MEMO

To: Out of Scope ASM Network Operations Manager

CC: s 9(2)(a) Out of Scope

From: Out of Scope

Date: 20/05/2022

Subject: Hikoi/Marches across the Auckland Harbour Bridge (R0)

The extension bridge box girders (outer 2 lanes both northbound and southbound of the Auckland Harbour Bridge) have natural frequencies of lateral vibration that are close to the frequency of people walking. Large groups of people walking together can cause the structure to vibrate from side to side in resonance – a phenomenon known as synchronous lateral excitation. Spans 1, 3 & 4 (figure 1) of the bridge are most prone to lateral vibration. It is estimated that dense crowds of people numbering as low as 250 can excite lateral vibrations of the extension bridges in those spans.

In previous marches, amplitudes of vibration of plus or minus 50mm have been recorded. The side-to-side motion was found to be well above people's comfort level when resonance was reached and may cause walkers to stumble. The opening and closing of the gap at deck level between the two bridges (figure 2), due to both pedestrian induced vibration and strong wind events, is a significant pinch point safety risk to pedestrians and could result in serious crushing injuries. In addition, the risks associated with conflict between uncontrolled pedestrians and live motorway traffic are extremely high and need to be mitigated.

While structural failure is not anticipated from such resonant vibrations, there is a risk that if left uncontrolled the vibrations may lead to the box girder deck banging against the truss deck which could cause some local damage.

It is recommended that crowd numbers are limited to 250 people per span, to mitigate the risk of pedestrian induced lateral movements.

Note, this guidance excludes the Auckland Marathon events. Crowd densities at these events are managed and running/ jogging does not typically induce synchronous lateral excitation as described above.

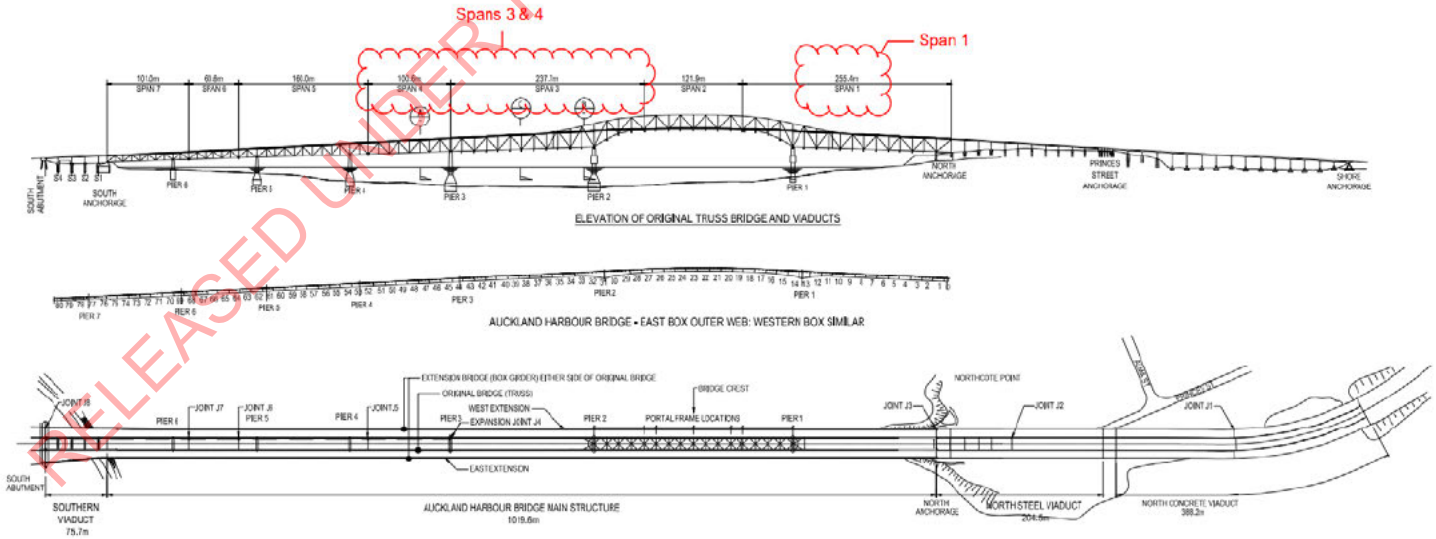

Figure 1: Span configuration

RELEASED UNDER THE OFFICIAL INFORMATION ACT 1982

Figure 2: Gap between bridge decks

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