

To Nick Hunter

Cc Graeme Belliss, Barry Dowsett

From Larry Cameron

Date 27 August 2013

Subject Revision of NZTA's EEM Passing Lane Length Factor Table A7.11

Purpose

1. This memo updates Table A7.11 Passing Lane Factors within NZTA's Economic Evaluation Manual (EEM).

Problem Definition

2. The current Table A7.11 does not take into account that the efficiency of the passing lane will change as traffic volumes increase, especially for shorter length passing lanes. Also, Table A7.11 does not consider gradient effects as the factors are applied to passing lanes with the same length but on different gradients.
3. There is no provision under the current EEM procedures for evaluating the extension of short-length passing lanes. It would be useful to have a methodology that determined the benefits for different lengths of passing lane (on similar gradient) under the same traffic growth conditions.

Revised Passing Lane Length Factors

4. Tables A7.11(a) & (b) provide revised passing lane length factors. Notes are provided overleaf.

Table A7.11a. Revised Passing Lane Length Factors for Travel Time Delays & Vehicle Operating Cost Savings									
AADT (veh/day)	Passing Lane Length (m, excl tapers)								
	400	600	800	1000	1200	1400	1600	1800	2000
2000	0.39	0.65	0.91	1.00	1.17	1.15	1.13	1.16	1.18
4000	0.30	0.60	0.86	1.00	1.19	1.30	1.40	1.48	1.55
6000	0.08	0.35	0.80	1.00	1.21	1.38	1.54	1.65	1.76
8000	0.04	0.18	0.60	1.00	1.22	1.43	1.63	1.76	1.88
10,000	0.02	0.11	0.38	0.82	1.24	1.47	1.69	1.83	1.96
12,000	0.02	0.08	0.27	0.57	1.06	1.49	1.73	1.88	2.03
14,000	0.01	0.06	0.20	0.43	0.80	1.32	1.76	1.93	2.09
16,000	0.01	0.05	0.16	0.34	0.63	1.04	1.59	1.97	2.14
18,000	0.01	0.04	0.13	0.28	0.51	0.85	1.30	1.81	2.19
20,000	0.01	0.03	0.11	0.23	0.43	0.71	1.09	1.51	2.03
22,000	0.01	0.03	0.09	0.20	0.37	0.60	0.93	1.29	1.73
24,000	0.01	0.02	0.08	0.17	0.32	0.52	0.80	1.11	1.50
26,000	0.00	0.02	0.07	0.15	0.28	0.46	0.70	0.98	1.31

Note: 1) Shaded values show either excluded values 1.6-2 km passing lane with 2,000-4,000 vpd or drop-off in efficiency. 2) The values are for passing lanes on flattish gradient with 110 km/hr overtaking speed. Refer to AUSTRROADS 2010 Modified Table VI within this memo for the equivalent length of the passing lane on a steeper gradient. 3) Refer to NZTA National Office for passing lanes that lie outside of the above range of values. 4) These factors do not apply to passing lanes in 2+1 layouts (continuous alternating passing lanes). 5) One-way hourly flows were converted to AADT, using a 45%/55% directional split and a peak hourly flow of 7.6% AADT.

AADT (veh/day)	Passing Lane Length (m, excl tapers)								
	400	600	800	1000	1200	1400	1600	1800	2000
2000	0.17	0.52	0.87	1.00	1.13	1.33	1.52	1.62	1.71
4000	0.13	0.48	0.82	1.00	1.18	1.30	1.41	1.50	1.59
6000	0.03	0.29	0.80	1.00	1.20	1.29	1.37	1.47	1.56
8000	0.02	0.15	0.60	1.00	1.21	1.30	1.38	1.48	1.58
10,000	0.01	0.09	0.38	0.82	1.21	1.31	1.40	1.51	1.61
12,000	0.01	0.07	0.27	0.57	1.03	1.32	1.43	1.55	1.66
14,000	0.01	0.05	0.20	0.43	0.78	1.17	1.47	1.59	1.71
16,000	0.00	0.04	0.16	0.34	0.61	0.92	1.32	1.61	1.73
18,000	0.00	0.03	0.13	0.28	0.50	0.75	1.08	1.47	1.75
20,000	0.00	0.03	0.11	0.23	0.42	0.63	0.90	1.23	1.62
22,000	0.00	0.02	0.09	0.20	0.36	0.53	0.77	1.05	1.38
24,000	0.00	0.02	0.08	0.17	0.31	0.46	0.66	0.91	1.19
26,000	0.00	0.02	0.07	0.15	0.27	0.41	0.58	0.80	1.05

Note: Same as notes for above Table A7.11a.

5. Two sets of revised factors have been developed (i) based on change in percentage of time spent following to apply to driver frustration benefits and (ii) based on change in the total time delayed to apply to travel time and VOC benefits.
6. A summary of the background research is provided (Appendix A) along with a worked example (Appendix B). The spreadsheet analysis steps for determining the tables is provided (Appendix C). A summary spreadsheet of the speed data for two NZ passing lane sites used to calibrate the effect of gradient within Appendix A is provided (Appendix D). Readers are advised to read Appendix A before attempting the worked example.

Limitations on Use

7. The following limitations are:
 - Factors for longer passing lanes (i.e. greater than 2000 m) have been deleted as there would be extrapolation errors and the previous EEM table only catered for up to 2000 m anyway. Any relative extrapolation error would be restricted to factors for 1800 and 2000 m passing lane as 1600 m has been calibrated. Values for 1,600-2,000 m passing lanes from 0-4,000 vpd have been deleted, as

these traffic volumes were below volumes recorded at the US calibration site for a 1.6 km passing lane.

- For passing lane lengths between the factors shown in the Tables A11.7 (a) & (b), interpolation is allowed. For example, travel time and vehicle operating costs for a 700 m passing lane at current 6,000 vpd would be $(0.35+0.80)/2 = 0.575$.
- Frustration savings benefits are based on isolated passing lanes but will need to take into account infilling between existing passing lanes, which will provide a new passing lane with shorter spacing, as well as shortening the spacing of the existing upstream passing lane.
- As the passing lane length factors vary with AADT, the passing lane performance will also vary. It is proposed that a weighted average passing lane length factor is used relative to AADT over the project life.
- Allow for differences in passing lane gradient by relating passing lane length to the current operating speed. (Note that AUSTRROADS 2010 has tables of passing lane length relative to operating speed).
- Where possible, passing lane lengths should be avoided if there will be a reduced passing lane length factor during the majority of the analysis period of the passing lane. While it may be economical to provide a shorter passing lane length at reduced efficiency, the level of service at these higher AADTs will be reduced. The passing lane lengths suggested within the Passing & Overtaking Policy's layout table will provide guidance on the choice of passing lane length to ensure an adequate level of service over the analysis period. Refer to NZTA website/state highways/technical guidance/passing & overtaking/technical information/passing and overtaking policy.

References

8. AUSTRROADS, 2010. Guide to Road Design Part 3: Geometric Design ISBN 978-1-921551-90-1, Australia.

Regards

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