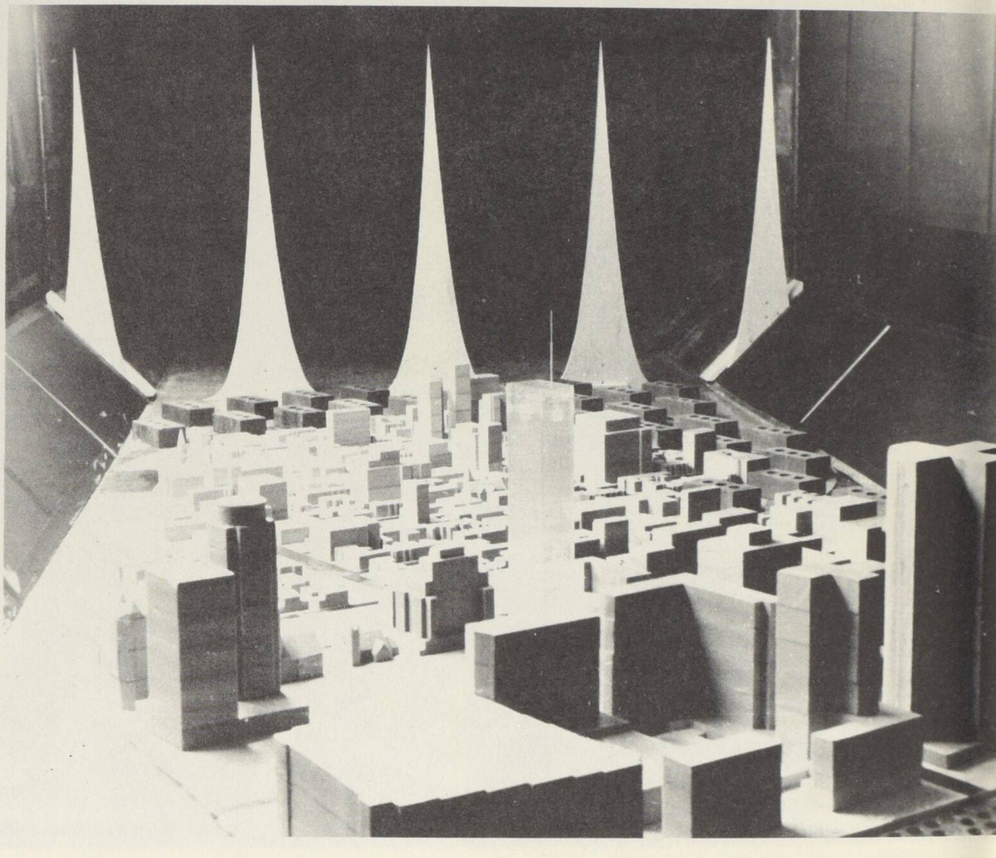
Model of section of downtown Montreal under study in wind tunnel. Spires produce the same kind of wind conditions on the model as the real wind.

Maquette de la partie de Montréal essayée en soufflerie. Les "chandelles" que l'on voit au fond à travers la veine permettent de bien simuler le vent.



that could be used to guide wind tunnel experimenters in tailoring wind tunnel flow conditions to simulate natural conditions of strong wind.

"What we are trying to do," says W. Alan Dalgliesh of the Building Structures Section, "is to get the answers before the problems come up."

Although several low-speed aeronautical wind tunnels exist which are occasionally used for investigating wind effects on buildings, their designs are not suited to the special needs of building aerodynamics, because they generate a low turbulence, constant velocity flow across a relatively short working section.

A wind tunnel specially designed to simulate wind was built in 1965 at the University of Western Ontario, under the direction of Dr. Alan G. Davenport, Professor of Engineering, assisted by an NRC grant.

This tunnel has a very long working section to allow a turbulent boundary layer to be generated, which at the downstream end is deep enough to simulate the atmospheric surface layer winds. A model of the CIL buildings along with the surrounding area of downtown Montreal, was tested in the boundary layer wind tunnel at Western in 1967.

As part of the program for checking the validity of modelling techniques and in order to obtain further information, the Building Structures Section also arranged to conduct wind tunnel studies in co-operation with the Low Speed Aerodynamics Section of NRC's National Aeronautical Establishment. Engineers of the Section are in the process of developing techniques for adapting conventional aeronautical wind tunnels for the study of surface wind effects.

Detailed plans for the construction of a model of a nearly one-square mile area in downtown Montreal were obtained from the Planning Department of the City of Montreal. A model was built to the scale 1:400 (one foot equals 400 feet). The area is bounded on the south by Windsor Station, on the North by Sherbrooke Street, on the east by University Avenue, and on the west by Dufort Street, and encompasses such buildings as Place Ville Marie, the Queen Elizabeth Hotel, Bonaventure Station, the Chateau Champlain, Mary Queen of the World Roman Catholic Church, and the main building of interest in the study, the Bank of Commerce Building, standing over 600 feet high. Prior to undertaking the model study, the latter building was instrumented for full-scale measurements with the full co-operation of the owner, Dorchester Commerce Realty Limited. The objective of taking measurements on this building was to relate over-all lateral wind-load on the structural frame to some convenient measure of wind strength. Although the researchers began by investigating the effects of wind on the structural frame of buildings, they found that the local effects of peak gusts on cladding, were every bit as important.

Despite the fact that measurements carried out 30 years ago on the Empire State Building seemed to indicate that it was unlikely that the wind tunnel techniques usually employed for aeronautical studies would give satisfactory agreement with full-scale measurements, NRC's Low Speed Aerodynamics Section found that the use of spires, four feet high, set two feet apart and shaped so as to modify the average speed of wind with height, gave them the correct scale of turbulence in the surface wind layer. As the wind goes between and around the spires, it is progressively slowed down near the ground and the desired variation of velocity with height can be obtained.

"The spires seem to produce the same kind of wind conditions to the scale model as the real wind," says R. J. Templin, head of NAE's Low Speed Aerodynamics Section. "We are getting close to the same magnitude pressure fluctuation on the model as the full-scale building for the same wind direction."

Of economic importance in the study of wind loads on actual tall buildings, is the wind load to be used when designing individual cladding ele- →