Airport Link

REQUEST FOR PROJECT CHANGE

GREENHOUSE GAS ASSESSMENT

- 26 May 2008

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
Change Report Issue	**26th May 2008**	**Dr Ken Robinson**	**P Zahnleiter**	**26th May 2008**	**-**

File name:	**AL_Traffic_Report_Changed_Project.doc**
Name of organisation:	**City North Infrastructure**
Name of project:	**Airport Link Request for Project Change**
Name of document:	**Greenhouse Gas Assessment**
Project number:	**QE07309.623**

Contents

1. Greenhouse gases

1.1 Introduction

A greenhouse gas inventory has been prepared for the construction and operation of the Changed Project, to provide an indication of the relative benefits and impacts of the project and as a comparison with the Reference Project.

The potential changes in vehicle contribution to greenhouse gas emissions between the Do-minimum scenario and the delivery of the Changed Project were investigated. The results were compared with the Reference Project.

To place energy usage in context, AGO (2005b) has calculated that in 2002 Queensland emitted 145.1 Mt CO2-e, consisting of 44.1 Mt CO2-e from electricity generation and 16.8 MT CO2-e from transport sources. The balance comes from industrial, agriculture and other sources.

The AGO Factors and Methods Workbook (AGO, 2005) were used in the preparation of the greenhouse gas inventory for the projects. The relevant emission factors are summarised in **Table 1**.

Table 1 – Emission factors for greenhouse gases

Source	Emission factor
Electricity end use (Qld)	1.058 kg CO2-e / kWh
Automotive diesel oil (diesel)	2.7 t CO2-e / kL
Automotive gasoline (petrol)	2.5 t CO2-e / kL

Source AGO (2005)

1.2 Construction

1.2.1 Construction works

Diesel and electrical power consumption estimates for the construction of the Airport Link project over 4 years are summarised as:

- Reference Project: 90 ML of diesel consumption and 62 million kWhr of electricity consumption

The greenhouse gas emissions from these energy consumption figures were estimated as:

- Reference Project: 0.31 Mt CO2-e

No direct information is available to allow comparison between the Changed project and the Reference Project. It is likely, however, that the differences between the projects would be small, given the similarity in alignment, construction method and timing. In both cases the greenhouse gases emitted would be about 0.3 Mt CO2-e over 4 years, and the proportion of greenhouse gases emitted would be 0.075 / 145.1 = 0.05% of the greenhouse gases emitted in Queensland in any one year.

1.2.2 Spoil haulage

To provide a quantitative comparison of greenhouse gas emissions between the Changed Project and the Reference, greenhouse gases emitted due to spoil haulage were assessed. Fuel usage and hence greenhouse gas emitted by spoil transport were estimated for the Changed Project and compared with the Reference Project. The results are shown in **Table 2**.

- **Table 2 – Fuel usage and greenhouse gas emissions from spoil haulage**

Reference Project		
Truck movements	248,000	
Distance travelled (km)	24	
Total VKT (km)	5,952,000	
Fuel usage (ML)	3.3	
GHG emissions (t CO2-e)	8640	
Changed Project with Toombul conveyor		
Truck movements	301,000	
Distance travelled (km)	12	
Total VKT (km)	3,612,000	
Fuel usage (ML)	2	
GHG emissions (t CO2-e)	5286	
Changed Project without Toombul conveyor	**Road header and cut and cover spoil by truck from all sites**	**TBM spoil by truck from Toombul site**
Truck movements	301,000	80,000
Distance travelled to spoil placement site (km)	12	4
Total VKT (km)	3,612,000	173,440
Fuel usage (ML)	2	0.1
GHG emissions (t CO2-e)	5286	468
GHG emissions (t CO2-e) (total)	5754	

Table 2 shows that greenhouse gas emissions from spoil haulage by truck is significantly less for the Changed Project (5286 tonnes CO2-e) compared with the Reference Design (8640 tonnes), due primarily to the shorter haul distance to spoil placement sites at BAC land compared with the Reference Design location at Fishermans Island and despite the much larger amount of spoil and hence truck movements required.

If the conveyor for TBM spoil from the Toombul site is not used, truck haulage would be greater for the Changed Project but still significantly less in terms of greenhouse gases emitted than the Reference Design.

It should be noted, however, that the use of the conveyor instead of trucks for TBM spoil from the Toombul site will result in a more greenhouse gases emitted. The conveyor power usage would be 500 MW at 70% loading. As it would operate over about 9 months, its power consumption would be about 2,116,800 kWhr. From Table 1 the CO2 produced is 1.058 kg/kWhr and would total about 2,239 tCO2-e.

Greenhouse gas emissions from energy usage for the preferred spoil transport from the Changed Report is 5286 (truck movements) + 2239 (conveyor usage) = 7525 tonnes CO2-e. This is still less than the 8640 tonnes CO2-e for the Reference Project and demonstrates an improved greenhouse performance for the Changed Project over the Reference Project.

1.3 Operation

1.3.1 Tunnel Operations

The estimated energy consumption and Greenhouse gas emissions during operation for the Reference Project and the Changed Project are shown in **Table 3.**

Table 3 – Energy consumption and greenhouse gas emissions during operations

Project	Energy Usage	Greenhouse gas Emissions
Reference Design	32 GWhr / year (mainly tunnel ventilation)	0.034 Mt CO2-e /year
Changed Project	68 GWhr / year (ventilation only) 95.6 GWhr / yr (total)	0.072 Mt CO2-e /year 0.101 Mt CO2-e /year

A direct comparison of total energy usage per year between the Reference Project and the Changed Project shows a significantly higher requirement and hence greenhouse gas emission level for the Changed Project. In the context of electrical energy usage and greenhouse gas production, this is low (0.101 / 44.1 = 0.2%) compared with the annual electrical energy usage and gas production in Queensland.

1.3.2 Road Network Performance

The delivery of the project may affect road network performance and therefore greenhouse gas emissions from Brisbane's vehicle fleet.

Aside from engine fuel efficiency modifications, greenhouse gas emission reductions may arise by either reducing vehicle kilometres travelled (VKT) for the network or improving the flow of traffic which improves the fuel efficiency of vehicles. For the purposes of this assessment, the efficiency of the road network was assumed to be reflected in a comparison of projected VKT with and without the project. The difference in VKT between "with project" and "without project" (also referred to as "do minimum") is shown in **Table 4** for both the Reference Project and Changed Project. The difference in VKT for the Reference Project is different from the results shown in the EIS as the modelling was undertaken using an updated BTSM based Airport Link strategic model.

- **Table 4 - Changes in VKT compared with Do-minimum for both projects**

	Reference Project	Changed Project
2012		
AWDT	79,000 km	67,000 km
Annual	26,070,000 km	22,110,000 km
2026		
AWDT	56,000 km	48,000 km
Annual	18,480,000 km	15,840,000 km

Notes: AWDT = Average weekday daily traffic. Annual = AWDT x 330

In 2012 and 2026 the Changed project will have a smaller increase in VKT on the network than the Reference Project, although the increases in VKT for both projects compared with the do minimum are about 0.1% of the VKT travelled across the Brisbane road network in those years.

The greenhouse gas emissions from vehicles were determined using the following assumptions:

- The vehicle fleet consists of 95% passenger cars and 5% heavy vehicles (4% rigid or medium trucks and 1% heavy or articulated trucks);
- Fuel consumption rates per kilometre are described from AGO (2005) (described in **Table 5**); and
- All heavy vehicles use diesel and small vehicles use petrol.

- **Table 5 – Fuel consumption rates**

Source	Fuel	Fuel consumption
Passenger car	Petrol	0.107 L/km
Medium trucks	Diesel	0.283 L/km
Heavy trucks	Diesel	0.542 L/km

The difference in greenhouse gases emissions as a result of changed network performance on the Brisbane road network due to the implementation of the Reference project or the Changed Project is shown in Table 6.

- **Table 6 - Differences in greenhouse gas emissions against do-minimum (tCO2-e / yr)**

Year	Reference Project	Changed Project	Differences between Projects
2012	+7803	+6618	1185
2026	+5532	+4741	791

The smaller increase in VKT against do-minimum for the Changed Project versus the Reference Project means a smaller increase in greenhouse gases emitted. The Changed Project would result in a smaller increase in

greenhouse gases emitted than the Reference Project. The Changed Project has a better performance than the Reference Project in terms of greenhouse gas emissions from the road network operation.

The results show there will be a small increase in greenhouse gas emissions for both projects due to an increase in VKT. The calculation methodology is conservative as it does not account for any improvement as a reduced road congestion that is likely to result along main major surface roads. Fuel consumption per vehicle under congested traffic conditions is approximately twice that under free-flow conditions (BTE, 2000).

It is likely that the implementation of the Airport Link Project would result in improved energy efficiency within Brisbane's vehicle fleet compared with the no project case. The performance in this regard would be better for the Changed Project than for the Reference Project.

1.4 Conclusions

No information is available to allow a direct comparison of energy usage during construction between the Changed Project and the Reference Project. It is likely, however, that the differences between the projects would be small, given the similarity in alignment, construction method and timing. In both cases the greenhouse gases emitted would be about 0.3 Mt CO2-e over 4 years, and the proportion of greenhouse gases emitted would be about 0.05% of the greenhouse gases emitted in Queensland in any one year.

A small proportion of the construction energy usage would be due to spoil transport. Greenhouse gas emissions from energy usage for the preferred spoil transport from the Changed Report is 7525 tonnes CO2-e, which is less than the 8640 tonnes CO2-e for the Reference Project and demonstrates a relatively better greenhouse performance for the Changed Project over the Reference Project.

A direct comparison of total operational energy usage per year between the Reference Project and the Changed Project shows a significantly higher requirement and hence greenhouse gas emission level for the Changed Project. In the context of electrical energy usage and greenhouse gas production, this number is still low (0.2%) compared with the annual electrical energy usage and associated greenhouse gas production in Queensland.

The changes in road network performance for the operation of the Changed Project versus the Reference Project would mean a smaller increase in greenhouse gases emitted and hence a better performance than the Reference Project. The results show, however, there will be a small increase (0.1%) in greenhouse gas emissions against the do-minimum option (if the project was not built) for both projects due to a small increase in vehicle kilometres travelled (VKT). The calculation methodology used was conservative as it does not account for any improvement as a reduced road congestion that is likely to result along main major surface roads. Fuel consumption per vehicle under congested traffic conditions is approximately twice that under free-flow conditions. On this basis, it is likely that the implementation of the Airport Link Project would result in improved energy efficiency within Brisbane's vehicle fleet compared with the no project case and the performance in this regard would be slightly better for the Changed Project than for the Reference Project.