

**REVIEW OF AIR QUALITY ISSUES:
AIRPORT LINK TENDER – BRISCONNECTIONS**

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Prepared for
City North Infrastructure Pty Ltd

By

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1. INTRODUCTION

This report has been prepared by Holmes Air Sciences on behalf of City North Infrastructure Pty Ltd (CNI). It provides a review of air quality issues associated with BrisConnections (BC) Tender to finance, construct and operate the Airport Link roadway project in Brisbane and to construct and deliver parts of the Northern Busway Project. It is a supporting document to the Request for Project Change Report prepared by CNI for this Tenderer.

The purpose of the report is to compare the BC proposal referred to herein as the “Changed Project” with the project referred to in the Coordinator-General’s Report and described in detail in the Environmental Impact Statement (EIS) and Supplementary Report dated April 2007. This is referred to herein as the “Reference Project”.

2. AIR QUALITY EFFECTS

This section reviews the air quality impacts of the Changed Project for three sections of the route identified as:

- Bowen Hills – Windsor
- Kedron
- Clayfield

In the EIS, air quality was assessed by computer based dispersion modelling which addressed:

- the emissions from the ventilation outlets with and without the Reference Project, taking into account other contributors such as the ventilation outlet for the NSBT project;
- the emissions from motor vehicles around surface roads with and without the Reference Project; and
- the existing environment for a wide range of meteorological conditions.

Impacts from changes to traffic on surface roads were assessed in detail in the Reference Project, both for air quality and health impacts. The air quality impacts were generally proportionate to the volume of traffic on the road. The changes in air quality impacts for the Changed Project have been assessed by comparing changes in traffic numbers on surface roads with the Reference Project. **Table 1** compares the traffic on some of the key surface roads for the Reference Project and the Changed Project. Traffic differences presented were estimated using the Brisbane Strategic Transport Model (BSTM) rather than the BC estimates.

Table 1 - Reference Project and Changed Project – comparison of project effects on key connecting roads

Location	Change in Average Weekday Traffic – 2012 (% change from Do Minimum)			Change in Average Weekday Traffic – 2026 (% change from Do Minimum)		
	EIS	Reference Project ¹	Changed Project ¹	EIS	Reference Project ¹	Changed Project ¹
Southern Connections						
NSBT (Brisbane River)	2,400 (3%)	4,900 (7%)	4,100 (6%)	8,000 (9%)	11,400 (15%)	11,400 (15%)
ICB (West of Bowen Bridge Road)	2,300 (2%)	2,500 (2%)	3,900 (4%)	2,300 (2%)	-500 (-0%)	-800 (-1%)
Hale Street (North of Milton Road)	200 (0%)	1,000 (1%)	400 (0%)	-700 (-1%)	-700 (-1%)	-700 (-1%)
Bowen Bridge Road (South of O'Connell Terrace)	800 (2%)	-2,500 (-5%)	-4,300 (-9%)	5,400 (10%)	1,200 (2%)	-1,800 (-3%)
Bowen Bridge Road (South of Butterfield Street)	-21,800 (-33%)	-11,700 (-20%)	-6,700 (-11%)	-23,500 (-31%)	-13,200 (-20%)	-5,600 (-8%)
Campbell Street (East of Mayne Road)	4,400 (20%)	8,100 (49%)	7,800 (47%)	5,800 (20%)	9,100 (39%)	7,500 (32%)
O'Connell Terrace (East of Bowen Bridge Road)	-1,700 (-11%)	-900 (-8%)	-2,000 (-18%)	-700 (-4%)	-1,800 (-12%)	-2,300 (-15%)
Brookes Street (South of St Pauls Terrace)	2,700 (13%)	2,900 (15%)	3,000 (16%)	2,400 (10%)	1,000 (4%)	1,600 (7%)
St Pauls Terrace (South of Brookes Street)	1,600 (12%)	600 (4%)	200 (1%)	800 (4%)	1,000 (6%)	400 (2%)
Gregory Terrace (West of Brookes Street)	-800 (-7%)	-200 (-2%)	0 (0%)	-1,800 (-12%)	-400 (-3%)	-300 (-2%)
Wickham Street (West of Brookes Street)	1,600 (5%)	1,700 (6%)	2,200 (8%)	1,500 (4%)	2,000 (7%)	2,500 (8%)
Ann Street (West of Brookes Street)	3,800 (12%)	3,300 (11%)	1,700 (6%)	3,800 (10%)	4,600 (13%)	2,700 (8%)
Montpelier Road (West of Breakfast Creek Road)	3,300 (12%)	3,700 (13%)	2,200 (8%)	2,900 (8%)	2,900 (9%)	1,600 (5%)
Gipps Street (North of Wickham Street)	-2,600 (-6%)	-3,100 (-8%)	-3,300 (-8%)	-2,200 (-5%)	-1,100 (-2%)	-2,100 (-5%)
Northern Connections						
Stafford Road (East of Richmond Street)	14,300 (56%)	13,300 (54%)	15,100 (61%)	17,400 (62%)	16,700 (62%)	18,700 (69%)
Stafford Road (West of Richmond Street)	13,000 (49%)	11,900 (46%)	12,400 (48%)	16,100 (55%)	15,700 (57%)	16,300 (59%)
Stafford Road (West of Webster Road)	6,200 (25%)	5,800 (24%)	5,700 (23%)	9,300 (37%)	8,900 (38%)	8,800 (37%)
Gympie Road (North of Broughton Road)	17,000 (22%)	17,000 (22%)	16,100 (21%)	21,800 (26%)	19,700 (23%)	19,400 (23%)
Gympie Road (South of Kitchener Road)	11,900 (16%)	12,300 (17%)	13,700 (18%)	14,600 (18%)	14,600 (18%)	16,300 (20%)
Gympie Road (North of Rode Road)	4,400 (6%)	4,000 (5%)	4,200 (5%)	8,300 (10%)	6,800 (8%)	6,900 (8%)
Rode Road (West of Gympie Road)	900 (3%)	1,300 (4%)	1,200 (4%)	-600 (-2%)	-100 (-0%)	-100 (-0%)
Sandgate Road (North of Schulz Canal)	-5,800 (-9%)	-4,900 (-7%)	-5,400 (-8%)	-6,400 (-9%)	-1,900 (-3%)	-2,400 (-3%)
East West Arterial (East of Widdop Street)	15,900 (27%)	16,500 (30%)	17,100 (31%)	10,400 (14%)	9,200 (12%)	8,800 (12%)

Notes : (1) From traffic modelling for Reference Project and Changed Project undertaken within updated BSTM-based Airport Link strategic model.

(2) Volumes shown are Do Something (with Airport Link) minus Do Minimum (without Airport Link).

BOWEN HILLS - WINDSOR

Traffic flows, from the updated BSTM traffic model have been examined for surface roads in the Bowen Hills and Windsor area. The difference between the “Do Minimal” (DM) or no tunnel option and the “Do Something” (DS) option for the Reference Project and for the Changed Project were calculated.

The most likely surface road locations with air quality impacts for the Reference Project were Bowen Bridge Road and Newmarket Road. For these roads the predictions showed compliance with air quality goals and an improvement in health outcomes. For the Changed Project, traffic numbers on the modelled roads in 2012 and 2026 in this section of the route, namely Bowen Bridge Road and Newmarket Road are forecast to decrease. The EIS conclusions for health impacts remain valid for the Changed Project.

Campbell Street traffic is forecast to increase for the Changed Project however the overall traffic numbers are low and the consequent health effects would be lower than those predicted on other roads for the Reference Project.

KEDRON

Traffic flows have been forecast for the Reference Project and for the Changed Project, based on the updated traffic model. Lutwyche Road north of Maygar Street is predicted to experience decreases in traffic numbers relative to the DM case for both the Reference Project and the Changed Project.

Traffic flows, from the updated traffic model have been examined for surface roads in the Kedron area. The difference between the DM or no tunnel option and the DS option for the Reference Project and for the Changed Project were calculated.

The most likely surface road locations with air quality impacts for the Reference Project were Gympie Road and Stafford Road.

For Stafford Road, the increase in traffic flows for both the Reference Project and Changed Project would be similar to each other and also to the EIS predictions. There was no difficulty achieving air quality goals or acceptable health outcomes for this road. The EIS conclusions for health impacts remain valid for the Changed Project.

For the Reference Project, traffic flows forecast for Gympie Road would lead to significant changes to annual average concentrations of NO₂. With the revised traffic modelling, the increases with and without Airport Link would be similar to the EIS for the Reference Project. For the Changed Project, the predicted traffic numbers would decrease slightly compared to the situation without the Airport Link. Therefore the health outcomes for the Changed Project would be slightly improved compared to the Reference Project along this section of the route.

An increase in traffic flows is predicted at the intersection of Lutwyche Road and Gympie Road where there would be a convergence of surface traffic and emerging tunnel traffic. In the Reference Project, the total traffic flows at this intersection were similar to the total traffic numbers on Gympie Road, but would be spread over double the number of lanes at this intersection, compared to the

continuing section of Gympie Road to the north. Consequently, the emissions would be more dispersed initially.

The configuration of the surface structures at this location would be different for the Changed Project, therefore a simple comparison of traffic numbers does not provide a complete picture of the change in impacts. Regardless, the Changed Project design is unlikely to result in any substantial change in air quality impacts.

CLAYFIELD

The surface roads in this location would experience the most changes to air quality due to changes in traffic flows. Traffic flows are predicted to decrease by about 7-20% on Sandgate Road for both the Reference Project and the Changed Project.

Traffic flows are also predicted to decrease on the Gateway Motorway by a similar extent for both the Reference Project and the Changed Project. The extent of the traffic impact on the Gateway Motorway for the Changed Project would be approximately 17% decrease in 2012 compared to a predicted 28% decrease in the EIS.

Traffic flows on both the East West Arterial and Airport Drive would increase by a similar amount for both the Reference Project and the Changed Project. For the Changed Project, the traffic impact would be an increase of approximately 30% in 2012 for the East West Arterial and approximately 4% in 2012 for Airport Drive. Similar increases were reported in the EIS for the Reference Project.

In summary there would be no significant changes in air quality along the major surface roads in this section of the route for the Changed Project compared to the Reference Project.

3. AIR QUALITY EFFECTS OF THE CHANGES TO THE VENTILATION SYSTEM

Air dispersion modelling was undertaken for the Changed Project to assess the changes in ambient air quality resulting from the dispersion from the ventilation outlets. This work was undertaken by Air Noise Environment on behalf of BC and presented in a report dated January 2008. Emission estimates from the ventilation outlets were undertaken at the three sites proposed in the EIS. These results were then compared with the results from the modelling undertaken for the reference project. The Changed Project model included the differences to the height and location of the ventilation outlets and traffic numbers in the tunnel.

The emission rates are summarised below in **Table 2** for the Changed Project and the Reference Project. The emissions for the reference project are taken from the EIS. The emissions for the Changed Project are based on the BC traffic forecasts. It should be noted that for the Reference Project, only congested scenarios were considered. For the Changed Project both normal and congested scenarios were modelled however the congested scenario considered was extreme. As will be discussed later, the Changed Project congested scenario was not considered to be representative of long-term operating conditions and was not used for predicting long-term average concentrations. Therefore the "Daily congested" estimate for the Changed Project included in **Table 2** would be a significant overestimate of daily emissions.

Table 2 - Ventilation Outlet Emission Predictions for Changed Project compared with the Reference Project - 2012

Reference Project		Changed Project			
Windsor					
Emissions	Daily (kg)	Peak (g/s)	Daily (kg)	Daily (kg)	Peak (g/s)
	Congested	Congested	Normal	Congested	Congested
CO	1352	42.74	1261	3302	49.59
NO _x	296	7.58	291	326	4.92
PM ₁₀	9	0.43	13	29	0.44
Kedron					
Emissions	Daily (kg)	Peak (g/s)	Daily (kg)	Daily (kg)	Peak (g/s)
	Congested	Congested	Normal	Congested	Congested
CO	2172	60.45	1064	2814	41.24
NO _x	327	10.55	215	276	4.06
PM ₁₀	14	0.49	10	25	0.38
Clayfield					
Emissions	Daily (kg)	Peak (g/s)	Daily (kg)	Daily (kg)	Peak (g/s)
	Congested	Congested	Normal	Congested	Congested
CO	1095	42.63	870	1440	22.37
NO _x	172	5.84	161	165	2.53
PM ₁₀	8	0.32	6	16	0.26

Emission rates were calculated based on traffic modelling for the Changed Report. While the EIS had a fixed stack diameter, the ventilation outlets for the Changed Project would have a variable stack diameter which could be adjusted to optimise the exit velocity. Estimated emission rates for the Windsor ventilation outlet were generally higher under congested conditions for the Changed Project than for the Reference Project although the maximum NO_x was higher for the Reference Project.

Emissions of NO_x and PM₁₀ under congested conditions from the Kedron ventilation outlet were less than the maximum emissions assumed in the EIS, although there were some sustained periods when the emission rate of PM₁₀ was higher for the Changed Project. Regardless, the predicted impacts for both the Reference Project and the Changed Project are well below the air quality goals at Kedron.

The calculated NO_x and PM₁₀ emissions from the Clayfield ventilation station under congested flow are less than the maximum emissions assumed in the EIS, although there are sustained periods where the estimated emissions are higher. The option of a lower outlet height at Clayfield was investigated. The predicted ground level concentrations would still be significantly below air quality goals with an outlet height of 25 m compared to the Reference Project height of 30 m. This lower height was adopted for the Changed Project.

In practice, the impacts of the ventilation outlets are minor both in terms of compliance with air quality goals and health risks. Changes in the tunnel ventilation are unlikely to result in significant changes to impacts on ambient air quality. The proposed parameters are well within those that are likely to achieve compliance with air quality goals.

While the EIS considered impacts in 2012, 2016 and 2026, the BC assessment considered impacts in 2012 only. The EIS estimates of daily emissions in 2016 and 2026 were higher than in 2012, however the impacts were low in all cases and not substantially different from year to year. For the Changed Project, it is not anticipated that the impacts in 2026 would be significantly different from the impacts in 2012. While the BC tender predicted a substantial increase in traffic numbers by 2026, this increase was also based on significant changes in vehicle technology. The EIS was conservative in its future emission predictions in that it did not assume any further improvement in vehicle technology or fuel standards. It assumed only that older cars would be replaced. In practice, emissions per vehicle are likely to decrease at a greater rate than that assumed in the EIS.

The modelling for the EIS examined an extreme congestion case to assess the air quality outcomes under whatever configuration was offered for the tenderers. It was assumed that this case occurred every day and the numbers in the Reference Project relate to this.

BC modelled 'normal' tunnel operating conditions. In addition, an 'extreme congestion' case was also modelled in relation to short-term goals only for this case, on the basis that modelling long-term goals with congested emission rates would overestimate long-term concentrations. This is a reasonable less conservative approach than that taken in the EIS assessment.

Table 3 also shows the total daily emissions and peak hour emissions for the Reference Project as well as the total daily emissions for the Changed Project under normal and congested operating conditions and the peak hour emissions for congested mode. The total daily emissions in congested mode for the Changed Project were similar to or higher than the total daily emissions for the reference project. However, the congested emissions were used to estimate the short-term impacts only for the Changed Project.

Table 3 shows the highest ground-level pollutant concentrations that are predicted in the study area due only to the emissions from the tunnel ventilation outlets. The results for the Reference Project are compared with those for the Changed Project. These are the highest concentrations due to the ventilation outlets predicted in the study area. In most areas the concentrations due to ventilation outlets would be much lower than these concentrations.

Despite the differences in the modelling approaches and the resulting differences in calculated emission rates between the Reference Project and the Changed Project, the findings are that the predicted concentrations would all be well below the air quality goals set by the Coordinator-General's conditions. The data also show that the contribution that tunnel ventilation outlet emissions make to the total concentration in the ambient air is a small fraction of the air quality goal.

Table 3 - Highest Modelled Ground-Level Concentrations due to VSOs

Pollutant and averaging time	2012	Relevant air quality goal
Reference project EIS maximum GLC		
Maximum 8-hour average CO (mg.m ³)	0.1	10
Maximum 1-hour average NO ₂ (µg/m ³)	15	246
Annual average NO ₂ (µg/m ³)	0.5	62
Maximum 24-hour average PM ₁₀ (µg/m ³)	0.5	50
Annual average PM ₁₀ (µg/m ³)	0.1	30
Changed Project Bowen Hills @ 30m		
Maximum 8-hour average CO (mg.m ³)	0.09	10
Maximum 8-hour average CO (mg.m ³) congested	0.24	10
Maximum 1-hour average NO ₂ (µg/m ³)	18.15	246
Maximum 1-hour average NO ₂ (µg/m ³) congested	29.75	
Annual average NO ₂ (µg/m ³)	0.27	62
Maximum 24-hour average PM ₁₀ (µg/m ³)	0.47	50
Annual average PM ₁₀ (µg/m ³)	0.06	30
Changed Project Kedron @ 30m		
Maximum 8-hour average CO (mg.m ³)	0.068	10
Maximum 8-hour average CO (mg.m ³) congested	0.15	10
Maximum 1-hour average NO ₂ (µg/m ³)	6.01	246
Maximum 1-hour average NO ₂ (µg/m ³) congested	7.52	10
Annual average NO ₂ (µg/m ³)	0.14	62
Maximum 24-hour average PM ₁₀ (µg/m ³)	0.37	50
Annual average PM ₁₀ (µg/m ³)	0.03	
Changed Project Clayfield @ 30m		
Maximum 8-hour average CO (mg.m ³)	0.15	10
Maximum 1-hour average NO ₂ (µg/m ³)	36.42	246
Annual average NO ₂ (µg/m ³)	0.15	62
Maximum 24-hour average PM ₁₀ (µg/m ³)	0.34	50
Annual average PM ₁₀ (µg/m ³)	0.03	
Changed Project Clayfield @ 25m		
Maximum 8-hour average CO (mg.m ³)	0.16	10
Maximum 8-hour average CO (mg.m ³) congested	0.37	10
Maximum 1-hour average NO ₂ (µg/m ³)	45.53	246
Maximum 1-hour average NO ₂ (µg/m ³) congested	64.9	246
Annual average NO ₂ (µg/m ³)	0.19	62
Maximum 24-hour average PM ₁₀ (µg/m ³)	0.41	50
Annual average PM ₁₀ (µg/m ³)	0.03	

Modelling undertaken for the Changed Project also included a reduction in the height of the Clayfield ventilation structure from 30m in the Reference Project to 25m in the Changed Project. Overall, the results indicate that the change in design and reduction in the height of the Clayfield ventilation outlet would not substantially affect the air quality impacts.

4. CONCLUSIONS

The potential air quality impacts of the Changed Project have been reviewed and compared with the Reference Project. It is concluded that the design and operation of the Changed Project is unlikely to result in any air quality or health impacts beyond those determined in the EIS. The EIS impacts were found to be within acceptable levels.

5. REFERENCES

Air Noise Environment (2008)

“Airport Link – Air Quality assessment of Ventilation Station Outlets” prepared by Air Noise Environment Pty Ltd, 3/4 Tombo Street, Capalaba Qld 4157, January 2008