MONASH UNIVERSITY ENVIRONMENTAL WIND TUNNEL

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1 INTRODUCTION

The Department of Mechanical Engineering of Monash University has recently constructed a large wind tunnel with funding from Monash University, the Electricity Supply Authorities Association and the Energy Research Development Corporation. The purpose of the facility is to simulate various sorts of natural wind systems so that tests may be made of the effect of the natural wind on dispersion of pollutants and on buildings, cars etc.. A schematic diagram showing the new wind tunnel and its major dimensions is shown overleaf.

2 TYPES OF NATURAL WIND SYSTEMS

Natural wind systems near the surface of the earth are characterised by their *stability*, which depends upon the amount of solar heating of the earth's surface and the wind speed. At wind speeds which are high in relation to the surface heat flux, the structure of the atmospheric boundary layer is affected little by the temperature of the earth's surface, and the stability is *neutral* : as applies for most wind engineering studies, as done in the existing 450kW wind tunnel.

This new facility has been built large enough to give adequate models of the dispersion of pollutants in the atmospheric boundary layer under *unstable* conditions when the boundary layer structure is dominated by free convection, as occurs most often in Australia. With the fans running slowly, and with heaters providing heat at the floor, the facility can provide a model of the convective boundary layer suitable for modelling the natural wind at a scale ratio of 1:200.

Overnight, the earth cools by radiation to space and dense air lies stably near the earth's surface : these conditions are referred to as *stable*. This sort of natural boundary layer has been modelled by heating air near the ceiling and fastening an inverted model to the ceiling. The heated air rises to the insulated ceiling and gives a very stable layer in which dispersion of pollutants and other effects can be modelled. This technique has already been applied to the modelling of dispersion in an open-cut coal pit.

3 WIND TUNNEL ACCESSORIES

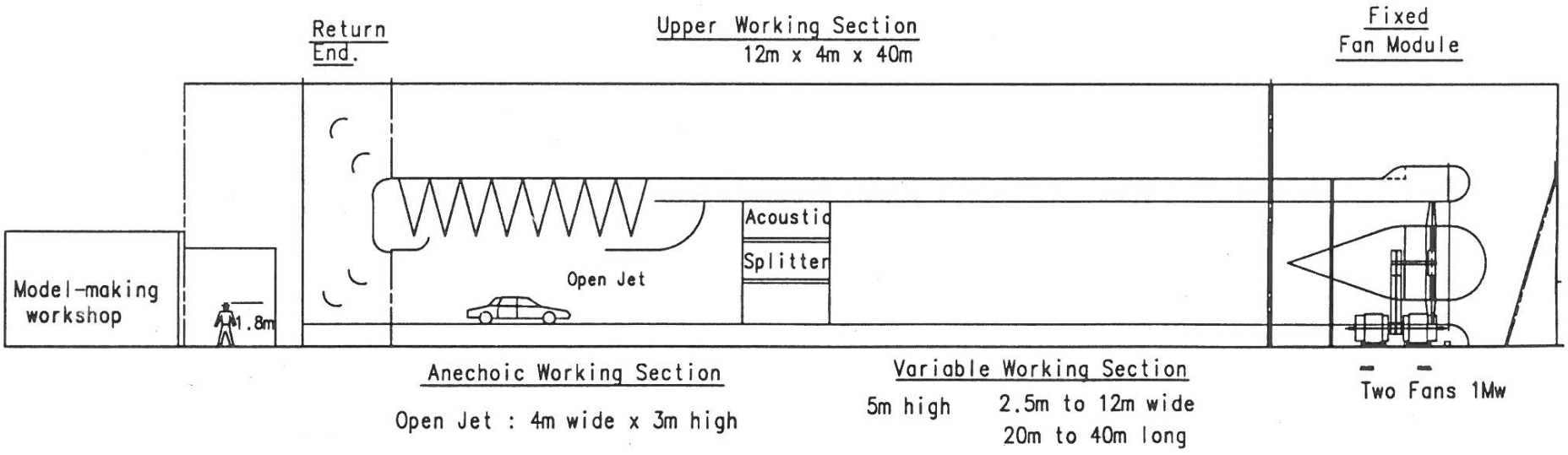
To support this sort of modelling, the model-making facilities have been concentrated into a workshop adjacent to the wind tunnel so that models can be made easily. Computer controlled data acquistion systems have been developed for both sophisticated data processing of turbulent air velocity and pressure measurements as well as for simple averaging and storage of transducer voltages. Currently,two 32-bit Perkin Elmer computers are in use. Instrumentation for the measurement of movement of air and tracers (for pollution dispersion studies) includes a sonic anemometer and mass spectrometers, as well as the usual pressure transducers, pitot tubes, hot wire anemometers etc. A 16 channel Flame Ionisation Detector system is under development for the measurement of concentrations of hydrocarbon tracer gases for use in pollutant dispersion studies.

SPECIFICATIONS :

Fan Module : Two 5m diameter variable speed fans
Capacity : 800 cubic meters /sec. maximum.

Power available : 2 x 1MVA transformers, 415 volt.
Heating : 230 kW.
Crane : 2 tonne.
Access Door : 3.6m x 3.6m

Upper working section fixed in size at 12m wide by 4m high by 40m long.
Variable working section has width variable from 2m to 12m , height 5m.



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