

Supplementary
Submission
No 20a

**INQUIRY INTO IMPACT OF THE WESTERN HARBOUR
TUNNEL AND BEACHES LINK**

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Date Received: 27 August 2021

Submission to the NSW Parliamentary Enquiry **on the Western Harbour Tunnel, 2021**

Submission from

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Terms of reference (e) and (m) of the Inquiry are:

(e) the extent to which the project is meeting the original goals of the project
(m) any other related matter.

The original (2012) goals of the project included:

2. Relieve road congestion so as to improve the speed, reliability and safety of travel in the M4 and M5 corridors, including parallel arterial roads.

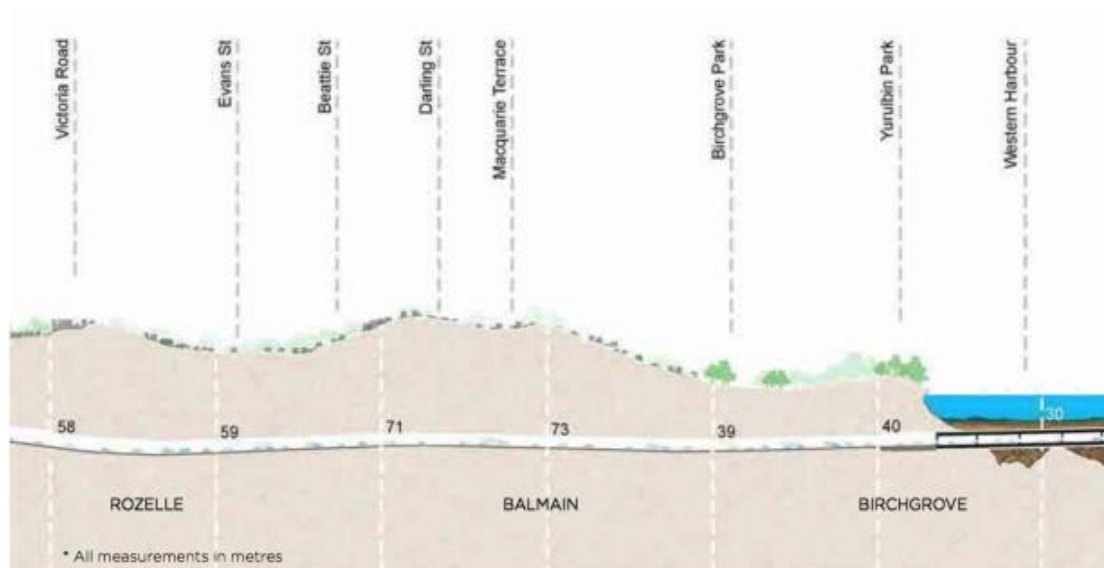
The construction of the Western Harbour Tunnel (WHT) will make the Westconnex tunnel system south of the harbour vulnerable to flooding caused by a major breach in the WHT. Should this occur, then goal (2) above, “the speed, reliability and safety of travel” in Westconnex will be seriously compromised.

SUMMARY

A hydrogen-fuelled or truck cargo explosion in the Western Harbour Tunnel could breach the tunnel’s submerged tube construction and flood the under-harbour tunnel. This will in turn flood the entire Westconnex tunnel system south of the harbour within hours, as the mainline tunnels of this system lie entirely below sea level.

This makes the Western Harbour Tunnel an attractive target for terrorists as its destruction would cripple the Westconnex transport network from Waverton Park to the M4 at Homebush, the M8 at Bexley North, the M5 at Arncliffe, and the M6 at Kogarah. It would take months if not years to restore the network to full operation and cost millions of dollars.

This vulnerability could be removed or at least alleviated by a simple change in the Western Harbour Tunnel design. Tunnel planning is in its final stages so action needs to be taken now.



EXPLOSION IN THE WESTERN HARBOUR TUNNEL

During peak hour one day, a truck will enter the Westconnex tunnel system, south of the harbour, and head towards the Western Harbour Tunnel (WHT). It will explode either by accident or by design, in the middle of the WHT, blowing perhaps a 6m diameter hole in the WHT roof, which would admit 350 cubic metres of sea water per second.

Initially this water will half fill one of the twin submerged tunnels and flow at a speed of 15 kph before spreading to both tunnels either as a result of the destruction of the intervening wall by the explosion or via existing cross passages between the tunnels.

Motorists will hear the sound of a loud explosion and experience a sudden rush of air filled with dust and the smell of explosive. Closer to the WHT, drivers will be deafened, car windows blown out and vehicle control may be lost.

For vehicles still 500m from the WHT in the tunnels under Balmain and Waverton, the next 60 seconds will bring the sight of water advancing towards them at 15 kph and carrying a wall of cars tumbling and spinning in every direction.

There will be nowhere to escape as vehicles already in the water will float and collide with other floating vehicles as they all are swept along in the deepening water. At some point the tunnel lighting system in that section of the tunnel will fail and half submerged vehicle headlights would be the only source of light. Vehicles will start filling with water and panicked drivers will attempt to swim to take refuge on pipe work and anything attached to the tunnel walls. Due to the fast moving, debris-filled water, none will make it.

The Westconnex Control Room in St Peters will notice that all the CCTV cameras in the WHT are dead and CCTV cameras further away show a cloud of dust and debris. Staff may have been able to just make out from the CCTV that cars in the WHT-bound tunnels had stopped and then, seconds later, rise into the air as a wall of water appears beneath them and starts pushing them back down the tunnel.

In tunnels heading away from the WHT most vehicles will outpace the water and only a couple of the closest vehicles will be engulfed. It will be a different story if a collision blocks this escape route.

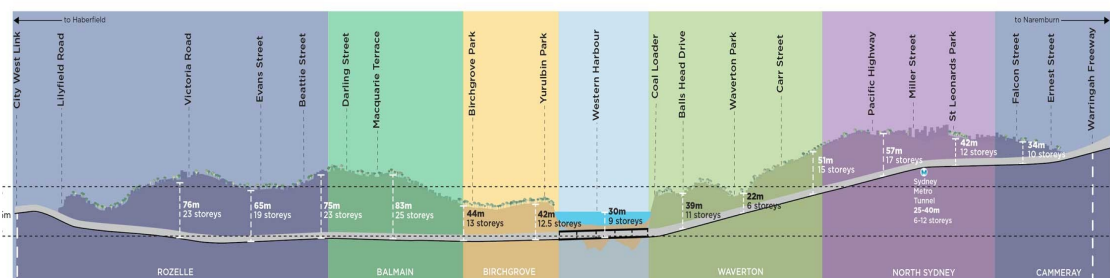
By this stage the control room staff should have realised that an explosion has breached the WHT. However their ability to control such a disaster is limited to the traffic lights at the tunnel portal and interchange entrances, the tunnel jet fans, the Variable Messaging System and Radio Re-broadcasting System. Westconnex has no doors capable of closing off tunnels and the seepage pumps are not powerful enough to cope with this volume of water.

As tunnels fill with water, the lighting and other tunnel systems such as CCTV cameras and messaging systems will progressively fail, section by section.

Within about ten minutes of the explosion, water will start flowing into the Rozelle Interchange, filling it from the bottom up in about 30 minutes.

Traffic control software may be programmed to automatically handle this level of disaster. Traffic lights at entrances would change to red and jet fans would try to clear the dust-filled air but would be progressively overpowered by the advancing water. The messaging systems would be warning of a major accident and directing vehicles already in the system to take the next exit, if necessary using one of the cross passages to reach an adjacent opposite-direction tunnel.

Vehicles which have not yet entered Westconnex will be stopped by traffic lights at the tunnel entrances which are all above sea level. Barring accidents, all tunnels remote from the WHT will empty of vehicles within ten minutes.



* All measurements in metres to tunnel road surface

Legend
 — Immersed tube tunnel
 - - - Driven tunnel

WHT cross-section. At the left hand side, the mainline tunnel connection to the rest of Westconnex is not shown, but rather the surface exit to the City West Link at Rozelle.

TUNNEL DAMAGE

The whole of the Westconnex tunnel system, south of the harbour, will fill with sea water within 5 hours of a WHT breach of the size indicated. Extensive tunnel damage will be inevitable and as there are no doors that can be closed to isolate the WHT from the rest of the system, there is nothing that the Westconnex staff can do to stop water flooding in. Both directions of tunnel will fill up together because they are linked every 120m by pedestrian cross passages. Eventually the only sections of tunnel above water will be the parts of the exit and entry ramps which are above sea level.

Westconnex will be out of action for months if not years. First the breach in the WHT submerged tunnel roof will have to be filled. Only then can the water be pumped out of the Westconnex system and vehicles and their drowned occupants retrieved. Then the damaged WHT submerged tunnel will need to be repaired or replaced and after several months immersed in sea water at a depth of 30m, almost every piece of in-tunnel infrastructure will have to be replaced.

SUGGESTED SOLUTIONS

[1] Control Centre response time is the major factor in limiting the number of vehicles in the tunnels headed for the WHT and minimising this response time is critical in reducing the number of lives lost. For a peak hour Control Centre response time of 1 minute, 380 people will drown in the tunnel from the Rozelle Interchange as well as a similar number coming from the north shore.

[2] The tunnel should be ramped upwards from each end of the WHT until the tunnel floor is above sea level. This will limit the repair cost of such a disaster by preventing sea water from flowing beyond those points and will also greatly reduce the attractiveness of the WHT as a terrorist target.

At larger water inflow rates or with a less vigilant Control Centre, ramping the tunnel to above sea level will also reduce the number of lives lost.

The planned WHT approach tunnel from the northern shore already rises quickly to sea level beneath Waverton Park but this is not the case at the Birchgrove end. Here the minimum ramp length to get to above sea level from the planned WHT floor depth of 30m is 750m, at the standard 4% incline. Beyond the point where the approach tunnels briefly rise above sea level, the tunnels could return to the original design depth.

Such a change to the approach tunnel design at the Birchgrove end, would provide an enormous advantage in the cost and speed of any repair because sea water will be prevented from spreading further than 750m into the entire tunnel system. For this reason such an incline should be incorporated into the plans for the WHT now, before construction can begin.

THE BEACHES-LINK HARBOUR TUNNEL

The other immersed-tube harbour tunnel, which is at Northbridge, is part of the Beaches Link and is subject to a similar threat. To the south west of this immersed tunnel, 4km of tunnels are below sea level and a similar solution will be required.