

What effects will wind have on the fabric roof proposed for Montréal's Olympic stadium? To find out, Dr. Peter Irwin prepares a detailed model for testing in the wind tunnel. (Photo: Bruce Kane, NRC)

Quels seront les effets du vent sur le toit de toile prévu pour le stade olympique de Montréal? Dans le cadre de ces recherches, le Dr Peter Irwin prépare une maquette détaillée en vue d'une série d'essais en soufflerie. (Photo: Bruce Kane, CNRC)



The Lion's Gate bridge emerges from the dawn fog shrouding Vancouver's First Narrows. (Photo: Vancouver Sun)

Le pont Lion's Gate de Vancouver émerge de la brume du matin qui enveloppe le Vancouver's First Narrows. (Photo: Vancouver Sun)

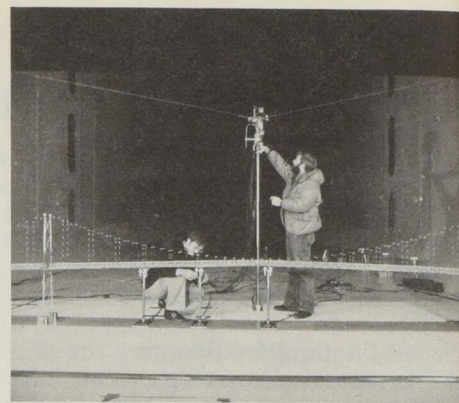
number of Canadian cities. Extensive full-scale measurements have been made of wind speed and direction, and the resulting pressures, suction, strains and movements. DBR's observations in the field have confirmed the validity of wind tunnel modelling, and have led to a body of useful advice and rules for building designers.

Similar contributions have been made to bridge design. NRC investigations have shown designers how to streamline road decks in order to minimize the kind of wind-induced vibrations which have been known to destroy bridges. An important study of the Lion's Gate bridge in Vancouver showed that the conventional way of testing bridge aerodynamics – with rigid models in a wind tunnel – was no longer adequate, for some of the most destructive bridge responses are excited by fluctuating gusts of wind, and to

observe these responses in a wind tunnel requires a model which is elastic – that is, which can copy, in scale, the deflections of its full-size counterpart.

The scope of wind engineering work at NRC is widening. It has included helping increase the efficiency with which trucks use fuel by reducing drag; measuring wind loads on a model of the removable fabric roof of Montreal's Olympic stadium; finding the most stable way to bundle power transmission lines. The latest question to be studied is the complex one of wind effects within the man-made canyons of a city.

Tall, slab-like buildings can reach up to deflect fast-moving winds down to street level, where they whistle and swirl around pedestrians and make unuseable the malls, gardens, sidewalks and other spaces which were designed for outdoor use.



A model of the Lion's Gate bridge spans the test section of the wind tunnel in which its responses to the wind were intensively investigated. (Photo: Bruce Kane, NRC)

Maquette du pont Lion's Gate de Vancouver à l'intérieur de la veine d'essais de la soufflerie où l'on procède à une étude détaillée de sa réponse à l'action du vent. (Photo: Bruce Kane, CNRC)

Three Canadian cities – Ottawa, Toronto and Calgary – are sufficiently concerned about this problem to consider legislation under which any proposed new building must be investigated to ensure that it will not make surface winds worse.

Before establishing whether winds might be made worse, of course, one has first to establish what they are like now. That is the object of an investigation which began in Ottawa this Spring. It is being carried out by NRC in conjunction with the City of Ottawa, the National Capital Commission and the Department of Public Works.

Wind speed measuring instruments are mounted on top of five large buildings ringing Ottawa's downtown core. The pattern of winds which they help map out will be compared to records kept at the open spaces of Ottawa airport. If there is reasonable correlation between these two sets of data, then researchers will be able to infer the downtown wind climate for many years back from the records kept at the airport. Then, in the second phase of the study, measurements will be made of the winds actually experienced by pedestrians at street level in downtown Ottawa. Finally a detailed model of the center of the city will be built and used to reproduce, in the wind tunnel, the same general pattern of winds as was measured outdoors. Under the proposed legislation, models of new buildings will be inserted into the city model and thus their effect on street level winds evaluated.

Moving air acts in subtle, fluctuating ways on the things we build. Dealing with these complexities, and developing the art of designing for them, is the task of an interesting new discipline – wind engineering. □

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