D4FC Factsheet 42:

Environmental Sustainability Institute

Contact details

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General project information

Name of project:	Environmental Sustainability Institute
Location of project:	Penryn, Cornwall
Type of project:	New build
Cost of project:	£30m

Project team

Client:	University of Exeter
Designer:	Stride Treglown
Contractor:	Leadbitter

Other organisations involved (and their role): Method (M&E), Halcrow (structural engineers), University of Exeter (building physicists and dissemination)

Project description

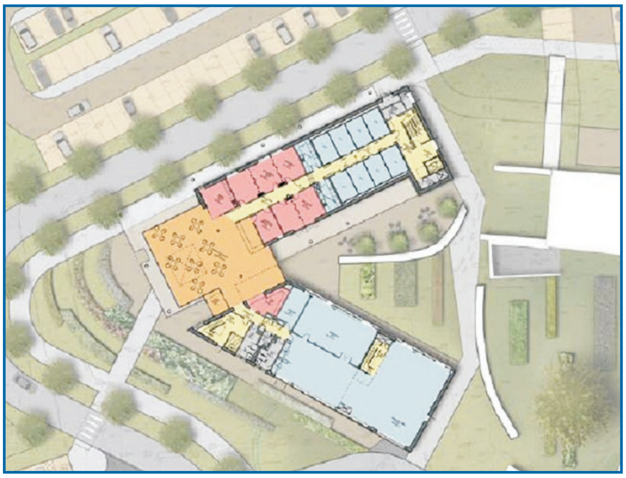
The University of Exeter's Environment and Sustainability Institute (ESI) is a £30m interdisciplinary centre leading cutting-edge research into solutions to problems of environmental change. It is based on the University's Cornwall Campus, near Falmouth. Its aim is to facilitate teaching, research and commercial application of environmental and sustainability knowledge. As such, it is being built to the highest sustainability standards (BREEAM Outstanding) and will have to be "living proof" of its credentials. This extends to being fully adaptable to the effects of climate change. The building will contain a mix of spaces including offices, laboratories, communal and workshop spaces, and as such the specific challenges to each of these spaces will make the findings of this work directly relevant to a large number of future buildings. The total gross internal area of the building is about 3200 sqm.

Project timescales and dates

Design and assessment period (pre-planning): August 2009 to April 2010

Construction period (post-consent): April 2011 to August 2012

Operation and monitoring period: August 2012 to July 2013



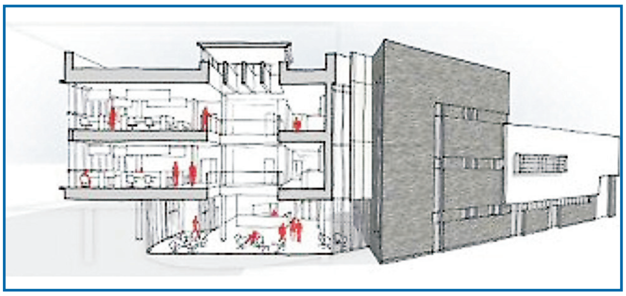
Further project details

1 What approach did you take in assessing risks and identifying adaptation measures to mitigate the risks?

- broad adaptation risks taken from TSB Design for Future Climate and the ESI project was assessed against those risks
- magnitude of climate impacts at the site were taken from site specific (5 x 5 km) climate projection data based on UKCP09 data using the University of Exeter Prometheus project
- the A1FI climate change scenario was chosen as it best represents the current status quo and takes a worst case scenario approach
- worst case climate change was assumed for building related risks. This implied using either the 10 per cent or 90 per cent probability scenarios depending on the parameter
- a more lenient approach was taken for landscaping issues, ie 33 per cent or 67 per cent scenarios as consequences of landscape failure were deemed to be less critical
- the“expect the best, plan for the worst, and prepare to be surprised” maxim was used as a useful guide
- the main risks identified for the project were overheating of the building/keeping cool both internally and externally, water stress due to reduced summer rainfall, increased risk of flooding downhill of the site and risks to the ability of the landscape and ecology to adapt to the future climate.

2 How have you communicated the risks and recommendations with your client? What methods worked well?

- the client was present at the risk assessment workshop which was used to discuss identified risks and potential adaptation measures. This was felt to be crucial to both inform and engage the client, manage expectations and steer adaptation proposals towards meaningful and realistic ends for the project scope and stage within the schedule
- adaptation risks and adaptations have been investigated as individual sub-tasks within the project. Output from each of these tasks has been communicated from the task investigator via the principal contractor and client project manager. RFIs have been produced where it has been agreed by the client to make changes to the design. This element of the project was communicated mainly through email, which was found to work well
- the adaptation study on this building was undertaken during the construction phase of the project. Under ideal circumstances adaptation would have been considered at this level of detail far earlier in the design stage. Had this been the case design team meetings would have been expected to play a greater and more useful role for communicating risks and recommendations.



3 What tools have you used to assess overheating and flood risks?

- thermal comfort: risks assessed by modelling of proposed initial design under future climates using the IES Virtual Environment using UKCP09 adapted weather files produced by the University of Exeter. Adaptation measures were investigated using parametric investigation of each of these issues using IES under 2030, 2050 and 2080 climates
- rainwater harvesting: risks were identified by analysing the rainfall distribution probabilities under present and future climates. 3000 years’ of probabilistic data was used for each time horizon. Calculations were performed using a macro based Excel tool written specifically for this project. This allowed a rainwater tank to be iteratively sized such that the same proportion of rainwater would be met under future climates as under today’s climate (sized for BREEAM credit compliance)
- drainage: the impact of climate change in return periods for storm events. These increased risks of flooding were analysed using the commercial software MicroDrainage to design potential uprated systems
- landscape and ecology: the key potential changes to critical environmental factors such as temperature, humidity, cloud cover and rainfall for summer and winter. These were then applied to the proposed landscape scheme, and alternative schemes were proposed based on existing published literature on different species types.

4 What has the client agreed to implement as a result of your adaptation work?

- the work is still ongoing and so a full list of recommendations has not been finalised
- for adopting recommendations, the client has agreed to the installation of a larger rainwater harvesting tank in order for expected performance of the system to be the same under future climate (and also extended dry periods) as under today’s climate
- recommendations were made that would have required significant updating of the site drainage, however this was rejected by the client because it would not have been feasible at this stage.

5 What were the major challenges so far in doing this adaptation work?

- as with any project, incentivising performance that goes beyond minimum regulatory standards (of which there are none specifically aimed at adaptation, though there are some overlapping issues) is always a challenge. Some of this barrier was addressed by targeting BREEAM innovation credits as an incentive to implement innovative adaptation

- some adaptation measures would have direct future benefit to the building, while others may be beneficial in a wider context, though not necessarily to the building itself. For example, runoff from flooding may not be critical on the site though could be increasingly detrimental to housing located downhill from the site. Whilst there is a challenge in capturing the future benefits occurring on-site, there is an even greater challenge when the measure does not even directly benefit the site. This is a similar problem as climate change mitigation where local action is needed to address a global problem
- aside from the additional capital cost of implementing adaptation measures, simply affording the time to investigate these issues would not have been possible without support of the TSB funding. It is unlikely that this depth of analysis could therefore be undertaken in future projects unless incentives or regulation change
- the adaptation study was started with the project already on-site. Clearly this has had a strong impact on what could practically be implemented either now or as part of a future refurbishment. Although the work is still in progress, it would seem likely that adaptation should be considered no later than RIBA Stage C.
- some potential future adaptation measures may not actually exist yet. For example, heat reduction from more efficient LED lighting is likely to occur, but actual design values have had to be estimated for the analysis in this project. Similarly, technologies such as phase change material constructions cannot be handled using existing tools such as IES
- as the issue of adaptation is not considered through the regulations, there is no definitive guidance on performance standards, which leads to uncertainty and unilateral decision making required at a project scale.

6 What advice would you give others undertaking adaptation strategies?

- the TSB Design for Future Climate document represents a good framework for considering the main issues
- adaptation should be considered early in the design stage – ideally by RIBA Stage C in the first instance
- while the depth of analysis taken on these TSB funded studies would not typically be realistic on most projects, testing the thermal comfort of the proposed design (which is likely to be the biggest climate change risk to the building) is straightforward for projects already using thermal modeling. The future weather files are free to download and running an extra few simulations would not take long. Clients should be encouraged to ask for this as part of their project brief
- even if no further adaptation measures are adopted now, consideration should be given to what future interventions could be made. The building as designed for today's climate should not preclude future modification and implementation of adaptation measures. It is likely that such an approach using changes to the design during maintenance and refurbishment periods is likely to be a more realistic approach rather than the building being climate change ready now.