Global Wind Technology Services

introduction

GWTS

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GWTS is dedicated to solving flow structure interaction problems. Our experienced engineers employ wind tunnel tests, computational fluid dynamics and parametric modeling to deliver the most practical engineering solutions to challenging problems. With considerable experience across all continents, GWTS engineers are able to integrate both global and local needs for an inclusive approach.

We work in a multi-disciplinary environment to provide projects with cost effective recommendations and alternative solutions. Our primary consideration is to present clients with the best outcome for their project, allowing for all boundaries and constraints.

We offer a variety of services, and we provide the resources that allow engineers to deliver their projects on time and on budget.

Our Services:

- Cladding pressures
- Structural wind loads
- Pollution dispersion
- Computation Fluid Dynamics
- Liquid damper design
- Full-scale measurements
- Pedestrian level wind
- Wind energy
- Microclimate
- Wind generated noise
- Wind driven rain
- Sunshade and reflectivity

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structural wind loads

Buffeting due to gusts of strong wind can cause dynamic loads on building structures. Tall, slender buildings are more susceptible to wind-induced motion, and can impact the comfort of the structure's occupants.

At GWTS we can determine the building's response to buffeting using state-of-the-art wind engineering techniques, improving the timeframe and cost effectiveness of projects by eradicating unknown elements and allowing key issues to be identified and addressed early on.

This prevents the necessity of making expensive modifications later in the development. We have multiple methods of assessment at our disposal, including desktop studies, wind tunnel studies or wind tunnel studies in combination with computational fluid dynamics (CFD).

Desktop Study

This involves collating and evaluating information relevant to the project, allowing a cost-effective preliminary assessment to be made. Desktop study of structural wind loads is based on experience, literature reviews, and building codes and standards. Desktop studies are often complimented by computational fluid dynamics (CFD) studies.

Computational Fluid Dynamics (CFD) Study

CFD is used to compliment desktop or wind tunnel studies. It is used to visualize and evaluate the behaviour of wind allowing for a faster turnaround time on projects with time constraints.

structural wind loads

Wind Tunnel Study

Wind tunnel testing is a powerful tool as it provides a high level of accuracy. We employ three different methods: high frequency base balance (HFBB), simultaneous pressure integrations and aeroelastic.

Simultaneous Pressure Integrations

This method requires a high resolution of pressure taps to capture all the local effects, which contribute to the global structural loads.

High Frequency Base Balance (HFBB)

This method has a considerable advantage over the older aeroelastic (stick model) techniques, which required scaled prototypes to be built and tuned to scaled values of mass, damping and stiffness. The process involves mounting a light weight, geometrically similar model of the prototype building onto a stiff base balance which provides wind force values in a given flow of wind. This method is commonly used for structural studies of buildings.

Aeroelastic method

The full aeroelastic method is still the most valuable method for determining the dynamic loads for very flexible or unusually shaped structures. For very flexible structures the first stage of the design can be done by HFBB method, and the final stage can be refined by using a full aeroelastic wind tunnel test. Combining aeroelastic modelling with HFBB helps reduce project costs.

cladding pressure

irregular facade elements requiring analysis

variable facade elements requiring analysis

Cladding Pressure Study

A cladding pressure study is used to predict the local pressure variations on façade and façade elements. A wind tunnel scale model is used to determine the net pressure of building envelopes and structural elements.

This type of study is recommended for high-rise buildings, convention centres, stadiums and structures where pressure distributions cannot be reliably predicted by referring to the codes and standards alone.

Wind tunnel testing of cladding pressures helps to reduce project cost by avoiding overly conservative design or underestimating the wind loads in a complex flow field.

cladding pressure

streamline analysis diagram

GWTS employs the latest 3D technology to model the detailed architectural features of buildings and capture all local pressure variations.

Clients receive the building model detail and the pressure tap (sensor) locations prior to model fabrication. All inputs are taken into consideration when finalizing the wind tunnel model.

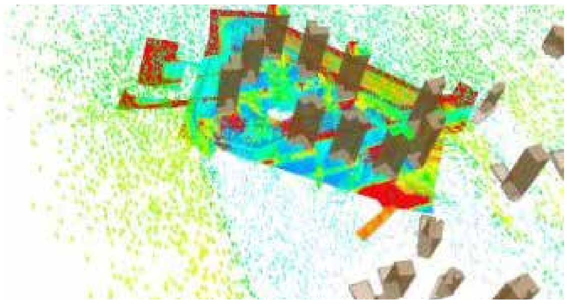
The wind tunnel study, both preliminary and final stage, is fully discussed with the design team and addresses all project specifications and requirements of local authorities.

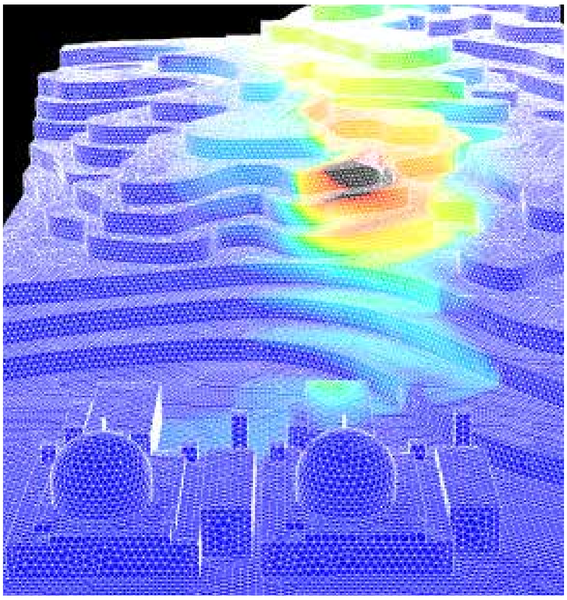
We provide:

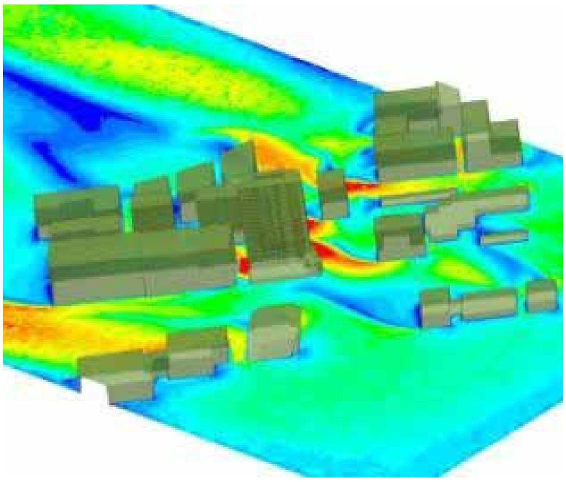
- Scaled 3D test model
- Existing and future model of the site
- High resolution imaging of pressure sensor locations
-Net pressures for all facade elements
- Dominant opening and wind breakage
- Internal pressures and loads
- Full presentation of the report to the design team

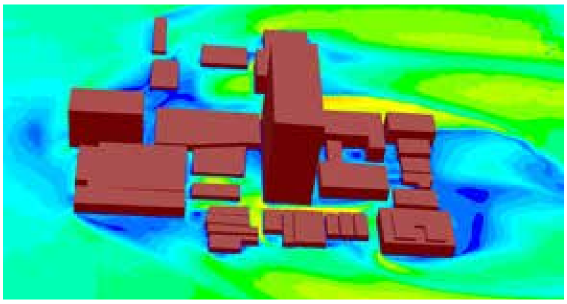
wind tunnel testing

computational fluid dynamics


internal ventilation analysis in urban environment


internal ventilation simulation


high density CFD flow visualization


high density CFD flow visualization

Computational fluid dynamics (CFD) utilizes computer simulation software to visualize and analyse fluid flow around a structure, and is used to investigate a vast range of engineering problems.

Through the use of CFD, engineers and architects can be assured that their structures will conform to specifications early in the design cycle, greatly accelerating the development process.

A CFD study can be used in:

- Microclimate
- Natural ventilation
- Outdoor thermal comfort
- Pollution dispersion
- Wind driven rain
- Wind noise
- Wind energy
- Wind structure interaction

pedestrian level wind

wind driven rain at pedestrian level

Pedestrian safety and comfort are vital considerations for architects and developers of new structures, requiring a cohesive effort from the design team, wind engineers and the local planning authorities to achieve these requirements.

Ground level wind conditions in areas adjacent to a proposed development are assessed using one of the three methods: desktop study, wind tunnel study and computational fluid dynamics (CFD) study.

Desktop Study

Desktop studies of pedestrian level wind is based on experience, a comprehensive literature review and current building standards and codes. The desktop study is the initial assessment of the pedestrian level wind study. For some projects, this assessment is sufficient for integrating into a development application document.

Computational Fluid Dynamics (CFD) Study

Pedestrian level wind testing using CFD allows us to create a visual representation of the behaviour of wind in a given area and the interaction between the wind and unusually shaped structures.

Wind Tunnel Study

Wind tunnel study of pedestrian level wind uses Irwin sensors to measure the wind speed at preselected locations. These locations will be determined in consultation with the design team. The assessment includes pedestrian safety and comfort criteria for walking, standing or sitting according to the intended use.

wind channeling effect in urban public realm

pollution dispersion

Pollutant dispersion has become a growing concern for cities, laboratories, industrial areas and car parks, where the concentration of pollutants reduces the quality of the microclimate. GWTS pollution dispersion studies utilize desktop, wind tunnel testing and Computational Fluid Dynamics to determine the best solution.

Above certain concentrations, exhaust gases may be odorous and/or dangerous to health. For larger developments where numerous residential, commercial or industrial exhausts are collected, re-entrainment via building air intakes or open windows should be minimized. A 'plume strike' on an apartment balcony should also be considered, as the results of such an event could be undesirable for the occupants who may be subjected to unpleasant odours.

Desktop Study

Desktop studies of pollution dispersion is based on the engineer's experience, a comprehensive literature review and a simple Gaussian model. The desktop study is the initial assessment of pollution dispersion for simple geometry and topography. This study also establishes whether there exists the need for further study using wind tunnel testing or CFD.

Computational Fluid Dynamics (CFD) Study

CFD is used to model internal flow as well as the effect of temperature. CFD will be used to determine the pollutant concentration and the effect of temperature. This analysis predicts the pattern of pollutant fallout. Our evaluation produces visual data that enables our engineers to work with the client to create effective solutions.

Wind Tunnel Study

Wind tunnel testing of pollutant dispersion is carried out with appropriate length scale , accurate modelling of plume discharge momentum and atmospheric velocity to measure complex aerodynamic effects. The relative concentration level in all selected locations will be determined for neutral atmospheric conditions. If the effect of a thermal gradient needs to be considered, CFD will be used.

wind generated noise


example of facade requiring analysis


wind generated noise due to facade elements

It is becoming increasingly common in modern architecture to make use of lightweight, narrow-section, hollow and/or porous components, for both structural and aesthetic purposes. These types of components can produce audible noise. Elements that vibrate or whistle in the wind can produce noise at all hours of the day, and the constant and erratic nature of this noise can pedestrian discomfort. Structural vibration of lightweight, flexible façade elements can also generate audible noise, particularly when vibrations are transmitted to building interiors via direct connection with the main structural elements of the building.

The most significant day-to-day adverse wind effects in a number of developments are caused by uncontrolled internal pressure fields and flows produced by the opening of windows on elevated facades, even during moderately windy conditions.

GWTS can produce a desktop study based on the engineer’s experience, a comprehensive literature review, parametric modelling, wind tunnel tests and computational fluid dynamics to predict wind generated noises.

wind energy

Wind energy is now the fastest growing renewable energy industry.

Our engineers' experience in structural load testing and the wind energy sector will assist in determining wind availability, local topography, wind turbine type and efficiency.

GWTS will guide you through all aspects of planning, design and implementation. Design guidance in the early stages of wind energy construction is critical, with site feasibility testing, meteorological modelling and energy generation prediction being key to a successful project and avoiding costly mitigation measures in the future.

microclimate


example of man made microclimate


GWTS full-scale measurement Melbourne CBD

Good planning and design makes it possible to achieve a pleasant microclimate in modern cities. Microclimate considerations play an important role in assuring the comfort of a building's occupants as well as favourable energy performance of the building itself. Microclimate studies are essential in creating natural ventilation and help to improve quality and circulation of air around a structure. They also help to prevent the emergence of 'heat islands' and other unpleasant phenomena on the pedestrian level.

The tools most often employed in this study are parametric study, wind tunnel testing and computational fluid dynamics (CFD). Factors such as the building's shape and orientation, distribution of surrounding buildings, the spacing between buildings, materials used and existing climate of the surroundings are all taken into consideration. The output of the study will include the evaluation of human comfort, thermal conditions and the year round performance of the nearby surroundings.

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