

K&P Engineering, Inc.

Structural Engineers

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MAR Construction

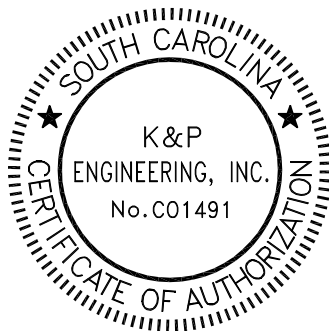
141 Riverchase Way
Lexington, SC 29072
Phone: (803) 796-8960

Metal Siding Calculations for Chapin High School

Chapin, SC

Job #: 15-227

November 19, 2015



Mailing Address:
P.O. Box 1416
Lexington, SC 29071

Street Address:
478 Highway 378 West
Lexington, SC 29072



[ASCE 7 Windspeed](#)
[ASCE 7 Ground Snow Load](#)
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Search Results

Query Date: Mon Nov 09 2015

Latitude: 34.1660

Longitude: -81.3498

**ASCE 7-10 Windspeeds
(3-sec peak gust in mph*):**

Risk Category I: 105

Risk Category II: 115

Risk Category III-IV: 120

MRI 10-Year:** 76

MRI 25-Year:** 84

MRI 50-Year:** 90

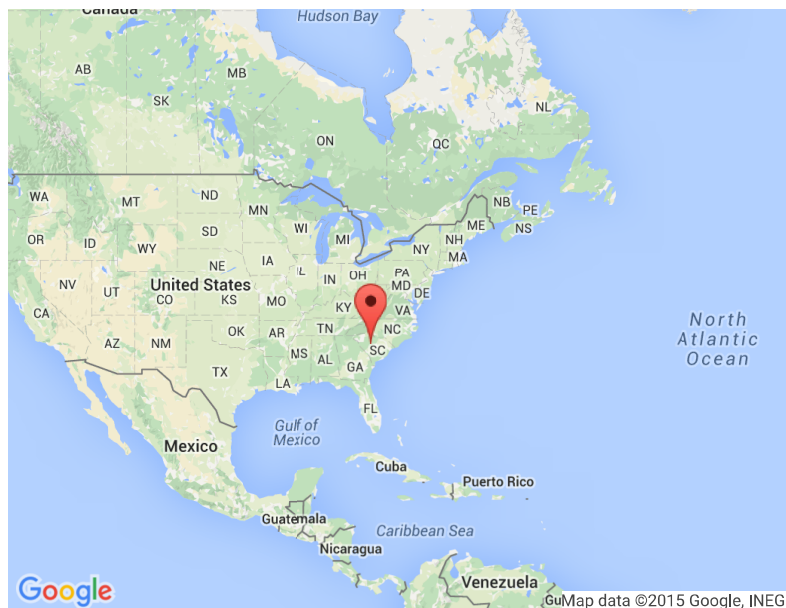
MRI 100-Year:** 96

ASCE 7-05 Windspeed:

92 (3-sec peak gust in mph)

ASCE 7-93 Windspeed:

76 (fastest mile in mph)



*Miles per hour

**Mean Recurrence Interval

Users should consult with local building officials to determine if there are community-specific wind speed requirements that govern.



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MecaWind Pro v2.2.7.0 per ASCE 7-10

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Date           : 11/9/2015                Project No.    : 15-227
Company Name   : K & P ENGINEERING, INC.   Designed By   : CFK
Address        : PO Box 1416              Description   : Chapin High School
City          : Lexington                 Customer Name  : MAR Construction
State         : SC                       Proj Location : Chapin, SC
File Location  : S:\K&P Job Files\2015-jobs\15-227 Chapin High School Wall Panels\Calcs\15-227 CC
Wind.wnd
    
```

Input Parameters: Directional Procedure All Heights Building (Ch 27 Part 1)

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Basic Wind Speed(V) = 120.00 mph
Structural Category = III                Exposure Category = C
Natural Frequency   = N/A              Flexible Structure = No
Importance Factor   = 1.00             Kd Directional Factor = 0.85
Damping Ratio (beta) = 0.01
Alpha               = 9.50
At                 = 0.11              Zg               = 900.00 ft
Am                 = 0.15              Bt               = 1.00
Cc                 = 0.20              Bm               = 0.65
Epsilon            = 0.20              l               = 500.00 ft
Pitch of Roof       = 0 : 12           Zmin            = 15.00 ft
h: Mean Roof Ht    = 50.00 ft         Slope of Roof(Theta) = .00 Deg
Rht: Ridge Ht      = 50.00 ft         Type of Roof     = FLAT
OH: Roof Overhang at Eave = .00 ft   Eht: Eave Height = 50.00 ft
Bldg Length Along Ridge = 200.00 ft   Overhead Type   = Overhang
                                           Bldg Width Across Ridge = 100.00 ft
    
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Wind Pressure on Components and Cladding (Ch 30 Part 1)

All pressures shown are based upon STRENGTH Design, with a Load Factor of 1

Width of Pressure Coefficient Zone "a" = 10.00 ft

Description	Width ft	Span ft	Area Zone ft^2	Max GCp	Min GCp	Max P psf	Min P psf		
Zone 4	4.00	1.33	5.3 4	0.90	-0.99	37.01	-40.10	x .6 = 24.1 psf	
Zone 5	4.00	1.33	5.3 5	0.90	-1.26	37.01	-49.35	x .6 = 29.6 psf	
Khcc:Comp. & Clad. Table 6-3 Case 1							=	1.09	
Qhcc:.00256*V^2*Khcc*Kht*Kd							=	34.27 psf	

Consider worst case wind load: 49.35 psf ultimate x .6 = 29.6 psf service load
 Panel span = 5'-0"

Determine screw spacing for panel to hat connx:

Allowable pullout per screw = 710/3 = 236.7 #

Screw Spacing = 236.7# / (29.6 psf x 5') = 1.60' = 19.2" say #10 screws @ 18" o.c.

Provide 5/8" 16 gage hats (MSG1) to support edges of panels at 5'-0" max. o.c.

Wind load on hats = 5 x 29.6 psf = 148 plf

Check bending in hats (attach hats to each stud at 32" o.c.):

M = 0.107 x 148 plf x 2.667'^2 = 112.6 lb-ft = 1.352 in.-k < M(allow) = 2.39 in.-k OK

Check connx of hats to 18 gage minimum studs/zees at 32" o.c.:

Corner Zones (within 10' of building corners):

Load to connx = 29.6 psf x 5' x 2.667' = 394.7 #

Fasten hat to ea. stud w/ (4) #10 screws

Allowable pullout per screw = 503/3 = 167.7 # (Safety Factor = 3)

Allowable pullout per connx (4 screws) = 4 x 167.7 = 670 # > 394.7 # OK

Interior Zones (10' away from building corners):

Load to connx = 24.1 psf x 5' x 2.667' = 321.4 #

Fasten hat to ea. stud w/ (2) #10 screws

Allowable pullout per screw = 503/3 = 167.7 #

Allowable pullout per connx (2 screws) = 2 x 167.7 = 335 # > 321.4 # OK

In Corner Zones (within 10' of corners): Fasten 5/8" hats to each stud (zee) @ 32" o.c. with 4 #10 screws

In Interior Zones (10' from corners): Fasten 5/8" hats to each stud (zee) @ 32" o.c. with 2 #10 screws



SUB-GIRTS AND CLIPS

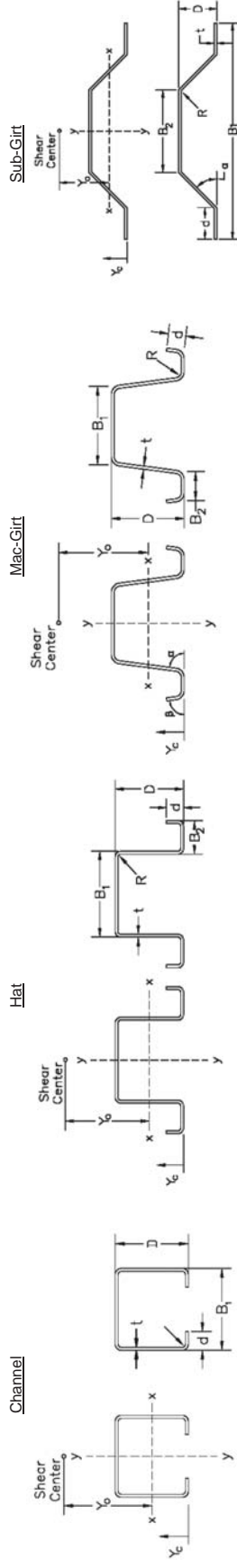
SUB-GIRTS

SUB-GIRT	DESCRIPTION	GAUGE	DIMENSION	FINISH
	MSG 1	16, 18, & 20	5/8" x 5 1/2"	Galvanized
	MSG 2	18 & 20	7/8" x 5 1/4"	Galvanized
	MSG 3	18 & 20	1 1/4" x 6"	Galvanized

CEE and ZEE CLIPS

<p>3" x 7" x 3/16" x 0" - 5 3/4" WT. = 3.22 Item #: 76810</p>	<p>3" x 3" x 3/16" x 0" - 5 3/4" WT. = 1.92 Item #: 76800</p>
<p>3 1/4" x 7 1/4" x 3/16" x 0" - 5 3/4" WT. = 3.52 Item #: 76830</p>	<p>3 1/4" x 3 1/4" x 3/16" x 0" - 5 3/4" WT. = 2.22 Item #: 76820</p>
<p>7 3/4" x 3/16" x 0" - 4" WT. = 1.70 Item #: 76850</p>	<p>5 3/4" x 3/16" x 0" - 4" WT. = 1.28 Item #: 76840</p>

Effective Section Properties: Channel, Hats, MAC Girts



Member	Ga.	Effective Section Properties										Web Crippling										
		Compression		Tension		Shear		Positive Moment (X Axis)		Negative Moment (X Axis)		Positive Moment (Y Axis)		Negative Moment (Y Axis)		End	Interior					
		A_g (in ²)	P_a (kip)	T_a (kip)	V_{ax} (kip)	M_{ax} (kip-in)	I_x (in ⁴)	S_x TOP (in ³)	S_x BOT (in ³)	I_{xc} (in ⁴)	S_{xc} TOP (in ³)	S_{xc} BOT (in ³)	M_{by} (kip-in)	I_y (in ⁴)	S_{eLEFT} (in ³)	S_{eRIGHT} (in ³)	M_{ay} (kip-in)	I_y (in ⁴)	S_{eLEFT} (in ³)	S_{eRIGHT} (in ³)	P_a (kip)	P_a (kip)
Channel	1.4375 x 1.625	0.266	8.67	10.03	2.91	1.68	3.77	0.080	0.135	0.095	0.095	5.51	0.125	0.158	0.151	0.158	5.51	0.125	0.151	0.158	2.07	4.00
Channel	1.4375 x 1.625	0.197	6.57	7.12	2.60	1.50	2.77	0.065	0.111	0.077	0.077	4.12	0.099	0.129	0.115	0.129	4.12	0.099	0.115	0.129	1.53	2.85
Hat	1.75 x 1.5	0.368	12.11	12.87	3.06	2.91	6.66	0.124	0.166	0.165	0.165	8.34	0.312	0.208	0.208	0.208	8.34	0.312	0.208	0.208	2.30	4.49
Hat	1.75 x 1.5	0.290	9.68	9.08	2.74	2.60	4.76	0.100	0.132	0.134	0.135	5.97	0.249	0.166	0.166	0.166	5.97	0.249	0.166	0.166	1.66	3.18
Hat	1.75 x 1.5	0.204	6.80	7.02	2.15	2.05	3.39	0.074	0.094	0.102	0.106	4.61	0.192	0.128	0.128	0.128	4.61	0.192	0.128	0.128	1.00	1.89
Hat	1.75 x 1.5	0.153	4.25	5.73	1.45	1.38	2.16	0.057	0.072	0.081	0.085	3.03	0.153	0.102	0.101	0.102	3.03	0.153	0.101	0.102	0.53	1.00
Mac-Girt	1.5 x 1.5	0.282	9.42	8.47	2.55	1.82	4.26	0.090	0.119	0.120	0.120	4.26	0.238	0.160	0.160	0.160	4.26	0.238	0.160	0.160	1.38	2.95
Mac-Girt	1.5 x 1.5	0.207	6.90	6.72	2.00	1.44	3.24	0.069	0.090	0.094	0.094	3.37	0.071	0.094	0.095	0.095	4.46	0.184	0.124	0.124	0.80	1.74
Mac-Girt	1.5 x 1.5	0.105	2.92	4.15	1.04	0.75	1.47	0.039	0.049	0.056	0.058	2.13	0.108	0.075	0.071	0.071	2.13	0.108	0.071	0.075	0.21	0.51
Sub-Girt	MSG 1	0.285	8.71	11.58	1.59	1.59	2.88	0.034	0.088	0.089	0.089	2.39	0.030	0.086	0.073	0.073	8.23	0.710	0.279	0.250	1.68	3.28
Sub-Girt	MSG 1	0.192	6.39	8.70	1.40	1.40	2.28	0.025	0.084	0.071	0.071	1.85	0.022	0.068	0.052	0.052	6.27	0.514	0.211	0.175	1.22	2.34
Sub-Girt	MSG 1	0.122	4.06	6.72	1.09	1.09	1.57	0.018	0.044	0.055	0.055	1.27	0.016	0.052	0.035	0.035	4.22	0.358	0.153	0.118	0.74	1.40
Sub-Girt	MSG 2	0.235	7.84	8.70	1.78	1.78	2.77	0.037	0.082	0.077	0.077	2.38	0.035	0.089	0.066	0.066	7.76	0.584	0.230	0.216	1.19	2.27
Sub-Girt	MSG 2	0.152	5.07	6.72	1.38	1.38	2.00	0.026	0.056	0.058	0.058	1.66	0.025	0.067	0.046	0.046	5.30	0.412	0.169	0.148	0.72	1.36
Sub-Girt	MSG 3	0.260	8.65	10.16	2.54	2.54	4.27	0.078	0.125	0.119	0.119	3.76	0.076	0.134	0.105	0.105	9.98	0.862	0.303	0.278	1.13	2.16
Sub-Girt	MSG 3	0.169	5.62	7.85	1.96	1.96	3.09	0.056	0.086	0.090	0.090	2.65	0.055	0.102	0.074	0.074	6.76	0.605	0.222	0.188	0.68	1.28

1. Section properties are calculated in accordance with the 2007 AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Material: 16 Gauge: A653 SS Grade 55 Steel, 18-20 Gauge: A653 SS Grade 80, 22-24 Gauge: A792 Grade 50 Class 1
3. Strength increase due to Cold Working has been applied where applicable
4. Web Crippling values are based on a 2 inch bearing length, one flange fastened to support
5. Appropriate factors of safety have been applied for Allowable Stress Design (ASD)
6. Strength calculations based on a fully braced condition
7. Consult with an engineering professional before using the above design aids

PULLOUT LOADS

Pullout In Steel - Average Ultimate in Pounds (35ksi Test Material)



Fastener Dia. & Point	Material Thickness									
	24 ga (.024")	22 ga (.021")	20 ga (.030")	18 ga (.048")	16 ga (.060")	14 ga (.075")	12 ga (.105")	1/8" (.125")	3/16" (.188")	1/4" (.250")
#10-16 DP3	208	267	295	503	710	968				
#12-14 DP3	215	292	343	555	752	1,066				
#12-14 DP1/Lap	261	338	390	649	890	1,259				
#12-24 DP4				375	500	978	1,200	2,000		3,844
#14-13 DP1	338	574	720	961	1,000	1,350				
1/4-14 DP3			343	533	886	1,077	2,170	2,030	3,863	*4,493

* Exceeds tensile strength

PULLOVER

Screw	Tee Clip 24 ga. (Ave. Ultimate)	Zee Clip 24 ga. (Ave. Ultimate)
#10 DP3	415 lbs.	510 lbs.
#12 GP	430 lbs.	692 lbs.
#14 DP1	407 lbs.	677 lbs.

* Berridge Clips

Pullout In Wood - Average Ultimate in Pounds



Fastener Dia. & Point	Wood Type						
	1/2" Plywood	5/8" Plywood	3/4" Plywood	7/16" OSB	19/32" OSB	23/32" OSB	2 x 4 SYP
#10-13 GP	350	390	550	234	326	352	572
#10-9 GP	362	396	558	235	331	358	575
#12-14 DP1/Lap	376	415	598	251	351	378	550
#12-14 GP	377	418	600	255	356	382	625
#14-13 DP1	407	483	625	325	367	440	675

Decking fasteners tested with full thread embedment. 2 x 4 SYP with 1" embedment

PERFORMANCE SPECIFICATIONS

Fastener Diameter & Material	Thread Diameter	Minimum Ultimate		
		Tensile (lbs.)	Shear (lbs.)	Torsional (lbs-in)
#10-9 / Carbon	0.200"	1,520	1,150	60
#10-9 / 410SS	0.200"	2,500	1,625	85
#10-13 / Carbon	0.195"	1,725	1,125	60
#10-13 / 304SS	0.195"	1,040	701	45
#10-16 / Carbon	0.186"	2,100	1,400	61
#10-16 / 410SS	0.186"	3,200	2,130	92
#12-14 / Carbon	0.212"	2,778	2,000	100
#12-14 / 304SS	0.212"	2,630	1,978	85
#12-24 / Carbon	0.213"	3,450	2,420	110
1/4-14 / Carbon	0.243"	4,275	2,600	150
#14-13 / Carbon	0.235"	3,620	2,500	115

FASTENER PROPERTIES

Thread Type and Point	Thread Major Dia.	Material	Head Dia.	Head Thickness	Drive	Finish
#10-16 DP2	.180"	C1022	.435"	.080"	#2 Sq/Phil	.0003" Zinc & Yellow
#10-24 DP3	.185"	C1022	.435"	.080"	#2 Sq/Phil	.0003" Zinc & Yellow
#10-13 GP	.190"	C1022 304 SS	.450"	.080"	#2 Sq/Phil	.0003" Zinc & Yellow Option: TRI-SEAL™ Coated Passivated
#10-16 DP3	.180"	C1022 304 SS	.450"	.080"	#2 Sq/Phil	.0003" Zinc & Yellow Passivated
#10-9 GP (ULP)	.200"	C1022 304 SS	.435"	.040"	#2 Sq/Phil	.0003" Zinc & Yellow Option: TRI-SEAL™ Coated Passivated
#12-14 GP	.220"	C1022 304 SS	.450"	.080"	#2 Sq/Phil	.0003" Zinc & Yellow Option: TRI-SEAL™ Coated Passivated
#12-14 DP1	.210"	C1022	.450"	.080"	#2 Sq/Phil	.0003" Zinc & Yellow
#12-14 DP3 (SD300)	.210"	C1022 304 SS	.450"	.080"	#2 Sq/Phil T-25 Torx	.0003" Zinc & Yellow Option: TRI-SEAL™ Coated .0003" Zinc & Clear
#12-24 DP4	.210"	C1022	.425"	.110"	#3 Sq	.001" Black Epoxy
#14-13 DP1	.238"	C1022	.500"	.090"	#2 Sq	.001" Black Epoxy
1/4-14 DP3	.245"	C1022	.500"	.080"	#2 Sq/Phil	.0003" Zinc & Yellow

TOOLING

Screwgun RPM
Carbon Steel & 410SS Fasteners
 2,500 RPM maximum
304 Stainless Steel Fasteners
 1,000 RPM maximum

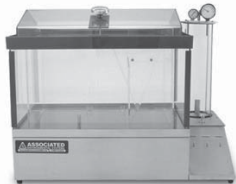


For optimal performance, use screwguns with torque control feature.
DO NOT OVER-TORQUE FASTENERS.

Fastening Tips

- A minimum of three (3) factors of safety should be used for most self-drilling or self-tapping fasteners. Consult a design professional for appropriate values.
- Install fastener perpendicular to the work surface and tighten to no more than approximately 70% of the torsional strength.
- Allow at least three full threads to extend beyond the material. For wood applications, allow 1" minimum embedment or full thread embedment in plywood and OSB for optimal pullout resistance.

SALT SPRAY



The chart to the right provides general information with regard to corrosion resistance of various plating and coatings. Contact TFC for detailed information.

SALT SPRAY Per ASTM B117 (Hours to red rust)
Carbon steel and 410 stainless steel materials

Coating	Salt Spray
.0002" min. (6um) zinc with clear chromate	32hrs
.0003" min. (8um) zinc plating with yellow dichromate	144hrs
Epoxy (ACQ Compatible)	500hrs
TRI-SEAL™ Long-life Coating (ACQ Compatible)	1,000hrs

FASTENER COMPATIBILITY FOR METAL ROOFING AND WALL CLADDING

Table developed by the Metal Construction Association Members (Rev. by MBMA 09.17.10)

Refer to page 16 for detailed information on this chart.

Metal Roof or Wall Cladding Material	Fastener Material								
	Zinc Plated Steel Screws ²	Organic Coated Steel Screws ²	Hot-Dip Galvanized Steel Nails ³ and Screws	Zinc-Alloy Head Steel Screws	Stainless Capped Head Steel Screws	Aluminum	Copper and Copper Alloys	300 Series Stainless Steel	400 Series Stainless Steel
Unpainted Galvanized Steel	Yes ⁴	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Painted Galvanized Steel	Yes ⁴	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Unpainted Galvalume Steel	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Painted Galvalume Steel	Yes ⁴	Yes	Yes	Yes	Yes	Yes	No	Yes ⁴	Yes ⁴
Aluminum	No	Yes	No	No	No	Yes	No	Yes	No
Copper & Copper Alloys	No	No	No	No	No	No	No	Yes	Yes ⁴
Stainless Steel	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Zinc alloy	No	No	No	No	No	Yes	No	Yes	Yes

DISCLAIMER: ALL DATA AND SPECIFICATIONS ARE BASED ON LABORATORY TESTS. APPROPRIATE SAFETY FACTORS SHOULD BE USED BY THE USER OR SPECIFIER. DETERMINING THE PROPER FASTENER IS THE RESPONSIBILITY OF THE USER OR SPECIFIER. BECAUSE APPLICATION CONDITIONS VARY, WE ASSUME NO LIABILITY FOR THE USE OF THIS INFORMATION.