Five Not So Easy Pieces
Designing and Constructing the Passive House Enclosure

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Outline

• Project Background & Context

• Building Design Overview

• Enclosure Design and Construction Process

• QA/QC / Commissioning

• The Importance of Details
Project Team

- Owner: REACH Community Development
- Owner’s Rep: Housing Development Center
- Architect: Ankrom Moisan Architects
- Contractor: Walsh Construction Co.
- PH Consultant: Green Hammer
- PHIUS+ Rater: Earth Advantage
- Mechanical Engineer: PAE Consulting Engineers
- Structural Engineer: Stonewood Structural Engineers
- Design Consultant: William Wilson Architects
Design Overview

Image courtesy of William Wilson Architects
Aerial View from South

Image courtesy of Ankrom Moisan Architects
Typical Roof Assembly: R-81
- 80 mil TPO roof membrane (fully adhered, white)
- 1/2" coverboard
- 12" polyisocyanurate insulation
- Self-adhered rubberized asphalt membrane vapor barrier (serves also as temp. roof)
- 3/4" plywood
- Prefabricated wood truss framing (trusses @ 24" o.c.)
- 5/8" gypsum wall board (2 layers)

Typical Exterior Wall Assembly: R-39
- Fiber cement siding w/ treated 1x wood furring @ 24" o.c.
- 1-1/2" rigid mineral wool insulation (8 lb. density)
- Spun-bonded polyolefin sheet water-resistive barrier
- 1/2" plywood with air sealing tape at all seams
- 2x10 wood framing (studs at 24" o.c.)
- 9 1/4" blown fiberglass insulation at all framing cavities
- Polyamide sheet vapor barrier
- 5/8" gypsum wall board

Typical Slab Assembly: R-19
- 4" concrete slab
- 15 mil polymer sheet vapor barrier
- 4" Type II expanded polystyrene insulation
- Gravel base with radon mitigation system piping

Enclosure Assemblies

Images courtesy of Ankrom Moisan Architects
Shading Elements
Enclosure Design & Construction Process

• Iterative design process

• Early concepts

• Coordinating the work
WALL A
- 11 7/8" TJI WALL FRAMING
- 11 7/8" BLOWN FG INSUL.
- WWR-VALUE = R-39
- MOISTURE: FAIR

WALL B
- 2x10 WALL FRAMING
- 9 1/4" BLOWN FG INSUL.
- 1 1/4" MINERAL WOOL EXT. INSUL.
- WWR-VALUE = R-40
- MOISTURE: GOOD

WALL C
- 2x8 WALL FRAMING
- 7/8" BLOWN FG INSUL.
- 3" MINERAL WOOL EXT. INSUL.
- WWR-VALUE = R-40
- MOISTURE: BETTER

WALL D
- 2x6 WALL FRAMING
- 5 1/2" BLOWN FG INSUL.
- 5" MINERAL WOOL EXT. INSUL.
- WWR-VALUE = R-47
- MOISTURE: BEST!

WALL E
- 2x6 WALL FRAMING
- 5 1/2" BLOWN FG INSUL.
- 7 1/2" BLOWN FG INSUL. W/ 7 1/2" TJI TRUSS.
- WWR-VALUE = R-48
- MOISTURE: ?
The Importance of Details

• Success is achieved - or not - at the details!

• To ensure performance at the detail level, establish continuity of the critical barriers and then clearly indicate that continuity in the design drawings
  – Water-shedding surface
  – Water-resistive barrier
  – Air barrier
  – Thermal barrier
  – Vapor barrier
Tracing The Critical Barriers

• Design and construction team members can use a review exercise where one traces the barriers through the various building enclosure drawings

• Verify continuity OR identify discontinuities in critical barriers

• Air barrier continuity is “proven” at the detail level; however, it is very helpful to construction team to indicate ABS in larger scale drawings
Wall Section

Images courtesy of Ankrom Moisan Architects
Design Drawing at Typical Exterior Wall to Foundation

Image courtesy of Ankrom Moisan Architects
Critical Barrier Continuity: Water-Shedding Surface
Critical Barrier Continuity: Water-Resistive Barrier
Critical Barrier Continuity: Water-Resistive Barrier
Critical Barrier Continuity: Air Barrier
Critical Barrier Continuity: Thermal Barrier
Critical Barrier Continuity: Vapor Barrier
Coordination Drawing at Typical Exterior Wall to Foundation
Critical Barrier Continuity: Air Barrier (Revised)
Critical Barrier Continuity: Vapor Barrier
Design Drawing at Typical Exterior Wall to Roof

Image courtesy of Ankrom Moisan Architects
Critical Barrier Continuity: Water-Shedding Surface
Critical Barrier Continuity: Water-Resistive Barrier
Critical Barrier Continuity: Air Barrier
Critical Barrier Continuity: Air Barrier
Critical Barrier Continuity: Air Barrier
Critical Barrier Continuity: Air Barrier ???
Critical Barrier Continuity: Thermal Barrier
Critical Barrier Continuity: Vapor Barrier
Coordination Drawing at Typical Exterior Wall to Roof
Critical Barrier Continuity: Air Barrier (Revised)
Critical Barrier Continuity: Vapor Barrier
Concluding Remarks

• Prelim. airtightness results: 0.075 ACH50

• It takes a team...working collaboratively and pushing in the same direction

• Early team integration pays off

• Proactive coordination and QC is essential

• Keep it simple