THERMAL COMFORT

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ACHIEVING COMFORTABLE ENVIRONMENTS

The success of a new urban environment or the redevelopment of an existing one is as much defined by the external spaces the development creates, as it is by the internal environments it houses. The success of external spaces can be made or broken by the levels of thermal comfort achieved in those areas. People make a vibrant space, and a contemporary external retail environment with outdoor dining can be ruined by cold winter breezes or overheating in the summer – rendering the spaces void of people.

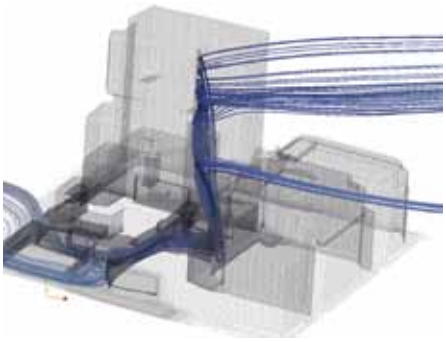
The question is then: how do we predict whether the external environment will be comfortable year round?

Simulating an environment

Before the advent of computer simulation, the assessment of thermal comfort in outdoor spaces was undertaken using hand calculations and design experience – learning from successes and failures of the past. The reduced cost of computer analysis in the 1990s allowed the virtual operation of external spaces to be simulated using historical weather conditions. However, the time taken to build the models, generate results and feed back the outcome into the design process was too lengthy for most design programs.

Jump forward to the early 2000s, and the cost of computer simulation and the processing power of computers meant results could be generated a lot faster than in the 1990s. Projects such as Rouse Hill Town Centre were simulated in a virtual environment to test for thermal comfort using the Standard Effective Temperature (OUT_SET) index for every hour of a typical year.

The OUT_SET index is important for non-air-conditioned environments, as it takes into account all physical and physiological parameters that affect thermal comfort. These parameters include air temperature, surface temperatures, relative humidity, wind speed, clothing levels and activity rates. OUT_SET calculates the useful cooling effect of the breeze in the summer, but also the discomforting effect of wind chill in the winter.



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Time a factor

In the early 2000s, the time-limiting factor in assessing thermal comfort of outdoor and semi-outdoor environments was the number of software types that had to be used to calculate something like OUT_SET. In all, four different types of software and three different models had to be created for the same project. This time-limiting factor led to the modelling often being undertaken post-concept stage, after the masterplan had been signed off. This took more time and meant results were only used for tweaking to the edges of the built form, rather than the more cost-effective approach of adapting the masterplan itself.

Over the last two years, we have seen rapid development in the software used for simulating thermal comfort in outdoor and semi-outdoor environments. It is now possible to simulate external environment conditions in about a quarter of the time it took in the early 2000s. The software developments have mainly been in the number of parameters that one type of software can analyse – reducing the number of models being built and the number of different software types being used to calculate thermal comfort.

It is now possible to simulate an external environment within the time constraints of concept design or masterplanning design. Depending upon the complexity of the design, the type of model the architect uses and the complexity of the analysis needed, it is possible to feed back concept design parameters in two to three days.

What it means for development

These advances in computer simulation allow a development team to develop and design for energy efficiency and external thermal comfort. It helps them combat urban heat island effect and to maximise natural ventilation breezes within the time limits of early urban development.

It also allows for subdivisions to be optimised for orientation, houses positioned and spaced for natural ventilation, and the cooling effect of parks and water features to be used as natural 'heat sinks' in an urban environment. It means the external spaces we create in our urban developments can be designed to be comfortable all year round, resulting in vibrant spaces.