| Connecting Strength

K2 Base Report

Davison House, North St, Worthing BN11 1ER, REV3 11.11.26

Project address	Davison House, North St, Worthing BN11 1ER, UK
Company	BRADBURY ELECTRICAL
Address	unit 8 centenary industrial estate 01273 206207, BN2 4AW, Brighton
Tel.	+447921259281
Website	bradburyelectrical.co.uk
E-Mail	alex@bradburyelectrical.co.uk
Planner	ALEX BRADBURY
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About us

K2 Systems. Innovative mounting system from a strong team.

Since 2004 we have been developing pioneering and highly functional mounting system solutions for photovoltaic installations around the world. Our systems are designed in our own product development department where we continually optimize and adapt mounting systems to the ever-changing market.

A knowledgeable and friendly team

Just like a mountain climbing team, K2 Systems is built on mutual trust. This applies to our customer service as well as within the company itself, because we believe a trusting partnership leads to successful photovoltaic projects.

Our employees place total focus on the needs and wishes of our customer. This is true in all company departments.

10 locations and worldwide sales network

In our international team, everyone works together to provide customers with competent, comprehensive and entirely personalized service.

This is especially true in the constant training our employees undergo with regards to product optimization, quality assurance, or innovations in construction techniques.

Quality management and certificates

K2 Systems stands for Connecting Strength, the highest quality, and precision-crafted and customized components. Our customers and business partners deeply appreciate all of these factors. Three independent authorities have tested, confirmed, and certified our skills and components. External authorities are not the only ones to have put K2 Systems to the test. Our internal quality control ensures that all our products are subject to a constant review process.

These measures all ensure the outstanding quality standards that exemplify products from K2 Systems, and which we maintain through largely exclusive "Made in Germany" or "Made in Europe" practices.



Product guarantee

K2 Systems offers a 12-year product warranty on all products in its integrated range. The use of high quality materials and a three-level quality inspection ensure these standards.

In a nutshell

As roof-top specialists, we offer effective and economical solutions for roofs all around the world and provide professional, fast and reliable support for our customers in the solar industry.

The static report is not including module and building verification.

Project overview

Roofs

Roof	System	Module	Height	Quantity	Total power
Area 1 Tile	SingleRail	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	8.00 m	25	11.625 kWp
Area 2 Flat	D-Dome 6.10 Xpress	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	6.00 m	12	5.58 kWp
Area 3 Flat	D-Dome 6.15 Xpress	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	6.00 m	8	3.72 kWp
Area 4 Tile	SingleRail	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	5.00 m	18	8.37 kWp
Total				**63**	**29.29 kWp**

Project information

Address	**Davison House, North St, Worthing BN11 1ER, UK**
Author	**ALEX BRADBURY**

Load settings

Design method	**BS EN**
Failure consequence class (CC)	**CC1**
Design working life	**25 years**
Terrain category	**Town Terrain**
Basic wind speed	**22.0 m/s**
Distance to shoreline	**5.00 km**
Distance inside town terrain	**0.00 km**
Snow load zone	**3**
Snow load on ground level	**0.50 kN/m²**

THE PROJECT IS VERIFIED.
The selected mounting system can be installed as planned
Thank you for choosing a K2 mounting system.

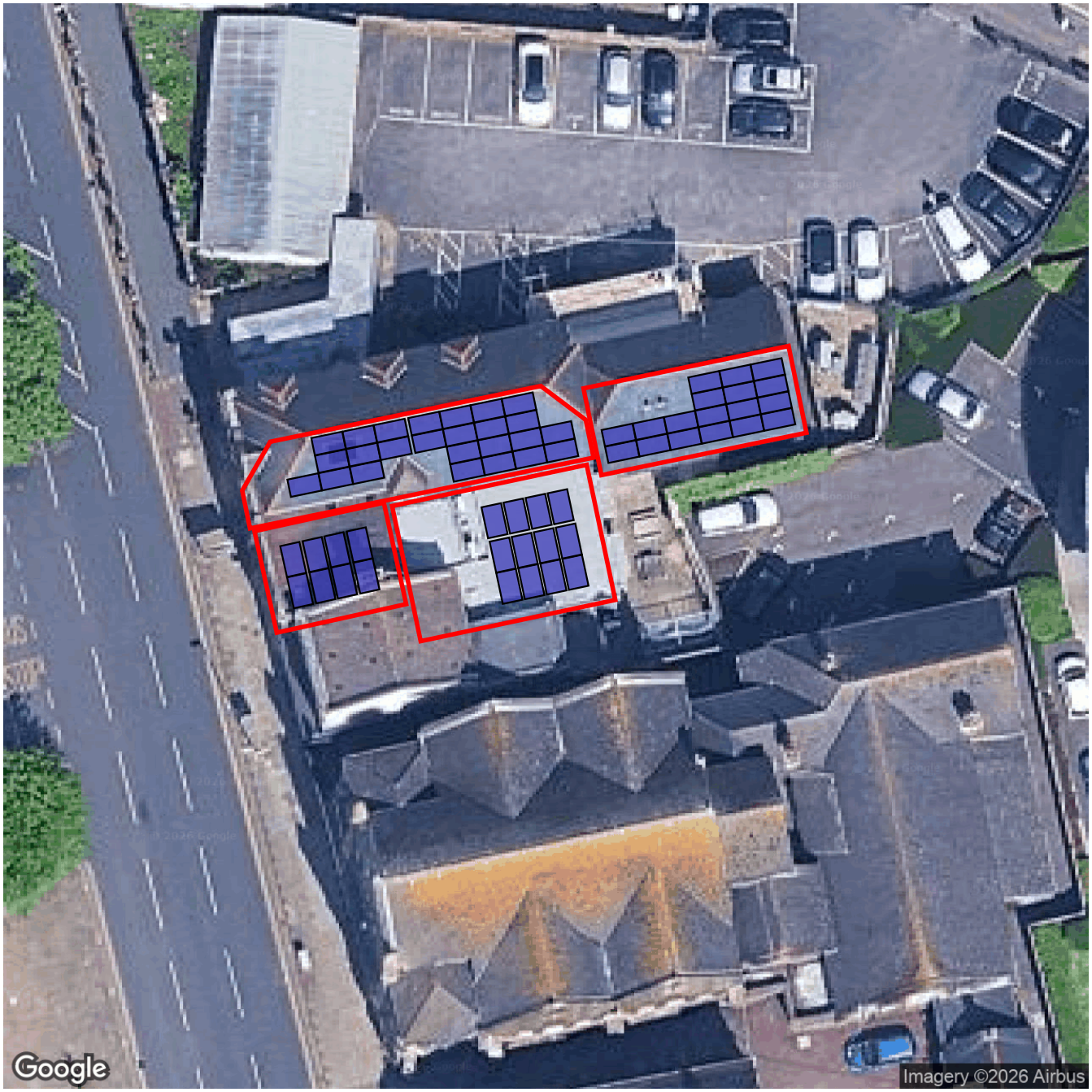
Area 2

Project overview

Warnings

- No porter was selected for the ballast. The safe positioning of the ballast is your responsibility.

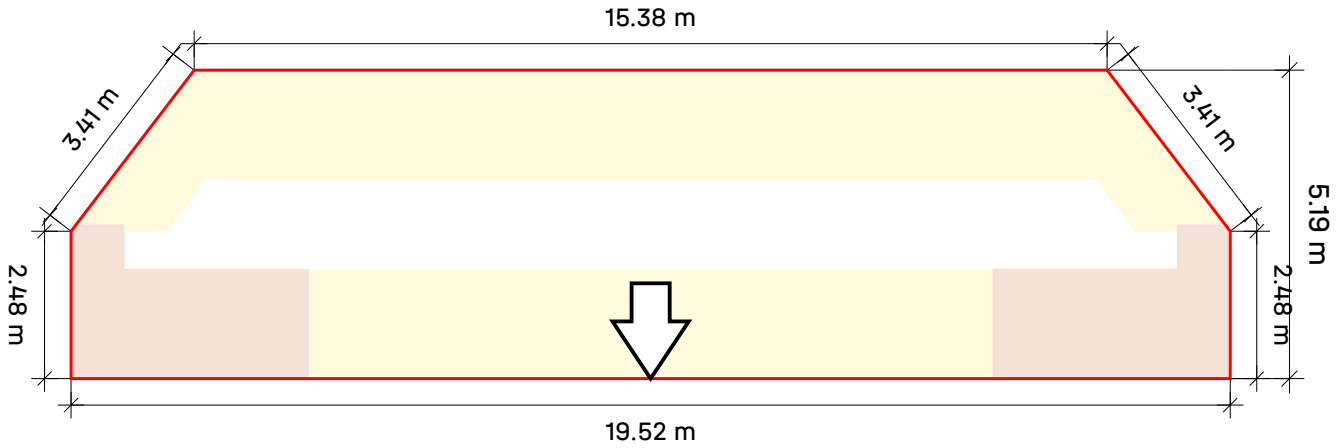
Davison House, North St, Worthing BN11 1ER, REV3 11.11.26



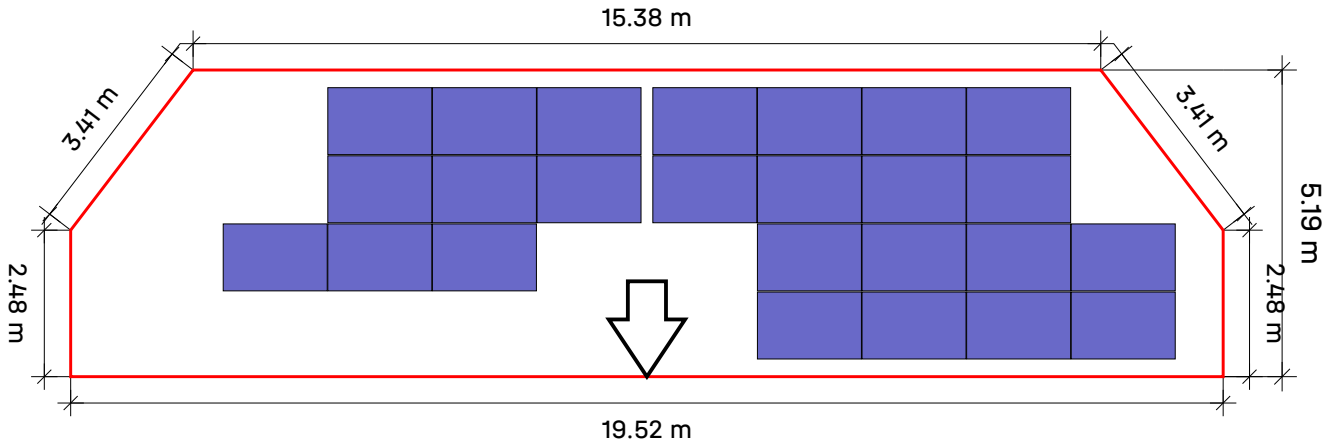
Project information

Address	**Davison House, North St, Worthing BN11 1ER, UK**
Author	**ALEX BRADBURY**

Area 1



Area 1



Roof	System	Module	Height	Quantity	Total power
Area 1 Tile	SingleRail	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	8.00 m	25	11.625 kWp

Area 1 | Assembly plan

Base rail

	Whole rails		Rail cutting		
Type	Total rail length	Quantity 3.65 m	Part of rail / Rest	Length	Rest
5*A	6.528 m	1*3.65 m	3.650	2.878 from 3.650	0.762
2*B	1.212 m		3.650	1.212 from 3.650	2.428
2*C	1.212 m		2.428	1.212 from 2.428	1.206
2*D	4.756 m	1*3.65 m	1.206	1.106 from 1.206	0.090
1*E	4.756 m	1*3.65 m	3.650	1.106 from 3.650	2.534
1*F	4.756 m	1*3.65 m	2.534	1.106 from 2.534	1.418

1 cm is viewed as lost for each cutting

Red numbers are leftover rails which will not be used any longer.

Upper rail

	Whole rails		Rail cutting		
Type	Total rail length	Quantity 3.65 m	Part of rail / Rest	Length	Rest
4*A	3.542 m		3.650	3.542 from 3.650	0.098
6*B	2.388 m		3.650	2.388 from 3.650	1.252
2*C	1.234 m		1.252	1.234 from 1.252	0.008
4*D	4.696 m	1*3.65 m	1.252	1.046 from 1.252	0.196
1*E	4.696 m	1*3.65 m	3.650	1.046 from 3.650	2.594
1*F	4.696 m	1*3.65 m	2.594	1.046 from 2.594	1.538

Fastener Spacing

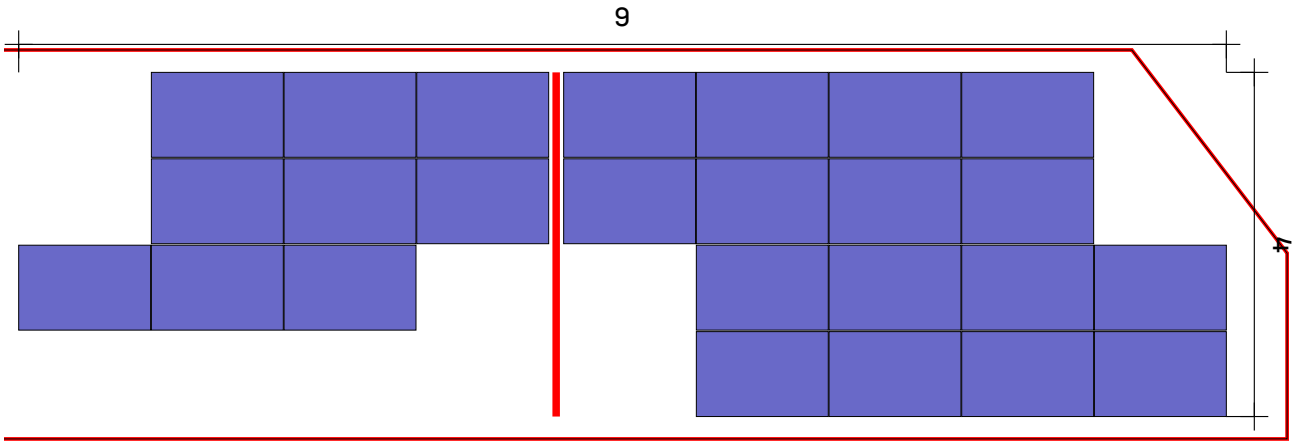
Module	Array	Distance	Maximum cantilever length [m]	Maximum fastener spacing [m]
1	Inner area	1.20 m	0.451	1.482
1	Ridge	1.20 m	0.451	1.482
1	Gableboard	1.20 m	0.451	1.457
1	Eaves	1.20 m	0.444	1.451
1	Corner region (eave)	1.20 m	0.427	1.365

Area 1 | Assembly plan

Module arrays

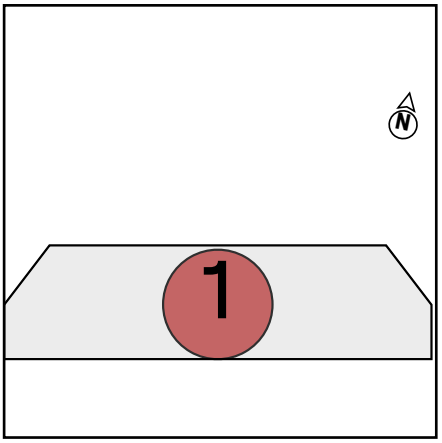
Module array	Width[m]	Length[m]	Width in modules	Length in modules
1	17.90	4.60	9	3

Area 1 | Module array 1

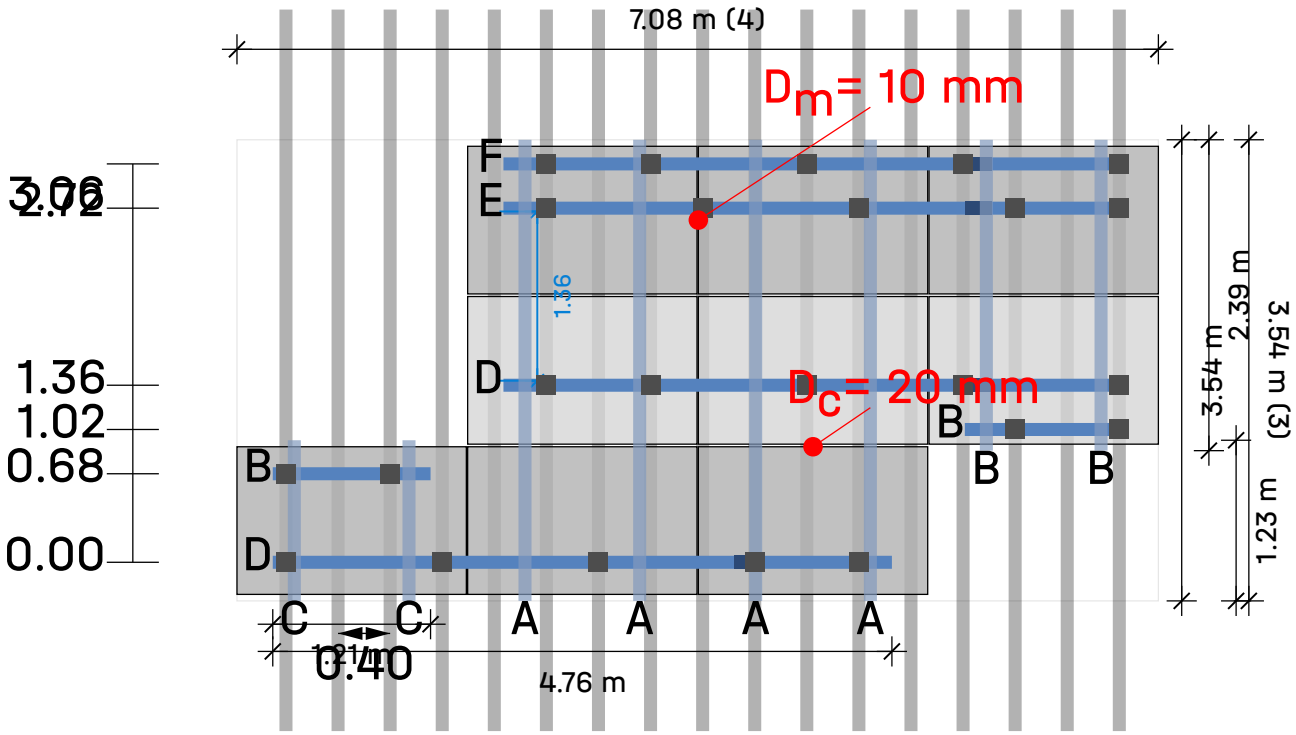


Roof (1) Module array 1

Mounting system	SingleRail
Module	25(11.625 kWp) x TSM-465NED9R.28 (Vertex S+ Shield)
Row spacing	1.77 m



Area 1 | Module array 1 | Module block 1

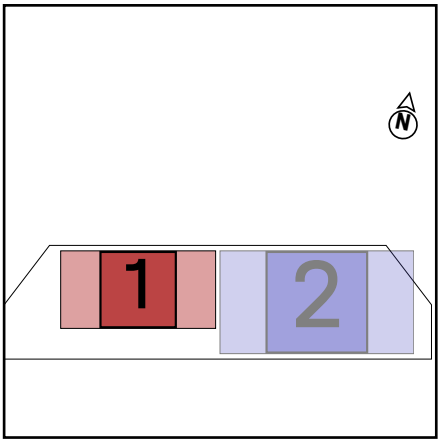


Roof (1) Module array 1 Module block 1

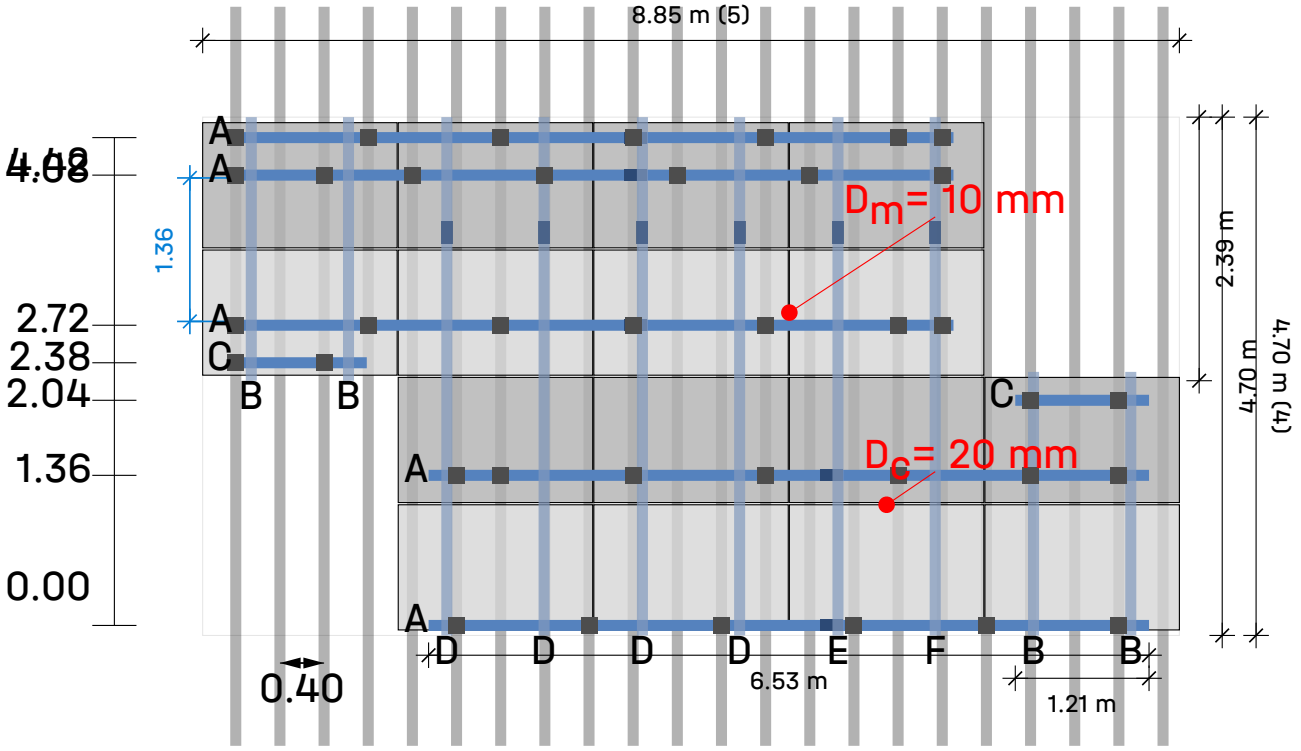
Modules (4 × 3) - 3 = **9**

Legend

- Fastener
- Mounting rail: K2 SingleRail 36
- Mounting rail (Upper): K2 SolidRail UltraLight 32
- Rail Distance [m]
- Dist. to neighbour module block/array [m]
- D_c Distance for clamping between modules
- D_m Distance between modules



Area 1 | Module array 1 | Module block 2

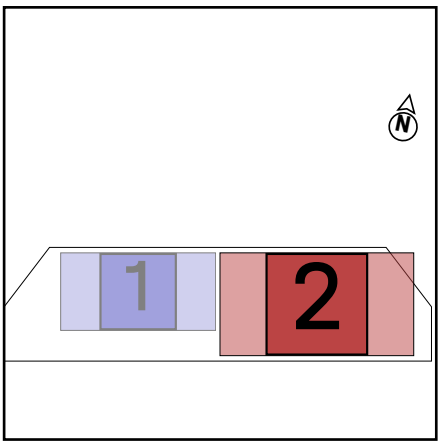


Roof (1) Module array 1 Module block 2

Modules (5 × 4) - 4 = **16**

Legend

- Fastener
- Mounting rail: K2 SingleRail 36
- Mounting rail (Upper): K2 SolidRail UltraLight 32
- Rail Distance [m]
- Dist. to neighbour module block/array [m]
- D_c Distance for clamping between modules
- D_m Distance between modules



Results | Area 1

Roof	System	Module	Height	Quantity	Total power
Area 1 Tile	SingleRail	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	8.00 m	25	11.625 kWp

Module

Name	TSM-465NED9R.28 (Vertex S+ Shield)
Manufacturer	Trina Solar Energy
Output power	465 Wp
Dimensions	1,762×1,134×30 mm
Weight	27.0 kg

Components

Fastener	SingleHook 3S
Base rails	K2 SingleRail 36
Upper rail	K2 SolidRail UltraLight 32

Material values

For material information refer to the product catalogue:
K2 Catalogue (k2-systems.com)

Loads on modules (Module dimensioning)

No. Module array	Roof areas	A-TrA [m²]	Ultimate state [Pa]				Serviceability [Pa]			
			Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥	Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥
1	Inner area	2.00	904.5	404.0	-374.5	79.3	715.9	320.6	-264.1	79.3
1	Ridge	2.00	904.5	404.0	-545.1	79.3	715.9	320.6	-397.9	79.3
1	Gableboard	2.00	904.5	404.0	-971.6	79.3	715.9	320.6	-732.4	79.3
1	Eaves	2.00	955.7	404.0	-374.5	79.3	756.0	320.6	-264.1	79.3
1	Corner region (eave)	2.00	1,115.7	404.0	-886.3	79.3	881.5	320.6	-665.5	79.3

Results | Area 1

Base rail - Utilisation result

No. Module array	Roof areas	Ultimate limit state Pr σ[%]	CL σ[%]	Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	BR [m]	Maximum values CL L_{max}[m]	Fst Fst D_{max}[m]
1	Inner area	65.6	0.0	70.6	46.5	1.200	1.360	0.451	1.482
1	Ridge	65.6	24.8	70.6	46.5	1.200	1.360	0.451	1.482
1	Gableboard	65.6	2.4	82.4	46.5	1.200	1.360	0.451	1.457
1	Eaves	68.4	15.3	73.9	48.9	1.200	1.360	0.444	1.451
1	Corner region (eave)	77.3	20.0	83.8	56.5	1.200	1.360	0.427	1.365

Upper rail - Utilisation result

No. Module array	Roof areas	Ultimate limit state Pr σ[%]	CL σ[%]	Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	UR [m]	Maximum values CL L_{max}[m]	Fst Fst D_{max}[m]
1	Inner area	52.7	9.4	---	59.5	1.360	---	0.455	1.587
1	Ridge	52.7	4.9	---	59.5	1.360	---	0.455	1.587
1	Gableboard	55.7	10.0	---	60.9	1.360	---	0.452	1.578
1	Eaves	55.6	13.2	---	62.8	1.360	---	0.448	1.565
1	Corner region (eave)	64.7	15.4	---	73.3	1.360	---	0.429	1.506

Pr	**Profile**	Fst D_{max}	**Maximum fastener spacing [m]**
Fst	**Fastener**	BR	**Base rail**
σ	**Stress**	UR	**Upper rail**
f	**Deflection**	Usab.	**serviceability limit state**
F	**Force**	CL	**Cantilever**
CL/L_{max}	**Maximum cantilever length [m]**		

Results | Area 1

Important information

- The dimensioning of the timber construction screws is not part of this structual analysis. This must be done on site. If the rafters are made of solid wood, glued laminated timber, cross laminated timber and laminated veneer lumber, assembly with 2 timber construction screws is usually sufficient. The edge distances must be uphold in accordance with the manufacturer's specifications.
- The structure was statically verified in accordance with Eurocode 9: Design of aluminium structures (EN 1999-1-1:2021) and Eurocode 3: Design of steel structures (EN 1993-1-1:2025) and offers sufficient load-bearing capacity and stability for the loads specified in the chapter 'Maximum actions on the components'.
- Adjustment factor for wind load regarding service life period, fW, is according to EN 1991-1-4/ NA
- Adjustment factor for snow load regarding service life period, fS, is according to EN 1991-1-3/ NA
- The structural design complies with BS EN 1990 - Basis of Structural Design.
- Snow loads are determined in accordance with National Annex BS NA EN 1991-1-3 (2018) - UK National Annex to EC1 - Action on structures - general actions - snow loads.
- Wind loads are determined in accordance with National Annex BS NA EN 1991-1-4 - UK National Annex to EC1 - Action on structures, general actions - wind actions.
- Service life is recognised according to 'Eurocode EN 1991:3 – Action on structures, Snow loads' and 'Eurocode EN 1991:4 – Actions on structures, Wind actions'. Subject to the Building Regulations and for security-relevant reasons the installation has to be dismantled at the end of its service life.
- Failure consequence class is considered according to 'Eurocode EN 1990 – Basis of structural design'.
- The person responsible for the execution of the work must check the load assumptions made with the conditions on site. If deviations are found, the person who prepared the static calculation must be consulted immediately.
- Please note our General Terms and Conditions of Use (TCU-E) in their currently valid version, available at: https://k2-systems.com/en/digital-services/general-terms-and-conditions-of-use-for-entrepreneurs-tcu-e/
  Please note in particular § 1, Special provisions for K2 Base, clause 3 (''Technical and specialist requirements on the Customer's premises.''), § 6 (''Limitation of warranty'') and § 7 (''Limitation of liability'').
- All instructions and requirements of the static calculations must be observed.
- Compliance with the regulations and requirements of the building permit and the building trade associations must be ensured during the execution of all work.
- All connections and anchoring measures must be carried out using approved and standardized connecting elements or parts only.
- Subordinate components that have not been verified must be implemented structurally.
- The ''General Rules'' for corrosion protection design of the structure are strongly recommended for application during implementation.
- The structure may only be climbed by trained and authorized personnel wearing appropriate safety equipment. Unauthorized use of the structure poses a risk of falling.

Structural analysis report | Area 1

General information

Name	**Davison House, North St, Worthing BN11 1ER, REV3 11.11.26**
Mounting system	**SingleRail**
Author	**ALEX BRADBURY**

Location information

Address	**Davison House, North St, Worthing BN11 1ER, UK**
Ground elevation	**9.86 m**

Roof information

Building height	**8.00 m**
Roof type	**Half Hip roof**
Roof pitch	**30°**
Roof covering	**Tile**
Min. roof edge distance	**0.00 m**
Rafter Spacing	**0.400 m**
Rafter width	**40.0 mm**
set edge rafter left	**No**
Rafter spacing left	**160.0 mm**
set edge rafter right	**No**
Rafter spacing right	**160.0 mm**
Batten spacing	**340.0 mm**

Loads

Design method	**BS EN**
Failure consequence class (CC)	**CC1**
Design working life	**25 years**
Terrain category	**Town Terrain**
Distance to shoreline	**5.00 km**
Distance inside town terrain	**0.00 km**

Wind load

Velocity pressure, 50 years	$q_{p,50}$	**= 0.726 kN/m²**
Adjustment factor for service life	f_w	**= 1.000**
Velocity pressure, 25 years	$q_{p,25}$	**= 0.669 kN/m²**

Structural analysis report | Area 1

Roof areas

No. Module array	Roof areas	Load impact area [m²]	maxCpe	minCpe	wind pressure [kN/m²]	wind suction [kN/m²]
1	Inner area	10.00	0.400	-0.600	0.268	-0.401
1	Ridge	10.00	0.400	-0.800	0.268	-0.535
1	Gableboard	10.00	0.400	-1.300	0.268	-0.870
1	Eaves	10.00	0.500	-0.600	0.335	-0.401
1	Corner region (eave)	10.00	0.800	-1.200	0.535	-0.803

Snow load

Snow load zone		3
Snow guard		No
Snow load on ground level	s_k	= 0.500 kN/m²
Shape coefficient for snow	μ_i	= 1.200
Factor for roof pitch	d_i	= 0.866
Snow load on roof, 50 year	$s_{i,50}$	= 0.520 kN/m²
Adjustment factor for service life	f_s	= 1.000
Snow load on roof, 25 years	$s_{i,25}$	= 0.483 kN/m²

Dead load

Weight of module	G_M	= 27.0 kg
Weight of mounting system per module		= 5.30 kg
Module area	A_M	= 2.00 m²
Dead weight of module per m²		= 13.51 kg/m²
Dead weight of mounting system per m²		= 2.65 kg/m²
Total dead load (excl. ballast) per m²		= 0.16 kN/m²

Structural analysis report | Area 1

Load combinations

Ultimate limit state

Partial safety factor unfavourable permanent load	$\gamma_{G,sup}$ = 1.35
Partial safety factor favourable permanent load	$\gamma_{G,inf}$ = 1.00
Partial safety factor destabilising permanent load	$\gamma_{G,dst}$ = 1.10
Partial safety factor stabilising permanent load	$\gamma_{G,stb}$ = 0.90
Partial safety factor variable loads	γ_{Q} = 1.50
Combination coefficient with regards to wind	$\psi_{0,W}$ = 0.60
Combination coefficient with regards to snow	$\psi_{0,S}$ = 0.50
Importance factor permanent	$\kappa_{FI,G}$ = 0.90
Importance factor variable	$\kappa_{FI,Q}$ = 0.85
Characteristic dead weight	G_k
Characteristic snow load on the roof	$S_{i,n}$
Characteristic wind load	W_k

Load case combination 01	LCC 01_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * S_{i,n}$
Load case combination 02	LCC 02_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Pressure}$
Load case combination 03	LCC 03_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (W_{k,Pressure} + \psi_{0,S} * S_{i,n})$
Load case combination 04	LCC 04_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (S_{i,n} + \psi_{0,W} * W_{k,Pressure})$
Load case combination 06	LCC 06_uls	$= \gamma_{G,inf} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Suction}$

Serviceability limit state

Combination coefficient with regards to wind	$\psi_{0,W}$ = 0.60
Combination coefficient with regards to snow	$\psi_{0,S}$ = 0.50

Load case combination 01	LCC 01_sls	$= G_k + S_{i,n}$
Load case combination 02	LCC 02_sls	$= G_k + W_{k,Pressure}$
Load case combination 03	LCC 03_sls	$= G_k + W_{k,Pressure} + \psi_{0,S} * S_{i,n}$
Load case combination 04	LCC 04_sls	$= G_k + S_{i,n} + \psi_{0,W} * W_{k,Pressure}$
Load case combination 06	LCC 06_sls	$= G_k + W_{k,Suction}$

Structural analysis report | Area 1

Maximum load on modules (Mounting system dimensioning)

No. Module array	Roof areas	A-TrA [m²]	Ultimate state [kN/m²]				Serviceability [kN/m²]			
			Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥	Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥
1	Inner area	10.00	0.905	0.404	-0.375	0.079	0.716	0.321	-0.264	0.079
1	Ridge	10.00	0.905	0.404	-0.545	0.079	0.716	0.321	-0.398	0.079
1	Gableboard	10.00	0.905	0.404	-0.972	0.079	0.716	0.321	-0.732	0.079
1	Eaves	10.00	0.956	0.404	-0.375	0.079	0.756	0.321	-0.264	0.079
1	Corner region (eave)	10.00	1.116	0.404	-0.886	0.079	0.882	0.321	-0.666	0.079

Max. load on fastener

No. Module array	Roof areas	A-TrA [m²]	Ultimate state [kN]				Serviceability [kN]			
			Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥	Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥
1	Inner area	10.00	1.550	0.692	-0.642	0.136	1.227	0.549	-0.453	0.136
1	Ridge	10.00	1.550	0.692	-0.934	0.136	1.227	0.549	-0.682	0.136
1	Gableboard	10.00	1.550	0.692	-1.665	0.136	1.227	0.549	-1.255	0.136
1	Eaves	10.00	1.638	0.692	-0.642	0.136	1.296	0.549	-0.453	0.136
1	Corner region (eave)	10.00	1.912	0.692	-1.519	0.136	1.511	0.549	-1.140	0.136

Resistance values of components

Base rail

Base rail	A [cm²]	I_y [cm⁴]	I_z [cm⁴]	W_y [cm³]	W_z [cm³]
K2 SingleRail 36	2.850	4.02	6.37	2.14	3.09

Upper rail

Upper rail	A [cm²]	I_y [cm⁴]	I_z [cm⁴]	W_y [cm³]	W_z [cm³]
K2 SolidRail UltraLight 32	2.610	2.59	5.54	1.57	2.84

Fastener

Fastener	$R_{D,Uplift,Perpendicular}$ [kN]	$R_{D,Pressure,Perpendicular}$ [kN]	$R_{D,Pressure,Parallel}$ [kN]
SingleHook 3S	2.17	2.67	2.40

Structural analysis report | Area 1

Base rail - Utilisation result

No. Module array	Roof areas	Ultimate limit state Pr σ[%]	Ultimate limit state CL σ[%]	Ultimate limit state Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	Distances BR [m]	Maximum values CL L_{max}[m]	Maximum values Fst Fst D_{max}[m]
1	Inner area	65.6	0.0	70.6	46.5	1.200	1.360	0.451	1.482
1	Ridge	65.6	24.8	70.6	46.5	1.200	1.360	0.451	1.482
1	Gableboard	65.6	2.4	82.4	46.5	1.200	1.360	0.451	1.457
1	Eaves	68.4	15.3	73.9	48.9	1.200	1.360	0.444	1.451
1	Corner region (eave)	77.3	20.0	83.8	56.5	1.200	1.360	0.427	1.365

Upper rail - Utilisation result

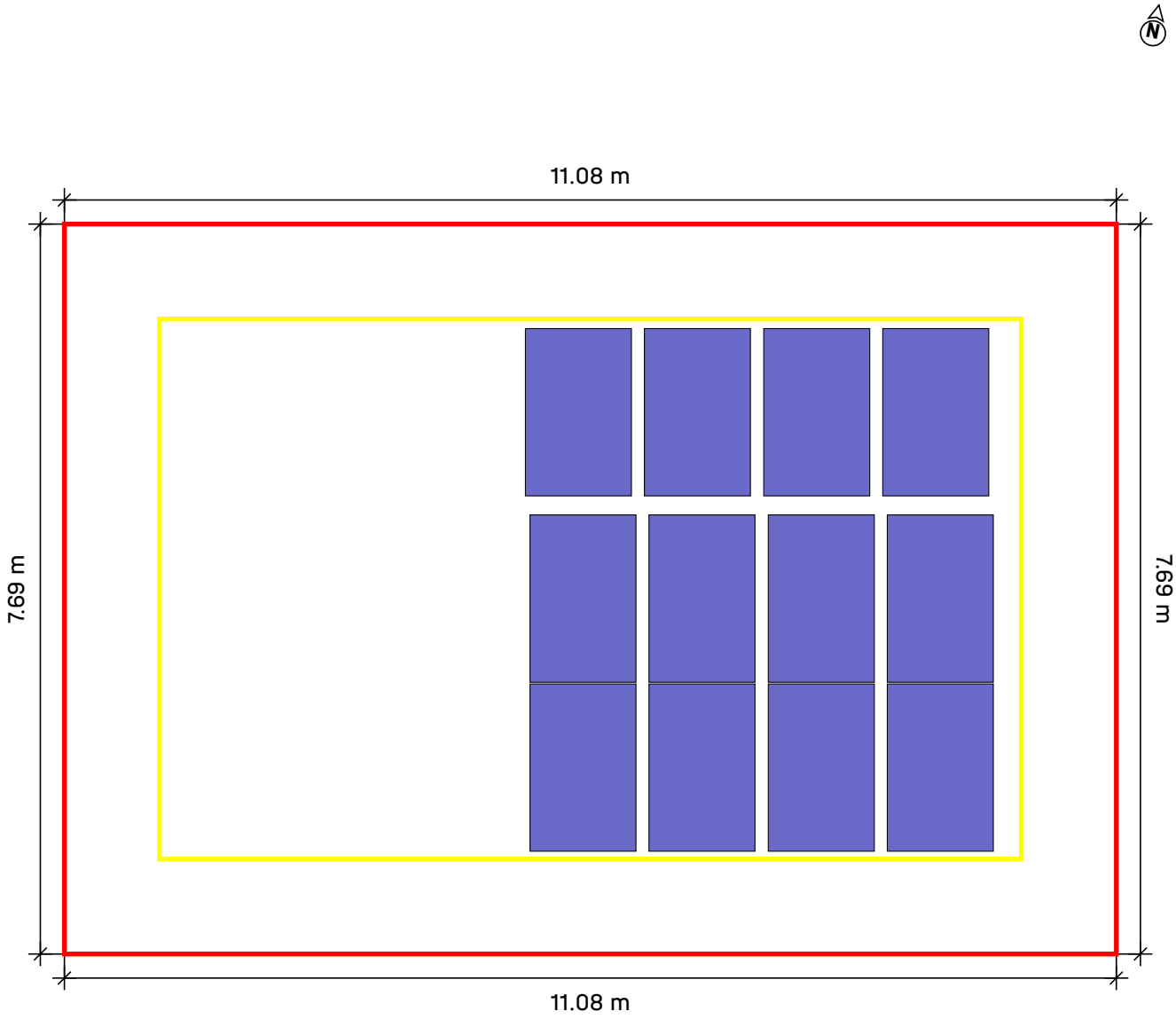
No. Module array	Roof areas	Ultimate limit state Pr σ[%]	Ultimate limit state CL σ[%]	Ultimate limit state Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	Distances UR [m]	Maximum values CL L_{max}[m]	Maximum values Fst Fst D_{max}[m]
1	Inner area	52.7	9.4	---	59.5	1.360	---	0.455	1.587
1	Ridge	52.7	4.9	---	59.5	1.360	---	0.455	1.587
1	Gableboard	55.7	10.0	---	60.9	1.360	---	0.452	1.578
1	Eaves	55.6	13.2	---	62.8	1.360	---	0.448	1.565
1	Corner region (eave)	64.7	15.4	---	73.3	1.360	---	0.429	1.506

Pr	**Profile**	Fst D_{max}	**Maximum fastener spacing [m]**
Fst	**Fastener**	BR	**Base rail**
σ	**Stress**	UR	**Upper rail**
f	**Deflection**	Usab.	**serviceability limit state**
F	**Force**	CL	**Cantilever**
CL/L_{max}	**Maximum cantilever length [m]**		

Area 1 | Bill of material

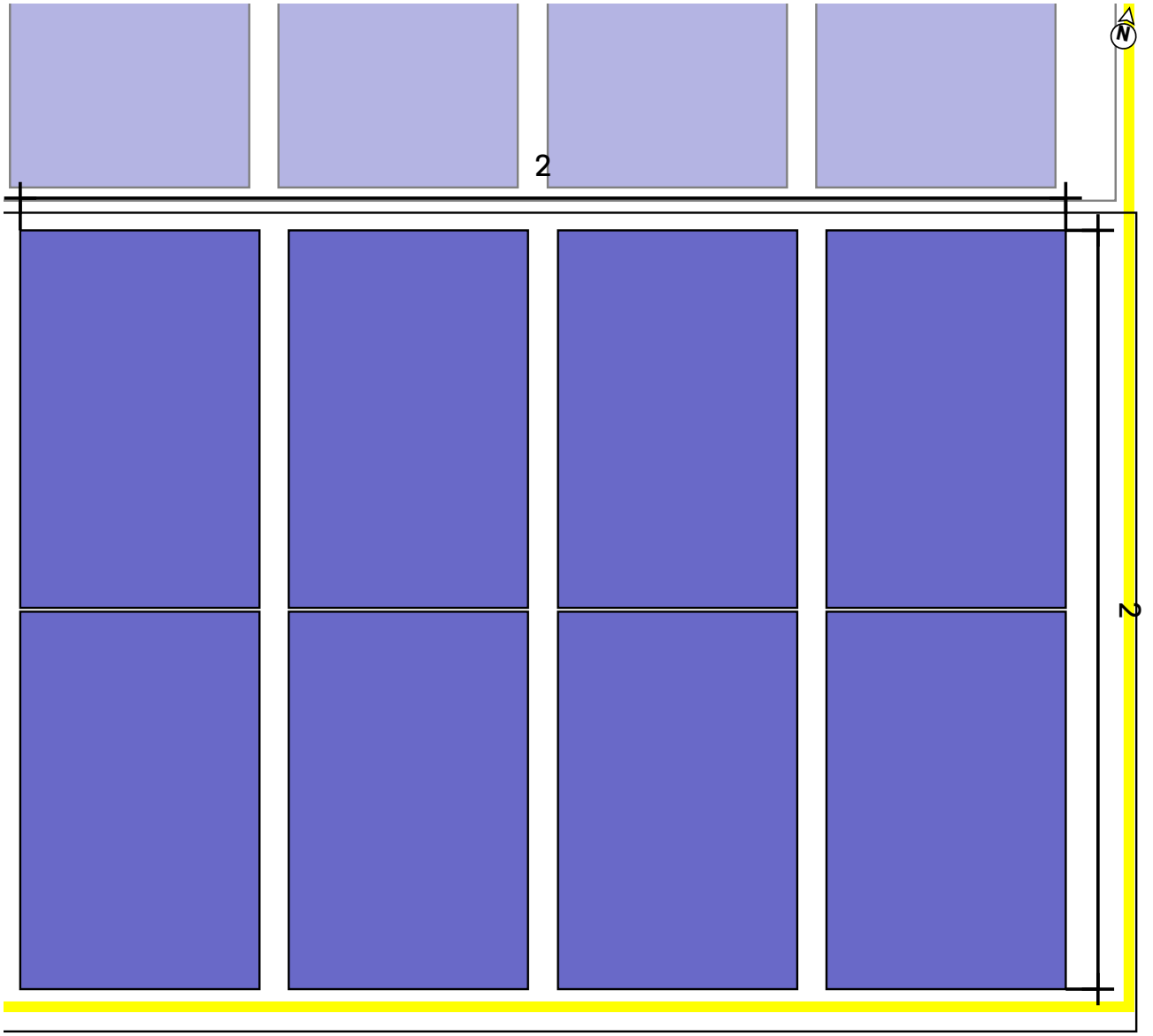
Position	Item no.	Item description	Quantity	Weight
1	2004112	Wood screw 8×100	124	3.3 kg
2	2003215	SingleHook 3S	62	32.9 kg
3	1004767	SingleRail 36 End Cap	26	0.2 kg
4	2004796	SolidRail UltraLight End Cap	36	0.2 kg
5	2003523	BlackCover SingleRail 36	26	0.7 kg
6	2004797	BlackCover SolidRail UltraLight	36	0.9 kg
7	2005041	Alpha PV-Clip	25	0.2 kg
8	2004057	K2 StairPlate Set	25	3.3 kg
9	2004258	SingleRail 36; 3.65 m	17	47.8 kg
10	2003605	SingleRail 36/50 RailConnector Set	9	2.2 kg
11	1004110	SolidRail CrossConnector Set	72	10.7 kg
12	2004540	K2 Clamp MC 25-40, Black	32	2.3 kg
13	2004545	K2 Clamp EC 25-40 Black	36	2.6 kg
14	2004264	SolidRail UltraLight; 3.65 m	17	43.7 kg
15	1004107	SolidRail UtraLight+Light RailConnector Set	6	1.4 kg
Total				**152.2 kg**

Area 2



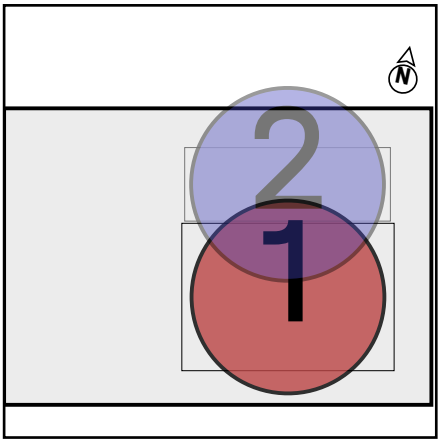
Roof	System	Module	Height	Quantity	Total power
Area 2 Flat	D-Dome 6.10 Xpress	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	6.00 m	12	5.58 kWp

Area 2 | Module array 1

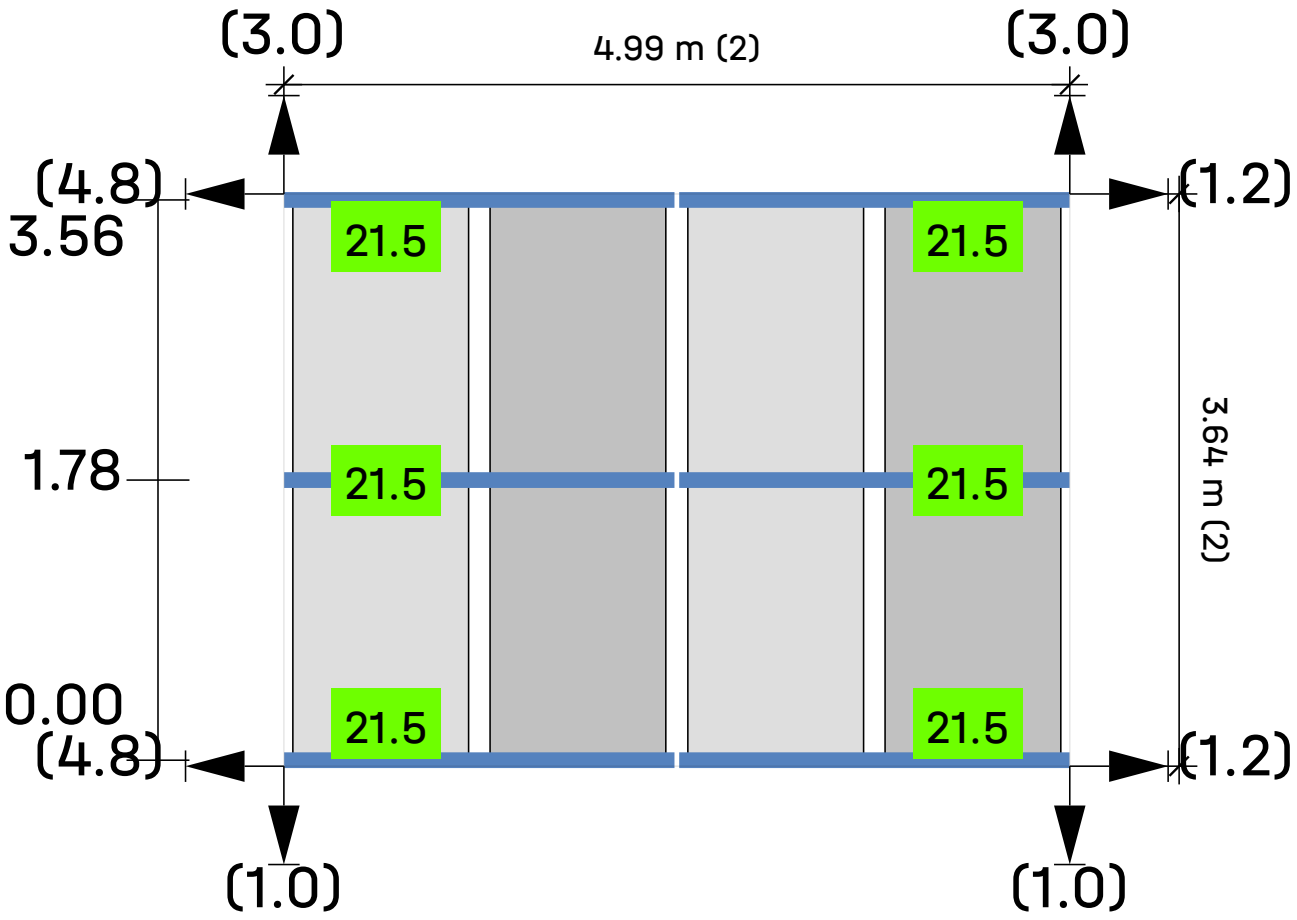


Roof (2) Module array (1)

Mounting system	D-Dome 6.10 Xpress
Module	8(3.72 kWp) x TSM-465NED9R.28 (Vertex S+ Shield)
Row spacing	2.51 m
service corridor	0.14 m



Area 2 | Module array 1 | Module block 1

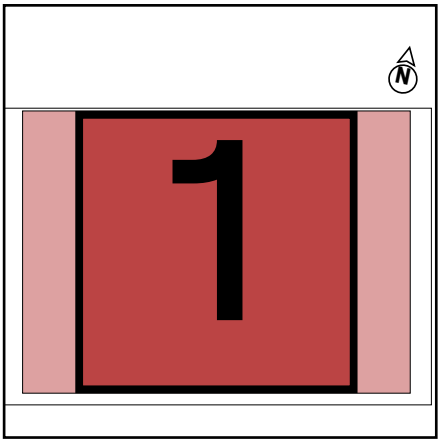


Roof (2) Module array (1) Module block 1

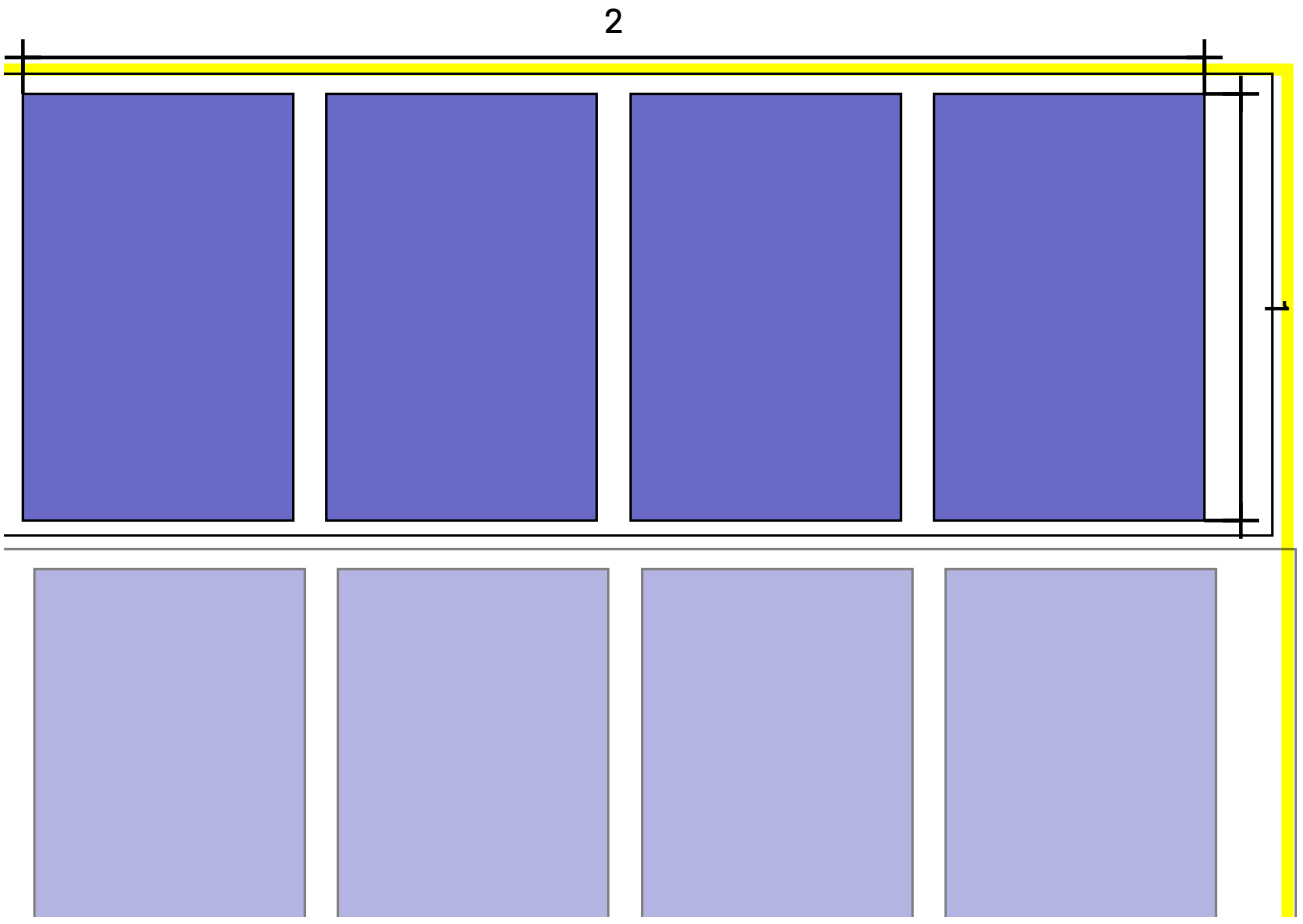
Modules 2 × 2 = **4**

Legend

- Mounting rail
- Row distance [m]
- Distance to roof edge [m]
- 25 Ballast in kilogram (kg)
- Porter Ballast

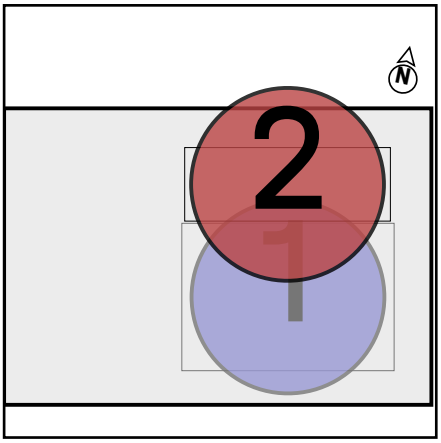


Area 2 | Module array 2

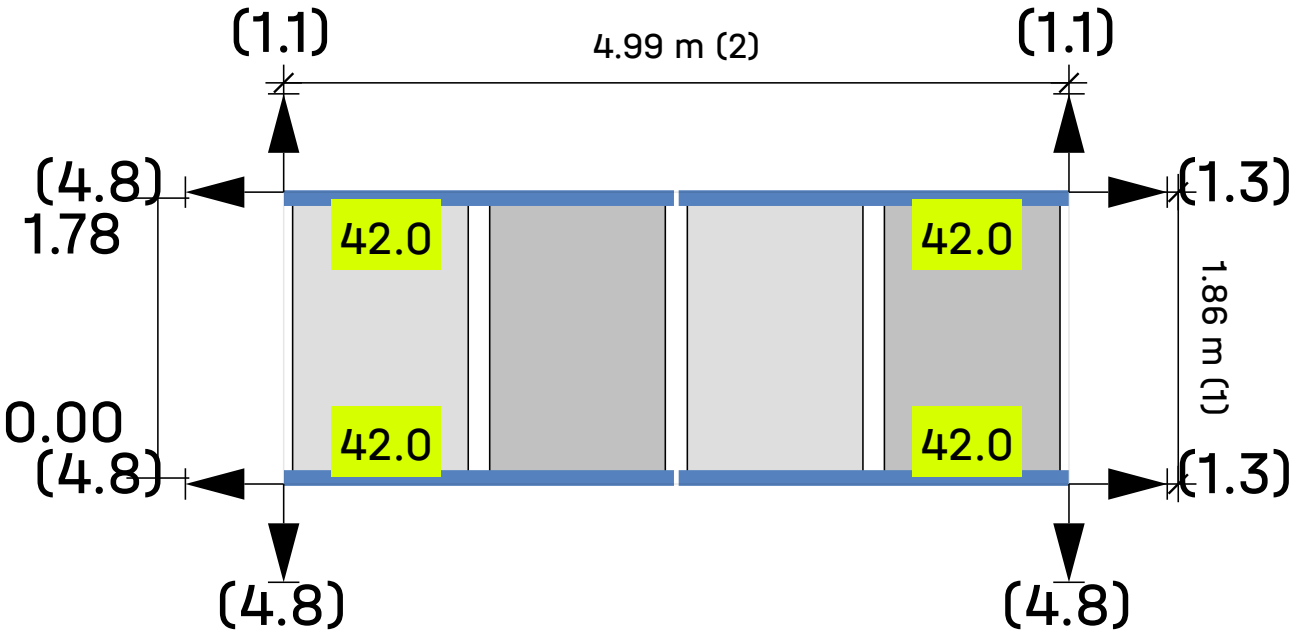


Roof (2) Module array 2

Mounting system	D-Dome 6.10 Xpress
Module	4(1.86 kWp) x TSM-465NED9R.28 (Vertex S+ Shield)
Row spacing	2.51 m
service corridor	0.14 m



Area 2 | Module array 2 | Module block 2

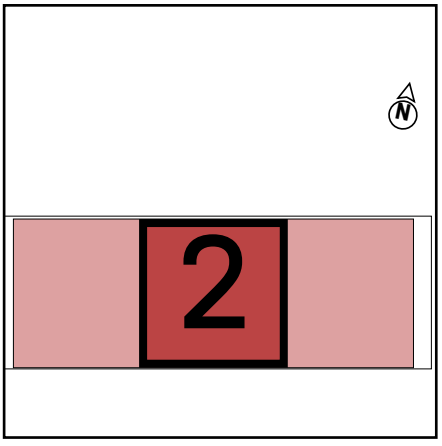


Roof (2) Module array 2 Module block 2

Modules 2 × 1 = **2**

Legend

- Mounting rail
- Row distance [m]
- Distance to roof edge [m]
- 25 Ballast in kilogram (kg)
- Porter Ballast



Results | Area 2

Roof	System	Module	Height	Quantity	Total power
Area 2 Flat	D-Dome 6.10 Xpress	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	6.00 m	12	5.58 kWp

Module

Name	TSM-465NED9R.28 (Vertex S+ Shield)
Manufacturer	Trina Solar Energy
Output power	465 Wp
Dimensions	1,762×1,134×30 mm
Weight	27.0 kg

Material values

For material information refer to the product catalogue:
K2 Catalogue (k2-systems.com)

Module clamps

Module clamp	DomeClamp Black MC Set 30-50
End clamp	DomeClamp EC Black Set 30-50

Verification system utilisation

Pressure	29.79%
Suction	24.33%

Loads on modules

Type	Pressure	Suction
Ultimate limit state	0.46 kPa	-0.54 kPa
Serviceability	0.36 kPa	-0.42 kPa

Specific loads

Module block	No. of modules	Ballast [kg]	Dead weight [kg]	Module block area [m²] (incl. service corridor)	Dead load [kN/m²]	Dead load (roof surface area) [kN/m²]
Block 1	8	129.0	370.20	18.16 m²	0.20	
Block 2	4	168.0	288.60	9.27 m²	0.31	
Total	**12**	**297.0**	**658.80**			**0.08**

Results | Area 2

Important information

- The proof of static equilibrium and load capacity of the system are carried out by checking the load cases uplift and sliding by wind according to wind tunnel expertise from IFI institute
- You will find a short version of the wind tunnel report and a certificate for the further static calculations on our homepage.
- The structure was statically verified in accordance with Eurocode 9: Design of aluminium structures (EN 1999-1-1:2021) and Eurocode 3: Design of steel structures (EN 1993-1-1:2025) and offers sufficient load-bearing capacity and stability for the loads specified in the chapter 'Maximum actions on the components'.
- Adjustment factor for wind load regarding service life period, fW, is according to EN 1991-1-4/ NA
- Adjustment factor for snow load regarding service life period, fS, is according to EN 1991-1-3/ NA
- All resistance values of components are determined from an external static engineering office.
- The structural design complies with BS EN 1990 - Basis of Structural Design.
- Snow loads are determined in accordance with National Annex BS NA EN 1991-1-3 (2018) - UK National Annex to EC1 - Action on structures - general actions - snow loads.
- Wind loads are determined in accordance with National Annex BS NA EN 1991-1-4 - UK National Annex to EC1 - Action on structures, general actions - wind actions.
- Service life is recognised according to 'Eurocode EN 1991:3 – Action on structures, Snow loads' and 'Eurocode EN 1991:4 – Actions on structures, Wind actions'. Subject to the Building Regulations and for security-relevant reasons the installation has to be dismantled at the end of its service life.
- Failure consequence class is considered according to 'Eurocode EN 1990 – Basis of structural design'.
- The person responsible for the execution of the work must check the load assumptions made with the conditions on site. If deviations are found, the person who prepared the static calculation must be consulted immediately.
- Please note our General Terms and Conditions of Use (TCU-E) in their currently valid version, available at: https://k2-systems.com/en/digital-services/general-terms-and-conditions-of-use-for-entrepreneurs-tcu-e/
  Please note in particular § 1, Special provisions for K2 Base, clause 3 (''Technical and specialist requirements on the Customer's premises.''), § 6 (''Limitation of warranty'') and § 7 (''Limitation of liability'').
- All instructions and requirements of the static calculations must be observed.
- Compliance with the regulations and requirements of the building permit and the building trade associations must be ensured during the execution of all work.
- All connections and anchoring measures must be carried out using approved and standardized connecting elements or parts only.
- Subordinate components that have not been verified must be implemented structurally.
- The "General Rules" for corrosion protection design of the structure are strongly recommended for application during implementation.
- The structure may only be climbed by trained and authorized personnel wearing appropriate safety equipment. Unauthorized use of the structure poses a risk of falling.

Structural analysis report | Area 2

General information

Name	**Davison House, North St, Worthing BN11 1ER, REV3 11.11.26**
Mounting system	**D-Dome 6.10 Xpress**
Author	**ALEX BRADBURY**

Location information

Address	**Davison House, North St, Worthing BN11 1ER, UK**
Ground elevation	**9.86 m**

Roof information

Building height	**6.00 m**
Roof type	**Flat roof**
Roof pitch	**2°**
Fastening method	**with Ballast**
Roof covering	**Flat**
Min. roof edge distance	**1.00 m**
Parapet wall height	**0.20 m**
Material	**Single ply membrane**
Friction coefficient	**0.4**

The friction coefficients given here must be checked onsite. If a lower value is found, this must be specified here for the ballast calculation!

Loads

Design method	**BS EN**
Failure consequence class (CC)	**CC1**
Design working life	**25 years**
Terrain category	**Town Terrain**
Distance to shoreline	**5.00 km**
Distance inside town terrain	**0.00 km**

Wind load

Velocity pressure, 50 years	$q_{p,50}$	**= 0.668 kN/m²**
Adjustment factor for service life	f_w	**= 1.000**
Velocity pressure, 25 years	$q_{p,25}$	**= 0.615 kN/m²**

Structural analysis report | Area 2

Snow load

Snow load zone		3
Snow guard		No
Snow load on ground level	s_k	= 0.500 kN/m²
Shape coefficient for snow	μ_i	= 0.800
Factor for roof pitch	d_i	= 0.999
Snow load on roof, 50 year	$s_{i,50}$	= 0.400 kN/m²
Adjustment factor for service life	f_s	= 1.000
Snow load on roof, 25 years	$s_{i,25}$	= 0.371 kN/m²

Dead load

Weight of module	G_M	= 27.0 kg
Weight of mounting system per module		= 3.15 kg
Module area	A_M	= 2.00 m²
Dead weight of module per m²		= 13.51 kg/m²
Dead weight of mounting system per m²		= 1.58 kg/m²
Total dead load (excl. ballast) per m²		= 0.15 kN/m²

Load combinations

Ultimate limit state

Partial safety factor unfavourable permanent load	$\gamma_{G,sup}$	= 1.35
Partial safety factor favourable permanent load	$\gamma_{G,inf}$	= 1.00
Partial safety factor destabilising permanent load	$\gamma_{G,dst}$	= 1.10
Partial safety factor stabilising permanent load	$\gamma_{G,stb}$	= 0.90
Partial safety factor variable loads	γ_Q	= 1.50
Combination coefficient with regards to wind	$\psi_{0,W}$	= 0.60
Combination coefficient with regards to snow	$\psi_{0,S}$	= 0.50
Importance factor permanent	$\kappa_{FI,G}$	= 0.90
Importance factor variable	$\kappa_{FI,Q}$	= 0.85
Characteristic dead weight	G_k	
Characteristic snow load on the roof	$S_{i,n}$	
Characteristic wind load	W_k	

Load case combination 01	LCC 01_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * S_{i,n}$
Load case combination 02	LCC 02_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Pressure}$
Load case combination 03	LCC 03_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (W_{k,Pressure} + \psi_{0,S} * S_{i,n})$
Load case combination 04	LCC 04_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (S_{i,n} + \psi_{0,W} * W_{k,Pressure})$
Load case combination 06	LCC 06_uls	$= \gamma_{G,inf} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Suction}$

Structural analysis report | Area 2

Static equilibrium

Uplift verification	LCC up	$= \gamma_{G,stb} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,n,Uplift}$
Displacement verification	LCC displ	$= \gamma_{G,stb} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,n,Displacement}$

Serviceability limit state

Combination coefficient with regards to wind	$\psi_{0,W} = 0.60$
Combination coefficient with regards to snow	$\psi_{0,S} = 0.50$

Load case combination 01	LCC 01_sls	$= G_k + S_{i,n}$
Load case combination 02	LCC 02_sls	$= G_k + W_{k,Pressure}$
Load case combination 03	LCC 03_sls	$= G_k + W_{k,Pressure} + \psi_{0,S} * S_{i,n}$
Load case combination 04	LCC 04_sls	$= G_k + S_{i,n} + \psi_{0,W} * W_{k,Pressure}$
Load case combination 06	LCC 06_sls	$= G_k + W_{k,Suction}$

Max. pressure on insulation

General information

Dead load system	$g_{System} = 0.15\ kN/m^2$

Load distribution underneath the building protection mat under Peak

Dimensions	380.0 × 75.3 mm	
	A_{eff}	$= 28{,}614.00\ mm^2$
	$A_{load\ range\ area}$	$= 2.00\ m^2$
Maximum ballast	$G_{acting\ ballast}$	$= 14.3\ kg$

Load distribution underneath the building protection mat under SD

Dimensions	380.0 × 75.3 mm	
	A_{eff}	$= 28{,}614.00\ mm^2$
	$A_{load\ range\ area}$	$= 1.00\ m^2$
Maximum ballast	$G_{acting\ ballast}$	$= 7.2\ kg$

Load combinations

	$\sigma_{Ek,heat\ insulation,Peak}$[Pa]	$\sigma_{Ek,heat\ insulation,SD}$[Pa]
Load case combination 00	15,236	7,618
Load case combination 01	40,917	20,458

Actions from dead loads (PV system + ballast)

$\sigma_{Ek,heat\ insulation,Peak}$	$\sigma_{Ek} = 15{,}236\ Pa$
$\sigma_{Ek,heat\ insulation,SD}$	$\sigma_{Ek} = 7{,}618\ Pa$

Structural analysis report | Area 2

Maximum actions (PV system + ballast + snow)

$\sigma_{Ek,heat\ insulation,Peak}$	max σ_{Ek} = 40,917 Pa
$\sigma_{Ek,heat\ insulation,SD}$	max σ_{Ek} = 20,458 Pa

Structural analysis report | Area 2

Ballast calculation

Ballast calculation uplift

Force per module pair perpendicular to the roof

$$F_z = q_p \cdot (-c_{pE} \cos(\alpha) A_M - c_{pW} \cos(\alpha) A_M)$$

F_z	uplift force per module unit in z-direction
q_p	local peak velocity pressure at roof height z
A_M	module area
α	module tilt angle
c_{pE}	cp-value of east module
c_{pW}	cp-value of west module

Ballast against uplift

$$m_{B,uplift} = \frac{\gamma_Q \cdot \kappa_{Fl,Q} \cdot F_z}{\gamma_{G,stb} \cdot \cos(\beta) \cdot g} \cdot \prod_i k_i - m_{DL}$$

m_{DL}	weight of module(s) and mounting system
β	roof pitch angle
k_α	correction factor for roof pitch
k_{ch}	correction factor for gust duration
k_d	correction factor for wind direction
k_p	correction factor for parapet walls
k_s	correction factor for large modules
k_R	correction factor for large row spacings

Structural analysis report | Area 2

Ballast calculation sliding

Force per module pair parallel to the roof

$$F_x = q_p \cdot (c_{pE} \sin(\alpha) A_M - c_{pW} \sin(\alpha) A_M)$$

$$F_y \approx 0$$

F_x	sliding force per module unit in x-direction
F_y	sliding force per module unit in y-direction
q_p	local peak velocity pressure at roof height z
c_{pE}	cp-value of east module
c_{pW}	cp-value of west module
A_M	module area
α	module tilt angle

Ballast against sliding

$$m_{B,sliding} = \frac{\gamma_Q \cdot \kappa_{Fl,Q} \cdot \left(\frac{\sqrt{F_x^2 + F_y^2}}{\mu_{R,0}} + F_z \right)}{\gamma_{G,stb} \cdot g} \cdot \prod_i k_i - m_{DL}$$

m_{DL}	weight of module(s) and mounting system
$\mu_{R,0}$	Friction coefficient
k_α	correction factor for roof pitch
k_{ch}	correction factor for gust duration
k_d	correction factor for wind direction
k_p	correction factor for parapet walls
k_s	correction factor for large modules
k_R	correction factor for large row spacings

	Highest ballast		Lowest ballast	
Case	Sliding	Uplift	Sliding	Uplift
c_{pW}	-0.556	-0.495	-0.368	-0.367
c_{pE}	0.051	-0.054	0.058	-0.038
k_α	1.10	1.00	1.10	1.00
k_{ch}	1.00	1.00	1.00	1.00
k_d	0.90	0.90	0.90	0.90
k_p	1.04	1.04	1.04	1.04
k_s	1.03	1.03	1.03	1.03

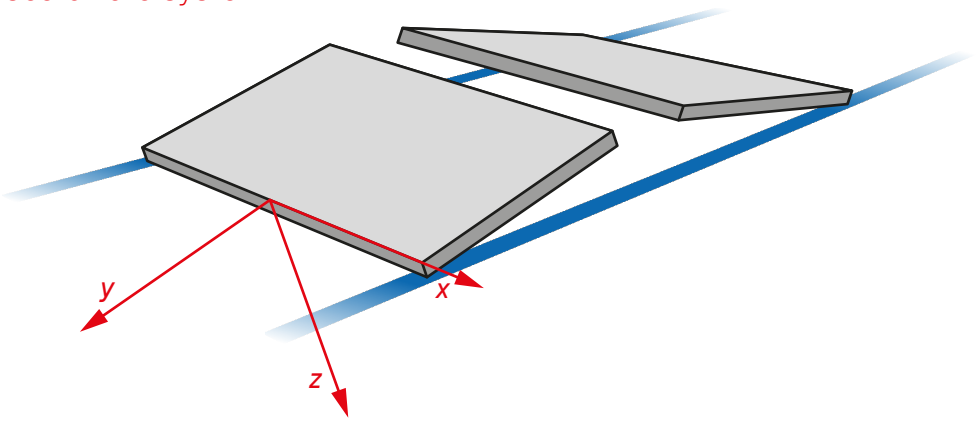
Structural analysis report | Area 2

k_R	1.00	1.00	1.00	1.00
A_M [m^2]	2.00	2.00	2.00	2.00
alpha [°]	10.0	10.0	10.0	10.0
qp [kN/m^2]	0.61	0.61	0.61	0.61
μ	0.4	-	0.4	-
Fx [kN]	0.130	-	0.091	-
Fz [kN]	0.612	0.664	0.376	0.490
$m_{ballast}$ [kg]	83.2	32.3	32.2	8.1
m_{DL} [kg]	60.3	60.3	60.3	60.3

Structural analysis report | Area 2

System proof

Coordinate system



x **Direction along the module edge**
y **Direction in module pitch direction**
z **Direction perpendicular to module surface**

External loads on modules - Module dimensioning

	Suction	Pressure (without wind)
Decisive load case	**LCC6**	**LCC1**
$c_{p,Module}$	**-0.684**	**-**
Ultimate limit state [kN/m²]	**-0.537**	**0.465**
Serviceability limit state [kN/m²]	**-0.421**	**0.364**

Utilization - Component dimensioning

Verification is performed as described in AbZ "Z-14.4-916" chapter 3.2.2 and design values from annex 4.2.

	Suction		Pressure	
Decisive load case		**LCC6**		**LCC3**
c_p		**-0.76**		**0.76**
Coordinate system direction	**y**	**z**	**y**	**z**
Maximum area load [kN/m²]	**0.0206**	**-0.451**	**0.0577**	**1.01**
Forces	$V_{x,d}$	$N_{z,d}$	$V_{x,d}$	$N_{z,d}$
Peak [kN]	**-**	**-0.547**	**-**	**1.22**
SD [kN]	**0.0162**	**-0.354**	**0.0453**	**-**
Design values R_d	$V_{x,k}/\gamma_m$	$N_{z,k}/\gamma_m$	$V_{x,k}/\gamma_m$	$N_{z,k}/\gamma_m$
Peak [kN]	**-**	**-2.25**	**-**	**11.1**

Structural analysis report | Area 2

SD [kN]	2.94	-4.5	2.94	-
Utilisation				
Peak [%]		24.33		11.02
SD [%]		8.41		1.54
BasicRail ballast [%]		**29.79**		**29.79**

Structural analysis report | Area 2

H-V-loads

According to wind tunnel report by I.F.I. Institut für Industrieaerodynamik GmbH

General information

Total number of modules	12	
Roof areas covered with modules	A	= ca. 27.43 m²
Dead load	$g_{k,System\ incl.\ ballast}$	= 0.24 kN/m²

Aerodynamic coefficients

	$C_{p,Pressure}$	= according to EN 1991-1-4
	$C_{F,x,averaged}$	= -0.04
	$C_{F,y,averaged}$	= 0.01
Edge distance correction	k_{Slxy}	= 1.00
Parapet wall- correction coefficient	k_p	= 1.04
Factor building height		= 1.00

Horizontal pressure

$W_{k,F,x}$ = -0.024 kN/m²
$W_{k,F,y}$ = 0.006 kN/m²

Vertical pressure

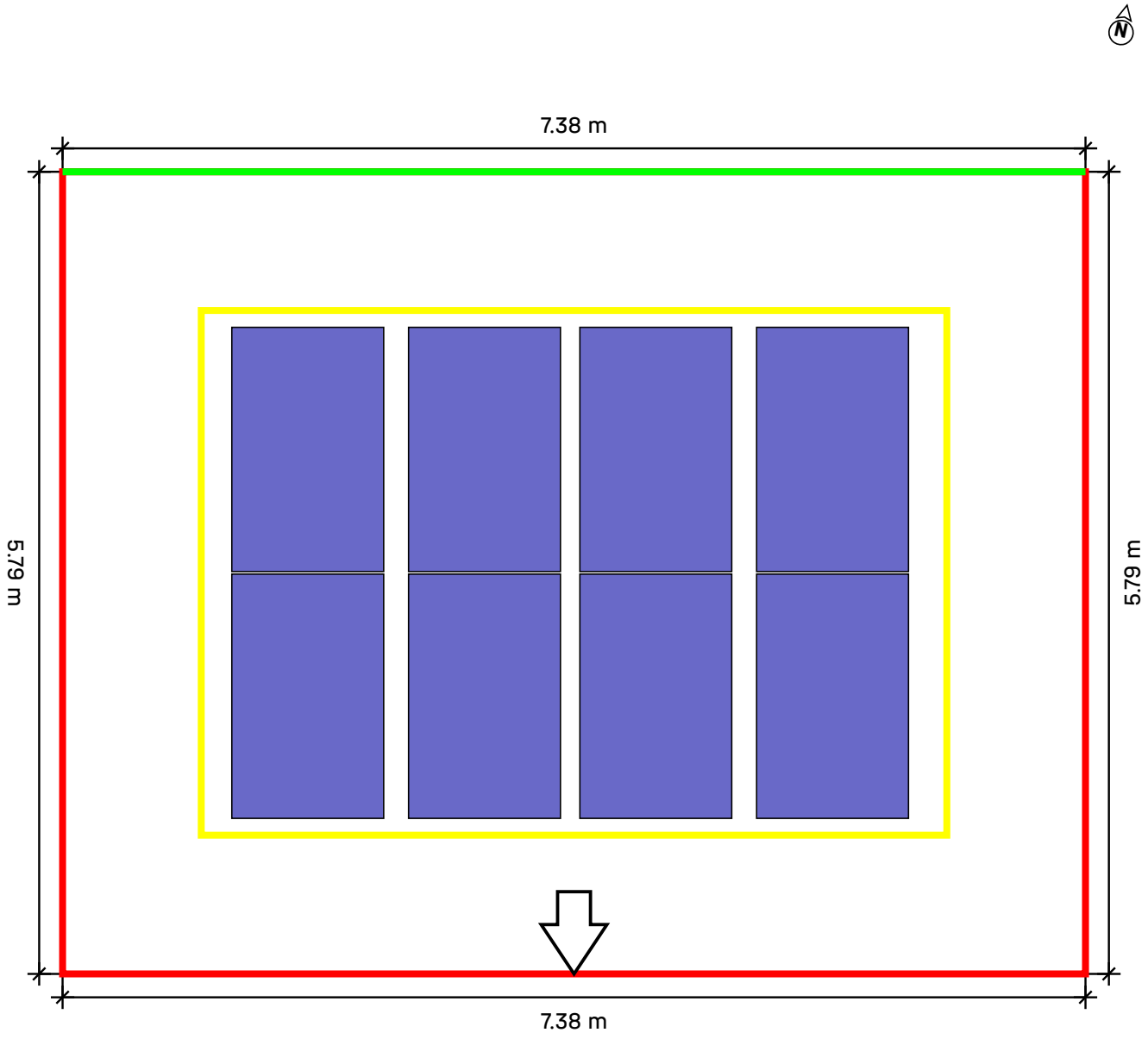
$g_{k,System\ incl.\ ballast}$	= 0.24 kN/m²
$W_{k,Pressure}$	- according to EN 1991-1-4
s_i	- according to EN 1991-1-3

Comment:
Flat roof vertical wind loads are essentially determined by its displacement effect and remain unchanged even with a flat pv structure. We advise using the aerodynamic coefficients according to DIN EN 1991-1-4 to calculate flat roofs.

Area 2 | Bill of material

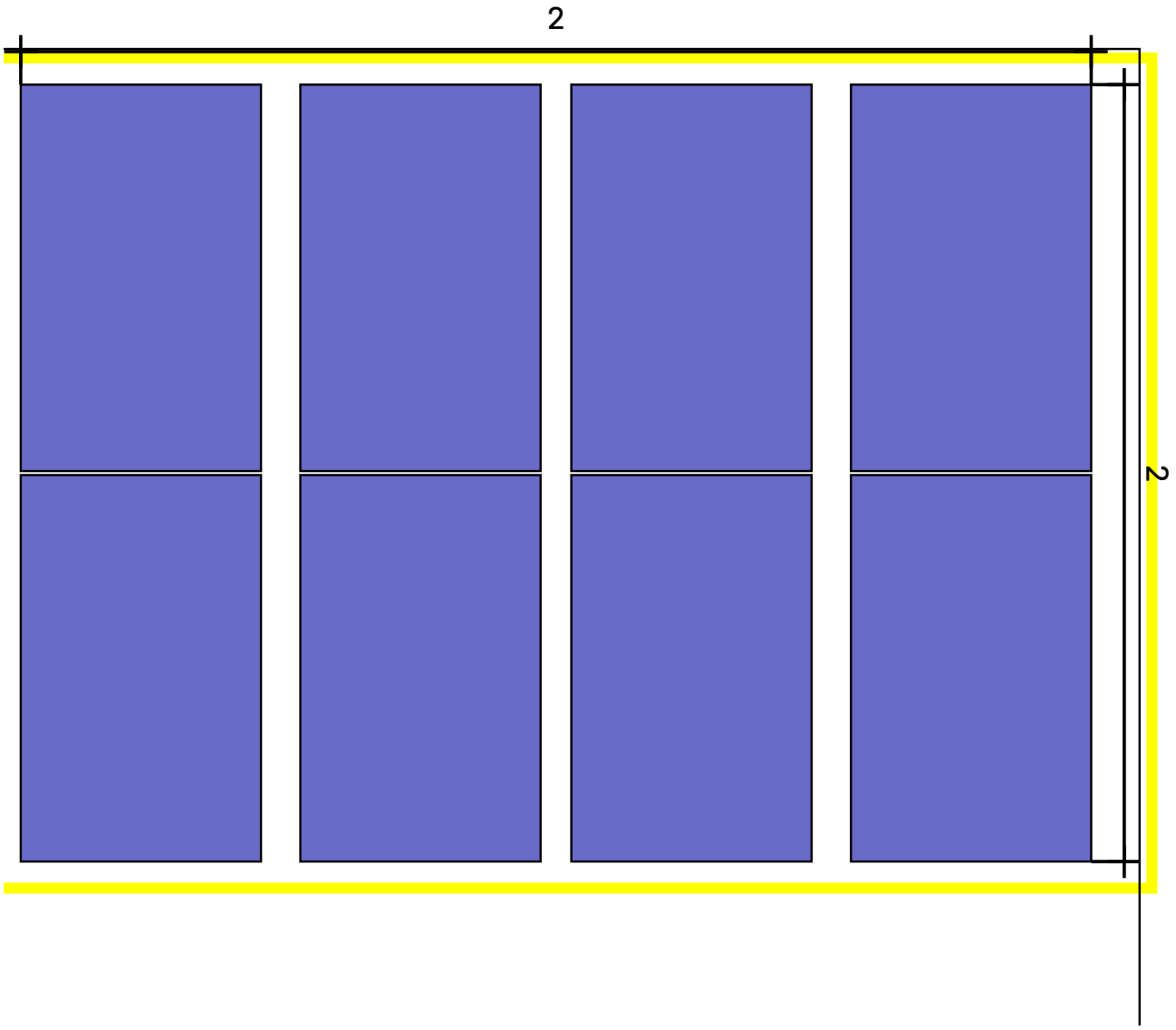
Position	Item no.	Item description	Quantity	Weight
1	2003620	D-Dome 6.10 Base Set	10	31.4 kg
2	2004125	Dome 6.10 Peak	20	6.0 kg
3	2004819	Dome 6 Xpress Connector	5	0.8 kg
4	2005041	Alpha PV-Clip	12	0.1 kg
5	2004057	K2 StairPlate Set	12	1.6 kg
6	2002609	DomeClamp Black MC Set 30-50	8	0.5 kg
7	2004564	DomeClamp EC Black Set 30-50	32	2.3 kg
8	2002300	Dome SpeedPorter	20	1.5 kg
Total				**44.1 kg**

Area 3



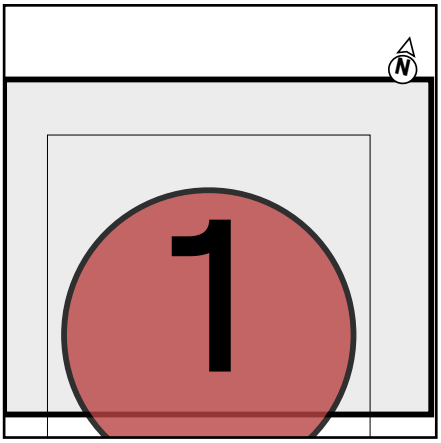
Roof	System	Module	Height	Quantity	Total power
Area 3 Flat	D-Dome 6.15 Xpress	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	6.00 m	8	3.72 kWp

Area 3 | Module array 1

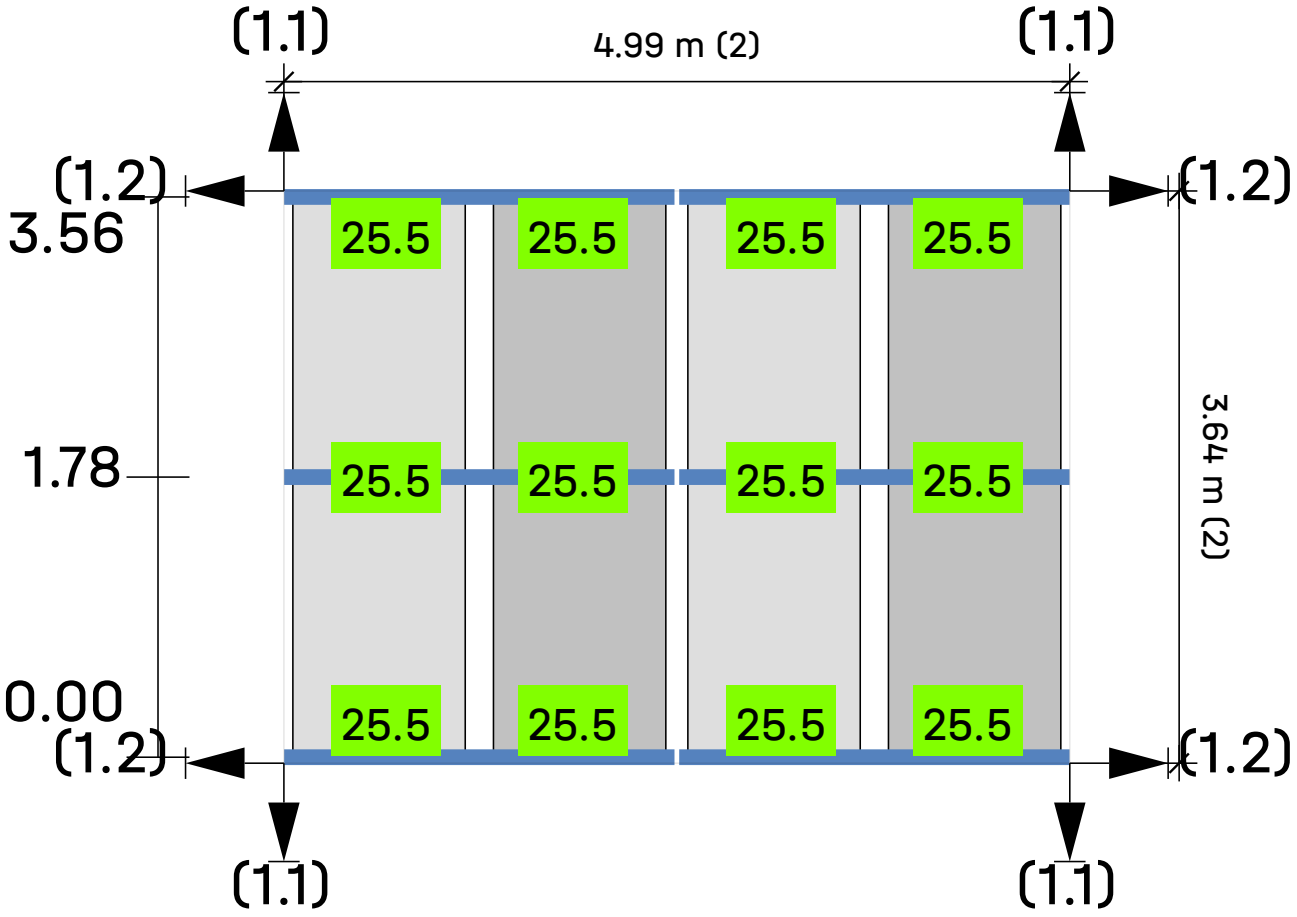


Roof (3) Module array 1

Mounting system	D-Dome 6.15 Xpress
Module	8(3.72 kWp) x TSM-465NED9R.28 (Vertex S+ Shield)
Row spacing	2.51 m
service corridor	0.14 m



Area 3 | Module array 1 | Module block 1

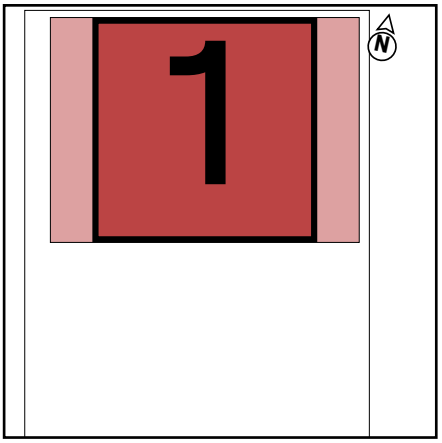


Roof (3) Module array (1) Module block 1

Modules 2 × 2 = **4**

Legend

- Mounting rail
- Row distance [m]
- Distance to roof edge [m]
- 25 Ballast in kilogram (kg)
- Porter Ballast



Results | Area 3

Roof	System	Module	Height	Quantity	Total power
Area 3 Flat	D-Dome 6.15 Xpress	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	6.00 m	8	3.72 kWp

Module

Name	TSM-465NED9R.28 (Vertex S+ Shield)
Manufacturer	Trina Solar Energy
Output power	465 Wp
Dimensions	1,762×1,134×30 mm
Weight	27.0 kg

Material values

For material information refer to the product catalogue:
K2 Catalogue (k2-systems.com)

Module clamps

Module clamp	DomeClamp Black MC Set 30-50
End clamp	DomeClamp EC Black Set 30-50

Ballast capacity

SpeedPorter	40.0 kg
Porter	108.0 kg

Verification system utilisation

Pressure	36.17%
Suction	27.64%

Loads on modules

Type	Pressure	Suction
Ultimate limit state	0.44 kPa	-0.58 kPa
Serviceability	0.35 kPa	-0.45 kPa

Results | Area 3

Specific loads

Module block	No. of modules	Ballast [kg]	Dead weight [kg]	Module block area [m²] (incl. service corridor)	Dead load [kN/m²]	Dead load (roof surface area) [kN/m²]
Block 1	**8**	**306.0**	**546.80**	**18.16 m²**	**0.30**	
Total	**8**	**306.0**	**546.80**			**0.13**

Results | Area 3

Important information

- The proof of static equilibrium and load capacity of the system are carried out by checking the load cases uplift and sliding by wind according to wind tunnel expertise from IFI institute
- You will find a short version of the wind tunnel report and a certificate for the further static calculations on our homepage.
- The structure was statically verified in accordance with Eurocode 9: Design of aluminium structures (EN 1999-1-1:2021) and Eurocode 3: Design of steel structures (EN 1993-1-1:2025) and offers sufficient load-bearing capacity and stability for the loads specified in the chapter 'Maximum actions on the components'.
- Adjustment factor for wind load regarding service life period, fW, is according to EN 1991-1-4/ NA
- Adjustment factor for snow load regarding service life period, fS, is according to EN 1991-1-3/ NA
- All resistance values of components are determined from an external static engineering office.
- The structural design complies with BS EN 1990 - Basis of Structural Design.
- Snow loads are determined in accordance with National Annex BS NA EN 1991-1-3 (2018) - UK National Annex to EC1 - Action on structures - general actions - snow loads.
- Wind loads are determined in accordance with National Annex BS NA EN 1991-1-4 - UK National Annex to EC1 - Action on structures, general actions - wind actions.
- Service life is recognised according to 'Eurocode EN 1991:3 – Action on structures, Snow loads' and 'Eurocode EN 1991:4 – Actions on structures, Wind actions'. Subject to the Building Regulations and for security-relevant reasons the installation has to be dismantled at the end of its service life.
- Failure consequence class is considered according to 'Eurocode EN 1990 – Basis of structural design'.
- The person responsible for the execution of the work must check the load assumptions made with the conditions on site. If deviations are found, the person who prepared the static calculation must be consulted immediately.
- Please note our General Terms and Conditions of Use (TCU-E) in their currently valid version, available at: https://k2-systems.com/en/digital-services/general-terms-and-conditions-of-use-for-entrepreneurs-tcu-e/
  Please note in particular § 1, Special provisions for K2 Base, clause 3 (''Technical and specialist requirements on the Customer's premises.''), § 6 (''Limitation of warranty'') and § 7 (''Limitation of liability'').
- All instructions and requirements of the static calculations must be observed.
- Compliance with the regulations and requirements of the building permit and the building trade associations must be ensured during the execution of all work.
- All connections and anchoring measures must be carried out using approved and standardized connecting elements or parts only.
- Subordinate components that have not been verified must be implemented structurally.
- The ''General Rules'' for corrosion protection design of the structure are strongly recommended for application during implementation.
- The structure may only be climbed by trained and authorized personnel wearing appropriate safety equipment. Unauthorized use of the structure poses a risk of falling.

Structural analysis report | Area 3

General information

Name	**Davison House, North St, Worthing BN11 1ER, REV3 11.11.26**
Mounting system	**D-Dome 6.15 Xpress**
Author	**ALEX BRADBURY**

Location information

Address	**Davison House, North St, Worthing BN11 1ER, UK**
Ground elevation	**9.86 m**

Roof information

Building height	**6.00 m**
Roof type	**Flat roof**
Roof pitch	**2°**
Fastening method	**with Ballast**
Roof covering	**Flat**
Min. roof edge distance	**1.00 m**
Parapet wall height	**0.20 m**
Material	**Single ply membrane**
Friction coefficient	**0.4**

The friction coefficients given here must be checked onsite. If a lower value is found, this must be specified here for the ballast calculation!

Loads

Design method	**BS EN**
Failure consequence class (CC)	**CC1**
Design working life	**25 years**
Terrain category	**Town Terrain**
Distance to shoreline	**5.00 km**
Distance inside town terrain	**0.00 km**

Wind load

Velocity pressure, 50 years	**$q_{p,50}$ = 0.668 kN/m²**
Adjustment factor for service life	**f_w = 1.000**
Velocity pressure, 25 years	**$q_{p,25}$ = 0.615 kN/m²**

Structural analysis report | Area 3

Snow load

Snow load zone	3	
Snow guard	No	
Snow load on ground level	s_k	= 0.500 kN/m²
Shape coefficient for snow	μ_i	= 0.800
Factor for roof pitch	d_i	= 0.999
Snow load on roof, 50 year	$s_{i,50}$	= 0.400 kN/m²
Adjustment factor for service life	f_s	= 1.000
Snow load on roof, 25 years	$s_{i,25}$	= 0.371 kN/m²

Dead load

Weight of module	G_M	= 27.0 kg
Weight of mounting system per module		= 3.10 kg
Module area	A_M	= 2.00 m²
Dead weight of module per m²		= 13.51 kg/m²
Dead weight of mounting system per m²		= 1.55 kg/m²
Total dead load (excl. ballast) per m²		= 0.15 kN/m²

Load combinations

Ultimate limit state

Partial safety factor unfavourable permanent load	$\gamma_{G,sup}$	= 1.35
Partial safety factor favourable permanent load	$\gamma_{G,inf}$	= 1.00
Partial safety factor destabilising permanent load	$\gamma_{G,dst}$	= 1.10
Partial safety factor stabilising permanent load	$\gamma_{G,stb}$	= 0.90
Partial safety factor variable loads	γ_Q	= 1.50
Combination coefficient with regards to wind	$\psi_{0,W}$	= 0.60
Combination coefficient with regards to snow	$\psi_{0,S}$	= 0.50
Importance factor permanent	$\kappa_{FI,G}$	= 0.90
Importance factor variable	$\kappa_{FI,Q}$	= 0.85
Characteristic dead weight	G_k	
Characteristic snow load on the roof	$S_{i,n}$	
Characteristic wind load	W_k	

Load case combination 01	LCC 01_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * S_{i,n}$
Load case combination 02	LCC 02_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Pressure}$
Load case combination 03	LCC 03_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (W_{k,Pressure} + \psi_{0,S} * S_{i,n})$
Load case combination 04	LCC 04_uls	$= \gamma_{G,sup} * \kappa_{FI,G} * G_k + \gamma_Q * \kappa_{FI,Q} * (S_{i,n} + \psi_{0,W} * W_{k,Pressure})$
Load case combination 06	LCC 06_uls	$= \gamma_{G,inf} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,Suction}$

Structural analysis report | Area 3

Static equilibrium

Uplift verification	LCC up	$= \gamma_{G,stb} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,n,Uplift}$
Displacement verification	LCC displ	$= \gamma_{G,stb} * G_k + \gamma_Q * \kappa_{FI,Q} * W_{k,n,Displacement}$

Serviceability limit state

Combination coefficient with regards to wind	$\psi_{0,W} = 0.60$
Combination coefficient with regards to snow	$\psi_{0,S} = 0.50$

Load case combination 01	LCC 01_sls	$= G_k + S_{i,n}$
Load case combination 02	LCC 02_sls	$= G_k + W_{k,Pressure}$
Load case combination 03	LCC 03_sls	$= G_k + W_{k,Pressure} + \psi_{0,S} * S_{i,n}$
Load case combination 04	LCC 04_sls	$= G_k + S_{i,n} + \psi_{0,W} * W_{k,Pressure}$
Load case combination 06	LCC 06_sls	$= G_k + W_{k,Suction}$

Max. pressure on insulation

General information

Dead load system	$g_{System} = 0.15$ kN/m²

Load distribution underneath the building protection mat under Peak

Dimensions	380.0 × 75.3 mm	
	A_{eff}	= 28,614.00 mm²
	$A_{load\ range\ area}$	= 2.00 m²
Maximum ballast	$G_{acting\ ballast}$	= 34.0 kg

Load distribution underneath the building protection mat under SD

Dimensions	380.0 × 75.3 mm	
	A_{eff}	= 28,614.00 mm²
	$A_{load\ range\ area}$	= 1.00 m²
Maximum ballast	$G_{acting\ ballast}$	= 8.5 kg

Load combinations

	$\sigma_{Ek,heat\ insulation,Peak}$[Pa]	$\sigma_{Ek,heat\ insulation,SD}$[Pa]
Load case combination 00	21,955	8,066
Load case combination 01	46,989	20,583

Actions from dead loads (PV system + ballast)

$\sigma_{Ek,heat\ insulation,Peak}$	$\sigma_{Ek} = 21{,}955$ Pa
$\sigma_{Ek,heat\ insulation,SD}$	$\sigma_{Ek} = 8{,}066$ Pa

Structural analysis report | Area 3

Maximum actions (PV system + ballast + snow)

$\sigma_{Ek,heat\ insulation,Peak}$	max σ_{Ek} = 46,989 Pa
$\sigma_{Ek,heat\ insulation,SD}$	max σ_{Ek} = 20,583 Pa

Structural analysis report | Area 3

Ballast calculation

Ballast calculation uplift

Force per module pair perpendicular to the roof

$$F_z = q_p \cdot (-c_{pE} \cos(\alpha) A_M - c_{pW} \cos(\alpha) A_M)$$

F_z	uplift force per module unit in z-direction
q_p	local peak velocity pressure at roof height z
A_M	module area
α	module tilt angle
c_{pE}	cp-value of east module
c_{pW}	cp-value of west module

Ballast against uplift

$$m_{B,uplift} = \frac{\gamma_Q \cdot \kappa_{Fl,Q} \cdot F_z}{\gamma_{G,stb} \cdot \cos(\beta) \cdot g} \cdot \prod_i k_i - m_{DL}$$

m_{DL}	weight of module(s) and mounting system
β	roof pitch angle
k_α	correction factor for roof pitch
k_d	correction factor for wind direction
k_A	correction factor for module blocks with more than 60 modules
k_{ch}	correction factor for gust duration
k_p	correction factor for parapet walls
k_R	correction factor for large row spacings
k_T	correction factor for module tilt angle

Structural analysis report | Area 3

Ballast calculation sliding

Force per module pair parallel to the roof

$$F_x = q_p \cdot (c_{pE} \sin(\alpha) A_M - c_{pW} \sin(\alpha) A_M)$$

$$F_y \approx 0$$

F_x	sliding force per module unit in x-direction
F_y	sliding force per module unit in y-direction
q_p	local peak velocity pressure at roof height z
c_{pE}	cp-value of east module
c_{pW}	cp-value of west module
A_M	module area
α	module tilt angle

Ballast against sliding

$$m_{B,sliding} = \frac{\gamma_Q \cdot \kappa_{Fl,Q} \cdot \left(\frac{\sqrt{F_x^2 + F_y^2}}{\mu_{R,0}} + F_z \right)}{\gamma_{G,stb} \cdot g} \cdot \prod_i k_i - m_{DL}$$

m_{DL}	weight of module(s) and mounting system
$\mu_{R,0}$	Friction coefficient
k_α	correction factor for roof pitch
k_d	correction factor for wind direction
k_A	correction factor for module blocks with more than 60 modules
k_{ch}	correction factor for gust duration
k_p	correction factor for parapet walls
k_R	correction factor for large row spacings
k_T	correction factor for module tilt angle

	Highest ballast		Lowest ballast	
Case	Sliding	Uplift	Sliding	Uplift
c_{pW}	-0.459	-0.573	-0.459	-0.573
c_{pE}	0.046	-0.042	0.046	-0.042
k_α	1.10	1.00	1.10	1.00
k_d	0.90	0.90	0.90	0.90
k_A	1.00	1.00	1.00	1.00
k_{ch}	1.00	1.00	1.00	1.00

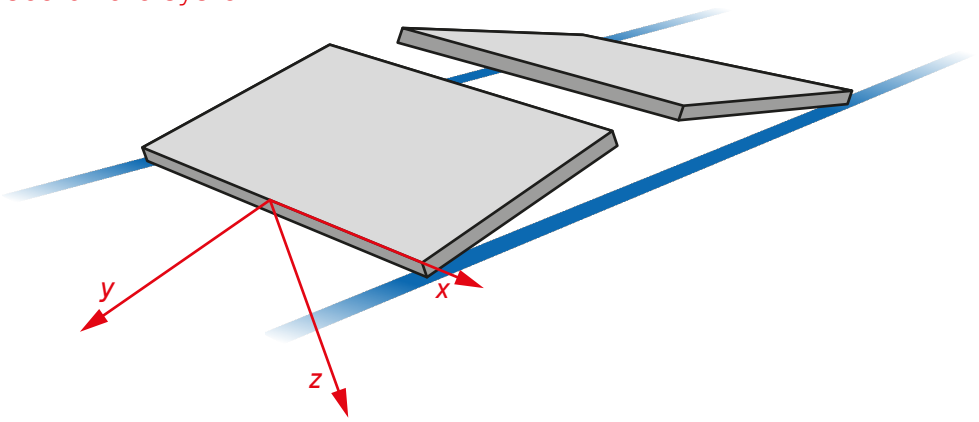
Structural analysis report | Area 3

k_p	1.04	1.04	1.04	1.04
k_R	1.00	1.00	1.00	1.00
k_T	1.02	1.02	1.02	1.02
A_M [m^2]	2.00	2.00	2.00	2.00
alpha [°]	15.0	15.0	15.0	15.0
qp [kN/m^2]	0.61	0.61	0.61	0.61
μ	0.4	-	0.4	-
Fx [kN]	0.161	-	0.161	-
Fz [kN]	0.491	0.731	0.491	0.731
$m_{ballast}$ [kg]	76.0	41.2	76.0	41.2
m_{DL} [kg]	60.2	60.2	60.2	60.2

Structural analysis report | Area 3

System proof

Coordinate system



x **Direction along the module edge**
y **Direction in module pitch direction**
z **Direction perpendicular to module surface**

External loads on modules - Module dimensioning

	Suction	Pressure (without wind)
Decisive load case	**LCC6**	**LCC1**
$c_{p,Module}$	**-0.735**	**-**
Ultimate limit state [kN/m²]	**-0.577**	**0.442**
Serviceability limit state [kN/m²]	**-0.452**	**0.346**

Utilization - Component dimensioning

Verification is performed as described in AbZ "Z-14.4-916" chapter 3.2.2 and design values from annex 4.2.

	Suction		Pressure	
Decisive load case		**LCC6**		**LCC3**
c_p		**-0.83**		**0.83**
Coordinate system direction	**y**	**z**	**y**	**z**
Maximum area load [kN/m²]	**0.0382**	**-0.512**	**0.106**	**1.05**
Forces	$V_{x,d}$	$N_{z,d}$	$V_{x,d}$	$N_{z,d}$
Peak [kN]	**-**	**-0.621**	**-**	**1.27**
SD [kN]	**0.03**	**-0.402**	**0.0829**	**-**
Design values R_d	$V_{x,k}/\gamma_m$	$N_{z,k}/\gamma_m$	$V_{x,k}/\gamma_m$	$N_{z,k}/\gamma_m$
Peak [kN]	**-**	**-2.25**	**-**	**11.1**

Structural analysis report | Area 3

SD [kN]	2.94	-4.5	2.94	-
Utilisation				
Peak [%]		27.64		11.47
SD [%]		9.95		2.82
BasicRail ballast [%]		**36.17**		**36.17**

Structural analysis report | Area 3

H-V-loads

According to wind tunnel report by I.F.I. Institut für Industrieaerodynamik GmbH

General information

Total number of modules	8	
Roof areas covered with modules	A	= ca. 18.16 m²
Dead load	$g_{k,System\ incl.\ ballast}$	= 0.30 kN/m²

Aerodynamic coefficients

	$C_{p,Pressure}$	= according to EN 1991-1-4
	$C_{F,x,averaged}$	= -0.07
	$C_{F,y,averaged}$	= 0.01
Edge distance correction	k_{Slxy}	= 1.00
Parapet wall- correction coefficient	k_p	= 1.04
Factor building height		= 1.00

Horizontal pressure

$W_{k,F,x}$ = -0.037 kN/m²
$W_{k,F,y}$ = 0.006 kN/m²

Vertical pressure

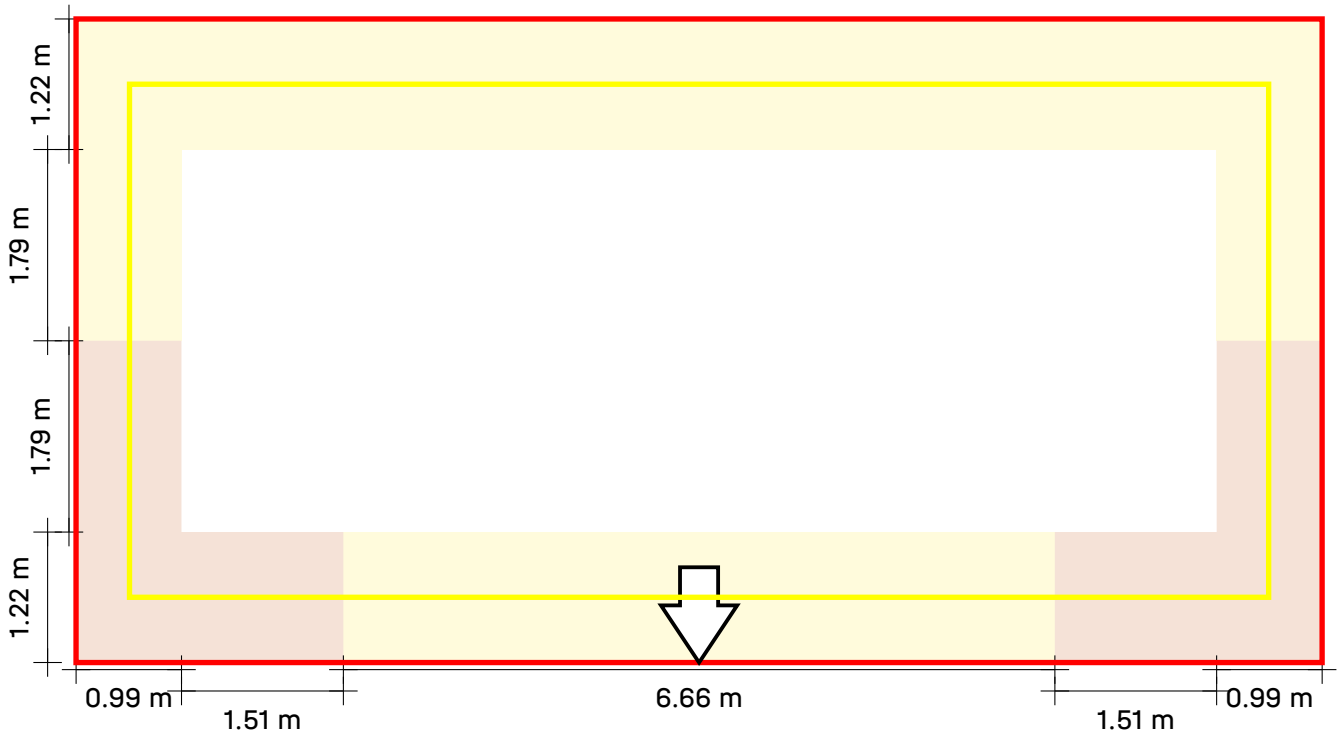
$g_{k,System\ incl.\ ballast}$	= 0.30 kN/m²
$W_{k,Pressure}$	- according to EN 1991-1-4
s_i	- according to EN 1991-1-3

Comment:
Flat roof vertical wind loads are essentially determined by its displacement effect and remain unchanged even with a flat pv structure. We advise using the aerodynamic coefficients according to DIN EN 1991-1-4 to calculate flat roofs.

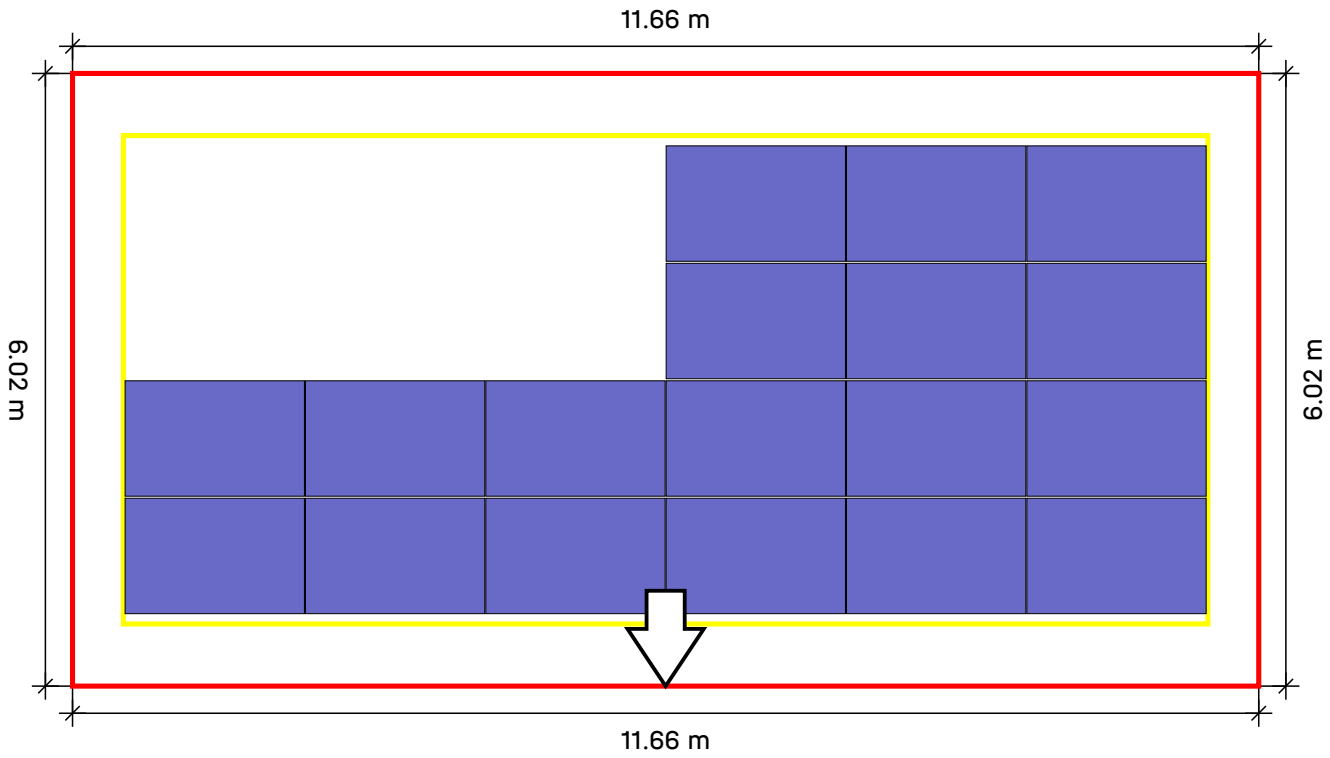
Area 3 | Bill of material

Position	Item no.	Item description	Quantity	Weight
1	2004500	D-Dome 6.15 Base Set	6	19.0 kg
2	2004174	Dome 6.15 Peak	12	4.9 kg
3	2004819	Dome 6 Xpress Connector	3	0.5 kg
4	2005041	Alpha PV-Clip	8	0.1 kg
5	2002609	DomeClamp Black MC Set 30-50	8	0.5 kg
6	2004564	DomeClamp EC Black Set 30-50	16	1.2 kg
7	2002300	Dome SpeedPorter	24	1.8 kg
Total				**27.9 kg**

Area 4



Area 4



Roof	System	Module	Height	Quantity	Total power
Area 4 Tile	SingleRail	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	5.00 m	18	8.37 kWp

Area 4 | Assembly plan

Base rail

	Whole rails		Rail cutting		
Type	Total rail length	Quantity 3.65 m	Part of rail / Rest	Length	Rest
2*A	10.072 m	2*3.65 m	3.650	2.772 from 3.650	0.868
1*B	4.756 m	1*3.65 m	3.650	1.106 from 3.650	2.534
1*C	4.756 m	1*3.65 m	2.534	1.106 from 2.534	1.418
1*D	4.756 m	1*3.65 m	1.418	1.106 from 1.418	0.302

1 cm is viewed as lost for each cutting

Red numbers are leftover rails which will not be used any longer.

Upper rail

	Whole rails		Rail cutting		
Type	Total rail length	Quantity 3.65 m	Part of rail / Rest	Length	Rest
6*A	2.388 m		3.650	2.388 from 3.650	1.252
6*B	4.696 m	1*3.65 m	1.252	1.046 from 1.252	0.196

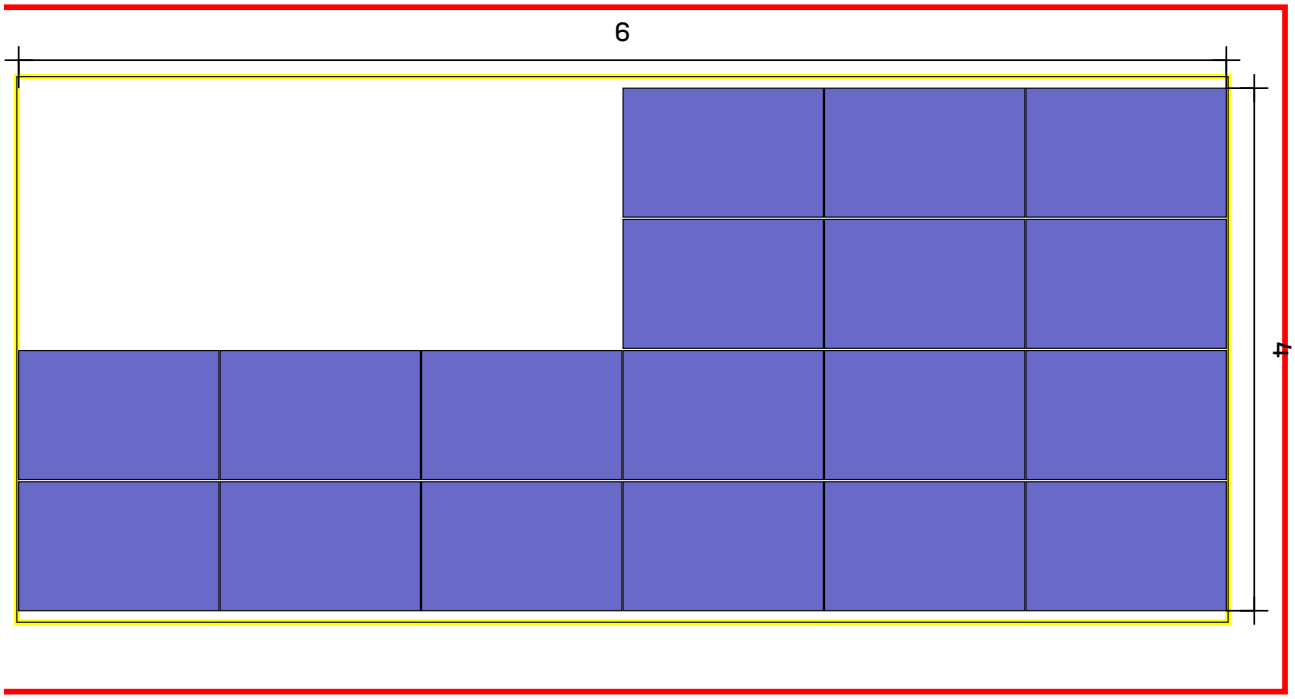
Fastener Spacing

Module	Array	Distance	Maximum cantilever length [m]	Maximum fastener spacing [m]
1	Field area	1.20 m	0.469	1.576
1	Eaves	1.20 m	0.467	1.565
1	Ridge	1.20 m	0.469	1.576
1	Gableboard	1.20 m	0.469	1.576
1	Corner region (eave)	1.20 m	0.445	1.460

Module arrays

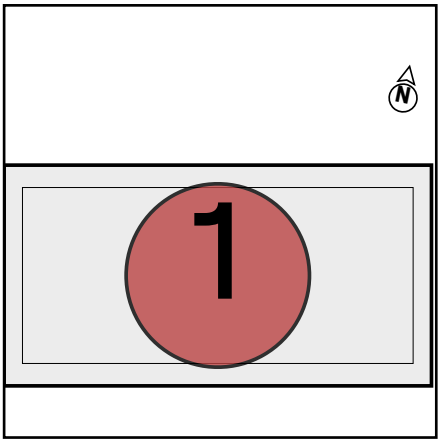
Module array	Width[m]	Length[m]	Width in modules	Length in modules
1	10.62	4.60	6	4

Area 4 | Module array 1

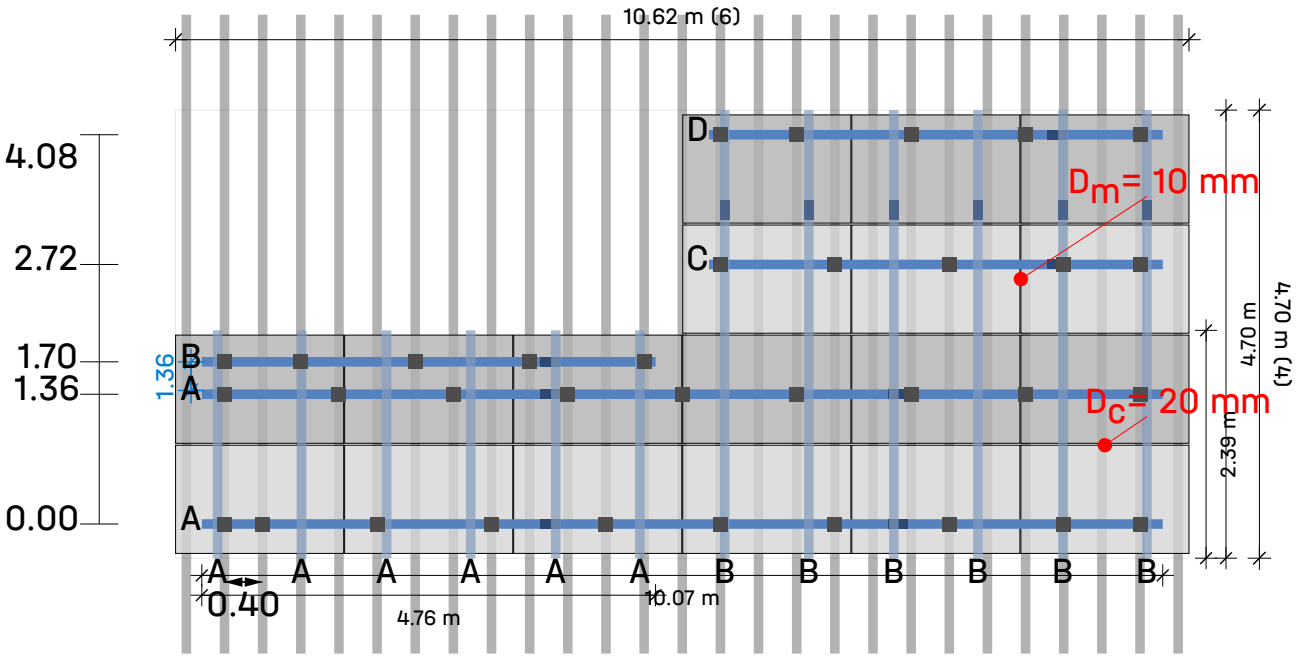


Roof 4 Module array 1

Mounting system	SingleRail
Module	18(8.37 kWp) x TSM-465NED9R.28 (Vertex S+ Shield)
Row spacing	1.77 m



Area 4 | Module array 1 | Module block 1

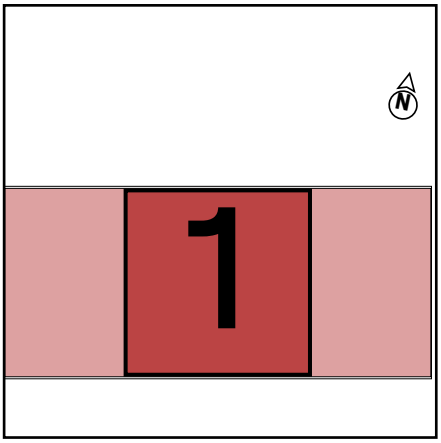


Roof (4) Module array 1 Module block 1

Modules (6 × 4) - 6 = **18**

Legend

- Fastener
- Mounting rail: K2 SingleRail 36
- Mounting rail (Upper): K2 SolidRail UltraLight 32
- Rail Distance [m]
- D_c Distance for clamping between modules
- D_m Distance between modules



Results | Area 4

Roof	System	Module	Height	Quantity	Total power
Area 4 Tile	SingleRail	TSM-465NED9R.28 (Vertex S+ Shield) 1,762×1,134×30 mm 465 Wp	5.00 m	18	8.37 kWp

Module

Name	TSM-465NED9R.28 (Vertex S+ Shield)
Manufacturer	Trina Solar Energy
Output power	465 Wp
Dimensions	1,762×1,134×30 mm
Weight	27.0 kg

Components

Fastener	SingleHook 3S
Base rails	K2 SingleRail 36
Upper rail	K2 SolidRail UltraLight 32

Material values

For material information refer to the product catalogue:
K2 Catalogue (k2-systems.com)

Loads on modules (Module dimensioning)

No. Module array	Roof areas	A-TrA [m²]	Ultimate state [Pa]				Serviceability [Pa]			
			Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥	Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥
1	Field area	2.00	778.0	388.7	-315.8	90.9	616.3	309.2	-219.7	90.9
1	Eaves	2.00	792.9	388.7	-315.8	90.9	628.0	309.2	-219.7	90.9
1	Ridge	2.00	778.0	388.7	-513.9	90.9	616.3	309.2	-375.1	90.9
1	Gableboard	2.00	778.0	388.7	-712.0	90.9	616.3	309.2	-530.4	90.9
1	Corner region (eave)	2.00	950.7	388.7	-761.5	90.9	751.8	309.2	-569.3	90.9

Results | Area 4

Base rail - Utilisation result

No. Module array	Roof areas	Ultimate limit state Pr σ[%]	Ultimate limit state CL σ[%]	Ultimate limit state Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	Distances BR [m]	Maximum values CL L_{max}[m]	Maximum values Fst Fst D_{max}[m]
1	Field area	58.0	0.0	62.7	40.4	1.200	1.360	0.469	1.576
1	Eaves	58.8	0.0	63.5	41.1	1.200	1.360	0.467	1.565
1	Ridge	58.0	2.9	62.7	40.4	1.200	1.360	0.469	1.576
1	Gableboard	58.0	11.4	62.7	40.4	1.200	1.360	0.469	1.576
1	Corner region (eave)	67.5	13.3	70.6	48.5	1.200	1.360	0.445	1.460

Upper rail - Utilisation result

No. Module array	Roof areas	Ultimate limit state Pr σ[%]	Ultimate limit state CL σ[%]	Ultimate limit state Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	Distances UR [m]	Maximum values CL L_{max}[m]	Maximum values Fst Fst D_{max}[m]
1	Field area	45.4	13.3	---	51.2	1.360	---	0.475	1.647
1	Eaves	46.2	16.0	---	52.2	1.360	---	0.472	1.640
1	Ridge	45.4	8.2	---	51.2	1.360	---	0.475	1.647
1	Gableboard	45.4	13.3	---	51.2	1.360	---	0.475	1.647
1	Corner region (eave)	55.3	19.1	---	62.5	1.360	---	0.449	1.568

Pr	**Profile**	Fst D_{max}	**Maximum fastener spacing [m]**
Fst	**Fastener**	BR	**Base rail**
σ	**Stress**	UR	**Upper rail**
f	**Deflection**	Usab.	**serviceability limit state**
F	**Force**	CL	**Cantilever**
CL/L_{max}	**Maximum cantilever length [m]**		

Results | Area 4

Important information

- The dimensioning of the timber construction screws is not part of this structual analysis. This must be done on site. If the rafters are made of solid wood, glued laminated timber, cross laminated timber and laminated veneer lumber, assembly with 2 timber construction screws is usually sufficient. The edge distances must be uphold in accordance with the manufacturer's specifications.
- The structure was statically verified in accordance with Eurocode 9: Design of aluminium structures (EN 1999-1-1:2021) and Eurocode 3: Design of steel structures (EN 1993-1-1:2025) and offers sufficient load-bearing capacity and stability for the loads specified in the chapter 'Maximum actions on the components'.
- Adjustment factor for wind load regarding service life period, fW, is according to EN 1991-1-4/ NA
- Adjustment factor for snow load regarding service life period, fS, is according to EN 1991-1-3/ NA
- The structural design complies with BS EN 1990 - Basis of Structural Design.
- Snow loads are determined in accordance with National Annex BS NA EN 1991-1-3 (2018) - UK National Annex to EC1 - Action on structures - general actions - snow loads.
- Wind loads are determined in accordance with National Annex BS NA EN 1991-1-4 - UK National Annex to EC1 - Action on structures, general actions - wind actions.
- Service life is recognised according to 'Eurocode EN 1991:3 – Action on structures, Snow loads' and 'Eurocode EN 1991:4 – Actions on structures, Wind actions'. Subject to the Building Regulations and for security-relevant reasons the installation has to be dismantled at the end of its service life.
- Failure consequence class is considered according to 'Eurocode EN 1990 – Basis of structural design'.
- The person responsible for the execution of the work must check the load assumptions made with the conditions on site. If deviations are found, the person who prepared the static calculation must be consulted immediately.
- Please note our General Terms and Conditions of Use (TCU-E) in their currently valid version, available at: https://k2-systems.com/en/digital-services/general-terms-and-conditions-of-use-for-entrepreneurs-tcu-e/
  Please note in particular § 1, Special provisions for K2 Base, clause 3 (''Technical and specialist requirements on the Customer's premises.''), § 6 (''Limitation of warranty'') and § 7 (''Limitation of liability'').
- All instructions and requirements of the static calculations must be observed.
- Compliance with the regulations and requirements of the building permit and the building trade associations must be ensured during the execution of all work.
- All connections and anchoring measures must be carried out using approved and standardized connecting elements or parts only.
- Subordinate components that have not been verified must be implemented structurally.
- The ''General Rules'' for corrosion protection design of the structure are strongly recommended for application during implementation.
- The structure may only be climbed by trained and authorized personnel wearing appropriate safety equipment. Unauthorized use of the structure poses a risk of falling.

Structural analysis report | Area 4

General information

Name	**Davison House, North St, Worthing BN11 1ER, REV3 11.11.26**
Mounting system	**SingleRail**
Author	**ALEX BRADBURY**

Location information

Address	**Davison House, North St, Worthing BN11 1ER, UK**
Ground elevation	**9.86 m**

Roof information

Building height	**5.00 m**
Roof type	**Gable roof**
Roof pitch	**35°**
Roof covering	**Tile**
Min. roof edge distance	**0.50 m**
Rafter Spacing	**0.400 m**
Rafter width	**40.0 mm**
set edge rafter left	**No**
Rafter spacing left	**230.0 mm**
set edge rafter right	**No**
Rafter spacing right	**230.0 mm**
Batten spacing	**340.0 mm**

Loads

Design method	**BS EN**
Failure consequence class (CC)	**CC1**
Design working life	**25 years**
Terrain category	**Town Terrain**
Distance to shoreline	**5.00 km**
Distance inside town terrain	**0.00 km**

Wind load

Velocity pressure, 50 years	$q_{p,50}$	**= 0.633 kN/m²**
Adjustment factor for service life	f_w	**= 1.000**
Velocity pressure, 25 years	$q_{p,25}$	**= 0.583 kN/m²**

Structural analysis report | Area 4

Roof areas

No. Module array	Roof areas	Load impact area [m²]	maxCpe	minCpe	wind pressure [kN/m²]	wind suction [kN/m²]
1	Field area	10.00	0.500	-0.600	0.291	-0.350
1	Eaves	10.00	0.533	-0.600	0.311	-0.350
1	Ridge	10.00	0.500	-0.867	0.291	-0.505
1	Gableboard	10.00	0.500	-1.133	0.291	-0.660
1	Corner region (eave)	10.00	0.800	-1.200	0.466	-0.699

Snow load

Snow load zone		3
Snow guard		No
Snow load on ground level	s_k	= 0.500 kN/m²
Shape coefficient for snow	μ_i	= 1.000
Factor for roof pitch	d_i	= 0.819
Snow load on roof, 50 year	$s_{i,50}$	= 0.410 kN/m²
Adjustment factor for service life	f_s	= 1.000
Snow load on roof, 25 years	$s_{i,25}$	= 0.380 kN/m²

Dead load

Weight of module	G_M	= 27.0 kg
Weight of mounting system per module		= 5.30 kg
Module area	A_M	= 2.00 m²
Dead weight of module per m²		= 13.51 kg/m²
Dead weight of mounting system per m²		= 2.65 kg/m²
Total dead load (excl. ballast) per m²		= 0.16 kN/m²

Structural analysis report | Area 4

Load combinations

Ultimate limit state

Partial safety factor unfavourable permanent load	$\gamma_{G,sup}$	= 1.35
Partial safety factor favourable permanent load	$\gamma_{G,inf}$	= 1.00
Partial safety factor destabilising permanent load	$\gamma_{G,dst}$	= 1.10
Partial safety factor stabilising permanent load	$\gamma_{G,stb}$	= 0.90
Partial safety factor variable loads	γ_{Q}	= 1.50
Combination coefficient with regards to wind	$\psi_{0,W}$	= 0.60
Combination coefficient with regards to snow	$\psi_{0,S}$	= 0.50
Importance factor permanent	$\kappa_{Fl,G}$	= 0.90
Importance factor variable	$\kappa_{Fl,Q}$	= 0.85
Characteristic dead weight	G_k	
Characteristic snow load on the roof	$S_{i,n}$	
Characteristic wind load	W_k	

Load case combination 01	LCC 01_uls	$= \gamma_{G,sup} * \kappa_{Fl,G} * G_k + \gamma_Q * \kappa_{Fl,Q} * S_{i,n}$
Load case combination 02	LCC 02_uls	$= \gamma_{G,sup} * \kappa_{Fl,G} * G_k + \gamma_Q * \kappa_{Fl,Q} * W_{k,Pressure}$
Load case combination 03	LCC 03_uls	$= \gamma_{G,sup} * \kappa_{Fl,G} * G_k + \gamma_Q * \kappa_{Fl,Q} * (W_{k,Pressure} + \psi_{0,S} * S_{i,n})$
Load case combination 04	LCC 04_uls	$= \gamma_{G,sup} * \kappa_{Fl,G} * G_k + \gamma_Q * \kappa_{Fl,Q} * (S_{i,n} + \psi_{0,W} * W_{k,Pressure})$
Load case combination 06	LCC 06_uls	$= \gamma_{G,inf} * G_k + \gamma_Q * \kappa_{Fl,Q} * W_{k,Suction}$

Serviceability limit state

Combination coefficient with regards to wind	$\psi_{0,W}$	= 0.60
Combination coefficient with regards to snow	$\psi_{0,S}$	= 0.50

Load case combination 01	LCC 01_sls	$= G_k + S_{i,n}$
Load case combination 02	LCC 02_sls	$= G_k + W_{k,Pressure}$
Load case combination 03	LCC 03_sls	$= G_k + W_{k,Pressure} + \psi_{0,S} * S_{i,n}$
Load case combination 04	LCC 04_sls	$= G_k + S_{i,n} + \psi_{0,W} * W_{k,Pressure}$
Load case combination 06	LCC 06_sls	$= G_k + W_{k,Suction}$

Structural analysis report | Area 4

Maximum load on modules (Mounting system dimensioning)

No. Module array	Roof areas	A-TrA [m²]	Ultimate state [kN/m²]				Serviceability [kN/m²]			
			Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥	Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥
1	Field area	10.00	0.778	0.389	-0.316	0.091	0.616	0.309	-0.220	0.091
1	Eaves	10.00	0.793	0.389	-0.316	0.091	0.628	0.309	-0.220	0.091
1	Ridge	10.00	0.778	0.389	-0.514	0.091	0.616	0.309	-0.375	0.091
1	Gableboard	10.00	0.778	0.389	-0.712	0.091	0.616	0.309	-0.530	0.091
1	Corner region (eave)	10.00	0.951	0.389	-0.762	0.091	0.752	0.309	-0.569	0.091

Max. load on fastener

No. Module array	Roof areas	A-TrA [m²]	Ultimate state [kN]				Serviceability [kN]			
			Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥	Pressure ⊥	Pressure ∥	Uplift ⊥	Uplift ∥
1	Field area	10.00	1.333	0.666	-0.541	0.156	1.056	0.530	-0.376	0.156
1	Eaves	10.00	1.359	0.666	-0.541	0.156	1.076	0.530	-0.376	0.156
1	Ridge	10.00	1.333	0.666	-0.881	0.156	1.056	0.530	-0.643	0.156
1	Gableboard	10.00	1.333	0.666	-1.220	0.156	1.056	0.530	-0.909	0.156
1	Corner region (eave)	10.00	1.629	0.666	-1.305	0.156	1.288	0.530	-0.975	0.156

Resistance values of components

Base rail

Base rail	A [cm²]	I_y [cm⁴]	I_z [cm⁴]	W_y [cm³]	W_z [cm³]
K2 SingleRail 36	2.850	4.02	6.37	2.14	3.09

Upper rail

Upper rail	A [cm²]	I_y [cm⁴]	I_z [cm⁴]	W_y [cm³]	W_z [cm³]
K2 SolidRail UltraLight 32	2.610	2.59	5.54	1.57	2.84

Fastener

Fastener	$R_{D,Uplift,Perpendicular}$ [kN]	$R_{D,Pressure,Perpendicular}$ [kN]	$R_{D,Pressure,Parallel}$ [kN]
SingleHook 3S	2.17	2.67	2.40

Structural analysis report | Area 4

Base rail - Utilisation result

No. Module array	Roof areas	Ultimate limit state Pr σ[%]	CL σ[%]	Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	BR [m]	Maximum values CL L_{max}[m]	Fst Fst D_{max}[m]
1	Field area	58.0	0.0	62.7	40.4	1.200	1.360	0.469	1.576
1	Eaves	58.8	0.0	63.5	41.1	1.200	1.360	0.467	1.565
1	Ridge	58.0	2.9	62.7	40.4	1.200	1.360	0.469	1.576
1	Gableboard	58.0	11.4	62.7	40.4	1.200	1.360	0.469	1.576
1	Corner region (eave)	67.5	13.3	70.6	48.5	1.200	1.360	0.445	1.460

Upper rail - Utilisation result

No. Module array	Roof areas	Ultimate limit state Pr σ[%]	CL σ[%]	Fst F[%]	Usab. Pr f[%]	Distances Fst [m]	UR [m]	Maximum values CL L_{max}[m]	Fst Fst D_{max}[m]
1	Field area	45.4	13.3	---	51.2	1.360	---	0.475	1.647
1	Eaves	46.2	16.0	---	52.2	1.360	---	0.472	1.640
1	Ridge	45.4	8.2	---	51.2	1.360	---	0.475	1.647
1	Gableboard	45.4	13.3	---	51.2	1.360	---	0.475	1.647
1	Corner region (eave)	55.3	19.1	---	62.5	1.360	---	0.449	1.568

Pr	**Profile**	Fst D_{max}	**Maximum fastener spacing [m]**
Fst	**Fastener**	BR	**Base rail**
σ	**Stress**	UR	**Upper rail**
f	**Deflection**	Usab.	**serviceability limit state**
F	**Force**	CL	**Cantilever**
CL/L_{max}	**Maximum cantilever length [m]**		

Area 4 | Bill of material

Position	Item no.	Item description	Quantity	Weight
1	2004112	Wood screw 8×100	68	1.8 kg
2	2003215	SingleHook 3S	34	18.0 kg
3	1004767	SingleRail 36 End Cap	10	0.1 kg
4	2004796	SolidRail UltraLight End Cap	24	0.2 kg
5	2003523	BlackCover SingleRail 36	10	0.3 kg
6	2004797	BlackCover SolidRail UltraLight	24	0.6 kg
7	2005041	Alpha PV-Clip	18	0.1 kg
8	2004057	K2 StairPlate Set	18	2.4 kg
9	2004258	SingleRail 36; 3.65 m	10	28.1 kg
10	2003605	SingleRail 36/50 RailConnector Set	7	1.7 kg
11	1004110	SolidRail CrossConnector Set	42	6.3 kg
12	2004540	K2 Clamp MC 25-40, Black	24	1.7 kg
13	2004545	K2 Clamp EC 25-40 Black	24	1.7 kg
14	2004264	SolidRail UltraLight; 3.65 m	12	30.8 kg
15	1004107	SolidRail UtraLight+Light RailConnector Set	6	1.4 kg
Total				**95.1 kg**

Bill of material

Position	Item no.	Item description	Quantity	Weight
1	2004112	Wood screw 8×100	192	5.2 kg
2	2003215	SingleHook 3S	96	50.9 kg
3	1004767	SingleRail 36 End Cap	36	0.3 kg
4	2004796	SolidRail UltraLight End Cap	60	0.4 kg
5	2003523	BlackCover SingleRail 36	36	0.9 kg
6	2004797	BlackCover SolidRail UltraLight	60	1.5 kg
7	2005041	Alpha PV-Clip	63	0.4 kg
8	2004057	K2 StairPlate Set	55	7.2 kg
9	2004258	SingleRail 36; 3.65 m	27	75.9 kg
10	2003605	SingleRail 36/50 RailConnector Set	16	3.9 kg
11	1004110	SolidRail CrossConnector Set	114	17.0 kg
12	2004540	K2 Clamp MC 25-40, Black	56	4.0 kg
13	2004545	K2 Clamp EC 25-40 Black	60	4.3 kg
14	2004264	SolidRail UltraLight; 3.65 m	29	74.5 kg
15	1004107	SolidRail UtraLight+Light RailConnector Set	12	2.7 kg
16	2003620	D-Dome 6.10 Base Set	10	31.4 kg
17	2004125	Dome 6.10 Peak	20	6.0 kg
18	2004819	Dome 6 Xpress Connector	8	1.2 kg
19	2002609	DomeClamp Black MC Set 30-50	16	0.9 kg
20	2004564	DomeClamp EC Black Set 30-50	48	3.5 kg
21	2002300	Dome SpeedPorter	44	3.3 kg
22	2004500	D-Dome 6.15 Base Set	6	19.0 kg
23	2004174	Dome 6.15 Peak	12	4.9 kg
Total				**319.2 kg**

Thank you for choosing a K2 mounting system.

Systems from K2 Systems are quick and easy to install.
We hope these instructions have helped.
Please contact us with any questions or suggestions for improvement.

Our contact data:

k2-systems.com/en/contact

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K2 Solar Mounting Solutions Ltd
Unit 46 Easter Park
Benyon Road
Aldermaston, RG7 2PQ
Great Britain
+44 1189 701280
info@k2-systems.uk.com
k2-systems.com/en