# steel CONNECT 4 CRITERIA OF EXTERNAL CLADDING **DESIGN TO EXTEND ITS** LIFESPAN



#### 10 YEARS STEEL ROOFING WITHOUT RUSTS

#### & STILL IN EXCELLENT APPEARANCE

Source: CS-ULT-03 COLORBOND® ULTRA steel at Teluk Nipah, Pangkor

#### **22 YEARS STEEL** ROOFING **EXPECTED TO** HAVE MORE SERVICE LIFESPAN

28 YEARS STEEL ROOFING IN EXCELLENT CONDITIONS

HOW TO ACHIEVE LONGER **LIFESPAN FOR** YOUR CLADDING THROUGH **DESIGN?** 

### **ROOF PITCH**



#### THE FLAT ROOF DESIGN HAS BEEN WIDELY ADOPTED

Source: BlueScope

#### FOR BUILDING BLOCKS DESIGN

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Source: BlueScope



#### AND MAXIMIZE THE SPACE USAGE



### WHAT IS FLAT ROOF



### DEFINED AS NEARLY HORIZONTAL ROOF PITCH

Source: BlueScope





#### DEFINED AS NEARLY HORIZONTAL ROOF PITCH



#### HOW TO DETERMINE ROOF PITCH



#### CAN BE DESCRIBED IN A RATIO

**ROOF PITCH CONSIDERATION** 

#### WHY WOULD YOU WANT TO DETERMINE ROOF PITCH?



#### REACT DIFFERENTLY DURING RAINY DAY



#### AFFECT THE WATER FLOW RATE





#### DETERMINE THE WATER LEVEL ON THE ROOF



**RISK OF** LEAKAGE IF WATER LEVEL BEYOND **ROOF PROFILE** HEIGHT





#### PROFILE / RIB HEIGHT

ROOF PITCH CONSIDERATION

Source: Unison Corporate Catalogue 2015

#### DIFFERENT PROFILE TO CATER WATER RUN-OFF



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Profile	CORRUGATED PROFILE
Steel Grade (N/mm <sup>2</sup> )	G550 ZINCALUME® steel
Effective Width of Coverage	700mm
Depth of Rib	24mm
Minimum Recommended Roof Pitch	3° (sheet length without end lap) 5° (sheet length with end lap)
Base Metal Thickness (BMT)	0.42mm
Total Coated Thickness (TCT)	0.47mm*

Corrugated profile



#### MINIMUM **ROOF PITCH** RECOMMENDED **IN BROCHURES**

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Source: https://www.lysaghtasean.com/my/wp-content/uploads/sites/3/2019/04/MY-Oct19-Lysaght-Spandek-Brochure.pdf

Steel Grade (MPa)	G550 (550MPa minimum yield stress)
Effective Width of Coverage	980mm
Depth of Rib	43mm
Minimum Recommended Roof Pitch	2° (1 in 30)
Base Metal Thickness	0.42mm, 0.48mm & 0.60mm



#### MINIMUM ROOF PITCH RECOMMENDED IN BROCHURES

Source: https://www.lysaghtasean.com/my/wpcontent/uploads/sites/3/2019/04/Lysaght-Klip-Lok-Optima-Brochure\_Mar-2020.pdf



#### CONSTANT CLIMATE CHANGE

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#### LONGER ROOF RUN

#### Corrugated Profile (Rib height = 29mm)

Rainfall Intensity (mm/hour)	Roof Slope				
	1 in 20 (3º)	1 in 12 (5º)	1 in 7.5( 7.5º)	1 in 6 (10º)	
200	105	123	139	152	
250	84	98	111	121	
300	70	82	92	101	
400	52	61	69	76	

Unit in meter

#### Corrugated Profile (Rib height = 24mm)

Rainfall Intensity (mm/hour)	Roof Slope				
	1 in 20 (3°)	1 in 12 (5⁰)	1 in 7.5(7.5°)	1 in 6(10⁰)	
150	43	51	57	63	
200	32	38	43	47	
250	26	30	34	38	
300	22	25	25 28		
400	16	19	21	23	

#### Unit in meter



#### MAXIMUM LENGTH GIVEN RAIN INTENSITY & ROOF PITCH

Source: https://www.lysaghtasean.com/my/wp-content/uploads/sites/3/2019/04/MY-Oct19-Lysaght-Spandek-Brochure.pdf

#### Concealed Fixed Profile (Rib height = 43mm)

Peak rainfall	Roof Slope (degrees)					
intensity (mm/hr)	2	3	4	5	8	10
100	502	588	663	732	873	1003
150	334	392	442	488	582	669
200	251	294	331	366	436	502
250	201	235	265	293	349	401
300	167	196	221	244	291	334
400	125	147	166	183	218	251
500	100	118	133	146	175	201

Penetrations will alter the flow of water on a roof. For assistance in design of roofs with penetrations, please seek advice from our information line.

### HIGHER RIB CAN CATER LONGER ROOF LENGTH

ROOF PITCH CONSIDERATION

Source: https://www.lysaghtasean.com/my/wpcontent/uploads/sites/3/2019/04/Lysaght-Klip-Lok-Optima-Brochure\_Mar-2020.pdf



#### CASE STUDY ON LONG LENGTH ROOF

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Source: BlueScope

### DEEP CORRUGATION CAN CARRY MORE WATER

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### ABLE TO SUSTAIN MORE LOAD

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Source: CS-XPD-03 MAS Hangar 06 COLORBOND® XPD steel case study.



#### SHOW NO SIGN OF PONDING

#### INTERNALLY NO LEAKAGE

Source: CS-XPD-03 MAS Hangar 06 COLORBOND® XPD steel case study.

## (2) PROFILE & BUILDING GEOMETRY

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2 PROFILE & BUILDING GEOMETRY

#### STEEL **PROFILES CAN** HELP FORM BUILDINGS INTO DIFFERENT SHAPES

2 PROFILE & BUILDING GEOMETRY

#### TO BUILD BUILDINGS IN WIDE ARRAY OF GEOMETRIES


# AND STILL BE SECURED & LOCKED PROPERLY **ONTO THE** STRUCTURE

........ 00000 ... ....................... ...... \*\*\*\*\*\*\*\*\* \* 0006409073 001030009 

Source: BlueScope

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### Pierced fixed profile

## Concealed fixed profile

# Standing seam profile

# USING DIFFERENT VERSATILE PROFILES



# CLIMATE CHANGE POSTS RISK TO BUILDINGS

Source: https://www.manchestereveningnews.co.uk/news/greater-manchester-news/man-taken-hospital-after-piece-14362636



# HOW TO PREVENT WIND UPLIFT?



# WIND BLOWN AT A BUILDING



# WIND SPEED DIFFERENCE

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HIGHER wind speed

LOWER wind

speed



SIDE WITH HIGHER WIND SPEED = NEGATIVE PRESSURE

STRONGER WIND = HIGHER NEGATIVE PRESSURE













# AFFECTED BY WIND SPEED



# GEOMETRY OF BUILDING CAN AFFECT THE WIND UPLIFT TENDENCY



# WIND AIRFLOW DIRECTION



# AREAS OF POSITIVE & NEGATIVE PRESSURE

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Source: https://www.civilengineeringx.com/bdac/wind-protection/



![](_page_48_Figure_1.jpeg)

AREAS OF POSITIVE & NEGATIVE PRESSURE

![](_page_49_Picture_0.jpeg)

![](_page_49_Picture_1.jpeg)

# HOW ABOUT BUILDING WITH OPENINGS?

Source: http://prugarinc.com/shingles/procedure-for-an-evaluation-of-wind-damage-to-shingles/

![](_page_50_Figure_1.jpeg)

# NEGATIVE PRESSURE FROM EXTERNAL

Source: http://prugarinc.com/shingles/procedure-for-an-evaluation-of-wind-damage-to-shingles/

![](_page_51_Figure_1.jpeg)

# POSITVE PRESSURE FROM INTERNAL

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Source: http://prugarinc.com/shingles/procedure-for-an-evaluation-of-wind-damage-to-shingles/

![](_page_52_Figure_1.jpeg)

# DETERMINE PROFILE LOCKING STRENGTH

Source: https://www.lysaghtasean.com/my/wpcontent/uploads/sites/3/2019/04/Lysaght-Klip-Lok-Optima-Brochure\_Mar-2020.pdf

Concealed Fixed Profile							
(0.42mm BMT) <b>←</b>				N	/ith edge	stiffener	(mm)
Span type		900	1200	1500	1800	2100	2400
Single	Serviceability	2.05	1.65	1.29	0.96	0.70	0.52
	Strength*	5.16	4.70	4.25	3.83	3.44	3.10
End	Serviceability	1.44	1.20	1.01	0.87	0.79	0.72
	Strength*	3.64	2.79	2.07	1.60	1.32	1.17
Internal	Serviceability	0.97	0.85	0.74	0.71	0.69	0.67
	Strength*	2.92	2.26	1.74	1.48	1.40	1.38
Concealed Fixed Profile							
(0.48mm BMT)	•			W	ith edge	stiffener (	mm)
Span type		900	1200	1500	1800	2100	2400
Single	Serviceability	2.57	2.07	1.60	1.19	0.85	0.62
	Strength*	7.13	6.07	5.07	4.19	3.51	3.07
End	Conviscopility	1 70	1 5 4	1 20	1 10	1 02	0.00
EIIU	Serviceability Strength*	3 78	3.26	1.30 2.74	2 24	1.03	0.89 1.48
		0.70	0.20				
Internal	Serviceability	1.43	1.19	1.02	1.01	0.98	0.94
	Strength*	3.65	2.76	2.10	2.00	1.90	1.80
Unit in kPa	11000		Printer and	AL LA			
	111	Cond	cealed	fixed		alle	
	18		profile	- Aller		ALE MAR	
	/	1 10			6		1

![](_page_53_Picture_2.jpeg)

# LOCKING FORCE FOR CONCEALED FIXED PROFILE

Source: https://www.lysaghtasean.com/my/wpcontent/uploads/sites/3/2019/04/Lysaght-Klip-Lok-Optima-Brochure\_Mar-2020.pdf

Concealed Fixed Profile				-14	lith odgo	stiffonor	(mm)
		000	1200	1500	1000	2100	2400
Span type		900	1200	1500	1800	2100	2400
Single	Serviceability	2.05	1.65	1.29	0.96	0.70	0.52
	Strength*	5.16	4.70	4.25	3.83	3.44	3.10
End	Serviceability	1.44	1.20	1.01	0.87	0.79	0.72
	Strength*	3.64	2.79	2.07	1.60	1.32	1.17
Internal	Serviceability	0.97	0.85	0.74	0.71	0.69	0.67
	Strength*	2.92	2.26	1.74	1.48	1.40	1.38
Concealed Fixed Profile (0.48mm BMT)	With edge stiffener (mm)						mm)
Span type		900	1200	1500	1800	2100	2400
Single	Serviceability	2.57	2.07	1.60	1.19	0.85	0.62
	Strength*	7.13	6.07	5.07	4.19	3.51	3.07
F.J.	On the bills	4 70	4 5 4	1.00	1 10	1 00	0.00
End	Serviceability Strongth*	1./J 2.70	1.54	1.30	1.18 2.24	1.U3 1.Q1	U.89 1 /Q
	Suengui	5.70	J.20	2.74	2.24	1.01	1.40
Internal	Serviceability	1.43	1.19	1.02	1.01	0.98	0.94
	Strength*	3.65	2.76	2.10	2.00	1.90	1.80
Unit in kPa	1.1200		<b>1</b>	ST. W			
i and i a	Concealed fixed						
	profile						
-		1 .	prome		K		
				ALL DO			THE REAL PROPERTY.

![](_page_54_Picture_1.jpeg)

# LOCKING FORCE FOR CONCEALED FIXED PROFILE

Source: https://www.lysaghtasean.com/my/wpcontent/uploads/sites/3/2019/04/Lysaght-Klip-Lok-Optima-Brochure\_Mar-2020.pdf

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Concealed Fixed Profile (0.42mm BMT)				v	/ith edae	stiffener (	(mm)
Span type		900	1200	1500	1800	2100	2400
Single	Serviceability	2.05	1.65	1.29	0.96	0.70	0.52
	Strength*	5.16	4.70	4.25	3.83	3.44	3.10
End	Serviceability	1.44	1.20	1.01	0.87	0.79	0.72
	Strength*	3.64	2.79	2.07	1.60	1.32	1.17
Internal	Serviceability	0.97	0.85	0.74	0.71	0.69	0.67
	Strength*	2.92	2.26	1.74	1.48	1.40	1.38
Concealed Fixed Profile (0.48mm BMT)◀	With edge stiffener (mm)						mm)
Span type		900	1200	1500	1800	2100	2400
Single	Serviceability	2.57	2.07	1.60	1.19	0.85	0.62
	Strength*	7.13	6.07	5.07	4.19	3.51	3.07
End	Serviceability	1.73	1.54	1.36	1.18	1.03	0.89
	Strength*	3.78	3.26	2.74	2.24	1.81	1.48
Internal	Serviceability	1.43	1.19	1.02	1.01	0.98	0.94
	Strength*	3.65	2.76	2.10	2.00	1.90	1.80
Unit in kPa		Cond	cealed f profile	ixed	1		

# LOCKING FORCE FOR CONCEALED FIXED PROFILE

Source: https://www.lysaghtasean.com/my/wpcontent/uploads/sites/3/2019/04/Lysaght-Klip-Lok-Optima-Brochure\_Mar-2020.pdf

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![](_page_56_Picture_0.jpeg)

### Pierced fixed corrugated profile (0.42mm BMT)

Type of	Fasteners ner sheet		Span (mm)						
Span	per support	Limit State	900	1200	1500	1800	2100	2400	
Single	3 🗕	Serviceability	2.04	1.64	1.27	0.96	0.72	0.54	
		Strength	9.30	7.60	6.05	4.80	3.85	3.25	
	4 🗕	Serviceability	4.24	3.07	2.02	1.20	0.68	0.42	
		Strength	11.40	9.20	7.35	5.80	4.75	4.10	
End	3	Serviceability	2.05	1.83	1.60	1.40	1.21	1.02	
		Strength	6.50	4.90	3.60	2.60	2.05	1.70	
	4	Serviceability	3.75	3.19	2.67	2.20	1.78	1.41	
		Strength	7.70	6.30	5.10	4.15	3.50	3.00	
Internal	3	Serviceability	1.96	1.81	1.67	1.52	1.37	1.23	
		Strength	7.70	6.40	5.20	4.20	3.20	2.50	
	4	Serviceability	4.74	4.05	3.38	2.67	2.20	1.73	
			Strength	9.50	7.55	6.00	4.80	3.90	3.30

Unit in kPa

Corrugated profile

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# LOCKING FORCE FOR CORRUGATED PROFILE

Source: https://www.lysaghtasean.com/my/wp-content/uploads/sites/3/2019/04/MY-Oct19-Lysaght-Spandek-Brochure.pdf

![](_page_57_Picture_0.jpeg)

### Pierced fixed corrugated profile (0.42mm BMT)

Type of	Fasteners		Span (mm)						
Span	per support	Limit State	900	1200	1500	1800	2100	2400	
Single	3	Serviceability	2.04	1.64	1.27	0.96	0.72	0.54	
		Strength	9.30	7.60	6.05	4.80	3.85	3.25	
	4	Serviceability	4.24	3.07	2.02	1.20	0.68	0.42	
		Strength	11.40	9.20	7.35	5.80	4.75	4.10	
End	3 🔶	Serviceability	2.05	1.83	1.60	1.40	1.21	1.02	
		Strength	6.50	4.90	3.60	2.60	2.05	1.70	
	4 🗕	Serviceability	3.75	3.19	2.67	2.20	1.78	1.41	
		Strength	7.70	6.30	5.10	4.15	3.50	3.00	
Internal	3	Serviceability	1.96	1.81	1.67	1.52	1.37	1.23	
		Strength	7.70	6.40	5.20	4.20	3.20	2.50	
	4	Serviceability	4.74	4.05	3.38	2.67	2.20	1.73	
		Strength	9.50	7.55	6.00	4.80	3.90	3.30	

Unit in kPa

Corrugated profile

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LOCKING FORCE FOR CORRUGATED PROFILE

Source: https://www.lysaghtasean.com/my/wp-content/uploads/sites/3/2019/04/MY-Oct19-Lysaght-Spandek-Brochure.pdf

![](_page_58_Picture_0.jpeg)

### Pierced fixed corrugated profile (0.42mm BMT)

Type of	Fasteners		Span (mm)						
Span	per support	Limit State	900	1200	1500	1800	2100	2400	
Single	3	Serviceability	2.04	1.64	1.27	0.96	0.72	0.54	
		Strength	9.30	7.60	6.05	4.80	3.85	3.25	
	4	Serviceability	4.24	3.07	2.02	1.20	0.68	0.42	
		Strength	11.40	9.20	7.35	5.80	4.75	4.10	
End	3 🔶	Serviceability	2.05	1.83	1.60	1.40	1.21	1.02	
		Strength	6.50	4.90	3.60	2.60	2.05	1.70	
	4 🔶	Serviceability	3.75	3.19	2.67	2.20	1.78	1.41	
		Strength	7.70	6.30	5.10	4.15	3.50	3.00	
Internal	3	Serviceability	1.96	1.81	1.67	1.52	1.37	1.23	
		Strength	7.70	6.40	5.20	4.20	3.20	2.50	
	4	Serviceability	4.74	4.05	3.38	2.67	2.20	1.73	
		Strength	9.50	7.55	6.00	4.80	3.90	3.30	

Unit in kPa

Corrugated profile

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# LOCKING FORCE FOR CORRUGATED PROFILE

Source https://www.lysaghtasean.com/my/wp-content/uploads/sites/3/2019/04/MY-Oct19-Lysaght-Spandek-Brochure.pdf:

![](_page_59_Picture_0.jpeg)

# (3)TREATMENT OF UNWASHED AREAS

![](_page_60_Picture_0.jpeg)

# DURABLE MATERIAL THAT CAN WITHSTAND MARINE CONDITION

Source: CS-ULT-1 Labuan Jetty using COLORBOND® ULTRA steel

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TREATMENT OF UNWASHED AREA

# DURABLE MATERIAL THAT CAN WITHSTAND MARINE CONDITION

Source: CS-ULT-1 Labuan Jetty using COLORBOND® ULTRA steel

3 TREATMENT OF UNWASHED AREA

# 15 YEARS STEEL CLADDING IN MARINE CONDITION

![](_page_63_Picture_0.jpeg)

![](_page_63_Picture_1.jpeg)

# WHAT IS UNWASHED AREA?

![](_page_64_Picture_0.jpeg)

# WHAT IS<br/>CONSIDERED<br/>AS<br/>UNWASHED<br/>AREA?

**3** TREATMENT OF UNWASHED AREA

# WHAT IS CONSIDERED AS UNWASHED AREA?

Source: BlueScope

Ceiling

![](_page_66_Picture_0.jpeg)

# SALT-LADEN AIR

Source: BlueScope

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![](_page_67_Picture_0.jpeg)

# INDUSTRIAL CONTAMINANT

Source: https://www.shutterstock.com/video/clip-7326472-smoke-rising-industrialchimney

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![](_page_68_Picture_0.jpeg)

# SIGN OF SALT SETTLEMENT ON UNWASHED AREA

![](_page_69_Picture_0.jpeg)

# INDUSTRIAL DUST SETTLEMENT ON UNWASHED AREA

Source: BlueScope

3 TREATMENT OF UNWASHED AREA

# INDUSTRIAL CONTAMINANT ON WASHED AREA

![](_page_71_Picture_0.jpeg)

# >20 YEARS IN INDUSTRIAL ENVIRONMENT (WASHED AREA)


# >20 YEARS IN INDUSTRIAL ENVIRONMENT (WASHED AREA)





>30 YEARS IN INDUSTRIAL ENVIRONMENT (WASHED VS UNWASHED)

Source: BlueScope

UNWASHED AREA

74



#### >30 YEARS IN INDUSTRIAL ENVIRONMENT (UNWASHED AREA)

Source: BlueScope



75



### WHY SHOULD **WE PAY ATTENTION TO** THE UNWASHED **AREA?**



## POTENTIAL UNWASHED AREA CORROSION

3 TREATMENT OF UNWASHED AREA

# POTENTIAL DETACHMENT FROM STRUCTURE

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3 TREATMENT OF UNWASHED AREA

#### MINIMIZE EFFECT OF UNWASHED AREA



**OR ELIMINATE** UNWASHED AREAS ENTIRELY BY PAIRING WITH VAPOUR BARRIER





#### EXAMPLE CAN BE FOIL MATERIAL





**TO SHIELD THE** UNWASHED SURFACES FROM **EXTERNAL** EXPOSURE

**3** TREATMENT OF UNWASHED AREA

**TO SHIELD THE** UNWASHED SURFACES FROM **EXTERNAL** EXPOSURE





#### CEILING & VAPOUR BARRIER





#### CEILING & VAPOUR BARRIER

# IMMERSION AREAS

(4

CLEPTER.

**PREVENTION OF CLADDING** 

### DWARF WALL + STEEL CLADDING

Steel cladding

#### Dwarf wall

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Steel cladding

#### **4** PREVENTION OF CLADDING IMMERSION

#### STEEL CLADDING

#### 11/11/2019 03:15 PM

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**PREVENTION OF CLADDING** IMMERSION

#### WHAT IS DEFINED AS IMMERSED AREA?



**PREVENTION OF CLADDING** IMMERSION

#### WHAT IS DEFINED AS IMMERSED AREA?

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#### WHAT IS DEFINED AS IMMERSED AREA?



**PREVENTION OF CLADDING** IMMERSION

# CORROSION REACTION AT IMMERSED AREA



#### HOW DOES IMMERSED AREA LOOK LIKE?

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### HOW DOES IMMERSED AREA LOOK LIKE?



# HOW DOES IMMERSED AREA LOOK LIKE?

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PREVENTION OF CLADDING

# **STEEL** CLADDING WITH A CLEARANCE FROM GROUND

Source: CS-XPD-03 MAS Hangar 06 COLORBOND® XPD steel case study.

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**PREVENTION OF CLADDING** IMMERSION

# NOT DIRECTLY IN CONTACT WITH ANY PLATFORM





# NOT DIRECTLY IN CONTACT WITH ANY PLATFORM

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#### PREVENT IMMERSED AREA

Sufficient masonry dwarf wall height

99

WAY AV AV AV AV AL TH



**PREVENTION OF CLADDING** IMMERSION

#### TREATMENT AT IMMERSED SURFACE

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#### **1. ROOF PITCH CONSIDERATION**

#### ALLOW PROPER WATER RUN-OFF TO PREVENT WATER PONDING

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Source: CS-XPD-03 MAS Hangar 06 COLORBOND® XPD steel case study.

#### 2. SUITABLE PROFILE & BUILDING GEOMETRY

MINIMIZE PRESSURE DIFFERENCE OR MAXIMIZE LOCKING STRENGTH TO PREVENT WIND UPLIFT

#### 3. TREATMENT OF UNWASHED AREA

MINIMIZE DEBRIS ACCUMULATION & PREVENT DETERIORATION FROM UNWASHED AREA

#### 4. PREVENTION OF CLADDING IMMERSION

ELIMINATE IMMERSION WITH MOISTURE RETAINING SUBSTANCES

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