SKM anthony hunts
Victoria House
Southampton Row
London
WC1B 4EA

Tel: +44 20 7759 2600
Fax: +44 20 7759 2601
Web: www.skmconsulting.com

Nigel Parfitt
Natural Environment Research Council
Polaris House
North Star Avenue
Swindon
SN2 1EU

30 January 2009

L05 AW to NP - Struct Assess Comp Rm revA
SE14094/F3.1

Dear Nigel

CEH Wallingford: Structural Assessment - First Floor Computer Room
Letter Report

We submit the above captioned project as follows: This amended letter report provides details on the alternative arrangement of IT racks proposed in our original letter, dated 13 January 2009.

1. Introduction

On the 7th January 2009, SKM anthony hunts were asked to complete a non-intrusive structural assessment of the computer room first floor structure at CEH Wallingford, Maclean Building, Benson Lane, Crowmarsh Gifford, Wallingford, Oxfordshire, OX10 8BB.

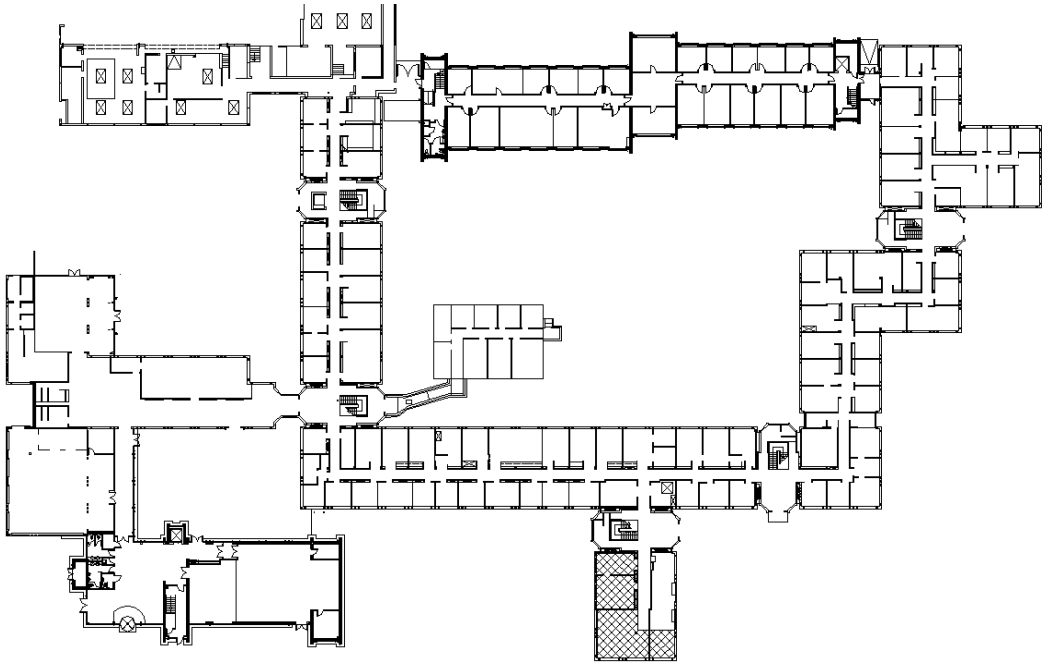
The Client proposes to install a number of potentially heavy IT server racks in the room and is concerned about the additional loading on the existing structure.

The computer room forms part of the original two-storey building on the site, constructed in the early 1970s. Drawing archives of the existing building were made available.

Figure 1 shows the location of the computer room.

2. Scope of Review

The scope of the review was to visit the site, ascertain the arrangement of the structure and its loading capacity, and make recommendations on the adequacy of the structure to support the proposed equipment. **Figure 6** shows the original proposed arrangement of equipment racks (Option 1). **Figure 7** shows the alternative proposed arrangement of equipment racks (Option 2).



- **Figure 1: Location of the computer room shown hatched**

3. Existing Building Structure

The existing building is a two-storey reinforced concrete (RC) structure, built in the early 1970s, with various extensions of similar construction built from the late 1970s to the late 1990s. The structural frame is of in-situ RC construction, with infill precast (PC) "T" planks forming the first floor slab. A non-structural 25mm screed was applied over the PC planks and main beams. Refer to **Figure 2** for the first floor general arrangement. The internal columns stop at first floor level.

4. Archive Drawings

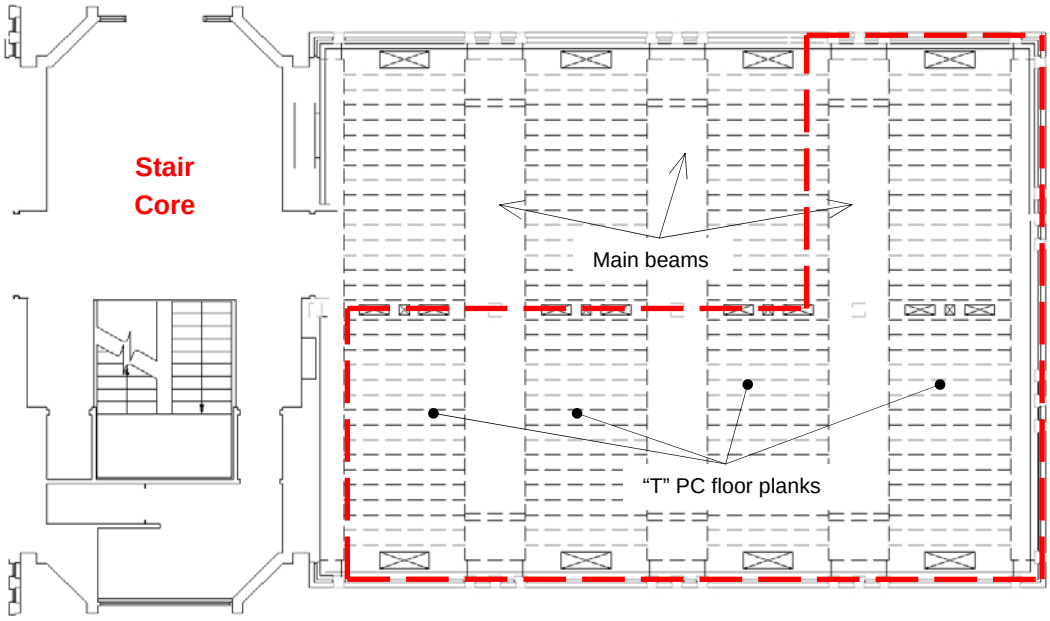
The following archive drawings were reviewed:

Dwg No.	Dwg Title	Company	Date
L191/7	2 Storey Precast Coding Layout First Floor Sheet 1	John H Webb Consulting Structural Eng. Oxford	25/2/70
L191/8	2 Storey Precast Coding Layout First Floor Sheet 2	As above	25/2/70
958/25 (was 191/29B)	Floor Plank & Service Unit Detail	As above	(c.1970)
685/26 (was 191/28G)	Main Floor Beams	As above	(c.1970)

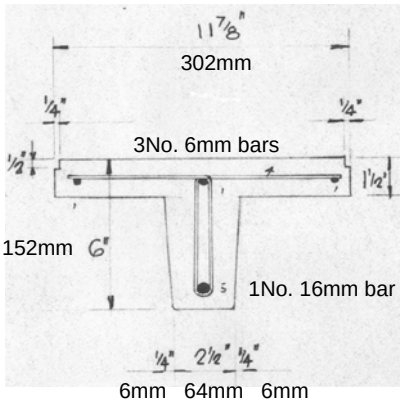
5. Inspection Carried Out

A visual inspection was carried out of the slab soffit through removed ceiling tiles and from the ground floor plant room, where there is a similar arrangement. **Figure 4** shows the PC "T" planks and main beam. The structural arrangement and dimensions were confirmed by structural record drawings found in the site archives file. This area has a raised access floor with supports at 600mm centres in each direction.

Fortuitously, drawing numbers L191/7 & 8 give design loadings for the first floor, which is the basis for our assessment. Drawing number 685/25 gives reinforcement and dimensional details of the beams and PC planks.



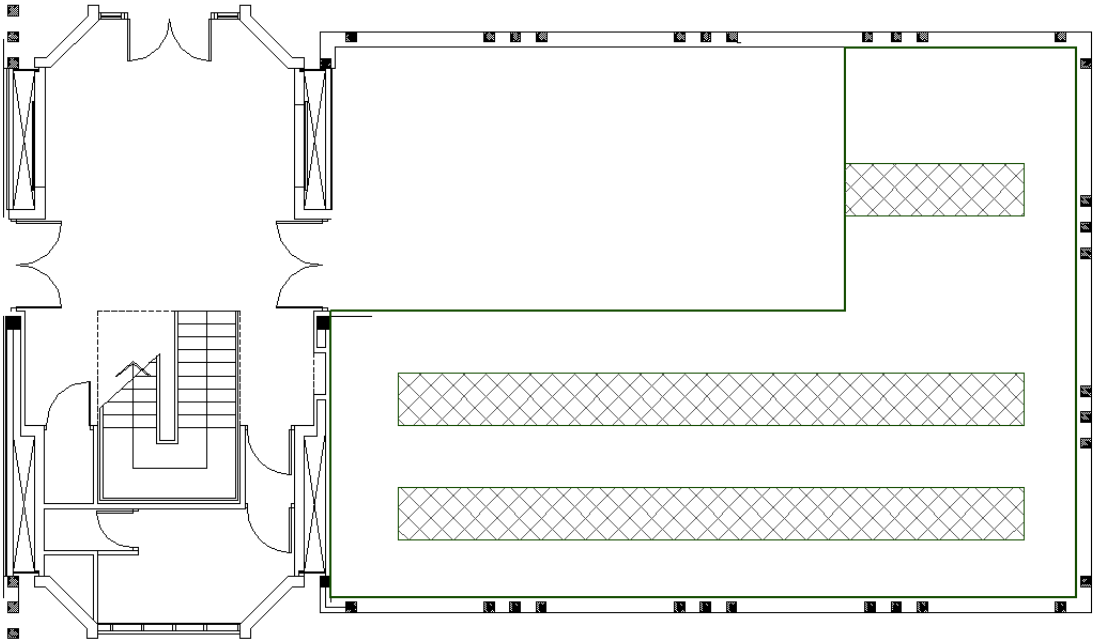
- **Figure 2: First floor structural layout**



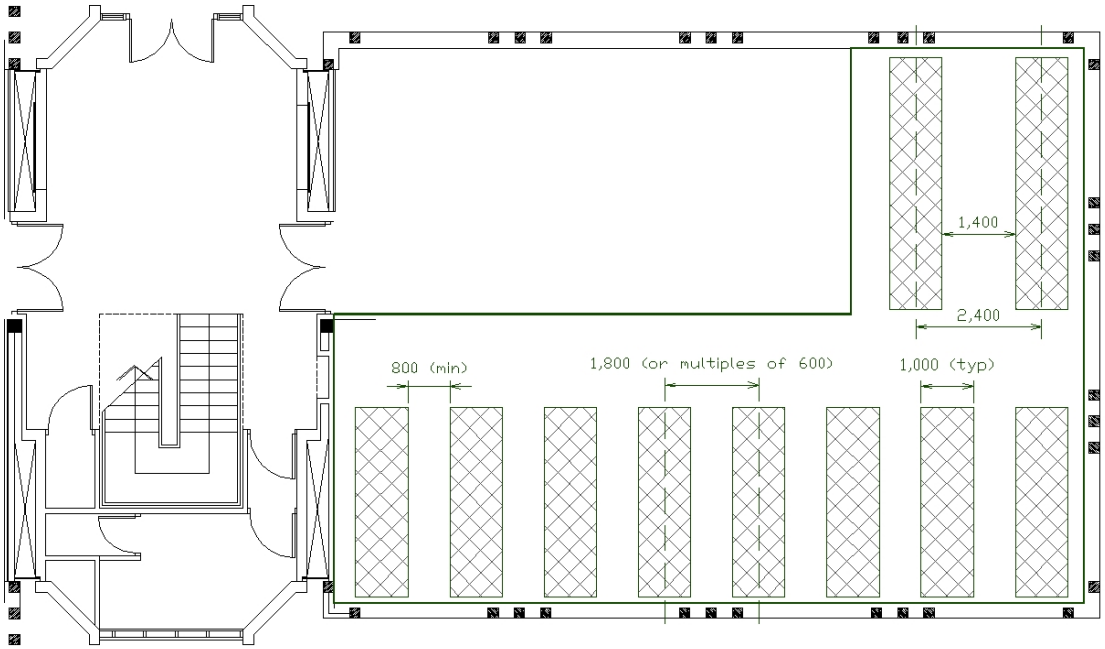
- **Figure 3: Typical "T" PC plank detail**

- **Figure 4: “T” PC planks and main beam**

- **Figure 5: Raised floor and spreader plate arrangement**



- **Figure 6: Option 1 - Proposed rack arrangement shown hatched**



- **Figure 7: Option 2 – Proposed rack arrangement shown hatched**

6. Assessment

As noted in section 5, we have based our assessment on design loading information given on drawing numbers L191/7 & 8. These loads produce an approximate design moment on the "T" floor planks and main beams of 5kNm and 248kNm, respectively.

We have been advised by the Client's IT department that their equipment racks currently weigh in the order of 600kg each and that they can theoretically reach 1000kg each. We have taken 800kg as a typical rack load over a 600mm x 1000mm plan area. Any casters or legs are removed to reduce point loading. However, due to the raised floor, there are point loads applied to the floor planks and main beams, through the supports, at 600mm centres.

For this localised assessment of the new loading we are able to reduce the original live load applied on the other areas, around the racks, and omit the original partition loading.

This proposed new loading, for option 1 (refer to **Figure 6**), produces an approximate maximum design moment on the "T" floor planks and main beams of 7.5kNm and 253kNm, respectively. The increase in moment on the floor planks will negate most, if not all, of the original design factor of safety, therefore we would recommend limiting each rack load in order to restore some of this factor of safety.

Alternatively, the Option 2 arrangement (refer to **Figure 7**) reduces the new design moments to 6.0kNm and 265kNm, which would be within acceptable limits.

Member-end shear forces have been considered but no detailed assessment has been carried out. As noted earlier in this section, some original loading can be removed. Therefore, the overall load is generally less than in the existing case, and the new shear loads are not critical.

7. Conclusions and Recommendation

Following a structural assessment, the following issues were identified:

- Fully loaded IT equipment racks (800-1000kg each) in the arrangement shown in **Figure 6** (option 1) would produce high forces in the structural members.
- In our opinion the structure does not have sufficient capacity for these loads.
- The loading of the PC planks is the critical loadcase.
- The alternative option 2 arrangement shown in **Figure 7** produces acceptable assessment forces for an 800kg per rack loading.

Our recommendations are as follows:

- A load limit of 700kg per rack should be observed for option 1.
- A load limit of 800kg per rack should be observed for option 2.
- For option 1, the two main rows should not be placed back to back in the centre of the room, but should have an access way between them.

- For either option, the rows of racks should be positioned centrally over a row of raised floor tiles in order to distribute the load evenly between two rows of floor supports.

If you have any queries please do not hesitate to contact the undersigned.

Yours sincerely

Andy Weddell
Senior Structural Engineer
Phone: 020 7759 2624
Fax: 020 7759 2601
E-mail: aweddell@skm.co.uk