

Structural Calculations

<u>Client:</u> Wingstop Restaurants, Inc

## Project: Wingstop Restaurant 1041 NE Sam Walton Lane

Lee's Summit, MO 64086

Project # WIL-MO-04-21

Date: June 16, 2021



## ATC Hazards by Location

#### **Search Information**

Address:	1041 NE Sam Walton Lane Lee's Summit, M 64086
Coordinates:	38.9312921, -94.36108949999999
Elevation:	993 ft
Timestamp:	2021-06-08T18:26:54.111Z
Hazard Type:	Wind



#### ASCE 7-16

**ASCE 7-10** 

#### **ASCE 7-05**

MRI 10-Year	mph	MRI 10-Year	76 mph	ASCE 7-05 Wind Speed	 90 mph
MRI 25-Year	mph	MRI 25-Year	84 mph		
MRI 50-Year 88 r	mph	MRI 50-Year	90 mph		
MRI 100-Year 94 r	mph	MRI 100-Year	96 mph		
Risk Category I 103 r	mph	Risk Category I	105 mph		
Risk Category II 109 r	mph	Risk Category II	115 mph		
Risk Category III 117 r	mph	Risk Category III-IV	120 mph		
Risk Category IV 122 r	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

## ATC Hazards by Location

#### Search Information 350 Unity Village Address: 1041 NE Sam Walton Lane Lee's Summit, MO Sair 993 ft East Hospital 64086 ecue **Coordinates:** 38.9312921, -94.36108949999999 nmi **Elevation:** 993 ft Timestamp: 2021-06-08T18:28:00.410Z Snow Hazard Type: Lee's Summit Google RMap data ©2021 **ASCE 7-16 ASCE 7-10 ASCE 7-05** Ground Snow Load 20 lb/sqft Ground Snow Load 20 lb/sqft Ground Snow Load 20 lb/sqft

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## ATC Hazards by Location

#### **Search Information**

Address:	1041 NE Sam Walton Lane Lee's Summit, MO 64086
Coordinates:	38.9312921, -94.36108949999999
Elevation:	993 ft
Timestamp:	2021-06-08T18:28:40.827Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	П

D-default

**MCER Horizontal Response Spectrum** 



#### Design Horizontal Response Spectrum





#### **Basic Parameters**

Site Class:

Name	Value	Description
SS	0.1	MCE <sub>R</sub> ground motion (period=0.2s)
S <sub>1</sub>	0.068	MCE <sub>R</sub> ground motion (period=1.0s)
S <sub>MS</sub>	0.16	Site-modified spectral acceleration value
S <sub>M1</sub>	0.164	Site-modified spectral acceleration value
S <sub>DS</sub>	0.106	Numeric seismic design value at 0.2s SA
S <sub>D1</sub>	0.109	Numeric seismic design value at 1.0s SA

#### Additional Information

Name	Value	Description
SDC	В	Seismic design category
Fa	1.6	Site amplification factor at 0.2s
Fv	2.4	Site amplification factor at 1.0s

CR <sub>S</sub>	0.927	Coefficient of risk (0.2s)
CR <sub>1</sub>	0.876	Coefficient of risk (1.0s)
PGA	0.047	MCE <sub>G</sub> peak ground acceleration
F <sub>PGA</sub>	1.6	Site amplification factor at PGA
PGA <sub>M</sub>	0.076	Site modified peak ground acceleration
ΤL	12	Long-period transition period (s)
SsRT	0.1	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.108	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.068	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.078	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

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

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St. Louis, MO 63026 636.349.1600 JOB TITLE Wingstop Restaurant Lee's Summit, MO JOB NO. WIL-MO-04-21 SHEET NO. CALCULATED BY K. Woodard DATE 6/10/21 CHECKED BY CRH DATE

www.struware.com

#### Code Search

**Code:** International Building Code 2018

#### Occupancy:

Occupancy Group = B Business

#### **Risk Category & Importance Factors:**

Risk Category =	П
Wind factor =	1.00
Snow factor =	1.00
Seismic factor =	1.00

#### **Type of Construction:**

Fire Rating:

Roof =	0.0 hr
Floor =	0.0 hr

#### **Building Geometry:**

0.25 / 12	1.2 deg
160.0 ft	
70.0 ft	
17.0 ft	
23.0 ft	
3.0 ft	
	0.25 / 12 160.0 ft 70.0 ft 17.0 ft 23.0 ft 3.0 ft

#### Live Loads:

<u>Roof</u>	0 to 200 sf:	20 psf
	200 to 600 sf:	24 - 0.02Area, but not less than 12 psf
	over 600 sf:	12 psf

#### Floor:

Typical Floor	N/A
Partitions	N/A

#### Case Engineering Inc.

796 Merus Ct St. Louis, MO 63026

636.349.1600

ASCE 7-16

#### JOB TITLE Wingstop Restaurant Lee's Summit, MO JOB NO. WIL-MO-04-21 SHEET NO. CALCULATED BY K. Woodard DATE 6/10/21 CHECKED BY CRH DATE

#### Wind Loads :

109 mph	
84.4 mph	
II	
В	
Enclosed Building	
+/-0.18	
0.85	
0.701	
0.596	
Monoslope	

Topographic Fa	ctor (ł	<u>(zt)</u>
Topography		Flat
Hill Height	(H)	80.0 ft
Half Hill Length	(Lh)	100.0 ft
Actual H/Lh	=	0.80
Use H/Lh	=	0.50
Modified Lh	=	160.0 ft
From top of cre	st: x =	50.0 ft
Bldg up/down w	vind?	downwind
H/Lh= 0.50		K <sub>1</sub> = 0.000
x/Lh = 0.31		K <sub>2</sub> = 0.792
z/Lh = 0.11		K <sub>3</sub> = 1.000
At Mean Roof H	łt:	
	14.1	

$$Kzt = (1+K_1K_2K_3)^2 = 1.00$$







<u>Gust E</u>	ffect Factor
h =	17.0 ft
B =	70.0 ft
/z (0.6h) =	30.0 ft

Flexible st	ructure if natural freque	ency < 1 Hz (T > 1 second).
If building	h/B>4 then may be fle	xible and should be investigated.
	h/B = 0.24	Rigid structure (low rise bldg)

#### G = 0.85 Using rigid structure formula

Rig	<u>gid Structure</u>	Flexible or Dynamically Sensitive Structure						
ē =	0.33	Natural Frequency $(\eta_1) =$	0.0 Hz					
ł =	320 ft	Damping ratio (β) =	0					
z <sub>min</sub> =	30 ft	/b =	0.45					
с =	0.30	/α =	0.25					
$g_Q, g_v =$	3.4	Vz =	70.2					
$L_z =$	310.0 ft	N <sub>1</sub> =	0.00					
Q =	0.88	R <sub>n</sub> =	0.000					
$I_z =$	0.30	R <sub>h</sub> =	28.282	η =	0.000	h =	17.0 ft	
G =	<b>0.86</b> use G = 0.85	R <sub>B</sub> =	28.282	η =	0.000			
		R <sub>L</sub> =	28.282	η =	0.000			
		g <sub>R</sub> =	0.000					
		R =	0.000					

$$Gf = 0.000$$

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JOB TITLE Wingstop Restaurant					
	Lee's Summit, MO				
JOB NO.	WIL-MO-04-21	SHEET NO.			
CALCULATED BY	K. Woodard	DATE	6/10/21		
CHECKED BY	CRH	DATE			

#### Snow Loads : ASCE 7- 16

Ri Llariz, agya ta	oof slope	= 1.2 deg
Horiz. eave to	riage alst (vv) :	= 70.0 π
Roof length parall	el to ridge (L) :	= 160.0 ft
Type of Roof		Monoslope
Ground Snow Load	Pg :	= 20.0 psf
Risk Category	:	=
Importance Factor	:	= 1.0
Thermal Factor	Ct :	= 1.00
Exposure Factor	Ce :	= 1.0
Pf = 0.7*Ce*Ct*I*Pa	:	= 14.0 psf
Unobstructed Slipperv	Surface	no po.
	Ganade	110
Sloped-roof Factor	Cs :	= 1.00
Balancod Snow Load		- 14 0 pcf
Dalaliceu Show Luau	•	- 14.0 psi
Dain an Onaw Comba		1 10 de m
Rain on Snow Surchal	ge Angle	1.40 deg
Code Maximum Rain S	Surcharge	5.0 pst
Rain on Snow Surchar	rge ÷	= 5.0 psf
Ps plus rain surcharge	. :	= 19.0 psf
Minimum Snow Load	Pm :	= 20.0 psf
Uniform Roof Design	Snow Load	= 20.0 psf

#### Nominal Snow Forces

Near ground level surface balanced snow load = 20.0 psf

NOTE: Alternate spans of continuous beams shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code for loading diagrams and exceptions for gable roofs..

#### lu = Up or downwind fetch 0.0 ft Projection height h = 0.0 ft Projection width/length lp = 0.0 ft Snow density g = 16.6 pcf Balanced snow height hb = 0.84 ft hd = 0.92 ft hc = -0.84 ft hc/hb <0.2 = -1.0 Ip <15', drift not req'd Drift height (hc) 0.00 ft = Drift width w = -6.75 ft $pd = \gamma^{*}hd =$ 0.0 psf Surcharge load: 14.0 psf Balanced Snow load: = 14.0 psf Windward Snow Drifts 2 - Against walls, parapets, etc Up or downwind fetch lu = 0.0 ft Projection height h = 0.0 ft 0.0 ft Projection width/length lp = g = Snow density 16.6 pcf hb = Balanced snow height 0.84 ft hd = 0.92 ft hc = -0.84 ft hc/hb < 0.2 = -1.0Ip <15', drift not req'd Drift height (hc) 0.00 ft Drift width w = -6.75 ft Surcharge load: 0.0 psf $pd = \gamma^*hd =$ Balanced Snow load: = 14.0 psf 14.0 psf



Note: If bottom of projection is at least 2 feet above hb then snow drift is not required.

#### Windward Snow Drifts 1 - Against walls, parapets, etc

CASSE Engineering Inc. Office: 636-349-1600 Fax: 636-349-1730 Website: www.caseengineeringinc.com		Client: Location: Subject: Engineer:	Wingstop Lee's Summit, MO Mechanical Rooftop Unit Weights and K. Woodard	Project Number: WIL-MO-04-21 Date: 6/10/2021 Reactions
<u>Equipm</u>	ent Weight	Factor	<u>Supports</u>	Reaction Load
RTU1:	855 lb	1.3	6	186
RTU2:	785 lb	1.3	4	256
RTU3:	lb	1.3	4	
MAU:	525 lb	1.2	4	158
Hood:	955 lb	1.1	14	*76 or 138
EF:	218 lb	1.0	4	55

\*When using this load case a 300 lb additional load must be added to any single hanger rod to account for a worker/tools hanging from the hanger.

Steel Joist Analysis of Irregular Loads J-1:Joist = 20K4Length =34 ftTrib. Width =5 ftE = 29000 (ks)Shear Failed from 0to 16, 23to 40Live $\Delta_a = L/240$ Max DCR =Allowable Loads:DCR Limits without reinforcement:Total Loads =212 plf (for stress)Live Load =212 plf (for deflection)Full Uniform Loads:Partial Uniform Loads:Dead Load =15 psfDead Load =15 psfDead Load =20 psfLive Load =20 psfLive Load =20 psfLive Load =0 psfFull Uniform Loads:End, =Dead Load =0 ftKart, =0 ftKart, =0 ftLive Load =0 lbsLive Load =0 lbsLive Load, =0 lbsLocation, =13.75 ftStart, =0 ftLive Load, =0 lbsLocation, =0 lbsLive Load, =0 lbsLocation, =0 lbsLive Load, =0 lbsLocation, =0 lbsLocation, =0 lbsLoad, =0 lbsLive Load, =0 lbsLocation, =0 lbsLoad, =0 lbsLive Load, =0 lbsLive Load, =0 lbsLive Load,	CA Engineer Office: 536 Fax: 6363 Website: www.casee	CONSTRUE       CUSTOMER:       Wingstop         LOCATION:       Lee's Summit, MO         SUBJECT:       Steel Joist Analysis for Mechanica         PREPARED BY:       K. Woodard       File:		PRC Il Units	DJECT N	UMBER: WIL-MO DATE: 6/10/202	-04-21 :1				
Joist = 20K4Strength Analysis Results: Bending 'assedLength =34 ftMax DCR =0.97Trib. Witht =5 ftMax DCR =0.97E = 20000 ksiShear Failed from 0to16, 23to40Max DCR =1.19Allowable Loads:DCR Limits without reinforcement:DCR Limits without reinforcement:Total Load, =212 pif (for deflection)DCR Limits without reinforcement:Full Uniform Loads:Partial Uniform Loads:Joist Reinforcement Design:Tead Load =15 psfDead Load, =0 psfT&B Chords:Live Load =20 psfLive Load, =0 psfFy =Opint Loads:End, =0 ftK =0.00Point Loads:End, =0 ftK =0.00Live Load, =0 lbsDisLive Load, =0 psfLive Load, =0 lbsLive Load, =0 ftFy =36 ksiRTU-2 =320 lbsDead Load, =0 psfUcR =1.00Live Load, =0 lbsLoading =0 ftFy =36 ksiRTU-2 =320 lbsEnd, =0 ftFy =36 ksiLoadion, =13.75 ftStart, =0 ftFy =36 ksiRTU-2 =320 lbsEnd, =0 ftK =1Live Load, =0 lbsPeak, =0 ftK =1Live Load, =0 lbsPeak, =0 ftK =1Live Load, =0 lbsPeak, =0 ftK =1Live Load	Steel Joist	Analys	sis of Irre	gular Loads	s J-1:						
Length =34 ftBending basedTrib. Witht =5 ftMax DCR =0.97E =29000 ksiShear Failed from 0to16, 23to40Live Lad, =L/240Max DCR =1.19Allowable Loads:212 plf (for stress)DCR Limits without reinforcement:Total Load, =212 plf (for deflection)DCR Limits without reinforcement:Full Uniform Loads:Partial Uniform Loads:Joist Reinforcement Design:Dead Load =15 psfDead Load, =0 psfLive Load =20 psfLive Load, =0 psfFy =Dint Loads:Eart, =0 ftK =Doint Loads:Dead Load, =0 psfDCR =Ive Load, =0 tbsDead Load, =0 psfDCR =Ive Load, =0 tbsLive Load, =0 psfDCR =Live Load, =0 tbsLive Load, =0 psfDCR =Live Load, =0 tbsLive Load, =0 psfDCR =Live Load, =0 tbsEnd_2 =0 ftK =Live Load, =0 tbsPeak, =0 ftDCR =Loadion, =10 tbsPeak, =0 ftNot RequiredLocation, =10 tbsPeak, =0 ftNot RequiredLocation, =0 tbsPeak, =0 ftWeb Reinforcement:Live Load, =0 tbsPeak, =0 ftWeb Reinforcement:Live Load, =0 tbsPeak, =0 ftWeb Reinforcement:Live Load, =0 tbsPeak, =0 ftWeb Reinforc	Joist =	20K4					Strength Anal	lysis Re	esults:		
Trib. Width =5 ftMax DCR =0.97E =29000 ksiShear Failed from 0to16, 23to40Live $\Lambda_a =$ L/240Max DCR =1.19Allowable Loads:DCR Limits without reinforcement:Total Load, =212 plf (for stress)Bending:1.00Live Load, =212 plf (for deflection)Shear:1.00Full Uniform Loads:Partial Uniform Loads:DCR Limits without reinforcement:Dead Load =15 psfDead Load, =0 psfT&B Chords:Full Uniform Loads:Partial Uniform Loads:Joist Reinforcement Design:Table Chords:0 psfFy =36 ksiLive Load =10 bsLive Load, =0 psfChord 8:Point Loads:End, =0 ftL =12 inRTU-2 =320 lbsDead Load, =0 psfDCR =0.00Live Load, =0 bsLive Load, =0 psfWebs:L2X2X1/8Location, =13.75 ftStart, =0 ftDCR =0.00Live Load, =0 lbs+Drift Load, =0 psfChord Reinforcement:Location, a =0 ftOpsf End, =0 ftDCR =0.03Loadion, a =0 ftOpsf End, =0 ftNot RequiredLoadion, a =0 ftOpsf End, =0 ftNot RequiredLoadion, a =0 ftOpsf End, =0 ftNot RequiredLoadion, a =0 ftNote: Bar jotst are typically constructedSymmetrically with equal sized web membersLocation, a =<	Length =	34 f	t				Bending	'assed			
E = 29000 ksiShear Failed from 0to 16, 23to 40Live $\Delta_a = 1/240$ Max DCR = 1.19Allowable Loads:DCR Limits without reinforcement:Total Load_a = 212 plf (for stress)Bending: 1.00Live Load_a = 212 plf (for deflection)Shear: 1.00Full Uniform Loads:Partial Uniform Loads:Dead Load = 15 psfDead Load = 0 psfLive Load = 20 psfLive Load, = 0 psfFoint Loads:Start, = 0 ftRTU-2 = 320 lbsDead Load, = 0 ftRTU-2 = 320 lbsDead Load, = 0 psfVe Load, = 0 lbsLive Load, = 0 ftLive Load, = 0 lbsLive Load, = 0 ftLive Load, = 0 lbsLive Load, = 0 ftLive Load, = 0 lbsEnd, = 0 ftLive Load, = 0 lbsEnd, = 0 ftLive Load, = 0 lbsDCR = 0.03Location, = 13.75 ftStart, = 0 ftRTU-2 = 320 lbsEnd, = 0 ftLocation, = 13.75 ftStart, = 0 ftNot RequiredDCR = 0.03Location, = 0 lbsPeak, = 0 ftLocation, = 0 ftOpsf End, = 0 ftLoad, = 0 lbsPeak, = 0 ftLocation, a = 0 ftOpsf End, = 0 ftLoad, = 0 lbsPeak, = 0 ftLoad, = 0 lbsPeak, = 0 ftLoad, = 0 lbsIs reinforcing reasonable?Load, = 0 lbsShear capacity 1.5 x Deft = 3021Location, a = 0 ftOpsf End, = 0 ftLocation, a = 0 ftNot RequiredLocation, a = 0 ftNote Start ord start bis endged. The accompanying shear diagram is based on the cocdeminimum allowable capacit	Trib. Width =	5 f	t				Max DCR =	0.97			
Live $\Delta_a = L/240$ Max DCR = 1.19Allowable Loads:DCR Limits without reinforcement:Total Load, =212 plf (for stress)Live Load, =212 plf (for deflection)Full Uniform Loads:Partial Uniform Loads:Dead Load =15 psfDead Load =20 psfLive Load =20 psfLive Load =20 psfLive Load =0 psfTRU 2 =320 lbsDead Load =0 psfRTU-2 =320 lbsLive Load =0 lbsLoads:Triangular Snow Drift Loads:Dead Load =0 lbsLoads:0 lbsLocation =19.33 ftTriangular Snow Drift Loads:Dead Load =0 lbsLoads:0 lbsLoads:0 lbsDead Load =0 ftDead Load =0 lbsDead Load =0 lbsLive Load =0 lbsDead Load =0 lbsLive Load = <td< td=""><td>E =</td><td>29000 k</td><td>si</td><td></td><td></td><td></td><td>Shear</td><td>Failed</td><td>from 0to16, 23</td><td>3to40</td></td<>	E =	29000 k	si				Shear	Failed	from 0to16, 23	3to40	
Allowable Loads: Total Load, =DCR Limits without reinforcement:Total Load, =212 plf (for stress) Live Load, =212 plf (for deflection)Full Uniform Loads: Live Load =212 plf (for deflection)Joist Reinforcement Design: T&B Chords:Full Uniform Loads: Live Load =20 psfLive Load, =0 psfFull Uniform Loads: Live Load =20 psfLive Load, =0 psfFoint Loads: Live Load, =0 psfFy =36 ksiPoint Loads: Live Load, =0 lbsLive Load, =0 psfPoint Loads: Live Load, =0 lbsLive Load, =0 psfRTU-2 =320 lbsDead Load, =0 psfWebs: L2X2X1/8Location, =13.75 ftStart, =0 ftFy =Stora, =0 lbsEnd, =0 ftK =Live Load, =0 lbsHort Loads:DCR =0.03Location, =13.75 ftStart, =0 ftNot RequiredLocation, =0 lbs+Drift Load, =0 psfChord Reinforcement:Live Load, =0 lbs+Drift Load, =0 psfChord Reinforcement:Live Load, =0 lbs+Drift Load, =0 psfFrom 8.25 ft to 13.5 ftLive Load, =0 lbsShear capacity at 1.5 x Depth =3021Live Load, =0 lbsIs reinforcing reasonable?NoLoad Load, =0 lbsShear capacity at 1.5 x Depth =302.1Location, a0 ftNote: Bar joits are typically constructed symmetrically with equil aiszed web members<	Live $\Delta_a$ =	L/240					Max DCR =	1.19			
Total Load, =       212 plf (for stress)       Bending:       1.00         Live Load, =       212 plf (for deflection)       Shear:       1.00         Full Uniform Loads:       Dead Load, =       0 psf       T&B Chords:       0.500 Dia. Rods         Live Load =       20 psf       Live Load, =       0 psf       T&B Chords:       0.500 Dia. Rods         Point Loads:       End, =       0 ft       K =       12 in         RTU-2 =       320 lbs       Dead Load, =       0 psf       DCR =       0.00         Live Load, =       0 lbs       Live Load, =       0 ft       Fy =       36 ksi         RTU-2 =       320 lbs       Dead Load, =       0 psf       Webs: L2X2X1/8         Location, =       13.75 ft       Start, =       0 ft       Fy =       36 ksi         RTU-2 =       320 lbs       End, =       0 ft       DCR =       0.00         Live Load, =       0 lbs       Peak, =       0 ft       Not Required         Location, =       19.33 ft       Triangular Snow Drift Loads:       DCR =       0.03         Location, =       0 ft       Opsf End, =       0 ft       Not Required         Live Load, =       0 lbs       Peak2 =       0 ft       (1) -	Allowable Loa	ds:					DCR Limits w	ithout r	einforcement:		
Live Load, = 212 pf (for deflection) Shear: 1.00 Full Uniform Loads: Partial Uniform Loads: Joist Reinforcement Design: Dead Load = 15 psf Dead Load, = 0 psf T&B Chords: 0.500 Dia. Rods Live Load = 20 psf Live Load, = 0 psf T&B Chords: 0.500 Dia. Rods Start, = 0 ft K = 0.65 Point Loads: End, = 0 ft L = 12 in RTU-2 = 320 lbs Dead Load <sub>2</sub> = 0 psf DCR = 0.00 Live Load, = 0 lbs Live Load <sub>2</sub> = 0 ft Fy = 36 ksi RTU-2 = 320 lbs Dead Load <sub>2</sub> = 0 ft Fy = 36 ksi RTU-2 = 320 lbs End <sub>2</sub> = 0 ft K = 1 Live Load <sub>2</sub> = 0 lbs Live Load <sub>2</sub> = 0 ft K = 1 Live Load <sub>2</sub> = 0 lbs End <sub>2</sub> = 0 ft K = 1 Live Load <sub>3</sub> = 0 lbs +Drift Loads: Dead Load <sub>3</sub> = 0 lbs +Drift Loads: Dead Load <sub>3</sub> = 0 lbs +Drift Load <sub>1</sub> = 0 psf Chord Reinforcement: Live Load <sub>4</sub> = 0 lbs Peak, = 0 ft Not Required Location <sub>3</sub> = 0 ft Opsf End <sub>1</sub> = 0 ft Location <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft Web Reinforcement: Live Load <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft Web Reinforcement: Live Load <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft Heat Not Required Location <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft Heat Not Required Location <sub>5</sub> = 0 ft Opsf End <sub>2</sub> = 0 ft (1) - L2X2X1/8 at Each Member From 8.25 ft to 13.5 ft Live Load <sub>6</sub> = 0 lbs Shear capacity at 1.5 x Depth = 3021 Live Load <sub>6</sub> = 0 lbs capacity at 1.5 x Depth = 3021 Live Load <sub>6</sub> = 0 lbs capacity at 0 ft Note: Bar loifs are typically constructed Symmetrically with equal sized web members along the lengh. As a result the allowable Live Load <sub>6</sub> = 0 lbs capacity is constant, except at the ends where Location <sub>7</sub> = 0 ft decreases until the web is engaged. The accompanying sheat diagram is based on the code minimum allowable capacity decreases to about 3021 lbs before leveling Add load = 0 lbs constant, except at the ends where Live Load <sub>6</sub> = 0 lbs constant, except at the ends where Location <sub>7</sub> = 0 ft decreases to about 3021 lbs before leveling Add load = 0 lbs constant, except at the ends where Live Load <sub>6</sub> = 0 lbs constant, except at the ends where Location <sub>7</sub> = 0 ft decreases to about 3021 lbs before leveling Add load = 0 lbs constant, except	Total Load <sub>a</sub> =	212 p	olf (for stress	3)			Bending:	1.00			
Full Uniform Loads:Joist Reinforcement Design:Dead Load =15psfDead Load_1 =0psfT&B Chords:0.500 Dia, RodsLive Load =20psfLive Load_1 =0psfFy =36ksiStart_1 =0ftL12in10101010Point Loads:End_1 =0ftL12in10101010RTU-2 =320lbsDead Load_2 =0psfDCR =0.000010 <td>Live Load<sub>a</sub> =</td> <td>212 p</td> <td>olf (for deflea</td> <td>ction)</td> <td></td> <td></td> <td>Shear:</td> <td>1.00</td> <td></td> <td></td>	Live Load <sub>a</sub> =	212 p	olf (for deflea	ction)			Shear:	1.00			
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Live Load = 20 psf Live Load, = 0 psf Fy = 36 ksi Start, = 0 ft K = 0.65 Point Loads: End, = 0 ft Let $L = 12$ in RTU-2 = 320 lbs Dead Load <sub>2</sub> = 0 psf DCR = 0.00 Live Load, = 0 lbs Live Load_2 = 0 psf Webs: L2X2X1/8 Location, = 13.75 ft Start <sub>2</sub> = 0 ft Fy = 36 ksi RTU-2 = 320 lbs End <sub>2</sub> = 0 ft K = 1 Live Load <sub>2</sub> = 0 lbs End <sub>2</sub> = 0 ft K = 1 Live Load <sub>3</sub> = 0 lbs +Drift Load, = 0 psf Chord Reinforcement: Live Load <sub>3</sub> = 0 lbs +Drift Load, = 0 psf Chord Reinforcement: Live Load <sub>4</sub> = 0 lbs Peak <sub>1</sub> = 0 ft Not Required Location <sub>3</sub> = 0 ft Opsf End, = 0 ft Web Reinforcement: Live Load <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft (1) - L2X2X1/8 at Each Member Dead Load <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft (1) - L2X2X1/8 at Each Member Dead Load <sub>5</sub> = 0 lbs Is reinforcing reasonable? No From 8.25 ft to 13.5 ft Live Load <sub>5</sub> = 0 lbs Shear capacity at 1.5 x Depth = 3021 Location <sub>5</sub> = 0 ft Note: Bar joists are typically constructed symmetrically with equal sized web members along the lengh. As a result the allowable Live Load <sub>6</sub> = 0 lbs constant, except at the ends where Location <sub>6</sub> = 0 ft Oft Cord Reinforcement Welds: Location <sub>7</sub> = 0 ft Reinforcement is only required at Live Load <sub>6</sub> = 0 lbs constant, except at the ends where Location <sub>7</sub> = 0 ft Reinforcement is only required at Live Load <sub>6</sub> = 0 lbs constant, except at the ends where Location <sub>7</sub> = 0 ft Reinforcement is only required at Live Load <sub>6</sub> = 0 lbs constant, except at the ends where Location <sub>7</sub> = 0 ft hote: Bar joists practices. For this Location <sub>7</sub> = 0 ft hote: Bar joists practices. For this Location <sub>7</sub> = 0 ft hote: Bar joist practices. For this Location <sub>7</sub> = 0 ft hote: Bar joist practices. For this Location <sub>7</sub> = 0 ft hote: Bar joist practices. For this Location <sub>8</sub> = 0 lbs constant, except at the ends where Location <sub>8</sub> = 0 lbs constant endered at to the code minimum and wable capacity Add load = 0 lbs constant end end practices. For this Locations where the applied shear is greater Locations at the the applied shear is greater Locations where the applied shear i	Dead Load =	15 p	osf	Dead Load <sub>1</sub> =	= 0	psf	T&B Chords:	0.500	Dia. Rods		
Start, 10ftK =0.65Point Loads:End, 10ftL =12RTU-2 =320IbsDead Load2 =0psfDCR =0.00Live Load, 20ftLive Load, 20ftFy =36kisLocation, 13.75ftStart, 20ftFy =36kisLocation, 13.75ftStart, 20ftFy =36kisLocation, 20ftFy =36kisLocation, 20ftFy =36kisLocation, 20ftftftLocation, 20ftftMoFrom 8.25ftNoFrom 20.5 ft to 25.25 ftLocation, 2OffWeb ReinforcementLocation, 2OffKeree Align Colspan="2"Location, 2 <td c<="" td=""><td>Live Load =</td><td><mark>20</mark> p</td><td>osf</td><td>Live Load<sub>1</sub> =</td><td>= 0</td><td>psf</td><td>Fy =</td><td>36</td><td>ksi</td><td></td></td>	<td>Live Load =</td> <td><mark>20</mark> p</td> <td>osf</td> <td>Live Load<sub>1</sub> =</td> <td>= 0</td> <td>psf</td> <td>Fy =</td> <td>36</td> <td>ksi</td> <td></td>	Live Load =	<mark>20</mark> p	osf	Live Load <sub>1</sub> =	= 0	psf	Fy =	36	ksi	
Point Loads:End1 = 0 ftL = 12 inRTU-2 = 320 lbsDead Load2 = 0 psfDCR = 0.00Live Load1 = 0 lbsLive Load2 = 0 psfDCR = 0.00Live Load1 = 13.75 ftStar2 = 0 ftFy = 36 ksiRTU-2 = 320 lbsEnd2 = 0 ftK = 1Live Load2 = 0 lbsDCR = 0.03Location2 = 19.33 ftTriangular Snow Drift Loads:Dead Load3 = 0 lbs+ Drift Load1 = 0 psfLocation3 = 0 ftOpsf End1 = 0 ftLocation4 = 0 lbsPeak2 = 0 ftLocation5 = 0 ftOpsf End1 = 0 ftLocation4 = 0 ftOpsf End2 = 0 ftLocation5 = 0 ftOpsf End2 = 0 ftLocation4 = 0 ftOpsf End2 = 0 ftLocation5 = 0 ftShear capacity at 1.5 x Depth = 3021Location6 = 0 lbsShear capacity at 1.5 x Depth = 3021Location6 = 0 ftNote Reinforcement:Location6 = 0 ftNote Reinforcement welds:Location6 = 0 ftNote Reinforcement along the lengh. As a result the allowableLive Load6 = 0 lbsconstruction and design practices. For thisLocation7 = 0 ftIt decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actualLive Load6 = 0 lbsConstruction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required atLive Load6 = 0 lbsIbsLocation7 = 0 ftIbsLocation8 = 0 ftIbsLocation8 = 0 ftIbsLocat				Start <sub>1</sub> =	= 0	ft	K =	0.65			
RTU-2 =320 lbsDead Load2 =0 psfDCR =0.00Live Load1 =0 lbsLive Load2 =0 psfWebs: L2X2X1/8Location1 =13.75 ftStart2 =0 ftFy =36 ksiRTU-2 =320 lbsEnd2 =0 ftK =1Live Load2 =0 lbsDCR =0.03DCR =0.03Location2 =19.33 ftTriangular Snow Drift Loads:DCR =0.03Dead Load3 =0 lbs+Drift Load1 =0 psfChord Reinforcement:Live Load3 =0 lbs+Drift Load2 =0 psfChord Reinforcement:Location3 =0 ft0 psf End1 =0 ftNot RequiredLocation4 =0 lbs+Drift Load2 =0 psfChord Reinforcement:Location4 =0 lbs+Drift Load2 =0 psfChord Reinforcement:Location4 =0 lbsPeak2 =0 ftWeb Reinforcement:Location4 =0 lbsPeak2 =0 ft(1) - L2X2X1/8 at Each MemberDead Load5 =0 lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLocation5 =0 ftNote: Bar joists are typically constructedsymmetrically with equal sized web members along the lengh. As a result the allowable code minimums and does not reflect actualChord Reinforcement Welds:Location5 =0 ftlbsconstruction and design practices. For this instance, minimum allowable capacityChord Reinforcement Welds:Location7 =0 ftlbsconstruction and design practices. For this instance	Point Loads:			End <sub>1</sub> =	= 0	ft	L =	12	in		
Live Load <sub>1</sub> = 0 lbs Live Load <sub>2</sub> = 0 psf Webs: L2X2X1/8 Location <sub>1</sub> = 13.75 ft Start <sub>2</sub> = 0 ft Fy = 36 ksi RTU-2 = 320 lbs End <sub>2</sub> = 0 ft K = 1 Live Load <sub>2</sub> = 0 lbs DCR = 0.03 Location <sub>2</sub> = 19.33 ft Triangular Snow Drift Loads: Dead Load <sub>3</sub> = 0 lbs +Drift Load <sub>1</sub> = 0 psf Chord Reinforcement: Live Load <sub>3</sub> = 0 lbs Peak <sub>1</sub> = 0 ft Not Required Location <sub>3</sub> = 0 ft 0 psf Chord Reinforcement: Live Load <sub>4</sub> = 0 lbs +Drift Load <sub>2</sub> = 0 psf Location <sub>4</sub> = 0 lbs Peak <sub>1</sub> = 0 ft Not Required Location <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft (1) - L2X2X1/8 at Each Member Dead Load <sub>5</sub> = 0 lbs Is reinforcing reasonable? No From 8.25 ft to 13.5 ft Live Load <sub>6</sub> = 0 lbs Shear capacity at 1.5 x Depth = 3021 Location <sub>5</sub> = 0 ft Note: Bar joists are typically constructed symmetrically with equal sized web members along the lengh. As a result the allowable Live Load <sub>7</sub> = 0 lbs constant, except at the ends where Location <sub>6</sub> = 0 ft accept and the allowable Live Load <sub>7</sub> = 0 lbs constant, except at the allowable Location <sub>7</sub> = 0 ft accept at the allowable Location <sub>7</sub> = 0 ft Bbs constant, except at the ends where Location <sub>7</sub> = 0 ft accept at the applied shear is greater Location <sub>8</sub> = 0 lbs off. Reinforcement is only required at Live Load <sub>8</sub> = 0 lbs and there the applied shear is greater Location <sub>8</sub> = 0 ft bls bar off. Reinforcement is only required at Live Load <sub>8</sub> = 0 lbs and there the applied shear is greater than these allowables. Web Reinforcement: Deam Load <sub>8</sub> = 0 lbs and there the applied shear is greater than these allowables. Web Reinforcement: Deam Load <sub>8</sub> = 0 lbs and there the applied shear is greater than these allowables. Deam the the transmitter the the transmitter the transmitter the transmitter the transmitter the transmitter than these allowables. Deam there the applied shear is greater than these allowables. Deam there the applied shear is greater than these allowables. Deam the transmitter the transmitter the transmitter the transmitter the transmitter than these allowables. Deam the transmitter the transmitter	RTU-2 =	320 II	os	Dead Load <sub>2</sub> =	= 0	psf	DCR =	0.00			
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Live Load <sub>2</sub> = 0 lbs $DCR = 0.03$ Location <sub>2</sub> = 19.33 ft <i>Triangular Snow Drift Loads:</i> Dead Load <sub>3</sub> = 0 lbs +Drift Load <sub>1</sub> = 0 psf <i>Chord Reinforcement:</i> Live Load <sub>3</sub> = 0 lbs Peak <sub>1</sub> = 0 ft Not Required Location <sub>3</sub> = 0 ft 0psf End <sub>1</sub> = 0 ft Dead Load <sub>4</sub> = 0 lbs +Drift Load <sub>2</sub> = 0 psf Live Load <sub>4</sub> = 0 lbs Peak <sub>2</sub> = 0 ft <i>Web Reinforcement:</i> Location <sub>4</sub> = 0 ft 0psf End <sub>2</sub> = 0 ft (1) - L2X2X1/8 at Each Member Dead Load <sub>5</sub> = 0 lbs Is reinforcing reasonable? No From 8.25 ft to 13.5 ft Live Load <sub>5</sub> = 0 lbs Shear capacity at 1.5 x Depth = 3021 Location <sub>5</sub> = 0 ft Note: Bar joists are typically constructed symmetrically with equal sized web members along the lengh. As a result the allowable Live Load <sub>6</sub> = 0 lbs construction and design practices. For this Location <sub>6</sub> = 0 ft list construction and design practices. For this Location <sub>7</sub> = 0 ft list construction and design practices. For this Location <sub>7</sub> = 0 ft list construction and design practices. For this Location <sub>7</sub> = 0 ft list construction and design practices. For this Location <sub>7</sub> = 0 ft list construction and design practices. For this Location <sub>7</sub> = 0 ft list construction and design practices. For this Location <sub>7</sub> = 0 ft list construction and design practices. For this Location <sub>7</sub> = 0 ft list construction and design practices. For this Location <sub>8</sub> = 0 lbs lostions where the applied shear is greater Location <sub>8</sub> = 0 lbs lostions where the applied shear is greater Location <sub>8</sub> = 0 ft than these allowables. Chord Reinforcement: Web Reinforcement:	RTU-2 =	320 II	os	End <sub>2</sub> =	= 0	ft	K =	1			
Location19.33 ftTriangular Snow Drift Loads:Dead Load0 lbs+Drift Load0 psfChord Reinforcement:Live Load0 lbsPeak0 ftNot RequiredLocation0 ft0psf End0 ftNot RequiredDead Load0 lbs+Drift Load0 psfWeb Reinforcement:Live Load0 lbs+Drift Load0 psfWeb Reinforcement:Location0 lbsPeak0 psf(1) - L2X2X1/8 at Each MemberLocation0 ft0psf End0 ft(1) - L2X2X1/8 at Each MemberDead Load0 lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Load0 lbsShear capacity at 1.5 x Depth =3021And From 20.5 ft to 25.25 ftLocation0 lbsShear capacity is constant, except at the ends whereAnd From 20.5 ft to 25.25 ftLocation0 lbscapacity is constant, except at the ends wherecompanying shear diagram is based on the code minimums and does not reflect actualLive Load0 lbsofffinstance, minimum allowable capacity decreases to about 3021 lbs before leveling Add load =0 lbsoff. Reinforcement is only required at Live LoadChord Reinforcement:Live Load0 lbsoff. Reinforcement is only required at LocationNot RequiredNot RequiredLocation0 lbsoff. Reinforcement is only required at LocationNot Required at LocationNot RequiredLocation0 lbsoff. Reinforcement is only required at LocationNot Required <td>Live Load<sub>2</sub> =</td> <td>0   </td> <td>os</td> <td></td> <td></td> <td></td> <td>DCR =</td> <td>0.03</td> <td></td> <td></td>	Live Load <sub>2</sub> =	0	os				DCR =	0.03			
Dead Load_3 =0 lbs+Drift Load_1 =0 psfChord Reinforcement:Live Load_3 =0 lbsPeak_1 =0 ftNot RequiredLocation_3 =0 ft0 psf End_1 =0 ftItDead Load_4 =0 lbs+Drift Load_2 =0 psfItLive Load_4 =0 lbsPeak_2 =0 ftWeb Reinforcement:Location_4 =0 ft0 psf End_2 =0 ft(1) - L2X2X1/8 at Each MemberDead Load_5 =0 lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Load_5 =0 lbsShear capacity at 1.5 x Depth =3021And From 20.5 ft to 25.25 ftLocation_5 =0 ftNote: Bar joists are typically constructedAnd From 20.5 ft to 25.25 ftDead Load_6 =0 lbscapacity is constant, except at the ends whereaccompanying shear diagram is based on the code minimums and does not reflect actualLive Load_7 =0 lbsocn struction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling Add load =0 lbsocn struction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling Add load =0 lbsocn struction and design practices. For this instance, minimum allowable shear is greater than these allowables.Chord Reinforcement:Live Load_8 =0 lbsoff. Reinforcement is only required at locations where the applied shear is greater than these allowables.Web Reinforcement:	Location <sub>2</sub> =	19.33 f	t	Triangular Si	now Drit	t Loads:					
Live Load3 =0lbsPeak1 =0ftNot RequiredLocation3 =0ft0psf End1 =0ftDead Load4 =0lbs+Drift Load2 =0psfLive Load4 =0lbsPeak2 =0ftWeb Reinforcement:Location4 =0ft0psf End2 =0ft(1) - L2X2X1/8 at Each MemberDead Load5 =0lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Load5 =0lbsShear capacity at 1.5 x Depth =3021And From 20.5 ft to 25.25 ftLocation5 =0ftNote: Bar joists are typically constructedsymmetrically with equal sized web membersLocation6 =0lbscapacity is constant, except at the ends wherealong the lengh. As a result the allowableLive Load6 =0lbscompanying shear diagram is based on the code minimums and does not reflect actualChord Reinforcement Welds:Location7 =0ftinstance, minimum allowable capacity decreases to about 3021 lbs before leveling Add load =0lbsconstruction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling Add load =0lbsconstruction and design practices.Add load =0lbsoff. Reinforcement is only required at locations where the applied shear is greater than these allowables.Web Reinforcement:	Dead Load <sub>3</sub> =	0	os	+Drift Load <sub>1</sub> =	= 0	psf	Chord Reinfo	rcemen	nt:		
Location0ft $0 psf End_1 = 0$ 0ftDead Load_40lbs $+Drift Load_2 = 0$ psfLive Load_40lbsPeak_2 = 0ft <i>Web Reinforcement:</i> Location_40ft0psf End_2 = 0ft(1) - L2X2X1/8 at Each MemberDead Load_50lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Load_50lbsShear capacity at 1.5 x Depth = 3021And From 20.5 ft to 25.25 ftLocation_50ftNote: Bar joists are typically constructedDead Load_60lbssare aresult the allowableLive Load_60lbscapacity is constant, except at the ends whereLocation_60ftit decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actualLive Load_70lbsconstruction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required at Live Load_8O lbsChord Reinforcement Welds: Not RequiredAdd load =0lbsoff. Reinforcement the applied shear is greater than these allowables.Web Reinforcement:	Live Load <sub>3</sub> =	0 II	os	Peak <sub>1</sub> =	= 0	ft	Not Required	1			
Dead Load_40lbs+Drift Load_20psfLive Load_40lbsPeak_20ftWeb Reinforcement:Location_40ft0psf End_20ft(1) - L2X2X1/8 at Each MemberDead Load_50lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Load_50lbsShear capacity at 1.5 x Depth =3021And From 20.5 ft to 25.25 ftLocation_50ftNote: Bar joists are typically constructedDead Load_60lbscapacity is constant, except at the ends whereLive Load_60lbscapacity is constant, except at the ends whereLocation_60ftit decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actualLive Load_70lbsconstruction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required at Live Load_6O lbsAdd load =0lbslocations where the applied shear is greater than these allowables.Not RequiredVeb Reinforcement:Veb Reinforcement:Veb Reinforcement:	Location <sub>3</sub> =	0 f	t	0psf End₁ =	= 0	ft					
Live Load_4 =0lbsPeak_2 =0ftWeb Reinforcement:Location_4 =0ft0psf End_2 =0ft(1) - L2X2X1/8 at Each MemberDead Load_5 =0lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Load_5 =0lbsShear capacity at 1.5 x Depth =3021And From 20.5 ft to 25.25 ftLocation_5 =0ftNote: Bar joists are typically constructedsymmetrically with equal sized web membersDead Load_6 =0lbscapacity is constant, except at the ends whereaccompanying shear diagram is based on the code minimums and does not reflect actualLive Load_7 =0lbsconstruction and design practices. For thisChord Reinforcement Welds:Location_7 =0ftReinforcement is only required atNot RequiredLive Load_8 =0lbslocations where the applied shear is greater than these allowables.Web Reinforcement:	Dead Load <sub>4</sub> =	0	os	+Drift Load <sub>2</sub> =	= 0	psf					
Location $=$ 0 ft0psf End $=$ 0 ft(1) - L2X2X1/8 at Each MemberDead Load $=$ 0 lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Load $=$ 0 lbsShear capacity at 1.5 x Depth =3021And From 20.5 ft to 25.25 ftLocation $=$ 0 ftNote: Bar joists are typically constructedAnd From 20.5 ft to 25.25 ftDead Load $=$ 0 lbssymmetrically with equal sized web membersalong the lengh. As a result the allowableLive Load $=$ 0 lbscapacity is constant, except at the ends wherecapacity is constant, except at the ends whereLocation $=$ 0 ftit decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actualChord Reinforcement Welds:Location $=$ 0 lbsoff. Reinforcement is only required at locations where the applied shear is greater than these allowables.Chord Reinforcement:	Live Load <sub>4</sub> =	0	os	Peak <sub>2</sub> =	= 0	ft	Web Reinford	ement:			
Dead Loads=0lbsIs reinforcing reasonable?NoFrom 8.25 ft to 13.5 ftLive Loads =0lbsShear capacity at 1.5 x Depth = $3021$ And From 20.5 ft to 25.25 ftLocations =0ftNote: Bar joists are typically constructedsymmetrically with equal sized web members along the lengh. As a result the allowableLive Load6 =0lbscapacity is constant, except at the ends where to capacity is constant, except at the ends where cocation6 =0Location6 =0ftit decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual Live Load7 =0Live Load7 =0lbsconstruction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling Add load =Chord Reinforcement Welds: Not RequiredAdd load =0lbslbslocations where the applied shear is greater than these allowables.Web Reinforcement:	$Location_4 =$	0 f	t	0psf End <sub>2</sub> =	= 0	ft	(1) - L2X2X1/	8 at Ea	ch Member		
Live Load <sub>5</sub> = 0 lbs Shear capacity at $1.5 \times Depth = 3021$ And From 20.5 ft to 25.25 ft Location <sub>5</sub> = 0 ft Note: Bar joists are typically constructed Symmetrically with equal sized web members along the lengh. As a result the allowable Live Load <sub>6</sub> = 0 lbs capacity is constant, except at the ends where Location <sub>6</sub> = 0 ft it decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual Live Load <sub>7</sub> = 0 lbs construction and design practices. For this Location <sub>7</sub> = 0 ft instance, minimum allowable capacity Add load = 0 lbs off. Reinforcement is only required at Live Load <sub>8</sub> = 0 lbs locations where the applied shear is greater Location <sub>8</sub> = 0 ft than these allowables. Web Reinforcement:	Dead Load <sub>5</sub> =	0	os Is reinf	orcing reasonable	?	No	From 8.25 ft	to 13.5	ft		
Location0ftNote: Bar joists are typically constructed symmetrically with equal sized web members along the lengh. As a result the allowableLive Load0lbscapacity is constant, except at the ends where it decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual Live LoadThe accompanying shear diagram is based on the code minimums and does not reflect actual code minimum allowable capacity decreases to about 3021 lbs before leveling Add load =Chord Reinforcement Welds: Not RequiredAdd load =0lbsoff. Reinforcement is only required at Locations where the applied shear is greater than these allowables.Web Reinforcement:	Live Load <sub>5</sub> =	0	Shear	capacity at 1.5 x D	epth =	3021	And From 20	.5 ft to	25.25 ft		
Dead Load_60lbssymmetrically with equal sized web members along the lengh. As a result the allowable capacity is constant, except at the ends where it decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual Live Load_7Chord Reinforcement Welds: Not RequiredLocation_70ftinstance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required at Live Load_8Chord Reinforcement Welds: Not RequiredAdd load =0lbslbslocations where the applied shear is greater than these allowables.Web Reinforcement:	Location <sub>5</sub> =	0 f	t Note:	Bar joists are ty	pically co	Instructed					
Live Load_6 =0lbscapacity is constant, except at the ends where it decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual Live Load_7 =0lbscapacity is constant, except at the ends where it decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual code minimum allowable capacity decreases to about 3021 lbs before leveling Add load =Chord Reinforcement Welds: Not RequiredAdd load =0lbsoff. Reinforcement is only required at locations where the applied shear is greater than these allowables.Web Reinforcement:	Dead Load <sub>6</sub> =	0	os along	the lengh. As a	result the	e allowable					
Location <sub>6</sub> =0ftit decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual Live Load <sub>7</sub> =0lbsChord Reinforcement Welds:Live Load <sub>7</sub> =0lbsconstruction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required at Live Load <sub>8</sub> =Chord Reinforcement Welds: Not RequiredAdd load =0lbslocations where the applied shear is greater than these allowables.Web Reinforcement:	Live Load <sub>6</sub> =	0	os capac	ity is constant, e	except at	the ends where	l.				
Dead LoadOIbscode minimums and does not reflect actual construction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling Add load = 0Chord Reinforcement Welds: Not RequiredAdd load = 0Ibsoff. Reinforcement is only required at locations where the applied shear is greater than these allowables.Web Reinforcement:	Location <sub>6</sub> =	0 f	t it decr	eases until the v	veb is er diagram	igaged. The					
Live Load7 =0lbsconstruction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required at Live Load8 =Chord Reinforcement Welds: Not RequiredAdd load =0lbslocations where the applied shear is greater than these allowables.Web Reinforcement:	Dead Load <sub>7</sub> =	0	os code i	minimums and d	oes not	reflect actual					
Location0ftInstance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required at locations where the applied shear is greater than these allowables.Chord Reinforcement Welds: Not RequiredLocation0lbslocations where the applied shear is greater than these allowables.Web Reinforcement:	Live Load <sub>7</sub> =	0	os constr	uction and desig	gn practio	ces. For this					
Add load =0lbsoff. Reinforcement is only required at locations where the applied shear is greater than these allowables.Not RequiredLocation 80ftWeb Reinforcement: $Web Reinforcement:$	Location <sub>7</sub> =	0 f	t Instan decres	ce, minimum all ases to about 30	owable c )21 lhs h	apacity efore leveling	Chord Reinfo	rcemen	t Welds:		
Live Load <sub>8</sub> = $\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	Add load =	0	DS off. Re	einforcement is o	only requ	ired at	Not Required	1			
Location <sub>8</sub> = 0 ft Web Reinforcement:	Live Load <sub>8</sub> =	0	os locatio	ons where the ap	oplied sh	ear is greater					
	Location <sub>8</sub> =	<mark>0</mark> f	t than t	nese allowables			Web Reinford	ement:			

 CASSE
 CUSTOMER:
 Wingstop
 PROJECT NUMBER: WIL-MO-04-21

 LOCATION:
 Lee's Summit, MO
 DATE: 6/10/2021

 Office: 536-349-1730
 SUBJECT:
 Steel Joist Analysis for Mechanical Units

 Website: www.caseengineeringinc.com
 PREPARED BY: K. Woodard
 File:
 0



CASSE Engineering Inc. Office: 636-349-1600 Fax: 636-349-1730 Website: www.caseengineeringinc.com		CUSTOMER: LOCATION: SUBJECT: PREPARED BY:	Wingstop Lee's Summit, MO Steel Joist Analysis K. Woodard	for Mechanical Ui File:	PRO	JECT NUMBER: WIL-MO-04-21 DATE: 6/10/2021
Steel Joist	Analysis o	of Irregular I	₋oads J-2:			
Joist =	20K4			S	trength Analy	/sis Results:
Length =	<mark>34</mark> ft				Bending	Failed from 9 to 31
Trib. Width =	<mark>5</mark> ft				Max DCR =	1.04
E =	<mark>29000</mark> ksi				Shear	Failed from 0to16, 23to40
Live $\Delta_a$ =	L/240				Max DCR =	1.31
Allowable Loa	ds:			D	CR Limits wi	thout reinforcement:
Total Load <sub>a</sub> =	212 plf (foi	<sup>-</sup> stress)			Bending:	1.00
Live Load <sub>a</sub> =	212 plf (for	deflection)			Shear:	1.00

Full Uniform Loads:

15 psf

~ ~

Dead Load =

.. . .

Live Load =	20	psr
Point Loads:		
RTU-2 =	320	lbs
Live Load <sub>1</sub> =	0	lbs
Location <sub>1</sub> =	13.75	ft
RTU-2 =	320	lbs
Live Load <sub>2</sub> =	0	lbs
Location <sub>2</sub> =	19.33	ft
EF =	91.85	lbs
Live Load <sub>3</sub> =	0	lbs
Location <sub>3</sub> =	0.67	ft
EF =	91.85	lbs
Live Load <sub>4</sub> =	0	lbs
Location <sub>4</sub> =	2.167	ft
Hood =	91.2	lbs
Live Load <sub>5</sub> =	0	lbs
Location <sub>5</sub> =	3.1	ft
Hood =	15.2	lbs
Live Load <sub>6</sub> =	0	lbs
Location <sub>6</sub> =	5.04	ft
Hood =	391.2	lbs
Live Load <sub>7</sub> =	0	lbs
Location <sub>7</sub> =	8.92	ft
Hood =	15.2	lbs
Live Load <sub>8</sub> =	0	lbs
Location <sub>a</sub> =	9.92	ft

Partial Uniform Loads: Dead Load<sub>1</sub>= 0 psf Live Load<sub>1</sub> = 0 psf Start₁ = 0 ft  $End_1 =$ 0 ft Dead Load<sub>2</sub>= 0 psf Live Load<sub>2</sub> = 0 psf Start<sub>2</sub> = 0 ft  $End_2 =$ 0 ft Triangular Snow Drift Loads: +Drift Load<sub>1</sub>= 0 psf Peak<sub>1</sub> = 0 ft  $0psf End_1 =$ 0 ft +Drift Load<sub>2</sub>= 0 psf Peak<sub>2</sub> = 0 ft  $0psf End_2 =$ 0 ft Is reinforcing reasonable? No 3021 Shear capacity at 1.5 x Depth = Note: Bar joists are typically constructed symmetrically with equal sized web members along the lengh. As a result the allowable capacity is constant, except at the ends where it decreases until the web is engaged. The accompanying shear diagram is based on the code minimums and does not reflect actual construction and design practices. For this instance, minimum allowable capacity decreases to about 3021 lbs before leveling off. Reinforcement is only required at locations where the applied shear is greater

than these allowables.

 T&B Chords:
 0.500
 Dia. Rods

 Fy =
 36
 ksi

 K =
 0.65
 12

 L =
 12
 in

 DCR =
 0.13
 Uebs:

 L1X1X1/8
 Fy =
 36
 ksi

 K =
 1
 DCR =
 0.26

Joist Reinforcement Design:

Chord Reinforcement: (2) - 0.5" Dia. 36 ksi Rods, T&B From 13 ft to 19.75 ft

Web Reinforcement: (1) - L1X1X1/8 at Each Member From 0 ft to 8.75 ft And From 11.75 ft to 13 ft And From 19.75 ft to 28.75 ft

Chord Reinforcement Welds: (2) - 0.125" x 1" Welds at 12"oc

Web Reinforcement: 0.125" x 1" Total Weld at Each End 

 CASSE
 CUSTOMER:
 Wingstop
 PROJECT NUMBER: WIL-MO-04-21

 LOCATION:
 Lee's Summit, MO
 DATE: 6/10/2021

 Office: 636-349-1730
 SUBJECT:
 Steel Joist Analysis for Mechanical Units

 Website: www.caseengineeringinc.com
 PREPARED BY: K. Woodard
 File:
 0



CASE Engineering Inc. Office: 836-349-1800 Fax: 836-349-1730 Website: www.caseengineeringinc.com		CUSTOMER: LOCATION: SUBJECT: PREPARED BY:	Wingstop Lee's Summit, MO Steel Joist Analysis K. Woodard	for Mechanical File:	PRO	DJECT NUMI D	BER: WIL-MO-04-21 ATE: 6/11/2021	
Steel Joist	Analy	/sis o	f Irregular L	₋oads J-3:				
Joist =	20K4					Strength Ana	lysis Resu	lts:
Length =	34	ft				Bending	Failed fro	om 9 to 31
Trib. Width =	5	ft				Max DCR =	1.05	
E =	29000	ksi				Shear	Failed fro	om 0to16, 23to40
Live $\Delta_a =$	L/240					Max DCR =	1.30	

0 psf

0 psf

0 ft

0 ft

0 psf

0 psf

0 ft

0 ft

0 psf

0 ft

0 ft

0 psf

0 ft

0 ft

No

3021

Start₁ =

End₁ =

Start<sub>2</sub> =

 $End_2 =$ 

Peak<sub>1</sub> =

Peak<sub>2</sub> =

0psf End₁ =

 $0psf End_2 =$ 

DCR Limits without reinforcement: Bending: 1.00 1.00 Shear:

Joist Reinforcement Design:

T&B Chords: 0.500 Dia. Rods Fv = 36 ksi K = 0.65 L = 12 in DCR = 0.14 Webs: L1X1X1/8 Fv = 36 ksi K = 1 DCR = 0.33

Chord Reinforcement: (2) - 0.5" Dia. 36 ksi Rods, T&B From 12.5 ft to 19.75 ft

Web Reinforcement: (1) - L1X1X1/8 at Each Member From 0 ft to 9.75 ft And From 19.75 ft to 28.5 ft

Chord Reinforcement Welds:

(2) - 0.125" x 1" Welds at 12"oc

Web Reinforcement: 0.125" x 1" Total Weld at Each End

Allowable Loads: Total Load<sub>a</sub> = 212 plf (for stress) Live Load<sub>a</sub> = 212 plf (for deflection) Full Uniform Loads: Partial Uniform Loads: Dead Load = Dead Load₁= 15 psf Live Load = Live Load<sub>1</sub> = 20 psf Point Loads: MAU = 263.9 lbs Dead Load<sub>2</sub>= Live Load₁ = 0 lbs Live Load<sub>2</sub> = Location<sub>1</sub> = 13.25 ft MAU = 263.9 lbs Live Load<sub>2</sub> = 0 lbs Location<sub>2</sub> = 19.17 ft Triangular Snow Drift Loads: EF = 18.15 lbs +Drift Load<sub>1</sub>= Live Load<sub>3</sub> = 0 lbs Location<sub>3</sub> = 0.67 ft Hood+EF = 145.1 lbs +Drift Load<sub>2</sub>= Live Load₄ = 0 lbs Location<sub>4</sub> = 2.167 ft Is reinforcing reasonable? Hood = 76 lbs Live Load<sub>5</sub> = 0 lbs Shear capacity at 1.5 x Depth = Note: Bar joists are typically constructed  $Location_5 =$ 3.1 ft symmetrically with equal sized web members Hood = 126.9 lbs along the lengh. As a result the allowable Live Load<sub>6</sub> = 0 lbs capacity is constant, except at the ends where it decreases until the web is engaged. The  $Location_6 = 5.04$  ft accompanying shear diagram is based on the Hood = 76 lbs code minimums and does not reflect actual Live Load<sub>7</sub> = 0 lbs construction and design practices. For this instance, minimum allowable capacity Location<sub>7</sub> = 8.92 ft decreases to about 3021 lbs before leveling Hood = 426.9 lbs off. Reinforcement is only required at Live Load<sub>8</sub> = locations where the applied shear is greater 0 lbs than these allowables.  $Location_8 = 9.92$  ft

 
 CASSE
 CUSTOMER:
 Wingstop
 PROJECT NUMBER: WIL-MO-04-21

 LOCATION:
 Lee's Summit, MO
 DATE: 6/11/2021

 Office: 636-349-1700 Fax: 636-349-1700
 SUBJECT:
 Steel Joist Analysis for Mechanical Units

 Website: www.caseengineeringinc.com
 PREPARED BY: K. Woodard
 File:
 0



CA Enginee	SE ring Inc.	CUSTC LOCAT SUBJE	MER: Wingsto ION: Lee's St CT: Steel Jo	p ummit, MO ist Analysis for	PRC Mechanical Units	DJECT N	UMBER: WIL-MO-04-21 DATE: 6/11/2021
Website: www.cased	engineeringi	inc.com PREPA	RED BY: K. Wood	dard F	ile:		
	Anal			1.4.			
Steel Joist	Analy	ysis of irreg	gular Loads	J-4:			
Joist =	20K4				Strength Anal	ysis Re	esults:
Length =	34	ft			Bending	assed	
Trib. Width =	5	ft			Max DCR =	0.89	
E =	29000	ksi			Shear	assed	
Live $\Delta_a =$	L/240				Max DCR =	0.98	
Allowable Loa	ds:				DCR Limits w	ithout r	einforcement:
Total Load <sub>a</sub> =	212	plf (for stress	)		Bending:	1.00	
Live Load <sub>a</sub> =	212	plf (for deflec	tion)		Shear:	1.00	
Full Uniform L	.oads:		Partial Unifori	m Loads:	Joist Reinford	ement	Design:
Dead Load =	15	psf	Dead Load <sub>1</sub> =	0 psf	T&B Chords:	0.500	Dia. Rods
Live Load =	20	psf	Live Load <sub>1</sub> =	0 psf	Fy =	36	ksi
			Start <sub>1</sub> =	<mark>0</mark> ft	K =	0.65	
Point Loads:			End <sub>1</sub> =	<mark>0</mark> ft	L =	12	in
MAU =	79	lbs	Dead Load <sub>2</sub> =	0 psf	DCR =	0.00	
Live Load <sub>1</sub> =	0	lbs	Live Load <sub>2</sub> =	0 psf	Webs:	L2X2X	(1/8
Location <sub>1</sub> =	13.25	ft	Start <sub>2</sub> =	<mark>0</mark> ft	Fy =	36	ksi
MAU =	79	lbs	$End_2 =$	<mark>0</mark> ft	K =	1	
Live Load <sub>2</sub> =	0	lbs			DCR =	0.00	-
$Location_2 =$	19.17	ft	Triangular Sn	ow Drift Loa	ds:		

0 psf

0 ft

0 ft

0 psf

0 ft

0 ft

+Drift Load<sub>1</sub>=

 $0psf End_1 =$ 

 $0psf End_2 =$ 

+Drift Load<sub>2</sub>=

Peak<sub>1</sub> =

Peak<sub>2</sub> =

RTU-1 = 325.5 lbs

Hood = 25.08 lbs

Hood = 25.08 lbs

Hood = 124.1 lbs

 $Location_8 = 9.92$  ft

 $Location_6 = 5.04$  ft

Location<sub>3</sub> = 1.33 ft

Location<sub>4</sub> = 2.167 ft

0 lbs

0 lbs

0 lbs

0 lbs

0 ft

0 lbs

0 lbs

0 lbs

0 ft

0 lbs

Live Load<sub>3</sub> =

Live Load<sub>4</sub> =

Dead Load =

Live Load<sub>5</sub> =

Location<sub>5</sub> =

Live Load<sub>6</sub> =

Dead Load =

Live Load<sub>7</sub> =

 $Location_7 =$ 

Live Load<sub>8</sub> =

Chord Reinforcement: **Not Required** 

Web Reinforcement: **Not Required** 

Chord Reinforcement Welds: **Not Required** 

Web Reinforcement: **Not Required** 

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 Website: www.caseengineeringinc.com
 PREPARED BY: K. Woodard
 File:
 0



Enginee Office: 638 Fax: 638- Website: www.case	CUSTO LOCATI SUBJEC inc.com PREPA	MER: ON: CT: RED BY:	Wingstop Lee's Sumi Steel Joist K. Woodare	mit, MO Analysis d	for Mechanical File:	UMBER: WIL-MO-04-21 DATE: 6/10/2021									
Steel Joist	Steel Joist Analysis of Irregular Loads J-5:														
Joist =	20K4						Strength Anal	ysis Re	sults:						
Length =	34	ft				Bending'assed									
Trib. Width =	5	ft				Max DCR = <b>0.86</b>									
E =	29000	ksi				Shear Failed from 0to16, 23to40									
Live $\Delta_a =$	L/240						Max DCR =	1.02							
Allowable Loa	ads:						DCR Limits w	ithout r	einforcement:						
Total Load <sub>a</sub> =	212	plf (for stress)	)				Bending:	1.00							
Live Load <sub>a</sub> =	212	plf (for deflect	ion)				Shear:	1.00							
Full Uniform L	.oads:		Partial	Uniform I	Loads:		Joist Reinforc	ement	Design:						
Dead Load =	15	psf	Dead I	Load <sub>1</sub> =	0 ps	f	T&B Chords:	0.500	Dia. Rods						
Live Load =	20	psf	Live L	.oad <sub>1</sub> =	<mark>0</mark> ps	f	Fy =	36	ksi						
			5	Start₁ =	<mark>0</mark> ft		K =	0.65							
Point Loads:				End₁ =	0 ft		L =	12	in						

0 psf

0 psf

0 ft

0 ft

0 psf

0 ft

0 ft

0 psf

0 ft

0 ft

No

3021

Hood =

Live Load<sub>1</sub> =

Live Load<sub>2</sub> =

Dead Load =

Live Load<sub>3</sub> =

 $Location_3 =$ 

Dead Load =

Live Load₄ =

Location₄ =

Dead Load =

Live Load<sub>5</sub> =

Location<sub>5</sub> =

Dead Load =

Live Load<sub>6</sub> =

 $Location_6 =$ 

Dead Load =

Live Load<sub>7</sub> =

Location<sub>7</sub> =

Dead Load =

Live Load<sub>8</sub> =

 $Location_8 =$ 

 $Location_2 =$ 

Location<sub>1</sub> =

509 lbs

2.33 ft

5.25 ft

RTU-1 = 148.8 lbs

0 lbs

0 lbs

0 lbs

0 lbs

0 ft

Dead Load<sub>2</sub>=

Live Load<sub>2</sub> =

+Drift Load<sub>1</sub>=

 $0psf End_1 =$ 

+Drift Load<sub>2</sub>=

 $0psf End_2 =$ 

Is reinforcing reasonable?

than these allowables.

Shear capacity at 1.5 x Depth =

Peak<sub>1</sub> =

Peak<sub>2</sub> =

Note: Bar joists are typically constructed

along the lengh. As a result the allowable

symmetrically with equal sized web members

capacity is constant, except at the ends where it decreases until the web is engaged. The

accompanying shear diagram is based on the

code minimums and does not reflect actual

construction and design practices. For this instance, minimum allowable capacity

decreases to about 3021 lbs before leveling

locations where the applied shear is greater

off. Reinforcement is only required at

Start<sub>2</sub> =

 $End_2 =$ 

Triangular Snow Drift Loads:

Web Reinforcement: (1) - L1X1X1/8 at Each Member From 1 ft to 2.25 ft

DCR =

Fy =

K =

DCR =

Chord Reinforcement:

Not Required

0.00

36 ksi

1

0.05

Webs: L1X1X1/8

Chord Reinforcement Welds:

**Not Required** 

Web Reinforcement: 0.125" x 1" Total Weld at Each End 

 CASSE
 CUSTOMER:
 Wingstop
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 Website: www.caseengineeringinc.com
 PREPARED BY: K. Woodard
 File:
 0



CASE				
Engineering Inc.				
PROJECT NAME:	Wingstop		PROJ # WIL-MO-04-	21
LOCATION:				
SUBJECT:	Unit Overturning Check RTU-2		Updated	8/8/2019
PREPARED BY:	K. Woodard		DATE:	6/10/2021
Ur	hit Overturning per ASCE 7-16 W	ind Design		Input
Risk Category			(Table 1.5-1)	Output
Exposure Category		В	(Section 26.7.3)	
Height Above Ground Level, z (ft)		17		
Velocity Pressure Exposure Coefficient Kz	0.6125	(Table 26.10-1)		
Topographic Factor, K <sub>zt</sub>	1.0	(Section 26.8-2 and Fi	gure 26.8-1)	
Wind Directionality Factor, K <sub>d</sub>		0.85	(Section 26.6 and Tab	le 26.6-1)
Ground Elevation Factor, K <sub>e</sub>		1	(Section 26.9 and Tab	le 26.9-1)
Ultimate Wind Speed 3-s Gust, V (mph)		109	(Figures 26.5-1 and 26	5.5-2)
Velocity Pressure a (nef)	$a = 0.0256 K V V V V^2$	15.0	(Equation 26.10-1)	
verservy riessure, q <sub>z</sub> (psi)	$q_Z = .00230\Lambda_Z\Lambda_Zt\Lambda_d\Lambda_eV^2$	15.8		
Equipment Parame	ters			
Depth, D (in) (Least horizontal dimension at the	e elevation considered)	44.3		
Wight, W (in) Height, H (in) (add curb beight to this, curb is tw	nically 14" MIN)	70.0		
Weight, W. (lb)		785		
		705		
Gust Factor, GC <sub>r</sub>		1.9	(Section 29.4.1)	
Decide that $A_{rec}$ Normal to the $M(red A_{rec}^2)$	$W \times H$	22.0		
Projected Area Normal to the wind, A <sub>f</sub> (Ft )	$A_f =$	22.0		
Design Wind Force, F <sub>b</sub> (lb), (ASD)	$F_h = q_z(GC_r)A_f$	411	(Equation 29.4-1)	
	· · · · · · ,			
Overturning Moment, M <sub>o</sub> (lb-in)	$M_0 = F_h x.67H$	12919		
Postoring Moment M (Ib in)	D	10424		
Restoring Moment, M <sub>R</sub> (ID-IN)	$M_R = .6W_p x \frac{1}{2}$	10421		
Resulant Force, (Ib)	$=\frac{M_O-M_R}{R}$	56		
n.	D			
Uplift?	sultant Force $> 0 \rightarrow YES$	YES		
Curb to Roof Fast	ener Strength			
3/8" Ø Steel Bolt				
<b>Tensile Strength, lbs</b> $= \frac{F_{nt} \times A_b}{1000} \times 1000$	2485	Ω = 2	.0	
Ω		Ept (kai) - 4	5.0	
(2) Bolts per side O.K.?	BOLTS O.K.	riit(KSI) = 4	5.0	
Resultant Force	Resultant Force	1		
$\frac{1}{2} < Tensile Strength \rightarrow 0.K.$	2 > 7	ensile Stren	$gth \rightarrow N.G.$	
Shear Strength lbs $-F_{nv} \times A_b \times 1000$	1491	Fnv (ksi) = 2	7.0	
$\frac{1}{\Omega} = \frac{1}{\Omega} \times 1000$	1+71			
(2) Bolts per side O.K.?	BOLTS O.K.	Ab (in <sup>2</sup> ) = 0	.11	
		J		
$\frac{\text{Design Wind Force}}{\text{Constraint}} < \text{Shear Strength} \rightarrow 0.8$	Lesign Wind Force	> Shear Stre	$ngth \rightarrow N.G.$	
4	4			

	-	
#10 Wood Screws		
Allowable Tensile Strength, lbs	216	
(4) Screws per side O.K.?	SCREWS O.K.	
$\frac{Resultant \ Force}{4} < Allowable \ Tensile \ Streng$	$th \rightarrow 0.K.$	$\frac{Resultant \ Force}{4} > Allowable \ Tensile \ Strength \rightarrow N.G.$
Allowable Shear Strength, lbs	144	
(4) Screws per side O.K.?	SCREWS O.K.	
Design Wind Force 8 < Allowable Shear Stren	$igth \rightarrow 0.K.$	$\frac{Design Wind Force}{8} > Allowable Shear Strength \rightarrow N.G.$
Curb Screw Streng	ŗth	
#10 Self-Tapping Screws into 18ga Curb		
Allowable Tensile Strength (per SSMA), lbs	109	
(4) Screws per side O.K.?	SCREWS O.K.	
$\frac{Resultant \ Force}{4} < Allowable \ Tensile \ Streng$	$th \rightarrow 0.K.$	$\frac{Resultant \ Force}{4} > Allowable \ Tensile \ Strength \rightarrow N.G.$
Allowable Shear Strength (per SSMA), lbs	263	
(4) Screws per side O.K.?	SCREWS O.K.	
Design Wind Force 8 < Allowable Shear Stren	$igth \rightarrow 0.K.$	$\frac{Design Wind Force}{8} > Allowable Shear Strength \rightarrow N.G.$

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CASE										
SAJL										
Engineering Inc.										
PROJECT NAME:	Wingstop	PROJ # WIL-MO-04-21								
LOCATION:										
SUBJECT:		Updated	8/8/2019							
PREPARED BY:	K. Woodard		DATE:	6/10/2021						
<u>Ur</u>	nit Overturning per ASCE 7-16 W	<u>ind Design</u>								
Pick Catagony				Input						
RISK Category		(Table 1.5-1)	Output							
Height Above Ground Level, z (ft)	17	(Section 20.7.5)								
Velocity Pressure Exposure Coefficient K.	0.6125	(Table 26.10-1)								
Tonographic Factor, K		1.0	(Section 26 8-2 and Ei	guro 26 8-1)						
Wind Directionality Easter K		1.0	(Section 20.6-2 and Tab	guie 20.8-1)						
Ground Elevation Factor, K		0.05		1= 20.0-1)						
Ground Elevation Factor, Ke		1	(Section 26.9 and Tab	ie 26.9-1)						
Ultimate wind Speed 3-s Gust, V (mph)		110	(Figures 26.5-1 and 26	o.5-2)						
Velocity Pressure, q <sub>z</sub> (psf)	$q_z = .00256 K_z K_{zt} K_d K_e V^2$	16.1	(Equation 26.10-1)							
Equipment Paramet	ters									
Depth, D (in) (Least horizontal dimension at the	elevation considered)	24.0								
Width, W (in)		100.0								
Height, H (in) (add curb height to this, curb is ty	pically 14" MIN)	29.0								
Weight, W <sub>p</sub> (lb)		525								
Gust Factor, GC <sub>r</sub>		1.9	(Section 29.4.1)							
Projected Area Normal to the Wind, A <sub>c</sub> (Ft <sup>2</sup> )	$A_{f} = \frac{W \times H}{W}$	20.1								
	144		(							
Design Wind Force, F <sub>h</sub> (lb), (ASD)	$F_h = q_z(GC_r)A_f$	370	(Equation 29.4-1)							
Quarturning Moment M. (Ib in)	M D (50	7404								
Overturning Moment, M <sub>o</sub> (Ib-In)	$M_0 = F_h x.6/H$	/194								
Restoring Moment. Ma (Ib-in)	$M_{-} = 6W_{-} r \frac{D}{D}$	3780								
	$M_R = .0 W_p \times \frac{1}{2}$	3700								
	M M									
Resulant Force, (lb)	$=\frac{M_0-M_R}{D}$	142								
	D									
Uplift?	sultant Force $> 0 \rightarrow YES$	YES								
Curb to Roof Fast	ener Strength									
3/8" Ø Steel Bolt			_							
<b>Tensile Strength, lbs</b> $= \frac{F_{nt} \times A_b}{1000} \times 1000$	2485	Ω = 2.	0							
Ω		Fint (lect)								
(2) Bolts per side O.K.?	BOLTS O.K.	FITT (KSI) = 45								
Resultant Force	Resultant Force	J								
$\frac{1}{2}$ < Tensile Strength $\rightarrow 0.K.$	1000000000000000000000000000000000000	<sup>r</sup> ensile Streng	$th \rightarrow N.G.$							
Shear Strongth lbs $F_{nv} \times A_h$	1401	Fnv (ksi) = 27	.0							
Snear strength, ibs $=\frac{nv}{\Omega} \times 1000$	1491									
(2) Bolts per side O.K.?	BOITSOK	Ab (in <sup>2</sup> ) = 0.	11							
L' Dons per side Onti:	BOLIS O.K.									
Design Wind Force	, Design Wind Force	> Shear Stro	$ath \rightarrow N G$							
$\frac{1}{4} < \text{Shear Strength} \rightarrow 0.K$	. 4	- 511041 51161	<i>igui / 11.0.</i>							

	-	
#10 Wood Screws		
Allowable Tensile Strength, lbs	216	
(4) Screws per side O.K.?	SCREWS O.K.	
$\frac{Resultant \ Force}{4} < Allowable \ Tensile \ Streng$	$th \rightarrow 0.K.$	$\frac{Resultant \ Force}{4} > Allowable \ Tensile \ Strength \rightarrow N.G.$
Allowable Shear Strength, lbs	144	
(4) Screws per side O.K.?	SCREWS O.K.	
Design Wind Force 8 < Allowable Shear Stren	$igth \rightarrow 0.K.$	$\frac{Design Wind Force}{8} > Allowable Shear Strength \rightarrow N.G.$
Curb Screw Streng	ŗth	
#10 Self-Tapping Screws into 18ga Curb		
Allowable Tensile Strength (per SSMA), lbs	109	
(4) Screws per side O.K.?	SCREWS O.K.	
$\frac{Resultant \ Force}{4} < Allowable \ Tensile \ Streng$	$th \rightarrow 0.K.$	$\frac{Resultant \ Force}{4} > Allowable \ Tensile \ Strength \rightarrow N.G.$
Allowable Shear Strength (per SSMA), lbs	263	
(4) Screws per side O.K.?	SCREWS O.K.	
Design Wind Force 8 < Allowable Shear Stren	$igth \rightarrow 0.K.$	$\frac{Design Wind Force}{8} > Allowable Shear Strength \rightarrow N.G.$

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# Joist Reference for Calcs



# PARTIAL EXISTING ROOF FRAMING PLAN

### PLAN NOTES:

 $\bigcirc$ SCALE: 1/4" = 1'-0"

- SEE SHEET S1 FOR GENERAL NOTES AND TYPICAL DETAILS.
- 2. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL DIMENSIONS AND
- ELEVATIONS PRIOR TO BEGINNING CONSTRUCTION.
- REFERENCE MECHANICAL DRAWINGS FOR EXACT WEIGHTS AND LOCATIONS OF 3. MECHANICAL EQUIPMENT.
- 4. SEE ARCHITECTURAL DRAWINGS FOR DIMENSIONS, SECTIONS, AND ELEVATIONS NOT
- SHOWN HEREON.
- 5. ALL NEW AND EXISTING MECHANICAL EQUIPMENT MOUNTED TO OR HUNG FROM EXISTING **ROOF** FRAMING STRUCTURE THAT HAS BEEN ACCOUNTED FOR IN STRUCTURAL CAPACITY ANALYSIS IS SHOWN ON FRAMING PLAN. GENERAL CONTRACTOR SHALL NOTIFY ARCHITECT AND ENGINEER OF RECORD IMMEDIATELY IF EQUIPMENT EXISTS THAT IS NOT SHOWN ON PLAN.

## STANDARD LOAD TABLE Based on a Maximum Allowable Tensile Stress of 30 ksi **OPEN WEB STEEL JOISTS, K-SERIES**

Stress of 30 ksi

Adopted by the Steel Joist Institute November 4, 1985; Revised to May 2, 1994 - Effective September 1, 1994

The black figures in the following table give the TOTAL safe uniformly distributed load-carrying capacities, in pounds per linear foot, of K-Series Steel Joists. The weight of DEAD loads, including the joists. must be deducted to determine the LIVE load-carrying capacities of the joists. The load table may be used for parallel chord joists installed to a maximum slope of 1/2 inch per foot.

The figures shown in RED in this load table are the LIVE loads per linear foot of joist which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the figures in RED by 1.5. In no case shall the TOTAL load capacity of the joists be exceeded.

The approximate joist weights per linear foot shown in these tables do not include accessories.

The approximate moment of inertia of the joist, in inches<sup>4</sup> is:  $I_1 = 26.767(W_{LL})(L^3)(10^6)$ , where  $W_{LL} = RED$  figure in the Load Table and L = (Span - .33) in feet.

For the proper handling of concentrated and/or varying loads, see Section 5.5 in the Recommended Code of Standard Practice.

Where the joist span exceeds the unshaded area of the table, the row of bridging nearest the mid span shall be diagonal bridging with bolted connections at chords and midspan.

Joist Designation	8K1	10K1	12K1	12K3	12K5	14K1	14K3	14K4	14K6	16K2	16K3	16K4	16K5	16K6	16K7	16K9
Depth (In.)	8	10	12	12	12	14	14	14	14	16	16	16	16	16	16	16
Approx. Wt. (lbs./ft.)	5.1	5.0	5.0	5.7	7.1	5.2	6.0	6.7	7.7	5.5	6.3	7.0	7.5	8.1	8.6	10.0
Span (ft.) ↓																
8	550 550															
9	550 550															
10	550 480	550 550														
11	532 377	550 542														
12	444 288	550 455	550 550	550 550	550 550											
13	377 225	479 363	550 510	550 510	550 510											
14	324 179	412 289	500 425	550 463	550 463	550 550	550 550	550 550	550 550							
15	281 145	358 234	434 344	543 428	550 434	511 475	550 507	550 507	550 507		1.1					
16	246 119	313 192	380 282	476 351	550 396	448 390	550 467	550 467	550 467	550 550						
17		277 159	336 234	420 291	550 366	395 324	495 404	550 443	550 443	512 488	550 526	550 526	550 526	550 526	550 526	550 526
18		246 134	299 197	374 245	507 317	352 272	441 339	530 397	550 408	456 409	508 456	550 490	550 490	550 490	550 490	550 490
19		221 113	268 167	335 207	454 269	315 230	395 287	475 336	550 383	408 347	455 386	547 452	550 455	550 455	550 455	550 455
20		199 97	241 142	302 177	409 230	284 197	356 246	428 287	525 347	368 297	410 330	493 386	550 426	550 426	550 426	550 426
21			218 123	273 153	370 198	257 170	322 212	388 248	475 299	333 255	371 285	447 333	503 373	548 405	550 406	550 406
22			199 106	249 132	337 172	234 147	293 184	353 215	432 259	303 222	337 247	406 289	458 323	498 351	550 385	550 385
23			181 93	227 116	308 150	214 128	268 160	322 188	395 226	277 194	308 216	371 252	418 282	455 307	507 339	550 363
24			166 81	208 101	282 132	196 113	245 141	295 165	362 199	254 170	283 189	340 221	384 248	418 269	465 298	550 346
25						180 100	226 124	272 145	334 175	234 150	260 167	313 195	353 219	384 238	428 263	514 311
26						166 88	209 110	251 129	308 156	216 133	240 148	289 173	326 194	355 211	395 233	474 276
27						154 79	193 98	233 115	285 139	200 119	223 132	268 155	302 173	329 188	366 208	439 246
28						143 70	180 88	216 103	265 124	186 106	207 118	249 138	281 155	306 168	340 186	408 220
29										173 95	193 106	232	261 139	285 151	317 167	380 198
30				1.4						161 86	180 96	216	244	266 137	296 151	355 178
31										151 78	168 87	203	228	249 124	277	332 161
32										142 71	158 79	190 92	214	233	259 124	311 147

#### STANDARD LOAD TABLE/OPEN WEB STEEL JOISTS, K-SERIES Based on a Maximum Allowable Tensile Stress of 30 ksi

Joist Designation	18K3	18K4	18K5	18K6	18K7	18K9	18K10	20K3	20K4	20K5	20K6	20K7	20K9	20K10	22K4	22K5	22K6	22K7	22K9	22K10	22K11
Depth (In.)	18	18	18	18	18	18	18	20	20	20	20	20	20	20	22	22	22	22	22	22	22
Approx. Wt. (lbs./ft.)	6.6	7.2	7.7	8.5	9.0	10.2	11.7	6.7	7.6	8.2	8.9	9.3	10.8	12.2	8.0	8.8	9.2	9.7	11.3	12.6	13.8
Span (ft.)														1							
	550	550	550	550	550	550	550														
18	550	550	550	550	550	550	550													-	
19	514 494	550 523	550 523	550 523	550 523	550 523	550 523														
20	463 423	550 490	550 490	550 490	550 490	550 490	550 490	517 517	550 550	550 550	550 550	550 550	550 550	550 550							
21	420 364	506 426	550 460	550 460	550 460	550 460	550 460	468 453	550 520	550 520	550 520	550 520	550 520	550 520							
22	382 316	460 370	518 414	550 438	550 438	550 438	550 438	426 393	514 461	550 490	550 490	550 490	550 490	550 490	550 548						
23	349	420	473	516	550	550	550 418	389	469	529	550	550	550	550	518	550	550	550	550	550	550
24	320	385	434	473	526	550	550	357	430	485	528	550	550	550	475	536	550	550	550	550	550
25	294	355	400	435	485	550	550	302	396	446	430	448 541	448 550	448 550	431	483	495 537	495 550	495 550	495 550	495 550
26	214	328	369	402	448	538	377 550	304	312 366	350 412	380 449	421 500	426 550	426 550	381 404	427 455	464 496	474 550	474 550	474 550	474 550
20	190 252	222 303	249 342	271 372	299 415	354 498	361 550	236	277 339	310 382	337 416	373 463	405 550	405 550	338 374	379 422	411 459	454 512	454 550	454 550	454 550
21	169 234	198 282	222	241	267	315	347 548	211	247	277	301	333	389	389	301	337	367	406	432	432	432
28	151	177	199	216	239	282	331	189	221	248	269	298	353	375	270	302	328	364	413	413	413
29	136	159	179	322 194	215	431 254	298	170	199	330 223	360 242	401 268	482 317	359	324 242	365	398 295	443 327	532 387	550 399	550 399
30	203 123	245 144	276 161	301 175	335 194	402 229	477 269	227 153	274 179	308 201	336 218	374 242	450 286	533 336	302 219	341 245	371 266	413 295	497 349	550 385	550 385
31	190 111	229 130	258 146	281 158	313 175	376 207	446 243	212 138	256 162	289 182	314 198	350 219	421 259	499 304	283 198	319 222	347 241	387 267	465 316	550 369	550 369
32	178 101	215 118	242 132	264 144	294 159	353 188	418 221	199 126	240 147	271 165	295 179	328 199	395 235	468 276	265 180	299 201	326 219	363 242	436 287	517 337	549 355
33	168 92	202	228 121	248 131	276 145	332 171	393 201	187 114	226 134	254 150	277	309 181	371	440 251	249 164	281	306 199	341	410	486	532 334
34	158 84	190 98	214	233	260	312	370 184	176	212	239	261	290	349	414	235	265	288	321	386	458	516
35	149	179	202	220	245	294	349	166	200	226	246	274	329	390	221	249	272	303	364	432	494
36	141	169	191	208	232	278	330	157	189	213	232	259	311	369	209	236	257	286	344	408	467
37	70	82	92	101	111	132	154	148	103	202	125	245	164 294	193 349	126	223	153 243	169 271	201 325	236 386	269 442
20								81 141	95 170	106 191	115 208	128 232	151 279	178 331	116 187	130 211	141 230	156 256	185 308	217 366	247 419
	-							74	87	98 181	106	118	139	164 314	107	119	130	144	170	200	228 397
39	_			_				69	81	90	98	109	129	151	98	110	120	133	157	185	211
40								64	75	84	91	101	119	140	91	102	111	123	146	171	195
41															161 85	95	197	114	135	314 159	359 181
42															153 79	173 88	188 96	209 106	252 126	299 148	342 168
43												0			146 73	165 82	179 89	200 99	240 117	285 138	326 157
44															139 68	157 76	171 83	191 92	229 109	272 128	311 146



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