

Property: **7 – 9 Piccadilly Gardens
Manchester,
M1 1LZ**

Client: **Thackeray Estates**

Report: **Structural Engineering Loading Assessment**

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1.0 Introduction

We were asked by Mr Giles Hoare of Thackeray Estates to prepare a structural engineers report on the potential of adding a number of additional lightweight commercial office space floors to the Superdrug building located on 7-9 Piccadilly Gardens, Manchester, M1 1LZ.

The purpose of the report was to undertake a preliminary assessment to confirm the structural viability of adding additional floors of commercial space to an existing retail building to the existing foundations. It is proposed that the upper floors of the existing building will be undergoing a conversion in office space. It is proposed to keep the ground and basement floors as retail space during the works.

Axiom Structures undertook a site visit on the 10th of March 2021. A visual inspection of the building was undertaken at the time of our visit. No intrusive investigations were undertaken or required for this stage of assessment but the Building Control application from the original development has been provided to us to assist in our review.

This report is confidential for use by Thackeray Estates and is limited to use for the purposes noted. The report is not to be relied upon by third parties.

2.0 Description

The retail building appears to be constructed in the early 2000's and currently consists of four floors which include the basement and plant room space located at the roof level. Housed on the ground and basement level there is currently a Superdrug Store that is in occupation. The first floor of the building appears to be an existing retail space with high floor to ceiling. The second floor consists of a plant room at the front and rear sections of the building. Situated between these two plantrooms is an outside courtyard space with a number of air conditioning units.

The main super structure consists of a steel frame supporting a 140mm thick composite concrete metal deck. The column spacings are typically on an 8.0m x 6.0m grid and these are supporting primary and secondary steel beams. The composite decking is typically spanning 2.0m between the secondary steel beams. These secondary beams appear are defined as 457x152x60UB. Given that the comflor deck is laid on top of the top flange of the steel beams, then it has been designed as a composite deck solution with metal shear studs.

The main central columns consist 305UC97 columns to the basement and ground floor level, while these reduce to 254UC107 above first floor level. The perimeter steel columns typically consist of 254UC107 to the basement and ground floor level, and reduces to 203UC86 above first floor levels. These columns are joined at first floor with a full moment splice connection. The main steel frame has an on-site applied fire protection coating.

Further to this, the roof and plant area is also formed from a steel frame structure and follows the same structural layout as retail spaces below (although the UB beams appear to be spaced closer together below the plant space). The plant rooms are encased in a lightweight roof panel and vertical cladding system which supported by cold rolled metal purlins at approximately 2.5 meter centers.

The existing basement contains the back of shop storage space, which is all contained within the basement area. The basement is formed in in-situ reinforced concrete which is likely to be a ground bearing slab supported off a compacted hardcore. The column spacing within the basement is typically the same column spacing as the superstructure above. Based on this, it means that there is no transfer structure contained within the building floor plates. This allows a direct load transfer through the columns into the foundations.

There are two stairs access points located within the building. The main core is located in the central portion of the building and consists of a stair, toilets and two lifts. This area has been infilled with non-load bearing blockwork. The second access stair area is located to the rear of the building and allows access to the basement car park. An inspection at high level did not indicate a presence of cross bracing around these core areas. Likewise, there was no concrete shear walls located around the stair cores at low levels. A review of the Building Control documentation indicates that the frame has been designed a moment frame.

There are a number of blockwork walls that surround the current stair core and plant area that may be adjusted during the proposed refurbishment works.

The British Geological map indicates that the founding soil is Devesia – Diamicton Formation overlaying Chester Formation Sandstone Bedrock Formation. Based on this, it is likely that a shallow foundation such as pad footing foundation is likely to have be utilised in supporting the building. This is further indicated by the historical Architectural drawings which appear consistent with this theory.

3.0 Findings

The total distributed imposed floor loads on the existing foundations were reduced with the number of storeys to Table 2 of BS6399-1:1996. For the current building there are three storeys (including the roof) of retail and M&E plant use so there is a 20% reduction to the total distributed imposed floor load although this is not indicated as being used in the Building Control calculations.

An assessments was undertaken on the proposed development. The proposal involves removing this existing comflor slab at second floor and roof level and installing a new floor structure and lowering the second floor level. Calculations were undertaken on two typical internal columns. One column that supports an existing plant space and a second column that supports the existing courtyard to see how many additional floors could be added within needing to undertake strengthening work to the existing foundations. Based on this, we calculated that the existing foundations would be able to carry an additional two or three floors while remaining within a nominal 10% increase in the overall loading. This is dependent on whether the existing column was supporting a plant room or external courtyard space.

Based on this, two separate load run down cases were calculated to find out the demands on the existing footings, this consists of a proposed and existing loading condition. A summary table of the load run down cases has been included as Appendix i.

For both the existing and proposed load case, BS6399-1:1996 was used for the imposed floor loads the proposed office usage, retail space and plant room. The proposed internal partition loading of the current building was kept 1.0kPa.

It has been assumed at this stage that the vertical extension will consist of a lightweight Metsec structural framing system that will be constructed off the existing steelwork column grid at second floor slab. The new steel columns will need to be fixed directly to the existing steelwork columns to ensure that there is a direct load transfer through the proposed and existing structure.

As there are now five or more suspended floors of retail and commercial floor loading, then the total imposed floor load can be reduced by 40%. The demands on the existing foundations were shown to be an increase of between a range of 6.6% and 8.1% increase for a typically courtyard column and an increase of 9.2% to 10.5% for a typical plant room column. It is assumed that the existing cladding to the lower floors will remain consistent.

Given the additional storeys, the lateral wind loadings on the building will increase due to the extra height. The increase in height will need to be carefully considered particularly on the party wall elevations. We believe through engineering judgment that there will be a solution for using the existing structural stability frame will be achievable but this will require further detailed analysis, if not then it may be possible to install some additional cross bracing within the rear stair core that provides access from the street to the upper floors.

4.0 Conclusions & Recommendations

By using the imposed floor loadings stated in BS6399-1:1996 in the load take down calculations that reflect the existing building usage, and using the live load reduction factor that is stated in this code to assist us in assessing the loading on the existing foundations. We have been able to show with our load take down calculations that no structural works would be required to strengthen the existing foundations when undertaking a vertical extension up to an additional three floors of commercial floor space on top of the existing steel frame structure. This is if the existing retail first floor is converted to commercial space at the same time.

As standard practise, Structural Engineers typically allow an additional 10% increase in loadings on foundation elements without the need to undertake a detailed assessment. This is based on limiting any potential settlement to acceptable levels. Our calculations for the typical internal columns show that we are confident we can remain within these limits with the additional floors as indicated on the section mark ups contained within the appendices.

A worst case solution would be to remove the existing masonry cladding within the rear stair core and installing additional cross bracing within these bays. This would allow a further reduction in the loading on the existing foundations which could then be utilised to support the additional wind loading. Cladding along the flank elevations should aim to be formed from a lightweight structure similar to Metsec or equivalent.

It should be noted that we have assumed that the existing retail and plant space was designed to the minimum requirements stated in British Standards. It is possible that the original developer may have requested additional loading capacity within the superstructure frame.

Further investigation and opening up works would be required to calculate the current imposed load capacity. If it is shown that the existing slab have a higher imposed capacity, then it may be possible to add further floors or minimise the amount of strengthening works.

We hope the above is clear, but if you have any questions please feel free to contact me directly.

Yours sincerely



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5.0 Appendix

(i) Load Run Down Summary Table

AXIOM STRUCTURES

Existing Loading Assumptions

Existing Flat Roof Loads			
	Dead: kN/m2	Imposed: kN/m2	Total
Insulated Roof Decking	0.15		
Steelwork Allowance	0.25		
Services	0.50		
Waterproofing	0.10		
Roof Imposed Loads		0.60	
SLS=	1.00	0.60	1.60

Existing External Courtyard			
	Dead: kN/m2	Imposed: kN/m2	Total
140mm Comflor Deck	2.50		
Services	0.50		
Steelwork Allowance	0.25		
Paving Slabs	1.20		
Insulation and waterporoofting	0.25		
Suspended Ceiling	0.25		
Plant Loading		3.00	
SLS=	4.95	3.00	7.95

Existing Plant Room Floors			
	Dead: kN/m2	Imposed: kN/m2	Total
140mm Comflor Deck	2.50		
Services	0.50		
Steelwork Allowance	0.25		
Suspended Ceiling	0.25		
Plant Loading		7.50	
SLS=	3.50	7.50	11.00

Existing Retail Floors			
	Dead: kN/m2	Imposed: kN/m2	Total
140mm Comflor Deck	2.50		
Services	0.50		
Steelwork Allowance	0.25		
Raised Floors & Suspended Ceiling	0.50		
Partition Allowance		1.00	
Retail Live Load		4.00	
SLS=	3.75	5.00	8.75

Assumed Office Loading Allowance

Proposed Roof Loads			
	Dead: kN/m2	Imposed: kN/m2	Total
Metal Deck Roof	0.10		
Services	0.50		
Finishes	0.30		
Insulation	0.04		
Live Load		0.60	
SLS=	0.94	0.60	1.54

Proposed Metsec Floor Loads Office			
	Dead: kN/m2	Imposed: kN/m2	Total
Metsec Joists & 18mm Chipboard	0.25		
Services	0.50		
Partition		1.00	
Gypsum Boards	0.13		
Finishes	0.12		
Commerical Space		2.50	
SLS=	1.00	3.50	1.00

Proposed Ground Floor Retail Floors			
	Dead: kN/m2	Imposed: kN/m2	Total
140mm Comflor Deck	2.50		
Services	0.50		
Steelwork Allowance	0.25		
Raised Floors & Suspended Ceiling	0.50		
Partition Allowance		1.00	
Retail Live Load		4.00	
SLS=	3.75	5.00	8.75

Proposed First Floor Office Floors			
	Dead: kN/m2	Imposed: kN/m2	Total
140mm Comflor Deck	2.50		
Services	0.50		
Steelwork Allowance	0.25		
Raised Floors & Suspended Ceiling	0.50		
Partition Allowance		1.00	
Retail Live Load		2.50	
SLS=	3.75	3.50	7.25

Typical Internal Column for Plant Area (removing second floor)

Existing Retail Loading											
	Area	Dead Load	Live Load	Live Load Reduction	Total Slab Loading	Wall Area	Wall Load	Total Wall Loading	Total Floor Load	Cum. Total	
Roof	59	1.00	0.75	0.60	94.4	0.0	0.0	0.0	94.4	94.4	
Plant	59	3.50	7.50	6.00	560.5	0.0	0.0	0.0	560.5	654.9	
1st Floor	59	3.75	5.00	4.00	457.3	0.0	0.0	0.0	457.3	1112.2	
Ground	59	3.75	5.00	4.00	457.3	0.0	0.0	0.0	457.3	1569.4	
Proposed Office Loading											
	Area	Dead Load	Live Load	Live Load Reduction (40%)	Total Slab Loading	Wall Length	Wall Load	Total Wall Loading	Total Floor Load	Cum. Total	% Increase
Roof	59	0.94	0.60	0.36	76.7	0.0	0.0	0.0	76.7	76.7	
6th Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	259.6	
5th Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	442.5	
4th Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	625.4	
3rd Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	808.3	756.25
2nd Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	991.2	51.35
1st Floor	59	3.75	3.50	2.10	345.2	0.0	0.0	0.0	345.15	1336.4	20.16
Ground Floor	59	3.75	5.00	3.00	398.3	0.0	0.0	0.0	398.25	1734.6	10.53

Typical Internal Column for Courtyard Area (removing second floor)

Existing Retail Loading											
	Area	Dead Load	Live Load	Live Load Reduction	Total Slab Loading	Wall Area	Wall Load	Total Wall Loading	Total Floor Load	Cum. Total	
Roof	59	1.00	0.60	0.48	87.3	0.0	0.0	0.0	87.3	87.3	
Courtyard	59	4.95	3.00	2.40	433.7	0.0	0.0	0.0	433.7	521.0	
1st Floor	59	3.75	5.00	4.00	457.3	0.0	0.0	0.0	457.3	978.2	
Ground	59	3.75	5.00	4.00	457.3	0.0	0.0	0.0	457.3	1435.5	
Proposed Office Loading											
	Area	Dead Load	Live Load	Live Load Reduction (40%)	Total Slab Loading	Wall Length	Wall Load	Total Wall Loading	Total Floor Load	Cum. Total	% Increase
Roof	59	0.94	0.60	0.36	76.7	0.0	0.0	0.0	76.7	76.7	
5th Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	259.6	
4th Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	442.5	
3rd Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	625.4	616.22
2nd Floor	59	1.00	3.50	2.10	182.9	0.0	0.0	0.0	182.90	808.3	55.15
1st Floor	59	3.75	3.50	2.10	345.2	0.0	0.0	0.0	345.15	1153.5	17.91
Ground Floor	59	3.75	5.00	3.00	398.3	0.0	0.0	0.0	398.25	1551.7	8.10

5.0 Appendix

(ii) Proposed Section Mark-Up With Structural Framing



21518 - Piccadilly Manchester-ASL-SK-002-P3 - Proposed scheme with second floor removed.