PCS Structural Solutions

Seattle 1011 Western Avenue, Suite 810 | Seattle, WA 98104 | 206.292.5076
Tacoma 1250 Pacific Avenue, Suite 701 | Tacoma, WA 98402 | 253.383.2797
Portland 101 SW Main Street, Suite 280 | Portland, OR 97204 | 503.232.3746

www.pcs-structural.com

STRUCTURAL CALCULATIONS

FOR

KCHA PARK ROYAL APARTMENTS
EXTERIOR IMPROVEMENTS
18309 96TH AVE NE
BOTHELL, WASHINGTON

PREPARED BY
PCS STRUCTURAL *SOLUTIONS*

AUGUST 16, 2021
21-034

PCS Structural Solutions

Project: KCHA- Park Royal | Job Number: 21-034

Sheet: of | Name: SLF

Originating Office: Seattle | Date: 2/21/2021

DESIGN CRITERIA CHECKLIST

CODE: IBC 2018, ASCE 7-16 | LOCATION: BOTHELL, WA

VERTICAL DESIGN CRITERIA

	DEAD	LIVE	PARTITION	CONCENTRATED
ROOF:	15 PSF	25 PSF		
CORRIDORS/STAIRS:	60 PSF	100 PSF		2000 #
LADDER	580 LB			(2) * 300

WIND DESIGN CRITERIA

BASIC WIND SPEED (V) =	110 MPH	(Per ASCE 7-16 Sec. 26.5.1, Fig. 26.5-1A; 1B; 1C & 1D, or as required by Bld'g Dept.)
RISK CATEGORY:	II	(Per ASCE 7-16 Table 1.5-1 & IBC Table 1604.5)
EXPOSURE CATEGORY:	B	(Per ACSE 7-16 Section 26.7.3)
DIRECTIONALITY FACTOR (K_d):	0.85	(Per ASCE 7-16 Table 26.6-1)
GUST EFFECT FACTOR (G):	0.85	(Per ASCE 7-16 Section 26.11)
TOPOGRAPHIC FACTOR (K_{zt}):	1.00	(Per ASCE 7-16 Section 26.8.2)
MEAN ROOF HEIGHT:	30 FT	(See ASCE 7-16 Section 26.2 - Definitions)
ELEVATION:	0 FT	(See ASCE 7-16 Section 26.9)
ENCLOSURE CLASSIFICATION:	Enclosed	(See ASCE 7-16 Secion 26.2 & Table 26.13-1)
ROOF TYPE:	Gable	(See ASCE 7-16 Figure 27.3-1)
ROOF SLOPE (__:12):	4.00:12	(Enter vertical rise in 12 horizontal units)
θ (degrees):	18.43	

SEISMIC DESIGN CRITERIA

RISK CATEGORY:	I & II	(Per ASCE 7-16 Table 1.5-1 & IBC Table 1604.5)
SITE CLASS:	D	(Per IBC Section 1613.2.2, Assumed as "D" or per Geotech.)
IMPORTANCE FACTOR (I_E):	1	(Per ASCE 7-16 Table 1.5-2)
STRUCTURAL SYSTEM (R):	6.5	(Per ASCE 7-16 Table 12.2-1)
OVERSTRENGTH FACTOR (Ω_o):	2.0	(Per ASCE 7-16 Table 12.2-1)

INFORMATION BELOW FROM "EARTHQUAKE SPECTRAL RESPONSE ACCELERATION MAPS" PER USGS

LATITUDE:	47.761	S_S =	1.275	F_a =	1.200
LONGITUDE:	-122.212	S_1 =	0.448	F_v =	1.800

DEFLECTION CRITERIA

FLOOR (LIVE):	L/	360	ROOF (LIVE):	L/	360
FLOOR (TOTAL):	L/	240	ROOF (TOTAL):	L/	240
WALLS:	L/	240	SPECIAL:	L/	

SOIL DESIGN CRITERIA

REPORT:	no
BEARING:	1500 PSF
ACTIVE:	N/A
PASSIVE:	250 PCF
COEFFICIENT OF FRICTION:	0.35
PILE TYPE:	NONE
VERTICAL CAPACITY :	N/A
UPLIFT CAPACITY:	N/A

VALUES ASSUMED

MINIMUM FOOTING DIMENSIONS:

CONTINUOUS:	N/A
SPREAD:	1'-6"
FROST DEPTH:	1'-6"
LATERAL CAPACITY:	N/A
SIZE:	N/A

PCS Structural Solutions

Project: KCHA- Park Royal | Job Number: 21-034

Sheet: _____ of _____ | Name: SLF

Originating Office: Seattle | Date: 02/21/21

DESIGN CRITERIA - WIND

BASIC WIND SPEED (V):	110 MPH	MEAN ROOF HEIGHT:	30 FT
RISK CATEGORY:	II	GROUND ELEVATION FACTOR (Ke):	1.00
EXPOSURE CATEGORY:	B	ENCLOSURE CLASSIFICATION:	Enclosed
DIRECTIONALITY FACTOR (K_d):	0.85	ROOF TYPE:	Gable
GUST EFFECT FACTOR (G):	0.85	ROOF SLOPE (__:12):	4.0:12
TOPOGRAPHIC FACTOR (K_{zt}):	1.00	θ (degrees):	18.43

ASCE 7-16 CHAPTER 27: WIND LOADS ON BUILDINGS: MWFRS (DIRECTIONAL PROCEDURE)
PART 1: ENCLOSED AND PARTIALLY ENCLOSED BUILDINGS OF ALL HEIGHTS

NOTE: q_z and q_i have conservatively been taken equal to q_h.

HORIZONTAL WALL PRESSURES (Figure 27.3-1)

	External Pressures ($q^*(GC_p)$):			Internal Pressures ($\pm q_i^*(GC_{pi})$)
L/B:	Windward wall	Leeward wall	Sidewall	All walls
0-1	12.5	-7.8	-11.0	3.3
2		-4.7		
≥4		-3.1		

ROOF PRESSURES (Figure 27.3-1)

		External Pressures ($q^*(GC_p)$):			Internal Pressures ($\pm q_i^*(GC_{pi})$)
Wind Direction:	h/L:	Windward (Positive)	Windward (Negative)	Leeward	All Roofs
Normal to Ridge for θ ≥ 10°	≤0.25	2.2	-5.7	-8.9	3.3
	0.50	-0.9	-7.7	-8.9	
	≥1.0	-2.8	-12.4	-9.4	

			External Pressures ($q^*(GC_p)$):		Internal Pressures ($\pm q_i^*(GC_{pi})$)
	h/L:	Horizontal Distance from Windward Edge	Positive Pressure	Negative Pressure	All Roofs
Normal to Ridge for θ < 10° and Parallel to Ridge for All θ	≤0.5	0 to h	-2.8	-14.1	3.3
		h to 2h		-7.8	
		>2h		-4.7	
	≥1.0	0 to h/2	-2.8	-20.4	
		>h/2		-11.0	

ASCE 7-16 27.1.5: Minimum Design Wind Loads: The wind load used for design of the MWFRS shall not be less than 16 PSF multiplied by the wall area of the building, and 8 PSF multiplied by the roof area of the building projected on a vertical plane normal to the assumed wind direction. Wall and roof loads shall be applied simultaneously.

ASCE 7-16 CHAPTER 30: WIND LOADS: COMPONENTS AND CLADDING
PART 1: LOW-RISE BUILDINGS (h≤60 ft)

ROOF SURFACES

Effective Wind Area	POSITIVE PRESSURES	NEGATIVE PRESSURES					
	ZONE						
	ALL ZONES	1	2e	2n	2r	3e	3r
10 SF	16.0	-40.2	-40.2	-58.6	-58.6	-58.6	-69.7
20 SF	16.0	-40.2	-40.2	-50.7	-50.7	-50.7	-59.7
50 SF	16.0	-24.4	-24.4	-40.2	-40.2	-40.2	-46.5
100 SF	16.0	-16.0	-16.0	-32.2	-32.2	-32.2	-36.5

WALL SURFACES & ROOF OVERHANGS

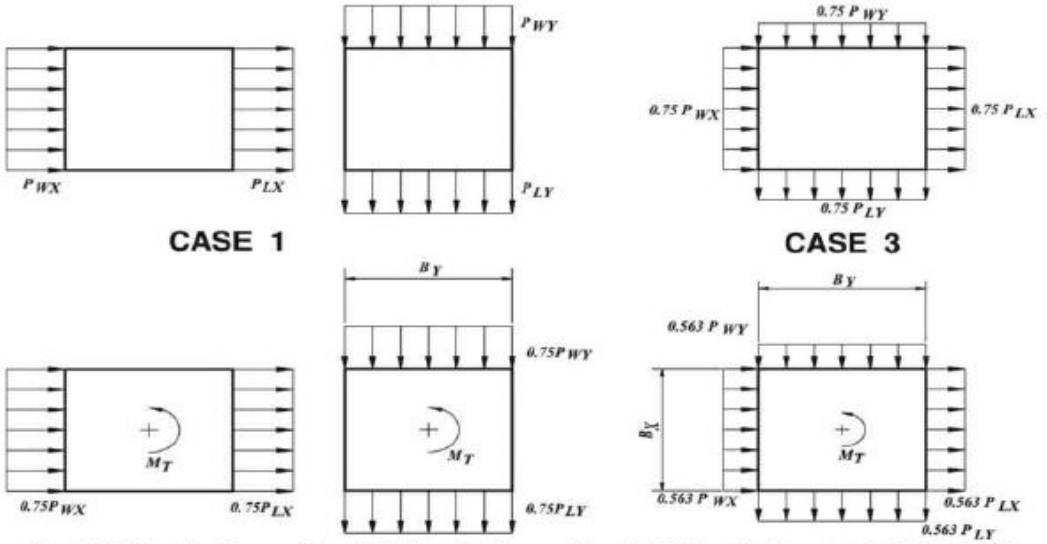
Effective Wind Area	WALL ZONES				ROOF OVERHANG ZONES					
	POSITIVE PRESSURES		NEGATIVE PRESSURES		NEGATIVE PRESSURES					
	4	5	4	5	1	2e	2n	2r	3e	3r
10 SF	21.7	21.7	-23.6	-29.1	-49.4	-49.4	-67.8	-67.8	-78.9	-89.9
20 SF	20.8	20.8	-22.6	-27.2	-49.4	-49.4	-61.9	-61.9	-68.6	-76.6
50 SF	19.5	19.5	-21.3	-24.6	-38.9	-38.9	-54.0	-54.0	-54.9	-59.0
100 SF	18.5	18.5	-20.3	-22.6	-31.0	-31.0	-48.0	-48.0	-44.6	-45.7
500 SF	16.2	16.2	-18.1	-18.1	-31.0	-31.0	-40.2	-40.2	-31.0	-45.7

ASCE 7-16 30.2.2: Minimum Design Wind Loads: The design wind pressure for C&C of buildings shall not be less than a net pressure of 16 PSF acting in either direction normal to the surface.

DESIGN CRITERIA - WIND

FIGURE 27.3-8: Main Wind Force Resisting System, Part 1 (All Heights): Design Wind Load Cases per ASCE 7-16

Diagrams



Notation

P_{WX}, P_{WY} = Windward face design pressure acting in the x, y principal axis, respectively.
P_{LX}, P_{LY} = Leeward face design pressure acting in the x, y principal axis, respectively.
$e(e_X, e_Y)$ = Eccentricity for the x, y principal axis of the structure, respectively.
M_T = Torsional moment per unit height acting about a vertical axis of the building.

Case 1. Full design wind pressure acting on the projected area perpendicular to each principal axis of the structure, considered separately along each principal axis.
Case 2. Three-quarters of the design wind pressure acting on the projected area perpendicular to each principal axis of the structure in conjunction with a torsional moment as shown, considered separately for each principal axis.
Case 3. Wind loading as defined in Case 1, but considered to act simultaneously at 75% of the specified value.
Case 4. Wind loading as defined in Case 2, but considered to act simultaneously at 75% of the specified value.

Notes

1. Design wind pressures for windward and leeward faces shall be determined in accordance with the provisions of Sections 27.3.1 and 27.3.2 as applicable for buildings of all heights.
2. Diagrams show plan views of buildings.

FIGURE 27.3-8 Main Wind Force Resisting System, Part 1 (All Heights): Design Wind Load Cases

DESIGN CRITERIA - WIND

FIGURE 27.3-1 Main Wind Force Resisting System, Part 1 (All Heights): External Pressure Coefficients, Cp, for Enclosed and Partially Enclosed Buildings - Walls and Roofs per ASCE 7-16

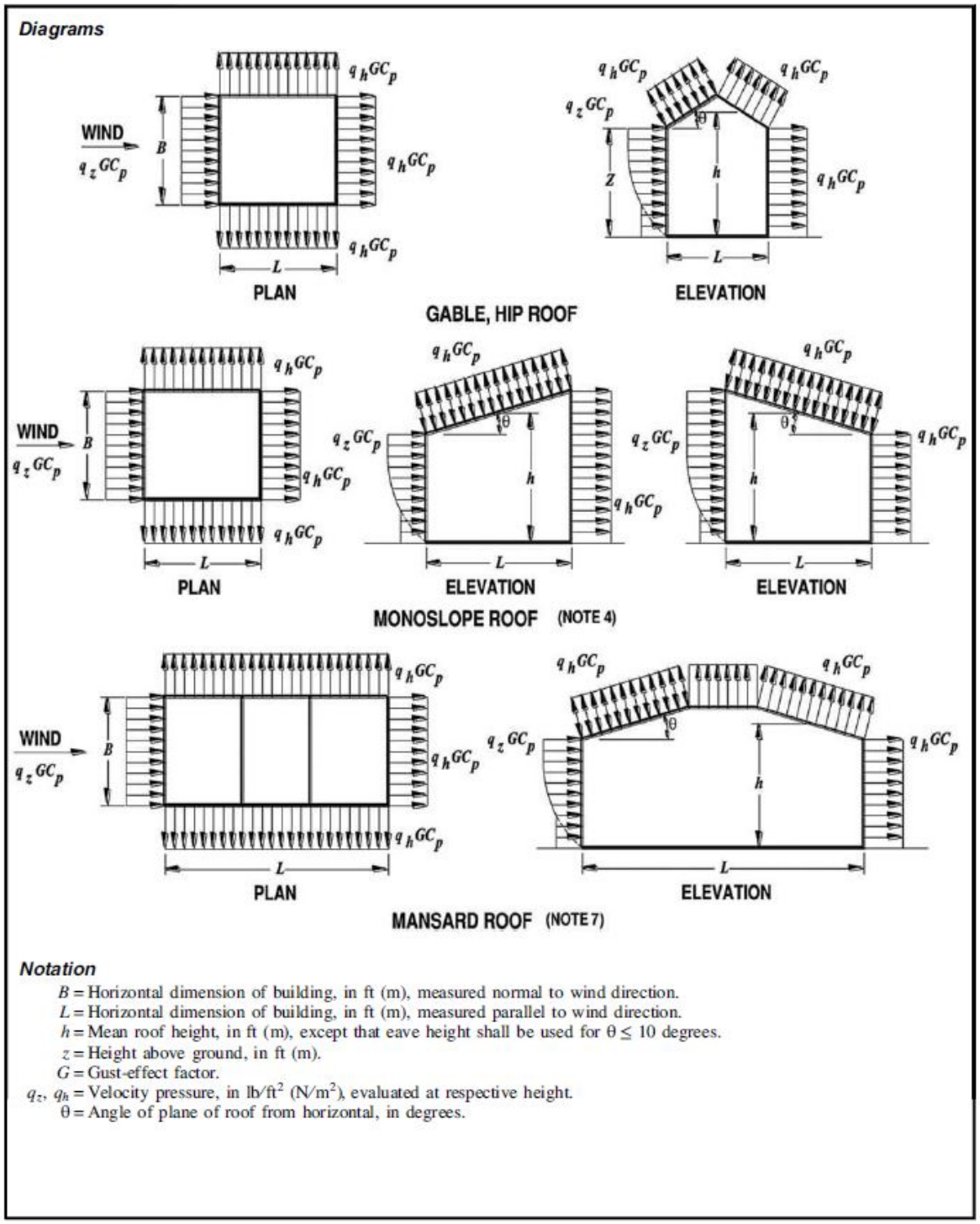
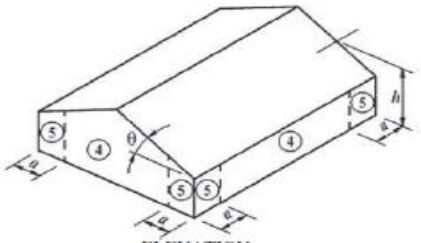


FIGURE 27.3-1 Main Wind Force Resisting System, Part 1 (All Heights): External Pressure Coefficients, C_p, for Enclosed and Partially Enclosed Buildings—Walls and Roofs

DESIGN CRITERIA - WIND

FIGURE 30.3-1: Components and Cladding [h ≤ 60 ft]: External Pressure Coefficients, (GCp), for Enclosed and Partially Enclosed Buildings - Walls

Diagram



Notation

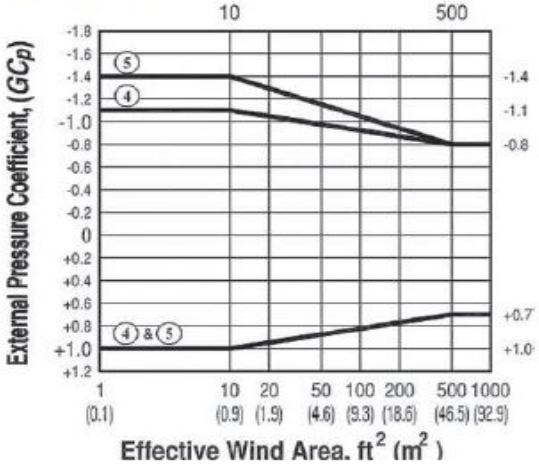
a = 10% of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).

Exception: For buildings with θ = 0° to 7° and a least horizontal dimension greater than 300 ft (90 m), dimension a shall be limited to a maximum of $0.8h$.

h = Mean roof height, in ft (m), except that eave height shall be used for θ ≤ 10°.

θ = Angle of plane of roof from horizontal, in degrees.

External Pressure Coefficient, (GC_p) - Walls



Notes

1. Vertical scale denotes (GCp) to be used with qh.
2. Horizontal scale denotes effective wind area, in ft² (m²).
3. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
4. Each component shall be designed for maximum positive and negative pressures.
5. Values of (GCp) for walls shall be reduced by 10% when θ ≤ 10°.

FIGURE 30.3-1 Components and Cladding [$h \leq 60$ ft ($h \leq 18.3$ m)]: External Pressure Coefficients, (GC_p), for Enclosed and Partially Enclosed Buildings—Walls

PCS Structural Solutions

Project: KCHA- Park Royal | Job Number: 21-034

Sheet: of | Name: SLF

Originating Office: Seattle | Date: 02/21/21

DESIGN CRITERIA - SEISMIC

ASCE 7-16 SECTION 12.8 - EQUIVALENT LATERAL FORCE PROCEDURE

OCCUPANCY CATEGORY:	I & II	LATITUDE:	47.761
SITE CLASS:	D	LONGITUDE:	-122.212
IMPORTANCE FACTOR (I_E):	1	S_S =	1.275
STRUCTURAL SYSTEM (R):	6.5	S_1 =	0.448
OVERSTRENGTH FACTOR (Ω_o):	2	F_a =	1.200
		F_v =	1.800

ASCE 7-16 SECTION 11.4 SEISMIC GROUND MOTION VALUES

Section 11.4.4 - Coefficients and Risk-Targeted Maximum Considered Earthquake (MCER) Spectral Response Acceleration Parameters

$S_{MS} = F_a*S_S$ = 1.530 $S_{M1} = F_v*S_1$ = 0.806

Section 11.4.5 - Design Spectral Response Acceleration Parameters

$S_{DS} = 2/3*S_{MS}$ = 1.020 $S_{D1} = 2/3*S_{M1}$ = 0.538

ASCE 7-16 SECTION 11.6 - SEISMIC DESIGN CATEGORY - SECTION 12.8.2 - PERIOD DETERMINATION

ASCE 7-16 TABLE 11.6-1			
SEISMIC DESIGN CATEGORY BASED ON S_{DS}			
	RISK CATEGORY:		
	I & II	III	IV
< 0.167g	A	A	A
< 0.33g	B	B	C
< 0.50g	C	C	D
>= 0.50g	D	D	D
	D		

ASCE 7-16 TABLE 11.6-2			
SEISMIC DESIGN CATEGORY BASED ON S_{D1}			
	RISK CATEGORY:		
	I & II	III	IV
< 0.067g	A	A	A
< 0.133g	B	B	C
< 0.20g	C	C	D
>= 0.20g	D	D	D
	D		

Each building and structure shall be assigned to the most severe Seismic Design Category in accordance with Table 11.6-1 or Table 11.6-2, irrespective of the fundamental period of vibration of the structure.

PERIOD DETERMINATION:	
C_t =	0.02
h_n =	30 FT
x =	0.75
$T_a = C_t*h_n^x$ =	0.256

ASCE 7-16 SECTION 12.8.1.1 - SEISMIC RESPONSE COEFFICIENT

GENERAL EQUATION:	$C_S = S_{DS}/(R/I)$ =	0.157	<--CONTROLS	EQ. 12.8-2
MAXIMUM:	CS = 1.5*SD1/(T*(R/I)) =	0.484		EQ. 12.8-3
MINIMUM:	$C_S = 0.044*S_{DS}*I > 0.01$ =	0.045		EQ. 12.8-5
For structures located where S1 > 0.6g				
	$C_S = 0.5*S_1/(R/I)$ =	0.000		EQ. 12.8-6

ASCE 7-10 SECTION 12.8.1 - SEISMIC BASE SHEAR

$V = C_S*W$ = **0.157*W**

W = the total dead load and applicable portion of other loads as indicated in Section 12.7.2

Hazards by Location

Search Information

Address: 18309 96th Ave NE, Bothell, WA 98011, USA

Coordinates: 47.7614634, -122.2126383

Elevation: 76 ft

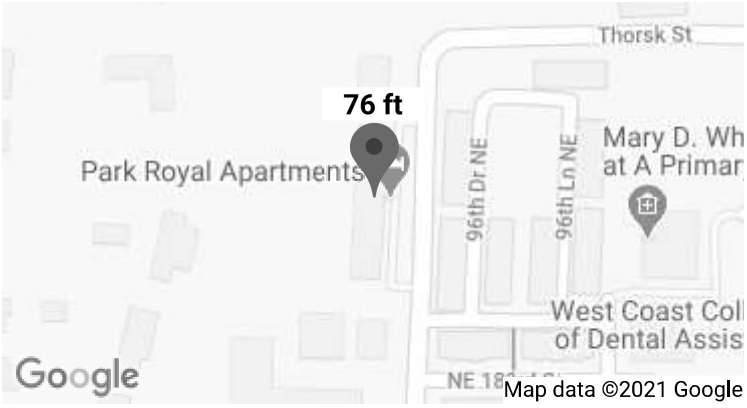
Timestamp: 2021-02-21T23:19:47.865Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D-default



Basic Parameters

Name	Value	Description
S_S	1.275	MCE_R ground motion (period=0.2s)
S_1	0.448	MCE_R ground motion (period=1.0s)
S_{MS}	1.53	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.02	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.908	Coefficient of risk (0.2s)
CR_1	0.896	Coefficient of risk (1.0s)
PGA	0.545	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.654	Site modified peak ground acceleration

T_L	6	Long-period transition period (s)
SsRT	1.275	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.404	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	2.784	Factored deterministic acceleration value (0.2s)
S1RT	0.448	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.5	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.196	Factored deterministic acceleration value (1.0s)
PGAd	0.99	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

Hazards by Location

Search Information

Address: 18309 96th Ave NE, Bothell, WA 98011, USA

Coordinates: 47.7614634, -122.2126383

Elevation: 76 ft

Timestamp: 2021-01-27T16:22:03.319Z

Hazard Type: Wind

ASCE 7-16

MRI 10-Year	67 mph
MRI 25-Year	74 mph
MRI 50-Year	78 mph
MRI 100-Year	83 mph
Risk Category I	92 mph
Risk Category II	98 mph
Risk Category III	105 mph
Risk Category IV	109 mph

ASCE 7-10

MRI 10-Year	72 mph
MRI 25-Year	79 mph
MRI 50-Year	85 mph
MRI 100-Year	91 mph
Risk Category I	100 mph
Risk Category II	110 mph
Risk Category III-IV	115 mph

ASCE 7-05

ASCE 7-05 Wind Speed	85 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

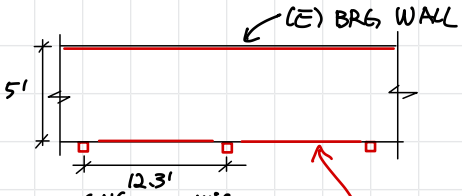
Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for

building code approval and interpretation for the building site described by latitude/longitude location in the report.

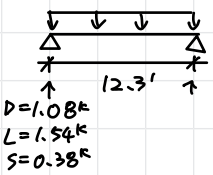
WALKWAY



DL = 65 PSF (CONC.) + 5 PSF (MISC) = 70 PSF

LL = 100 PSF

- EDGE CHANNEL TYP.



$W = (70^{PSF}D + 100^{PSF}L + 25^{PSF}S)\,5'/2 = 175^{PLF}D + 250^{PLF}L + 127.5^{PLF}S$

→ C6X13 ($DCR_B = 0.813$, $\Delta_L = 0.258" = \ell/572$, $\Delta_{TOT} = 0.438" = \ell/337$)

- COL TYP.

$P = (1.08^K D + 1.54^K L + 0.38^K S) \times 2 = 2.16^K D + 3.08^K L + 0.76^K$

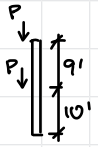
- APPLIED TO COL EDGE
- HT = 10'

→ HSS4X4X1/4 ($DCR_{AISC} = 0.125$)

SPREAD FTG = $\sqrt{\frac{(2.16+3.08^K)}{1.5^{KSF}}} = 1.87' \rightarrow 2'\times 2'$ SPREAD FTG

(1.5 KSF: ASSUMED SOIL BRG)

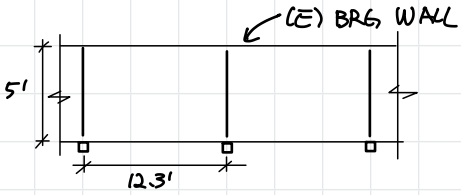
COL W/ 2 LVLS ORIGINATING FROM BASEMENT LVL)



→ HSS4X4X1/4 (FROM ENERCALC, $DCR_{AISC} = 0.18$)

SPREAD FTG = $\frac{2(2.16+3.08^K)}{1.5} = 6.96^{SF} \rightarrow 2'\times 4'$ SPREAD FTG

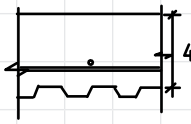
WALKWAY



$DL = 65^{PSF}_{CONC.} + 5^{PSF}_{MISC} = 70^{PSF}$

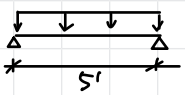
$LL = 100^{PSF}$

- CONC. DECK



- USE MTL DECK AS FORMWORK TO POUR AND DESIGN CONC. SECTION AS ONE-WAY SLAB PER ACI 318-14 CH7.

$w = (70^{PSF}D + 100^{PSF}L + 25^{PSF}S) \times 1'$



$M_u = [1.2(70^{PLF}) + 1.6(100^{PLF})]5'^2/8 = 763^{\#-FT}$ PER FT

$\frac{M_u}{\phi b d^2} = \frac{763 \times 12^{\#-IN}}{.9(12")(3.5")^2} = 69.2^{PSI} \rightarrow \rho_{min} = .0033$

(3.5" = 4.5" − 3/4" COVER − 1/4" BAR = 3.5")

$\rightarrow A_s = \rho d b = .0033(12" \times 3.5") = 0.14\ in^2 \Rightarrow$ #4 @ 12" O.C.

$a = \frac{A_s f_y}{b d} = \frac{0.2in^2 \times 60^{ksi}}{12" \times 3"} = 0.33"$

$c = \frac{a}{\beta_1} = 0.39"$, $\varepsilon_t = \frac{d-c}{c}(.003) = 0.0288 > 0.005 \rightarrow$ TENSION CONTROL

$\phi M_n = \phi A_s f_y (d - \frac{a}{2}) = .9(.20in^2)(60^{ksi})(3.5" - .33") = 34.24^{k-in} = 2.85^{k-ft} > M_u$

PER ACI 318-14 §T7.3.1.1, MIN THICKNESS = $l/20 = 3"$

PER ACI 318-14 §T7.6.1.1, $A_{s,min} = .0018 A_g$

PER ACI §25.2, $s_{min} = 4d_b$

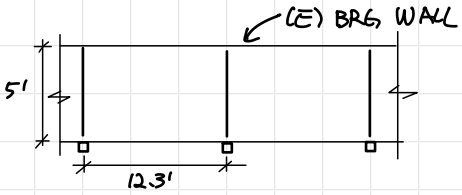
$s_{max} = \min < \begin{matrix} 3h \\ 18" \end{matrix}$

$\Rightarrow$ 4 1/2" CONC. W/ #4 @ 12" O.C. E.W.

(SEE ENERCALC FOR DEFLECTION CALC)

- (E) BRG. WALL
  - NEW WALKWAY STRUCTURE LAYOUT IS SIMILAR TO EXISTING WALKWAY STRUCTURE SO THE WALKWAY LOADING ON THE (E) BEARING WALL IS THE SAME. THEREFORE, EXISTING BEARING WALL STRUCTURE IS SUFFICIENT TO SUPPORT THE NEW WALKWAY.

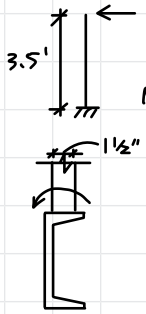
WALKWAY



$DL = 65^{PSF}_{CONC.} + 5^{PSF}_{MISC} = 70^{PSF}$

$LL = 100^{PSF}$

- HAND RAIL



$M_u = 1.6(213^{\#} \times 3.5') = 1190^{\#\text{-FT}} = 14.28^{K\text{-IN}}$

→ HSS 2x1½x3/16 ($\phi M_n = 1.95^{KF}$ O.K.)

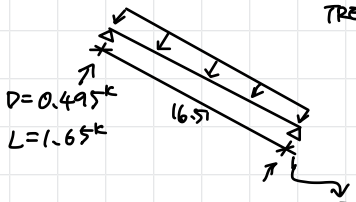
POST TO BASE PL WELD

$C/T = \frac{M_u}{1.5''} = 9.52^{K}$

WELD $D_{reqd} = \frac{9.52^{K}}{1.392 \times 1.5'' \times 2} = 2.3$

→ 1/4" FILLET WELD ALL AROUND

- STAIR FRAMING



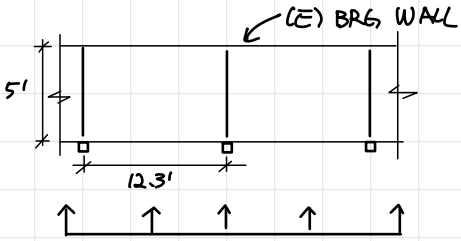
TREAD = $145^{PCF} \times 2''/12 = 24^{PSF}$ → DL = 30^{PSF}

$W = (30D + 100L)\,4'/2 = 60^{PLF}D + 200^{PLF}D$

→ C12x20.7 (DCR = 0.205, $\Delta_L = 0.09'' = L/2210$, $\Delta_T = 0.116'' = L/1701$)

SOIL BRG. AREA REQ'D = $\frac{(.495 + 1.65^{K})}{1.5^{KSF}} = 1.43^{SF}$ → 1' THICKED SLAB

WALKWAY – LATERAL



$DL = 65^{PSF}_{CONC.} + 5^{PSF}_{MISC} = 70^{PSF}$

$LL = 100^{PSF}$

- WALKWAY SEISMIC LATERAL LOAD TRANSFERS TO BLDG EXISTING WOOD SHEAR WALLS. THE OVERAL SEISMIC WEIGHT OF WALKWAY STRUCTURE DOES NOT CHANGE FROM (E) STRUCTURE. THUS, EXISTING LATERAL FORCE RESISTING WOOD SHEARWALLS ARE SUFFICIENT FOR NEW WALKWAY STRUCTURE.

- COLLECTOR TO BLDG

PER ASCE 7-16 § 12.10.2.1 COLLECTOR ELEMENTS @ SEISMIC DESIGN CRITERIA = C, D, E, F

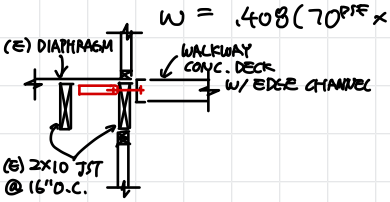
EXCEPTION: DIAPHRAGM FORCE CAN BE USED AS COLLECTOR FORCE IN WOOD LIGHT-FRAME SHEAR WALL STRUCTURES.

- USE MAX DIAPH FORCE EQN (12.10-3) TO CALCULATE COLLECTOR FORCE FOR SIMPLICITY & CONSERVATIVE APPROACH.

$F_{px} = 0.4 S_{DS} I_e w_{px}$

$= 0.4(1.02)(1.0) w_{px} = 0.408 w_{px}$

$w = .408(70^{PSF} \times 5') = 143^{PLF}$ → TRY COLLECTOR @ 6'-0" O.C.



$P_{COLL} = 858^{\#}$ @ 6' O.C.

$\times .7 = 601^{\#}$ (ASD)

→ HTT4 OR HDU2

(E) FLR DIAPH: 3/4" P.W. SHT'G

- ASSUME 19/32 SHT'G UNBLOCKED W/ 10d @ 6" O.C AT EDGES

$V_a = 430^{PLF} \Longrightarrow 215^{PLF}$ (ASD)

→ REQ'D DIA LENGTH = $601^{\#} / 215^{PLF} = 2.8'$

⇒ STRAP 3' W/ BLOCK'G BTWN (E) JST.

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327
PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Edge channel

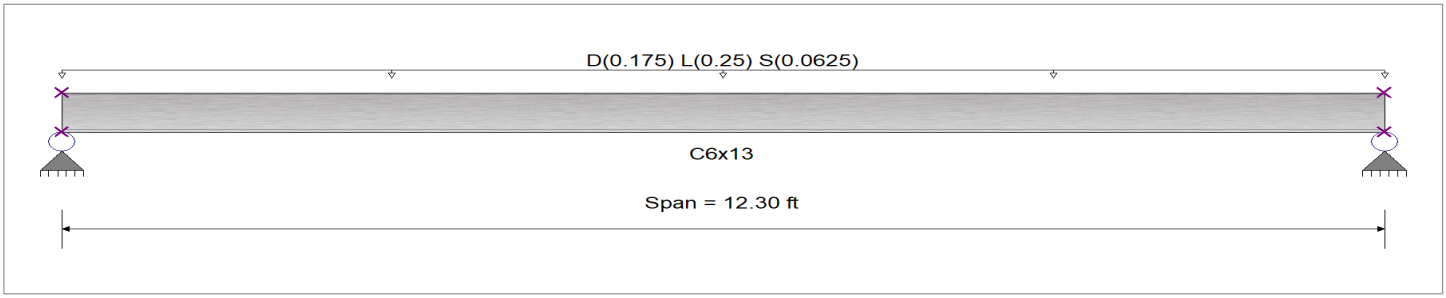
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 36.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.070, L = 0.10, S = 0.0250 ksf, Tributary Width = 2.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.813 : 1	Maximum Shear Stress Ratio =	0.077 : 1
Section used for this span	C6x13	Section used for this span	C6x13
Mu : Applied	12.127 k-ft	Vu : Applied	3.944 k
Mn * Phi : Allowable	14.916 k-ft	Vn * Phi : Allowable	50.972 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
Location of maximum on span	6.150 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.258 in	Ratio =	572 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.438 in	Ratio =	337 >=240.
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 12.30 ft	1	0.311	0.030	4.63		4.63	16.57	14.92	1.14	1.00	1.51	56.64	50.97
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 12.30 ft	1	0.773	0.074	11.54		11.54	16.57	14.92	1.14	1.00	3.75	56.64	50.97
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 12.30 ft	1	0.813	0.077	12.13		12.13	16.57	14.92	1.14	1.00	3.94	56.64	50.97
+1.20D+1.60Lr+L+1.60H													
Dsgn. L = 12.30 ft	1	0.583	0.056	8.70		8.70	16.57	14.92	1.14	1.00	2.83	56.64	50.97
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 12.30 ft	1	0.266	0.025	3.97		3.97	16.57	14.92	1.14	1.00	1.29	56.64	50.97
+1.20D+L+1.60S+1.60H													
Dsgn. L = 12.30 ft	1	0.710	0.068	10.59		10.59	16.57	14.92	1.14	1.00	3.44	56.64	50.97
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 12.30 ft	1	0.393	0.037	5.86		5.86	16.57	14.92	1.14	1.00	1.91	56.64	50.97
+1.20D+0.50Lr+L+W+1.60H													
Dsgn. L = 12.30 ft	1	0.583	0.056	8.70		8.70	16.57	14.92	1.14	1.00	2.83	56.64	50.97
+1.20D+L+0.50S+W+1.60H													
Dsgn. L = 12.30 ft	1	0.623	0.059	9.29		9.29	16.57	14.92	1.14	1.00	3.02	56.64	50.97
+0.90D+W+1.60H													
Dsgn. L = 12.30 ft	1	0.200	0.019	2.98		2.98	16.57	14.92	1.14	1.00	0.97	56.64	50.97
+1.20D+L+0.20S+E+1.60H													
Dsgn. L = 12.30 ft	1	0.599	0.057	8.94		8.94	16.57	14.92	1.14	1.00	2.91	56.64	50.97
+0.90D+E+0.90H													
Dsgn. L = 12.30 ft	1	0.200	0.019	2.98		2.98	16.57	14.92	1.14	1.00	0.97	56.64	50.97

Steel Beam

DESCRIPTION: Walkway Edge channel

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.4383	6.185		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.614	2.614
Overall MINimum	0.384	0.384
+D+H	1.076	1.076
+D+L+H	2.614	2.614
+D+Lr+H	1.076	1.076
+D+S+H	1.461	1.461
+D+0.750Lr+0.750L+H	2.229	2.229
+D+0.750L+0.750S+H	2.518	2.518
+D+0.60W+H	1.076	1.076
+D+0.750Lr+0.750L+0.450W+H	2.229	2.229
+D+0.750L+0.750S+0.450W+H	2.518	2.518
+0.60D+0.60W+0.60H	0.646	0.646
+D+0.70E+0.60H	1.076	1.076
+D+0.750L+0.750S+0.5250E+H	2.518	2.518
+0.60D+0.70E+H	0.646	0.646
D Only	1.076	1.076
L Only	1.538	1.538
S Only	0.384	0.384
H Only		

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327
PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Edge channel-Landing

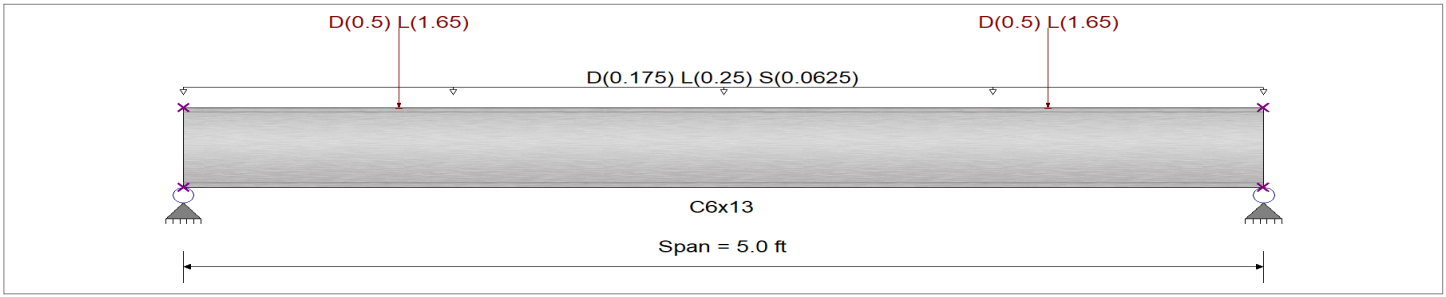
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 36.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.070, L = 0.10, S = 0.0250 ksf, Tributary Width = 2.50 ft

Point Load : D = 0.50, L = 1.650 k @ 4.0 ft

Point Load : D = 0.50, L = 1.650 k @ 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.280 : 1	Maximum Shear Stress Ratio =	0.095 : 1
Section used for this span	C6x13	Section used for this span	C6x13
Mu : Applied	5.244 k-ft	Vu : Applied	4.843 k
Mn * Phi : Allowable	18.715 k-ft	Vn * Phi : Allowable	50.972 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
Location of maximum on span	2.500 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.024 in	Ratio =	2,507 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.034 in	Ratio =	1766 >=240.
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 5.00 ft	1	0.077	0.026	1.47		1.47	21.17	19.05	1.07	1.00	1.31	56.64	50.97
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 5.00 ft	1	0.275	0.093	5.15		5.15	20.77	18.70	1.05	1.00	4.77	56.64	50.97
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 5.00 ft	1	0.280	0.095	5.24		5.24	20.79	18.71	1.05	1.00	4.84	56.64	50.97
+1.20D+1.60Lr+L+1.60H													
Dsgn. L = 5.00 ft	1	0.197	0.067	3.69		3.69	20.81	18.73	1.05	1.00	3.40	56.64	50.97
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 5.00 ft	1	0.066	0.022	1.26		1.26	21.17	19.05	1.07	1.00	1.13	56.64	50.97
+1.20D+L+1.60S+1.60H													
Dsgn. L = 5.00 ft	1	0.212	0.072	4.00		4.00	20.93	18.84	1.06	1.00	3.65	56.64	50.97
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 5.00 ft	1	0.081	0.027	1.57		1.57	21.43	19.29	1.08	1.00	1.38	56.64	50.97
+1.20D+0.50Lr+L+W+1.60H													
Dsgn. L = 5.00 ft	1	0.197	0.067	3.69		3.69	20.81	18.73	1.05	1.00	3.40	56.64	50.97
+1.20D+L+0.50S+W+1.60H													
Dsgn. L = 5.00 ft	1	0.202	0.068	3.79		3.79	20.85	18.77	1.05	1.00	3.48	56.64	50.97

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Edge channel-Landing

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values: max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values: VuMax	Vnx	Phi*Vnx
+0.90D+W+1.60H													
Dsgn. L = 5.00 ft	1	0.049	0.017	0.94		0.94	21.17	19.05	1.07	1.00	0.84	56.64	50.97
+1.20D+L+0.20S+E+1.60H													
Dsgn. L = 5.00 ft	1	0.199	0.067	3.73		3.73	20.83	18.75	1.05	1.00	3.43	56.64	50.97
+0.90D+E+0.90H													
Dsgn. L = 5.00 ft	1	0.049	0.017	0.94		0.94	21.17	19.05	1.07	1.00	0.84	56.64	50.97

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.0340	2.514		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.213	3.213
Overall MINimum	0.156	0.156
+D+H	0.938	0.938
+D+L+H	3.213	3.213
+D+Lr+H	0.938	0.938
+D+S+H	1.094	1.094
+D+0.750Lr+0.750L+H	2.644	2.644
+D+0.750L+0.750S+H	2.761	2.761
+D+0.60W+H	0.938	0.938
+D+0.750Lr+0.750L+0.450W+H	2.644	2.644
+D+0.750L+0.750S+0.450W+H	2.761	2.761
+0.60D+0.60W+0.60H	0.563	0.563
+D+0.70E+0.60H	0.938	0.938
+D+0.750L+0.750S+0.5250E+H	2.761	2.761
+0.60D+0.70E+H	0.563	0.563
D Only	0.938	0.938
L Only	2.275	2.275
S Only	0.156	0.156
H Only		

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:26PM

Steel Column

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Col

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS4x4x1/4**
Analysis Method : Load Resistance Factor
Steel Stress Grade
Fy : Steel Yield 46.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 10 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 122.10 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 10.0 ft, Yecc = 2.0 in, D = 2.160, L = 3.080, S = 0.760 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.1247** : 1
Load Combination +1.20D+1.60L+0.50S+1.60H
Location of max.above base 9.933 ft
At maximum location values are . . .
Pu 8.047 k
0.9 * Pn 91.738 k
Mu-x -1.308 k-ft
0.9 * Mn-x : 16.181 k-ft
Mu-y 0.0 k-ft
0.9 * Mn-y : 16.181 k-ft

Maximum Load Reactions . .
Top along X-X k
Bottom along X-X k
Top along Y-Y k
Bottom along Y-Y k

Maximum Load Deflections . . .
Along Y-Y in at ft above base
for load combination :
Along X-X in at ft above base
for load combination :

PASS Maximum Shear Stress Ratio = **0.004135** : 1
Load Combination +1.20D+1.60L+0.50S+1.60H
Location of max.above base 0.0 ft
At maximum location values are . . .
Vu : Applied 0.1317 k
Vn * Phi : Allowable 31.842 k

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	k-ft	My - End Moments @ Base	My - End Moments @ Top

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	k-ft	My - End Moments @ Base	My - End Moments @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance

Steel Section Properties : HSS4x4x1/4

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:26PM

Steel Column

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

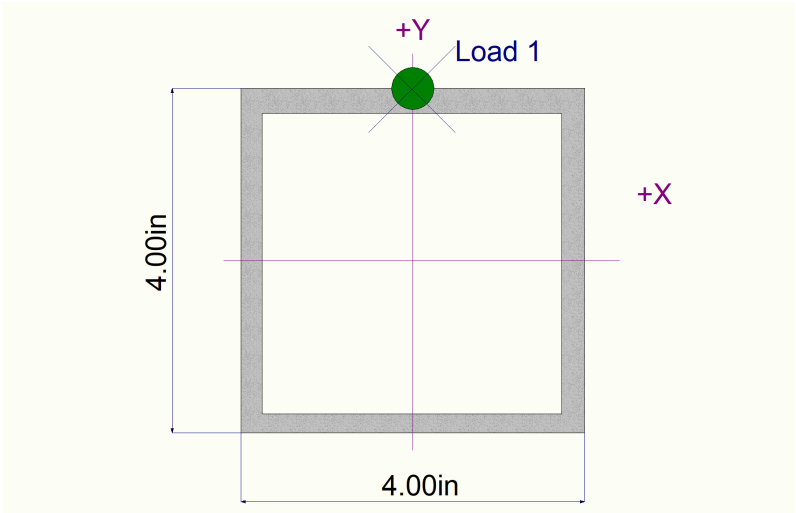
PCS STRUCTURAL SOLUTIONS

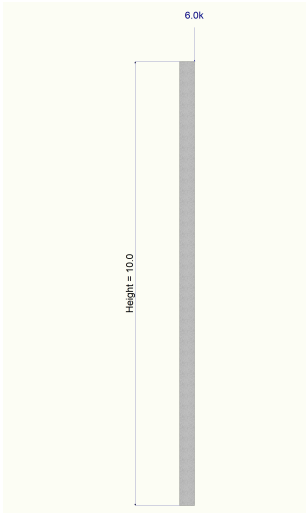
DESCRIPTION: Walkway Col

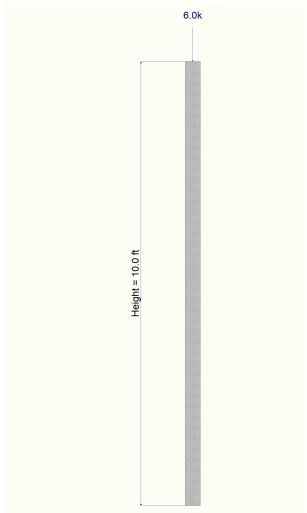
Steel Section Properties : HSS4x4x1/4

Depth	=	4.000	in	I xx	=	7.80	in^4	J	=	12.800 in^4
Design Thick	=	0.233	in	S xx	=	3.90	in^3			
Width	=	4.000	in	R xx	=	1.520	in			
Wall Thick	=	0.250	in	Zx	=	4.690	in^3			
Area	=	3.370	in^2	I yy	=	7.800	in^4	C	=	6.560 in^3
Weight	=	12.210	plf	S yy	=	3.900	in^3			
				R yy	=	1.520	in			
Ycg	=	0.000	in							

Sketches







Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Column

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327
PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Col w/ 2 lvls

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS4x4x1/4**
Analysis Method : Load Resistance Factor
Steel Stress Grade
Fy : Steel Yield 46.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 19 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 231.990 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 19.0 ft, Yecc = 2.0 in, D = 2.160, L = 3.080, S = 0.760 k
Axial Load at 19.0 ft, Yecc = 2.0 in, D = 2.160, L = 3.080, S = 0.760 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.2493** : 1
Load Combination +1.20D+1.60L+0.50S+1.60H
Location of max.above base 18.872 ft
At maximum location values are . . .
Pu 16.078 k
0.9 * Pn 91.738 k
Mu-x -2.616 k-ft
0.9 * Mn-x : 16.181 k-ft
Mu-y 0.0 k-ft
0.9 * Mn-y : 16.181 k-ft

Maximum Load Reactions . .
Top along X-X k
Bottom along X-X k
Top along Y-Y k
Bottom along Y-Y k

Maximum Load Deflections . . .
Along Y-Y in at ft above base
for load combination :
Along X-X in at ft above base
for load combination :

PASS Maximum Shear Stress Ratio = **0.004353** : 1
Load Combination +1.20D+1.60L+0.50S+1.60H
Location of max.above base 0.0 ft
At maximum location values are . . .
Vu : Applied 0.1386 k
Vn * Phi : Allowable 31.842 k

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	k-ft	My - End Moments @ Base	My - End Moments @ Top

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	k-ft	My - End Moments @ Base	My - End Moments @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance

Steel Section Properties : HSS4x4x1/4

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Column

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

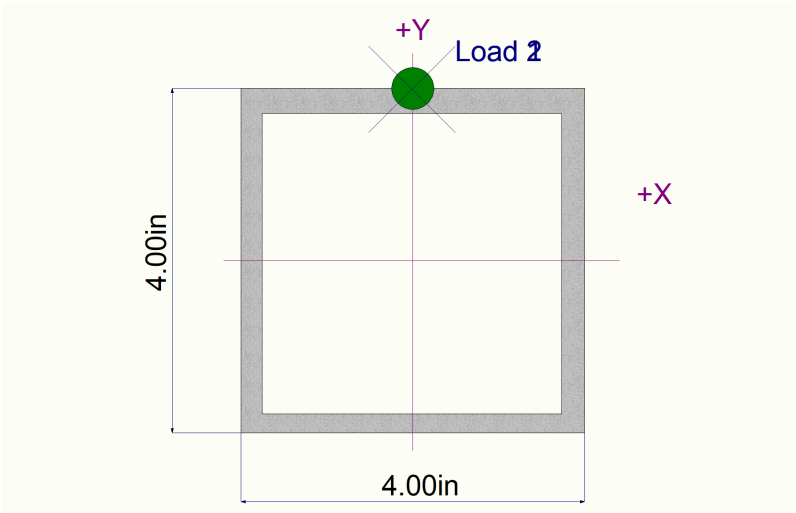
PCS STRUCTURAL SOLUTIONS

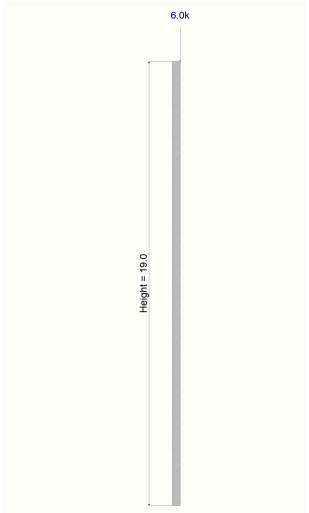
DESCRIPTION: Walkway Col w/ 2 lvls

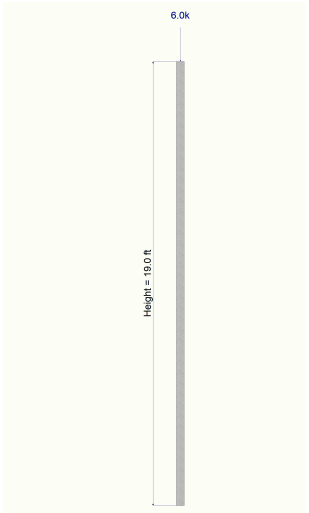
Steel Section Properties : HSS4x4x1/4

Depth	=	4.000	in	I xx	=	7.80	in^4	J	=	12.800 in^4
Design Thick	=	0.233	in	S xx	=	3.90	in^3			
Width	=	4.000	in	R xx	=	1.520	in			
Wall Thick	=	0.250	in	Zx	=	4.690	in^3			
Area	=	3.370	in^2	I yy	=	7.800	in^4	C	=	6.560 in^3
Weight	=	12.210	plf	S yy	=	3.900	in^3			
				R yy	=	1.520	in			
Ycg	=	0.000	in							

Sketches







Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Concrete Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327
PCS STRUCTURAL SOLUTIONS

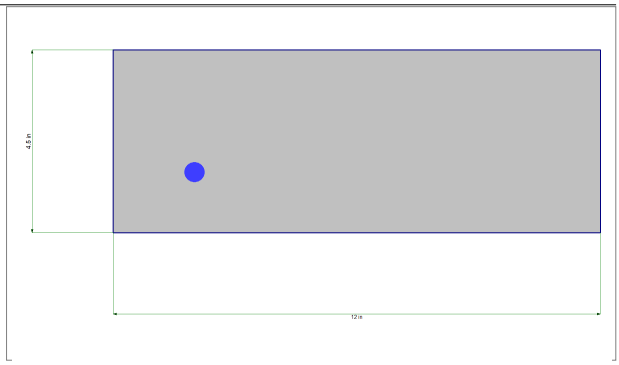
DESCRIPTION: Walkway Concrete Deck

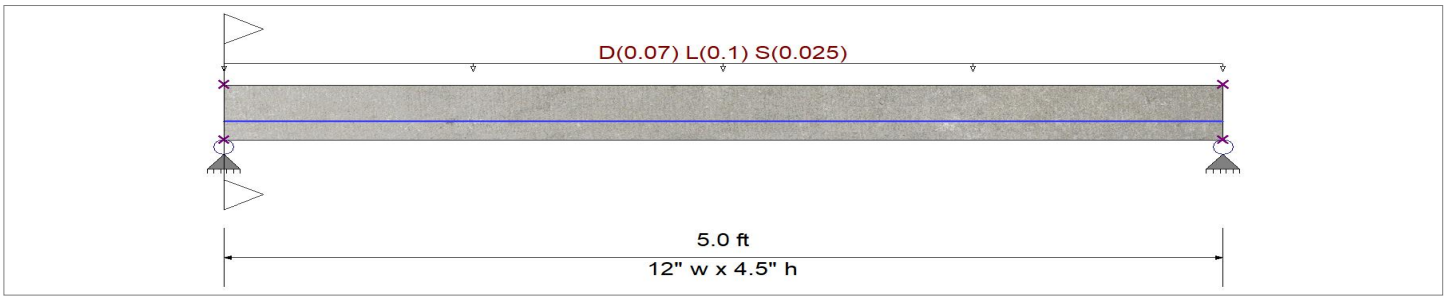
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c$^{1/2}$ * 7.50	=	375.0 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup =		2





Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 4.50 in
Span #1 Reinforcing....
1-#4 at 1.50 in from Bottom, from 0.0 to 5.0 ft in this span

Load for Span Number 1
Uniform Load : D = 0.070, L = 0.10, S = 0.0250 ksf, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.322** : 1	Maximum Deflection			
Section used for this span		**Typical Section**	Max Downward Transient Deflection	0.005 in	Ratio =	12142 >=360.
Mu : Applied		0.8016 k-ft	Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0
Mn * Phi : Allowable		2.488 k-ft	Max Downward Total Deflection	0.008 in	Ratio =	7142 >=180.
Location of maximum on span		2.505 ft	Max Upward Total Deflection	0.000 in	Ratio =	0 <180.0
Span # where maximum occurs		Span # 1				

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	0.425	0.425
Overall MINimum	0.062	0.062
+D+H	0.175	0.175
+D+L+H	0.425	0.425
+D+Lr+H	0.175	0.175
+D+S+H	0.237	0.237
+D+0.750Lr+0.750L+H	0.362	0.362
+D+0.750L+0.750S+H	0.409	0.409
+D+0.60W+H	0.175	0.175
+D+0.750Lr+0.750L+0.450W+H	0.362	0.362
+D+0.750L+0.750S+0.450W+H	0.409	0.409
+0.60D+0.60W+0.60H	0.105	0.105
+D+0.70E+0.60H	0.175	0.175
+D+0.750L+0.750S+0.5250E+H	0.409	0.409

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Concrete Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Concrete Deck

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+0.60D+0.70E+H	0.105	0.105
D Only	0.175	0.175
L Only	0.250	0.250
S Only	0.062	0.062
H Only		

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+1.60L+0.50S+1.60H	1	0.00	3.00	0.64	0.64	0.00	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.05	3.00	0.63	0.63	0.03	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.11	3.00	0.61	0.61	0.07	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.16	3.00	0.60	0.60	0.10	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.22	3.00	0.59	0.59	0.13	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.27	3.00	0.57	0.57	0.17	0.86	2.89	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.33	3.00	0.56	0.56	0.20	0.71	2.83	Vu < PhiVc/2	lot Reqd 9.6.	2.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.38	3.00	0.54	0.54	0.23	0.60	2.79	Vu < PhiVc/2	lot Reqd 9.6.	2.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.44	3.00	0.53	0.53	0.26	0.52	2.76	Vu < PhiVc/2	lot Reqd 9.6.	2.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.49	3.00	0.52	0.52	0.28	0.45	2.73	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.55	3.00	0.50	0.50	0.31	0.40	2.72	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.60	3.00	0.49	0.49	0.34	0.36	2.70	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.66	3.00	0.47	0.47	0.37	0.32	2.69	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.71	3.00	0.46	0.46	0.39	0.29	2.68	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.77	3.00	0.45	0.45	0.42	0.27	2.67	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.82	3.00	0.43	0.43	0.44	0.25	2.66	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.87	3.00	0.42	0.42	0.46	0.23	2.65	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.93	3.00	0.40	0.40	0.49	0.21	2.64	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	0.98	3.00	0.39	0.39	0.51	0.19	2.64	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.04	3.00	0.37	0.37	0.53	0.18	2.63	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.09	3.00	0.36	0.36	0.55	0.16	2.63	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.15	3.00	0.35	0.35	0.57	0.15	2.62	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.20	3.00	0.33	0.33	0.59	0.14	2.62	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.26	3.00	0.32	0.32	0.60	0.13	2.61	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.31	3.00	0.30	0.30	0.62	0.12	2.61	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.37	3.00	0.29	0.29	0.64	0.11	2.61	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.42	3.00	0.28	0.28	0.65	0.11	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.48	3.00	0.26	0.26	0.67	0.10	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.53	3.00	0.25	0.25	0.68	0.09	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.58	3.00	0.23	0.23	0.69	0.08	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.64	3.00	0.22	0.22	0.71	0.08	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.69	3.00	0.21	0.21	0.72	0.07	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.75	3.00	0.19	0.19	0.73	0.07	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.80	3.00	0.18	0.18	0.74	0.06	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.86	3.00	0.16	0.16	0.75	0.05	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.91	3.00	0.15	0.15	0.76	0.05	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	1.97	3.00	0.14	0.14	0.77	0.04	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.02	3.00	0.12	0.12	0.77	0.04	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.08	3.00	0.11	0.11	0.78	0.03	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.13	3.00	0.09	0.09	0.78	0.03	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.19	3.00	0.08	0.08	0.79	0.03	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.24	3.00	0.07	0.07	0.79	0.02	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.30	3.00	0.05	0.05	0.80	0.02	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.35	3.00	0.04	0.04	0.80	0.01	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.40	3.00	0.02	0.02	0.80	0.01	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.46	3.00	0.01	0.01	0.80	0.00	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.51	3.00	-0.00	0.00	0.80	0.00	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Concrete Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Concrete Deck

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.20D+1.60L+0.50S+1.60H	1	2.57	3.00	-0.02	0.02	0.80	0.01	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.62	3.00	-0.03	0.03	0.80	0.01	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.68	3.00	-0.05	0.05	0.80	0.01	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.73	3.00	-0.06	0.06	0.79	0.02	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.79	3.00	-0.07	0.07	0.79	0.02	2.57	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.84	3.00	-0.09	0.09	0.79	0.03	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.90	3.00	-0.10	0.10	0.78	0.03	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	2.95	3.00	-0.12	0.12	0.78	0.04	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.01	3.00	-0.13	0.13	0.77	0.04	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.06	3.00	-0.14	0.14	0.76	0.05	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.11	3.00	-0.16	0.16	0.75	0.05	2.58	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.17	3.00	-0.17	0.17	0.74	0.06	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.22	3.00	-0.19	0.19	0.73	0.06	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.28	3.00	-0.20	0.20	0.72	0.07	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.33	3.00	-0.21	0.21	0.71	0.07	2.59	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.39	3.00	-0.23	0.23	0.70	0.08	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.44	3.00	-0.24	0.24	0.69	0.09	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.50	3.00	-0.26	0.26	0.67	0.09	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.55	3.00	-0.27	0.27	0.66	0.10	2.60	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.61	3.00	-0.28	0.28	0.64	0.11	2.61	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.66	3.00	-0.30	0.30	0.63	0.12	2.61	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.72	3.00	-0.31	0.31	0.61	0.13	2.61	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.77	3.00	-0.33	0.33	0.59	0.14	2.62	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.83	3.00	-0.34	0.34	0.58	0.15	2.62	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.88	3.00	-0.35	0.35	0.56	0.16	2.62	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.93	3.00	-0.37	0.37	0.54	0.17	2.63	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	3.99	3.00	-0.38	0.38	0.52	0.18	2.63	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.04	3.00	-0.40	0.40	0.50	0.20	2.64	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.10	3.00	-0.41	0.41	0.47	0.22	2.65	Vu < PhiVc/2	lot Reqd 9.6.	2.6	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.15	3.00	-0.42	0.42	0.45	0.23	2.65	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.21	3.00	-0.44	0.44	0.43	0.26	2.66	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.26	3.00	-0.45	0.45	0.40	0.28	2.67	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.32	3.00	-0.47	0.47	0.38	0.31	2.68	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.37	3.00	-0.48	0.48	0.35	0.34	2.69	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.43	3.00	-0.49	0.49	0.33	0.38	2.71	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.48	3.00	-0.51	0.51	0.30	0.43	2.72	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.54	3.00	-0.52	0.52	0.27	0.48	2.75	Vu < PhiVc/2	lot Reqd 9.6.	2.7	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.59	3.00	-0.54	0.54	0.24	0.56	2.77	Vu < PhiVc/2	lot Reqd 9.6.	2.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.64	3.00	-0.55	0.55	0.21	0.65	2.81	Vu < PhiVc/2	lot Reqd 9.6.	2.8	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.70	3.00	-0.56	0.56	0.18	0.78	2.86	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.75	3.00	-0.58	0.58	0.15	0.96	2.93	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.81	3.00	-0.59	0.59	0.12	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.86	3.00	-0.61	0.61	0.09	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.92	3.00	-0.62	0.62	0.05	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0
+1.20D+1.60L+0.50S+1.60H	1	4.97	3.00	-0.63	0.63	0.02	1.00	2.94	Vu < PhiVc/2	lot Reqd 9.6.	2.9	0.0	0.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	5.000	0.80	2.49	0.32
+1.40D+1.60H					
Span # 1	1	5.000	0.31	2.49	0.12
+1.20D+0.50Lr+1.60L+1.60H					
Span # 1	1	5.000	0.76	2.49	0.31
+1.20D+1.60L+0.50S+1.60H					

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Concrete Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Walkway Concrete Deck

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
Span # 1 +1.20D+1.60Lr+L+1.60H	1	5.000	0.80	2.49	0.32
Span # 1 +1.20D+1.60Lr+0.50W+1.60H	1	5.000	0.57	2.49	0.23
Span # 1 +1.20D+L+1.60S+1.60H	1	5.000	0.26	2.49	0.11
Span # 1 +1.20D+1.60S+0.50W+1.60H	1	5.000	0.70	2.49	0.28
Span # 1 +1.20D+0.50Lr+L+W+1.60H	1	5.000	0.39	2.49	0.16
Span # 1 +1.20D+L+0.50S+W+1.60H	1	5.000	0.57	2.49	0.23
Span # 1 +0.90D+W+1.60H	1	5.000	0.61	2.49	0.25
Span # 1 +1.20D+L+0.20S+E+1.60H	1	5.000	0.20	2.49	0.08
Span # 1 +0.90D+E+0.90H	1	5.000	0.59	2.49	0.24
Span # 1	1	5.000	0.20	2.49	0.08

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L+H	1	0.0084	2.500		0.0000	0.000

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Beam

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327
PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Stair Stringer

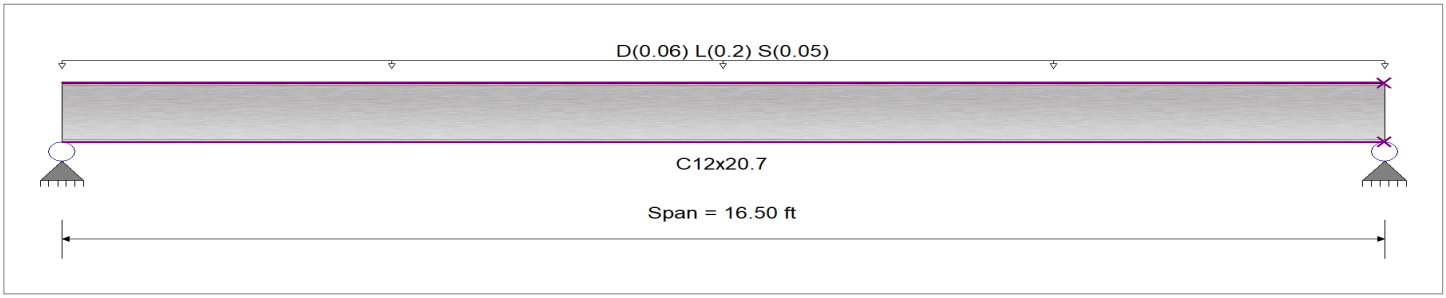
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 36.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.030, L = 0.10, S = 0.0250 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.205 : 1	Maximum Shear Stress Ratio =	0.052 : 1
Section used for this span	C12x20.7	Section used for this span	C12x20.7
Mu : Applied	14.191 k-ft	Vu : Applied	3.440 k
Mn * Phi : Allowable	69.120 k-ft	Vn * Phi : Allowable	65.785 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
Location of maximum on span	8.250 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.090 in	Ratio =	2,210 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.116 in	Ratio =	1701 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	Summary of Moment Values: max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values: VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 16.50 ft	1	0.041	0.011	2.86		2.86	76.80	69.12	1.00	1.00	0.69	73.09	65.78
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 16.50 ft	1	0.193	0.049	13.34		13.34	76.80	69.12	1.00	1.00	3.23	73.09	65.78
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 16.50 ft	1	0.205	0.052	14.19		14.19	76.80	69.12	1.00	1.00	3.44	73.09	65.78
+1.20D+1.60Lr+L+1.60H													
Dsgn. L = 16.50 ft	1	0.134	0.034	9.26		9.26	76.80	69.12	1.00	1.00	2.24	73.09	65.78
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 16.50 ft	1	0.035	0.009	2.45		2.45	76.80	69.12	1.00	1.00	0.59	73.09	65.78
+1.20D+L+1.60S+1.60H													
Dsgn. L = 16.50 ft	1	0.173	0.044	11.98		11.98	76.80	69.12	1.00	1.00	2.90	73.09	65.78
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 16.50 ft	1	0.075	0.019	5.17		5.17	76.80	69.12	1.00	1.00	1.25	73.09	65.78
+1.20D+0.50Lr+L+W+1.60H													
Dsgn. L = 16.50 ft	1	0.134	0.034	9.26		9.26	76.80	69.12	1.00	1.00	2.24	73.09	65.78
+1.20D+L+0.50S+W+1.60H													
Dsgn. L = 16.50 ft	1	0.146	0.037	10.11		10.11	76.80	69.12	1.00	1.00	2.45	73.09	65.78
+0.90D+W+1.60H													
Dsgn. L = 16.50 ft	1	0.027	0.007	1.84		1.84	76.80	69.12	1.00	1.00	0.45	73.09	65.78
+1.20D+L+0.20S+E+1.60H													
Dsgn. L = 16.50 ft	1	0.139	0.035	9.60		9.60	76.80	69.12	1.00	1.00	2.33	73.09	65.78
+0.90D+E+0.90H													
Dsgn. L = 16.50 ft	1	0.027	0.007	1.84		1.84	76.80	69.12	1.00	1.00	0.45	73.09	65.78

Steel Beam

DESCRIPTION: Stair Stringer

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.1164	8.297		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.145	2.145
Overall MINimum	0.297	0.297
+D+H	0.495	0.495
+D+L+H	2.145	2.145
+D+Lr+H	0.495	0.495
+D+S+H	0.908	0.908
+D+0.750Lr+0.750L+H	1.733	1.733
+D+0.750L+0.750S+H	2.042	2.042
+D+0.60W+H	0.495	0.495
+D+0.750Lr+0.750L+0.450W+H	1.733	1.733
+D+0.750L+0.750S+0.450W+H	2.042	2.042
+0.60D+0.60W+0.60H	0.297	0.297
+D+0.70E+0.60H	0.495	0.495
+D+0.750L+0.750S+0.5250E+H	2.042	2.042
+0.60D+0.70E+H	0.297	0.297
D Only	0.495	0.495
L Only	1.650	1.650
S Only	0.413	0.413
H Only		

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Column

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

PCS STRUCTURAL SOLUTIONS

DESCRIPTION: Stair Handrail

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS2x1-1/2x3/16**
Analysis Method : Load Resistance Factor
Steel Stress Grade
Fy : Steel Yield 46.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 3.50 ft
Top & Bottom Fixity Top Free, Bottom Fixed
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 3.50 ft, K = 2.1
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 3.50 ft, K = 2.1

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 12.880 lbs * Dead Load Factor
BENDING LOADS . . .
Lat. Point Load at 3.50 ft creating My-y, L = 0.2130 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.6645** : 1
Load Combination +1.20D+0.50Lr+1.60L+1.60H
Location of max.above base 0.0 ft
At maximum location values are . . .
Pu 0.01546 k
0.9 * Pn 9.091 k
Mu-x 0.0 k-ft
0.9 * Mn-x : 2.205 k-ft
Mu-y -1.193 k-ft
0.9 * Mn-y : 1.797 k-ft

Maximum Load Reactions . .
Top along X-X k
Bottom along X-X k
Top along Y-Y k
Bottom along Y-Y k

Maximum Load Deflections . . .
Along Y-Y in at ft above base
for load combination :
Along X-X in at ft above base
for load combination :

PASS Maximum Shear Stress Ratio = **0.04837** : 1
Load Combination +1.20D+0.50Lr+1.60L+1.60H
Location of max.above base 0.0 ft
At maximum location values are . . .
Vu : Applied 0.3408 k
Vn * Phi : Allowable 7.045 k

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	k-ft	My - End Moments @ Base	My - End Moments @ Top

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	k-ft	My - End Moments @ Base	My - End Moments @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance

Steel Section Properties : HSS2x1-1/2x3/16

Project Title: KCHA PARK ROYAL
Engineer: HP
Project ID: 21-034
Project Descr:

Printed: 10 AUG 2021, 3:27PM

Steel Column

File: 21034 KCHA Park Royal.ec6

Lic. # : KW-06002327

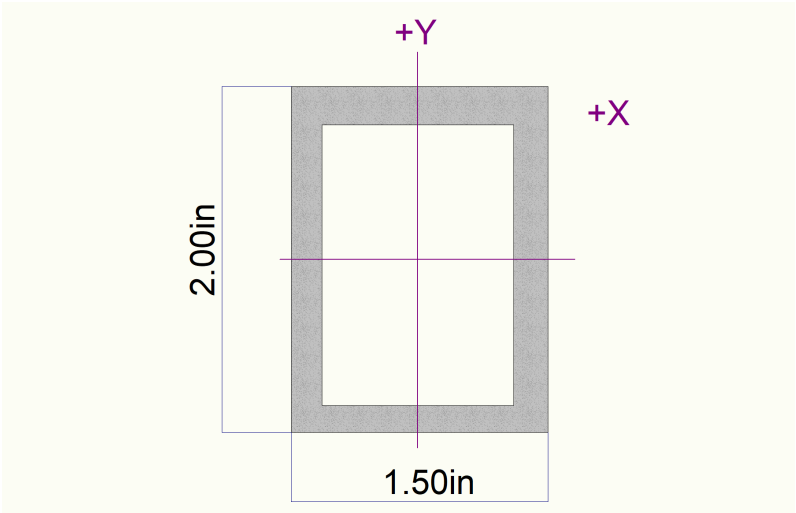
PCS STRUCTURAL SOLUTIONS

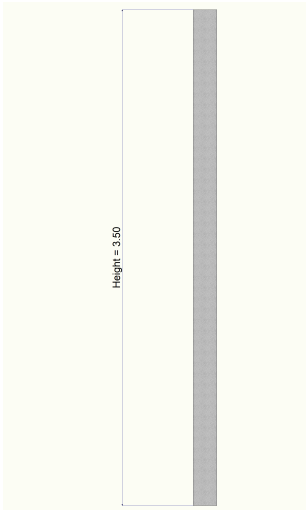
DESCRIPTION: Stair Handrail

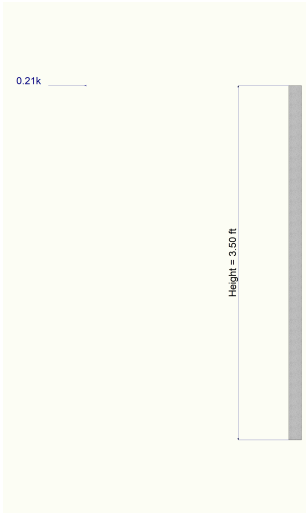
Steel Section Properties : HSS2x1-1/2x3/16

Depth	=	2.000	in	I xx	=	0.50	in^4	J	=	0.664	in^4
Design Thick	=	0.174	in	S xx	=	0.50	in^3	Cw	=	0.82	in^6
Width	=	1.500	in	R xx	=	0.697	in				
Wall Thick	=	0.187	in	Zx	=	0.639	in^3				
Area	=	1.020	in^2	I yy	=	0.313	in^4	C	=	0.822	in^3
Weight	=	3.680	plf	S yy	=	0.417	in^3				
				R yy	=	0.554	in				
				Zy	=	0.521	in^3				
Ycg	=	0.000	in								

Sketches





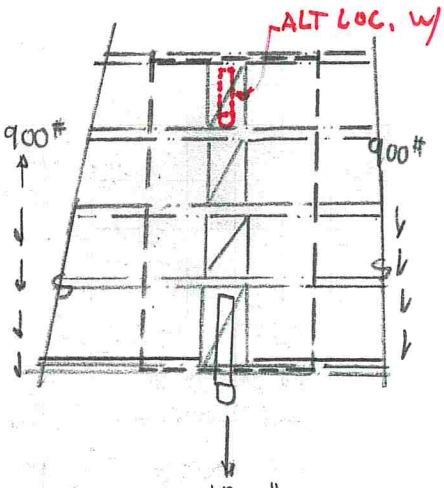


PCS Structural Solutions

Project: KCHA PARK ROYAL APART. Job No: 21-034

Subject: FALL RESTRAINT Sheet 1/1 Name: SLF

Originating Office: ☒ Seattle ☐ Tacoma ☐ Portland Date: 1-26-21



$V_{ASD} = 1.8k$

$\perp$ PERP JST

$V_A = 166$ PLF

$\ell_{req'd} = 900\#/166\ PLF = 5.4$ FT

$V_{act} = \frac{900\#}{6'-0"} = 150$ PLF

$f_v = \frac{(1.5)(900)}{(3.5)(22.5)} = 17$ PSI

(E) ROOF

½" SHT'G

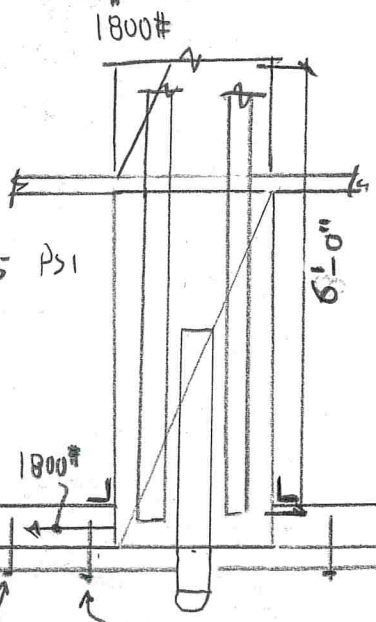
8d @ 6" OC EDGE

8d @ 12" OC FIELD

2x8 @ 24" OC HF RAFTERS

$V_A = 360\,[1-(.5-.42)]/2.0$

$= 166$ PLF ✓OK



∴ 4x BLKG x 22½"

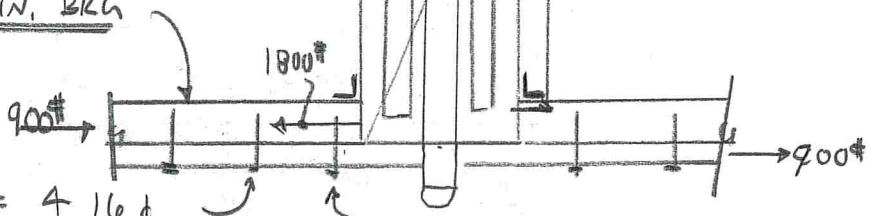
∴ 6'-0" BLKG ↓

OR 6'-0" STRAPS

CS22 w/ (2) ROWS 8d@

$f_{ct} = \frac{1800}{1.5(5.5)} = 218$ PSI < 405 PSI ✓OK

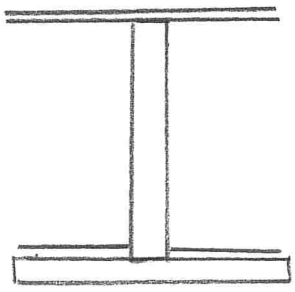
∴ 2x6 MIN. BRG



2x-2x SPLICE

$900/(122)(2.0) = 4$ 16d OR

@ 6" OC ∴ ℓ = 2'-0" w/ 16d @ 6" OC



(E) 2x8 IN TENSION

$f_{c\ TEN.} = 900\#/(1.5)(7.25) = 82$ PSI

∴ (E) 2x8 ½ LOAD

PCS Structural Solutions

Project: KCHA PARK ROYAL Job No: 21-034

Subject: LADDER SUPPORT Sheet 1/1 Name: SLF

Originating Office: ☐ Seattle ☐ Tacoma ☐ Portland Date: 1-28-21

LADDER WT 600#

P = 600# + (1+1)(300#) = 1,200#

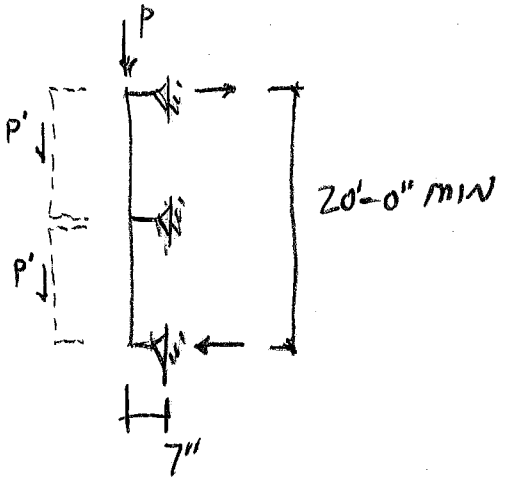
P' = (50%)(600#) + 300# = 600#

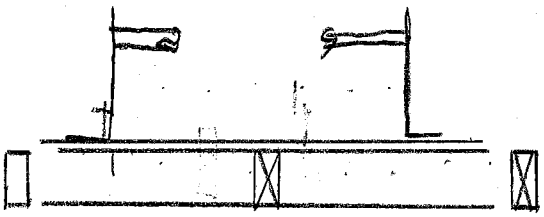
T = C = 600(7")/10'(12"/1') = 35#

V = 1200#/3 = 400#

HUC48 GF >> 50% 400#

↳ ATTACHMENT EA SIDE





∴ 4x8 BLKG W/ HUC48 EA. END OKAY