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INC
MATERIAL HANDLING ENGINEERING
EST. 1985

SPECIAL PRODUCTS	*CONVEYORS*	*STORAGE RACKS*	*OTHER SERVICES*	*SHELVING*	*SPECIAL PRODUCTS*
TANK SUPPORTS	TALL SUPPORTS	SELECTIVE	SEISMIC ANALYSIS	METAL	SHUTTLES
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SHEDS	PICK MODULES	FLOW RACK	STATE APPROVALS	GONDOLAS	FENCING SYSTEMS
WORK PLATFORMS	ROOF VERIFICATION	CANTILEVER	PRODUCT TESTING	LOCKERS	MODULAR OFFICES
FOOTINGS			TITLE 24	CATWALKS	MINI-LOAD SYSTEMS

PRCTI20250149

LICENSED IN 50 STATES

Calculations required to be provided by the Permittee on site for all Inspections

City of Puyallup
Building
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City of Puyallup
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Building | Planning
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ANALYSIS OF
STORAGE RACKS
FOR
Coastal Pacific Food
322 Valley Avenue NW, Puyallup, WA
Job No. 25-0106

Approved by:

SAL E. FATEEN, P.E.
3/5/2025

SAL E. FATEEN
STATE OF WASHINGTON
#29553
REGISTERED
PROFESSIONAL ENGINEER

Digitally signed by Sal Fateen
Date: 2025.03.06 09:20:43-08'00'

EXPIRES
04-12-2026

1130 E. Cypress St * Covina, CA 91724 * (909) 869-0989

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Scope:

This storage system analysis is intended to determine its compliance with appropriate building codes with respect to static and seismic forces.

The storage racks are prefabricated and are to be field assembled only, with no field welding.

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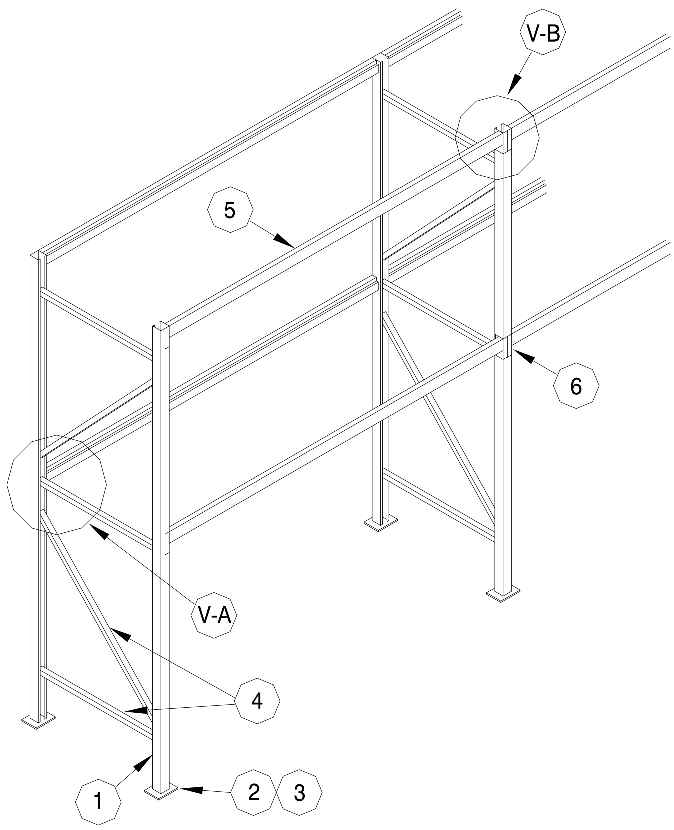
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 2
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_071

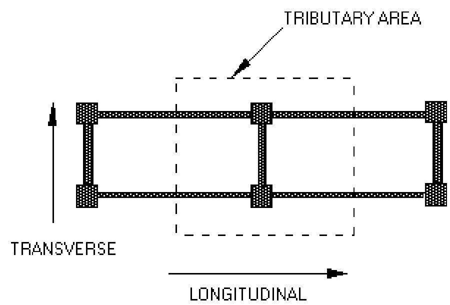
The storage racks consist of several bays, interconnected in one or both directions,with the columns of the vertical frames being common between adjacent bays. This analysis will focus on a tributary bay to be analyzed in both the longitudinal and transverse direction. Stability in the longitudinal direction is maintained by the beam to column moment resisting connections, while bracing acts in the transverse direction.



CONCEPTUAL DRAWING

Some components may not be used or may vary

Legend
1. Column
2. Base Plate
3. Anchors
4. Bracing
5. Beam
6. Connector



NOTE: ACTUAL CONFIGURATION SHOWN ON COMPONENTS & SPECIFICATIONS SHEET

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FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 3
CALCULATED BY: ang
DATE: 3/5/2025

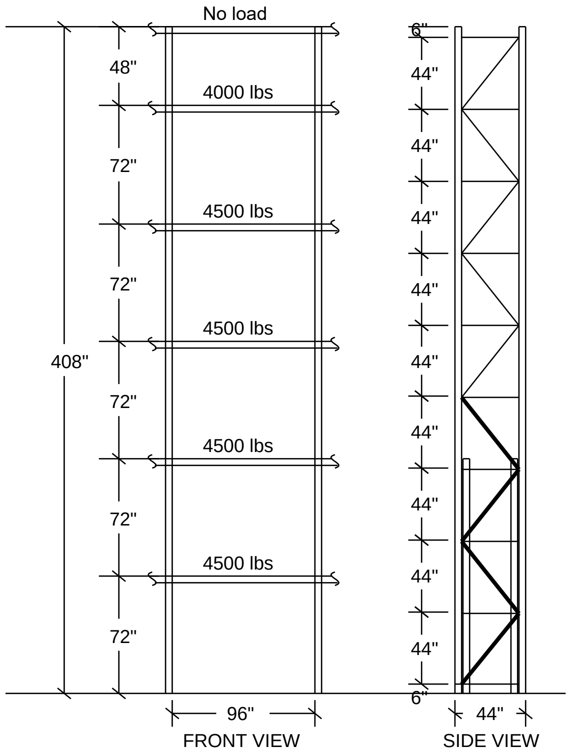
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS Configuration 1: Type A-S H 1.7

Analysis per section 2209 of the 2021 IBC

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 937 lbs. P_{static} = 11300 lbs.

Levels: 6 Panels: 9 S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 3259 lbs. $P_{seismic}$ = 14721 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 4 X 4.5 Steel = 50000 psi Stress = 48% (level 3) **BACKER TO LEVEL 2** C 4 X 4.5 Steel = 50000 psi Stress = 41% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 46% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 93% (panel 5) **1ST-4TH DIAGONAL** L 2 x 2 - .125 Stress = 46%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 88% Max stress = 88% (level 1)	2 Bolt @ 4" cc Connector Stress = 82% Max stress = 82% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 18%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 28% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 96%

Notes:
Analyzed as single row. 2 x 2 x 0.125" angle brace at diagonals 1-4.

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FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 4
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS

Configuration 2: Type A-T Tunnel
Adjacent to: Type A-S

H 1.7

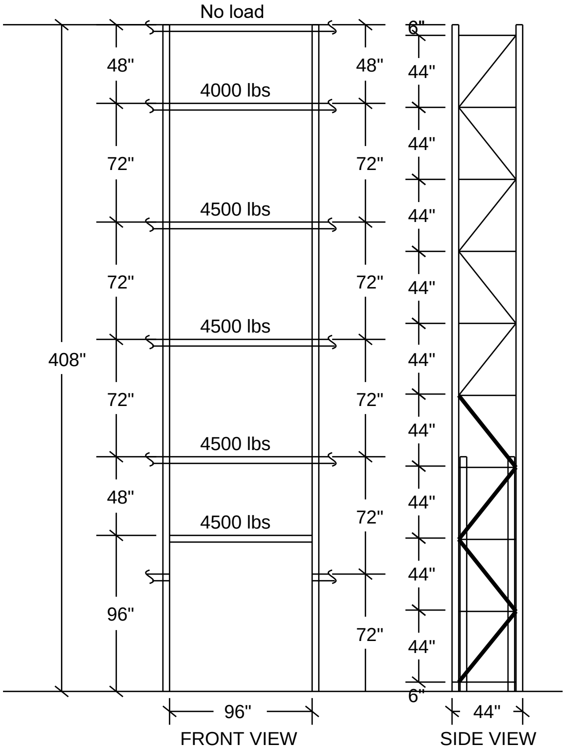
Analysis per section 2209 of the 2021 IBC

Levels: 6 Panels: 9

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 937 lbs.
V_{Trans} = 3259 lbs.

P_{static} = 11300 lbs.
$P_{seismic}$ = 14671 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 4 X 4.5 Steel = 50000 psi Stress = 48% (level 3) **BACKER TO LEVEL 3** C 4 X 4.5 Steel = 50000 psi Stress = 41% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 46% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 93% (panel 5) **1ST-4TH DIAGONAL** L 2 x 2 - .125 Stress = 46%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 88% Max stress = 88% (level 1)	2 Bolt @ 4" cc Connector Stress = 37% Max stress = 43% (level 2)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 18%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 28% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 95%

Notes:
Analyzed as single row interior tunnel bay. Adjacent to Type A-S. 2 x 2 x 0.125" angle brace at diagonals 1-4.

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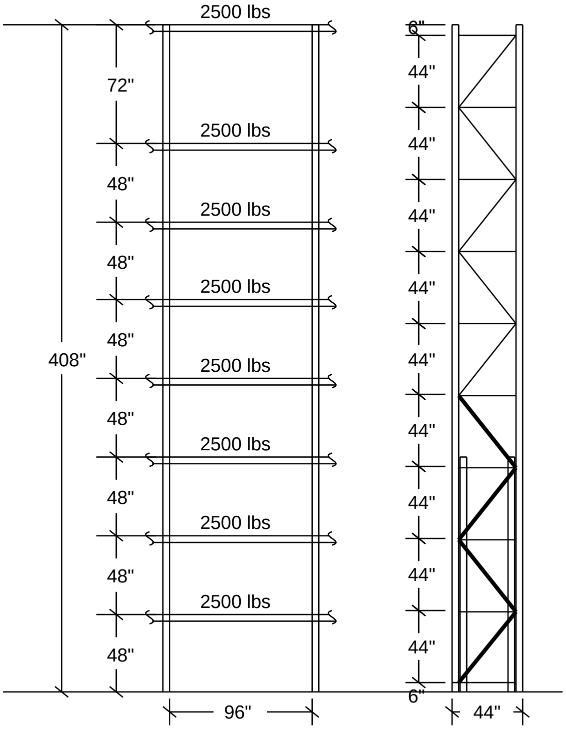
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 5
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS   Configuration 3: Type B-S   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 8 Panels: 9 Load per Level

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 853 lbs. P_{static} = 10280 lbs.
S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 2966 lbs. $P_{seismic}$ = 14043 lbs.



FRONT VIEW   SIDE VIEW

FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 78% (level 4) **BACKER TO LEVEL 3** C 3 X 3.5 Steel = 50000 psi Stress = 45% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 43% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 83% (panel 5) **1ST-4TH DIAGONAL** L 2 x 2 - .125 Stress = 43%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 50% Max stress = 50% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 23%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 27% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 97%

Notes:
Analyzed as single row.   2 x 2 x 0.125" angle brace at diagonals 1-4.

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FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 6
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS

Analysis per section 2209 of the 2021 IBC

Levels: 7 Panels: 9 Load per Level

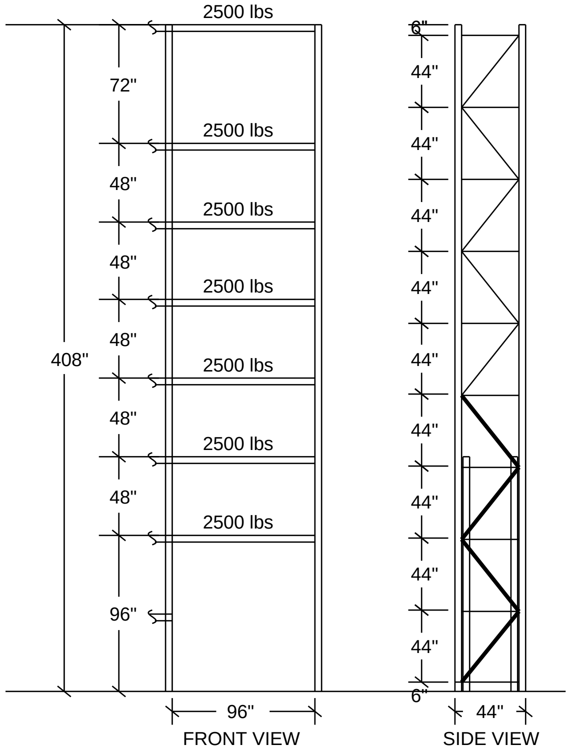
Configuration 4: Type B-T Tunnel
End-of-Row Tunnel Bay

H 1.7

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 372 lbs.
V_{Trans} = 1296 lbs.

P_{static} = 4494 lbs.
$P_{seismic}$ = 6335 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 36% (level 3) **BACKER TO LEVEL 2** C 3 X 3.5 Steel = 50000 psi Stress = 49% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 19% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 42% (panel 5) **1ST-4TH DIAGONAL** L 2 x 2 - .125 Stress = 19%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 39% Max stress = 39% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 10%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 12% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 45%

Notes:
Analyzed as single row end-of-row tunnel bay. Adjacent to Type B-S. 2 x 2 x 0.125" angle brace at diagonals 1-4.

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ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 7
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

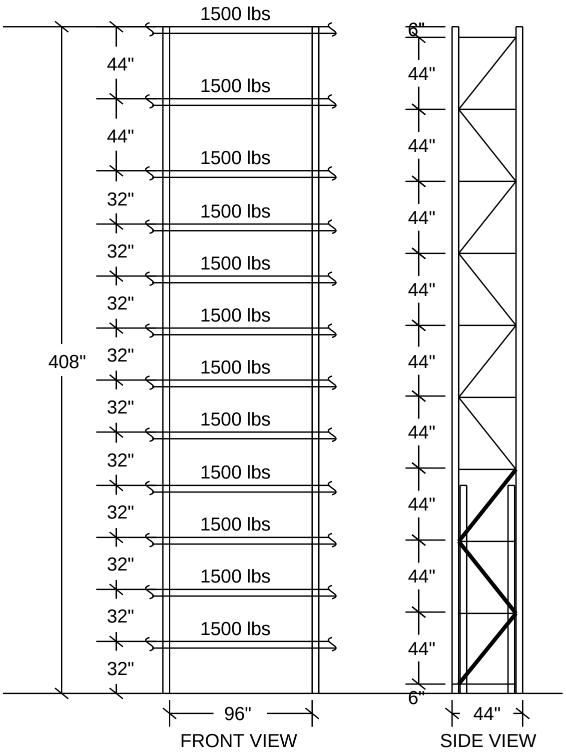
COMPONENTS AND SPECIFICATIONS Configuration 5: Type C-S

H 1.7

Analysis per section 2209 of the 2021 IBC

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 810 lbs. P_{static} = 9600 lbs.

Levels: 12 Panels: 9 S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 2817 lbs. $P_{seismic}$ = 12997 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 4.1 Steel = 50000 psi Stress = 70% (level 5) **BACKER TO LEVEL 4** C 3 X 4.1 Steel = 50000 psi Stress = 31% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 40% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 93% (panel 4) **1ST-3RD DIAGONAL** L 2 x 2 - .125 Stress = 40%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 31% Max stress = 31% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 22%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 25% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 90%

Notes:
Analyzed as single row. 2 x 2 x 0.125" angle brace at diagonals 1-3.

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FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 8
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS

Analysis per section 2209 of the 2021 IBC

Levels: 10 Panels: 9

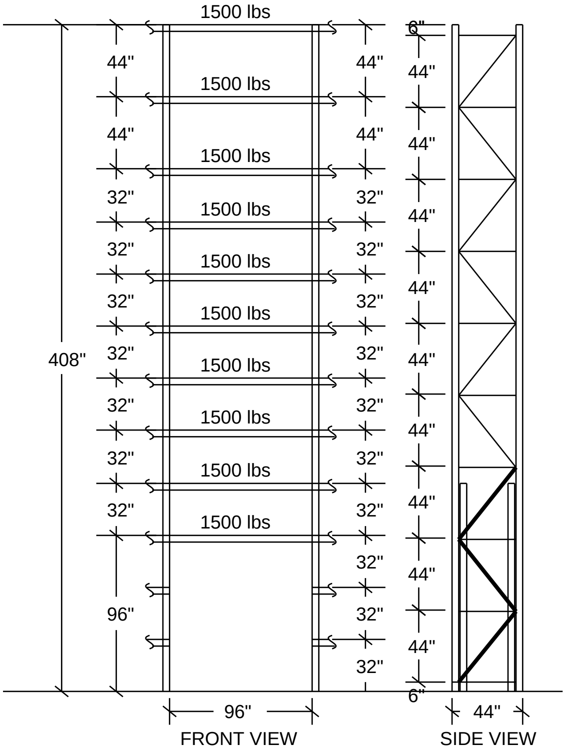
Configuration 6: Type C-T Tunnel
Adjacent to: Type C-S

H 1.7

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 742 lbs.
V_{Trans} = 2582 lbs.

P_{static} = 8800 lbs.
$P_{seismic}$ = 12238 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 4.1 Steel = 50000 psi Stress = 68% (level 3) **BACKER TO LEVEL 4** C 3 X 4.1 Steel = 50000 psi Stress = 28% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 38% (panel 3) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 93% (panel 4) **1ST-3RD DIAGONAL** L 2 x 2 - .125 Stress = 38%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 21% Max stress = 21% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 20%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 23% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 85%

Notes:
Analyzed as single row interior tunnel bay. Adjacent to Type C-S. 2 x 2 x 0.125" angle brace at diagonals 1-3.

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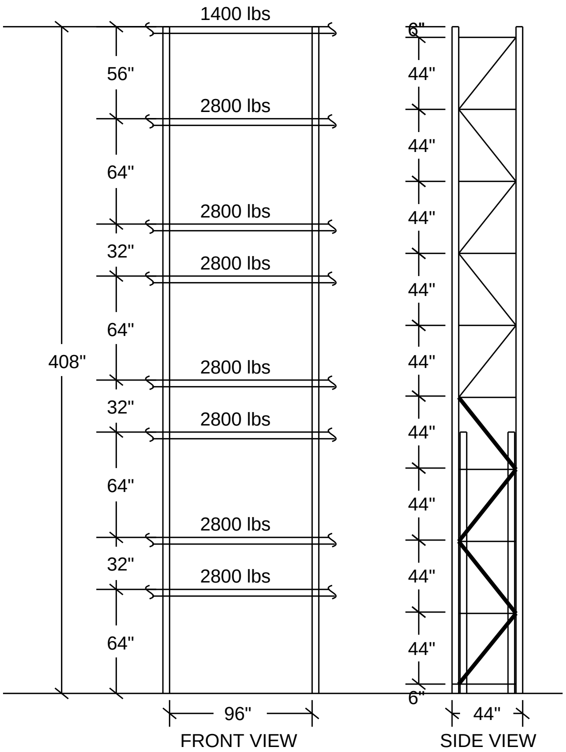
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 9
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS Configuration 7: Type E-S H 1.7

Analysis per section 2209 of the 2021 IBC

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 908 lbs. P_{static} = 10900 lbs.

Levels: 8 Panels: 9 Load per Level S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 3159 lbs. $P_{seismic}$ = 14420 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 4.1 Steel = 50000 psi Stress = 65% (level 4) **BACKER TO LEVEL 3** C 3 X 4.1 Steel = 50000 psi Stress = 56% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 45% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 83% (panel 5) **1ST-4TH DIAGONAL** L 2 x 2 - .125 Stress = 45%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 55% Max stress = 55% (level 1)	2 Bolt @ 4" cc Connector Stress = 58% Max stress = 58% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 24%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 28% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 97%

Notes:
Analyzed as single row. 2 x 2 x 0.125" angle brace at diagonals 1-4.

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FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 10
CALCULATED BY: ang
DATE: 3/5/2025

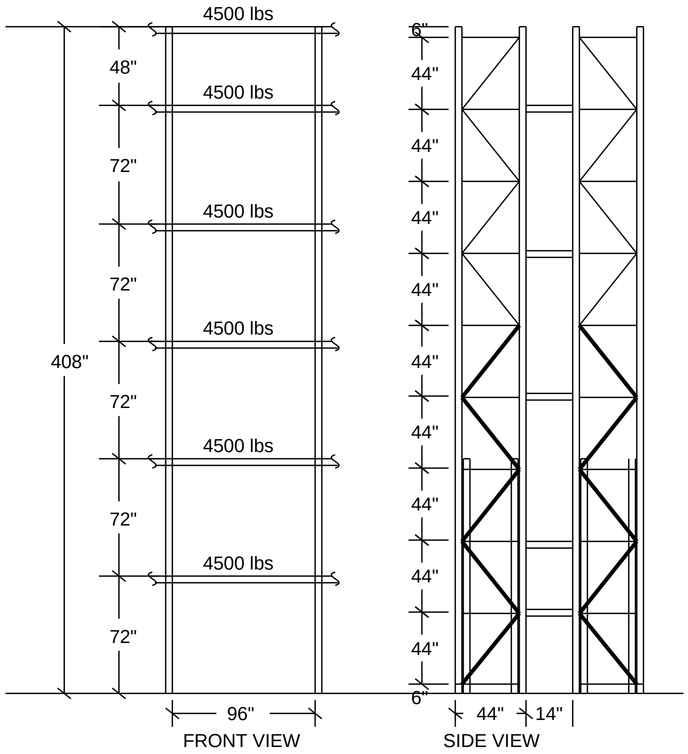
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS Configuration 8: Type A-D H 1.7

Analysis per section 2209 of the 2021 IBC

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 1142 lbs. P_{static} = 13800 lbs.

Levels: 6 Panels: 9 Load per Level S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 3971 lbs.



FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 4 X 4.5 Steel = 50000 psi Stress = 74% (level 3) **BACKER TO LEVEL 2** C 4 X 4.5 Steel = 50000 psi Stress = 53% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 56% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 80% (panel 6) **1ST-5TH DIAGONAL** L 2 x 2 - .125 Stress = 56%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 88% Max stress = 88% (level 1)	2 Bolt @ 4" cc Connector Stress = 98% Max stress = 98% (level 1)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 24%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 38% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 81%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c. 2 x 2 x 0.125" angle brace at diagonals 1-5.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 11
CALCULATED BY: ang
DATE: 3/5/2025

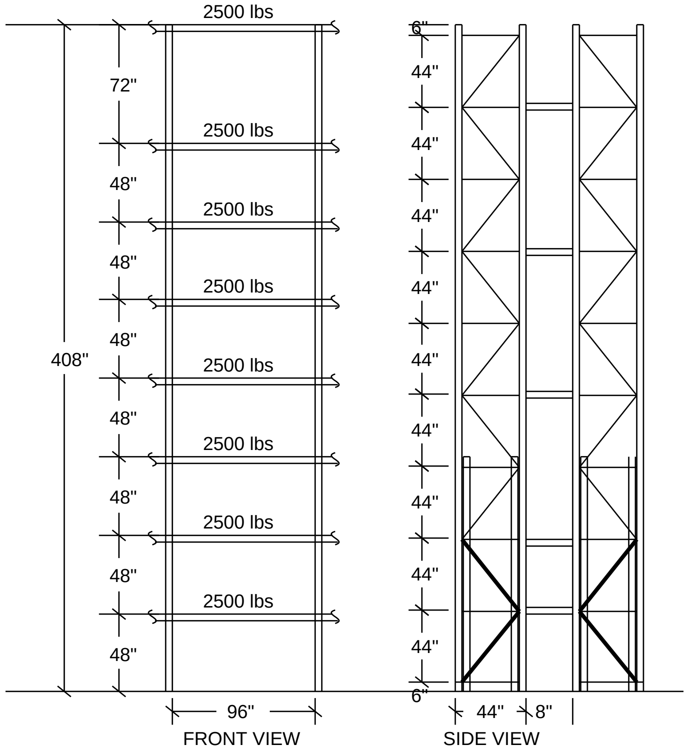
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS   Configuration 9: Type B-D   H 1.7

Analysis per section 2209 of the 2021 IBC

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 867 lbs. P_{static} = 10400 lbs.

Levels: 8   Panels: 9 S_1 = 0.44 F_v = 1.86   SDC = D V_{Trans} = 3017 lbs.



FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 79% (level 4) **BACKER TO LEVEL 3** C 3 X 3.5 Steel = 50000 psi Stress = 46% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 43% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 90% (panel 3) **1ST-2ND DIAGONAL** L 2 x 2 - .125 Stress = 43%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 50% Max stress = 50% (level 1)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 24%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 27% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 8%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c.   2 x 2 x 0.125" angle brace at diagonals 1-2.

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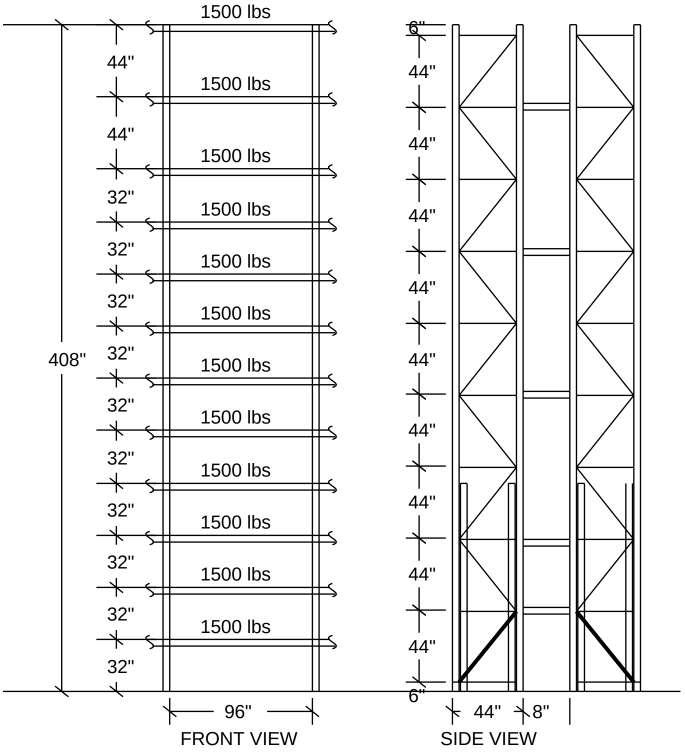
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 12
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS Configuration 10: Type C-D H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 12 Panels: 9 Load per Level

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 810 lbs. P_{static} = 9600 lbs.
S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 2817 lbs.



FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 79% (level 5) **BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress = 35% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 40% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 96% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 40%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 31% Max stress = 31% (level 1)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 22%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 25% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 90%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c. 2 x 2 x 0.125" angle brace at 1st diagonal.

SEIZMIC INC
MATERIAL HANDLING ENGINEERING
EST. 1985

TEL:(909)869-0989
1130 E. CYPRESS ST, COVINA, CA 91724

PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 13
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_071

COMPONENTS AND SPECIFICATIONS Configuration 11: Type D-D H 1.7

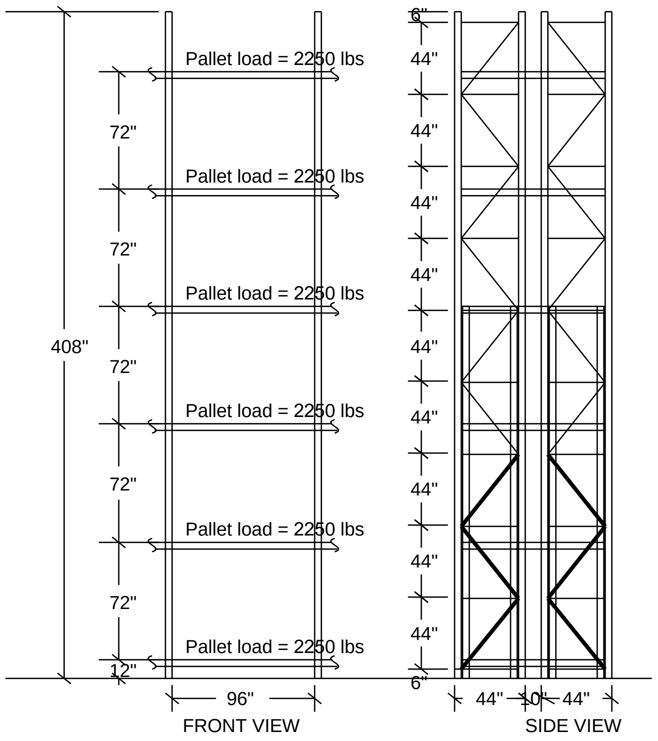
Analysis per section 2209 of the 2021 IBC

Levels: 6 Panels: 9

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 2284 lbs.
V_{Trans} = 7943 lbs.

P_{static} = 15177 lbs.



EXTERIOR FRAME	OK	EXT. BEAM OK	EXT. CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 65% (level 5) **BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress = 67% (level 2)	**HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 57% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 90% (panel 4) **1ST-3RD DIAGONAL** L 2 x 2 - .125 Stress = 60%	C 3 x 3.5 Steel = 50000 psi Stress = 70% (level 1)	2 Bolt @ 4" cc Connector Stress = 55% (level 2)

INTERIOR FRAME	OK	INTERIOR BEAM OK	INT. CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 70% (level 5)	**BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress: 67% (level 2)	C 4 x 4.5 Steel = 50000 psi Stress = 46% (level 1)	2 Bolt @ 4" cc Connector Stress = 58% (level 2)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi **EXTERIOR** 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 27% **INTERIOR** 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 27%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 31% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 34%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c. 2 x 2 x 0.125" angle brace at diagonals 1-3.

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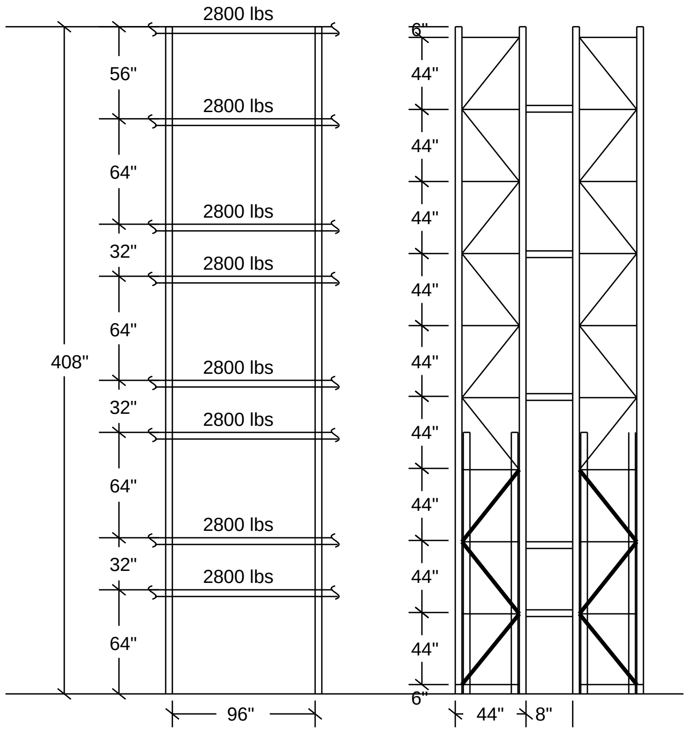
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 14
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

COMPONENTS AND SPECIFICATIONS   Configuration 12: Type E-D   H   1.7

Analysis per section 2209 of the 2021 IBC

Levels: 8   Panels: 9   Load per Level

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 966 lbs. P_{static} = 11600 lbs.
S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 3359 lbs.



FRONT VIEW   SIDE VIEW

FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 84% (level 4) **BACKER TO LEVEL 3** C 3 X 3.5 Steel = 50000 psi Stress = 70% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 48% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 94% (panel 4) **1ST-3RD DIAGONAL** L 2 x 2 - .125 Stress = 48%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 55% Max stress = 55% (level 1)	2 Bolt @ 4" cc Connector Stress = 62% Max stress = 62% (level 1)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 27%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 31% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 20%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c.   2 x 2 x 0.125" angle brace at diagonals 1-3.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 15
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_072

COMPONENTS AND SPECIFICATIONS   Configuration 13: Type F-D   H 1.7

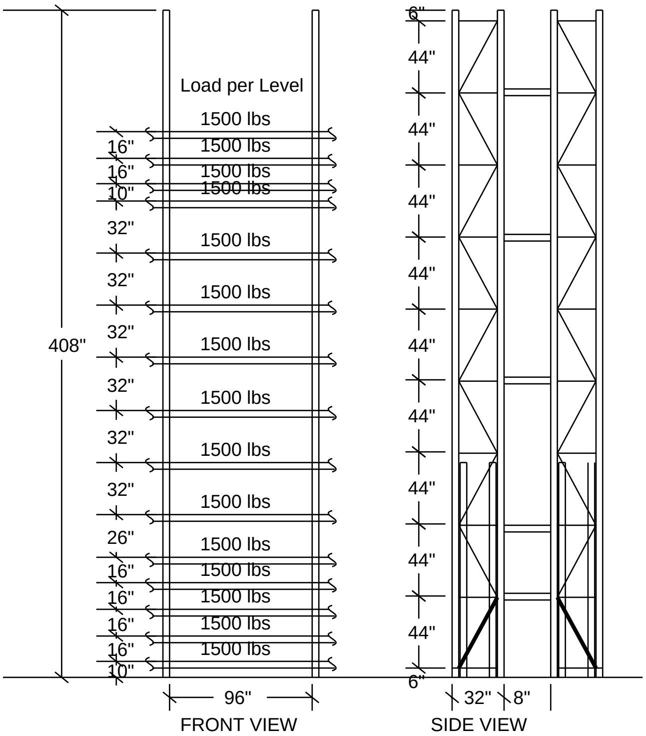
Analysis per section 2209 of the 2021 IBC

Levels: 15   Panels: 9

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 1012 lbs.
V_{Trans} = 3522 lbs.

P_{static} = 12000 lbs.



FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 95% (level 8) **BACKER TO LEVEL 7** C 3 X 3.5 Steel = 50000 psi Stress = 50% (level 7) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 42% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 95% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 42%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 16% Max stress = 20% (level 6)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 31%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 35% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 50%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c.   2 x 2 x 0.125" angle brace at 1st diagonal.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 16
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_072

COMPONENTS AND SPECIFICATIONS Configuration 14: Type G-S H 1.7

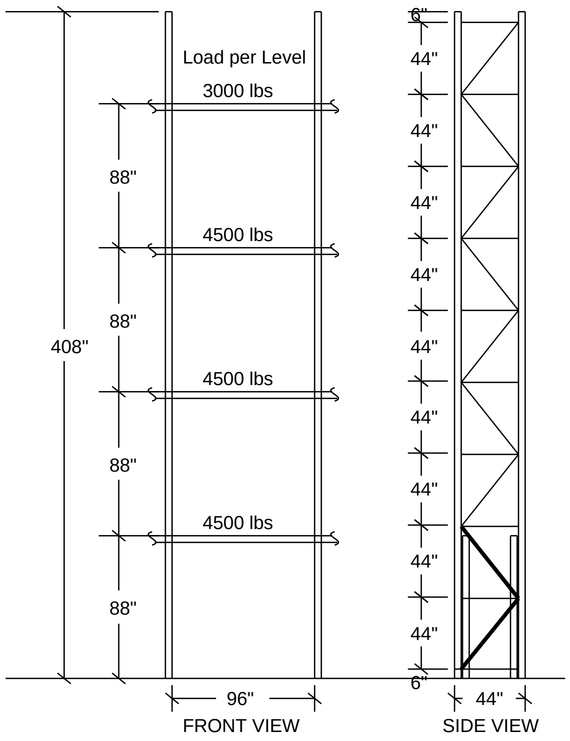
Analysis per section 2209 of the 2021 IBC

Levels: 4 Panels: 9

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 700 lbs.
V_{Trans} = 2434 lbs.

P_{static} = 8450 lbs.
$P_{seismic}$ = 11003 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 78% (level 2) **BACKER TO LEVEL 1** C 3 X 3.5 Steel = 50000 psi Stress = 74% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 39% (panel 2) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 94% (panel 3) **1ST-2ND DIAGONAL** L 2 x 2 - .125 Stress = 39%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 88% Max stress = 88% (level 1)	2 Bolt @ 4" cc Connector Stress = 75% Max stress = 75% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 18%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 20% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 66%

Notes:
Analyzed as single row. 2 x 2 x 0.125" angle brace at diagonals 1-2.

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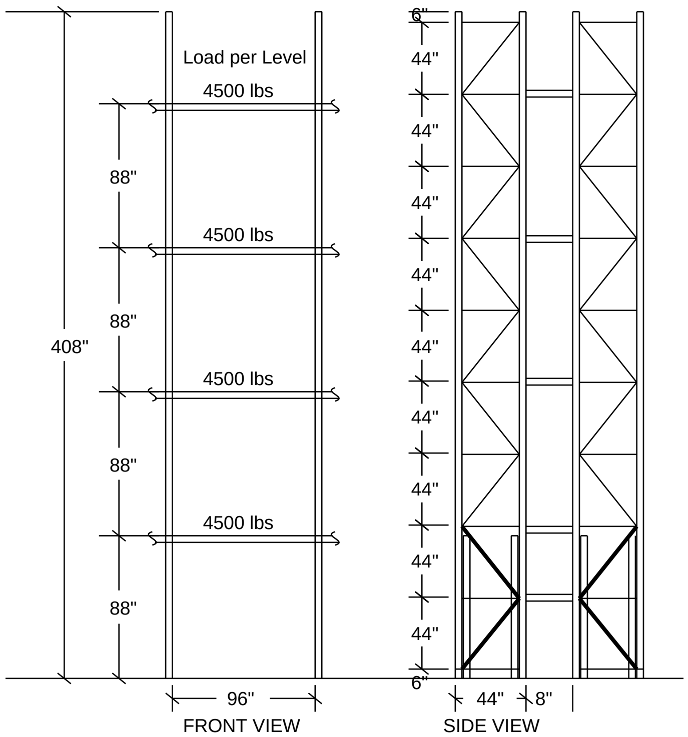
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 17
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_072

COMPONENTS AND SPECIFICATIONS   Configuration 15: Type G-D   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 4   Panels: 9

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 761 lbs. P_{static} = 9200 lbs.
S_1 = 0.44 F_v = 1.86   SDC = D V_{Trans} = 2647 lbs.



FRAME OK	**BEAM** OK	**CONNECTOR** OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 90% (level 2) **BACKER TO LEVEL 1** C 3 X 3.5 Steel = 50000 psi Stress = 81% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 43% (panel 2) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 81% (panel 3) **1ST-2ND DIAGONAL** L 2 x 2 - .125 Stress = 43%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 88% Max stress = 88% (level 1)	2 Bolt @ 4" cc Connector Stress = 80% Max stress = 80% (level 1)

Base Plate OK	**Slab & Soil** OK	**Anchors** OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 20%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 23% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 79%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c.   2 x 2 x 0.125" angle brace at diagonals 1-2.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 18
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_072

COMPONENTS AND SPECIFICATIONS Configuration 16: Type H-S H 1.7

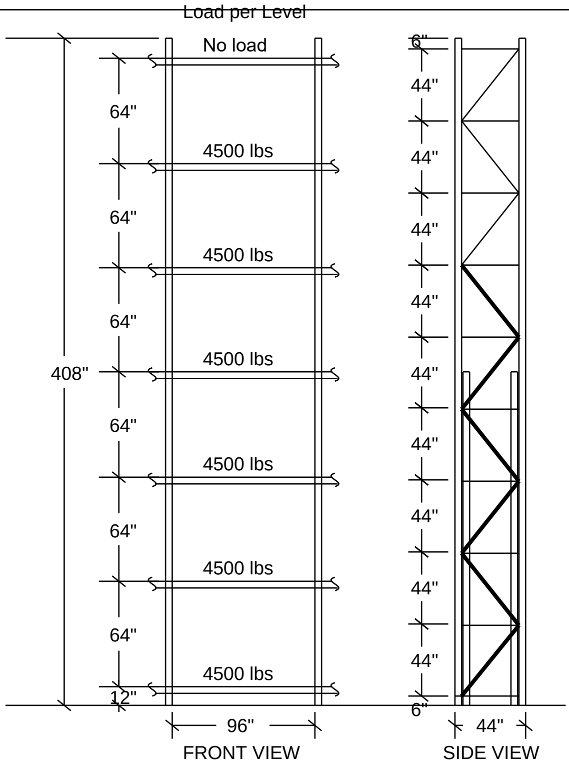
Analysis per section 2209 of the 2021 IBC

Levels: 7 Panels: 9

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 1148 lbs.
V_{Trans} = 3992 lbs.

P_{static} = 13850 lbs.
$P_{seismic}$ = 16405 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 48% (level 5) **BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress = 61% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 57% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 79% (panel 1) **1ST-6TH DIAGONAL** L 2 x 2 - .125 Stress = 57%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 88% Max stress = 88% (level 1)	2 Bolt @ 4" cc Connector Stress = 45% Max stress = 54% (level 2)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 28%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 32% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 97%

Notes:
Analyzed as single row. 2 x 2 x 0.125" angle brace at diagonals 1-6.

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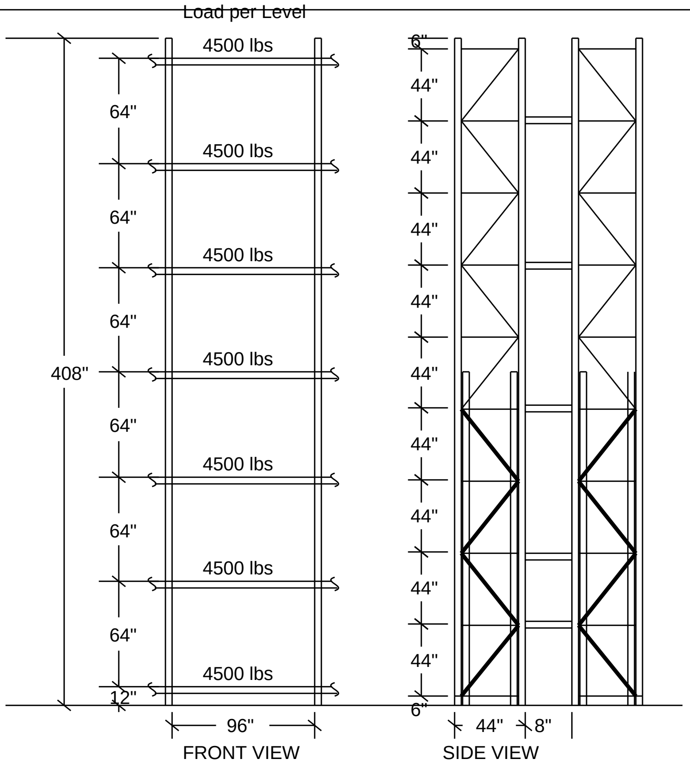
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 19
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_072

COMPONENTS AND SPECIFICATIONS   Configuration 17: Type H-D   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 7   Panels: 9

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 1332 lbs. P_{static} = 16100 lbs.
S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 4633 lbs.



FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 81% (level 5) **BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress = 79% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 66% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 95% (panel 5) **1ST-4TH DIAGONAL** L 2 x 2 - .125 Stress = 66%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 88% Max stress = 88% (level 1)	2 Bolt @ 4" cc Connector Stress = 50% Max stress = 63% (level 2)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 36%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 42% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 51%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c.   2 x 2 x 0.125" angle brace at diagonals 1-4.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 20
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_072

COMPONENTS AND SPECIFICATIONS   Configuration 18: Type I-D   H 1.7

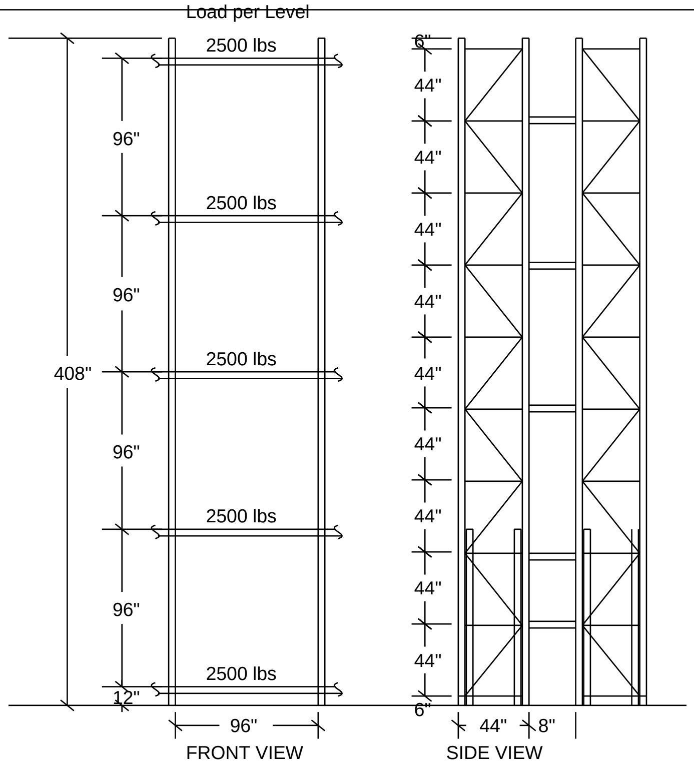
Analysis per section 2209 of the 2021 IBC

Levels: 5   Panels: 9

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 542 lbs.
V_{Trans} = 1885 lbs.

P_{static} = 6500 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 70% (level 3) **BACKER TO LEVEL 2** C 3 X 3.5 Steel = 50000 psi Stress = 56% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 27% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 62% (panel 1)	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 27% Max stress = 33% (level 2)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 15%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 17% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 63%

Notes:
This calculation summary applies only to back-to-back rows.
Standard row spacers are required in this profile.

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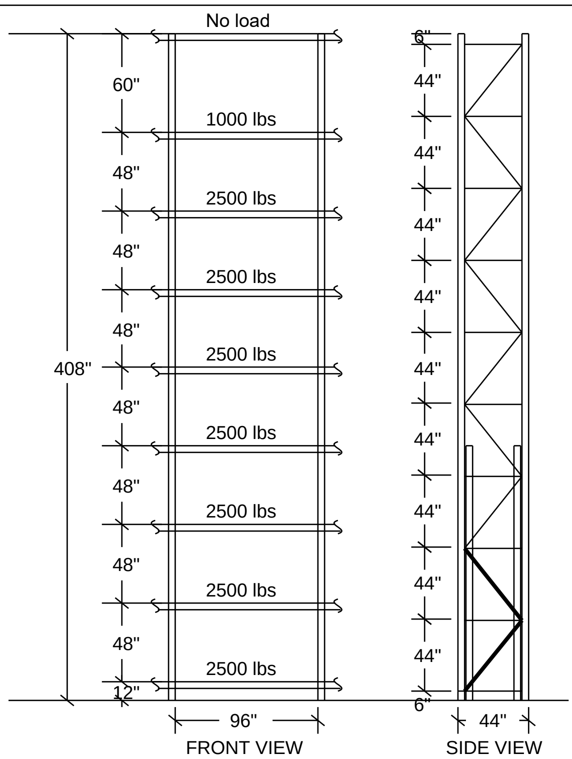
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 21
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_072

COMPONENTS AND SPECIFICATIONS   Configuration 19: Type J-S   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 9   Panels: 9

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 812 lbs. P_{static} = 9700 lbs.
S_1 = 0.44 F_v = 1.86   SDC = D V_{Trans} = 2825 lbs. $P_{seismic}$ = 11063 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 49% (level 5) **BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress = 35% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 41% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 94% (panel 3) **1ST-2ND DIAGONAL** L 2 x 2 - .125 Stress = 41%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 26% Max stress = 31% (level 2)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 19%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 22% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 65%

Notes:
Analyzed as single row.   2 x 2 x 0.125" angle brace at diagonals 1-2.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 22
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_072

COMPONENTS AND SPECIFICATIONS

Analysis per section 2209 of the 2021 IBC

Levels: 7 Panels: 9

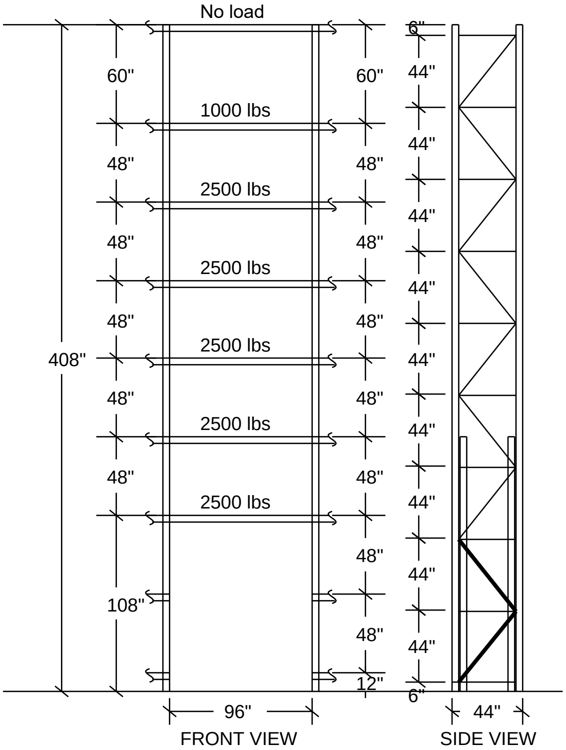
Configuration 20: Type J-T
Tunnel Adjacent to: Type J-S

H 1.7

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 704 lbs.
V_{Trans} = 2448 lbs.

P_{static} = 8400 lbs.
$P_{seismic}$ = 9906 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 46% (level 3) **BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress = 31% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 35% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 94% (panel 3) **1ST-2ND DIAGONAL** L 2 x 2 - .125 Stress = 35%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 27% Max stress = 27% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 17%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 20% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 60%

Notes:
Analyzed as single row interior tunnel bay. Adjacent to Type J-S. 2 x 2 x 0.125" angle brace at diagonals 1-2.

SEIZMIC INC
MATERIAL HANDLING ENGINEERING
EST. 1985

TEL:(909)869-0989
1130 E. CYPRESS ST, COVINA, CA 91724

PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 23
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_072

COMPONENTS AND SPECIFICATIONS Configuration 21: Type J-D

H 1.7

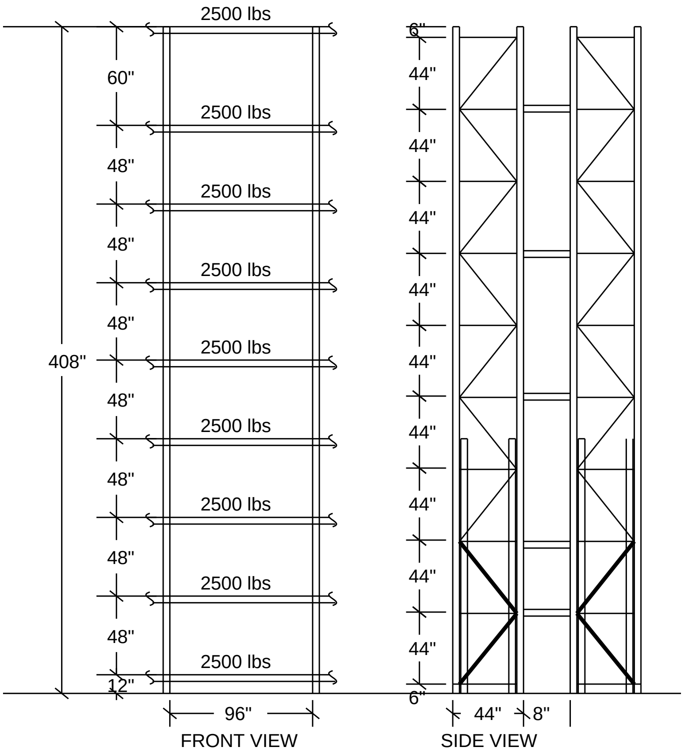
Analysis per section 2209 of the 2021 IBC

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 976 lbs.
V_{Trans} = 3394 lbs.

P_{static} = 11700 lbs.

Levels: 9 Panels: 9



FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 82% (level 5) **BACKER TO LEVEL 4** C 3 X 3.5 Steel = 50000 psi Stress = 48% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 49% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 95% (panel 3) **1ST-2ND DIAGONAL** L 2 x 2 - .125 Stress = 49%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 30% Max stress = 36% (level 2)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 26%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 30% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 18%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c. 2 x 2 x 0.125" angle brace at diagonals 1-2.

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1130 E. CYPRESS ST, COVINA, CA 91724

PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 24
CALCULATED BY: ang
DATE: 3/5/2025

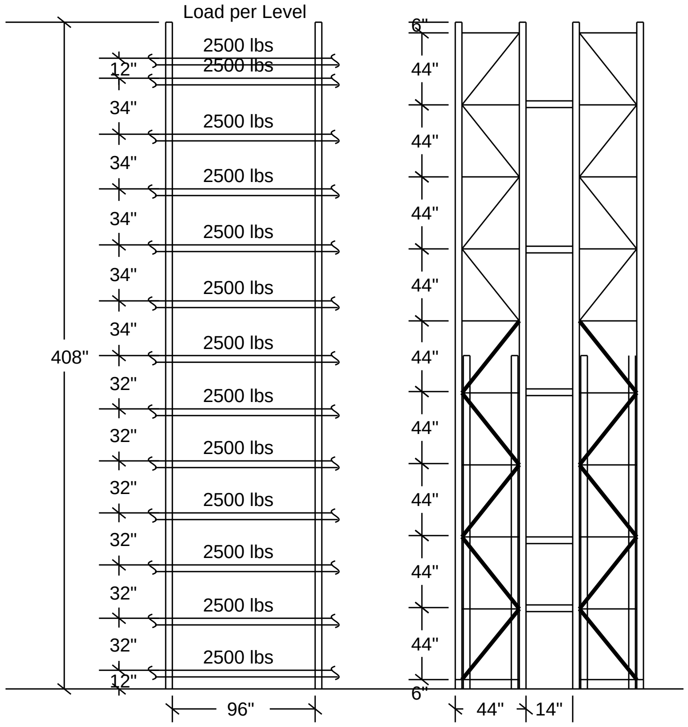
PN: 20240709_072

COMPONENTS AND SPECIFICATIONS   Configuration 22: Type K-D   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 13   Panels: 9

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 1410 lbs. P_{static} = 16900 lbs.
S_1 = 0.44 F_v = 1.86   SDC = D V_{Trans} = 4903 lbs.



FRONT VIEW   SIDE VIEW

FRAME OK	**BEAM** OK	**CONNECTOR** OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 86% (level 8) **BACKER TO LEVEL 7** C 3 X 3.5 Steel = 50000 psi Stress = 61% (level 3) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 70% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 81% (panel 1) **1ST-5TH DIAGONAL** L 2 x 2 - .125 Stress = 70%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 33% Max stress = 37% (level 2)

Base Plate OK	**Slab & Soil** OK	**Anchors** OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 38%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 44% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 91%

Notes:
This calculation summary applies only to back-to-back rows with frame ties.
Use (5) frame ties per upright. Minimum structural frame tie Sx is 1.0 cu. in. C3 x 3.5.
Attach to face of column with 3/8" thk. plate and (4) 1/2" A449 bolts at 4" o.c.   2 x 2 x 0.125" angle brace at diagonals 1-5.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 25
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS Configuration 23: Type N-S H 1.7

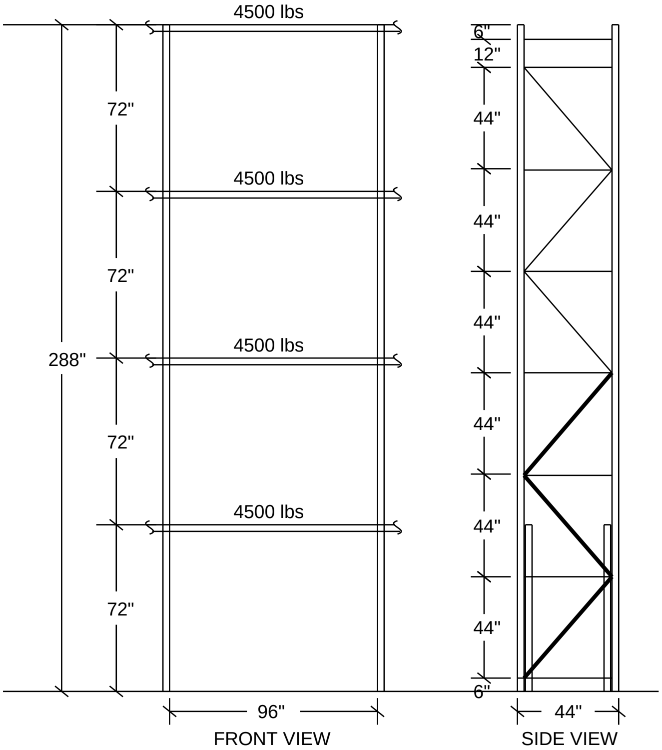
Analysis per section 2209 of the 2021 IBC

Levels: 4 Panels: 7 Load per Level

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 761 lbs.
V_{Trans} = 2647 lbs.

P_{static} = 9200 lbs.
$P_{seismic}$ = 10197 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 76% (level 2) **BACKER TO LEVEL 1** C 3 X 3.5 Steel = 50000 psi Stress = 63% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 43% (panel 2) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 75% (panel 4) **1ST-3RD DIAGONAL** L 2 x 2 - .125 Stress = 43%	C 4 x 4.5 Steel = 50 ksi Max Static Cap. = 7278 lb. Stress = 63% Max stress = 63% (level 1)	2 Bolt @ 4" cc Connector Stress = 61% Max stress = 61% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 18%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 20% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 54%

Notes:
Analyzed as single row. 2 x 2 x 0.125" angle brace at diagonals 1-3.

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1130 E. CYPRESS ST, COVINA, CA 91724

PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 26
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS   Configuration 24: Type N-D   H 1.7

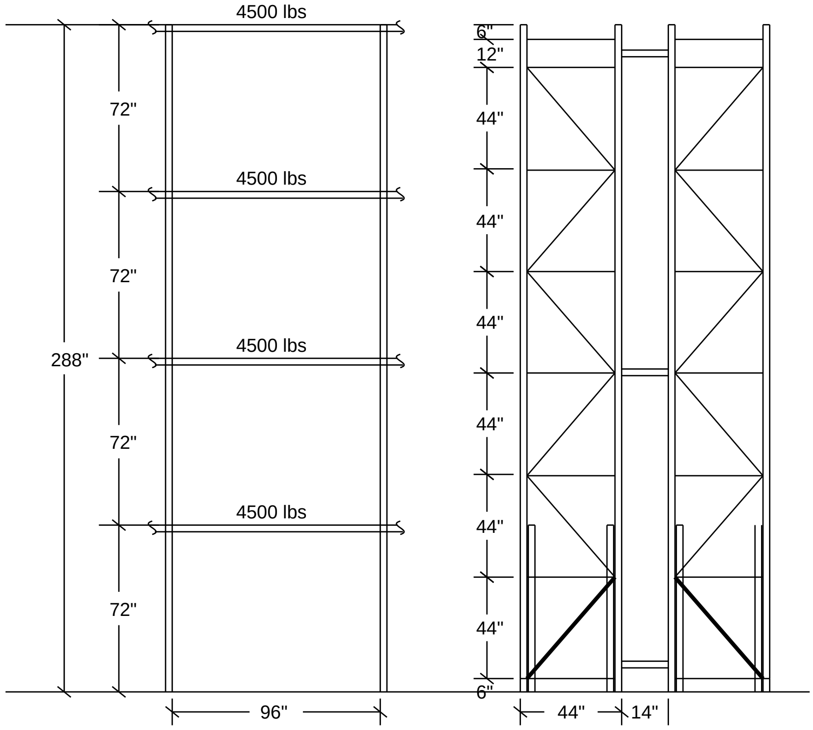
Analysis per section 2209 of the 2021 IBC

Levels: 4   Panels: 7   Load per Level

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86   SDC = D

V_{Long} = 761 lbs.
V_{Trans} = 2647 lbs.

P_{static} = 9200 lbs.



FRONT VIEW   SIDE VIEW

FRAME OK	**BEAM** OK	**CONNECTOR** OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 76% (level 2) **BACKER TO LEVEL 1** C 3 X 3.5 Steel = 50000 psi Stress = 63% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 43% (panel 2) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 95% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 43%	C 4 x 4.5 Steel = 50 ksi Max Static Cap. = 7278 lb. Stress(st) = 63% Max stress = 63% (level 1)	2 Bolt @ 4" cc Connector Stress = 61% Max stress = 61% (level 1)

Base Plate OK	**Slab & Soil** OK	**Anchors** OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 18%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 20% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 54%

Notes:
This calculation summary applies only to back-to-back rows.
Standard row spacers are required in this profile.
2 x 2 x 0.125" angle brace at 1st diagonal.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 27
CALCULATED BY: ang
DATE: 3/5/2025

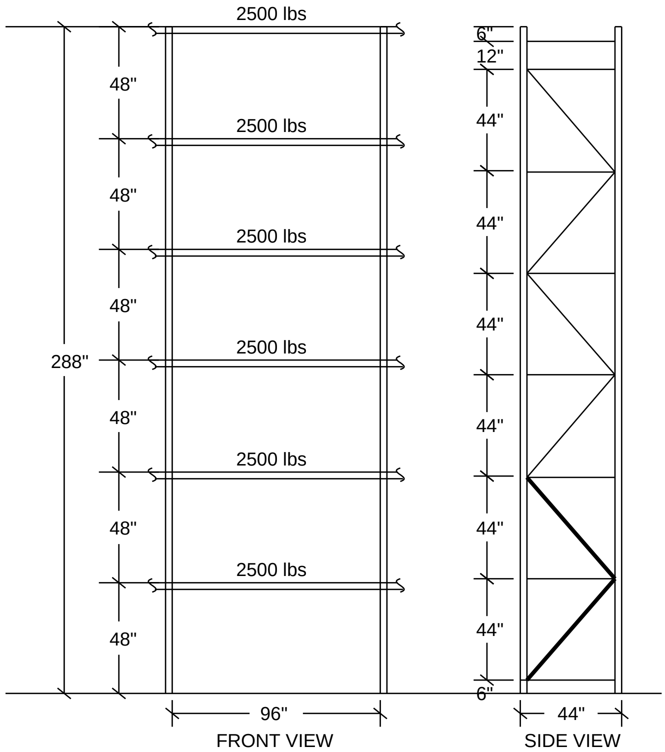
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS   Configuration 25: Type O-S   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 6   Panels: 7   Load per Level

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 650 lbs. P_{static} = 7800 lbs.
S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 2263 lbs. $P_{seismic}$ = 8108 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 91% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 37% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 81% (panel 3) **1ST-2ND DIAGONAL** L 2 x 2 - .125 Stress = 37%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 40% Max stress = 40% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 15%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 17% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 43%

Notes:
Analyzed as single row.   2 x 2 x 0.125" angle brace at diagonals 1-2.

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PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 28
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_073

COMPONENTS AND SPECIFICATIONS Configuration 26: Type O-D H 1.7

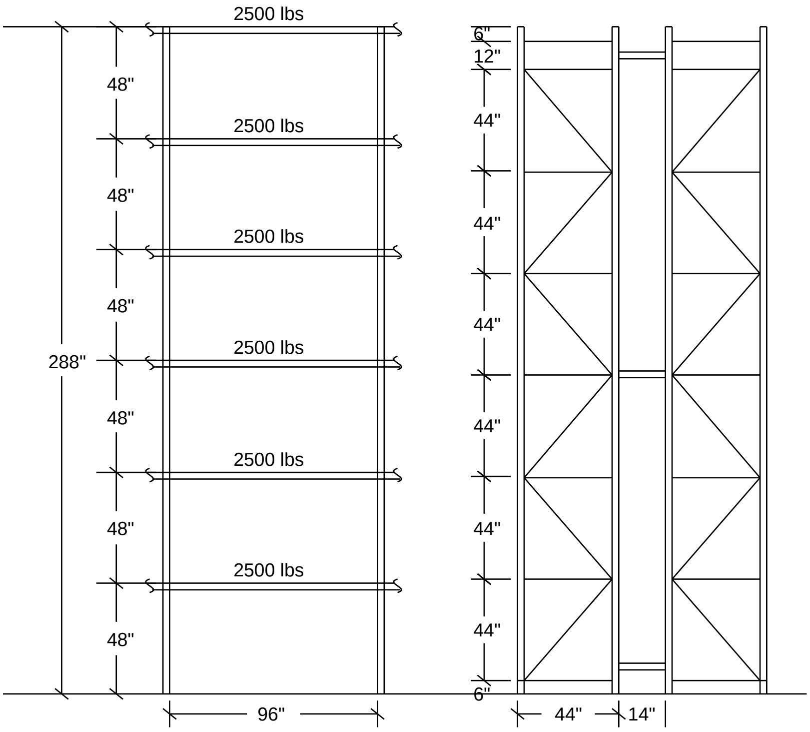
Analysis per section 2209 of the 2021 IBC

Levels: 6 Panels: 7 Load per Level

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 650 lbs.
V_{Trans} = 2263 lbs.

P_{static} = 7800 lbs.



FRONT VIEW SIDE VIEW

FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 91% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 37% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 92% (panel 1)	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 49% Max stress = 49% (level 1)	2 Bolt @ 4" cc Connector Stress = 40% Max stress = 40% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 15%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 17% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 43%

Notes:
This calculation summary applies only to back-to-back rows.
Standard row spacers are required in this profile.

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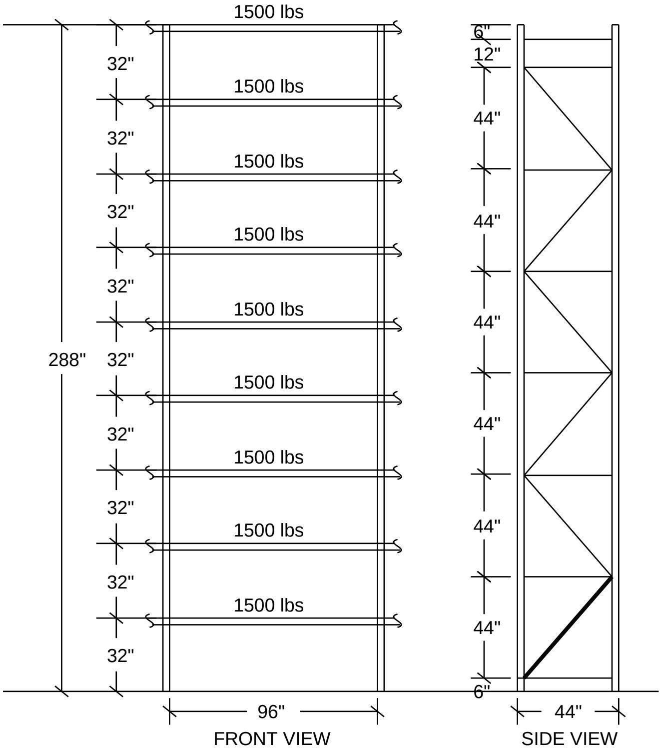
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 29
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS   Configuration 27: Type P-S   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 9   Panels: 7   Load per Level

$S_s = 1.28$ $F_a = 1.0$ $I = 1$ $V_{Long} = 607$ lbs. $P_{static} = 7200$ lbs.
$S_1 = 0.44$ $F_v = 1.86$ SDC = D $V_{Trans} = 2113$ lbs. $P_{seismic} = 7260$ lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 84% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 34% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 91% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 34%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 24% Max stress = 24% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 14%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 15% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 38%

Notes:
Analyzed as single row.   2 x 2 x 0.125" angle brace at 1st diagonal.

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1130 E. CYPRESS ST, COVINA, CA 91724

PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 30
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS

Analysis per section 2209 of the 2021 IBC

Levels: 7 Panels: 7 Load per Level

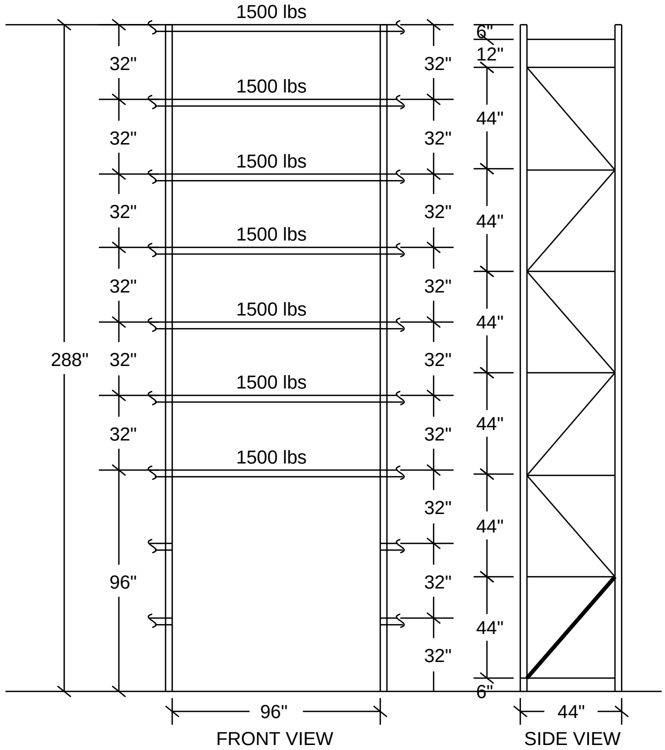
Configuration 28: Type P-T
Tunnel Adjacent to: Type P-S

H 1.7

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 540 lbs.
V_{Trans} = 1878 lbs.

P_{static} = 6400 lbs.
$P_{seismic}$ = 6808 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 75% (level 1 adj.) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 30% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 89% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 30%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 16% Max stress = 16% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 12%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 14% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 36%

Notes:
Analyzed as single row interior tunnel bay. Adjacent to Type P-S. 2 x 2 x 0.125" angle brace at 1st diagonal.

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1130 E. CYPRESS ST, COVINA, CA 91724

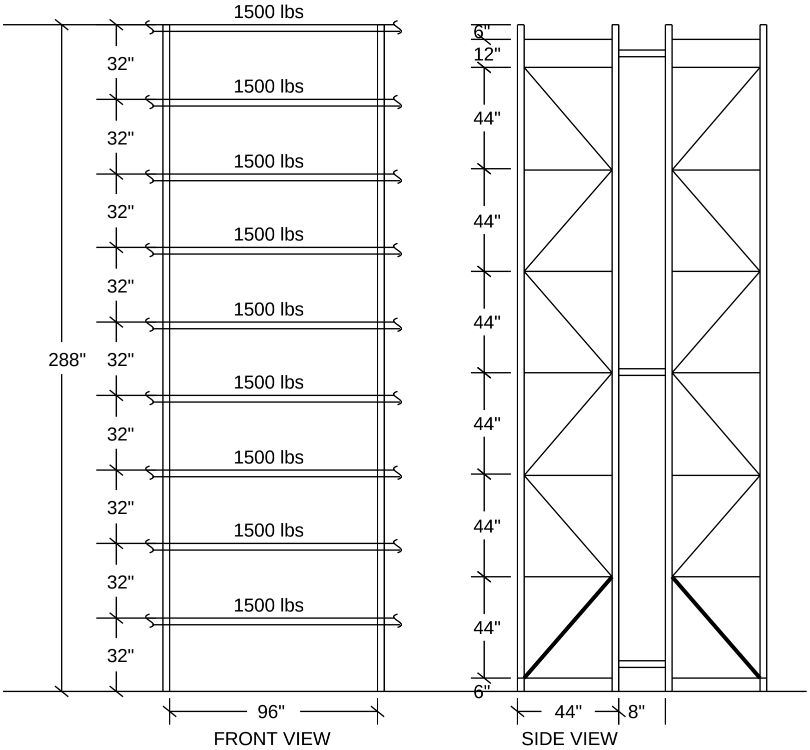
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 31
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS   Configuration 29: Type P-D   H 1.7

Analysis per section 2209 of the 2021 IBC

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 607 lbs. P_{static} = 7200 lbs.

Levels: 9 Panels: 7 Load per Level S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 2113 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 84% (level 2) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 34% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 70% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 34%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 24% Max stress = 24% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 14%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 15% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 38%

Notes:
This calculation summary applies only to back-to-back rows.
Standard row spacers are required in this profile.

2 x 2 x 0.125" angle brace at 1st diagonal.

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TEL:(909)869-0989
1130 E. CYPRESS ST, COVINA, CA 91724

PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 32
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_073

COMPONENTS AND SPECIFICATIONS   Configuration 30: Type R-S   H 1.7

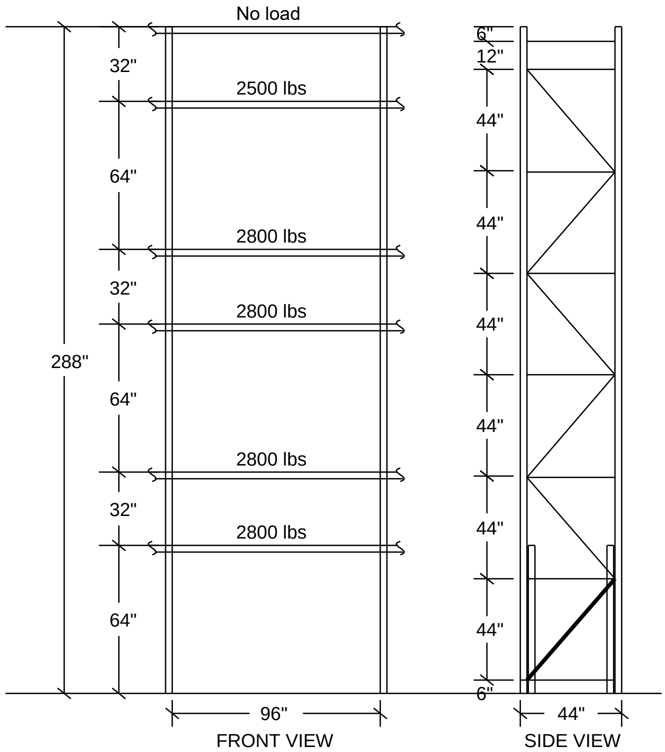
Analysis per section 2209 of the 2021 IBC

Levels: 6   Panels: 7   Load per Level

S_s = 1.28 F_a = 1.0 I = 1
S_1 = 0.44 F_v = 1.86 SDC = D

V_{Long} = 597 lbs.
V_{Trans} = 2078 lbs.

P_{static} = 7150 lbs.
$P_{seismic}$ = 6583 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 55% (level 2) **BACKER TO LEVEL 1** C 3 X 3.5 Steel = 50000 psi Stress = 40% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 34% (panel 2) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 95% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 34%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 55% Max stress = 55% (level 1)	2 Bolt @ 4" cc Connector Stress = 41% Max stress = 41% (level 1)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 13%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 14% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 31%

Notes:
Analyzed as single row.   2 x 2 x 0.125" angle brace at 1st diagonal.

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TEL:(909)869-0989
1130 E. CYPRESS ST, COVINA, CA 91724

PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 33
CALCULATED BY: ang
DATE: 3/5/2025

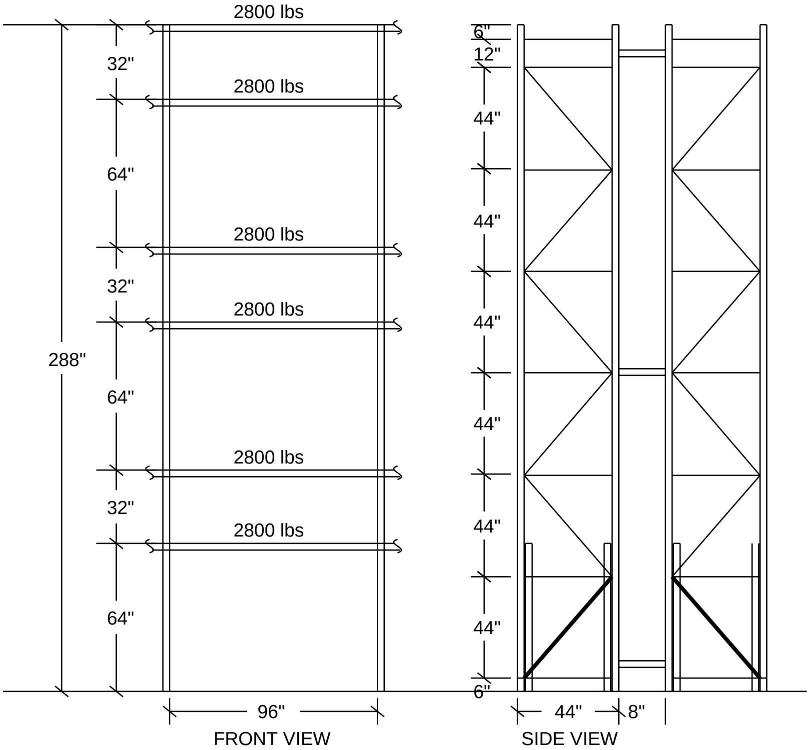
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS   Configuration 31: Type R-D   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 6   Panels: 7   Load per Level

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 724 lbs. P_{static} = 8700 lbs.
S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 2519 lbs.



FRAME OK	BEAM OK	CONNECTOR OK
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 77% (level 2) **BACKER TO LEVEL 1** C 3 X 3.5 Steel = 50000 psi Stress = 48% (level 1) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 41% (panel 2) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 91% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 41%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress(st) = 55% Max stress = 55% (level 1)	2 Bolt @ 4" cc Connector Stress = 48% Max stress = 48% (level 1)

Base Plate OK	Slab & Soil OK	Anchors OK
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 17%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 19% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 50%

Notes:
This calculation summary applies only to back-to-back rows.
Standard row spacers are required in this profile.   2 x 2 x 0.125" angle brace at 1st diagonal.

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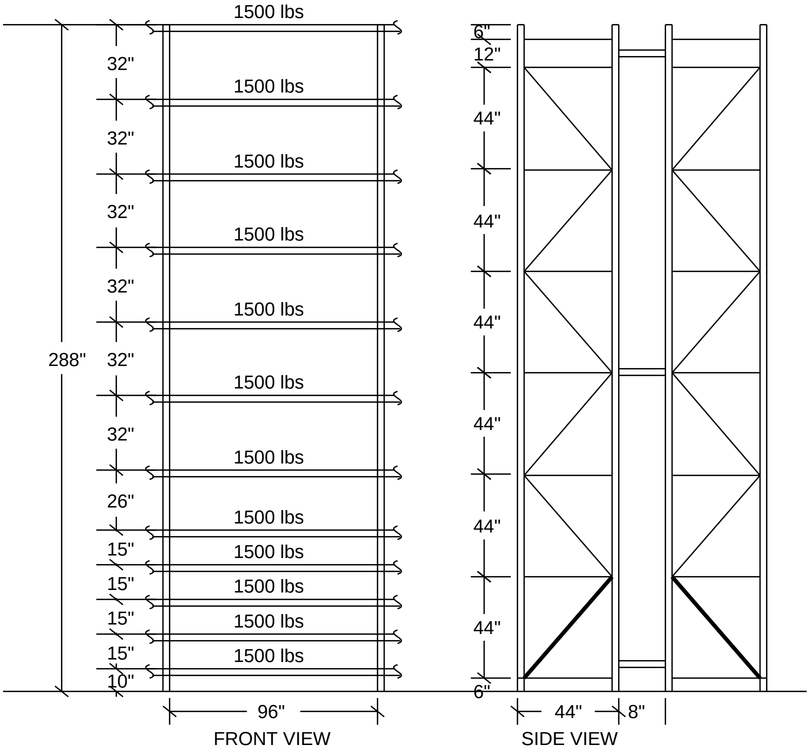
PROJECT: Coastal Pacific Food
FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 34
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_073

COMPONENTS AND SPECIFICATIONS   Configuration 32: Type S-D   H 1.7

Analysis per section 2209 of the 2021 IBC

Levels: 12   Panels: 7   Load per Level

S_s = 1.28 F_a = 1.0 I = 1 V_{Long} = 810 lbs. P_{static} = 9600 lbs.
S_1 = 0.44 F_v = 1.86 SDC = D V_{Trans} = 2817 lbs.



FRAME	BEAM	CONNECTOR
COLUMN C 3 X 3.5 Steel = 50000 psi Stress = 92% (level 4) **HORIZONTAL BRACE** 1.5 x 1.5 - .125 Stress = 46% (panel 1) **DIAGONAL BRACE** 1.5 x 1.5 - .125 Stress = 73% (panel 2) **1ST DIAGONAL** L 2 x 2 - .125 Stress = 46%	C 3 x 3.5 Steel = 50 ksi Max Static Cap. = 5214 lb. Stress = 30% Max stress = 30% (level 1)	2 Bolt @ 4" cc Connector Stress = 13% Max stress = 15% (level 6)

Base Plate	Slab & Soil	Anchors
Steel = 36000 psi 10 x 10 x 0.375 in. 4 anchors/plate Moment = 0 in-lb. Stress = 17%	Slab = 8" x 4000 psi Sub Grade Reaction = 50 pci Slab Bending Stress = 20% (S)	Hilti Kwik Bolt TZ 2 (KB-TZ2) ESR-4266 0.625 in. x 4.5 in. Embed. Pullout Capacity = 2912 lbs. Shear Capacity = 4999 lbs. Anchor stress = 44%

Notes:
This calculation summary applies only to back-to-back rows.
Standard row spacers are required in this profile.

2 x 2 x 0.125" angle brace at 1st diagonal.

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FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 35
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

Loads and Distributions: Type A-S

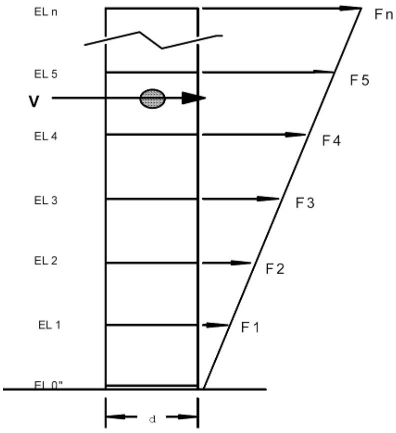
Determines seismic base shear per Section 2.6 of the RMI & Section 2209, of the 2021 IBC

# of Levels:	6	SDC:	D	R_L:	6	Ss:	1.28
Pallets Wide:	2	W_{PL}:	22000	R_T:	4	S1:	0.44
Pallets Deep:	1	W_{DL}:	600 lbs	Fa:	1	Ip:	1
Pallet Load:	2250	Fv:	1.86	Tl:	1.5		
Total Frame Load:	22600 lbs						

$S_{DS} = 2/3 \cdot S_s \cdot F_a =$ **0.85**

$S_{D1} = 2/3 \cdot S_1 \cdot F_v =$ **0.55**

$W_s = 0.67 \cdot W_{PL} + W_{DL} =$ **15340 lbs**



Seismic Shear per RMI 2012 2.6.3:

Longitudinal

$V_{long1} = C_s \cdot I_p \cdot W_s$

$= S_{D1} / (T_L \cdot R_L) \cdot I_P \cdot W_s$

$= 0.55 / (1.5 \cdot 6) \cdot 1 \cdot 15340 =$ **937.44 lbs**

V_{long} need not be greater than:

$V_{long2} = C_s \cdot I_p \cdot W_s$

$= S_{DS} / R_L \cdot I_P \cdot W_s$

$= 0.85 / 6 \cdot 1 \cdot 15340 =$ **2173.17 lbs**

If S_1 >= 0.6, then V_{long} shall not be less than:

$V_{long3} = C_s \cdot I_p \cdot W_s$

$= 0.5 \cdot S_1 / R_L \cdot I_P \cdot W_s$

$= 0.5 \cdot 0.44 / 6 \cdot 1 \cdot 15340 =$ **562.47 lbs**

V_{long} shall not be less than:

$V_{long4} = C_s \cdot I_p \cdot W_s$

$= \text{Max}[0.044 \cdot S_{DS}, 0.03] \cdot I_P \cdot W_s$

$= \text{Max}[0.04, 0.03] \cdot 1 \cdot 15340 =$ **573.72 lbs**

Since: $937.44 \le 2173.17$
$\& \ 937.44 \ge 562.47$
$\& \ 937.44 \ge 573.72$

V_{long} = 937 lbs

Transverse

V_{trans} need not be greater than:

$V_{trans1} = C_s \cdot I_p \cdot W_s$

$= S_{DS} / R_T \cdot I_P \cdot W_s$

$= 0.85 / 4 \cdot 1 \cdot 15340 =$ **3259.75 lbs**

If S_1 >= 0.6, then V_{trans} shall not be less than:

$V_{trans2} = C_s \cdot I_p \cdot W_s$

$= 0.5 \cdot S_1 / R_T \cdot I_P \cdot W_s$

$= 0.5 \cdot 0.44 / 4 \cdot 1 \cdot 15340 =$ **843.7 lbs**

V_{trans} shall not be less than:

$V_{trans3} = C_s \cdot I_p \cdot W_s$

$= \text{Max}[0.044 \cdot S_{DS}, 0.5 \cdot S_1 / R_T, 0.03] \cdot I_P \cdot W_s$

$= \text{Max}[0.04, 0.06, 0.03] \cdot 1 \cdot 15340 =$ **843.7 lbs**

Since: $3259.75 \ge 843.7$
$\& \ 3259.75 \ge 843.7$

V_{trans} = 3259 lbs

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Loads and Distributions: Type A-S (Page 2)

$$f_i = V \frac{W_i H_i}{\Sigma W_i H_i}$$

		Longitudinal			Transverse		
Level	h_x	w_x	$w_x h_x$	f_i	w_x	$w_x h_x$	f_i
1	72	2300	165600	64.27	2300	165600	223.53
2	144	2300	331200	128.53	2300	331200	447.06
3	216	2300	496800	192.8	2300	496800	670.59
4	288	2300	662400	257.07	2300	662400	894.12
5	360	2050	738000	286.41	2050	738000	996.17
6	408	50	20400	7.92	50	20400	27.54

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Fundamental Period of Vibration (Longitudinal)

Per FEMA 460 Appendix A - Development of An Analytical Model for the Displacement Based Seismic Design of Storage Racks in Their Down Aisle Direction

$$T = 2\pi \sqrt{\frac{\sum_{i=1}^{N_L} W_{pi} h_{pi}^2}{g(N_c(\frac{k_c k_{be}}{k_c + k_{be}}) + N_b\left(\frac{k_b k_{ce}}{k_b + k_{ce}}\right))}} \quad \text{(A-7)}$$

Where:

W_{pi} = the weight of the ith pallet supported by the storage rack

h_{pi} = the elevation of the center of gravity of the ith pallet with respect to the base of the storage rack

g = the acceleration of gravity

N_L = the number of loaded levels

k_c = the rotational stiffness of the connector

k_{be} = the flexural rotational stiffness of the beam-end

k_b = the rotational stiffness of the base plate

k_{ce} = the flexural rotational stiffness of the base upright-end

N_c = the number of beam-to-upright connections

N_b = the number of base plate connections

$$k_{be} = \frac{6EI_b}{L}$$

$$k_{ce} = \frac{4EI_c}{H}$$

$$k_b = \frac{EI_c}{H}$$

L = the clear span of the beams

H = the clear height of the upright

I_b = the moment of inertia about the bending axis of each beam

I_c = the moment of inertia of each base upright

E = the Young's modulus of the beams

Calculated T = 3.86

Since the calculated T is greater than 1.5, the more conservative value of 1.5 is used in the calculations

# of levels	6
min. # of bays	3
N_c	72
N_b	8
k_c	500 kip-in/rad
k_{be}	2894 kip-in/rad
k_b	263 kip-in/rad
k_{ce}	1055 kip-in/rad
I_b	1.57 in^4
L	96 in
I_c	3.65 in^4
H	408 in
E	29500 ksi

Level	h_{pi}	W_{pi}
1	105 in	4 kip
2	177 in	4 kip
3	249 in	4 kip
4	321 in	4 kip
5	381 in	4 kip
6	442 in	0 kip

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ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 38
CALCULATED BY: ang
DATE: 3/5/2025
PN: 20240709_071

LRFD Basic Load Combinations: Type A-S

2021 IBC& RMI / ANSI MH 16.1

V_{Trans} = **3,259 lbs**
$M_{Trans} = \Sigma(f_{Trans} \cdot h_x)$ = **852,678 in-lbs**
β = 0.7

V_{Long} = **937 lbs**
$E_{Trans} = M_{Trans}$ / frame depth = **19,379 lbs**
β = 1.0 (Uplift combination only)

P = Product Load / 2 = **11,000 lbs**
ρ = 1

D = Dead Load $\cdot$ 0.5 = **300 lbs**
S_{DS} = .85

L = Live Load = **0 lbs** S = Snow Load = **0 lbs** R = Rain Load = **0 lbs**
Lr = Live Roof Load = **0 lbs** W = Wind Load = **0 lbs**

Basic Load Combinations

1. Dead Load = 1.4 D + 1.2 P
= $(1.4 \cdot 300) + (1.2 \cdot 11{,}000)$= **13,620 lbs**

2. Gravity Load = 1.2 D + 1.4 P + 1.6 L + 0.5 (L_r or S or R)
= $(1.2 \cdot 300) + (1.4 \cdot 11{,}000) + (1.6 \cdot 0) + (0.5 \cdot 0)$= **15,759 lbs**

3. Snow/Rain = 1.2D + 0.85P + (0.5L or 0.5W) + 1.6(L_r or S or R)
= $(1.2 \cdot 300) + (0.85 \cdot 11{,}000) + (0.5 \cdot 0) + (1.6 \cdot 0)$= **9,710 lbs**

4. Wind Load = 1.2D + 0.85P + 0.5L + 1.0W + 0.5(L_r or S or R)
= $(1.2 \cdot 300) + (0.85 \cdot 11{,}000) + (0.5 \cdot 0) + (1.0 \cdot 0) + (0.5 \cdot 0)$= **9,710 lbs**

5A. Seismic Load (Transverse) = $(1.2 + 0.2S_{DS})D + (1.2 + 0.2S_{DS})\beta P + 0.5L + \rho E_{Trans} + 0.2S$
= $(1.2 + 0.2 \cdot .85) \cdot 300 + (1.2 + 0.2 \cdot .85) \cdot 0.7 \cdot 11{,}000 + 0.5 \cdot 0 + 1 \cdot 19{,}379 + 0.2 \cdot 0$= **30,339 lbs**

5B. Seismic Load (Longitudinal) = $(1.2 + 0.2S_{DS})D + (1.2 + 0.2S_{DS})\beta P + 0.5L + \rho E_{Long} + 0.2S$
= $(1.2 + 0.2 \cdot .85) \cdot 300 + (1.2 + 0.2 \cdot .85) \cdot 0.7 \cdot 11{,}000 + 0.5 \cdot 0 + 1 \cdot 0 + 0.2 \cdot 0$= **10,959 lbs**

6. Wind Uplift = $0.9D + 0.9P_{app} + 1.0W$
= $0.9 \cdot 300 + 0.9 \cdot 11{,}000 + 1.0 \cdot 0$ = **270 lbs**

7. Seismic Uplift = $(0.9 - 0.2S_{DS})D + (0.9 - 0.2S_{DS})\beta P_{app} - \rho E_{Trans}$
= $(0.9 - 0.2 \cdot .85) \cdot 300 + (0.9 - 0.2 \cdot .85) \cdot 1 \cdot 11{,}000 - 1 \cdot 19{,}379$= **-11,130 lbs**
For a single beam, D = **32 lbs** P = **2,250 lbs** I = **281 lbs**
See Base Plate tension Analysis for Over-Strength factor application.

8. Product/Live/Impact = 1.2D + 1.6L + 0.5(SorR) + 1.4P + 1.4I
$(1.2 \cdot 32) + (1.6 \cdot 0) + (0.5 \cdot 0) + (1.4 \cdot 2{,}250) + (1.4 \cdot 281)$ = **3,581 lbs**

ASD Load Combinations for Slab Analysis

1. $(1 + 0.105S'_{DS})D + 0.75((1.4 + 0.14S_{DS})\beta P + 0.7\rho E)$
   = $(1 + 0.105 \cdot .85) \cdot 300 + 0.75((1.4 + 0.14 \cdot .85) \cdot 0.7 \cdot 11{,}000 + 0.7 \cdot 1 \cdot 19{,}379)$= **19,273 lbs**
2. $(1 + 0.14S_{DS})D + (0.85 + 0.14S_{DS})\beta P + 0.7\rho E$
   = $(1 + 0.14 \cdot .85) \cdot 300 + (0.85 + 0.14 \cdot .85) \cdot 0.7 \cdot 11{,}000 + 0.7 \cdot 1 \cdot 19{,}379$= **21,362 lbs**
3. D + P
   = 300 + 11,000 = **11,300 lbs**

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FOR: Raymond West_Edgar Bet
ADDRESS: 322 Valley Avenue
Puyallup, WA
SHEET#: 39
CALCULATED BY: ang
DATE: 3/5/2025

PN: 20240709_071

Longitudinal Analysis: Type A-S

This analysis is based on the Portal Method, with the point of contra flexure of the columns assumed at mid-height between beams, except for the lowest portion, where the base plate provides only partial fixity and the contra flexure is assumed to occur closer to the base (or at the base of pinned condition, where the base plate cannot carry moment).

$M_{ConnR} = M_{ConnL} = M_{Conn}$

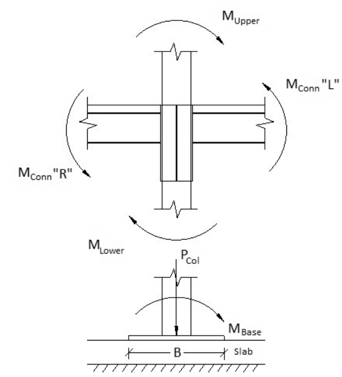
$M_{Conn} = ((M_{Upper} + M_{Lower}) / 2) + M_{Ends}$

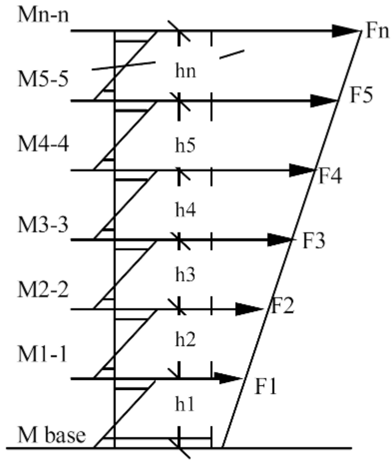
$V_{Col} = V_{Long}$ / # of columns = **469 lbs**

$M_{Base} =$ **0 in-lbs**

$M_{Lower} = ((V_{col} \cdot h_i) - M_{Base}$

(469 lbs · 70 in.) - 0 in-lbs = 32830 in-lbs





FRONT ELEVATION

Levels	h_i	f_i	Axial Load	Moment	Beam End Moment	Connector Moment
1	72	32	11,300	32,830	6,231	39,061
2	72	64	9,000	32,830	6,231	39,061
3	72	96	6,700	32,830	6,231	39,061
4	72	129	4,400	32,830	6,231	39,061
5	72	143	2,100	32,830	5,549	32,751
6	48	4	50	21,574	87	10,874

COLUMN WITH BACKER ANALYSIS: Type A-S (Level 1)

AISC360 E2 Effective Length

K_xL_x/R_x = 1.7 · 70 / 1.63 = **73.2**

K_yL_y/R_y = 1 · 44 / 0.91 = **48.2**

$(KL/R)_{max}$ = Max(K_xL_x/R_x, K_yL_y/R_y) = **73.2** (shall not exceed 200)

Compression Analysis

AISC360 E3 Flexure Buckling of Members Without Slender Elements

K_x	1.7
L_x	70 in
R_x	1.63
K_y	1
L_y	44 in
R_y	0.91
R_{ts}	0.52
S_x	3.66
h_o	3.7
F_y	50,000 psi
A_g	2.76 sq in

Strong Axis - Elastic buckling stress

F_e = $\Pi^2E / (K_xL_x/R_x)^2 = \Pi^2 \cdot 29{,}500$ ksi / $(73.2)^2$ = **54.4 ksi**

Since: $K_xL_x/R_x \leq 4.71 \cdot (E/Fy)^{1/2}$

F_{cr} = $(0.658^{Fy/Fe}) \cdot F_y$ = **34.03 ksi**

Nominal compressive strength:

P_{ns} = $F_{cr} \cdot A_g$ = 34.03 · 2.76 = **93,918 lbs**

Weak Axis - Elastic buckling stress

F_e = $\Pi^2E / (K_yL_y/R_y)^2 = \Pi^2 \cdot 29{,}500$ ksi / $(48.2)^2$ = **125.4 ksi**

Since: $K_yL_y/R_y \leq 4.71 \cdot (E/Fy)^{1/2}$

F_{cr} = $(0.658^{Fy/Fe}) \cdot F_y$ = **42.31 ksi**

Nominal compressive strength:

P_{nw} = $F_{cr} \cdot A_g$ = 42.31 · 2.76 = **116,782 lbs**

P_{n1} = Min(Pns, Pnw) = **93,918 lbs**

AISC360 Torsional and Flexural-Torsional Buckling of Members Without Slender Elements

F_{ex} = $\Pi^2E / (K_xL_x/R_x)^2$ = **54.4 ksi**

F_{ez} = $(\Pi^2E \cdot C_w / (K_yL_y)^2 + GJ) \cdot 1 / A_g \cdot ro^2$ = **87.8 ksi**

F_e = $((F_{ex} + F_{ez}) / 2H \cdot (1 - (1 - 4F_{ex}F_{ez}H / (F_{ex} + F_{ez})^2)^{1/2})$ = **42.7 ksi**

Since: $K_xL_x/R_x \leq 4.71 \cdot (E/Fy)^{1/2}$

F_{cr} = $(0.658^{Fy/Fe}) \cdot F_y$ = **30.62 ksi**

P_{n2} = $F_{cr} \cdot A_g$ = **84,507 lbs**

P_n = Min(P_{n1}, P_{n2}) = **84,507 lbs**

P_c = $\phi \cdot P_n$ = **76,057 lbs**

P_{trans} = **30,339 lbs** P_{long} = **10,960 lbs** P_{st} = **15,760 lbs**

P_{max} = MAX(P_{trans}, P_{long}, P_{st}) = **30,340 lbs**

Stress = P_{max} / P_c = **40%**

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Column Analysis

Bending Analysis

AISC360 F2 Doubly Symmetric Compact I-Shaped Members and Channels Bent About Their Major Axis

Yielding

M_{nx1} = $M_p = F_y \cdot Z_x$ = **106,001 in-lbs**

Lateral-Torsional Buckling

L_p = $1.76 \cdot R_y \cdot (E/F_y)^{1/2}$ = **39 in.**

c = $h_o/2 \cdot (I_y/C_w)^{1/2} = 2.13$

L_r = $1.95 \cdot R_{ts} \cdot E/(0.7F_y) \cdot (((J \cdot c) / S_x h_o) + (((J \cdot c) / S_x h_o)^2 + 6.76(0.7F_y/E)^2)^{1/2})^{1/2}$ = **123.5 in.**

L_b = L_x = **70 in.**

F_{cr} = $Cb\Pi^2 E / (L_b / R_{ts})^2 \cdot (1 + 0.078 J \cdot c / (S_x h_o) \cdot (L_b / R_{ts})^2)^{1/2}$ = **63.16 ksi**

Since: $L_p < L_b < L_r$

M_{nx2} = $C_b(M_p - 0.7F_y S_x)((L_b - L_p))$ = **114,105 in-lbs**

M_{nx} = $\mathrm{MIN}(M_{nx1}, M_{nx2})$ = MIN(106,001, 114,105) = **106,001 in-lbs**

AISC360 F6 I-Shaped Members and Channels Bent About Their Minor Axis

Yielding

M_{ny} = $M_p = \mathrm{Min}(F_y \cdot Z_y, 1.6 \cdot F_y \cdot S_y)$ = **26,551 in-lbs**

M_{cx} = $\phi_b \cdot M_{nx} = 0.9 \cdot M_{nx}$ = **95,401 in-lbs**

M_{cy} = $\phi_b \cdot M_{ny} = 0.9 \cdot M_{ny}$ = **23,896 in-lbs**

M_{rx} = **32810.56 in-lbs**

M_{rx}/M_{cx} = 32810.56 / 95,401 = **34%**

M_{ry}/M_{cy} = Mry / 23,896 = **0%**

Combined Compression and Bending Analysis

AISC360 H1 Doubly and Singly Symmetric Members Subject to Flexure and Axial Force

P_{long}/P_c = 10,960 lb / 76,057 lb = 0.14

Since: $P_{long}/P_c < 0.2$

Stress = $P_{long}/2P_c + (M_{rx}/M_{cx} + M_{ry}/M_{cy})$ = **42%**

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COLUMN ANALYSIS: Type A-S (Level 3)

AISC360 E2 Effective Length

K_xL_x/R_x = 1.5 · 70 / 1.63 = **64.4**

K_yL_y/R_y = 1 · 44 / 0.46 = **96.3**

$(KL/R)_{max}$ = Max(K_xL_x/R_x, K_yL_y/R_y) = **96.3** (shall not exceed 200)

Compression Analysis

AISC360 E3 Flexure Buckling of Members Without Slender Elements

Strong Axis - Elastic buckling stress

K_x	1.5
L_x	70 in
R_x	1.63
K_y	1
L_y	44 in
R_y	0.46
R_{ts}	0.52
S_x	1.83
h_o	3.7
F_y	50,000 psi
A_g	1.38 sq in

F_e = $\Pi^2E / (K_xL_x/R_x)^2 = \Pi^2 \cdot 29{,}500$ ksi / $(64.4)^2$ = **70.2 ksi**

Since: $K_xL_x/R_x \leq 4.71 \cdot (E/Fy)^{1/2}$

F_{cr} = $(0.658^{Fy/Fe}) \cdot F_y$ = **37.11 ksi**

Nominal compressive strength:

P_{ns} = $F_{cr} \cdot A_g$ = 37.11 · 1.38 = **51,206 lbs**

Weak Axis - Elastic buckling stress

F_e = $\Pi^2E / (K_yL_y/R_y)^2 = \Pi^2 \cdot 29{,}500$ ksi / $(96.3)^2$ = **31.4 ksi**

Since: $K_yL_y/R_y \leq 4.71 \cdot (E/Fy)^{1/2}$

F_{cr} = $(0.658^{Fy/Fe}) \cdot F_y$ = **25.68 ksi**

Nominal compressive strength:

P_{nw} = $F_{cr} \cdot A_g$ = 25.68 · 1.38 = **35,439 lbs**

P_{n1} = Min(Pns, Pnw) = **35,439 lbs**

AISC360 Torsional and Flexural-Torsional Buckling of Members Without Slender Elements

F_{ex} = $\Pi^2E / (K_xL_x/R_x)^2$ = **70.2 ksi**

F_{ez} = $(\Pi^2E \cdot C_w / (K_yL_y)^2 + GJ) \cdot 1 / A_g \cdot ro^2$ = **87.8 ksi**

F_e = $((F_{ex} + F_{ez}) / 2H \cdot (1 - (1 - 4F_{ex}F_{ez}H / (F_{ex} + F_{ez})^2)^{1/2})$ = **50.4 ksi**

Since: $K_xL_x/R_x \leq 4.71 \cdot (E/Fy)^{1/2}$

F_{cr} = $(0.658^{Fy/Fe}) \cdot F_y$ = **33.02 ksi**

P_{n2} = $F_{cr} \cdot A_g$ = **45,563 lbs**

P_n = Min(P_{n1}, P_{n2}) = **35,439 lbs**

P_c = $\phi \cdot P_n$ = **31,895 lbs**

P_{trans} = **15,587 lbs** P_{long} = **6,508 lbs** P_{st} = **9,460 lbs**

P_{max} = MAX(P_{trans}, P_{long}, P_{st}) = **15,587 lbs**

Stress = P_{max} / P_c = **49%**

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Column Analysis

Bending Analysis

AISC360 F2 Doubly Symmetric Compact I-Shaped Members and Channels Bent About Their Major Axis

Yielding

M_{nx1} = $M_p = F_y \cdot Z_x$ = **106,001 in-lbs**

Lateral-Torsional Buckling

L_p = $1.76 \cdot R_y \cdot (E/F_y)^{1/2}$ = **19.5 in.**

c = $h_o/2 \cdot (I_y/C_w)^{1/2} = 1.07$

L_r = $1.95 \cdot R_{ts} \cdot E/(0.7F_y) \cdot (((J \cdot c) / S_x h_o) + (((J \cdot c) / S_x h_o)^2 + 6.76(0.7F_y/E)^2)^{1/2})^{1/2}$ = **90.1 in.**

L_b = L_x = **70 in.**

F_{cr} = $Cb\Pi^2E / (L_b / R_{ts})^2 \cdot (1 + 0.078J \cdot c / (S_x h_o) \cdot (L_b / R_{ts})^2)^{1/2}$ = **46.18 ksi**

Since: $L_p < L_b < L_r$

M_{nx2} = $C_b(M_p - 0.7F_yS_x)((L_b - L_p))$ = **75,995 in-lbs**

M_{nx} = $MIN(M_{nx1}, M_{nx2})$ = MIN(106,001, 75,995) = **75,995 in-lbs**

AISC360 F6 I-Shaped Members and Channels Bent About Their Minor Axis

Yielding

M_{ny} = $M_p = Min(F_y \cdot Z_y, 1.6 \cdot F_y \cdot S_y)$ = **21,201 in-lbs**

M_{cx} = $\phi_b \cdot M_{nx} = 0.9 \cdot M_{nx}$ = **68,396 in-lbs**

M_{cy} = $\phi_b \cdot M_{ny} = 0.9 \cdot M_{ny}$ = **19,081 in-lbs**

M_{rx} = **9933 in-lbs**

M_{rx}/M_{cx} = 9933 / 68,396 = **15%**

M_{ry}/M_{cy} = Mry / 19,081 = **0%**

Combined Compression and Bending Analysis

AISC360 H1 Doubly and Singly Symmetric Members Subject to Flexure and Axial Force

P_{long}/P_c = 6,508 lb / 31,895 lb = 0.2

Since: $P_{long}/P_c \geq 0.2$

Stress = $P_{long}/P_c + 8/9 \cdot (M_{rx}/M_{cx} + M_{ry}/M_{cy})$ = **34%**

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DATE: 3/5/2025
PN: 20240709_071

BEAM ANALYSIS Type A-S

Flexural Member Strength Determination

1. Check Yield Strength

$M_n = M_P = F_y Z_x = 50 \cdot 1.24 = \mathbf{62\ in.\ kips}$

2. Check Lateral-Torsional Buckling

a. Determine Limiting Length for Lateral-Torsional Buckling, L_P

$L_P = 1.76 \cdot R_y \cdot (E / F_y)^{1/2} = 1.76 \cdot 0.394 \cdot (29500 / 0.394)^{1/2} = \mathbf{16.84\ in.}$

b. Determine Limiting Length for Inelastic Lateral-Torsional Buckling, L_r

$C = H_o / 2 \cdot (I_y / C_w)^{1/2} = 2.73 / 2 \cdot (0.169 / 0.276)^{1/2} = \mathbf{1.07}$

$L_r = 1.95 \cdot R_{ts} \cdot (E / 0.7 \cdot F_y) \cdot (J \cdot C / S_x \cdot H_o)^{1/2}$
$\cdot (1 + (1 + 6.76(0.7 \cdot F_y / (E \cdot S_x \cdot H_o / J \cdot C))^2)^{1/2})^{1/2}$

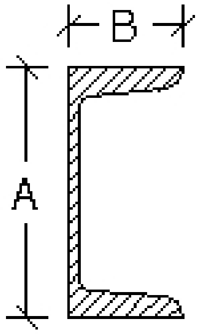
$= 1.95 \cdot 0.456 \cdot (29500 / 0.7 \cdot 50) \cdot (0.02 \cdot 1.07 / 1.04 \cdot 2.73)^{1/2} \cdot (1 + (1 + 6.76(0.7 \cdot 50 / (29500 \cdot 1.04 \cdot 2.73 / 0.02 \cdot 1.07))^2)^{1/2})^{1/2} = \mathbf{100.1\ in.}$

c. When $L_P <= L_b <= L_r$

$M_n = C_b \cdot (M_P - (M_P - (0.7 \cdot F_y \cdot S_x)) \cdot (L_b - L_P) / (L_r - L_P))$
$= 1.14 \cdot (62.0 - (62.0 - (0.7 \cdot 50.0 \cdot 1.04)) \cdot (96 - 16.84) / (100.1 - 16.84))$
$= \mathbf{42.93\ in\text{-}kip}$

$\phi \cdot M_n = \mathbf{38.64\ in\text{-}kip}$

Revised M_n = the minimum of M_n and M_P = **42.93 in-kip**
$W = \phi \cdot M_n \cdot 8 \cdot (\#\ of\ Beams) / (L \cdot R_m \cdot \Omega)$
$= 38.64 \cdot 8 \cdot 2 / 96 \cdot 0.77 \cdot 1.6 =$ **5214** lbs/pair



C 3 x 3.5
SECTION PROPERTIES

A =	3.0 in.
B =	1.37 in.
Ag =	1.09 in.
Iy =	0.169
Sx =	1.04
Zx =	1.24
Ry =	0.394
Rts =	0.456
Ho =	2.73
J =	0.023
Cw =	0.276
Fy =	50.0
E =	29500
Beam Length L =	96
Lb =	96
ϕ_b =	0.9

Check Deflection Capacity

$\Delta_{max} = \Delta_{ss} \cdot R_d$

$\Delta_{max} = L / 180$

$R_d = 1 - (4 \cdot F \cdot L) / (5 \cdot F \cdot L + 10 \cdot E \cdot I_x)$
$= - (4 \cdot 500 \cdot 96) / (5 \cdot 500 \cdot 96 + 10 \cdot 29500 \cdot 1.57) = \mathbf{0.73}$

$\Delta_{ss} = (5 \cdot W \cdot L^3) / (384 \cdot E \cdot I_x)$

$L / 180 = (5 \cdot W \cdot L^3 \cdot R_d) / (384 \cdot E \cdot I_x \cdot (\#\ of\ Beams))$

$W = (384 \cdot E \cdot I_x \cdot 2) / (180 \cdot 5 \cdot L^2 \cdot R_d)$
$= (384 \cdot 29500 \cdot 1.57 \cdot 2) / (180 \cdot 5 \cdot 96^2 \cdot 0.73) \cdot 1000 =$ **5900** lbs/pair

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Allowable and Actual Bending Moment at Each Level

$M_{static}=Wl^2 / 8$ $M_{allow,static}=W_{allow,static} \cdot l^2 / 8$ $M_{seismic}=M_{conn}$ $M_{allow,seismic}=S_x \cdot F_b$

Level	M_{static}	$M_{allow,static}$	$M_{seismic}$	$M_{allow,seismic}$	Result
1	27,600	31,284	14,958	31,284	Pass
2	27,600	31,284	9,239	31,284	Pass
3	27,600	31,284	6,347	31,284	Pass
4	27,600	31,284	3,864	31,284	Pass
5	24,576	31,284	2,775	31,284	Pass
6	576	31,284	44	31,284	Pass

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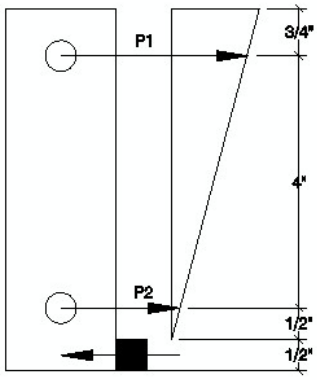
Beam to Column Analysis: Type A-S

1. Shear Strength of Bolt



Bolt Diameter = **0.5 in.**

$F_n = F_{nv} = \mathbf{54000\ psi}$ AISI Table E3.4-1

$A_b = d^2 \cdot \Pi / 4 = \mathbf{0.2\ in.}$

$P_n = A_b \cdot F_n = \mathbf{10602.88\ lbs}$ AISI Table E3.4-1

$P_{Shear} = \phi P_n = 0.75 \cdot P_n = \mathbf{7952\ lbs}$

2. Bearing Strength of Bolt

Column Thickness t_c = **0.13 in.**

Since $d / t_c < 10$ C = 3

$m_f =$ **1.0**

$F_u =$ **65000 psi**

$P_n = C \cdot m_f \cdot d \cdot t_c \cdot F_u = \mathbf{12187.5\ lbs}$ AISI E3.3.1 -1

$P_{Bearing} = \phi P_n = 0.75 \cdot 12187.5 = \mathbf{9140\ lbs}$

3. Moment Strength of Bracket

Edge Dist. = **1 in.**

$T_{Clip} =$ **0.179 in.**

$S_{Clip} =$ **0.127 in.³**

$M_n = S_c \cdot F_y = \mathbf{6985\ in\text{-}lbs}$ AISI C3.1.1 -1

$M_{Strength} = \phi M_n = 0.9 \cdot M_n = 0.9 \cdot S_{Clip} \cdot F_y = \mathbf{6286.5\ in\text{-}lbs}$

$C =$ **1.11**

$d =$ Edge Dist. / 2 = **0.5 in.**

$M_{Strength} = c \cdot d \cdot P_{Clip}$

$P_{Clip} = M_{Strength} / (c \cdot d) = \mathbf{10297\ lbs}$

Minimum Value of P1 Governs

$P_1 = \text{Min}(P_{Shear}, P_{Bearing}, P_{Clip}) = \mathbf{7952\ lbs}$

$M_{Conn\text{-}Allow} = (P_1 \cdot 4.5) + (P_1 \cdot (0.5 / 4.5) \cdot 0.5) = \mathbf{36225.78\ in\text{-}lbs}$

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TRANSVERSE ANALYSIS: BRACING: Type A-S

It is assumed that the lower panel resists the frame shear in tension and compression.

If horizontal and diagonal members are the same, analysis will be done on the diagonal member as it will govern.

V_{Trans} = **2,321.07 lbs**

$L_{Diag} = ((L - 6)^2 + (D - 2B)^2)^{1/2}$ = **57.8 in.**

$V_{Diag} = (V_{Trans} \cdot L_{Diag}) / (D - 2B)$ = **3,282.5 lbs**

$(k \cdot l) / r_{min}$ = 1 · 57.8 in. / 0.465 = **124.2 in.**

$$F_e = \frac{\Pi^2 e}{(k \cdot l / r_{min})^2} = \mathbf{18{,}872\ psi}$$

$F_y / 2$ = **25,000**

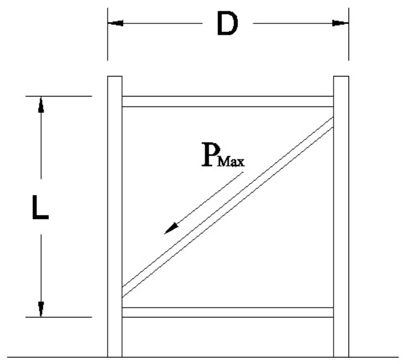
$F_e < F_y / 2$

$F_n = F_e$ = **18,872 psi**

P_n = Area · F_n = **6,775 lbs**

$P_a = P_n / \Omega_c$ = **3,529 lbs**

Brace Stress = VDiag / Pa = **93%**



SIDE ELEVATIONS

Panel Height L = 44 in.

Panel Depth D = 44 in.

Column Depth B = 4.74 in.

Ω_c = **1.80**

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POST-INSTALLED ANCHOR ANALYSIS PER ACI 318-19(ACI 318-14), CHAPTER 17 Configuration 1 Type A-S

Assumed cracked concrete application

Anchor Type	**0.625" dia., 4 hef, 6" min, slab**				
ICC Report Number	**ESR-4266**			$1.5 \cdot h_{ef}$	= **6 in.**
Slab Thickness (h)	= **8 in.**	C_{a1}	= 12	use$C_{a1,adj}$	= **6 in.**
Min. Slab Thickness (h)	= **6 in.**	C_{a2}	= 12	use$C_{a2,adj}$	= **6 in.**
Concrete Strength (f_c)	= **4000 psi**				
Diameter (d_a)	= **0.625 in.**			$3 \cdot h_{ef}$	= **12 in.**
Nominal Embedment (h_{nom})	= **4.5 in.**				
Effective Embedment (h_{ef})	= **4 in.**	S_1	= **8 in.**	Use $S_{1,adj}$	= **8 in.**
Number of Anchors (n)	= **4**	S_2	= **8 in.**	Use $S_{2,adj}$	= **8 in.**
e\`N	= **0**				
e\`V	= **0**				

From ICC ESR Report

A_{se} = **0.164 sq.in.**

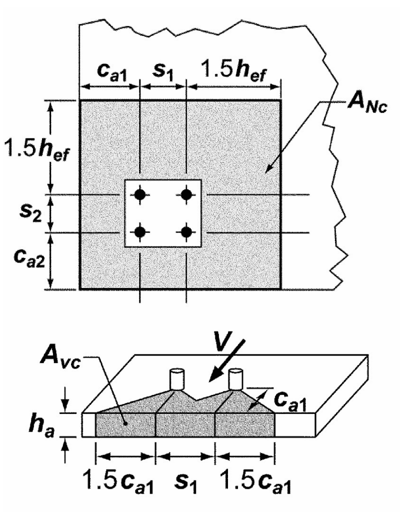
$f`_{uta}$ = **106700 psi**

S_{min} = **2.25 in.**

C_{min} = **2.75 in.**

C_{ae} = **9 in.**

$N_{p,cr}$ = **9999 lbs**



	$\phi_{Seismic}$	Adj. Strength
Tension Capacity = **3883 lbs**	0.75	**2912 lbs**
Shear Capacity = **6665 lbs**	0.75	**4999 lbs**

ANCHOR ANALYSIS - TENSION STRENGTH Configuration 1 Type A-S

Steel Strength	17.4.1
ϕ = **0.75**	17.3.3.a i
$\phi N_{sa} = \phi n A_{se} f_{uta} = 0.75 \cdot 4 \cdot 0.164 \cdot 106700 =$ **52,496 lbs**	17.4.1.2
Concrete Breakout Strength ϕN_{cbg}	17.4.2
ϕ = **0.65**	17.3.3 c ii Category 1-B
$A_{Nc} = (C_{a1.adj} + S_{1.adj} + 1.5h_{ef}) \cdot (C_{a2.adj} + S_{2.adj} + 1.5h_{ef}) =$ **400 sq.in.**	
$A_{Nco} = 9h_{ef}^2 =$ **144 sq.in.**	
Check if $A_{Nco} \geq A_{Nc}$ $A_{Nc}/A_{Nco} =$ **2.778**	
$\Psi_{ec,N} =$ **1**	17.4.2.4
$\Psi_{ed,N} =$ **1**	17.4.2.5
$\Psi_{C,N} =$ **1**	17.4.2.6
$K_c =$ **17**	
$\lambda_a =$ **1**	
$N_b = K_c \lambda_a (f_c)^{0.5} (h_{ef})^{1.5} =$ **8601 lbs**	17.4.2.2 d
$\Psi_{cp,N} =$ **1**	17.4.2.7
$\phi N_{cbg} = \phi(A_{Nc}/A_{Nco})(\Psi_{ec,N})(\Psi_{ed,N})(\Psi_{C,N})(\Psi_{cp,N})(N_b)$	17.4.2.1
$0.65 \cdot (400/144) \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 8601 =$ **15,530 lbs**	
Pullout Strength ϕN_{pn}	17.4.3
ϕ=**0.65**	17.3.3 c ii Category 1-B
$\Psi_{cp} =$ **1**	17.4.3.6
$\phi N_{pn} = \phi \Psi_{cp} N_{p,cr} (f_c/2500)^{0.5} =$ **32,884 lbs**	17.4.3.1

Steel Strength (ϕN_{sa}) = **52,496 lbs**

Embedment Strength - Concrete Breakout Strength (ϕN_{cbg}) = **15,530 lbs**

Embedment Strength - Pullout Strength (ϕN_{pn}) = **32,884 lbs**

ANCHOR ANALYSIS - SHEAR STRENGTH Configuration 1 Type A-S

Steel Strength ϕV_{sa} V_{sa}=10,255 / Anchor -- per report	17.5.1
ϕ = **0.65**	17.3.3. Condition a ii
$\phi V_{sa} = \phi n \cdot V_{sa} = 0.65 \cdot 4 \cdot 10{,}255 =$ **26,663 lbs**	17.5.1.2a
Concrete Breakout Strength ϕV_{cbg}	17.5.2
ϕ = **0.7**	17.3.3 ci-B
$A_{Vc} = (1.5C_{a1} + S_{1.adj} + 1.5C_{a1})h_a =$ **352 sq.in.**	
$A_{Vco} = 3C_{a1}h_a =$ **288 sq.in.**	
Check if $A_{Vco} \geq A_{Vc}$ $A_{Vc}/A_{Vco} =$ **1.222**	
$\Psi_{ec,V}$ = **1**	17.5.2.5
$\Psi_{ed,V}$ = **0.9**	17.5.2.6
$\Psi_{C,V}$ = **1**	17.5.2.7
$\Psi_{h,V}$ = **1.5**	17.5.2.8
d_a = **0.625 in.**	17.5.2.2
L_e = **1.25 in.**	17.2.6 d
λ_a = **1**	
The smaller of $7(L_e / d_a)^{0.2}(d_a)^{0.5}\lambda_a(f_c)^{0.5}ca1^{1.5}$ and $9\lambda_a(f_c)^{0.5}ca1^{1.5}$ = **16,713 lbs**	17.5.2.2 a, 17.5.2.2 b
$\phi V_{cbg} = \phi(A_{Vc}/A_{Vco})(\Psi_{ec,V})(\Psi_{ed,V})(\Psi_{C,V})(\Psi_{h,V})(V_b)$	17.5.2.1
$0.7 \cdot (352/288) \cdot 1 \cdot 0.9 \cdot 1 \cdot 1.5 \cdot 16{,}713 =$ **38,606 lbs**	
Pryout Strength ϕV_{cpg}	17.5.3
ϕ= **0.7**	17.3.3 Ci-B
K_{cp} = **2**	17.5.3.1
N_{cbg} = **23,892 lbs**	
$\phi V_{cpg} = \phi K_{cp} N_{cbg} = 0.7 \cdot 2 \cdot 23{,}892 =$ **33,449 lbs**	

Steel Strength (ϕV_{sa}) = **26,663 lbs**

Embedment Strength - Concrete Breakout Strength (ϕV_{cbg}) = **38,606 lbs**

Embedment Strength - Pryout Strength (ϕV_{cpg}) = **33,449 lbs**

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OVERTURNING ANALYSIS Configuration1 Type A-S

Per RMI Sec 2.6.9 and ASCE7-16. Sec 15.5.3.6. Weight of rack with all levels loaded to 67% capacity, & with only top level loaded

FULLY LOADED

W_{pl} = **22,000 lbs** W_{dl} = **600 lbs**

$W_{pl} \cdot 67\% = 22{,}000 \cdot 0.67 =$ **14,740 lbs**

$V_{Trans} = (1 \cdot 0.2125 \cdot 1 \cdot ((0.67 \cdot 14{,}740) + 600)) =$ **2,226 lbs**

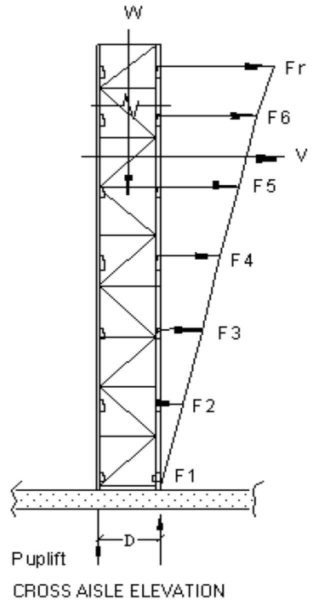
$M_{ovt} = V_{Trans} \cdot Ht = 2{,}226 \cdot 291 =$ **647,766 in-lbs**

$M_{st} = ((W_{pl} \cdot 0.67) + W_{dl}) \cdot d \cdot Factor$

$= ((22{,}000 \cdot 0.67) + 600) \cdot 44 \cdot 0.5 =$ **337,480 in-lbs**

$P_{uplift} = 1 \cdot (M_{ovt} - M_{st})/d = (647{,}766 - 337{,}480) / 44 =$ **7,051 lbs**

$P_{MaxDown} = 1 \cdot (M_{ovt} + M_{st}) / d = (647{,}766 + 337{,}480) / 44 =$ **22,391 lbs**



TOP SHELF LOADED

Shear = **127 lbs**

$M_{ovt} = V_{Top} \cdot Ht = 127 \cdot (408 + ((48 - 10) / 2)) =$ **54,229 in-lbs**

$M_{st} = (l + W_{dl}) \cdot d = (0 + 600) \cdot (44 \cdot 0.5) =$ **13,200 in-lbs**

$P_{uplift} = 1 \cdot (M_{ovt} - M_{st})/d = (54{,}229 - 13{,}200) / 44 =$ **932 lbs**

SIDE LOADS ON TOP SHELF

Top loaded shelf level (H) = **408 in.**

$M_{ovt} = 1.6 \cdot 350 \cdot H = 1.6 \cdot 350 \cdot 408 =$ **228kip**

$P_{uplift} = M_{ovt}/d = 228 / 44 =$ **5,192 lbs**

ANCHORS

No. of Anchors (#Anchors): **4**

Pull Out Capacity per Anchor (T_{Anchor}): **2,912 lbs**

Shear Capacity per Anchor: **4,999 lbs**

COMBINED STRESS

Fully Loaded	= ((7,051 / 4) / 2,912) + ((2,226 / 8) / 4,999)	= **0.661**
Top Shelf Loaded	= ((932 / 4) / 2,912) + ((127 / 8) / 4,999)	= **0.083**
Seismic UpLift Critical (LC#7B)	= (11,130 / 4) / 2,912	= **0.956**
Side Load Top Shelf	= (5,192 / 4) / 2,912	= **0.446**

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Base Plate Analysis: Type A-S

The base plate will be analyzed with the rectangular stress resulting from the vertical load P, combined with the triangular stresses resulting from the moment Mb (if any). Three criteria are used in determining Mb:
1. Moment capacity of the base plate
2. Moment capacity of the anchor bolts
3. $V_{col} \cdot h/2$ (full fixity)

Mb is the smallest value obtained from these three criteria.

$F_y = \mathbf{36000\ psi}$

$P_{col} = \mathbf{30339\ lbs}$

$M_{Base} = \mathbf{0\ in\text{-}lbs}$

$P/A = P_{col}/(D \cdot B) = 30339 / (10 \cdot 10) = \mathbf{303\ psi}$

$f_b = M_{Base} / (D \cdot B^2 / 6) = 0 / (10 \cdot 10^2 / 6) = \mathbf{0\ psi}$

$f_{b2} = f_b \cdot (2 \cdot b_1 / B) = 0 \cdot (2 \cdot 3/10) = \mathbf{0\ psi}$

$f_{b1} = f_b - f_{b2} = 0 - 0 = \mathbf{0\ psi}$

$M_b = wb_1^2 / 2 = (b_1^2 / 2) \cdot (f_a + f_{b1} + 0.67 \cdot f_{b2})$

$= (3^2 / 2) \cdot (303 + 0 + 0.67 \cdot 0) = \mathbf{1365.26\ in\text{-}lbs}$

$S_{Base} = (B \cdot t^2) / 6 = \mathbf{0.23 sq.in.}$

$F_{Base} = 0.9 \cdot F_y = \mathbf{32{,}400\ psi}$

$f_b / F_b = M_b / (S_{Base} \cdot F_{Base}) = 1365.26 / (0.23 \cdot 32{,}400) = \mathbf{0.18}$

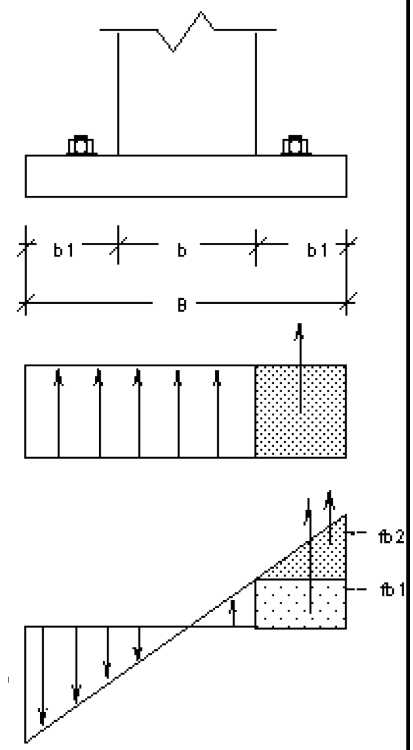

Plate width B =	10 in.
Plate depth D =	10 in.
Plate thickness t =	0.38 in.
Column width b =	4 in.
Column depth d =	1.58 in.
b1 =	3 in.

Equation for Maximum Considered Earthquake Base Rotation

Per RMI 2012 Commentary 2.6.4

$$\alpha_S = \frac{\sum_{i=1}^{N_L} W_{pi} h_{pi} \left(\frac{k_c + k_{be}}{k_c k_{be}}\right)}{\left(N_c + N_b \left(\frac{k_b k_{ce}}{k_c k_{be}}\right)\left(\frac{k_c + k_{be}}{k_b + k_{ce}}\right)\right)}$$

α_s - the first iteration of the second order amplification term computed using W_{pi} from section 2.6.4 of the Commentary

Where:

W_{pi} = the weight of the ith pallet supported by the storage rack

h_{pi} = the elevation of the center of gravity of the ith pallet with respect to the base of the storage rack

N_L = the number of loaded levels

k_c = the rotational stiffness of the connector

k_{be} = the flexural rotational stiffness of the beam-end

k_b = the rotational stiffness of the base plate

k_{ce} = the flexural rotational stiffness of the base upright-end

N_c = the number of beam-to-upright connections

N_b = the number of base plate connections

$$k_{be} = \frac{6EI_b}{L} \quad k_{ce} = \frac{4EI_c}{H} \quad k_b = \frac{EI_c}{H}$$

L = the clear span of the beams

H = the clear height of the upright

I_b = the moment of inertia about the bending axis of each beam

I_c = the moment of inertia of each base upright

E = the Young's modulus of the beams

# of levels	6
min. # of bays	3
N_c	72
N_b	8
k_c	500 kip-in/rad
k_{be}	2894 kip-in/rad
k_b	263 kip-in/rad
k_{ce}	1055 kip-in/rad
I_b	1.57 in^4
L	96 in
I_c	3.65 in^4
H	408 in
E	29500 ksi

Level	h_{pi}	W_{pi}
1	105 in	4 kip
2	177 in	4 kip
3	249 in	4 kip
4	321 in	4 kip
5	381 in	4 kip
6	442 in	0 kip

α_s = 0.86

Per RMI 2012 7.1.3

$$\theta_b = \frac{C_d(1+\alpha_S)M_b}{k_b}$$

C_d= the deflection amplification factor per section 2.6.6
M_b= the base moment from analysis
Θ_b= 0.26

Per RMI 2012 2.6.6,

in unbraced direction, seismic separation for rack structure is 0.05 h_{total}. Therefore

$\tan\Theta_{max}$=0.5 Θ_{max}=2.862 rad Θ_b ok

Maximum moment in base plate

M_{max}= if one anchor, then 0 OR (# of anchors / 2) * anchor pull out capacity * spacing of anchor(Sx)

M_{max}=46,592 kip-in $\geq M_b$ OK

SLAB AND SOIL ANALYSIS (LRFD)

Slab/Soil analysis based on Empirical Method - FEMA 460 Appendix D

P_{max} = Gravity_Load (see Basic Load Combinations) = **30,339 lbs**

f'_t = $7.5 \cdot (f'_c)^{1/2}$ = **474 psi**

$d,req'd$ = $(P_{max}/(\phi \cdot 1.72 \cdot ((K_s \cdot r_1 / E_c) \cdot 10^4 + 3.6) \cdot f'_t))^{1/2}$ = **3.799 in.**

b = $(E_c \cdot d,req'd^3 / (12 \cdot (1 - \mu^2) \cdot k_s))^{1/4}$ = **24.096 in.**

$b,req'd$ = $1.5 \cdot b$ = **36 in.**

P_n = $1.72[(k_s \cdot r_1 / E_c) \cdot 10^4 + 3.6] \cdot f'_t \cdot t^2$ = **224,186 lbs**

P_a = $\phi \cdot P_a$ = **134,512 lbs**

P_{max} / P_a = **0.23**

SLAB AND SOIL ANALYSIS (ASD)

P_{max} = MAX(ASD Load Combo 1, ASD Load Combo 2, ASD Load Combo 3)
= **21,362 lbs**

f'_t = $7.5 \cdot (f'_c)^{1/2}$ = **474 psi**

P_n = $1.72[(k_s \cdot r_1 / E_c) \cdot 10^4 + 3.6] \cdot f'_t \cdot t^2$ = **224,186 lbs**

$d,req'd$ = $(P_{max}/(\phi \cdot 1.72 \cdot ((K_s \cdot r_1 / E_c) \cdot 10^4 + 3.6) \cdot f'_t))^{1/2}$ = **3.799 in.**

b = $(E_c \cdot d,req'd^3 / (12 \cdot (1 - \mu^2) \cdot k_s))^{1/4}$ = **24.096 in.**

$b,req'd$ = $1.5 \cdot b$ = **36 in.**

P_a = P_n / Ω = **74,729 lbs**

P_{max} / P_a = **0.29**

Base Plate	
Width B	10 in.
Depth W	10 in.

Frame	
Frame depth d	44 in.

Concrete	
Thickness t	8 in.
f'c	4,000 psi
ϕ	0.6
Ω	3
λ	1
k_s	50 pci
r_1	5 in
E_c	3,604,997 psi