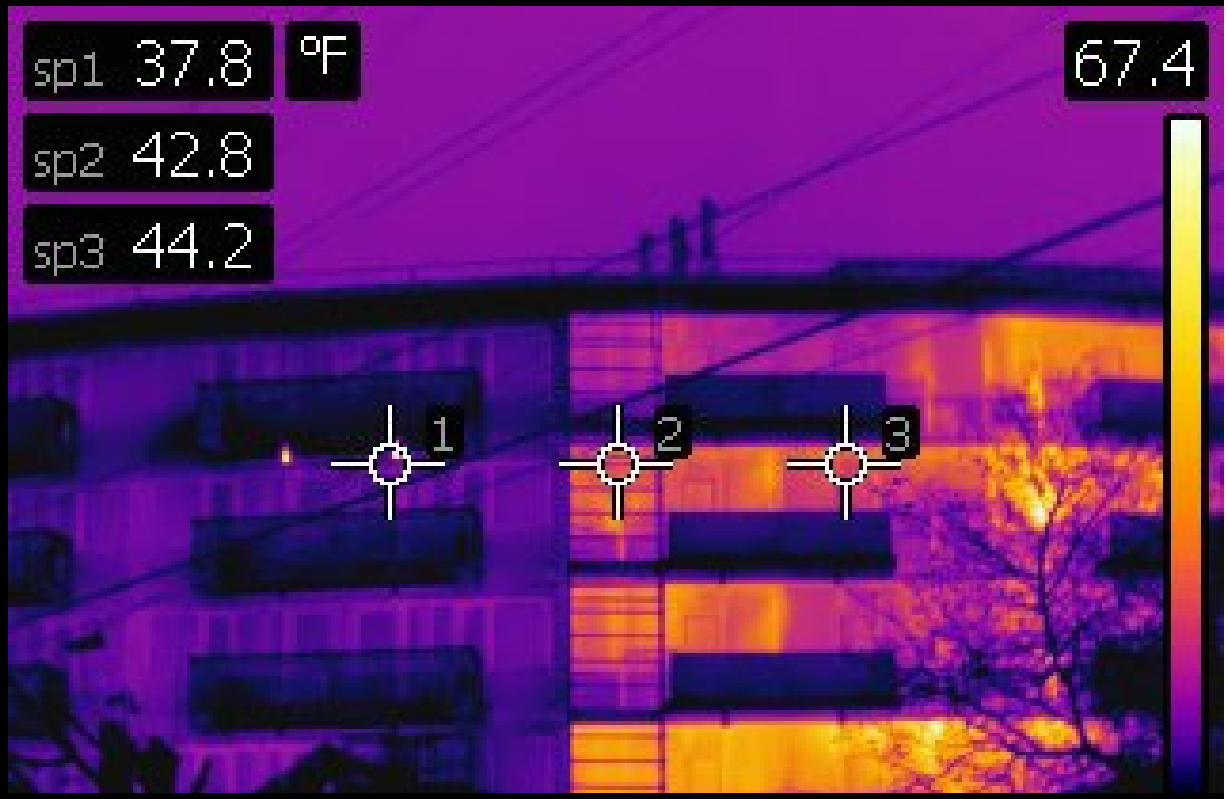
Building Beyond the Code: The Contractor's Role in the Development of High Performance Buildings



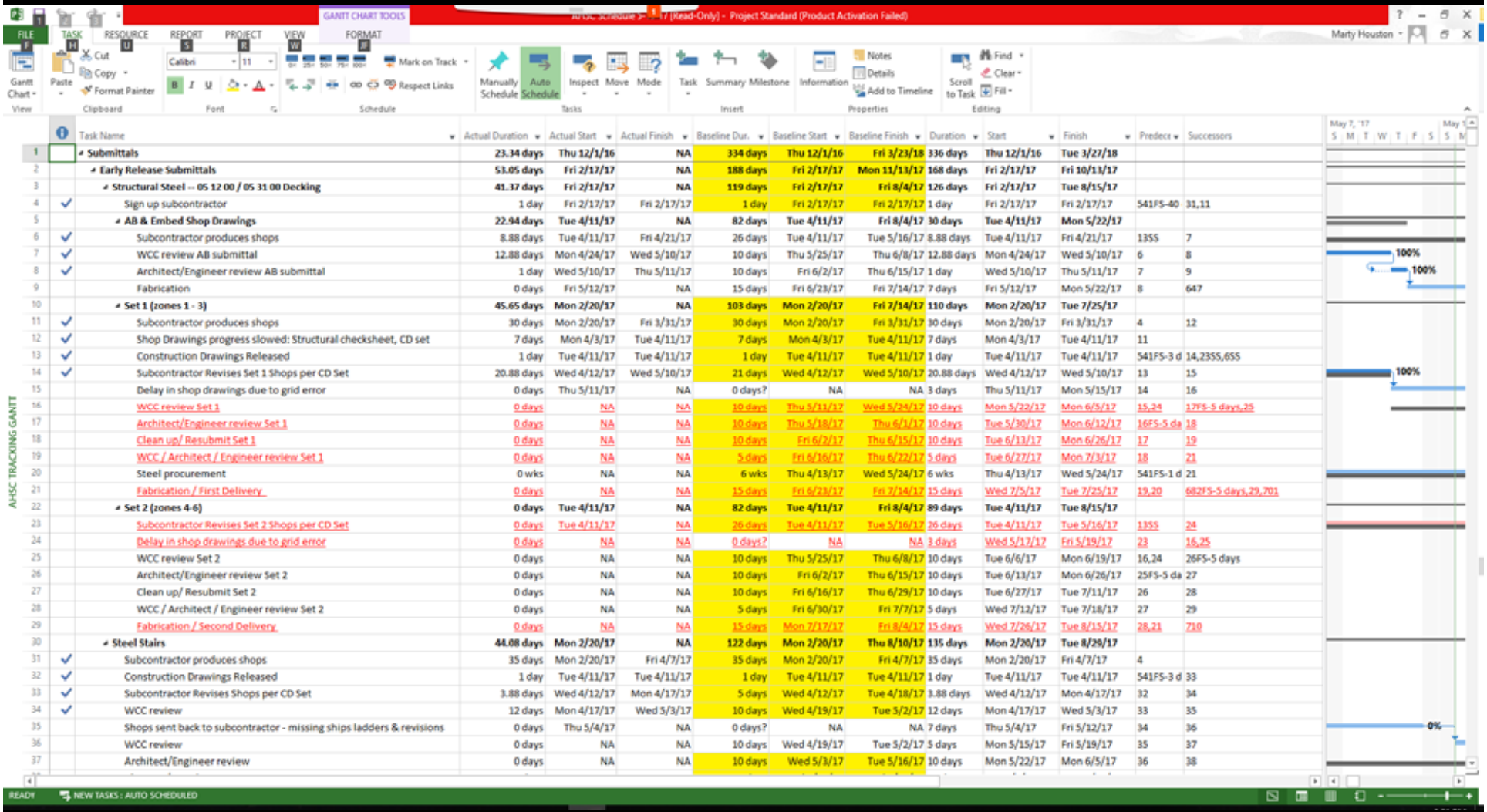
SEABEC Symposium
May 2017

Martin Houston
AIA, CSI, LEED AP
Walsh Construction Co.

Specify the standard for buildings and are based on protecting the public health, safety and general welfare

Least Fire Resistant
Least Safe
Least Accessible
Least Energy Efficient
Least Structurally Sound

RDF BUILDERS				Project: 0.00								Type of Estimate: Final Estimate				10/2/2015		
1424				Equipment		Labor				Material		Subcontract		Overhead		Grand	Estimated	
Ph's #	Phase	Quant	Unit	Rate	Total	Pr'tvy	Hours	Rate	Total	Rate	Total	Rate	Total	Rate	Total	Total	Unit Cost	
3300	Site Concrete	37	cy		2,388		437	61.45	26,862		9,273		-		-	38,523	1,048.76	38,523
3310	FOOTINGS																	-
3310.5	Continuous Footings -- Site	-	cy		-		-	-	-		-		-		-	-	-	-
3321.5	Walls -- Planter Curbs	7	cy		474		49	61.45	2,990		1,365		-		-	4,830	662.06	4,830
3321-10	Form & Strip	452	cf		-	11.50	39	61.45	2,415	0.85	384		-		-		6.19	2,800
3321-13	Forming Accessories	452	cf		-		-	-	-	0.35	158		-		-		0.35	158
3321-18	Patching & Sacking	452	sf		-	150.00	3	61.45	185	0.20	90		-		-		0.61	276
3321-19	Curing	226	sf		-	450.00	1	61.45	31	0.03	7		-		-		0.17	38
3321-20	Concrete / Placement / Pump	7	cy	65	474	1.25	6	61.45	359	99.50	726		-		-		213.66	1,559
					-		-	-	-		-		-		-		-	-
	RDF Mark-up				-		-	-	-		-		-	4,830	-		-	-
					-		-	-	-		-		-		-		-	-
3321.5	Walls -- Site Planters	-	cy		-		-	-	-		-		-		-	-	-	-
3321.5	Walls -- Courtyard Planters	29	cy		1,913		388	61.45	23,872		7,908		-		-	33,694	1,144.59	33,694
3321-10	Form & Strip	1,885	cf		-	6.00	314	61.45	19,308	2.00	3,770		-		-		12.24	23,078
3321-13	Forming Accessories	1,885	cf		-		-	-	-	0.35	660		-		-		0.35	660
3321-14	Blockouts	56	lf		-	8.00	7	61.45	430	0.75	42		-		-		8.43	472
3321-16	Chamfer/Rustication	677	lf		-	30.00	23	61.45	1,387	0.15	102		-		-		2.20	1,488
3321-18	Patching & Sacking	1,885	sf		-	115.00	16	61.45	1,007	0.20	377		-		-		0.73	1,384
3321-19	Curing	943	sf		-	450.00	2	61.45	129	0.03	28		-		-		0.17	157
3321-20	Concrete / Placement / Pump	29	cy	65	1,913	1.25	24	61.45	1,447	99.50	2,929		-		-		213.66	6,290
3321-24	Embeds	8	ea		-	3.00	3	61.45	164		-		-		-		20.48	164
					-		-	-	-		-		-		-		-	-
	RDF Mark-up				-		-	-	-		-		-	33,694	-		-	-
					-		-	-	-		-		-		-		-	-
																		-
3300	Cast-in-Place Concrete	10,576	cy		704,603		26,216	75.20	1,971,407		1,525,328		138,278		68,809	4,408,426	416.83	4,408,426
3310	FOOTINGS																	-
3310	Continuous Footings	-	cy		-	-	-	-	-		-		-		-	-	-	-
3311	Pier Footings	-	cy		-	-	-	-	-		-		-		-	-	-	-
3312	Grade Beams	-	cy		-	-	-	-	-		-		-		-	-	-	-
3313	Monolithic Footings	-	cy		-	-	-	-	-		-		-		-	-	-	-
3314	Mat Foundations	255	cy		2,554	5.0	157	61.45	9,620		27,240		-		-	39,414	154.35	39,414
3314-10	Form & Strip	786	cf		-	6.00	131	61.45	8,050	1.25	983		-		-		11.49	9,033
3314-13	Form Accessories	786	cf		-		-	-	-	0.35	275		-		-		0.35	275
3314-20	Concrete / Placement / Pump	255	cy	10	2,554	10.00	26	61.45	1,569	101.75	25,983		-		-		117.90	30,106
					-		-	-	-		-		-		-		-	-
	RDF Mark-up				-		-	-	-		-		-	39,414	-		-	-
					-		-	-	-		-		-		-		-	-

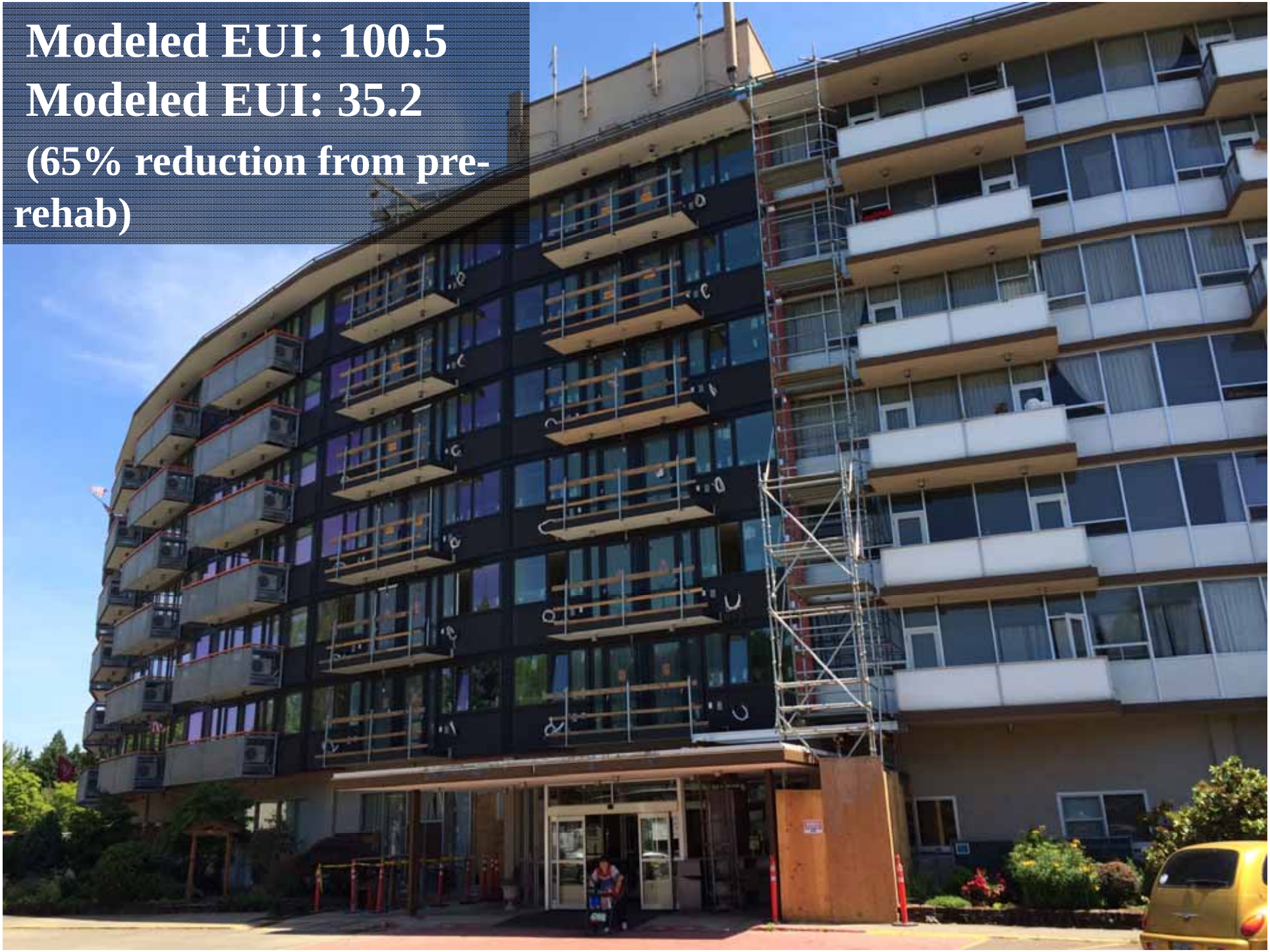


		Task Name	Actual Duration	Actual Start	Actual Finish	Baseline Dur.	Baseline Start	Baseline Finish	Duration	Start	Finish	Predece	Successors
1		**Submittals**	**23.34 days**	**Thu 12/1/16**	**NA**	**334 days**	**Thu 12/1/16**	**Fri 3/23/18**	**336 days**	**Thu 12/1/16**	**Tue 3/27/18**		
2		**Early Release Submittals**	**53.05 days**	**Fri 2/17/17**	**NA**	**188 days**	**Fri 2/17/17**	**Mon 11/13/17**	**168 days**	**Fri 2/17/17**	**Fri 10/13/17**		
3		**Structural Steel -- 05 12 00 / 05 31 00 Decking**	**41.37 days**	**Fri 2/17/17**	**NA**	**119 days**	**Fri 2/17/17**	**Fri 8/4/17**	**126 days**	**Fri 2/17/17**	**Tue 8/15/17**		
4	✓	Sign up subcontractor	1 day	Fri 2/17/17	Fri 2/17/17	1 day	Fri 2/17/17	Fri 2/17/17	1 day	Fri 2/17/17	Fri 2/17/17	541FS-40	31,11
5		**AB & Embed Shop Drawings**	**22.94 days**	**Tue 4/11/17**	**NA**	**82 days**	**Tue 4/11/17**	**Fri 8/4/17**	**30 days**	**Tue 4/11/17**	**Mon 5/22/17**		
6	✓	Subcontractor produces shops	8.88 days	Tue 4/11/17	Fri 4/21/17	26 days	Tue 4/11/17	Tue 5/16/17	8.88 days	Tue 4/11/17	Fri 4/21/17	13SS	7
7	✓	WCC review AB submittal	12.88 days	Mon 4/24/17	Wed 5/10/17	10 days	Thu 5/25/17	Thu 6/8/17	12.88 days	Mon 4/24/17	Wed 5/10/17	6	8
8	✓	Architect/Engineer review AB submittal	1 day	Wed 5/10/17	Thu 5/11/17	10 days	Fri 6/2/17	Thu 6/15/17	1 day	Wed 5/10/17	Thu 5/11/17	7	9
9		Fabrication	0 days	Fri 5/12/17	NA	15 days	Fri 6/23/17	Fri 7/14/17	7 days	Fri 5/12/17	Mon 5/22/17	8	647
10		**Set 1 (zones 1 - 3)**	**45.65 days**	**Mon 2/20/17**	**NA**	**103 days**	**Mon 2/20/17**	**Fri 7/14/17**	**110 days**	**Mon 2/20/17**	**Tue 7/25/17**		
11	✓	Subcontractor produces shops	30 days	Mon 2/20/17	Fri 3/31/17	30 days	Mon 2/20/17	Fri 3/31/17	30 days	Mon 2/20/17	Fri 3/31/17	4	12
12	✓	Shop Drawings progress slowed: Structural checksheet, CD set	7 days	Mon 4/3/17	Tue 4/11/17	7 days	Mon 4/3/17	Tue 4/11/17	7 days	Mon 4/3/17	Tue 4/11/17	11	
13	✓	Construction Drawings Released	1 day	Tue 4/11/17	Tue 4/11/17	1 day	Tue 4/11/17	Tue 4/11/17	1 day	Tue 4/11/17	Tue 4/11/17	541FS-3 d	14,23SS,65S
14	✓	Subcontractor Revises Set 1 Shops per CD Set	20.88 days	Wed 4/12/17	Wed 5/10/17	21 days	Wed 4/12/17	Wed 5/10/17	20.88 days	Wed 4/12/17	Wed 5/10/17	13	15
15		Delay in shop drawings due to grid error	0 days	Thu 5/11/17	NA	0 days?	NA	NA	3 days	Thu 5/11/17	Mon 5/15/17	14	16
16		WCC review Set 1	0 days	NA	NA	10 days	Thu 5/11/17	Wed 5/24/17	10 days	Mon 5/22/17	Mon 6/5/17	15,24	17FS-5 days,25
17		Architect/Engineer review Set 1	0 days	NA	NA	10 days	Thu 5/18/17	Thu 6/1/17	10 days	Tue 5/30/17	Mon 6/12/17	16FS-5 da	18
18		Clean up/ Resubmit Set 1	0 days	NA	NA	10 days	Fri 6/2/17	Thu 6/15/17	10 days	Tue 6/13/17	Mon 6/26/17	17	19
19		WCC / Architect / Engineer review Set 1	0 days	NA	NA	5 days	Fri 6/16/17	Thu 6/22/17	5 days	Tue 6/27/17	Mon 7/3/17	18	21
20		Steel procurement	0 wks	NA	NA	6 wks	Thu 4/13/17	Wed 5/24/17	6 wks	Thu 4/13/17	Wed 5/24/17	541FS-1 d	21
21		Fabrication / First Delivery	0 days	NA	NA	15 days	Fri 6/23/17	Fri 7/14/17	15 days	Wed 7/5/17	Tue 7/25/17	19,20	682FS-5 days,29,701
22		**Set 2 (zones 4-6)**	**0 days**	**Tue 4/11/17**	**NA**	**82 days**	**Tue 4/11/17**	**Fri 8/4/17**	**89 days**	**Tue 4/11/17**	**Tue 8/15/17**		
23		Subcontractor Revises Set 2 Shops per CD Set	0 days	Tue 4/11/17	NA	26 days	Tue 4/11/17	Tue 5/16/17	26 days	Tue 4/11/17	Tue 5/16/17	13SS	24
24		Delay in shop drawings due to grid error	0 days	NA	NA	0 days?	NA	NA	3 days	Wed 5/17/17	Fri 5/19/17	23	16,25
25		WCC review Set 2	0 days	NA	NA	10 days	Thu 5/25/17	Thu 6/8/17	10 days	Tue 6/6/17	Mon 6/19/17	16,24	26FS-5 days
26		Architect/Engineer review Set 2	0 days	NA	NA	10 days	Fri 6/2/17	Thu 6/15/17	10 days	Tue 6/13/17	Mon 6/26/17	25FS-5 da	27
27		Clean up/ Resubmit Set 2	0 days	NA	NA	10 days	Fri 6/16/17	Thu 6/29/17	10 days	Tue 6/27/17	Tue 7/11/17	26	28
28		WCC / Architect / Engineer review Set 2	0 days	NA	NA	5 days	Fri 6/30/17	Fri 7/7/17	5 days	Wed 7/12/17	Tue 7/18/17	27	29
29		Fabrication / Second Delivery	0 days	NA	NA	15 days	Mon 7/17/17	Fri 8/4/17	15 days	Wed 7/26/17	Tue 8/15/17	28,21	710
30		**Steel Stairs**	**44.08 days**	**Mon 2/20/17**	**NA**	**122 days**	**Mon 2/20/17**	**Thu 8/10/17**	**135 days**	**Mon 2/20/17**	**Tue 8/29/17**		
31	✓	Subcontractor produces shops	35 days	Mon 2/20/17	Fri 4/7/17	35 days	Mon 2/20/17	Fri 4/7/17	35 days	Mon 2/20/17	Fri 4/7/17	4	
32	✓	Construction Drawings Released	1 day	Tue 4/11/17	Tue 4/11/17	1 day	Tue 4/11/17	Tue 4/11/17	1 day	Tue 4/11/17	Tue 4/11/17	541FS-3 d	33
33	✓	Subcontractor Revises Shops per CD Set	3.88 days	Wed 4/12/17	Mon 4/17/17	5 days	Wed 4/12/17	Tue 4/18/17	3.88 days	Wed 4/12/17	Mon 4/17/17	32	34
34	✓	WCC review	12 days	Mon 4/17/17	Wed 5/3/17	10 days	Wed 4/19/17	Tue 5/2/17	12 days	Mon 4/17/17	Wed 5/3/17	33	35
35		Shops sent back to subcontractor - missing ships ladders & revisions	0 days	Thu 5/4/17	NA	0 days?	NA	NA	7 days	Thu 5/4/17	Fri 5/12/17	34	36
36		WCC review	0 days	NA	NA	10 days	Wed 4/19/17	Tue 5/2/17	5 days	Mon 5/15/17	Fri 5/19/17	35	37
37		Architect/Engineer review	0 days	NA	NA	10 days	Wed 5/3/17	Tue 5/16/17	10 days	Mon 5/22/17	Mon 6/5/17	36	38

These are standard processes/expectations if you want a code compliant building


Existing EUI: 112
Measured EUI: 46
(59% reduction from pre-rehab)
49.6
37.3
FLIR

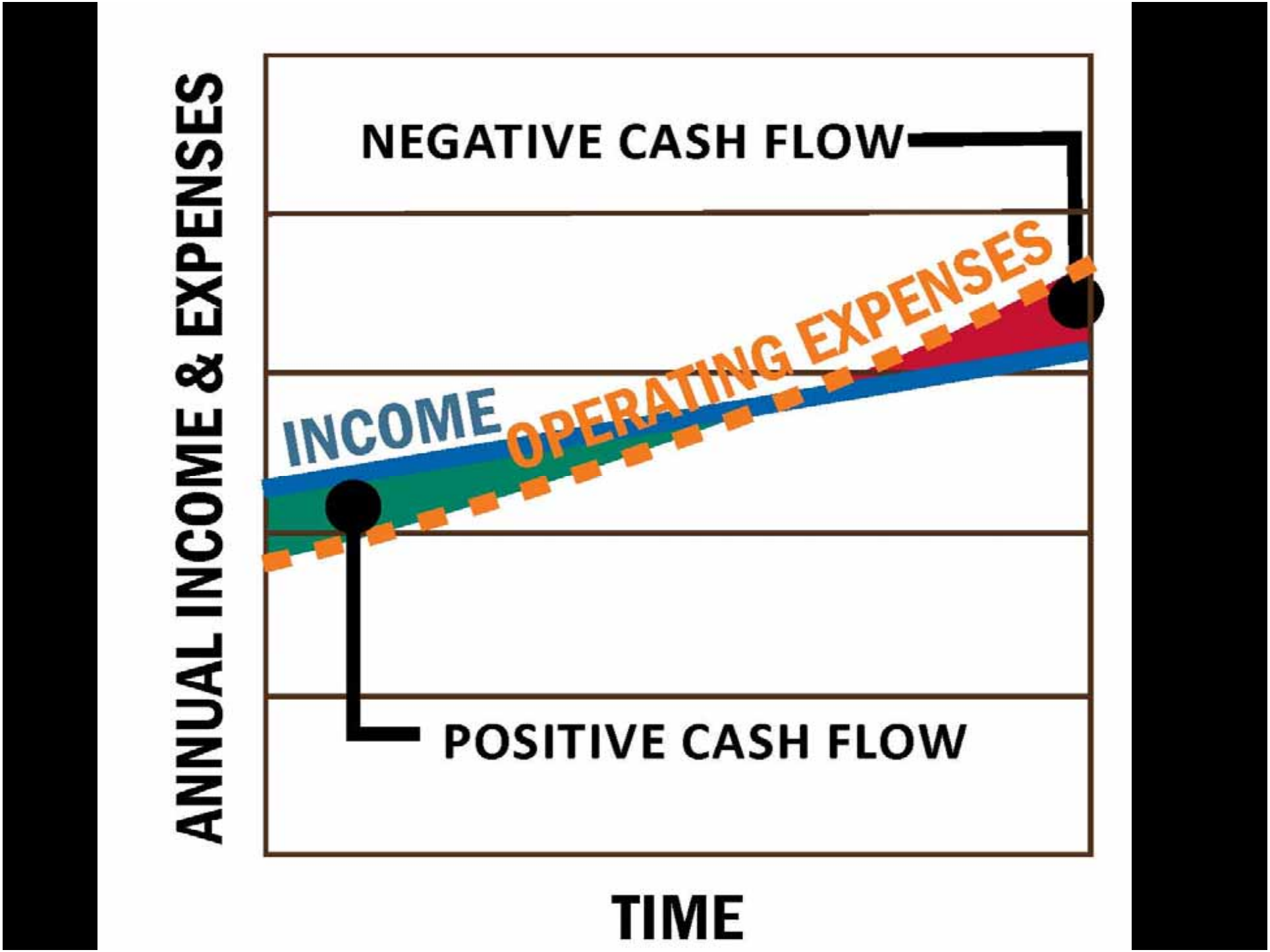
Modeled EUI: 100.5
Modeled EUI: 35.2
(65% reduction from pre-rehab)




Modeled EUI: 22.5
Measured EUI: 20.9


Modeled EUI:
20.2

Traditional Design Bid Build May Not Work


ANNUAL INCOME & EXPENSES
NEGATIVE CASH FLOW
INCOME
OPERATING EXPENSES
POSITIVE CASH FLOW
TIME

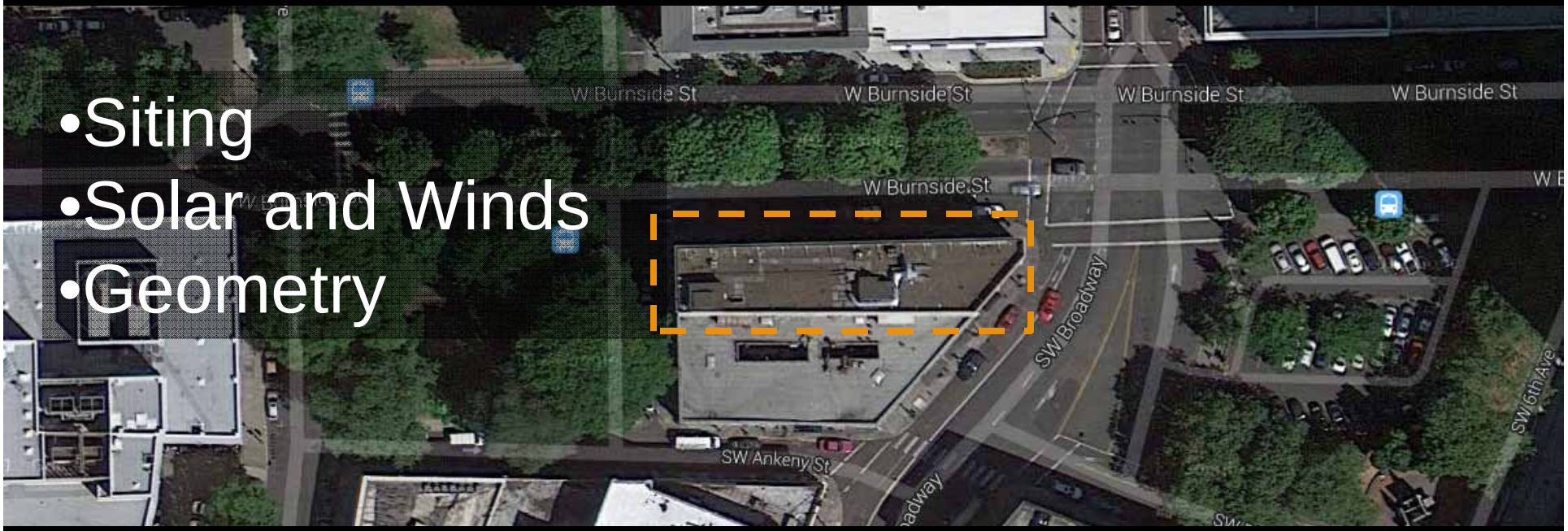
MARK O. HATFIELD BUILDING

Deep Energy Retrofit

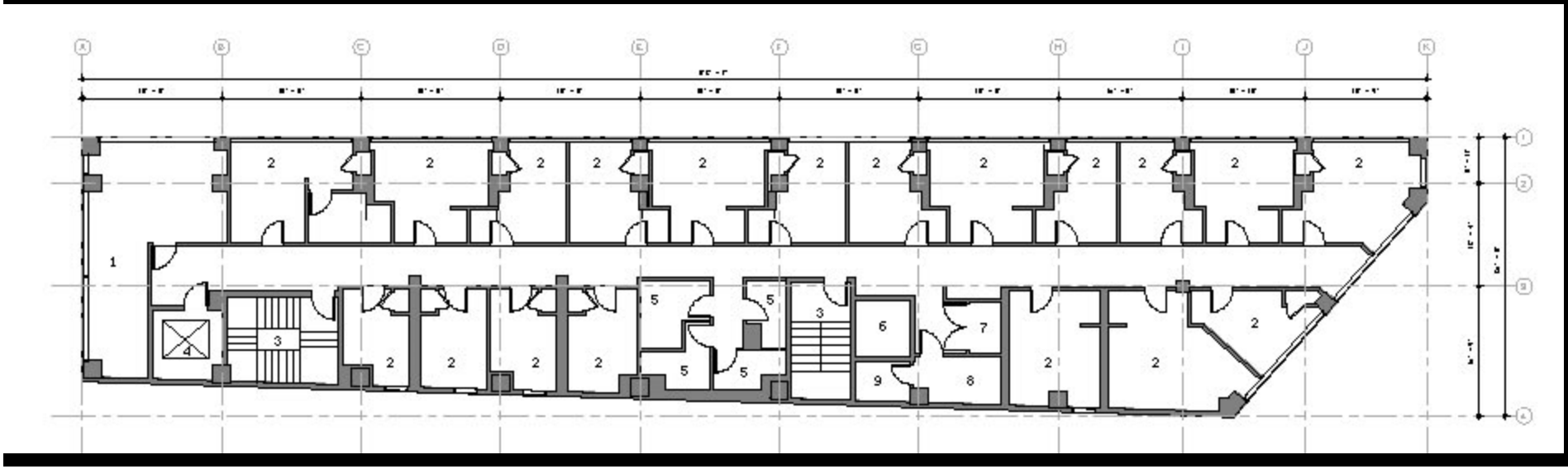
- **106 S.R.O Units**
- **43,964 sq.ft.**
- **8 Floors**
- **Shared Bathrooms**
- **Shared Kitchens**

MARK O. HATFIELD BUILDING

Basic Building Design



- Siting
- Solar and Winds
- Geometry



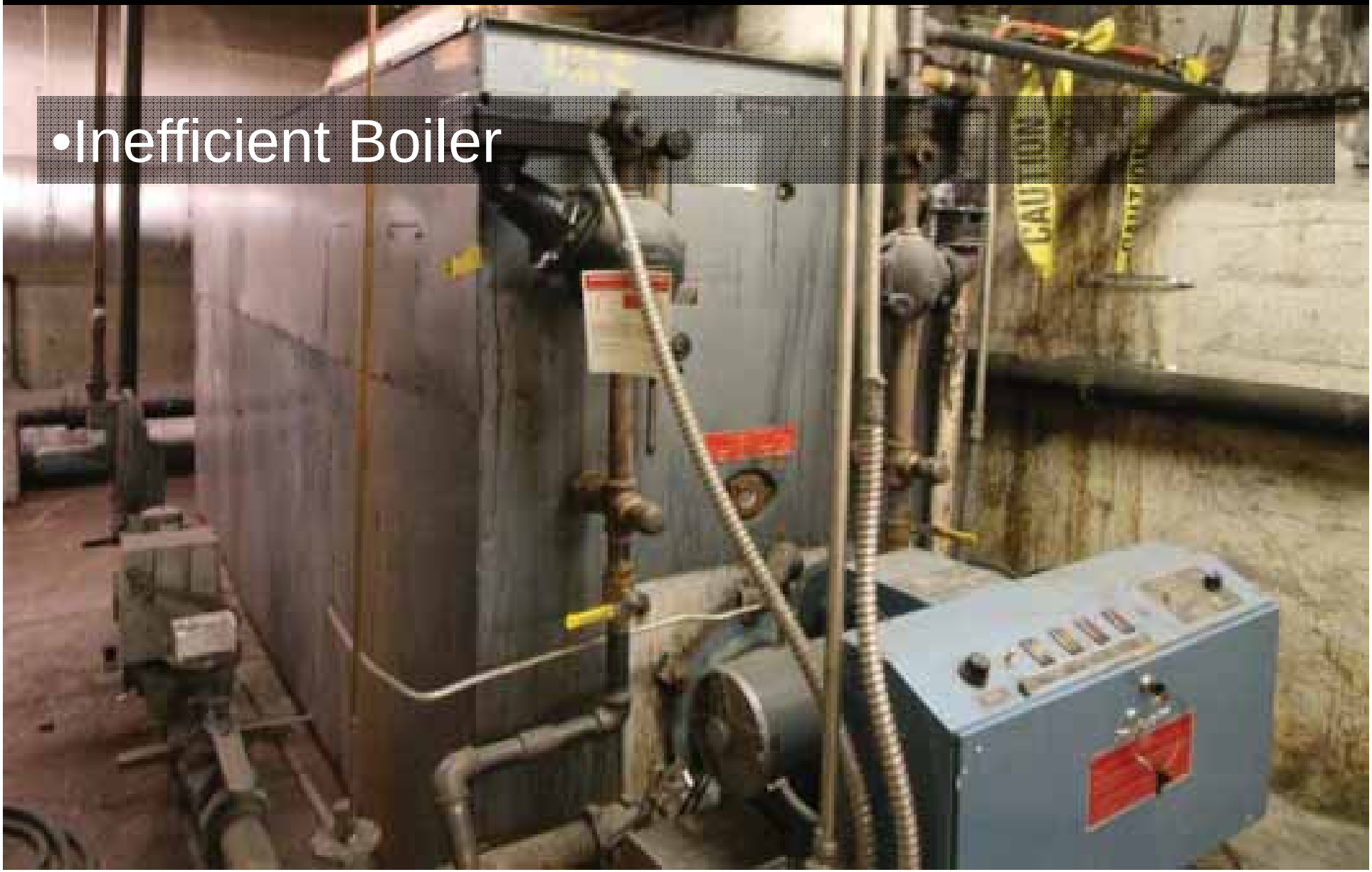
MARK O. HATFIELD BUILDING

Enclosure

- Window to Wall Ratio
- Thermal Bridging
- Frame
- Windows

MARK O. HATFIELD BUILDING

Mechanical

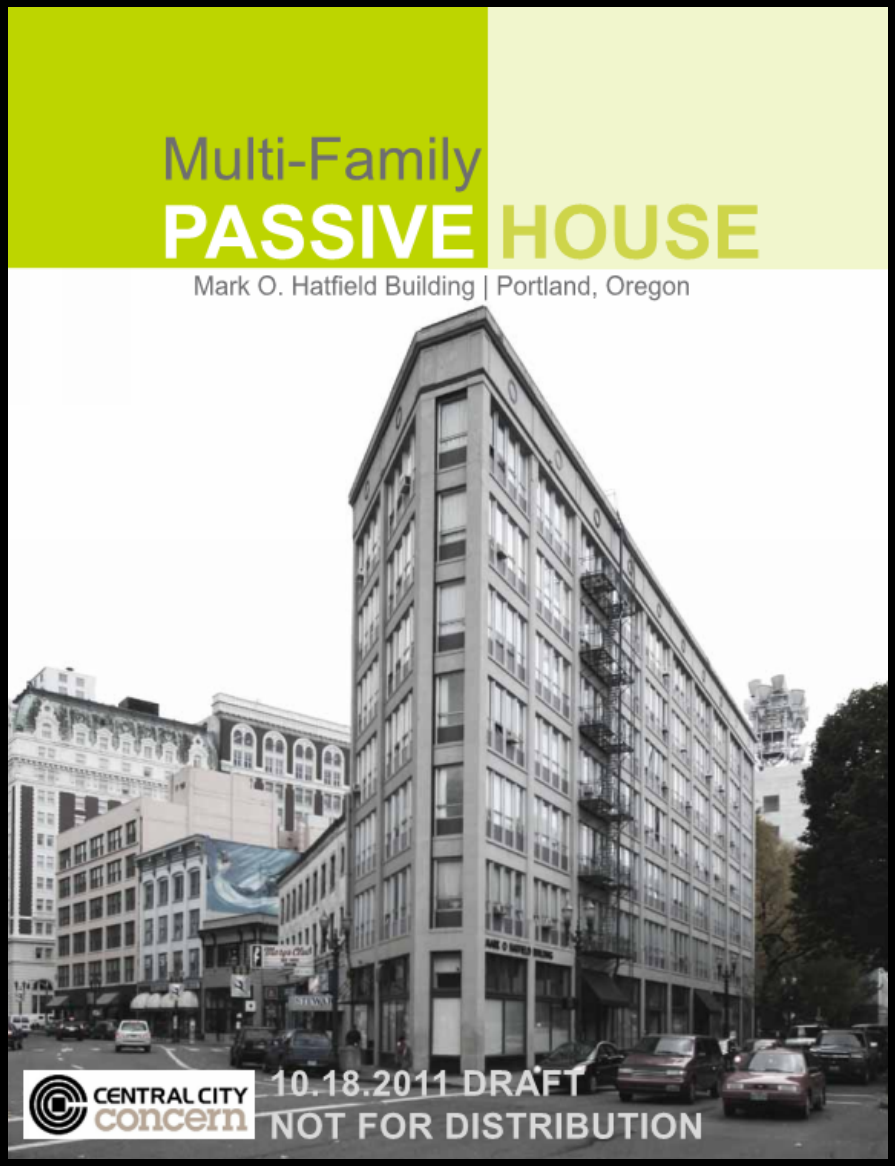


- Inefficient Boiler

MARK O. HATFIELD BUILDING
Mechanical

PASSIVE HOUSE FEASIBILITY

A Phased Approach to Deep Energy Retrofits



PAE CONSULTING ENGINEERS, INC.

SERA

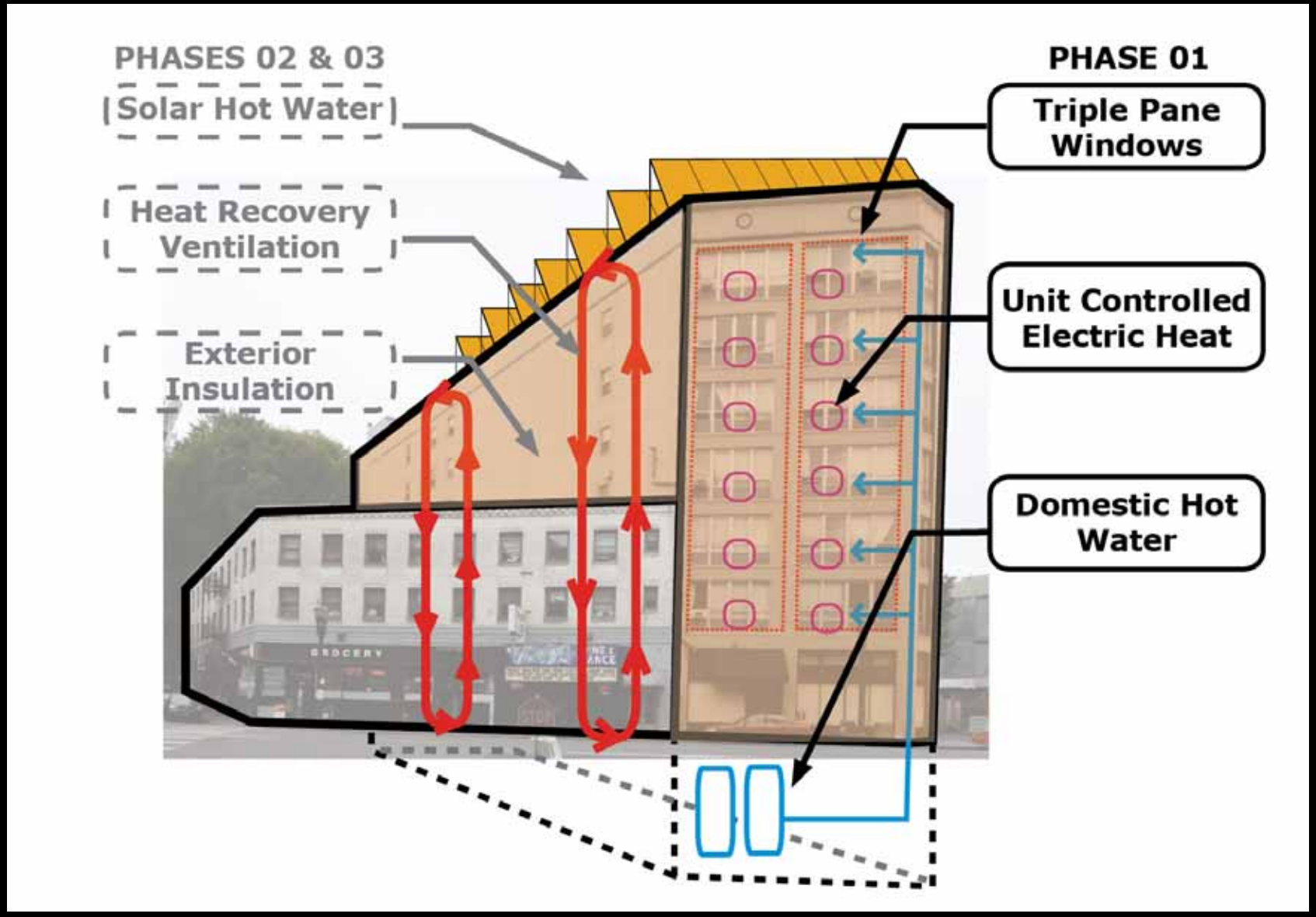
green hammer
DESIGN | BUILD | ENERGY

WALSH Construction Co.

CENTRAL CITY concern

BIG PICTURE PLANNING

The Ideal Package

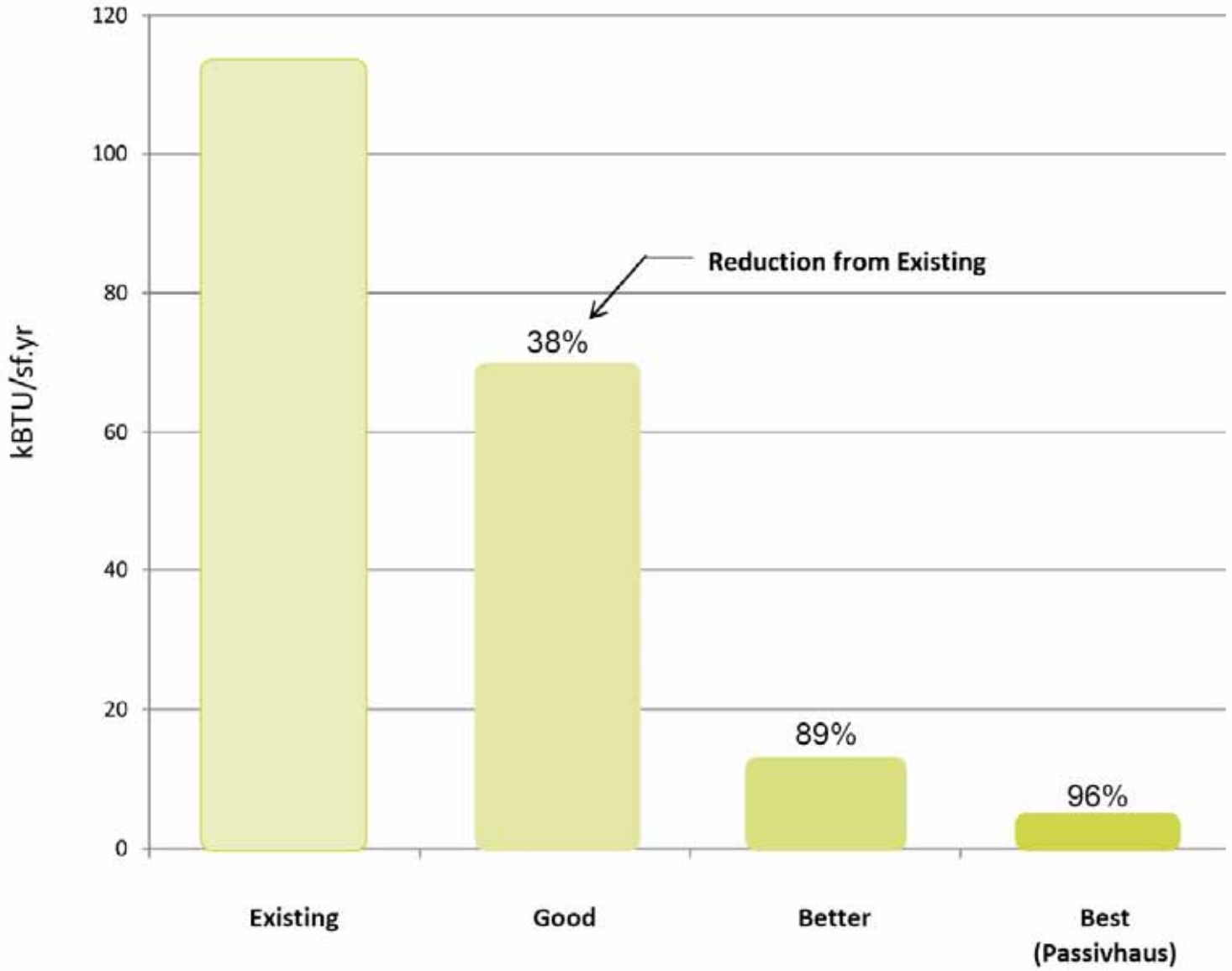


ASSEMBLY OPTIONS

	Existing Building	Good Rehab	Better Rehab	Best Rehab Passive House
Basement Slab Insulation	none	none	none	none
First Floor Insulation	none	none	none	none
Wall Insulation	none	none	2" EPS Exterior Insulation	6" EPS Exterior Insulation
Roof Insulation	Existing 4" Polyiso Board	Existing 4" Polyiso Board w/limited repair	Existing 4" Polyiso Board w/limited repair	Existing 4" Polyiso Board w/limited repair
Window Frame	Aluminum (not thermally broken)	Fiberglass (Cascadia 300 tilt/ turn)	Fiberglass (Cascadia 300 tilt/ turn)	Fiberglass/Vinyl (Rehau Geneo Euroline 4700)
Frame U-Value	unknown	0.289	0.289	0.14
Window Glazing	Single Pane	2-pane/Cardinal LoE 366 Argon	3-pane/Cardinal LoE 366/180 Argon	3-pane Rehau Geneo PHZ
U Value IGU	1.02	0.20	0.12	0.11
Airtightness (ACH at 50 pa)	10	5.00	0.60	0.60
Airtightness (cfm/ sf, 75a)			0.16	0.16

ENVELOPE PERFORMANCE STUDY

Annual Heating EUI (Source: Green Hammer)



COMPLETED PROJECT SCOPE

Phase 01

- Single pane windows replaced with Cascadia triple pane windows
- Windows and flashing designed to anticipate EIFS at a later date
- Mechanical ventilation designed to anticipate HRV at a later date
- Heating disconnected from oversized boiler and switched to unit electric heaters with connection to window watchers
- Installed new high efficiency DHW Heaters
- Concrete repair and air sealing
- Lighting upgrade in common areas (T12's to T8's and occupancy sensors)

Challenges

- **Site Access**
- **Safety**
- Contract Structure
- Size of Windows
- Unit Access/Timing


Challenges
•Site Access
•Safety
•Contract Structure
•Size of Windows
•Unit Access/Timing

Challenges

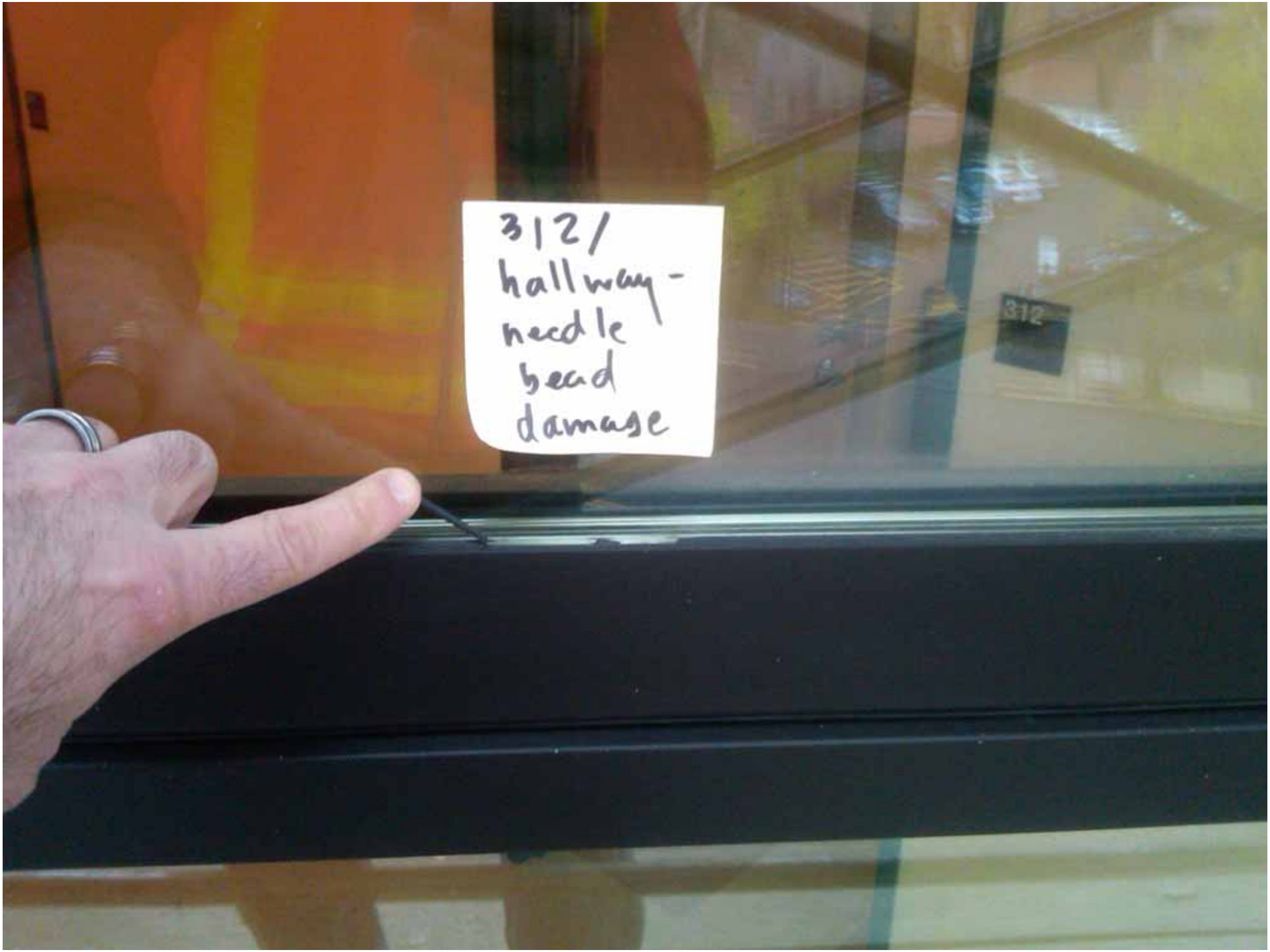
- Site Access
- Safety
- Contract Structure
- **Size of Windows**
- Unit Access/Timing

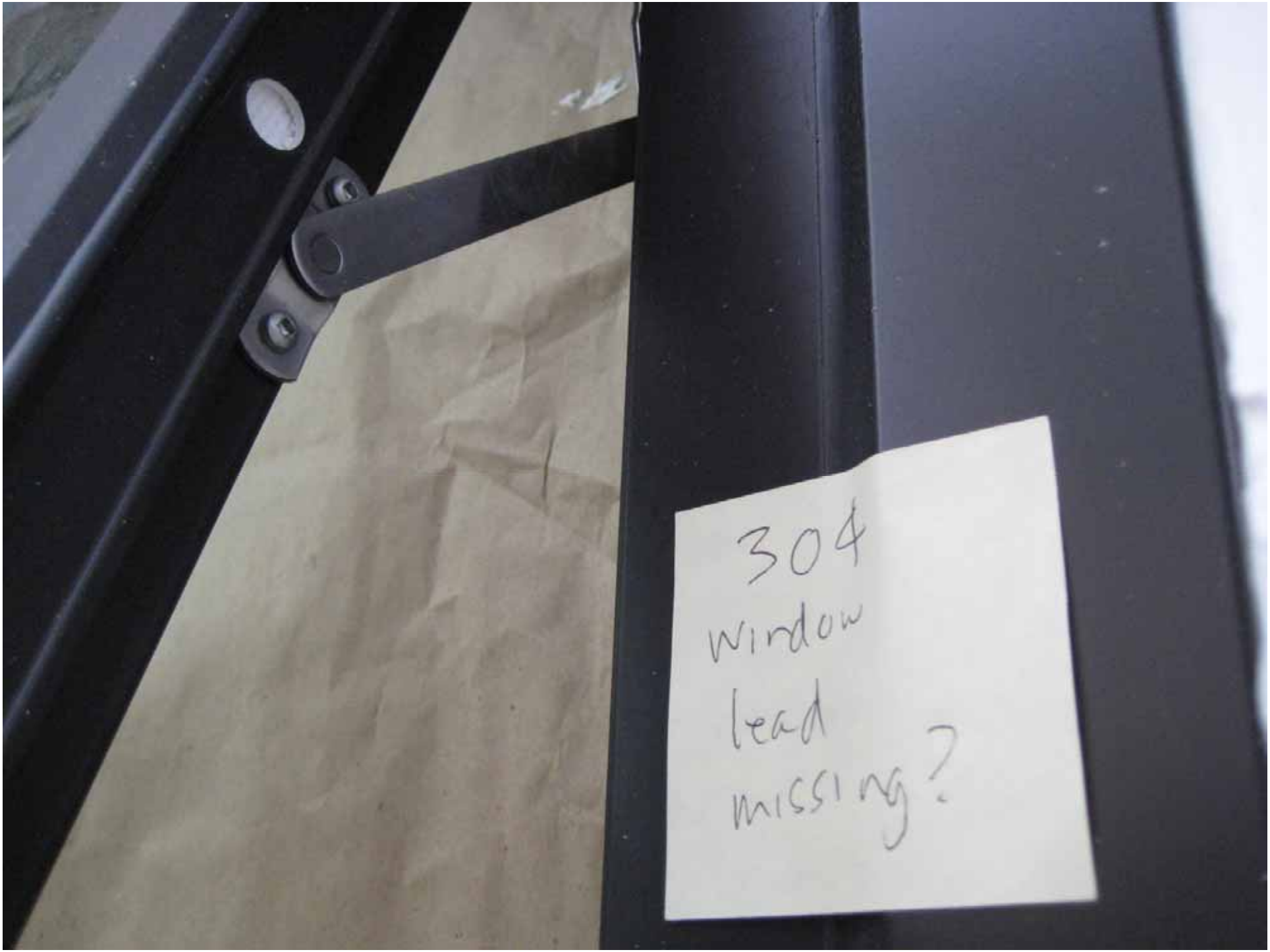

Challenges
•Site Access
•Safety
•Contract Structure
•Size of Windows
•Unit Access/Timing
08/22/2011

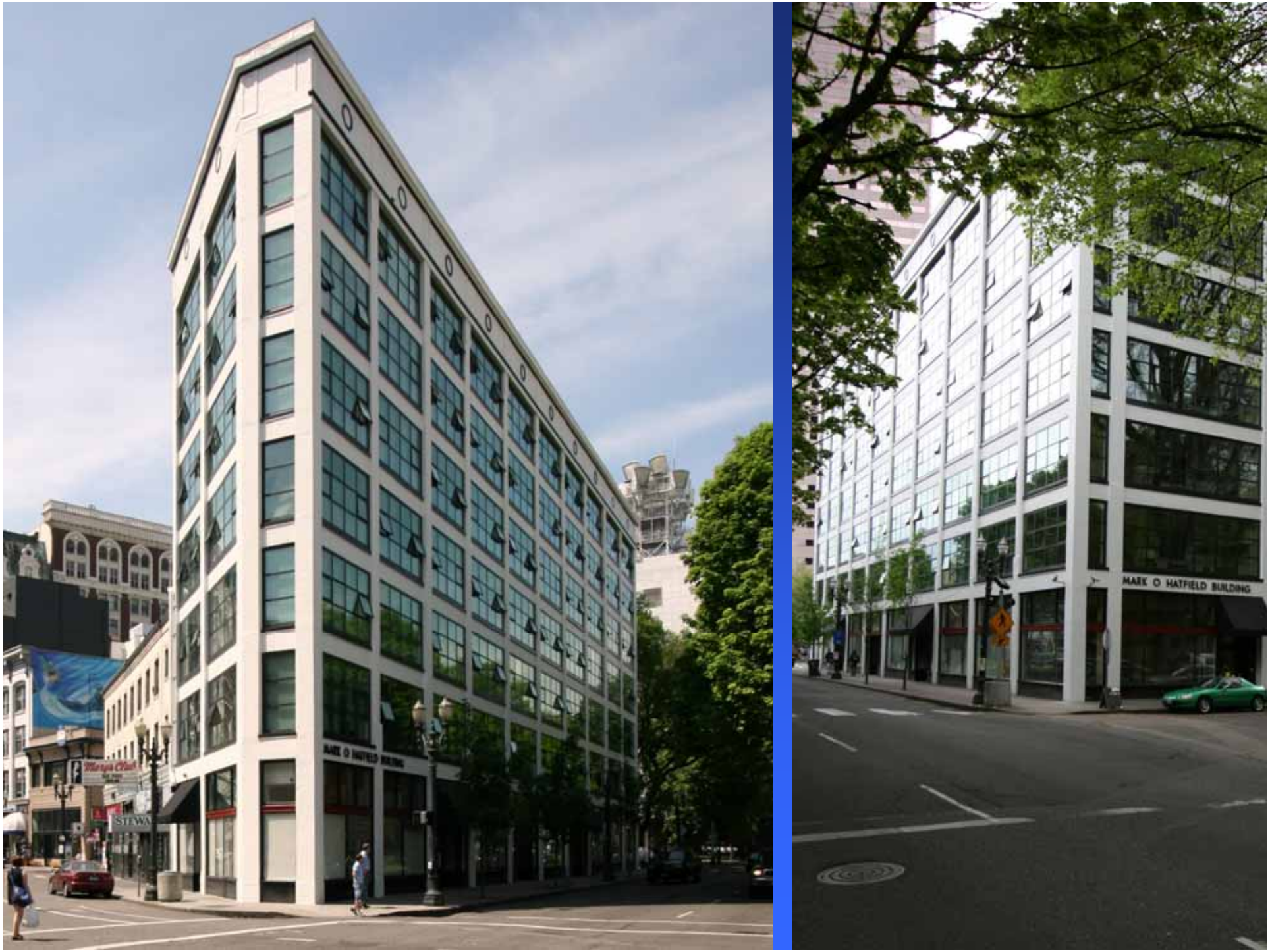

12/02/2011


12/02/2011


12/02/2011


312
312/
hallway -
needle
head
damage


304
window
lead
missing?


MARK O HATFIELD BUILDING

Test Date:	12-9-11	Formal Test Pressure:		Cycle #	Start Time	End Time	# Ingress	# Leaks	Pass / Fail
Week Day:	Friday	Pressure in psf:	9.70 psf	1	11:42	11:57	Ø	Ø	Pass
Specimen ID:	1	Equivalent Pa:	464 Pa		FINAL TEST RESULTS: Window: FULL PASS Installation: FULL PASS				
Level:	2	Equivalent "WC:	1.87" WC						
Unit #:	Commons	Velocity Pressure:	61.5 mph						
Elevation:	North	(+/-) Pressure:	(-)	Negative					
Location:	Break Room	Procedure (A):	Uniform	Static					
Documented Instances of Formal Leakage:			No	Ø					

TEST PHOTOS:

1

Audience members observe specimen performance from

2

View of exterior of test area where scaffolding had been

Air Leakage Testing of Mockup

	Air Density				
	(lb/ft^3)	Reference Density			
	0.078139286	0.075			
total flow Qt (cfm)	actual leakage Qs (cfm)	Opbr crack length L (ft)	Opbr rate of leak qL (cfm - ft)	Unit area A (ft^2)	Unit area rate of leak qA (cfm - ft^2)
14	1.041857143		#DIV/0!	116	0.008981527


49.6
37.3
FLIR


Sp3 34.7
Sp1 30.7
Sp2 30.2
47.4 °F
30.9

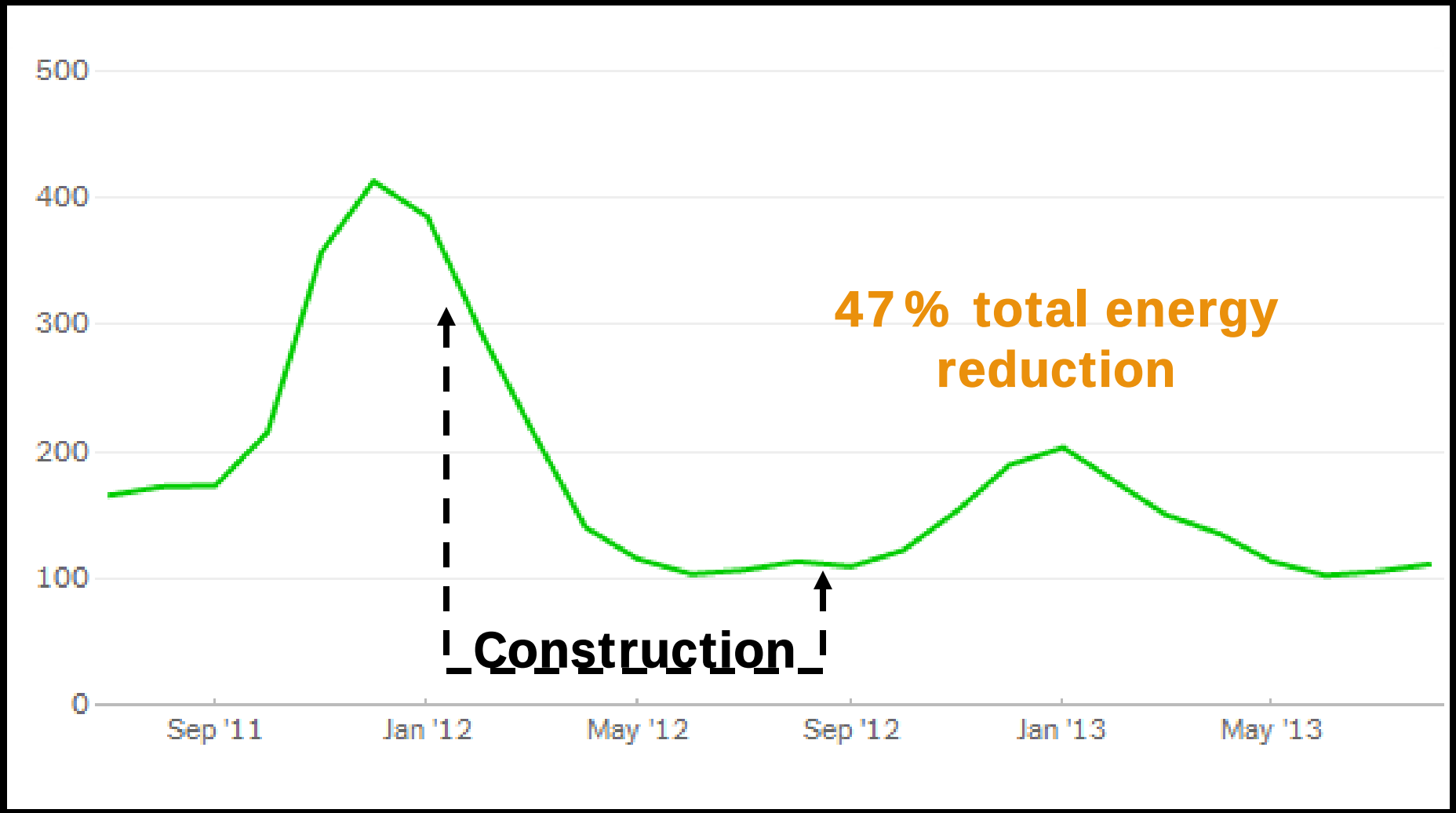

52.1
37.4
FLIR


47.1
36.4
FLIR


47.1
36.4
FLIR

PERFORMANCE

Total Energy Use (BTU's per Sq.Ft.)



PERFORMANCE

Dollars Per Occupant Per Year

Before Rehab: $770
After Rehab: $530
Savings: $240

Dollars Per Year (Whole Building)

Before Rehab: $81,620
After Rehab: $56,224
Savings: $25,396

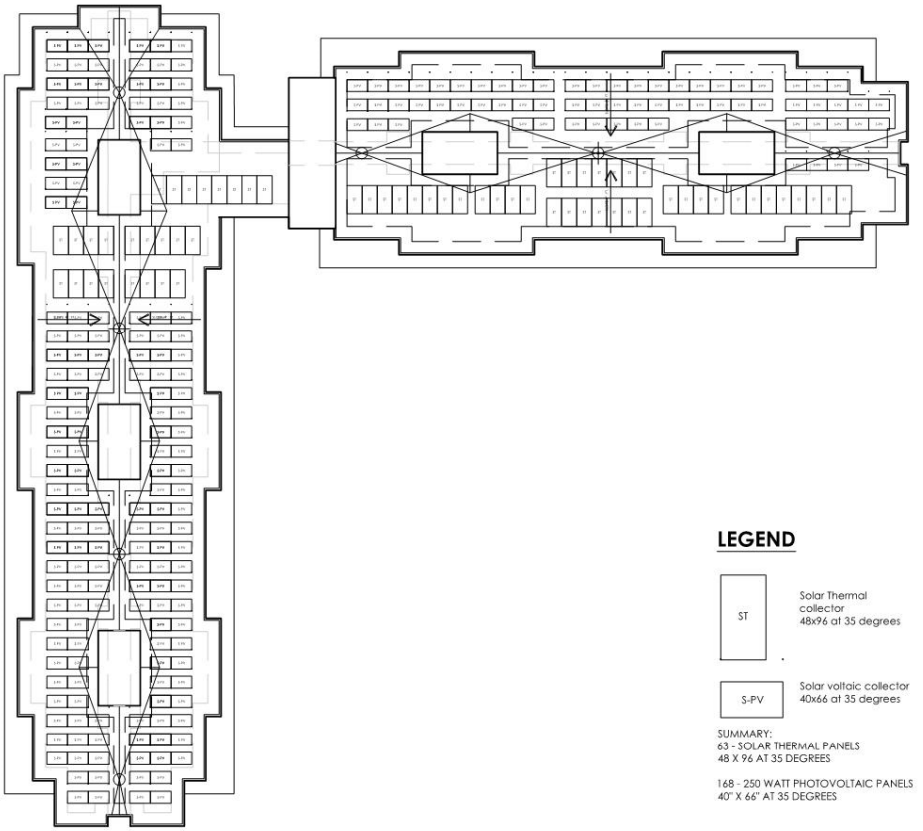
Percent Savings in Dollars Per Year: 31%

Someone Has to Measure and Know the Metrics

Orchards at Orenco
Passive House Construction


©SkyShots 2014

Design Stage Interface
REACH/Ankrom/WCC



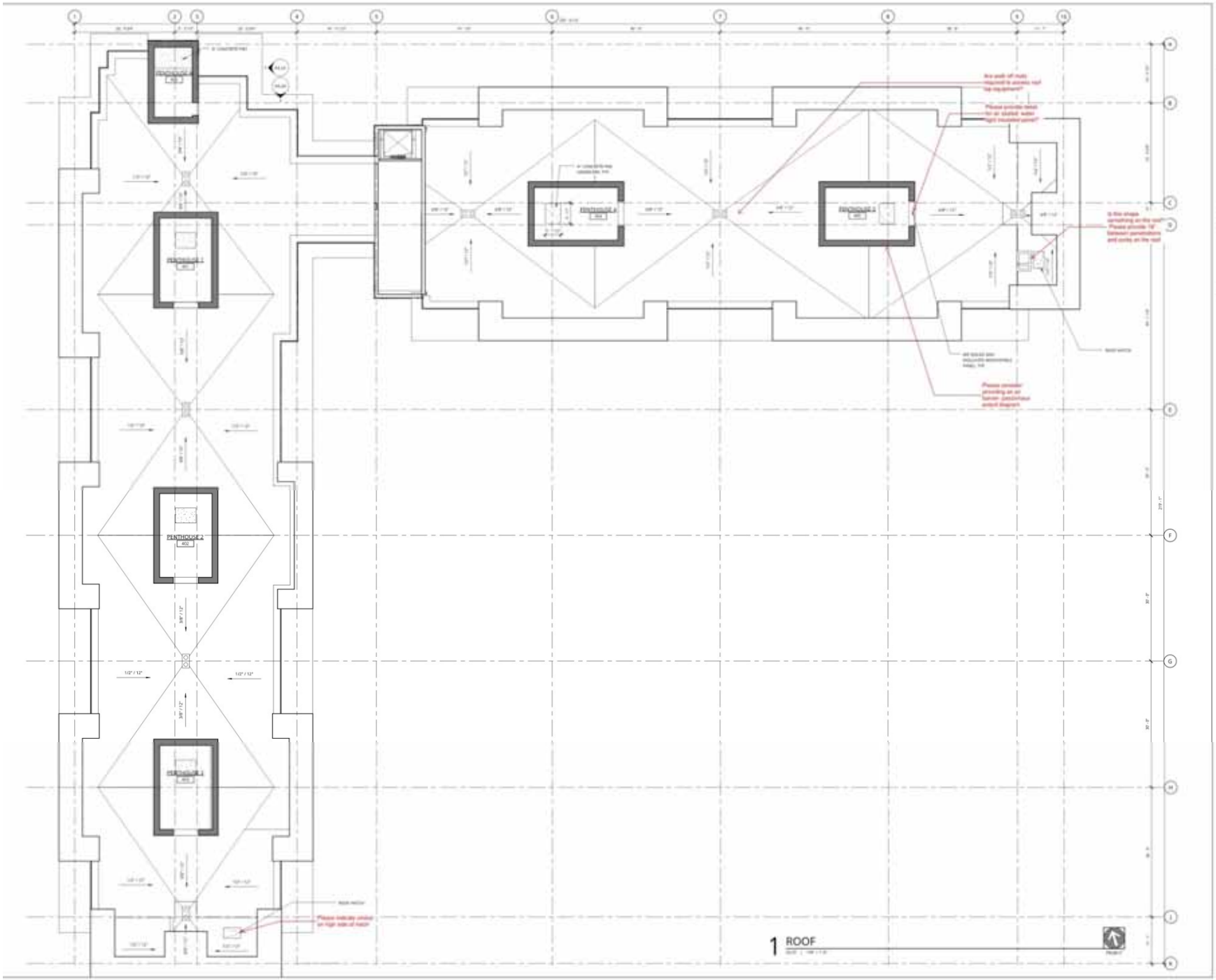
1 SOL2.3 SCHEMATIC SOLAR ROOF PLAN

SCALE: 1"=30'-0"

The Orchards at Orenco

william wilson architects
1010 SW ELEVENTH AVENUE, PORTLAND, OREGON
(503) 223-6693 Fax: (503) 274-0052 www.wwarchi

Courtesy Ankrom Moisan



1 ROOF

Ankrom Moisan

ORCHARDS AT ORENCO - PHASE I
NW 231ST AVENUE & CHERRY DRIVE HILLSBORO, OREGON

REACH COMMUNITY DEVELOPMENT

REVISION	DATE	REASON FOR ISSUE

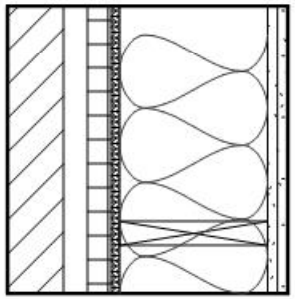
ROOF PLAN

DD SET

DATE 09/27/13
PROJECT NUMBER 130025
SCALE 1/8" = 1'-0"

DRAWING SHEET NUMBER A2.91

WOOD STUDS



BRICK VENEER
AIR SPACE
MINERAL FIBER INSULATION
WRB
PLYWOOD SHEATHING
WOOD STUDS
BLOWN-IN INSULATION
VAPOR BARRIER
GYPSUM WALLBOARD
GYPSUM WALLBOARD

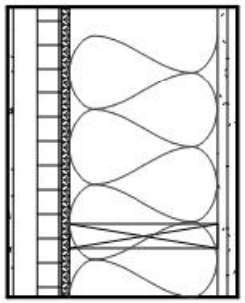
What is the vapor control layer material? Where in the specification is it called out?

If this wall is not rated, why are two layers of GWB required?

60A2

FIRE RATING / SOURCE: 0 HOUR

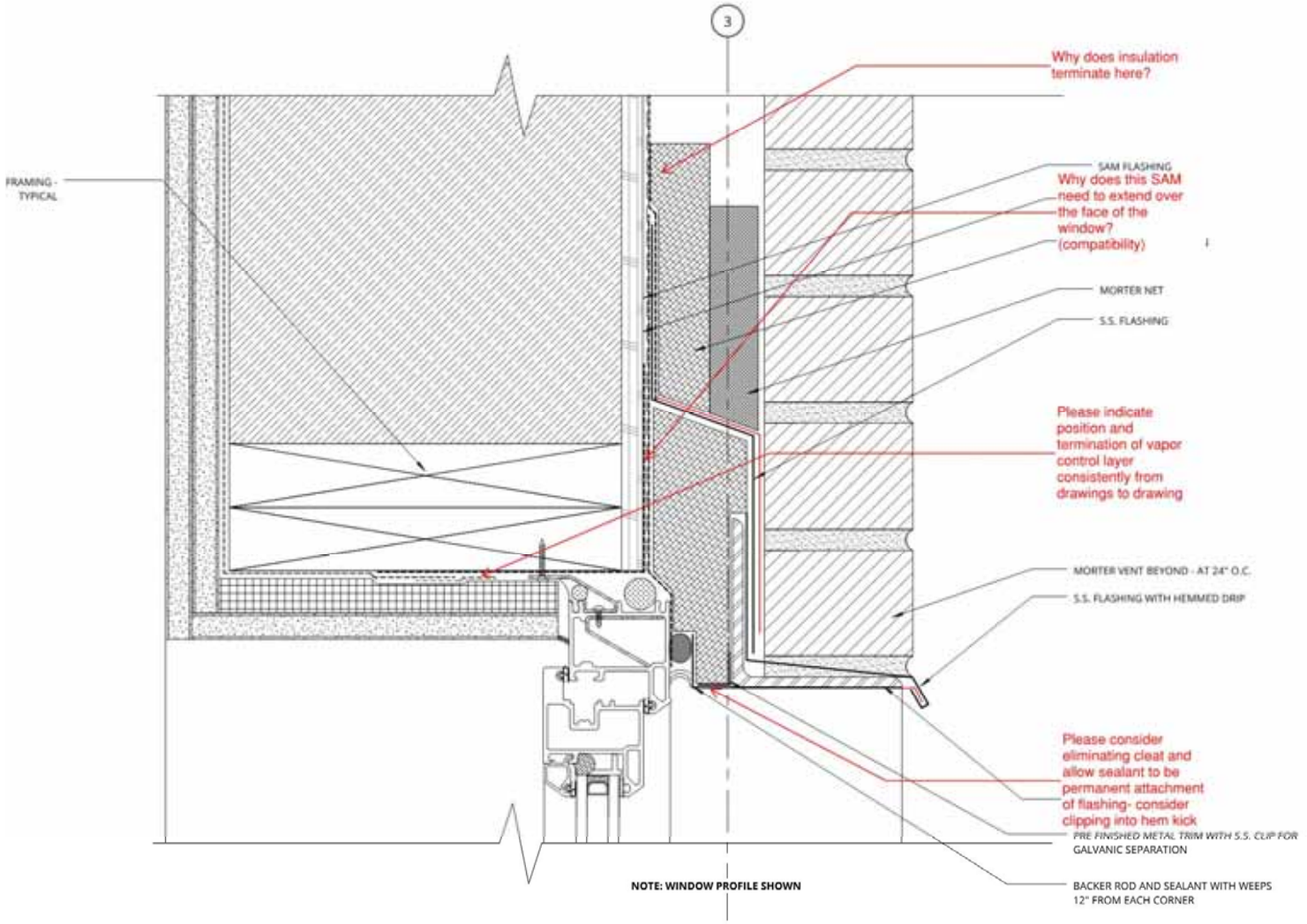
STC RATING / SOURCE:



FIBER CEMENT SIDING
AIR SPACE
MINERAL FIBER INSULATION
WRB
PLYWOOD SHEATHING
WOOD STUDS
BLOWN-IN INSULATION
VAPOR BARRIER
GYPSUM WALLBOARD
GYPSUM WALLBOARD

10 NON PH -WINDOW HEAD

A4.03 | 6" = 1'-0"



22 DTL SECT AT BRICK - DOOR SIM.

A4.03 | 6" = 1'-0"

ORCHARDS AT ORENCO - PHASE I

NW 231ST AVENUE & CHERRY DRIVE HILLSBORO, OREGON

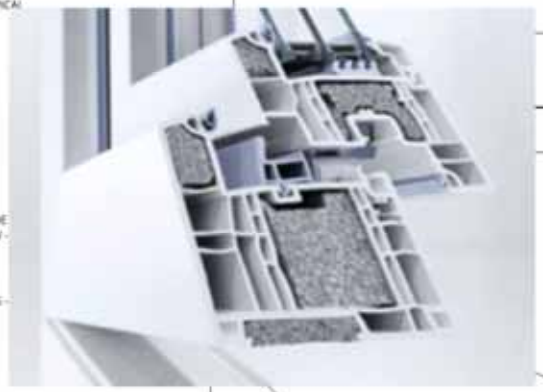
REACH COMMUNITY DEVELOPMENT

REVISION	DATE	REASON FOR ISSUE

DOOR DETAILS

DD SET

DATE	REVISION
09/27/13	
PROJECT NUMBER 134025	SHEET NUMBER A4.03
SCALE 6" = 1'-0"	



PT VERTICAL FURRING STRIP

EXTERIOR INSULATION

RIGID INSULATION

FOIL TAPE AT VAPOR BARRIER TERMINUS - TYPICAL

Note that the profile shown does not match specified window. Cascadia typically allows attachment through sill as shown- not sure if Euroline does- may be able to use their insert nail fin instead. Also need to see if the front of the window is properly supported

SAM FLASHING

SEE STRUCT. FOR FR

CONTINOUS SELANT AT INSIDE WINDOW -

SEE STRUCT. FOR FRAMING -

HEMMED EDGE WITH CLEAT AND CONTINUOUS SEALANT CONTINUE TO OUTSIDE FACE OF WINDOW TRIM - TYPICAL

RIGID INSULATION

FIBER CEMENT SIDING - SEE ELEVATIONS FOR EXPOSURE

PT VERTICAL FURRING STRIPS

EXTERIOR INSULATION

WRB

1 1/2"

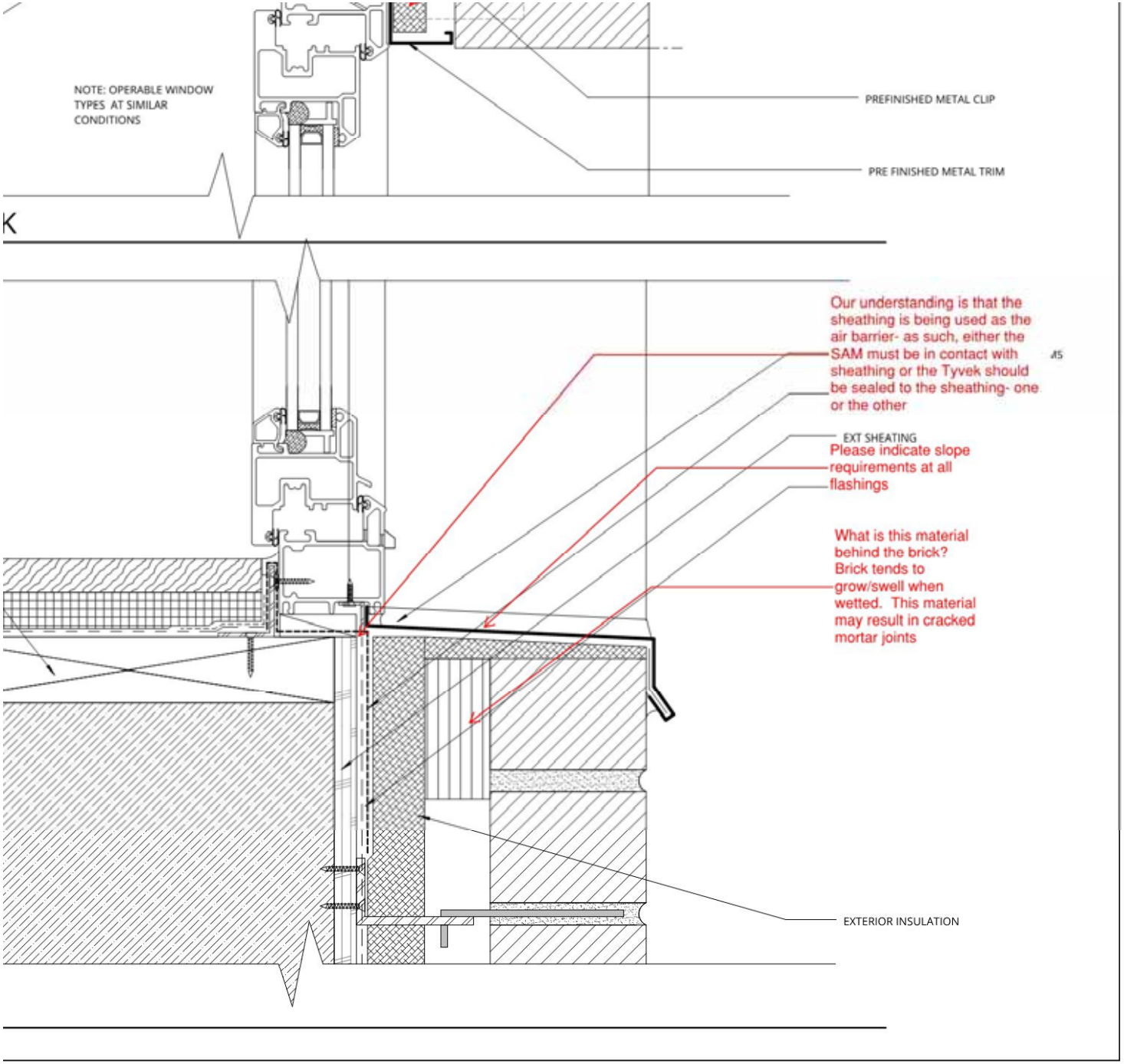
EXT SHEATING

FOIL TAPE AT VAPOR BARRIER TERMINUS - TYPICAL

C:\ Revit Projects\Orchards at Orenco\134025-14-Orchards Orenco_amandaa.rvt

19 DTL-SILL AT LAP SIDING

A4.12 | 6" = 1'-0"



ORCHARDS AT ORENC

NW 231ST AVENUE & CHERRY DRIVE

REACH COMMUNITY DEVELOPMENT

REVISION	DATE	REASON FOR ISSUE

WINDOW DETAILS

DD SET

DATE 09/27/13	REVISION
PROJECT NUMBER 134025	SHEET NUMBER A4.12
SCALE 6" = 1'-0"	

C. Firestone Building Products Co: Product: UltraPly TPO; www.firestonebpco.com.

D. Johns Manville Corporation; ST6RA series single ply: www.jm.com.

2.02 PERFORMANCE REQUIREMENTS

A. Installed roofing membrane and base flashings to remain watertight, resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. UL Class A for Roofing System.

C. Wind resistance to meet:
1. Factory Mutual (FM) Class 1-90. Membrane r
2. Wind Design Criteria: 80 mph, Exposure B.

This suggests a fully adhered system. This is an excellent application method, but is very sensitive to weather and may not be possible at the time of installation

2.03 MATERIALS

A. Membrane: Scrim-reinforced, thermoplastic polyolefin (TPO)-based sheet per ASTM D 6878 and bearing UL label on packaging.
1. Sheet Width: 120 inches minimum.
2. Thickness: 0.060 inch, nominal, when measured in accordance with ASTM D 751.
   a. Minimum weather surface thickness: 15 mils.
3. Color: White.
4. Breaking Strength: 366 lbf, when tested in accordance with ASTM D 751, Grab Method.
5. Elongation, ultimate, of unreinforced membrane (ASTM D 412, Die C): 500 percent.
6. Tear strength (ASTM D 751, Procedure B), 8 x 8 inch sample: 86 lbf
7. Brittleness test (ASTM D 2137, at minus 45 deg C): Pass.

PART 2 PRODUCTS

2.01 MATERIALS

A. As noted above in Related Requirements. Materials specified make up the air barrier system of the building to be inspected and tested.

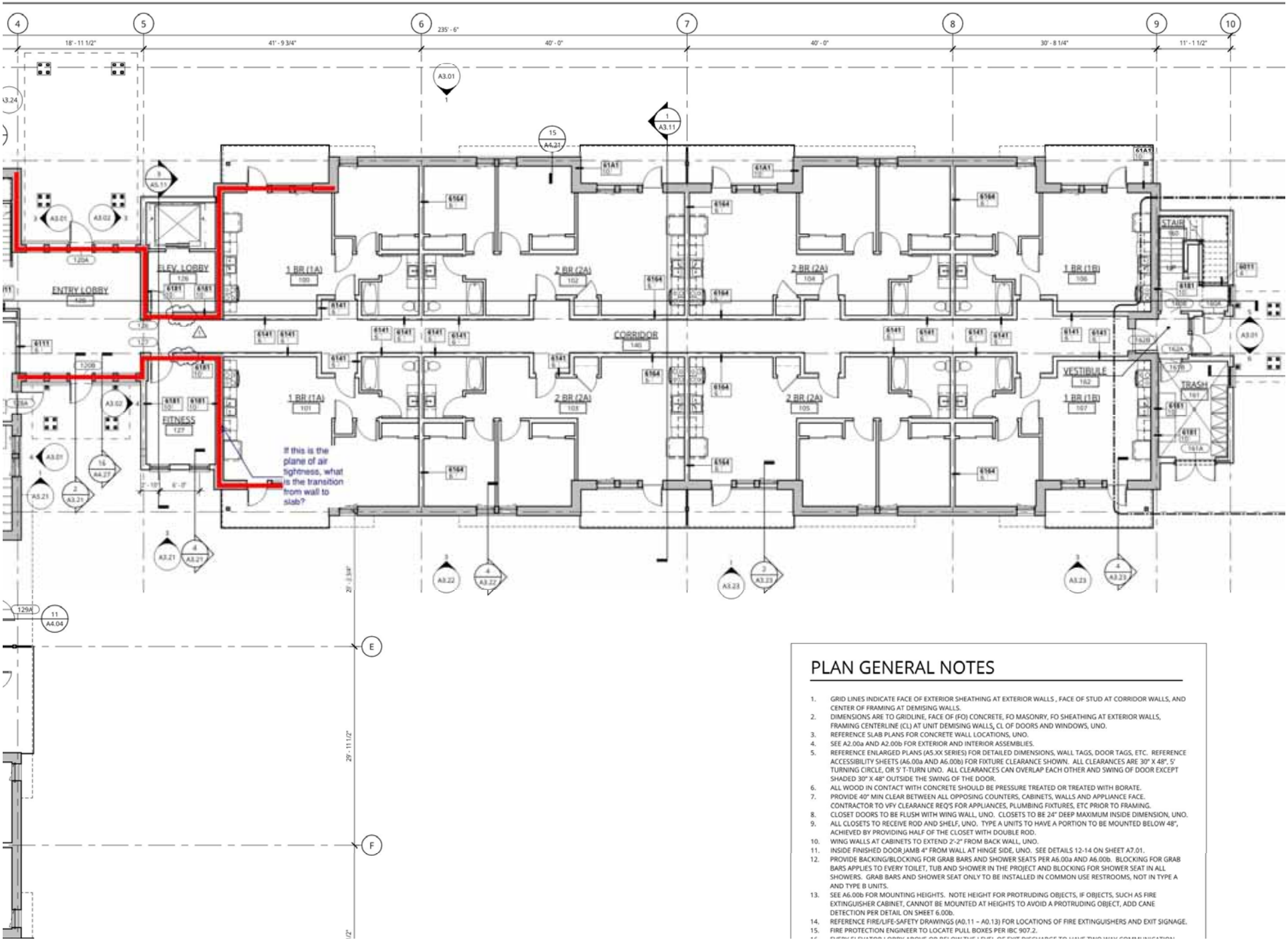
2.02 PERFORMANCE REQUIREMENTS

A. Materials:
1. Air barrier system materials in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft2 under pressure differential of 0.3 in. water (1.57psf) (0.0002 L/sm2 @ 75 Pa) when tested in accordance with ASTM E2178.

B. Assemblies of Materials and Components:
1. Air permeance not to exceed 0.04 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (0.002L/s.m2 @ 75 Pa) when tested in accordance with ASTM E1677 or E783.

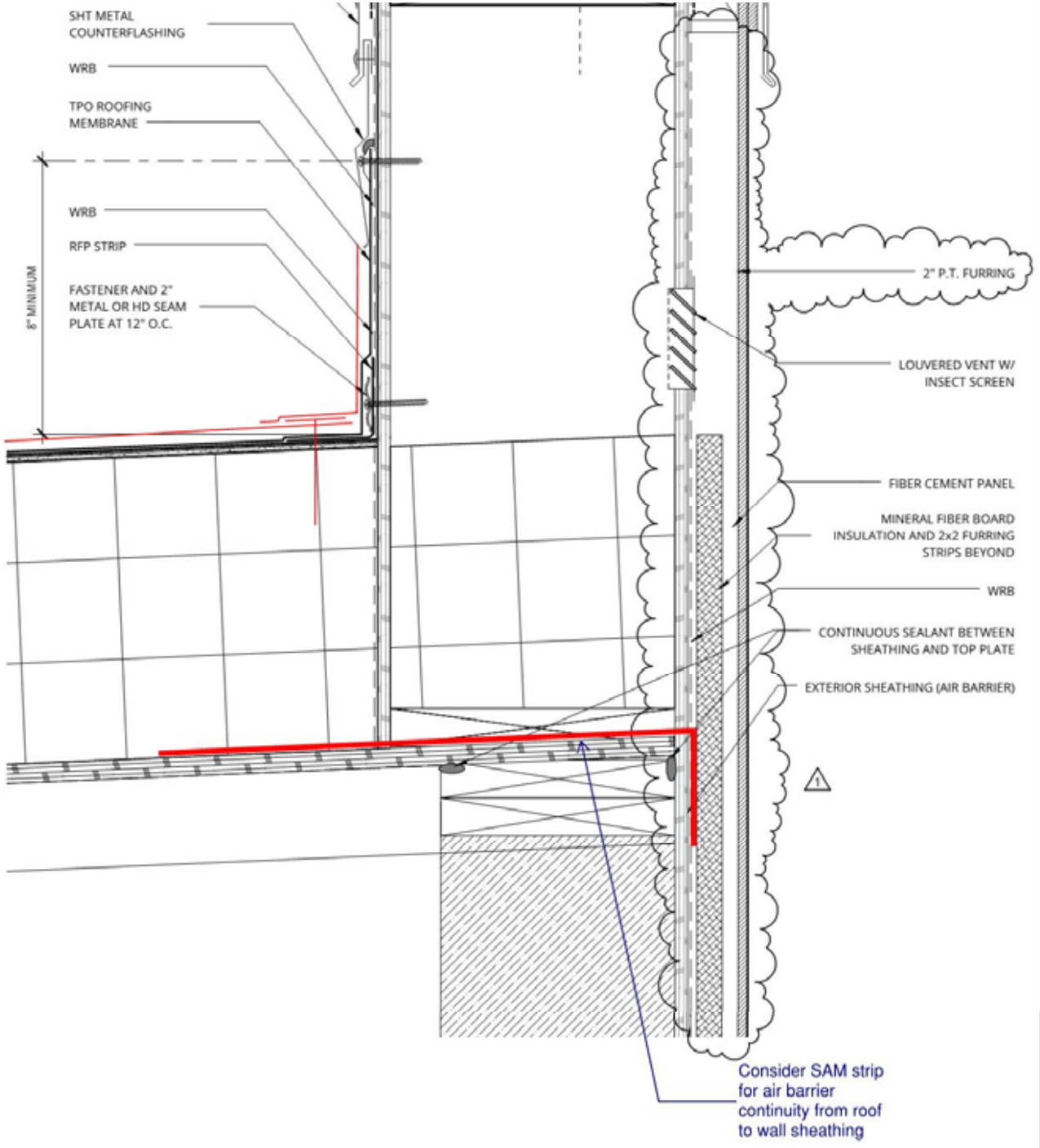
C. Air tightness Goal of Entire Building:
1. Air leakage of the entire building shall not exceed 0.40 cfm/sf under a pressure differential of 0.3 in. water (1.57psf)(0. 02L/sm2 @ 75 Pa) when tested according to

This goal seems low for passivhaus



PLAN GENERAL NOTES

1. GRID LINES INDICATE FACE OF EXTERIOR SHEATHING AT EXTERIOR WALLS , FACE OF STUD AT CORRIDOR WALLS, AND CENTER OF FRAMING AT DEMISING WALLS.
2. DIMENSIONS ARE TO GRIDLINE, FACE OF (FO) CONCRETE, FO MASONRY, FO SHEATHING AT EXTERIOR WALLS, FRAMING CENTERLINE (CL) AT UNIT DEMISING WALLS, CL OF DOORS AND WINDOWS, UNO.
3. REFERENCE SLAB PLANS FOR CONCRETE WALL LOCATIONS, UNO.
4. SEE A2.00a AND A2.00b FOR EXTERIOR AND INTERIOR ASSEMBLIES.
5. REFERENCE ENLARGED PLANS (A5.XX SERIES) FOR DETAILED DIMENSIONS, WALL TAGS, DOOR TAGS, ETC. REFERENCE ACCESSIBILITY SHEETS (A6.00a AND A6.00b) FOR FIXTURE CLEARANCE SHOWN. ALL CLEARANCES ARE 30" X 48", 5' TURNING CIRCLE, OR 5' T-TURN UNO. ALL CLEARANCES CAN OVERLAP EACH OTHER AND SWING OF DOOR EXCEPT SHADED 30" X 48" OUTSIDE THE SWING OF THE DOOR.
6. ALL WOOD IN CONTACT WITH CONCRETE SHOULD BE PRESSURE TREATED OR TREATED WITH BORATE.
7. PROVIDE 40" MIN CLEAR BETWEEN ALL OPPOSING COUNTERS, CABINETS, WALLS AND APPLIANCE FACE. CONTRACTOR TO VFY CLEARANCE REQ'S FOR APPLIANCES, PLUMBING FIXTURES, ETC PRIOR TO FRAMING.
8. CLOSET DOORS TO BE FLUSH WITH WING WALL, UNO. CLOSETS TO BE 24" DEEP MAXIMUM INSIDE DIMENSION, UNO.
9. ALL CLOSETS TO RECEIVE ROD AND SHELF, UNO. TYPE A UNITS TO HAVE A PORTION TO BE MOUNTED BELOW 48", ACHIEVED BY PROVIDING HALF OF THE CLOSET WITH DOUBLE ROD.
10. WING WALLS AT CABINETS TO EXTEND 2'-2" FROM BACK WALL, UNO.
11. INSIDE FINISHED DOOR JAMB 4" FROM WALL AT HINGE SIDE, UNO. SEE DETAILS 12-14 ON SHEET A7.01.
12. PROVIDE BACKING/BLOCKING FOR GRAB BARS AND SHOWER SEATS PER A6.00a AND A6.00b. BLOCKING FOR GRAB BARS APPLIES TO EVERY TOILET, TUB AND SHOWER IN THE PROJECT AND BLOCKING FOR SHOWER SEAT IN ALL SHOWERS. GRAB BARS AND SHOWER SEAT ONLY TO BE INSTALLED IN COMMON USE RESTROOMS, NOT IN TYPE A AND TYPE B UNITS.
13. SEE A6.00b FOR MOUNTING HEIGHTS. NOTE HEIGHT FOR PROTRUDING OBJECTS, IF OBJECTS, SUCH AS FIRE EXTINGUISHER CABINET, CANNOT BE MOUNTED AT HEIGHTS TO AVOID A PROTRUDING OBJECT, ADD CANE DETECTION PER DETAIL ON SHEET 6.00b.
14. REFERENCE FIRE/LIFE-SAFETY DRAWINGS (A0.11 – A0.13) FOR LOCATIONS OF FIRE EXTINGUISHERS AND EXIT SIGNAGE.
15. FIRE PROTECTION ENGINEER TO LOCATE PULL BOXES PER IBC 907.2.



PARAPET AT PH WALL

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Construction Stage Interface
REACH/Ankrom/WCC
Building Envelope Coordination

Detailed Agenda for Orchards Orenco

Building Envelope Coordination Meeting

6520 NE Cherry Dr Hillsboro
Tuesday, July 1st

1. General
- ❑ introductions / sign-up sheet

2. Schedule
- ❑ review overall construction schedule
- ❑ establish approximate start dates for all trades / review general sequencing of work
- ❑ establish dates for mockup construction & review

3. Submittal Procedures
- ❑ review submittal process & requirements for each trade
- ❑ review previously-issued approvals
- ❑ identify potential lead time issues
- ❑ review mock-up requirements

4. RFI / Clarification Procedures
- ❑ review RFI process & requirements
- ❑ establish process for resolving design issues / details not specifically addressed in drawings

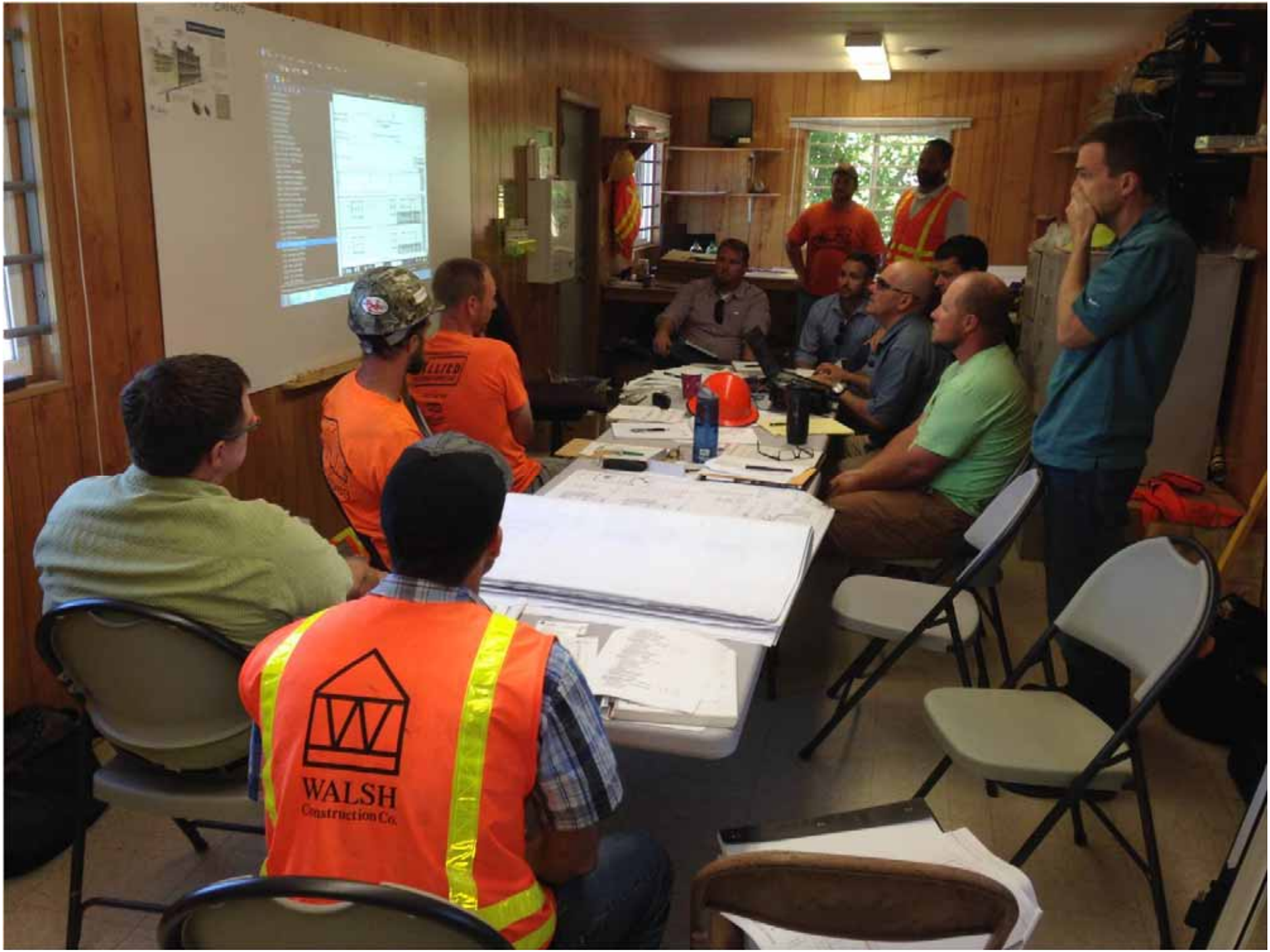
5. Framing and Air Barrier 8:30AM-9:30AM
Timberland, RDF, SIGA
- ❑ review specifications: **014010**
  - performance requirements
  - product requirements
  - installation requirements
  - submittal requirements
  - QA/QC requirements (including testing)
  - warranty requirements
- ❑ review drawings:
  - detail requirements A2.00d (6,9,12,15,18), A3.21 (1), A4.13 (7,13,15,19,21), A4.22, A4.26 (Esp 3)
- ❑ identify sequencing impacts on details
- ❑ review areas requiring coordination between trades
- ❑ identify design issues / details not specifically addressed in drawings

6. Roofing 9:00AM-10:00AM
Snyder, Firestone
- ❑ review specifications: **075413**
  - product requirements
  - installation requirements
  - submittal requirements
  - QA/QC requirements
  - warranty requirements
- ❑ review drawings:
  - detail requirements A4.23-A4.26
- ❑ identify sequencing impacts on details
- ❑ review areas requiring coordination between trades
- ❑ identify design issues / details not specifically addressed in drawings

7. Sheet Metal Roofing 9:30AM-10:30AM
Brown Sheet Metal
- ❑ review specifications: **074113, 076200**
  - product requirements
  - installation requirements
  - submittal requirements
  - QA/QC requirements
  - warranty requirements
- ❑ review drawings:
  - detail requirements A4.22, A4.23, A4.25
- ❑ identify sequencing impacts on details
- ❑ review areas requiring coordination between trades
- ❑ identify design issues / details not specifically addressed in drawings

8. Interior Insulation 10:30AM-11:15AM
JB Insulation
- ❑ review specifications: **072126**
  - performance requirements
  - product requirements
  - installation requirements
  - submittal requirements
  - QA/QC requirements (including testing)
  - warranty requirements
- ❑ review drawings:
  - detail requirements A4.13, A2.00d
- ❑ identify sequencing impacts on details
- ❑ review areas requiring coordination between trades
- ❑ identify design issues / details not specifically addressed in drawings

9. WRB, Exterior Insulation, Cladding 11:00AM-2:30PM
Matson, Dupont, Hardie, Roxul
For each roofing type:
- ❑ review specifications: **072505, 074646, 072100**
  - product requirements
  - installation requirements
  - submittal requirements
  - QA/QC requirements


WALSH
Construction Co.

Framing and Air Barrier

Schedule/General

1. Schedule: Completion June 2015. Currently working on below slab and foundation construction. Framing begins on August 9th (mobilization). Roof sheathing to be completed by November 1, 2014. RDF will be taping seams in the sheathing as the sheathing is installed. Main slab on grade pour begins mid July.
2. **Timberland** indicated that there may be a lead time with 2x10 KD lumber and will look into need to order early.

Drawing Review

1. 11/A4.23- sealant as the air barrier transition to be changed to SAM pre-strip (PW 100/40- 18" strip) prior to placing parapet framing. Parapet bottom plate to be set in sealant on SAM to minimize air leakage from nail holes.
2. LTT 19 shown on 11/S503 to be detailed with sealant around penetration and bottom plate of strap to complete air tightness.
3. **WCC to RFI** Stonewood regarding minimizing fasteners through bottom plate of parapet framing.
4. **WCC to RFI** if drywall clips can be used in lieu of blocking shown on 6/A2.00d to allow for installation of insulation in stud cavity.
5. 2/S501- sequence requires 24" strip of vapor barrier prior to installation of 2.25" x3/4" rip of plywood and pre-rock (GWB) prior to installation of joists.
6. 18/A2.00d- sealant to be installed at gaps in floor sheathing to complete air barrier (**WCC**).
7. 15/A2.00d- fire caulking is not required at sheathing gap at floor line- SIGA tape to be installed over backer rod at these locations.
8. 11/A4.22- Timberland to add blocking for strip vents 5.25" back from inside face of fascia (2 pieces- one either side of strip vent).
9. 3/A4.26- 2x4 wall framing to be installed after air barrier construction is complete at the 2x10 sheathed wall. **Timberland/RDF**

Roofing

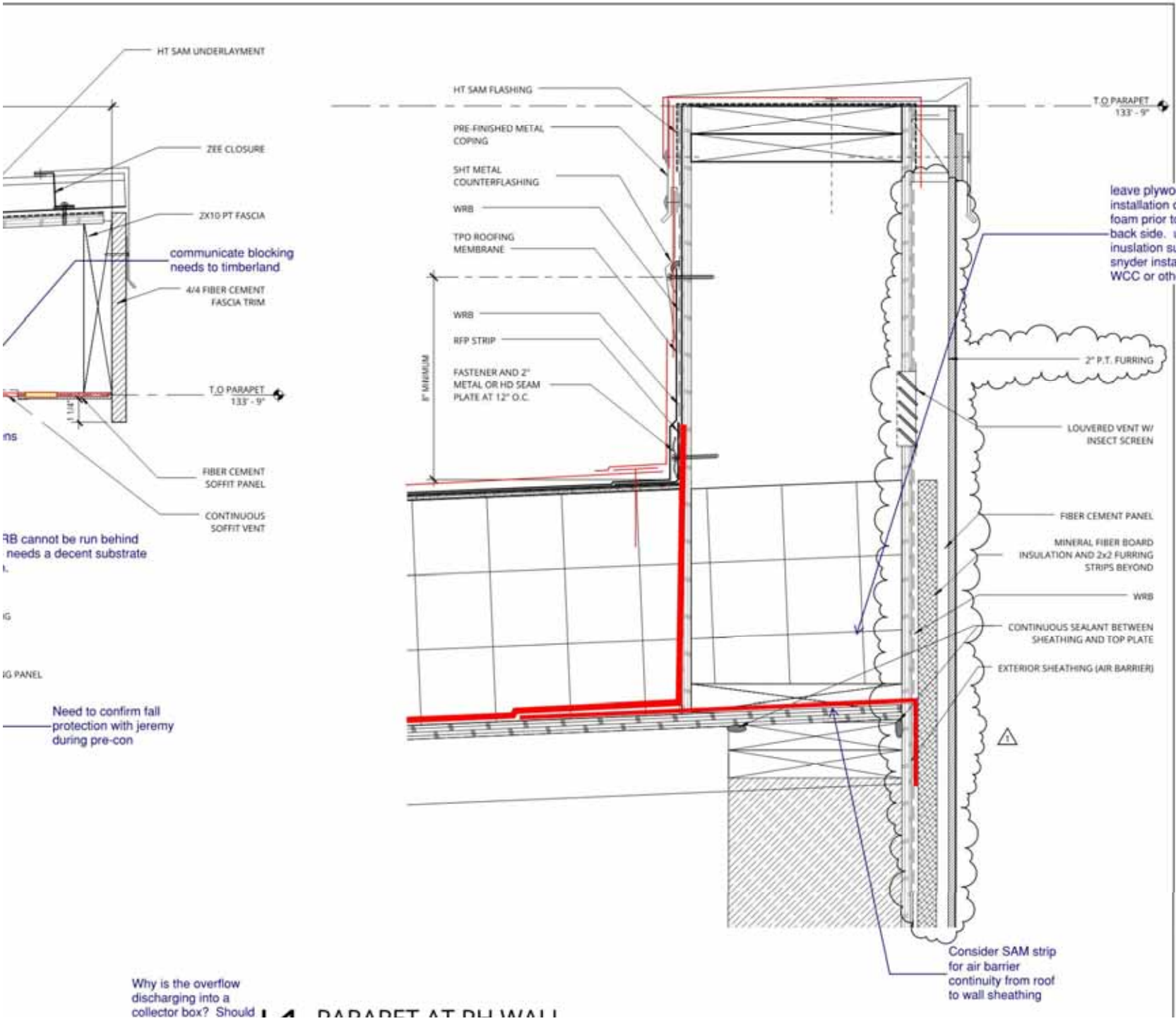
Schedule/General

1. Project is to be complete June 2015
2. Vapor barrier installation is to begin November 6, 2014 in zone 1.
3. Roof installation (zone 1) is to be complete December 18, 014.
4. Roof installation (zone 2) starts November 13, 2014 and must be completed by January 15, 2015.
5. Installed roof membrane must be protected from HVAC and sheet metal trades by a layer of ¾" rigid insulation topped with ½" plywood at roof entries, all walkway areas and around mechanical equipment.
6. Snyder to review substrate prior to installation of vapor barrier and after insulation installation to eliminate areas of ponding water.
7. Minimum temperature to install TPO- 50F. Team is considering installing SBS modified asphalt roofing, which has a minimum temperature for installation of 40F. Owner to review costs and durability considerations.

Roofing Specification and Drawing/Installation Review

1. System is a fully adhered Firestone Ultra Ply TPO.
2. System consists of 4'x4' Dens Deck boards fully adhered followed by three layers of insulation with seams staggered installed with adhesive or hot asphalt below TPO membrane. Base layer of insulation will be 4'x8' sheets followed by 4'x4' sheets.
3. **Snyder** is to supply a cost for leak detection- ILD.
4. 075413 1.09 manufacturer's inspections to be scheduled by **Snyder** with WCC present.
5. 075413 1.10 C warranty language must be verified by **Snyder** ("building materials or contents damage").

3. Bid proposal includes borate treated 1x4 furring. Need to confirm if Comfort Board IS or Rockboard 80 is to be used (**WCC RFI**).
4. Need to verify fastener attachment of furring with Stonehard Design. Need to verify if dimensional lumber or plywood for furring was assumed. Also need to verify that borate treatment is acceptable (**WCC RFI**).
5. Quickflash will be used for hose bibs and electrical penetrations.
6. A hose bib and electrical outlet shall be added to the mock up construction.
7. All penetrations need to be detailed with Siga Wigluv at the sheathing to complete air tightness (**RDF**).
8. Sonolastic 150 (Master Seal 150) to be used between window and trim and from siding to trim. Pre-construction adhesion testing to be conducted prior to mock up (**Nick/Atlas/BASF**).
9. Need to verify temporary fastening of semi rigid insulation prior to installation of furring members (**WCC**).
10. 085313 2.02- Performance criteria to be verified (in accordance with energy model) through shop drawing review process (**AM, GH, WCC**).
11. 085313 2.03 F- Back dam to be 18 gauge supplied by Euroline.
12. 085313 2.03 – Michael Bonn would like to see if 60% and 70% screens are available in addition to the 80% submitted. (**Euroline**)
13. 085313 3.03 B- QED has issued a testing proposal that is acceptable to AM/HDC.
14. 1/A4.12 Euroline noted their concerns about use of spray foam at rough openings, which may present window drainage problems. Concerns were duly noted- **GH** to confirm if deletion of spray foam is acceptable within PHIUS model.
15. 4/A4.12- Details need to be revised to provide adequate drainage at flashing behind lintel and to provide uniform interface of windows, cladding and flashing (**MS/WCC** to provide suggested revised details for review).
16. 13/A4.12- Vapor barrier is not taped to the window pre-wrap. Team to consider using Hardie Trim Tabs for construction of window trims- verify on mock up.
17. 16/A4.12- Nee to verify if air seal will be constructed using Dow 795 or CWS (**WCC RFI**). Both exterior joints to be installed by NWMR.
18. 19/A4.12- Joint between flashing and trim to be re-configured to provide movement capacity (**MS** sketches).
19. 22/A4.12- Flashing terminates at jambs with down turn leg to support sealant from brick to flashing- joint to be installed by NWMR. We need to determine how cleat at brick is fastened- confirm with Brown Sheet Metal (**WCC/Brown**).
20. 16/A4.13- Sealant is currently shown installed to furring- this detail needs to be re-configured to allow installation of sealant to trim (**WCC RFI**).
21. 19/A4.13- Vapor barrier needs to be installed as part of exterior wall framing- prior to interior suds.
22. 22/A4.13- **WCC RFI** if sealant is to be installed from window to flashing as shown in other typical details.
23. 24/A4.13- Sill detail should be similar to passive house window sill/brick detail.
24. 15/A4.21- Sealant as shown to be deleted at bottom of sheathing. Please consider extending sheathing to bottom of plate so that fewer transitions in SAM are required. Sam to be installed 6" onto plywood and then down concrete to below FERO clip. **B+B** to determine if thinner brick can be used at angle to allow for better drainage.
25. 17/A4.21- Area of brick cavity below through wall flashing at level 1 slab to be slugged solid with mortar (**WCC RFI**).
26. 19/A4.21- Although non passive house, this area needs to be air tight- extend SAM onto face of sheathing 6" at bottom of wood sheathing. SAM to extend 6" above top of mortar net. Below grade flashing is to terminate with a straight hem, not a kick as shown.
27. 7/A4.22- Sequence of installation of fiber cement trim needs to be reviewed- currently, the trim can neither be installed in sequence nor painted (**WCC RFI**).
28. 9/A4.22- **WCC RFI** type of paint to be used on exposed PT lumber.
29. 13/A4.22- It was suggested that flashing from cladding onto roof be constructed as a through wall flashing (**WCC RFI**).



L4 PARAPET AT PH WALL

REGISTERED ARCHITECT
STATE OF OREGON

Ankrom Moisan

6720 SW MACADAM AVENUE, SUITE
PORTLAND, OR 97219
T 503-245-7100

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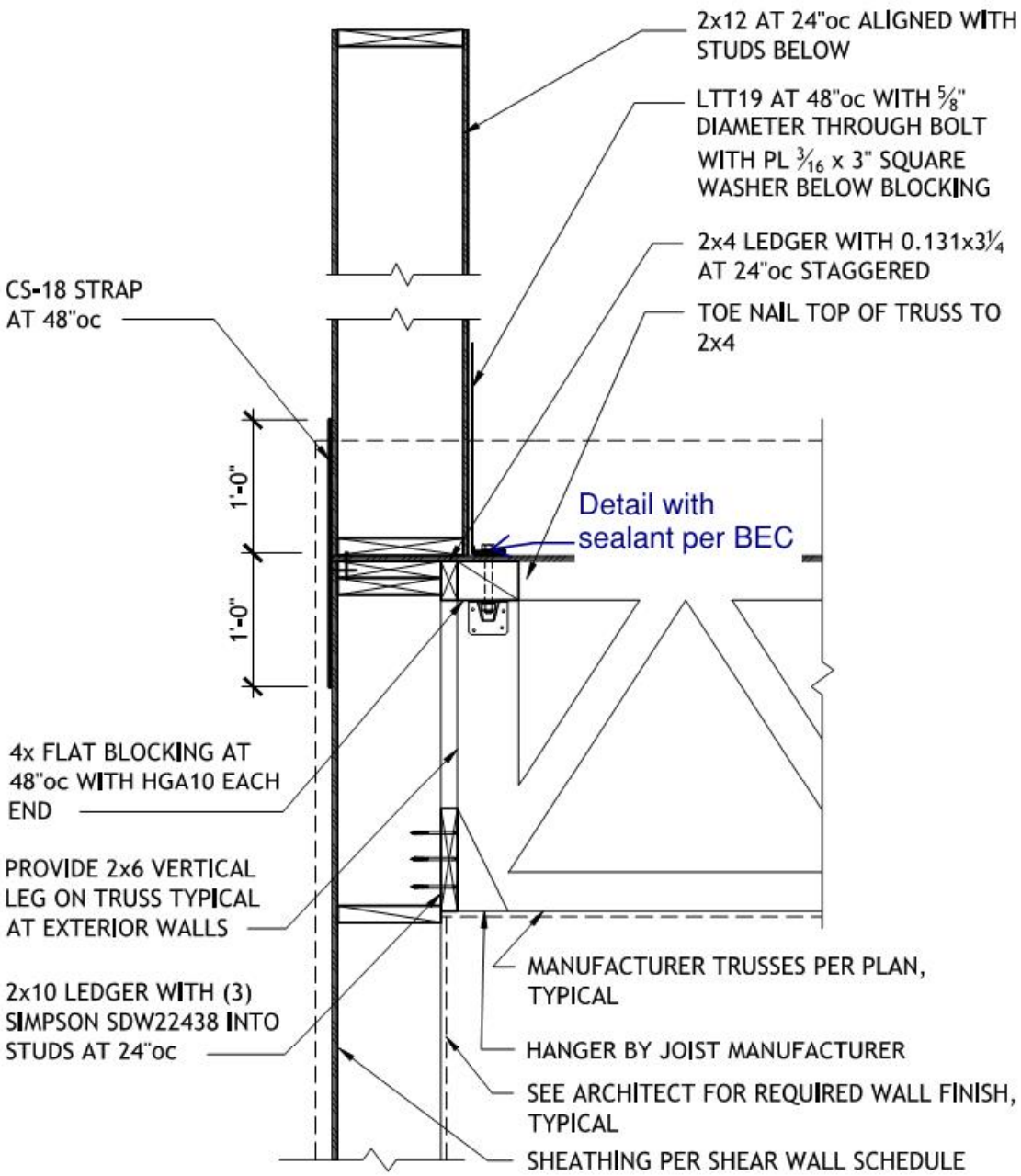
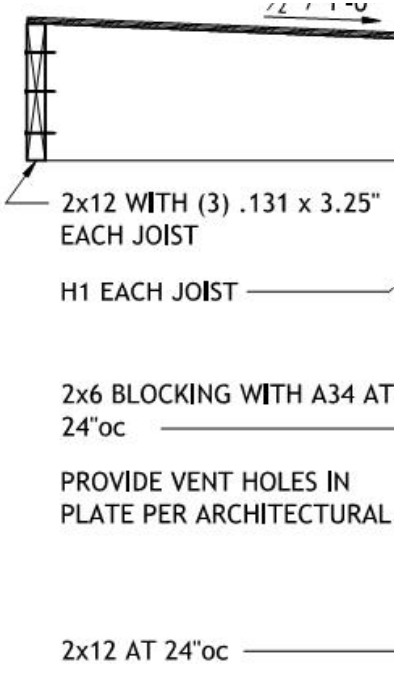


11 EXTERIOR WALL AT ROOF

3/4" = 1'-0"



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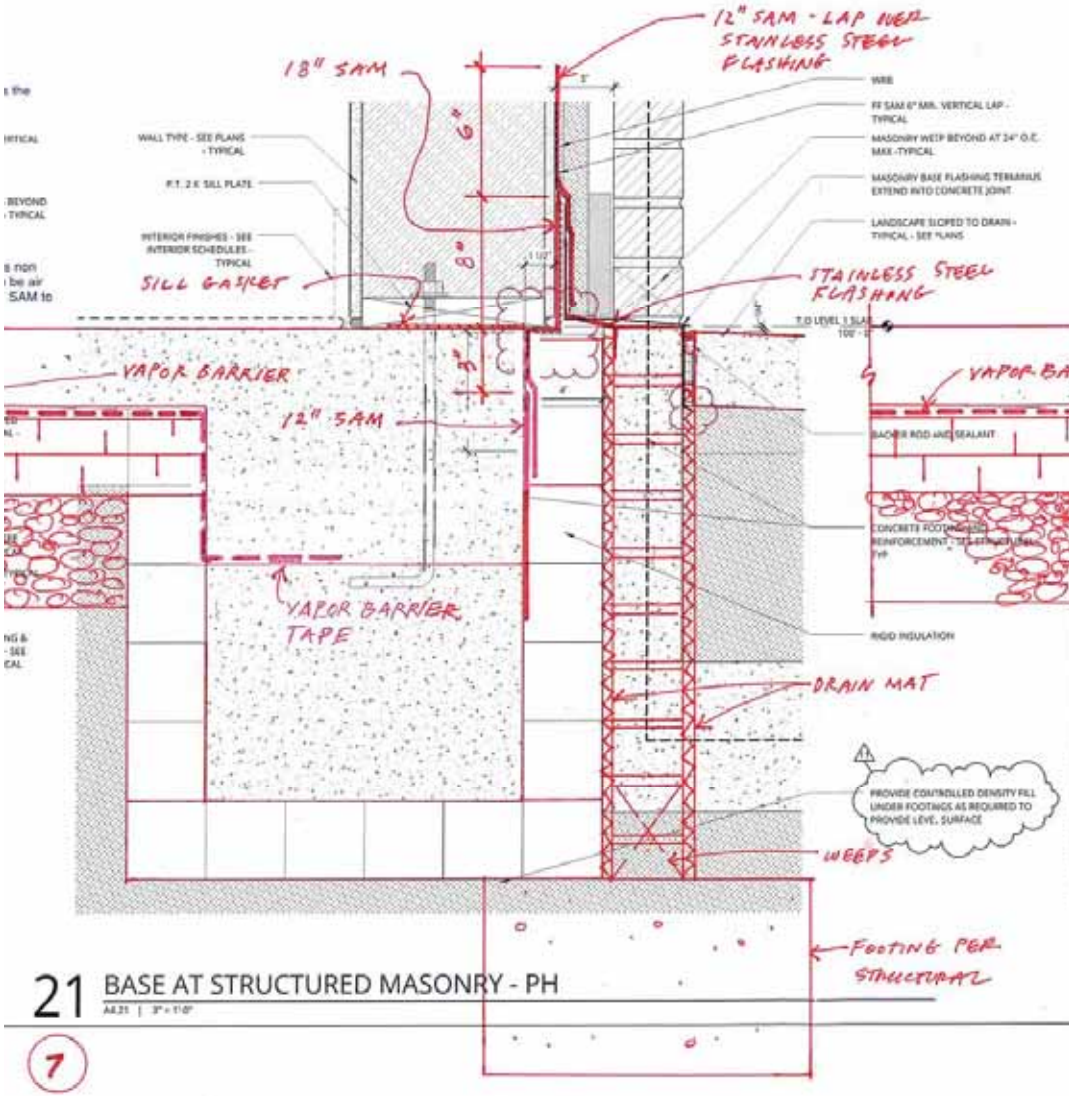
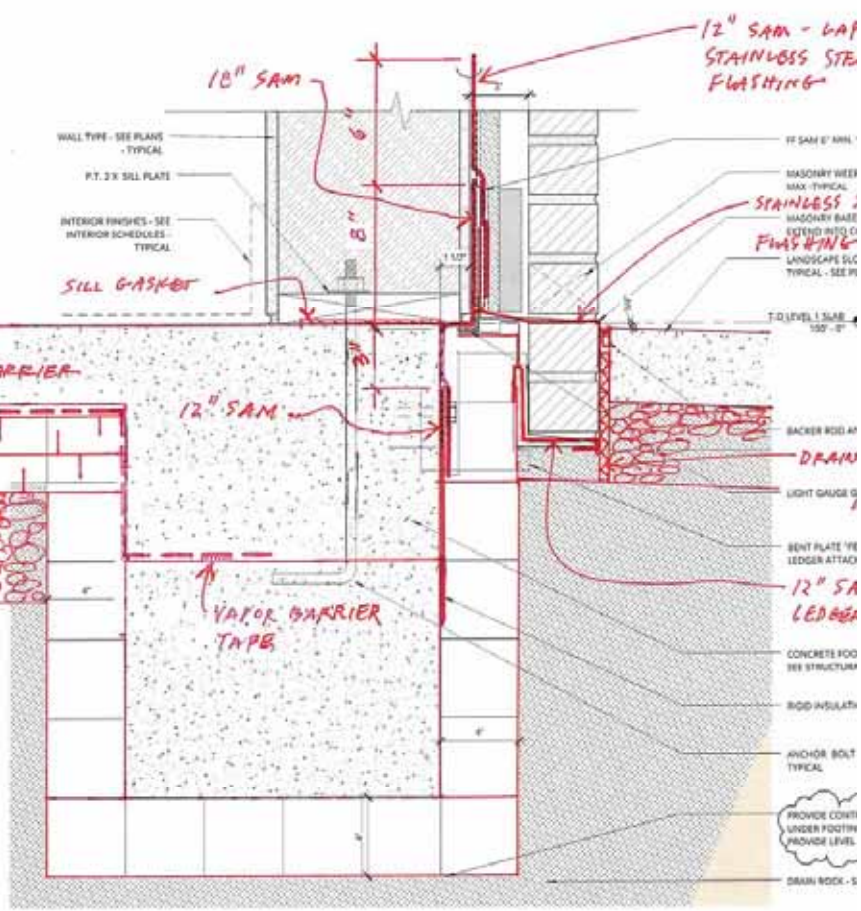


21 BASE AT STRUCTURED MASONRY - PH

A4.21 | 3" = 1'-0"

7



23 BASE AT BRICK WAINSCOT - PH

A4.21 | 3" = 1'-0"

8

FOUNDATION COORDINATION DRAWINGS

7/29/

Construction Stage Interface REACH/Ankrom/WCC Mock Up


COMMERCIAL WRAP


COMMERCIAL
Meets the ASTM E1677 Type I Air Barrier requirements when installed as an air barrier according to DuPont™ Tyvek® installation
exigences de la norme ASTM E1677 pour les pare-air de type I lorsqu'ils sont installés conformément aux instructions
DuPont™ Tyvek®.
Meets ICC-ES AC-38 Water-Resistive Barrier & Air Barrier Material requirements. ICC-ES Evaluation Report ESR-2376/Spécifié aux
ICC-ES AC-38 pour les membranes résistantes à l'eau et les pare-air. Rapport d'évaluation ESR-2376 de l'ICC-ES.
CCMC 13119-R, Breather Type Sheathing Membrane/Membranes de revêtement perméables à la vapeur d'eau - CCMC
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Qualified Envelope Diagnostics, Inc.
AAMA ACCREDITED LAB & FIELD TESTING AGENCY
Address: 2206-3 NW Birdsdale Avenue, Gresham, OR 97030
Seattle Phone: 206-363-0577 — Gresham Phone: 503-328-9549
Web: www.qed.com / www.qedlaboregon.com

3294-01 Orchards at Orenco Phase 1

REPORT DATE: August 29, 2014

REFERENCE TEST DATE (S): August 20, 2014

SUBMITTED TO:	DISTRIBUTED TO:	PROJECT LOCATION:
Jessica Woodruff Reach Orenco LLC c/o Reach Community Development	Jessica Woodruff Craig@housingdevelopment.org	Hillsboro, Oregon

TEST AUDIENCE:

Dan Swinton-Euroline
Mario Holos- Euroline
Travis Moore- WCC
Craig Kelley- HDC
Jessica Woodruff- REACH
Bill Wilson- QED LAB
Dalan Askew - WCC
Rick Hart- Euroline
Nick Kurkov- RDF
Jeremy Brooks- WCC
Amanda ASA-AMA
Jay Nees- Walsh
Mike Poirier- QED LAB

ENVIRONMENTAL CONDITIONS (Daily Average)

Temperature: 66°
Wind Speed: 6 mph
Barometric Pressure: 29.9 in Hg

SUMMARY OF TEST RESULTS:

On August 20, 2014, technicians performed AAMA-accredited window testing at the Orchards at Orenco project in Hillsboro, Oregon. Testing was performed in accordance with ASTM E 1105 (*Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference*) per AAMA 502-12 *(Voluntary Specification for Field Testing of Newly Installed Fenestration Products*) and the Project Specifications and per AAMA 503-08 (*Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Glazing Systems*) and the Project Specifications.

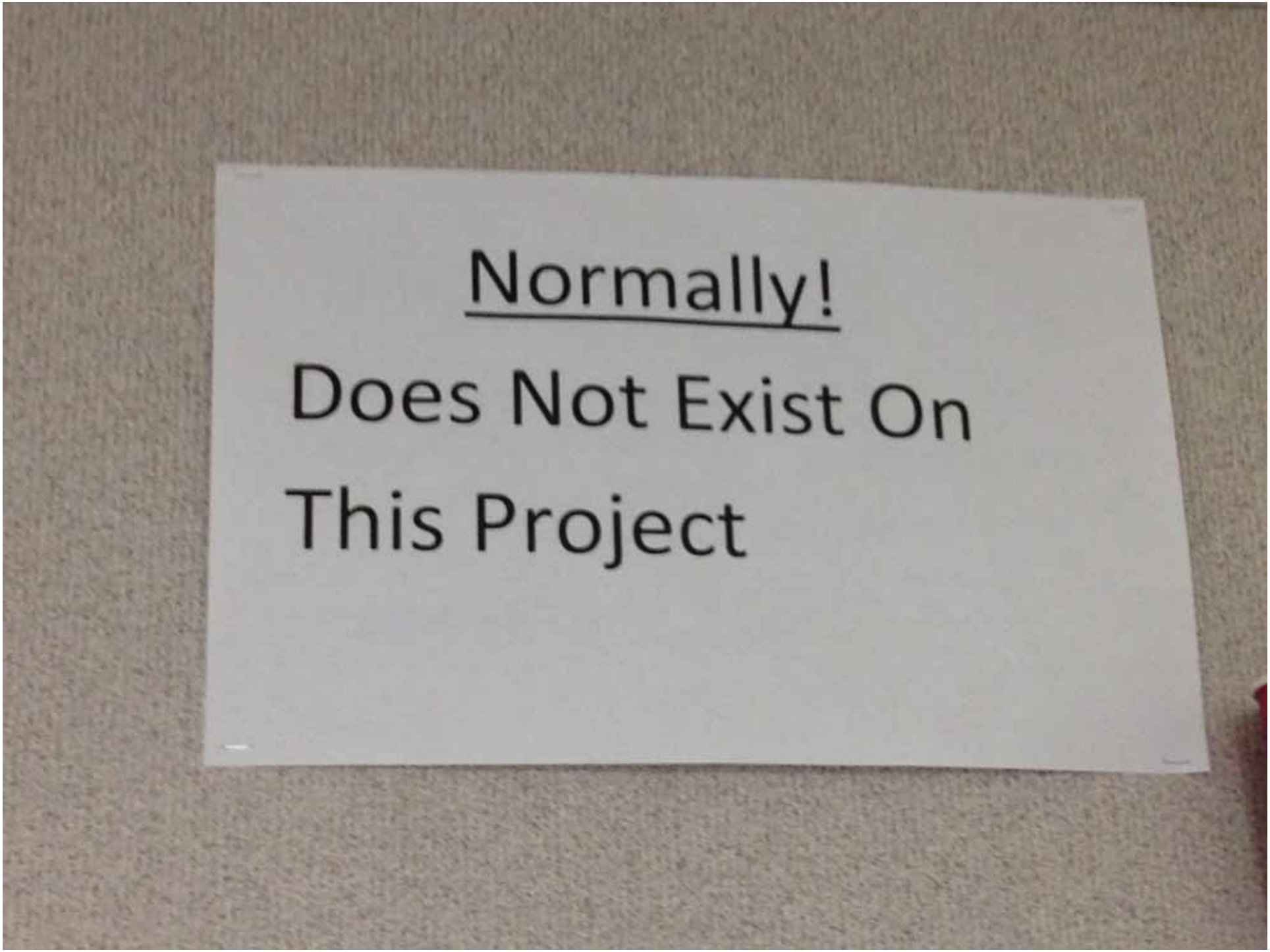
Test Date	Location	Master Test	Daily Test	Specimen ID	Product Type	Test Pressure	Final Result	Observations
8/20/14	Mock up	1	1	1	Door	6.00 psf	PASS	Ø Leaks
8/20/14	Mock up	2	2	1	Door	12.00 psf	PASS	Ø Leaks
8/20/14	Mock up	3	3	2	Tilt/Turn	6.00 psf	PASS	Ø Leaks
8/20/14	Mock up	4	4	2	Tilt/Turn	15.00 psf	PASS	Ø Leaks

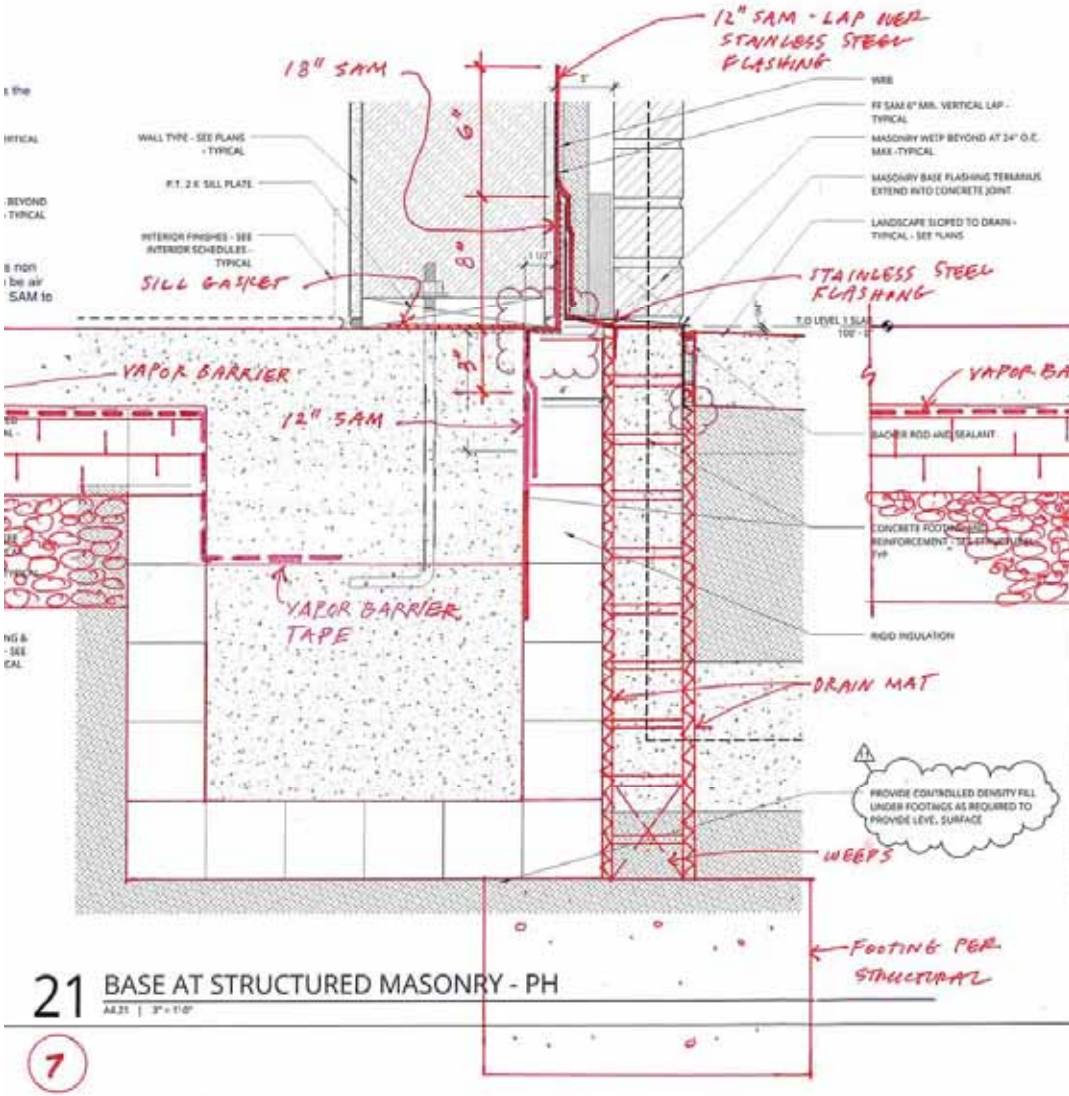
** Testing was performed at 6.00 PSF interior vacuum pressure in accordance with the project specification. Test pressures that exceed 6.00 PSF were conducted for exploratory purposes only for a 5-minute period.*

Master Test: 1									
Test Date:	8/20/14	**Formal Test Pressure:**		**Cycle #**	**Start Time**	**End Time**	**# Ingress**	**# Leaks**	**Pass / Fail**
Week Day:	Wednesday	**Pressure in psf:**	6.00 psf	**1**	10:14	10:19	Ø	Ø	PASS
Specimen ID:	1	**Equivalent Pa:**	287 Pa	**2**	10:20	10:25			
Level:	1st Floor	**Equivalent "WC:**	1.15 "WC	**3**	10:26	10:31			
Unit #:	Mock up	**Velocity Pressure:**	48 mph	**4**	10:32	10:37			
Elevation:	South	**(+/-) Pressure:**	-	Negative	**FINAL TEST RESULT: PASS**				
Location:	-	**Procedure (B):**	Cyclic	Static					
Documented Instances of Formal Leakage:			None						

Comments/Observations: Master Test 1 is the initial assessment of Specimen 1, a Euroline-brand door measuring 40" x 86 ½ ". Prior to testing, a purge was run to remove debris and/or moisture from the test area. Master Test 1 tested Specimen 1 at 6.00 psf. Technicians did not observe any water intrusion during the test and Specimen 1 received a Pass.

Construction Process
WCC/Subs

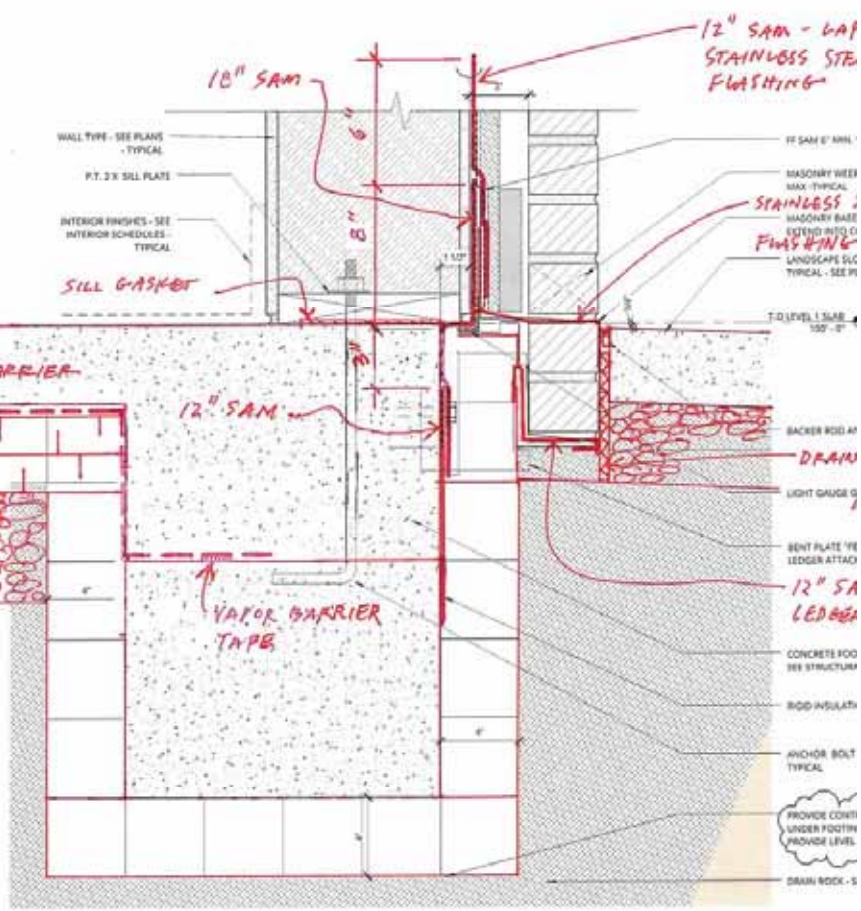

Normally!
Does Not Exist On
This Project



21 BASE AT STRUCTURED MASONRY - PH

A4.21 | 3" = 1'-0"

7



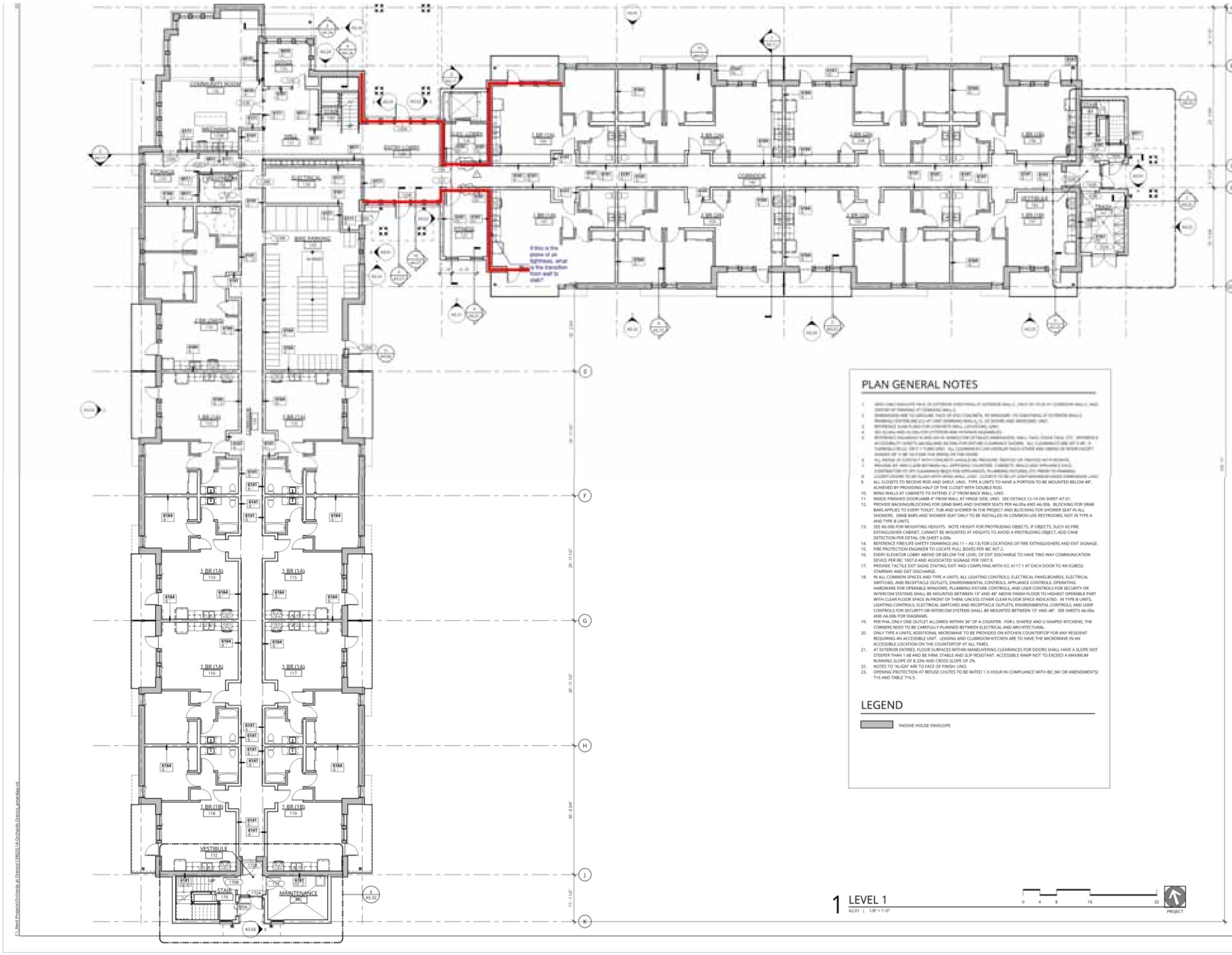
23 BASE AT BRICK WAINSCOT - PH

A4.21 | 3" = 1'-0"

8

FOUNDATION COORDINATION DRAWINGS

7/29/



PLAN GENERAL NOTES

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. ALL CLOSETS TO RECEIVE ROD AND SHELF, UNO. TYPE A UNITS TO HAVE A PORTION TO BE MOUNTED BELOW 48", ACHIEVED BY PROVIDING HALF OF THE CLOSET WITH DOUBLE ROD.
10. WING WALLS AT CABINETS TO EXTEND 2'-2" FROM BACK WALL, UNO.
11. INSIDE FINISHED DOOR JAMB 4" FROM WALL AT HINGE SIDE, UNO. SEE DETAILS 12-14 ON SHEET A7.01.
12. PROVIDE BACKING/BLOCKING FOR GRAB BARS AND SHOWER SEATS PER A6.00a AND A6.00b. BLOCKING FOR GRAB BARS APPLIES TO EVERY TOILET, TUB AND SHOWER IN THE PROJECT AND BLOCKING FOR SHOWER SEAT IN ALL SHOWERS. GRAB BARS AND SHOWER SEAT ONLY TO BE INSTALLED IN COMMON USE RESTROOMS, NOT IN TYPE A AND TYPE B UNITS.
13. SEE A6.00b FOR MOUNTING HEIGHTS. NOTE HEIGHT FOR PROTRUDING OBJECTS, IF OBJECTS, SUCH AS FIRE EXTINGUISHER CABINET, CANNOT BE MOUNTED AT HEIGHTS TO AVOID A PROTRUDING OBJECT, ADD CANE DETECTION PER DETAIL ON SHEET 6.00b.
14. REFERENCE FIRE/LIFE-SAFETY DRAWINGS (A0.11 – A0.13) FOR LOCATIONS OF FIRE EXTINGUISHERS AND EXIT SIGNAGE.
15. FIRE PROTECTION ENGINEER TO LOCATE PULL BOXES PER IBC 907.2.
16. EVERY ELEVATOR LOBBY ABOVE OR BELOW THE LEVEL OF EXIT DISCHARGE TO HAVE TWO WAY COMMUNICATION DEVICE PER IBC 1007.8 AND ASSOCIATED SIGNAGE PER 1007.9.
17. PROVIDE TACTILE EXIT SIGNS STATING 'EXIT' AND COMPLYING WITH ICC A117.1 AT EACH DOOR TO AN EGRESS STAIRWAY AND EXIT DISCHARGE.
18. IN ALL COMMON SPACES AND TYPE A UNITS, ALL LIGHTING CONTROLS, ELECTRICAL PANELBOARDS, ELECTRICAL SWITCHES, AND RECEPTACLE OUTLETS, ENVIRONMENTAL CONTROLS, APPLIANCE CONTROLS, OPERATING HARDWARE FOR OPERABLE WINDOWS, PLUMBING FIXTURE CONTROLS, AND USER CONTROLS FOR SECURITY OR INTERCOM SYSTEMS SHALL BE MOUNTED BETWEEN 15" AND 48" ABOVE FINISH FLOOR TO HIGHEST OPERABLE PART WITH CLEAR FLOOR SPACE IN FRONT OF THEM, UNLESS OTHER CLEAR FLOOR SPACE INDICATED. IN TYPE B UNITS, LIGHTING CONTROLS, ELECTRICAL SWITCHES AND RECEPTACLE OUTLETS, ENVIRONMENTAL CONTROLS, AND USER CONTROLS FOR SECURITY OR INTERCOM SYSTEMS SHALL BE MOUNTED BETWEEN 15" AND 48". SEE SHEETS A6.00a AND A6.00b FOR DIAGRAMS.
19. PER FHA, ONLY ONE OUTLET ALLOWED WITHIN 36" OF A COUNTER. FOR L SHAPED AND U SHAPED KITCHENS, THE CORNERS NEED TO BE CAREFULLY PLANNED BETWEEN ELECTRICAL AND ARCHITECTURAL.
20. ONLY TYPE A UNITS, ADDITIONAL MICROWAVE TO BE PROVIDED ON KITCHEN COUNTERTOP FOR ANY RESIDENT REQUIRING AN ACCESSIBLE UNIT. LEASING AND CLUBROOM KITCHEN ARE TO HAVE THE MICROWAVE IN AN ACCESSIBLE LOCATION ON THE COUNTERTOP AT ALL TIMES.
21. AT EXTERIOR ENTRIES, FLOOR SURFACES WITHIN MANEUVERING CLEARANCES FOR DOORS SHALL HAVE A SLOPE NOT STEEPER THAN 1:48 AND BE FIRM, STABLE AND SLIP RESISTANT. ACCESSIBLE RAMP NOT TO EXCEED A MAXIMUM RUNNING SLOPE OF 8.33% AND CROSS SLOPE OF 2%.
22. NOTES TO "ALIGN" ARE TO FACE OF FINISH, UNO.
23. OPENING PROTECTION AT REFUSE CHUTES TO BE RATED 1 ½ HOUR IN COMPLIANCE WITH IBC (W/ OR AMENDMENTS) 716 AND TABLE 716.5.

LEGEND

PASSIVE HOUSE ENVELOPE

1 LEVEL 1
A2.01 | 1/8" = 1'-0"

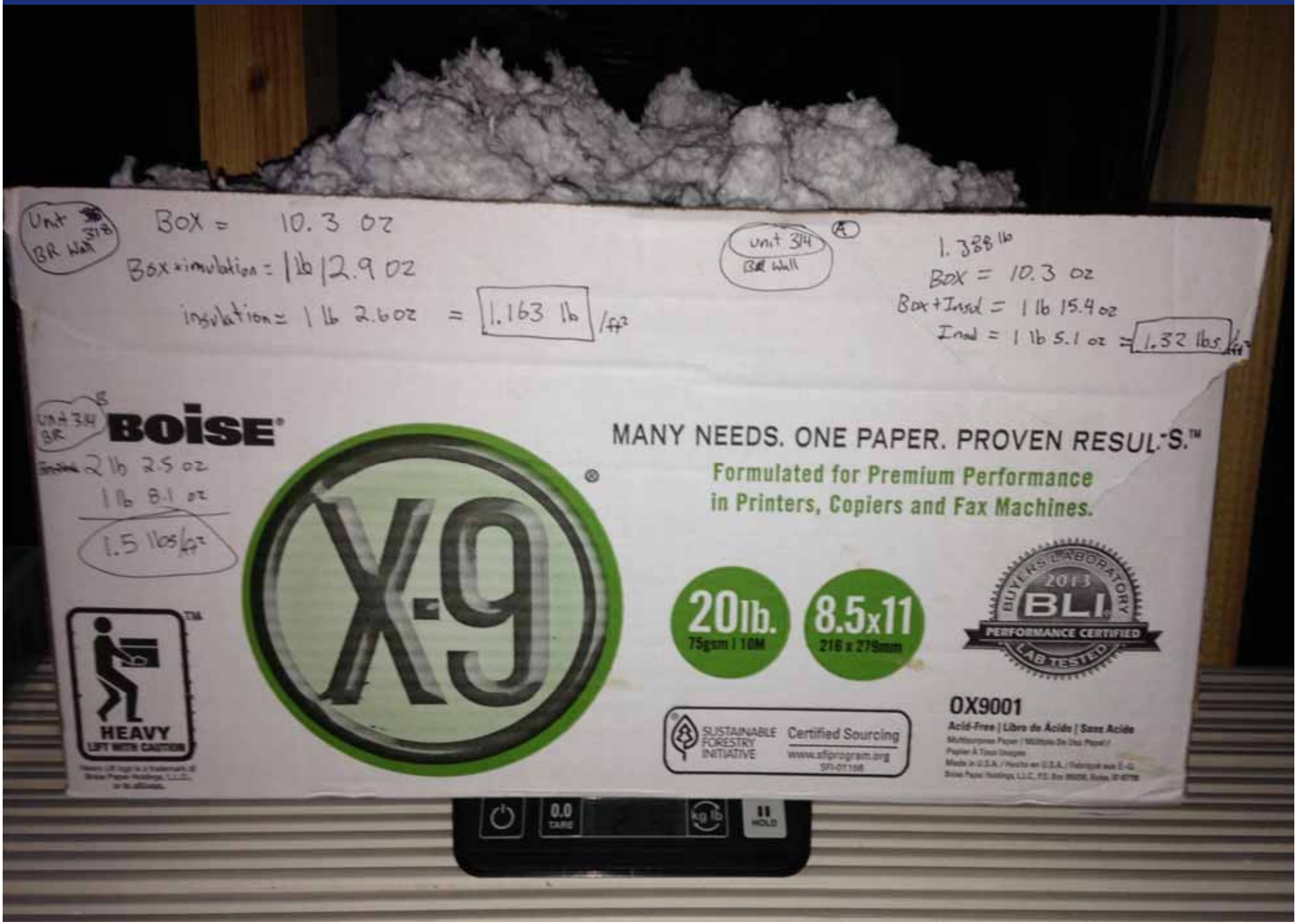

Raflecto
Wrap


Tyvek
Tyvek
Tyvek
Tyvek

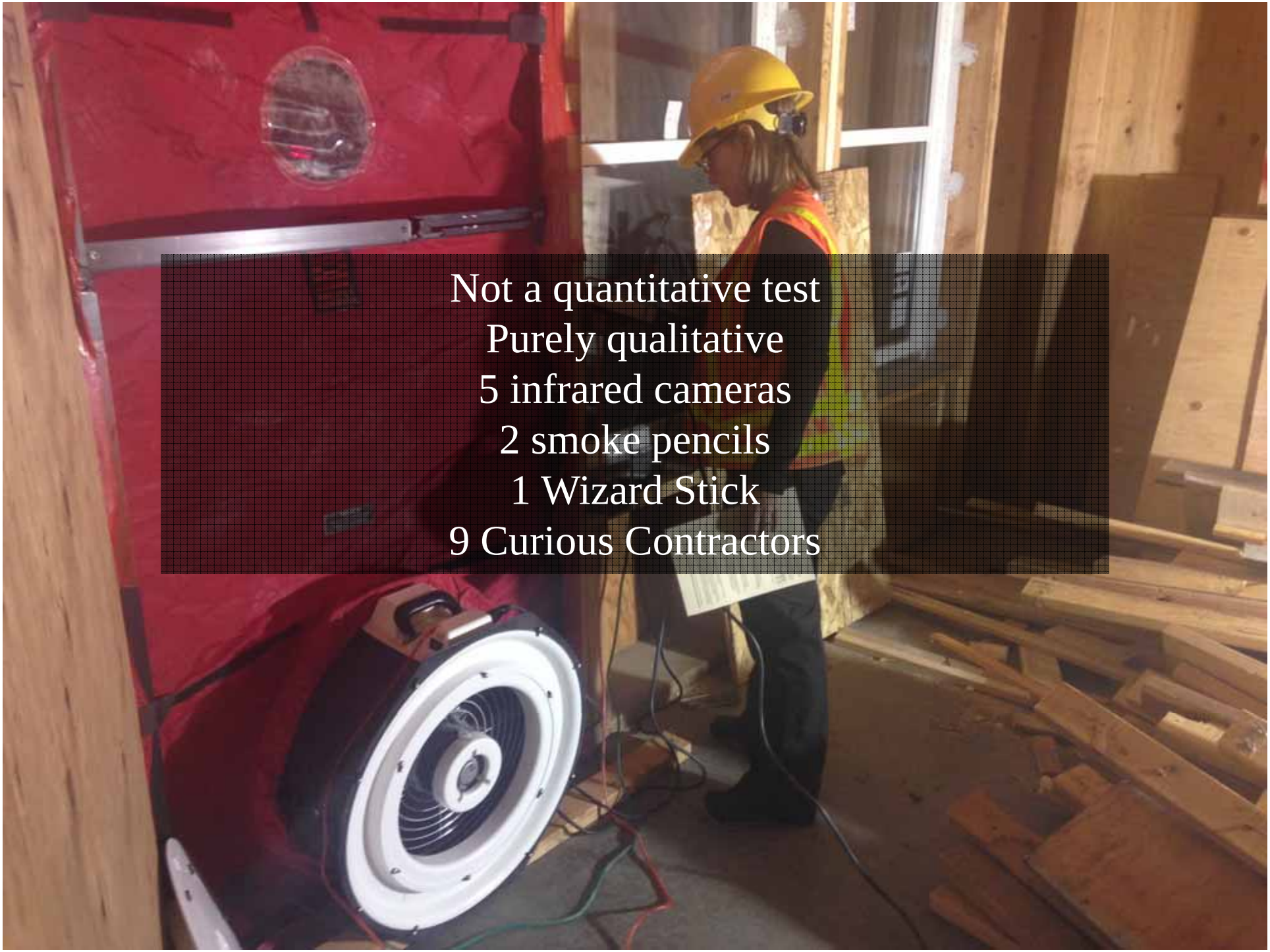

V-Force
V-Force

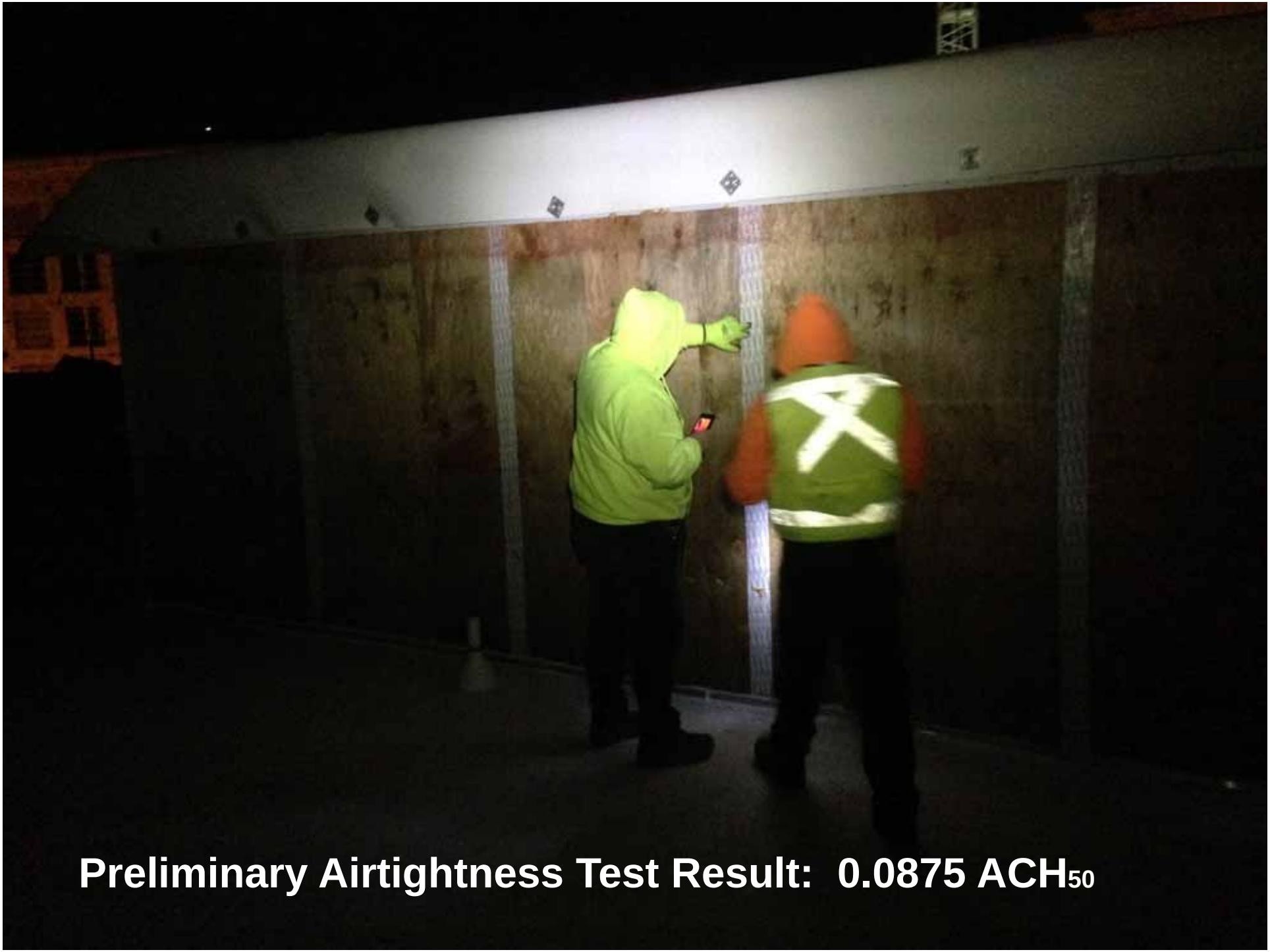

Panera
upper
cab.

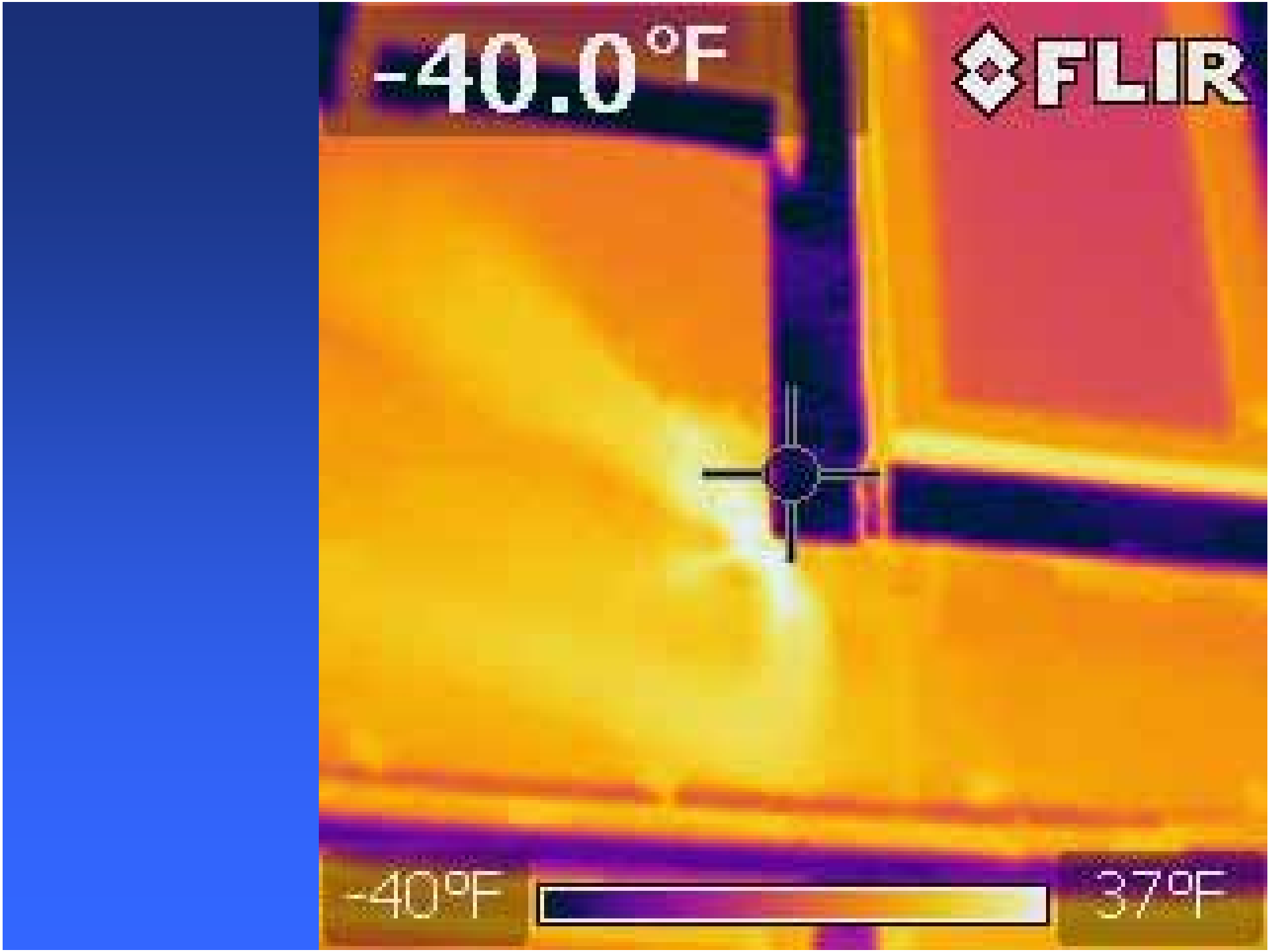

CertainTeed
MEMBRAIN
CertainTeed

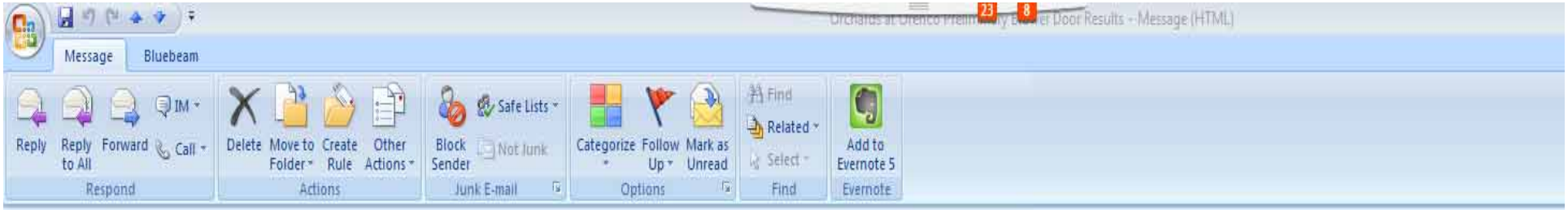

Unit 316 BR Wall 318
Box = 10.3 oz
Box+insulation = 1lb 12.9 oz
insulation = 1 lb 2.6oz = 1.163 lb /ft²
unit 314 BR Wall
1.388 lb
Box = 10.3 oz
Box+Insul = 1 lb 15.4 oz
Insul = 1 lb 5.1 oz = 1.32 lbs /ft²
Unit 314 BR
2 lb 2.5 oz
1 lb 8.1 oz
1.5 lbs/ft²
BOISE
MANY NEEDS. ONE PAPER. PROVEN RESULTS.™
Formulated for Premium Performance in Printers, Copiers and Fax Machines.
X-9
20lb. 75gsm | 10M
8.5x11 216 x 279mm
BUYER'S LABORATORY 2013 BLI PERFORMANCE CERTIFIED LAB TESTED
HEAVY LIFT WITH CAUTION
SUSTAINABLE FORESTRY INITIATIVE Certified Sourcing www.sfiprogram.org
OX9001
Acid-Free | Libre de Ácido | Sans Acide
0.0 TARE
HOLD

Performance Verification
WCC/RDF


Not a quantitative test
Purely qualitative
5 infrared cameras
2 smoke pencils
1 Wizard Stick
9 Curious Contractors


Preliminary Airtightness Test Result: 0.0875 ACH50


-40.0°F
FLIR
-40°F
37°F



You forwarded this message on 11/21/2014 2:59 PM.

From: Ryan Shanahan [rshanahan@earthadvantage.org]
To: Craig Kelley; Jessica Woodruff; Mike Steffen; Marty Houston; Jay Nees; Jeremy Brooks; Michael Bonn; Dylan Lamar
Cc: Sara Walker
Subject: Orchards at Orenco Preliminary Blower Door Results

Message | Preliminary BD Test Results 11-21-14.xlsx (9 KB) | Prelim BD Manometer Photo.jpg (20 KB)

Hey guys,

I've attached a spreadsheet here with the results of today's preliminary testing. I can honestly tell you that these are the best results I've ever seen and that everyone involved has a lot to be proud of!

The -50 pa result of .056 ACH is right up there with the tightest BD test in the world! http://www.worldrecordacademy.com/technology/tightest_residential_building_Dillingham_house_sets_world_record_213292.html

Congratulations all!

PS. Does anyone have a PR/FL@50 photo better than the one I attached?

Ryan Shanahan CPHC, PHIUS+ Rater
Green Building Consultant

E rshanahan@earthadvantage.org
C 971.344.7227

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earthadvantage.org / portland, or

Earth Advantage has **certified 14,000 homes** and counting!

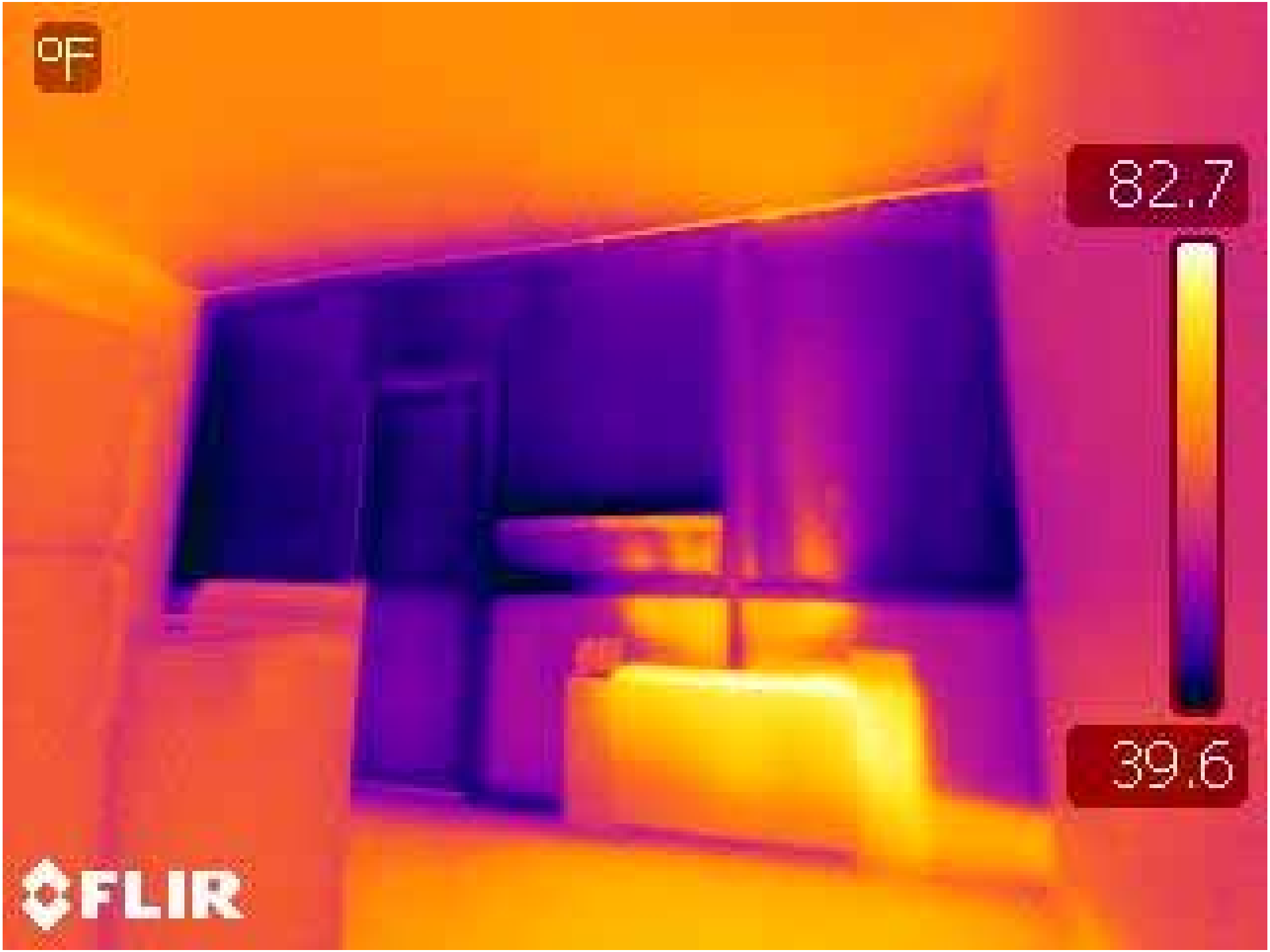
[redacted]

		CFM @ 50	Actual CFM	ACH50	
Negative Pressure					
	25	356	224	0.056185243	
	50	359	359	0.056658714	
	75	362	451	0.057132185	
Positive Pressure					
	25	602	374	0.095009877	
	50	594	594	0.093747287	
	75	582	767	0.091853403	
Average		**476**		**0.075124089**	**(.006529 CFM / SQ FT Gross Envelope)**
w/ 18x24" hole		5320		0.83962217	
w/ 11x11" hole		3820		0.602886596	

[redacted]


Westmoreland Union Manor


°F
56.1
33.4
FLIR

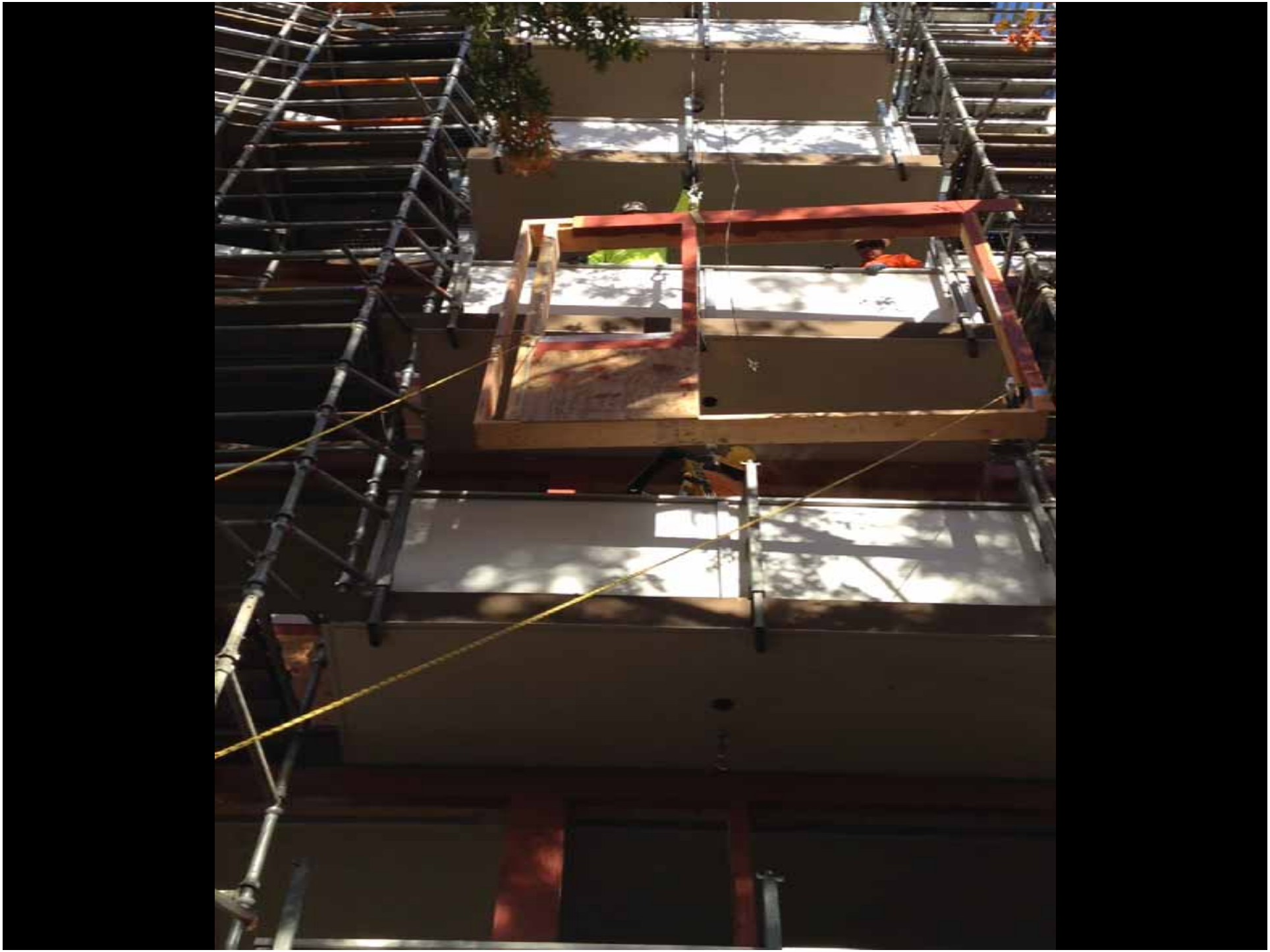

°F
82.7
39.6
FLIR


Protecto Wrap
Protecto-Tak
DANGER


PC
APLS
280
2962


MSCU 291876 [1]


245136 0
US2210

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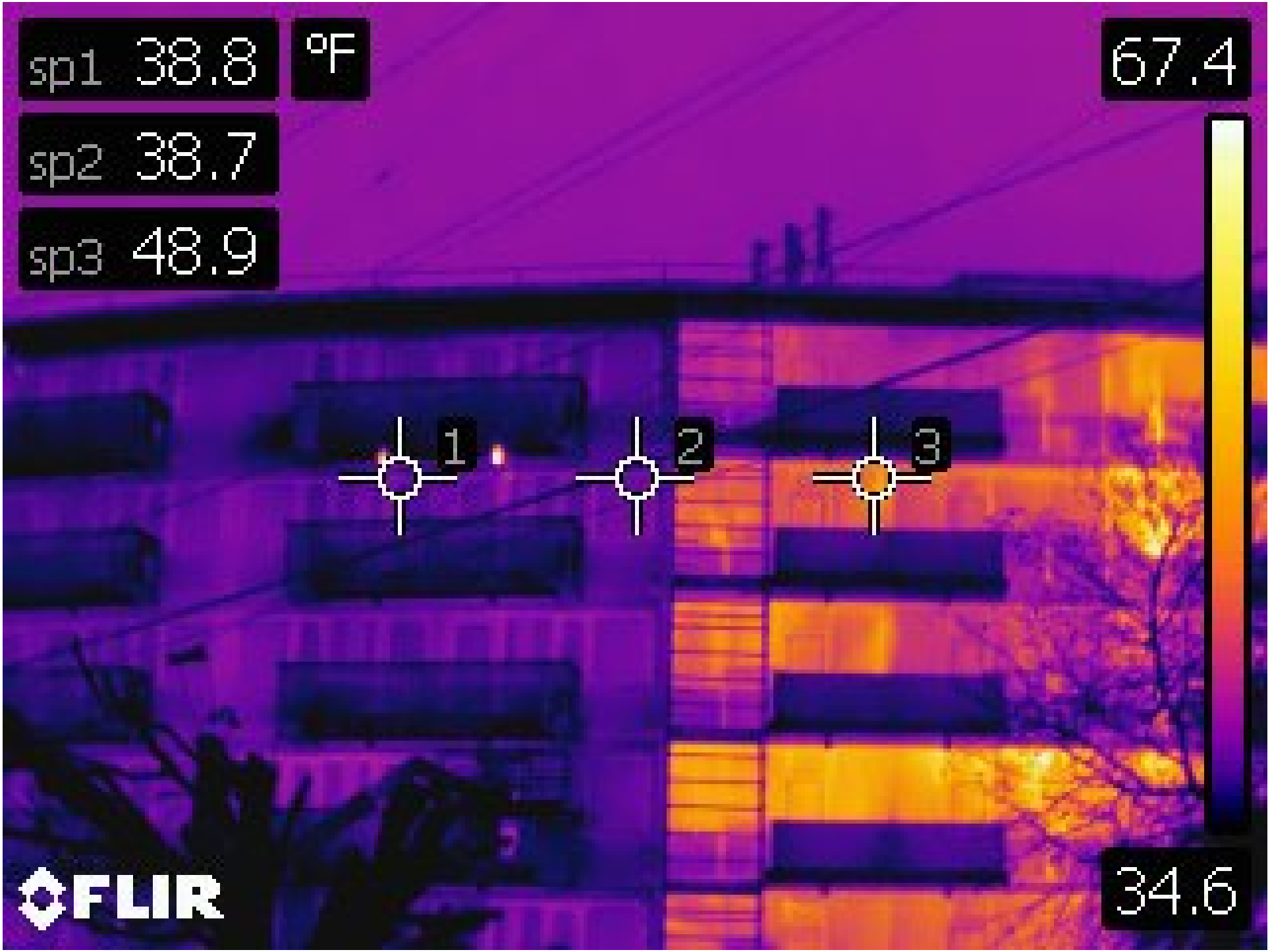
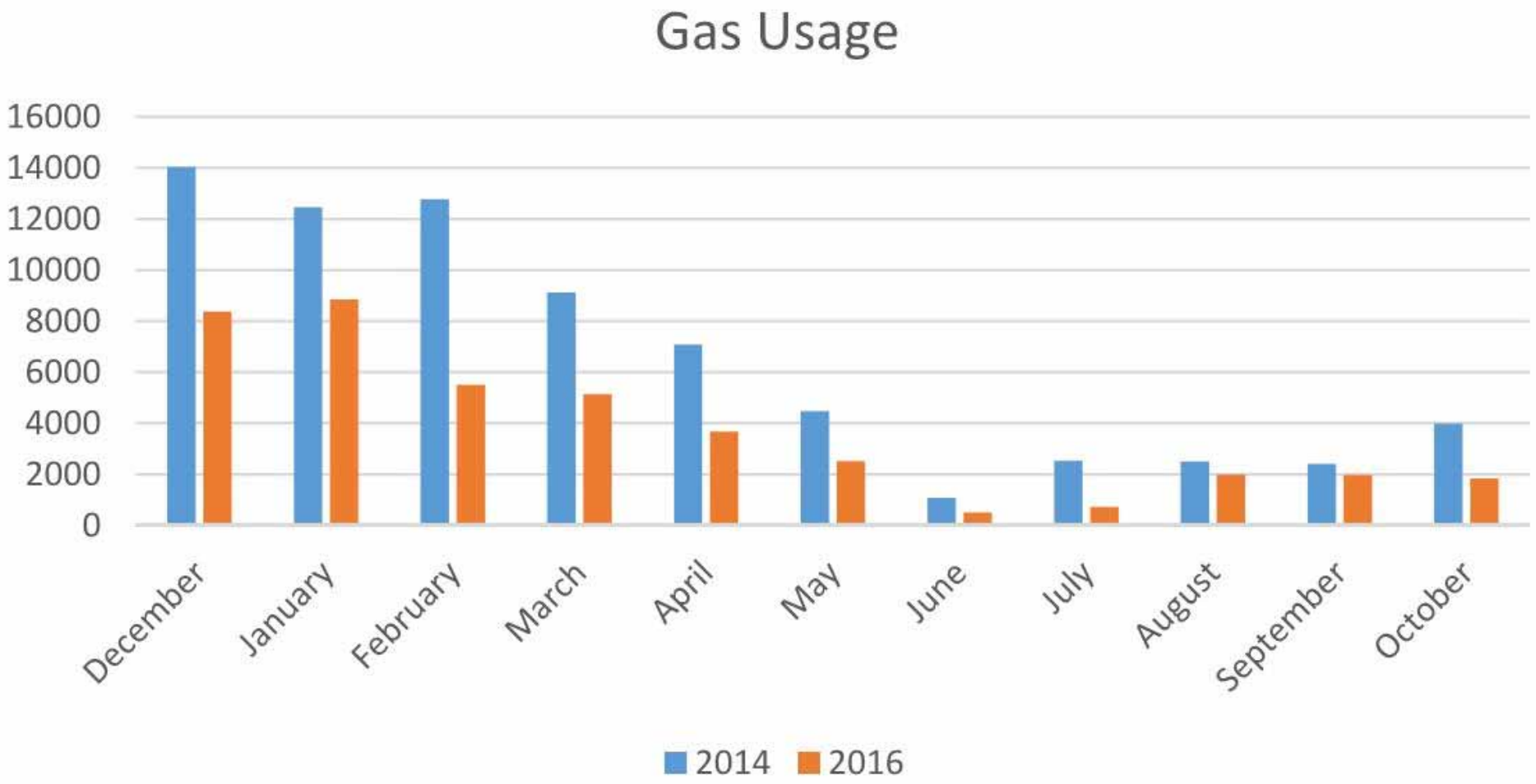

sp1 38.8 °F
sp2 38.7
sp3 48.9
67.4
1
2
3
FLIR
34.6


Gas Usage
16000
14000
12000
10000
8000
6000
4000
2000
0
December
January
February
March
April
May
June
July
August
September
October
2014
2016