

May 19, 2023

Stormy Shanks KCL Engineering 312 NW 10th Ave., Suite 100 Portland, OR 97209

RE: BSD Southridge HS HVAC Upgrades

EELLC Project No. 22190

Dear Stormy:

Attached please find calculation sheets C1 through C11, dated May 19, 2023, which verify the structural adequacy of the existing roof structure supporting RTUs 1 through 13 to be replaced at Southridge High School at 9625 SW 125th Ave in Beaverton, Oregon, as shown on M0.0 through M5.3 dated May 19, 2023. Design is based on the provisions of the 2022 Oregon Structural Specialty Code. Note anchorage of replacement RTU units, as well as evaluation of other mechanical unit replacements is outside of our scope. Note that potential catwalks matching the length and width of RTUs 1-9, and 11-13 shall be limited to a maximum distributed self-weight allowance of 10 pounds per square foot and shall be designed and anchored to structure by others. RTU 10 shall not have a catwalk adjacent.

Please call if you have any questions.

Sincerely,

Leif Erickson, S.E. Managing Principal

Enclosures

(E) Roof Deed Loads: Roofing & cover Board 6 psf Insulation 3 psf 1/2" metal Decking 3 psf MEP 4 psf MISC 2 psf A 195f Check difference in (N) & (E) RTU weights does not exceed 5%. Note most units will we ish less and the existing structure is by inspection. See following pages for further evaluation on select us (E) weight 24,195 24,195 24,195 24,195 24,195 16,792" 22,000 (N) weight 14700" 1500" 1500" 1500" 16700" 17800" 17800" 1799x490 73x9 (Does not Change who) 73x99x515 73x99x518							C1
Client K.C. ENGINEERS Revised Date 5/17/23 Revised Date 22.196 ENGINEERS Date Date 22.196 Date 23.196 Date 24.196 Date 24.196	Project Sowth	ridge HS	EQ	UILIBRIUM	By U		Sheet #
ENGINEERS9 Date Revised Date 22190 (E) Roof Dead Loads: Roofing & Cover Board 6 psf Trishlation 1/2" metal Decking 3 psf MEP MISC JOISTS Check difference in (N) & (E) RTU weights does not exceed 51 Note most units will we igh less and the existing string is not by inspection. See following pages for further evaluation an exect (N) weight 24,19516 24,1951	Location	0			Date	5/17/23	
ENGINEERS Date 22190 (E) Roof Dead Loads: Roofing & cover Board 6 psf This had from 3 psf 1/2" netal Decking 3 psf MEP 4 psf MISC 2 psf To 1sts 3 psf 21 psf Check difference in (N) & (E) RTU weights does not exceed 5%. Note most units will weigh less and the existing strangists of hydrogen and the existing strangists of hydrogen and the existing strangists of hydrogen evaluation on select units of hydrogen existing strangists of hydrogen evaluation on select units of hydrogen existing strangists of hydrogen evaluation on select units of hydrogen existing strangists and the existing strangists of hydrogen evaluation on select units of hydrogen existing strangists and hydrogen existing strangists for hydrogen existing strangists and hydrogen	Client				1		Job #
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This hation 1/2" Netal Decking 3 psf 1/2" Netal Decking MEP MISC 2 psf MISC JOISTS 2 psf 2 1 psf Check difference in (N) & (E) RTU weights does not Exceed 51. Note most units will use igh less and the existing structure by inspection. See following pages for hunter evaluation on select use by inspection. See following pages for hunter evaluation on select use (E) weight RTU-1 (E) weight RTU-1 ZU,1951 ZH,1951 ZH,1951 ZH,195	Roofing	& cover &	Board	6 PSF			
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Change (NO) Ok By Ok Ok Ok See following Ok FTU-7 PTU-8 PTU-9 PTU-10 PTU-11 PTU-12 PTU-13 PTU	(E) weight (N) weight	24,195" 14700"	RTV-2 24,19516	24,19515 1560018	24,195 h 15600'b	RTU-5 16,942"	22,000 1480016
(HxwxL) incles inspection ETU-7 ETU-8 ETU-9 ETU-10 ETU-11 ETU-12 ETU-13 13,925 16 13,900 10 7,500 16 11,600 10 10,200 11 10,200 11 10,200 11 10,340 11 97,99×442 77,476×388 96×77×436 96×77×256 97×99×268 58,94×244 77,96x: see following OK Note this unit OK Calcs OK Special cub Odapter and will not have	(Does not	73×99×515	73×99×515	73×99×53	8 73×99×5	38 97,99249	2 73×99×51
\$\frac{\text{FTU-7}}{15,673 \\ 13,925 \\ \text{13,925 \\ \text{13,900 \\ \text{17,500 \\ \text{17,500 \\ \text{17,500 \\ \text{10,200 \\ \text{10,200\te	(HXWXL) incles	ok By inspection	OK	OK	OK	see followi	n ok
14800" 10700" 11100% 7500% 10500% 5800% 10200 97x99x442 77x96x388 96x77x42 96x77x256 97x99x288 56x94x244 77x96x3 Lee following OK OK Note this unit OK OK OK Calcs Calcs Adapter and Will not have	RTU-7	RTU-8		RTV-10	RTV-11		RTU-13
14800" 10700" 11100" 7500" 10500" 5800" 10200 97x99x442 77x96x388 96x77x436 96x77x256 97x99x288 56x94x244 77x96x3 Cel following OK Note this unit OK OK OK to recieve a special cubb adapter and will not have		13,92516	13,900%	7,500 16	11,400016	10,20016	10,340"
cele following OK OK Note this unit OK OK OK to recieve a special cubb adapter and will not have		1070017	1110016				1020018
Special CMB adapter and will not have	97×99×442	774961388	96x77x436	96×77×25	6 97×99×288	55x94x244	77×96×368
a catwalk adjacent	calos	OK .	OK	adapter a will not ha	nd are	ok	OK

			C2
Project Southwidge HS	EQUILIBRIUM	By 47	Sheet #
Location		Date 5/17/23	
Client		Revised	Job #
100	ENGINEERS	Date	22190
RTU-5		24'-8" 8'	popential contract
Check worst case (E) Jo	nist fol	24'-8" 8' W W,	Cartural
Change in loading		À	A
Existing!		@7'-4"oc	
W = 21 PSF D 25 PSF S 20 PSF L		e 7-9" sc	
W, = 16942 (99x490/144) = 50.3	psf		
Mmax = 103,54 KPt			
Vmax = (0.3k			
New:			
W = 21 psf D + 10 psf C 25 psf s 20 psf L	outwalk D		
W, = 167001/(994 490/144) = 49.69			
Mmax = 104,7 Fft >103.54	HE 1011, L105)	/. ok	
Vmax = 10.814 > 10.3 = 1	04,91, 4 1057. OK		
No Reinforcement o			

Project File: Southridge Calcs.ec6

Project Title: Engineer: Project ID: Project Descr:

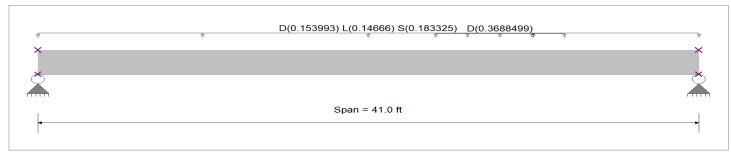
General Beam Analysis

DESCRIPTION: RTU-5 - (E)

General Beam Properties

Elastic Modulus 29,000.0 ksi

Span #1 Span Length = 41.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4



Applied Loads

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

Uniform Load: D = 0.0210, L = 0.020, S = 0.0250 ksf, Tributary Width = 7.333 ft

Uniform Load: D = 0.05030 ksf, Extent = 24.670 -->> 32.670 ft, Tributary Width = 7.333 ft, (RTU)

DESIGN SUMMARY

Maximum Bending = Load Combination	103.533 k-ft +D+0.750L+0.750S	Maximum Shear = Load Combination	10.294 k +D+0.750L+0.750S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	22.755 ft	Location of maximum on span	41.000 ft
Maximum Deflection			
Max Downward Transient Deflection	4.051 in	121	
Max Upward Transient Deflection	0.051 in	9563	
Max Downward Total Deflection	10.865 in	45	
Max Upward Total Deflection	0.049 in	10079	

Maximum Forces & Stresses for Load Combinations

Load Combination	Max Stress R	atios	Summary of Moment Values (k-ft)			Shear Values (k)	
Segment Length	Span #	M V	Mmax +	Mmax - Ma - Max	Mnx Mnx/Omega Cb	Rm Va Max	Vnx Vnx/Omega
Overall MAXimum Enve	lope						
Dsgn. L = 41.00 ft	· 1		103.53	103.53		10.29	
D Only							
Dsgn. L = 41.00 ft	1		52.97	52.97		5.22	
+D+L							
Dsgn. L = 41.00 ft	1		82.67	82.67		8.23	
+D+S							
Dsgn. L = 41.00 ft	1		90.24	90.24		8.98	
+D+0.750L							
Dsgn. L = 41.00 ft	1		75.15	75.15		7.48	
+D+0.750L+0.750S							
Dsgn. L = 41.00 ft	1		103.53	103.53		10.29	
+0.60D							
Dsgn. L = 41.00 ft	1		31.78	31.78		3.13	

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl Loc	cation in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S	1	10.8645	20.910		0.0000	0.000
Vertical Reactions			Suppor	t notation : Far left is #1	Values in KIPS	

Vertical Reactions			Support notation : Far left is #1	Values in KIPS
Load Combination	Support 1	Support 2		
Overall MAXimum Overall MINimum	9.118	10.294		
D Only	4.044	5.220		
+D+L	7.051	8.227		
+D+S	7.802	8.978		
+D+0.750L	6.299	7.475		
+D+0.750L+0.750S	9.118	10.294		
+0.60D	2.427	3.132		

General Beam Analysis		Project File: Southridge Calcs.ec6
LIC# : KW-06017318, Build:20.23.04.05	EQUILIBRIUM ENGINEERS LLC	(c) ENERCALC INC 1983-2023

DESCRIPTION: RTU-5 - (E)

Vertical Reactions	Support notation : Far left is #1	Values in KIPS
--------------------	-----------------------------------	----------------

Load Combination	Support 1	Support 2
L Only	3.007	3.007
S Only	3.758	3.758

General Beam Analysis

LIC#: KW-06017318, Build:20.23.04.05 EQUILIBRIUM ENGINEERS LLC

(c) ENERCALC INC 1983-2023

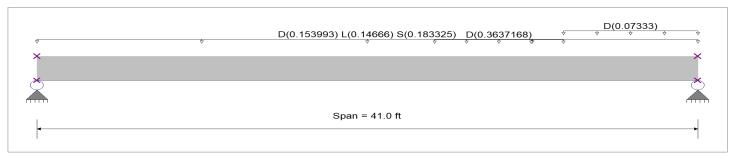
Project File: Southridge Calcs.ec6

DESCRIPTION: RTU-5 - (N)

General Beam Properties

Elastic Modulus 29,000.0 ksi

Span #1 Span Length = 41.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4



Applied Loads

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

Uniform Load: D = 0.0210, L = 0.020, S = 0.0250 ksf, Tributary Width = 7.333 ft

Uniform Load: D = 0.04960 ksf, Extent = 24.670 -->> 32.670 ft, Tributary Width = 7.333 ft, (RTU)

Uniform Load: D = 0.010 ksf, Extent = 32.670 -->> 41.0 ft, Tributary Width = 7.333 ft, (Catwalk)

DESIGN SUMMARY

Maximum Bending =	104.664 k-ft	Maximum Shear =	10.814 k
Load Combination	+D+0.750L+0.750S	Load Combination	+D+0.750L+0.750S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	22.755 ft	Location of maximum on span	41.000 ft
Maximum Deflection			
Max Downward Transient Deflection	4.051 in	121	
Max Upward Transient Deflection	0.051 in	9563	
Max Downward Total Deflection	10.993 in	44	
Max Upward Total Deflection	0.050 in	9873	

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stre	ss Ratios	Ratios Summary of Moment Values (k-ft)				Shear Values (k)	
Segment Length	Span #	M	V	Mmax +	Mmax - Ma - Max	Mnx Mnx/Omega Cb	Rm	Va Max	VnxVnx/Omega
Overall MAXimum Enve	elope								
Dsgn. L = 41.00 ft	1			104.66	104.66			10.81	
D Only									
Dsgn. L = 41.00 ft	1			54.22	54.22			5.74	
+D+L									
Dsgn. L = 41.00 ft	1			83.85	83.85			8.75	
+D+S									
Dsgn. L = 41.00 ft	1			91.39	91.39			9.50	
+D+0.750L									
Dsgn. L = 41.00 ft	1			76.34	76.34			8.00	
+D+0.750L+0.750S									
Dsgn. L = 41.00 ft	1			104.66	104.66			10.81	
+0.60D									
Dsgn. L = 41.00 ft	1			32.53	32.53			3.44	
Occasion Marchael	Dadie de								

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S	1	10.9934	20.910		0.0000	0.000
Vertical Pagetions			Support	notation : For left is #1	Values in KIPS	

Vertical Reactions			Support notation : Far left is #1	Values in KIPS
Load Combination	Support 1	Support 2		
Overall MAXimum Overall MINimum	9.167	10.814		
D Only	4.094	5.740		
+D+L +D+S	7.100 7.852	8.747 9.498		
+D+0.750L	6.349	7.995		

General Beam AnalysisProject File: Southridge Calcs.ec6LIC#: KW-06017318, Build:20.23.04.05EQUILIBRIUM ENGINEERS LLC(c) ENERCALC INC 1983-2023

DESCRIPTION: RTU-5 - (N)

Vertical Reactions	Support notation : Far left is #1	Values in KIPS
VCI IICAI INCACTIONS	Capport notation : r ai lott lo ii i	

Load Combination	Support 1	Support 2
+D+0.750L+0.750S	9.167	10.814
+0.60D	2.456	3.444
L Only	3.007	3.007
S Only	3.758	3.758

			C7
Project Southvidge HS	EQUILIBRIUM	Ву Е	Sheet #
Location		Date 5/17/23	
Client		Revised	Job #
·	ENGINEERS3	Date	22190
RTU-7		r r r r	Hentia)
check worst case (B) Jois			iv l
Change in loading. Note (A 50'	A
ceiling grid not included		50	
Existing:			
W= 21 psf D 25 psf S			
20 psf L			
W1=15673/(99x442)/144 = 51,6 PS	>f		
Mmax = 145,4 kft			
Vmax = 12.36 =			
New!			
W= 21 psf D + 10 psf Co	itwalk		
20 PSF L			
W, = 1480016/(99 7442)/144 = 48.	794		
Mmax = 150.9, LFE >145.4E		012	
Vmax = 12.6 × >12.36 × 102			
No reinforcement of	(E) Structure reg	mired	

100.0 in^4

Project File: Southridge Calcs.ec6

Project Title: Engineer: Project ID: Project Descr:

General Beam Analysis

DESCRIPTION: RTU 7 - (E)

General Beam Properties

Elastic Modulus 29,000.0 ksi

Span #1 Span Length = 50.0 ft Area = 10.0 in^2 Moment of Inertia =

D(0.3783828) D(0.153993) L(0.14666) S(0.183325)

Applied Loads

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

Uniform Load: D = 0.0210, L = 0.020, S = 0.0250 ksf, Tributary Width = 7.333 ft

Uniform Load: D = 0.05160 ksf, Extent = 8.333 -->> 16.50 ft, Tributary Width = 7.333 ft, (RTU)

DESIGN SUMMARY

Maximum Bending = Load Combination	145.380 k-ft +D+0.750L+0.750S	Maximum Shear = Load Combination	12.360 k +D+0.750L+0.750S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	23.000 ft	Location of maximum on span	0.000 ft
Maximum Deflection Max Downward Transient Deflection	8.961 in	66	
Max Upward Transient Deflection	0.114 in	5272	
Max Downward Total Deflection Max Upward Total Deflection	22.910 in 0.104 in	26 5763	

Maximum Forces & Stresses for Load Combinations

Load Combination Max Stress Ratios Summary of Moment Values (k-ft)							Shear Values (k)		
Segment Length	Span #	M	V	Mmax +	Mmax - Ma - Max	Mnx Mnx/Omega Cb	Rm	Va Max	VnxVnx/Omega
Overall MAXimum Enve	elope								
Dsgn. L = 50.00 ft	· 1			145.38	145.38			12.36	
D Only									
Dsgn. $L = 50.00 \text{ ft}$	1			69.22	69.22			6.17	
+D+L									
Dsgn. L = 50.00 ft	1			114.12	114.12			9.84	
+D+S									
Dsgn. L = 50.00 ft	1			125.47	125.47			10.76	
+D+0.750L									
Dsgn. L = 50.00 ft	1			102.80	102.80			8.92	
+D+0.750L+0.750S									
Dsgn. L = 50.00 ft	1			145.38	145.38			12.36	
+0.60D									
Dsgn. L = 50.00 ft	1			41.53	41.53			3.70	
Occasion Marchaelan	Dadie de								

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl Lo	cation in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S	1	22.9095	24.750		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	

Load Combination	Support 1	Support 2
Overall MAXimum	12.360	10.804
Overall MINimum		
D Only	6.173	4.617
+D+L	9.839	8.284
+D+S	10.756	9.200
+D+0.750L	8.923	7.367
+D+0.750L+0.750S	12.360	10.804
+0.60D	3.704	2.770

General Beam AnalysisProject File: Southridge Calcs.ec6LIC#: KW-06017318, Build:20.23.04.05EQUILIBRIUM ENGINEERS LLC(c) ENERCALC INC 1983-2023

DESCRIPTION: RTU 7 - (E)

 Vertical Reactions
 Support notation : Far left is #1
 Values in KIPS

Load Combination	Support 1	Support 2	
L Only	3.667	3.667	
S Only	4.583	4.583	

General Beam Analysis

LIC#: KW-06017318, Build:20.23.04.05 EQUILIBRIUM ENGINEERS LLC

Project File: Southridge Calcs.ec6

(c) ENERCALC INC 1983-2023

DESCRIPTION: RTU 7 - (N)

General Beam Properties

Elastic Modulus 29,000.0 ksi **Span #1** Span Length =

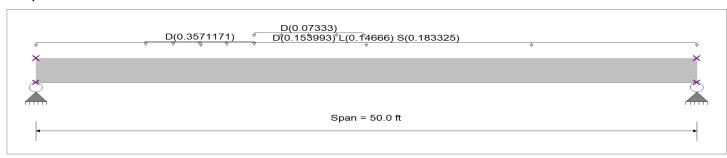
50.0 ft

Area =

10.0 in^2

Moment of Inertia =

100.0 in^4



Applied Loads

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

Uniform Load: D = 0.0210, L = 0.020, S = 0.0250 ksf, Tributary Width = 7.333 ft

Uniform Load: D = 0.04870 ksf, Extent = 8.333 -->> 16.50 ft, Tributary Width = 7.333 ft, (RTU)

Uniform Load: D = 0.010 ksf, Extent = 16.50 -->> 24.833 ft, Tributary Width = 7.333 ft, (Catwalk)

DESIGN SUMMARY

Maximum Bending =	(150.912 k-ft)	Maximum Shear =	12.588 k
Load Combination	+D+0.750L+0.750S	Load Combination	+D+0.750L+0.750S
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
Location of maximum on span	23.000 ft	Location of maximum on span	0.000 ft
Maximum Deflection			
Max Downward Transient Deflection	8.961 in	66	
Max Upward Transient Deflection	0.114 in	5272	
Max Downward Total Deflection	23.630 in	25	
Max Upward Total Deflection	0.111 in	5428	
•	*****		

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Rati	os	Summary of Mom	She	Shear Values (k)	
Segment Length	Span #	M V	Mmax +	Mmax - Ma - Max	Mnx Mnx/Omega Cb Rm	Va Max	VnxVnx/Omega
Overall MAXimum Enve	elope						
Dsgn. L = 50.00 ft	· 1		150.91	150.91		12.59	
D Only							
Dsgn. $L = 50.00 \text{ ft}$	1		74.69	74.69		6.40	
+D+L							
Dsgn. $L = 50.00 \text{ ft}$	1		119.68	119.68		10.07	
+D+S							
Dsgn. L = 50.00 ft	1		131.02	131.02		10.98	
+D+0.750L							
Dsgn. L = 50.00 ft	1		108.37	108.37		9.15	
+D+0.750L+0.750S							
Dsgn. L = 50.00 ft	1		150.91	150.91		12.59	
+0.60D							
Dsgn. L = 50.00 ft	1		44.82	44.82		3.84	
0	D (1 4)						

Overall Maximum Deflections

	Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	+D+0.750L+0.750S	1	23.6304	24.750		0.0000	0.000
٧	ertical Reactions			Support	notation : Far left is #1	Values in KIPS	

Load Combination	Support 1	Support 2
Overall MAXimum	12.588	11.014
Overall MINimum		
D Only	6.401	4.827

+D+L 10.067 8.493 +D+S 10.984 9.410 +D+0.750L 9.150 7.577

General Beam AnalysisProject File: Southridge Calcs.ec6LIC#: KW-06017318, Build:20.23.04.05EQUILIBRIUM ENGINEERS LLC(c) ENERCALC INC 1983-2023

DESCRIPTION: RTU 7 - (N)

Vertical ReactionsSupport notation : Far left is #1Values in KIPS

Load Combination	Support 1	Support 2
+D+0.750L+0.750S	12.588	11.014
+0.60D	3.840	2.896
L Only	3.667	3.667
S Only	4.583	4.583