Metal Roof and Wall Systems

ENGINEERING REPORT

Accomack Co. Emergency Operation. Ctr.

Melfa, VA.

(Accomack)

Engineering Calculations

MANUFACTURER'S DISCLAIMER

It is the roofing contractor's responsibility to ensure that the Component System is installed per the manufacturer's standard details and erection practices listed in the MBCI Technical Installation Manual, latest edition. Any special flashing requirements falling outside the parameters of MBCI's standard details must be pre-approved by MBCI's Engineering Department. If required, the use of any field-seaming machine, other than that provided by MBCI, may damage panels, void all warranties and will void engineering data. All engineering test data becomes null and void if the component system does not meet the aforementioned criteria and/or the specific instructions defined in this engineering analysis. MBCI takes no responsibility for the adequacy of any structural framing/substrate not provided by MBCI on this project.

Metal Roof and Wall Systems

ENGINEERING DESIGN SUMMARY

Job Number:	12-1676-18	Exposure Category	C
Job Name:	Accomack Co. Emergency Operation. Ctr.	Ground Snow:	15-psf
Location:	Melfa, Virginia	Wind Velocity:	150-mph
Building Code:	IBC 2012	Deflection:	L/180
Occupancy	Category IV		

GUTTER & DOWNSPOUT DESIGN

Gutter and downspouts are standard MBCI trim. Locate downspouts per plans.

NOTES:

1. Substrate thickness is 16 ga. Hats.
2. Given dimensions are worst case.
3. **Wind speed per code / per Truss Drawings**. Rainfall intensity per MBMA climate data.
4. Exposure C.
5. Enclosed building.
6. Risk category IV – essential.
7. All panel endlaps must occur over a structural support.
8. **Truss Company to verify 3'-0" Hat spacing is okay on the Roof.**

EXCLUSIONS:

1. FM design and certification.
2. Valley design.
3. Wall panel design. Fascia panel design. Soffit panel design.
4. **Framing design, except roof Hats.**
5. **Attachment of roof hats to roof Truss**
6. Design of Materials not supplied by MBCI
7. Any project specifications (none provided)

A (6:12)

Roof Type:	Gable		
Building Length:	44-ft	Live Load:	20-psf
Building Width:	30-ft	Dead Load:	0.94-psf
Roof Slope:	6:12	Collateral Load:	0
Zone Width (a)	3 - ft	UL Construction:	167

ROOF SPACING DESIGN

Panel Profile: PBR	Width: 36	Gage: 26	Clip: N/A
	Use (3) #12-14 HWH WW Fastening To Min. 16 ga. Hats		
Panel Attachment Spacing:	Corners (3)	3.00-ft	
	Edge (2)	3.00-ft	
	Main (1)	3.00-ft	

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Metal Roof and Wall Systems

B (4:12)

Roof Type:	Gable		
Building Length:	24-ft	Live Load:	20-psf
Building Width:	18-ft	Dead Load:	0.94-psf
Roof Slope:	4:12	Collateral Load:	0
Zone Width (a)	3 - ft	UL Construction:	167

ROOF SPACING DESIGN

Panel Profile: PBR — Width: 36 — Gage: 26 — Clip: N/A

Use (3) #12-14 HWH WW Fastening To Min. 16 ga. Hats

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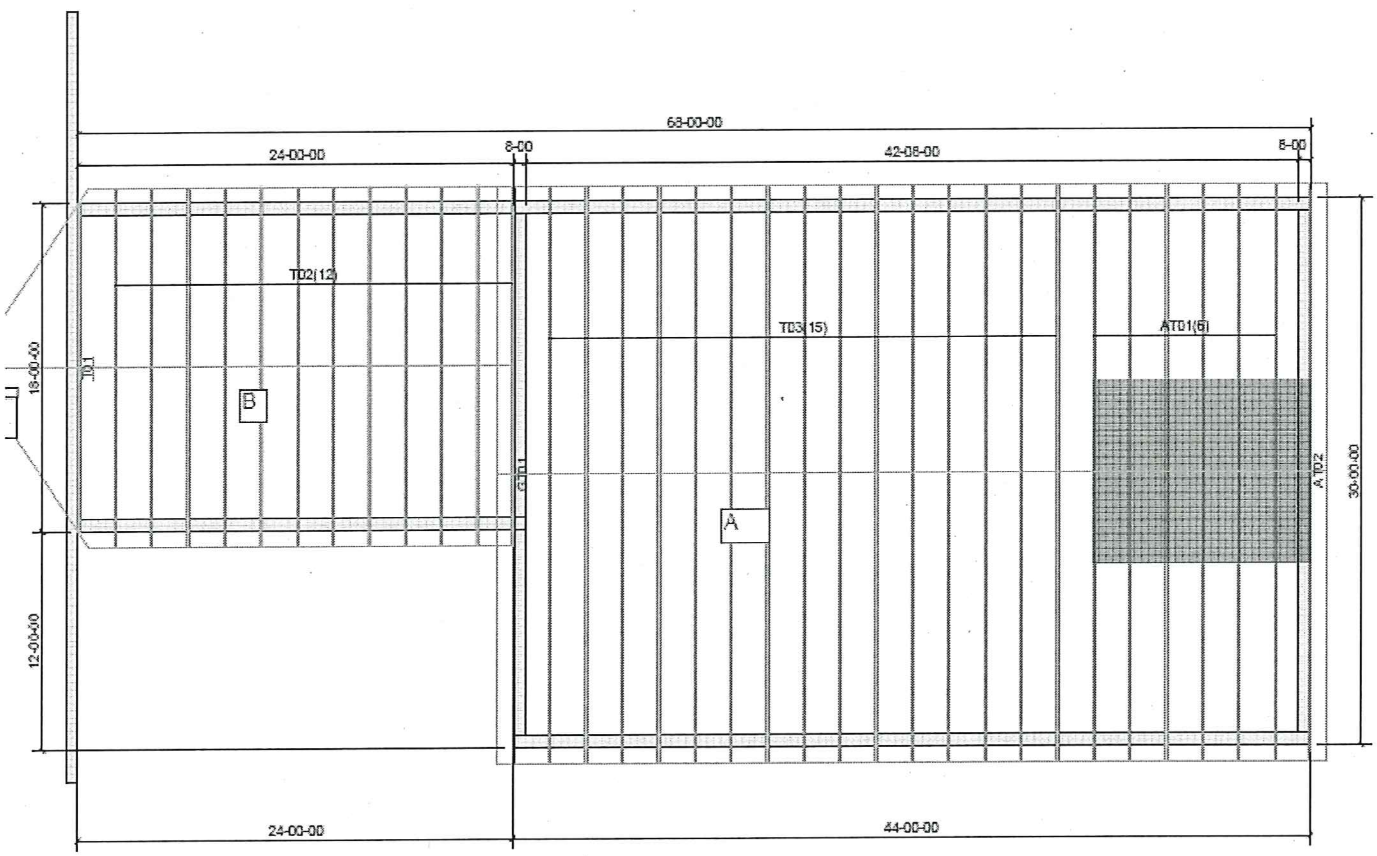

Metal Roof and Wall Systems

ENGINEERING REPORT

Project Number:	12-1676-18	**Page:**	3
Project Name:	Accomack Co. Emergency Operation. Ctr.	**Engineered By:**	AZ, P.E.
City:	Melfa	**For:**	Preliminary Calculations
State:	Virginia	**Date:**	10/11/2018
Building:	A (6:12)		

A (6:12)

CODE DATA

Building Code: IBC 2012

Exposure Category: C

Open terrain with scattered obstructions having heights generally less than 30-ft This category includes flat open country, grasslands and shorelines in hurricane prone regions.

Risk Category: Category IV

Buildings and other structures designed as essential facilities including, but not limited to:

- Hospitals and other health care facilities having surgery or emergency treatment facilities
- Fire, rescue and police stations and emergency vehicle garages
- Designated earthquake, hurricane, or other emergency shelters
- Communications centers and other facilities required for emergency response
- Power generating stations and other public utility facilities required in an emergency
- Ancillary structures (including, but not limited to communication towers, fuel storage tanks, cooling towers, electrical substation structures, fire water storage tanks or other structures housing or supporting water or other fire-suppression material or equipment) required for operation of Category IV structures during an emergency.
- Aviation control towers, air traffic control centers and emergency aircraft hangars
- Water storage facilities and pump structures required to maintain water pressure for fire suppression
- Buildings and other structures having critical national defense functions

Enclosure: Enclosed

Load Combinations: D = dead load, Lr = roof live load, S = snow load, W = wind load.

1) 0.6 D + 0.6 W
2) D + L_r
3) D + S
4) D + 0.75 (0.6W + L_r)
5) D + 0.75 (0.6W + S)

BUILDING DATA

Building Length:	44-ft	**Building Width:**	30-ft
Mean Height:	13.75-ft	**Roof Slope:**	**6:12**
Edge Zone, a:	3 - ft	**Tributary Area:**	10-sqft
Roof Type:	Gable	**Max. Panel:**	16.77-ft

DESIGN CRITERIA

Dead Load:	0.94-psf	**Collateral Load:**	0-psf
Live Load:	20-psf	**Wind Velocity (V):**	150-mph
Ground Snow Load:	15-psf		

Metal Roof and Wall Systems

ENGINEERING REPORT

Project Number:	12-1676-18	**Page:**	4
Project Name:	Accomack Co. Emergency Operation. Ctr.	**Engineered By:**	AZ, P.E.
City:	Melfa	**For:**	Preliminary Calculations
State:	Virginia	**Date:**	10/11/2018
Building:	A (6:12)		

CODE CRITERIA

qz = 41.6-psf

		Negative	Positive
Roof Panel Coefficients:	Corners (3)	-2.78	.68
(GCp-GCpi)	Edge (2)	-1.88	.68
	Main (1)	-1.08	.68
Roof Panel Design Loads:	Corners (3)	-69.32	16.96
P = qh(GCp-GCpi)	Edge (2)	-46.88	16.96
	Main (1)	-26.93	16.96

CONTRACT DOCUMENT QUALIFICATIONS

Building Code:	IBC 2012	**Risk Category:**	Category IV
Exposure:	C		
Live Load:	20-psf	**Wind Load:**	150-mph
Collateral Load:	0-psf	**Ground Snow:**	15-psf
Deflection:	L/180	**UL Construction:**	167

Note: These calculations are preliminary. Calculations are not final unless affixed with an engineering seal and bears the signature of the said engineer. Additional costs may be associated with signing and sealing of calculations.

ROOF SPACING DESIGN

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Panel Attachment Spacing:	Corners (3)	3.00-ft	
	Edge (2)	3.00-ft	
	Main (1)	3.00-ft	

ROOF CONNECTION DESIGN

Maximum Attachment Load = P × Attachment Space × Panel Width × pry factor = 69.32-psf × 3-ft × 3-ft × 1 = 624-lbs

Try (3) #12-14 HWH WW Fastening To Min. 16 ga. Hats

Ultimate Pullout Per Fastener 716-lbs

Allowable Factor Of Safety 3

Factor Of Safety = 3 * 716 / 624 = 3.44 Therefore O.K.

Ultimate Pullover Per Fastener 794-lbs

Allowable Factor Of Safety 3

Factor Of Safety = 3 * 794 / 624 = 3.82 Therefore O.K.

ROOF CONNECTION SOLUTION

Use (3) #12-14 HWH WW Fastening To Min. 16 ga. Hats

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ENGINEERING REPORT

Project Number: 12-1676-18
Project Name: Accomack Co. Emergency Operation. Ctr.
City: Melfa
State: Virginia
Building: B (4:12)

Engineered By: AZ, P.E.
For: Preliminary Calculations
Date: 10/11/2018

B (4:12)

CODE DATA

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BUILDING DATA

Building Length:	24-ft	**Building Width:**	18-ft
Mean Height:	11.5-ft	**Roof Slope:**	**4:12**
Edge Zone, a:	3 - ft	**Tributary Area:**	10-sqft
Roof Type:	Gable	**Max. Panel:**	9.49-ft

DESIGN CRITERIA

Dead Load:	0.94-psf	**Collateral Load:**	0-psf
Live Load:	20-psf	**Wind Velocity (V):**	150-mph
Ground Snow Load:	15-psf		

Metal Roof and Wall Systems

ENGINEERING REPORT

Project Number:	12-1676-18	**Page:**	6
Project Name:	Accomack Co. Emergency Operation. Ctr.	**Engineered By:**	AZ, P.E.
City:	Melfa	**For:**	Preliminary Calculations
State:	Virginia	**Date:**	10/11/2018
Building:	B (4:12)		

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ENGINEERING REPORT

Project Number: 12-1676-18
Project Name: Accomack Co. Emergency Operation. Ctr.
City: Melfa
State: Virginia
Building: B (4:12)

Engineered By: AZ, P.E.
For: Preliminary Calculations
Date: 10/11/2018

Downspout Spacing Requirements

Gutter Depth (ft.) =	0.4580	Rainfall Intensity (in/hr) =	6.00
Gutter Width (ft.) =	0.4375	Drainage Width (ft.) =	15.00
Downspout Area (sq.	14.00		
DS (Gutter) =	99.61	DS (Downspout) =	186.67

Maximum Downspout Spacing Allowed (ft.) = 50.00

Based on 5.5" X 5.25" Standard Gutter W / 4" x 3.5" standard Downspouts.

CFS Version 8.0.5
Analysis: 12-1676-18 Roof Hats.anl
HS1-16 ga. @ 3'-0"

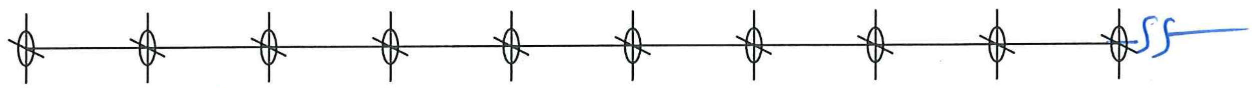
Ahad Zangbari
NCI Group Inc.

Rev. Date: 10/11/2018 11:55:16 AM
By: Ahad Zangbari
Printed: 10/11/2018 11:56:27 AM

Roof Hats

HS1-16 ga. @ 3'-0" (Typ.)

Attachment to Trusses not by MBCI.



Spans

2'-0" (Typ.)

Analysis Inputs

Members

	Section File	Revision Date and Time
1	HS1-16ga..sct	8/2/2010 11:45:55 AM

	Start Loc. (ft)	End Loc. (ft)	Braced Flange	R	kϕ (lb)	Lm (ft)
1	0.000	18.000	None	0.0000	0.0000	20.000

	ex (in)	ey (in)
1	0.0000	0.0000

Supports

	Type	Location (ft)	Bearing (in)	Fastened	K
1	XYT	0.000	2.000	No	1.0000
2	XYT	2.000	2.000	No	1.0000
3	XYT	4.000	2.000	No	1.0000
4	XYT	6.000	2.000	No	1.0000
5	XYT	8.000	2.000	No	1.0000
6	XYT	10.000	2.000	No	1.0000
7	XYT	12.000	2.000	No	1.0000
8	XYT	14.000	2.000	No	1.0000
9	XYT	16.000	2.000	No	1.0000
10	XYT	18.000	2.000	No	1.0000

Loading: Dead Load

	Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1	Distributed	116.600	0.000	18.000	-2.82	-2.82	lb/ft

Loading: Roof Live Load

	Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1	Distributed	116.600	0.000	18.000	-60.00	-60.00	lb/ft

Loading: Wind Load

	Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1	Distributed	90.000	0.000	3.000	347.00	347.00	lb/ft
2	Distributed	90.000	3.000	18.000	219.60	219.60	lb/ft

Rev. Date: 10/11/2018 11:55:16 AM
By: Ahad Zangbari
Printed: 10/11/2018 11:56:27 AM

Loading: Wp

Type	Angle (deg)	Start Loc. (ft)	End Loc. (ft)	Start Magnitude	End Magnitude	
1 Distributed	90.000	0.000	18.000	-85.00	-85.00	lb/ft

Load Combination: D+Lr
Specification: 2012 North American Specification - US (ASD)
Inflection Point Bracing: Yes

Loading	Factor
1 Beam Self Weight	1.0000
2 Dead Load	1.0000
3 Roof Live Load	1.0000

Load Combination: D+0.75(.6Wp+Lr)
Specification: 2012 North American Specification - US (ASD)
Inflection Point Bracing: Yes

Loading	Factor
1 Beam Self Weight	1.0000
2 Dead Load	1.0000
3 Wp	0.4500
4 Roof Live Load	0.7500

Load Combination: 0.6D+0.6W
Specification: 2012 North American Specification - US (ASD)
Inflection Point Bracing: Yes

Loading	Factor
1 Beam Self Weight	0.6000
2 Dead Load	0.6000
3 Wind Load	0.6000

Member Check - 2012 North American Specification - US (ASD)

Load Combination: 0.6D+0.6W
Design Parameters at 2.00000 ft, Left side:

Lx	0.42264 ft	Ly	0.40951 ft	Lt	0.40951 ft
Kx	1.0000	Ky	1.0000	Kt	1.0000

Section: HS1-16ga..sct
Material Type: A1011 HSLAS Grade 55/1, Fy=55 ksi

Cbx	1.6667	Cby	1.7728	ex	0.0000 in
Cmx	1.0000	Cmy	1.0000	ey	0.0000 in
Braced Flange: None		kϕ	0 lb		
Red. Factor, R: 0		Lm	20.00000 ft		

Loads:	P (lb)	Mx (lb-ft)	Vy (lb)	My (lb-ft)	Vx (lb)
Total	0	84.32	248	0.32	1
Applied	0	84.32	248	0.32	1
Strength	11112	449.43	3213	587.68	1834

Effective section properties at applied loads:

Ae	0.37524 in^2	Ixe	0.12461 in^4	Iye	0.30856 in^4
		Sxe(t)	0.16375 in^3	Sye(l)	0.21413 in^3
		Sxe(b)	0.16862 in^3	Sye(r)	0.21413 in^3

Interaction Equations

NAS Eq. C5.2.1-1	(P, Mx, My)	0.000 + 0.188 + 0.001 = 0.188 <= 1.0
NAS Eq. C5.2.1-2	(P, Mx, My)	0.000 + 0.188 + 0.001 = 0.188 <= 1.0
NAS Eq. C3.3.1-1	(Mx, Vy)	Sqrt(0.035 + 0.006)= 0.203 <= 1.0

```
NAS Eq. C3.3.1-1      (My, Vx)      Sqrt(0.000 + 0.000)= 0.001 <= 1.0
```

CFS Version 8.0.5
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HS1-16 ga. @ 3'-0"

Ahad Zangbari
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Rev. Date: 10/11/2018 11:55:16 AM
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Printed: 10/11/2018 11:56:37 AM

Envelope of all combinations, Y Direction