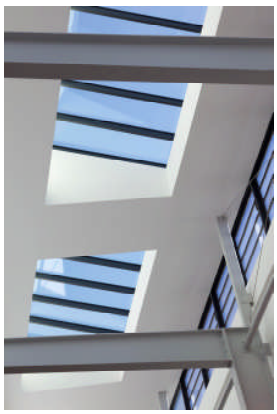
POST OCCUPANCY EVALUATION REPORT

NOTTINGHAM GEOSPATIAL BUILDING







MARCH 2012

1. Introduction

QTC Projects were appointed to carry out the Post Occupancy Evaluation following the submission of a tender for services dated 10 August 2011 to the Development Director, University Estate Office. The appointment was confirmed on 19 September 2011.

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

Questionnaires

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

a) User
- a representative sample of 18 users of the building being evaluated consisting of academic, research and support staff

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

c) Estate Office – Development and Facilities & Operations Sections

d) Main Contractor

A Sample of the User Questionnaires is shown in Appendix 1.

Interviews

Interviews were held with the following:

a) Nottingham Geospatial Institute
   - Prof Terry Moore, Head
   - Stella Fuller, Building Manager

b) Chair of Project Management Group
   - Prof Alan Dodson

c) Estate Office
   - Tim Brooksbank, Development Director
   - Richard Wigginton, Project Officer

A meeting also took place with the Facilities & Operations Team

d) Maber Architects - Alex Lipinski

e) WT Partnership QS - Stuart Bates

f) Edmond Shipway Services Consultants - John Chatterton

g) Price & Myers Structural Engineers - Steve Wickham

Workshop

A one day workshop was held on 13 February 2012 (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	Nottingham Geospatial Building
Size	2944m² (Gross Area)
No of Storeys	3 storeys
Occupants	Nottingham Geospatial Institute Horizon, School of Computer Science Tenants: Ordnance Survey Vigance EADS Nottingham Scientific Ltd

Types of space	Research Laboratories Offices (cellular and open plan) Business Incubation Units Meeting/seminar rooms Stores/workshop Rooftop Test Track Computer server rooms
Construction Period	48 weeks
Start on site	28 October 2008
Completion	12 October 2009

Net Construction Costs

At Start of Construction	£3,737,019
At Final Account stage	£3,955,000 (including additional works)

Funding	University, ERDF

Consultant Team

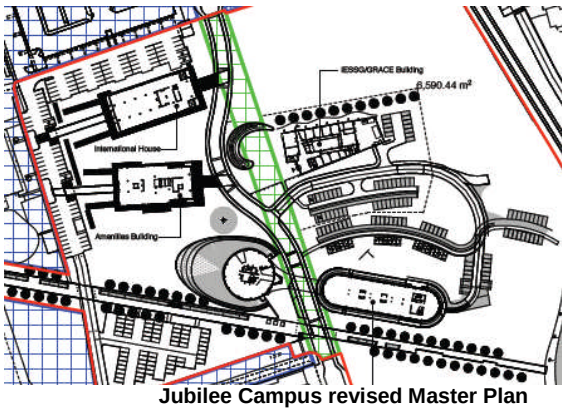
Project Manager	Sand Project Management, Birmingham
Architects	Maber Associates, Nottingham
Cost Managers/QS	WT Partnership, Nottingham
Services Engineer	Edmond Shipway, Nottingham
Structural Engineer	Price & Myers, Nottingham

Retained Services Consultants

Building Services	Edmond Shipway, Nottingham

Contractor	Clegg Construction Ltd, Nottingham
Building Contract	JCT Design & Build 2005

Photograph: Martine Hamilton Knight



Jubilee Campus revised Master Plan

4. Project Background and Description

The purpose of the project was to establish a centre of excellence in Global Navigation Satellite Systems (GNSS) in the East Midlands and build on existing world-leading research and training at the University. The core research activities are provided by the Centre for Geospatial Science and the University's Institute of Engineering Surveying and Space Geodesy which are co-located within the new building. Since the initial occupation and space allocations Horizon, part of Computer Science, have now taken over space on the second floor.

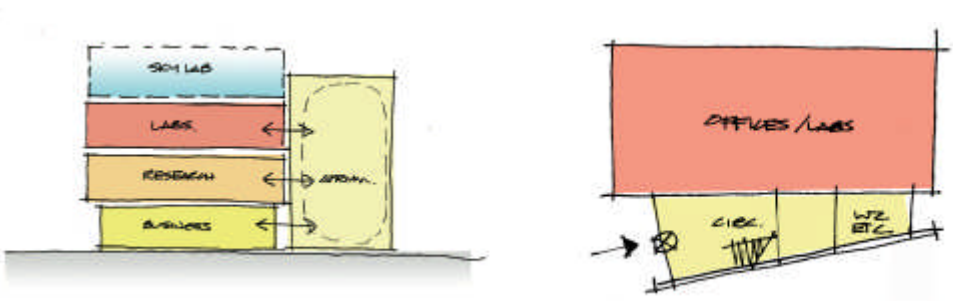
Thus the building provides a 'state of the art' facility on the University's Innovation Park, located on the former Raleigh Cycle site at the Jubilee Campus.

Nottingham City Council formally approved the Jubilee Campus development brief in December 2004 based on the original 10 year Master Plan created by Hopkins Architects. This has been superceded by a revised master plan produced by Make Architects which takes into account further land acquisitions made by the University including the site of the Geospatial Building. Outline planning consent for the revised master plan was granted in November 2005.

A detailed design brief was provided by the University as part of the design competition information which sets out the requirements, design constraints and other considerations. The target construction cost at the design briefing stage based on a building floor area of 2000m² was set at £3.2m excluding fees, client direct costs and vat. The project was jointly funded by the University and ERDF through the East Midlands Development Agency.

The primary objectives of the design were to include the following principles:

- To relate the new building to the MAKE Master Plan and optimise opportunities afforded by good orientation
- To maximise visual links to the rest of the campus
- To create a building with a distinct identity, yet still relating to the MAKE Master Plan
- To create a bespoke high quality working environment suitable for research activity
- To create a building that encourages communication between the commercial and academic elements through physical form and circulation
- To provide a flexible and robust building that meets the University's requirements for today and in the future
- To create a building that is honest and expressive of its function both internally and externally
- To provide the opportunity for delight through the integration of art
- To embody the best practice sustainable principles



The building is composed of two main elements: a three storey rectilinear pavilion block and a triangular wedge which forms the atrium.

The building is orientated east-west in line with the Master Plan in order to make the most of natural daylight and ventilation opportunities. The three storey pavilion block provides accommodation on the ground floor for the more public elements relating to industrial outreach, business development and training. It also incorporates the equipment and storage areas. The first and second floors provide research and laboratory accommodation together with cellular and open plan offices. The roof area provides a test track for related satellite equipment use.

The wedge element is the multi-height atrium space which contains the shared elements, including reception, stairs, lift and toilets. The atrium is the hub of the facility where you enter the building and access all levels.

A simple palette of materials has been used which were selected to relate to the other adjacent buildings on the campus. Horizontal zinc cladding panels are used for the north/south elevations as well as the cladding to the box ends to the pavilion and framing the vertical solar screens. A louvred screen forms the front end of the atrium and polished fair face concrete blockwork for the plinth and staircase walls.

The design of the building was developed through to RIBA Stage D and main contractor tenders were invited in April 2008. A number of value engineering exercises took place to reduce construction costs closer to the original target budget without compromising best value. Construction commenced in October 2008 with handover of the building twelve months later. The project was completed on time and within the revised budget.

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

Table 1 Project Milestones

Outline Planning Permission (Master Plan)	**28 Nov 2005**
University Design Brief Issued	**Aug 2007**
Consultant Appointments	**Dec 2007**
Planning Submission (Reserved Matters)	**11 March 2008**
Planning Approval (Reserved Matters)	**10 June 2008**
Initial Tenders invited	**April 2008**
Initial Tenders submitted	**23 May 2008**
Post Tender Exercise (Clegg tender)	**27 June 2008**
VE Stage 1	**July 2008**
VE Stage 2	**11 Aug 2008**
VE Stage 3	**2 Sep 2008**
Contractor appointed	**29 Sep 2008**
Contract start date (on site works)	**27 Oct 2008**
Contract completion date	**29 Sep 2009**
Actual completion date	**12 Oct 2009**
Final Account agreed	**5 July 2010**

5. User Satisfaction

Building user satisfaction has been assessed from the responses to the questionnaires received and analysis of the comments made. Appendix 3 shows a range of bar charts covering the following areas:

- Satisfaction with specific room types, ie open plan and cellular offices, entrance foyer/reception, networking space, seminar rooms and overall impression of the building
- Security
- Accessibility
- Cleanliness
- Air quality
- Internal room temperature
- Distraction from noise
- Lighting conditions, natural and artificial
- Data connectivity at the workspace
- AV equipment in teaching/lecture rooms

Overall, 18 responses were received from a representative group comprising researchers, academic and a support staff. The responses to the specific room types show a reasonable level of satisfaction which on average equates to “acceptable”. The lowest level of room satisfaction was shown for the reception area. The comments from the respondents indicate this is due to the absence of staff managing the reception desk which is misleading to visitors.

However building occupants are generally impressed with the overall impact of the building in terms of its distinct identity and the image it provides for the Department. The atrium is considered to be a light and pleasant space and is the focal point of the building, providing break-out and general social space and access to all levels via the prominent main staircase.

The offices have received a mixed response in terms of satisfaction. Generally the cellular offices have received a favourable response but the occupants of the open plan areas on the first and second floors have been critical of the distraction from noise emanating from the foyer/atrium area and insufficient natural light feeding into the working areas from the atrium.

Satisfaction levels for accessibility were above the average line and cleaning was in the upper quartile with no major issues raised. Less satisfaction was shown for security due to some staff being concerned that minor thefts have occurred and that the open sided office spaces compromise security.

Turning to environmental conditions, air quality was considered reasonable although an office with no opening windows, created from a later subdivision, attracted some criticism. Generally internal temperatures in summer were considered acceptable but in winter 55% of respondents thought temperatures were too low at times.

Respondents thought the level of natural light was adequate except for the open plan offices with borrowed light.

With the ICT/Data at the workspace, 61% of respondents considered this worked well and 88% were positive about the AV equipment in the seminar rooms.

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.

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

6. Procurement

Consultant Team

The University carried out a rigorous selection process, shortlisting five Architects and inviting them to tender for the commission of Architect for the project based on a detailed design brief prepared by the University's Estate Office. Acting as lead consultant, the Architects selected their own Services and Structural Engineers as part of their team.

Schemes which were to be "substantially visually resolved" were presented as part of the tenders and two firms of Architects were selected to proceed to the final stage presentation. The Architects' designs were assessed separately from the fee bids to ensure the assessment panel was not influenced by price alone. The Architects were appointed in December 2007 to proceed to RIBA Stage C/D.

Following RIBA Stage D, the Architect and Structural Engineer were novated to the contractor under a separate novation agreement. The Services Engineer was retained by the University to check services design development and monitor quality against the agreed specification. The Consultant Quantity Surveyor, Project Manager (also acting as Contract Administrator) and CDM Co-ordinator were separately appointed by the University. A BREEAM consultant was also appointed and thus the Geospatial Building was the first University project to receive formal BREEAM accreditation.

Retained Services

The University retained the Services Engineer rather than novating to the contractor in order to provide a quality control process through the detailed design and construction phases. Generally this was considered to be a worthwhile process although better clarity of roles and responsibilities set out in the Consultant's Appointment document would be helpful.

Building Contract/Tender Process

The form of contract used on this project was the JCT Design and Build Contract 2005. The use of this contract with partial novation works well for this type of project and helps to achieve good value for the University.

The following process was used for the appointment of the main contractor:

- Ten contractors selected by the University to receive the pre-qualification questionnaire
- Six contractors returned questionnaire on time
- Five contractors selected for tender (6^{th} held in reserve – Laser Build)
- Four contractors returned tenders. (Cleggs confirmed unable to submit tender in time available). All tenders considerable over pre-tender estimate and budget
- Cleggs given time (4 weeks) to submit tender
- Revised tenders invited from four contractors: two lowest from original tender list + Cleggs + Laser Build (Value Engineering Exercise 1)
- Two lowest selected (Value Engineering Exercise 2)
- Lowest selected – Cleggs (Value Engineering Exercise 3)

The initial budget set for the project was £3.2m which was below the OJEU threshold and therefore the requirements of OJEU did not need to be met. Following outline design, the cost estimates increased above the OJEU threshold of £3.49m (2009) and continued above this for the remainder of the project period. The intention was always to bring the cost down to below £3.5m but this was never achieved.

Following receipt and opening of the initial tenders Clegg Construction, who did not submit a tender, were given further time to submit their price.

Recommendations

i) The use of the JCT Design and Build contract with partial novation continues to be the most appropriate form for this type of project and should continue to be used

ii) PMG should consider the building procurement from information and recommendations given by the Quantity Surveyor to ensure the most appropriate procurement strategy is followed

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:

Planning Stage

The general view of the design team was that there was adequate information provided at the briefing stage and good liaison with the Estate Office.

There were no problems with the process for the submission for approval of reserved matters. The University has a good relationship with the Local Authority and early meetings with the Planning Officer took place as the design developed well before the formal application. There were no onerous conditions applied to the approval.

Atrium

There were some changes made during the design development. The main staircase as envisaged by the Architects as the “learning stair” was not achieved. It was intended to make better use of the landings as social spaces but the Building Officer insisted on continuous handrails which prevented this.

Originally the roof to the atrium was to be completely glazed but this was changed to individual rooflights not only to reduce costs but also to assist in delivering the thermal model.

Despite these changes, the atrium remains the focus of the building as the Architects intended. It is a light and airy space and creates a very positive impression when first entering the building.

Reception Point

The atrium space at the entrance level includes a purpose built reception desk designed to provide a greeting and information point for visitors. Regretfully, this has never been used as intended, remaining unattended since the building opened.

Toilet Provision

Some comments have been made by the tenants occupying space on the ground floor that the toilet facilities on this floor are inadequate especially when the training rooms are being used. The Design Team has confirmed that the toilet provision complies with approved codes of practice and no comments of a similar nature have been received concerning this issue.

Kitchen Area

The building was designed to accommodate two kitchen areas/beverage points: one in the original staff room (C05) on the second floor and the other as part of the social space off the first floor landing of the atrium staircase.

Due to increased occupation (Horizon moved in following completion of the building), the staff room is now used as a seminar/meeting room. Consequently, the beverage point off the first floor landing has been extended behind a dado height fixed partition. This has reduced the amount of seating space at this level.

On future projects where staff rooms are provided as part of University policy, consideration should be given to whether kitchen facilities should be provided in a separate room in order to maximise flexibility of space.

Test Track area on roof


Extended kitchen area

Roof Test Track

A track was designed as a permanent facility on which testing could take place. A series of pillars or 'monuments' were also incorporated to act as receivers and were built from foundation level through the building to terminate at roof level. It is understood the pillars work very well as part of the Institute's research activities. The clear view of the sky was a fundamental requirement and this was achieved although the reflective properties of the insulation to the roof mounted ventilation ductwork caused some initial problems.

Some details of the test track were set out in the original design brief but the procurement of the installation took longer than anticipated mainly because of the unique and bespoke nature of this facility

Recommendations

i) On future projects consideration should be given to whether kitchen facilities should be provided in a separate room in order to maximise flexibility of space

ii) Where possible, details of specialist installations should be set out at an earlier stage as possible

8. User Issues

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

Heating in Winter

A number of building users commented that the building is cold in winter and has never been completely effective. Reference has been made to the fourteen electric convector heaters which were fitted later to some of the rooms. It is acknowledged when calculating the heat loads, Termodeck made an error in not including heat losses through the end glazed walls. The Services Engineer challenged these calculations at the time and the additional heaters were intended to solve the problem.

In addition, an inbalance in the heating system caused low temperatures in the cellular offices on the north side of the building. It was reported at the workshop that meetings with Termodeck have recently taken place to resolve the low temperatures. Adjustments now need to be monitored to ensure these adjustments/balancing have been effective

Wall mounted convector heaters

Notice regarding noise levels

Noise Disturbance

The results of the satisfaction survey showed a relatively low score for noise disturbance. Comments were predominantly from those staff occupying the open plan areas who complained that noise from activities in the atrium filter into their workspace. In fact signs have been posted at first floor landing level requesting that noise levels are kept to a minimum in this area.

Measures have been taken post occupation to lessen the noise impact by introducing fixed glazed screens to part of the open side of the first floor office space and carpeting the first floor landing around the kitchen and seating area.

However noise is still regarded as a problem and consideration could be given to introducing some form of acoustic treatment such as acoustic panels within the atrium.

Natural Light

The environmental concept envisaged by the Architects for the open plan offices is stated in the Stage D Report:

> *"Light and air from the atrium will feed into the depth of the office plans and form part of the low energy strategy"*

Despite this, the users of the open plan office space have commented on the need for permanent artificial lighting and that borrowed natural light from the atrium is inadequate to illuminate the deep plan space. This has been exacerbated by the inclusion of offices along the north wall as requested by the user client and ratified by PMG.

It is now difficult to find a solution/modification within the open plan space without loss of cellular offices.

There is also an unforeseen issue regarding low sunlight (2.30pm – 4.30pm) which comes through the clerestorey windows to the atrium and causes glare in the second floor open plan office. This has been identified since new occupants (Horizon) moved in and consideration could be given to looking at ways to mitigate this glare.

Main Entrance Doors/Porch

Entry to the building is via card access which activates the inner doors of the entrance lobby. Visitors can therefore gain access to the lobby but are unable to proceed into the building without first using the telephone in the lobby requesting someone within the building comes to the entrance to allow them access.

Since occupation, rainwater penetration has occurred through the porch roof which has subsequently been re-roofed as a building defect. Due to the orientation of the building (west facing), water still penetrates this area on occasions after a heavy downpour of driving rain leaving a wet carpet in the porch area.

The automatic entrance doors have also broken down on several occasions (Twelve calls were made to Estates Help Desk over three years 2009-2011)

Security

Once inside the building, there is open access to corridors and toilets but the offices have secure access. The side openings to the open plan offices however are a concern to users who feel that security is compromised. Theft from the building is still an issue for users and advice could be sought from the University's Security Officer.

The partial glazing to the open side of the offices has improved the situation but the opening window in this panel should be made more secure.

Thefts from the bike racks are still a security issue according to users although information is not known on the extent of this. Although not intended to be a security fence, the design of the railings around the compound enable a foothold to be gained which enables trespassers to climb over the fence more easily.

Disabled Access

The location of the lift in the building is at the eastern end of the building and remote from the main entrance. Disabled access to the lift can be gained at ground floor level but access to the social space and kitchen area at first floor level cannot be gained without going through a secure area. A lot of thought was given to disabled access at the design stage and an Access Plan was produced. The location of the lift had to be moved due to the need to provide a clear view of the sky at roof level.

It has therefore been accepted that the restricted routes will be internally managed to ensure that disabled access is not compromised.

Building User Manual

During user interviews it was mentioned that, as a user, "they have not been told about how the specialist heating system works". It is noted that Building User Manuals now form part of the information provided on all current buildings and are issued to one or two key users of the buildings.

Recommendations

Heating in Winter
i) Commissioning procedures should be improved to simulate winter heating conditions where possible. It is noted that this is now required under the revised BREEAM assessment criteria

ii) Where Termodeck systems are used there should be improved co-ordination with the main contractor's mechanical subcontractor

iii) Improved checks should be introduced to ensure heat loss calculations are validated

Noise Disturbance
i) Consideration could be given to introducing some form of acoustic treatment such as sound absorbing panels

Natural Light
i) Ways to mitigate glare from the atrium in the second floor open plan office could investigated

Main Entrance Doors/Porch
i) It should be recognised that where main entrances to buildings which are designed to be west facing, there is a likelihood of water penetration during situations of excessive driving rain

Security
i) The opening window in the fixed glazed panel to the open side of the first floor office overlooking the landing and kitchen area should be made more secure.

ii) Where appropriate, the design of future fencing should be such that it is not possible to gain a foothold and climb over the fence

9. Cost Management and Project Procedures

The Estate Office has confirmed that a Project Execution Plan was produced for this project. The project followed robust and well established University procedures for the management of projects.

Regular progress meetings were held between February and August 2008 and monthly site meetings were held between December 2008 and August 2009. Regular reports were submitted to the Project Management Group which had responsibility for project oversight and recommendations on budget approvals. Regular cost reports were produced throughout the project design development and construction.

Table 2	Budget

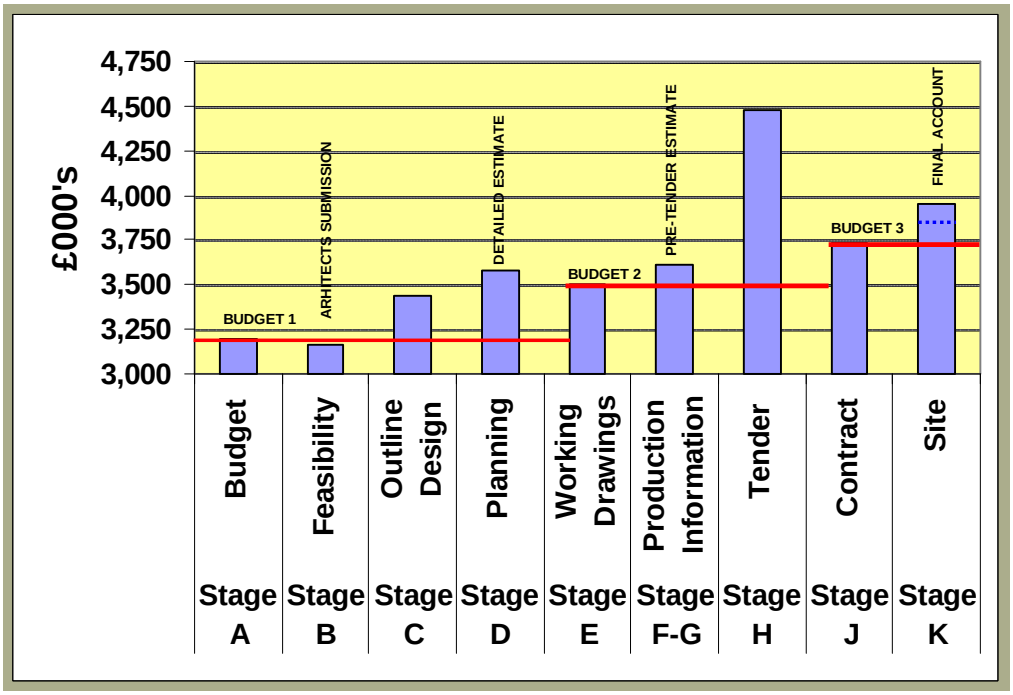


Table 2 shows the changes in the cost estimates as the project developed and the changes in budget to reflect the increased costs. Value Engineering exercises were undertaken following receipt of initial tenders which were considerably above the pre-tender estimate. This was due to an underestimation of the market rates of certain elements of design in what was a volatile construction market at the time.

There were good management processes in place for change control. The only issue related to what constituted change requiring an instruction and what should have been part of the contractor's responsibility under design development (e.g pump station for drainage). Any potential 'grey areas' need to be flagged up as part of an early warning system on Design and Build contracts to determine their validity as changes/instructions.

Recommendations

i) On Design and Build contracts the Quantity Surveyor should ensure that early warning systems are provided so that the contractor is given the opportunity to assess design development versus client change

10. Construction Issues

There were no issues with the programme apart from the commissioning process and the time allowed for this in the programme. A longer period for this process may have eliminated some of the problems experienced later with the heating installation.

As part of the value engineering exercise, the structural frame was changed from reinforced concrete to steel. This involved some re-design work by the Structural Engineer.

Although some thermal mass was lost in changing to a steel frame, the Termodeck system utilised precast concrete hollow floor planks which provided the heat sink to absorb or release heat from or into the air path within the planks. Termodeck were brought in as a separate subcontractor working alongside the M & E subcontractors.

Two separate issues arose relating to the heating. When the building was first occupied it became apparent that errors had been made in the fabric heat loss calculations to the end glazed walls resulting in low temperatures being experienced in some of the rooms. This was addressed with the installation of additional electric heaters.

The second issue related to the balancing of the heating system and the difficulty in achieving optimum room temperatures. It has taken considerable time (over two years) to adjust the system to ensure all rooms are at the right temperature and this issue needs to be addressed on future projects where the Termodeck system is used.

Greater involvement of the Termodeck consultant is needed at an earlier stage and better co-ordination between Termodeck and the M & E subcontractors.

In dealing with problems post handover, the user client's view is that the contractor provided good customer service.

Recommendations

i) Where the Termodeck system is used greater involvement of the Termodeck consultant is needed at an earlier stage

ii) Better co-ordination is needed between Termodeck and the M & E subcontractors

11. Facilities and Operations Issues

Comments from Facilities and Operations are positive about the building. It is considered "a better level of construction" compared to earlier buildings and maintenance call outs are well below the average for this type of building.

Overall, the building has performed well with no major problems experienced apart from a roof leak due to services on the roof (now rectified), breakdowns to the automatic entrance doors and heating adjustments (mentioned earlier in this report). Maintenance to the atrium may be a problem when working at high level and access is needed.

Regarding involvement of the Facilities and Operations team in the design development and construction stages of the project, the procedures in the University's Communication Framework are being followed but more involvement at the handover and commissioning stages is still needed. Facilities and Operations would welcome the opportunity to have more site visits.

During the Defects Liability Period there are occasions, when faults are reported, where it is unclear whether these are the responsibility of the contractor under defects liability or they should be dealt with by University Maintenance. A suggestion has been made to consider including in the main contract a one year maintenance contract operated by the main contractor. This contract would run in parallel with the defects period but would help to eliminate any ambiguities in responsibility.

Other measures such as faults being dealt with through the Maintenance Help Desk with the main contractor reporting back when works have been completed are operating informally but this needs to be built into University standard procedures.

Recommendations

i) Continue to involve Facilities and Operations at the handover and commissioning stages

ii) Continue to provide opportunities for site visits for Facilities and Operations during construction

iii) Consider introducing a one year maintenance contract as part of the main contractor's responsibility throughout the defects liability period

iv) Formalise fault reporting and completion by the main contractor through the Help Desk as part of University standard procedures

12. Sustainability

The University's Environmental Strategy sets out clear aims and objectives for sustainability relating to new capital projects. These include:

- Improving the environmental performance of buildings by moving towards carbon neutral energy performance, promoting renewable energy systems, reducing water consumption and waste output
- Ensuring that all developments go beyond current legislation and utilise environmental best practice where practicable, whilst seeking best value for the University at all times

As part of the strategy, environmental targets have been included in the design, construction and occupation of new buildings and refurbishments and where appropriate all buldings are to be designed and constructed to a standard equivalent to BREEAM HE "Excellent" as a minimum.

The Nottingham Geospatial Building has achieved the BREEAM HE "Excellent" standard and was highly commended in the RICS East Midlands Awards for 'Sustainability'. A number of energy efficiency measures have been incorporated into the building:

- Use of Termodeck system to reduce energy load
- Biomass boiler in conjunction with high efficiency gas-fired condensing boilers
- High efficiency lighting (except atrium)
- Lighting linked to motion sensors (in toilets and some offices)
- Water conservation measures in toilets

Rainwater harvesting was originally included but this was omitted as part of the cost savings needed at tender stage.

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 this would be achieved through the installation of a biomass boiler and this was demonstrated in calculations shown in the Planning Energy Statement issued to the City Council in December 2008

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Benchmarking data was used to assess energy use and M & E Consultants set out targets in the Stage D Design Report. The design assessment figures are shown in Table 3 set against the actual consumption for 2011 (figures provided by Facilities and Operations)

Table 3 Energy Performance 2011

	DESIGN ASSESSMENT			ACTUAL FOR 2011			
	KWh/m²/ Yr	KWh/yr	KgCO2/ yr	KWh/m²/ Yr	KWh/yr	KgCO2/ yr	Costs £
GAS	88	176,000	32,300	78	156,000	28,600	4,900
ELECTRICITY	106	212,000	111,200	198	396,000	207,700	37,800
BIOMASS				18	36,000	1,400	1,550
TOTAL	194	388,000	143,500	294	588,000	237,700	44,250

DESIGN ASSESSMENT FIGURES BASED ON 2,000M² GIA

ACTUAL FIGURES BASED ON 2,278M²

NOTE: Biomass boiler did not run between 12 Feb 2011 and 25 October 2011 (approx 9 months)

In comparing the figures the following observations are made:

- The 50kW biomass boiler was intended to provide 45% of the building space heating demand. In reality it has only provided 18.75%
- Actual electricity consumption has exceeded the design assessment figure by 87%
- The biomass boiler did not operate between February 2011 and 25 October 2011
- The building is not achieving the requirement for 10% of total energy use to be from renewable sources
- The original design assessment was based on a 2000m² building floor area compared to the actual 2278m²
- On a daily basis the users are in the building longer than originally anticipated

From discussions with Facilities and Operations it has been noted that the biomass boiler is controlled by the building management system using particular temperature parameters. These may need to be adjusted. Also there were some issues during the winter of 2011 relating to fuel reliability and it is understood that running costs for the biomass boiler are up to three times that of the gas boiler. Clearly these issues need to be investigated by Operations and Facilities to ensure the biomass boiler is operating as intended and that it achieves the energy targets originally set.

It should be noted that assessment using benchmarking data alone may not provide an accurate comparison and a more realistic assessment methodology should be considered on future projects based on likely University usage. Furthermore, the commitment made to BREEAM will ensure that heating from renewable energy sources is regularly monitored and re-assessed following initial installation.

Recommendations

i) Check the operating temperature parameters for the biomass boiler operation controlled by the building management system

ii) Investigate further the reasons for the downtime in the biomass boiler operation in 2011 and identify remedial action

iii) Consider the requirement of a more realistic assessment of predicted energy use at design stage based on likely usage in addition to using CIBSE and other guidelines

13. Summary of Recommendations

Procurement

i) The use of the JCT Design and Build contract with partial novation continues to be the most appropriate form for this type of project and should continue to be used

ii) PMG should consider the building procurement from information and recommendations given by the Quantity Surveyor to ensure the most appropriate procurement strategy is followed

Design Issues

i) On future projects consideration should be given to whether kitchen facilities should be provided in a separate room in order to maximise flexibility of space

ii) Where possible, details of specialist installations should be set out at an earlier stage as possible

User Issues

Heating in Winter
i) Commissioning procedures should be improved to simulate winter heating conditions where possible. It is noted that this is now required under the revised BREEAM assessment criteria

ii) Where Termodeck systems are used there should be improved co-ordination with the main contractor's mechanical subcontractor

iii) Improved checks should be introduced to ensure heat loss calculations are validated

Noise Disturbance
i) Consideration could be given to introducing some form of acoustic treatment such as sound absorbing panels

Natural Light
i) Ways to mitigate glare from the atrium in the second floor open plan office could investigated

Main Entrance Doors/Porch
i) It should be recognised that where main entrances to buildings which are designed to be west facing, there is a likelihood of water penetration during situations of excessive driving rain

Security
i) The opening window in the fixed glazed panel to the open side of the first floor office overlooking the landing and kitchen area should be made more secure.

ii) Where appropriate, the design of future fencing should be such that it is not possible to gain a foothold and climb over the fence

Cost Management and Project Procedures

i) On Design and Build contracts the Quantity Surveyor should ensure that early warning systems are provided so that the contractor is given the opportunity to assess design development versus client change

Construction Issues

i) Where the Termodeck system is used greater involvement of the Termodeck consultant is needed at an earlier stage

ii) Better co-ordination is needed between Termodeck and the M & E subcontractors

Facilities and Operations

i) Continue to involve Facilities and Operations at the handover and commissioning stages

ii) Continue to provide opportunities for site visits for Facilities and Operations during construction

iii) Consider introducing a one year maintenance contract as part of the main contractor's responsibility throughout the defects liability period

iv) Formalise fault reporting and completion by the main contractor through the Help Desk as part of University standard procedures

Sustainability

i) Check the operating temperature parameters for the biomass boiler operation controlled by the building management system

ii) Investigate further the reasons for the downtime in the biomass boiler operation in 2011 and identify remedial action

iii) Consider the requirement of a more realistic assessment of predicted energy use at design stage based on likely usage in addition to using CIBSE and other guidelines

Acknowledgements: Front cover photographs by Martine Hamilton Knight

APPENDIX 1

Sample Questionnaire

POST OCCUPANCY EVALUATION

BUILDING USER SATISFACTION QUESTIONNAIRE

BUILDING: NOTTINGHAM GEOSPATIAL BUILDING

Occupation (Please tick most relevant or state in 'other')
Administrative staff
Researcher
Lecturer
Student
Other…….....

Date ……..

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. Answers to questions 5 – 9 should relate to your own workspace. Completed questionnaires should be emailed to Tony@qtcprojects.co.uk

1 – Satisfaction with types of space in building

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

A: Seminar Rooms	Poor	1	2	3	4	5	Excellent
B: Offices	Poor	1	2	3	4	5	Excellent
C: Networking Space	Poor	1	2	3	4	5	Excellent
D: Reception area	Poor	1	2	3	4	5	Excellent
E: Other *(Please state)* ……..	Poor	1	2	3	4	5	Excellent
F: Overall Impression	Poor	1	2	3	4	5	Excellent

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?

Not 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 - Air Quality

5.1 Are you content with air quality at your workplace?

Not content Very content

1	2	3	4	5	6	7	8	9	10

5.2 Is the air fresh or stale?

Stale Fresh

1	2	3	4	5	6	7	8	9	10

5.3 Is the air humid or dry?

Too humid Too dry

1	2	3	4	5	6	7	8	9	10

5.4 Do you have control over natural ventilation (ie opening windows)?

No Yes

1	2	3	4	5	6	7	8	9	10

6 - Temperature

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

Too cold Too hot

1	2	3	4	5	6	7	8	9	10

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

Too cold Too hot

1	2	3	4	5	6	7	8	9	10

6.3 Do you have control over temperature?

No Yes

1	2	3	4	5	6	7	8	9	10

7 - Noise

7.1 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

8 - Light

8.1 Is there too much or too little natural light?

Too little Too much

1	2	3	4	5	6	7	8	9	10

8.2 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

9 - ICT/Data

9.1 How well is voice and data connectivity provided at the workspace?

Inadequate Well provided

1	2	3	4	5	6	7	8	9	10

9.2 Is the AV equipment in the teaching/lecture rooms effective?

Does not work well Works well

1	2	3	4	5	6	7	8	9	10

10 - 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. If relevant to a particular question please give the question number.

Thank you for completing the questionnaire.
Completed forms should be returned to Tony@qtcprojects.co.uk

Appendix 2

Post Occupancy Review Workshop

Held on Monday 13 February 2012

List of Attendees

User Representatives

Sean Ince	Senior Technical Support Officer
Sophie Dale-Black	Horizon Operations Manager

Estate Office

Tim Brooksbank	Development Director
Richard Wigginton	Project Officer
Barry Chadwick	Operations and Facilities Director
Chris Dickinson	General Manager Maintenance
Steve Gilbert	Senior Building Surveyor
Mark Bonsall	Senior Engineer
Lisa Haynes	Space Resource Manager

Design Team

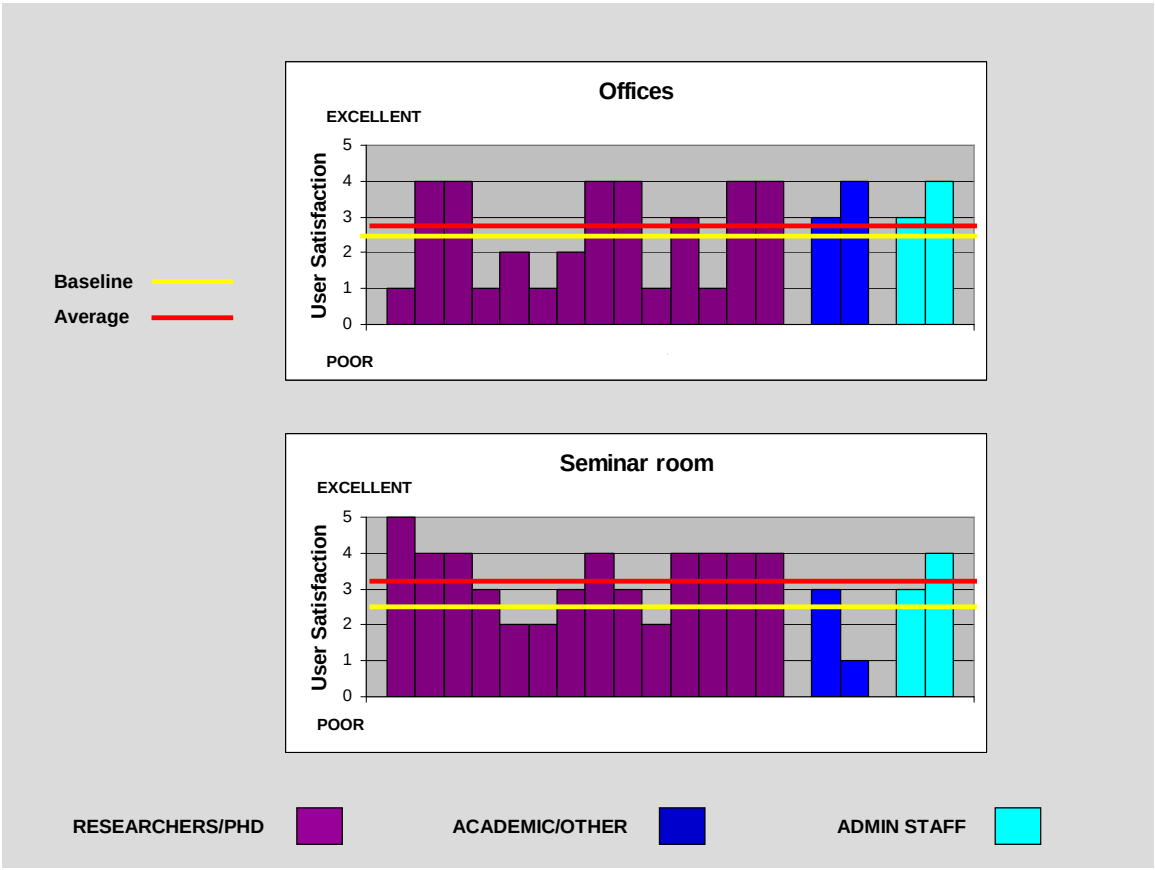
Alex Lipinski	Maber– Architects
John Chatterton	Edmond Shipway – Services Engineers
Steve Wickham	Price and Myers – Structural Engineers
Stuart Bates	WT Partnership – Quantity Surveyors

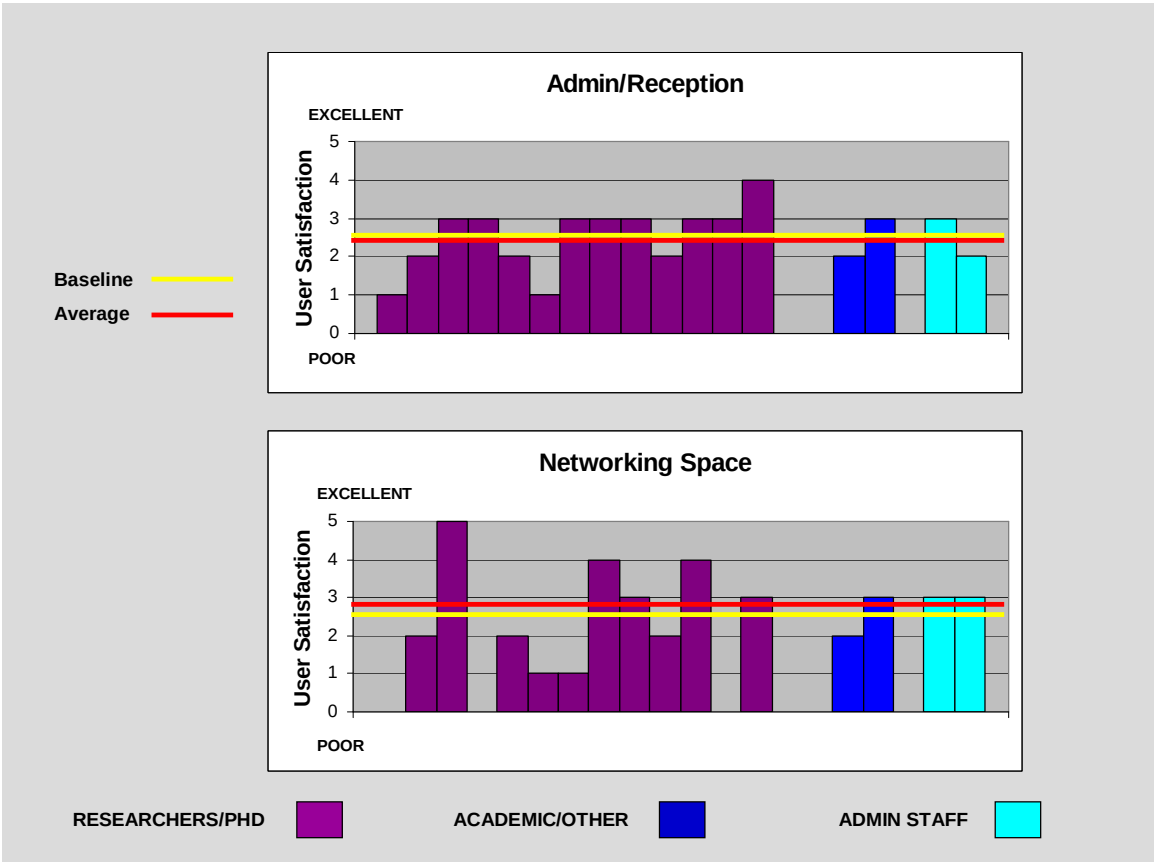
Contractor

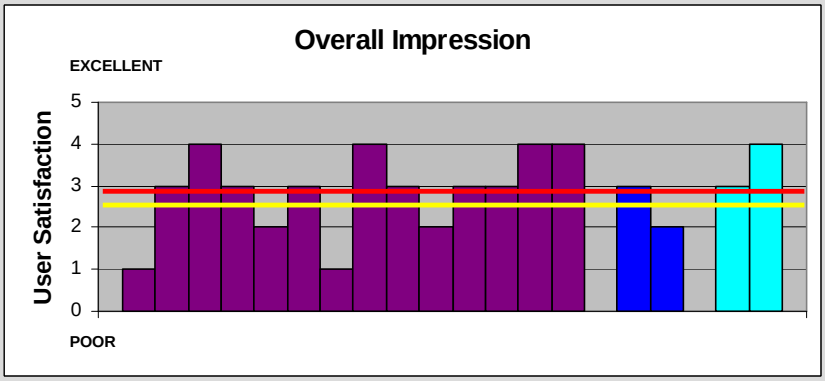
Ben Roffey	Clegg Construction

APPENDIX 3

User Satisfaction Charts


Offices
EXCELLENT
User Satisfaction
5
4
3
2
1
0
POOR
Baseline
Average
Seminar room
EXCELLENT
User Satisfaction
5
4
3
2
1
0
POOR
RESEARCHERS/PHD
ACADEMIC/OTHER
ADMIN STAFF

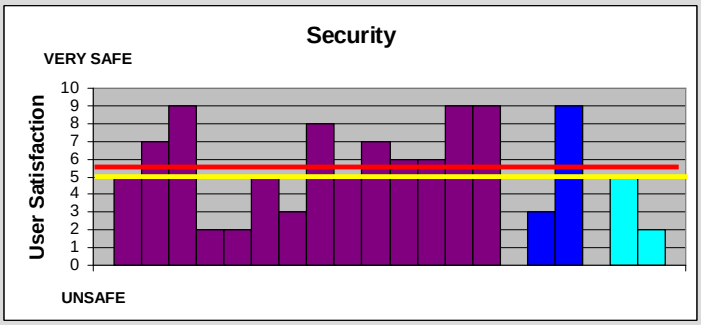

Admin/Reception
EXCELLENT
User Satisfaction
5
4
3
2
1
0
POOR
Baseline
Average
Networking Space
EXCELLENT
User Satisfaction
5
4
3
2
1
0
POOR
RESEARCHERS/PHD
ACADEMIC/OTHER
ADMIN STAFF



Baseline

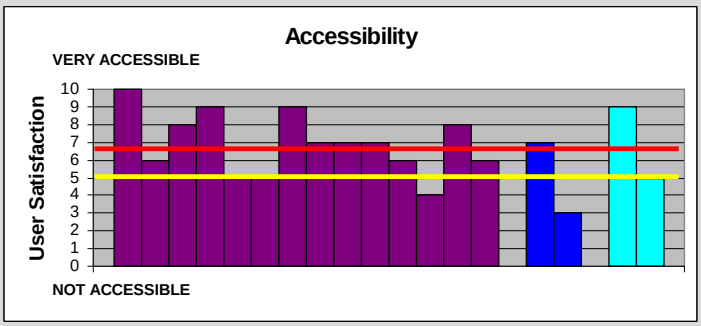
Average

RESEARCHERS/PHD ACADEMIC/OTHER ADMIN STAFF



Baseline

Average



RESEARCHERS/PHD ACADEMIC/OTHER ADMIN STAFF

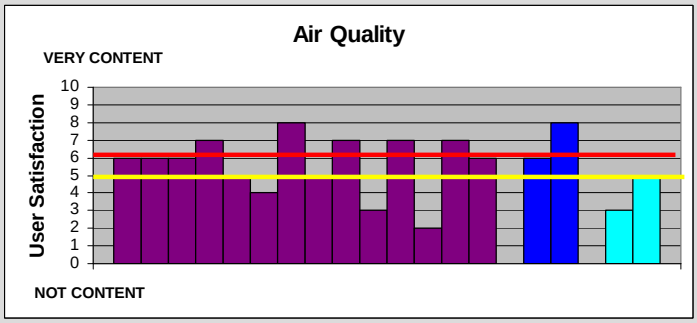
Baseline

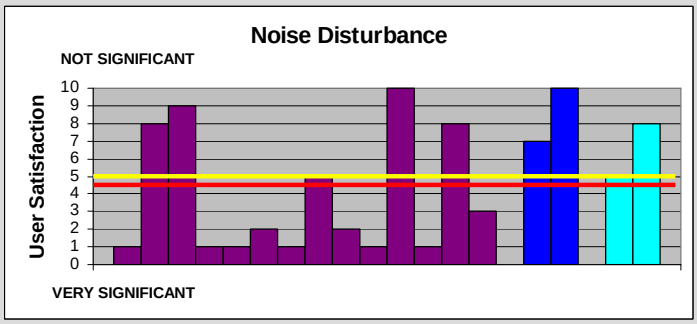
Average

RESEARCHERS/PHD ACADEMIC/OTHER ADMIN STAFF

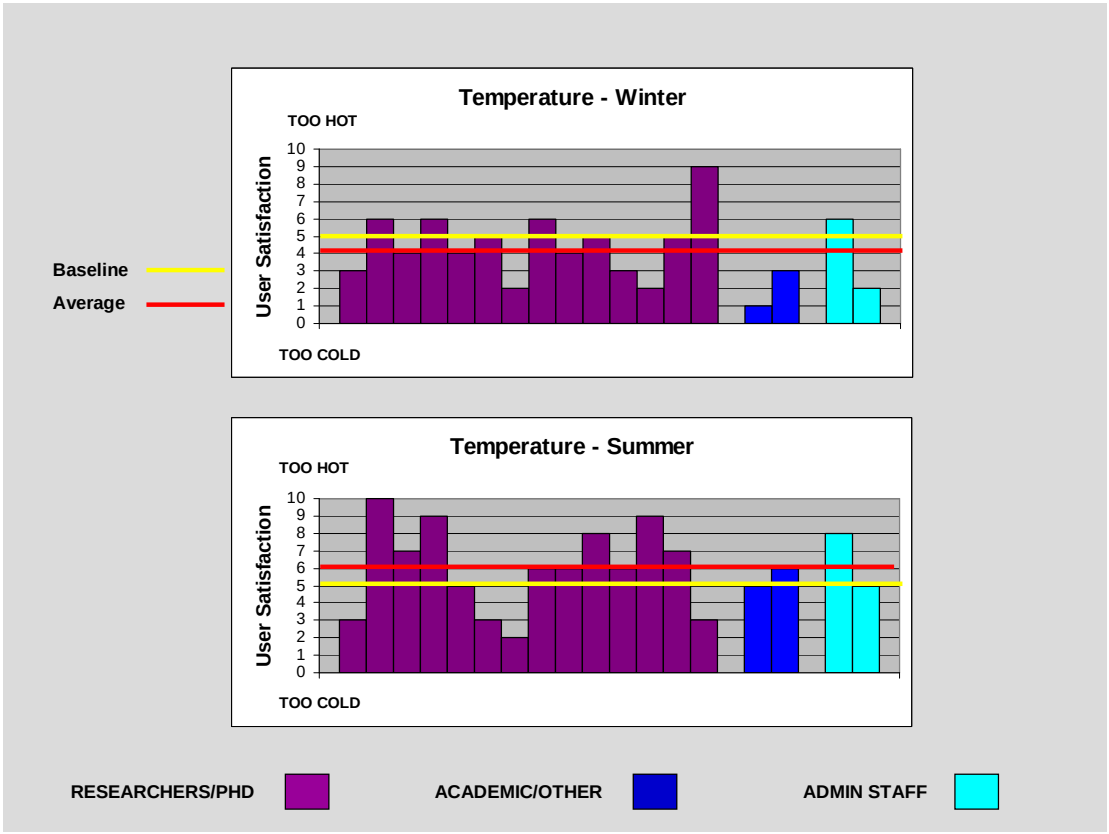
Baseline

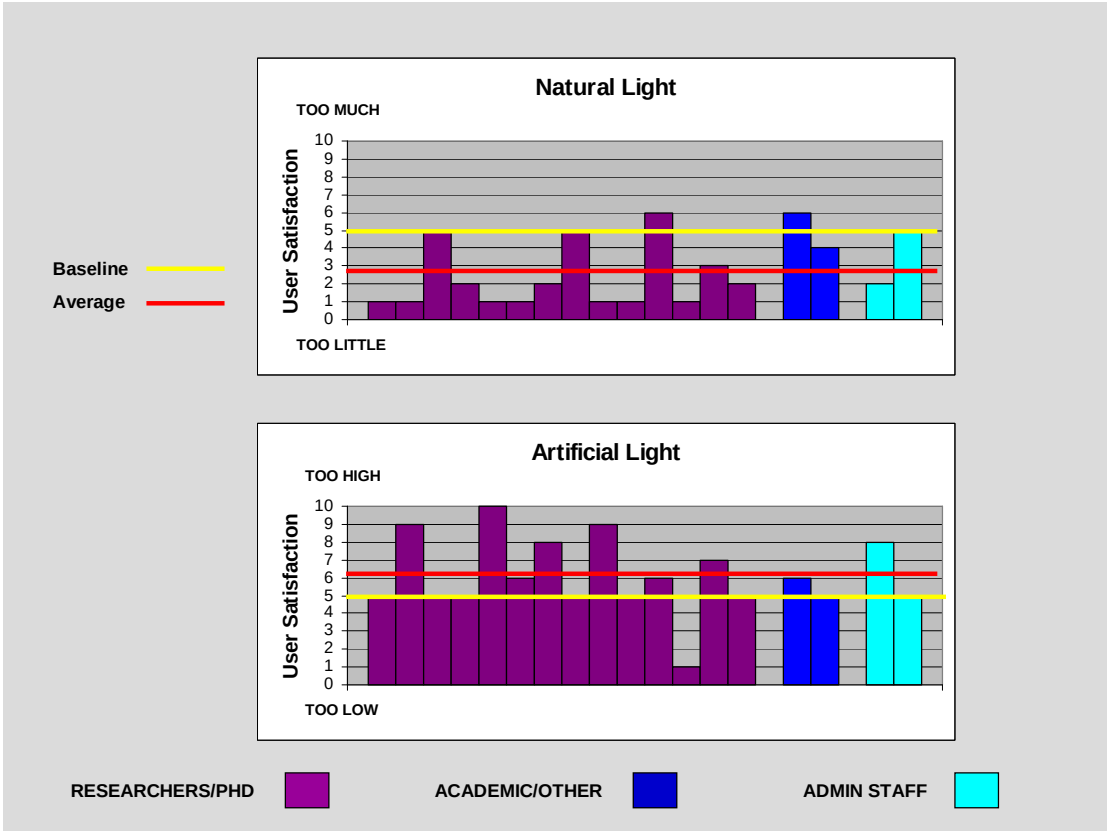
Average

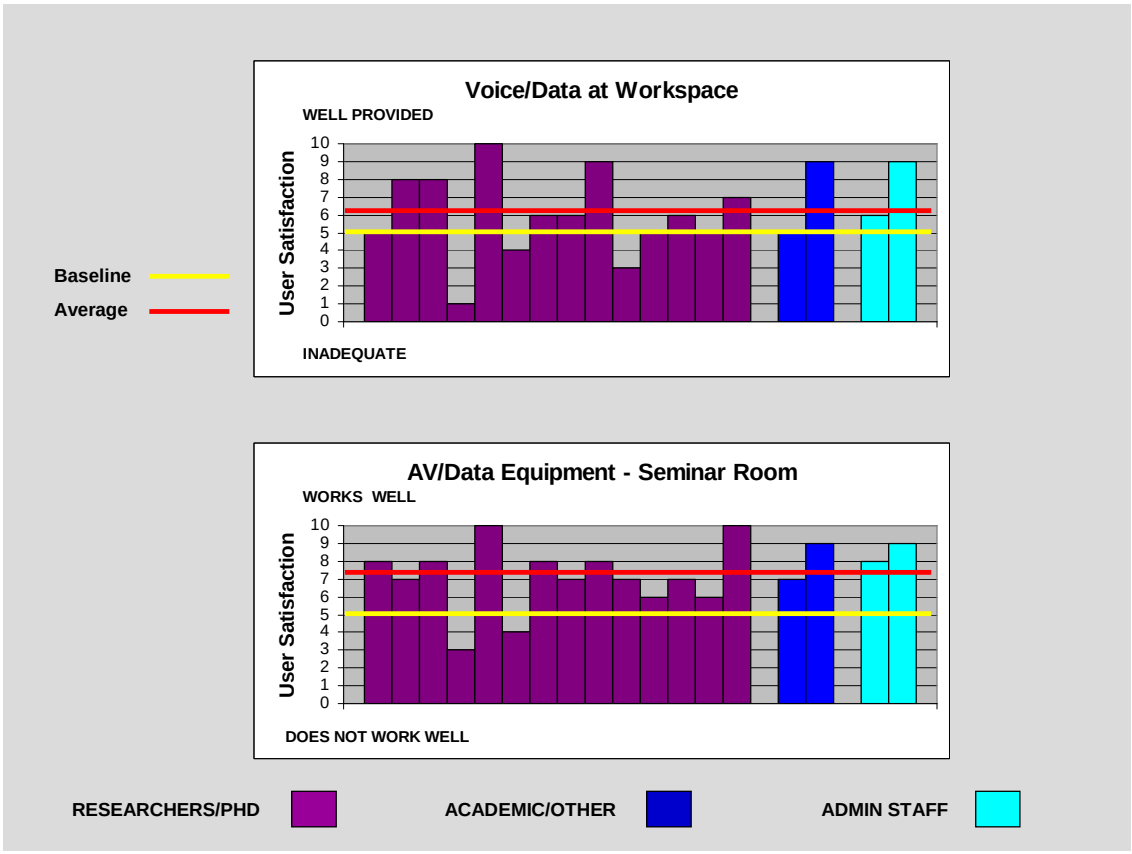




RESEARCHERS/PHD ACADEMIC/OTHER ADMIN STAFF


Temperature - Winter
TOO HOT
User Satisfaction
10
9
8
7
6
5
4
3
2
1
0
TOO COLD
Baseline
Average
Temperature - Summer
TOO HOT
User Satisfaction
TOO COLD
RESEARCHERS/PHD
ACADEMIC/OTHER
ADMIN STAFF


Natural Light
TOO MUCH
User Satisfaction
10
9
8
7
6
5
4
3
2
1
0
TOO LITTLE
Baseline
Average
Artificial Light
TOO HIGH
User Satisfaction
TOO LOW
RESEARCHERS/PHD
ACADEMIC/OTHER
ADMIN STAFF


Voice/Data at Workspace
WELL PROVIDED
User Satisfaction
10
9
8
7
6
5
4
3
2
1
0
INADEQUATE
Baseline
Average
AV/Data Equipment - Seminar Room
WORKS WELL
User Satisfaction
10
9
8
7
6
5
4
3
2
1
0
DOES NOT WORK WELL
RESEARCHERS/PHD
ACADEMIC/OTHER
ADMIN STAFF