10 September 2014

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

NorthConnex Application Number: SSI 13_6136

Please find following my submission letter in relation to the exhibition of the EIS for the NorthConnex project.

Firstly I would like to state that I support the concept of the NorthConnex tunnel (on the assumption that this will address traffic issues along Pennant Hills Road).

However I would like to **object** to the current design of the project based on numerous concerns that I have. These have arisen from reading the NorthConnex EIS and from attending the various community meetings.

First I would like to note that the sole focus of the NorthConnex project seems to be fixing traffic issues at Pennant Hills (and the air quality in this area) and there is no regard being given to the flow-on effects in suburbs such as Wahroonga. Transurban is advertising the NorthConnex project with taglines such as “Up to 15 minutes travel time saving” (when many people affected by the tunnel – such as children - will not be using it) and overlooking the issue that this project will cause a massive shift in the location where vehicle emissions will be concentrated.

My concerns are also largely due to the fact that the design presented by Transurban does not represent a best practice or gold standard design for a tunnel. There are far superior solutions in other first world countries, such as Japan, where all road tunnels are filtered. Other countries, such as the USA, do not place tunnel ventilation stacks in residential areas. Better tunnel designs can also be seen in the other Sydney tunnels.

At 9km long, the NorthConnex tunnel will be a precedent for Australia and the Southern Hemisphere. It will carry at least 5,000 trucks and 9,000 cars per day which will make it one of Australia’s busiest motorways. It is absolutely imperative that its design is best practice for travellers of the tunnel and the surrounding community at Wahroonga which is the hardest hit by this proposal.

Based on the current design that Transurban has put forward, I am concerned about the likely serious health effects that will occur for the residents and school students at Wahroonga. These health effects are based on the multiple, large-scale research studies which have been previously conducted around the world, as well as documented evidence from other smaller tunnels in Sydney.

I request that Transurban and the Department of Planning give due consideration to my concerns which are outlined below.

1. **Proposed placement of the northern ventilation stack in Wahroonga is inappropriate for a number of reasons**

a) Wahroonga is one of the densest residential and school districts in Australia

The proposed location of the northern ventilation stack at 19 Woonona Avenue, Wahroonga, is a densely residential area and is less than 50m from homes. There is no other tunnel ventilation stack in Sydney that is so close to houses. If you assess tunnel designs from other first world countries, you will also find that tunnel ventilation stacks are normally not located so close to residential areas.

I refer to Transurban's very own independent air quality expert, Dr Gerda Kuschel, who spoke at the NorthConnex Air Quality Forum at Hornsby RSL. In her previous research and in an email I received from Dr Kuschel on 11 August 2014 on this subject, she advised that with regard to ventilation stacks, *"ideally they should be located away from residential areas".*

In Dr Kuschel's report **"Stocktake of Air Quality in and around State Highway tunnels" (April 2010)** she makes the following findings:

> *"One of the great advantages of road tunnels is the opportunity to deliberately site portals (or stacks) away from sensitive receptors so that road transport emissions may be removed from dense residential areas improving local air quality" (page 13)*
>
> *"If this localised impact is too high the tunnel air can be vented elsewhere, at a ventilation station, and possibly via a tall stack. In some cases this stack is some distance from the tunnel so that tunnel air may be vented into the atmosphere in a non-residential location" (page 13)*

These same findings were also made in **the 2008 Report "Air Quality in and around Traffic Tunnels"** by the National Health and Medical Research Council (NHMRC) (page 69 of the report).

Furthermore, and just as importantly, the proposed location at Wahroonga is one of the most densely-populated school districts in Sydney and Australia. There are 9,300 school students attending 23 schools (mostly primary schools and preschools) within close proximity of the stack.

As I outline further below, it is the young children that are at the most risk of serious health effects from vehicle emissions. It has been documented that vehicle emissions permanently impair the development of children's lungs, and that this is irreversible even after exposure to pollution ceases. The unique physiology of children, such as increased respiratory rate, also makes them more susceptible to the effects of air pollution.

There are also several aged care facilities in the area. Hornsby Hospital is just over 500m from the stack location.

As part of this email, and discussed further below, I request that Transurban assess alternative options to the current design. I understand that a feasibility study of different options has not yet been conducted.

b) The topography and climatic conditions at Wahroonga are unsuitable for the location of a (short) 23m stack

The proposed northern ventilation stack is intended to be only 23m tall. The proposed stack site of 19 Woonona Avenue, Wahroonga is in a valley. At this location, the height of the stack would not clear the surrounding terrain and emissions would be inadequately dispersed.

One of the main principles in achieving the most effective dispersion of particulate matter relates to stack height. If the proposed northern stack was substantially higher, the pollution would disperse far more effectively into the atmosphere and reduce the exposure at ground level.
To support this notion, in the **2008 Report "Air Quality in and around Traffic Tunnels"**, the NHMRC makes the following finding: *"Concentrations at ground level are significantly reduced as the height of the stack increases, and very tall stacks can have minimal to zero impact in their local vicinity" (page 74).*

Further, this report finds that:

> *"The advantages of tall stacks are also somewhat diminished if sited on valley floors. The trapping of pollutants emitted in valleys has been known for over a century. Causes for pollutant trapping include sheltering from the wind, inversions capping the valley, katabatic flow down valley sides, and interactions between these processes. For achieving the full benefits of stack venting compared to portal emissions in populated areas, especially if sensitive receptors are located above the valley or on valley slopes, stacks need to be taller than valley sides to take advantage of natural atmospheric dispersion." (page 74)*

In the EIS, Transurban chose the location for the northern stack at Wahroonga based on satellite imagery. However this only measures distances to 6m, which is insufficient detail for assessing this as the best location.

By comparison, the ventilation stack for the Cross City tunnel (2.1km long) is 65m high. The height of this stack appears to be a far better design option.

As a further point, the NorthConnex project design and the EIS relies on the assumption that optimal dispersion of particulates occurs when there is sufficient wind at the site. However the models used in the EIS do not draw on any weather data at the proposed site at Wahroonga. Instead they draw on weather stations from Sydney Airport and Terrey Hills, which are 16km and 7km away respectively, and would likely have very different climatic conditions.

I refer to the **2008 Report "Air Quality in and around Traffic Tunnels"** by the NHMRC which makes the following statements:

> *"Modelling and monitoring of dispersion at road tunnel portals have demonstrated the important role played by ambient wind speed and direction. Wind speed and direction are even more important when assessing the tunnel's contribution to air quality in the wider neighbourhood (up to ~1 km from the tunnel openings). Potential long-term effects will be biased towards areas predominantly downwind of tunnel ventilation points, according to prevailing meteorology. In addition, other locations may be impacted episodically as a result of a particular set of meteorological conditions. In any such assessments, it is important that consistent local weather patterns are considered carefully to understand the full picture. For example, a given location may have a prevailing southwesterly wind when viewed as an annual average. However, a seasonal analysis may reveal that northeasterlies are more common at a certain time of year. An understanding of consistent diurnal cycles is important for road tunnel assessment. For example, it is not uncommon for many cities to experience different prevailing wind directions and lower wind*

speeds in the morning. Thus, the most highly impacted area may not necessarily be that considered to be downwind according to annual prevailing winds. Maximum emissions may occur in the morning peak, coinciding with minimum dispersion due to lower wind speeds, with the plume directed in a different direction than the annual prevailing wind." (page 72)

I attended the Independent Doctors Forum at Barker College last week and listened to evidence provided by Associate Professor Chard who has done research in this area. He presented wind speed data compiled from Davidson (near Terrey Hills), which demonstrated a much higher wind speed than at Wahroonga, where there was virtually no wind at all. Based on this data, dispersion of particulates would not be nearly as efficient at Wahroonga as Terrey Hills (on which the EIS is based).

Another factor making the proposed site at Wahroonga inappropriate relates to the regular temperature inversions that occur in the area. Having such a low stack would mean it is far more likely for pollution to be trapped underneath the inversion and stay there for many hours in the morning until the inversion lifts. This trapped pollution would not only create further health problems but noticeable smog in the environment which would not be desirable.

This issue is also referred to in the NHMRC 2008 Report:

"Studies have shown that vertical dispersion of substances emitted at the surface is reduced in the morning due to the reduction in vertical motion and turbulence associated with nocturnal cooling of the surface. In many parts of the world, nocturnal inversions (ie when the atmosphere becomes thermally stratified, effectively putting a 'lid' on the surface layer of the atmosphere) are common. Although this is partly offset in urban areas by the release of anthropogenic and stored heat from the surface through the night, surface concentrations still remain raised relative to emissions. Even in the absence of inversions, direct measurements have shown that ventilation of the urban canopy is inhibited at night." (page 73)

This issue further contributes to the fact that dispersion of particulate matter at Wahroonga will not be effective.

To summarise, Associate Professor Chard made reference to the following principles which would improve dispersion of particulate matter:

- Having a higher vent stack
- Increased exit velocity of emissions (translating in a lower concentration at ground level)
- Reducing the diameter of the stack
- Increasing the temperate of the particulate matter to increase buoyancy.

2. <u>It is grossly inadequate to have only two ventilation stacks on a 9km long tunnel</u>

This tunnel will be the longest road tunnel in Australia and the Southern Hemisphere.

It will be a critical piece of infrastructure designed for use by generations to come.

Therefore, it needs to be designed as best as possible in the first instance (not after the fact when problems arise).

If we compare the designs of the other major road tunnels in Sydney, we find the following:

- The M5 East tunnel is 4km long, with three ventilation stacks and a 1km pipeline to pump emissions away into an industrial area.
- The Lane Cove tunnel is only 3km long and has two ventilation stacks.
- The Cross City tunnel is only 2.1km long and has one (very tall) ventilation stack of 65m high.

However, Transurban is proposing 9km of tunnel and only two ventilation stacks. This does not make sense. It is disproportionate to have only two ventilation stacks for such a long tunnel. To achieve more even dispersion of particulates, and based on the ratios of the other tunnels in Sydney, there ideally should be multiple ventilation stacks along the length of the tunnel (at least four or five).

This would also take the burden of pollution away from Wahroonga, which will receive more than 50% of all the vehicle emissions from 9km of tunnel (taking into account the incline at the northern end).

Having multiple stacks also has the advantage of ensuring the in-tunnel air quality is better and the tunnel is safer for vehicles. It is proposed that there will be (at a minimum) 5,000 trucks and 9,000 cars travelling in the NorthConnex per day. Using other Sydney tunnels as a guide, it is highly likely there will be regular breakdowns and catastrophic events such as a truck catching on fire. These events would contribute to spike in air pollution in the tunnel or vehicles being trapped for extended periods. By having multiple ventilation stacks, this would allow the contaminated air to be emitted from the tunnel at more regular intervals, thereby ensuring a safer tunnel environment.

3. <u>Inadequate modelling of air quality in the EIS</u>

The EIS advises that there will be a 38% decrease in air pollution along the “project corridor” (i.e. Pennant Hills Road).

However, quite inexplicably, the corresponding increase in air pollution at Wahroonga is forecast to be “negligible”.

I understand from reading the EIS that the particulate matter will be subjected to a process where it is mixed with fresh air etc. before being emitted at the northern ventilation stack.

However, various omissions made in the EIS’s air quality modelling mean that Transurban is unable to accurately calculate what the net effect on air quality will be at Wahroonga.

Some of these omissions include:

- The ambient air quality at the site of the proposed northern ventilation stack (19 Woonona Avenue, Wahroonga) has not been measured and collected for purposes of modelling for the EIS.

  The weather stations that the EIS relies on are from Lindfield and Prospect, which are 15km and 20km away respectively. At such distances, these areas would likely have far different weather patterns.

- No modelling of ultrafine particles of PM0.1 and below

  The EIS only measures particulate matter of PM10 and PM2.5, however there is no modelling of ultrafine particles of PM0.1 and below.

I believe that this is unacceptable given that one of the main purposes of the NorthConnex is to become a motorway for over 5,000 heavy trucks a day. This will only increase over time as traffic volumes increase and with the notion that trucks will be penalised for not using the tunnel.

Trucks and many cars emit diesel fumes which are the leading source of ultrafine particles. **Ultrafine particles are potentially the most dangerous particulate matter as they are breathed deep into the airways, inflaming the lungs and affecting other areas of the body. There is also a higher concentration of ultrafine particles in vehicle emissions than other particulate matter.**

The World Health Organisation classifies diesel emissions as "carcinogenic".

In its January 2013 Review Panel Report **"Understanding the Health Effects of Ambient Ultrafine Particles"**, the Boston Health Effects Institute made the following finding:

> *"Several factors - the unique physical properties of UFPs, their interactions with tissues and cells, their potential for translocation beyond the lung - have led scientists to expect that UFPs may have specific or enhanced toxicity relative to other particle size fractions and may contribute to effects beyond the respiratory system." (page 65)*

There a great body of other emerging research to demonstrate that the ultrafine particles represent the most serious air pollution risk to public health. **To exclude them from the EIS means that air pollution calculations are grossly understated.**

- The EIS does not include any modelling for worst-case scenarios such as a truck catching on fire or breakdown inside the tunnel. This is a regular occurrence in other Sydney tunnels. This would have a detrimental effect on air pollution.

Based on the issues listed above, I cannot see how the EIS can accurately quantify the net effect on air quality at Wahroonga.

I would like to request that Transurban redo the EIS modelling to provide a more accurate measure of air quality? This includes the collection of ambient air quality at the Woonona Avenue site initially, so that the full picture of "before" and "after" the tunnel is built, could be assessed.

With regards to portal emissions:

I also note that portal emissions have been built into the tunnel design and not ruled out for future use. Could you please clarify this issue? The 2008 NHMRC report found that (with reference to the M5 East): *"portal emissions have an impact on ground-level concentrations that is up to 50 times greater than if the same emissions occurred from the [35 m] stack".*

4. Adverse health effects

The current design proposed by Transurban is for the northern ventilation stack to be placed in a dense residential and school district. This will mean that more than 50% of the total vehicle emissions currently experienced along Pennant Hills Road (including 5,000 trucks per day) will be pumped out at Wahroonga, which currently receives very little pollution.

How can this possibly be justified?

The close proximity of the stack to residents and schools will mean it is highly likely that the proven documented adverse health effects from air pollution will occur at Wahroonga – but on a very large scale, given that the tunnel will be the longest in Australia and the Southern Hemisphere. There has been no medical research conducted in Australia on a tunnel this long. **The effects are likely to be dire and far worse than those currently documented.**

International air pollution experts state that there is no safety threshold to the amount of air pollution causing health impacts, hence there is no “safe level”.

Research findings from scientific literature include the following health effects from vehicle emissions:

- There is an increased risk of death in people exposed to particulate matter, even when exposure is within concentration ranges well below the present European standards.
- Air pollution causes lung cancer and is associated with bladder cancer.
- According to the World Health Organisation (WHO), there were 223,000 deaths from lung cancer worldwide in 2010 as a result of air pollution.
- WHO classifies diesel emissions as a carcinogen (cancer-causing), belonging in the “same deadly category as asbestos, arsenic and mustard gas”.
- Studies show that children suffer from impaired lung function growth which is irreversible and persists into later life even after exposure ceases, i.e. damage is permanent.
- Ultrafine particles are more toxic when inhaled than other measurable particles. They are greatly absorbed into tissues and the circulation system and are important factors in determining cardiopulmonary toxicity.
- Both short-term and long-term exposures to particulate matter are associated with a host of cardiovascular diseases including heart attacks, arrhythmias, strokes and an increased risk of death from the above cardiovascular causes.
- Residents living around tunnel ventilation stacks report more upper and lower respiratory symptoms and have lower lung volumes.
- Low birth weights are more common in pregnant women exposed to traffic pollution
- Exposure to traffic-related air pollution during pregnancy and during the first year of life is associated with autism.
- Higher levels of long-term pollution are associated with significantly faster cognitive decline, i.e. development of dementia.
- Outdoor pollutant levels correlate with those measured indoors in houses exposed to air traffic pollution.

A recent study by the OECD has found that Australia is amongst only 14 out of 34 developed countries in the world where deaths from air pollution have increased in the last five years. Between 2005 and 2010, deaths from air pollution increased in Australia by 68%. Evidence suggests that road transport is responsible for about half of these deaths.

An ongoing prospective mortality study of 1.2 million adults conducted by the American Cancer Society in 1982 demonstrated that fine particulate and sulfur-oxide air pollution were associated with an increased risk of lung cancer and death from heart and lung diseases. Each 10 microgram increase in fine particulate air pollution was associated with a 4%, 6% and 8% increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively.

The 2008 NHMRC report provides the following evidence in relation to air pollution health effects:

> *"Long-term effects [of pollutants] cited by O'Meara (2004) include decreased lung function growth in children, increased nonmalignant respiratory deaths and increased mortality from lung cancer." (page 91)*
> *"In the 'six cities' study in the United States, air pollution was positively associated with death from lung cancer and cardiopulmonary disease but not with death from all other causes. Mortality was most strongly associated with fine particulates, including sulfates (Dockery et al 1993). A re-analysis confirmed the 26% increase in all-cause mortality in the most polluted city (Steubenville, Ohio) compared to the least polluted city (Portage, Wisconsin) (Krewski et al 2005)." (page 88)*

> *"The overall association between urban air pollution and respiratory morbidity has also been investigated, including exacerbation of asthma, allergy and respiratory infections in both adults and children (Anderson et al 1997, Atkinson et al 1999, Kunzli et al 2000, Wong et al 2002, Heinrich 2003, Bernstein 2004, Chang et al 2004). In general, the literature has confirmed adverse effects, including the biological mechanisms through which PM is able to exert toxic effects (Sandstrom et al 2005). For children, although air pollution has long been thought to exacerbate minor acute illnesses, recent studies have suggested that air pollution, particularly traffic-related pollution, is associated with infant mortality and the development of asthma and atopy (Schwartz 2004)." (page 88)*

A local study of the Lane Cove Tunnel by Cowie et al on **"Respiratory Health before and after the Opening of a Road Traffic Tunnel: A Planned Evaluation" (November 2012)** made the following finding:

> *"The most consistently observed change was in residents living within a 650 m radius of the eastern ventilation stack. After the tunnel opened these subjects reported more upper and lower respiratory tract symptoms and had evidence of lower spirometric function, particularly lower FVC" (page 11)*

> *"It is possible, though, that the adverse findings are due to pollutants or size fractions other than those measured. Measurements of PM10 probably do not adequately reflect the particulate content of emissions in tunnels and some studies show that PM10 and PM2.5 do not represent TRAP as well as other pollutants such as NOx, NO2, black carbon or elemental carbon. Smaller size PM fractions that is, PM1 or PM0.1 (ultrafine particles (UFP)) are of lower mass, are present in far greater numbers, and, due to their oxidative potential, larger surface areas and ability to attach to other compounds, are considered to pose greater toxicity risks than PM10. Furthermore, elevated levels of UFP have been observed inside tunnels." (page 12)*

Local documented research evidence from the M5 East shows an increase in cases of lung cancer in the six years following the opening of the tunnel in 2001.

The report **"A review of cancer registry data in response to concerns about a possible excess of cancer associated with the emissions from the M5 East tunnel" (July 2012)** conducted by Public Health Unit, South Western Sydney and Sydney Local Health Districts Public Health, deals with this issue.

This report recommended that ongoing monitoring of this issue would be required and no real causes for the increase in lung cancer (other than the tunnel being opened) could be identified: *"None of the above*

reasons would on their own completely discount the possibility of the increase in lung cancer incidence being truly associated with air pollution from the M5 East tunnel stack and portals." (page 60)

We should keep in mind that monitoring systems on tunnels such as the M5 East and Lane Cove tunnel are not equipped to measure the effects of ultrafine particles. Therefore, how can the air quality and its full and detrimental health effects possibly be adequately assessed?
We should also keep in mind that research findings for the M5 East and Lane Cove tunnel were for much smaller tunnels with smaller levels of vehicle emissions. The NorthConnex will be three times as long as the Lane Cove tunnel.

Summary

My concern with the NorthConnex is that this will become a case study for Australian health for the future. The NorthConnex tunnel will be more than twice as long as any existing tunnel in Australia and with significantly higher levels of pollution. It is unknown how much traffic the NorthConnex will carry (at a minimum of 5,000 trucks and 9,000 cars per day which is already substantial) and this could potentially be much higher in the longer term than estimated in the EIS.

Most importantly, given the long-term nature of this project, many of the adverse health effects will not be measurable until years to come. In addition, there is not sufficient air quality monitoring equipment available to measure the full effects in the environment (such as ultrafine particles which are classified by WHO as "carcinogenic").

I would like to ask the Government and Transurban:

- **Who will be accountable/liable for any adverse health effects from the northern ventilation stack?**
- **Who will be accountable/liable when it is proven that the modelling in the EIS is incorrect?**

I understand that a full and transparent options assessment process has not been undertaken to assess alternative designs for this project.

Unlike other projects in Sydney, there are genuine, practical alternatives for locating the stack and portals in non-residential areas.

Other feasible design options include:

- Extension of the tunnel by a mere 1.5km north into the industrial area near Asquith (in line with Stokes Avenue) and venting the emissions into the national park. I understand that an example of this was presented in the 'Equilibria' proposal.

  Extension of the tunnel presents numerous benefits, including:

  - The road-tunnel gradient at the northern point would be flatter, thereby reducing emissions.
  - The portal and stack could be located far away from the nearest residential area.
  - Adverse impacts to public health would be reduced.
  - The community concern related to this project would decline and ensure it could move forward.

- Adopting a similar design to the M5 East in having an additional tunnel/pipeline to vent away the emissions into industrial land.

- Having multiple ventilation stacks along the length of the tunnel. As discussed earlier in my letter, it is reasonable to have numerous ventilation stacks on such a long tunnel (say four or five). This would also improve the in-tunnel air quality and better manage issues around vehicles catching on fire (causing a spike in pollution) or major stoppages within the tunnel.

- Filtration. All of the road tunnels in Japan (as well as many other first world countries) are filtered. Filtration is part of a gold standard design. Could filtration be built into the initial design (not retrofitted when the need arises) so that there are reduced health impacts on the public? Ideally this should be part of an overall stack redesign however there would need to be a guarantee given that it would operate permanently and not be switched off as has been the case with the M5 East.

These options are all feasible in achieving a gold standard design which Australia deserves. Traffic through this tunnel will only increase over generations to come, therefore every effort needs to be made to ensure the design is as best as possible and the public health is maintained.

I also request the following:

- The air quality and human health impact assessment be revised to address the issues raised above.
- An independent options assessment process should be undertaken to assess alternative locations for the northern ventilation stack and portal.
- A Life Cycle Analysis and assessment for the provision of filtration is undertaken.
- A long-term health study on children and residents in areas impacted by stack emissions 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 Transurban's claim of no portal emissions is justified.
- Portal emissions from the NorthConnex tunnel in the future are banned.
- The Submissions Report/Preferred Project be exhibited to allow the community to respond to the revised information contained in the report.
- The Department of Planning 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.

I would also like to endorse the EIS submission from CAPS Group who are a hard-working group dedicated to supporting the interests of Wahroonga and surrounding areas.

Thank you for your time in this matter.

Regards

Stephanie Pickford
9 Cleveland Street
Wahroonga NSW 2076