D4FC Factsheet 32:
Swim4Exeter

Contact details

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General project information

Name of project:	Swim4Exeter
Location of project:	Exeter, Devon
Type of project:	New built public swimming pool
Cost of project:	£10m

Project team

Client:	Exeter City Council
Designer:	Gale & Snowden Architects
Contractor:	N/A

Other organisations involved (and their role): Exeter University (building physicists and dissemination), Jenkins Hansford Partnership (quantity surveyors and cost consultants)

Project description

The project involved the assessment of three sites for future climate and the design and build of a new state of the art indoor public pool facility in Exeter, including a main national/county standard swimming pool and a learners' pool with supporting facilities together with dry sports facilities.

It will set itself apart from other public swimming pools in the UK with its energy-saving Passivhaus design. This will be achieved by a compact design, a high standard building envelope and the highly efficient building services equipment – it is intended that the building will be the first Passivhaus certified swimming pool in the UK. The client's intention is to provide a low environmental impact building that employs best practice in low energy and healthy building design meeting the needs of the Exeter Community.

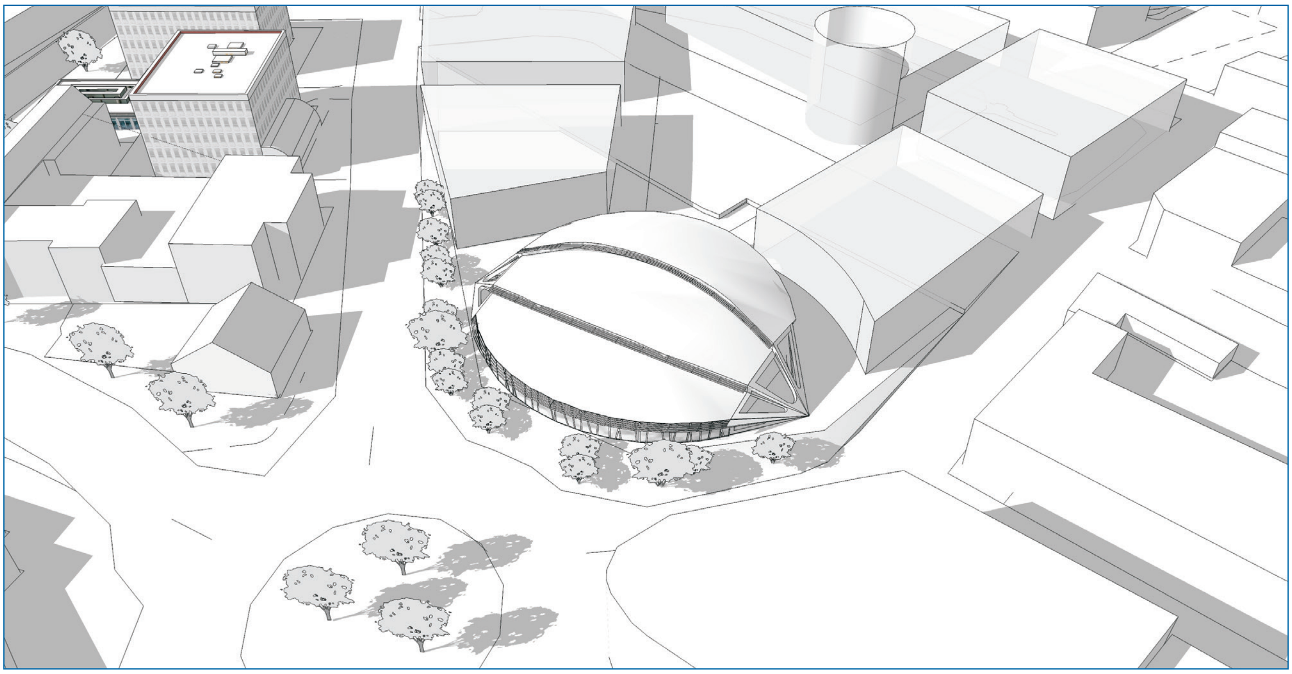
The passive design approach paid particular attention to the sun cycle around highly glazed facades and the swimming pool's responsiveness to changing temperature conditions. Glazing ratios and building form have been assessed to maximise daylight and optimise solar gains. Shading strategies, various ventilation strategies, innovative low energy cooling strategies such as ground cooling (earth tubes, piped exchangers), radiative night sky cooling and phase change materials have been investigated together with various integrated landscape design opportunities that help moderate the micro climate.

Project timescales and dates

Design and assessment period (pre-planning): autumn 2011 to autumn 2012

Construction period (post-consent): TBC

Operation and monitoring period: TBC



Further project details

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

- to identify and assess potential climate change risks for this building project a site independent, generic, qualitative risk assessment has been prepared. Potential risks were based on the *Design for Future Climate* report and Gale & Snowden's experience from their work on a previous D4FC project. The risks were structured in three main sections, ie comfort, construction and water management. Each risk was rated on a scale of one to five for its probability and impact and as a result of the multiplication of these two factors was given a risk magnitude. A graphical analysis of all individual risk magnitudes was used to identify the overall vulnerability of this building type to specific aspects of climate change
- this assessment was then used to also inform the decision on the selection of appropriate weather files from Exeter University's Prometheus project.

Thermal comfort

- various forms of thermal modelling of design throughout the design process from initial concept
- literature review: guidance on overheating (EN7730, EN15251, CIBSE, ASHRAE), internal and external planting, green roofs and façade greening in terms of temperature and water attenuation, evaporation from pool water and relative humidity in swimming pools
- swimming pool case studies UK and abroad (including the first German Passivhaus swimming pool).

Water management

- assess water use and potential savings
- assess existing ground conditions, characteristics, topography, and environmental impact on sub-soils
- assess flood risk using EA maps and ECC SFRA
- review landscape mitigation options (surface water retention and rainwater harvesting)
- review construction techniques/options (low water use treatment and filtration techniques, options to reuse water, rainwater/greywater harvesting, low water use appliances, SuDS, water storage on site).

The following mitigation measures are currently being considered:

Thermal comfort

The wet areas can be designed in a way that solar gains will be beneficial almost all year round. However, the dry sports facility has been identified as the most vulnerable part with regards to internal thermal comfort and rising temperatures under future climate scenarios. The following strategies have been identified to be successful in limiting the risk of overheating:

- internal zoning taking regard of different temperature requirements with super insulated compartment walls between, eg the wet area and the dry sports area
- north orientation of dry sports area and south facing wet areas
- cross flow and stack ventilation to dry sports area
- intermediate or heavy weight construction
- ground cooling via earth tube or soil to brine heat exchanger
- reduction of internal gains by relocating plant outside the thermal envelope
- landscape design and green roof to moderate microclimate.

Water management:

The following measures are currently being investigated to address the risk of flooding/droughts under future climate scenarios:

- inclusion of green roofs and landscape design that allows to retain water on site using permaculture design principles
- rainwater harvesting and storage
- inclusion of SuDS.

Reduction of potable water use. The water demand of a swimming pool building is a combination of water used for water treatment (refilling and backwashing of filters), evaporation from pool water and water used for hygiene (showers, toilets).

Under this project the following water saving measures to reduce the water demand are being investigated:

- increased internal humidity to reduce evaporation rates
- reuse of water for backwashing
- recouping of water and latent heat from exhaust air via post MVHR heat pump systems
- use of water saving appliances for showers toilets etc
- use of water saving filtration techniques.

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

CCA risks and communication have been communicated to the clients as follows:

- the clients are part of the design team and attend all meetings and so are fully informed on all aspects of the project
- notes of meetings and building precedent case studies are disseminated to the team including the clients.

The presentation of thermal modelling using CGI has worked well to graphically show the client what effects future climates could have on the building design.

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

- PMV/PDD method in accordance with BS EN 7730 to analyse comfort range for various internal temperature zones
- IES dynamic modelling to assess energy use and overheating
- PHPP to assess energy use and overheating and to show compliance with the Passivhaus methodology
- Exeter City's strategic flood risk assessment and consultation with EA to identify flood risks for all three sites.

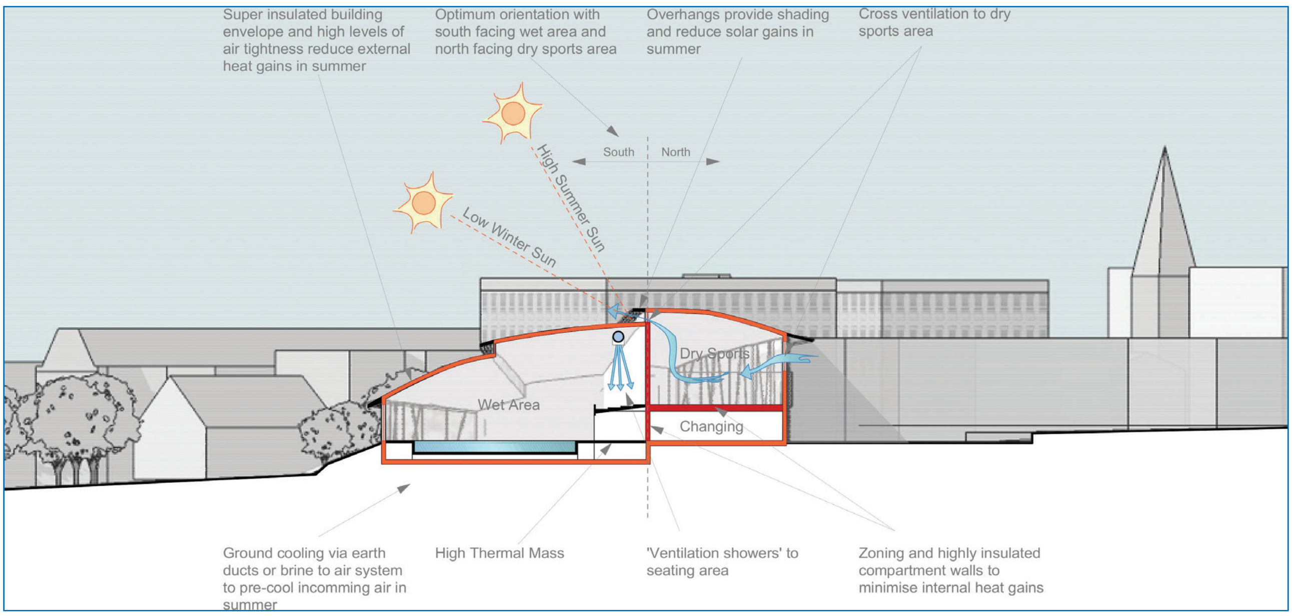
4 What has the client agreed to implement as a result of your adaptation work?

At present the project costs are under consideration therefore no decisions have been made to what is or is not to be incorporated into the building. Subject to the above, it has been agreed that the following will be adopted:

- Passivhaus design methodology
- optimised solar orientation with south facing wet areas and north facing dry sports area
- internal zoning and super insulated compartment walls between different temperature zones
- cross flow and stack ventilation
- night cooling strategy
- high mass construction
- optimisation of internal humidity levels to reduce evaporation rates
- low water use ultra filtration in combination with UV treatment
- low water use appliances
- storage and reuse of water for backwashing
- inclusion of movable floor construction and covers to pools to reduce evaporation.

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

- methods for accurately modelling the effect from evaporation on energy demand and comfort level in IES or PHPP were not readily available and needed to be investigated



- lack of guidance. Currently there is hardly any literature or good practice guidance on thermal comfort levels in swimming pools and leisure buildings
- compatibility with current design and good practice guidance. A high performance building envelope with no thermal bridging in combination with a low chemical filtration system will allow to operate the pool at higher humidity levels without detrimental effect to the building fabric or its users. However, this is a diversion from current good practice and it will expose the client and designers to additional risks if the building is not constantly monitored for its performance.
- planting is a living building material. When considering the climate change scenarios to 2080, it is unclear on how plant species will or not adapt or succumb to pest and diseases with gradual change. So it was considered appropriate to concentrate on the structure and principles of the external design and associated characteristics of the plants, for future climate change
- site restrictions. The limited size of the site restricted the design of the building and restricted the use of certain CCA strategies, eg ground cooling, incorporating the surface water storage needs of future extreme events.

6 What advice would you give others undertaking adaptation strategies?

- a simple passive design approach at concept stage can provide a robust strategy to mitigate impacts from future climate scenarios, eg layout of the building to allow cross ventilation and to control solar and internal gains
- Passivhaus principles provide a robust approach to future climate change
- introduce thermal modelling at concept stage and use it as a design tool and not a compliance tool
- consider the role the landscape and external planting can play at introducing micro-climates and dealing with changing rain fall patterns at the start
- if the site and budget allow it, build in the possibility for using active cooling systems. For example MVHR systems can use ground cooling to reduce excessive heat build up in prolonged periods of high external temperatures
- a detailed study of built examples and construction approaches in different climates has proven helpful.