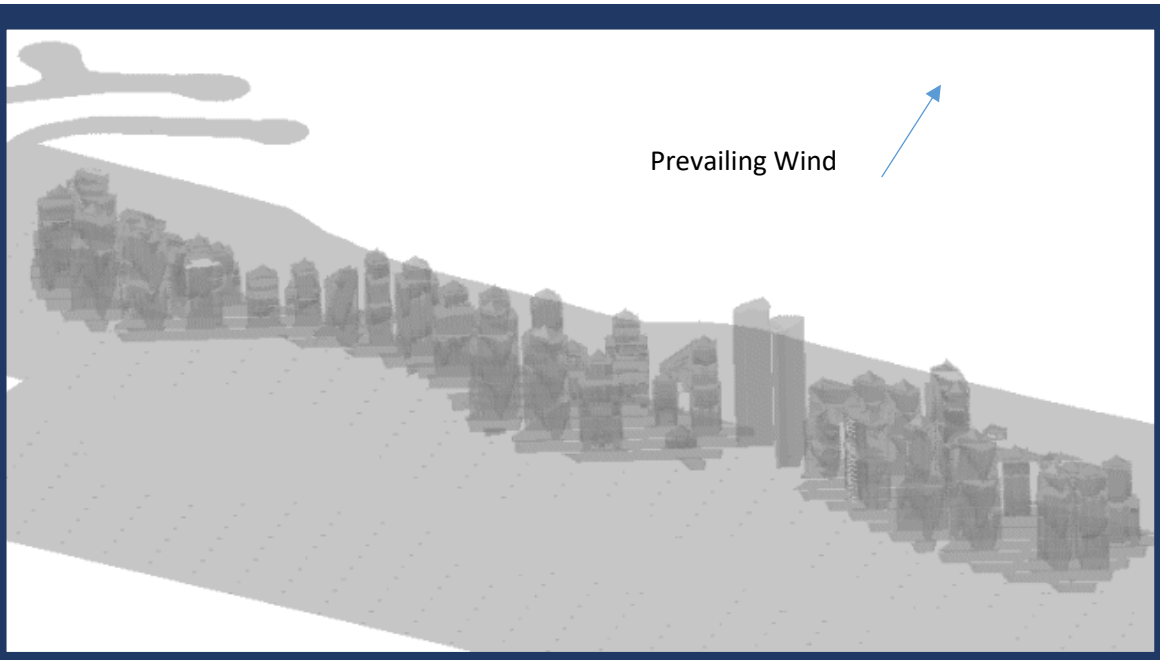
PHOENICS Case Study: Environmental
Jubeirah Beach Complex, Dubai

This study was concerned with the localised environmental conditions prevailing in the Jubeirah beachfront complex in Dubai, United Arab Emirates. The concern was that high wind conditions might adversely affect both the occupants of the buildings, at balcony level, and pedestrians at ground level.

The objectives of this study were to:

- Investigate the influence of different wind speeds and directions on air flow throughout the residential area;
- 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 residents.



Jubeirah Beach complex (Dubai)

In the past, such an investigation would have required:

- The construction of a small-scale physical model;
- Testing of the physical model in a wind-tunnel;
- Extensive measurements being taken;
- 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 as a whole has been studied in order that 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 in a single geometry file, including all 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.

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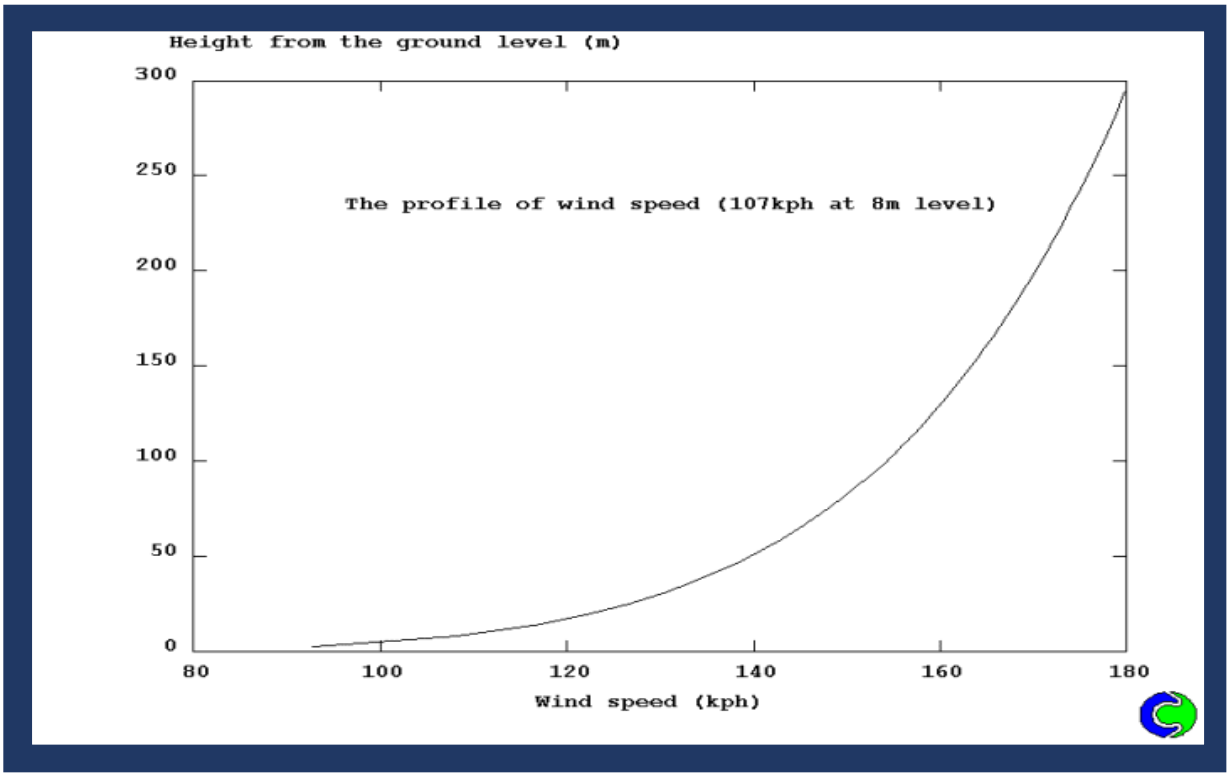
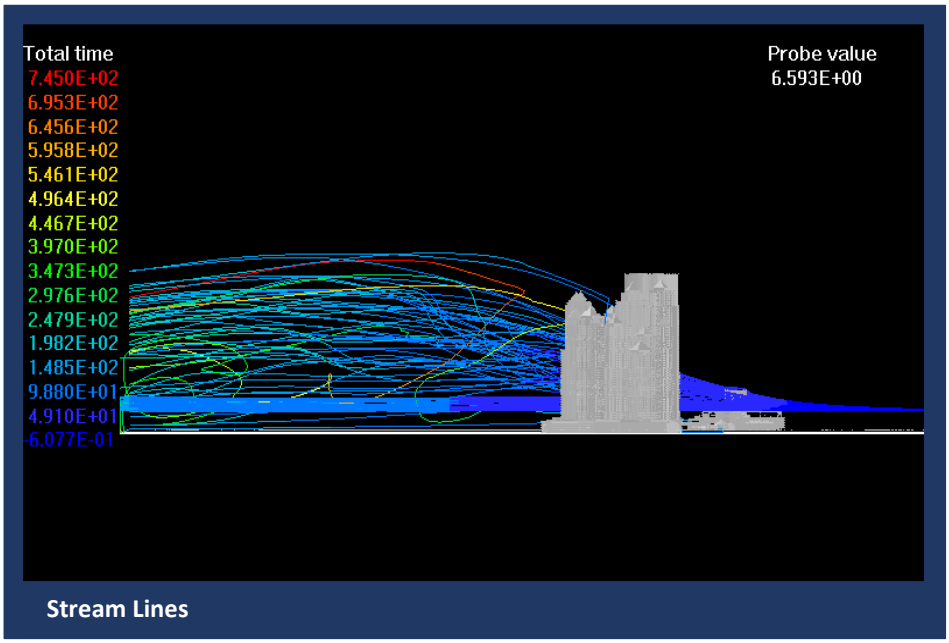


Boundary Conditions

A wind profile of U1/7 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

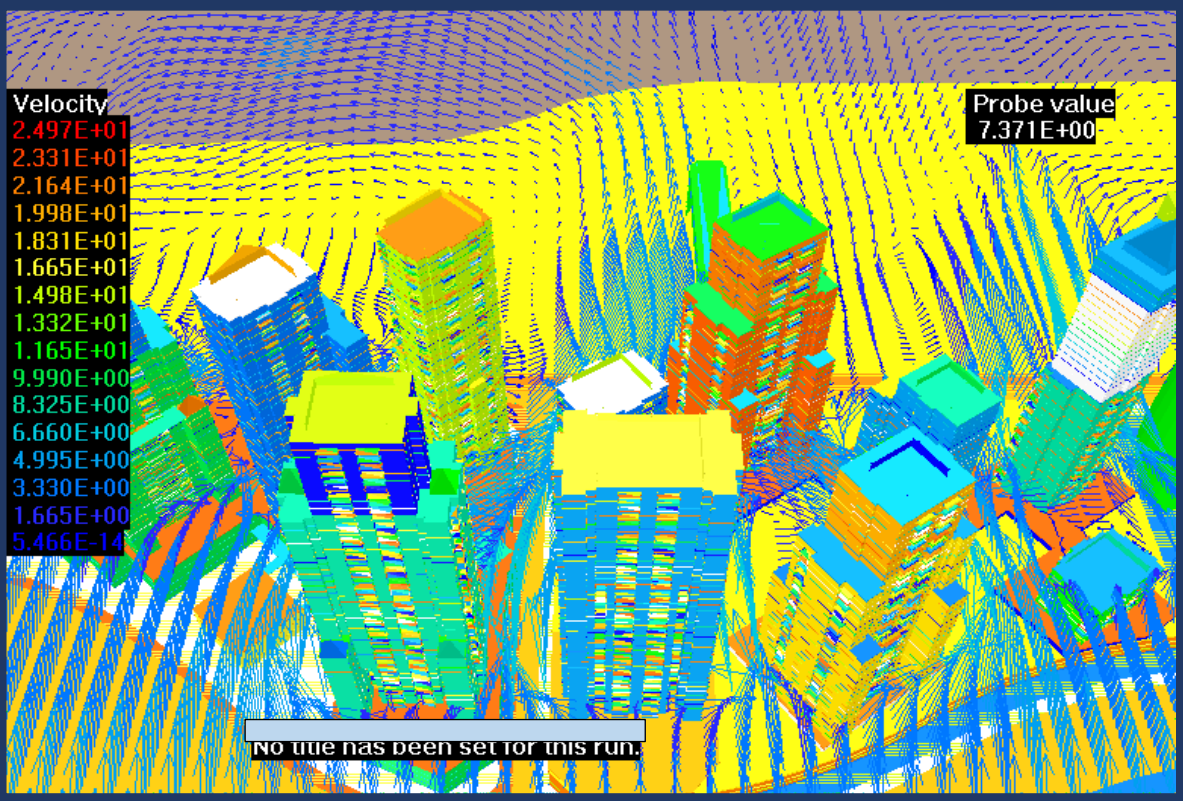


Stream Lines

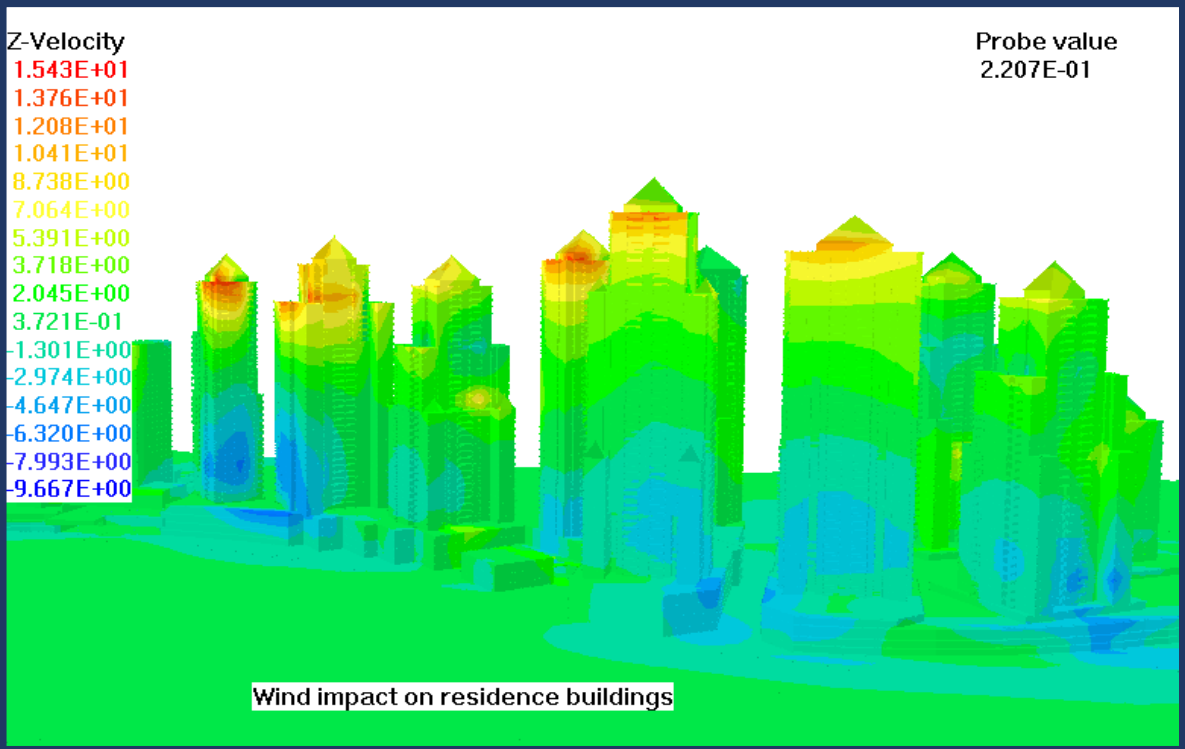
Initial results showed that, under certain conditions, there existed the potential for strong up-drafts and very high wind speeds near the top of most buildings. There also existed the potential for strong suction and turbulence at street-level at the base and rear area of the buildings.

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.



Velocity Vectors



Surface Contours