

Betsy Pettit, FAIA

## A18 Deep Energy Retrofits for Existing Single Family Homes Details

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Residential Design and Construction 2010

14 April 2010



# Deep Energy Retrofit Details

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- There are approximately 60 million units of housing in the U.S. that were built prior to 1960.
- Most of these will need major systems replaced in the near future.
- As siding, windows, and roof claddings need to be replaced, opportunities arise to reduce the overall energy use of these homes.
- Insulating sheathings and new better performing windows will increase comfort while reducing energy use.
- Once enclosure losses are reduced, old boilers, furnaces, and air conditioners can be replaced and downsized with more efficient equipment.
- Whole house ventilation equipment completes the upgrades, insuring good indoor air quality.
- Details and results from several case studies of cold climate deep energy retrofits will be presented.

# Deep Energy Retrofit Details

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- **Objective**
  - To explore the enclosure and mechanical system replacement design successes, failures, and specific needs for future Deep Energy Retrofits
- **Goal**
  - To provide details for a guidance document that can be used by homeowners, builders, architects, and building owners to improve the energy performance of their building
- **Key Issues to Address**
  - Roofs, walls, foundations, windows and mechanical systems
  - Exterior to interior insulation transitions
  - Roof to wall transitions
  - Porches and decks
  - Performance metrics and outcome accountability
  - Phased retrofit strategies
  - Air barriers on board sheathed walls and roofs
  - Masonry bearing walls

# Deep Energy Retrofit Details

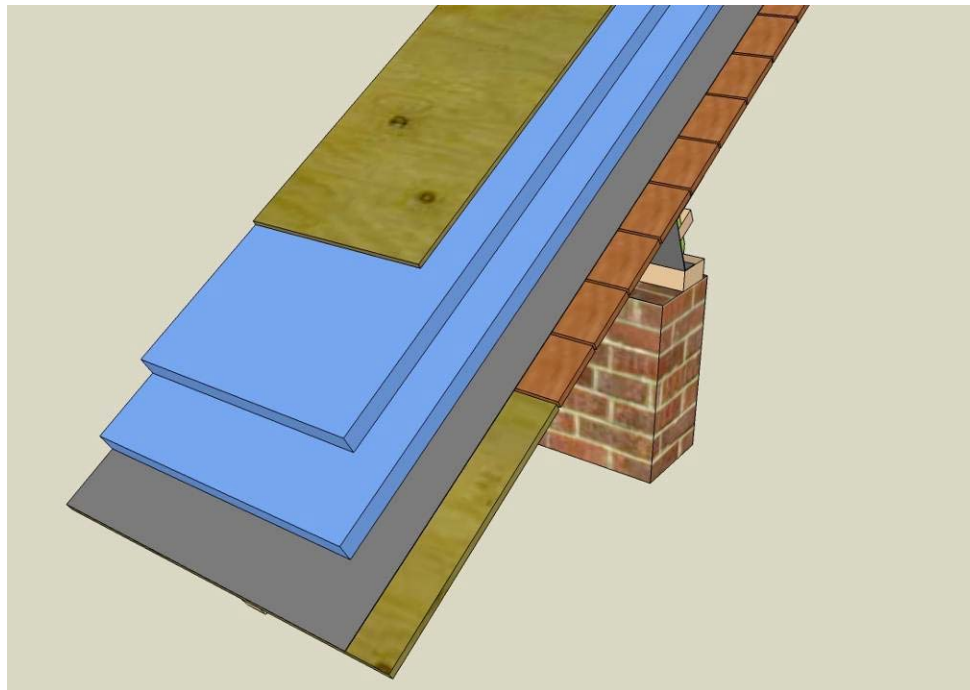
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- Retrofit Building Components
  - Roof
  - Roof to Wall
  - Wall
  - Wall to Foundation
  - Foundation
  - Windows
  - Doors

# Deep Energy Retrofit Details

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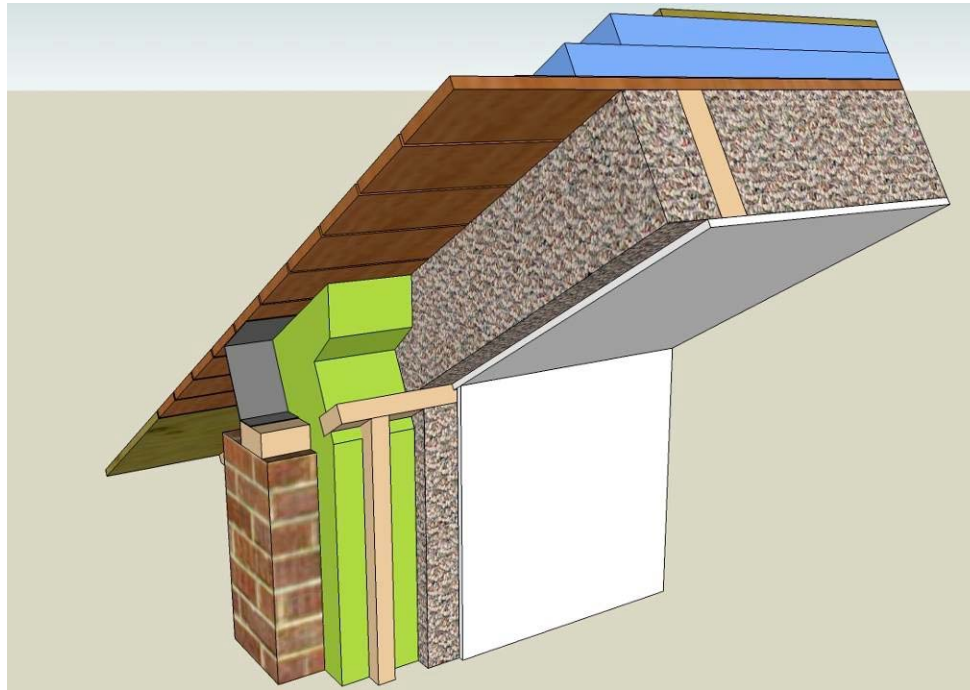
- Roof
  - Insulating sheathing above existing roof board sheathing



# Deep Energy Retrofit Details

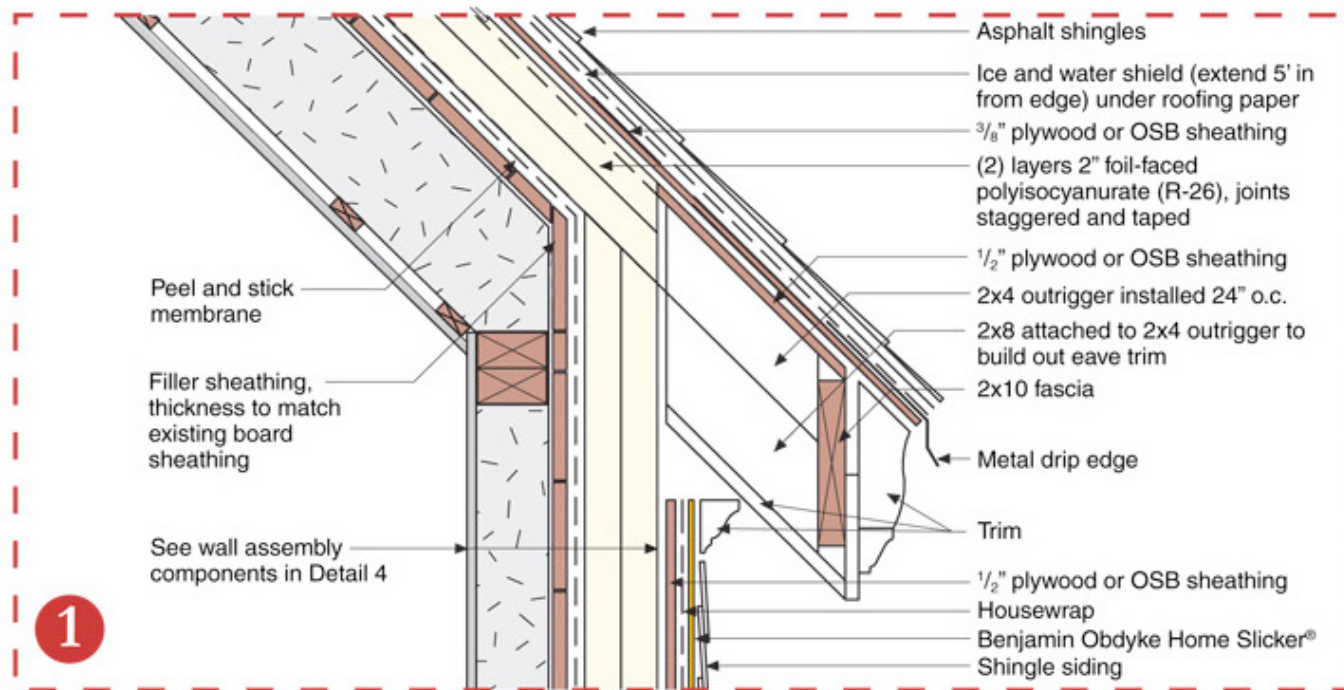
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- Roof
  - Insulating sheathing above existing roof board sheathing and spray foam and cellulose in rafter bay



# Deep Energy Retrofit Details

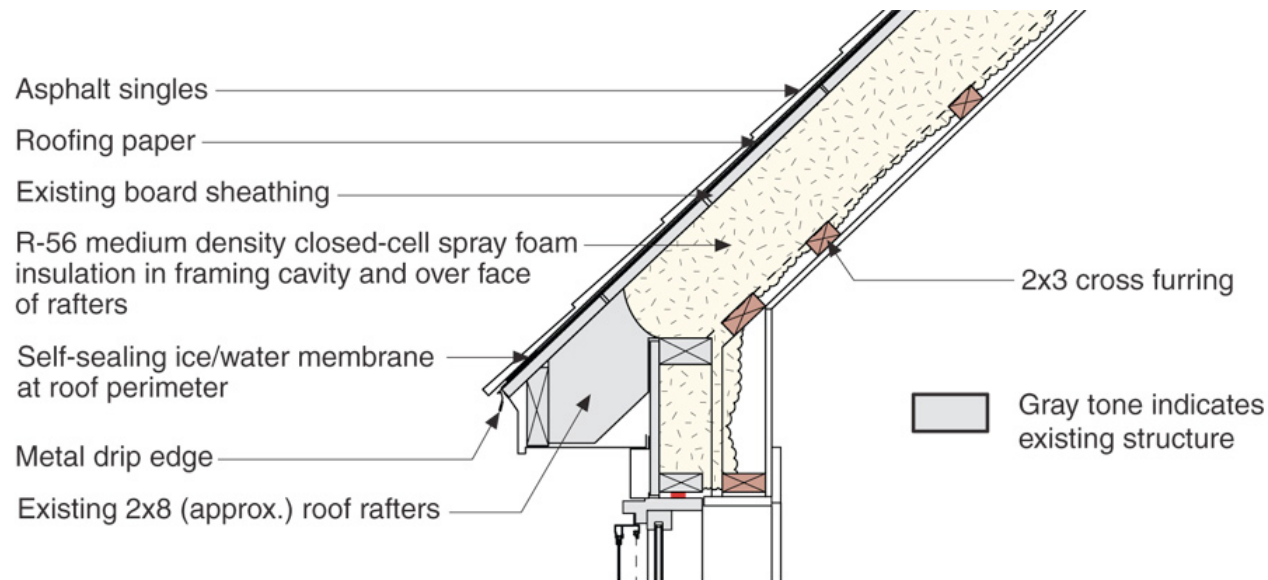
- Roof
  - Insulating sheathing above existing roof board sheathing and cellulose in rafter bay





# Deep Energy Retrofit Details

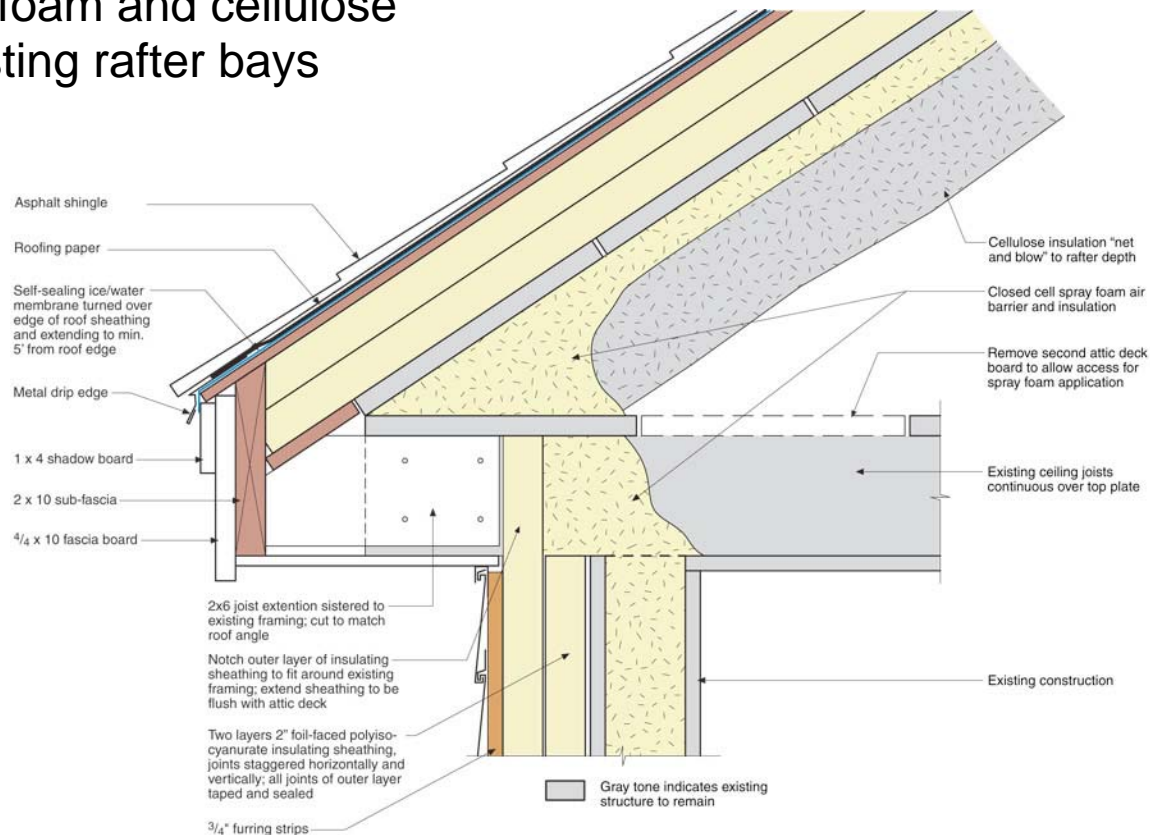
- Roof
  - Spray foam in existing rafter bays





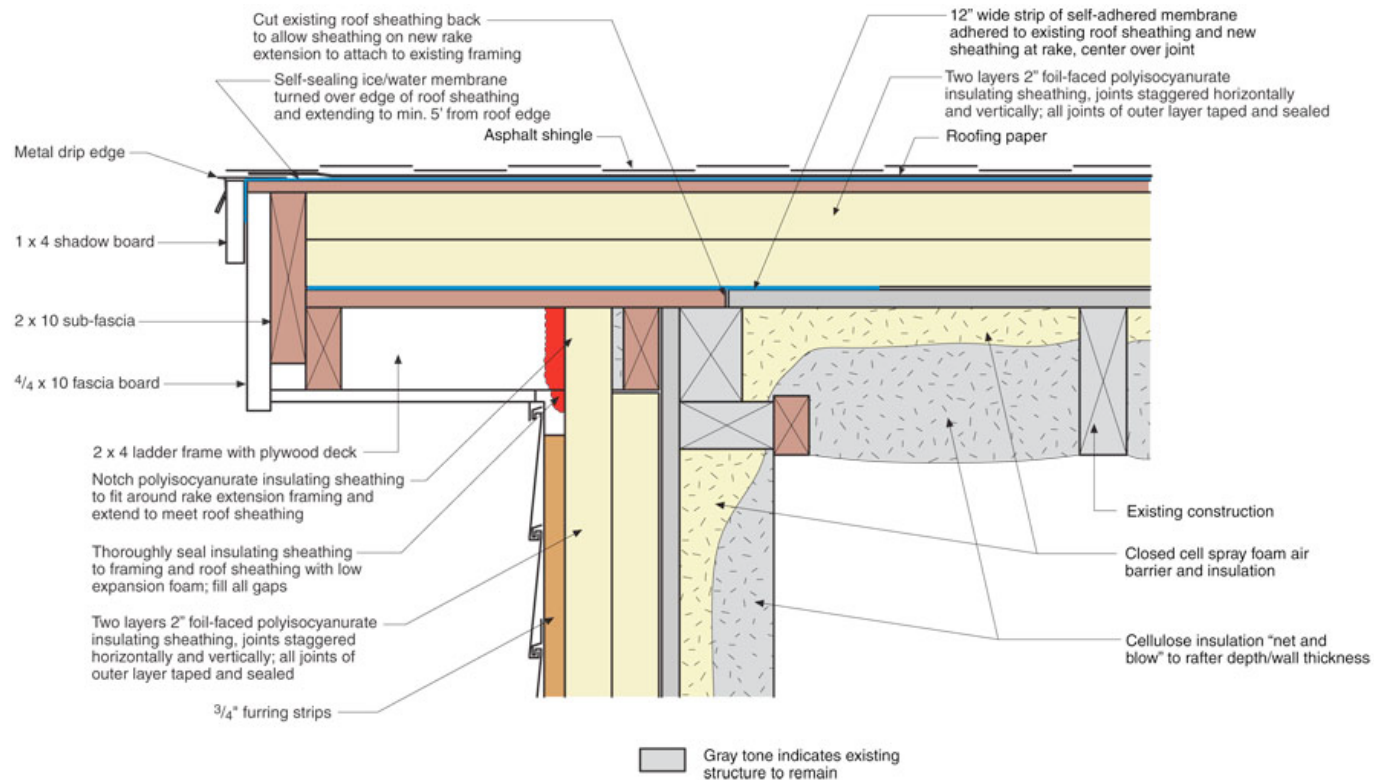
# Deep Energy Retrofit Details

- Roof
  - Insulating sheathing above existing roof board sheathing and spray foam and cellulose in existing rafter bays



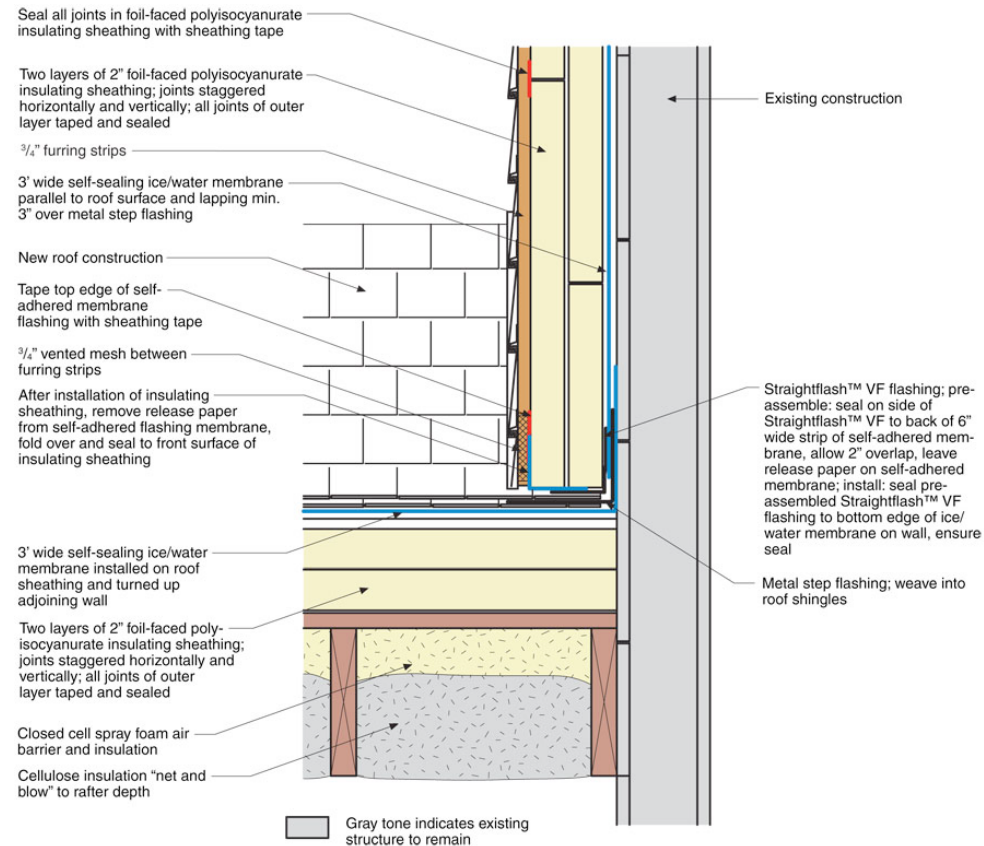
# Deep Energy Retrofit Details

- Roof
  - Insulating sheathing above existing roof board sheathing and spray foam and cellulose in existing rafter bays



# Deep Energy Retrofit Details

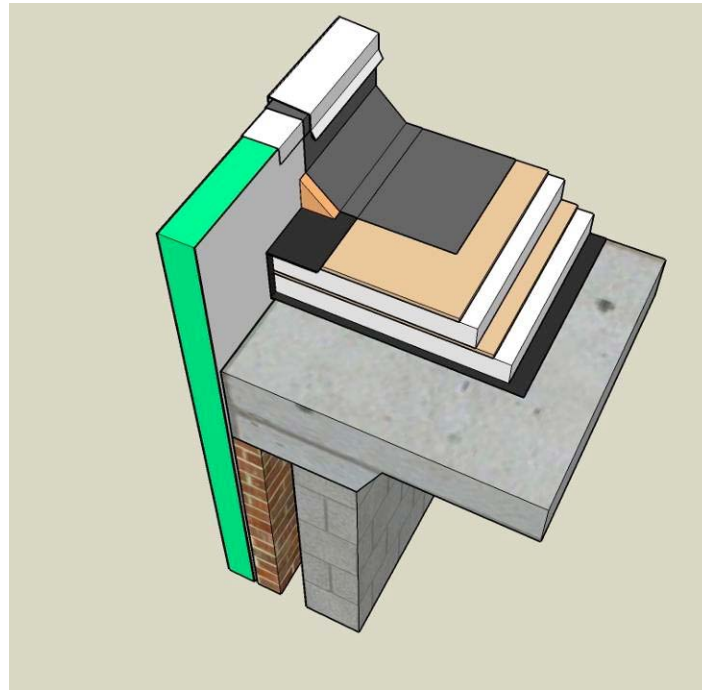
- Roof
  - Roof to wall transition – 4” insulating sheathing



# Deep Energy Retrofit Details

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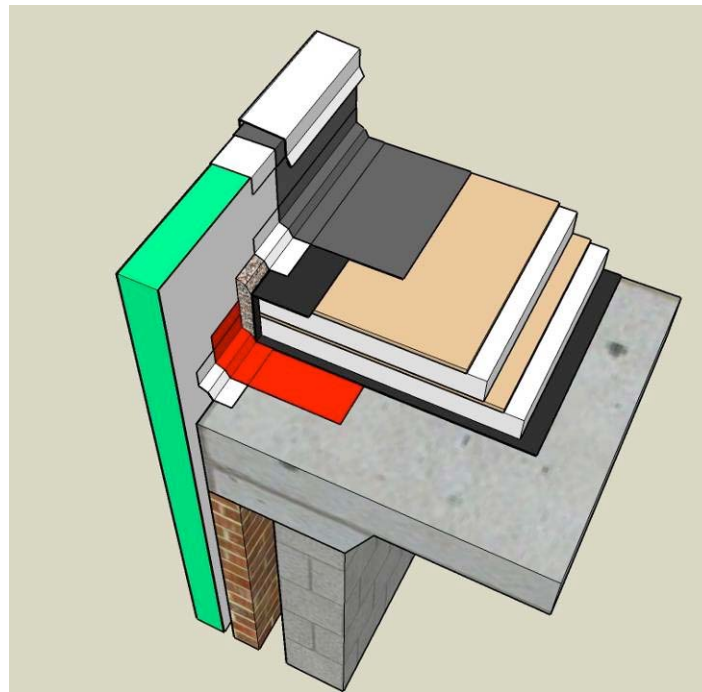
- Roof
  - Metal panel parapet



# Deep Energy Retrofit Details

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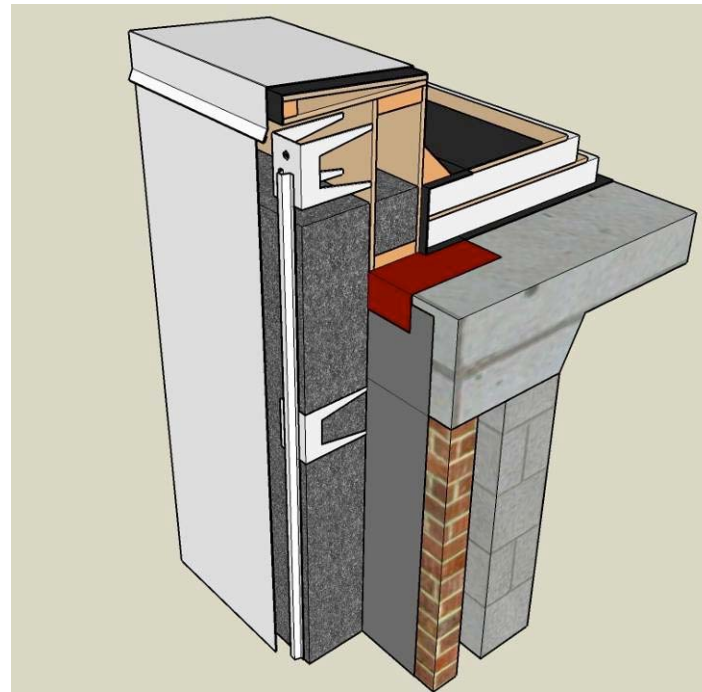
- Roof
  - Metal panel parapet



# Deep Energy Retrofit Details

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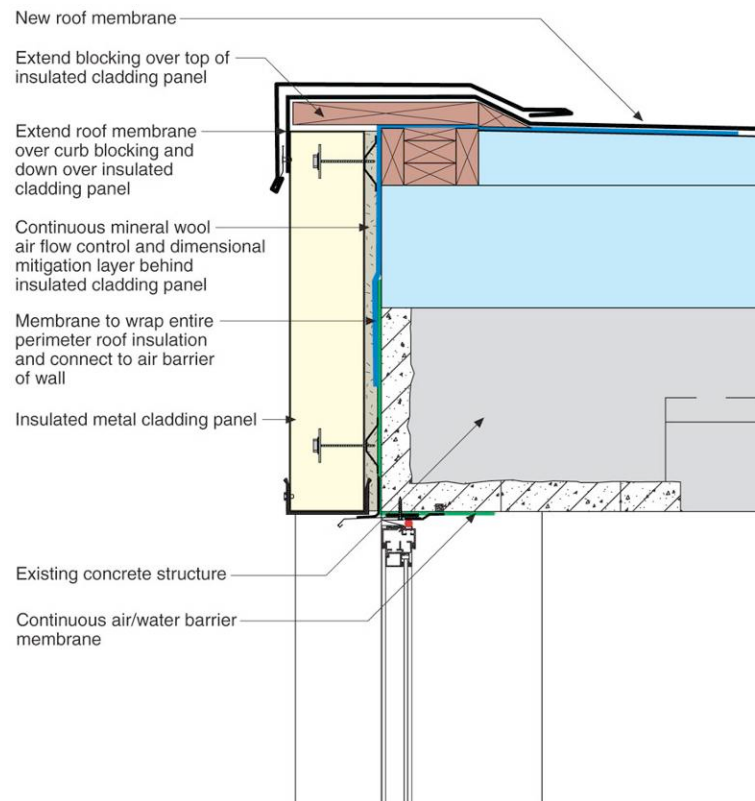
- Roof
  - Metal panel and framed parapet





# Deep Energy Retrofit Details

- Roof
  - Roof to wall transition – insulated metal panel

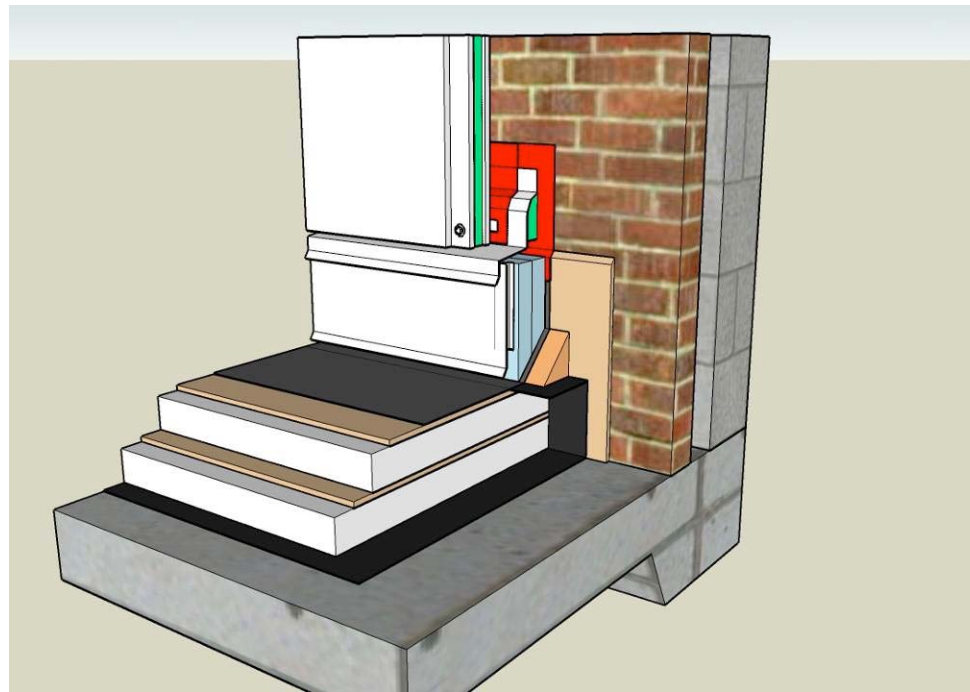




# Deep Energy Retrofit Details

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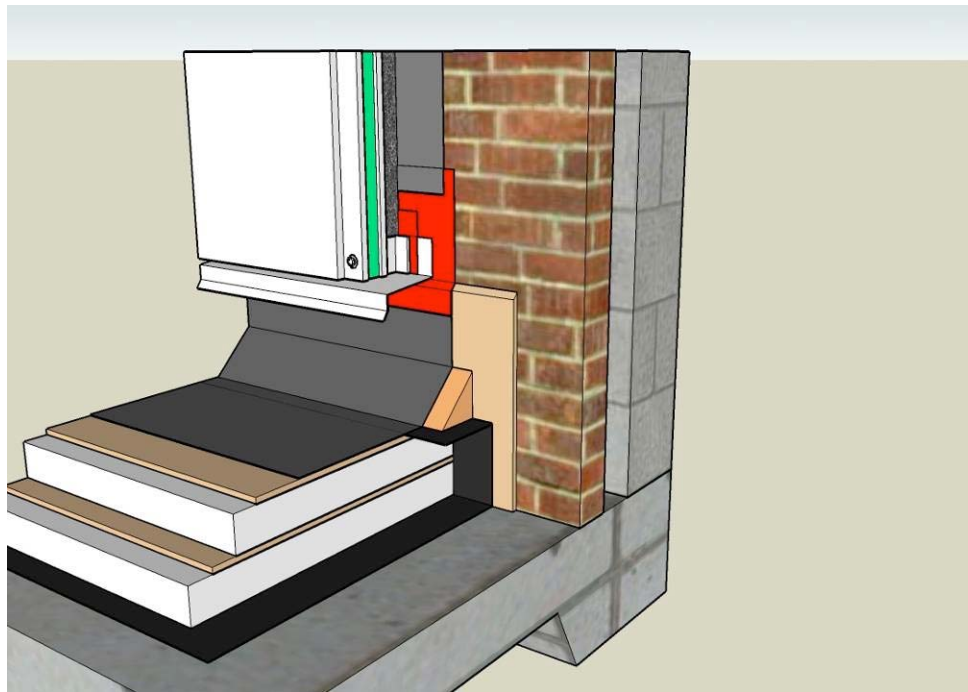
- Roof
  - Roof to wall transition – insulated metal panel



# Deep Energy Retrofit Details

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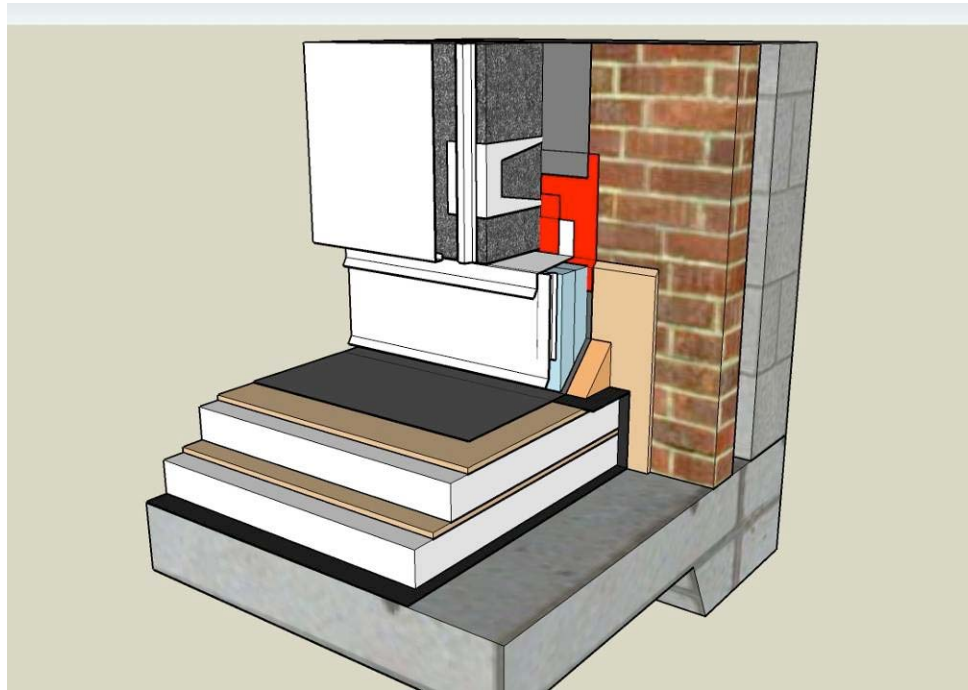
- Roof
  - Roof to wall transition – insulated metal panel



# Deep Energy Retrofit Details

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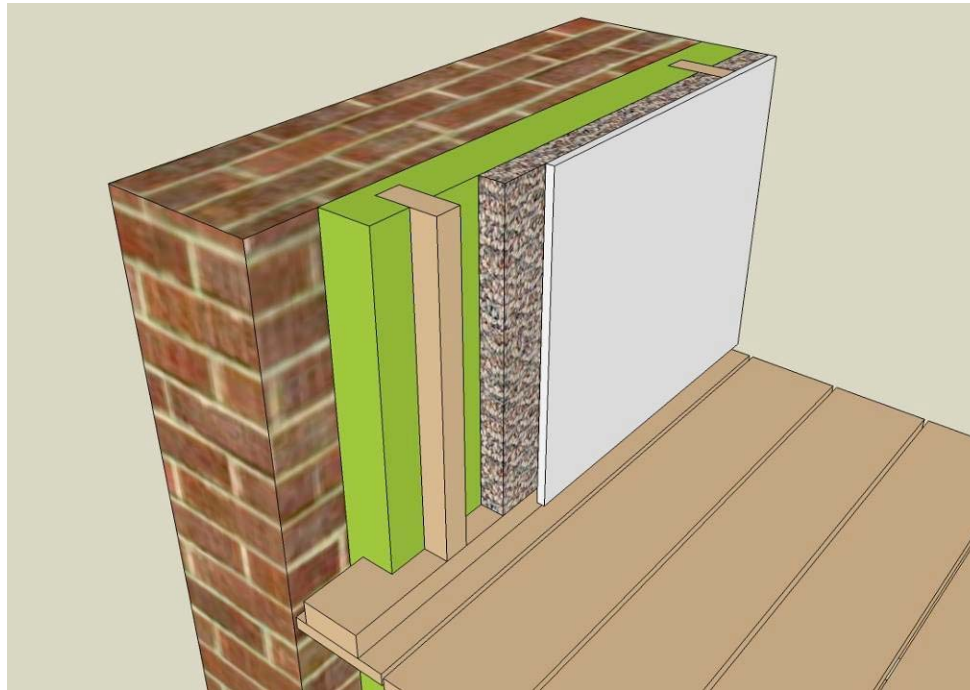
- Roof
  - Roof to wall transition – insulated metal panel



# Deep Energy Retrofit Details

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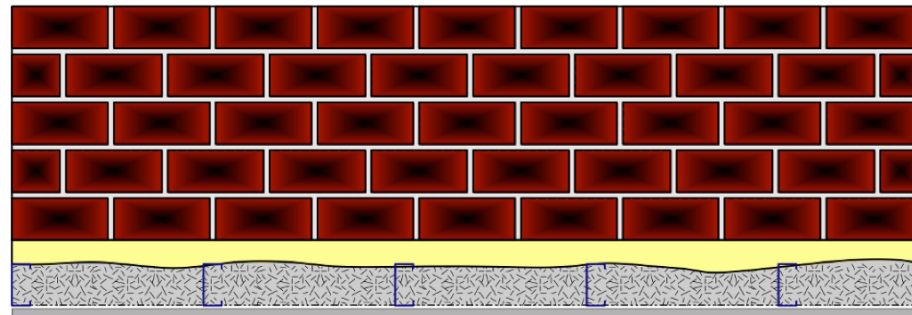
- Wall
  - Spray foam and cellulose to interior of brick wall



# Deep Energy Retrofit Details

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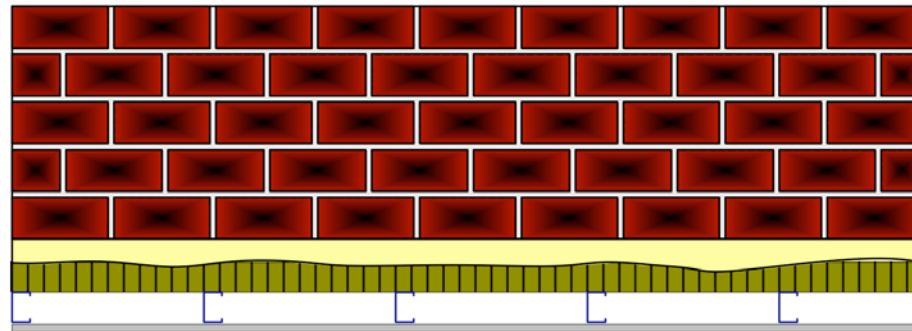
- Wall
  - Spray foam and cellulose to interior of brick wall



# Deep Energy Retrofit Details

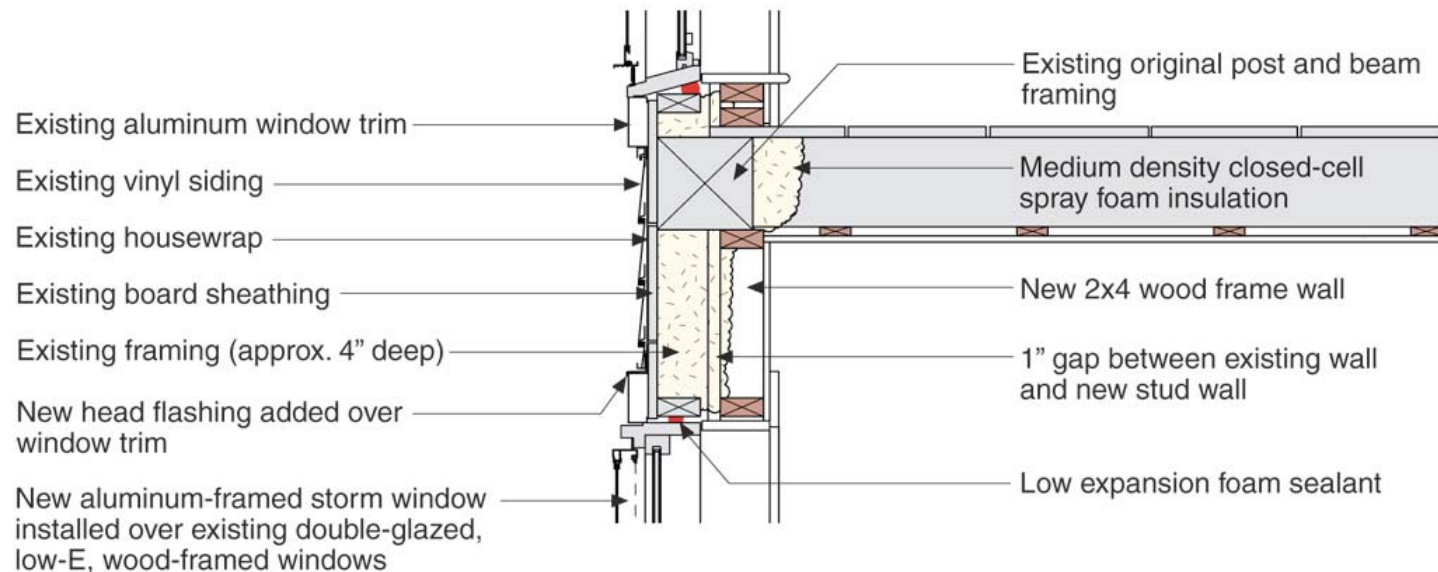
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- Wall
  - Spray foam and mineral wool to interior of brick wall



# Deep Energy Retrofit Details

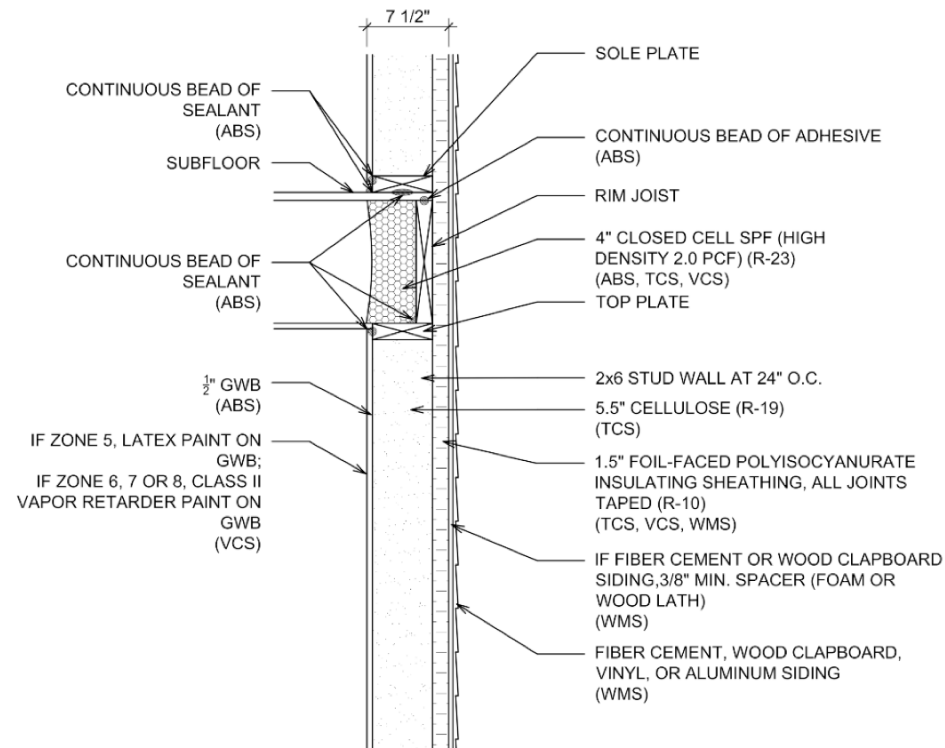
- Wall
  - Spray foam in existing stud bays





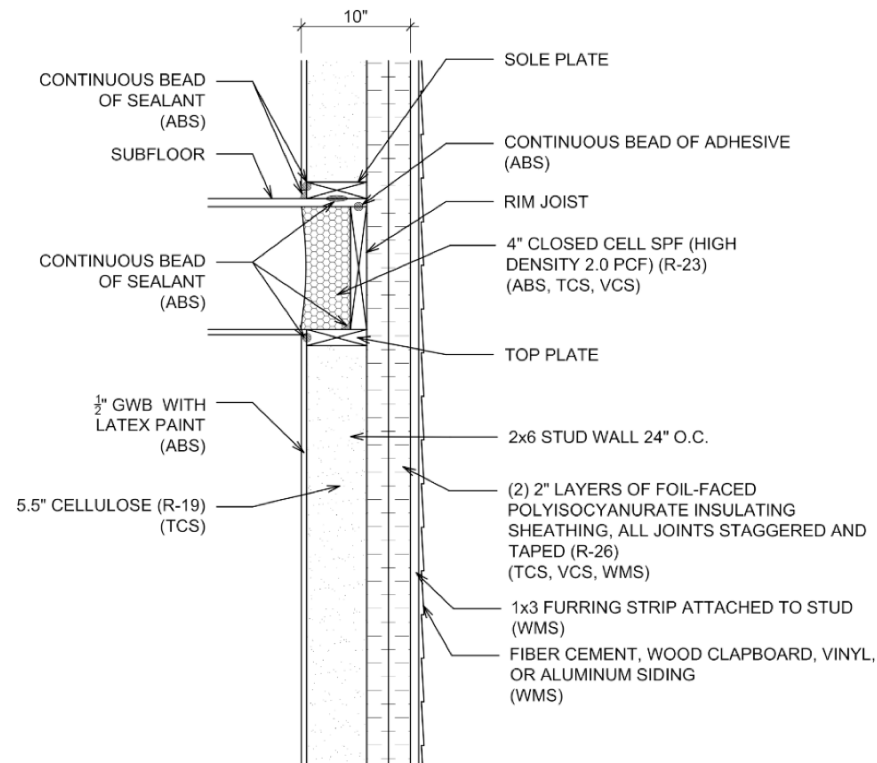
# Deep Energy Retrofit Details

- Wall
  - 1.5" insulating sheathing  
(Note: Wall drawn as new construction but can apply to retrofits)



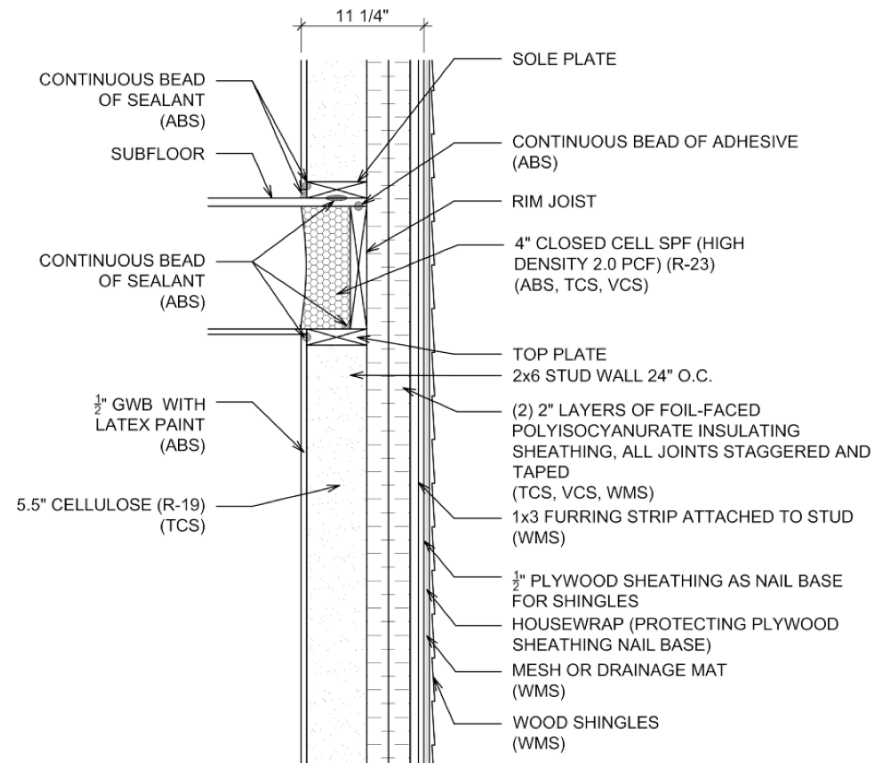
# Deep Energy Retrofit Details

- Wall
  - 4" insulating sheathing  
(Note: Wall drawn as new construction but can apply to retrofits)



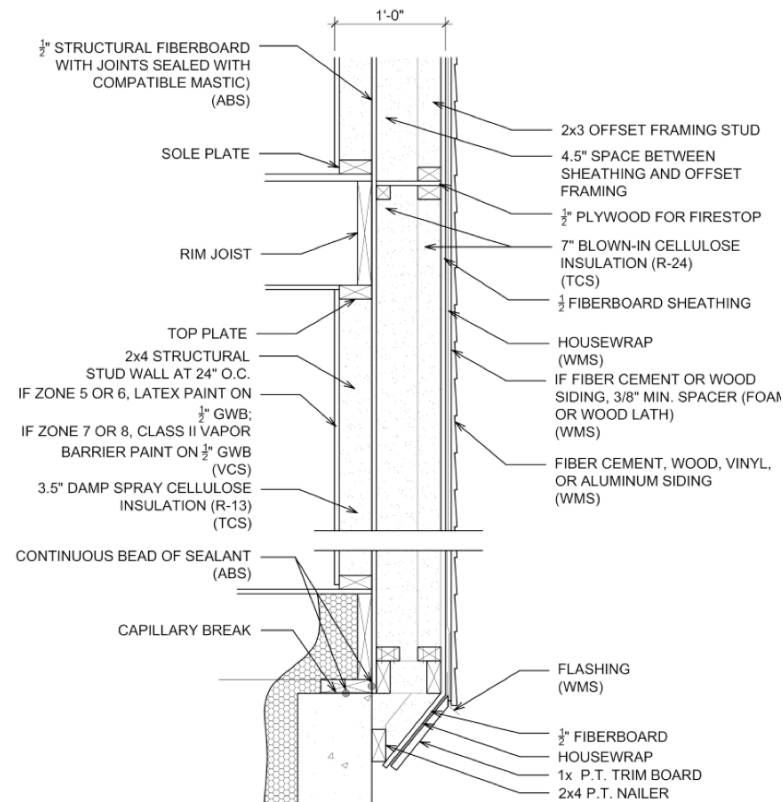
# Deep Energy Retrofit Details

- Wall
  - 4" insulating sheathing with shingles  
(Note: Wall drawn as new construction but can apply to retrofits)



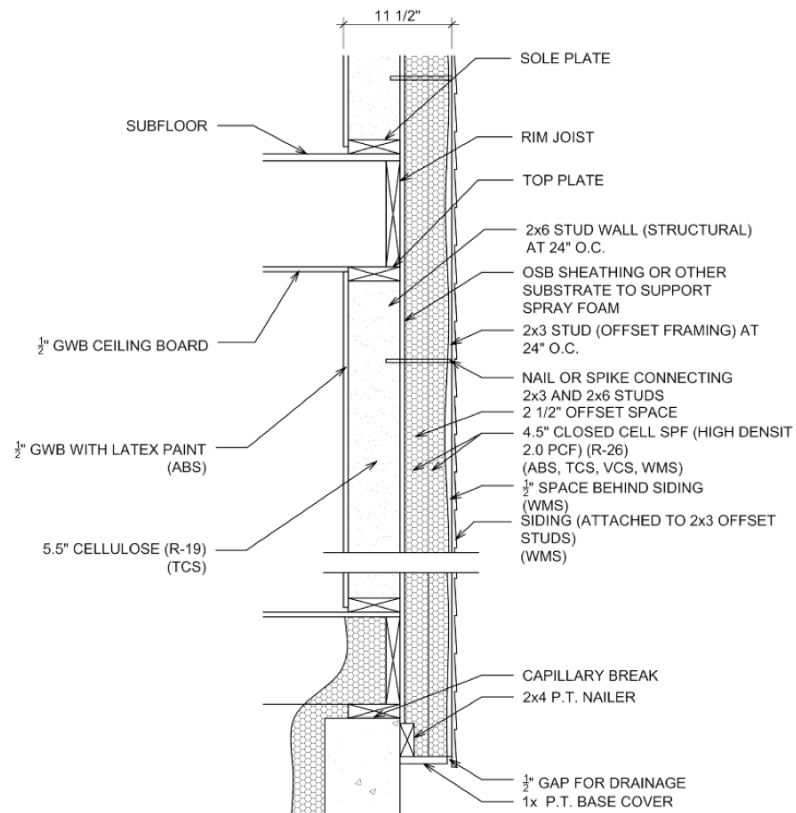
# Deep Energy Retrofit Details

- Wall
  - Double stud with interior load-bearing wall  
(Note: Wall drawn as new construction but can apply to retrofits)



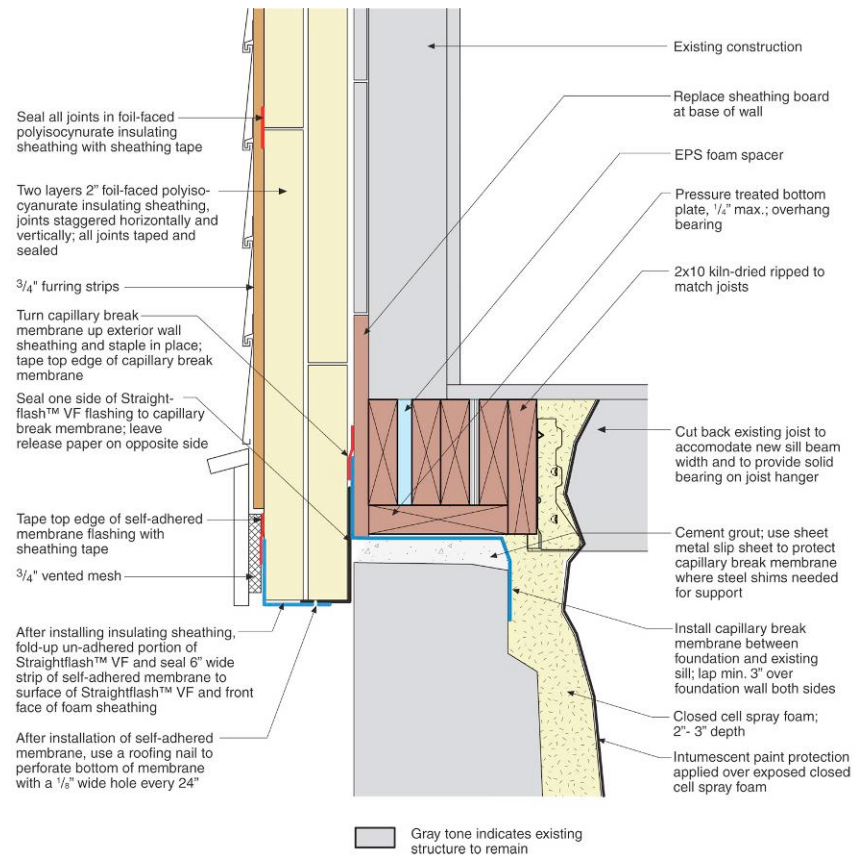
# Deep Energy Retrofit Details

- Wall
  - Offset framed wall  
(Note: Wall drawn as new construction but can apply to retrofits)



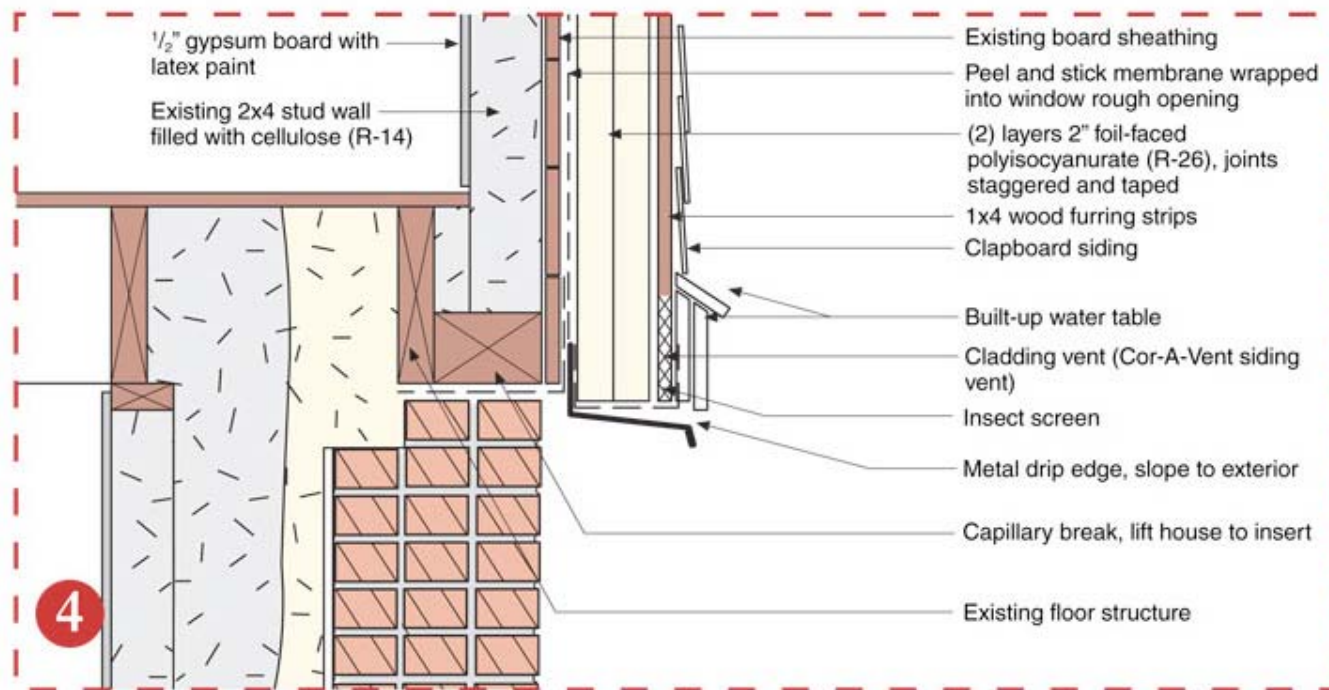
# Deep Energy Retrofit Details

- Foundation
  - Wall to foundation transition – 4” insulating sheathing



# Deep Energy Retrofit Details

- Foundation
  - Wall to foundation transition – 4” insulating sheathing

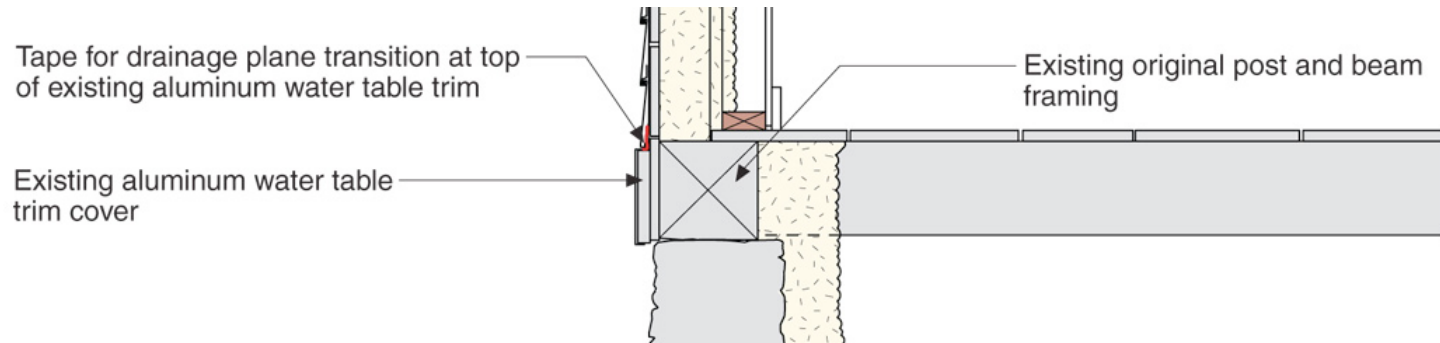




# Deep Energy Retrofit Details

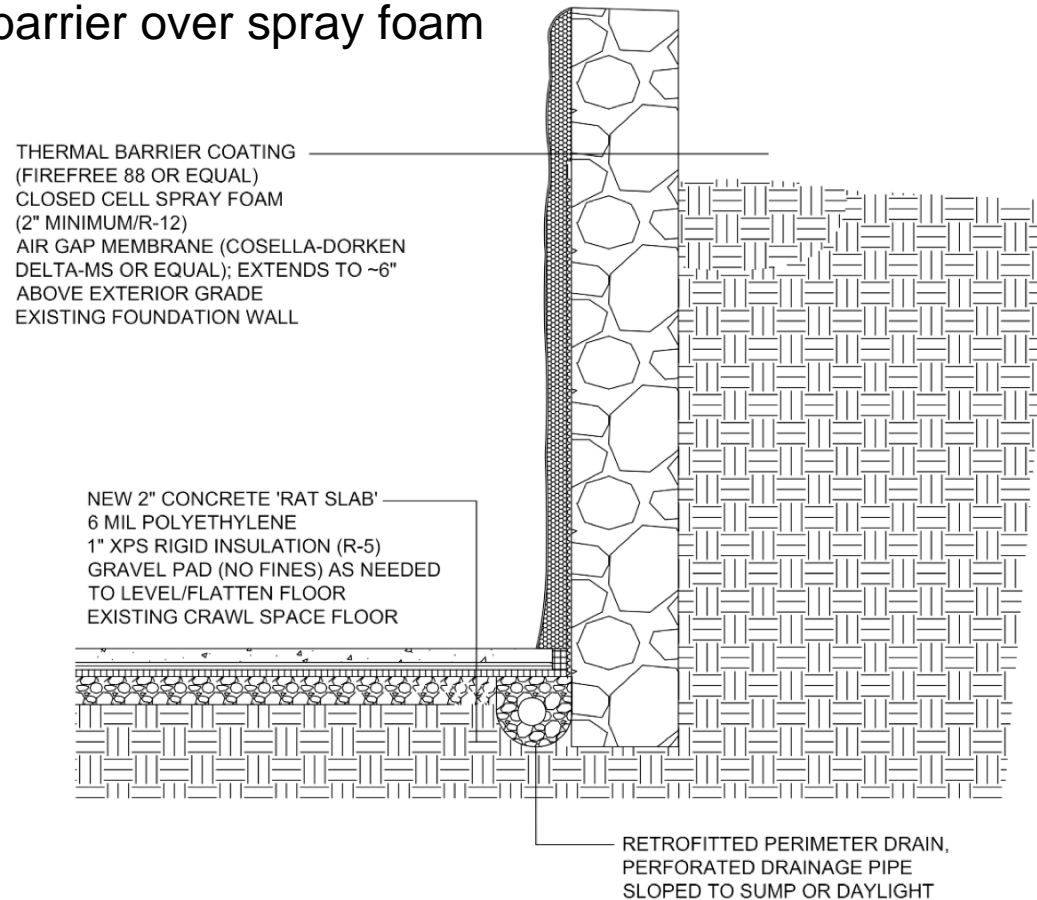
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- Foundation
  - Wall to foundation transition – spray foam



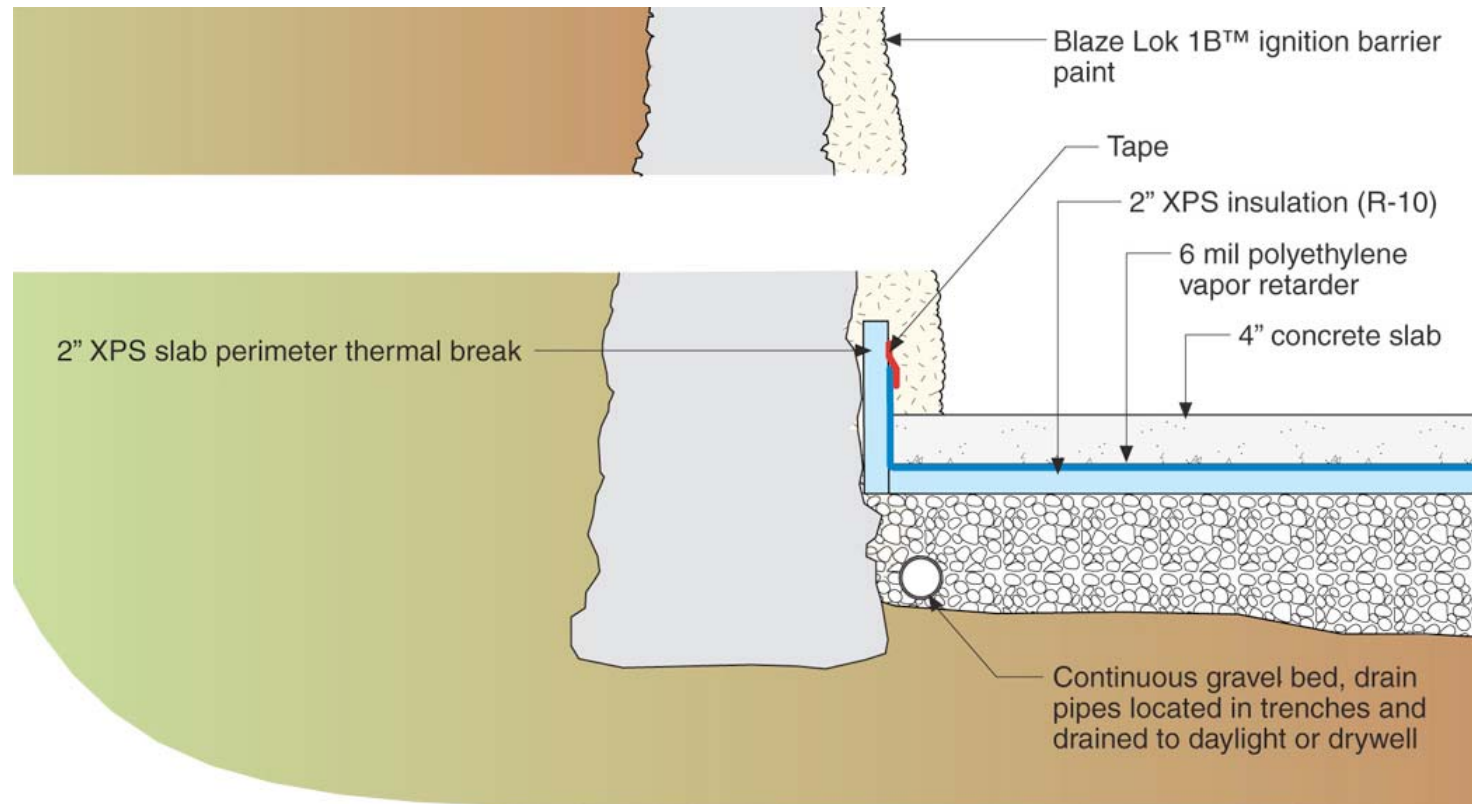
# Deep Energy Retrofit Details

- Foundation
  - Thermal barrier over spray foam



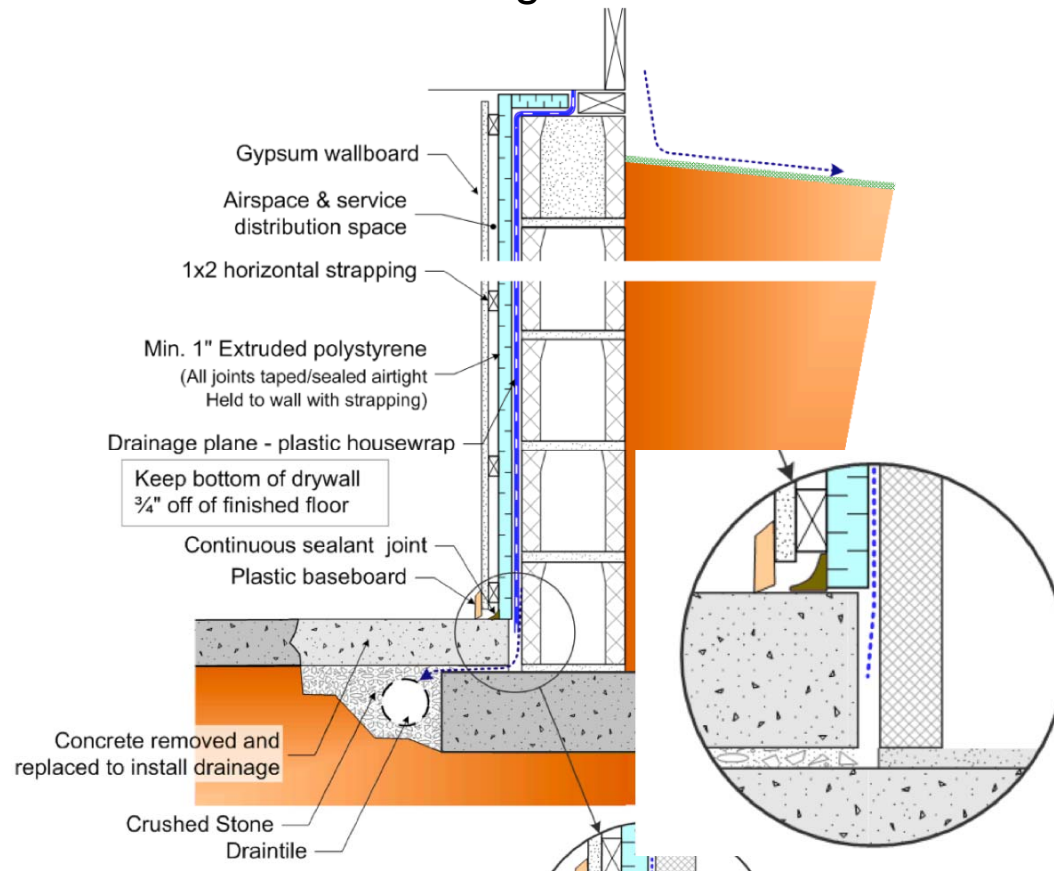
# Deep Energy Retrofit Details

- Foundation
  - Interior perimeter drain



# Deep Energy Retrofit Details

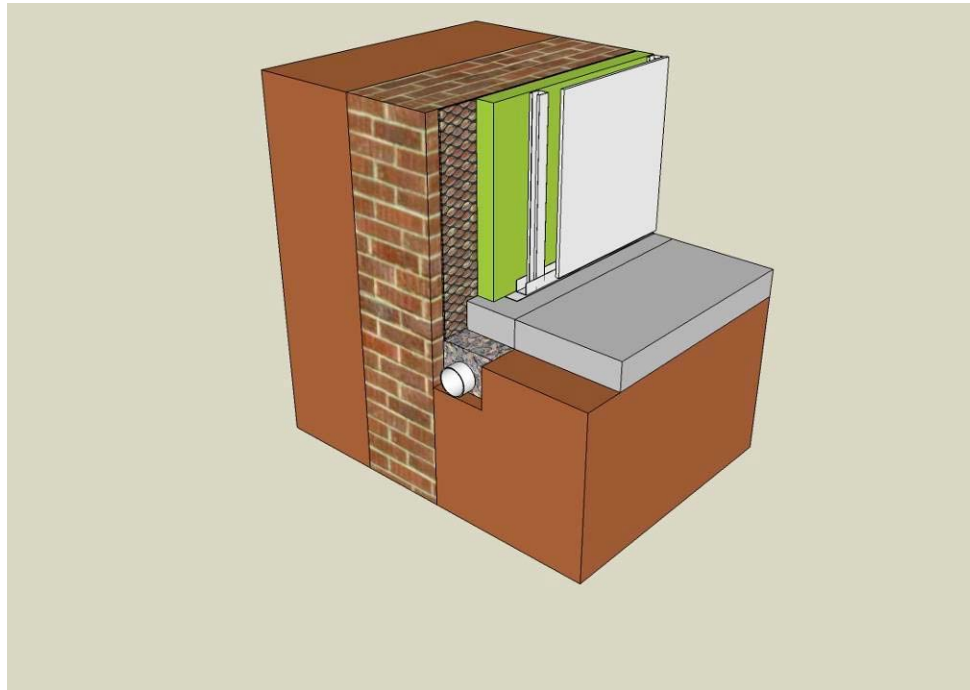
- Foundation
  - Interior perimeter drain and existing concrete slab



# Deep Energy Retrofit Details

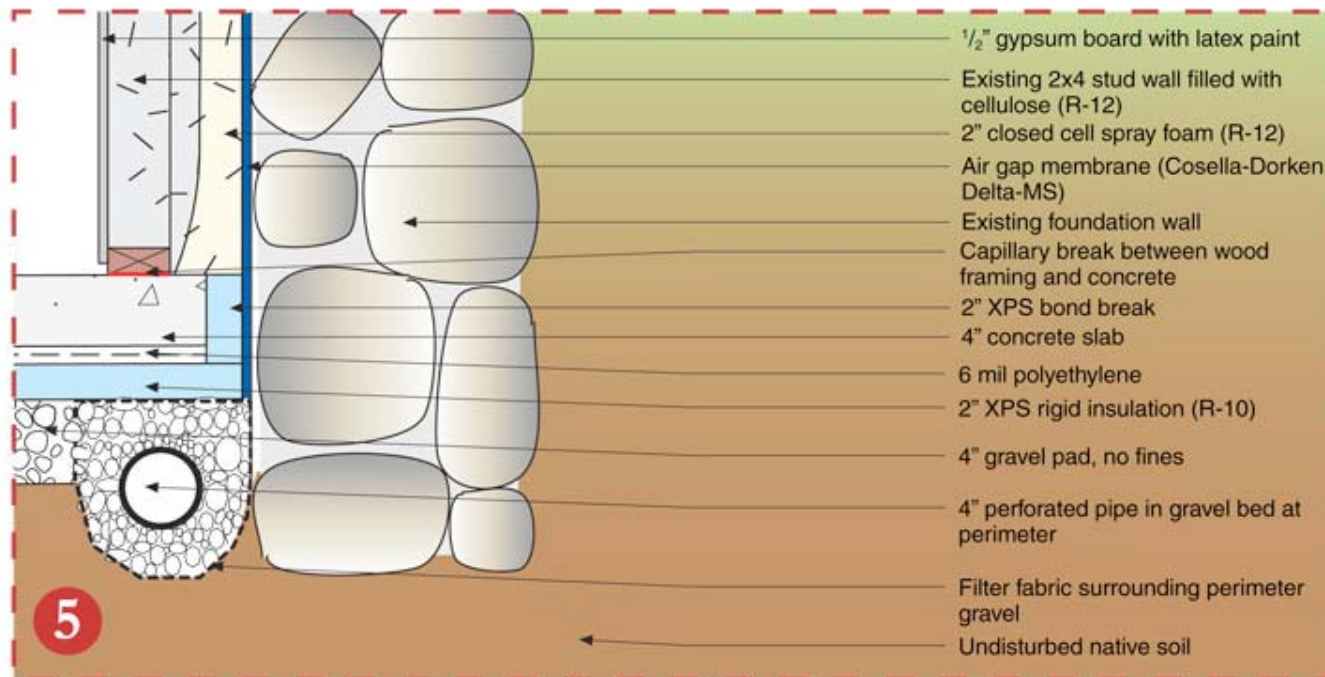
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- Foundation
  - Interior perimeter drain and existing concrete slab



# Deep Energy Retrofit Details

- Foundation
  - Interior perimeter drain and new concrete slab

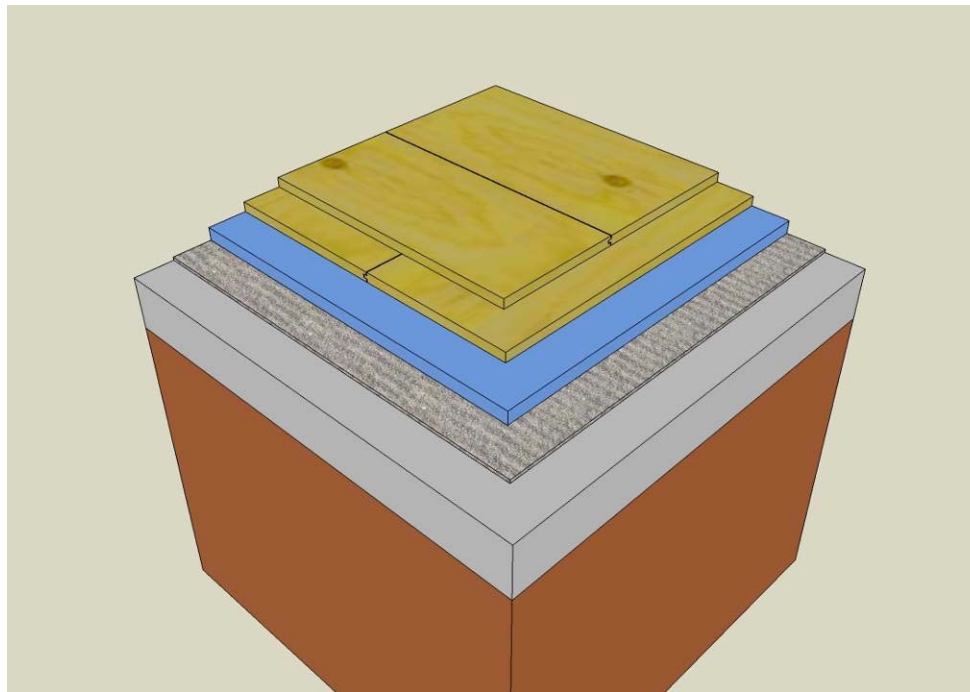




# Deep Energy Retrofit Details

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- Foundation
  - Insulated floor above existing slab

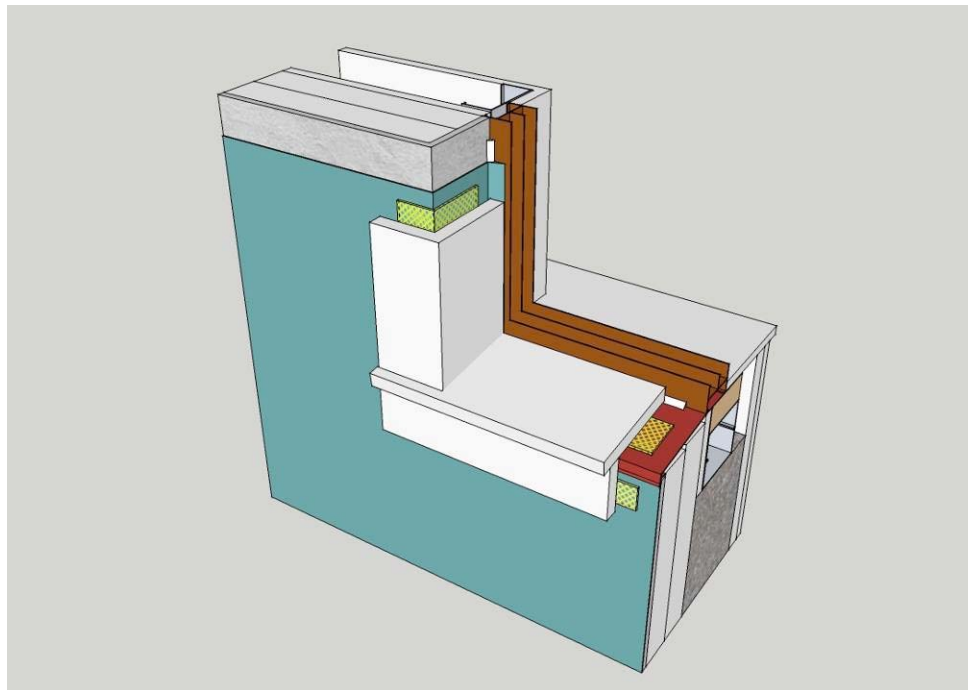




# Deep Energy Retrofit Details

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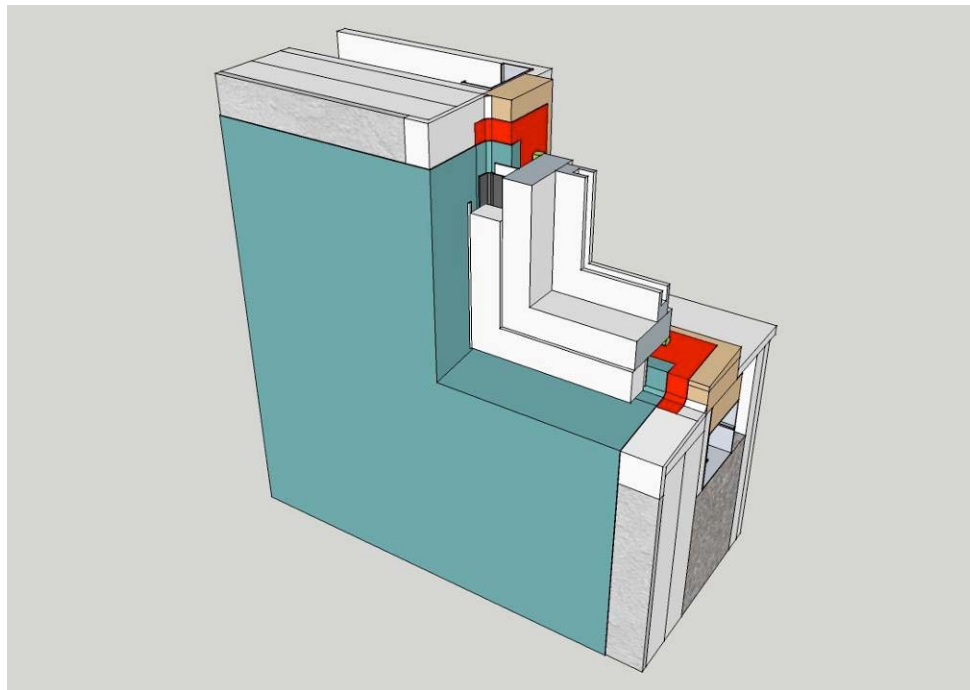
- Windows
  - Replacement in EIFS wall



# Deep Energy Retrofit Details

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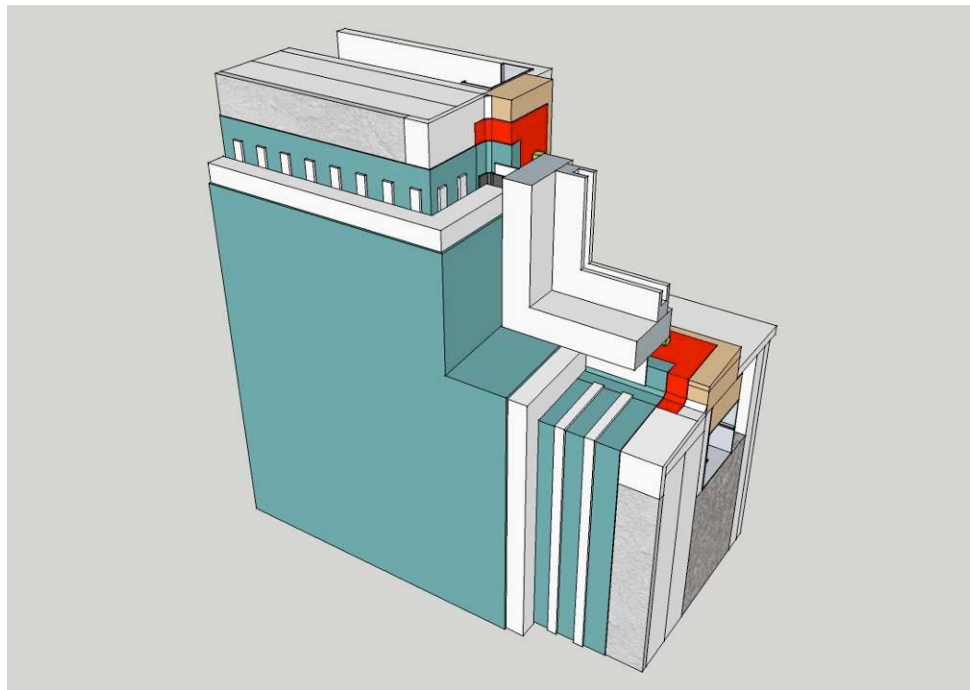
- Windows
  - Replacement in EIFS wall



# Deep Energy Retrofit Details

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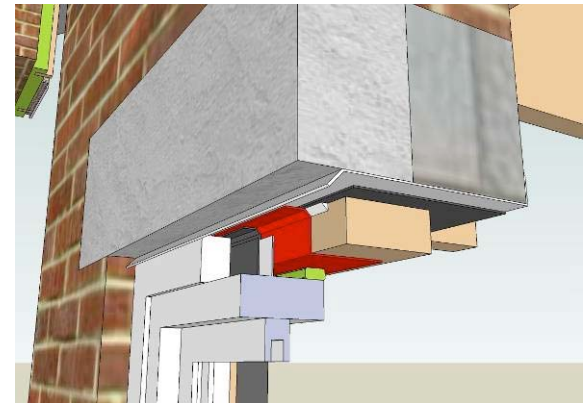
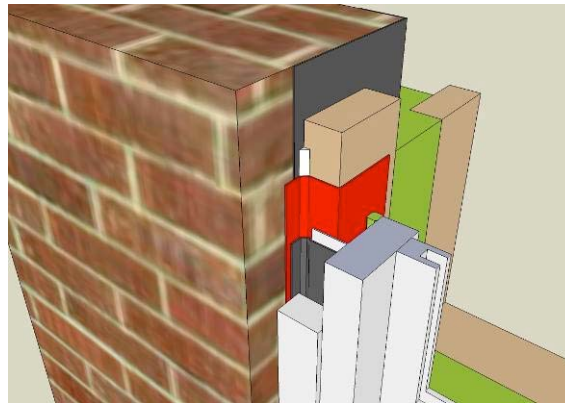
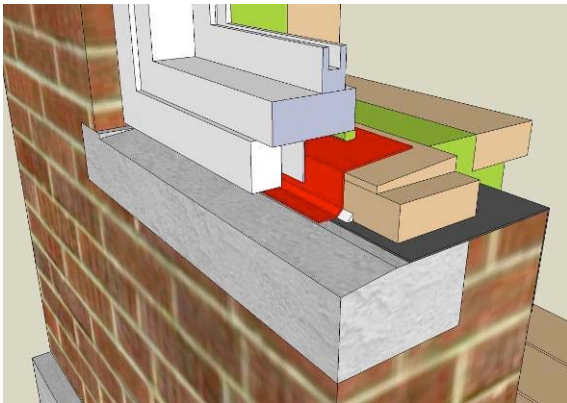
- Windows
  - Replacement in EIFS wall



# Deep Energy Retrofit Details

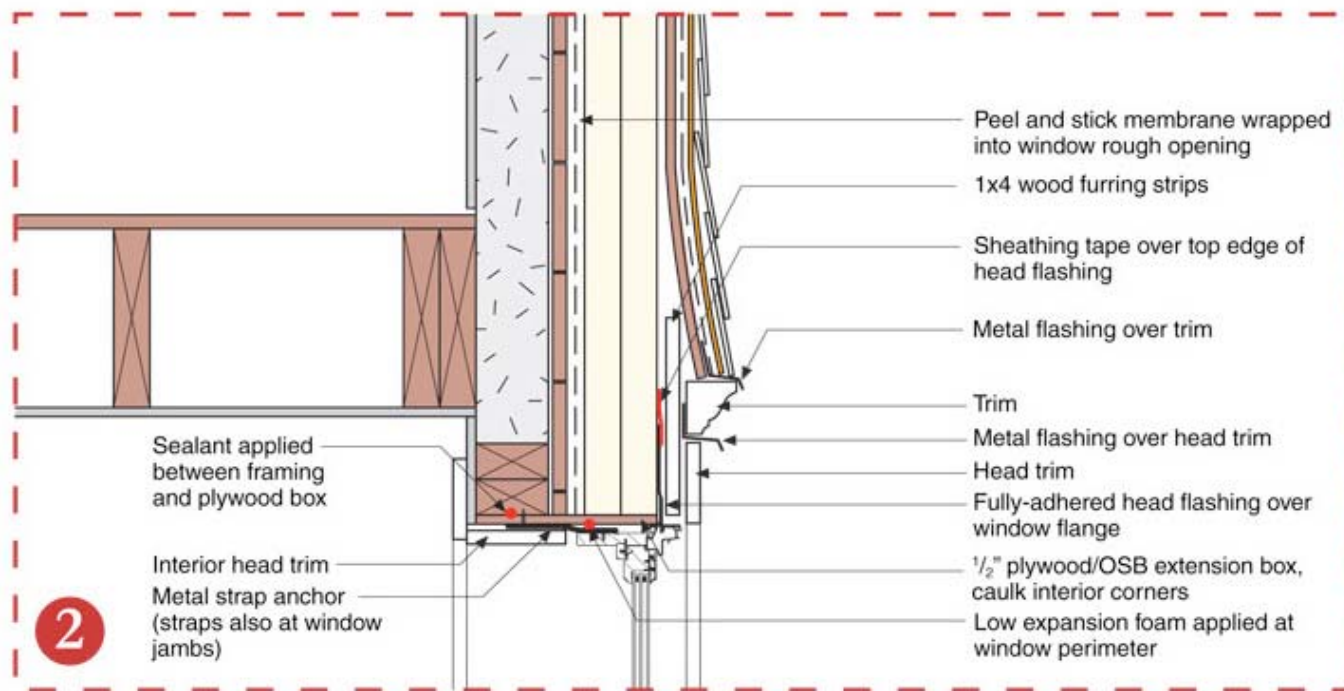
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- Windows
  - Replacement in brick wall



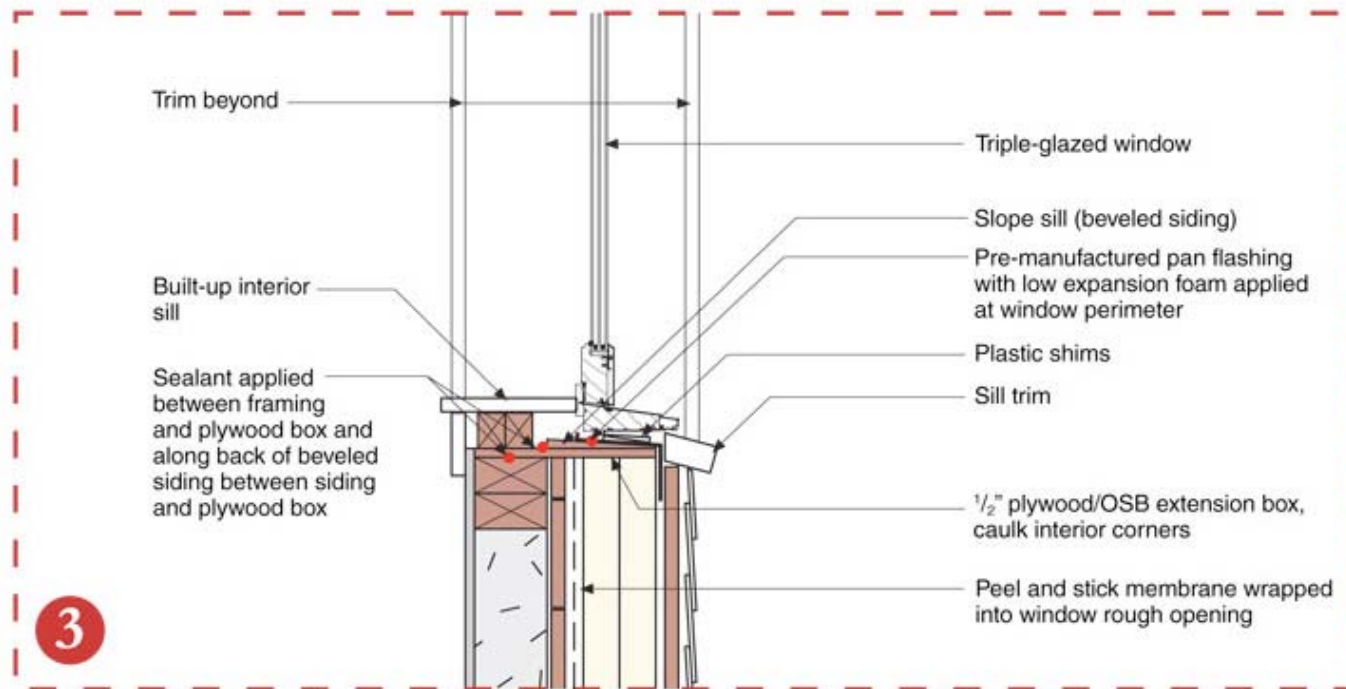
# Deep Energy Retrofit Details

- Windows
  - Replacement in wood framed wall – “outie”



# Deep Energy Retrofit Details

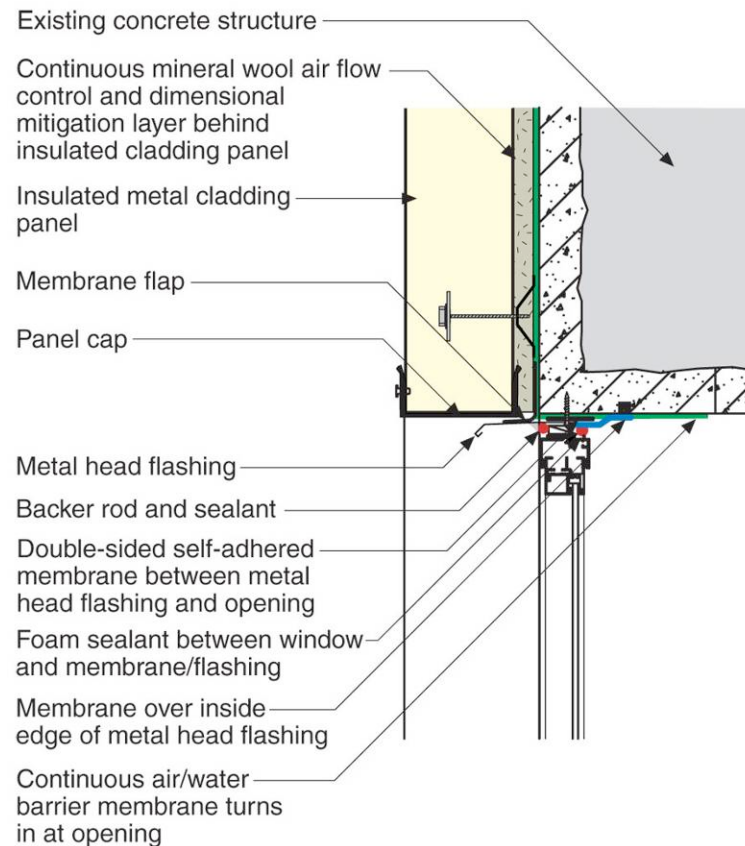
- Windows
  - Replacement in wood framed wall – “outie”





# Deep Energy Retrofit Details

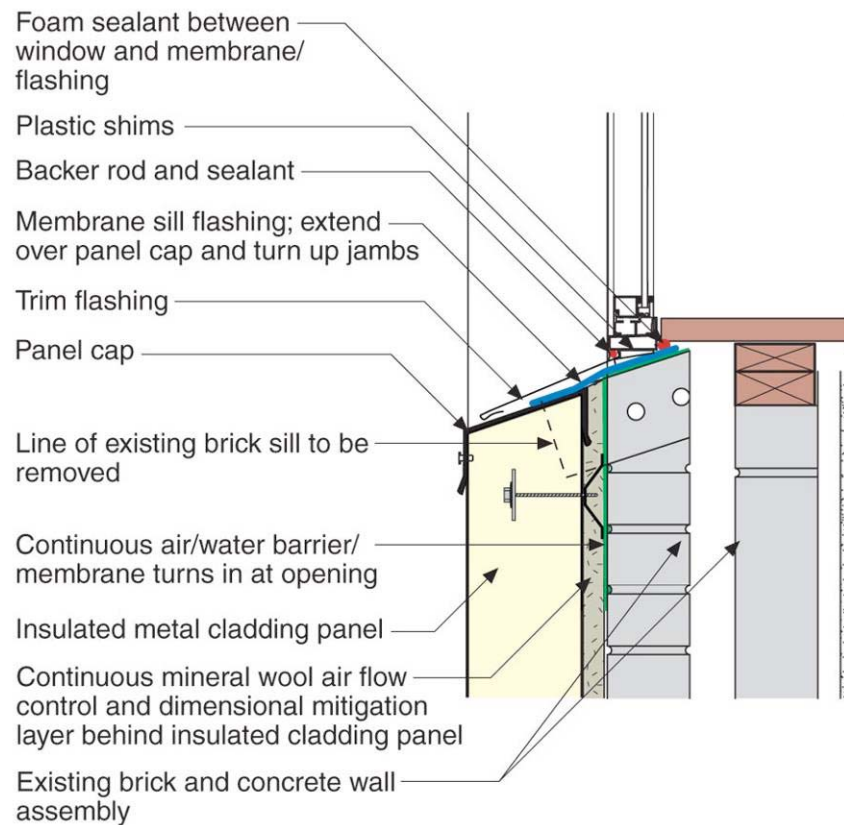
- Windows
  - Replacement in concrete wall





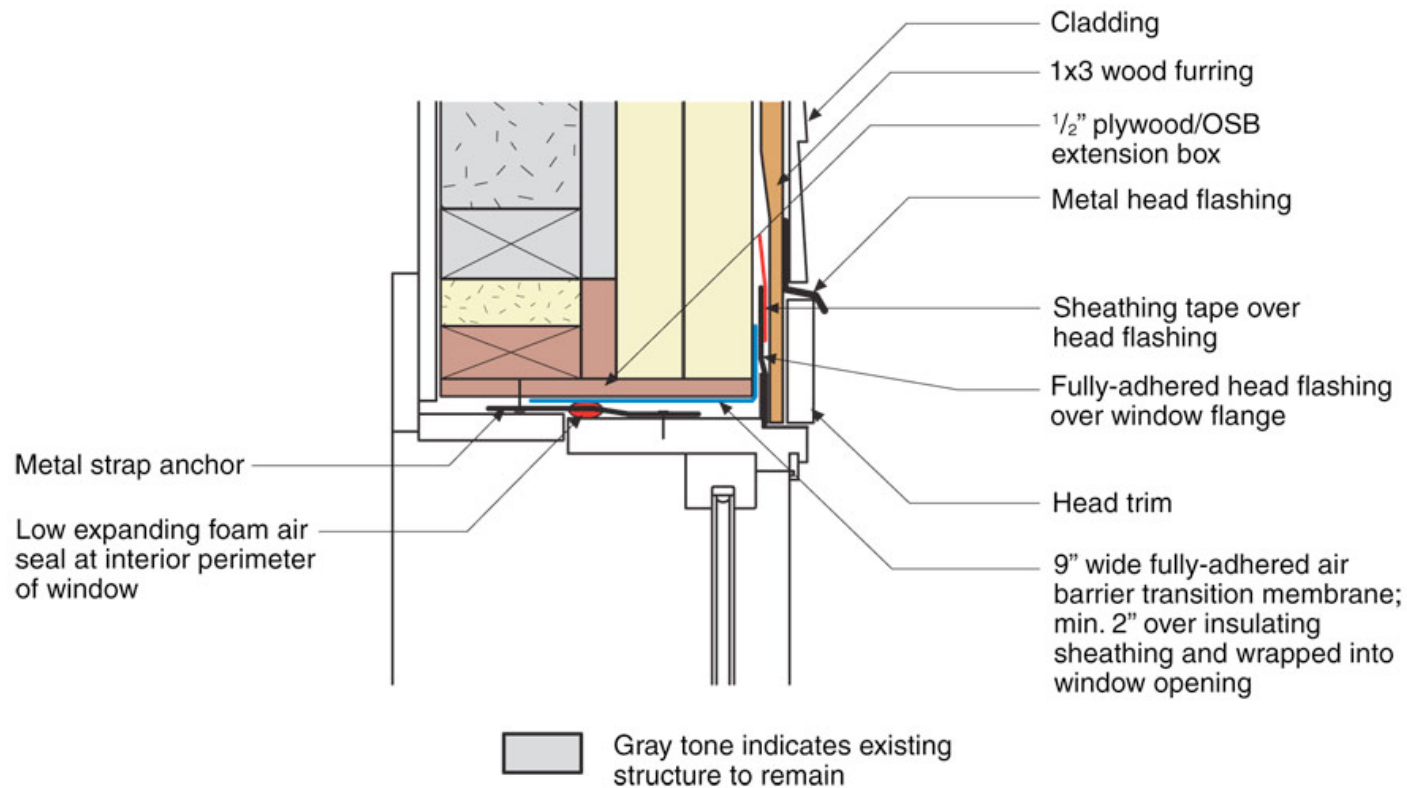
# Deep Energy Retrofit Details

- Windows
  - Replacement in brick and CMU wall



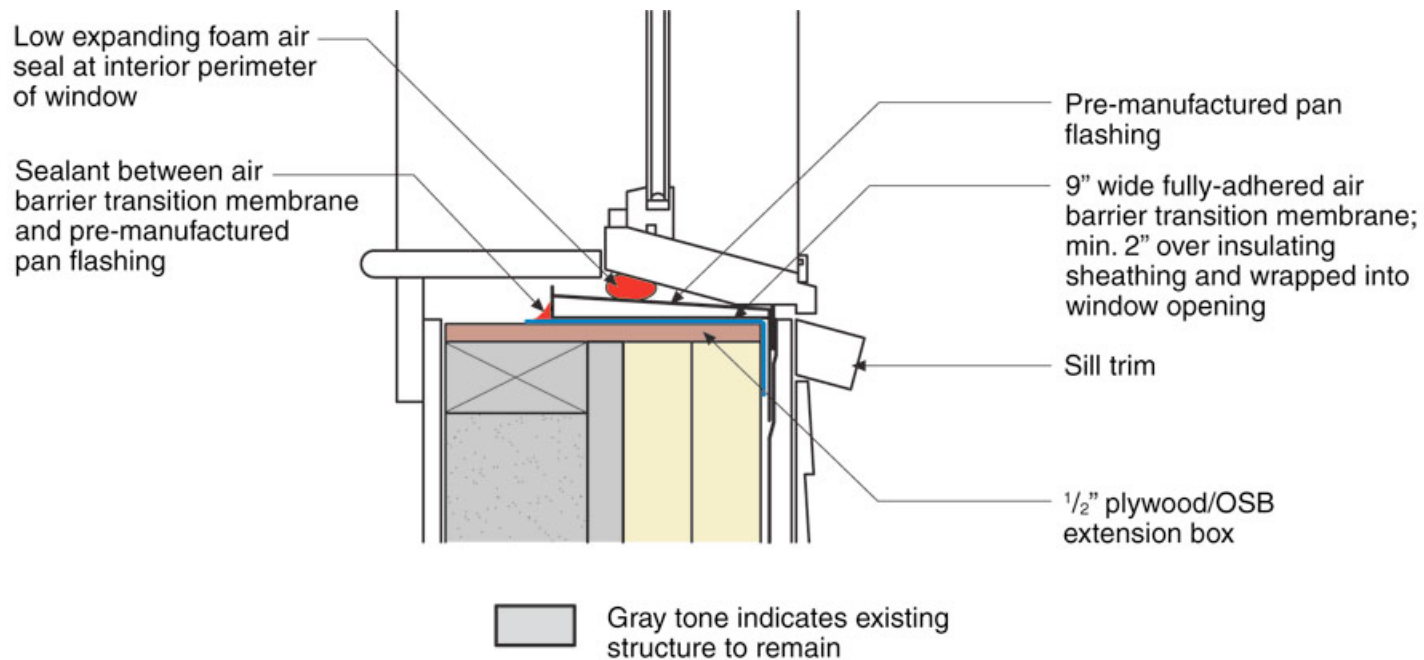
# Deep Energy Retrofit Details

- Windows
  - Replacement in wood framed wall – “outie”



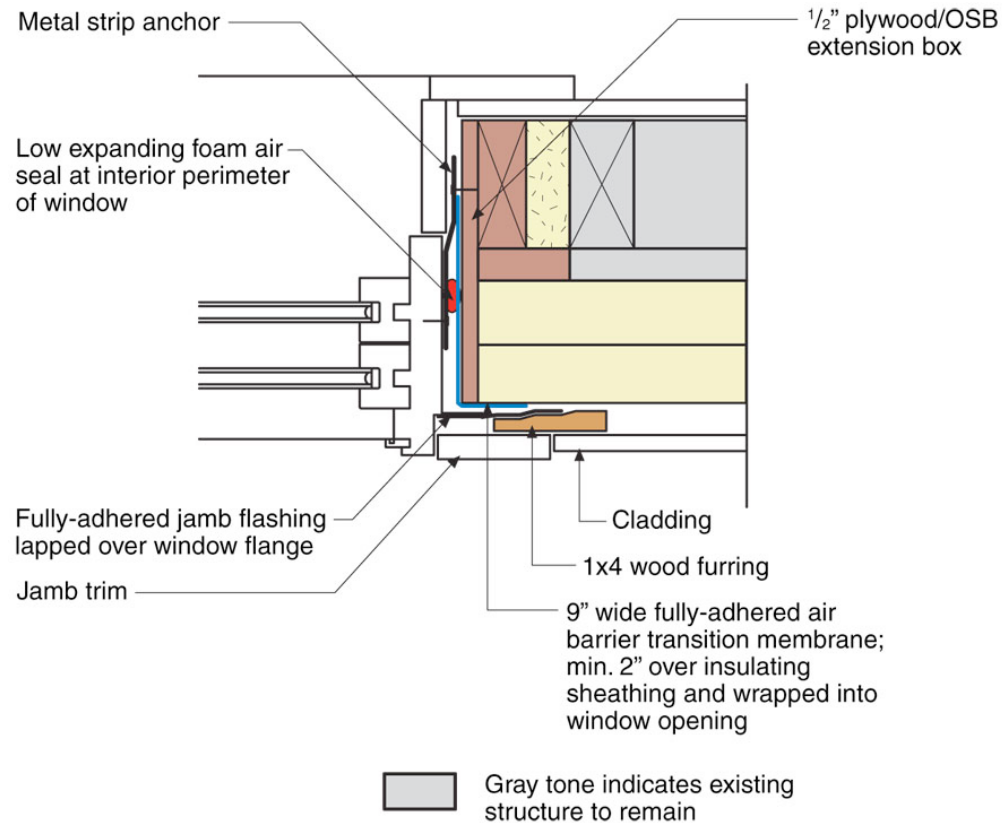
# Deep Energy Retrofit Details

- Windows
  - Replacement in wood framed wall – “outie”



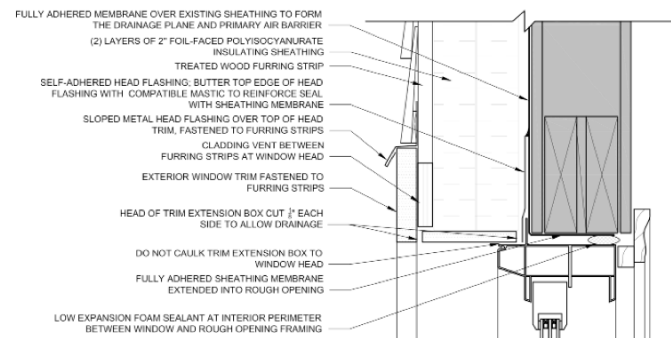
# Deep Energy Retrofit Details

- Windows
  - Replacement in wood framed wall – “outie”

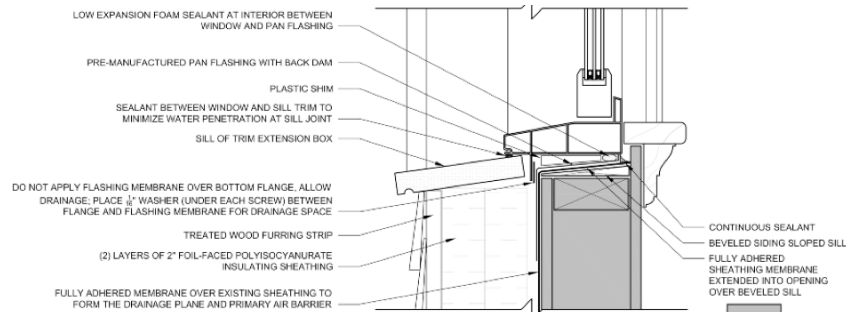


# Deep Energy Retrofit Details

- Windows
  - Replacement in wood framed wall – with flange – “innie”

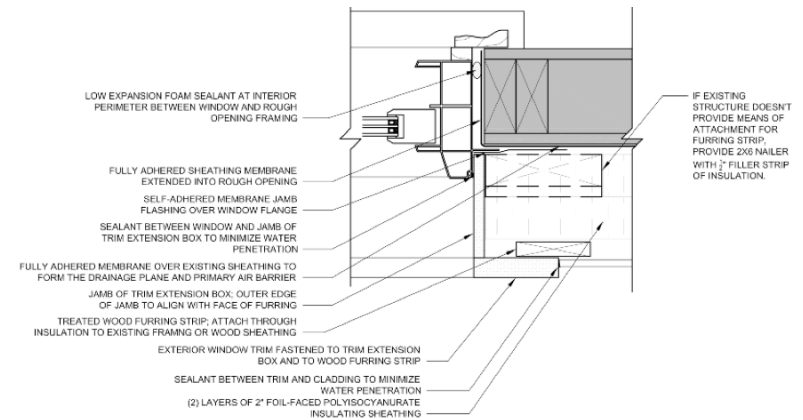


3 WINDOW HEAD DETAIL  
SCALE: 3" = 1'-0"



1 WINDOW SILL DETAIL  
SCALE: 3" = 1'-0"

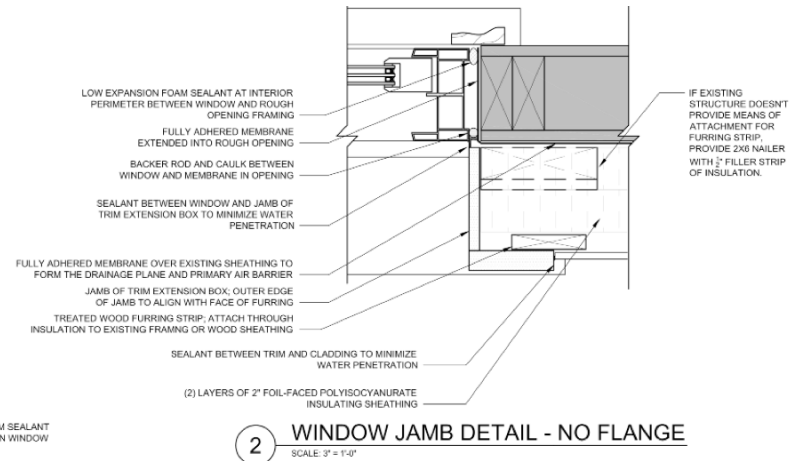
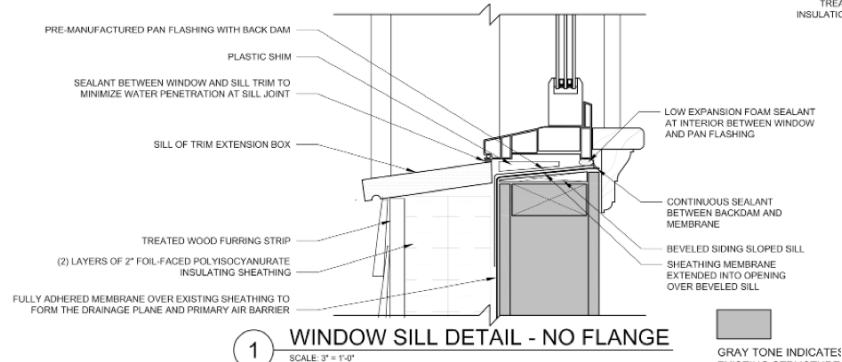
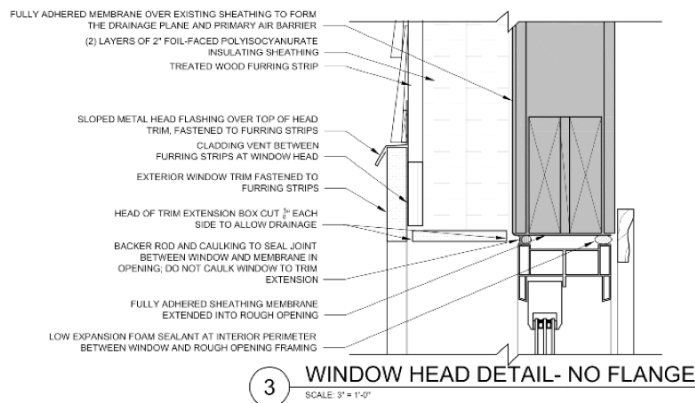
GRAY TONE INDICATES



2 WINDOW JAMB DETAIL  
SCALE: 3" = 1'-0"

# Deep Energy Retrofit Details

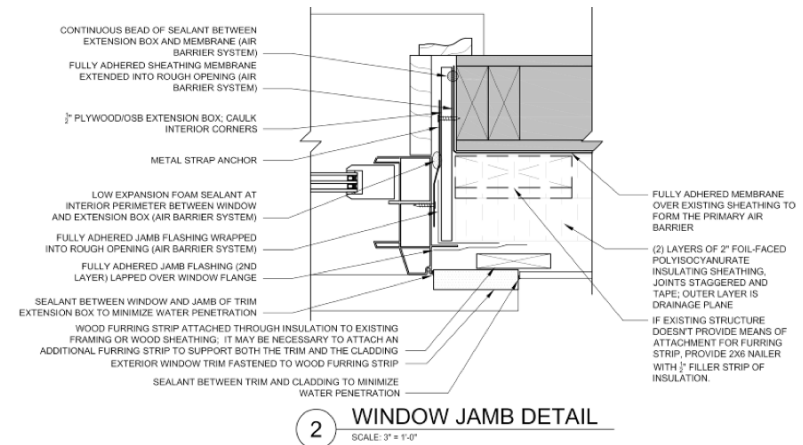
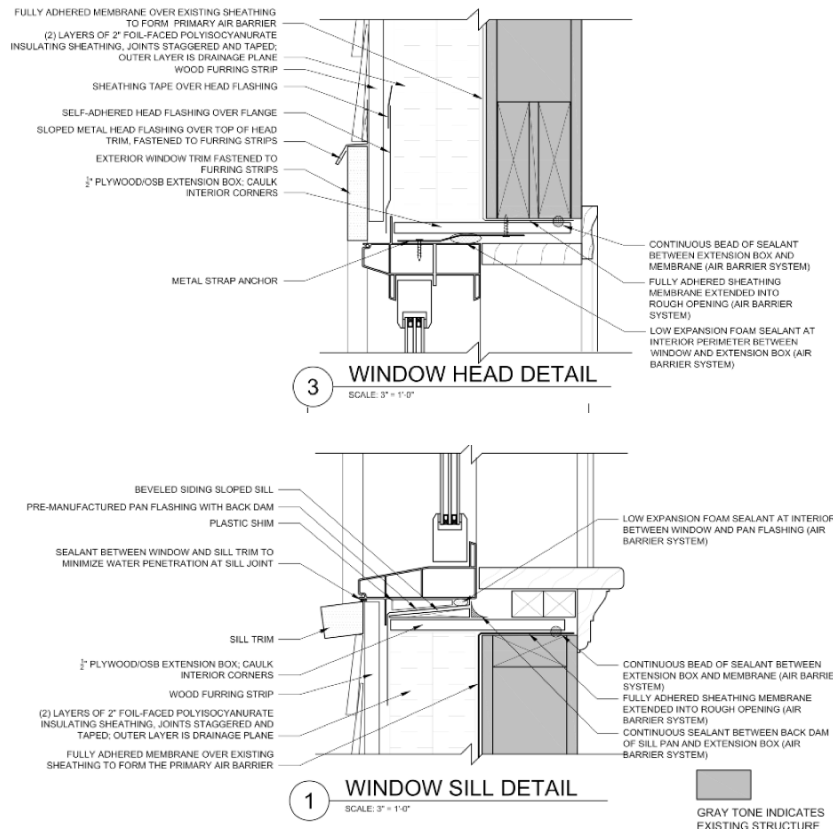
- Windows
  - Replacement in wood framed wall – no flange – “innie”





# Deep Energy Retrofit Details

- Windows
  - Replacement in wood framed wall – with flange – “outie”

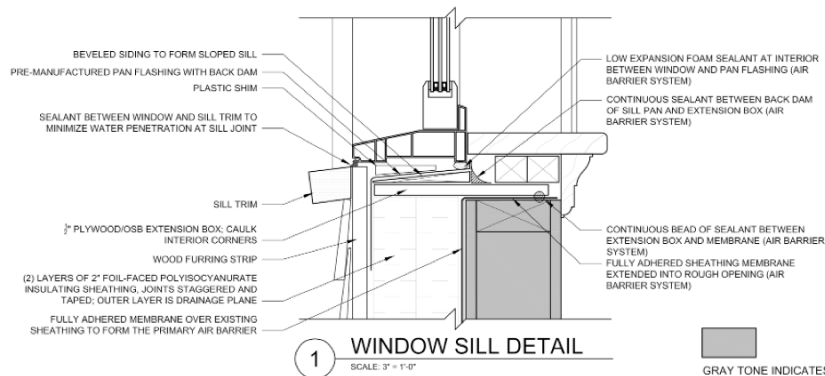
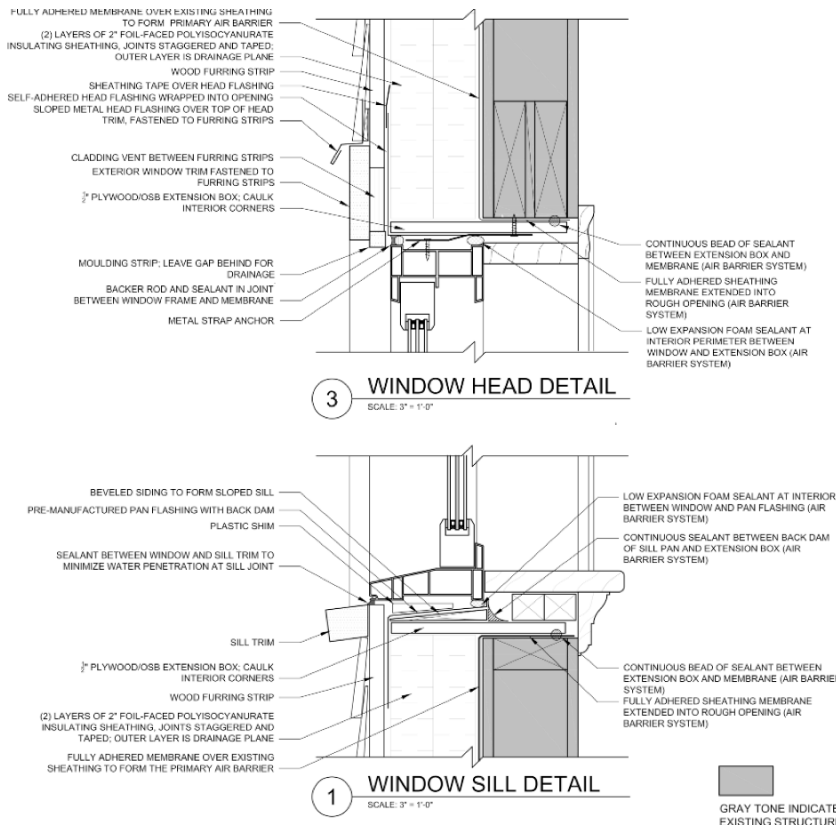




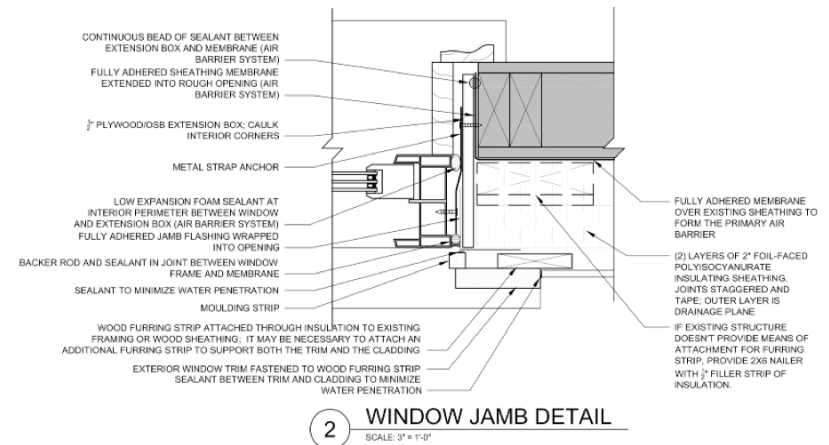
# Deep Energy Retrofit Details

- Windows

- Replacement in wood framed wall – no flange – “outie”

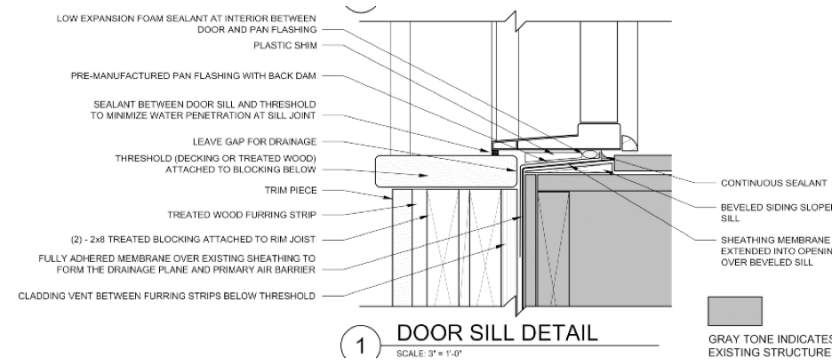
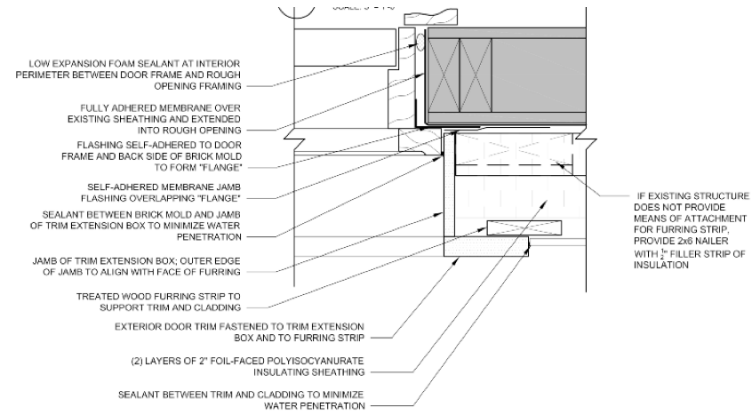
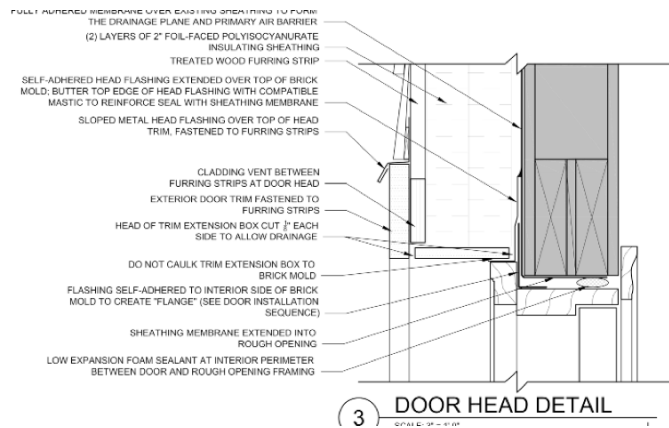


GRAY TONE INDICATES EXISTING STRUCTURE



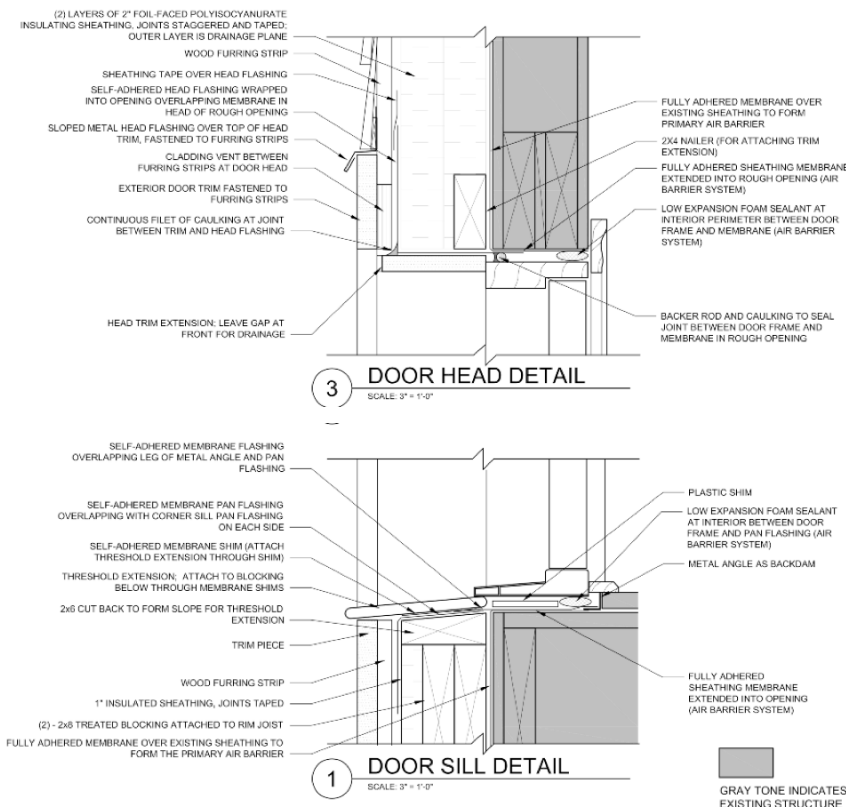
# Deep Energy Retrofit Details

- Doors
  - Replacement in wood framed wall



# Deep Energy Retrofit Details

- Doors
  - Replacement in wood framed wall



**3 DOOR HEAD DETAIL**  
SCALE: 3" = 1'-0"

