Development Services

From Concept to Construction

Phone: 503-823-7300 Email: bds@portlandoregon.gov 1900 SW 4th Ave, Portland, OR 97201
More Contact Info (http://www.portlandoregon.gov//bds/article/519984)

APPEAL SUMMARY

Status: Decision Rendered - Reconsideration of ID 14610, items 2 and 3

Appeal ID: 14739	**Project Address:** 46 NE Tillamook St
Hearing Date: 3/8/17	**Appellant Name:** Dylan Lamar
Case No.: B-012	**Appellant Phone:** 503-804-1746 x102
Appeal Type: Building	**Plans Examiner/Inspector:** Steven Mortensen
Project Type: commercial	**Stories:** 3 **Occupancy:** R-2 **Construction Type:** V-B
Building/Business Name: Tillamook Row - NW	**Fire Sprinklers:** Yes - 13R Throughout
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 16-280746-CO
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5]	**Proposed use:** R-2 Multifamily Residential

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	OSSC 1026.6
Requires	Exterior exit stairways shall be separated from the interior of the building as required in Section 1022.2 (1 hour fire barrier in our case). Openings shall be limited to those necessary for egress from normally occupied spaces. Also, because our exterior stairways project beyond the face of the building, our plans examiner has directed us to provide fire separation and protected openings for a minimum of 10 feet from the stairway per Section 1022.7, a section of the code that does not apply to exterior stairways, and which is not referred to in Section 1026. Section 1026.5 which does apply to our exterior exit stair, indicates that a 10 foot fire separation distance is required only from the lot line or other buildings on the same lot.
Proposed Design	The design contains four exterior exit stairways each of which provides egress for one or two dwelling units (Occupancy of 9 – 18). Adjacent to the stairways are entrance doors and sidelites, as well as fixed and operable windows. At the stairway landings we have doors which provide access to a mechanical closet with Energy Recovery Ventilators (ERV's). The ERV's are located immediately behind the doors—there is no ability for a person to pass into the closet or use the closet for other purposes. The door would be locked other than when in active use by service personnel standing on the landing with the door open to change the ERV filters approximately twice per year. Each ERV's has an intake and exhaust duct which would penetrate the wall above and below the stair. Due to the low occupancy, we propose to provide 1 hour fire-rated exterior walls and protected openings surrounding the stairways and continuing for a minimum distance of 5 feet from the stairways (see attached "Exterior Stair Opening Protection.PDF"). Entry doors will be solid ¾ hour

rated and all glazing within 5 feet shall be fixed windows protected with a closely spaced water curtain sprinkler.

At the mechanical room doors at the stair landings, we propose the use of 1 hour rated fire doors (same rating as the wall) which are self-closing per 716.5.9.

At the ERV ducts we propose 1 hour fusible link fire dampers. At the other doors and windows along the main façade of the building we propose unrated doors and windows with interior closely spaced water curtain sprinklers protecting each opening.

Reason for alternative The proposed separation exceeds that required by code. Considering the 13R sprinkler system, the low occupancy served by these stairs and the availability of numerous egress windows, the risk to life safety is very low.

Appeal item 2

Code Section OSSC 722.6.2

Requires 722.6.2.3 prescribes 20 minutes of fire resistance for 2x4 wood studs at 16"o.c.
722.6.2.5 prescribes 15 minutes of fire resistance to various types of insulation filling a stud cavity.

Proposed Design Apply 20 minutes of fire resistance to 2x8 wood studs at 16"o.c.

Apply 15 minutes of fire resistance to a 1 1/2" layer of continuous mineral wool insulation (8.0 lb/cf) on the exterior side of the stud wall, as shown in the wall assembly attached.

The assembly would then have the following fire resistance as calculated per OSSC 722.6.2.1:

FIRE EXPOSURE FROM INTERIOR:

5/8” TYPE X GYPSUM BOARD 40 MIN TABLE 722.6.2 (1)
2x8 WOOD STUDS 16” O.C. 20 MIN TABLE 722.6.2 (2)
GLASS FIBER CAVITY INSULATION 15 MIN TABLE 722.6.2 (5)
TOTAL 75 MIN

FIRE EXPOSURE FROM EXTERIOR:

1 1/2" MINERAL WOOL, 8.0 LB/CF 15 MIN TABLE 722.6.2 (5)
15/32” PLYWOOD, EXTERIOR 10 MIN TABLE 722.6.2 (1)
2x8 WOOD STUDS 16” O.C. 20 MIN TABLE 722.6.2 (2)
GLASS FIBER CAVITY INSULATION 15 MIN TABLE 722.6.2 (5)
TOTAL 60 MIN

Mineral wool to be held in place by 1x4 battens fastened to wall with #8 screws at 24" O.C. max, with min 1" embedment into studs.

Reason for alternative Using larger wood studs (i.e. 2x8 instead of 2x4) is acceptable for UL ratings without reducing the assembly fire resistance rating.

Mineral wool proposed is a Non-Combustible material with a Flame Spread rating of 0 and a melting point of 2,150 degrees F (see attached data sheet). A continuous 1 1/2" thick layer of this material would have at least a 15 minute fire resistance, which is equivalent to, for example, a layer of 19/32" plywood per Table 722.6.2 (1). By contrast plywood is a combustible material with a flame spread rating of approximately 100. Further, 1 1/2" of 8.0 pcf mineral wool results in 1.0 psf density of mineral wool material, whereas 722.6.2.5 prescribes 15 minutes of fire resistance to

3.3 pcf mineral wool within a 2x4 stud cavity (which is not continuous) which achieves 0.96 psf density of mineral wool material.

A desired option is to allow 2x2 blocking to break the mineral wool, similar to studs breaking stud cavity insulation, to help keep the siding in a uniform plane.

A similar appeal was approved by the City of Seattle, substituting a continous layer of 1 1/4" mineral wool insulation (8 lb/cf) for a layer of 5/8" Type X gypsum board. See attached.

APPEAL DECISION

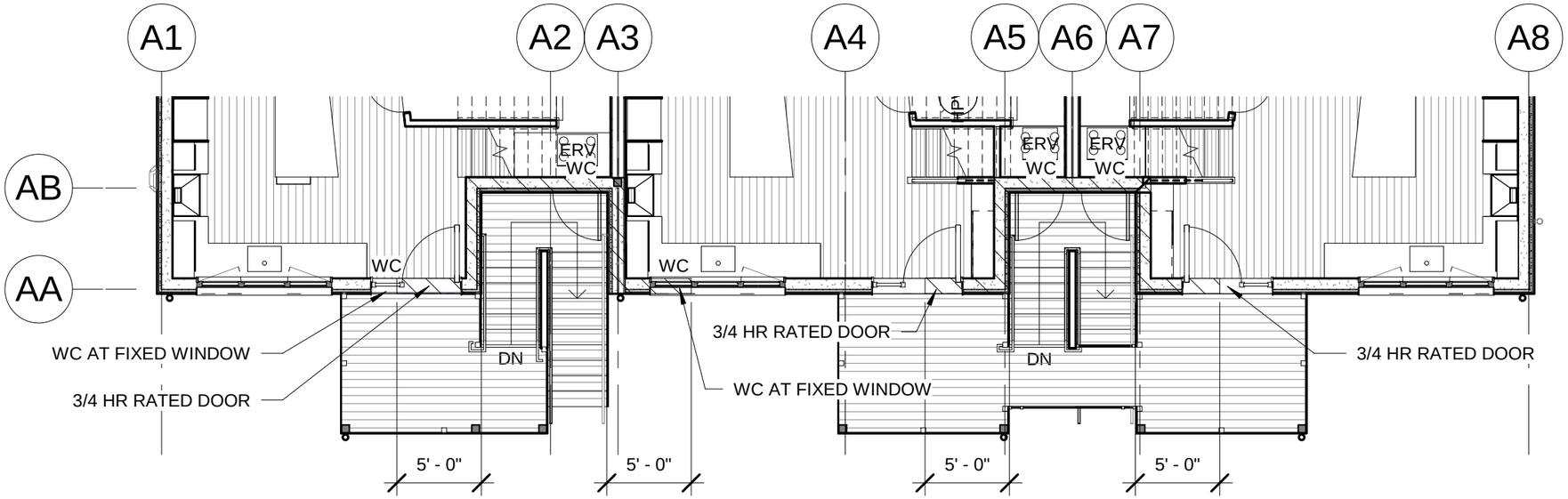
1a. 5' of protected openings in walls less than 90 degrees to exterior exit stair, sprinklers in lieu of protected openings: Granted as proposed provided sprinklers are installed a minimum of 4 inches and a maximum of 24 inches from the fixed opening(s) spaced at 6 feet on center. Sprinklers are to be installed on the occupied side of the openings and shall be capable of wetting the entire surface. A separate permit from the Fire Marshal's Office is required.
1b. 1 hour fire self-closing door to mechanical room opening to exterior exit stair: Granted provided a sprinkler head is installed within the mechanical room.

2. Alternate method for determining fire resistance rating of exterior wall assembly: Denied. Proposal does not demonstrate equivalent fire protection.

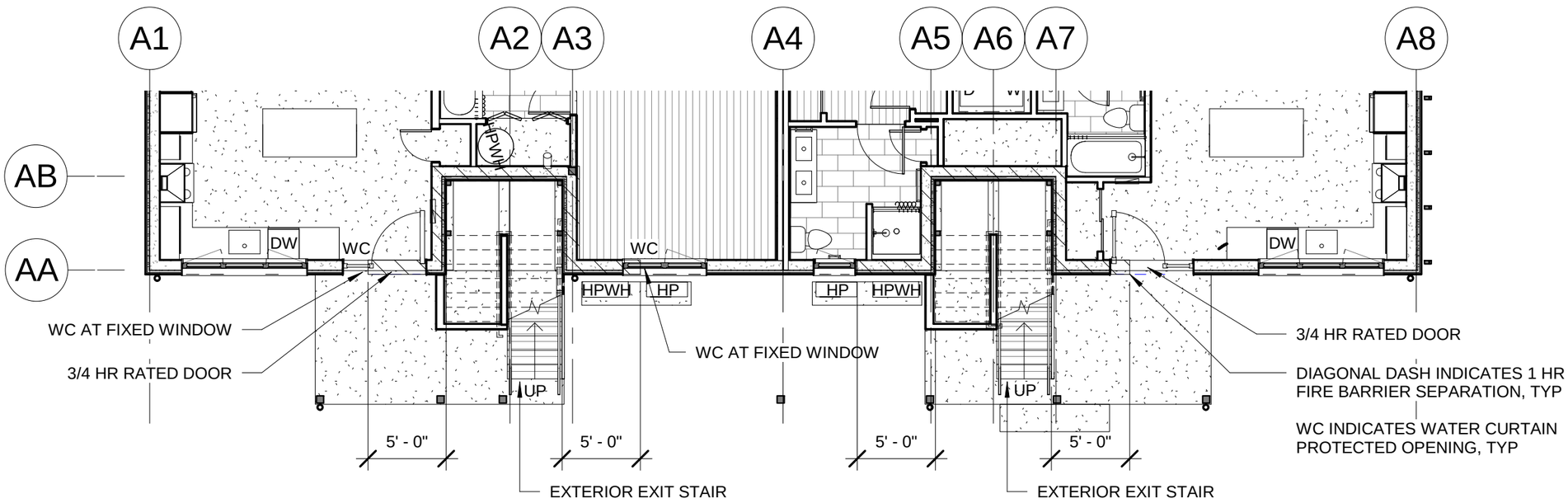
Appellant may contact Steve Mortensen (503-823-7272) with questions.

For the items granted, the Administrative Appeal Board finds that the information submitted by the appellant demonstrates that the approved modifications or alternate methods are consistent with the intent of the code; do not lessen health, safety, accessibility, life, fire safety or structural requirements; and that special conditions unique to this project make strict application of those code sections impractical.

Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 180 calendar days of the date this decision is published. For information on the appeals process and costs, including forms, appeal fee, payment methods and fee waivers, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.



1 NW STRUCTURE - SECOND FLOOR STAIR PLAN
1/8" = 1'-0"



2 NW STRUCTURE - FIRST FLOOR STAIR PLAN
1/8" = 1'-0"

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REGISTERED ARCHITECT
ERICA P. DUNN
PORTLAND, OREGON
5477
STATE OF OREGON

TILLAMOOK ROW NW STRUCTURE

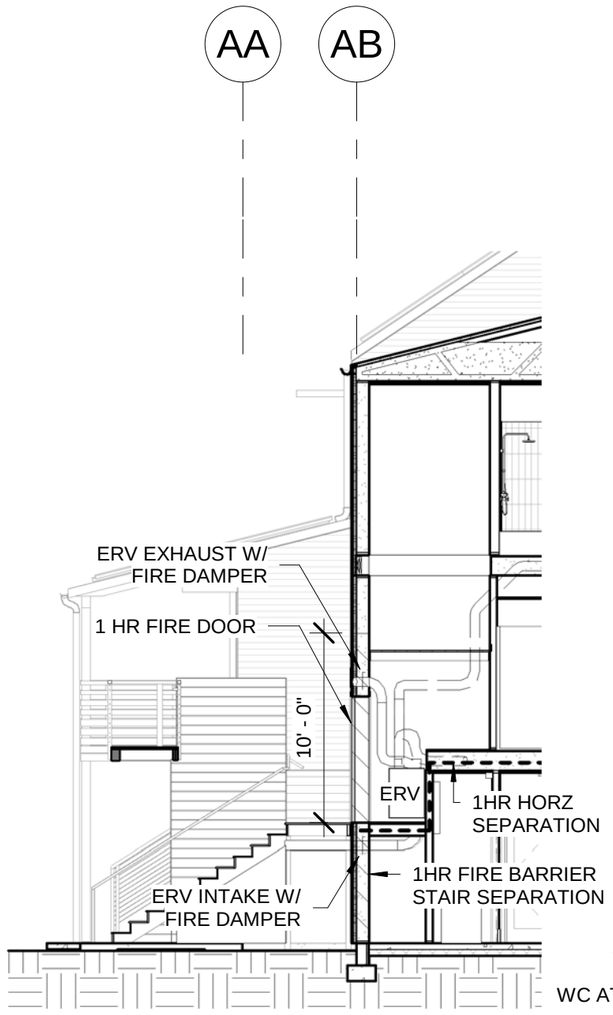
CODE APPEAL
2/20/2017

CONSTRUCTION PACKAGES:
- [x] FOUNDATIO
- [ ] FRAME
- [ ] ENVELOPE
- [ ] MEP ROUGH-IN
- [ ] FINISHES

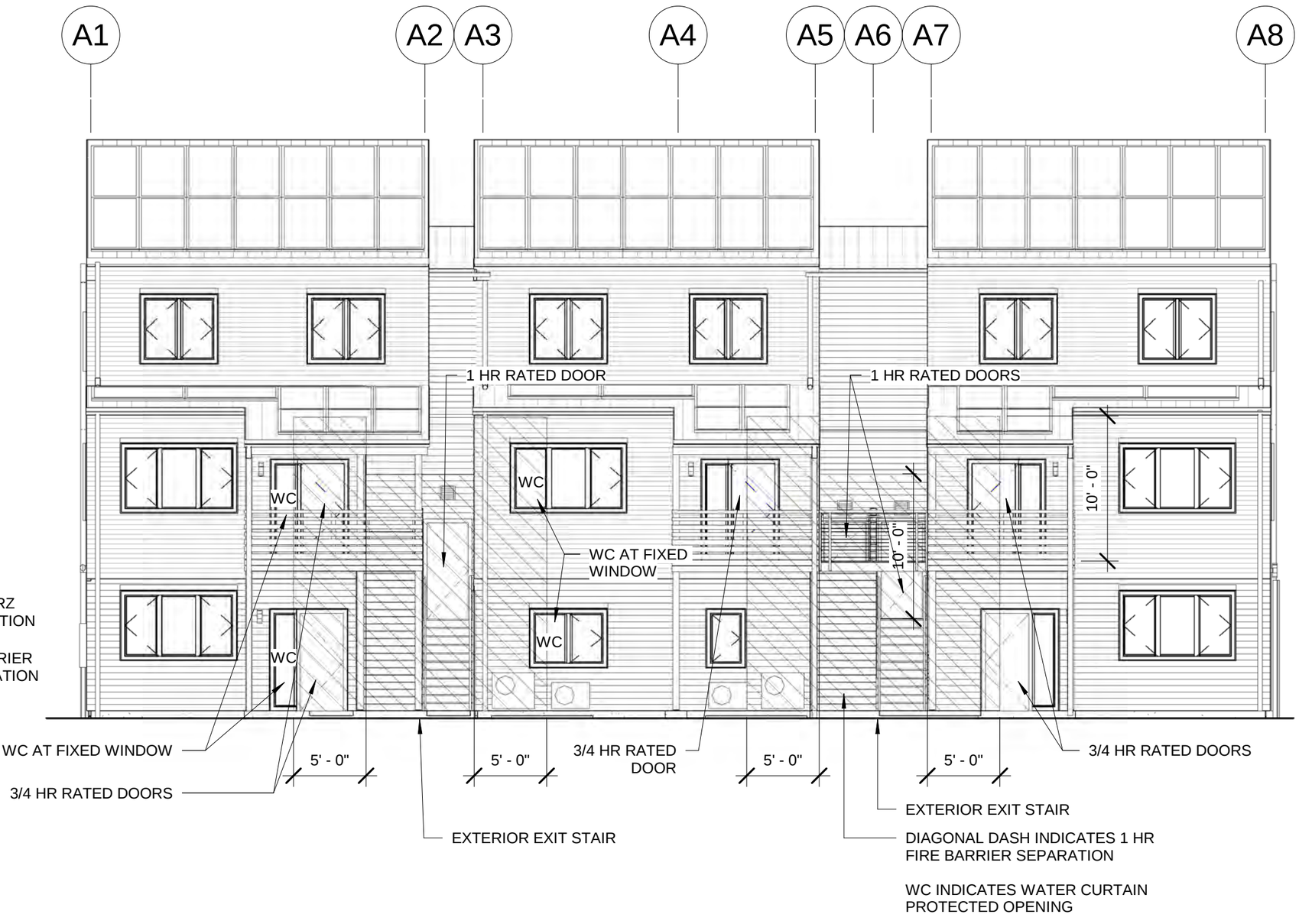
ISSUE	DATE
REV	

STAIR OPENING PROTECTION

APL-01



2 SECTION AT STAIR
1/8" = 1'-0"



1 SOUTH ELEVATION
1/8" = 1'-0"

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TILLAMOOK ROW
NW STRUCTURE

CODE APPEAL
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- ☐ MEP ROUGH-IN
- ☐ FINISHES

ISSUE	DATE
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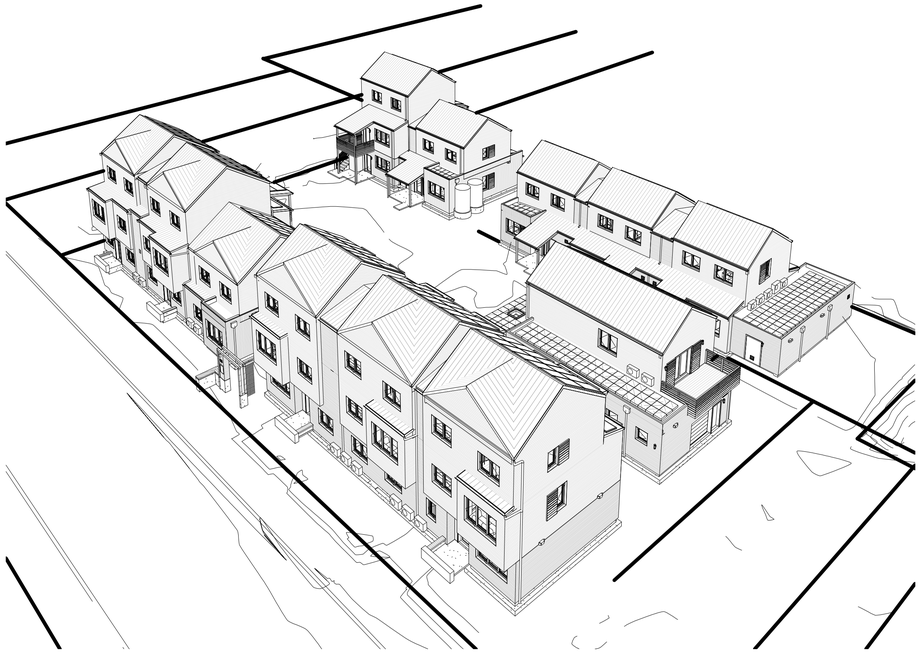
STAIR ELEVATION & SECTION

APL-02

TILLAMOOK ROW

NET-ZERO-ENERGY POCKET NEIGHBORHOOD



PROJECT DIRECTORY

OWNER

BCMC TILLAMOOK, LLC
4039 N MISSISSIPPI AVE #205
PORTLAND, OR 97227
(503) 282-1605
CONTACT: ANDREW WOODBURN

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503.334.1870
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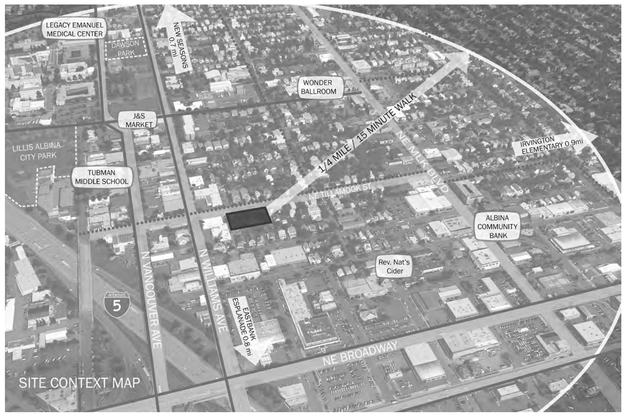
MECHANICAL ENGINEER

IMAGINENERGY
503.477.9585
CONTACT: JONATHAN COHEN

SHEET INDEX



VICINITY MAP

NOT TO SCALE

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TILLAMOOK ROW

BCMC TILLAMOOK, LLC
20 NE TILLAMOOK, PORTLAND, OR 97212

PERMIT SET
11/30/2016

CONSTRUCTION PACKAGES:

- ☐ FOUNDATION
- ☐ FRAME
- ☐ ENVELOPE
- ☐ MEP ROUGH-IN
- ☐ FINISHES

ISSUE	DATE
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COVER SHEET

AG000

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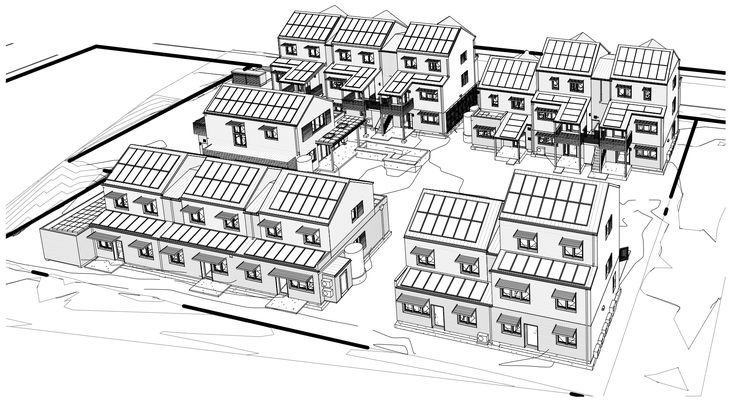
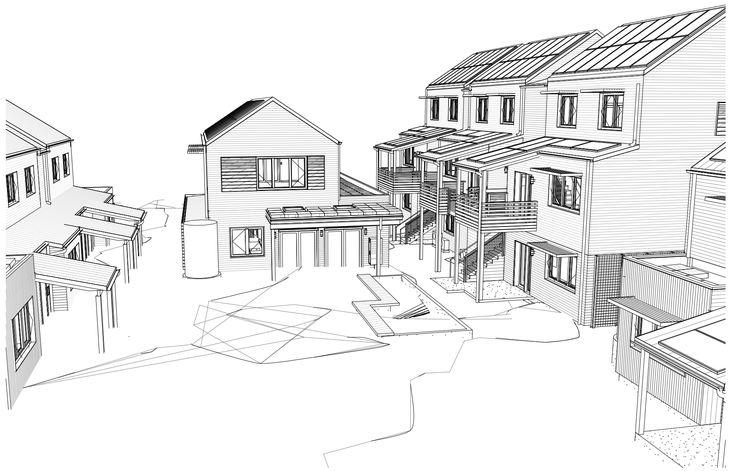
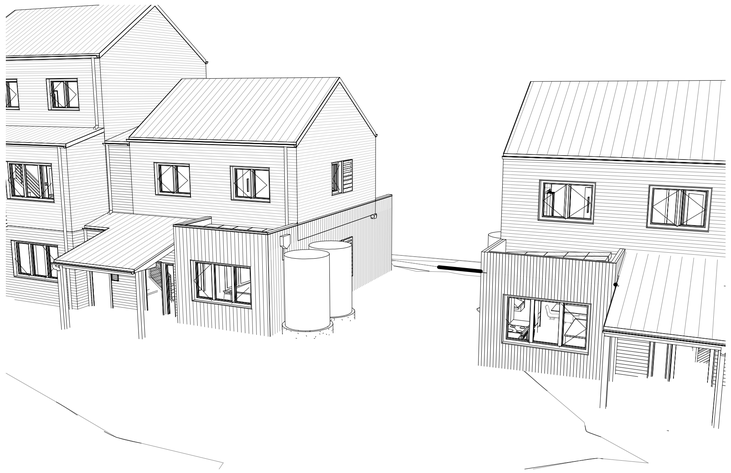


2 SE AERIAL



3 COURTYARD AERIAL LOOKING WEST



1 COURTYARD AERIAL LOOKING SOUTH

PERSPECTIVE VIEWS ARE FOR GENERAL ILLUSTRATION PURPOSES ONLY. REFER TO PLAN, ELEVATIONS AND SECTION DRAWINGS FOR CONSTRUCTION INFORMATION.

LEGEND

◎	3" RISER, ABS OR PVC PIPE, SCHED 40
– – –	3" LATERAL, MIN 1% SLOPE, ABS OR PVC PIPE, SCHED 40
◇	SIDEWALL EXIT TO ROOF TERMINATION, SEE DET'L

ABBREVIATIONS

@	AT
AB	AIR BARRIER
ACOUS	ACOUSTICAL
ADJ	ADJUSTABLE
AFF	ABOVE FINISH FLOOR
ALUM	ALUMINUM
APPROX	APPROXIMATE
ARCH	ARCHITECT
BD	BOARD
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BEAM
BOT	BOTTTOM
BO	BOTOM OF
BR	BACKER ROD
CAB	CABINET
CPT	CARPET
CJ	CONTROL JOINT
CT	CERAMIC TILE
CTB	CERAMIC TILE BASE
CLG	CEILING
CLR	CLEAR
CO	CASED OPENING
COL	COLUMN
CONC	CONCRETE
CONSTR	CONSTRUCTION
CONT	CONTINUOUS
CTR	CENTER
DBL	DOUBLE
DEPT	DEPARTMENT
DET	DETAIL
DIA	DIAMETER
DIM	DIMENSION
DN	DOWN
DR	DOOR
DWG	DRAWING
E	EAST
(E)	EXISTING
EA	EACH
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
ELEV	ELEVATOR
EMER	EMERGENCY
ENCL	ENCLOSURE
ENGR	ENGINEER
EQ	EQUAL
EQUIP	EQUIPMENT
EXPO	EXPOSED
EXP	EXPANSION
EXT	EXTERIOR
FC	FIBER-CEMENT
FD	FLOOR DRAIN
FDN	FOUNDATION
FG	FIBERGLASS
FIN	FINISH
FLR	FLOOR
F.O.	FACE OF
FP	FROST PROOF
FRP	FIBER REINFORCED PLASTIC
FT	FOOT, FEET
FTG	FOOTING
FUT	FUTURE
GA	GAUGE
GALV	GALVANIZED
GL	GLASS, GLAZING
GND	GROUND
GR	GRADE
GWB	GYPSUM WALL BOARD
GYP	GYPSUM
HB	HOSE BIB
HGR	JOIST HANGER
HORZ	HORIZONTAL
HR	HOUR
HT	HEIGHT
ID	INSIDE DIAMETER
INSUL	INSULATION
INT	INTERIOR
JT	JOINT
KIT	KITCHEN
LAV	LAVATORY
LKR	LOCKER
LT	LIGHT
MAX	MAXIMUM
MECH	MECHANICAL
MEMB	MEMBRANE
MTL	METAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
M.O.	MASONRY OPENING
MUL	MULLION
(N)	NEW
N	NORTH
N.I.C.	NOT IN CONTRACT
NO	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
O.F.A.C.I.	OWNER FURNISHED & ASSEMBLED, CONTRACTOR INSTALLED
O.F.C.I.	OWNER FURNISHED, CONTRACTOR INSTALLED
O.F.O.I.	OWNER FURNISHED, OWNER INSTALLED
OPNG	OPENING
PL	PLATE
PLAS	PLASTER
PLYWD	PLYWOOD
PT	PRESSURE TREATED
PTN	PARTITION
R	RISER
RAD	RADIUS
RD	ROOF DRAIN
REF	REFERENCE
REFR	REFRIGERATOR
REINF	REINFORCED
REQ	REQUIRED
RESIL	RESILIENT
RM	ROOM
RO	ROUGH OPENING
S	SOUTH
SE	STRUCTURAL ENGINEER
SCHED	SCHEDULE
SECT	SECTION
SBFLR	SUBFLOOR
SF	SQUARE FEET
SHT	SHEET
SHTG	SHEATHING
SIM	SIMILAR
SKYLT	SKYLIGHT
SPEC	SPECIFICATION
SQ	SQUARE
S/S	STAINLESS STEEL
ST	STONE
STA	STATION
STB	STONE BASE
STD	STANDARD
STL	STEEL
STOR	STORAGE
STRL	STRUCTURAL
SUSP	SUSPENDED
SYM	SYMMETRICAL
TB	TOWEL BAR
T.O.	TOP OF
T.O. PL	TOP OF PLATE
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VIF	VERIFY IN FIELD
W/	WITH
WP	WATERPROOF,WATERPROOFING
WRB	WEATHER RESISTANT BARRIER

Area Schedule (Gross Building)				
Building Name	Area Type	Level	Area	Perimeter
COMMONS STRUCTURE	Gross Building Area	FIRST FLOOR T.O. SLAB	1329 SF	145' - 10"
COMMONS STRUCTURE	Gross Building Area	SECOND FLOOR T.O. SUBFLOOR	823 SF	113' - 10"
			2151 SF	
NE STRUCTURE	Gross Building Area	FIRST FLOOR T.O. SLAB	2547 SF	232' - 10"
NE STRUCTURE	Gross Building Area	SECOND FLOOR T.O. SUBFLOOR	2415 SF	236' - 10"
NE STRUCTURE	Gross Building Area	THIRD FLOOR T.O. SUBFLOOR	1309 SF	150' - 8"
			6270 SF	
NW STRUCTURE	Gross Building Area	FIRST FLOOR T.O. SLAB	2295 SF	246' - 10"
NW STRUCTURE	Gross Building Area	SECOND FLOOR T.O. SUBFLOOR	2462 SF	256' - 10"
NW STRUCTURE	Gross Building Area	THIRD FLOOR T.O. SUBFLOOR	1991 SF	208' - 10"
			6748 SF	
SE STRUCTURE	Gross Building Area	FIRST FLOOR T.O. SLAB	1792 SF	174' - 7"
SE STRUCTURE	Gross Building Area	SECOND FLOOR T.O. SUBFLOOR	1469 SF	171' - 4"
SE STRUCTURE	Gross Building Area	THIRD FLOOR T.O. SUBFLOOR	580 SF	96' - 8"
			3841 SF	
SW STRUCTURE	Gross Building Area	FIRST FLOOR T.O. SLAB	2671 SF	228' - 10"
SW STRUCTURE	Gross Building Area	SECOND FLOOR T.O. SUBFLOOR	1731 SF	202' - 11"
			4403 SF	
Grand total			23413 SF	

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- ☐ FINISHES

ISSUE	DATE
REV	

NOTES

AG001

GOVERNING CODES

BUILDING	OREGON STRUCTURAL SPECIALTY CODE (OSSC)	2014
MECHANICAL	OREGON MECHANICAL SPECIALTY CODE (OMSC)	2014
PLUMBING	OREGON PLUMBING SPECIALTY CODE (OPSC)	2014
ELECTRICAL	OREGON ELECTRICAL SPECIALTY CODE (OESC)	2014
ENERGY	OREGON ENERGY EFFICIENCY SP. CODE (OEESC)	2014
FIRE	OREGON FIRE CODE (OFC)	2014
	NFPA	2013
ACCESSIBILITY	OREGON STRUCTURAL SP. CODE	2014
	ANSI A117.1	2009
SOLAR	OREGON SOLAR CODE	2010

PROJECT DESCRIPTION

PROJECT INCLUDES 16 NEW APARTMENT UNITS AND COMMON SPACES IN 5 BUILDINGS ORGANIZED AROUND A CENTRAL COURTYARD. NET ZERO ENERGY PERFORMANCE IS TARGETED. UNITS INCLUDE (3) ONE-BEDROOM UNITS, (2) TWO-BEDROOM UNITS, AND (11) THREE-BEDROOM UNITS. ADDITIONAL STRUCTURES INCLUDE GARBAGE/RECYCLING AND COVERED BIKE PARKING AS WELL AS A SURFACE PARKING LOT FOR 7 PARKING SPACES. PRIMARY PEDESTRIAN ENTRY AND PRIMARY VEHICULAR ENTRY ARE LOCATED ALONG NE TILLAMOOK.

SITE AND ZONING INFORMATION

PROJECT ADDRESS: 16, 20 NE TILLAMOOK ST.
PORTLAND, OR 97212

LEGAL DESCRIPTION: ALBINA, BLOCK 23
E25' OF LOT 1 AND 2, W 40' OF N100' OF LOT 4,
S 50' OF LOT 4, E 10' OF N 100' OF LOT 4,
LOT 5, 6, AND 7

PROPERTY ID: R102346, R102348, R102349, R102350,
R102351, R102352

SITE AREA: 32,500SF

BASE ZONING OF SITE: R2 (RESIDENTIAL 2,000)

OVERLAY: a (ALTERNATIVE DESIGN DENSITY)

LAND USE CASE FILE: N/A

DENSITY: **MAXIMUM:** 16 **PROVIDED:** 16

PROPERTY LINE SETBACKS: SEE SHEET A004 FOR WALL AREA CALCS

	MIN REQ'D:	**PROVIDED:**
FRONT(NORTH):	10 FT	10 FT
REAR (SOUTH) BLDG C/D:	8 FT (MAX)	>10 FT
REAR (SOUTH) STORAGE:	5 FT	5 FT
SIDE (WEST):	6 FT	>20 FT
SIDE (EAST) BLDG B:	6 FT	6 FT
SIDE (EAST) BLDG C:	5 FT	5 FT

SITE LANDSCAPE AREA: **REQUIRED:** 30% OF SITE (9750 SF) **PROVIDED:** 44% (14,377 SF)

COURTYARD HARDSCAPE: **REQUIRED:** < 30% 25% **PROVIDED:** (1,926 SF OF 7,633 SF)

MAX BUILDING COVERAGE: **ALLOWED:** 50% (16,250 SF) **PROVIDED:** 41% (13,245 SF)

MAX BUILDING LENGTH: **ALLOWED:** 100 FT **PROVIDED:** 81'-6"

PARKING INTERIOR LANDSCAPE: **REQUIRED:** NONE (FEWER THAN 10 PARKING SPACE) **PROVIDED:**

LANDSCAPE SCREENING: **REQUIRED:** L3 AT PARKING **PROVIDED** L3 AT PARKING

PARKING AND LOADING: (TABLE 266-1) **REQUIRED:** NONE **PROVIDED:** 7 (INCLUDING 1 ADA)

BIKE PARKING

	REQUIRED:	**PROVIDED:**
LONG TERM:	19	50
SHORT TERM:	2	4

TREE PRESERVATION
TOTAL NON-EXEMPT TREES OVER 12" DIAMETER = 1
TOTAL PRESERVED TREES OVER 12" DIAMETER = 1
SEE SHEET A100 FOR TREE PROTECTION PLAN AND TREE SURVEY DETAIL

TREE DENSITY
TOTAL SITE AREA = 32,500SF
REQUIRED TREE DENSITY = 6,500SF
PROVIDED TREE DENSITY = 9,900SF
33 SMALL TREES - SEE L100 FOR LOCATION ON SITE

(6) BETULA NIGRA 'CULLY' HERITAGE =	1,800SF
(3) CORNUS NUTALLII =	900SF
(9) GINKO BILOBA 'AUTUMN GOLD' =	2,700SF
(5) LAGERSTROEMIA X NATCHEZ =	1,500SF
(8) STEWARTIA PSEUDOCAMILLIA =	2,400SF
(2) ACER JAPONICUM =	600SF

BUILDING CONSTRUCTION, HEIGHT & AREAS

SEE SHEET A004 - FIRE LIFE SAFETY PLANS

FIRE RESISTIVE BUILDING ELEMENTS

FIRE RESISTANCE RATING REQUIREMENTS (TABLE 601):

BUILDING ELEMENT:	**RATING REQUIRED:**
STRUCTURAL FRAME:	0 HR
BEARING WALLS - EXTERIOR :	0 HR
BEARING WALLS - INTERIOR:	0 HR
NONBEARING WALLS - INTERIOR:	0 HR
FLOOR CONSTRUCTION:	0 HR
ROOF CONSTRUCTION:	0 HR

SEPARATION DISTANCES (TABLE 602):
SEE SHEET A004, FIRE LIFE SAFETY PLANS

EXTERIOR WALL OPENING PROTECTION (TABLE 705.8):
SEE SHEET A004, FIRE LIFE SAFETY PLANS

VERTICAL SEPARATION OF OPENINGS (705.8.5):
VERTICAL SEPARATION OF OPENINGS NOT REQUIRED BY USE OF EXCEPTION 1:
1. 3 STORIES OR LESS IN HEIGHT

FIRE PARTITIONS (708):
FIRE PARTITIONS SHALL HAVE A FIRE RESISTANCE RATING OF NOT LESS THAN 1 HOUR. DRAFTSTOPPING TO CONTINUE THROUGH ATTIC, SEPARATING ATTIC SPACE INTO MAX 3000 SF AREA, AND COMBINING THE ATTICS OF NO MORE THAN TWO DWELLING UNITS.

HORIZONTAL ASSEMBLIES (711.3):
HORIZONTAL ASSEMBLIES SEPARATING DWELLING UNITS IN THE SAME BUILDING SHALL BE A MINIMUM OF 1-HOUR FIRE RESISTANCE RATED CONSTRUCTION.

OPENING PROTECTIVES (SECTION 716):
SHAFT ACCESS: 1 HR
DOORS IN OTHER FIRE BARRIERS: 1 HR
FIRE DOORS SHALL BE SELF-CLOSING OR AUTOMATIC CLOSING

CONCEALED SPACES (718.3):
DRAFTSTOPPING SHALL BE PROVIDED IN FLOOR/CEILING SPACES AT FIRE PARTITIONS (PARTY WALLS) BETWEEN DWELLING UNITS.

FIRE RESISTIVE INTERIOR FINISHES (TABLE 803.5):
SPRINKLERED:
CLASS C FINISHES FOR ALL EXIT STAIRWAYS/ENCLOSURES AND ALL ROOMS AND ENCLOSED SPACES.

BUILDING FIRE PROTECTION + SUPPRESSION

AUTOMATIC FIRE SPRINKLERS: ALL R -2 OCCUPANCY BUILDINGS WILL BE EQUIPED WITH AN AUTOMATIC FIRE SPRINKLER SYSTEM IN ACCORDANCE WITH NFPA 13R PER 903.2.8 AND 903.3.1.2.

FIRE ALARM: MANUAL FIRE ALARM SYSTEM REQUIRED PER 907.2.9.1

SMOKE ALARM: REQUIRED ON THE CEILING OR WALL OUTSIDE EACH SEPARATE SLEEPING AREA IN THE IMMEDIATE VICINTY OF BEDROOMS. REQUIRD IN EACH ROOM USED FOR SLEEPING PURPOSES. REQUIRED IN EACH STORY WITHIN A DWELLING UNIT.

STANDPIPE SYSTEM: NOT REQ'D

FIRE SPRINKLER AND FIRE ALARM PERMITS TO BE OBTAINED SEPARATELY

MEANS OF EGRESS

STAIRWAYS (1009)

ENCLOSURE: ALL INTERIOR STAIRWAYS ARE EITHER WITHIN AN R-2 DWELLING OR SERVE ONLY TWO STORIES AND THEREFORE DO NOT REQUIRE ENCLOSURE PER 1009.3, EXCEPTION 1 & 2.
WIDTH: ALL STAIRWAYS MIN WIDTH = 36" PER 1009.4 EXCEPTION 1. ALL STAIRS SERVE LESS THAN 50 OCCUPANTS.
DIMENSIONS: INTERIOR STAIRS WITHIN AN R-2 DWELLING:
MAX RISER HEIGHT = 7 3/4"
MIN TREAD DEPTH = 10"
NOSING: 3/4" - 1 1/4" (REQ'D FOR TREAD DEPTH < 11")
ALL OTHER STAIRS:
MAX RISER HEIGHT = 7" (MIN 4")
MIN TREAD DEPTH = 11"
HANDRAILS: ONE SIDE ONLY WITHIN DWELLING UNITS (1009.15, EXCPT 2)
BOTH SIDES, ALL OTHER LOCATIONS
34 - 38" ABOVE NOSINGS
PROFILE: 1 1/2" DIAM CIRCULAR OR 1" X 2" RECTANGULAR
1 1/2" MIN CLEARANCE FROM WALL, 4 1/2" MAX PROJECTION
EXTENSION AT TOP: 12" HORIZONTAL
EXTENSION AT BOTTOM: 12" SLOPED WITH RETURN TO WALL OR FLOOR

RAMPS (1010)

SLOPE: MIN 1:12 FOR MEANS OF EGRESS, OTHERWISE MIN 1:8.
MAX CROSS-SLOPE 2%
RISE: 30" MAX
LANDINGS: 60" MIN LENGTH FOR ACCESSIBLE ROUTE
48" MIN LENGTH FOR NON ACCESSIBLE ROUTE
36" MIN LENGTH WITHIN NON-ACCESSIBLE R-2 DWELLING UNITS
HANDRAILS: REQ'D BOTH SIDES OF RAMPS WITH >6" RISE

MEANS OF EGRESS - CONT.

GUARDS (1013)

WHERE REQ'D: ELEVATION CHANGES >30"
HEIGHT: 42" MIN EXCEPT AS FOLLOWS
36" MIN WITHIN R-2 DWELLING UNITS
34" MIN FOR STAIRS WITHIN R-2 DWELLING UNITS (MAX 38" IF HANDRAIL)
OPENINGS: 4 3/8" OPENINGS ALLOWED WITHIN R-2 DWELLING UNITS
WINDOW SILLS: 36" MIN SILL HEIGHT IF 6 FT ABOVE GRADE (OR PROVIDE GUARD)

EXIT ACCESS (1014)

COMMON PATH OF EGRESS TRAVEL:

USE	MAX ALLOWED	PROVIDED
B,S	100 FT (OCCUP<30)	77 FT
R-2	125 FT (NFPA 13R SPRINKLER)	<60 FT

EXIT & EXIT ACCESS DOORWAYS (1015)

ONE REQ'D FROM R-2 DWELLING UNITS WITH OCCUP LOAD < 20 & NFPA 13R SPRINKLER
ONE REQ'D FROM GROUP B AND S SPACES WHERE OCCUPANCY < 49

EGRESS BALCONIES (1019)

WALL SEPARATION: UNPROTECTED OPENINGS ALLOWED ADJACENT TO UNRATED EXTERIOR WALLS (1018.5, EXCPT 5).
LOCATION: MIN 10' FIRE SEPARATION DISTANCE

EXTERIOR EXIT STAIRWAYS AND RAMPS (1026)

LOCATION: MIN 10' FIRE SEPARATION DISTANCE **(SUBJECT TO APPEAL)**
PROTECTION: NOT REQ'D SINCE NOT REQ'D TO BE ENCLOSED PER 1009.3

EMERGENCY ESCAPE & RESCUE (1029)

MIN NET CLEAR AREA: 5.7 SF (5.0 SF AT GRADE LEVEL)
MIN NET CLEAR HEIGHT: 24"
MIN NET CLEAR WIDTH: 20"
MAX HEIGHT FROM FLOOR: 44"

ENERGY CODE REQUIREMENTS

THE DEVELOPMENT IS A NET-ZERO ENERGY PROECT INCLUDING HIGHLY INSULATED WALLS, TRIPLE-PANE WINDOWS, STRINGENT AIRTIGHTNESS AND ENERGY-RECOVERY VENTILATION.

COMPLIANCE PATH: PRESCRIPTIVE PATH

SECTION 502:

BUILDING ELEMENT:	**MIN. ALLOWED:**	**PROVIDED:**
ROOF (ATTIC)	R-38	R-5.15 MIN
WALLS (WOOD FRAMED)	R-21	R-29.6
WALLS (BELOW GRADE)	R-7.5ci	NO WALLS BELOW GRADE
FLOORS (UNHEATED SLAB)	R-10 FOR 24" BELOW	R-16.7ci
WINDOWS AND DOORS (>50% GLAZED)	U= 0.35 SHGC = 0.40 0.3 CFM/SF	U=0.14 SHGC = 0.50, 0.30
WINDOW/WALL RATIO	30% MAX	VARIES, 17% MAX
SKYLIGHTS	U=0.60 SHGC = 0.40	NO SKYLIGHTS
OPAQUE DOOR, SWING	U=0.70	U=0.70
OPAQUE DOOR, ROLL UP	U=0.50 0.4 CFM/SF	U=0.50

A CONTINUOUS AIR BARRIER IS PROVIDED TARGETING 0.08 CFM/SF @ 50PA WHOLE BUILDING. THE AIR BARRIER CONSISTS OF TAPED PLYWOOD SEAMS AT ROOF AND WALLS, TAPED TO A SEALED CONCRETE SLAB. ALL PENETRATIONS OF THE AIR BARRIER SHALL BE SEALED WITH AN APPROVED TAPE OR SEALANT.

PLUMBING FIXTURES

OCCUPANCY	**OCCUP LOAD**	**WATER CLOSET**	**LAVATORY**	**FOUNTAIN**
FLOOR 1				
SMALL ASSEMBLY	38	38/75 = 0.51	38/200 = 0.19	0 (DINING)
BUSINESS (CRAFT/OFFICE)	6	6/25 = 0.24	6/40 = 0.15	0
STORAGE	3	3/100 = 0.03	3/100 = 0.03	0
FLOOR 1 - REQUIRED		0.78	0.37	0
FLOOR 1 - PROVIDED		1	1	0
FLOOR 2				
FITNESS	19	19/25 = 0.76	19/40 = 0.48	0
FLOOR 2 - PROVIDED		1	1	0

*ALL RESIDENTIAL DWELLING UNITS (R-2) HAVE AT LEAST ONE WATER CLOSET, LAVATORY, AND BATHTUB.

RADON CONTROL

SEE RADON CONTROL PLAN

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- ☐ FINISHES

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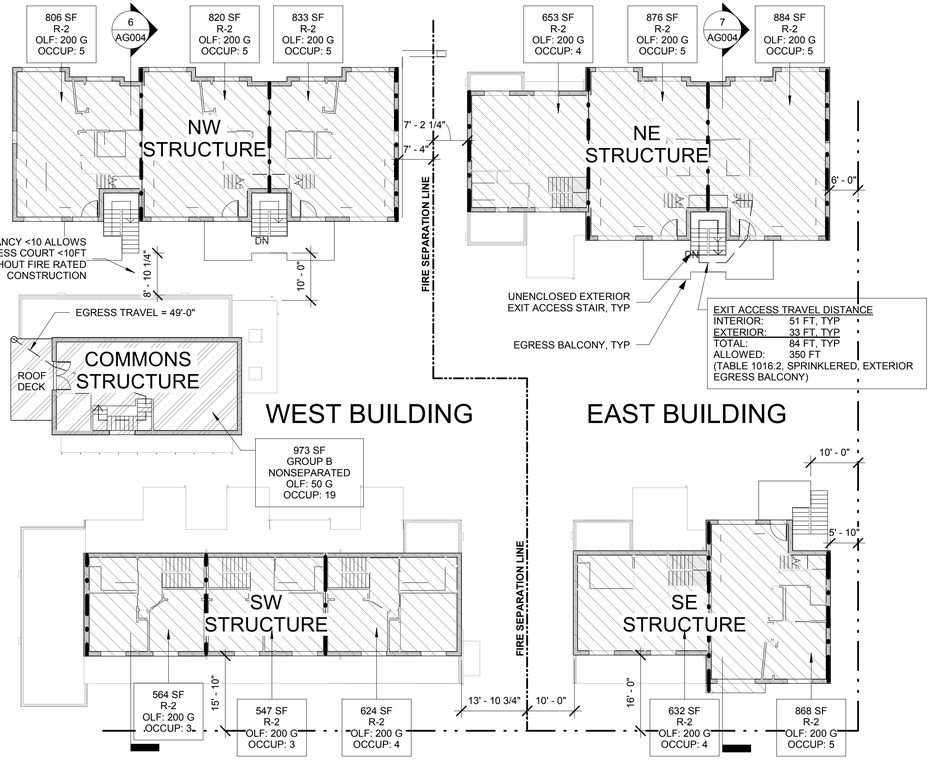
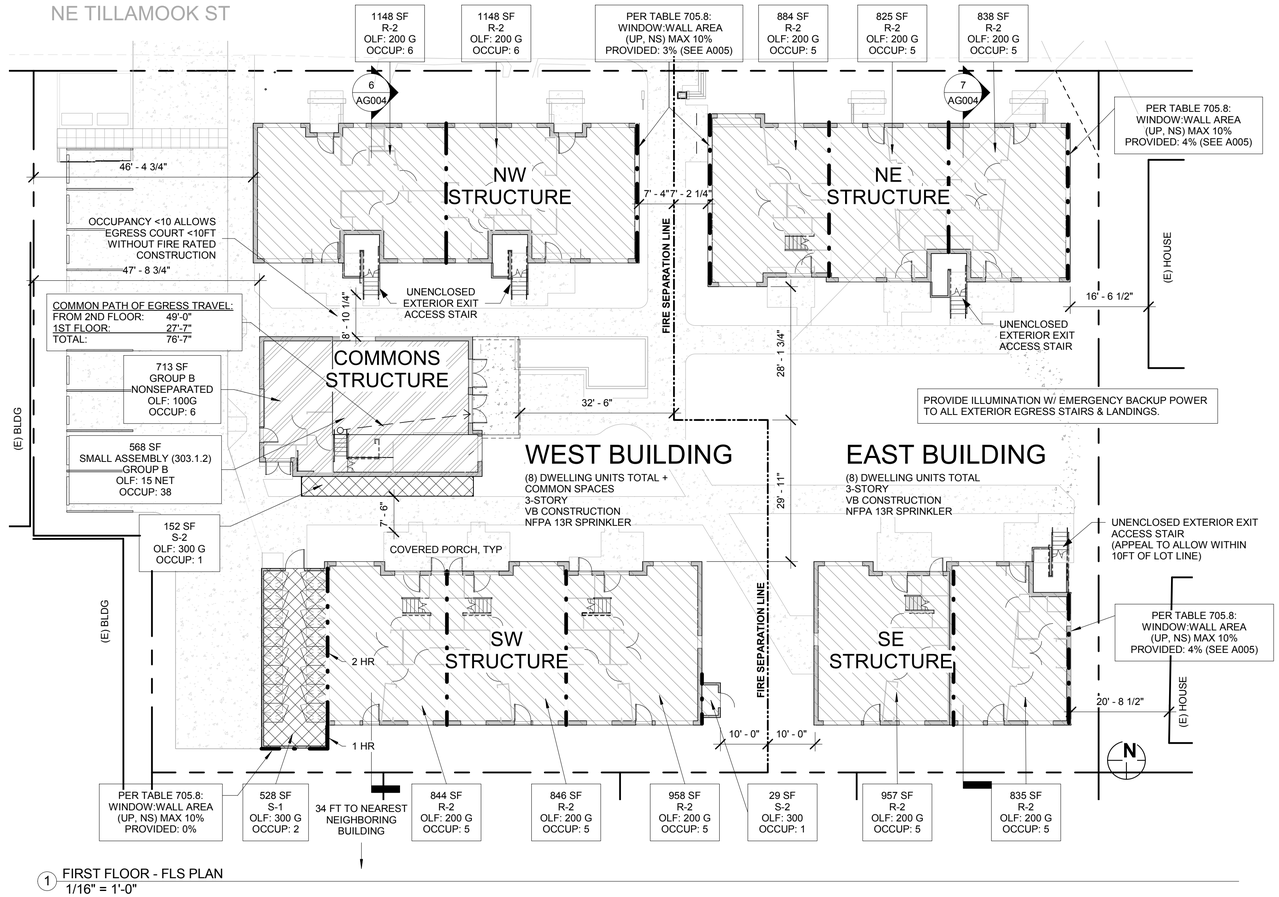
ZONING & CODE INFO

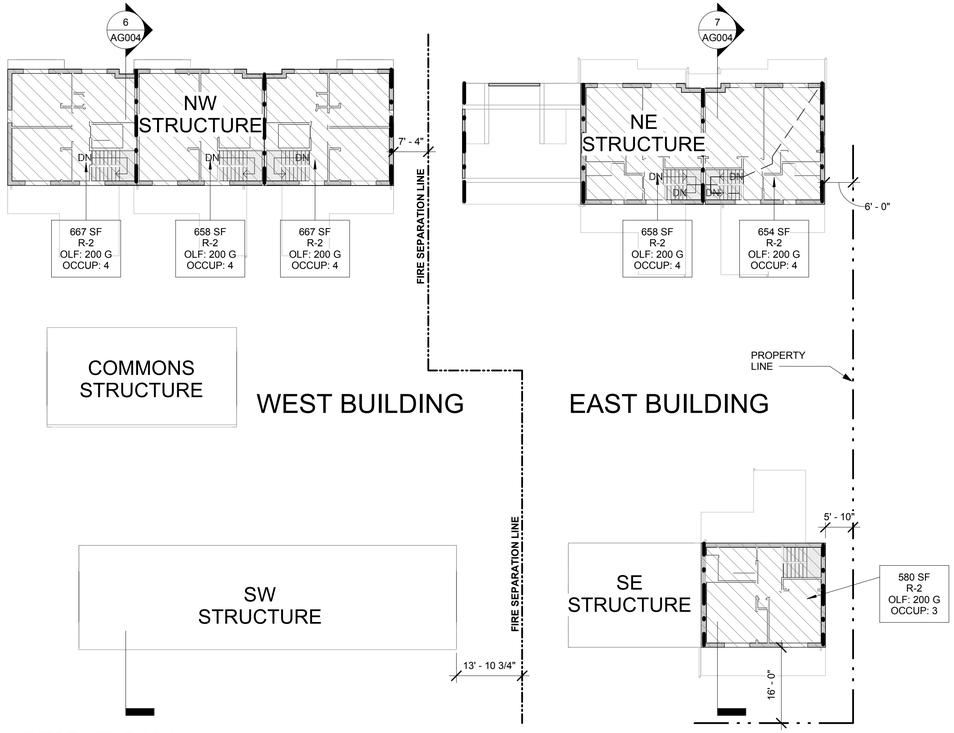
AG002



2 SECOND FLOOR - FLS PLAN
1/16" = 1'-0"



1 FIRST FLOOR - FLS PLAN
1/16" = 1'-0"



3 THIRD FLOOR - FLS PLAN
1/16" = 1'-0"

OCCUPANCY LEGEND

- R-2
- B
- S-1 AND S-2
- 1 HR FIRE PARTITION
- 2 HR FIRE PARTITION

FIRE RESISTIVE BUILDING ELEMENTS

SEPARATION DISTANCES (TABLE 602):
ALL WALLS HAVE 10 FT OR GREATER FIRE SEPARATION DISTANCE (0 FIRE RATING) EXCEPT AS FOLLOWS:

WALL	FIRE SEP DIST	FIRE RATING
NW STRUCTURE, EAST WALL	7'-4"	1 HR
SW STRUCTURE, SOUTH WALL OF S-1	5'-0"	1 HR
NE STRUCTURE, WEST WALL	7'-2"	1 HR
NE STRUCTURE, EAST WALL	6'-0"	1 HR
SE STRUCTURE, EAST WALL	5'-0"	1 HR

EXTERIOR WALL OPENING PROTECTION (TABLE 705.8):
SEE WINDOW:WALL RATIO IN PLANS ABOVE, AND ELEVATION AREA TAKE-OFFS ON SHEET A005

BUILDING CONSTRUCTION, HEIGHT, & AREA

FIVE STRUCTURES TO BE PERMITTED AS TWO BUILDINGS.

CONSTRUCTION TYPE: TYPE V-B

ALLOWABLE HEIGHT: 2 STORIES/40 FT
INCREASE OF 1 STORY AND 20 FEET OF HEIGHT WITH NFPA 13R FIRE SPRINKLER THROUGHOUT PER 504.2

PROPOSED HEIGHT: VARIES - 3 STORIES/ 36 FT MAX

ALLOWABLE AREA (503): TYPE VB

R-2	7,000 SF
B	9,000 SF
S-1	9,000 SF
S-2	13,500 SF

PROPOSED AREAS - WEST BUILDING

	STORY TOTAL	R-2	B	S-1	S-2	SMALL ASSEMBLY (ACCESSORY - B)
1ST FLOOR	6980	4944	713	528	181	614
2ND FLOOR	5167	4194	973	0	0	0
3RD FLOOR	1992	1992	0	0	0	0
TOTAL	14110					

PROPOSED AREAS - EAST BUILDING

	STORY TOTAL	R-2
1ST FLOOR	4339	4339
2ND FLOOR	3913	3913
3RD FLOOR	1892	1892
TOTAL	10144	

NONSEPARATED OCCUPANCY (508.3)
MOST RESTRICTIVE PROVISIONS OF CH 9 (R-2) SHALL APPLY TO ALL AREAS.
ALLOWABLE BUILDING AREA AND HEIGHT SHALL BE BASED ON MOST RESTRICTIVE OCCUPANCY (R-2).
ALL DWELLING UNITS SHALL BE SEPARATED FROM CONTIGUOUS OCCUPANCIES BY 1 HR FIRE PARTITION PER SECT 420.

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FIRE LIFE SAFETY PLANS

AG003

NE TILLAMOOK ST

NE TILLAMOOK ST

NEW STREET FRONTAGE STANDARDS

(E) STONE WALL TO BE REMOVED AND REUSED

STEPPING STONE PATH TO PATIO, TYP. ALONG NE TILLAMOOK

PRIMARY PEDESTRIAN ENTRY

225'

(E) SIDEWALK

(E) PROP LINE

NEW PROP LINE

ROW ENCROACHMENT

16' - 0"

ELEV: 144

81' - 0"

15' - 0 3/4"

76' - 0"

12' - 0"

0' - 6" CURB

4' - 0" FURN

6' - 0" SDWLK

1' - 6"

4' - 0"

HYD

(E) TREE

(E) DRIVEWAY

EASEMENT

STORMWATER PLANTER

20' - 9"

F2 SCREEN

RECYCLING

1 A106

6' - 0"

PAVERS

5' - 0"

2' - 0"

14' - 0"

20' - 0"

3' - 5"

PATIO

L2 SCREEN

HP

5.58" SETBACK PROJECTION

NW STRUCTURE

(5) DWELLING UNITS TOTAL
(3) THREE-BEDRM; (2) TWO-BEDRM
FINISH FLOOR EL: 147'
3-STORY

W D

DW

HPWH

GREEN WALL TRELLIS

ARBOR

BENCH

2 A105

SETBACK PROJECTIONS, SEE SHEET A004

5 1/8" SETBACK PROJECTION

FDC

14' - 6 1/4"

(2) BIKE STAPLES MIN 18" X 30" GALV STL

SHORT-TERM BIKE PARKING (4)

2' - 4"

3' - 6"

5' - 0"

1' - 0"

6' - 0"

RAINWATER CISTERN

RAINWATER CISTERN

NE STRUCTURE

(5) DWELLING UNITS TOTAL
(3) THREE-BEDRM; (2) ONE-BEDRM
FINISH FLOOR EL: 147'
3-STORY

W/D

ERV

1' - 2 1/4" SETBACK PROJECTION (MECH EQUIP, WALL-HUNG)

33' - 0"

F2 SCREEN

5' - 8"

8' - 3 1/2"

PORCH

8' - 0"

46' - 6"

1' - 9 3/4"

5' - 6"

SIDE SETBACK, NE BUILDING

2' - 10"

5' - 0"

PICNIC TABLE

148'-1 3/4"

100'

(E) BUILDING

L3 SCREEN

8' - 6" TYP

8' - 0"

VAN ACCESSIBLE

9' - 0"

29' - 0"

COMMONS STRUCTURE

COMMON SPACE
FINISH FLOOR EL: 147.5'
2-STORY

PLANTER

WATER FEATURE

4 A105

TREE PROTECTION FENCING DURING CONSTRUCTION

ECOLAWN

(E) TREE TO REMAIN

STORMWATER BASIN

LATTICE FENCE, 4X4 WWR

DW

ERV

BIKE STORAGE

4' - 3"

6' - 0"

RAINWATER CISTERN

STEPPING STONES

MAIN ENTRANCE DISTANCE = 118'
STRAIGHT-LINE DISTANCE = 106.5'
(11% GREATER)

121.00°

59.00°

4' - 0"

L2 SCREEN

L3 SCREEN

25'

(3) REMOVEABLE BOLLARDS

5' - 0"

5' - 0"

4' - 0"

1' - 6"

8' - 6"

PORCH

SW STRUCTURE

(3) DWELLING UNITS TOTAL
(3) THREE-BEDRM
FINISH FLOOR EL: 148'
2-STORY

W/D

RAISED BEDS

RAINWATER CISTERN

PICNIC TABLE

10' - 0"

7' - 0"

SE STRUCTURE

(3) DWELLING UNITS TOTAL
(2) THREE-BEDRM; (1) ONE-BEDRM
FINISH FLOOR EL: 148'
3-STORY

5' - 10"

6" SETBACK PROJECTION (MECH EQUIP, WALL-HUNG)

(E) BUILDING

50'

L3 SCREEN

PAVED SPORT COURT

18' - 1 13/32"

BASKETBALL HOOP (OWNER INSTALLED)

L3 SCREEN

REAR SETBACK, SE BUILDING STORAGE

REAR SETBACK, SW BUILDING

L2 SCREEN

REAR SETBACK, SE BUILDING

SIDE SETBACK, SE BUILDING

200'

N

1 SITE PLAN
1/8" = 1'-0"

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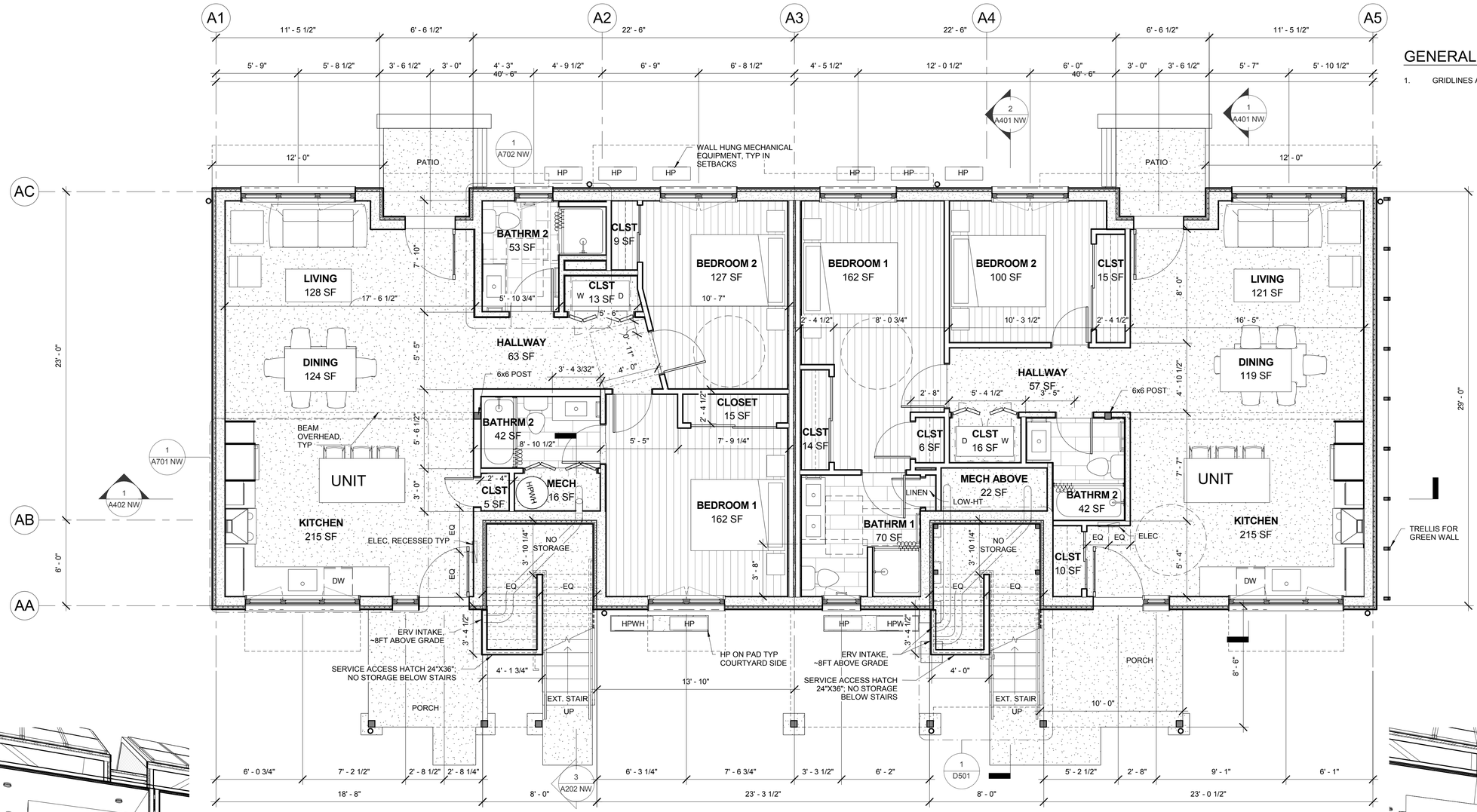
SITE PLAN

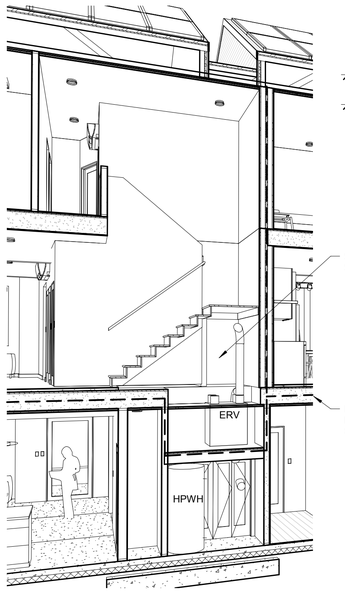
A101

GENERAL NOTES

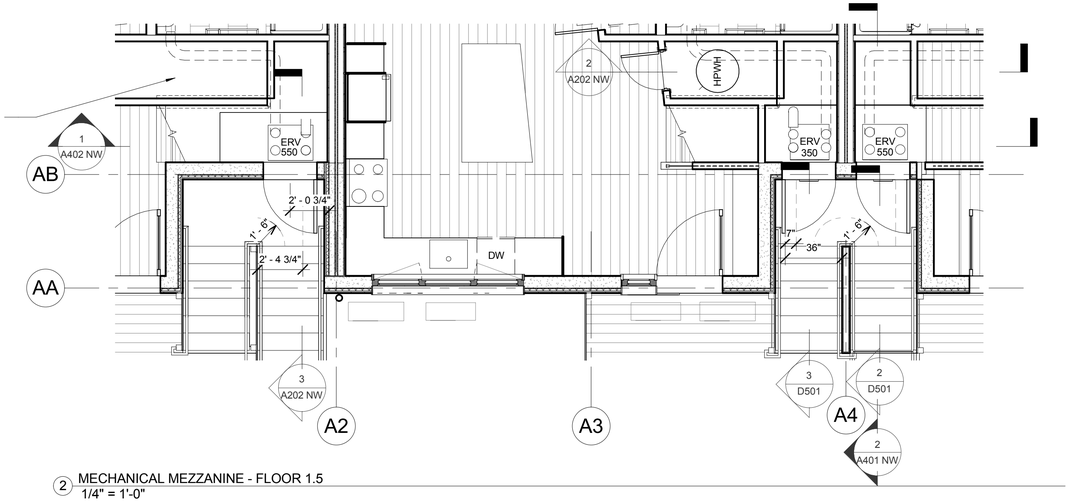
1. GRIDLINES ARE AT FACE OF FRAMING



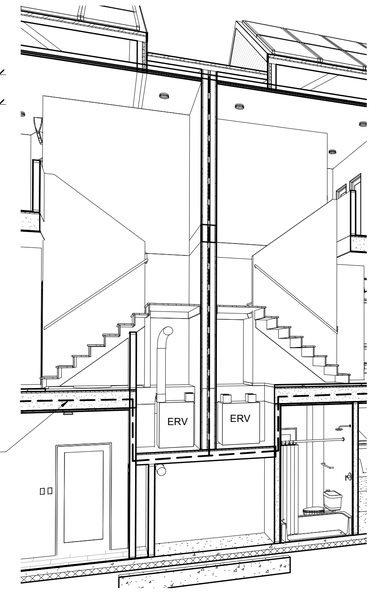
1 BLDG A - FIRST FLOOR
1/4" = 1'-0"



4 Mech Mezzanine - West



2 MECHANICAL MEZZANINE - FLOOR 1.5
1/4" = 1'-0"



3 Mech Mezzanine - East

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FIRST FLOOR PLAN

A201 NW

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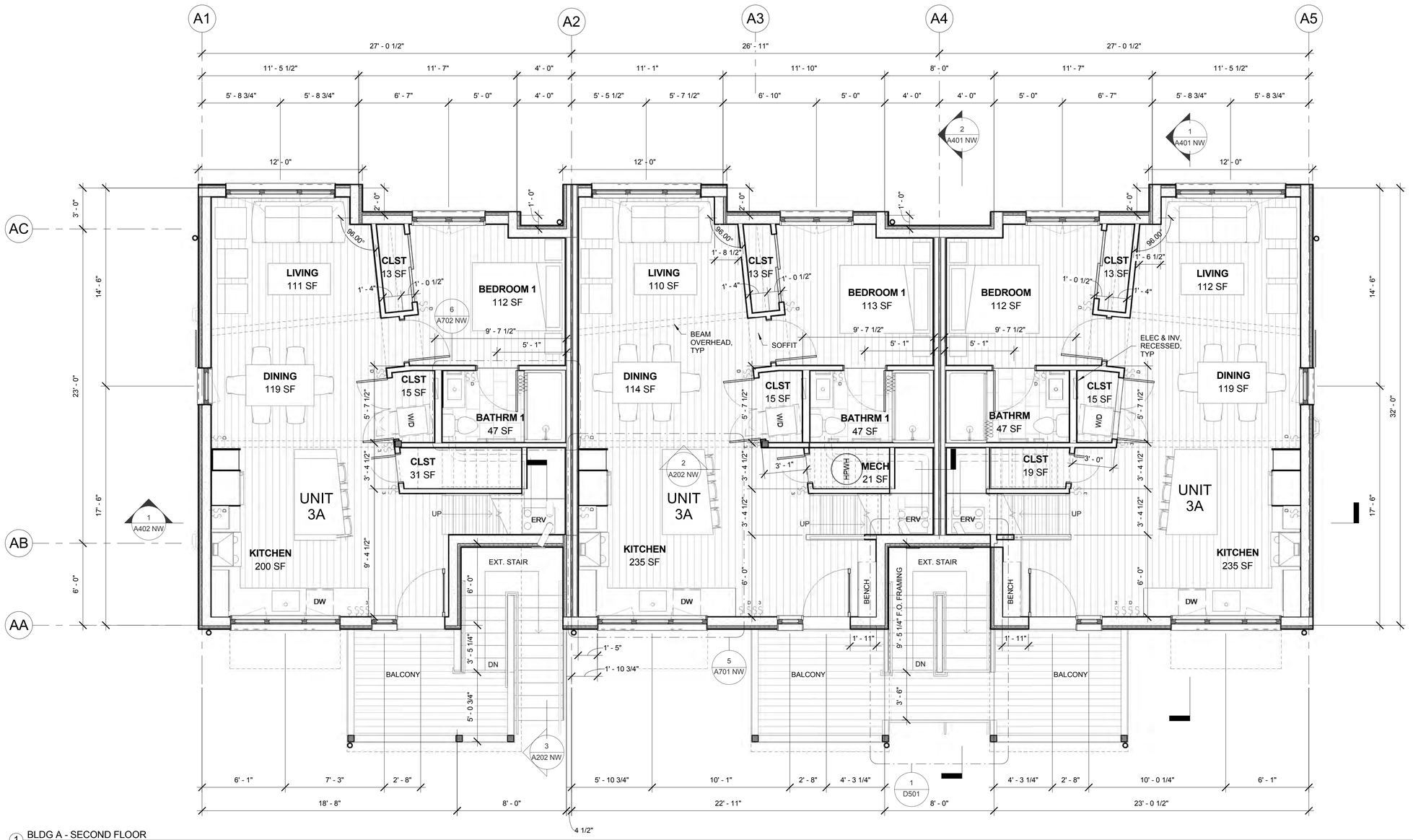
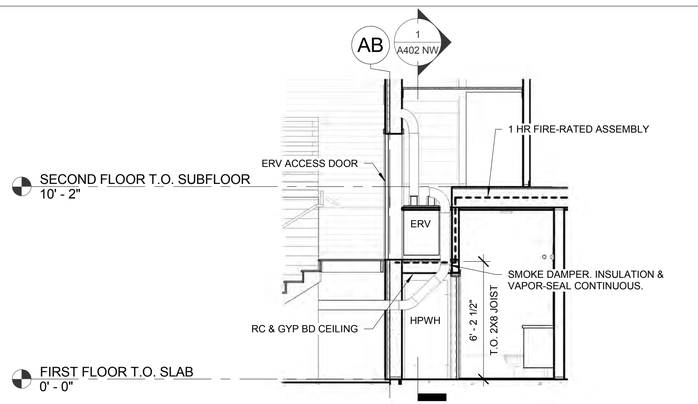
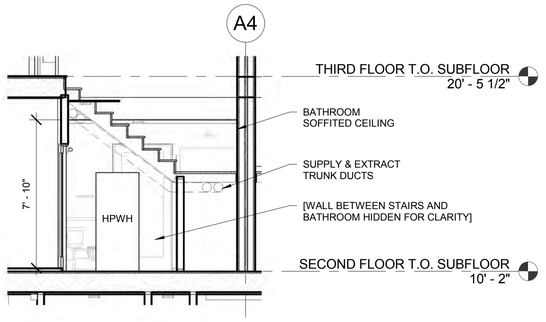


1 BLDG A - SECOND FLOOR
1/4" = 1'-0"



3 DETAIL SECTION - WEST MECH MEZZANINE
1/4" = 1'-0"



2 DETAIL SECTION - ERV DUCT TO THIRD FLOOR
1/4" = 1'-0"

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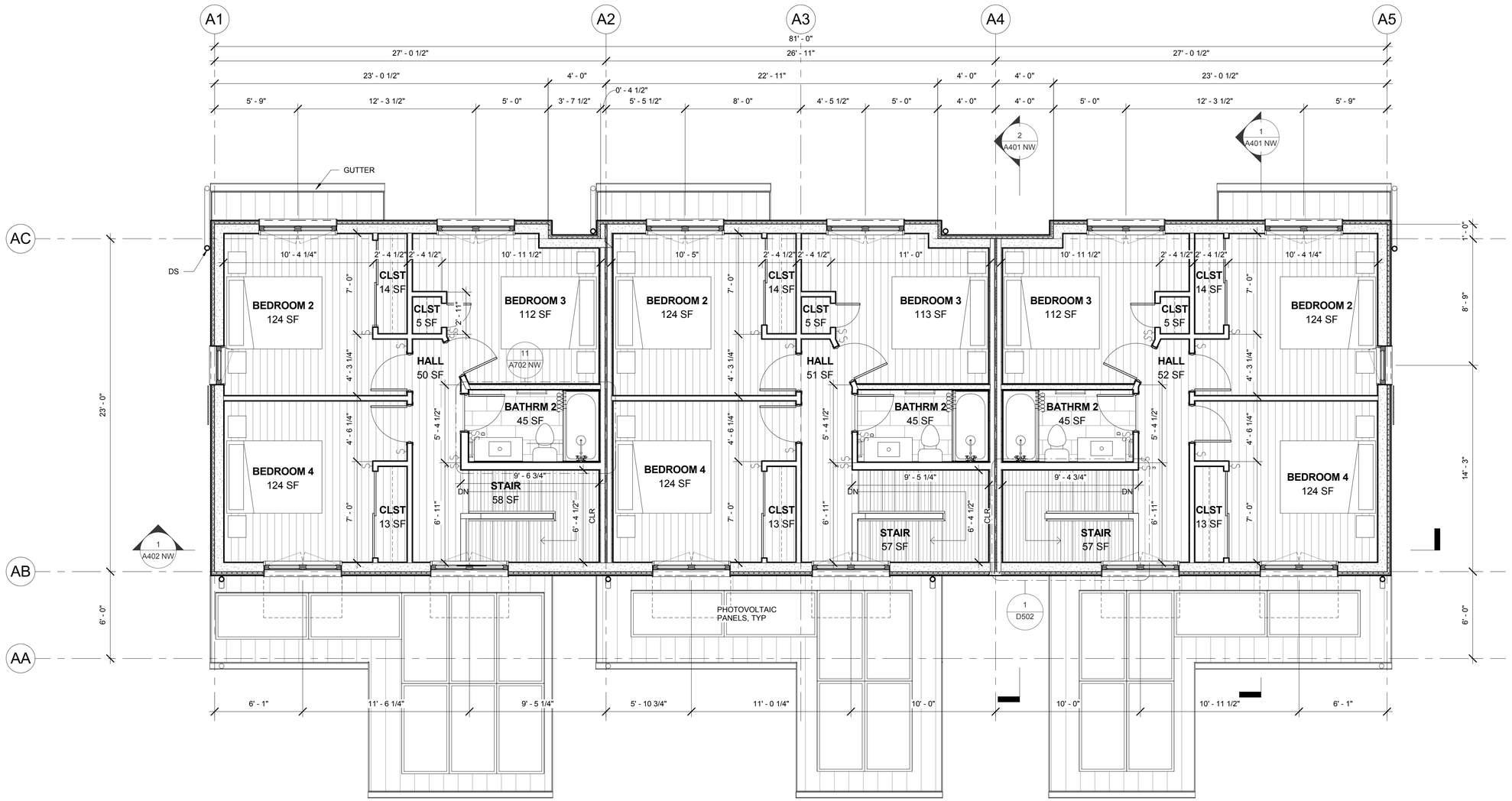
SECOND FLOOR PLAN

A202 NW



1 BLDG A - THIRD FLOOR
1/4" = 1'-0"

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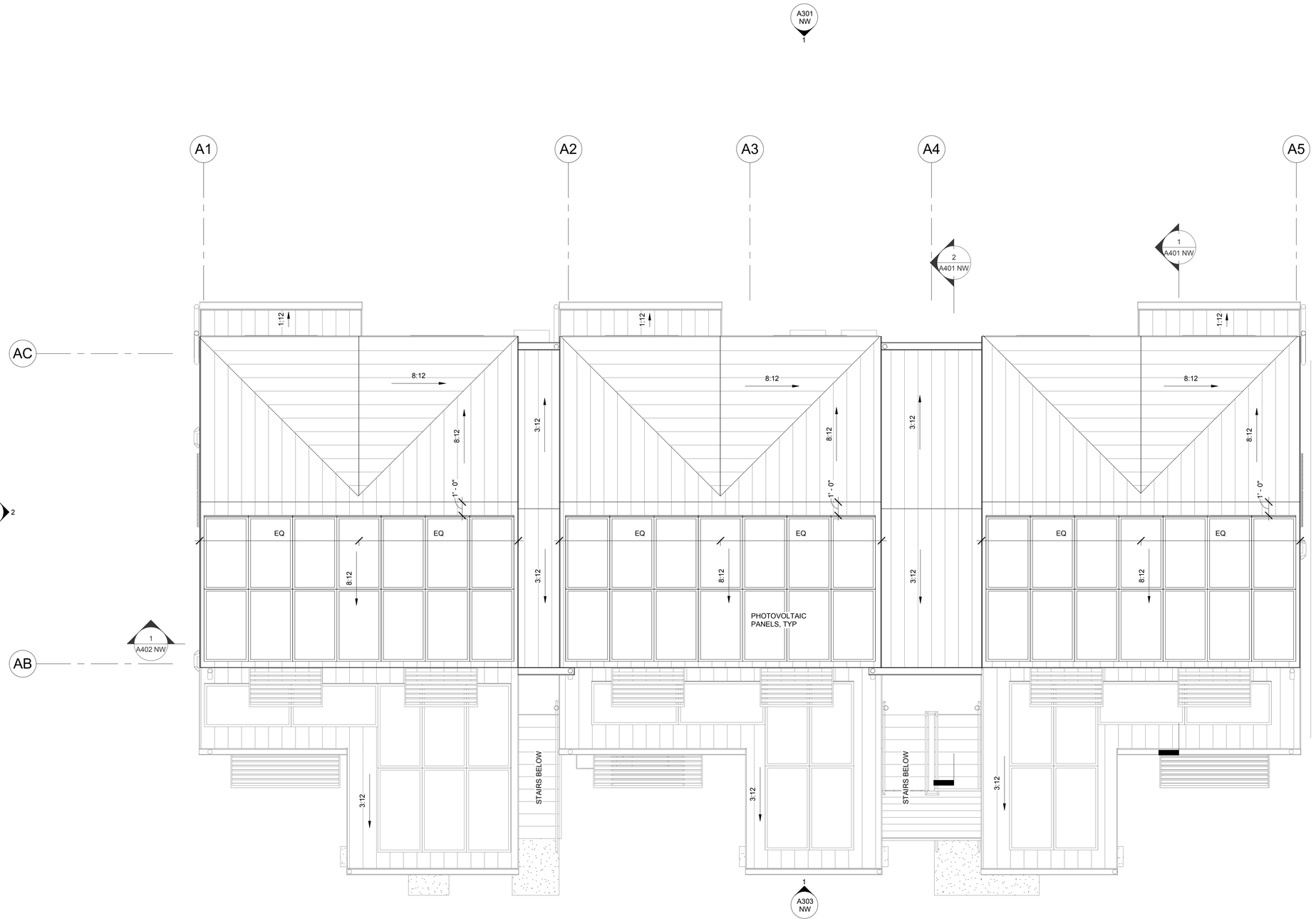
THIRD FLOOR PLAN

A203 NW



1 04 ROOF PLAN
1/4" = 1'-0"

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ROOF PLAN

A204
NW

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1 NORTH
1/4" = 1'-0"

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ELEVATIONS - NORTH

A301 NW

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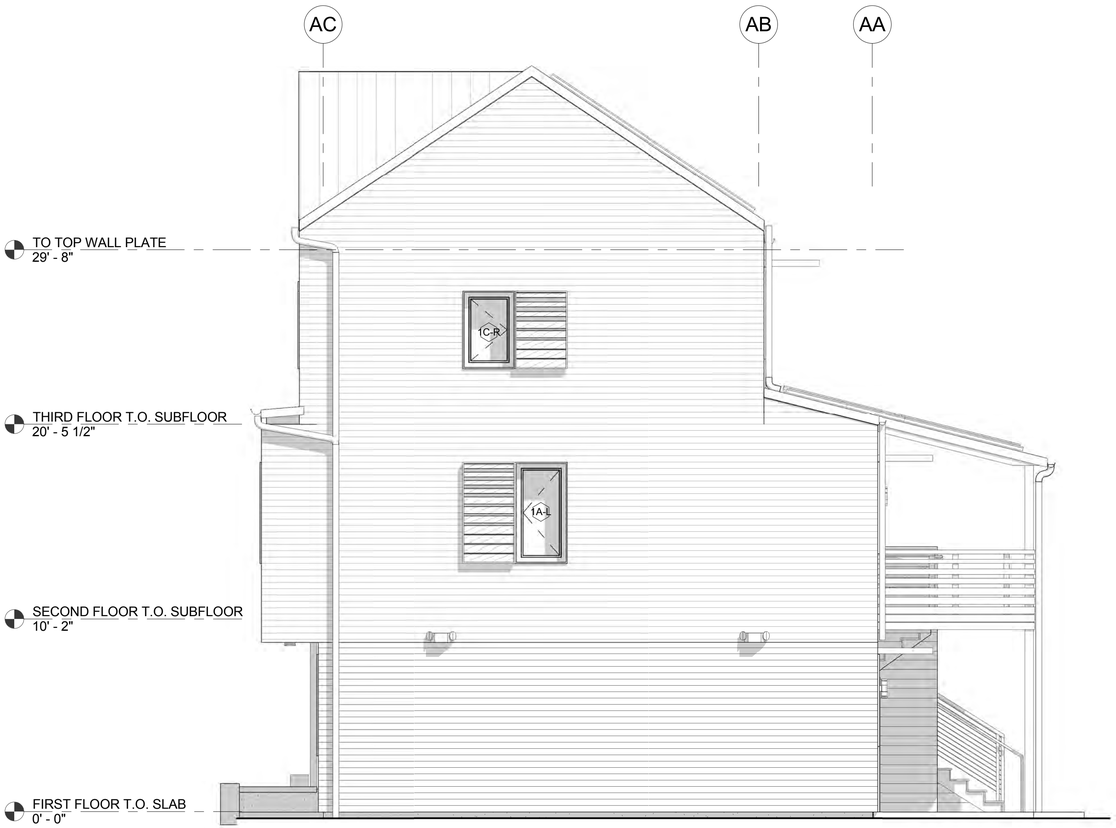
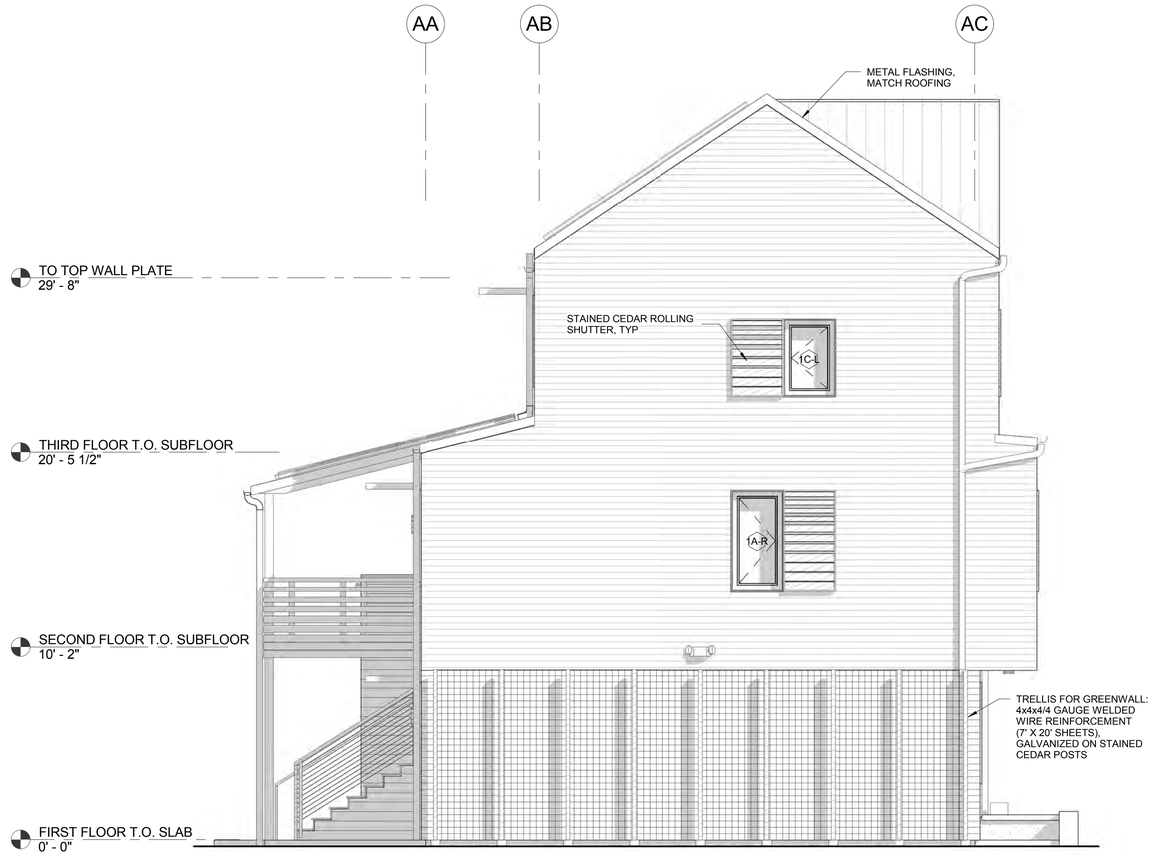


2 WEST
1/4" = 1'-0"



1 EAST
1/4" = 1'-0"

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green hammer
1323 SE 6TH AVENUE PORTLAND, OR 97214
(P) 503.804.1746 (F) 503.232.7924
www.greenhammer.com

REGISTERED ARCHITECT
ERICA P. DUNN
PORTLAND, OREGON
5477
STATE OF OREGON

TILLAMOOK ROW
NW STRUCTURE

BCMC TILLAMOOK, LLC
20 NE TILLAMOOK ST.
PORTLAND, OR 97212

PERMIT SET
11/30/2016

CONSTRUCTION PACKAGES:

- ☐ FOUNDATION
- ☐ FRAME
- ☐ ENVELOPE
- ☐ MEP ROUGH-IN
- ☐ FINISHES

ISSUE	DATE
REV	

ELEVATIONS
- EAST +
WEST

A302
NW

1 SOUTH
1/4" = 1'-0"

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12/13/2016 10:00:58 AM

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ERICA P. DUNN
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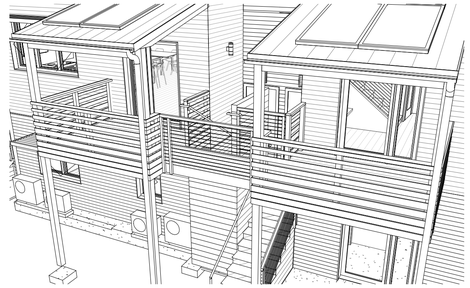
- ☐ MEP ROUGH-IN
- ☐ FINISHES

ISSUE	DATE
REV	

ELEVATIONS
- SOUTH

A303
NW

1 Bldg Persp NW



4 EXTERIOR BALCONIES & STAIR

3 EXTERIOR STAIR

2 Bldg Persp SE

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- ☐ FRAME
- ☐ ENVELOPE
- ☐ MEP ROUGH-IN
- ☐ FINISHES

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PERSPECTIVES

A304
NW

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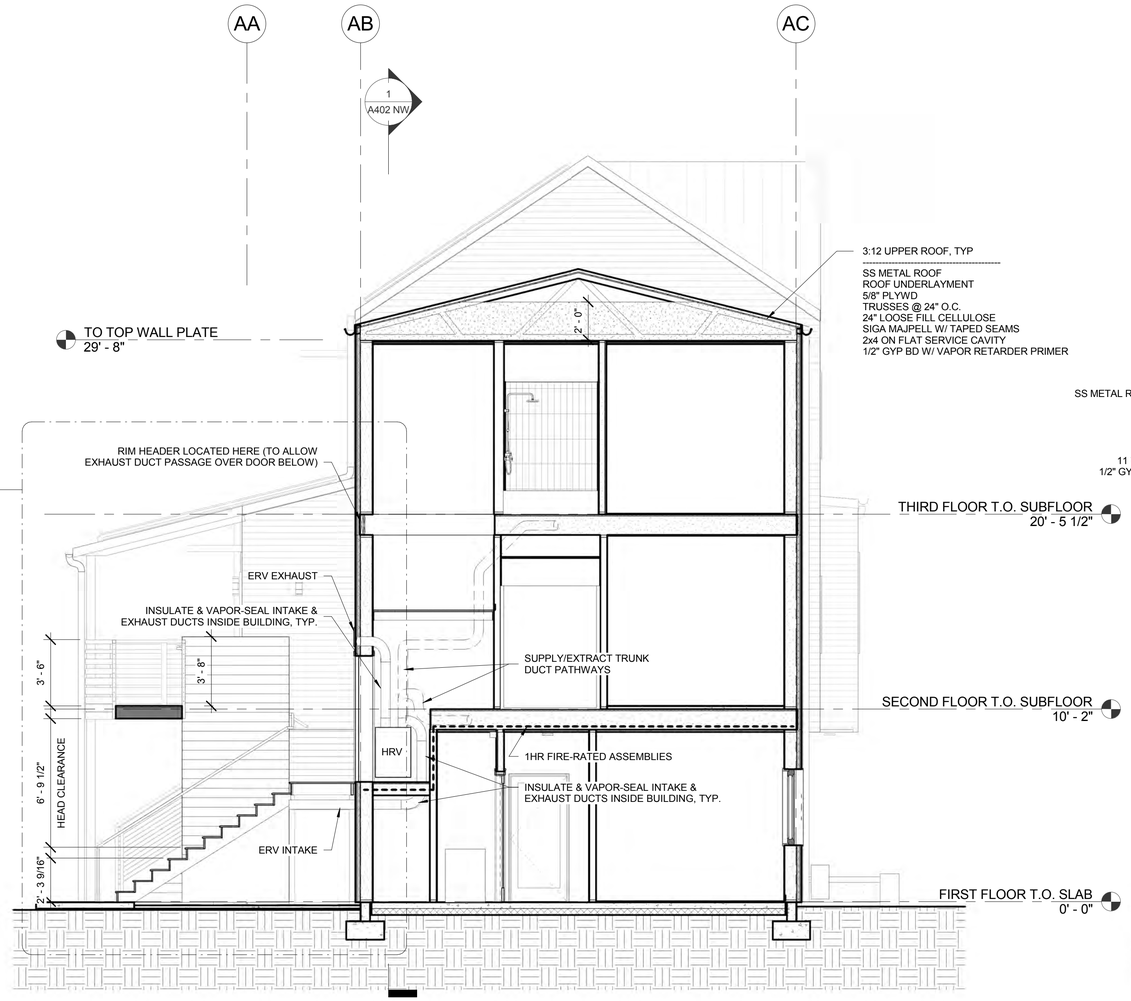
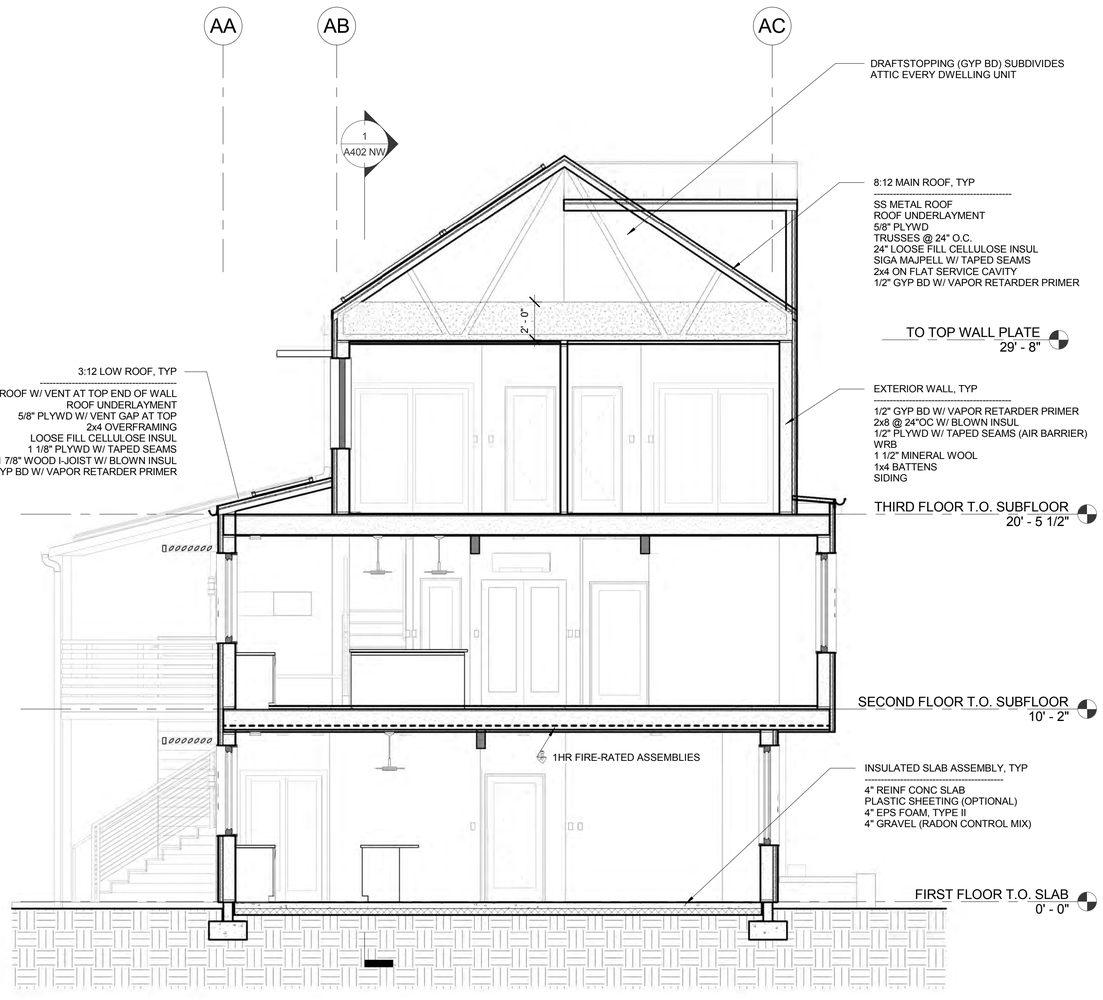


2 N-S BUILDING SECTION - EAST UNIT
1/4" = 1'-0"



1 N-S BUILDING SECTION
1/4" = 1'-0"

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REGISTERED ARCHITECT
ERICA P. DUNN
PORTLAND, OREGON
5477
STATE OF OREGON

TILLAMOOK ROW NW STRUCTURE

BCMC TILLAMOOK, LLC
20 NE TILLAMOOK ST.
PORTLAND, OR 97212

PERMIT SET
11/30/2016

CONSTRUCTION PACKAGES:
- ☐ FOUNDATION
- ☐ FRAME
- ☐ ENVELOPE
- ☐ MEP ROUGH-IN
- ☐ FINISHES

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BUILDING SECTION

A401 NW

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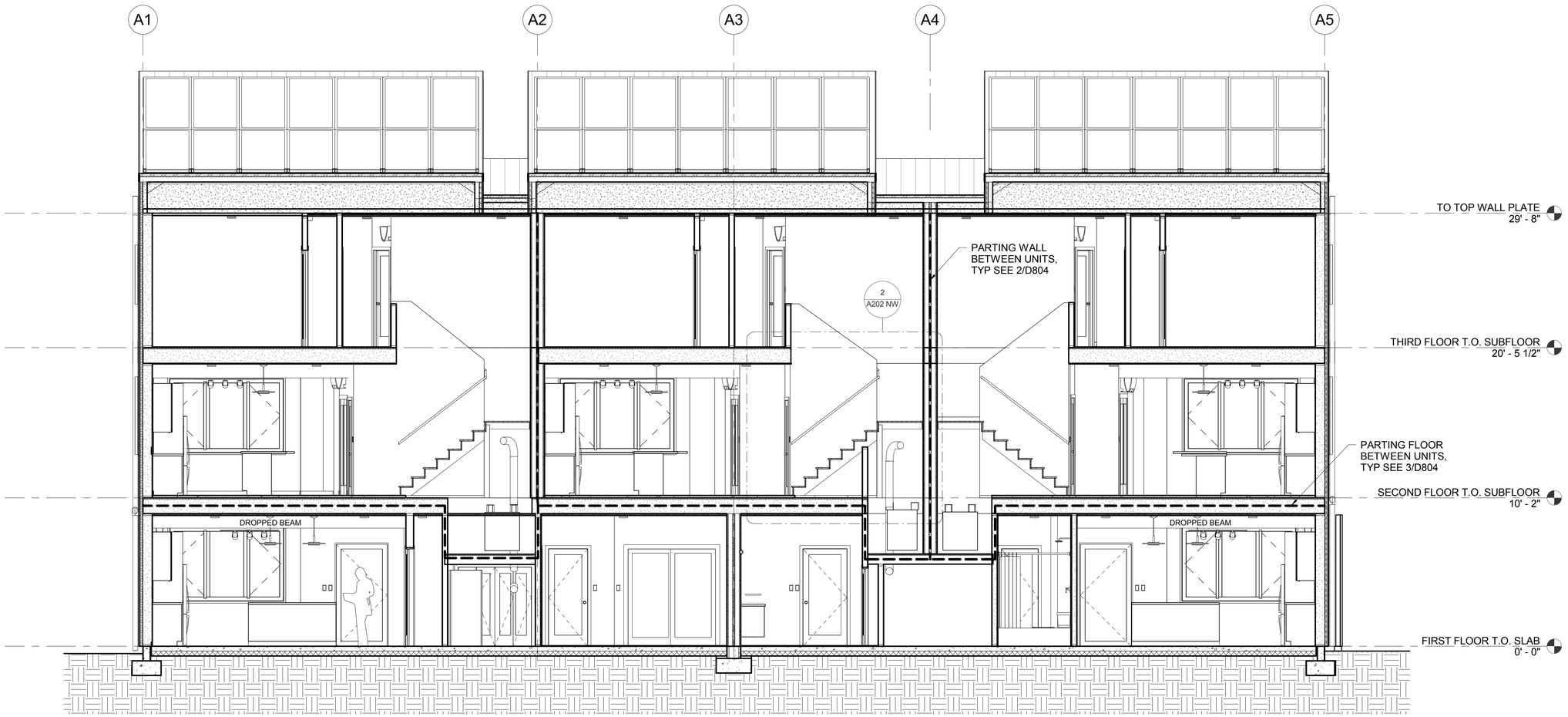

1 E-W BUILDING SECTION AT INT STAIR 01
1/4" = 1'-0"

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REGISTERED ARCHITECT
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PORTLAND, OREGON
5477
STATE OF OREGON

TILLAMOOK ROW
NW STRUCTURE

BCMC TILLAMOOK, LLC
20 NE TILLAMOOK ST.
PORTLAND, OR 97212

PERMIT SET
11/30/2016

CONSTRUCTION PACKAGES:
- ☐ FOUNDATION
- ☐ FRAME
- ☐ ENVELOPE
- ☐ MEP ROUGH-IN
- ☐ FINISHES

ISSUE	DATE
REV	

BUILDING SECTION

A402 NW

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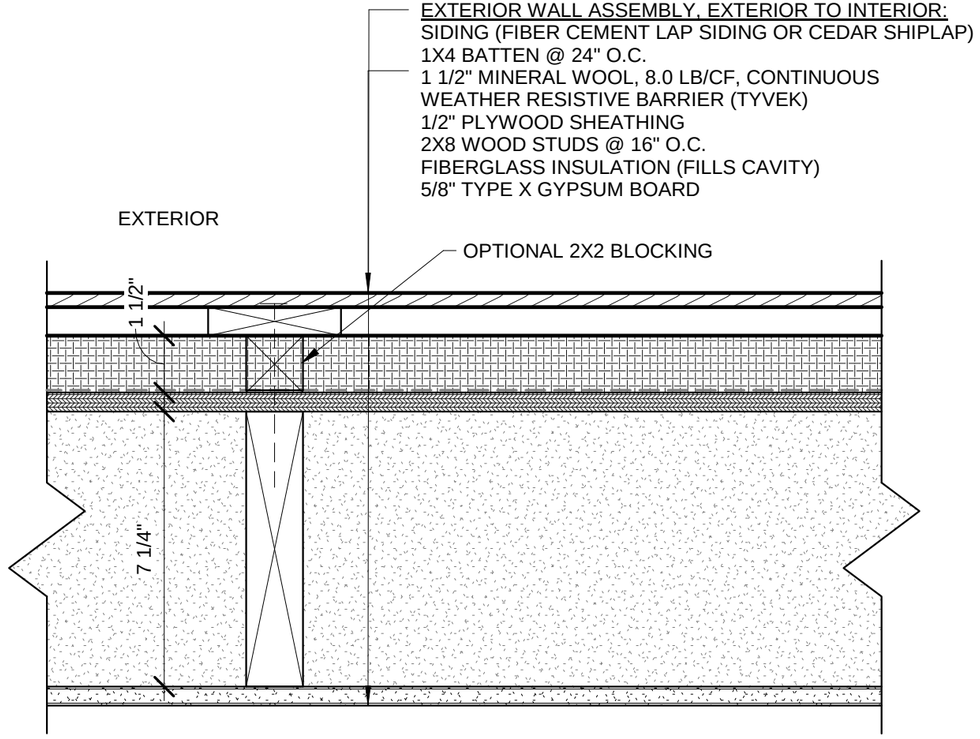

1 EXTERIOR WALL PLAN SECTION
3" = 1'-0"

OSSC 722.6.2 - WOOD WALL ASSEMBLY FIRE RESISTANCE CALCULATION

REQUIRES

722.6.2.3 prescribes 20 minutes of fire resistance for 2x4 wood studs at 16"o.c.
722.6.2.5 prescribes 15 minutes of fire resistance to various types of insulation filling a stud cavity.

PROPOSED

Apply 20 minutes of fire resistance to 2x8 wood studs at 16"o.c.

Apply 15 minutes of fire resistance to a 1 1/2" layer of continuous mineral wool insulation (8.0 lb/cf) on the exterior side of the stud wall, as shown in the wall assembly attached.

The assembly would then have the following fire resistance as calculated per OSSC 722.6.2.1:

FIRE EXPOSURE FROM INTERIOR:

5/8" TYPE X GYPSUM BOARD	40 MIN	TABLE 722.6.2 (1)
2x8 WOOD STUDS 16" O.C.	20 MIN	TABLE 722.6.2 (2)
GLASS FIBER CAVITY INSULATION	15 MIN	TABLE 722.6.2 (5)
TOTAL	75 MIN	

FIRE EXPOSURE FROM EXTERIOR:

1 1/2" MINERAL WOOL, 8.0 LB/CF	15 MIN	TABLE 722.6.2 (5)
15/32" PLYWOOD, EXTERIOR	10 MIN	TABLE 722.6.2 (1)
2x8 WOOD STUDS 16" O.C.	20 MIN	TABLE 722.6.2 (2)
GLASS FIBER CAVITY INSULATION	15 MIN	TABLE 722.6.2 (5)
TOTAL	60 MIN	

Mineral wool to be held in place by 1x4 battens fastened to wall with #8 screws at 24" O.C. max, with min 1" embedment into studs.

REASON

Using larger wood studs (i.e. 2x8 instead of 2x4) is acceptable for UL ratings without reducing the assembly fire resistance rating.

Mineral wool proposed is a Non-Combustible material with a Flame Spread rating of 0 and a melting point of 2,150 degrees F (see attached data sheet). A continuous 1 1/2" thick layer of this material would have at least a 15 minute fire resistance, which is equivalent to, for example, a layer of 19/32" plywood per Table 722.6.2 (1). By contrast plywood is a combustible material with a flame spread rating of approximately 100. Further, 1 1/2" of 8.0 pcf mineral wool results in 1.0 psf density of mineral wool material, whereas 722.6.2.5 prescribes 15 minutes of fire resistance to 3.3 pcf mineral wool within a 2x4 stud cavity (which is not continuous) which achieves 0.96 psf density of mineral wool material.

A desired option is to allow 2x2 blocking to break the mineral wool, similar to studs breaking stud cavity insulation, to help keep the siding in a uniform plane.

A similar appeal was approved by the City of Seattle, substituting a continous layer of 1 1/4" mineral wool insulation (8 lb/cf) for a layer of 5/8" Type X gypsum board. See attached.

green hammer
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(P) 503.804.1746 (F) 503.232.7924
www.greenhammer.com

REGISTERED ARCHITECT
ERICA P. DUNN
PORTLAND, OREGON
5477
STATE OF OREGON

TILLAMOOK ROW
NE STRUCTURE

CODE APPEALS
03/03/2017

CONSTRUCTION PACKAGES:
- ☒ FOUNDATIO
- ☒ FRAME
- ☐ ENVELOPE
- ☐ MEP ROUGH-IN
- ☐ FINISHES

ISSUE	DATE
REV	

EXTERIOR WALL FIRE RATING

APL-07

ROXUL®
The Better Insulation™

Technical Product Information

ROXUL ComfortBoard™ IS
Residential Insulated Sheathing

BOARD INSULATION 07210*

BOARD INSULATION 07 21 13**

General Product Information:

ROXUL® products are mineral wool fibre insulations made from basalt rock and slag. This combination results in a non-combustible product with a melting point of approximately 2150°F (1177°C), which gives it excellent fire resistance properties. ROXUL mineral wool is a water repellent yet vapour permeable material.

Description & Common Applications:

The COMFORTBOARD™ IS product is a rigid mineral wool insulation sheathing board that is non-combustible, water repellent, fire resistant and sound absorbent. This product is an exterior non-structural insulation sheathing board for high performance residential wall systems.

Compliance and Performance:

ASTM C 612	Mineral Fiber Block and Board Thermal Insulation	Type IVB, Complies
CAN/ULC-S702	Mineral Fibre Thermal Insulation for Buildings	Type 1, Complies
CCMC Evaluation Listing		13573-L

Fire Performance:

ASTM E 136	Behaviour of Materials at 750°C (1382°F)	Non-Combustible
CAN/ULC-S114	Test for Non-Combustibility	Non-Combustible
ASTM E 84 (UL 723)	Surface Burning Characteristics	Flame Spread = 0 Smoke Developed = 0
CAN/ULC-S102	Surface Burning Characteristics	Flame Spread = 0 Smoke Developed = 0

Moisture Resistance:

ASTM C 1104	Moisture Sorption	0.05 %

Water Vapour Permeance:

ASTM E 96	Water Vapour Transmission, Desiccant Method	1768 ng/Pa.s.m² (31 perm)

Fungi Resistance:

ASTM C 1338	Determination of Fungi Resistance	Passed

Thermal Resistance:

ASTM C 518 (C 177)	R-value/inch @ 75°F	4.0 hr.ft².F/Btu
	RSI value/25.4 mm @ 24°C	0.70 m²K/W

Corrosive Resistance:

ASTM C 665	Corrosiveness to Steel	Non-corrosive
ASTM C 795 ****	Stainless Steel Stress Corrosion Specification as per Test Methods C871 and C692: U.S. Nuclear Regulatory Commission, Reg. Guide #1.36: U.S. Military Specifications MIL-I-24244 (all versions including B and C)	Non-corrosive

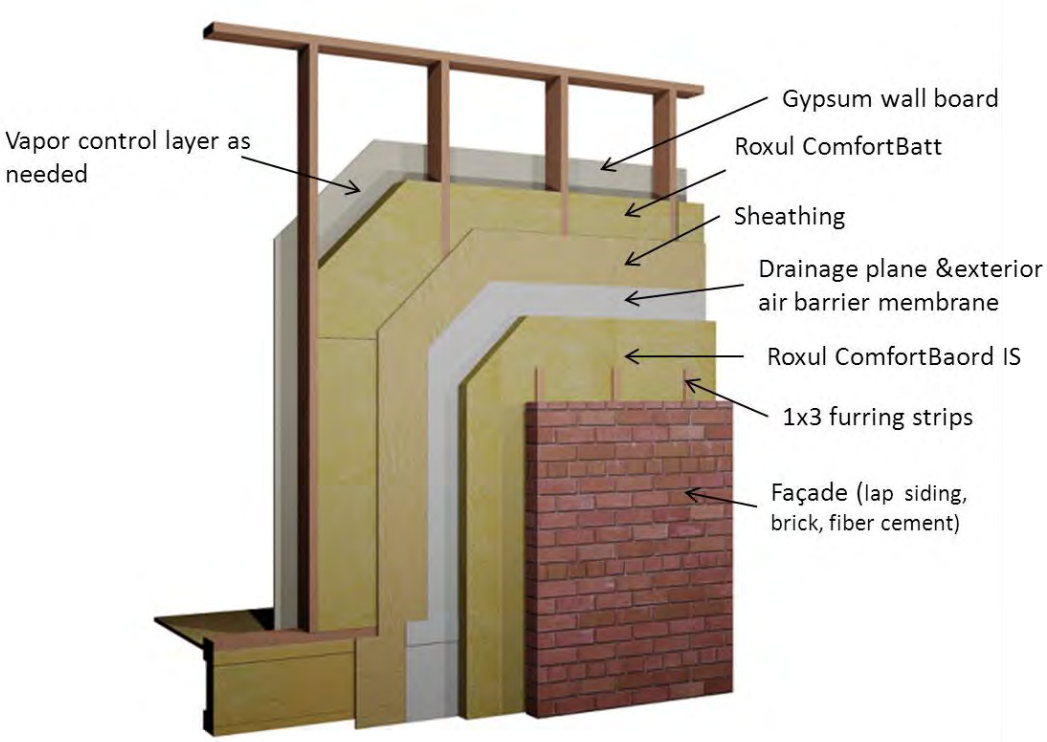
Acoustical Performance:

ASTM C 423
CO-EFFICIENTS AT FREQUENCIES

Thickness	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
1.5”	0.21	0.64	0.92	1.00	0.95	1.01	0.90
2.0”	0.43	0.78	0.90	0.97	0.97	1.00	0.90
3.0”	0.75	0.82	0.89	0.94	1.00	1.00	0.90

*MASTER FORMAT 1995 EDITION **MASTER FORMAT 2004 EDITION

ROXUL
ComfortBoard IS
Residential Insulated Sheathing



Compressive Strength:

ASTM C 165	at 10 %	745 psf (35.5 kPa)
	at 25 %	1270 psf (61 kPa)

Density:

ASTM C 612-00 – Actual 8.0 lb/ft^3 128 kg/m^3

Dimensions:

24” (width) x 48” (length)
610 mm x 1219 mm

36” (width) x 48” (length)
610 mm x 1219 mm

48” (width) x 96” (length)
1219 mm x 2438 mm

Thickness:

Product is available in 1.25” 1.5” 2” 3”
For additional sizes, please contact our customer service representatives.

Key Application Qualifiers:

- Good compressive strength
- Low moisture sorption
- Durability
- Fire resistance
- Excellent thermal resistance
- Non-corrosive
- Chemically inert
- CFC and HCFC free product and process
- Made from natural & recycled materials

Other ROXUL Products:

Please consult ROXUL for all your insulation needs. We have an extensive range of products for all applications from pipe insulation to commercial products to residential batts. ROXUL invites all inquiries and will act promptly to service all of your requirements.

Note:
As ROXUL Inc. has no control over installation design and workmanship, accessory materials or application conditions, ROXUL Inc. does not warranty the performance or results of any installation containing ROXUL Inc’s. products. ROXUL Inc’s. overall liability and the remedies available are limited by the general terms and conditions of sale. This warranty is in lieu of all other warranties and conditions expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

ROXUL INC. **Milton, Ontario Tel: 905-878-8474** **Fax: 905-878-8077**
www.roxul.com **Tel: 1-800-265-6878** **Fax: 1-800-991-0110**
Revised: October 27, 2014
Replaces: July 04, 2013

City of Seattle
Department of Planning and Development (DPD)
www.seattle.gov/dpd
700 Fifth Ave, Suite 2000, P.O. Box 34019, Seattle, WA 98124-4019
Phone: 206-684-8850

Code Modification or Alternate Request

Date Requested: December 20, 2011

Contact Information:

Name: Amy Hartwell
Mailing Address: 1301 First Avenue
Suite 301
Seattle, WA 98101
Phone Number: 206.902.5524
Fax Number: 206.467.0627
E-mail Address: ahartwell@gglo.com

Relationship to Project:

- O Owner
- ⊙ Design Professional
- O Contractor

Project Information:

A/P Number: 6256329
Address: 2401 NE BLAKELEY ST Seattle, WA
Code Edition: 2006 Seattle Building Code

Structure Information:

Project Description:
Exterior cladding & window replacement.

Occupancy Group(s)/ Character:
R-1 / A-3 (based on original UBC permit)
Type of Construction: Type V, 1-hour
Number of Stories: 4
Basements/ Mezzanines: 0
Sprinkler Location: None

Code Modification Request:

Ref. SBC 104.9. A code modification is a waiver of a code requirement, and is intended to provide flexibility to the building official where there are practical difficulties meeting specific code requirements so long as the intent of the code is accomplished.

The requestor is expected to demonstrate:

1. *There are practical difficulties involved in strictly conforming to the provisions of the code; and*
2. *The modification conforms with the intent and purpose of the code; and*
3. *Together with other safety features of the building or other relevant circumstances, the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety, accessibility and sanitation.*

When engaged for the project, the registered design professional in responsible charge shall submit the request for a code modification under their seal and signature, including a statement that in their professional opinion, the proposal is in conformance with the intent and purpose of the code and the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety, accessibility and sanitation.

Please attach plans showing your proposal.

Code Alternate Request:

Ref. SBC 104.10. A code alternate is intended to provide for introduction of alternate materials, systems and methods for which the code did not anticipate, provisional upon the alternate complying with the code and providing an equivalent solution. Essentially, a code alternate is intended to meet a performance standard rather than a prescriptive standard.

The requestor is expected to demonstrate that the alternate does not conflict with the code and together with other safety features of the building or other relevant circumstances, will provide an equivalent level of strength, effectiveness, fire resistance, durability, safety, accessibility and sanitation.

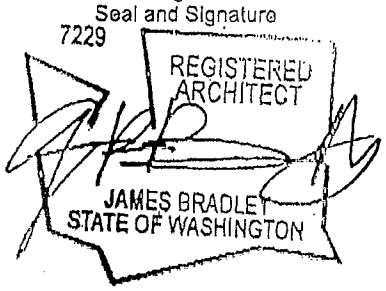
Construction Review & Inspection Quality
Jonathan Siu, Principal Engineer

When engaged for the project, the registered design professional in responsible charge shall submit the request for a code alternate under their seal and signature, including a statement that in their professional opinion the alternate is equivalent to the code provisions.

Please attach plans showing your proposal.

CITY OF SEATTLE
DEPT. OF PLANNING
AND
DEVELOPMENT
DEC 29 2011

Washington State
Seal and Signature



DPD Use Only

- O Approved
- O Approved with Amendment
- O Denied

APPROVED Subject to Errors And Omissions

BY Kaveh Aminian

Reasons:

PER PROFESSIONAL OF RECORD JUSTIFICATIONS & SEC. 721.6 OF SBC 2006. APPROVAL IS ONLY FOR FIRE RESISTIVE EQUIVALENCY & NOT FOR PERFORMANCE OF THE MATERIAL FOR OTHER PURPOSES.

Description of Alternate/ Modification (include reason for request):

In order to acheive a 1-hour fire rating from both interior and exterior sides,a new exterior wall assembly is proposed for this renovation project. Please refer to the attached Letter of Explanation for a description of materials proposed.

Description of Code Requirement (include section):

Please refer to the attached Letter of Explanation.

Justification (attach copies of any reference, test reports, expert opinions, etc.):

Please refer to attached product cutsheets for Roxul ComfortBoard showing fire-resistive properties.

December 20, 2011

Mr. Kaveh Aminian
City of Seattle Department of Planning & Development
700 Fifth Avenue, Suite 2000
Seattle, WA 98124-4019

Re: Code Modification Request, 1-Hour Wall Assembly
Blakeley Manor Rehabilitation, DPD Project No. 6256329
2401 NE Blakeley Street, Seattle, WA 98105

Dear Mr. Aminian,

Please find the following information pertaining to this Code Modification Request:

Pertaining to the Description of Alternate/Modification

Blakeley Manor is an existing four-story stucco-sided apartment building operated by the Seattle Housing Authority which will soon undergo renovation. The scope of work includes removal of the existing stucco and lath finish and replacement with 15/32" exterior plywood for shear, a liquid applied weather and air resistive barrier system, an exterior layer of mineral wool for added thermal insulation, and a rainscreen siding system using cementitious lap or panel siding over 2x4 PT furring strips. The existing wood stud framing, batt insulation, and interior GWB remain in place unless damaged.

The replacement wall assembly was reviewed by the DPD as part of our permit set and is the same assembly used on several other permitted SHA renovation projects: 6255337, 6256140, and 6251153. These projects' permits were issued under the 2006 SBC. During a courtesy field inspection at Nelson Manor (6255337), Warren Parker labeled the assembly as "failed" because it was not rated from both interior and exterior sides as required per 704.9, 2006 SBC - ie, it did not have an exterior layer of GWB.

Initially we were hoping to prove this assembly's fire resistivity from the exterior face by calculating its fire resistance per Section 720 and sub sections of the 2006 SBC for a "Prescriptive Fire Resistance" approach. According to Section 721.6 Wood Assemblies and Tables 721.6.2(1), 721.6.2(2) and 721.6.2(5) our proposed assembly would be allowed the following cumulative fire resistance ratings for the individual components:

1) <u>As calculated from inside out:</u>

Existing 5/8" interior Type X GWB	40 minutes	Table 721.6.2(1)
Existing 2x6 wood stud framing @ 16" o.c.	20 minutes	Table 721.6.2(2)
Glass fiber batt insulation	15 minutes	See Section 721.6.2.5 & Table 721.6.2(5) – Not needed for FR rating
15/32" exterior plywood	10 minutes	Table 721.6.2(1)
TOTAL	**85 minutes**	Meets reqs of 1-hr wall from interior

2) <u>As calculated from outside in:</u>

Fiber Cement Siding	0 minutes	According to James Hardie representative
1 ¼" Thick Mineral Wool (density = 4.4 pcf)	15 minutes	Table 721.6.2(5)
15/32" exterior plywood	10 minutes	Table 721.6.2(1)
Glass fiber batt insulation	15 minutes	See Section 721.6.2.5 & Table 721.6.2(5). May be needed for FR rating.
Existing 2x6 wood stud framing @ 16" o.c.	20 minutes	Table 721.6.2(2)
TOTAL	**60 minutes**	Meets reqs. of 1-hr wall from exterior

However, you had expressed concerns about this assembly since the proposed layer of mineral wool was discontinuous between the furring strips. Therefore, we have revised the wall assembly detail to show a continuous 1 ¼" thick higher density mineral wool layer, Roxul's ComfortBoard IS, installed over the sheathing. The new proposed mineral wool will increase density and weight from 4.4 PCF to 8.0 PCF. The furring strips will be installed through the mineral wool to the existing studs. The continuous mineral wool will provide enhanced fire resistance and the increased density will improve thermal performance while eliminating thermal bridging. We believe this assembly meets the intent of Section 721, Calculated Fire Resistance, by providing a 1-hour rated wall as tested from the exterior face.

Enclosed with this document is a cut-sheet of Roxul's ComfortBoard IS product, the mineral wool we prefer to use. Also please find a detail of the revised, proposed wall assembly.

It is my professional opinion that the proposed wall assembly code modification for Blakeley Manor meets the intent of the 2006 Seattle Building Code. This opinion is true and sound to my best information, knowledge, and belief.

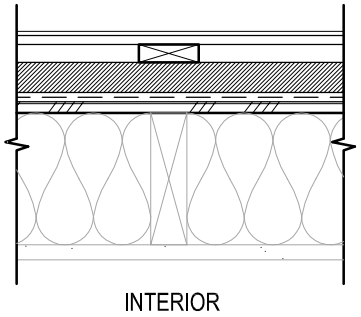
Sincerely,

GGLO, LLC

James Bradley, AIA
Principal

Att: Exhibit A – Revised Wall Assembly
Exhibit B – Roxul ComfortBoard IS Technical Data
Exhibit C – Roxul Deflection Test Report

EXHIBIT A: REVISED WALL ASSEMBLY



FIBER REINFORCED CEMENTITIOUS LAP SIDING, 4" EXPOSURE
1x3 PT RAINSCREEN STRAPPING ATTACHED TO FRAMING PER SIDING MANUFACTURER'S RECOMMENDATIONS
R-5 MINERAL WOOL INSULATION
LIQUID-APPLIED WEATHER RESISTIVE BARRIER
EXTERIOR PLYWOOD SHEATHING: (1) LAYER 15/32" CDX 32/16 PLYWOOD NAILED 6" O.C. AT ALL EDGES, 12" IN THE FIELD, WITH 10 PENNY SHORT NAILS (2-1/4" LONG, 0.148 IN. DIAMETER), ALL EDGES BLOCKED. MINIMUM SIZE OF PLYWOOD SHEATHING SHALL BE 24" HIGH x 16" WIDE
EXIST 2x6 FRAMING MEMBERS TO REMAIN. IF REPLACEMENT REQUIRED DUE TO DAMAGE, MEMBERS SHALL BE REPLACED w/ NOM 2x6 INCH SPACED 16 IN. OC w/ TWO 2x6 INCH TOP AND ONE 2x6 INCH BOTTOM PLATES. ALL NEW FRAMING SHALL BE DF-L #2 TO MATCH EXISTING.
R-21 BATT INSULATION TO REPLACE EXISTING, AS REQUIRED
EXIST INTERIOR TYPE 'X' GWB TO REMAIN, REPLACE DAMAGED AS REQ'D
NOTE: ALL FLOORS 2X RIM TO TOP PLATE - ADD (1) LTP4 AT 16" OC. FASTEN EACH LTP4 WITH (12) 8D X 1 1/2 NAILS DIRECT TO THE FRAMING (BELOW SHEATHING) OR WITH (12) 8X 2 3/8 NAILS OVER SHEATHING. CONTRACTOR TO COORDINATE CLIP LOCATIONS AND INSTALLATION WITH OTHER TRADES AND EXISTING CONDITIONS INCLUDING PLUMBING AND ELECTRICAL.

* REFER TO ELEVATIONS FOR EXTERIOR COLOR KEYNOTE LEGEND

1 HR

TEST SOURCE:
2006 SBC
TABLES
721.6.2(1),
721.6.2(2), &
721.6.2(5)

EXHIBIT B

ROXUL®
The Better Insulation™

Technical Product Information

ROXUL ComfortBoard™ IS
Residential Insulated Sheathing

BOARD INSULATION 07210*
BOARD INSULATION 07 21 13**

General Product Information:

ROXUL® products are mineral wool fibre insulations made from basalt rock and slag. This combination results in a non-combustible product with a melting point of approximately 2150°F (1177°C), which gives it excellent fire resistance properties. ROXUL mineral wool is a water repellent yet vapour permeable material.

Description & Common Applications:

The ComfortBoard™ IS product is a rigid mineral wool insulation sheathing board that is non-combustible, water repellent, fire resistant and sound absorbent. This product is exterior non-structural insulation sheathing for high performance residential wall systems.

Compliance and Performance:

ASTM C 612	Mineral Fiber Block and Board Thermal Insulation	Type IVB, Complies
CAN/ULC –S702	Mineral Fibre Thermal Insulation for Buildings	Type 1, Complies

Fire Performance:

ASTM E 136	Behaviour of Materials at 750°C (1382°F)	Non-Combustible
CAN/ULC S114	Test for Non-Combustibility	Non-Combustible
ASTM E 84(UL 723)	Surface Burning Characteristics	Flame Spread = 5 Smoke Developed = 10
CAN/ULC S102	Surface Burning Characteristics	Flame Spread = 5 Smoke Developed = 10

Moisture Resistance:

ASTM C 1104	Moisture Sorption	0.05%

Water Vapour Permeance:

ASTM E 96	Water Vapour Transmission, Desiccant Method	1768 ng/Pa.s.m$_2$ (30.9 perm)

Fungi Resistance

ASTM C1338	Determination of Fungi Resistance	Passed

Thermal Resistance:

ASTM C 518 (C 177)	R-value/inch @ 75°F RSI value/25.4 mm @ 24°C	4.0 hr.ft².F/Btu*** 0.72 m²K/W

Corrosive Resistance:

ASTM C 665	Corrosiveness to Steel	Pass
ASTM C 795 ****	Stainless Steel Stress Corrosion Specification as per Test Methods C871 and C692: U.S. Nuclear Regulatory Commission, Reg. Guide #1.36: U.S. Military Specifications MIL-I-24244 (all versions including B and C)	Conforms

Acoustical Performance

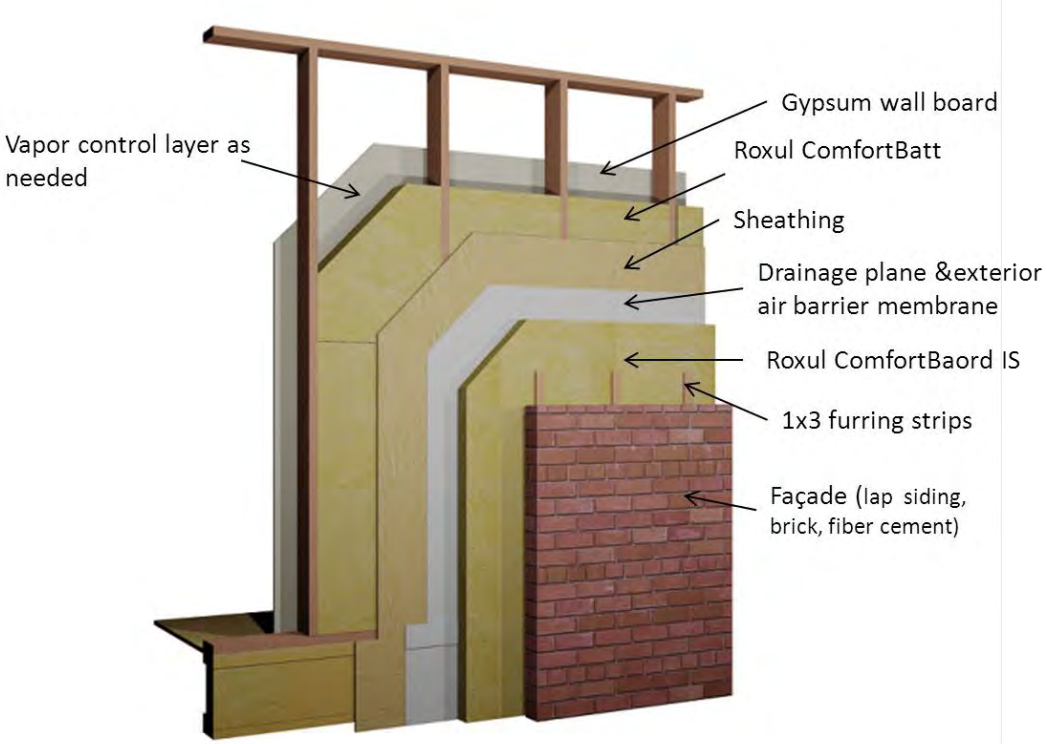
ASTM C423
CO-EFFICIENTS AT FREQUENCIES

Thickness	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
1.5”	0.21	0.64	0.92	1.00	0.95	1.01	0.90
2.0”	0.43	0.78	0.90	0.97	0.97	1.00	0.90
3.0”	0.75	0.82	0.89	0.94	1.00	1.00	0.90

*MASTER FORMAT 1995 EDITION **MASTER FORMAT 2004 EDITION
*** at the time of manufacturing

EXHIBIT B

ROXUL
ComfortBoard™ IS
Residential Insulated Sheathing



Compressive Strength:

ASTM C 165	at 10%	743 psf (35.6 kPa)
	at 25%	1269 psf (60.8 kPa)

Density:

ASTM C 612-00 – Actual 8.0 lbs/ft^3 128 kg/m^3

Dimensions:

24" (width) x 48" (length)
610 mm x 1219 mm

36" (width) x 48" (length)
610 mm x 1219 mm

48" (width) x 96" (length)
1219 mm x 2438 mm

Thickness:

Product is available in 1.25" 1.5" 2" 3"
For additional sizes, please contact our customer service representatives.

Key Application Qualifiers:

- Good compressive strength
- Low moisture sorption
- Durability
- Fire resistance
- Excellent thermal resistance
- Non-corrosive
- Chemicallyinert
- CFC and HCFC free product and process
- Made from natural & recycled materials

Other ROXUL Products:

Please consult ROXUL for all your insulation needs. We have an extensive range of products for all applications from pipe insulation to commercial products to residential batts. ROXUL invites all inquiries and will act promptly to service all of your requirements.

Note:
As ROXUL Inc. has no control over installation design and w orkmanship, accessory materials or application conditions, ROXUL Inc. does not w arranty the performance or results of any installation containing ROXUL Inc's. products. ROXUL Inc's. overall liability and the remedies available are limited by the general terms and conditions of sale. This w arranty is in lieu of all other w arranties and conditions expressed or implied, including the w arranties of merchantability and fitness for a particular purpose.

ROXUL INC. **Milton, Ontario Tel: 905-878-8474** **Fax: 905-878-8077**
www.roxul.com **Tel: 1-800-265-6878** **Fax: 1-800-991-0110**
Revised: Nov 1, 2011

March 3, 2011

Mark Bromiley
Roxul Inc.
420 Bronte St. S. Suite 105
Milton, Ontario, L9T 0H9

Via email: mark.bromiley@roxul.com

Re: Roxul – Exterior Insulation Deflection Testing

Background

As society demands more energy efficient buildings, codes and builders are responding by increasing the R-value of the building enclosure, in particular the above-grade wall. Given than the cavity of the standard 2x6 wood frame wall used in low-rise housing is already filled with insulation, the clear path forward to higher R-values is to add layers of exterior insulation. Although other solutions are possible, exterior insulation layers have the benefits that:

1. At thicknesses of up to 1.5", exterior insulation has long been used by the industry, and hence there is experience with it installation and detailing,
2. Thermal bridging through framing members, floor joists, lintels, etc. is very significantly reduced, increasing the wall R-value significantly,
3. The risk of cold-weather condensation within the moisture-vulnerable wood framing is significantly reduced, and potentially eliminated,
4. A range of target R-values can be easily reached as similar details can be used for the design of walls that have 2, 3, 4 or even 6" of insulation,
5. The marginal cost of increasing framing thickness and/or building double-walls usually outweighs the marginal cost of adding insulating sheathing layers.

Highly-permeable insulation like Roxul has the added benefit that it allows very fast outward drying during cold weather: this dries the wood-frame cavity very quickly, even if the framing is wet from construction or becomes wet because of incidental water leaks.

A major impediment to the wide-spread adoption of exterior sheathing behind direct applied claddings such as vinyl, wood, fibre cement, stucco and adhered veneer, is the lack of information about the structural performance of claddings installed over insulating sheathing. Foam plastic insulations, which have much higher compressive strengths (often 15 to 25 psi @10% deformation) than most Roxul products (often 1 to 5 psi) are seen as better products for this application. The concern is that the insulation is not or stiff strong enough to suspend claddings and deformations may occur causing cracking, and other issues.

Very little testing has been conducted to show the strength and stiffness of insulation supporting cladding and no testing results of Roxul insulation is available.

The most common method of attaching cladding over thick insulation is to use wood furring (strapping) attached with screws through the insulation to the framing as shown in Figure 1.

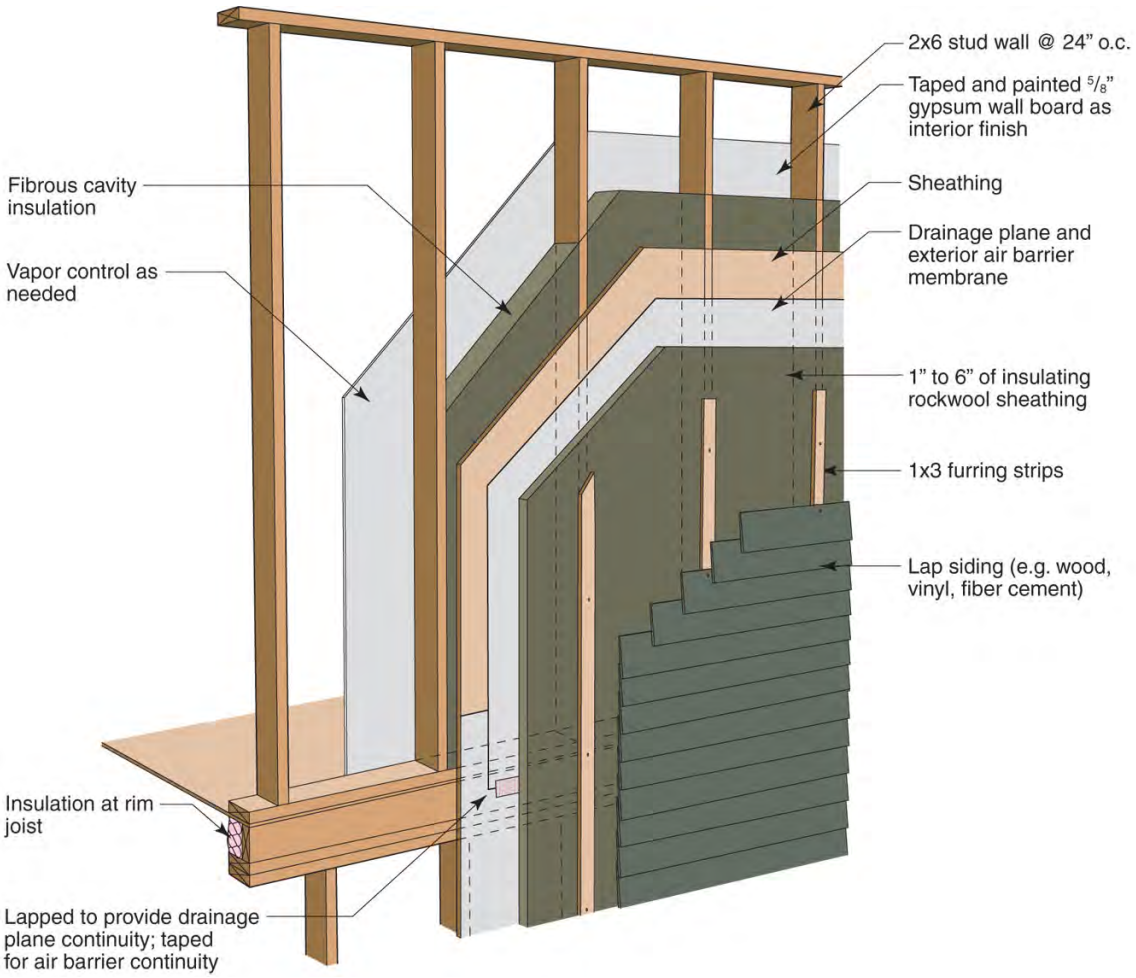


Figure 1: Typical application of semi-rigid Roxul insulation over wood framing

Objective

The objective of this study is to quantify the relationship between cladding gravity loads and deflection under cladding weights of up to 30 pound per square foot. These results are intended to be used to provide guidance to designers, builders, and code officials involved in projects using Roxul brand semi-rigid rockwool sheathing.

Scope

This report summarizes the results of load deflection testing deflection of strapping over six types of Roxul exterior insulation as shown in Table 1. These walls were tested on 24" oc framing, with strapping attachment screws at vertical spacings of 16" oc. Other variables such as 16" oc framing, different screw sizes and spacings were outside the

scope of the testing program. This study was designed to simulate walls providing the least support practically likely (thin screws wide spacing of studs and fasteners) and hence the highest likely deflections. If improved construction standards are used, such as stronger screws and/or more frequent screw spacing, the amount of deflection would decrease. This is meant to be a type of worst case, yet realistic, scenario.

Table 1: Roxul insulation types to be tested

Insulation Product	**Approximate Density (lb/ft^3)**
1.25” Cavity Rock MonoDensity	4.1
3” Cavity Rock DualDensity	3.4 / 6.2
1.25” RB60	6.0
1.25” RB80	8.0
3” RB80	8.0
1.25” Drainboard	8.0
1” Type IV extruded polystyrene	2.0

Testing Apparatus

To conduct the testing, a 2x wall frame with 24” stud spacing was securely fastened to a concrete block wall in the laboratory. OSB sheathing and a house wrap were installed over the sheathing. The different types of Roxul insulation were installed over the house wrap, and held in place by screws driven through nominal 1x3 strapping (actual dimension ¾”x 2.5”) connected directly to the wood framing (Figure 2). The strapping was attached with screws spaced vertically at 16” oc. Given the 24” spacing of the framing, this is 2.67 square feet per fastener (or about 4 connectors per square meter).

Figure 3 presents photographs of the screws used for strapping attachment for both 1.25” thick insulation and 3” thick insulation. To attach strapping over 1.25” thick insulation, 3” deck screws were used. For the first tests the strapping over 3” thick insulation was attached using #9 x 5” trim head bronze wood screws were used (middle screw in Figure 3). After inspection of the screws following the first test, this screw showed considerable permanent deflection, and the smaller diameter heads pulled deep into the wood of the furring strip. Hence, subsequent test of 3” thick insulation used #10 x 5” wood screws with standard head sizes. These screws showed a marked improvement in performance.

Figure 2 : Roxul insulation attached to wall frame ready for test

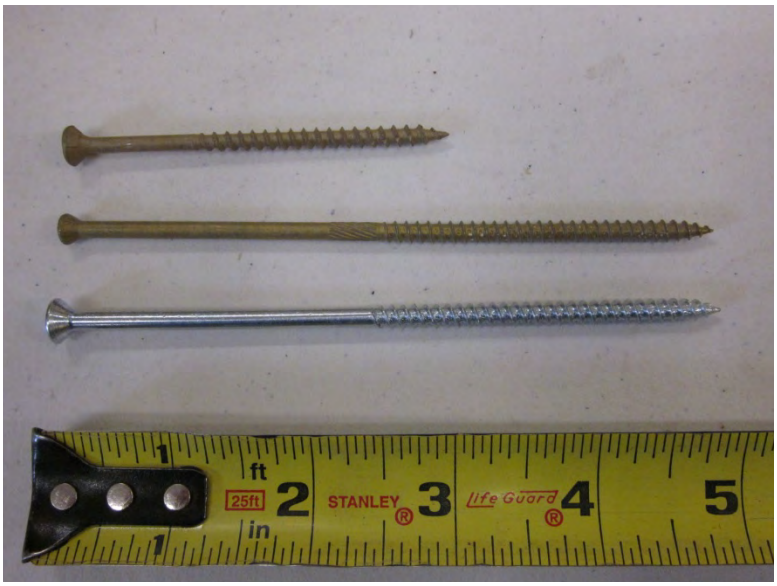


Figure 3 : Strapping attachment screws

A 2 tonne-capacity hydraulic ram was used to apply force to a metal angle in contact with the bottom edge of both strapping pieces (Figure 4). To measure the applied force a 1000 lbf (4500 N) strain gauge load cell (with ±0.4 lbf rated accuracy) was placed between the angle and the ram.

Deflection gauges (with a resolution of 1/1000" or 0.025 mm) were used to measure the movement of the wall sheathing and the strapping on both the left and right side. Metal

clips were attached to the strapping to allow deflection gauges to measure the strapping movement.

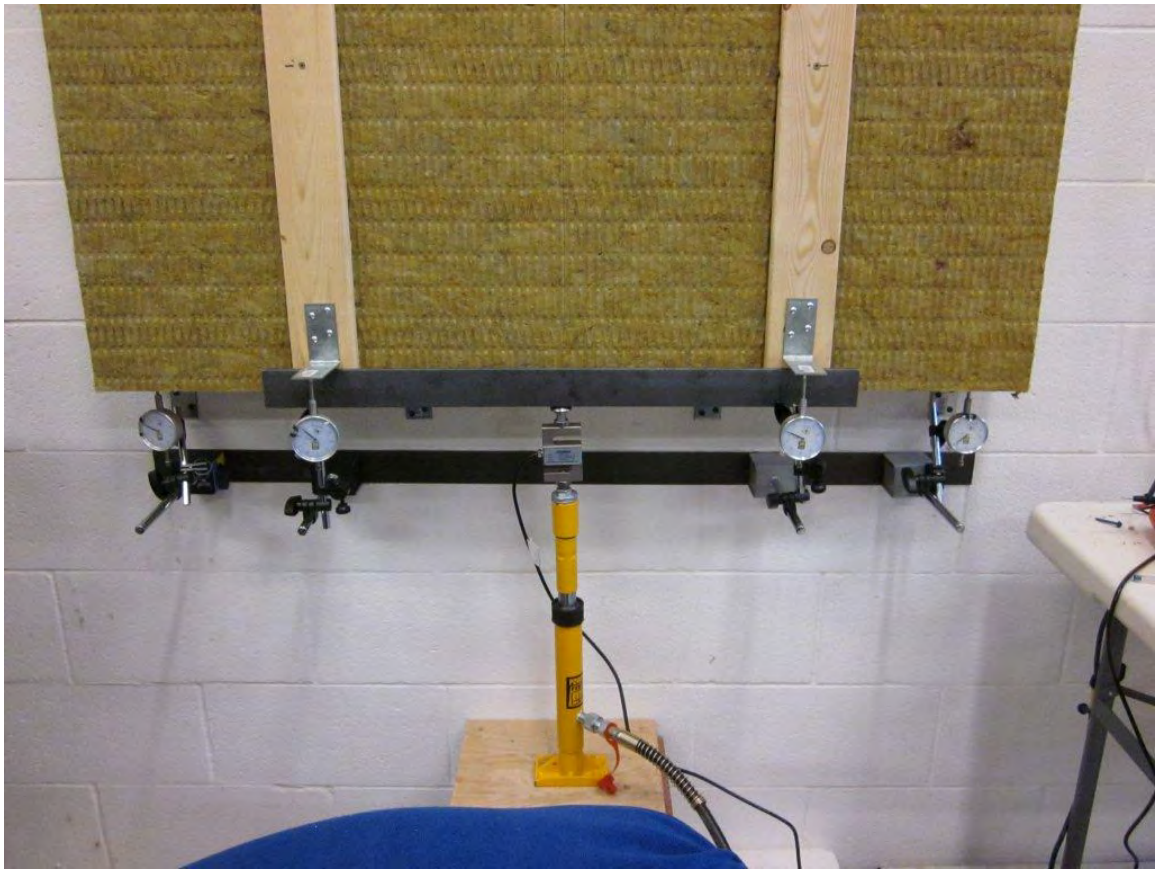


Figure 4: Hydraulic Ram with load cell and deflection gauges measuring strapping movement (sheathing deflection gauges not shown)

Loads were applied in increments of 100 lbs between 100 lbs and 1,000 lbs. The four deflection readings were recorded at each increment. Each load increment was applied over about 30 to 60 seconds and the readings taken with 30 seconds. All of the tests were conducted three times on the same test specimen. The wall was loaded to 1000 lbs, unloaded, and reloaded two more times.

Results and Analysis

The average deflection was calculated by determining the average of the deflection of the right and left strapping pieces and subtracting any movement measured in the wall frame. In general, the framing moved very little (about 10% of the total deflection).

For all of the specimens, the first time the wall was loaded the deflection was significantly larger and than the last two tests. The second pair of tests showed good repeatability. It is assumed that this behavior is due to the wall assembly "seating" itself or "settling in". The amount of seating could be increased by attaching the initial torque during installation of the screws: controlling the amount of screw torque was a challenge as it was not always easy to achieve perfectly plumb strapping.

The results of load and deflection can be compared to spatial mass density of typical claddings shown in Table 2. These weights are meant to be representative of all similar claddings although some cladding types might be outside of the range listed. The testing was conducted to approximately twice the weight of the heaviest cladding in the table, adhered stone veneer (i.e., 15 psf x 4 x 8 x 2 = 960 pds). These ranges of cladding weights are shown in the analysis graph as shaded areas in Figure 5.

Table 2 : Approximate cladding weights

Cladding Type	Typical mass density range (psf)	Equivalent weight for 4'x8' test panel (lbs)
Vinyl siding	0.6-1.0	20-32
Wood siding	1.0-1.5	32-48
Fiber cement siding	3-5	96-160
Cement stucco	10-12	320-384
Adhered stone veneer	12-15	384-480

Figure 5 plots the load-deflection curves for 3" CavityRock. As this graph is representative of all of the insulations tested, the remaining load-deflection graphs are attached in the appendix, and the results are summarized in Table 3. As can be seen, the load-deflection curve has a degree of curvature to it, but it largely linear for the first 100-200 pounds (eg. the load imposed by lap siding).

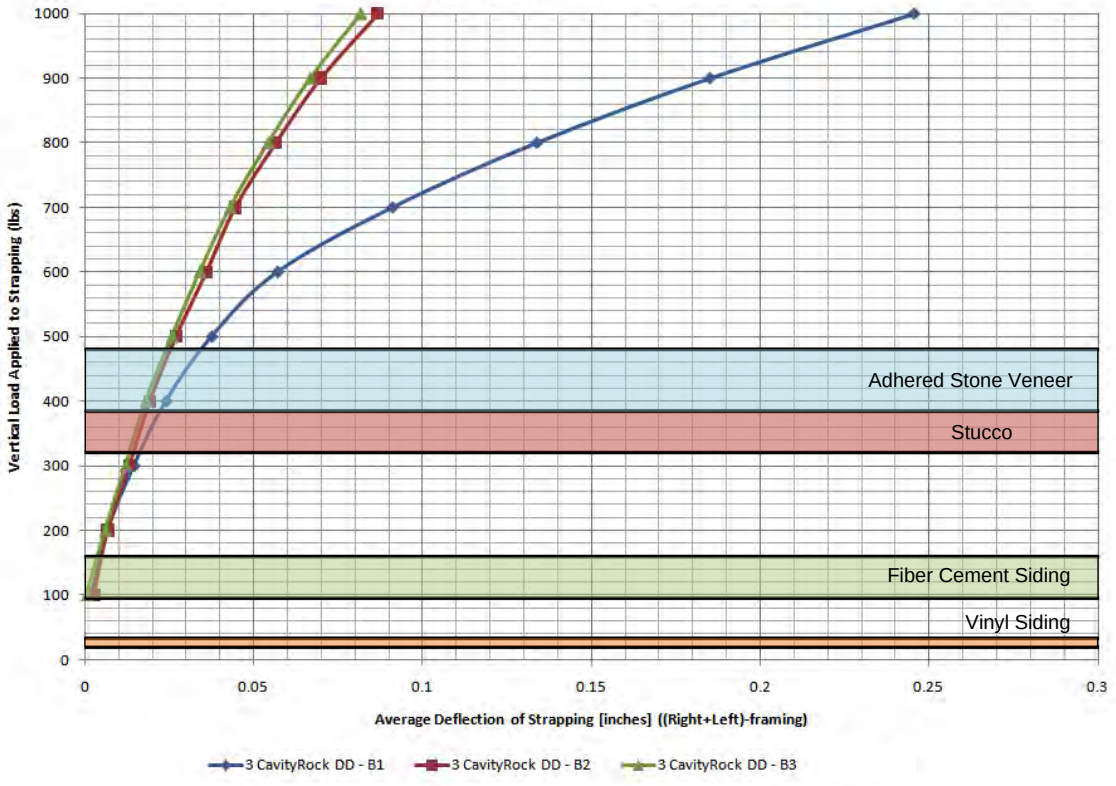


Figure 5: Deflection Testing of 3" CavityRock

Table 3 shows the deflection results for all three 1000lb loadings on each test system in the order of least average deflection to greatest average deflection. The average deflection was calculated from all three loadings and used to determine the performance order. If the average was taken of the second and third repeatable deflection on each wall, the relative ranking of performance would not change.

Table 3 : Summary of Deflection Results at 1000 lbs

Insulation	Density [lb/ft^3]	Compressive Strength (@25%) [kPa]	1st Loading [inches]	2nd Loading [inches]	3rd Loading [inches]	Average [inches]
1" XPS	-	-	0.068	0.0355	0.0345	0.0460
1 ¼" RB80	8	60.8	0.089	0.034	0.030	0.0506
3" RB80	8	60.8	0.094	0.038	0.027	0.0529
3" RB60	6	28.1	0.117	0.044	0.041	0.0672
1 ¼" CavityRock MD	4.1	-	0.134	0.076	0.069	0.0927
3" CavityRock MD	6.2 / 3.4	-	0.246	0.087	0.082	0.1379
1 ¼" CavityRock with no OSB sheathing	4.1	-	0.166	0.136	0.1335	0.1452
1 ¼" DrainBoard	8	35	0.265	0.090	0.092	0.1486

Table 4 summarizes the measured data into what is a more useful format. For each of the product types the initial deflection measured is used to predict the deflection in service for three typical cladding types. Given that measurements of less than 0.010" are difficult to measure repeatedly or reliably, and that such a deflection is negligible in service, any deflections of less than 0.01" (0.25 mm) have been simply entered as "<0.01" in the table.

Table 4: Estimated Deflection (inches) in Service for Typical Cladding Loads

Insulation & Thickness	Vinyl Siding (1 psf)	Fiber Cement Siding (4 psf)	Stucco 3/4" (12 psf)
1.25" Cavity Rock MonoDensity	<0.01	0.012	0.050
3" Cavity Rock DualDensity	<0.01	<0.01	0.020
3" RB60	<0.01	<0.01	0.014
1.25" RB80	<0.01	<0.01	0.010
3" RB80	<0.01	<0.01	<0.01
1.25" Drainboard	<0.01	<0.01	0.045
1" Type IV extruded polystyrene, no OSB	<0.01	<0.01	0.120
1.25" Cavity Rock MonoDensity, no OSB	<0.01	0.015	0.060

Note: Assumes studs at 24" o.c. or closer, and minimum #10 fasteners at maximum 16" vertical spacing through nominal 1x3 furring strips. Deflection is based on the initial loading, and assumes that no creep occurs over long-term. Wind suction pressure may control the design of the fastening in high wind areas, not vertical deflection.

Summary and Conclusions

- All of the insulations tested showed very little deflection (less than 0.01" or 0.25 mm) at the loads imposed by lap siding (of wood, vinyl, or fiber cement)
- The least amount of deflection was experienced by RB80, with a density of 8lb/ft^3 and the highest rated compressive strength of the Roxul insulations tested.
- The 1" Type 4 extruded polystyrene was no stiffer than the RB80
- If the strapping and insulation are not attached tightly to the wall sheathing, the initial deflection can be expected to be larger than if the insulation is firmly clamped, and the cladding attached with nail guns or other techniques that caused settling.
- All six materials tested resulted in very similar patterns of deflection. The first loading produced the largest amount of deflection for each wall, and the second and third tests were very similar and repeatable with much less deflection, approximately half as much as the initial loading.

Note that these tests were conducted to simulate some of the worst-case realistic scenarios for deflection (i.e., 24" o.c. strapping, and 16" vertical spacing between screws). This is equivalent to only 4 fasteners per square meter. Also, the screws used were the lowest quality, length and thickness that would be reasonable for this

application. Using more screws, more often would likely decrease deflection, but more testing is required to determine the amount that the deflection could be decreased.

Recommendations

It is recommended that field trials be conducted to gain feedback from installers in the field. It was noted that some care was required when installing the screws to attach the fastening so as to ensure a plumb strapping: excess or insufficient screw torque could cause the strap to be bent.

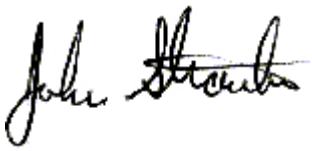
In practice, recommending screw attachments at 12” o.c for 24” o.c framing and 16” for 16” o.c framing would provide some additional safety factors.

Despite the very favourable results achieved, it is recommended that field testing, in a test facility or on a jobsite, should be conducted to assess the potential for stucco or adhered veneer cracking over a 1-2 year test period before proceeding with wider deployment.

If you have any questions or comments about any part of this report, please do not hesitate to call or email.

Sincerely

Jonathan Smegal, MASc.
Associate EIT



John Straube, Ph.D. P.Eng.
Principal

EXHIBIT C

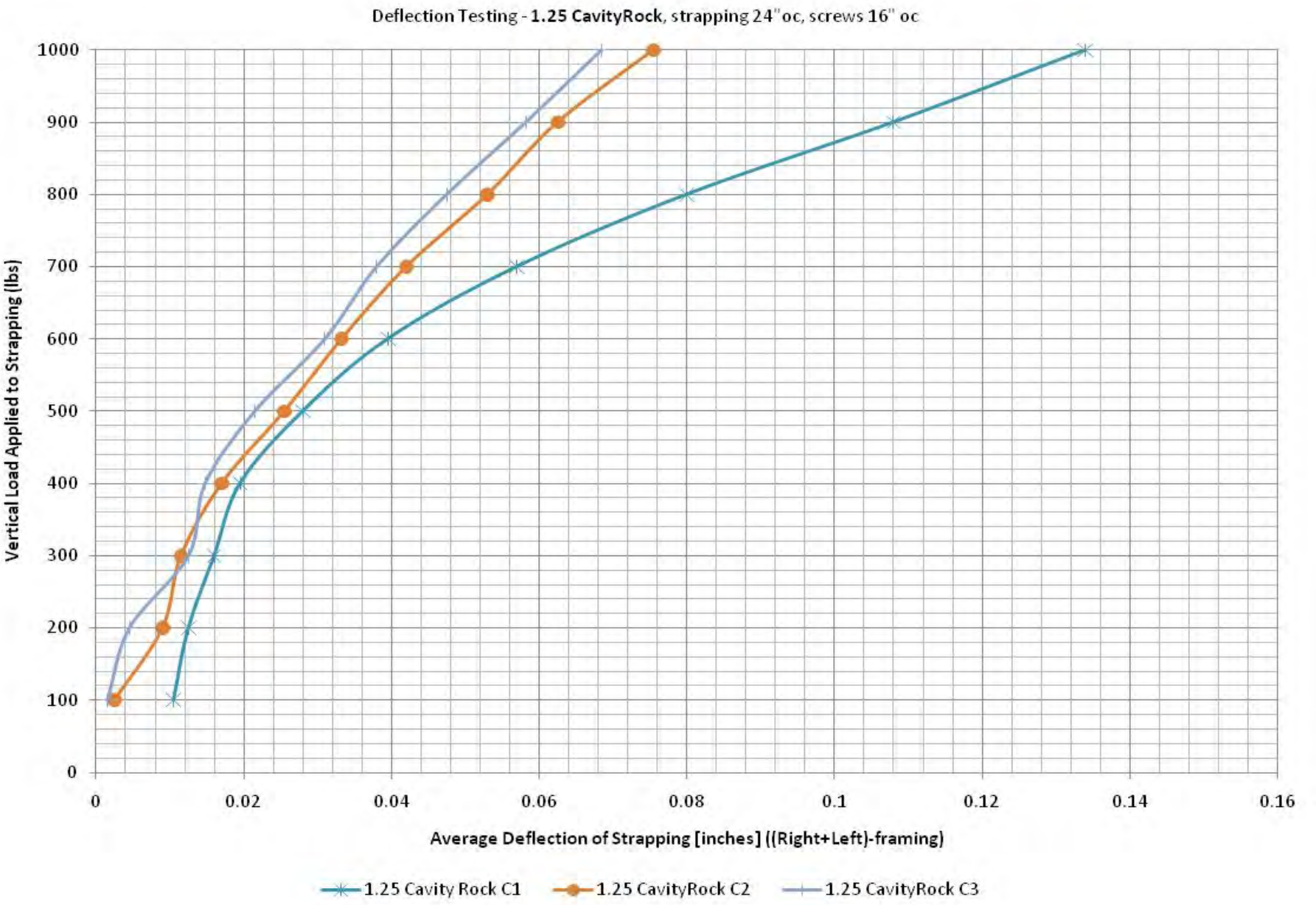

Deflection Testing - 1.25 CavityRock, strapping 24"oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
Average Deflection of Strapping [inches] ((Right+Left)-framing)
1.25 Cavity Rock C1
1.25 CavityRock C2
1.25 CavityRock C3

EXHIBIT C

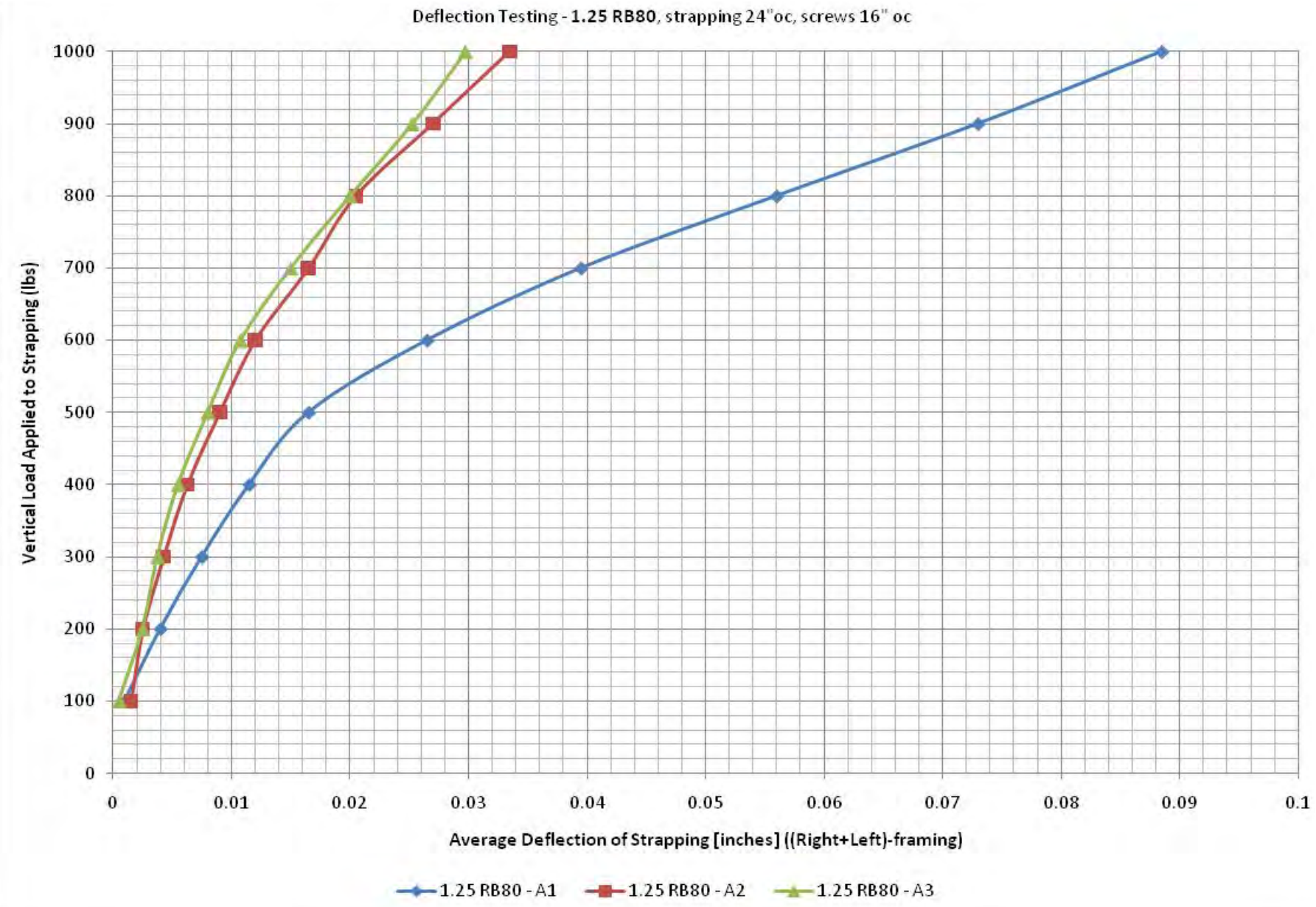

Deflection Testing - 1.25 RB80, strapping 24"oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
Average Deflection of Strapping [inches] ((Right+Left)-framing)
1.25 RB80 - A1
1.25 RB80 - A2
1.25 RB80 - A3

EXHIBIT C

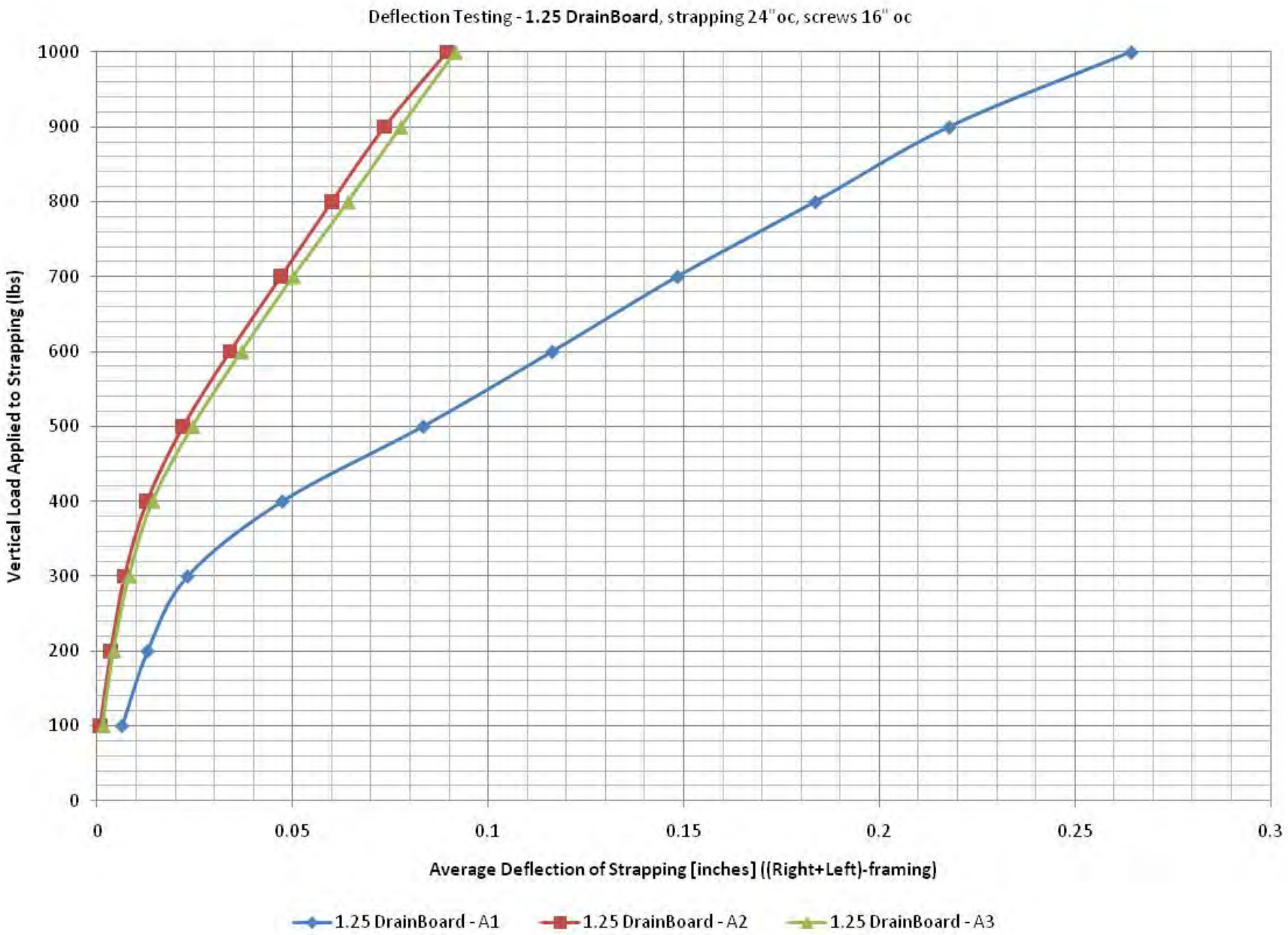

Deflection Testing - 1.25 DrainBoard, strapping 24" oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.05
0.1
0.15
0.2
0.25
0.3
Average Deflection of Strapping [inches] ((Right+Left)-framing)
1.25 DrainBoard - A1
1.25 DrainBoard - A2
1.25 DrainBoard - A3

EXHIBIT C

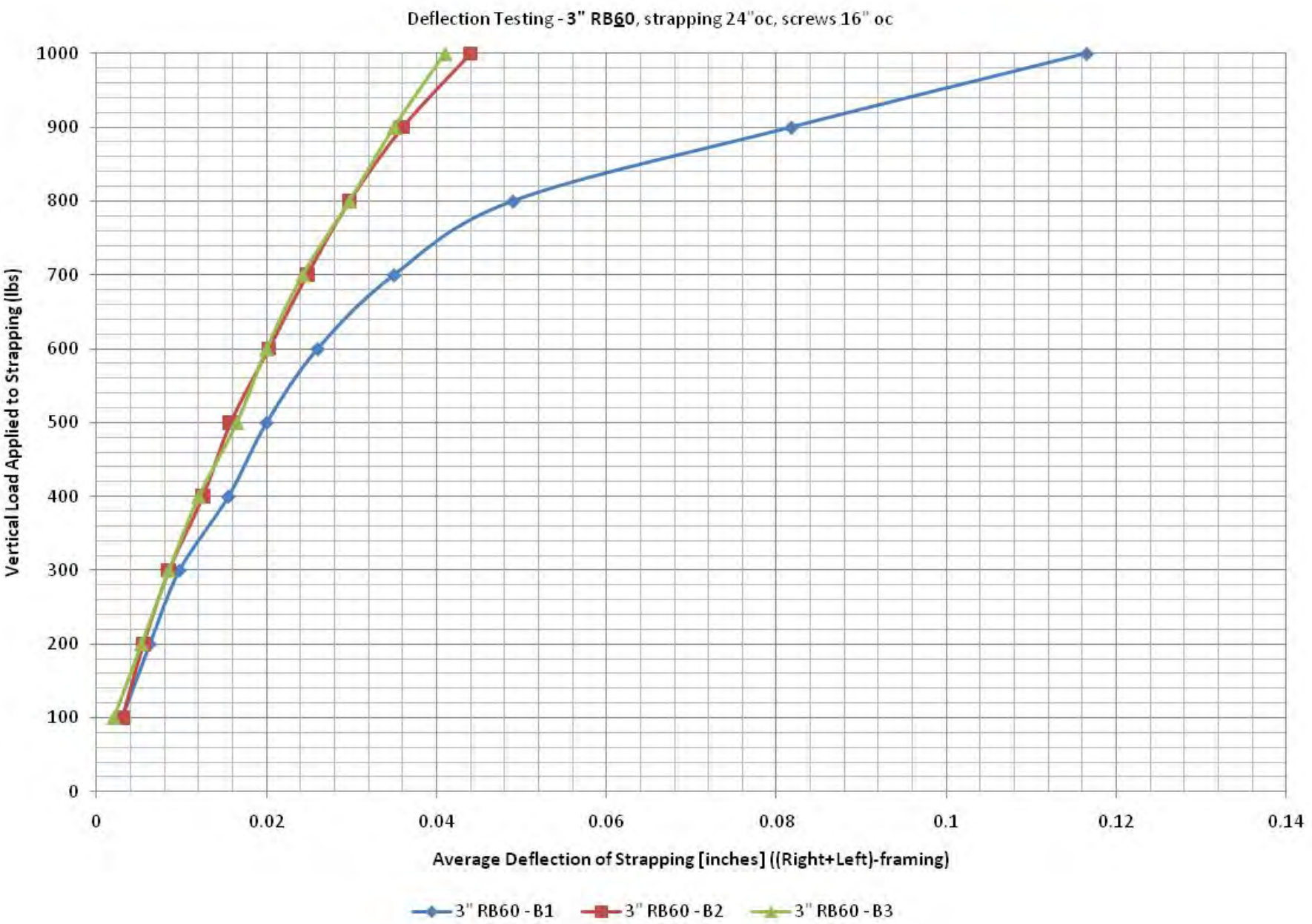

Deflection Testing - 3" RB60, strapping 24"oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
Average Deflection of Strapping [inches] ((Right+Left)-framing)
3" RB60 - B1
3" RB60 - B2
3" RB60 - B3

EXHIBIT C

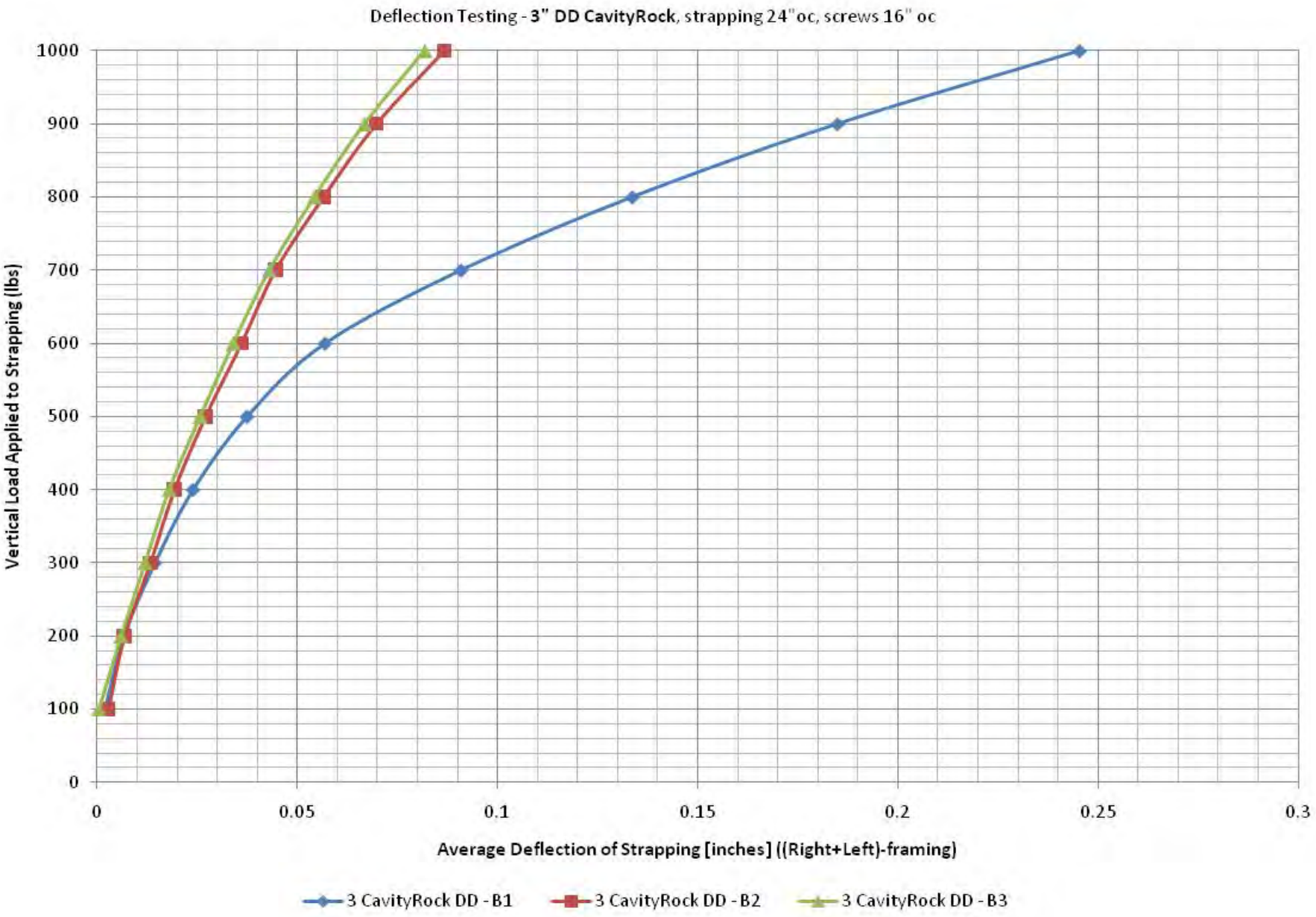

Deflection Testing - 3" DD CavityRock, strapping 24"oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.05
0.1
0.15
0.2
0.25
0.3
Average Deflection of Strapping [inches] ((Right+Left)-framing)
3 CavityRock DD - B1
3 CavityRock DD - B2
3 CavityRock DD - B3

EXHIBIT C

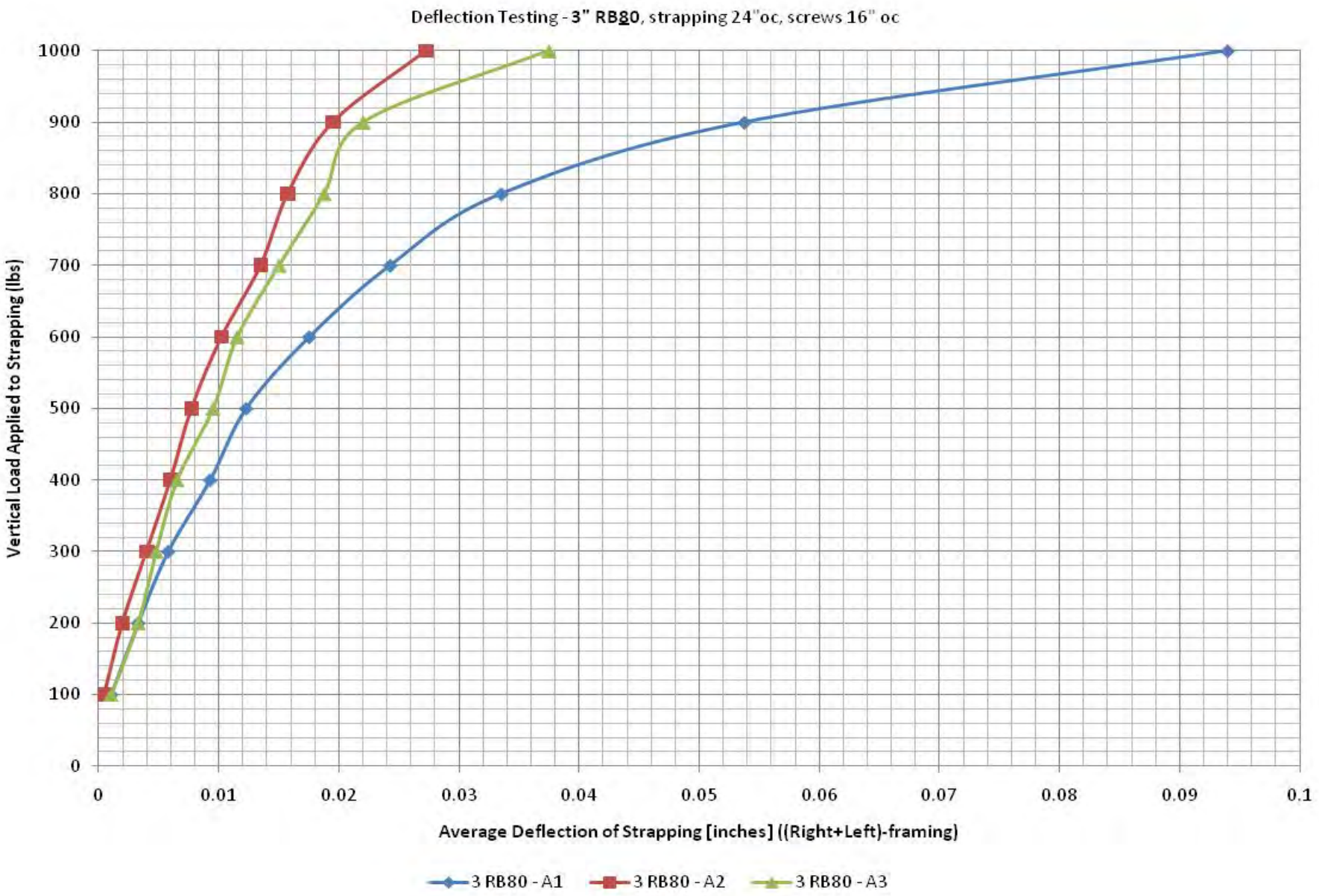

Deflection Testing - 3" RB80, strapping 24"oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
Average Deflection of Strapping [inches] ((Right+Left)-framing)
3 RB80 - A1
3 RB80 - A2
3 RB80 - A3

EXHIBIT C

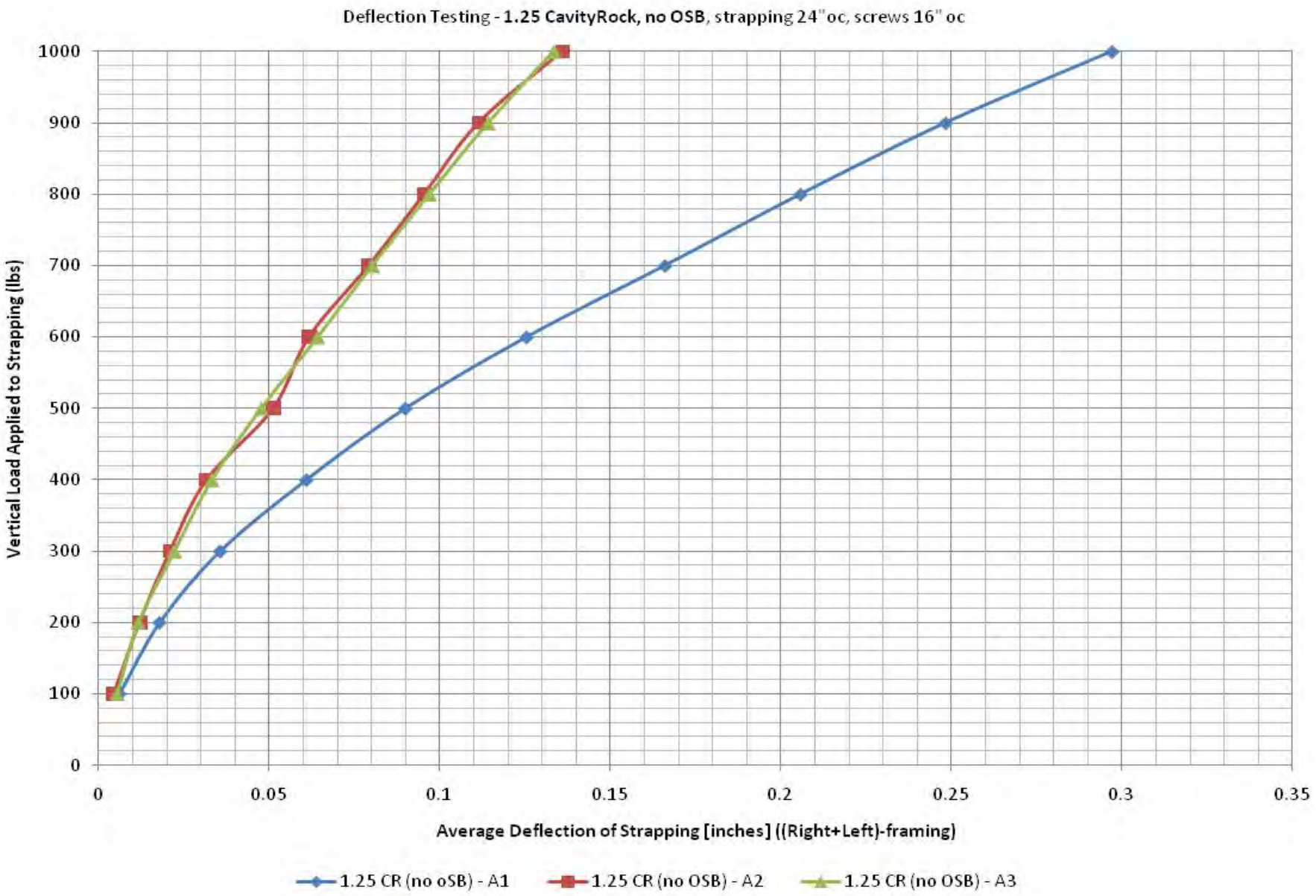
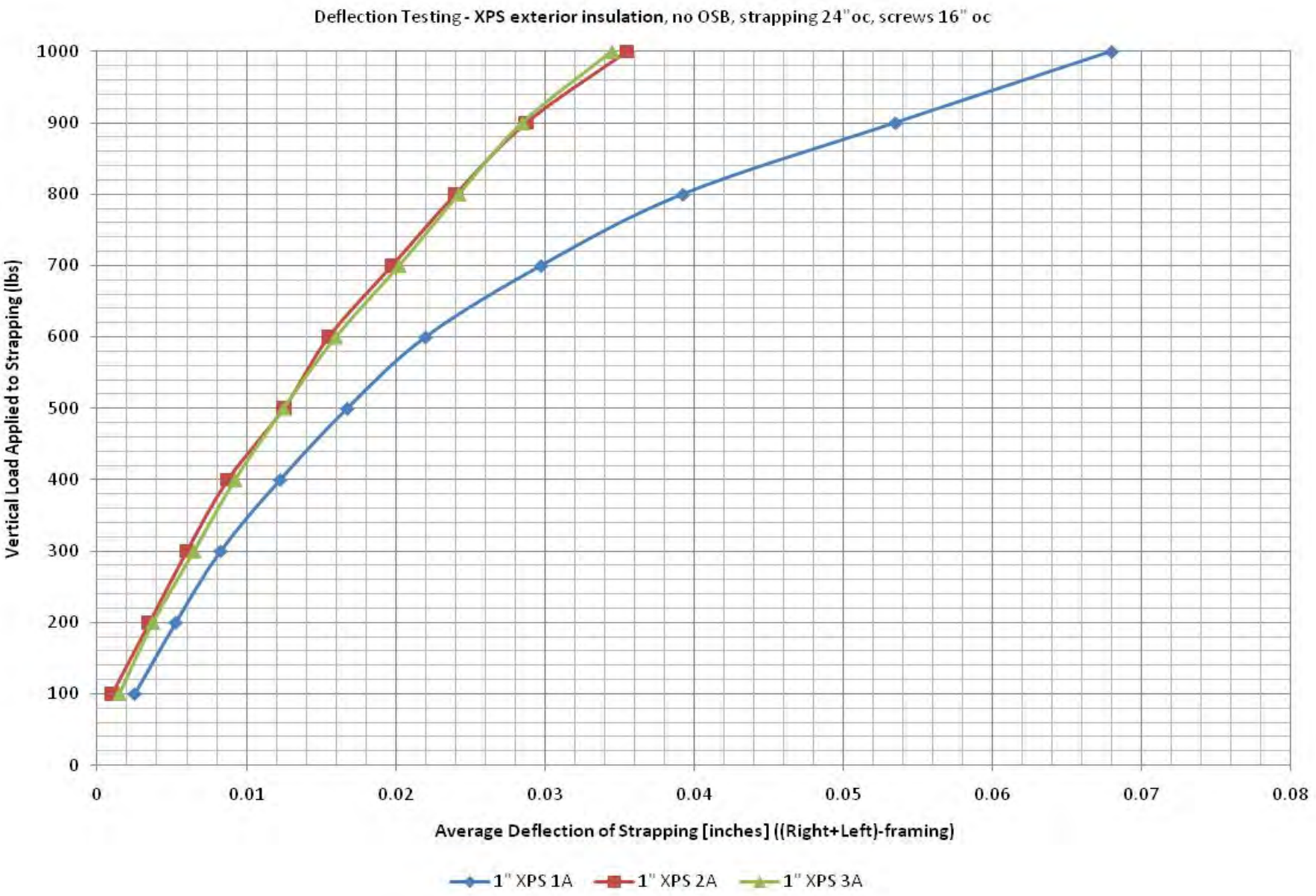

Deflection Testing - 1.25 CavityRock, no OSB, strapping 24"oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
Average Deflection of Strapping [inches] ((Right+Left)-framing)
1.25 CR (no oSB) - A1
1.25 CR (no OSB) - A2
1.25 CR (no OSB) - A3

EXHIBIT C


Deflection Testing - XPS exterior insulation, no OSB, strapping 24"oc, screws 16" oc
Vertical Load Applied to Strapping (lbs)
1000
900
800
700
600
500
400
300
200
100
0
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
Average Deflection of Strapping [inches] ((Right+Left)-framing)
1" XPS 1A
1" XPS 2A
1" XPS 3A