CHAM Limited

Pioneering CFD Software for Education & Industry

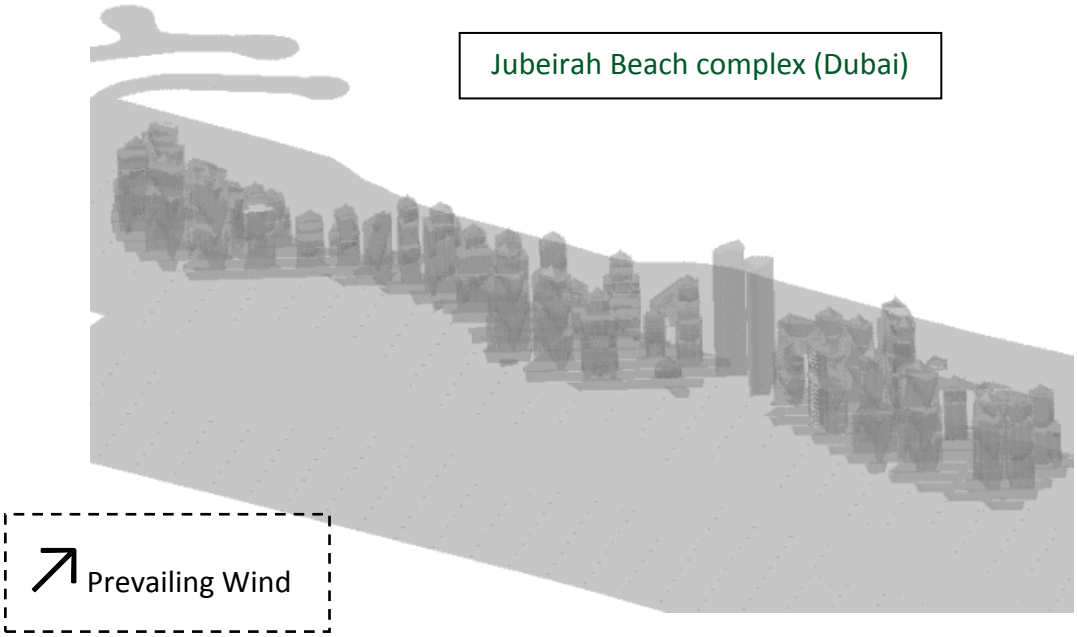
CHAM Case Study - Flow Around Buildings

Jubeirah Beach complex (Dubai)

This CHAM Consultancy project was concerned with the localised environmental conditions prevailing in the Jubeirah beachfront complex in Dubai, United Arab Emirates. The customer's concern was that high wind conditions might adversely affect both the occupants of the buildings at balcony level, as well as the pedestrians at ground level.

The objectives of this project were:

- to investigate the influence of different wind speeds and wind directions on the air flow throughout the residential area; and
- to reveal any unusual wind patterns that may cause up-drafts or down-drafts that could render podium, balcony, penthouse or terraced areas at lower or upper levels dangerous to the residents.



In the past, such an investigation would have required:

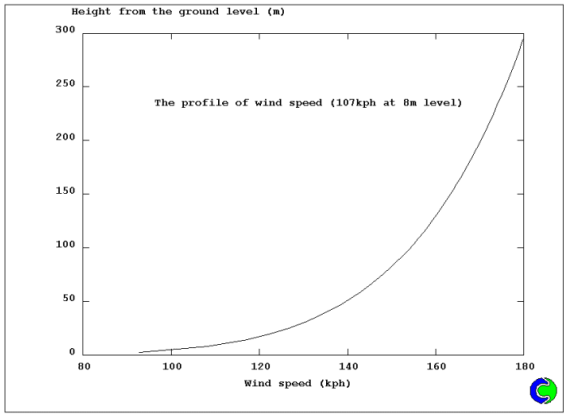
- the construction of a small-scale physical model;
- testing of physical the model in a wind-tunnel;
- taking extensive measurements;
- making allowance for scale factors.

Simulation techniques enable the same information to be obtained more swiftly, and at lower financial cost.

In the first stage of the work, covered here, the complex has been studied as a whole, in order that the influences of one building on another can be assessed. Subsequent stages concentrated on finer detail, such as individual buildings and parts of buildings where the first-stage study had indicated a potential for problematic areas.

Geometry and calculation domain

The domain covers the entire area of 2939m x 1300m, provided by the client in a single geometry file, including all the buildings and surrounding areas. The height of 300m from the ground in the vertical direction of the calculation domain provides about 100m of open space above the tallest building.



Boundary conditions

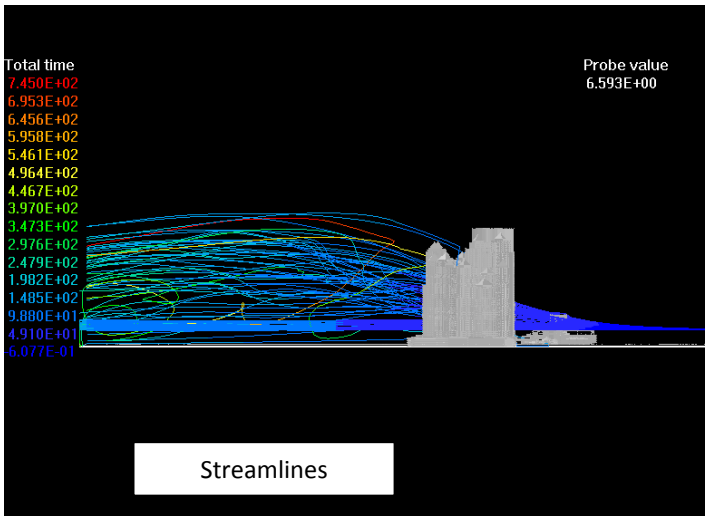
A wind profile of $U^{1/7}$ with the measured wind speed at a height of 8m is employed at the boundaries where the wind enters the domain.

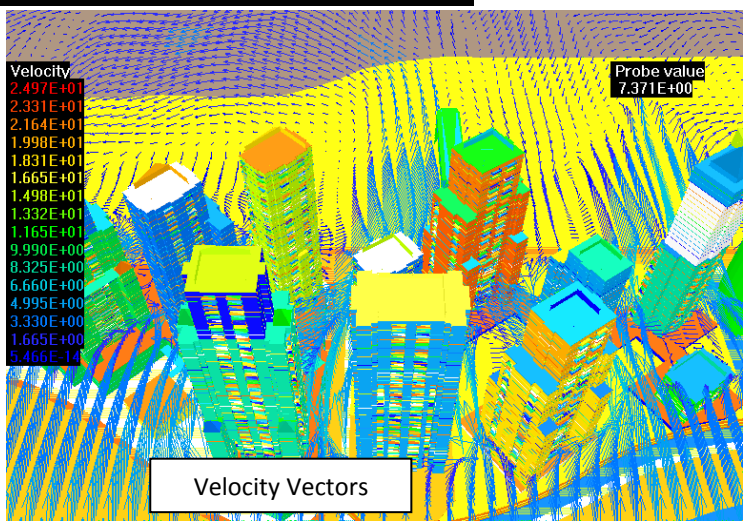
The IN-FORM (INput of FORMulae) feature was used to set the boundary layer profile.

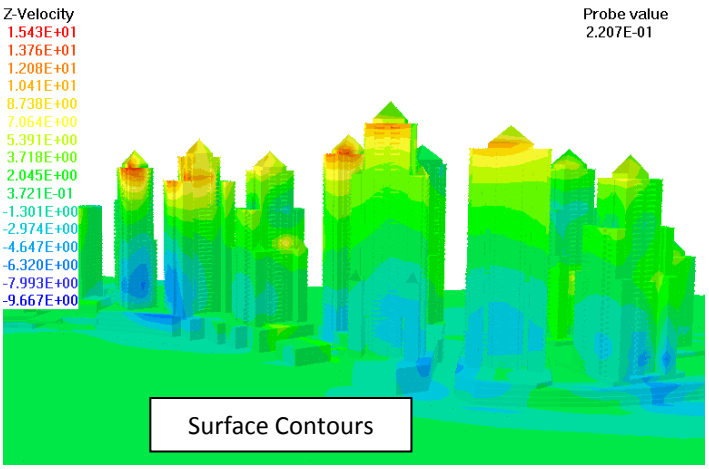
Results

The initial results showed that, under certain conditions, there existed the potential for strong up-drafts and very high wind speeds near the top of most buildings. There also existed the potential for strong suction and street-level turbulence at the base and rear area of the buildings.

With a maximum specified in-coming wind speed of 107 kph, it was established that the local velocities could reach over 200 kph. The CFD model enabled designers to consider design changes including the placement of ‘strategic’ foliage and other forms of wind break at street-level.







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