Microclimate
WIND ENGINEERING & ARCHITECTURAL AERODYNAMICS
Urban regeneration and large-scale masterplan development is placing increasing emphasis on the quality of external areas in the vicinity of buildings for recreational use with a view to making urban life style more sustainable.

The comfort and safety of users in these spaces is often an imperative requirement for planning approval and can be crucial to the commercial success of large-scale developments. As a result, Environmental Impact Assessments (EIA) and environmental design development requires designers and developers to embark on detailed study of external microclimate not only in the pre-planning stages, but also in the detailed design stages. To support designers in this process BMT Fluid Mechanics (BMT) maintains a highly resourceful and experienced group of micro-climate and building physics experts, which have developed a number of in-house numerical and physical modelling.

KEY SERVICES
- Wind climate analysis
- Pedestrian wind comfort analysis / environmental impact assessment
- Wind comfort analysis for balconies & roof top terraces
- Thermal comfort / wind chill assessment
- Wind mitigation scheme development
- Sunlight / daylight & shadow analysis
- Experience-based desk study assessments
- Detailed modelling studies

KEY BENEFITS
- External microclimate control
- Interactive wind mitigation scheme development
- Interactive design optimisation

SITE WIND CLIMATE ANALYSIS

Wind speeds for environmental design are not generally specified in building codes. As a result, the specification of wind speeds for environmental design requires careful analysis of long-term wind statistics that need to be purposely acquired for the site.

BMT has access to global wind record databases, which provide long-term wind statistics. By application of sophisticated industry-standard wind models of the atmospheric boundary layer, site-specific wind climate models are generated for each development.

SITE WIND CLIMATE ANALYSIS CONT

This process needs to carefully consider the surrounding terrain of the development. In this way a generic wind regime is generated for the target site that includes not only site specific wind statistics but also wind speed and turbulence distributions incident to the development that can be simulated in detailed wind modelling studies.

WIND MICROCLIMATE ASSESSMENT

At an early stage in the design development, experience-based wind microclimate assessments using desk study methodology can provide useful guidance to design development by way of identifying key areas of potential impact on ground level wind conditions and likely extent of required wind mitigation schemes. Depending on particular requirements of planning authorities, this level of wind assessment is often adequate for obtaining outline planning permission for large-scale development.

Increasingly, however, detailed industry-standard wind modelling studies are required to provide quantification of spatial extent and severity of ground level impacts in terms of accepted comfort and safety criteria to support detailed planning applications.

Once comfort and safety classifications have been derived the wind environment can be easily interpreted in terms of suitability for intended pedestrian uses, thereby, allowing the need for inclusion of wind mitigation schemes in further design development to be gauged.

In the case of high-rise developments, low rise podium areas, higher level balconies and roof-top terraces / sky gardens often experience wind conditions which are unacceptable for intended out-door recreational use and, therefore, require purposeful development of wind barrier schemes.
The test programme is easily facilitated. Remote interaction with high-resolution video monitoring equipment integrated into the wind tunnel test section, allows cost effective use of wind tunnel facilities with interaction with the solution development process and the interactive nature of the above approach allows assessment locations.

Smoke visualisation techniques can also be employed to provide further understanding of the physical wind flow patterns that may be causing adverse wind conditions.

The interactive nature of the above approach allows design and client teams to have maximum real-time interaction with the solution development process and makes cost effective use of wind tunnel facility time. With the availability of web-based video conferencing tools and high-resolution video monitoring equipment integrated into the wind tunnel test section, remote interaction with the test programme is easily facilitated.

Accurate determination of the wind regime experienced by a development requires model-scale boundary layer wind tunnel modelling. BMT have developed highly client-interactive testing methodology, with instantaneous analysis and interpretation, that allows local mitigation schemes to be validated for effectiveness and also, in the case of large scale master plan developments, allows variation of massing scenarios to be evaluated with full client participation.

These studies are based on sophisticated multi-channel instrumentation, which allows simultaneous measurement of mean as well as gust wind speeds at 140+ assessment locations. Smoke visualisation techniques can also be employed to provide further understanding of the physical wind flow patterns that may be causing adverse wind conditions.

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THERMAL COMFORT ANALYSIS

In addition to wind comfort analysis, in terms of wind force, BMT also provides thermal comfort analysis that considers ambient temperature can be an important consideration in assessing the suitability of external microclimate, especially in extremely hot or cold climates.

The assessment of thermal comfort requires application of 3D dynamic thermal numerical modelling tools such as TAS that can analyse local thermal fluxes due to convection, solar radiation and advection.

SUNLIGHT / DAYLIGHT ANALYSIS

Apart from wind, the quality of external microclimate is also impacted by availability of sunlight and daylight in key pedestrian spaces, which respectively depend on direct exposure solar radiation and diffused skylight. BMT operates a number of specialist 3D numerical modelling tools to allow these effects to be reliably quantified leading to a qualification of the quality of natural lighting in key spaces and comparison with existing site conditions. These methods can also be employed where there is concern over availability of sunlight in internal spaces, and recommendations for design adjustment made where appropriate.