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PROMETHEUS PROJECT

The Adaptation and Resilience in a Changing Climate Coordination Network

STAKEHOLDER PERSPECTIVE DOCUMENT

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Lessons Learned

1.1 Purpose

The aim of this short paper is to provide a view on the value of the Prometheus project's research from the perspective of Jacobs Engineering UK, a participant in the study and potential end-user of its outputs.

1.2 Content

Overall relevance and usefulness of research

This project has represented a useful learning exercise for Jacobs.

The new weather/climate data provided were generally readily useable in the TAS modelling tools already being used in thermal simulations for the case study designs.

The use of the new data generally indicated that thermal comfort objectives for the buildings would be challenged by future climate conditions and is something we would like to give consideration to further.

From the research, we believe the industry as a whole, clients commissioning the design of new buildings and the benchmarks set within the Building Regulations are generally insufficiently focussed on future impacts of climate change on buildings.

Dealing with future climate scenarios requires whole-team approaches to collaboration in relation to site planning, orientation, construction type, materials, visual impacts, building service, energy strategies, costs etc.

What it can tell us about a particular issue

Buildings, or areas within them, will significantly overheat because of climate change and designing in a way that anticipates and avoids the impacts is generally challenging using current design approaches.

Low energy/ low carbon building designs will be increasingly dependent on passive techniques that rely on optimisation of building envelope design features such as orientation, solar shade, thermal insulation and thermal mass to deliver increasingly tougher carbon savings demanded by building regulations. Designing for climate resilience in this context results in particular challenges.

Low energy buildings are much more sensitive to the effects from the external climate that could occur over a typical building lifetime (25 – 50 years). It is important to understand the particular sensitivities of passive design solutions that are intrinsic to the building fabric. Passive ventilation for example may provide low energy cooling under a current climate scenario but may contribute to overheating

under a future scenario. Designers therefore need to be able to apply sensitivity testing to proposed solutions.

To deal with modern design pressures, designers need thermal modelling tools to establish solutions and prove compliance. It is clear existing tools can be adapted to deal with the modelling for future climate impacts. Thermal modelling must however start very early in the design process and is likely to require revision through the design stages as the design team collaboratively seeks optimum solutions.

Relying on air conditioning to counter overheating, as opposed to designing-in the required building performance improvements at the outset, may increase future CO_2 emissions. Retrofitting for climate resilience is likely to be more costly than designed-in resilience.

Having to deal with the requirements of climate change may currently be seen by many designers and budget holders as an item that sits outside the normal scope for the design. This view will need to be increasingly understood and addressed going forward.

Sustainable approaches to building design should include the flexibility to adapt building use to avoid early obsolescence. Clients would benefit from explanation of long term issues.

A simple explanation of underlying principles of the outputs, but not the details

With extreme climate change impacts, the opportunities for the mitigation of overheating is limited, even with major adjustments to designs. This points towards the need to address the design at a more fundamental level (i.e. building orientation, shape and internal planning), which might have been possible at the start of the project but would be much more difficult if not impossible at the current advanced stage.

In terms of cost implications, most of the adjustments would incur significant additional costs.

Increasing thermal mass coupled with night cooling has potential for significant cost increase. It is also worth noting that the concrete walls required to increase thermal mass would have the impact of increasing the overall embodied energy of the building's materials. Fabric adjustments are also likely to have an undesired effect on the intended aesthetics of the building.

We consider building envelope is the first line of defence in avoiding building overheating. Buildings with poorly orientated or excessive areas of glazing or highly insulated/ low air permeability buildings may be more at risk than previous generation buildings in very warm summers as it is more difficult for them to lose heat.

Engagement of stakeholders and the benefits accrued from exchange of information

Early engagement is key to making a positive contribution to fundamental design decisions – but not easy to achieve.

At this stage of understanding, design processes must remain flexible and iterative to build in responses to climate change but this may have impacts on required budgets over the lifetime of the design process. Therefore the project funders should factor-in contingency i.e. design time and technologies etc.

Did the outcomes meet the needs of you as a stakeholder?

It showed us that engagement with the design process needs to happen earlier to enable fundamental decisions to be made without compromising project programme and costs.

The implications are that we need to raise awareness amongst our clients and design teams of the need to model, cost for and adapt for climate change

Comments on the utility and transferability of the outputs, potential conflicts or risk of uncertainty with respect to other available similar outputs possibly with a different message

The key is to get the client to understand the probability scenarios and what they really mean.

Changes in frequency of occurrence of temperatures over comfort criteria can appear to be a little subjective if not understood and can be difficult to explain to laypersons.

Implications of not designing to future climates appeared significant.

Comments on exchange of knowledge

Exchange of knowledge to the design teams is relatively straightforward although the data files are very large and cumbersome to transfer to the modellers.

We conveyed the requirements of the exercise to the modellers via a 4.5 page paper on the methodology. Obtaining inputs from designers had to be squeezed into their busy schedules.

Engagement with the clients happened mainly at initiation, where the requirements were conveyed, and at the end where approval for the outputs was sought. On-going liaison of client requirements was communicated via respective project managers.

Problems/ limitations and lessons learned for a user perspective - how might similar engagement (or dissemination) be undertaken next time highlight gaps and further (research) requirements

Traditionally, dynamic thermal models using detailed climate data are undertaken after basic building design and layout has been established. This limits the potential effectiveness of predictive climate change impact models as it is often too late to make biggest impact changes to the design.

There is a need to simplify early stage modelling so that climate files can be used earlier in concept design. Engagement with climate change should be a consideration for current designs as the resultant buildings resulting will be impacted in their lifetimes.

Promote value to users and other stakeholders.

The following may be useful going forward:

- Develop cost impact scenarios – i.e. cost to the project and to the building users.
- Develop meaningful thermal comfort and health impact explanations.
- Embrace climate change within standard 'fit for purpose' scope.
- Consider if designing for climate change may provide an initial commercial advantage.
- Recommend new benchmarks to CIBSE.