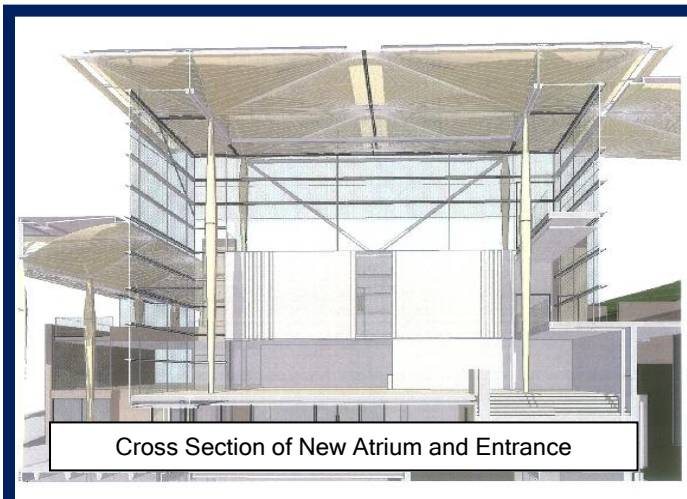
CHAM

PHOENICS Case Study: HVAC
Art Gallery Ventilation

Existing structure Auckland Art Gallery



Cross Section of New Atrium and Entrance

This project focused on a modern design proposed as an extension to the historic Art Gallery in Auckland, New Zealand. It involves an analysis of the effectiveness of the ventilation system for the new building design, modelled under various occupancy scenarios and other operational conditions.

The Art Gallery is a redevelopment of the existing Gallery in Auckland, New Zealand. The final building will consist of a major new building merging with the old Heritage Gallery, constructed in the mid to late nineteenth century (shown here). For the purposes of the CFD study, the interconnection between the Heritage building and the new build was considered as having little or no impact on the performance of the new building's air conditioning system.

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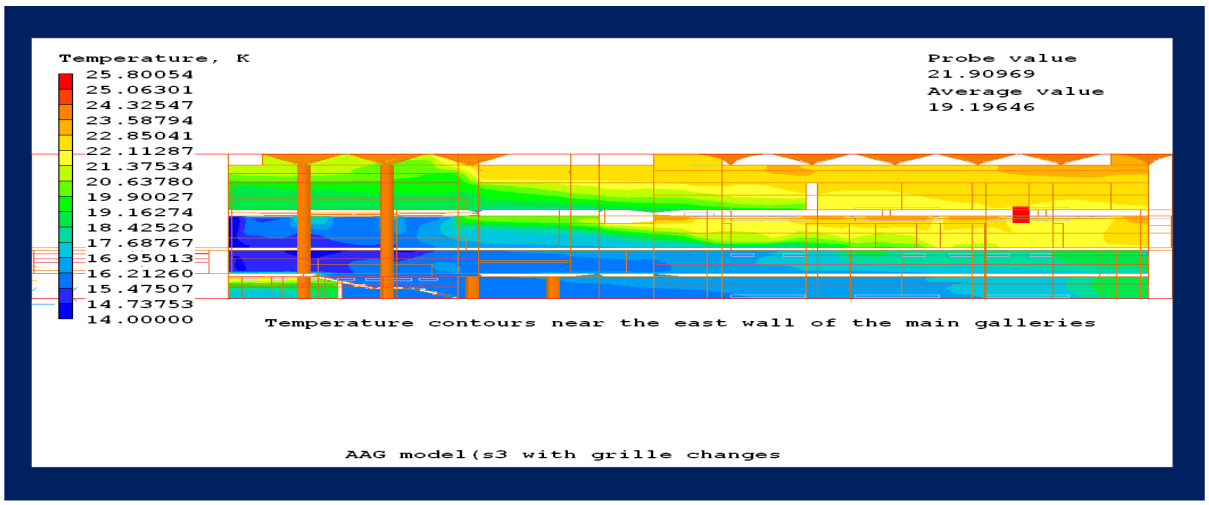
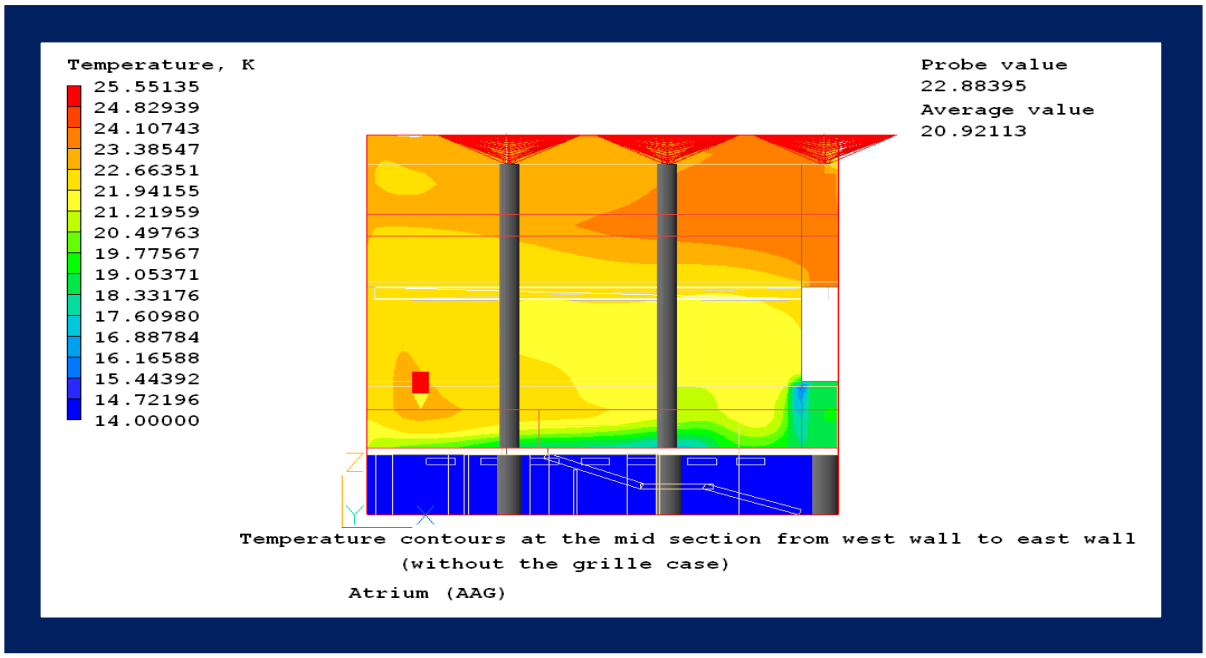
The new Atrium has four levels; Levels L1 and L2 being double height, with the mezzanine and L3 being single storey heights. The Atrium sits above the main entrance at ground floor (street) level and is surrounded by "platforms" at each level overlooking the central void space.

"Squeeze entry openings" lead off from the Atrium into to the main galleries at Levels 1 and 2. All Atrium levels are interconnected via open grand staircases typically shielded from view by “feature walls” obscuring the passenger lift lobbies. Extraction fans are located at high levels in the Atrium, with replacement air being introduced into the Atrium via the main entry doors.

These fans provide normal air relief for the air conditioning system, as the volume of fresh air into gallery/Atrium changes to meet the changes in occupancy.

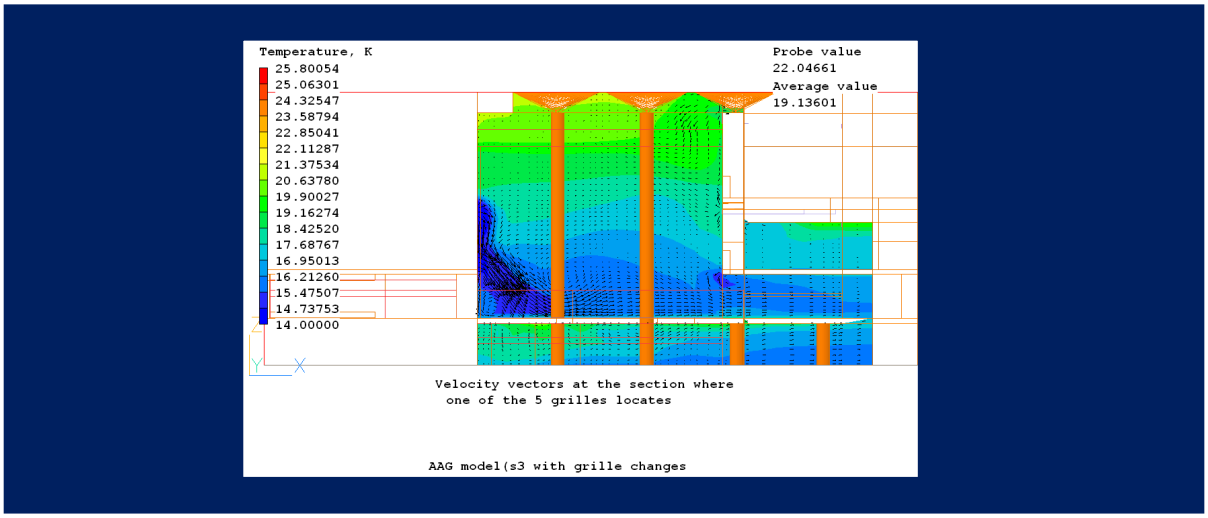


The work scope was to provide reports for the Atrium (together with openings into a number of adjacent galleries) for a number of varying scenarios in both the Atrium and in some of the galleries.

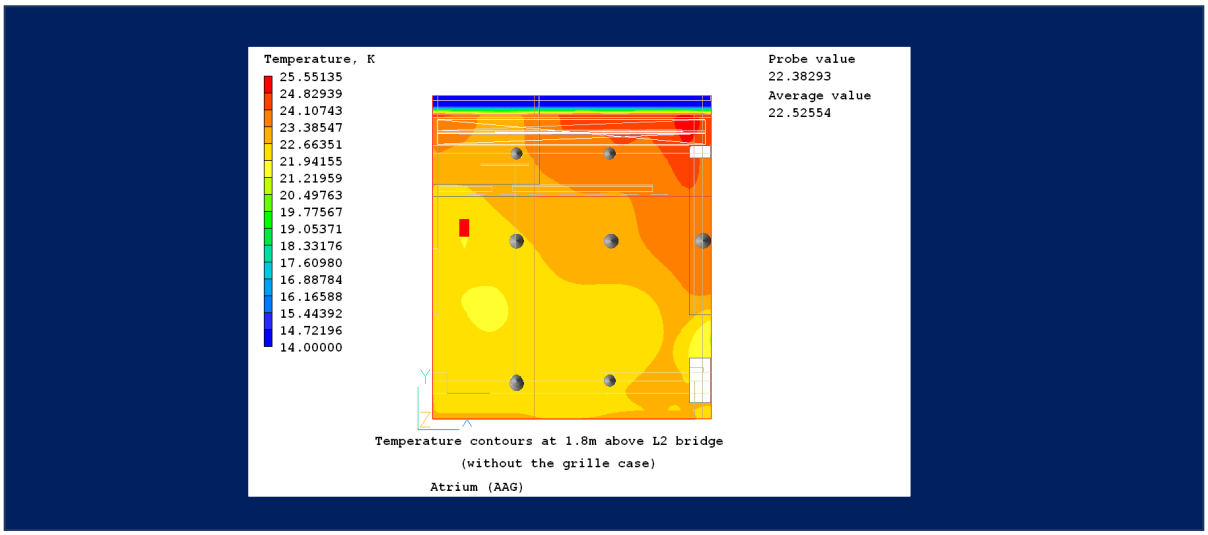


Modelling with PHOENICS assessed:

- Effects on air conditioning performance of varying populations in the atrium and galleries,
- Impact of one upon the proposed air distribution arrangements, and
- Impact of infiltration into the atrium/galleries during ceremonial events when doors on the north wall (direction of prevailing wind) will be open to the elements.



The Atrium and all adjacent galleries were modelled as a whole, to provide information on air direction through the squeeze entries under differing airflows and population levels. In addition, temperature profiles are indicated in each of the main spaces for the various scenarios considered.



The results highlighted several regions for potential thermal discomfort that visitors might experience under adverse conditions that were readily resolved through small, but significant, design changes.