In the matter of	the Resource Management Act 1991 ("the Act")
and	of submissions by Waka Kotahi NZ Transport Agency (submitter 275) on Proposed Waimakariri District Plan Review – Hearing Stream 5

Supplementary Statement of Evidence of Robert Swears for Waka Kotahi - Transport Engineering

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1 Qualifications and Experience

1. My full name is Robert Clive Swears. I prepared a primary statement of transport engineering evidence dated 4 August 2023. This document is a supplementary statement that describes my consideration of sight distance criteria for the Waimakariri Proposed District Plan.

2. I am a Technical Principal (Road Safety and Traffic Engineering) with WSP NZ Ltd where I have been employed for 33 years; working primarily as a road safety and transportation engineer. I have been engaged by Waka Kotahi to provide independent transport engineering expert evidence in relation to the proposed Waimakariri District Plan Review - Hearing Stream 5. I am Chartered Professional Engineer (Transportation) and a Chartered Member of Engineering New Zealand (CMEngNZ). I have the qualifications and experience outlined in my primary statement of evidence. I reaffirm that I have and will continue to abide by the Code of Conduct for Expert Witnesses (2023).

2 Summary of Evidence

3. This supplementary statement of evidence considers the sight distance criteria for accesses to be incorporated in the District Plan. In this statement, I describe my concerns regarding the approach proposed by Stantec (2019) and Waimakariri (2023) in relation to sight distance.

4. I conclude this statement by proposing that road safety should not be compromised through adopting exceptional sight distance values intended for constrained locations in the District Plan. My proposal is that values which may incorporate a

measure of conservatism should be adopted as the standard approach.

3 Sight Distance Criteria for Proposed District Plan

3.1 Sight Distances Described in Technical Review Report

5. Stantec (2019, Section 8) describes sight distance criteria at accesses and refers to Austroads guidance. While Stantec (2019) is not specific, given the date on which the report was prepared and the information contained in Table 8-1, it appears likely that Stantec considered Austroads (2017).

6. The Austroads Guide to Road Design Part 4A has since been updated (Austroads, 2023). However, the sight distance values recorded in Tables A9 to A11 of the Austroads (2017) document appear to be the same as those in the updated Austroads (2023) document. Therefore, I have referred to the more recent document.

7. Stantec (2019, Section 8) refers to Austroads safe intersection sight distance (SISD) requirements and also to extended design domain (EDD) SISD requirements. In that regard, Stantec notes that "[…] sight distances at accesses should comply with the sight distance requirements for intersections. However, […Austroads] acknowledges that the criteria often cannot be met **in constrained environments** and the […EDD SISD] can be used." [emphasis added].

8. I consider it important to put the Austroads (2017 and 2023, Section A.1) EDD SISD criteria in perspective, as illustrated by the following quotations:

   (i) "Application of EDD involves identification and documentation of driver capability. Ultimately, the

capabilities that are accepted may have to pass the test of what is reasonable capability […] The decision to use EDD should not be taken lightly."

(ii) Normal design domain (NDD) values "[…] should be used wherever practical. […] Design values outside of NDD are only to be used if approved in writing by the […] road agency […]"

(iii) "Through collective experience it has been accepted for a very long time that the use of minimum values for several parameters at the same location does not constitute good practice and generally leads to an inferior or unsafe design."

9. That is, the EDD approach should be the exception rather than the rule and careful consideration is required before adopting the approach.

10. The sight distance requirements described by Stantec (2019, Table 8-1) are shown below:

Table 8-1: Austroads SISD Requirements

Design speed (km/h)	SISD (m)	EDD[2] SISD (m)
40	73	58
50	97	77
60	123	97
70	151	120
80	181	144
90	214	169
100	250	197
110	285	226

11. The reaction times associated with these sight distances are defined using the colour coding listed below:

(i) Green: SISD with 2.0 second reaction time on road, 3.0 second observation time on access (Austroads, 2023, Table 3.2).

(ii) Red: EDD SISD 2.0 second reaction time on road, 2.0 second observation time on access (Austroads, 2023, Table A 10).

(iii) Blue: EDD SISD 2.5 second reaction time on road, 1.5 second observation time on access (Austroads, 2023, Table A 9).

12. Stantec (2019, Table 8-2) also refers to the sight distance table included in the Planning Policy Manual (PPM, Waka Kotahi, 2007, page 182). To demonstrate the alignment between them, I have included below copies of both tables.

Table 8-2: PPM Sight Distance Requirements

Speed Limit (km/h)	Minimum Sight Distance (m)
50	113
60	140
70	170
80	203
90	240
100	282

Suggested minimum sight distance for permitted activities:

1. The minimum sight distance, as per Diagram A and Perspective A of Transit New Zealand's Planning Policy Manual 2007, shall be:

Posted speed limit (km/h)	Minimum sight distance (m)
50	113
60	140
70	170
80	203
90	240
100	282

13. There is not an exact correlation between the Waka Kotahi (2007) sight distance criteria (immediately above) and the safe intersection sight distance (SISD) criteria described by Austroads (2017 and 2023). However, the Waka Kotahi values are approximately equivalent to the highlighted SISD values below from the Austroads (2023, Table 3.2) document; I have used colour highlighting to correlate these with the Waka Kotahi values in the table above.

Design speed (km/h)	Based on safe intersection sight distance for cars[1] h_1 = 1.1; h_2 = 1.25, d = 0.36[2]; Observation time = 3 sec					
	R_T = 1.5 sec[3]		R_T = 2.0 sec		R_T = 2.5 sec	
	SISD (m)	K	SISD (m)	K	SISD (m)	K
40	67	4.9	73	6	–	–
50	90	8.6	97	10	–	–
60	114	14	123	16	–	–
70	141	22	151	25	–	–
80	170	31	181	35	–	–
90	201	43	214	49	226	55
100	234	59	248	66	262	74
110	–	–	285	87	300	97
120	–	–	324	112	341	124
130	–	–	365	143	383	157

14. Essentially, for lower speed limits, Waka Kotahi (2007) has adopted a reaction time of 1.5 seconds, while for a 100 km/h speed limit a reaction time of 2.0 seconds has been adopted.

There is not a clear basis behind the Waka Kotahi (2007) value for a 90 km/h speed limit; it appears to be the average between the sight distance criteria for a 100 km/h design speed where the reaction time is 1.5 - 2.0 seconds.

15. Stantec (2019, Section 8.2) correctly notes that the Waka Kotahi (2007) values are based on speed limit plus 10 km/h. For example, the sight distance criterion for a 100 km/h speed limit is based on a design speed of 110 km/h. The reason for this approach is that it simplifies the application of a district plan through not requiring applicants to determine the operating speed for the section of road to which an access is proposed.

16. Therefore, I agree with Stantec (2019) that "The PPM requirements are more onerous than the Austroads EDD requirements [...] taking the design speed to be the speed limit plus 10km/h [sic]."

17. While there may be conservatism in the Waka Kotahi (2007) approach to operating speed, the reaction times adopted for rural operating speeds are not conservative. That is, Waka Kotahi has adopted reaction times lower than those ordinarily used for conservative analysis. Therefore, on balance, the Waka Kotahi (2007) simplifying approach does not appear to be unreasonable.

3.2 Waimakariri District Council Assessment

18. On 22 August 2023, Mr Pearson (Waka Kotahi) was provided with a copy of the memorandum (Waimakariri, 2023) prepared by Mr Binder in which reference is made to the Stantec (2019) report. Mr Binder (Waimakariri, 2023, paragraph 21) concludes that the values from the Stantec (2019) report should be

adopted rather than the values from the Planning Policy Manual (Waka Kotahi, 2007).

19. Waimakariri (2023, paragraph 18) favours the Austroads (2023) approach, however, the comparison described in the previous section of this supplementary statement does not appear to have been made. That is, while the Waka Kotahi (2007) document is not recent, the document is not a "[…] long-superseded publication […]". The fundamental concepts in the PPM are clearly reflected in the 2023 content of the Austroads guide.

20. As Waimakariri (2023) correctly notes, the Austroads (2023) SISD criteria "provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle on a minor road approach moving into a collision situation […] and to decelerate to a stop before reaching the collision point." (Austroads, 2023, page 19). That is, the onus is on the driver of the vehicle on the main road to decelerate to avoid collision with a vehicle crossing or joining the main road.

21. The title of Austroads (2023) Table 3.2 (which is included beneath paragraph 13 of this supplementary statement) highlights that the SISD criteria are for cars. Therefore, at any location where there are heavy vehicles in the traffic stream, allowance needs to be made for the greater stopping distances for those heavy vehicles.

22. The values in the Austroads table are based on the assumption the average grade over the braking length is zero (that is, on average, the road is flat). Austroads (2023, page 21) requires that where the average grade is not zero, SISD should be calculated using correction factors based on the average grade.

23. Another matter to consider is the acceleration rate of vehicles exiting a property access and the potential for the exiting vehicle to be travelling at a slow speed at the point when a vehicle on the road approaches. Once again, light vehicles typically accelerate faster than heavy vehicles, therefore, there may be an argument for shorter sight distances for locations where the entering traffic comprises a very high proportion of light vehicles; for example, residential activity.

24. However, the variability in parameters for each situation can become complex, therefore, I consider the approach described in the District Plan should be suitable for most situations.

3.3 Proposed Solution

25. Based on the Stantec (2019, Table 8.3) and Waimakariri (2023, Table TRAN-19) approach I understand the correlation between the proposed sight distances, the Austroads (2023) criteria, and the PPM is as summarised in the table below (I have used coloured highlights to identify the direct correlations):

Speed[1] (km/h)	Stantec (2019) and Waimakariri (2023)		Austroads (2023); based on Stantec (2019) values[2]		PPM[3]
	Residential	Other	SISD	EDD SISD	
30	40				67
40	60	75	73	58	90
50	80	100	97	77	113
60	100	125	123	97	140
70		150	151	120	170
80		180	181	144	203
90		215	214	169	240
100		250	250	197	282

26. It appears that the approach proposed by Stantec (2019) and Waimakariri (2023) is to adopt the least conservative criteria for locations where the speed limit is 60 km/h or less. While from a crash severity perspective, I consider it more reasonable to accept lower standards where the risk of death and serious injury is less, it does not explain why the least conservative (EDD SISD) criteria should be adopted as the standard criteria.

[1] For the Stantec, Waimakariri, and Waka Kotahi sources, speed relates to speed limit, however, for Austroads it relates to design speed.

[2] The SISD values are based on a reaction time of 2.0 seconds, which is not conservative for higher operating speeds.

[3] Refer to paragraph 33 of this statement for the basis on which the highlighted PPM values have been included in this table.

27. For speed limits greater than 60 km/h, Waimakariri (2023) proposes to adopt Austroads SISD parameters, however, in doing so allowance is not provided for reaction times being greater than 2 seconds, operating speeds being faster than speed limits, roads not being flat, nor to the traffic stream comprising heavy vehicles.

28. There will be situations where the sight distance constraints for a property, to which access must[4] be provided, dictate that sub optimal sight distances must be accepted. However, I consider that those situations should be the exception rather than the rule.

29. From a transport engineering perspective it is practicable to determine the traffic volume and operating speed for an existing road, the average grade of the road on approach to an access, measure sight distances, and identify opportunities for increasing sight distance where necessary. It is also practicable, with input from human factors specialists to draw conclusions regarding reaction times of road users and the likely observation time for a property access based on the nature of the access and the likely users of that access.

30. However, from a district plan perspective, it appears onerous to require applicants to conduct transport engineering and human factors analysis to consider the adequacy of sight distance for every property access.

[4] Because of the requirement for land that has a road frontage to be able to access the most appropriate road frontage.

31. Noting that extended design domain (EDD) criteria may be suitable for constrained situations, I consider it reasonable for sight distance analysis associated with those constrained situations to take into account the various parameters associated with EDD. However, the decision to apply EDD parameters "should not be taken lightly". Therefore, I consider it undesirable to adopt the EDD minimum criteria for the District Plan.

32. I do not consider that road safety should be compromised through adopting exceptional values (EDD SISD) or values that do not include a margin for variability in traffic stream behaviour and / or topography in the District Plan. If the SISD design speed values are accepted as being applicable for speed limits, it appears likely there will not be a margin of error for situations where reaction times are greater than 2 seconds, operating speeds are faster than speed limits, roads are not flat, and / or the traffic stream includes heavy vehicles.

33. Therefore, I consider that the original sight distance criteria, based on the Planning Policy Manual (Waka Kotahi, 2007) should be adopted for the District Plan. However, at the time the PPM was prepared, speed limits of 30 km/h and 40 km/h were unusual, therefore, the PPM does not refer to minimum sight distance standards for those speed limits. Based on the speed limit plus 10 km/h approach of the PPM and a reaction time of 1.5 seconds, I consider that the sight distance table from the PPM could be extended to incorporate a sight distance of 90 m for a 40 km/h speed limit and of 67 m for a 30 km/h speed limit. Those values are taken from the Austroads (2023, Table 3.2) table, which is replicated below paragraph 13 of this

supplementary statement. They are also shown in context in the table beneath paragraph 25 of this statement.

34. For those situations where the sight distance is less than the PPM values, I consider that specific analysis should be undertaken to determine the parameters for that location and identify the most appropriate solution.

Robert Swears

23 August 2023

4 Appendix A: References

35. I referred to the following sources in this supplementary statement of evidence:

- Austroads, 2017, *Guide to Road Design Part 4A, Unsignalised and Signalised Intersections*, Austroads, Sydney, Australia.
- Austroads, 2023, *Guide to Road Design Part 4A, Unsignalised and Signalised Intersections*, Austroads, Sydney, Australia.
- Stantec, 2019, *Technical Review, District Plan Review (Draft), prepared for Waimakariri District Council, March 2019*, Stantec, Christchurch.
- Waka Kotahi, 2007, *Planning Policy Manual, for Integrated Planning and Development of State Highways, Version 1 - Effective from 1 August 2007 - for Comment*, Waka Kotahi (formerly Transit New Zealand), Wellington.
- Waimakariri District Council, 2023, *Expert transport advice on TRAN chapter*, memorandum dated 21 August 2023 from Shane Binder (Senior Transportation Engineer, Waimakariri District Council) to Andrew McClellan (Consultant Planner) and Matt Bacon (Development Planning Manager).