3. Safety benefits of the renewed tunnel, from GCCS, 2017-08-21

Third in a series of requested inputs to Victor Wei, P. Eng., Director, Transportation, City of Richmond

Naturally, the principal structure in the Massey Thruway Renewal Project is the South Arm crossing structure—either the upgraded and expanded tunnel or the bridge that the previous BC government preferred. One point of agreement: everyone wants to use it with due confidence it is safe.

Best for safety: From that safety perspective, GCCS suggests it is optimal to add four lanes (Richmond's Option 1) as a pair of 2-lane tunnel tubes—a new tube on each side of the Legacy Tube. (That should also be cost-friendly, user-friendly, timeline-friendly, etc., but the focus here is on assurance of safety.)

Basically, there would be four lanes heading in each direction (two in a new tube, two in the Legacy Tube).

As shown, each new tube is about 50 metres from the Legacy Tube, essentially within the Hwy 99 tunnel corridor. On the northwest side, access is between the Canfisco dock/plant to the east and the BC Ferries maintenance dock/facility. On the southeast side, access is via Deas Island Regional Park.

The BC Ferries cove (shown here with one ferry docked) was the low-lying site of the single-use dry dock where the six segments of the tunnel were fabricated in the late 1950s. It was then flooded so they could be floated (sealed at the ends) into position.

Traffic safety: GCCS is impressed with the Richmond concept of an additional outer lane through the tunnel in each direction—between the closest interchanges. At last, it would enable safe merging/diverging where it is has been *unsafe*. For instance, where traffic from Steveston Hwy merges into the tunnel-bound traffic, statistical evidence indicates many crashes there, year after year. As well, anecdotal evidence indicates that the related fear prompts people to avoid driving through the tunnel.

The effect is roughly a one-third boost in tunnel-exiting capacity, so the earthquake warning system will] more certainly get everyone out in time. As well, perhaps, a lower speed limit could be applied to those user-empathic segments of outer lane, among the ways to tailor the feature for a safe and calm experience.

The simplicity of the tunnel is in contrast to the complexity of the proposed bridge. For instance, the tunnel project would include a simple two-level Steveston Interchange, not the proposed bridge's famous faux Los Angeles interchange, with its many ways for drivers to err and crash.

Seismic safety: With this design, two tubes out of the three would theoretically sustain no damage at all in the worst earthquake in 475 years and only repairable damage in the worst one in 2,450 years.

Furthermore, bringing the new tubes into use before doing the external seismic upgrade of the Legacy Tube would make that upgrade safer, especially since the current level of Legacy Tube traffic could be diverted entirely to the new tubes. (The temporary closure of the Legacy Tube would also enable the extensive *internal* renewal work to take place efficiently in the Legacy Tube.)

Along with the obvious benefits for seismic safety stated so far, there is an intriguing possibility that the new tubes could make the Legacy Tube seismically safer than ever thought possible.

This builds on the fact that studies like the 2002 Seismic Retrofits by Rensselaer Polytechnic simulation show that lateral movement of the tunnel, which the external upgrade must address well, is an effect of seismic waves in the *upper 10 metres* of adjacent soil. Remediation* to that depth can be very effective.

The new tunnel tubes, with nearby state-of-the-art remediation, would normally not be damaged by even a fairly high-magnitude earthquake.

With the new tubes dissipating seismic waves and arresting ground movement, one would expect the Legacy Tube—between them and only about 50 metres from them—to be further protected as a result. *Is there an independent expert who could confirm this?*

Extreme-weather safety: The tunnel is well suited to the increasing incidence of extreme weather. Unlike a bridge, the tunnel would not typically be dangerous in storm winds, ice, blizzards, torrential rain or thick fog. It would therefore be one of the most reliable lifeline corridors—for emergency response in calamities when a bridge might sometimes even make the situation worse.

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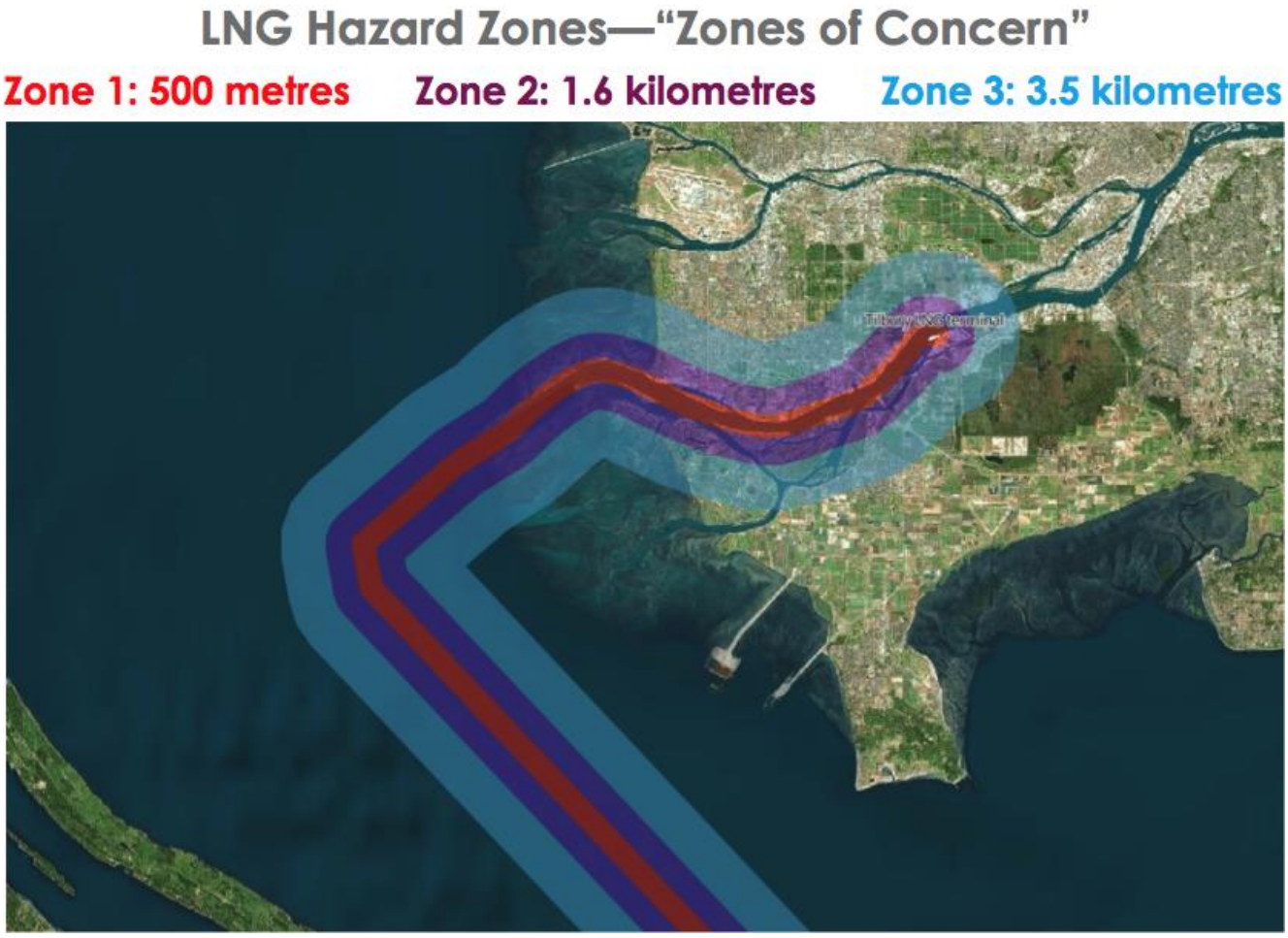
* Note: A 2016 report for the previous government made concerning comments that make the remediation seem risky, but the report made suspect use of sources. For example, when it referred to a 2007 seismic densification value engineering study's examination of ways to limit the *risk of cost overruns* in the external seismic upgrade, the 2016 report treated the financial risks as *safety* risks. Also, provincial records have revealed that the parent company of the report writers, which makes large donations to the BC Liberals, received a $24,250,000 contract in 2013 to be the "George Massey Bridge Project Owner's Engineer" (the government's *bridge* engineer). That makes them less credible when critiquing the *competing tunnel* option. There are real seismic safety concerns, but the appearance of skewing by consultants with possible conflict of interest means that independent analysis is needed.

Safety from LNG explosions: When the Tilbury LNG plant (with much increased capacity) exports LNG, the carriers will pass through the Massey Crossing. A bridge there might enable a terrorist to drop a bomb on one. That seems as likely as a major earthquake. To add to the following background from the Fraser Voices' *Let the Fraser Live*, read Kevin Washbrook's thorough *Sailing Into Unknown Waters*.

The BC Wilderness Committee has created a colour-coded risk map of the area on the basis of a US Coast Guard document that outlines "zones of concern" in the event of an LNG tanker accident:

Zone 1 is where an LNG spill could pose severe public safety and property hazard.	Zone 2 would be "less severe" in a wider hazard zone—up to 1.6 kilometres away.	Zone 3 would spread further into Ladner and Richmond. It is considered the maximum distance a cloud of escaped LNG vapour could drift without dispersing. If ignited, the cloud could burn back to the tanker and result in a "pool fire."



First responding: In either of the new tubes, responders could reach crashes via a pathway—primarily provided for cyclists in one and pedestrians (and mobility-aid users such as wheelchair users) in the other. However, since the whole renewed tunnel will take every opportunity to provide and encourage safety, the need for first responders will be significantly reduced in the best possible way.

Details to come: Can two new 2-lane tubes provide better value per dollar than a single 4-lane tube? The next response in this series will provide details on such questions that are beyond the safety topic.