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**Subject** Summary of Structural Assessment of Bromyard, Peterchurch, Sarnsfield and Skenfrith House  
**Date** 21 November 2017 **Job No/Ref** 245112-05

## 1 Ledbury Estate: Introduction

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Arup was appointed by Southwark Council to carry out a structural engineering assessment of the four 14-storey high tower blocks on the Ledbury Estate in Peckham, south London.

This document provides a summary of the Arup report called “Ledbury Estate: Structural Assessment of Bromyard, Peterchurch, Sarnsfield and Skenfrith House” dated 20 November 2017.

## 2 Description of the Buildings

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There are four tower blocks on the Ledbury Estate: Bromyard House, Peterchurch House, Sarnsfield House and Skenfrith House.

All of the blocks are 14 storeys high and ‘H-shaped’. In every block there are four flats per floor; two flats on both sides of the stairwell and lifts in the middle.



Figure 1 Peterchurch House

In Skenfrith House and Peterchurch House, half of the flats have one bedroom and half have three bedrooms. In Sarnsfield House and Bromyard House, the bottom five storeys have one bedroom and three bedroom flats, and above this, all flats have two bedrooms.

### 3 How the buildings were built

The four 14-storey tower blocks on Ledbury Estate were built between 1968 and 1970. They were built and owned by the Greater London Council and then passed on to Southwark Council in the 1980s.

The floors and walls were made out of concrete panels which were made in a factory, and delivered to Ledbury “flat packed” on lorries. These panels were then lifted into place and connected together to make the overall building structure.

All of the wall panels are about 2.7m tall, which is the height of one storey. The floor panels are about 2.7m wide and between 2.7m and 5.4m long.

Each floor panel is supported by two walls, one at each end of the floor panel.

In the flats, there are three main types of wall panels. The “flank” walls and internal “cross” walls support the floor slab panels. The other external walls don’t need to support the floor slab panels because these are already being supported by the cross walls and the flank walls.

The areas containing the lift and stairs in the middle of the buildings are also built from concrete panels.

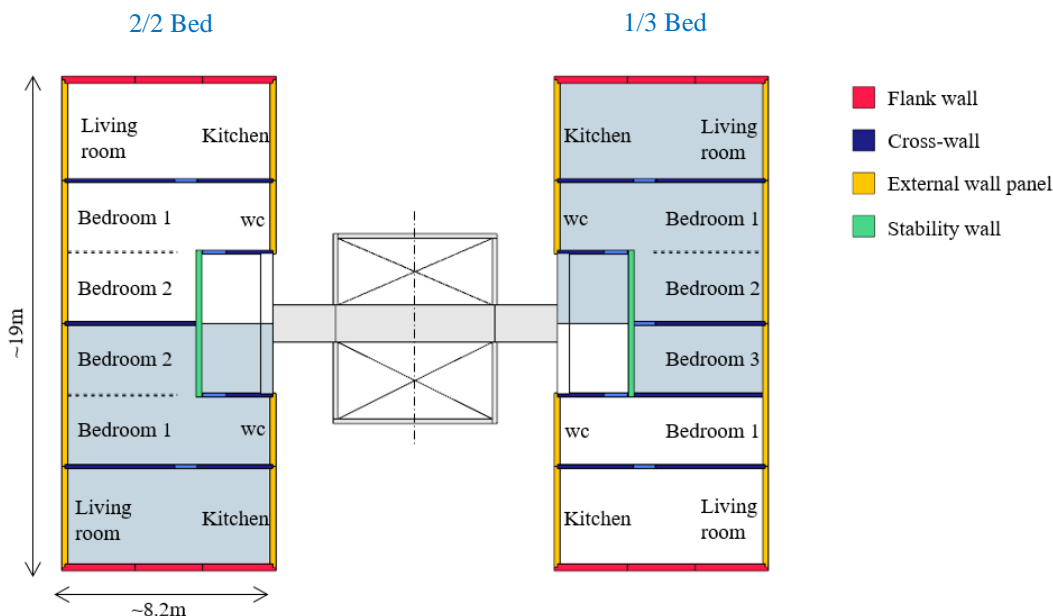


Figure 2 Approximate floorplan of the Ledbury Estate tower blocks. For illustrative purposes a one and three bedroom flat layout is shown on the same floor as a two-bedroom. Some partition walls have been omitted for clarity.

## 4 History of similar buildings

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There are many other tower blocks that were built in the 1960s and 1970s in a very similar way as those at Ledbury: by making large concrete panels in factories and then assembling them into overall buildings. These buildings are called large panel system (LPS) blocks.

One of these blocks was a 22 storey building called Ronan Point, in Canning Town, London.

In May 1968, there was a gas explosion in one of the flats on the 18th floor of Ronan Point. The explosion blew out a flank wall panel and as a result, the whole of one corner of the building collapsed. The gas explosion caused much more damage than expected, and so this was called a “disproportionate collapse”.

Later that year, the Government issued two documents, which required all LPS blocks over six storeys high that had already been built to be assessed by a Structural Engineer. These assessments were to check whether, if there was another gas explosion like at Ronan Point, would the buildings experience a disproportionate collapse? If any building did not pass this check, either it had to be strengthened, or the gas supply to the building had to be removed. If the gas supply was removed, the buildings still had to be checked but now for resistance to a smaller explosion to reflect the fact that the main gas supply had now been removed. These documents also required buildings to be checked for their resistance to wind. Finally, any LPS building over six storeys high that had not yet been built, needed to be built to the new standards set out in these documents.

In 2012 the Building Research Establishment and the Department for Communities and Local Government published a guidance document to update the guidance written in 1968. This guidance has been followed in the Arup assessment of the four tower blocks at Ledbury Estate.

## 5 Structural assessment

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### 5.1 Phase 1

In July 2017 Arup was asked by Southwark Council to investigate reports of cracking from residents of the Ledbury Estate.

Some of these cracks were up to 30mm wide, some were smaller, and some were understood to change in size depending on how hot or cold it was outside.

Arup concluded that the cracks were actually gaps between the separate concrete panels that make up the buildings. None of gaps affected the strength of the buildings. This was explained at the meeting to residents on 11 July 2017.

### 5.2 Phase 2

After Phase 1, Arup was asked by Southwark Council to check the structure of the four tower blocks to ensure they could withstand the kind of gas explosion that had happened at Ronan Point in 1968. The reason that this kind of explosion was checked was because the four tower blocks had a piped gas supply.

The records of Southwark Council, the Building Research Establishment (BRE) and the original builder were searched, but no information was found from the time when the buildings were built.

The London Metropolitan Archives had some basic information. There were receipts for £53,700 of “remedial works” done in 1968-1969, but no further information on what these remedial works were. There was also a note which said the design of the blocks had been changed to meet the requirements of the Government documents in 1968, but it didn’t say how or what exactly had been changed. At that time the blocks were owned by the Greater London Council (GLC) and not by Southwark Council.

There wasn’t enough information on paper to be certain of how the buildings were built or precisely what “remedial works” had been carried out.

The only way to find out more about the structure was to carry out a number of “intrusive investigations”. This involved breaking out bits of the concrete structure in the two flats that were vacant at the time. This allowed the team to find out what steel connections and reinforcing bars were hidden inside the concrete, and whether any of the “remedial works” could be seen.

From these investigations and from structural calculations, it was found that the buildings were at risk of a disproportionate collapse if there was a gas explosion from the piped gas supply. As soon as this was known in August 2017, Southwark Council decided to remove the piped gas supply to the buildings. This reduced the risk of a gas explosion happening.

### **5.3 Phase 3**

Removing the gas supply reduced the risk of disproportionate collapse but did not make the risk go away. BRE guidance states that buildings should be able to experience other types of accidental damage without incurring disproportionate collapse (e.g. vehicle impact, where relevant) and should be able to withstand explosions caused by bottled gas.

Arup had to carry out a further assessment of the buildings, again following the guidance set out by the BRE and the Department for Communities and Local Government in 2012.

In Phase 2, Arup had investigated the structure in two flats. It was important to find out if the findings from these two flats were the same in other areas. As a result, Arup carried out more intrusive investigations in 19 flats across all four of the buildings on the Ledbury Estate.

As well as the risk of disproportionate collapse, Arup also looked at the resistance to exceptionally strong winds, and whether the concrete panels (which are now nearly 50 years old) had deteriorated in any way.

#### **5.3.1 Disproportionate collapse**

The Arup assessment shows that the buildings are not strong enough to satisfy the BRE guidance for accidental damage to buildings that do not have piped gas and therefore need to be strengthened.

Many of the strengthening measures to the concrete walls and floors will require local removal and reinstatement of plaster finishes, floor finishes and floor screeds, heating pipes, radiators, sanitary ware including baths, and kitchens.

The following parts of the four buildings need to be strengthened:

- Floor units next to flank walls and external wall panels (all levels, all buildings)
- Cross-walls (including party walls) at upper levels (Level 8 upwards, all buildings)
- Cross-walls: party walls between one- and three- bedroom flats in Bromyard House and Sarnsfield House
- Connections between the external wall panels and the floors/internal walls

In the Arup report “Structural Assessment of Bromyard, Peterchurch, Sarnsfield and Skenfrith House” there are some sketches to give a basic idea of what the strengthening could be and where it would be needed.

Until such strengthening measures are in place, the use of bottled gas and oxygen cylinders should be banned.

### **5.3.2 Wind resistance**

The Arup assessment showed that there is adequate resistance to wind load.

The external wall panels are helping to resist the wind pressures on the building.

In the investigations, it was found that the material in the joints between the external wall panels was variable and so it is recommended that these all be inspected and repaired if necessary, for long term resistance to wind loading.

### **5.3.3 Condition**

Tests done on the concrete during the investigations in the flats showed that the concrete and the embedded steel reinforcement is in good condition.

## **6 Conclusions**

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The structural assessment has shown that, the buildings need to be strengthened to meet the guidelines for disproportionate collapse for these types of buildings, set by the Building Research Establishment and the Department for Communities and Local Government in 2012.

The piped gas supply has been turned off which has removed the main risk that might lead to a disproportionate collapse. The use of bottled gas and oxygen cylinders should also be banned until the strengthening is in place.