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By email
03 January 2023

John Smith
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Barton House

Structural fire safety (DRAFT)

Dear John,

Introduction

Arup has been asked to (1) peer review Ridge's structural investigation findings to date; and (2) undertake a structure fire safety assessment of Barton House.

On 11th December 2023 Arup issued a summary of its preliminary conclusions on (1) and (2) above. We issued a revised note on 13th December 2023 responding to additional technical queries raised by BCC. We have now completed our review of the information from the recent intrusive investigations and structural fire analysis and our conclusions are set out below. For clarity, this letter replaces the preliminary conclusions set out our letters of 11th and 13th December 2023.

(1) Peer review of Ridge structural investigation findings

Ridge prepared a revised technical letter on 21st December 2023 providing a high-level summary of their structural investigation findings to date and current recommendations. Arup has reviewed and commented on Ridge's letter. In summary:

a) We generally agree with the Ridge technical letter, and specifically the recommendation to fire protect the steel frames ('goalposts') adjacent to flank walls, which seems a sensible and efficient solution to provide greater confidence in the overall robustness of the structural frame. We agree that any new fire protection recommended should be designed and installed by competent persons to achieve 90 minutes load bearing fire resistance.

b) We note that Ridge proposes some local repair works to a visible crack in the top of the slab in Flat 91. The proposed repair will consist of 'stitching' across this crack using reinforcing bars placed between precast floor beams, in between the existing robustness tie bars. Since

there is some doubt as to the cause of this crack, and the repair is simple and localised, we are not opposed to this work being done.

c) Ridge summarises that their initial (limited) investigation work led to their conclusion that the robustness ties were inadequate, resulting in the building being vulnerable to a disproportionate collapse event. Their subsequent (more extensive) investigation work has resulted in confidence that the robustness ties are generally adequate, and where they are not, they can be supplemented by fire protecting the retrofitted steel frames in strategic locations (as noted in a) above). Based on the outcome of the latest investigation work, we agree with Ridge's conclusion that these measures would appropriately mitigate the risk of disproportionate collapse.

(2) Current structural findings from structural fire analysis

a) Based on the intrusive investigations and the preliminary conclusions reached by Ridge regarding structural robustness, Arup has undertaken a structural fire safety assessment. The aim of which is to assess whether there is a risk of disproportionate collapse in the event of a fire.

b) The full parameters/ assumptions adopted by Arup in this assessment will be set out in our final report Our findings are reliant on Ridge's final conclusions on structural robustness and therefore should these change from their letter dated 21st December 2023, our preliminary conclusions set out below may change.

c) However, from Ridge's conclusions set out in their letter referenced above; it is our opinion that a single dwelling fire does not present a risk of disproportionate collapse due to the potential for load redistribution through structural robustness ties and/or the proposed fire protected steel goalposts.

d) Arup has further carried out a review of the required fire resistance of the structure using legislation and codes of practice in force at the time of construction of Barton House and an assessment of the potential period of fire resistance achieved by the structure using the Nov 2023 survey information.

e) As a residential building which appears (from our review of the original design drawings and historical design codes) to have been designed originally with a stay put evacuation strategy, it is our opinion that the required period of fire resistance for elements of structure at the time of construction was 90 minutes; this exceeded the 60 minute fire resistance requirement for residential buildings set out in local building bylaws at the time. A greater period of fire resistance was recommended in buildings designed for a stay put evacuation strategy. It should be noted that under current fire safety guidance, the recommended period of fire resistance for a high rise residential building is 120 minutes.

f) An assessment of the actual fire resistance of the load bearing elements of structure in Barton House using simple analytical methods has been carried out. The assessment conducted by Arup is based on resistance to a single dwelling fire. This is the basis of design as set out in the legislation and codes of practice at the time of construction of Barton House and currently.

g) We assessed the primary load bearing elements of structure on the residential floors of the building (Level 1 -14), these are the floor slabs and the internal cross walls and flank walls.

From our assessment the floor slabs, which appears to be of a proprietary 'gothic' hollow beam and concrete infill construction, achieve between 55 – 70 minutes fire resistance. The internal walls and flank walls achieve between 80 to greater than 90 minutes fire resistance.

h) The fire resistance of the floor slabs and in some instances the walls is therefore less than the 90 minutes fire resistance standard required for a stay put evacuation strategy. This means that in the event of a single dwelling fire there is an increased risk of *local structural* failure compared to a structure which would achieve at least 90 minutes fire resistance. This is distinct from the risk of disproportionate collapse which we address at point 2(c).

i) The fire resistance is, however, commensurate with byelaws in place at the time of construction for buildings which did not rely on stay put evacuation, i.e. 60 minutes.

j) To address this identified risk at Barton House, there are two potential options:

- The first is to increase the fire performance of the existing structure. For example, this can be achieved by applied fire protection to the slab soffits or fire protection to all the existing steel frame goal posts (i.e. not just the flank wall goal posts being suggested by Ridge to enhance robustness). Note that this option would require further structural fire assessment work to be undertaken.
- Alternatively, a simultaneous evacuation strategy initiated by means of reliably detecting the outbreak of fire anywhere within a flat followed by automatic building wide alarm. This performance standard is set out in the NFCC Guidance to support a temporary change to a simultaneous evacuation strategy in purpose-built blocks of flats v4 Appendix A.

k) Arup understands from BCC that the façade of Barton House contains combustible Expanded Polystyrene (EPS) as part of a render finished insulation system; the fire safety hazards associated with this system have not been assessed by Arup with the exception of the considering the potential impact on the structural fire assessment of the building. The risk management of the EPS shall continue to be managed by BCC until such time as it is removed, or the building is decommissioned. An uncontrolled external fire involving the EPS which causes multi-dwelling fires is significantly more extreme than a single dwelling fire for the structure. The presence of the EPS therefore further increases the risk associated with the identified lower period of fire resistance of the structure.

l) Based on our assessment of the structure and the hazard presented by the EPS with regards to the potential impact on the structure for a fire spreading via the façade, it is our opinion that a simultaneous evacuation strategy initiated by means of detecting a fire anywhere within flats will provide a greater reduction in risk level than increasing the fire performance of the existing structure. The inclusion of such a system also aligns with the NFCC guidance where an all-out evacuation strategy is adopted.

m) It is our understanding that at date of issuing this letter that BCC intend to pursue the option of a simultaneous evacuation strategy initiated by means of reliably detecting the outbreak of fire anywhere within a flat followed by automatic building wide alarm for Barton House.

n) Arup understand that BCC have instructed further scanning measurement of cover to concrete reinforcement for the slabs. Should a greater of depth of concrete cover be consistently identified compared to that used in the above calculations of fire resistance period, Arup shall re-review their assessment.

(3) Obligations under the RRO and Building Safety Act

To meet obligations under relevant fire safety legislation, if BCC decide to re-occupy Barton House:

- **a)** The Responsible Person should: include this assessment and the recommendations for methods of mitigating the identified risk in their fire safety risk assessment; and review their procedures for serious and imminent danger, including the necessity for Personal Emergency Evacuation Plans (PEEPs).
- **b)** The Principal Accountable Person should consider this assessment and the recommendations for methods of mitigating the identified risk in the preparation of their safety case; including sharing with any person(s) appointed to assist them in preparation of the safety case.

(4) Conclusions and recommendations

Our findings are reliant on Ridge's final conclusions on structural robustness and therefore should these change from their letter dated 21st December 2023, our preliminary conclusions may change.

We generally agree with the preliminary Ridge technical letter, and specifically the recommendation to fire protect the steel frames ('goalposts') adjacent to flank walls to increase the overall robustness of the structural frame. Based on the outcome of the latest investigation work, we agree with Ridge's conclusion that these measures would appropriately mitigate the risk of disproportionate collapse.

To address the identified lower period of load bearing fire resistance of the structure and the hazard presented by EPS, it is recommended that a simultaneous evacuation strategy initiated by means of detecting a fire anywhere within flat is adopted. Such a system is described in the NFCC guidance. The BCC will need to consider our assessment in discharging their roles as Responsible Person and Principal Accountable Person under the Building Safety Act.

Yours Sincerely,

Ove Arup & Partners Ltd
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