The University of Nottingham

UNITED KINGDOM · CHINA · MALAYSIA

POST OCCUPANCY EVALUATION REPORT

ENERGY TECHNOLOGIES BUILDING



DECEMBER 2014

FINAL

QTC projects

1. Introduction

QTC Projects were appointed to carry out the Post Occupancy Evaluation following the submission of a tender for services dated 25 March 2014 to the Senior Capital Projects Officer, University Estate Office.

2. Scope of the Review

Evaluation Technique

The evaluation was conducted at Project Review stage (1 – 2 years after handover) and has been undertaken in line with the criteria and guidance contained in the HEFCE/AUDE publication, 'Guide to Post Occupancy Evaluation'.

Analysis

Analysis broadly followed the University's brief for undertaking the evaluation and consisted of reviewing all written information received concerning the building together with information collated from the questionnaires and workshop. Particular areas reviewed were:

Purpose and scope of project (brief)
Some aspects of the building procurement process
Building user feedback
Cost management and control
Construction and project management
Functional and technical performance
Sustainability - Assessment against BREEAM criteria
- Review of energy efficiency measures incorporated into the design

Questionnaires

Questionnaires were developed to obtain information and feedback from five specific groups:

a) User (On-line survey)
- a representative sample of 37 users of the building being evaluated consisting of Academic/Admin staff and PGR students

A sample of the user questionnaire is shown in Appendix 1

b) User Client
- Prof Mark Sumner, Electrical Energy Systems
- Prof Gavin Walker, Sustainable Energy

c) Consultant Design Team
- Architect
- Project Manager
- Quantity Surveyor
- Services Consultant
- Structural Engineer

d) Estate Office – Development/Operations & Facilities

e) Main Contractor

Interviews

Interviews were held with the following:

a) ALCE Project Manager – Melanie Watts
Sustainable Energy – Prof Gavin Walker
Electrical Energy Systems – Prof Mark Sumner
ALCE Project Director – Prof Colin Snape

b) Estate Office
Richard Wigginton – Senior Capital Projects Officer

c) Maber Architects – Nick Keightley and Paul Anderton

d) Clegg Construction – Salv Martello

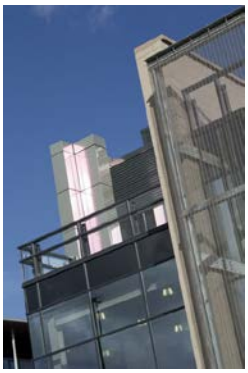
Edmond Shipway Project Manager and QS declined to be interviewed.

Workshop

A half day workshop was held on 9 December 2014 (a list of attendees is shown in Appendix 2).

The format for the workshop was a presentation by QTC Projects acting as facilitator which included feedback from the user satisfaction questionnaires. The workshop helped to highlight the key issues that had been raised in the questionnaires and interviews which were then discussed and debated.

The information from the workshop provided important comment which has been incorporated into this report.


3. Building Data

Name	Energy Technologies Building
Size	3177m² (Gross Internal Area)
No of Storeys	3 storeys plus roof area
Occupants	Research Groups for Faculty of Engineering
Types of space	Offices (single and shared) Specialist Lab areas Seminar room Prototyping Hall Exhibition space Ancillary space
Construction Period	46 weeks
Start on site	3 May 2011
Contract Completion	20 March 2012
Practical Completion	6 September 2012

Net Construction Costs

At Start of Construction	£5,466,988
At Final Account stage	Commercial settlement reached
Funding	University, Wolfson Foundation, ERDF

Consultant Team

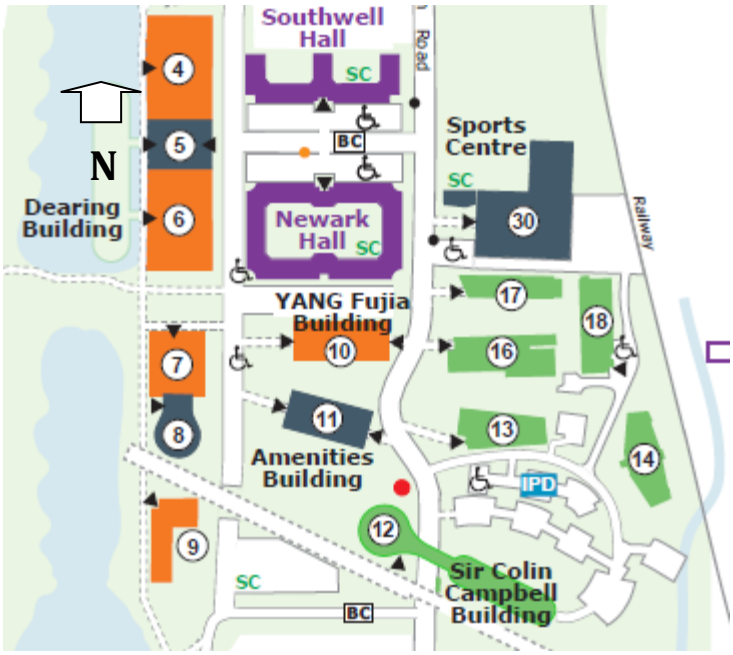
Project Manager	Edmond Shipway, Nottingham
Architects	Maber, Nottingham
Cost Managers/QS	Edmond Shipway, Nottingham
Services Engineer	AECOM, London
Structural Engineers	Price and Myers, Nottingham
Contractor	Clegg Construction, Nottingham
Building Contract	JCT Design & Build 2005 (Rev 2 2009)



4. Project Background and Description

The building, located on the Jubilee campus, is an exemplar low carbon facility dedicated to the research and development of sustainable technologies. With part funding from ERDF and a grant from the Wolfson Foundation, the investment in a new building has enabled the University to strengthen its leading role in global energy research and its commitment to developing low carbon technologies.

As part of the design competition the University issued a design brief in November 2009 which identified the site for development which stipulated that it had to be in line with the University Campus Development Plan formally adopted by Nottingham City Council in December 2004 and updated in the Development Framework issued in February 2006.



The building which comprises three main elements of a front facade block and two 3 storey rectilinear blocks, sits comfortably on the site (16). It is bordered to the west by Triumph Road on which the building's frontage gives a predominantly glazed and open aspect, to the north by the Institute of Mental Health Building (17), to the south by the Nottingham Geospatial Building (13) and to the east by the Aerospace Technology Centre (18).

The final design and finished building is sited alongside a mix of contemporary architecture which make up the University Campus and it respects the original master planning principles. The three storey building houses a mix of office accommodation, specialist laboratories, prototyping hall, exhibition/event space and large seminar room.

The main entrance facing Triumph Road makes subtle references to other buildings on the Innovation Park through use of large expanses of glazing which reflect the cladding materials used on adjacent buildings. At the same time the building displays its own identity through the bold use of iridescent rainscreen cladding. A dark grey cladding system is also used for the prototyping hall.

The roof of the building incorporates a laboratory area as well as green and brown roof areas which will provide space for solar panels as well as valuable ecological habitats. Photovoltaic panels have also been fitted to the south facing roof slopes to the Prototyping Hall.

The building structure combines the use of reinforced concrete and steel frames the former providing thermal mass where necessary and the latter providing long roof spans and flexibility in construction.

The main contract works commenced on site in May 2011 and were completed in September the following year. The building has achieved an 'Outstanding' rating in line with the Building Research Establishment's environmental assessment methodology (BREEAM), being one of the first research-led laboratory buildings to achieve this highest level of environmental standard.

The building has also received a number of awards for its design, innovation and sustainability credentials.

A full list of project milestones is shown in Table 1.

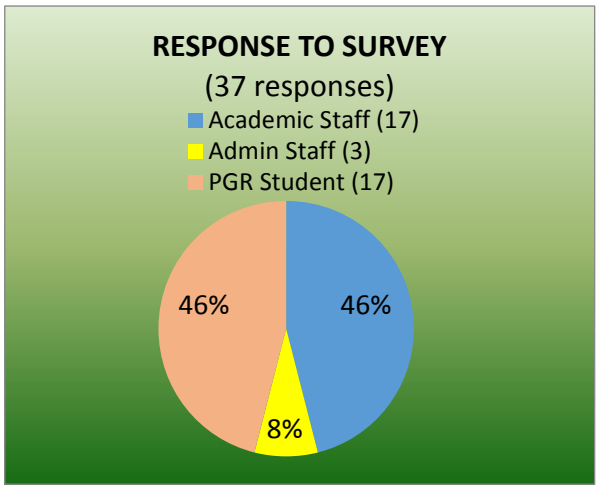
Table 1 Project Milestones

Design Brief issued	16 November 2009
Design competition submission	February 2010
Planning Approval	30 November 2010
Main contract tenders submitted	14 January 2011
Tender report	March 2011
Contract start date	3 May 2011
Contract completion date	20 March 2012
Actual completion date	6 September 2012
Official opening	17 October 2012

5. User Satisfaction

Building user satisfaction has been assessed from the responses to the on-line questionnaires received and analysis of the comments made. The results are shown in a series of bar charts covering the following areas:

- Satisfaction with specific room types, ie shared and single offices, seminar room, specialist laboratories, prototyping hall, exhibition hall, ancillary space and overall impression of the building
- Security
- Accessibility
- Cleanliness
- Internal room temperature
- Distraction from noise
- Lighting conditions, natural and artificial
- Data connectivity at the workspace/Wi-Fi
- AV equipment in seminar room



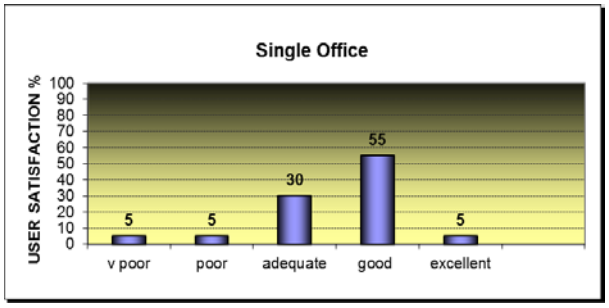
Overall, 37 responses were received from a representative group comprising Academic/Admin staff and PGR students. This is approximately 34% of occupants of the building which is a reasonable response.

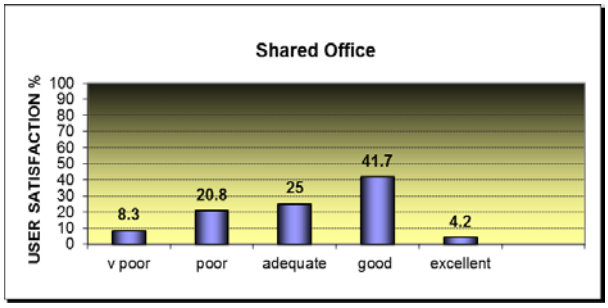
Users were asked to give a response on their overall impression of the building and this has shown a reasonable level of satisfaction.

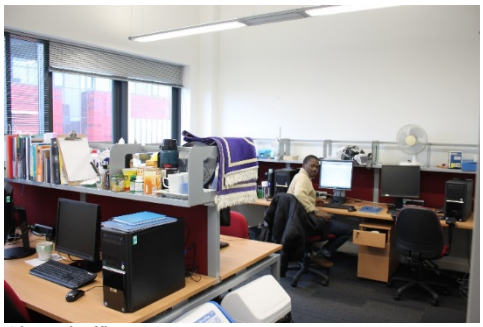
50% of respondents rated the building good to excellent.

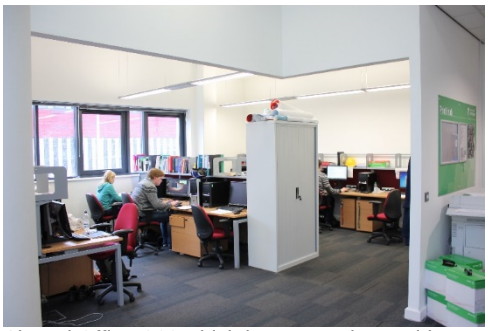
Single and shared offices are located on all three floors on the north side of the building with direct access off the spine corridor. Two shared offices, A09 and C08 were originally open to the corridor but room A09 has now been partitioned off to improve the working environment.

Most respondents occupying single offices were satisfied, with 85% rating them adequate to good. In the shared offices the level of satisfaction is reduced to 67% (adequate to good rating).

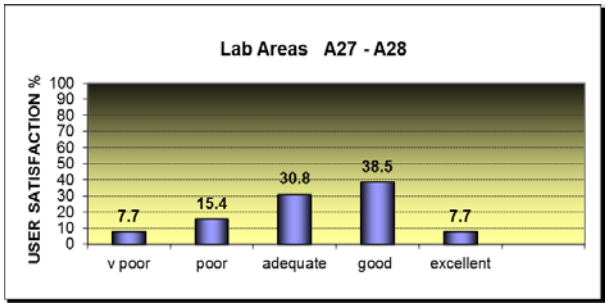


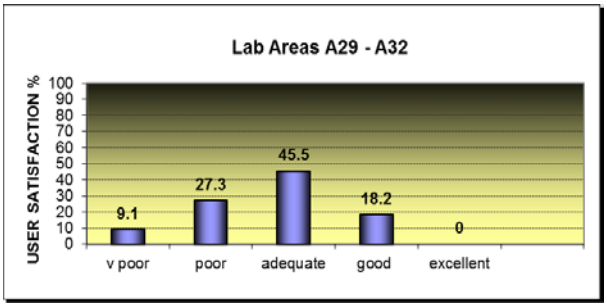


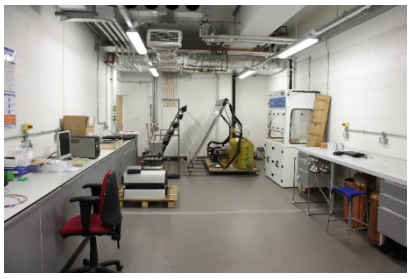

Shared office C04


Shared Office C08 which is open to the corridor

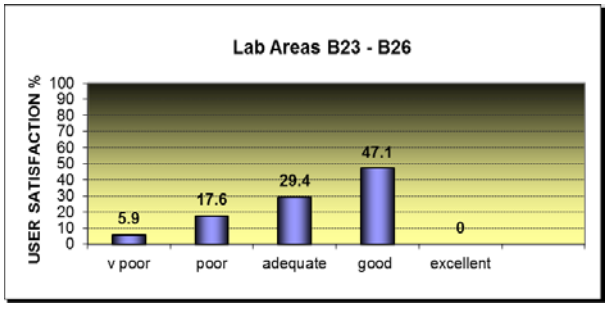
The specialist laboratory areas take up the majority of space in the building and are located on all three floors. The level of satisfaction varies but overall, the rating of good to excellent ranges from 18% to 46%.

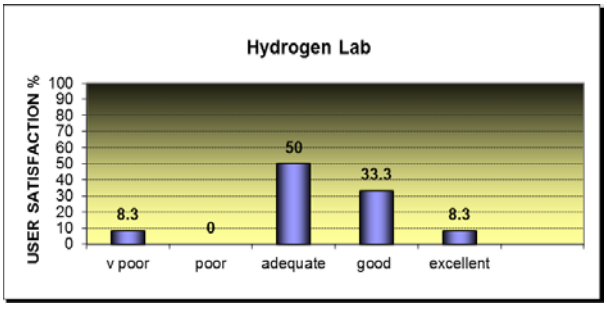


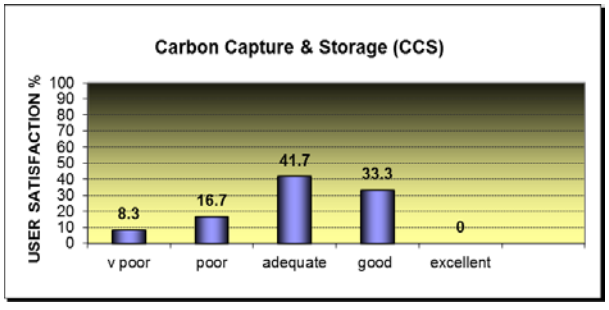


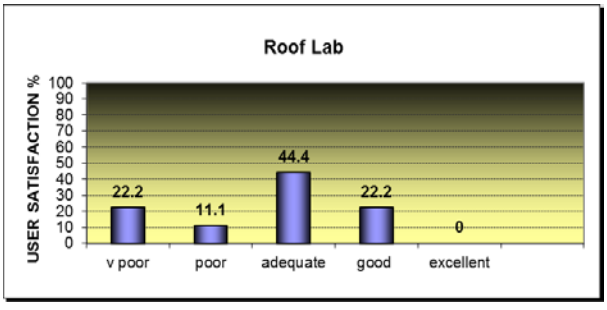


The scores reflect the difficulties experienced when the building was handed over and the length of time it has taken to adequately fit-out the laboratories for research purposes. There was some level of breakdown in communication due to changes in some end users which lead to further post occupancy fit-out. However it was confirmed at the workshop that despite these issues and apart from the prototyping hall, the building does deliver on providing facilities for specialist research.



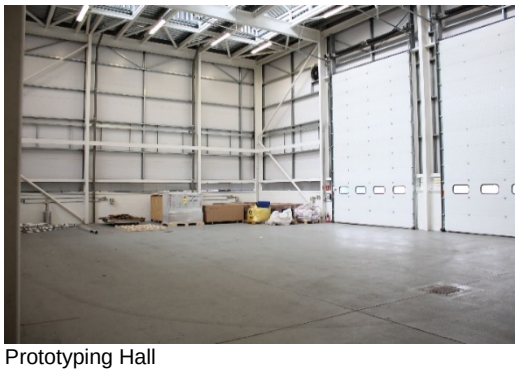




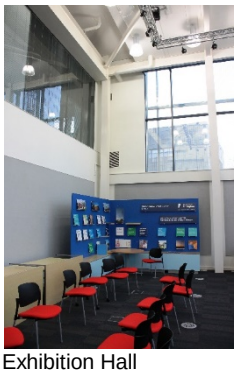


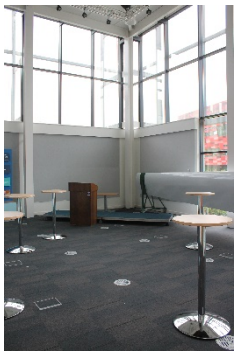
The large prototyping hall, a light industrial type space, was originally intended as an area for construction and testing full-scale prototypes of building facades and materials with an adjacent external test area.

The take-up on the use of this facility has not been good and other research uses for energy technologies are now being considered by the University.

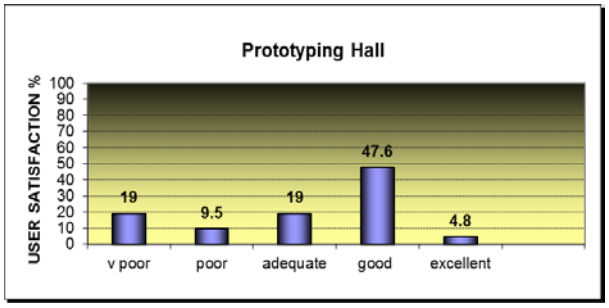


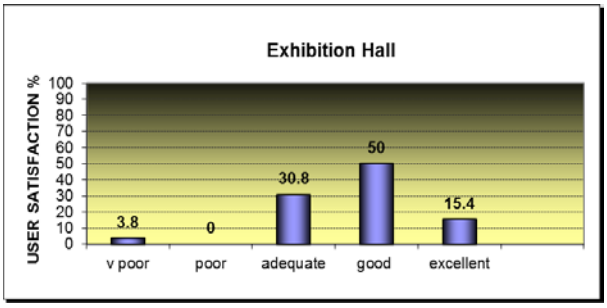
Prototyping Hall





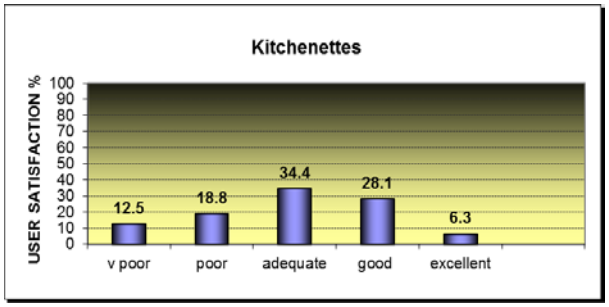
Exhibition Hall

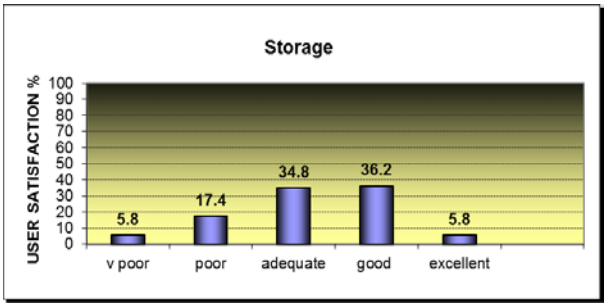




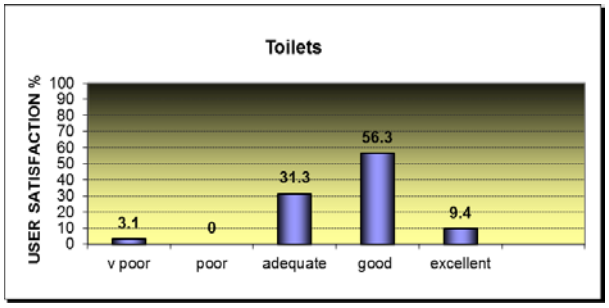
The exhibition space is highly rated (65% good to excellent) and provides very good facilities for exhibitions, demonstrations and conferences linked to the use of the seminar room.

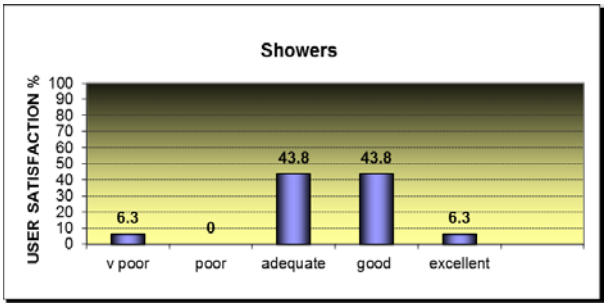
The kitchenettes show a reasonable level of satisfaction but some respondents felt the facility was too small and wrongly located particularly the C Floor kitchenette adjacent the open shared office. There were no major issues raised concerning the availability of storage.



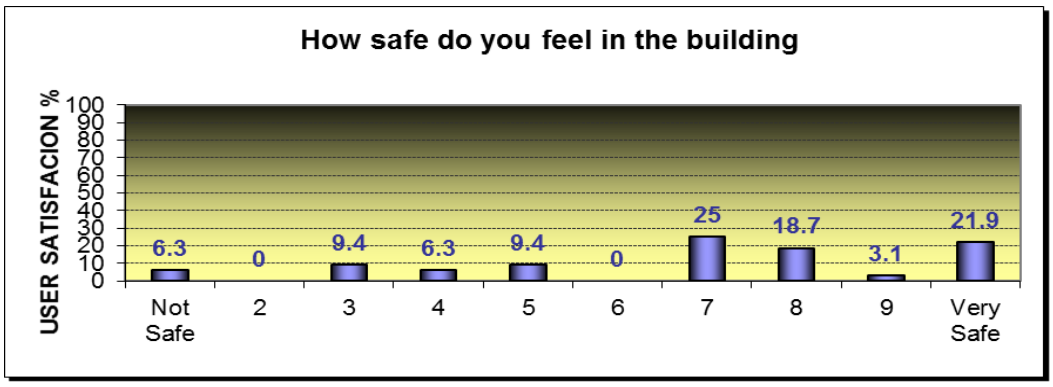


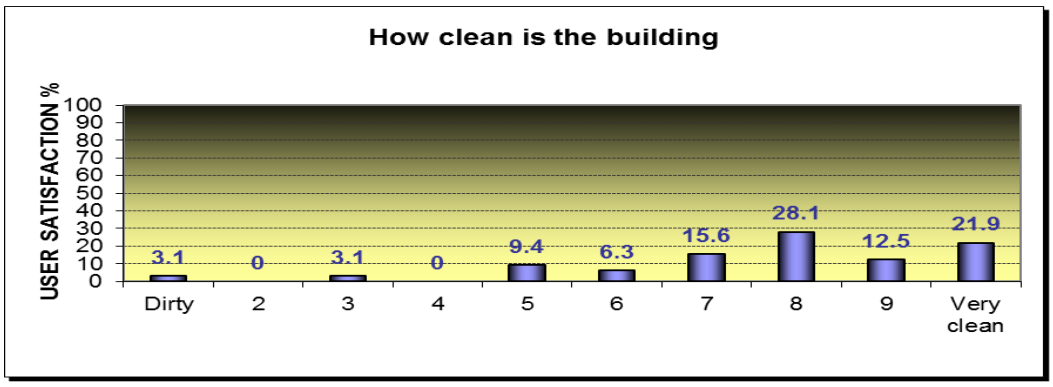
The toilets and shower areas are regarded as good facilities with over 65% of respondents regarding the toilets as good or excellent and over 50% for the showers.



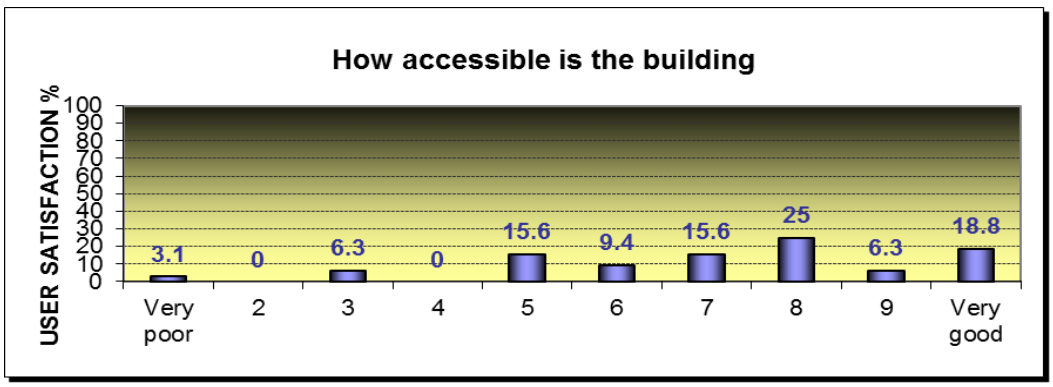


Looking at the charts for building amenity and comfort, most users felt safe in the building. However there were concerns regarding security to the rear of the building which has now been addressed with the installation of card access control. The lack of CCTV coverage at the rear is also being addressed with the installation of a new replacement camera.



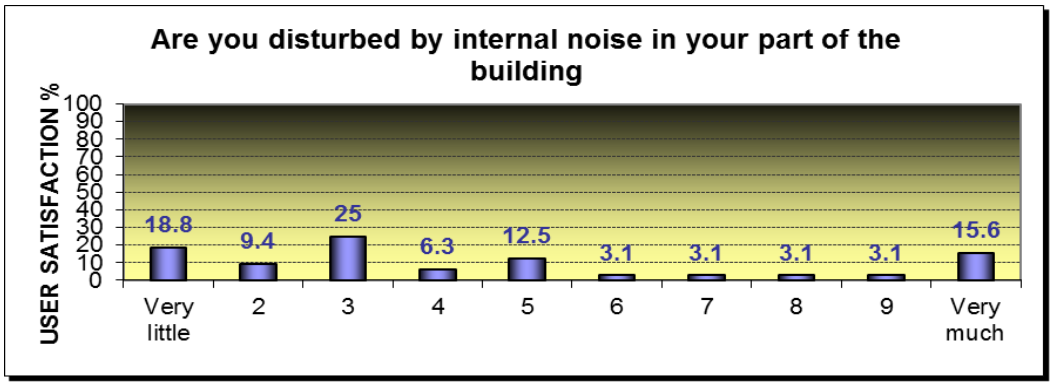


Overall, users are mostly content with the cleanliness of the building.



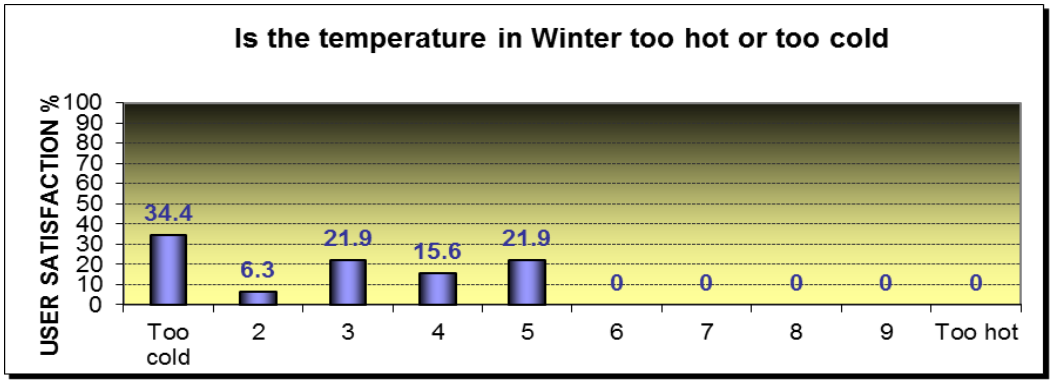
There were fairly positive responses on accessibility. Some respondents commented on the location of the lift being remote from the main entrance but it was noted at the workshop that the lift is used for both passengers and goods to service the labs on the upper floors and this influenced the final location for the lift.

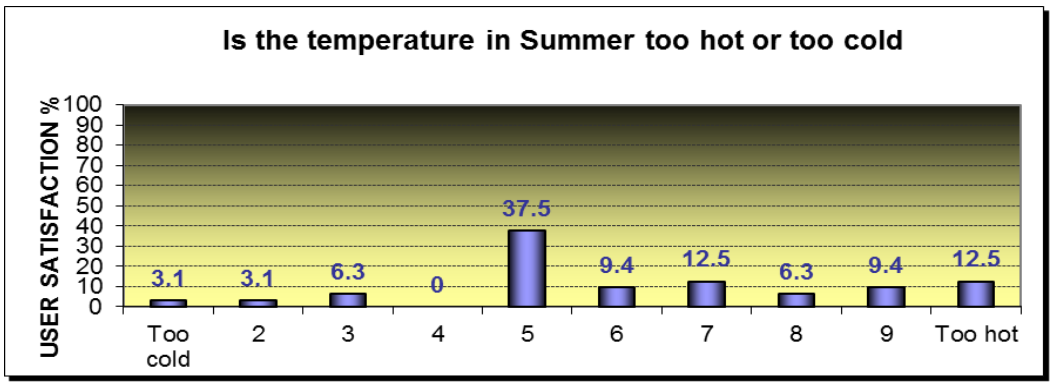
The response to the disturbance from noise question presented scores across the full range. Scores were influenced by those working in the open plan office space who experience noise disturbance emanating from others working in this space and in particular occupants of C08 who expressed concern regarding noise from the adjacent kitchenette.



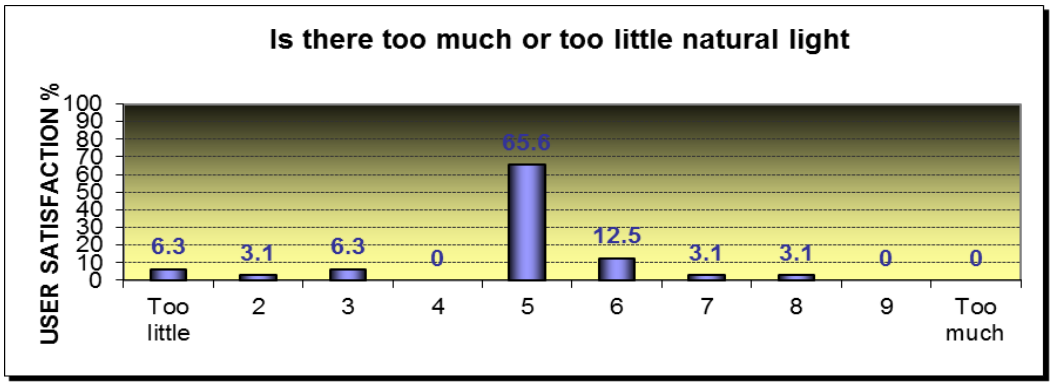
Regarding temperatures in the building, the charts show some interesting results particularly for winter. In winter respondents are indicating that 79% are too cold whilst in summer 40% consider the building or work area too warm.

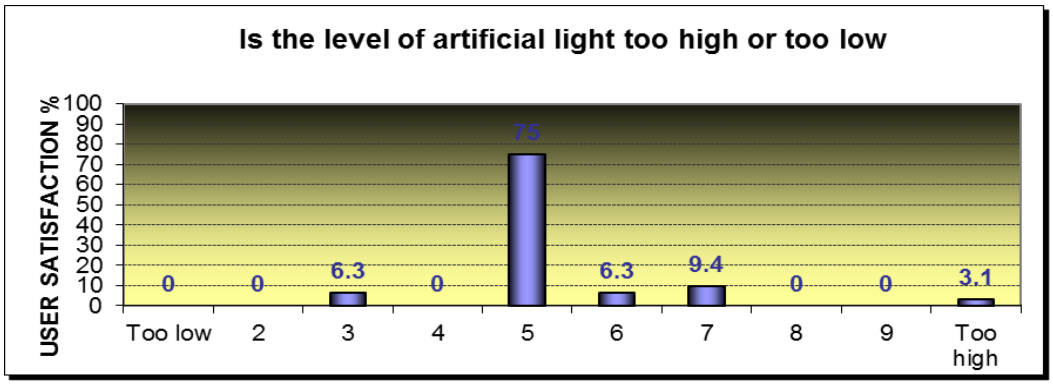
The temperature control is an ongoing issue, particularly in the offices, some lab areas and the exhibition hall and this is reflected in the responses.

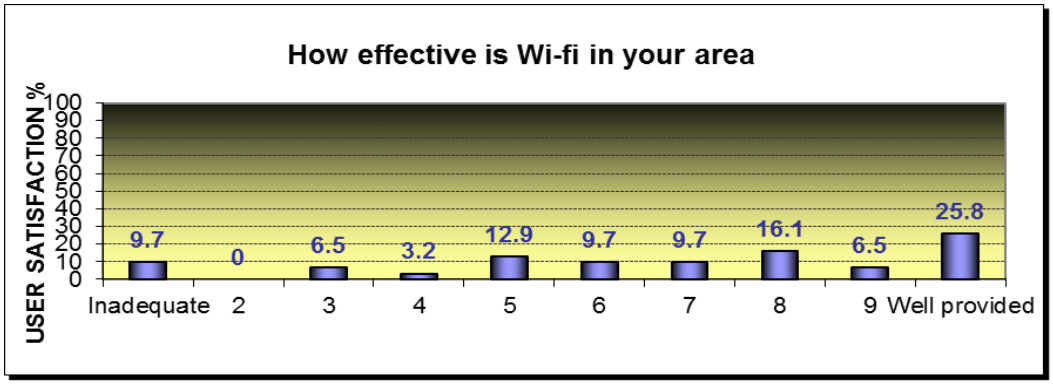




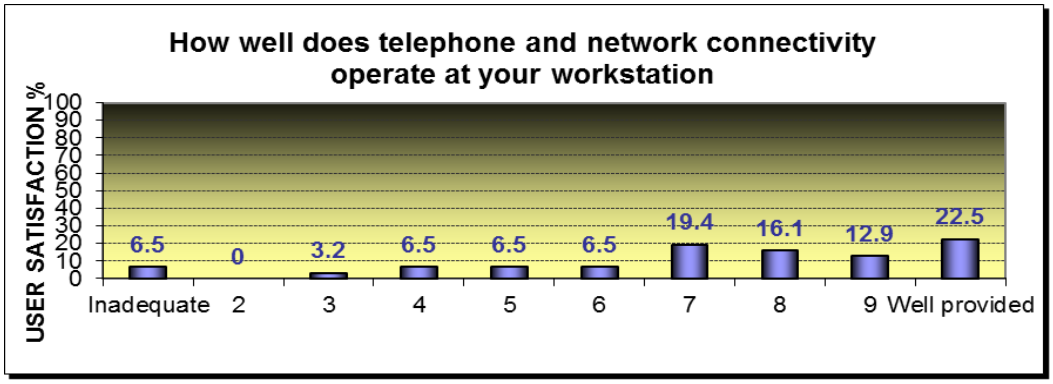
Regarding light both natural and artificial, generally respondents to the survey are satisfied but some users were concerned that as the offices are on the north side of the building they tend to be too dark and require the dependence on artificial light. Artificial lighting in the building appears to be acceptable to the users apart from some comments on the automatic controls.

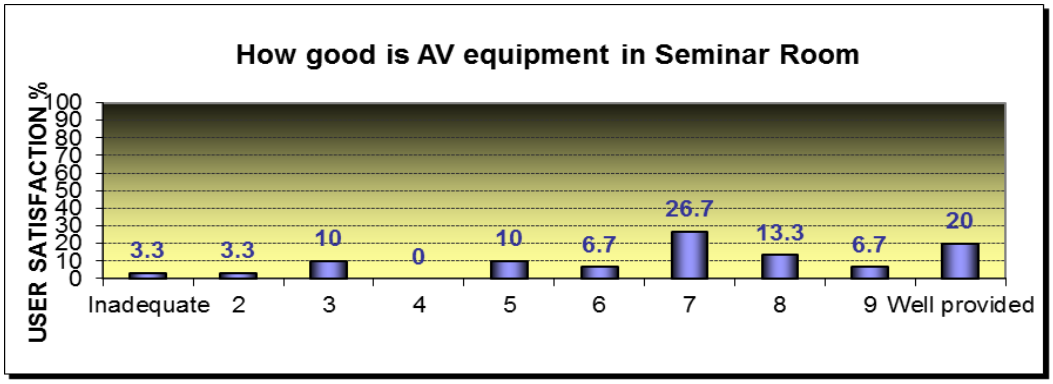






The scores on how good the Wi-Fi is at the workplace were fairly positive. (68%) Respondents also felt that telephone and network connectivity worked reasonably well. The satisfaction levels for the seminar room AV equipment are less positive as users have experienced a number of problems with this technically complex installation.





Resulting from the questionnaire responses, interviews and various discussions, a number of issues have been highlighted and were presented at the POE workshop for further discussion/debate. The issues have been grouped under the following headings and considered in more detail in this report:

- User Issues
- Design Issues
- Construction Issues
- Facilities and Operations
- Project Management
- Procurement and Cost Management
- Sustainability

6. User Issues

A number of user issues and comments were raised during the interviews and from the questionnaire returns which were discussed at the workshop. These are listed below and commentary given.

Heating and Cooling

The responses to the satisfaction survey indicate a problem with the temperatures in the offices. This is made worse by the location of the floor vents in relation to a person seated at their desk. This needs further assessment to consider whether some of the floor vents can be relocated and temperatures adjusted.

Temperatures in the labs and exhibition hall also need to be reviewed. Assessment on a room by room basis would provide comprehensive data on where adjustments need to take place.

Quality/suitability of electrical floor boxes

The Estate Office policy is to, where possible, avoid the use of floor boxes and use perimeter trunking. In deep plan spaces this may not be possible. In this building floor boxes have been used in one laboratory area which is not appropriate and should be avoided. Also the quality of the boxes has been referred to by users as having “sharp edges and regularly damage the outer sheath of cables.” The Estate Office recognises the issues with floor boxes and their specification is constantly being reviewed to ensure the right quality and fitness for purpose is achieved.

Kitchenettes

Kitchen facilities within buildings are necessary in order to provide basic amenities for staff and other users. How these are provided depends on the layout and configuration of floor plans and how the architects can integrate them into their overall design.

Small kitchenettes or beverage points off circulation space have been used in this building as opposed to a separate room or rooms that function as a kitchen.

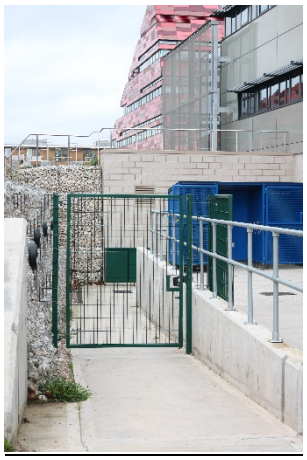
Consideration should therefore be given for the design brief to clearly stipulate how this function is to be provided, balancing the need to provide adequate facilities with the need for space

Fire Vents

The fire strategy for this building incorporates roof vents over the main corridor spine and staircase which open when the fire alarm is activated. The issue for users is that the vents seem to remain open for a long period once the alarm has been de-activated and people are allowed back into the building. On rainy days this results in the photocopier getting wet as well as the main staircase which may be a safety hazard.

The operation of the fire vents should therefore be investigated.

Ramped Rear Access



The building has a ramped service access to the rear of the electrical lab. Users have commented that the ramp is far too narrow for goods vehicles to reverse close to the access doors for off-loading. This was discussed at the workshop and the design intent, which was endorsed by PMG, was that forklift trucks would be used to transport equipment/plant the short distance to the access doors.

Noise Disturbance

A number of comments have been made regarding noise disturbance experienced by occupants of office C08. This office has an open side directly onto the corridor and adjacent kitchenette. Noise is generated from the activities around the kitchenette where groups tend to congregate.

A solution to this would be to construct a partition to screen off the office completely from the corridor. This has been done to office A09 with some success.

Staff Social Space

Users have commented that there is no common area for staff to congregate over lunch or meet informally outside their offices. The design brief did not include for this type of space and there seems to be some inconsistency across recently completed capital projects regarding the provision of this sort of space. The policy needs to be clarified and the provision of this space raised with users at the preliminary design stage.

Recommendations

i) Carry out further assessment of the heating and cooling in the building and make adjustments/modifications where necessary. Consider relocating floor vents where possible

ii) The use of electrical floor boxes should be avoided where possible. Where they cannot be avoided in deep plan space, the specification of floor boxes should continue to be reviewed by the Estate Office to ensure the right quality and fitness for purpose is achieved

iii) Consideration should be given for the design brief for kitchen/kitchenette facilities to clearly stipulate how this function is to be provided, balancing the need to provide adequate facilities with the need for space efficiency

iv)The operation of the fire vents should be investigated to ensure closure is activated as soon as possible following a fire alarm activation

v) Consider partitioning C08 off from the corridor to reduce noise disturbance. An option would be for the Faculty to refer this to SMC for their consideration

vi) Review the policy of provision of staff social space in new buildings and ensure the option to include is discussed at the early design stage with user representatives

7. Design Issues

A number of comments relating to design were raised during the interviews and from the questionnaire returns which were discussed at the workshop. These are listed as follows and commentary given:

Design Brief

The University issued a design brief at the competition stage. As an initial design document, it was adequately detailed and provided sufficient information on which to commence preliminary designs. The Design Team considered there was good communication through the University's Estate Office via the Senior Capital Projects Officer.

User Consultation and Design Development

From the discussions with the design team, Estate Office and end users there were clearly issues with how the design was developed with the involvement of users, identified at the time, for the specialist lab areas.

During the course of the design development and as occupancy requirements evolved, there were issues with the user groups as senior academics left or moved on. At the same time the Faculty of Engineering underwent a restructuring of its organisation.

The University was very keen to make progress with the project and developed robust pre-tender information in a short space of time. Post tender design development was the responsibility of the main contractor under the Design and Build contract and adjusting the programme to give more design time at this stage would have helped.

The building also had a number of departments initially involved in its occupation and with varying research requirements that needed to be reflected in the evolving design. The project would have benefitted from having a single point of contact for what is a multidisciplinary facility. This single point of contact could have brought the users together and acted as a conduit for communication.

Design Co-ordination

Design co-ordination on this project could have been better. Although the main contractor has stated that the pre-design was incomplete which led to extensive design co-ordination issues, it should be noted that this project was completed under a Design and Build contract with the main contractor responsible for completing the design post tender.

Other issues which affected design co-ordination were the contractor's decision to re-tender the mechanical and electrical services at a late stage (the steel frame was already being erected at the time). Once appointed, the main contractor had difficulty in engaging them positively and struggling to get them to perform ultimately had a fundamental effect on construction stage progress.

The need to achieve a BREEAM 'Outstanding' rating also added further complexity.

Planning Stage

It was noted at the workshop that there were no issues with obtaining the necessary planning approvals. The siting of the project was in line with the approved Masterplan and Development Framework and sympathetic to adjacent buildings.

Mechanical & Electrical Design

Lessons have been learnt on the installation of biofuel Combined Heat & Power (CHP) systems following the problems caused by the biofuel leaking onto the flat roof which melted the roofing material. The M & E Consultants' recommendation is that on future projects with this type of installation the fuel tank should be set within a bund with the pump sets also located inside this bund. The roofing membrane should also be carefully selected.

Structural Design

In looking at how the design process might be improved on future projects the Structural Engineers would certainly use Building Information Modelling (BIM) to model building services and drainage in 3D which will improve the transfer of information between the design team and the tendering contractors.

Recommendations

i) On future projects ensure that the programme allows sufficient time for the contractor's design development stage to be completed

ii) Where possible engage an appropriate single point of contact to represent the end users such as a Faculty Operations and Facilities Manager

iii) As part of the employers' requirements document stipulate the need for naming if possible and the early appointment of the M & E subcontractor and for the main contractor to make provision for adequate design and its co-ordination

iv)The use of BIM should be considered on future projects for services and drainage to improve communication of design information

8. Construction Issues

Contractor Performance

The general view from both the Design Team and the Estate Office is that the underestimation by the contractor of the complexity of the building engineering services and their integration with the reinforced concrete frame structure and the poor performance of the M&E subcontractor contributed to the difficulties on this project.

The issue of adequate design development post tender, as stated earlier, was the main contractor's responsibility and perhaps the contractor should have reflected more on this before commencement of construction.

Programme

The programme of 46 weeks was not generous bearing in mind the complexities of the building services but was achievable. Contaminated land issues, discrepancies on site survey drawings and delayed completion of the contractor's M&E design were contributory factors resulting in a project overrun of 24 weeks.

Quality

The quality of the finishes both internally and externally are good and to a standard expected by the University. Although the adaptation, fitting out of the labs and resolution of snags took a relatively long time to complete, these spaces are now operating effectively.

Commissioning/Handover

Commissioning on this project could have been improved. Delays on the project meant that the period for commissioning was very tight and some issues are still being dealt with.

The ongoing problems with the CHP, fuel storage and fuel delivery system were due, in part, to issues with commissioning and the implications of the roof leak and the insurance matters surrounding this.

Handover and practical completion were achieved by the date stated. Post completion work was needed before the labs were fully operational and this fell either to the Estate Office to address shortfalls or to the normal process of Faculty operational fit-out.

Delays/Extensions of time

The contractor submitted a claim for loss and expense related to the delay but this was robustly contested by the Consultant Project Manager/QS. A commercial settlement was finally reached relating to time and cost.

Outstanding Defects/Design Issues

The main issues outstanding are:

- Ongoing problems with the CHP system as mentioned earlier (defect)
- Poor design of the LV panel in relation to the position of the bus coupler. Its position does not allow maintenance on the ETB board without isolating the power supplies to other buildings (design issue)

Health and Safety

There were no health and safety issues raised, the contractor conducting site operations in a satisfactory manner.

Recommendations

i) Ensure future projects involving complex engineering services allow sufficient programme time and reflect the process needed for adequate design development

ii) Ensure sufficient time is given to the commissioning period

iii) Resolve outstanding defects and design issues if funding allows

9. Operations and Facilities Issues

Involvement of Maintenance Team

On this project, maintenance staff were involved in the project to some extent and this could be improved. It is noted that on later projects a more structured approach has been applied and this should continue on all future projects.

Building Materials/Services Specification

There were no major issues concerning the specification of building materials and mechanical and electrical services. Comments were made regarding the daylight sensors controlling the artificial lighting in the offices which may need some adjustment.

Fault Reporting

There were no issues regarding fault reporting through the Estate Office helpdesk. Building users understood the process and were satisfied with the arrangements.

Operations & Maintenance Manuals

The Operations and Maintenance manuals were produced by consultants who have produced sets of documents for a number of University capital projects and there is now a consistency in their production and content.

Cleaning

Cleanliness in the building was considered to be a good standard and there were no major issues.

Security

Issues relating to the lack of CCTV to the rear of the building are now being addressed and it is noted that security has improved with the installation of swipe card access.

Recommendations

i) Continue to improve the communication with the Operations and Facilities Team
ii) Adjust the daylight sensors to the artificial lighting where necessary

10. Project Management

The consultant Project Manager and Quantity Surveyor declined to participate in the project evaluation workshop and were unavailable for interview thus very little information has been obtained from the Consultants.

Communication was considered to be effective on this project. The consultant design team and main contractor all had positive ratings for the Estate Office's communication and the accessibility of the University's Project Officer.

As with all University capital projects, this project was overseen and monitored by a Project Management Group (PMG) which included representation from the building user client. Once the final scheme was selected by the University, the project was delivered successfully through the normal PMG process.

11. Procurement and Cost Management

Procurement

The Architects on this project acted as lead design consultant, being appointed following the outcome of a design competition. This has proved to be a worthwhile and beneficial process as it enables the client to consider a range of design initiatives and different approaches to interpretation of the brief. The consultant Project Manager and Quantity Surveyor were separate appointments.

The Architects and Structural Engineers were novated to the contractor at around design stage D with the Building Services Engineers being retained on the client side to provide a monitoring role and quality control service.
It is considered that stage D+ or stage E is the most appropriate point in the design process at which to novate as more design certainty has been achieved by this stage, leaving the final design development and completion for the main contractor's team under the Design and Build contract.

The main contractor selection followed standard University procedures. Following a pre-qualification exercise, five contractors were invited to tender for the proposed works and submitted compliant tenders. The appointment of the preferred contractor took place following a detailed assessment of tenders. The process and recommendations were set out in a detailed tender report approved by PMG.

The form of contract used was the JCT Design and Build contract 2005 (revision 2 2009). This form of contract works well particularly since the contract clauses remain unamended and thus requiring less negotiation. In this form it is considered to provide good value in balancing cost and quality.

Cost Management

Cost management was challenging on this project but was managed well by the consultant Project Manager and QS. Regular cost plans and cost checks were prepared prior to tender and once construction commenced, regular cost reports were produced. PMG was kept regularly informed through the monthly cost reports and was able to monitor expenditure effectively and direct as required.

The final costs on this project have been agreed through a commercial settlement with the contractor and to the satisfaction of the University.

12. Sustainability

The design brief for this project stipulated a BREEAM target of 'Outstanding' measured against the current BREEAM 2008 criteria and this has been achieved.

It is a requirement of the Nottingham City Council Planning Guidelines that 10% of all energy used (interpreted through CO_2 emissions) in new developments over 1000m² be obtained from low carbon emission or renewable energy sources.

The design intent was that following an appraisal of possible options this would be achieved through the installation of a biofuel CHP plant which provides heating both for ETB and the adjacent IMH Building. In addition, the building uses innovative earth tubes which use the thermal mass of the surrounding earth to provide cooling and preheating of ventilation air.

The design assumptions and calculations on CO_2 emissions show that with the energy technologies installed in the building, the predicted 53 tonnes CO_2/annum is reduced by 124% to -13 tonnes CO_2/annum. It has not been possible to validate this emission reduction due to the problems being experienced with the CHP operation.

A number of energy efficiency and sustainability measures have been incorporated into the building, namely:

- Biofuel CHP plant
- Earth tube passive cooling and preheating
- Energy efficient lighting linked to occupancy/daylight sensors
- Exposed concrete thermal mass
- External shading to control solar gain
- Green roof

Recommendations

i) Once the CHP plant is operating successfully, record energy consumption and compare with design targets for the building to demonstrate the required CO_2 emission reductions

13. Conclusion

This has been a challenging project to deliver but despite this the University has achieved a building which is an exemplar of low carbon technology and a sound base for sustainable energy research.

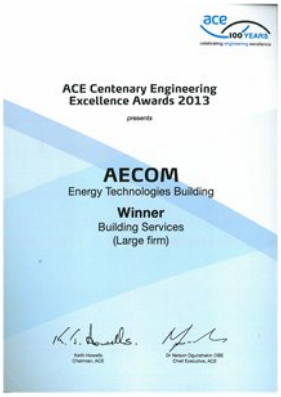
The building has received a number of awards in recognition of the building's innovative energy technologies:

2013 RICS Design & Innovation Award – Highly Commended

2013 Construction News 'Sustainable project of the year under £10m' Construction Award – Highly Commended

2013 ACE Centenary Engineering Excellence Awards – Winner of 'Building Services Large' Design Award

2014 Building Research Establishment BREEAM Awards - Winner



14. Summary of Recommendations

	Action
User Issues	
i) Carry out further assessment of the heating and cooling in the building and make adjustments/modifications where necessary. Consider relocating floor vents where possible	Operations and Facilities
ii) The use of electrical floor boxes should be avoided where possible. Where they cannot be avoided in deep plan space, the Estate Office should continue to review the specification of floor boxes to ensure the right quality and fitness for purpose is achieved.	Development
iii) Consideration should be given for the design brief for kitchen/kitchenette facilities to clearly stipulate how this function is to be provided, balancing the need to provide adequate facilities with the need for space efficiency	Development
iv)The operation of the fire vents should be investigated to ensure closure is activated as soon as possible following a fire alarm activation	Operations and Facilities
v) Consider partitioning C08 off from the corridor to reduce noise disturbance. An option would be for the Faculty to refer this to SMC for their consideration	Faculty
vi) Review the policy of provision of staff social space in new buildings and ensure the option to include is discussed at the early design stage with user representatives	Development
Design Issues	
i) On future projects ensure that the programme allows sufficient time for the main contractor's design development to be completed	Development
ii) Where possible engage an appropriate single point of contact to represent the end users such as a Faculty Operations and Facilities Manager	Development
iii) As part of the employers' requirements document stipulate the need for naming if possible and the early appointment of the M & E subcontractor and for the main contractor to make provision for adequate design and its co-ordination	Development
iv)The use of BIM should be considered on future projects for services and drainage to improve communication of design information	Estate Office

Construction Issues

i) Ensure future projects involving complex engineering services allow sufficient programme time and reflect the process needed for adequate design development	Development
ii) Ensure sufficient time is given to the commissioning period	Development Operations and Facilities
iii) Resolve outstanding defects	Development Operations and Facilities

Operations and Facilities Issues

i) Continue to improve the communication with the Operations and Facilities Team	Development Operations and Facilities
ii) Adjust the daylight sensors to the artificial lighting where necessary	Operations and Facilities

Sustainability

i) Once the CHP plant is operating successfully, record energy consumption and compare with design targets for the building to demonstrate the required CO_2 emission reductions	Sustainability

APPENDIX 1

Sample Questionnaire

POST OCCUPANCY EVALUATION

BUILDING USER SATISFACTION QUESTIONNAIRE (On-line survey method used)

BUILDING: ENERGY TECHNOLOGIES BUILDING

Occupation (Please tick most relevant or state in 'other')
Academic staff
Admin staff
PGR Student

An evaluation of your building is being conducted to assess how well it performs for those who occupy it. This information will be used to assess areas that might need improvement and provide feedback that can be used for the benefit of similar future buildings.

Please complete the following questions relating to the above project by ticking the appropriate boxes and adding comments where requested.

1 – Satisfaction with types of space in building

Please rate the overall quality of the following areas:
(Please tick)

A: Single Office	1 V Poor	2	3	4	5 Excellent	N/A
B: Shared Office	1 V Poor	2	3	4	5 Excellent	N/A
C: Seminar Room	1 V Poor	2	3	4	5 Excellent	N/A
D: Exhibition Hall	1 V Poor	2	3	4	5 Excellent	N/A
E: Prototyping Hall	1 V Poor	2	3	4	5 Excellent	N/A
F: Lab Areas A27-A28	1 V Poor	2	3	4	5 Excellent	N/A
G: Lab Areas A29-A32	1 V Poor	2	3	4	5 Excellent	N/A
H: Lab Areas B23-B26	1 V Poor	2	3	4	5 Excellent	N/A
I: Hydrogen Lab	1 V Poor	2	3	4	5 Excellent	N/A
J: Roof Lab	1 V Poor	2	3	4	5 Excellent	N/A
K: Workshop	1 V Poor	2	3	4	5 Excellent	N/A
L: Carbon Capture Storage (CCS)	1 V Poor	2	3	4	5 Excellent	N/A
M: Kitchenettes	1 V Poor	2	3	4	5 Excellent	N/A
N: Toilets	1 V Poor	2	3	4	5 Excellent	N/A
O: Showers	1 V Poor	2	3	4	5 Excellent	N/A
P: Overall Impression	1 V Poor	2	3	4	5 Excellent	N/A

2 - Security

2.1 How safe do you feel in the building? (*Please tick)*

Unsafe Very safe

1	2	3	4	5	6	7	8	9	10

3 - Accessibility

3.1 How accessible is the building? (*Please tick)*

Not easily accessible Very accessible

1	2	3	4	5	6	7	8	9	10

4 - Cleanliness

4.1 How clean is the building?

Dirty Clean

1	2	3	4	5	6	7	8	9	10

5 - Temperature

5.1 Is the temperature in winter too cold or too hot?

Too cold Too hot

1	2	3	4	5	6	7	8	9	10

5.2 Is the temperature in summer too cold or too hot?

Too cold Too hot

1	2	3	4	5	6	7	8	9	10

6 - Noise

6.1 Do you suffer distraction caused by noise in your part of the building?

Very significant Not significant

1	2	3	4	5	6	7	8	9	10

7 - Light

7.1 Is there too much or too little natural light?

Too little Too much

1	2	3	4	5	6	7	8	9	10

7.2 Is the level of artificial light too high or too low?

Too low Too high

1	2	3	4	5	6	7	8	9	10

8 – Telephone/Network Connectivity/Av Equipment

8.1 How well does telephone and network connectivity operate at your workstation?

Inadequate Well provided

1	2	3	4	5	6	7	8	9	10

8.2 Is the AV equipment in the teaching/meeting rooms adequate?

Inadequate Well provided

1	2	3	4	5	6	7	8	9	10

9 - Comments

If you have any additional comments that you would like to make about any aspect of the building and your working environment please note them here.

Thank you for completing the questionnaire.

Appendix 2

ENERGY TECHNOLOGIES BUILDING

Post Occupancy Evaluation Workshop

Held on Tuesday 9 December 2014

List of Attendees

User Representatives

Melanie Watts	ALCE Project Manager
Prof Mark Sumner	Electrical Energy Systems

Estate Office

Richard Wigginton	Senior Capital Projects Oficer
Adrian Mawdesley	Space Resource Manager
Chris Dickinson	General Manager Maintenance
Tim Wilson	Senior Building Surveyor
Cliff Hogan-George	Domestic Services Operations Manager
Mark Bonsall	Senior Engineer
Alison Morgan	Senior Security Officer

Design Team

Paul Anderton	Maber Architects
Sasha Krstanovic	AECOM – Building Services Engineers
Mark Lusher	Price and Myers – Structural Enginee

Contractor

Salv Martello	Clegg Construction

Apologies

Gary Byard	Security Supervisor
Prof Gavin Walker	Sustainable Energy
Prof Colin Snape	ALCE Project Director
Nick Keightley	Maber Architects

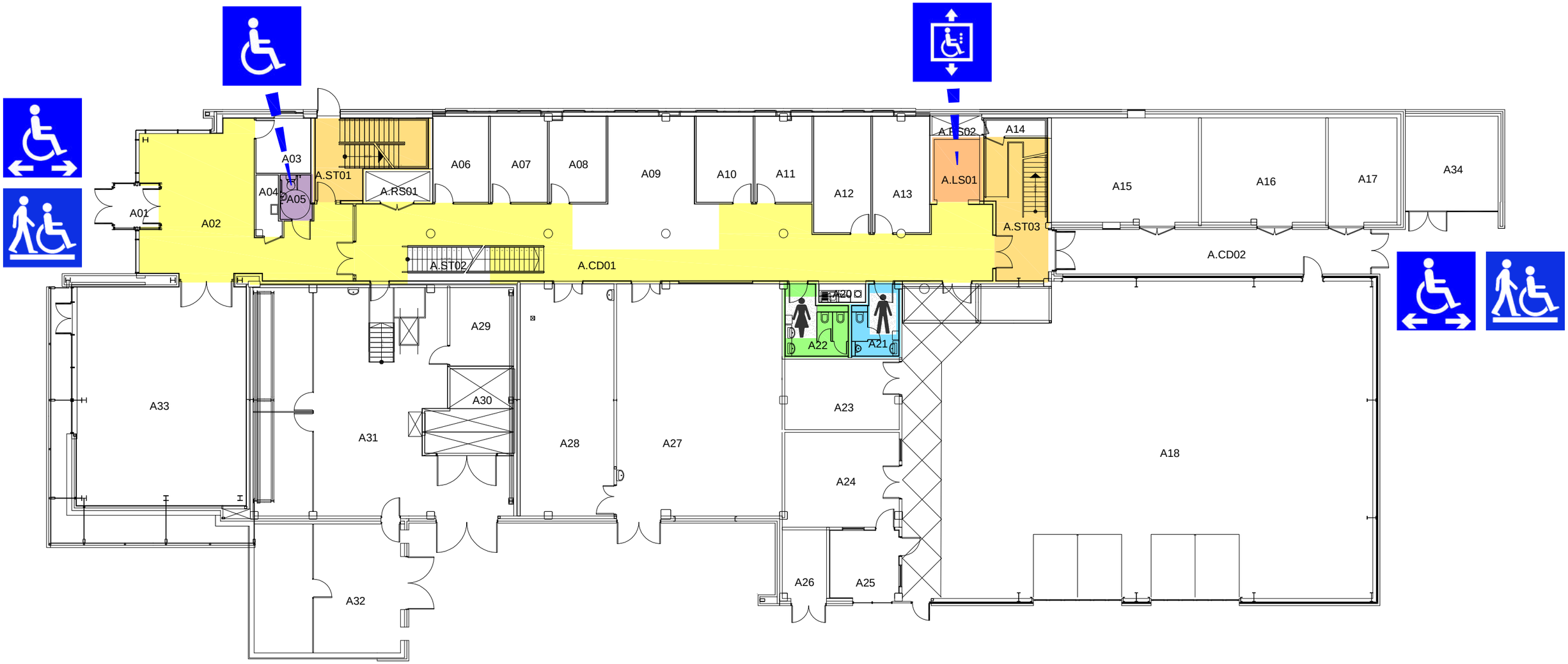
Note Guy Brooks and Tony Goulding, Edmond Shipway, declined to participate in the POE workshop

APPENDIX 3

Floor Plans

Energy Technologies Building - A Floor Plan

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA



Key

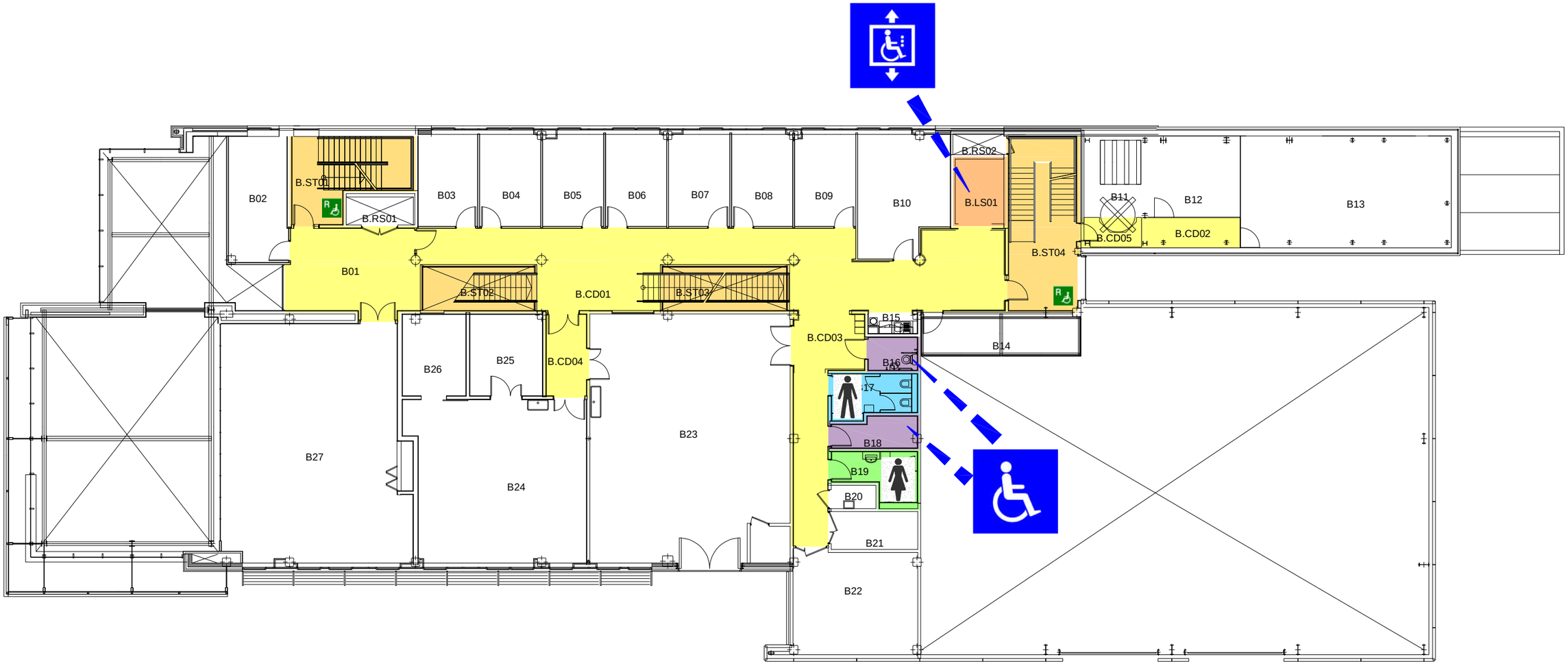
- Designated Badge-Holder Parking
- Access Ramp
- Automatic Doors
- Accessible Lift
- Entrance
- Accessible Entrance
- Evacuation Chair
- Emergency Refuge
- Toilet (Female / Male)
- Accessible Toilet
- Reception
- Refectory/Cafe
- Central Timetabled Room
- Circulation
- Stairs
- Lift
- Fire Assembly Point

May 2012
Estate Office

www.nottingham.ac.uk/estate/

Energy Technologies Building - B Floor Plan

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA



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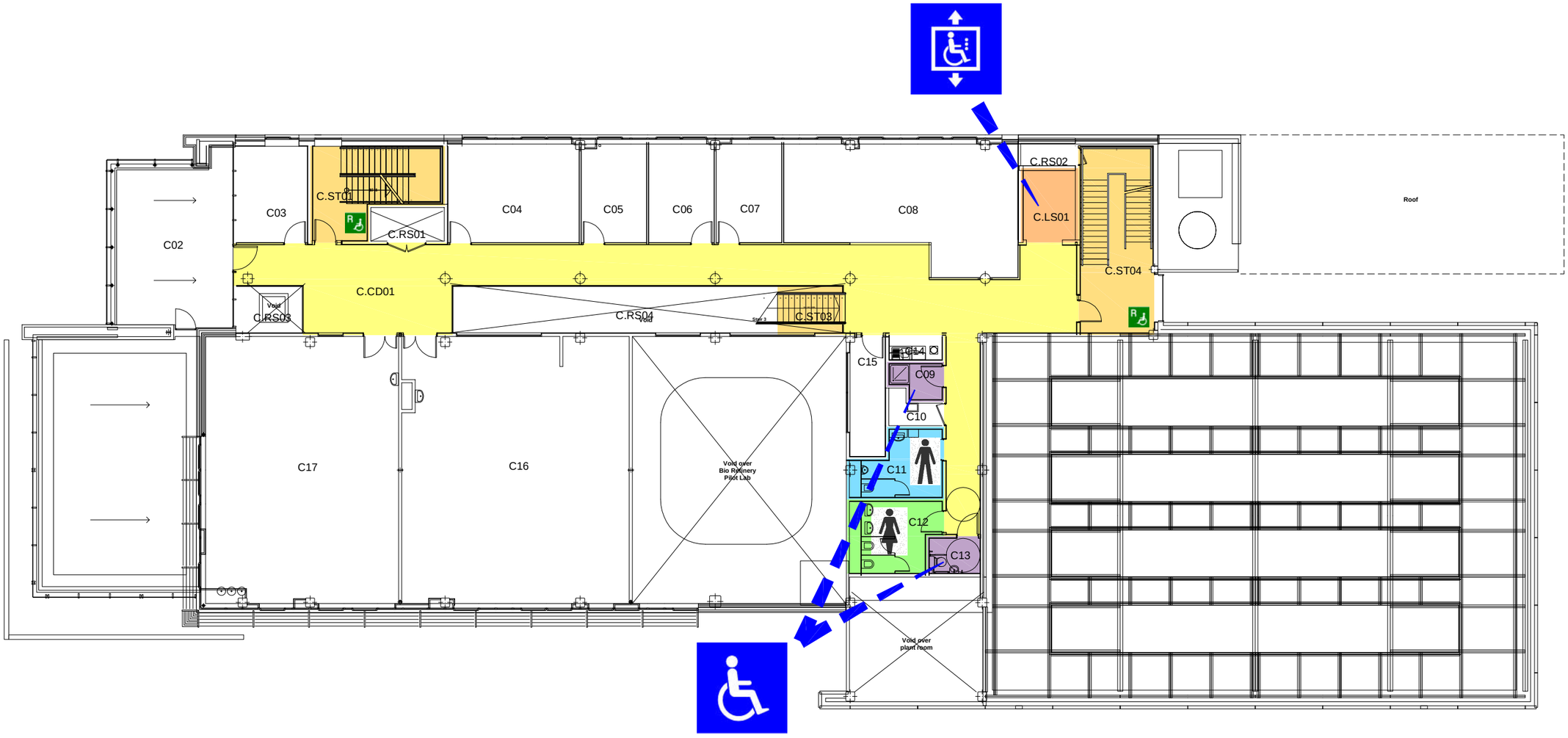
- Accessible Toilet
- Reception
- Refectory/Cafe
- Central Timetabled Room
- Circulation
- Stairs
- Lift
- Fire Assembly Point

May 2012
Estate Office

www.nottingham.ac.uk/estate/

Energy Technologies Building - C Floor Plan

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA



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