

# Structural Calculations Package

**Title: PV Panel Assessment at Wolf Laundry Ashroyd Business Park**

**Location: Ashroyd Business Park, S74 9SB**

**Job Number: 24-121**

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**Date of Issue: 24-06-2024**



# Calculations

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<b>Project No</b>	24-121	<b>Page</b>	C2	<b>Rev</b>	
<b>Date</b>	June 2024	<b>By</b>	JD		

## Design Information

Client	Adam Hetherington
Relevant British Standards, Eurocodes, Codes of Practice and Design Standards	EUROCODE 1: ACTIONS ON STRUCTURES, EN1991 BS6399:PART1LOADINGS, PART 2: WIND LOADINGS AND PART 3: SNOW LOAD BS5950:PART 1:2000 - STRUCTURAL USE OF STEELWORK IN BUILDING
Intended building usage	COMMERCIAL
Subsoil conditions	PERMISSIBLE GROUND BEARING PRESSURE 50 kN/m <sup>2</sup>
Special Considerations	NONE

## Index

Pages	Elements of structure	Pages	Elements of structure
CO2	SUMMARY PAGE		
C04	LOADING SCHEDULE		
C05TO C10	STRUCTURAL CALCULATIONS		
APPENDIX A Separate PDF	STRUCTURAL PORTAL FRAME ANALYSIS		

## Quality Management Check

## Calculations

Rev	Date	Checked	Pages	Revision Details
-	June 2024	DD	C01 TO 10	

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<b>Project No</b>	24-121	<b>Page</b>	C3	<b>Rev</b>	
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## Loading Schedule

### Loadings

#### **Roof Construction:**

<u>Dead Load:</u>	<u>kN/m<sup>2</sup></u>
Outer covering, insulation, and metal deck liner	0.20
Services	0.10
Purlins	0.10
Total (measured on slope):	0.40kN/m <sup>2</sup>

<u>Super Imposed Load:</u>	<u>kN/m<sup>2</sup></u>
Rafter Level	0.60

Pv Dead Load = 0.15kN/m<sup>2</sup>

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<b>Project No</b>	24-121	<b>Page</b>	C4	<b>Rev</b>	
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## **Snow Loading (EN1991-1-3:2003+A1:2005)**

Altitude: 152m

Location: Barnsley (S74 9SB)

Zone: 4

Frame Length: approx. 14770mm to Apex

Pitch: 6.0 degrees

Refer to calculation pages C07 to C08 for analysis and design.

Adopt, a snow loading  $0.56\text{kN/m}^2$  on slope

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<b>Project No</b>	24-121	<b>Page</b>	C5	<b>Rev</b>	
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## **Steel Portal Frame Analysis A (BS5950)**

Wind Load will be calculated by the analysis program based on site specific data.

Snow Load =  $0.56\text{kN/m}^2$  (snow load is less than imposed load analysis in BS6399 and therefore imposed load allowance will be adopted for design check).

Portal Frame Centres = 7.4m

Portal Frame Span = 29.54m

Height to Eaves = 9m

Portal Frame Pitch = 6 degrees

Existing Rafter Section Size = 457x152x52UB

Existing Column Section size = 610x229x101UB

Haunch length as measured = 3.5m from column face.

Purpose of this analysis is to determine if the steel portal frame building has sufficient capacity in the frame members to support the additional load of full coverage PV panels.

Applied load is as per the loading schedule.

Refer to calculation Appendix A for analysis.

Therefore, by analysis it has been proven that the existing steel section sizes that create the portal frame structure are suitable for the proposed load.

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<b>Project No</b>	24-121	<b>Page</b>	C6	<b>Rev</b>	
<b>Date</b>	June 2024	<b>By</b>	JD		

## Purlin Check

Existing purlin size = 202.Z.13

Purlin Span = 7.5m

Purlin Centres = 1.2m

Applied load is as per loading schedule.

Refer to calculation pages C10 for analysis via Metspec software.

Therefore, by analysis it has been proven that the existing purlins are suitable for the proposed load.

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<b>Project No</b>	24-121	<b>Page</b>	C7	<b>Rev</b>	
<b>Date</b>	June 2024	<b>By</b>	JD		

## General Notes

All dimensions are to be checked on site by the main contractor prior to placing any of the structural components on order.

None of the details which are shown within these calculations are to be altered without any such alterations first being agreed with Dunster Consulting.

# Calculations

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<b>Project No</b>	24-121	<b>Page</b>	C8	<b>Rev</b>	
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## SNOW LOADING

**In accordance with EN1991-1-3:2003+A1:2015 incorporating corrigenda dated December 2004 and March 2009 and the UK national annex NA+A1:2015 to BS EN 1991-1-3:2003+A1:2015 incorporating Corrigendum No.1**

Tedds calculation version 1.0.14

### Characteristic ground snow load

Location; Barnsley  
 Site altitude above sea level (user modified value);  $A = 152$  m  
 Zone number (user modified value);  $Z = 4.0$   
 Density of snow;  $\gamma = 2.00$  kN/m<sup>3</sup>  
 Characteristic ground snow load;  $s_k = ((0.15 + (0.1 \times Z + 0.05)) + ((A - 100m) / 525m)) \times 1\text{kN/m}^2 = 0.70$  kN/m<sup>2</sup>  
 Exposure coefficient (Normal);  $C_e = 1.0$   
 Thermal coefficient;  $C_t = 1.0$   
 Snow fence; Not present

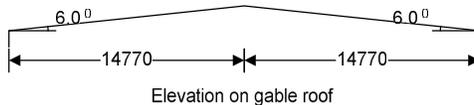
### Building details

Roof type; Duopitch  
 Width of roof (left on elevation);  $b_1 = 14.77$  m  
 Width of roof (right on elevation);  $b_2 = 14.77$  m  
 Slope of roof (left on elevation);  $\alpha_1 = 6.00$  deg  
 Slope of roof (right on elevation);  $\alpha_2 = 6.00$  deg

### Shape coefficients

Shape coefficient roof (Table 5.2);  $\mu_{2,\alpha_1,T52} = 0.80$   
 Shape coefficient roof (Table 5.2);  $\mu_{2,\alpha_2,T52} = 0.80$   
 Shape coefficient roof (Table UK NA.2);  $\mu_{1,\alpha_1,NA2} = 0.80$   
 Shape coefficient roof (Table UK NA.2);  $\mu_{1,\alpha_2,NA2} = 0.80$

Case	Diagram	Shape coef	Coef	Loading (kN/m <sup>2</sup> )
Case (i)		$\mu_{2,\alpha_1,T52}$	0.800	0.56
Case (ii)		$\mu_{2,\alpha_2,T52}$	0.800	0.56
Case (iii)		$\mu_{1,\alpha_1,NA2}$	0.800	0.56



### Loadcase 1 Table 5.2

Loading to roof 1 (LHS);  $s_{1,1} = \mu_{2,\alpha_1,T52} \times C_e \times C_t \times s_k = 0.56$  kN/m<sup>2</sup>

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<b>Project No</b>	24-121	<b>Page</b>	C9	<b>Rev</b>	
<b>Date</b>	June 2024	<b>By</b>	JD		

Loading to roof 2 (RHS);

$$s_{2\_1} = \mu_{2\_a2\_T52} \times C_e \times C_t \times s_k = \mathbf{0.56 \text{ kN/m}^2}$$

**Loadcase 2 UK NA.2**

Loading to roof 1 (LHS);

$$s_{1\_2} = 0 \times C_e \times C_t \times s_k = \mathbf{0.00 \text{ kN/m}^2}$$

Loading to roof 2 (RHS);

$$s_{2\_2} = \mu_{1\_a2\_NA2} \times C_e \times C_t \times s_k = \mathbf{0.56 \text{ kN/m}^2}$$

**Loadcase 3 UK NA.2**

Loading to roof 1 (LHS);

$$s_{1\_3} = \mu_{1\_a1\_NA2} \times C_e \times C_t \times s_k = \mathbf{0.56 \text{ kN/m}^2}$$

Loading to roof 2 (RHS);

$$s_{2\_3} = 0 \times C_e \times C_t \times s_k = \mathbf{0.00 \text{ kN/m}^2}$$

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<b>Project No</b>	24-121	<b>Page</b>	C10	<b>Rev</b>	
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## **/MetSPEC EURO/® DESIGN SUITE**

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Sheet No:            of  
 Job No.:  
 Designer:  
 Date: 06/06/2024  
**Registered Details:-**  
 Dunster Consulting Ltd  
 Larchbank, Beverley,  
 Harrogate, HG3 5HS  
 Tel: 07909227334 Fax: -  
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Site:

Comment:

### PURLIN SELECTION

Z PURLIN SYSTEM TYPE: SLEEVED METAL CLADDING

#### Dimensions & Limits

Span: 7.500 m  
 Centres: 1.200 m  
 Deflection Limit: Span/ 180  
 Roof Slope: 6.0 deg.

#### Design Loads in kN/m²

Dead : 0.400  
 Service : 0.150  
 Imposed : 0.600 Uniform Snow : 0.556  
 Wind Uplift : 1.000 Wind Pressure : 0.800

### SELECTED PURLINS

Section	Pass	Unfactored load for deflection	Ultimate download	Ultimate wind uplift
Required Loads in kN/m² :		1.150	2.304	1.100
Capacity Loads in kN/m² :				
Section Reference	Weight in kg/m	Restraint		
202.Z.23	6.17	1 Sags	1.801	3.268

The above values assume that the cladding panel or liner tray is screw fixed to the section(s) at a maximum spacing of 600mm.