12/11/2023 | Submission Number 2 | Revision Number

NEW SERVER ROOM AND STORAGE AT MEZZANINE WITH HVAC SYSTEM.

1442 S BON VIEW AV

B202301766

B202301766

CITY OF ONTARIO

City of Ontario | Building Department
**APPROVED & REVIEWED**
**FOR CODE COMPLIANCE**
The issuance of a permit and approval of these plans shall not be construed to permit or approve any violation of the applicable codes or ordinances.
Date: 01/16/2024 1:39:17 PM

# STRUCTURAL CALCULATIONS

# FOR

# TRANSPORTATION CENTER

# ONTARIO-MONTCLAIR SCHOOL DISTRICT

**ONTARIO, CA**

**KNA No. 403.022**

**December 2023**

**REVIEWED**
*FOR*
CODE COMPLIANCE
*Dec 15, 2023*
BPR CONSULTING GROUP

**Prepared Under the Direction of:**

REGISTERED PROFESSIONAL ENGINEER
JOSH RANDALL
No. 4506
Exp. 6-30-25
STRUCTURAL
★ STATE OF CALIFORNIA ★

**Josh Randall**

**Registered Structural Engineer, S.E. 4506 (CA)**

KNA STRUCTURAL ENGINEERS

9931 Muirlands Blvd., Irvine, CA 92618
Tel (949) 462-3200 • Fax (949) 462-3201
www.KNAstructural.com

TRANSPORTATION CENTER
ONTARIO-MONTCLAIR SCHOOL DISTRICT
ONTARIO, CA



KNA Job No. 403.022
December, 2023

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| | | | |
|---|---|---|---|
| PROJECT | OMSD TRANSPORTATION CENTER | SHEET | |
| | | JOB NO | 403.022 |
| | | DATE | 09/23 |
| CLIENT | PBK | BY | AJMS |

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# Project Design Criteria

TO BE INCLUDED IN DWGs ON ARCH SHEETS AS WELL

## PROJECT DESIGN CRITERIA

1. BASIC DESIGN LIVE LOADS:

| | |
|---|---|
| ROOF: | 20 PSF (REDUCIBLE) |
| FLOOR: | |
| MEZZANINE LIGHT STORAGE: | 125 PSF |
| MEZZANINE HEAVY STORAGE: | 250 PSF |

2. WIND LOADS

RISK CATEGORY: II
EXPOSURE CATEGORY: C
ULTIMATE DESIGN WIND SPEED (3-SECOND GUST), $V_{ULT}$ = 110 MPH
NOMINAL DESIGN WIND SPEED, $V_{ASD}$ = 85 MPH
VELOCITY PRESSURE EXPOSURE COEFFICIENT, $K_Z$ = 0.84 (@ 25 FT)
TOPOGRAPHIC FACTOR, $K_{Zt}$ = 1.0
WIND DIRECTIONALITY FACTOR, $K_d$ = 0.85
GROUND ELEVATION FACTOR, Ke = 0.96 (@ 912 FT ASL)

A. MWFRS – DIRECTIONAL PROCEDURE (ASCE 7–16, CH. 27 PART 1)

$q_Z = 0.00256\ K_Z\ K_{Zt}\ K_d\ Ke\ V_{ULT}^2 =$ 23.9 PSF

$P = qGC_P - q_i(GC_{Pi})$

GUST EFFECT FACTOR, G = 0.85
EXTERNAL PRESSURE COEFFICIENT, $C_P$ = [FIG. 27.4–1 THRU 27.4–3] 27.4–3]
INTERNAL PRESSURE COEFFICIENT, $(GC_{Pi})$ = TABLE 26.13–1

B. COMPONENTS & CLADDING (ASCE 7–16, CH. 30)

$q_h = 0.00256\ K_Z\ K_{Zt}\ K_d\ V_{ULT}^2 =$ 19.6 PSF

$P = q_h\ [(GC_P) - (GC_{Pi})]$

GUST EFFECT FACTOR, G = 0.85
EXTERNAL PRESSURE COEFFICIENT, $(G_{CP})$ = [FIG. 30.3–1 THRU 30.3–7]
INTERNAL PRESSURE COEFFICIENT, $(GC_{Pi})$ = TABLE 26.13–1

3. EARTHQUAKE LOADS

<u>SEISMIC DESIGN CRITERIA</u>

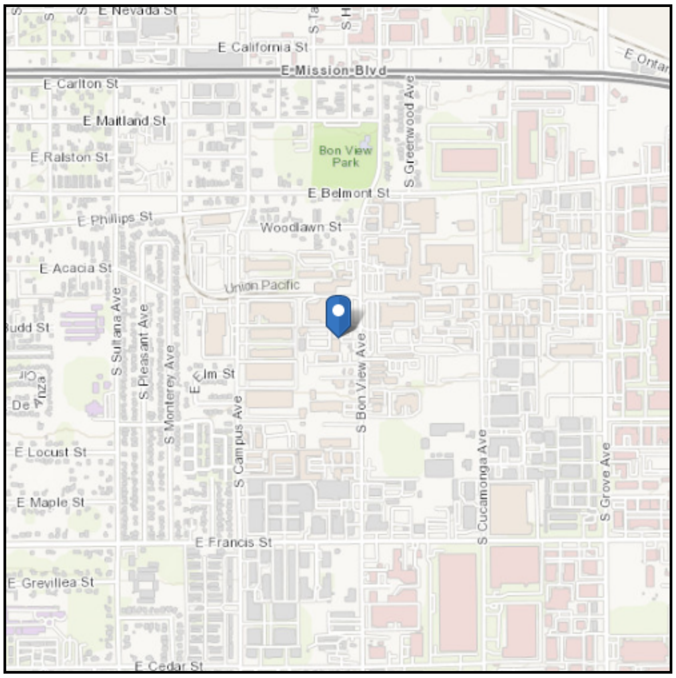
$S_S$ = 1.740g
$S_1$ = 0.570g
SITE CLASS: D
$F_A$ = 1.0
$F_V$ = 1.7
$S_{DS}$ = 1.250g
$S_{D1}$ = 0.930g
RISK CATEGORY: II
SEISMIC DESIGN CATEGORY: D

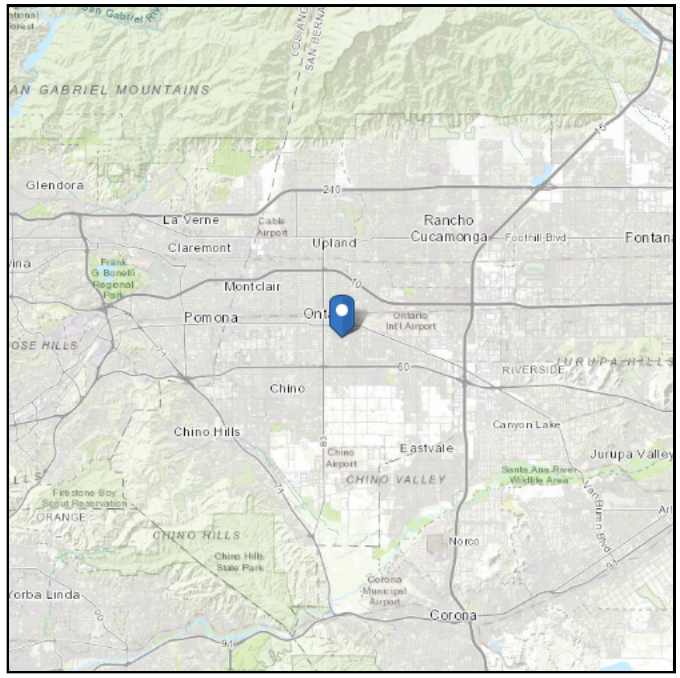
# ASCE 7 Hazards Report

**Address:**
1442 S Bon View Ave
Ontario, California
91761

**Standard:** ASCE/SEI 7-22
**Risk Category:** III
**Soil Class:** Default

**Latitude:** 34.047143
**Longitude:** -117.638079
**Elevation:** 906.9511123098362 ft (NAVD 88)




## Wind

**Results:**

| | |
|---|---|
| Wind Speed | 102 Vmph |
| 10-year MRI | 66 Vmph |
| 25-year MRI | 72 Vmph |
| 50-year MRI | 77 Vmph |
| 100-year MRI | 81 Vmph |
| 300-year MRI | 89 Vmph |
| 700-year MRI | 95 Vmph |
| 1,700-year MRI | 102 Vmph |
| 3,000-year MRI | 106 Vmph |
| 10,000-year MRI | 115 Vmph |
| 100,000-year MRI | 133 Vmph |
| 1,000,000-year MRI | 151 Vmph |

Data Source: ASCE/SEI 7-22, Fig. 26.5-1C and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Tue Sep 19 2023

Special Wind Region -- This site is in a special wind region as shown in Fig. 26.5-1 and should 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.

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 3% probability of exceedance in 50 years (annual exceedance probability = 0.000588, MRI = 1,700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2.

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# Seismic

Default

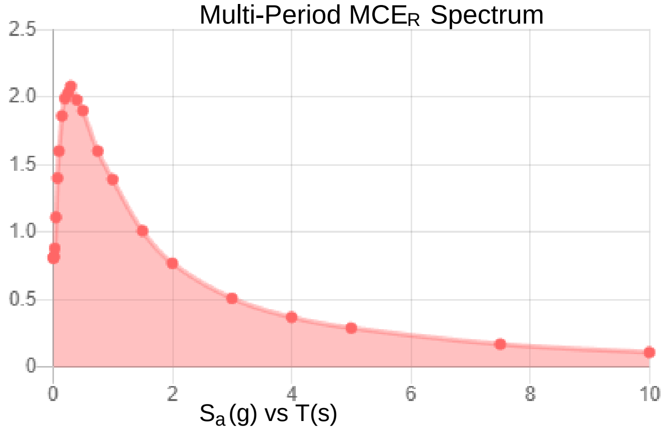
**Site Soil Class:**

**Results:**

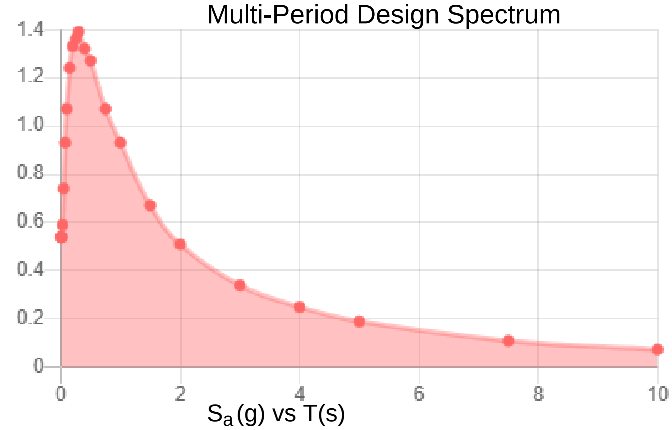
| | | | |
|---|---|---|---|
| $PGA_M$ : | 0.67 | $T_L$ : | 8 |
| $S_{MS}$ : | 1.87 | $S_S$ : | 1.74 |
| $S_{M1}$ : | 1.39 | $S_1$ : | 0.57 |
| $S_{DS}$ : | 1.25 | $V_{S30}$ : | 260 |
| $S_{D1}$ : | 0.93 | | |

**Seismic Design Category: D**

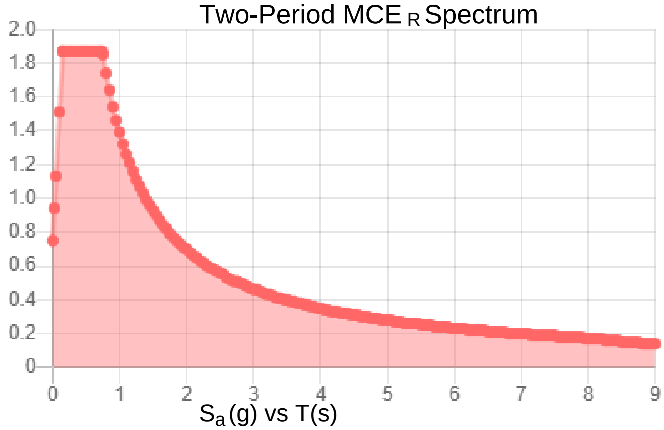
Multi-Period $MCE_R$ Spectrum



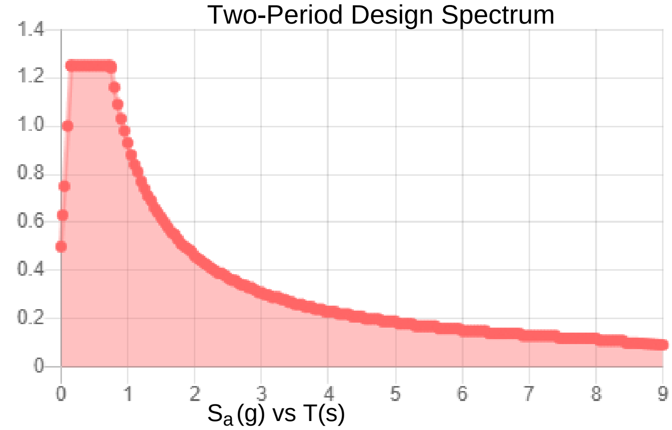

Multi-Period Design Spectrum




Two-Period $MCE_R$ Spectrum




Two-Period Design Spectrum




$MCE_R$ Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

**Data Accessed:** **Tue Sep 19 2023**

**Date Source:**

**USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.**

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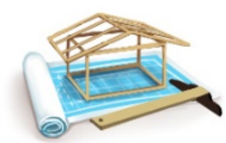
AMERICAN SOCIETY OF CIVIL ENGINEERS

CITY OF ONTARIO
BUILDING DEPARTMENT
303 East B Street
Ontario, CA 91764
Ph (909)395-2023, Fax (909)395-2180

INFORMATION BULLETIN
**103**
Effective: 1 / 1 / 2023
Revised: 9 / 6 / 2023

# CITY OF ONTARIO

# STRUCTURES BASIC DESIGN CRITERIA



## STRUCTURES DESIGN CRITERIA:

| | | | |
|---|---|---|---|
| **Seismic Design Category (SDC)** | D | 2022 CBC | |
| | $D_2$ | 2022 CRC | |
| **Basic Wind Speed** (per City Ordinance)<br>*Note:*<br>$V_{ult}$ = ultimate design wind speed | $V_{ult}$ = 103 mph | For Risk Category I | 2022 CBC |
| | $V_{ult}$ = 110 mph | For Risk Category II | |
| | $V_{ult}$ = 118 mph | For Risk Category III | |
| | $V_{ult}$ = 122 mph | For Risk Category IV | |
| | $V_{ult}$ = 110 mph | 2022 CRC | |
| **Wind Exposure** (per City Ordinance) | C | | |
| **Soil Bearing Capacity** | 1,500 psf (default value per 2022 CBC Table 1806.2) or per soil report. | | |
| **Soil Lateral Bearing Capacity** | 100 psf/ft (default value per 2022 CBC Table 1806.2) or per soil report. | | |
| **Climate Zone** | 10 | | |
| **Rainfall** | 2” per hour or per hydrology report | | |

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SHEET

PROJECT OMSD TRANSPORTATION CENTER

JOB NO 403.022

DATE 09/23

CLIENT PBK

BY AJMS

CLIENT NO.

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# CALCULATIONS

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| | | | |
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# (E) FRAMING CHECK (GRAVITY)

See snips below from As-Builts that show storage floor loading at the mezzanine floor. See below for information on each reference snip.
As-Builts show thorough information proving gravity members were designed to support CBC standard storage loads & Interior partition weight already.
(N) storage room created and the rest of the area will still function as light storage. No new forklift entry points have been created so no movement of heavy storage area.

LOADING INFORMATION

| | | |
|---|---|---|
| LIVE LOAD: | 20.0 | PSF |
| FRAME LOAD: | 12<br>16 | PSF (OVER 600 SQ FT)<br>PSF (200-600 SQ FT) |
| WIND LOAD: | 70. | MPH |
| ADDL LOAD: | 5.0 | PSF |
| BLDG YR/CODE: | 88 UBC | |
| SEISMIC ZONE: | 4 | |
| MBMA BLDG USE: | 1 | |
| EXPOSURE: | B | |

ACCESSORIES

SEE ACCESSORY LISTINGS ON ATTACHED ELEVATIONS AND PLAN DRAWINGS.

ADDITIONAL LOADS

FLOOR LOADS: 250/125 PSF

1.35 TON UNDERHUNG BRIDGE CRANE

## Cover Page Design Parameters

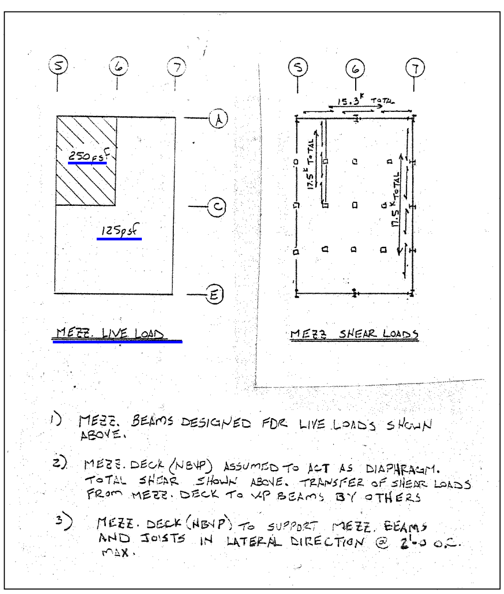
Floor Live Loads listed & match CBC standard.
5.0 PSF of Add'l Loading shown as well.

3.) DESIGN REQUIREMENTS:

a. Top Cord is/~~is not~~ supported by the deck.
b. Live Load deflection shall not exceed (~~L/240~~, L/360).
c. Design Joist Spacing = 2.0 ft. 1.5'
d. Design Live Load = 125 PSF. 250psf
Gross Wind Uplift = — PSF. —
Deck Dead Load = 35 PSF. 35psf
User Collateral Load = — PSF. —
Concentrated Dead Loads as indicated on drawing.

## Mezzanine General Notes

Again, Storage Live floor loads shown.
Dead Load Listed as well.
And a note, Joist spacing increased at heavy storage areas, proving the storage loads were considered.




## Mezzanine Loads Overview

Storage live loads shown graphically to where applicable, light storage covers entire floor area.

**THEREFORE, (E) MEZZANINE FLOOR FRAMING ADEQUATE TO SUPPORT STORAGE AND ADDED WEIGHT FROM INTERIOR PARTITIONS.**

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# (E) FRAMING CHECK (LATERAL)

See snips below from As-Builts that show storage floor loading at the mezzanine floor and 5 PSF add'l weight, typically for interior partitions. See below for information on each reference snip.

As-Builts show thorough information proving lateral members were designed to support CBC standard storage loads. 1988 UBC Section 2312.(e).1.A, addresses inclusion of 25% of LL to seismic load.

(N) storage room created and the rest of the area will still function as light storage. No new forklift entry points have been created so no movement of heavy storage area.

**LOADING INFORMATION**

| | | |
|---|---|---|
| LIVE LOAD: | 20.0 | PSF |
| FRAME LOAD: | 12<br>16 | PSF (OVER 600 SQ FT)<br>PSF (200-600 SQ FT) |
| WIND LOAD: | 70. | MPH |
| ADDL LOAD: | 5.0 | PSF |
| BLDG YR/CODE: | 88 UBC | |
| SEISMIC ZONE: | 4 | |
| MBMA BLDG USE: | 1 | |
| EXPOSURE: | B | |

**ACCESSORIES**

SEE ACCESSORY LISTINGS ON ATTACHED ELEVATIONS AND PLAN DRAWINGS.

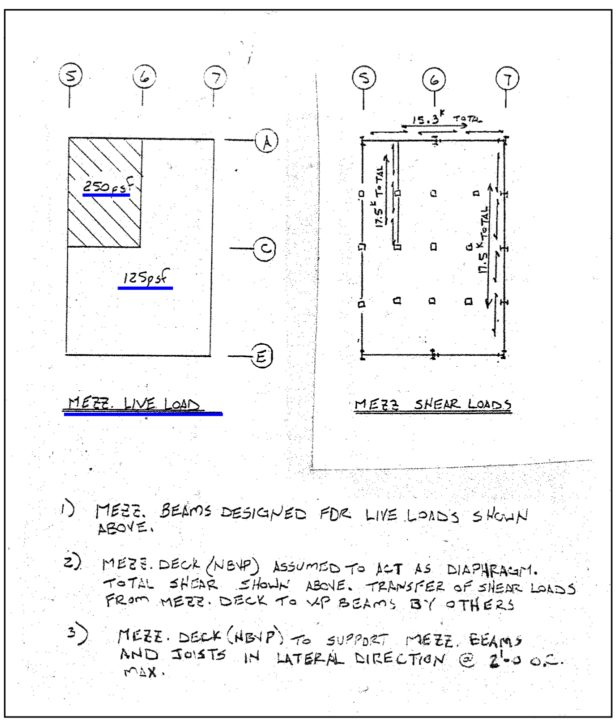
**ADDITIONAL LOADS**

FLOOR LOADS: 250/125 PSF

1.35 TON UNDERHUNG BRIDGE CRANE

### Cover Page Design Parameters

5.0 PSF of Add'l Loading shown as well, standard for when considering interior partitions. This weight gets included in seismic weight for lateral force, therefore (E) frames already designed to support interior partition walls.




### Mezzanine Loads Overview

Storage live loads shown graphically to where applicable.

Also noted is that the Mezzanine floor was designed to act as a diaphragm & would transfer the loads accordingly. These resultant shear loads are also shown transferring to the respective frame.

**THEREFORE, (E) MEZZANINE LATERAL FRAMING ADEQUATE TO SUPPORT STORAGE AND ADDED WEIGHT FROM INTERIOR PARTITIONS.**

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## ADD'L SEISMIC WT CHECK

TO FURTHER DEMONSTRATE THAT THE (E) SYSTEM CAN TAKE THE SMALL ADD'L LOADS FROM INTERIOR PARTITIONS AND CLG WEIGHT, THE FOLLOWING CALCS SHOWS ADDED SEISMIC MASS AS A PERCENTAGE OF THE (E) SEISMIC MASS. % CHANGE IS MINIMAL, < 5%

NOTE: SEE PREVIOUS PAGES WHERE 5 PSF OF "EXTRA LOADS" WAS ALREADY CONSIDERED IN ORIGINAL DESIGN

### MEZZANINE ADD'L SEISMIC MASS CHECK

(E) Mezz Seismic Mass

| | | | |
|---|---|---|---|
| Floor DL | = | 35 PSF | PER AS BUILTS |
| Floor Area | = | 2400 $FT^2$ | 40' x 60' |
| Storage Light LL | = | 125 PSF | |
| L. Stor. Area | = | 1800 $FT^2$ | |
| Storage Heavy LL | = | 250 PSF | |
| H. Stor. Area | = | 600 $FT^2$ | |
| (E) Mezz S. Mass | = | 177.75 KIPS | =(35*2400) + (0.25*((125*1800)+(250*600))) |

(N) Interior Partition Mezz Seismic Mass

| | | | |
|---|---|---|---|
| Part. Wall DL | = | 8 PSF | PER DL TAKEOFF, SEE NEXT PAGE |
| Wall Area | = | 780 $FT^2$ | 120' Long x 13' Tall x 1/2 (BOTTOM HALF OF WALL) |
| S. Wall Mass | = | 6.24 KIPS | |

% Floor Mass Added = 3.5% < 5%

THERFORE, MEZZANINE LATERAL SYSTEM OK FOR ADD'L LOADS

### ROOF SEISMIC MASS CHECK

(E) Roof Seismic Mass

| | | | |
|---|---|---|---|
| Roof DL | = | 17 PSF | PER AS-BUILTS (12 psf + 5 psf |
| Roof Area | = | 7680 $FT^2$ | 128' x 60' |
| Wall DL | = | 15 PSF | |
| Wall Area | = | 4324 $FT^2$ | 376' Long x 23' Tall x 1/2 (BOTTOM HALF OF WALL) |
| (E) Roof S. Mass | = | 195.42 KIPS | =(17*7680) + (15*4324) |

(N) Roof Seismic Mass

| | | | |
|---|---|---|---|
| Part. Wall DL | = | 8 PSF | PER DL TAKEOFF, SEE NEXT PAGE |
| Wall Area | = | 780 $FT^2$ | 120' Long x 13' Tall x 1/2 (TOP HALF OF WALL) |
| S. Wall Mass | = | 6.24 KIPS | |
| CLG DL | = | 4 PSF | SUSPENDED CLG |
| CLG Area | = | 670 $FT^2$ | |
| S. Roof Mass | = | 2.68 KIPS | 8.92 KIP TOTAL |

% Roof Mass Added = 4.6% < 5%

THERFORE, ROOF DECK SUPPORTING LATERAL SYSTEM OK FOR ADD'L LOADS

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| CLIENT | PBK | BY | AMS |

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## DESIGN LOADS

### TYP. (N) INTERIOR PARTITION WALL

| | | |
|---|---|---|
| 3-5/8" x 25 GA. METAL STUDS @ 16" O.C. | 1.0 | PSF |
| (2) SIDES OF 5/8" GYP. BOARD | 5.6 | |
| INSULATION | 1.0 | |
| MISC | 0.4 | |
| DEAD LOAD = | 8.0 | PSF |
| LIVE LOAD = (LIGHT STORAGE) | 125.0 | PSF |

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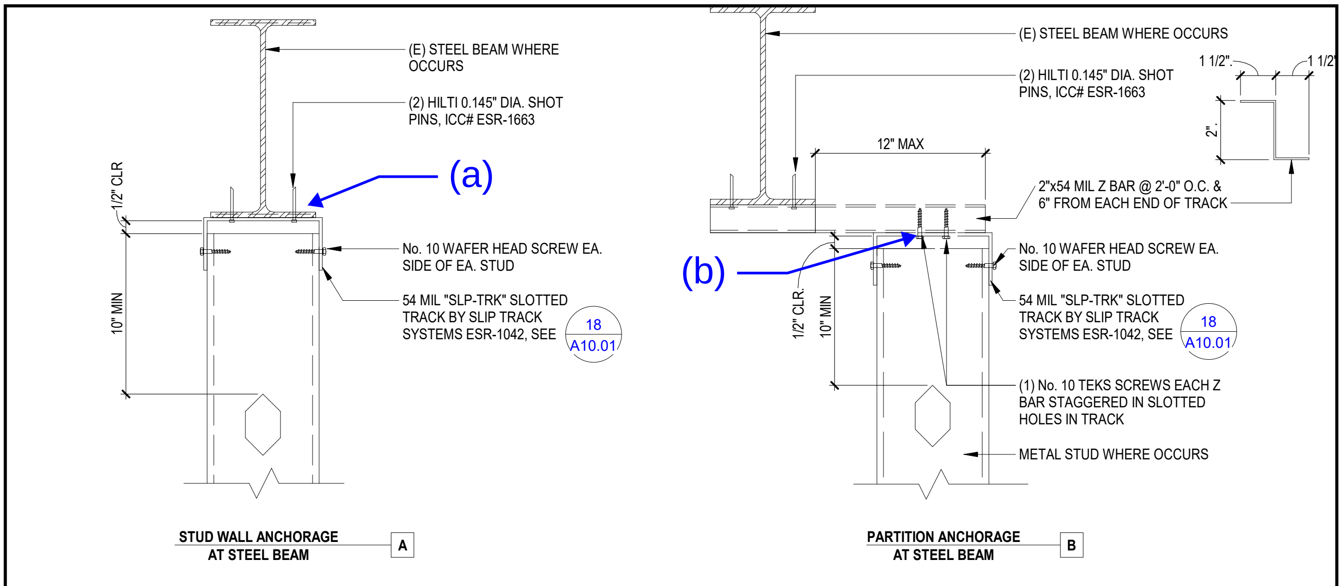
## PARTITION WALL TOP SUPPORT CONNECTION TO STEEL BEAM

-a) CHECKING #10 SMS TO RESIST OOP RXN FROM TRACK TO Z BAR

-b) CHECKING HILTI X-R SHOT PIN TO RESIST OOP RXN FROM TRACK TO STEEL BEAM




**24** PARTITION ANCHOR. AT BEAM

3" = 1'-0"

LOADING

| | | | |
|---|---|---|---|
| TRIB WIDTH | = | 2 FT | |
| W | = | 12.0 PSF | INTERIOR OOP LOADING |
| HEIGHT | = | 13 FT | |
| WL | = | 24.00 PLF | |
| $P_{MAX}$ | = | 156 # | 1.0E |

a) TOP TRACK SHOT PIN CONN. CAPACITY

-(2) HILTI X-R PINS @ 2'-0" O.C. MAX (0.145"ø ICC ESR-1663)

ALL. SHEAR = 380 # MIN. STEEL THICKNESS (CONSERVATIVE)

SHEAR STRESS RATIO: $Z_{ACT} / Z'_{ALL}$ = 0.4105

(2) 0.145"ø HILTI X-R SHOT PINS @ 2'-0" O.C. MAX ADEQUATE FOR PARTITION TOP SUPPORT. MAX HT = 13'-0"

b) TOP TRACK SCREW CONN. CAPACITY

-(2) #10 TEK SCREWS PER ICC ESR-1976

ALL. SHEAR = 462.4 # *0.8 (SEIS REDUCTION FACTOR)

SHEAR STRESS RATIO: $Z_{ACT} / Z'_{ALL}$ = 0.3374

(2) #10 TEK SCREWS @ EA. ZBAR @ 2'-0" O.C. MAX ADEQUATE FOR PARTITION TOP SUPPORT. MAX HT = 13'-0"

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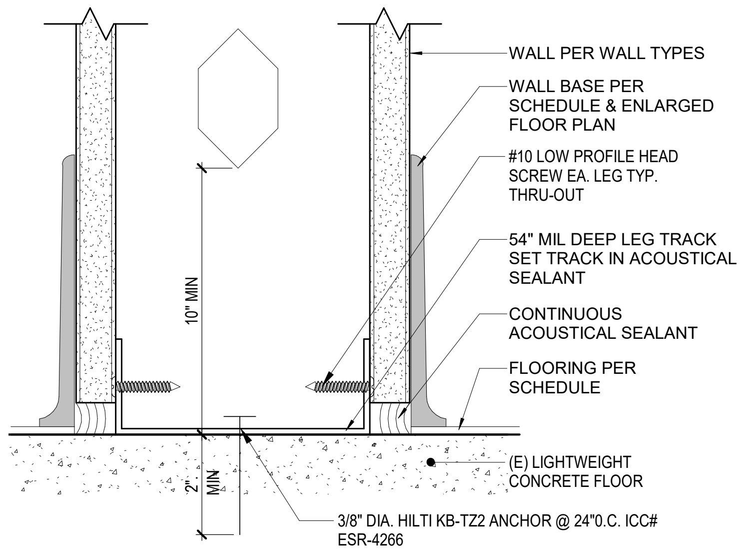
## PARTITION WALL FLOOR SUPPORT CONNECTION TO CONC OVER METAL DECK

-a) CHECKING 1/4" HILTI KB-TZ2 @ 24" O.C. FROM BOTTOM TRACK TO CONC. OVER METAL DECK
AS-BUILTS DO NOT PROVIDE EXACT DECK CONCRETE THICKNESS, BUT CONSERVATIVELY CONSIDERED AS 2.5" MIN, AND ANCHOR EMBED AS BEEN REDUCED TO MIN POSSIBLE EMBED OF 1.5" EFF.




SEE FINAL DRAWINGS FOR BOLT INFORMATION

**05** TYPICAL MTL STUD WALL BASE
6" = 1'-0"

LOADING

| | | | |
|---|---|---|---|
| TRIB WIDTH | = | 2 FT | |
| W | = | 10.0 PSF | INTERIOR OOP LOADING - DBL GYP (CONSERVATIVE) |
| HEIGHT | = | 13 FT | |
| WL | = | 20.00 PLF | |
| | | | |
| $P_{MAX}$ | = | 130 # | 1.0E |
| $P_{MAX}$ | = | 325 # | 1.0E * Ω |

a) BOTTOM TRACK KB-TZ2 TO CONC OVER METAL DECK

-(1) 1/4"ø HILTI KB-TZ2 @ 2'-0" O.C. MAX W/1.5" MIN. EMBED (ICC ESR-1663)
2.5" MIN. CONC. THICKNESS & 2500 PSI MIN. ASSUMED CONSERVATIVELY

% MAX UTILIZATION: 44%

1/4" HILTI KB-TZ2 @ 2'-0" O.C. MAX W/ 1.5" MIN. EMBED (ICC ESR-4266) IS ADEQUATE

SEE FOLLOWING PAGES FOR HILTI PROFIS ENGINEERING REPORT

www.hilti.com

| | | | |
|---|---|---|---|
| Company: | | Page: | 1 |
| Address: | | Specifier: | |
| Phone I Fax: | \| | E-Mail: | |
| Design: | KB-TZ2 @ Bottom Track Connection | Date: | 11/30/2023 |
| Fastening point: | | | |

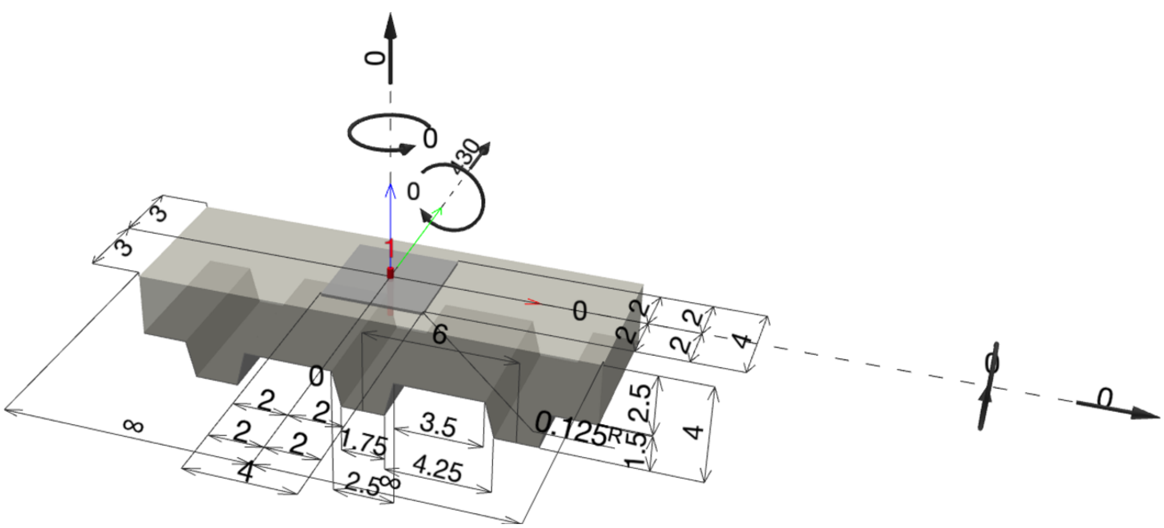
**Specifier's comments:**

## 1 Input data

| | |
|---|---|
| Metal deck: | B Deck |
| Metal deck type: | B |
| Anchor installation: | On top of concrete-filled metal deck |
| **Anchor type and diameter:** | **Kwik Bolt TZ2 - CS 1/4** |
| Item number: | 2210173 KB-TZ2 1/4x2 1/8 |
| Effective embedment depth: | $h_{ef,act}$ = 1.500 in., $h_{nom}$ = 1.750 in. |
| Material: | Carbon Steel |
| Evaluation Service Report: | ESR-4266 |
| Issued I Valid: | 12/17/2021 \| 12/1/2023 |
| Proof: | Design Method ACI 318-14 / Mech in concrete over metal deck installation |
| Stand-off installation: | $e_b$ = 0.000 in. (no stand-off); t = 0.125 in. |
| Anchor plate[R] : | $l_x$ x $l_y$ x t = 4.000 in. x 4.000 in. x 0.125 in.; (Recommended plate thickness: not calculated) |
| Profile: | no profile |
| Base material: | cracked concrete, 3000, $f_c$' = 3,000 psi; h = 2.500 in. |
| **Installation:** | **hammer drilled hole, Installation condition: Dry** |
| Reinforcement: | tension: condition B, shear: condition B; no supplemental splitting reinforcement present |
| | edge reinforcement: none or < No. 4 bar |

[R] - The anchor calculation is based on a rigid anchor plate assumption.

**Geometry [in.] & Loading [lb, in.lb]**



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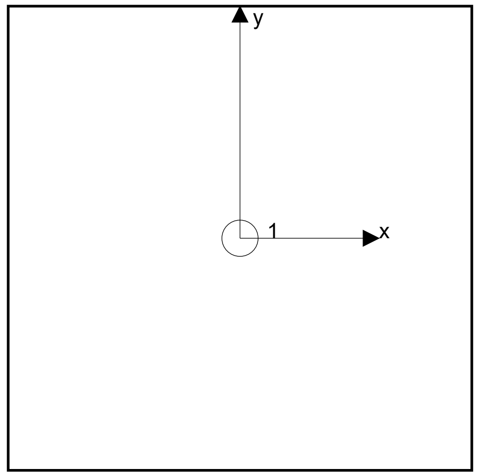
| Design: | KB-TZ2 @ Bottom Track Connection | Date: | 11/30/2023 |
| Fastening point: | | | |

### 1.1 Design results

| Case | Description | Forces [lb] / Moments [in.lb] | Seismic | Max. Util. Anchor [%] |
|---|---|---|---|---|
| 1 | Combination 1 | $N = 0; V_x = 0; V_y = 430;$ $M_x = 0; M_y = 0; M_z = 0;$ | no | 58 |

## 2 Load case/Resulting anchor forces




**Anchor reactions [lb]**
Tension force: (+Tension, -Compression)

| Anchor | Tension force | Shear force | Shear force x | Shear force y |
|---|---|---|---|---|
| 1 | 0 | 430 | 0 | 430 |

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

## 3 Tension load

| | Load $N_{ua}$ [lb] | Capacity $\phi$ $N_n$ [lb] | Utilization $\beta_N = N_{ua}/\phi$ $N_n$ | Status |
|---|---|---|---|---|
| Steel Strength* | N/A | N/A | N/A | N/A |
| Pullout Strength* | N/A | N/A | N/A | N/A |
| Concrete Breakout Failure** | N/A | N/A | N/A | N/A |

* highest loaded anchor **anchor group (anchors in tension)

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| Fastening point: | | | |

## 4 Shear load

| | Load $V_{ua}$ [lb] | Capacity $\phi$ $V_n$ [lb] | Utilization $\beta_V = V_{ua}/\phi\ V_n$ | Status |
|---|---|---|---|---|
| Steel Strength* | 430 | 875 | 50 | OK |
| Steel failure (with lever arm)* | N/A | N/A | N/A | N/A |
| Pryout Strength** | 430 | 1,197 | 36 | OK |
| Concrete edge failure in direction y+** | 430 | 744 | 58 | OK |

* highest loaded anchor **anchor group (relevant anchors)

### 4.1 Steel Strength

$V_{sa}$ = ESR value refer to ICC-ES ESR-4266
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

**Variables**

| $A_{se,V}$ [in.$^2$] | $f_{uta}$ [psi] |
|---|---|
| 0.02 | 122,404 |

**Calculations**

| $V_{sa}$ [lb] |
|---|
| 1,346 |

**Results**

| $V_{sa}$ [lb] | $\phi_{steel}$ | $\phi\ V_{sa}$ [lb] | $V_{ua}$ [lb] |
|---|---|---|---|
| 1,346 | 0.650 | 875 | 430 |

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| Fastening point: | | | |

### 4.2 Pryout Strength

$V_{cp} = k_{cp} \left[ \left( \frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ed,N} \; \psi_{c,N} \; \psi_{cp,N} \; N_b \right]$ — ACI 318-14 Eq. (17.5.3.1a)

$\phi \; V_{cp} \geq V_{ua}$ — ACI 318-14 Table 17.3.1.1

$A_{Nc}$ see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$A_{Nc0} = 9 \; h_{ef}^2$ — ACI 318-14 Eq. (17.4.2.1c)

$\psi_{ed,N} = 0.7 + 0.3 \left( \frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0$ — ACI 318-14 Eq. (17.4.2.5b)

$\psi_{cp,N} = \text{MAX}\left( \frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0$ — ACI 318-14 Eq. (17.4.2.7b)

$N_b = k_c \; \lambda_a \; \sqrt{f'_c} \; h_{ef}^{1.5}$ — ACI 318-14 Eq. (17.4.2.2a)

**Variables**

| $k_{cp}$ | $h_{ef}$ [in.] | $c_{a,min}$ [in.] | $\psi_{c,N}$ |
|---|---|---|---|
| 1 | 1.500 | 3.000 | 1.000 |

| $c_{ac}$ [in.] | $k_c$ | $\lambda_a$ | $f'_c$ [psi] |
|---|---|---|---|
| 5.000 | 17 | 1.000 | 3,000 |

**Calculations**

| $A_{Nc}$ [in.$^2$] | $A_{Nc0}$ [in.$^2$] | $\psi_{ed,N}$ | $\psi_{cp,N}$ | $N_b$ [lb] |
|---|---|---|---|---|
| 20.25 | 20.25 | 1.000 | 1.000 | 1,711 |

**Results**

| $V_{cp}$ [lb] | $\phi_{concrete}$ | $\phi \; V_{cp}$ [lb] | $V_{ua}$ [lb] |
|---|---|---|---|
| 1,711 | 0.700 | 1,197 | 430 |

### 4.3 Concrete edge failure in direction y+

$V_{cb} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ — ACI 318-14 Eq. (17.5.2.1a)

$\phi\ V_{cb} \geq V_{ua}$ — ACI 318-14 Table 17.3.1.1

$A_{Vc}$ see ACI 318-14, Section 17.5.2.1, Fig. R 17.5.2.1(b)

$A_{Vc0} = 4.5\ c_{a1}^2$ — ACI 318-14 Eq. (17.5.2.1c)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ — ACI 318-14 Eq. (17.5.2.6b)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ — ACI 318-14 Eq. (17.5.2.8)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2} \sqrt{d_a}\right) \lambda_a \sqrt{f'_c}\ c_{a1}^{1.5}$ — ACI 318-14 Eq. (17.5.2.2a)

**Variables**

| $c_{a1}$ [in.] | $c_{a2}$ [in.] | $\psi_{c,V}$ | $h_a$ [in.] | $l_e$ [in.] |
|---|---|---|---|---|
| 3.000 | - | 1.000 | 2.500 | 1.500 |

| $\lambda_a$ | $d_a$ [in.] | $f'_c$ [psi] | $\psi_{parallel,V}$ |
|---|---|---|---|
| 1.000 | 0.250 | 3,000 | 1.000 |

**Calculations**

| $A_{Vc}$ [in.$^2$] | $A_{Vc0}$ [in.$^2$] | $\psi_{ed,V}$ | $\psi_{h,V}$ | $V_b$ [lb] |
|---|---|---|---|---|
| 22.50 | 40.50 | 1.000 | 1.342 | 1,425 |

**Results**

| $V_{cb}$ [lb] | $\phi_{concrete}$ | $\phi\ V_{cb}$ [lb] | $V_{ua}$ [lb] |
|---|---|---|---|
| 1,062 | 0.700 | 744 | 430 |

## 5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-14, Section 17.8.1.

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| Fastening point: | | | |

## Fastening meets the design criteria!

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| Fastening point: | | | |

## 6 Installation data

Profile: no profile

Hole diameter in the fixture: $d_f$ = 0.312 in.

Plate thickness (input): 0.125 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: Kwik Bolt TZ2 - CS 1/4

Item number: 2210173 KB-TZ2 1/4x2 1/8

Maximum installation torque: 48 in.lb

Hole diameter in the base material: 0.250 in.

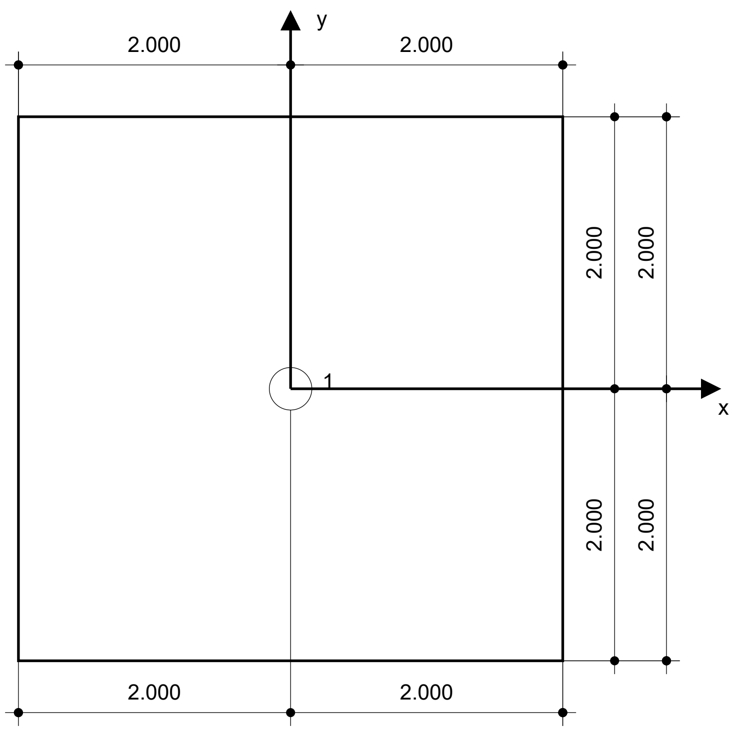
Hole depth in the base material: 2.000 in.

Minimum thickness of the base material: 2.500 in.

Hilti KB-TZ2 stud anchor with 1.75 in embedment, 1/4, Carbon steel, installation per ESR-4266

### 6.1 Recommended accessories

| Drilling | Cleaning | Setting |
|---|---|---|
| • Suitable Rotary Hammer<br>• Properly sized drill bit | • Manual blow-out pump | • Torque wrench<br>• Hammer |




**Coordinates Anchor [in.]**

| Anchor | x | y | $c_{-x}$ | $c_{+x}$ | $c_{-y}$ | $c_{+y}$ |
|---|---|---|---|---|---|---|
| 1 | 0.000 | 0.000 | - | - | 3.000 | 3.000 |

| | | | |
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| Fastening point: | | | |

## 7 Remarks; Your Cooperation Duties

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| | ONTARIO-MONTCLAIR SCHOOL DISTRICT | DATE | 12/23 |
| CLIENT | PBK | BY | AMS |

CLIENT NO. ______

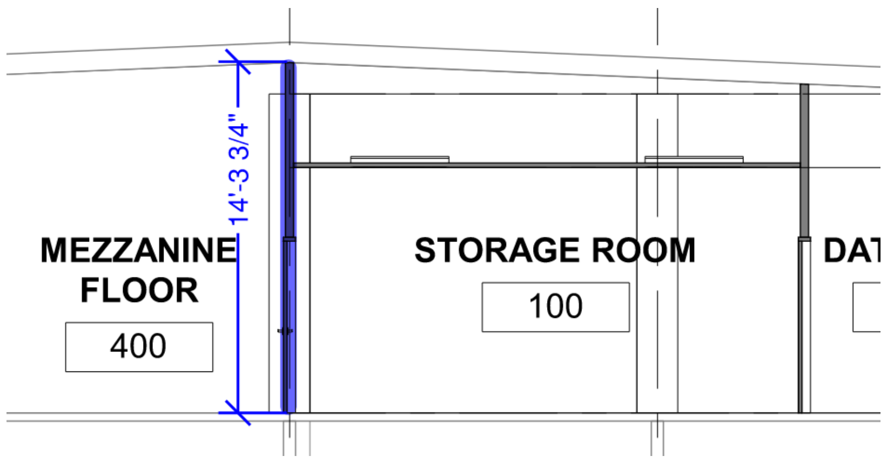
REVIEWED BY ______

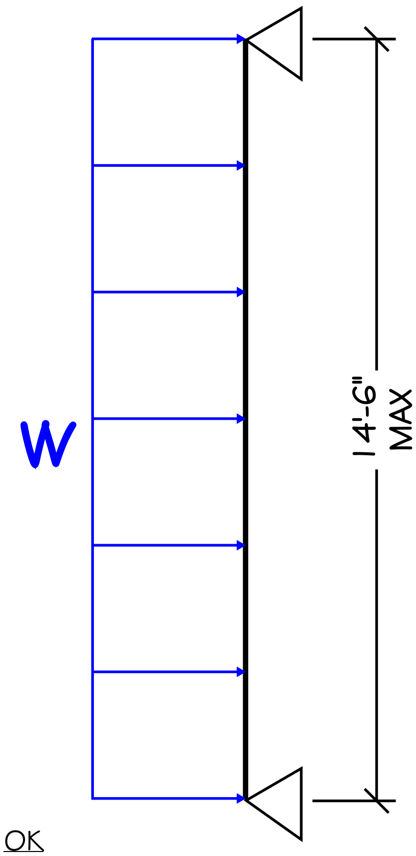
DATE ______



WALL STUD CHECK

CHECKING 362S162-43 STUD SIZE FOR MAX INT. PARTITION HT.




| | | | | |
|---|---|---|---|---|
| STUD HT | = | 14.5 FT | = | 174 IN |
| TRIB WIDTH | = | 1.333 FT | = | 16 IN |
| P | = | 10.0 PSF | | (8 PSF WALL WT) |
| W | = | 13.33 PLF | = | 0.00111 K/IN |

Mu = $(wHT^2/8)$ = 4.21 KIN

TRY: 3-5/8" x 18GA METAL STUDS (362S162-43)

| | | | |
|---|---|---|---|
| Mn (362S162-43) | = | 7.3 KIN | OK |
| $I_{XE}$ (362S162-43) | = | 0.71 $IN^4$ | |

| | | | | |
|---|---|---|---|---|
| P | = | 10 PSF | | |
| W | = | 13.33 PLF | = | 0.00111 K/IN |

$\Delta$ = $(5wl^4)/384EI$ = 0.64 IN

$\Delta$ALL = L/240 = 0.73 IN OK

(SEE ATTACHED CLARK DIETRICH CATALOG SHEET FOR STUD CAPACITIES)

SEE INTERTEK REPORT CCRR-0206 FOR FULL CLARK DIETRICH CATALOG

PROVIDE: MIN. 3-5/8" 18GA METAL STUDS @ 16" O.C.

# INTERIOR WALL HEIGHTS

With structural framing

3-5/8" Structural Framing

| Member | Spacing (in) o.c. | 5psf L/120 | 5psf L/240 | 5psf L/360 |
|---|---|---|---|---|
| 362S137-33 | 12 | 23' 3" | 18' 5" | 16' 1" |
| | 16 | 21' 1" | 16' 9" | 14' 8" |
| | 24 | 17' 6" | 14' 8" | 12' 10" |
| 362S137-43 | 12 | 25' 3" | 20' 1" | 17' 6" |
| | 16 | 23' 0" | 18' 3" | 15' 11" |
| | 24 | 20' 1" | 15' 11" | 13' 11" |
| 362S137-54 | 12 | 27' 1" | 21' 6" | 18' 9" |
| | 16 | 24' 7" | 19' 6" | 17' 1" |
| | 24 | 21' 6" | 17' 1" | 14' 11" |
| 362S137-68 | 12 | 28' 11" | 22' 11" | 20' 1" |
| | 16 | 26' 3" | 20' 10" | 18' 3" |
| | 24 | 22' 11" | 18' 3" | 15' 11" |
| 362S137-97 | 12 | 31' 10" | 25' 3" | 22' 1" |
| | 16 | 28' 11" | 22' 11" | 20' 1" |
| | 24 | 25' 3" | 20' 1" | 17' 6" |
| | | | | |
| 362S162-33 | 12 | 24' 4" | 19' 4" | 16' 11" |
| | 16 | 22' 2" | 17' 7" | 15' 4" |
| | 24 | 18' 9" | 15' 4" | 13' 5" |
| 362S162-43 | 12 | 26' 6" | 21' 0" | 18' 5" |
| | 16 | 24' 1" | 19' 1" | 16' 8" |
| | 24 | 21' 0" | 16' 8" | 14' 7" |
| 362S162-54 | 12 | 28' 5" | 22' 6" | 19' 8" |
| | 16 | 25' 10" | 20' 6" | 17' 11" |
| | 24 | 22' 6" | 17' 11" | 15' 7" |
| 362S162-68 | 12 | 30' 5" | 24' 1" | 21' 1" |
| | 16 | 27' 7" | 21' 11" | 19' 2" |
| | 24 | 24' 1" | 19' 2" | 16' 9" |
| 362S162-97 | 12 | 33' 6" | 26' 7" | 23' 3" |
| | 16 | 30' 5" | 24' 2" | 21' 1" |
| | 24 | 26' 7" | 21' 1" | 18' 5" |

3-5/8" Structural Framing

| Member | Spacing (in) o.c. | 5psf L/120 | 5psf L/240 | 5psf L/360 |
|---|---|---|---|---|
| 362S200-33 | 12 | 25' 8" | 20' 4" | 17' 9" |
| | 16 | 23' 3" | 18' 6" | 16' 2" |
| | 24 | 19' 8" | 16' 2" | 14' 1" |
| 362S200-43 | 12 | 28' 0" | 22' 3" | 19' 5" |
| | 16 | 25' 5" | 20' 2" | 17' 8" |
| | 24 | 22' 3" | 17' 8" | 15' 5" |
| 362S200-54 | 12 | 30' 0" | 23' 10" | 20' 10" |
| | 16 | 27' 3" | 21' 8" | 18' 11" |
| | 24 | 23' 10" | 18' 11" | 16' 6" |
| 362S200-68 | 12 | 32' 2" | 25' 6" | 22' 3" |
| | 16 | 29' 2" | 23' 2" | 20' 3" |
| | 24 | 25' 6" | 20' 3" | 17' 8" |
| 362S200-97 | 12 | 35' 6" | 28' 3" | 24' 8" |
| | 16 | 32' 3" | 25' 8" | 22' 5" |
| | 24 | 28' 3" | 22' 5" | 19' 7" |
| | | | | |
| 362S250-43 | 12 | 29' 6" | 23' 5" | 20' 6" |
| | 16 | 26' 10" | 21' 3" | 18' 7" |
| | 24 | 23' 5" | 18' 7" | 16' 3" |
| 362S250-54 | 12 | 31' 7" | 25' 1" | 21' 11" |
| | 16 | 28' 8" | 22' 9" | 19' 11" |
| | 24 | 25' 1" | 19' 11" | 17' 4" |
| 362S250-68 | 12 | 33' 11" | 26' 11" | 23' 6" |
| | 16 | 30' 10" | 24' 6" | 21' 5" |
| | 24 | 26' 11" | 21' 5" | 18' 8" |
| 362S250-97 | 12 | 37' 7" | 29' 10" | 26' 1" |
| | 16 | 34' 2" | 27' 1" | 23' 8" |
| | 24 | 29' 10" | 23' 8" | 20' 8" |



**Notes:**

1. Studs are checked for simple-span deflection and stress. Stress calculations are made for mid-span fully braced moment, end shear through the unperforated section and shear moment interaction through the perforated section 10" away from the end bearing.
2. A 1/3 stress increase is not used.
3. Limiting heights are based on continuous lateral support of each flange over the full height of the stud.
4. Listed limiting heights are based on steel properties only.
5. End reactions must be checked for web crippling separately.
6. Web crippling check based on 1-inch end bearing. Where limiting heights are followed by "e", web stiffeners are required.
7. Allowable moment is the lesser of local and distortional buckling. Stud distortional buckling based on an assumed $K\phi = 0$.
8. Members marked with an [1] have h/t > 200, and thus require end stiffeners.
9. Capacities are calculated according to the AISI S100-16 (2020) w/S2-20. A 1-1/2" by 4" knockout spaced no closer than 24" o.c. is assumed. (3/4" for 2-1/2" studs).
10. All values are based on Fy=33ksi for 33mil and 43mil Studs, and Fy=50ksi for 54mil, 68mil and 97mil Studs.
11. For deflection calculations, interior wall loads have been multiplied by 1.0 per AISI S240.

**Complies with AISI S100-16 (2020) w/S2-20 • IBC 2021**

# 3-5/8" STUD/TRACK PROPERTIES

| | Member | Design thickness (in) | Yield strength Fy (ksi) | Gross Properties Area ($in^2$) | Weight (lb/ft) | Ix ($in^4$) | Sx ($in^3$) | Rx (in) | Iy ($in^4$) | Ry (in) | Effective Properties Ixe ($in^4$) | Sxe ($in^3$) | Ma (in-k) | Mad (in-k) | Torsional Properties Jx1000 ($in^4$) | Cw ($in^6$) | Xo (in) | m (in) | Ro (in) | β | Lu (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3-5/8" Stud | 362S137-33 | 0.0346 | 33 | 0.236 | 0.804 | 0.479 | 0.264 | 1.42 | 0.0594 | 0.501 | 0.479 | 0.232 | 4.59 | 4.48 | 0.094 | 0.165 | -1.00 | 0.615 | 1.81 | 0.694 | 34.7 |
| | 362S137-43 | 0.0451 | 33 | 0.306 | 1.04 | 0.616 | 0.340 | 1.42 | 0.0755 | 0.497 | 0.616 | 0.320 | 6.33 | 6.30 | 0.207 | 0.208 | -0.991 | 0.608 | 1.80 | 0.697 | 34.6 |
| | 362S137-54 | 0.0566 | 50 | 0.379 | 1.29 | 0.756 | 0.417 | 1.41 | 0.0911 | 0.490 | 0.756 | 0.382 | 11.42 | 11.15 | 0.405 | 0.251 | -0.978 | 0.601 | 1.79 | 0.700 | 27.9 |
| | 362S137-68 | 0.0713 | 50 | 0.470 | 1.60 | 0.923 | 0.509 | 1.40 | 0.109 | 0.481 | 0.923 | 0.493 | 14.77 | 14.55 | 0.797 | 0.302 | -0.959 | 0.592 | 1.76 | 0.704 | 27.8 |
| | 362S137-97 | 0.1017 | 50 | 0.648 | 2.20 | 1.23 | 0.678 | 1.38 | 0.138 | 0.461 | 1.23 | 0.663 | 24.11 | 19.84 | 2.23 | 0.390 | -0.922 | 0.573 | 1.72 | 0.713 | 27.8 |
| | 362S162-33 | 0.0346 | 33 | 0.262 | 0.892 | 0.551 | 0.304 | 1.45 | 0.099 | 0.616 | 0.551 | 0.268 | 5.29 | 5.22 | 0.105 | 0.297 | -1.31 | 0.789 | 2.05 | 0.592 | 42.6 |
| | 362S162-43 | 0.0451 | 33 | 0.340 | 1.16 | 0.710 | 0.392 | 1.45 | 0.127 | 0.611 | 0.710 | 0.372 | 7.34 | 7.32 | 0.230 | 0.376 | -1.30 | 0.782 | 2.04 | 0.594 | 42.5 |
| | 362S162-54 | 0.0566 | 50 | 0.422 | 1.44 | 0.873 | 0.482 | 1.44 | 0.154 | 0.605 | 0.873 | 0.444 | 13.28 | 12.94 | 0.451 | 0.457 | -1.28 | 0.774 | 2.02 | 0.597 | 34.4 |
| | 362S162-68 | 0.0713 | 50 | 0.524 | 1.78 | 1.07 | 0.590 | 1.43 | 0.186 | 0.596 | 1.07 | 0.574 | 17.19 | 16.94 | 0.887 | 0.552 | -1.26 | 0.765 | 2.00 | 0.600 | 34.4 |
| | 362S162-97 | 0.1017 | 50 | 0.724 | 2.46 | 1.44 | 0.792 | 1.41 | 0.241 | 0.577 | 1.44 | 0.776 | 27.54 | 23.24 | 2.50 | 0.723 | -1.23 | 0.745 | 1.95 | 0.606 | 34.5 |
| | 362S200-33 | 0.0346 | 33 | 0.297 | 1.01 | 0.648 | 0.358 | 1.48 | 0.177 | 0.772 | 0.642 | 0.294 | 5.81 | 5.99 | 0.118 | 0.577 | -1.74 | 1.03 | 2.41 | 0.478 | 53.6 |
| | 362S200-43 | 0.0451 | 33 | 0.385 | 1.31 | 0.836 | 0.461 | 1.47 | 0.227 | 0.767 | 0.836 | 0.427 | 8.43 | 8.43 | 0.261 | 0.734 | -1.73 | 1.02 | 2.40 | 0.480 | 53.5 |
| | 362S200-54 | 0.0566 | 50 | 0.479 | 1.63 | 1.03 | 0.568 | 1.47 | 0.277 | 0.761 | 1.03 | 0.490 | 14.66 | 14.88 | 0.511 | 0.896 | -1.71 | 1.02 | 2.38 | 0.482 | 43.3 |
| | 362S200-68 | 0.0713 | 50 | 0.595 | 2.02 | 1.27 | 0.698 | 1.46 | 0.337 | 0.753 | 1.27 | 0.666 | 19.95 | 19.72 | 1.01 | 1.09 | -1.70 | 1.01 | 2.36 | 0.484 | 43.3 |
| | 362S200-97 | 0.1017 | 50 | 0.826 | 2.81 | 1.71 | 0.945 | 1.44 | 0.446 | 0.735 | 1.71 | 0.929 | 32.04 | 27.81 | 2.85 | 1.44 | -1.66 | 0.99 | 2.32 | 0.487 | 43.6 |
| | 362S250-43 | 0.0451 | 33 | 0.430 | 1.46 | 0.980 | 0.541 | 1.51 | 0.385 | 0.946 | 0.980 | 0.449 | 8.88 | 9.06 | 0.292 | 1.23 | -2.20 | 1.28 | 2.83 | 0.396 | 64.1 |
| | 362S250-54 | 0.0566 | 50 | 0.535 | 1.82 | 1.21 | 0.668 | 1.50 | 0.473 | 0.940 | 1.20 | 0.514 | 15.40 | 15.93 | 0.571 | 1.51 | -2.18 | 1.27 | 2.81 | 0.397 | 52.0 |
| | 362S250-68 | 0.0713 | 50 | 0.666 | 2.27 | 1.49 | 0.823 | 1.50 | 0.578 | 0.931 | 1.49 | 0.689 | 20.64 | 21.32 | 1.13 | 1.84 | -2.17 | 1.26 | 2.79 | 0.398 | 52.0 |
| | 362S250-97 | 0.1017 | 50 | 0.927 | 3.16 | 2.03 | 1.12 | 1.48 | 0.773 | 0.913 | 2.03 | 1.06 | 35.51 | 32.45 | 3.20 | 2.45 | -2.13 | 1.24 | 2.75 | 0.401 | 52.5 |
| 3-5/8" Track | 362T125-33 | 0.0346 | 33 | 0.212 | 0.721 | 0.438 | 0.232 | 1.44 | 0.0301 | 0.377 | 0.385 | 0.174 | 3.44 | — | 0.0845 | 0.076 | -0.658 | 0.410 | 1.63 | 0.836 | — |
| | 362T125-43 | 0.0451 | 33 | 0.276 | 0.939 | 0.571 | 0.302 | 1.44 | 0.0388 | 0.375 | 0.531 | 0.245 | 4.84 | — | 0.187 | 0.098 | -0.654 | 0.407 | 1.62 | 0.838 | — |
| | 362T125-54 | 0.0566 | 50 | 0.346 | 1.18 | 0.723 | 0.378 | 1.45 | 0.0481 | 0.373 | 0.678 | 0.312 | 9.34 | — | 0.369 | 0.123 | -0.648 | 0.404 | 1.63 | 0.841 | — |
| | 362T125-68 | 0.0713 | 50 | 0.436 | 1.48 | 0.921 | 0.475 | 1.45 | 0.0596 | 0.370 | 0.908 | 0.427 | 12.78 | — | 0.738 | 0.156 | -0.641 | 0.399 | 1.63 | 0.846 | — |
| | 362T125-97 | 0.1017 | 50 | 0.621 | 2.11 | 1.34 | 0.675 | 1.47 | 0.0822 | 0.364 | 1.34 | 0.675 | 22.70 | — | 2.14 | 0.226 | -0.626 | 0.390 | 1.64 | 0.854 | — |
| | 362T150-33 | 0.0346 | 33 | 0.229 | 0.780 | 0.499 | 0.264 | 1.48 | 0.0499 | 0.467 | 0.414 | 0.180 | 3.56 | — | 0.091 | 0.124 | -0.854 | 0.522 | 1.77 | 0.766 | — |
| | 362T150-43 | 0.0451 | 33 | 0.298 | 1.02 | 0.650 | 0.344 | 1.48 | 0.0644 | 0.465 | 0.575 | 0.255 | 5.04 | — | 0.202 | 0.160 | -0.850 | 0.519 | 1.77 | 0.768 | — |
| | 362T150-54 | 0.0566 | 50 | 0.374 | 1.27 | 0.823 | 0.431 | 1.48 | 0.0801 | 0.462 | 0.735 | 0.325 | 9.74 | — | 0.400 | 0.202 | -0.844 | 0.516 | 1.77 | 0.772 | — |
| | 362T150-68 | 0.0713 | 50 | 0.471 | 1.60 | 1.05 | 0.542 | 1.49 | 0.100 | 0.460 | 0.993 | 0.449 | 13.43 | — | 0.799 | 0.257 | -0.836 | 0.511 | 1.77 | 0.777 | — |
| | 362T150-97 | 0.1017 | 50 | 0.672 | 2.29 | 1.53 | 0.771 | 1.51 | 0.138 | 0.453 | 1.53 | 0.733 | 21.94 | — | 2.32 | 0.374 | -0.820 | 0.501 | 1.78 | 0.787 | — |
| | 362T200-33 | 0.0346 | 33 | 0.264 | 0.897 | 0.619 | 0.329 | 1.53 | 0.110 | 0.645 | 0.464 | 0.190 | 3.76 | — | 0.105 | 0.269 | -1.27 | 0.754 | 2.09 | 0.631 | — |
| | 362T200-43 | 0.0451 | 33 | 0.343 | 1.17 | 0.808 | 0.427 | 1.53 | 0.142 | 0.643 | 0.650 | 0.270 | 5.34 | — | 0.233 | 0.350 | -1.27 | 0.752 | 2.09 | 0.633 | — |
| | 362T200-54 | 0.0566 | 50 | 0.431 | 1.47 | 1.02 | 0.536 | 1.54 | 0.177 | 0.640 | 0.832 | 0.345 | 10.34 | — | 0.460 | 0.442 | -1.26 | 0.748 | 2.09 | 0.638 | — |
| | 362T200-68 | 0.0713 | 50 | 0.543 | 1.85 | 1.31 | 0.675 | 1.55 | 0.221 | 0.638 | 1.14 | 0.480 | 14.38 | — | 0.919 | 0.564 | -1.25 | 0.743 | 2.09 | 0.643 | — |
| | 362T200-97 | 0.1017 | 50 | 0.773 | 2.63 | 1.92 | 0.963 | 1.57 | 0.308 | 0.632 | 1.84 | 0.804 | 24.06 | — | 2.67 | 0.825 | -1.23 | 0.732 | 2.10 | 0.655 | — |
| | 362T300-33 | 0.0346 | 33 | 0.333 | 1.13 | 0.861 | 0.457 | 1.61 | 0.327 | 0.992 | 0.546 | 0.197 | 3.89 | — | 0.133 | 0.811 | -2.16 | 1.23 | 2.87 | 0.434 | — |
| | 362T300-43 | 0.0451 | 33 | 0.434 | 1.48 | 1.12 | 0.594 | 1.61 | 0.425 | 0.990 | 0.767 | 0.290 | 5.73 | — | 0.294 | 1.05 | -2.15 | 1.23 | 2.86 | 0.435 | — |
| | 362T300-54 | 0.0566 | 50 | 0.544 | 1.85 | 1.43 | 0.746 | 1.62 | 0.531 | 0.988 | 0.985 | 0.371 | 11.11 | — | 0.581 | 1.34 | -2.15 | 1.23 | 2.86 | 0.439 | — |
| | 362T300-68 | 0.0713 | 50 | 0.685 | 2.33 | 1.82 | 0.941 | 1.63 | 0.665 | 0.985 | 1.36 | 0.519 | 15.55 | — | 1.16 | 1.71 | -2.14 | 1.22 | 2.86 | 0.443 | — |
| | 362T300-97 | 0.1017 | 50 | 0.977 | 3.32 | 2.68 | 1.350 | 1.66 | 0.937 | 0.979 | 2.27 | 0.887 | 26.55 | — | 3.37 | 2.52 | -2.12 | 1.21 | 2.86 | 0.453 | — |



For additional general notes, see page 6

[1]Web-height-to-thickness ratio exceeds 200. Web stiffeners are required at all support points and concentrated loads.

*Allowable moment includes cold work of forming.

**Gross Properties:**

- Ix = Moment of Inertia of cross-section about the x-axis.
- Sx = Section Modulus about the x-axis.
- Rx = Radius of Gyration of cross-section about the x-axis.
- Iy = Moment of Inertia of cross-section about the y-axis.
- Ry = Radius of Gyration of cross-section about the y-axis.

**Effective Properties:**

- Ixe = Effective Moment of Inertia of cross-section about the x-axis.
- Sxe = Effective Section Modulus about the x-axis.
- Ma = Allowable Moment based on local buckling.
- Mad = Allowable Moment based on distortional buckling, assuming $K\phi=0$.

**Torsional and Other Properties:**

- J = St. Venant Torsional Constant. The values of J shown in the tables have been factored by 1000.
- Cw = Torsional Warping Constant.
- Xo = Distance from shear center to the centroid along the principal axis.
- m = Distance from shear center to mid-plane of web.
- Ro = Polar Radius of Gyration of cross-section about the shear center.
- Beta = $1-(Xo/Ro)^2$
- Lu = Critical unbraced length for lateral-torsional buckling. Members are considered fully braced when unbraced length is less than Lu.

**Complies with AISI S100-16 (2020) w/S2-20 • IBC 2021**