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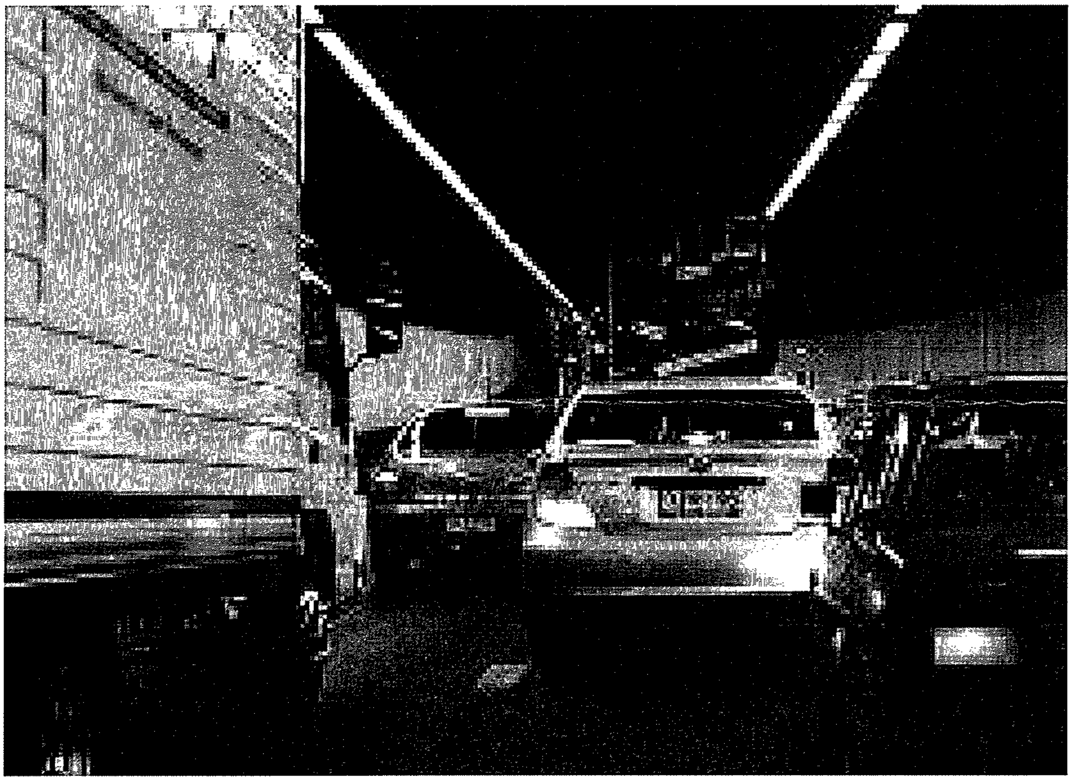
SUBMISSION - NORTHCONNEX



9/8/2014 Engineer/Wahroonga Resident: Lin Ma

SUBMISSION - NORTHCONNEX

NorthConnex EIS Submission

8 September 2014

Director - Infrastructure Projects
Department of Planning and Environment
Number: SSI 13_6136
Major Projects Assessment
GPO Box 39
SYDNEY NSW 2001

Via online form:
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6136

NorthConnex Application Number: SSI 13_6136

Please find below my submission in response to the exhibition of the EIS for NorthConnex.

1. Executive Summary

First, I would like to state we **object** to the project as described in the EIS.

I have a high level of concern regarding the following issues and request that these be considered by NorthConnex and the Department of Planning. In regards to the NorthConnex tunnel, I am concerned about:

- The placement of the northern ventilation stack in the centre of a densely populated residential area in Wahroonga, where 9,300 school children will be exposed, as well as multiple aged care facilities, hospitals, businesses and homes.

- I am concerned about the EIS underestimated tunnel vehicle emission, and that the Air Quality design analysis A inadequately satisfied the claimed tunnel capacity.

- The placement of the northern ventilation stack in the Wahroonga valley where there are often low wind speeds will result in poor dispersion and community exposure to high levels of tunnel emission. A majority of heavy air pollution will have gravitation sedimentation within a distance of 50m to 1500m around the stack

- I am concerned about the project including future provisions for portal emissions in densely populated areas, which will result in emissions remaining at ground level, and hence expose the local population to pollutants. The zero portal emission is practically impossible. Realistically, the portal emission is likely to be around 8% of total emission & this is unavoidable.

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- I am highly concerned about the multiple large scale research studies that suggest the impacts of air pollutants on health are serious. This exposure represents major ongoing health risks, including cancer and chronic lung disease.

- I am concerned that a full and transparent options assessment process was not undertaken to assess alternative designs for the project. Unlike other tunnel projects in Sydney there are alternatives for locating the stack and portals in non-residential areas.

- I am proposing a cost-effective alternative 'cut & cover' tunnel extension (refer to the attached design conceptual sketches) for relocation of Northbound portal & stack into bush land & industrial zone.

2. Instruction

My name is Lin Ma, a professional civil/structural engineer with more than 20 years of experience & a resident of Wahroonga. I have been previously involved in the design & construction of a number of tunnel projects inclusive but not limited to the Eastern Distributor, micro-tunnels in Western Corridor Recycle Water Scheme in SE Queensland, New Southern Railway International/Domestic Terminals and Sydney Harbor Tunnel & the Western Harbor Crossing in Hong Kong. I have reviewed the NorthConnex Environmental Impact Statements particularly Volume 3 which describes the air quality and human health risk assessment. I would like to express my high level of concern on the tunnel vehicle emission calculation, the northern stack pollution and possible portal emission in the middle of the Wahroonga residential zone. I would like to strongly recommend and an alternative 'cut & cover' tunnel extension to resolve these issues.

3. Air Quality

3.1 EIS underestimated tunnel vehicle emission

NorthConnex Project overview clearly states that the NorthConnex would take 5,000 trucks off Pennant Hills Road each day, and it would have capacity to carry more than 100,000 vehicles per day (50,000 in each direction). However the EIS emission calculation misleadingly used the figure of 19,500 vehicles per day per direction as the basis for their calculation. Refer to Appendix A for the handwritten calculations in relation to the EIS "Predicted tunnel traffic flow –northbound" in 2029.

In my professional opinion, the EIS vehicle emission has been underestimated by using the figure of 19,500 daily vehicles in lieu of 50,000 daily vehicles. Therefore, the purported EIS calculation is not only unreliable but raises the concern whether it accurately includes the "5,000 [daily] trucks off Pennant Hills Road".

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3.2 Air quality modelling - design analysis A was inadequate to meet the tunnel capacity

The EIS Air Quality Executive Summary states that the Design analysis A is a theoretical worst case scenario with 4,000 passenger car units per tunnel, refer to page 34 of the Summary.

I independently assessed the calculations contained in the Summary and have found that the EIS calculations underestimate the vehicle emission for the claimed tunnel capacity by a factor of 1.5.

I will now describe the steps that I performed to reach this conclusion. The below calculations are evidenced and can be found in Appendix B.

First, I converted the emission rates from g/s to kg/day, as I believe this is a more transparent reflection of results which a reasonable member of public will be able to understand. In Design Analysis A, I totaled the emission rates of CO, NOx, PM10 & PM2.5 (g/s) to be 10.4g/s which is equivalent to 900kg/day.

Next, I assumed the emissions were calculated for all passenger cars & diesel trucks in a ratio of 8:1 (as suggested on page 1 of the NorthConnex Project Overview which states "Pennant Hills Road currently carries around 80,000 vehicles including more than 10,000 trucks per day"). Assuming the NorthConnex has capacity to carry more than 50,000 vehicles in each direction per day, I assumed a hypothetical vehicle capacity of 43,750 passenger cars and 6250 diesel truck per day (ratio 8:1).

Next, in accordance with *The World Road Association-PIARC* 2012 Emission Factors for Australia, I recalculated the following emissions with reasonable speeds and a conservative gradient in Northbound. I found that total vehicle emissions for 43,750 cars and 6250 trucks is approximately **1400kg/day** or **1.4ton/day**. This is inclusive of 29kg/day of PM10 and PM2.5, which is an alarming figure.

Finally, the comparison of my calculation of 1400kg/day in vehicle emission to the EIS Design analysis A of 900kg/day, I believe the EIS Analysis underestimates vehicle emission by a factor of 1.5.

3.3 Stack Pollution

The placement of the Northern ventilation stack in the Wahroonga valley where there are often low wind speeds, in particular on calm days with average wind speeds of 2 to 5 km/hour, which will result in the poor dispersion of air pollution and high emission exposure to the community. I have calculated that the majority of heavy air pollutions will have gravitation sedimentation within a distance of 50m to 1500m around the stack, refer to Appendix C - Simplified Calculation for Air Pollution Gravitational Sedimentation around Stack.

In my calculations, I have applied basic theories of Physics and my engineering experience. I acknowledge my calculation of the dispersion and travel distance of air pollution is simplified however it gives a reasonable indication as to the true consequences of the pollution produced by the NorthConnex Stack, refer to Appendix C.

The basis of my calculation rests on the scientific densities of the primary pollutants in air pollution. These have average densities of CO=1.2kg/m^3, NO2=1.9kg/m^3 and the density of small aerosols of PM10 & PM2.5 is between 1500kg/m^3 & 2360kg/m^3. Pollutants will gravitationally sediment as they have a higher density than natural air (1.2kg/m^3).

3.4 Portal Emission

I am concerned about the project including future provisions for portal emissions in densely populated areas. In my professional opinion, the zero portal emission is technically impossible, I believe the portal emission is likely around 8% of total emission & unavoidable in reality e.g. M5 East Portals. Please refer to Appendix D-Simplified spreadsheet calculation for portal emission, which I have briefly summarized below:

- Vehicle emission within last 300m distance is equivalent to 3.33% of total 9km tunnel emission

- Average volume ratio drawn by vehicle/fan capacity is 4.6% at axial fan location 300m from portal; please notice the exit vehicles will also create a proportion of air release whining the negative pressure zone generated by fans.

- Total portal emission is likely around 8% of total tunnel emission

4. Human Health Risk Impacts

I am highly concerned about the multiple large scale research studies that suggest the impacts of air pollutants on health are serious. These include increased death from heart disease, increased risks of lung cancer, stroke, poor lung growth in children, increased asthma, and recent research suggesting low birth weight for pregnant women, increased autism, and congenital heart defects. These studies confirm air pollutants have prothrombotic and inflammatory effects on humans which cause the above health problems.

I am concerned about the large amount of diesel emissions which will be emitted from the NorthConnex tunnel, as it is being designed for heavy freight to bypass Pennant Hills Rd. Diesel emissions have been classified as carcinogenic by the World Health Organisation, and also contain a larger number of fine particles which penetrate deep into lung tissue and remain there causing inflammation.

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5. Alternative design

Importantly, I would like to propose an alternative 'cut & cover' tunnel extension & relocate Northbound portal & stack into bush land & industrial zone, please find the attached "Appendix E- Alternative 'Cut & Cover' Tunnel" design sketch for your consideration. I have briefly listed some advantages of my alternate design below:

- Flat tunnel to minimize emission & increase energy efficiency which ought to be in the NorthConnex first instance. Therefore I propose the last portion of Northbound tunnel to be as flat as possible to avoid any vertical bend in the transition zone between the driving & 'cut & cover' tunnels. This has should be a lesson learnt from the design mistakes in the M5 Tunnels.

- Use the 'cut & cover' concept to further extend Northbound portal & stack into industrial & bush land zone.

- Basically use existing freeway as a tunnel base & build walls/roof 'cover' to facilitate mechanical ventilation or rooftop for landscape/solar energy.

- Existing freeway at North Wahroonga has sufficient minimum 36m width to accommodate the 'cut & cover' tunnel in the middle of aisle as shown on section A-A, and provide advantage to access tunnel at side walls for all fire emergence(EIS does not consider currently).

- The precast walls & roof structures could be 1/4 cost of drilling tunnel per km, the structural cost of 1.3km 'cut & cover' tunnel could be about $50million, which provides budget allowance to keep all Northbound portal/stack away from residential zone.

- The remaining existing freeway between the Pacific Highway and Junction Bridge should remain as is for any future increased traffic flow.

6. Conclusion

To address my concerns I request that the following actions are undertaken:

- The air quality on vehicle emission shall be reassessed in line with the proposed tunnel capacity 50,000 vehicles per day, and human health impact assessment need to be revised to address the issues raised above.

- An independent options assessment process should be undertaken to assess the above proposed alternative 'cut & cover' tunnel extension & relocated the Northbound ventilation stack and portal into bush land & industrial zone.

- A long term health study on children and residents in areas impacted by stack discharges be included as part of the conditions of approval.

- A comprehensive air quality monitoring program is developed and implemented.

- An independent review of the ventilation system is undertaken to ensure that NorthConnex's claim of no portal emissions is justified. Portal emissions from NorthConnex in the future are banned.

- The Submissions Report/Preferred Project to be publically exhibited to allow the community to respond to the revised information contained in the report.

- I note that the Department of Planning and Environment does not approve the project in its current form as it clearly does not meet the principles of Ecologically Sustainable Development as required by the Environmental Planning and Assessment Act.

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Address: 32 Lochville Street, Wahroonga 2076 NSW

Signature:

APPENDIX A

4.2.8.3 Emissions from surface roads

The forecast vehicle numbers for the surface roads potentially affected by the project were based on outputs from the strategic traffic model and traffic surveys conducted in December 2013 (refer to technical working paper: traffic and transport (AECOM, 2014). Turning movements at each of the road junctions on the network were also provided for morning and afternoon peak periods, and factors provided to allow determination of 24 hour representative traffic flows. The surface roads surrounding the project and the existing Pennant Hills Road corridor were converted to 335 road links with associated gradients, which were entered into the CAL3QHCR model. Hourly pollutant emission rates were estimated for each road link, representing combined emissions from the different vehicle types (passenger cars, light vehicles and heavy vehicles). Pollutants were modelled for both the opening year (2019) and 10 years after opening (2029) using meteorological data from 2009, 2010 and 2011 to capture the likely meteorological conditions.

CAL3QHCR does not include $PM_{2.5}$ as a modelling species. The concentrations of PM_{10} estimated by the CAL3QHCR model were multiplied by 0.95 (the maximum ratio of $PM_{2.5}$ to PM_{10} calculated for the tunnel emissions as described in **Section 4.2.7.1**) to estimate $PM_{2.5}$ pollutant concentrations at each receiver.

4.2.8.4 Emissions from the project tunnels

The number of vehicles within the northbound and southbound tunnels would vary throughout a 24-hour period and, subsequently, the level of pollutant emissions associated with vehicle movements would vary. Forecast hourly traffic data, including heavy vehicle percentages and vehicle speeds for each tunnel for the opening year of the tunnel and 10 years after opening (2019 and 2029, respectively), are shown graphically in **Figure 9** and **Figure 10**, which illustrate the forecast increase in traffic flows between 2019 and 2029 assessment years for the northbound and southbound tunnels.

For 2019, the predicted percentage of heavy vehicles varied hourly, and ranged from 28.0 per cent to 28.5 percent for the northbound tunnel and from 27.8 per cent to 28.6 per cent in the southbound tunnel.

For 2029, the percentage of heavy vehicles ranged from 24.5 per cent to 25.0 per cent in the northbound tunnel and from 24.5 per cent to 25.2 per cent in the southbound tunnel over the course of a 24 hour period.

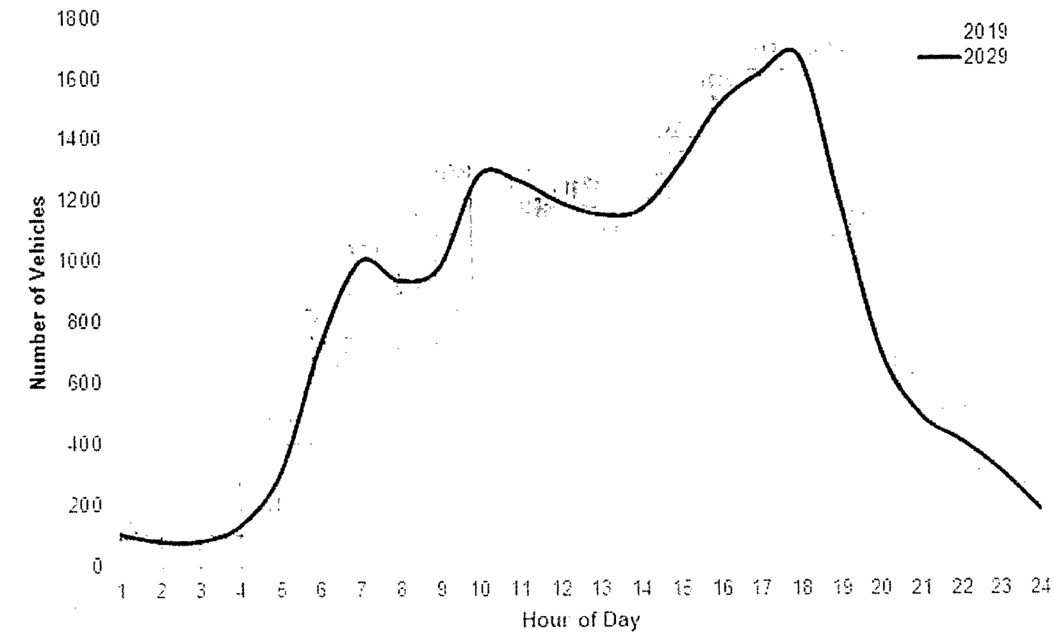


Figure 9 Predicted tunnel traffic flows – northbound = [illegible]

NOTE: A SUMMARY OF UNDER GRAPH AREA FOR 2029 = 17500 VEHICLES/DAY WHICH IS FAR LESS THAN THE TUNNEL CAPACITY [illegible] VEHICLE/DAY

Appendix B - Comparison with EIS Design Analysis A with 4000 Passenger car units & NorthConnex Tunnel Vehicle Capacity

Q1. Does air quality design analysis A underestimate total vehicle emission?

1: EIS - Air qulity Executive Summary states Design analysis A as a theoretical worst case scenario with 4,000 passgenger car units per two lane main alignment tunnel(on air qulaity page 34)
I assumed total Emisions were calculated from all passenger cars + emissions from these diesel Heavy good vehicles in 1:8 proportion
Design Analysis A - Emission rates (g/s) was subtracted from air qulaity Appendix H -Emision calculations(below)

Design analysis A - daily emission as summed below:

	Average emission rates(g/s)	Average daily rate (kg/day)	
CO	3.899g/s	336.9kg/day	
NOx	5.468g/s	472kg/day	
PM10	0.3229g/s	27.83kg/day	
PM2.5	0.3057g/s	26.4kg/day	
TVOCs	0.3916g/s	33.8kg/day	
Total Emissions	10.4g/s	897kg/da\ approx =	900kg/day

That was unconservative with assumption of all fresh intake air, but the fact is these air intake from M2 interchange was unclean & polluted air

1.1: NorthConnex would have capcity to carry more than 100,000 vehivles per day(50,000 in each direction)

In accordance with current 1:8 of Truck to Vehicles ratio at Pennant Hills Rd
So I assumed its vehicle capcity has No. of 43,750 passenger cars & No of 6,250 diesel heavy good trucks per day
In accordance with current PIARC emision factors for Australia, the following Emissions were calculated below:
43, 750 Passenger Cars with assumption of speed 80km/h & average gradient 0%(which is conservative in Northbound)

Type of emission	Emission fator(g/h)	Time (hour) in 9km tunnel	No. of cars	emission(g/day)	Emission(kg/day)		
CO emission =	161	0.1125	43750	792422 =	792 kg/day		
NOx emission =	30	0.1125	43750	147656 =	148 kg/day		
PM emission was not listed in current PIARC emisoin factors for somereason							
6,250 disesl heavy good trucks with assumption of speed 80km/h & average gradient 0%							
CO emission =	98.9	0.1125	6250	69539 =	70 kg/day		
NOx emission =	499.4	0.1125	6250	351141 =	351 kg/day		
PM emission =	87.7m2/h *0.1125*6250/4.7			12072g =	12 kg/day		
PM from no exhaust in PIARC technology standard A table 27 =			0.028g/km*9*43,750+0.104g/km*9*6250=		16.9 kg/day		
Total emission of 50,000 vehicles per day					1390 kg/day	=	1.39 ton/day

In comparision of EIS Design analysis A & tunnel capacity 50,000 vehivles per day = 900kg/139kg = 65% lower or 1.5 time different

Conclusion - EIS Design Analysis A was 1.5 time underestimated total emission for tunnel capacity

Appendix C - Simplified Calculation for Air Pollution Gravitational Sedimentation around Stack

Assumed air release speed at stack(from EIS)	**U (m/s) =**	-15			**Assumed average wind speed (m/s)=**	2	m/s		
Assumed natural air densiy at 20 degree	**r of air kg/m3**	1.204	**F=ma**						
Assumed height of Stack m(from EIS)	**H (m) =**	15	**SW-Fair=ma**	**Fair: air buoyancy force**					**St=Ws*T**
Acceleration of gravity	**g m/s^2**	9.8	**V= U + a*t V at rest =**	**0**	**V^2=U^2 +2*a*S1**	**St=S1+H**	**St=V*t+1/2*a*t2**		**St-total air pollution**
Assumed polluted air density with PM heaver than air g/m^3			**a (m/s^2)**	**t1 time to rest in sec**	**vertical dist S1 (m)**	**total St(m)**	**t2 time to ground**	**toatl time T= t1 + t2 (sec)**	**travel distance (m)**
Polluted air density	1	2.36	4.800	3.1	23.4	38.4	4.0	7.1	14
Polluted air density	2	2.197	4.428	3.4	25.4	40.4	4.3	7.7	15
Polluted air density	3	2.033	3.997	3.8	28.1	43.1	4.6	8.4	17
Polluted air density	4	1.870	3.490	4.3	32.2	47.2	5.2	9.5	19
Polluted air density	5	1.706	2.885	5.2	39.0	54.0	6.1	11.3	23
Polluted air density	6	1.543	2.153	7.0	52.3	67.3	7.9	14.9	30
Polluted air density	7	1.5	1.934	7.8	58.2	73.2	8.7	16.5	33
Polluted air density	8	1.45	1.663	9.0	67.7	82.7	10.0	19.0	38
Polluted air density	9	1.44	1.606	9.3	70.0	85.0	10.3	19.6	39
Polluted air density	10	1.43	1.549	9.7	72.6	87.6	10.6	20.3	41
Polluted air density	11	1.42	1.491	10.1	75.5	90.5	11.0	21.1	42
Polluted air density	12	1.41	1.432	10.5	78.6	93.6	11.4	21.9	44
Polluted air density	13	1.4	1.372	10.9	82.0	97.0	11.9	22.8	46
Polluted air density	14	1.39	1.311	11.4	85.8	100.8	12.4	23.8	48
Polluted air density	15	1.38	1.250	12.0	90.0	105.0	13.0	25.0	50
Polluted air density	16	1.37	1.187	12.6	94.7	109.7	13.6	26.2	52
Polluted air density	17	1.36	1.124	13.3	100.1	115.1	14.3	27.7	55
Polluted air density	18	1.35	1.060	14.2	106.1	121.1	15.1	29.3	59
Polluted air density	19	1.34	0.995	15.1	113.1	128.1	16.0	31.1	62
Polluted air density	20	1.33	0.928	16.2	121.2	136.2	17.1	33.3	67
Polluted air density	21	1.32	0.861	17.4	130.6	145.6	18.4	35.8	72
Polluted air density	22	1.31	0.793	18.9	141.9	156.9	19.9	38.8	78
Polluted air density	23	1.305	0.758	19.8	148.3	163.3	20.8	40.5	81
Polluted air density	24	1.3	0.724	20.7	155.5	170.5	21.7	42.4	85
Polluted air density	25	1.295	0.689	21.8	163.4	178.4	22.8	44.5	89
Polluted air density	26	1.29	0.653	23.0	172.2	187.2	23.9	46.9	94
Polluted air density	27	1.285	0.618	24.3	182.1	197.1	25.3	49.5	99
Polluted air density	28	1.28	0.582	25.8	193.3	208.3	26.8	52.5	105
Polluted air density	29	1.275	0.546	27.5	206.1	221.1	28.5	56.0	112
Polluted air density	30	1.27	0.509	29.5	220.9	235.9	30.4	59.9	120
Polluted air density	31	1.265	0.473	31.7	238.1	253.1	32.7	64.5	129
Polluted air density	32	1.26	0.436	34.4	258.3	273.3	35.4	69.9	140
Polluted air density	33	1.255	0.398	37.7	282.5	297.5	38.7	76.3	153
Polluted air density	34	1.25	0.361	41.6	311.9	326.9	42.6	84.2	168
Polluted air density	35	1.245	0.323	46.5	348.6	363.6	47.5	93.9	188
Polluted air density	36	1.24	0.285	52.7	395.4	410.4	53.7	106.4	213
Polluted air density	37	1.235	0.246	61.0	457.3	472.3	62.0	122.9	246
Polluted air density	38	1.2325	0.227	66.2	496.4	511.4	67.2	133.4	267
Polluted air density	39	1.23	0.207	72.4	543.1	558.1	73.4	145.8	292
Polluted air density	40	1.2275	0.188	80.0	599.6	614.6	80.9	160.9	322
Polluted air density	41	1.225	0.168	89.3	669.6	684.6	90.3	179.6	359
Polluted air density	42	1.2225	0.148	101.1	758.6	773.6	102.1	203.3	407
Polluted air density	43	1.22	0.129	116.7	875.3	890.3	117.7	234.4	469
Polluted air density	44	1.219	0.121	124.4	932.9	947.9	125.4	249.8	500

Polluted air density	45	1.218	0.113	133.2	998.7	1013.7	134.2	267.3	535
Polluted air density	46	1.217	0.105	143.3	1074.7	1089.7	144.3	287.6	575
Polluted air density	47	1.216	0.097	155.1	1163.3	1178.3	156.1	311.2	622
Polluted air density	48	1.215	0.089	169.1	1268.0	1283.0	170.1	339.1	678
Polluted air density	49	1.214	0.081	185.8	1393.6	1408.6	186.8	372.6	745
Polluted air density	50	1.213	0.073	206.3	1547.2	1562.2	207.3	413.6	827
Polluted air density	51	1.212	0.065	231.9	1739.2	1754.2	232.9	464.8	930
Polluted air density	52	1.211	0.057	264.8	1986.0	2001.0	265.8	530.6	1061
Polluted air density	53	1.21	0.049	308.7	2315.1	2330.1	309.7	618.3	1237
Polluted air density	54	1.209	0.041	370.1	2775.8	2790.8	371.1	741.2	1482
Polluted air density	55	1.208	0.032	462.2	3466.8	3481.8	463.2	925.5	1851
Polluted air density	56	1.207	0.024	615.8	4618.6	4633.6	616.8	1232.6	2465
Polluted air density	57	1.206	0.016	923.0	6922.2	6937.2	924.0	1846.9	3694
Polluted air density	58	1.205	0.008	1844.4	13832.9	13847.9	1845.4	3689.8	7380

Notes:

1. For air pollution density equla to or less than natural air density will be floating or emission to atmosphere at/over the Stack
2. The above simplified calculation is the simplest method for air pollution gravitational sedimentation with assumption of homogenrous distribution in the physics theory, which is very limited to accuatrely predict dispersion of air pollution.
3. The various polluted air density with nitrogen dioxide, cardon monoxide, pm10 & pm2.5 shall be further confirmed with the poroposed air quality information around the Stack.

Appendix D - Simplifiled method to calculate Northern Portal Emission

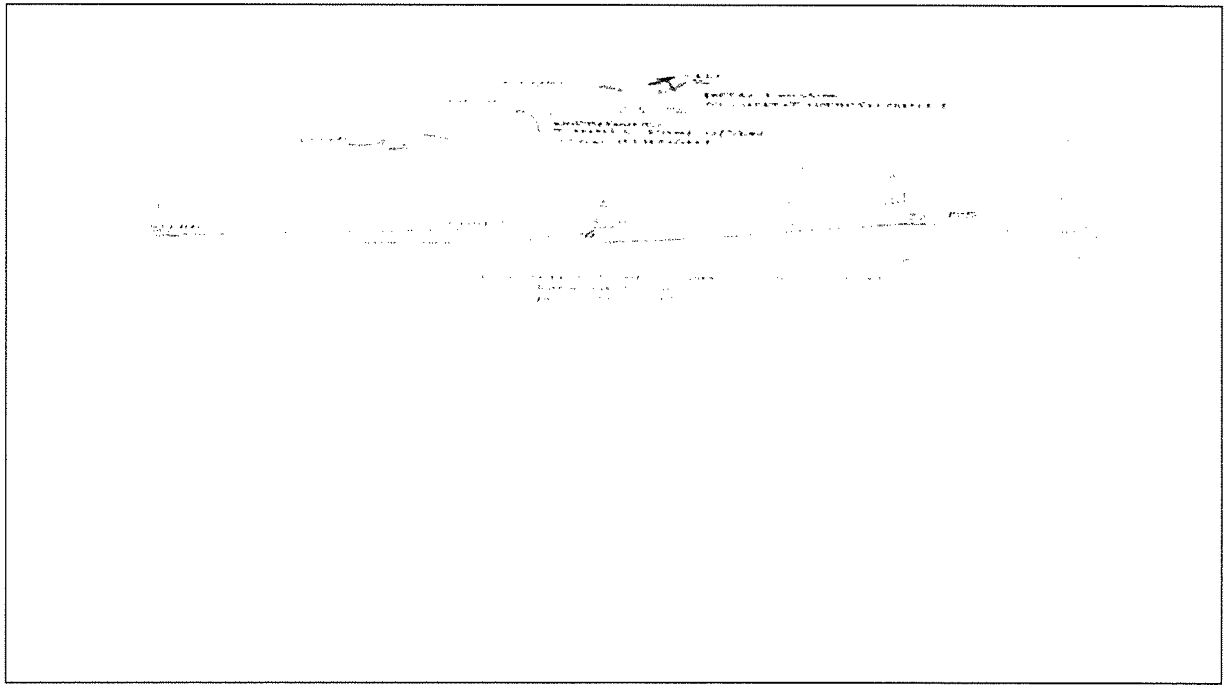
Portal emission can be considered in two components of A & B below:

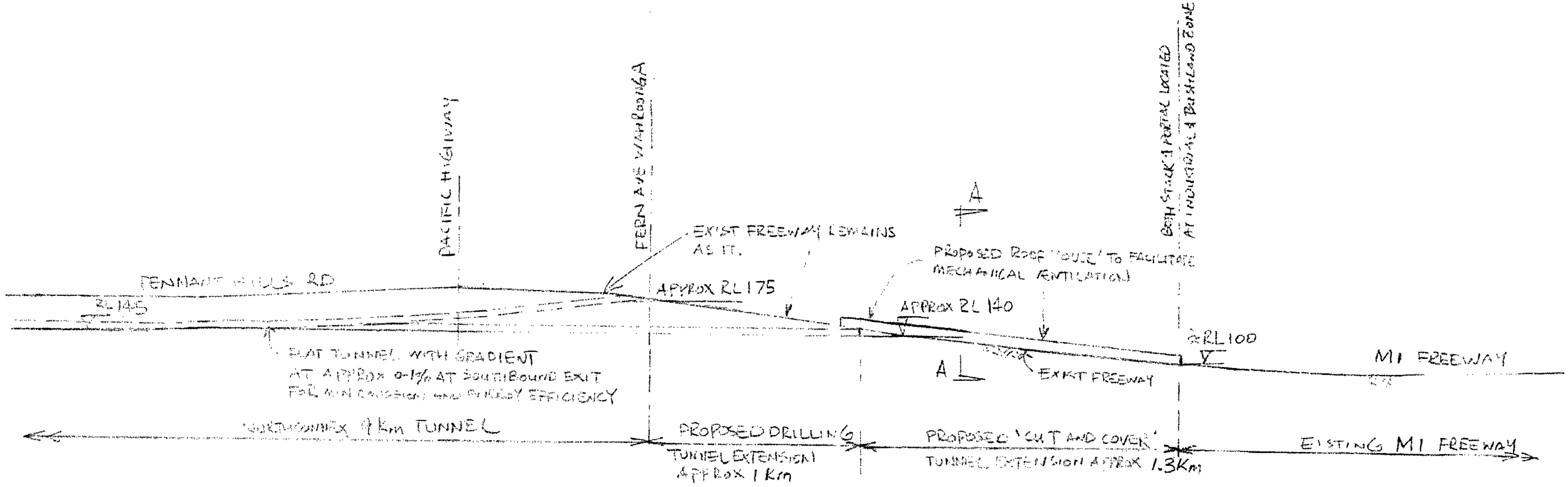
A. Vehicle emission within 300m is drawn out by exit vehicles at portal
If clost axial vent jet fans are located 300m from portal, these vehicle emission with last distance shall be drawn out by exit vehicles from portal
So that min portal emission is equivlant to 300m/9000m = 3.33% of total tunnel emission

B. Simplifiled method to calculate the volume raiot of fan capacity/exit vehicles at last axial fan location(300m away from portal)

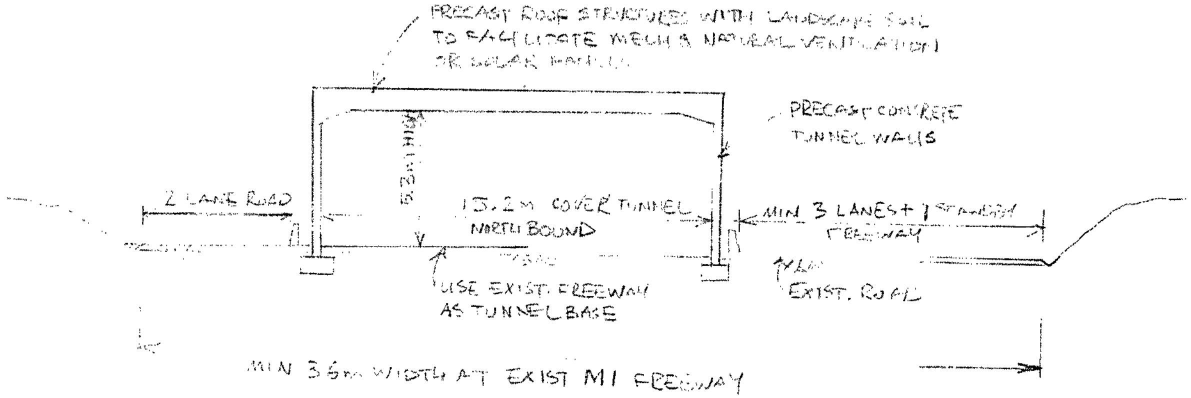
As EIS stated that max vechicle flow at 4000 passenger car units per hour in two lanel tunnel(from EIS)				
Number of Diesel trucks per hour in accordance with 1:8 ratio(from EIS)	500 trucks			
Number of cars per hour in accordance with 1:8 ratio(from EIS)	3500 cars			
Assumed average truck size = 2.5m width x 4.3 high x 12.5 length =	135 m^3			
Assumed average car size = 2m width x 1.5m high x 5m length =	15 m^3			
Total truck volumn per hour = 500 x 135m^3 =	67500 m^3/hr			
Total car volumn per hour = 3500 x 15 =	52500 m^3/hr			
Total volume of air drawn out portal by exit vehicles =	120000 m^3/hr	=	33.3 m^3/s	
Maximum fan capacity at Stack (from EIS) =	700 m^3/s			
Total air volume drawn by fans & vehicles = 700+33.3 =	733 m^3/s			
Average volume ratio drawn by vehicles = air drawn by vehicle exit/total volumn by fans and vehicles	4.55 %			

So total estimated Portal Emission = A + B = 3.33% + 4.6% = 8% approx





ALTERNATIVE TUNNEL LONGITUDINAL SECTION



SECTION A-A 1:200
AT 'CUT & COVER' TUNNEL

APPENDIX E

ALTERNATIVE PROPOSAL FOR 'CUT & COVER' TUNNEL EXTENSION AT WAHROONGA

AT 5 / 9 / 14