PH TEAM

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• SENIOR PROJECT MANAGER, ZA+D, LLC

PASSIVE TO POSITIVE
MICHAEL HINDLE, CPHC®, CPHB®, HERS
• PRESIDENT, BOARD OF MANAGERS
  PASSIVE HOUSE ALLIANCE – UNITED STATES

HAMEL BUILDERS
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BLAISE RASTELLO
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WEINBERG COMMONS
A PASSIVE HOUSE RETROFIT TALE OF EPIC PROPORTIONS
A LONG, LONG TIME AGO IN SE, D.C.
NEIGHBORHOOD & HOMELESSNESS

Washington, D.C. Metro Area Homelessness, 2011
Point-In-Time Count Estimates of the Homeless Population

Rate of Homelessness
- 5 - 11
- 12 - 21
- 22 - 109

SOURCE: HOMELESSNESS RESEARCH INSTITUTE
CLIMATE

Marine

Cold / Very Cold

Mixed-Humid

Hot-Dry / Mixed-Dry

Hot-Humid

Source: TBOAKE.COM
PROJECT BACKGROUND

- (3) BLDGS. / 36 (2) BR UNITS
- 675 NRSF EA.
- PARTIAL BASEMENT / CRAWL SPACE
- (3) STORIES
CHALLENGE:
POOR SPATIAL QUALITY & CONSTRAINT
PROJECT BACKGROUND

- (3) BLDGS. / 36 (2) BR UNITS
- 675 NRSF EA.
- PARTIAL BASEMENT / CRAWL SPACE
- (3) STORIES

NON-DESCRIPT SENSE OF PLACE

WASTEFUL, INAPPROPRIATE, AND OUT-DATED SYSTEMS
PROJECT BACKGROUND

LOW-TECH, UN-INSULATED BUILDING ENCLOSURE

UNHEALTHY INTERIOR ENVIRONMENT
EXISTING CONDITIONS

PRE-RETROFIT
NO MANAGEMENT OF
CONDENSATION PLANE
TEMPERATURES –

MOLD GROWTH
ASSURED!!
DEVELOPER ETHICS

• TRUE AFFORDABILITY: health, comfort and economic stability

• FINANCIAL STABILITY: low and reliable cost through efficiency – no spikes – very predictable

• COMFORT: comfortable by design, naturally and easily

• HEALTH: good IAQ assured
COMMON OCCUPANT HEALTH PROBLEMS

PRIMARY CONTRIBUTORS TO OCCUPANT HEALTH ISSUES

MOISTURE IN ALL FORMS
- BULK WATER
- MOISTURE CARRIED THROUGH INFILTRATION/EXFILTRATION
- MOISTURE CARRIED THROUGH DIFFUSION
- INTERNAL MOISTURE LOADS

MOLD GROWTH – ASTHMA, ALLERGIES, AND OTHER AILMENTS
AN ORDINARY RENOVATION?

REPAIR-UPGRADE FINISHES, MINIMAL IF ANY INSULATION

NO MANAGEMENT OF CONDENSATION PLANE TEMPERATURES –

MOLD GROWTH STILL ASSURED!!

Dew point of interior air = @ 52.5°F

The entire furred out cavity is below dew point of interior air ! @ 53°F
UNINSULATED MASONRY?

COMFORT FACTORS?
- Air temp
- RH
- Air velocity
- Mean radiant surface temps

surface temp = 58°F!!!
ENTER: THE PH RETROFIT
ELIMINATE LOSS:
(almost!)

CONTINUOUS INSULATION
DEFINING THE THERMAL ENVELOPE
SUPER-INSULATED AND VAPOR OPEN

PRE “VE” ENCLOSURE

- EXIST. PLASTER OVER GYP. BD. SUBSTRATE & VERT. 1X FURRING
- BRICK & CMU BACK-UP
- 9 1/2” WD. ‘I’-JOISTS @ 24” O.C., MECH. ATTACH. @ 36” O.C., STAGGERED
- FLUID-APPLIED AIR AND WATER RESISTIVE BARRIER
- 8” MINERAL WOOL INSULATION @ 6 LB./CU. FT. DENSITY
- HORIZ. 5/4 WD. FURRING @ 18” O.C., STAGGERED
- 5/8” FIBER CEMENT CLADDING ON PROPRIETARY CLIPS
ENVELOPE DESIGN + OCCUPANT HEALTH

RETROFIT - MANAGE CONDENSATION PLANE TEMPERATURES –

THIS WALL WILL NOT GROW MOLD

Dew point of interior air = @ 52.5°F

The entire masonry structure is above the dew-point of interior air. Layers outside masonry wall are vapor open.
VAPOR OPEN ASSEMBLIES FOR HEALTH, SAFETY, AND DURABILITY

VAPOR OPEN ASSEMBLIES DRY TO BOTH SIDES

MANAGEMENT OF FIRST CONDENSATION PLANE TEMPERATURES
Interior surface temps are above 65°F. Convection drafts eliminated and comfortable radiant surface temperature.
ORIENTATION:
PRE-DETERMINED SITING
ORIENTATION AND SOLAR GAIN
OPTIMIZING COMFORT
SOLAR GAIN CONTROL & QUALITY OF SPACE
HEATING AND COOLING

ASYMMETRICAL LOADS + DISTRIBUTION
SOLUTION: FIXED SOLAR SHADING
SOLAR GAIN WHEN YOU WANT IT (AND NOT WHEN YOU DON’T!!)
PEAK HEATING
PEAK HEATING

Solar Gain / Heating December

[Graph showing solar gains and heating power over time]

[Diagram showing solar angles and days of the year]
SHOULDER SEASON
- Cool

Solar Gain / Hourly – February 21

Februax / October

Solar Gain / Hourly – February 21
Solar Gain / Heating February

SHOULDER SEASON
- Cool
PEAK SUN = PEAK COOLING?

Solar Gain / Cooling June

[Graph showing solar gain and cooling data for June with time and temperature readings.]
SHOULDER SEASON - THE REAL OVERHEATING RISK

Solar Gain / Hourly - April / August
HEATING AND COOLING DESIGN

VRF WITH HEAT EXCHANGE:
EFFECTIVE LOW LOAD OPERATION,
HEATING AND COOLING DESIGN

VRF WITH HEAT EXCHANGE:
DUCTED DISTRIBUTION
HVAC DESIGN
ERV COMMON VENTILATION & DISTRIBUTION BY QUADRANT
ECONOMIC STABILITY:

Energy Savings Yield

Graph showing annual heating costs for code home and passive house under different price scenarios for heating costs and electricity.

CASE STUDY:
FROM THEORY TO REALITY
THE HIGH-PERFORMANCE ENCLOSURE
CHALLENGE:
ROOF DETAILS
CHALLENGE: ROOF TREATMENT
SOLUTION:
LOW-TECH FRAMING & TAPING
SOLUTION:
KEEP IT SIMPLE –
TAPE AND SHEATHING
SOLUTION:

INCLUDE IN VOLUME
SOLUTION: UTILIZE HARDY CONTROL LAYERS
CHALLENGE: CRAWLSPACE TREATMENT
SOLUTION: MINIMIZE RISK
SOLUTION: 
BREAK ONE OF OUR RULES
FOUNDATION SOLUTION:
OPTIMIZE AND CAPITALIZE
CASE STUDY:
CONSTRUCTION PROCESS
"Hey, could you give us some cost feedback on assemblies options?"

"Get all your “A-Team” subs in here and we will explain it all before they price it."

"THAT MINERAL WOOL AND PROSOCO ARE UN-GODLY EXPENSIVE – YOU GOTTA GET THAT OUTTA THERE"

"Why is this an add? I thought you said the mineral wool and Prosoco were ungodly expensive"

ESTIMATING – HOW DO YOU PRICE SOMETHING NONE OF “YOUR GUYS” EVER HEARD OF??

"PUT IN IN THE DRAWINGS AND I’LL PRICE IT"

"WE’RE GONNA PUT THIS OUT ON THE STREET."

"Well it is not as robust, but if you are sure it will save us real money we can go with . . ."

"MY GUYS HAVE NEVER DONE THIS– THEY WAY UNDER-BID IT"
PRE-CONSTRUCTION CHALLENGES

SUBCONTRACTOR BUY-IN
LESS ROBUST AND HARDER TO BUILD

POST "VE" ENCLOSURE

• EXIST. PLASTER OVER GYP. BD. SUBSTRATE & VERT. 1X FURRING
• BRICK & CMU BACK-UP
• 9½" WD. ‘I’-JOISTS @ 24" O.C., MECH. ATTACH. @ 36" O.C., STAGGERED
• 2.2 LBS./CU. FT. DENSITY SPRAY-APPLIED FIBERGLASS
• REINF. WRB SERVES AS AIR-TIGHT LAYER
• VERT. 2 3/8" W. AIR SEALING TAPE
• HORIZ. 5/4 WD. FURRING @ 18" O.C., STAGGERED
• 5/8" FIBER CEMENT CLADDING ON PROPRIETARY CLIPS
AIR-TIGHTNESS: NOW TO THE EXTERIOR

DEFINING THE AIR-TIGHTNESS LAYER:

- Reduces drafts
- Reduces low humidity in winter
- Reduces excess humidity in summer
ALL STRIPPED DOWN
CREATING THE INSULATION CAVITY
CREATING THE INSULATION CAVITY
THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE
THE AIR-TIGHT LAYER SEQUENCE
DETAILS AS A RESULT OF “VALUE-ENGINEERING”
CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE
CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE
CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE
THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE
THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE
WHINING BERG LIST

- Typical Bath Layouts
- Kitchen Layouts (Elevations)
- HVAC Submittals Approved
- ELEC Submittals
- Tub Surround Submittal
- Foam Block R Value + Thickness BPC
- EXT Block Hollow Needs to Be Filled for Water
- Foam Block Type + Thickness Bold C Steel
- EDDRain RF
- Gas Lines Are HOT + Need To Be Removed
- Delta Accessories Submittals Approved
- 3/4 vs 1" Window Furring
- Stoop Dimensions
- 2 hr Shaft Depression
CONSTRUCTION CHALLENGES

SUBSTITUTION REQUESTS
CONSTRUCTION CHALLENGES

INSTALLATION QUALITY

“TRUST, BUT VERIFY” - EVERYTHING
CONSTRUCTION CHALLENGES

TEMPORARY MATERIAL PROTECTION AND SEQUENCE
CONSTRUCTION CHALLENGES

LACK OF SUBCONTRACTOR CONTROL
CONSTRUCTION CHALLENGES

LACK OF SUBCONTRACTOR CONTROL
CONSTRUCTION CHALLENGES

LACK OF SUBCONTRACTOR CONTROL
SEQUENCING REQUIREMENTS FOR ACHIEVING PASSIVE HOUSE AIR-TIGHTNESS:

1) ALL (1) BUILDINGS FOR THIS PROJECT ARE SUBJECT TO THE PASSIVE HOUSE AIR-TIGHTNESS CRITERIA. IT IS DEFINED AS 0.6 ACBH PA (AIR CHANGES PER HOUR UNDER 0.6 PASCALS OF PRESSURE).

2) THE AIR-TIGHTNESS WILL BE MEASURED VIA KNOCK-OUT BUILDING APPLICATION WITH A BLOWER DOOR TESTING BY A CERTIFIED PHYSICIAN ACCORDING TO PASSIVE GUIDELINES.

3) PRIOR TO COMMENCEMENT OF AIR-SEALING WORK, AN (AIR-SEALING-SPECIFIC) PRE-CONSTRUCTION MEETING MUST BE CONDUCTED. THE GENERAL CONTRACTOR, AIR-SEALING CONTRACTORS, ARCHITECT, BUILDING SCIENCE CONSULTANT, AND THE OWNER/OWNER'S REPRESENTATIVE MUST BE IN ATTENDANCE.

4) PRIOR TO COMMENCEMENT OF WINDOW INSTALLATION WORK, A (WINDOW-SPECIFIC) PRE-CONSTRUCTION MEETING MUST BE CONDUCTED. THE GENERAL CONTRACTOR, WINDOW AND DOOR CONTRACTOR(S), AIR-SEALING CONTRACTOR(S), ARCHITECT, BUILDING SCIENCE CONSULTANT, AND THE OWNER/OWNER'S REPRESENTATIVE MUST BE IN ATTENDANCE.

5) THE AIR-TIGHT LAYER INDICATED THROUGHOUT THE SET OF CONTRACT DOCUMENTS IS REPRESENTED BY A THICK RED DASHED LINE. GENERALLY, FOR THE SUPERSTRUCTURE, THIS LAYER IS TO BE AT THE EXTERIOR FACE OF EXISTING BUILDING SHELL (MASONRY). THIS LAYER ALSO PERFORMS AS THE SECONDARY DRAINAGE PLANE TO THE ASSEMBLY. APPLICATION SPECIFICATIONS OF THE AIR AND MOISTURE BARRIER MUST BE STRICLY ADHERED. REFER TO A-SPEC SECTIONS 650. THE PRE-FOR THE EXTERIOR SIDE (TOP) OF ROOF SHEATHING IS THE AIR-TIGHT LAYER. REFER TO APPlicable DETAILS FOR MORE SPECIFIC.

6) GENERALLY FOR SUB-GRADE CONDITIONS, THE AIR-TIGHT LAYER IS TO BE FROM THE INTERIOR FACE OF EXISTING BUILDING SHELL, AND THE TOP SIDE OF EXISTING BASEMENT/GRANITE/FLOOR. REFER TO APPlicable DETAILS FOR MORE SPECIFIC.

7) ALL PENETRATIONS, FASTENINGS THROUGH AND ATTACHMENTS TO MUST BE PERFORMED WITH EXTREME CARE AND ARE SUBJECT TO FIELD INSPECTION BY THE ARCHITECT, BUILDING SCIENCE CONSULTANT AT ANY TIME AND PRIOR TO COVERING OVER. SCHEDULING OF ALL COVERING INSTALLATIONS MUST BE GIVEN TO INSPECTING UNITS WITH 24 HRS. ADVANCE NOTICE.


9) THE SHEATHING AND AIR SEALING JUNCTIONS (TAPERED JOINS, PARAPET AND SILL CONNECTIONS, etc.) MUST BE TEMPORARILY PROTECTED FROM CLIMATIC TEMPERATURE EXTREMES, WEATHER, WATER, AND MOISTURE UNTIL THE FINAL APPLICATION OF THE INSULATING LAYER(S) IS COMPLETE.

10) A QUALIFYING AIR-TIGHTNESS TEST MUST BE ACHIEVED AFTER THE COMPLETE INSTALLATION OF THE VAPOR AND AIR BARRIER LAYER INCLUDING PERIMETER TERMINATIONS, SEAM CONNECTIONS, AND MATERIAL TRANSITIONS, etc., IN THE BASEMENT AND GRANITE/FLOOR. THIS TEST MUST CONCERN WITH AIR-TIGHTNESS TEST ITEM 8 ABOVE.

11) AN ADDITIONAL QUALIFYING AIR-TIGHTNESS TEST MUST BE ACHIEVED AFTER THE APPLICATION OF THE VERTICAL Y-JOINT SYSTEM PROPOSED TO STAND THE EXTERIOR INSULATION PANELS AND GLASSING SYSTEM, AND PRIOR TO THE APPLICATION OF EXTERIOR INSULATION.

12) PRIOR TO THE INSTALLATION OF THE VAPOR AND AIR BARRIER LAYER AND INSULATION IN THE GRANITE/FLOOR, ALL MECHANICAL, ELECTRICAL, AND PLUMBING RUGH-IN WORK TO BE COMPLETE THESE SPACES.

In the circumstance that rough-in work in the granspace is not feasibly phased as outlined in item 12 above, or there is a subsequent change to the scope of work, insulation and Air-tight layers must be fully protected to prevent puncture, compression, or disintegration. The contractor is responsible to submit a protection plan prior to commencing such work. The protection plan is subject to review and approval by the architect, building science consultant, and owner/owners representative. 45 days allowed for submission.
CONSTRUCTION CHALLENGES

...TELL THEM YOU TOLD THEM...
CONSTRUCTION CHALLENGES

...TELL THEM AGAIN.
CONSTRUCTION CHALLENGES

MOCK-UP
CHALLENGES WITH BUILDING

MOLD...
UNFORESEEN, INHERENT CHALLENGES,
BULK WATER, CAPILLARY ACTION
CHALLENGES WITH BUILDING

...CAPILLARY...
CHALLENGES WITH BUILDING

...AND HYDROSTATIC MOISTURE...
CHALLENGES WITH BUILDING ...AND BULK WATER.
INTERIOR ENVIRONMENT:
QUALITY OF NATURAL LIGHT
INTERIOR ENVIRONMENT: QUALITY OF NATURAL LIGHT
INTERIOR ENVIRONMENT: AVOID “TUNNEL VISION”
...AND OPTIMIZED SOLAR GAIN.
THANK YOU

QUESTIONS?