

**BEFORE THE HEARING PANEL**

**IN THE MATTER** of the Resource Management Act 1991

**AND**

**IN THE MATTER** of an application to Hamilton City Council for Private  
Plan Change 7 to the Hamilton City District Plan by  
Green Seed Consultants Limited

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**STATEMENT OF EVIDENCE OF ALASTAIR JAMES BLACK**

**Dated 22 October 2021**

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## INTRODUCTION

1. My full name is Alastair James Black. I hold a Bachelor of Engineering degree (Civil, 2002) from the University of Canterbury. I am a Chartered Member of Engineering New Zealand (CMEngNZ) and a Chartered Professional Engineer (CPEng). I have worked in the transportation field for 19 years.
2. I am based in Hamilton and have worked for Gray Matter Ltd as a transportation engineer since March 2009. For two years prior to that I was a Project Engineer for the London Borough of Hammersmith and Fulham. For the previous six years I was a civil/transportation engineer with Opus International Consultants Ltd in Hamilton.
3. I am familiar with the transport issues arising in and around Hamilton, having provided advice to local authorities including Hamilton City Council, Waipa District Council, Matamata Piako District Council and Waikato District Council. I have also provided advice to Waka Kotahi NZ Transport Agency (“Waka Kotahi”) and developers on range of transport related projects in the area. I have the following specific experience relevant to the matters within the scope and purpose of this statement of evidence:
  - a. Consultant civil/transportation engineer for Road Controlling Authorities assisting in the review of consent applications including quarries, industrial, intensive farming, commercial, childcare and residential developments within wider Waikato Region;
  - b. Consultant civil/transportation engineer for developers, landowners and local authorities preparing traffic impact assessments for development proposals including quarries,

intensive farming, rest homes, museums, childcares, schools, commercial and residential developments;

- c. Consultant transportation engineer for Hamilton City Council assisting in the development of the transportation provisions for the Operative District Plan and currently assisting with Plan Change 5 for Peacocke, reviewing the Peacocke Structure Plan;
  - d. Consultant project manager for Hamilton City Council and NZTA for the Southern Links Investigation achieving and managing the designation for 32km of proposed arterial road network to the south of Hamilton;
  - e. I have completed the NZTA Road Safety Engineering Workshop and have led safety audits on urban and rural improvement projects and development proposals affecting local roads and state highways; and
  - f. I am a Certified Commissioner under the Ministry for the Environment's 'Making Good Decisions' course.
4. I provided a report<sup>1</sup> assessing transport matters arising under the proposed Rotokauri North Private Plan Change (**PC7**) dated 6 September 2021 which was included in Appendix D to the s 42A report.

#### **CODE OF CONDUCT**

5. I have read the Environment Court Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014 and agree to comply with it. I confirm that the opinions expressed in this statement are within my area of expertise except where I state that I have relied on the

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<sup>1</sup> "PC7 Rotokauri North – Updated Transportation Review" (6 September 2021)

evidence of other persons. I have not omitted to consider materials or facts known to me that might alter or detract from the opinions I have expressed.

#### **SCOPE OF EVIDENCE**

6. In my evidence I provide a summary of the findings in my report appended to the s 42A report, and comment on matters raised in the evidence of Green Seed and submitters.

#### **SUMMARY OF REPORT**

7. In my report I concluded that from a transport planning perspective, the ultimate location and transport connections for PC7 generally appear appropriate and provide good links to significant transport corridors (SH1, SH39 and the minor arterial). However, the proposal is inadequate in terms of the support for passenger transport (“PT”) corridors and multi-modal connections to the wider area beyond the structure plan area. This is due to out of sequence nature of the timing and the lack of existing services and safe facilities for pedestrians, cyclists and bus users along nearby transport corridors.
8. In my view, the out of sequence development of PC7 is not good practice, presents significant risks for the safety of vulnerable road users, and is inconsistent with the Government Policy Statement on Land Transport 2021-31 (“GPS”). The GPS has four strategic priorities:
  - a. A transport system where no-one is killed or seriously injured;
  - b. Improving freight connections for economic development;
  - c. Providing people with better transport options; and
  - d. Developing a low carbon transport system that support emissions reductions while improving safety and inclusive access.

9. There are very few options to provide interim public transport services or walking and cycling connections until the remainder of the Rotokauri Structure Plan area is developed. This limits transport options for residents until the remainder of the transport network is constructed by HCC or other parties – route choice is limited and the journey lengths means that walking or cycling will be unattractive and interim public transport services are unlikely to be provided.
10. The out of sequence nature of the Plan Change does not support the effective or attractive provision of public transport services and will likely rely on private vehicle travel. Relying on what is likely to be low occupancy private vehicles will not reduce or manage vehicle kilometres travelled or reduce carbon emissions. This does not support a low carbon transport system that reduces transport emissions.
11. PC7 results in significant additional traffic on the existing local road network. The traffic changes and consequential adverse effects that result from the development are sensitive to the timing and provision of the minor arterial network and staging of development. In my view, either the mitigation should be built as part of development or a definitive, spatially-defined staging plan should be part of the structure plan so that the implementation of transport infrastructure is clearly defined within the planning provisions, rather than relying on future assessments.
12. Based on HCC's current Long Term Plan ("LTP"), it is unlikely that the minor arterial network will be constructed until the mid-2030's. In my view a realistic timeframe for the duration of adverse effects on Burbush and Exelby Roads before alternatives are available is 15 years. In my opinion this duration should be considered as long term and justifying mitigation<sup>2</sup>

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<sup>2</sup> E.g. Austroads assessment of auxiliary lane justification is based on a 10 year period.

13. The infrastructure proposed as part of the Plan Change does not provide adequate transport connections for all road users in accordance with safe system design principles and results in a transport network that is likely to lead to an increase in deaths and serious injuries, contrary to Vision Zero objectives for a reduction in harm. I am concerned that the Plan Change could result in adverse effects, including a risk of death and serious injury crashes because of the mainly rural and peri-urban transport network. Without explicit direction for staging and mitigation, the effects of subdivision and development may be incremental and cumulative, making them potentially difficult to assess and require adequate mitigation.
14. My review and assessment of the ITA and proposed Implementation Plan concluded that the proposed triggers were too high and changes were required to lower them and reduce the risk of adverse effects. The proposed triggers for infrastructure improvements are based on a number of assumptions which have not been sensitivity tested.

#### **UPDATED POSITION**

15. In preparing this evidence I have reviewed the following:
  - a. Statement of Evidence of Leo Donald Hills (24 September 2021);
  - b. Statement of Evidence of Michael Wood (8 October 2021);
  - c. Statement of Evidence of Duncan Tindall (8 October 2021);
  - d. Statement of Evidence of Heather Louise Perring (8 October 2021);
  - e. Letter from Waikato Regional Council (8 October 2021); and
  - f. Reply Statement of Evidence of Leo Donald Hills (15 October 2021).

16. I participated in Expert Witness Caucusing as documented in the Joint Witness Statements (“JWS”) dated 21 September 2021, 5 October 2021, 12 October 2021 and 14 October 2021.

### ***Staging***

17. I remain concerned that PC7 does not include clear staging that directly links specific stages/areas of development to specific infrastructure improvements. The potential for unacceptable outcomes from the lack of staging is acknowledged by Mr Hills<sup>3</sup>.
18. The proposed provisions provide initial triggers for development and cumulative thresholds that trigger other upgrades. This provides flexibility for the developer but results in uncertainty for the receiving environment depending on how the development is staged.

### ***Infrastructure Improvements within the Plan Change Area***

19. Through caucusing the provisions relating to improvements triggered by the initial stages of development and related to transport infrastructure immediately adjacent to the Plan Change area have been agreed as set out in JWS #2<sup>4</sup>.

### ***Infrastructure Improvements beyond the Plan Change Area***

20. I remain concerned that the infrastructure improvements proposed to manage the transport effects on the existing rural network beyond the Plan Change area are not adequate. As outlined by Ms Perring<sup>5</sup> the Rotokauri Structure Plan sets out the expectation that development would be sequenced south to north and that developers will bear the full cost of infrastructure to support out of sequence development.

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<sup>3</sup> Hills EIC, paragraph 8.4

<sup>4</sup> Joint Witness Statement of Experts in Relation to Transport and Planning (5 October 2021), Rule 3.6A.4.2(f)(ii) Table 1, Items 1-7

<sup>5</sup> Perring EIC, paragraphs 3.2-3.4

21. In his evidence Mr Hills<sup>6</sup> describes the 2041 modelling based on scenarios 'with' and 'without' the minor arterial. As outlined in my Report (Section 3.2.3 and Figure 3) the transport network included in the 'without' scenario includes the future collector and minor arterial networks beyond the Plan Change area. This over-states the route choice that future drivers will have during this interim period.
22. There is no funding for the minor arterial network included in HCC's LTP and I am concerned that full development of the Plan Change area could prior development of the future collector and minor arterial networks beyond the Plan Change area. In this scenario the development will rely on the existing rural network for travel, i.e. Exelby Road, Burbush Road and SH39. This has been addressed through additional modelling provided as part of JWS #4.
23. As described by Mr Hills in his ITA and evidence<sup>7</sup> the existing network consists of narrow rural roads with no facilities for walking or cycling other than high speed traffic lanes.
24. Mr Hills<sup>8</sup> disagrees with my comments on the increase in traffic volume. In my Report I was referring to an increase in traffic from the current volumes recorded by HCC on the mobileroad.org website. The 2020 hourly volumes for Exelby Road and Burbush Road as assessed by Mr Hills<sup>9</sup> are 55-59veh/hr. I acknowledge the difference between these 2020 recorded volumes and those modelled for 2021 in Footnote 9 of my Report. The discrepancy between the existing traffic volumes and the 2021 modelled volumes has not been resolved and indicates uncertainty in the model outputs.

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<sup>6</sup> Hills EIC, paragraphs 5.15-5.30

<sup>7</sup> Hills EIC, paragraphs 4.1-4.18

<sup>8</sup> Hills EIC, paragraphs 8.7 and 8.7

<sup>9</sup> Hills EIC, Table 3



25. Mr Hills<sup>10</sup> summarised the outputs of Select Link analysis that indicate a small increase in traffic on the Burbush Exelby Road corridor . He provided me with the Select Link Analysis by email<sup>11</sup>. As discussed above<sup>12</sup>, I am concerned that this modelling relies on the future transport network to be provided by others. As a result I have not relied on these model outputs, preferring to rely on the outputs attached to JWS #4 and provided to me via email<sup>13</sup>.
26. Mr Hills had additional modelling completed testing scenarios based on the 2021 transport network with three levels of development (150, 500 and 2,000 dwellings) within Rotokauri North. In my view, although they are a limited number of snapshots of potential development, these are the most appropriate scenarios to test the interim effects of the proposal. I note that these are simply examples of potential development since there the staging and location rules for development in the proposal are not explicit, and I remain concerned about the potential for unexpected outcomes.
27. The initial outputs were provided to me by email<sup>14</sup> and I responded highlighting initial concerns with these outputs via email<sup>15</sup>. My concerns were discussed at the JWS conferencing on 14 October 2021 (JWS #4) where agreement was reached on several matters.
28. From my review of the model outputs I note that:
  - a. In the 150 and 500 dwelling scenarios the majority of trips are using SH39 Koura Drive and SH1 over Burbush and Exelby Roads. With the initial stages of development accessed via the proposed SH39 roundabout this is the shortest and fastest route to the

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<sup>10</sup> Hills, paragraph 8.11

<sup>11</sup> Email Leo Hills to Alastair Black, 29/09/2021

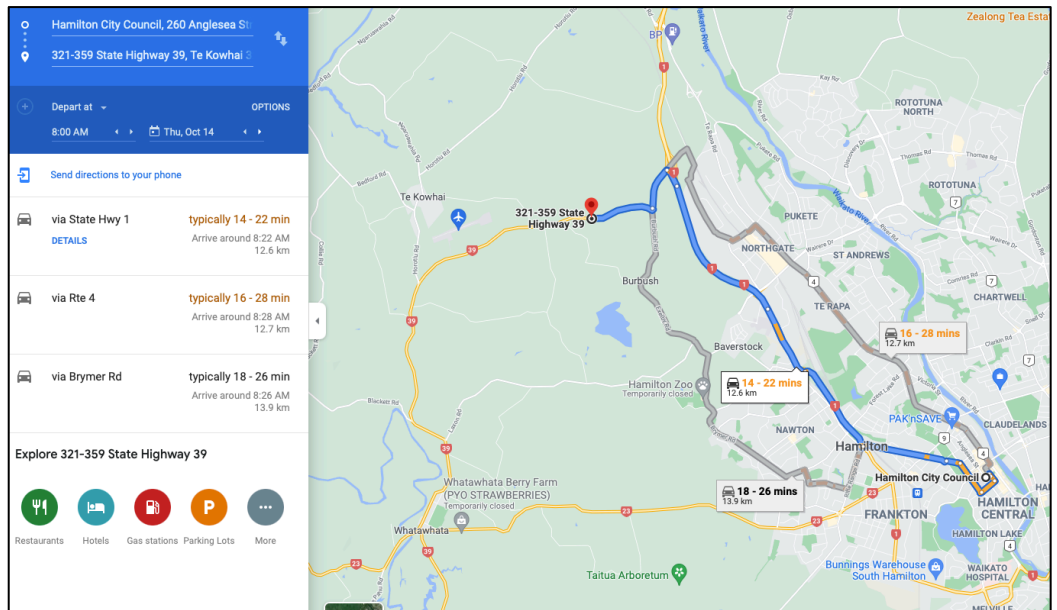
<sup>12</sup> Black EIC, paragraph 21

<sup>13</sup> Email Leo Hills to Alastair Black, 12 October 2021

<sup>14</sup> Email Rebekah Hill to Expert Witnesses, dated 12 October 2021

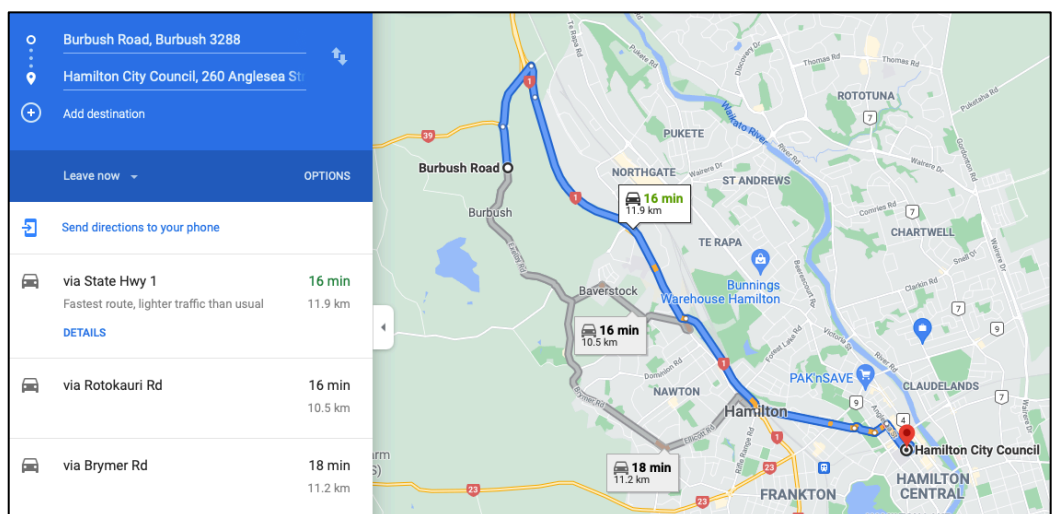
<sup>15</sup> Email Alastair Black to Leo Hills, dated 12 October 2021

Hamilton CBD. This is illustrated in the following image from Google Maps.



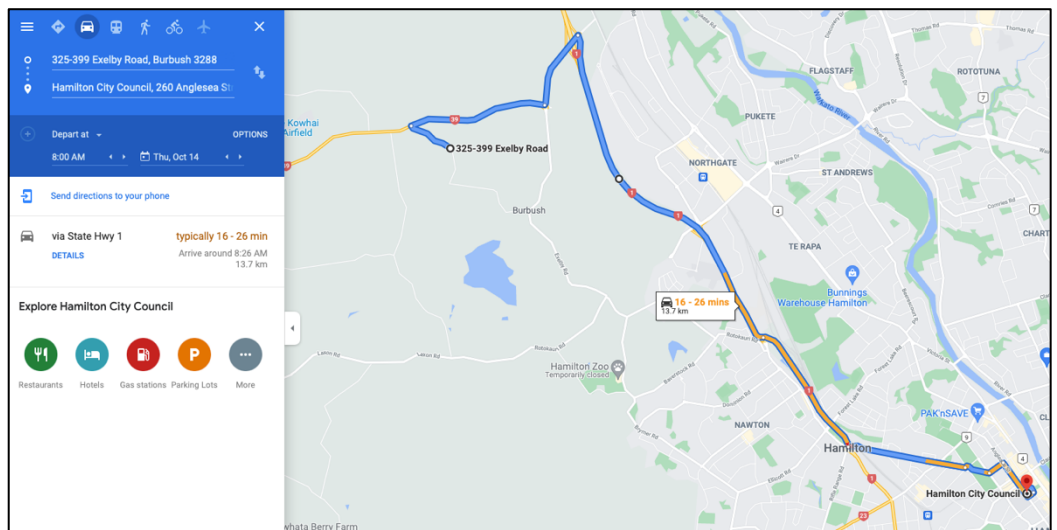
**Figure 1: Google Traffic from SH39 (Thursday 14 October 2021, 8am)**

- b. The connection of the Plan Change area to Burbush Road results in the Exelby Road/ Burbush Road route having a shorter distance and similar travel time to SH1. This is illustrated in the following image from Google Maps. In my opinion, this indicates that route selection will be heavily influenced by driver behaviour and perceptions.

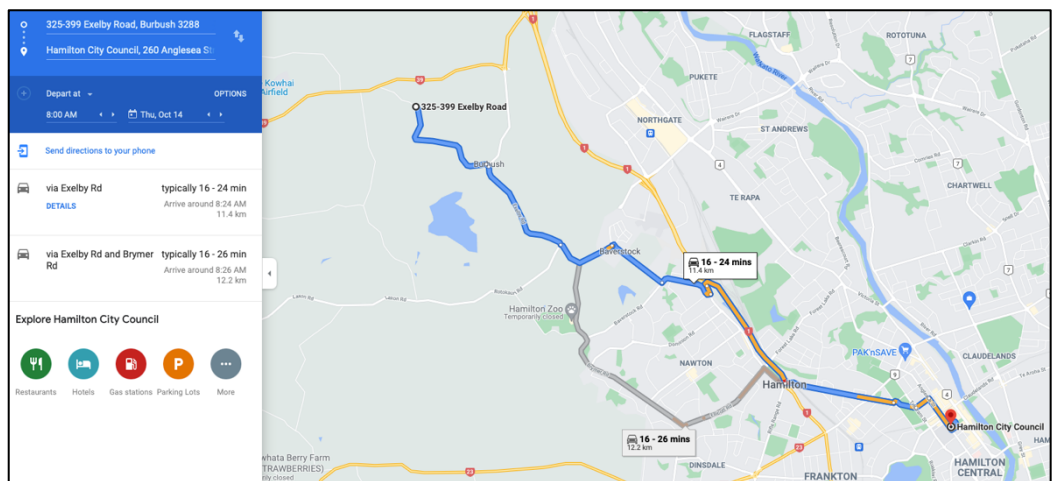


**Figure 2: Google Traffic from Burbush Road (Thursday 14 October 2021, 7.58am)**

- c. Once a connection to Exelby Road is provided the travel time from this intersection to the Hamilton CBD is very similar (16-26mins). However the travel distance is shorter, 11.4-12.2km via the local roads compared to 13.7km via SH1. In my opinion, this indicates that route selection from the western side of the Plan Change area will be heavily influenced by driver behaviour and perceptions.



**Figure 3: Google Traffic from Exelby Road via SH1 (Thursday 14 October 2021, 8am)**



**Figure 4: Google Traffic from Exelby Road via Exelby and Burbush Roads (Thursday 14 October 2021, 8am)**

- d. The traffic volumes on Burbush Road and Exelby Road (south of Burbush Road) increase significantly between the 500 and 2,000 dwelling scenarios. An updated table of hourly and daily traffic

volumes extracted from the revised model outputs is include as Attachment 1.

***Burbush Road and Exelby Road (south of Burbush Road)***

29. As stated in JWS #4, I am concerned that the increase in traffic on Exelby Road (south of Burbush Road) and Burbush Road means that the seal widening to 7.7m (5.7m carriageway plus 1m shoulders) may not be sufficient.
30. The District Plan<sup>16</sup> does not provide cross-section standards for rural roads. Instead, collectors in the Future Urban zone are required to provide an 8m sealed width and 2.5m shared off-road footpath and cycle path on both sides of the road. Standards for rural collector roads vary depending on the source. The Proposed Waikato District Plan<sup>17</sup> requires a 10m seal width for rural collectors with more than 1,000veh/day. As discussed in my Report (Section 3.3) Austroads provides standards for rural roads which requires 3.5m wide traffic lanes once the traffic volume exceeds 1,000veh/day.
31. The proposed widening is based on providing a 7.7m seal width for rural collector as described in NZS4404<sup>18</sup>. NZS4404 requires footpaths on both sides of the road which are not included in the proposal.
32. In the long-term Burbush Road and Exelby Road south of the site will be upgraded to an urban collector standard as other development takes place. The timing of these upgrades is uncertain as it depends on others. In my view the proposed upgrades should address the transport effects of 2,000 dwelling scenario on the existing transport network.
33. I disagree with Mr Hills<sup>19</sup> that the traffic volume on this section of Exelby Road will be approximately 5,000veh/day. My assessment shows the daily

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<sup>16</sup> Table 15-6a)ii) Criteria for the form of Transport Corridors

<sup>17</sup> Proposed Waikato District Plan, Table 14.12.5.15 Access and Road Conditions (Rural and Country Living Zones)

<sup>18</sup> NZS 4404:2010 Land Development and Subdivision Infrastructure, Table 3.2

<sup>19</sup> Hills Reply, paragraph 3.32

traffic volume on Exelby Road (north of Lee Road) will be approximately 7,400veh/day in the 2,000 dwelling scenario (refer Attachment 1). This is more than double that modelled in the 500 dwelling scenario (3,000veh/day). In the 2041 scenario the traffic volumes reduces to 5,400veh/day as the wider transport network provides alternative routes. By way of comparison, SH39 currently carries 4,600-5,800veh/day<sup>20</sup>.

34. Mr Hills did not address the effects on this corridor at JWS conferencing. In his reply Mr Hills<sup>21</sup> replies on four points which I respond to below:
- a. He considers that full development is unlikely to occur without other development being constructed to the south. He provides no information to support that position. I consider a scenario with no development to the south to be a real one as:
    - i. HCC does not have funding for construction of the minor arterial network in their LTP. HCC sought and has been unsuccessful in achieving alternative funding for the Rotokauri Stage 1 and Stage 2 infrastructure. Applications included the Housing Infrastructure Fund, Shovel Ready Stimulus funding, Infrastructure Funding and Finance opportunities, and the recent Infrastructure Acceleration Fund applications. The current network could be the only transport network in the area for a period of approximately 15 year and the developer related to this plan change has been quoted in the media<sup>22</sup> that *“the whole development is expected to take five to seven years to complete”*.

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<sup>20</sup> Hills EIC, Table 3

<sup>21</sup> Hills Reply, paragraph 3.33

<sup>22</sup> <https://www.stuff.co.nz/waikato-times/news/300397251/hundred-million-dollar-pitch-for-2000-homes-built-in-rotokauri>

- ii. There are no provisions proposed in the plan change that limit development within the Plan Change if the minor arterial or other transport infrastructure is not in place;
- b. A change in speed limit cannot be relied upon as mitigation as there is no certainty that it will be implemented.
- c. In my view relying solely on traffic volumes to determine road standards is inconsistent with safe system design principles and Vision Zero. It does not consider the existing deficiencies of the transport network that will be exacerbated by the significant increase in traffic predicted by the model if no other transport infrastructure is provided. These deficiencies have been acknowledge by Mr Hills<sup>23</sup>. I disagree with his statement<sup>24</sup> that *“I do not consider PC7 should be responsible for essentially fixing a road to current HCC standards that has existing deficiencies.”* As discussed above<sup>25</sup>, the District Plan expects development to be sequenced south to north and for developers to bear the full cost of infrastructure to support out of sequence development. In my view, the development creates the potential for approximately 7,400veh/day on Exelby Road and should provide appropriate mitigation for that increase.
- d. Relying on future assessments increases the risk of adverse incremental and cumulative effects that could be avoided through more detailed staging provisions. These staging provisions should set a maximum limit on the number of dwellings until the minor arterial or other infrastructure is provided or require further upgrades to the affected roads.

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<sup>23</sup> Hills Reply, paragraph 3.31

<sup>24</sup> Hills Reply, paragraphs 3.9(b) and 3.31

<sup>25</sup> Paragraph 20

35. I have used the crash prediction models in the Waka Kotahi Crash Estimation Compendium<sup>26</sup> to predict the injury crash rate for mid-block crashes on Exelby Road. My analysis has considered a range of cross-sections and traffic volumes. Detailed calculations are provided at Attachment 2 with the outputs summarised below.

Scenario	Existing (5.5m sealed width)	Proposed (7.7m sealed width)	Seal widening to 9.5m
2021 (base)	1.06	N/A	N/A
2021 with 500 dwellings	1.04	0.67	N/A
2021 with 2,000 dwellings	N/A	1.58	1.01

**Table 1: Predicted Injury Crash Rate for Mid-Block crashes on Exelby Road (injury crashes per year)**

36. My analysis shows that the base scenario mid-block crash rate is 1.06 injury crashes/year. This reduces to 0.67 injury crashes/year in the 500 dwelling scenario with the agreed widening. This does not include crashes that may occur at intersections along the corridor.
37. Without additional mitigation the 2,000 dwelling scenario results in 50% increase in crash rate to 1.58 injury crashes/year. A further increase of the sealed width to a total of 9.5m reduces the predicted crash rate to 1.01 injury crashes/year, broadly matching the base crash rate.
38. Simply increasing the sealed width to 9.5m may result in unintended safety effects through higher vehicle speeds and increasing demand for walking and cycling in the sealed shoulders. It would not address safety concerns at intersections or concerns about the horizontal or vertical geometry. A detailed safety assessment of the corridor should be required to determine the scope of work to address these concerns. Therefore, the provisions should be flexible enough to allow for alternative mitigation (e.g.

<sup>26</sup> Crash Estimation Compendium, First Edition, Amendment 1

improvements to geometry) that achieves a predicted crash rate to 1 injury crash per year (similar to the existing crash rate).

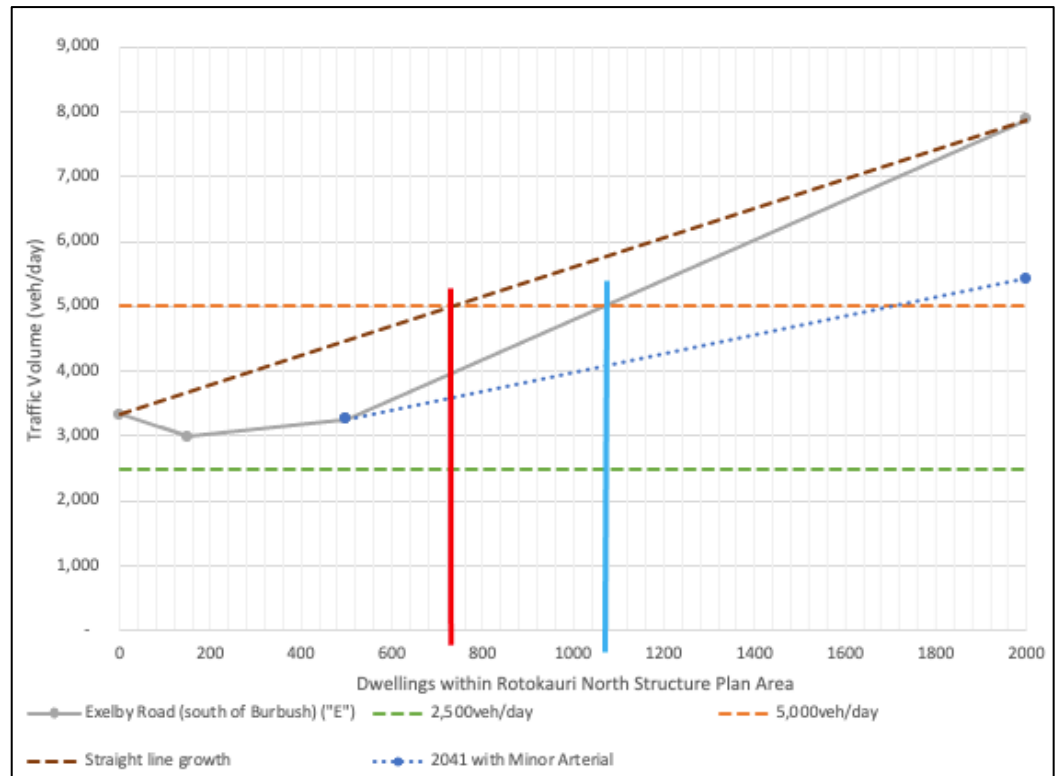
39. Providing a 2.5m wide shared path is consistent with the District Plan<sup>27</sup> requirements for collectors in the Future Urban zone.
40. Determining a trigger and nature of further upgrades is complex. The traffic volumes on these corridors are sensitive to the staging and location of connections to the Rotokauri North Structure Plan, timing of the minor arterial and the rate of development and nature of upgrades provided by other developers south of the site.
41. Using the methodology above, the predicted injury crash rate for a 7.7m sealed width increases to 1 injury crash per year with a traffic volume of approximately 5,000veh/day. As shown on the figure below, this equates to development of around 700 to 1,000 dwellings. If traffic volumes growth linearly between the base and 2,000 dwelling scenarios, the trigger is 700 dwellings (red vertical line on the figure below). This increases to approximately 1,000 dwellings based on the traffic model outputs (blue vertical line).
42. On the figure below, the blue dashed line shows linear traffic growth from the 2021 scenario with 500 dwellings to the 2041 scenario with the minor arterial in place. However, the timing for construction of this infrastructure is uncertain. In the future 2041 scenario, the traffic volume is close to 5,000veh/day threshold described above and no further upgrade would be triggered.
43. In my view the minor arterial needs to be continuous from the Plan Change area to the existing minor arterial network to be an attractive alternative route to the Exelby Road/ Burbush Road corridor. This means the minor arterial needs to extend to either:

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<sup>27</sup> Table 15-6a)ii) Criteria for the form of Transport Corridors



- a. the Te Wetini Drive/ Taiatea Drive intersection; or
- b. the Arthur Porter Drive/ Te Kowhai Road intersection.



**Figure 5: Modelled Traffic Volume on Exelby Road**

44. As discussed earlier, I am concerned that route selection and hence the model outputs is sensitive to staging and the location of connections to the existing network.
45. I consider that improvements to the corridor beyond seal widening to 7.7m should include better provision for walking and cycling, and address existing deficiencies at intersections and curves (e.g. improvements to vertical and horizontal geometry, sight distance, curve widening, etc).
46. Due to uncertainties in the staging and provision of infrastructure by others, I consider that a conservative approach should be taken. I recommend that Exelby Road (south of Burbush Road) and Burbush Road (south of the site) be widened to 9.5m (or equivalent mitigation to achieve a predicted injury crash rate no greater than 1 injury crash per year) and

that a 2.5m wide shared path be triggered by cumulative development exceeding 700 dwellings.

***Exelby Road (north of Burbush Road)***

47. On Exelby Road (north of Burbush Road), the 2021 network with 2,000 dwellings results in a daily traffic volume of approximately 1,300veh/day. This is lower than the agreed seal widening threshold of 2,500veh/day which is based on addressing efficiency effects and change in function of the transport corridor.
48. Like the submitters I remain concerned about the potential for adverse safety effects from additional traffic using Exelby Road (north of Burbush Road). In my view the Film provided by Ms Perring<sup>28</sup> illustrates the safety concerns.
49. The number of existing pedestrians and cycling using the Exelby Road appears low, and therefore the probability of a crash involving this type of user is low. However, crashes involving pedestrians or cyclists are more likely to result in death or serious injury. As shown below, at a collision speed of 60km/h, the probability of pedestrian or cyclist fatality is nearly 100%.

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<sup>28</sup> Perring, paragraph 1.3



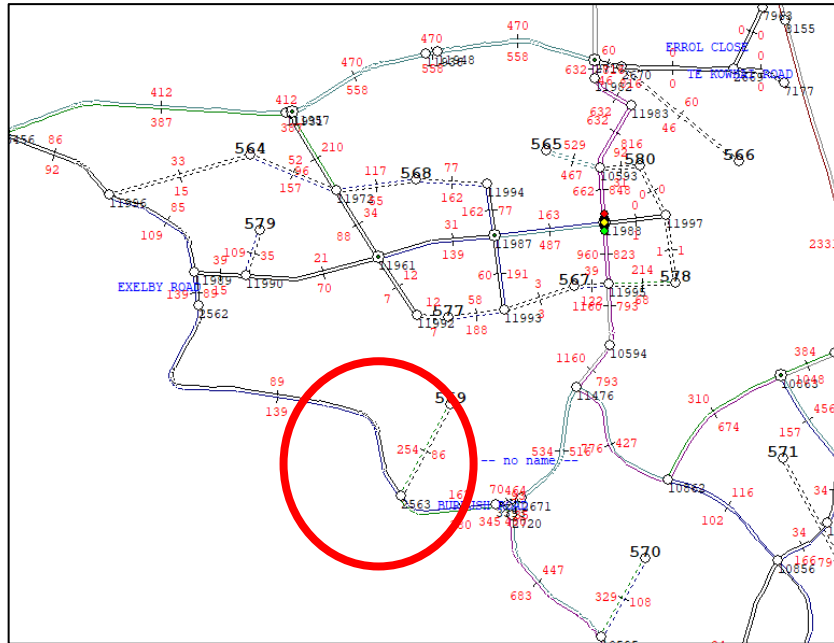
53. Rather than rely on future assessment of safety effects as part of a subdivision or land use application I prefer that an upgrade is required in the District Plan provisions to address safety concerns.
54. Widening to 7.7m is consistent with the upgrade agreed elsewhere on Exelby and Burbush Roads. The additional width provides improved safety for road users by providing more space to avoid collisions, reducing their likelihood. It does not address the risk for people who chose to walk or cycle. However, it provides a 1m wide sealed shoulder which could be cyclists. This is less than the desirable widths of 1.5m and 2.0m for 60km/h and 80km/h posted speed limits<sup>33</sup>.
55. I acknowledge that the model outputs do not show a significant change in traffic volumes on this corridor. As discussed above, I am concerned that route selection will be influenced by driver behaviour and perceptions. In my view, a conservative approach should be taken and I recommend that Exelby Road (north of Burbush Road) be widened to a sealed width of 7.7m when the first new dwelling/lot has access onto Exelby Road (including via any new transport corridor which connects to Exelby Road).

#### ***Exelby Road/ Burbush Road Intersection***

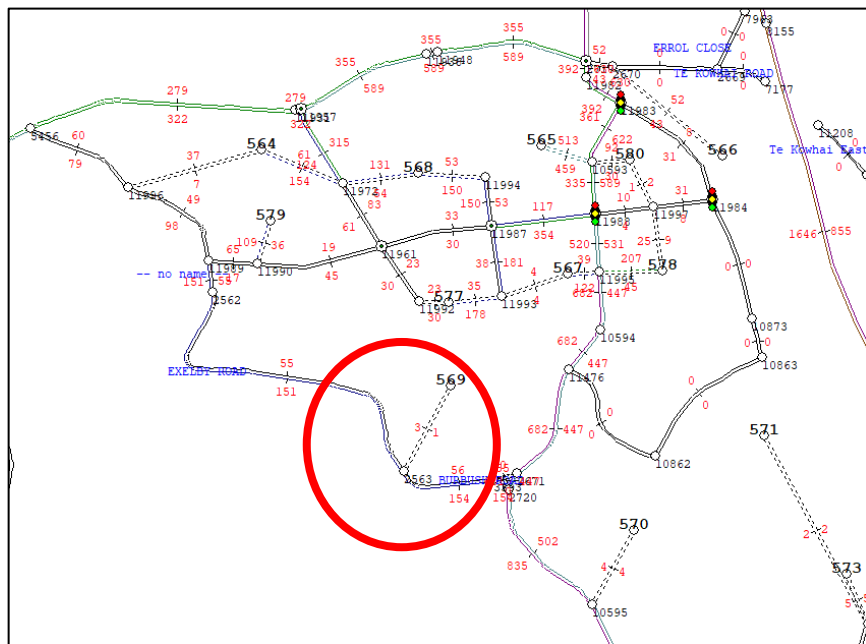
56. I have reviewed the revised modelling attached to JWS #4 to further understand the turning movements at this intersection. Comparison of these model outputs to those attached to the revised ITA show that the majority of the turning movements are associated with future development of the property south of the Plan Change area. As shown in the figures below, the model loads all traffic from this area to Exelby Road via node 569 which results in right-turn demand at the Exelby Road/ Burbush Road intersection.

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<sup>33</sup> Cycling Aspects of Austroads Guides, Table 4.3 (Section 4.3.4 refers to Table 4.3 for guidance on the width of sealed shoulders)



**Figure 7: 2041 PM Peak Flows**



**Figure 8: 2021 Network with 2000 dwellings, PM Peak Flows**

57. I remain of the view that a roundabout is desirable due to the unusual intersection layout and to manage vehicle speeds and minimise the risk of crashes. However, based on the lower turning volumes from the revised modelling, I do not consider that a roundabout is not warranted. I agree that the intersection should be upgraded to a single priority-controlled intersection with a right-turn bay. Mr Hills<sup>34</sup> states that the proposed

<sup>34</sup> Hills Reply, paragraph 3.40

upgrade “*can meet appropriate sight distance requirements*”, but he has not provided evidence through plans or long-sections demonstrating that this is the case.

***Exelby Road/ Rotokauri Road Intersection***

58. In forming his view that no upgrade is required at this intersection, Mr Hills opinion<sup>35</sup> appears to rely on the low turning volumes attributed to the 2041 scenarios (which includes a significantly different transport network) and few crashes having been recorded at the site. I agree that the crash history shows low crash numbers compared to what would be expected from typical prediction models but these are less reliable for low volume intersections. Good practice for transport network planning would require the need for an upgrade to be based on the future traffic volumes expected to use the intersection.
59. I have further reviewed the revised modelling attached to JWS #4 to consider the effects at this intersection. In the 500 dwelling scenario there are 152veh/hr turning right from Rotokauri Road into Exelby Road increasing to 428veh/hr in the PM peak (or one turning vehicle every 8 seconds). This is significantly higher than the 15-16veh/hr considered by Mr Hills in his evidence<sup>36</sup>. The turning volumes in the 2041 scenarios are lower as the minor arterial and wider collector network is included providing alternative routes. Without that wider network the plan change relies on Exelby Road for access once a connection is made to Burbush Road.
60. Mr Hills has not provided an assessment of the potential safety effects at this intersection based on the traffic modelling attached to JWS #4.

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<sup>35</sup> Hills EIC paragraph 8.17-8.21

<sup>36</sup> Hills EIC, paragraph 8.20

61. I have used the product-flow models in the Waka Kotahi Crash Estimation Compendium<sup>37</sup> to estimate the injury crash rate at a priority-controlled intersection and at a roundabout. Detailed calculations are provided at Attachment 3 with the outputs summarised below.

Scenario	Priority-Controlled	Roundabout
2021 (base)	0.21	N/A
2021 with 500 dwellings	0.21	0.14
2021 with 2,000 dwellings	0.35	0.17

**Table 2: Predicted Injury Crash Rate at Exelby Road/ Rotokauri Road intersection (injury crashes per year)**

62. My analysis shows that the crash rate at the priority-controlled intersection remains the same in the base and 500 dwelling scenarios (0.21 injury crashes per year equates to one injury crash every 4.8 years). Compared to the Base scenario, the 2,000 dwelling scenario results in a 70% increase in the predicted crash rate to 0.35 injury crashes per year. Upgrading this intersection to a roundabout reduces the crash rate to 0.17 injury crashes per year, slightly lower than the Base and 500 dwelling scenarios.
63. As stated in my Report (Section 3.5), I consider the Safe System treatment for this intersection is a roundabout as it will reduce both the crash rate (or likelihood of a crash occurring) and the severity of a crash due to the lower vehicle speeds.
64. In my view the roundabout upgrade is required somewhere between the 500 dwelling and 2,000 dwelling scenarios. Due to the uncertainty in staging of the development and staging of transport infrastructure by others, I recommend that the upgrade be required at the same time Exelby Road is widened.
65. I note that the future traffic volumes at this intersection are lower once the minor arterial has been constructed (refer to Attachment 1). There may be

<sup>37</sup> Crash Estimation Compendium, First Edition, Amendment 1

an alternative trigger or approach with the minor arterial or collector network in place but I do not have sufficient information to make that assessment.

66. I confirm my view that a roundabout is required to mitigate the effects of the plan change due to the increase in traffic at an intersection with tight horizontal geometry and limited sight distance. In the absence of more detailed staging or modelling scenarios by the Applicant, and for construction safety, efficiency and consistency a roundabout should be provided at the same time Exelby Road is widened (i.e. once 500 dwellings/lots have been developed or a connection provided to Burbush Road).

***Exelby Road/ Lee Road Intersection***

67. I disagree with Mr Hills<sup>38</sup> on effects at the Lee Road intersection. The crash history is based on the current traffic volumes – 550veh/day based on 2020 counts or approximately 3,300veh/day based on the model outputs.
68. As shown in Attachment 3, the traffic volume on Exelby Road increases to approximately 7,400veh/day. This change in traffic volume results in an increase in exposure for turning vehicles to collisions with traffic on Exelby Road. This increase in risk has not been quantified by Mr Hills, instead relying on the ‘Rotokauri Rise’ development to upgrade this intersection.
69. The timing for an upgrades required for ‘Rotokauri Rise’ development are uncertain and cannot be relied on to address the potential adverse safety effects. There is a risk that development in Rotokauri North occurs prior to an intersection upgrade associated with the Rotokauri Rise development.
70. The potential safety effects could be addressed by specifically adding this intersection to the list of matters to be addressed in the Information Requirements for a Broad ITA.

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<sup>38</sup> Hills Rely, paragraphs 3.11-3.14



***Shoulder Widening and Travel Speed***

71. Ms Perring<sup>39</sup> discusses the issues of carriageway width and operating speed. I note that the source material for Figure 15-6c referred to in her evidence is based on research of residential and mixed-use areas in the UK, not rural roads. I agree that the carriageway width influences vehicle operating speeds however other factors such as alignment and nature of the adjacent land use also influence operating speed.
  
72. I agree that widening of Exelby and Burbush Roads from 5.5m to 7.7m may result in an increase in operating speed. However, these roads currently have poor horizontal and vertical alignment and no shoulders. The intent of the widening is to provide sealed shoulders to improve road safety by providing space for errant vehicles to recover and more space for cyclists and to some extent pedestrians to avoid passing vehicles. Waka Kotahi's High Risk Rural Roads Guide<sup>40</sup> indicates a 20-30% reduction in crashes from providing sealed shoulder with the greatest benefits provided by the first 0.8m of sealed shoulder.
  
73. Detailed design and safety audits of the proposed widening should require a review of delineation and signage along these corridors that will improve safety for road users.
  
74. I confirm my view that sealed widening to provide sealed shoulders is appropriate as an initial interim measure to address the increase in traffic from this development until urbanisation of the corridors is completed by other developers. While there may be an increase in vehicle speeds in some locations (most likely on the straights), the shoulder widening will have safety benefits particularly on the curves where tracking over the centreline increases the risk of head-on crashes.

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<sup>39</sup> Perring EIC, paragraph 6.4

<sup>40</sup> High-risk Rural Roads Guide, Waka Kotahi (September 2011), Appendix E3.2 Shoulder Widening

75. Elsewhere (paragraphs 33-44) I have discussed my concerns about the need for further upgrades or limits on development due to the predicted increase in traffic volume to 7,400veh/day without the minor arterial or wider collector network in place.

### ***Heavy Vehicles***

76. I do not support Ms Perring's<sup>41</sup> proposed provision prohibiting heavy vehicle movements on Exelby or Burbush Roads south of the site. It is unclear to me how this ban would be enforced and monitored. Given the development could be staged and developed over a number of years this would likely require an on-going effort and enforcement. My understanding<sup>42</sup> is that this type of ban would typically require Council to use their bylaw-making powers under the Local Government Act. I do not consider that a ban of heavy vehicles can be relied upon, or if imposed, to practicably enforceable and therefore unlikely to be effective.

### ***Speed Limits***

77. Ms Perring<sup>43</sup> urges HCC to bring forward speed reductions for Exelby and Burbush Roads. She also considers that the speed limit on Te Kowhai Road East should be reduced<sup>44</sup>. I have discussed this with HCC staff and they have confirmed these roads are identified in Council's speed limit review programme for this financial year. Consultation will seek feedback on a 60km/h speed limit. They note that public consultation is challenging with Covid alert level restrictions and the need to coordinate with Waikato District Council for changes on the council boundary.
78. Waka Kotahi's MegaMaps Tool<sup>45</sup> gives the mean operating speed of Exelby Road as 58km/h and 60km/h on Burbush Road. In my view a change in

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<sup>41</sup> Perring EIC, paragraph 7.3

<sup>42</sup> RTS16 Guide to Heavy Vehicle Management, Section 14.6

<sup>43</sup> Perring EIC, paragraphs 7.9

<sup>44</sup> Perring EIC, paragraph 7.10

<sup>45</sup> <https://www.nzta.govt.nz/safety/partners/speed-management-resources/mega-maps/>

speed limit is unlikely to have a significant impact on travel times as the mean operating speed is similar to the proposed speed limit.

### ***Walking and Cycling***

79. I support the view of Mr Hills<sup>46</sup> and Mr Tindall<sup>47</sup> that walking and cycling connections are required from the Plan Change area to the existing walking and cycling network.
80. I support the inclusion of provisions<sup>48</sup> which requires provision of walking and cycling facilities connecting the development to the existing shared paths at the SH39/ Burbush Road roundabout and Mangaharakeke Drive (SH1) . This addresses some of the concerns raised in my Report (Sections 3.6.1 and 3.6.3).
81. I remain concerned about the lack of detail for walking and cycling facilities within the Plan Change area. The existing Rotokauri Structure Plan<sup>49</sup> includes a cycleway/walkway alongside the minor arterial and collector networks, within the green drainage corridor and connecting to and through future reserves.

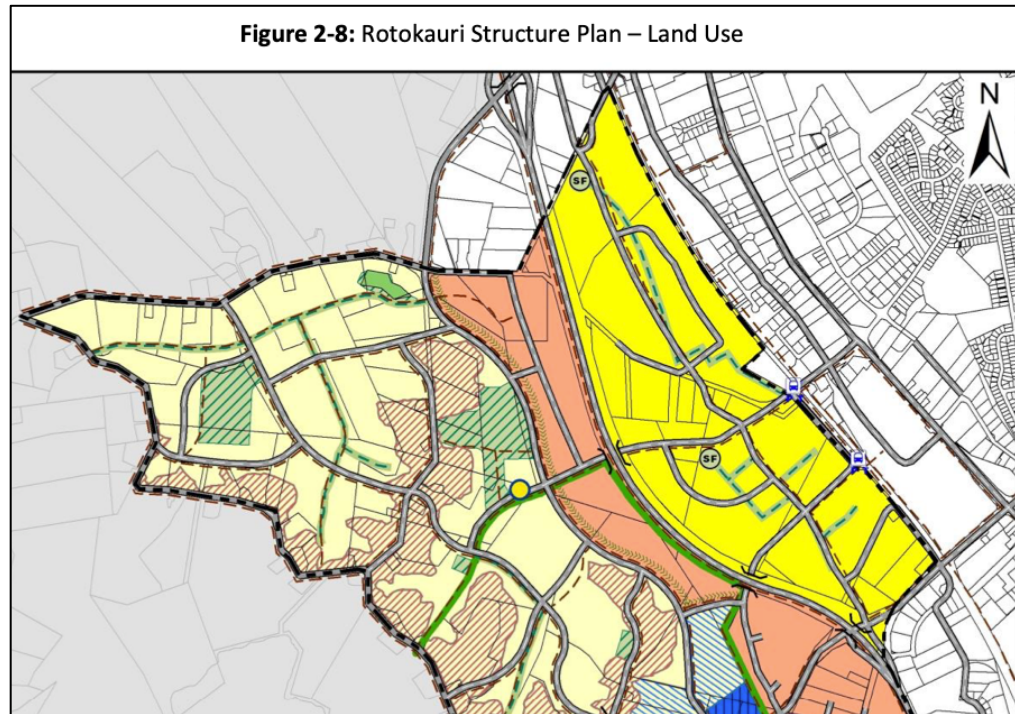
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<sup>46</sup> Hills EIC, paragraph 2.3

<sup>47</sup> Tindall EIC, paragraph 4.3

<sup>48</sup> Joint Witness Statement of Experts in Relation to Transport and Planning (5 October 2021), Rule 3.6A.4.2(f)(ii) Table 1, Items 6-7

<sup>49</sup> Hamilton Operative District Plan, Figure 2-8 Rotokauri Structure Plan – Land Use and Figure 2-10 Rotokauri Structure Plan – Open Space Network



**Figure 9: Rotokauri Structure Plan (Figure 2-8)**

82. While Mr Wood's evidence<sup>50</sup> is focused on the shared path connection to the SH39/ Burbush Road roundabout, I consider his comments on the Hamilton-Waikato Metro Area Mode Shift Plan<sup>51</sup> are also relevant to the provision of walking and cycling facilities within the structure plan area.
83. I acknowledge<sup>52</sup> that the parts of the network illustrated in my Report (Figure 14) that extend beyond the green space and open space networks may not be appropriate for inclusion on a structure plan if the area is limited or constrained. However, since this proposal is for out of sequence development, continuity of accessible links is an important issue and needs to be considered as part of planning decisions that contribute to well-functioning urban environments that have good accessibility for all people and active travel.
84. An active mode network should be illustrated on the Structure Plan map to aid interpretation and future assessment of walking and cycling. However,

<sup>50</sup> Wood EIC, paragraph 7.1

<sup>51</sup> <https://www.nzta.govt.nz/assets/resources/keeping-cities-moving/Hamilton-Waikato-regional-mode-shift-plans.pdf>

<sup>52</sup> JWS #3

when combined with the existing assessment criteria (G2b) and G14), the revised assessment criteria O8 addresses some of the concerns raised in my Report (Section 3.6.2) relating to walking and cycling.

### ***Public Transport***

85. To facilitate mode shift and ensure that public transport is an attractive mode choice I consider that appropriate public transport infrastructure should be incorporated at the time of development. Retro-fitting of public transport infrastructure can be costly and the requirement to consult with affected landowners through Local Government Act processes can lead to delays once dwellings are constructed and occupied.
86. I confirm my view that public transport routes should be identified on the Structure Plan maps to inform assessment of future transport corridor design.
87. I support the amended Assessment Criteria O7 as agreed in the JWS #3. Identifying the public transport routes on the structure plan figure and inclusion of the amended Assessment Criteria O7 address the concerns I raised in my Report (Section 3.7) relating to the ultimate provision of public transport services.
88. As set out in my Report (Section 3.7), I remain concerned that an effective public transport service is unlikely to be provided to the early stages of the development. I support the WRC statement that:

*“An interim public transport solution is important for providing a viable travel alternative for those unable to access a private vehicle and for engraining travel behaviours from the outset to meet Hamilton City Council’s mode-share targets and goals related to reducing reliance on private vehicles for travel.”*<sup>53</sup>

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<sup>53</sup> WRC letter dated 8 October 2021, page 1 (fourth paragraph)

89. I acknowledge the position of WRC that the provision of interim bus services is outside the scope of their submission but remains an important matter for future discussions between WRC, HCC and the developer:

*“WRC acknowledges that the issue of providing an interim public transport solution goes beyond the scope of what was raised in its initial submission and is unprecedented in district plan change processes. We acknowledge that we do not have a financing model identified but look forward to continuing discussions with the developer to provide the best public transport services for the Rotokauri North area.”*<sup>54</sup>

90. As discussed in my Report (Section 3.7), any initial PT services are likely to be demand responsive services (i.e. the use of small or medium sized vehicles providing door-to-door services). I understand that WRC has no funding for PT services to out-of-sequence development. Therefore, early implementation of PT services will require discussions on funding between the developer, HCC and WRC which is beyond the scope of the District Plan.

## **CONCLUSION**

91. I remain of the view that from a transport planning perspective, the ultimate location and transport connections for PC7 generally appear appropriate and provide good links to significant transport corridors (SH1, SH39 and the minor arterial).
92. I support the proposed provisions agreed during expert conferencing.
93. I am concerned that the infrastructure improvements proposed to manage the transport effects on the existing rural network beyond the Plan Change area are not adequate. The staging and location rules for development in the proposal are not explicit, and I remain concerned about the potential for unexpected outcomes. In my view further provisions are necessary to address adverse safety effects on Burbush Road and Exelby Road and at the Exelby Road/ Rotokauri Road intersection.

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<sup>54</sup> WRC letter dated 8 October 2021, page 2 (second paragraph)

94. Mr Hills relies on modelled traffic volumes and typical cross-section standards combined with the low crash history to conclude that no further upgrades are required. This does not recognise that an increase in traffic volume from this development will exacerbate the risk of crashes at existing deficiencies on these narrow rural roads.
95. I remain concerned that the traffic modelling is under-estimating trips in general<sup>55</sup> and that it under-estimates the attractiveness of Exelby Road and Burbush Road for trips to and from the Plan Change area.
96. In my opinion, the Google Maps information supports concerns that once a connection to Exelby Road is made route selection will be sensitive to driver behaviour and perceptions. In my view, a conservative approach should be taken and seal widening of Exelby Road (north of Burbush Road) required once a connection to Exelby Road is made.
97. I consider that improvements beyond seal widening of Burbush Road and Exelby Road (south of Burbush Road) are required to mitigate the adverse safety effects arising from the expected increase in traffic to 7,400veh/day. Due to uncertainties in the staging and provision of infrastructure by others, I consider that a conservative approach should be taken and upgrades be triggered by cumulative development exceeding 700 dwellings. These improvements should include widening to 9.5m (or equivalent mitigation to achieve a predicted injury crash rate no greater than 1 injury crash per year) and a 2.5m wide shared path on one side of the road.
98. I confirm my view that a roundabout is required to mitigate safety effects at the Exelby Road/ Rotokauri Road intersection. In the absence of more detailed staging or modelling scenarios by the Applicant, I am of the view that a roundabout should be provided at the same time Exelby Road is

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<sup>55</sup> Gray Matter (6 September 2021), Section 3.2

widened (i.e. once 500 dwellings/lots have been developed or a connection provided to Burbush Road).

99. I remain of the view that the proposal is inadequate in terms of the support for passenger transport (PT) corridors and multi-modal connections to the wider area beyond the plan change area. This is due to out of sequence nature of the timing and the lack of existing services and safe facilities for pedestrians, cyclists and bus users along nearby transport corridors.
100. Attachment 4 includes the revised transport triggers to be inserted into Rule 3.6A.4.2f) Table 2 Transport Triggers and upgrades outside of Rotokauri North. The bold text indicates the changes sought by HCC.

**Alastair James Black**

**22 October 2021**



Attachment 1: WRTM Hourly and Daily Traffic Volumes

Scenario	Ref.	Location	AM Peak WRTM 2hr volume	1hr volume (veh/hr) (0.571)	Diff compared to Base		PM Peak WRTM 2hr volume	1hr volume (veh/hr) (0.556)	Diff compared to Base		Location	Ref.	Daily Volume (veh/day)
2021 Base	A	Exelby Road (north)	241	138			224	125			Exelby Road (north)	A	1311
	B	SH39 (west)	404	231			524	291			SH39 (west)	B	2610
	B2	SH39 (north, Koura Drive)	765	437			888	494			SH39 (north, Koura Drive)	B2	4653
	C	Exelby Road (nth of Burbush)	253	144			235	131			Exelby Road (nth of Burbush)	C	1376
	D	Burbush Road	286	163			321	178			Burbush Road	D	1709
	E	Exelby Road (nth of Lee)	551	315			559	311			Exelby Road (nth of Lee)	E	3127
	G	Waikato Expressway	2,249	1284			2,439	1356			Waikato Expressway	G	13201
2021 Network (150hh)	A	Exelby Road (north)	231	132	-6	-4%	212	118	-7	-5%	Exelby Road (north)	A	1249
	B	SH39 (west)	404	231	0	0%	508	282	-9	-3%	SH39 (west)	B	2566
	B2	SH39 (north, Koura Drive)	827	472	35	8%	983	547	53	11%	SH39 (north, Koura Drive)	B2	5094
	B3	SH39 (east)	532	304	73	32%	566	315	23	8%	SH39 (east)	B3	3092
	C	Exelby Road (nth of Burbush)	234	134	-11	-8%	216	120	-11	-8%	Exelby Road (nth of Burbush)	C	1269
	D	Burbush Road	246	140	-23	-14%	285	158	-20	-11%	Burbush Road	D	1495
	G	Waikato Expressway	2,310	1319	35	3%	2,542	1413	57	4%	Waikato Expressway	G	13662
2021 Network (500hh)	A	Exelby Road (north)	241	138	0	0%	217	121	-4	-3%	Exelby Road (north)	A	1291
	B	SH39 (west)	420	240	9	4%	538	299	8	3%	SH39 (west)	B	2695
	B2	SH39 (north, Koura Drive)	1055	602	372	85%	1248	694	200	41%	SH39 (north, Koura Drive)	B2	6481
	B3	SH39 (east)	802	458	227	99%	977	543	252	86%	SH39 (east)	B3	5006
	C	Exelby Road (nth of Burbush)	244	139	-5	-4%	217	121	-10	-8%	Exelby Road (nth of Burbush)	C	1300
	D	Burbush Road	284	162	-1	-1%	325	181	2	1%	Burbush Road	D	1714
	G	Waikato Expressway	2,384	1361	77	6%	2,540	1412	56	4%	Waikato Expressway	G	13868
2021 Network (2000hh)	A	Exelby Road (north)	159	91	-47	-34%	139	77	-47	-38%	Exelby Road (north)	A	840
	B	SH39 (west)	488	279	48	21%	601	334	43	15%	SH39 (west)	B	3064
	B2	SH39 (north, Koura Drive)	1488	850	413	95%	1917	1066	572	116%	SH39 (north, Koura Drive)	B2	9578
	B3	SH39 (east)	738	421	191	83%	944	525	234	80%	SH39 (east)	B3	4731
	C	Exelby Road (nth of Burbush)	218	124	-20	-14%	210	117	-14	-11%	Exelby Road (nth of Burbush)	C	1206
	D	Burbush Road	1,053	601	438	268%	1,129	628	449	252%	Burbush Road	D	6145
	G	Waikato Expressway	2,266	1294	10	1%	2,501	1391	34	3%	Waikato Expressway	G	13422
2041 Network (2000hh and minor arterial)	A	Exelby Road (north)	77	44	5	12%	83	46	17	60%	Exelby Road (north)	A	451
	B	SH39 (west)	768	439	30	7%	896	498	-6	-1%	SH39 (west)	B	4684
	B2	SH39 (north, Koura Drive)	1833	1047	329	46%	2189	1217	337	38%	SH39 (north, Koura Drive)	B2	11319
	B3	SH39 (east)	989	565	156	38%	1,114	619	116	23%	SH39 (east)	B3	5921
	C	Exelby Road (nth of Burbush)	391	223	15	7%	433	241	29	14%	Exelby Road (nth of Burbush)	C	2320
	D	Burbush Road	590	337	0	0%	666	370	-38	-9%	Burbush Road	D	3536
	E	Exelby Road (nth of Lee)	931	532	5	1%	1,013	563	-101	-15%	Exelby Road (nth of Lee)	E	5474
	F1	Minor Arterial (north)	1,459	833	833	N/A	1,747	971	971	N/A	Minor Arterial (north)	F1	9022
	F2	Minor Arterial (south)	565	323	323	N/A	1,004	558	558	N/A	Minor Arterial (south)	F2	4404
	F3	Collector	87	50	50	N/A	123	68	68	N/A	Collector	F3	590
	G	Waikato Expressway	3,126	1785	22	1%	3,362	1869	30	2%	Waikato Expressway	G	18271
H	Te Kowahi Road U/pass	1,161	663	462	230%	1,565	870	548	170%	Te Kowahi Road U/pass	H	7665	



## Attachment 2: Exelby Road/ Rotokauri Road Intersection Crash Analysis

### Roundabout (Crash Compendium, Section 6.4)

	$b_0$	$b_1$
Rural Roundabout >80km/h	4.33E-04	0.53

#### 2021 Network with 500 dwellings

Roundabout 1	Description	Q <sub>approach</sub>	A <sub>T</sub>
Leg 1	Exelby Leg	3369	0.03
Leg 2	Rotokauri West	7320	0.05
Leg 3	Rotokauri East	9303	0.05
Leg 4	Future Leg	0	0.00
<b>Total</b>	<b>(injury crashes per year)</b>		<b>0.14</b>

#### 2021 Network with 2000 dwellings

Roundabout 1	Description	Q <sub>approach</sub>	A <sub>T</sub>
Leg 1	Exelby Leg	7968	0.05
Leg 2	Rotokauri West	7374	0.05
Leg 3	Rotokauri East	13455	0.07
Leg 4	Future Leg	0	0.00
<b>Total</b>	<b>(injury crashes per year)</b>		<b>0.17</b>
	<b>Difference</b>		<b>0.03</b>

### Priority-T intersection (Crash Compendium, Section 6.3)

Intersection Type	$b_0$	$b_1$	$b_2$
Priority - Cross	3.74E-04	0.39	0.50
Priority - T	3.52E-04	0.18	0.57
Traffic Signals - Cro	3.15E-04	0.52	0.19
Traffic Signals - T	4.41E-02	0.37	-0.10

Intersection	Description	Intersection Type	Rotokauri		Exelby			A <sub>T</sub>	Crash every ?? Years	Compared to 2021 Base
			Q <sub>major</sub>	Q <sub>minor</sub>	$b_0$	$b_1$	$b_2$			
Rotokauri/ Exelby	2020 (Hills Evidence, Table 3)	Priority - T	1,900	550	3.52E-04	0.18	0.57	<b>0.05</b>	20.0	N/A
Rotokauri/ Exelby	2021 (no development)	Priority - T	16,698	3,438	3.52E-04	0.18	0.57	<b>0.21</b>	4.8	N/A
Rotokauri/ Exelby	2021 with 500du	Priority - T	16,623	3,369	3.52E-04	0.18	0.57	<b>0.21</b>	4.8	-1%
Rotokauri/ Exelby	2021 with 2000du	Priority - T	20,829	7,968	3.52E-04	0.18	0.57	<b>0.35</b>	2.8	68%

	$b_0$	$b_1$
Urban Roundabout 50-70km/h	4.81E-04	0.58

#### 2021 Network with 500 dwellings

Roundabout 1	Description	Q <sub>approach</sub>	A <sub>T</sub>
Leg 1	Exelby Leg	3369	0.05
Leg 2	Rotokauri West	7320	0.08
Leg 3	Rotokauri East	9303	0.10
Leg 4	Future Leg	0	0.00
<b>Total</b>	<b>(injury crashes per year)</b>		<b>0.23</b>

#### 2021 Network with 2000 dwellings

Roundabout 1	Description	Q <sub>approach</sub>	A <sub>T</sub>
Leg 1	Exelby Leg	7968	0.09
Leg 2	Rotokauri West	7374	0.08
Leg 3	Rotokauri East	13455	0.12
Leg 4	Future Leg	0	0.00
<b>Total</b>	<b>(injury crashes per year)</b>		<b>0.29</b>
	<b>Difference</b>		<b>0.06</b>

### Approach Volumes (AADT on approach)

Converting 2hr modelled volumes to daily  
 Convert to 1hr\* 0.6  
 Convert to daily 10

2021 500du	Hourly		
	AM	PM	Daily
Exelby Leg	552	571	3369
Rotokauri West	1115	1325	7320
Rotokauri East	1428	1673	9303

2021 2,000du	Hourly		
	AM	PM	Daily
Exelby Leg	1294	1362	7968
Rotokauri West	1132	1326	7374
Rotokauri East	2096	2389	13455

2021 Base	Hourly		
	AM	PM	Daily
Exelby Leg	565	581	3438
Rotokauri West	1115	1332	7341
Rotokauri East	1431	1688	9357

\* Attachment 1 uses conversion factors of 0.571 and 0.556 to convert 2hr volumes to 1hr. Mr Hills has previously used 0.6 in his assessment

# Attachment 3: Exelby Road, Mid-Block Crash Analysis

Waka Kotahi, Crash Compendium, Section 3.1

## Rural Road Mid-block Crash Analysis

Input	Factor	Value	Notes
Table 3 (horizontal alignment)	$b_0$	29	Secondary collector, curved
Table 5 (cross-section)	Existing CMFs	1.17	Existing = 2.75m lane, 0m shoulder
	Proposed CMFs	0.75	Proposed, widening to 7.7m (2.75m lane + 1m shoulder)
Length (km)		2.5	

Predicted injury crashes per year				Alternate Mitigation, sealed width =			
Scenario	AADT (veh/day)	Exposure (X)	Existing	Proposed	10m	9.5m	9m
			5.5m cross-section	7.7m cross-section			
2021 (base)	3,438	0.031	1.06	N/A	0.41	0.48	0.55
2021 with 500 dwellings	3,369	0.031	1.04	0.67			
2021 with 2,000 dwellings	7,968	0.073	N/A	1.58	0.86	1.01	1.16

## Sensitivity test

2021 with 500 dwellings	5,039	0.046	1.00	Sensitivity test to determine traffic volume that results in crash rate of 1.0 injury crashes/yr.
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Injury crashes per year	= crash rate ( $b_0$ ) x Exposure(X) x $\Sigma$ CMFs
$\Sigma$ Crash Modifying Factor (CMF)	= CMF <sub>1</sub> * CMF <sub>2</sub> * ... (e.g. lane and shoulder width)
X, Exposure (mid-blocks)	= L x AADT x 365 / 10 <sup>8</sup>
Where:	AADT = annual average daily traffic
	L = length (km)
Coefficient $b_0$ is provided in Table 2 and Table 3 for the various levels of the One Network Road Classification (ONRC). The	

Table 5: Cross-section crash modifying factors (CMFs)

CMFs for Road Type 3 (Secondary Collector and Access)					
Seal shoulder width	Lane width				
	2.75m	3.00m	3.25m	3.50m	3.60m
0m	1.17	1.10	1.03	0.96	0.93
0.25m	1.10	1.03	0.96	0.89	0.86
0.50m	1.03	0.96	0.89	0.82	0.79
0.75m	0.89	0.82	0.75	0.68	0.66
1.00m	0.75	0.68	0.61	0.55	0.52
1.50m	0.61	0.55	0.48	0.41	0.41
2.00m	0.48	0.41	0.41	0.41	0.41

**Attachment 4: Rule 3.6A.4.2f) Table 2 Transport Triggers and upgrades outside of Rotokauri North.**

The bold text indicates changes sought by HCC.

<b>Transport corridor construction or improvement</b>	<b>Construction Improvement or</b>	<b>Development Trigger</b>
1. Exelby Road – South of Burbush Road	Seal widening to achieve a 7.7m sealed width (comprising 5.7m carriageway plus 1m sealed shoulders)	500 dwellings/lots or the first new dwelling/lot with access onto Burbush Road (including via any new transport corridor which connects to Burbush Road).
<b>1A. Exelby Road – South of Burbush Road</b>	<b>Without the minor arterial in place, seal widening to achieve a 9.5m sealed width, or equivalent mitigation to achieve a predicted injury crash rate no greater than 1 injury crash per year. 2.5m wide shared path on one side of the road</b>	<b>700 dwellings/lots</b>
<b>1B. Exelby Road – South of Burbush Road</b>	<b>N/A</b>	<b>With the minor arterial in place, no further upgrade is required.</b>  <b>The minor arterial needs to provide a continuous connection from Rotokauri North to either:</b> <ul style="list-style-type: none"> <li>• <b>the Te Wetini Drive/ Taiatea Drive intersection; or</b></li> <li>• <b>the Arthur Porter Drive/ Te Kowhai Road intersection.</b></li> </ul>
<b>2. Exelby Road – North of Burbush Road</b>	<b>Seal widening to achieve a 7.7m sealed width (comprising 5.7m carriageway plus 1m sealed shoulders)</b>	<b>500 dwellings/lots or the first new dwelling/lot with access onto Exelby Road (including via any new transport corridor which connects to Exelby Road).</b>
3. Burbush Road between Rotokauri North and Exelby Road	Seal widening to achieve a 7.7m sealed width (comprising 5.7m carriageway plus 1m sealed shoulders)	500 dwellings/lots or the first new dwelling/lot with access onto Burbush Road (including via any new transport corridor which connects to Burbush Road).

Transport corridor construction or improvement	Construction Improvement or	Development Trigger
3A. Burbush Road between Rotokauri North and Exelby Road	Seal widening to achieve a 9.5m sealed width, or equivalent mitigation to achieve a predicted injury crash rate no greater than 1 injury crash per year. 2.5m wide shared path on one side of the road	700 dwellings/lots
3B. Burbush Road between Rotokauri North and Exelby Road	N/A	<p>With the minor arterial in place, no further upgrade is required.</p> <p>The minor arterial needs to provide a continuous connection from Rotokauri North to either:</p> <ul style="list-style-type: none"> <li>• the Te Wetini Drive/ Taiatea Drive intersection; or</li> <li>• the Arthur Porter Drive/ Te Kowhai Road intersection.</li> </ul>
4. Exelby Road/Burbush Road Intersection	Upgrade to a single priority intersection with right turn bay.	500 dwellings/lots or the first new dwelling/lot with access onto Burbush Road (including via any new transport corridor which connects to Burbush Road).
5. Exelby Road/ Rotokauri Road intersection	Upgrade of intersection to a roundabout.	500 dwellings/lots or the first new dwelling/lot with access onto Burbush Road (including via any new transport corridor which connects to Burbush Road).