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Array Frame Engineering Certification

For: ANTAI SOLAR AUSTRALIA
 PTY LTD
 Level 1 suite 1.02/309 Pitt
 St, Sydney NSW 2000

Job No.: 10166
Date: 24/08/2021

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Current Revision		0				

Approval			
Author Signature		Approver Signature	
Name	Yesim Kocabalkan	Name	L. Van Spaandonk
Title	Structural Engineer	Title	Principal Engineer

Our Ref: 10166-05/YK
24 August 2021

ANTAI SOLAR AUSTRALIA PTY LTD
Level 1 suite 1.02/309 Pitt St
Sydney NSW 2000

PV Array Frame Engineering Certification

RE: AS/NZ 1170.2 Certification for Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof)

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof) within Australia. The design check is based on the information and test reports provided by ANTAI SOLAR AUSTRALIA PTY LTD.

Components of the system covered in this certificate shown in the table below:

Component	Part No
Rail	ATL-TYN-355A(ATL-DR-355A); ATL-TYN-355B (ATL-DR-355B)
Rail Splice	ATL-TYN-304/54 (ATL-DR-JOINER)
Tin interface	ATL-FWNY-05 (ATL-IK-TIN)
Tille Hook	AT-TYN-hook01 (ATL-IK-TILE)
Inter Clamp Kit	ATL-GN-003 (ATL-IC-30/35, ATL-IC-35/40)
End Clamp Kit	ATL-CG-018 (ATL-EC-30/35, ATL-EC-35/40)

This certificate is **only valid** for Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof) itself. The roof structure or the building structure and PV panels shall be assessed separately and accordingly.

This certificate is **only valid** when fixing into minimum 1.9BMT steel or minimum JD4 seasoned timber. If the fixing condition is different from those conditions, interface spacing shall be reviewed and validated.

This certificate is **only valid** as a whole. Any information extracted from this certificate is not valid if standing alone.

We find the Installation of Flush Mounted System on Tile/Tin Roof (Pierced Fix Roof) for Australian use to be structurally sufficient based on the following conditions:

- Wind loads to AS/NZ1170.2:2011(R2016) Wind actions
- Wind region **A, B, C, D**
- Wind terrain category **2 & 3**
- Wind average recurrence interval of **200 years**
- Maximum building height **20m**
- The maximum assessed PV panel dimensions are **2300mm x 1200mm**
- Weight of the PV panel and array frame to be 15 kg/m²
- Material of Rails to be **AL6005-T6**
- The spacings are determined based on fixings into minimum JD4 seasoned timber and 1.9mm thick steel purlins
- For purlin thickness $t=1.5\text{mm}$, decrease the spacing to 79%
- For purlin thickness $t=1.2\text{mm}$, decrease the spacing to 70%
- Each PV panel to be installed using **2 rails** minimum in all circumstances
- No PV panel to be installed within 2xs from edges and ridge. "s" is the maximum gap between the underside of the panel and the roof surface when installed on the roof ($50\text{mm} \leq s \leq 300\text{mm}$)
- Installation of PV panels to be done in accordance with the PV panels installation manual
- The certification **excludes** assessment of roof structure and PV panels
- For Corrosivity Category C4, decrease the spacing to 92%
- For Corrosivity Category C5, decrease the spacing to 84%

Refer to attached summary table for interface spacing (Unit: mm)

NOTES:

- **The recommended spacing nominated in this certification is based on the capacity of the array frame and the fixing of array frames to the roof, not the roof structure and PV panels. It is the responsibility of the installer to adopt the most critical spacing.**
- **If any of the above conditions cannot be met, the structural engineer must be notified immediately.**
- **Tile interface is considered reaching its serviceability limit when then unloaded (residual) displacement reach approx. 30% of loaded displacement.**
- **The capacity of L Feet was obtained from test report no. MT-18/377, dated 16.04.2018 and provided by Melbourne Testing Services.**
- **The capacity of roof tile hook was obtained from test report no. MY-14/473, dated 04.07.2014 and provided by Melbourne Testing Services.**
- **The spacing shown in the interface tables shall be adjusted based on the assessment and requirement of the roof structures.**

Construction is to be carried out strictly in accordance with the manufacturers instructions. This work was designed by **Yesim Kocabalkan** in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles. This certificate is only valid till 24/08/2023. Gamcorp should be contacted for future validation. Contact Gamcorp for customised system or if the site conditions are not covered by this assessment.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd



L. Van Spaandonk
Principal Engineer
FIEAust CPEng NER 5038980
NT Registration: 244137ES
QLD Registration: 18703
VIC Registration: PE0001956
TAS Registration: CC7366

Attachments:

- Summary table for interface spacing, Flush mount - Tin Roof (Pierced Fix Roof);
- Summary table for interface spacing, Flush mount – Tile Roof



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Structural Design Documentation

Flush Array Frame System Spacing Table For Tin Roof

According to AS/NZS 1170.2-2011 (R2016)

with Rail ATL-TYN-355A (ATL-DR-355A)

within Australia

Terrain Category 2 & 3

For: ANTAI SOLAR AUSTRALIA PTY LTD
Level 1 suite 1.02/309 Pitt St
Sydney NSW 2000



Job Number: 9670-05
Date: 7 May 2021

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ISO 9001:2015 Registered Firm
Certificate No: AU1222

Job No: 9670-05
Client: ANTAI SOLAR AUSTRALIA PTY LTD
Project: Flush Array Frame System Spacing Table For Tin
Roof with Rail ATL-TYN-355A (ATL-DR-355A)
Address: within Australia

Australian Standards

AS/NZS 1170.0:2002 – Structural design actions, Part 0: General principles

AS/NZS 1170.1:2002 (R2016) – Structural design actions, Part 1: Permanent, imposed
and other actions

AS/NZS 1170.2:2011 (R2016) – Structural design actions, Part 2: Wind actions

AS/NZS 1664.1:1997 – Aluminium structures - Limit state design

AS 4100:2020 – Steel Structures

AS/NZS 4600:2018 – Cold-formed Steel Structures

Wind Terrain Category: WTC 2 & 3

Designed: JD

Checked: AA

Date: May-21

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
 Project: **Solar Array Interface Spacing Table**
 Address: **within Australia**
 Designed: **JD**

Job: **9670-05**
 Date: **May-21**

Checked: **AA**

Flush Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail: ATL-TYN-355A(ATL-DR-355A)
 Type of Interface: L-Feet
 Solar Panel Dimension: 2.3mx1.2m
 Terrain category: **2**

Roof Angle (Φ) - $\Phi < 5^\circ$

Wind Region	Building Height - H (m)							
	H \leq 5		5<H \leq 10		10<H \leq 15		15<H \leq 20	
	End	Central	End	Central	End	Central	End	Central
A	1270	1505	775	1275	665	1145	630	1080
B	835	1035	665	845	605	725	470	690
C	315	530	--	325	--	--	--	--
D	--	--	--	--	--	--	--	--

Roof Angle (Φ) - $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height - H (m)							
	H \leq 5		5<H \leq 10		10<H \leq 15		15<H \leq 20	
	End	Central	End	Central	End	Central	End	Central
A	1270	1600	775	1485	665	1355	630	1275
B	835	1225	665	995	605	900	470	840
C	315	625	--	515	--	465	--	325
D	--	400	--	--	--	--	--	--

Roof Angle (Φ) - $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height - H (m)							
	H \leq 5		5<H \leq 10		10<H \leq 15		15<H \leq 20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
A	1525	1785	1325	1670	1190	1600	1125	1565
B	1075	1685	880	1365	750	1225	715	1150
C	555	855	450	695	270	625	--	590
D	245	545	--	445	--	400	--	380

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
 Project: **Solar Array Interface Spacing Table**
 Address: **within Australia**
 Designed: **JD**

Job: **9670-05**
 Date: **May-21**

Checked: **AA**

Flush Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail: ATL-TYN-355A(ATL-DR-355A)
 Type of Interface: L-Feet
 Solar Panel Dimension: 2.3mx1.2m
 Terrain category: **3**

Roof Angle (Φ) – $\Phi < 5^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
A	1500	1620	1500	1620	1330	1530	1180	1465
B	1020	1260	1020	1260	880	1085	750	965
C	525	645	525	645	450	555	270	495
D	--	415	--	415	--	245	--	--

Roof Angle (Φ) – $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
A	1500	1725	1500	1725	1330	1630	1180	1560
B	1020	1495	1020	1495	880	1285	750	1140
C	525	760	525	760	450	655	270	585
D	--	485	--	485	--	420	--	365

Roof Angle (Φ) – $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
A	1645	1900	1645	1900	1555	1810	1485	1745
B	1310	1830	1310	1830	1130	1750	1005	1565
C	670	1040	670	1040	580	890	515	795
D	430	660	430	660	365	570	--	505

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
 Project: **Solar Array Interface Spacing Table**
 Address: **within Australia**
 Designed: **JD**

Job: **9670-05**
 Date: **May-21**

Checked: **AA**

General Notes

Note 1 Following components are satisfied to use according to AS/NZS 1170.2-2011(R2016)

Components	Part Number	Description
Rail	ATL-TYN-355A	As per drawing& test report provided by client
Splice	ATL-TYN-304/54	
L Feet	ATL-FWNY-05	

Note 2 Spacing calculated based on 1.9mm steel purlin or 35mm screw embedment length into timber (JD4 seasoned timber).

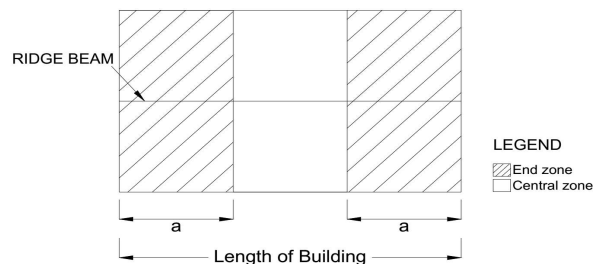
Note 3 Recommended screws

Metal Purlins/Battens 14g-10 TPI Teks screws or approved equivalent
 Timber Purlins/Battens 14g-10 TPI T17 screws or approved equivalent

Note 4 Maximum uplift wind pressure is limited to 5 kPa. "--" states more uplift pressure.

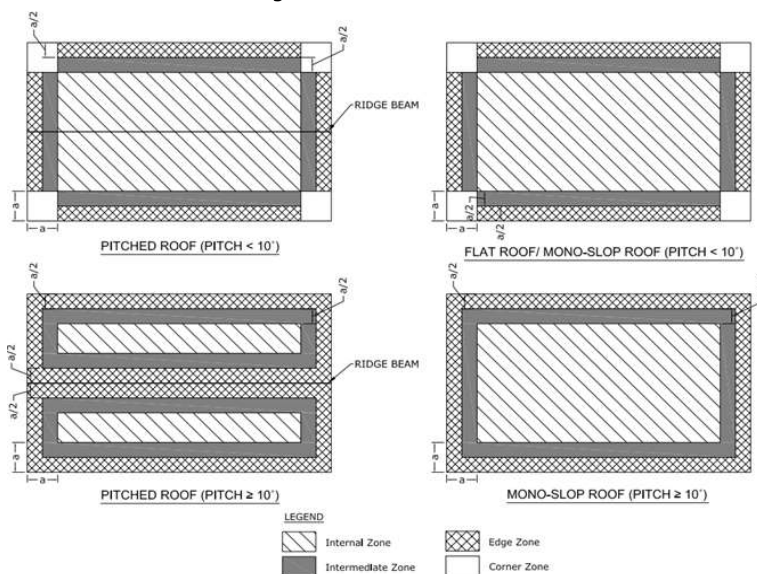
Note 5 Deflection is limited to Minimum of L/120 and 15mm

Note 6 For definition of (End/Central) roof zones, Refer Figure D9 of AS/NZS 1170.2:2011 (R2016) or Figure A as below
 For definition of intermediate and internal roof zones, Refer Figure B as below



In Figure A, the value of dimension "a" is 1/3 of the length of building

Figure A



In Figure B, the value of dimension "a" is the minimum of 0.2b, 0.2d and h. (b & d are building dimensions and h is its height)

Figure B

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
Project: **Solar Array Interface Spacing Table**
Address: **within Australia**
Designed: **JD**

Job: **9670-05**
Date: **May-21**

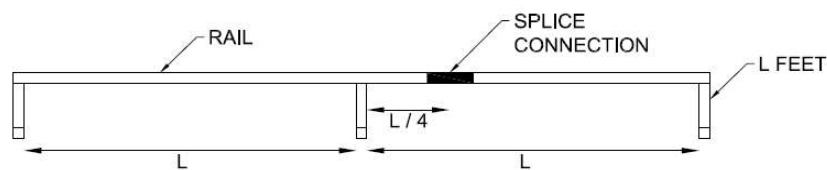
Checked: **AA**

Note 7

Terrain Category 2 (TC2) refers to open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare, e.g. farmland and cleared subdivisions with isolated trees and uncut grass.
Terrain Category 3 (TC3) refers to terrain with numerous closely spaced obstructions having heights generally from 3 m to 10 m. The minimum density of obstructions shall be at least the equivalent of 10 house-size obstructions per hectare, e.g. suburban housing, light industrial estates or dense forests.

Note 8

The optimised location of rail splice connection is at quarter length of the spacing of the interface. No Splice connection should be placed at the centre of spacing or over the interface.





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Structural Design Documentation

Flush Array Frame System Spacing Table For Tin Roof

According to AS/NZS 1170.2-2011 (R2016)

with Rail ATL-TYN-355B (ATL-DR-355B)

within Australia

Terrain Category 2 & 3

For: ANTAI SOLAR AUSTRALIA PTY LTD
Level 1 suite 1.02/309 Pitt St
Sydney NSW 2000



Job Number: 9670-05
Date: 7 May 2021

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Certificate No: AU1222

Job No: 9670-05
Client: ANTAI SOLAR AUSTRALIA PTY LTD
Project: Flush Array Frame System Spacing Table For Tin
Roof with Rail ATL-TYN-355B (ATL-DR-355B)
Address: within Australia

Australian Standards

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AS/NZS 1170.1:2002 (R2016) – Structural design actions, Part 1: Permanent, imposed
and other actions

AS/NZS 1170.2:2011 (R2016) – Structural design actions, Part 2: Wind actions

AS/NZS 1664.1:1997 – Aluminium structures - Limit state design

AS 4100:2020 – Steel Structures

AS/NZS 4600:2018 – Cold-formed Steel Structures

Wind Terrain Category: WTC 2 & 3

Designed: JD

Checked: AA

Date: May-21

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
 Project: **Solar Array Interface Spacing Table**
 Address: **within Australia**
 Designed: **JD**

Job: **9670-05**
 Date: **May-21**

Checked: **AA**

Flush Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail: ATL-TYN-355B(ATL-DR-355B)
 Type of Interface: L feet
 Solar Panel Dimension: 2.3mx1.2m
 Terrain category: **2**

Roof Angle (Φ) - $\Phi < 5^\circ$

Wind Region	Building Height - H (m)							
	H \leq 5		5<H \leq 10		10<H \leq 15		15<H \leq 20	
	End	Central	End	Central	End	Central	End	Central
A	1270	1415	620	1275	540	1145	--	650
B	675	1035	505	680	--	620	--	595
C	--	420	--	--	--	--	--	--
D	--	--	--	--	--	--	--	--

Roof Angle (Φ) - $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height - H (m)							
	H \leq 5		5<H \leq 10		10<H \leq 15		15<H \leq 20	
	End	Central	End	Central	End	Central	End	Central
A	1270	1505	620	1395	540	1340	--	1275
B	675	1225	505	995	--	715	--	680
C	--	625	--	395	--	245	--	--
D	--	270	--	--	--	--	--	--

Roof Angle (Φ) - $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height - H (m)							
	H \leq 5		5<H \leq 10		10<H \leq 15		15<H \leq 20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
A	1435	1700	1325	1570	1190	1505	--	1470
B	1075	1625	705	1365	640	1225	610	1150
C	550	855	--	695	--	625	--	590
D	--	545	--	435	--	270	--	--

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
 Project: **Solar Array Interface Spacing Table**
 Address: **within Australia**
 Designed: **JD**

Job: **9670-05**
 Date: **May-21**

Checked: **AA**

Flush Array Frame System Spacing Table for Tin Roof (mm)

Type of Rail: ATL-TYN-355B(ATL-DR-355B)
 Type of Interface: L feet
 Solar Panel Dimension: 2.3mx1.2m
 Terrain category: **3**

Roof Angle (Φ) – $\Phi < 5^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
A	1410	1525	1410	1525	1330	1440	1180	1380
B	1020	1260	1020	1260	705	1085	630	825
C	410	645	410	645	--	555	--	355
D	--	300	--	300	--	--	--	--

Roof Angle (Φ) – $5^\circ \leq \Phi \leq 30^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	End	Central	End	Central	End	Central	End	Central
A	1410	1625	1410	1625	1330	1535	1180	1465
B	1020	1495	1020	1495	705	1285	630	1140
C	410	760	410	760	--	655	--	585
D	--	485	--	485	--	300	--	--

Roof Angle (Φ) – $30^\circ \leq \Phi \leq 60^\circ$

Wind Region	Building Height – H (m)							
	H≤5		5<H≤10		10<H≤15		15<H≤20	
	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal	Intermediate	Internal
A	1550	1815	1550	1815	1460	1730	1400	1650
B	1310	1750	1310	1750	1130	1655	1005	1565
C	670	1040	670	1040	580	890	395	795
D	315	660	315	660	--	570	--	505

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
 Project: **Solar Array Interface Spacing Table**
 Address: **within Australia**
 Designed: **JD**

Job: **9670-05**
 Date: **May-21**

Checked: **AA**

General Notes

Note 1 Following components are satisfied to use according to AS/NZS 1170.2-2011(R2016)

Components	Part Number	Description
Rail	ATL-TYN-355B	As per drawing& test report provided by client
Splice	ATL-TYN-304/54	
L Feet	ATL-FWNY-05	

Note 2 Spacing calculated based on 1.9mm steel purlin or 35mm screw embedment length into timber (JD4 seasoned timber).

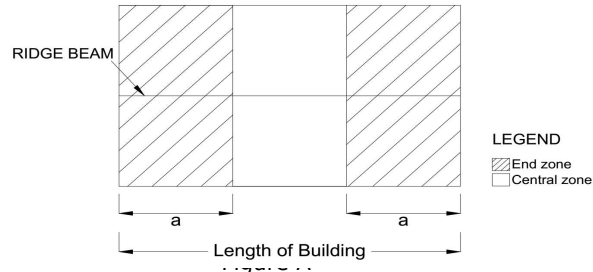
Note 3 Recommended screws

Metal Purlins/Battens 14g-10 TPI Teks screws or approved equivalent
 Timber Purlins/Battens 14g-10 TPI T17 screws or approved equivalent

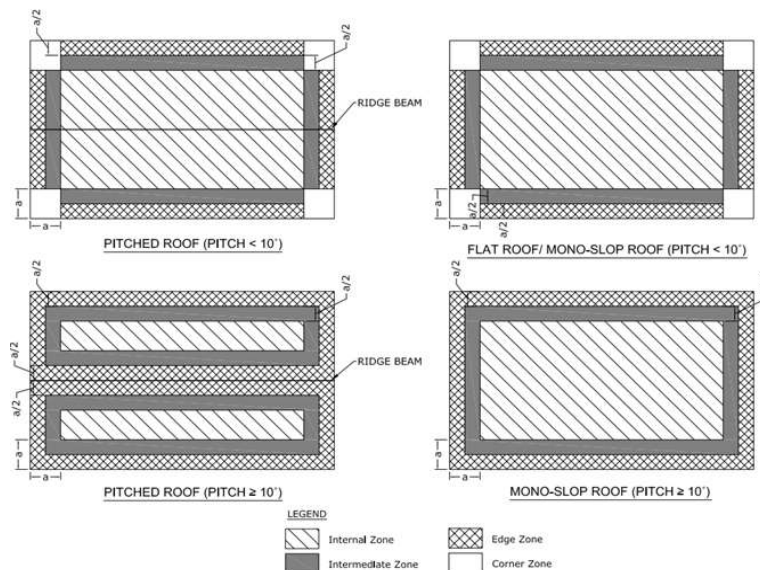
Note 4 Maximum uplift wind pressure is limited to 5 kPa. "--" states more uplift pressure.

Note 5 Deflection is limited to Minimum of L/120 and 15mm

Note 6 For definition of (End/Central) roof zones, Refer Figure D9 of AS/NZS 1170.2:2011 (R2016) or Figure A as below
 For definition of intermediate and internal roof zones, Refer Figure B as below



In Figure A, the value of dimension "a" is 1/3 of the length of building



In Figure B, the value of dimension "a" is the minimum of 0.2b, 0.2d and h. (b & d are building dimensions and h is its height)

Figure B

Client: **ANTAI SOLAR AUSTRALIA PTY LTD**
Project: **Solar Array Interface Spacing Table**
Address: **within Australia**
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Note 7

Terrain Category 2 (TC2) refers to open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare, e.g. farmland and cleared subdivisions with isolated trees and uncut grass.
Terrain Category 3 (TC3) refers to terrain with numerous closely spaced obstructions having heights generally from 3 m to 10 m. The minimum density of obstructions shall be at least the equivalent of 10 house-size obstructions per hectare, e.g. suburban housing, light industrial estates or dense forests.

Note 8

The optimised location of rail splice connection is at quarter length of the spacing of the interface. No Splice connection should be placed at the centre of spacing or over the interface.

