

(JA/55)

Barbara Lane – Floors & Columns

Tina Donoghue

From: Barbara Lane <Barbara.Lane@arup.com>
Sent: 17 June 2017 08:23
To: Allen, John: CP-Plan: RBKC
Cc: Tony Jones (E); Nigel Annereau
Subject: RE: floors

Importance: High

John

As you know yesterday we observed through photographic evidence that the corner column on Level 13 appears to have failed.

We subsequently were shown photographic evidence that this column was in a failed state on Thursday 15th June.

There also appear to be failed concrete "panels" on both sides of this column, and potentially some cracking in the adjacent columns (right hand side looking at the plans)

[I would recommend a column numbering system be put in place on site today so that all parties operating and making decisions can very swiftly understand locations – there was some delay yesterday establishing this].

Arup explained the local and global collapse mechanisms yesterday and it is important both events remain part of all safety planning and response on site.

This building is in an unknown post fire state, due to the scale of fire in multiple locations per floor, and multiple floors.

We asked that monitoring measures be put in place on site last night – based on the briefing from USAR on their equipment and skills in using this equipment.

They did not know the accuracy of the vertical movement they might measure – please establish that today.

Regardless we advised remote sensing monitoring equipment be put in place in the building as a matter of urgency, to supplement USAR's equipment. You briefed last night this might be Monday or that your demolition experts may have some equipment in house, which would be more immediate. Regardless we strongly recommend, regardless of it being a weekend, that equipment that can monitor within 5-10mm of accuracy as a minimum be put in place on site.

On Wednesday night we strongly recommended that all columns on all floors be monitored for cracking and this should continue to be the case.

Tony Jones and Nigel Annereau from Arup are attending site today, and will discuss with you again matters regarding propping. They had some time to review the structural drawings we received last night.

Arup staff will not be entering any areas where there has not yet been an opportunity for body recovery, and we will be retaining this position on the project – this is because we don't have any experience/training in these matters, not for any lack of willingness to assist.

As agreed with LFB commanding staff last night, please find our suggestions regarding entering floors. We note that LFB have substantial experience in these matters and it is entirely appropriate they decide themselves on their own risk levels, and how they wish to proceed.

6 people per apartment, seems reasonable subject to the following actions before entering the apartment area:

- A) check soffit (below) for any spalling worse than already seen. I.e. Two layers of bars with no concrete around them
- B) check no significant deflection of slab already
- C) before entering the apartment, the slab should be loaded progressively and if it is felt to deflect noticeably, retreat.
- D) ongoing monitoring of columns through the works – any noticeable cracking/movement, retreat.

We understand there is no longer water on the slab; there is however debris of varying amounts floor to floor.

The consequence of slab failure on staff working on the floor below, and people working on the floor above, must be considered: keeping the storey below or two storeys below, and keeping one storey above clear, being one means of mitigating this risk.

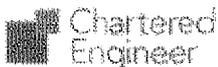
However if LFB wish to manage this risk themselves and work on all floors, this is a decision for them. We understand they intend to locally prop and locally monitor at all times and are substantially experienced in mitigating and monitoring this risk.

The ongoing movement monitoring of the building brings more clarity on what risk they are mitigating. Hence the importance of this being in place.

As they are doing casualty evacuation, the floor loads change again, depending on the number and condition of the casualties. And the structure is in an unquantified state after this extreme event. These are substantial unknowns therefore, so everyone should be prepared to react accordingly.

Barbara

Dr Barbara Lane FREng CEng



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From: Barbara Lane
Sent: 15 June 2017 15:40
To: 'John.allen@rbkc.gov.uk'
Subject: floors
Importance: High

John

As you know we have no drgs, not on the scene, no detailed information and have done no form of analysis or investigation, so this is just our best professional guidance on a no liability basis (which I am obliged to make clear, no alarm intended).

We also have no idea what temperature and when the rebar was exposed to – this is VIP wrt its residual strength today.

Checklist:

4 people seems reasonable subject to:

A) check soffit for any spalling worse than already seen. I.e. Two layers of bars with no concrete around them

B) No significant deflection of slab already

C) No more than 50-80mm standing water on slab

D) slab loaded progressively and if it is felt to deflect noticeably, retreat.

Further information below to support these 4 items.

Assuming an original design live load of 1.5kN/sq.m

4 fire fighters might be expected to apply between 0.12 and 0.16kN/sq.m to the overall bay sizes, or approximately 10% of the intended design live load.

100mm depth of water gives about 1kN/sq.m.

So if the outer floors are waterlogged to 100mm depth then adding fire fighters would take the applied live load up to about 77% of design live load.

If rebar has been exposed to temperatures above 700°C then the floor would be reaching or exceeding its residual capacity with 4 persons standing on it.

Going in one at a time could reduce the risk of sudden failure but the brigade must react and make their own decisions on the basis of this information.

If they are doing casualty evacuation, *then the floor loads change again, depending on the number and condition of the casualties.*

Items for consideration

- 1) the limited evidence we have found regarding the original structural design, is that the cross walls were not intended to be load bearing. They appear to be concrete and cast integral with slab below. Information on head detail would confirm – if you want to investigate further. Nonetheless they are likely to be carrying some load now. You could review load path of walls through lower storeys and basement.
- 2) panels not shown on original construction photos –these are likely to be only there to attach windows to.

3) 4 people seems reasonable subject to:

- A) check soffit for any spalling worse than already seen. I.e. Two layers of bars with no concrete around them
- B) No significant deflection of slab already
- C) no more than 50-80mm standing water on slab
- D) slab loaded progressively and if it is felt to deflect noticeably, retreat.

4)As mentioned last night acoustic monitoring of the building may give indication of ongoing damage. It may be that background noise from the movement as it cools would mask further bar breaks or significant crushing. Happy to ask about if anyone thinks useful?

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