



Preliminary report: Canopy Roof

The Good Guyz

Preliminary Report

Content : Preliminary Report
Structure : Canopy Roof
Manufacturer : Kontent Structures
Document owner : The Good Guyz
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1. Introduction

The Good Guyz have requested IB Tent Engineers to investigate their canopy roof construction for covering a stage. This document provides the reaction forces needed to validate the truss construction with a third party.

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4. Static analysis

The 3D Finite Element Software, “RFEM by Dlubal”, was used for performing a statical analysis.

A 3D model was analysed nonlinearly and according to the second-order theory. The printout RFEM report will be provided upon request.

4.1. Standards

- EN 1990-1-1 “Fundamentals of Structural Design and NB”
- EN 1999-1-1 “Aluminium structures”
- EN 13782:2015 “Tents – Safety”
- EN 13814: 2004

4.2. Documents

- KM24 - Technical drawing - Area 1 - Isometric view Spanten – 240612
- KM24 - Technical drawing - Area 1 - Plots Spanten - 240612[76]
- KM24 - Technical drawing - Area 1 - Side view Spanten - 240612[36]
- KM24 - Technical drawing - Area 1 - Top view Spanten – 240612
- KM24 - Technical drawing - Area 1 - 240613.DWG
- Overkapping Keinemusik - The Good Guyz.DWG
- Static analysis RFEM software;
 - 240626 Kontent & The Good Guyz Canopy roof _ qp 0.45 kN/m²
 - 240626 Kontent & The Good Guyz Canopy roof _ qp 0.3 kN/m²

5. Loads on structure

5.1. Own weight

The RFEM software has automatically incorporated the own weight of the components.

5.2. Wind loads

Situation 1: When the structure is not in use, wind gusts up to a peak wind pressure of 0.450 kN/m² is considered.

$q_p(z)$	450 [N/m ²]
$V(z)$	26.8 97 [m/s] / [km/h]

	0	II	III	
$v_{b,0}$	15.9	20.0	22.5	[m/s]
	57	72	81	[km/u]
	7	8	9	[Bft]
	kust	onbebouwd	bebouwd	

Situation 2: When the structure is in use, wind gusts up to a peak wind pressure of 0.30 kN/m² is considered.

$q_p(z)$	300 [N/m ²]
$V(z)$	21.9 79 [m/s] / [km/h]

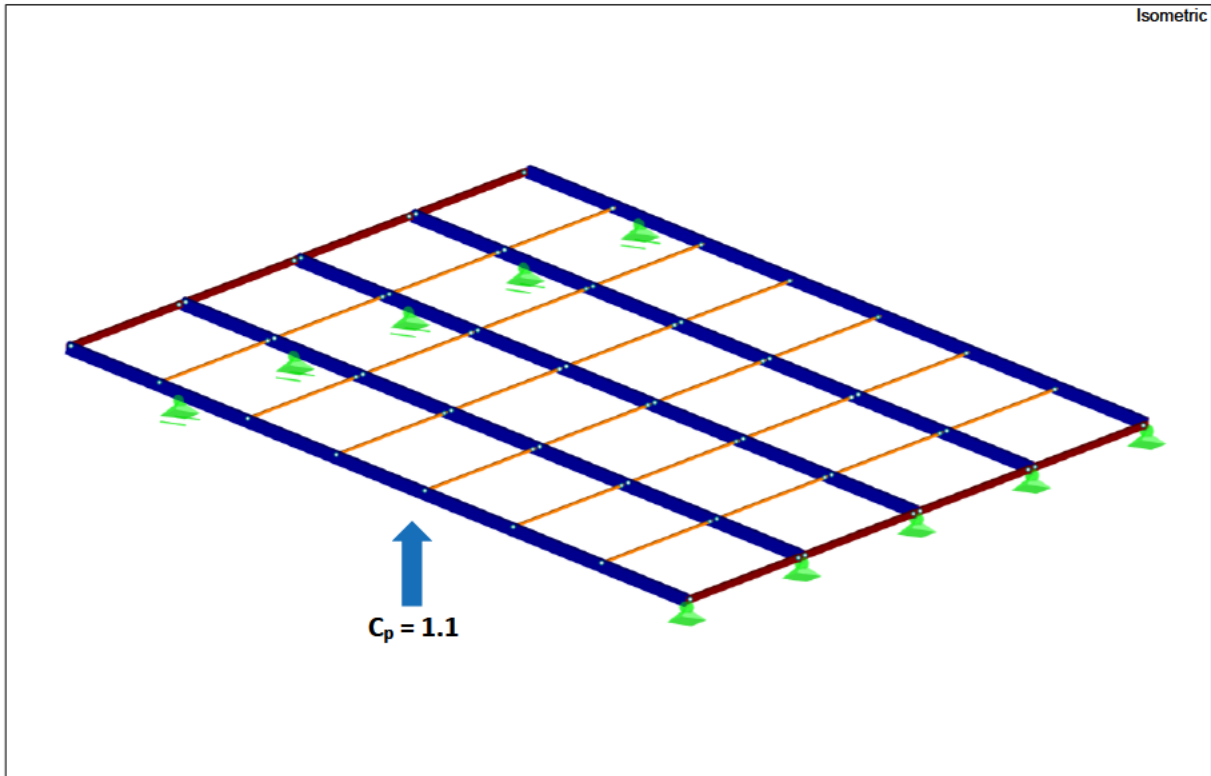
	0	II	III	
$v_{b,0}$	13.0	16.3	18.4	[m/s]
	47	59	66	[km/u]
	6	7	8	[Bft]
	kust	onbebouwd	bebouwd	

5.3. Wind pressure coefficients

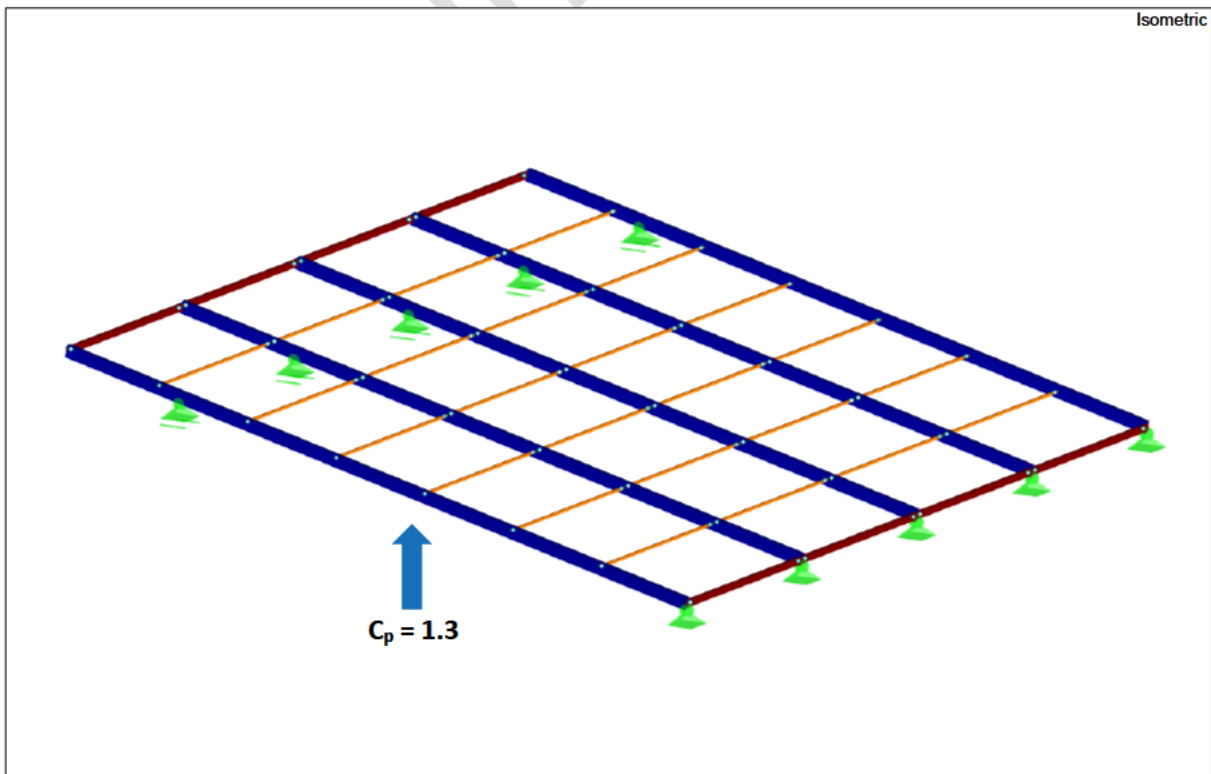
Wind pressure coefficients are applied according to the below scheme (See below pages).

5.3.1. Wind load: Wind upwards (LC3) – $C_p \times q_p$

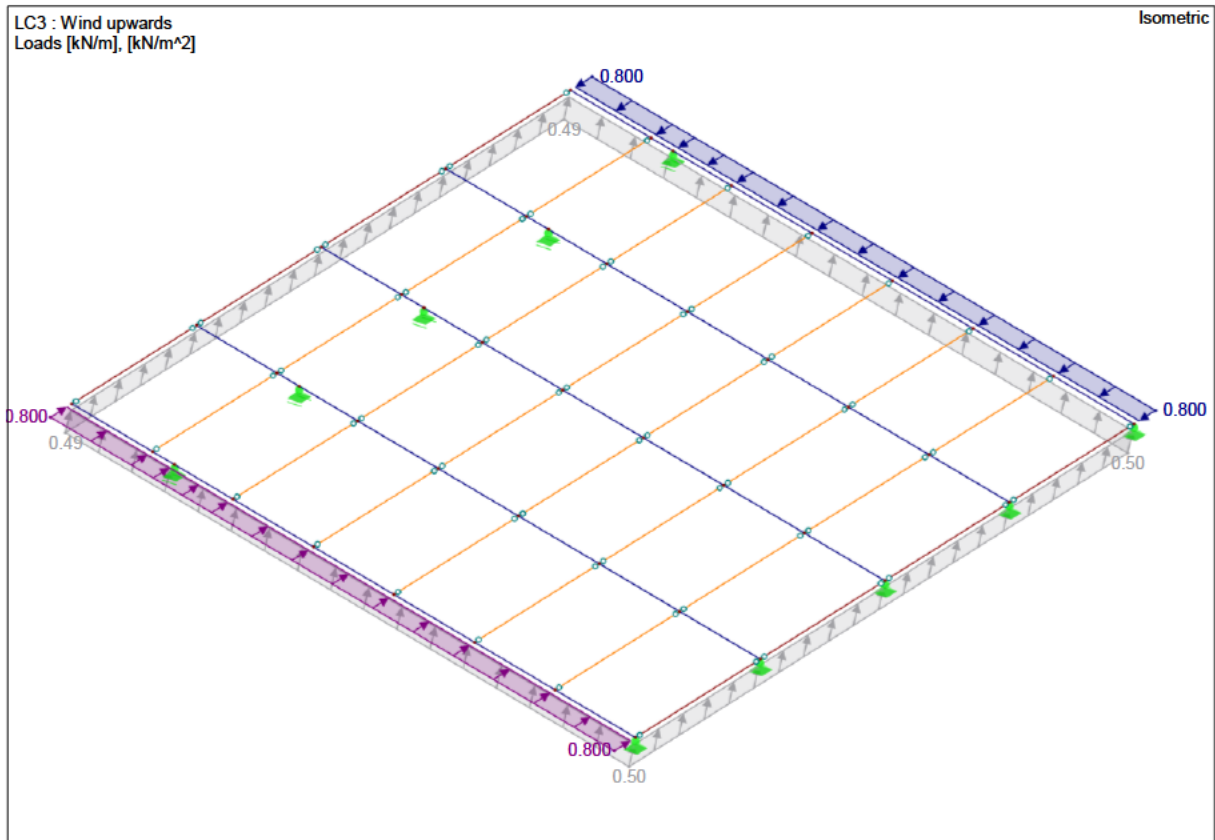
When the structure is not in use, the back wall will be removed during peak wind conditions. Therefore, no wind obstruction is expected, and a C_p value of 1.1 is chosen for this situation (situation 1).



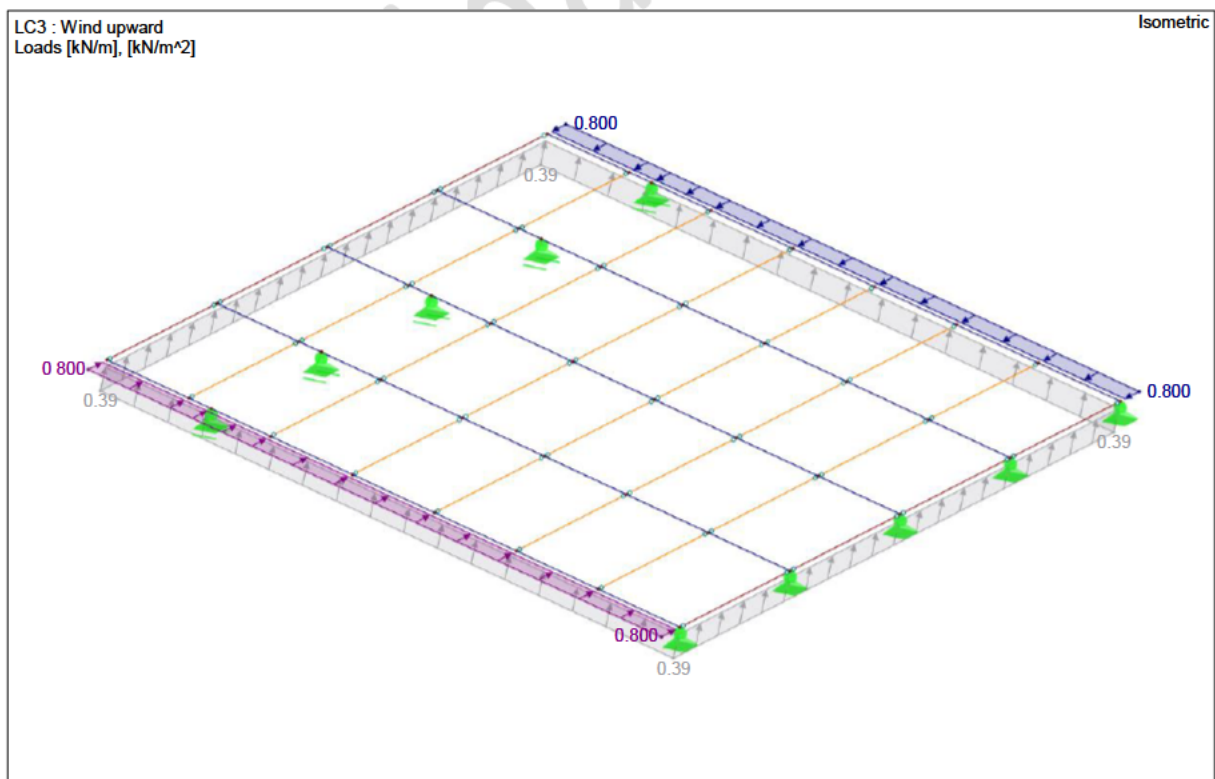
When the structure is in use, the back wall will remain in position. Therefore, wind obstruction is expected, and a C_p value of 1.3 is chosen for this situation (situation 2).



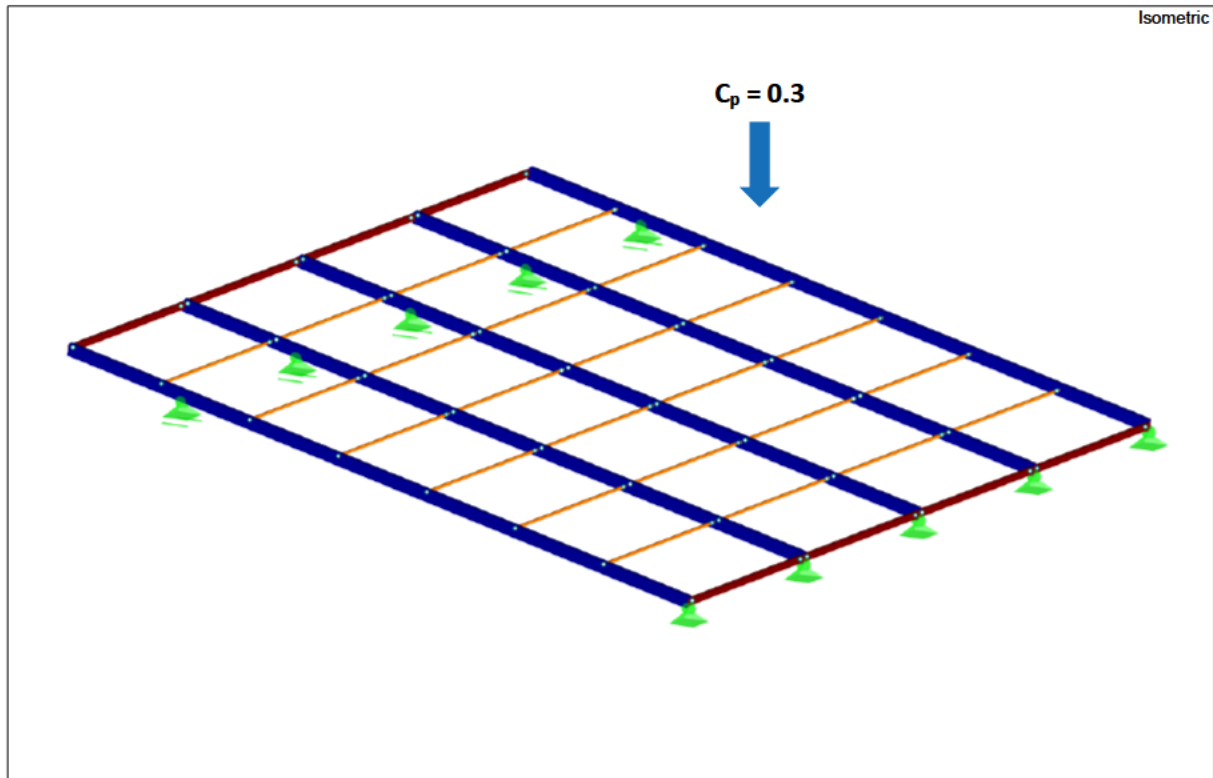
5.3.1.1. Situation 1: Structure is not in use ($q_p = 0.45 \text{ kN/m}^2$)



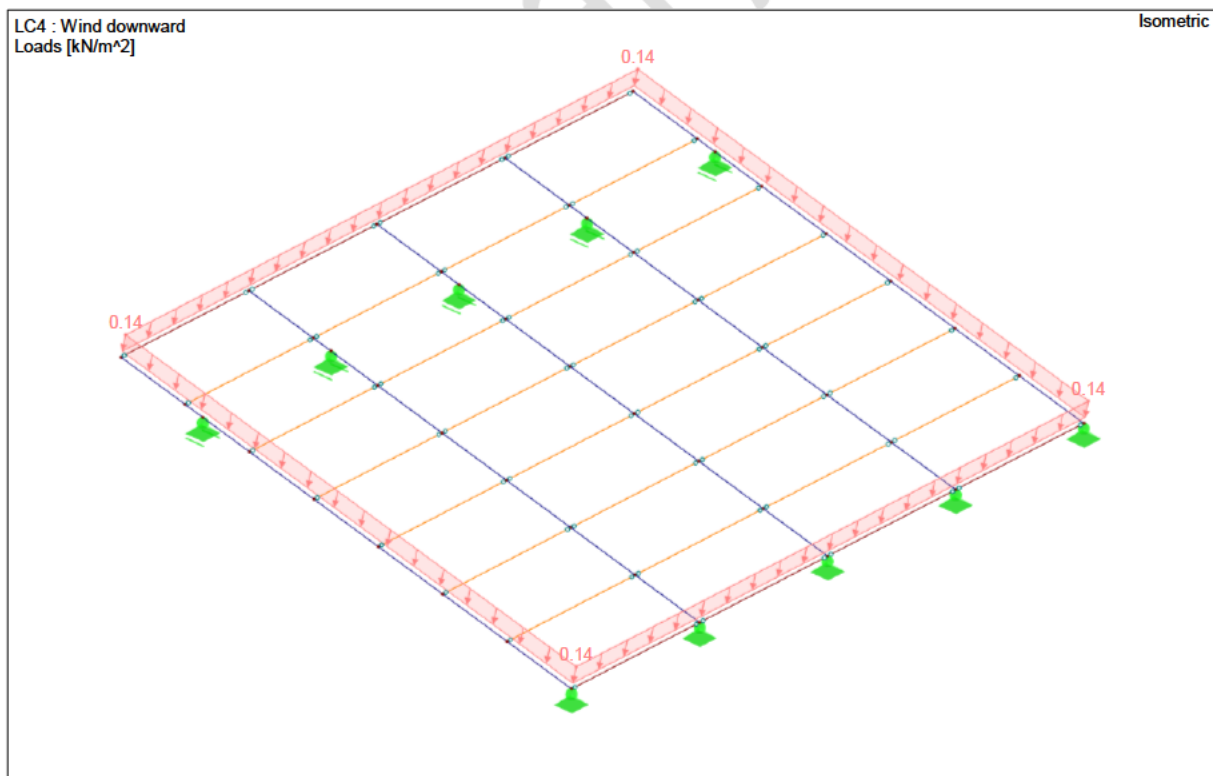
5.3.1.2. Situation 2: Structure is in use ($q_p = 0.3 \text{ kN/m}^2$)



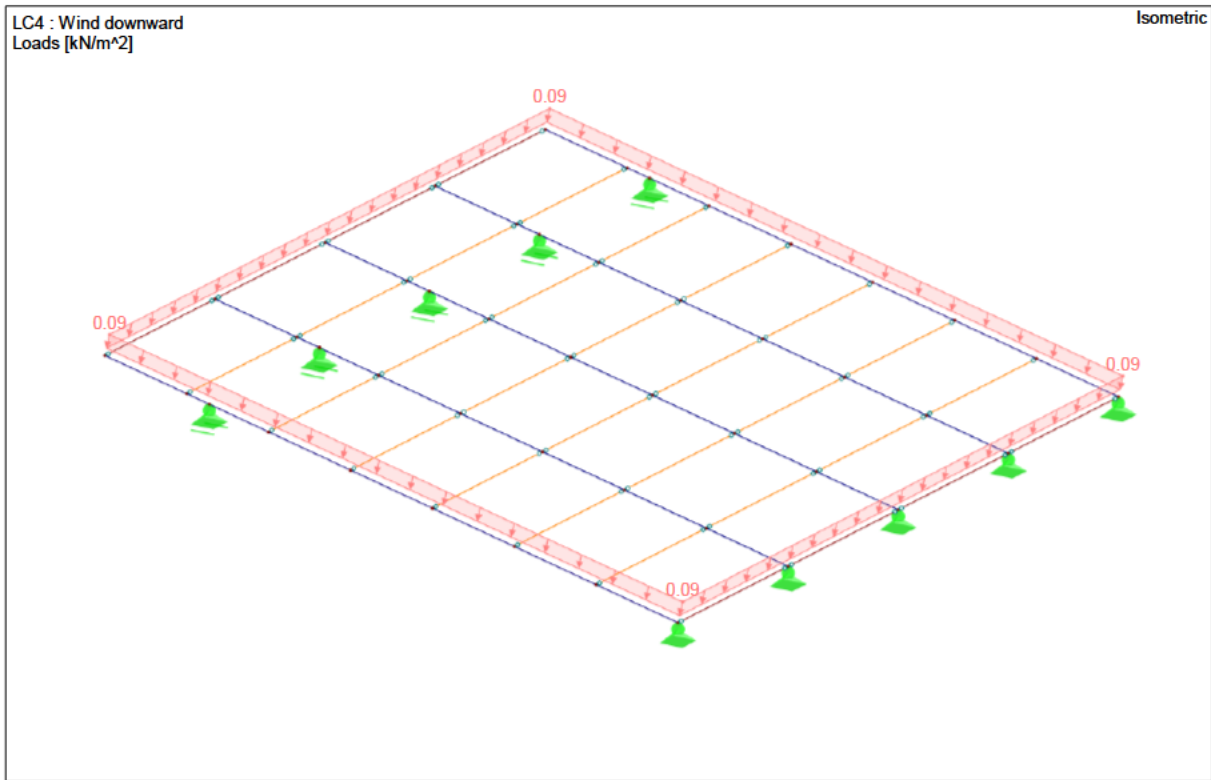
5.3.2. Wind load: Wind downwards (LC4) – $c_p \times q_p$



5.3.2.1. Situation 1: Structure is not in use ($q_p = 0.45 \text{ kN/m}^2$)



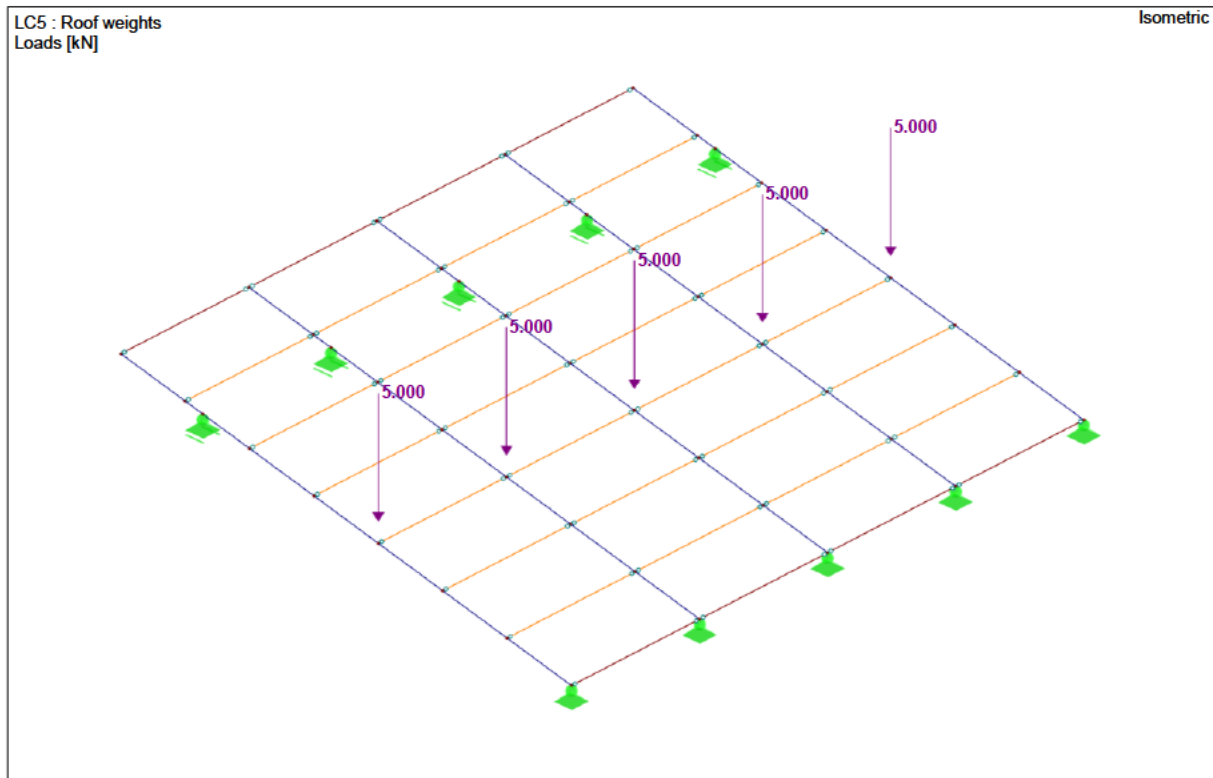
5.3.2.2. Situation 2: Structure is in use ($q_p = 0.3 \text{ kN/m}^2$)



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5.4. Roof weights

For the preliminary investigation, hanging weights of 500 kg per rafter frame have been applied on the roof.



5.5. Seismic forces

Seismic forces may generally not be considered because of the flexibility and light weight of the tent. Therefore, seismic forces have not been examined.

5.6. Live loads

This static analysis includes no floors, stairways, landings, ramps, raised floors, or platforms.

5.7. Equivalent load;

The stability is checked with a vertical uniformly distributed equivalent load of 0.1 kN/m^2 (10 kg/m^2) on the roof.

5.8. Imperfections

Imperfections have been taken into account by adding an additional load case, "imperfection" according to EN 1993-1-1: 2005-07

5.9. Load cases and combinations

5.9.1. Load cases

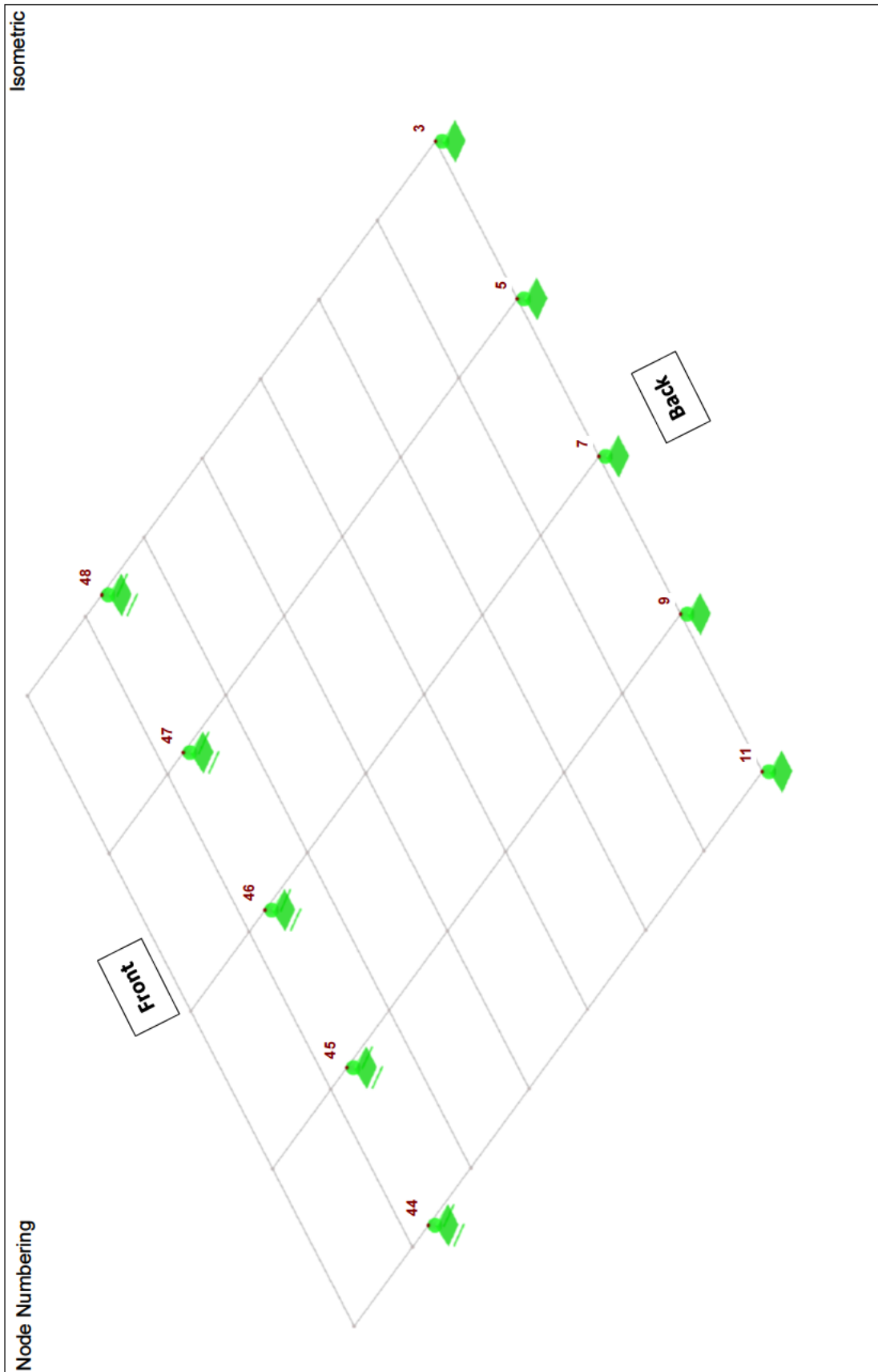
Load Case	Load Case Description	To Solve	EN 1990 CEN Action Category	Self-Weight - Factor in Direction			
				Active	X	Y	Z
LC1	Own weight	+	Permanent	+	0.000	0.000	-1.000
LC2	Wind from left	+	Wind	-	0.000	0.000	0.000
LC3	Wind upwards	+	Wind	-	0.000	0.000	0.000
LC4	Wind downward	+	Wind	-	0.000	0.000	0.000
LC5	Roof weights	+	Permanent/Imposed	-	0.000	0.000	0.000
LC6	Equivalent load	+	Permanent/Imposed	-	0.000	0.000	0.000
LC7	Imperfections	+	Imperfection	-	0.000	0.000	0.000

5.9.2. Load combinations

Load Combin.	DS	Load Combination Description	To Solve	LC.1		LC.2		LC.3		LC.4	
				Factor	No.	Factor	No.	Factor	No.	Factor	No.
CO1	0	Wind from left	+	1.350	LC1	1.500	LC2	1.000	LC7		
CO2	0	Wind upwards	+	1.350	LC1	1.500	LC3	1.000	LC7		
CO3	0	Wind downwards	+	1.350	LC1	1.500	LC4	1.000	LC7		
CO4	0	Wind downwards and roof weight	+	1.350	LC1	1.350	LC4	1.350	LC5	1.000	LC7
CO5	0	Roof weight	+	1.350	LC1	1.500	LC5	1.000	LC7		
CO6	0	Equivalent Load	+	1.350	LC1	1.350	LC6	1.000	LC7		

6. Reaction forces

6.1. Node numbers

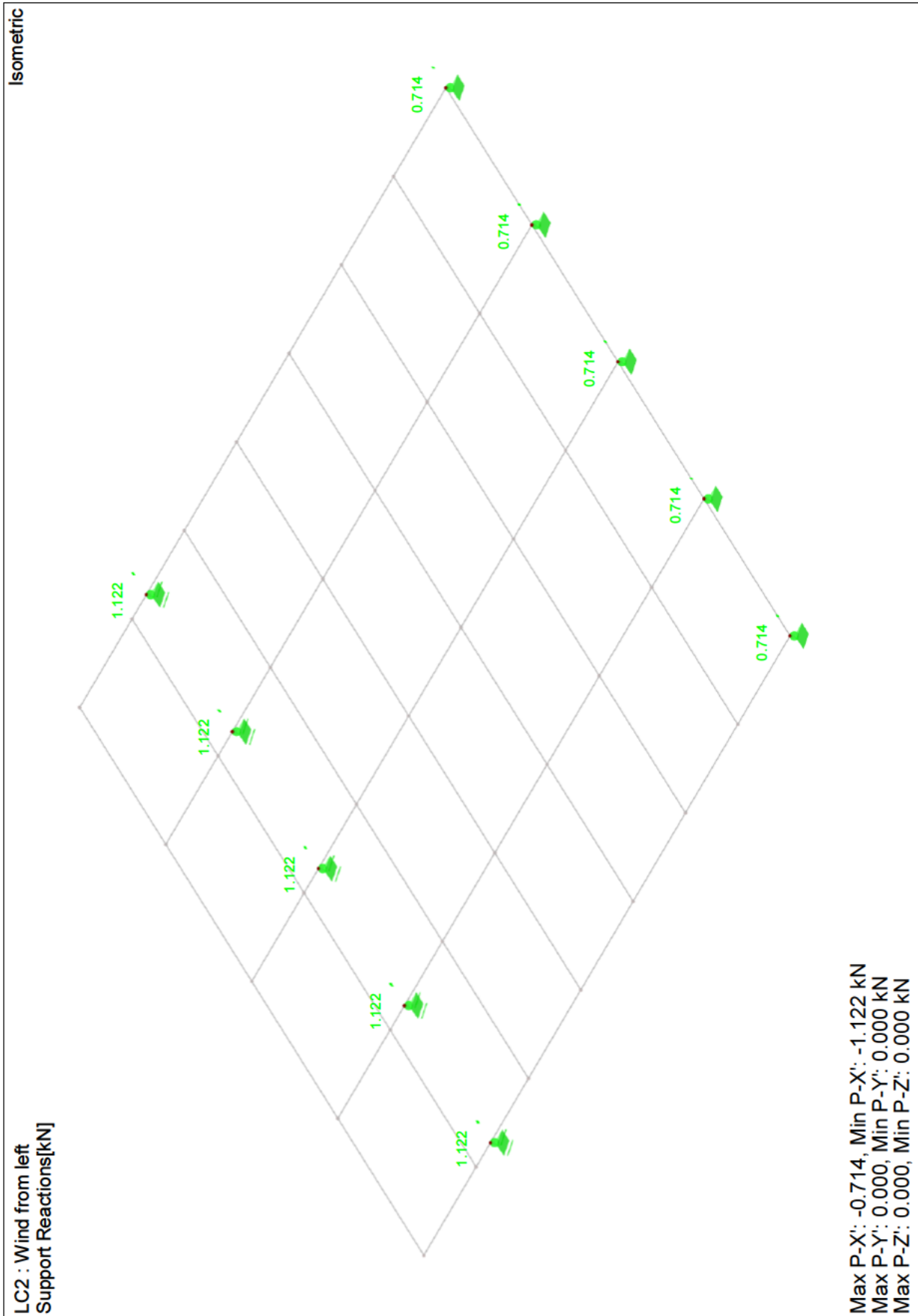


6.2.1.1. Reaction forces (LC1)

Node No.	Support Forces [kN]		
	$P_{X'}$	$P_{Y'}$	$P_{Z'}$
3	0.056	0.000	-1.184
5	0.000	0.000	-1.506
7	0.000	0.000	-1.505
9	0.000	0.000	-1.506
11	-0.056	0.000	-1.184
44	-0.016	0.000	-1.864
45	-0.007	0.000	-2.367
46	0.000	0.000	-2.368
47	0.007	0.000	-2.367
48	0.016	0.000	-1.864
Σ Forces	0.000	0.000	-17.715
Σ Loads	0.000	0.000	-17.715

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6.2.2. Wind from left (LC2)

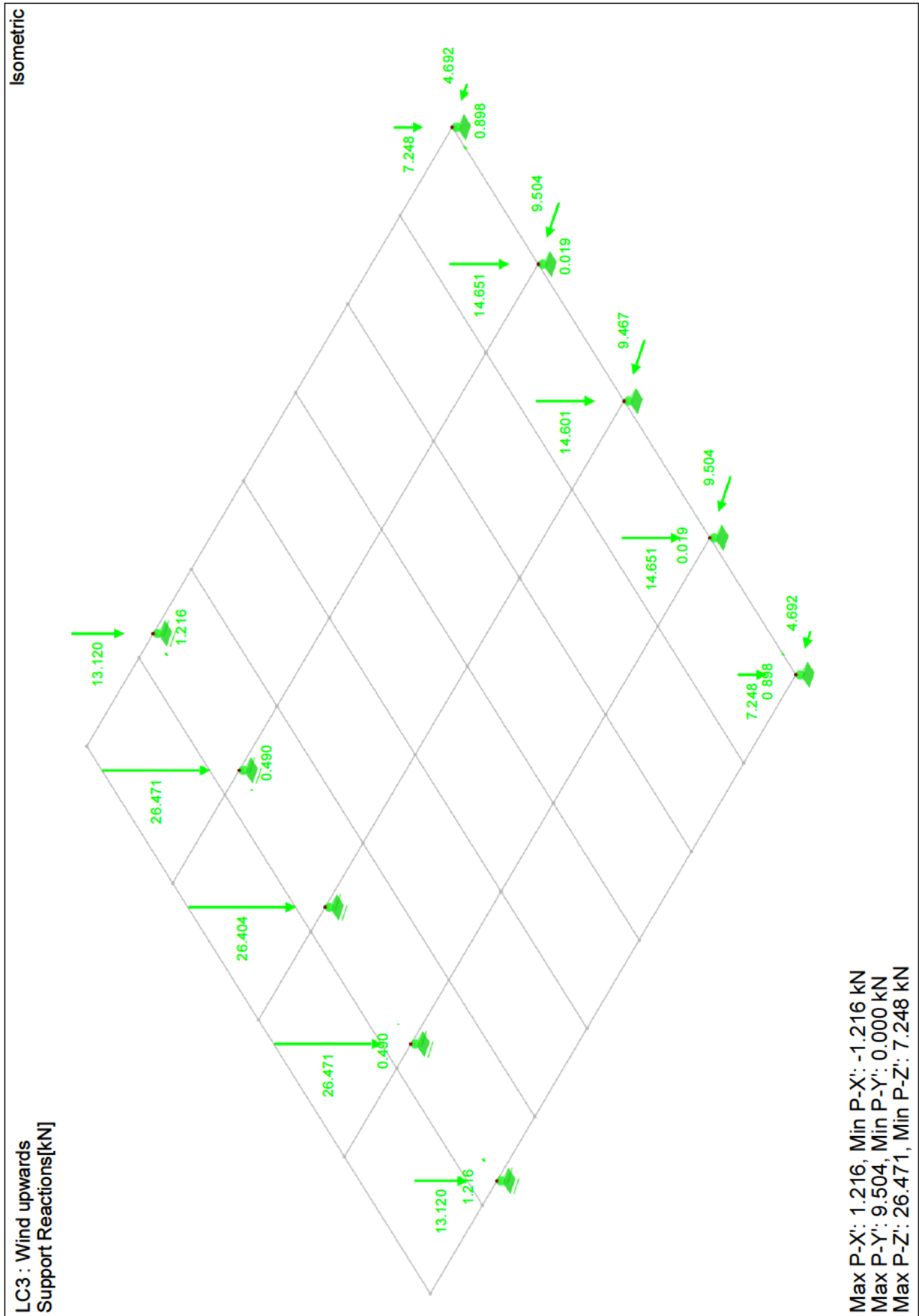


6.2.2.1. Reaction forces (LC2)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	-0.714	0.000	0.000
5	-0.714	0.000	0.000
7	-0.714	0.000	0.000
9	-0.714	0.000	0.000
11	-0.714	0.000	0.000
44	-1.122	0.000	0.000
45	-1.122	0.000	0.000
46	-1.122	0.000	0.000
47	-1.122	0.000	0.000
48	-1.122	0.000	0.000
Σ Forces	-9.180	0.000	0.000
Σ Loads	-9.180	0.000	0.000

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6.2.3. Wind upwards (LC3)

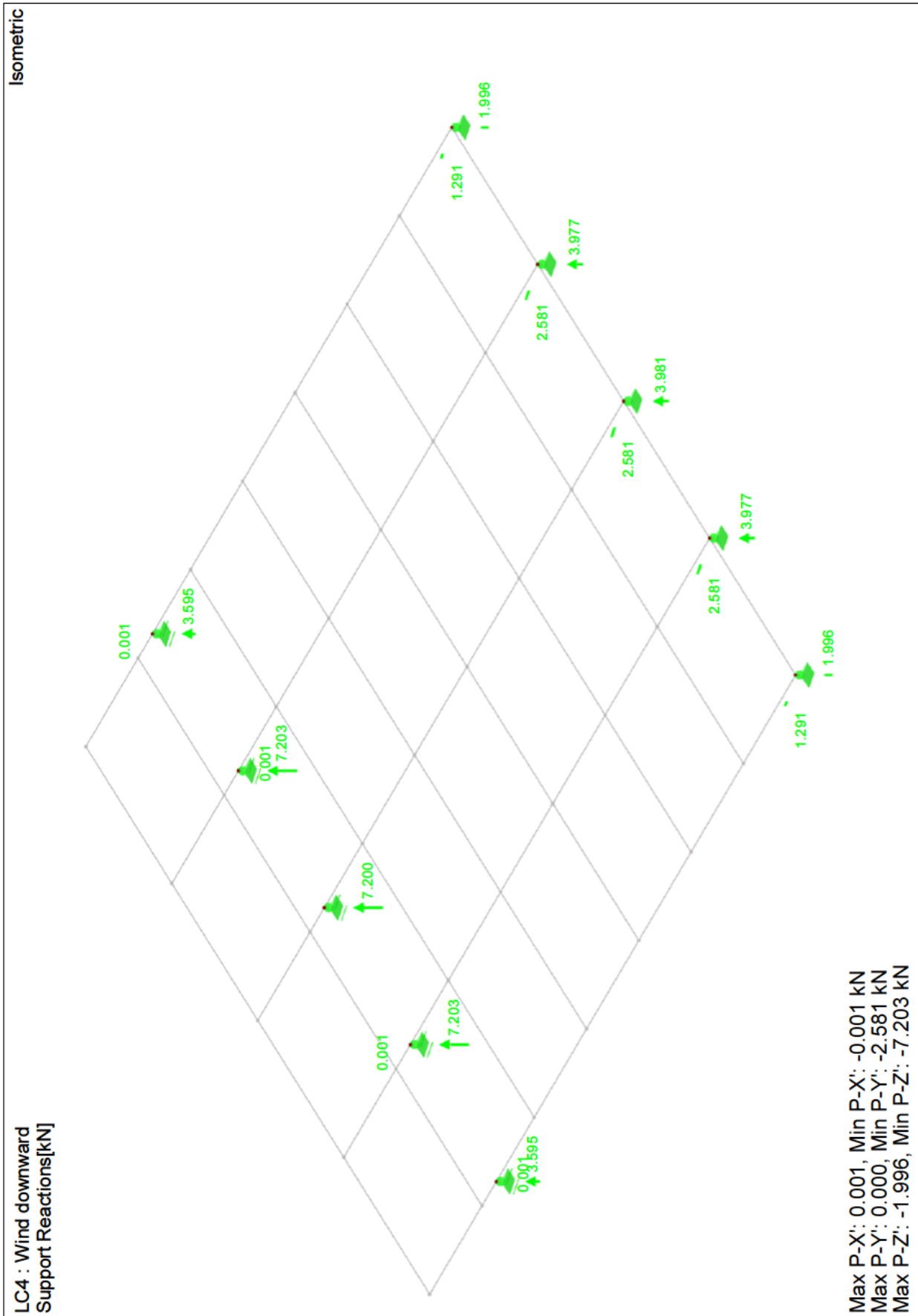


6.2.3.1. Reaction forces (LC3)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.898	4.692	7.248
5	0.019	9.504	14.651
7	0.000	9.467	14.601
9	-0.019	9.504	14.651
11	-0.898	4.692	7.248
44	-1.216	0.000	13.120
45	-0.490	0.000	26.471
46	0.000	0.000	26.404
47	0.490	0.000	26.471
48	1.216	0.000	13.120
Σ Forces	0.000	37.859	163.985
Σ Loads	0.000	37.859	163.985

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6.2.4. Wind downwards (LC4)

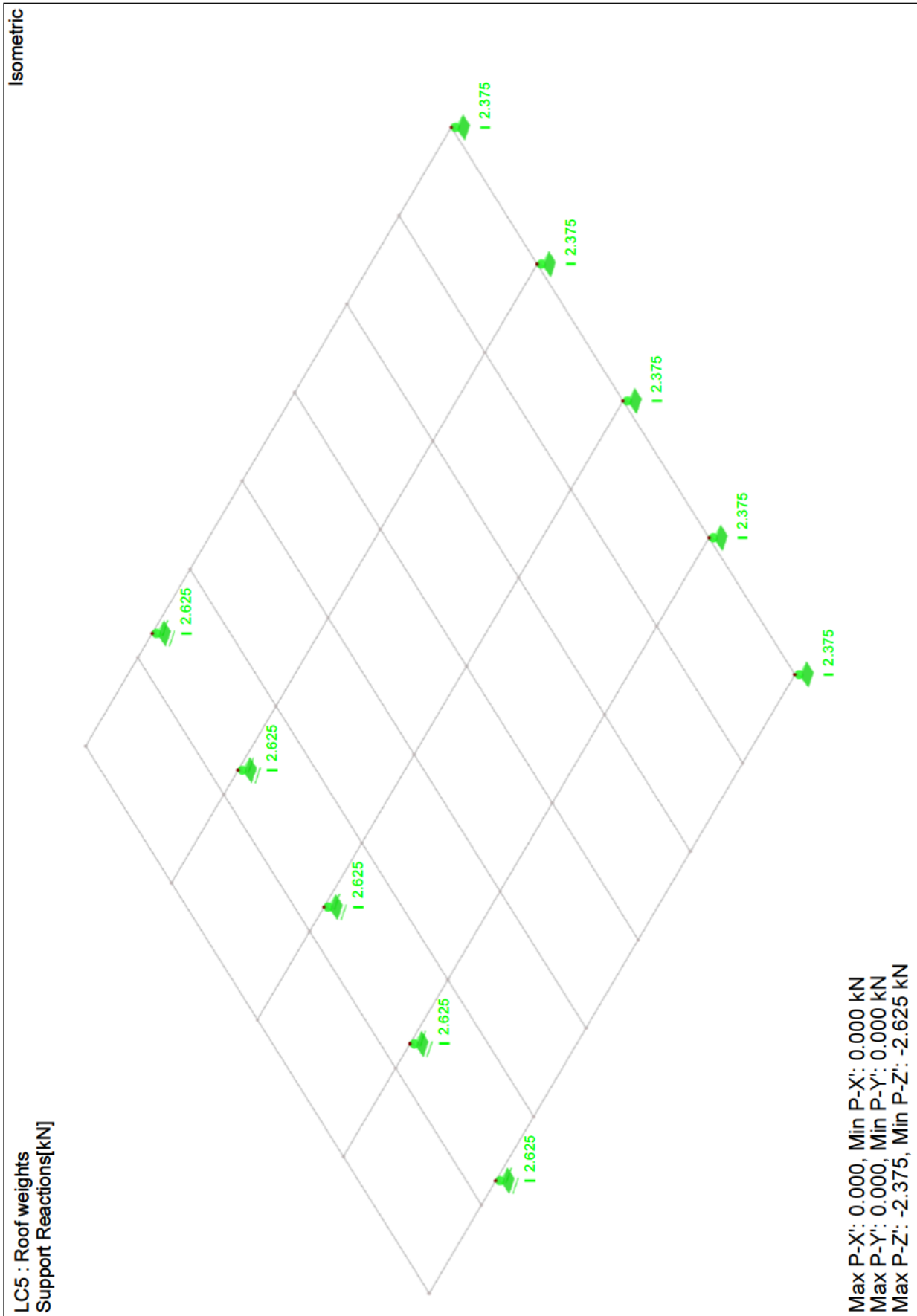


6.2.4.1. Reaction forces (LC4)

Node No.	Support Forces [kN]		
	P_X	P_Y	P_Z
3	0.000	-1.291	-1.996
5	0.000	-2.581	-3.977
7	0.000	-2.581	-3.981
9	0.000	-2.581	-3.977
11	0.000	-1.291	-1.996
44	0.001	0.000	-3.595
45	-0.001	0.000	-7.203
46	0.000	0.000	-7.200
47	0.001	0.000	-7.203
48	-0.001	0.000	-3.595
Σ Forces	0.000	-10.325	-44.724
Σ Loads	0.000	-10.325	-44.724

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6.2.5. Roof weights (LC5)

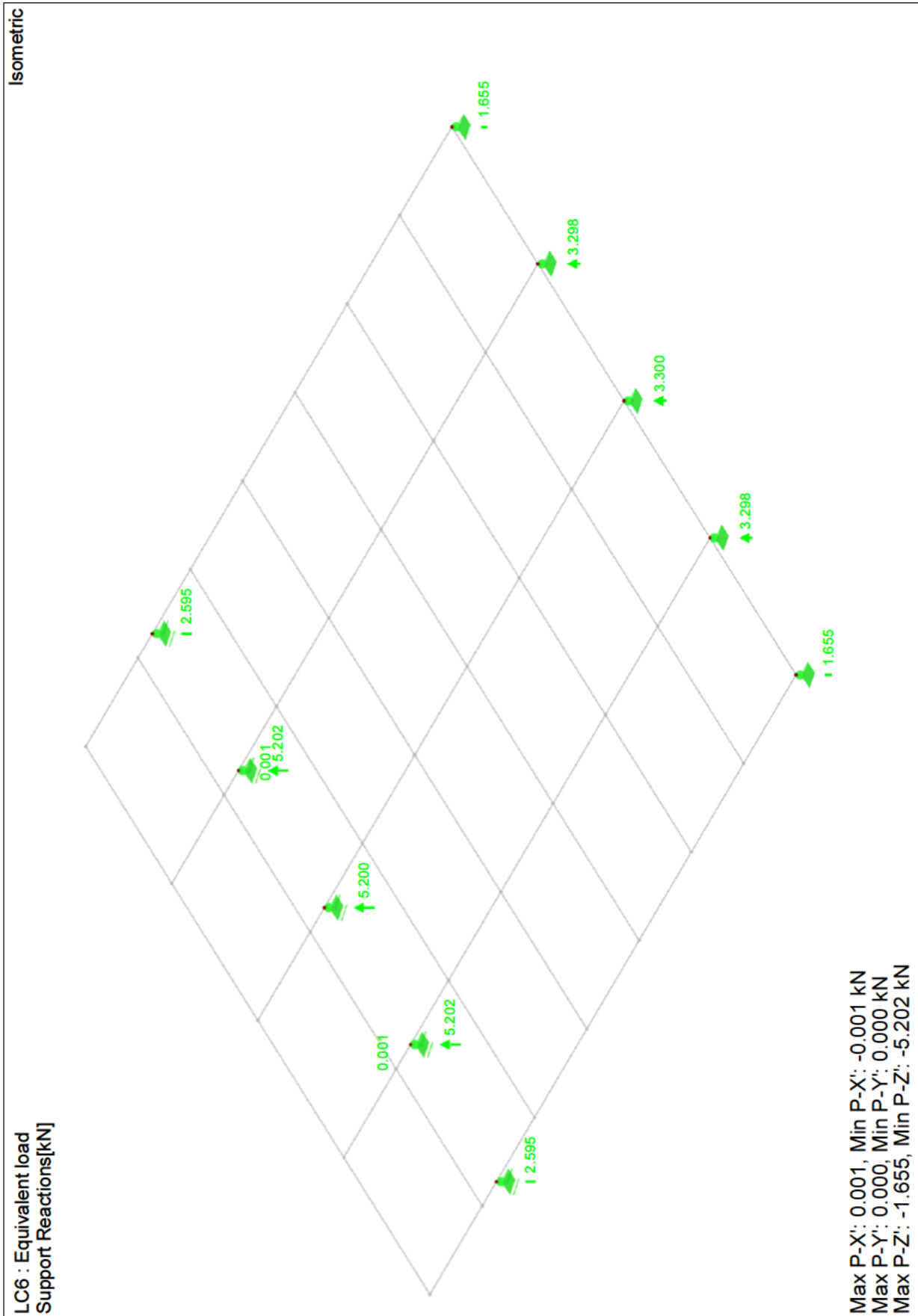


6.2.5.1. Reaction forces (LC5)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.000	0.000	-2.375
5	0.000	0.000	-2.375
7	0.000	0.000	-2.375
9	0.000	0.000	-2.375
11	0.000	0.000	-2.375
44	0.000	0.000	-2.625
45	0.000	0.000	-2.625
46	0.000	0.000	-2.625
47	0.000	0.000	-2.625
48	0.000	0.000	-2.625
Σ Forces	0.000	0.000	-25.000
Σ Loads	0.000	0.000	-25.000

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6.2.6. Equivalent load (LC6)



6.2.6.1. Reaction forces (LC6)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.000	0.000	-1.655
5	0.000	0.000	-3.298
7	0.000	0.000	-3.300
9	0.000	0.000	-3.298
11	0.000	0.000	-1.655
44	0.000	0.000	-2.595
45	-0.001	0.000	-5.202
46	0.000	0.000	-5.200
47	0.001	0.000	-5.202
48	0.000	0.000	-2.595
Σ Forces	0.000	0.000	-34.000
Σ Loads	0.000	0.000	-34.000

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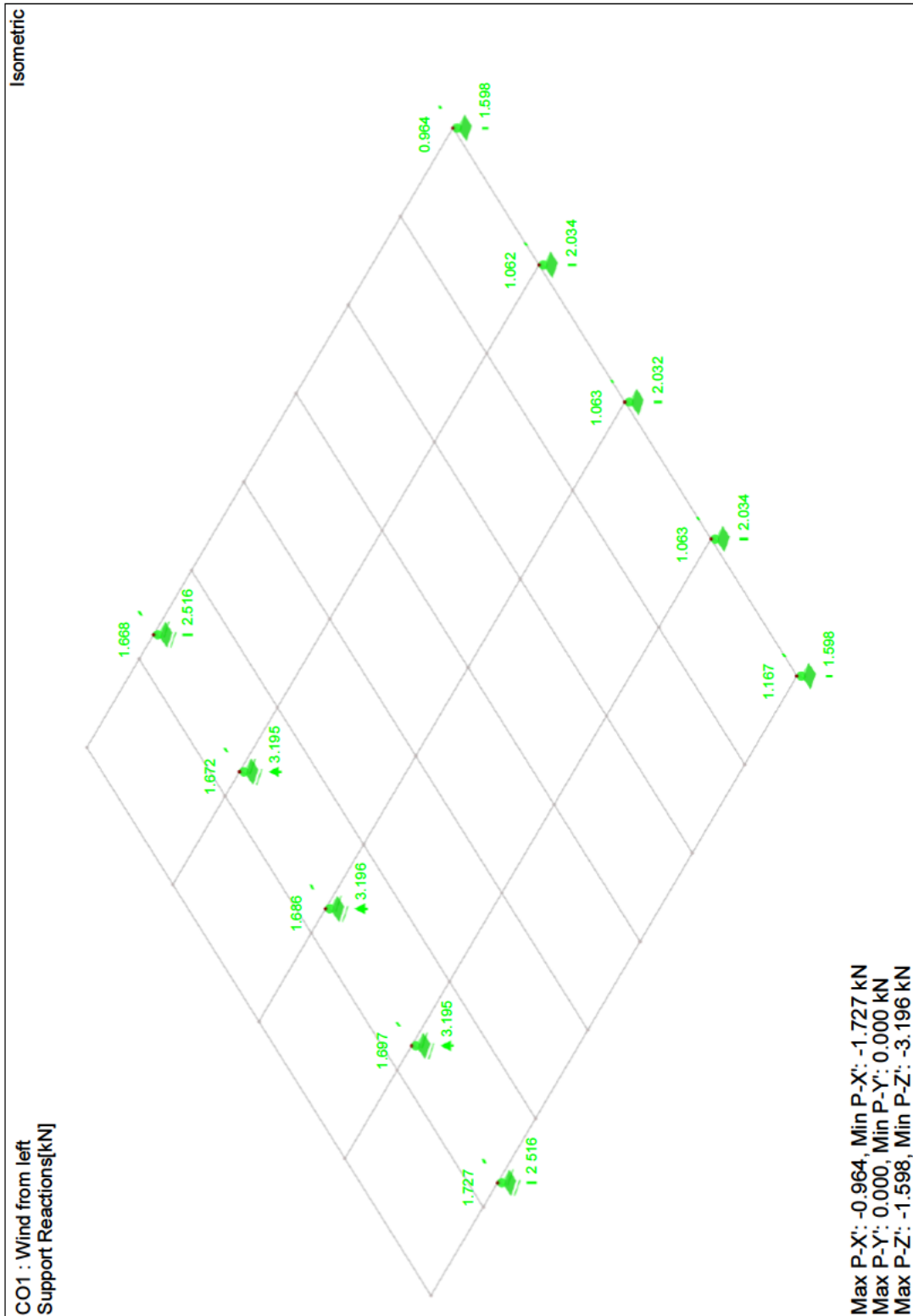
6.2.7. Wind from left (CO1)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind from left = 1.5

Imperfection = 1.0



6.2.7.1. Reaction forces (CO1)

Node No.	Support Forces [kN]		
	$P_{X'}$	$P_{Y'}$	$P_{Z'}$
3	-0.964	0.000	-1.598
5	-1.062	0.000	-2.033
7	-1.063	0.000	-2.032
9	-1.063	0.000	-2.034
11	-1.167	0.000	-1.598
44	-1.727	0.000	-2.516
45	-1.697	0.000	-3.195
46	-1.686	0.000	-3.196
47	-1.672	0.000	-3.195
48	-1.668	0.000	-2.516
Σ Forces	-13.770	0.000	-23.916
Σ Loads	-13.770	0.000	-23.916

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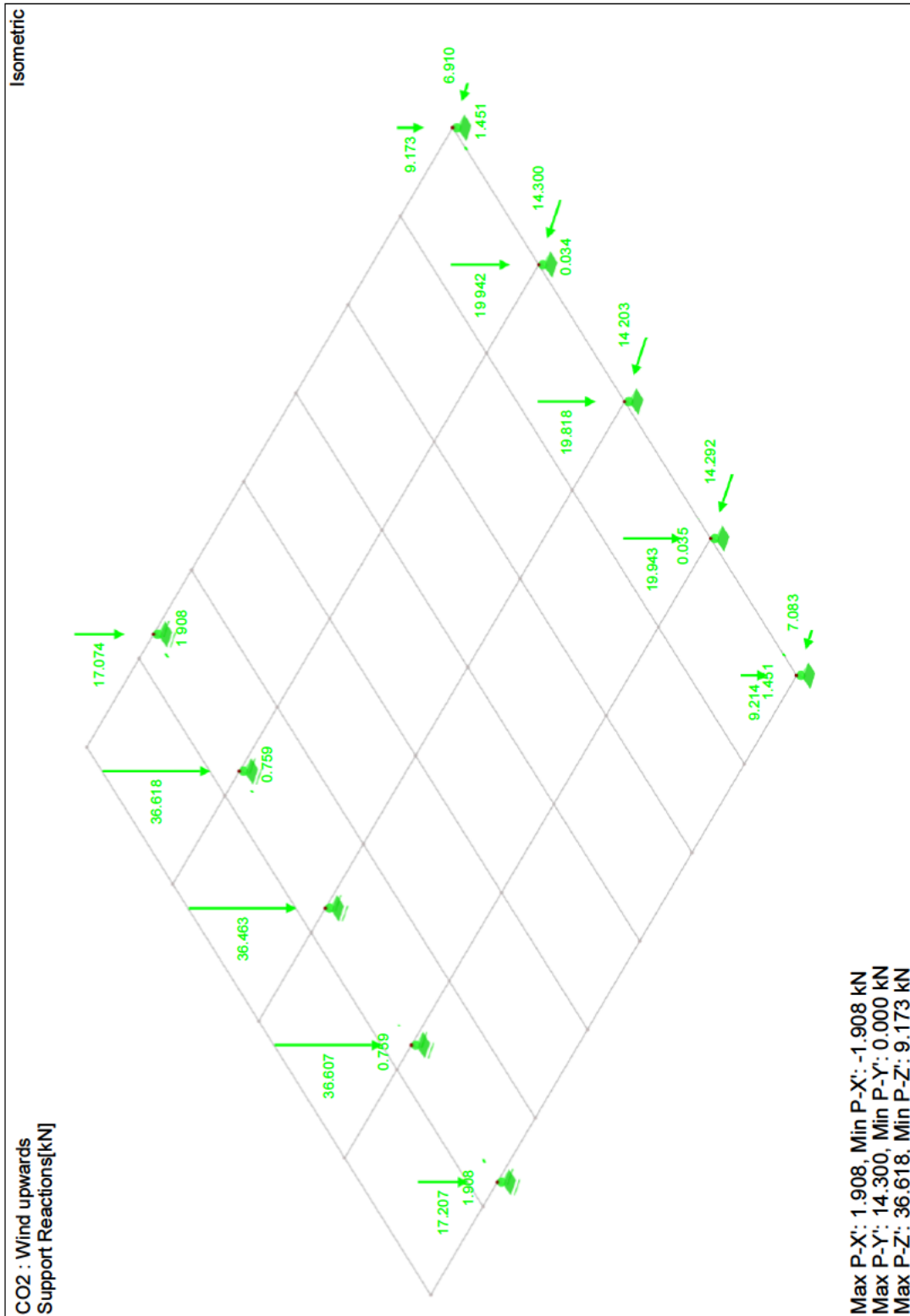
6.2.8. Wind upwards (CO2)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind upwards = 1.5

Imperfection = 1.0



6.2.8.1. Reaction forces (CO2)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	1.451	6.910	9.173
5	0.034	14.300	19.942
7	0.000	14.203	19.818
9	-0.035	14.292	19.943
11	-1.451	7.083	9.214
44	-1.908	0.000	17.207
45	-0.759	0.000	36.607
46	0.000	0.000	36.463
47	0.759	0.000	36.618
48	1.908	0.000	17.074
Σ Forces	0.000	56.788	222.060
Σ Loads	0.000	56.788	222.060

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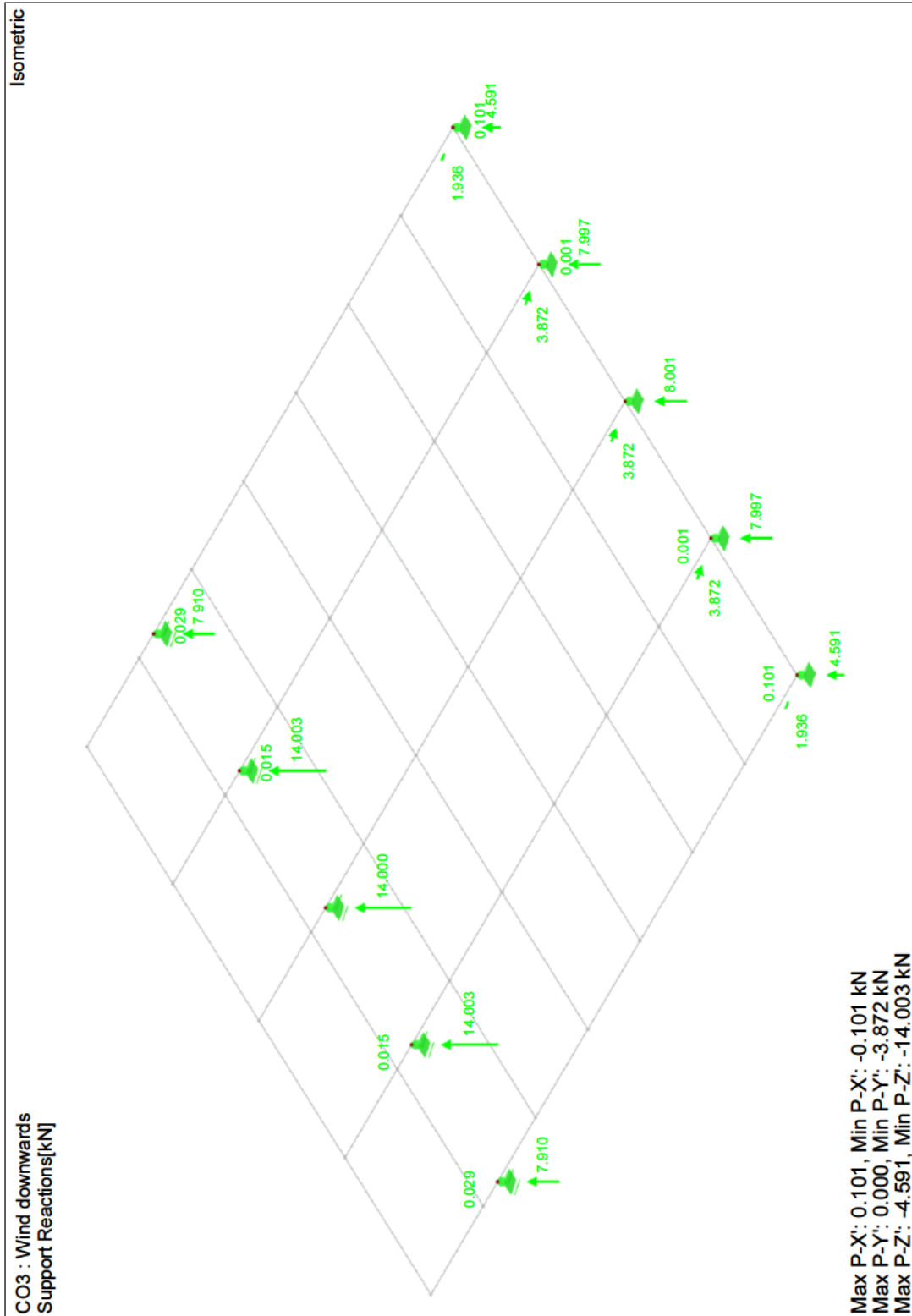
6.2.9. Wind downwards (CO3)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind downwards = 1.5

Imperfection = 1.0



6.2.9.1. Reaction forces (CO3)

Node No.	Support Forces [kN]		
	$P_{X'}$	$P_{Y'}$	$P_{Z'}$
3	0.101	-1.936	-4.591
5	0.001	-3.872	-7.997
7	0.000	-3.872	-8.001
9	-0.001	-3.872	-7.997
11	-0.101	-1.936	-4.591
44	-0.029	0.000	-7.910
45	-0.015	0.000	-14.003
46	0.000	0.000	-14.000
47	0.015	0.000	-14.003
48	0.029	0.000	-7.910
Σ Forces	0.000	-15.488	-91.002
Σ Loads	0.000	-15.488	-91.002

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6.2.10. Wind downwards and roof weights (CO4)

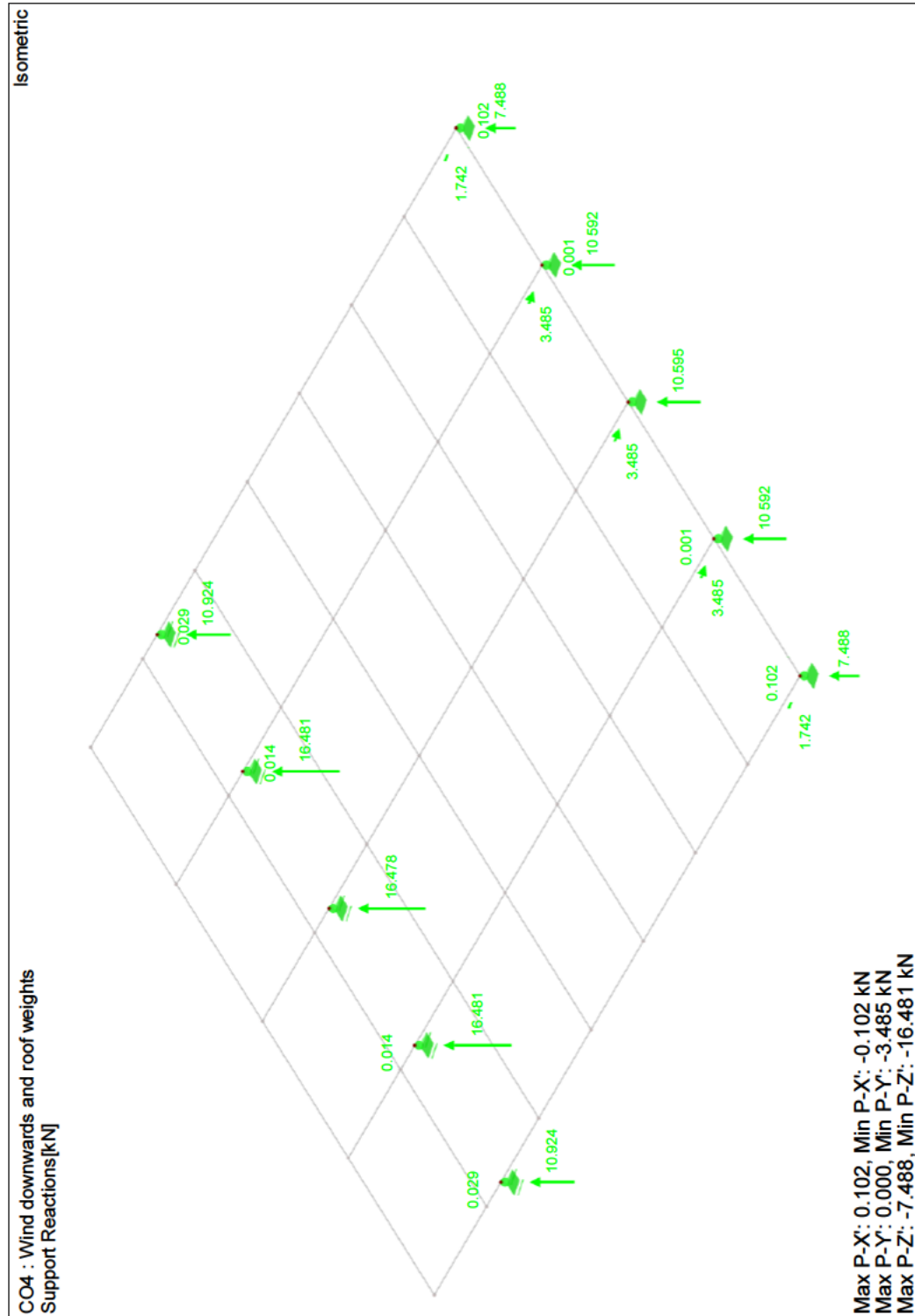
Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind downwards = 1.35

Roof weights = 1.35

Imperfection = 1.0



6.2.10.1. Reaction forces (CO4)

Node No.	Support Forces [kN]		
	P_X	P_Y	P_Z
3	0.102	-1.742	-7.488
5	0.001	-3.485	-10.592
7	0.000	-3.485	-10.595
9	-0.001	-3.485	-10.592
11	-0.102	-1.742	-7.488
44	-0.029	0.000	-10.924
45	-0.014	0.000	-16.481
46	0.000	0.000	-16.478
47	0.014	0.000	-16.481
48	0.029	0.000	-10.924
Σ Forces	0.000	-13.939	-118.043
Σ Loads	0.000	-13.939	-118.043

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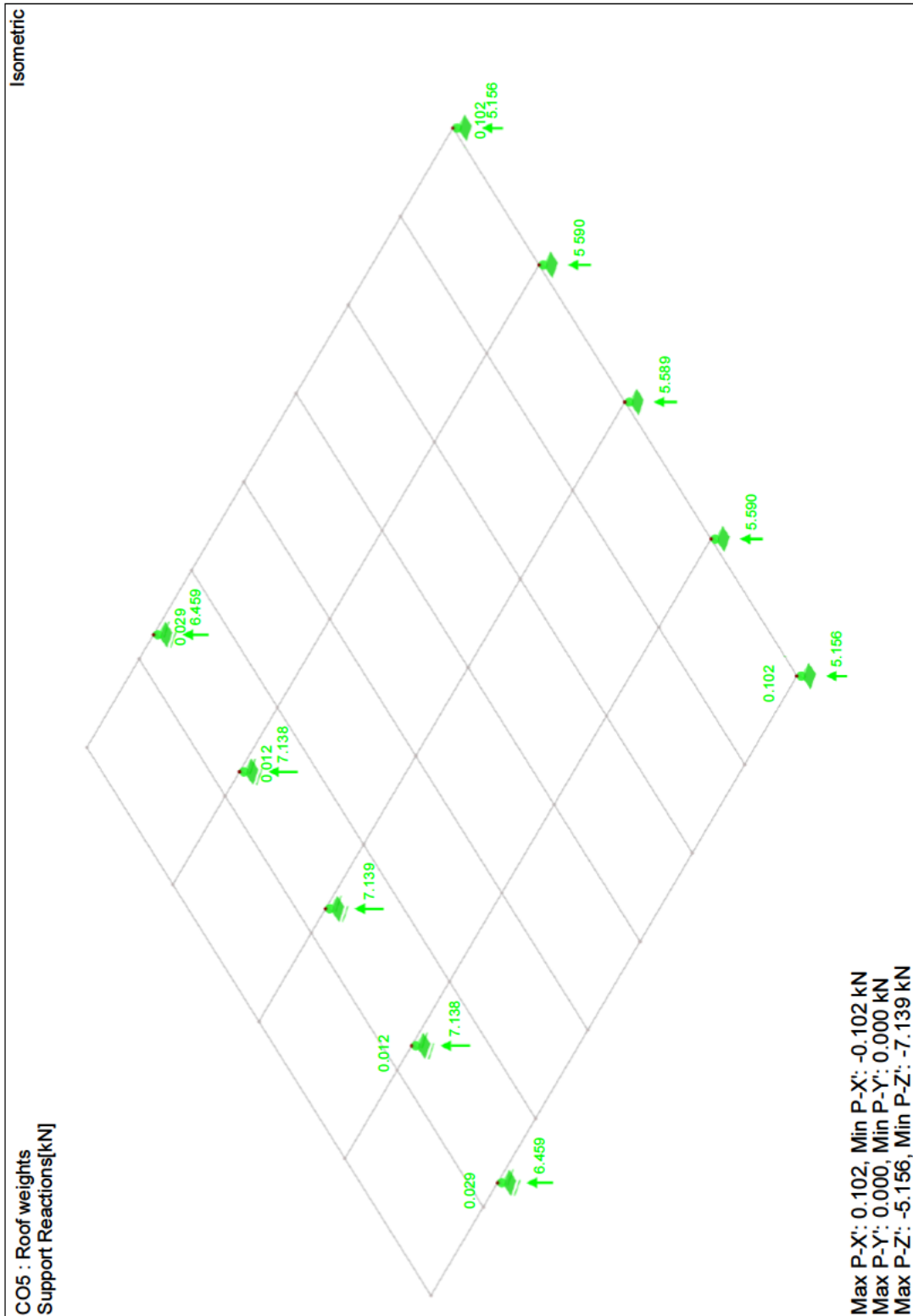
6.2.11. Roof weights (CO5)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Roof weights = 1.5

Imperfection = 1.0



6.2.11.1. Reaction forces (CO5)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.102	0.000	-5.156
5	0.000	0.000	-5.590
7	0.000	0.000	-5.589
9	0.000	0.000	-5.590
11	-0.102	0.000	-5.156
44	-0.029	0.000	-6.459
45	-0.012	0.000	-7.138
46	0.000	0.000	-7.139
47	0.012	0.000	-7.138
48	0.029	0.000	-6.459
Σ Forces	0.000	0.000	-61.416
Σ Loads	0.000	0.000	-61.416

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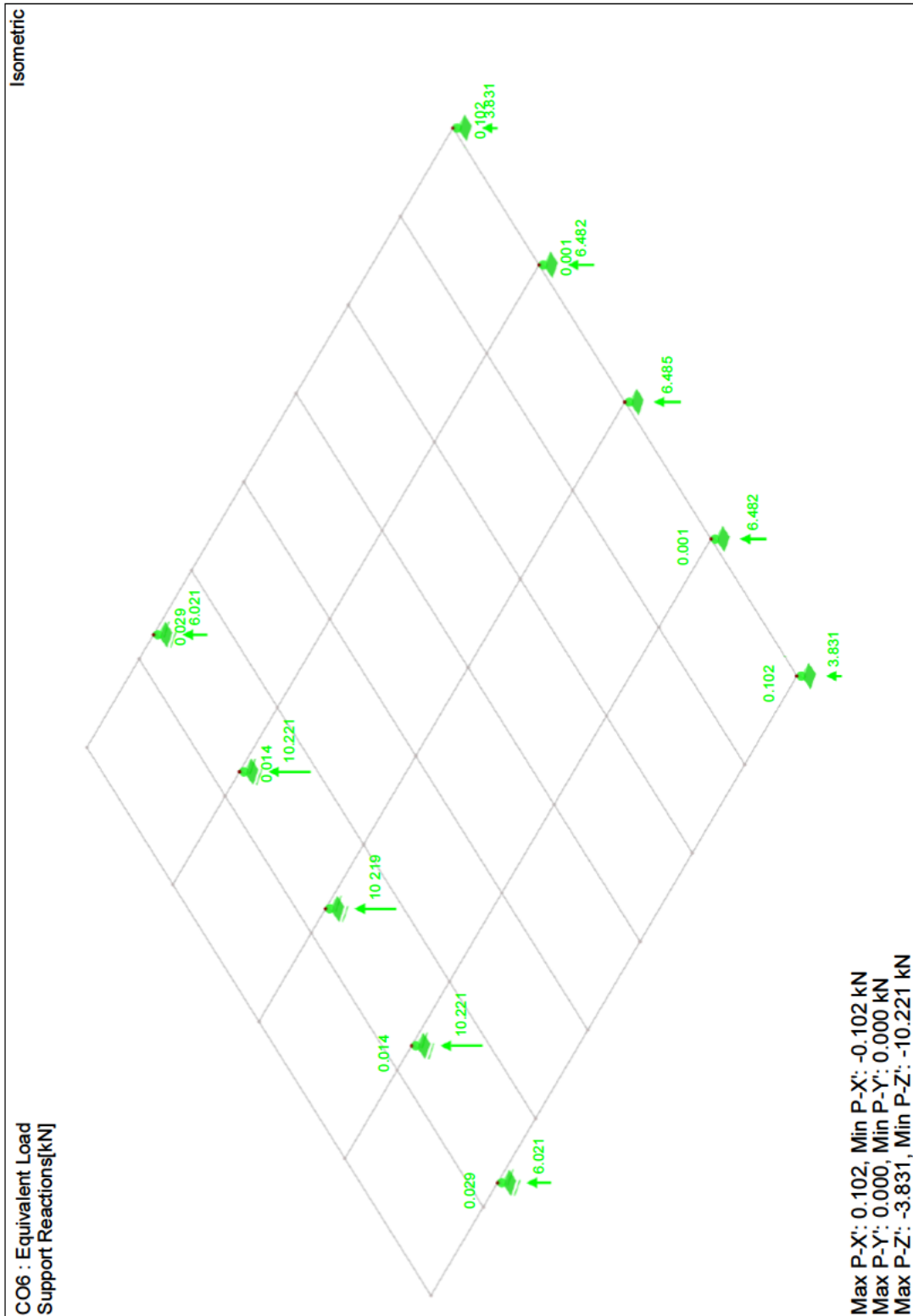
6.2.12. Equivalent load (CO6)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Equivalent load = 1.35

Imperfection = 1.0



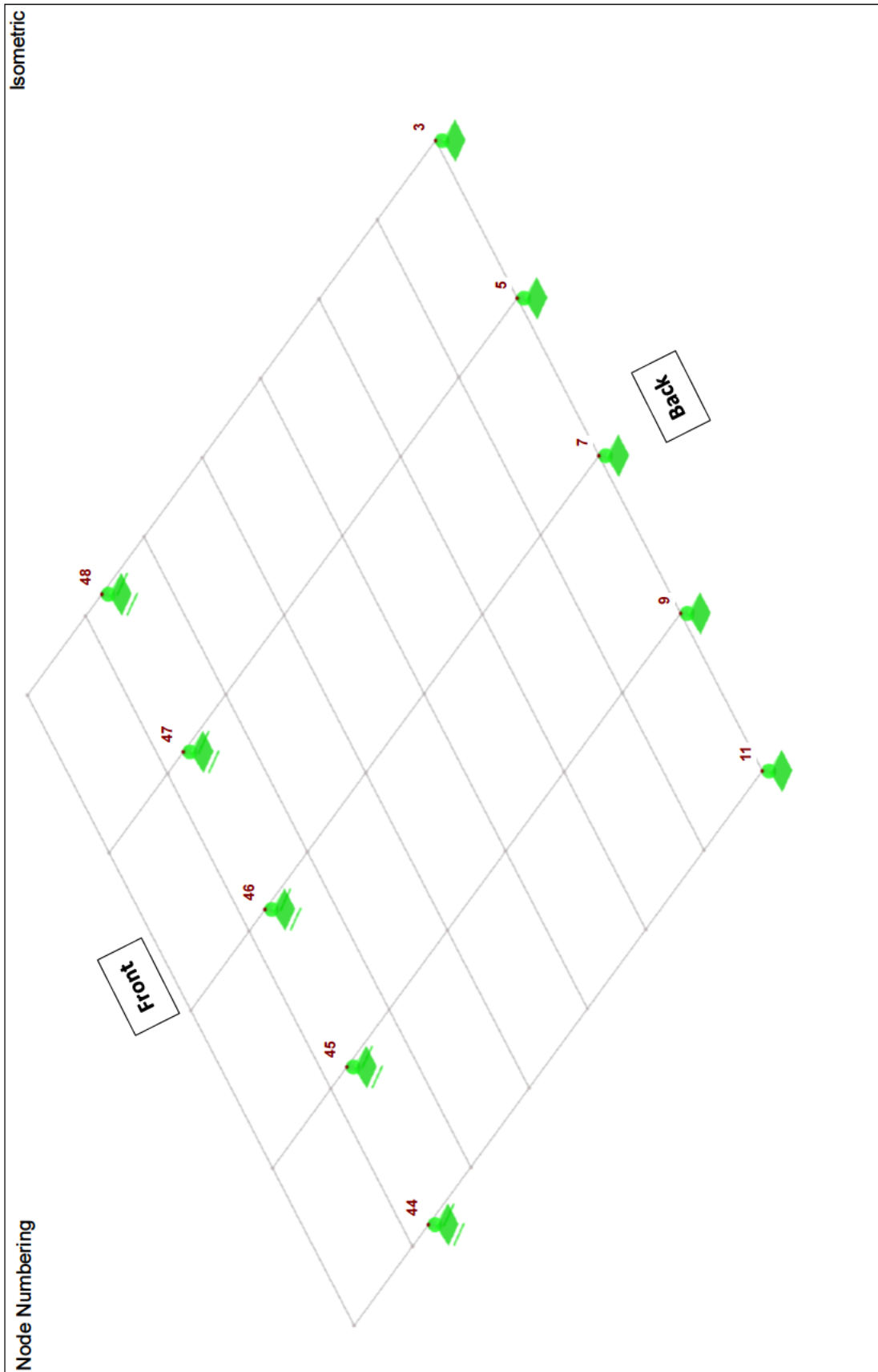
6.2.12.1. Reaction forces (CO6)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.102	0.000	-3.831
5	0.001	0.000	-6.482
7	0.000	0.000	-6.485
9	-0.001	0.000	-6.482
11	-0.102	0.000	-3.831
44	-0.029	0.000	-6.021
45	-0.014	0.000	-10.221
46	0.000	0.000	-10.219
47	0.014	0.000	-10.221
48	0.029	0.000	-6.021
Σ Forces	0.000	0.000	-69.816
Σ Loads	0.000	0.000	-69.816

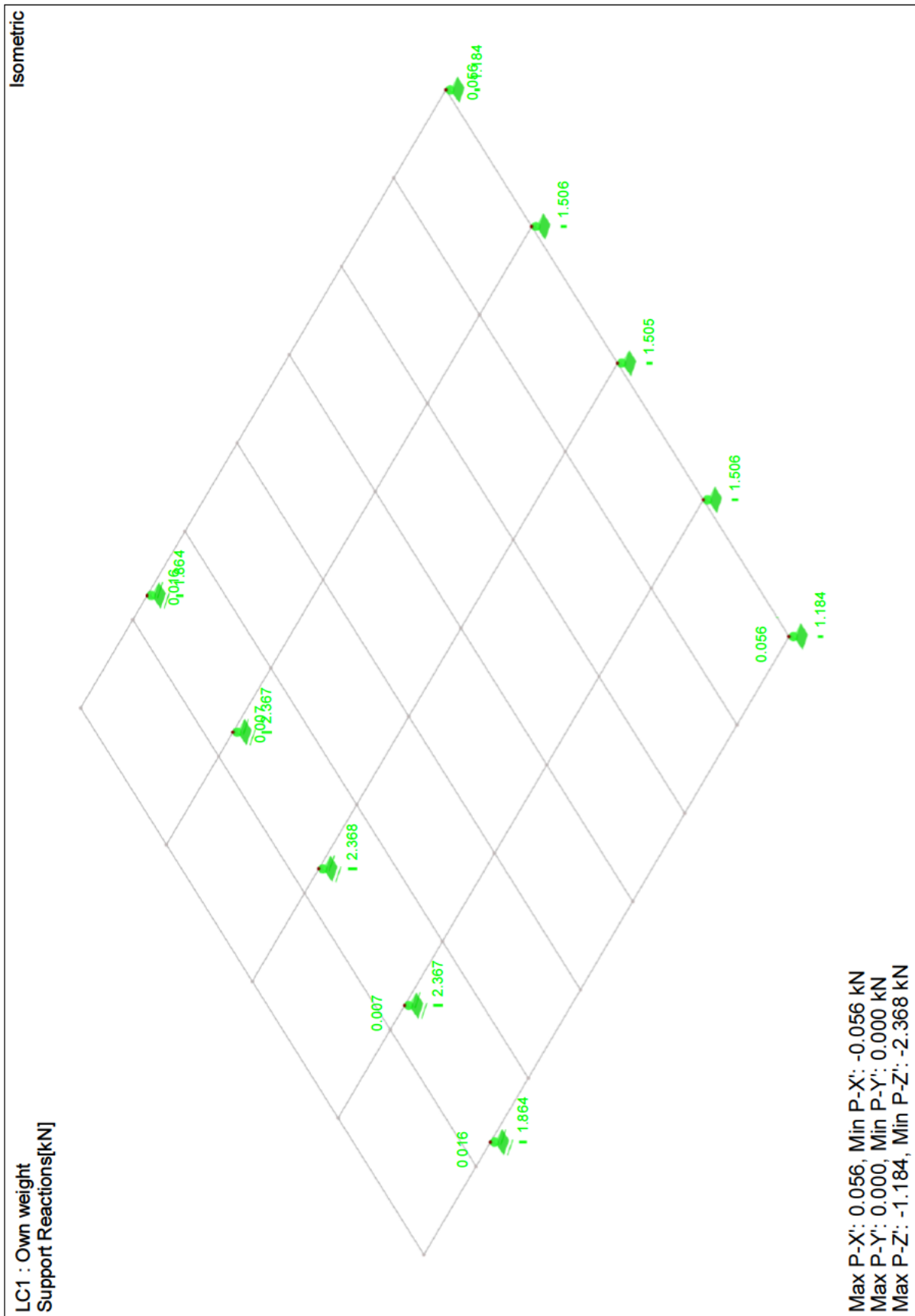
Preliminary Report

6.3. Reaction forces: Structure is in use ($q_p = 0.3 \text{ kN/m}^2$)

6.3.1. Node numbers



6.3.2. Own weight (LC1)

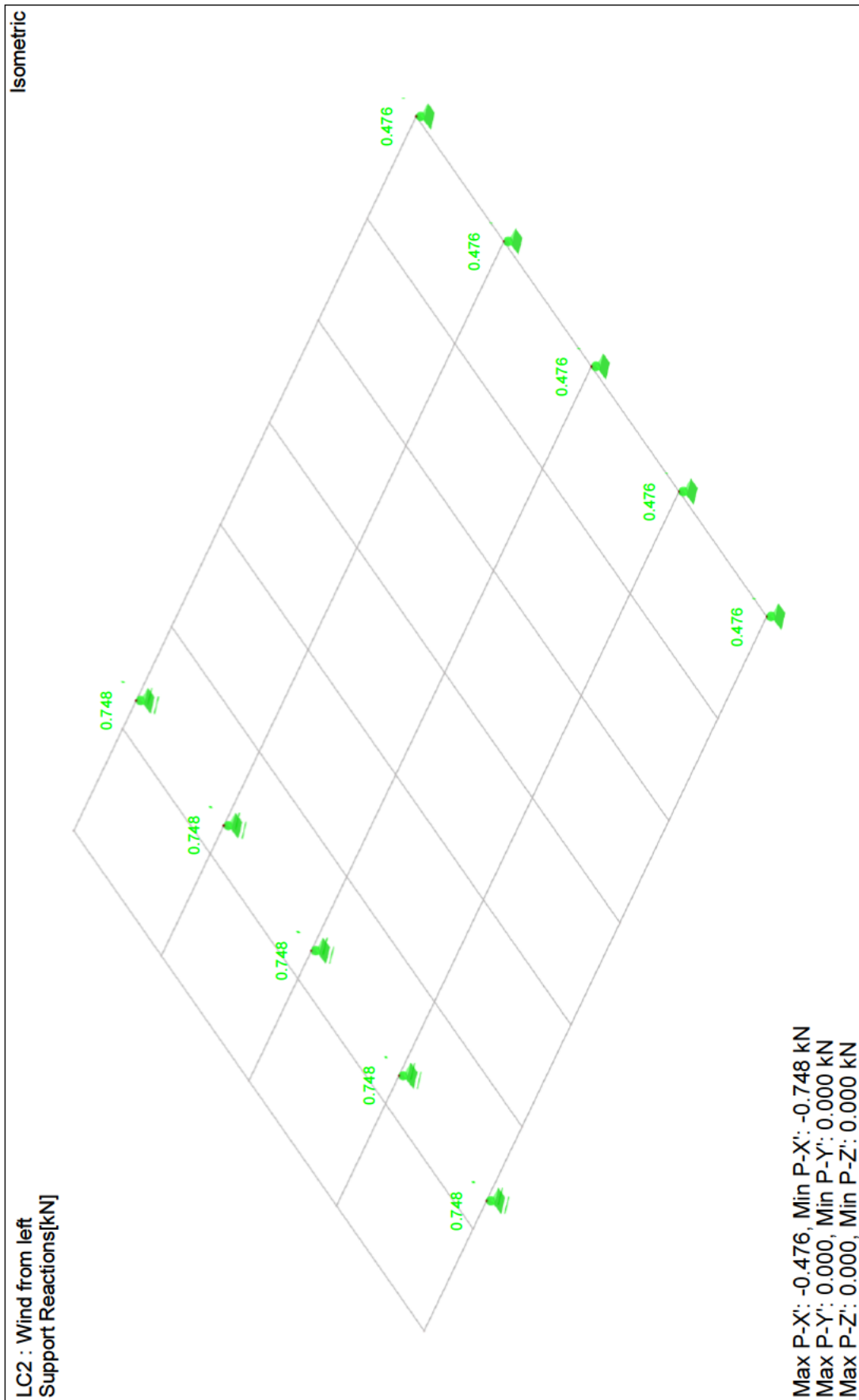


6.3.2.1. Reaction forces (LC1)

Node No.	Support Forces [kN]		
	$P_{X'}$	$P_{Y'}$	$P_{Z'}$
3	0.056	0.000	-1.184
5	0.000	0.000	-1.506
7	0.000	0.000	-1.505
9	0.000	0.000	-1.506
11	-0.056	0.000	-1.184
44	-0.016	0.000	-1.864
45	-0.007	0.000	-2.367
46	0.000	0.000	-2.368
47	0.007	0.000	-2.367
48	0.016	0.000	-1.864
Σ Forces	0.000	0.000	-17.715
Σ Loads	0.000	0.000	-17.715

Preliminary Report

6.3.3. Wind from left (LC2)

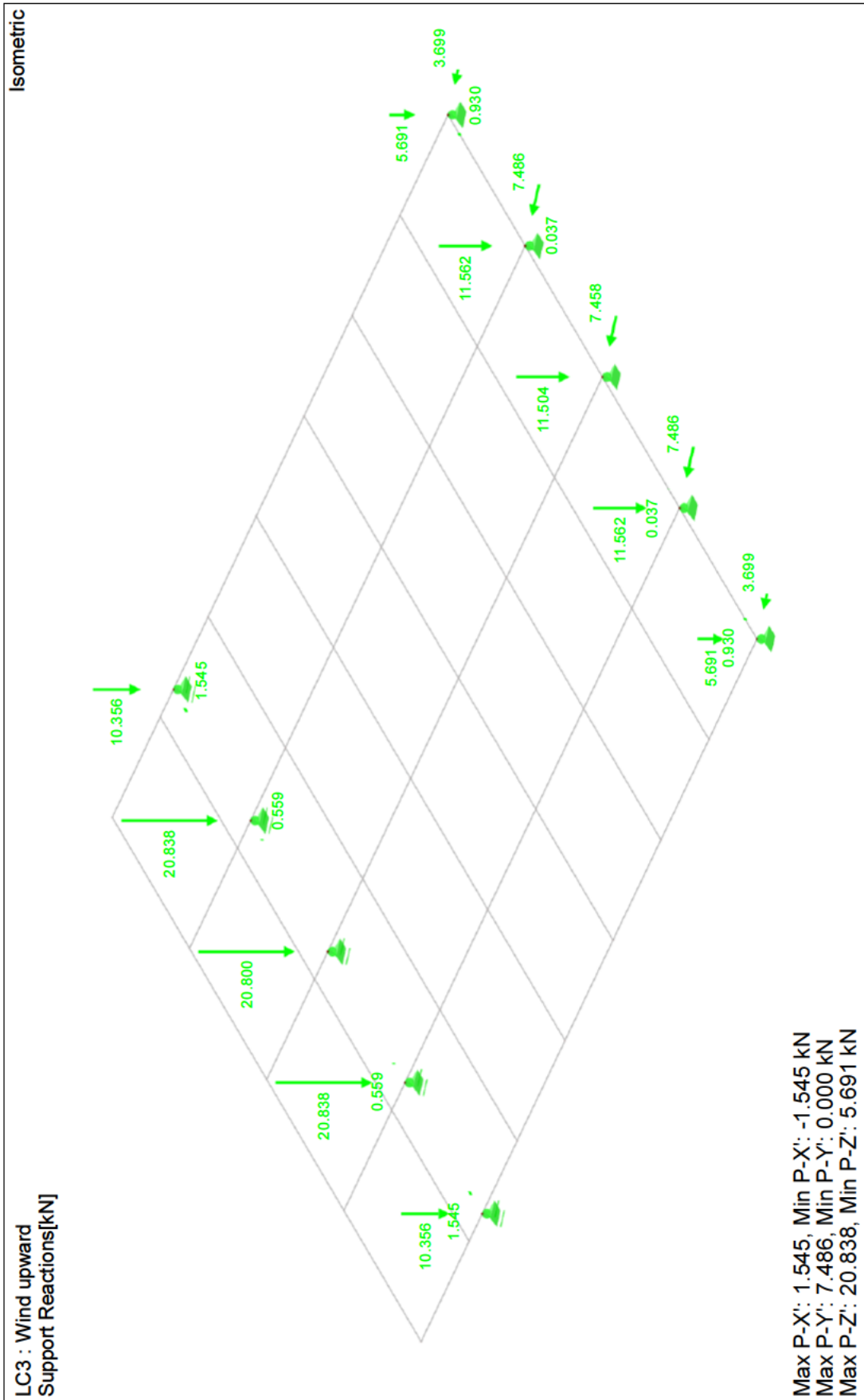


6.3.3.1. Reaction forces (LC2)

Node No.	Support Forces [kN]		
	$P_{x'}$	$P_{y'}$	$P_{z'}$
3	-0.476	0.000	0.000
5	-0.476	0.000	0.000
7	-0.476	0.000	0.000
9	-0.476	0.000	0.000
11	-0.476	0.000	0.000
44	-0.748	0.000	0.000
45	-0.748	0.000	0.000
46	-0.748	0.000	0.000
47	-0.748	0.000	0.000
48	-0.748	0.000	0.000
Σ Forces	-6.120	0.000	0.000
Σ Loads	-6.120	0.000	0.000

Preliminary Report

6.3.4. Wind Upward (LC3)

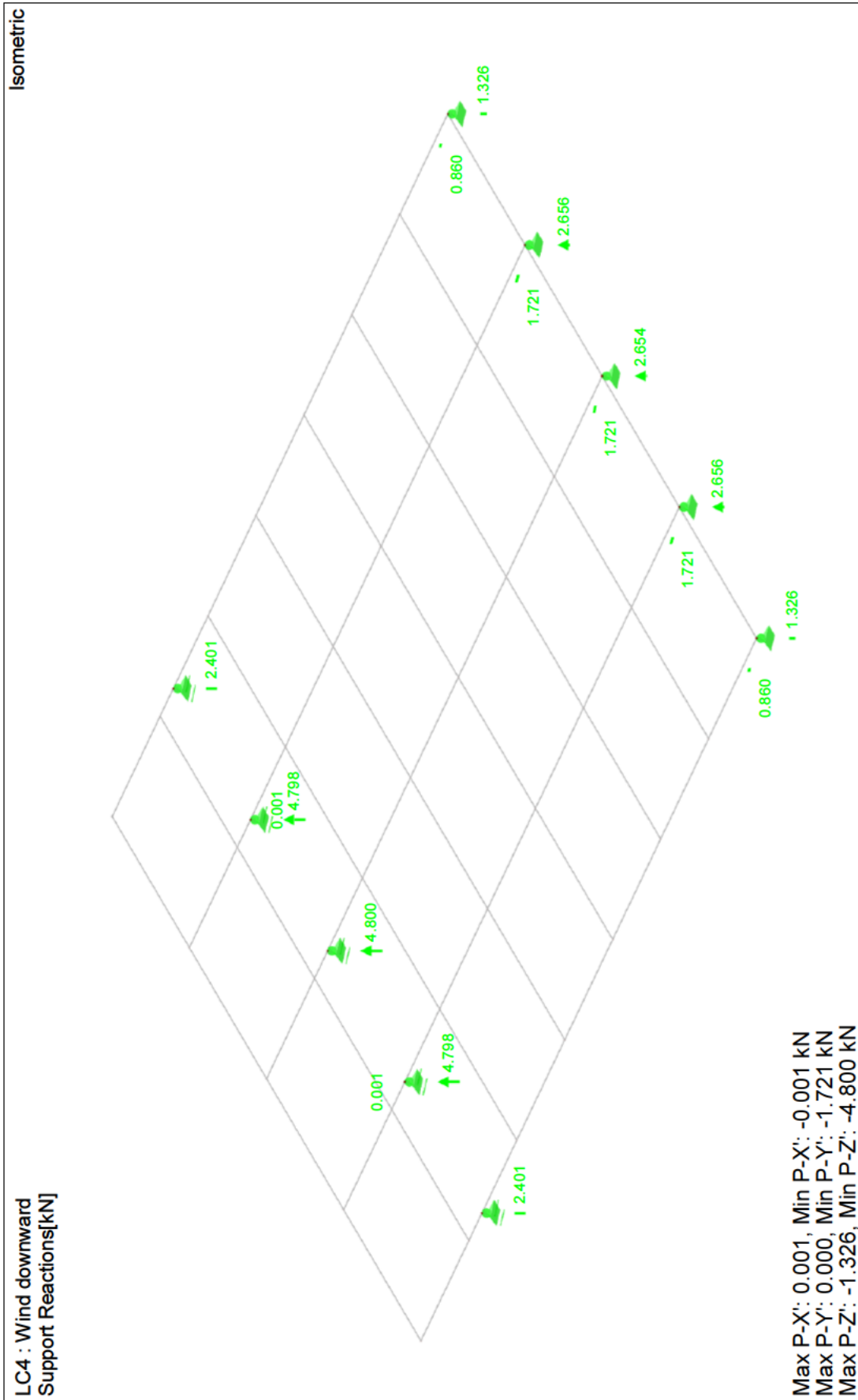


6.3.4.1. Reaction forces (LC3)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.930	3.699	5.691
5	0.037	7.486	11.562
7	0.000	7.458	11.504
9	-0.037	7.486	11.562
11	-0.930	3.699	5.691
44	-1.545	0.000	10.356
45	-0.559	0.000	20.838
46	0.000	0.000	20.800
47	0.559	0.000	20.838
48	1.545	0.000	10.356
Σ Forces	0.000	29.828	129.201
Σ Loads	0.000	29.828	129.201

Preliminary Report

6.3.5. Wind downward (LC4)

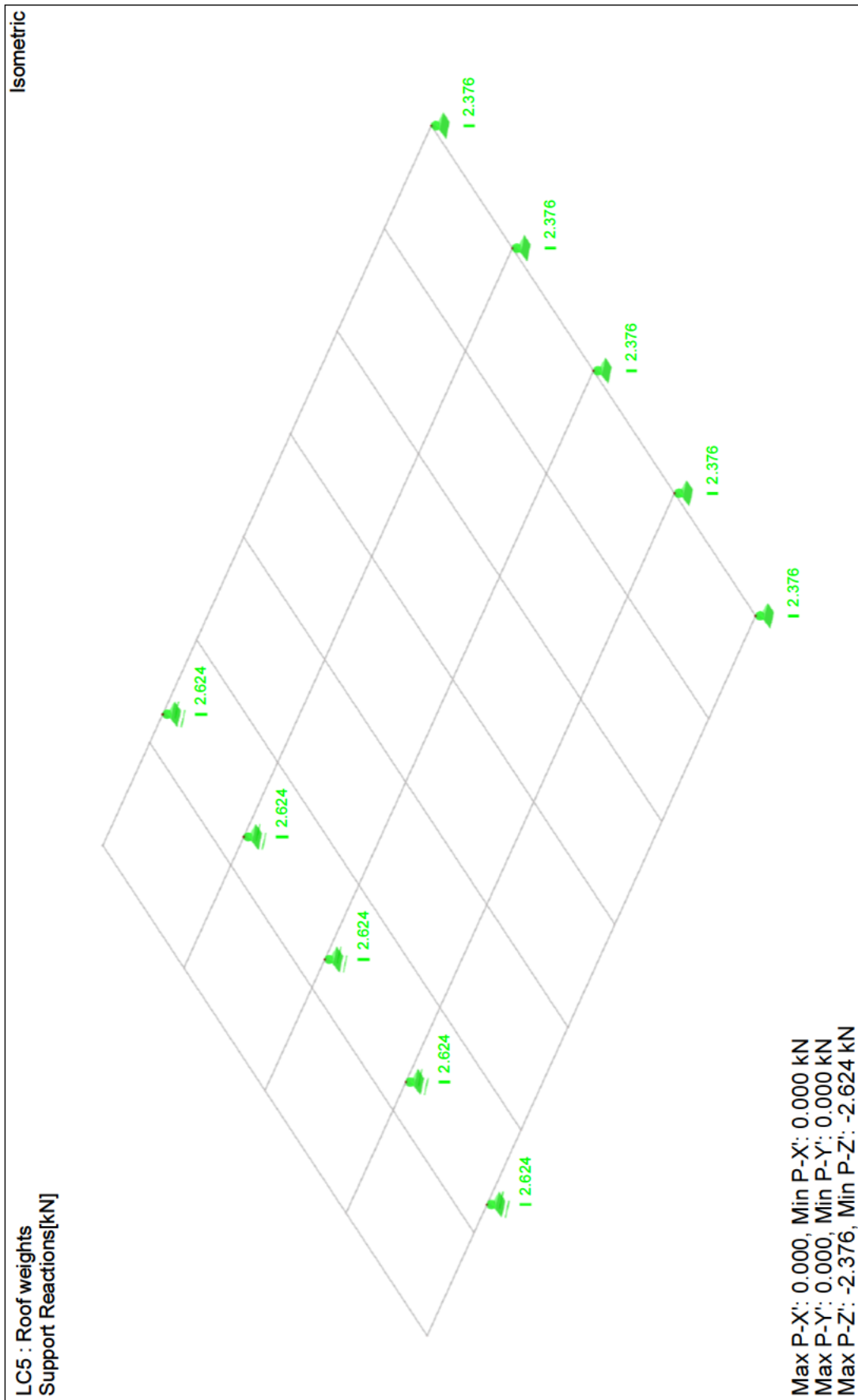


6.3.5.1. Reaction forces (LC4)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.000	-0.860	-1.326
5	0.000	-1.721	-2.656
7	0.000	-1.721	-2.654
9	0.000	-1.721	-2.656
11	0.000	-0.860	-1.326
44	0.000	0.000	-2.401
45	-0.001	0.000	-4.798
46	0.000	0.000	-4.800
47	0.001	0.000	-4.798
48	0.000	0.000	-2.401
Σ Forces	0.000	-6.884	-29.816
Σ Loads	0.000	-6.884	-29.816

Preliminary Report

6.3.6. Roof weight (LC5)

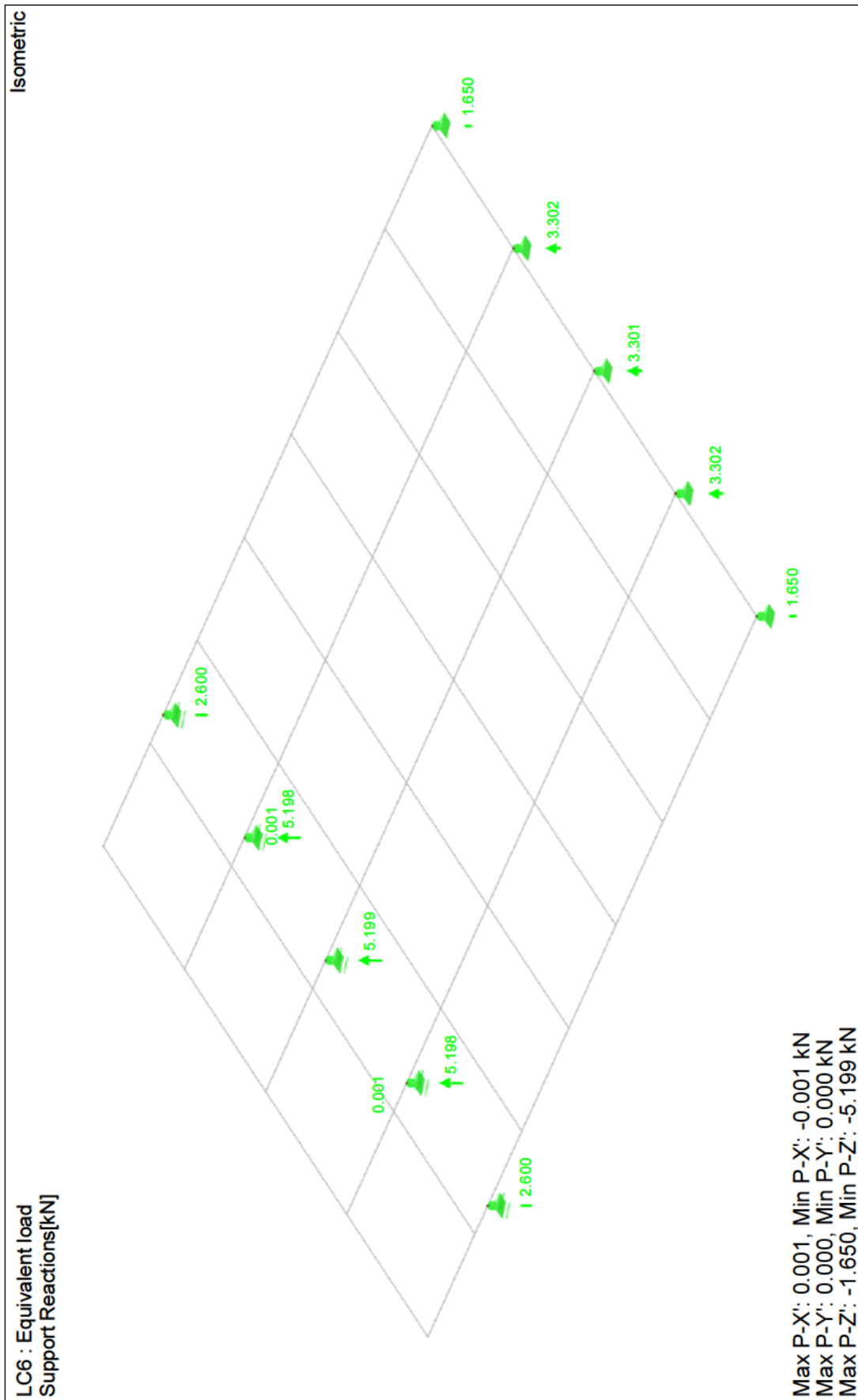


6.3.6.1. Reaction forces (LC5)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.000	0.000	-2.376
5	0.000	0.000	-2.376
7	0.000	0.000	-2.376
9	0.000	0.000	-2.376
11	0.000	0.000	-2.376
44	0.000	0.000	-2.624
45	0.000	0.000	-2.624
46	0.000	0.000	-2.624
47	0.000	0.000	-2.624
48	0.000	0.000	-2.624
Σ Forces	0.000	0.000	-25.000
Σ Loads	0.000	0.000	-25.000

Preliminary Report

6.3.7. Equivalent load (LC6)



6.3.7.1. Reaction forces (LC6)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.000	0.000	-1.650
5	0.000	0.000	-3.302
7	0.000	0.000	-3.301
9	0.000	0.000	-3.302
11	0.000	0.000	-1.650
44	0.000	0.000	-2.600
45	-0.001	0.000	-5.198
46	0.000	0.000	-5.199
47	0.001	0.000	-5.198
48	0.000	0.000	-2.600
Σ Forces	0.000	0.000	-34.000
Σ Loads	0.000	0.000	-34.000

Preliminary Report

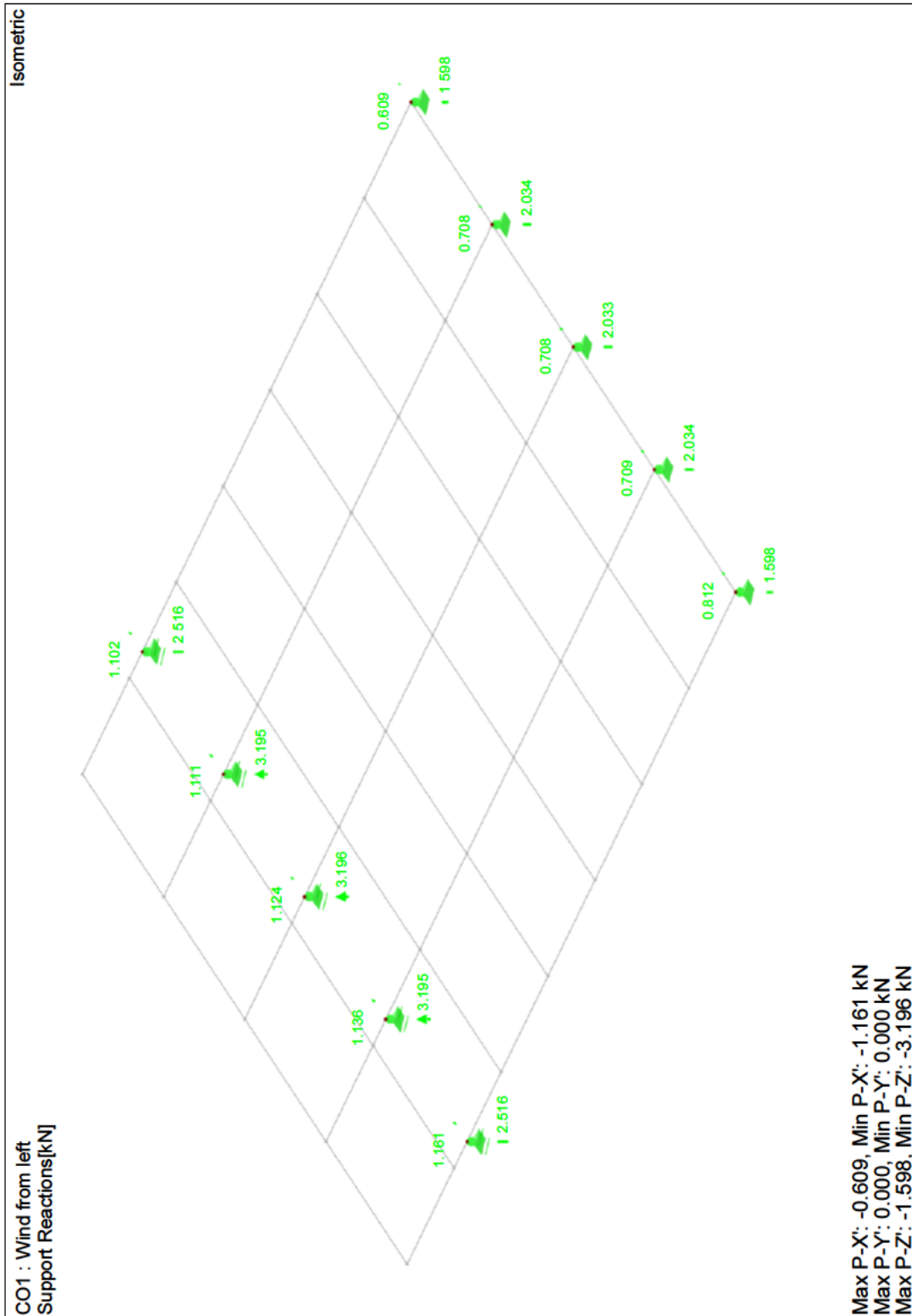
6.3.8. Wind from left (CO1)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind from left = 1.5

Imperfection = 1.0



6.3.8.1. Reaction forces (CO1)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	-0.609	0.000	-1.598
5	-0.708	0.000	-2.034
7	-0.708	0.000	-2.033
9	-0.709	0.000	-2.034
11	-0.812	0.000	-1.598
44	-1.161	0.000	-2.516
45	-1.136	0.000	-3.195
46	-1.124	0.000	-3.196
47	-1.111	0.000	-3.195
48	-1.102	0.000	-2.516
Σ Forces	-9.180	0.000	-23.916
Σ Loads	-9.180	0.000	-23.916

Preliminary Report

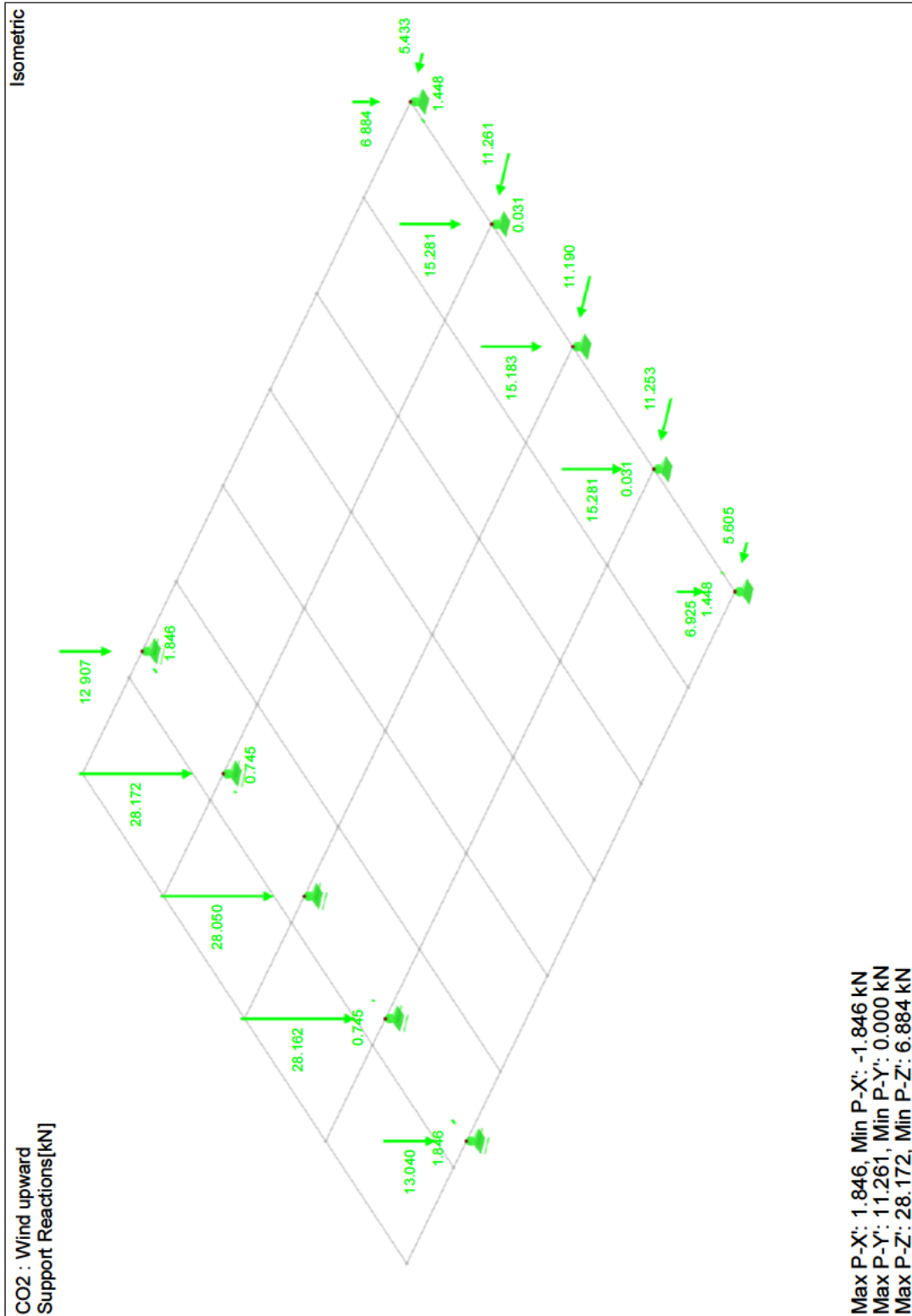
6.3.9. Wind upwards (CO2)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind upwards = 1.5

Imperfection = 1.0



6.3.9.1. Reaction forces (CO2)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	1.448	5.433	6.884
5	0.031	11.261	15.281
7	0.000	11.190	15.183
9	-0.031	11.253	15.281
11	-1.448	5.605	6.925
44	-1.846	0.000	13.040
45	-0.745	0.000	28.162
46	0.000	0.000	28.050
47	0.745	0.000	28.172
48	1.846	0.000	12.907
Σ Forces	0.000	44.742	169.884
Σ Loads	0.000	44.742	169.884

Preliminary Report

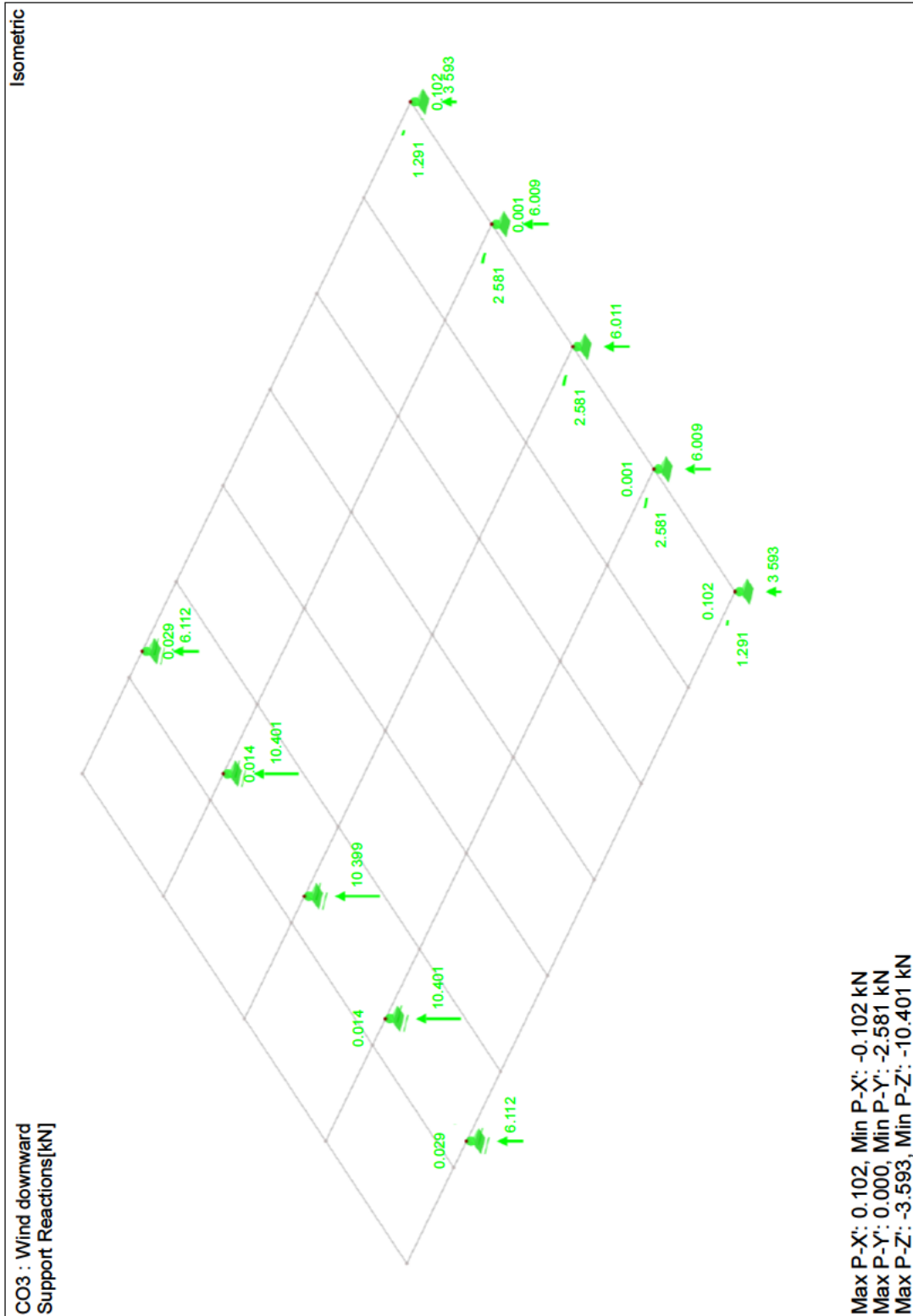
6.3.10. Wind downwards (CO3)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind downwards = 1.5

Imperfection = 1.0



6.3.10.1. Reaction forces (CO3)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.102	-1.291	-3.593
5	0.001	-2.581	-6.009
7	0.000	-2.581	-6.011
9	-0.001	-2.581	-6.009
11	-0.102	-1.291	-3.593
44	-0.029	0.000	-6.112
45	-0.014	0.000	-10.401
46	0.000	0.000	-10.399
47	0.014	0.000	-10.401
48	0.029	0.000	-6.112
Σ Forces	0.000	-10.325	-68.640
Σ Loads	0.000	-10.325	-68.640

Preliminary Report

6.3.11. Wind downwards and roof weights (CO4)

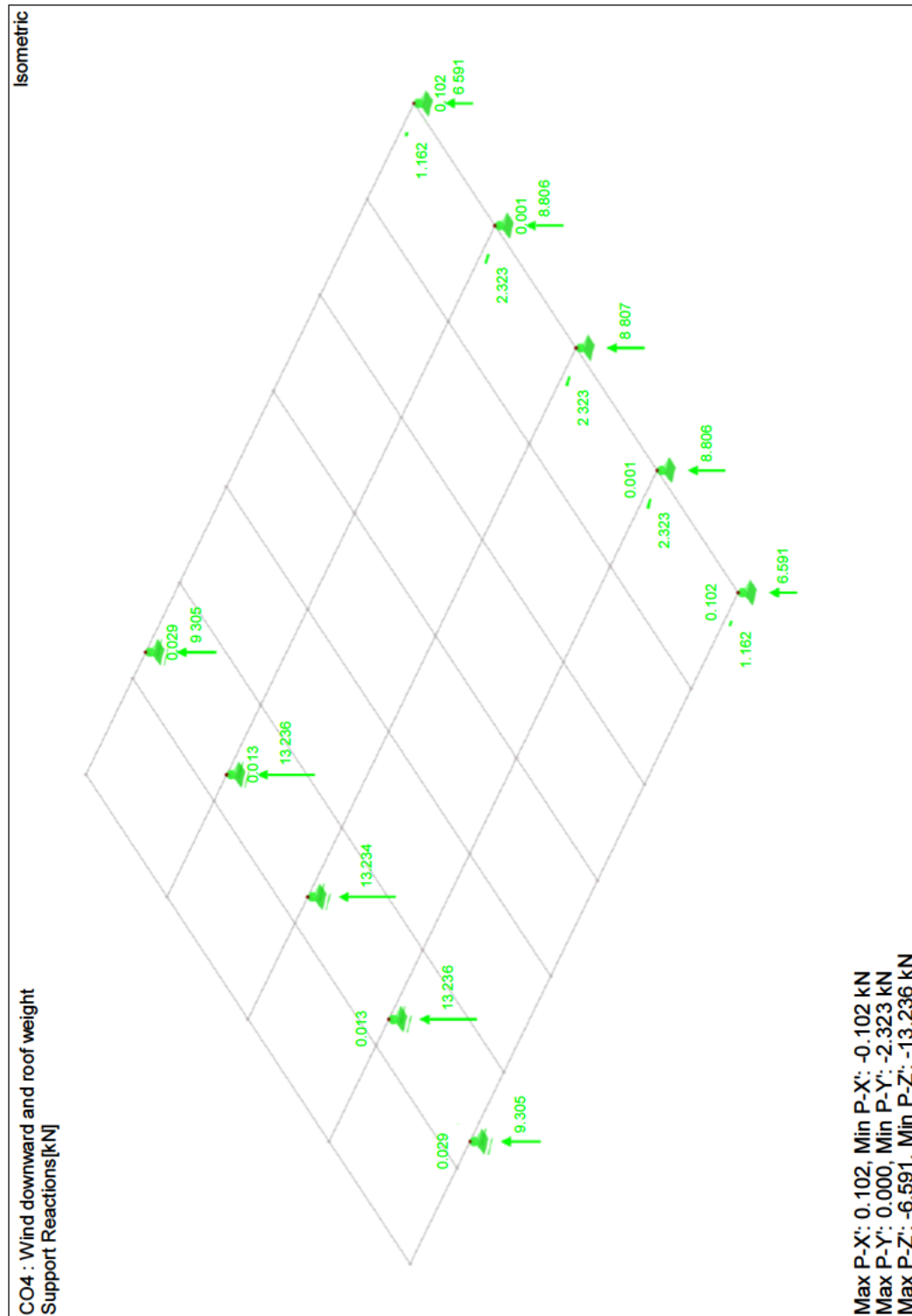
Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Wind downwards = 1.35

Roof weights = 1.35

Imperfection = 1.0



6.3.11.1. Reaction forces (CO4)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.102	-1.162	-6.591
5	0.001	-2.323	-8.806
7	0.000	-2.323	-8.807
9	-0.001	-2.323	-8.806
11	-0.102	-1.162	-6.591
44	-0.029	0.000	-9.305
45	-0.013	0.000	-13.236
46	0.000	0.000	-13.234
47	0.013	0.000	-13.236
48	0.029	0.000	-9.305
Σ Forces	0.000	-9.293	-97.917
Σ Loads	0.000	-9.293	-97.917

Preliminary Report

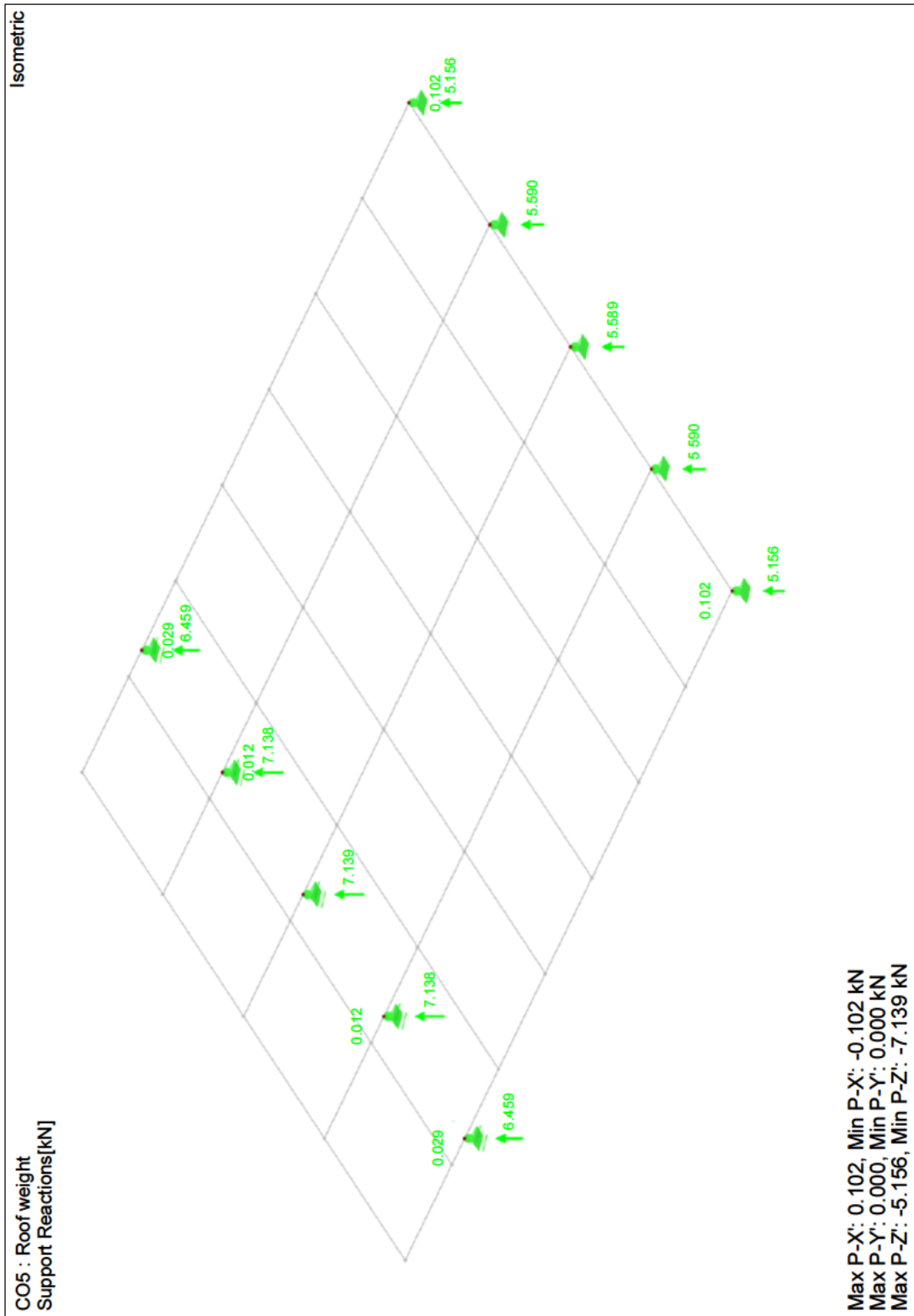
6.3.12. Roof weights (CO5)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Roof weights = 1.5

Imperfection = 1.0



6.3.12.1. Reaction forces (CO5)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.102	0.000	-5.156
5	0.000	0.000	-5.590
7	0.000	0.000	-5.589
9	0.000	0.000	-5.590
11	-0.102	0.000	-5.156
44	-0.029	0.000	-6.459
45	-0.012	0.000	-7.138
46	0.000	0.000	-7.139
47	0.012	0.000	-7.138
48	0.029	0.000	-6.459
Σ Forces	0.000	0.000	-61.416
Σ Loads	0.000	0.000	-61.416

Preliminary Report

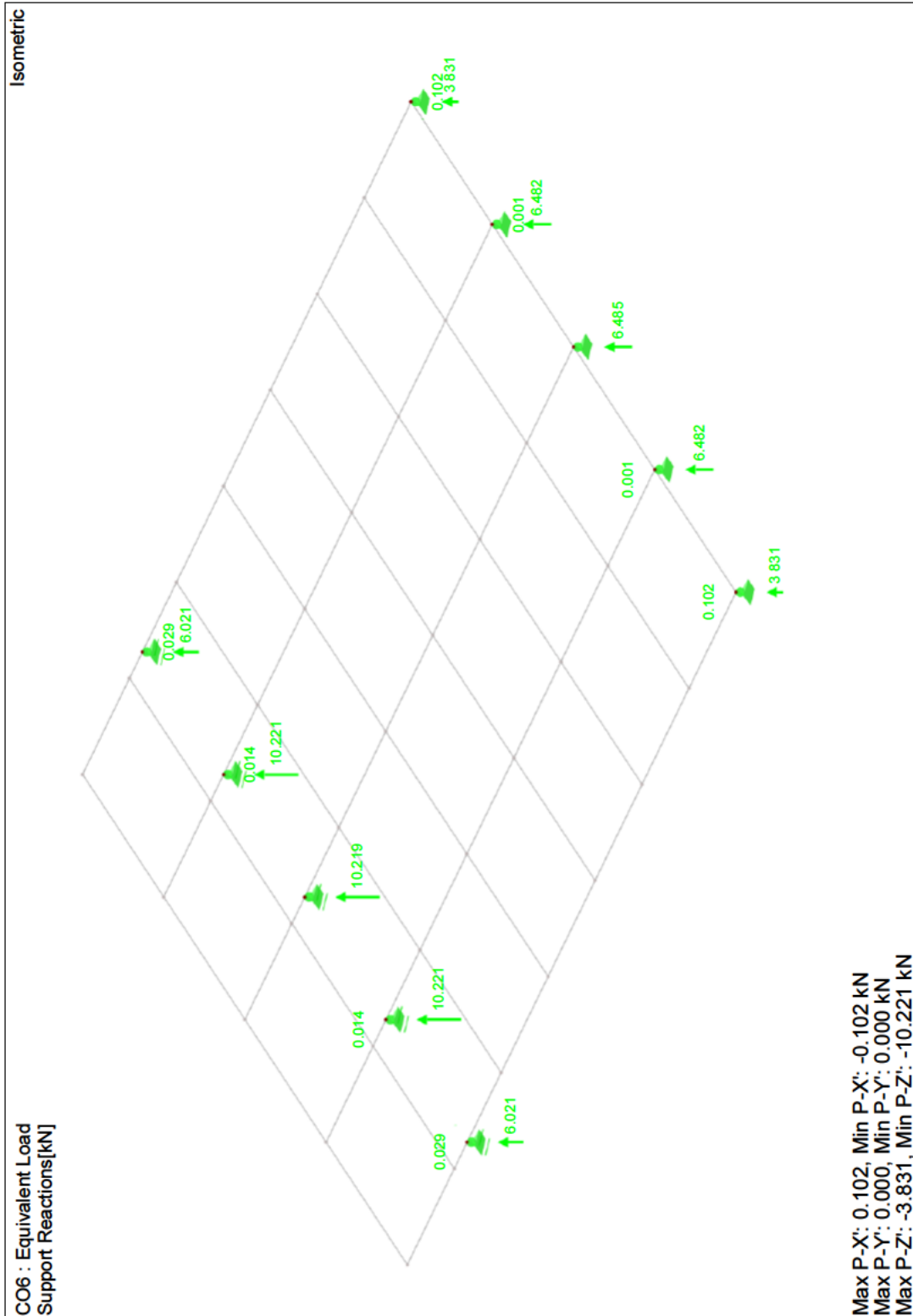
6.3.13. Equivalent load (CO6)

Factor of safety (FOS) are applied according to the below scheme,

Own weight = 1.35

Equivalent load = 1.35

Imperfection = 1.0



6.3.13.1. Reaction forces (CO6)

Node No.	Support Forces [kN]		
	P_x	P_y	P_z
3	0.102	0.000	-3.831
5	0.001	0.000	-6.482
7	0.000	0.000	-6.485
9	-0.001	0.000	-6.482
11	-0.102	0.000	-3.831
44	-0.029	0.000	-6.021
45	-0.014	0.000	-10.221
46	0.000	0.000	-10.219
47	0.014	0.000	-10.221
48	0.029	0.000	-6.021
Σ Forces	0.000	0.000	-69.816
Σ Loads	0.000	0.000	-69.816

Preliminary Report