CS CONSULTING

GROUP

DUBLIN | LONDON | LIMERICK

Green Roof Load Analysis

St John's Wood

London NW8 0HJ

Client: Grove Developments

Job No. G019U

18/01/21

1.0 INTRODUCTION

The existing St John's Wood Care Home is a building of five storeys including a basement, with the central block constructed in a steelwork frame with composite slabs on piled foundations. Surrounding this steel frame is a two-to-three-storey concrete frame that will not be affected during this project.

It is proposed to erect an additional storey on top of the existing roof at level 4 in the form of a lightweight steel construction. A structural assessment was carried out to determine the loading capacity of the existing building foundations for the additional floor and also for a "green roof" over this new construction.

The following pages outline the unit loads for the proposed extension and green roof with a load comparison of the load on a typical worst-case internal column. This column was checked for the new structures load with a lightweight roof and then with a green roof. This is to check whether the additional load on the existing piled foundation will be within acceptable limits. As a standard Engineering principle/practice and from past experience it is typical a building of over 20 years old would have settled into the ground and have additional capacity in its foundations of the order of up to approx. 10%. The report also contains extracts from a structural model done in Tekla Structural Designer for the whole existing steel frame, to check whether any of the existing steel members are overloaded with the proposed additional loads.

2.0 CONCLUSION

The load analysis indicates that with the lightweight roof option, the additional load on the worst-case internal column is less than 10%. The existing building appeared to show no signs of structural distress. As noted earlier typically load increases of less than 10% on existing foundations are

considered to be acceptable without the need for further investigation on the condition of the substructure.

Further assessment for the green roof loading found this load increase is just above 20%. We consider this to be in excess of what would be acceptable on an existing foundation under standard Engineering practice and principles.

Further checks with a structural model of the existing superstructure revealed that the fourth-floor beams do not have the capacity for the additional loads from the structure when a green roof loading is applied (refer to final page of the calculations).

We trust you find the above in order however should you have any further queries please do not hesitate to contact us.

Sincerely,

Ricardo Molina, MIStructE, C.Eng, B.Eng
Senior Structural Engineer
for CS Consulting Engineers

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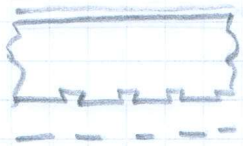
LOAD ANALYSIS

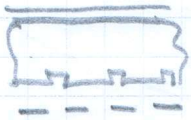
EXISTING LOADS

TYPICAL FLOOR



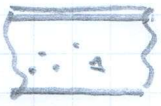
Finishes - vynil/carpet	0.10	
120 composite holoub slab	2.90	
Ceilig + services	0.40	
Steelwork s.w	0.50	
TOTAL DEAD	3.90	kN/m²
Bedrooms - A3	2.0	} average out
Corridors - C31	3.0	
Partition allowance (2 kN/m)	+0.3	
AVERAGE IMPOSED	3.3	kN/m²

LEVEL 4 ROOF



Finishes - asphalt	1.20	
120 composite slab	2.90	
Ceilig + services	0.40	
Steelwork s.w	0.50	
TOTAL DEAD	5.00	kN/m²
Roof with access - C31 TOTAL IMPOSED	3.00	kN/m²

LEVEL -1 BASEMENT



Finishes	0.10	
200 suspended RC slab (assumed)	5.0	
TOTAL DEAD	5.10	kN/m²
Communal area - C31	3.0	} TOTAL IMPOSED 3.8 kN/m²
Partition allowance	0.8	

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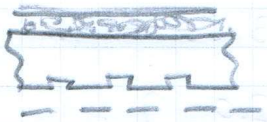
NEW LOADS

TYPICAL FLOOR

As existing DEAD = 3.90 kN/m²

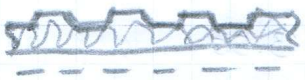
IMPOSED = 3.30 kN/m²

LEVEL 4



New finishes	0.10
Existing roof finishes	1.20
120 composite slab	2.90
Ceiling + services	0.40
Steelwork S.W.	0.50
TOTAL DEAD	5.10 kN/m²
Bedrooms	2.0
Corridors	3.0
Partition allowance (3 kN/m)	1.2
IMPOSED	3.6 kN/m²

LEVEL 5 NEW ROOF



Membrane + metal deck + ins.	0.50
~~Insulation~~ Ceiling + services	0.40
Steelwork S.W.	0.30
TOTAL DEAD	1.20 kN/m²
Roof, limited access IMPOSED	0.60 kN/m²

BASEMENT

As existing DEAD = 5.10 kN/m²

IMPOSED = 3.8 kN/m²

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LOAD COMPARISON

Worst case column : C3

Loaded area per floor : $\frac{6.54}{2} \times \frac{12.5}{2} = 20.44\ m^2$

EXISTING	AREA	DEAD	IMP.	TOTAL (SLS) ULS
L04	20.44	5.0	3.0	163.52
L03	"	3.9	3.3	147.2
L02	"	"	"	147.2
L01	"	"	"	147.2
L00	"	"	"	147.2
BASE	"	5.1	3.8	181.9
COLUMN S.W	15.5	0.45		7.0
			TOTAL	941.2 kN

PROPOSED	AREA	DEAD	IMP.	
L05	20.44	1.2	0.6	36.8
L04	"	5.1	3.6	177.8
L03	"	3.9	3.3	147.2
L02	"	"	"	147.2
L01	"	"	"	147.2
L00	"	"	"	147.2
BASE	"	5.1	3.8	181.9
COLUMN S.W.	16.6	0.45		8.3
			TOTAL	993.6 kN

TOTAL INCREASE = 993.6 − 941.2 = 52.4 kN

PROPORTION INCREASE = $\frac{52.4}{941.2}$ = 5.56% ACCEPTABLE

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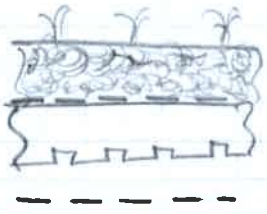
NEW LOADS : GREEN ROOF OPTION

LEVEL 5 GREEN ROOF



180m Sedum + planting + membrane	3.50
120 composite slab	2.90
ceiling + services	0.40
steelwork S.W.	0.50
	7.3 kN/m²
Roof with access	1.5 kN/m²

LOAD COMPARISON

Worst case column C3 - loaded area 20.44 m²

PROPOSED	AREA	DEAD	IMPOSED	TOTAL LOAD
LO5	20.44	7.3	1.5	179.9
LO4	"	5.1	3.6	177.8
LO3	"	3.9	3.3	147.2
LO2	"	"	"	147.2
LO1	"	"	"	147.2
LOO	"	"	"	147.2
BASE	"	5.1	3.8	181.9
COLUMNS.W.	18.6	0.45		8.3
				1136.7 kN

Total increase = 1136.7 - 941.2 = 195.5 kN

Proportion increase = $\frac{195.5}{941.2}$ % = 20.7%

Increase in load is not acceptable without further investigation and/or strengthening works.

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LOAD COMPARISON