Green Gown Awards 2015

Finalist's case study

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University of East Anglia

Built Environment

Modelling sustainability through intelligent design at UEA

University of East Anglia

Profile

- HEI
- 14,600 students (inc. full and part time students)
- 3,280 staff
- Edge of city

About the project

Summary

Crome Court is UEA's newest and most energy efficient accommodation block, and the one with the strongest environmental credentials. The award-winning and BREEAM Excellent project, delivered to the University in August 2014, came in £800,000 under budget, in a record-breaking timescale and as one of the first projects in the UK to have achieved a fully-integrated BIM Level 2. Building on previous lessons from other elements of UEA's low carbon campus, it pioneered new techniques and intelligent modelling concepts. The building saves over 74 tonnes of carbon (74tCO_2e) per year.

The building includes 232 en-suite student residential rooms, with kitchen and dining rooms per flat, and a communal facility on the ground floor. It is arranged in 5 to 7 storeys in a south-facing U-shaped configuration. Its high-quality spec and finish has ensured very positive response from residents and a new level of environmental data to help shape future accommodation design at UEA.

Project innovation

Crome Court was the first building on campus to fully embrace Building Information Modelling, or BIM. It is one of the first projects in the UK to have achieved a fully-integrated, '6D', BIM Level 2. As a result, the project won the 2015 RICS Grand Final for 'Design through Innovation' in addition to an award for computing excellence and collaboration within the built environment: the 2014 Construction Computing Awards' 'Collaboration Project of the Year'. With only 98 weeks between starting design and completing the project, the BIM process enabled both speedy delivery and the integration of sustainable principles from the very earliest stages.

BIM helped ensure impressive levels of space efficiency. To identify room efficiency, the Gross Internal Area (including all space within the building, such as lifts, dead space and risers) is divided by the number of lettable bedrooms. The smaller the ratio, the more efficiently space is being utilised (and, by extension, the greater the value to the University and as an example of effective use of resources). The national average is around 30m^2 per bedroom; Crome Court delivered around 25m^2 per bedroom. The Blackdale Development, currently under construction, used Crome Court as a blueprint and has surpassed these levels of high efficiency with a designed efficiency ratio of 23m^2 per bedroom. This includes additional social space per student flat. (For the sake of clarity, the actual rooms are around 12m^2.)

The results

The problem

The University sought a new, on-campus en-suite accommodation option to support increasing student numbers while continuing to deliver a top-quality level of student experience. The project objectives were to achieve very high standards of sustainability within a challenging £9m construction budget and to a very fast programme of 22 months from concept to completion.

The approach

BIM is a technology-led process that enables people to come together: designers work alongside core team members to see how design elements will interact in a virtual way. As clients, UEA were able to identify clashes ahead of the build and have more confidence that the finished produce would meet objectives. As an intelligent system, it helped to get all internal stakeholders on board and provided certainty in the process.

The project brief was developed in January 2013, with part of the brief that the building must be operational for September 2014. This tight timescale forced us down certain procurement routes. We needed to hit the ground running, and with University sign-off we were able to single source a 'dream team'. This team saw an opportunity to develop their own BIM capabilities on a live project, and BIM became a crucial part of the procurement and planning process.

Through the use of the BIM model we were able to secure planning consent in under six months. Although the project was only at RIBA stage D, with planning consent under our belt and the design convincing and well thought out, we were able to move away from the anticipated two-stage tender process, with its inherent risks, to a less risky single stage Design & Build tender process. We were proved right with the BIM model; as part of the tender information the contractors were able to price on reduced risk. Furthermore, by implementing BIM, some of the financial efficiencies we achieved were able to be reinvested into the project. Items such as the grey water recycling and green wall, which are ethically the right solutions but are financially questionable, would have been a "soft" value engineering target had the tenders not been so advantageous. In conclusion we found that through the necessity of the programme constraints we made an opportunity to bring together the right people to use new technology, which helped us procure the building as a turn-key solution under a single stage D&B un-amended JCT contract. This exceeded all expectations in aiding the timely delivery of the project.

Our goals

Initial stakeholder meetings with students identified the importance of 'green' issues. As a result, we aimed to deliver a building where students can live comfortably but also know that their building is in harmony with their own environmental aspirations. This is exemplified by the touch screen energy monitor in every kitchen, displaying the flat's energy use plotted as a percentage against the building's best and worst performing flats. We hope to engender a healthy level of competition that may help raise awareness of energy usage which students will take with them through their lives beyond the University.

Performance and results

The building produces 95% less CO_2 emissions than the same building under regulation standards, through high levels of insulation and renewables. Thermal insulation and air tightness are greater than current building regulations, and (against a 10% local planning requirement) 69% of the calculated energy use is provided by renewables (PV panels, biomass and gas CHP).

Environmentally, Crome Court is a low-impact building. Its cross laminated timber (CLT) structure delivered carbon savings, with less embodied carbon than a steel framed or a concrete building. The timber also acts as carbon storage due to the trees absorbing carbon dioxide from the atmosphere during growth. The structure of Crome Court is constructed from approximately 1750m^3 of timber, sequestering nearly 1400 tonnes of CO_2. It will be approximately 4 years of continued use before the building's carbon emissions will approach the carbon stored within the structure.

The use of grey water in toilets throughout the building reduces the University's environmental impact, a particularly important feature as East Anglia is an area with some of the lowest rainfall in the UK. The green wall is a stunning feature for the building and University, and irrigating it through rainwater recycling reduces the impact of the building while also replacing some biodiversity and rainwater absorption lost from the building's footprint. The flooring in the surrounding hard landscaping was created from recycled aggregates, reducing impacts on landfill, while UEA's planting strategy encourages drought tolerant and native species of plants.

The future

Lessons learned

1 – Use BIM as a tool to show value for money. BIM helped ensure impressive levels of space efficiency: while the national Gross Internal Area average is around 30m^2 per bedroom, Crome Court delivered around 25m^2 per bedroom. The Blackdale Development, our next accommodation addition currently under construction, used Crome Court as a blueprint and through BIM has surpassed these levels of high efficiency with a designed efficiency ratio of 23m^2 per bedroom.

2 – Take advantage of BIM as an aide to collaboration. As an intelligent system, BIM helped to get all internal stakeholders on board and provided certainty in the process. As clients, we were able to identify clashes ahead of the build and have more confidence that the finished produce would meet objectives. Crome Court has given the University management confidence in BIM as a cost-effective tool to enable financial efficiency, at the same time as bringing additional environmental improvements and opportunities to challenge preconceptions of standard and innovative building practices.

3 – Promote the wider environmental agenda through case study examples. The use of cross-laminated timber meant a considerably lighter frame, reducing the required size of the foundations and therefore the related impact of concrete and other carbon-intensive materials. We used this to discuss embedded carbon with our project managers. CLT is also more efficient waste-wise than steel or concrete; we found a strong case study in promoting the zero waste produced on site, and how factory offcuts were used to create other products such as biomass pellets. The pre-fabricated walls reduced the noise and disturbance to other campus users; Crome Court was built in the centre of a built-up area while surrounding residences within 10m of the build site were still being inhabited, with only one noise complaint during the whole project!

The project has raised the quality of design for student residences at UEA, demonstrated through feedback from a post-occupational review. Students enjoy the building and its distinctive design, and ease of use has made it popular. Student experience is a key deliverable for UEA so this feedback, alongside financial viability, has shaped future residential build strategy. The kitchen and social spaces have been very popular in feedback, with views out across the UEA lake and nearby parklands.

The building is setting a standard for sustainability by acting as a blueprint that will be achievable for 'mainstream' developments elsewhere, as these high standards are achieved within a realistic budget and to a very fast programme. It is an example of a high-quality development that has been popular with both users and with the project teams within the University.

Further information

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View our video on Crome Court: https://youtu.be/4in5PocEYyM

More information on UEA's low carbon campus: www.uea.ac.uk/about/sustainability/campus/buildings/low-carbon-campus

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