

Insulation Requirements per the 2009 International Energy Conservation Code & the 2009 Pa. Alternative Energy Code for Residential Buildings

As per the Pennsylvania Uniform Construction Code, we now fall under the guidelines of the 2009 codes. Some significant changes have been brought about, some are as follows:

- 1) R-13 is required in exterior walls.
- 2) R-10 for 24" is required for slabs.
- 3) R-38 is required in ceilings, but R-30 may be used in a roof/ceiling assembly (cathedral) when the design does not allow a higher "R" value.
- 4) "RES CHECK" may still be used to show lower values, taking into consideration the "fenestration and solar heat gain coefficients" of all windows, glazed doors and skylights.

Please refer to some of these areas on the attached pages, any other questions please contact the building inspector.

Thank You Building Department

SECTION PA300
BUILDING THERMAL ENVELOPE

PA301 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table PA301 based on the climate zone specified in PA201.

PA301.1 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

Table PA301
Insulation and Fenestration Requirements by Component ^a

Climate Zone	Fenestration U-factor	Skylights ^b U-factor	Ceiling R-value	Wood frame wall R-value	Mass Wall R-value ^h	Floor R-value	Basement ^c wall R-value	Slab ^d R-value and depth	Crawlspace ^e wall R-value
South	0.35	0.60	38	13	5/10	19	10/13	10, 2 ft	10/13
Central	0.35	0.60	38	20 ^o or 13 + 5 ^g	13/17	30 ^f	10/13	10, 2 ft	10/13
North	0.35	0.60	49	20 ^o or 13 + 5 ^g	15/19	30 ^f	15/19	10, 4 ft	10/13

- Notes:
- a. R-values are minimums. U-factors and solar heat gain coefficient (SHGC) are maximums. R-19 batts compressed in to nominal 2 x 6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
 - b. The fenestration U-factor column excludes skylights.
 - c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
 - d. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less, in zones 1 through 3 for heated slabs.
 - e. Low density spray applied foam and cellulose insulation in a 2x6 wall cavity shall be considered in compliance with this requirement.
 - f. Or insulation sufficient to fill the framing cavity, R-19 minimum. Floor insulation may also be reduced to R-19 if installed above an unconditioned basement.
 - g. "13 + 5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
 - h. The second R-value applies when more than half the insulation is on the interior.

PA302 Specific insulation requirements.

PA302.1 Ceilings with attic spaces. When Section PA301 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.

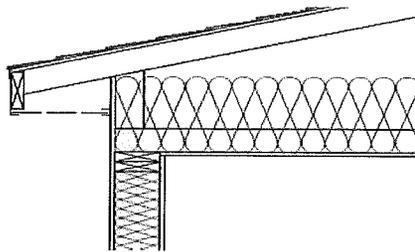


Figure PA 302.1
Ceiling Insulation With Full-Height
Uncompressed Insulation Above The Top Plate

PA113 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required *labels*. The certificate shall be completed by the builder or registered *design professional*. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor) and ducts outside *conditioned spaces*; *U*-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area.

The certificate shall list the types and efficiencies of heating, cooling and service water heating *equipment*. Where a gas-fired unvented room heater, electric furnace and/or baseboard electric heater is installed in the residence, the certificate shall list “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces or electric base board heaters.

SECTION PA200
CLIMATE ZONES

PA201 General. Climate zones listed in PA201.1 shall be used.

PA201.1 Climate Zones

South: Bucks, Chester, Delaware, Montgomery, Philadelphia, York

Central: All other counties

North: Cameron, Clearfield, Elk, McKean, Potter, Susquehanna, Tioga, Wayne

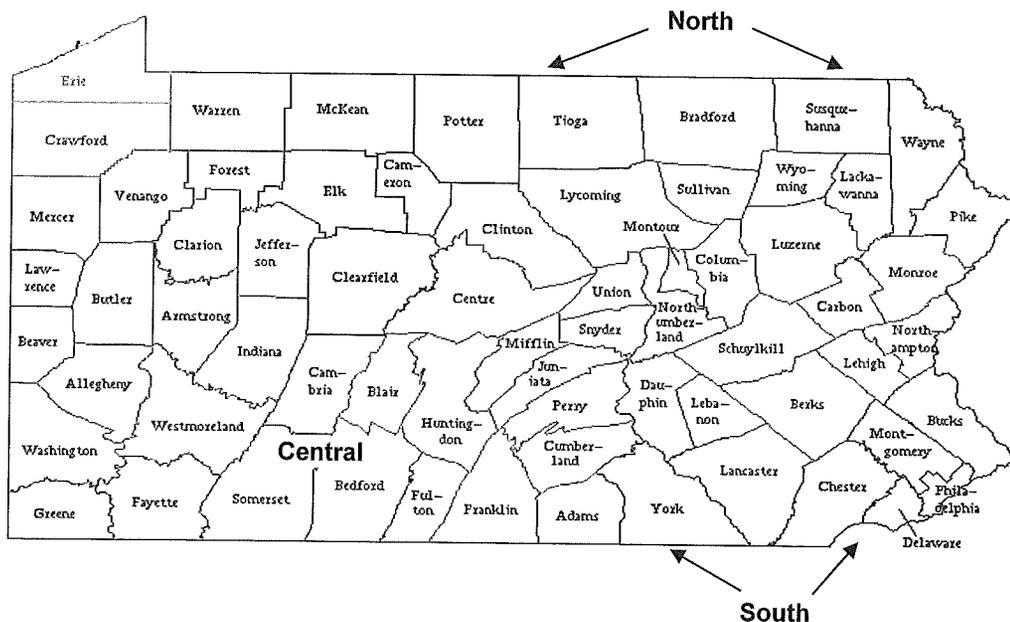


Figure PA201.1
Pennsylvania Climate Zones

PA302.4 Walls between conditioned and unconditioned spaces. Walls between conditioned and unconditioned spaces may be insulated to R-13. This includes walls between conditioned space and garages, and walls and ceilings of stairwells leading to unconditioned basements.

PA302.5 Mass walls. Mass walls, for the purposes of this chapter, shall be considered above-grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.

PA302.6 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

PA302.7 Basement walls. *Exterior walls* associated with conditioned basements shall be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below *grade* or to the *basement* floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections PA301.

PA302.8 Slab-on-grade floors. Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table PA301. The insulation can be installed on either the exterior or interior of the foundation wall.

Exterior Insulation: Exterior insulation shall be installed from the top of the slab and extend below grade the distance listed in Table PA301 by any combination of vertical insulation or horizontal insulation extending away from the building. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. Insulation shall also meet PA 111.1.

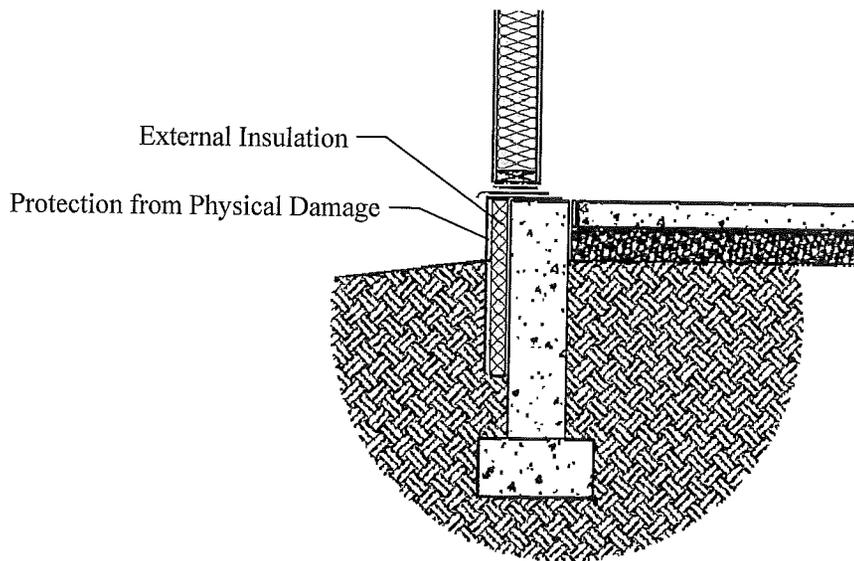


Figure PA 302.8 (1)
Exterior Slab Insulation

Interior Insulation: Interior insulation shall be installed from the bottom of the slab and extend the distance provided in Table PA301 by any combination of vertical insulation or horizontal insulation extending under the slab. The slab edge shall be separated from the foundation wall by a continuous ½ inch thermal break as per Figure PA302.8.(2) A thermal break shall be created by a material suitable for ground contact, which includes, but is not limited to, asphalt impregnated fiber board or extruded polystyrene. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.

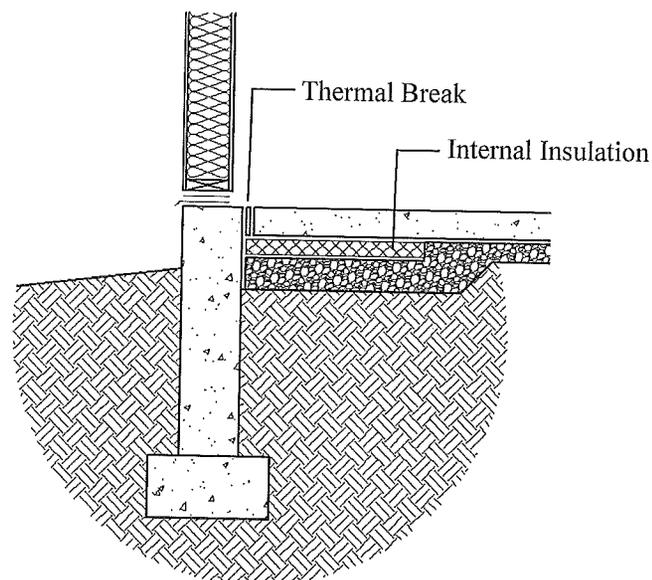


Figure PA 302.8 (2)
Interior Slab Insulation

PA302.9 Crawl space walls. As an alternative to insulating floors over crawl spaces, insulation of crawl space walls shall be permitted when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished *grade* level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All joints of the vapor retarder shall overlap by 6 inches (152 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached to the stem wall.

PA302.10 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

PA302.11 Thermally isolated sunroom insulation. The minimum ceiling insulation *R*-values shall be *R*-24. The minimum wall *R*-value shall be *R*-13. New wall(s) separating the sunroom from *conditioned space* shall meet the *building thermal envelope* requirements.

PA303 Fenestration.

PA303.1 *U*-factor. An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

General guidelines for foundations

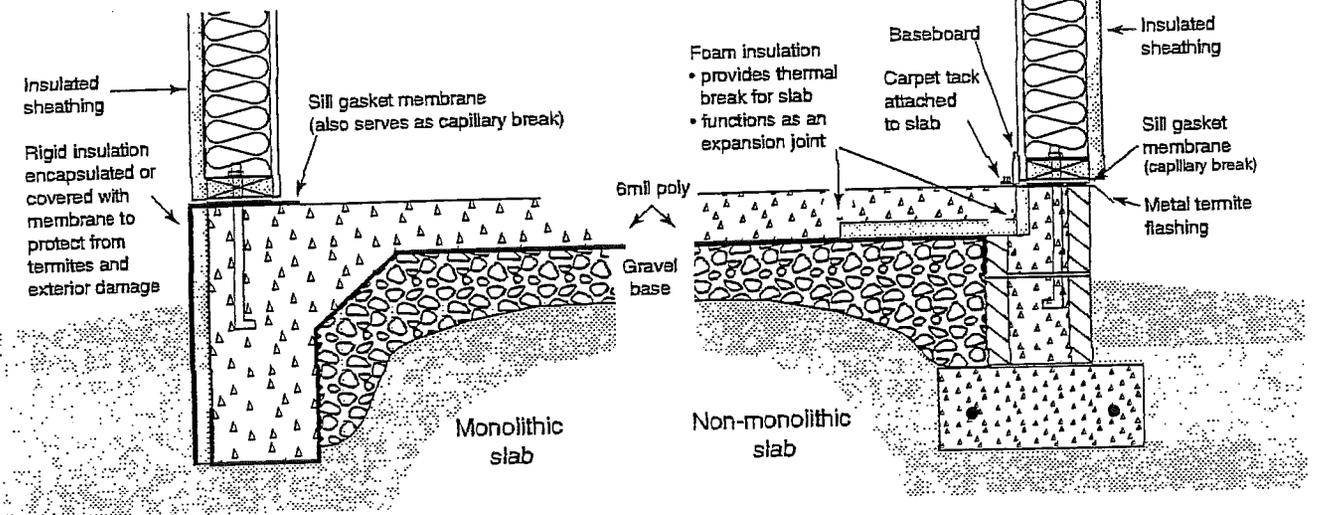
The bottom level of a home, whether slab-on-grade, floor over a crawl space, or underground basement, is susceptible to moisture and deterioration problems due to contact with the earth. The best approaches for preventing these problems will depend on the local climate and style of construction, but the same general rules apply to all foundation systems:

- ❑ Keep all untreated wood materials away from the earth.
- ❑ Provide rain drainage, such as gutters, to conduct rain water away from the house in non-arid climates.
- ❑ Slope the earth away from the house for at least five feet at a minimum 5% grade (3 inches in 5 feet).
- ❑ Provide a water managed foundation drainage system at the bottom of the footing when the foundation floor (interior grade) is below the exterior grade.
- ❑ Insulate between the conditioned and unconditioned portions of the foundation system. In termite-prone areas, extra care should be taken to prevent termites from tunneling through the insulation.

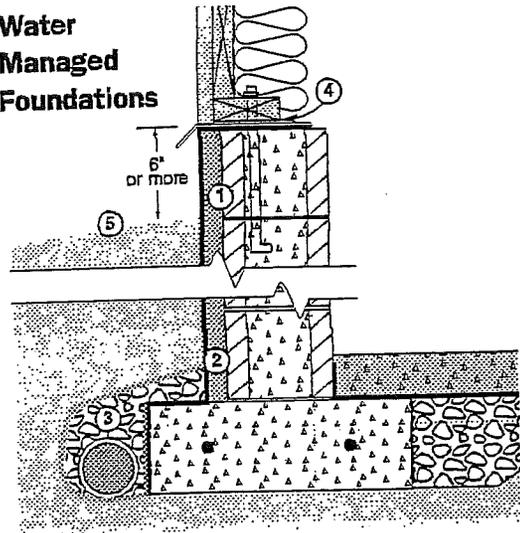
Methods of insulating slab-on-grade floors

Slabs lose energy primarily due to heat conducted outward and through the perimeter of the slab. Insulating the exterior edge of the slab in most sections of the country can reduce winter heating bills by 10% to 20%. Slab insulation is recommended in many localities by the Model Energy Code or state energy codes.

Insulation approaches to termite-resistant, slab-on-grade foundations



Water Managed Foundations



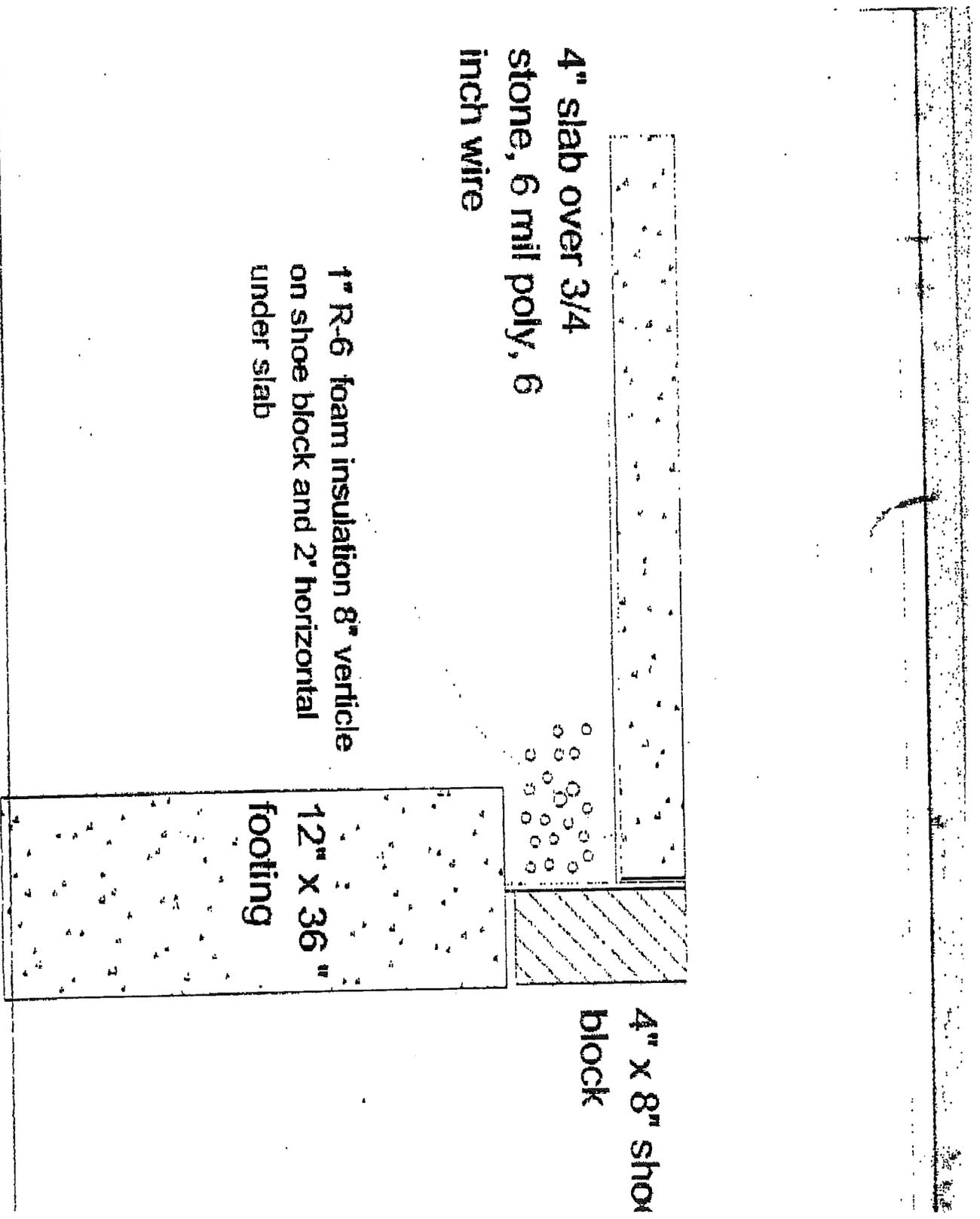
1. Damp-proof below-grade portion of foundation wall - this is to seal the wall against ground moisture penetration.
2. Install drainage plane material or gravel against foundation wall - this relieves hydrostatic pressure and channels water to the drain.
3. Cover perforated drain pipe with gravel and cover with filter fabric. Locate drain beside footing, not on top - this creates an underground gutter.
4. Add sill gasket membrane - this serves as a capillary break to reduce wicking of water from the concrete and provides air sealing.
5. When backfilling foundation wall, slope earth away from house 5%.

4" slab over 3/4
stone, 6 mil poly, 6
inch wire

1" R-6 foam insulation 8" verticle
on shoe block and 2' horizontal
under slab

4" x 8" shoe
block

12" x 36 "
footing



Wood and Insulation Sizes

Nominal Size	Actual Size	**	R-Value "Fanfold"	Actual Thickness
2x3	1 ½ x 2 ½		(R-1.5)	3/8"
			R-13	3 ½"
2x4	1 ½ x 3 ½		R-15	3 ½"
			R-19	6 ¾"
2x6	1 ½ x 5 ½		R-25	8"
2x8	1 ½ x 7 ¼		R-30	9 ¾"
2x10	1 ½ x 9 ¼		R-38	13 ½"
2x12	1 ½ x 11 1/8		R-21C	5 ½"
			R-30C	8 ¼"
			R-38C	10"

The following are just a few of the available materials which may be used, there are many manufactured named products which may be used meeting ASTM standards:

Owens Corning Foamboard (Polystyrene Insulation)

1/2	R-3
3/4	R-4
1"	R-5
1 ½	R-7.5
2"	R-10
3"	R-15
4"	R-20

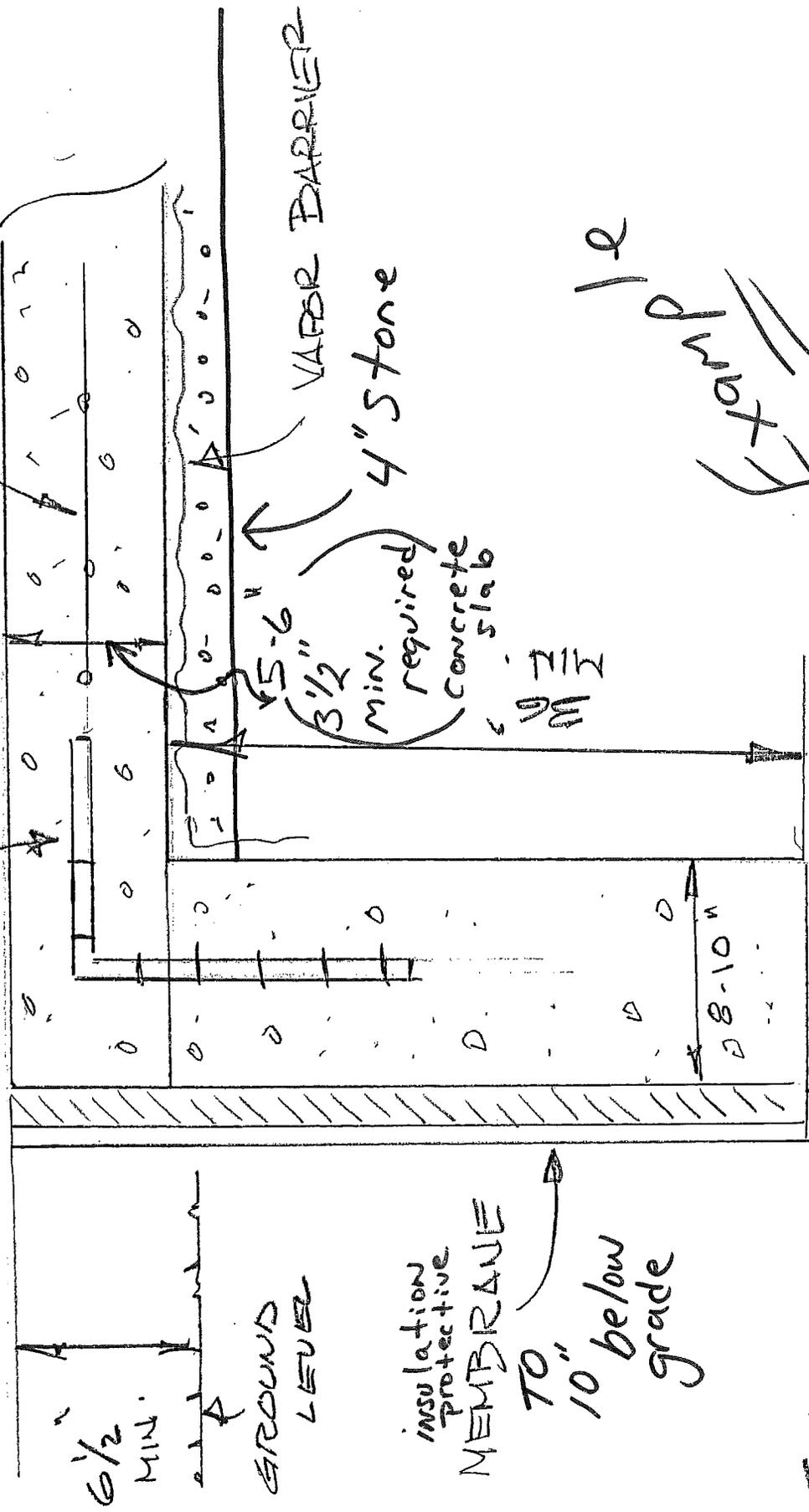
Dow Insulating Sheathing (Structural Foamboard)

1/2	R-3.3
5/8	R-4.1
3/4	R-5.0
1"	R-6.5
1 3/8	R-9.1
1 ½	R-10
1 7/8	R-12

(An additional R-2.8 can be obtained when used with an air space)

REINFORCING WIRE
optional

DEBAG



6 1/2 MIN.

GROUND LEVEL

insulation protective MEMBRANE TO 10" below grade

VAPOR BARRIER
4" Stone

5-6" (3 1/2" MIN. required) concrete slab

Stamp

SLAB

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INSULATION

24" Vertical poured foundation from TOP w/ capped slab

Falls under mono-slab requirement

FAELCE