Tillamook County **DEPARTMENT OF COMMUNITY DEVELOPMENT**
BUILDING, PLANNING & ON-SITE SANITATION SECTIONS

1510 – B Third Street
Tillamook, Oregon 97141
www.tillamookcounty.gov
(503) 842-3408

Land of Cheese, Trees and Ocean Breeze

Floodway Development Permit #851-24-000596-PLNG:
LIGHT/TAYLOR

NOTICE TO MORTGAGEE, LIENHOLDER, VENDOR OR SELLER:
ORS 215 REQUIRES THAT IF YOU RECEIVE THIS NOTICE,
IT MUST BE PROMPTLY FORWARDED TO THE PURCHASER

NOTICE OF ADMINISTRATIVE REVIEW
Date of Notice: July 25, 2025

Notice is hereby given that the Tillamook County Department of Community Development is considering the following:

851-24-000596-PLNG: A review of a Floodway Development Permit for the placement of a 5-unit residential structure near the Nestucca River. Located in the Unincorporated Community of Pacific City/Woods, the subject property is accessed via Brooten Road, a County road, zoned Pacific City/Woods Commercial One (PCW-C1), and designated as Tax Lot 1601 of Section 19CA, Township 4 South, Range 10 West of the Willamette Meridian, Tillamook County, Oregon. The Applicant is Kalli Light. The property owner is Arthur Robert Taylor.

Written comments received by the Department of Community Development prior to 4:00p.m. on August 8, 2025, will be considered in rendering a decision. Comments should address the criteria upon which the Department must base its decision. A decision will be rendered no sooner than the next business day, August 11, 2025.

Notice of the application, a map of the subject area, and the applicable criteria are being mailed to all property owners within 250 feet of the exterior boundaries of the subject parcel for which an application has been made and other appropriate agencies at least 14 days prior to this Department rendering a decision on the request.

A copy of the application, along with a map of the request area and the applicable criteria for review are available for inspection on the Tillamook County Department of Community Development website: https://www.tillamookcounty.gov/commdev/landuseapps and is also available for inspection at the Department of Community Development office located at 1510-B Third Street, Tillamook, Oregon 97141.

If you have any questions about this application, please call the Department of Community Development at 503-842-3408 Ext. 3423 or sarah.thompson@tillamookcounty.gov.

Sincerely,

Melissa Jenck, CFM, Senior Planner

Sarah Absher, CFM, Director
Enc. Applicable Ordinance Criteria, Maps

REVIEW CRITERIA

ARTICLE III – ZONE REGULATIONS

TCLUO SECTION 3.510: FLOOD HAZARD OVERLAY ZONE

(1) The fill is not within a Coastal High Hazard Area.

(2) Fill placed within the Regulatory Floodway shall not result in any increase in flood levels during the occurrence of the base flood discharge.

(3) The fill is necessary for an approved use on the property.

(4) The fill is the minimum amount necessary to achieve the approved use.

(5) No feasible alternative upland locations exist on the property.

(6) The fill does not impede or alter drainage or the flow of floodwaters.

(7) If the proposal is for a new critical facility, no feasible alternative site is available.

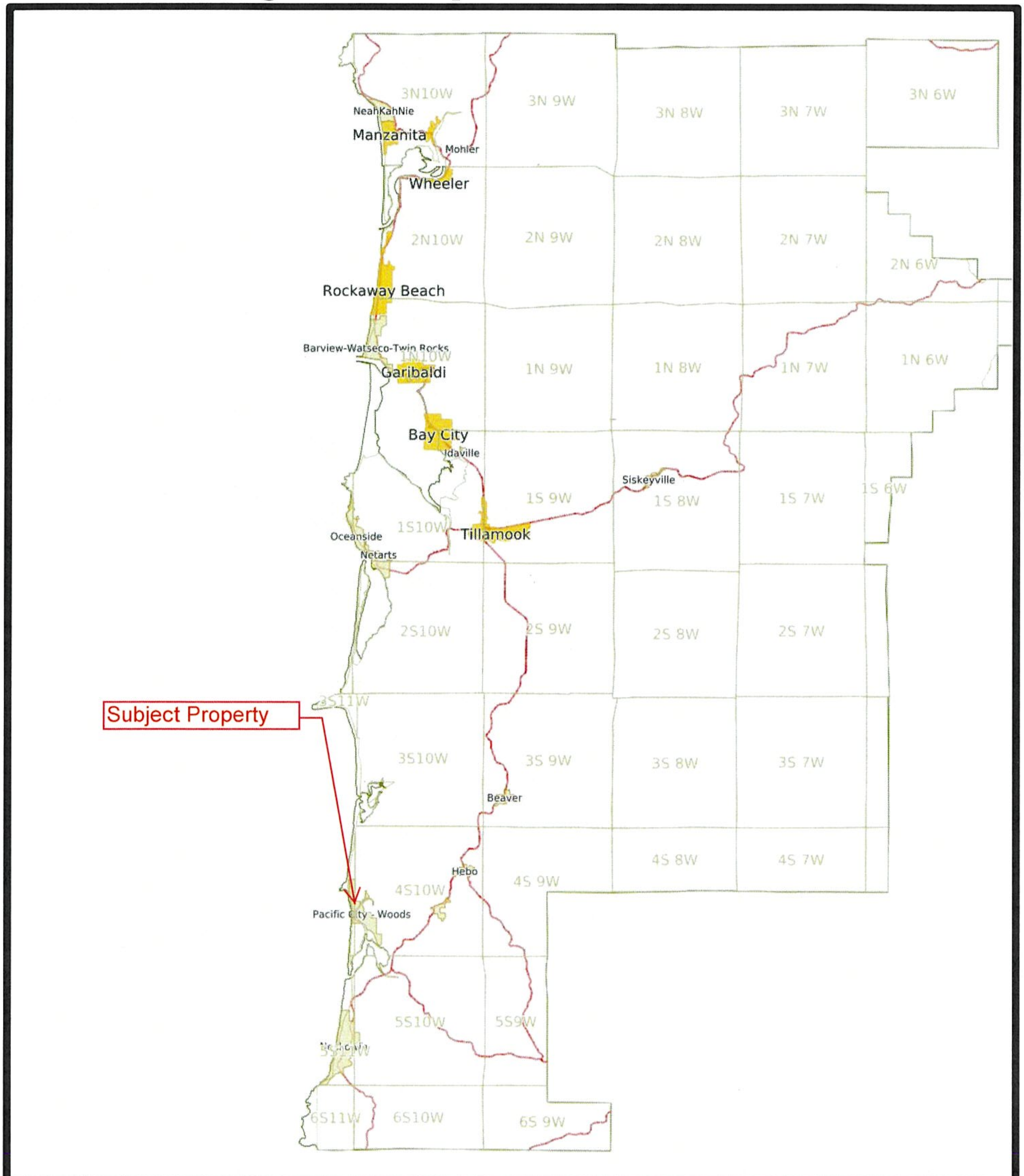
(8) For creation of new, and modification of, Flood Refuge Platforms, the following apply, in addition to (14)(a)(1-4) and (b)(1-5):

> i. The fill is not within a floodway, wetland, riparian area or other sensitive area regulated by the Tillamook County Land Use Ordinance.
>
> ii. The property is actively used for livestock and/or farm purposes,
>
> iii. Maximum platform size = 10 sq ft of platform surface per acre of pasture in use, or 30 sq ft per animal, with a 10-ft wide buffer around the outside of the platform,
>
> iv. Platform surface shall be at least 1 ft above base flood elevation,
>
> v. Slope of fill shall be no steeper than 1.5 horizontal to 1 vertical,
>
> vi. Slope shall be constructed and/or fenced in a manner so as to prevent and avoid erosion.

Conditions of approval may require that if the fill is found to not meet criterion (5), the fill shall be removed or, where reasonable and practical, appropriate mitigation measures shall be required of the property owner. Such measures shall be verified by a certified engineer or hydrologist that the mitigation measures will not result in a net rise in floodwaters and be in coordination with applicable state, federal and local agencies, including the Oregon Department of Fish and Wildlife.

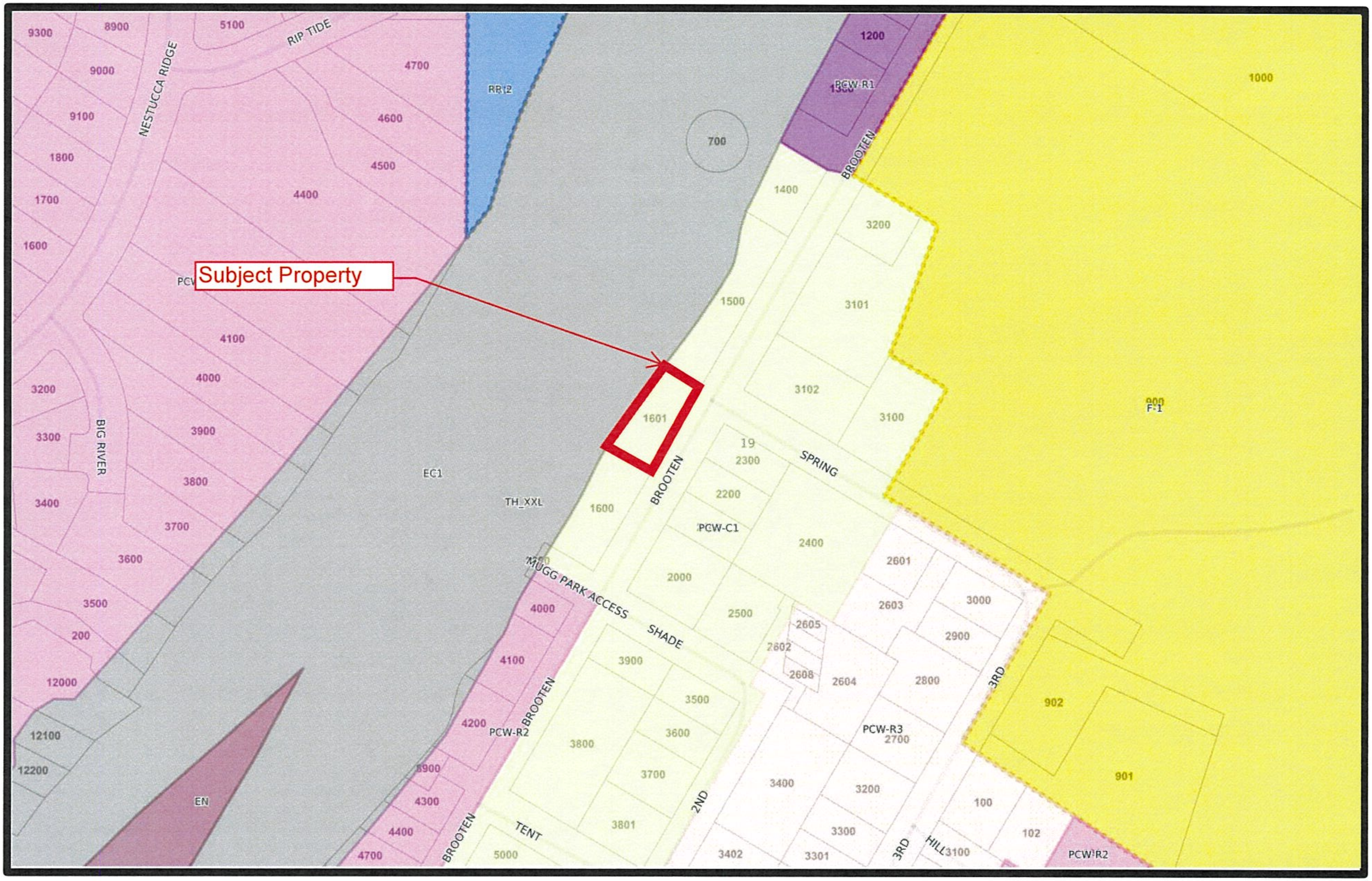
EXHIBIT A

Vicinity Map



Generated with the GeoMOOSE Printing Utilities

Zoning Map



Generated with the GeoMOOSE Printing Utilities

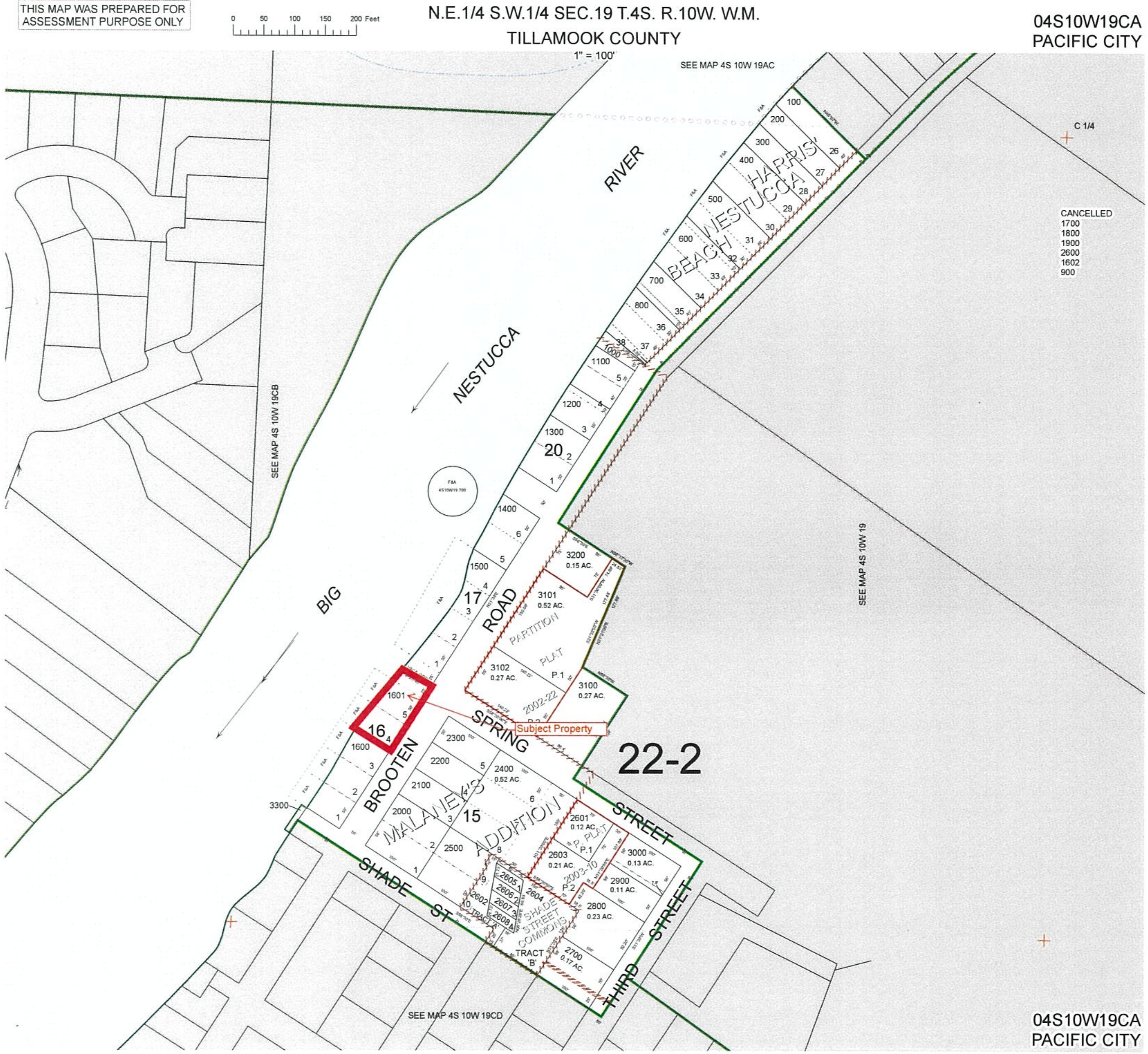
THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSE ONLY

N.E.1/4 S.W.1/4 SEC.19 T.4S. R.10W. W.M.

TILLAMOOK COUNTY

1" = 100'

04S10W19CA
PACIFIC CITY

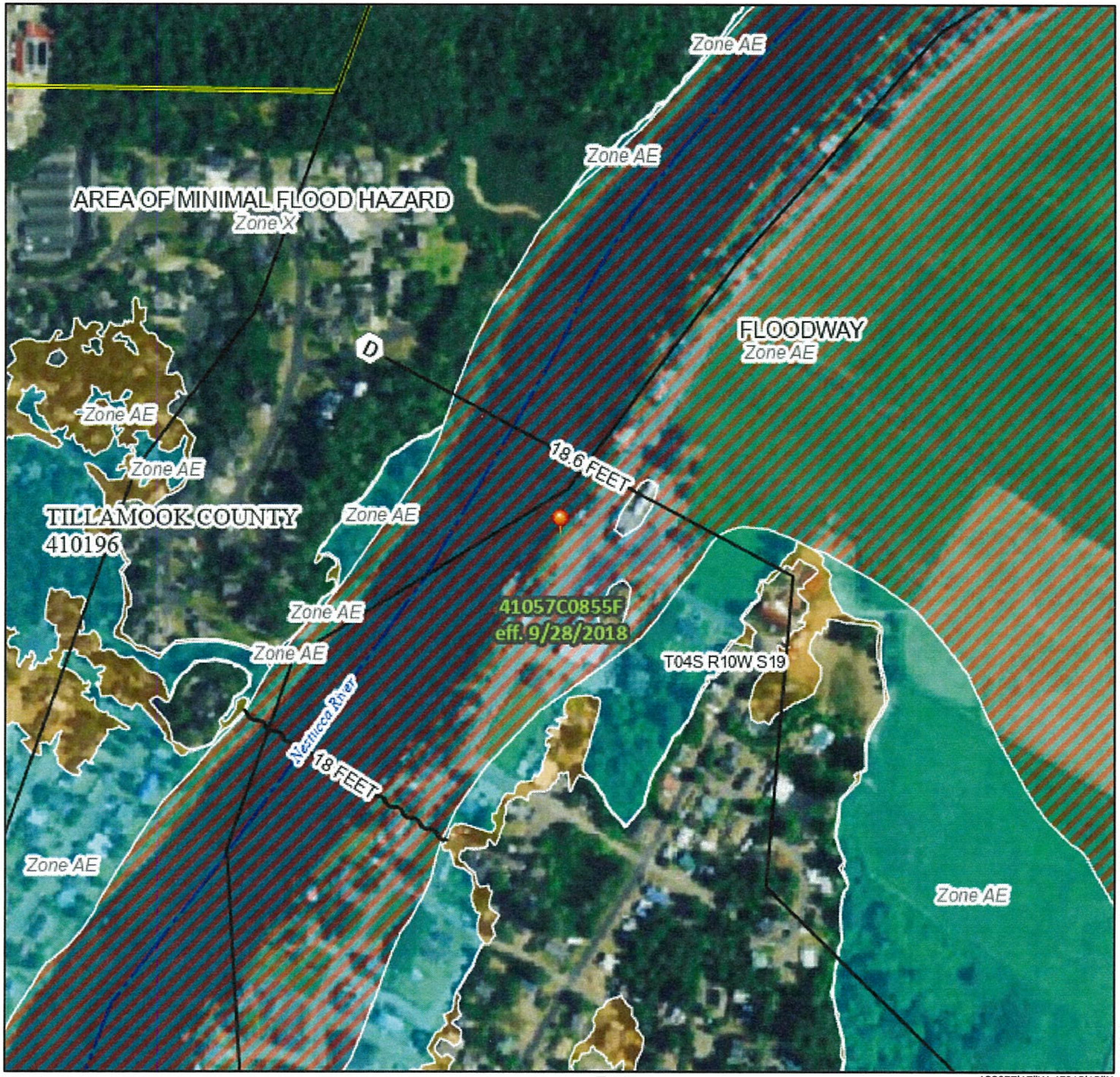


04S10W19CA
PACIFIC CITY

Revised 7/31/23, WS

National Flood Hazard Layer FIRMette

123°57'54"W 45°12'39"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

123°57'17"W 45°12'13"N

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
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- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

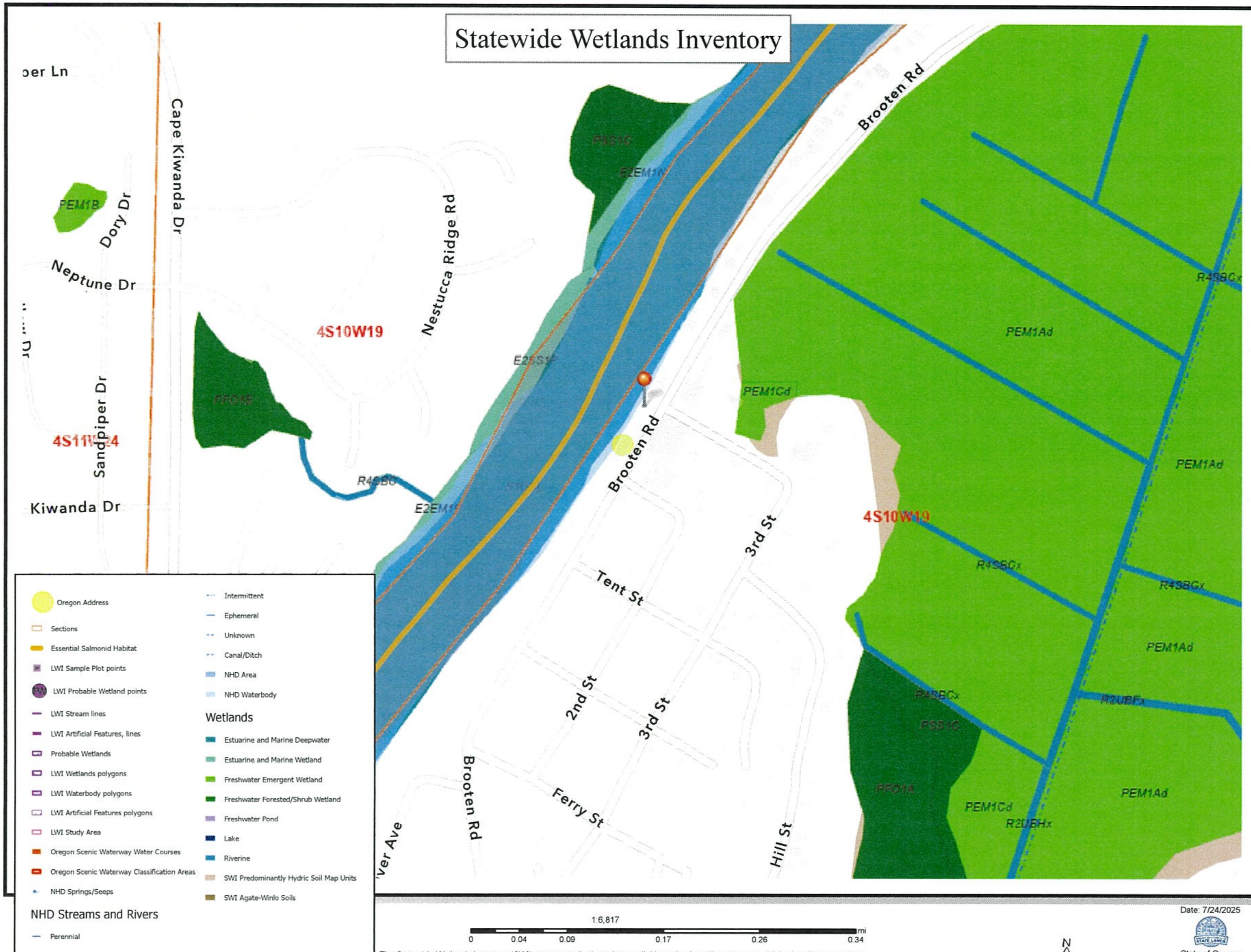
The pin displayed on the map is an approximate point selected by the user and does not represe[nt] an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/24/2025 at 7:19 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Statewide Wetlands Inventory



The Statewide Wetlands Inventory (SWI) represents the best data available at the time this map was published and is updated as new data becomes available. In all cases, actual field conditions determine the presence, absence and boundaries of wetlands and waters (such as creeks and ponds). An onsite investigation by a wetland professional can verify actual field conditions.

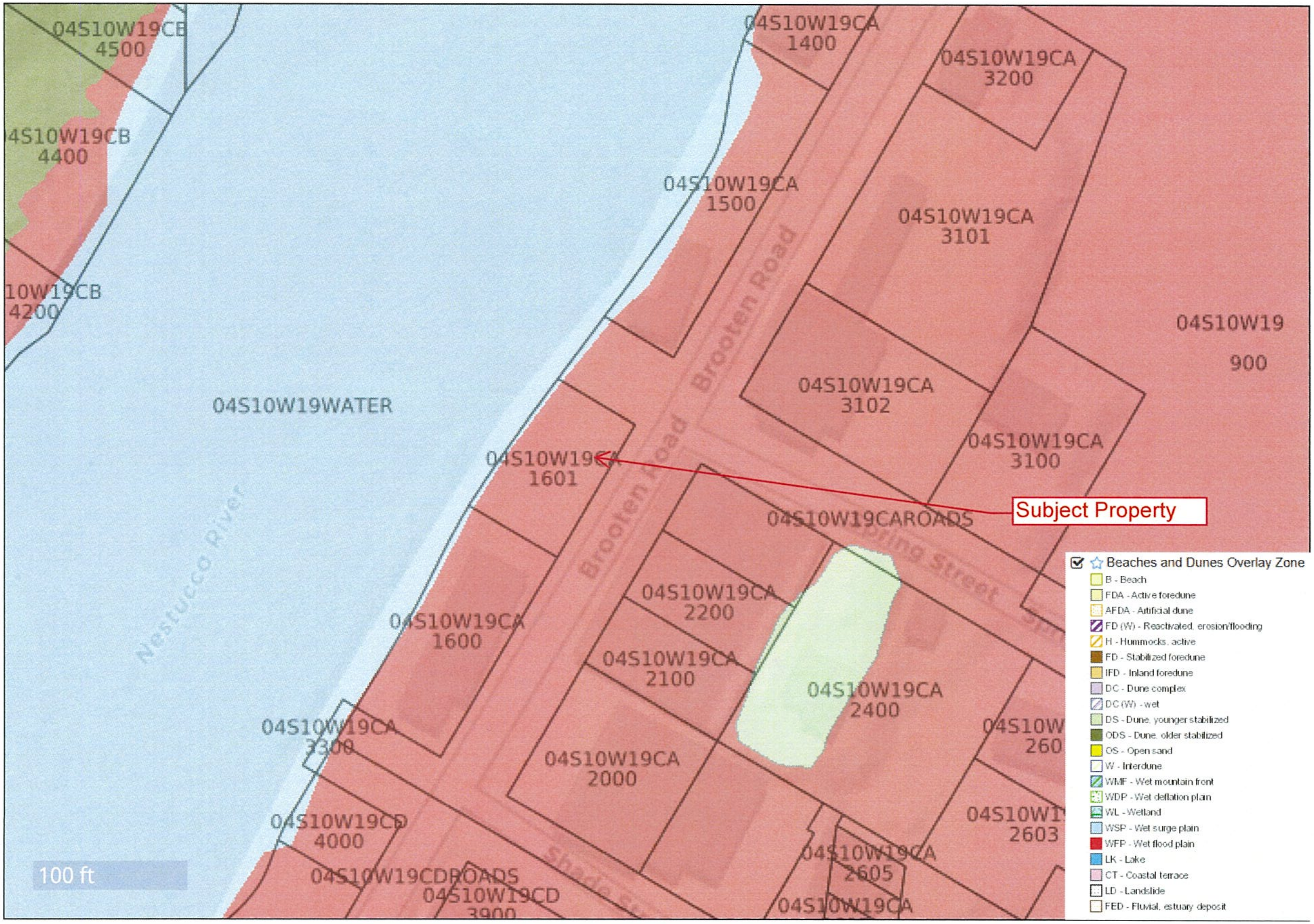
Date: 7/24/2025

State of Oregon
Department of State Lands
775 Summer Street, NE, Ste 100
Salem, OR. 97301-1279

https://www.oregon.gov/dsl/WW/Pages/SWI.aspx

Hazard Map

Oregon Coastal Atlas



Printed 11 / 14 / 2024

EXHIBIT B

Tillamook County Department of Community Development
1510-B Third Street. Tillamook, OR 97141 | Tel: 503-842-3408 Fax: 503-842-1819
www.co.tillamook.or.us

DEVELOPMENT PERMIT

OFFICE USE ONLY	
Date Stamp RECEIVED NOV 2 1 2024 BY: DCD	
☐Approved	☐Denied
Received by:	
Receipt #:	
Fees: 1690-	
Permit No: 851-24-000596-PLNG	

Applicant ☐ *(Check Box if Same as Property Owner)*
Name: Kalli Light Phone: 360-903-7470
Address: 15903 Park Place Ct
City: Oregon City State: OR Zip: 97045
Email: Kalli@relevantbuildings.com

Property Owner
Name: Robert Taylor Phone: 503-354-4836
Address: 22675 SW Vermillion Drive
City: Tualatin State: OR Zip: 97062
Email: bob@materialcg.com

Description of Work: Proposing a new 6-unit multifamily structure with ground floor parking and dwelling units above on second floor.

Location:
Site Address: Brooten Rd, Pacific City, OR 97135

Map Number: 4S	10W	19 CA	1601
Township	Range	Section	Tax Lot(s)

Complete all applicable fields:

Regulatory Floodway: ✓ Estuary: ☐	Floodplain: ✓
New: ✓ Addition: ☐ Replacement: ☐	Remodel: ☐ Demolish: ☐
Dwelling: (6) 320 sq.ft. dwelling units	Accessory Structure:
Culvert Diameter: Length:	Bridge Length: Width:
Fence Height:	Retaining Wall Height:
Streambank Stabilization:	Other:
Fill/Removal/Grading: CY	Vegetation Removal: CY

Structure/Damage $:	5 Year Construction $:
Substantial improvement/damage threshold 50% cost vs. value	

Flood Insurance Rate Map (FIRM) Panel Info

Tillamook County	Panel Number: 41057C /0855
Effective Date: 09/28/18	Property Flood Zone(s): AE
Floodway: (Y) N	Project Flood Zone(s): AE
Stream/Waterbody Name: Nestucca River	

Elevation Data (NAVD 88)

Base Flood Elevation: 18.4'	First Habitable Floor: F.F. 21.4'
Lowest Floor/Horizontal Member: F.F. 21.4'	
Enclosed Area: N/A - breakaway walls	Flood Vent Area: N/A

Other Required Permits

Authorization
This permit application does not assure permit approval. The applicant and/or property owner shall be responsible for obtaining any other necessary federal, state, and local permits. The applicant verifies that the information submitted is complete, accurate, and consistent with other information submitted with this application.

Property Owner Signature (Required) Date 11/15/24

Applicant Signature Date 11/15/2024

Tillamook County Department of Community Development
1510-B Third Street, Tillamook, OR 97141 | *Tel: 503-842-3408* *Fax: 503-842-1819*
www.co.tillamook.or.us

DEVELOPMENT PERMIT

OFFICE USE ONLY
Date Stamp
☐Approved ☐Denied
Received by:
Receipt #:
Fees:
Permit No: 851-___-______-PLNG

Applicant ☐ *(Check Box if Same as Property Owner)*

Name: Kalli Light Phone: 360-903-7470
Address: 15903 Park Place Ct
City: Oregon City State: OR Zip: 97045
Email: Kalli@relevantbuildings.com

Property Owner

Name: Robert Taylor Phone: 503-354-4836
Address: 22675 SW Vermillion Drive
City: Tualatin State: OR Zip: 97062
Email: bob@materialcg.com

Description of Work: Proposing a new 5-unit multifamily structure with ground floor parking and dwelling units above on second floor.

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Township	Range	Section	Tax Lot(s)

Complete all applicable fields:

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New: ✓ Addition:	Replacement:	Remodel: Demolish:

Dwelling: (5) 320 sq.ft. dwelling units	Accessory Structure: N/A
Culvert Diameter: N/A Length:	Bridge Length: N/A Width:
Fence Height:	Retaining Wall Height: N/A
Streambank Stabilization: N/A	Other:
Fill/Removal/Grading: Ø CY	Vegetation Removal: Ø CY

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Property Owner Signature (Required) Date 11/25/24

Applicant Signature Date 11/25/24

rel·e·vant build·ing com·pa·ny

APPROPRIATE TO THE CURRENT TIME, PERIOD, OR CIRCUMSTANCES

relevantbuildings.com

RECEIVED
APR 25 2025
AW mail

TO: Melissa Jenck, Senior Planner, CFM, Tillamook County

FROM: Kalli Light, Applicant

DATE: April 23rd, 2025

RE: Response to Incomplete Letter for Floodplain Permit #851-24-000652-PLNG

Attached to this letter are the requested materials to complete the Floodplain Development Permit review #851-24-000652-PLNG. Additional application materials include:

- Completed Floodplain Development Permit application form
- Site plan package, including:
  - Tax Map
  - FEMA FIRM Map
  - Survey of Existing Conditions
  - SP-1.0 – Proposed Conditions Site Plan
  - SP-2.0 – Proposed Parking Plan
  - SP-3.0 – Proposed Utility Plan
- Grading Plan is combined with SP-1.0 Proposed Conditions Site Plan. Pre- and post-construction elevations to match as noted on the site plan.
- Structural plans, including:
  - Engineered foundation plans
  - Preliminary structural engineering above BFE for reference
  - Architectural Plans
  - Floor plans
  - Elevation plans, which include location of BFE and freeboard in relation to proposed structures
  - Breakaway garage walls (no flood vents proposed)
  - Proposed location of utilities
- Elevation certificate for all 5 units prepared by Oregon Registered Professional Surveyor
- Findings detailing compliance with Floodplain Development Criteria, contained in TCLUO Section 3.510(14)(b)
- Floodway Encroachment No-Rise Certification Completed by an Oregon Registered Professional Engineer

Please let me know if you have any questions as you review the application materials. Thank you always for your patience and guidance on this project.

Sincerely,

Kalli Light
Relevant Buildings
360-903-7470
Kalli@relevantbuildings.com

Incompleteness Letter - For Reference

Tillamook County

DEPARTMENT OF COMMUNITY DEVELOPMENT
BUILDING, PLANNING & ON-SITE SANITATION SECTIONS

1510 – B Third Street
Tillamook, Oregon 97141
www.tillamookcounty.gov
503.842.3408

Land of Cheese, Trees and Ocean Breeze

December 23, 2024

TAYLOR, ARTHUR ROBERT
22675 SW VERMILLION DR
TUALATIN, OR 97062

KALLI LIGHT
15903 PARK PLACE CT
OREGON CITY, OR 97045

RE: Incomplete application for Floodplain Development Permit review 851-24-000652-PLNG

To Whom It May Concern:

In reviewing the above-listed Floodplain Development Permit application, we have determined the application to be incomplete and identified the following as information required in order to deem your application complete or as information requested to supplement your application and/or clarify your proposal:

- Completed floodplain development permit, including square footage/dimensions of total building, fill volumes, etc.
- Site plan:
  - North arrow, property line boundaries, existing and proposed structure locations, location of existing and proposed onsite sanitation system(s), location of any creeks or other waterways, locations of existing trees/vegetation (indicate removal, if applicable), location and description of materials to be stored onsite during and/or after development, location and quantity of fill, grade and excavation activities, location of any restoration activities.
- Grading Plan:
  - Illustrate existing and proposed site elevations in plan and profile views, as necessary to describe activities.
    - Must depict pre and post grade.
  - Specify location and quantity of fill and excavation, source of fill materials & onsite disposal location(s).
- Structural Plans
  - Foundation plan/floor plan/elevation(s).
    - Depict location of Base Flood Elevation (BFE) and freeboard upon elevation profiles. Include mean sea level in relation to proposed structure(s).
    - Showing location and sizes of all flood openings, if required. Must depict location of flood openings relative to finished grade.
    - Depict location of all utilities, machinery/equipment and tanks to service the structure, including propane tanks, electrical meters, outlets, etc.
  - Depiction/information identifying flood resistant materials to be used.
- Elevation Certificate (EC), as applicable.
  - Pre-Construction Elevation Certificate signed by an Oregon Registered Professional Surveyor.
  - EC must be generated for the proposed plans submitted as part of the development project. An EC that does not match plans provided to this Department will not be accepted.
  - Materials as required by the EC, such as engineered flood opening details, must be attached to the EC.

- Findings detailing compliance with Floodplain Development Criteria, contained in TCLUO Section 3.510(14)(b), attached.
- Floodway Encroachment No Rise Certification completed by an Oregon Registered Professional Engineer.
    - Certification shall include hydrologic and hydraulic analyses that development shall not result in any increase in flood levels.
    - See FEMA Region X Guidance document on submission details for a "No-Rise" certification.
- Additional compliance requirements, such as a liability waiver may be required by Tillamook County for submission.

Please read and complete the enclosed acknowledgement form and indicate whether or not you intend to provide more information to complete the application or that you consider the application complete. Please return the form to Department of Community Development by the date indicated on the form. An incomplete application cannot receive an extension of time. If no response is received by the 181st day, from application submittal, this request will be deemed null and void.

Please provide all requested materials and information in a consolidated package, providing all updates at one time. This will assist staff with review of completeness items.

If you have any questions regarding these issues, please email melissa.jenck@tillamookcounty.gov or call us at 503-842-3408 x 3412.

Respectfully,
Tillamook County Department of Community Development

Melissa Jenck

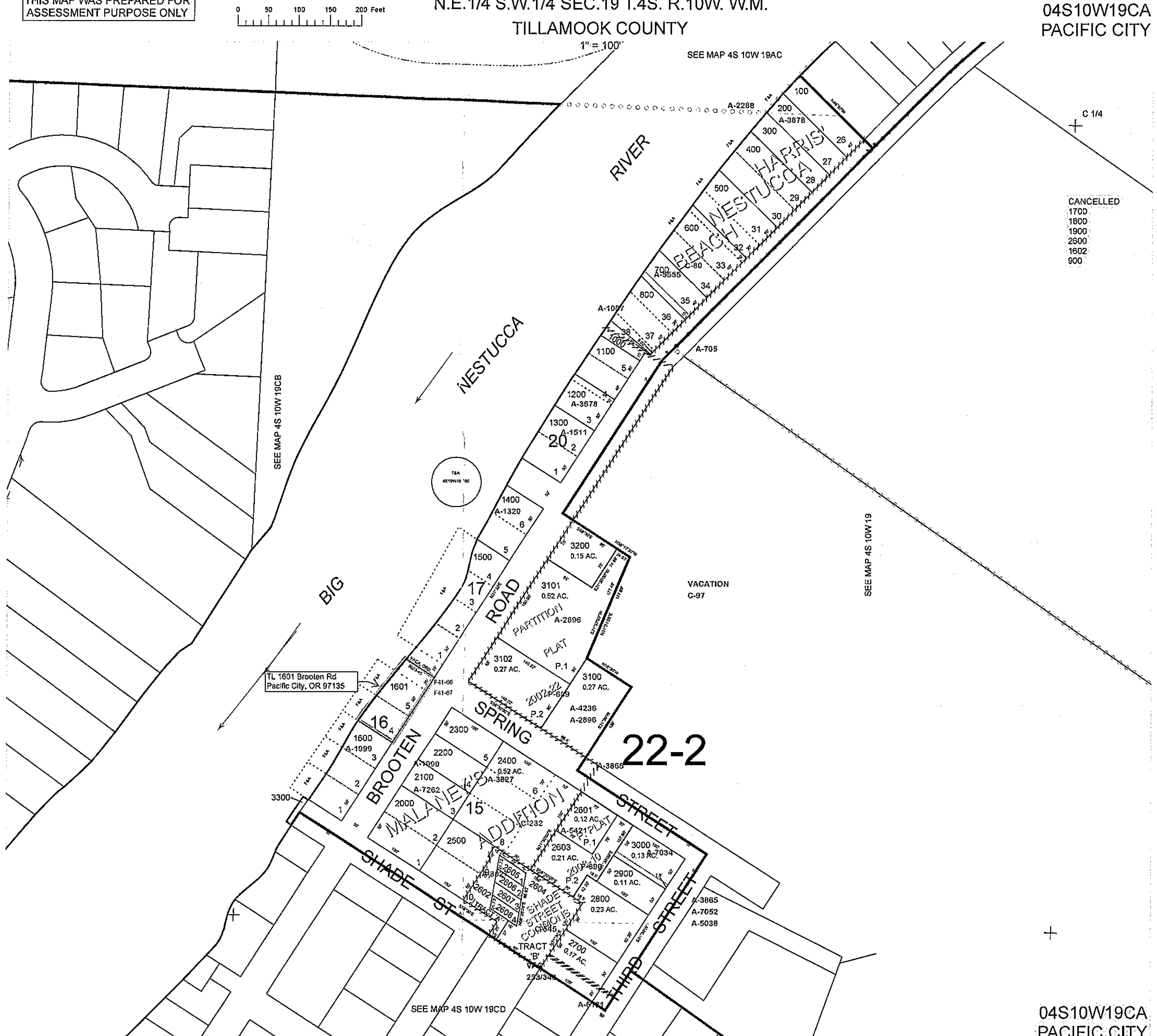
Melissa Jenck, Senior Planner, CFM
Cc'd: Sarah Absher – Director

Enclosed: Incomplete Application Response, FEMA FIRM, Invoice, Payment Instructions, Criteria, No-Rise Analysis Requirements

THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSE ONLY

N.E.1/4 S.W.1/4 SEC.19 T.4S. R.10W. W.M.
TILLAMOOK COUNTY

04S10W19CA
PACIFIC CITY

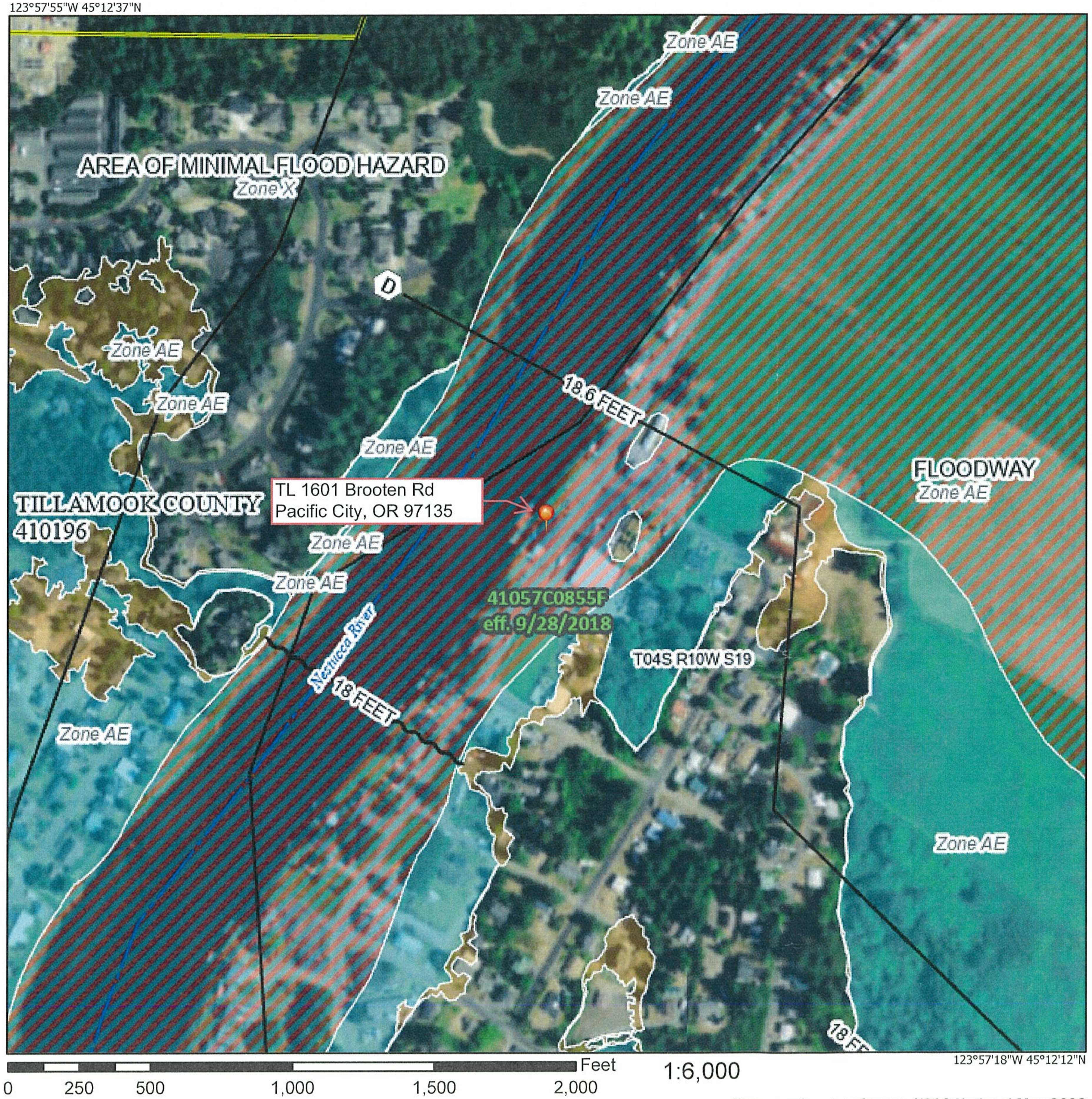


04S10W19CA
PACIFIC CITY
Revised 7/31/23, WS

National Flood Hazard Layer FIRMette

FEMA

123°57'55"W 45°12'37"N



123°57'18"W 45°12'12"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
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- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

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- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

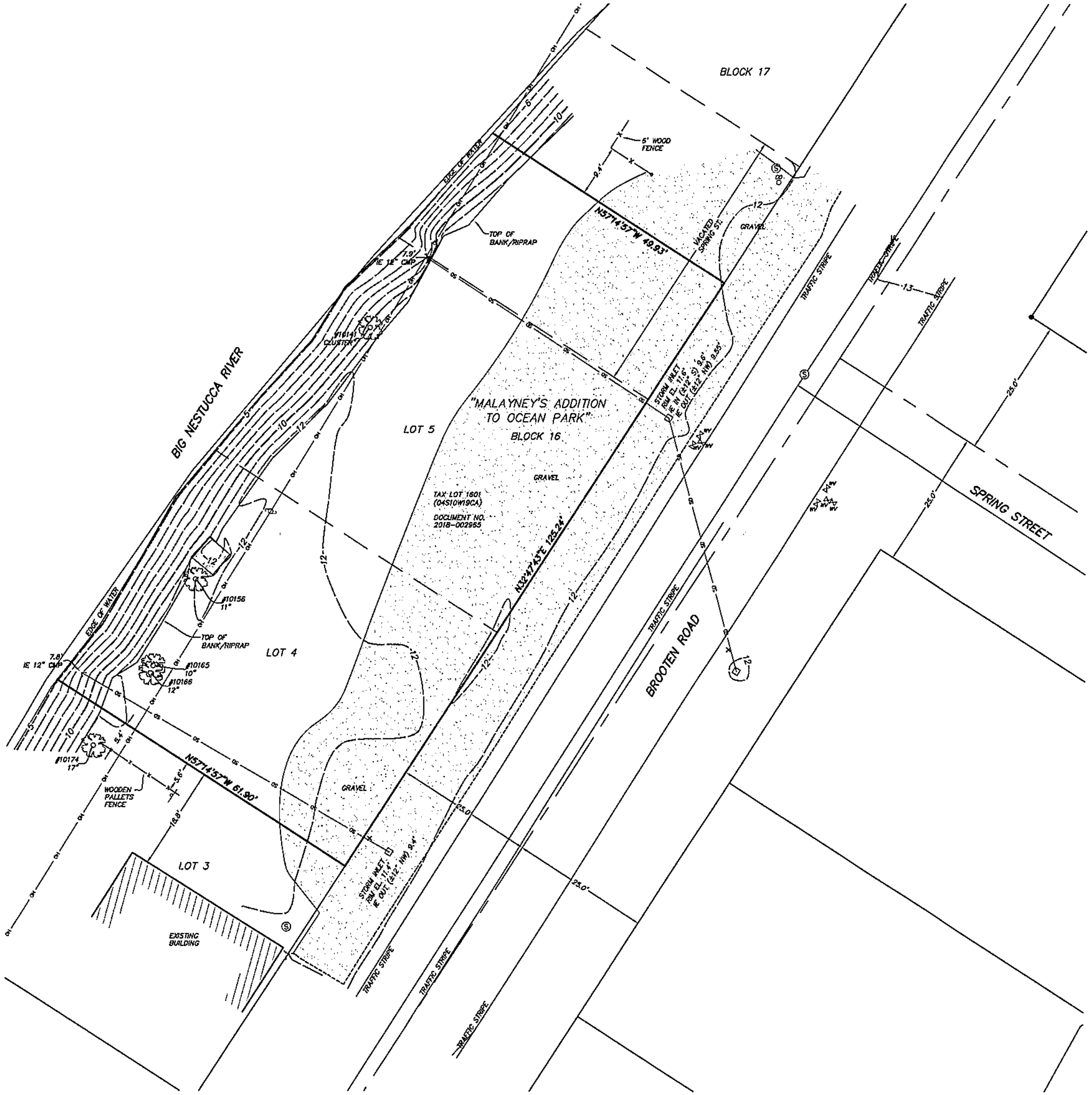
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/2/2024 at 5:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

EXISTING CONDITIONS MAP

LOCATED IN THE
S.W. 1/4 SECTION 19, T.4S., R.10W., W.M.
CITY OF PACIFIC CITY, TILLAMOOK COUNTY, OREGON
REVISED OCTOBER 15, 2024   SCALE 1"=10'



SURVEY NOTES:

THE DATUM FOR THIS SURVEY IS BASED UPON A STATIC GPS OBSERVATION OF LOCAL CONTROL POINTS, PROCESSED THROUGH OPUS. DATUM IS NAVD 88.

BASIS OF BEARINGS IS SOUTH 17°09'37" WEST, BETWEEN CONTROL POINTS 20 AND 1, BASED ON STATIC GPS OBSERVATIONS, POST PROCESSED THROUGH OPUS. BEARINGS ARE BASED ON OREGON STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NAD83(2011).

NO WARRANTIES ARE MADE AS TO MATTERS OF UNWRITTEN TITLE, SUCH AS ADVERSE POSSESSION, ESTOPPEL, ACQUIESCENCE, ETC.

NO TITLE REPORT WAS SUPPLIED OR USED IN THE PREPARATION OF THIS MAP.

UTILITY NOTES:

THE UNDERGROUND UTILITIES AS SHOWN ON THIS MAP ARE SHOWN BASED ON A COMBINATION OF INFORMATION, INCLUDING VISIBLE ABOVE GROUND STRUCTURES, AVAILABLE AS BUILT AND GIS MAPPING FROM LOCAL JURISDICTIONS, AS WELL AS SURFACE MARKINGS BY ONE CALL TICKET NUMBER 24094963 DATED APRIL 24, 2024.

THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED.

THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES ARE IN THE EXACT LOCATION INDICATED, ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE.

THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES. SUBSURFACE AND ENVIRONMENTAL CONDITIONS WERE NOT EXAMINED OR CONSIDERED AS A PART OF THIS SURVEY. NO STATEMENT IS MADE CONCERNING THE EXISTENCE OF UNDERGROUND OR OVERHEAD CONTAINERS OR FACILITIES THAT MAY AFFECT THE USE OR DEVELOPMENT OF THIS TRACT. THIS SURVEY DOES NOT CONSTITUTE A TITLE SEARCH BY SURVEYOR.

INVERT ELEVATIONS AND PIPE SIZES SHOWN ARE APPROXIMATE ONLY, BASED ON FIELD OBSERVATIONS AS WELL AS AVAILABLE AS-BUILT DATA. ALL PIPE SIZES SHALL BE FIELD VERIFIED BY THE OWNER, ENGINEER, CONTRACTOR, AND GOVERNING AGENCY PRIOR TO ANY CONSTRUCTION ACTIVITY. SURVEYOR DOES NOT WARRANT THE ACCURACY OF ANY PIPE SIZES SHOWN ON THIS SURVEY.

FEMA NOTE:

PER FEMA FLOOD INSURANCE RATE MAP NUMBER 41057C0855F, WITH AN EFFECTIVE DATE OF SEPTEMBER 28, 2018, THE SUBJECT PROPERTY IS LOCATED IN ZONE AE – SPECIAL FLOOD HAZARD AREA, REGULATORY FLOODWAY.

SUBJECT PROPERTY HAS A BASE FLOOD ELEVATION OF 18.4 FEET, NAVD 88 DATUM.

TILLAMOOK COUNTY REQUIRES NEW CONSTRUCTION TO BE 3.00 FEET ABOVE BASE FLOOD ELEVATION, OR AT 21.4 FEET ELEVATION NAVD FOR THIS SPECIFIC SITE.

LEGEND:

Some Symbols shown may not be used on map

- DECIDUOUS TREE
- EVERGREEN TREE
- DEAD TREE
- STORM SEWER MANHOLE
- CATCH BASIN
- CURB INLET
- AREA DRAIN
- DITCH INLET
- SANITARY SEWER CLEANOUT
- SANITARY SEWER MANHOLE
- FIRE HYDRANT
- WATER MANHOLE
- WATER METER
- WATER VALVE
- HOSE BIB
- IRRIGATION CONTROL VALVE
- GAS VALVE
- GAS METER
- MAILBOX
- UTILITY RISER
- UTILITY BOX
- TELEPHONE MANHOLE
- TELEPHONE RISER
- STORM OUTFALL
- SIGN
- BOLLARD
- FOUND MONUMENT
- DOWN SPOUT TO STORM SYSTEM
- DOWN SPOUT TO SPLASH GUARD OR GROUND W/ PIPE DIRECTION
- COLUMN
- TRAFFIC SIGNAL POLE
- UTILITY POLE
- LIGHT POLE
- GUY WIRE
- ELECTRIC BOX
- ELECTRIC METER
- TRANSFORMER
- ELECTRIC RISER
- HEAT PUMP
- GATE POST
- CABLE TV BOX
- CABLE TV RISER
- OVERHEAD LINE
- GAS LINE
- ELECTRICAL LINE
- COMMUNICATIONS LINE
- SANITARY SEWER LINE
- STORM DRAIN LINE
- WATER LINE
- FENCE LINE
- HANDRAIL
- ARBORVITAE ROW
- CONCRETE SURFACE
- ASPHALT SURFACE

GRAPHIC SCALE

(IN FEET)
1 INCH = 10FT.

SIGNED ON: ____________

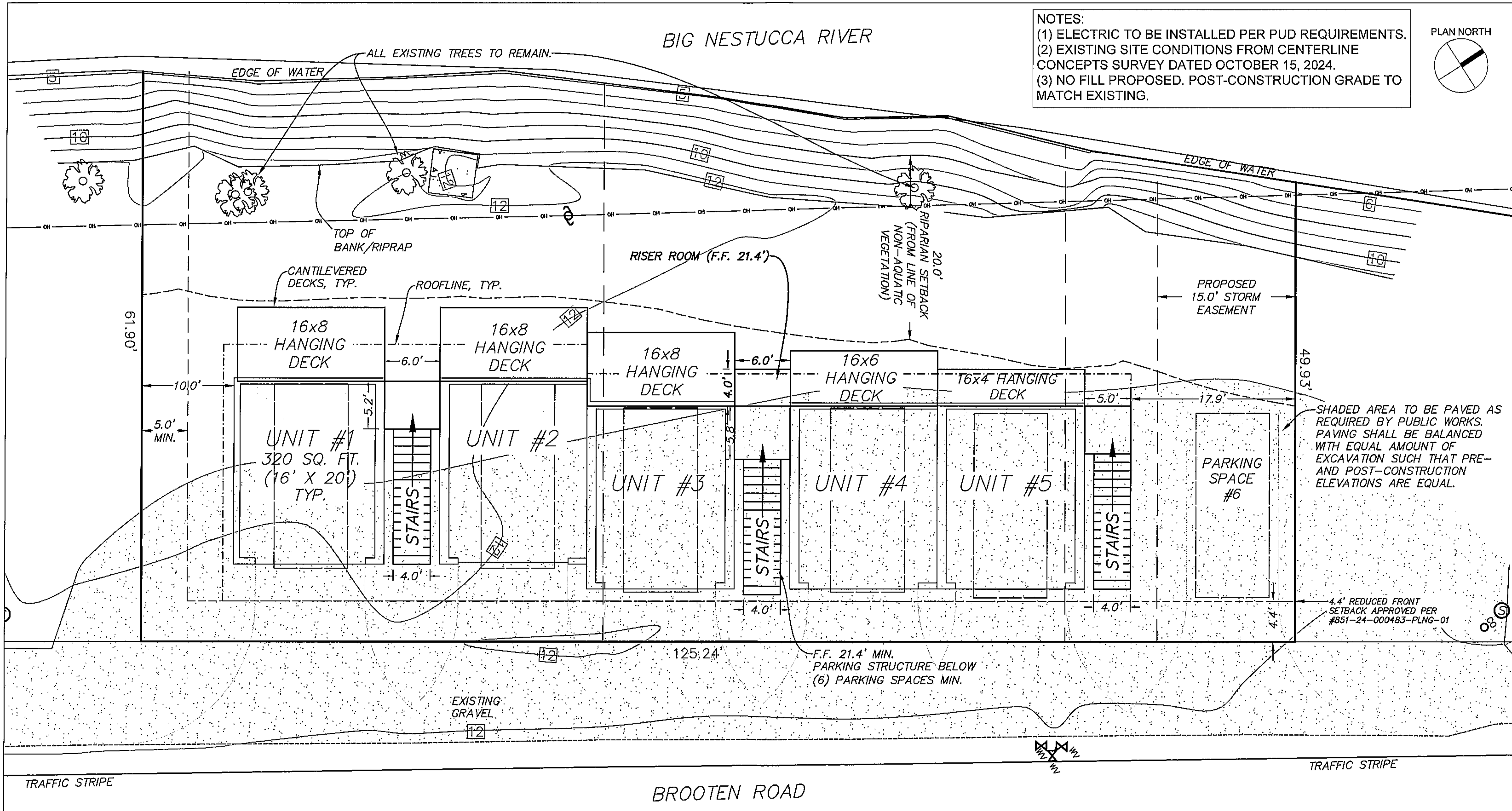
REGISTERED
PROFESSIONAL
LAND SURVEYOR

OREGON
JULY 13, 2004
TOBY G. BOLDEN
60377LS

RENEWS: DECEMBER 31, 2025

CENTERLINE CONCEPTS
LAND SURVEYING, INC.
19376 MOLALLA AVE., SUITE 120
OREGON CITY, OREGON 97045
PHONE 503.650.0188 FAX 503.650.0189

PLOTTED:M:\PROJECTS\RELEVANT BLDG-BROOTEN RD-34650\DWG\ECM-C3D.dwg



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ROBERT TAYLOR

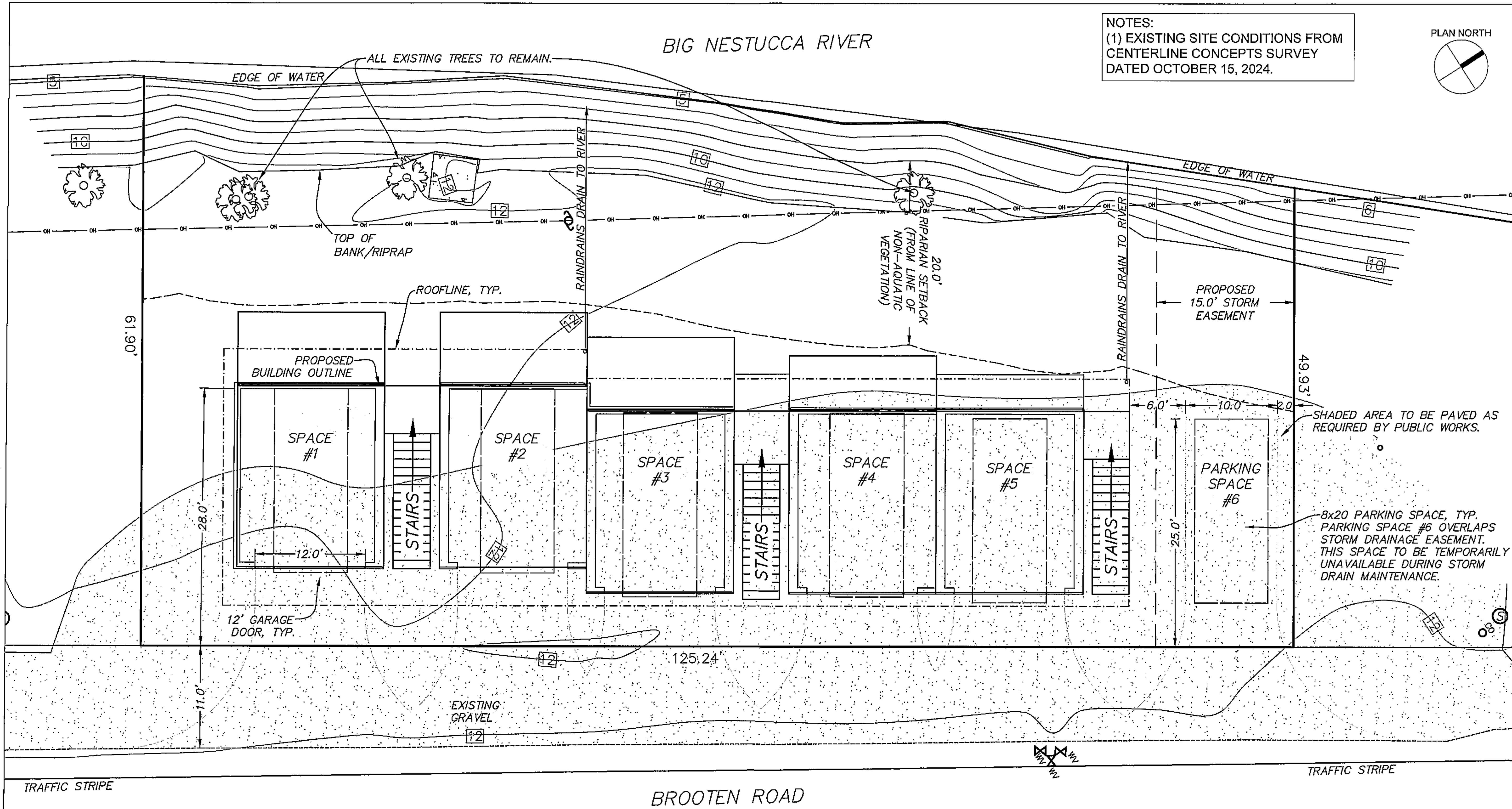
0 BROOTEN RD
PACIFIC CITY, OR 97135

SITE PLAN

Project number	
EST.	7-18-2024 KML
REV.	10-29-2024 KML
REV.	4-23-2025 KML

SP - 1.0

Scale: 1" = 10'-0"



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0 BROOTEN RD
PACIFIC CITY, OR 97135

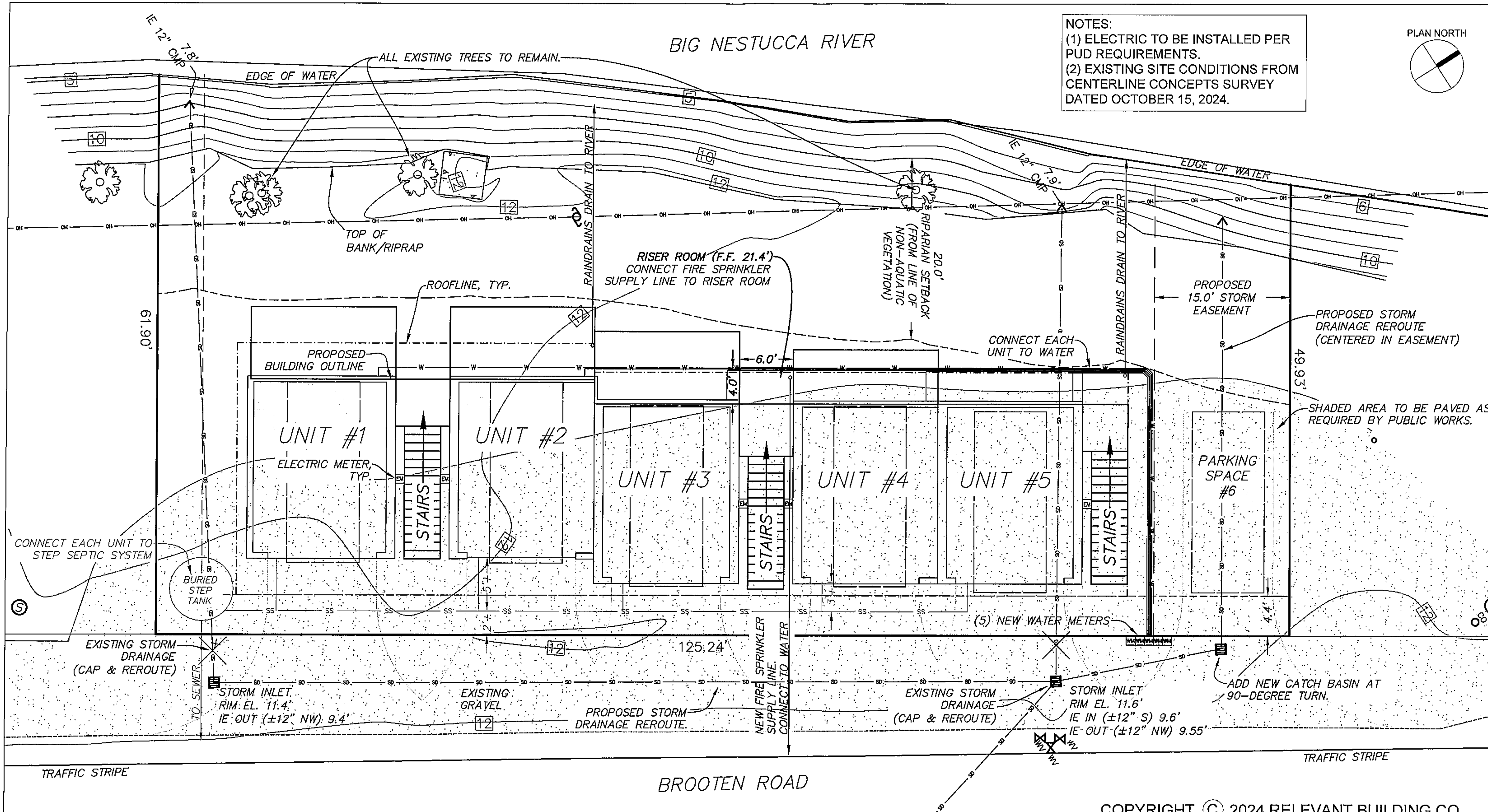
PARKING PLAN

Project number	
EST.	10-29-2024 KML
REV.	11-25-2024 KML
REV.	4-23-2025 KML

SP - 2.0

Scale: 1" = 10'-0"

NOTES:
(1) ELECTRIC TO BE INSTALLED PER PUD REQUIREMENTS.
(2) EXISTING SITE CONDITIONS FROM CENTERLINE CONCEPTS SURVEY DATED OCTOBER 15, 2024.



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APPROPRIATE TO THE CURRENT TIME, PERIOD, OR CIRCUMSTANCES

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ROBERT TAYLOR

0 BROOTEN RD
PACIFIC CITY, OR 97135

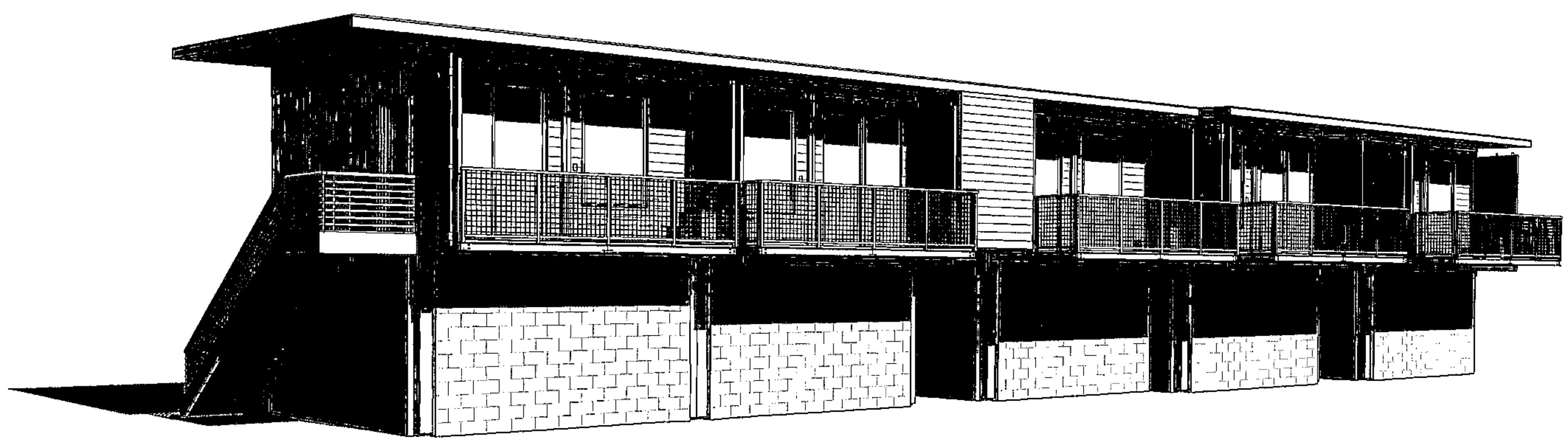
UTILITY PLAN

Project number	
EST.	7-18-2024 KML
REV.	10-29-2024 KML
REV.	4-23-2025 KML

SP - 3.0

Scale: 1" = 10'-0"

1 STREET VIEW



2 RIVER VIEW

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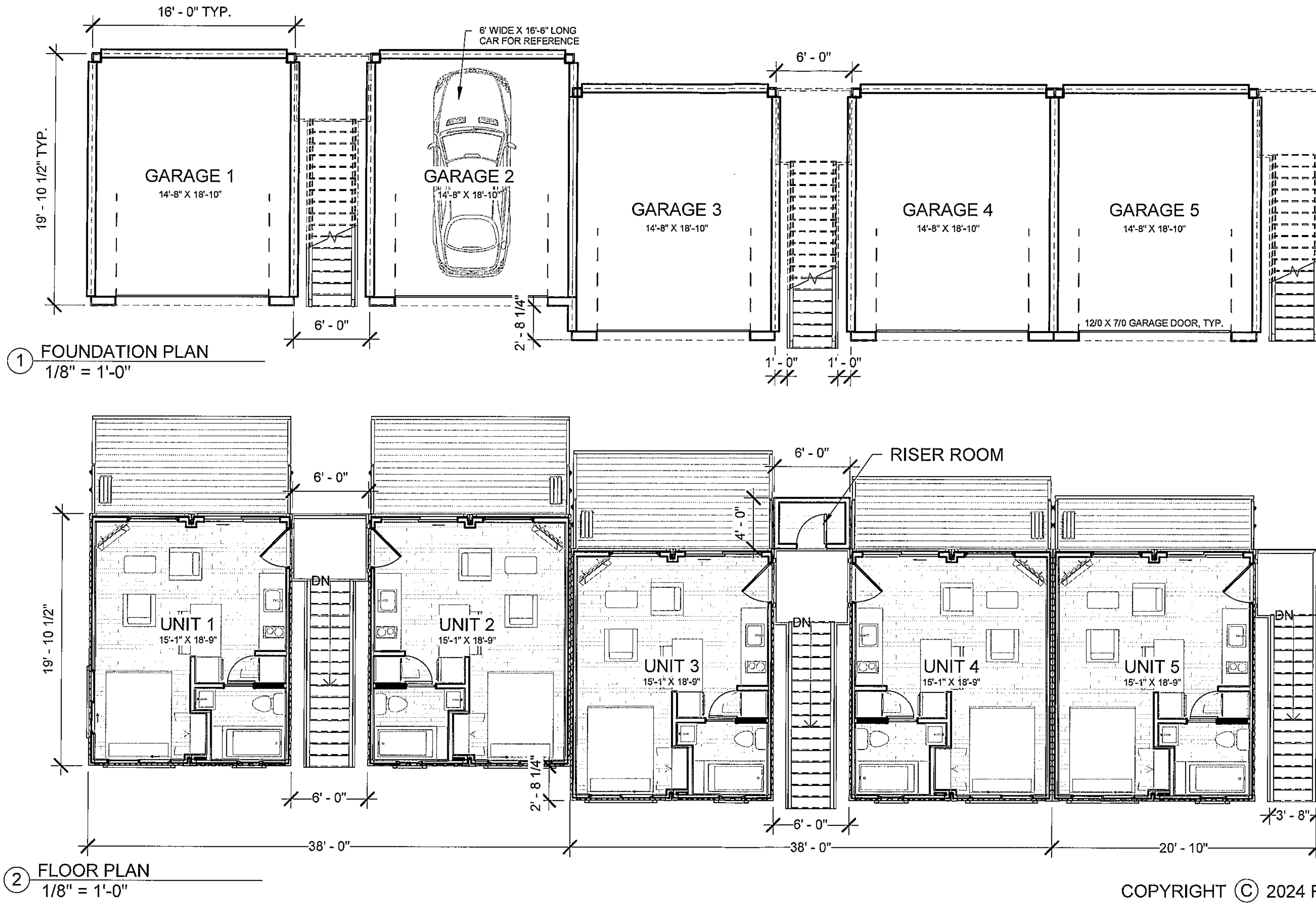

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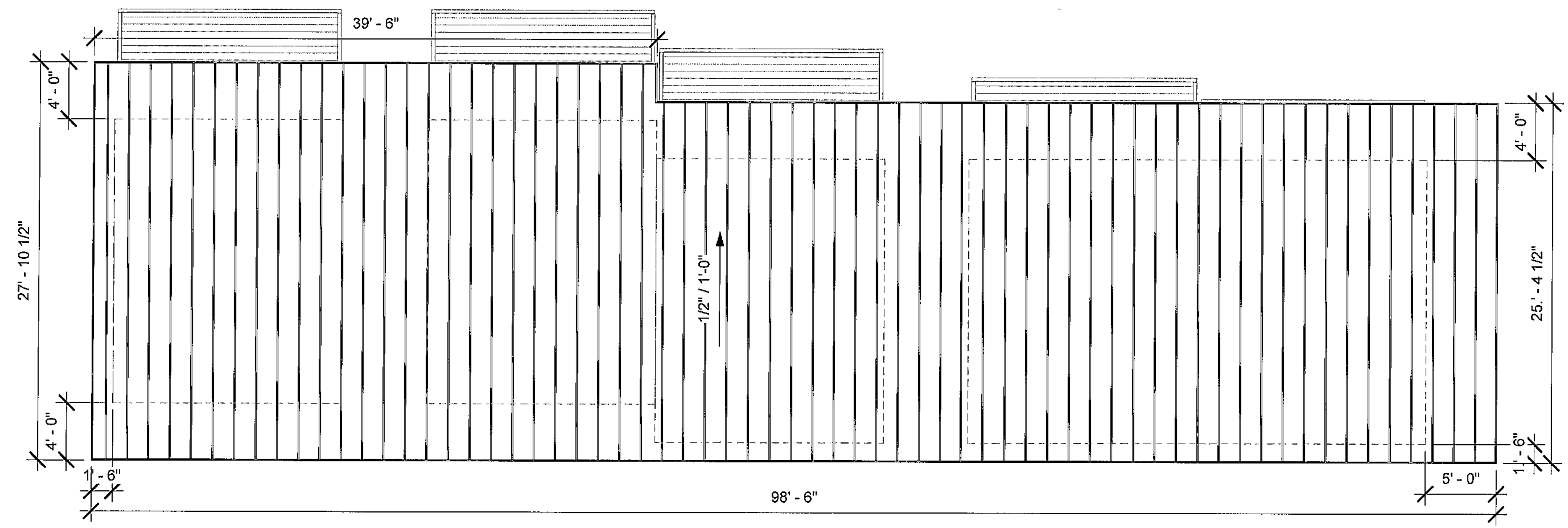
NESTUCCA RIVER

No.	Description	Date

SITE LAYOUT

Project number	TAYLOR	A101
Date	1/15/2024	
Drawn by	SP	
Checked by	KL / CC	Scale 1/8" = 1'-0"



(1) SITE ROOF PLAN
1/8" = 1'-0"

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NESTUCCA RIVER

No.	Description	Date

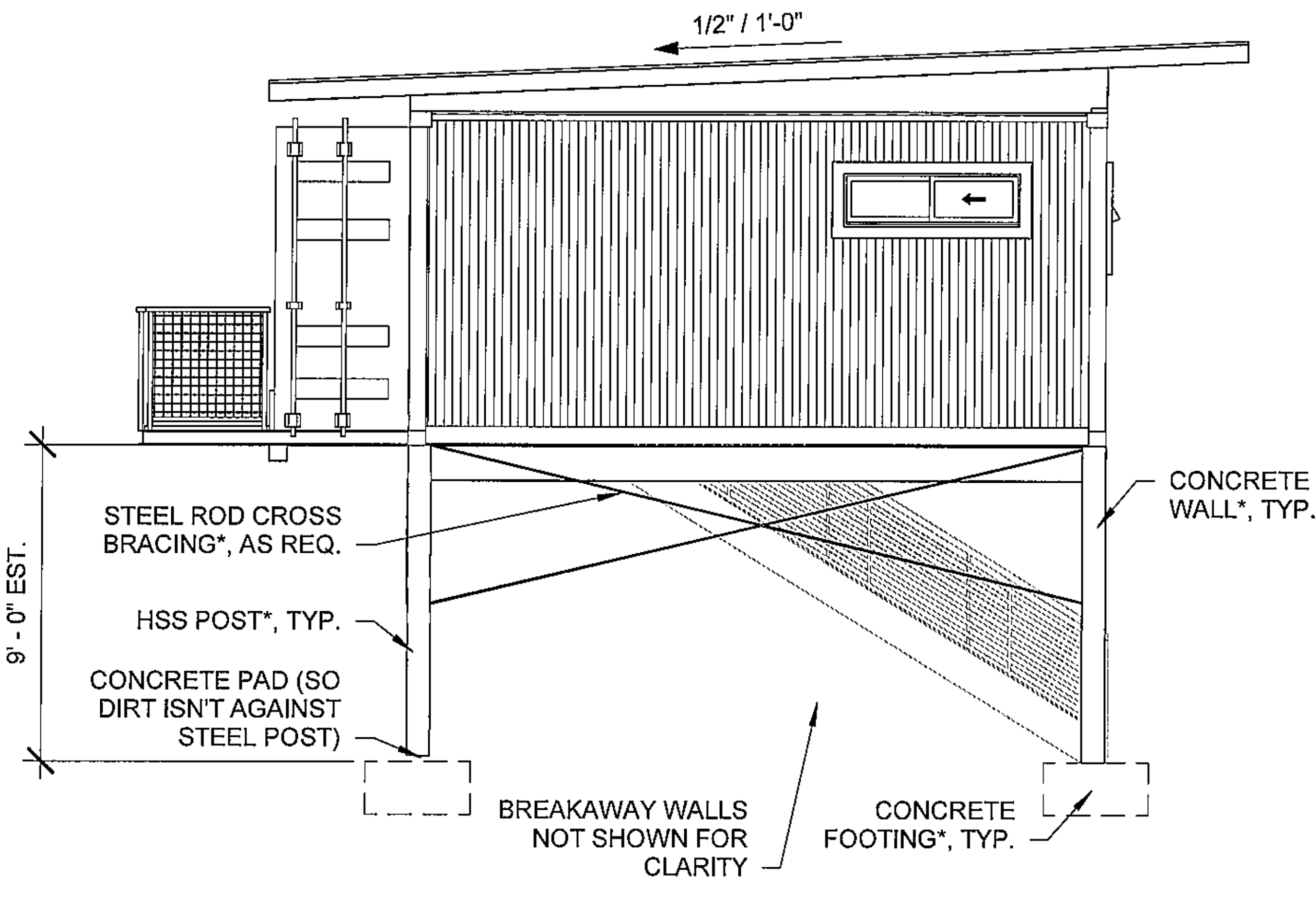
SITE ROOF PLAN

Project number	TAYLOR
Date	1/15/2024
Drawn by	SP
Checked by	CC

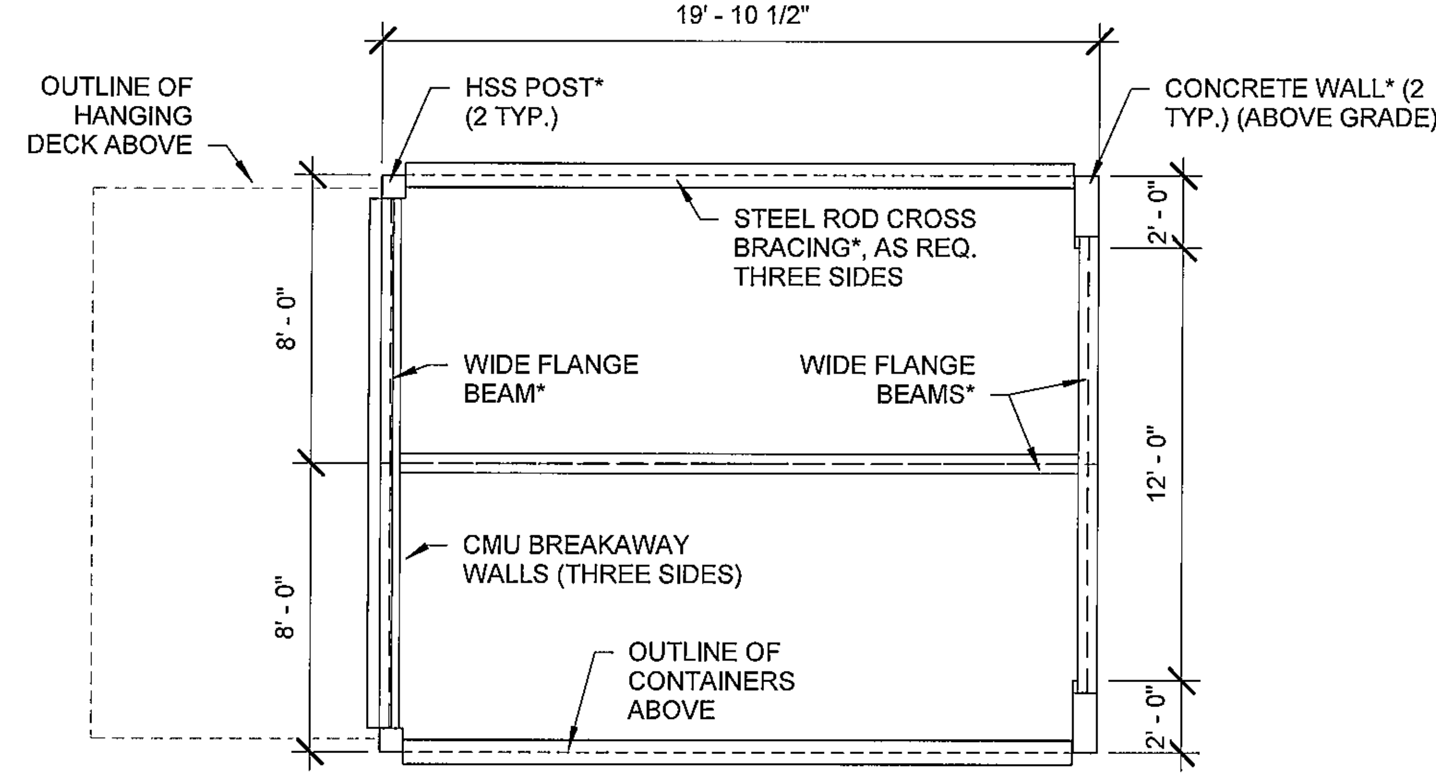
A102

Scale 1/8" = 1'-0"

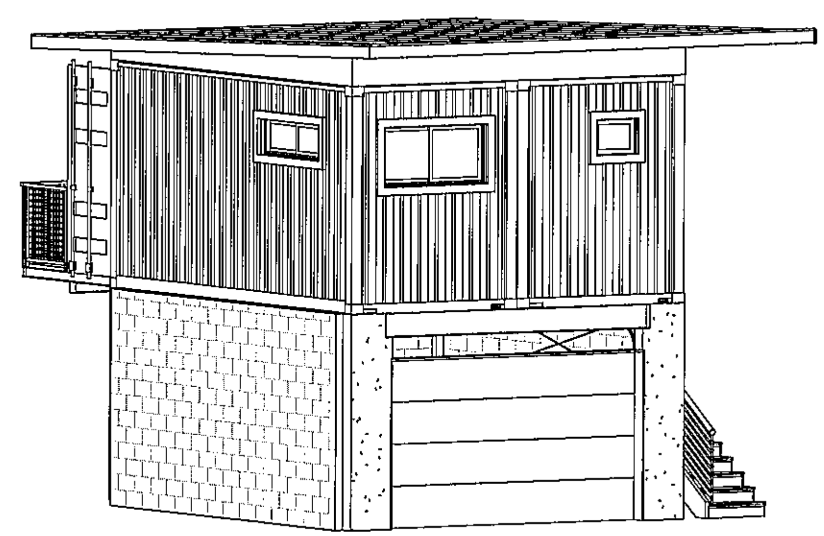
*NOTE: ALL SIZES AND CONNECTIONS TO BE DETERMINED BY SITE-SPECIFIC ENGINEERING.



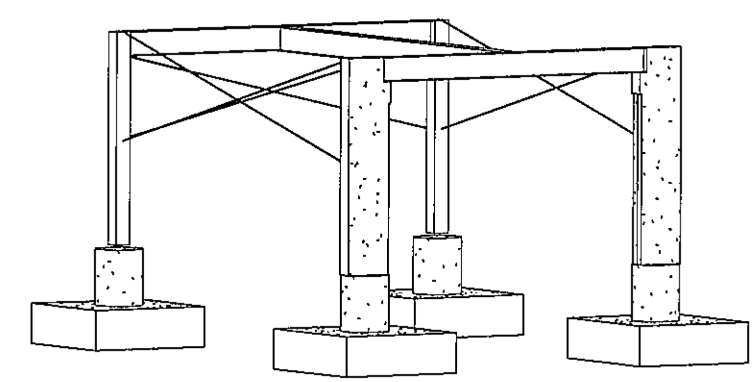
1 LEFT UNIT 1
3/16" = 1'-0"



2 BOTTOM OF CONTAINER
3/16" = 1'-0"



3 3D STRUCTURE - ABOVE GRADE



4 3D FOUNDATION

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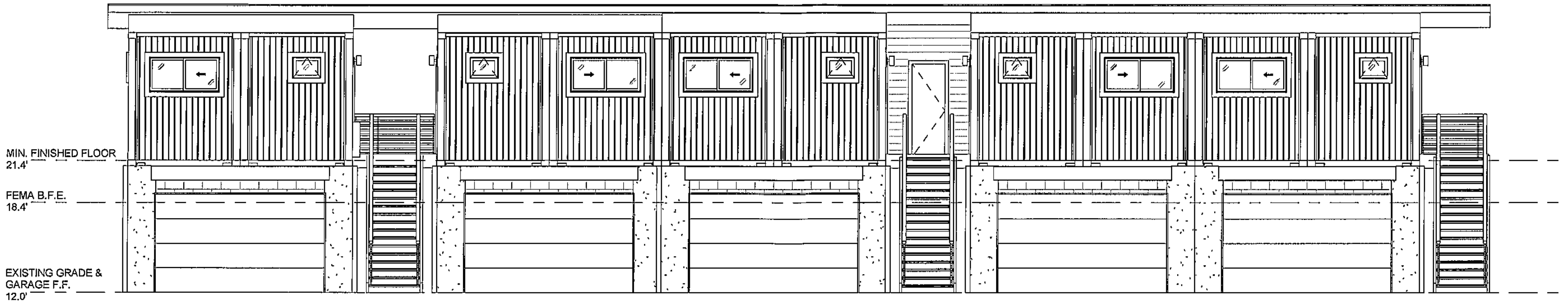
NESTUCCA RIVER

No.	Description	Date

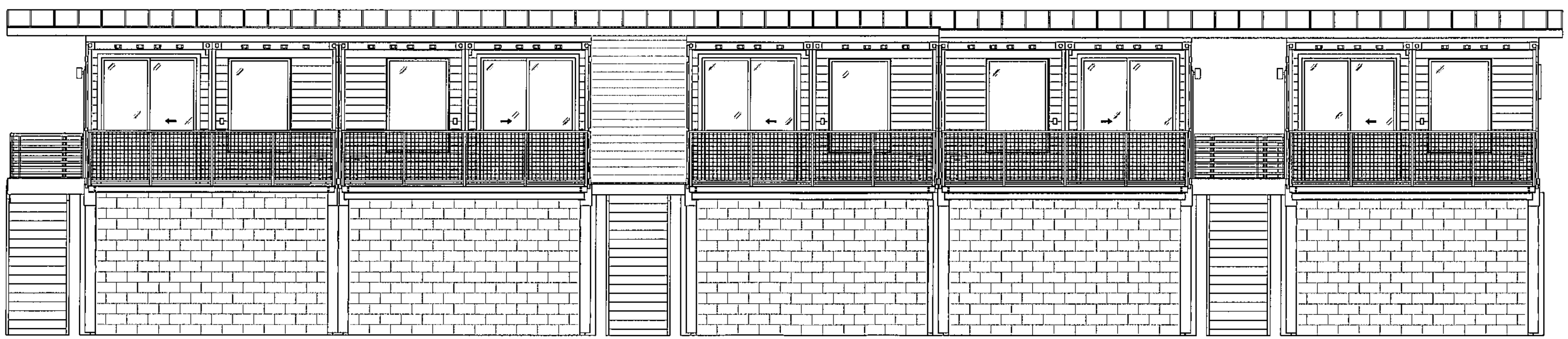
PROPOSED SADU FND, TYP.

Project number	TAYLOR	A103
Date	1/15/2024	
Drawn by	SP	
Checked by	CC	Scale 3/16" = 1'-0"

NOTE: ALL ELEVATIONS ARE REFERENCED TO A NAVD 88 DATUM AS INDICATED ON THE CENTERLINE CONCEPTS, INC. SURVEY DATED 10/15/2024.



1 FRONT
1/8" = 1'-0"



2 REAR
1/8" = 1'-0"

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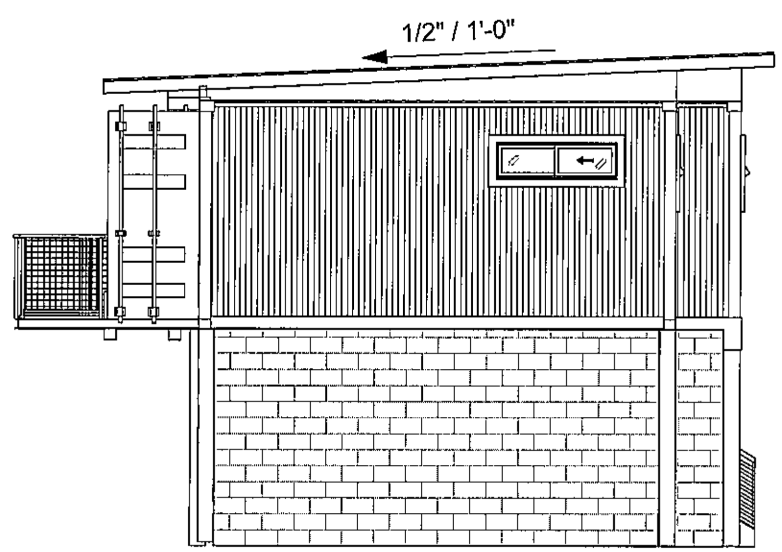
NESTUCCA RIVER

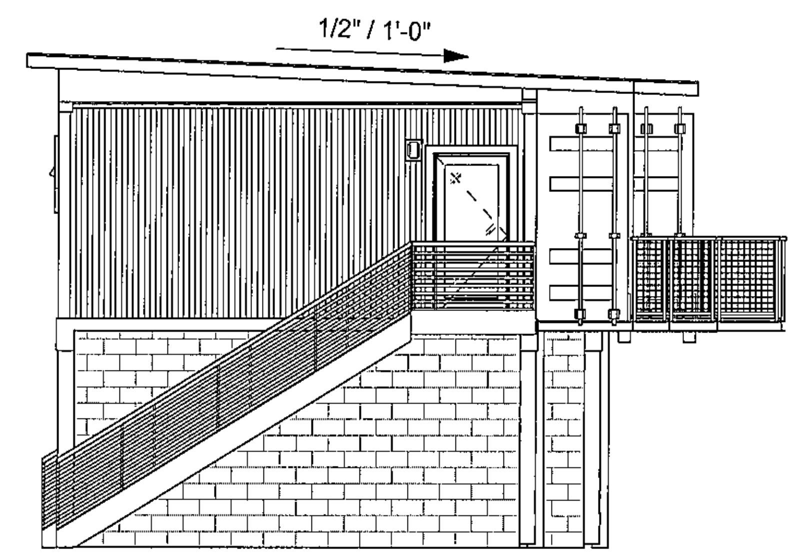
No.	Description	Date

ELEVATIONS

Project number	TAYLOR	A201
Date	1/15/2024	
Drawn by	SP	
Checked by	CC	Scale 1/8" = 1'-0"



1 LEFT
1/8" = 1'-0"



2 RIGHT
1/8" = 1'-0"

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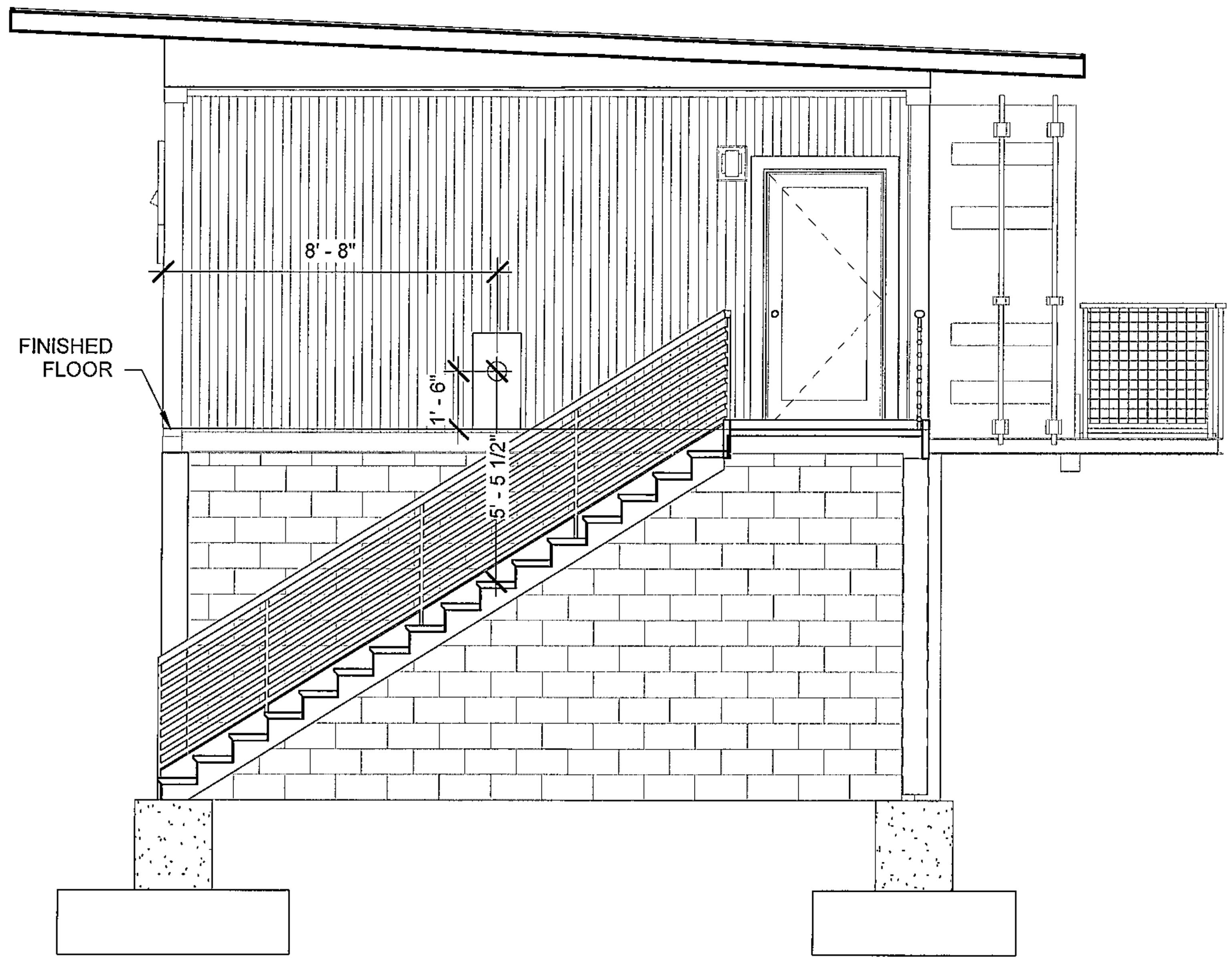
NESTUCCA RIVER

No.	Description	Date

ELEVATIONS

Project number	TAYLOR	A202
Date	1/15/2024	
Drawn by	SP	
Checked by	CC	Scale 1/8" = 1'-0"



1 TYP. ELECTRICAL METER LOCATION
1/4" = 1'-0"

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NESTUCCA RIVER

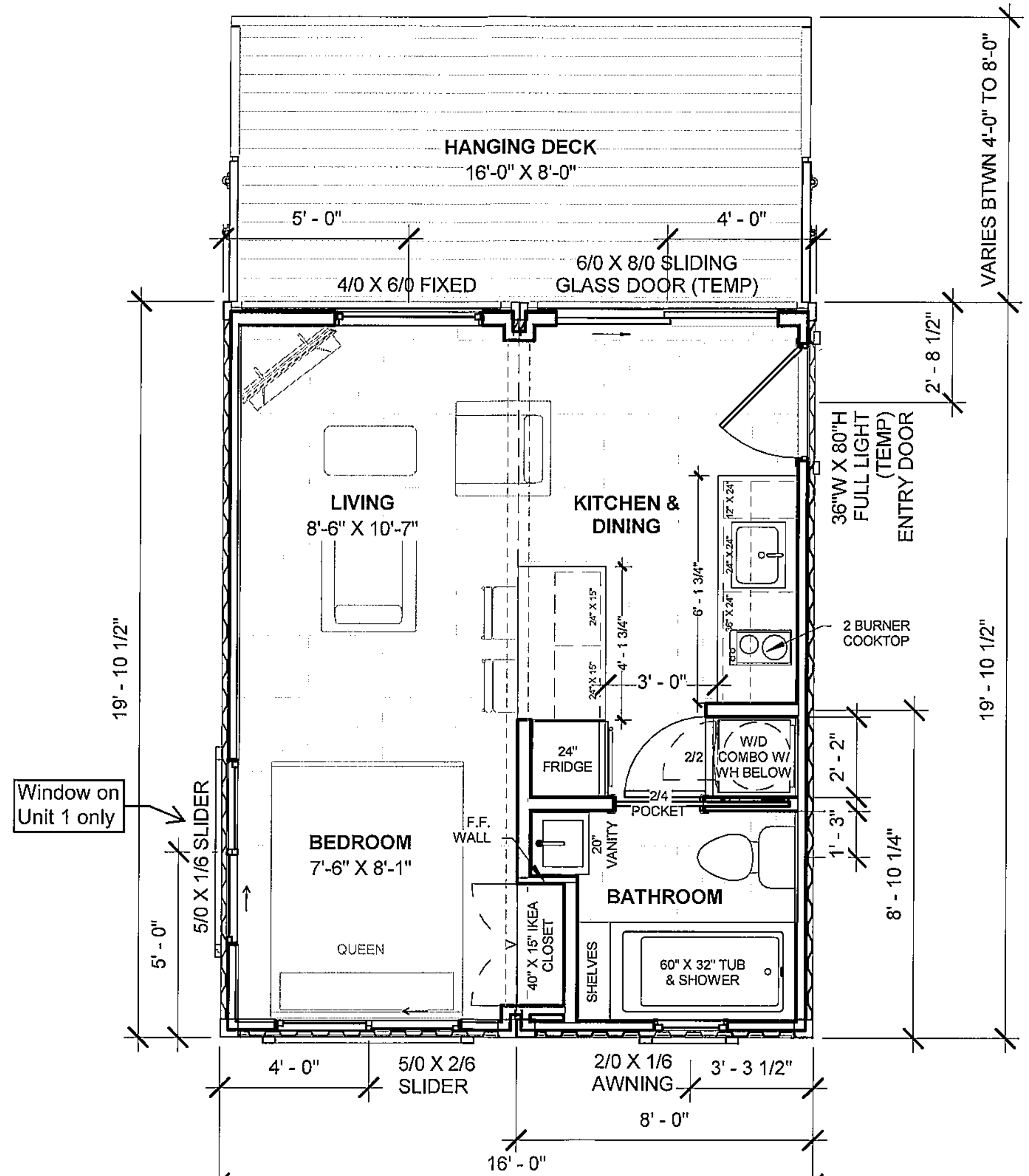
No.	Description	Date

ELECTRIC METER

Project number	TAYLOR	A303
Date	1/15/2024	
Drawn by	SP	
Checked by	CC	Scale 1/4" = 1'-0"

NOTE: ALL PLUMBING FIXTURES, CABINETS AND KITCHEN APPLIANCES TO BE PROVIDED AND INSTALLED BY RBC. ALL FURNITURE (GRAY SCALED) ARE SHOWN AS REFERENCE ONLY AND TO BE PROVIDED AND INSTALLED BY OWNER OR OTHERS.

Reference Plan
(Unit 1)



1 FLOOR PLAN
1/4" = 1'-0"

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SADU CITY 20

318 SQ. FT.

No.	Description	Date

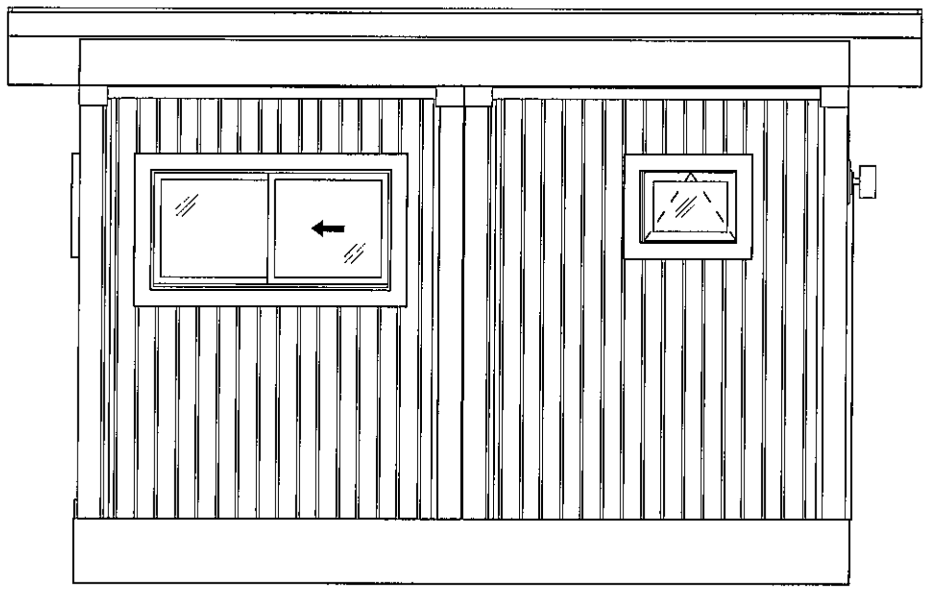
FLOOR PLAN

Project number	NESTUCCA - UNIT 1
Date	12/9/2022
Drawn by	LC/SP
Checked by	CC

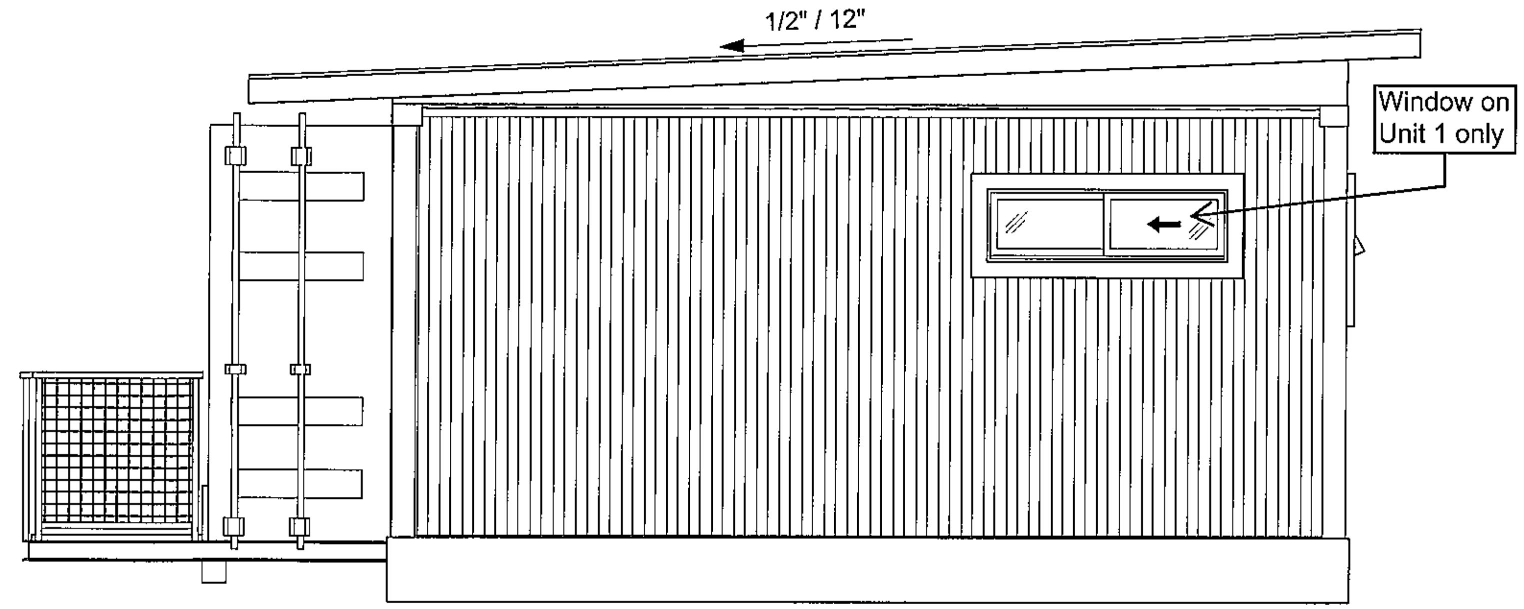
A101

Scale 1/4" = 1'-0"

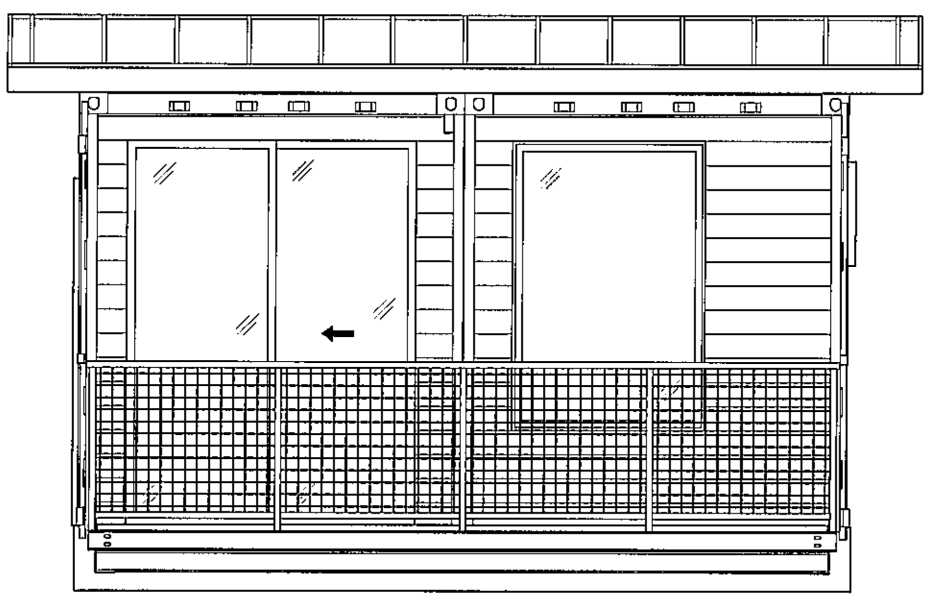
Reference Plan
(Unit 1)



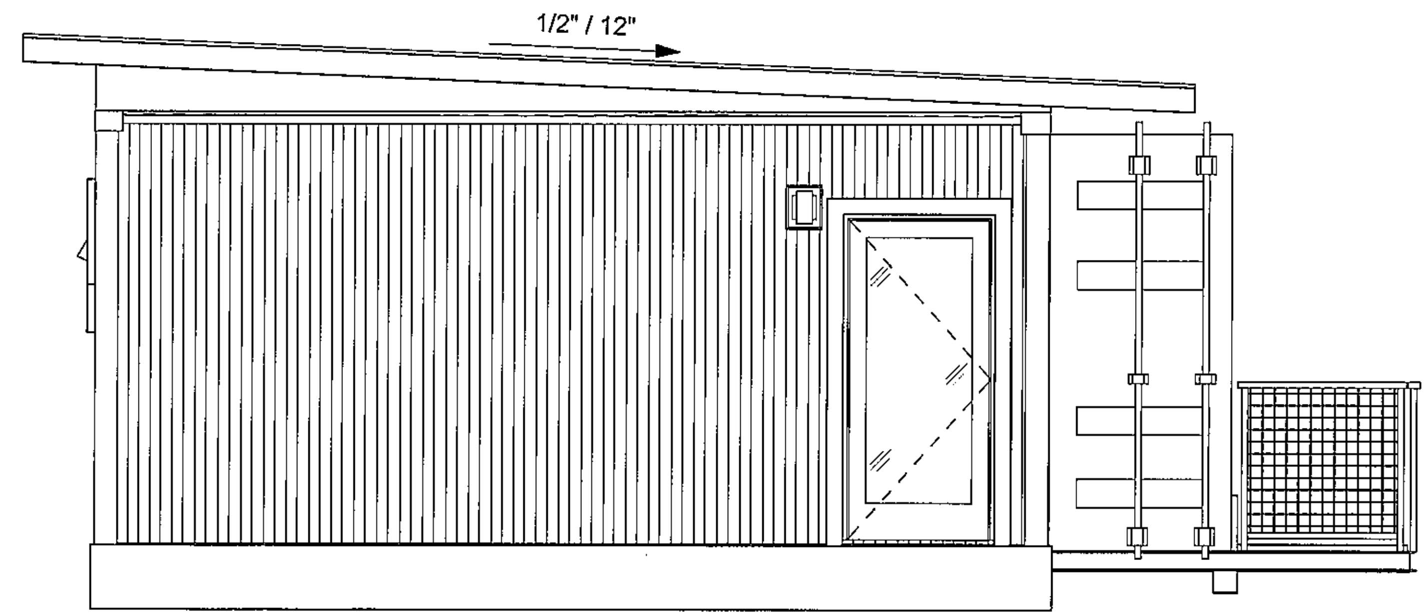
① FRONT
1/4" = 1'-0"



② LEFT
1/4" = 1'-0"



③ REAR
1/4" = 1'-0"



④ RIGHT
1/4" = 1'-0"

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SADU CITY 20

318 SQ. FT.

No.	Description	Date

ELEVATIONS

Project number	NESTUCCA - UNIT 1	A202
Date	12/9/2022	
Drawn by	LC/SP	
Checked by	CC	Scale 1/4" = 1'-0"

GENERAL NOTES - FOUNDATION:

DESIGN STANDARD 2022 OREGON STRUCTURAL SPECIALTY CODE (OSSC)

DESIGN CRITERIA

1. DESIGN GRAVITY LOADS, UNLESS NOTED OTHERWISE:
   - a. FLOOR LIVE LOADS
     - I. RESIDENTIAL LIVING SPACE — 40 PSF
   - b. ROOF LIVE LOADS
     - I. CONSTRUCTION/LIVE LOAD — 20 PSF
   - c. ROOF SNOW LOAD CRITERIA
     - I. FLAT ROOF SNOW LOAD — 25 PSF
     - II. SOLAR PANEL ALLOWANCE — 5 PSF
2. WIND CRITERIA:
   - a. STANDARD — 2022 OSSC
   - b. WIND SPEED — 120 MPH
   - c. EXPOSURE — C
   - d. INTERNAL PRESSURE COEFFICIENT — +/- 0.018
3. SEISMIC CRITERIA
   - a. SITE CLASS — D
   - b. SDS — 1.024
   - c. SEISMIC DESIGN CATEGORY — D
   - d. BASIC SEISMIC FORCE RESISTING SYSTEM
     - I. DETAILED REINFORCED CONCRETE WALLS — R=2
     - II. TENSION ONLY CROSS BRACES — R=2

GENERAL

1. CODES REFERENCED IN THESE NOTES ARE THE VERSIONS MOST RECENTLY ADOPTED BY THE PERMITTING AUTHORITY.
2. VERIFY DIMENSIONS AND CONDITIONS WITH THE ARCHITECTURAL DRAWINGS. FIELD VERIFY DIMENSIONS AND ELEVATIONS RELATIVE TO THE EXISTING STRUCTURE PRIOR TO FABRICATION OF MATERIALS.
3. FOR FEATURES OF CONSTRUCTION NOT FULLY SHOWN, PROVIDE THE SAME TYPE AND CHARACTER AS SHOWN FOR SIMILAR CONDITIONS, SUBJECT TO REVIEW BY THE STRUCTURAL ENGINEER OF RECORD.
4. APPLY, PLACE, ERECT, OR INSTALL ALL PRODUCTS AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
5. ADEQUATELY BRACE STRUCTURE AND ALL STRUCTURAL COMPONENTS AGAINST WIND, LATERAL EARTH, AND SEISMIC FORCES UNTIL THE PERMANENT LATERAL FORCE-RESISTING SYSTEMS HAVE BEEN INSTALLED.

SITE PREPARATION

1. REMOVE VEGETATION, RUBBISH, AND EXISTING FILL WITHIN BUILDING FOOTPRINT AND 5'-0" MINIMUM BEYOND THE FOOTPRINT. STRIP TOP 6" OF SOIL MINIMUM.
2. PRE-ROLL AREA WITHIN BUILDING FOOTPRINT AND 5'-0" MINIMUM BEYOND WITH A HEAVY VIBRATORY ROLLER OR LOADED DUMP TRUCK. MAKE 3 PASSES MINIMUM OVER THE ENTIRE AREA.
3. REMOVE AREAS OF SOIL, AS REQUIRED, THAT EXHIBIT EXCESSIVE WEAVING OR DEFLECTION UNDER THE WEIGHT OF THE ROLLER OR DUMP TRUCK.
4. BACK-FILL EXCAVATED AREAS WITH STRUCTURAL FILL AS DESCRIBED BELOW.

STRUCTURAL FILL OR BACK-FILL

1. STRUCTURAL BACKFILL MATERIAL
   - a. SAND AND GRAVEL MIXTURE OR CRUSHED ROCK
   - b. WELL GRADED FROM COARSE TO FINE WITH LESS THAN 10% BY WEIGHT OF THE MINUS ¾" FRACTION PASSING THE NO. 200 SEIVE.
   - c. FREE OF ORGANICS, RUBBISH, CLAY BALLS OR ROCKS LARGER THAN 4"
2. PLACE STRUCTURAL FILL IN LOOSE LIFTS, MAXIMUM OF 8" IN THICKNESS
3. COMPACT STRUCTURAL FILL TO A MINIMUM DENSITY OF 95% OF MAXIMUM DRY DENSITY, AS DETERMINED BY ASTM D 1557
4. VERIFY ADEQUACY OF STRUCTURAL FILL COMPACTION WITH RANDOM FIELD DENSITY TESTS.
5. COMPACT THE STRUCTURAL FILL WITH 5' - 0" OF RETAINING OR BASEMENT WALLS WITH LIGHTWEIGHT, HANDHELD EQUIPMENT. EXERCISE CARE TO AVOID DAMAGE TO WALLS.

FOUNDATIONS

1. FOUNDATION CRITERIA
   - a. ALLOWABLE SOIL BEARING PRESSURE — 1,500 PSF
   - b. FROST DEPTH — 12 INCHES
   - c. COEFFICIENT OF FRICTION — 0.30
2. PLACE FOOTINGS ON FIRM, UNDISTURBED NATIVE SOIL OR ON STRUCTURAL FILL (SEE "STRUCTURAL FILL" NOTES FOR ADDITIONAL INFORMATION)
3. LOCATE BOTTOM OF FOOTINGS BELOW MINIMUM FROST DEPTH UNLESS OTHERWISE NOTED.
4. PRIOR TO PLACEMENT OF CONCRETE, REMOVE ALL DISTURBED SOIL FROM FOOTING EXCAVATION.

CAST-IN-PLACE CONCRETE

ALL CONCRETE WORK SHALL CONFORM TO ACI 301.

PREPARE MIXES FOR EACH TYPE OF CONCRETE.

1. PROPORTION MIXES BY EITHER LABORATORY TRIAL BATCH OR FIELD EXPERIENCE METHODS, USING MATERIALS TO BE EMPLOYED ON THE WORK FOR EACH CLASS OF CONCRETE REQUIRED AS SPECIFIED IN ACI 301.
2. CERTIFIED REPORTS SHALL BE FURNISHED FOR EACH PROPOSED MIX FOR EACH TYPE OF WORK OF THIS SECTION.
3. CONTRACTOR SHALL SUBMIT CONCRETE MIX DESIGNS, ALONG WITH TEST DATA FOR A MINIMUM OF (30) BREAK TESTS, A MINIMUM OF (2) WEEKS PRIOR TO PLACING CONCRETE.

ADMIXTURES:

1. AIR ENTRAINING AGENT IN ACCORDANCE WITH ASTM C260 AND WATER-REDUCING ADMIXTURES CONFORMING TO ASTM 494, USED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, MAY BE INCORPORATED IN CONCRETE DESIGN MIXES.
2. CONCRETE MIXES FOR EXTERIOR HORIZONTAL SURFACES EXPOSED TO WEATHER SHALL HAVE ENTRAINED AIR BETWEEN 5% - 7% BY VOLUME.
3. FLY ASH SHALL CONFORM TO ASTM C618 AND SHALL BE LIMITED TO 15% MAXIMUM CEMENTITIOUS MATERIAL BY WEIGHT.

USE PORTLAND CEMENT TYPE I OR II; CONFORM WITH ASTM C 150. SUPPLY FROM ONE (1) SOURCE.

AGGREGATES SHALL CONFORM WITH ASTM C 33 AND BE THOROUGHLY CLEANED AND WASHED PRIOR TO USE.

CONCRETE STRENGTHS SHALL BE VERIFIED BY STANDARD 28-DAY CYLINDER TESTS PER ASTM C39, AND SHALL BE AS FOLLOWS:

1. FOOTINGS & SLABS: F_C = 4,000 PSI AT 28 DAYS
2. WALLS: F_C = 4,000 PSI AT 28 DAYS

MAXIMUM SLUMP FOR CONCRETE SHALL BE 5" PLUS OR MINUS 1".

SAMPLES FOR STRENGTH TESTS OF EACH CLASS OF CONCRETE PLACED EACH DAY SHALL BE TAKEN NO LESS THAN ONCE PER DAY, OR NO LESS THAN ONCE PER EACH (150) CUBIC YARDS OF CONCRETE, OR NO LESS THAN ONCE PER EACH (5,000) SQUARE FEET OF SURFACE AREA FOR SLABS OR WALLS.

NO WATER SHALL BE ADDED TO THE CONCRETE OTHER THAN THAT REQUIRED BY THE MIX DESIGN APPROVED BY THE ENGINEER OF RECORD.

IN AREAS WHERE MOISTURE WILL BE DETRIMENTAL TO FLOOR COVERINGS OR EQUIPMENT INSIDE THE PROPOSED STRUCTURE, APPROPRIATE VAPOR BARRIER AND DAMP-PROOFING MEASURES SHOULD BE IMPLEMENTED. APPROPRIATE DESIGN PROFESSIONALS SHOULD BE CONSULTED REGARDING VAPOR BARRIER AND DAMP PROOFING SYSTEMS, VENTILATION, BUILDING MATERIAL SELECTION AND MOLD PREVENTION ISSUES, WHICH ARE OUTSIDE HAYDEN ENGINEERS AREA OF EXPERTISE.

CONCRETE REINFORCING STEEL

REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO ASTM A615, GRADE 60 UNLESS NOTED OTHERWISE.

REINFORCING STEEL TO BE WELDED SHALL CONFORM TO ASTM A706.

REINFORCING STEEL SHALL BE DETAILED IN ACCORDANCE WITH THE LATEST EDITION OF THE ACI 315 "DETAILS AND DETAILING CONCRETE REINFORCEMENT".

REINFORCING STEEL SHALL HAVE THE FOLLOWING PROTECTIVE CLEARANCES:

- a. CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH:
  - I. ALL REINFORCING SIZES: 3"
- b. CONCRETE EXPOSED TO EARTH AND WEATHER:
  - I. #5 BAR, W31 OR D31 WIRE AND SMALLER: 1 ½"

UNLESS NOTED OTHERWISE ALL REINFORCEMENT LAP SPLICES SHALL BE AS FOLLOWS:

BAR SIZE	SPLICE (FC<=3500PSI)	SPLICE (FC>4000PSI)
#3	24"	19"
#4	32"	25"
#5	39"	31"

- c. THESE LENGTHS APPLY ONLY TO UNCOATED REINFORCING STEEL WITH NORMAL WEIGHT CONCRETE, CLEAR SPACING BETWEEN BARS NOT LESS THAN (2) BAR DIAMETERS AND CLEAR COVER NOT LESS THAN (1) BAR DIAMETER. FOR LIGHTWEIGHT CONCRETE OR REDUCED SPACING/COVER, MULTIPLY LENGTHS BY 1.3.
- d. FOR TOP BARS (BARS WITH MORE THAN 12" OF FRESH CONCRETE CAST BELOW THE BARS) MULTIPLY LENGTHS BY 1.3

CONCRETE ACCESSORIES

HEADED STUDS:

1. ASTM F1554, GRADE 36
2. NELSON HEADED WELD STUDS SHALL BE AUTOMATICALLY WELDED WITH THE MANUFACTURER'S STANDARD EQUIPMENT IN STRICT ACCORDANCE WITH THEIR RECOMMENDATIONS.

MASONRY BREAKAWAY WALL

CONCRETE MASONRY CONSTRUCTION

1. HOLLOW CONCRETE MASONRY UNITS: TYPE I, MEDIUM WEIGHT, 2,000 PSI MINIMUM ON NET SECTION, 2 CELL UNITS. CONFORM WITH ASTM C 90.
2. 28 DAY COMPRESSIVE STRENGTH, F_M OF 2,000 PSI MINIMUM.

FACING (VENEER) BRICK UNITS: 2500 PSI UNITS. CONFORM WITH ASTM C 62, C 216, AND C 652

STRUCTURAL MASONRY MORTAR:

1. TYPE "N", CONFROM TO ASTM C 270

REFERENCE CODE: TMS 602-16 BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES

STRUCTURAL STEEL

DESIGN, FABRICATION, AND ERECTION SHALL BE IN ACCORDANCE WITH THE "AISC SPECIFICATION FOR THE DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS."

STRUCTURAL STEEL SHALL BE AS FOLLOWS, UNLESS NOTED OTHERWISE:

1. HOLLOW STRUCTURAL SECTIONS (HSS): ASTM A500, GRADE B (F_Y=46 KSI)
2. WIDE FLANGE SHAPES: ASTM A992, GRADE 50
3. CHANNELS, PLATES, ANGLES: ASTM A36
4. BOLTS: ASTM A325
5. MISCELLANEOUS STEEL: ASTM A36

ALL EXTERIOR EXPOSED STEEL TO BE HOT DIPPED GALVANIZED OR POWDER COATED UNLESS NOTED OTHERWISE.

ALL FABRICATED STEEL TO BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL.

ALL STEEL TO BE SHOP COATED.

WELDS:

ALL WELDED CONNECTIONS ARE TO BE PERFORMED IN ACCORDANCE WITH THE LATEST VERSION OF AWS D1.3 SPECIFICATIONS FOR WELDING SHEET STEEL IN STRUCTURES. SEE AWS D19.0 WELDING ZINC COATED STEEL AND ANSI STANDARD Z49.1 FOR INFORMATION REGARDING SAFE WELDING PROCEDURES.

WELDING ELECTRODES SHALL BE E70XX.

MINIMUM WELD THROAT THICKNESS MUST MATCH OR EXCEED THE BASE STEEL THICKNESS OF THE THINNEST CONNECTED PART, UNLESS NOTED OTHERWISE ON DRAWINGS.

IN WELDING, THE ZINC COATING ON STEEL FRAMING WILL BE BURNED AWAY; THEREFORE A ZINC RICH PAINT MUST BE APPLIED TO THE WELD AREA TO PROVIDE ADEQUATE CORROSION RESISTANCE.

ALL WELDS PERFORMED SHALL CONFORM TO THE AWS STANDARDS FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION AND SHALL BE 3/16" MINIMUM UNLESS NOTED OTHERWISE.

PREQUALIFIED WELDING PROCEDURES ARE TO BE USED, UNLESS AWS QUALIFICATION IS SUBMITTED TO THE ARCHITECT/ENGINEER PRIOR TO FABRICATION.

REGISTERED PROFESSIONAL ENGINEER
18,525
OREGON
DARRON R. HAYDEN
EXPIRES: 08/30/25

TAYLOR SADU

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APPROPRIATE TO THE CURRENT TIME, PERIOD, OR CIRCUMSTANCES

relevant building company
503.475.6129
ccoffman@coffmanteam.com
www.relevantbuildings.com

HAYDEN ENGINEERS
STRUCTURAL | CIVIL
12480 SW 68th. Ave., Tigard, Oregon 97223
(503) 968-9994 Hayden-Engineers.com

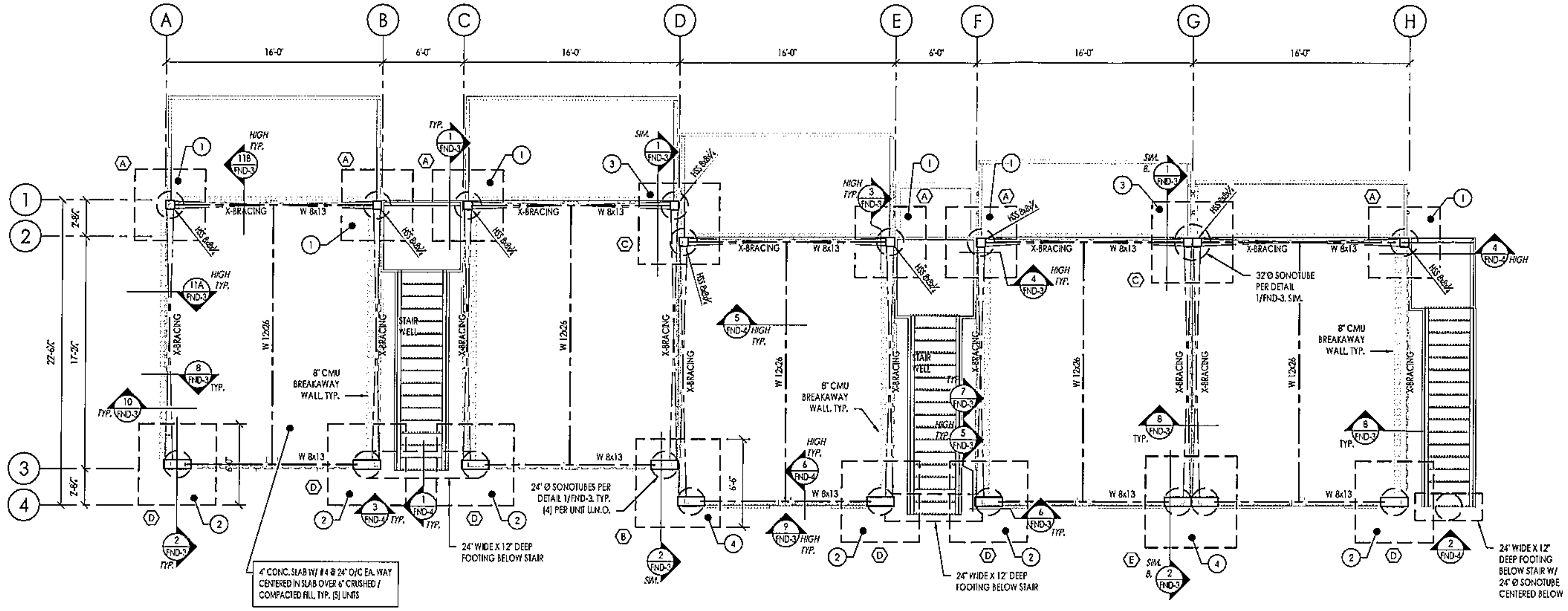
PROJECT:
CONTAINER CONVERSION FOUNDATION
MODEL :
TAYLOR SADU MULTIFAMILY

SHEET CONTENT
GENERAL NOTES

JOB No. 24261.01
DRAWN DM/KN
CHECKED KN/DH
DATE 04.21.2025
REVISIONS

SHEET
FND-1 OF 4

4/21/2025 11:32 AM



1 FND-2 FOUNDATION & UPPER FLOOR FRAMING PLAN

24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG

SCALE: 3/16" = 1'-0"

-	FTG. REACTION SCHEDULE (ASD)	
1	13,930 LBS DOWN	3,300 LBS UP
2	8,800 LBS DOWN	5,830 LBS UP
3	14,090 LBS DOWN	6,590 LBS UP
4	23,400 LBS DOWN	6,590 LBS UP

FOOTING SCHEDULE

MK	SIZE	REINFORCING	REMARKS
A	5'-3" x 5'-3" x 20" THICK	(8) #5 EA. WAY TOP & BOTT.	
B	6'-6" x 6'-3" x 20" THICK	(15) #5 EA. WAY TOP & BOTT.	
C	6'-0" x 6'-0" 20" THICK	(13) #5 EA. WAY TOP & BOTT.	
D	6'-0" x 5'-9" 20" THICK	(8) #5 EA. WAY TOP & BOTT.	
E	6'-9" x 6'-9" 20" THICK	(16) #5 EACH WAY TOP & BOTT.	

4/21/2025 11:32 AM

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 18,525 OREGON SEPT. 10, 2001 DARRON R. HAYDEN

EXPIRES: 06/30/25

TAYLOR SADU

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APPROPRIATE TO THE CURRENT TIME, PERIOD, OR CIRCUMSTANCES

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ccoffman@coffmanteam.com
www.relevantbuildings.com

HAYDEN ENGINEERS
STRUCTURAL | CIVIL
12480 SW 68th. Ave., Tigard, Oregon 97223
(503) 968-9994 Hayden-Engineers.com

PROJECT:
CONTAINER CONVERSION FOUNDATION
MODEL :
TAYLOR SADU MULTIFAMILY

SHEET CONTENT
FOUNDATION PLAN

JOB No.
24261.01

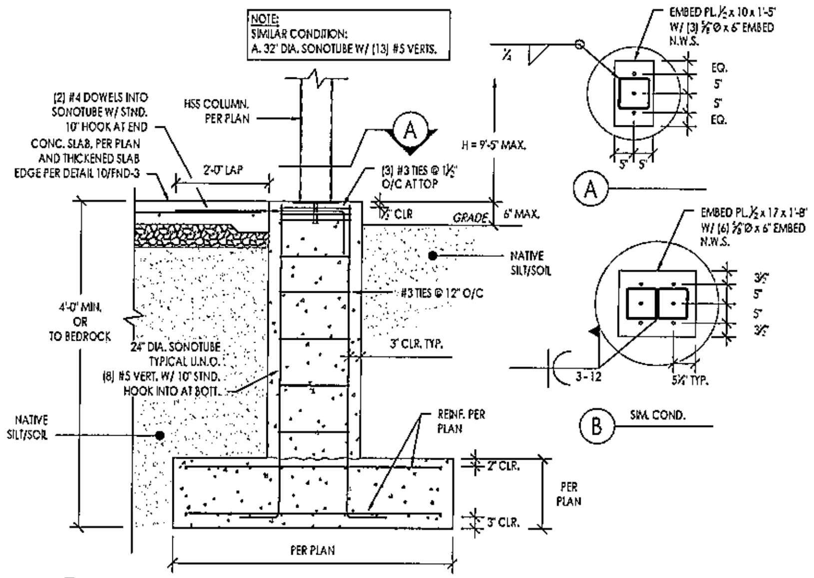
DRAWN
DM/KN

CHECKED
KN/DH

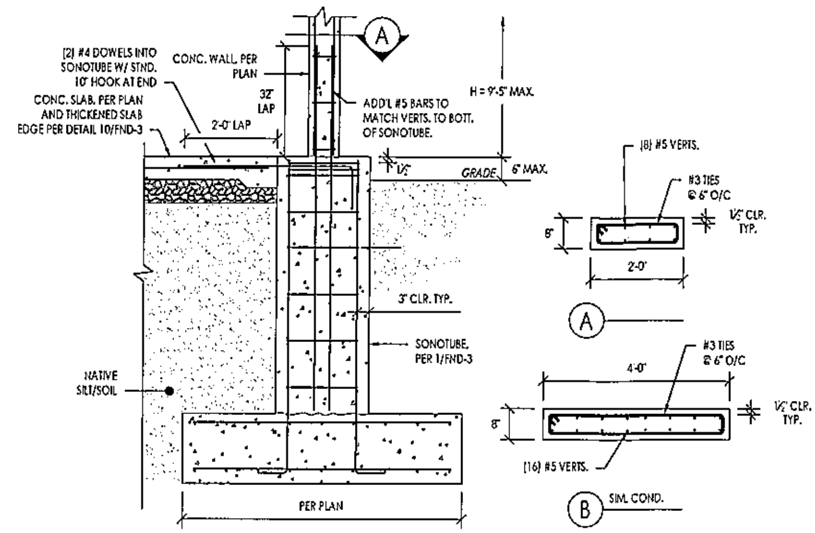
DATE 04.21.2025

REVISIONS

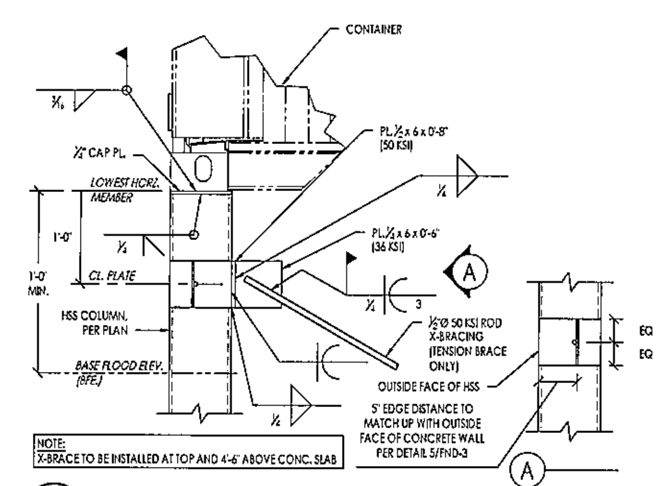
SHEET
FND-2 OF 4



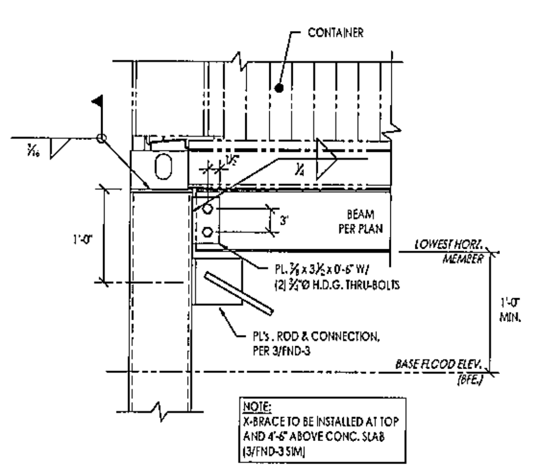
1 TYPICAL FOOTING SECTION
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: ½"=1'-0"



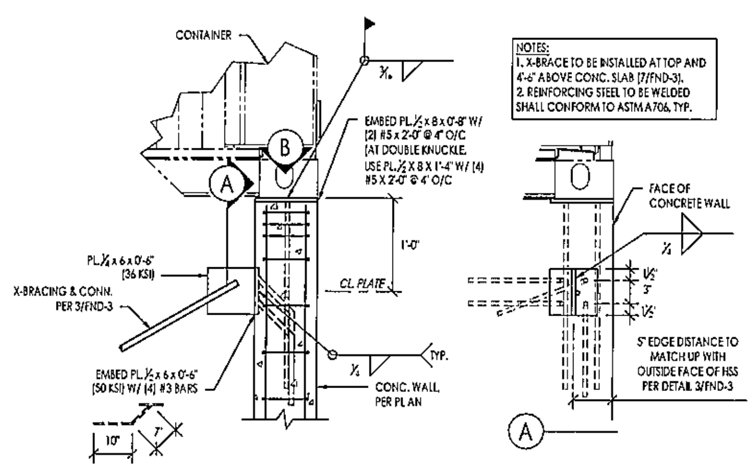
2 FOOTING SECTION
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: ½"=1'-0"



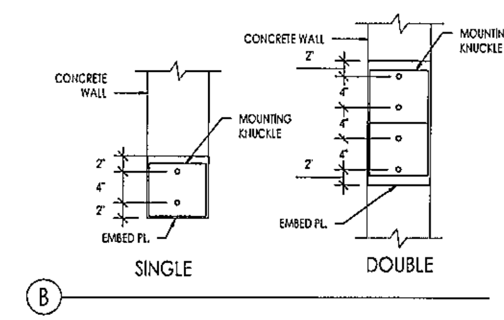
3 DETAIL - X-BRACING CONNECTION
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"

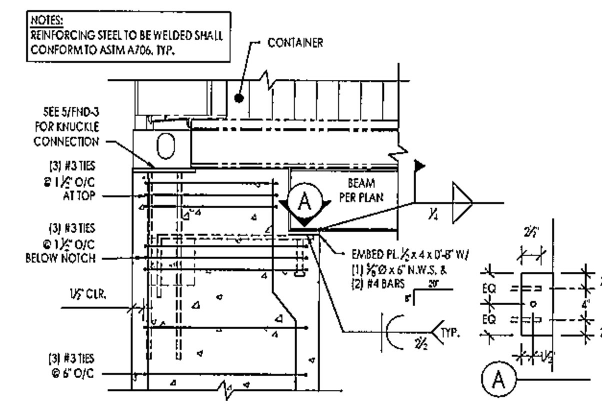


4 DETAIL - X-BRACING CONNECTION
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"

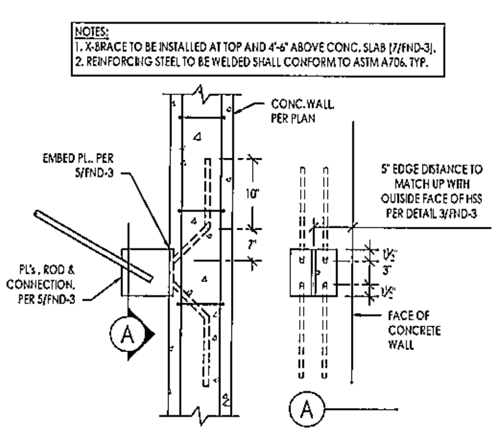


5 DETAIL - X-BRACING/CONC. WALL CONNECTION
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"

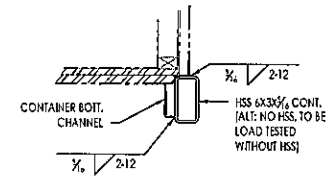




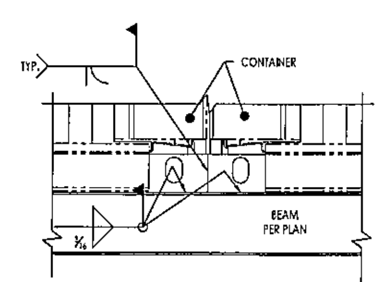
6 DETAIL - CONC. WALL / BEAM CONN.
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"



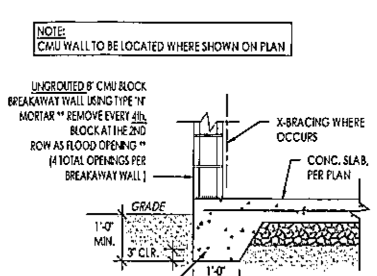
7 DETAIL - X-BRACING/CONC. WALL CONN.
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"



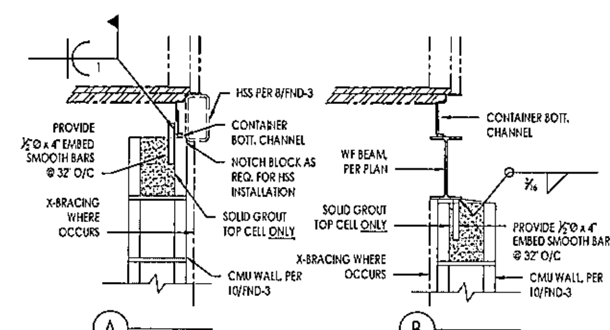
8 PERIMETER REINF.
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"



9 CONTAINER / BEAM CONN.
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"



10 FOOTING SECTION
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: ½"=1'-0"



11 BREAKWAY WALL TOP CONN.
FND-3 24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"

4/21/2025 11:32 AM

REGISTERED PROFESSIONAL ENGINEER 18,525 OREGON DARRON R. HAYDEN
EXPIRES: 06/30/25

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REVISIONS

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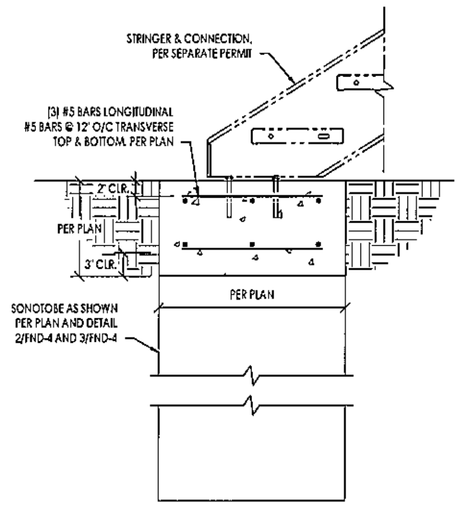
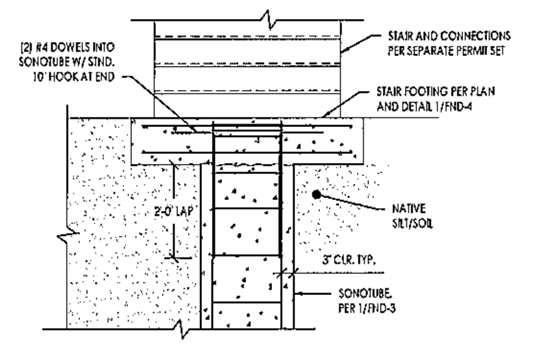
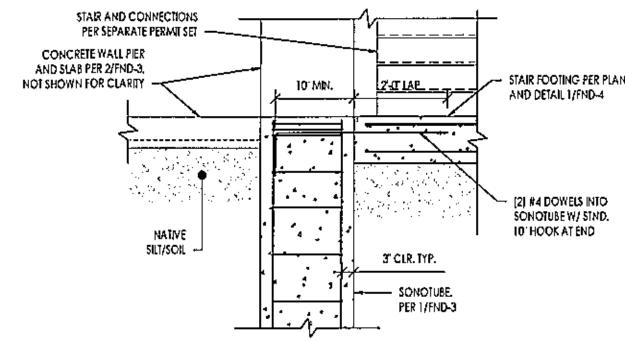
FND-3 OF 4



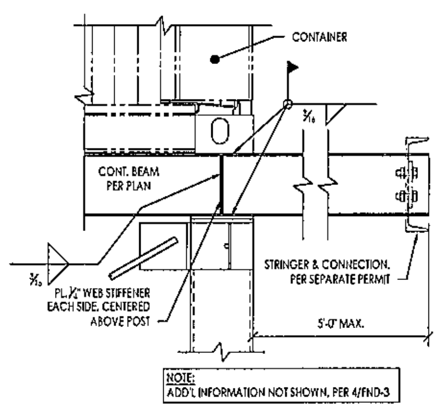
1 FND-4 STRINGER FOOTING
24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"



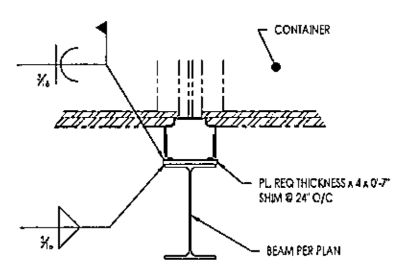
2 FND-4 FOOTING SECTION
24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: ½"=1'-0"



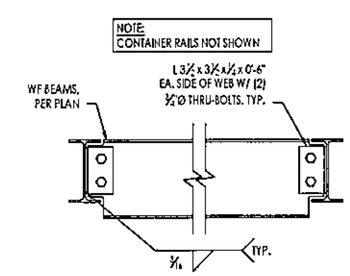
3 FND-4 FOOTING SECTION
24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: ½"=1'-0"



4 FND-4 SECTION
24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"



5 FND-4 SECTION
24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"



6 FND-4 BEAM / BEAM CONN.
24261 – NESTUCCA RIVER FOUNDATION.01 – SHEETS.DWG SCALE: 1"=1'-0"

4/21/2025 11:32 AM

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 18,525 OREGON SEPT. 10, 2001 DARRON R. HAYDEN
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SHEET
FND-4 OF 4

GENERAL NOTES - CONTAINER:

DESIGN STANDARD 2022 OREGON STRUCTURAL SPECIALTY CODE (OSSC)

DESIGN CRITERIA

1. DESIGN GRAVITY LOADS, UNLESS NOTED OTHERWISE:
   a. FLOOR LIVE LOADS
      i. RESIDENTIAL LIVING SPACE 40 PSF
      ii. STAIRS AND EXITS 100 PSF
   b. ROOF LIVE LOADS
      i. CONSTRUCTION/LIVE LOAD 20 PSF
   c. ROOF SNOW LOAD CRITERIA
      i. FLAT ROOF SNOW LOAD 25 PSF
      ii. SOLAR PANEL ALLOWANCE 5 PSF
2. WIND CRITERIA:
   a. STANDARD 2022 OSSC
   b. WIND SPEED 120 MPH
   c. EXPOSURE C
   d. INTERNAL PRESSURE COEFFICIENT +/- 0.018
3. SEISMIC CRITERIA
   a. SITE CLASS D
   b. SDS 1.024
   c. SEISMIC DESIGN CATEGORY D
   d. BASIC SEISMIC FORCE RESISTING SYSTEM
      i. LIGHT-FRAME WALLS OF ALL OTHER MATERIALS R=2

GENERAL

1. CODES REFERENCED IN THESE NOTES ARE THE VERSIONS MOST RECENTLY ADOPTED BY THE PERMITTING AUTHORITY.
2. VERIFY DIMENSIONS AND CONDITIONS WITH THE ARCHITECTURAL DRAWINGS. FIELD VERIFY DIMENSIONS AND ELEVATIONS RELATIVE TO THE EXISTING STRUCTURE PRIOR TO FABRICATION OF MATERIALS.
3. FOR FEATURES OF CONSTRUCTION NOT FULLY SHOWN, PROVIDE THE SAME TYPE AND CHARACTER AS SHOWN FOR SIMILAR CONDITIONS, SUBJECT TO REVIEW BY THE STRUCTURAL ENGINEER OF RECORD.
4. APPLY, PLACE, ERECT, OR INSTALL ALL PRODUCTS AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
5. ADEQUATELY BRACE STRUCTURE AND ALL STRUCTURAL COMPONENTS AGAINST WIND, LATERAL, EARTH, AND SEISMIC FORCES UNTIL THE PERMANENT LATERAL FORCE-RESISTING SYSTEMS HAVE BEEN INSTALLED.

PROPRIETARY INFORMATION

1. ALL DRAWINGS, CALCULATIONS, NOTES, DESIGN CONCEPTS, CONNECTION DETAILS, DIMENSIONS, MEANS AND METHODS OF CONSTRUCTION AND HEREIN CONTAINED DATA IS CONSIDERED PROPRIETARY IN NATURE AND MAY NOT BE DISTRIBUTED, COPIED, REPRODUCED, SHARED, OR DISCLOSED OTHERWISE UNLESS WRITTEN PERMISSION IS GRANTED BY RELEVANT BUILDING COMPANY.
2. THIS INTELLECTUAL PROPERTY IS SOLELY OWNED BY RELEVANT BUILDING COMPANY. ALL IDEAS CONTAINED HEREIN ARE PROPRIETARY INFORMATION.
3. USE OF THESE DOCUMENTS IS SUBJECT TO THE TERMS AND CONDITIONS OF A PROPRIETARY INFORMATION AGREEMENT. UNAUTHORIZED DISCLOSURE WILL NOT BE TOLERATED AND WILL LEAD TO LEGAL REMEDY AS PRESCRIBED BY LOCAL, STATE, AND FEDERAL LAW.
4. DO NOT COPY OR DUPLICATE ANY INFORMATION ASSOCIATED WITH THIS PROJECT WITHOUT SPECIFIC WRITTEN AUTHORIZATION BY RELEVANT BUILDING CO.

STRUCTURAL STEEL

DESIGN, FABRICATION, AND ERECTION SHALL BE IN ACCORDANCE WITH THE "AISC SPECIFICATION FOR THE DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS."

STRUCTURAL STEEL SHALL BE AS FOLLOWS, UNLESS NOTED OTHERWISE:

1. HOLLOW STRUCTURAL SECTIONS (HSS): ASTM A500, GRADE B (F_Y=46 KSI)
2. WIDE FLANGE SHAPES: ASTM A992, GRADE 50
3. CHANNELS, PLATES, ANGLES: ASTM A36
4. PIPES: ASTM A53, GRADE B (F_Y=35 KSI)
5. BOLTS: ASTM A325-N
6. ANCHOR BOLTS: ASTM F1554, GRADE 36
7. MISCELLANEOUS STEEL: ASTM A36
8. STEEL COMPONENTS OF THE CONTAINER SHALL BE AS FOLLOWS, UNLESS NOTED OTHERWISE:
   a. FRONT END ASSEMBLY:
      i. FRONT CORNER POST CORTEN A
      ii. FRONT SILL CORTEN A
      iii. FRONT PANEL CORTEN A
      iv. FRONT RAIL CORTEN A
   b. BASE ASSEMBLY:
      i. BOTTOM SIDE RAIL CORTEN A
      ii. CROSSMEMBER CORTEN A
      iii. FORK POCKET ASSEMBLY CORTEN A
      iv. FLOOR CENTER RAIL CORTEN A
      v. FLOOR SUPPORT ANGLE CORTEN A
      vi. COVER PLATE CORTEN A
   c. REAR END ASSEMBLY:
      i. REAR CORNER POST (OUTER) CORTEN A
      ii. REAR CORNER POST (INNER) SM50YA
      iii. REAR HEADER CAP CORTEN A
      iv. DOOR HEADER LOWER CORTEN A
      v. DOOR SILL CORTEN A
      vi. DOOR PANEL FRAME CORTEN A
      vii. DOOR HINGE S25C, ELECTRO ZINC PLATED
   d. SIDE WALL ASSEMBLY:
      i. SIDE PANEL CORTEN A
      ii. TOP SIDE RAIL CORTEN A
      iii. LASHING BAR, LASHING RING SS41, ELECTRO ZINC PLATED
      iv. VENTILATOR A.B.S.
   e. ROOF:
      i. ROOF CORNER GUSSET CORTEN A
      ii. ROOF PANEL CORTEN A
   f. FLOOR:
      i. FLOOR BOARD APITONG/HARDWOOD PLYWOOD

ALL EXPOSED STEEL BELOW FINISH GRADE TO BE COATED WITH ASPHALTIC PAINT PRIOR TO BACKFILLING.

ALL EXTERIOR EXPOSED STEEL TO BE HOT DIPPED GALVANIZED OR POWDER COATED UNLESS NOTED OTHERWISE.

ALL FABRICATED STEEL TO BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL.

ALL STEEL TO BE SHOP COATED.

ALL WELDED CONNECTIONS ARE TO BE PERFORMED IN ACCORDANCE WITH THE LATEST VERSION OF AWS D1.3 SPECIFICATIONS FOR WELDING SHEET STEEL IN STRUCTURES. SEE AWS D19.0 WELDING ZINC COATED STEEL AND ANSI STANDARD Z49.1 FOR INFORMATION REGARDING SAFE WELDING PROCEDURES.

WELDING ELECTRODES SHALL BE E70XX.

MINIMUM WELD THROAT THICKNESS MUST MATCH OR EXCEED THE BASE STEEL THICKNESS OF THE THINNEST CONNECTED PART, UNLESS NOTED OTHERWISE ON DRAWINGS.

IN WELDING, THE ZINC COATING ON STEEL FRAMING WILL BE BURNED AWAY; THEREFORE A ZINC RICH PAINT MUST BE APPLIED TO THE WELD AREA TO PROVIDE ADEQUATE CORROSION RESISTANCE.

ALL WELDS PERFORMED SHALL CONFORM TO THE AWS STANDARDS FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION AND SHALL BE 3/16" MINIMUM UNLESS NOTED OTHERWISE.

PREQUALIFIED WELDING PROCEDURES ARE TO BE USED, UNLESS AWS QUALIFICATION IS SUBMITTED TO THE ARCHITECT/ENGINEER PRIOR TO FABRICATION.

FRAMING LUMBER

SAWN LUMBER DESIGN IS BASED ON THE LATEST EDITION OF THE NATIONAL DESIGN SPECIFICATION.

SAWN LUMBER SHALL CONFORM TO WEST COAST LUMBER INSPECTION BUREAU OR WESTERN WOOD PRODUCTS ASSOCIATION GRADING RULES.

LUMBER SPECIES & GRADES TO BE DOUGLAS FIR NO. 2 OR BETTER (HEM-FIR NO. 2 OR BETTER FOR PRESSURE TREATED) UNLESS NOTED OTHERWISE.

ALL LUMBER IN PERMANENT CONTACT WITH CONCRETE OR EXPOSED TO WEATHER SHALL BE PRESSURE TREATED UNLESS AN APPROVED BARRIER IS PROVIDED.

ALL HANGERS, NAILES, AND FASTENERS IN CONTACT WITH PRESSURE TREATED LUMBER OR EXPOSED TO OPEN AIR SHALL BE HOT DIPPED GALVANIZED OR STAINLESS STEEL.

MAXIMUM MOISTURE CONTENT:

1. HORIZONTAL MEMBERS (TOP AND BOTTOM PLATES) SHALL BE KILN DRIED (KD) WITH A MAXIMUM MOISTURE CONTENT 15%
2. VERTICAL MEMBERS WITH A MAXIMUM MOISTURE CONTENT OF 19%

PROVIDE SOLID BLOCKING (SAME DEPTH OF MEMBER) AT ALL POINTS OF BEARING (MAXIMUM SPACING OF 6'-0" O.C.) AT JOISTS WITH A 5:1 OR GREATER DEPTH-TO-THICKNESS RATIO OR WHERE 1 EDGE OF JOIST IS NOT ATTACHED TO SHEATHING, WALLBOARD, BRACING, ETC.

PROVIDE DOUBLE JOISTS UNDER ALL PARALLEL PARTITIONS, UNLESS NOTED OTHERWISE.

PROVIDE BLOCKING BETWEEN STUDS (OR OTHER MEANS OF BRACING) AT WOOD BEARING WALLS TO PREVENT STUD BUCKLING PRIOR TO INSTALLATION OF GYPSUM WALLBOARD.

PLYWOOD SHEATHING

PLYWOOD PANELS SHALL CONFORM TO THE REQUIREMENTS OF "U.S. PRODUCT STANDARD PS 1 FOR CONSTRUCTION AND INDUSTRIAL PLYWOOD" OR APA PRP-108 PERFORMANCE STANDARDS.

WHERE 1/2" OR 3/4" SHEATHING IS SPECIFIED, THE THICKNESS SHALL BE 15/32" MINIMUM AND 23/32" MINIMUM RESPCTIVELY.

UNLESS NOTED OTHERWISE ROOF AND FLOOR SHEATHING PANELS SHALL BE APA RATED SHEATHING, EXPOSURE 1, OF THE THICKNESS AND SPAN RATING SHOWN ON THE DRAWINGS.

UNLESS NOTED OTHERWISE WALL SHEATHING PANELS SHALL BE APA RATED SHEATHING, EXPOSURE 1, WITH A SPAN RATING OF 24/0 OR BETTER.

PLYWOOD INSTALLATION SHALL BE IN CONFORMANCE WITH APA RECOMMENDATIONS.

ALLOW 1/8" SPACING AT PANEL ENDS AND EDGES, UNLESS OTHERWISE RECOMMENDED BY THE PANEL MANUFACTURER.

ROOF AND FLOOR SHEATHING SHALL BE INSTALLED WITH FACE GRAIN PERPENDICULAR TO SUPPORTS, EXCEPT AS INDICATED ON THE DRAWINGS.

SUBSTITUTION OF ORIENTED STRAND BOARD (OSB) FOR PLYWOOD IS ACCEPTABLE IF THE OSB:

1. CONFORMS WITH APA PERFORMANCE STANDARDS FOR WOOD BASED STRUCTURAL PANELS PRP-105 AND UNITED STATES PRODUCT STANDARD PS 2-92.
2. IS MANUFACTURED WITH EXTERIOR GLUE.
3. HAS A LOAD/SPAN RATING INDEX EQUAL TO PLYWOOD SHEATHING SPECIFIED ON THE DRAWINGS.
4. BEARS THE APA TRADEMARK.

PROVIDE PRESSURE-TREATED PLYWOOD WHERE INDICATED ON DRAWINGS. CONFORM TO AWPA STANDARD C-9. MARK SHEETS WITH AWPB.

PROTECT FLOOR AND ROOF SHEATHING FROM EXTREME WET CONDITIONS.

ALL FLOOR SHEATHING SHALL BE GLUED TO THE SUPPORTING MEMBERS.

GLUE LAMINATED MEMBERS

GLUED LAMINATED MEMBERS SHALL BE FABRICATED IN CONFORMANCE WITH U.S. PRODUCT STANDARD PS 56, "STRUCTURAL GLUED LAMINATED TIMBER" AND AMERICAN INSTITUTE OF TIMBER CONSTRUCTIONS, AITC 117.

EACH MEMBER SHALL BEAR AN AITC OR APA-EWS IDENTIFICATION MARK AND BE ACCOMPANIED BY A CERTIFICATE OF CONFORMANCE.

ONE COAT OF END SEALER SHALL BE APPLIED IMMEDIATELY AFTER TRIMMING IN EITHER SHOP OR FIELD.

GLUED LAMINATED BEAMS SHALL BE VISUALLY GRADED WESTERN SPECIES INDUSTRIAL GRADE, AND OF THE STRENGTH INDICATED:

1. SIMPLE SPAN: 24F-V4
2. CONTINUOUS OR CANTILEVERED SPANS: 24F-V8

PROVIDE STANDARD 3500 FOOT RADIUS CAMBER, UNLESS NOTED OTHERWISE ON DRAWINGS.

ERECT MEMBERS ACCORDING TO AITC SPECIFICATIONS.

CONNECTIONS AND FASTENERS

FRAMING ACCESSORIES AND STRUCTURAL FASTENERS SHALL BE THE SIZE AND TYPE SHOWN ON THE DRAWINGS AND MANUFACTURED BY SIMPSON STRONG-TIE COMPANY OR AN ENGINEER APPROVED EQUAL.

SILL PLATE ANCHOR BOLTS: ASTM F1554, GRADE 36, @ 48" O/C MAX. U.N.O.

HANGERS NOT SHOWN SHALL BE SIMPSON 'HU' OF THE SIZE RECOMMENDED FOR MEMBER.

ALL HARDWARE, ANCHOR BOLTS, AND FASTENERS IN CONTACT WITH PRESSURE TREATED LUMBER SHALL BE SIMPSON Z-MAX, HOT-DIPPED GALVANIZED, OR STAINLESS STEEL U.N.O.

FRAMING CONNECTORS SHALL HAVE ALL THE NAIL HOLES FILLED AS SPECIFIED BY THE CONNECTOR MANUFACTURER UNLESS NOTED OTHERWISE.

ALL NAILS SHOWN ON THE DRAWINGS SHALL BE COMMON NAILS UNLESS NOTED OTHERWISE.

1. 8D: 0.131" Ø; 2-1/2" LENGTH
2. 10D: 0.148" Ø; 3" LENGTH
3. 16D: 0.162" Ø; 3-1/2" LENGTH

TYPICAL NAILING CONNECTIONS SHALL BE PER THE 'FASTENING SCHEDULE' TABLE WITHIN CHAPTER 23 OF THE REFERENCED CODE, UNLESS NOTED OTHERWISE ON THE DRAWINGS.

SPECIAL INSPECTION PROGRAM			
TYPES OF WORK	PERIODIC	CONTINUOUS	COMMENTS
STEEL:			
FILLET WELDS LESS THAN OR EQUAL TO 5/16"	X		

SPECIAL INSPECTION PROGRAM NOTES:

1. PROVIDE SPECIAL INSPECTION, SPECIAL TESTING, REPORTING AND COMPLIANCE PROCEDURES ACCORDING TO CHAPTER 17 OF THE INTERNATIONAL BUILDING CODE
2. SPECIAL INSPECTOR QUALIFICATIONS: DEMONSTRATE COMPETENCE, TO THE SATISFACTION OF THE BUILDING OFFICIAL, FOR INSPECTION OF THE PARTICULAR TYPE OF CONSTRUCTION OR OPERATION IN QUESTION.
3. PRIOR TO THE BEGINNING OF CONSTRUCTION, REVIEW THE SPECIAL INSPECTION REQUIREMENTS WITH THE ARCHITECT, ENGINEER, BUILDING OFFICIAL, GENERAL CONTRACTOR AND SPECIAL INSPECTORS.
4. DUTIES OF THE SPECIAL INSPECTOR INCLUDE, BUT ARE NOT LIMITED TO:
   a. OBSERVE THE WORK FOR CONFORMANCE WITH THE APPROVED PERMIT DRAWINGS AND SPECIFICATIONS. BRING DISCREPANCIES TO THE IMMEDIATE ATTENTION OF THE GENERAL CONTRACTOR FOR CORRECTION. THEN, IF UNCORRECTED, THE ENGINEER AND TO THE BUILDING OFFICIAL.
   b. FURNISH INSPECTION REPORTS FOR EACH INSPECTION TO THE BUILDING OFFICIAL, ARCHITECT, ENGINEER, GENERAL CONTRACTOR AND OWNER IN A TIMELY MANNER.
   c. SUBMIT A FINAL REPORT STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS INSPECTED, AND WHETHER THE WORK IS IN CONFORMANCE WITH THE APPROVED PERMIT DRAWINGS AND SPECIFICATIONS.
5. DUTIES OF THE GENERAL CONTRACTOR INCLUDE, BUT ARE NOT LIMITED TO:
   a. NOTIFY SPECIAL INSPECTOR THAT WORK IS READY FOR INSPECTION AT LEAST 24 HOURS BEFORE THE INSPECTION IS REQUIRED.
   b. MAINTAIN ACCESS TO WORK REQUIRING SPECIAL INSPECTION UNTIL IT HAS BEEN OBSERVED AND INDICATED TO BE IN CONFORMANCE BY THE SPECIAL INSPECTOR AND APPROVED BY THE BUILDING OFFICIAL.
   c. PROVIDE THE SPECIAL INSPECTOR WITH ACCESS TO APPROVED PERMIT DRAWINGS AND SPECIFICATIONS AT THE JOB SITE.
   d. MAINTAIN JOB-SITE COPIES OF ALL REPORTS SUBMITTED BY THE SPECIAL INSPECTOR.
6. DEFINITIONS:
   a. CONTINUOUS INSPECTION: THE SPECIAL INSPECTOR IS OBSERVING THE WORK REQUIRING SPECIAL INSPECTION AT ALL TIMES.
   b. PERIODIC INSPECTION: THE SPECIAL INSPECTOR IS ON SITE AS REQUIRED TO CONFIRM THAT THE WORK REQUIRING SPECIAL INSPECTION IS IN CONFORMANCE.

MODEL NESTUCCA

SHEET INDEX

SHEET NUMBER	DESCRIPTION
S1.0	SHEET INDEX
	STRUCTURAL GENERAL NOTES
S2.0	STAIR/PORCH FRAMING PLAN
	CEILING FRAMING PLAN
S2.1	ROOF PLAN
S3.0	TYPICAL WALL SECTION DETAIL
	TYPICAL WINDOW REINFORCING DETAIL
	TYPICAL DOOR REINFORCING DETAIL
	MARRIAGE LINE DETAIL
S3.1	ROOF SECTIONS
	HANGING DECK DETAILS
	HANGING DECK SECTION

STRUCTURAL
REGISTERED PROFESSIONAL ENGINEER
18,525
OREGON
SEPT. 10, 2001
DARRON R. HAYDEN
EXPIRES: 06/30/25

TAYLOR SADU

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ccoffman@coffmanteam.com
www.relevantbuildings.com

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STRUCTURAL | CIVIL

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(503) 968-9994 Hayden-Engineers.com

PROJECT:

CONTAINER CONVERSION
MODEL :
TAYLOR SADU
MULTIFAMILY

SHEET CONTENT

JOB No.
24261.01

DRAWN DM

CHECKED

DATE 04.21.2025

REVISIONS

SHEET
S1.0 OF 6

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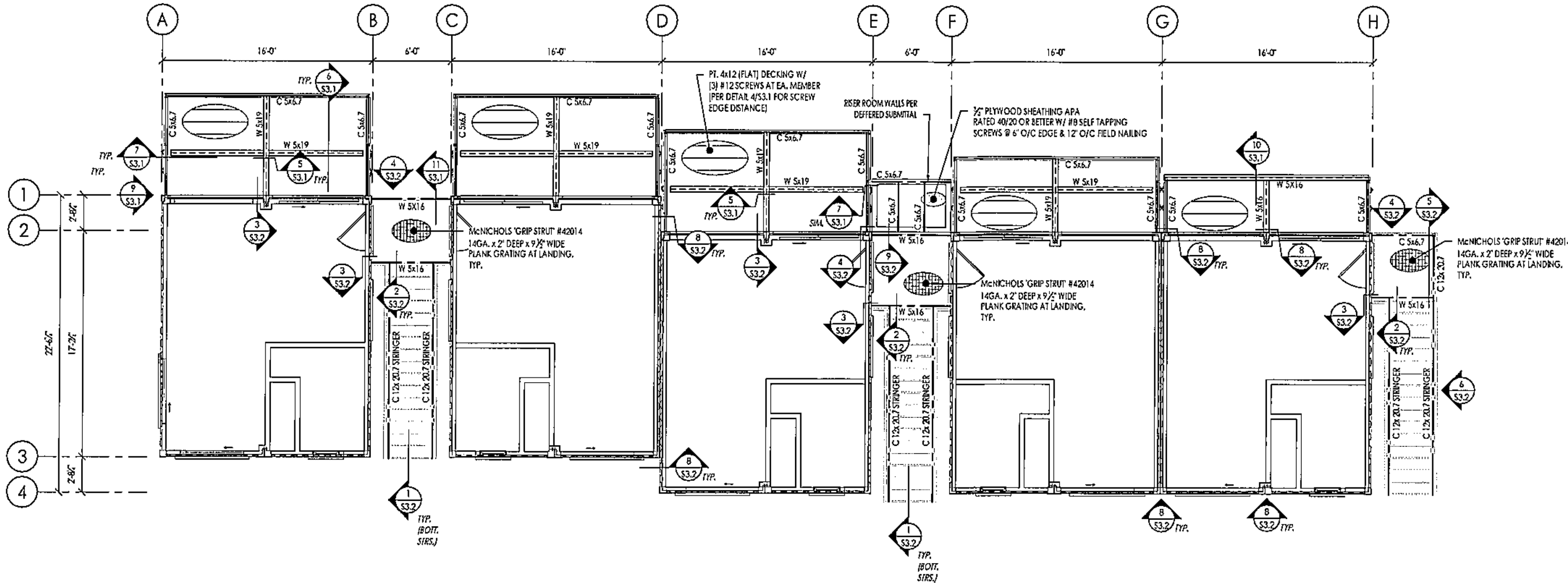

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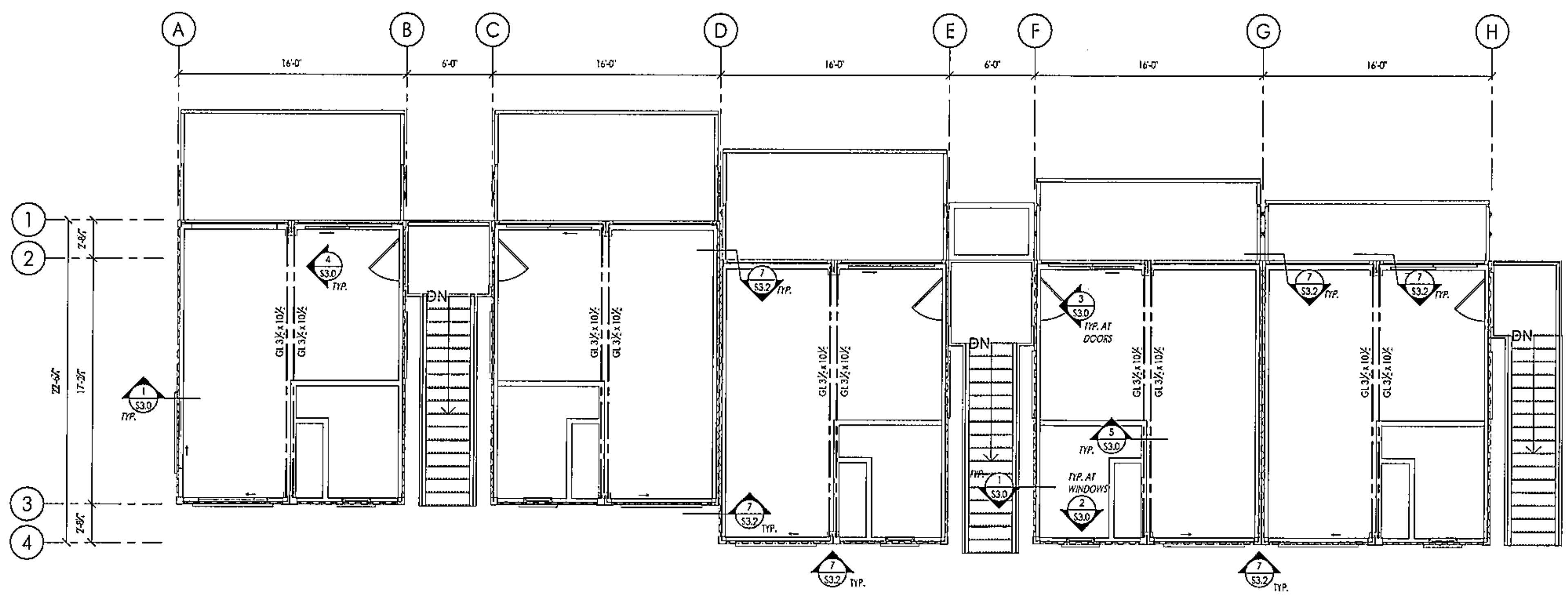
S2.0 24261 – NESTUCCA RIVER.01 – SHEETS.DWG SCALE: ³⁄₁₆"=1'-0"



2 CEILING FRAMING PLAN
S2.0 24261 – NESTUCCA RIVER.01 – SHEETS.DWG SCALE: ³⁄₁₆"=1'-0"

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SHEET CONTENT
EXTERIOR CONTAINER SUPPORT FRAMING & CEILING FRAMING PLANS

JOB No.	24261.01
DRAWN	DM
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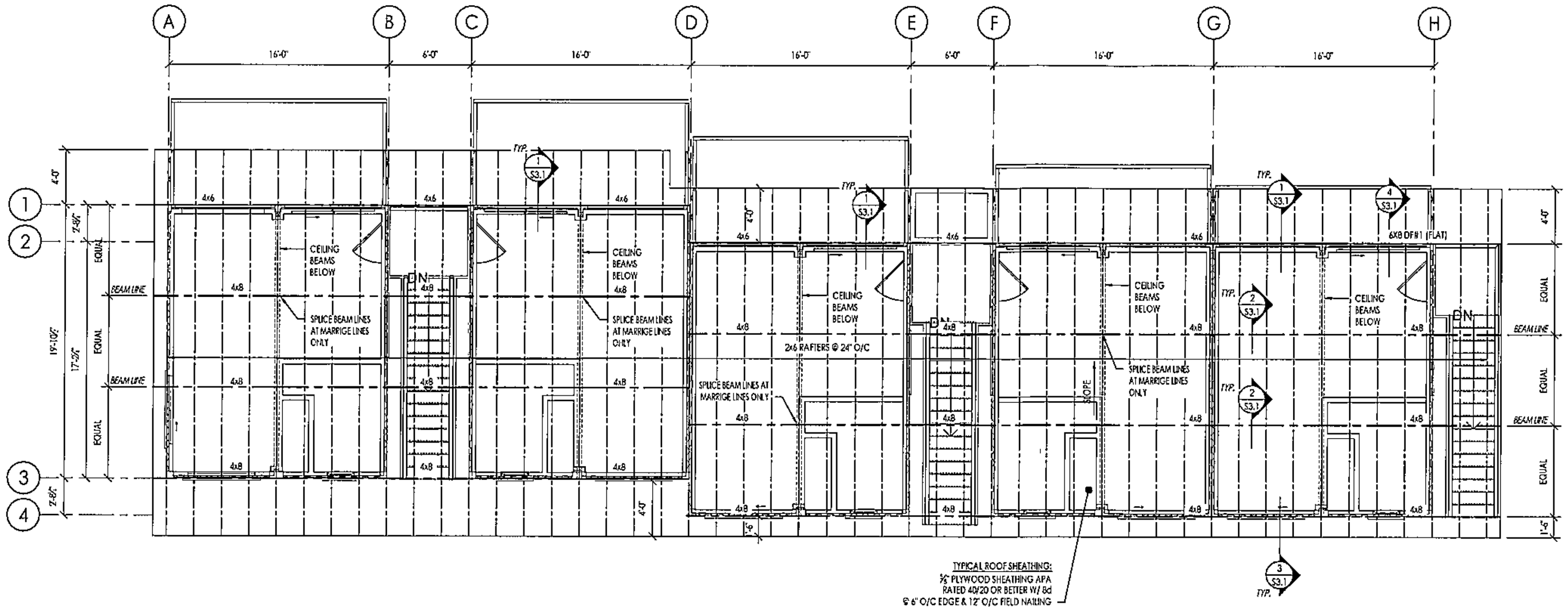
DATE	04.21.2025
REVISIONS	
SHEET	S2.0 OF 6



1 S2.1 ROOF FRAMING
24261 – NESTUCCA RIVER.01 – SHEETS.DWG
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STRUCTURAL REGISTERED PROFESSIONAL ENGINEER 18,525 OREGON SEPT. 10, 2001 DARRON R. HAYDEN
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SHEET S2.1 of 6

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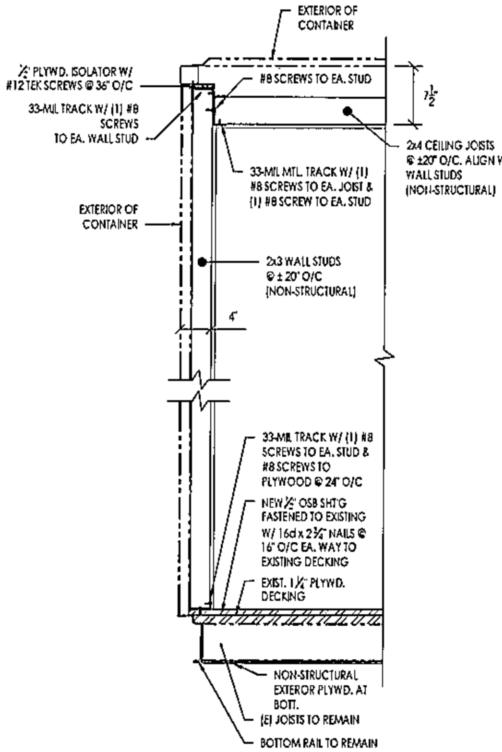

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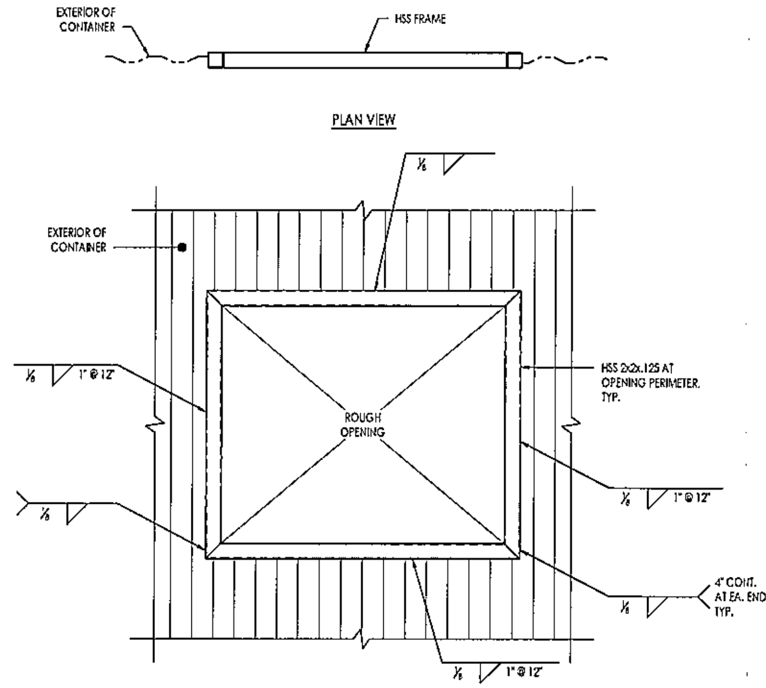

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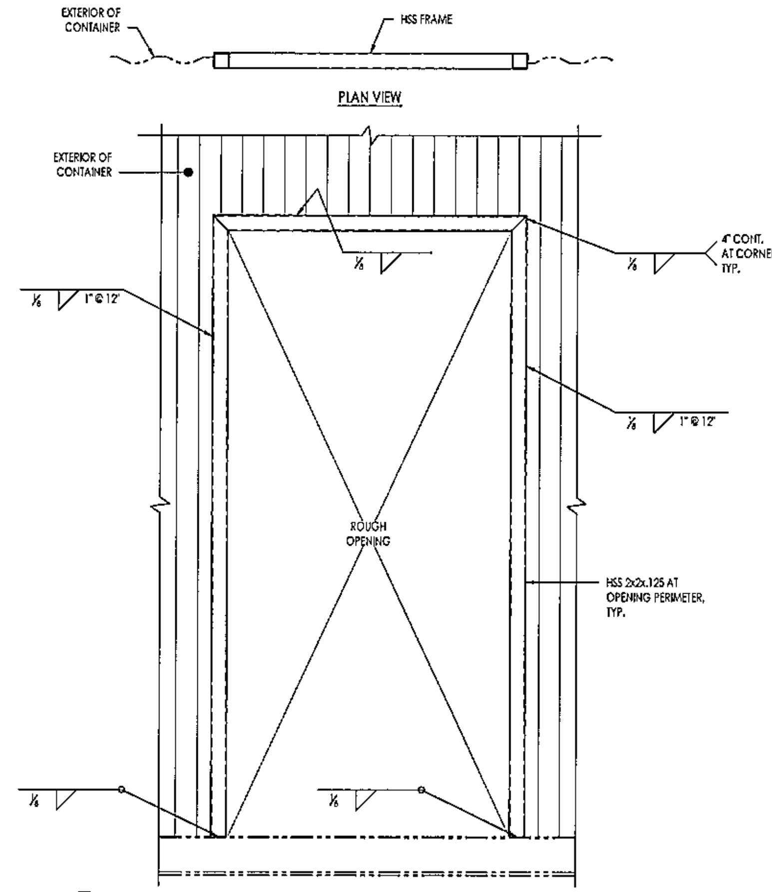

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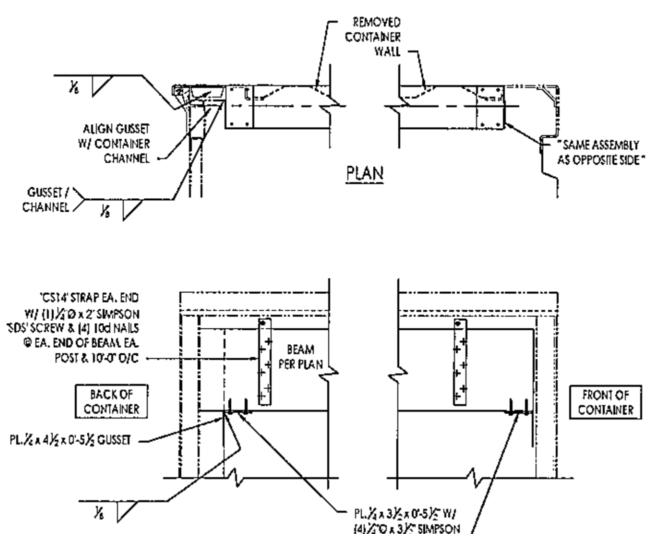

4 SECTION
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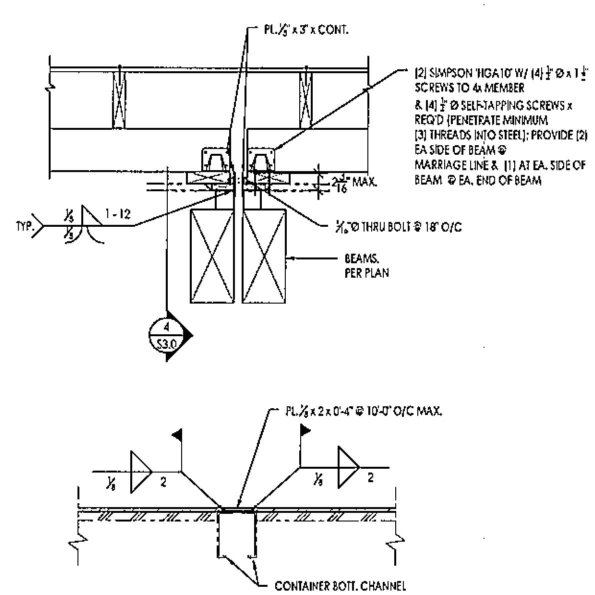

5 SECTION - MARRIAGE LINE
S3.0 24261 - NESTUCCA RIVER.01 - SHEETS.DWG 2020
SCALE: 1"=1'-0"

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EXTERIOR CONTAINER SUPPORT FRAMING & CEILING FRAMING PLANS

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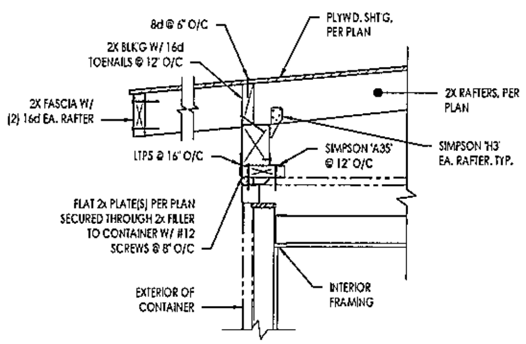
SHEET S3.0 OF 6



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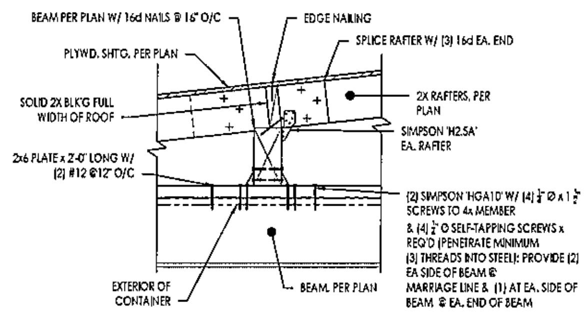

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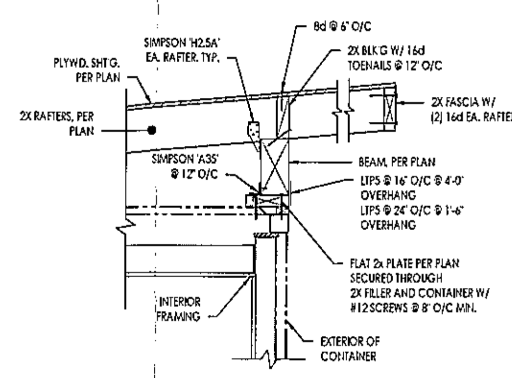

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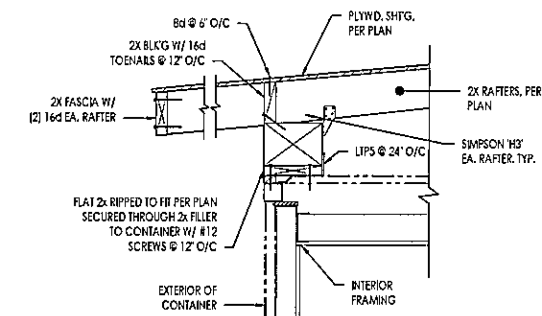

4 ROOF SECTION
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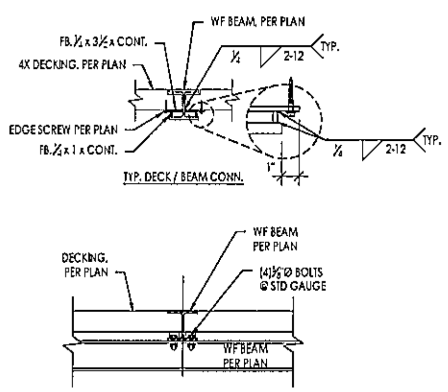
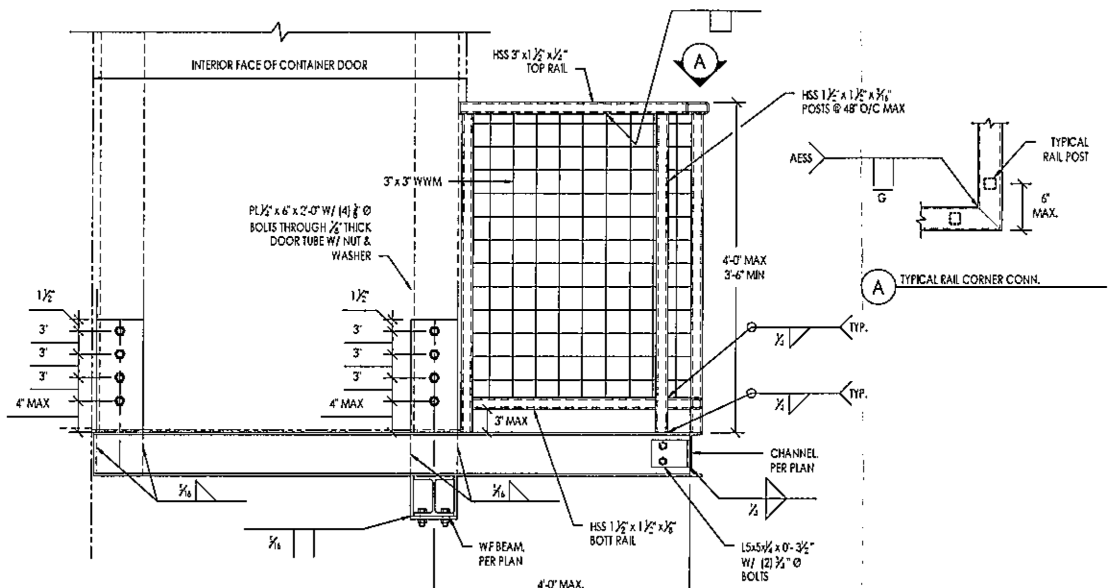
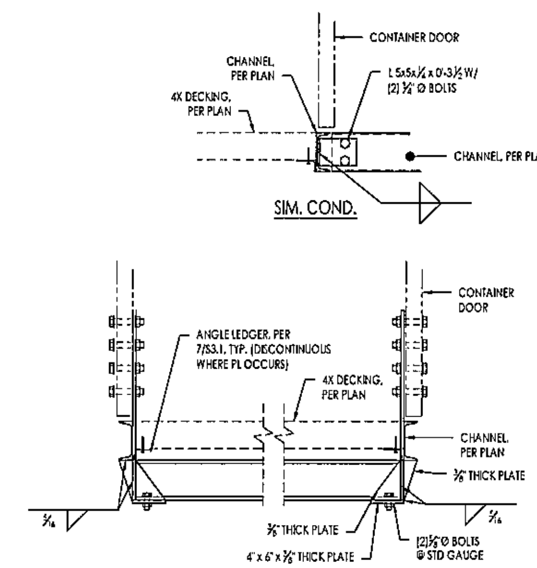


5 4x DECKING TO STEEL BEAM
S3.1 24261 – NESTUCCA RIVER.01 – SHEETS.DWG SCALE: 3/4"=1'-0"



6 DOOR REAR PATIO DETAIL
S3.1 24261 – NESTUCCA RIVER.01 – SHEETS.DWG SCALE: 1"=1'-0"



7 DECK SECTION
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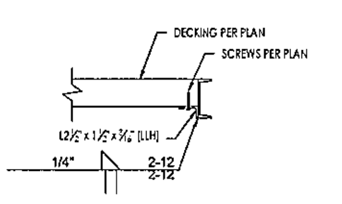

8 CONNECTION DETAIL
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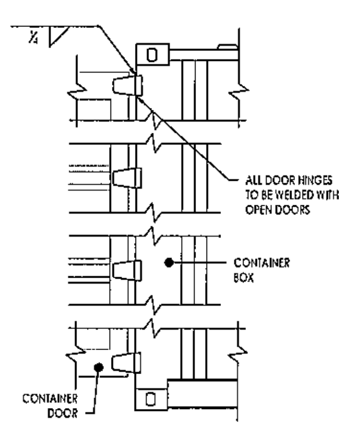
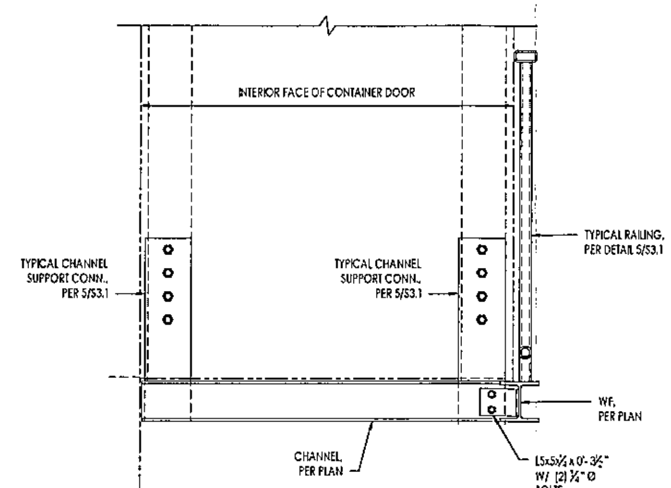


9 DETAIL - PERMANENTLY OPEN DOOR
S3.1 24261 – NESTUCCA RIVER.01 – SHEETS.DWG SCALE: 1"=1'-0"



10 DOOR REAR PATIO DETAIL
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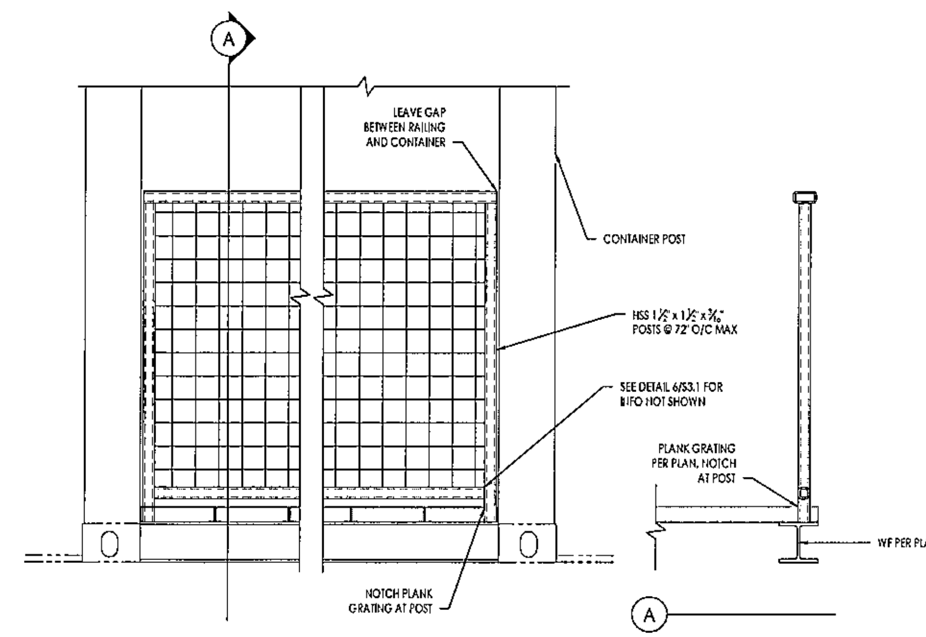

11 REAR GAURDRAIL DETAIL
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JOB No. 24261.01
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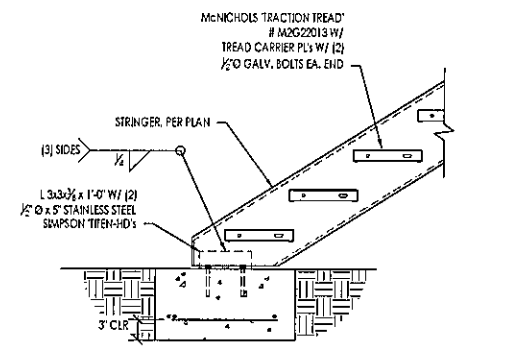
SHEET
S3.1 OF 6



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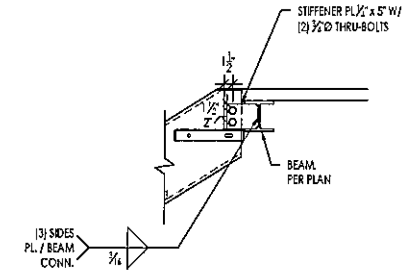
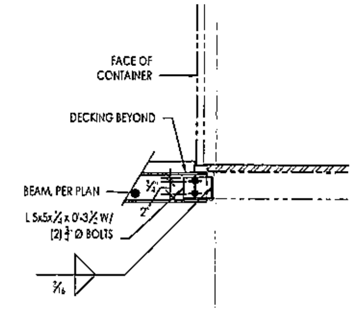
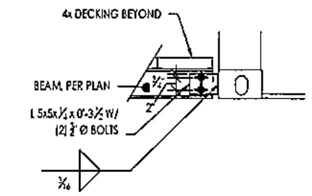


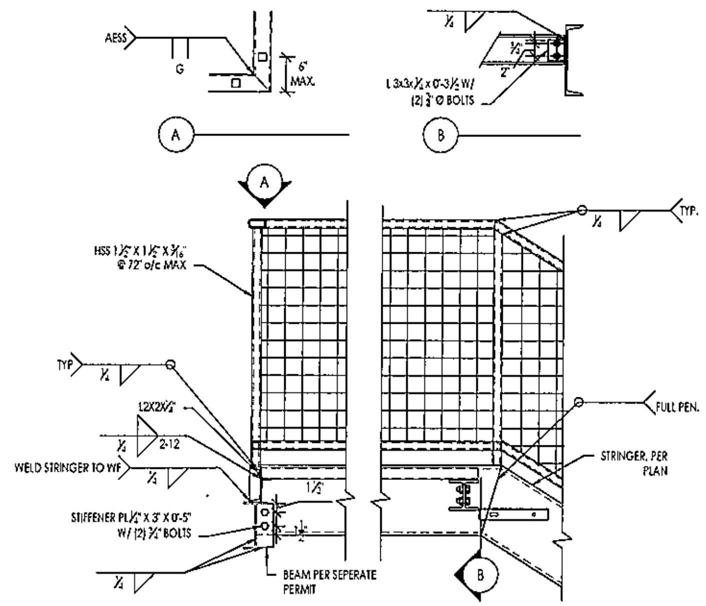
2 S3.2 STRINGER TO BEAM DETAIL



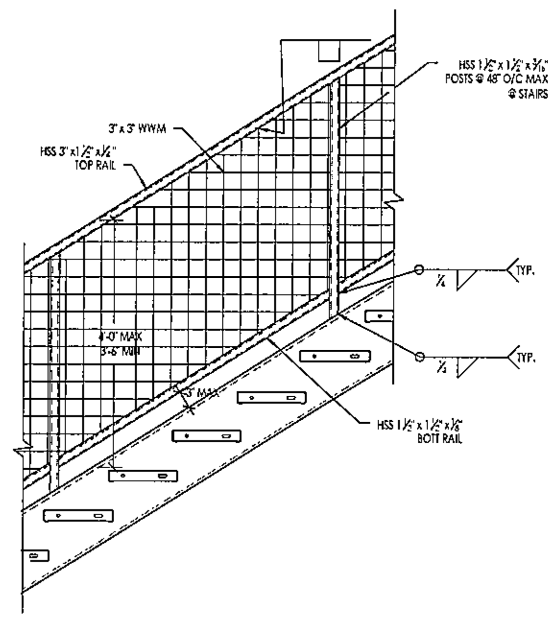
3 S3.2 BEAM TO STRUCTURE



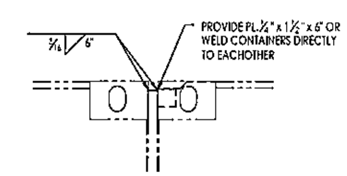
4 S3.2 BEAM TO STRUCTURE



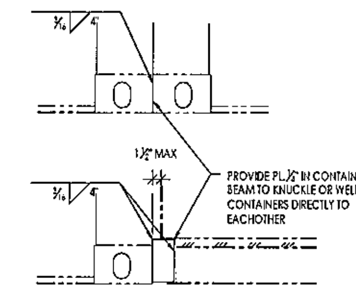
5 S3.2 SECTION



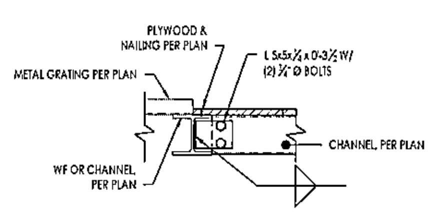
6 S3.2 STAIR HANDRAIL DETAIL



7 S3.2 SECTION - MARRIAGE LINE



8 S3.2 SECTION - MARRIAGE LINE



9 S3.2 CONNECTION DETAIL

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SHEET S3.2 OF 6

National Flood Insurance Program

Elevation Certificate

and Instructions

2023 EDITION

UNIT 1

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE AND INSTRUCTIONS

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this data collection is estimated to average 3.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and submitting this form. You are not required to respond to this collection of information unless a valid OMB control number is displayed on this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing the burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20742, Paperwork Reduction Project (1660-0008). **NOTE: Do not send your completed form to this address.**

PRIVACY ACT STATEMENT

Authority: Title 44 CFR § 61.7 and 61.8.

Principal Purpose(s): This information is being collected for the primary purpose of documenting compliance with National Flood Insurance Program (NFIP) floodplain management ordinances for new or substantially improved structures in designated Special Flood Hazard Areas. This form may also be used as an optional tool for a Letter of Map Amendment (LOMA), Conditional LOMA (CLOMA), Letter of Map Revision Based on Fill (LOMR-F), or Conditional LOMR-F (CLOMR-F), or for flood insurance rating purposes in any flood zone.

Routine Use(s): The information on this form may be disclosed as generally permitted under 5 U.S.C. § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/ FEMA-003 – *National Flood Insurance Program Files System of Records Notice* 79 Fed. Reg. 28747 (May 19, 2014) and upon written request, written consent, by agreement, or as required by law.

Disclosure: The disclosure of information on this form is voluntary; however, failure to provide the information requested may impact the flood insurance premium through the NFIP. Information will only be released as permitted by law.

PURPOSE OF THE ELEVATION CERTIFICATE

The Elevation Certificate is an important administrative tool of the NFIP. It can be used to provide elevation information necessary to ensure compliance with community floodplain management ordinances, to inform the proper insurance premium, and to support a request for a LOMA, CLOMA, LOMR-F, or CLOMR-F.

The Elevation Certificate is used to document floodplain management compliance for Post-Flood Insurance Rate Map (FIRM) buildings, which are buildings constructed after publication of the FIRM, located in flood Zones A1–A30, AE, AH, AO, A (with Base Flood Elevation (BFE)), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, and A99. It may also be used to provide elevation information for Pre-FIRM buildings or buildings in any flood zone.

As part of the agreement for making flood insurance available in a community, the NFIP requires the community to adopt floodplain management regulations that specify minimum requirements for reducing flood losses. One such requirement is for the community to obtain the elevation of the lowest floor (including basement) of all new and substantially improved buildings, and maintain a record of such information. The Elevation Certificate provides a way for a community to document compliance with the community's floodplain management ordinance.

Use of this certificate does not provide a waiver of the flood insurance purchase requirement. Only a LOMA or LOMR-F from the Federal Emergency Management Agency (FEMA) can amend the FIRM and remove the federal mandate for a lending institution to require the purchase of flood insurance. However, the lending institution has the option of requiring flood insurance even if a LOMA/LOMR-F has been issued by FEMA. The Elevation Certificate may be used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. Lowest Adjacent Grade (LAG) elevations certified by a land surveyor, engineer, or architect, as authorized by state law, will be required if the certificate is used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. A LOMA, CLOMA, LOMR-F, or CLOMR-F request must be submitted with either a completed FEMA MT-EZ or MT-1 application package, whichever is appropriate. If the certificate will only be completed to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request, there is an option to document the certified LAG elevation on the Elevation Form included in the MT-EZ and MT-1 application.

This certificate is used only to certify building elevations. A separate certificate is required for floodproofing. Under the NFIP, non-residential buildings can be floodproofed up to or above the BFE. A floodproofed building is a building that has been designed and constructed to be watertight (substantially impermeable to floodwaters) below the BFE. Floodproofing of residential buildings is not permitted under the NFIP unless FEMA has granted the community an exception for residential floodproofed basements. The community must adopt standards for design and construction of floodproofed basements before FEMA will grant a basement exception. For both floodproofed non-residential buildings and residential floodproofed basements in communities that have been granted an exception by FEMA, a floodproofing certificate is required.

The expiration date on the form herein does not apply to certified and completed Elevation Certificates, as a completed Elevation Certificate does not expire, unless there is a physical change to the building that invalidates information in Section A Items A8 or A9, Section C, Section E, or Section H. In addition, this form is intended for the specific building referenced in Section A and is not invalidated by the transfer of building ownership.

Additional guidance can be found in FEMA Publication 467-1, *Floodplain Management Bulletin: Elevation Certificate.*

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

OMB Control No. 1660-0008
Expiration Date: 06/30/2026

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION

FOR INSURANCE COMPANY USE

Policy Number: ____________

Company NAIC Number: ____________

A1. Building Owner's Name: Arthur Robert Taylor

A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address

City: Pacific City State: OR ZIP Code: 97135

A3. Property Description (e.g., Lot and Block Numbers or Legal Description) and/or Tax Parcel Number:
Tax Lot 1601, Map 04S10W19CA / Document No. 2017-02965, Tillamook County Records

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.): Residential

A5. Latitude/Longitude: Lat. 45°12'22.45" N Long. 123°57'37.75" W Horiz. Datum: ☐ NAD 1927 ☒ NAD 1983 ☐ WGS 84

A6. Attach at least two and when possible four clear color photographs (one for each side) of the building (see Form pages 7 and 8).

A7. Building Diagram Number: 6

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s): 318 sq. ft.

b) Is there at least one permanent flood opening on two different sides of each enclosed area? ☒ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade:
Non-engineered flood openings: 0 Engineered flood openings: 6

d) Total net open area of non-engineered flood openings in A8.c: 0 sq. in.

e) Total rated area of engineered flood openings in A8.c (attach documentation – see Instructions): 1200 sq. ft.

f) Sum of A8.d and A8.e rated area (if applicable – see Instructions): 1200 sq. ft.

A9. For a building with an attached garage:

a) Square footage of attached garage: n/a sq. ft.

b) Is there at least one permanent flood opening on two different sides of the attached garage? ☐ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade:
Non-engineered flood openings: ________ Engineered flood openings: ________

d) Total net open area of non-engineered flood openings in A9.c: ________ sq. in.

e) Total rated area of engineered flood openings in A9.c (attach documentation – see Instructions): ________ sq. ft.

f) Sum of A9.d and A9.e rated area (if applicable – see Instructions): ________ sq. ft.

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1.a. NFIP Community Name: Tillamook County B1.b. NFIP Community Identification Number: 410196

B2. County Name: Tillamook County B3. State: OR B4. Map/Panel No.: 41057C/0855 B5. Suffix: F

B6. FIRM Index Date: 09/28/2018 B7. FIRM Panel Effective/Revised Date: 09/28/2018

B8. Flood Zone(s): AE B9. Base Flood Elevation(s) (BFE) (Zone AO, use Base Flood Depth): 18.4'

B10. Indicate the source of the BFE data or Base Flood Depth entered in Item B9:
☐ FIS ☒ FIRM ☐ Community Determined ☐ Other: ____________

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source: ____________

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No
Designation Date: ____________ ☐ CBRS ☐ OPA

B13. Is the building located seaward of the Limit of Moderate Wave Action (LiMWA)? ☐ Yes ☒ No

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ______ Company NAIC Number: ______

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☒ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, AO, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, A99. Complete Items C2.a–h below according to the Building Diagram specified in Item A7. In Puerto Rico only, enter meters.
Benchmark Utilized: GPS - See Section D Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.
☐ NGVD 1929 ☒ NAVD 1988 ☐ Other: ______

Datum used for building elevations must be the same as that used for the BFE. Conversion factor used? ☐ Yes ☒ No
If Yes, describe the source of the conversion factor in the Section D Comments area.

		Check the measurement used:
a) Top of bottom floor (including basement, crawlspace, or enclosure floor):	12.0	☒ feet ☐ meters
b) Top of the next higher floor (see Instructions):	21.4	☒ feet ☐ meters
c) Bottom of the lowest horizontal structural member (see Instructions):	n/a	☐ feet ☐ meters
d) Attached garage (top of slab):	n/a	☐ feet ☐ meters
e) Lowest elevation of Machinery and Equipment (M&E) servicing the building (describe type of M&E and location in Section D Comments area):		☐ feet ☐ meters
f) Lowest Adjacent Grade (LAG) next to building: ☒ Natural ☐ Finished	12.0	☒ feet ☐ meters
g) Highest Adjacent Grade (HAG) next to building: ☒ Natural ☐ Finished	12.1	☒ feet ☐ meters
h) Finished LAG at lowest elevation of attached deck or stairs, including structural support:	12.0	☒ feet ☐ meters

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by state law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

Were latitude and longitude in Section A provided by a licensed land surveyor? ☐ Yes ☐ No

SIGNED ON: 5-28-2025

☐ Check here if attachments and describe in the Comments area.

Certifier's Name: James B. Brown License Number: 60379

Title: Professional Land Surveyor

Company Name: Centerline Concepts Land Surveying, Inc.

Address: 19376 Molalla Avenue, Suite 120

City: Oregon City State: OR ZIP Code: 97045

Telephone: (503) 650-0188 Ext.: ______ Email: jamesb@centerlineconcepts.com

Signature: Date: 5-28-25

REGISTERED PROFESSIONAL LAND SURVEYOR
OREGON
NOVEMBER 30, 2007
JAMES BURTON BROWN
60379
EXPIRES: 12-31-2025
Place Seal Here

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including source of conversion factor in C2; type of equipment and location per C2.e; and description of any attachments):
--Benchmark utilized in section C2 is based on static GPS observations post-processed by OPUS.
--This is a Pre-Construction Elevation certificate for proposed Unit 1
--Engineered Flood Vent in A8e is a Smart Vent Model 1540-510. 1 vent rated 200 sf

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address City: Pacific City State: OR ZIP Code: 97135	FOR INSURANCE COMPANY USE Policy Number: ______ Company NAIC Number: ______

SECTION E – BUILDING MEASUREMENT INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO, ZONE AR/AO, AND ZONE A (WITHOUT BFE)

For Zones AO, AR/AO, and A (without BFE), complete Items E1–E5. For Items E1–E4, use natural grade, if available. If the Certificate is intended to support a Letter of Map Change request, complete Sections A, B, and C. Check the measurement used. In Puerto Rico only, enter meters.

Building measurements are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

E1. Provide measurements (C.2.a in applicable Building Diagram) for the following and check the appropriate boxes to show whether the measurement is above or below the natural HAG and the LAG.

a) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the LAG.

E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (C2.b in applicable Building Diagram) of the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E3. Attached garage (top of slab) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without BFE) or Zone AO must sign here. *The statements in Sections A, B, and E are correct to the best of my knowledge*

☐ Check here if attachments and describe in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ______ Company NAIC Number: ______

SECTION G – COMMUNITY INFORMATION (RECOMMENDED FOR COMMUNITY OFFICIAL COMPLETION)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Section A, B, C, E, G, or H of this Elevation Certificate. Complete the applicable item(s) and sign below when:

G1. ☐ The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by state law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)

G2.a. ☐ A local official completed Section E for a building located in Zone A (without a BFE), Zone AO, or Zone AR/AO, or when item E5 is completed for a building located in Zone AO.

G2.b. ☐ A local official completed Section H for insurance purposes.

G3. ☐ In the Comments area of Section G, the local official describes specific corrections to the information in Sections A, B, E and H.

G4. ☐ The following information (Items G5–G11) is provided for community floodplain management purposes.

G5. Permit Number: ______ G6. Date Permit Issued: ______

G7. Date Certificate of Compliance/Occupancy Issued: ______

G8. This permit has been issued for: ☐ New Construction ☐ Substantial Improvement

G9.a. Elevation of as-built lowest floor (including basement) of the building: ______ ☐ feet ☐ meters Datum: ______

G9.b. Elevation of bottom of as-built lowest horizontal structural member: ______ ☐ feet ☐ meters Datum: ______

G10.a. BFE (or depth in Zone AO) of flooding at the building site: ______ ☐ feet ☐ meters Datum: ______

G10.b. Community's minimum elevation (or depth in Zone AO) requirement for the lowest floor or lowest horizontal structural member: ______ ☐ feet ☐ meters Datum: ______

G11. Variance issued? ☐ Yes ☐ No If yes, attach documentation and describe in the Comments area.

The local official who provides information in Section G must sign here. *I have completed the information in Section G and certify that it is correct to the best of my knowledge. If applicable, I have also provided specific corrections in the Comments area of this section.*

Local Official's Name: ______ Title: ______

NFIP Community Name: ______

Telephone: ______ Ext.: ______ Email: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Signature: ______ Date: ______

Comments (including type of equipment and location, per C2.e; description of any attachments; and corrections to specific information in Sections A, B, D, E, or H):

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ______ Company NAIC Number: ______

SECTION H – BUILDING'S FIRST FLOOR HEIGHT INFORMATION FOR ALL ZONES (SURVEY NOT REQUIRED) (FOR INSURANCE PURPOSES ONLY)

The property owner, owner's authorized representative, or local floodplain management official may complete Section H for all flood zones to determine the building's first floor height for insurance purposes. Sections A, B, and I must also be completed. Enter heights to the nearest tenth of a foot (nearest tenth of a meter in Puerto Rico). ***Reference the Foundation Type Diagrams (at the end of Section H Instructions) and the appropriate Building Diagrams (at the end of Section I Instructions) to complete this section.***

H1. Provide the height of the top of the floor (as indicated in Foundation Type Diagrams) above the Lowest Adjacent Grade (LAG):

a) **For Building Diagrams 1A, 1B, 3, and 5–8.** Top of bottom floor (include above-grade floors only for buildings with crawlspaces or enclosure floors) is: ______ ☐ feet ☐ meters ☐ above the LAG

b) **For Building Diagrams 2A, 2B, 4, and 6–9.** Top of next higher floor (i.e., the floor above basement, crawlspace, or enclosure floor) is: ______ ☐ feet ☐ meters ☐ above the LAG

H2. Is all Machinery and Equipment servicing the building (as listed in Item H2 instructions) elevated to or above the floor indicated by the H2 arrow (shown in the Foundation Type Diagrams at end of Section H instructions) for the appropriate Building Diagram?
☐ Yes ☐ No

SECTION I – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and H must sign here. *The statements in Sections A, B, and H are correct to the best of my knowledge.* **Note:** If the local floodplain management official completed Section H, they should indicate in Item G2.b and sign Section G.

☐ Check here if attachments are provided (including required photos) and describe each attachment in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address

City: Pacific City State: OR ZIP Code: 97135

FOR INSURANCE COMPANY USE

Policy Number:

Company NAIC Number:

Instructions: Insert below at least two and when possible four photographs showing each side of the building (for example, may only be able to take front and back pictures of townhouses/rowhouses). Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." Photographs must show the foundation. When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo One

Photo One Caption: Clear Photo One

Photo Two

Photo Two Caption: Clear Photo Two

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

Continuation Page

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: Company NAIC Number:

Insert the third and fourth photographs below. Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo Three

Photo Three Caption:

Clear Photo Three

Photo Four

Photo Four Caption:

Clear Photo Four

ICC EVALUATION SERVICE

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ESR-2074

Reissued 02/2021
Revised 04/2021
This report is subject to renewal 02/2023.

DIVISION: 08 00 00—OPENINGS

SECTION: 08 95 43—VENTS/FOUNDATION FLOOD VENTS

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514 FLOOD VENT SEALING KIT #1540-526

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ICC-ES Evaluation Report

ESR-2074

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012, 2009 and 2006 *International Building Code®* (IBC)
- 2021, 2018, 2015, 2012, 2009 and 2006 *International Residential Code®* (IRC)
- 2021, 2018 *International Energy Conservation Code®* (IECC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Physical operation
- Water flow

2.0 USES

The Smart Vent® units are engineered mechanically operated flood vents (FVs) employed to equalize hydrostatic pressure on walls of enclosures subject to rising or falling flood waters. Certain models also allow natural ventilation.

3.0 DESCRIPTION

3.1 General:

When subjected to rising water, the Smart Vent® FVs internal floats are activated, then pivot open to allow flow in either direction to equalize water level and hydrostatic pressure from one side of the foundation to the other. The FV pivoting door is normally held in the closed position by a buoyant release device. When subjected to rising water, the buoyant release device causes the unit to unlatch, allowing the door to rotate out of the way and allow flow. The water level stabilizes, equalizing the lateral forces. Each unit is fabricated from stainless steel. Smart Vent® Automatic Foundation Flood Vents are available in various models and sizes as described in Table 1. The SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 units each contain two vertically arranged openings per unit.

3.2 Engineered Opening:

The FVs comply with the design principle noted in Section 2.7.2.2 and Section 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)] for a maximum rate of rise and fall of 5.0 feet per hour (0.423 mm/s). In order to comply with the engineered opening requirement of ASCE/SEI 24, Smart Vent FVs must be installed in accordance with Section 4.0.

3.3 Ventilation:

The SmartVENT® Model #1540-510 and SmartVENT® Overhead Door Model #1540-514 both have screen covers with $^1/_4$-inch-by-$^1/_4$-inch (6.35 by 6.35 mm) openings, yielding 51 square inches (32 903 mm^2) of net free area to supply natural ventilation. The SmartVENT® Stacking Model #1540-511 consists of two Model #1540-510 units in one assembly, and provides 102 square inches (65 806 mm^2) of net free area to supply natural ventilation. Other FVs described in this report do not offer natural ventilation.

3.4 Flood Vent Sealing Kit:

The Flood Vent Sealing Kit Model #1540-526 is used with SmartVENT® Model #1540-520. It is a Homasote 440 Sound Barrier® (ESR-1374) insert with 21 – 2-inch-by-2-inch (51 mm x 51 mm) squares cut in it. See Figure 4.

4.0 DESIGN AND INSTALLATION

4.1 SmartVENT® and FloodVENT®:

SmartVENT® and FloodVENT® are designed to be installed into walls or overhead doors of existing or new construction from the exterior side. Installation of the vents must be in accordance with the manufacturer's instructions, the applicable code and this report. Installation clips allow mounting in masonry and concrete walls of any thickness. In order to comply with the engineered opening design principle noted in Section 2.7.2.2 and 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)], the Smart Vent® FVs must be installed as follows:

- With a minimum of two openings on different sides of each enclosed area.

- With a minimum of one FV for every 200 square feet (18.6 m^2) of enclosed area, except that the SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 must be installed with a minimum of one FV for every 400 square feet (37.2 m^2) of enclosed area.
- Below the base flood elevation.
- With the bottom of the FV located a maximum of 12 inches (305.4 mm) above the higher of the final grade or floor and finished exterior grade immediately under each opening.

4.2 Flood Vent Sealing Kit

The Flood Vent Sealing Kit Model 1540-526 is used in conjunction with FloodVENT® Model #1540-520. When installed and tested in accordance with ASTM E283, the FV and Flood Vent Sealing Kit assembly have an air leakage rate of less than 0.2 cubic feet per minute per lineal foot (18.56 l/min per lineal meter) at a pressure differential of 1 pound per square foot (50 Pa) based on 12.58 lineal feet (3.8 lineal meters) contained by the Flood Vent Sealing Kit.

5.0 CONDITIONS OF USE

The Smart Vent® FVs described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The Smart Vent® FVs must be installed in accordance with this report, the applicable code and the manufacturer's installation instructions. In the event of a conflict, the instructions in this report govern.

5.2 The Smart Vent® FVs must not be used in the place of "breakaway walls" in coastal high hazard areas, but are permitted for use in conjunction with breakaway walls in other areas.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Mechanically Operated Flood Vents (AC364), dated August 2015 (editorially revised February 2021).

6.2 Test report on air infiltration in accordance with ASTM E283.

7.0 IDENTIFICATION

7.1 The Smart VENT® models and the Flood Vent Sealing Kit described in this report must be identified by a label bearing the manufacturer's name (Smartvent Products, Inc.), the model number, and the evaluation report number (ESR-2074).

7.2 The report holder's contact information is the following:

SMART VENT PRODUCTS, INC.
430 ANDBRO DRIVE, UNIT 1
PITMAN, NEW JERSEY 08071
(877) 441-8368
www.smartvent.com
info@smartvent.com

TABLE 1—MODEL SIZES

MODEL NAME	MODEL NUMBER	MODEL SIZE (in.)	COVERAGE (sq. ft.)
FloodVENT®	1540-520	$15^3/_4$" X $7^3/_4$"	200
SmartVENT®	1540-510	$15^3/_4$" X $7^3/_4$"	200
FloodVENT® Overhead Door	1540-524	$15^3/_4$" X $7^3/_4$"	200
SmartVENT® Overhead Door	1540-514	$15^3/_4$" X $7^3/_4$"	200
Wood Wall FloodVENT®	1540-570	14" X $8^3/_4$"	200
Wood Wall FloodVENT® Overhead Door	1540-574	14" X $8^3/_4$"	200
SmartVENT® Stacker	1540-511	16" X 16"	400
FloodVent® Stacker	1540-521	16" X 16"	400

For **SI:** 1 inch = 25.4 mm; 1 square foot = m^2

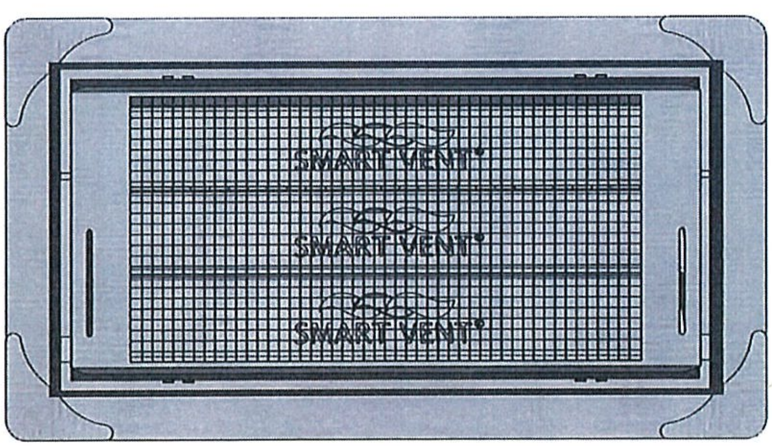

FIGURE 1—SMART VENT: MODEL 1540-510

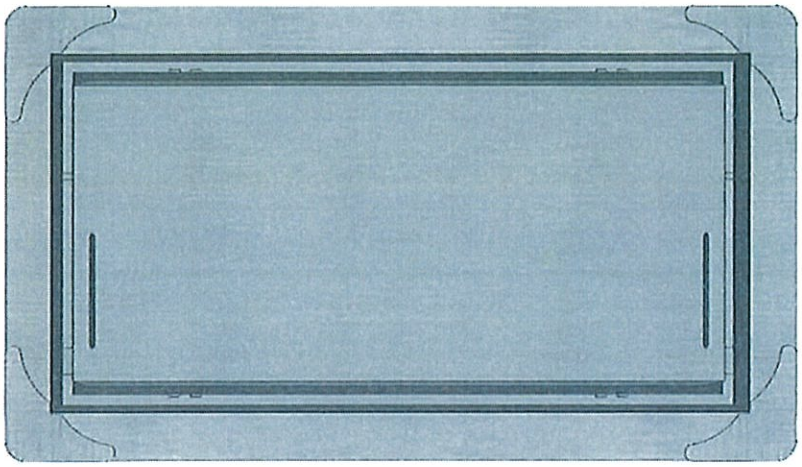

FIGURE 2—SMART VENT MODEL 1540-520

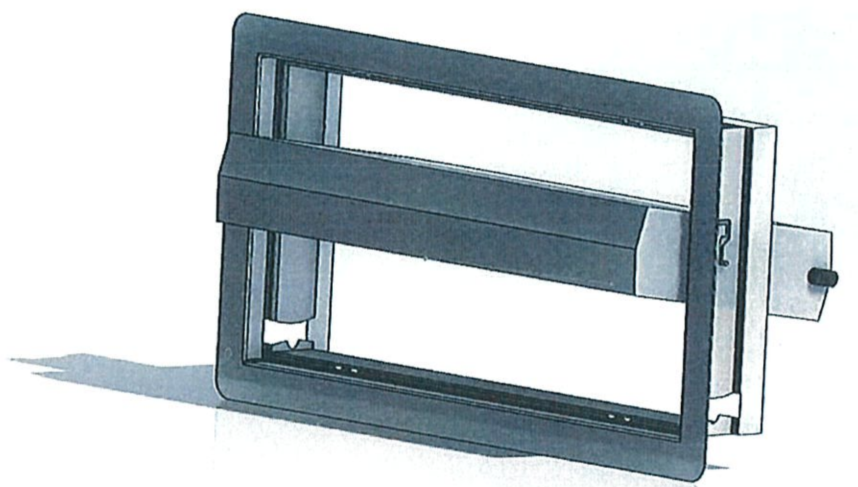

FIGURE 3—SMART VENT: SHOWN WITH FLOOD DOOR PIVOTED OPEN

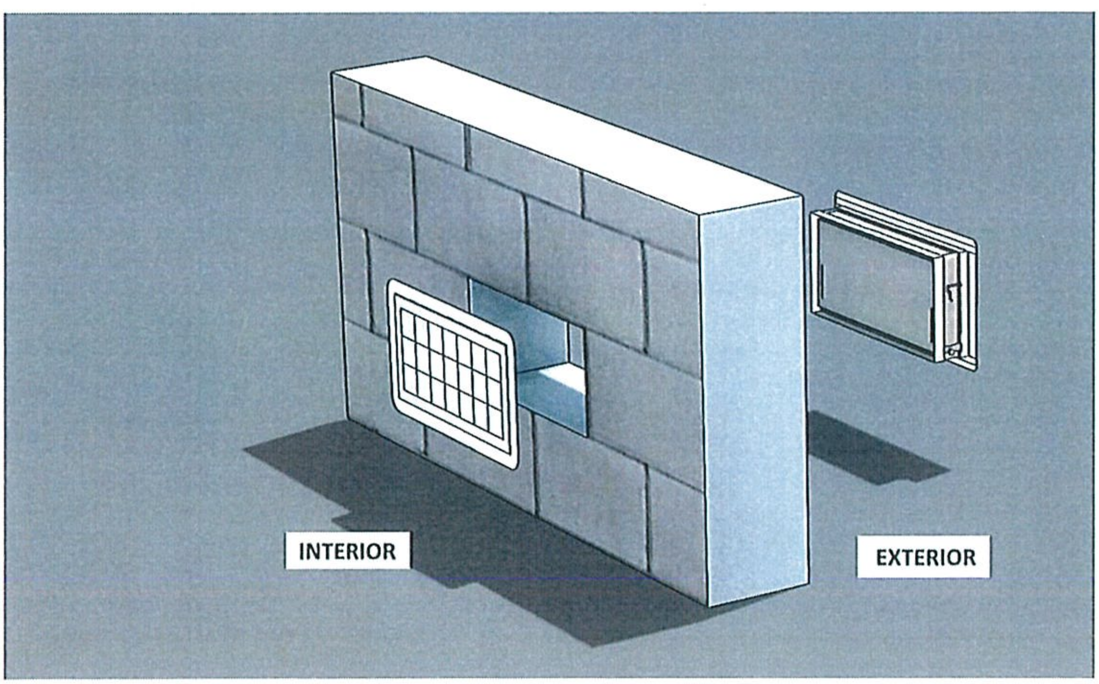

FIGURE 4—FLOOD VENT SEALING KIT

ICC-ES Evaluation Report

ESR-2074 CBC and CRC Supplement

Reissued February 2021

Revised April 2021

This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with codes noted below.

Applicable code editions:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with 2019 CBC Chapter 12, provided the design and installation are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 12 and 16 , as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the 2019 CRC, provided the design and installation are in accordance with the 2018 *International Residential Code®* (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

ICC-ES Evaluation Report

ESR-2074 FBC Supplement

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the *Florida Building Code—Building* and the *Florida Building Code-Residential*, provided the design requirements are determined in accordance with the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2074 for 2018 *International Building Code®* meet the requirements of the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable.

Use of the Smart Vent® Automatic Foundation Flood Vents has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential*.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

SMART VENT® - Model: 1540-510

ICC ES™

Dual Function SMART VENT®
Superior Flood Protection and Natural Air Ventilation

ICC-ES Evaluated and FEMA Accepted Foundation Flood Vents

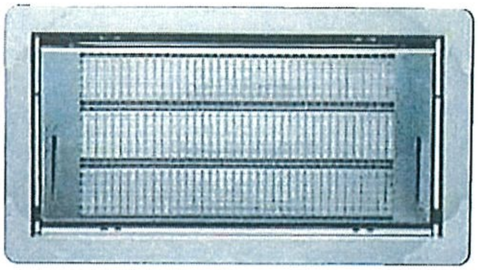
- Potential savings on homeowner's NFIP premiums
- Preserves aesthetic beauty of a home by requiring 2/3 less vents
- Each vent certified to protect 200 sq. ft. of your home
- Code Compliant, FEMA accepted, ICC-ES Evaluated
- All Stainless Steel construction meets or exceeds flood and corrosion resistance code requirements
- Patented automatic floats release bi-directional flood door
- Temperature controlled louvers automatically open in warm weather and close in cold weather

One 16" x 8" vent is certified to cover 200 square feet of enclosed area for flood protection and 51 square inches for ventilation

SMART VENT® models are certified to provide flood protection and ventilation. This model is used for a home with a crawl space or any enclosed area that desires natural air ventilation and flood protection. All stainless steel construction resists weather and pest.

SMART VENT

www.smartvent.com • 877-441-8368



Model #:	1540-510
Installation Type:	Masonry Wall
Style:	louvered
Dimensions:	16″ x 8″
Rough Opening:	16¼″ x 8¼″ (one block, or CMU)
Finish:	Stainless Steel *(Standard)*

Available Powder Coat Colors For Special Order:

White Wheat Gray Black Stainless (standard)

Optional Accessories:
Fire Damper, Interior Trim Flange & Inner Sleeve, Rain Shield

Other Models Available: Insulated FLOOD VENT, Overhead Garage Door Model, Stacked and Quad Configurations, Models for Wood Studded Wall Applications and Pour in Place Buck Systems.

There's more online at www.smartvent.com
Dealer Locator, Installer Locator, Cad Drawings, Installation Instructions, Technical Specifications, Frequently Asked Questions, Videos, Testimonials, Resource Library Database, Insurance Forms.

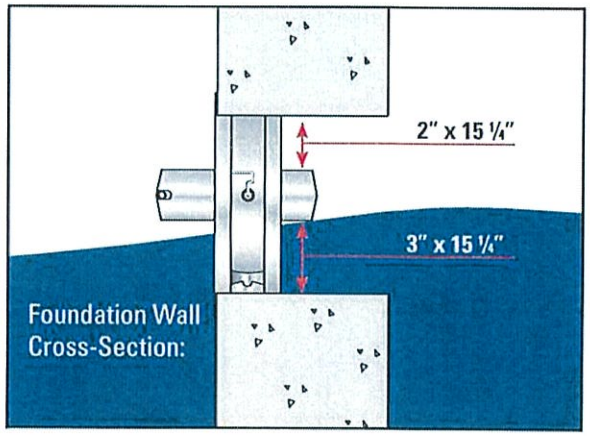
Rapidly rising floodwater can put extreme pressure on the foundation walls causing improperly vented structures to buckle and collapse. SMART VENTS® quickly and efficiently equalize the pressure and minimize damage.

How it works:

Flood Protection: The SMART VENT® door is latched closed until flood water enters. Entering flood water lifts the patented internal floats which unlatches and rotates the door open. This allows the flood water to automatically enter and exit through the frame opening, relieving the pressure from your foundation walls.

Ventilation: A bimetal coil (like a thermostat, no electricity is needed) automatically opens and closes the ventilation louvers as temperature changes. They will be closed when it is freezing outside and open when it is warm outside to provide natural ventilation.

Important note: SMART VENT® does not rely on the louvers to let floodwater in and out. Regardless of the louvers' position, opened or closed, when floodwater flows into the door, the internal floats release the door to rotate open to relieve the hydrostatic pressure. The louvers and pest screen are rotated out of the path of the floodwater. The temperature-controlled louvers are for ventilation purposes only.



How does one SMART VENT® provide so much coverage?

You may have heard that FEMA requires that flood openings provide one square inch of opening per one square foot of enclosed area, referring to dimensions of the opening in proportion to the space to be vented. This is only partially correct. FEMA's regulations and guidelines do state that a non-engineered flood vent solution must (among other requirements) provide one square inch of opening per square foot of enclosed area to be vented. However; all SMART VENT® products are ICC-ES certified engineered openings. They have been designed, engineered, tested, rated, and certified to provide flood relief so efficiently that only one unit is needed for 200 square feet of enclosed area. It would be our pleasure to contact your code official, surveyor, or insurance agent if they require more information.

National Flood Insurance Program

Elevation Certificate

and Instructions

2023 EDITION

UNIT 2

FEMA

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE AND INSTRUCTIONS

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this data collection is estimated to average 3.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and submitting this form. You are not required to respond to this collection of information unless a valid OMB control number is displayed on this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing the burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20742, Paperwork Reduction Project (1660-0008). **NOTE: Do not send your completed form to this address.**

PRIVACY ACT STATEMENT

Authority: Title 44 CFR § 61.7 and 61.8.

Principal Purpose(s): This information is being collected for the primary purpose of documenting compliance with National Flood Insurance Program (NFIP) floodplain management ordinances for new or substantially improved structures in designated Special Flood Hazard Areas. This form may also be used as an optional tool for a Letter of Map Amendment (LOMA), Conditional LOMA (CLOMA), Letter of Map Revision Based on Fill (LOMR-F), or Conditional LOMR-F (CLOMR-F), or for flood insurance rating purposes in any flood zone.

Routine Use(s): The information on this form may be disclosed as generally permitted under 5 U.S.C. § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/ FEMA-003 – *National Flood Insurance Program Files System of Records Notice* 79 Fed. Reg. 28747 (May 19, 2014) and upon written request, written consent, by agreement, or as required by law.

Disclosure: The disclosure of information on this form is voluntary; however, failure to provide the information requested may impact the flood insurance premium through the NFIP. Information will only be released as permitted by law.

PURPOSE OF THE ELEVATION CERTIFICATE

The Elevation Certificate is an important administrative tool of the NFIP. It can be used to provide elevation information necessary to ensure compliance with community floodplain management ordinances, to inform the proper insurance premium, and to support a request for a LOMA, CLOMA, LOMR-F, or CLOMR-F.

The Elevation Certificate is used to document floodplain management compliance for Post-Flood Insurance Rate Map (FIRM) buildings, which are buildings constructed after publication of the FIRM, located in flood Zones A1–A30, AE, AH, AO, A (with Base Flood Elevation (BFE)), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, and A99. It may also be used to provide elevation information for Pre-FIRM buildings or buildings in any flood zone.

As part of the agreement for making flood insurance available in a community, the NFIP requires the community to adopt floodplain management regulations that specify minimum requirements for reducing flood losses. One such requirement is for the community to obtain the elevation of the lowest floor (including basement) of all new and substantially improved buildings, and maintain a record of such information. The Elevation Certificate provides a way for a community to document compliance with the community's floodplain management ordinance.

Use of this certificate does not provide a waiver of the flood insurance purchase requirement. Only a LOMA or LOMR-F from the Federal Emergency Management Agency (FEMA) can amend the FIRM and remove the federal mandate for a lending institution to require the purchase of flood insurance. However, the lending institution has the option of requiring flood insurance even if a LOMA/LOMR-F has been issued by FEMA. The Elevation Certificate may be used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. Lowest Adjacent Grade (LAG) elevations certified by a land surveyor, engineer, or architect, as authorized by state law, will be required if the certificate is used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. A LOMA, CLOMA, LOMR-F, or CLOMR-F request must be submitted with either a completed FEMA MT-EZ or MT-1 application package, whichever is appropriate. If the certificate will only be completed to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request, there is an option to document the certified LAG elevation on the Elevation Form included in the MT-EZ and MT-1 application.

This certificate is used only to certify building elevations. A separate certificate is required for floodproofing. Under the NFIP, non-residential buildings can be floodproofed up to or above the BFE. A floodproofed building is a building that has been designed and constructed to be watertight (substantially impermeable to floodwaters) below the BFE. Floodproofing of residential buildings is not permitted under the NFIP unless FEMA has granted the community an exception for residential floodproofed basements. The community must adopt standards for design and construction of floodproofed basements before FEMA will grant a basement exception. For both floodproofed non-residential buildings and residential floodproofed basements in communities that have been granted an exception by FEMA, a floodproofing certificate is required.

The expiration date on the form herein does not apply to certified and completed Elevation Certificates, as a completed Elevation Certificate does not expire, unless there is a physical change to the building that invalidates information in Section A Items A8 or A9, Section C, Section E, or Section H. In addition, this form is intended for the specific building referenced in Section A and is not invalidated by the transfer of building ownership.

Additional guidance can be found in FEMA Publication 467-1, *Floodplain Management Bulletin: Elevation Certificate.*

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

OMB Control No. 1660-0008
Expiration Date: 06/30/2026

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION

FOR INSURANCE COMPANY USE

Policy Number: ____________

Company NAIC Number: ____________

A1. Building Owner's Name: Arthur Robert Taylor

A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address

City: Pacific City State: OR ZIP Code: 97135

A3. Property Description (e.g., Lot and Block Numbers or Legal Description) and/or Tax Parcel Number: Tax Lot 1601, Map 04S10W19CA / Document No. 2017-02965, Tillamook County Records

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.): Residential

A5. Latitude/Longitude: Lat. 45°12'22.45" N Long. 123°57'37.75" W Horiz. Datum: ☐ NAD 1927 ☒ NAD 1983 ☐ WGS 84

A6. Attach at least two and when possible four clear color photographs (one for each side) of the building (see Form pages 7 and 8).

A7. Building Diagram Number: 6

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s): 318 sq. ft.

b) Is there at least one permanent flood opening on two different sides of each enclosed area? ☒ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade:
Non-engineered flood openings: 0 Engineered flood openings: 6

d) Total net open area of non-engineered flood openings in A8.c: 0 sq. in.

e) Total rated area of engineered flood openings in A8.c (attach documentation – see Instructions): 1200 sq. ft.

f) Sum of A8.d and A8.e rated area (if applicable – see Instructions): 1200 sq. ft.

A9. For a building with an attached garage:

a) Square footage of attached garage: n/a sq. ft.

b) Is there at least one permanent flood opening on two different sides of the attached garage? ☐ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade:
Non-engineered flood openings: ______ Engineered flood openings: ______

d) Total net open area of non-engineered flood openings in A9.c: ______ sq. in.

e) Total rated area of engineered flood openings in A9.c (attach documentation – see Instructions): ______ sq. ft.

f) Sum of A9.d and A9.e rated area (if applicable – see Instructions): ______ sq. ft.

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1.a. NFIP Community Name: Tillamook County B1.b. NFIP Community Identification Number: 410196

B2. County Name: Tillamook County B3. State: OR B4. Map/Panel No.: 41057C/0855 B5. Suffix: F

B6. FIRM Index Date: 09/28/2018 B7. FIRM Panel Effective/Revised Date: 09/28/2018

B8. Flood Zone(s): AE B9. Base Flood Elevation(s) (BFE) (Zone AO, use Base Flood Depth): 18.4'

B10. Indicate the source of the BFE data or Base Flood Depth entered in Item B9:
☐ FIS ☒ FIRM ☐ Community Determined ☐ Other: ______

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source: ______

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No
Designation Date: ______ ☐ CBRS ☐ OPA

B13. Is the building located seaward of the Limit of Moderate Wave Action (LiMWA)? ☐ Yes ☒ No

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number:
	Company NAIC Number:

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☒ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, AO, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, A99. Complete Items C2.a–h below according to the Building Diagram specified in Item A7. In Puerto Rico only, enter meters.
Benchmark Utilized: GPS - See Section D Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.
☐ NGVD 1929 ☒ NAVD 1988 ☐ Other:

Datum used for building elevations must be the same as that used for the BFE. Conversion factor used? ☐ Yes ☒ No
If Yes, describe the source of the conversion factor in the Section D Comments area.

Check the measurement used:

Item	Elevation	Feet	Meters
a) Top of bottom floor (including basement, crawlspace, or enclosure floor):	12.0	☒ feet	☐ meters
b) Top of the next higher floor (see Instructions):	21.4	☒ feet	☐ meters
c) Bottom of the lowest horizontal structural member (see Instructions):	n/a	☐ feet	☐ meters
d) Attached garage (top of slab):	n/a	☐ feet	☐ meters
e) Lowest elevation of Machinery and Equipment (M&E) servicing the building (describe type of M&E and location in Section D Comments area):		☐ feet	☐ meters
f) Lowest Adjacent Grade (LAG) next to building: ☒ Natural ☐ Finished	12.0	☒ feet	☐ meters
g) Highest Adjacent Grade (HAG) next to building: ☒ Natural ☐ Finished	12.1	☒ feet	☐ meters
h) Finished LAG at lowest elevation of attached deck or stairs, including structural support:	12.0	☒ feet	☐ meters

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by state law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

Were latitude and longitude in Section A provided by a licensed land surveyor? ☐ Yes ☐ No

☐ Check here if attachments and describe in the Comments area.

Certifier's Name: James B. Brown License Number: 60379

Title: Professional Land Surveyor

Company Name: Centerline Concepts Land Surveying, Inc.

Address: 19376 Molalla Avenue, Suite 120

City: Oregon City State: OR ZIP Code: 97045

Telephone: (503) 650-0188 Ext.: Email: jamesb@centerlineconcepts.com

Signature: Date: 5-28-2025

SIGNED ON: 5-28-2025

REGISTERED PROFESSIONAL LAND SURVEYOR
OREGON
NOVEMBER 30, 2007
JAMES BURTON BROWN
60379
EXPIRES: 12-31-2025

Place Seal Here

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including source of conversion factor in C2; type of equipment and location per C2.e; and description of any attachments):
--Benchmark utilized in section C2 is based on static GPS observations post-processed by OPUS.
--This is a Pre-Construction Elevation certificate for proposed Unit 2
--Engineered Flood Vent in A8e is a Smart Vent Model 1540-510. 1 vent rated 200 sf

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address City: Pacific City State: OR ZIP Code: 97135	FOR INSURANCE COMPANY USE Policy Number: ______ Company NAIC Number: ______

SECTION E – BUILDING MEASUREMENT INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO, ZONE AR/AO, AND ZONE A (WITHOUT BFE)

For Zones AO, AR/AO, and A (without BFE), complete Items E1–E5. For Items E1–E4, use natural grade, if available. If the Certificate is intended to support a Letter of Map Change request, complete Sections A, B, and C. Check the measurement used. In Puerto Rico only, enter meters.

Building measurements are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction

*A new Elevation Certificate will be required when construction of the building is complete.

E1. Provide measurements (C.2.a in applicable Building Diagram) for the following and check the appropriate boxes to show whether the measurement is above or below the natural HAG and the LAG.

a) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the LAG.

E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (C2.b in applicable Building Diagram) of the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E3. Attached garage (top of slab) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without BFE) or Zone AO must sign here. *The statements in Sections A, B, and E are correct to the best of my knowledge*

☐ Check here if attachments and describe in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: ______ Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address City: Pacific City State: OR ZIP Code: 97135	FOR INSURANCE COMPANY USE Policy Number: _____ Company NAIC Number: _____

SECTION G – COMMUNITY INFORMATION (RECOMMENDED FOR COMMUNITY OFFICIAL COMPLETION)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Section A, B, C, E, G, or H of this Elevation Certificate. Complete the applicable item(s) and sign below when:

G1. ☐ The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by state law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)

G2.a. ☐ A local official completed Section E for a building located in Zone A (without a BFE), Zone AO, or Zone AR/AO, or when item E5 is completed for a building located in Zone AO.

G2.b. ☐ A local official completed Section H for insurance purposes.

G3. ☐ In the Comments area of Section G, the local official describes specific corrections to the information in Sections A, B, E and H.

G4. ☐ The following information (Items G5–G11) is provided for community floodplain management purposes.

G5. Permit Number: _____ G6. Date Permit Issued: _____

G7. Date Certificate of Compliance/Occupancy Issued: _____

G8. This permit has been issued for: ☐ New Construction ☐ Substantial Improvement

G9.a. Elevation of as-built lowest floor (including basement) of the building: _____ ☐ feet ☐ meters Datum: _____

G9.b. Elevation of bottom of as-built lowest horizontal structural member: _____ ☐ feet ☐ meters Datum: _____

G10.a. BFE (or depth in Zone AO) of flooding at the building site: _____ ☐ feet ☐ meters Datum: _____

G10.b. Community's minimum elevation (or depth in Zone AO) requirement for the lowest floor or lowest horizontal structural member: _____ ☐ feet ☐ meters Datum: _____

G11. Variance issued? ☐ Yes ☐ No If yes, attach documentation and describe in the Comments area.

The local official who provides information in Section G must sign here. *I have completed the information in Section G and certify that it is correct to the best of my knowledge. If applicable, I have also provided specific corrections in the Comments area of this section.*

Local Official's Name: _____ Title: _____

NFIP Community Name: _____

Telephone: Ext.: _____ Email: _____

Address: _____

City: _____ State: _____ ZIP Code: _____

Signature: _____ Date: _____

Comments (including type of equipment and location, per C2.e; description of any attachments; and corrections to specific information in Sections A, B, D, E, or H):

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address City: Pacific City State: OR ZIP Code: 97135	FOR INSURANCE COMPANY USE Policy Number: ______ Company NAIC Number: ______

SECTION H – BUILDING'S FIRST FLOOR HEIGHT INFORMATION FOR ALL ZONES (SURVEY NOT REQUIRED) (FOR INSURANCE PURPOSES ONLY)

The property owner, owner's authorized representative, or local floodplain management official may complete Section H for all flood zones to determine the building's first floor height for insurance purposes. Sections A, B, and I must also be completed. Enter heights to the nearest tenth of a foot (nearest tenth of a meter in Puerto Rico). ***Reference the Foundation Type Diagrams (at the end of Section H Instructions) and the appropriate Building Diagrams (at the end of Section I Instructions) to complete this section.***

H1. Provide the height of the top of the floor (as indicated in Foundation Type Diagrams) above the Lowest Adjacent Grade (LAG):

a) **For Building Diagrams 1A, 1B, 3, and 5–8.** Top of bottom floor (include above-grade floors only for buildings with crawlspaces or enclosure floors) is: ______ ☐ feet ☐ meters ☐ above the LAG

b) **For Building Diagrams 2A, 2B, 4, and 6–9.** Top of next higher floor (i.e., the floor above basement, crawlspace, or enclosure floor) is: ______ ☐ feet ☐ meters ☐ above the LAG

H2. Is all Machinery and Equipment servicing the building (as listed in Item H2 instructions) elevated to or above the floor indicated by the H2 arrow (shown in the Foundation Type Diagrams at end of Section H instructions) for the appropriate Building Diagram?
☐ Yes ☐ No

SECTION I – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and H must sign here. *The statements in Sections A, B, and H are correct to the best of my knowledge.* **Note:** If the local floodplain management official completed Section H, they should indicate in Item G2.b and sign Section G.

☐ Check here if attachments are provided (including required photos) and describe each attachment in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: ______ Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	**FOR INSURANCE COMPANY USE**
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ____ Company NAIC Number: ____

Instructions: Insert below at least two and when possible four photographs showing each side of the building (for example, may only be able to take front and back pictures of townhouses/rowhouses). Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." Photographs must show the foundation. When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo One

Photo One Caption: Clear Photo One

Photo Two

Photo Two Caption: Clear Photo Two

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

Continuation Page

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number:
	Company NAIC Number:

Insert the third and fourth photographs below. Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo Three

Photo Three Caption: Clear Photo Three

Photo Four

Photo Four Caption: Clear Photo Four

ICC EVALUATION SERVICE

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ICC-ES Evaluation Report

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ESR-2074

Reissued 02/2021
Revised 04/2021
This report is subject to renewal 02/2023.

DIVISION: 08 00 00—OPENINGS
SECTION: 08 95 43—VENTS/FOUNDATION FLOOD VENTS

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514 FLOOD VENT SEALING KIT #1540-526

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

A Subsidiary of INTERNATIONAL CODE COUNCIL®

ICC EVALUATION SERVICE®

ICC-ES Evaluation Report

ESR-2074

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012, 2009 and 2006 *International Building Code®* (IBC)
- 2021, 2018, 2015, 2012, 2009 and 2006 *International Residential Code®* (IRC)
- 2021, 2018 *International Energy Conservation Code®* (IECC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Physical operation
- Water flow

2.0 USES

The Smart Vent® units are engineered mechanically operated flood vents (FVs) employed to equalize hydrostatic pressure on walls of enclosures subject to rising or falling flood waters. Certain models also allow natural ventilation.

3.0 DESCRIPTION

3.1 General:

When subjected to rising water, the Smart Vent® FVs internal floats are activated, then pivot open to allow flow in either direction to equalize water level and hydrostatic pressure from one side of the foundation to the other. The FV pivoting door is normally held in the closed position by a buoyant release device. When subjected to rising water, the buoyant release device causes the unit to unlatch, allowing the door to rotate out of the way and allow flow. The water level stabilizes, equalizing the lateral forces. Each unit is fabricated from stainless steel. Smart Vent® Automatic Foundation Flood Vents are available in various models and sizes as described in Table 1. The SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 units each contain two vertically arranged openings per unit.

3.2 Engineered Opening:

The FVs comply with the design principle noted in Section 2.7.2.2 and Section 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)] for a maximum rate of rise and fall of 5.0 feet per hour (0.423 mm/s). In order to comply with the engineered opening requirement of ASCE/SEI 24, Smart Vent FVs must be installed in accordance with Section 4.0.

3.3 Ventilation:

The SmartVENT® Model #1540-510 and SmartVENT® Overhead Door Model #1540-514 both have screen covers with $^1/_4$-inch-by-$^1/_4$-inch (6.35 by 6.35 mm) openings, yielding 51 square inches (32 903 mm^2) of net free area to supply natural ventilation. The SmartVENT® Stacking Model #1540-511 consists of two Model #1540-510 units in one assembly, and provides 102 square inches (65 806 mm^2) of net free area to supply natural ventilation. Other FVs described in this report do not offer natural ventilation.

3.4 Flood Vent Sealing Kit:

The Flood Vent Sealing Kit Model #1540-526 is used with SmartVENT® Model #1540-520. It is a Homasote 440 Sound Barrier® (ESR-1374) insert with 21 – 2-inch-by-2-inch (51 mm x 51 mm) squares cut in it. See Figure 4.

4.0 DESIGN AND INSTALLATION

4.1 SmartVENT® and FloodVENT®:

SmartVENT® and FloodVENT® are designed to be installed into walls or overhead doors of existing or new construction from the exterior side. Installation of the vents must be in accordance with the manufacturer's instructions, the applicable code and this report. Installation clips allow mounting in masonry and concrete walls of any thickness. In order to comply with the engineered opening design principle noted in Section 2.7.2.2 and 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)], the Smart Vent® FVs must be installed as follows:

- With a minimum of two openings on different sides of each enclosed area.

- With a minimum of one FV for every 200 square feet (18.6 m^2) of enclosed area, except that the SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 must be installed with a minimum of one FV for every 400 square feet (37.2 m^2) of enclosed area.
- Below the base flood elevation.
- With the bottom of the FV located a maximum of 12 inches (305.4 mm) above the higher of the final grade or floor and finished exterior grade immediately under each opening.

4.2 Flood Vent Sealing Kit

The Flood Vent Sealing Kit Model 1540-526 is used in conjunction with FloodVENT® Model #1540-520. When installed and tested in accordance with ASTM E283, the FV and Flood Vent Sealing Kit assembly have an air leakage rate of less than 0.2 cubic feet per minute per lineal foot (18.56 l/min per lineal meter) at a pressure differential of 1 pound per square foot (50 Pa) based on 12.58 lineal feet (3.8 lineal meters) contained by the Flood Vent Sealing Kit.

5.0 CONDITIONS OF USE

The Smart Vent® FVs described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The Smart Vent® FVs must be installed in accordance with this report, the applicable code and the manufacturer's installation instructions. In the event of a conflict, the instructions in this report govern.

5.2 The Smart Vent® FVs must not be used in the place of "breakaway walls" in coastal high hazard areas, but are permitted for use in conjunction with breakaway walls in other areas.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Mechanically Operated Flood Vents (AC364), dated August 2015 (editorially revised February 2021).

6.2 Test report on air infiltration in accordance with ASTM E283.

7.0 IDENTIFICATION

7.1 The Smart VENT® models and the Flood Vent Sealing Kit described in this report must be identified by a label bearing the manufacturer's name (Smartvent Products, Inc.), the model number, and the evaluation report number (ESR-2074).

7.2 The report holder's contact information is the following:

SMART VENT PRODUCTS, INC.
430 ANDBRO DRIVE, UNIT 1
PITMAN, NEW JERSEY 08071
(877) 441-8368
www.smartvent.com
info@smartvent.com

TABLE 1—MODEL SIZES

MODEL NAME	MODEL NUMBER	MODEL SIZE (in.)	COVERAGE (sq. ft.)
FloodVENT®	1540-520	$15^3/_4$" X $7^3/_4$"	200
SmartVENT®	1540-510	$15^3/_4$" X $7^3/_4$"	200
FloodVENT® Overhead Door	1540-524	$15^3/_4$" X $7^3/_4$"	200
SmartVENT® Overhead Door	1540-514	$15^3/_4$" X $7^3/_4$"	200
Wood Wall FloodVENT®	1540-570	14" X $8^3/_4$"	200
Wood Wall FloodVENT® Overhead Door	1540-574	14" X $8^3/_4$"	200
SmartVENT® Stacker	1540-511	16" X 16"	400
FloodVent® Stacker	1540-521	16" X 16"	400

For **SI:** 1 inch = 25.4 mm; 1 square foot = m^2

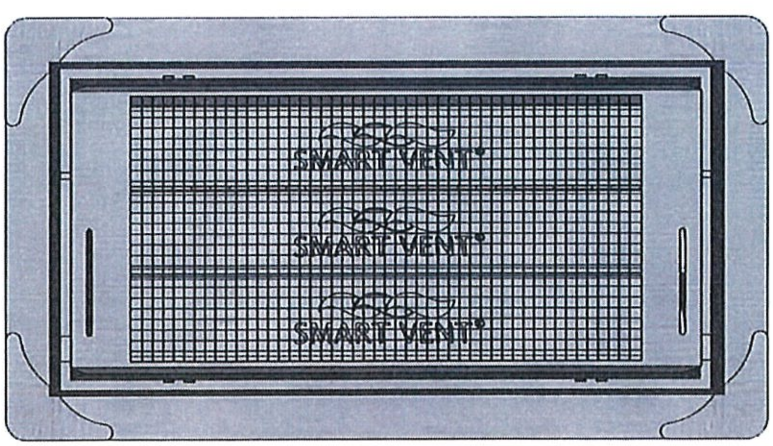


FIGURE 1—SMART VENT: MODEL 1540-510

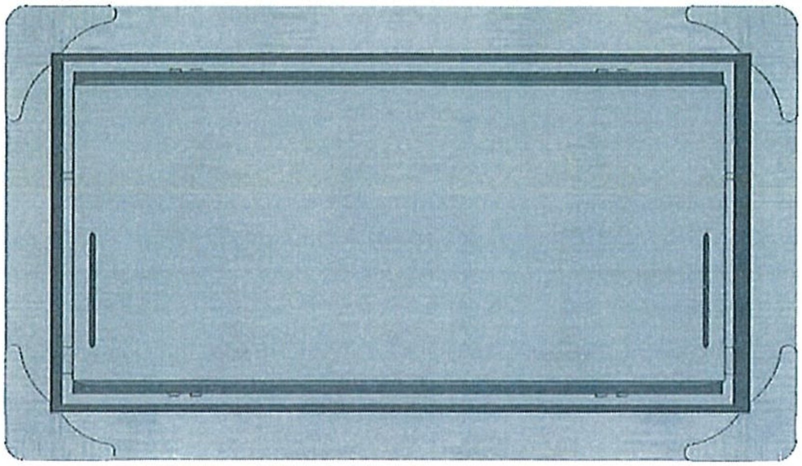


FIGURE 2—SMART VENT MODEL 1540-520

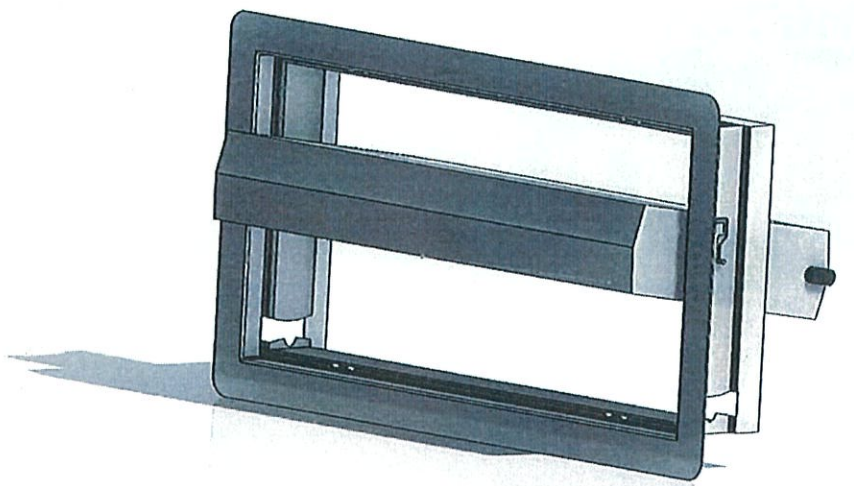


FIGURE 3—SMART VENT: SHOWN WITH FLOOD DOOR PIVOTED OPEN

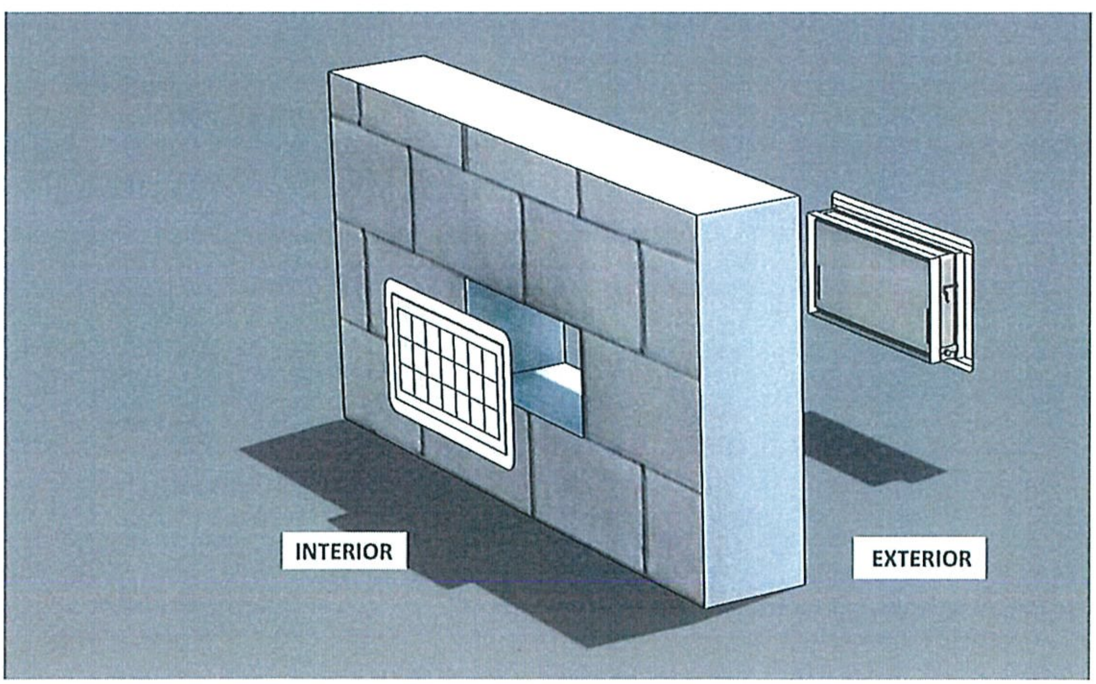


FIGURE 4—FLOOD VENT SEALING KIT

ICC-ES Evaluation Report

ESR-2074 CBC and CRC Supplement

Reissued February 2021

Revised April 2021

This report is subject to renewal February 2023.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with codes noted below.

Applicable code editions:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with 2019 CBC Chapter 12, provided the design and installation are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 12 and 16 , as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the 2019 CRC, provided the design and installation are in accordance with the 2018 *International Residential Code®* (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

ICC-ES Evaluation Report

ESR-2074 FBC Supplement

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the *Florida Building Code—Building* and the *Florida Building Code-Residential* , provided the design requirements are determined in accordance with the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2074 for 2018 *International Building Code®* meet the requirements of the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable.

Use of the Smart Vent® Automatic Foundation Flood Vents has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* .

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

SMART VENT® - Model: 1540-510

ICC ES™

Dual Function SMART VENT®

Superior Flood Protection and Natural Air Ventilation

ICC-ES Evaluated and FEMA Accepted Foundation Flood Vents

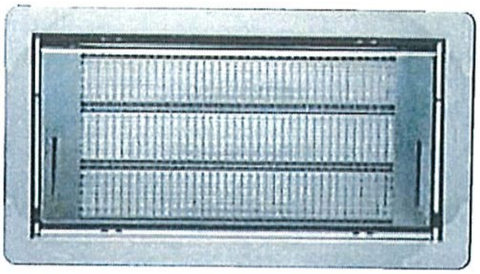
- Potential savings on homeowner's NFIP premiums
- Preserves aesthetic beauty of a home by requiring 2/3 less vents
- Each vent certified to protect 200 sq. ft. of your home
- Code Compliant, FEMA accepted, ICC-ES Evaluated
- All Stainless Steel construction meets or exceeds flood and corrosion resistance code requirements
- Patented automatic floats release bi-directional flood door
- Temperature controlled louvers automatically open in warm weather and close in cold weather

One 16" x 8" vent is certified to cover 200 square feet of enclosed area for flood protection and 51 square inches for ventilation

SMART VENT® models are certified to provide flood protection and ventilation. This model is used for a home with a crawl space or any enclosed area that desires natural air ventilation and flood protection. All stainless steel construction resists weather and pest.

SMART VENT

www.smartvent.com • 877-441-8368



Model #:	1540-510
Installation Type:	Masonry Wall
Style:	louvered
Dimensions:	16" x 8"
Rough Opening:	16¼" x 8¼" (one block, or CMU)
Finish:	Stainless Steel *(Standard)*

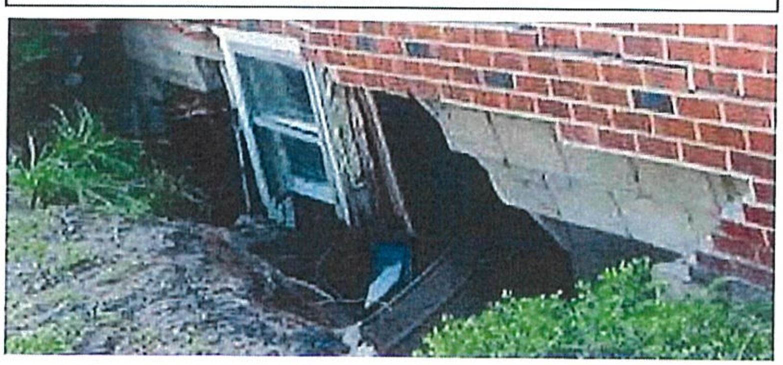
Available Powder Coat Colors For Special Order:

White Wheat Gray Black Stainless (standard)

Optional Accessories:
Fire Damper, Interior Trim Flange & Inner Sleeve, Rain Shield

Other Models Available: Insulated FLOOD VENT, Overhead Garage Door Model, Stacked and Quad Configurations, Models for Wood Studded Wall Applications and Pour in Place Buck Systems.

There's more online at www.smartvent.com
Dealer Locator, Installer Locator, Cad Drawings, Installation Instructions, Technical Specifications, Frequently Asked Questions, Videos, Testimonials, Resource Library Database, Insurance Forms.



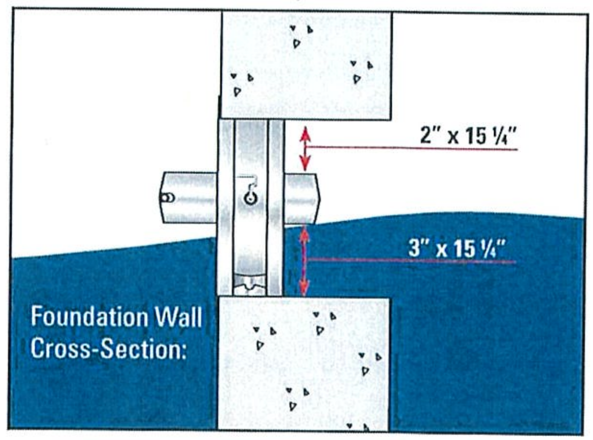
Rapidly rising floodwater can put extreme pressure on the foundation walls causing improperly vented structures to buckle and collapse. SMART VENTS® quickly and efficiently equalize the pressure and minimize damage.

How it works:

Flood Protection: The SMART VENT® door is latched closed until flood water enters. Entering flood water lifts the patented internal floats which unlatches and rotates the door open. This allows the flood water to automatically enter and exit through the frame opening, relieving the pressure from your foundation walls.

Ventilation: A bimetal coil (like a thermostat, no electricity is needed) automatically opens and closes the ventilation louvers as temperature changes. They will be closed when it is freezing outside and open when it is warm outside to provide natural ventilation.

Important note: SMART VENT® does not rely on the louvers to let floodwater in and out. Regardless of the louvers' position, opened or closed, when floodwater flows into the door, the internal floats release the door to rotate open to relieve the hydrostatic pressure. The louvers and pest screen are rotated out of the path of the floodwater. The temperature-controlled louvers are for ventilation purposes only.



How does one SMART VENT® provide so much coverage?

You may have heard that FEMA requires that flood openings provide one square inch of opening per one square foot of enclosed area, referring to dimensions of the opening in proportion to the space to be vented. This is only partially correct. FEMA's regulations and guidelines do state that a non-engineered flood vent solution must (among other requirements) provide one square inch of opening per square foot of enclosed area to be vented. However; all SMART VENT® products are ICC-ES certified engineered openings. They have been designed, engineered, tested, rated, and certified to provide flood relief so efficiently that only one unit is needed for 200 square feet of enclosed area. It would be our pleasure to contact your code official, surveyor, or insurance agent if they require more information.

National Flood Insurance Program

Elevation Certificate

and Instructions

2023 EDITION

UNIT 3

FEMA

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE AND INSTRUCTIONS

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this data collection is estimated to average 3.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and submitting this form. You are not required to respond to this collection of information unless a valid OMB control number is displayed on this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing the burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20742, Paperwork Reduction Project (1660-0008). **NOTE: Do not send your completed form to this address.**

PRIVACY ACT STATEMENT

Authority: Title 44 CFR § 61.7 and 61.8.

Principal Purpose(s): This information is being collected for the primary purpose of documenting compliance with National Flood Insurance Program (NFIP) floodplain management ordinances for new or substantially improved structures in designated Special Flood Hazard Areas. This form may also be used as an optional tool for a Letter of Map Amendment (LOMA), Conditional LOMA (CLOMA), Letter of Map Revision Based on Fill (LOMR-F), or Conditional LOMR-F (CLOMR-F), or for flood insurance rating purposes in any flood zone.

Routine Use(s): The information on this form may be disclosed as generally permitted under 5 U.S.C. § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/ FEMA-003 – *National Flood Insurance Program Files System of Records Notice* 79 Fed. Reg. 28747 (May 19, 2014) and upon written request, written consent, by agreement, or as required by law.

Disclosure: The disclosure of information on this form is voluntary; however, failure to provide the information requested may impact the flood insurance premium through the NFIP. Information will only be released as permitted by law.

PURPOSE OF THE ELEVATION CERTIFICATE

The Elevation Certificate is an important administrative tool of the NFIP. It can be used to provide elevation information necessary to ensure compliance with community floodplain management ordinances, to inform the proper insurance premium, and to support a request for a LOMA, CLOMA, LOMR-F, or CLOMR-F.

The Elevation Certificate is used to document floodplain management compliance for Post-Flood Insurance Rate Map (FIRM) buildings, which are buildings constructed after publication of the FIRM, located in flood Zones A1–A30, AE, AH, AO, A (with Base Flood Elevation (BFE)), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, and A99. It may also be used to provide elevation information for Pre-FIRM buildings or buildings in any flood zone.

As part of the agreement for making flood insurance available in a community, the NFIP requires the community to adopt floodplain management regulations that specify minimum requirements for reducing flood losses. One such requirement is for the community to obtain the elevation of the lowest floor (including basement) of all new and substantially improved buildings, and maintain a record of such information. The Elevation Certificate provides a way for a community to document compliance with the community's floodplain management ordinance.

Use of this certificate does not provide a waiver of the flood insurance purchase requirement. Only a LOMA or LOMR-F from the Federal Emergency Management Agency (FEMA) can amend the FIRM and remove the federal mandate for a lending institution to require the purchase of flood insurance. However, the lending institution has the option of requiring flood insurance even if a LOMA/LOMR-F has been issued by FEMA. The Elevation Certificate may be used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. Lowest Adjacent Grade (LAG) elevations certified by a land surveyor, engineer, or architect, as authorized by state law, will be required if the certificate is used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. A LOMA, CLOMA, LOMR-F, or CLOMR-F request must be submitted with either a completed FEMA MT-EZ or MT-1 application package, whichever is appropriate. If the certificate will only be completed to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request, there is an option to document the certified LAG elevation on the Elevation Form included in the MT-EZ and MT-1 application.

This certificate is used only to certify building elevations. A separate certificate is required for floodproofing. Under the NFIP, non-residential buildings can be floodproofed up to or above the BFE. A floodproofed building is a building that has been designed and constructed to be watertight (substantially impermeable to floodwaters) below the BFE. Floodproofing of residential buildings is not permitted under the NFIP unless FEMA has granted the community an exception for residential floodproofed basements. The community must adopt standards for design and construction of floodproofed basements before FEMA will grant a basement exception. For both floodproofed non-residential buildings and residential floodproofed basements in communities that have been granted an exception by FEMA, a floodproofing certificate is required.

The expiration date on the form herein does not apply to certified and completed Elevation Certificates, as a completed Elevation Certificate does not expire, unless there is a physical change to the building that invalidates information in Section A Items A8 or A9, Section C, Section E, or Section H. In addition, this form is intended for the specific building referenced in Section A and is not invalidated by the transfer of building ownership.

Additional guidance can be found in FEMA Publication 467-1, *Floodplain Management Bulletin: Elevation Certificate.*

OMB Control No. 1660-0008
Expiration Date: 06/30/2026

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION

FOR INSURANCE COMPANY USE

Policy Number:

Company NAIC Number:

A1. Building Owner's Name: Arthur Robert Taylor

A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address

City: Pacific City State: OR ZIP Code: 97135

A3. Property Description (e.g., Lot and Block Numbers or Legal Description) and/or Tax Parcel Number:
Tax Lot 1601, Map 04S10W19CA / Document No. 2017-02965, Tillamook County Records

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.): Residential

A5. Latitude/Longitude: Lat. 45°12'22.45" N Long. 123°57'37.75" W Horiz. Datum: ☐ NAD 1927 ☒ NAD 1983 ☐ WGS 84

A6. Attach at least two and when possible four clear color photographs (one for each side) of the building (see Form pages 7 and 8).

A7. Building Diagram Number: 6

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s): 318 sq. ft.

b) Is there at least one permanent flood opening on two different sides of each enclosed area? ☒ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade:
Non-engineered flood openings: 0 Engineered flood openings: 6

d) Total net open area of non-engineered flood openings in A8.c: 0 sq. in.

e) Total rated area of engineered flood openings in A8.c (attach documentation – see Instructions): 1200 sq. ft.

f) Sum of A8.d and A8.e rated area (if applicable – see Instructions): 1200 sq. ft.

A9. For a building with an attached garage:

a) Square footage of attached garage: n/a sq. ft.

b) Is there at least one permanent flood opening on two different sides of the attached garage? ☐ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade:
Non-engineered flood openings: ______ Engineered flood openings: ______

d) Total net open area of non-engineered flood openings in A9.c: ______ sq. in.

e) Total rated area of engineered flood openings in A9.c (attach documentation – see Instructions): ______ sq. ft.

f) Sum of A9.d and A9.e rated area (if applicable – see Instructions): ______ sq. ft.

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1.a. NFIP Community Name: Tillamook County B1.b. NFIP Community Identification Number: 410196

B2. County Name: Tillamook County B3. State: OR B4. Map/Panel No.: 41057C/0855 B5. Suffix: F

B6. FIRM Index Date: 09/28/2018 B7. FIRM Panel Effective/Revised Date: 09/28/2018

B8. Flood Zone(s): AE B9. Base Flood Elevation(s) (BFE) (Zone AO, use Base Flood Depth): 18.4'

B10. Indicate the source of the BFE data or Base Flood Depth entered in Item B9:
☐ FIS ☒ FIRM ☐ Community Determined ☐ Other:

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source:

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No
Designation Date: ______ ☐ CBRS ☐ OPA

B13. Is the building located seaward of the Limit of Moderate Wave Action (LiMWA)? ☐ Yes ☒ No

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address

City: Pacific City State: OR ZIP Code: 97135

FOR INSURANCE COMPANY USE

Policy Number:

Company NAIC Number:

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☒ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction

*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, AO, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, A99. Complete Items C2.a–h below according to the Building Diagram specified in Item A7. In Puerto Rico only, enter meters.

Benchmark Utilized: GPS - See Section D Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.

☐ NGVD 1929 ☒ NAVD 1988 ☐ Other:

Datum used for building elevations must be the same as that used for the BFE. Conversion factor used? ☐ Yes ☒ No

If Yes, describe the source of the conversion factor in the Section D Comments area.

Check the measurement used:

Item	Elevation	Feet	Meters
a) Top of bottom floor (including basement, crawlspace, or enclosure floor):	12.0	☒	☐
b) Top of the next higher floor (see Instructions):	21.4	☒	☐
c) Bottom of the lowest horizontal structural member (see Instructions):	n/a	☐	☐
d) Attached garage (top of slab):	n/a	☐	☐
e) Lowest elevation of Machinery and Equipment (M&E) servicing the building (describe type of M&E and location in Section D Comments area):		☐	☐
f) Lowest Adjacent Grade (LAG) next to building: ☒ Natural ☐ Finished	11.9	☒	☐
g) Highest Adjacent Grade (HAG) next to building: ☒ Natural ☐ Finished	12.0	☒	☐
h) Finished LAG at lowest elevation of attached deck or stairs, including structural support:	12.0	☒	☐

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by state law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

Were latitude and longitude in Section A provided by a licensed land surveyor? ☐ Yes ☐ No

☐ Check here if attachments and describe in the Comments area.

SIGNED ON: 5-28-2025

Certifier's Name: James B. Brown License Number: 60379

Title: Professional Land Surveyor

Company Name: Centerline Concepts Land Surveying, Inc.

Address: 19376 Molalla Avenue, Suite 120

City: Oregon City State: OR ZIP Code: 97045

Telephone: (503) 650-0188 Ext.: Email: jamesb@centerlineconcepts.com

Signature: Date: 5-28-2025

REGISTERED PROFESSIONAL LAND SURVEYOR

OREGON NOVEMBER 30, 2007 JAMES BURTON BROWN 60379

EXPIRES: 12-31-2025

Place Seal Here

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including source of conversion factor in C2; type of equipment and location per C2.e; and description of any attachments):

--Benchmark utilized in section C2 is based on static GPS observations post-processed by OPUS.

--This is a Pre-Construction Elevation certificate for proposed Unit 3

--Engineered Flood Vent in A8e is a Smart Vent Model 1540-510. 1 vent rated 200 sf

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ______ Company NAIC Number: ______

SECTION E – BUILDING MEASUREMENT INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO, ZONE AR/AO, AND ZONE A (WITHOUT BFE)

For Zones AO, AR/AO, and A (without BFE), complete Items E1–E5. For Items E1–E4, use natural grade, if available. If the Certificate is intended to support a Letter of Map Change request, complete Sections A, B, and C. Check the measurement used. In Puerto Rico only, enter meters.

Building measurements are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction

*A new Elevation Certificate will be required when construction of the building is complete.

E1. Provide measurements (C.2.a in applicable Building Diagram) for the following and check the appropriate boxes to show whether the measurement is above or below the natural HAG and the LAG.

a) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the LAG.

E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (C2.b in applicable Building Diagram) of the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E3. Attached garage (top of slab) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without BFE) or Zone AO must sign here. *The statements in Sections A, B, and E are correct to the best of my knowledge*

☐ Check here if attachments and describe in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ____ Company NAIC Number: ____

SECTION G – COMMUNITY INFORMATION (RECOMMENDED FOR COMMUNITY OFFICIAL COMPLETION)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Section A, B, C, E, G, or H of this Elevation Certificate. Complete the applicable item(s) and sign below when:

G1. ☐ The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by state law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)

G2.a. ☐ A local official completed Section E for a building located in Zone A (without a BFE), Zone AO, or Zone AR/AO, or when item E5 is completed for a building located in Zone AO.

G2.b. ☐ A local official completed Section H for insurance purposes.

G3. ☐ In the Comments area of Section G, the local official describes specific corrections to the information in Sections A, B, E and H.

G4. ☐ The following information (Items G5–G11) is provided for community floodplain management purposes.

G5. Permit Number: ____ G6. Date Permit Issued: ____

G7. Date Certificate of Compliance/Occupancy Issued: ____

G8. This permit has been issued for: ☐ New Construction ☐ Substantial Improvement

G9.a. Elevation of as-built lowest floor (including basement) of the building: ____ ☐ feet ☐ meters Datum: ____

G9.b. Elevation of bottom of as-built lowest horizontal structural member: ____ ☐ feet ☐ meters Datum: ____

G10.a. BFE (or depth in Zone AO) of flooding at the building site: ____ ☐ feet ☐ meters Datum: ____

G10.b. Community's minimum elevation (or depth in Zone AO) requirement for the lowest floor or lowest horizontal structural member: ____ ☐ feet ☐ meters Datum: ____

G11. Variance issued? ☐ Yes ☐ No If yes, attach documentation and describe in the Comments area.

The local official who provides information in Section G must sign here. *I have completed the information in Section G and certify that it is correct to the best of my knowledge. If applicable, I have also provided specific corrections in the Comments area of this section.*

Local Official's Name: ____ Title: ____

NFIP Community Name: ____

Telephone: ____ Ext.: ____ Email: ____

Address: ____

City: ____ State: ____ ZIP Code: ____

Signature: ____ Date: ____

Comments (including type of equipment and location, per C2.e; description of any attachments; and corrections to specific information in Sections A, B, D, E, or H):

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ______ Company NAIC Number: ______

SECTION H – BUILDING'S FIRST FLOOR HEIGHT INFORMATION FOR ALL ZONES (SURVEY NOT REQUIRED) (FOR INSURANCE PURPOSES ONLY)

The property owner, owner's authorized representative, or local floodplain management official may complete Section H for all flood zones to determine the building's first floor height for insurance purposes. Sections A, B, and I must also be completed. Enter heights to the nearest tenth of a foot (nearest tenth of a meter in Puerto Rico). *Reference the Foundation Type Diagrams (at the end of Section H Instructions) and the appropriate Building Diagrams (at the end of Section I Instructions) to complete this section.*

H1. Provide the height of the top of the floor (as indicated in Foundation Type Diagrams) above the Lowest Adjacent Grade (LAG):

a) **For Building Diagrams 1A, 1B, 3, and 5–8.** Top of bottom floor (include above-grade floors only for buildings with crawlspaces or enclosure floors) is: ______ ☐ feet ☐ meters ☐ above the LAG

b) **For Building Diagrams 2A, 2B, 4, and 6–9.** Top of next higher floor (i.e., the floor above basement, crawlspace, or enclosure floor) is: ______ ☐ feet ☐ meters ☐ above the LAG

H2. Is all Machinery and Equipment servicing the building (as listed in Item H2 instructions) elevated to or above the floor indicated by the H2 arrow (shown in the Foundation Type Diagrams at end of Section H instructions) for the appropriate Building Diagram?
☐ Yes ☐ No

SECTION I – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and H must sign here. *The statements in Sections A, B, and H are correct to the best of my knowledge.* Note: If the local floodplain management official completed Section H, they should indicate in Item G2.b and sign Section G.

☐ Check here if attachments are provided (including required photos) and describe each attachment in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: ______ Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ____ Company NAIC Number: ____

Instructions: Insert below at least two and when possible four photographs showing each side of the building (for example, may only be able to take front and back pictures of townhouses/rowhouses). Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." Photographs must show the foundation. When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo One

Photo One Caption: Clear Photo One

Photo Two

Photo Two Caption: Clear Photo Two

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

Continuation Page

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number:
	Company NAIC Number:

Insert the third and fourth photographs below. Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo Three

Photo Three Caption:

Clear Photo Three

Photo Four

Photo Four Caption:

Clear Photo Four

ICC EVALUATION SERVICE

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ICC-ES Evaluation Report

ESR-2074

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Reissued 02/2021
Revised 04/2021
This report is subject to renewal 02/2023.

DIVISION: 08 00 00—OPENINGS
SECTION: 08 95 43—VENTS/FOUNDATION FLOOD VENTS

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514 FLOOD VENT SEALING KIT #1540-526

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

A Subsidiary of INTERNATIONAL CODE COUNCIL

ES ICC EVALUATION SERVICE®

ICC-ES Evaluation Report

ESR-2074

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514 FLOOD VENT SEALING KIT #1540-526

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2021, 2018, 2015, 2012, 2009 and 2006 *International Residential Code*® (IRC)
- 2021, 2018 *International Energy Conservation Code*® (IECC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Physical operation
- Water flow

2.0 USES

The Smart Vent® units are engineered mechanically operated flood vents (FVs) employed to equalize hydrostatic pressure on walls of enclosures subject to rising or falling flood waters. Certain models also allow natural ventilation.

3.0 DESCRIPTION

3.1 General:

When subjected to rising water, the Smart Vent® FVs internal floats are activated, then pivot open to allow flow in either direction to equalize water level and hydrostatic pressure from one side of the foundation to the other. The FV pivoting door is normally held in the closed position by a buoyant release device. When subjected to rising water, the buoyant release device causes the unit to unlatch, allowing the door to rotate out of the way and allow flow. The water level stabilizes, equalizing the lateral forces. Each unit is fabricated from stainless steel. Smart Vent® Automatic Foundation Flood Vents are available in various models and sizes as described in Table 1. The SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 units each contain two vertically arranged openings per unit.

3.2 Engineered Opening:

The FVs comply with the design principle noted in Section 2.7.2.2 and Section 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)] for a maximum rate of rise and fall of 5.0 feet per hour (0.423 mm/s). In order to comply with the engineered opening requirement of ASCE/SEI 24, Smart Vent FVs must be installed in accordance with Section 4.0.

3.3 Ventilation:

The SmartVENT® Model #1540-510 and SmartVENT® Overhead Door Model #1540-514 both have screen covers with $^{1}/_{4}$-inch-by-$^{1}/_{4}$-inch (6.35 by 6.35 mm) openings, yielding 51 square inches (32 903 mm^2) of net free area to supply natural ventilation. The SmartVENT® Stacking Model #1540-511 consists of two Model #1540-510 units in one assembly, and provides 102 square inches (65 806 mm^2) of net free area to supply natural ventilation. Other FVs described in this report do not offer natural ventilation.

3.4 Flood Vent Sealing Kit:

The Flood Vent Sealing Kit Model #1540-526 is used with SmartVENT® Model #1540-520. It is a Homasote 440 Sound Barrier® (ESR-1374) insert with 21 – 2-inch-by-2-inch (51 mm x 51 mm) squares cut in it. See Figure 4.

4.0 DESIGN AND INSTALLATION

4.1 SmartVENT® and FloodVENT®:

SmartVENT® and FloodVENT® are designed to be installed into walls or overhead doors of existing or new construction from the exterior side. Installation of the vents must be in accordance with the manufacturer's instructions, the applicable code and this report. Installation clips allow mounting in masonry and concrete walls of any thickness. In order to comply with the engineered opening design principle noted in Section 2.7.2.2 and 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)], the Smart Vent® FVs must be installed as follows:

- With a minimum of two openings on different sides of each enclosed area.

- With a minimum of one FV for every 200 square feet (18.6 m^2) of enclosed area, except that the SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 must be installed with a minimum of one FV for every 400 square feet (37.2 m^2) of enclosed area.
- Below the base flood elevation.
- With the bottom of the FV located a maximum of 12 inches (305.4 mm) above the higher of the final grade or floor and finished exterior grade immediately under each opening.

4.2 Flood Vent Sealing Kit

The Flood Vent Sealing Kit Model 1540-526 is used in conjunction with FloodVENT® Model #1540-520. When installed and tested in accordance with ASTM E283, the FV and Flood Vent Sealing Kit assembly have an air leakage rate of less than 0.2 cubic feet per minute per lineal foot (18.56 l/min per lineal meter) at a pressure differential of 1 pound per square foot (50 Pa) based on 12.58 lineal feet (3.8 lineal meters) contained by the Flood Vent Sealing Kit.

5.0 CONDITIONS OF USE

The Smart Vent® FVs described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The Smart Vent® FVs must be installed in accordance with this report, the applicable code and the manufacturer's installation instructions. In the event of a conflict, the instructions in this report govern.

5.2 The Smart Vent® FVs must not be used in the place of "breakaway walls" in coastal high hazard areas, but are permitted for use in conjunction with breakaway walls in other areas.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Mechanically Operated Flood Vents (AC364), dated August 2015 (editorially revised February 2021).

6.2 Test report on air infiltration in accordance with ASTM E283.

7.0 IDENTIFICATION

7.1 The Smart VENT® models and the Flood Vent Sealing Kit described in this report must be identified by a label bearing the manufacturer's name (Smartvent Products, Inc.), the model number, and the evaluation report number (ESR-2074).

7.2 The report holder's contact information is the following:

SMART VENT PRODUCTS, INC.
430 ANDBRO DRIVE, UNIT 1
PITMAN, NEW JERSEY 08071
(877) 441-8368
www.smartvent.com
info@smartvent.com

TABLE 1—MODEL SIZES

MODEL NAME	MODEL NUMBER	MODEL SIZE (in.)	COVERAGE (sq. ft.)
FloodVENT®	1540-520	15$^3/_4$" X 7$^3/_4$"	200
SmartVENT®	1540-510	15$^3/_4$" X 7$^3/_4$"	200
FloodVENT® Overhead Door	1540-524	15$^3/_4$" X 7$^3/_4$"	200
SmartVENT® Overhead Door	1540-514	15$^3/_4$" X 7$^3/_4$"	200
Wood Wall FloodVENT®	1540-570	14" X 8$^3/_4$"	200
Wood Wall FloodVENT® Overhead Door	1540-574	14" X 8$^3/_4$"	200
SmartVENT® Stacker	1540-511	16" X 16"	400
FloodVent® Stacker	1540-521	16" X 16"	400

For SI: 1 inch = 25.4 mm; 1 square foot = m^2

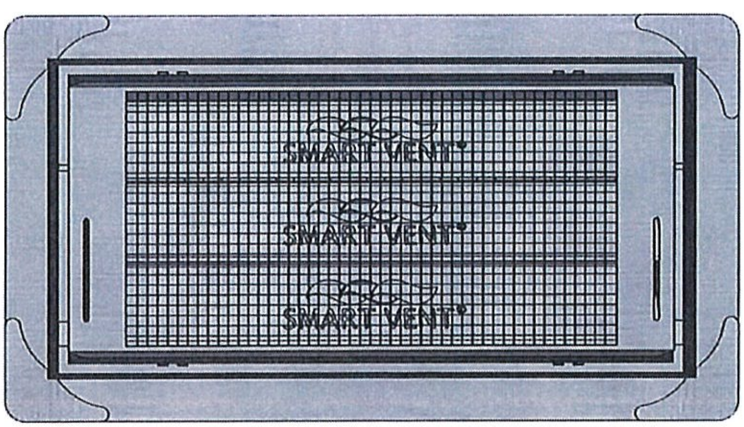

FIGURE 1—SMART VENT: MODEL 1540-510

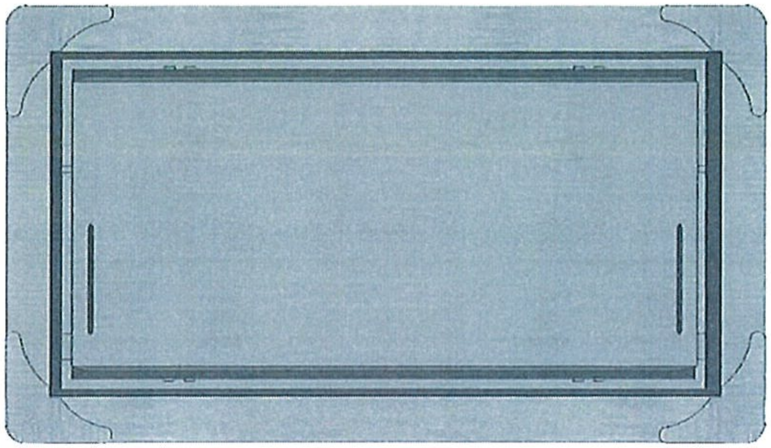

FIGURE 2—SMART VENT MODEL 1540-520

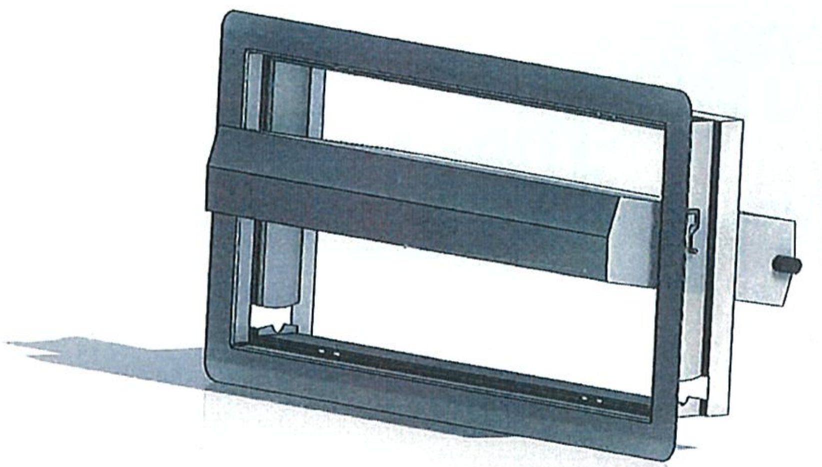

FIGURE 3—SMART VENT: SHOWN WITH FLOOD DOOR PIVOTED OPEN

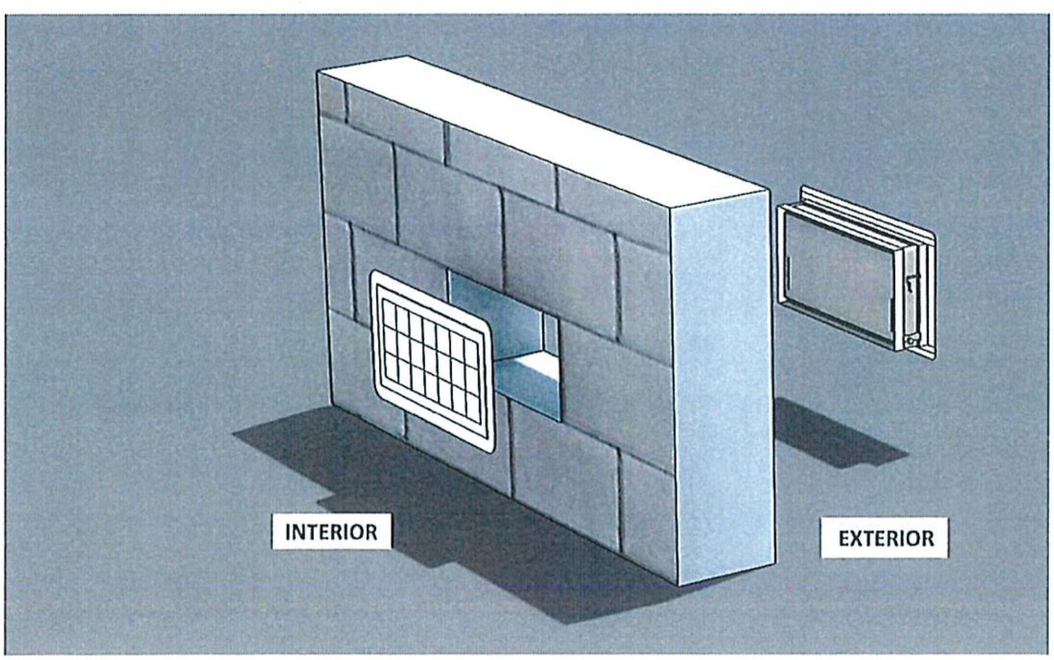

FIGURE 4—FLOOD VENT SEALING KIT

ICC-ES Evaluation Report

ESR-2074 CBC and CRC Supplement

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with codes noted below.

Applicable code editions:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with 2019 CBC Chapter 12, provided the design and installation are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 12 and 16 , as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the 2019 CRC, provided the design and installation are in accordance with the 2018 *International Residential Code®* (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

ICC-ES Evaluation Report

ESR-2074 FBC Supplement

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

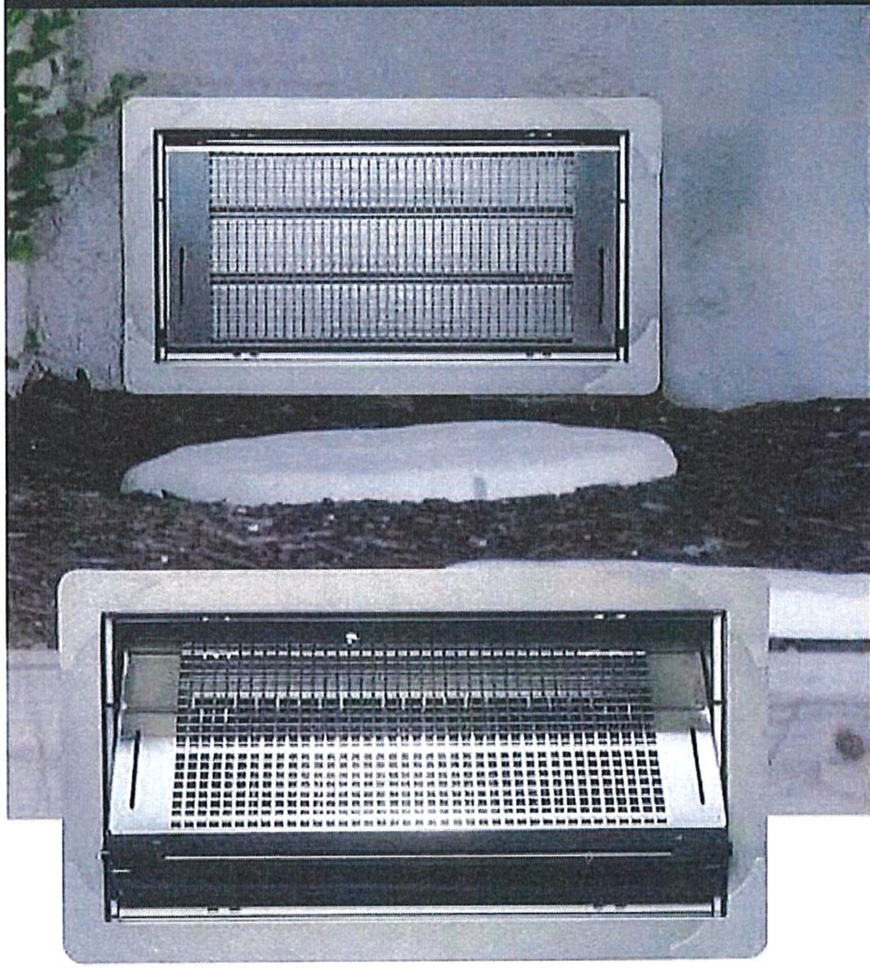
The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the *Florida Building Code—Building* and the *Florida Building Code-Residential*, provided the design requirements are determined in accordance with the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2074 for 2018 *International Building Code®* meet the requirements of the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable.

Use of the Smart Vent® Automatic Foundation Flood Vents has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential*.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

SMART VENT® - Model: 1540-510



ICC ES™

Dual Function SMART VENT®

Superior Flood Protection and Natural Air Ventilation

ICC-ES Evaluated and FEMA Accepted Foundation Flood Vents

- Potential savings on homeowner's NFIP premiums
- Preserves aesthetic beauty of a home by requiring 2/3 less vents
- Each vent certified to protect 200 sq. ft. of your home
- Code Compliant, FEMA accepted, ICC-ES Evaluated
- All Stainless Steel construction meets or exceeds flood and corrosion resistance code requirements
- Patented automatic floats release bi-directional flood door
- Temperature controlled louvers automatically open in warm weather and close in cold weather

One 16" x 8" vent is certified to cover 200 square feet of enclosed area for flood protection and 51 square inches for ventilation

SMART VENT® models are certified to provide flood protection and ventilation. This model is used for a home with a crawl space or any enclosed area that desires natural air ventilation and flood protection. All stainless steel construction resists weather and pest.

SMART VENT

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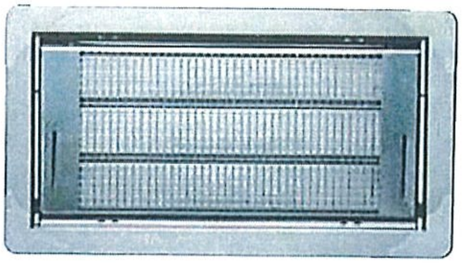


Model #:	1540-510
Installation Type:	Masonry Wall
Style:	louvered
Dimensions:	16" x 8"
Rough Opening:	16¼" x 8¼" (one block, or CMU)
Finish:	Stainless Steel *(Standard)*

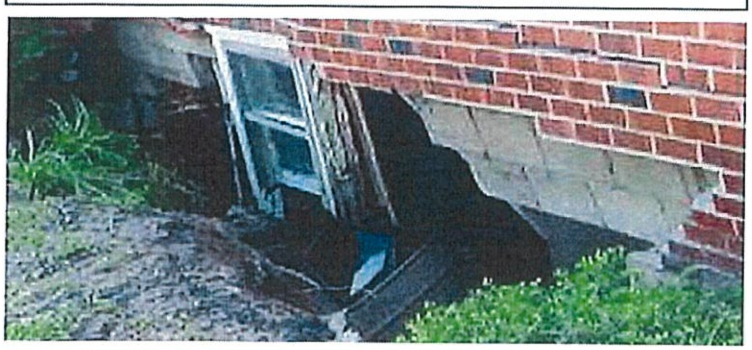
Available Powder Coat Colors For Special Order:

White Wheat Gray Black Stainless (standard)

Optional Accessories:
Fire Damper, Interior Trim Flange & Inner Sleeve, Rain Shield

Other Models Available: Insulated FLOOD VENT, Overhead Garage Door Model, Stacked and Quad Configurations, Models for Wood Studded Wall Applications and Pour in Place Buck Systems.

There's more online at www.smartvent.com
Dealer Locator, Installer Locator, Cad Drawings, Installation Instructions, Technical Specifications, Frequently Asked Questions, Videos, Testimonials, Resource Library Database, Insurance Forms.



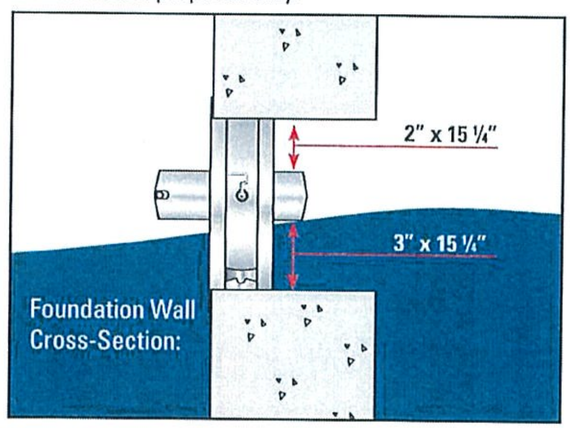
Rapidly rising floodwater can put extreme pressure on the foundation walls causing improperly vented structures to buckle and collapse. SMART VENTS® quickly and efficiently equalize the pressure and minimize damage.

How it works:

Flood Protection: The SMART VENT® door is latched closed until flood water enters. Entering flood water lifts the patented internal floats which unlatches and rotates the door open. This allows the flood water to automatically enter and exit through the frame opening, relieving the pressure from your foundation walls.

Ventilation: A bimetal coil (like a thermostat, no electricity is needed) automatically opens and closes the ventilation louvers as temperature changes. They will be closed when it is freezing outside and open when it is warm outside to provide natural ventilation.

Important note: SMART VENT® does not rely on the louvers to let floodwater in and out. Regardless of the louvers' position, opened or closed, when floodwater flows into the door, the internal floats release the door to rotate open to relieve the hydrostatic pressure. The louvers and pest screen are rotated out of the path of the floodwater. The temperature-controlled louvers are for ventilation purposes only.



How does one SMART VENT® provide so much coverage?

You may have heard that FEMA requires that flood openings provide one square inch of opening per one square foot of enclosed area, referring to dimensions of the opening in proportion to the space to be vented. This is only partially correct. FEMA's regulations and guidelines do state that a non-engineered flood vent solution must (among other requirements) provide one square inch of opening per square foot of enclosed area to be vented. However; all SMART VENT® products are ICC-ES certified engineered openings. They have been designed, engineered, tested, rated, and certified to provide flood relief so efficiently that only one unit is needed for 200 square feet of enclosed area. It would be our pleasure to contact your code official, surveyor, or insurance agent if they require more information.

National Flood Insurance Program

Elevation Certificate

and Instructions

2023 EDITION

UNIT 4

FEMA

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE AND INSTRUCTIONS

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this data collection is estimated to average 3.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and submitting this form. You are not required to respond to this collection of information unless a valid OMB control number is displayed on this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing the burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20742, Paperwork Reduction Project (1660-0008). **NOTE: Do not send your completed form to this address.**

PRIVACY ACT STATEMENT

Authority: Title 44 CFR § 61.7 and 61.8.

Principal Purpose(s): This information is being collected for the primary purpose of documenting compliance with National Flood Insurance Program (NFIP) floodplain management ordinances for new or substantially improved structures in designated Special Flood Hazard Areas. This form may also be used as an optional tool for a Letter of Map Amendment (LOMA), Conditional LOMA (CLOMA), Letter of Map Revision Based on Fill (LOMR-F), or Conditional LOMR-F (CLOMR-F), or for flood insurance rating purposes in any flood zone.

Routine Use(s): The information on this form may be disclosed as generally permitted under 5 U.S.C. § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/ FEMA-003 – *National Flood Insurance Program Files System of Records Notice* 79 Fed. Reg. 28747 (May 19, 2014) and upon written request, written consent, by agreement, or as required by law.

Disclosure: The disclosure of information on this form is voluntary; however, failure to provide the information requested may impact the flood insurance premium through the NFIP. Information will only be released as permitted by law.

PURPOSE OF THE ELEVATION CERTIFICATE

The Elevation Certificate is an important administrative tool of the NFIP. It can be used to provide elevation information necessary to ensure compliance with community floodplain management ordinances, to inform the proper insurance premium, and to support a request for a LOMA, CLOMA, LOMR-F, or CLOMR-F.

The Elevation Certificate is used to document floodplain management compliance for Post-Flood Insurance Rate Map (FIRM) buildings, which are buildings constructed after publication of the FIRM, located in flood Zones A1–A30, AE, AH, AO, A (with Base Flood Elevation (BFE)), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, and A99. It may also be used to provide elevation information for Pre-FIRM buildings or buildings in any flood zone.

As part of the agreement for making flood insurance available in a community, the NFIP requires the community to adopt floodplain management regulations that specify minimum requirements for reducing flood losses. One such requirement is for the community to obtain the elevation of the lowest floor (including basement) of all new and substantially improved buildings, and maintain a record of such information. The Elevation Certificate provides a way for a community to document compliance with the community's floodplain management ordinance.

Use of this certificate does not provide a waiver of the flood insurance purchase requirement. Only a LOMA or LOMR-F from the Federal Emergency Management Agency (FEMA) can amend the FIRM and remove the federal mandate for a lending institution to require the purchase of flood insurance. However, the lending institution has the option of requiring flood insurance even if a LOMA/LOMR-F has been issued by FEMA. The Elevation Certificate may be used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. Lowest Adjacent Grade (LAG) elevations certified by a land surveyor, engineer, or architect, as authorized by state law, will be required if the certificate is used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. A LOMA, CLOMA, LOMR-F, or CLOMR-F request must be submitted with either a completed FEMA MT-EZ or MT-1 application package, whichever is appropriate. If the certificate will only be completed to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request, there is an option to document the certified LAG elevation on the Elevation Form included in the MT-EZ and MT-1 application.

This certificate is used only to certify building elevations. A separate certificate is required for floodproofing. Under the NFIP, non-residential buildings can be floodproofed up to or above the BFE. A floodproofed building is a building that has been designed and constructed to be watertight (substantially impermeable to floodwaters) below the BFE. Floodproofing of residential buildings is not permitted under the NFIP unless FEMA has granted the community an exception for residential floodproofed basements. The community must adopt standards for design and construction of floodproofed basements before FEMA will grant a basement exception. For both floodproofed non-residential buildings and residential floodproofed basements in communities that have been granted an exception by FEMA, a floodproofing certificate is required.

The expiration date on the form herein does not apply to certified and completed Elevation Certificates, as a completed Elevation Certificate does not expire, unless there is a physical change to the building that invalidates information in Section A Items A8 or A9, Section C, Section E, or Section H. In addition, this form is intended for the specific building referenced in Section A and is not invalidated by the transfer of building ownership.

Additional guidance can be found in FEMA Publication 467-1, *Floodplain Management Bulletin: Elevation Certificate*.

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

OMB Control No. 1660-0008
Expiration Date: 06/30/2026

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION

FOR INSURANCE COMPANY USE

Policy Number:

Company NAIC Number:

A1. Building Owner's Name: Arthur Robert Taylor

A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address

City: Pacific City State: OR ZIP Code: 97135

A3. Property Description (e.g., Lot and Block Numbers or Legal Description) and/or Tax Parcel Number: Tax Lot 1601, Map 04S10W19CA / Document No. 2017-02965, Tillamook County Records

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.): Residential

A5. Latitude/Longitude: Lat. 45°12'22.45" N Long. 123°57'37.75" W Horiz. Datum: ☐ NAD 1927 ☒ NAD 1983 ☐ WGS 84

A6. Attach at least two and when possible four clear color photographs (one for each side) of the building (see Form pages 7 and 8).

A7. Building Diagram Number: 6

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s): 318 sq. ft.

b) Is there at least one permanent flood opening on two different sides of each enclosed area? ☒ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade:
Non-engineered flood openings: 0 Engineered flood openings: 6

d) Total net open area of non-engineered flood openings in A8.c: 0 sq. in.

e) Total rated area of engineered flood openings in A8.c (attach documentation – see Instructions): 1200 sq. ft.

f) Sum of A8.d and A8.e rated area (if applicable – see Instructions): 1200 sq. ft.

A9. For a building with an attached garage:

a) Square footage of attached garage: n/a sq. ft.

b) Is there at least one permanent flood opening on two different sides of the attached garage? ☐ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade:
Non-engineered flood openings: ______ Engineered flood openings: ______

d) Total net open area of non-engineered flood openings in A9.c: ______ sq. in.

e) Total rated area of engineered flood openings in A9.c (attach documentation – see Instructions): ______ sq. ft.

f) Sum of A9.d and A9.e rated area (if applicable – see Instructions): ______ sq. ft.

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1.a. NFIP Community Name: Tillamook County B1.b. NFIP Community Identification Number: 410196

B2. County Name: Tillamook County B3. State: OR B4. Map/Panel No.: 41057C/0855 B5. Suffix: F

B6. FIRM Index Date: 09/28/2018 B7. FIRM Panel Effective/Revised Date: 09/28/2018

B8. Flood Zone(s): AE B9. Base Flood Elevation(s) (BFE) (Zone AO, use Base Flood Depth): 18.4'

B10. Indicate the source of the BFE data or Base Flood Depth entered in Item B9:
☐ FIS ☒ FIRM ☐ Community Determined ☐ Other:

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source:

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No
Designation Date: ______ ☐ CBRS ☐ OPA

B13. Is the building located seaward of the Limit of Moderate Wave Action (LiMWA)? ☐ Yes ☒ No

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ____ Company NAIC Number: ____

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☒ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, AO, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, A99. Complete Items C2.a–h below according to the Building Diagram specified in Item A7. In Puerto Rico only, enter meters.
Benchmark Utilized: GPS - See Section D Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.
☐ NGVD 1929 ☒ NAVD 1988 ☐ Other:

Datum used for building elevations must be the same as that used for the BFE. Conversion factor used? ☐ Yes ☒ No
If Yes, describe the source of the conversion factor in the Section D Comments area.

Check the measurement used:

Item	Value	feet	meters
a) Top of bottom floor (including basement, crawlspace, or enclosure floor):	12.0	☒ feet	☐ meters
b) Top of the next higher floor (see Instructions):	21.4	☒ feet	☐ meters
c) Bottom of the lowest horizontal structural member (see Instructions):	n/a	☐ feet	☐ meters
d) Attached garage (top of slab):	n/a	☐ feet	☐ meters
e) Lowest elevation of Machinery and Equipment (M&E) servicing the building (describe type of M&E and location in Section D Comments area):		☐ feet	☐ meters
f) Lowest Adjacent Grade (LAG) next to building: ☒ Natural ☐ Finished	11.8	☒ feet	☐ meters
g) Highest Adjacent Grade (HAG) next to building: ☒ Natural ☐ Finished	12.0	☒ feet	☐ meters
h) Finished LAG at lowest elevation of attached deck or stairs, including structural support:	12.0	☒ feet	☐ meters

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by state law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

Were latitude and longitude in Section A provided by a licensed land surveyor? ☐ Yes ☐ No

SIGNED ON: 5-28-2025

☐ Check here if attachments and describe in the Comments area.

Certifier's Name: James B. Brown License Number: 60379

Title: Professional Land Surveyor

Company Name: Centerline Concepts Land Surveying, Inc.

Address: 19376 Molalla Avenue, Suite 120

City: Oregon City State: OR ZIP Code: 97045

Telephone: (503) 650-0188 Ext.: Email: jamesb@centerlineconcepts.com

REGISTERED
PROFESSIONAL
LAND SURVEYOR
OREGON
NOVEMBER 30, 2007
JAMES BURTON BROWN
60379
EXPIRES: 12-31-2025

Signature: Date: 5-28-2025

Place Seal Here

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including source of conversion factor in C2; type of equipment and location per C2.e; and description of any attachments):
--Benchmark utilized in section C2 is based on static GPS observations post-processed by OPUS.
--This is a Pre-Construction Elevation certificate for proposed Unit 4
--Engineered Flood Vent in A8e is a Smart Vent Model 1540-510. 1 vent rated 200 sf

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address City: Pacific City State: OR ZIP Code: 97135	FOR INSURANCE COMPANY USE Policy Number: ______ Company NAIC Number: ______

SECTION E – BUILDING MEASUREMENT INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO, ZONE AR/AO, AND ZONE A (WITHOUT BFE)

For Zones AO, AR/AO, and A (without BFE), complete Items E1–E5. For Items E1–E4, use natural grade, if available. If the Certificate is intended to support a Letter of Map Change request, complete Sections A, B, and C. Check the measurement used. In Puerto Rico only, enter meters.

Building measurements are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

E1. Provide measurements (C.2.a in applicable Building Diagram) for the following and check the appropriate boxes to show whether the measurement is above or below the natural HAG and the LAG.

a) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the LAG.

E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (C2.b in applicable Building Diagram) of the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E3. Attached garage (top of slab) is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is: ______ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without BFE) or Zone AO must sign here. *The statements in Sections A, B, and E are correct to the best of my knowledge*

☐ Check here if attachments and describe in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ICC-ES Evaluation Report

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

ESR-2074

Reissued 02/2021
Revised 04/2021
This report is subject to renewal 02/2023.

DIVISION: 08 00 00—OPENINGS

SECTION: 08 95 43—VENTS/FOUNDATION FLOOD VENTS

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514 FLOOD VENT SEALING KIT #1540-526

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

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ICC-ES Evaluation Report

ESR-2074

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012, 2009 and 2006 *International Building Code®* (IBC)
- 2021, 2018, 2015, 2012, 2009 and 2006 *International Residential Code®* (IRC)
- 2021, 2018 *International Energy Conservation Code®* (IECC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Physical operation
- Water flow

2.0 USES

The Smart Vent® units are engineered mechanically operated flood vents (FVs) employed to equalize hydrostatic pressure on walls of enclosures subject to rising or falling flood waters. Certain models also allow natural ventilation.

3.0 DESCRIPTION

3.1 General:

When subjected to rising water, the Smart Vent® FVs internal floats are activated, then pivot open to allow flow in either direction to equalize water level and hydrostatic pressure from one side of the foundation to the other. The FV pivoting door is normally held in the closed position by a buoyant release device. When subjected to rising water, the buoyant release device causes the unit to unlatch, allowing the door to rotate out of the way and allow flow. The water level stabilizes, equalizing the lateral forces. Each unit is fabricated from stainless steel. Smart Vent® Automatic Foundation Flood Vents are available in various models and sizes as described in Table 1. The SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 units each contain two vertically arranged openings per unit.

3.2 Engineered Opening:

The FVs comply with the design principle noted in Section 2.7.2.2 and Section 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)] for a maximum rate of rise and fall of 5.0 feet per hour (0.423 mm/s). In order to comply with the engineered opening requirement of ASCE/SEI 24, Smart Vent FVs must be installed in accordance with Section 4.0.

3.3 Ventilation:

The SmartVENT® Model #1540-510 and SmartVENT® Overhead Door Model #1540-514 both have screen covers with $^{1}/_{4}$-inch-by-$^{1}/_{4}$-inch (6.35 by 6.35 mm) openings, yielding 51 square inches (32 903 mm^2) of net free area to supply natural ventilation. The SmartVENT® Stacking Model #1540-511 consists of two Model #1540-510 units in one assembly, and provides 102 square inches (65 806 mm^2) of net free area to supply natural ventilation. Other FVs described in this report do not offer natural ventilation.

3.4 Flood Vent Sealing Kit:

The Flood Vent Sealing Kit Model #1540-526 is used with SmartVENT® Model #1540-520. It is a Homasote 440 Sound Barrier® (ESR-1374) insert with 21 – 2-inch-by-2-inch (51 mm x 51 mm) squares cut in it. See Figure 4.

4.0 DESIGN AND INSTALLATION

4.1 SmartVENT® and FloodVENT®:

SmartVENT® and FloodVENT® are designed to be installed into walls or overhead doors of existing or new construction from the exterior side. Installation of the vents must be in accordance with the manufacturer's instructions, the applicable code and this report. Installation clips allow mounting in masonry and concrete walls of any thickness. In order to comply with the engineered opening design principle noted in Section 2.7.2.2 and 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)], the Smart Vent® FVs must be installed as follows:

- With a minimum of two openings on different sides of each enclosed area.

- With a minimum of one FV for every 200 square feet (18.6 m^2) of enclosed area, except that the SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 must be installed with a minimum of one FV for every 400 square feet (37.2 m^2) of enclosed area.
- Below the base flood elevation.
- With the bottom of the FV located a maximum of 12 inches (305.4 mm) above the higher of the final grade or floor and finished exterior grade immediately under each opening.

4.2 Flood Vent Sealing Kit

The Flood Vent Sealing Kit Model 1540-526 is used in conjunction with FloodVENT® Model #1540-520. When installed and tested in accordance with ASTM E283, the FV and Flood Vent Sealing Kit assembly have an air leakage rate of less than 0.2 cubic feet per minute per lineal foot (18.56 l/min per lineal meter) at a pressure differential of 1 pound per square foot (50 Pa) based on 12.58 lineal feet (3.8 lineal meters) contained by the Flood Vent Sealing Kit.

5.0 CONDITIONS OF USE

The Smart Vent® FVs described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The Smart Vent® FVs must be installed in accordance with this report, the applicable code and the manufacturer's installation instructions. In the event of a conflict, the instructions in this report govern.

5.2 The Smart Vent® FVs must not be used in the place of "breakaway walls" in coastal high hazard areas, but are permitted for use in conjunction with breakaway walls in other areas.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Mechanically Operated Flood Vents (AC364), dated August 2015 (editorially revised February 2021).

6.2 Test report on air infiltration in accordance with ASTM E283.

7.0 IDENTIFICATION

7.1 The Smart VENT® models and the Flood Vent Sealing Kit described in this report must be identified by a label bearing the manufacturer's name (Smartvent Products, Inc.), the model number, and the evaluation report number (ESR-2074).

7.2 The report holder's contact information is the following:

SMART VENT PRODUCTS, INC.
430 ANDBRO DRIVE, UNIT 1
PITMAN, NEW JERSEY 08071
(877) 441-8368
www.smartvent.com
info@smartvent.com

TABLE 1—MODEL SIZES

MODEL NAME	MODEL NUMBER	MODEL SIZE (in.)	COVERAGE (sq. ft.)
FloodVENT®	1540-520	$15^3/_4$" X $7^3/_4$"	200
SmartVENT®	1540-510	$15^3/_4$" X $7^3/_4$"	200
FloodVENT® Overhead Door	1540-524	$15^3/_4$" X $7^3/_4$"	200
SmartVENT® Overhead Door	1540-514	$15^3/_4$" X $7^3/_4$"	200
Wood Wall FloodVENT®	1540-570	14" X $8^3/_4$"	200
Wood Wall FloodVENT® Overhead Door	1540-574	14" X $8^3/_4$"	200
SmartVENT® Stacker	1540-511	16" X 16"	400
FloodVent® Stacker	1540-521	16" X 16"	400

For **SI:** 1 inch = 25.4 mm; 1 square foot = m^2

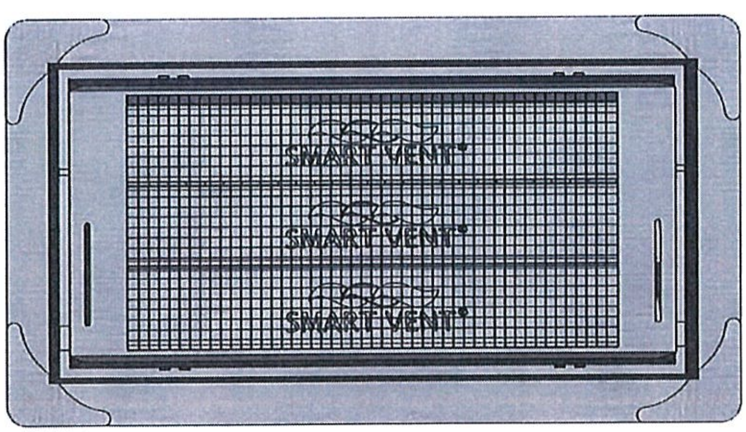

FIGURE 1—SMART VENT: MODEL 1540-510

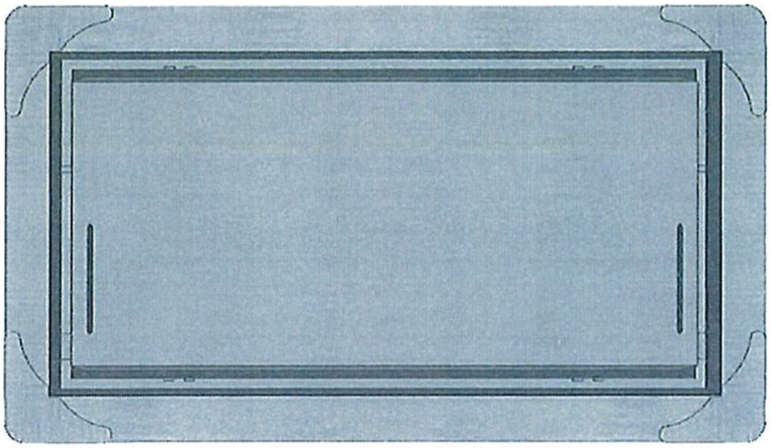

FIGURE 2—SMART VENT MODEL 1540-520

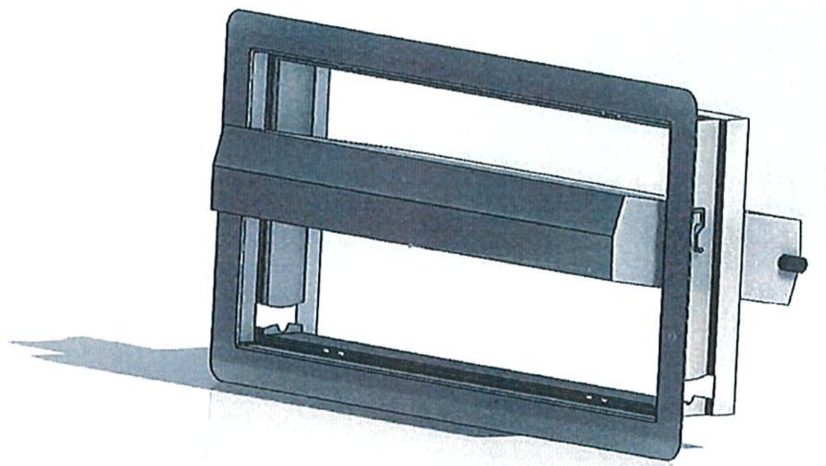

FIGURE 3—SMART VENT: SHOWN WITH FLOOD DOOR PIVOTED OPEN

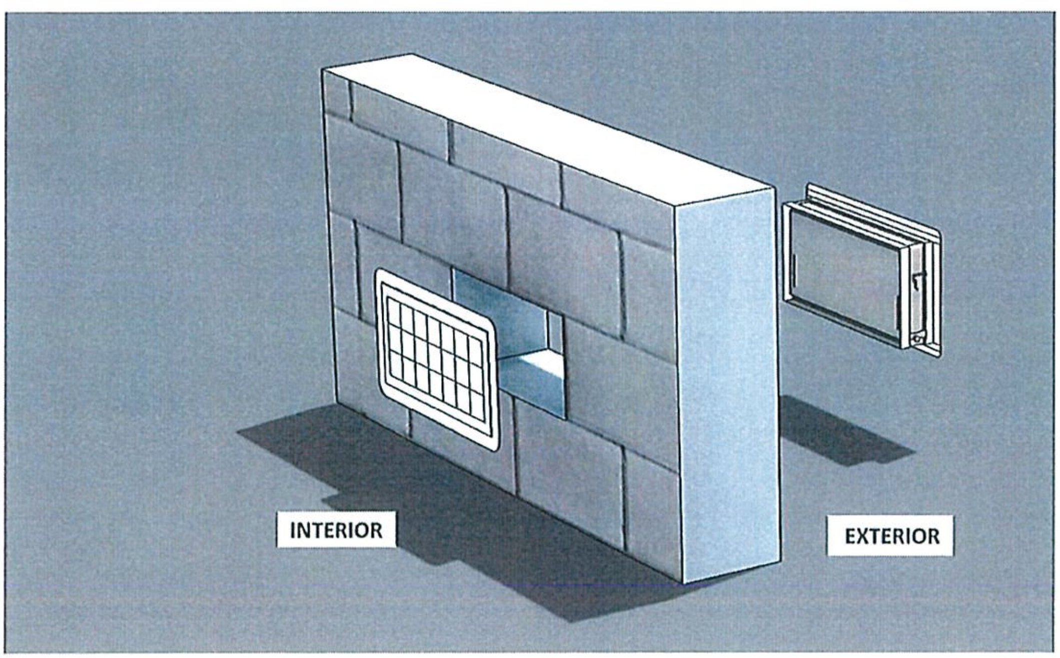

FIGURE 4—FLOOD VENT SEALING KIT

DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with codes noted below.

Applicable code editions:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with 2019 CBC Chapter 12, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 12 and 16 , as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the 2019 CRC, provided the design and installation are in accordance with the 2018 *International Residential Code*® (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

ICC-ES Evaluation Report

ESR-2074 FBC Supplement

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

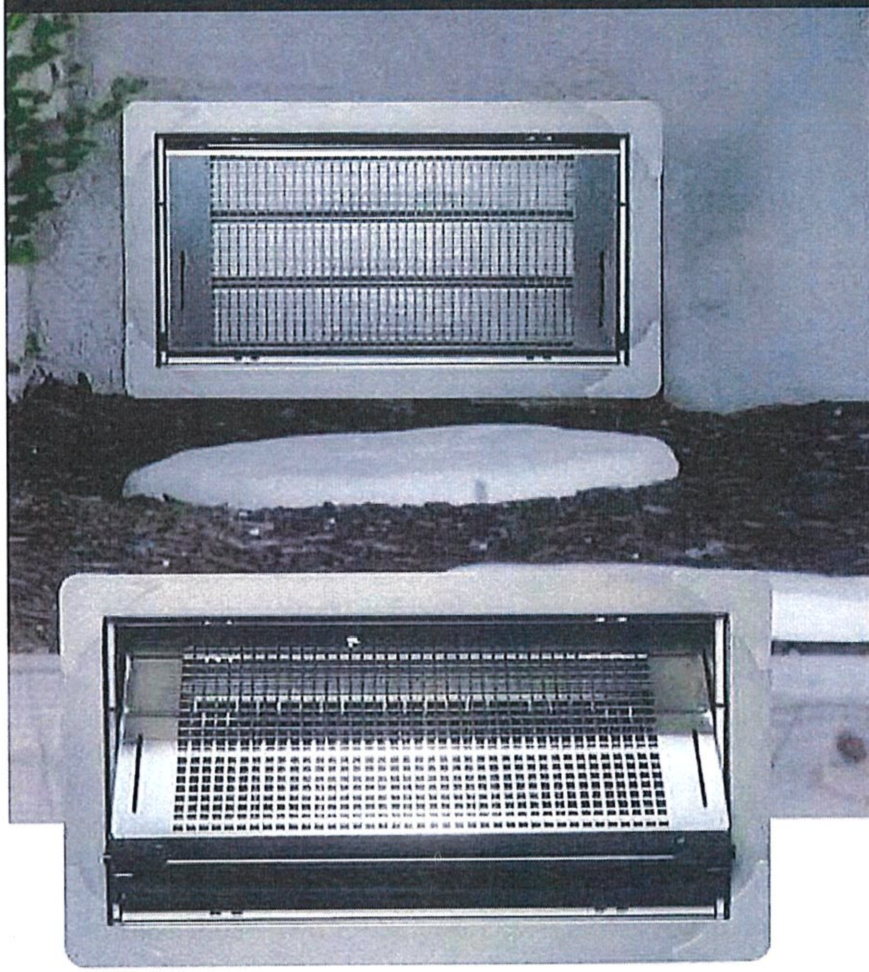
The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the *Florida Building Code—Building* and the *Florida Building Code-Residential*, provided the design requirements are determined in accordance with the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2074 for 2018 *International Building Code®* meet the requirements of the *Florida Building Code-Building* or the *Florida Building Code-Residential,* as applicable.

Use of the Smart Vent® Automatic Foundation Flood Vents has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential*.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

SMART VENT® - Model: 1540-510



Dual Function SMART VENT®

Superior Flood Protection and Natural Air Ventilation

ICC-ES Evaluated and FEMA Accepted Foundation Flood Vents

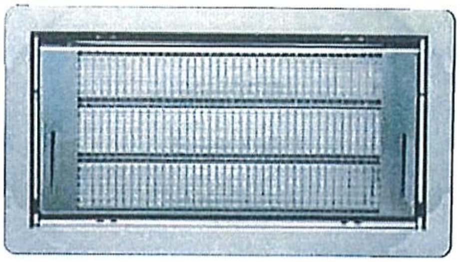
- Potential savings on homeowner's NFIP premiums
- Preserves aesthetic beauty of a home by requiring 2/3 less vents
- Each vent certified to protect 200 sq. ft. of your home
- Code Compliant, FEMA accepted, ICC-ES Evaluated
- All Stainless Steel construction meets or exceeds flood and corrosion resistance code requirements
- Patented automatic floats release bi-directional flood door
- Temperature controlled louvers automatically open in warm weather and close in cold weather

One 16" x 8" vent is certified to cover 200 square feet of enclosed area for flood protection and 51 square inches for ventilation

SMART VENT® models are certified to provide flood protection and ventilation. This model is used for a home with a crawl space or any enclosed area that desires natural air ventilation and flood protection. All stainless steel construction resists weather and pest.

SMART VENT

www.smartvent.com • 877-441-8368



Model #:	1540-510
Installation Type:	Masonry Wall
Style:	louvered
Dimensions:	16" x 8"
Rough Opening:	16¼" x 8¼" (one block, or CMU)
Finish:	Stainless Steel *(Standard)*

Available Powder Coat Colors For Special Order:

White · Wheat · Gray · Black · Stainless (standard)

Optional Accessories:
Fire Damper, Interior Trim Flange & Inner Sleeve, Rain Shield

Other Models Available: Insulated FLOOD VENT, Overhead Garage Door Model, Stacked and Quad Configurations, Models for Wood Studded Wall Applications and Pour in Place Buck Systems.

There's more online at www.smartvent.com
Dealer Locator, Installer Locator, Cad Drawings, Installation Instructions, Technical Specifications, Frequently Asked Questions, Videos, Testimonials, Resource Library Database, Insurance Forms.

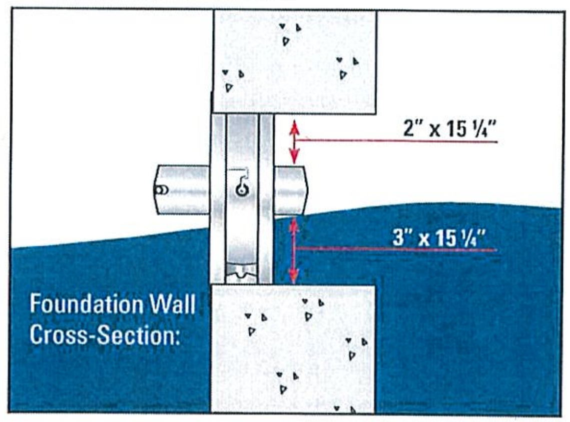
Rapidly rising floodwater can put extreme pressure on the foundation walls causing improperly vented structures to buckle and collapse. SMART VENTS® quickly and efficiently equalize the pressure and minimize damage.

How it works:

Flood Protection: The SMART VENT® door is latched closed until flood water enters. Entering flood water lifts the patented internal floats which unlatches and rotates the door open. This allows the flood water to automatically enter and exit through the frame opening, relieving the pressure from your foundation walls.

Ventilation: A bimetal coil (like a thermostat, no electricity is needed) automatically opens and closes the ventilation louvers as temperature changes. They will be closed when it is freezing outside and open when it is warm outside to provide natural ventilation.

Important note: SMART VENT® does not rely on the louvers to let floodwater in and out. Regardless of the louvers' position, opened or closed, when floodwater flows into the door, the internal floats release the door to rotate open to relieve the hydrostatic pressure. The louvers and pest screen are rotated out of the path of the floodwater. The temperature-controlled louvers are for ventilation purposes only.



How does one SMART VENT® provide so much coverage?

You may have heard that FEMA requires that flood openings provide one square inch of opening per one square foot of enclosed area, referring to dimensions of the opening in proportion to the space to be vented. This is only partially correct. FEMA's regulations and guidelines do state that a non-engineered flood vent solution must (among other requirements) provide one square inch of opening per square foot of enclosed area to be vented. However; all SMART VENT® products are ICC-ES certified engineered openings. They have been designed, engineered, tested, rated, and certified to provide flood relief so efficiently that only one unit is needed for 200 square feet of enclosed area. It would be our pleasure to contact your code official, surveyor, or insurance agent if they require more information.

National Flood Insurance Program

Elevation Certificate

and Instructions

2023 EDITION

UNIT 5

FEMA

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE AND INSTRUCTIONS

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this data collection is estimated to average 3.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and submitting this form. You are not required to respond to this collection of information unless a valid OMB control number is displayed on this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing the burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20742, Paperwork Reduction Project (1660-0008). **NOTE: Do not send your completed form to this address.**

PRIVACY ACT STATEMENT

Authority: Title 44 CFR § 61.7 and 61.8.

Principal Purpose(s): This information is being collected for the primary purpose of documenting compliance with National Flood Insurance Program (NFIP) floodplain management ordinances for new or substantially improved structures in designated Special Flood Hazard Areas. This form may also be used as an optional tool for a Letter of Map Amendment (LOMA), Conditional LOMA (CLOMA), Letter of Map Revision Based on Fill (LOMR-F), or Conditional LOMR-F (CLOMR-F), or for flood insurance rating purposes in any flood zone.

Routine Use(s): The information on this form may be disclosed as generally permitted under 5 U.S.C. § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/ FEMA-003 – *National Flood Insurance Program Files System of Records Notice* 79 Fed. Reg. 28747 (May 19, 2014) and upon written request, written consent, by agreement, or as required by law.

Disclosure: The disclosure of information on this form is voluntary; however, failure to provide the information requested may impact the flood insurance premium through the NFIP. Information will only be released as permitted by law.

PURPOSE OF THE ELEVATION CERTIFICATE

The Elevation Certificate is an important administrative tool of the NFIP. It can be used to provide elevation information necessary to ensure compliance with community floodplain management ordinances, to inform the proper insurance premium, and to support a request for a LOMA, CLOMA, LOMR-F, or CLOMR-F.

The Elevation Certificate is used to document floodplain management compliance for Post-Flood Insurance Rate Map (FIRM) buildings, which are buildings constructed after publication of the FIRM, located in flood Zones A1–A30, AE, AH, AO, A (with Base Flood Elevation (BFE)), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, and A99. It may also be used to provide elevation information for Pre-FIRM buildings or buildings in any flood zone.

As part of the agreement for making flood insurance available in a community, the NFIP requires the community to adopt floodplain management regulations that specify minimum requirements for reducing flood losses. One such requirement is for the community to obtain the elevation of the lowest floor (including basement) of all new and substantially improved buildings, and maintain a record of such information. The Elevation Certificate provides a way for a community to document compliance with the community's floodplain management ordinance.

Use of this certificate does not provide a waiver of the flood insurance purchase requirement. Only a LOMA or LOMR-F from the Federal Emergency Management Agency (FEMA) can amend the FIRM and remove the federal mandate for a lending institution to require the purchase of flood insurance. However, the lending institution has the option of requiring flood insurance even if a LOMA/LOMR-F has been issued by FEMA. The Elevation Certificate may be used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. Lowest Adjacent Grade (LAG) elevations certified by a land surveyor, engineer, or architect, as authorized by state law, will be required if the certificate is used to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request. A LOMA, CLOMA, LOMR-F, or CLOMR-F request must be submitted with either a completed FEMA MT-EZ or MT-1 application package, whichever is appropriate. If the certificate will only be completed to support a LOMA, CLOMA, LOMR-F, or CLOMR-F request, there is an option to document the certified LAG elevation on the Elevation Form included in the MT-EZ and MT-1 application.

This certificate is used only to certify building elevations. A separate certificate is required for floodproofing. Under the NFIP, non-residential buildings can be floodproofed up to or above the BFE. A floodproofed building is a building that has been designed and constructed to be watertight (substantially impermeable to floodwaters) below the BFE. Floodproofing of residential buildings is not permitted under the NFIP unless FEMA has granted the community an exception for residential floodproofed basements. The community must adopt standards for design and construction of floodproofed basements before FEMA will grant a basement exception. For both floodproofed non-residential buildings and residential floodproofed basements in communities that have been granted an exception by FEMA, a floodproofing certificate is required.

The expiration date on the form herein does not apply to certified and completed Elevation Certificates, as a completed Elevation Certificate does not expire, unless there is a physical change to the building that invalidates information in Section A Items A8 or A9, Section C, Section E, or Section H. In addition, this form is intended for the specific building referenced in Section A and is not invalidated by the transfer of building ownership.

Additional guidance can be found in FEMA Publication 467-1, *Floodplain Management Bulletin: Elevation Certificate.*

OMB Control No. 1660-0008
Expiration Date: 06/30/2026

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION

FOR INSURANCE COMPANY USE

Policy Number: ____

Company NAIC Number: ____

A1. Building Owner's Name: Arthur Robert Taylor

A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address

City: Pacific City State: OR ZIP Code: 97135

A3. Property Description (e.g., Lot and Block Numbers or Legal Description) and/or Tax Parcel Number: Tax Lot 1601, Map 04S10W19CA / Document No. 2017-02965, Tillamook County Records

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.): Residential

A5. Latitude/Longitude: Lat. 45°12'22.45" N Long. 123°57'37.75" W Horiz. Datum: ☐ NAD 1927 ☒ NAD 1983 ☐ WGS 84

A6. Attach at least two and when possible four clear color photographs (one for each side) of the building (see Form pages 7 and 8).

A7. Building Diagram Number: 6

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s): 318 sq. ft.

b) Is there at least one permanent flood opening on two different sides of each enclosed area? ☒ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade:
Non-engineered flood openings: 0 Engineered flood openings: 6

d) Total net open area of non-engineered flood openings in A8.c: 0 sq. in.

e) Total rated area of engineered flood openings in A8.c (attach documentation – see Instructions): 1200 sq. ft.

f) Sum of A8.d and A8.e rated area (if applicable – see Instructions): 1200 sq. ft.

A9. For a building with an attached garage:

a) Square footage of attached garage: n/a sq. ft.

b) Is there at least one permanent flood opening on two different sides of the attached garage? ☐ Yes ☐ No ☐ N/A

c) Enter number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade:
Non-engineered flood openings: ____ Engineered flood openings: ____

d) Total net open area of non-engineered flood openings in A9.c: ____ sq. in.

e) Total rated area of engineered flood openings in A9.c (attach documentation – see Instructions): ____ sq. ft.

f) Sum of A9.d and A9.e rated area (if applicable – see Instructions): ____ sq. ft.

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1.a. NFIP Community Name: Tillamook County B1.b. NFIP Community Identification Number: 410196

B2. County Name: Tillamook County B3. State: OR B4. Map/Panel No.: 41057C/0855 B5. Suffix: F

B6. FIRM Index Date: 09/28/2018 B7. FIRM Panel Effective/Revised Date: 09/28/2018

B8. Flood Zone(s): AE B9. Base Flood Elevation(s) (BFE) (Zone AO, use Base Flood Depth): 18.5'

B10. Indicate the source of the BFE data or Base Flood Depth entered in Item B9:
☐ FIS ☒ FIRM ☐ Community Determined ☐ Other: ____

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source: ____

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No
Designation Date: ____ ☐ CBRS ☐ OPA

B13. Is the building located seaward of the Limit of Moderate Wave Action (LiMWA)? ☐ Yes ☒ No

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ______ Company NAIC Number: ______

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☒ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, AO, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, A99. Complete Items C2.a–h below according to the Building Diagram specified in Item A7. In Puerto Rico only, enter meters.

Benchmark Utilized: GPS - See Section D   Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.
☐ NGVD 1929 ☒ NAVD 1988 ☐ Other:

Datum used for building elevations must be the same as that used for the BFE. Conversion factor used? ☐ Yes ☒ No
If Yes, describe the source of the conversion factor in the Section D Comments area.

Check the measurement used:

Item	Elevation	Feet	Meters
a) Top of bottom floor (including basement, crawlspace, or enclosure floor):	12.0	☒ feet	☐ meters
b) Top of the next higher floor (see Instructions):	21.4	☒ feet	☐ meters
c) Bottom of the lowest horizontal structural member (see Instructions):	n/a	☐ feet	☐ meters
d) Attached garage (top of slab):	n/a	☐ feet	☐ meters
e) Lowest elevation of Machinery and Equipment (M&E) servicing the building (describe type of M&E and location in Section D Comments area):		☐ feet	☐ meters
f) Lowest Adjacent Grade (LAG) next to building: ☒ Natural ☐ Finished	11.8	☒ feet	☐ meters
g) Highest Adjacent Grade (HAG) next to building: ☒ Natural ☐ Finished	11.9	☒ feet	☐ meters
h) Finished LAG at lowest elevation of attached deck or stairs, including structural support:	11.9'	☒ feet	☐ meters

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by state law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

Were latitude and longitude in Section A provided by a licensed land surveyor? ☐ Yes ☐ No

☐ Check here if attachments and describe in the Comments area.

SIGNED ON: 5-28-2025

Certifier's Name: James B. Brown   License Number: 60379

Title: Professional Land Surveyor

Company Name: Centerline Concepts Land Surveying, Inc.

Address: 19376 Molalla Avenue, Suite 120

City: Oregon City   State: OR   ZIP Code: 97045

Telephone: (503) 650-0188   Ext.: ______   Email: jamesb@centerlineconcepts.com

REGISTERED PROFESSIONAL LAND SURVEYOR
OREGON
NOVEMBER 30, 2007
JAMES BURTON BROWN
60379
EXPIRES: 12-31-2025

Place Seal Here

Signature: ______   Date: 5-28-2025

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including source of conversion factor in C2; type of equipment and location per C2.e; and description of any attachments):
--Benchmark utilized in section C2 is based on static GPS observations post-processed by OPUS.
--This is a Pre-Construction Elevation certificate for proposed Unit 5
--Engineered Flood Vent in A8e is a Smart Vent Model 1540-510. 1 vent rated 200 sf

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address City: Pacific City State: OR ZIP Code: 97135	FOR INSURANCE COMPANY USE Policy Number: ____ Company NAIC Number: ____

SECTION E – BUILDING MEASUREMENT INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO, ZONE AR/AO, AND ZONE A (WITHOUT BFE)

For Zones AO, AR/AO, and A (without BFE), complete Items E1–E5. For Items E1–E4, use natural grade, if available. If the Certificate is intended to support a Letter of Map Change request, complete Sections A, B, and C. Check the measurement used. In Puerto Rico only, enter meters.

Building measurements are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction

*A new Elevation Certificate will be required when construction of the building is complete.

E1. Provide measurements (C.2.a in applicable Building Diagram) for the following and check the appropriate boxes to show whether the measurement is above or below the natural HAG and the LAG.

a) Top of bottom floor (including basement, crawlspace, or enclosure) is: ____ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is: ____ ☐ feet ☐ meters ☐ above or ☐ below the LAG.

E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (C2.b in applicable Building Diagram) of the building is: ____ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E3. Attached garage (top of slab) is: ____ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is: ____ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without BFE) or Zone AO must sign here. *The statements in Sections A, B, and E are correct to the best of my knowledge*

☐ Check here if attachments and describe in the Comments area.

Property Owner or Owner's Authorized Representative Name: ____

Address: ____

City: ____ State: ____ ZIP Code: ____

Telephone: ____ Ext.: ____ Email: ____

Signature: ____ Date: ____

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: ____ Company NAIC Number: ____

SECTION G – COMMUNITY INFORMATION (RECOMMENDED FOR COMMUNITY OFFICIAL COMPLETION)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Section A, B, C, E, G, or H of this Elevation Certificate. Complete the applicable item(s) and sign below when:

G1. ☐ The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by state law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)

G2.a. ☐ A local official completed Section E for a building located in Zone A (without a BFE), Zone AO, or Zone AR/AO, or when item E5 is completed for a building located in Zone AO.

G2.b. ☐ A local official completed Section H for insurance purposes.

G3. ☐ In the Comments area of Section G, the local official describes specific corrections to the information in Sections A, B, E and H.

G4. ☐ The following information (Items G5–G11) is provided for community floodplain management purposes.

G5. Permit Number: ____ G6. Date Permit Issued: ____

G7. Date Certificate of Compliance/Occupancy Issued: ____

G8. This permit has been issued for: ☐ New Construction ☐ Substantial Improvement

G9.a. Elevation of as-built lowest floor (including basement) of the building: ____ ☐ feet ☐ meters Datum: ____

G9.b. Elevation of bottom of as-built lowest horizontal structural member: ____ ☐ feet ☐ meters Datum: ____

G10.a. BFE (or depth in Zone AO) of flooding at the building site: ____ ☐ feet ☐ meters Datum: ____

G10.b. Community's minimum elevation (or depth in Zone AO) requirement for the lowest floor or lowest horizontal structural member: ____ ☐ feet ☐ meters Datum: ____

G11. Variance issued? ☐ Yes ☐ No If yes, attach documentation and describe in the Comments area.

The local official who provides information in Section G must sign here. *I have completed the information in Section G and certify that it is correct to the best of my knowledge. If applicable, I have also provided specific corrections in the Comments area of this section.*

Local Official's Name: ____ Title: ____

NFIP Community Name: ____

Telephone: Ext.: ____ Email: ____

Address: ____

City: ____ State: ____ ZIP Code: ____

Signature: ____ Date: ____

Comments (including type of equipment and location, per C2.e; description of any attachments; and corrections to specific information in Sections A, B, D, E, or H):

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address City: Pacific City State: OR ZIP Code: 97135	FOR INSURANCE COMPANY USE Policy Number: ______ Company NAIC Number: ______

SECTION H – BUILDING'S FIRST FLOOR HEIGHT INFORMATION FOR ALL ZONES (SURVEY NOT REQUIRED) (FOR INSURANCE PURPOSES ONLY)

The property owner, owner's authorized representative, or local floodplain management official may complete Section H for all flood zones to determine the building's first floor height for insurance purposes. Sections A, B, and I must also be completed. Enter heights to the nearest tenth of a foot (nearest tenth of a meter in Puerto Rico). *Reference the Foundation Type Diagrams (at the end of Section H Instructions) and the appropriate Building Diagrams (at the end of Section I Instructions) to complete this section.*

H1. Provide the height of the top of the floor (as indicated in Foundation Type Diagrams) above the Lowest Adjacent Grade (LAG):

a) **For Building Diagrams 1A, 1B, 3, and 5–8.** Top of bottom floor (include above-grade floors only for buildings with crawlspaces or enclosure floors) is: ______ ☐ feet ☐ meters ☐ above the LAG

b) **For Building Diagrams 2A, 2B, 4, and 6–9.** Top of next higher floor (i.e., the floor above basement, crawlspace, or enclosure floor) is: ______ ☐ feet ☐ meters ☐ above the LAG

H2. Is all Machinery and Equipment servicing the building (as listed in Item H2 instructions) elevated to or above the floor indicated by the H2 arrow (shown in the Foundation Type Diagrams at end of Section H instructions) for the appropriate Building Diagram?
☐ Yes ☐ No

SECTION I – PROPERTY OWNER (OR OWNER'S AUTHORIZED REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and H must sign here. *The statements in Sections A, B, and H are correct to the best of my knowledge.* **Note:** If the local floodplain management official completed Section H, they should indicate in Item G2.b and sign Section G.

☐ Check here if attachments are provided (including required photos) and describe each attachment in the Comments area.

Property Owner or Owner's Authorized Representative Name: ______

Address: ______

City: ______ State: ______ ZIP Code: ______

Telephone: Ext.: ______ Email: ______

Signature: ______ Date: ______

Comments:

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	**FOR INSURANCE COMPANY USE**
City: Pacific City State: OR ZIP Code: 97135	Policy Number: Company NAIC Number:

Instructions: Insert below at least two and when possible four photographs showing each side of the building (for example, may only be able to take front and back pictures of townhouses/rowhouses). Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." Photographs must show the foundation. When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo One

Photo One Caption: Clear Photo One

Photo Two

Photo Two Caption: Clear Photo Two

ELEVATION CERTIFICATE

IMPORTANT: MUST FOLLOW THE INSTRUCTIONS ON INSTRUCTION PAGES 1-11

BUILDING PHOTOGRAPHS

Continuation Page

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.: no address	FOR INSURANCE COMPANY USE
City: Pacific City State: OR ZIP Code: 97135	Policy Number: Company NAIC Number:

Insert the third and fourth photographs below. Identify all photographs with the date taken and "Front View," "Rear View," "Right Side View," or "Left Side View." When flood openings are present, include at least one close-up photograph of representative flood openings or vents, as indicated in Sections A8 and A9.

Photo Three

Photo Three Caption: Clear Photo Three

Photo Four

Photo Four Caption: Clear Photo Four

ICC EVALUATION SERVICE

Most Widely Accepted and Trusted

ICC-ES Evaluation Report

ESR-2074

Reissued 02/2021
Revised 04/2021
This report is subject to renewal 02/2023.

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

DIVISION: 08 00 00—OPENINGS
SECTION: 08 95 43—VENTS/FOUNDATION FLOOD VENTS

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

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A Subsidiary of INTERNATIONAL CODE COUNCIL®

ICC-ES Evaluation Report

ESR-2074

Reissued February 2021
Revised April 2021
This report is subject to renewal February 2023.

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DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514 FLOOD VENT SEALING KIT #1540-526

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012, 2009 and 2006 *International Building Code®* (IBC)
- 2021, 2018, 2015, 2012, 2009 and 2006 *International Residential Code®* (IRC)
- 2021, 2018 *International Energy Conservation Code®* (IECC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Physical operation
- Water flow

2.0 USES

The Smart Vent® units are engineered mechanically operated flood vents (FVs) employed to equalize hydrostatic pressure on walls of enclosures subject to rising or falling flood waters. Certain models also allow natural ventilation.

3.0 DESCRIPTION

3.1 General:

When subjected to rising water, the Smart Vent® FVs internal floats are activated, then pivot open to allow flow in either direction to equalize water level and hydrostatic pressure from one side of the foundation to the other. The FV pivoting door is normally held in the closed position by a buoyant release device. When subjected to rising water, the buoyant release device causes the unit to unlatch, allowing the door to rotate out of the way and allow flow. The water level stabilizes, equalizing the lateral forces. Each unit is fabricated from stainless steel. Smart Vent® Automatic Foundation Flood Vents are available in various models and sizes as described in Table 1. The SmartVENT® Stacking Model #1540-511 and FloodVENT® Stacking Model #1540-521 units each contain two vertically arranged openings per unit.

3.2 Engineered Opening:

The FVs comply with the design principle noted in Section 2.7.2.2 and Section 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)] for a maximum rate of rise and fall of 5.0 feet per hour (0.423 mm/s). In order to comply with the engineered opening requirement of ASCE/SEI 24, Smart Vent FVs must be installed in accordance with Section 4.0.

3.3 Ventilation:

The SmartVENT® Model #1540-510 and SmartVENT® Overhead Door Model #1540-514 both have screen covers with $^{1}/_{4}$-inch-by-$^{1}/_{4}$-inch (6.35 by 6.35 mm) openings, yielding 51 square inches (32 903 mm^2) of net free area to supply natural ventilation. The SmartVENT® Stacking Model #1540-511 consists of two Model #1540-510 units in one assembly, and provides 102 square inches (65 806 mm^2) of net free area to supply natural ventilation. Other FVs described in this report do not offer natural ventilation.

3.4 Flood Vent Sealing Kit:

The Flood Vent Sealing Kit Model #1540-526 is used with SmartVENT® Model #1540-520. It is a Homasote 440 Sound Barrier® (ESR-1374) insert with 21 – 2-inch-by-2-inch (51 mm x 51 mm) squares cut in it. See Figure 4.

4.0 DESIGN AND INSTALLATION

4.1 SmartVENT® and FloodVENT®:

SmartVENT® and FloodVENT® are designed to be installed into walls or overhead doors of existing or new construction from the exterior side. Installation of the vents must be in accordance with the manufacturer's instructions, the applicable code and this report. Installation clips allow mounting in masonry and concrete walls of any thickness. In order to comply with the engineered opening design principle noted in Section 2.7.2.2 and 2.7.3 of ASCE/SEI 24-14 [Section 2.6.2.2 of ASCE/SEI 24-05 (2012, 2009, 2006 IBC and IRC)], the Smart Vent® FVs must be installed as follows:

- With a minimum of two openings on different sides of each enclosed area.

ICC-ES Evaluation Report

ESR-2074 CBC and CRC Supplement

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REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with codes noted below.

Applicable code editions:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with 2019 CBC Chapter 12, provided the design and installation are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 12 and 16 , as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the 2019 CRC, provided the design and installation are in accordance with the 2018 *International Residential Code®* (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

DIVISION: 08 00 00—OPENINGS
Section: 08 95 43—Vents/Foundation Flood Vents

REPORT HOLDER:

SMART VENT PRODUCTS, INC.

EVALUATION SUBJECT:

SMART VENT® AUTOMATIC FOUNDATION FLOOD VENTS: MODELS #1540-520; #1540-521; #1540-510; #1540-511; #1540-570; #1540-574; #1540-524; #1540-514
FLOOD VENT SEALING KIT #1540-526

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Smart Vent® Automatic Foundation Flood Vents, described in ICC-ES evaluation report ESR-2074, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 *Florida Building Code—Building*
- 2020 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Smart Vent® Automatic Foundation Flood Vents, described in Sections 2.0 through 7.0 of the evaluation report ESR-2074, comply with the *Florida Building Code—Building* and the *Florida Building Code-Residential*, provided the design requirements are determined in accordance with the *Florida Building Code-Building* or the *Florida Building Code-Residential*, as applicable. The installation requirements noted in ICC-ES evaluation report ESR-2074 for 2018 *International Building Code®* meet the requirements of the *Florida Building Code-Building* or the *Florida Building Code-Residential*, as applicable.

Use of the Smart Vent® Automatic Foundation Flood Vents has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential*.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued February 2021 and revised April 2021.

SMART VENT® - Model: 1540-510

ICC ES

Dual Function SMART VENT®
Superior Flood Protection and Natural Air Ventilation

ICC-ES Evaluated and FEMA Accepted Foundation Flood Vents

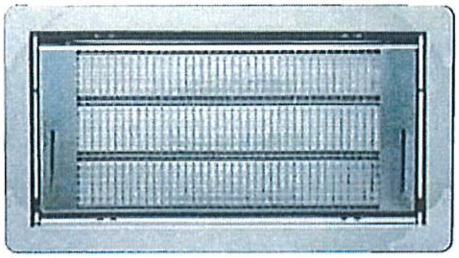
- Potential savings on homeowner's NFIP premiums
- Preserves aesthetic beauty of a home by requiring 2/3 less vents
- Each vent certified to protect 200 sq. ft. of your home
- Code Compliant, FEMA accepted, ICC-ES Evaluated
- All Stainless Steel construction meets or exceeds flood and corrosion resistance code requirements
- Patented automatic floats release bi-directional flood door
- Temperature controlled louvers automatically open in warm weather and close in cold weather

One 16" x 8" vent is certified to cover 200 square feet of enclosed area for flood protection and 51 square inches for ventilation

SMART VENT® models are certified to provide flood protection and ventilation. This model is used for a home with a crawl space or any enclosed area that desires natural air ventilation and flood protection. All stainless steel construction resists weather and pest.

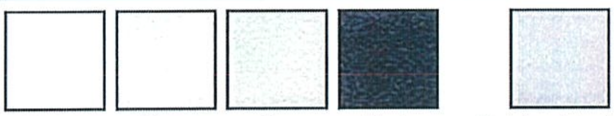
SMART VENT

www.smartvent.com • 877-441-8368



Model #:	1540-510
Installation Type:	Masonry Wall
Style:	louvered
Dimensions:	16" x 8"
Rough Opening:	16¼" x 8¼" (one block, or CMU)
Finish:	Stainless Steel *(Standard)*

Available Powder Coat Colors For Special Order:



White Wheat Gray Black Stainless (standard)

Optional Accessories:
Fire Damper, Interior Trim Flange & Inner Sleeve, Rain Shield

Other Models Available: Insulated FLOOD VENT, Overhead Garage Door Model, Stacked and Quad Configurations, Models for Wood Studded Wall Applications and Pour in Place Buck Systems.

There's more online at www.smartvent.com
Dealer Locator, Installer Locator, Cad Drawings, Installation Instructions, Technical Specifications, Frequently Asked Questions, Videos, Testimonials, Resource Library Database, Insurance Forms.

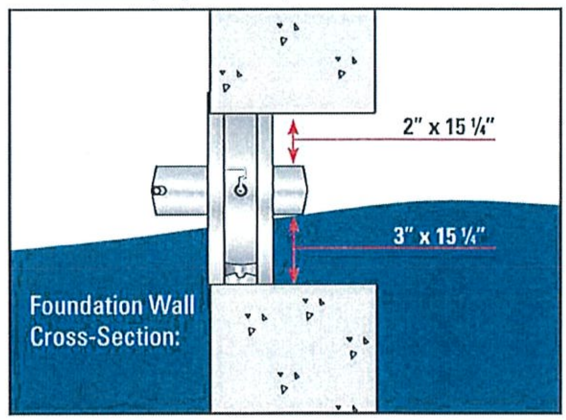
Rapidly rising floodwater can put extreme pressure on the foundation walls causing improperly vented structures to buckle and collapse. SMART VENTS® quickly and efficiently equalize the pressure and minimize damage.

How it works:

Flood Protection: The SMART VENT® door is latched closed until flood water enters. Entering flood water lifts the patented internal floats which unlatches and rotates the door open. This allows the flood water to automatically enter and exit through the frame opening, relieving the pressure from your foundation walls.

Ventilation: A bimetal coil (like a thermostat, no electricity is needed) automatically opens and closes the ventilation louvers as temperature changes. They will be closed when it is freezing outside and open when it is warm outside to provide natural ventilation.

Important note: SMART VENT® does not rely on the louvers to let floodwater in and out. Regardless of the louvers' position, opened or closed, when floodwater flows into the door, the internal floats release the door to rotate open to relieve the hydrostatic pressure. The louvers and pest screen are rotated out of the path of the floodwater. The temperature-controlled louvers are for ventilation purposes only.



How does one SMART VENT® provide so much coverage?

You may have heard that FEMA requires that flood openings provide one square inch of opening per one square foot of enclosed area, referring to dimensions of the opening in proportion to the space to be vented. This is only partially correct. FEMA's regulations and guidelines do state that a non-engineered flood vent solution must (among other requirements) provide one square inch of opening per square foot of enclosed area to be vented. However; all SMART VENT® products are ICC-ES certified engineered openings. They have been designed, engineered, tested, rated, and certified to provide flood relief so efficiently that only one unit is needed for 200 square feet of enclosed area. It would be our pleasure to contact your code official, surveyor, or insurance agent if they require more information.

Tax Lot 1601 Brooten Rd, Pacific City Hydraulic Analysis Report (Revision 4)

prepared for

Relevant Building Company

prepared by

Jake Hofeld, P.E.

Digitally signed by Jake Hofeld
Date: 2025.04.22 16:54:41 -07'00'

WATERWAYS CONSULTING, INC.

REGISTERED PROFESSIONAL ENGINEER
77870PE
OREGON
JANUARY 3, 2011
JAKE DYLAN HOFELD
EXPIRES: 6/30/2025

April 22, 2025

WATERWAYS CONSULTING

Contents

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List of Attachments

Tax Lot 1601 Brooten Rd, Pacific City Hydraulic Analysis Report (Revision 4)

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INTRODUCTION

Waterways Consulting Inc. (Waterways) has been retained by Relevant Building Company to evaluate the hydraulic effects on the Nestucca River during a 100-year base flood discharge from a proposed building on an existing vacant property. The project is located on the east (left) bank floodplain of the Nestucca River at Tax Lot 1601 on Brooten Road in Pacific City, Oregon (**Figure 1**). The proposed building structure will include a 2150 square-foot structure approximately centered on the property in the north/south direction, and setback a minimum of 20 feet from the riparian vegetation at the riverbank. The new structure will include five second-story units, set on HSS posts and concrete support walls with garage space on the ground floor surrounded by break away walls and a garage door. This proposed design will also include three exterior stairways that lead to the units from the ground level. The units also include overhanging balconies on the river ride of the building. The entire property is located within the FEMA designated floodway, effective September 28, 2018 (**Figure 2**).

The following report has been prepared to support floodplain development permitting with Tillamook County for the proposed project and presents our hydraulic analysis of existing and proposed conditions for the 100-year flood event along the Nestucca River within the vicinity of the proposed residential structure addition. This report is based on the guidance outlined in Section 3.510(9)(a) of the Tillamook County Land Use Ordinance which requires, "...certification is provided by a professional registered civil engineer demonstrating through hydrologic and hydraulic analysis performed in accordance with standard engineering practice that such encroachment shall not result in any increase in flood levels during the occurrence of the based flood discharge."

HYDRAULIC MODELING METHODOLOGY

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) has mapped Nestucca River at the project area as a Special Flood Hazard Area (SFHA) within the regulatory floodway Zone AE (**Figure 2**). Tillamook County provided Waterways with a hydraulic model of the Nestucca River covering the project area for a Letter of Map Revision (LOMR), effective September 24, 2015 (Case. Number 14-10-1727P). The LOMR and corresponding hydraulic model conducted in the United States Army Corps of Engineers (USACE) Hydraulic Engineering Center River Analysis Software (HEC-RAS) by West Consultants updated the previous modeling and FIRM Panels dated August 1, 1978. All elevations are referenced to a NAVD 88 vertical datum. This model was used as the basis for all hydraulic modeling.

Waterways updated the hydraulic analysis using HEC-RAS, version 6.4.1. A one-dimensional hydraulic model was completed to characterize the existing and proposed conditions at the project site during the 100-year recurrence interval peak flow at the Nestucca River. Additional cross sections were added to the provided model in the vicinity of the project area. The two modeling scenarios include the Existing Conditions Model ("Ex. Cond." is the Plan identifier in the model) and the Proposed Conditions Model ("Prop. Cond." is the Plan identifier in the model). **Figure 5** shows the proposed project location, cross section locations used in the hydraulic analysis, and the effective FEMA floodplain and floodway boundaries (FEMA, 2018).

Existing Conditions Model

Additional cross sections added to the LOMR model were sampled from a terrain surface derived from LiDAR data from the Department of Geology and Mineral Industries (DOGAMI) North Coast collected by Watershed Sciences Inc. in 2009. LiDAR was updated and overlain with existing topographic survey data for the project parcel. The existing topographic survey was provided by Relevant Building Company, dated August 7, 2024 (**Figure 3**). Bathymetry for the additional cross sections were interpolated from upstream and downstream cross sections of the LOMR model.

The downstream model boundary extends approximately 1.87 miles downstream of the project area and the upstream model boundary extends approximately 1.96 miles upstream of the project area (**Figure 5**). The bridge crossing geometry at Ferry Street and at Pacific Avenue downstream of the project area were included in the model from drawings provided by Oregon Department of Transportation (ODOT) and Tillamook County. Hydraulic roughness values for the additional cross sections were based on values published in the provided model. Hydraulic roughness values, known as Manning's Roughness, for the additional cross sections are outlined in **Table 1**.

Table 1*. Manning's Roughness for Different Land Use Types*

Land Use Type	Manning's 'n'
Channel	0.031
Open Pervious Areas (grassed)	0.04
Residential Area	0.08
Open Pervious Areas (trees)	0.10

Proposed Conditions Model

The proposed conditions model included the additional cross sections created in the existing conditions model. The existing conditions terrain was updated with the proposed structure footprints provided by design drawings supplied from the client (**Figure 3**). The proposed structures were modeled as a blocked obstruction for the 8-inch by 8-inch wide HSS posts and concrete wall corner supports at cross sections located at the upstream and downstream sides of the proposed structure. Breakaway walls on the lower level of the design drawings have been designed by others to collapse during the base flood event and were not included as part of the blocked obstructions. The garage doors are located parallel to river flow and are adequately captured in the model by the blocked obstructions at the corner supports.

The proposed grade was raised at the base level of the structures to elevation 12.0. To achieve "no-rise" conditions for this analysis, the proposed conditions design includes excavation of the portion of the property within the ODFW riparian setback. The modeling results indicate that this portion of the property needs to be excavated to approximately elevation 11.25 (roughly 6-9 inches of excavation) and sloped to drain to the river (**Figure 4**). Any paving for proposed parking shall be balanced with an equal amount of excavation such that the finished paved surface elevations match the preconstruction ground surface elevations on the road side of the structures.

Boundary Conditions

The downstream boundary condition used in the two models was set to a known water surface elevation of 14.15 feet (NAVD 88) per the provided model. The downstream boundary condition is located downstream of FEMA Cross Section A near where Nestucca River meets the Nestucca Bay.

Peak Flow Hydrology

According to the FEMA FIS report and the provided model, the 100-year peak flow event for this portion of the Nestucca River is 49,700 cubic feet per second (cfs). Therefore, 49,700 cfs was assumed for the 100-year peak flow (i.e. base flood discharge) in all models.

RESULTS

Results of the hydraulic modeling are presented in **Attachment A**. These results show that the combination of the proposed structure and associated grading outlined above will not result in a rise to the water surface elevations at any cross sections in the model. The model results do show a 0.01-foot decrease from existing to proposed conditions in water surface elevations at the four cross sections coinciding with the proposed structures and grading.

CONCLUSIONS

The results of this hydraulic analysis indicate no rise in the 100-year water surface elevations for the Proposed Conditions Model when compared to the Existing Conditions Model. Based on this, the proposed project satisfies the requirement of Section 3.510(9)(a) of the Tillamook County Land Use Ordinance.

REFERENCES

Federal Emergency Management Agency. 2018. Flood Insurance Rate Maps (FIRMs) for Tillamook County (panel 0855), Oregon and Incorporated Areas. September 28, 2018.

Federal Emergency Management Agency. 2018. Flood Insurance Study (FIS) for Tillamook County, Oregon and Incorporated Areas. September 8, 2018.

U.S. Army Corps of Engineers. Hydrologic Engineering Center. Computer Program HEC-RAS Version 6.4.1 Davis, California. June 2023.

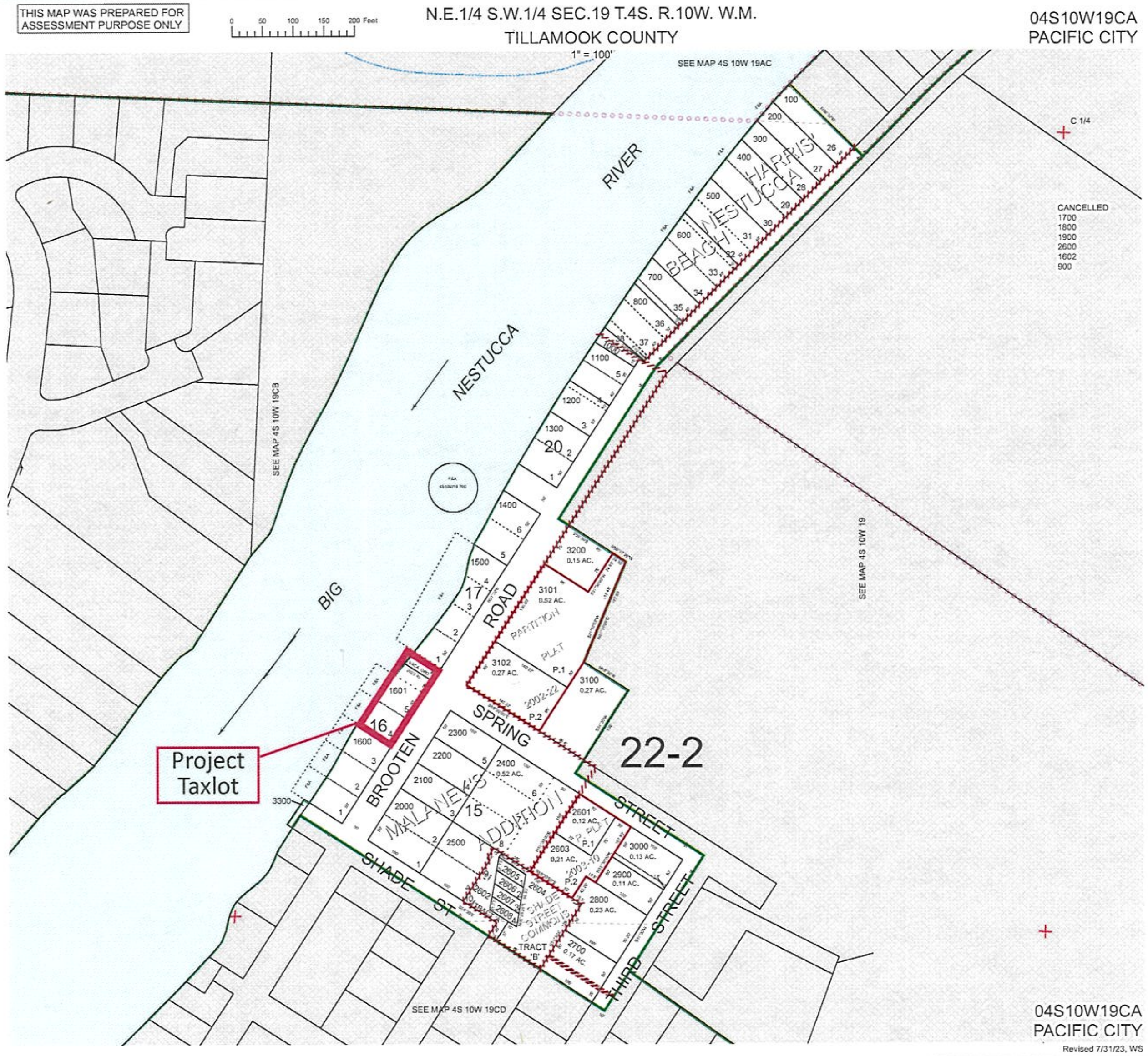
U.S. Army Corps of Engineers. Hydrologic Engineering Center. Hydraulic Reference Manual. Version 5.0 Davis, California. February 2016.

Watershed Sciences. LiDAR Remote Sensing Data Collection Oregon North Coast. Prepared for Department of Geology and Mineral Industries (DOGAMI). December 21, 2009.

West Consultants. Hydraulic Engineering Center River Analysis Software (HEC-RAS) Model of the Nestucca River. 2014.

Federal Emergency Management Agency. Design and Construction Guidance for Breakaway Walls (NFIP Technical Bulletin 9). September 2021.

FIGURES



FIGURE

1

Tax Lot Location

(Map Sourced from Tillamook County Assessment and Taxation Website)

Tax Lot 1601
Brooten Road
Hydraulic Analysis Report

WATERWAYS CONSULTING, INC.
Santa Cruz, CA | watways.com | Portland, OR

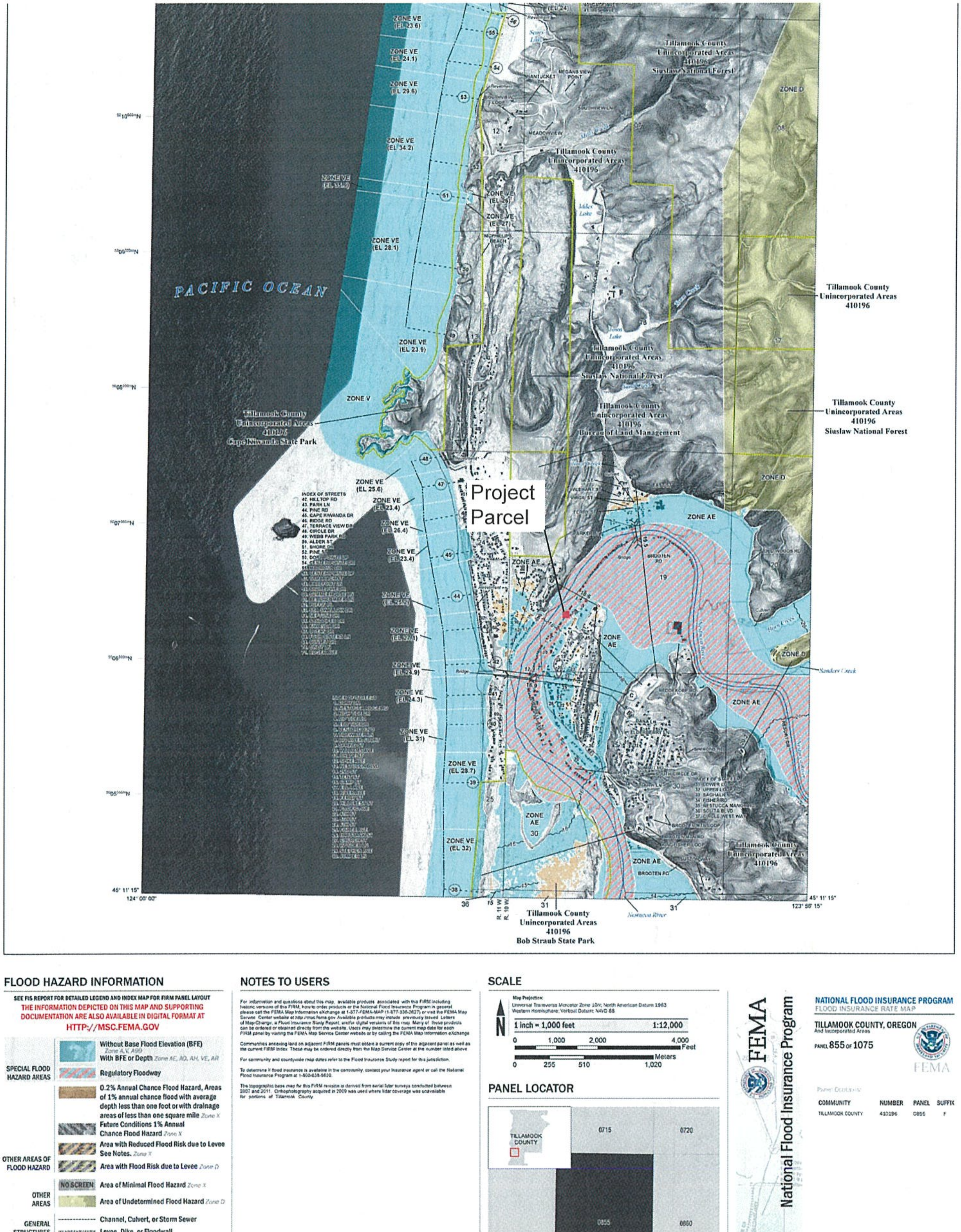


FIGURE 2: FEMA Firm Panel

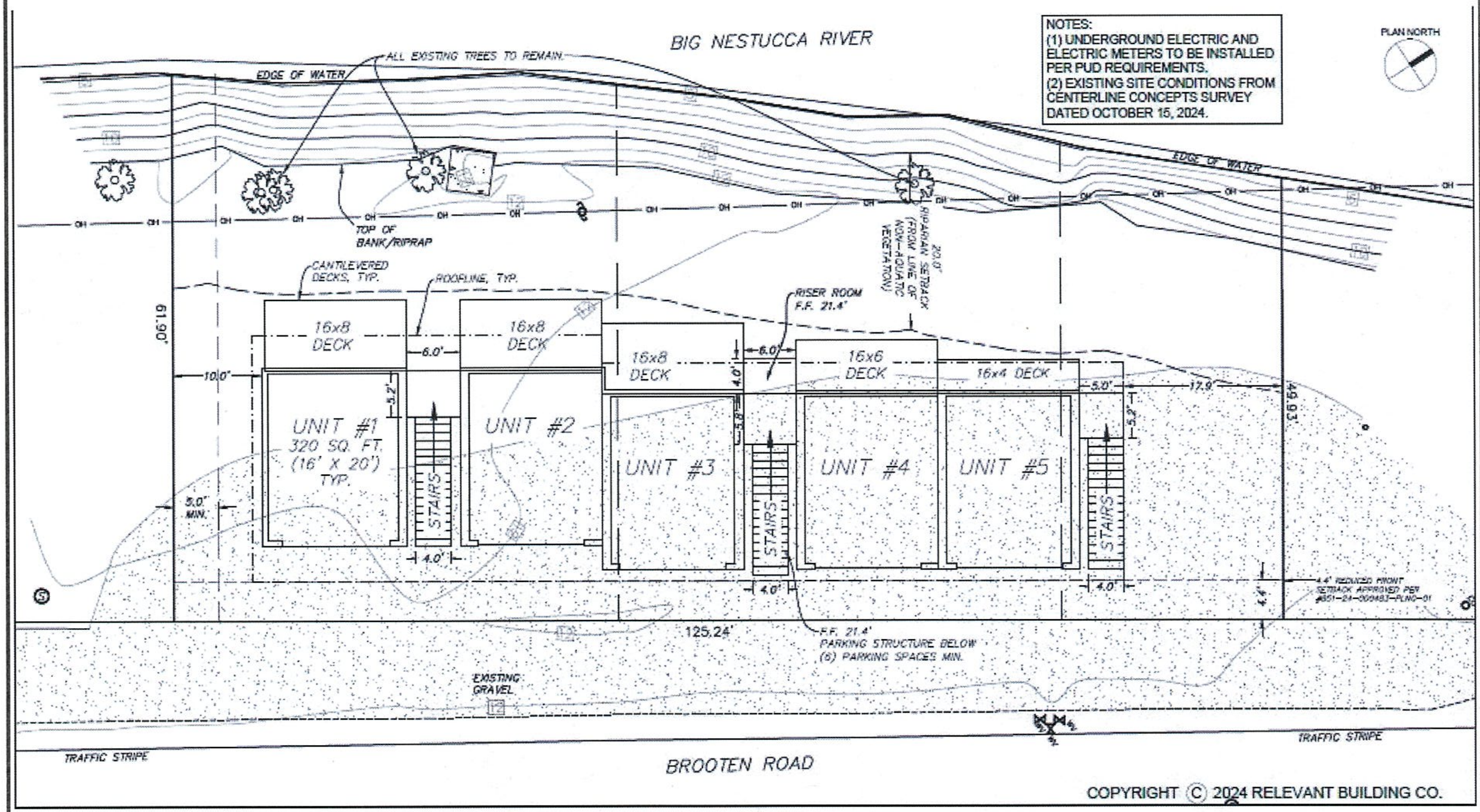


FIGURE 3

Property Survey and Site Plan

Tax Lot 1601
Brooten Road
Hydraulic Analysis Report

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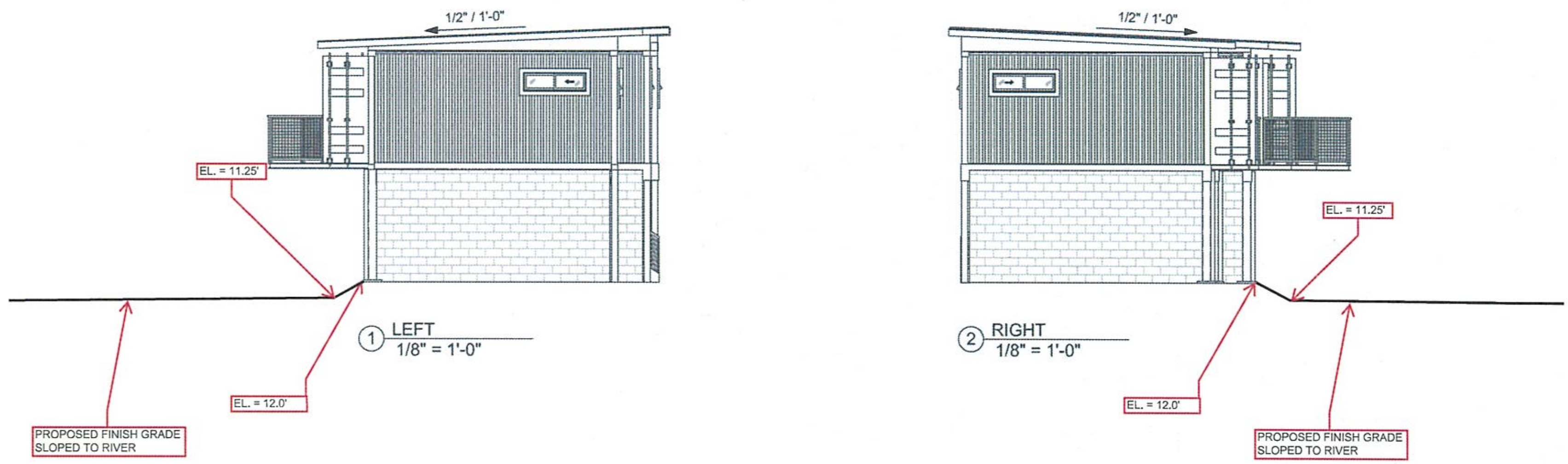

rel•e•vant build•ing com•pa•ny

www.relevantbuildings.com

NESTUCCA RIVER

No.	Description	Date

ELEVATIONS		
Project number	TAYLOR	A202
Date	1/15/2024	
Drawn by	SP	
Checked by	CC	Scale 1/8" = 1'-0"

1/23/2025 2:58:49 PM

FIGURE 4

Proposed Building Elevations

Tax Lot 1601
Brooten Road
Hydraulic Analysis Report

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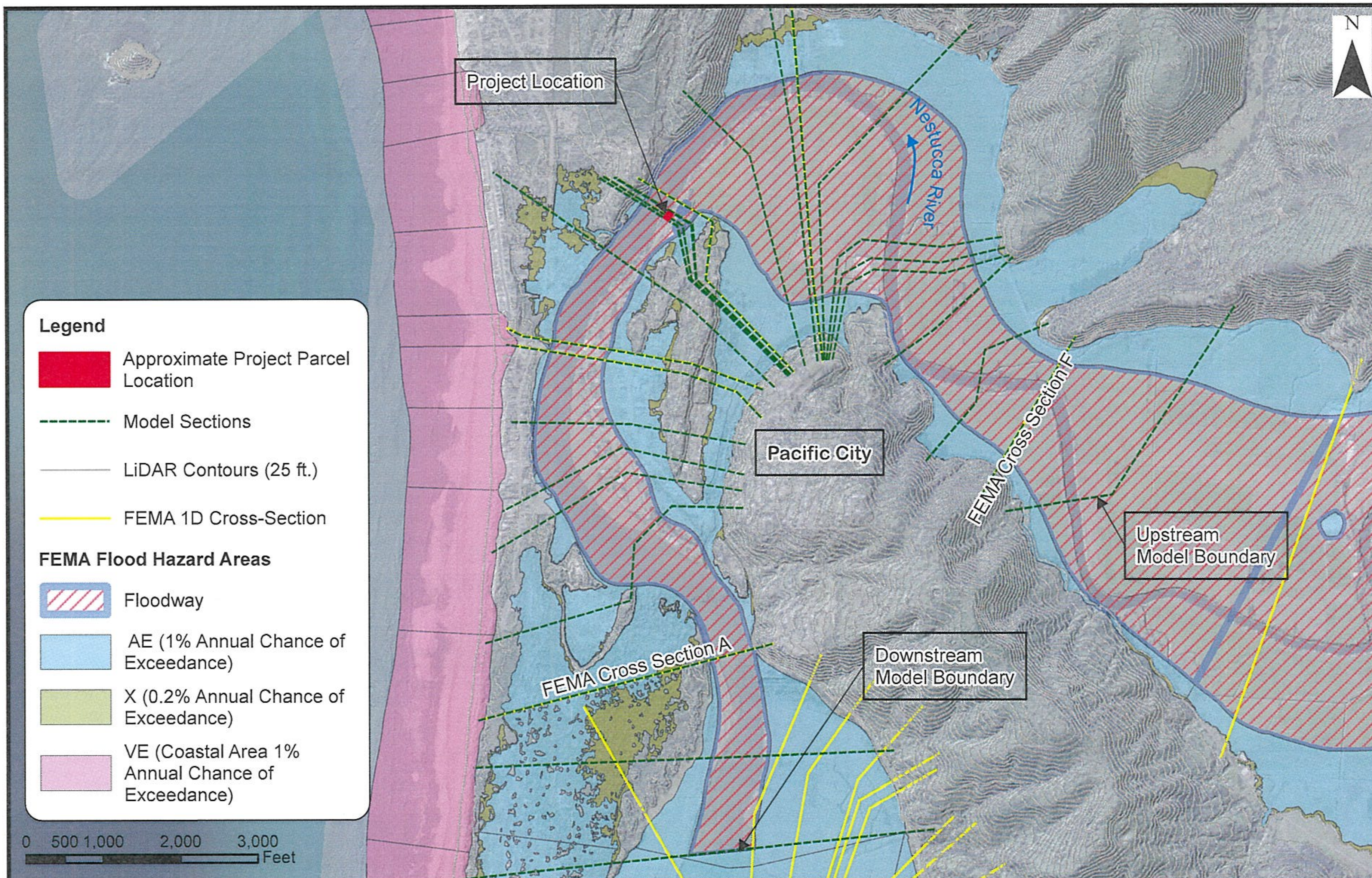

FIGURE 5

Hydraulic Analysis Overview Map of Proposed Project

Tax Lot 1601
Brooten Road
Hydraulic Analysis Report

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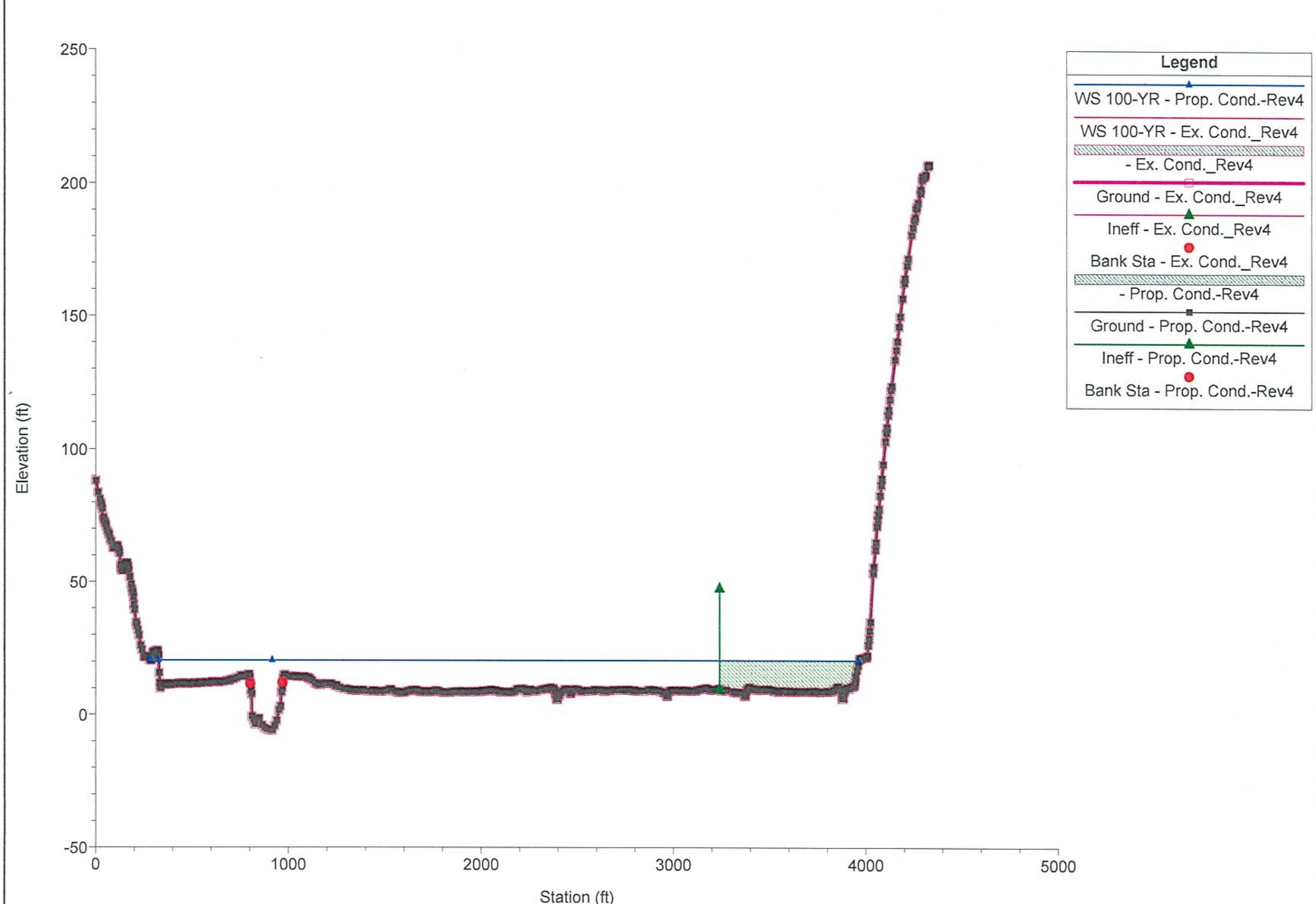
Attachment A

HEC-RAS Output Files

HEC-RAS River: Nestucca River Reach: Lower Profile: 100-YR

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Lower	22553.94	100-YR	Ex. Cond._Rev4	49700.00	-5.99	20.54	12.22	20.60	0.000089	3.04	32381.24	3646.37	0.11
Lower	22553.94	100-YR	Prop. Cond.-Rev4	49700.00	-5.99	20.54	12.22	20.60	0.000089	3.04	32383.06	3646.39	0.11
Lower	21008.6	100-YR	Ex. Cond._Rev4	49700.00	-8.92	20.14		20.36	0.000255	5.16	17954.99	1744.07	0.19
Lower	21008.6	100-YR	Prop. Cond.-Rev4	49700.00	-8.92	20.14		20.36	0.000255	5.16	17956.21	1744.07	0.19
Lower	20157.05	100-YR	Ex. Cond._Rev4	49700.00	-9.15	20.00	12.36	20.15	0.000209	4.40	20115.46	2302.96	0.17
Lower	20157.05	100-YR	Prop. Cond.-Rev4	49700.00	-9.15	20.00	12.36	20.15	0.000209	4.40	20116.83	2302.97	0.17
Lower	19079.89	100-YR	Ex. Cond._Rev4	49700.00	-11.85	19.76		19.94	0.000225	5.00	20403.30	1888.90	0.18
Lower	19079.89	100-YR	Prop. Cond.-Rev4	49700.00	-11.85	19.76		19.94	0.000225	5.00	20404.76	1888.90	0.18
Lower	18019.8	100-YR	Ex. Cond._Rev4	49700.00	-7.69	19.60	11.35	19.74	0.000183	4.29	22312.81	2668.90	0.16
Lower	18019.8	100-YR	Prop. Cond.-Rev4	49700.00	-7.69	19.60	11.35	19.74	0.000183	4.29	22314.46	2668.91	0.16
Lower	17875.97	100-YR	Ex. Cond._Rev4	49700.00	-7.60	19.58	11.05	19.71	0.000165	4.10	23192.63	2677.66	0.16
Lower	17875.97	100-YR	Prop. Cond.-Rev4	49700.00	-7.60	19.58	11.05	19.71	0.000165	4.10	23194.36	2677.66	0.16
Lower	17653.2	100-YR	Ex. Cond._Rev4	49700.00	-4.67	19.60	11.28	19.66	0.000093	3.19	29442.08	3181.97	0.12
Lower	17653.2	100-YR	Prop. Cond.-Rev4	49700.00	-4.67	19.60	11.28	19.67	0.000093	3.19	29444.25	3181.98	0.12
Lower	15949.74	100-YR	Ex. Cond._Rev4	49700.00	-7.67	19.55	9.86	19.58	0.000032	1.89	46986.45	4377.84	0.07
Lower	15949.74	100-YR	Prop. Cond.-Rev4	49700.00	-7.67	19.55	9.86	19.58	0.000032	1.89	46989.70	4377.84	0.07
Lower	14728.64	100-YR	Ex. Cond._Rev4	49700.00	-9.90	19.50	10.23	19.54	0.000043	2.45	37542.53	3856.78	0.09
Lower	14728.64	100-YR	Prop. Cond.-Rev4	49700.00	-9.90	19.50	10.23	19.54	0.000043	2.45	37545.40	3856.80	0.09
Lower	14621.23			Bridge									
Lower	14544.91	100-YR	Ex. Cond._Rev4	49700.00	-8.62	19.48	10.32	19.52	0.000044	2.52	37128.25	3872.15	0.09
Lower	14544.91	100-YR	Prop. Cond.-Rev4	49700.00	-8.62	19.48	10.32	19.52	0.000044	2.52	37131.12	3872.17	0.09
Lower	13541.26	100-YR	Ex. Cond._Rev4	49700.00	-7.81	19.44	10.21	19.48	0.000051	2.48	32968.05	3280.62	0.10
Lower	13541.26	100-YR	Prop. Cond.-Rev4	49700.00	-7.81	19.44	10.21	19.48	0.000051	2.48	32970.37	3280.63	0.10
Lower	12396	100-YR	Ex. Cond._Rev4	49700.00	-3.59	18.58		19.29	0.000455	7.03	9152.35	2054.14	0.30
Lower	12396	100-YR	Prop. Cond.-Rev4	49700.00	-3.59	18.58		19.29	0.000455	7.03	9153.07	2054.19	0.30
Lower	12232.5	100-YR	Ex. Cond._Rev4	49700.00	-3.50	18.27		19.18	0.000586	7.75	7359.40	2136.11	0.34
Lower	12232.5	100-YR	Prop. Cond.-Rev4	49700.00	-3.50	18.27		19.18	0.000586	7.75	7360.43	2136.13	0.34
Lower	12209.11	100-YR	Ex. Cond._Rev4	49700.00	-3.49	18.27		19.17	0.000585	7.72	7456.65	2150.00	0.34
Lower	12209.11	100-YR	Prop. Cond.-Rev4	49700.00	-3.49	18.26		19.17	0.000590	7.75	7425.21	2148.59	0.34
Lower	12156.75	100-YR	Ex. Cond._Rev4	49700.00	-3.45	18.24		19.13	0.000599	7.72	7528.92	2037.85	0.34
Lower	12156.75	100-YR	Prop. Cond.-Rev4	49700.00	-3.45	18.23		19.14	0.000602	7.75	7522.18	2036.29	0.34
Lower	12151.91	100-YR	Ex. Cond._Rev4	49700.00	-3.45	18.24		19.13	0.000600	7.72	7534.11	2030.29	0.34
Lower	12151.91	100-YR	Prop. Cond.-Rev4	49700.00	-3.45	18.23		19.13	0.000603	7.73	7534.93	2028.88	0.34
Lower	12117.41	100-YR	Ex. Cond._Rev4	49700.00	-3.43	18.20		19.11	0.000614	7.78	7444.74	2043.21	0.34
Lower	12117.41	100-YR	Prop. Cond.-Rev4	49700.00	-3.43	18.19		19.11	0.000616	7.80	7451.85	2041.84	0.34
Lower	12102.8	100-YR	Ex. Cond._Rev4	49700.00	-3.43	18.19		19.10	0.000614	7.79	7457.32	2063.84	0.34
Lower	12102.8	100-YR	Prop. Cond.-Rev4	49700.00	-3.43	18.19		19.10	0.000614	7.79	7457.32	2063.84	0.34
Lower	11367.2	100-YR	Ex. Cond._Rev4	49700.00	-3.05	17.73	9.51	18.65	0.000621	7.83	7532.11	2017.15	0.34
Lower	11367.2	100-YR	Prop. Cond.-Rev4	49700.00	-3.05	17.73	9.51	18.65	0.000621	7.83	7532.11	2017.15	0.34
Lower	10048.77	100-YR	Ex. Cond._Rev4	49700.00	-3.49	16.97	9.18	17.81	0.000619	7.53	8674.57	2062.18	0.34
Lower	10048.77	100-YR	Prop. Cond.-Rev4	49700.00	-3.49	16.97	9.18	17.81	0.000619	7.53	8674.57	2062.18	0.34
Lower	9942.323			Bridge									
Lower	9904.361	100-YR	Ex. Cond._Rev4	49700.00	-8.44	16.82	8.05	17.51	0.000542	6.93	10023.92	2094.07	0.31
Lower	9904.361	100-YR	Prop. Cond.-Rev4	49700.00	-8.44	16.82	8.05	17.51	0.000542	6.93	10023.92	2094.07	0.31
Lower	8988.11	100-YR	Ex. Cond._Rev4	49700.00	-4.80	16.61	8.14	16.97	0.000329	5.36	12949.13	1986.55	0.24
Lower	8988.11	100-YR	Prop. Cond.-Rev4	49700.00	-4.80	16.61	8.14	16.97	0.000329	5.36	12949.13	1986.55	0.24
Lower	8192.259	100-YR	Ex. Cond._Rev4	49700.00	-18.19	16.35	6.30	16.72	0.000308	5.47	12921.58	2041.81	0.23
Lower	8192.259	100-YR	Prop. Cond.-Rev4	49700.00	-18.19	16.35	6.30	16.72	0.000308	5.47	12921.58	2041.81	0.23
Lower	7839.108	100-YR	Ex. Cond._Rev4	49700.00	-6.96	16.25	6.76	16.61	0.000310	5.16	12464.76	1879.15	0.23
Lower	7839.108	100-YR	Prop. Cond.-Rev4	49700.00	-6.96	16.25	6.76	16.61	0.000310	5.16	12464.76	1879.15	0.23
Lower	6628.945	100-YR	Ex. Cond._Rev4	49700.00	-1.36	16.04	6.84	16.27	0.000208	3.91	14212.35	3171.30	0.19
Lower	6628.945	100-YR	Prop. Cond.-Rev4	49700.00	-1.36	16.04	6.84	16.27	0.000208	3.91	14212.35	3171.30	0.19
Lower	4746.314	100-YR	Ex. Cond._Rev4	49700.00	-11.72	14.76	7.45	15.56	0.000672	7.30	7417.23	2442.34	0.34
Lower	4746.314	100-YR	Prop. Cond.-Rev4	49700.00	-11.72	14.76	7.45	15.56	0.000672	7.30	7417.23	2442.34	0.34
Lower	3370.732	100-YR	Ex. Cond._Rev4	49700.00	-3.40	14.28	6.63	14.73	0.000430	5.53	9803.55	3594.57	0.27
Lower	3370.732	100-YR	Prop. Cond.-Rev4	49700.00	-3.40	14.28	6.63	14.73	0.000430	5.53	9803.55	3594.57	0.27

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4



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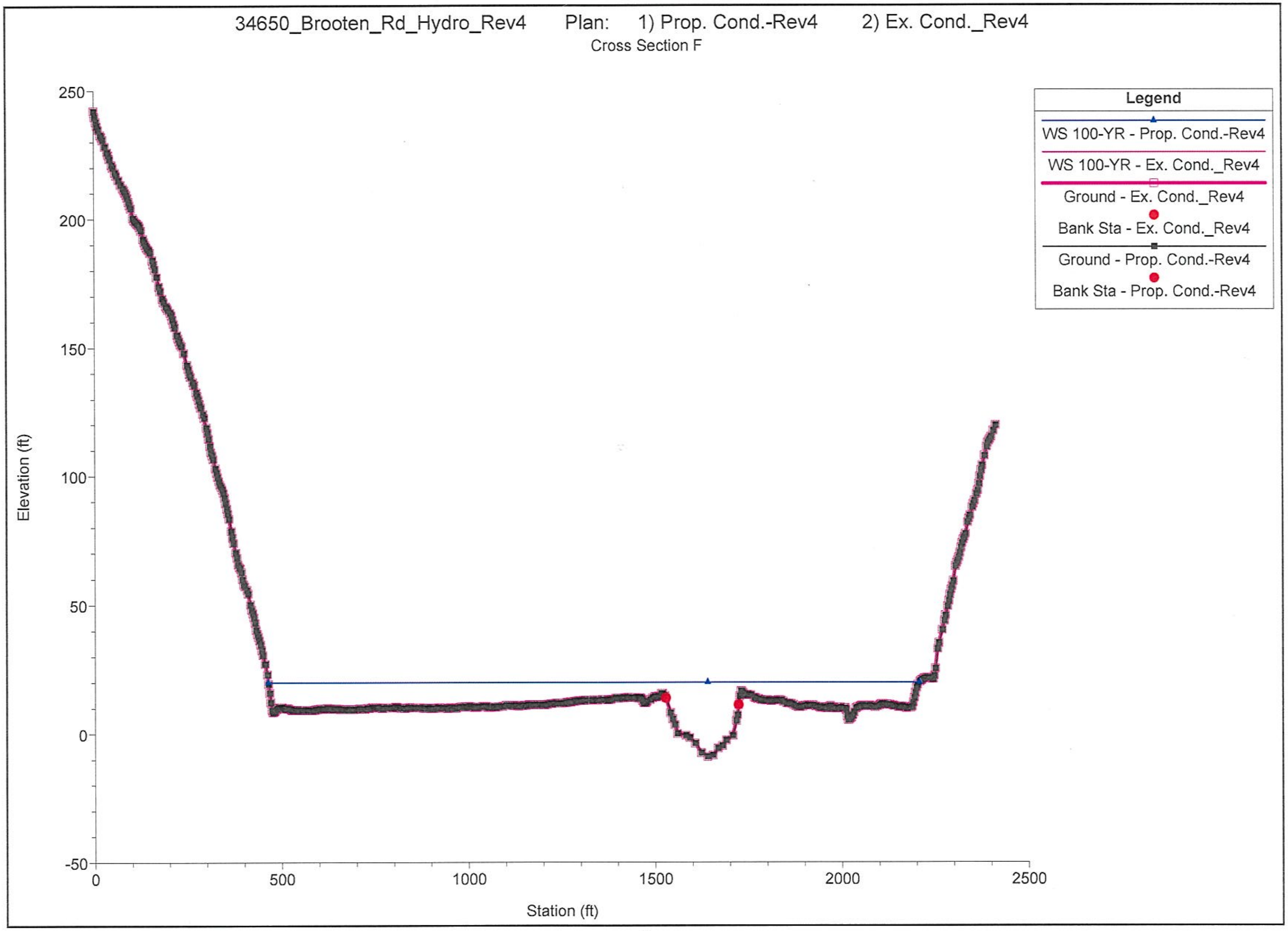
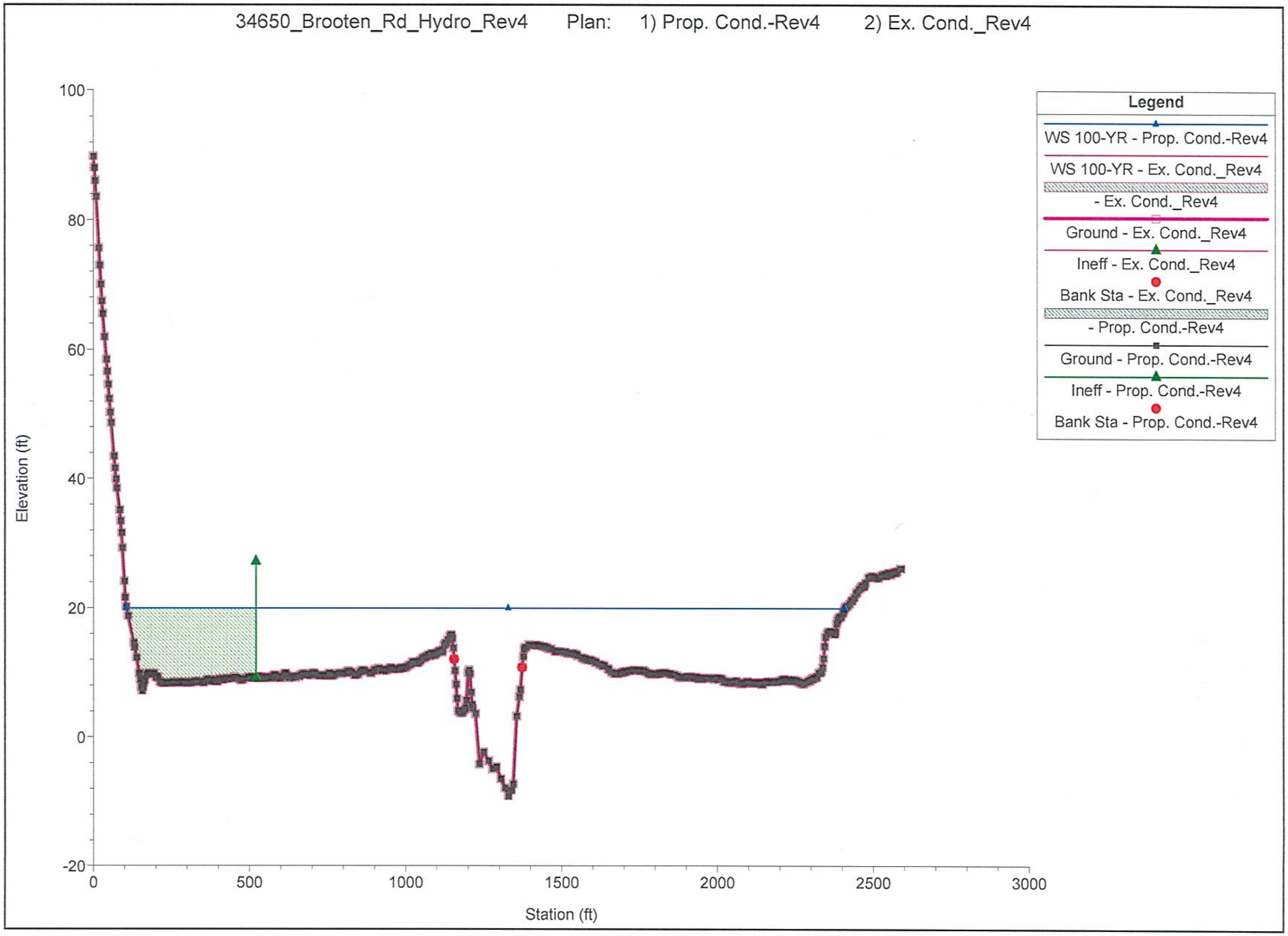
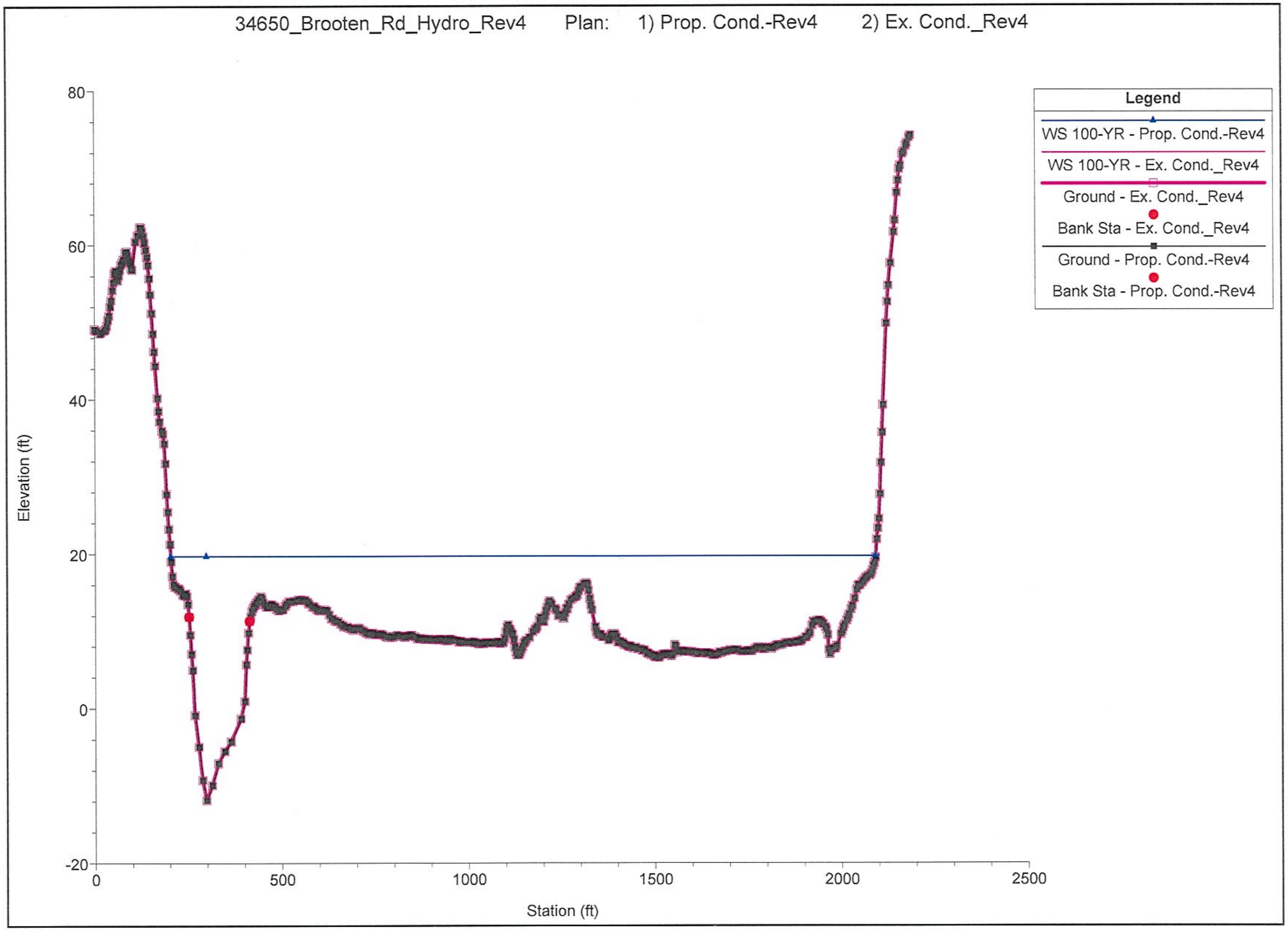
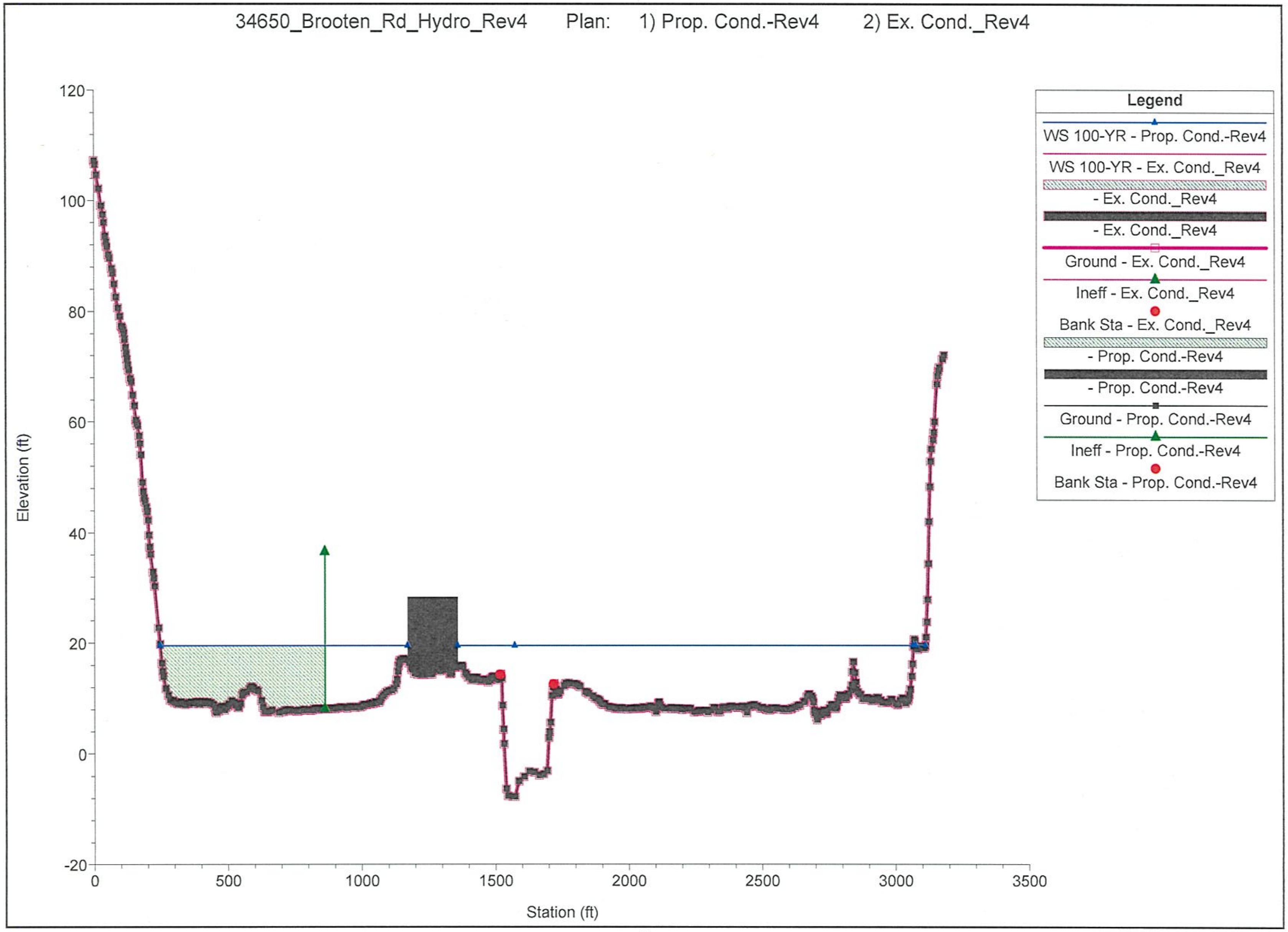
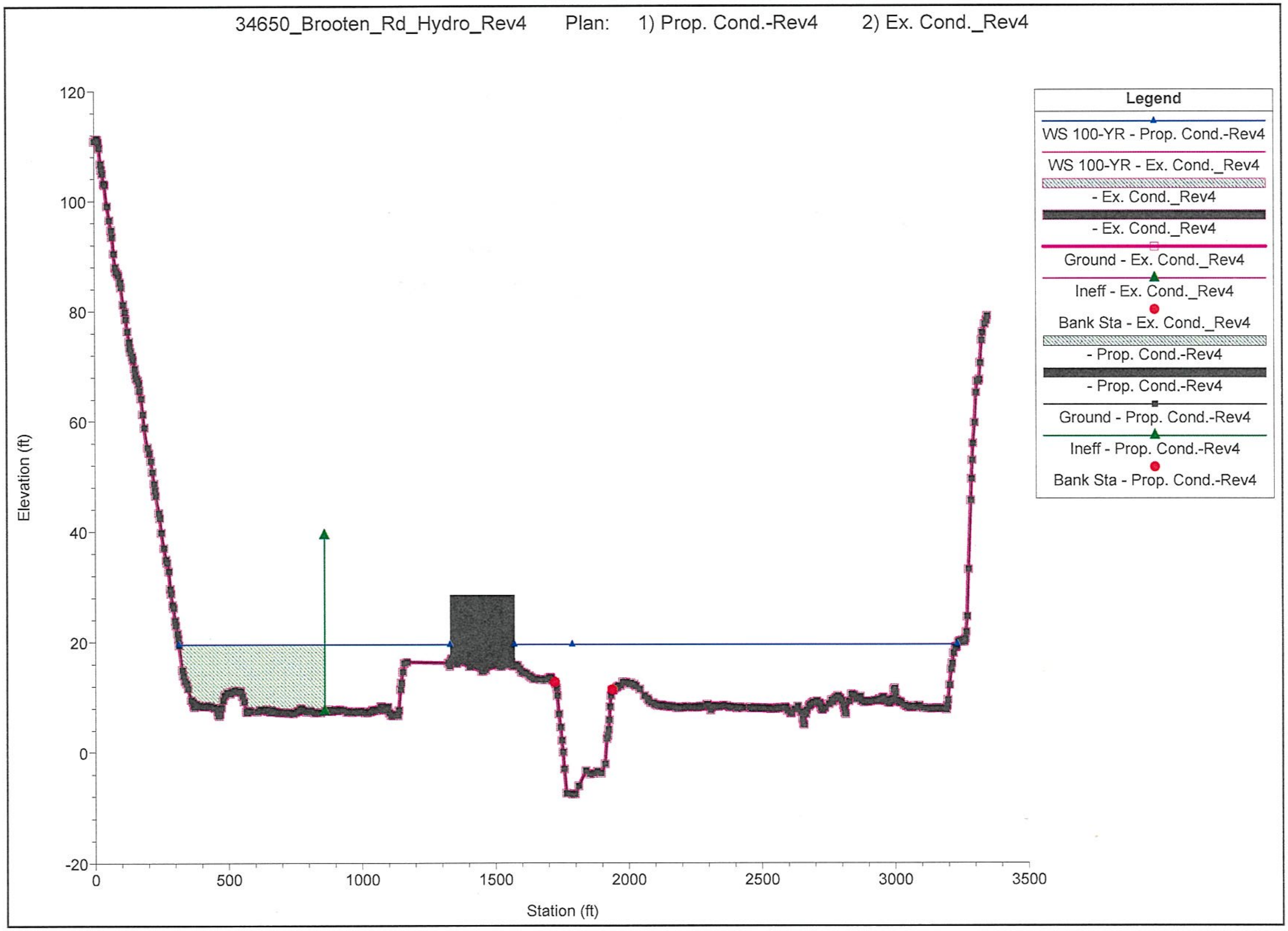
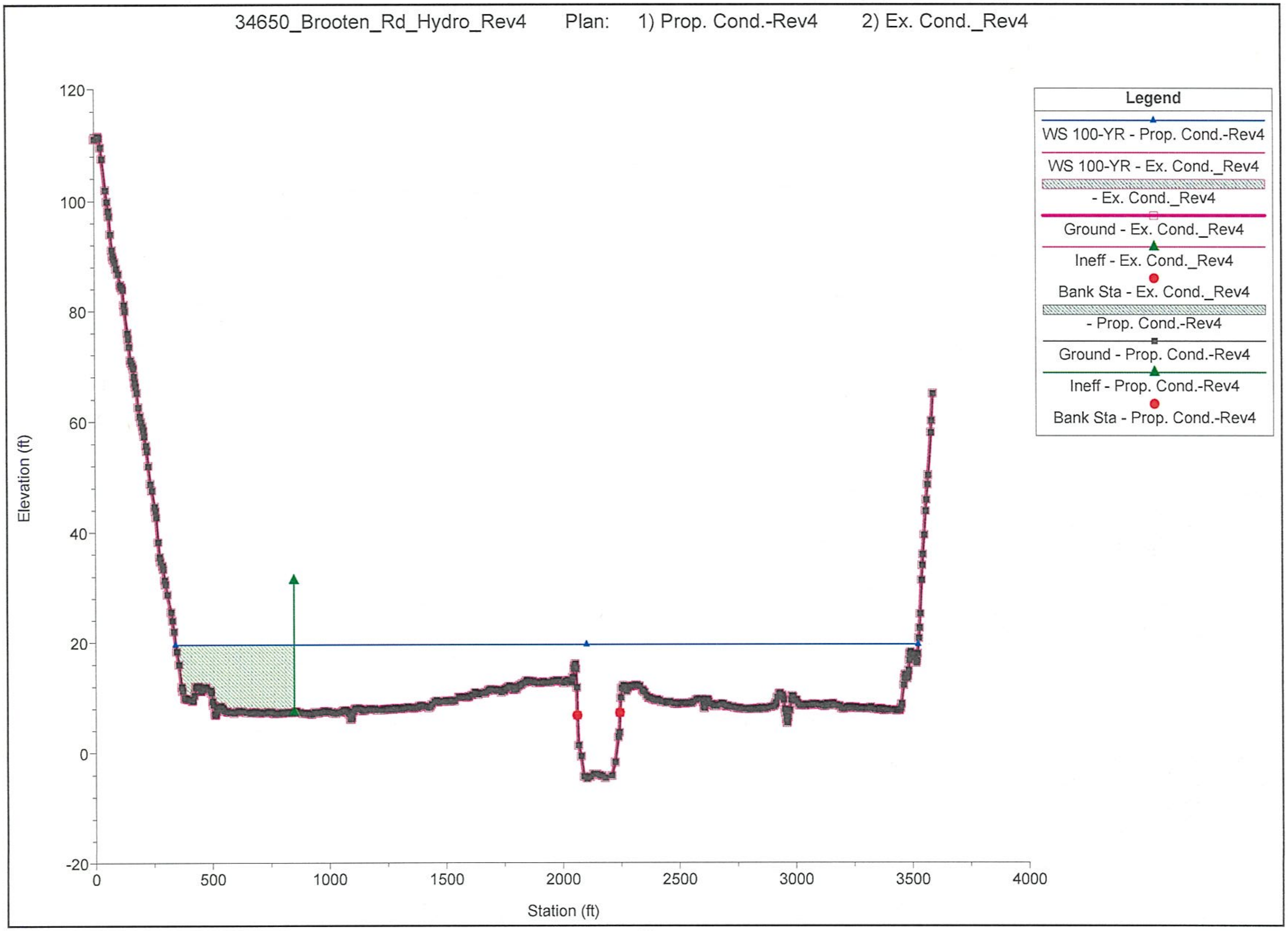

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Cross Section F
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
Ground - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
250
200
150
100
50
0
-50
0
500
1000
1500
2000
2500
Station (ft)

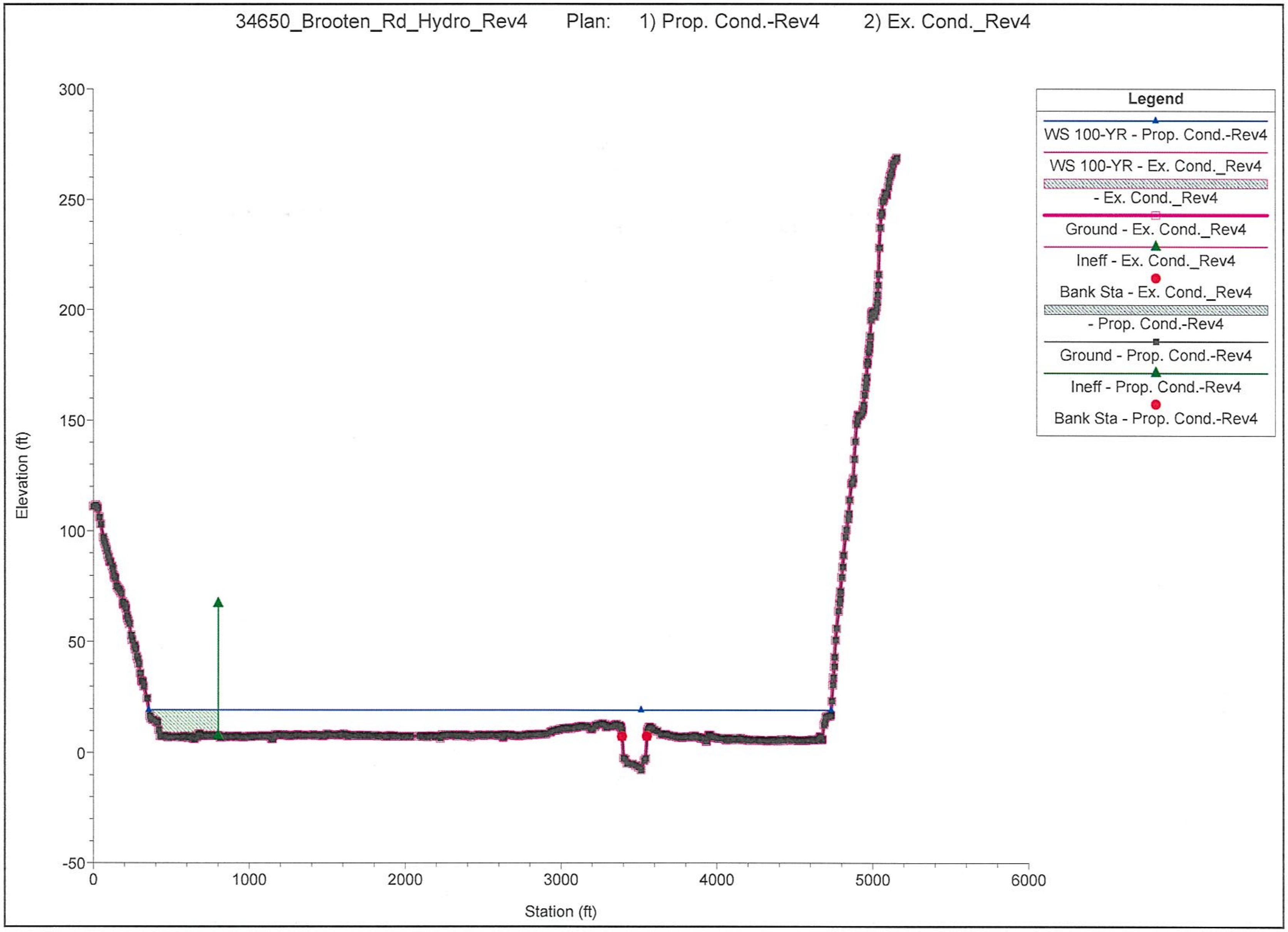

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
Station (ft)


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
Ground - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
Station (ft)
80
60
40
20
0
-20
0
500
1000
1500
2000
2500

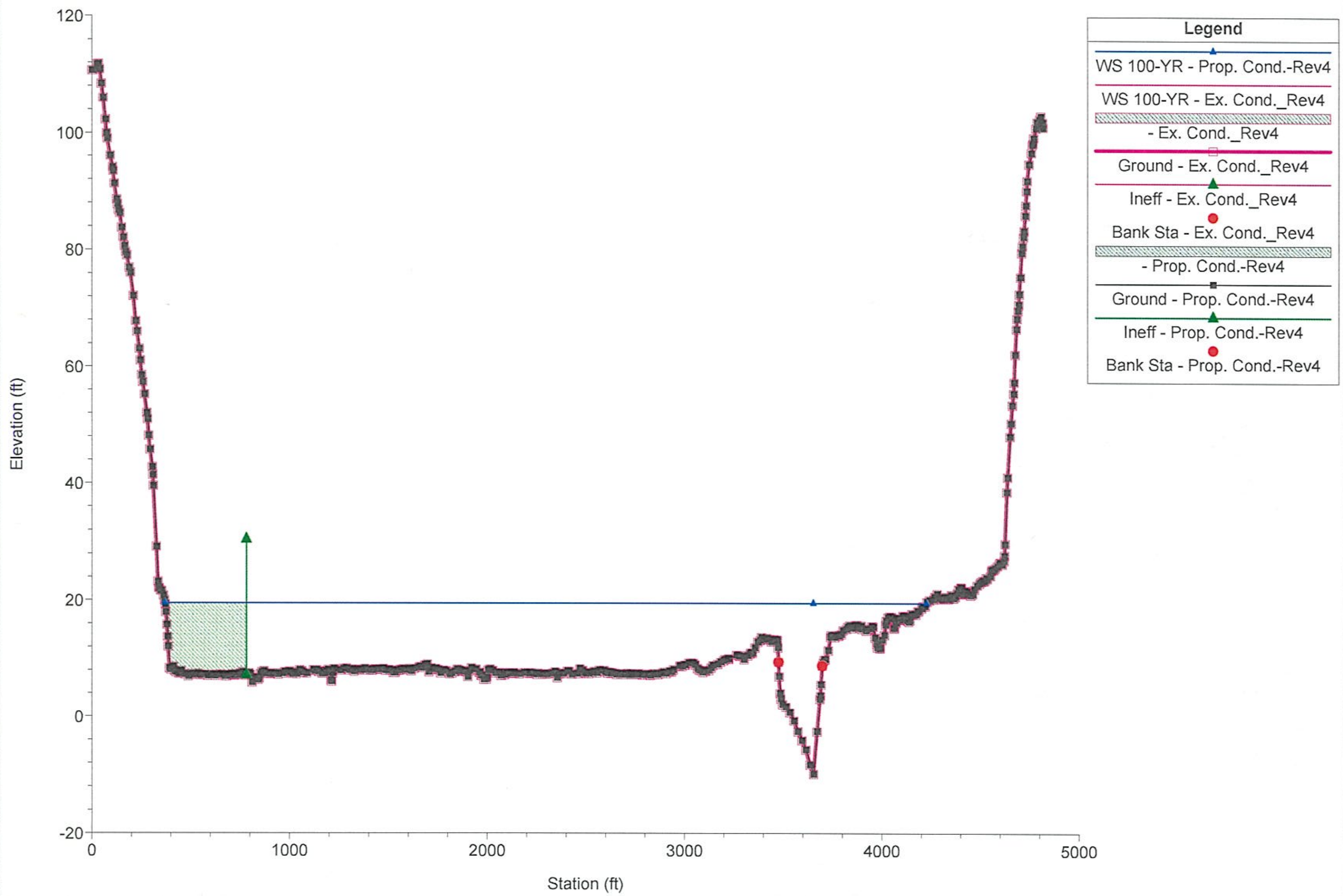

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
Station (ft)
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
Station (ft)


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)

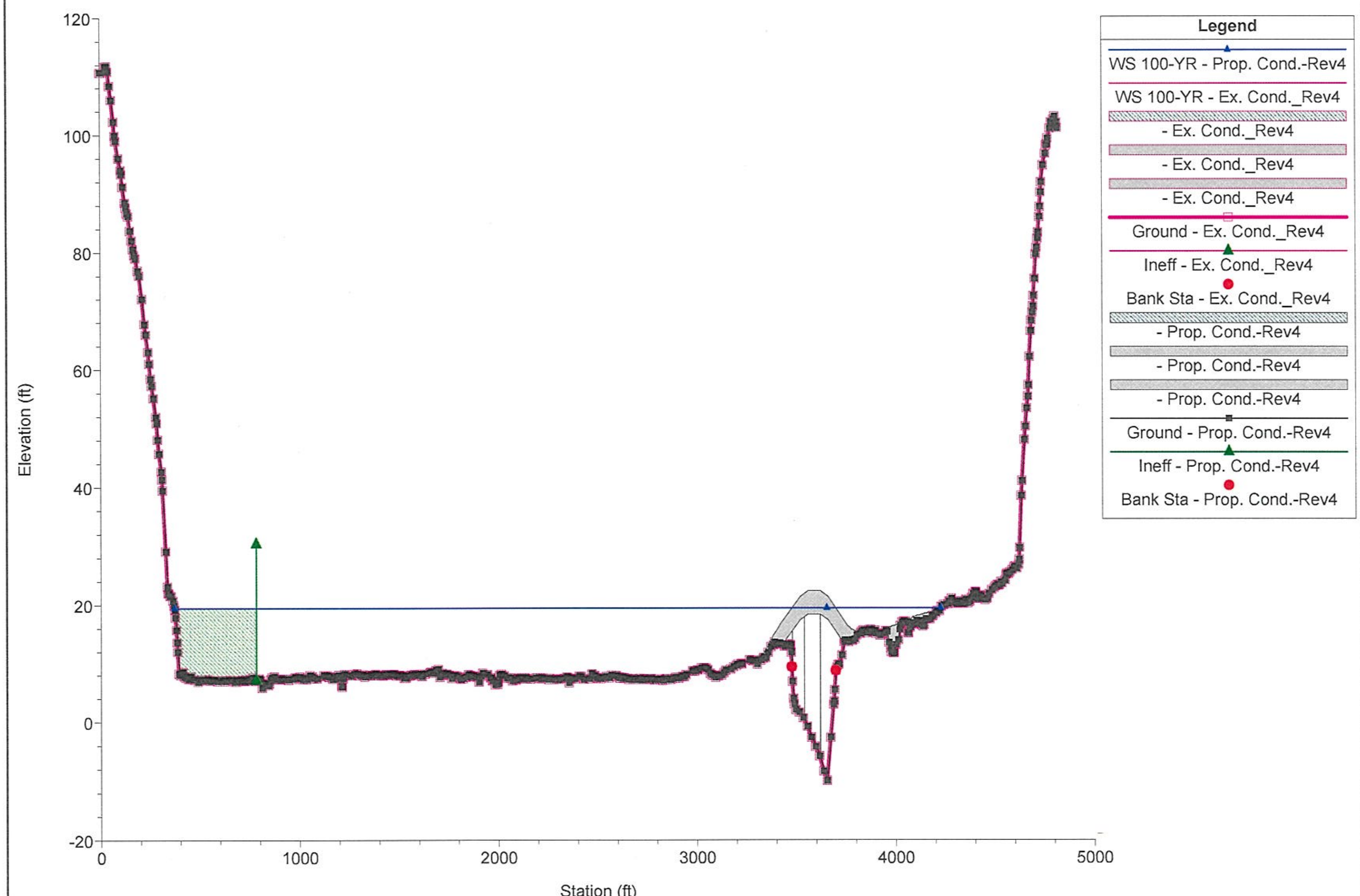

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Elevation (ft)
300
250
200
150
100
50
0
-50
0
1000
2000
3000
4000
5000
6000
Station (ft)
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Cross Section E

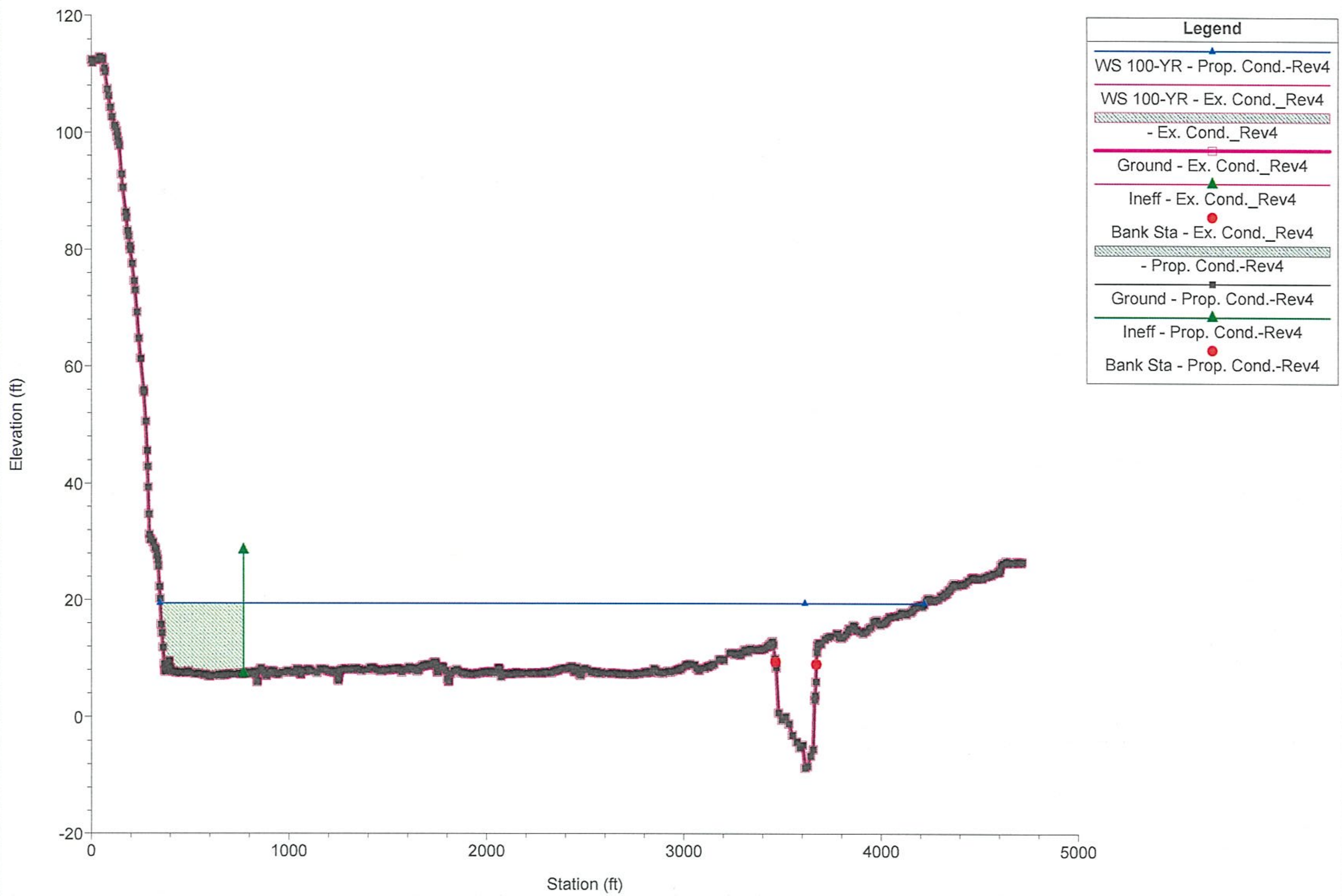


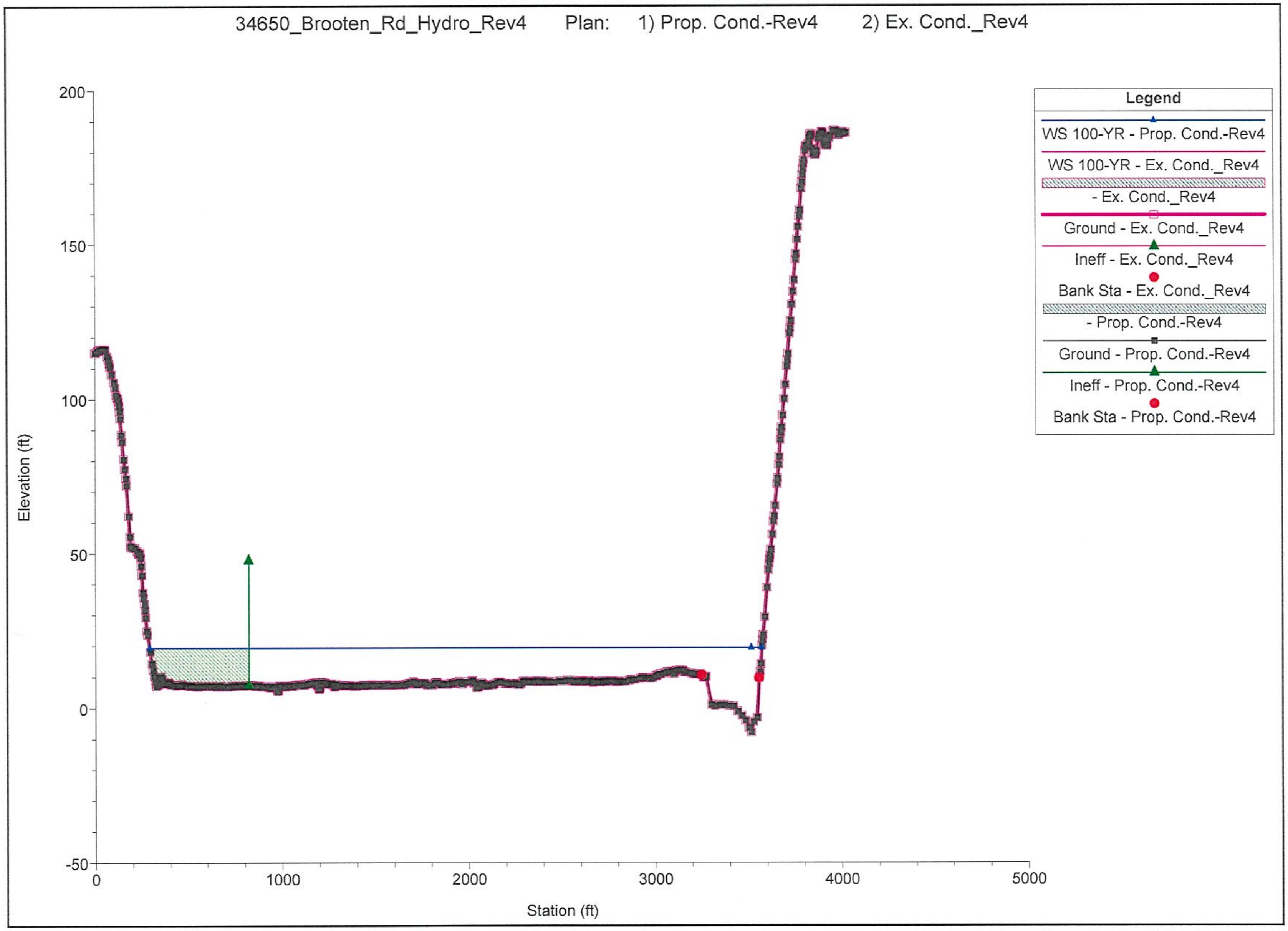
34650_Brooten_Rd_Hydro_Rev4   Plan: 1) Prop. Cond.-Rev4   2) Ex. Cond._Rev4

Based on drawings provided by Tillamook Co.

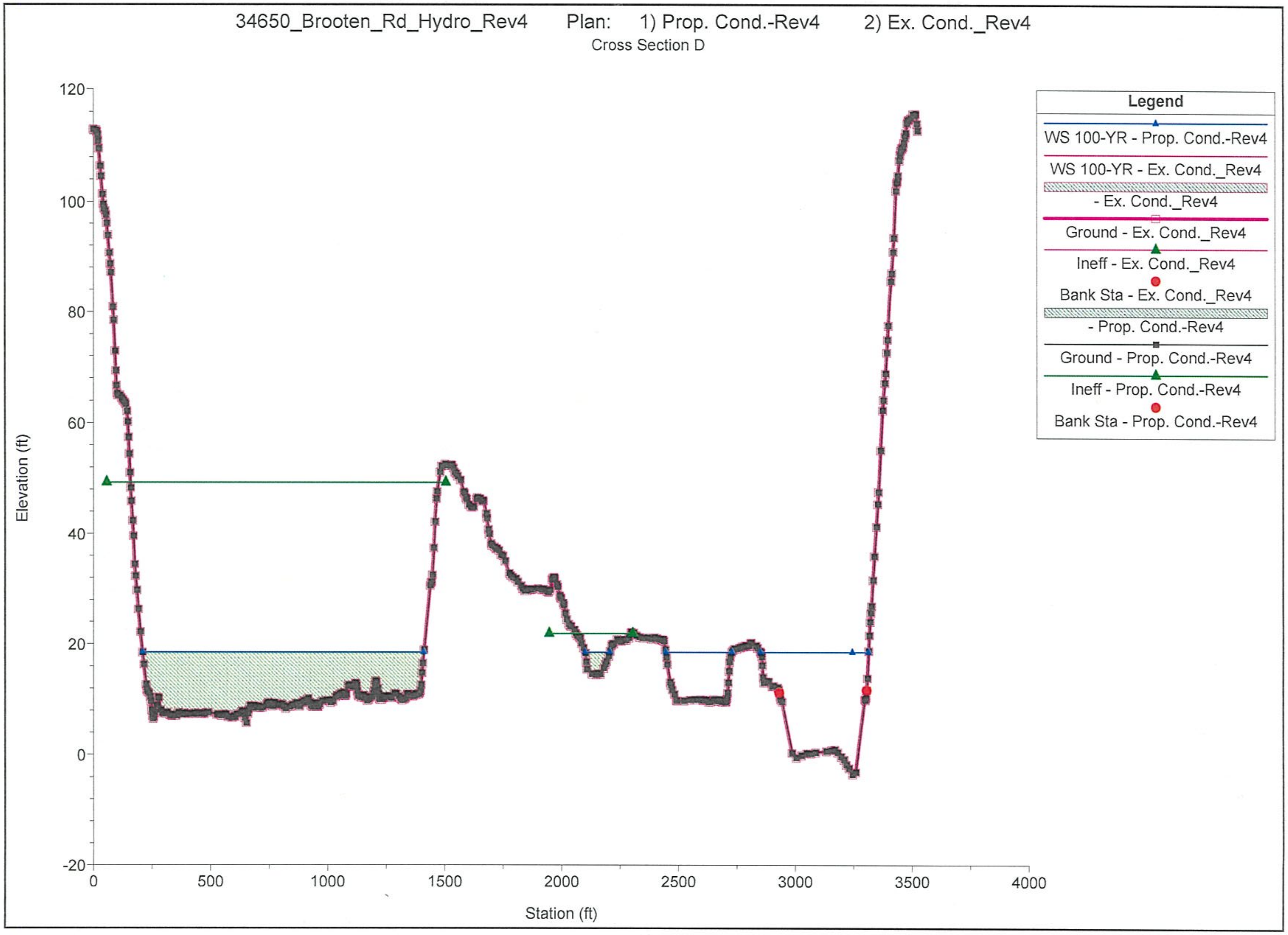


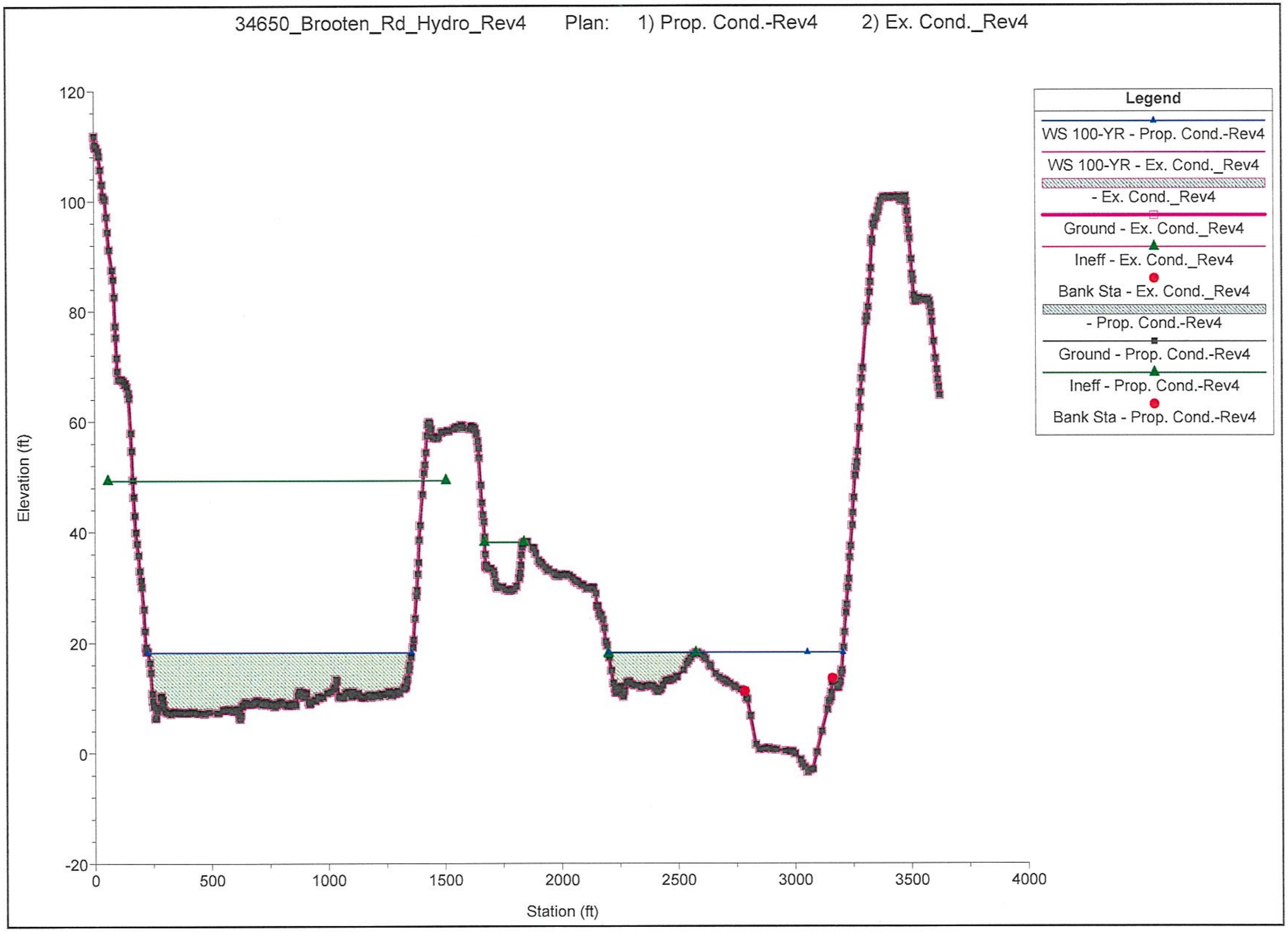
34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4

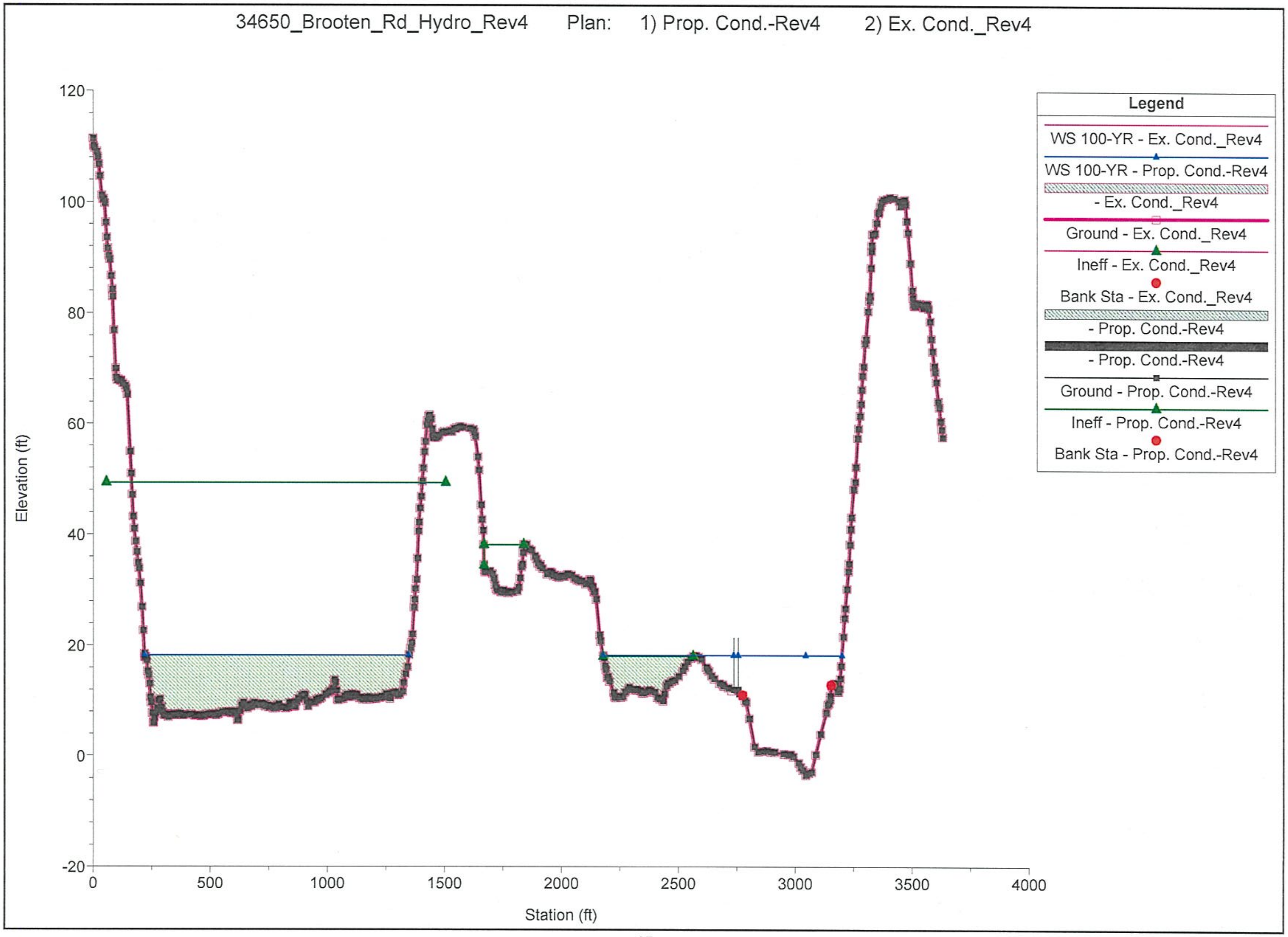




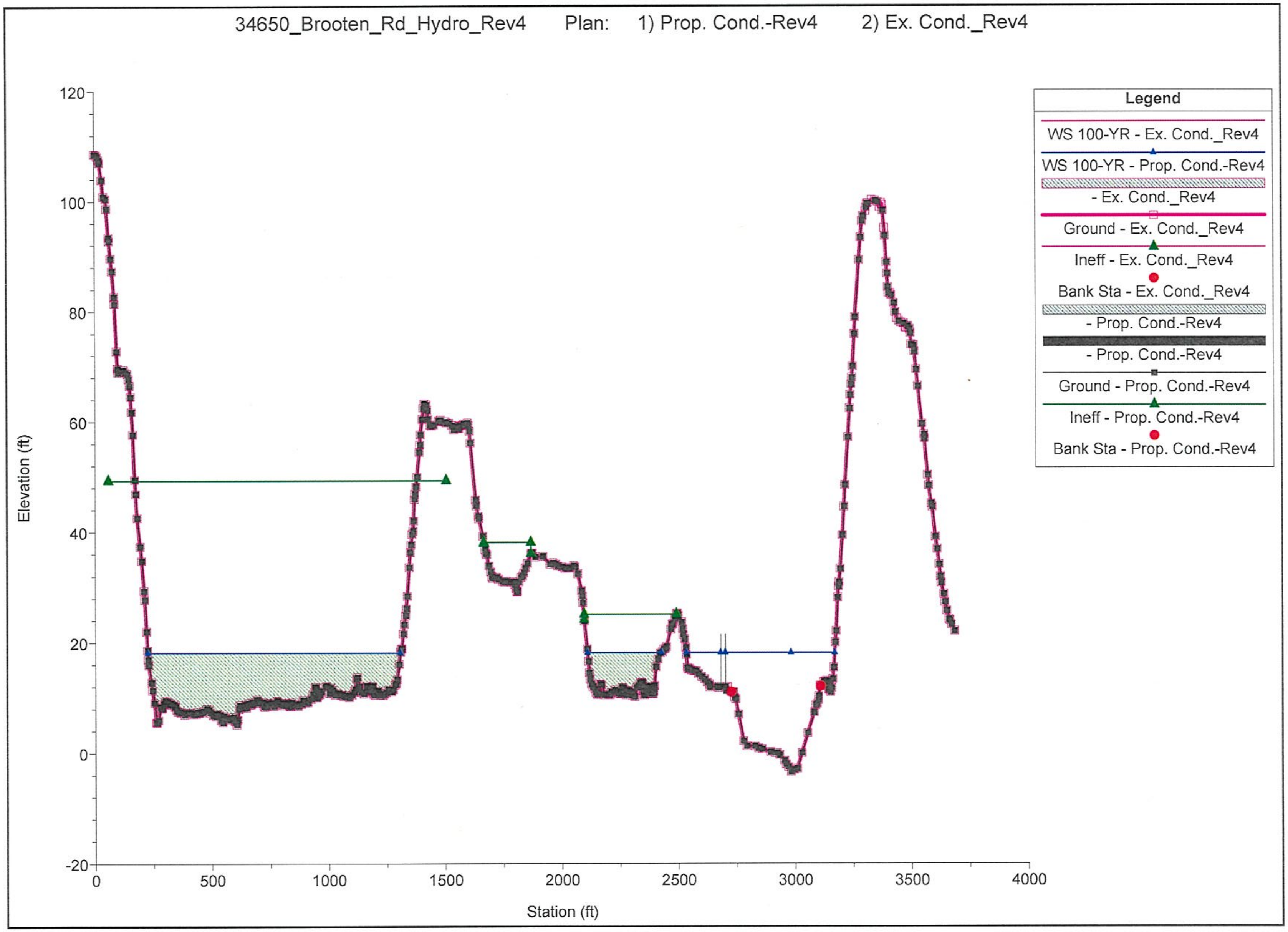
34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Elevation (ft)
200
150
100
50
0
-50
Station (ft)
0
1000
2000
3000
4000
5000
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4

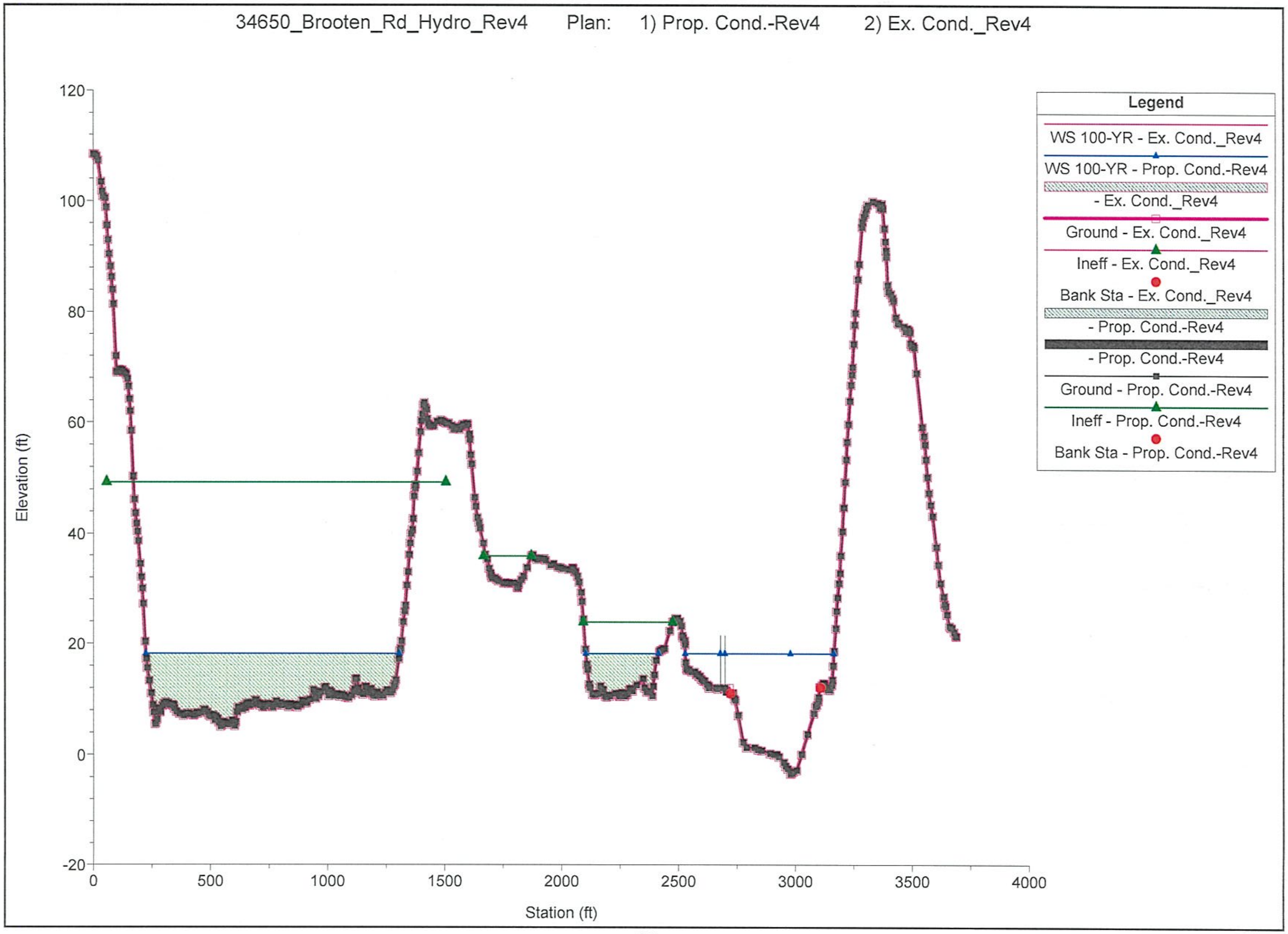

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Cross Section D
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Elevation (ft)
Station (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Legend
WS 100-YR - Prop. Cond.-Rev4
WS 100-YR - Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4

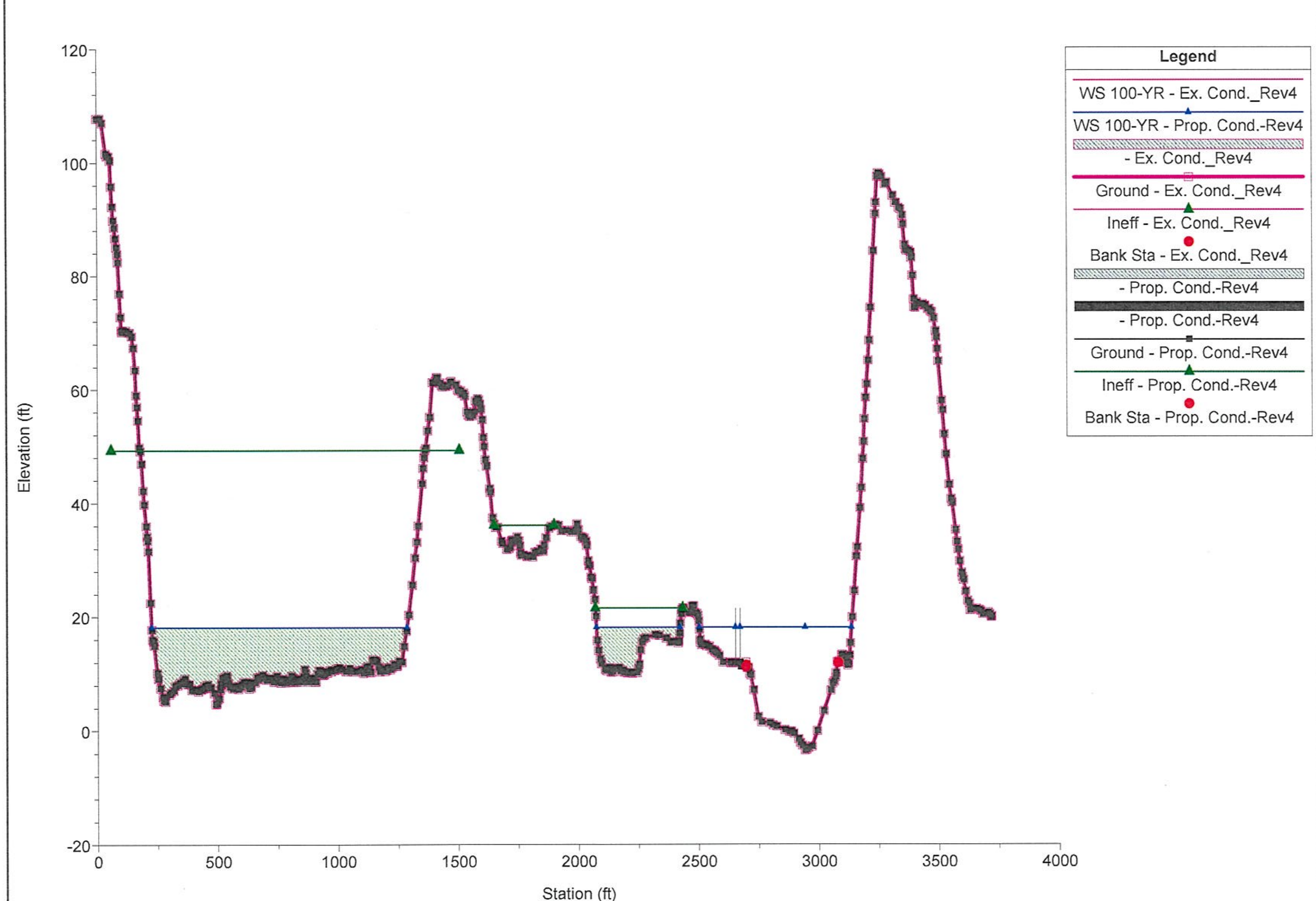


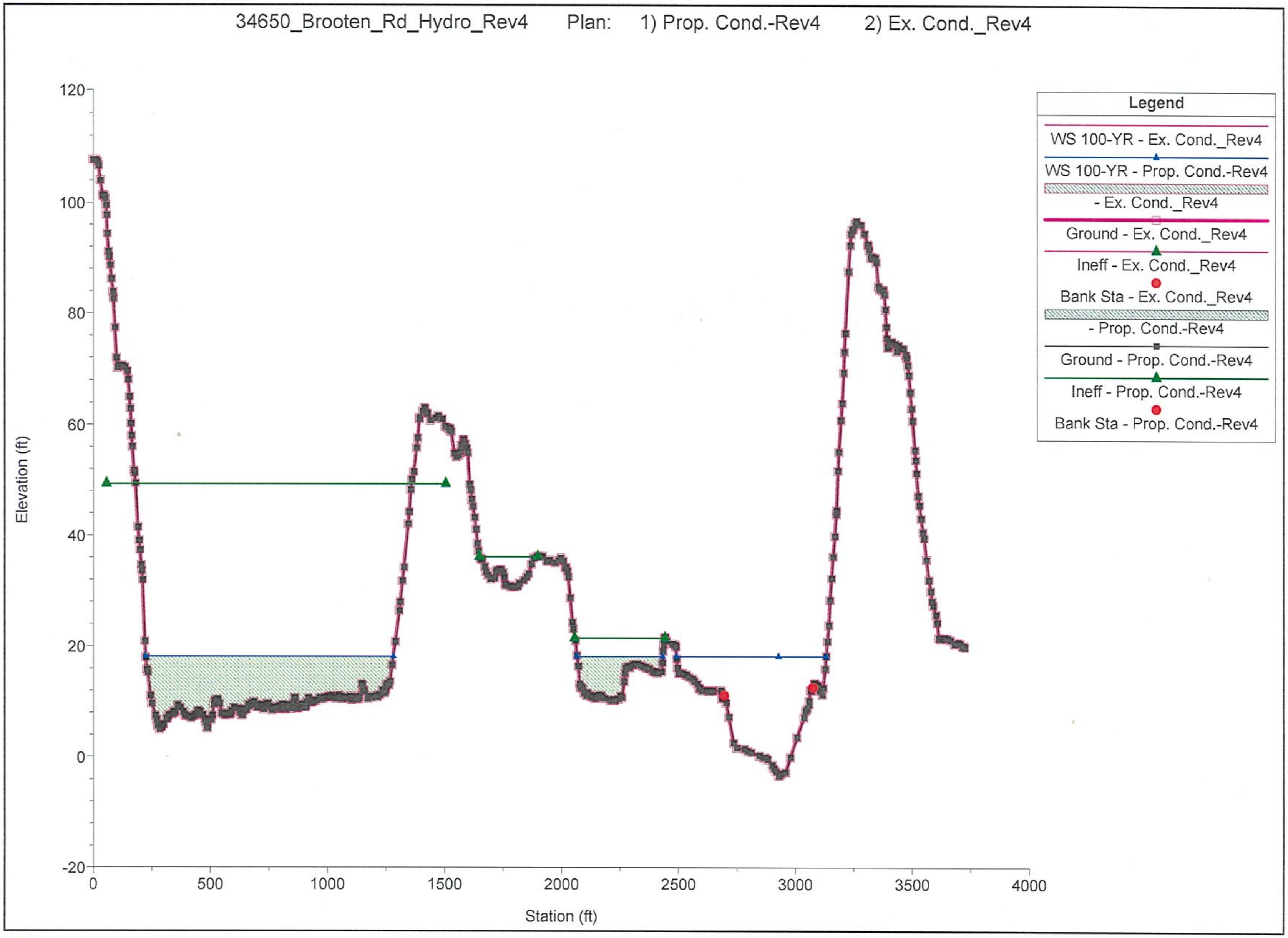
34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)

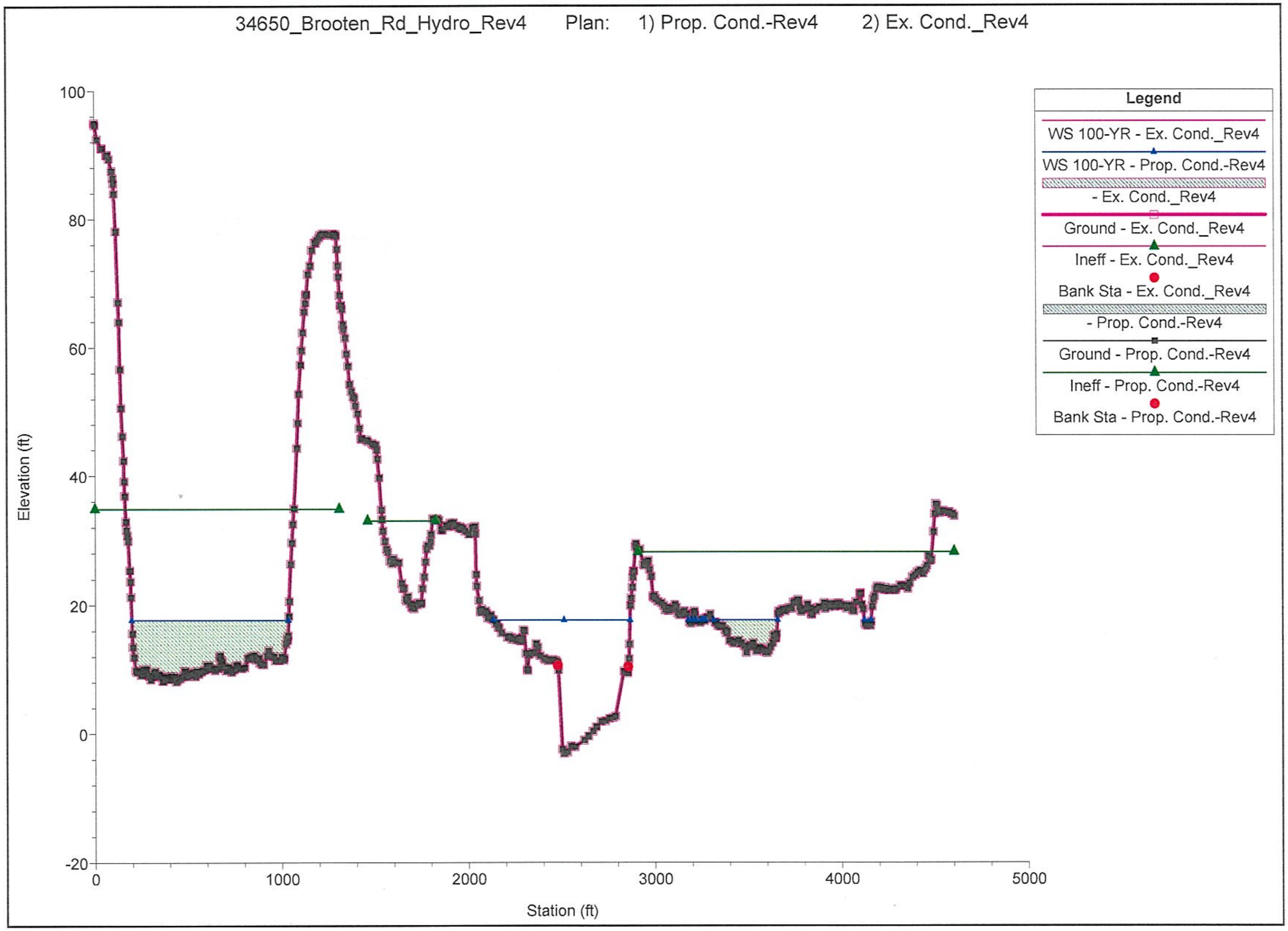

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4

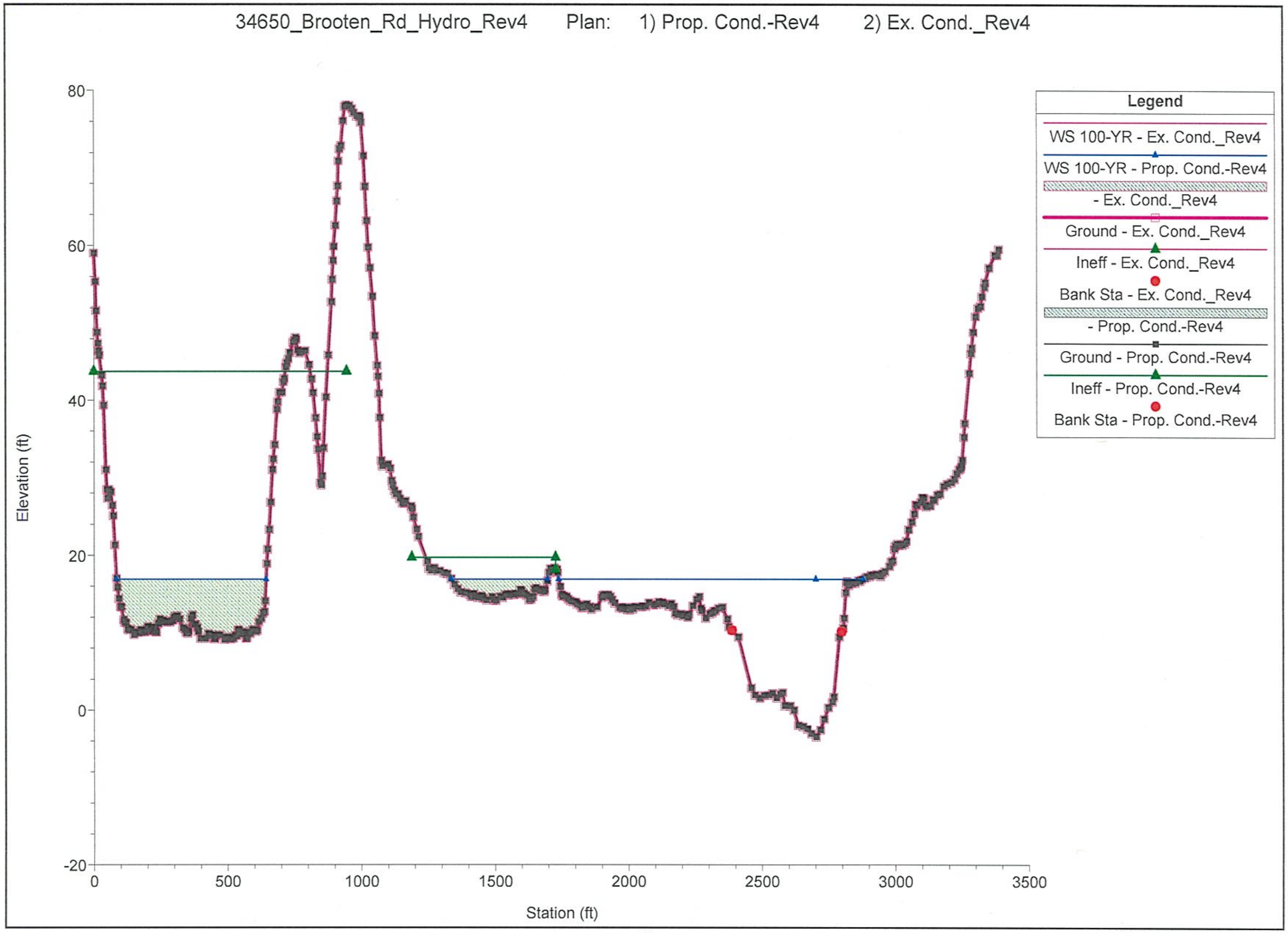
34650_Brooten_Rd_Hydro_Rev4   Plan: 1) Prop. Cond.-Rev4   2) Ex. Cond._Rev4



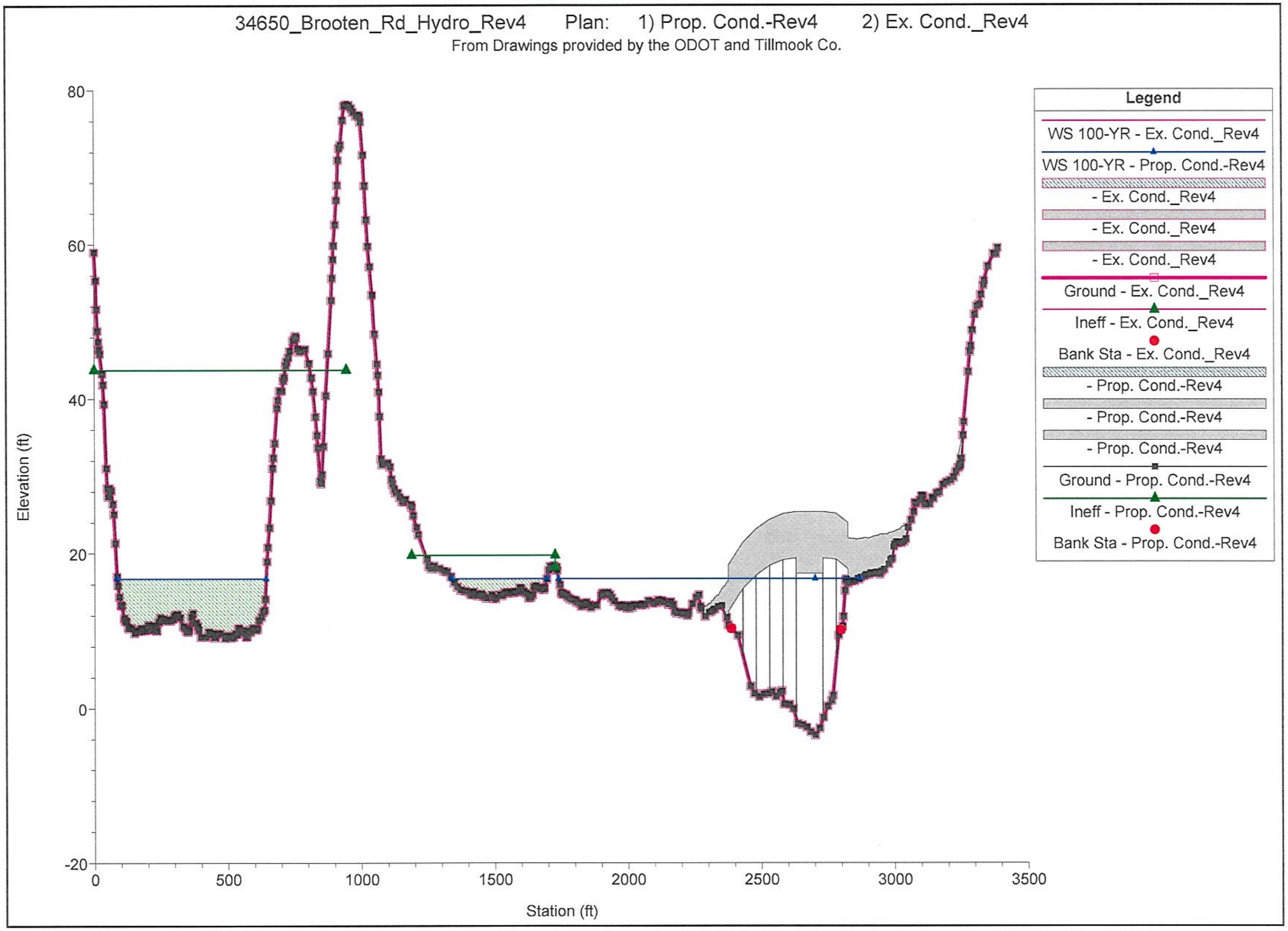


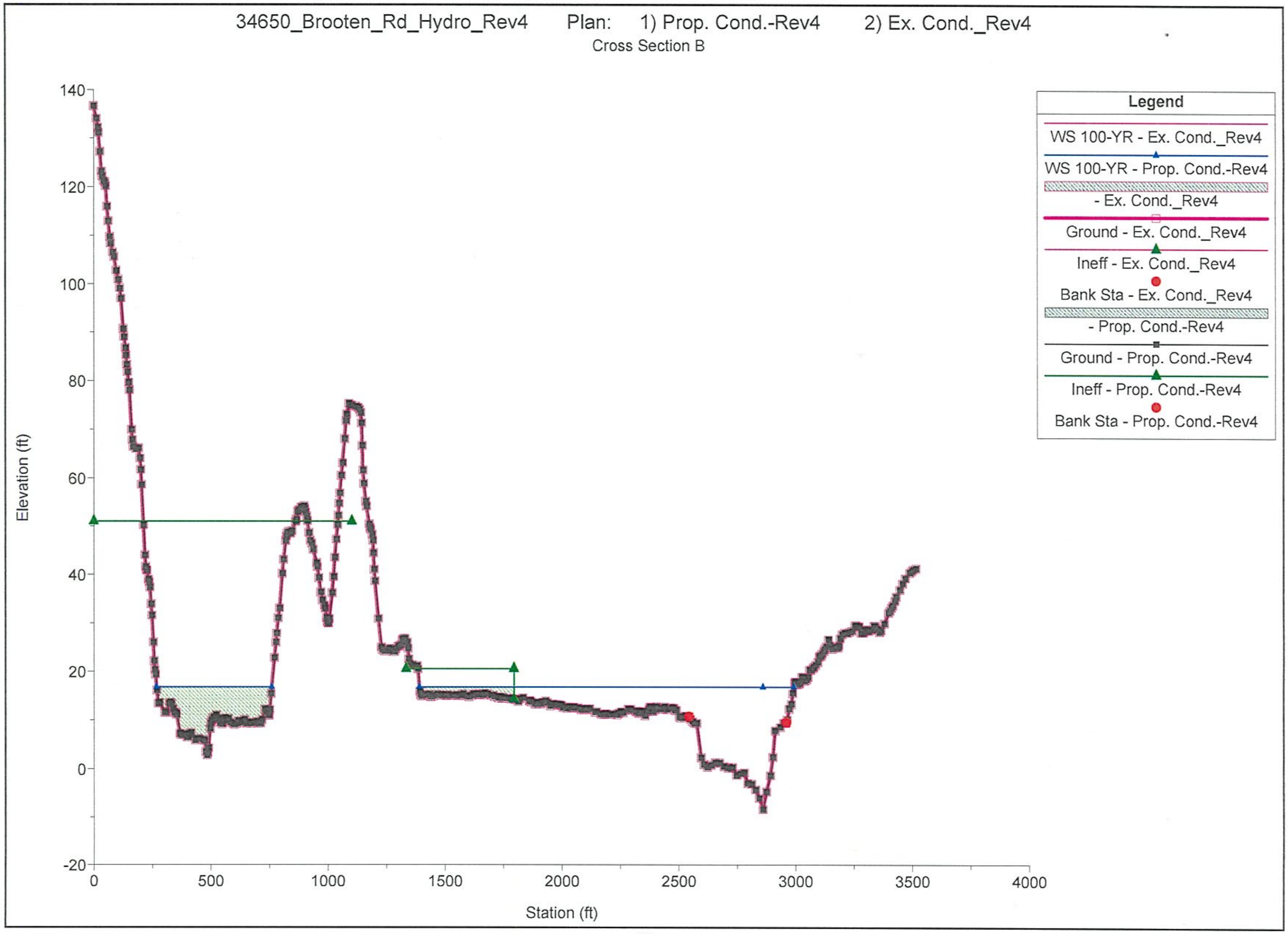
34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
100
80
60
40
20
0
-20
0
1000
2000
3000
4000
5000
Station (ft)



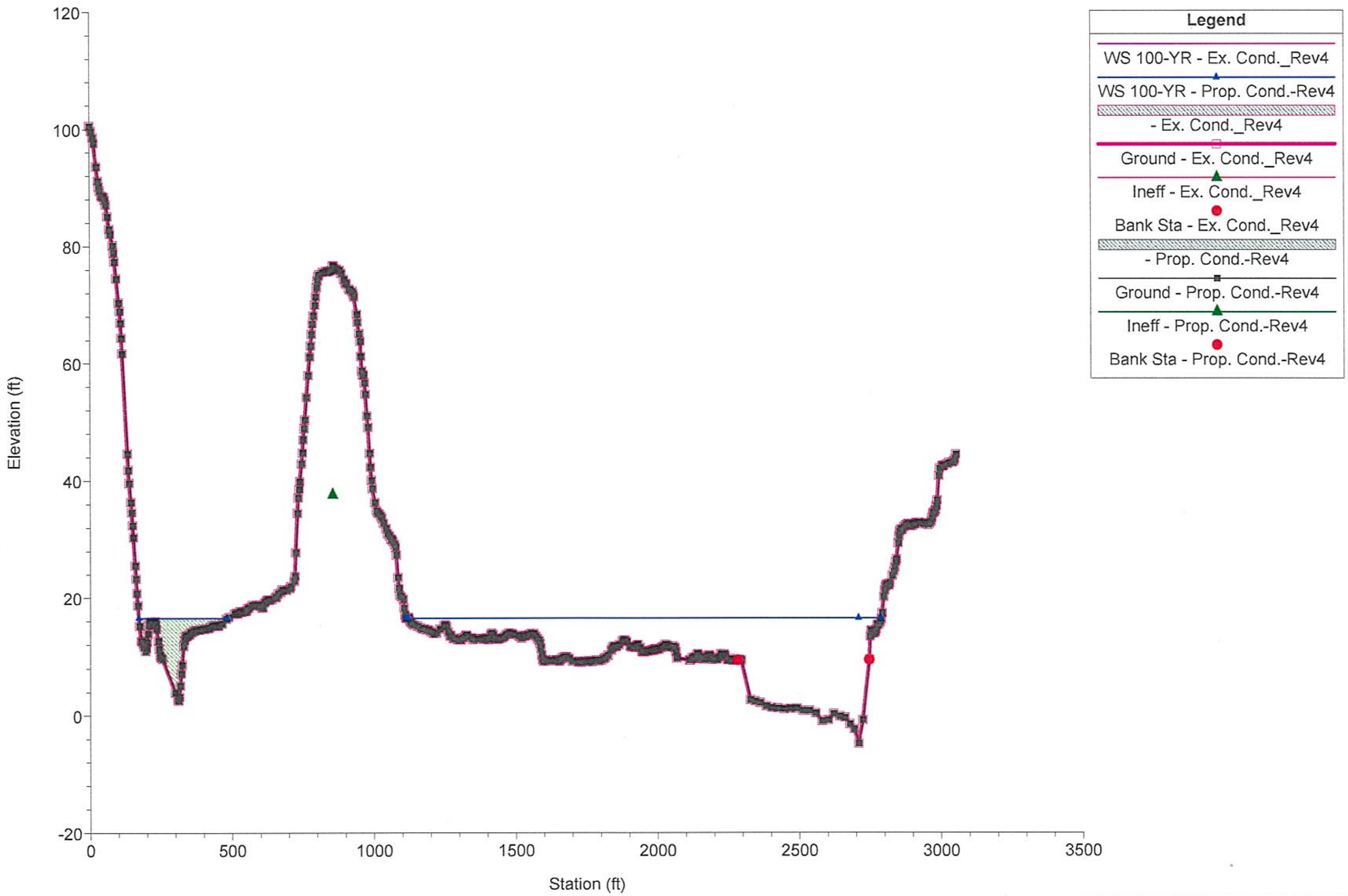
34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
Station (ft)


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
From Drawings provided by the ODOT and Tillmook Co.
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
- Ex. Cond._Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
- Prop. Cond.-Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
80
60
40
20
0
-20
Station (ft)
0
500
1000
1500
2000
2500
3000
3500

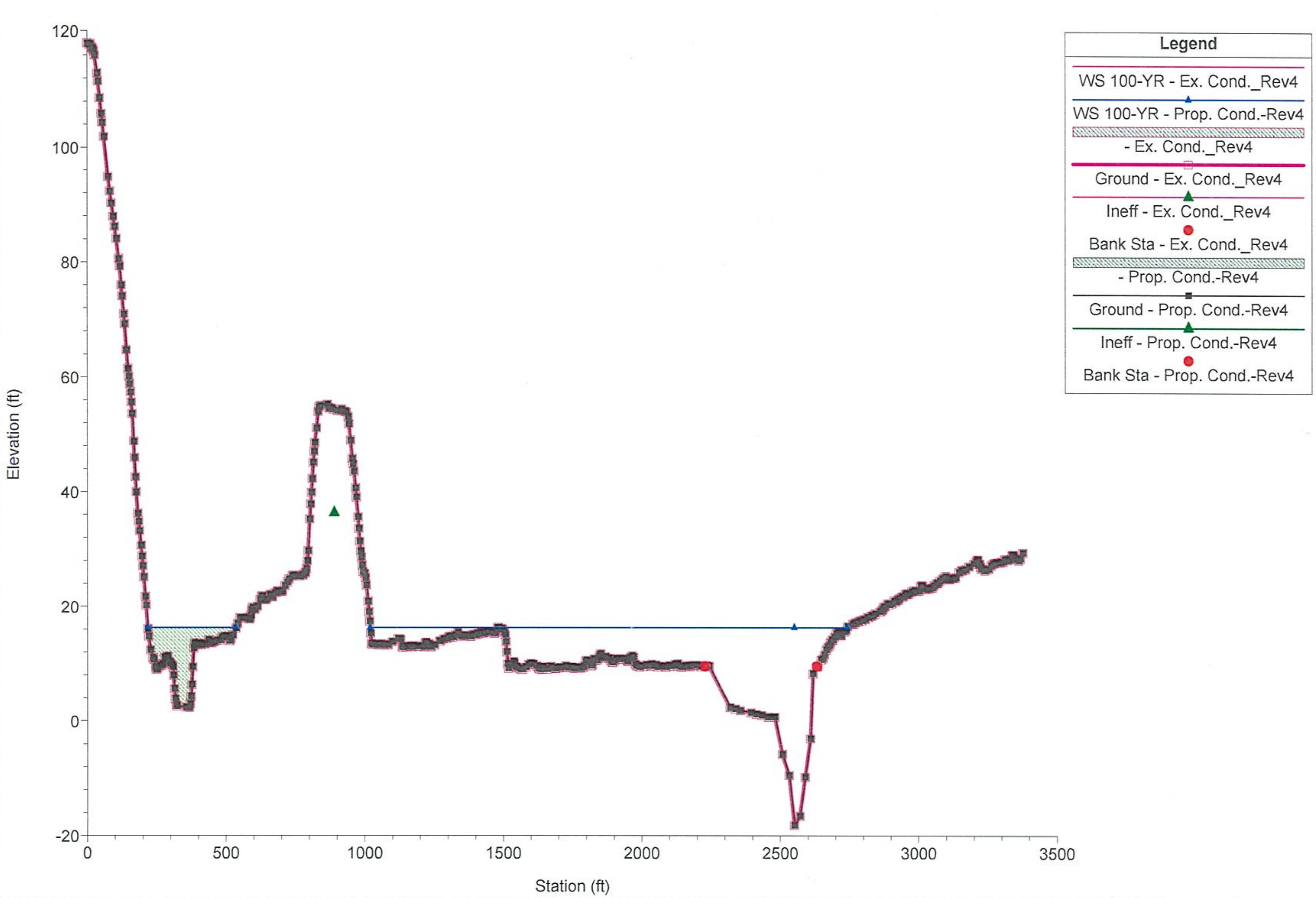


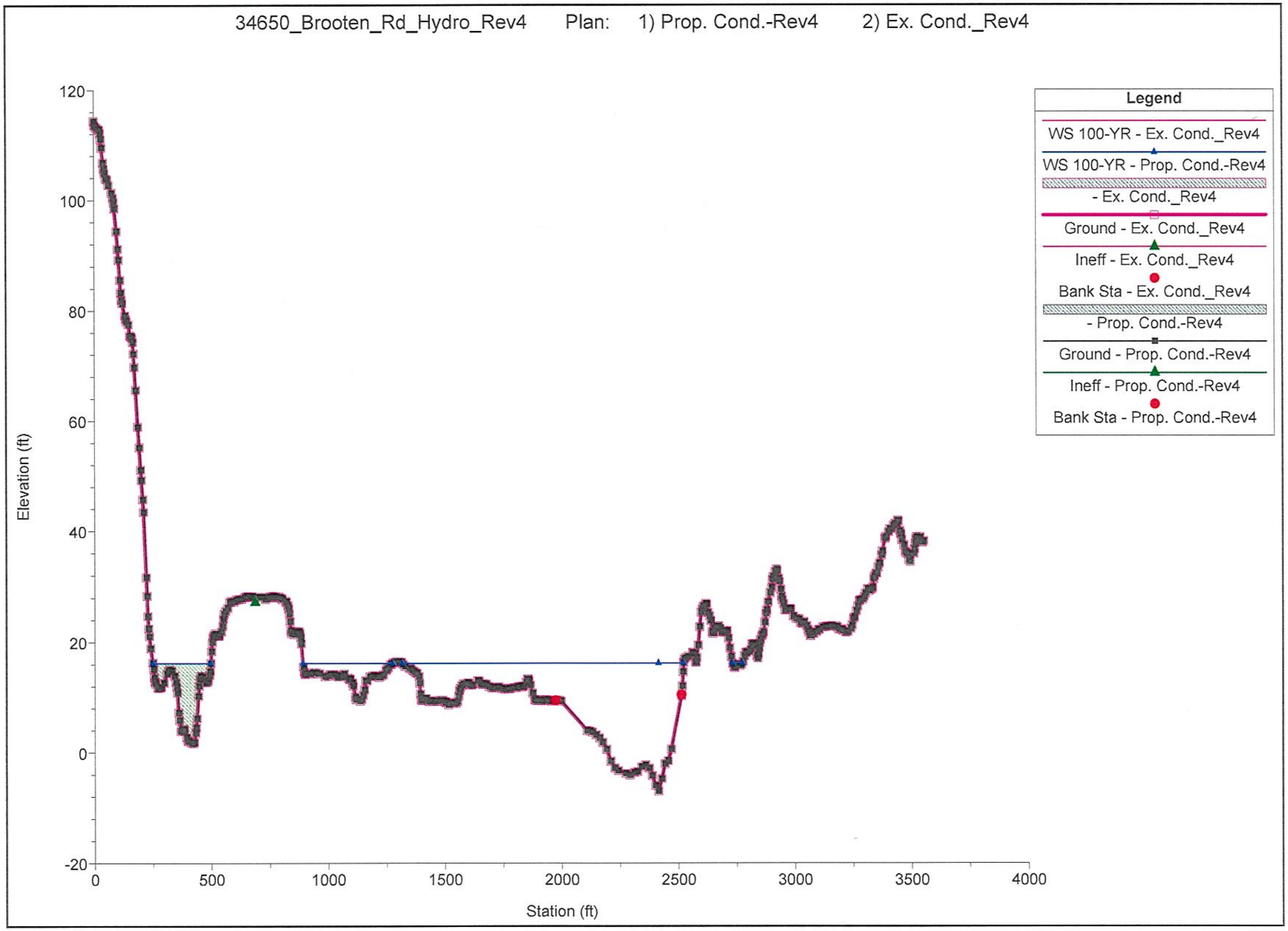
34650_Brooten_Rd_Hydro_Rev4
Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Cross Section B
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
140
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)

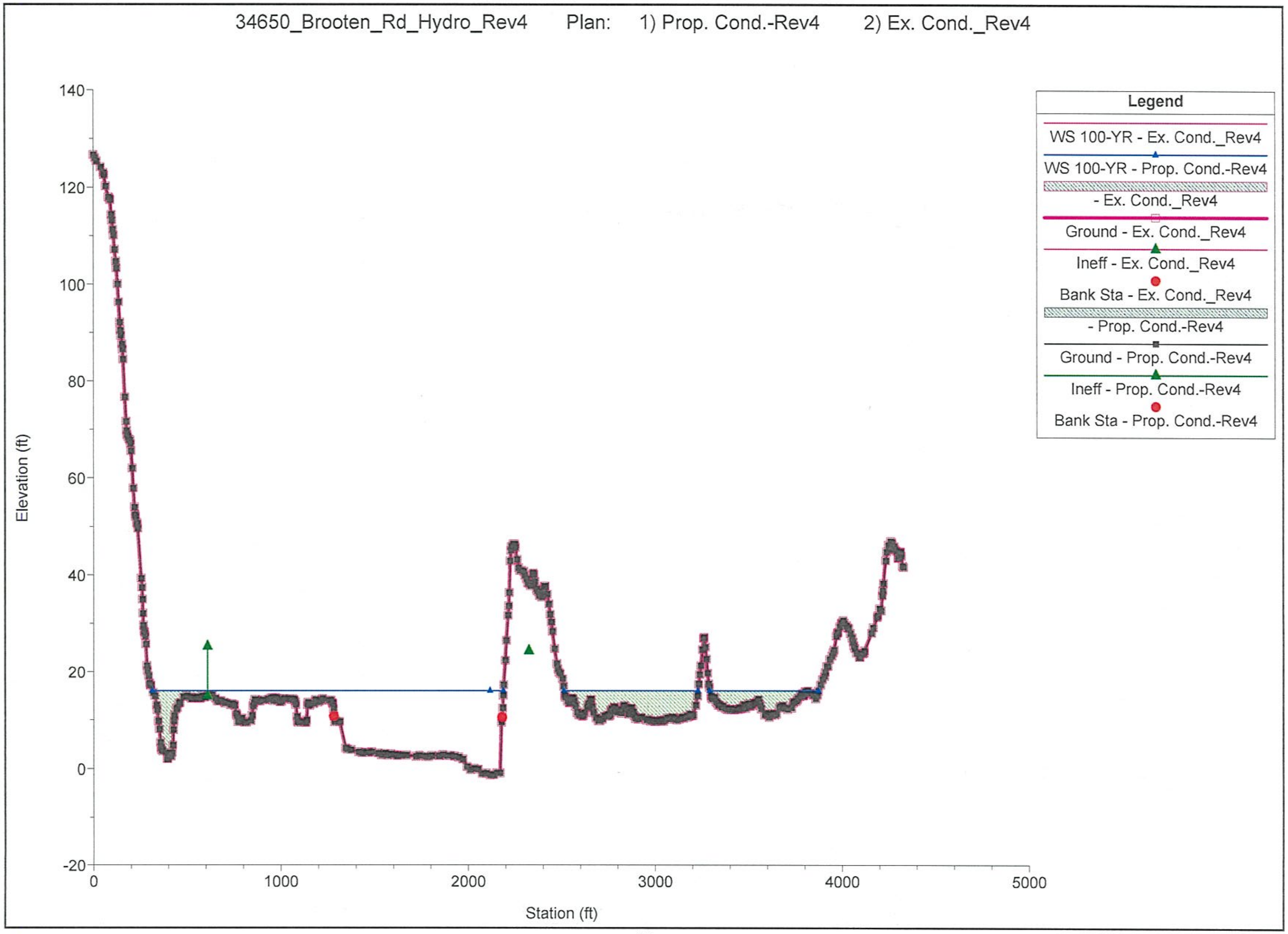
34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4

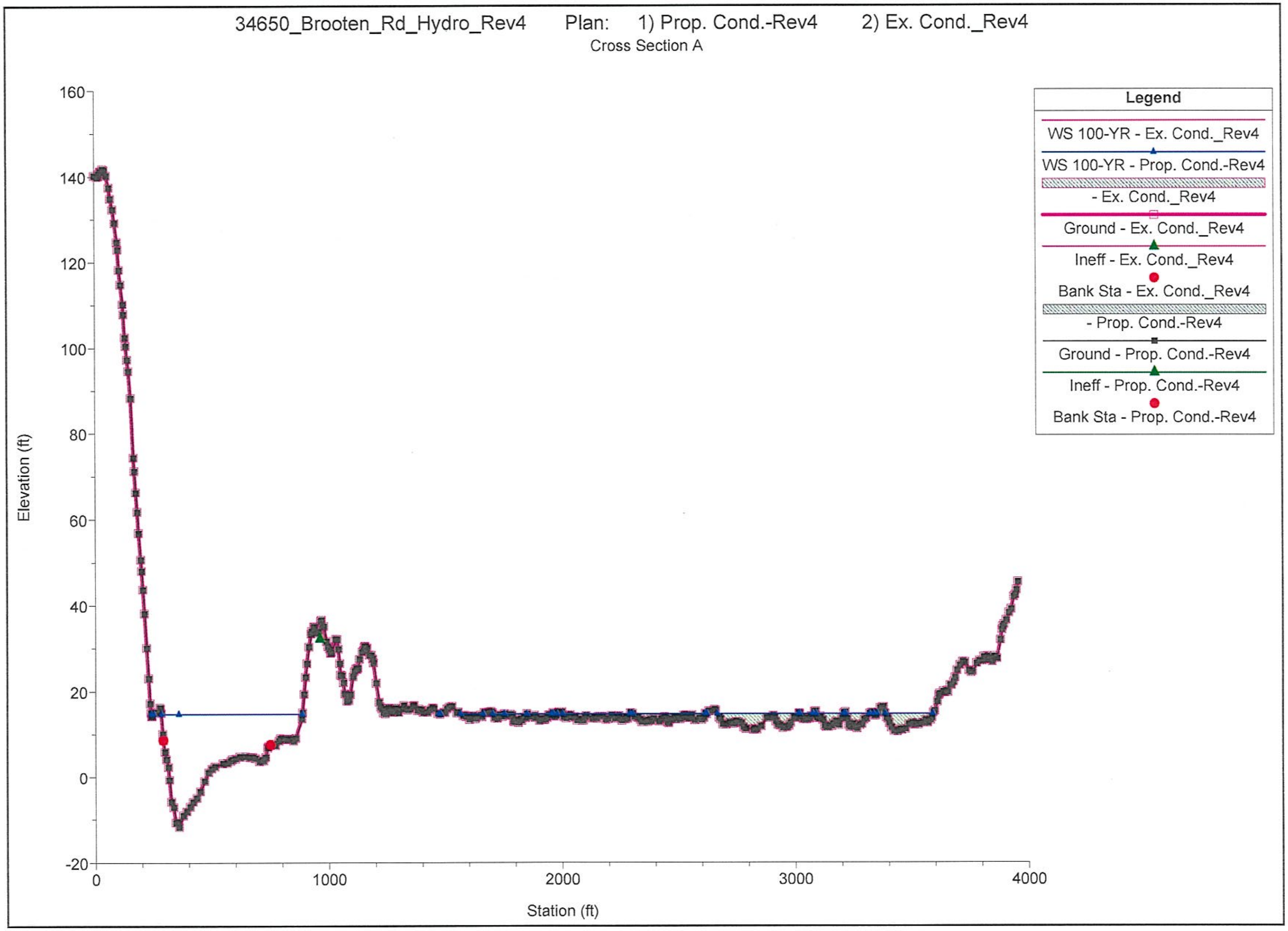


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4

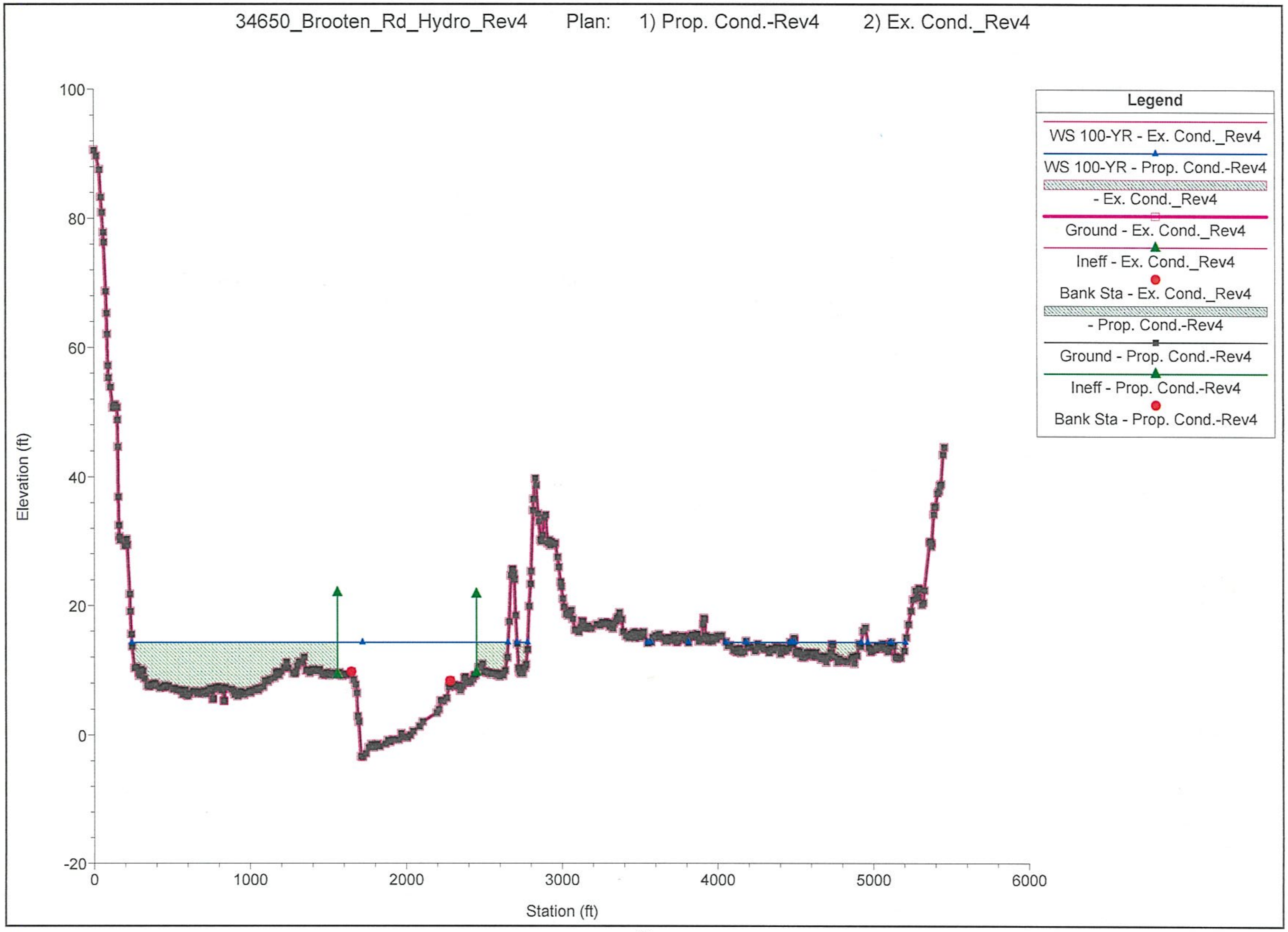



34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
120
100
80
60
40
20
0
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Station (ft)


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
140
120
100
80
60
40
20
0
-20
0
1000
2000
3000
4000
5000
Station (ft)

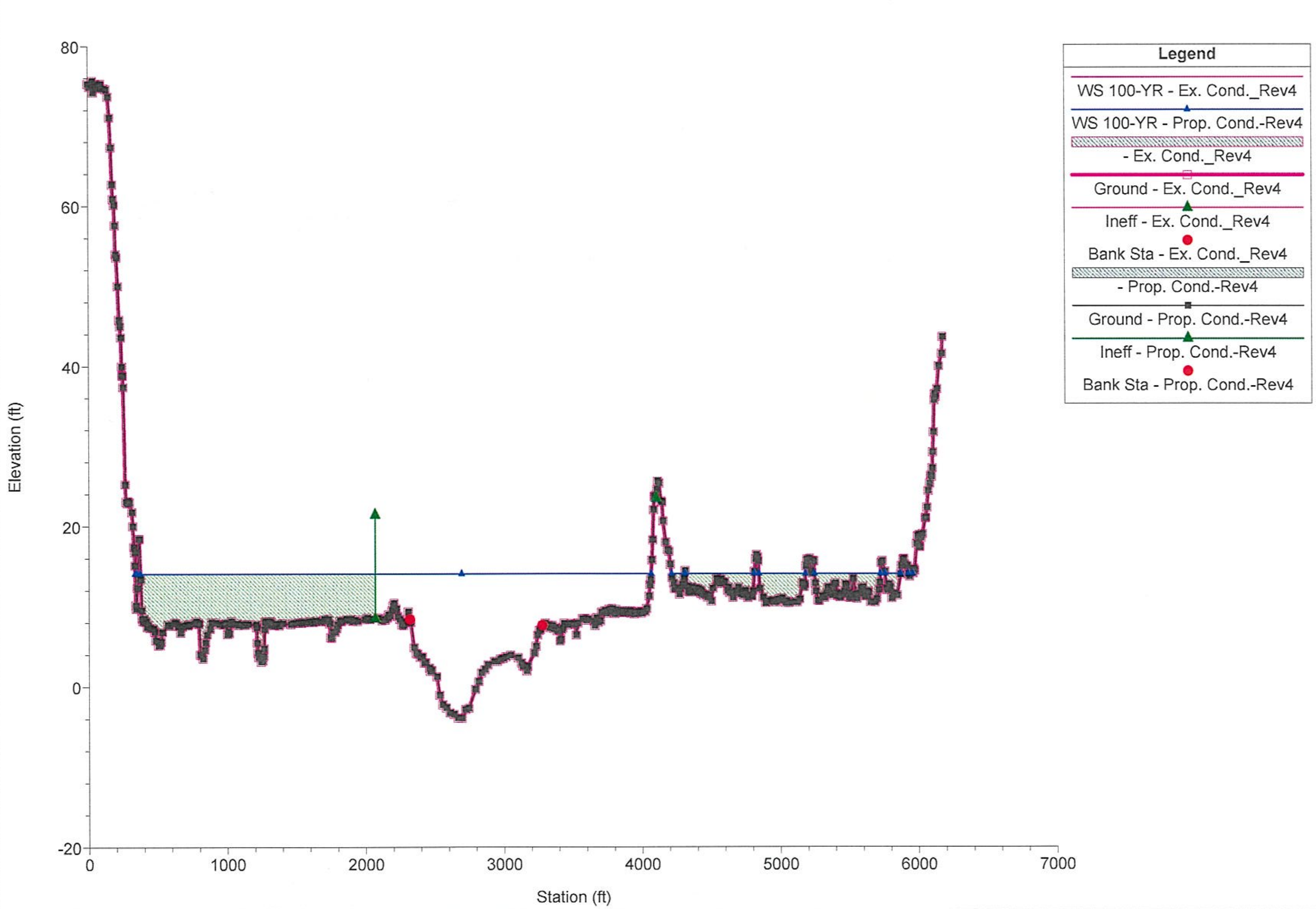


34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Cross Section A
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
Station (ft)
160
140
120
100
80
60
40
20
0
-20
0
1000
2000
3000
4000



34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4
Legend
WS 100-YR - Ex. Cond._Rev4
WS 100-YR - Prop. Cond.-Rev4
- Ex. Cond._Rev4
Ground - Ex. Cond._Rev4
Ineff - Ex. Cond._Rev4
Bank Sta - Ex. Cond._Rev4
- Prop. Cond.-Rev4
Ground - Prop. Cond.-Rev4
Ineff - Prop. Cond.-Rev4
Bank Sta - Prop. Cond.-Rev4
Elevation (ft)
100
80
60
40
20
0
-20
0
1000
2000
3000
4000
5000
6000
Station (ft)

34650_Brooten_Rd_Hydro_Rev4 Plan: 1) Prop. Cond.-Rev4 2) Ex. Cond._Rev4



HEC-RAS River: Nestucca River Reach: Lower Profile: 100-YR (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Lower	2099.855	100-YR	Ex. Cond._Rev4	49700.00	-3.90	14.15	5.85	14.31	0.000175	3.42	17693.71	5262.50	0.17
Lower	2099.855	100-YR	Prop. Cond.-Rev4	49700.00	-3.90	14.15	5.85	14.31	0.000175	3.42	17693.71	5262.50	0.17

April 23rd, 2025

TYPE II – FLOODPLAIN DEVELOPMENT REVIEW CRITERIA
Applicant's Submittal

APPLICANT: Kalli Light, Relevant Buildings
15903 Park Place Ct, Oregon City, OR 97045

OWNER: Robert Taylor
22675 SW Vermillion Dr, Tualatin, OR 97062

REQUEST: Requesting Floodplain Development Review in order to build a five-unit multifamily housing structure within a FEMA mapped floodway.

LOCATION: Site address: Brooten Rd, Pacific City, OR 97135
Map number: 4S1019CA01601
Tax lot number: 1601
Legal description: *Malaney's add to Ocean Park Block 16, Lot 4 & 5*

BACKGROUND

We are proposing a five-unit multifamily housing structure at the above location. The subject property is roughly 0.18 acres (7,840 sq. ft.) and is currently vacant. The property consists of three lots of record that are combined to form a single tax lot (1601). The zoning for this lot is Pacific City/Woods Commercial 1 (PCW-C1). The front of the property faces Brooten Road while the rear property line abuts the Big Nestucca River. The property is within a FEMA mapped floodway and flood zone AE. Because this property is within a FEMA flood zone, we are submitting this Floodplain Development Review application as part of the permit process to build this multifamily housing structure.

Prior land use approvals for this property that will be relevant to this application include:

- **851-24-000483-PLNG**: Conditional Use approval for the placement of five-unit multi-family dwellings.
- **851-24-000483-PLNG-01**: Variance approval to reduce the required 10-foot front yard setback for a residential structure in the PCW-C1 zone to 4.4-feet.
- **851-24-000483-PLNG-02**: Riparian Exception approval to reduce the required 50-foot riparian setback to 20-feet for the placement of the proposed multi-family structure.

TLCUO SECTION 3.510(14)(b) Development Permit Review Criteria:

1. The fill is not within a Coastal High Hazard Area.
   Applicant Response: Complies as proposed. The subject property is not within a Coastal High Hazard Area. Per TCLUO section 3.510.4, a Coastal High Hazard Area is defined as "*An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources.* ***The area is designated on the FIRM as Zone V1-V30, VE or V.***"

   The FEMA FIRM map, which is included for reference in this application, shows that this property is within FEMA Zone "AE." Therefore, this property is not within the V1-V30, VE, or V zones that define Coastal High Hazard Areas. Given that the subject property is not within a Coastal High Hazard Area, this means that we are not proposing any fill within a Coastal High Hazard Area.

2. Fill placed within the Regulatory Floodway shall not result in any increase in flood levels during the occurrence of the base flood discharge.
   Applicant Response: Complies as proposed. The subject property is within the regulatory floodway as noted on the attached FEMA FIRM map. As part of this floodplain review application, I am including a hydraulic analysis report that was completed by an Oregon Registered Professional Engineer. Waterways Consulting, Inc, has completed hydraulic analysis reports for other projects along the Nestucca River within Tillamook County, and is familiar with the modeling and reporting requirements for the floodplain review application. The engineer stated in the conclusion section of their report that, "*The results of this hydraulic analysis indicate no rise in the 100-year water surface elevations for the Proposed Conditions Model when compared to the Existing Conditions Model. Based on this, the proposed project satisfies the requirement of Section 3.510(9)(a) of the Tillamook County Land Use Ordinance.*"

   As certified by our engineer, the proposed project meets this criterion because this development will not result in any increase in flood levels during the base flood (otherwise known as the 100-year flood) discharge.

3. The fill is necessary for an approved use on the property.
   Applicant Response: Complies as proposed. The proposed use for this property is a 5-unit multi-family structure in the PCW-C1 zone. The proposed use was approved under conditional use application #851-24-000483-PLNG.

   Per TCLUO 3.510.4, "fill" is defined as, "*Any material such as, but not limited to, sand, gravel, soil, rock or gravel that is placed on land including existing and natural floodplains, or in waterways, for the purposes of development or redevelopment.*" We are do not intend to use any fill for this project. Given that we are not planning to add any fill and this 5-unit multi-family structure is an approved use on this property, the proposed project is meeting this criterion.

4. The fill is the minimum amount necessary to achieve the approved use.
   Applicant Response: Complies as proposed. We are not proposing any fill for this project. The subject site is already relatively flat and matches the elevation of the surrounding area. As noted in the engineer's hydraulic analysis, "*Any paving for proposed parking shall be balanced with an equal amount of excavation such that the finished paved surface elevations match the preconstruction ground surface elevations on the road side of the structures.*" In short, the proposed project is using the minimum fill amount necessary to achieve the approved use because we do not intend to add any fill for the proposed project.

5. No feasible alternative upland locations exist on the property.
   Applicant Response: Complies as proposed. The entire property is within FEMA flood zone AE, as shown on the FIRM map. Aside from the river bank, the property is also completely flat at 12-ft above mean sea level, as shown on the existing conditions survey. Therefore, there are no feasible alternative upland locations on the property. Regardless of where the building is placed on the property, it will be within a FEMA flood zone.

   Further, the property is very shallow. The northern property line is just 49.93 feet. The property is also constrained by a 20-foot riparian setback along the rear lot line, a 15-foot stormwater easement along the north side property line, 4.4-foot front setback (approved under 8531-24-000483-PLNG-01), and a 5-foot south side setback. In order for the proposed building to meet these required setbacks and easements, the only feasible location is the one shown on the proposed site plan.

6. The fill does not impede or alter drainage or the flow of floodwaters.
   Applicant Response: Complies as proposed. We do not intend to use any fill for this project, which means that this project will not impede or alter the drainage or the flow of floodwaters.

   The no-rise analysis by the Oregon State Registered Engineer also confirms that this project will not result in any increase in flood levels. Th engineer's conclusion further supports the fact that the drainage and flow of floodwaters will not be altered by this development.

7. If the proposal is for a new critical facility, no feasible alternative site is available.
   Applicant Response: Not applicable. We are not proposing a new critical facility. We are proposing multifamily dwellings. Therefore, criterion #7 does not apply to this project.

8. For creation of new, and modification of, Flood Refuge Platforms, the following apply, in addition to (14)(a)(l-4) and (b)(l-5):
   i. The fill is not within a floodway, wetland, riparian area or other sensitive area regulated by the Tillamook County Land Use Ordinance.
   ii. The property is actively used for livestock and/or farm purposes,
   iii. Maximum platform size = 10 sq ft of platform surface per acre of pasture in use, or 30 sq ft per animal, with a 10-ft wide buffer around the outside of the platform,

iv. Platform surface shall be at least 1 ft above base flood elevation,
v. Slope of fill shall be no steeper than 1.5 horizontal to 1 vertical,
vi. Slope shall be constructed and/or fenced in a manner so as to prevent and avoid erosion.

Applicant Response: Not applicable. We are not proposing the creation or modification of a flood refuge platform. Therefore, criterion #8 does not apply to this project.

Conditions of approval may require that if the fill is found to not meet criterion (5), the fill shall be removed or, where reasonable and practical, appropriate mitigation measures shall be required of the property owner. Such measures shall be verified by a certified engineer or hydrologist that the mitigation measures will not result in a net rise in floodwaters and be in coordination with applicable state, federal and local agencies, including the Oregon Department of Fish and Wildlife.

Applicant Response: Not applicable. This project meets Criterion #5 as explained above. Therefore, this criterion is not applicable.

Structural Calculations
for
Nestucca River - Multifamily Container
34450 Brooten Rd
Pacific City, Oregon 97135
April 21, 2025

DESIGN CODE

2022 Oregon Structural Specialty Code

DESIGN LOADS

Seismic, S_{DS}	1.024 g
Wind, Exposure "C"	120 mph

CONTENTS

Gravity & Lateral Calculations

STRUCTURAL
REGISTERED PROFESSIONAL
ENGINEER
18,525
OREGON
SEPT. 10, 2001
DARRON R. HAYDEN
EXPIRES: 06/30/25

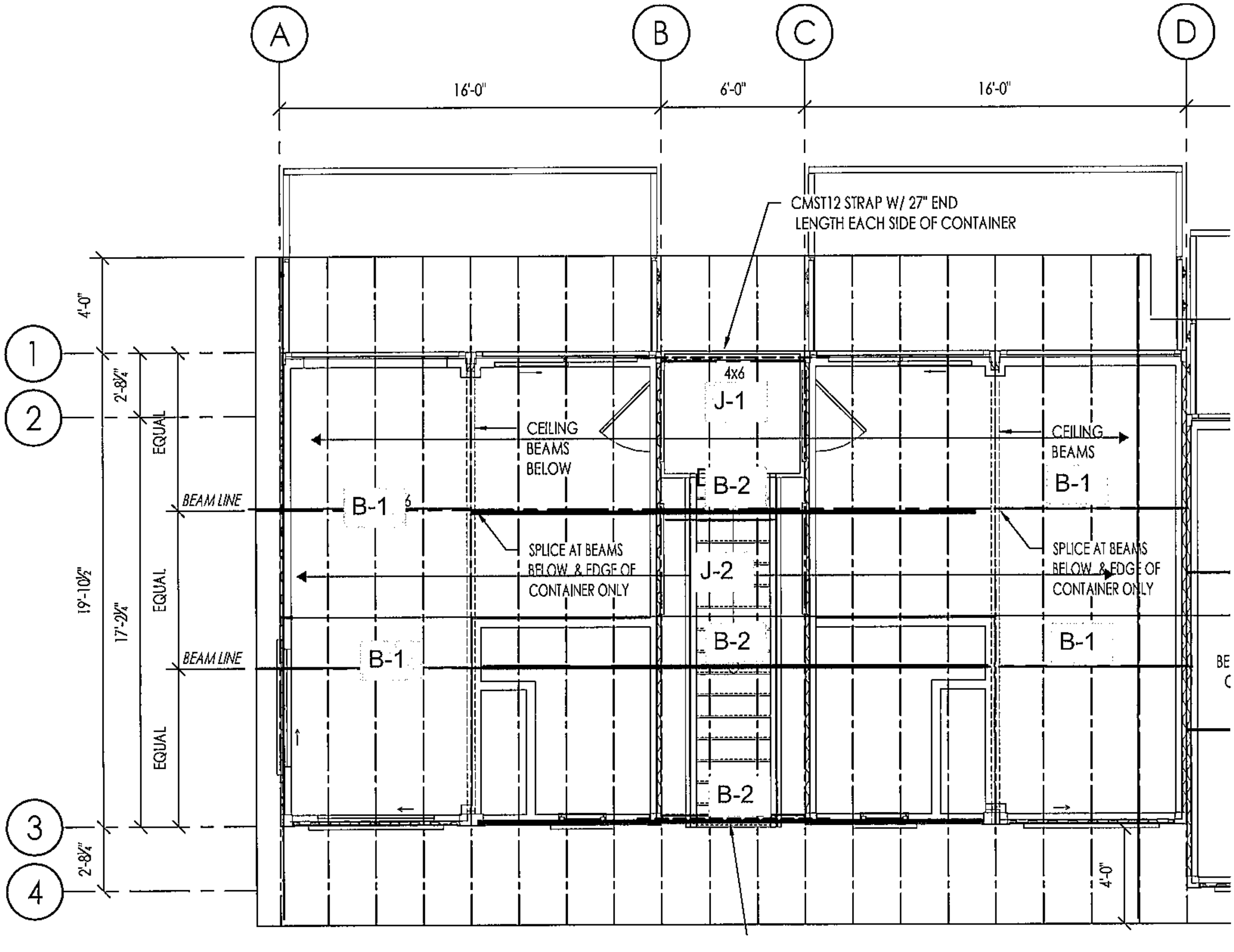
SCOPE OF WORK

The attached calculations pertain to gravity and lateral analysis of the new residential structure using steel intermodel containers (IMSC) at the above address. This scope of work does not include any analysis of the foundation.

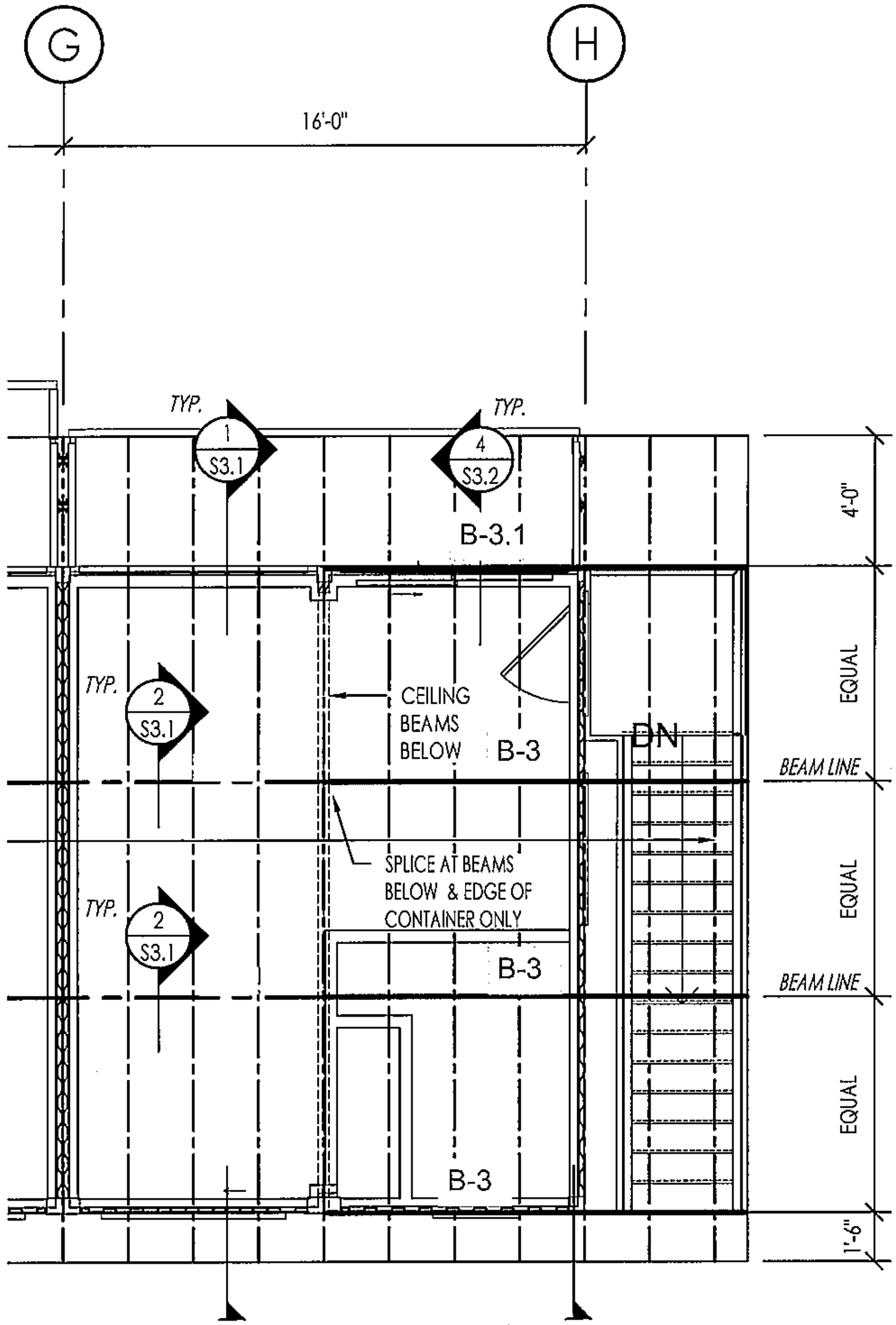
Design Criteria

Dead Load Roof	=	13 psf	*Includes 5 psf Solar Panel Allowance	
Live (Roof) Load	=	20 psf		
Snow Load	=	25 psf		
Dead Load Floor	=	15 psf		
Live Load	=	40 psf		
V_W	=	120 mph	Exposure Cat.	C
S_S	=	1.28 g	Site Class	D
S_1	=	0.67 g		
S_{DS}	=	1.02 g		

GRAVITY



ROOF FRAMING (TYPICAL)



ROOF FRAMING (TYPICAL)

HAYDEN
ENGINEERS
STRUCTURAL | CIVIL

Wood Beam		Project File: Nestucca River.ec6
LIC# : KW-06014171, Build:20.24.09.03	HAYDEN CONSULTING ENGINEERS	(c) ENERCALC, LLC 1982-2024

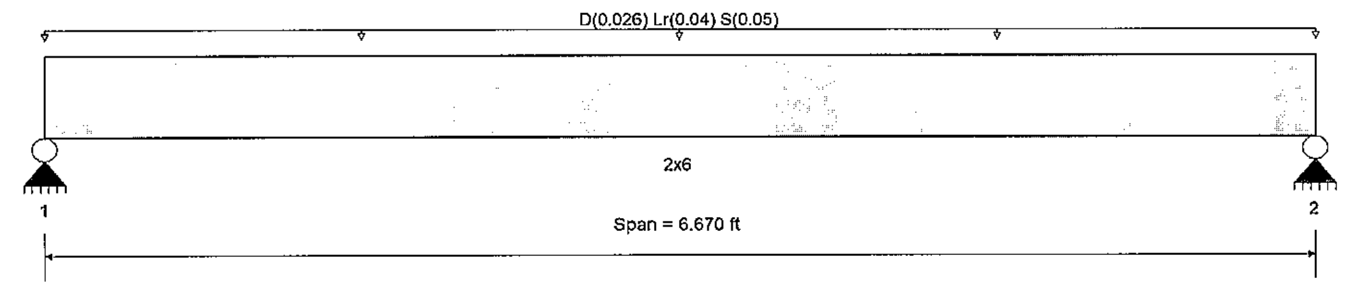
DESCRIPTION: J-2

ODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-16

laterial Properties

Analysis Method :	Allowable Stress Design	Fb +	875.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	875.0 psi	Ebend- xx	1,300.0 ksi
		Fc - Prll	600.0 psi	Eminbend - xx	470.0 ksi
Wood Species	: Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	170.0 psi		
		Ft	425.0 psi	Density	31.210 pcf
Beam Bracing	: Beam is Fully Braced against lateral-torsional buckling			Repetitive Member Stress Increase	



pplied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0130, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 2.0 ft

ESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.446** : 1	Maximum Shear Stress Ratio	=	**0.205** : 1
Section used for this span		**2x6**	Section used for this span		**2x6**
fb: Actual	=	670.64 psi	fv: Actual	=	40.03 psi
F'b	=	1,504.34 psi	F'v	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.335 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.083 in	Ratio =	966 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.126 in	Ratio =	635 >=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a

ertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.253	0.253
Max Upward from Load Combinations	0.253	0.253
Max Upward from Load Cases	0.167	0.167
D Only	0.087	0.087
+D+Lr	0.220	0.220
+D+S	0.253	0.253
+D+0.750Lr	0.187	0.187
+D+0.750S	0.212	0.212
+0.60D	0.052	0.052
Lr Only	0.133	0.133
S Only	0.167	0.167

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Wood Beam

Project File: 24261.01 Nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: B-1

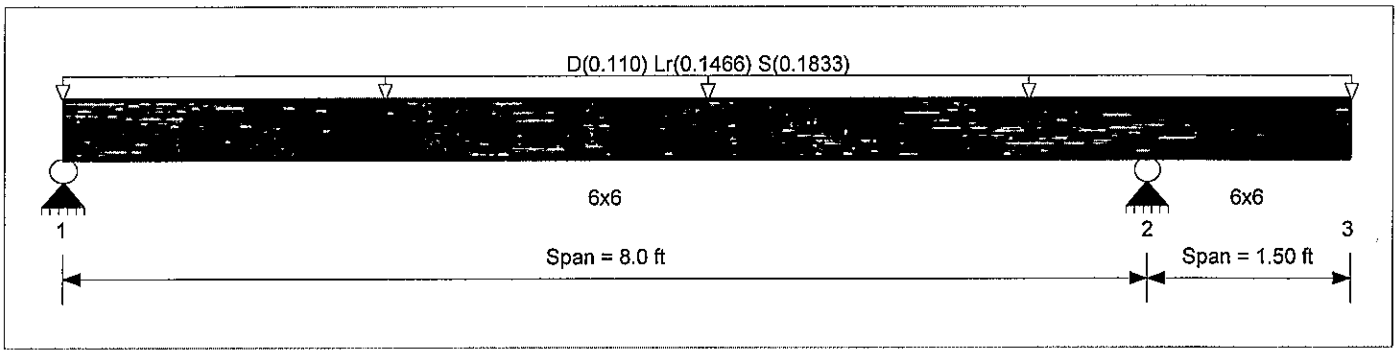
CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	875.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
		Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	170.0 psi		
		Ft	425.0 psi	Density	31.210pcf

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 7.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.939** 1	Maximum Shear Stress Ratio	=	**0.275** : 1
Section used for this span		**6x6**	Section used for this span		**6x6**
fb: Actual	=	944.94psi	fv: Actual	=	53.70 psi
F'b	=	1,006.25psi	F'v	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.844ft	Location of maximum on span	=	7.553 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.157 in	Ratio =	609 >=360	Span: 1 : S Only
Max Upward Transient Deflection	-0.086 in	Ratio =	418 >=360	Span: 2 : S Only
Max Downward Total Deflection	0.252 in	Ratio =	381 >=240	Span: 1 : +D+S
Max Upward Total Deflection	-0.137 in	Ratio =	262 >=240	Span: 2 : +D+S

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	1.132	1.654	
Max Upward from Load Combinations	1.132	1.654	
Max Upward from Load Cases	0.707	1.034	
D Only	0.424	0.620	
+D+Lr	0.990	1.447	
+D+S	1.132	1.654	
+D+0.750Lr	0.849	1.240	
+D+0.750S	0.955	1.395	
+0.60D	0.255	0.372	
Lr Only	0.566	0.827	
S Only	0.707	1.034	

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Wood Beam

Project File: 24261.01 Nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS

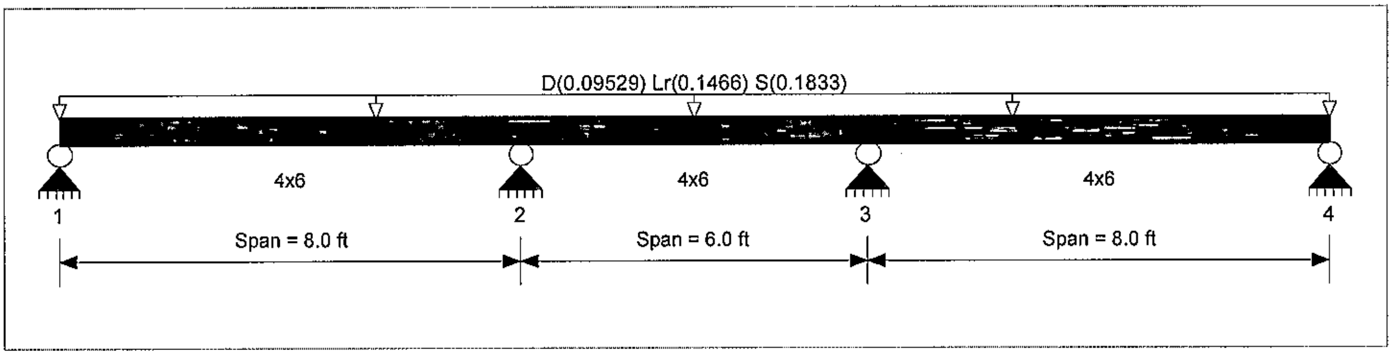
DESCRIPTION: B-2

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	875.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
		Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	170.0 psi		
		Ft	425.0 psi	Density	31.210pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : D = 0.0130, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 7.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.803** : 1	Maximum Shear Stress Ratio	=	**0.474** : 1
Section used for this span		**4x6**	Section used for this span		**4x6**
fb: Actual	=	1,050.70psi	fv: Actual	=	92.59 psi
F'b	=	1,308.13psi	F'v	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	4.639ft	Location of maximum on span	=	6.000 ft
Span # where maximum occurs	=	Span # 3	Span # where maximum occurs	=	Span # 2

Maximum Deflection

Max Downward Transient Deflection	0.164 in	Ratio =	584 >=360	Span: 1 : S Only
Max Upward Transient Deflection	-0.037 in	Ratio =	1940 >=360	Span: 2 : S Only
Max Downward Total Deflection	0.249 in	Ratio =	384 >=240	Span: 1 : +D+S
Max Upward Total Deflection	-0.056 in	Ratio =	1276 >=240	Span: 2 : +D+S

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Max Upward from all Load Conditions	0.928	2.136	2.136	0.928
Max Upward from Load Combinations	0.928	2.136	2.136	0.928
Max Upward from Load Cases	0.610	1.405	1.405	0.610
D Only	0.317	0.731	0.731	0.317
+D+Lr	0.806	1.855	1.855	0.806
+D+S	0.928	2.136	2.136	0.928
+D+0.750Lr	0.684	1.574	1.574	0.684
+D+0.750S	0.775	1.785	1.785	0.775
+0.60D	0.190	0.438	0.438	0.190
Lr Only	0.488	1.124	1.124	0.488
S Only	0.610	1.405	1.405	0.610

Wood Beam

Project File: 24261.01 Nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: B-3

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	875.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	875.0 psi	Ebend- xx	1,300.0ksi
		Fc - Prll	600.0 psi	Eminbend - xx	470.0ksi
Wood Species	: Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	170.0 psi		
		Ft	425.0 psi	Density	31.210pcf
Beam Bracing	: Beam is Fully Braced against lateral-torsional buckling				

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : D = 0.0150, Lr = 0.020, S = 0.0250 ksf,. Tributary Width = 6.670 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.998** 1	Maximum Shear Stress Ratio	=	**0.402** : 1
Section used for this span		**4x8**	Section used for this span		**4x8**
fb: Actual	=	1,305.22psi	fv: Actual	=	78.57 psi
F'b	=	1,308.13psi	F'v	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	8.000ft	Location of maximum on span	=	7.419 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.275 in	Ratio =	436 >=360	Span: 2 : S Only
Max Upward Transient Deflection	-0.014 in	Ratio =	7029 >=360	Span: 1 : S Only
Max Downward Total Deflection	0.440 in	Ratio =	272 >=240	Span: 2 : +D+S
Max Upward Total Deflection	-0.022 in	Ratio =	4393 >=240	Span: 1 : +D+S

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	0.650	2.818	
Max Upward from Load Combinations	0.650	2.818	
Max Upward from Load Cases	0.406	1.761	
D Only	0.244	1.057	
+D+Lr	0.569	2.466	
+D+S	0.650	2.818	
+D+0.750Lr	0.488	2.114	
+D+0.750S	0.549	2.378	
+0.60D	0.146	0.634	
Lr Only	0.325	1.409	
S Only	0.406	1.761	

HAYDEN ENGINEERS
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Wood Beam

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS

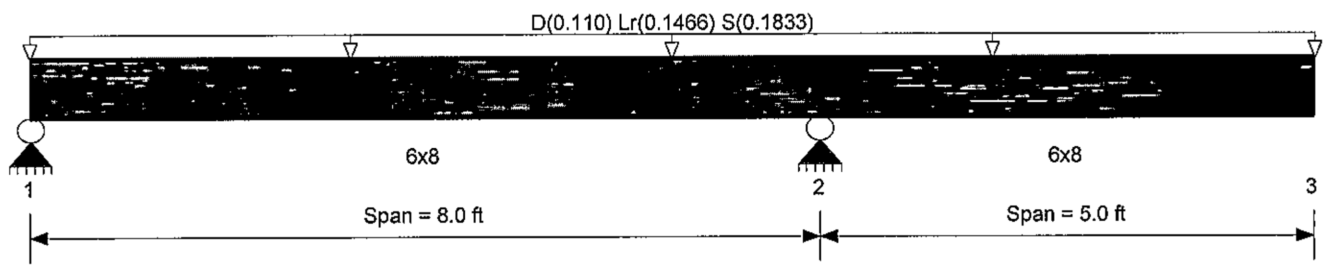
DESCRIPTION: B-3.1

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	1350 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	1350 psi	Ebend- xx	1600 ksi
		Fc - Prll	925 psi	Eminbend - xx	580 ksi
Wood Species	: Douglas Fir-Larch	Fc - Perp	625 psi		
Wood Grade	: No.1	Fv	170 psi		
		Ft	675 psi	Density	31.21 pcf
Beam Bracing	: Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 7.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.749**: 1	Maximum Shear Stress Ratio	=	**0.272** : 1
Section used for this span		**6x8** (weak orientation)	Section used for this span		**6x8** (weak orientation)
fb: Actual	=	1,163.11 psi	fv: Actual	=	53.11 psi
F'b	=	1,552.50 psi	F'v	=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	8.000 ft	Location of maximum on span	=	7.419 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

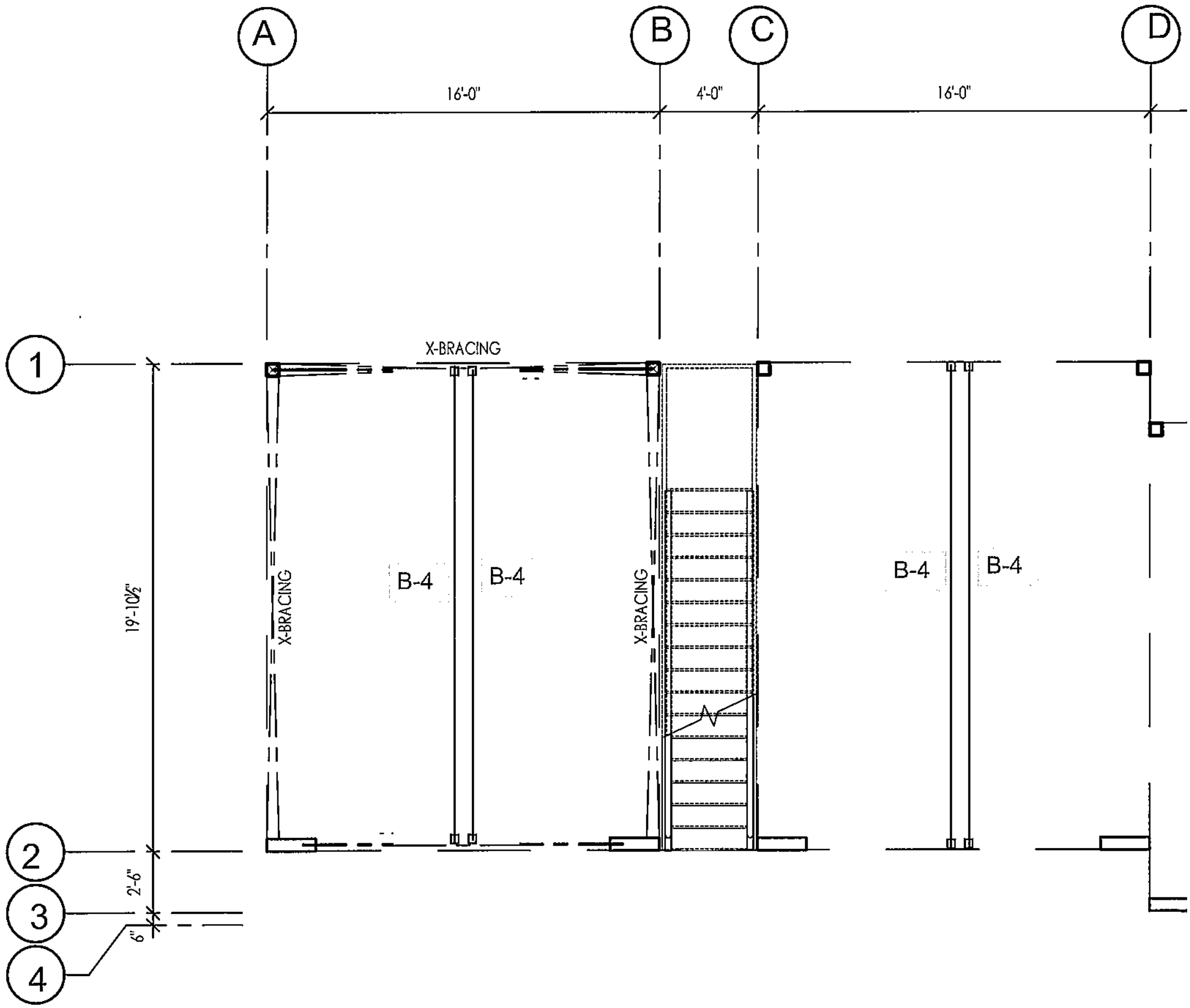
Maximum Deflection

Max Downward Transient Deflection	0.262 in	Ratio =	456	>=360	Span: 2 : S Only
Max Upward Transient Deflection	-0.013 in	Ratio =	7365	>=360	Span: 1 : S Only
Max Downward Total Deflection	0.420 in	Ratio =	284	>=240	Span: 2 : +D+S
Max Upward Total Deflection	-0.021 in	Ratio =	4603	>=240	Span: 1 : +D+S

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	0.715	3.097	
Max Upward from Load Combinations	0.715	3.097	
Max Upward from Load Cases	0.447	1.936	
D Only	0.268	1.161	
+D+Lr	0.625	2.710	
+D+S	0.715	3.097	
+D+0.750Lr	0.536	2.323	
+D+0.750S	0.603	2.613	
+0.60D	0.161	0.697	
Lr Only	0.357	1.548	
S Only	0.447	1.936	



CEILING FRAMING (TYPICAL)

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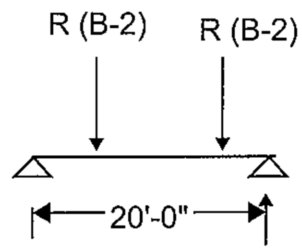
Nestucca River - Multifamily Container

BY	SS	DATE	4/18/25
REV		DATE	
JOB NO	24261.01		
SHEET		OF	

B-4



R (B-2) = 350# D + 530# Lr + 670# S

R (B-4) = 350# D + 530# Lr + 670#S
= 1.020 k

USE 3 1/2 x 10 1/2 24F-V4 GLB

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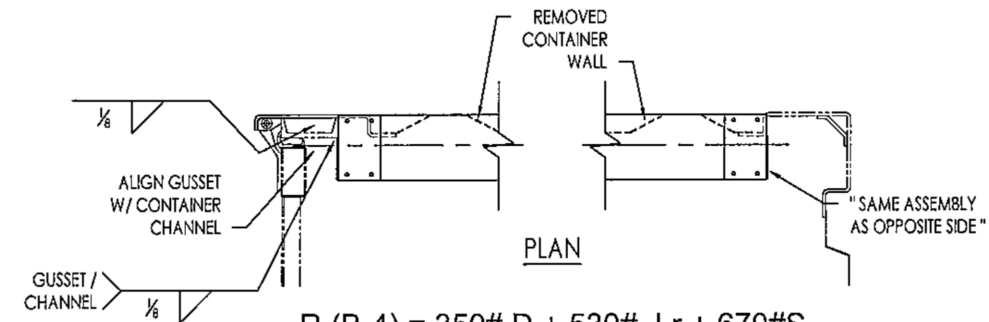
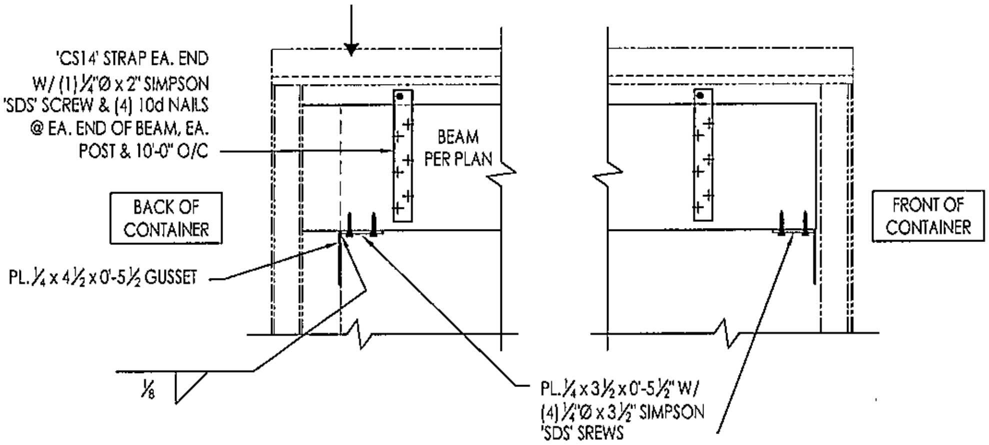
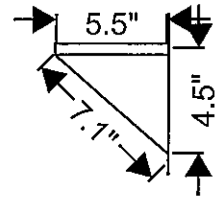
Nestucca River - Multifamily Container

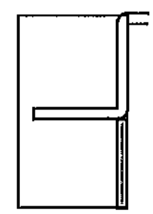
BY	SS	DATE	4/18/25
REV		DATE	
JOB NO	24261.01		
SHEET		OF	



R (B-4) = 350# D + 530# Lr + 670#S
= 1.020 k







Check Plate: M = (1.020 k) (1.75") = 1.785 k-in

$$t_{min} = \sqrt{\frac{(6)(1.785\text{ k-in})}{(0.9)(36\text{ksi})(5.5")}} = 0.245" < 1/4" \text{ OK}$$

Check Gusset Plate: P = 1020 lb / sin 45 = 1442 lb

t = 1/4"

I = bd^3/12 = (4.5")(1/4)^3 / 12 = 5.86 x 10^-3
r = √I/A = √I/(1/4 x 4.5") = 0.072

KL/r = 7.1 / 0.0721 = 98 from AISC table 4-14 = 13 k (ASD)

P/A = 1442 lb / (1/4)(4.5") = 1282 lb/in2

P/A < KL/r OK

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(503) 968-9994 Hayden-Engineers.com

Nestucca River - Multifamily Container

BY SS DATE 4/18/25
REV DATE
JOB NO 24261.01
SHEET OF

Wood Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

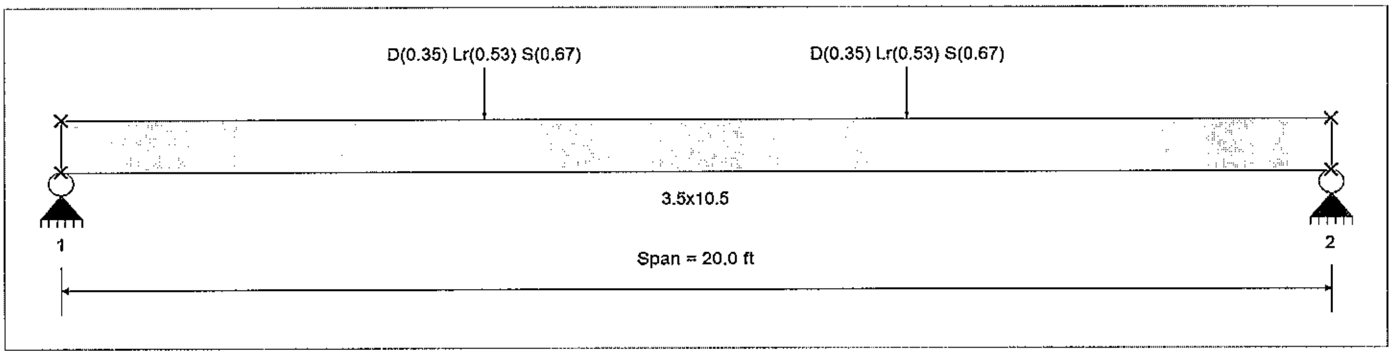
DESCRIPTION: B-4

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	2,400.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	1,850.0 psi	Ebend- xx	1,800.0 ksi
		Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Wood Species :	DF/DF	Fc - Perp	650.0 psi	Ebend- yy	1,600.0 ksi
Wood Grade :	24F-V4	Fv	265.0 psi	Eminbend - yy	850.0 ksi
		Ft	1,100.0 psi	Density	31.210 pcf
Beam Bracing :	Completely Unbraced				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Point Load : D = 0.350, Lr = 0.530, S = 0.670 k @ 6.670 ft
Point Load : D = 0.350, Lr = 0.530, S = 0.670 k @ 13.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.502** 1	Maximum Shear Stress Ratio	=	**0.137** : 1
Section used for this span		**3.5x10.5**	Section used for this span		**3.5x10.5**
fb: Actual	=	1,269.44 psi	fv: Actual	=	41.63 psi
F'b	=	2,528.23 psi	F'v	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	6.715 ft	Location of maximum on span	=	13.358 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

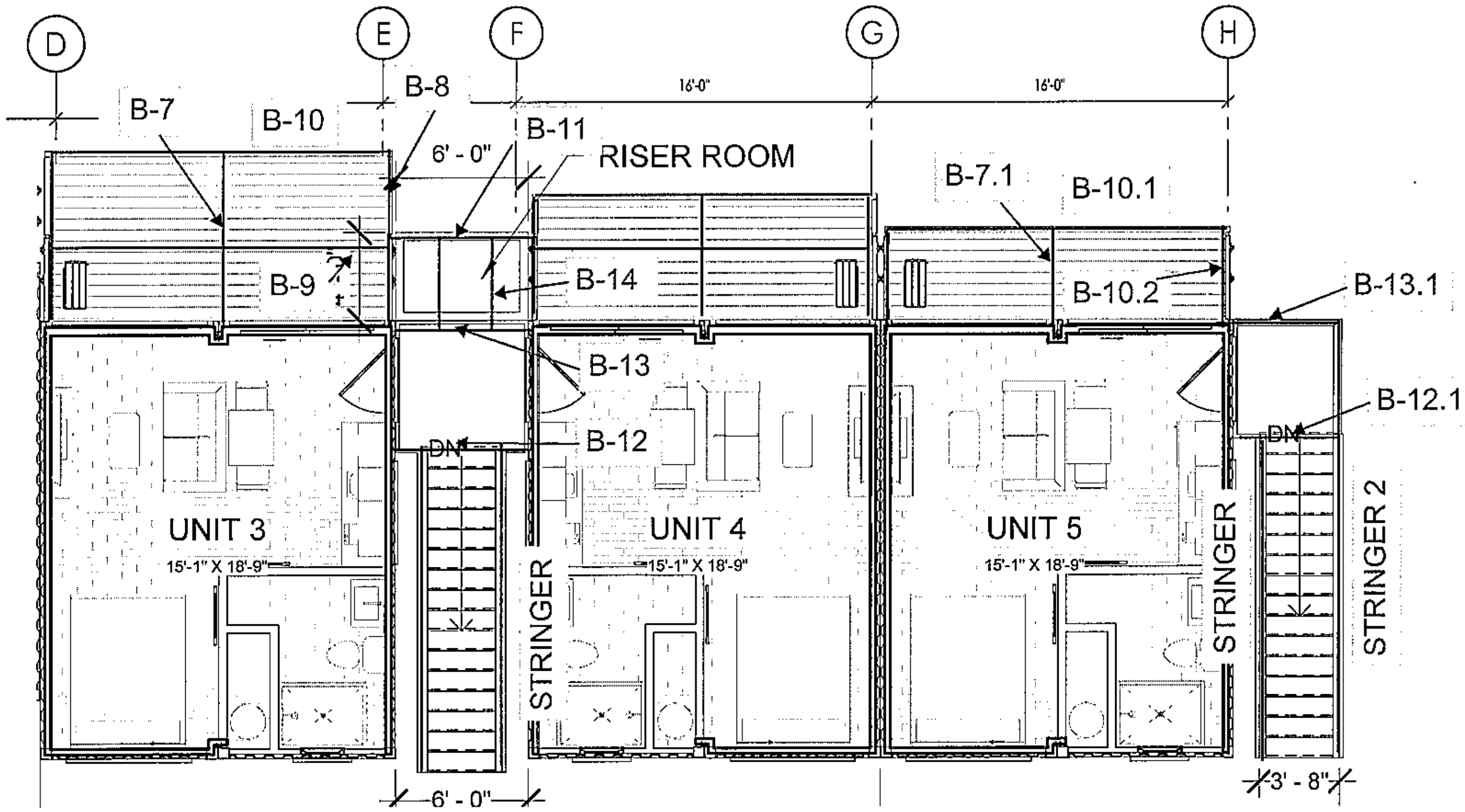
Maximum Deflection

Max Downward Transient Deflection	0.544 in	Ratio =	441 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.828 in	Ratio =	289 >=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.020	1.020
Max Upward from Load Combinations	1.020	1.020
Max Upward from Load Cases	0.670	0.670
D Only	0.350	0.350
+D+Lr	0.880	0.880
+D+S	1.020	1.020
+D+0.750Lr	0.748	0.748
+D+0.750S	0.853	0.853
+0.60D	0.210	0.210
Lr Only	0.530	0.530
S Only	0.670	0.670



STAIRS & PORCHES FRAMING TYP.

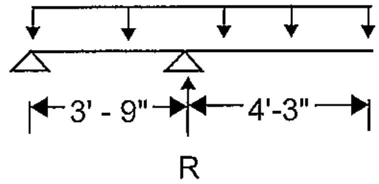
Hanging Deck

B-7

w = 15 psf D + 60 psf L + 25 psf S

TRIB = 8'

R (B-7) = 1.02k D + 4.10k Lr + 1.71k S

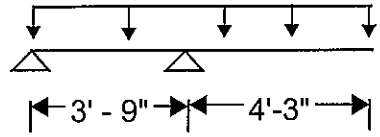


USE W5X16

B-8

w = 15 psf D + 60 psf L + 25 psf S

TRIB = 4'

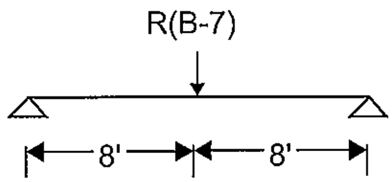


USE C5X6.7

B-9

TRIB = 8'

R (B-7) = 1.02k D + 4.10k Lr + 1.71k S

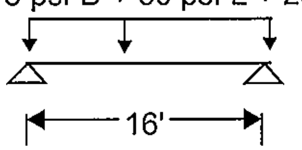


USE W5x19

B-10

w = 15 psf D + 60 psf L + 25 psf S

TRIB = 1'

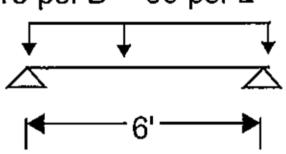


USE C5x6.7

B-11

w = 15 psf D + 60 psf L + 25 psf S

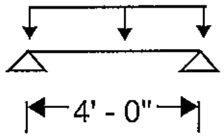
TRIB = 2'



USE C5X6.7

B-7.1 w = 15 psf D + 60 psf L + 25 psf S

TRIB = 8'

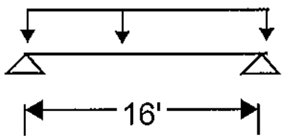


R (B-7.1) = 1.275 K

USE W5x16

B-10.1
w = 15 psf D + 60 psf L + 25 psf S

TRIB = 1'



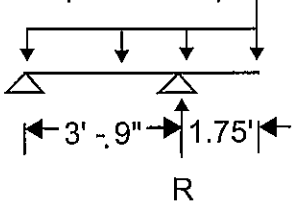
R (B-10.1) = 1.24 K

USE W5X16

B-10.1

B-10.2 w = 15 psf D + 60 psf L + 25 psf S

TRIB = 1'

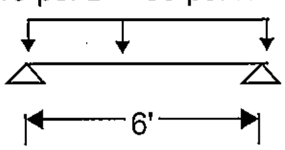


R (B-10.2) = 0.755 K

USE C5X6.7

B-14
w = 15 psf D + 60 psf L + 25 psf S

TRIB = 2'



USE C5X6.7

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Wood Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

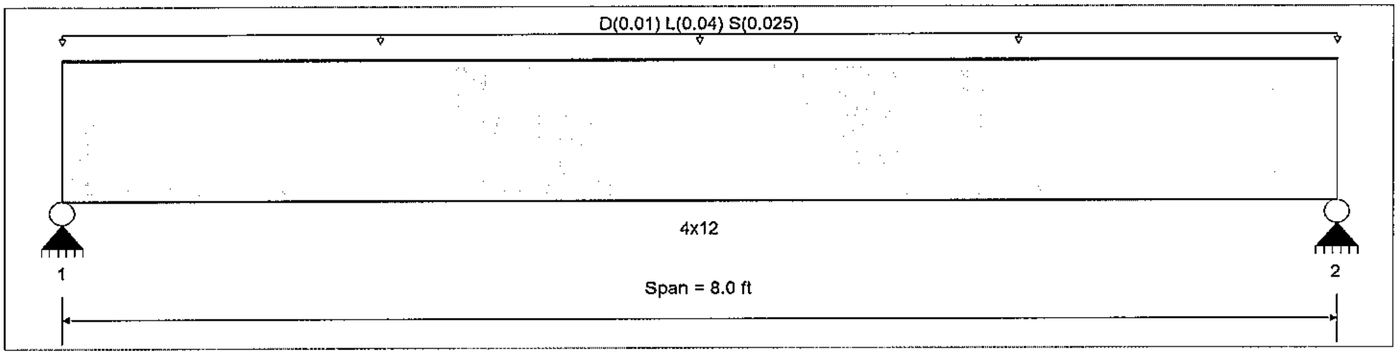
DESCRIPTION: HANGING DECK DECKING

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	675.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-22 / IBC 2024 (L<=100psf)	Fb -	675.0 psi	Ebend- xx	1,100.0 ksi
		Fc - Prll	500.0 psi	Eminbend - xx	400.0 ksi
Wood Species :	Hem-Fir	Fc - Perp	405.0 psi		
Wood Grade :	No.2	Fv	140.0 psi		
		Ft	350.0 psi	Density	26.840 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling			Repetitive Member Stress Increase	



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.010, L = 0.040, S = 0.0250 ksf, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.306**: 1	Maximum Shear Stress Ratio	=	**0.052** : 1
Section used for this span		**4x12**	Section used for this span		**4x12**
		(weak orientation)			*(weak orientation)*
fb: Actual	=	208.98 psi	fv: Actual	=	5.84 psi
F'b	=	683.10 psi	F'v	=	112.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.000 ft	Location of maximum on span	=	7.066 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.088 in Ratio =	1087 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in Ratio =	0 <360	n/a
Max Downward Total Deflection	0.117 in Ratio =	818 >=240	Span: 1 : +D+0.750L+0.5250S
Max Upward Total Deflection	0 in Ratio =	0 <240	n/a

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.213	0.213
Max Upward from Load Combinations	0.213	0.213
Max Upward from Load Cases	0.160	0.160
D Only	0.040	0.040
+D+L	0.200	0.200
+D+0.70S	0.110	0.110
+D+0.750L	0.160	0.160
+D+0.750L+0.5250S	0.213	0.213
+0.60D	0.024	0.024
+D+0.750L+0.10S	0.170	0.170
L Only	0.160	0.160
S Only	0.100	0.100

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Steel Beam — Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 — HAYDEN CONSULTING ENGINEERS —

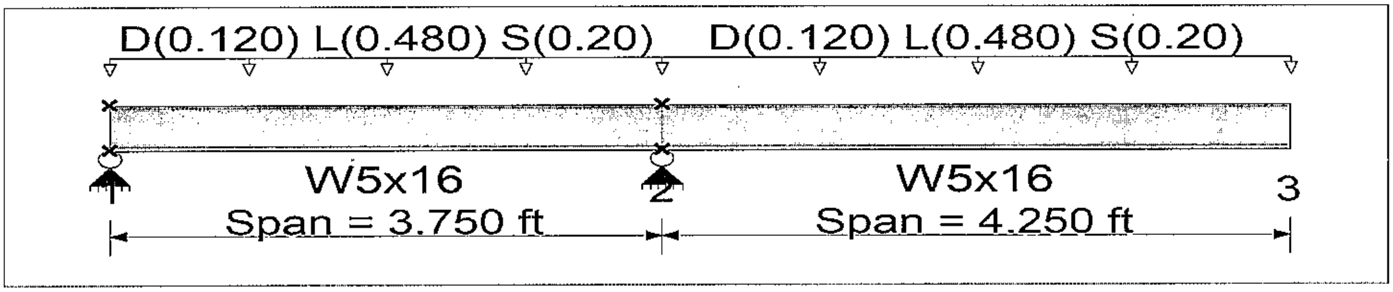
DESCRIPTION: B-7 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 8.0 ft
Load for Span Number 2
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.226** : 1	Maximum Shear Stress Ratio =	**0.107** : 1
Section used for this span	**W5x16**	Section used for this span	**W5x16**
Ma : Applied	5.419 k-ft	Va : Applied	2.570 k
Mn / Omega : Allowable	24.027 k-ft	Vn/Omega : Allowable	24.048 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	3.750 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.106 in	Ratio =	962	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.008 in	Ratio =	5,899	>=360	Span: 2 : L Only
Max Downward Total Deflection	0.133 in	Ratio =	770	>=240.	Span: 2 : +D+L
Max Upward Total Deflection	-0.010 in	Ratio =	4720	>=240.	Span: 2 : +D+L

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+L	-0.0095	2.310
+D+L	2	0.1325	4.250		0.0000	2.310

Vertical Reactions

Support notation : Far left is #· — Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions		5.120	
Max Upward from Load Combinations		5.120	
Max Upward from Load Cases		4.096	
Max Downward from all Load Conditions (Resis	-0.320		
Max Downward from Load Combinations (Resi:	-0.320		
Max Downward from Load Cases (Resisting Uţ	-0.256		
D Only	-0.064	1.024	
+D+L	-0.320	5.120	
+D+0.70S	-0.139	2.219	
+D+0.750L	-0.256	4.096	
+D+0.750L+0.5250S	-0.312	4.992	
+0.60D	-0.038	0.614	
+D+0.750L+0.10S	-0.267	4.267	
L Only	-0.256	4.096	
S Only	-0.107	1.707	

HAYDEN ENGINEERS
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Steel Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

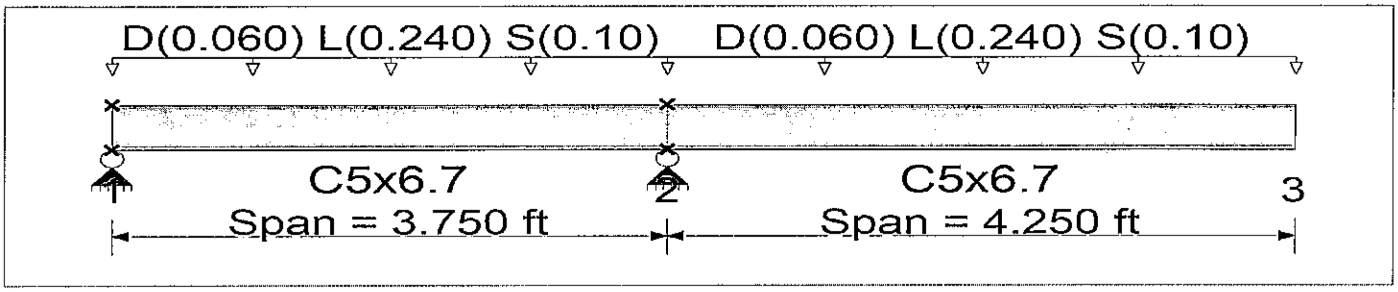
DESCRIPTION: B-8 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 4.0 ft
Load for Span Number 2
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 4.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.374** : 1	Maximum Shear Stress Ratio =	**0.075** : 1
Section used for this span	**C5x6.7**	Section used for this span	**C5x6.7**
Ma : Applied	2.709 k-ft	Va : Applied	1.285 k
Mn / Omega : Allowable	7.253 k-ft	Vn/Omega : Allowable	17.066 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	3.750 ft
Span # where maximum occurs	Span # 2	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.152 in	Ratio =	672	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.011 in	Ratio =	4,124	>=360	Span: 2 : L Only
Max Downward Total Deflection	0.190 in	Ratio =	538	>=240.	Span: 2 : +D+L
Max Upward Total Deflection	-0.014 in	Ratio =	3299	>=240.	Span: 2 : +D+L

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+L	-0.0136	2.310
+D+L	2	0.1895	4.250		0.0000	2.310

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions		2.560	
Max Upward from Load Combinations		2.560	
Max Upward from Load Cases		2.048	
Max Downward from all Load Conditions (Resis	-0.160		
Max Downward from Load Combinations (Resi	-0.160		
Max Downward from Load Cases (Resisting Up	-0.128		
D Only	-0.032	0.512	
+D+L	-0.160	2.560	
+D+0.70S	-0.069	1.109	
+D+0.750L	-0.128	2.048	
+D+0.750L+0.5250S	-0.156	2.496	
+0.60D	-0.019	0.307	
+D+0.750L+0.10S	-0.133	2.133	
L Only	-0.128	2.048	
S Only	-0.053	0.853	

HAYDEN ENGINEERS
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Steel Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.25.02.04 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

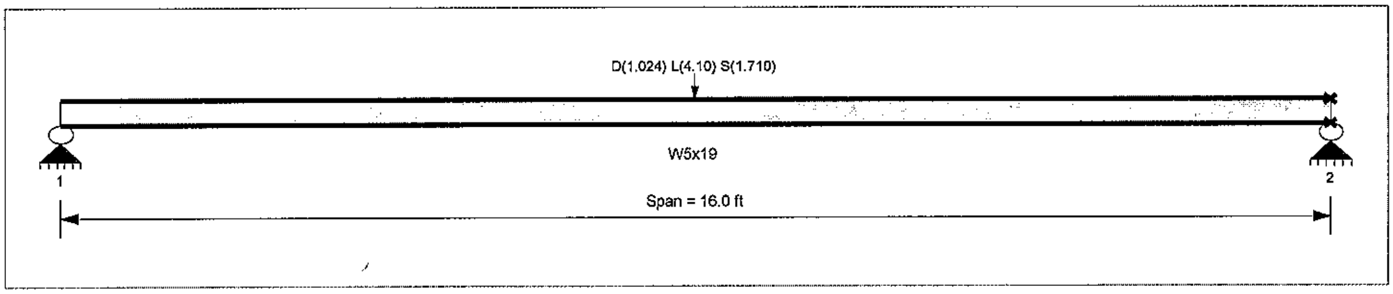
DESCRIPTION: B-9 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : D = 1.024, L = 4.10, S = 1.710 k @ 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.708** : 1	Maximum Shear Stress Ratio =	**0.092** : 1
Section used for this span	**W5x19**	Section used for this span	**W5x19**
Ma : Applied	20.496 k-ft	Va : Applied	2.562 k
Mn / Omega : Allowable	28.942 k-ft	Vn/Omega : Allowable	27.810 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.794 in Ratio =	241 >=240.	Span: 1 : L Only
Max Upward Transient Deflection	0 in Ratio =	0 <240.0	n/a
Max Downward Total Deflection	0.995 in Ratio =	193 >=180.	Span: 1 : +D+L
Max Upward Total Deflection	0 in Ratio =	0 <180.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.9949	8.000		0.0000	0.000

Vertical Reactions

Support notation : Far left is #' Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.562	2.562
Max Upward from Load Combinations	2.562	2.562
Max Upward from Load Cases	2.050	2.050
D Only	0.512	0.512
+D+L	2.562	2.562
+D+0.70S	1.111	1.111
+D+0.750L	2.050	2.050
+D+0.750L+0.5250S	2.498	2.498
+0.60D	0.307	0.307
+D+0.750L+0.10S	2.135	2.135
L Only	2.050	2.050
S Only	0.855	0.855

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Steel Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

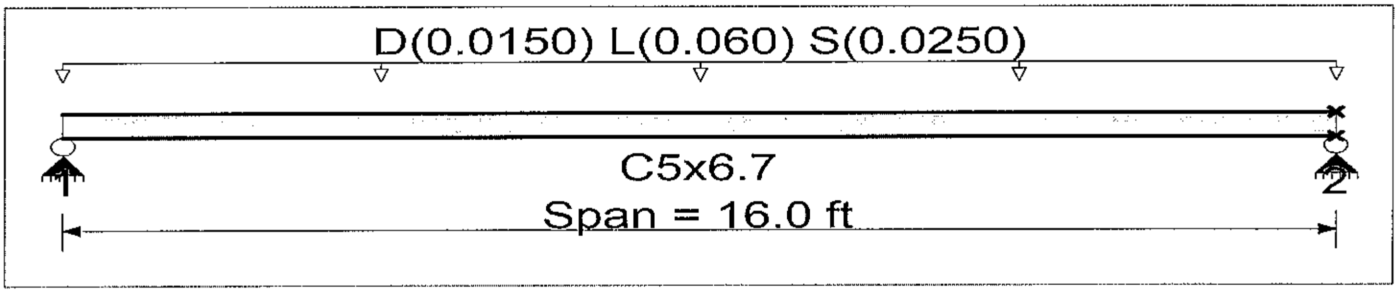
DESCRIPTION: B-10 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.271** : 1	Maximum Shear Stress Ratio =	**0.035** : 1
Section used for this span	**C5x6.7**	Section used for this span	**C5x6.7**
Ma : Applied	2.400 k-ft	Va : Applied	0.60 k
Mn / Omega : Allowable	8.857 k-ft	Vn/Omega : Allowable	17.066 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.409 in	Ratio =	468	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.512 in	Ratio =	375	>=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.5122	8.046		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.600	0.600
Max Upward from Load Combinations	0.600	0.600
Max Upward from Load Cases	0.480	0.480
D Only	0.120	0.120
+D+L	0.600	0.600
+D+0.70S	0.260	0.260
+D+0.750L	0.480	0.480
+D+0.750L+0.5250S	0.585	0.585
+0.60D	0.072	0.072
+D+0.750L+0.10S	0.500	0.500
L Only	0.480	0.480
S Only	0.200	0.200

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Steel Beam

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

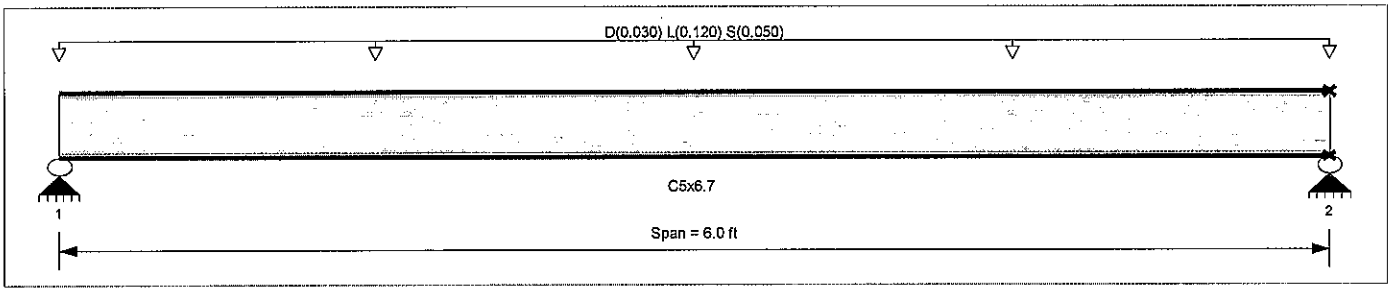
DESCRIPTION: B-11 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.076** : 1	Maximum Shear Stress Ratio =	**0.026** : 1
Section used for this span	**C5x6.7**	Section used for this span	**C5x6.7**
Ma : Applied	0.675 k-ft	Va : Applied	0.450 k
Mn / Omega : Allowable	8.857 k-ft	Vn/Omega : Allowable	17.066 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.016 in Ratio =	4,443 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in Ratio =	0 <360	n/a
Max Downward Total Deflection	0.020 in Ratio =	3554 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0203	3.017		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.450	0.450
Max Upward from Load Combinations	0.450	0.450
Max Upward from Load Cases	0.360	0.360
D Only	0.090	0.090
+D+L	0.450	0.450
+D+0.70S	0.195	0.195
+D+0.750L	0.360	0.360
+D+0.750L+0.5250S	0.439	0.439
+0.60D	0.054	0.054
+D+0.750L+0.10S	0.375	0.375
L Only	0.360	0.360
S Only	0.150	0.150

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Steel Beam Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

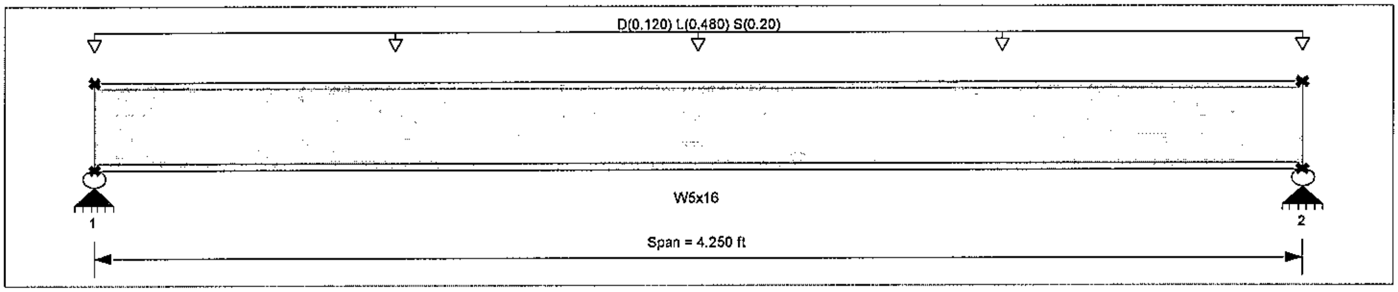
DESCRIPTION: B-7.1 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.056** : 1	Maximum Shear Stress Ratio =	**0.053** : 1
Section used for this span	**W5x16**	Section used for this span	**W5x16**
Ma : Applied	1.355 k-ft	Va : Applied	1.275 k
Mn / Omega : Allowable	24.027 k-ft	Vn/Omega : Allowable	24.048 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.006 in	Ratio =	8,941 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.007 in	Ratio =	7153 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0071	2.137		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.275	1.275
Max Upward from Load Combinations	1.275	1.275
Max Upward from Load Cases	1.020	1.020
D Only	0.255	0.255
+D+L	1.275	1.275
+D+0.70S	0.553	0.553
+D+0.750L	1.020	1.020
+D+0.750L+0.5250S	1.243	1.243
+0.60D	0.153	0.153
+D+0.750L+0.10S	1.063	1.063
L Only	1.020	1.020
S Only	0.425	0.425

HAYDEN ENGINEERS
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Steel Beam Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

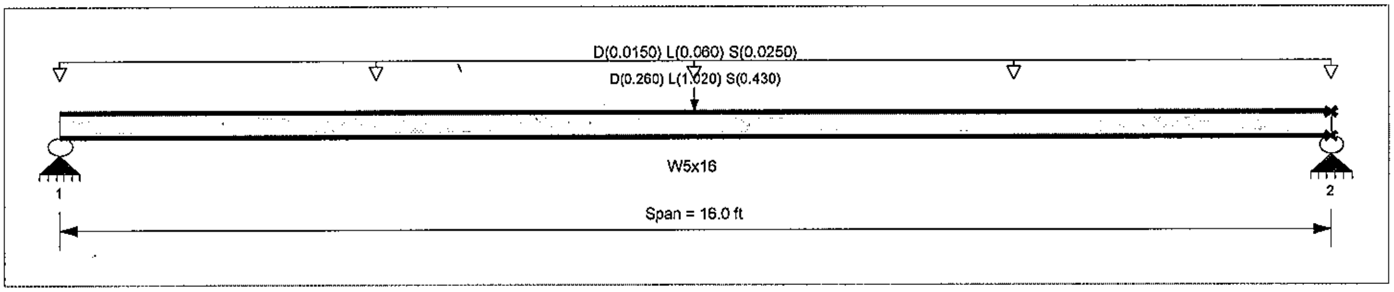
DESCRIPTION: B-10.1 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 1.0 ft
Point Load : D = 0.260, L = 1.020, S = 0.430 k @ 8.0 ft, (B-7.1)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.313** : 1	Maximum Shear Stress Ratio =	**0.052** : 1
Section used for this span	**W5x16**	Section used for this span	**W5x16**
Ma : Applied	7.520 k-ft	Va : Applied	1.240 k
Mn / Omega : Allowable	24.027 k-ft	Vn/Omega : Allowable	24.048 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.386 in Ratio =	496 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in Ratio =	0 <360	n/a
Max Downward Total Deflection	0.484 in Ratio =	396 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.4844	8.046		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.240	1.240
Max Upward from Load Combinations	1.240	1.240
Max Upward from Load Cases	0.990	0.990
D Only	0.250	0.250
+D+L	1.240	1.240
+D+0.70S	0.541	0.541
+D+0.750L	0.993	0.993
+D+0.750L+0.5250S	1.210	1.210
+0.60D	0.150	0.150
+D+0.750L+0.10S	1.034	1.034
L Only	0.990	0.990
S Only	0.415	0.415

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Steel Beam	Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS

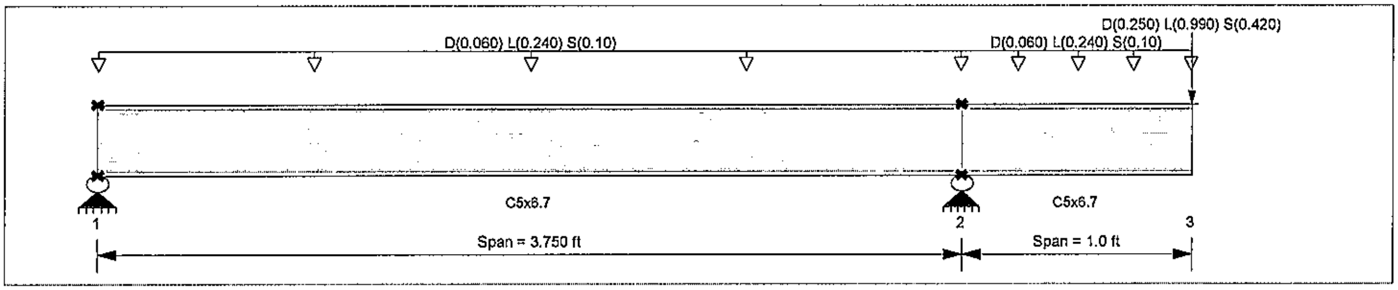
DESCRIPTION: B-10.2 (HANGING DECK)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 4.0 ft
Load for Span Number 2
Uniform Load : D = 0.0150, L = 0.060, S = 0.0250 ksf, Tributary Width = 4.0 ft
Point Load : D = 0.250, L = 0.990, S = 0.420 k @ 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.157** : 1	Maximum Shear Stress Ratio =	**0.090** : 1
Section used for this span	**C5x6.7**	Section used for this span	**C5x6.7**
Ma : Applied	1.390 k-ft	Va : Applied	1.540 k
Mn / Omega : Allowable	8.857 k-ft	Vn/Omega : Allowable	17.066 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	3.750 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.010 in Ratio = 2,471 >=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.003 in Ratio = 13,187 >=360	Span: 2 : L Only
Max Downward Total Deflection	0.012 in Ratio = 1972 >=240.	Span: 2 : +D+L
Max Upward Total Deflection	-0.004 in Ratio = 10508 >=240.	Span: 1 : +D+L

Overall Maximum Deflections

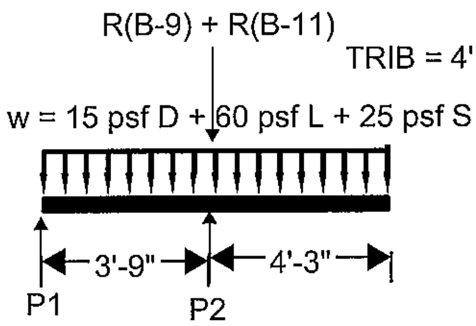
Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+D+L	-0.0043	2.565
2	+D+L	0.0122	1.000		0.0000	2.565

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	0.192	2.473	
Max Upward from Load Combinations	0.192	2.473	
Max Upward from Load Cases	0.154	1.976	
D Only	0.038	0.497	
+D+L	0.192	2.473	
+D+0.70S	0.081	1.080	
+D+0.750L	0.153	1.979	
+D+0.750L+0.5250S	0.186	2.416	
+0.60D	0.023	0.298	
+D+0.750L+0.10S	0.160	2.062	
L Only	0.154	1.976	
S Only	0.062	0.833	

Rear Deck Beams (B-8)

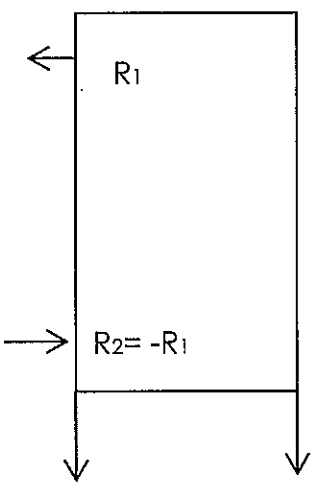


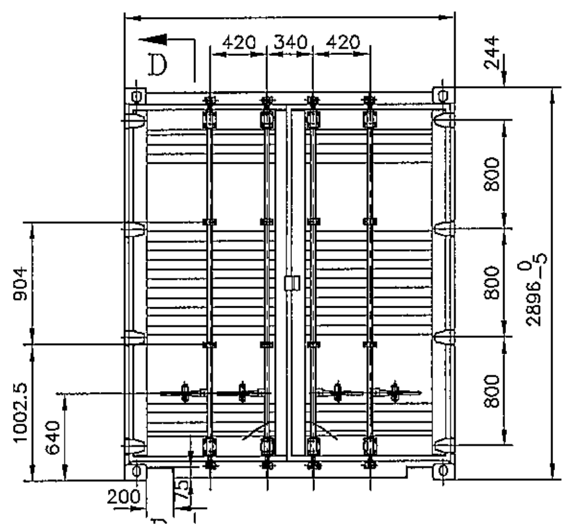
R1 (B-8)= -0.03k D + -0.13k L + -0.05k S
R2 (B-8) = 0.51k D + 2.05k L + 0.850k S

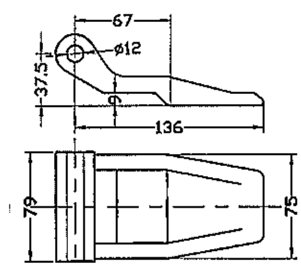
R (B-9) = 0.512k D + 2.05k L + 0.860k S
R (B-11) = 0.06k D + 0.24k L + 0.10k S

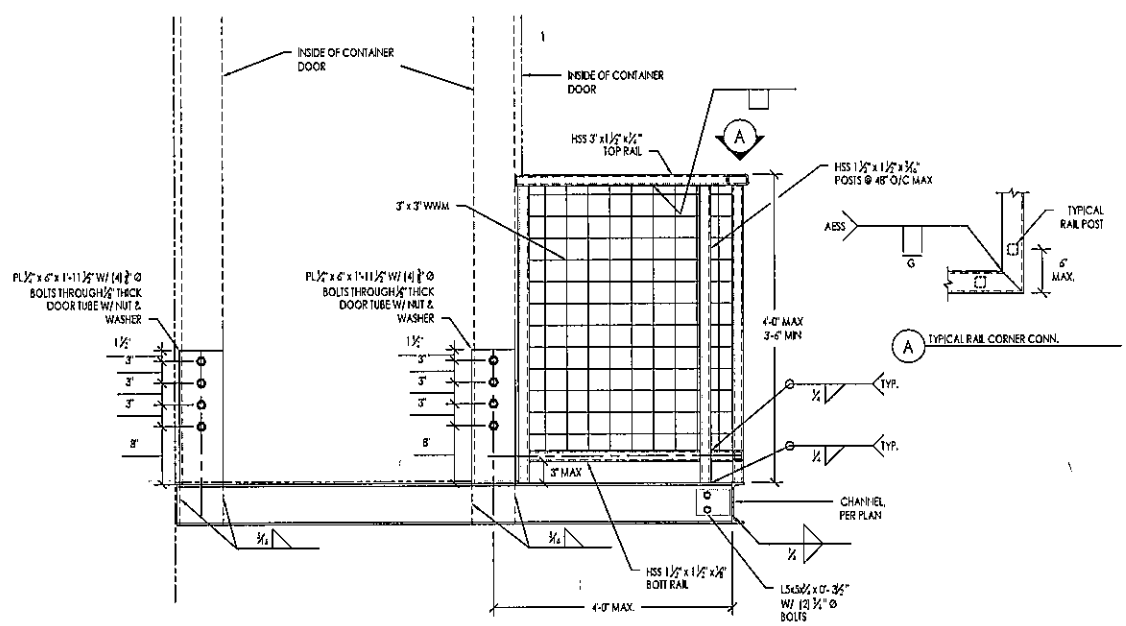
P1 = -0.03k D + -0.13k L + -0.05k S
P2 = 1.082k D + 4.34k L + 1.81k S
MAX LOAD COMBO = (D+0.75L + 0.75S)
P1 = -0.165 K
P2 = 5.7 K

IMSC Door as Support

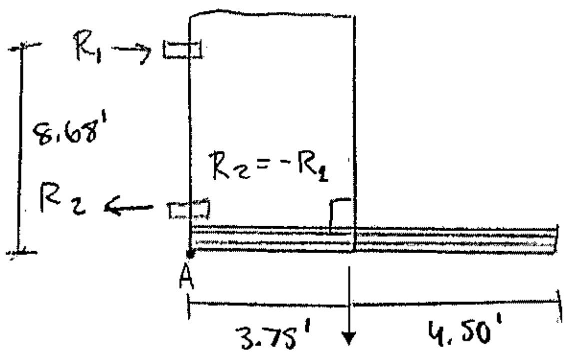








Hanging Deck Door Support



P2 = 5.7K

$\circlearrowright + \; \Sigma M_A = (5.7K \times 3.75') - (R1 \times 8.68')$

$R_1 \cdot 8.68' = 21.375$ k-ft

$R_1 = 2.46$ k

$R_2 = -2.46$ k

Allowable Tension

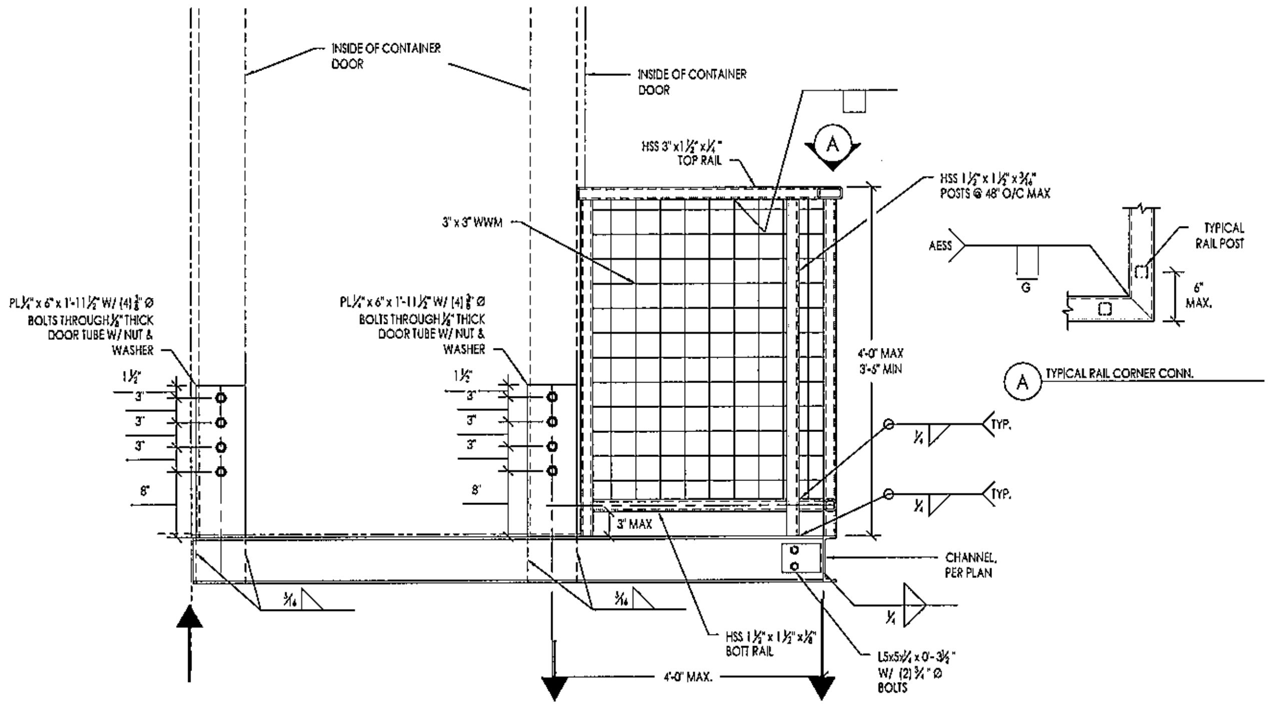
Steel Strength – 12mm (~7/16") Dia. Hinge Pins, $F_y = 30$ ksi (ASTM A276-304)
– Door Hinges, $F_y = 58$ ksi (ASTM A307, C' conservatively assumed)

$V_a \text{ Rod} = \frac{F_n A_b}{\Omega} = 30 \text{ ksi} \cdot ((0.4375''/2)^2 \cdot 3.145)/2 = 2.25$ kips/interface

$= 4.5$ kips per hinge

4.5 k allowable / 2.46 k req'd = F.O.S. = 1.83

Connection to Door



P1 = 0.165K P2 = 5.7K B-10 R = 0.6 K

Check Weld

Rn/Ω = (0.928 kip/in) Dl

D = 5
l = 5"
Rn/Ω = 23.2 k > 5.7k OK

Check Steel in Tension

Rn/Ω = Fy Ag
Ω = 1.67 (ASD)
Fy = 36 ksi
Ag = 0.25" x 6" = 1.5in2
Rn/Ω = 32.33 k > 5.7k OK

Check Bolts in Shear

3/8" bolts nominal area = 0.11"
Fnv/Ω = 27 ksi
27 ksi x 0.11 = 2.97 k x 4 bolts = 11.88 k
Rn/Ω = 11.88 k > 5.7k OK

Check Plate Buckling

I = bd^3/12 = (6)(0.25)^3/12 = 7.8125x10^-3
r = $\sqrt{I/A} = \sqrt{0.00078/(0.25)(6)}$ = 0.72
KL/r = 12.5"/0.072" = 174
Fy = 36 ksi
Fcr/Ωc = 4.96k
4.96k < 165 lb OK

Check Weld at front of deck

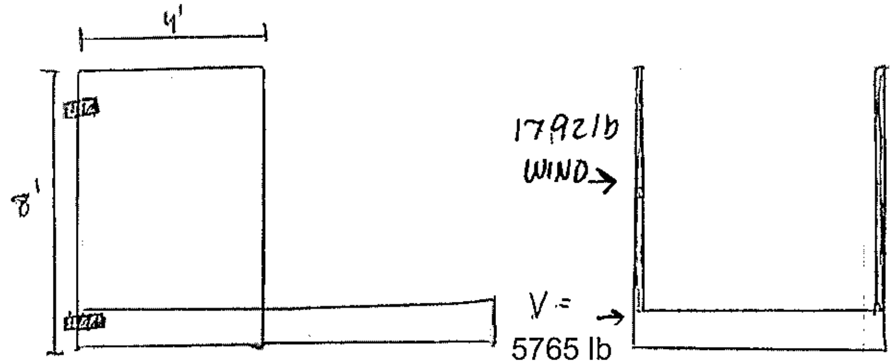
Rn/Ω = (0.928 kip/in) Dl

D = 4
l = 5"
Rn/Ω = 18.5 k > 5.7k OK

Check Bolts at front of deck

1/4" bolts nominal area = 0.049"
Fnv/Ω = 27 ksi
27 ksi x 0.049
= 1.32 k x 2 bolts = 2.65 k
Rn/Ω = 2.65 k > 0.6k OK

Hinge Welding Container Door



SEISMIC:

Deck Wt = 20 psf D + 60 psf L x (8' x 16') = 10240 lb

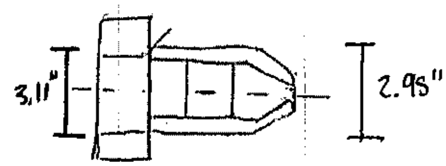
V = 0.563W = 5765 lb

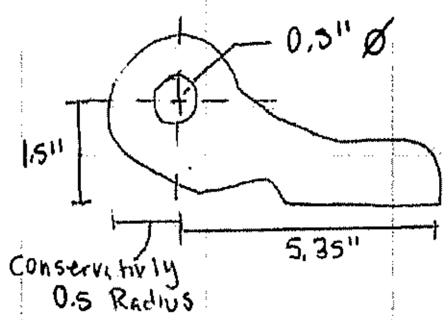
WIND:

Door = 4' · 8' = 32 ft² · 2 = 64 ft²

P_{SA} = 28 psf · 64 ft² = 1792 lb

(EXPOSURE D, 135 mph) (conservative)





Circumfrence = $2\pi R$ = 3.14"

1/4" weld : D = 4

$\frac{R_n}{\Omega} = (0.928 \text{ kip-in}) D \ell$

$\frac{R_n}{\Omega}$ = (0.928)(4)(3.14") = 11.65 k

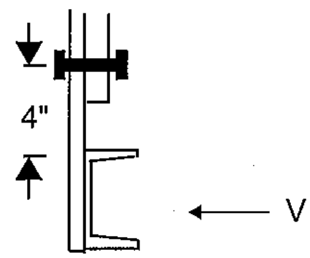
$\frac{R_n}{\Omega}$ = 11.65 k > V

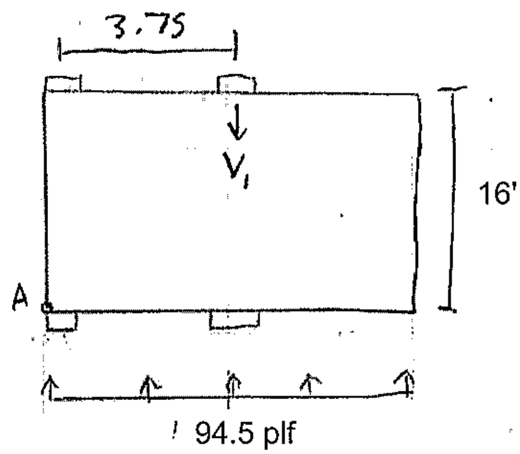
OK ✓

→ WELD ALL AROUND HINGE

OK ✓

Check Plate Bending





Wt = 15 psf D x 16' = 240 plf

V = 0.563W = 135 plf (ULT)

V = 0.7 x 135 plf = 94.5 plf (ASD)

$\circlearrowleft \Sigma M_A$ = (94.5 plf x 8' x 4') - (3.75 x V1)

V1 = 806 lb / 2 sides of door = 403 lb

M = (0.403 k) (4") = 1.612 k-in

Flat plate bending in weak axis

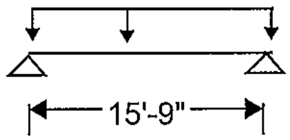
$$t_{min} = \sqrt{\frac{6\,(1.612\ \text{k-in})}{0.9\,(36)\,(6")}} = 0.223"$$ → 1/4" PLATE OK ✓

STAIRS

Stringer

w = 15 psf D + 100 psf L + 25 psf S

TRIB = 2'



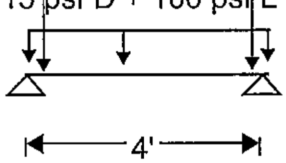
USE C12X20.7

B-12

Stringer Stringer

w = 15 psf D + 100 psf L + 25 psf S

TRIB = 3'

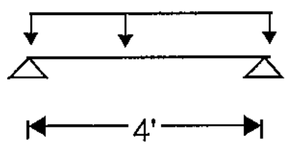


USE C5X6.7

B-13

w = 15 psf D + 100 psf L + 25 psf S

TRIB = 5.125'

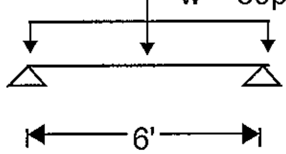


USE W5X6.7

Handrail

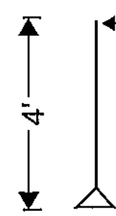
Or 250 # L

w = 50psf L



USE W5X6.7

Handrail Post



Rmax Handrail = 300 # L

USE W5X6.7

HAYDEN ENGINEERS STRUCTURAL | CIVIL

(503) 968-9994 Hayden-Engineers.com

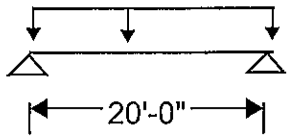
Nestucca River - Multifamily Container

BY	SS	DATE	4/18/25
REV		DATE	
JOB NO	24261.01		
SHEET		OF	

Stringer 2

w = 15 psf D + 100 psf L + 25 psf S

TRIB = 2'



USE C12X20.7

BOLT CONNECTION:

(2) 3/4" BOLTS SHEAR CAPACITY (ASD) = 5.97 X 2 = 11.9 K > MAX REACTION = 3.3 K OK

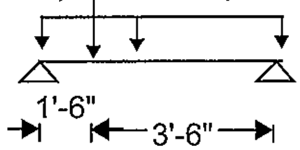
Rn = 0.6 x 36 ksi x (3" x 1/4") = 16.2 k / 2 = 8.1 k > 3.3 k

B-12.1

Stringer

w = 15 psf D + 100 psf L + 25 psf S

TRIB = 2.6'



USE W5x16

B-13.1

USE C5x6.7 supported by WF below

Min Angle Thickness:

M = 2" x (2.75' x 12" x (0.1plf L + 0.015 plf D)x 12") = 7.6 k-in

$$t_{min} = \sqrt{\frac{6\ (7.6\ \text{k-in})}{0.9\ (36\ \text{ksi})(12")}} = 0.117"$$

USE L2x2x1/4

Check Handrail Post reaction on Stringer

M = 0.300k x 4' x 12" = 14.4 k-in

$$t_{min} = \sqrt{\frac{6\ (14.4\ \text{k-in})}{0.9\ (36\ \text{ksi})(36")}}$$ = 0.27" THICKNESS < FLANGE THICKNESS = 0.32" OK

MATL/ TYPE	GAUGE	DEPTH (mm)	LBS./LF (kg/m)	LOAD/ DEFL	CLEAR SPAN 24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	108"	120"	132"	144"
CARBON STEEL & GALVANIZED STEEL	14	1-1/2" (38.1)	3.60 (5.36)	U	663	426	296	219	168	134	109	90	77	--	--	--	--	--	--	--	--
				D	0.06	0.10	0.14	0.20	0.26	0.33	0.41	0.50	0.59	--	--	--	--	--	--	--	--
				C	525	421	352	303	266	238	215	197	182	--	--	--	--	--	--	--	--
				D	0.05	0.08	0.11	0.16	0.21	0.26	0.33	0.40	0.47	--	--	--	--	--	--	--	--
		2" (50.8)	3.80 (5.65)	U	1100	705	491	362	278	220	179	148	125	107	93	81	72	58	47	--	--
				D	0.06	0.09	0.13	0.17	0.23	0.29	0.36	0.43	0.52	0.61	0.71	0.82	0.94	1.20	1.51	--	--
				C	730	698	583	501	440	392	354	323	298	276	258	242	228	205	187	--	--
				D	0.04	0.07	0.10	0.14	0.18	0.23	0.28	0.35	0.41	0.49	0.57	0.66	0.75	0.96	1.20	--	--
		2-1/2" (63.5)	4.10 (6.10)	U	1262	809	563	415	318	252	205	170	144	123	106	93	82	66	54	45	--
				D	0.04	0.06	0.08	0.11	0.14	0.18	0.23	0.28	0.33	0.39	0.45	0.52	0.60	0.76	0.95	1.17	--
				C	730	730	669	574	504	449	406	370	341	316	295	277	261	235	214	197	--
				D	0.02	0.04	0.06	0.09	0.12	0.15	0.18	0.22	0.26	0.31	0.36	0.42	0.48	0.61	0.76	0.94	--
	12	1-1/2" (38.1)	5.00 (7.44)	U	906	581	405	298	229	182	148	123	104	89	77	67	60	--	--	--	--
				D	0.07	0.11	0.16	0.21	0.28	0.36	0.44	0.54	0.64	0.76	0.89	1.02	1.17	--	--	--	--
				C	718	575	481	413	363	324	292	267	246	228	213	200	189	--	--	--	--
				D	0.06	0.09	0.13	0.17	0.23	0.29	0.35	0.43	0.52	0.61	0.71	0.82	0.94	--	--	--	--
		2" (50.8)	5.40 (8.04)	U	1398	896	624	460	353	280	228	189	160	137	119	104	92	74	61	51	43
				D	0.05	0.08	0.11	0.16	0.20	0.26	0.32	0.39	0.47	0.55	0.65	0.75	0.85	1.10	1.38	1.69	2.03
				C	1107	887	741	637	559	499	451	412	380	353	329	309	292	264	241	222	206
				D	0.04	0.06	0.09	0.12	0.16	0.21	0.26	0.31	0.37	0.44	0.52	0.60	0.68	0.88	1.10	1.35	1.63
		2-1/2" (63.5)	5.70 (8.48)	U	2090	1339	931	685	525	416	338	280	236	201	174	152	134	107	87	73	62
				D	0.04	0.06	0.09	0.13	0.17	0.21	0.26	0.32	0.38	0.44	0.52	0.60	0.68	0.87	1.08	1.32	1.58
				C	1400	1325	1106	949	832	741	668	609	559	518	482	452	425	380	345	316	293
				D	0.03	0.05	0.07	0.10	0.13	0.17	0.21	0.25	0.30	0.36	0.41	0.48	0.54	0.69	0.86	1.05	1.27
		3" (76.2)	6.10 (9.08)	U	2644	1694	1177	866	664	525	426	353	297	254	219	192	169	134	110	91	77
				D	0.04	0.06	0.08	0.11	0.14	0.18	0.22	0.27	0.32	0.38	0.44	0.51	0.58	0.74	0.92	1.12	1.35
				C	1400	1400	1398	1200	1051	936	844	769	706	653	608	569	535	478	434	397	367
				D	0.02	0.04	0.06	0.09	0.11	0.15	0.18	0.22	0.26	0.31	0.35	0.41	0.47	0.59	0.74	0.90	1.08
STAINLESS STEEL TYPE 304	16	2" (50.8)	3.20 (4.76)	U	720	462	322	238	183	145	118	98	83	71	59	--	--	--	--	--	--
				D	0.05	0.08	0.11	0.16	0.20	0.26	0.32	0.39	0.47	0.55	0.61	--	--	--	--	--	--
				C	570	457	382	329	289	258	234	214	197	184	165	--	--	--	--	--	--
				D	0.04	0.06	0.09	0.12	0.16	0.21	0.26	0.31	0.38	0.44	0.49	--	--	--	--	--	--
STAINLESS STEEL TYPE 316		2" (50.8)	3.20 (4.76)	U	626	400	278	204	156	123	100	82	69	59	51	--	--	--	--	--	--
				D	0.04	0.06	0.10	0.13	0.17	0.22	0.27	0.32	0.39	0.45	0.53	--	--	--	--	--	--
				C	492	397	330	283	248	220	198	180	165	152	141	--	--	--	--	--	--
				D	0.03	0.05	0.08	0.10	0.14	0.17	0.22	0.26	0.31	0.36	0.42	--	--	--	--	--	--

U - Uniform Load - Lbs./Sf. D - Deflection in Inches C - Concentrated Load - Lbs./Ft. of Width at Mid Span | Span and loading values to the left of the bolded black line produce a deflection of 1/4" or less under a uniform load of 100 Lbs./Sf., allowing for safe pedestrian comfort. Span and loading values to the right of the bolded black line are applicable to other types of loads at the discretion of a licensed engineer. Technical information provided is theoretical and for evaluation by technically skilled persons, with any use thereof to be at their independent discretion and risk. **McNICHOLS** shall have no responsibility or liability for results obtained or damages resulting from improper evaluation or use of Plank Grating.

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Steel Beam

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

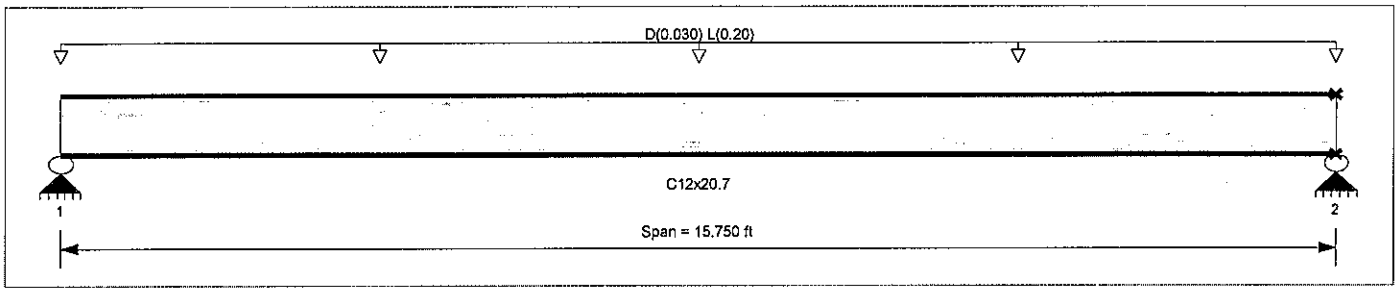
DESCRIPTION: Stringer

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, L = 0.10 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.122** : 1	Maximum Shear Stress Ratio =	**0.032** : 1
Section used for this span	**C12x20.7**	Section used for this span	**C12x20.7**
Ma : Applied	7.774 k-ft	Va : Applied	1.974 k
Mn / Omega : Allowable	63.872 k-ft	Vn/Omega : Allowable	60.790 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.074 in	Ratio =	2,541 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.093 in	Ratio =	2028 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0932	7.920		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.974	1.974
Max Upward from Load Combinations	1.974	1.974
Max Upward from Load Cases	1.575	1.575
D Only	0.399	0.399
+D+L	1.974	1.974
+D+0.750L	1.581	1.581
+0.60D	0.240	0.240
L Only	1.575	1.575

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Steel Beam

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

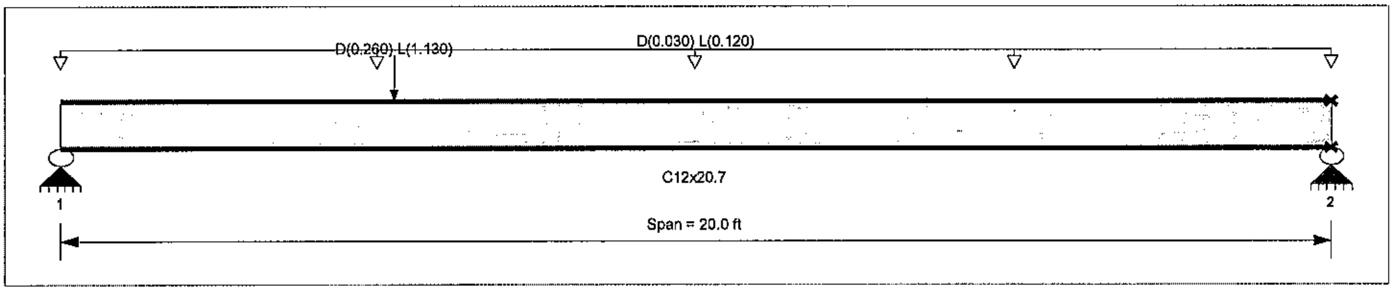
DESCRIPTION: Stringer 2

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, L = 0.060 ksf, Tributary Width = 2.0 ft
Point Load : D = 0.260, L = 1.130 k @ 5.250 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.197** : 1	Maximum Shear Stress Ratio =	**0.045** : 1
Section used for this span	**C12x20.7**	Section used for this span	**C12x20.7**
Ma : Applied	12.574 k-ft	Va : Applied	2.732 k
Mn / Omega : Allowable	63.872 k-ft	Vn/Omega : Allowable	60.790 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.179 in	Ratio =	1,341 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.242 in	Ratio =	990 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.2423	9.657		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.732	2.072
Max Upward from Load Combinations	2.732	2.072
Max Upward from Load Cases	2.033	1.497
D Only	0.699	0.575
+D+L	2.732	2.072
+D+0.750L	2.224	1.698
+0.60D	0.419	0.345
L Only	2.033	1.497

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Steel Beam — Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 — HAYDEN CONSULTING ENGINEERS — (c) ENERCALC, LLC 1982-2025

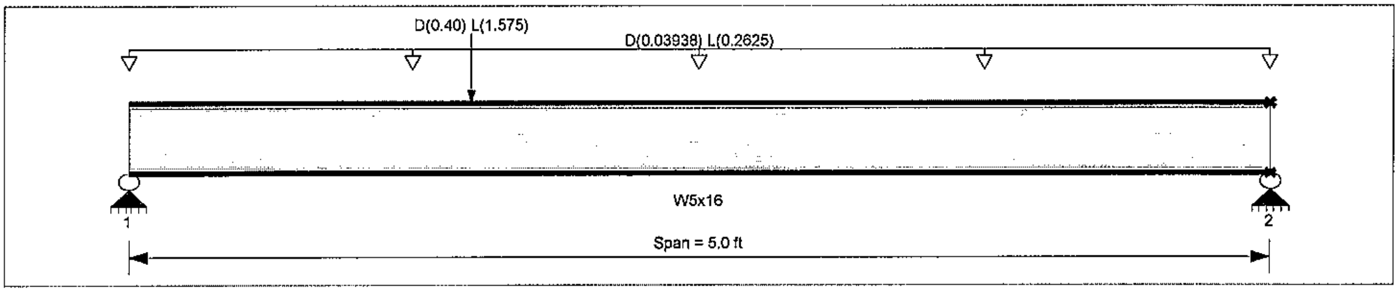
DESCRIPTION: B-12.1

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Load(s) for Span Number 1
Point Load : D = 0.40, L = 1.575 k @ 1.50 ft, (Stringer)
Uniform Load : D = 0.0150, L = 0.10 ksf, Tributary Width = 2.625 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.121** : 1	Maximum Shear Stress Ratio =	**0.091** : 1
Section used for this span	**W5x16**	Section used for this span	**W5x16**
Ma : Applied	2.908 k-ft	Va : Applied	2.177 k
Mn / Omega : Allowable	24.027 k-ft	Vn/Omega : Allowable	24.048 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.015 in	Ratio =	3,964 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.019 in	Ratio =	3204 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0187	2.357		0.0000	0.000

Vertical Reactions

Support notation : Far left is # — Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.177	1.387
Max Upward from Load Combinations	2.177	1.387
Max Upward from Load Cases	1.759	1.129
D Only	0.419	0.259
+D+L	2.177	1.387
+D+0.750L	1.738	1.105
+0.60D	0.251	0.155
L Only	1.759	1.129

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

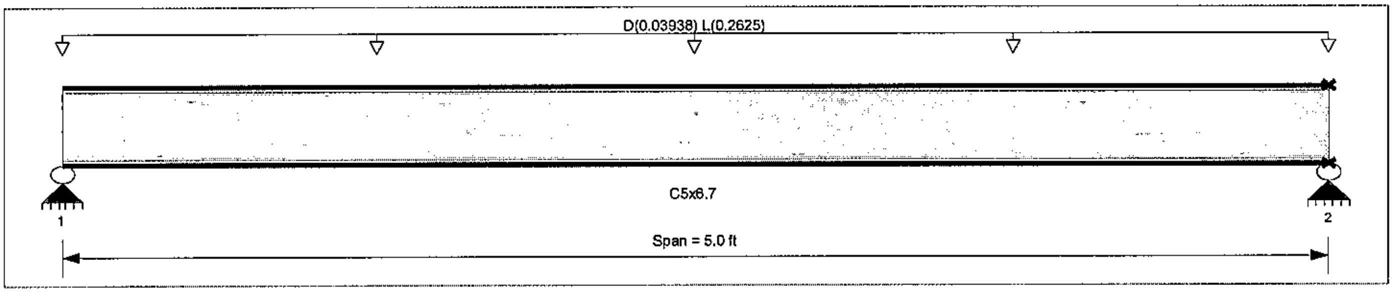
DESCRIPTION: B-12.2

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, L = 0.10 ksf, Tributary Width = 2.625 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.109** : 1	Maximum Shear Stress Ratio =	**0.045** : 1
Section used for this span	**C5x6.7**	Section used for this span	**C5x6.7**
Ma : Applied	0.964 k-ft	Va : Applied	0.7714 k
Mn / Omega : Allowable	8.857 k-ft	Vn/Omega : Allowable	17.066 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.017 in	Ratio =	3,509 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.020 in	Ratio =	2986 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0201	2.514		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.771	0.771
Max Upward from Load Combinations	0.771	0.771
Max Upward from Load Cases	0.656	0.656
D Only	0.115	0.115
+D+L	0.771	0.771
+D+0.750L	0.607	0.607
+0.60D	0.069	0.069
L Only	0.656	0.656

HAYDEN ENGINEERS
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Steel Beam — Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 — HAYDEN CONSULTING ENGINEERS — (c) ENERCALC, LLC 1982-2025

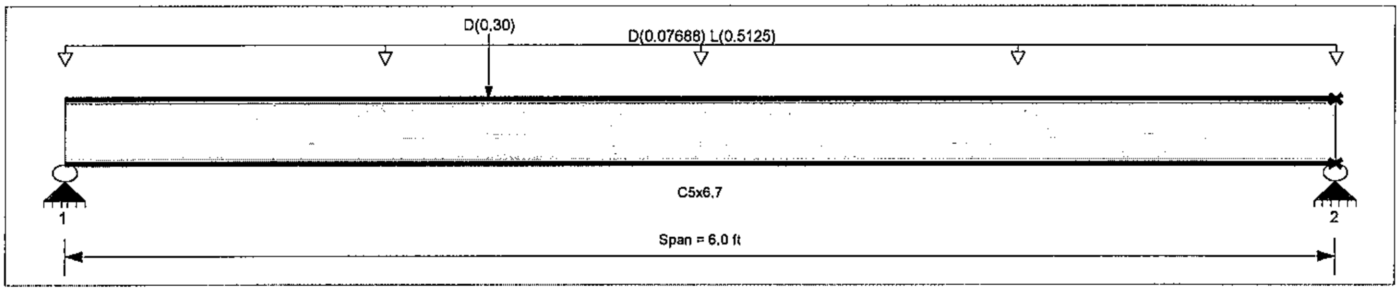
DESCRIPTION: B-13

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, L = 0.10 ksf, Tributary Width = 5.125 ft
Point Load : D = 0.30 k @ 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.338** : 1	Maximum Shear Stress Ratio =	**0.117** : 1
Section used for this span	**C5x6.7**	Section used for this span	**C5x6.7**
Ma : Applied	2.991 k-ft	Va : Applied	1.988 k
Mn / Omega : Allowable	8.857 k-ft	Vn/Omega : Allowable	17.066 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.069 in	Ratio =	1,040 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.090 in	Ratio =	803 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0897	2.983		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.988	1.888
Max Upward from Load Combinations	1.988	1.888
Max Upward from Load Cases	1.538	1.538
D Only	0.451	0.351
+D+L	1.988	1.888
+D+0.750L	1.604	1.504
+0.60D	0.270	0.210
L Only	1.538	1.538

Steel Column

DESCRIPTION: B-13 IN SHEAR

Code References

Calculations per AISC 360-16, IBC 2021
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **C5x6.7**
Analysis Method : Allowable Strength
Steel Stress Grade
Fy : Steel Yield 36.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 6.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition :
Unbraced Length for buckling ABOUT X-X Axis = 6.0 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 6.0 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 40.20 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 6.0 ft, E = 11.960 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, D = 0.1280, L = 0.5120 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.9393** : 1
Load Combination +D+0.750L+0.5250E
Location of max.above base 2.980 ft
At maximum location values are . . .
Pa : Axial 6.319 k
Pn / Omega : Allowabl 13.658 k
Ma-x : Applied 2.304 k-ft
Mn-x / Omega : Allowable 4.297 k-ft
Ma-y : Applied 0.0 k-ft
Mn-y / Omega : Allowable 1.069 k-ft

PASS Maximum Shear Stress Rati **0.1563** : 1
Load Combination +D+L
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 1.920 k
Vn / Omega : Allowable 12.287 k

Maximum Load Reactions . .
Top along X-X 0.0 k
Bottom along X-X 0.0 k
Top along Y-Y 1.920 k
Bottom along Y-Y 1.920 k

Maximum Load Deflections . . .
Along Y-Y 0.08696 in at 3.020ft above base
for load combination :+D+L
Along X-X 0.0 in at 0.0ft above base
for load combination :

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X @ Top	Y-Y Axis Reaction @ Base	Y-Y @ Top	Mx - End Moments k-ft @ Base	Mx @ Top	My - End Moments @ Base	My @ Top
D Only	0.040			0.384	0.384				
+D+L	0.040			1.920	1.920				
+D+0.750L	0.040			1.536	1.536				
+0.60D	0.024			0.230	0.230				
+D+0.70E	8.412			0.384	0.384				
+D+0.750L+0.5250E	6.319			1.536	1.536				
+0.60D+0.70E	8.396			0.230	0.230				
L Only				1.536	1.536				
E Only	11.960								

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X @ Top	Y-Y Axis Reaction @ Base	Y-Y @ Top	Mx - End Moments k-ft @ Base	Mx @ Top	My - End Moments @ Base	My @ Top
Axial @ Base	Maximum	11.960								
"	Minimum				1.536	1.536				
Reaction, X-X Axis Base	Maximum	0.040			0.384	0.384				
"	Minimum	0.040			0.384	0.384				
Reaction, Y-Y Axis Base	Maximum	0.040			1.920	1.920				
"	Minimum	11.960								

HAYDEN ENGINEERS
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Steel Column

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS

DESCRIPTION: B-13 IN SHEAR

Extreme Reactions

		Axial Reaction	X-X Axis Reaction	k	Y-Y Axis Reaction		Mx - End Moments	k-ft	My - End Moments	
Item	Extreme Value	@ Base	@ Base	@ Top	@ Base	@ Top	@ Base	@ Top	@ Base	@ Top
Reaction, X-X Axis Top	Maximum	0.040			0.384	0.384				
"	Minimum	0.040			0.384	0.384				
Reaction, Y-Y Axis Top	Maximum	0.040			0.384	0.384				
"	Minimum	11.960								
Moment, X-X Axis Base	Maximum	0.040			0.384	0.384				
"	Minimum	0.040			0.384	0.384				
Moment, Y-Y Axis Base	Maximum	0.040			0.384	0.384				
"	Minimum	0.040			0.384	0.384				
Moment, X-X Axis Top	Maximum	0.040			0.384	0.384				
"	Minimum	0.040			0.384	0.384				
Moment, Y-Y Axis Top	Maximum	0.040			0.384	0.384				
"	Minimum	0.040			0.384	0.384				

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0000 in	0.000 ft	0.017 in	3.020 ft
+D+L	0.0000 in	0.000 ft	0.087 in	3.020 ft
+D+0.750L	0.0000 in	0.000 ft	0.070 in	3.020 ft
+0.60D	0.0000 in	0.000 ft	0.010 in	3.020 ft
+D+0.70E	0.0000 in	0.000 ft	0.017 in	3.020 ft
+D+0.750L+0.5250E	0.0000 in	0.000 ft	0.070 in	3.020 ft
+0.60D+0.70E	0.0000 in	0.000 ft	0.010 in	3.020 ft
L Only	0.0000 in	0.000 ft	0.070 in	3.020 ft
E Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : C5x6.7

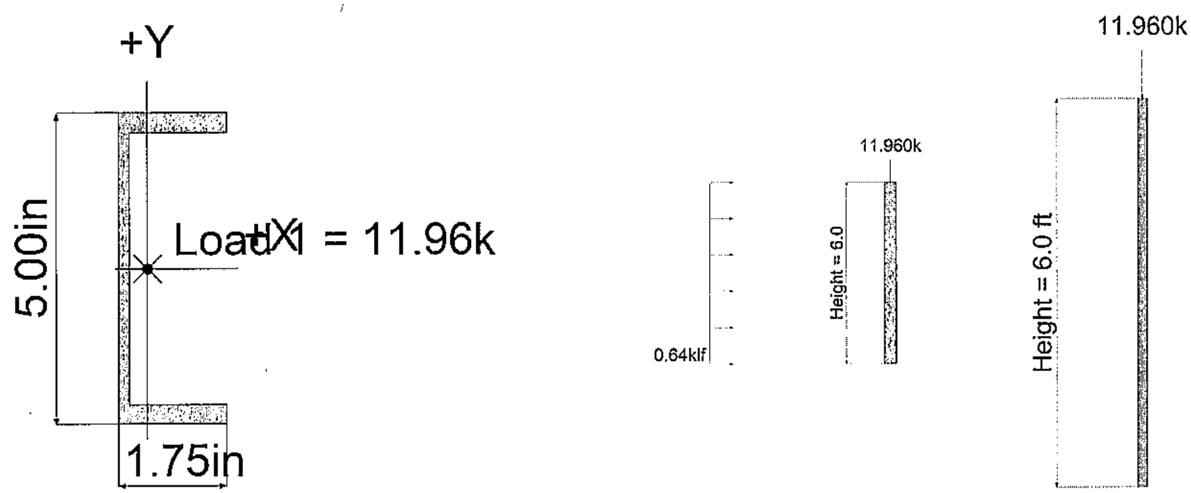
Depth	=	5.000 in	I xx	=	7.48 in^4	J	=	0.055 in^4
Web Thick	=	0.190 in	S xx	=	2.99 in^3	Cw	=	2.22 in^6
Flange Width	=	1.750 in	R xx	=	1.950 in	Ro	=	2.260 in
Flange Thick	=	0.320 in	Zx	=	3.550 in^3	H	=	0.790 in
Area	=	1.970 in^2	I yy	=	0.470 in^4			
Weight	=	6.700 plf	S yy	=	0.372 in^3	Wno	=	2.360 in^2
Kdesign	=	0.750 in	R yy	=	0.489 in	Sw	=	0.380 in^4
			Zy	=	0.757 in^3	Qf	=	1.210 in^3
rts	=	0.584 in				Qw	=	1.800 in^3
Ycg	=	0.000 in				Wn2	=	1.510
Xcg	=	0.484 in				Sw2	=	0.220
Xp	=	0.215 in				Sw3	=	0.110
Eo	=	0.000 in						

Steel Column Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS

DESCRIPTION: B-13 IN SHEAR

Sketches



HAYDEN ENGINEERS
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Steel Beam

Project File: 24261.01 nestucca.ec6

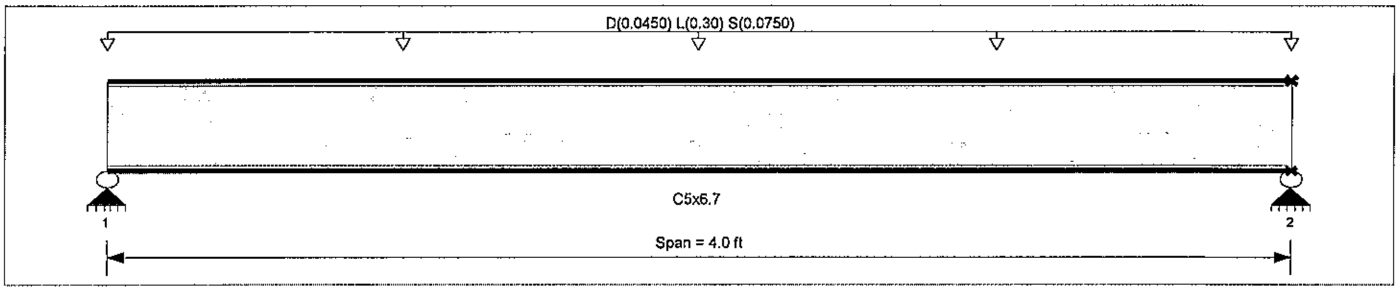
DESCRIPTION: B-14

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, L = 0.10, S = 0.0250 ksf, Tributary Width = 3.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.079** : 1	Maximum Shear Stress Ratio =	**0.041** : 1
Section used for this span	**C5x6.7**	Section used for this span	**C5x6.7**
Ma : Applied	0.703 k-ft	Va : Applied	0.7034 k
Mn / Omega : Allowable	8.857 k-ft	Vn/Omega : Allowable	17.066 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.008 in Ratio =	5,998 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in Ratio =	0 <360	n/a
Max Downward Total Deflection	0.009 in Ratio =	5116 >=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in Ratio =	0 <240.0	n/a

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0094	2.011		0.0000	0.000

Vertical Reactions

Support notation : Far left is #' Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.703	0.703
Max Upward from Load Combinations	0.703	0.703
Max Upward from Load Cases	0.600	0.600
D Only	0.103	0.103
+D+L	0.703	0.703
+D+0.70S	0.208	0.208
+D+0.750L	0.553	0.553
+D+0.750L+0.5250S	0.632	0.632
+0.60D	0.062	0.062
+D+0.750L+0.10S	0.568	0.568
L Only	0.600	0.600
S Only	0.150	0.150

DESCRIPTION: Handrail Post

Code References

Calculations per AISC 360-16, IBC 2021
Load Combinations Used : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

Steel Section Name : **HSS1-1/2x1-1/2x3/16**
Analysis Method : Allowable Strength
Steel Stress Grade
Fy : Steel Yield 36.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 4.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition :
Unbraced Length for buckling ABOUT X-X Axis = 4.0 ft, K = 2.1
Unbraced Length for buckling ABOUT Y-Y Axis = 4.0 ft, K = 2.1

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 12.160 lbs * Dead Load Factor
BENDING LOADS . . .
Lat. Point Load at 4.0 ft creating My-y, L = 0.30 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	**0.003510** : 1	
Load Combination	D Only	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Pa : Axial	0.01216	k
Pn / Omega : Allowabl	3.464	k
Ma-x : Applied	0.0	k-ft
Mn-x / Omega : Allowable	0.7293	k-ft
Ma-y : Applied	0.0	k-ft
Mn-y / Omega : Allowable	1.432	k-ft
PASS Maximum Shear Stress Rati	**0.0** : 1	
Load Combination	0.0	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	0.0	k
Vn / Omega : Allowable	0.0	k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.0 k
Bottom along Y-Y	0.0 k

Maximum Load Deflections . . .

Along Y-Y	0.0 in	at	0.0ft	above base
for load combination :				
Along X-X	0.0 in	at	0.0ft	above base
for load combination :				

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
D Only	0.012								
+D+L	0.012								
+D+0.750L	0.012								
+0.60D	0.007								
L Only									

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
Axial @ Base	Maximum	0.012								
"	Minimum									
Reaction, X-X Axis Base	Maximum	0.012								
"	Minimum	0.012								
Reaction, Y-Y Axis Base	Maximum	0.012								
"	Minimum	0.012								
Reaction, X-X Axis Top	Maximum	0.012								
"	Minimum	0.012								
Reaction, Y-Y Axis Top	Maximum	0.012								
"	Minimum	0.012								
Moment, X-X Axis Base	Maximum	0.012								
"	Minimum	0.012								

HAYDEN ENGINEERS
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Steel Column Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Handrail Post

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
Moment, Y-Y Axis Base	Maximum	0.012								
"	Minimum	0.012								
Moment, X-X Axis Top	Maximum	0.012								
"	Minimum	0.012								
Moment, Y-Y Axis Top	Maximum	0.012								
"	Minimum	0.012								

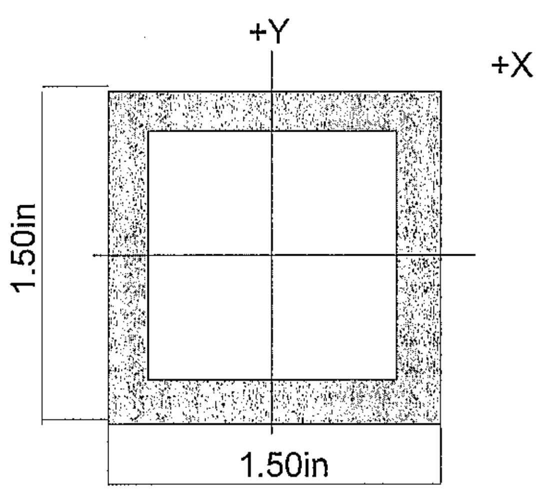
Maximum Deflections for Load Combinations

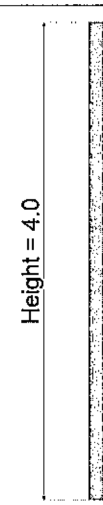
Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

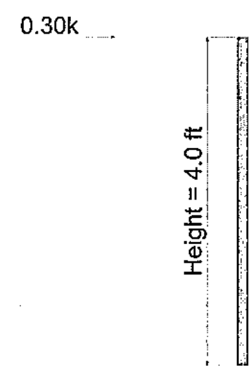
Steel Section Properties : HSS1-1/2x1-1/2x3/16

Depth	=	1.500 in	I xx	=	0.24 in^4	J	=	0.414 in^4
Design Thick	=	0.174 in	S xx	=	0.31 in^3			
Width	=	1.500 in	R xx	=	0.528 in			
Wall Thick	=	0.187 in	Zx	=	0.406 in^3			
Area	=	0.840 in^2	I yy	=	0.235 in^4	C	=	0.592 in^3
Weight	=	3.040 plf	S yy	=	0.314 in^3			
			R yy	=	0.528 in			
Ycg	=	0.000 in						

Sketches







HAYDEN ENGINEERS
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Steel Column

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Handrail

Code References

Calculations per AISC 360-16, IBC 2021
Load Combinations Used : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

Steel Section Name :	**HSS1-1/2x1-1/2x3/16**	Overall Column Height	6.0 ft
Analysis Method :	Allowable Strength	Top & Bottom Fixity	Top & Bottom Pinned
Steel Stress Grade		Brace condition :	
Fy : Steel Yield	36.0 ksi	Unbraced Length for buckling ABOUT X-X Axis = 6.0 ft, K = 1.0	
E : Elastic Bending Modulus	29,000.0 ksi	Unbraced Length for buckling ABOUT Y-Y Axis = 6.0 ft, K = 1.0	

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 18.240 lbs * Dead Load Factor
BENDING LOADS . . .
Lat. Point Load at 3.0 ft creating Mx-x, D = 0.30 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	**0.6142** : 1	
Load Combination	D Only	
Location of max.above base	2.980	ft
At maximum location values are . . .		
Pa : Axial	0.01824	k
Pn / Omega : Allowabl	6.790	k
Ma-x : Applied	0.4470	k-ft
Mn-x / Omega : Allowable	0.7293	k-ft
Ma-y : Applied	0.0	k-ft
Mn-y / Omega : Allowable	1.432	k-ft
PASS Maximum Shear Stress Rati	**0.03408** : 1	
Load Combination	D Only	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	0.150	k
Vn / Omega : Allowable	4.402	k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.150 k
Bottom along Y-Y	0.150 k

Maximum Load Deflections . . .

Along Y-Y 0.3458 in at 3.020ft above base
for load combination : D Only

Along X-X 0.0 in at 0.0ft above base
for load combination :

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
D Only	0.018			0.150	0.150				
+0.60D	0.011			0.090	0.090				

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
Axial @ Base	Maximum	0.018			0.150	0.150				
"	Minimum	0.011			0.090	0.090				
Reaction, X-X Axis Base	Maximum	0.018			0.150	0.150				
"	Minimum	0.018			0.150	0.150				
Reaction, Y-Y Axis Base	Maximum	0.018			0.150	0.150				
"	Minimum	0.011			0.090	0.090				
Reaction, X-X Axis Top	Maximum	0.018			0.150	0.150				
"	Minimum	0.018			0.150	0.150				
Reaction, Y-Y Axis Top	Maximum	0.018			0.150	0.150				
"	Minimum	0.011			0.090	0.090				
Moment, X-X Axis Base	Maximum	0.018			0.150	0.150				
"	Minimum	0.018			0.150	0.150				
Moment, Y-Y Axis Base	Maximum	0.018			0.150	0.150				
"	Minimum	0.018			0.150	0.150				
Moment, X-X Axis Top	Maximum	0.018			0.150	0.150				

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Steel Column

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Handrail

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction k @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments k-ft @ Top	My - End Moments @ Base	My - End Moments @ Top
"	Minimum	0.018			0.150	0.150				
Moment, Y-Y Axis Top	Maximum	0.018			0.150	0.150				
"	Minimum	0.018			0.150	0.150				

Maximum Deflections for Load Combinations

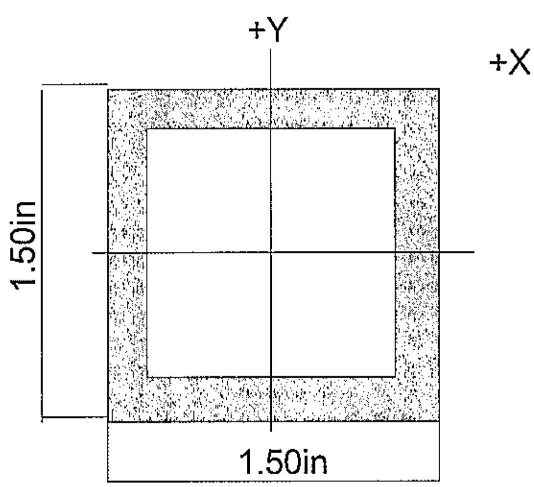
Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0000 in	0.000 ft	0.346 in	3.020 ft
+0.60D	0.0000 in	0.000 ft	0.207 in	3.020 ft

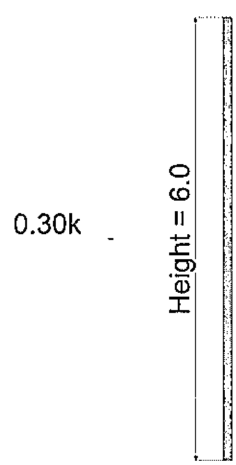
Steel Section Properties : HSS1-1/2x1-1/2x3/16

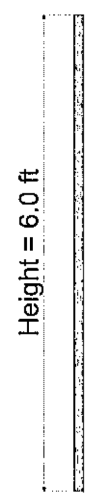
Depth	=	1.500 in	I xx	=	0.24 in^4	J	=	0.414 in^4
Design Thick	=	0.174 in	S xx	=	0.31 in^3			
Width	=	1.500 in	R xx	=	0.528 in			
Wall Thick	=	0.187 in	Zx	=	0.406 in^3			
Area	=	0.840 in^2	I yy	=	0.235 in^4	C	=	0.592 in^3
Weight	=	3.040 plf	S yy	=	0.314 in^3			
			R yy	=	0.528 in			

Ycg	=	0.000 in

Sketches







Roof Panels

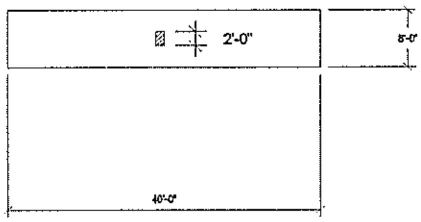
6.8.2 Procedure

A load of 300 kg [1] Shall be uniformly distributed over an area of 600mm x 300mm [1] located at the weakest area of the rigid roof of the container.

ISO 1496 Roof Test Procedure

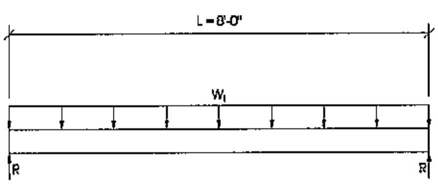
Bending / Flexure

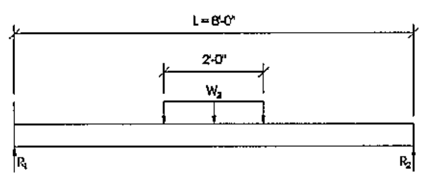
Testing Procedure consists of a 300 kg (≅ 660 lbs) test
Load over a 600 mm x 300 mm (≅ 2' x 1') area



Plan View of ISO Test

Calculate an equivalent uniform load that produces a moment equal to the moment produced by the ISO Test Criteria





$$Mmax = \frac{wl^2}{8}$$

$$Mmax = \frac{w_2 l_2\, l}{4}$$

$$\frac{w_1 l^2}{8} = \frac{(w l_e) l}{4} \text{ Solving for } w_1 \text{ yields: } \quad W_1 = \frac{2\, w_2 l_2}{l} = \quad 165 \text{ plf}$$

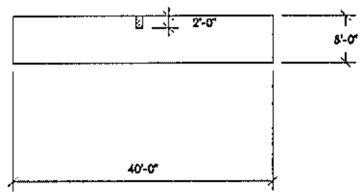
Roof Panels cont.

The total maximum allowable* load on the roof panels is 165 plf for bending. The test procedure takes place over a 1' - 0" width.

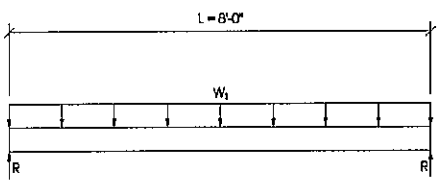
The maximum allowable UDL is	165 psf	for bending.	> D+S = 38 psf

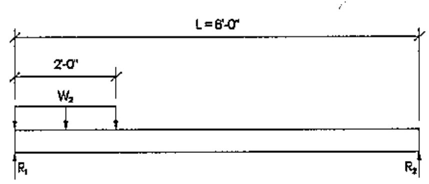
*Acceptance Criteria for roof test is "no permanent deformation..."
We can assume the assembly is tested to verify it remains within it's elastic limits.

Shear



Calculate an equivalent uniform load that produces a reaction (shear force) equal to the reaction produced by the ISO test criteria





$$R = \frac{w_2 l_2}{2l}\,(2l - l_2)$$

$$\frac{w_1\ l}{2} = \frac{w_2\ l_2}{2\,l}\,(2\,l - l_2)$$ Solving for w_1 yields:

$$w_1 = \frac{w_2\ l_2}{l_2}\,(2\,l - l_2)$$

= 72 plf

The total maximum allowable load on the roof panels is 72 plf for shear. The test procedure takes place over a 1' - 0" width.

The maximum allowable UDL is	72 psf	for shear	> D+S = 38 psf

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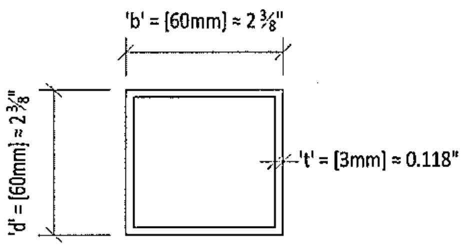
Roof Beams

Section Properties



- Cor - Ten A Steel:

Fy = 355 MPa ≅ 50 Ksi

Fu = 470 MPa ≅ 70 Ksi

$$Z = \frac{{d_{out}}^3}{4} - \frac{d_{in}^3}{4}$$

$$Z = \frac{60\ mm^3}{4} - \frac{54\ mm^3}{4}$$

$$Z = 14{,}634\ mm^3$$

Z = 0.035 in3

A = 1.06 in2

$$I = \frac{d_{out}^4 - d_{in}^4}{12}$$

$$I = \frac{60\ mm^4 - 54\ mm^4}{12}$$

$$I = 371{,}412\ mm^4$$

I = 0.89 in^4

Compactness

$$\begin{cases} \lambda = \frac{b}{t} \\ \lambda_p = 1.12\sqrt{\frac{E}{F_y}} \end{cases}$$

AISC 360-16 Table B4.1b

$$\lambda = \frac{b}{t} = \frac{60\ mm}{3\ mm} = 20$$

$$\lambda_p = 1.12\sqrt{\frac{E}{Fy}} = 1.12\sqrt{\frac{29X10^6\ Ksi}{50\ Ksi}} = 27$$

E = 3E+07 ksi

$\lambda < \lambda_p \therefore section\ is\ compact\ \therefore yielding\ is\ controlling\ failure\ mode$

Yielding

$$M_n = M_p = F_y Z$$

AISC 360-16 Eq. F7-1

$$M_n = (50\ Ksi)(0.89\ in^3)$$

$$M_n = 44.5\ Kip \cdot in$$

M_n = 3.71 Kip-ft

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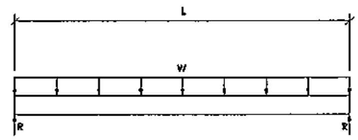
Roof Beams Cont.

Solve for l_{max}

Tributary width max. 7.33 ft

w = [13psf DL + 20psf LLR + 25psf SL](7.33ft)

w = [95.29psf DL + 146.6psf LLR + 183.25psf SL]



$w_{ASD(Transient)}$ = 183.25 plf SL = 15.27 pli SL

$w_{ASD(Total)}$ = DL + SL

$w_{ASD(Total)}$ = 278.54 plf = 23.21 pli

Set Mmax = Mn/Ω

$$M_{Max} = \frac{wl_{max}^2}{8}$$

$$\frac{M_n}{\Omega} = \frac{3.7\ Kip \cdot ft}{1.67} = 2.22\ Kip \cdot ft$$

$$l_{max} = \sqrt{\frac{8\frac{M_n}{\Omega}}{w}}$$

l_{max} = 7.99 ft (for bending)

Check Deflection

$$\Delta_{Max} = \frac{5wl^4}{384\ EI}$$

Set Δ_{Max} equal to deflection criteria

Try l_{min} = 5.67 ft (for deflection)

Total (w=23.22pli)	Transient (w=15.28pli)
$\frac{5wl_{max}^4}{384\ EI} \leq \frac{l_{max}}{240}$	$\frac{5wl_{max}^4}{384\ EI} \leq \frac{l_{max}}{360}$
0.99 ≤ 0.399	0.65 ≤ 0.266
$\frac{5wl_{min}^4}{384\ EI} \leq \frac{l_{min}}{240}$	$\frac{5wl_{min}^4}{384\ EI} \leq \frac{l_{min}}{360}$
0.25 ≤ 0.284	0.16 ≤ 0.189

∴ The use of the 'Roof Beam' is limited to 5.67ft without additional reinforcement and is governed by total load deflection.

SEE FOLLOWING PAGE FOR "ROOF BEAM" ABOVE CONTAINER DOORS. EQUVALENT 4X2X1/8 BEAM IS CONSERVATIVE.

Steel Beam Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS

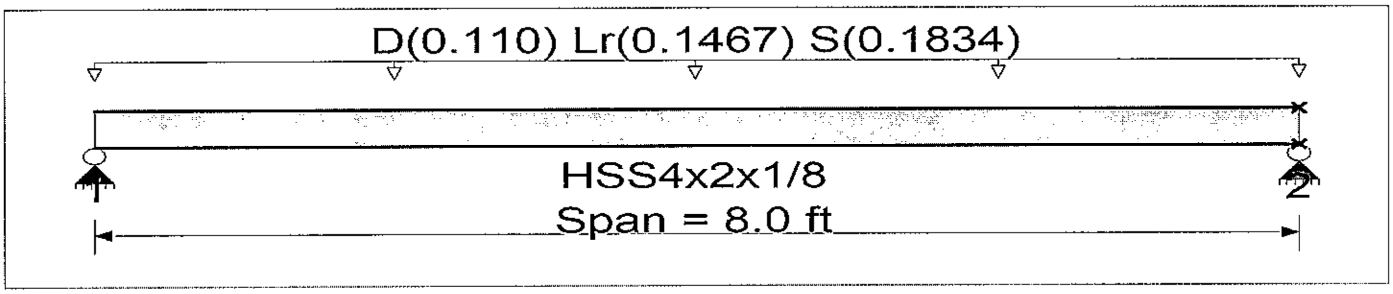
DESCRIPTION: Container Roof Beam @ Doors

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 7.335 ft, (Roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.539** : 1	Maximum Shear Stress Ratio =	**0.073** : 1
Section used for this span	**HSS4x2x1/8**	Section used for this span	**HSS4x2x1/8**
Ma : Applied	2.054 k-ft	Va : Applied	1.027 k
Mn / Omega : Allowable	3.810 k-ft	Vn/Omega : Allowable	14.003 k
Load Combination	+D+Lr	Load Combination	+D+Lr
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.221 in	Ratio =	434	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.309 in	Ratio =	310	>=240.	Span: 1 : +D+Lr
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Overall Maximum Deflections

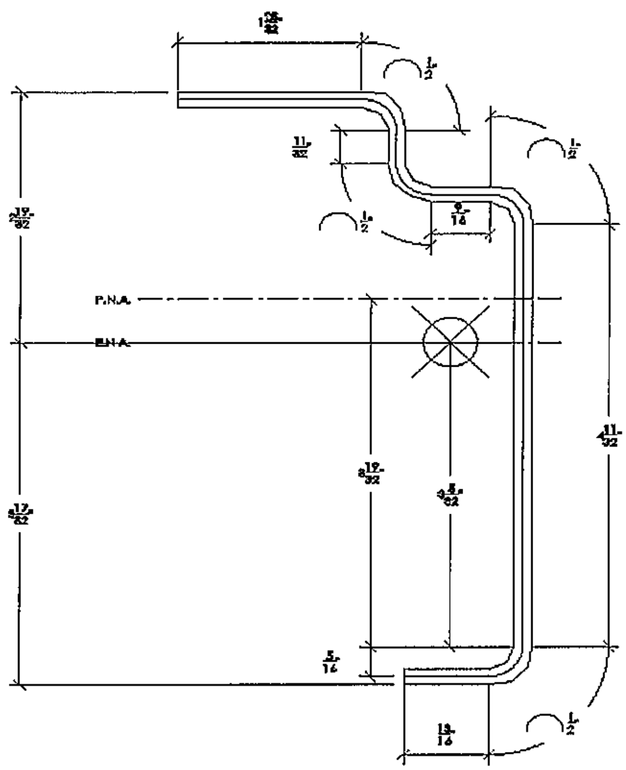
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr	1	0.3093	4.023		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.027	1.027
Max Upward from Load Combinations	1.027	1.027
Max Upward from Load Cases	0.734	0.734
D Only	0.440	0.440
+D+Lr	1.027	1.027
+D+0.70S	0.954	0.954
+D+0.750Lr	0.880	0.880
+D+0.5250S	0.825	0.825
+0.60D	0.264	0.264
+D+0.10S	0.513	0.513
Lr Only	0.587	0.587
S Only	0.734	0.734

Section Properties



Area:	**1.59763sq in**
Perimeter:	19.91235in
Bounding box:	X:-2.56233 - 0.76310 in
	Y:-3.53062 - 2.59276 in
Centroid:	X:0.00000in
	Y:0.00000in
Moments of inertia:	**X:** 7.39665 in^4
	Y:1.33225 sq.in sq in
Product of Inertia	XY:1.96166 sq.in sq in
Radii of Gyration:	X:2.15169 in
	Y:0.91318 in

Principal moments (sq in sq in) and X-Y directions about centroid:

Y:7.97587 along [0.95907 0.28318]

Z:075303 along [-0.28318 0.95907]

$$S_t = \frac{I}{C} \qquad S_c = \frac{I}{C}$$

$$S_t = \frac{7.397\ in}{3.53\ in} \qquad S_c = \frac{7.397\ in}{2.59\ in}$$

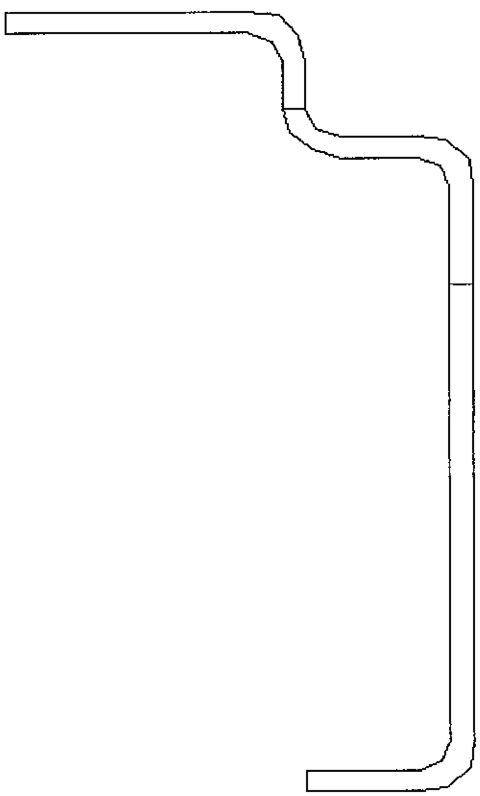
$$S_t = 2.09\ in^3 \qquad S_c = 2.85\ in^3$$

Floor Beam Cont.

Section Properties Cont.

Determine Plastic Modulus, Z

$$Z = A_c y_c + A_t y_t$$
$$Z = (0.803\ in^2)(1.45\ in) + (0.795\ in^2)(2.36\ in)$$
$$Z = 3.04\ in^3$$



Area:	0.80316 sq in
Perimeter:	10.14026 in
Bounding box:	X: -3.24517 – 0.00027 in
	Y: 0.00000 – 2.14601 in
Centroid:	X: -1.23247 in
	Y: 1.44625 in
Moments of inertia:	X: 1.99696 sq in sq in
	Y: 2.00195 sq in sq in
Product of inertia:	XY: 1.86770 sq in sq in
Radii of gyration:	X: 1.57683 in
	Y: 1.57879 in

Area:	0.79447 sq in
Perimeter:	10.09317 in
Bounding box:	X: -1.11230 – 0.00027 in
	Y: -3.97730 – 0.00000 in
Centroid:	X: -0.12718 in
	Y: -2.36047 in
Moments of inertia:	X: 5.71856 sq in sq in
	Y: 0.07521 sq in sq in
Product of inertia:	XY: -0.39341 sq in sq in
Radii of gyration:	X: 2.68290 in
	Y: 0.30767 in

Floor Beam Cont.

Section Properties Cont.

Web Slenderness

Use channel equations,

$$\lambda = \frac{h}{t_w} \qquad \text{(AISC 360-16 Table B4.lb)}$$

$$\lambda = \frac{4.3475\ in}{0.177\ in}$$

$$\lambda = 24$$

$Determine\ \lambda_p$

$$\lambda_p = 3.76\sqrt{\frac{E}{F_y}}$$

E = 3E+07 ksi

$$\lambda_p = 3.76\sqrt{\frac{29 \times 10^6}{50 \times 10^3}}$$

$$\lambda_p = 91 > \lambda$$

$\therefore Web\ is\ compact$

Flange Slenderness

$$\lambda_t = \frac{b_{top}}{t} \qquad \lambda_c = \frac{b_{bot}}{t}$$

$$\lambda_t = \frac{(4.125\ in)}{(0.177\ in)} \qquad \lambda_c = \frac{(0.8125\ in)}{(0.177\ in)}$$

$$\lambda_t = 23.3 \qquad \lambda_c = 4.59$$

$Determine\ \lambda_p$

$$\lambda_p = 3.8\sqrt{\frac{E}{F_y}}$$

$$\lambda_p = 9.54$$

$Determine\ \lambda_c$

$$\lambda_r = 1.0\sqrt{\frac{E}{F_y}}$$

$$\lambda_r = 25.1$$

$Top\ is\ non-compact\ ;\ Bracing\ of\ top\ flange\ for\ LBT\ \&\ Local\ Buckling\ to\ be\ provided$

$Bott\ is\ compact$

$M_n = M_p = F_y Z_y \leq 1.6 F_y S_y$ *(AISC 360-16 Eq. F6-1)*

$F_y Z_y = (50\ Ksi)(3.04\ in^3)$
$F_y Z_y = 152\ Kip \cdot in = 12.67\ Kip \cdot ft\ (Governing)$

$1.6 F_y S_y = 1.6(50\ Ksi)(2.09\ in^3)$
$1.6 F_y S_y = 232\ Kip \cdot in = 19.33\ Kip \cdot ft$

$$\frac{M_n}{\Omega} = \frac{12.67\ Kip \cdot ft}{1.67}$$

$\frac{M_n}{\Omega} =$ 7.58 Kip-ft

Floor Beams Cont.

Tributary width max. 4 ft (ROOF)
Tributary width max. 4 ft (FLOOR)

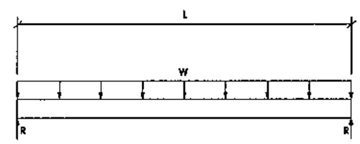
Solve for l_{max}

w = [13psf DL + 20psf LLR + 25psf SL](4ft) + [15psf DL + 40psf LL](4ft)

w = [112psf DL + (80psf LLR + 160psf LL) + 100psf SL]

$w_{ASD(Transient)}$ = 160 plf LL = 13.33 pli LL

$w_{ASD(Total)}$ = DL + LL
$w_{ASD(Total)}$ = 220 plf = 18.33 pli



Set Mmax = Mn/Ω

$$M_{Max} = \frac{w l_{max}^2}{8}$$

$$\frac{M_n}{\Omega} = 7.58\ Kip \cdot ft$$

$$l_{max} = \sqrt{\frac{8\frac{M_n}{\Omega}}{w}}$$

l_{max} = 16.61 ft (for bending)

Check Deflection

$$\Delta_{Max} = \frac{5wl^4}{384\ EI}$$

Set Δ_{Max} equal to deflection criteria

Try l_{min} = 12.50 ft (for deflection)

Total (w=18.34pli)	Transient (w=13.34pli)
$\frac{5w l_{max}^4}{384\ EI} \leq \frac{l_{max}}{240}$	$\frac{5w l_{max}^4}{384\ EI} \leq \frac{l_{max}}{360}$
1.76 ≤ 0.830	1.28 ≤ 0.554
$\frac{5w l_{min}^4}{384\ EI} \leq \frac{l_{min}}{240}$	$\frac{5w l_{min}^4}{384\ EI} \leq \frac{l_{min}}{360}$
0.56 ≤ 0.625	0.41 ≤ 0.417

∴ The use of the 'Floor Beam' is limited to 12.5ft without additional reinforcement and is governed by transient load deflection.

ADDITIONAL LOAD TESTING TO BE CONDUCTED TO ALLOW FURTHER FLOOR BEAM SPAN

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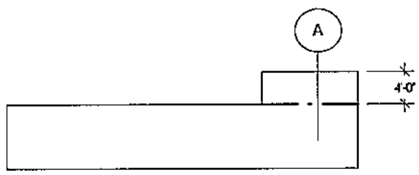
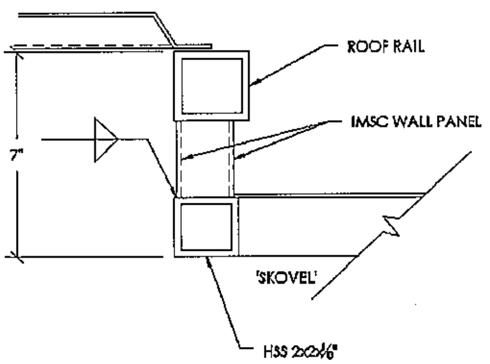
Skovel Roof Beam (Case 1 - For Openings)

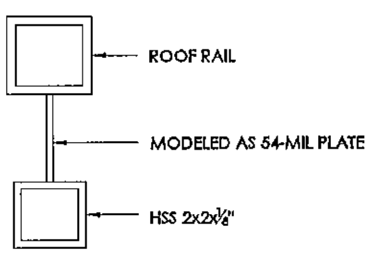


Plan View of a Typical Skovel



(A) SECTION @ 'SKOVEL' BEAM

Simplify Model to determine section properties



$$Fy = 46\ Ksi$$

Simplified Section

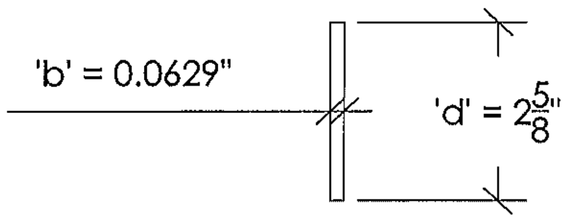
Skovel Roof Beam Cont.

Roof Beam

Reference page for roof beam section properties

A = 1.060 in2
I = 0.892 in4
Z = 0.035 in3

Web



b = 0.06 in
d = 2.63 in

$$A = bd$$

A = 0.1651 in2

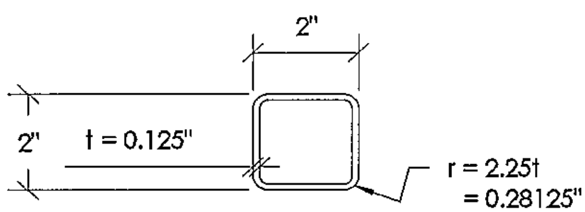
$$I = \frac{bd^3}{12}$$

I = 0.0948 in4

$$S = \frac{bd^2}{6}$$

S = 0.0722 in3

HSS 2 x 2 x 1/8"



- **Section Properties per AISC 360-16 Table 1-12**

A = 0.840 in2
I = 0.486 in4
S = 0.486 in3

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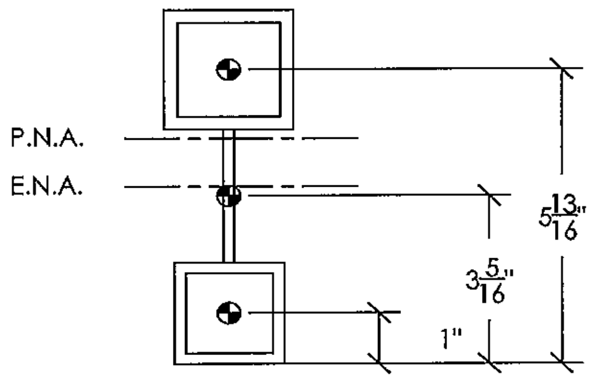
Composite Section



$$\bar{y} = \frac{\sum_{n=1}^{3} A_n C_{ya}}{\Sigma_{n=1}^{2} A_n}$$

$$\bar{y} = \frac{(1\ in)(0.84\ in^2) + (3.3125\ in)(0.165\ in^2) + (5.8125\ in)(1.06\ in^2)}{(0.84\ in^2) + (0.165\ in^2) + (1.06\ in^2)}$$

$\bar{y}$= 3.66 in

Determine Compsite I w/ Paralell Axis Theorum

$I = (0.486\ in^4) + (0.84\ in^2)(3.66\ in\ - 1\ in)^2$	HSS
$+(0.095\ in^4) + (0.165\ in^2)(3.66\ in - 3.3125\ in)^2$	Plate
$+(0.89\ in^4) + (1.06\ in^2)(5.8125\ in - 3.66\ in)^2$	Roof Beam

I = 12.35 in4

Potential Failure Modes

Both 'tube' elements are compact sections per previous analysis (see page) and AISC 360-16 Table 1-12A.

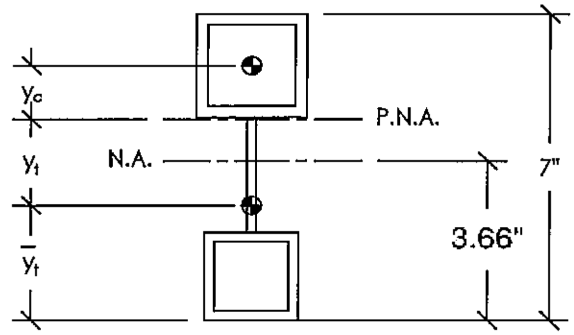
The top and bottom of the composite beam will be braced ∴ LTB failure need not be considered

Determine Plastic Section Modulus

$$\sum_{n=1}^{3} A_n = (0.165 \text{ in}^2 + 1.06 \text{ in}^2 + 0.84 \text{ in}^2) = \quad 2.07 \text{ in2}$$

$$\text{PNA location where } A_t = A_c = \frac{A_{gross}}{2} = \quad 1.03 \text{ in2}$$

$$Z = A_c\gamma_c + A_t\gamma_t$$



Determine PNA from top. Since $A_c > A_{Roof\ Beam}$, assume PNA occurs in bottom flange of roof beam

$$(1.03\ in^2) = (1.06\ in^2) - (2.375\ in\ - y_{PNA})(2.375\ in)$$
$$y_{PNA} = 2.362\ in$$

Since $y_{PNA} \cong depth\ of\ Roof\ Beam, assume\ y_{PNA} =$ $2.375"\ for\ simplicity$

$$\gamma_t \cong \frac{(0.84\ in^2)\left(2.625\ in + \frac{2\ in}{2}\right) + (0.165\ in^2)\left(\frac{2.625\ in}{2}\right)}{(0.84\ in^2) + (0.165\ in^2)}$$

$$\gamma_t \cong 3.245\ in$$

$$\gamma_c \cong \frac{2.375\ in}{2} = 1.188\ in$$

$$Z = (1.03\ in^2)(1.188\ in) + (1.03\ in^2)(3.245\ in)$$

$$\boldsymbol{Z = 4.57\ in^3}$$

Composite Section cont.

Elastic Section Modulus

$S = \frac{I}{C}$

$S_{xt} =$ (12.35in4)/(7in - 3.66in)

$S_{xt} =$ 3.69 in3

$S_{xc} =$ (12.35in4)/(3.66in)

$S_{xc} =$ 3.38 in3

Compression Flange Yielding

$M_n = R_{pc} M_{yc} = R_{pc} F_y S_{xc}$ where: (AISC 360-16 Eq. F4-D)

$R_{pc} = \frac{M_p}{M_{yc}}$ when $\frac{h_c}{t_w} < \lambda_{pw}$ See Next page for checking assumption

$R_{pc} \equiv \frac{Z}{S_{yc}}$

$R_{pc} = \frac{4.57\ in^3}{3.38\ in^3}$

$R_{pc} = 1.35$

$M_n = 1.35\ (46\ Ksi)(3.38\ in^3)$

$M_n =$ 209.8 Kip-ft

$M_n =$ 17.48 Kip-ft

Composite Section cont.

Determine λ

$$\lambda = \frac{h_c}{t_w}$$

Where:
$h_c = 2(y - t_{fc})$
$t_w = web\ thickness = 0.0629$ in
$y = 3.64\ in$
$t_{fc} = 2.375\ in$

$$\lambda = \frac{2(3.64\ in - 2.375\ in)}{0.0629\ in}$$
$\lambda = 40.2$

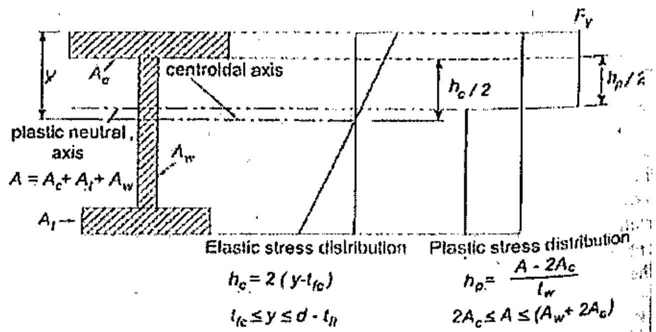


Fig. C-F4.1. Elastic and plastic stress distributions.

Determine λ_r

$$\lambda_r = 5.70\sqrt{\frac{E}{Fy}}$$

E = 3E+07 ksi

$$\lambda_r = 5.7\sqrt{\frac{29 \times 10^6\ psi}{50 \times 10^3\ psi}}$$
$\lambda_r = 137$

Conclusion

$\lambda < \lambda_r \therefore web\ is\ not\ slender$

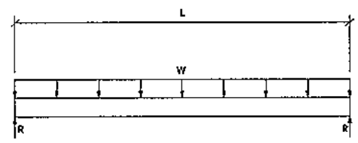
Composite Section cont.

Solve for I_{max} Tributary width max. 14 ft

w = [13psf DL + 20psf LLR + 25psf SL](14ft)

w = [182psf DL + 280psf LLR + 350psf SL]

$w_{ASD(Transient)}$ = 350 plf SL = 29.17 pli SL



$w_{ASD(Total)}$ = DL + SL

$w_{ASD(Total)}$ = 532 plf = 44.33 pli

Set Mmax = Mn/Ω

$$M_{Max} = \frac{w l_{max}^2}{8}$$

$$\frac{M_n}{\Omega} = \frac{17.48\ Kip \cdot ft}{1.67} = \quad 10.47 \text{ Kip-ft}$$

$$l_{max} = \sqrt{\frac{8\frac{M_n}{\Omega}}{w}}$$

l_{max} = 12.55 ft (for bending)

Check Deflection

$$\Delta_{Max} = \frac{5wl^4}{384\ EI}$$

Set Δ_{Max} equal to deflection criteria

Try l_{min} = 5.67 ft (for deflection)

Total (w=44.34pli)	Transient (w=29.17pli)
$\frac{5w l_{max}^4}{384\ EI} \leq \frac{l_{max}}{240}$	$\frac{5w l_{max}^4}{384\ EI} \leq \frac{l_{max}}{360}$
0.83 ≤ 0.627	0.54 ≤ 0.418
$\frac{5w l_{min}^4}{384\ EI} \leq \frac{l_{min}}{240}$	$\frac{5w l_{min}^4}{384\ EI} \leq \frac{l_{min}}{360}$
0.03 ≤ 0.284	0.02 ≤ 0.189

∴ The use of the 'Skovel Roof Beam' is limited to 5.67ft without additional reinforcement and is governed by total load deflection.

Composite Section cont.

Allowable Shear

$$R_{Max} = \frac{w\ell}{2} = \quad 1.51\ \text{kip}$$

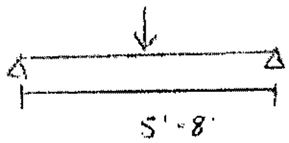
$$R_n = 0.6F_yA_g \qquad (AISC\ 360-16\ EQ.J4-3)$$

$$\frac{R_n}{\Omega} = 0.6\frac{(50{,}000\ psi)(0.165\ in^2)}{1.5}$$

$$\frac{R_n}{\Omega} = 3.30\ Kip \geq R\ \surd\ \text{OK}$$

Check Window Headers w/ Point Load

Max Load
B-2 + B-3 = 1.521K



$$M_{MAX} = \frac{Pl}{4} = \frac{(1.521\,K) \times (5.67')}{4} = 2.16\ K\text{-}ft$$

$M_{allowable}$ = 10.47 kip-ft > 2.16 K-ft OK ✓

$$\Delta_{MAX} = \frac{Pl^3}{48(EI)} = \frac{(1.283\,K)(5.67')^3}{48(29 \times 10^6)(12.35\,in^4)} = 1.36 \times 10^{-8}$$

$$\frac{L}{240} = \frac{5.67' \times 12}{240} = 0.2835'' > 1.36 \times 10^{-8}\ \text{OK} ✓$$

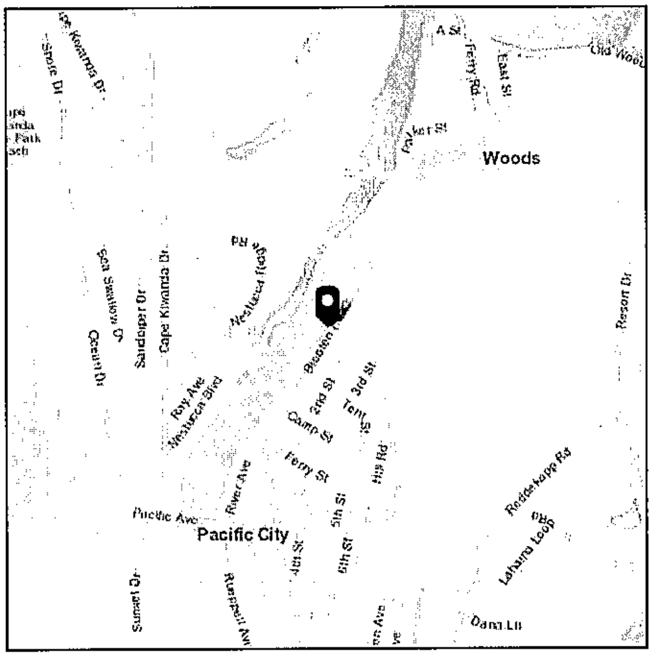
→ WINDOW HEADERS OK ✓

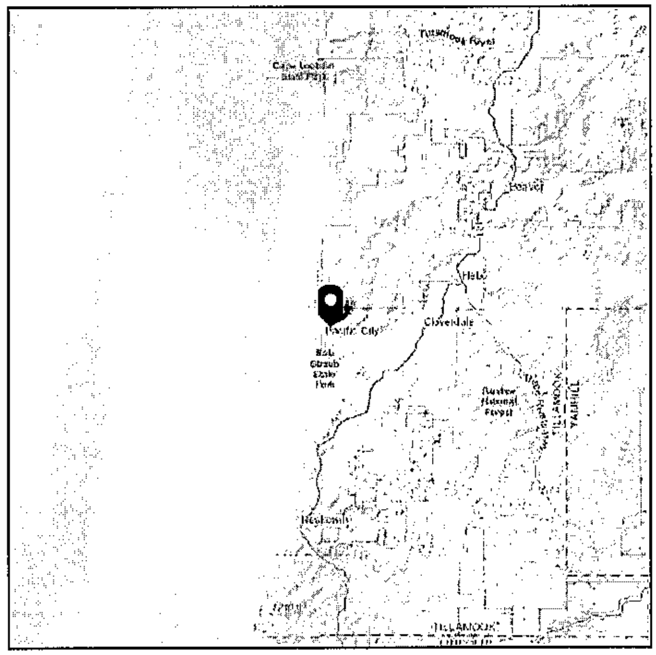
LATERAL

ASCE Hazards Report

AMERICAN SOCIETY OF CIVIL ENGINEERS

Address:	**Standard:**	ASCE/SEI 7-16	**Latitude:**	45.207119
No Address at This Location	**Risk Category:**	II	**Longitude:**	-123.959825
	Soil Class:	D - Default (see Section 11.4.3)	**Elevation:**	11.80888589953788 ft (NAVD 88)





Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.28	S_{D1} :	N/A
S_1 :	0.667	T_L :	16
F_a :	1.2	PGA :	0.634
F_v :	N/A	PGA_M :	0.761
S_{MS} :	1.536	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.024	C_v :	1.356

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Sun Nov 17 2024

Date Source: USGS Seismic Design Maps

Lateral Design

Seismic Base Shear Loading

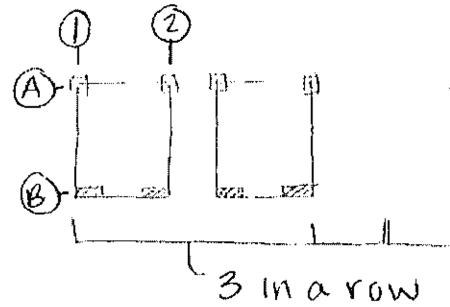
Risk Category II

$V =$	$\frac{FS_{DS}}{R}$		(ASCE 7-16 EQ. 12.14-12)
Stories	2		
F	1.1		(ASCE 7-16 § 12.14.8.1)
S_{DS}	1.024	g	(ASCE 7 Hazards Report)
R	2		(ASCE 7-16 Table 12.14-1)
V=	0.563	W	
			(ASCE 7-16 § 2.4.5)

Wind Loading

Basic Design Wind Speed =	120	mph		(2022 OSSC Table 1609.3)
Exposure	C			
$p_s =$	$\lambda K_{zt} p_{S30}$			(ASCE 7-16 EQ. 28.5-1)
Mean Roof Ht.	20	ft		
Roof Pitch	0.5	→	2 Degrees	
P_{S30} (wall)	22.9	psf		(ASCE 7-16 Fig. 28.5-1)
P_{S30} (roof)	11.9	psf		(ASCE 7-16 Fig. 28.5-1)
λ	1.29			(ASCE 7-16 Fig. 28.5-1)
K_{zt}	1.0			(ASCE 7-16 § 26.8.2)
p_s (wall) =	29.5	psf		
p_s (roof) =	15.4	psf		
				(ASCE 7-16 § 2.4.1)
				(ASCE 7-16 § 2.4.1)

Overall Building Lateral Loads (unfactored)



Wind

$p_{wall} = 29.5$ psf
$p_{roof} = 15.4$ psf → flat roof → use p_{wall} only

Siesmic

$V = 0.563\ W$
↳ wall 10 psf
roof 15 psf
floor 15 psf

Wind

Roof

$V_{AB} = 29.5\text{ psf} \times \left(\frac{22'11''}{2} \times \frac{9'6''}{2}\right)$
$= 1606$ lb (Along whole length of building)

$V_{12} = 29.5\text{ psf} \times \left(\frac{16'}{2} \times \frac{9'6''}{2}\right)$
$= 1121$ lb (Along each long side of each unit)

Floor

$V_{AB} = 29.5\text{ psf}\left(\frac{22'11''}{2} \times 9'6''\right)$
$= 3212$ lb (Along whole length of building)

$V_{12} = 29.5\text{ psf}\ (16'/2 \times 9'6'')$
$= 2242$ lb (Along each long side of each unit)

SEISMIC

Roof

$V_{AB} = 0.563 \left(15\,psf \times \frac{2587}{2}\,sf + \frac{10\,psf}{2} \times \frac{1985}{2}\,sf\right)$

$= 13717$ lb (Along length of whole building)

$= 9602$ lb (ASD)

$V_{12} = 0.563 \left(15\,psf \times \frac{448}{2}\,sf + \frac{10\,psf}{2} \times 16' \times 20'/2\right)$

$= 2342$ lb (Along each long side of each unit)

$= 1640$ lb (ASD)

Floor

$V_A = 0.563 \left(25\,psf \times \frac{1985}{2}\,sf + 15\,psf \times 413\right)$

$= 17457$ lb

$= 12220$ lb (ASD) (Along length of whole building)

$V_B = 0.563 \left(25\,psf \times \frac{1985}{2}\,sf\right)$

$= 13970$ lb

$= 9779$ lb (ASD) (Along length of whole building)

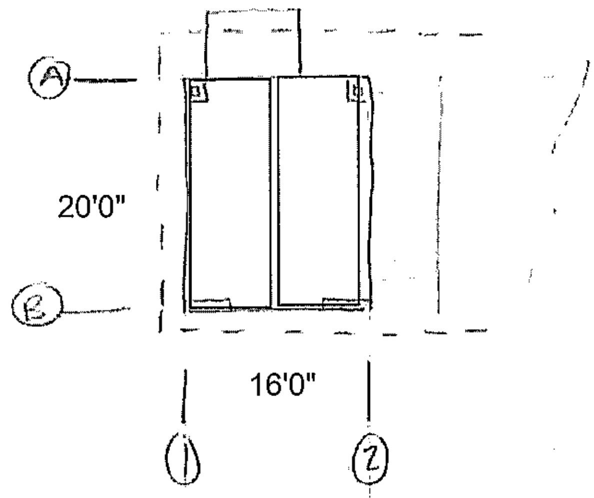
$V_{12} = 0.563 \left(25\,psf \times 16' \times 20'/2 + 15\,psf \times 128\,sf\right)$

$= 3333$ lb

$= 2333$ lb (ASD)

(Along each long side of each unit)

For One Unit



Siesmic

Roof

$V_B = \frac{9602 \text{ lb}}{10}$ (ASD)

$= 961$ lb

$V_A = \frac{9602 \text{ lb}}{5}$ (ASD)

$= 1922$ lb

$V_{12} = 1640$ lb (ASD)

Floor

$V_B = \frac{12220 \text{ lb}}{10}$

$= 1234$ lb (ASD)

$V_A = \frac{12220 \text{ lb}}{5}$

$= 2444$ lb (ASD)

$V_{12} = 2333$ lb (ASD)

Wind

$V_B = 965 \text{ lb} / 12$

$= 81$ lb (ASD)

$V_A = 965 \text{ lb} / 6$

$= 161$ lb (ASD)

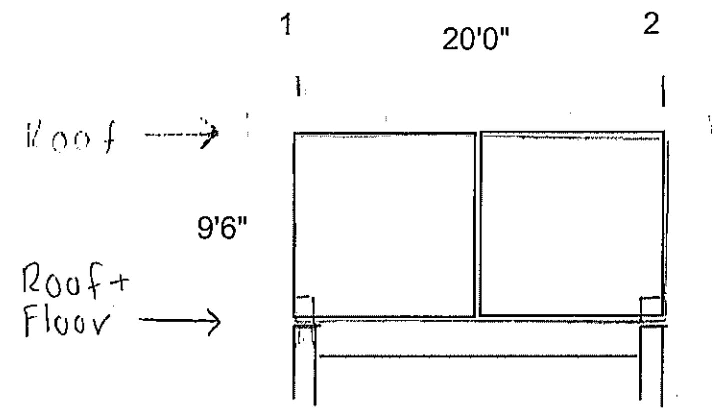
$V_{12} = 673$ lb (ASD)

$V_B = 161$ lb (ASD)

$V_A = 322$ lb (ASD)

$V_{12} = 1346$ lb (ASD)

Total lateral load



★ Seismic ★

@ Roof

V_B = 961 lb (ASD)
V_A = 1922 lb (ASD)
V_{12} = 1640 lb (ASD)

@ Floor

V_B = 2195 lb (ASD)
V_A = 4366 lb (ASD)
V_{12} = 3973 lb (ASD)

Wind

@ Roof

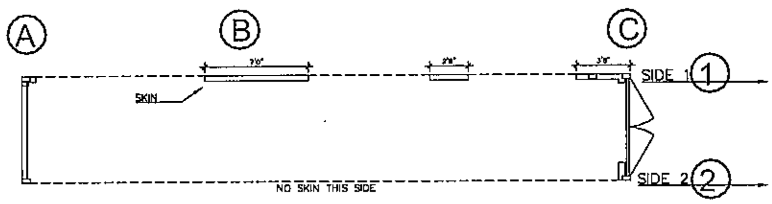
V_B = 81 lb (ASD)
V_A = 161 lb (ASD)
V_{12} = 673 lb (ASD)

@ Floor

V_B = 242 lb (ASD)
V_A = 483 lb (ASD)
V_{12} = 2019 lb (ASD)

CONTAINER CAPACITY (SEE PULL TESTS ATTATCHED TO CALCULATIONS)

Suite Spot River 45'
Container Pull Test Diagram



Allowable Load:

1-2 LONG SIDE:
6000lbs/(7' + 2.5' + 3.67' TOTAL SKIN) =
450 plf ALLOWABLE

A-B SHORT SIDE:
6000LBS/(8') = 750 plf ALLOWABLE

A-B PULL TEST WITH OPEN DOORS
= 6000LBS ALLOWABLE

TOTAL SEISMIC LOADS:	TOTAL WIND LOADS:
VAB = 1373 lbs	VAB = 134 lbs
V12 = 2692 lbs	V12 = 1121 lbs

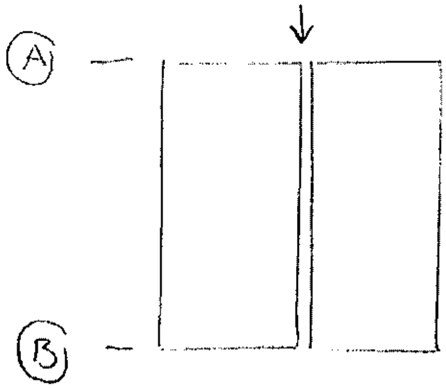
SEISMIC GOVERNS

ALLOWABLE LOAD:
@ 1/2 12' MIN TOTAL CONTAINER SKIN x 450 plf = 5400 lb > 2692 LB OK

@A/B SEE CONTAINER PULL TEST, open door 6000lb no permanent change = 6000 lbs > 1373 lb OK

SHEAR TRANSFER @ ROOF

(ULT)
$V = 2692\ lb \times 2.5 = 6730\ lb$



$\leftarrow$ 1373 lb (ULT)
$\times 2.5 = 3432\ lb$

$\leftarrow$ 1373 lb
$\times 2.5 = 3432\ lb$

BOLT SHEAR STRENGTH

6730 lb

36" o/c

5/16" BOLTS @ 36" o/c

20' / (18"/12") = 6 bolts

6730 lb / 6 = 1122 lb shear / BOLT

5/16" BOLT CAPACITY = $R_n = \frac{F_n A_b}{\Omega}$

$= (27)(0.0767) = 2.07\ k$

2.07 k > 1122 lbs OK ✓

BOLT TENSILE STRENGTH

3432 lb

5/16" BOLTS = $R_n = \frac{F_n A_b}{\Omega}$

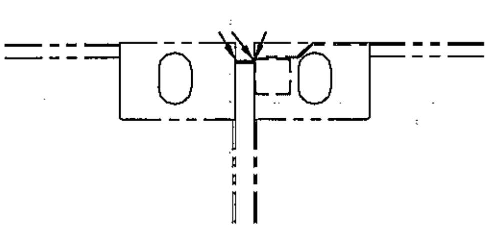
$= (45)(0.0767) = 3.45\ k$

3.45 k > 3.432 k OK ✓

CHECK WELD BETWEEN CONTAINERS

WELD = $\frac{R_n}{\Omega}$ = 0.928 kip/in DR

WELD = 0.928 kip/in (2)(4") = 7.42 k
3.432 # < 7.42 #



CHECK PLATE BETWEEN CONTAINERS

Rn = 0.5 x 36 ksi x (3" x 1/4") =13.5 > 7.42 k

Check Plate Buckling

I = bd^3/12 = (6)(0.25)^3/12 = 7.8125x10^-3
r = √I/A = √0.00078/(0.25)(6) = 0.72
KL/r = 1.5"/0.072" = 20.8
Fy = 36 ksi
Fcr/Ωc = 21.1k
21.1k < 14.98 lb OK

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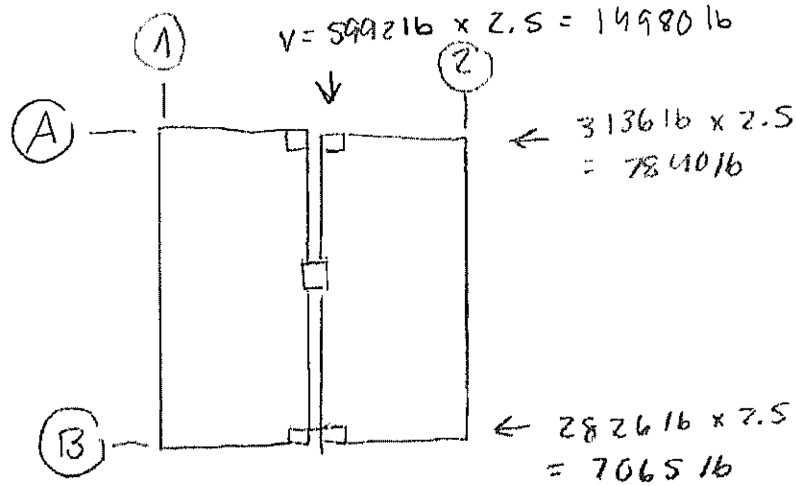
NESTUCCA

BY ____ DATE ____
REV ____ DATE ____
JOB NO ____
SHEET ____ OF ____

SHEAR TRANSFER @ FLOOR



<u>CHECK WELD STRENGTH 1/2</u>

14980 lbs

WELD = $\frac{R_n}{\Omega}$ = 0.928 kip/in Dℓ

∴ 14.98 K = 0.928 kip/in (4)ℓ

ℓ = 4.035 in weld

→ USE MIN 6" WELD

<u>CHECK WELD STRENGTH A/B</u>

7840 lbs

WELD = $\frac{R_n}{\Omega}$ = 0.928 kip/in Dℓ

7.840 k = 0.928 kip/in (4)ℓ

ℓ = 2.11 in weld

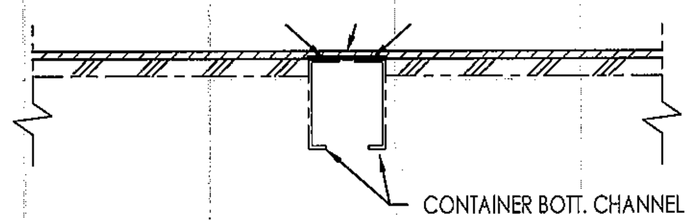
→ USE 4" MIN WELD

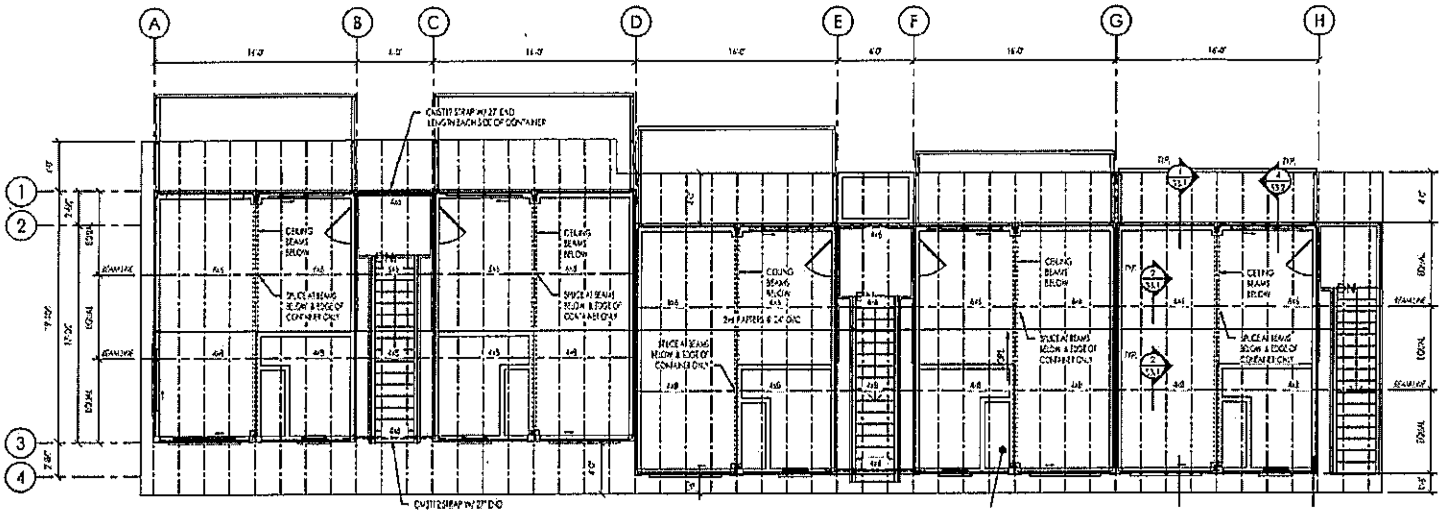
<u>CHECK PLATE BETWEEN CONTAINERS</u>

Steel in Shear Rn = 0.6 x 36 ksi x (6" x 1/4") = 32.4 / 2 = 16.2 k > 14.980 k

<u>Check Plate Buckling</u>

I = bd^3/12 = (6)(0.25)^3/12 = 7.8125x10^-3
r = √I/A = √0.00078/(0.25)(6) = 0.72
KL/r = 1.5"/0.072" = 20.8
Fy = 36 ksi
Fcr/Ωc = 21.1k
21.1k < 14.98 lb OK

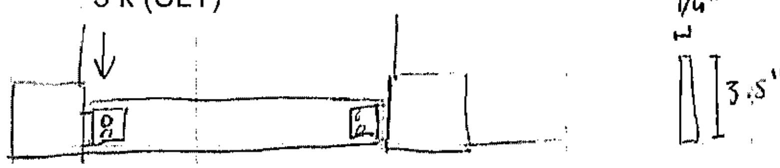




Max Shear at Line 1 & 3 = 31174 # (ult) (13171 # Roof + 17457 # Floor)
31174 # / 5 = 6235 # x 2.5 (OMEGA) = 15587 #

3 k (ULT)

15587 # ←



A307 3/4" BOLTS = 5.97 K (ASD) IN SHEAR X 2 = 11.94 K (ULT) X 2 = 23.9 K > 15.587 K

Steel in Shear Yielding:

Rn = 0.6 x 36 ksi x (3.5" x 1/4") = 18.9 k (ult) > 3 k

Steel in Shear Rupture:

Rn = 0.6 x 58 ksi x (2" x 1/4") = 17.4 k (ult) > 3 k

Steel in Tension Yielding:

Rn = 36 ksi x (3.5" x 1/4") = 31.5 k (ult) > 15.587 k

Steel in Tension Rupture:

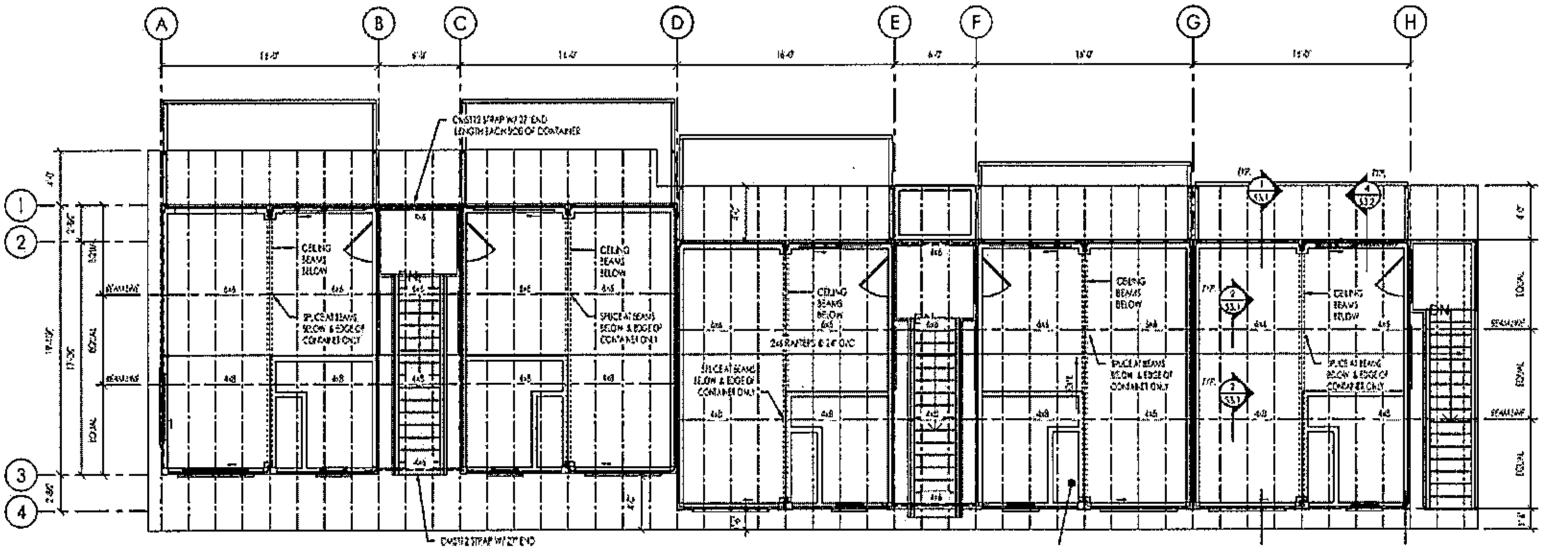
Rn = 58 ksi x (2" x 1/4") = 18 k (ult) > 15.587 k

(36 kips conservative)

CHECK WELD

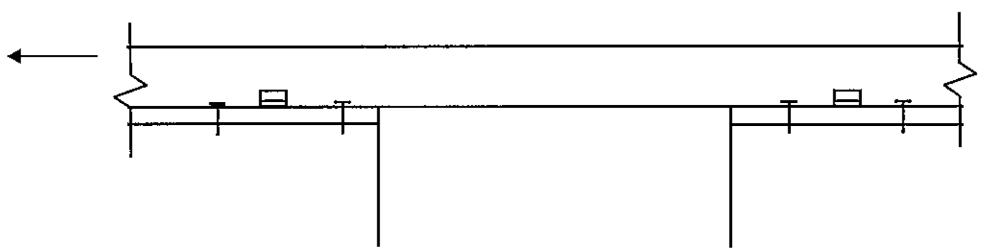
WELD = $\frac{R_n}{\Omega}$ = 0.928 kip/in DL

WELD = 0.928 kip/in (3)(3.5") = 9.744 k
(ASD) X 2 = 19.489 (ULT)
> 15.587 k



Max Shear at Line 1 & 3 = 9602 # (ASD)
9602 # / 5 = 1920 # (ASD)/0.7 x 2.5 (OMEGA) = 6859 #

6859 #



6860 # / 16 FT =429 # / FT

A35 @ 12" O/C = 555 #
(2) #12 SCREWS @ 8" O/C = 2X 150 # / (8"/12") = 450 # / FT

Roof Sheathing:

9602 # / 108 ft = 89 #/ft

5/8" plywood sheathing w/ 8d nails @ 6" o/c capacity = 200 plf > 89 plf OK

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Steel Column

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: B-13 IN SHEAR

Code References

Calculations per AISC 360-16, IBC 2021
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name :	**W5x16**	Overall Column Height	6.0 ft
Analysis Method :	Allowable Strength	Top & Bottom Fixity	Top & Bottom Pinned
Steel Stress Grade		Brace condition :	
Fy : Steel Yield	36.0 ksi	Unbraced Length for buckling ABOUT X-X Axis = 6.0 ft, K = 1.0	
E : Elastic Bending Modulus	29,000.0 ksi	Unbraced Length for buckling ABOUT Y-Y Axis = 6.0 ft, K = 1.0	

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 96.197 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 6.0 ft, D = -15.587 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, D = 0.1280, L = 0.5120 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	**0.2571** : 1	
Load Combination	+D+L	
Location of max.above base	2.980	ft
At maximum location values are . . .		
Pa : Axial	-15.491	k
Pn / Omega : Allowabl	85.497	k
Ma-x : Applied	2.880	k-ft
Mn-x / Omega : Allowable	17.299	k-ft
Ma-y : Applied	0.0	k-ft
Mn-y / Omega : Allowable	8.228	k-ft
PASS Maximum Shear Stress Rati	**0.1109** : 1	
Load Combination	+D+L	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	1.920	k
Vn / Omega : Allowable	17.315	k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	1.920 k
Bottom along Y-Y	1.920 k

Maximum Load Deflections . . .

Along Y-Y 0.03040 in at 3.020ft above base
for load combination :+D+L

Along X-X 0.0 in at 0.0ft above base
for load combination :

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction k @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments k-ft @ Top	My - End Moments @ Base	My - End Moments @ Top
D Only	-15.491			0.384	0.384				
+D+L	-15.491			1.920	1.920				
+D+0.750L	-15.491			1.536	1.536				
+0.60D	-9.294			0.230	0.230				
L Only				1.536	1.536				

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction k @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments k-ft @ Top	My - End Moments @ Base	My - End Moments @ Top
Axial @ Base	Maximum				1.536	1.536				
"	Minimum	-15.491			0.384	0.384				
Reaction, X-X Axis Base	Maximum	-15.491			0.384	0.384				
"	Minimum	-15.491			0.384	0.384				
Reaction, Y-Y Axis Base	Maximum	-15.491			1.920	1.920				
"	Minimum	-9.294			0.230	0.230				
Reaction, X-X Axis Top	Maximum	-15.491			0.384	0.384				
"	Minimum	-15.491			0.384	0.384				
Reaction, Y-Y Axis Top	Maximum	-15.491			0.384	0.384				
"	Minimum				1.536	1.536				

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STRUCTURAL | CIVIL

Steel Column

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: B-13 IN SHEAR

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction k @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments k-ft @ Top	My - End Moments @ Base	My - End Moments @ Top
Moment, X-X Axis Base	Maximum	-15.491			0.384	0.384				
"	Minimum	-15.491			0.384	0.384				
Moment, Y-Y Axis Base	Maximum	-15.491			0.384	0.384				
"	Minimum	-15.491			0.384	0.384				
Moment, X-X Axis Top	Maximum	-15.491			0.384	0.384				
"	Minimum	-15.491			0.384	0.384				
Moment, Y-Y Axis Top	Maximum	-15.491			0.384	0.384				
"	Minimum	-15.491			0.384	0.384				

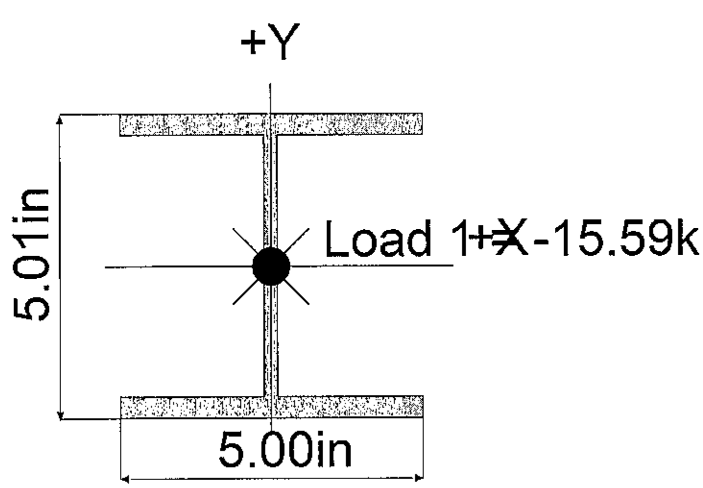
Maximum Deflections for Load Combinations

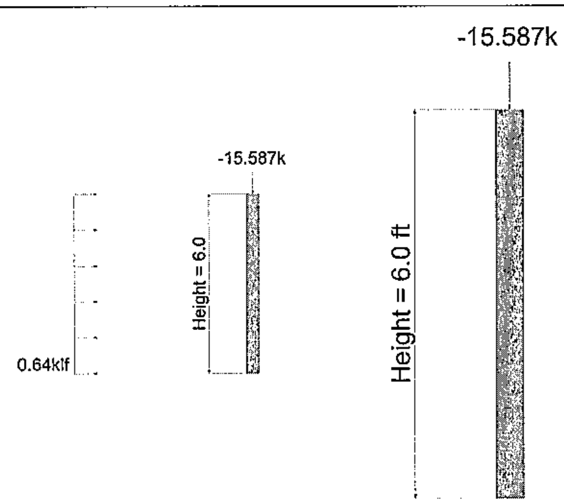
Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0000 in	0.000 ft	0.006 in	3.020 ft
+D+L	0.0000 in	0.000 ft	0.030 in	3.020 ft
+D+0.750L	0.0000 in	0.000 ft	0.024 in	3.020 ft
+0.60D	0.0000 in	0.000 ft	0.004 in	3.020 ft
L Only	0.0000 in	0.000 ft	0.024 in	3.020 ft

Steel Section Properties : W5x16

Depth	=	5.010 in	I xx	=	21.40 in^4	J	=	0.192 in^4
Web Thick	=	0.240 in	S xx	=	8.55 in^3	Cw	=	40.60 in^6
Flange Width	=	5.000 in	R xx	=	2.130 in			
Flange Thick	=	0.360 in	Zx	=	9.630 in^3			
Area	=	4.710 in^2	I yy	=	7.510 in^4			
Weight	=	16.033 plf	S yy	=	3.000 in^3	Wno	=	5.810 in^2
Kdesign	=	0.660 in	R yy	=	1.260 in	Sw	=	2.620 in^4
K1	=	0.438 in	Zy	=	4.580 in^3	Qf	=	1.990 in^3
rts	=	1.430 in				Qw	=	4.740 in^3
Ycg	=	0.000 in						

Sketches

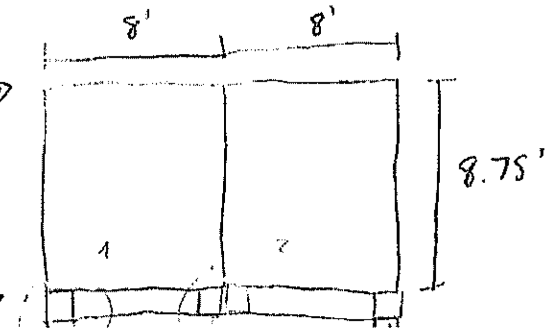




(A)

1373 lb
× 2.5 = 3433 lb

TOTAL SHEAR:
4785 lb
× 2.5 = 11962.5 l



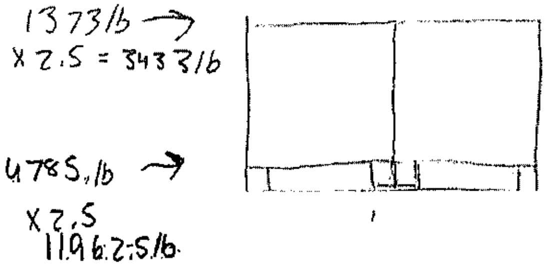
MAX GRAVITY LOAD = 4.404 K

$V = 3433 \text{ lb} / 16' = 214' \text{ lb/ft}$

$M_{OT} = 214 \text{ lb/ft} \times 16 \times 8.75' = 29960 \text{ ft}\cdot\text{lb}$

$T/C = \dfrac{15019 \text{ ft}\cdot\text{lb}}{16} = 1873 \text{ lb}$

(B)



V = 3433 lb / 16' = 214 lb/ft

Mot = 214 lb/ft × 16' × 8.75' = 29960 ft-lb

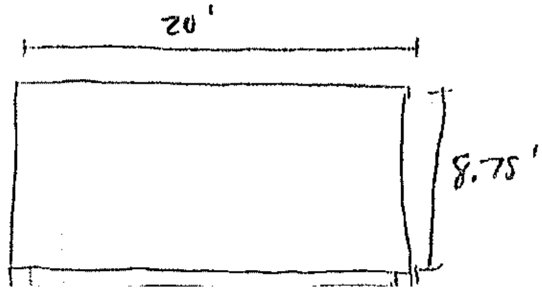
$T/C = \frac{15019 \text{ ft-lb}}{16'} = 1873 \text{ lb}$

SHEAR @ BASE = 11962.5 / 2 = 5.981 K

① & ②

2692 lb →
× 2.5 =
6730 lb

TOTAL SHEAR: 5992 lb →
× 2.5 =
14980 lb



$V = 6730 / 20' = 336.5\ \text{lb/ft}$

$M_{OT} = 336.5\ \text{lb/ft} \times 20' \times 8.75' = 58887.5\ \text{lb-ft}$

$T/C = \dfrac{58887.5\ \text{ft}\cdot\text{lb}}{20'} = 2944\ \text{lb}$

SHEAR @ BASE = 14980 lb/2 = 7490 lb

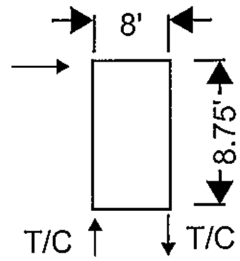
HAYDEN ENGINEERS STRUCTURAL | CIVIL		BY	SS	DATE 4/18/25
	Nestucca River - Multifamily Container	REV		DATE
		JOB NO	24261.01	
(503) 968-9994 Hayden-Engineers.com		SHEET		OF

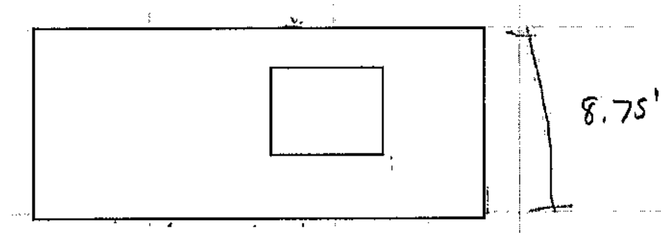
CONTAINER SHEAR WALLS

WORST CASE WHERE A GRAVITY LOAD APPLIED:

AT SHORT SIDE OF CONTAINERS
REFER TO PULL TESTS FOR
MAXIMUM CAPACITY

(1) = 2692 lbs SEISMIC





TOTAL SHEAR WALL = 12'

V = 2626/12 = 218.8 LB/FT

M_{OT} = 218.8 LB/FT X 8' X 8.75' = 15316 FT-LB

T/C = M_{OT} / Width = 15316 FT-LB/12' = 1276 LB

Rev. Date: 9/12/2024 9:53:27 AM
By: SophiaSpisak
Printed: 10/17/2024 8:31:20 AM

Section Inputs

Material: A242
No cold work of forming strength increase.
No inelastic reserve strength increase.

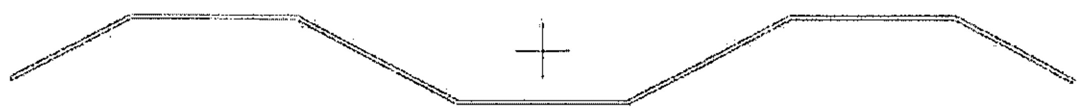
Modulus of Elasticity, E	29500 ksi
Yield Strength, Fy	50 ksi
Tensile Strength, Fu	70 ksi
Min Elongation in 2 inches	21 %
Torsion Constant Override, J	0 in^4
Warping Constant Override, Cw	0 in^6

Panel, Thickness 0.063 in
Placement of Part from Origin:

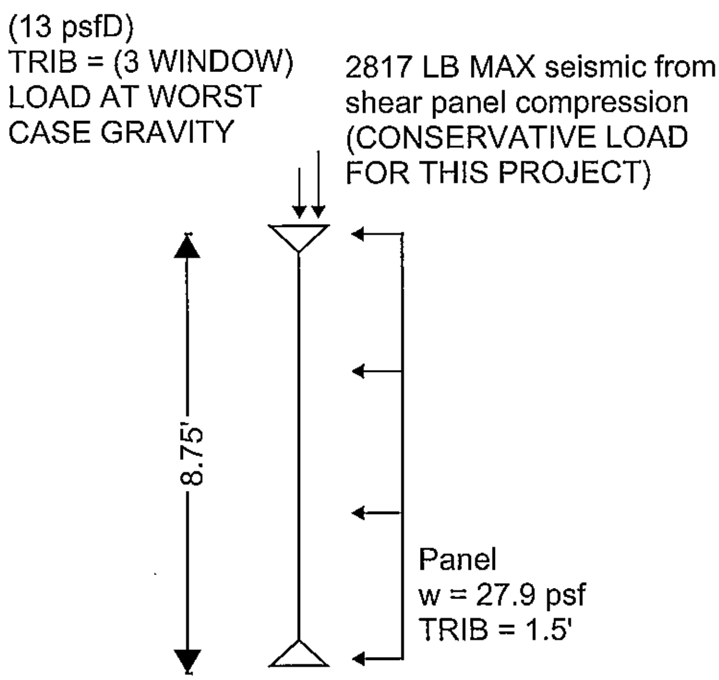
X to center of gravity	0 in
Y to center of gravity	0 in

Centerline dimensions, Open shape

	Length (in)	Angle (deg)	Radius (in)	Web	k Coef.	Hole Size (in)	Distance (in)
1	2.2180	27.900	0.084900	Deck	0.000	0.0000	1.1090
2	2.7560	0.000	0.084900	Single	0.000	0.0000	1.3780
3	3.0300	-27.900	0.084900	None	0.000	0.0000	1.5150
4	2.8300	0.000	0.084900	Single	0.000	0.0000	1.4150
5	3.0300	27.900	0.084900	Deck	0.000	0.0000	1.5150
6	2.7560	0.000	0.084900	Single	0.000	0.0000	1.3780
7	2.2180	-27.900	0.084900	Deck	0.000	0.0000	1.1090



Rev. Date: 10/31/2024 11:35:03 AM
By: SophiaSpisak
Printed: 10/31/2024 11:46:50 AM



Analysis Inputs

General
  Member Orientation: Vertical
  Calculate global buckling using specification equations
  Do not include torsion in member checks

Members

	Section File	Revision Date and Time
1	Container Skin Analysis 1'-6.cfss	9/12/2024 9:53:27 AM

	Material	Area (in²)	Length (ft)	Weight (k)
1	A242	1.1864	8.7500	0.035294
	Total		8.7500	0.035294

	Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	kϕ (k)	Lm (ft)	ex (in)	ey (in)
1	0.0000	8.7500	None	0.0000	0.0000	8.7500	0.000	0.000

Supports

	Type	Location (ft)	Bearing (in)	Fastened	K
1	XYT	0.0000	2.00	No	1.0000
2	XYT	8.7500	2.00	No	1.0000

Rev. Date: 11/8/2024 12:05:59 PM
By: SophiaSpisak
Printed: 11/8/2024 12:06:28 PM

Loading: Dead Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Axial		0.0000	8.7500	0.4680	0.4680	k

Loading: Roof Live Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Axial		0.0000	8.7500	0.7200	0.7200	k

Loading: Snow Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Axial		0.0000	8.7500	0.8750	0.8750	k

Loading: Wind Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.0000	8.7500	-0.042000	-0.042000	k/ft
2 Axial		0.0000	8.7500	0.5950	0.5950	k

Loading: Earthquake Load

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Axial		0.0000	8.7500	2.8170	2.8170	k

Rev. Date: 11/8/2024 12:05:59 PM
By: SophiaSpisak
Printed: 11/8/2024 12:06:28 PM

Load Combination: D+0.525E+0.75L+0.1S
Specification: AISI S100-16/S3-22, US, ASD
Inflection Point Bracing: No

	Loading	Factor
1	Dead Load	1.000
2	Earthquake Load	0.525
3	Live Load	0.750
4	Product Load	0.750
5	Snow Load	0.100

Load Combination: 0.6D+0.7E
Specification: AISI S100-16/S3-22, US, ASD
Inflection Point Bracing: No

	Loading	Factor
1	Dead Load	0.600
2	Earthquake Load	0.700

Member Check - AISI S100-16/S3-22, US, ASD

Load Combination: D+0.75(L+0.6W+Lr)
Design Parameters at 4.3750 ft:

Lx	8.7500 ft	Ly	8.7500 ft	Lt	8.7500 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: Container Skin Analysis 1'-6.cfss
Material Type: A242, Fy=50 ksi

Cbx	1.1364	Cby	1.0000	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None		kφ	0 k		
Red. Factor, R: 0		Lm	20.0000 ft		

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	1.276	2.171	0.000	0.000	0.000
Applied	1.276	2.813	0.000	0.000	0.000
Strength	3.810	8.226	3.840	21.920	16.431

Interaction Equations

Eq. H1.2-1	(P, Mx, My)	0.335 + 0.342 + 0.000 = 0.677 <= 1.0
Eq. H2-1	(Mx, Vy)	Sqrt(0.088 + 0.000)= 0.297 <= 1.0
Eq. H2-1	(My, Vx)	Sqrt(0.000 + 0.000)= 0.000 <= 1.0

Panel element 2 d_o/b_o exceeds 0.7.
Panel element 6 d_o/b_o exceeds 0.7.
Edge stiffener D/w exceeds 0.8.
Edge stiffener angle not within 40°-140°.

Screw Capacities

Table Notes

1. Capacities based on AISI S100 Section E4.
2. When connecting materials of different steel thicknesses or tensile strengths, use the lowest values. Tabulated values assume two sheets of equal thickness are connected.
3. Capacities are based on Allowable Strength Design (ASD) and include safety factor of 3.0.
4. Where multiple fasteners are used, screws are assumed to have a center-to-center spacing of at least 3 times the nominal diameter (d).
5. Screws are assumed to have a center-of-screw to edge-of-steel dimension of at least 1.5 times the nominal diameter (d) of the screw.
6. Pull-out capacity is based on the lesser of pull-out capacity in sheet closest to screw tip or tension strength of screw.
7. Pull-over capacity is based on the lesser of pull-over capacity for sheet closest to screw header or tension strength of screw.
8. Values are for pure shear or tension loads. See AISI Section E4.5 for combined shear and pull-over.
9. Screw Shear (Pss), tension (Pts), diameter, and head diameter are from CFSEI Tech Note (F701-12).
10. Screw shear strength is the average value, and tension strength is the lowest value listed in CFSEI Tech Note (F701-12).
11. Higher values for screw strength (Pss, Pts), may be obtained by specifying screws from a specific manufacturer.

Allowable Screw Connection Capacity (lbs)

Thickness (Mils) (Gauge)	Design Thickness	Fy Yield (ksi)	Fu Tensile (ksi)	#6 Screw (Pss = 643 lbs, Pts = 419 lbs) 0.138" dia, 0.272" Head			#8 Screw (Pss= 1278 lbs, Pts = 586 lbs) 0.164" dia, 0.272" Head			#10 Screw (Pss= 1644 lbs, Pts = 1158 lbs) 0.190" dia, 0.340" Head			#12 Screw (Pss= 2330 lbs, Pts = 2325 lbs) 0.216" dia, 0.340" Head			¼" Screw (Pss= 3048 lbs, Pts = 3201 lbs) 0.250" dia, 0.409" Head		
				Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over	Shear	Pull-Out	Pull-Over
18 (25)	0.0188	33	33	44	24	84	48	29	84	52	33	105	55	38	105	60	44	127
27 (22)	0.0283	33	33	82	37	127	89	43	127	96	50	159	102	57	159	110	66	191
30 (20)	0.0312	33	33	95	40	140	103	48	140	111	55	175	118	63	175	127	73	211
33 (20)	0.0346	33	45	151	61	140	164	72	195	177	84	265	188	95	265	203	110	318
43 (18)	0.0451	33	45	214	79	140	244	94	195	263	109	345	280	124	345	302	144	415
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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54 (16)	0.0566	50	65	214	140	140	426	171	195	534	198	386	569	225	625	613	(261)	752
68 (14)	0.0713	50	65	214	140	140	426	195	195	548	249	386	777	284	775	866	328	948
97 (12)	0.1017	50	65	214	140	140	426	195	195	548	356	386	777	405	775	1,016	468	1,067
118 (10)	0.1242	50	65	214	140	140	426	195	195	548	386	386	777	494	775	1,016	572	1,067

Weld Capacities

Table Notes

1. Capacities based on the AISI S100 Specification Sections E2.4 for fillet welds and E2.5 for flare groove welds.
2. When connecting materials of different steel thicknesses or tensile strengths, use the lowest values.
3. Capacities are based on Allowable Strength Design (ASD).
4. Weld capacities are based on E60 electrodes. For material thinner than 68 mil, 0.030" to 0.035" diameter wire electrodes may provide best results.
5. Longitudinal capacity is considered to be loading in the direction of the length of the weld.
6. Transverse capacity is loading in perpendicular direction of the length of the weld.
7. For flare groove welds, the effective throat of weld is conservatively assumed to be less than 2t.
8. For longitudinal fillet welds, a minimum value of EQ E2.4-1, E2.4-2, and E2.4-4 was used.
9. For transverse fillet welds, a minimum value of EQ E2.4-3 and E2.4-4 was used.
10. For longitudinal flare groove welds, a minimum value of EQ E2.5-2 and E2.5-3 was used.

Allowable Weld Capacity (lbs / in)

Thickness (Mils)	Design Thickness	Fy Yield (ksi)	Fu Tensile (ksi)	Fillet Welds		Flare Groove Welds	
				Longitudinal	Transverse	Longitudinal	Transverse
43	0.0451	33	45	499	864	544	663
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
54	0.0566	50	65	905	1566	985	1202
68	0.0713	50	65	1140	1972	1241	1514
97	0.1017	50	65	1269	1269	-[1]	-[1]

[1] *Weld capacity for material thickness greater than 0.10" requires engineering judgment to determine leg of welds, W1 and W2.*

WIND LOAD - ASCE 7-16

120 mph, Exposure C, Mean Roof Height = 20.0 ft

K_{zt} at Base = 1

K_d = 0.85 , Roof Slope 0.0 degrees (0:12)

Enclosed Building, GC_{pi} = 0.18

(Wind Loads Shown are for Alternate Basic Load Combinations Using Allowable Stress Design and are Multiplied by a Factor of 0.6 to convert to ASD)

WALL COMPONENTS AND CLADDING per ASCE7-16 Figure 30.3-1

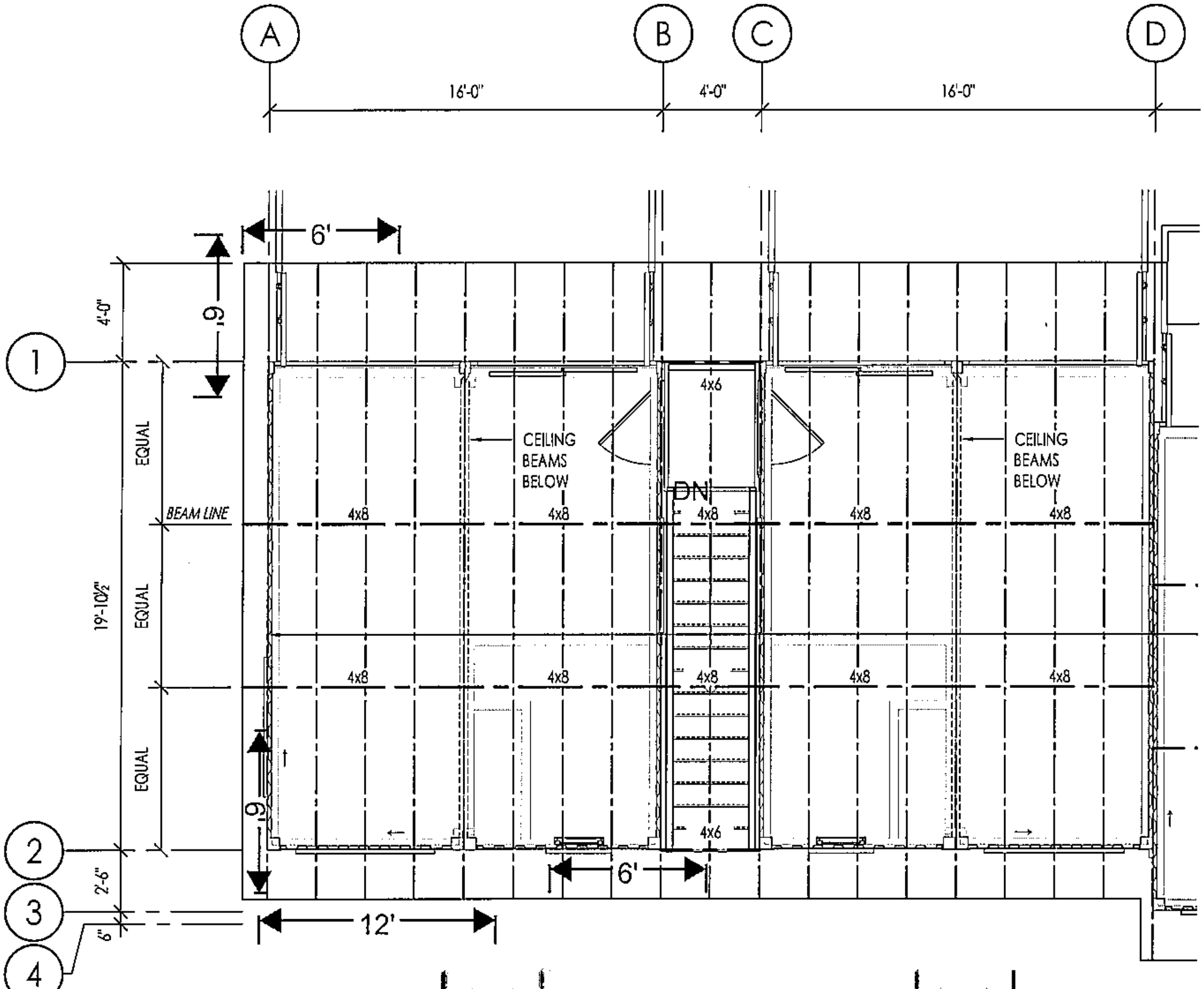
Tributary Area (ft2)	GCp by Zone Zone 4 (+/-)	 Zone 5 (+/-)
10 ft^2	0.90/-0.99	0.90/-1.26
50 ft^2	0.79/-0.88	0.79/-1.04
500 ft^2	0.63/-0.72	0.63/-0.72

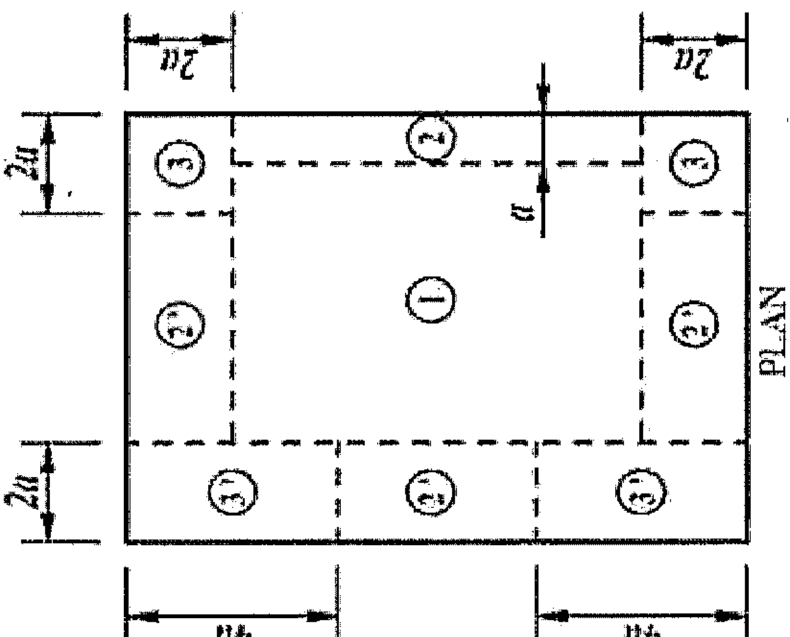
Height z (ft)	K_z	K_{zt}	K_e	q_z (psf)	Tributary Area (ft2)	Wind Pressures (psf) by Zone () Windward (4,5)	 Leeward (4)	 Leeward (5)
0 - 20	0.90	1.00	1.00	28.26	10	18.3	-19.8	-24.4
					50	16.4	-18.0	-20.6
					500	13.7	-15.3	-15.3

ROOF COMPONENTS AND CLADDING - MONOSLOPE ROOF ASCE7-16 Figure 30.3-5A

K_h = 0.90; K_{zt} at roof = 1.00; K_e = 1.00; q_h = 28.26 psf

	Positive Pressure, p (psf)				Negative Pressure, p (psf)			
	A=10		A=100		A=10		A=100	
Zone	GC_p	p	GC_p	p	GC_p	p	GC_p	p
1	0.30	9.60	0.20	9.60	-1.10	-21.70	-1.10	-21.70
2	0.30	9.60	0.20	9.60	-1.30	-25.09	-1.20	-23.40
3	0.30	9.60	0.20	9.60	-1.80	-33.57	-1.20	-23.40
2'	0.30	9.60	0.20	9.60	-1.60	-30.18	-1.50	-28.49
3'	0.30	9.60	0.20	9.60	-2.60	-47.14	-1.60	-30.18





MAX SHEAR @ ROOF BEAM LINES = 0.563 (15 PSF X (4 + 6.67/2) X 19') + (10PSF/2 X 19')
V = 1230 LB

UPLIFT

Uplift @ Beam Line 1

Beam Line 1 = (6.625/2) + (4) x 2' = 14.625 ft2

Uplift = 33 psf upflit (ZONE 3 INTERPOLATED) - 0.6 x 8 psf dead = 28.2 psf
Uplift = 30.1 psf upflit (ZONE 2' INTERPOLATED) - 0.6 x 8 psf dead = 25.3 psf

TOTAL UPLIFT = (28.2 psf x 12') + (25.3 psf X 2.625 FT2) = 404 psf

LTP5 CAPACITY = 490 LB > 404 LB OK

@ 12" o/c Uplift =211 lbs @8" O/C Uplift = 121 lbs
#12 SCREW INTO 16 GA CAPACITY = 225 LB X 2 = 450 > 211 LB OK

#12 SCREW SHEAR CAPACITY IN WOOD = 290 LBS

SHEAR MAX = 429 # / FT W/ (2) SCREWS
8" O/C = 143# SHEAR EA. SCREW

121/450 + 143/290 = 0.76 OK

USE LTP5 @ 24" O/C
(2) #12 SCREWS @ 12" O/C

Uplift @ Middle Rafters

Beam Line = 6.67 x 2' = 13.34 ft2

Uplift = 30.18 psf upflit (zone 2') - 0.6 x 8 psf dead = 25.38 psf

TOTAL UPLIFT = (25.38 psf x 13.34) = 339 psf

H2.5A CAPACITY = 700 LB > 339 LB OK

Reaction @ Container Ends = (8'/2 + 2' x 6.67') = 40.02 ft2

Uplift = 29.6 psf upflit (zone 2' interpolated) - 0.6 x 8 psf dead = 24.8 psf

TOTAL UPLIFT = 24.8 psf x 40.02ft2 = 992 lb

HGA10 CAPACITY = 650 LB X 2 = 1300 LB > 992 LB OK

SHEAR MAX = 1230 LB / 16' = 76.9 LB/FT

HGA10 SHEAR CAPACITY = 1165 LB X 2 > 1230 LB OK

1/4" **SCREW** INTO 16 GA CAPACITY = 261 LB X 4 = 1044 > 992 LB OK

USE H2.5 @ EA RAFTER
(2) @ BEAM LINE HGA10

UPLIFT

Uplift @ Beam Line 3 (4 foot overhang)

Beam Line 2 = (6.67/2) + (4) x 2' = 14.67 ft2

Uplift = 47.14 psf upflit (ZONE 3') - 0.6 x 8 psf dead = 42.34 psf

TOTAL UPLIFT = (42.14 psf x 14.67') = 618 #

H2.5A CAPACITY = 700 LB > 618 LB OK

LTP5 CAPACITY = 490 psf @ 16" o/c
618 # /2 x 1.33 = 411#
490 # > 411# OK

@ 12" o/c Uplift = 309 lbs
#12 SCREW INTO 16 GA CAPACITY = 225 LB X 2 = 450 > 309 LB OK

#12 SCREW SHEAR CAPACITY IN WOOD = 145 LBS X 2 = 290 LBS

246/450 + 77/290 = 0.81 OK

SHEAR MAX = 1230 LB / 16' = 76.9 LB/FT

USE H2.5 @ EA RAFTER
LTP5 @ 16" O/C
(2) #12 SCREWS @ 12" O/C

Uplift @ Beam Line 2 (2.5' overhang)

Beam Line 2 = (6.67/2) + (2.5) x 2' = 11.67 ft2

Uplift = 47.14 psf upflit (ZONE 3') - 0.6 x 8 psf dead = 42.34 psf

TOTAL UPLIFT = (42.14 psf x 11.67') = 491.77 psf

H2.5A CAPACITY = 700 LB > 491.77 LB OK

LTP5 CAPACITY = 565 psf
491.77 lbs uplift < 565 lb OK

@ 12" o/c Uplift = 246 lbs
#12 SCREW INTO 16 GA CAPACITY = 225 LB X 2 = 450 > 246 LB OK

#12 SCREW SHEAR CAPACITY IN WOOD = 145 LBS X 2 = 290 LBS

246/450 + 77/290 = 0.81 OK

SHEAR MAX = 1230 LB / 16' = 76.9 LB/FT

USE H2.5 @ EA RAFTER
LTP5 @ 24" O/C
(2) #12 SCREWS @ 12" O/C

Lateral Analysis

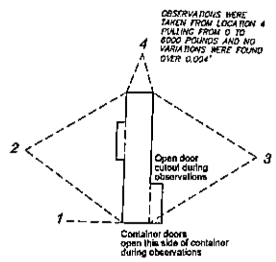
The components of the Main Lateral Force Resisting Systems (MLFRS) of typical, unmodified Intermodal Shipping Containers (IMSCs) are unknown; however, IMSC's that comply with ISO 1496 have clear performance requirements regarding lateral loading. ISO 1496 Section 6.10 requires that IMSC's designated 1A, 1AA, 1AX, 1B, 1BB, 1BX, 1C, 1CC, and 1CX are subjected to test forces of 150 kN (≈33,700 lbs) and "Upon completion of the test, the containers shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use..." Additionally, "...the sideways deflection of the top of the container with respect to the bottom of the container, at the time it is under full transverse rigidity test conditions, shall not cause the sum of the changes in length of the two diagonals to exceed 60 mm (≈2 3/8")"

The IMSC's to be converted for residential use will be heavily modified; therefore, these test results are not applicable to our scenario. In lieu of determining structural capacities of individual components of the MLFRS, Hayden Consulting Engineers in coordination with Rel-e-vant Buildings, have conducted proof testing on a "Step 3" unit. The "Step 1" unit consists of an IMSC modified with new openings in the metal panels to allow for windows and doors, no openings over 6'-0" width are anticipated. The "Step 2" unit is similar to the "Step 1" unit but includes a cantilevered portion of floor and roof (bump-out), this bump-out is anticipated to be no more than 12'-0" wide and the "Step 2" unit is anticipated to have openings no wider than 6'-0". The "Step 3" unit is similar to the "Step 2" unit but includes (2) cantilevered portions of floor and roof (bump-outs). The "Step 3" unit has been tested and the results applied to the design of the "Step 2" and "Step 1" units because it is the most heavily modified and least stiff configuration in regards to lateral rigidity resulting in a conservative design for the "Step 2" and "Step 1" units.

Testing Procedure

An IMSC modified to a Step 3 configuration was supported at all (4) bottom corner fittings by an existing slab on grade. Each corner fitting was restrained against lateral and vertical movement by use of post-installed anchors. A series of (4) tests were conducted to assess the performance of the IMSC's MLFRS. Test loads were applied in 1000 lb increments, starting at 1000 lbs up to 6000 lbs. Test 1 consisted of test forces applied parallel to the rear-end frame. Tests 2, 3, and 4 consisted of test forces applied to the center of rigging that was attached to opposing ends of the container (i.e. front- and rear-end frames and side walls). Fig. 1 below gives a visual representation of these tests.

Three points were measured for deflection during these tests; (1) located at either end of the IMSC and (1) at the mid-point of the IMSC. Test loads defined by Hayden Consulting Engineers were applied at the locations shown in Fig. 1 and deflections at the points previously stated were measured by a Professional Land Surveyor.



Acceptance Criteria

The acceptance criteria is similar to that of ISO 1496 Section 6.10. No permanent deflection that will render the IMSC unsuitable for further use and no more than a 2 3/8" deflection when measuring the diagonals of the loaded wall. Based on this criteria, a maximum allowable horizontal deflection of 3 21/32" at the top-most corner during loading is acceptable.

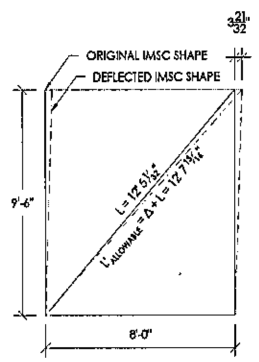


Fig. 2 - Allowable Horizontal Deflection

Test Results

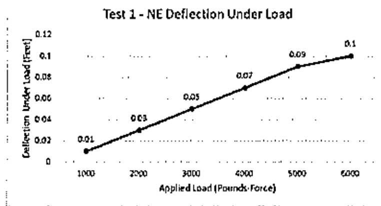
The worst-case measured deflection was during Test 1 in the SE corner of the IMSC. At 6000 lbs a 0.1' (≈1.2") deflection was measured and, when the test load was removed, a 0.01' (≈1/8") deflection was recorded. The worst-case permanent deflection was measured during Test 1 after a 4000 lb load was applied and was 0.02' (≈1/4"). The active deflection of the IMSC do not exceed the 3 21/32" allowable and the permanent deflections of less than 1/8" during the 3000 lb test load, which exceed the force calculated, is negligible and of minimal concern. No large, permanent deflections were measured and all tests recovered more than 75% of the maximum deflection measured. Tabulated deflections can be found on the following pages.

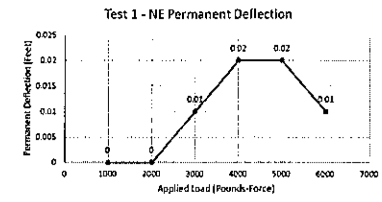
Conclusion

Based on the results of the testing, Hayden Consulting Engineers concludes that the Step 1, Step 2, and Step 3 series have retained enough lateral capacity to be appropriate for use in locations that have a design Wind Speed of 135 mph and an Exposure Category of C, a 5% Damped Design Spectral Acceleration at Short Periods, Sds, of 1.0, or any combination of values lesser than those previously stated, based on a calculated required lateral capacity of 5 kips, maximum. Additionally, the MLFRS appears to remain elastic under maximum loading.

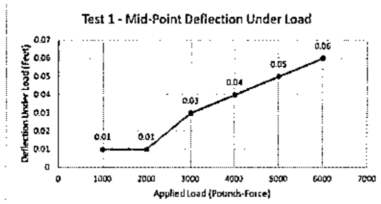
Lateral Analysis, cont.

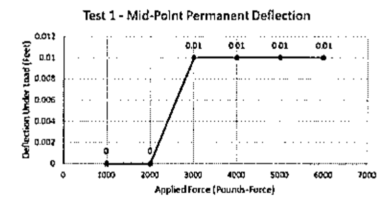
Test	Load	Location	Deflection Under Load	Permanent Deflection
1	1000	SE	0.01	0
1	2000	SE	0.03	0
1	3000	SE	0.05	0.01
1	4000	SE	0.07	0.02
1	5000	SE	0.09	0.02
1	6000	SE	0.1	0.01



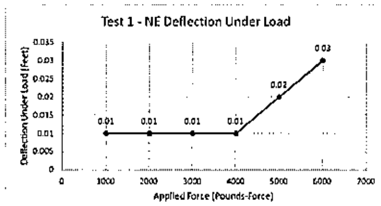


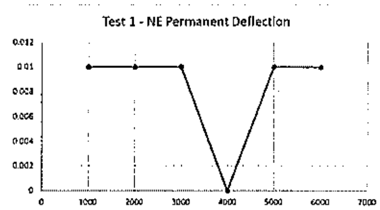
Test	Load	Location	Deflection Under Load	Permanent Deflection
1	1000	Mid	0.01	0
1	2000	Mid	0.01	0
1	3000	Mid	0.03	0.01
1	4000	Mid	0.04	0.01
1	5000	Mid	0.05	0.01
1	6000	Mid	0.06	0.01



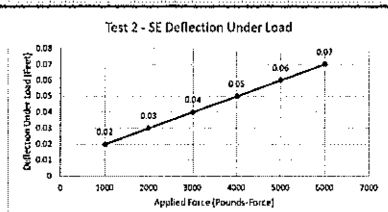


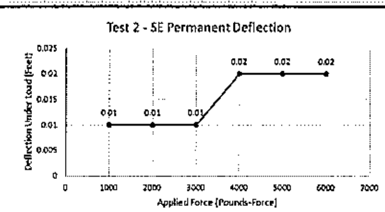
Test	Load	Location	Deflection Under Load	Permanent Deflection
1	1000	NE	0.01	0.01
1	2000	NE	0.01	0.01
1	3000	NE	0.01	0.01
1	4000	NE	0.01	0
1	5000	NE	0.02	0.01
1	6000	NE	0.03	0.01



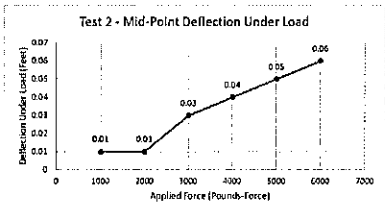


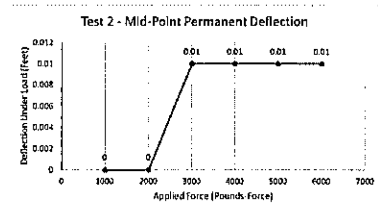
Test	Load	Location	Deflection Under Load	Permanent Deflection
2	1000	SE	0.02	0.01
2	2000	SE	0.03	0.01
2	3000	SE	0.04	0.01
2	4000	SE	0.05	0.02
2	5000	SE	0.06	0.02
2	6000	SE	0.07	0.02



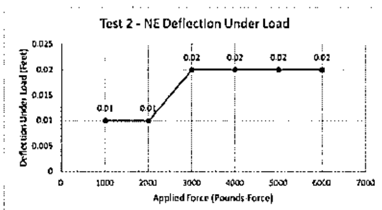


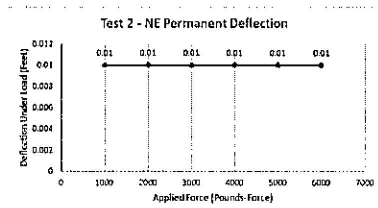
Test	Load	Location	Deflection Under Load	Permanent Deflection
2	1000	Mid	0.01	0
2	2000	Mid	0.01	0
2	3000	Mid	0.03	0.01
2	4000	Mid	0.04	0.01
2	5000	Mid	0.05	0.01
2	6000	Mid	0.06	0.01





Test	Load	Location	Deflection Under Load	Permanent Deflection
2	1000	NE	0.01	0.01
2	2000	NE	0.01	0.01
2	3000	NE	0.02	0.01
2	4000	NE	0.02	0.01
2	5000	NE	0.02	0.01
2	6000	NE	0.02	0.01





NOTE: Pull test 1 was conducted @ location with container doors open

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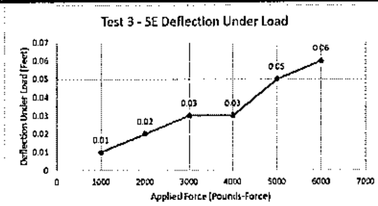
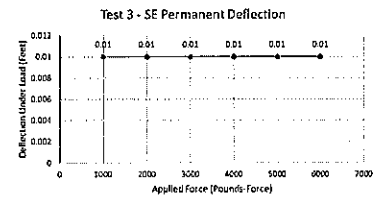
BY ________ DATE ________
REV ________ DATE ________
JOB NO ________
SHEET ________ OF ________

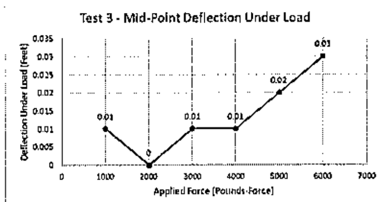
Lateral Analysis, cont.

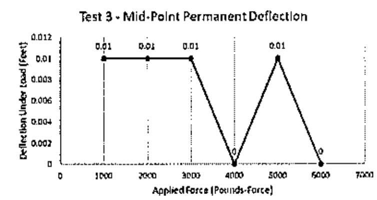
Test	Load	Location	Deflection Under Load	Permanent Deflection
3	1000	SE	0.01	0.01
3	2000	SE	0.02	0.01
3	3000	SE	0.03	0.01
3	4000	SE	0.03	0.01
3	5000	SE	0.05	0.01
3	6000	SE	0.06	0.01



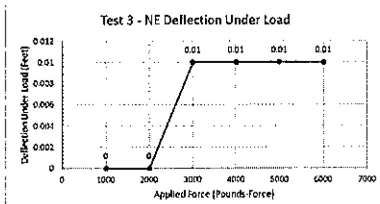


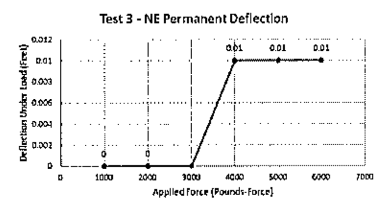
Test	Load	Location	Deflection Under Load	Permanent Deflection
3	1000	Mid	0.01	0.01
3	2000	Mid	0	0.01
3	3000	Mid	0.01	0.01
3	4000	Mid	0.01	0
3	5000	Mid	0.02	0.01
3	6000	Mid	0.03	0





Test	Load	Location	Deflection Under Load	Permanent Deflection
3	1000	NE	0	0
3	2000	NE	0	0
3	3000	NE	0.01	0
3	4000	NE	0.01	0.01
3	5000	NE	0.01	0.01
3	6000	NE	0.01	0.01





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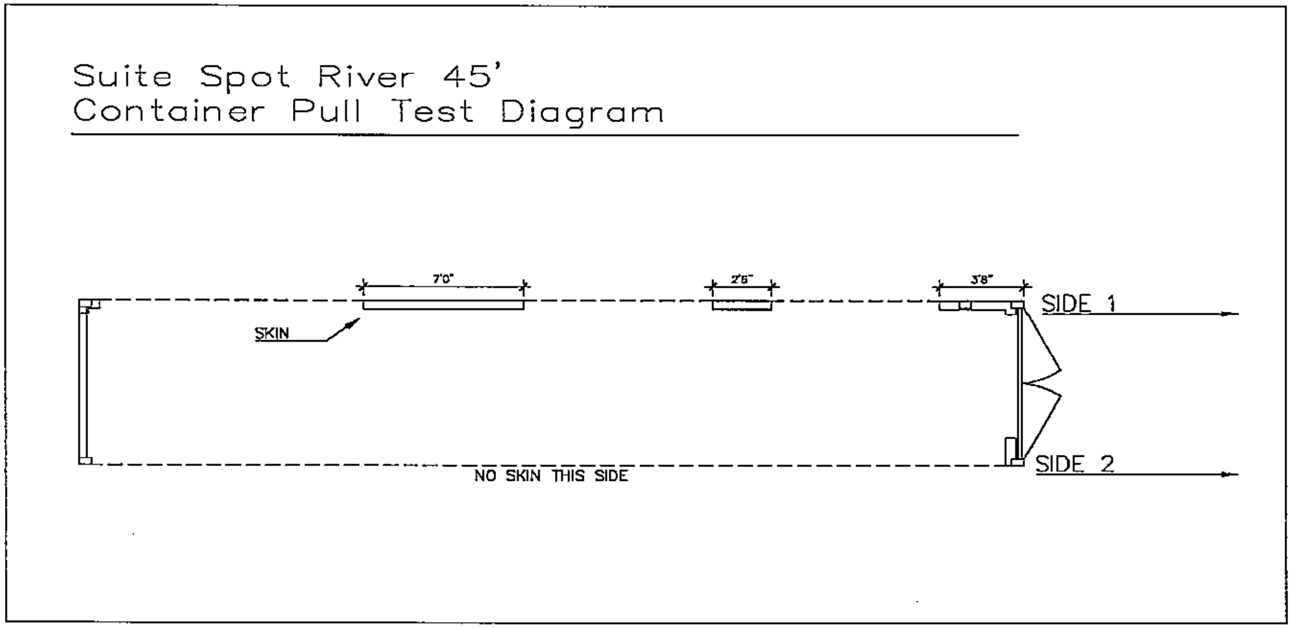
BY ____ DATE ____
REV ____ DATE ____
JOB NO ____
SHEET ____ OF ____

SUITE SPOT RIVER 45' CONTAINER PULL TEST
DATE: 5-7-19



Side 1

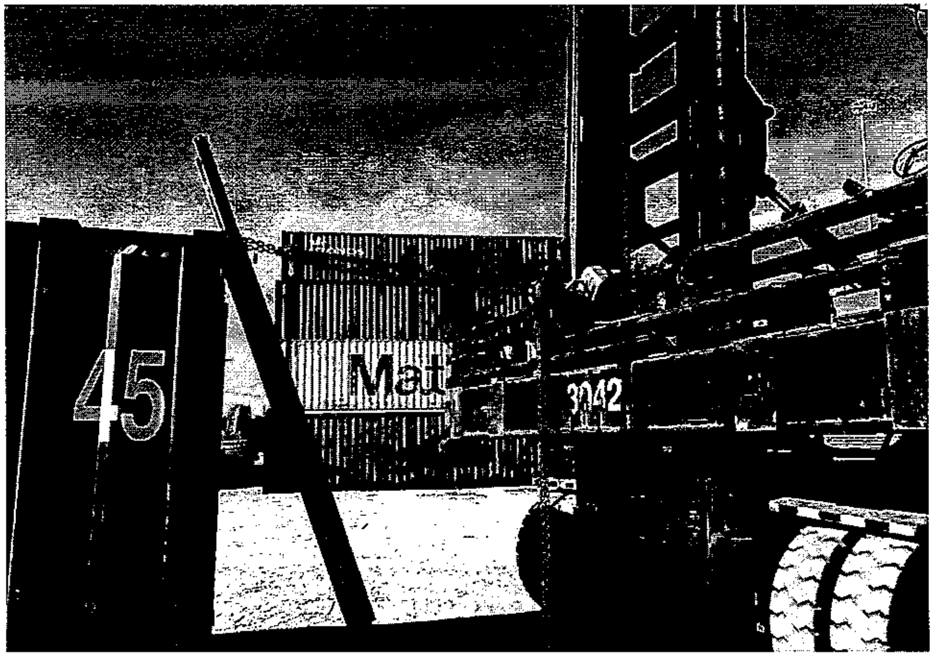
Force of pull (pounds)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
Deviation at x lbs of force (inches)	1/8	1/4	3/8	1/2	5/8	3/4	1	1-1/8
Deviation at 0 lbs of force (inches)	0	0	0	0	1/16	1/16	1/8	1/8

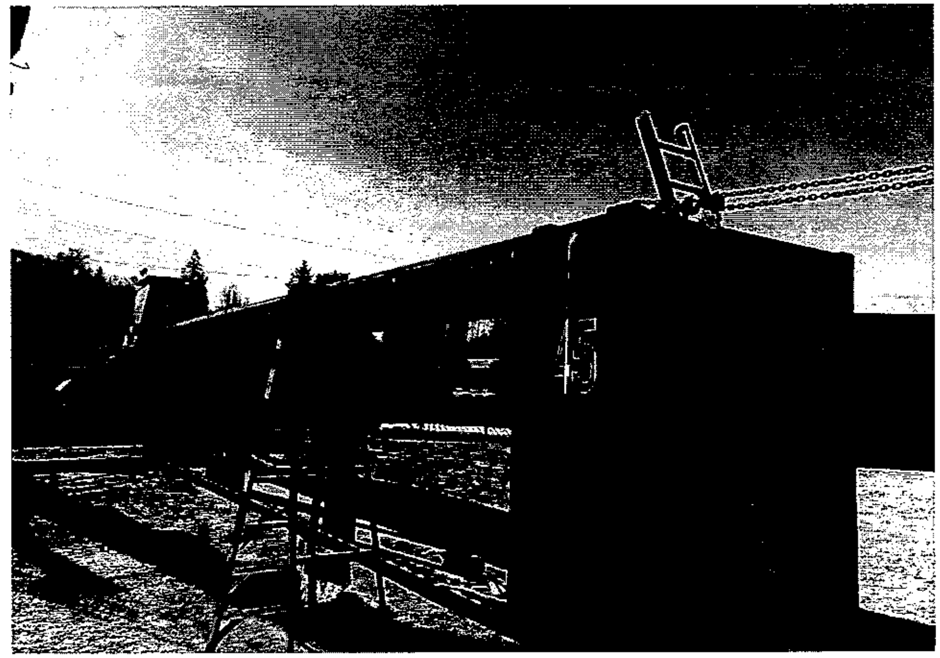
Side 2

Force of pull (pounds)	1,000	2,000	3,000	4,000	5,000	6,000
Deviation (inches)	1/8	3/8	5/8	7/8	1-1/8	1-3/8
Deviation at 0 lbs of force (inches)	0	0	0	0	0	0

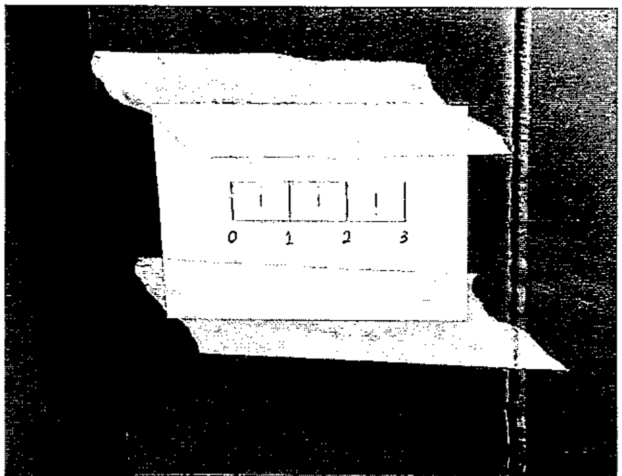
Note: testers released force back to 0lbs in between pulls for each side. Deviations from the baseline at 0 lbs were recorded.

45' Container Testing Setup

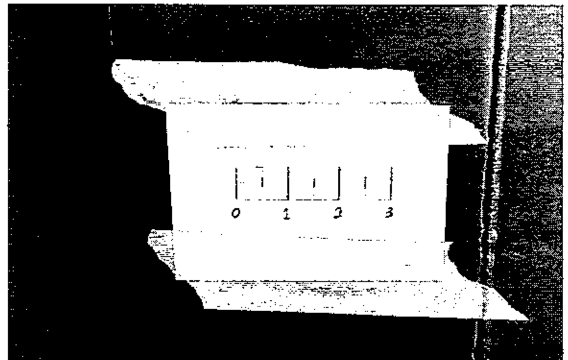




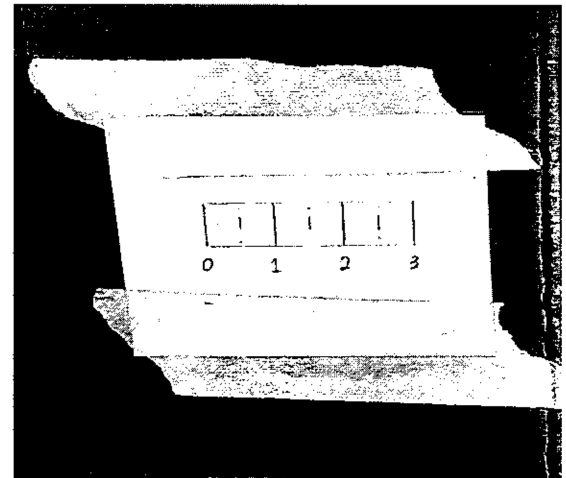
45' Container Pull Test: Side 1 Data



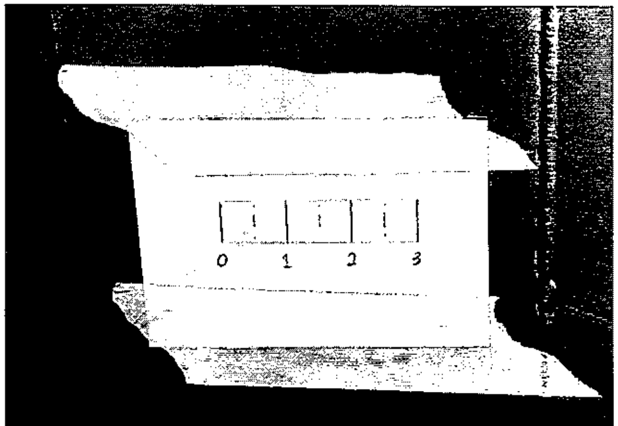
Side 1 - Baseline set to 0



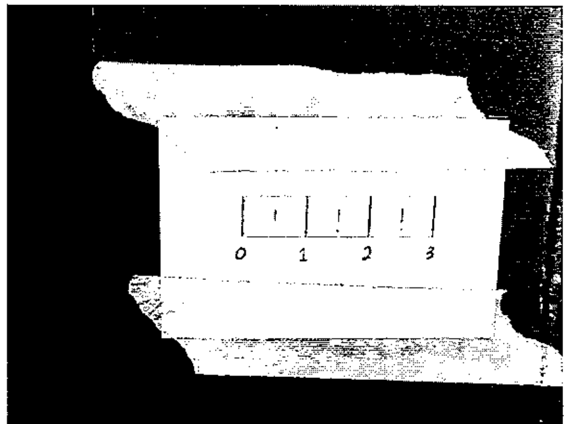
Side 1 - 1,000 lbs



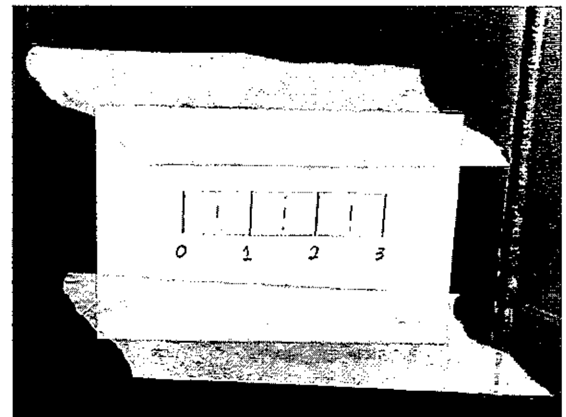
Side 1 - 2,000 lbs



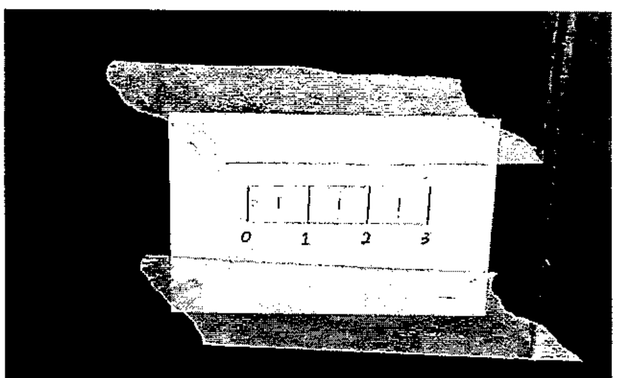
Side 1 - 3,000 lbs



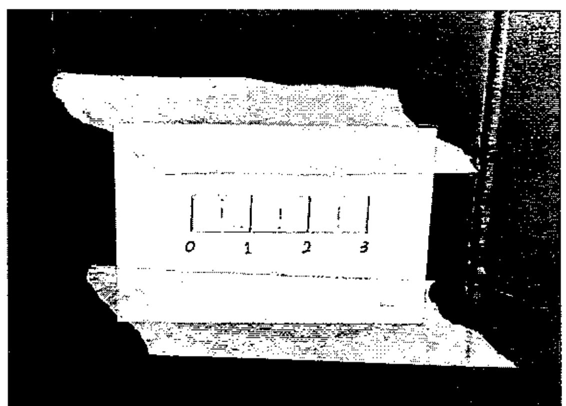
Side 1 - 4,000 lbs



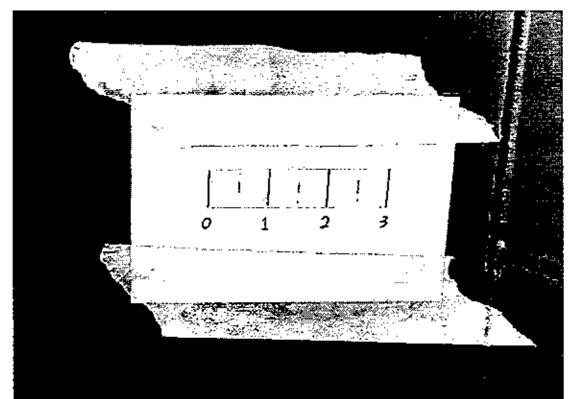
Side 1 - 5,000 lbs



Side 1 - Set back to 0 after 5,000 lbs

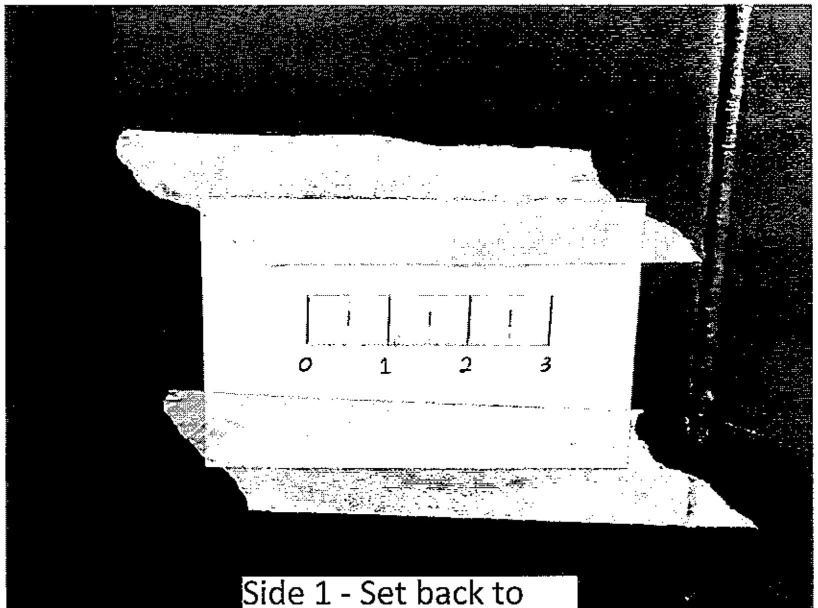


Side 1 - 6,000 lbs

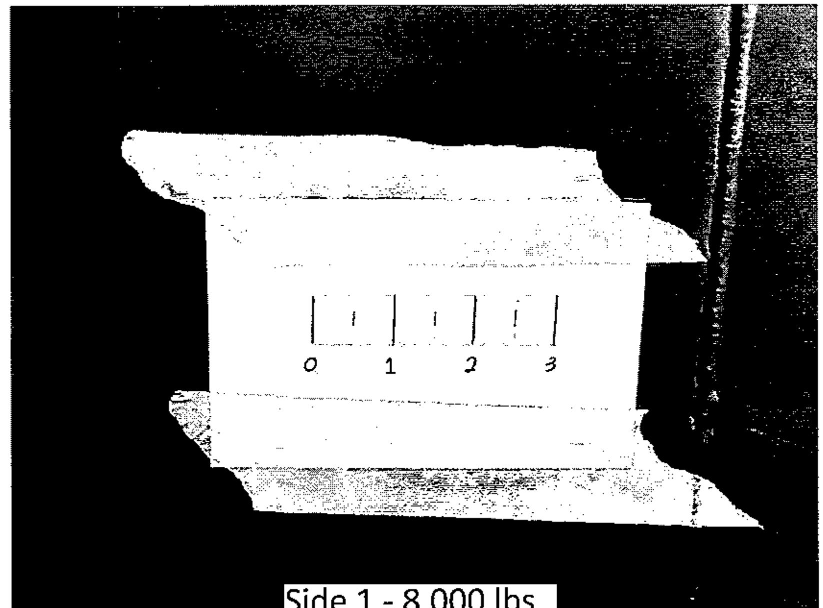


Side 1 - 7,000 lbs

45' Container Pull Test: Side 1 Data (Con'd)

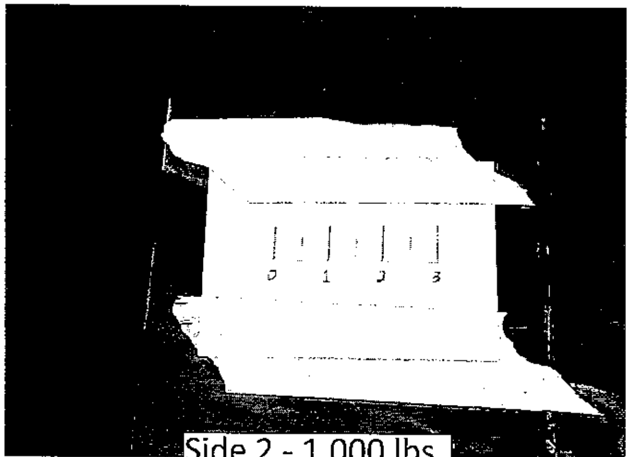


Side 1 - Set back to after 7,000 lbs

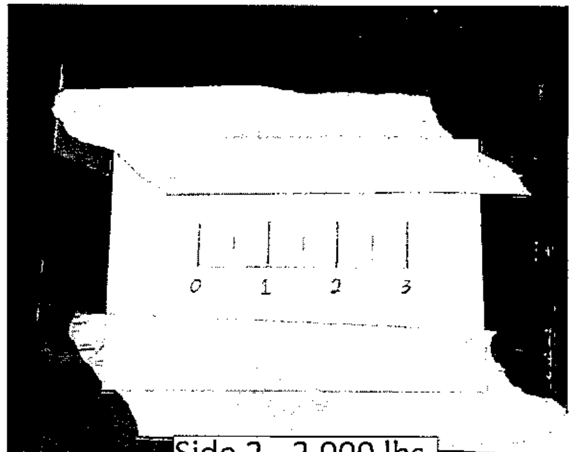


Side 1 - 8,000 lbs

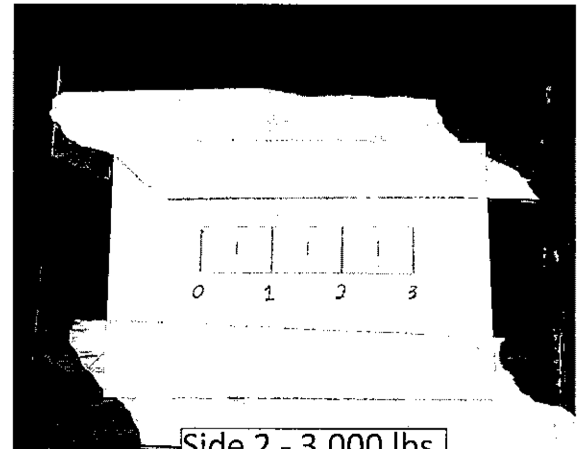
45' Container Pull Test: Side 2 Data



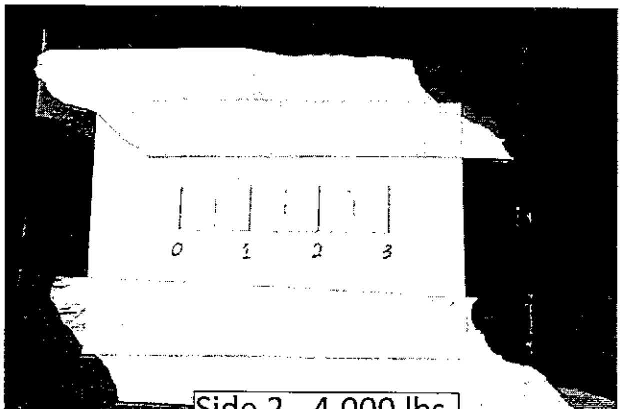
Side 2 - 1,000 lbs



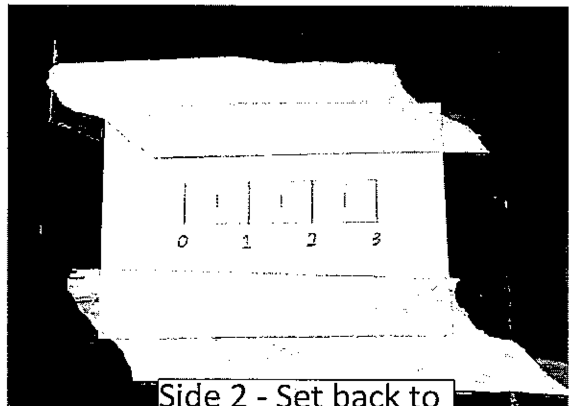
Side 2 - 2,000 lbs



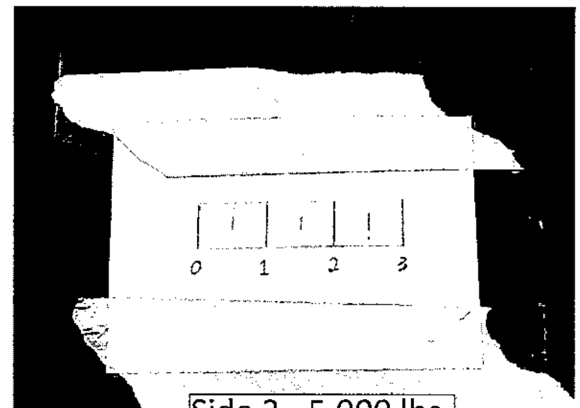
Side 2 - 3,000 lbs



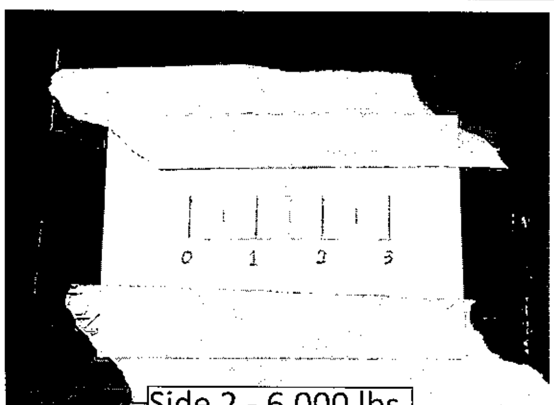
Side 2 - 4,000 lbs



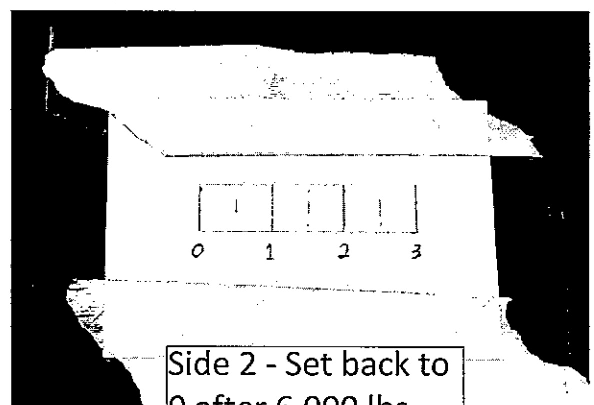
Side 2 - Set back to 0 after 4,000 lbs



Side 2 - 5,000 lbs



Side 2 - 6,000 lbs



Side 2 - Set back to 0 after 6,000 lbs

Structural Calculations
for
Nestucca River - Multifamily Foundation
34450 Brooten Rd
Pacific City, Oregon 97135
April 21, 2025

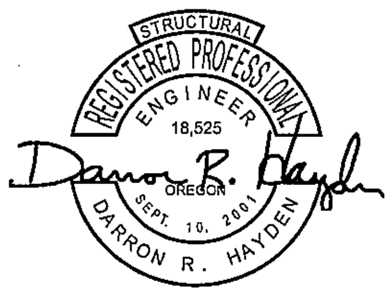
DESIGN CODE
2022 Oregon Structural Specialty Code

DESIGN LOADS

Seismic, S_{DS}	1.024 g
Wind, Exposure "C"	120 mph

CONTENTS

Gravity & Lateral Calculations



EXPIRES: 06/30/25

SCOPE OF WORK
The attached calculations pertain to gravity and lateral analysis of a pier/stilt foundation system in a riverine flood zone (AE) at the above address. This scope of work does not include any analysis of the containers above.

LATERAL LOADS

ASCE 7-22-S2

'Fa' is represented as 'H' in Enercalc pages

LRFD LOAD COMBOS

R=0

4b. $1.2D + 1.0W + 1.0F_a + 1.0L + (0.5L_r \text{ or } 0.3S \text{ or } \cancel{0.5R})$

5b. $0.9D + 0.5W + 1.0F_a$

ASD LOAD COMBOS

5b. $D + 0.6W + 0.7F_a$

R=0

6b. $D + 0.75L + 0.75(0.6W) + 0.75(L_r \text{ or } 0.7S \text{ or } \cancel{R}) + 0.7F_a$

7b. $0.6D + 0.6W + 0.7F_a$

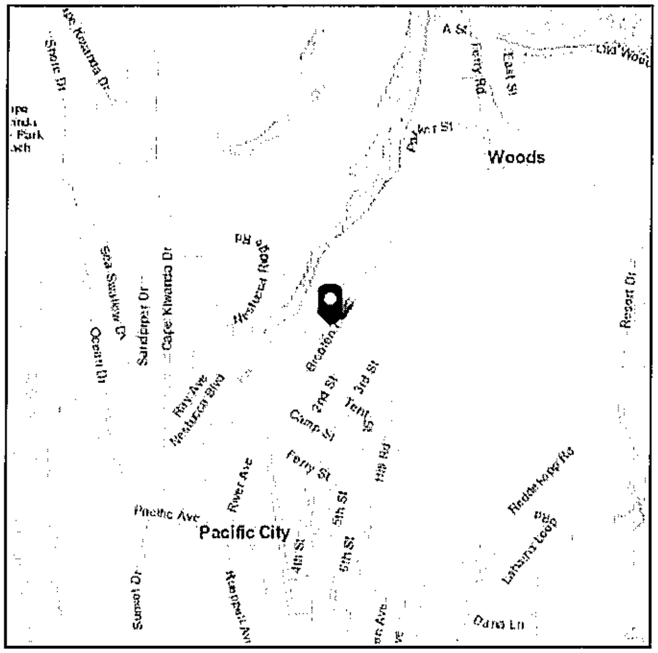
ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

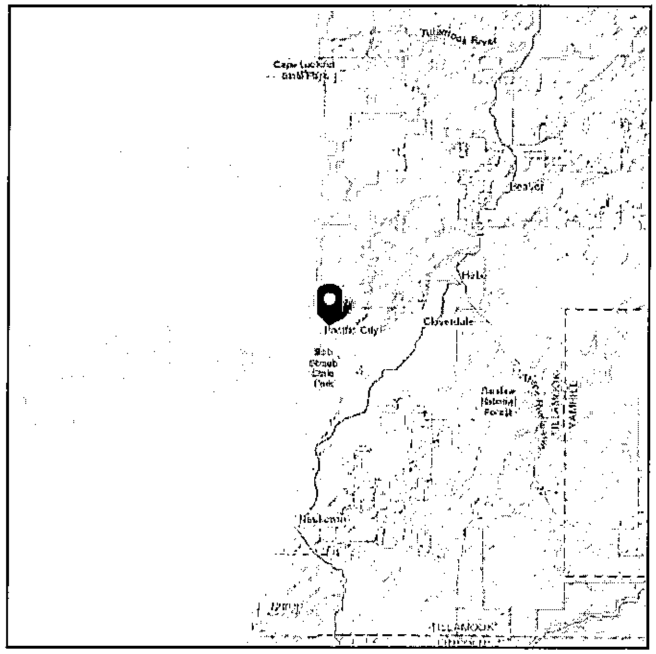
ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see Section 11.4.3)

Latitude: 45.207119
Longitude: -123.959825
Elevation: 11.80888589953788 ft (NAVD 88)





Wind

Results:

Wind Speed	95 Vmph
10-year MRI	65 Vmph
25-year MRI	71 Vmph
50-year MRI	75 Vmph
100-year MRI	81 Vmph
Special	Special Wind Region -- Mountainous terrain, gorges, and special wind regions shown in Fig. 26.5-1 shall be examined for unusual wind conditions. The Authority Having Jurisdiction shall, if necessary, adjust the values given in Fig. 26.5-1 to account for higher local wind speeds. Such adjustment shall be based on meteorological information and an estimate of the basic wind speed obtained in accordance with the provisions in Section 26.5.3.

← 120 mph in special wind region - Tillamook County

Data Source:	ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed:	Mon Nov 18 2024

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.28	S_{D1} :	N/A
S_1 :	0.667	T_L :	16
F_a :	1.2	PGA :	0.634
F_v :	N/A	PGA_M :	0.761
S_{MS} :	1.536	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.024	C_v :	1.356

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Mon Nov 18 2024

Date Source: USGS Seismic Design Maps

Seismic Base Shear Loading

Risk Category II

$$V = \frac{FS_{DS}}{R}$$ (ASCE 7-16 EQ. 12.14-12)

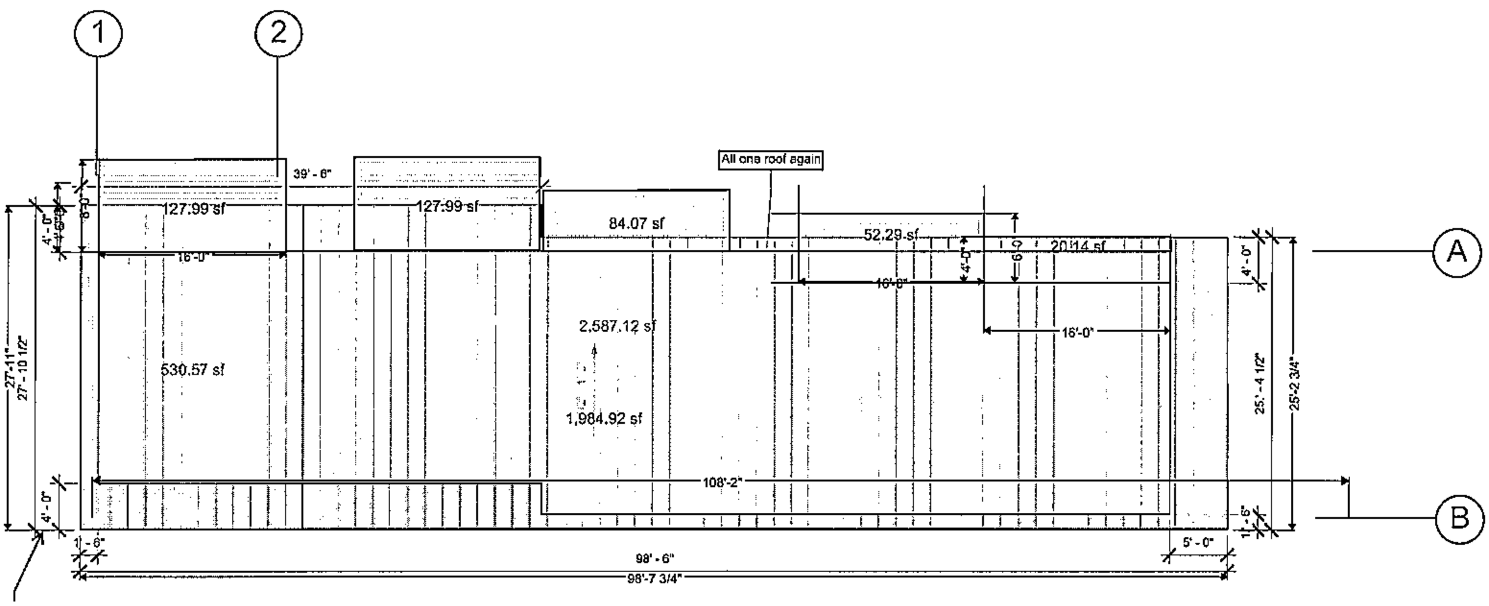
Stories	2		
F	1.1		(ASCE 7-16 § 12.14.8.1)
S_{DS}	1.024	g	(ASCE 7 Hazards Report)
R	2		(ASCE 7-16 Table 12.14-1)
V=	0.563	W	
(ASD) **V=**	**0.394**	**W**	(ASCE 7-16 § 2.4.5)

Wind Loading

Basic Design Wind Speed =	120	mph		(2022 OSSC Table 1609.3)
Exposure	C			

$p_s = \lambda K_{zt} p_{S30}$ (ASCE 7-16 EQ. 28.5-1)

Mean Roof Ht.	20	ft		
Roof Pitch	0.5	→	2 Degrees	
P_{S30} (wall)	22.9	psf		(ASCE 7-16 Fig. 28.5-1)
P_{S30} (roof)	11.9	psf		(ASCE 7-16 Fig. 28.5-1)
λ	1.29			(ASCE 7-16 Fig. 28.5-1)
K_{zt}	1.0			(ASCE 7-16 § 26.8.2)
p_s (wall) =	29.5	psf		
p_s (roof) =	15.4	psf		
(ASD) **p_s (wall) =**	**17.7**	**psf**		(ASCE 7-16 § 2.4.1)
(ASD) **p_s (roof) =**	**9.2**	**psf**		(ASCE 7-16 § 2.4.1)



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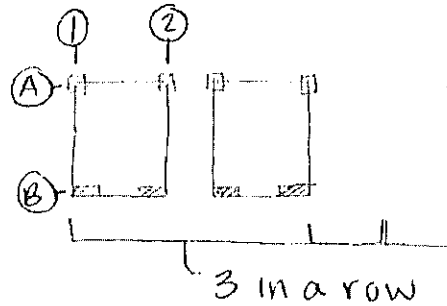
(503) 968-9994 Hayden-Engineers.com

Nestucca River - Multifamily Foundation

BY	KMN	DATE	11/15/24
REV		DATE	
JOB NO	24261		
SHEET	7	OF	170

Overall Building Lateral Loads (unfactored)



Wind

$p_{wall} = 29.5$ psf
$p_{roof} = 15.4$ psf → flat roof → use p_{wall} only

Siesmic

$V = 0.563\ W$
↳ wall 10 psf
roof 15 psf
floor 15 psf

Wind

Roof

$V_{AB} = 29.5\ psf \times \left(\frac{22'11''}{2} \times \frac{9'6''}{2}\right)$
$= 1606$ lb (Along whole length of building)
$= 965$ lb (ASD)

$V_{12} = 29.5\ psf \times \left(\frac{16'}{2} \times \frac{9'6''}{2}\right)$
$= 1121$ lb (Along each long side of each unit)
$= 673$ lb (ASD)

Floor

$V_{AB} = 29.5\ psf \left(\frac{22'11''}{2} \times 9'6''\right)$
$= 3212$ lb (Along whole length of building)
$= 1927$ lb (ASD)

$V_{12} = 29.5\ psf\ (16'/2 \times 9'6'')$
$= 2242$ lb (Along each long side of each unit)
$= 1346$ lb (ASD)

Wind Cont

Foundation

$V_{AB} = 1606\ lb$
$= 965\ lb\ (ASD)$

$V_{12} = 1121\ lb$
$= 673\ (ASD)$

Seismic

Roof

$V_{AB} = 0.563 \left(15\,psf \times \frac{2587}{2} sf + \frac{10\,psf}{2} \times \frac{1985}{2} sf\right)$

$= 13717$ lb (Along length of whole building)

$= 9602$ lb (ASD)

$V_{12} = 0.563 \left(15\,psf \times \frac{448}{2} sf + \frac{10\,psf}{2} \times 16' \times 20'/2\right)$

$= 2342$ lb (Along each long side of each unit)

$= 1640$ lb (ASD)

Floor

$V_A = 0.563 \left(25\,psf \times \frac{1985}{2} sf + 15\,psf \times 413\right)$

$= 17457$ lb

$= 12220$ lb (ASD) (Along length of whole building)

$V_B = 0.563 \left(25\,psf \times \frac{1985}{2} sf\right)$

$= 13970$ lb

$= 9779$ lb (ASD) (Along length of whole building)

$V_{12} = 0.563 \left(25\,psf \times 16' \times 20'/2 + 15\,psf \times 128\,sf\right)$

$= 3333$ lb

$= 2333$ lb (ASD)

(Along each long side of each unit)

Seismic Cont.

Foundation

$V_{AB} = 0.563 \left(20\,psf \times \frac{1985\ sf}{2} \right)$

$= 11176$ lb

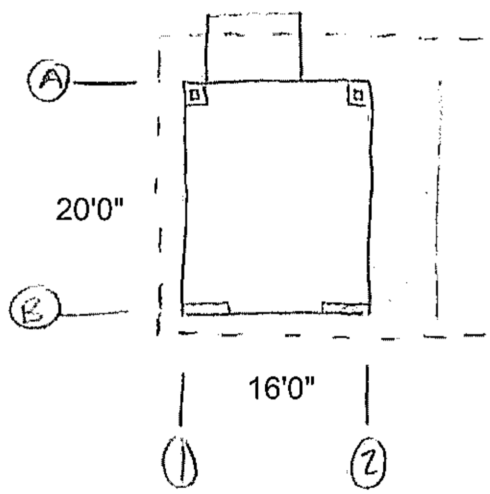
$= 7823$ lb (ASD) (full length of building)

$V_{12} = 0.563 \left(20\,psf \times 16' \times 20'/2 \right)$

$= 1802$ lb

$= 1261$ lb (ASD) (each sides of unit)

For One Unit



- (2) 24"x6" Conc Piers on Line B ← shear resisted by 10 piers in this direction
- Steel X-Brace on Lines A, 1, + 2 ← tension only brace resists shear by 5 braces in this direction

Siesmic

Roof

$V_B = \frac{9602 \text{ lb}}{10}$ (ASD)

$= 961$ lb ☆

$V_A = \frac{9602 \text{ lb}}{5}$ (ASD)

$= 1922$ lb ☆

$V_{12} = 1640$ lb (ASD) ☆

Floor

$V_B = \frac{12220 \text{ lb}}{10}$

$= 1234$ lb (ASD) ☆

$V_A = \frac{12220 \text{ lb}}{5}$

$= 2444$ lb (ASD)

$V_{12} = 2333$ lb (ASD) ☆

Wind

$V_B = 965 \text{ lb} / 12$

$= 81$ lb (ASD)

$V_A = 965 \text{ lb} / 6$

$= 161$ lb (ASD)

$V_{12} = 673$ lb (ASD)

$V_B = 161$ lb (ASD)

$V_A = 322$ lb (ASD)

$V_{12} = 1346$ lb (ASD)

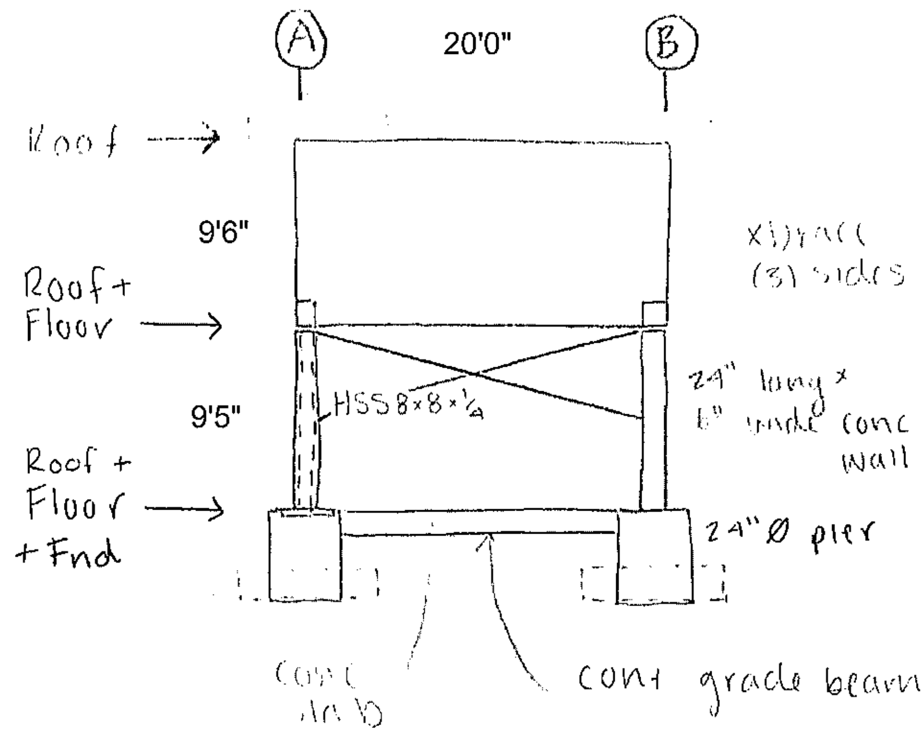
Seismic Cont.

Wind Cont

Foundation

Seismic	Wind
V_B = 783 lb (ASD) ☆	V_B = 81 lb (ASD)
V_A = 1565 lb (ASD) ☆	V_A = 162 lb (ASD)
V_{12} = 1261 lb (ASD) ☆	V_{12} = 673 lb (ASD)

Total lateral load



Seismic

@ Roof

V_B = 961 lb (ASD)
V_A = 1922 lb (ASD)
V_{12} = 1640 lb (ASD)

@ Floor

V_B = 2195 lb (ASD)
V_A = 4366 lb (ASD)
V_{12} = 3973 lb (ASD)

@ Foundation

V_B = 3939 lb (ASD)
V_A = 5931 lb (ASD)
V_{12} = 5234 lb (ASD)

Wind

@ Roof

V_B = 81 lb (ASD)
V_A = 161 lb (ASD)
V_{12} = 673 lb (ASD)

@ Floor

V_B = 242 lb (ASD)
V_A = 483 lb (ASD)
V_{12} = 2019 lb (ASD)

@ Foundation

V_B = 323 lb (ASD)
V_A = 645 lb (ASD)
V_{12} = 2692 lb (ASD)

Overturning Loads (Seismic)

AB direction

$$T/C = \left(V_{A\,\text{Roof}}^{\nearrow \text{OR } V_B} \times 9'6" + V_{A\,\text{Roof+Floor}}^{\nearrow \text{OR } V_B} \times 9'5" \right) / 16'$$

= 1863 lb OR 3694 lb (ASD)
Line B Line A ✱

= 2661 lb OR 5277 lb (unfactored)

LINE A GOVERNS
OVERTURNING
ANCHORAGE

12 direction

$$T/C = \left(V_{12\,\text{Roof}} \times 9'6" + V_{12\,\text{Roof+Floor}} \times 9'5" \right) / 20'$$

= 3313 lb (ASD)

= 4733 lb (unfactored)

Overturning loads (Wind) (same formulas as seismic)

AB direction

T/C = 191 lb (LINE B) OR 380 LB (LINE A) (ASD)

= 318 lb (LINE B) OR 634 LB (LINE A) (UNFACTORED)

* 12 direction

T/C = 1271 lb (ASD)

= 2118 lb (unfactored)

OT Seismic ASD
Ca = 3694 lb
Cb = 1863 lb
C12 = 3313 lb

OT Seismic Unfactored
Ca = 5277 lb
Cb = 2661 lb
C12 = 4733 lb

OT Wind ASD
Ca = 380 lb
Cb = 191 lb
C12 = 1271 lb

OT Wind Unfactored
Ca = 634 lb
Cb = 318 lb
C12 = 2118 lb

WIND LOAD - ASCE 7-16

120 mph, Exposure C, Mean Roof Height = 10.0 ft

K_{zt} at Base = 1

K_d = 0.85 , Roof Slope 0.0 degrees (0:12)

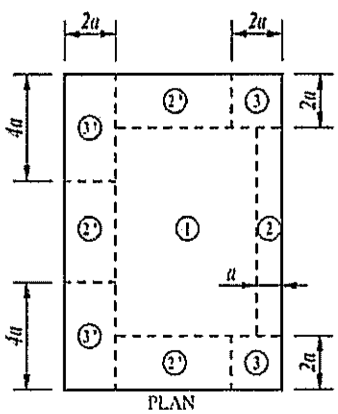
Partially Open Building, GC_{pi} = 0.18

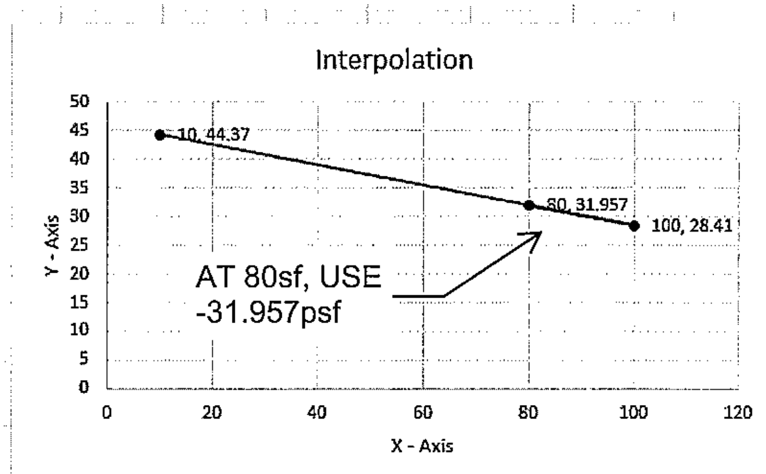
(Wind Loads Shown are for Alternate Basic Load Combinations Using Allowable Stress Design and are Multiplied by a Factor of 0.6 to convert to ASD)

ROOF COMPONENTS AND CLADDING - MONOSLOPE ROOF ASCE7-16 Figure 30.3-5A

K_h = 0.85; K_{zt} at roof = 1.00; K_e = 1.00; q_h = 26.60 psf

	Positive Pressure, p (psf)				Negative Pressure, p (psf)			
	A=10		A=100		A=10		A=100	
Zone	GC_p	p	GC_p	p	GC_p	p	GC_p	p
1	0.30	9.60	0.20	9.60	-1.10	-20.43	-1.10	-20.43
2	0.30	9.60	0.20	9.60	-1.30	-23.62	-1.20	-22.02
3	0.30	9.60	0.20	9.60	-1.80	-31.60	-1.20	-22.02
2'	0.30	9.60	0.20	9.60	-1.60	-28.41	-1.50	-26.81
3'	0.30	9.60	0.20	9.60	-2.60	-44.37	-1.60	-28.41





Afloor = 80sf

Dresisting = 20psf (roof, floor, wall)

Wup = -31.957psf x 80sf = -2557 lb

Net uplift = (-31.957psf + 0.6 x 16psf) x 80sf = -1789 lb

At posts and piers

FLOOD LOADS

Flood Loads (ASCE 7-22 Chapter 5)

Flood Information

Flood Zone: AE

Risk Category
II

V = **2.50** ft/s, design flood velocity

Still Water Depth

d_f = **0.65(BFE-G+E)** ft, design still water flood depth above grade

BFE =	18.42	ft, base flood elevation
G =	12	ft, ground elevation
E =	2	ft, eroded depth (assumed)

d_f = **5.5** ft, design still water flood depth

SWEL = **d_f + G** ft, design still water flood elevation above grade

SWEL = **17.5** ft, design still water flood elevation above grade

Hydrodynamic Surchage Depth (ASCE 7-22 § 5.4.3)

$$d_h = \frac{aV^2}{2g}$$ ft, equivalent surcharge depth above (ASCE 7-22 EQ. 5.4-1)

a =	1.25	coefficient of drag or shape factor (not less than 1.25)
g =	32.2	ft/s2, acceleration due to gravity
V =	2.50	ft/s, design flood velocity

d_h = **0.12** ft, equivalent surcharge depth above BFE
18.54 ft, equivalent surcharge elevation above BFE

Hydrodynamic Loads on 24" long x 8" wide concrete wall in strong direction

(ASCE 7-22 § 5.4.3)

Drag Force on Components due to Hydrodynamic Loads and Debris

$F_{drag} = 0.5\rho_w C_d V^2 h(b+C_{cx}s/2)$ lb (ASCE 7-22-S2 EQ. 5.4-4)

Freshwater	ρ_w =	1.94	lb s2/ft4, mass density of freshwater	
	C_d =	1.6	coefficient of drag for structural components	(ASCE 7-22-S2 Table 5.4-1)
	V =	2.50	ft/s, design flood velocity	
	h =	6.58	ft, submergered height of column/wall above foundation	
	b =	0.67	ft, width of column/wall perpendicular to direction of flow	
	C_{cx} =	0.70	debris damming closure ratio	(ASCE 7-22-S2 Table 5.3-1)
	s =	9.0	ft, average clear spacing of columns/walls	
	F_{drag} =	**244**	lb, at each corner, applied @ h/2	

Drag Force on Lateral Force Resisting System

$F_{drag} = 0.5\rho_w C_d V^2 B d_f$ lb (ASCE 7-22-S2 EQ. 5.4-5)

ρ_w =	1.94	lb s2/ft4, mass density of freshwater	
C_d =	1.25	coefficient of drag for rectilinear buildings and structures	(ASCE 7-22-S2 Table 5.4-2)
V =	2.50	ft/s, design flood velocity	
B =	0.67	ft, overall building width perpendicular to flow direction	BFE will not go up to the walls of the home, so B = width concrete pier
d_f =	5.5	ft, design still water flood depth	
F_{drag} =	**28**	lb	

Total Drag per Column/Wall

$F_{dragTOT}$ = **272** lb, at each corner, applied @ h/2

Flood Loads Cont. (ASCE 7-22 Chapter 5)

Hydrodynamic Loads on 24" long x 8" wide concrete wall in weak direction

(ASCE 7-22 § 5.4.3)

~~Drag Force on Components due to Hydrodynamic Loads and Debris~~

River flow perpendicular to wall in weak direction = No drag force due to hydrodynamic loads and debris

Drag Force on Lateral Force Resisting System

$F_{drag} = \mathbf{0.5\rho_w C_d V^2 B d_f}$ lb (ASCE 7-22-S2 EQ. 5.4-5)

ρ_w =	1.94	lb s2/ft4, mass density of freshwater	
C_d =	1.25	coefficient of drag for rectilinear buildings and structures	(ASCE 7-22-S2 Table 5.4-2)
V =	2.50	ft/s, design flood velocity	
B =	2	ft, overall building width perpendicular to flow direction	BFE will not go up to the walls of the home, so B = length concrete pier
d_f =	5.5	ft, design still water flood depth	
F_{drag} =	**83**	lb, at each corner, applied @ h/2	

Flood Loads Cont. (ASCE 7-22 Chapter 5)

Hydrodynamic Loads on HSS8x8 (ASCE 7-22 § 5.4.3)

Drag Force on Components due to Hydrodynamic Loads and Debris

$$F_{drag} = 0.5\rho_w C_d V^2 h(b+C_{cx}s/2) \quad \text{lb}$$ (ASCE 7-22-S2 EQ. 5.4-4)

Freshwater	ρ_w =	1.94	lb s2/ft4, mass density of freshwater	
	C_d =	2	coefficient of drag for structural components	(ASCE 7-22-S2 Table 5.4-1)
	V =	2.50	ft/s, design flood velocity	
	h =	6.58	ft, submergered height of column/wall above foundation	
	b =	0.67	ft, width of column/wall perpendicular to direction of flow	
	C_{cx} =	0.70	debris damming closure ratio	(ASCE 7-22-S2 Table 5.3-1)
	s =	9.0	ft, average clear spacing of columns/walls	
	F_{drag} =	**304**	lb, at each corner, applied @ h/2	

Drag Force on Lateral Force Resisting System

$$F_{drag} = 0.5\rho_w C_d V^2 B d_f \quad \text{lb}$$ (ASCE 7-22-S2 EQ. 5.4-5)

ρ_w =	1.94	lb s2/ft4, mass density of freshwater	
C_d =	1.25	coefficient of drag for rectilinear buildings and structures	(ASCE 7-22-S2 Table 5.4-2)
V =	2.50	ft/s, design flood velocity	
B =	0.67	ft, overall building width perpendicular to flow direction	BFE will not go up to the walls of the home, so B = width of HSS column
d_f =	5.5	ft, design still water flood depth	
F_{drag} =	**28**	lb	

Total Drag per Column/Wall

$F_{dragTOT}$ = **332** lb, at each corner, applied @ h/2

Flood Loads Cont. (ASCE 7-22 Chapter 5)

Debris Impact Load (ASCE 7-22 § 5.4.5)

$$F_I = \frac{\pi W V C_I C_O C_D C_B R_{MAX}}{2g\Delta t}$$ lb, impact force applied at df (ASCE 7-22 EQ. C5.4-3)

$W =$	1000	lb, debris weight (1000lb typical)	
$V =$	2.50	ft/s, design flood velocity	
$C_I =$	1	importance coefficient	(ASCE 7-22 Table C5.4-1)
$C_O =$	0.8	orientation coefficient (0.8 typical)	
$C_D =$	1	depth coefficient	(ASCE 7-22 Table C5.4-2, Fig. C5.4-1)
$C_B =$	1	blockage coefficient	(ASCE 7-22 Table C5.4-3, Fig. C5.4-2)
$R_{MAX} =$	0.6	maximum response ratio for impulsive load	(ASCE 7-22 Table C5.4-4)
$g =$	32.2	ft/s2, acceleration due to gravity	
$\Delta t =$	0.03	s, impact duration (0.03s typical)	
$F_I =$	**1951**	lb, impact force applied at d_f	

Flood Loads Cont. (ASCE 7-22 Chapter 5)

Scour (ASCE 7-22-S2 § 5.3.8)

At Vertical Piles and Columns

S_m =	**2D**	ft, scour depth below eroded grade	(ASCE 7-22-S2 EQ. 5.3-13)
D =	2	ft, pile or column diameter	
S_m =	**4.00**	ft, scour depth below eroded grade	
	6.00	ft, scour elevation below eroded grade	

FOUNDATION DESIGN

Overall Footing Loads

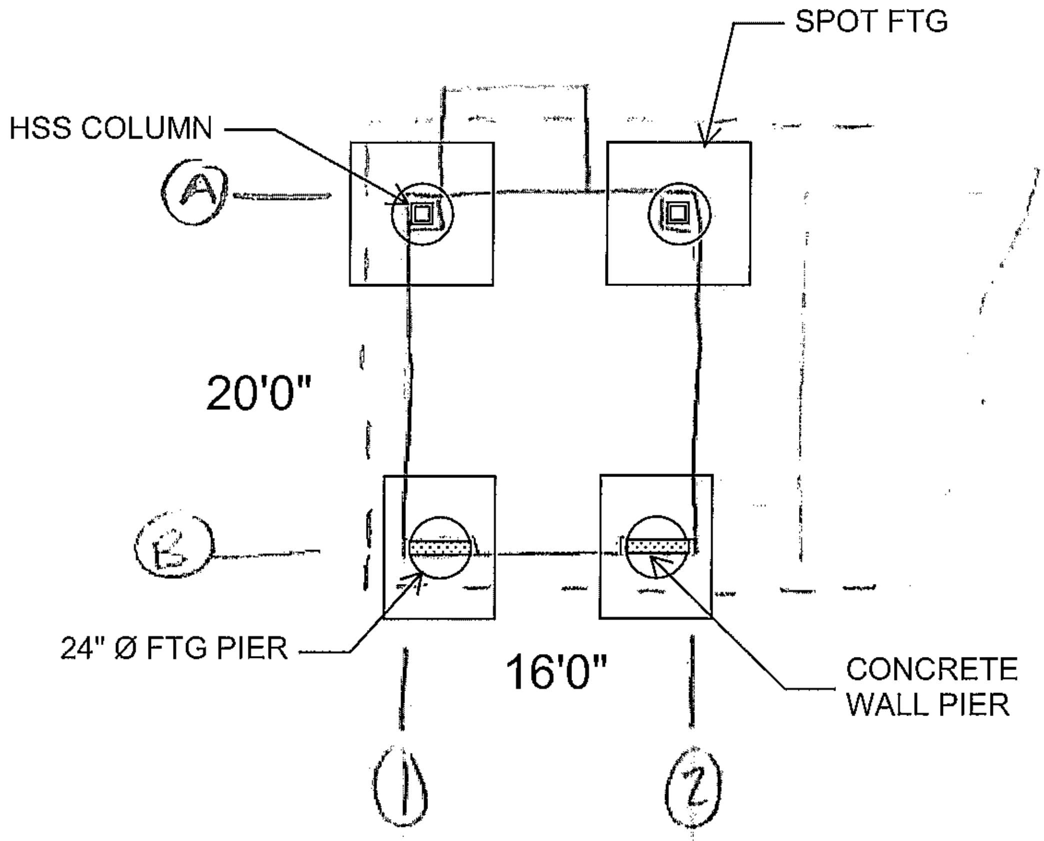
	Grids	Down	Up		
1	A1	13928	3296	lb (ASD)	siesmic in A direction governs
	A2			lb (ASD)	
2	B1	8798	5829	lb (ASD)	siesmic in 12 direction governs
	B2			lb (ASD)	

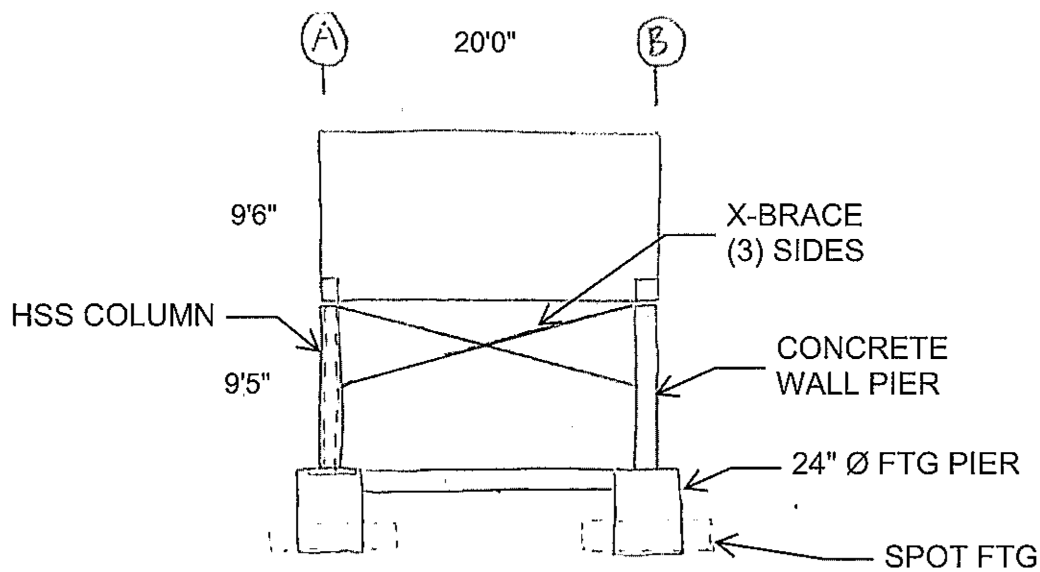
	CF	Down	Up		
4	1	23400	6591	lb (ASD)	siesmic in A direction governs
	2			lb (ASD)	
3	3	14085		lb (ASD)	siesmic in 12 direction governs
	4			lb (ASD)	

D (ftg pier +spot ftg) 11112 lb

D (ftg pier +spot ftg) 6667.2 lb (ASD) > Up load of any footing

Therefore, no net uplift on footings


SPOT FTG
HSS COLUMN
A
20'0"
B
24" Ø FTG PIER
16'0"
CONCRETE
WALL PIER
1
2


A
20'0"
B
9'6"
X-BRACE
(3) SIDES
HSS COLUMN
9'5"
CONCRETE
WALL PIER
24" Ø FTG PIER
SPOT FTG

Gravity Loads to Posts/Footings

D =	15	psf, roof
D =	15	psf, floor / deck
L =	40	psf, floor
L =	60	psf, deck
S =	25	psf, roof
S =	10	psf, deck

CF-1	Atrib (sf)			HSS 1 & 2	
	roof	floor	deck		
	112	80	64		
D	1680	1200	960	**3840**	
L		3200	3840	**7040**	
S	2800		640	**3440**	
ASD	D + 0.75(L+S)			**11700**	lb

CF-2	Atrib (sf)			HSS 1	
	roof	floor	deck		
	112	80	32		
D	1680	1200	480	**3360**	
L		3200	1920	**5120**	
S	2800		320	**3120**	
ASD	D + 0.75(L+S)			**9540**	lb

Atrib (sf)			HSS 2	
roof	floor	deck		
112	80	48		
1680	1200	720	**3600**	
	3200	2880	**6080**	
2800		480	**3280**	
D + 0.75(L+S)			**10620**	lb

CF-3	Atrib (sf)		HSS 1	
	roof	floor		
	112	80		
D	1680	1200	**2880**	
L		3200	**3200**	
S	2800		**2800**	
ASD	D + 0.75(L+S)		**7380**	lb

Atrib (sf)		HSS 2	
roof	floor		
92	80		
1380	1200	**2580**	
	3200	**3200**	
2300		**2300**	
D + 0.75(L+S)		**6705**	lb

CF-4	Atrib (sf)		HSS 1 & 2	
	roof	floor		
	92	80		
D	1380	1200	**2580**	
L		3200	**3200**	
S	2300		**2300**	
ASD	D + 0.75(L+S)		**6705**	lb

Gravity Loads to Posts/Footings

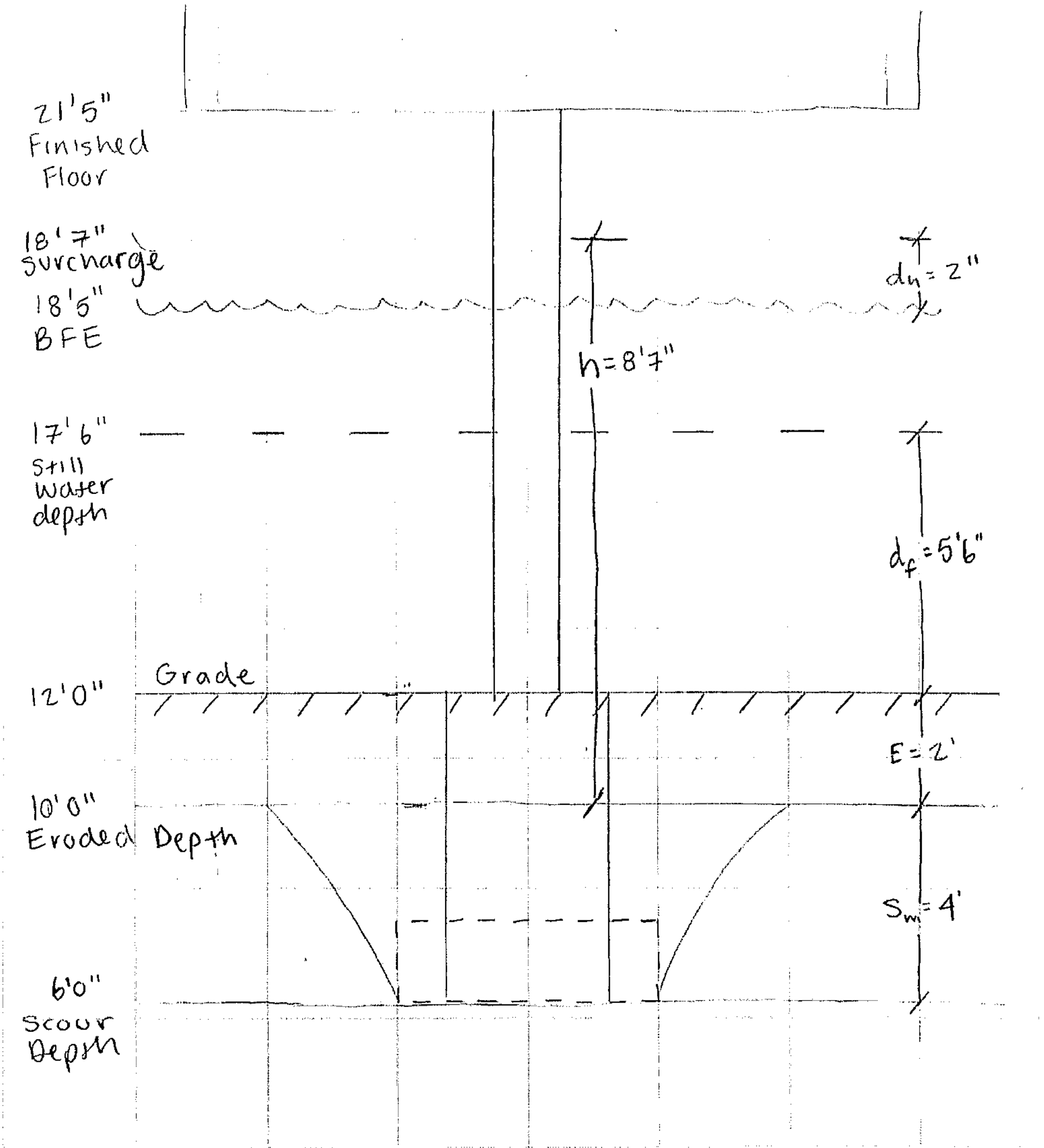
D =	15	psf, roof
D =	15	psf, floor / deck
L =	40	psf, floor
L =	60	psf, deck
S =	25	psf, roof
S =	10	psf, deck

UNIT 5 GL 2A	Atrib (sf)				
	roof	floor	deck		
	182	80	62		
D	2730	1200	930	**4860**	
L		3200	3720	**6920**	
S	4550		620	**5170**	
ASD	D + 0.75(L+S)			**13927.5**	lb

Pmax used for FTG

UNIT 1 GL 2B	Atrib (sf)			
	roof	floor		
	154	80		
D	2310	1200	**3510**	
L		3200	**3200**	
S	3850		**3850**	
ASD	D + 0.75(L+S)		**8797.5**	lb

Part 1:
Loads to HSS and Concrete Wall Piers



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Taylor/Nestucca River - Foundation

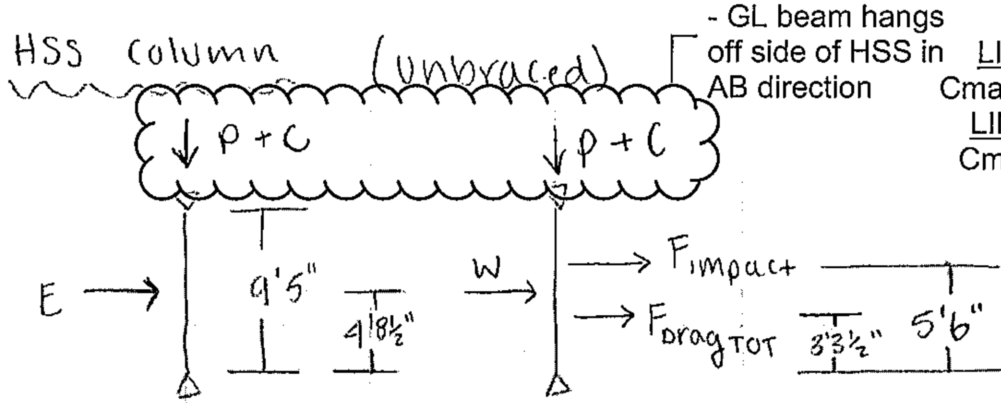
BY KMN DATE 11/13/24
REV ____ DATE ____
JOB NO 24261
SHEET 31 OF 170

Loads on HSS + Concrete Walls

Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb

with 4" eccentricity
- GL beam hangs
off side of HSS in
AB direction

LINE A (unfactored)
Cmax = 5277 lb (seismic)
LINE 12 (unfactored)
Cmax = 2118 lb (wind)



seismic

Wind + Flood

E_{MAX} = 9900 lb (Adjusted + Unfactored)

conservative loading

W = 2019 lb (asd) 3365 lb (unfactored)
(floor V12 direction)
W = 483 lb (asd) 805 lb (unfactored)
(floor VA direction)

F_{impact} = 1951 lb

$F_{dragTOT}$ = 332 lb

Use HSS 8x8x¼

Reactions

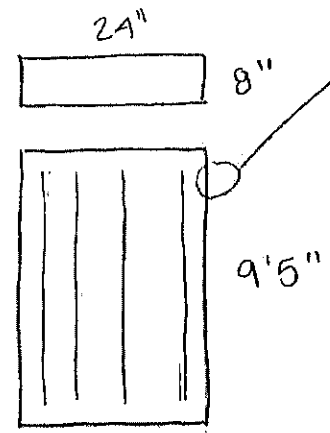
AB direction		12 direction	
Vmax @ bottom	@ top	Vmax @ bottom	@ top
D = 172 lb	D = 172 lb	D = 43 lb	D = 43 lb
L = 245 lb	L = 245 lb	L = 61 lb	L = 61 lb
S = 183 lb	S = 183 lb	S = 46 lb	S = 46 lb
W = 477 lb	W = 328 lb	W = 1701 lb	W = 1664 lb
E = 5126 lb	E = 4774 lb	E = 4986 lb	E = 4914 lb
F = 1028 lb	F = 1255 lb	F = 1028 lb	F = 1255 lb

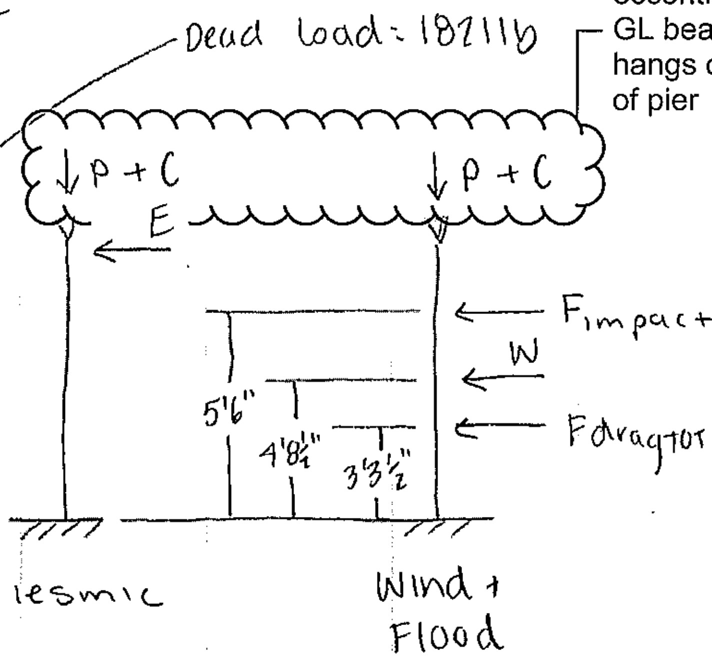
Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb

LINE B (unfactored)
Cmax = 2661 lb (seismic)
LINE 12 (unfactored)
Cmax = 2118 lb (wind)

Concrete Wall - Strong

with 12" eccentricity - GL beam hangs off side of pier





Use 24" wide x 8" thick wall w/ (8) #5 verts eq spaced

E = 2195 lb (asd)
3136 lb (unfactored)
Vb @ floor

242 lb (asd)
W = 404 lb (unfactored)
V_B @ Floor

F_{impact} = 1951 lb

in strong direction → $F_{dragtor}$ = 272 lb

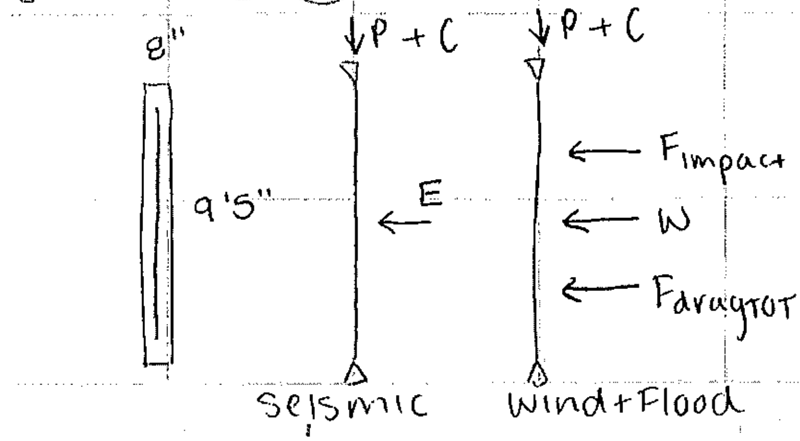
Reactions
AB direction

Vmax @ bottom	@ top	Mmax @ bottom
D = 774 lb	D = 774 lb	D = 2430 ft lb
L = 1102 lb	L = 1102 lb	L = 3460 ft lb
S = 823 lb	S = 823 lb	S = 2585 ft lb
W = 615 lb	W = 211 lb	W = 1773 ft lb
E = 424 lb	E = 424 lb	E = 1330 ft lb
F = 1376 lb	F = 847 lb	F = 3642 lb

Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb

LINE B (unfactored)
Cmax = 2661 lb (seismic)
LINE 12 (unfactored)
Cmax = 2118 lb (wind)

Concrete Wall-Weak (same dimensions as strong direction)



E = 9900 lb Adjusted (unfactored)

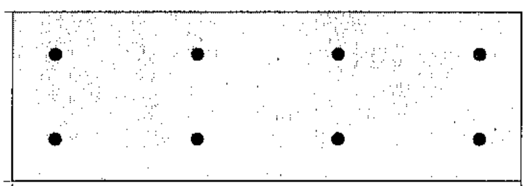
W = 3365 lb (unfactored) V_{12} @ Floor

F_{impact} = 1951 lb

$F_{dragtot}$ = 83 lb

in weak direction

NOTE: shear ties not required per ACI 318-19 Table 9.6.3.1
h (beam depth) <= 10"



Reactions

12 direction

Vmax @ bottom	@ top
D = 43 lb	D = 43 lb
L = 61 lb	L = 61 lb
S = 46 lb	S = 46 lb
W = 1701 lb	W = 1664 lb
E = 4974 lb	E = 4926 lb
F = 866 lb	F = 1168 lb

Steel Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: HSS Column - Seismic w/ eccentricity

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name :	HSS8x8x1/4	Overall Column Height	9.420 ft
Analysis Method :	Allowable Strength	Top & Bottom Fixity	Top & Bottom Pinned
Steel Stress Grade		Brace condition :	
Fy : Steel Yield	36.0 ksi	Unbraced Length for buckling ABOUT X-X Axis = 9.420 ft, K = 1.0	
E : Elastic Bending Modulus	29,000.0 ksi	Unbraced Length for buckling ABOUT Y-Y Axis = 9.420 ft, K = 1.0	

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 242.960 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.420 ft, Xecc = -4.0 in, Yecc = -1.0 in, D = 4.860, L = 6.920, S = 5.170, E = 5.277 k
BENDING LOADS . . .
Lat. Point Load at 4.720 ft creating Mx-x, E = 9.90 k
Lat. Point Load at 4.720 ft creating My-y, E = 9.90 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	**0.9617** : 1	
Load Combination	+D+0.70E	
Location of max.above base	4.742	ft
At maximum location values are . . .		
Pa : Axial	8.797	k
Pn / Omega : Allowabl	143.022	k
Ma-x : Applied	16.604	k-ft
Mn-x / Omega : Allowable	36.826	k-ft
Ma-y : Applied	17.680	k-ft
Mn-y / Omega : Allowable	36.826	k-ft
PASS Maximum Shear Stress Rati	**0.08545** : 1	
Load Combination	+D+0.70E	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Va : Applied	3.760	k
Vn / Omega : Allowable	44.005	k

Maximum Load Reactions . .

Top along X-X	4.774 k
Bottom along X-X	5.126 k
Top along Y-Y	4.914 k
Bottom along Y-Y	4.986 k

Maximum Load Deflections . . .

Along Y-Y 0.1488 in at 4.742ft above base
for load combination : E Only

Along X-X 0.1551 in at 4.805ft above base
for load combination : E Only

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.073	PASS	9.42 ft	1.31	1.28	35.89	35.89	0.004	PASS	0.00 ft
+D+S	0.149	PASS	9.42 ft	1.31	1.28	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L	0.150	PASS	9.42 ft	1.31	1.28	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L+0.750S	0.207	PASS	9.42 ft	1.31	1.28	35.89	35.89	0.011	PASS	0.00 ft
+0.60D	0.044	PASS	9.42 ft	1.31	1.28	35.89	35.89	0.002	PASS	0.00 ft
+D+0.70E	0.962	PASS	4.74 ft	1.31	1.28	35.89	35.89	0.085	PASS	0.00 ft
+D+0.750L+0.750S+0.525	0.816	PASS	4.74 ft	1.31	1.28	35.89	35.89	0.072	PASS	0.00 ft
+0.60D+0.70E	0.944	PASS	4.74 ft	1.31	1.28	35.89	35.89	0.084	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
+D+L	12.023	-0.417	-0.417	0.104	-0.104				
D Only	5.103	-0.172	-0.172	0.043	-0.043				
+D+S	10.273	-0.355	-0.355	0.089	-0.089				
+D+0.750L	10.293	-0.356	-0.356	0.089	-0.089				
+D+0.750L+0.750S	14.170	-0.493	-0.493	0.123	-0.123				

Steel Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: HSS Column - Seismic w/ eccentricity

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
+D+0.750L+0.5250S	13.007	-0.452	-0.452	0.113	-0.113				
+0.60D	3.062	-0.103	-0.103	0.026	-0.026				
+D+0.70E	8.797	-3.760	3.170	3.533	3.397				
+D+0.750L+0.750S+0.5250E	16.941	-3.184	2.013	2.741	2.457				
+0.60D+0.70E	6.756	-3.692	3.238	3.516	3.414				
L Only	6.920	-0.245	-0.245	0.061	-0.061				
S Only	5.170	-0.183	-0.183	0.046	-0.046				
E Only	5.277	-5.126	4.774	4.986	4.914				

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
Axial @ Base	Maximum	16.941	-3.184	2.013	2.741	2.457		1.391		5.566
"	Minimum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
Reaction, X-X Axis Base	Maximum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
"	Minimum	5.277	-5.126	4.774	4.986	4.914		0.440		1.759
Reaction, Y-Y Axis Base	Maximum	5.277	-5.126	4.774	4.986	4.914		0.440		1.759
"	Minimum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
Reaction, X-X Axis Top	Maximum	5.277	-5.126	4.774	4.986	4.914		0.440		1.759
"	Minimum	14.170	-0.493	-0.493	0.123	-0.123		1.161		4.642
Reaction, Y-Y Axis Top	Maximum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
"	Minimum	5.277	-5.126	4.774	4.986	4.914		0.440		1.759
Moment, X-X Axis Base	Maximum	12.023		-0.417	0.104	-0.104		0.982		3.927
"	Minimum	12.023		-0.417	0.104	-0.104		0.982		3.927
Moment, Y-Y Axis Base	Maximum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
"	Minimum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
Moment, X-X Axis Top	Maximum	16.941	-3.184	2.013	2.741	2.457		1.391		5.566
"	Minimum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
Moment, Y-Y Axis Top	Maximum	16.941	-3.184	2.013	2.741	2.457		1.391		5.566
"	Minimum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0078 in	5.500 ft	0.002 in	5.500 ft
+D+L	0.0190 in	5.500 ft	0.005 in	5.500 ft
+D+S	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L+0.750S	0.0225 in	5.500 ft	0.006 in	5.500 ft
+D+0.750L+0.5250S	0.0206 in	5.500 ft	0.005 in	5.500 ft
+0.60D	0.0047 in	5.500 ft	0.001 in	5.500 ft
+D+0.70E	0.1162 in	4.805 ft	0.106 in	4.742 ft
+D+0.750L+0.750S+0.5250E	0.1034 in	4.868 ft	0.084 in	4.805 ft
+0.60D+0.70E	0.1131 in	4.805 ft	0.105 in	4.742 ft
L Only	0.0112 in	5.500 ft	0.003 in	5.500 ft
S Only	0.0083 in	5.500 ft	0.002 in	5.500 ft
E Only	0.1551 in	4.805 ft	0.149 in	4.742 ft

Steel Section Properties : HSS8x8x1/4

Steel Section Properties : HSS8x8x1/4

HAYDEN ENGINEERS
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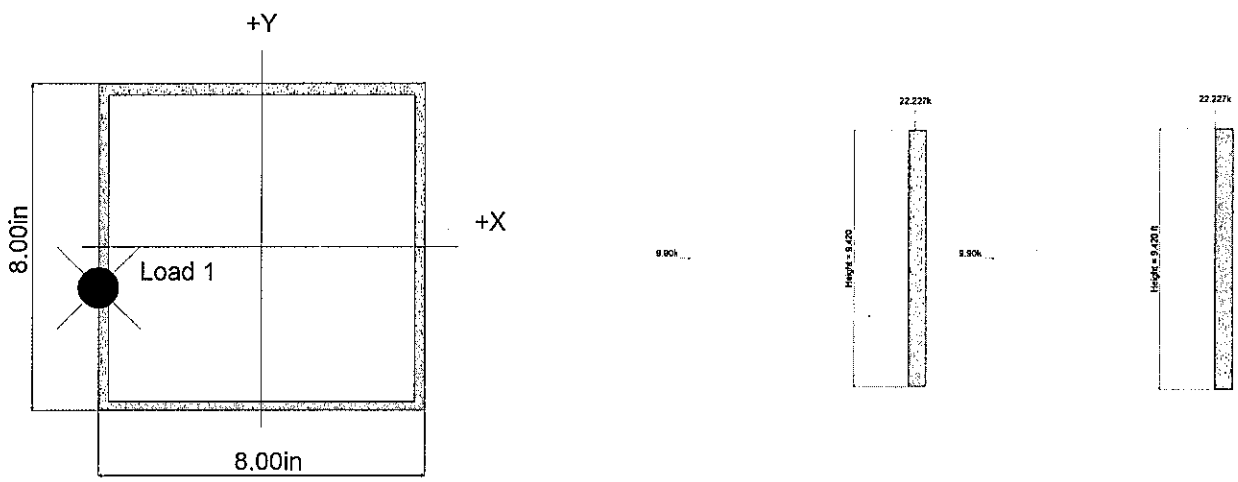
Steel Column

DESCRIPTION: HSS Column - Seismic w/ eccentricity

Depth	=	8.000 in	I xx	=	70.70 in^4	J	=	111.000 in^4
Design Thick	=	0.233 in	S xx	=	17.70 in^3			
Width	=	8.000 in	R xx	=	3.150 in			
Wall Thick	=	0.250 in	Zx	=	20.500 in^3			
Area	=	7.100 in^2	I yy	=	70.700 in^4	C	=	28.100 in^3
Weight	=	25.792 plf	S yy	=	17.700 in^3			
			R yy	=	3.150 in			
Ycg	=	0.000 in						

Sketches



HAYDEN ENGINEERS STRUCTURAL | CIVIL

Steel Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: HSS Column - Wind + Flood both direction

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS8x8x1/4**

Analysis Method :	Allowable Strength	Overall Column Height	9.420 ft
Steel Stress Grade		Top & Bottom Fixity	Top & Bottom Pinned
Fy : Steel Yield	36.0 ksi	Brace condition :	
E : Elastic Bending Modulus	29,000.0 ksi		

Unbraced Length for buckling ABOUT X-X Axis = 9.420 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 9.420 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 242.960 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.420 ft, Xecc = -4.0 in, Yecc = -1.0 in, D = 4.860, L = 6.920, S = 5.170, W = 2.118 k
BENDING LOADS . . .
Lat. Point Load at 4.710 ft creating Mx-x, W = 3.365 k
Lat. Point Load at 5.50 ft creating Mx-x, H = 1.951 k
Lat. Point Load at 3.290 ft creating Mx-x, H = 0.3320 k
Lat. Point Load at 4.710 ft creating My-y, W = 0.8050 k
Lat. Point Load at 5.50 ft creating My-y, H = 1.951 k
Lat. Point Load at 3.290 ft creating My-y, H = 0.3320 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	**0.3989**	: 1
	Load Combination	+D+0.750L+0.450W+0.70H	
	Location of max.above base	5.50	ft
	At maximum location values are . . .		
	Pa : Axial	11.246	k
	Pn / Omega : Allowabl	143.022	k
	Ma-x : Applied	6.947	k-ft
	Mn-x / Omega : Allowable	36.826	k-ft
	Ma-y : Applied	6.295	k-ft
	Mn-y / Omega : Allowable	36.826	k-ft
PASS	Maximum Shear Stress Rati	**0.04206**	: 1
	Load Combination	+0.60D+0.60W+0.70H	
	Location of max.above base	5.50	ft
	At maximum location values are . . .		
	Va : Applied	1.851	k
	Vn / Omega : Allowable	44.005	k

Maximum Load Reactions . .

Top along X-X	1.255 k
Bottom along X-X	1.386 k
Top along Y-Y	1.851 k
Bottom along Y-Y	1.783 k

Maximum Load Deflections . . .

Along Y-Y 0.05482 in at 4.805 ft above base
for load combination : +D+0.60W+0.70H

Along X-X 0.04974 in at 5.121 ft above base
for load combination : +D+0.750L+0.5250S+0.450W+0.70H

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.073	PASS	9.42 ft	1.27	1.24	35.89	35.89	0.004	PASS	0.00 ft
+D+S	0.149	PASS	9.42 ft	1.27	1.24	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L	0.150	PASS	9.42 ft	1.27	1.24	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L+0.750S	0.207	PASS	9.42 ft	1.27	1.24	35.89	35.89	0.011	PASS	0.00 ft
+D+0.60W	0.216	PASS	4.74 ft	1.27	1.24	35.89	35.89	0.024	PASS	0.00 ft
+D+0.750L+0.450W	0.221	PASS	4.74 ft	1.27	1.24	35.89	35.89	0.019	PASS	0.00 ft
+0.60D+0.60W	0.198	PASS	4.74 ft	1.27	1.24	35.89	35.89	0.024	PASS	0.00 ft
+0.60D	0.044	PASS	9.42 ft	1.27	1.24	35.89	35.89	0.002	PASS	0.00 ft
+D+0.60W+0.70H	0.383	PASS	4.74 ft	1.27	1.24	35.89	35.89	0.042	PASS	5.50 ft
+0.60D+0.60W+0.70H	0.365	PASS	4.74 ft	1.27	1.24	35.89	35.89	0.042	PASS	5.50 ft
+D+0.750L+0.450W+0.70I	0.399	PASS	5.50 ft	1.27	1.24	35.89	35.89	0.036	PASS	0.00 ft

HAYDEN ENGINEERS

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Steel Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: HSS Column - Wind + Flood both direction

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
+D+L	12.023	-0.417	-0.417	0.104	-0.104				
D Only	5.103	-0.172	-0.172	0.043	-0.043				
+D+S	10.273	-0.355	-0.355	0.089	-0.089				
+D+0.750L	10.293	-0.356	-0.356	0.089	-0.089				
+D+0.750L+0.750S	14.170	-0.493	-0.493	0.123	-0.123				
+D+0.60W	6.374	-0.458	0.025	1.064	0.955				
+D+0.60W+0.70H	6.374	-1.178	0.903	1.783	1.834				
+D+0.750L+0.450W+0.70H	11.246	-1.290	0.670	1.574	1.538				
+D+0.750L+0.5250S+0.450W+0.70H	13.960	-1.386	0.574	1.598	1.514				
+0.60D+0.60W+0.70H	4.333	-1.109	0.972	1.766	1.851				
+D+0.750L+0.450W	11.246	-0.570	-0.208	0.854	0.660				
+D+0.750L+0.750S+0.450W	15.124	-0.708	-0.345	0.889	0.625				
+0.60D+0.60W	4.333	-0.390	0.093	1.047	0.972				
+0.60D	3.062	-0.103	-0.103	0.026	-0.026				
L Only	6.920	-0.245	-0.245	0.061	-0.061				
S Only	5.170	-0.183	-0.183	0.046	-0.046				
W Only	2.118	-0.477	0.328	1.701	1.664				
H Only		-1.028	1.255	1.028	1.255				

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
Axial @ Base	Maximum	15.124	-0.708	-0.345	0.889	0.625		1.240		4.960
"	Minimum		-1.028	1.255	1.028	1.255				
Reaction, X-X Axis Base	Maximum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
"	Minimum	13.960	-1.386	0.574	1.598	1.514		1.143		4.572
Reaction, Y-Y Axis Base	Maximum	6.374	-1.178	0.903	1.783	1.834		0.511		2.044
"	Minimum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
Reaction, X-X Axis Top	Maximum		-1.028	1.255	1.028	1.255				
"	Minimum	14.170	-0.493	-0.493	0.123	-0.123		1.161		4.642
Reaction, Y-Y Axis Top	Maximum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
"	Minimum		-1.028	1.255	1.028	1.255				
Moment, X-X Axis Base	Maximum	12.023		-0.417	0.104	-0.104		0.982		3.927
"	Minimum	12.023		-0.417	0.104	-0.104		0.982		3.927
Moment, Y-Y Axis Base	Maximum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
"	Minimum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
Moment, X-X Axis Top	Maximum	15.124	-0.708	-0.345	0.889	0.625		1.240		4.960
"	Minimum		-1.028	1.255	1.028	1.255				
Moment, Y-Y Axis Top	Maximum	15.124	-0.708	-0.345	0.889	0.625		1.240		4.960
"	Minimum		-1.028	1.255	1.028	1.255				

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0078 in	5.500 ft	0.002 in	5.500 ft
+D+L	0.0190 in	5.500 ft	0.005 in	5.500 ft
+D+S	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L+0.750S	0.0225 in	5.500 ft	0.006 in	5.500 ft
+D+0.60W	0.0169 in	5.121 ft	0.032 in	4.805 ft
+D+0.60W+0.70H	0.0394 in	4.994 ft	0.055 in	4.805 ft
+D+0.750L+0.450W+0.70H	0.0454 in	5.058 ft	0.049 in	4.868 ft
+D+0.750L+0.5250S+0.450W+0.70H	0.0497 in	5.121 ft	0.050 in	4.868 ft
+0.60D+0.60W+0.70H	0.0363 in	4.931 ft	0.054 in	4.805 ft
+D+0.750L+0.450W	0.0230 in	5.247 ft	0.027 in	4.805 ft
+D+0.750L+0.750S+0.450W	0.0292 in	5.311 ft	0.028 in	4.868 ft
+0.60D+0.60W	0.0138 in	5.058 ft	0.032 in	4.742 ft
+0.60D	0.0047 in	5.500 ft	0.001 in	5.500 ft
L Only	0.0112 in	5.500 ft	0.003 in	5.500 ft
S Only	0.0083 in	5.500 ft	0.002 in	5.500 ft

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DESCRIPTION: HSS Column - Wind + Flood both direction

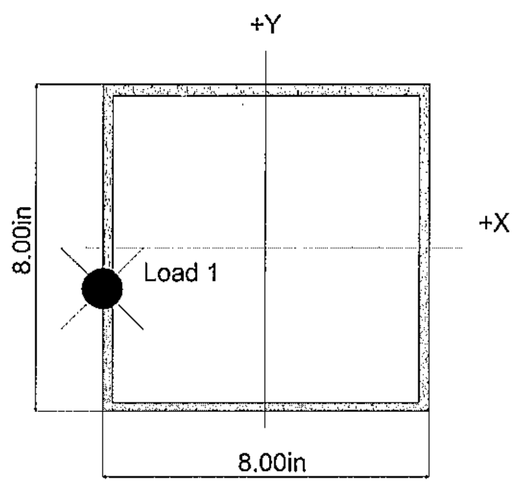
Maximum Deflections for Load Combinations

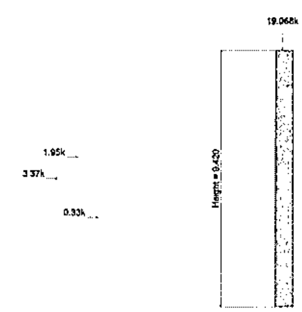
Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
W Only	0.0153 in	4.868 ft	0.051 in	4.742 ft
H Only	0.0321 in	4.931 ft	0.032 in	4.931 ft

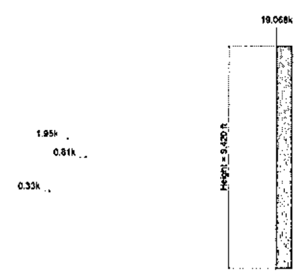
Steel Section Properties : HSS8x8x1/4

Depth	=	8.000 in	I xx	=	70.70 in^4	J	=	111.000 in^4
Design Thick	=	0.233 in	S xx	=	17.70 in^3			
Width	=	8.000 in	R xx	=	3.150 in			
Wall Thick	=	0.250 in	Zx	=	20.500 in^3			
Area	=	7.100 in^2	I yy	=	70.700 in^4	C	=	28.100 in^3
Weight	=	25.792 plf	S yy	=	17.700 in^3			
			R yy	=	3.150 in			
Ycg	=	0.000 in						

Sketches







Steel Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: HSS Column - Wind + Flood 12 direction

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS8x8x1/4**
Analysis Method : Allowable Strength
Steel Stress Grade
Fy : Steel Yield 36.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 9.420 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition :
Unbraced Length for buckling ABOUT X-X Axis = 9.420 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 9.420 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 242.960 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.420 ft, Xecc = -4.0 in, Yecc = -1.0 in, D = 4.860, L = 6.920, S = 5.170, W = 2.118 k
BENDING LOADS . . .
Lat. Point Load at 4.710 ft creating Mx-x, W = 3.365 k
Lat. Point Load at 5.50 ft creating Mx-x, H = 1.951 k
Lat. Point Load at 3.290 ft creating Mx-x, H = 0.3320 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	**0.2861**	: 1
	Load Combination	+D+0.750L+0.450W+0.70H	
	Location of max.above base	5.50	ft
	At maximum location values are . . .		
	Pa : Axial	11.246	k
	Pn / Omega : Allowabl	143.022	k
	Ma-x : Applied	6.947	k-ft
	Mn-x / Omega : Allowable	36.826	k-ft
	Ma-y : Applied	2.142	k-ft
	Mn-y / Omega : Allowable	36.826	k-ft
PASS	Maximum Shear Stress Rati	**0.04206**	: 1
	Load Combination	+0.60D+0.60W+0.70H	
	Location of max.above base	5.50	ft
	At maximum location values are . . .		
	Va : Applied	1.851	k
	Vn / Omega : Allowable	44.005	k

Maximum Load Reactions . .

Top along X-X	0.5266	k
Bottom along X-X	0.5266	k
Top along Y-Y	1.851	k
Bottom along Y-Y	1.783	k

Maximum Load Deflections . . .

Along Y-Y 0.05482 in at 4.805 ft above base
for load combination : +D+0.60W+0.70H

Along X-X 0.0240 in at 5.50 ft above base
for load combination : +D+0.750L+0.750S+0.450W

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios Stress Ratio	Status	Location
D Only	0.073	PASS	9.42 ft	1.27	1.66	35.89	35.89	0.004	PASS	0.00 ft
+D+S	0.149	PASS	9.42 ft	1.27	1.66	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L	0.150	PASS	9.42 ft	1.27	1.66	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L+0.750S	0.207	PASS	9.42 ft	1.27	1.66	35.89	35.89	0.011	PASS	0.00 ft
+D+0.60W	0.185	PASS	4.74 ft	1.27	1.66	35.89	35.89	0.024	PASS	0.00 ft
+D+0.750L+0.450W	0.198	PASS	4.74 ft	1.27	1.66	35.89	35.89	0.019	PASS	0.00 ft
+0.60D+0.60W	0.167	PASS	4.74 ft	1.27	1.66	35.89	35.89	0.024	PASS	0.00 ft
+0.60D	0.044	PASS	9.42 ft	1.27	1.66	35.89	35.89	0.002	PASS	0.00 ft
+D+0.60W+0.70H	0.269	PASS	4.74 ft	1.27	1.66	35.89	35.89	0.042	PASS	5.50 ft
+0.60D+0.60W+0.70H	0.251	PASS	4.74 ft	1.27	1.66	35.89	35.89	0.042	PASS	5.50 ft
+D+0.750L+0.450W+0.70I	0.286	PASS	5.50 ft	1.27	1.66	35.89	35.89	0.036	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
+D+L	12.023	-0.417	-0.417	0.104	-0.104				

DESCRIPTION: HSS Column - Wind + Flood 12 direction

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
D Only	5.103	-0.172	-0.172	0.043	-0.043				
+D+S	10.273	-0.355	-0.355	0.089	-0.089				
+D+0.750L	10.293	-0.356	-0.356	0.089	-0.089				
+D+0.750L+0.750S	14.170	-0.493	-0.493	0.123	-0.123				
+D+0.60W	6.374	-0.217	-0.217	1.064	0.955				
+D+0.60W+0.70H	6.374	-0.217	-0.217	1.783	1.834				
+D+0.750L+0.450W+0.70H	11.246	-0.389	-0.389	1.574	1.538				
+D+0.750L+0.5250S+0.450W+0.70H	13.960	-0.485	-0.485	1.598	1.514				
+0.60D+0.60W+0.70H	4.333	-0.148	-0.148	1.766	1.851				
+D+0.750L+0.450W	11.246	-0.389	-0.389	0.854	0.660				
+D+0.750L+0.750S+0.450W	15.124	-0.527	-0.527	0.889	0.625				
+0.60D+0.60W	4.333	-0.148	-0.148	1.047	0.972				
+0.60D	3.062	-0.103	-0.103	0.026	-0.026				
L Only	6.920	-0.245	-0.245	0.061	-0.061				
S Only	5.170	-0.183	-0.183	0.046	-0.046				
W Only	2.118	-0.075	-0.075	1.701	1.664				
H Only				1.028	1.255				

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
Axial @ Base	Maximum	15.124	-0.527	-0.527	0.889	0.625		1.240		4.960
"	Minimum				1.028	1.255				
Reaction, X-X Axis Base	Maximum				1.028	1.255				
"	Minimum	15.124	-0.527	-0.527	0.889	0.625		1.240		4.960
Reaction, Y-Y Axis Base	Maximum	6.374	-0.217	-0.217	1.783	1.834		0.511		2.044
"	Minimum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
Reaction, X-X Axis Top	Maximum				1.028	1.255				
"	Minimum	15.124	-0.527	-0.527	0.889	0.625		1.240		4.960
Reaction, Y-Y Axis Top	Maximum				1.028	1.255				
"	Minimum				1.028	1.255				
Moment, X-X Axis Base	Maximum	12.023		-0.417	0.104	-0.104		0.982		3.927
"	Minimum	12.023		-0.417	0.104	-0.104		0.982		3.927
Moment, Y-Y Axis Base	Maximum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
"	Minimum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
Moment, X-X Axis Top	Maximum	15.124	-0.527	-0.527	0.889	0.625		1.240		4.960
"	Minimum				1.028	1.255				
Moment, Y-Y Axis Top	Maximum	15.124	-0.527	-0.527	0.889	0.625		1.240		4.960
"	Minimum				1.028	1.255				

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0078 in	5.500 ft	0.002 in	5.500 ft
+D+L	0.0190 in	5.500 ft	0.005 in	5.500 ft
+D+S	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L+0.750S	0.0225 in	5.500 ft	0.006 in	5.500 ft
+D+0.60W	0.0099 in	5.500 ft	0.032 in	4.805 ft
+D+0.60W+0.70H	0.0099 in	5.500 ft	0.055 in	4.805 ft
+D+0.750L+0.450W+0.70H	0.0177 in	5.500 ft	0.049 in	4.868 ft
+D+0.750L+0.5250S+0.450W+0.70H	0.0221 in	5.500 ft	0.050 in	4.868 ft
+0.60D+0.60W+0.70H	0.0068 in	5.500 ft	0.054 in	4.805 ft
+D+0.750L+0.450W	0.0177 in	5.500 ft	0.027 in	4.805 ft
+D+0.750L+0.750S+0.450W	0.0240 in	5.500 ft	0.028 in	4.868 ft
+0.60D+0.60W	0.0068 in	5.500 ft	0.032 in	4.742 ft
+0.60D	0.0047 in	5.500 ft	0.001 in	5.500 ft
L Only	0.0112 in	5.500 ft	0.003 in	5.500 ft
S Only	0.0083 in	5.500 ft	0.002 in	5.500 ft
W Only	0.0034 in	5.500 ft	0.051 in	4.742 ft

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Steel Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: HSS Column - Wind + Flood 12 direction

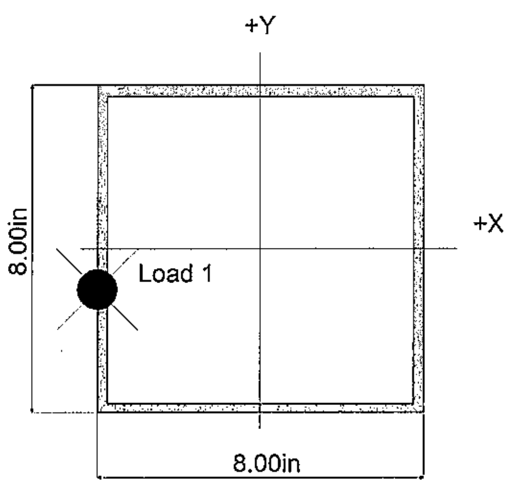
Maximum Deflections for Load Combinations

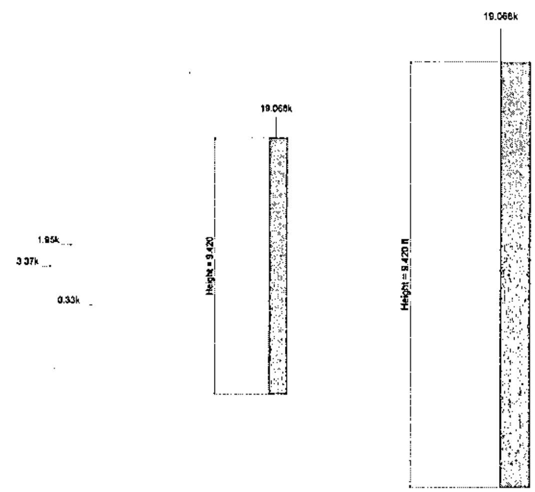
Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
H Only	0.0000 in	0.000 ft	0.032 in	4.931 ft

Steel Section Properties : HSS8x8x1/4

Depth	=	8.000 in	I xx	=	70.70 in^4	J	=	111.000 in^4
Design Thick	=	0.233 in	S xx	=	17.70 in^3			
Width	=	8.000 in	R xx	=	3.150 in			
Wall Thick	=	0.250 in	Zx	=	20.500 in^3			
Area	=	7.100 in^2	I yy	=	70.700 in^4	C	=	28.100 in^3
Weight	=	25.792 plf	S yy	=	17.700 in^3			
			R yy	=	3.150 in			
Ycg	=	0.000 in						

Sketches





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Steel Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: HSS Column - Wind + Flood AB direction

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS8x8x1/4**
Analysis Method : Allowable Strength
Steel Stress Grade
Fy : Steel Yield 36.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 9.420 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition :
Unbraced Length for buckling ABOUT X-X Axis = 9.420 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 9.420 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 242.960 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.420 ft, Xecc = -4.0 in, Yecc = -1.0 in, D = 4.860, L = 6.920, S = 5.170, W = 2.118 k
BENDING LOADS . . .
Lat. Point Load at 4.710 ft creating My-y, W = 0.8050 k
Lat. Point Load at 5.50 ft creating My-y, H = 1.951 k
Lat. Point Load at 3.290 ft creating My-y, H = 0.3320 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.2248** : 1
Load Combination +D+0.750L+0.450W+0.70H
Location of max.above base 5.50 ft
At maximum location values are . . .
Pa : Axial 11.246 k
Pn / Omega : Allowabl 143.022 k
Ma-x : Applied 0.5354 k-ft
Mn-x / Omega : Allowable 36.826 k-ft
Ma-y : Applied 6.295 k-ft
Mn-y / Omega : Allowable 36.826 k-ft

PASS Maximum Shear Stress Ratio **0.02932** : 1
Load Combination +D+0.750L+0.450W+0.70H
Location of max.above base 0.0 ft
At maximum location values are . . .
Va : Applied 1.290 k
Vn / Omega : Allowable 44.005 k

Maximum Load Reactions . .
Top along X-X 1.255 k
Bottom along X-X 1.386 k
Top along Y-Y 0.1316 k
Bottom along Y-Y 0.1316 k

Maximum Load Deflections . . .
Along Y-Y 0.006001 in at 5.50 ft above base
for load combination : +D+0.750L+0.750S+0.450W
Along X-X 0.04974 in at 5.121 ft above base
for load combination : +D+0.750L+0.5250S+0.450W+0.70H

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.073	PASS	9.42 ft	1.66	1.24	35.89	35.89	0.004	PASS	0.00 ft
+D+S	0.149	PASS	9.42 ft	1.66	1.24	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L	0.150	PASS	9.42 ft	1.66	1.24	35.89	35.89	0.008	PASS	0.00 ft
+D+0.750L+0.750S	0.207	PASS	9.42 ft	1.66	1.24	35.89	35.89	0.011	PASS	0.00 ft
+D+0.60W	0.092	PASS	9.42 ft	1.66	1.24	35.89	35.89	0.010	PASS	0.00 ft
+D+0.750L+0.450W	0.164	PASS	9.42 ft	1.66	1.24	35.89	35.89	0.013	PASS	0.00 ft
+0.60D+0.60W	0.070	PASS	4.74 ft	1.66	1.24	35.89	35.89	0.009	PASS	0.00 ft
+0.60D	0.044	PASS	9.42 ft	1.66	1.24	35.89	35.89	0.002	PASS	0.00 ft
+D+0.60W+0.70H	0.182	PASS	5.50 ft	1.66	1.24	35.89	35.89	0.027	PASS	0.00 ft
+0.60D+0.60W+0.70H	0.162	PASS	5.50 ft	1.66	1.24	35.89	35.89	0.025	PASS	0.00 ft
+D+0.750L+0.450W+0.70I	0.225	PASS	5.50 ft	1.66	1.24	35.89	35.89	0.029	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction (k) @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments (k-ft) @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
+D+L	12.023	-0.417	-0.417	0.104	-0.104				

DESCRIPTION: HSS Column - Wind + Flood AB direction

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction k @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments k-ft @ Top	My - End Moments @ Base	My - End Moments @ Top
D Only	5.103	-0.172	-0.172	0.043	-0.043				
+D+S	10.273	-0.355	-0.355	0.089	-0.089				
+D+0.750L	10.293	-0.356	-0.356	0.089	-0.089				
+D+0.750L+0.750S	14.170	-0.493	-0.493	0.123	-0.123				
+D+0.60W	6.374	-0.458	0.025	0.054	-0.054				
+D+0.60W+0.70H	6.374	-1.178	0.903	0.054	-0.054				
+D+0.750L+0.450W+0.70H	11.246	-1.290	0.670	0.097	-0.097				
+D+0.750L+0.5250S+0.450W+0.70H	13.960	-1.386	0.574	0.121	-0.121				
+0.60D+0.60W+0.70H	4.333	-1.109	0.972	0.037	-0.037				
+D+0.750L+0.450W	11.246	-0.570	-0.208	0.097	-0.097				
+D+0.750L+0.750S+0.450W	15.124	-0.708	-0.345	0.132	-0.132				
+0.60D+0.60W	4.333	-0.390	0.093	0.037	-0.037				
+0.60D	3.062	-0.103	-0.103	0.026	-0.026				
L Only	6.920	-0.245	-0.245	0.061	-0.061				
S Only	5.170	-0.183	-0.183	0.046	-0.046				
W Only	2.118	-0.477	0.328	0.019	-0.019				
H Only		-1.028	1.255						

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction k @ Base	X-X Axis Reaction k @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments k-ft @ Base	Mx - End Moments k-ft @ Top	My - End Moments @ Base	My - End Moments @ Top
Axial @ Base	Maximum	15.124	-0.708	-0.345	0.132	-0.132		1.240		4.960
"	Minimum		-1.028	1.255						
Reaction, X-X Axis Base	Maximum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
"	Minimum	13.960	-1.386	0.574	0.121	-0.121		1.143		4.572
Reaction, Y-Y Axis Base	Maximum	15.124	-0.708	-0.345	0.132	-0.132		1.240		4.960
"	Minimum		-1.028	1.255						
Reaction, X-X Axis Top	Maximum		-1.028	1.255						
"	Minimum	14.170	-0.493	-0.493	0.123	-0.123		1.161		4.642
Reaction, Y-Y Axis Top	Maximum	3.062	-0.103	-0.103	0.026	-0.026		0.243		0.972
"	Minimum		-1.028	1.255						
Moment, X-X Axis Base	Maximum	12.023		-0.417	0.104	-0.104		0.982		3.927
"	Minimum	12.023		-0.417	0.104	-0.104		0.982		3.927
Moment, Y-Y Axis Base	Maximum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
"	Minimum	12.023	-0.417	-0.417	0.104	-0.104		3.927		0.982
Moment, X-X Axis Top	Maximum	15.124	-0.708	-0.345	0.132	-0.132		1.240		4.960
"	Minimum		-1.028	1.255						
Moment, Y-Y Axis Top	Maximum	15.124	-0.708	-0.345	0.132	-0.132		1.240		4.960
"	Minimum		-1.028	1.255						

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0078 in	5.500 ft	0.002 in	5.500 ft
+D+L	0.0190 in	5.500 ft	0.005 in	5.500 ft
+D+S	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L	0.0162 in	5.500 ft	0.004 in	5.500 ft
+D+0.750L+0.750S	0.0225 in	5.500 ft	0.006 in	5.500 ft
+D+0.60W	0.0169 in	5.121 ft	0.002 in	5.500 ft
+D+0.60W+0.70H	0.0394 in	4.994 ft	0.002 in	5.500 ft
+D+0.750L+0.450W+0.70H	0.0454 in	5.058 ft	0.004 in	5.500 ft
+D+0.750L+0.5250S+0.450W+0.70H	0.0497 in	5.121 ft	0.006 in	5.500 ft
+0.60D+0.60W+0.70H	0.0363 in	4.931 ft	0.002 in	5.500 ft
+D+0.750L+0.450W	0.0230 in	5.247 ft	0.004 in	5.500 ft
+D+0.750L+0.750S+0.450W	0.0292 in	5.311 ft	0.006 in	5.500 ft
+0.60D+0.60W	0.0138 in	5.058 ft	0.002 in	5.500 ft
+0.60D	0.0047 in	5.500 ft	0.001 in	5.500 ft
L Only	0.0112 in	5.500 ft	0.003 in	5.500 ft
S Only	0.0083 in	5.500 ft	0.002 in	5.500 ft
W Only	0.0153 in	4.868 ft	0.001 in	5.500 ft

Steel Column

DESCRIPTION: HSS Column - Wind + Flood AB direction

Maximum Deflections for Load Combinations

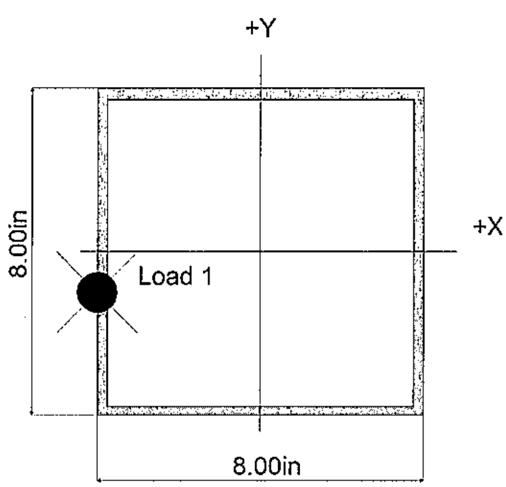
Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
H Only	0.0321 in	4.931 ft	0.000 in	0.000 ft

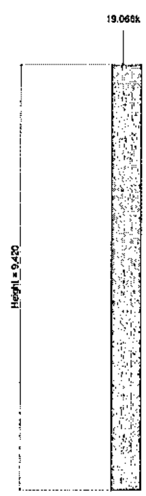
Steel Section Properties : HSS8x8x1/4

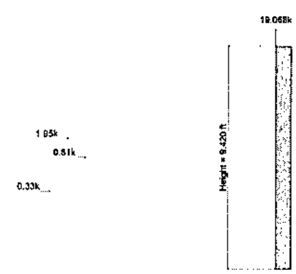
Depth	=	8.000 in	I xx	=	70.70 in^4	J	=	111.000 in^4
Design Thick	=	0.233 in	S xx	=	17.70 in^3			
Width	=	8.000 in	R xx	=	3.150 in			
Wall Thick	=	0.250 in	Zx	=	20.500 in^3			
Area	=	7.100 in^2	I yy	=	70.700 in^4	C	=	28.100 in^3
Weight	=	25.792 plf	S yy	=	17.700 in^3			
			R yy	=	3.150 in			

Ycg	=	0.000 in

Sketches







HAYDEN ENGINEERS
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Concrete Beam

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

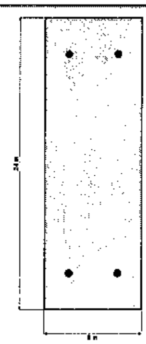
DESCRIPTION: Wall Pier - Strong

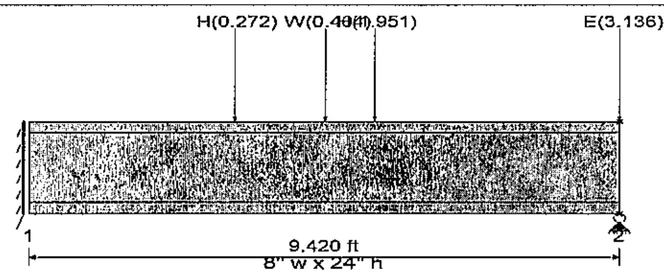
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combination Set : ASCE 7-16

General Information

f'c	=	4.0 ksi	ϕ Phi Values	Flexure :	0.90
fr =7.5 * λ * f'c$^{1/2}$	=	474.342 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 8.0 in, Height = 24.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 9.420 ft in this span 2-#5 at 3.0 in from Top, from 0.0 to 9.420 ft in this span

Point Load : W = 0.4040 k @ 4.710 ft
Point Load : H = 1.951 k @ 5.50 ft
Point Load : H = 0.2720 k @ 3.290 ft
Point Load : E = 3.136 k @ 9.420 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.075 : 1**		
Section used for this span	**Typical Section**		
Mu : Applied	-4.356 k-ft		
Mn * Phi : Allowable	58.301 k-ft		
Location of maximum on span	0.000 ft		
Span # where maximum occurs	Span # 1		
Maximum Deflection			
Max Downward Transient Deflection	0.001 in	Ratio = 107987 >=360.0	E Only
Max Upward Transient Deflection	0.000 in	Ratio = 0 <360.0	Overall MAXimum Envelope
Max Downward Total Deflection	0.001 in	Ratio = 107987 >=240.0	Span: 1 : H Only
Max Upward Total Deflection	0.000 in	Ratio = 0 <240.0	Span: 1 : H Only

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.376	3.136
Max Upward from Load Combinations	1.130	0.669
Max Upward from Load Cases	1.376	3.136
+0.60W	0.167	0.076
+0.450W	0.125	0.057

DESCRIPTION: Wall Pier - Strong

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
E Only * 0.70	0.000	2.195
E Only * 0.5250	0.000	1.646
W Only	0.278	0.126
E Only	0.000	3.136
H Only	1.376	0.847
+0.60W+0.70H	1.130	0.669
+0.450W+0.70H	1.088	0.650

Shear Stirrup Requirements

Entire Beam Span Length : Vu < Phi*Vc / 2, Req'd Vs = Not Reqd per 9.6.3.1, Stirrups are not required.

HAYDEN ENGINEERS
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Concrete Beam

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

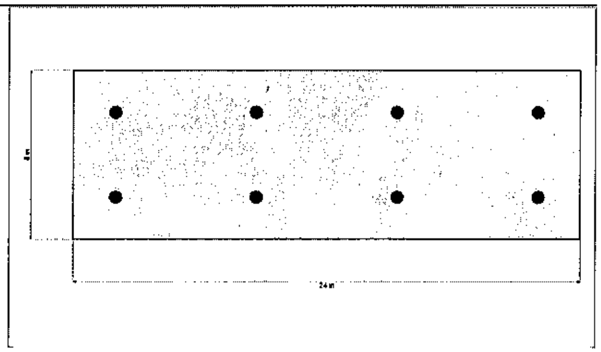
DESCRIPTION: Wall Pier - Weak

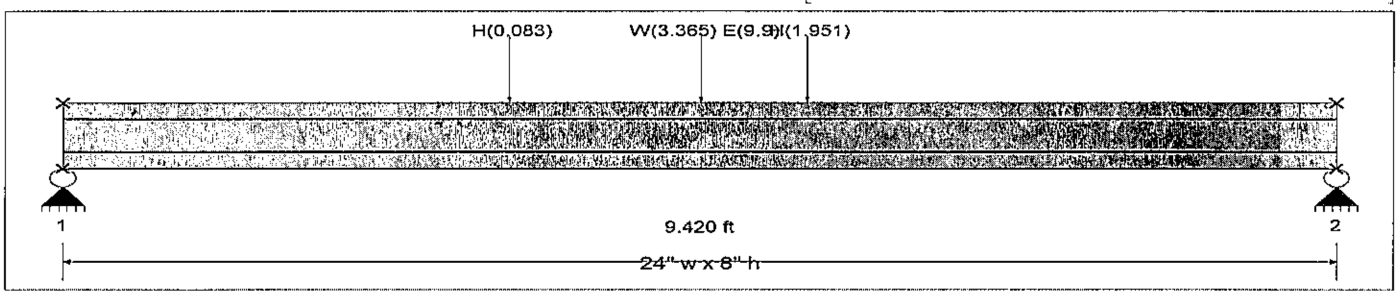
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combination Set : ASCE 7-16

General Information

f'c	=	4.0 ksi	ϕ Phi Values	Flexure :	0.90
fr =7.5 * λ * f'c$^{1/2}$	=	474.342 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 24.0 in, Height = 8.0 in
Span #1 Reinforcing....
4-#5 at 2.0 in from Bottom, from 0.0 to 9.420 ft in this span
4-#5 at 2.0 in from Top, from 0.0 to 9.420 ft in this span

Point Load : W = 3.365, E = 9.90 k @ 4.710 ft
Point Load : H = 1.951 k @ 5.50 ft
Point Load : H = 0.0830 k @ 3.290 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.703** : 1	
Section used for this span	**Typical Section**	
Mu : Applied	23.272 k-ft	
Mn * Phi : Allowable	33.095 k-ft	
Location of maximum on span	4.701 ft	
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.267 in	Ratio =	423 >=281.0	H Only
Max Upward Transient Deflection	0.000 in	Ratio =	0 <281.0	Overall MAXimum Envelope
Max Downward Total Deflection	0.267 in	Ratio =	423 >=240.0	Span: 1 : E Only
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : E Only

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	4.950	4.950
Max Upward from Load Combinations	1.616	1.827
Max Upward from Load Cases	4.950	4.950
+0.60W	1.010	1.010
+0.450W	0.757	0.757
E Only * 0.70	3.465	3.465

DESCRIPTION: Wall Pier - Weak

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
E Only * 0.5250	2.599	2.599
W Only	1.683	1.683
E Only	4.950	4.950
H Only	0.866	1.168
+0.60W+0.70H	1.616	1.827
+0.450W+0.70H	1.363	1.575

Shear Stirrup Requirements

Entire Beam Span Length : Vu < Phi*Vc / 2, Req'd Vs = Not Reqd per 9.6.3.1, Stirrups are not required.

HAYDEN ENGINEERS
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Concrete Beam

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.02.28 HAYDEN CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

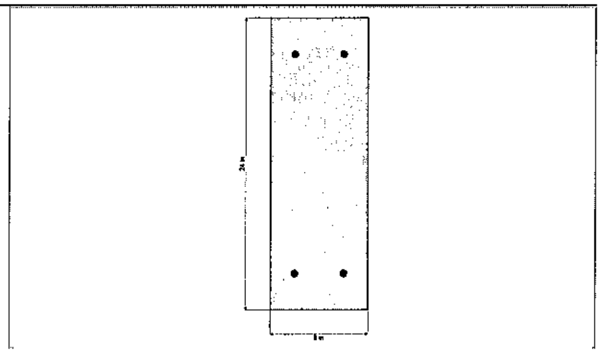
DESCRIPTION: Wall Pier - Dead Load only

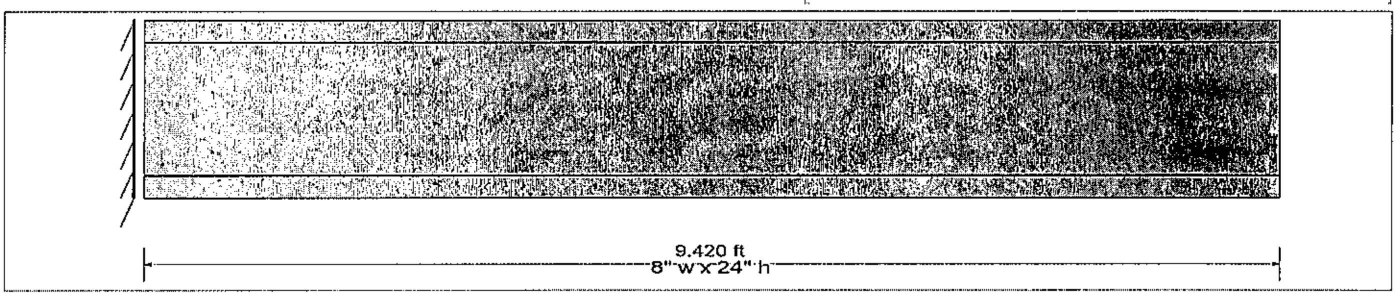
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

General Information

f'c	=	4.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = $f'c^{1/2}$ * 7.50	=	474.342 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup =		2





Cross Section & Reinforcing Details

Rectangular Section, Width = 8.0 in, Height = 24.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 9.420 ft in this span 2-#5 at 3.0 in from Top, from 0.0 to 9.420 ft in this span

Beam self weight calculated and added to loads

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.206** : 1			
Section used for this span	**Typical Section**			
Mu : Applied	-12.009 k-ft			
Mn * Phi : Allowable	58.301 k-ft			
Location of maximum on span	0.000 ft			
Span # where maximum occurs	Span # 1			
Maximum Deflection				
Max Downward Transient Deflection	0.000 in	Ratio =	0 <360.0	
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	
Max Downward Total Deflection	0.011 in	Ratio =	19780 >=240.0	Span: 1 : D Only
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : D Only

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.821	
Max Upward from Load Combinations	1.093	
Max Upward from Load Cases	1.821	
D Only	1.821	
+0.60D	1.093	

HAYDEN
ENGINEERS
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Concrete Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Wall Pier - Strong/AB direction

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

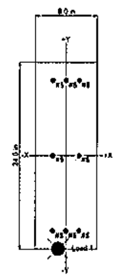
f'c : Concrete 28 day streng	=	2.50 ksi
E =	=	3,122.0 ksi
Density	=	150.0 pcf
β	=	0.850
fy - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits		*ASTM A615 Bars Used*
Min. Reinf.	=	1.0 %
Max. Reinf.	=	8.0 %

Overall Column Height = 9.420 ft
End Fixity Top Pinned, Bottom Fixed
Brace condition for deflection (buckling) along colun
X-X (width) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0

Column Cross Section

Column Dimensions : 24.0in high x 8.0in Wide, Column Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 4 - #5 bars @ corners,, 1 - #5 bars top & bottom between corner bars, 1 - #5 bars left & right between corner



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 1,884.0 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.420 ft above base, Xecc = -1.0in, Yecc = -12.0in, D = 4.860, L = 6.920, S = 5.170, W = 2.118, E = 2.661 k
BENDING LOADS . . .
Lat. Point Load at 4.710 ft creating Mx-x, W = 0.4040 k
Lat. Point Load at 5.50 ft creating Mx-x, H = 1.951 k
Lat. Point Load at 3.290 ft creating Mx-x, H = 0.2720 k
Lat. Point Load at 9.420 ft creating Mx-x, E = 3.136 k

DESIGN SUMMARY

Load Combination +1.20D+L+1.60S
Location of max.above base 9.357 ft

Maximum Stress Ratio **0.175 : 1**
Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5

Pu =	23.285 k	φ * Pn =	134.342 k
Mu-x =	20.812 k-ft	φ * Mn-x =	119.105 k-ft
Mu-y =	1.734 k-ft	φ* Mn-y =	0.5342 k-ft
		φ =	0.650
Mu Angle =	5.0 deg		
Mu at Angle =	20.884 k-ft	φMn at Angle =	119.363 k-ft

Pn & Mn values located at Pu-Mu vector intersection with capacity curv

Column Capacities . .

Pnmax : Nominal Max. Compressive Axial Capaci	551.53 k
Pnmin : Nominal Min. Tension Axial Capacity	k
φ Pn, max : Usable Compressive Axial Capacity	286.796 k
φ Pn, min : Usable Tension Axial Capacity	k

Maximum SERVICE Load Reactions .

Top along Y-Y	0.2034 k	Bottom along Y-Y	0.2034 k
Top along X-X	2.440 k	Bottom along X-X	3.272 k

Maximum SERVICE Load Deflections . .

Along Y-Y 0.003487 in at 6.069 ft above base
for load combination : +D+0.750L+0.5250S+0.450W+0.70H
Along X-X 0.002269 in at 6.322 ft above base
for load combination : +D+0.750L+0.750S+0.5250E

General Section Informatio β = 0.850 θ = 0.80

ρ : % Reinforcing	1.292 %	Rebar % Ok
Reinforcing Area	2.480 in^2	
Concrete Area	192.0 in^2	

Concrete Column

DESCRIPTION: Wall Pier - Strong/AB direction

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	Axial Load k φ * Pn	Bending Analysis k-ft δx	δx * Mux	δy	δy * Muy	Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+1.60L	Actual	Actual	9.36	19.16	136.38	1.000	16.73	1.000	1.39	5.000	16.79	118.85	**0.141**
+1.20D+1.60L+0.50S	Actual	Actual	9.36	21.75	134.34	1.000	19.29	1.000	1.61	5.000	19.36	119.36	**0.162**
+1.20D+L	Actual	Actual	9.36	15.01	139.74	1.000	12.62	1.000	1.05	5.000	12.67	118.00	**0.107**
+1.20D+0.50W	Actual	M2,min	9.36	9.15	150.98	1.002	6.91	1.000	0.64	5.000	6.94	115.00	**0.060**
+1.20D+L+1.60S	Actual	Actual	9.36	23.28	134.34	1.000	20.81	1.000	1.73	5.000	20.88	119.36	**0.175**
+1.20D+1.60S+0.50W	Actual	Actual	9.36	17.42	136.38	1.005	15.23	1.000	1.25	5.000	15.29	118.85	**0.129**
+1.20D+L+W	Actual	Actual	9.36	17.13	136.38	1.005	14.94	1.000	1.23	5.000	14.99	118.85	**0.126**
+1.20D+L+0.50S+W	Actual	Actual	9.36	19.72	134.34	1.005	17.55	1.000	1.44	5.000	17.61	119.36	**0.148**
+0.90D+W	Actual	M2,min	9.36	8.19	145.59	1.002	6.51	1.000	0.57	5.000	6.53	116.46	**0.056**
+0.90D+0.50W+H	Actual	M2,min	9.36	7.13	127.27	1.002	-6.73	1.000	0.50	4.000	6.75	121.26	**0.056**
+1.20D+L+W+H	Actual	Actual	9.36	17.13	136.38	1.005	14.94	1.000	1.23	5.000	14.99	118.85	**0.126**
+1.20D+L+0.30S+W+H	Actual	Actual	9.36	18.68	134.34	1.005	16.50	1.000	1.35	5.000	16.56	119.36	**0.139**
+1.20D+L+0.20S+E	Actual	Actual	9.36	18.71	136.38	1.000	16.28	1.000	1.36	5.000	16.34	118.85	**0.137**
+0.90D+E	Actual	M2,min	9.36	8.73	145.59	1.000	6.96	1.000	0.61	5.000	6.99	116.46	**0.060**

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction k @ Base	X-X Axis Reaction k @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	Mx - End Moments k-ft @ Base	Mx - End Moments k-ft @ Top	My - End Moments @ Base	My - End Moments @ Top
+D+L	0.156	0.156	1.876	1.876	13.664	-5.890		-0.491	
D Only	0.064	0.064	0.774	0.774	6.744	-2.430		-0.202	
+D+S	0.133	0.133	1.597	1.597	11.914	-5.015		-0.418	
+D+0.750L	0.133	0.133	1.600	1.600	11.934	-5.025		-0.419	
+D+0.750L+0.750S	0.185	0.185	2.218	2.218	15.812	-6.964		-0.580	
+D+0.60W+0.70H	0.081	0.081	2.106	0.307	8.015	-6.043		-0.255	
+D+0.750L+0.450W+0.70H	0.146	0.146	2.840	1.102	12.887	-8.372		-0.458	
+D+0.750L+0.750S+0.450W	0.197	0.197	2.495	2.313	16.765	-7.761		-0.620	
+D+0.750L+0.5250S+0.450W+0.70H	0.182	0.182	3.272	1.534	15.601	-9.729		-0.572	
+D+0.70E	0.089	0.089	1.070	1.070	8.607	-3.361		-0.280	
+D+0.750L+0.750S+0.5250E	0.203	0.203	2.440	2.440	17.209	-7.662		-0.639	
+0.60D+0.70E	0.063	0.063	0.761	0.761	5.909	-2.389		-0.199	
L Only	0.092	0.092	1.102	1.102	6.920	-3.460		-0.288	
S Only	0.069	0.069	0.823	0.823	5.170	-2.585		-0.215	
W Only	0.028	0.028	0.615	0.211	2.118	-1.773		-0.088	
E Only	0.035	0.035	0.424	0.424	2.661	-1.330		-0.111	
H Only			1.376	0.847		-3.642			

Maximum Moment Reactions

Note: Only non-zero reactions are listed.

Load Combination	Moment About X-X Axis @ Base	Moment About X-X Axis @ Top		Moment About Y-Y Axis @ Base	Moment About Y-Y Axis @ Top	
+D+L	-5.890		k-ft	-0.491		k-ft
D Only	-2.430		k-ft	-0.202		k-ft
+D+S	-5.015		k-ft	-0.418		k-ft
+D+0.750L	-5.025		k-ft	-0.419		k-ft
+D+0.750L+0.750S	-6.964		k-ft	-0.580		k-ft
+D+0.60W+0.70H	-6.043		k-ft	-0.255		k-ft
+D+0.750L+0.450W+0.70H	-8.372		k-ft	-0.458		k-ft
+D+0.750L+0.750S+0.450W	-7.761		k-ft	-0.620		k-ft
+D+0.750L+0.5250S+0.450W+0.70H	-9.729		k-ft	-0.572		k-ft
+D+0.70E	-3.361		k-ft	-0.280		k-ft
+D+0.750L+0.750S+0.5250E	-7.662		k-ft	-0.639		k-ft
+0.60D+0.70E	-2.389		k-ft	-0.199		k-ft
L Only	-3.460		k-ft	-0.288		k-ft
S Only	-2.585		k-ft	-0.215		k-ft
W Only	-1.773		k-ft	-0.088		k-ft
E Only	-1.330		k-ft	-0.111		k-ft
H Only	-3.642		k-ft			k-ft

Concrete Column

Project File: 24261 - foundation.ec6

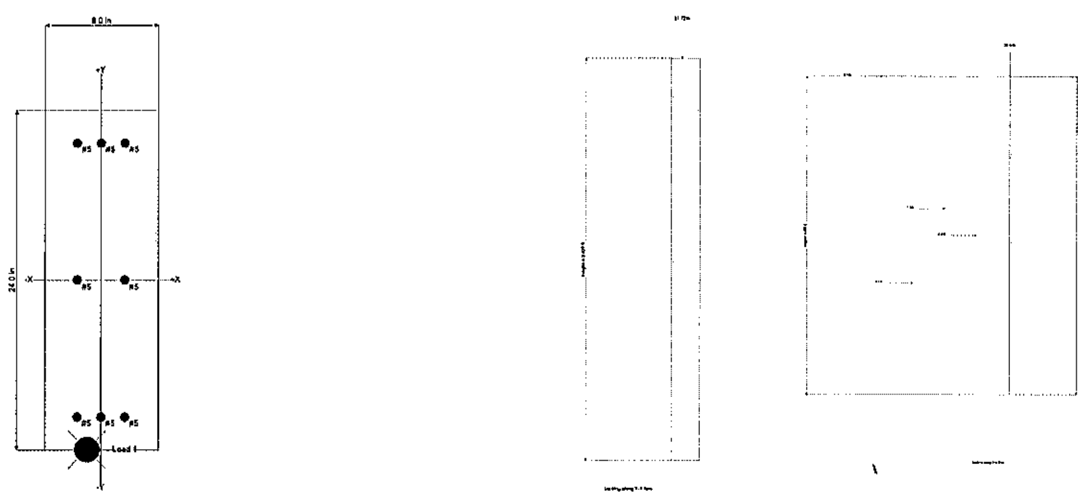
LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Wall Pier - Strong/AB direction

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
D Only	-0.0007	in	6.322	ft	0.001	in	6.322	ft
+D+L	-0.0017	in	6.322	ft	0.002	in	6.322	ft
+D+S	-0.0015	in	6.322	ft	0.002	in	6.322	ft
+D+0.750L	-0.0015	in	6.322	ft	0.002	in	6.322	ft
+D+0.750L+0.750S	-0.0021	in	6.322	ft	0.003	in	6.322	ft
+D+0.60W+0.70H	-0.0009	in	6.322	ft	0.002	in	5.943	ft
+D+0.750L+0.450W+0.70H	-0.0016	in	6.322	ft	0.003	in	6.069	ft
+D+0.750L+0.750S+0.450W	-0.0022	in	6.322	ft	0.003	in	6.259	ft
+D+0.750L+0.5250S+0.450W+0.70H	-0.0020	in	6.322	ft	0.003	in	6.069	ft
+0.60D+0.60W+0.70H	-0.0006	in	6.322	ft	0.002	in	5.816	ft
+D+0.70E	-0.0010	in	6.322	ft	0.001	in	6.322	ft
+D+0.750L+0.750S+0.5250E	-0.0023	in	6.322	ft	0.003	in	6.322	ft
+0.60D+0.70E	-0.0007	in	6.322	ft	0.001	in	6.322	ft
L Only	-0.0010	in	6.322	ft	0.001	in	6.322	ft
S Only	-0.0008	in	6.322	ft	0.001	in	6.322	ft
W Only	-0.0003	in	6.322	ft	0.001	in	5.943	ft
E Only	-0.0004	in	6.322	ft	0.001	in	6.322	ft
H Only	0.0000	in	0.000	ft	0.001	in	5.500	ft

Sketches



Interaction Diagrams

HAYDEN ENGINEERS
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DESCRIPTION: Wall Pier - Weak/12 direction

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

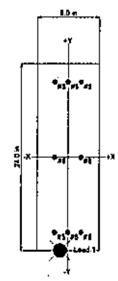
f'c : Concrete 28 day strenç	=	2.50 ksi
E =	=	3,122.0 ksi
Density	=	150.0 pcf
β	=	0.850
fy - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits		*ASTM A615 Bars Used*
Min. Reinf.	=	1.0 %
Max. Reinf.	=	8.0 %

Overall Column Height = 9.420 ft
End Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along colun
X-X (width) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0

Column Cross Section

Column Dimensions : 24.0in high x 8.0in Wide, Column Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 4 - #5 bars @ corners,, 1 - #5 bars top & bottom between corner bars, 1 - #5 bars left & right between corner



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 1,884.0 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 9.420 ft above base, Xecc = -1.0in, Yecc = -12.0in, D = 4.860, L = 6.920, S = 5.170, W = 2.118, E = 2.661 k
BENDING LOADS . . .
Lat. Point Load at 5.50 ft creating My-y, H = 1.951 k
Lat. Point Load at 3.290 ft creating My-y, H = 0.0830 k
Lat. Point Load at 4.710 ft creating My-y, W = 3.365, E = 9.90 k

DESIGN SUMMARY

Load Combination	+0.90D+E
Location of max.above base	9.357 ft

Maximum Stress Ratio **0.321 : 1**
Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5

Pu =	8.731 k	φ * Pn =	26.657 k
Mu-x =	6.988 k-ft	φ * Mn-x =	76.095 k-ft
Mu-y =	23.962 k-ft	φ * Mn-y =	16.428 k-ft
		φ =	0.750
Mu Angle =	73.0 deg		
Mu at Angle =	24.960 k-ft	φMn at Angle =	77.835 k-ft

Pn & Mn values located at Pu-Mu vector intersection with capacity curv

Column Capacities . .

Pnmax : Nominal Max. Compressive Axial Capaci	551.53 k
Pnmin : Nominal Min. Tension Axial Capacity	k
φ Pn, max : Usable Compressive Axial Capacity	286.796 k
φ Pn, min : Usable Tension Axial Capacity	k

Maximum SERVICE Load Reactions .

Top along Y-Y	4.926 k	Bottom along Y-Y	4.974 k
Top along X-X	1.627 k	Bottom along X-X	1.627 k

Maximum SERVICE Load Deflections . .

Along Y-Y 0.005285 in at 5.50 ft above base
for load combination : +D+0.750L+0.750S+0.5250E
Along X-X 0.09480 in at 4.742 ft above base
for load combination : E Only

General Section Informatio β =0.850 θ = 0.80

ρ : % Reinforcing	1.292 %	Rebar % Ok
Reinforcing Area	2.480 in^2	
Concrete Area	192.0 in^2	

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Concrete Column
Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Wall Pier - Weak/12 direction

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	φ * Pn	Bending Analysis k-ft δx	δx * Mux	δy	δy * Muy	Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+1.60L	Actual	Actual	9.36	19.16	136.38	1.000	16.79	1.000	1.40	5.000	16.85	118.85	**0.142**
+1.20D+1.60L+0.50S	Actual	Actual	9.36	21.75	134.34	1.000	19.36	1.000	1.61	5.000	19.43	119.36	**0.163**
+1.20D+L	Actual	Actual	9.36	15.01	139.74	1.000	12.67	1.000	1.06	5.000	12.71	118.00	**0.108**
+1.20D+0.50W	Actual	Actual	9.36	9.15	129.17	1.000	6.84	1.023	4.32	32.000	8.09	114.92	**0.070**
+1.20D+L+1.60S	Actual	Actual	9.36	23.28	132.63	1.000	20.88	1.000	1.74	5.000	20.96	119.79	**0.175**
+1.20D+1.60S+0.50W	Actual	Actual	9.36	17.42	130.67	1.000	15.06	1.044	4.77	17.000	15.80	118.49	**0.133**
+1.20D+L+W	Actual	Actual	9.36	17.13	116.28	1.000	14.77	1.044	8.86	30.000	17.23	117.81	**0.146**
+1.20D+L+0.50S+W	Actual	Actual	9.36	19.72	119.78	1.000	17.34	1.050	9.04	26.000	19.55	118.52	**0.165**
+0.90D+W	Actual	Actual	9.36	8.19	86.07	1.000	6.45	1.020	8.31	52.000	10.52	111.30	**0.095**
+0.90D+0.50W+H	Actual	Actual	9.36	7.13	77.27	1.000	5.40	1.018	8.29	56.000	9.89	107.47	**0.092**
+1.20D+L+W+H	Actual	Actual	9.36	17.13	102.68	1.000	14.77	1.044	13.02	40.000	19.69	117.46	**0.168**
+1.20D+L+0.30S+W+H	Actual	Actual	9.36	18.68	105.92	1.000	16.31	1.048	13.14	38.000	20.95	117.50	**0.178**
+1.20D+L+0.20S+E	Actual	Actual	9.36	18.71	68.13	1.000	16.34	1.048	24.99	56.000	29.85	108.04	**0.276**
+0.90D+E	Actual	Actual	9.36	8.73	26.66	1.000	6.99	1.022	23.96	73.000	24.96	77.84	**0.321**

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
+D+L	0.104	0.104	1.251	1.251	13.664				
D Only	0.043	0.043	0.516	0.516	6.744				
+D+S	0.089	0.089	1.065	1.065	11.914				
+D+0.750L	0.089	0.089	1.067	1.067	11.934				
+D+0.750L+0.750S	0.123	0.123	1.479	1.479	15.812				
+D+0.60W+0.70H	1.670	1.773	0.651	0.651	8.015				
+D+0.750L+0.450W+0.70H	1.461	1.477	1.168	1.168	12.887				
+D+0.750L+0.750S+0.450W	0.889	0.625	1.580	1.580	16.765				
+D+0.750L+0.5250S+0.450W+0.70H	1.485	1.453	1.456	1.456	15.601				
+D+0.70E	3.524	3.406	0.714	0.714	8.607				
+D+0.750L+0.750S+0.5250E	2.734	2.463	1.627	1.627	17.209				
+0.60D+0.70E	3.507	3.423	0.507	0.507	5.909				
L Only	0.061	0.061	0.735	0.735	6.920				
S Only	0.046	0.046	0.549	0.549	5.170				
W Only	1.701	1.664	0.225	0.225	2.118				
E Only	4.974	4.926	0.282	0.282	2.661				
H Only	0.866	1.168							

Maximum Moment Reactions

Note: Only non-zero reactions are listed.

Load Combination	Moment About X-X Axis @ Base	@ Top	Moment About Y-Y Axis @ Base	@ Top
+D+L		k-ft		k-ft
D Only		k-ft		k-ft
+D+S		k-ft		k-ft
+D+0.750L		k-ft		k-ft
+D+0.750L+0.750S		k-ft		k-ft
+D+0.60W+0.70H		k-ft		k-ft
+D+0.750L+0.450W+0.70H		k-ft		k-ft
+D+0.750L+0.750S+0.450W		k-ft		k-ft
+D+0.750L+0.5250S+0.450W+0.70H		k-ft		k-ft
+D+0.70E		k-ft		k-ft
+D+0.750L+0.750S+0.5250E		k-ft		k-ft
+0.60D+0.70E		k-ft		k-ft
L Only		k-ft		k-ft
S Only		k-ft		k-ft
W Only		k-ft		k-ft
E Only		k-ft		k-ft
H Only		k-ft		k-ft

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Concrete Column

Project File: 24261 - foundation.ec6

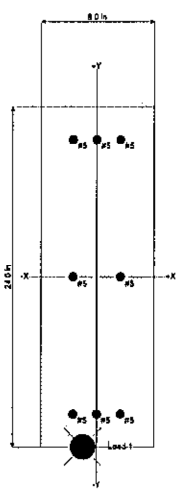
LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

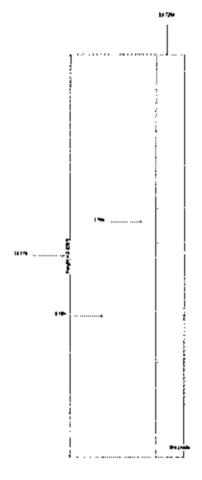
DESCRIPTION: Wall Pier - Weak/12 direction

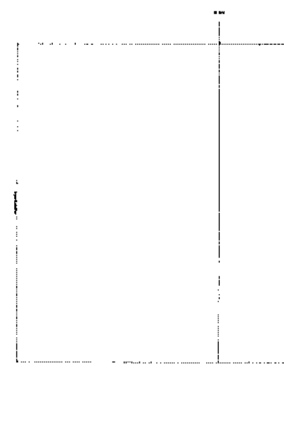
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
D Only	-0.0013	in	5.500	ft	0.002	in	5.500	ft
+D+L	-0.0030	in	5.500	ft	0.004	in	5.500	ft
+D+S	-0.0026	in	5.500	ft	0.003	in	5.500	ft
+D+0.750L	-0.0026	in	5.500	ft	0.003	in	5.500	ft
+D+0.750L+0.750S	-0.0036	in	5.500	ft	0.005	in	5.500	ft
+D+0.60W+0.70H	-0.0337	in	4.868	ft	0.002	in	5.500	ft
+D+0.750L+0.450W+0.70H	-0.0302	in	4.868	ft	0.004	in	5.500	ft
+D+0.750L+0.750S+0.450W	-0.0182	in	4.868	ft	0.005	in	5.500	ft
+D+0.750L+0.5250S+0.450W+0.70H	-0.0308	in	4.868	ft	0.005	in	5.500	ft
+0.60D+0.60W+0.70H	-0.0332	in	4.868	ft	0.001	in	5.500	ft
+D+0.70E	-0.0676	in	4.742	ft	0.002	in	5.500	ft
+D+0.750L+0.750S+0.5250E	-0.0533	in	4.805	ft	0.005	in	5.500	ft
+0.60D+0.70E	-0.0671	in	4.742	ft	0.002	in	5.500	ft
L Only	-0.0018	in	5.500	ft	0.002	in	5.500	ft
S Only	-0.0013	in	5.500	ft	0.002	in	5.500	ft
W Only	-0.0325	in	4.742	ft	0.001	in	5.500	ft
E Only	-0.0948	in	4.742	ft	0.001	in	5.500	ft
H Only	-0.0185	in	4.931	ft	0.000	in	0.000	ft

Sketches







Interaction Diagrams

Part 2:
Loads to 24"Ø Footing
Piers

WIND LOADS @ FOUNDATION

$V_B = 81$ lb (ASD)

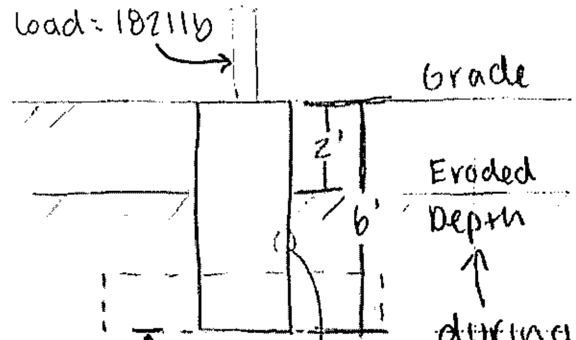
$V_A = 162$ lb (ASD)

$V_{12} = 673$ lb (ASD)

Loads on 24" Ø piers

$q_a = 1500$ psf

Dead Load = 1821 lb



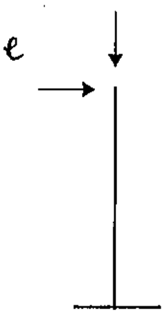
during Flood Only

Spot Footing

$h_{pier} = 6' - d_{FTG} = 4'4"$

Dead Load = 2112 lb

Slab @ Grade
↓
Siesmic loads dissipate into Slab
↓
No check Req



@ HSS AB direction

↓ P + C

→ V_{MAX}

P =

Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb
~~Dwall = 1821 lb~~

C_{max} =
W = 2118 lb
E = 5277 lb

Vmax
D = 172 lb
L = 245 lb
S = 183 lb
W = 477 lb
= 162 lb (VA @ fnd)
F = 1028 lb

(governs)

@ Concret Wall (strong/AB direction)

M_{MAX} ↓ P + C

→ V_{MAX}

Pmax Dwall = 1821 lb
D = 4860 lb
L = 6920 lb
S = 5170 lb

C_{max} =
W = 2118 lb
E = 4733 lb

V_{MAX} =
D = 774 lb (from pier rxn)
L = 1102 lb (from pier rxn)
S = 823 lb (from pier rxn)
W = 615 lb (from pier rxn)
= 81 (vb @ fnd)
F = 1376 lb (from pier rxn)

M_{max} =
D = 2430 ft lb
L = 3460 ft lb
S = 2585 ft lb
W = 1773 ft lb
F = 3642 lb

Use 24" Ø w/ (8) #5 bars Vert + #3 ties @ 12" o/c and (3) @ Top

@ HSS 12 direction

↓ P + C

→ VMAX

~~Dwall = 1821 lb~~

Pz ↓

Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb

C_{max} = ↓
W = 2118 lb
E = 5277 lb

Vmax

D = 43 lb
L = 61 lb
S = 46 lb
W = 1701 lb
= 673 lb (V12 @ fnd)
F = 1028 lb

@ Concrete Wall (weak/12 direction)

↓ P + C

→ VMAX

Pz ↓

Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb

Dwall = 1821 lb

C_{max} =
W = 2118 lb
E = 4733 lb

VMAX = ↓

@ concrete wall - weak
D = 43 lb (from pier rxn)
L = 61 lb (from pier rxn)
S = 46 lb (from pier rxn)
W = 1701 lb (from pier rxn)
= 673 lb (v12 @ fnd)
F = 866 lb (from pier rxn)

X / 12

Z / AB

24" Ø Pier Reactions

@ HSS

	V_{MAX}	M_{MAX}
X / 12 direction	D = 43 lb L = 61 lb S = 46 lb W = 2374 lb F = 1028 lb	D = 405 ft lb L = 557 ft lb S = 431 ft lb W = 10110 ft lb F = 4454 lb
Z / AB direction	D = 172 lb L = 245 lb S = 183 lb W = 639 lb F = 1028 lb	D = 1620 ft lb L = 2307 ft lb S = 1723 ft lb W = 2063 ft lb F = 4454 lb

USE 24" Ø X 4'3" EMBED MAX FOOTING WITH (8) #5 VERTS AND #3 TIES AT 12" O/C

@ Concrete Wall

	V_{MAX}	M_{MAX}
X / 12 direction (weak wall)	D = 43 lb L = 61 lb S = 46 lb W = 2374 lb F = 866 lb	D = 187 ft lb L = 264 ft lb S = 200 ft lb W = 10285 ft lb F = 3752 lb
Z / AB direction (strong wall)	D = 774 lb L = 1102 lb S = 823 lb W = 696 lb F = 1376 lb	D = 5784 ft lb L = 8234 ft lb S = 6150 ft lb W = 4788 ft lb F = 9604 lb

HAYDEN ENGINEERS
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Concrete Beam

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

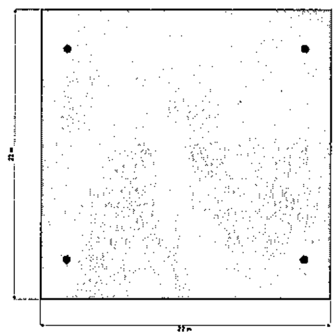
DESCRIPTION: Ftg Pier - @ HSS 12 direction

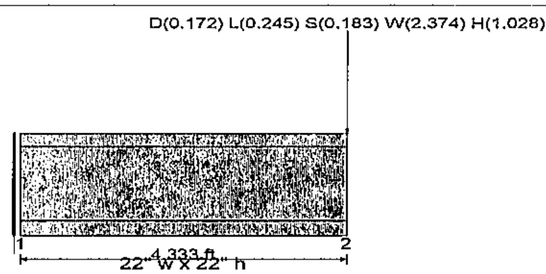
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combination Set : ASCE 7-16

General Information

f'c =	4.0 ksi	ϕ Phi Values	Flexure :	0.90	
fr = 7.5 * λ * f'c$^{1/2}$ =	474.342 psi		Shear :	0.750	
ψ Density =	145.0 pcf	β_1 =		0.850	
λ LtWt Factor =	1.0				
Elastic Modulus =	3,122.0 ksi	Fy - Stirrups		40.0	ksi
fy - Main Rebar =	60.0	E - Stirrups =		29,000.0	ksi
E - Main Rebar =	29,000.0 ksi	Stirrup Bar Size #		3	
		Number of Resisting Legs Per Stirrup =		2	





Cross Section & Reinforcing Details

Rectangular Section, Width = 22.0 in, Height = 22.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 4.333 ft in this span 2-#5 at 3.0 in from Top, from 0.0 to 4.333 ft in this span

Point Load : D = 0.1720, L = 0.2450, S = 0.1830, W = 2.374, H = 1.028 k @ 4.333 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.289 : 1**
Section used for this span	**Typical Section**
Mu : Applied	-16.933 k-ft
Mn * Phi : Allowable	58.605 k-ft
Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.002 in	Ratio =	56980 >=360.0	S Only
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	Overall MAXimum Envelope
Max Downward Total Deflection	0.002 in	Ratio =	56980 >=240.0	Span: 1 : W Only
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : W Only

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.374	
Max Upward from Load Combinations	2.316	
Max Upward from Load Cases	2.374	
D Only	0.172	
+D+L	0.417	
+D+S	0.355	
+D+0.750L	0.356	
+D+0.750L+0.750S	0.493	
+D+0.60W	1.596	

DESCRIPTION: Ftg Pier - @ HSS 12 direction

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750L+0.450W	1.424	
+0.60D+0.60W	1.528	
+0.60D	0.103	
L Only	0.245	
S Only	0.183	
W Only	2.374	
H Only	1.028	
+D+0.60W+0.70H	2.316	
+0.60D+0.60W+0.70H	2.247	
+D+0.750L+0.450W+0.70H	2.144	
+D+0.750L+0.5250S+0.450W+0.70H	2.240	

Shear Stirrup Requirements

Entire Beam Span Length : Vu < Phi*Vc / 2, Req'd Vs = Not Reqd per 9.6.3.1, Stirrups are not required.

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Concrete Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Ftg Pier - @ HSS - Ab direction

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

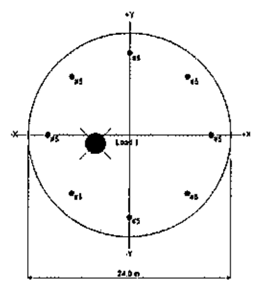
f'c : Concrete 28 day strenç	=	2.50 ksi
E =	=	3,122.0 ksi
Density	=	150.0 pcf
β	=	0.850
fy - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits		*ASTM A615 Bars Used*
Min. Reinf.	=	0.50 %
Max. Reinf.	=	8.0 %

Overall Column Height = 4.333 ft
End Fixity Top Free, Bottom Fixed
Brace condition for deflection (buckling) along colun
X-X (width) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0

Column Cross Section

Column Dimensions : 24.0in Diameter, Column Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 8 - #5 bars



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 2,041.88 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 4.333 ft above base, Xecc = -4.0in, Yecc = -1.0in, D = 4.860, L = 6.920, S = 5.170, W = 2.118, E = 5.277 k
BENDING LOADS . . .
Lat. Point Load at 4.333 ft creating My-y, D = 0.1720, L = 0.2450, S = 0.1830, W = 0.6390, H = 1.028 k

DESIGN SUMMARY

Load Combination +1.20D+L+1.60S
Location of max.above base 4.304 ft

Maximum Stress Ratio **0.051 : 1**
Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5

Pu =	23.474 k	φ * Pn =	458.031 k
Mu-x =	2.582 k-ft	φ * Mn-x =	49.211 k-ft
Mu-y =	6.986 k-ft	φ* Mn-y =	135.438 k-ft
		φ =	0.650
Mu Angle =	70.0 deg		
Mu at Angle =	7.448 k-ft	φMn at Angle =	144.580 k-ft

Pn & Mn values located at Pu-Mu vector intersection with capacity curv

Column Capacities . .

Pnmax : Nominal Max. Compressive Axial Capaci	1,104.86 k
Pnmin : Nominal Min. Tension Axial Capacity	k
φ Pn, max : Usable Compressive Axial Capacity	574.53 k
φ Pn, min : Usable Tension Axial Capacity	k

Maximum SERVICE Load Reactions .

Top along Y-Y	1.168 k	Bottom along Y-Y	1.459 k
Top along X-X	0.0 k	Bottom along X-X	0.0 k

Maximum SERVICE Load Deflections . .

Along Y-Y -0.000441 in at 4.333 ft above base
for load combination : +D+0.750L+0.750S+0.5250E
Along X-X -0.001312 in at 4.333 ft above base
for load combination : +D+0.750L+0.750S+0.5250E

General Section Informatio β =0.850 θ = 0.80

ρ : % Reinforcing 0.5482 % Rebar % Ok
Reinforcing Area 2.480 in^2
Concrete Area 452.389 in^2

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	Axial Load k φ * Pn	Bending Analysis k-ft δx	δx * Mux	δy	δy * Muy	Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+1.60L	M2,min	Actual	4.30	19.35	461.32	1.000	2.13	1.000	5.62	69.000	6.01	143.61	**0.042**

HAYDEN ENGINEERS
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Concrete Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Ftg Pier - @ HSS - Ab direction

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	φ * Pn	δx	δx * Mux	δy	δy * Muy	Bending Analysis k-ft Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+1.60L+0.50S	M2,min	Actual	4.30	21.94	458.03	1.000	2.41	1.000	6.48	70.000	6.91	144.58	**0.048**
+1.20D+L	M2,min	Actual	4.30	15.20	471.13	1.000	1.67	1.000	4.24	68.000	4.56	140.61	**0.032**
+1.20D+0.50W	M2,min	Actual	4.30	9.34	494.04	1.000	1.03	1.000	2.28	66.000	2.50	132.92	**0.019**
+1.20D+L+1.60S	M2,min	Actual	4.30	23.47	458.03	1.000	2.58	1.000	6.99	70.000	7.45	144.58	**0.051**
+1.20D+1.60S+0.50W	M2,min	Actual	4.30	17.61	464.53	1.000	1.94	1.000	5.03	69.000	5.39	142.65	**0.038**
+1.20D+L+W	M2,min	Actual	4.30	17.32	467.75	1.000	1.91	1.000	4.92	69.000	5.28	141.67	**0.037**
+1.20D+L+0.50S+W	M2,min	Actual	4.30	19.91	461.32	1.000	2.19	1.000	5.78	69.000	6.18	143.61	**0.043**
+0.90D+W	M2,min	Actual	4.30	8.33	484.21	1.000	0.92	1.000	2.14	67.000	2.33	136.34	**0.017**
+0.90D+0.50W+H	M2,min	Actual	4.30	7.27	268.21	1.000	0.80	1.000	-4.70	80.000	4.77	175.02	**0.027**
+1.20D+L+W+H	M2,min	Actual	4.30	17.32	467.75	1.000	1.91	1.000	4.90	69.000	5.25	141.67	**0.037**
+1.20D+L+0.30S+W+H	M2,min	Actual	4.30	18.87	464.53	1.000	2.08	1.000	5.41	69.000	5.80	142.65	**0.041**
+1.20D+L+0.20S+E	M2,min	Actual	4.30	21.51	458.03	1.000	2.37	1.000	6.34	70.000	6.77	144.58	**0.047**
+0.90D+E	M2,min	Actual	4.30	11.49	471.04	1.000	1.26	1.000	3.21	69.000	3.45	140.65	**0.025**

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
+D+L	0.417	1.168			13.822	-0.982		2.120	
D Only	0.172	1.168			6.902	-0.405		0.875	
+D+S	0.355	1.168			12.072	-0.836		1.805	
+D+0.750L	0.356	1.168			12.092	-0.838		1.809	
+D+0.750L+0.750S	0.493	1.168			15.969	-1.161		2.506	
+D+0.60W+0.70H	1.275	1.168			8.173	-0.511		-3.481	
+D+0.750L+0.450W+0.70H	1.363	1.168			13.045	-0.917		-2.238	
+D+0.750L+0.750S+0.450W	0.781	1.168			16.922	-1.240		1.578	
+D+0.750L+0.5250S+0.450W+0.70H	1.459	1.168			15.759	-1.143		-1.749	
+D+0.70E	0.172	1.168			10.596	-0.713		2.106	
+D+0.750L+0.750S+0.5250E	0.493	1.168			18.740	-1.391		3.430	
+0.60D+0.70E	0.103	1.168			7.835	-0.551		1.756	
L Only	0.245	1.168			6.920	-0.577		1.245	
S Only	0.183	1.168			5.170	-0.431		0.930	
W Only	0.639	1.168			2.118	-0.177		-2.063	
E Only		1.168			5.277	-0.440		1.759	
H Only	1.028	1.168						-4.454	

Maximum Moment Reactions

Note: Only non-zero reactions are listed.

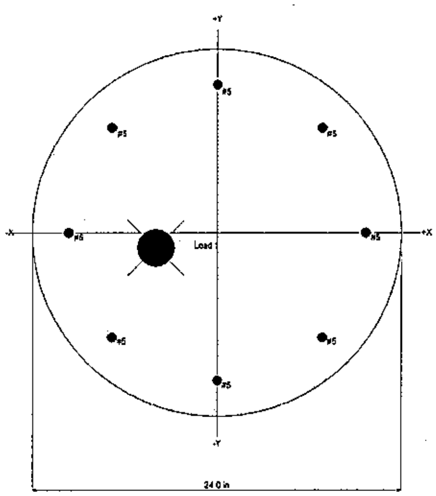
Load Combination	Moment About X-X Axis @ Base	@ Top		Moment About Y-Y Axis @ Base	@ Top	
+D+L	-0.982		k-ft	2.120		k-ft
D Only	-0.405		k-ft	0.875		k-ft
+D+S	-0.836		k-ft	1.805		k-ft
+D+0.750L	-0.838		k-ft	1.809		k-ft
+D+0.750L+0.750S	-1.161		k-ft	2.506		k-ft
+D+0.60W+0.70H	-0.511		k-ft	-3.481		k-ft
+D+0.750L+0.450W+0.70H	-0.917		k-ft	-2.238		k-ft
+D+0.750L+0.750S+0.450W	-1.240		k-ft	1.578		k-ft
+D+0.750L+0.5250S+0.450W+0.70H	-1.143		k-ft	-1.749		k-ft
+D+0.70E	-0.713		k-ft	2.106		k-ft
+D+0.750L+0.750S+0.5250E	-1.391		k-ft	3.430		k-ft
+0.60D+0.70E	-0.551		k-ft	1.756		k-ft
L Only	-0.577		k-ft	1.245		k-ft
S Only	-0.431		k-ft	0.930		k-ft
W Only	-0.177		k-ft	-2.063		k-ft
E Only	-0.440		k-ft	1.759		k-ft
H Only			k-ft	-4.454		k-ft

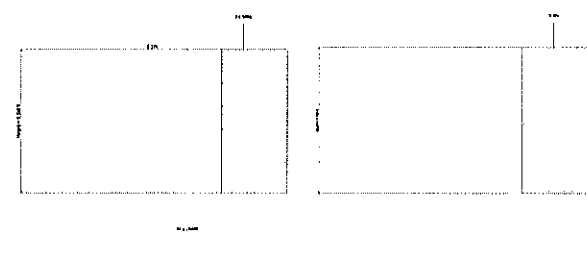
DESCRIPTION: Ftg Pier - @ HSS - Ab direction

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
D Only	0.0004	in	4.333	ft	-0.000	in	4.333	ft
+D+L	0.0009	in	4.333	ft	-0.000	in	4.333	ft
+D+S	0.0007	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L	0.0007	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L+0.750S	0.0010	in	4.333	ft	-0.000	in	4.333	ft
+D+0.60W+0.70H	-0.0005	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L+0.450W+0.70H	-0.0001	in	3.286	ft	-0.000	in	4.333	ft
+D+0.750L+0.750S+0.450W	0.0009	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L+0.5250S+0.450W+0.70H	0.0001	in	4.333	ft	-0.000	in	4.333	ft
+0.60D+0.60W+0.70H	-0.0007	in	4.333	ft	-0.000	in	4.333	ft
+D+0.70E	0.0007	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L+0.750S+0.5250E	0.0013	in	4.333	ft	-0.000	in	4.333	ft
+0.60D+0.70E	0.0006	in	4.333	ft	-0.000	in	4.333	ft
L Only	0.0005	in	4.333	ft	-0.000	in	4.333	ft
S Only	0.0004	in	4.333	ft	-0.000	in	4.333	ft
W Only	-0.0004	in	4.333	ft	-0.000	in	4.333	ft
E Only	0.0006	in	4.333	ft	-0.000	in	4.333	ft
H Only	-0.0009	in	4.304	ft	0.000	in	0.000	ft

Sketches





Interaction Diagrams

HAYDEN ENGINEERS
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Concrete Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Ftg Pier - @ HSS - 12 direction

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

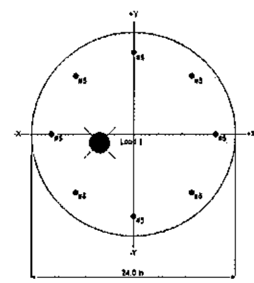
f'c : Concrete 28 day streng	=	2.50 ksi
E =	=	3,122.0 ksi
Density	=	150.0 pcf
β	=	0.850
fy - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits		*ASTM A615 Bars Used*
Min. Reinf.	=	0.50 %
Max. Reinf.	=	8.0 %

Overall Column Height = 4.333 ft
End Fixity Top Free, Bottom Fixed
Brace condition for deflection (buckling) along colun
X-X (width) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0

Column Cross Section

Column Dimensions : 24.0in Diameter, Column Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 8 - #5 bars



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 2,041.88 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 4.333 ft above base, Xecc = -4.0in, Yecc = -1.0in, D = 4.860, L = 6.920, S = 5.170, W = 2.118, E = 5.277 k
BENDING LOADS . . .
Lat. Point Load at 4.333 ft creating Mx-x, D = 0.0430, L = 0.0610, S = 0.0460, W = 2.374, H = 1.028 k

DESIGN SUMMARY

Load Combination	+1.20D+L+0.30S+W+H
Location of max.above base	4.304 ft
Maximum Stress Ratio	**0.082 : 1**

Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5

Pu =	18.871 k	φ * Pn =	228.564 k
Mu-x =	-13.920 k-ft	φ * Mn-x =	169.372 k-ft
Mu-y =	5.474 k-ft	φ* Mn-y =	65.013 k-ft
		φ =	0.7212
Mu Angle =	21.0 deg		
Mu at Angle =	14.958 k-ft	φMn at Angle =	181.658 k-ft

Pn & Mn values located at Pu-Mu vector intersection with capacity curv

Column Capacities . .

Pnmax : Nominal Max. Compressive Axial Capaci	1,104.86 k
Pnmin : Nominal Min. Tension Axial Capacity	k
φ Pn, max : Usable Compressive Axial Capacity	574.53 k
φ Pn, min : Usable Tension Axial Capacity	k

Maximum SERVICE Load Reactions .

Top along Y-Y	1.168 k	Bottom along Y-Y	0.0 k
Top along X-X	0.0 k	Bottom along X-X	2.374 k

Maximum SERVICE Load Deflections . .

Along Y-Y 0.002121 in at 4.333 ft above base
for load combination : W Only
Along X-X -0.001764 in at 4.333 ft above base
for load combination : +D+0.750L+0.750S+0.5250E

General Section Informatio β =0.850 θ = 0.80

ρ : % Reinforcing	0.5482 %	Rebar % Ok
Reinforcing Area	2.480 in^2	
Concrete Area	452.389 in^2	

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	Axial Load k φ * Pn	Bending Analysis k-ft δx	δx * Mux	δy	δy * Muy	Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+1.60L	M2,min	Actual	4.30	19.35	461.32	1.000	2.13	1.000	5.63	69.000	6.02	143.61	**0.042**

HAYDEN ENGINEERS
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Concrete Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Ftg Pier - @ HSS - 12 direction

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	φ * Pn	δx	δx * Mux	δy	δy * Muy	Bending Analysis k-ft Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+1.60L+0.50S	M2,min	Actual	4.30	21.94	458.03	1.000	2.41	1.000	6.50	70.000	6.93	144.58	**0.048**
+1.20D+L	M2,min	Actual	4.30	15.20	471.04	1.000	1.67	1.000	4.25	69.000	4.57	140.65	**0.032**
+1.20D+0.50W	Actual	Actual	4.30	9.34	300.93	1.000	-4.79	1.000	2.30	26.000	5.31	170.18	**0.031**
+1.20D+L+1.60S	M2,min	Actual	4.30	23.47	454.72	1.000	2.58	1.000	7.01	70.000	7.47	145.53	**0.051**
+1.20D+1.60S+0.50W	Actual	Actual	4.30	17.61	412.23	1.000	-4.42	1.000	5.05	49.000	6.72	156.77	**0.043**
+1.20D+L+W	Actual	Actual	4.30	17.32	274.69	1.000	-9.54	1.000	4.96	27.000	10.75	171.27	**0.063**
+1.20D+L+0.50S+W	Actual	Actual	4.30	19.91	304.14	1.000	-9.42	1.000	5.82	32.000	11.07	170.17	**0.065**
+0.90D+W	Actual	Actual	4.30	8.33	153.87	1.000	-9.91	1.000	2.16	12.000	10.15	187.75	**0.054**
+0.90D+0.50W+H	Actual	Actual	4.30	7.27	140.16	1.000	-9.31	1.000	1.81	11.000	9.49	181.78	**0.052**
+1.20D+L+W+H	Actual	Actual	4.30	17.32	215.03	1.000	-13.99	1.000	4.96	20.000	14.84	184.72	**0.080**
+1.20D+L+0.30S+W+H	Actual	Actual	4.30	18.87	228.56	1.000	-13.92	1.000	5.47	21.000	14.96	181.66	**0.082**
+1.20D+L+0.20S+E	M2,min	Actual	4.30	21.51	458.03	1.000	2.37	1.000	6.35	70.000	6.78	144.58	**0.047**
+0.90D+E	M2,min	Actual	4.30	11.49	467.75	1.000	1.26	1.000	3.22	69.000	3.46	141.67	**0.024**

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	Mx - End Moments k-ft @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
+D+L		1.168	0.104		13.822	-0.531		3.927	
D Only		1.168	0.043		6.902	-0.219		1.620	
+D+S		1.168	0.089		12.072	-0.450		3.343	
+D+0.750L		1.168	0.089		12.092	-0.453		3.350	
+D+0.750L+0.750S		1.168	0.123		15.969	-0.627		4.643	
+D+0.60W+0.70H		1.168	2.187		8.173	-8.965		2.044	
+D+0.750L+0.450W+0.70H		1.168	1.877		13.045	-7.215		3.668	
+D+0.750L+0.750S+0.450W		1.168	1.192		16.922	-3.923		4.960	
+D+0.750L+0.5250S+0.450W+0.70H		1.168	1.901		15.759	-7.093		4.572	
+D+0.70E		1.168	0.043		10.596	-0.527		2.851	
+D+0.750L+0.750S+0.5250E		1.168	0.123		18.740	-0.857		5.566	
+0.60D+0.70E		1.168	0.026		7.835	-0.439		2.203	
L Only		1.168	0.061		6.920	-0.312		2.307	
S Only		1.168	0.046		5.170	-0.232		1.723	
W Only		1.168	2.374		2.118	-10.110		0.706	
E Only		1.168			5.277	-0.440		1.759	
H Only		1.168	1.028			-4.454			

Maximum Moment Reactions

Note: Only non-zero reactions are listed.

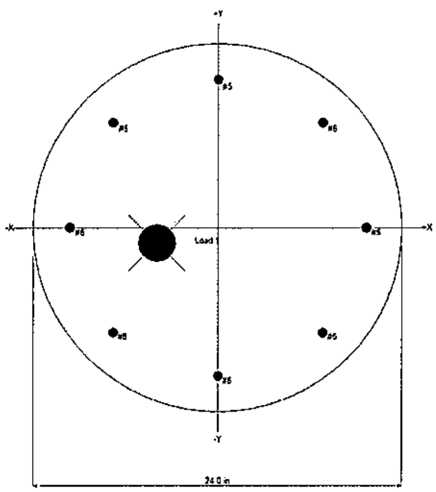
Load Combination	Moment About X-X Axis @ Base	Moment About X-X Axis @ Top		Moment About Y-Y Axis @ Base	Moment About Y-Y Axis @ Top	
+D+L	-0.531		k-ft	3.927		k-ft
D Only	-0.219		k-ft	1.620		k-ft
+D+S	-0.450		k-ft	3.343		k-ft
+D+0.750L	-0.453		k-ft	3.350		k-ft
+D+0.750L+0.750S	-0.627		k-ft	4.643		k-ft
+D+0.60W+0.70H	-8.965		k-ft	2.044		k-ft
+D+0.750L+0.450W+0.70H	-7.215		k-ft	3.668		k-ft
+D+0.750L+0.750S+0.450W	-3.923		k-ft	4.960		k-ft
+D+0.750L+0.5250S+0.450W+0.70H	-7.093		k-ft	4.572		k-ft
+D+0.70E	-0.527		k-ft	2.851		k-ft
+D+0.750L+0.750S+0.5250E	-0.857		k-ft	5.566		k-ft
+0.60D+0.70E	-0.439		k-ft	2.203		k-ft
L Only	-0.312		k-ft	2.307		k-ft
S Only	-0.232		k-ft	1.723		k-ft
W Only	-10.110		k-ft	0.706		k-ft
E Only	-0.440		k-ft	1.759		k-ft
H Only	-4.454		k-ft			k-ft

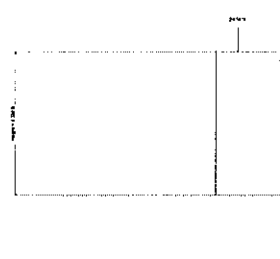
DESCRIPTION: Ftg Pier - @ HSS - 12 direction

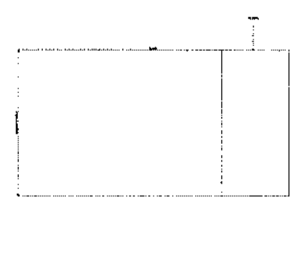
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
D Only	0.0005	in	4.333	ft	-0.000	in	4.333	ft
+D+L	0.0012	in	4.333	ft	-0.000	in	4.333	ft
+D+S	0.0011	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L	0.0011	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L+0.750S	0.0015	in	4.333	ft	-0.000	in	4.333	ft
+D+0.60W+0.70H	0.0006	in	4.333	ft	0.002	in	4.333	ft
+D+0.750L+0.450W+0.70H	0.0012	in	4.333	ft	0.001	in	4.333	ft
+D+0.750L+0.750S+0.450W	0.0016	in	4.333	ft	0.001	in	4.333	ft
+D+0.750L+0.5250S+0.450W+0.70H	0.0014	in	4.333	ft	0.001	in	4.333	ft
+0.60D+0.60W+0.70H	0.0004	in	4.333	ft	0.002	in	4.333	ft
+D+0.70E	0.0009	in	4.333	ft	-0.000	in	4.333	ft
+D+0.750L+0.750S+0.5250E	0.0018	in	4.333	ft	-0.000	in	4.333	ft
+0.60D+0.70E	0.0007	in	4.333	ft	-0.000	in	4.333	ft
L Only	0.0007	in	4.333	ft	-0.000	in	4.333	ft
S Only	0.0005	in	4.333	ft	-0.000	in	4.333	ft
W Only	0.0002	in	4.333	ft	0.002	in	4.333	ft
E Only	0.0006	in	4.333	ft	-0.000	in	4.333	ft
H Only	0.0000	in	0.000	ft	0.001	in	4.304	ft

Sketches







Interaction Diagrams

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Concrete Beam

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

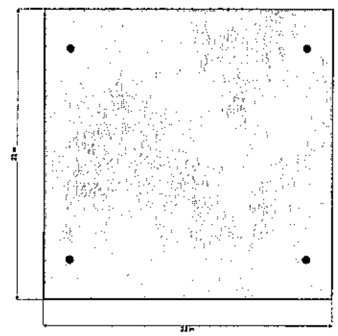
DESCRIPTION: Ftg Pier - @ Wall Pier Strong/AB direction

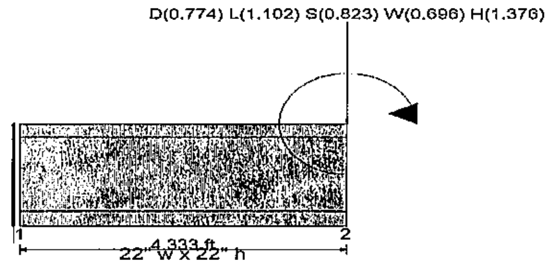
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combination Set : ASCE 7-16

General Information

f'c	=	4.0 ksi	ϕ Phi Values	Flexure :	0.90
$fr = 7.5 * \lambda * f'c^{1/2}$	=	474.342 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup =		2





Cross Section & Reinforcing Details

Rectangular Section, Width = 22.0 in, Height = 22.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 4.333 ft in this span 2-#5 at 3.0 in from Top, from 0.0 to 4.333 ft in this span

Point Load : D = 0.7740, L = 1.102, S = 0.8230, W = 0.6960, H = 1.376 k @ 4.333 ft
Moment : D = 2.430, L = 3.460, S = 2.585, W = 1.773, H = 3.642 k-ft, Location = 4.333 ft from left end of this span

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.536** : 1
Section used for this span	**Typical Section**
Mu : Applied	-31.411 k-ft
Mn * Phi : Allowable	58.605 k-ft
Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.002 in	Ratio =	51296	>=360.0	W Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	H Only
Max Downward Total Deflection	0.005 in	Ratio =	20256	>=240.0	Span: 1 : +D+0.750L+0.5250S+0.450W+0.70H
Max Upward Total Deflection	0.000 in	Ratio =	0	<240.0	Span: 1 : +D+0.750L+0.5250S+0.450W+0.70H

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	3.309	
Max Upward from Load Combinations	3.309	
Max Upward from Load Cases	1.376	
D Only	0.774	
+D+L	1.876	
+D+S	1.597	

DESCRIPTION: Ftg Pier - @ Wall Pier Strong/AB direction

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750L	1.600	
+D+0.750L+0.750S	2.218	
+D+0.60W	1.192	
+D+0.750L+0.450W	1.914	
+0.60D+0.60W	0.882	
+0.60D	0.464	
L Only	1.102	
S Only	0.823	
W Only	0.696	
H Only	1.376	
+D+0.60W+0.70H	2.155	
+0.60D+0.60W+0.70H	1.845	
+D+0.750L+0.450W+0.70H	2.877	
+D+0.750L+0.5250S+0.450W+0.70H	3.309	

Shear Stirrup Requirements

Entire Beam Span Length : Vu < Phi*Vc / 2, Req'd Vs = Not Reqd per 9.6.3.1, Stirrups are not required.

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Concrete Beam

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

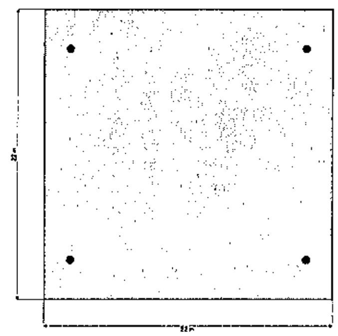
DESCRIPTION: Ftg Pier - @ Wall Pier Weak/12 direction

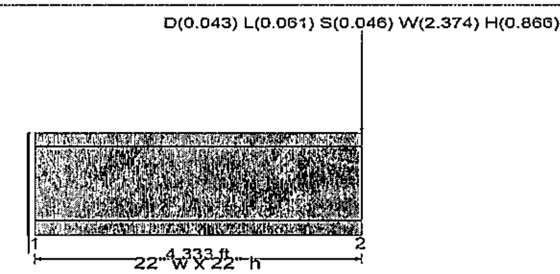
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combination Set : ASCE 7-16

General Information

f'c	=	4.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = $7.5 * \lambda * f'c^{1/2}$	=	474.342 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 22.0 in, Height = 22.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 4.333 ft in this span 2-#5 at 3.0 in from Top, from 0.0 to 4.333 ft in this span

Point Load : D = 0.0430, L = 0.0610, S = 0.0460, W = 2.374, H = 0.8660 k @ 4.333 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.249** : 1		
Section used for this span	**Typical Section**		
Mu : Applied	-14.585 k-ft		
Mn * Phi : Allowable	58.605 k-ft		
Location of maximum on span	0.000 ft		
Span # where maximum occurs	Span # 1		

Maximum Deflection

Max Downward Transient Deflection	0.002 in	Ratio = 56980 >=360.0	S Only
Max Upward Transient Deflection	0.000 in	Ratio = 0 <360.0	Overall MAXimum Envelope
Max Downward Total Deflection	0.002 in	Ratio = 56980 >=240.0	Span: 1 : W Only
Max Upward Total Deflection	0.000 in	Ratio = 0 <240.0	Span: 1 : W Only

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.374	
Max Upward from Load Combinations	2.074	
Max Upward from Load Cases	2.374	
D Only	0.043	
+D+L	0.104	
+D+S	0.089	
+D+0.750L	0.089	
+D+0.750L+0.750S	0.123	
+D+0.60W	1.467	

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DESCRIPTION: Ftg Pier - @ Wall Pier Weak/12 direction

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750L+0.450W	1.157	
+0.60D+0.60W	1.450	
+0.60D	0.026	
L Only	0.061	
S Only	0.046	
W Only	2.374	
H Only	0.866	
+D+0.60W+0.70H	2.074	
+0.60D+0.60W+0.70H	2.056	
+D+0.750L+0.450W+0.70H	1.763	
+D+0.750L+0.5250S+0.450W+0.70H	1.787	

Shear Stirrup Requirements

Entire Beam Span Length : Vu < Phi*Vc / 2, Req'd Vs = Not Reqd per 9.6.3.1, Stirrups are not required.

HAYDEN ENGINEERS
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Concrete Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Ftg Pier - @ Wall Pier - Vertical Load Check

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

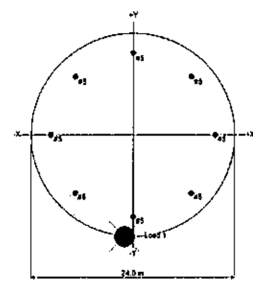
f'c : Concrete 28 day streng	=	2.50 ksi
E =	=	3,122.0 ksi
Density	=	150.0 pcf
β	=	0.850
fy - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits		*ASTM A615 Bars Used*
Min. Reinf.	=	0.50 %
Max. Reinf.	=	8.0 %

Overall Column Height = 4.333 ft
End Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along colun
X-X (width) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0

Column Cross Section

Column Dimensions : 24.0in Diameter, Column Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 8 - #5 bars



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 2,041.88 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 4.333 ft above base, Xecc = -1.0in, Yecc = -12.0in, D = 6.681, L = 6.920, S = 5.170, W = 2.118, E = 4.733 k

DESIGN SUMMARY

Load Combination	+1.20D+L+1.60S
Location of max.above base	4.304 ft
Maximum Stress Ratio	**0.123 : 1**

Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5

Pu =	25.659 k	φ * Pn =	208.942 k
Mu-x =	23.053 k-ft	φ * Mn-x =	186.594 k-ft
Mu-y =	2.823 k-ft	φ* Mn-y =	22.810 k-ft
		φ =	0.7838
Mu Angle =	7.0 deg		
Mu at Angle =	23.226 k-ft	φMn at Angle =	188.105 k-ft

Pn & Mn values located at Pu-Mu vector intersection with capacity curve

Column Capacities . .

Pnmax : Nominal Max. Compressive Axial Capaci	1,104.86 k
Pnmin : Nominal Min. Tension Axial Capacity	k
φ Pn, max : Usable Compressive Axial Capacity	574.53 k
φ Pn, min : Usable Tension Axial Capacity	k

Maximum SERVICE Load Reactions .

Top along Y-Y	0.3507 k	Bottom along Y-Y	0.3507 k
Top along X-X	4.208 k	Bottom along X-X	4.208 k

Maximum SERVICE Load Deflections . .

Along Y-Y 0.000753 in at 2.530 ft above base
for load combination : +D+0.750L+0.750S+0.5250E
Along X-X .0000630 in at 2.530 ft above base
for load combination : +D+0.750L+0.750S+0.5250E

General Section Informatio β = 0.850 θ = 0.80

ρ : % Reinforcing	0.5482 %	Rebar % Ok
Reinforcing Area	2.480 in^2	
Concrete Area	452.389 in^2	

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	φ * Pn	δx	δx * Mux	δy	δy * Muy	Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+1.60L	Actual	M2,min	4.30	21.54	211.35	1.000	18.96	1.000	2.37	7.000	19.11	187.86	**0.102**
+1.20D+1.60L+0.50S	Actual	M2,min	4.30	24.12	208.94	1.000	21.53	1.000	2.65	7.000	21.69	188.11	**0.115**
+1.20D+L	Actual	M2,min	4.30	17.39	218.50	1.000	14.84	1.000	1.91	7.000	14.96	187.03	**0.080**

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Concrete Column

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Ftg Pier - @ Wall Pier - Vertical Load Check

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	Axial Load k φ * Pn	Bending Analysis k-ft δx	δx * Mux	δy	δy * Muy	Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.20D+0.50W	Actual	M2,min	4.30	11.53	234.31	1.000	9.02	1.000	1.27	8.000	9.10	184.35	**0.049**
+1.20D+L+1.60S	Actual	M2,min	4.30	25.66	208.94	1.000	23.05	1.000	2.82	7.000	23.23	188.11	**0.123**
+1.20D+1.60S+0.50W	Actual	M2,min	4.30	19.80	213.73	1.000	17.23	1.000	2.18	7.000	17.37	187.60	**0.093**
+1.20D+L+W	Actual	M2,min	4.30	19.51	213.73	1.000	16.94	1.000	2.15	7.000	17.08	187.60	**0.091**
+1.20D+L+0.50S+W	Actual	M2,min	4.30	22.09	211.35	1.000	19.51	1.000	2.43	7.000	19.66	187.86	**0.105**
+0.90D+W	Actual	M2,min	4.30	9.97	227.37	1.000	8.08	1.000	1.10	8.000	8.15	185.70	**0.044**
+1.20D+L+0.20S+E	Actual	M2,min	4.30	23.15	208.94	1.000	20.57	1.000	2.55	7.000	20.72	188.11	**0.110**
+0.90D+E	Actual	M2,min	4.30	12.58	218.50	1.000	10.67	1.000	1.38	7.000	10.76	187.03	**0.058**

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction k @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	Mx - End Moments k-ft @ Base	Mx @ Top	My - End Moments @ Base	My @ Top
D Only	0.128	0.128	1.542	1.542	8.723				
+D+L	0.262	0.262	3.139	3.139	15.643				
+D+S	0.228	0.228	2.735	2.735	13.893				
+D+0.750L	0.228	0.228	2.740	2.740	13.913				
+D+0.750L+0.750S	0.303	0.303	3.635	3.635	17.790				
+D+0.60W	0.153	0.153	1.835	1.835	9.994				
+D+0.750L+0.450W	0.247	0.247	2.960	2.960	14.866				
+D+0.750L+0.750S+0.450W	0.321	0.321	3.855	3.855	18.743				
+0.60D+0.60W	0.102	0.102	1.218	1.218	6.505				
+D+0.70E	0.192	0.192	2.307	2.307	12.036				
+D+0.750L+0.750S+0.5250E	0.351	0.351	4.208	4.208	20.275				
+0.60D+0.70E	0.141	0.141	1.690	1.690	8.547				
L Only	0.133	0.133	1.597	1.597	6.920				
S Only	0.099	0.099	1.193	1.193	5.170				
W Only	0.041	0.041	0.489	0.489	2.118				
E Only	0.091	0.091	1.092	1.092	4.733				

Maximum Moment Reactions

Note: Only non-zero reactions are listed.

Load Combination	Moment About X-X Axis @ Base	Moment About X-X Axis @ Top		Moment About Y-Y Axis @ Base	Moment About Y-Y Axis @ Top	
D Only			k-ft			k-ft
+D+L			k-ft			k-ft
+D+S			k-ft			k-ft
+D+0.750L			k-ft			k-ft
+D+0.750L+0.750S			k-ft			k-ft
+D+0.60W			k-ft			k-ft
+D+0.750L+0.450W			k-ft			k-ft
+D+0.750L+0.750S+0.450W			k-ft			k-ft
+0.60D+0.60W			k-ft			k-ft
+D+0.70E			k-ft			k-ft
+D+0.750L+0.750S+0.5250E			k-ft			k-ft
+0.60D+0.70E			k-ft			k-ft
L Only			k-ft			k-ft
S Only			k-ft			k-ft
W Only			k-ft			k-ft
E Only			k-ft			k-ft

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	-0.0000 in	2.530 ft	0.000 in	2.530 ft
+D+L	-0.0000 in	2.530 ft	0.001 in	2.530 ft
+D+S	-0.0000 in	2.530 ft	0.000 in	2.530 ft
+D+0.750L	-0.0000 in	2.530 ft	0.000 in	2.530 ft
+D+0.750L+0.750S	-0.0001 in	2.530 ft	0.001 in	2.530 ft
+D+0.60W	-0.0000 in	2.530 ft	0.000 in	2.530 ft
+D+0.750L+0.450W	-0.0000 in	2.530 ft	0.001 in	2.530 ft
+D+0.750L+0.750S+0.450W	-0.0001 in	2.530 ft	0.001 in	2.530 ft

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Concrete Column

Project File: 24261 - foundation.ec6

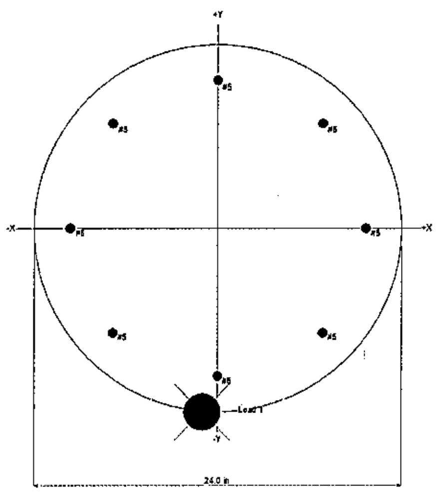
LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

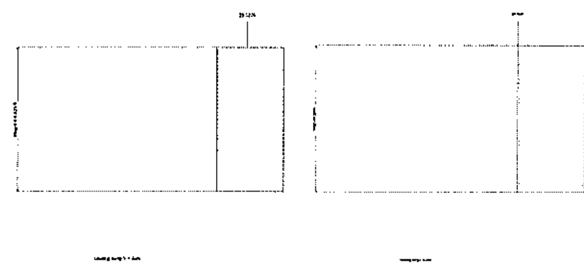
DESCRIPTION: Ftg Pier - @ Wall Pier - Vertical Load Check

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance		Max. Y-Y Deflection		Distance	
+0.60D+0.60W	-0.0000	in	2.530	ft	0.000	in	2.530	ft
+D+0.70E	-0.0000	in	2.530	ft	0.000	in	2.530	ft
+D+0.750L+0.750S+0.5250E	-0.0001	in	2.530	ft	0.001	in	2.530	ft
+0.60D+0.70E	-0.0000	in	2.530	ft	0.000	in	2.530	ft
L Only	-0.0000	in	2.530	ft	0.000	in	2.530	ft
S Only	-0.0000	in	2.530	ft	0.000	in	2.530	ft
W Only	0.0000	in	0.000	ft	0.000	in	2.530	ft
E Only	-0.0000	in	2.530	ft	0.000	in	2.530	ft

Sketches





Interaction Diagrams

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

Concrete Beam	Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.02.28 HAYDEN CONSULTING ENGINEERS (c) ENERCALC INC 1983-2023

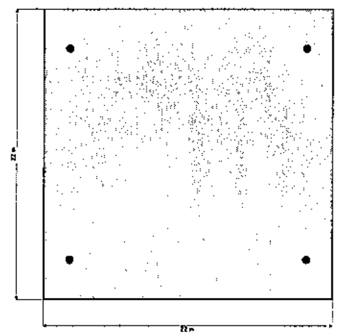
DESCRIPTION: Ftg Pier - Dead Load only

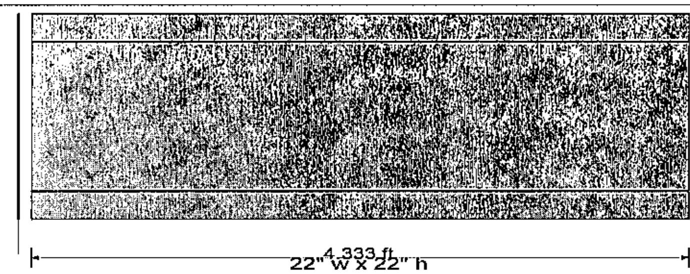
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

General Information

f'c	= 4.0 ksi	ϕ Phi Values	Flexure :	0.90
$fr = f'c^{1/2} * 7.50$	= 474.342 psi		Shear :	0.750
ψ Density	= 145.0 pcf	β_1	=	0.850
λ LtWt Factor	= 1.0			
Elastic Modulus	= 3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	= 60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	= 29,000.0 ksi	Stirrup Bar Size #		3
		Number of Resisting Legs Per Stirrup =		2





Cross Section & Reinforcing Details

Rectangular Section, Width = 22.0 in, Height = 22.0 in
Span #1 Reinforcing....
2-#5 at 3.0 in from Bottom, from 0.0 to 4.333 ft in this span 2-#5 at 3.0 in from Top, from 0.0 to 4.333 ft in this span

Beam self weight calculated and added to loads

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.109 : 1**			
Section used for this span	**Typical Section**			
Mu : Applied	-6.406 k-ft			
Mn * Phi : Allowable	58.605 k-ft			
Location of maximum on span	0.000 ft			
Span # where maximum occurs	Span # 1			
Maximum Deflection				
Max Downward Transient Deflection	0.000 in	Ratio =	0 <360.0	
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	
Max Downward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : D Only
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : D Only

Vertical Reactions

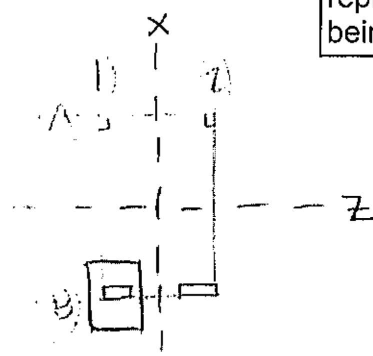
Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.112	
Max Upward from Load Combinations	1.267	
Max Upward from Load Cases	2.112	
D Only	2.112	
+0.60D	1.267	

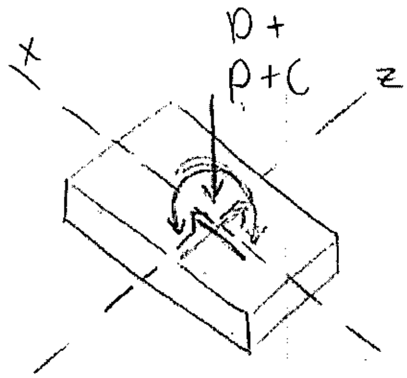
Part 3:
Spot Footings

Mx and Mz are enercalc terminology and are represented as being about it's axis

qa = 1500psf *1.333 = 2000psf



Spot Footing



@ Concrete Wall

lateral D,L,S loads not used with Pres

Strong direction

M_x = D = 5784 ft lb
L = 8234 ft lb
S = 6150 ft lb
W = 4788 ft lb
F = 9604 lb

(AB)

V_x = D = 43 lb
L = 61 lb
S = 46 lb
W = 2374 lb
F = 866 lb

(12)

Weak direction

M_z = D = 187 ft lb
L = 264 ft lb
S = 200 ft lb
W = 10285 ft lb
F = 3752 lb

(12)

V_z = D = 774 lb
L = 1102 lb
S = 823 lb
W = 696 lb
F = 1376 lb

(AB)

P = ↓

Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb

C_{max} = ↓

W = 2118 lb

E = 4733 lb

Dead Load resisting

8psf ($A_{roof} + A_{floor}$)

P_{res} = 1328 lb

D = Pier Dead load

Wall = 1821 lb

F+g = 2112 lb

P + D = 8793 lb $(DL)_{TOT}$

Check w/ resisting loads only (No P)

use 6'0" x 5'9" x 20"
w/ (8) #5
o/c ew / top + bott

(Pfull+lateral D,L,S loads governs)

Mx and Mz are enercalc terminology and are represented as being about the opposite axis

Spot Footing Cont.

@ HSS

$P_{res} + D_{Ftg\ Only} = 3440$ lb (DL) TOT

$P_{res} = 8psf(A_{roof} + A_{Floor})$
$= 1328$ lb DL

lateral D,L,S loads not used with Pres

$C_{max} =$
W = 2118
E = 5277 lb

Replace w/

$P_o + D_{Ftg} = 6972$ lb

$P =$
Pmax
D = 4860 lb
L = 6920 lb
S = 5170 lb

$M_x =$
D = 1620 ft lb
L = 2307 ft lb
S = 1723 ft lb
W = 2063 ft lb (AB)
F = 4454 lb

$V_x =$
D = 43 lb
L = 61 lb
S = 46 lb
W = 2374 lb (12)
F = 1028 lb

$V_z =$
D = 172 lb
L = 245 lb
S = 183 lb
W = 639 lb (AB)
F = 1028 lb

$M_z =$
D = 405 ft lb
L = 557 ft lb
S = 431 ft lb
W = 10110 ft lb (12)
F = 4454 lb

Use 5'3" SQ × 20"
w/ (8) #5 ew / top + bott
(Pres governs)

HAYDEN ENGINEERS
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General Footing

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Spot Footing - @ Concrete Wall

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

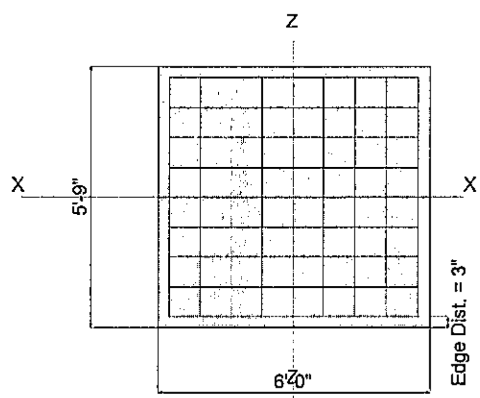
General Information

Material Properties		
f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750
Analysis Settings		
Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values		
Allowable Soil Bearing	=	2.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30
Increases based on footing Depth		
Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft
Increases based on footing plan dimension		
Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

Width parallel to X-X Axis	=	6.0 ft
Length parallel to Z-Z Axis	=	5.750 ft
Footing Thickness	=	20.0 in
Pedestal dimensions...		
px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete...		
at Bottom of footing	=	3.0 in



Reinforcing

Bars parallel to X-X Axis		
Number of Bars	=	9
Reinforcing Bar Size	=	# 5
Bars parallel to Z-Z Axis		
Number of Bars	=	9
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	Bars along Z-Z Axis
# Bars required within zone	97.9 %
# Bars required on each side of zone	2.1 %

Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	8.793		6.920	5.170	2.118	4.733		k
OB : Overburden	=								ksf
M-xx	=	5.784		8.234	6.150	4.788		9.604	k-ft
M-zz	=	0.1870		0.2640	0.20	10.285		3.752	k-ft
V-x	=	0.0430		0.0610	0.0460	2.374		0.8660	k
V-z	=	0.7740		1.102	8.230	0.6960		1.376	k

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

General Footing

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Spot Footing - @ Concrete Wall

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9645	Soil Bearing	1.929 ksf	2.0 ksf	+D+0.750L+0.5250S+0.450W+0.70H
PASS	2.057	Overturning - X-X	16.141 k-ft	33.204 k-ft	+0.60D+0.60W+0.70H
PASS	2.808	Overturning - Z-Z	12.337 k-ft	34.647 k-ft	+0.60D+0.60W+0.70H
PASS	1.685	Sliding - X-X	2.056 k	3.465 k	+0.60D+0.60W+0.70H
PASS	1.007	Sliding - Z-Z	8.086 k	8.145 k	+D+0.750L+0.750S+0.450W
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1258	Z Flexure (+X)	4.513 k-ft/ft	35.873 k-ft/ft	+1.20D+L+0.30S+W+H
PASS	0.09089	Z Flexure (-X)	3.261 k-ft/ft	35.873 k-ft/ft	+1.20D+L+1.60S
PASS	0.2195	X Flexure (+Z)	7.556 k-ft/ft	34.428 k-ft/ft	+1.20D+L+1.60S
PASS	0.02860	X Flexure (-Z)	0.9845 k-ft/ft	34.428 k-ft/ft	+0.90D+E
PASS	0.1066	1-way Shear (+X)	7.999 psi	75.0 psi	+1.20D+L+0.30S+W+H
PASS	0.07364	1-way Shear (-X)	5.523 psi	75.0 psi	+1.20D+L+1.60S
PASS	0.1856	1-way Shear (+Z)	13.923 psi	75.0 psi	+1.20D+L+1.60S
PASS	0.02725	1-way Shear (-Z)	2.044 psi	75.0 psi	+1.20D+1.60S+0.50W
PASS	0.1410	2-way Punching	21.153 psi	150.0 psi	+1.20D+L+1.60S

Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

General Footing

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Spot Footing - @ Concrete Wall w/ resisting loads only

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

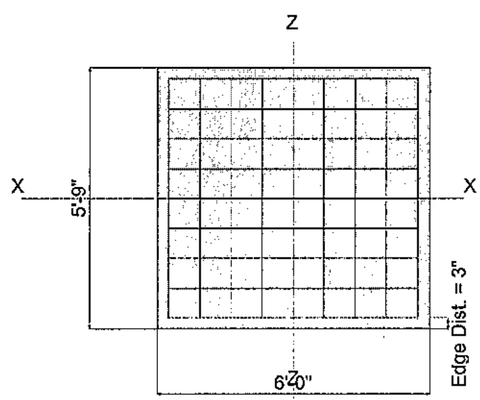
Width parallel to X-X Axis	=	6.0 ft
Length parallel to Z-Z Axis	=	5.750 ft
Footing Thickness	=	20.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0 in



Reinforcing

Bars parallel to X-X Axis

Number of Bars	=	9
Reinforcing Bar Size	=	# 5

Bars parallel to Z-Z Axis

Number of Bars	=	9.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	Bars along Z-Z Axis
# Bars required within zone	97.9 %
# Bars required on each side of zone	2.1 %

Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	5.261				2.118	4.733		k
OB : Overburden	=								ksf
M-xx	=					4.778		9.604	k-ft
M-zz	=					10.285		3.752	k-ft
V-x	=					2.374		0.8660	k
V-z	=					0.6960		1.376	k

HAYDEN
ENGINEERS
STRUCTURAL | CIVIL

General Footing

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS

DESCRIPTION: Spot Footing - @ Concrete Wall w/ resisting loads only

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.5247	Soil Bearing	0.7870 ksf	1.50 ksf	+D+0.60W+0.70H about X-X axis
PASS	2.280	Overturning - X-X	11.891 k-ft	27.111 k-ft	+0.60D+0.60W+0.70H
PASS	2.322	Overturning - Z-Z	12.182 k-ft	28.290 k-ft	+0.60D+0.60W+0.70H
PASS	1.393	Sliding - X-X	2.031 k	2.829 k	+0.60D+0.60W+0.70H
PASS	2.049	Sliding - Z-Z	1.381 k	2.829 k	+0.60D+0.60W+0.70H
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.07782	Z Flexure (+X)	2.792 k-ft/ft	35.873 k-ft/ft	+1.20D+W+H
PASS	0.03443	Z Flexure (-X)	1.235 k-ft/ft	35.873 k-ft/ft	+0.90D+E
PASS	0.07250	X Flexure (+Z)	2.496 k-ft/ft	34.428 k-ft/ft	+1.20D+W+H
PASS	0.03294	X Flexure (-Z)	1.134 k-ft/ft	34.428 k-ft/ft	+0.90D+E
PASS	0.06748	1-way Shear (+X)	5.061 psi	75.0 psi	+1.20D+W+H
PASS	0.02798	1-way Shear (-X)	2.099 psi	75.0 psi	+0.90D+E
PASS	0.06097	1-way Shear (+Z)	4.573 psi	75.0 psi	+1.20D+W+H
PASS	0.02578	1-way Shear (-Z)	1.934 psi	75.0 psi	+0.90D+E
PASS	0.05146	2-way Punching	7.718 psi	150.0 psi	+0.90D+E

Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

General Footing

DESCRIPTION: Spot Footing - @ HSS

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

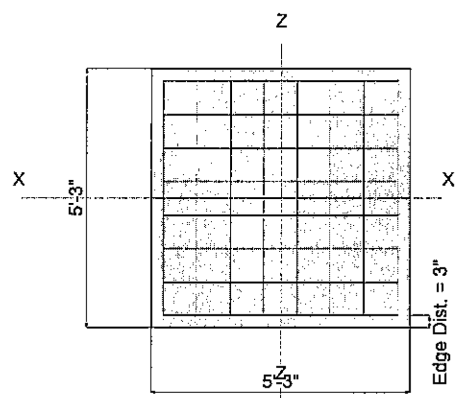
Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

Width parallel to X-X Axis	=	5.250 ft
Length parallel to Z-Z Axis	=	5.250 ft
Footing Thickness	=	20.0 in



Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in

Rebar Centerline to Edge of Concrete...

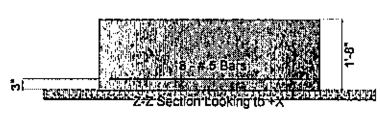
at Bottom of footing	=	3.0 in

Reinforcing

Bars parallel to X-X Axis		
Number of Bars	=	8
Reinforcing Bar Size	=	# 5
Bars parallel to Z-Z Axis		
Number of Bars	=	8
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	6.973		6.920	5.170	2.118	5.277		k
OB : Overburden	=								ksf
M-xx	=	1.620		2.307	1.723	2.063		4.454	k-ft
M-zz	=	0.4050		0.5570	0.4310	10.110		4.454	k-ft
V-x	=	0.0430		0.0610	0.0460	2.374		1.028	k
V-z	=	0.1720		0.2450	0.1830	0.6390		1.028	k

General Footing

DESCRIPTION: Spot Footing - @ HSS

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6520	Soil Bearing	1.304 ksf	2.0 ksf	+D+0.750L+0.5250S+0.450W+0.70H
PASS	3.381	Overturning - X-X	7.338 k-ft	24.809 k-ft	+0.60D+0.60W+0.70H
PASS	1.902	Overturning - Z-Z	13.043 k-ft	24.809 k-ft	+0.60D+0.60W+0.70H
PASS	1.307	Sliding - X-X	2.170 k	2.835 k	+0.60D+0.60W+0.70H
PASS	2.351	Sliding - Z-Z	1.206 k	2.835 k	+0.60D+0.60W+0.70H
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1267	Z Flexure (+X)	4.428 k-ft/ft	34.956 k-ft/ft	+1.20D+L+0.30S+W+H
PASS	0.07868	Z Flexure (-X)	2.750 k-ft/ft	34.956 k-ft/ft	+1.20D+L+1.60S
PASS	0.1084	X Flexure (+Z)	3.789 k-ft/ft	34.956 k-ft/ft	+1.20D+L+0.30S+W+H
PASS	0.06178	X Flexure (-Z)	2.159 k-ft/ft	34.956 k-ft/ft	+1.20D+L+1.60S
PASS	0.1087	1-way Shear (+X)	8.156 psi	75.0 psi	+1.20D+L+0.30S+W+H
PASS	0.06231	1-way Shear (-X)	4.673 psi	75.0 psi	+1.20D+L+1.60S
PASS	0.09184	1-way Shear (+Z)	6.888 psi	75.0 psi	+1.20D+L+0.30S+W+H
PASS	0.04668	1-way Shear (-Z)	3.501 psi	75.0 psi	+1.20D+L+1.60S
PASS	0.1267	2-way Punching	19.003 psi	150.0 psi	+1.20D+L+1.60S

Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

General Footing

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Spot Footing - @ HSS w/ resisting loads only

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	110.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

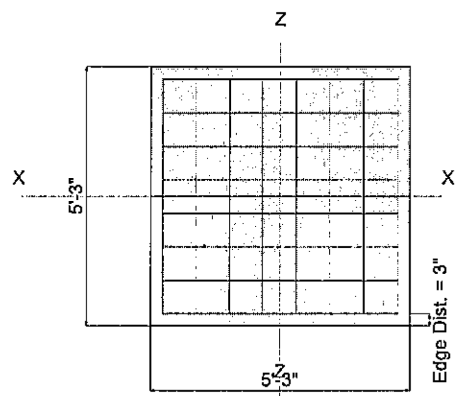
Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

Width parallel to X-X Axis	=	5.250 ft
Length parallel to Z-Z Axis	=	5.250 ft
Footing Thickness	=	20.0 in



Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0 in

Reinforcing

Bars parallel to X-X Axis

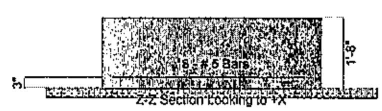
Number of Bars	=	8.0
Reinforcing Bar Size	=	# 5

Bars parallel to Z-Z Axis

Number of Bars	=	8.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.440				2.118	5.277		k
OB : Overburden	=								ksf
M-xx	=					2.063		4.454	k-ft
M-zz	=					10.110		4.454	k-ft
V-x	=					2.374		1.028	k
V-z	=					0.6390		1.028	k

General Footing

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS

DESCRIPTION: Spot Footing - @ HSS w/ resisting loads only

DESIGN SUMMARY

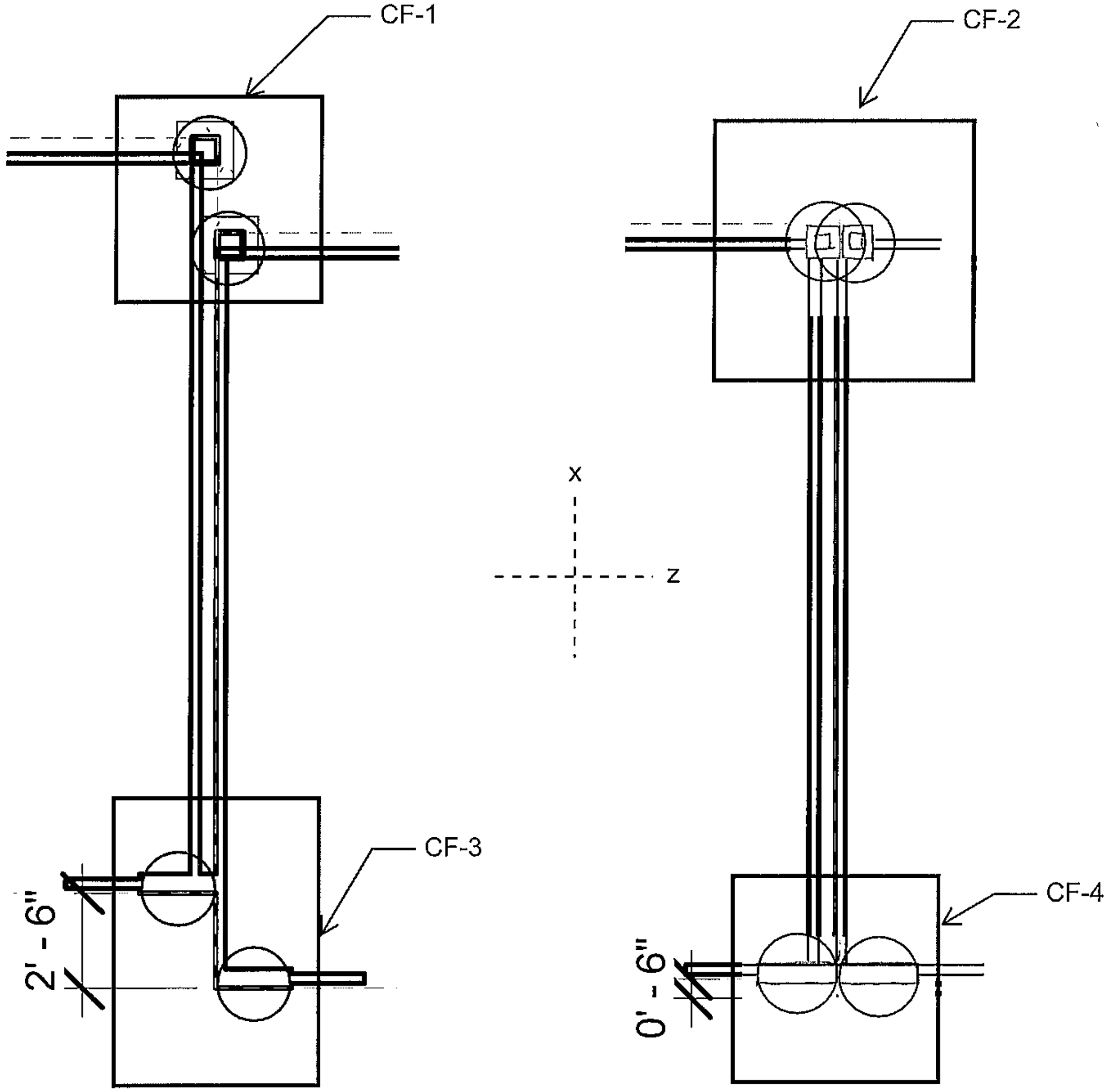
Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6947	Soil Bearing	1.042 ksf	1.50 ksf	+0.60D+0.60W+0.70H about Z-Z axis
PASS	3.107	Overturning - X-X	6.194 k-ft	19.245 k-ft	+0.60D+0.60W+0.70H
PASS	1.509	Overturning - Z-Z	12.757 k-ft	19.245 k-ft	+0.60D+0.60W+0.70H
PASS	1.026	Sliding - X-X	2.144 k	2.199 k	+0.60D+0.60W+0.70H
PASS	1.994	Sliding - Z-Z	1.103 k	2.199 k	+0.60D+0.60W+0.70H
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.08357	Z Flexure (+X)	2.921 k-ft/ft	34.956 k-ft/ft	+1.20D+W+H
PASS	0.02994	Z Flexure (-X)	1.047 k-ft/ft	34.956 k-ft/ft	+0.90D+E
PASS	0.04766	X Flexure (+Z)	1.666 k-ft/ft	34.956 k-ft/ft	+1.20D+W+H
PASS	0.02994	X Flexure (-Z)	1.047 k-ft/ft	34.956 k-ft/ft	+0.90D+E
PASS	0.07583	1-way Shear (+X)	5.687 psi	75.0 psi	+1.20D+W+H
PASS	0.02398	1-way Shear (-X)	1.798 psi	75.0 psi	+0.90D+E
PASS	0.04131	1-way Shear (+Z)	3.098 psi	75.0 psi	+1.20D+W+H
PASS	0.02398	1-way Shear (-Z)	1.798 psi	75.0 psi	+0.90D+E
PASS	0.04502	2-way Punching	6.753 psi	150.0 psi	+0.90D+E

Top reinforcing mat required (see 'Bending' tab).

Hand check required for anchor pullout.

Part 4:
Combined Spot Footings



COMBINED FOOTINGS

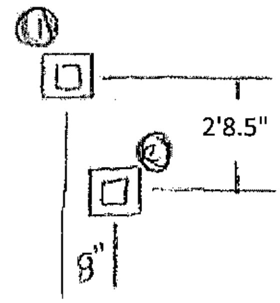
Combined Spot Footings

For all footings: qa = 1500psf *1.333 = 2000psf

No overturning in z/AB direction - loads cancel out
Lateral Loads - D, L, S not used with Presisting
Lateral Loads in z/AB direction - only HSS 1 takes load, both wall piers take load

Pfull		
D =	4860	lb
L =	6920	lb
S =	5170	lb

Presisting		
D =	1328	lb



CF-1
@ HSS

Point Loads		
Pfull **OR** Presisting		
Dftg =	2112	lb
W =	2118	lb
E =	5277	lb

Pfull		
Dtot =	6972	lb

Presisting		
Dtot =	3440	lb

Lateral Loads (ft lb, lb)					
	D	L	S	W	F
Mx	1620	2307	1723	2063	4454
Vx	43	61	46	2374	1028
Mz	405	557	431	10110	4454
Vz	172	245	183	639	1028

For Mx and Vz:
D, L, & S is negative at HSS 1 For Mx and Mz:
W & F not applied at HSS 2

CF-1	Ftg Size		
	Lx	**6**	12 dir.
	Wz	**6**	AB dir.
HSS 1	ex	**1.646**	
	ez	**2.667**	
HSS 2	ex	**4.354**	
	ez	**3.333**	

Reinforcing					
12 direction			AB direction		
Asreq =	0.432	in2/ft	Asreq =	0.432	in2/ft
Asreq*Lx =	2.592	in2	Asreq*Wz =	2.592	in2
n#5 =	9	#5 bars	n#5 =	9	#5 bars

USE 6'0" SQ x 20" DEEP FOOTING W/ (9) #5 BARS EACH WAY, TOP & BOTTOM
Pres governs

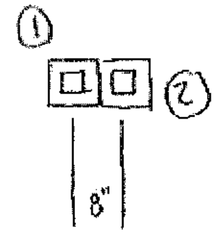
Combined Spot Footings

For all footings: qa = 1500psf *1.333 = 2000psf

No overturning in z/AB direction - loads cancel out
Lateral Loads - D, L, S not used with Presisting
Lateral Loads in z/AB direction - only HSS 1 takes load, both wall piers take load

Pfull		
D =	4860	lb
L =	6920	lb
S =	5170	lb

Presisting		
D =	1328	lb



CF-2
@ HSS

Point Loads			
Pfull **OR** Presisting			
Dftg =	2112	lb	Not applied at HSS 2 - pier footings overlap
W =	2118	lb	
E =	5277	lb	

Pfull		
Dtot =	6972	lb

Presisting		
Dtot =	3440	lb

Lateral Loads (ft lb, lb)						
	D	L	S	W	F	
Mx	1620	2307	1723	2063	4454	For Mx and Vz:
Vx	43	61	46	2374	1028	D, L, & S is negative at HSS 1 For Mx
Mz	405	557	431	10110	4454	and Mz:
Vz	172	245	183	639	1028	W & F not applied at HSS 2

CF-2	Ftg Size		
	Lx	**6**	12 dir.
	Wz	**6**	AB dir.
HSS 1	ex	**3**	
	ez	**2.667**	
HSS 2	ex	**3**	
	ez	**3.333**	

Reinforcing					
12 direction			AB direction		
Asreq =	0.432	in2/ft	Asreq =	0.665	in2/ft
Asreq*Lx =	2.592	in2	Asreq*Wz =	3.987	in2
n#5 =	9	#5 bars	n#5 =	**13**	#5 bars

USE 6'0" SQ x 20" DEEP FOOTING W/ (13) #5 BARS EACH WAY, TOP & BOTTOM
Pfull governs

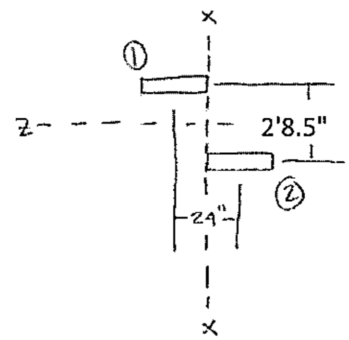
Combined Spot Footings

For all footings: qa = 1500psf *1.333 = 2000psf

No overturning in z/AB direction - loads cancel out
Lateral Loads - D, L, S not used with Presisting
Lateral Loads in z/AB direction - only HSS 1 takes load, both wall piers take load

Pfull		
D =	4860	lb
L =	6920	lb
S =	5170	lb

Presisting		
D =	1328	lb



CF-3
@ Concrete Wall Pier

Point Loads		
Pfull **OR** Presisting		
Dftg =	2112	lb
Dwall =	1821	lb
W =	2118	lb
E =	4733	lb

Pfull		
Dtot =	8793	lb

Presisting		
Dtot =	5261	lb

Lateral Loads (ft lb, lb)					
	D	L	S	W	F
Mx	5784	8234	6150	4788	9604
Vx	43	61	46	234	866
Mz	187	264	200	10285	3752
Vz	774	1102	823	696	1376

For Mx and Vz:
D, L, & S is negative at Peir 1

CF-3	Ftg Size (ft)		
	Lx	**6.5**	12 dir.
	Wz	**6.25**	AB dir.
Pier 1	ex	**1.896**	
	ez	**2.125**	
Pier 2	ex	**4.604**	
	ez	**4.125**	

Reinforcing					
12 direction			AB direction		
Asreq =	0.432	in2/ft	Asreq =	0.723	in2/ft
Asreq*Lx =	2.808	in2	Asreq*Wz =	4.51563	in2
n#5 =	10	#5 bars	n#5 =	**15**	#5 bars

USE 6'6" x 6'3" x 20" DEEP FOOTING W/ (15) #5 BARS EACH WAY, TOP & BOTTOM
Pfull governs

Combined Spot Footings

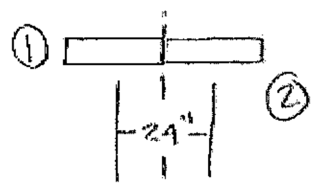
For all footings: qa = 1500psf *1.333 = 2000psf

No overturning in z/AB direction - loads cancel out
Lateral Loads - D, L, S not used with Presisting
Lateral Loads in z/AB direction - only HSS 1 takes load, both wall piers take load

Pfull		
D =	4860	lb
L =	6920	lb
S =	5170	lb

Presisting		
D =	1328	lb

CF-4
@ Concrete Wall Pier



Point Loads		
Pfull **OR** Presisting		
Dftg =	2112	lb
Dwall =	1821	lb
W =	2118	lb
E =	4733	lb

Pfull		
Dtot =	8793	lb

Presisting		
Dtot =	5261	lb

Lateral Loads (ft lb, lb)					
	D	L	S	W	F
Mx	5784	8234	6150	4788	9604
Vx	43	61	46	2374	866
Mz	187	264	200	10285	3752
Vz	774	1102	823	696	1376

For Mx and Vz:
D, L, & S is negative at Peir 1

CF-4	Ftg Size (ft)		
	Lx	**6.75**	12 dir.
	Wz	**6.75**	AB dir.
Pier 1	ex	**3.375**	
	ez	**2.375**	
Pier 2	ex	**3.375**	
	ez	**4.375**	

Reinforcing					
12 direction			AB direction		
Asreq =	0.432	in2/ft	Asreq =	0.723	in2/ft
Asreq*Lx =	2.916	in2	Asreq*Wz =	4.87688	in2
n#5 =	10	#5 bars	n#5 =	**16**	#5 bars

USE 6'9" SQ x 20" DEEP FOOTING W/ (16) #5 BARS EACH WAY, TOP & BOTTOM
Pfull governs

General Footing by FEM

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-1

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019

General Information

Material Properties

f'c : Concrete	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

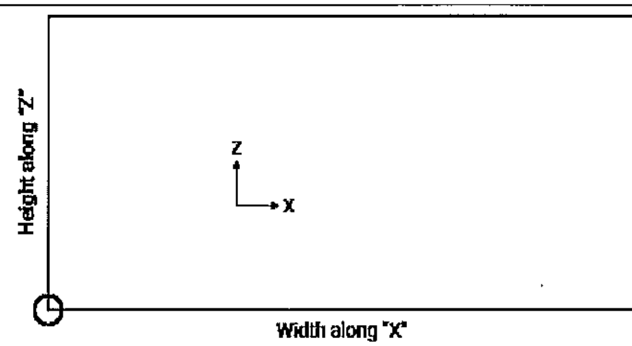
Footing Information

Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis	=	6.0 ft
Height along "Z" Axis	=	6.0 ft



Footing Target Mesh Element Size	=	1.440 in
Footing Thickness	=	20.0 in

Footing Stiffness

Ieff = Ig * Cracking Factor

Cracking Factor = 0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom = 3.0 in

=

◯ **: (0,0) Origin for Pedestal centroid location**

Overburden load on footing

Overburden DL	=	ksf
Omit at pedestal locations	=	Yes

Pedestal 1 Information

Description		
Shape		Round
CCW Rotation of Pedestal		0.00 deg
Pedestal Centroid to Footing Datum		
Along "X"	=	1.646 ft
Along "Z"	=	2.667 ft
Target Mesh Element Size	=	2.0 in

Diameter		24.0 in
Pedestal Height	=	12.0 in
M & V Applied with respect to:	=	Footing Axes
Omit @ Footprint of all pedestals	=	Yes
Punching Shear Perimeter Adjustment Factor	=	1.0
Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	6.972	-1.620	0.4050	0.0430	-0.1720
L : Live	6.920	-2.307	0.5570	0.0610	-0.2450
S : Snow	5.170	-1.723	0.4310	0.0460	-0.1830
H : Earth		4.454	4.454	1.028	1.028

HAYDEN ENGINEERS

STRUCTURAL | CIVIL

DESCRIPTION: CF-1

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
W : Wind #1	2.118	2.063	10.110	2.374	0.6390
E : Seismic #1	5.277				

Pedestal 2 Information

Description			Diameter		24.0 in
Shape	Round				
CCW Rotation of Pedestal	0.00	deg	Pedestal Height	=	12 in
Pedestal Centroid to Footing Datum			M & V Applied with respect to:	=	Footing Axes
Along "X" =	4.354	ft	Omit @ Footprint of all pedestals	=	Yes
Along "Z" =	3.333	ft	Punching Shear Perimeter Adjustment Factor	=	1
Target Mesh Element Size =	2.0	in	Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	6.972	1.620	0.4050	0.0430	0.4050
Lr : Roof Live					0.5570
L : Live	6.920	2.307	0.5570	0.0610	0.4310
S : Snow	5.170	1.723	0.4310	0.0460	
H : Earth			4.454	1.028	
W : Wind #1	2.118		10.110	2.374	
E : Seismic #1	5.277				

Results

Overturning : Lowest Stability Ratio = 1.59 at CCW Angle 90 deg for Load Combination: +0.60D+0.60W1+0.70H

Sliding : Lowest Sliding Ratio = 3.29 for Load Combination: +0.60D+0.60W1

Soil Bearing : Max. Soil pressure = 1.869 ksf for Load Combination +D+0.750L+0.5250S+0.450W1+0.70H

Punching Shear : Max. Ratio = 0.06314 for LdComb: +0.90D+E1, vu= 0.005990 ksi, vn= 0.09487 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing : Mu-XX = 21.003 ft-k/ft at Shell ID 1509, (X,Z)= (5.598, -1.502) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, BOTTOM of Footing : Mu-ZZ = 13.411 ft-k/ft at Shell ID 2282, (X,Z)= (4.113, -3.492) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

X-X Flexure, TOP of Footing : Mu-XX = 1.551 ft-k/ft at Shell ID 873, (X,Z)= (2.276, -3.620) for LdComb: +0.90D+0.90W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, TOP of Footing : Mu-ZZ = 27.014 ft-k/ft at Shell ID 1151, (X,Z)= (1.009, -0.1676) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.000	51.017	999.000
	45	14.391	70.287	4.884
	60	17.626	67.410	3.825
	75	19.659	59.940	3.049
	90	20.352	48.384	2.377
	105	20.340	57.389	2.821
	120	18.942	64.418	3.401
	135	16.253	67.057	4.126
	150	12.456	65.126	5.228
	165	7.811	58.757	7.522

DESCRIPTION: CF-1

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Moments k-ft Resisting	Overturning Ratio
	180	2.633	48.384	18.376
	195	2.543	64.526	25.371
	210	2.280	76.270	33.448
	225	1.862	82.817	44.482
	240	1.317	83.719	63.592
	255	0.681	78.917	115.804
	270	0.000	68.736	999.000
	285	0.000	79.598	999.000
	300	0.000	85.036	999.000
	315	0.000	84.678	999.000
	330	0.000	78.550	999.000
	345	0.000	67.069	999.000
+0.60D+0.60W1+0.70H				
	0	0.0	56.1	999.000
	30	15.213	72.736	4.781
	45	21.514	73.849	3.433
	60	26.350	69.929	2.654
	75	29.389	61.243	2.084
	90	30.426	48.384	1.590
	105	31.374	57.389	1.829
	120	30.184	64.418	2.134
	135	26.938	67.057	2.489
	150	21.855	65.126	2.980
	165	15.283	58.757	3.845
	180	7.670	48.384	6.308
	195	7.408	67.133	9.062
	210	6.642	81.307	12.241
	225	5.423	89.940	16.584
	240	3.835	92.443	24.106
	255	1.985	88.647	44.657
	270	0.000	78.810	999.000
	285	0.000	90.632	999.000
	300	0.000	96.278	999.000
	315	0.000	95.363	999.000
	330	0.000	87.949	999.000
	345	0.000	74.541	999.000
+0.60D+0.70E1				
	0	1.2	64.5	51.750
	30	1.392	87.357	62.761
	45	1.323	90.132	68.134
	60	1.164	86.764	74.562
	75	0.925	77.483	83.752
	90	0.624	62.923	100.902
	105	1.022	74.956	73.368
	120	1.350	84.398	62.514
	135	1.586	88.088	55.525
	150	1.715	85.775	50.022
	165	1.726	77.617	44.964
	180	1.620	64.170	39.611
	195	1.565	78.430	50.122
	210	1.403	87.346	62.258
	225	1.146	90.309	78.837
	240	0.810	87.118	107.553
	255	0.419	77.989	186.005
	270	0.000	63.546	999.000
	285	0.323	78.086	241.902
	300	0.624	87.304	140.000
	315	0.882	90.572	102.701
	330	1.080	87.669	81.167
	345	1.205	78.790	65.402
+D+0.60W1				
	0	0.0	78.4	999.000
	30	10.384	105.708	10.180

DESCRIPTION: CF-1

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Moments k-ft Resisting	Overturning Ratio
	45	14.685	108.891	7.415
	60	17.986	104.653	5.819
	75	20.060	93.284	4.650
	90	20.768	75.557	3.638
	105	20.806	89.618	4.307
	120	19.426	100.595	5.178
	135	16.723	104.716	6.262
	150	12.880	101.701	7.896
	165	8.159	91.756	11.247
	180	2.882	75.557	26.221
	195	2.783	97.913	35.178
	210	2.495	113.597	45.521
	225	2.038	121.539	59.649
	240	1.441	121.198	84.121
	255	0.746	112.598	150.977
	270	0.000	96.325	999.000
	285	0.000	113.344	999.000
	300	0.000	122.639	999.000
	315	0.000	123.576	999.000
	330	0.000	116.092	999.000
	345	0.000	100.696	999.000
+D+0.60W1+0.70H				
	0	0.0	83.5	999.000
	30	15.421	110.070	7.138
	45	21.808	112.453	5.156
	60	26.710	107.172	4.012
	75	29.791	94.587	3.175
	90	30.842	75.557	2.450
	105	31.840	89.618	2.815
	120	30.669	100.595	3.280
	135	27.407	104.716	3.821
	150	22.278	101.701	4.565
	165	15.631	91.756	5.870
	180	7.918	75.557	9.542
	195	7.648	100.520	13.143
	210	6.857	118.633	17.300
	225	5.599	128.662	22.979
	240	3.959	129.922	32.816
	255	2.049	122.329	59.690
	270	0.000	106.398	999.000
	285	0.000	124.378	999.000
	300	0.000	133.881	999.000
	315	0.000	134.261	999.000
	330	0.000	125.491	999.000
	345	0.000	108.169	999.000
+D+0.70E1				
	0	2.1	92.8	44.642
	30	2.320	125.411	54.060
	45	2.205	129.323	58.656
	60	1.939	124.423	64.154
	75	1.542	111.043	72.016
	90	1.039	90.095	86.686
	105	1.703	107.401	63.076
	120	2.250	120.991	53.772
	135	2.644	126.336	47.780
	150	2.858	123.071	43.063
	165	2.877	111.419	38.727
	180	2.700	92.174	34.139
	195	2.608	112.621	43.183
	210	2.338	125.392	53.626
	225	1.909	129.619	67.892
	240	1.350	125.012	92.602
	255	0.699	111.886	160.109

General Footing by FEM

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-1

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
	270	0.000	91.135	999.000
	285	0.538	112.047	208.266
	300	1.039	125.323	120.580
	315	1.470	130.058	88.485
	330	1.800	125.931	69.955
	345	2.008	113.221	56.389
+D+0.750L+0.5250S+0.450W1+0.70I				
+D+0.750L+0.5250S+0.450W1+0.70I	0	0.0	97.0	999.000
+D+0.750L+0.5250S+0.450W1+0.70I	30	13.245	129.001	9.739
+D+0.750L+0.5250S+0.450W1+0.70I	45	18.732	132.207	7.058
+D+0.750L+0.5250S+0.450W1+0.70I	60	22.942	126.403	5.510
+D+0.750L+0.5250S+0.450W1+0.70I	75	25.588	111.986	4.376
+D+0.750L+0.5250S+0.450W1+0.70I	90	26.491	89.936	3.395
+D+0.750L+0.5250S+0.450W1+0.70I	105	27.425	106.674	3.890
+D+0.750L+0.5250S+0.450W1+0.70I	120	26.490	119.739	4.520
+D+0.750L+0.5250S+0.450W1+0.70I	135	23.750	124.645	5.248
+D+0.750L+0.5250S+0.450W1+0.70I	150	19.392	121.056	6.243
+D+0.750L+0.5250S+0.450W1+0.70I	165	13.712	109.218	7.965
+D+0.750L+0.5250S+0.450W1+0.70I	180	7.097	89.936	12.672
+D+0.750L+0.5250S+0.450W1+0.70I	195	6.855	117.005	17.068
+D+0.750L+0.5250S+0.450W1+0.70I	210	6.146	136.100	22.144
+D+0.750L+0.5250S+0.450W1+0.70I	225	5.018	145.921	29.077
+D+0.750L+0.5250S+0.450W1+0.70I	240	3.549	145.797	41.087
+D+0.750L+0.5250S+0.450W1+0.70I	255	1.837	135.737	73.897
+D+0.750L+0.5250S+0.450W1+0.70I	270	0.000	116.427	999.000
+D+0.750L+0.5250S+0.450W1+0.70I	285	0.000	137.574	999.000
+D+0.750L+0.5250S+0.450W1+0.70I	300	0.000	149.345	999.000
+D+0.750L+0.5250S+0.450W1+0.70I	315	0.000	150.939	999.000
+D+0.750L+0.5250S+0.450W1+0.70I	330	0.000	142.247	999.000
+D+0.750L+0.5250S+0.450W1+0.70I	345	0.000	123.860	999.000
+D+0.750L+0.750S				
	0	3.7	95.2	25.473
	30	4.171	128.035	30.695
	45	3.965	131.795	33.243
	60	3.488	126.574	36.291
	75	2.773	112.726	40.647
	90	1.870	91.197	48.773
	105	2.839	109.137	38.437
	120	3.615	123.287	34.100
	135	4.145	129.035	31.129
	150	4.392	125.990	28.684
	165	4.340	114.358	26.349
	180	3.992	94.934	23.780
	195	3.856	115.787	30.026
	210	3.457	128.749	37.239
	225	2.823	132.937	47.091
	240	1.996	128.065	64.157
	255	1.033	114.466	110.781
	270	0.000	93.067	999.000
	285	0.967	114.533	118.418
	300	1.868	128.193	68.609
	315	2.642	133.117	50.377
	330	3.236	128.970	39.851
	345	3.610	116.033	32.146
+D+0.750L+0.750S+0.450W1				
	0	2.0	100.9	49.422
	30	10.101	135.847	13.448
	45	13.229	139.882	10.574
	60	15.454	134.385	8.696
	75	16.627	119.730	7.201
	90	16.666	96.916	5.815
	105	17.132	115.481	6.741
	120	16.430	130.053	7.916

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

General Footing by FEM

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-1

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
	135	14.608	135.762	9.294
	150	11.791	132.219	11.214
	165	8.170	119.666	14.647
	180	3.992	98.957	24.787
	195	3.856	124.983	32.411
	210	3.457	142.491	41.213
	225	2.823	150.288	53.238
	240	1.996	147.844	74.065
	255	1.033	135.324	130.967
	270	0.000	113.582	999.000
	285	0.528	135.829	257.033
	300	1.021	148.819	145.775
	315	1.444	151.667	105.051
	330	1.768	144.180	81.539
	345	1.972	126.867	64.328
+D+0.750L+0.750S+0.5250E1				
	0	3.7	111.8	29.921
	30	4.171	150.742	36.139
	45	3.965	155.303	39.173
	60	3.488	149.280	42.801
	75	2.773	133.085	47.988
	90	1.870	107.820	57.663
	105	2.839	128.853	45.380
	120	3.615	145.418	40.221
	135	4.145	152.073	36.687
	150	4.392	148.364	33.778
	165	4.340	134.545	31.000
	180	3.992	111.556	27.943
	195	3.856	136.145	35.305
	210	3.457	151.455	43.806
	225	2.823	156.444	55.419
	240	1.996	150.772	75.532
	255	1.033	134.825	130.484
	270	0.000	109.689	999.000
	285	0.967	134.891	139.467
	300	1.868	150.900	80.762
	315	2.642	156.625	59.274
	330	3.236	151.677	46.868
	345	3.610	136.392	37.786
+D+0.750Lr+0.750L				
	0	2.1	71.7	34.515
	30	2.320	96.100	41.425
	45	2.205	98.767	44.797
	60	1.939	94.704	48.831
	75	1.542	84.186	54.599
	90	1.039	67.932	65.361
	105	1.991	81.113	40.739
	120	2.807	91.483	32.590
	135	3.432	95.619	27.862
	150	3.823	93.238	24.391
	165	3.953	84.504	21.377
	180	3.814	70.011	18.356
	195	3.684	85.476	23.202
	210	3.303	95.117	28.797
	225	2.697	98.275	36.440
	240	1.907	94.736	49.678
	255	0.987	84.741	85.846
	270	0.000	68.971	999.000
	285	0.538	85.190	158.347
	300	1.039	95.604	91.986
	315	1.470	99.502	67.696
	330	1.800	96.620	53.672
	345	2.008	87.152	43.406

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General Footing by FEM

DESCRIPTION: CF-1

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+D+0.750Lr+0.750L+0.450W1				
	0	0.4	77.5	201.985
	30	8.250	103.912	12.595
	45	11.469	106.855	9.317
	60	13.906	102.516	7.372
	75	15.396	91.190	5.923
	90	15.836	73.651	4.651
	105	16.283	87.457	5.371
	120	15.621	98.249	6.289
	135	13.895	102.346	7.366
	150	11.221	99.468	8.864
	165	7.783	89.811	11.540
	180	3.814	74.034	19.411
	195	3.684	94.672	25.698
	210	3.303	108.859	32.957
	225	2.697	115.627	42.874
	240	1.907	114.515	60.050
	255	0.987	105.599	106.975
	270	0.000	89.487	999.000
	285	0.099	106.487	1072.791
	300	0.192	116.230	606.127
	315	0.271	118.052	435.317
	330	0.332	111.830	336.699
	345	0.370	97.986	264.506
+D+0.750Lr+0.750L+0.450W1+0.70H				
+D+0.750Lr+0.750L+0.450W1+0.70H	0	0.0	82.1	999.000
+D+0.750Lr+0.750L+0.450W1+0.70H	30	12.955	107.941	8.332
+D+0.750Lr+0.750L+0.450W1+0.70H	45	18.321	110.145	6.012
+D+0.750Lr+0.750L+0.450W1+0.70H	60	22.438	104.842	4.672
+D+0.750Lr+0.750L+0.450W1+0.70H	75	25.027	92.395	3.692
+D+0.750Lr+0.750L+0.450W1+0.70H	90	25.909	73.651	2.843
+D+0.750Lr+0.750L+0.450W1+0.70H	105	27.218	87.358	3.210
+D+0.750Lr+0.750L+0.450W1+0.70H	120	26.672	98.057	3.676
+D+0.750Lr+0.750L+0.450W1+0.70H	135	24.308	102.074	4.199
+D+0.750Lr+0.750L+0.450W1+0.70H	150	20.288	99.136	4.887
+D+0.750Lr+0.750L+0.450W1+0.70H	165	14.885	89.441	6.009
+D+0.750Lr+0.750L+0.450W1+0.70H	180	8.467	73.651	8.698
+D+0.750Lr+0.750L+0.450W1+0.70H	195	8.179	96.909	11.849
+D+0.750Lr+0.750L+0.450W1+0.70H	210	7.333	113.563	15.487
+D+0.750Lr+0.750L+0.450W1+0.70H	225	5.987	122.478	20.457
+D+0.750Lr+0.750L+0.450W1+0.70H	240	4.234	123.047	29.064
+D+0.750Lr+0.750L+0.450W1+0.70H	255	2.191	115.230	52.581
+D+0.750Lr+0.750L+0.450W1+0.70H	270	0.000	99.560	999.000
+D+0.750Lr+0.750L+0.450W1+0.70H	285	0.000	117.421	999.000
+D+0.750Lr+0.750L+0.450W1+0.70H	300	0.000	127.280	999.000
+D+0.750Lr+0.750L+0.450W1+0.70H	315	0.000	128.466	999.000
+D+0.750Lr+0.750L+0.450W1+0.70H	330	0.000	120.896	999.000
+D+0.750Lr+0.750L+0.450W1+0.70H	345	0.000	105.088	999.000
+D+L				
	0	2.1	70.6	33.979
	30	2.320	95.135	41.009
	45	2.205	97.980	44.440
	60	1.939	94.147	48.544
	75	1.542	83.898	54.412
	90	1.039	67.932	65.361
	105	1.703	81.113	47.637
	120	2.250	91.483	40.657
	135	2.644	95.619	36.163
	150	2.858	93.238	32.624
	165	2.877	84.504	29.372
	180	2.700	70.011	25.930
	195	2.608	85.476	32.775
	210	2.338	95.117	40.678

HAYDEN ENGINEERS
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General Footing by FEM

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-1

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
	225	1.909	98.275	51.475
	240	1.350	94.736	70.175
	255	0.699	84.741	121.265
	270	0.000	68.971	999.000
	285	0.538	84.902	157.811
	300	1.039	95.047	91.450
	315	1.470	98.715	67.160
	330	1.800	95.655	53.136
	345	2.008	86.076	42.870
+D+Lr				
	0	2.1	72.1	34.694
	30	2.320	96.421	41.564
	45	2.205	99.030	44.916
	60	1.939	94.889	48.927
	75	1.542	84.283	54.661
	90	1.039	67.932	65.361
	105	2.087	81.113	38.863
	120	2.993	91.483	30.568
	135	3.694	95.619	25.882
	150	4.144	93.238	22.498
	165	4.312	84.504	19.599
	180	4.185	70.011	16.728
	195	4.043	85.476	21.143
	210	3.625	95.117	26.242
	225	2.959	98.275	33.207
	240	2.093	94.736	45.271
	255	1.083	84.741	78.229
	270	0.000	68.971	999.000
	285	0.538	85.287	158.526
	300	1.039	95.790	92.165
	315	1.470	99.765	67.875
	330	1.800	96.941	53.851
	345	2.008	87.511	43.585
+D+S				
	0	4.3	103.4	24.099
	30	4.788	139.001	29.029
	45	4.551	143.067	31.435
	60	4.004	137.382	34.312
	75	3.184	122.336	38.425
	90	2.147	98.952	46.096
	105	3.218	118.478	36.814
	120	4.071	133.888	32.892
	135	4.645	140.174	30.174
	150	4.904	136.907	27.919
	165	4.828	124.310	25.748
	180	4.423	103.242	23.342
	195	4.272	125.890	29.467
	210	3.830	139.959	36.539
	225	3.128	144.490	46.199
	240	2.212	139.175	62.932
	255	1.145	124.375	108.647
	270	0.000	101.099	999.000
	285	1.110	124.409	112.055
	300	2.145	139.242	64.920
	315	3.033	144.585	47.667
	330	3.715	140.075	37.706
	345	4.143	126.019	30.414

Sliding Results

Load Combination	Vertical Bearing (k)	Friction Coefficient	Sliding Resistance (k)	Applied Sliding Force (k)	Sliding Ratio
+D+L	36.484	0.300	10.945	6318977669	4621105213
+D+Lr	22.644	0.300	6.793	0539170739	0288527788

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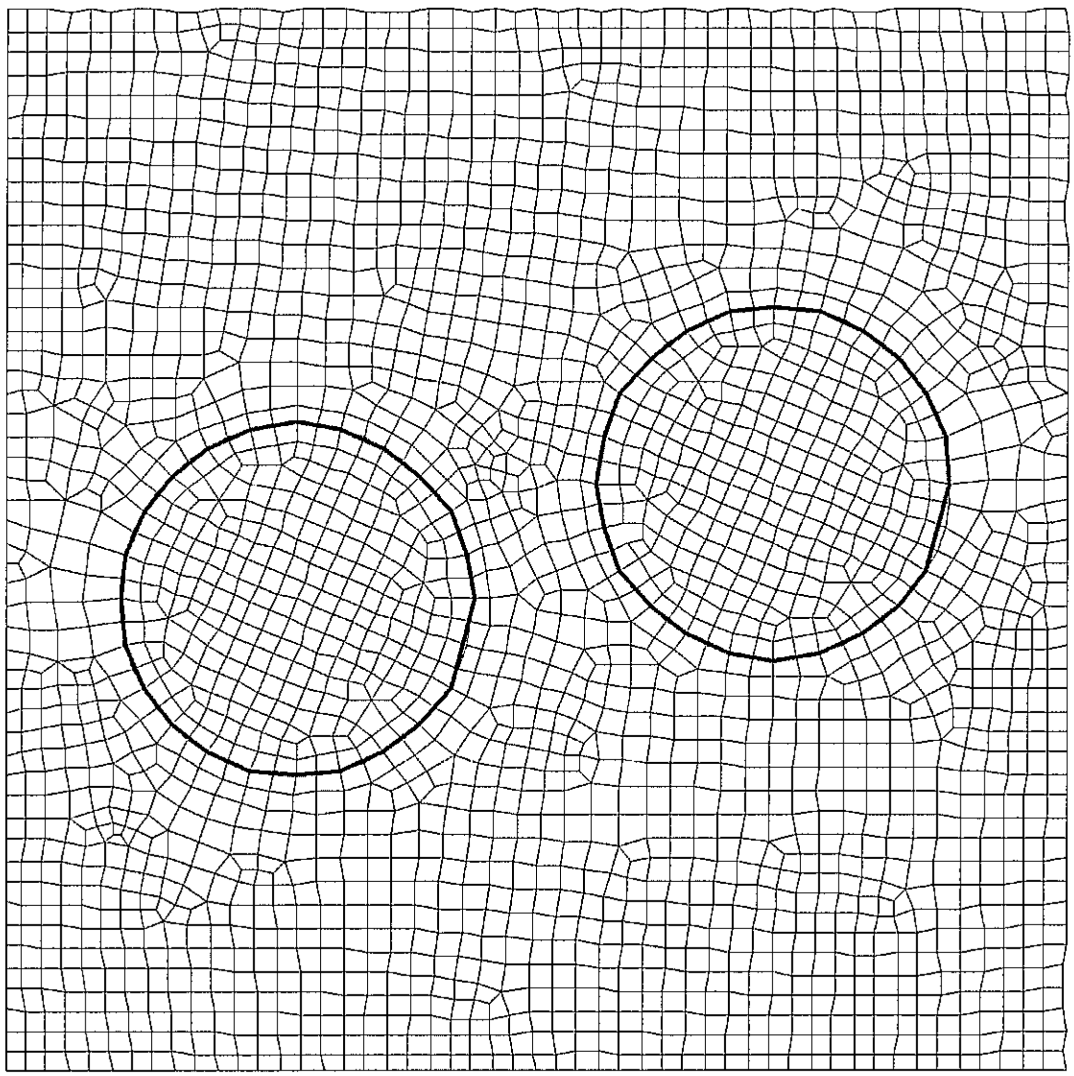
DESCRIPTION: CF-1

Sliding Results

Load Combination	Vertical Bearing (k)	Friction Coefficient	Sliding Resistance (k)	Applied Sliding Force (k)	Sliding Ratio
+D+S	32.984	0.300	9.895	3719174948	7929303768
+D+0.750Lr+0.750L	33.024	0.300	9.907	2904336585	9183689785
+D+0.750L+0.750S	40.779	0.300	12.234	8457011785	4061748336
+D+0.60W1	25.186	0.300	7.556	6402440575	2843658210
+D+0.60W1+0.70H	0.000	0.300	0.000	8389527485	
+D+0.750Lr+0.750L+0.450W1+0.70H	0.000	0.300	0.000	6489843767	
+D+0.750L+0.5250S+0.450W1+0.70H	0.000	0.300	0.000	7457708972	
+0.60D+0.60W1+0.70H	0.000	0.300	0.000	6461453418	
+D+0.750Lr+0.750L+0.450W1	34.931	0.300	10.479	1662046133	3178580961
+D+0.750L+0.750S+0.450W1	42.686	0.300	12.806	7060361057	3739998194
+0.60D+0.60W1	16.129	0.300	4.839	1798139169	4848799920
+D+0.70E1	30.032	0.300	9.010	6318977669	2493024940
+D+0.750L+0.750S+0.5250E1	46.320	0.300	13.896	8457011785	4157434598
+0.60D+0.70E1	20.968	0.300	6.290	5791386601	9737120948

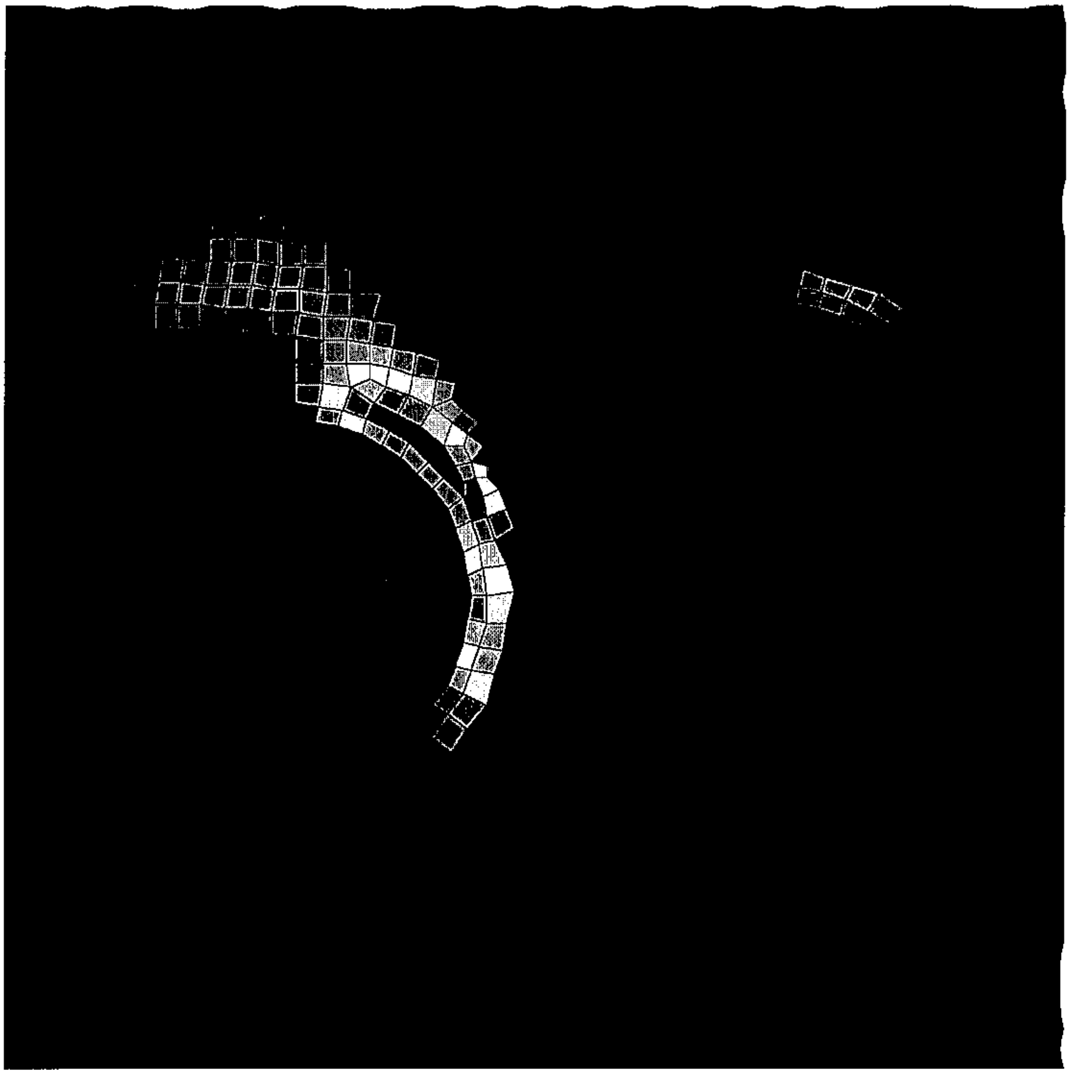
DESCRIPTION: CF-1

Generated Mesh



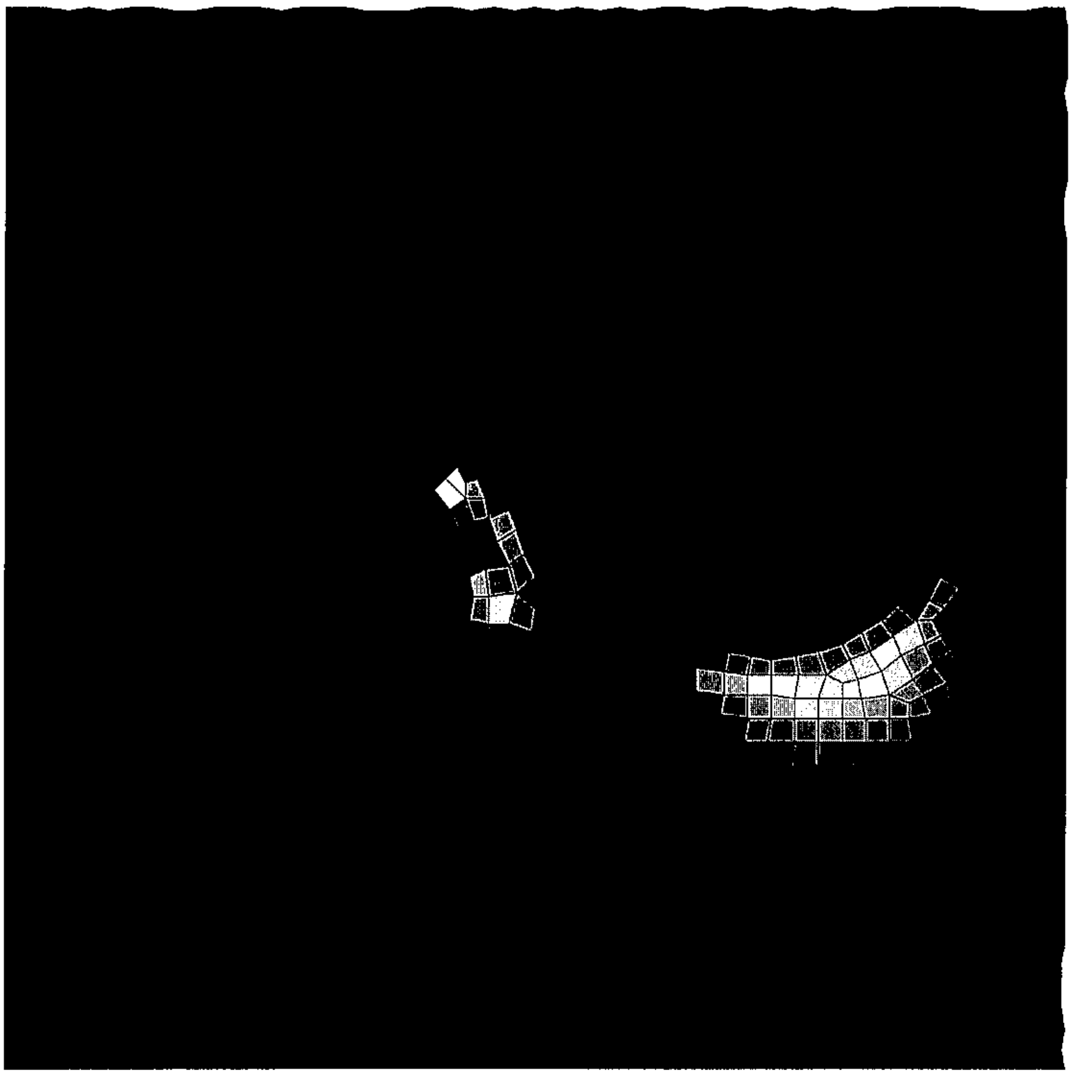
DESCRIPTION: CF-1

Wood-Armer Moments, TOP of Footing, Mu-XX all Load Combinations



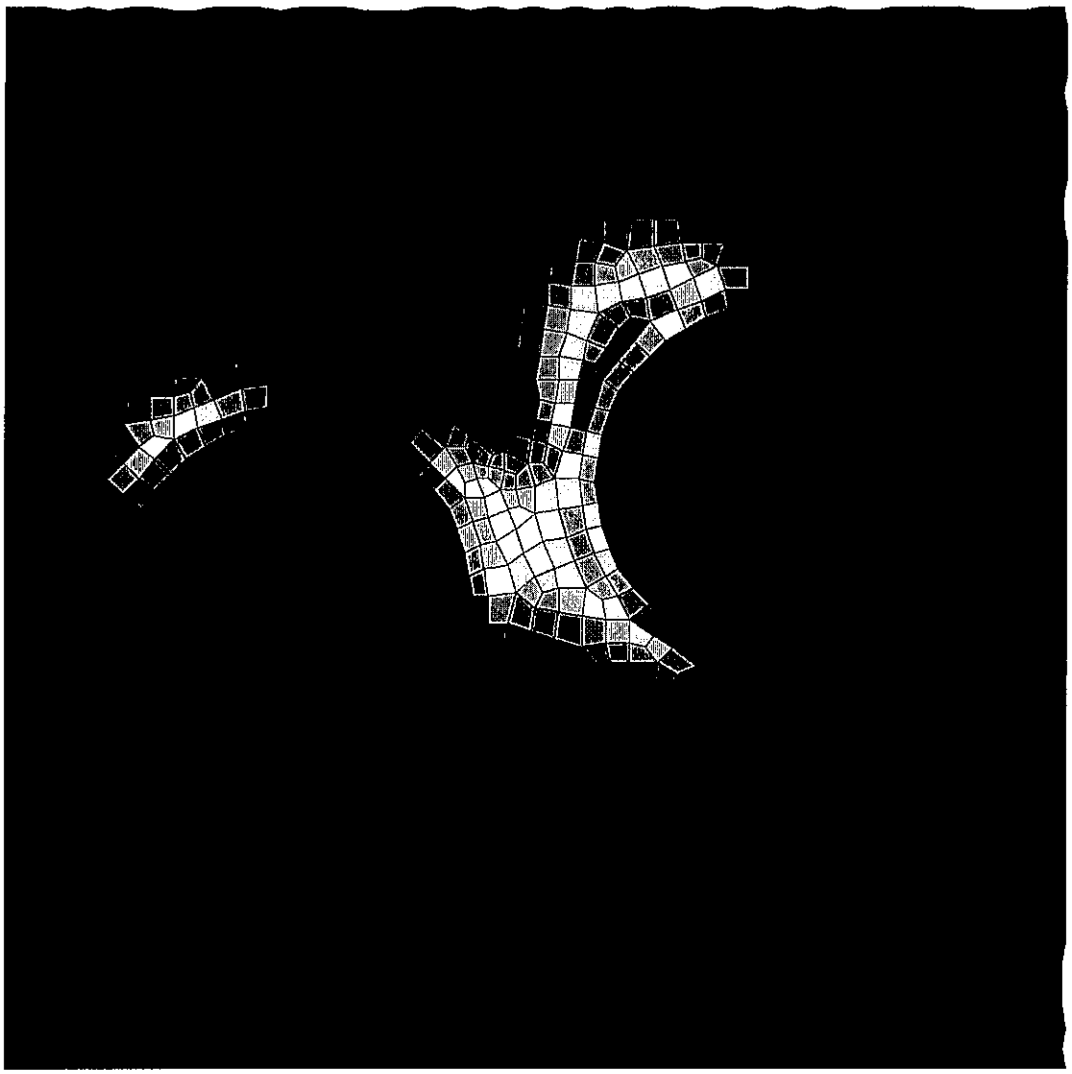
DESCRIPTION: CF-1

Wood-Armer Moments, TOP of Footing, Mu-YY all Load Combinations



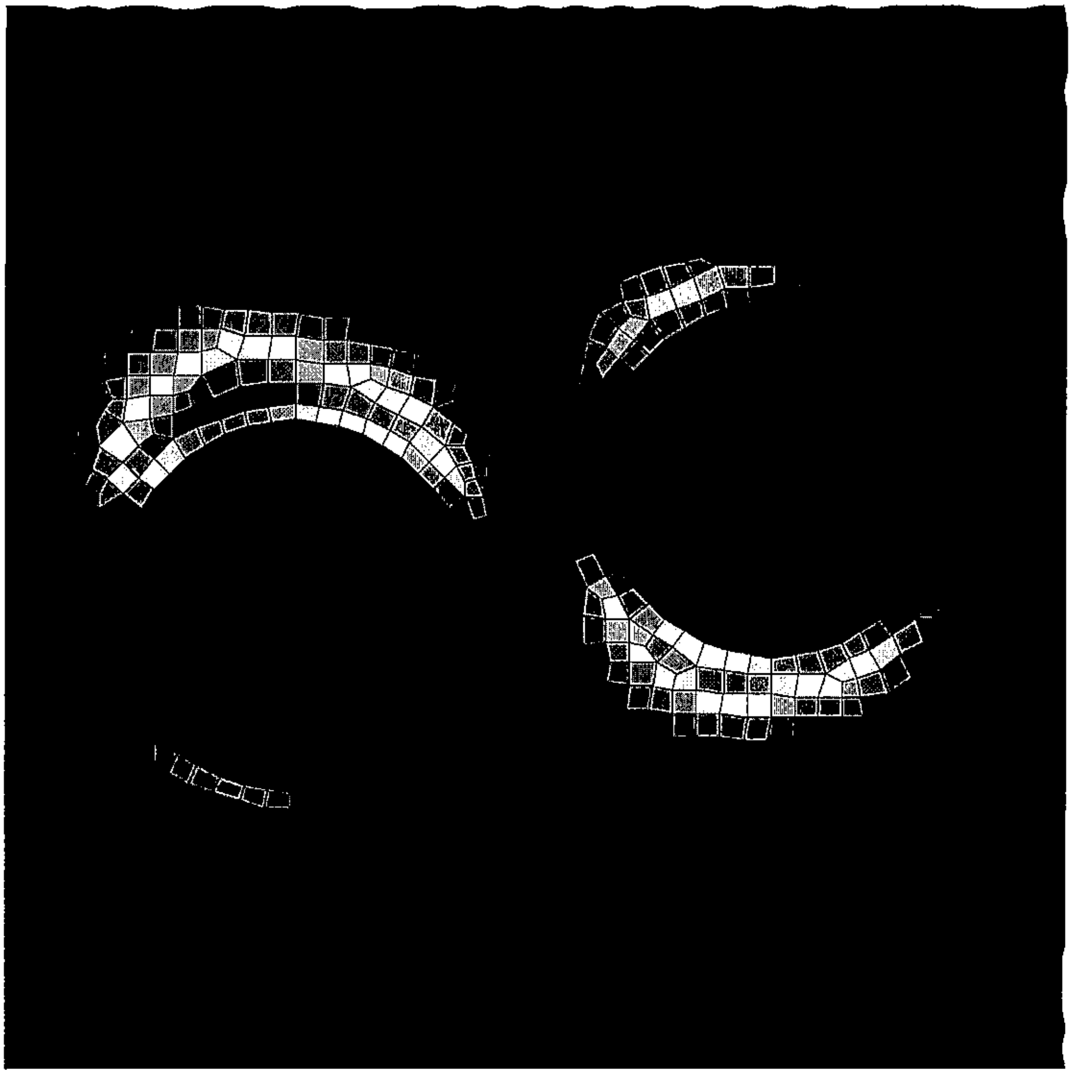
DESCRIPTION: CF-1

Wood-Armer Moments, BOTTOM of Footing, Mu-XX all Load Combinations



DESCRIPTION: CF-1

Wood-Armer Moments, BOTTOM of Footing, Mu-YY all Load Combinations



HAYDEN ENGINEERS

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General Footing by FEM

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-1 - w/ resisting loads only

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019

General Information

Material Properties

f'c : Concrete	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

Footing Information

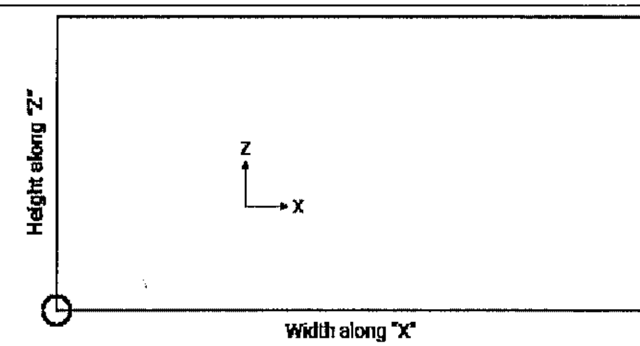
Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis = 6.0 ft

Height along "Z" Axis = 6.0 ft



Footing Target Mesh Element Size = 1.440 in

Footing Thickness = 20.0 in

Footing Stiffness

Ieff = Ig * Cracking Factor

Cracking Factor = 0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom = 3.0 in

=

◯ : **(0,0) Origin for Pedestal centroid location**

Overburden load on footing

Overburden DL = ksf

Omit at pedestal locations = Yes

Pedestal 1 Information

Description

Shape Round

CCW Rotation of Pedestal 0.00 deg

Pedestal Centroid to Footing Datum

Along "X" = 1.646 ft

Along "Z" = 2.667 ft

Target Mesh Element Size = 2.0 in

Diameter 24.0 in

Pedestal Height = 12.0 in

M & V Applied with respect to: = Footing Axes

Omit @ Footprint of all pedestals = Yes

Punching Shear Perimeter Adjustment Factor = 1.0

Punching α = 40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	3.440				
H : Earth		4.454	4.454	1.028	1.028
W : Wind #1	2.118	2.063	10.110	2.374	0.6390
E : Seismic #1	5.277				

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

General Footing by FEM

Project File: 24261 - foundation.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-1 - w/ resisting loads only

Pedestal 2 Information

Description			Diameter		24.0 in
Shape		Round			
CCW Rotation of Pedestal		0.00 deg	Pedestal Height	=	12 in
Pedestal Centroid to Footing Datum			M & V Applied with respect to:	=	Footing Axes
Along "X"	=	4.354 ft	Omit @ Footprint of all pedestals	=	Yes
Along "Z"	=	3.333 ft	Punching Shear Perimeter Adjustment Factor	=	1
Target Mesh Element Size	=	2.0 in	Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	3.440				
H : Earth			4.454	1.028	
W : Wind #1	2.118		10.110	2.374	
E : Seismic #1	5.277				

Results

Overturning : Lowest Stability Ratio = 1.20 at CCW Angle 90 deg for Load Combination: +0.60D+0.60W1+0.70H

Sliding : Lowest Sliding Ratio = 2.50 for Load Combination: +0.60D+0.60W1

Soil Bearing : Max. Soil pressure = 1.976 ksf for Load Combination +0.60D+0.60W1+0.70H

Punching Shear : Max. Ratio = 0.04244 for LdComb: +0.90D+E1, vu= 0.003183 ksi, vn= 0.0750 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing : Mu-XX = 21.003 ft-k/ft at Shell ID 1509, (X,Z)= (5.598, -1.502)
for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, BOTTOM of Footing : Mu-ZZ = 13.411 ft-k/ft at Shell ID 2282, (X,Z)= (4.113, -3.492)
for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

X-X Flexure, TOP of Footing : Mu-XX = 1.989 ft-k/ft at Shell ID 937, (X,Z)= (2.574, -3.323)
for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, TOP of Footing : Mu-ZZ = 27.014 ft-k/ft at Shell ID 1151, (X,Z)= (1.009, -0.1676)
for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.000	37.929	999.000
	45	13.950	52.041	3.730
	60	17.086	49.855	2.918
	75	19.057	44.270	2.323
	90	19.729	35.669	1.808
	105	19.642	42.307	2.154
	120	18.216	47.489	2.607
	135	15.549	49.434	3.179
	150	11.822	48.011	4.061
	165	7.289	43.316	5.942
	180	2.260	35.669	15.781
	195	2.183	48.791	22.349
	210	1.957	58.589	29.932
	225	1.598	64.394	40.291
	240	1.130	65.810	58.234
	255	0.585	62.742	107.254
	270	0.000	55.398	999.000
	285	0.000	63.327	999.000
	300	0.000	66.940	999.000
	315	0.000	65.992	999.000

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General Footing by FEM

Project File: 24261 - CF2.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-2

Code References

Calculations per ACI 318-19, IBC 2021

General Information

Material Properties

f'c : Concrete	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

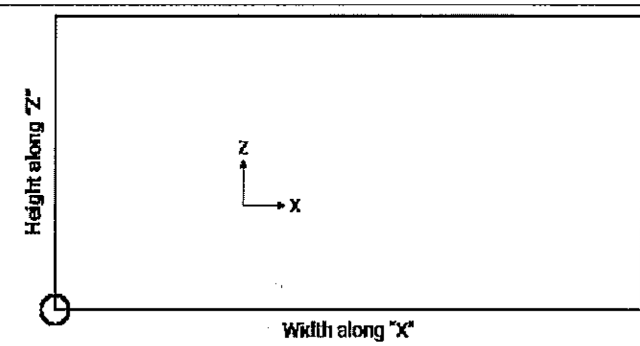
Footing Information

Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis	=	6.0 ft
Height along "Z" Axis	=	6.0 ft



Footing Target Mesh Element Size	=	1.440 in
Footing Thickness	=	20.0 in

Footing Stiffness

Ieff = Ig * Cracking Factor

Cracking Factor = 0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom = 3.0 in
=

◯ : **(0,0) Origin for Pedestal centroid location**

Overburden load on footing

Overburden DL	=	ksf
Omit at pedestal locations	=	Yes

Pedestal 1 Information

Description		
Shape		Round
CCW Rotation of Pedestal		0.00 deg
Pedestal Centroid to Footing Datum		
Along "X"	=	3.0 ft
Along "Z"	=	2.660 ft
Target Mesh Element Size	=	0.6660 in

Diameter		8.0 in
Pedestal Height	=	12.0 in
M & V Applied with respect to:	=	Footing Axes
Omit @ Footprint of all pedestals	=	Yes
Punching Shear Perimeter Adjustment Factor	=	1.0
Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	6.972	-1.620	0.4050	0.0430	-0.1720
L : Live	6.920	-2.307	0.5570	0.0610	-0.2450
S : Snow	5.170	-1.723	0.4310	0.0460	-0.1830
H : Earth		4.454	4.454	1.028	1.028

DESCRIPTION: CF-2

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
W : Wind #1	2.118	2.063	10.110	2.374	0.6390
E : Seismic #1	5.277				

Pedestal 2 Information

Description			Diameter	8.0 in
Shape	Round			
CCW Rotation of Pedestal	0.00	deg	Pedestal Height =	12 in
Pedestal Centroid to Footing Datum			M & V Applied with respect to: =	Footing Axes
Along "X" =	3.0	ft	Omit @ Footprint of all pedestals =	Yes
Along "Z" =	3.330	ft	Punching Shear Perimeter Adjustment Factor =	1
Target Mesh Element Size =	0.660	in	Punching α =	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	4.860	1.620	0.1740	0.0880	0.4050
L : Live	6.920	2.307	0.1140	0.530	0.5570
S : Snow	5.170	1.723	0.2180	0.1110	0.4310
H : Earth			4.454	1.028	
W : Wind #1	2.118		10.110	2.374	
E : Seismic #1	5.277				

Results

Overturning : Lowest Stability Ratio = 1.47 at CCW Angle 90 deg for Load Combination: +0.60D+0.60W1+0.70H
Sliding : Lowest Sliding Ratio = 2.98 for Load Combination: +0.60D+0.60W1
Soil Bearing : Max. Soil pressure = 1.874 ksf for Load Combination +D+0.750L+0.5250S+0.450W1+0.70H
Punching Shear : Max. Ratio = 0.08778 for LdComb: +0.90D+E1, vu= 0.008327 ksi, vn= 0.09487 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing : Mu-XX = 36.954 ft-k/ft at Shell ID 2852, (X,Z)= (4.260, -5.333)
for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4936 in2/ft
Z-Z Flexure, BOTTOM of Footing : Mu-ZZ = 49.371 ft-k/ft at Shell ID 184, (X,Z)= (2.978, -2.997)
for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.6645 in2/ft
X-X Flexure, TOP of Footing : Mu-XX = 9.350 ft-k/ft at Shell ID 1405, (X,Z)= (2.824, -2.322)
for LdComb: +0.90D+0.90W1+H, As-reqd= 0.4320 in2/ft
Z-Z Flexure, TOP of Footing : Mu-ZZ = 26.022 ft-k/ft at Shell ID 2954, (X,Z)= (3.335, -4.970)
for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.000	46.743	999.000
	45	14.344	64.577	4.502
	60	17.568	61.981	3.528
	75	19.595	55.161	2.815
	90	20.286	44.582	2.198
	105	20.276	53.002	2.614
	120	18.885	59.593	3.156
	135	16.206	62.122	3.833
	150	12.423	60.418	4.863
	165	7.794	54.597	7.005
	180	2.633	45.055	17.112

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

General Footing by FEM

Project File: 24261 - CF2.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS

DESCRIPTION: CF-2 - w/ resisting loads only

Code References

Calculations per ACI 318-19, IBC 2021

General Information

Material Properties

f'c : Concrete	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

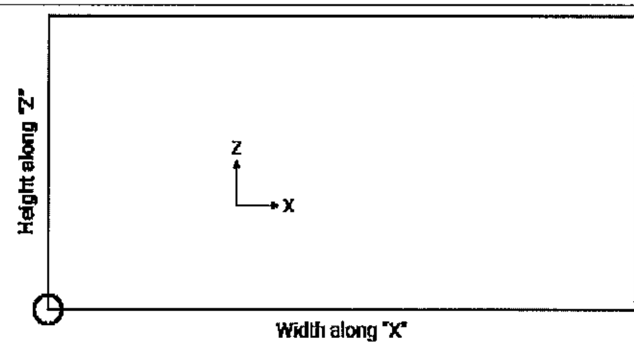
Footing Information

Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis	=	6.0 ft
Height along "Z" Axis	=	6.0 ft



Footing Target Mesh Element Size	=	1.440 in
Footing Thickness	=	20.0 in

Footing Stiffness

Ieff = Ig * Cracking Factor

Cracking Factor = 0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom = 3.0 in

=

◯ : **(0,0) Origin for Pedestal centroid location**

Overburden load on footing

Overburden DL	=	ksf
Omit at pedestal locations	=	Yes

Pedestal 1 Information

Description		
Shape		Round
CCW Rotation of Pedestal		0.00 deg
Pedestal Centroid to Footing Datum		
Along "X"	=	3.0 ft
Along "Z"	=	2.667 ft
Target Mesh Element Size	=	0.50 in

Diameter		6.0 in
Pedestal Height	=	12.0 in
M & V Applied with respect to:	=	Footing Axes
Omit @ Footprint of all pedestals	=	Yes
Punching Shear Perimeter Adjustment Factor	=	1.0
Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	3.440				
H : Earth		4.454	4.454	1.028	1.028
W : Wind #1	2.118	2.063	10.110	2.374	0.6390
E : Seismic #1	5.277				

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

General Footing by FEM

Project File: 24261 - CF2.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-2 - w/ resisting loads only

Pedestal 2 Information

Description			Diameter		6.0 in
Shape	Round				
CCW Rotation of Pedestal	0.00	deg	Pedestal Height	=	12 in
Pedestal Centroid to Footing Datum			M & V Applied with respect to:	=	Footing Axes
Along "X" =	3.0	ft	Omit @ Footprint of all pedestals	=	Yes
Along "Z" =	3.333	ft	Punching Shear Perimeter Adjustment Factor	=	1
Target Mesh Element Size =	0.50	in	Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	1.328				
H : Earth			4.454	1.028	
W : Wind #1	2.118		10.110	2.374	
E : Seismic #1	5.277				

Results

Overturning : Lowest Stability Ratio = 1.07 at CCW Angle 90 deg for Load Combination: +0.60D+0.60W1+0.70H

Sliding : Lowest Sliding Ratio = 2.24 for Load Combination: +0.60D+0.60W1

Soil Bearing : Max. Soil pressure = 0.836 ksf for Load Combination +D+0.60W1+0.70H

Punching Shear : Max. Ratio = 0.04904 for LdComb: +0.90D+E1, vu= 0.004652 ksi, vn= 0.09487 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing : Mu-XX = 36.954 ft-k/ft at Shell ID 2852, (X,Z)= (2.605, -3.446) for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4936 in2/ft

Z-Z Flexure, BOTTOM of Footing : Mu-ZZ = 49.371 ft-k/ft at Shell ID 184, (X,Z)= (3.199, -2.839) for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.6645 in2/ft

X-X Flexure, TOP of Footing : Mu-XX = 19.764 ft-k/ft at Shell ID 5352, (X,Z)= (2.937, -3.054) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, TOP of Footing : Mu-ZZ = 27.903 ft-k/ft at Shell ID 5340, (X,Z)= (2.986, -2.957) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.000	33.705	999.000
	45	13.950	46.367	3.324
	60	17.086	44.451	2.602
	75	19.057	39.505	2.073
	90	19.729	31.867	1.615
	105	19.642	37.907	1.930
	120	18.216	42.638	2.341
	135	15.549	44.464	2.860
	150	11.822	43.259	3.659
	165	7.289	39.107	5.365
	180	2.260	32.289	14.286
	195	2.183	44.543	20.403
	210	1.957	53.761	27.466
	225	1.598	59.316	37.114
	240	1.130	60.828	53.825
	255	0.585	58.195	99.481
	270	0.000	51.596	999.000
	285	0.000	58.562	999.000
	300	0.000	61.536	999.000
	315	0.000	60.317	999.000

HAYDEN ENGINEERS
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General Footing by FEM

Project File: 24261 - CF34.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-3

Code References

Calculations per ACI 318-19, IBC 2021

General Information

Material Properties

f'c : Concrete	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

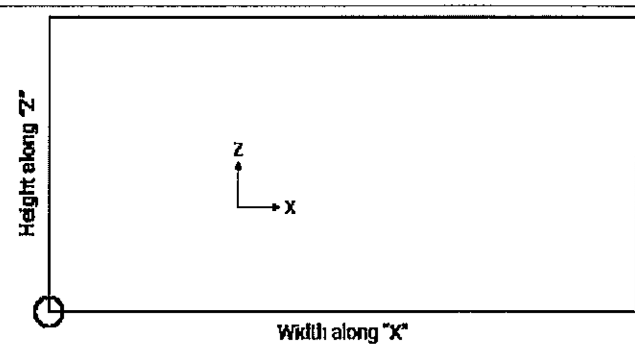
Footing Information

Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis	=	6.50 ft
Height along "Z" Axis	=	6.250 ft



Footing Target Mesh Element Size	=	1.560 in
Footing Thickness	=	20.0 in

Footing Stiffness

Ieff = Ig * Cracking Factor

Cracking Factor	=	0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom	=	3.0 in
	=	

◯ : **(0,0) Origin for Pedestal centroid location**

Overburden load on footing

Overburden DL	=	ksf
Omit at pedestal locations	=	Yes

Pedestal 1 Information

Description		
Shape		Round
CCW Rotation of Pedestal		0.00 deg
Pedestal Centroid to Footing Datum		
Along "X"	=	1.896 ft
Along "Z"	=	2.125 ft
Target Mesh Element Size	=	2.0 in

Diameter 24.0 in

Pedestal Height	=	12.0 in
M & V Applied with respect to:	=	Footing Axes
Omit @ Footprint of all pedestals	=	Yes
Punching Shear Perimeter Adjustment Factor	=	1.0
Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	8.793	-5.784	0.1870	0.0430	-0.7740
L : Live	6.920	-8.234	0.2640	0.0610	-1.102
S : Snow	5.170	-6.150	0.20	0.0460	-0.8230
H : Earth		9.604	3.752	0.8660	1.376

DESCRIPTION: CF-3

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
W : Wind #1	2.118	4.788	10.285	0.2340	0.6960
E : Seismic #1	4.733				

Pedestal 2 Information

Description

Shape: Round

CCW Rotation of Pedestal: 0.00 deg

Pedestal Centroid to Footing Datum
- Along "X" = 4.604 ft
- Along "Z" = 4.125 ft

Target Mesh Element Size = 2.0 in

Diameter 24.0 in

Pedestal Height = 12 in

M & V Applied with respect to: = Footing Axes

Omit @ Footprint of all pedestals = Yes

Punching Shear Perimeter Adjustment Factor = 1

Punching α = 40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	8.793	5.784	0.1870	0.0430	0.7740
L : Live	6.920	8.234	0.2640	0.0610	1.102
S : Snow	5.170	6.150	0.20	0.0460	0.8230
H : Earth		9.604	3.752	0.8660	1.376
W : Wind #1	2.118	4.788	10.285	0.2340	0.6960
E : Seismic #1	4.733				

Results

Overturning : Lowest Stability Ratio = 2.23 at CCW Angle 180 deg for Load Combination: +0.60D+0.60W1+0.70H

Sliding : Lowest Sliding Ratio = 6.35 for Load Combination: +0.60D+0.60W1

Soil Bearing : Max. Soil pressure = 1.985 ksf for Load Combination +D+0.750L+0.5250S+0.450W1+0.70H

Punching Shear : Max. Ratio = 0.07093 for LdComb: +0.90D+E1, vu= 0.006729 ksi, vn= 0.09487 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing : Mu-XX = 24.892 ft-k/ft at Shell ID 4798, (X,Z)= (3.375, -2.453)
for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, BOTTOM of Footing : Mu-ZZ = 53.541 ft-k/ft at Shell ID 184, (X,Z)= (6.307, -6.189)
for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.7225 in2/ft

X-X Flexure, TOP of Footing : Mu-XX = 1.098 ft-k/ft at Shell ID 582, (X,Z)= (3.040, -1.908)
for LdComb: +0.90D+0.90W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, TOP of Footing : Mu-ZZ = 27.020 ft-k/ft at Shell ID 5340, (X,Z)= (2.986, -2.957)
for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.722	68.020	94.158
	45	10.023	91.724	9.151
	60	12.012	87.441	7.280
	75	13.181	77.200	5.857
	90	13.453	61.697	4.586
	105	15.245	72.753	4.772
	120	15.998	81.318	5.083
	135	15.661	84.341	5.385
	150	14.257	81.617	5.725
	165	11.881	73.331	6.172
	180	8.695	60.047	6.906

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General Footing by FEM

Project File: 24261 - CF34.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-3 - w/ resisiting loads only

Code References

Calculations per ACI 318-19, IBC 2021

General Information

Material Properties

f'c : Concrete	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

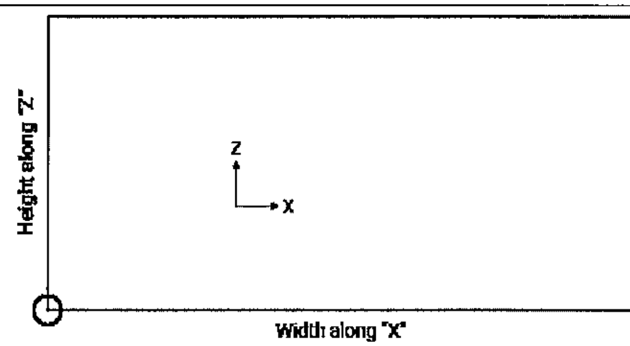
Footing Information

Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis = 6.50 ft
Height along "Z" Axis = 6.250 ft



Footing Target Mesh Element Size = 1.560 in
Footing Thickness = 20.0 in

Footing Stiffness

Ieff = Ig * Cracking Factor
Cracking Factor = 0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom = 3.0 in
=

◯ : **(0,0) Origin for Pedestal centroid location**

Overburden load on footing

Overburden DL = ksf
Omit at pedestal locations = Yes

Pedestal 1 Information

Description		
Shape		Round
CCW Rotation of Pedestal		0.00 deg
Pedestal Centroid to Footing Datum		
Along "X"	=	1.896 ft
Along "Z"	=	2.125 ft
Target Mesh Element Size	=	2.0 in

Diameter		24.0 in
Pedestal Height	=	12.0 in
M & V Applied with respect to:	=	Footing Axes
Omit @ Footprint of all pedestals	=	Yes
Punching Shear Perimeter Adjustment Factor	=	1.0
Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	5.261				
H : Earth		9.604	3.752	0.8660	1.376
W : Wind #1	2.118	4.788	10.285	0.2340	0.6960
E : Seismic #1	4.733				

General Footing by FEM

Project File: 24261 - CF34.ec6

DESCRIPTION: CF-3 - w/ resisiting loads only

Pedestal 2 Information

Description			Diameter	24.0 in	
Shape	Round				
CCW Rotation of Pedestal	0.00	deg	Pedestal Height	=	12 in
Pedestal Centroid to Footing Datum			M & V Applied with respect to:	=	Footing Axes
Along "X" =	4.604	ft	Omit @ Footprint of all pedestals	=	Yes
Along "Z" =	4.125	ft	Punching Shear Perimeter Adjustment Factor	=	1
Target Mesh Element Size =	2.0	in	Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	5.261				
H : Earth		9.604	3.752	0.8660	1.376
W : Wind #1	2.118	4.788	10.285	0.2340	0.6960
E : Seismic #1	4.733				

Results

Overturning : Lowest Stability Ratio = 1.74 at CCW Angle 180 deg for Load Combination: +0.60D+0.60W1+0.70H

Sliding : Lowest Sliding Ratio = 10.04 for Load Combination: +0.60D+0.60W1

Soil Bearing : Max. Soil pressure = 1.863 ksf for Load Combination +0.60D+0.60W1+0.70H

Punching Shear : Max. Ratio = 0.03941 for LdComb: +0.90D+E1, vu= 0.003739 ksi, vn= 0.09487 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing : Mu-XX = 24.892 ft-k/ft at Shell ID 4798, (X,Z)= (3.375, -2.453) for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, BOTTOM of Footing : Mu-ZZ = 53.541 ft-k/ft at Shell ID 184, (X,Z)= (6.307, -6.189) for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.7225 in2/ft

X-X Flexure, TOP of Footing : Mu-XX = 2.345 ft-k/ft at Shell ID 1198, (X,Z)= (3.048, -2.20) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, TOP of Footing : Mu-ZZ = 27.020 ft-k/ft at Shell ID 5340, (X,Z)= (2.986, -2.957) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.000	54.052	999.000
	45	9.257	72.107	7.790
	60	11.337	68.528	6.045
	75	12.645	60.279	4.767
	90	13.091	47.923	3.661
	105	14.708	56.364	3.832
	120	15.323	62.882	4.104
	135	14.894	65.114	4.372
	150	13.450	62.909	4.677
	165	11.089	56.416	5.087
	180	7.973	46.079	5.780
	195	7.701	60.301	7.830
	210	6.905	70.413	10.198
	225	5.638	75.726	13.432
	240	3.986	75.879	19.034
	255	2.064	70.861	34.340
	270	0.000	61.013	999.000
	285	0.000	72.924	999.000
	300	0.000	79.865	999.000
	315	0.000	81.364	999.000

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General Footing by FEM

Project File: 24261 - CF34.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-4

Code References

Calculations per ACI 318-19, IBC 2021

General Information

Material Properties

f'c : Concrete	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

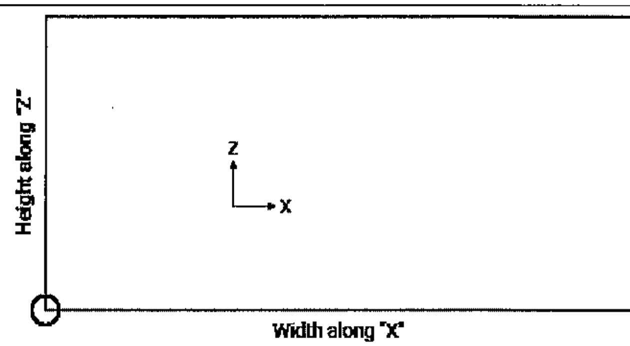
Footing Information

Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis	=	6.750 ft
Height along "Z" Axis	=	6.750 ft



Footing Target Mesh Element Size	=	1.620 in
Footing Thickness	=	20.0 in

Footing Stiffness

Ieff = Ig * Cracking Factor

Cracking Factor	=	0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom	=	3.0 in
	=	

○ : **(0,0) Origin for Pedestal centroid location**

Overburden load on footing

Overburden DL	=	ksf
Omit at pedestal locations	=	Yes

Pedestal 1 Information

Description		
Shape		Round
CCW Rotation of Pedestal		0.00 deg
Pedestal Centroid to Footing Datum		
Along "X"	=	3.375 ft
Along "Z"	=	2.375 ft
Target Mesh Element Size	=	0.6666 in

Diameter		8.0 in
Pedestal Height	=	12.0 in
M & V Applied with respect to:	=	Footing Axes
Omit @ Footprint of all pedestals	=	Yes
Punching Shear Perimeter Adjustment Factor	=	1.0
Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	8.793	-5.784	0.1870	0.0430	-0.7740
L : Live	6.920	-8.234	0.2640	0.0610	-1.102
S : Snow	5.170	-6.150	0.20	0.0460	-0.8230
H : Earth		9.064	3.752	0.8660	1.376

General Footing by FEM

Project File: 24261 - CF34.ec6

DESCRIPTION: CF-4

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
W : Wind #1	2.118	4.788	10.285	2.374	0.6960
E : Seismic #1	4.733				

Pedestal 2 Information

Description			Diameter	8.0 in	
Shape	Round				
CCW Rotation of Pedestal	0.00	deg	Pedestal Height	=	12 in
Pedestal Centroid to Footing Datum			M & V Applied with respect to:	=	Footing Axes
Along "X" =	3.375	ft	Omit @ Footprint of all pedestals	=	Yes
Along "Z" =	4.375	ft	Punching Shear Perimeter Adjustment Factor	=	1
Target Mesh Element Size =	0.6660	in	Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	8.793	5.784	0.1870	0.0430	0.7740
L : Live	6.920	8.234	0.2640	0.0610	1.102
S : Snow	5.170	6.150	0.20	0.0460	0.8230
H : Earth		9.604	3.752	0.8660	1.376
W : Wind #1	2.118	4.788	10.285	2.374	0.6960
E : Seismic #1	4.733				

Results

Overturning : Lowest Stability Ratio = 2.28 at CCW Angle 105 deg for Load Combination: +0.60D+0.60W1+0.70H

Sliding : Lowest Sliding Ratio = 3.48 for Load Combination: +0.60D+0.60W1

Soil Bearing : Max. Soil pressure = 1.834 ksf for Load Combination +D+0.750L+0.5250S+0.450W1+0.70H

Punching Shear : Max. Ratio = 0.09861 for LdComb: +0.90D+E1, vu= 0.009355 ksi, vn= 0.09487 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing :	Mu-XX = 27.415 ft-k/ft at Shell ID 2088, (X,Z)= (3.761, -4.392) for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4320 in2/ft
Z-Z Flexure, BOTTOM of Footing :	Mu-ZZ = 53.541 ft-k/ft at Shell ID 184, (X,Z)= (3.531, -4.060) for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.7225 in2/ft
X-X Flexure, TOP of Footing :	Mu-XX = 10.282 ft-k/ft at Shell ID 4099, (X,Z)= (2.997, -4.454) for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4320 in2/ft
Z-Z Flexure, TOP of Footing :	Mu-ZZ = 27.020 ft-k/ft at Shell ID 5340, (X,Z)= (2.970, -2.765) for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.722	75.182	104.072
	45	14.866	100.175	6.739
	60	17.942	95.170	5.304
	75	19.796	83.680	4.227
	90	20.301	66.487	3.275
	105	21.860	79.047	3.616
	120	21.929	88.881	4.053
	135	20.503	92.657	4.519
	150	17.681	90.118	5.097
	165	13.653	81.439	5.965
	180	8.695	67.209	7.729

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LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-4 - w/ resisiting loads only

Code References

Calculations per ACI 318-19, IBC 2021

General Information

Material Properties

f'c : Concrete	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ψ : Concrete Density	=	145.0 pcf
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Poissons Ratio	=	0.150
φ Values Flexure	=	0.90
Shear	=	0.750
Min Steel Ratio : Temp Reinf (based on thick)		
(Steel Area / Concrete Area)	=	0.00180

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Subgrade Modulus	=	0.250 kip/in3
Soil Density	=	110.0 kip/in3
Coefficient of Soil/Concrete Friction	=	0.30

Stability Settings

MIN. Safety Factors:

Overturning	=	1.0 :1
Sliding	=	1.0 :1

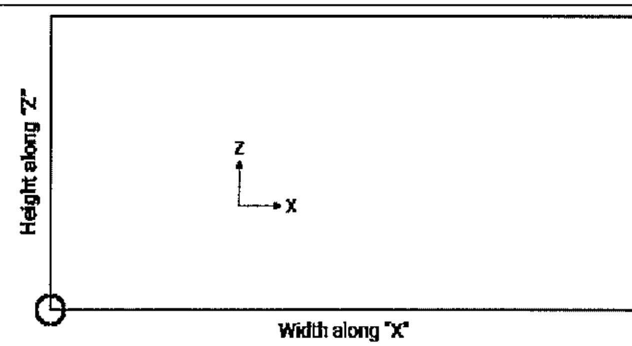
Footing Information

Footing Shape

Footing Shape Rectangle

Footing Dimensions

Width along "X" Axis	=	6.750 ft
Height along "Z" Axis	=	6.750 ft



Footing Target Mesh Element Size	=	1.620 in
Footing Thickness	=	20.0 in

◯ : **(0,0) Origin for Pedestal centroid location**

Footing Stiffness

Ieff = Ig * Cracking Factor

Cracking Factor = 0.250

Rebar Clearance

Clear Cover from Footing Top & Bottom = 3.0 in

=

Overburden load on footing

Overburden DL	=	ksf
Omit at pedestal locations	=	Yes

Pedestal 1 Information

Description		
Shape		Round
CCW Rotation of Pedestal		0.00 deg
Pedestal Centroid to Footing Datum		
Along "X"	=	3.375 ft
Along "Z"	=	2.375 ft
Target Mesh Element Size	=	0.6666 in

Diameter 8.0 in

Pedestal Height	=	12.0 in
M & V Applied with respect to:	=	Footing Axes
Omit @ Footprint of all pedestals	=	Yes
Punching Shear Perimeter Adjustment Factor	=	1.0
Punching α	=	40

Loads	+P towards -Y, P-y k	+M = higher pressure at +X & +Z, M-xx k-ft	M-zz k-ft	+V acts towards +X & +Z V-x k	V-z k
D : Dead Load	5.261				
H : Earth		9.604	3.752	0.8660	1.376
W : Wind #1	2.118	4.788	10.285	0.2340	0.6960
E : Seismic #1	4.733				

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General Footing by FEM

Project File: 24261 - CF34.ec6

LIC# : KW-06014171, Build:20.24.12.17 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: CF-4 - w/ resisiting loads only

Pedestal 2 Information

Description			Diameter		8.0 in
Shape		Round			
CCW Rotation of Pedestal		0.00 deg	Pedestal Height	=	12 in
Pedestal Centroid to Footing Datum			M & V Applied with respect to:	=	Footing Axes
Along "X"	=	3.375 ft	Omit @ Footprint of all pedestals	=	Yes
Along "Z"	=	4.375 ft	Punching Shear Perimeter Adjustment Factor	=	1
Target Mesh Element Size	=	0.6660 in	Punching α	=	40

Loads	+P towards -Y, P-y (k)	+M = higher pressure at +X & +Z, M-xx (k-ft)	M-zz (k-ft)	+V acts towards +X & +Z V-x (k)	V-z (k)
D : Dead Load	5.261				
H : Earth		9.604	3.752	0.8660	1.376
W : Wind #1	2.118	4.788	10.285	0.2340	0.6960
E : Seismic #1	4.733				

Results

Overturning : Lowest Stability Ratio = 1.97 at CCW Angle 180 deg for Load Combination: +0.60D+0.60W1+0.70H

Sliding : Lowest Sliding Ratio = 10.53 for Load Combination: +0.60D+0.60W1

Soil Bearing : Max. Soil pressure = 1.508 ksf for Load Combination +0.60D+0.60W1+0.70H

Punching Shear :Max. Ratio = 0.05479 for LdComb: +0.90D+E1, vu= 0.005198 ksi, vn= 0.09487 ksi

Wood-Armer Mu & As :

X-X Flexure, BOTTOM of Footing : Mu-XX = 27.415 ft-k/ft at Shell ID 2088, (X,Z)= (3.761, -4.392)
for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, BOTTOM of Footing : Mu-ZZ = 53.541 ft-k/ft at Shell ID 184, (X,Z)= (3.531, -4.060)
for LdComb: +1.20D+L+0.30S+W1+H, As-reqd= 0.7225 in2/ft

X-X Flexure, TOP of Footing : Mu-XX = 8.681 ft-k/ft at Shell ID 5297, (X,Z)= (2.988, -2.394)
for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Z-Z Flexure, TOP of Footing : Mu-ZZ = 27.020 ft-k/ft at Shell ID 5340, (X,Z)= (2.970, -2.765)
for LdComb: +1.20D+W1+H, As-reqd= 0.4320 in2/ft

Detailed Results

Stability Results

Load Combination	Rotation Angle CCW	Moments k-ft Overturning	Resisting	Overturning Ratio
+0.60D+0.60W1				
	0	0.000	60.155	999.000
	45	9.257	79.434	8.581
	60	11.337	75.268	6.639
	75	12.645	65.973	5.217
	90	13.091	52.182	3.986
	105	14.708	61.894	4.208
	120	15.323	69.474	4.534
	135	14.894	72.321	4.856
	150	13.450	70.238	5.222
	165	11.089	63.370	5.714
	180	7.973	52.182	6.545
	195	7.701	67.298	8.739
	210	6.905	77.827	11.272
	225	5.638	83.053	14.732
	240	3.986	82.619	20.725
	255	2.064	76.555	37.099
	270	0.000	65.273	999.000
	285	0.000	78.618	999.000
	300	0.000	86.605	999.000
	315	0.000	88.691	999.000

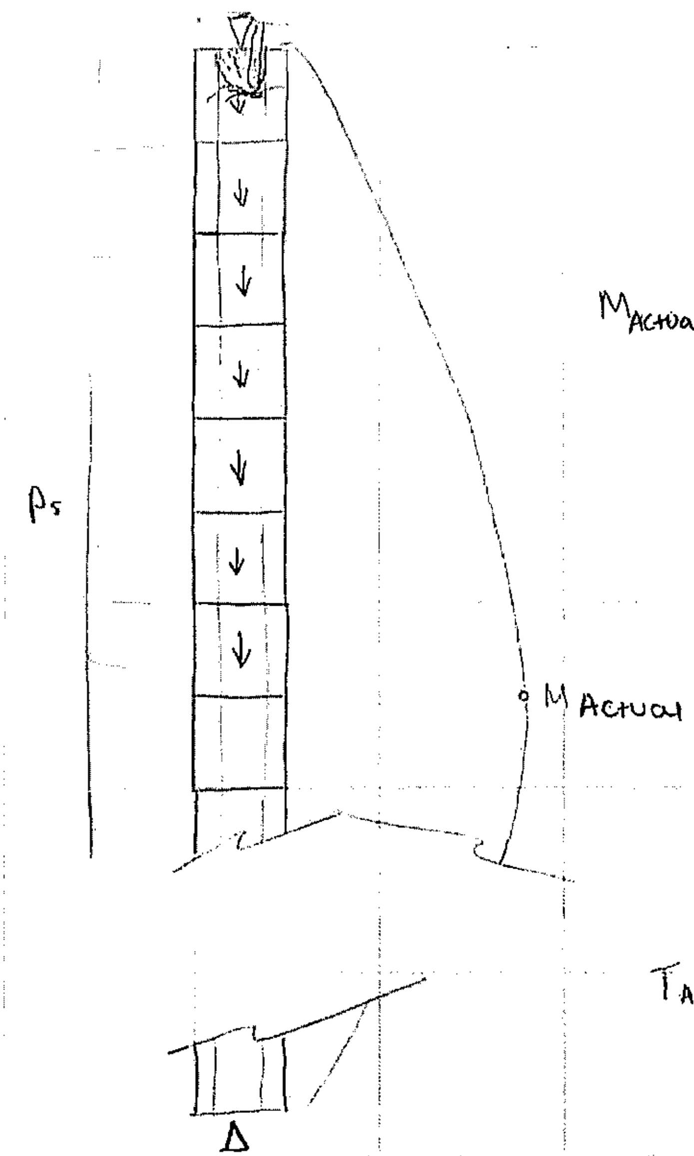
BREAKAWAY WALL DESIGN

Breakaway Wall Design $h = 9'5"$

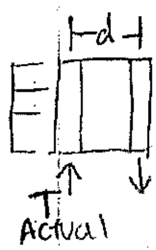
8" Masonry ungrouted

N Mortar
Tensile flexural strength = 25 psi

$p_s(\text{Wall}) = 17.7\ \text{psf}$ (ASD) wind governs



$$M_{Actual} = \frac{w l^2}{8} = \frac{17.7\ \text{psf} \times (9'5")^2}{8} = 196\ \frac{\text{ft lb}}{\text{ft}}$$



$$T_{Actual} = \frac{M_{MAX}}{d}$$

$$T_{Actual} = \frac{\frac{196\ \text{ft lb}}{\text{ft}} \times 12"}{8" - 1.25"}$$

mortar thickness

$$T_{Actual} = 350\ \text{lb/ft}$$
$$= 30\ \text{lb/in}$$

$$T_{Allow} = 25\ \text{psi} \times 1.25" = 31.25" > T_{Actual}$$ ✓

$P_{MAX} = 20\,psf$

$$M_{MAX} = \frac{20\,psf \times (9'5")^2}{8} = 222\ \frac{ft\,lb}{ft}$$

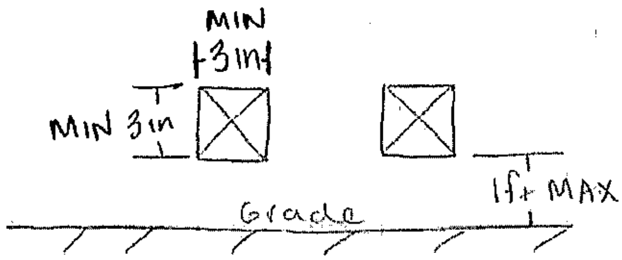
$$T_{MAX} = \frac{222\,ft\,lb/ft \times 12"}{8" - 1.25"} = 395\,lb/ft$$

$$= 32\,lb/in$$

$T_{MAX} > T_{Allow} > T_{Actual}$ ✓

USE 8" MASONRY BLOCKS
UNGROUTED WITH N-TYPE MORTAR

Openings in Breakaway Walls



$$\frac{1\,in^2 \text{ Net Area of Openings}}{1\,ft^2 \text{ Net enclosed Area}}$$

$$\frac{1\,in^2}{1\,ft^2} = \frac{x}{16' \times 20'} \qquad x = 320\,in^2$$

Try 16" x 8" openings (one Masonry block)

$A = 144\,in^2$

$$\frac{320\,in^2}{128\,in^2} = 2.5 \rightarrow 3$$

Use (3) 16"x18" openings

↳ Masonry blocks

X-BRACE DESIGN

Eccentrically Braced Frame

conservative load

V_u @ Floor Grid 12 = 5.991k (seismic) unfactored

$1.25\, R_y T_{cap} = 1.25 \times 1.1 \times 7.2\,k = 9.9\,kip$ (seismic adjusted) unfactored → 6.93 k (ASD)

for 36ksi

1/2" Ø Rod

$T_{cap} = A F_y = 0.2\,in^2 \times 50\,ksi \times 0.6$

$= 7.2\,kip$

$\text{Overstrength} = \frac{9.9\,k}{5.991k} = 1.65$

$\boxed{\text{USE 1/2" Ø 50 KSI ROD AS TENSION BRACE}}$

Lateral Design

Seismic Design Force for X-Brace Rod

Risk Category II

	V=	5991.0 #	Line V12 @ FLOOR
(ASD)	**V=**	**4193.7 #**	

Cross Brace Connection Design

Height	4.5	ft
Width	16	ft
Angle, θ	16	°
# of Cross Brace Locations	**1**	

Diagonal Members Act in:
Tension Only

Forces	Horz.	5991 #	->	4194 (ASD)
	Diagonal	**6223 #**	**->**	**4356 (ASD)**
	Vertical	1685 #	->	1179 (ASD)

Seismic Design Force for Connections

Risk Category II

	V=	9900.0 #	Seismic adjusted unfactored
(ASD)	**V=**	**6930.0 #**	

Cross Brace Connection Design

Height	4.5	ft
Width	16	ft
Angle, θ	16	°
# of Cross Brace Locations	**1**	

Diagonal Members Act in:
Tension Only

Forces	Horz.	9900 #	->	6930 (ASD)
	Diagonal	**10284 #**	**->**	**7199 (ASD)**
	Vertical	2784 #	->	1949 (ASD)

$$For\ Ten.\ Only:\ F_{Horz.} = \frac{v}{\#\ of\ Cross\ Braces}$$

$$F_{Diag.} = \frac{F_{Horz.}}{\cos(\theta)};\quad F_{Vert.} = \frac{F_{Horz.}}{\tan(\theta)}$$

X Brace

Rod

1/2" Ø Rod

$T_{cap} = A F_y = 0.2\ in^2 \times 50\ ksi \times 0.6$

$T_{cap} = 7.2K$ 1/2" Ø 36ksi

$T_{DIAG.} = 6223\ lb < 7200\ lb$ ✓

Use 1/2" Ø Rod 50ksi

Connections $\Omega = 2.0$

	Unfactored	w/ Ω	ASD w/ Ω
Horiz. :	9900 lb	19800 lb	13860 lb
Diagonal :	10284 lb	20568 lb	14398 lb
Vertical :	2784 lb	5568 lb	3898 lb

Weld

ASD Capacity $= 0.928\ K/in \times 4 \times 4"$

$= 14848\ lb > 14398\ lb$ ✓

(ASD)

Use 1/4" fillet weld 4" long min

Gusset Plate

Use PL 1/4 x 6 x 4

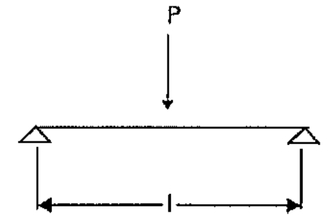
→ Horiz. = 19800 lb (ULT)

PL $T_{cap} = A \times F_y = 1/4" \times 6" \times 36ksi$

$= 36000\ lb$

$19800\ lb < T_{cap}$ ✓

Plate Design @ HSS x-Brace Connection



Weak-Axis Bending

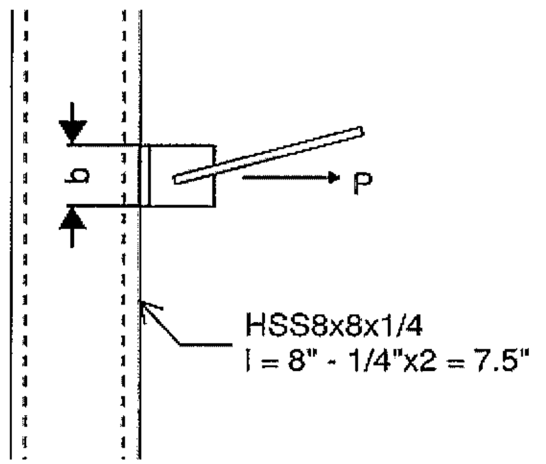
loading	P	13860	lb (ASD)
length of plate	l	7.5	in
steel strength	F_y	50000	psi
actual moment	M	25987.5	lb-in

b, (in)	t, required thickness (in)	
6	**0.51**	**1/2**

$M = Pl/4$

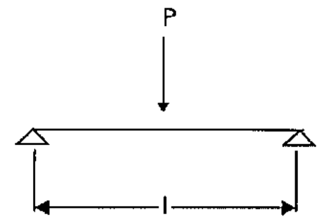
$t = \sqrt{6M/(0.9F_y b)} - t_{hss}$

$t_{hss} = 0.25"$



USE PL1/2x8x6 50ksi to HSS

Plate Design @ Concrete Wall Pier x-Brace Connection



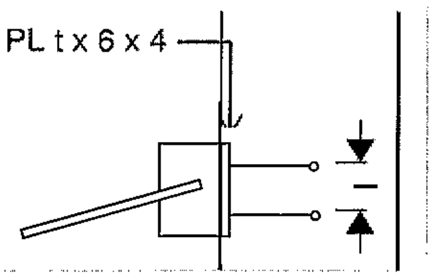
Weak-Axis Bending

loading	P	13860	lb (ASD)
length of plate	l	3	in
steel strength	F_y	50000	psi
actual moment	M	10395	lb-in

$M = Pl/4$

b, (in)	t, required thickness (in)	
6	**0.48**	**1/2**

$t = \sqrt{(6M/(0.9F_y b))}$

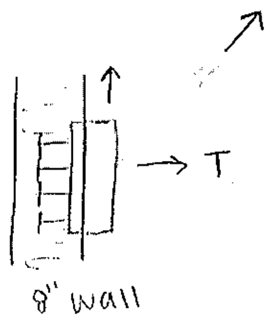


USE PL1/2x6x6 embed in concrete wall
50ksi

f'_c 4000psi

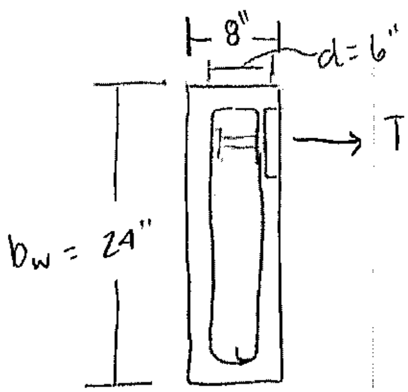
$f_{yt} = 60ksi$

Connections to Concrete wall



⟹ ties for tension

$T_{MAX} = 19800\,lb$ (seismic adjusted E w/ Ω LRFD)



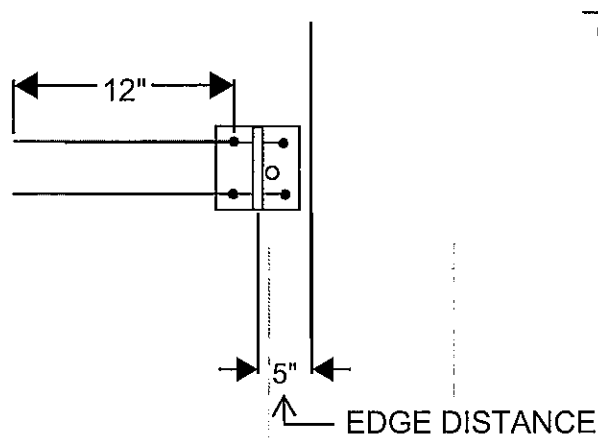
Tallow #3 = 0.11in2 x 60ksi = 6.6k

Tmax / Tallow = 3 bars min

shear tie strength

$$\frac{V_s}{\Phi} = \frac{A_v f_{yt} d}{s} \implies s = \frac{A_v f_{yt} d\, \Phi}{V_s}$$

$$s = \frac{0.11 \times 60000 \times 6" \times 0.75}{19800\,lb} = 1.5 \text{ in}$$



USE (4) #3 bars welded to PL1/2x6x6 and bent 12" min into wall

HSS BASE CONNECTION

Load Combos to Concrete Anchor Ω = 2 to be used with seismic loads only

Finding **Tmax**

ASD Load Combos	LRFD Load Combos
T = 0.6D+0.6W	T = 0.9D+W
T = 0.6D+0.7ΩE	T = 0.9D+ΩE

	0.6D =	0.6Pres lb **797** lb	
AB	0.6W =	Wup+Cab **-2937**	lb lb
	0.7E =	Ca lb **-3694** lb	
12	0.6W =	Wup+C12 **-3828**	lb lb
	0.7E =	C12 lb **-3313** lb	

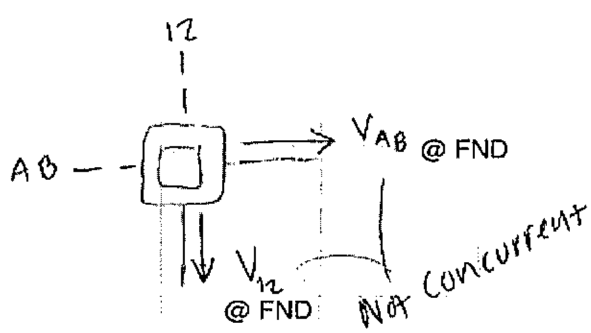
	0.9D =	0.9Pres lb **1195** lb	
AB	W =	(Wup+Cab)/.6 **-4895**	lb lb
	E =	Ca/.7 lb **-5277.1** lb	
12	W =	(Wup+C12)/.6 **-6380**	lb lb
	E =	C12/.7 lb **-4732.9** lb	

ASD	Wind Load Combos (lb)			
Cxn	Tab	T12	Vab	V12
1 HSS	-2140	-3031	645	2692
2 HSS	-2140	-6062.4	645	5384

LRFD	Wind Load Combos (lb)			
Cxn	Tab	T12	Vab	V12
1 HSS	-3700	-5185	645	2692
2 HSS	-3700	-10370	645	5384

ASD	Seismic Load Combos (lb)			
Cxn	Tab	T12	Vab	V12
1 HSS	-6591.2	-5829.2	11862	10468
2 HSS	-6591.2	-11658	11862	20936

LRFD	Seismic Load Combos (lb)			
Cxn	Tab	T12	Vab	V12
1 HSS	**-9359.1**	-8270.5	**11862**	10468
2 HSS	-9359.1	**-16541**	11862	**20936**



SIMPSON Strong-Tie

Anchor Designer™ for Concrete Software
Version 3.3.2501.2

Company:		Date:	11/22/2024
Engineer:		Page:	1
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Project description:
Location:
Design name: Design

Comment:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Cast-in-place
Material: AWS Type A
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 6.000
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 7.38
c_{min} (inch): 1.38
s_{min} (inch): 2.50

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: Yes
Ignore 6do requirement: No
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 10.00 x 17.00 x 0.25
Yield stress: 36000 psi

Profile type/size: 8X8X1/4

Recommended Anchor
Anchor Name: Headed Stud - 5/8"Ø AWS Type A Headed Stud

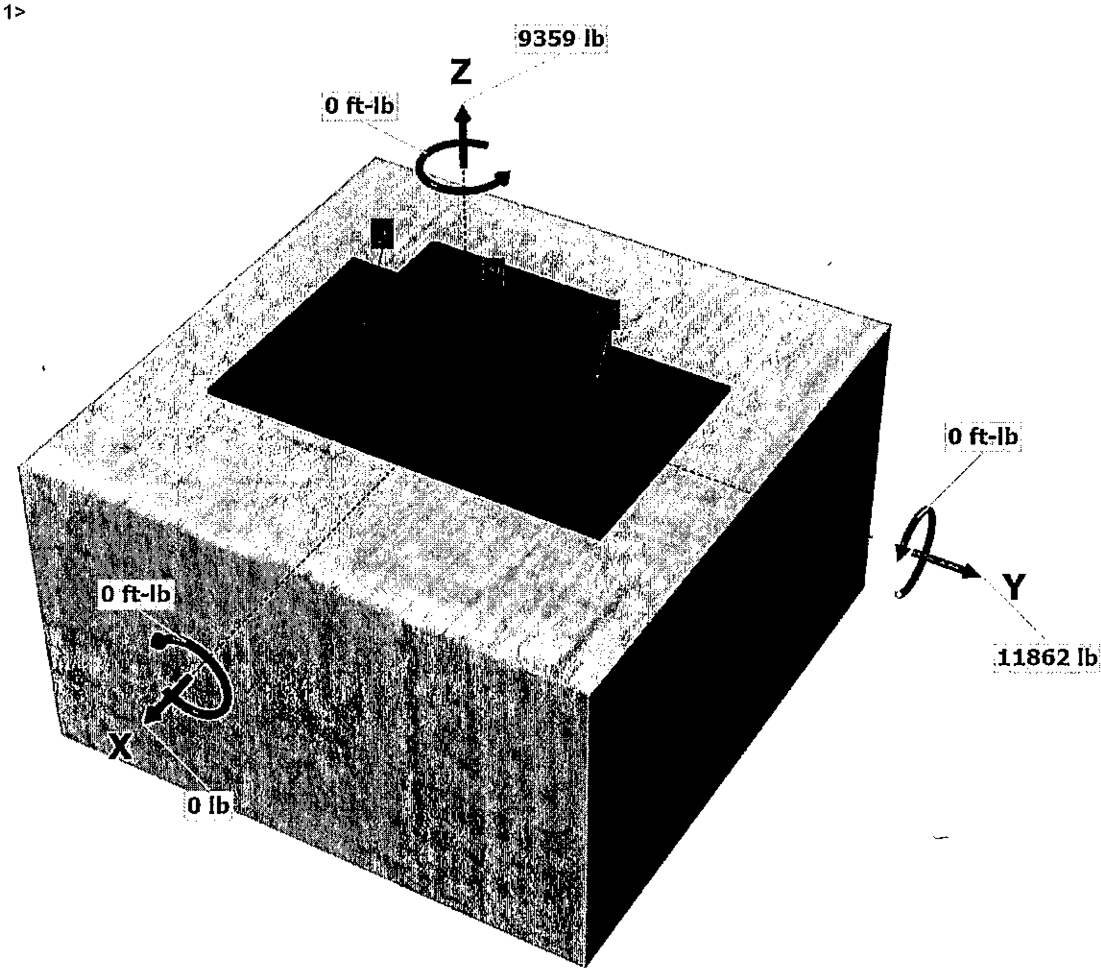
Use PL 3/8 x 10 x 17 Plate w/
(3) 5/8"Ø x 6" headed studs

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.10.5.3 (d) is satisfied
Ductility section for shear: 17.10.6.3 (c) is satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

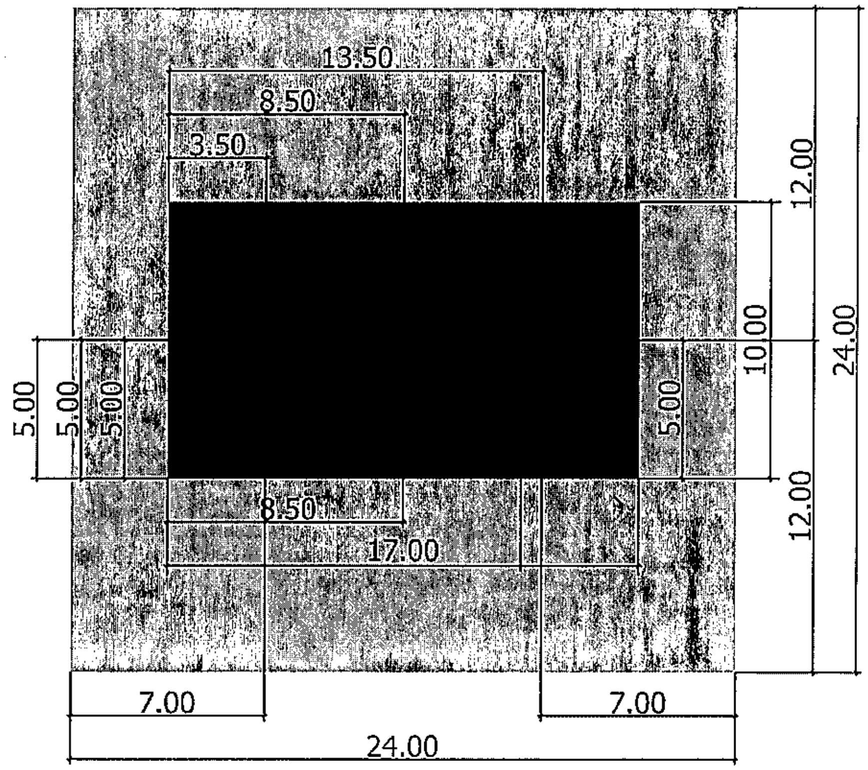
Strength level loads:

N_{ua} [lb]:	9359
V_{uax} [lb]:	0
V_{uay} [lb]:	11862
M_{ux} [ft-lb]:	0
M_{uy} [ft-lb]:	0
M_{uz} [ft-lb]:	0

<Figure 1>



<Figure 2>

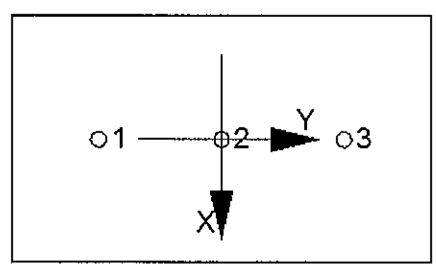


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	3119.7	0.0	3954.0	3954.0
2	3119.7	0.0	3954.0	3954.0
3	3119.7	0.0	3954.0	3954.0
Sum	9359.0	0.0	11862.0	11862.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 9359
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
18715	0.75	14036

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
24.0	1.00	2500	6.000	17636

$0.75\phi N_{cbg} = 0.75\phi\,(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	$0.75\phi N_{cbg}$ (lb)
432.00	324.00	7.00	1.000	0.933	1.00	1.000	17636	0.70	11522

6. Pullout Strength of Anchor in Tension (Sec. 17.6.3)

$0.75\phi N_{pn} = 0.75\phi \Psi_{c,P} N_p = 0.75\phi \Psi_{c,P} 8 A_{brg} f'_c$ (Sec. 17.5.1.2, Eq. 17.6.3.1 & 17.6.3.2.2a)

$\Psi_{c,P}$	A_{brg} (in^2)	f'_c (psi)	ϕ	$0.75\phi N_{pn}$ (lb)
1.0	0.92	2500	0.70	9660

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
18715	1.0	0.65	12165

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp}N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	432.00	324.00	1.000	0.933	1.000	1.000	17636	0.70	30726

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	3120	14036	0.22	Pass
Concrete breakout	**9359**	**11522**	**0.81**	**Pass (Governs)**
Pullout	3120	9660	0.32	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	3954	12165	0.33	Pass
Pryout	**11862**	**30726**	**0.39**	**Pass (Governs)**

Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Utilization Ratio	Permissible	Status
Sec. R17.8	0.71	0.20	91.2%	1.0	Pass

5/8"Ø AWS Type A Headed Stud with hef = 6.000 inch meets the selected design criteria.

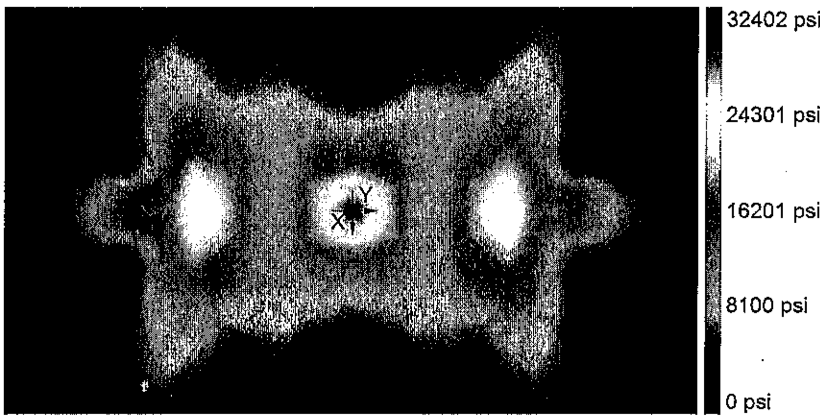
Base Plate Thickness

Required base plate thickness: 0.5 inches

Steel	**36000 psi**
Maximum stress	**32402 psi**
Calculated plate thickness	**0.327 inch**

Stress distribution

USE PL 3/8



For ACI and CSA design methods, maximum base plate stress is limited to 0.9 times yield stress.
For ETAG and EN-1992-4 design method, maximum base plate stress is limited to yield stress divide by 1.5.
Plate stress is derived using Von Mises theory.

$$\sigma_{xx} = \frac{F_{xx}}{t} + \frac{6M_{xx}}{t^2} \text{ (@ bottom) or } \sigma_{xx} = \frac{F_{xx}}{t} - \frac{6M_{xx}}{t^2} \text{ (@ top)}$$

$$\sigma_{yy} = \frac{F_{yy}}{t} + \frac{6M_{yy}}{t^2} \text{ (@bottom) or } \sigma_{yy} = \frac{F_{yy}}{t} - \frac{6M_{yy}}{t^2} \text{ (@ top)}$$

$$\sigma_{xy} = \frac{F_{xy}}{t} + \frac{6M_{xy}}{t^2} \text{ (@bottom) or } \sigma_{xy} = \frac{F_{xy}}{t} - \frac{6M_{xy}}{t^2} \text{ (@ top)}$$

$$\sigma_{xz} = \frac{V_x}{t}$$

$$\sigma_{yz} = \frac{V_y}{t}$$

$\sigma_{xx}, \sigma_{yy}, \sigma_{xy}$ as follows:

$$S_1 = \frac{\sigma_{xx} + \sigma_{yy}}{2} + \sqrt{\left(\frac{\sigma_{xx} - \sigma_{yy}}{2}\right)^2 + \sigma_{xy}^2}$$

$$S_2 = \frac{\sigma_{xx} + \sigma_{yy}}{2} - \sqrt{\left(\frac{\sigma_{xx} - \sigma_{yy}}{2}\right)^2 + \sigma_{xy}^2}$$

$$S_3 = 0$$

$$\sigma_{VonMises} = \sqrt{\frac{(S_1 - S_2)^2 + (S_1 - S_3)^2 + (S_2 - S_3)^2}{2}}$$

12. Warnings

- Concrete breakout strength in shear has not been evaluated against applied shear load(s) per designer option. Refer to ACI 318 Section 17.5.2.1 for conditions where calculations of the concrete breakout strength may not be required.

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.

- Designer must exercise own judgement to determine if this design is suitable.

SIMPSON Strong-Tie

Anchor Designer™ for Concrete Software
Version 3.3.2501.2

Company:		Date:	11/22/2024
Engineer:		Page:	1
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Project description:
Location:
Design name: Design

Comment:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Cast-in-place
Material: AWS Type A
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 6.000
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 7.38
C_{min} (inch): 1.38
S_{min} (inch): 2.50

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: Yes
Ignore 6do requirement: No
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 20.00 x 17.00 x 0.25

Recommended Anchor
Anchor Name: Headed Stud - 5/8"Ø AWS Type A Headed Stud

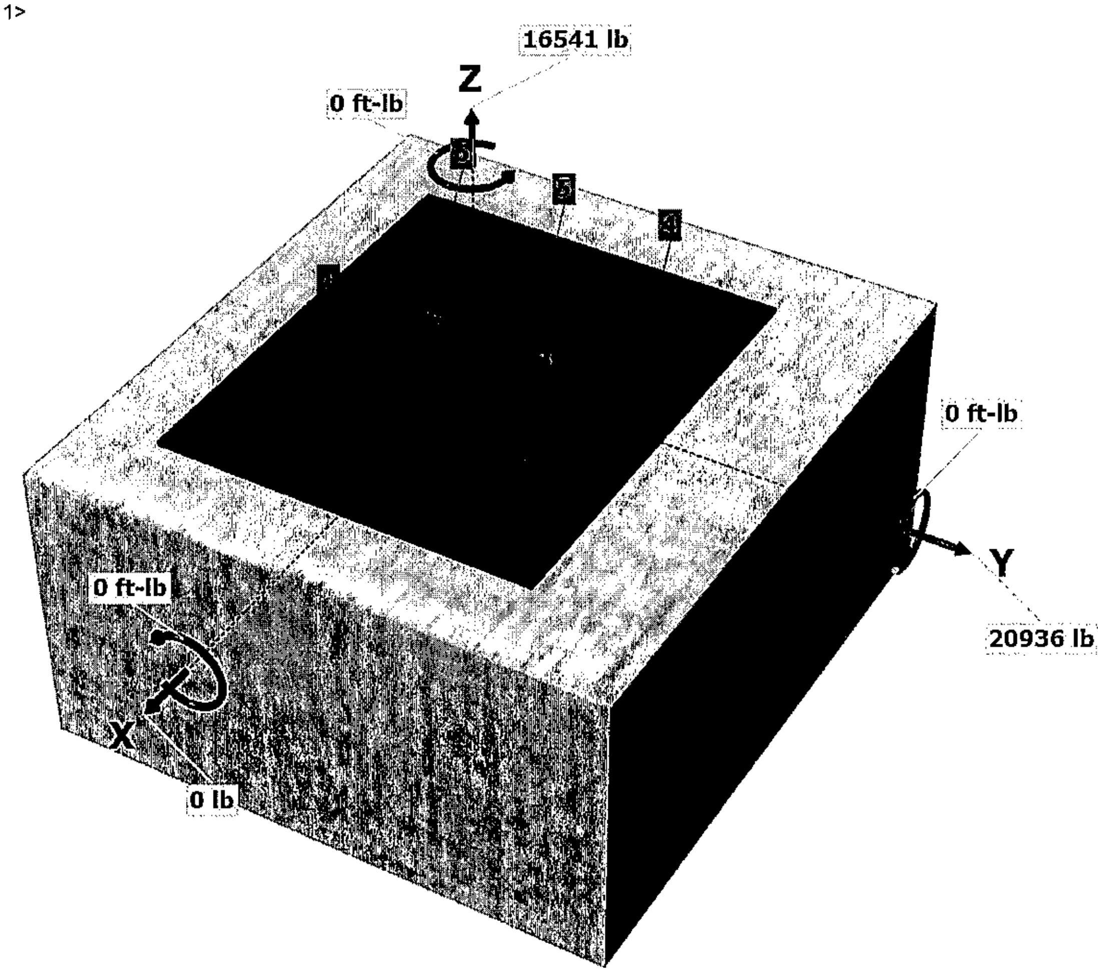
Use PL 3/8 x 17 x 20 Plate w/
(6) 5/8"Ø x 6" headed studs

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.10.5.3 (d) is satisfied
Ductility section for shear: 17.10.6.3 (c) is satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

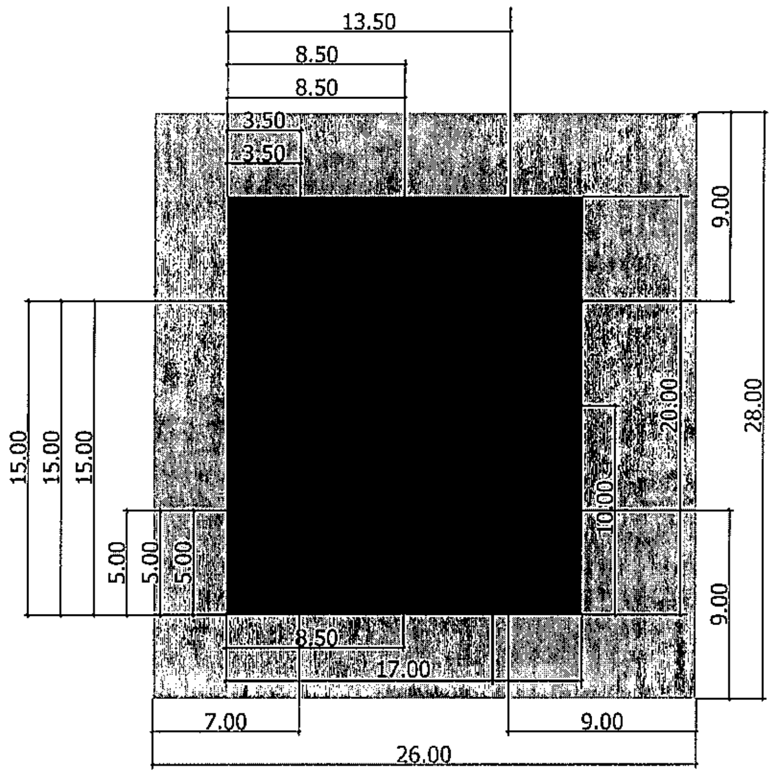
Strength level loads:

N_{ua} [lb]:	16541
V_{uax} [lb]:	0
V_{uay} [lb]:	20936
M_{ux} [ft-lb]:	0
M_{uy} [ft-lb]:	0
M_{uz} [ft-lb]:	0

<Figure 1>



<Figure 2>

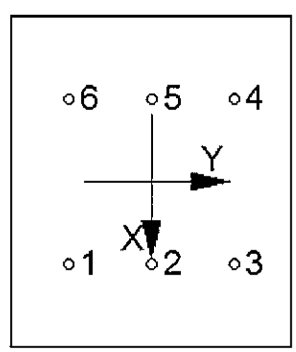


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	2756.8	0.0	3489.3	3489.3
2	2756.8	0.0	3489.3	3489.3
3	2756.8	0.0	3489.3	3489.3
4	2756.8	0.0	3489.3	3489.3
5	2756.8	0.0	3489.3	3489.3
6	2756.8	0.0	3489.3	3489.3
Sum	16541.0	0.0	20936.0	20936.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 16541
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
18715	0.75	14036

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
24.0	1.00	2500	6.000	17636

$0.75\phi N_{cbg} = 0.75\phi\ (A_{Nc} / A_{Nco})\ \Psi_{ec,N}\ \Psi_{ed,N}\ \Psi_{c,N}\ \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	$0.75\phi N_{cbg}$ (lb)
728.00	324.00	7.00	1.000	0.933	1.00	1.000	17636	0.70	19417

6. Pullout Strength of Anchor in Tension (Sec. 17.6.3)

$0.75\phi N_{pn} = 0.75\phi \Psi_{c,P} N_p = 0.75\phi \Psi_{c,P} 8 A_{brg} f'_c$ (Sec. 17.5.1.2, Eq. 17.6.3.1 & 17.6.3.2.2a)

$\Psi_{c,P}$	A_{brg} (in^2)	f'_c (psi)	ϕ	$0.75\phi N_{pn}$ (lb)
1.0	0.92	2500	0.70	9660

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
18715	1.0	0.65	12165

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	728.00	324.00	1.000	0.933	1.000	1.000	17636	0.70	51780

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, $øN_n$ (lb)	Ratio	Status
Steel	2757	14036	0.20	Pass
Concrete breakout	**16541**	**19417**	**0.85**	**Pass (Governs)**
Pullout	2757	9660	0.29	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, $øV_n$ (lb)	Ratio	Status
Steel	3489	12165	0.29	Pass
Pryout	**20936**	**51780**	**0.40**	**Pass (Governs)**

Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Utilization Ratio	Permissible	Status
Sec. R17.8	0.77	0.22	98.7%	1.0	Pass

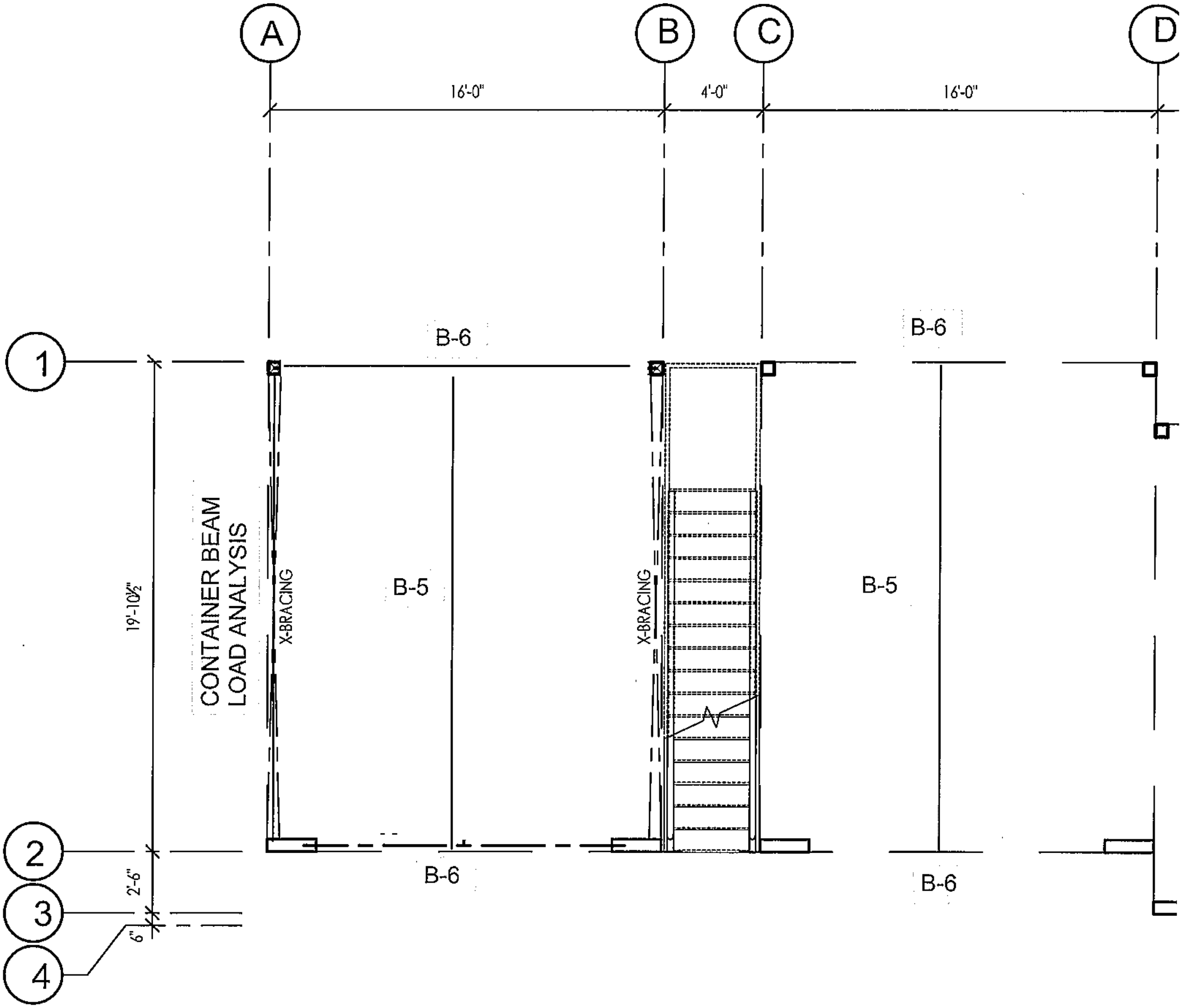
5/8"Ø AWS Type A Headed Stud with hef = 6.000 inch meets the selected design criteria.

similar ratio to 1 HSS,
USE PL 3/8

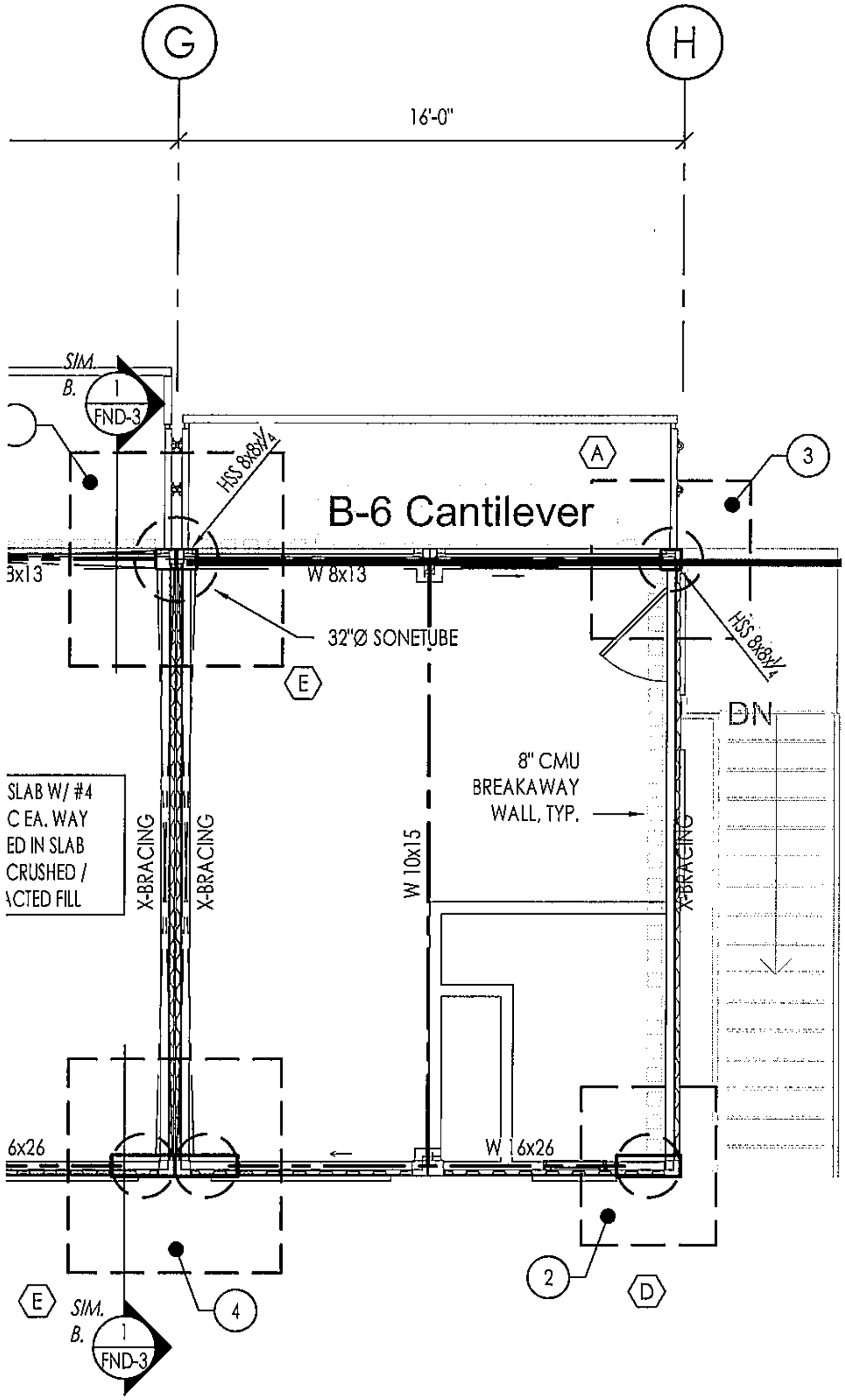
12. Warnings

- Concrete breakout strength in shear has not been evaluated against applied shear load(s) per designer option. Refer to ACI 318 Section 17.5.2.1 for conditions where calculations of the concrete breakout strength may not be required.
- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.
- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.

EXTERIOR FLOOR BEAM DESIGN

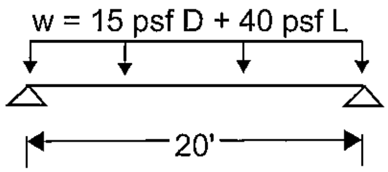


EXTERIOR FLOOR FRAMING (TYPICAL)



EXTERIOR FLOOR FRAMING (TYPICAL)

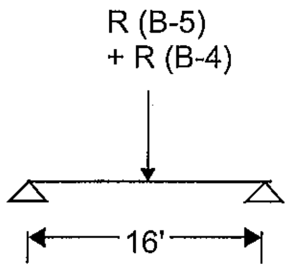
B-5



TRIB = 8'

$\boxed{\text{USE W 10x15}}$

B-6

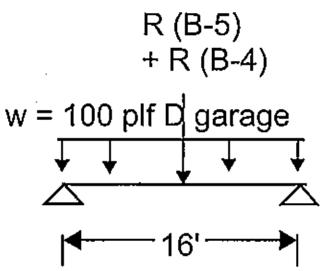


R (B-4) = 350# D + 530# Lr + 670# S

R(B-5) = 1200# D + 3200# L

$\boxed{\text{W8x13}}$

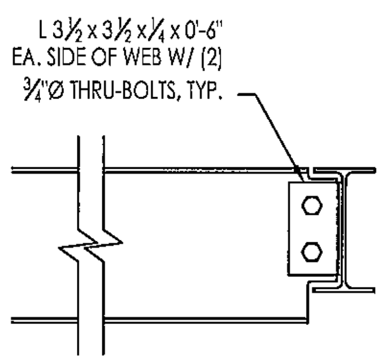
B-7



R (B-4) = 350# D + 530# Lr + 670# S

R(B-5) = 1200# D + 3200# L

$\boxed{\text{w16x26}}$

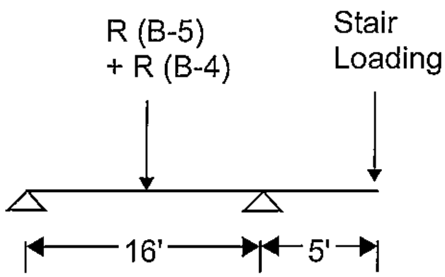


BOLT CONNECTION:

(2) 3/4" BOLTS SHEAR CAPACITY= 11.9 K X 2 = 23.8 K

> MAX GRAVITY REACTION = 4.36 K OK
> MAX LATERAL LOAD = 14.98 K

B-6



R (B-4) = 350# D + 530# Lr + 670# S

R(B-5) = 1200# D + 3200# L

Stair Loading = 460# D + 2830# L

W8x13

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Steel Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

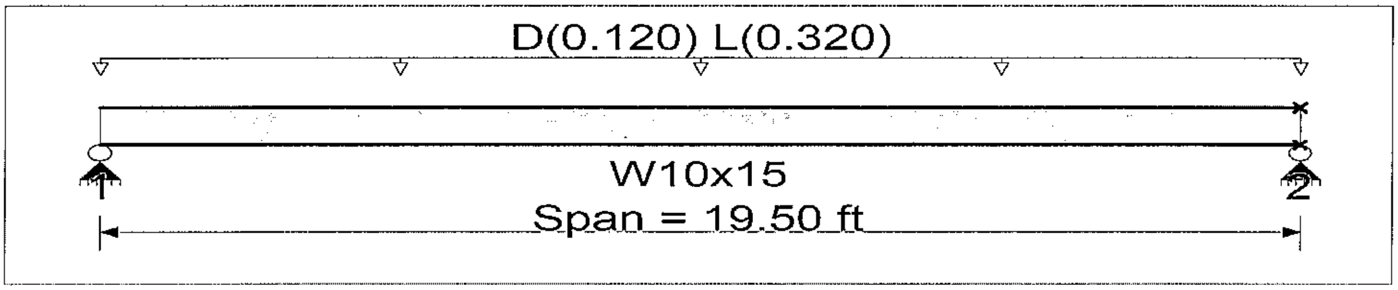
DESCRIPTION: B-5 Floor (Steel)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.542** : 1	Maximum Shear Stress Ratio =	**0.096** : 1
Section used for this span	**W10x15**	Section used for this span	**W10x15**
Ma : Applied	21.627 k-ft	Va : Applied	4.436 k
Mn / Omega : Allowable	39.920 k-ft	Vn/Omega : Allowable	46.0 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.523 in	Ratio =	447	>=360.	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360.0	n/a
Max Downward Total Deflection	0.744 in	Ratio =	314	>=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.7442	9.806		0.0000	0.000

Vertical Reactions

Support notation : Far left is #' Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	4.436	4.436
Max Upward from Load Combinations	4.436	4.436
Max Upward from Load Cases	3.120	3.120
D Only	1.316	1.316
+D+L	4.436	4.436
+D+0.750L	3.656	3.656
+0.60D	0.790	0.790
L Only	3.120	3.120

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Steel Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

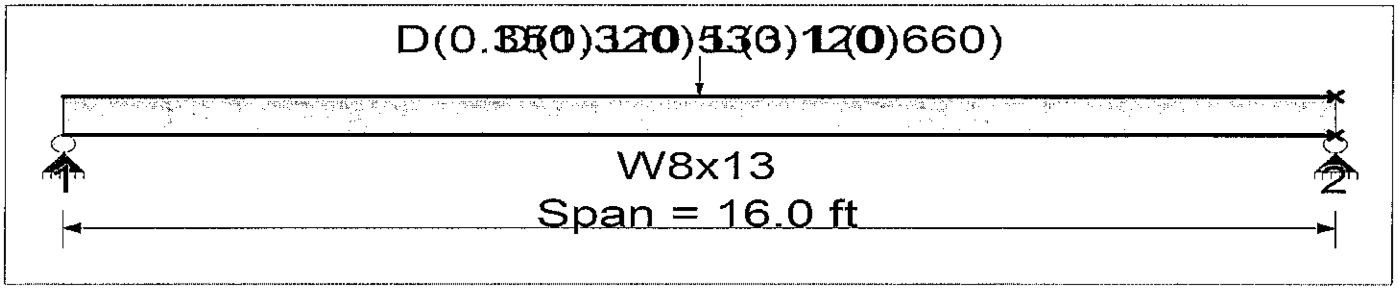
DESCRIPTION: B-6 (Steel)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : D = 1.320, L = 3.120 k @ 8.0 ft, (Floor)
Point Load : D = 0.350, Lr = 0.530, L = 0.660 k @ 8.0 ft, (Roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.833 : 1**	Maximum Shear Stress Ratio =	**0.081 : 1**
Section used for this span	**W8x13**	Section used for this span	**W8x13**
Ma : Applied	21.800 k-ft	Va : Applied	2.725 k
Mn / Omega : Allowable	26.168 k-ft	Vn/Omega : Allowable	33.814 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.487 in	Ratio =	393	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.703 in	Ratio =	273	>=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.7028	8.000		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.725	2.725
Max Upward from Load Combinations	2.725	2.725
Max Upward from Load Cases	1.890	1.890
D Only	0.835	0.835
+D+L	2.725	2.725
+D+Lr	1.100	1.100
+D+0.750Lr+0.750L	2.451	2.451
+D+0.750L	2.253	2.253
+0.60D	0.501	0.501
Lr Only	0.265	0.265
L Only	1.890	1.890

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Steel Beam

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

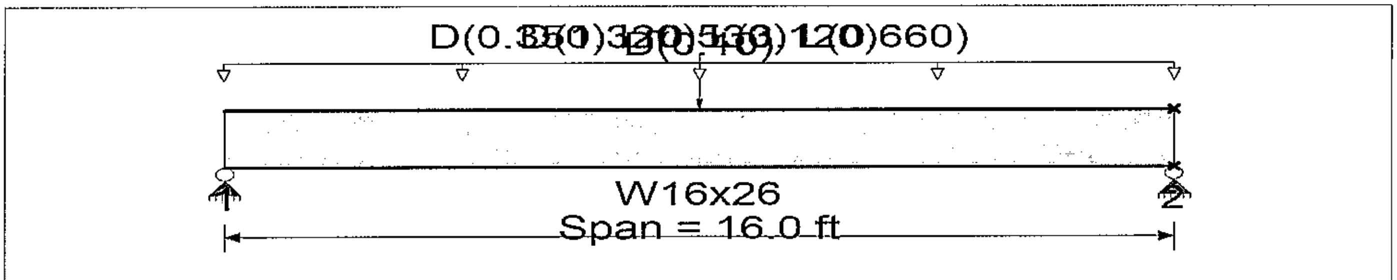
DESCRIPTION: B-7 (Steel)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, SDPWS 2021
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : D = 1.320, L = 3.120 k @ 8.0 ft, (Floor)
Point Load : D = 0.350, Lr = 0.530, L = 0.660 k @ 8.0 ft, (Roof)
Uniform Load : D = 0.10 ksf, Tributary Width = 1.0 ft, (Garage Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.246** : 1	Maximum Shear Stress Ratio =	**0.054** : 1
Section used for this span	**W16x26**	Section used for this span	**W16x26**
Ma : Applied	25.000 k-ft	Va : Applied	3.525 k
Mn / Omega : Allowable	101.457 k-ft	Vn/Omega : Allowable	64.868 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.064 in	Ratio =	2,994	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.109 in	Ratio =	1755	>=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.1094	8.046		0.0000	0.000

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	3.525	3.525
Max Upward from Load Combinations	3.525	3.525
Max Upward from Load Cases	1.890	1.890
D Only	1.635	1.635
+D+L	3.525	3.525
+D+Lr	1.900	1.900
+D+0.750Lr+0.750L	3.251	3.251
+D+0.750L	3.053	3.053
+0.60D	0.981	0.981
Lr Only	0.265	0.265
L Only	1.890	1.890

HAYDEN ENGINEERS
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General Beam Analysis

Project File: Nestucca River.ec6

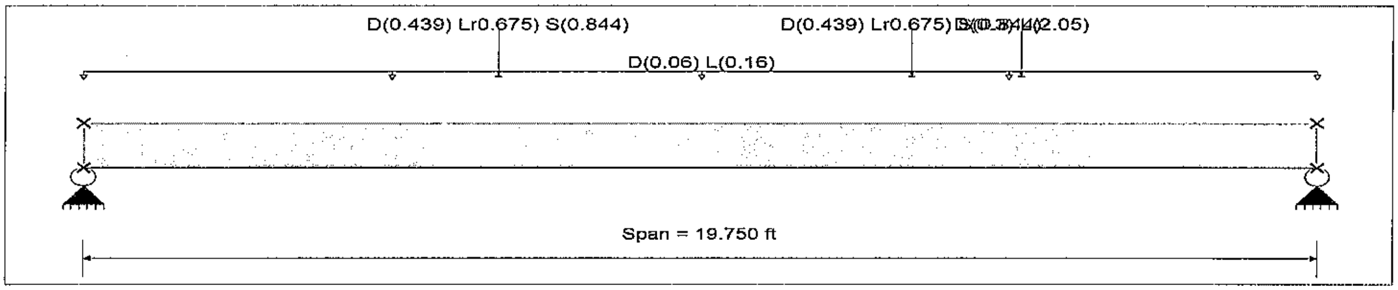
LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

DESCRIPTION: Container Beam Analysis

General Beam Properties

Elastic Modulus 29,000.0 ksi

Span #1 Span Length = 19.750 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load(s) for Span Number 1

Point Load : D = 0.30, L = 2.050 k @ 15.0 ft, (Stairs)

Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 4.0 ft, (Floor)

Point Load : D = 0.4390, Lr = 0.6750, S = 0.8440 k @ 6.625 ft, (Roof Point Load)

Point Load : D = 0.4390, Lr = 0.6750, S = 0.8440 k @ 13.250 ft, (Roof Point Load)

DESIGN SUMMARY

Maximum Bending =	19.908 k-ft		Maximum Shear =	4.399 k
Load Combination	+D+L		Load Combination	+D+L
Span # where maximum occurs	Span # 1		Span # where maximum occurs	Span # 1
Location of maximum on span	12.443 ft		Location of maximum on span	19.750 ft
Maximum Deflection				
Max Downward Transient Deflection	0.323 in	734		
Max Upward Transient Deflection	0.002 in	138122		
Max Downward Total Deflection	0.487 in	486		
Max Upward Total Deflection	0.002 in	157418		

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750Lr+0.750L	1	0.4873	10.171		0.0000	0.000

Vertical Reactions

Support notation : Far left is # Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.174	4.399
Overall MINimum		
D Only	1.101	1.262
+D+L	3.174	4.399
+D+Lr	1.772	1.941
+D+0.70S	1.688	1.857
+D+0.750Lr+0.750L	3.159	4.124
+D+0.750L+0.5250S	3.096	4.061
+0.60D	0.661	0.757
+D+0.750L+0.10S	2.740	3.700
Lr Only	0.671	0.679
L Only	2.073	3.137
S Only	0.839	0.849

HAYDEN ENGINEERS
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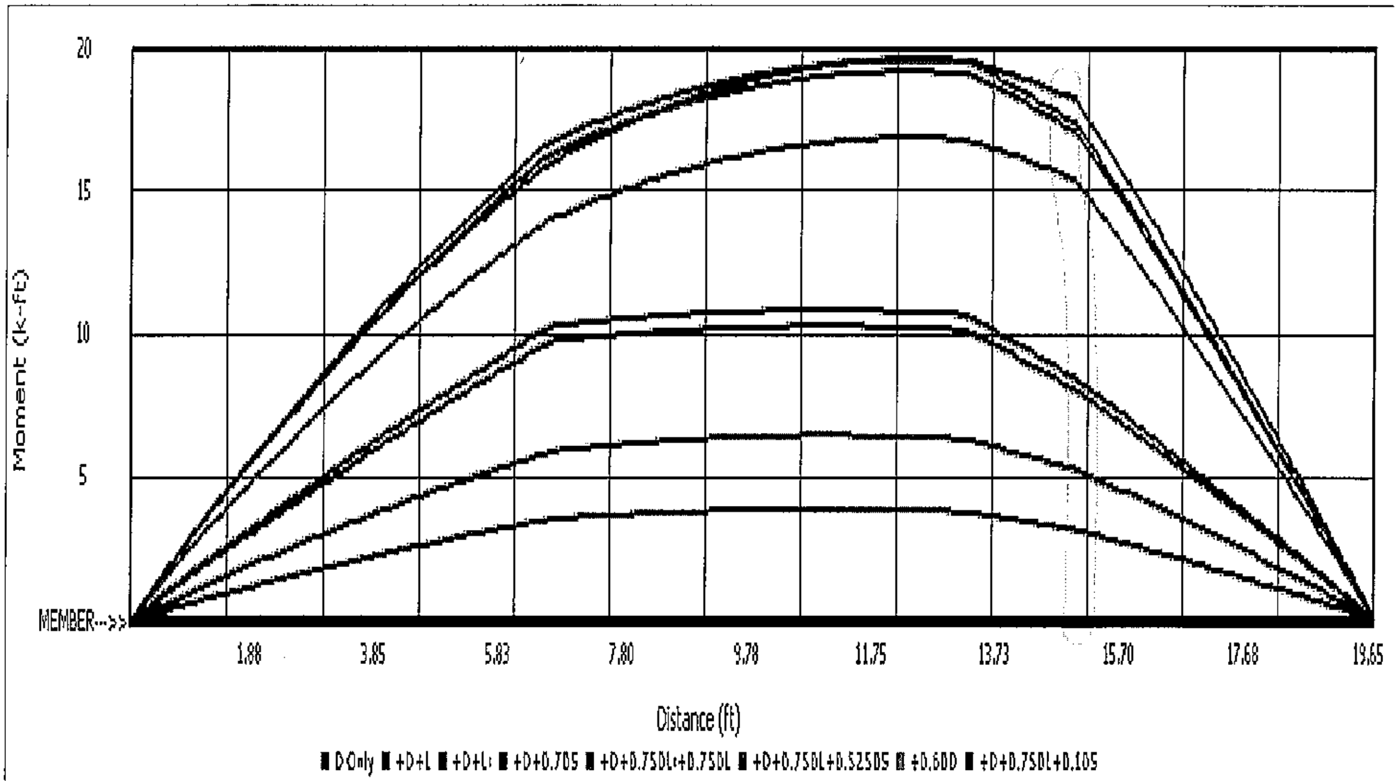
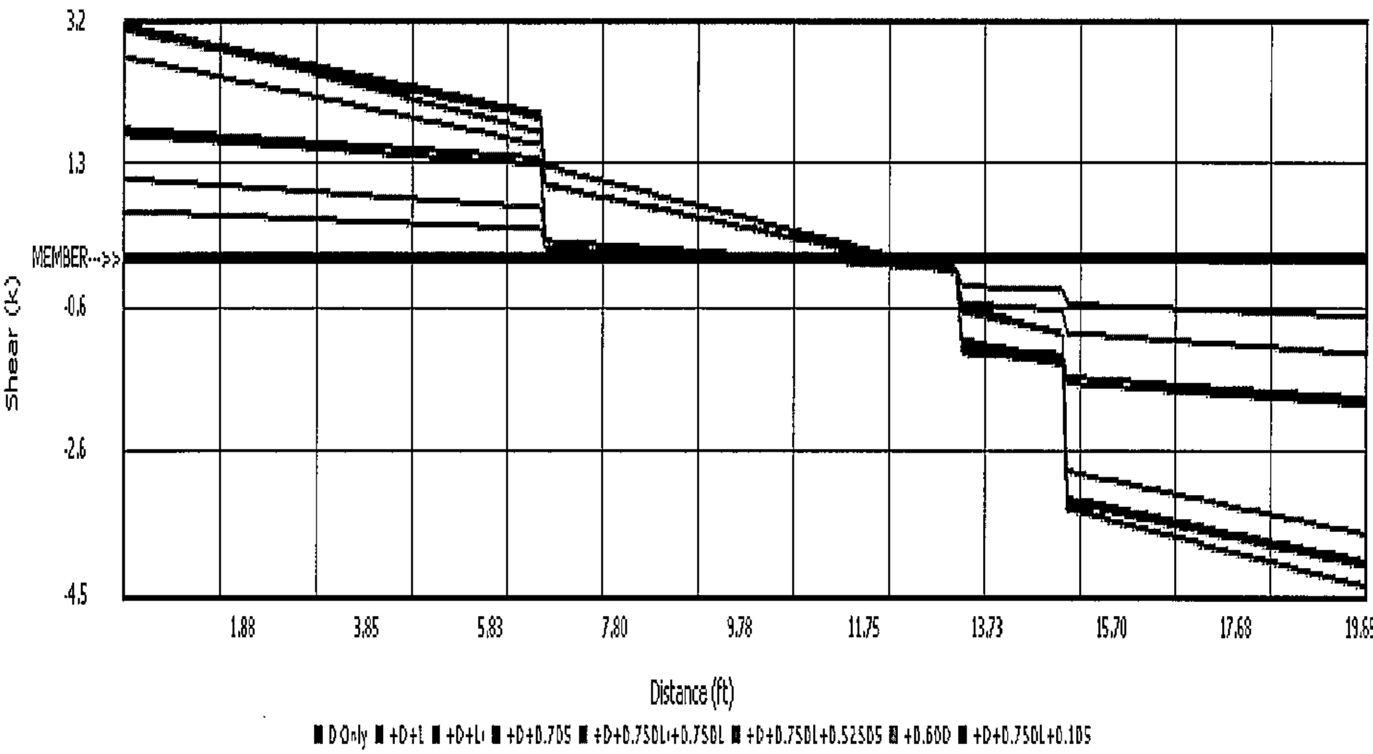
General Beam Analysis

Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

DESCRIPTION: Container Beam Analysis





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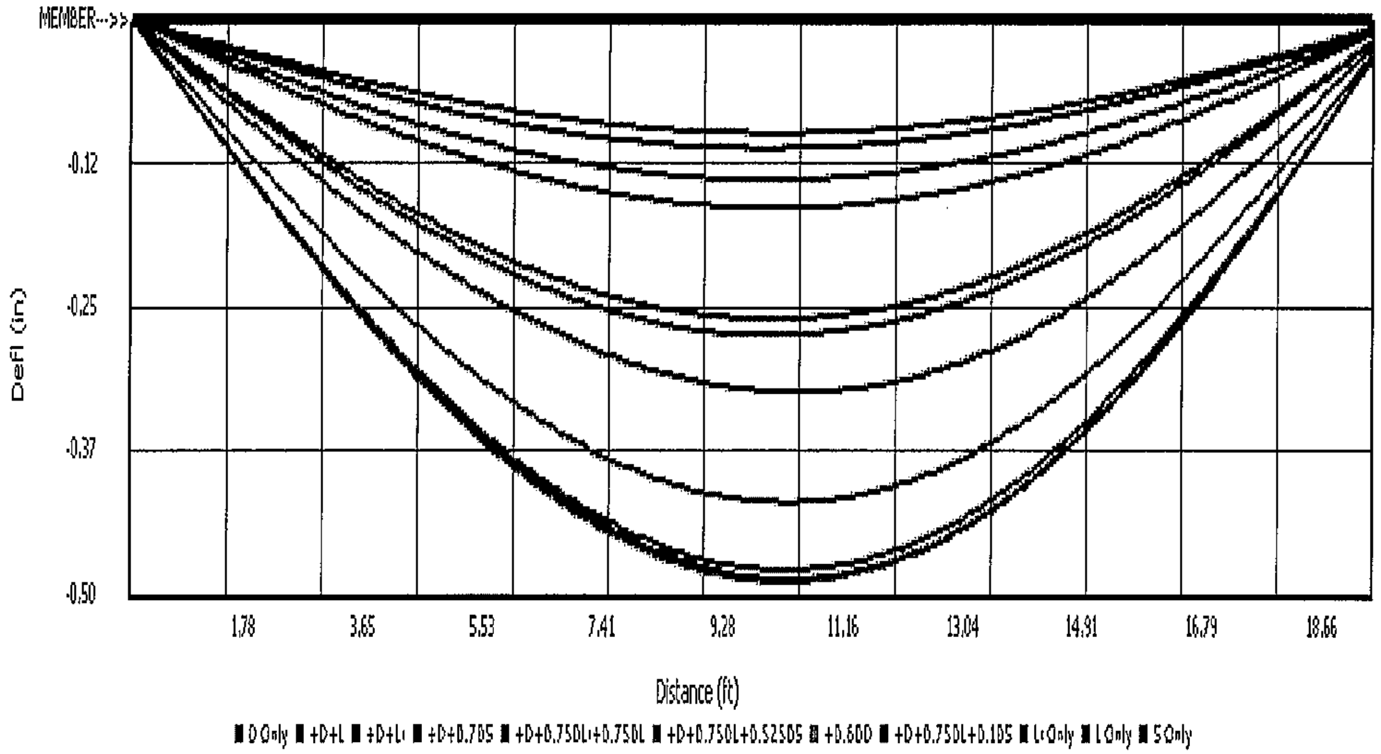
General Beam Analysis
. Project File: Nestucca River.ec6

LIC# : KW-06014171, Build:20.24.09.03 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2024

DESCRIPTION: Container Beam Analysis



Summary of Values per Beam Span

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
Overall MAXimum Envelope	0.00	Span 1	3.174	0.000
Overall MAXimum Envelope	1.98	Span 1	2.803	5.887
Overall MAXimum Envelope	3.95	Span 1	2.448	11.073
Overall MAXimum Envelope	5.93	Span 1	2.092	15.556
Overall MAXimum Envelope	7.90	Span 1	0.997	18.132
Overall MAXimum Envelope	9.88	Span 1	0.562	19.344
Overall MAXimum Envelope	11.85	Span 1	0.128	19.871
Overall MAXimum Envelope	13.83	Span 1	-1.286	19.442
Overall MAXimum Envelope	15.80	Span 1	-3.530	15.660
Overall MAXimum Envelope	17.78	Span 1	-3.965	8.259
Overall MAXimum Envelope	19.75	Span 1	-4.399	0.000
D Only	0.00	Span 1	1.101	0.000
D Only	1.98	Span 1	0.982	2.057
D Only	3.95	Span 1	0.864	3.880
D Only	5.93	Span 1	0.745	5.470
D Only	7.90	Span 1	0.188	6.265
D Only	9.88	Span 1	0.069	6.519
D Only	11.85	Span 1	-0.049	6.539
D Only	13.83	Span 1	-0.607	6.072
D Only	15.80	Span 1	-1.025	4.517
D Only	17.78	Span 1	-1.144	2.376
D Only	19.75	Span 1	-1.262	0.000
+D+L	0.00	Span 1	3.174	0.000

HAYDEN ENGINEERS
STRUCTURAL | CIVIL

DESCRIPTION: Container Beam Analysis

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+D+L	1.98	Span 1	2.739	5.839
+D+L	3.95	Span 1	2.305	10.821
+D+L	5.93	Span 1	1.870	14.944
+D+L	7.90	Span 1	0.997	17.649
+D+L	9.88	Span 1	0.562	19.189
+D+L	11.85	Span 1	0.128	19.871
+D+L	13.83	Span 1	-0.746	19.442
+D+L	15.80	Span 1	-3.530	15.660
+D+L	17.78	Span 1	-3.965	8.259
+D+L	19.75	Span 1	-4.399	0.000
+D+Lr	0.00	Span 1	1.772	0.000
+D+Lr	1.98	Span 1	1.653	3.382
+D+Lr	3.95	Span 1	1.535	6.530
+D+Lr	5.93	Span 1	1.416	9.444
+D+Lr	7.90	Span 1	0.184	10.703
+D+Lr	9.88	Span 1	0.065	10.949
+D+Lr	11.85	Span 1	-0.053	10.960
+D+Lr	13.83	Span 1	-1.286	10.097
+D+Lr	15.80	Span 1	-1.704	7.200
+D+Lr	17.78	Span 1	-1.823	3.717
+D+Lr	19.75	Span 1	-1.941	0.000
+D+0.70S	0.00	Span 1	1.688	0.000
+D+0.70S	1.98	Span 1	1.569	3.217
+D+0.70S	3.95	Span 1	1.451	6.199
+D+0.70S	5.93	Span 1	1.332	8.948
+D+0.70S	7.90	Span 1	0.184	10.149
+D+0.70S	9.88	Span 1	0.066	10.396
+D+0.70S	11.85	Span 1	-0.053	10.409
+D+0.70S	13.83	Span 1	-1.201	9.595
+D+0.70S	15.80	Span 1	-1.620	6.866
+D+0.70S	17.78	Span 1	-1.738	3.550
+D+0.70S	19.75	Span 1	-1.857	0.000
+D+0.750Lr+0.750L	0.00	Span 1	3.159	0.000
+D+0.750Lr+0.750L	1.98	Span 1	2.803	5.887
+D+0.750Lr+0.750L	3.95	Span 1	2.448	11.073
+D+0.750Lr+0.750L	5.93	Span 1	2.092	15.556
+D+0.750Lr+0.750L	7.90	Span 1	0.791	18.132
+D+0.750Lr+0.750L	9.88	Span 1	0.436	19.344
+D+0.750Lr+0.750L	11.85	Span 1	0.080	19.854
+D+0.750Lr+0.750L	13.83	Span 1	-1.220	19.118
+D+0.750Lr+0.750L	15.80	Span 1	-3.413	14.887
+D+0.750Lr+0.750L	17.78	Span 1	-3.769	7.794
+D+0.750Lr+0.750L	19.75	Span 1	-4.124	0.000
+D+0.750L+0.5250S	0.00	Span 1	3.096	0.000
+D+0.750L+0.5250S	1.98	Span 1	2.740	5.763
+D+0.750L+0.5250S	3.95	Span 1	2.385	10.825
+D+0.750L+0.5250S	5.93	Span 1	2.029	15.184

DESCRIPTION: Container Beam Analysis

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+D+0.750L+0.5250S	7.90	Span 1	0.792	17.716
+D+0.750L+0.5250S	9.88	Span 1	0.436	18.929
+D+0.750L+0.5250S	11.85	Span 1	0.081	19.440
+D+0.750L+0.5250S	13.83	Span 1	-1.157	18.741
+D+0.750L+0.5250S	15.80	Span 1	-3.350	14.636
+D+0.750L+0.5250S	17.78	Span 1	-3.705	7.669
+D+0.750L+0.5250S	19.75	Span 1	-4.061	0.000
+0.60D	0.00	Span 1	0.661	0.000
+0.60D	1.98	Span 1	0.589	1.234
+0.60D	3.95	Span 1	0.518	2.328
+0.60D	5.93	Span 1	0.447	3.282
+0.60D	7.90	Span 1	0.113	3.759
+0.60D	9.88	Span 1	0.042	3.911
+0.60D	11.85	Span 1	-0.029	3.923
+0.60D	13.83	Span 1	-0.364	3.643
+0.60D	15.80	Span 1	-0.615	2.710
+0.60D	17.78	Span 1	-0.686	1.425
+0.60D	19.75	Span 1	-0.757	0.000
+D+0.750L+0.10S	0.00	Span 1	2.740	0.000
+D+0.750L+0.10S	1.98	Span 1	2.384	5.059
+D+0.750L+0.10S	3.95	Span 1	2.029	9.417
+D+0.750L+0.10S	5.93	Span 1	1.673	13.072
+D+0.750L+0.10S	7.90	Span 1	0.794	15.358
+D+0.750L+0.10S	9.88	Span 1	0.439	16.575
+D+0.750L+0.10S	11.85	Span 1	0.083	17.090
+D+0.750L+0.10S	13.83	Span 1	-0.796	16.603
+D+0.750L+0.10S	15.80	Span 1	-2.989	13.210
+D+0.750L+0.10S	17.78	Span 1	-3.344	6.956
+D+0.750L+0.10S	19.75	Span 1	-3.700	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	2.07	Span 1	0.153
Overall MAXimum Envelope	4.15	Span 1	0.290
Overall MAXimum Envelope	6.22	Span 1	0.399
Overall MAXimum Envelope	8.30	Span 1	0.466
Overall MAXimum Envelope	10.37	Span 1	0.487
Overall MAXimum Envelope	12.44	Span 1	0.458
Overall MAXimum Envelope	14.52	Span 1	0.380
Overall MAXimum Envelope	16.59	Span 1	0.255
Overall MAXimum Envelope	18.66	Span 1	0.097
Overall MAXimum Envelope	19.75	Span 1	0.008
D Only	0.00	Span 1	0.000
D Only	2.07	Span 1	0.052
D Only	4.15	Span 1	0.098

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Steel Beam

Project File: 24261.01 nestucca.ec6

LIC# : KW-06014171, Build:20.25.03.24 HAYDEN CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

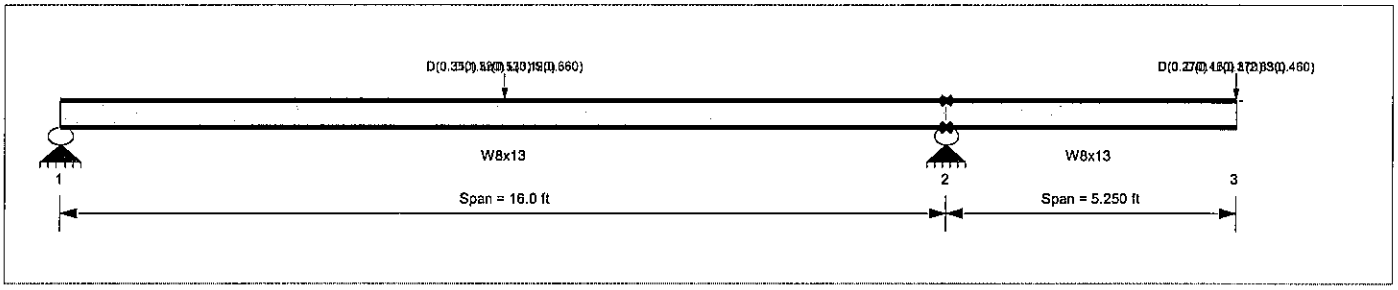
DESCRIPTION: B-6 Cantilever (Steel)

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Load(s) for Span Number 1
Point Load : D = 1.320, L = 3.120 k @ 8.0 ft, (Floor)
Point Load : D = 0.350, Lr = 0.530, S = 0.660 k @ 8.0 ft, (Roof)
Load(s) for Span Number 2
Point Load : D = 0.460, L = 2.830 k @ 5.250 ft, (Stairs)
Point Load : D = 0.270, Lr = 0.370, S = 0.460 k @ 5.250 ft, (Roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.721 : 1**	Maximum Shear Stress Ratio =	**0.109 : 1**
Section used for this span	**W8x13**	Section used for this span	**W8x13**
Ma : Applied	18.870 k-ft	Va : Applied	3.679 k
Mn / Omega : Allowable	26.168 k-ft	Vn/Omega : Allowable	33.814 k
Load Combination	+D+L	Load Combination	+D+L
		Location of maximum on span	16.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.436 in	Ratio = 288	>=240.	Span: 2 : L Only
Max Upward Transient Deflection	-0.050 in	Ratio = 3,864	>=240.	Span: 2 : L Only
Max Downward Total Deflection	0.431 in	Ratio = 292	>=240.	Span: 2 : +D+L
Max Upward Total Deflection	-0.013 in	Ratio = 9882	>=240.	Span: 2 : D Only

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+0.750L+0.750S	0.1983	6.784	L Only	-0.0497	13.568
2	L Only	0.4364	5.250		0.0000	13.568

Vertical Reactions

Support notation : Far left is #' Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	1.320	7.308	
Max Upward from Load Combinations	1.320	7.308	
Max Upward from Load Cases	0.689	5.319	
D Only	0.689	1.989	
+D+L	1.320	7.308	
+D+Lr	0.832	2.745	
+D+S	0.868	2.930	
+D+0.750Lr+0.750L	1.270	6.545	
+D+0.750L+0.750S	1.297	6.684	
+0.60D	0.413	1.193	
Lr Only	0.144	0.756	
L Only	0.631	5.319	
S Only	0.179	0.941	

With Additional Load Testing Container Beam may be sufficient on its own

COMPOSITE CONTAINER BEAM

HSS 6x3x5/16

kL/r = 19'/ 1.75"/12" = 130

Fcr/Omega (ASD) 36 ksi = 8.86 ksi

P/A = (5.613 k x 2.5 omega)/4.10in2 = 3.42 ksi

Container Beam Alone:

kL/r = 19'/ 2.15169"/12" = 106

Fcr/Omega (ASD) 36 ksi = 11.9 ksi

P/A = (5.613 k x 2.5 omega)/1.6in2 = 8.77 ksi

$$\frac{KL}{r} > \frac{P}{A} \quad OK \checkmark$$

STRENGTH:

$$\frac{M_n}{\Omega} = \frac{F_y S_{min}}{1.67} \qquad S = \frac{I}{c} = \frac{12.83573}{3.182\ in} = 4.0338$$

$$\frac{M_n}{\Omega} = \frac{(50ksi)(4.0338)}{(12")(1.67)} = 10.06\ k\text{-}ft$$

$$M_{MAX} = \frac{(13psf_{\text{ROOF DEAD}} \times 4') + (15psf_{\text{FLOOR DEAD}} \times 4') + (8psf_{\text{WALL DEAD}} \times 8')\ (19)^2}{8}$$

$$M_{MAX} = 7924\ k\text{-}ft$$

$$M_{STAIR} = \frac{P_a b}{l} = \frac{(300lb)(15')(4')}{19} = 947\ lb\text{-}ft \qquad M_{TOTAL} = 8871\ lb\text{-}ft$$

$\frac{P}{P_a} + \frac{F}{F_a} =$ 3.42 ksi/8.86 ksi + 8821 k-ft/10060 k-ft = 1.26 < 1.33 OK

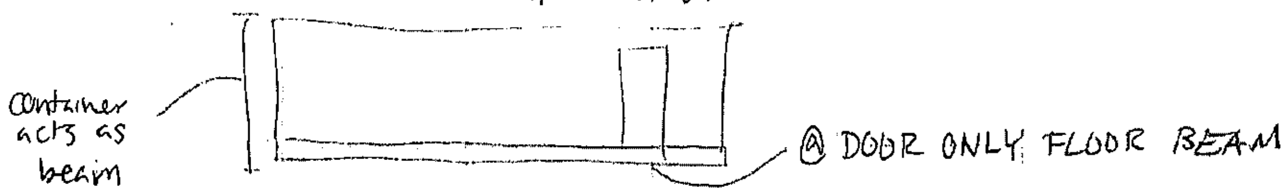
COMPOSITE CONTAINER BEAM GRAVITY

$$\frac{M_n}{\Omega} = \frac{F_y S_{min}}{1.67} = 10.06 \text{ K} \cdot \text{ft}$$

$$M_{MAX} = 19.929 \text{ K-ft}$$

$$\frac{M_n}{\Omega} = 19.929 = \frac{(50\text{ksi})(S_{min})}{12''\ (1.67)}$$

$$S_{min} = 7.987$$



$$M_{@\ DOOR} = 16.375 \text{ k} \cdot \text{ft}$$

$$S_{min} = 6.56$$

$$6 \times 3 \times 9/16 : S = 6.69 > 6.56 \ \checkmark \text{OK}$$

M @ Container "Beam"

$$M_{Max} = 84.8\ Kip \cdot ft \leq \frac{M_n}{\Omega} \quad \sqrt{OK}$$

(See following page for container maximum moment calculation)

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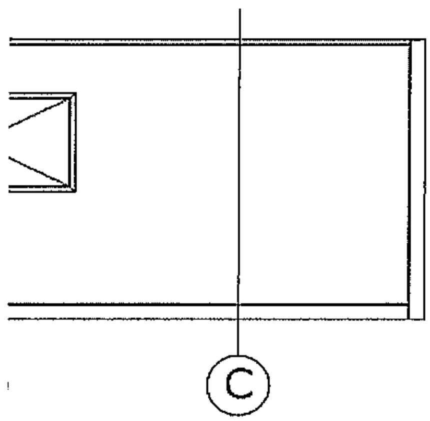
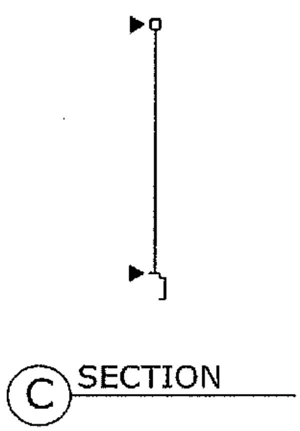
Floor Beams





Floor Beams Cont.
C Section Properties

Determine PNA

$$A_{Panel} = (114\ in - 2.375\ in - 6.125\ in)(0.0629\ in)$$
$$A_{Panel} = 6.64\ in^2$$

$$I_{Panel} = \frac{(0.0629\ in)(114\ in - 2.375\ in - 6.125\ in)^3}{12}$$
$$I_{Panel} = 6155\ in^4$$

$$\bar{y} = \frac{\sum_{n=1}^{3} A_n C_{Yn}}{\sum_{n=1}^{2} A_n}$$

$$\begin{aligned}\bar{y} = &[(1.60\ in^2)(3.53\ in) && \text{Floor Beam}\\ &+(1.06\ in^2)\left(114\ in\ - \frac{2.375\ in}{2} in\right) && \text{Roof Composite Section}\\ &+(6.64)\left(\frac{114\ in - 2.375\ in - 6.125\ in}{2} + 6.125\ in\right)] && \text{Wall Panel}\\ &\div [(1.60\ in^2) + (1.06\ in^2) + (6.64\ in^2)]\end{aligned}$$

$$\bar{y} = 55.5\ in$$

$$I = \sum_{n=1}^{2} I_{CM_n} + A_n d_n^2$$
$$\begin{aligned}I = &(7.40\ in^4) + (1.60\ in^2)(55.5\ in - 3.53\ in)^2\\ &+(0.89\ in^4) + (1.06\ in^2)\left(114\ in\ - 55.5\ in - \frac{2.375\ in}{2}\right)^2\\ &+(6155\ in^4) + (6.64\ in^2)\left(\frac{114\ in - 2.375\ in - 6.125\ in}{2} + 6.125\ in - 55.5\ in\right)^2\end{aligned}$$

$$I = 14{,}042\ in^4$$

Allowable Moment

$$\frac{M_n}{\Omega} = \frac{F_y S_{Min}}{1.67} = \frac{F_y \cdot I}{1.67 \cdot C}$$ (AISC 360-16 Eq F 12 - 1)

$$\frac{M_n}{\Omega} = \frac{(50\ Ksi)(14{,}042\ in^4)}{1.67(114\ in - 55.5\ in)}$$

$$\frac{M_n}{\Omega} = 7187\ Kip \cdot in$$

$$\frac{M_n}{\Omega} = 599\ Kip \cdot ft$$

Actual Moment

$$M_{Max} = \frac{w\ell}{8}$$

$$M_{Max} = \frac{(335\ plf)(45\ ft)^2}{8}$$

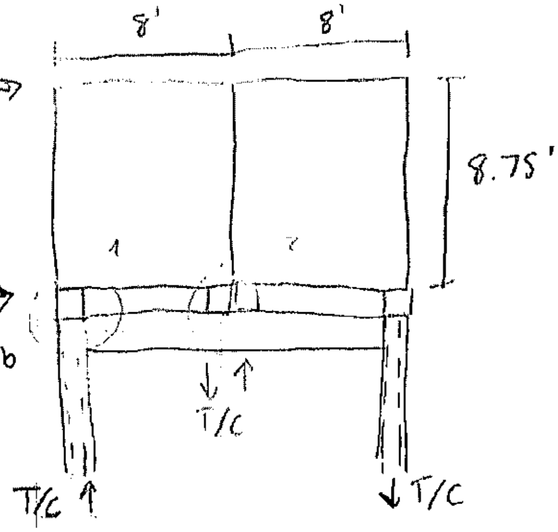
$$M_{Max} = 84{,}800\ lb \cdot ft$$

$$M_{Max} = 84.8\ Kip \cdot ft \leq \frac{M_n}{\Omega} \quad \sqrt{OK}$$

(A)

1373 lb →
× 2.5 = 3433 lb

TOTAL SHEAR: →
4785 lb
× 2.5 = 11962.5 lb



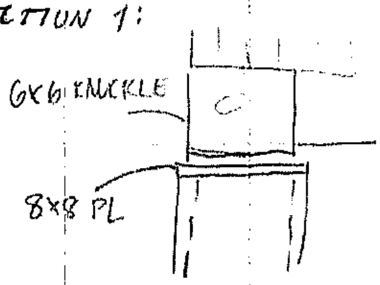
MAX GRAVITY LOAD = 4.404 K

$V = 3433\ lb / 16' = 214\ lb/ft$

$M_{or} = 214\ lb/ft \times 16 \times 8.75' = 29960\ ft \cdot lb$

$T/C = \frac{15019\ ft \cdot lb}{16} = 1873\ lb$

CONNECTION 1:



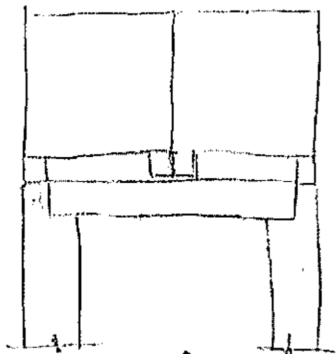
CHECK PL FOR BENDING

$M = \frac{Pl}{4} = \frac{(\ \ )(8")}{4} = 8.8\ k\text{-}in$

$t_{min} = \sqrt{\frac{6M}{0.9 F_y (8")}} = 0.45$

⇒ USE 1/2" THICK PLATE

(B)



V = 3433lb / 16' = 214 lb/ft

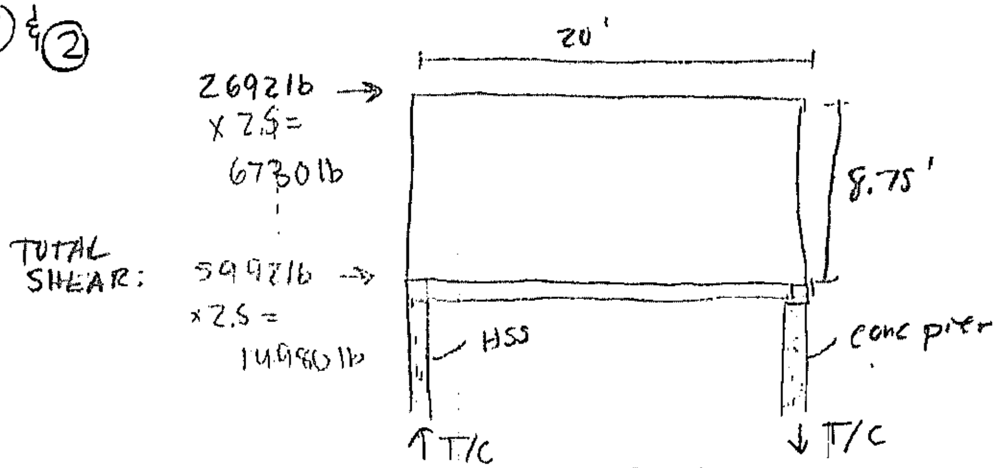
Mot = 214 lb/ft × 16' × 8.75' = 29960 ft-lb

$T/C = \dfrac{15019\ ft\text{-}lb}{16'} = 1873 lb$

SHEAR @ BASE = 11962.5 / 2 = 5,981 K

→ CONNECTION @ MIDDLE OF BEAM , SEE (A)

① & ②



$V = 6730 / 20' = 336.5 \text{ lb/ft}$

$M_{OT} = 336.5 \text{ lb/ft} \times 20' \times 8.75' = 58887.5 \text{ lb-ft}$

$T/C = \dfrac{58887.5 \text{ ft·lb}}{20'} = 2944 \text{ lb}$

SHEAR @ BASE $= 14980 \text{ lb}/2 = 7490 \text{ lb}$

CHECK WELD:

$\dfrac{R_n}{\Omega} = 0.928 \text{ kip/in } Dl$

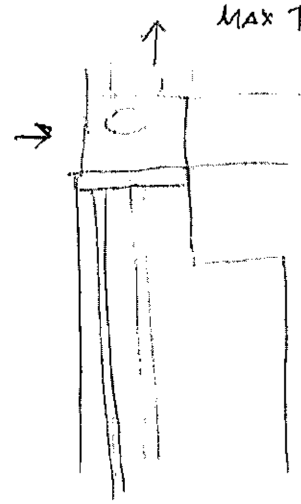
$D = 3/16 \quad l = 12"$

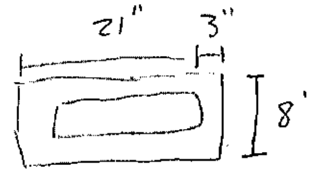
$\dfrac{R_n}{\Omega} = 0.928 \text{ kip/in } (3)(12)$

$\dfrac{R_n}{\Omega} = 33.4K > 14.98K$ ✓ OK conservative load

MAX TENSION: 11862 lb seismic (unfactored)

MAX SHEAR:
5992 lb. x 2.5
= 14980 lb





Tension:

$T_s = 0.9(F_y)A_s$ #3 BAR $A_s = 0.11 \times 3$ BARS $f_y = 60ksi$

$T_s = 17.82K > 11862\,lb$ OK ✓

SHEAR @ TIES:

$T_s = 0.9(F_y)A_s$ $A_s = 0.11 \times 2$

$T_s = 11.88\,K$

(3) #3 TIES $T_s \times 3 = 35.6\,K$ ✓ OK

$\text{Development Length} = \frac{F_y}{25 \times \sqrt{f'_c}}\, d_b = 14''$

<u>SHEAR FRICTION (22.9.4.3 ACI 318-19)</u>

Vallow = As*fy*phi*(mu*sina+cosa)

mu = 0.7 (concrete place against structural steel with headed stud or welded rebar)
As = (2) #5 = 0.62 in2
fy = 60 ksi
a = 45 degrees (for use in combination with shear reinforcing ties)
phi = 0.75 (for shear)

Vallow = 23.48 kips

V (seismic out-of plane) = 9900 lb x Ω =19800lb

V < Vallow

USE (2) #5 WELDED BARS TO UNDERSIDE OF EMBED PL