

**To** James Hughes  
**Cc**  
**From** Richard Landon-Lane  
**Date** 30 November 2020  
**Subject** WEX: Ohinewai 110km/h RSA Review

Hi James,

Table below is a summary of the 2016 RSA issues, the 2016 "Safety Engineer/Client Decision", and my 2020 Comments and recommendation for close-out. **GREEN** is where I believe the 2016 decisions are still appropriate, **BLUE** may require some extra analysis by designer. **RED** is where I think the 2016 decision should be re-visited.

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3.1.1	<p>MINOR – Ohinewai – Curved W-section at Entranceways is essentially "non-gating"</p> 	<p>No room to provide flare for continuous protection and RSB-2 from TM-2008 is considered acceptable solution.</p> <p>Considered Acceptable.</p>	<p>Not clear on the pre-implementation plans, but appropriate clear areas for both the W-section and WRSB must be provided to mitigate the gating risk.</p> <p><b>Individual driveways to be assessed</b> whether flared WRSB could be provided to mitigate risk further.</p>	<p>I'm assuming that the accessway requires the vehicle to decelerate and accelerate on the shoulder before turning into the accessway or merging into the live lane.</p> <p>This manoeuvre will increase risk@110km/h. We should ensure that there is sufficient shoulder for the acceleration and deceleration manoeuvres to be undertaken clear of the live lane.</p> <p>If there are no alternatives available, then this is a risk that will perpetuate.</p> <p>I consider this to represent a much greater risk than the curve of the guardrail or safety barrier configuration.</p>	<p>W-section curved trailing end terminals at entranceways to remain. The barrier is offset 3.5m from the edge line either side of the entranceways which provides sufficient room for deceleration/acceleration.</p>

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3.1.2	<p>MODERATE – Off Ramps - insufficient sight distance for 10s of travel time to taper &amp; nose (desirable need 335m =120km/h design speed)</p> <ul style="list-style-type: none"> <li>• Ohinewai Northbound off-ramp</li> <li>• Te Rapa SH39 Southbound Off-Ramp</li> <li>• Te Rapa SH39 Northbound Off-Ramp</li> </ul>	<ul style="list-style-type: none"> <li>• Ohinewai – Increase barrier offset from 3.0 to 3.5m =&gt; 335m SD provided. Client Decision = Yes</li> <li>• TR S'Bnd – Barrier offset could be increased from 3.0 to 4.5m to achieve 335m SD. Would require additional berm &amp; swale works. Current Design SD = 288m = 8.6s @120km/h or 9.4s@110km/h. Client Decision = Accept 288m SD.</li> <li>• TR N'Bnd – 335m Achieved, no change required</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Ohinewai – Agree with 2016 Decision</b></li> <li>• TR S'Bnd - Small concern that going beyond 4.0m offset increases the risk of bigger impact angles. Would like to know <b>how much extra SD we can get from going to 4.0m offset instead of 4.5m</b>. If this can get us to 305m SD (=10.0s @ 110kmh) this would be a good outcome.</li> <li>• TR N'Bnd – <b>Agree with 2016 assessment.</b></li> </ul>	<p>As a rule, we try and limit barrier offsets to 4.0m max to manage impact angles and also to discourage use as an additional lane.</p> <p>I don't believe that it is worth providing the additional SD for 120km/h. I would recommend leaving the barrier offset at 3.0m at the first location and accept the 288m SD for the second.</p>	<ul style="list-style-type: none"> <li>• Ohinewai off ramp – no change required.</li> <li>• TR S'Bnd off ramp – no change required.</li> <li>• TR N'Bnd off ramp – no change required.</li> </ul>
3.1.3	<p>MODERATE – Deficient WRSB laps with existing barrier systems.</p> <ol style="list-style-type: none"> <li>1. New Leading WRSB terminal in front of existing Trailing Terminal [1 location – Cambridge 3800 LHS]</li> <li>2. New Trailing WRSB terminal behind existing leading terminal [14 location, 3xOhinewai, 7xNgaruwahia, 4xTe Rapa]</li> <li>3. WRSB terminals have insufficient lateral clearance and overlap [3 locations, 2xOhinewai, 1x Cambridge]</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove existing flared terminals and install as per TM-2013 detail RSB-7A. Client Decision = Yes</li> <li>2. All laps to be as per RSB-7A. Client Decision = Yes</li> <li>3. Plans diagrammatic only, All terminals and laps to be as per RSB-7A. Client Decision = Yes</li> </ol>	<ol style="list-style-type: none"> <li>1. <b>Agree with 2016 Decision</b></li> <li>2. <b>Agree with 2016 Decision</b></li> <li>3. <b>Agree with 2016 Decision.</b></li> </ol>	Agreed	All WRSB terminals and overlaps to be consistent with TM-2013 RSB-7A.
3.1.4	<p>MODERATE – Ohinewai – Deficient Armitage Road Diverge. Recommend install crash cushion &amp; extend barrier down Armitage road to cover Expressway length of need.</p> 	<p>Existing flax considered frangible and serves a purpose as a headlight screen. Armitage Road considered a flat run-out area.</p> 	<p>Agree lower risk, but <b>still see merit installing barrier down Armitage Road</b> fence to cover off the Expressway LON. As a loss-of-control vehicle is unlikely to pull up in time. This appears that it would be easy to do.</p>	Agree with RLL.	<p>Design has been amended to provide for extension of barrier and crash cushion down Armitage Rd.</p> <p>In addition, the deceleration lane has been extended by 30m to meet 110kph design requirements.</p>

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3.1.5	<p>MODERATE – Conflict with new barriers &amp; Existing light poles.</p> <ol style="list-style-type: none"> <li>Existing poles within the dynamic deflection of the WRSB</li> <li>Existing poles in front of new barriers</li> </ol>	<ol style="list-style-type: none"> <li>Existing poles have shear bases, no change proposed. Client Decision = Acceptable.</li> <li>All poles will be relocated behind barrier. Client Decision = must be outside dynamic deflection zone.</li> </ol>	<ol style="list-style-type: none"> <li>Prefer all poles are relocated, but as a minimum - as per 2016 Safety Engineer Comment, <b>all shear bases within the dynamic deflection zone should be checked for correct torque settings</b></li> <li><b>Agree with 2016 Decision</b>, any relocated poles must be clear of dynamic deflection.</li> </ol>	<p>Locating the poles outside the tested deflection may require excessive outreaches to achieve the appropriate lighting levels. This needs to be checked.</p> <p>If this is an issue, then the offset to the columns may be brought down to 1.5m.</p>	<p>All poles in project site to be relocated to 1.5m behind new barrier to achieve lighting consistency. All shear bases within deflection zone to be tested to ensure correct torque settings.</p>
3.1.6	<p>MODERATE – Te Rapa – Deficient WRSB break for cyclists. 25m gap in barrier for cyclists to exit. Recommend install parallel barrier system (similar to Cambridge section) to cover Expressway LON.</p>	<p>Design modified. Client Decision = Yes</p>	<p><b>Agree with 2016 Decision</b>, note 2016 Safety Engineers comments that the exit must not be too tight (Some negative feedback received on Cambridge example). <b>Review exit geometrics for appropriateness.</b></p>	<p>It is my understanding that the Te Rapa section of the WEX is not being considered for 110km/h speed limit.</p>	<p>No action required at this time.</p>
3.1.7	<p>MINOR – General conflicts/omissions with committed/in progress WEX works. Recommend co-ordinate with Rangiriri &amp; Huntly works.</p>	<p>In process of obtaining designs, design will be amended as necessary to provide continuity though entire expressway.</p>	<p><b>Agree that co-ordination and match-ins with adjacent sections should be achieved.</b></p>	<p>Agree with RLL</p>	<p>Rangiriri and Huntly sections are now complete and the Ohinewai design has been amended to match into these sections. Note that RS/RP has changed as a result and this is evident on the amended drawings.</p> <p>To be considered further in the refinement of the Ngaruawahia section design.</p>
3.1.8	<p>MINOR – Maintenance bay conflicts. Proposed maintenance bays appear to conflict with existing topography</p> <ol style="list-style-type: none"> <li>Ohinewai 7980 RHS – fill embankment for overbridge. Recommend move north.</li> <li>Ngaruawahia 4170 LHS – Existing drain &amp; headwall. Recommend move North.</li> </ol>	<ol style="list-style-type: none"> <li>Moved 15m North to avoid embankment</li> <li>Moved south to provide regular spacing between maintenance bays.</li> </ol>	<p><b>Agree with 2016 Safety Engineer Comment that Maintenance bay locations also need to be checked for sightlines.</b></p>	<p>Agree with RLL</p>	<ol style="list-style-type: none"> <li>The northbound maintenance bay has been relocated further north, clear of the overbridge embankment. The sightlines to each of the three proposed maintenance bays meet the minimum 210m requirement. However, contractors should ensure that appropriate TM is used for maintenance activities and vegetation in the vicinity of the bays is kept clear to maintain sightlines.</li> <li>To be considered further in the refinement of the Ngaruawahia section design.</li> </ol>

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3.1.9	<p>MODERATE – Ngaruawahia Section – Deficiencies associated with future-proofing Hamilton Section Integration.</p> <ol style="list-style-type: none"> <li>Setout is based on ultimate configuration, risk that Contractor sets out based on existing configuration</li> <li>5750-5850 LHS incorrectly labelled as WRSB, should be W-section.</li> <li>5890 LHS transition cannot be achieved as drawn.</li> <li>6430-6510, barrier closer than 3.0m =&gt; adversely affect SSD</li> <li>0060-6350 – Median barrier incorrectly located =&gt; tie-ins therefore incorrect</li> <li>0600-6100 Existing wide shoulder used by NZ Police for enforcement purposes, need to ensure enforcement provision is still provided for.</li> <li>Northbound (north of Lake Road Overbridge) WRSB proposed some distance from median edgeline – risk that vehicles may then park on the RHS instead of the usual LHS.</li> </ol>	<ol style="list-style-type: none"> <li>Electronic Setout data to be supplied to Contractor</li> <li>Drawing amended</li> <li>Drawing amended</li> <li>Barrier moved to 3.0m offset</li> <li>This barrier is being relocated as part of the Hamilton Section works</li> <li>Wide expressway shoulders not suitable for Police enforcement. Client Decision = Police enforcement provisions to be provided as part of 'Weigh Right' project.</li> <li>This wide shoulder is to accommodate future Hamilton Section, Safe hit posts have been installed to discourage vehicles pulling off. These will be ultimately be removed as continuous barrier protection is provided. CLIENT DECISION: Safe Hit posts installation not agreed as considered unnecessary and can impede sight distance</li> </ol>	<ol style="list-style-type: none"> <li>Agree with 2016 Decision</li> <li>Agree with 2016 Decision</li> <li>Agree with 2016 Decision</li> <li>Agree with 2016 Decision</li> <li>Agree with 2016 Decision</li> <li>Agree with 2016 Decision</li> <li>If Safe Hit posts are still there, assess any forward sight visibility issues.</li> </ol>	Agree with RLL comments	<p>No change required for Ohinewai section.</p> <p>To be considered further in the refinement of the Ngaruawahia section design.</p>
3.1.10	<p>SIGNIFICANT – General – OGPA Conflict with cyclists. OGPA lip will be in the centre of the shoulder available to cyclists. Recommend extend OGPA to barrier face.</p>	<p>Drawings to be clarified – OGPA only on Ngaruawahia &amp; Te Rapa. Drawings amended to show OGPA extended to within 300mm of barrier face. Client Decision: 500mm Offset to be used.</p>	<p>Consider 500mm offset doesn't go far enough to fully mitigate cyclists preferred path. Agree with 2016 Designer &amp; Safety Engineer recommendation to go with 300mm.</p>	<p>I consider 500mm is close enough to provide shy-distance to the barrier for cyclists and vehicles using the shoulder. Assuming that the shoulder is 3.0m to the barrier face.</p>	<p>No change required for Ohinewai section.</p> <p>To be considered further in the refinement of the Ngaruawahia and Te Rapa Sections.</p>

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3.1.11	<p>MINOR – General – Various Barrier Deficiencies</p> <ol style="list-style-type: none"> <li>&gt;3.0m offset observed in several locations</li> <li>Existing barriers less than 3.0m offset (Te Rapa 1700-1850 RHS)</li> <li>Ngaruwahia section - Various leading end terminals missing from existing median rigid barriers (i.e. at Bridge piers). These are near existing WRSB. Recommend installing rigid barrier terminals to address issue from dynamic deflection.</li> </ol>	<ol style="list-style-type: none"> <li>Drawings amended</li> <li>Existing barriers are 2.8-2.9m offset in a few locations, considered low-risk</li> <li>Outside of scope of project.</li> </ol>	<ol style="list-style-type: none"> <li>Agree with 2016 Decision</li> <li>Agree low-risk, recommend check that existing barrier position is not causing any SD issues which need to be rectified.</li> <li>This seems an unacceptable risk, if there is no appropriate transition from WRSB to Rigid barrier, then this should be rectified.</li> </ol>	<p>I do not understand how these were omitted in the first instance but, given that they are missing, why this is considered out of scope.</p> <p>Agree with RLL - A standard WRBS to rigid transition should be considered in all locations. Where this is not practicable, a departure should be sought.</p>	<p>No change required for Ohinewai section.</p> <p>To be considered further in the refinement of the Ngaruwahia and Te Rapa Sections.</p>

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3.2.1	<p>MODERATE – General forward sight Distance deficiencies</p> <ul style="list-style-type: none"> <li>Review all sight distances on the basis of 120km/h design speed.</li> <li>Review all existing safety barriers for conformance for 120km/h design speed.</li> </ul>	<p>Graham Taylor (NZTA) decision that 210m SSD is acceptable.</p> <p>Two locations where 210m SSD has been compromised by installation of new barriers.</p> <ol style="list-style-type: none"> <li>Ohinewai Northbound Curve 2.8-3.2. 3.0m Barrier offset gives 180m SSD, needs to be 4.75m to achieve 210m. Could be achieved by trimming vegetation.</li> <li>Ngaruwahia Northbound ramp to future WEX Hamilton Bypass Connection. 3.0m offset barrier is on top of high embankment and at bridge, would require significant earthworks and bridge widening.</li> <li>Ngaruwahia Southbound 720mR curve to future WEX Hamilton Connection, Sufficient Berm width to achieve 210mSSD. Drawings to be amended.</li> </ol> <p>Client Decision: Please advise</p> <ul style="list-style-type: none"> <li>What can be achieved with 0.2m object height</li> <li>What can be achieved with 0.8m object height</li> <li>What is available seal width for manoeuvring at WEX Hamilton connection (Sec.5.5.1 of AGRD 3)</li> </ul>	<ol style="list-style-type: none"> <li>Agree with 2016 commentary, trim vegetation, move barrier and achieve 210m SSD</li> <li>Agree with 2016 Client Decision, assess what can be achieved for a 0.2m &amp; 0.8m scenarios.</li> <li>Agree with 2016 commentary, use available berm, move barrier to achieve 210m SSD.</li> </ol>	<ol style="list-style-type: none"> <li>Limit the barrier offset to 4.0m – which provides 197m of SSD.</li> <li>Agree with RLL</li> <li>Agree with RLL</li> </ol>	<ol style="list-style-type: none"> <li>Barrier through curve to be offset 4.0m and vegetation to be cleared. This will provide a SSD of 210m for 0.2m object height (stationary object on road) and 210m for 0.8m object height (car tail light).</li> <li>To be considered further in the refinement of the Ngaruwahia Section.</li> <li>To be considered further in the refinement of the Ngaruwahia Section.</li> </ol>

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3.2.2	MODERATE – General – Acceleration Distances on On-Ramps. Check all on-ramp lengths are appropriate for the predicted higher merge speeds.	<p>On Ramps at Ohinewai, SH18 Gordonton, Te Rapa Drive &amp; Koura Road all have lengths ranging from 300m to 430m.</p> <p>With an entry speed of 30km/h and typical 3-4% downgrade, 350m required to achieve 110km/h.</p> <p>Safety Engineer: For ramps &lt;350m request widening in the merge area to allow for additional manoeuvre space.</p> <p>Client Decision: Shoulder widening changes the ramp configuration and is considered unacceptable. Low volumes on Expressway, no design changes.</p>	<p>From AGRD, Ramp Length = 585m x 0.6 correction factor for 3-4% downgrade = 350m.</p> <p>Shortest ramp is 300m 300m / 0.6 =&gt; 500m flat grade acceleration length</p> <p>425m Equivalent flat grade length required for 100km/h.</p> <p>Calculated merge speed: = 105.6km/h =&gt; Acceptable</p> <p><b>Recommend no design change necessary.</b></p>	Agree with RLL	No change necessary.
3.2.3	<p>MINOR – General – Various Sign Deficiencies</p> <ol style="list-style-type: none"> <li>Speed threshold signage in medians – may be large &amp; non-frangible for wind loading. Recommend install appropriate protection to prevent vehicle interaction with median signage.</li> <li>Rangiriri Section – Advanced warning speed signs at CH.15150 may be obscured by Bridge piers/abutments. Recommend relocate signs.</li> <li>Cambridge section – 100km/h threshold to southbound on-ramp missing. Recommend install.</li> <li>Ngaruwahia section – Advance 80km/h warning sign at 1860 inappropriately sized. Recommend 900x900mm.</li> <li>General – Proposed 110km/h signs at 4.71 (Te Rapa Northbound) and 0.73 (Ngaruwahia Southbound) are located at or near areas of multiple decision making. Recommend relocate to 4s of travel time beyond commencement of dual lanes.</li> </ol>	<ol style="list-style-type: none"> <li>9m wide median with frangible posts proposed. Given frangible posts additional median protection not considered necessary.</li> <li>Signs relocated</li> <li>Drawings amended</li> <li>Proposed signs are 1200x1200 or 900x900</li> <li>110km/h at Ngaruwahia, lane gain situation, no driver decision. Safety Engineer &amp; Client Decision =&gt; OK</li> </ol> <p>110km/h at Te Rapa located at start of two lanes, consider very minor driver decision.</p> <p>Safety Engineer prefers location is downstream, and requires liaison with Mike Pilgrim to ensure 80/110 change is in appropriate place.</p>	<ol style="list-style-type: none"> <li><b>Agree with 2016 Decision</b></li> <li><b>Agree with 2016 Decision</b></li> <li><b>Agree with 2016 Decision</b></li> <li><b>Agree with 2016 Decision</b></li> <li>Ngaruwahia – <b>Agree with 2016 Decision</b></li> </ol> <p>Te Rapa – Agree with 2016 Safety Engineer Comments – <b>Has Review from Mike P occurred?</b></p>	Agree with RLL	<p>No change necessary for Ohinewai section.</p> <ol style="list-style-type: none"> <li>No change necessary.</li> <li>No further changes necessary.</li> <li>No further changes necessary.</li> <li>To be considered further in the refinement of the Ngaruwahia Section.</li> <li>No change necessary for the Ngaruawaia section. To be considered further in the refinement of the Te Rapa Section.</li> </ol>