

Appendix E

Method for calculating

crash reductions

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Hi Sam,

This memo records the methodology and analysis results in regarding to quantifying the number of fatal / serious crashes reductions as a result of the Wellington Northern Corridor RoNS improvements.

It should be noted that this methodology still needs approval from NZTA before any information to be released.

The number of Fatal and Serious (we recommend focussing on these as other crashes will take significant time and be of less impact) crashes have be extracted on the current SH1 from Airport to Levin in the past five year (1st January 2008 – 31st December 2012) from the NZTA “Crash Analysis System” (CAS). There were 18 fatal and 105 serious crashes being report during this period.


The WNCR CAS Fatal / Serious crashes plot can be found in attachment A.

Factors from EEM A6.20(a) were applied in order to predict the actual number of fatal and serious crashes (i.e. including the under reported crashes). This resulted in 19 fatal and 177 serious crashes for the last 5 years.

Nine sections as per WNCR projects parts have been identified as following:

1. Airport to Mount Vic Tunnel;
2. Mount Victoria Tunnel to Terrace Tunnel;
3. Terrace Tunnel to Aotea;
4. Aotea to Ngauranga;
5. Ngauranga to Linden;
6. Linden to MacKay;
7. MacKay to Peka Peka;
8. Peka Peka to Otaki North; and
9. Otaki North to Levin.

The following three crash prediction models were used under do minimum scenario in order to weight and factor theses site specific accident (from historical accident data) to a same and



POLICE CRASH LIST REPORT

2008-2012 Crashes

Run on: 30 May 2013

Crash List: AINZSH

Total Injury Crashes: 16955
Total Non-Injury Crashes: 0

Deaths 885
Serious Injuries 4187
Minor Injuries 19198

| Crash Movement | Number | % |
|------------------------------------|--------|-------|
| Overtaking Crashes | 1177 | 7 |
| Straight Road Lost Control/Head On | 2875 | 17 |
| Bend - Lost Control/Head On | 5434 | 32 |
| Rear End/Obstruction | 4020 | 24 |
| Crossing/Turning | 2718 | 16 |
| Pedestrian Crashes | 584 | 3 |
| Miscellaneous Crashes | 147 | 1 |
| Total | 16955 | 100 % |

| Crash Type | Single Party | Multiple Party | Total |
|--------------|--------------|----------------|-------|
| Intersection | 815 | 3898 | 4713 |
| MidBlock | 6380 | 5862 | 12242 |
| Total | 7195 | 9760 | 16955 |

| Location | Local road | State Highway | Total |
|------------|------------|---------------|-------|
| Urban road | 0 | 4454 | 4454 |
| Open road | 0 | 12501 | 12501 |
| Total | 0 | 16955 | 16955 |

| Environment | Light/Overcast | Dark/Twilight | Total |
|-------------|----------------|---------------|-------|
| Dry | 8836 | 3265 | 12101 |
| Wet | 2772 | 1684 | 4456 |
| Icy | 229 | 152 | 381 |
| Total | 11837 | 5101 | 16938 |

| Drivers at fault or part fault in Injury crashes | Male | Female | Total |
|--|-------|--------|-------|
| 15-19 years | 1450 | 878 | 2328 |
| 20-24 | 1791 | 985 | 2776 |
| 25-29 | 1143 | 622 | 1765 |
| 30-39 | 1707 | 934 | 2641 |
| 40-49 | 1838 | 890 | 2728 |
| 50-59 | 1461 | 676 | 2137 |
| 60-69 | 882 | 455 | 1337 |
| 70+ | 765 | 462 | 1227 |
| Total | 11037 | 5902 | 16939 |

| Drivers at fault or part fault in Injury crashes | Male | Female | Total |
|--|-------|--------|-------|
| Full | 7374 | 3689 | 11063 |
| Learner | 694 | 401 | 1095 |
| Restricted | 1432 | 1133 | 2565 |
| Never licensed | 152 | 96 | 248 |
| Disqualified | 206 | 29 | 235 |
| Overseas | 728 | 349 | 1077 |
| Expired | 75 | 39 | 114 |
| Other/Unknown | 608 | 234 | 842 |
| Total | 11269 | 5970 | 17239 |

| Injury crash factors (*) | No.Inj.Crashes | % Inj.Crashes |
|--------------------------|----------------|---------------|
| Alcohol | 2137 | 13 |
| Too fast | 2725 | 16 |
| Failed Giveaway/Stop | 2722 | 16 |
| Failed Keep Left | 503 | 3 |
| Overtaking | 462 | 3 |
| Incorrect Lane/posn | 2871 | 17 |
| Poor handling | 4899 | 29 |
| Poor Observation | 6088 | 36 |
| Poor judgement | 2477 | 15 |
| Fatigue | 1739 | 10 |
| Disabled/old/ill | 716 | 4 |
| Pedestrian factors | 410 | 2 |
| Vehicle factors | 931 | 5 |
| Other | 1409 | 8 |
| Total | 30089 | 177 % |

(*) factors are counted once against a crash - ie two fatigued drivers count as one fatigue crash factor.

| Day/Period | 0000-0259 | 0300-0559 | 0600-0859 | 0900-1159 | 1200-1459 | 1500-1759 | 1800-2059 | 2100-2400 | Total |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|
| Mon | 83 | 66 | 391 | 365 | 410 | 504 | 222 | 115 | 2156 |
| Tue | 54 | 81 | 399 | 377 | 380 | 556 | 241 | 137 | 2225 |
| Wed | 79 | 73 | 389 | 319 | 397 | 575 | 282 | 157 | 2271 |
| Thu | 90 | 83 | 367 | 337 | 434 | 602 | 298 | 178 | 2389 |
| Fri | 127 | 112 | 339 | 344 | 502 | 746 | 398 | 238 | 2806 |
| Sat | 207 | 163 | 240 | 428 | 576 | 471 | 321 | 239 | 2645 |
| Sun | 197 | 200 | 192 | 343 | 465 | 542 | 277 | 143 | 2359 |
| Total | 837 | 778 | 2317 | 2513 | 3164 | 3996 | 2039 | 1207 | 16851 |

| Month of year | Injury | % | Non-Injury | % | Total | % |
|---------------|--------|-------|------------|-------|-------|-------|
| Jan | 1572 | 9 | 0 | 0 | 1572 | 9 |
| Feb | 1473 | 9 | 0 | 0 | 1473 | 9 |
| Mar | 1576 | 9 | 0 | 0 | 1576 | 9 |
| Apr | 1520 | 9 | 0 | 0 | 1520 | 9 |
| May | 1449 | 9 | 0 | 0 | 1449 | 9 |
| Jun | 1372 | 8 | 0 | 0 | 1372 | 8 |
| Jul | 1410 | 8 | 0 | 0 | 1410 | 8 |
| Aug | 1240 | 7 | 0 | 0 | 1240 | 7 |
| Sep | 1171 | 7 | 0 | 0 | 1171 | 7 |
| Oct | 1299 | 8 | 0 | 0 | 1299 | 8 |
| Nov | 1310 | 8 | 0 | 0 | 1310 | 8 |
| Dec | 1563 | 9 | 0 | 0 | 1563 | 9 |
| Total | 16955 | 100 % | 0 | 100 % | 16955 | 100 % |

| Crash (in 5 Yrs) | Serious | Minor | Non-Inj | Total |
|------------------|-------------|--------------|---------|--------------|
| 2008158 (177) | 680 (908) | 2888 (4204) | 0 (-) | 3726 (5289) |
| 2009172 (197) | 675 (906) | 2706 (4139) | 0 (-) | 3553 (5242) |
| 2010166 (187) | 579 (789) | 2677 (3925) | 0 (-) | 3422 (4901) |
| 2011132 (150) | 583 (767) | 2447 (3556) | 0 (-) | 3162 (4473) |
| 2012146 (174) | 620 (817) | 2326 (3374) | 0 (-) | 3092 (4365) |
| Total774 (885) | 3137 (4187) | 13044(19198) | 0 (-) | 16955(24270) |

Note: last 5 years of crashes shown

comparable level as the predicted WNCR option level. WTSM predicted Average Annual Daily Traffic (AADT) was assumed in the crash prediction model.

- Model 5, General urban mid-block;
- Model 11, Rural two-lane roads; and
- Model 13, Motorway and four-lane divided rural roads.

Based on the total New Zealand State Highway data between years 2008 and 2012, the fatal and serious crashes contribute 23.1% of the total injury crashes.

The CAS summary report for New Zealand State Highway crashes between 1st January 2008 and 31st December 2012 can be found in attachment B.

By taking consideration of the traffic growth and growth rate adjustment (as described in EEM A6.5), the predicted total fatal and serious crashes will be 142 for a five years period in 2031 under do minimum scenario.

Same prediction models and methodologies are applied to the WNCR option scenario, the predicted total fatal and serious crashes will be 102 for a five years period in 2031 under WNCR expressway scenarios. Therefore, the WNCR schemes will save 40 fatal / serious crashes per 5 years period under year 2031.

Detailed calculation summary can be found in attachment C.

According to the total New Zealand SH past 5 years' historical data, the fatal crashes contribute 19.8% of the sum of fatal and serious crashes. However, based on the past 5 years' historical data on WNCR, the same figure drops to 9.7% (Fatal / (Fatal + Serious)). Therefore, it is believed that the WNCR expressway will save 4 to 8 fatal crashes (or 36 to 32 serious crashes) per 5 years period under year 2031.

In New Zealand, one fatal crash normally kills 1.14 people on average; this implies the WNCR will save 5 to 9 lives per 5 years under 2031 traffic condition level.

Please feel free to contact me directly for any assistance on these.

Regards



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Appendix C - Attachment C

| | WNCR Section | Location | Crash Function | Speed (km/hr) | Length (km) | AADT1 (veh/day) | Site Type | Predicted Accident Rate (inj/yr) | Year Zero | Predicted Accident Rate in Year Zero (inj/yr) | Predicted F&S Accident Rate in Year Zero (inj/yr) | Weighting Factor | Report F&S Rate in 2012 (inj/yr) | Growth Rate | Report F&S Rate in 2031 (inj/yr) | Final Weighted F&S Rate in Year Zero (inj/yr) | Option | |
|-----------------|----------------------------|--|---|---------------|-------------|-----------------|----------------------|----------------------------------|-----------|---|---|------------------|----------------------------------|-------------|----------------------------------|---|---|--|
| | | | | | | | | | | | | | | | | | Final Weighted F&S Rate in Year Zero (inj/yr) | Final Weighted F&S Accident Rate in Year Zero (inj/yr) |
| DoMin | 1 Airport to Mt Vic Tunnel | Midblock between Broadway/SH1 and Dufferin St/SH1 | (05) General urban mid-blocks (50-70kph) | 70 | 4.7 | 34000 | (05)MID3 Arterial | 9.87 | 2031 | 7.40 | 1.71 | 0.50 | 5 | 1.1% | 5 | 5 | 3 | |
| | 2 Tunnel to Tunnel | Midblock between Dufferin St/SH1 and Willis St/SH1 | (05) General urban mid-blocks (50-70kph) | 50 | 1.4 | 54000 | (05)MID3 Arterial | 5.12 | 2031 | 1.28 | 0.30 | 0.85 | 2 | 0.6% | 2 | 2 | 1 | |
| | 3 Terrace Tunnel | Midblock between Willis St/SH1 and Aotea on-ramp | (13) Motorway and four-lane divided rural roads | 100 | 3.5 | 48000 | (13)MID4 Motorway | 6.36 | 2031 | 4.77 | 1.10 | 0.65 | 2 | 0.6% | 2 | 2 | 1 | |
| | 4 Aotea to Ngauranga | Midblock between Aotea on-ramp and Ngauranga Int' | (13) Motorway and four-lane divided rural roads | 100 | 2.9 | 88000 | (13)MID4 Motorway | 12.68 | 2031 | 9.51 | 2.19 | 0.48 | 1 | 0.6% | 1 | 1 | 2 | |
| | 5 Ngauranga to Linden | Midblock between Ngauranga Int' and SH1 near Collins Ave | (13) Motorway and four-lane divided rural roads | 100 | 11.0 | 65000 | (13)MID4 Motorway | 31.00 | 2031 | 23.25 | 5.36 | 0.28 | 6 | 0.7% | 6 | 6 | 6 | |
| | 6 Linden to MacKay | Midblock between SH1 near Collins Ave and MacKay/SH1 | (13) Motorway and four-lane divided rural roads | 100 | 26.5 | 22000 | (13)MID5 4Lane Rural | 18.62 | 2031 | 13.97 | 3.22 | 0.39 | 6 | 0.2% | 5 | 4 | 4 | |
| | 7 Mackays to Peka Peka | Midblock between MacKay/SH1 and Peka Peka Rd/SH1 | (11) Rural two-lane roads (>=80kph) | 100 | 18.2 | 22000 | (00)N/A0 | 14.31 | 2031 | 10.73 | 2.48 | 0.51 | 6 | 1.5% | 7 | 5 | 5 | |
| | 8 Peka Peka to Otaki | Midblock between Peka Peka Rd/SH1 and Taylors Rd/SH1 | (11) Rural two-lane roads (>=80kph) | 80 | 12.8 | 18000 | (00)N/A0 | 8.23 | 2031 | 6.17 | 1.42 | 0.56 | 5 | 1.4% | 5 | 5 | 3 | |
| | 9 Otaki to Levin | Midblock between Taylors Rd/SH1 and Kawi Rd/SH1 | (11) Rural two-lane roads (>=80kph) | 80 | 23.7 | 17000 | (00)N/A0 | 14.40 | 2031 | 10.80 | 2.49 | 0.57 | 6 | 0.7% | 5 | 5 | 4 | |
| | 1 Airport to Mt Vic Tunnel | Midblock between Broadway/SH1 and Dufferin St/SH1 | (05) General urban mid-blocks (50-70kph) | 70 | 4.5 | 34000 | (05)MID3 Arterial | 9.45 | 2031 | 7.08 | 1.6 | | | | | | 3 | 3 |
| | 2 Tunnel to Tunnel | Midblock between Dufferin St/SH1 and Willis St/SH1 | (05) General urban mid-blocks (50-70kph) | 50 | 1.1 | 60000 | (05)MID3 Arterial | 4.56 | 2031 | 1.14 | 0.3 | | | | | | 1 | 0 |
| | 3 Terrace Tunnel | Midblock between Willis St/SH1 and Aotea on-ramp | (13) Motorway and four-lane divided rural roads | 100 | 3.5 | 53000 | (13)MID4 Motorway | 7.34 | 2031 | 5.50 | 1.3 | | | | | | 1 | 2 |
| | 4 Aotea to Ngauranga | Midblock between Aotea on-ramp and Ngauranga Int' | (13) Motorway and four-lane divided rural roads | 100 | 2.9 | 89000 | (13)MID4 Motorway | 12.89 | 2031 | 9.67 | 2.2 | | | | | | 2 | 2 |
| | 5 Ngauranga to Linden | Midblock between Ngauranga Int' and SH1 near Collins Ave | (13) Motorway and four-lane divided rural roads | 100 | 11.0 | 47000 | (13)MID4 Motorway | 19.37 | 2031 | 14.53 | 3.4 | | | | | | 6 | 4 |
| | 6 Linden to MacKay | Midblock between SH1 near Collins Ave and MacKay/SH1 | (13) Motorway and four-lane divided rural roads | 100 | 26.0 | 18000 | (13)MID4 Motorway | 11.39 | 2031 | 8.54 | 2.0 | | | | | | 4 | 3 |
| | 7 Mackays to Peka Peka | Midblock between MacKay/SH1 and Peka Peka Rd/SH1 | (13) Motorway and four-lane divided rural roads | 100 | 17.8 | 17000 | (13)MID4 Motorway | 7.18 | 2031 | 5.38 | 1.2 | | | | | | 5 | 2 |
| | 8 Peka Peka to Otaki | Midblock between Peka Peka Rd/SH1 and Taylors Rd/SH1 | (13) Motorway and four-lane divided rural roads | 100 | 11.5 | 19000 | (13)MID4 Motorway | 5.45 | 2031 | 4.09 | 0.9 | | | | | | 3 | 2 |
| | 9 Otaki to Levin | Midblock between Taylors Rd/SH1 and Kawi Rd/SH1 | (13) Motorway and four-lane divided rural roads | 100 | 23.7 | 18000 | (13)MID4 Motorway | 10.38 | 2031 | 7.78 | 1.8 | | | | | | 4 | 3 |
| DoMin | Option | | Saving Crash | | | | | | | | | | | | | | | |
| 5 years Fatal | 28 | | 20 | | | | | | | | | | | | | | -8 | |
| 5 years Serious | 114 | | 81 | | | | | | | | | | | | | | -32 | |
| Total F&S | 142 | | 101 | | | | | | | | | | | | | | -40 | |