



RIDGE

KESTREL COURT
SWANBOROUGH PLACE
BRIGHTON & HOVE
BRIGHTON BN2 5PZ

STRUCTURAL ROBUSTNESS PRELIMINARY EXECUTIVE SUMMARY REPORT

JUNE 2024

RIDGE

Brighton & Hove City Council

KESTREL COURT, BRIGHTON & HOVE, BRIGHTON BN2 5PZ STRUCTURAL ROBUSTNESS PRELIMINARY EXECUTIVE SUMMARY REPORT

Prepared for

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1. INTRODUCTION

1.1. Site Address

Kestrel Court
Swanborough Place
Brighton and Hove
Brighton
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1.2. Structural Engineering Brief

Ridge and Partners LLP (Ridge) were appointed by Brighton and Hove City Council to carry out structural investigations to determine the robustness of the residential building, Kestrel Court, Brighton. The appointment came following owners of LPS dwelling buildings, which includes Brighton and Hove City Council, being required to seek professional advice regarding the safety of their assets by the Ministry of Housing, Communities & Local Government (MHCLG).

The resultant brief was to carry out an audit on the construction of the building, based on available historic information, followed by detailed intrusive investigations into selected areas of the building. The construction details of the building obtained from this audit forms the basis of the structural assessment, to determine whether the construction of the building was sufficient to resist disproportionate collapse in the event of accidental loading from an internal gas explosion, referred to technically as a deflagration.

1.3. Report Contents

The contents of this report relate exclusively to the construction of Kestrel Court and its structural condition at the time of inspection. The report has been compiled following the visual inspection and a series of intrusive and non-intrusive tests conducted on a limited number of pre-selected areas of the building structure.

This preliminary summary report documents the findings of the investigation work undertaken to date the full findings will follow the issue of the full structural assessment into the robustness of the building against disproportionate collapse.

1.4. Limitations

Throughout the duration of the intrusive investigations the building remained inhabited by residents. This presented challenges to the investigation teams in terms of availability of vacant flats within which intrusive investigations could be undertaken. Three suitable flats were identified, although none were available at top floor level and as such no information was obtained at that level.

Whilst the investigative works were detailed, with multiple tests carried out in each of the three flats, it should be noted that many areas of the building were not tested and thus the assessment of the building can only be based on what was uncovered in the representative investigation. The investigations were also only carried out from within the flats. No works were carried out externally or in the communal areas due to H&S concerns for the residents.

All flats within the building are single level dwellings (no duplex). It was therefore not possible to obtain core samples from floor slabs during this investigative phase. Ridge advised the client that core sampling could be undertaken within a cupboard off the communal area which would reduce the impact on residents from this intrusive works. Core samples have not been completed and lab test results have not been received at the time of completing the calculations which inform this report. The calculation for the key element checks have therefore been undertaken using an assumed compressive strength within the assessment, which will be verified following the receipt of the lab test results.

The client provided access to a limited selection of archive drawings, which contained mostly Architectural general arrangements. None of the documents provided any information regarding the structural elements and typical construction of the building.

However, a previous report from 2015 ‘Feasibility Report on additional lift shaft door openings’ by Frankham Structural Engineers provides an indication of the building structure type. The report indicates that the lift shafts in Swallow Court, Kestrel Court and Kingfisher Court were inspected to understand the feasibility of forming new openings. The remaining buildings in the Whitehawk Estate were assumed to be of similar construction. The report includes no reference of visible defects to the lift shaft.

An additional report from 2019 by Pick Everard ‘Structural Engineers Report’ completed visual inspections of the building in addition to carbonation testing and High Alumina Cement (HAC) testing from ground floor level only. The report found no structural defects and stated that the structure appeared to be in ‘good’ condition – recommending only localised repairs and further investigations.

2. BACKGROUND INFORMATION ON KESTREL COURT

2.1. General Building Information

Kestrel Court is one of five residential buildings in the Whitehawk Estate. Additional reports have been produced for the remaining four buildings named Swallow Court, Kingfisher Court, Falcon Court, and Heron Court.

The ground floor load bearing structure is believed to be constructed of in-situ reinforced concrete columns and beams forming a podium at first floor level. It is also noted that part of the ground floor to Kestrel Court has been used as retail space. All masonry between ground and first floor is believed to be non-loadbearing.

Above the reinforced concrete podium, the construction of the remaining ten upper floor levels comprises of Large Panel System (LPS) construction, consisting of precast floor and wall panels. The internal core, containing two lift shafts, stairs and risers is also constructed of a precast panel construction. All the buildings within the Whitehawk Estate are estimated to have been constructed circa 1965 and are believed to be of Wates LPS design.

Figure 1: Aerial Image of North Whitehawk Buildings Indicating Kestrel Court Location

The floor plan of the structure appears to be formed of two overlapping squares centred around the central lift and stair core located within the overlapping section, with six two-bedroom dwellings per level. The flats are accessed via a communal corridor around the central lift core. The building contains 60 residential dwellings.

The structure has been largely unaltered during its lifetime. The only significant alteration appears to be additional openings formed in the lift shaft walls to provide two lift openings at each level. Rather than the original alternate floor stops for lifts. Review of a BRE report 'The structural adequacy and durability of large panel system buildings – Part 1', first published in 1987, also identified that remedial ties had been installed to strengthen the structure, believed to be in response to circulars 62/68 and 71/68.

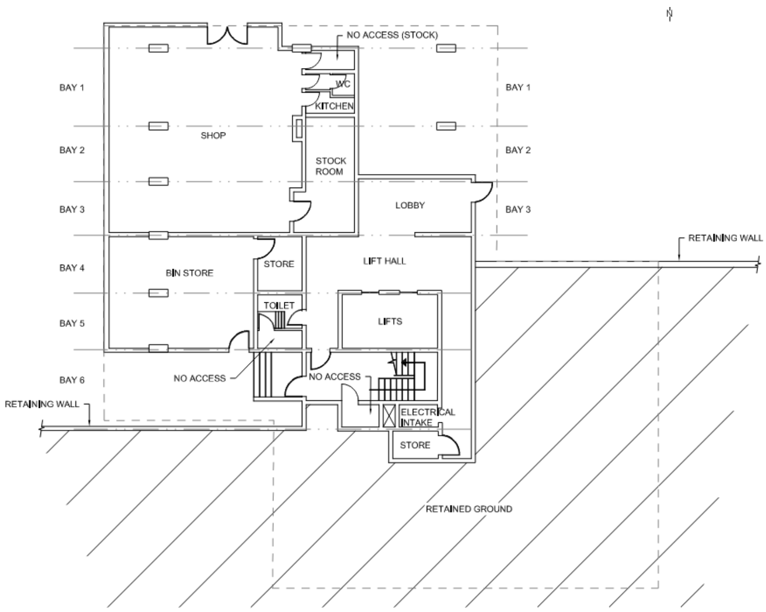


Figure 2: Kestrel Court Ground Floor Layout with Outline of Upper Storey Structure Over

The wider site is relatively steeply sloped; however, the local site upon which the building is situated has been levelled to create a private parking area. To accommodate this, a curved retaining wall has been constructed to the southeast corner of the site, which returns into the building structure approximately mid-way along its west flank. Additionally, a retaining wall was constructed parallel to the east flank, to accommodate the level difference between the Kestrel Court and Heron Court parking areas, which returns into the building structure at approximately mid-way along the east flank and is connected to the building. The ground to the north of the site is retained at approximately first-floor level.

By review of British Geological Society mapping data, it is understood that the site is underlain by Seaford Chalk Formation, comprising of Chalk. It is anticipated, given the bearing strata, construction, and form that the structure will be supported on piled foundations.

Figure 3: Aerial Image of Kestrel Court

3. EXECUTIVE SUMMARY

The Large Panel System (LPS) dwelling building, Kestrel Court, Brighton has been assessed for its robustness to resist accidental loading and its susceptibility to progressive collapse.

A select number of flats were subjected to intrusive and non-intrusive investigations, including visual inspection, concrete testing and intrusive opening-up works. The results of the investigations were documented and used as the basis of the structural assessment.

The assessment was carried out in accordance with BRE Report 511. The document states that LPS buildings can be assessed under three criteria, of which a building needs only pass one. The criteria and results relating to Kestrel Court are as follows:

3.1. LPS Criterion 1: Adequate Ties (Reinforcement) within Joints

Kestrel Court is an 11-storey building structure and as such falls under consequence class 2b of the Building Regulations Approved Document A3 which is used as the basis for classification within BRE Report 511. Consequence class 2b requires the building to comprise effective horizontal and vertical ties between loadbearing elements. The findings of the intrusive opening-up works were assessed against the tie force requirements set out in BS 8110-1:1997. The results of the assessment for each joint type are presented in the table below:

JOINT TYPE	ADEQUACY
Flank wall	Partial [1]
Cross wall	Partial [1]
Spine wall	Partial [2]
Vertical element connections	Inadequate [3]

[1] Floor to wall joints were found to have horizontal ties at regular spacings; however, those observed do not achieve the required capacity set out by BS 8110-1:1997, and as such do not form effective ties. The vertical tie detailing does not provide continuity between vertical elements and as such is considered ineffective.

[2] The spine walls were identified to comprise similar construction joint detailing to the cross walls noted above.

[3] Ties connecting the upper edge of walls to the floor slab were observed, however, no tying reinforcement was present to the base of the walls, and as such no effective tying between vertical elements were observed to be present. It should be noted that the quality of installation and embedment depth to the remedial ties previously installed were observed to vary, and as such did not form effective ties and were discounted from our assessment.

Further to the assessment results above, it should also be noted that in several locations, improperly installed reinforcement was observed, whereby the hoop of the "U-bars", which formed the ties, had been bent away and resultantly did not interact with the transverse lacer bars within the joint. In these instances, the tie would provide no resistive force and be considered ineffective.

The above assessments rely on the ties having been consistently installed throughout the building, construction defects will reduce the overall resistance of the building against disproportionate collapse.

The levelling bars, of which there were 2No. per vertical wall panel toward the edges, extended through the floor joint to the base of the wall panel above, to support a coupler and levelling nut, which allowed for the levelling of panels during construction. This detail does not provide a continuous vertical tie between elements, and subsequently the detail does not form an effective vertical tie.

3.2. LPS Criterion 2: Adequate Strength to Resist Accidental Loads

To satisfy LPS Criterion 2, each of the critical loadbearing structural elements are assessed as 'key elements', which comprises checks to determine whether they have sufficient strength to withstand loading from accidental overpressures caused by an internal deflagration. The magnitude of the overpressure to be tested is determined on the three criteria below:

1. An LPS dwelling building with a piped gas supply within or to any part of the building – an assessment overpressure of 34 kN/m^2 should be used generally throughout the building.

2. An LPS dwelling building with a basement – an assessment overpressure of 34 kN/m^2 should be used in the basement and in any other zone where an explosive mixture of gas might accumulate (potentially from an external source).

3. An LPS dwelling building without a basement and without a piped gas supply to any part of the building – an assessment overpressure of 17 kN/m^2 should be used, which considers the occurrence of a deflagration from sources such as bottled gas, large aerosols and cannisters, brought into the building by residents or others.

Kestrel Court utilises a communal heating system served by a gas boiler within a detached single storey structure separate to the building. There is no gas supply to building, specifically the upper floors, which are constructed from the LPS form of construction. We therefore consider that the LPS sections of Kestrel Court should be assessed against the lower 17kN/m^2 overpressure. Each of the LPS structural elements forming the building have been subjected to key element checks, with the results presented in the following table:

STRUCTURAL ELEMENT	ADEQUACY
Flank wall	Inadequate [4]
Cross wall	Inadequate [5]
Spine wall	Inadequate [5]
Roof / floor slabs	Inadequate [6]

[4] Due to the single layer of 150mm square 5mmØ mesh being located centrally within the 150mm thick wall, the section is unlikely to mobilise an adequate leverarm to place the reinforcement into tension in the event of a deflagration. As such, the wall has been assessed as a plain concrete wall and fails in flexure at all levels.

[5] Due to the single layer of 150mm square 5mmØ mesh being located centrally within the 175mm thick wall, the section is unlikely to mobilise an adequate leverarm to place the reinforcement into tension in the event of a deflagration. As such, the wall has been assessed as a plain concrete wall and fails in flexure from level 5-11. Note: spine walls are considered similar to cross walls and as such have not been assessed separately.

[6] In the absence of suitable laboratory test data, the 100mm deep roof and floor slabs were assessed using a normalised characteristic concrete compressive strength, f_{ck} of 30N/mm^2. This value is based on previous

testing results from similar construction buildings. The slabs are to be reassessed following receipt of accurate laboratory test data that is currently underway, which may provide more favourable results; however, due to the depth of the slabs, it is unlikely that that a reasonable increase in strength will result in the slabs being determined as adequate to resist the forces from a deflagration.

3.3. LPS Criterion 3: Ability to Mobilise Alternative Load Paths

Due to the likely failure of multiple structural elements in the event of a single deflagration, it is unlikely that alternative load paths would be developed to prevent disproportionate collapse in the current condition.

ALTERNATIVE LOAD PATHS
Unable to mobilise alternative load paths
Inadequate

4. CONCLUSIONS

Based on the findings of our structural investigation, we conclude that the building structure to Kestrel Court is insufficiently robust to resist disproportionate collapse in the event of a deflagration at any location within the building, in its current condition.

5. RECOMMENDATIONS

To address the failings of the disproportionate collapse requirements, works would be required to the building. We would therefore recommend that the required remaining life of the building should be discussed. It is likely that, if the buildings are to be retained long-term, that this will include strengthening works.

A risk analysis should be carried out to determine:

- Whether the risk can be reduced to an acceptable level through risk-reduction measures for the duration of the remaining life of the building.

- Whether risk-reduction measures alone are not sufficient, and strengthening works are required.

If the risk analysis determines that strengthening works are required, a suitably qualified structural engineer should undertake the design for the strengthening proposals to the building structure.

We also recommend that a cost-benefit analysis is undertaken, which should account for the proposed remaining life of the building, to understand whether the strengthening works are feasible.

Depending on the findings of the cost-benefit analysis, an accelerated demolition programme may need to be considered.

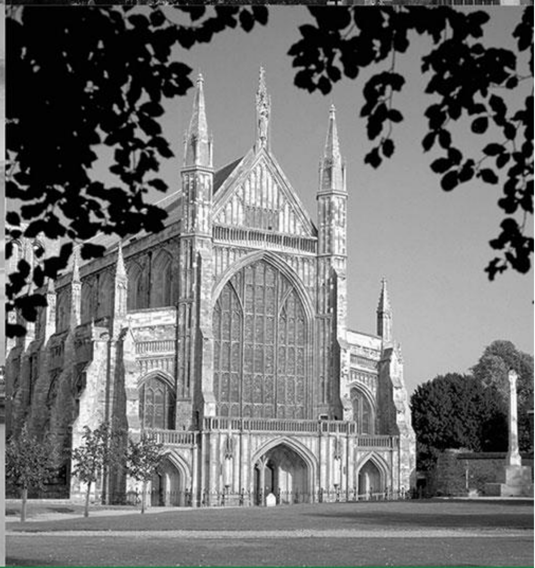
5.1. Historic Costs:

From our experience with other LPS projects which have required strengthening works to remediate failures found in their robustness, the costs can range greatly dependent on the amount of strengthening works required.

For the building structures we have been involved with, the construction costs have ranged from £1.5M (4-storey, 14 flats) to £13M (19 storeys, 102 flats). These values are exclusive other associated costs such as decants, refurbishment etc.





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