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529F15.00

Dear Jo

Downtown Development – Wind Effects (Queen Elizabeth Square)

1. Background

In January 2015 Opus Research prepared a report that described the results of a wind tunnel study of the proposed Downtown development for central Auckland (Opus Research Report 15-529F15.00M). The development design evaluated in this report comprised a 178m high tower and a 16.5m high podium that occupied the entire city block apart from the area of Queen Elizabeth Square and the small area adjacent to HSBC House at the northeast corner of the block. Resource consent for this development has been applied for under existing planning provisions. A plan change is being applied for relating to area of Queen Elizabeth Square, including the area adjacent to HSBC House. Under this plan change the height limit being applied sought for this space is 19m.

As part of the wind tunnel study described above, additional testing was also performed on a development design that had essentially the same tower and podium design, but included building over Queen Elizabeth Square and the northeast corner of the block. This letter describes the results of this testing in the vicinity of Queen Elizabeth Square, and assesses the wind effects against the performance criteria specified in the City of Auckland District Plan.

2. Wind Tunnel Test Procedures

Wind tunnel testing was carried out using Opus Research' existing 1:300 scale model of Auckland, updated to reflect buildings that currently exist or are under construction. A scale model of the development was built that included a level of detail consistent with design features expected to have a potential impact on wind conditions. Figure 1 shows a view of the wind tunnel model showing the extension of the podium over Queen Elizabeth Square and the adjacent space.

Wind speed measurements were made using a hot-film anemometer for the nine wind directions 20°, 40°, 60°, 80°, 200°, 220°, 240°, 260°, 280° which are representative of the prevailing wind directions over Auckland. Measurements of mean wind speed were made at a number of locations around the redevelopment site at a scale height of 1.5m. These were made for the existing situation and the proposed development design shown in Figure 1. Figure 2 shows the locations of these measurements. Mean wind speeds measured in the wind tunnel were related to full-scale meteorological data using ratios of the wind speeds measured at 1.5m and at a reference height of 150m. The full-scale mean wind speeds that were calculated for each location and direction are equalled or exceeded for 50 hours per year over a 20° arc centred on the specified direction. These directional mean speeds were then combined using a directional probability analysis to produce an overall wind speed that is exceeded for 50 hours per year for all wind directions combined.

These overall mean wind speeds can be related to the wind performance categories (A to E) specified in the City of Auckland District Plan (2004).

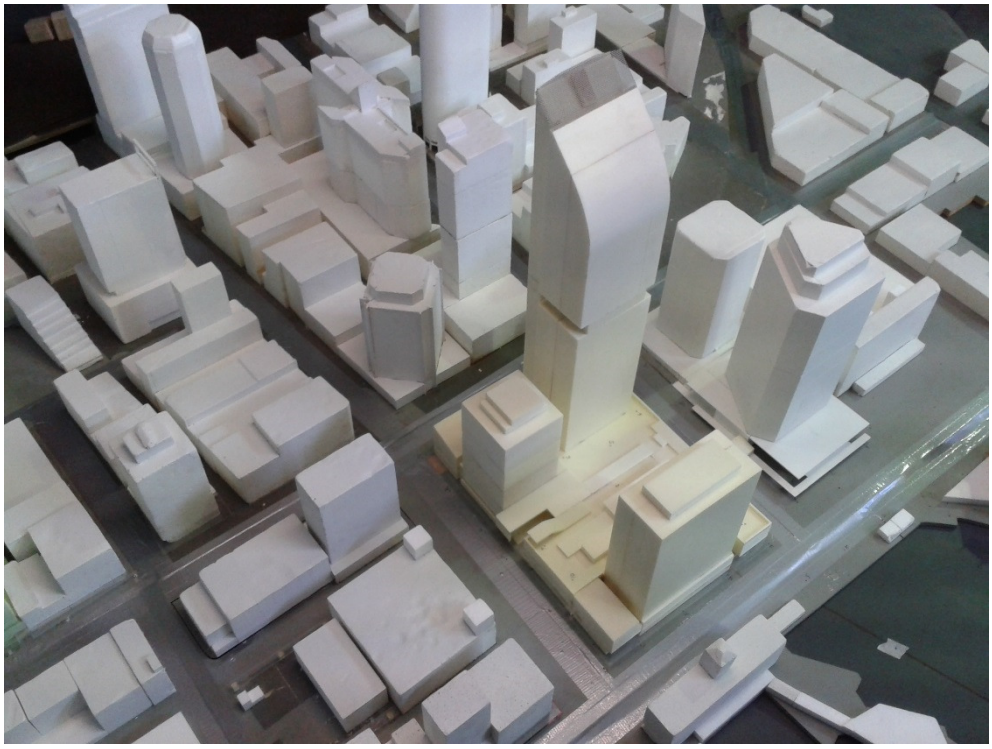

Figure 1: **View of the wind tunnel model – building over Queen Elizabeth Square**

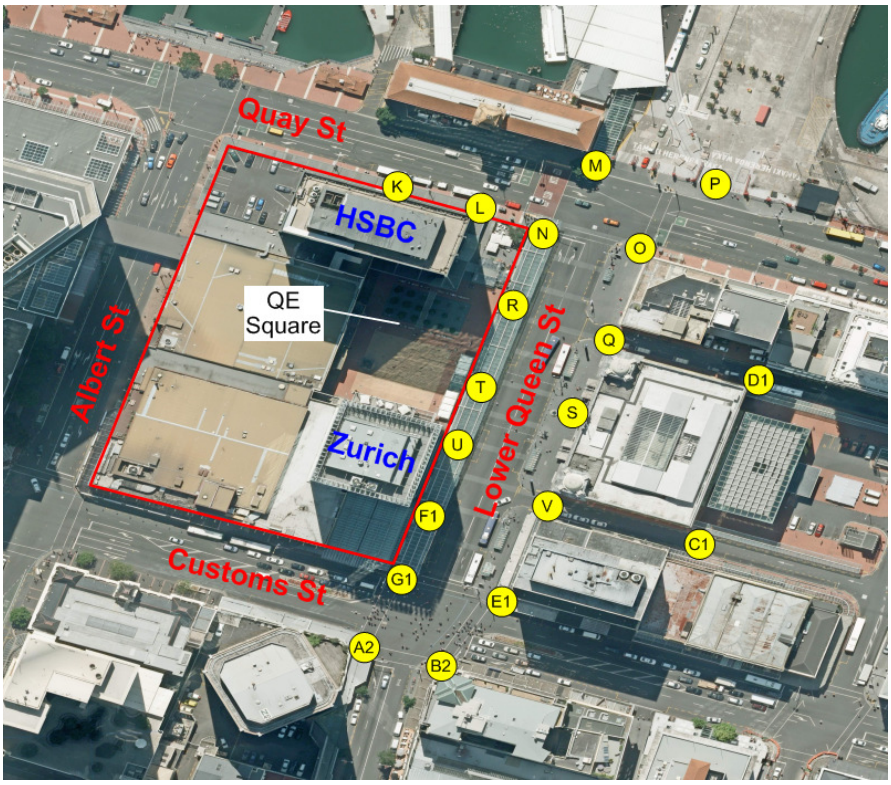

Figure 2: **Wind Speed Measurement Locations**
(with the development site outlined in red)

3. Results

The wind performance category for each location is listed in Table 1 for (1) the existing situation, (2) for the proposed development as originally tested, and (3) for the proposed development design including building over Queen Elizabeth Square. We estimate that a change of less than 0.5m/s in the wind speed is not significant within the limitations of the wind tunnel test method. Consequently a change of less than 0.5m/s can appear to indicate a change in wind performance category (e.g. location K in Table 1) but should not be taken as indicating a significant change in the measured wind conditions. To make this clearer, a significant change in wind performance category is indicated in Table 1 by a ▲ or ▽ symbol.

Table 1: Net measured mean wind speeds and wind performance categories

Notes: Exg = existing situation. New = proposed development as originally tested. QE = including building over QE Square. = not measured. ▲ = increase in category. ▽ = decrease in category. Change = change in category between New and QE.

Location	Net Wind Speed (m/s)			Wind Performance Category			
	Exg	New	QE	Exg	New	QE	Change
K	4.7	4.4	4.4	B	A	A	
L	6.9	5.6	5.5	B	B	B	
M	6.1	5.3	5.3	B	B	B	
N	6.8	6.1	6.1	B	B	B	
O	9.7	10.0	9.9	D	D	D	
P	5.3	6.3	6.3	B	B	B	
Q	6.6	6.1	6.1	B	B	B	
R	8.5	7.2	9.0	C	C	C	
S	5.0	7.0	7.3	B	B	C	
T	6.3	5.5	6.7	B	B	B	
U	5.7	6.3	8.3	B	B	C	▲
V	5.8	6.9	6.8	B	B	B	
C1	4.6	4.7	4.7	A	A	A	
D1	6.1	7.0	6.9	B	B	B	
E1	4.5	5.4	5.0	A	B	B	
F1	5.0	6.5	7.6	B	B	C	▲
G1	6.8	8.3	8.8	B	C	C	
A2	4.7	5.5	5.5	B	B	B	
B2	6.0	5.8	5.8	B	B	B	

4. Concluding Comments

Table 1 shows that the effect on wind conditions in the vicinity of Queen Elizabeth Square caused solely by the difference between a proposed development design that does not include building over Queen Elizabeth Square and the area at the northeast corner of the city block, and one that does, is relatively minor. There is a small localised area of Lower Queen Street, north of Customs Street, where there are changes in the wind performance category that are attributable to the change in the building configuration. Here, conditions change from Category B to Category C as a result of building over Queen Elizabeth Square. Category C conditions are considered acceptable for typical footpaths under the Auckland City Council wind rules.

The height of the proposed development's podium that was tested in the wind tunnel was around 16.5m. Under the plan change that that is being applied for, the height limit for this podium space is around 19.0m, an increase of approximately 2.5m, which is less than a typical single storey in height. Numerous wind tunnel studies have shown that an increase of a single typical storey to a

building of this size and height is very small. Accordingly, I would assess that the design changes to the podium will not change the results shown in Table 1, or the comments above.

If you have any questions regarding the wind tunnel testing, or the results, please do not hesitate to call me (021 243 9386).

Regards

Neil Jamieson
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