required for durable and efficient structure
- Scope and complexity determined by thickness of foam

Energy retrofits with multiple layers of foam

Significant investment and detail required

One window detail option

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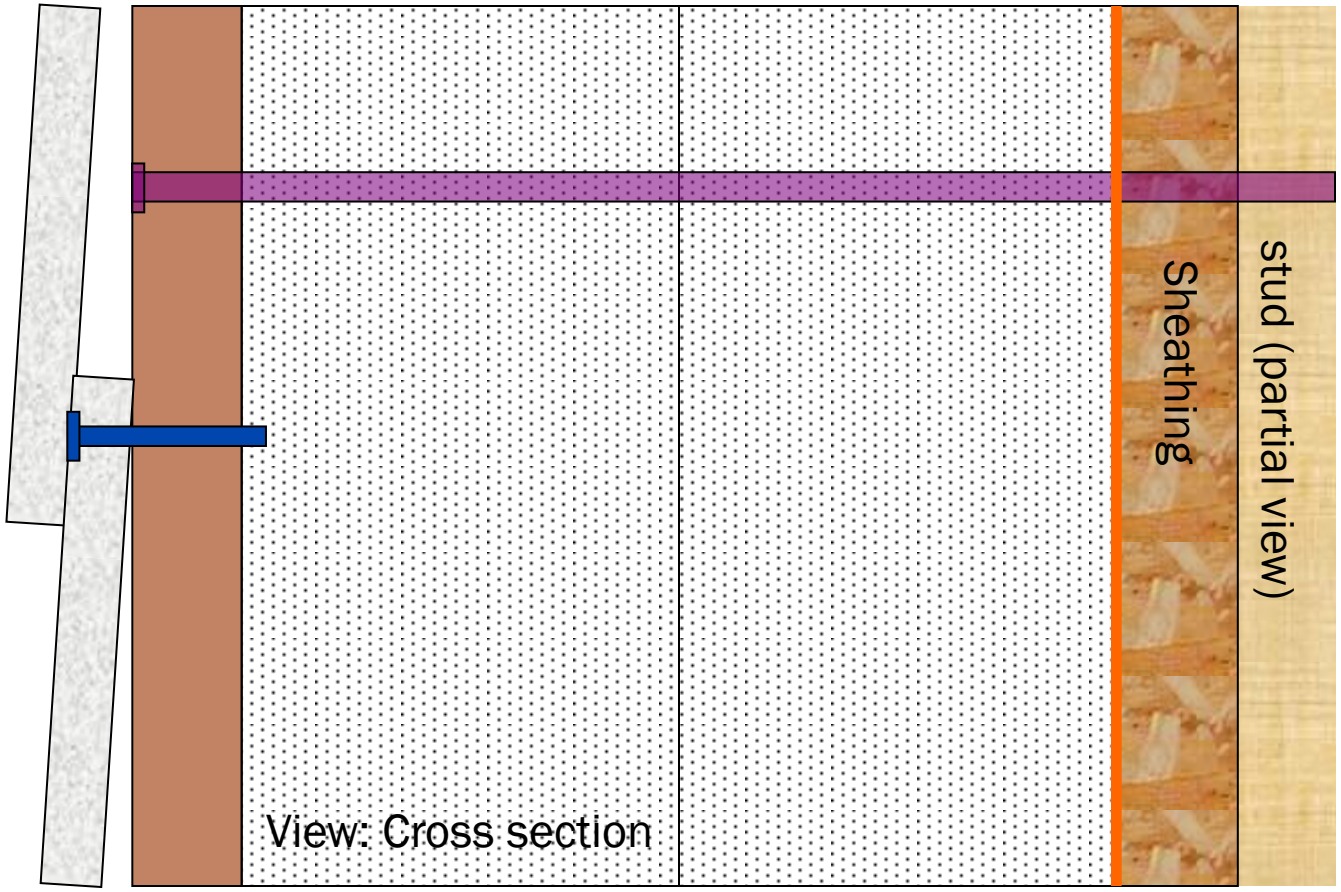
Outside rigid foam insulation



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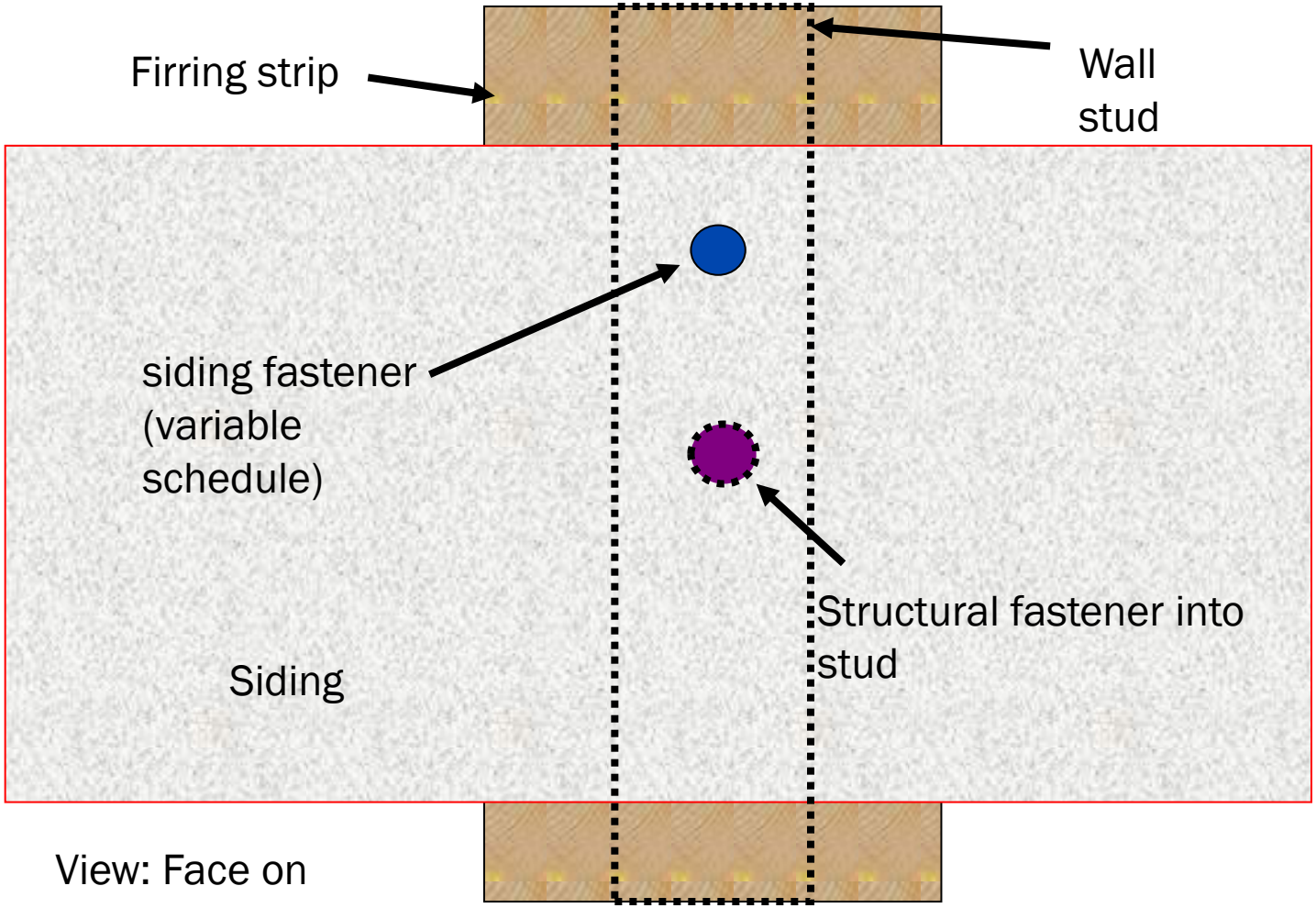
Outside rigid foam insulation



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Single 1-1/2” layer of unfaced foam

Southeast Alaska weatherization project – cost-effective and good performance in that climate

Before starting an OIT project

- Consult an experienced contractor or building professional
- Identify your efficiency goals and design accordingly
- Determine scope and budget
- Use “house as a system” thinking
- Include a ventilation system

Resources

- AHFC - Research Information Center
- Alaska Residential Building Manual
  www.ahfc.us
- Cold Climate Housing Research Center
  www.cchrc.org
- One stop shop for AK Energy Efficiency information
  www.akenergyefficiency.org