5100 East Grand Ave.
Dallas, TX 75223

AEP SPAN
Engineered Solutions in Metal

Tel 800-527-2503
Tel 214-827-1740
Fax 214-828-1394

CITY

TO:

RECEIVED
MAR 26 2008
BRENTWOOD
DEVELOPMENT DEPT.

Kimmel Construction, Inc.
1815 Stockton Blvd
Sacramento, CA 95816
Attn: Rick Harr

PRES____ VP____ CNTLR____
MBD____ EST____ PM____

MAR 17 2008

JOB____ JOB# 839
KIMMEL CONSTRUCTION, INC.

FROM:

AEP-Span
5100 East Grand Avenue
Dallas, TX 75223

DATE:

March 10, 2008

SUBJECT:

Senior Adult Education Center
Brentwood, CA
Standing Seam Metal Roof
Structural Calculation Package

PROJECT NUMBER:

302548A

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REGISTERED PROFESSIONAL ENGINEER
JAMES L. MITCHELL
No. S3081
Exp. 6/30/09
STRUCTURAL
STATE OF CALIFORNIA

3/14/08

Roof Area #3

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Cupola

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Soffit

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___ No Exceptions Taken
___ Submit Specified Item
___ Correct As Noted
___ Revise and Resubmit
___ Rejected
✓ Receipt Acknowledged

Corrections or comments made on submittals during this review do not relieve the contractor from compliance with the requirements of the drawings and specifications. This check is for review of general conformance with the design concept of the project and general compliance with information given in the Contract Documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selection of fabrication processes and techniques of construction, coordinating the work of the trades, and performing the work in a safe and satisfactory manner.

BY: [illegible]

Date: 1/3/20/08

CHATTROOK / KWOK ARCHITECTS

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PANEL ATTACHMENT SUMMARY

Project: Senior Adult Education Center
Location: Brentwood, CA

Project Information:

Panel:	DS-17-24 HP
Building Code:	UBC 1997 / CBC 2001
Basic Wind Speed:	70 mph
Importance:	1.00
Maximum Height:	38 ft
Roof Slope:	5.0:12
Roof Snow Load:	15 psf
Substrate:	16 ga (.060")

Summary:

Clip Attachment:

Roof Areas #1-3	Zone :	Cont.	Discont.	Zone Width
	Clip Spacing :	**48 in.**	**48 in.**	**N/A**
	Max. Load @ Clips :	199 lbs		

Cupola	Zone :	Cont.	Discont.	Zone Width
	Clip Spacing :	**42 in.**	**42 in.**	**N/A**
	Max. Load @ Clips :	194 lbs		

Fasteners : **(2) #14-13 Concealor PH**

Panel Fixity:

Fix panels with minimum : **(3)** #14 screws.

Joggle Cleat Summary:

Distance to first clip is **8 in.** *max. away from eave.*

Design Data	
Building Code	UBC 1997 / CBC 2001
Roof Live Load	20 psf
Collateral Load	0 psf
Wind Speed	70 MPH
Ground Snow Load	0 psf
Building Use Group	Standard Occupancy

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SNOW LOAD CALCULATION

Ground Snow Load, p_g : **15.0 psf** Horizontal distance from ridge to eave, W : 29.0 ft

Roof Pitch : 5.0:12 22.62° Roof Shape : hip/gable

7.3 Flat Roof Snow Loads, p_f

Eq. 7-1, Flat Roof Snow Load, p_f : $0.7\ C_e\ C_t\ I\ p_g$

Terrain Category : C

Exposure of Roof : Fully Exposed

Table 7-2, Exposure Factor, Ce : 1.0

Table 7-3, Thermal Factor, Ct : 1.0

Table 7-4, Importance, I : 1.0 General Occupancy

Flat Roof Snow Load, p_f : 10.5 psf

7.4 Sloped-Roof Snow Loads, p_s

Eq. 7-2, Sloped Roof Snow Load, p_s : $C_s p_f$

Surface Roughness : Unobstructed Slippery

Roof slope factor, C_s : 0.68

p_s : **7.1 psf**

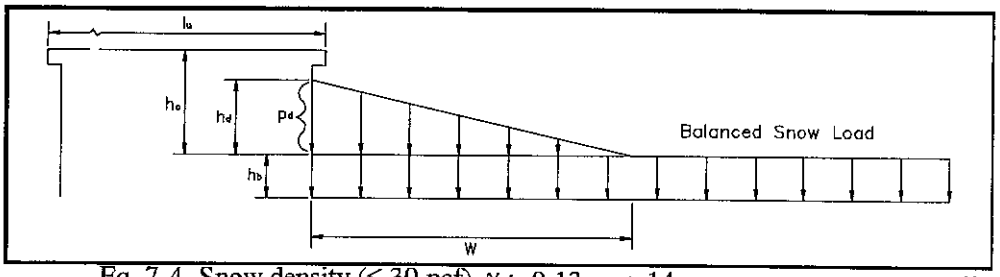
7.6 Unbalanced Roof Snow Loads

Unbalanced Snow Loads required? TRUE

Eq. 7-3, Unbalanced Snow load factor, β : 1

Unbalanced Snow Load = 1.2(1+b/2)ps/Ce : **12.8 psf**

7.7 Drifts on Lower Roofs



Eq. 7-4, Snow density (≤ 30 pcf), γ : $0.13\ p_g + 14$ γ : 16.0 pcf

Difference in height of adjacent roof : 9.00 ft

Balanced Snow Load depth, $h_b = p_f \div \gamma$: 0.66 ft fig 7-9

h_c : 8.34 ft

h_c/h_b : 12.67 ft > 0.2, Drift loads required

Max. Drift Snow Depth, h_d : $0.43 \times l_u^{1/3} (p_g+10)^{1/4} - 1.5$

Upper Roof Length, l_u : 50.00 ft h_d : 2.04 ft

Lower Roof Length, l_l : 29.00 ft 3/4 h_d : 1.09 ft

Max. Drift Snow Depth, h_d : 2.04 ft Upper Roof Length controls

Drift width, w : **8.17 ft**

Max. Drift Snow Load, $p_d = h_d\ \gamma$: **32.6 psf**

Superimposed Drift and Balanced : **39.7 psf**

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GUTTER & DOWNSPOUT ANALYSIS

State :	CA
County :	Contra Costa
Gutter Type :	Exterior
Rainfall Intensity, I :	3 in/hr
Downspout Cross-Sectional Area, A :	20.0 sq.in.
Gutter Depth, d :	7.0 in.
Gutter Width, w :	6.0 in.

The equation for downspout spacing is:

$$\frac{0.481 \times R^{5/14} \times I^{5/14} \times \left(\frac{L \times 2}{T}\right)^{13/28}}{43{,}200^{5/14} \times \left(\frac{w}{12}\right)^{3/7} \times \left(\frac{d}{12}\right)^{4/7}} \leq 1.0$$

For downspout area:

$$\frac{I \times R \times L}{1200 \times A} \leq 1$$

Main Roof

MARK	Drain Length (ft)	T End =1 Cntr=2	Roof Width R (ft)	Downspout Spacing Eq. ≤ 1	Downspout Area Eq. ≤ 1
Area 1	**87.0**	2	29.00	0.76	0.32

Actual Length of Entire Roof ∴ **O.K.**

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Booking Number : 302548A
Job Name : Senior Adult Education Center
Job Location : Brentwood, CA

Entered By : R. Armstrong
Date : 3/10/2008

Summary: For Design Span HP 1 3/4" tall, 17" wide, 24ga Panels

	Enclosed Structures	
	Cont.	Discont.
Allowable Spacing :	4.0 ft	3.9 ft
Controlling Case :	1592	1592
Max. Load @ Clip :	103 lbs	199 lbs
Zone Width :	5.8 ft	

Note:
Space all clips @ 48" o.c. max

Design Criteria:

Design :	**UBC 1997 /CBC 2001**	*Structural Notes*
Capacity Increase for Wind :	Increased 4/3	*Local/State Code*
Design Pressure :	$P = C_e C_q q_s I_w$	*Eq. 20-1*
Basic Wind Speed, V :	70 MPH	*Structural Notes*
Occupancy Category :	4. Standard Occupancy	*Table 16-K*
Importance, I_w :	1.00	*Structural Notes*
Exposure :	C, Open fields	*Structural Notes*
Wind Stagnation Pressure, q_s :	12.5 psf	*Table 16-F*

Roof Information: **Roof Area #1**

Building Type :	Enclosed	
Substrate :	16 ga (.060")	
Eave Height :	20.0 ft	
Ridge Height :	31.0 ft	
Width :	58.0 ft	
Pitch :	5.00:12 = 23°	
Mean Roof Height, h :	25.5 ft	
Exposure, Gust Factor, C_e :	1.18	*Table 16-G*
Zone Width :	5.8 ft	
Dead Load, D :	2.0 psf	
Live Load, L :	20.0 psf	*Table 16-C*
Ground Snow Load, S_g :	15.0 psf	*Fig. A-16*

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Design Loads:

Table 16-H pressure coefficients

Outward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	1.30	2.60
$P = C_e C_q q_s I_w$:	19 psf	39 psf

Inward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	0.00	0.00
$P = C_e C_q q_s I_w$:	0 psf	0 psf
P + D + (L or S) :	22 psf	22 psf

Panel Capacity:

Panel :	DS-17-24 HP	
Tested Span :	2.0 ft	4.0 ft
Allowable Uplift :	55 psf	37 psf

Outward	Enclosed Structures	
Zone :	Cont.	Discont.
Req'd Capacity :	19 psf	39 psf
Support Spacing :	4.0 ft	3.9 ft

Gravity From the 1996 AISI Cold Formed Steel Specification:

Panel Width :	1.4 ft		
Allowable Moment :	153.4 lb-ft	*C3.1.1-1*	
Allowable Shear :	1198 lbs	*C3.2-2,3*	
Spacing for Combined Bending & Shear :	7.0 ft	*C3.3.1-1*	*3-spans*
Allowable Internal Support Web-Crippling :	601 lbs	*C3.4-4*	
Spacing for Web-Crippling :	17.5 ft	*C3.4-4*	*3-spans*
Maximum spacing between supports for gravity :	**5.0 ft**		

Fastener Pullout Capacity:

Substrate :	16 ga (.060")		
Fastener :	#14-13 Concealor PH		
Ultimate Pullout :	900 lbs		*Triangle Fastener Fastening Design Center*
Number of Fasteners :	2	per clip	
Factor of Safety :	3.00		*metal safety factor*
Ra :	300 lbs	/screw	
Clip Pry Coefficient :	0.67		
Ra :	536 lbs	/clip (increased 4/3 for wind)	
Panel Width :	16 in.		
Ra :	402 lbs	/ft panel (based on above panel width)	

W = Wind pressure, L = Max. clip spacing for various pressure zones

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	Screw Pullout Clip Spacing	
	Enclosed Structures	
	Cont.	Discont.
L = Ra/(Wx1.1) :	5.0 ft	5.0 ft

UL Requirements:

UL Construction # : 365
UL Clip Spacing : **4.0 ft**
UL Fasteners : (2) 10-16x1" PH #2 Phillips

Thermal Expansion Design:

Assume temperature differential of 150 °F
ΔL = Change in panel length for a specific temperature differential.
η = Coefficient of linear expansion, in/in/Deg F
ΔT = Temperature differential @ worst case swing, Deg F.
L = Worst case length of panel (in)

η : 6.5E-6 in/in/Deg F (Steel)
ΔT : 150° F
L : 377 in. 31.4 ft
ΔL : ($\eta \times \Delta T \times L$)
ΔL : 0.37 in.

Provide 3/8" clearance for thermal movement.

Snow Drag Calculation:

Required

Snow Load, P_s : 15.0 psf
Roof Slope, α : 5.0:12 = 23°
Panel Width, w : 16 in.

Horizontal Length, L : 31.4 ft
Drag Load : Ps × Sine a × w/12 × L
Required Load / Panel : **242 lbs**

Panel Gauge : DS-17-24 HP
Blocking Substrate : 16 ga (.060")
Nominal Screw Diameter : 14

t_1 : 0.0232 Fu_1 : 52
t_2 : 0.06 Fu_2 : 52
d : 0.25 t_1/t_2 : 0.39

Allowable Wood Drag, Z : N/A

Pns_1 : 1605 $= 4.2\,(t_2^3\,d)^{1/2}\,Fu_2$ for $t_1/t_2 < 1$ use min of all 3
Pns_2 : 814 $= 2.7\,t_1\,d\,Fu_1$ for $t_1/t_2 > 2.5$ use min of Pns_2 and Pns_3
Pns_3 : 2106 $= 2.7\,t_2\,d\,Fu_2$ for $1 < t_1/t_2 < 2.5$ interpolate

Pns : 814
Pns/3 : 271

Allowable Drag / Screw : **271**
Screws Req'd / Panel : **3**

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Check Joggle Cleat Connection:

Maximum Uplift	P :	39 psf			
Distance to first clip	y :	8 in.			
Unit width (screw spacing)	x :	12 in.			

Check panel hem:

Panel gauge	t_p :	24 ga.			
Panel yield strength	f_y :	50 ksi			
Thermal Clearance	ΔL :	3/8 in.			
$R = (y/2) \times P$	R :	12.88 lbs			
$M = R \times \Delta L$	M :	4.83 lb-in			
$S_{min} = x \times t_p^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	4.23 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	4.23 ksi	**O.K.**

Check joggle cleat flexural strength:

Joggle cleat gauge	t_j :	24 ga.			
Cleat yield strength	f_y :	50 ksi			
$M = R \times 1.625$ in	M :	20.9 lb-in			
$S_{min} = x \times t_j^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	18.32 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	18.32 ksi	**O.K.**

Check pullout on fasteners:

	Fastener :	#14-13 Concealor PH			
	Substrate :	16 ga (.060")			
	Ultimate Pull-Out :	900			
	Factor of Safety :	3	(metal)		
Prying factor, distance: force to fulcrum ÷ screw to fulcrum :		3.79			
$T_{pullout} = R \times$ Prying factor	Tpullout :	49 lbs			
$T_{allow} = T_{ult} \div SF$	Tallow :	300 lbs	>	49 lbs	**O.K.**

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Booking Number : 302548A
Job Name : Senior Adult Education Center
Job Location : Brentwood, CA

Entered By : R. Armstrong
Date : 3/10/2008

Summary: For Design Span HP 1 3/4" tall, 17" wide, 24ga Panels

	Enclosed Structures	
	Cont.	Discont.
Allowable Spacing :	4.0 ft	4.0 ft
Controlling Case :	1592	1592
Max. Load @ Clip :	94 lbs	189 lbs
Zone Width :	5.8 ft	

Note:
Space all clips @ 48" o.c. max

Design Criteria:

Design :	**UBC 1997 /CBC 2001**	*Structural Notes*
Capacity Increase for Wind :	Increased 4/3	*Local/State Code*
Design Pressure :	$P = C_e C_q q_s I_w$	*Eq. 20-1*
Basic Wind Speed, V :	70 MPH	*Structural Notes*
Occupancy Category :	4. Standard Occupancy	*Table 16-K*
Importance, I_w :	1.00	*Structural Notes*
Exposure :	C, Open fields	*Structural Notes*
Wind Stagnation Pressure, q_s :	12.5 psf	*Table 16-F*

Roof Information: **Roof Area #2**

Building Type :	Enclosed	
Substrate :	16 ga (.060")	
Eave Height :	11.0 ft	
Ridge Height :	23.1 ft	
Width :	58.0 ft	
Pitch :	5.00:12 = 23°	
Mean Roof Height, h :	17.0 ft	
Exposure, Gust Factor, C_e :	1.08	*Table 16-G*
Zone Width :	5.8 ft	
Dead Load, D :	2.0 psf	
Live Load, L :	20.0 psf	*Table 16-C*
Ground Snow Load, S_g :	15.0 psf	*Fig. A-16*
Design Snow Load, S_d :	39.7 psf	

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Design Loads:

Table 16-H pressure coefficients

Outward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	1.30	2.60
$P = C_e\, C_q\, q_s\, I_w$:	18 psf	35 psf

Inward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	0.00	0.00
$P = C_e\, C_q\, q_s\, I_w$:	0 psf	0 psf
P + S :	42 psf	42 psf

Panel Capacity:

Panel :	DS-17-24 HP	
Tested Span :	2.0 ft	4.0 ft
Allowable Uplift :	55 psf	37 psf

Outward	Enclosed Structures	
Zone :	Cont.	Discont.
Req'd Capacity :	18 psf	35 psf
Support Spacing :	4.0 ft	4.0 ft

Gravity From the 1996 AISI Cold Formed Steel Specification:

Panel Width :	1.4 ft		
Allowable Moment :	153.4 lb-ft	*C3.1.1-1*	
Allowable Shear :	1198 lbs	*C3.2-2,3*	
Spacing for Combined Bending & Shear :	5.1 ft	*C3.3.1-1*	*3-spans*
Allowable Internal Support Web-Crippling :	601 lbs	*C3.4-4*	
Spacing for Web-Crippling :	9.2 ft	*C3.4-4*	*3-spans*
Maximum spacing between supports for gravity :	**5.0 ft**		

Fastener Pullout Capacity:

Substrate :	16 ga (.060")		
Fastener :	#14-13 Concealor PH		
Ultimate Pullout :	900 lbs		*Triangle Fastener Fastening Design Center*
Number of Fasteners :	2	per clip	
Factor of Safety :	3.00		*metal safety factor*
Ra :	300 lbs	/screw	
Clip Pry Coefficient :	0.67		
Ra :	536 lbs	/clip (increased 4/3 for wind)	
Panel Width :	16 in.		
Ra :	402 lbs	/ft panel (based on above panel width)	

W = Wind pressure, L = Max. clip spacing for various pressure zones

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	Screw Pullout Clip Spacing	
	Enclosed Structures	
	Cont.	Discont.
L = Ra/(Wx1.1) :	5.0 ft	5.0 ft

UL Requirements:

UL Construction # : 365
UL Clip Spacing : **4.0 ft**
UL Fasteners : (2) 10-16x1" PH #2 Phillips

Thermal Expansion Design:

Assume temperature differential of 150 °F
ΔL = Change in panel length for a specific temperature differential.
η = Coefficient of linear expansion, in/in/Deg F
ΔT = Temperature differential @ worst case swing, Deg F.
L = Worst case length of panel (in)

η : 6.5E-6 in/in/Deg F (Steel)
ΔT : 150° F
L : 377 in. 31.4 ft
ΔL : ($\eta \times \Delta T \times L$)
ΔL : 0.37 in.

Provide 3/8" clearance for thermal movement.

Snow Drag Calculation:

Required

Snow Load, P_s : 39.7 psf
Roof Slope, α : 5.0:12 = 23°
Panel Width, w : 16 in.

Horizontal Length, L : 31.4 ft
Drag Load : Ps × Sine a × w/12 × L
Required Load / Panel : **639 lbs**

Panel Gauge : DS-17-24 HP
Blocking Substrate : 16 ga (.060")
Nominal Screw Diameter : 14

t_1 : 0.0232 Fu_1 : 52
t_2 : 0.06 Fu_2 : 52
d : 0.25 t_1/t_2 : 0.39

Allowable Wood Drag, Z : N/A

Pns_1 : 1605 $= 4.2\,(t_2^3\,d)^{1/2}\,Fu_2$ for $t_1/t_2 < 1$ use min of all 3
Pns_2 : 814 $= 2.7\,t_1\,d\,Fu_1$ for $t_1/t_2 > 2.5$ use min of Pns_2 and Pns_3
Pns_3 : 2106 $= 2.7\,t_2\,d\,Fu_2$ for $1 < t_1/t_2 < 2.5$ interpolate

Pns : 814
Pns/3 : 271

Allowable Drag / Screw : **271**
Screws Req'd / Panel : **3**

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Check Joggle Cleat Connection:

Maximum Uplift	P :	35 psf			
Distance to first clip	y :	8 in.			
Unit width (screw spacing)	x :	12 in.			

Check panel hem:

Panel gauge	t_p :	24 ga.			
Panel yield strength	f_y :	50 ksi			
Thermal Clearance	ΔL :	3/8 in.			
$R = (y/2) \times P$	R :	11.79 lbs			
$M = R \times \Delta L$	M :	4.42 lb-in			
$S_{min} = x \times t_p^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	3.87 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	3.87 ksi	**O.K.**

Check joggle cleat flexural strength:

Joggle cleat gauge	t_j :	24 ga.			
Cleat yield strength	f_y :	50 ksi			
$M = R \times 1.625$ in	M :	19.2 lb-in			
$S_{min} = x \times t_j^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	16.77 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	16.77 ksi	**O.K.**

Check pullout on fasteners:

	Fastener :	#14-13 Concealor PH			
	Substrate :	16 ga (.060")			
	Ultimate Pull-Out :	900			
	Factor of Safety :	3	(metal)		
Prying factor, distance: force to fulcrum ÷ screw to fulcrum :		3.79			
$T_{pullout} = R \times$ Prying factor	Tpullout :	45 lbs			
$T_{allow} = T_{ult} \div SF$	Tallow :	300 lbs	>	45 lbs	**O.K.**

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Date : 3/10/2008

Summary: For Design Span HP 1 3/4" tall, 17" wide, 24ga Panels

	Enclosed Structures	
	Cont.	Discont.
Allowable Spacing :	4.0 ft	4.0 ft
Controlling Case :	1592	1592
Max. Load @ Clip :	93 lbs	186 lbs
Zone Width :	2.8 ft	

Note:
Space all clips @ 48" o.c. max

Design Criteria:

Design :	**UBC 1997 /CBC 2001**	*Structural Notes*
Capacity Increase for Wind :	Increased 4/3	*Local/State Code*
Design Pressure :	$P = C_e C_q q_s I_w$	*Eq. 20-1*
Basic Wind Speed, V :	70 MPH	*Structural Notes*
Occupancy Category :	4. Standard Occupancy	*Table 16-K*
Importance, I_w :	1.00	*Structural Notes*
Exposure :	C, Open fields	*Structural Notes*
Wind Stagnation Pressure, q_s :	12.5 psf	*Table 16-F*

Roof Information: **Roof Area #3**

Building Type :	Enclosed	
Substrate :	16 ga (.060")	
Eave Height :	13.0 ft	
Ridge Height :	18.8 ft	
Width :	28.0 ft	
Pitch :	5.00:12 = 23°	
Mean Roof Height, h :	15.9 ft	
Exposure, Gust Factor, C_e :	1.07	*Table 16-G*
Zone Width :	2.8 ft	
Dead Load, D :	2.0 psf	
Live Load, L :	20.0 psf	*Table 16-C*
Ground Snow Load, S_g :	15.0 psf	*Fig. A-16*
Design Snow Load, S_d :	39.7 psf	

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Design Loads:

Table 16-H pressure coefficients

Outward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	1.30	2.60
$P = C_e C_q q_s I_w$:	17 psf	35 psf

Inward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	0.00	0.00
$P = C_e C_q q_s I_w$:	0 psf	0 psf
P + S :	42 psf	42 psf

Panel Capacity:

Panel :	DS-17-24 HP	
Tested Span :	2.0 ft	4.0 ft
Allowable Uplift :	55 psf	37 psf

Outward	Enclosed Structures	
Zone :	Cont.	Discont.
Req'd Capacity :	17 psf	35 psf
Support Spacing :	4.0 ft	4.0 ft

Gravity From the 1996 AISI Cold Formed Steel Specification:

Panel Width :	1.4 ft		
Allowable Moment :	153.4 lb-ft	*C3.1.1-1*	
Allowable Shear :	1198 lbs	*C3.2-2,3*	
Spacing for Combined Bending & Shear :	5.1 ft	*C3.3.1-1*	*3-spans*
Allowable Internal Support Web-Crippling :	601 lbs	*C3.4-4*	
Spacing for Web-Crippling :	9.2 ft	*C3.4-4*	*3-spans*
Maximum spacing between supports for gravity :	**5.0 ft**		

Fastener Pullout Capacity:

Substrate :	16 ga (.060")		
Fastener :	#14-13 Concealor PH		
Ultimate Pullout :	900 lbs		*Triangle Fastener Fastening Design Center*
Number of Fasteners :	2	per clip	
Factor of Safety :	3.00		*metal safety factor*
Ra :	300 lbs	/screw	
Clip Pry Coefficient :	0.67		
Ra :	536 lbs	/clip (increased 4/3 for wind)	
Panel Width :	16 in.		
Ra :	402 lbs	/ft panel (based on above panel width)	

W = Wind pressure, L = Max. clip spacing for various pressure zones

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	Screw Pullout Clip Spacing	
	Enclosed Structures	
	Cont.	Discont.
L = Ra/(Wx1.1) :	5.0 ft	5.0 ft

UL Requirements: UL Construction # : 365
UL Clip Spacing : **4.0 ft**
UL Fasteners : (2) 10-16x1" PH #2 Phillips

Thermal Expansion Design:

Assume temperature differential of 150 °F
ΔL = Change in panel length for a specific temperature differential.
η = Coefficient of linear expansion, in/in/Deg F
ΔT = Temperature differential @ worst case swing, Deg F.
L = Worst case length of panel (in)

η : 6.5E-6 in/in/Deg F (Steel)
ΔT : 150° F
L : 182 in. 15.2 ft
ΔL : ($\eta \times \Delta T \times L$)
ΔL : 0.18 in.

Provide 3/8" clearance for thermal movement.

Snow Drag Calculation:

Required

Snow Load, P_s : 39.7 psf
Roof Slope, α : 5.0:12 = 23°
Panel Width, w : 16 in.

Horizontal Length, L : 15.2 ft
Drag Load : Ps × Sine a × w/12 × L
Required Load / Panel : **309 lbs**

Panel Gauge : DS-17-24 HP
Blocking Substrate : 16 ga (.060")
Nominal Screw Diameter : 14

t_1 : 0.0232 Fu_1 : 52
t_2 : 0.06 Fu_2 : 52
d : 0.25 t_1/t_2 : 0.39

Allowable Wood Drag, Z : N/A

Pns_1 : 1605 $= 4.2\,(t_2^3\,d)^{1/2}\,Fu_2$ for $t_1/t_2 < 1$ use min of all 3
Pns_2 : 814 $= 2.7\,t_1\,d\,Fu_1$ for $t_1/t_2 > 2.5$ use min of Pns_2 and Pns_3
Pns_3 : 2106 $= 2.7\,t_2\,d\,Fu_2$ for $1 < t_1/t_2 < 2.5$ interpolate

Pns : 814
Pns/3 : 271

Allowable Drag / Screw : **271**
Screws Req'd / Panel : **3**

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Check Joggle Cleat Connection:

Maximum Uplift	P :	35 psf			
Distance to first clip	y :	8 in.			
Unit width (screw spacing)	x :	12 in.			

Check panel hem:

Panel gauge	t_p :	24 ga.			
Panel yield strength	f_y :	50 ksi			
Thermal Clearance	ΔL :	3/8 in.			
$R = (y/2) \times P$	R :	11.61 lbs			
$M = R \times \Delta L$	M :	4.35 lb-in			
$S_{min} = x \times t_p^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	3.81 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	3.81 ksi	**O.K.**

Check joggle cleat flexural strength:

Joggle cleat gauge	t_j :	24 ga.			
Cleat yield strength	f_y :	50 ksi			
$M = R \times 1.625$ in	M :	18.9 lb-in			
$S_{min} = x \times t_j^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	16.52 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	16.52 ksi	**O.K.**

Check pullout on fasteners:

	Fastener :	#14-13 Concealor PH			
	Substrate :	16 ga (.060")			
	Ultimate Pull-Out :	900			
	Factor of Safety :	3	(metal)		
Prying factor, distance: force to fulcrum ÷ screw to fulcrum :		3.79			
$T_{pullout} = R \times$ Prying factor	Tpullout :	44 lbs			
$T_{allow} = T_{ult} \div SF$	Tallow :	300 lbs	>	44 lbs	**O.K.**

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Booking Number : 302548A
Job Name : Senior Adult Education Center
Job Location : Brentwood, CA

Entered By : R. Armstrong
Date : 3/10/2008

Summary: For Design Span HP 1 3/4" tall, 17" wide, 24ga Panels

	Unenclosed Structures	
	Cont.	Discont.
Allowable Spacing :	4.0 ft	3.5 ft
Controlling Case :	1592	1592
Max. Load @ Clip :	112 lbs	194 lbs
Zone Width :	0.9 ft	

Note:
Space all clips @ 42" o.c. max

Design Criteria:

Design :	**UBC 1997 /CBC 2001**	*Structural Notes*
Capacity Increase for Wind :	Increased 4/3	*Local/State Code*
Design Pressure :	$P = C_e C_q q_s I_w$	*Eq. 20-1*
Basic Wind Speed, V :	70 MPH	*Structural Notes*
Occupancy Category :	4. Standard Occupancy	*Table 16-K*
Importance, I_w :	1.00	*Structural Notes*
Exposure :	C, Open fields	*Structural Notes*
Wind Stagnation Pressure, q_s :	12.5 psf	*Table 16-F*

Roof Information: **Cupola**

Building Type :	Unenclosed	
Substrate :	22 ga (.030")	
Eave Height :	36.0 ft	
Ridge Height :	37.9 ft	
Width :	9.0 ft	
Pitch :	5.00:12 = 23°	
Mean Roof Height, h :	36.9 ft	
Exposure, Gust Factor, C_e :	1.29	*Table 16-G*
Zone Width :	0.9 ft	
Dead Load, D :	2.0 psf	
Live Load, L :	20.0 psf	*Table 16-C*
Ground Snow Load, S_g :	15.0 psf	*Fig. A-16*

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Design Loads:

Table 16-H pressure coefficients

Outward	Unenclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	1.30	2.60
$P = C_e C_q q_s I_w$:	21 psf	42 psf

Inward	Unenclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	0.00	0.00
$P = C_e C_q q_s I_w$:	0 psf	0 psf
P + D + (L or S) :	22 psf	22 psf

Panel Capacity:

Panel :	DS-17-24 HP	
Tested Span :	2.0 ft	4.0 ft
Allowable Uplift :	55 psf	37 psf

Outward	Unenclosed Structures	
Zone :	Cont.	Discont.
Req'd Capacity :	21 psf	42 psf
Support Spacing :	4.0 ft	3.5 ft

Gravity Gravity loads are supported by solid substrate.

Fastener Pullout Capacity:

Substrate :	22 ga (.030")		
Fastener :	#14-13 Concealor PH		
Ultimate Pullout :	564 lbs		*Triangle Fastener Fastening Design Center*
Number of Fasteners :	2	per clip	
Factor of Safety :	3.00		*metal safety factor*
Ra :	188 lbs	/screw	
Clip Pry Coefficient :	0.67		
Ra :	336 lbs	/clip (increased 4/3 for wind)	
Panel Width :	16 in.		
Ra :	252 lbs	/ft panel (based on above panel width)	

W = Wind pressure, L = Max. clip spacing for various pressure zones

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	Screw Pullout Clip Spacing	
	Unenclosed Structures	
	Cont.	Discont.
L = Ra/(Wx1.1) :	5.0 ft	5.0 ft

UL Requirements: UL Construction # : 366
UL Clip Spacing : **4.0 ft**
UL Fasteners : (2) 14-13, truss head, to penetrate deck 1"

Thermal Expansion Design:

Assume temperature differential of 150 °F
ΔL = Change in panel length for a specific temperature differential.
η = Coefficient of linear expansion, in/in/Deg F
ΔT = Temperature differential @ worst case swing, Deg F.
L = Worst case length of panel (in)

η : 6.5E-6 in/in/Deg F (Steel)
ΔT : 150° F
L : 58 in. 4.9 ft
ΔL : ($\eta \times \Delta T \times L$)
ΔL : 0.06 in.

Provide 3/8" clearance for thermal movement.

Snow Drag Calculation:

Required

Snow Load, P_s : 15.0 psf
Roof Slope, α : 5.0:12 = 23°
Panel Width, w : 16 in.

Horizontal Length, L : 4.9 ft
Drag Load : Ps × Sine a × w/12 × L
Required Load / Panel : **37 lbs**

Panel Gauge : DS-17-24 HP
Blocking Substrate : 22 ga (.030")
Nominal Screw Diameter : 14

t_1 : 0.0232 Fu_1 : 52
t_2 : 0.0299 Fu_2 : 52
d : 0.25 t_1/t_2 : 0.78

Allowable Wood Drag, Z : N/A

Pns_1 : 565 $= 4.2\,(t_2^3\,d)^{1/2}\,Fu_2$ for $t_1/t_2 < 1$ use min of all 3
Pns_2 : 814 $= 2.7\,t_1\,d\,Fu_1$ for $t_1/t_2 > 2.5$ use min of Pns_2 and Pns_3
Pns_3 : 1049 $= 2.7\,t_2\,d\,Fu_2$ for $1 < t_1/t_2 < 2.5$ interpolate

Pns : 565
Pns/3 : 188

Allowable Drag / Screw : **188**
Screws Req'd / Panel : **3**

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Check Joggle Cleat Connection:

Maximum Uplift	P :	42 psf			
Distance to first clip	y :	8 in.			
Unit width (screw spacing)	x :	12 in.			

Check panel hem:

Panel gauge	t_p :	24 ga.			
Panel yield strength	f_y :	50 ksi			
Thermal Clearance	ΔL :	3/8 in.			
$R = (y/2) \times P$	R :	13.98 lbs			
$M = R \times \Delta L$	M :	5.24 lb-in			
$S_{min} = x \times t_p^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	4.59 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	4.59 ksi	**O.K.**

Check joggle cleat flexural strength:

Joggle cleat gauge	t_j :	24 ga.			
Cleat yield strength	f_y :	50 ksi			
$M = R \times 1.625$ in	M :	22.7 lb-in			
$S_{min} = x \times t_j^2 \div 6$	S_{min} :	0.00114 in³			
$f_b = M \div S_{min}$	f_b :	19.88 ksi			
$F_b = 0.6 \times f_y$	F_b :	30.00 ksi	>	19.88 ksi	**O.K.**

Check pullout on fasteners:

	Fastener :	#14-13 Concealor PH			
	Substrate :	22 ga (.030")			
	Ultimate Pull-Out :	564			
	Factor of Safety :	3	(metal)		
Prying factor, distance: force to fulcrum ÷ screw to fulcrum :		3.79			
$T_{pullout} = R \times$ Prying factor	Tpullout :	53 lbs			
$T_{allow} = T_{ult} \div SF$	Tallow :	188 lbs	>	53 lbs	**O.K.**

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Booking Number : 302548A
Job Name : Senior Adult Education Center
Job Location : Brentwood, CA

Entered By : R. Armstrong
Date : 3/10/2008

Summary: For Prestige 1 1/2" tall, 12" wide, 24ga Panels

	Enclosed Structures	
	Cont.	Discont.
Allowable Spacing :	7.0 ft	7.0 ft
Controlling Case :	1592	Pullout
Max. Load @ Fasteners :	174 lbs	216 lbs
Zone Width :	3.0 ft	

Note:
Space hat channels @ 30" o.c. max;
Panel legs must be stitch fastened together.

Design Criteria:

Design :	**UBC 1997 /CBC 2001**	*Structural Notes*
Capacity Increase for Wind :	Increased 4/3	*Local/State Code*
Design Pressure :	$P = C_e C_q q_s I_w$	*Eq. 20-1*
Basic Wind Speed, V :	70 MPH	*Structural Notes*
Occupancy Category :	4. Standard Occupancy	*Table 16-K*
Importance, I_w :	1.00	*Structural Notes*
Exposure :	C, Open fields	*Structural Notes*
Wind Stagnation Pressure, q_s :	12.5 psf	*Table 16-F*

Roof Information:

	Soffit		
Building Type :	Enclosed		
Substrate :	22 ga (.030")		
Min. Height :	31.0 ft		
Max. Height :	31.0 ft		
Width :	9.0 ft		
Pitch :	13.00:12 =	47°	
Mean Roof Height, h :	31.0 ft		
Exposure, Gust Factor, C_e :	1.24		*Table 16-G*
Zone Width :	3.0 ft		
Dead Load, D :	0.0 psf		
Live Load, L :	0.0 psf		*Table 16-C*
Ground Snow Load, S_g :	0.0 psf		*Fig. A-16*

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Design Loads:

Table 16-H pressure coefficients

Outward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	1.20	1.50
$P = C_e\, C_q\, q_s\, I_w$:	19 psf	23 psf

Inward	Enclosed Structures	
	Cont.	Discont.
Pressure Coefficient, C_q :	1.20	1.20
$P = C_e\, C_q\, q_s\, I_w$:	19 psf	19 psf
P + D + (L or S) :	19 psf	19 psf

Panel Capacity:

Panel :	Prestige	
Span :	6.0 ft	7.0 ft
Allowable Uplift :	31 psf	23 psf

Outward	Enclosed Structures	
Zone :	Cont.	Discont.
Req'd Capacity :	19 psf	23 psf
Support Spacing :	7.0 ft	7.0 ft

Gravity Gravity loads are supported by solid substrate.

Fastener Pullout Capacity:

Substrate :	22 ga (.030")		
Fastener :	#10-16x1" Tek-3 PH		
Ultimate Pullout :	267 lbs		*Triangle Fastener Fastening Design Center*
Number of Fasteners :	2	per panel	
Factor of Safety :	3.00		*metal safety factor*
Ra :	89 lbs	per screw	
Pry Coefficient :	1		
Ra :	237 lbs	per screw (increased 4/3 for wind)	
Panel Width :	16 in.		
Ra :	178 lbs	per ft panel (based on above panel width)	

W = Wind pressure, L = Max. spacing for various pressure zones

	Screw Pullout Spacing	
	Enclosed Structures	
	Cont.	Discont.
L = Ra/(Wx1.1) :	8.7 ft	7.0 ft

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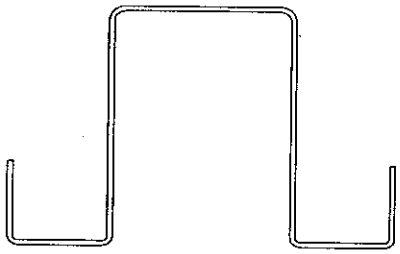
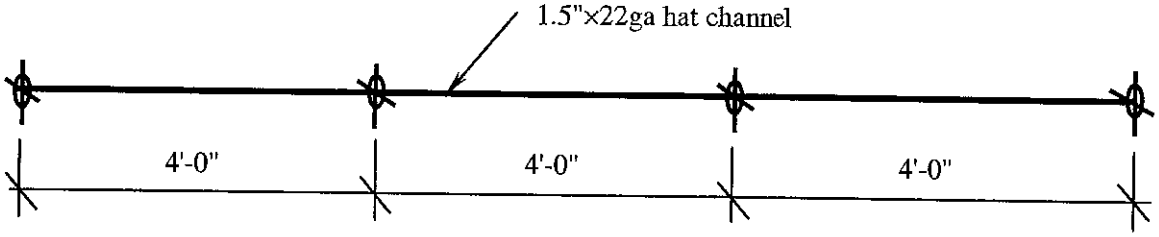
22ga Hat Design @ Soffit

CFS Part	1.5" hat channel
Thickness	0.0299 in
Radius	0.09375 in
Closed	No
Xcg	0 in
Ycg	0 in



Section Inputs			
Length (in)	Angle (deg)	Radius(in)	Web
0.525	-90	0.0375	None
0.608	0	0.0375	Single
1.495	90	0.0375	Single
1.085	0	0.0375	Single
1.495	-90	0.0375	Single
0.606	0	0.0375	Single
0.512	90	0.0375	None



Loading:	Type	Angle	Start Location	End Location	Start Magnitude	End Magnitude
Wind $_{pressure}$	Distributed	90°	0.0 ft	12.0 ft	-0.0475 k/ft	-0.0475 k/ft
Wind $_{suction}$	Distributed	90°	0.0 ft	3.0 ft	0.0575 k/ft	0.0575 k/ft
Wind $_{suction}$	Distributed	90°	3.0 ft	12.0 ft	0.0475 k/ft	0.0475 k/ft

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Member Check - 1999 AISI Specification (ASD)

Load Combination: **Pressure**

Design Parameters at 4.0000 ft, Right side:

Lx	4.0000 ft	Ly	4.0000 ft	Lt	4.0000 ft
Kx	1.000	Ky	1.000	Kt	1.000

Section: 22ga Hat @ Soffit.sct

Cbx	1.000	Cby	1.000	ex	0.0000 in
Cmx	1.000	Cmy	1.000	ey	0.0000 in

Braced Flange: None Moment Reduction, R: 0.0000

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.000	-0.912	0.095	0.000	0.0000
Applied	0.000	-0.912	0.095	0.000	0.0000
Strength	0.932	0.942	1.074	1.395	0.7478

Effective section properties at applied loads:

Ae	0.17974 in^2	Ixe	0.055160 in^4	Iye	0.085598 in^4
		Sxe(t)	0.066092 in^3	Sye(l)	0.076585 in^3
		Sxe(b)	0.083523 in^3	Sye(r)	0.076323 in^3

Interaction Equations

AISI Eq. C5.2.1-1 (P, Mx, My)	0.000 + 0.968 + 0.000 = 0.968 ≤1.0
AISI Eq. C5.2.1-2 (P, Mx, My)	0.000 + 0.968 + 0.000 = 0.968 ≤1.0
AISI Eq. C3.3.1-1 (Mx, Vy)	0.493 + 0.008 = 0.501 ≤1.0
AISI Eq. C3.3.1-1 (My, Vx)	0.000 + 0.000 = 0.000 ≤1.0

Maximum Shears, Moments, and Deflections Load Combination: Wind Pressure

Location (ft)	Shear (l) (k)	Shear (r) (k)	Reaction (k)
0.000	0.00000	0.07600	0.07600
4.000	-0.11400	0.09500	**0.20900**
8.000	-0.09500	0.11400	0.20900
12.000	-0.07600	0.00000	0.07600

Maximum reaction, deflection, and moment for the pressure loading are highlighted and bold.

Location (ft)	Moment (k-in)	Location (ft)	Deflection (in)	Inflections (ft)
1.600	0.72960	1.784	**-0.088897**	3.200
4.000	**-0.91200**	4.451	0.005380	5.106
6.000	0.22800	6.000	-0.006726	6.894
8.000	-0.91200	7.549	0.005380	8.800
10.400	0.72960	10.216	-0.088897	

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Member Check - 1999 AISI Specification (ASD)

Load Combination: **Suction**

Design Parameters at 4.0000 ft, Right side:

Lx	4.0000 ft	Ly	4.0000 ft	Lt	4.0000 ft
Kx	1.000	Ky	1.000	Kt	1.000

Section: 22ga Hat @ Soffit.sct

Cbx	1.054	Cby	1.000	ex	0.0000 in
Cmx	1.000	Cmy	1.000	ey	0.0000 in

Braced Flange: None Moment Reduction, R: 0.0000

Loads:	P (k)	Mx (k-in)	Vy (k)	My (k-in)	Vx (k)
Total	0.000	1.016	-0.098	0.000	0.0000
Applied	0.000	1.016	-0.098	0.000	0.0000
Strength	0.932	1.306	1.074	1.395	0.7478

Effective section properties at applied loads:

Ae	0.17974 in^2	Ixe	0.055160 in^4	Iye	0.085598 in^4
		Sxe(t)	0.066092 in^3	Sye(l)	0.076585 in^3
		Sxe(b)	0.083523 in^3	Sye(r)	0.076323 in^3

Interaction Equations

AISI Eq. C5.2.1-1 (P, Mx, My)	0.000 + 0.778 + 0.000 = 0.778 ≤1.0
AISI Eq. C5.2.1-2 (P, Mx, My)	0.000 + 0.778 + 0.000 = 0.778 ≤1.0
AISI Eq. C3.3.1-1 (Mx, Vy)	0.605 + 0.008 = 0.613 ≤1.0
AISI Eq. C3.3.1-1 (My, Vx)	0.000 + 0.000 = 0.000 ≤1.0

Maximum Shears, Moments, and Deflections Load Combination: Wind Suction

Location (ft)	Shear (l) (k)	Shear (r) (k)	Reaction (k)
0.000	0.00000	-0.09259	-0.09259
4.000	0.12741	-0.09770	**-0.22510**
8.000	0.09230	-0.11346	-0.20577
12.000	0.07654	0.00000	-0.07654

Maximum reaction, deflection, and moment for the suction loading are highlighted and bold.

Location (ft)	Moment (k-in)	Location (ft)	Deflection (in)	Inflections (ft)
1.610	-0.8946	1.794	**0.10855**	3.223
4.000	**1.0155**	4.615	-0.00657	5.240
6.057	-0.1901	6.114	0.00821	6.873
8.000	0.8861	7.442	-0.00657	8.777
10.389	-0.7400	10.206	0.10855	