Metal Roofing – Practical Design

JRS ENGINEERING
BUILDING ENVELOPE CONSULTANTS

Metal Roofing – Practical Design

- ✓ Learning Outcomes
  - Minimum Requirements
  - Design Resources
  - Low Slope Metal Roofing
  - Design Details
  - Continuously Insulated (Ci) Systems

Minimum Requirements

- ✓ Requires components to shed water and prevent water due to ice damming from entering the building
- ✓ Code requires minimum fastener type
  - Corrosion resistant, ½" into sheathing
- ✓ Slope
  - 3 in12, unless specifically designed by manufacturer for low slope applications
- ✓ Flashings at various intersections

Minimum Requirements

Metal Roofing in the Building Codes

- ✓ 9.23.16.1.(1) Required Roof Sheathing
  - <Except where the 1-in-50 hourly wind pressure is less than 0.8kPa and the seismic spectral response acceleration S_a (0.2), is less than or equal to 0.70,> continuous lumber or panel-type roof sheathing shall be installed to support the roofing.
    - All locations in BC fall below the wind pressure requirement.
    - What About Seismic

Minimum Requirements

Metal Roofing in the Building Codes

✓ Most areas along the south coastline fall within the seismic area requiring full sheathing, including Squamish and out to Chilliwack.

Minimum Requirements

Metal Roofing in the Building Codes

✓ 9.26.13 – Sheet Metal Roofing

- Thickness
  - Sheet metal roofing shall be not less than:
    - 0.33 mm thick galvanized steel, (roughly 29 gauge)
    - 0.46 mm thick copper,
    - 0.46 mm thick zinc, or
    - 0.48 mm thick aluminum.
- Support
  - <Except as provided in Sentence 9.23.16.1.(1),> where sheet metal roofing is not supported by roof decking but spans between spaced supports, the panels shall be designed to support the specified *live loads* for the roof.

Minimum Requirements

- ✓ What else is in the building code?
  - Only other assistance in the building code is a reference to the SMACNA Architectural Sheet Metal Manual with respect to flashing design.
- ✓ So in essence as long as you put a 29 Gauge thick sheet metal onto a fully supported roof it meets code, right?

Minimum Requirements

Metal Roofing in the Building Codes

✓ What about the "designed for specified *Live Load*" comment in part 9?

- This is specifically in the event of the roof not having sheathing and the metal needing to act as the sheathing.

✓ However, in the structural portion of the code the roof will still need to be designed to meet the specified live loads that each component will be anticipated to need to accommodate.

- This is to design the type, size, and frequency of clips and drag load fasteners.

Minimum Requirements

Metal Roofing in the Building Codes

✓ Clip spacing is determined based on the wind uplift requirements of the metal roof.

*RCABC manual require 2' o/c for clips

This is a standard guide and not for design purposes.

✓ Similar to flat roofs there are various zones that require potential fastener pattern increases

✓ With pitched roofs there are six (6) zones with the difference being overhangs.

Minimum Requirements

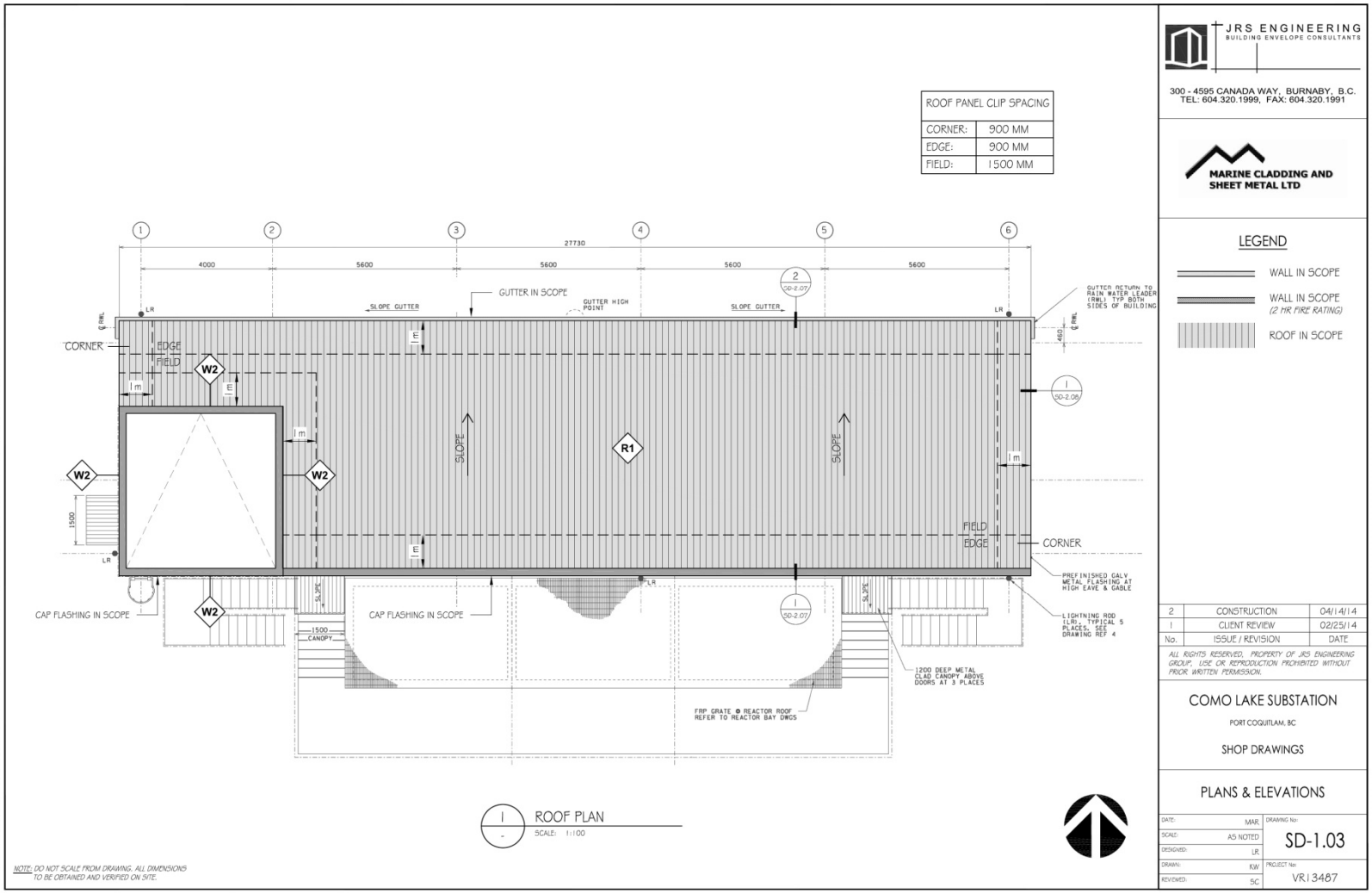
Metal Roofing in the Building Codes

✓ Drag load fastener requirements are based on the snow load for the project.

✓ Longer panels typically require increased fastener frequency.

*RCABC manual require 2 drag load screws per panel

This is a standard guide and not for design purposes.


ROOF PANEL CLIP SPACING
CORNER: 900 MM
EDGE: 900 MM
FIELD: 1500 MM
27730
4000
5600
5600
5600
5600
GUTTER IN SCOPE
SLOPE GUTTER
GUTTER HIGH POINT
GUTTER RETURN TO RAIN WATER LEADER (RWL) TYP BOTH SIDES OF BUILDING
CORNER
EDGE
FIELD
W2
R1
SLOPE
CAP FLASHING IN SCOPE
1500 CANOPY
PREFINISHED GALV METAL FLASHING AT HIGH EAVE & GABLE
LIGHTNING ROD (LR), TYPICAL 5 PLACES, SEE DRAWING REF 4
1200 DEEP METAL CLAD CANOPY ABOVE DOORS AT 3 PLACES
FRP GRATE @ REACTOR ROOF REFER TO REACTOR BAY DWGS
ROOF PLAN
SCALE: 1:100
NOTE: DO NOT SCALE FROM DRAWING. ALL DIMENSIONS TO BE OBTAINED AND VERIFIED ON SITE.
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BUILDING ENVELOPE CONSULTANTS
300 - 4595 CANADA WAY, BURNABY, B.C.
TEL: 604.320.1999, FAX: 604.320.1991
MARINE CLADDING AND SHEET METAL LTD
LEGEND
WALL IN SCOPE
WALL IN SCOPE (2 HR FIRE RATING)
ROOF IN SCOPE
2 CONSTRUCTION 04/14/14
1 CLIENT REVIEW 02/25/14
No. ISSUE / REVISION DATE
ALL RIGHTS RESERVED. PROPERTY OF JRS ENGINEERING GROUP. USE OR REPRODUCTION PROHIBITED WITHOUT PRIOR WRITTEN PERMISSION.
COMO LAKE SUBSTATION
PORT COQUITLAM, BC
SHOP DRAWINGS
PLANS & ELEVATIONS
DATE: MAR
SCALE: AS NOTED
DESIGNED: LR
DRAWN: KW
REVIEWED: SC
DRAWING No: SD-1.03
PROJECT No: VR13487

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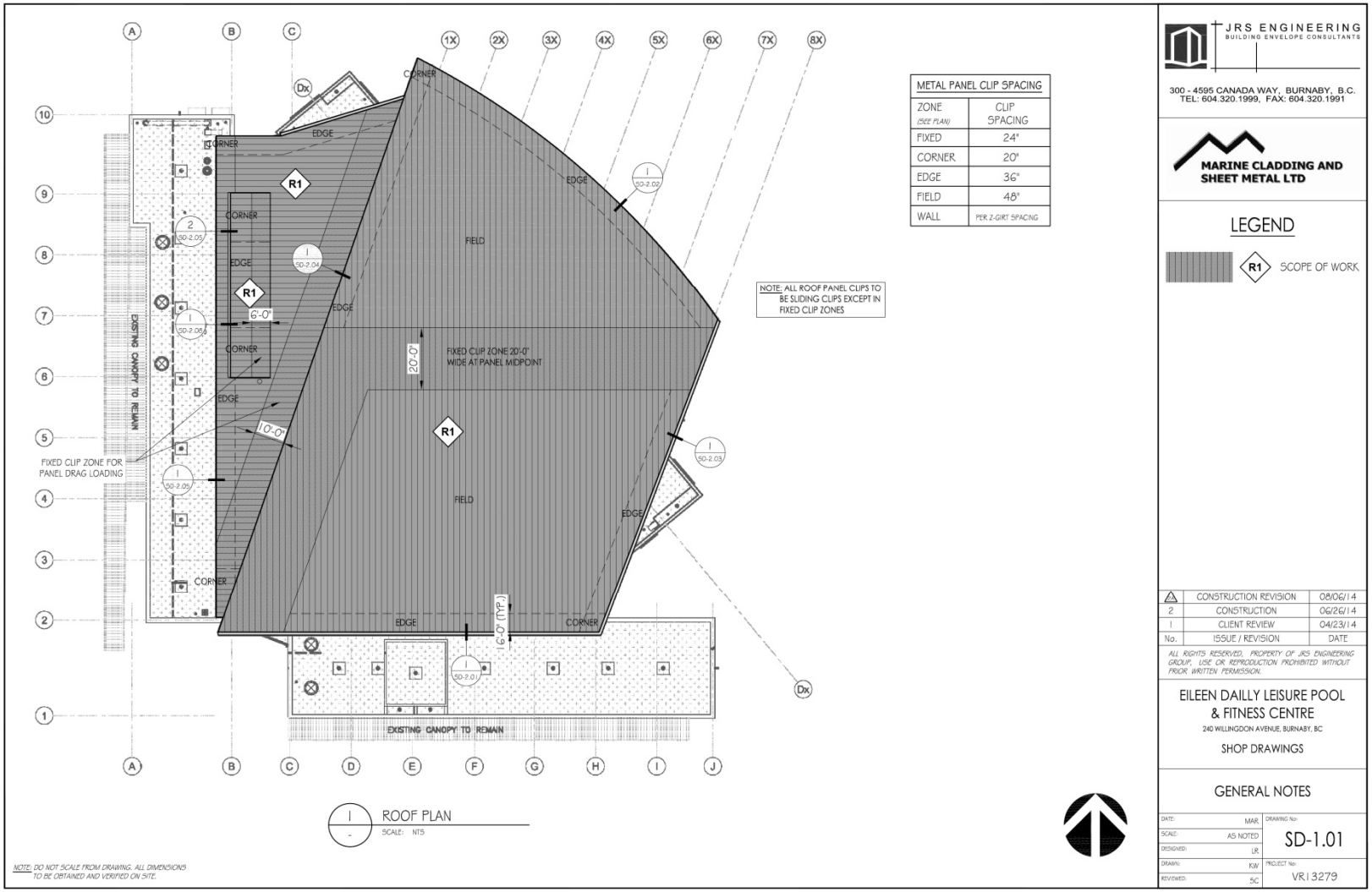
METAL PANEL CLIP SPACING
ZONE (SEE PLAN) | CLIP SPACING
FIXED | 24"
CORNER | 20"
EDGE | 36"
FIELD | 48"
WALL | PER Z-GIRT SPACING
NOTE: ALL ROOF PANEL CLIPS TO BE SLIDING CLIPS EXCEPT IN FIXED CLIP ZONES
FIXED CLIP ZONE 20'-0" WIDE AT PANEL MIDPOINT
FIXED CLIP ZONE FOR PANEL DRAG LOADING
EXISTING CANOPY TO REMAIN
EXISTING CANOPY TO REMAIN
ROOF PLAN
SCALE: NTS
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LEGEND
SCOPE OF WORK
2 | CONSTRUCTION REVISION | 08/06/14
2 | CONSTRUCTION | 06/26/14
1 | CLIENT REVIEW | 04/23/14
No. | ISSUE / REVISION | DATE
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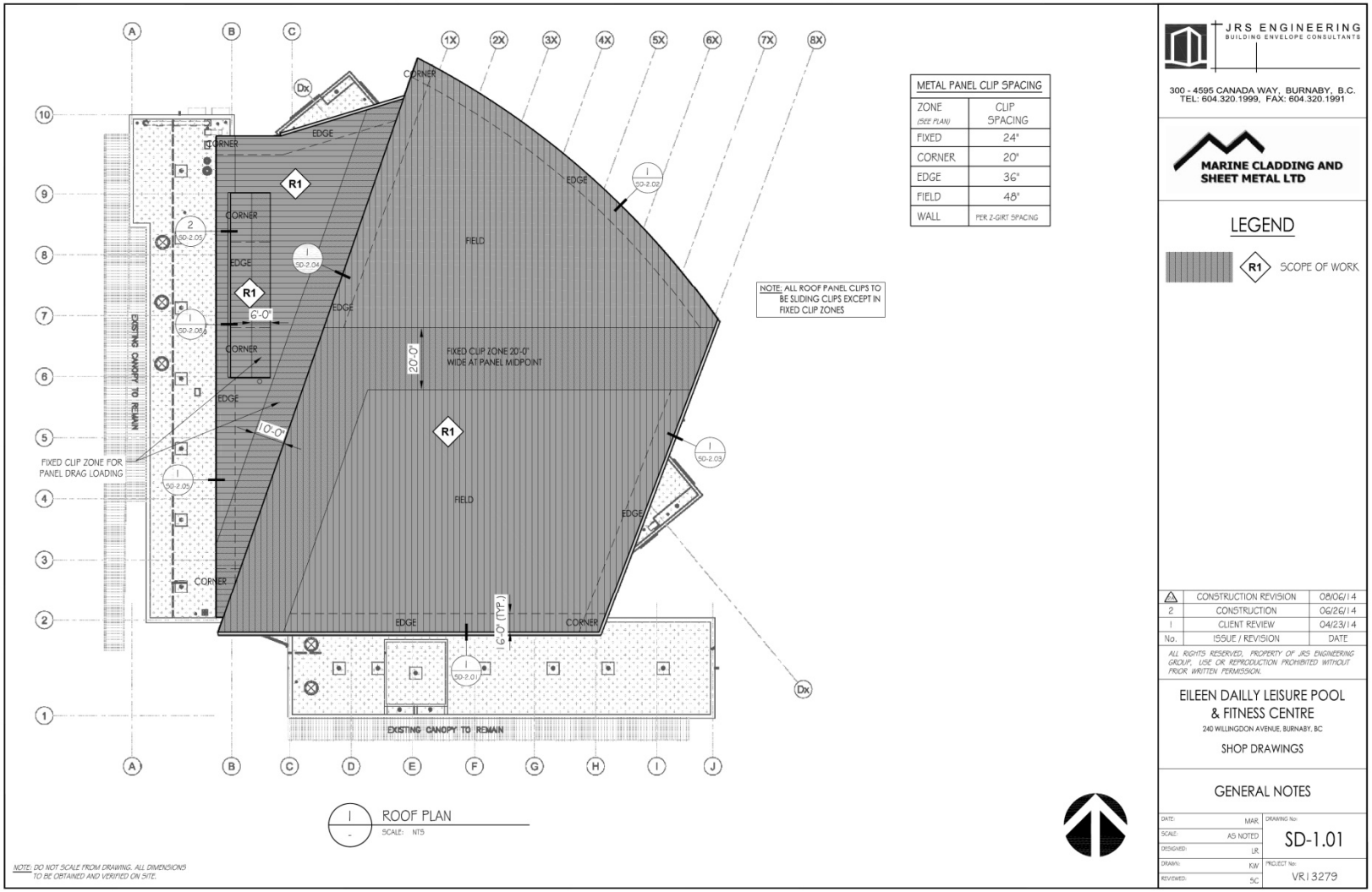
SHOP DRAWINGS
GENERAL NOTES
DATE: MAR
SCALE: AS NOTED
DESIGNED: LR
DRAWN: KW
REVIEWED: SC
DRAWING No: SD-1.01
PROJECT No: VR13279

- ✓ Thermal Expansion
  - To detail the eave drip edge clip thermal expansion must be determined.
  - For every 10’ of length the metal will expand roughly 0.08” per 100 degrees Fahrenheit.
  - In Burnaby this works out to about 0.12” per 10’ length on dark colour pitched metal roofs
  - How much can be expected on previous example?
    - Roof is roughly 180’ long ~ 2.17”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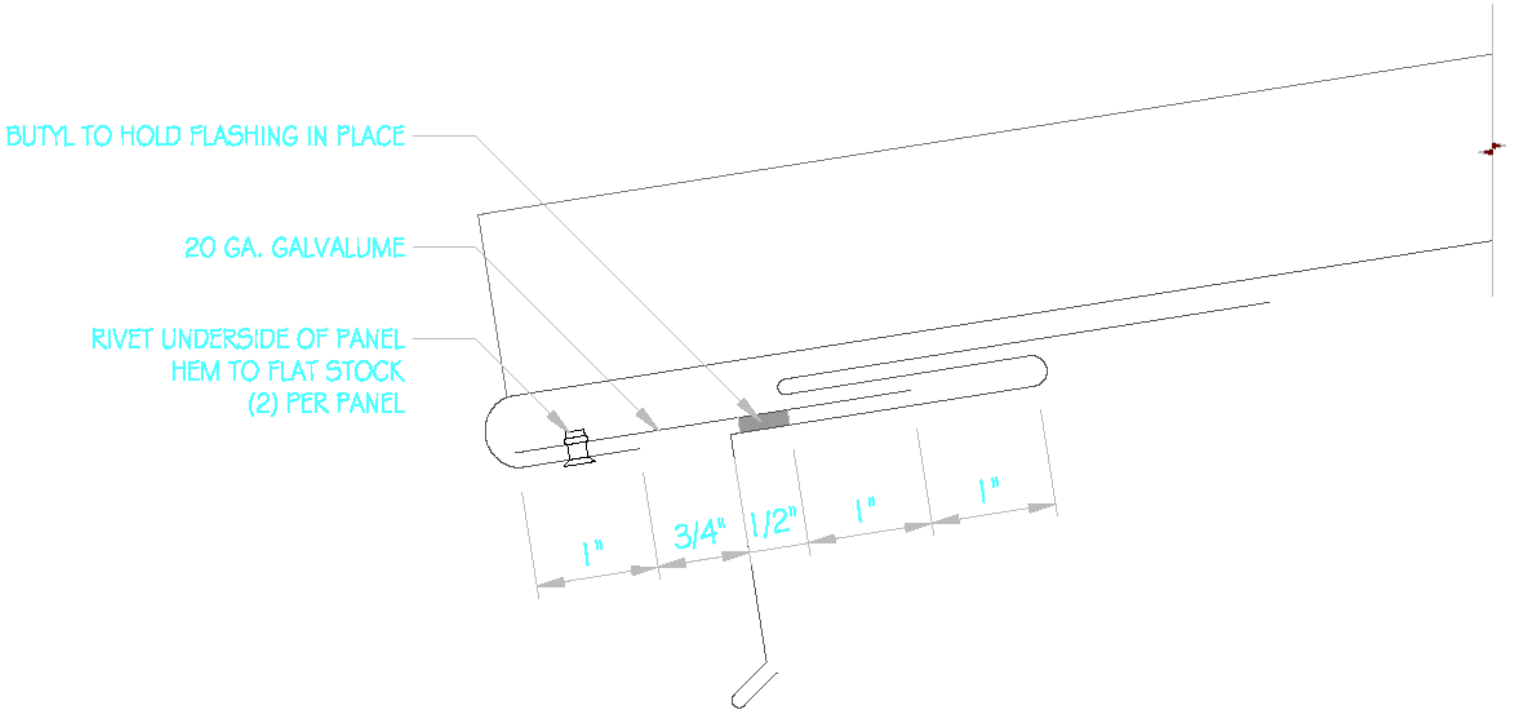

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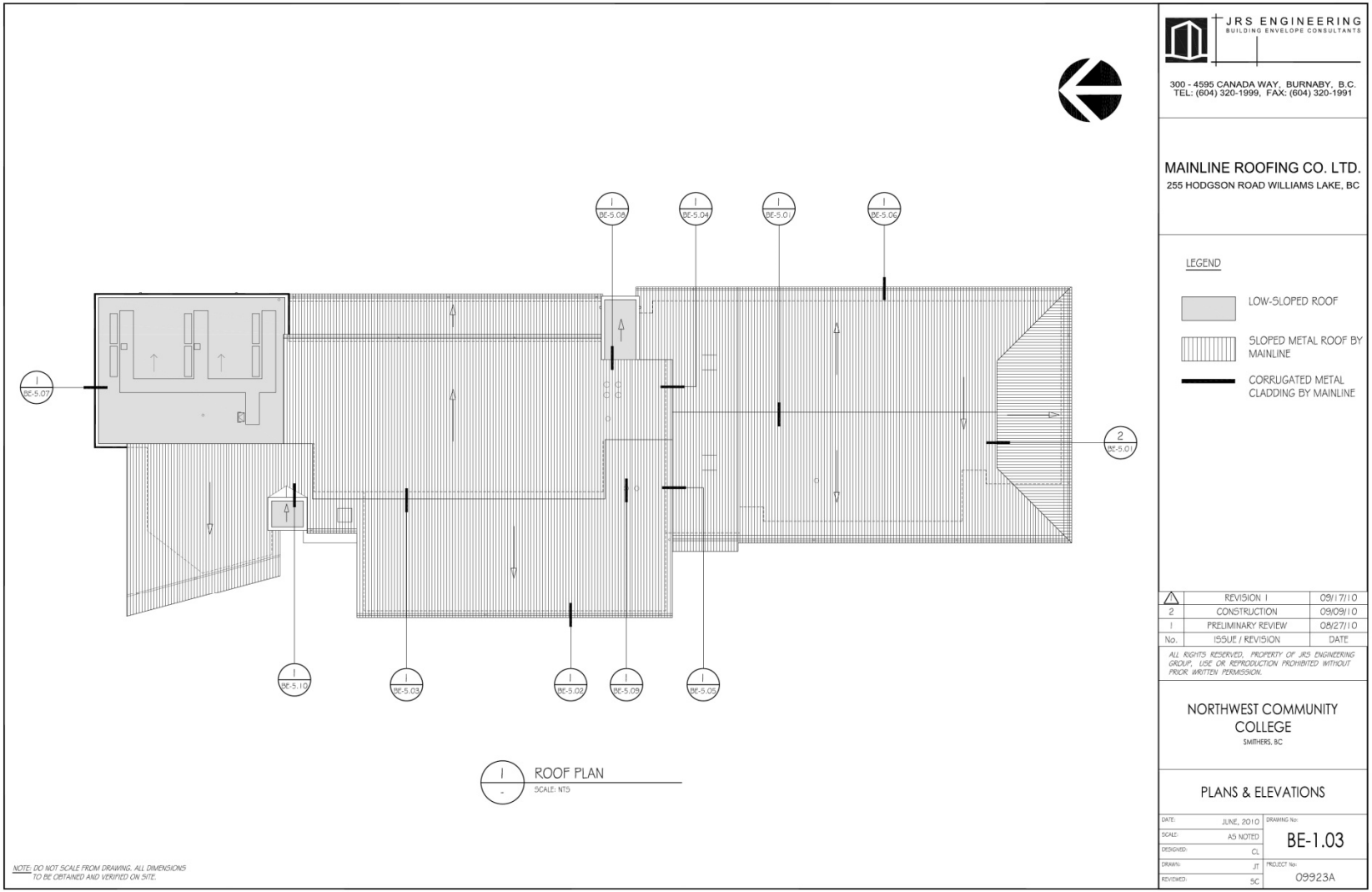

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MAINLINE ROOFING CO. LTD.
255 HODGSON ROAD WILLIAMS LAKE, BC

LEGEND

- LOW-SLOPED ROOF
- SLOPED METAL ROOF BY MAINLINE
- CORRUGATED METAL CLADDING BY MAINLINE

No.	ISSUE / REVISION	DATE
3	REVISION 1	09/17/10
2	CONSTRUCTION	09/09/10
1	PRELIMINARY REVIEW	08/27/10

NORTHWEST COMMUNITY COLLEGE
SMITHERS, BC

PLANS & ELEVATIONS

DATE:	JUNE, 2010	DRAWING No:	BE-1.03
SCALE:	AS NOTED		
DESIGNED:	CL		
DRAWN:	JT	PROJECT No:	09923A
REVIEWED:	SC		

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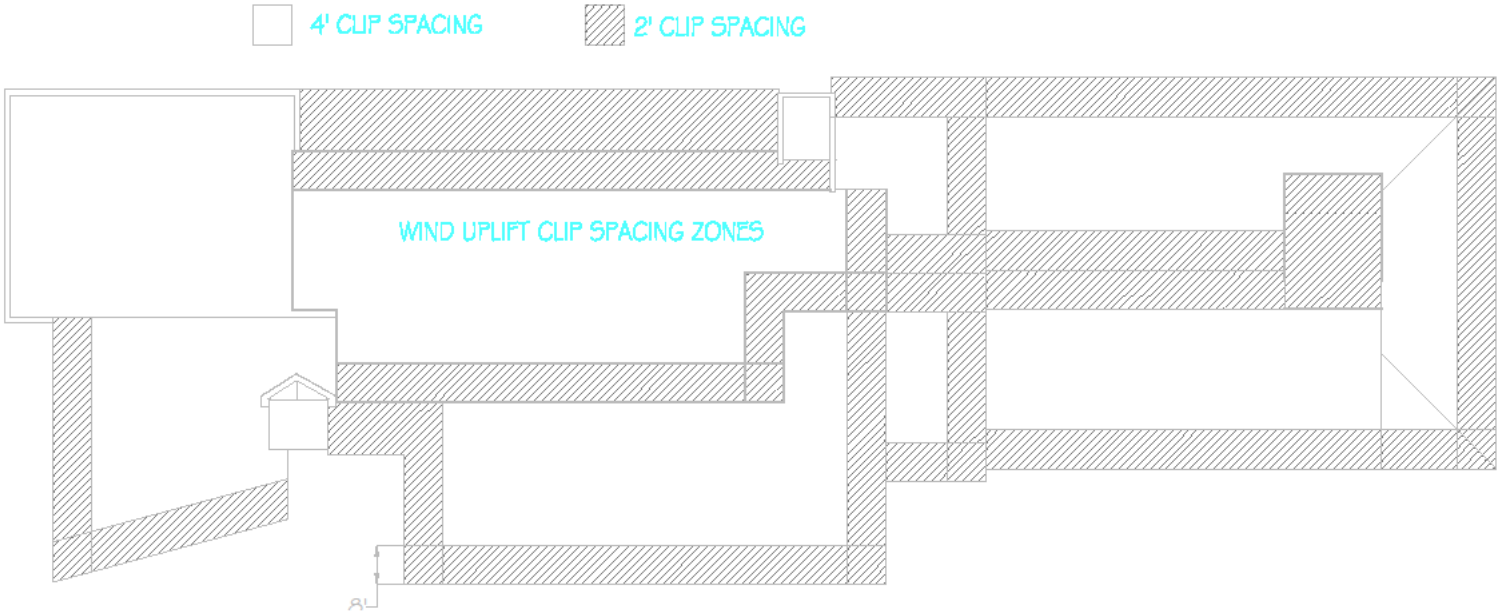
RCI WESTERN CANADA CHAPTER AGM - 2015

SHOP DRAWING FOR NORTHWEST COMMUNITY COLLEGE - ROOF & WALL CLADDING

SMITHERS, BC



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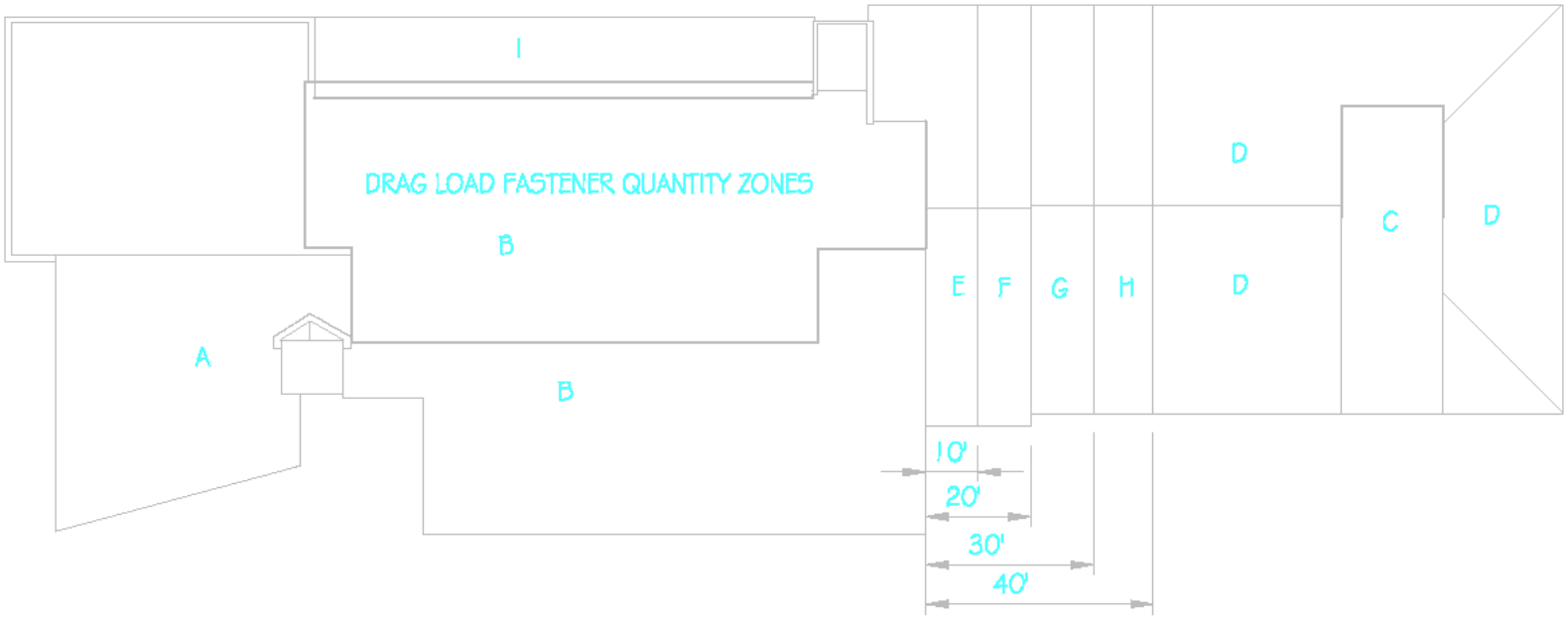

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UPLIFT FASTENERS AND CLIPS

- 158-FC-22G CLIPS SPACED AT 4' O.C. EXCEPT 8' FROM ANY ROOF RIDGE, RAKE OR EAVE WHERE CLIPS SHALL BE SPACED AT 2' O.C. (SEE DIAGRAM AT TOP RIGHT OF RP-0.02). A CLIP MUST BE LOCATED A MINIMUM OF 6" FROM THE BOTTOM OF EACH PANNEL.

-3: UPLIFT FASTENERS FROM CLIP TO 2X4 WOOD BLOCKING
#12-14 2" METAL TO WOOD WAFER HEAD FASTENERS

-4: UPLIFT FASTEMERS FROM 2X4 WOOD BLOCKING TO STEEL DECK
#12-14 TEK WAFER HEAD FASTENERS *c/w* WASHER SPACED AT 10" O.C. (APPROPRIATE LENGTH TO SUIT FULL PENETRATION OF STRUCTURAL STEEL DECK*)

DRAG LOAD FASTENERS

-5: #12-14 2.5" TEK GASKETED DRAG LOAD FASTENER QTY PER PANEL WIDTH*

ZONE:	A	B	C	D	E	F	G	H	I
QTY:	4	5	9	6	15	13	11	9	5

*FASTENERS MUST BE LOCATED A MINIMUM OF 1" FROM EACH OTHER AND FROM THE END OF THE PANEL.

-6: #14-14 TEK WAFER HEAD FASTENER (APPROPRIATE LENGTH TO FULLY PENETRATE STEEL DECK*, OR PENETRATE INTO T&G DECK BY 2". QUANTITY BY ZONE AS PER ABOVE.

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FASTENER SPACING ALONG PANEL (WIND UPLIFT)

> 7:12	
CORNERS	5-3/16"
SIDES	10-3/8"
FIELD	25-15/16"
EDGE DIST. ZONE	14'-0"

DRAG LOAD FASTENERS

	ROOF SLOPE		
PANEL LENGTH	6:12	4:12	3:12
1' - 10'	3	2	2
11' - 20'	6	4	3
21 - 30'	9	6	4
31' - 40'	11	8	5
41' - 50'		10	
51' - 60'		11	
61' - 70'		13	

2A

*Specific to Specific Project

Design Resources

- ✓ Building Codes
- ✓ RCI Courses
  - Metal Roofing - 2 day course
- ✓ Industry Manuals
  - SMACNA Architectural Sheet Metal Manual
  - SMACNA Architectural Sheet Metal Inspection Manual
  - NRCA Metal Panel and SPF Roof Systems—2012
  - RCABC Roofing Practices Manual
- ✓ Industry Manufacturers

Low Slope Metal

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Low Slope Metal

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Low Slope or Curved Metal Roof Systems

- ✓ Specialty testing needs to be performed on the panel to determine the performance of the metal panel under low slope and curved conditions.
- ✓ ASTM E 2140 (09) - Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
- ✓ FBC - TAS 114 – Test Procedures for Roof System Assemblies in the High-Velocity Hurricane Zone Jurisdiction

Design Details

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Design Details

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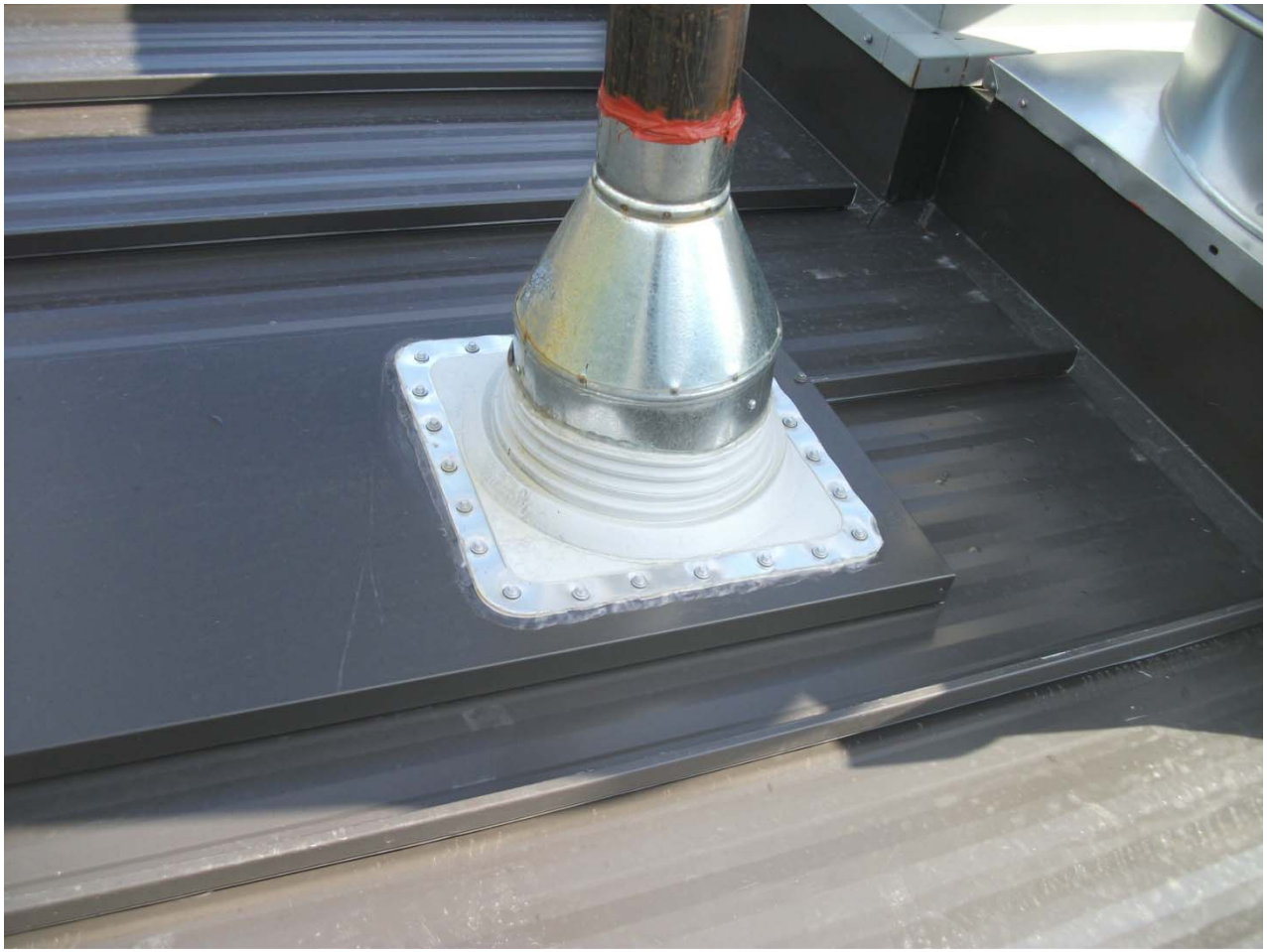

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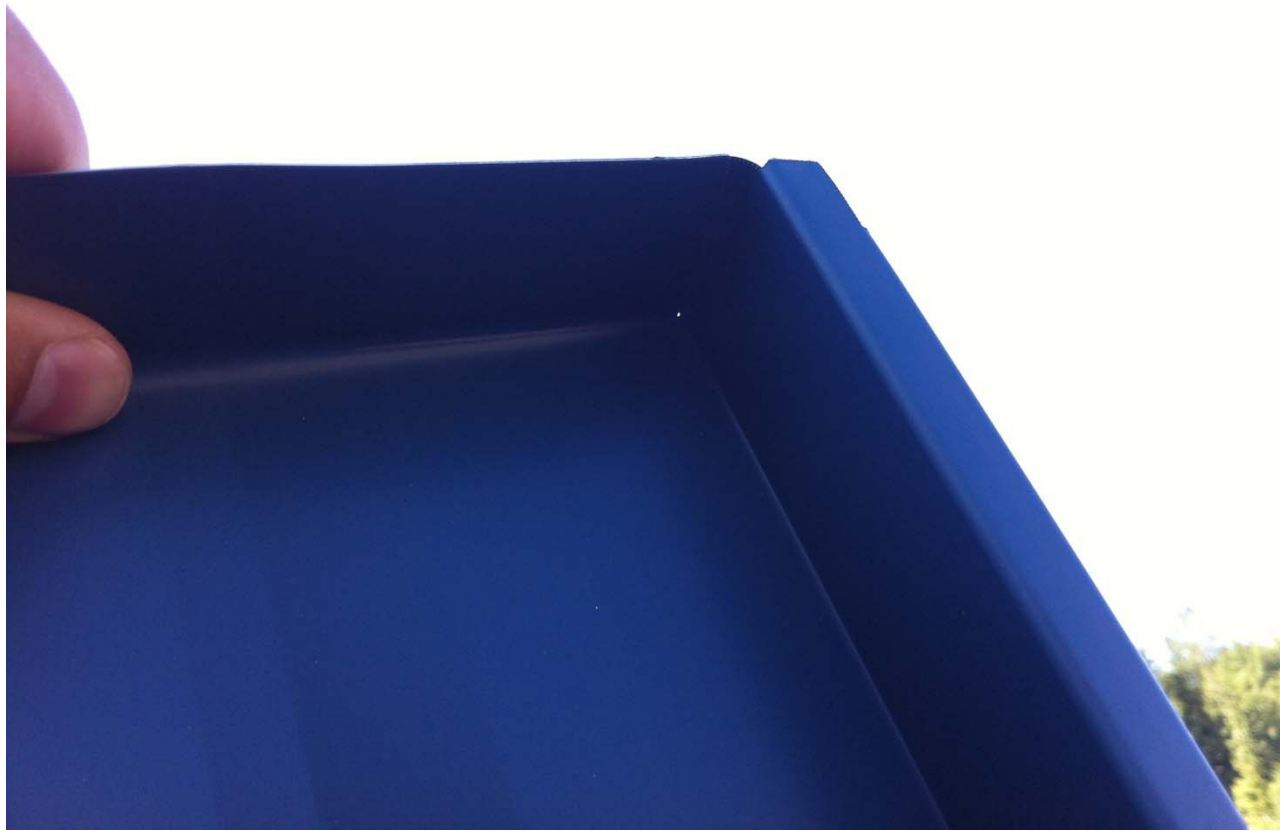

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Continuously Insulated (Ci) Systems

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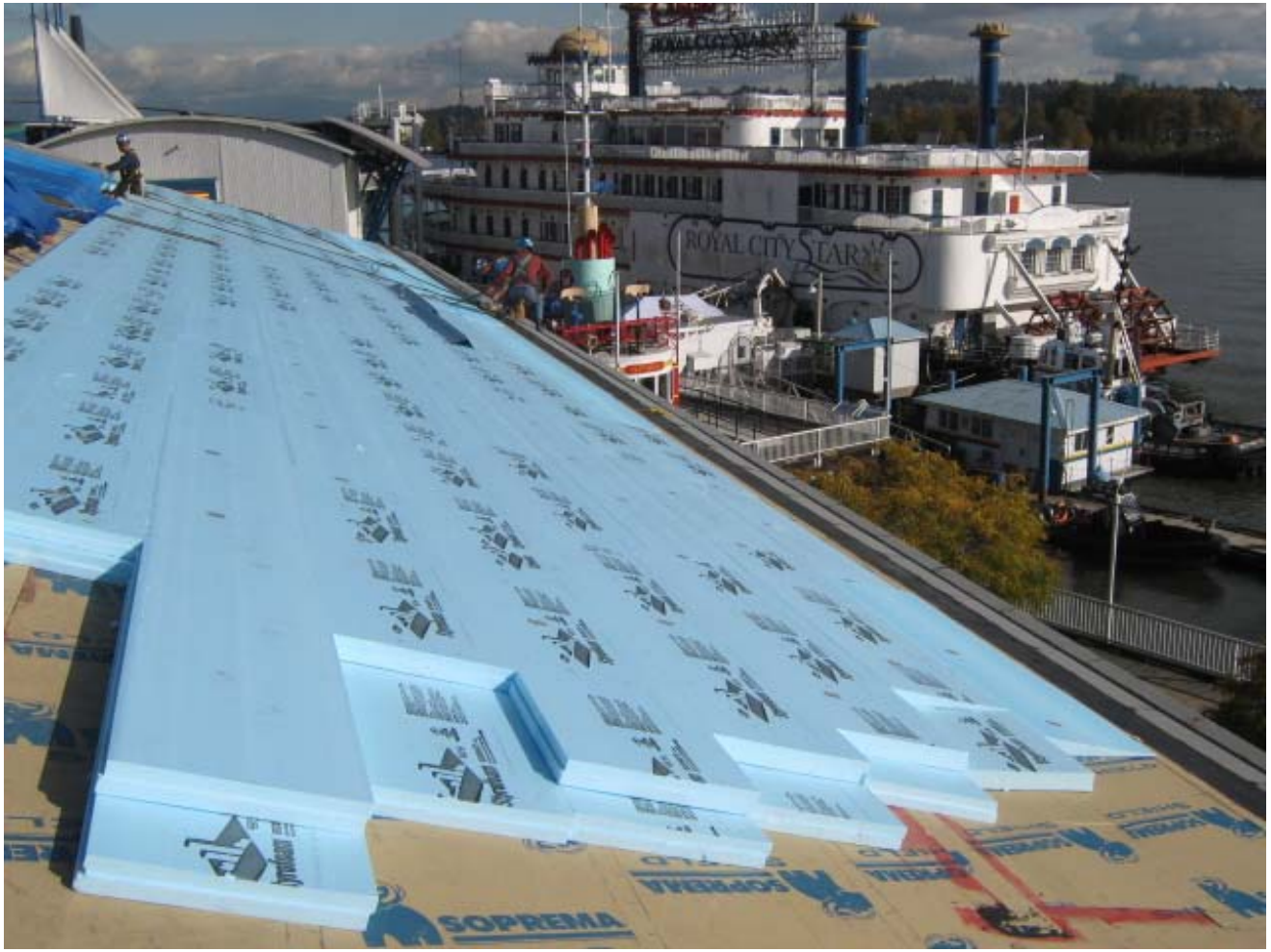

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Continuously Insulated (Ci) Systems

Closure

- ✓ Topics
  - Minimum Requirements
  - Design Resources
  - Low Slope Metal Roofing
  - Design Details
  - Continuously Insulated (Ci) Systems

Closure

- ✓ Thank You

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