Memorandum

To: Nick Seymour – Auckland Council

From: Max Robitzsch

Date: 2 March 2017

Job N^{o}: 13182

Subject: Further Modelling and Design Assistance for Mt Albert Town Centre Upgrade

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As set out in our offer of service of 22 February 2017, we are pleased to provide the following design assistance and traffic modelling work to further inform the Mt Albert Town Centre Upgrade.

1. Design Assistance Tasks

1.1 Task 1 (Longer Mt Albert Road Right Turn Lane)

In this task, the design implications of lengthening the dedicated future right turn lane from Mt Albert Road into New North Road are being assessed. The traffic model / capacity implications are discussed separately in Section 2.2.1 of this memorandum.

1.1.1 Concept Design For Right Turn lengthening

Significant improvements are feasible for the Mt Albert Road approach delays particularly in the AM peak, if the dedicated right turn lane is lengthened from 50m as assumed in earlier model iterations, to approximately 80m (value chosen for the purposes of this assessment). This is because with the proposed diamond phasing (which is otherwise much more efficient) some traffic at the back of a queue may not be able to reach the through-and-left lane if the queue in the right turn lane exceeds 50m.

It appears unproblematic to achieve the "default" 50m length (though this design work – mainly road marking design - has not yet occurred, based on the most recent plans from the Design & Build team). This also appears possible without any further car parking loss on Mt Albert Road compared to the proposed and consulted plans.

The concept design work undertaken now has found that further lengthening of the right turn would start to impact on some existing Mt Albert Road car parks, as shown in the attached sketch **Figure 1**. To achieve even approximately 60m formal (full-width) right turn lane length, and approximately 70m effective queue length (i.e. ability of approaching drivers to still pass around the end of the queue slowly), approximately 3 car parks would have to be removed (see further discussion below).

It is noted that in practice, the effective queue length that drivers not intending to turn right could navigate around the end of would be even higher, possibly some 80m as assumed in the traffic model exercise discussed later – but that this would mean these drivers would strongly encroach into the cycle lane / bus stop to do so.

Regarding car parking, to achieve the increased length in the concept design sketch attached, the following changes are considered:

- On the north side of Mt Albert Road, two car parks would need to be removed (mandatory for the proposal to work). These are located directly upstream of a bus stop, and should already be removed from a perspective of providing a proper entry taper to the stop. They are currently understood to be signed P30.
- On the south side of Mt Albert Road, the car parking removal is more optional.
  - If no car parks are removed, the effective queue length provided is some 70m, but any queue longer than 60m would lead to cars bypassing the queue encroaching into the cycle lane / bus stop.
  - If one car park is removed, this would be the one located immediately adjacent to the east of the westbound bus stop (which currently zero entry taper). This would ensure the narrow road section at the start of the dedicated right turn lane is widened significantly in practice. The bus entry taper is even more significantly increased (more than a car park length), as the removal of the single car park also adds a driveway to the entry taper length. This would help both buses (making proper alignment to the stop easier) and general traffic (by extending practical queue length possible). It could thereby extend the effective queue length to some 80m. However, any queue beyond some 70m would still encroach on at least the cycle lane.
  - If a further two car parks are removed, 80m effective queue length could be provided, and do so without affecting the cycle lane, or with much less effect on the cycle lane (TBC detailed design). Some manoeuvring around the end of any very long queue would remain required.

It is noted that the issues with the cycle lane being used – and blocked outright – by vehicles in this area is already a known problem. Certain choices could further exacerbate the existing encroachment into the cycle lane, and attendant safety issues.

In summary, and in light of the Test 1 model results in Section 2.2.1, we recommend further consideration of this option, either to be implemented immediately, or as a later addition. However, due to the car park removal, it is not so uncontroversial as for it to be included in the default assumptions for the remaining modelling.

1.1.2 Alternate Concept Design Considered

It may be possible to, in detailed design, create a layout which reinstates some kerbside car parking (3-5 spaces) on the northern side of Mt Albert Road, between the intersection and the #6 Mt Albert Road address. This assumes that the existing cross-section can be safely adapted from four lanes and two cycle lanes to three lanes (as per the publicly consulted layout), two cycle lanes, and one parking lane.

However, the new northern cycle lane would need to be wider than minimum to reduce door zone risks. As such, it is not yet certain that this proposal is feasible in the available width. The feasibility may also depend on whether kerb lines can be moved (slightly) to achieve this, while retaining sufficiently wide footpaths.

We suggest that a closer design review (exceeding the scope and urgent time frame of this initial assessment) should be considered. This could be undertaken within the "buffer" already provided to TDG for further works. If such design is feasible, this could be combined with the above lane lengthening works to achieve the capacity benefits (especially in the AM peak) without losing any car parking on Mt Albert Road, and also possibly assist with resolving the cycle lane blockage issues that already exist here.

1.2 Task 2 (Filter Turn Sightline Assessment)

To review the feasibility of filter right turns from New North Road into Mt Albert Road, TDG has undertaken a sightline assessment. The assessment has been completed using Section 3.2.3 Minimum Gap Sight Distance of Austroads Part 4A and a conservative design speed assumption of 60km/h. The assessment is based on an assumed position for the vehicle waiting to turn right into Mt Albert Road at the location shown in sketch **Figure 2**. The figure shows three visibility assessments:

- The visibility line shown in red provides a visibility of approximately 67m and assumes that a vehicle can turn across one lane of traffic only (i.e. the nearside traffic lane is completely free of traffic). This equates to a Minimum Gap Acceptance of 4 seconds. As can be seen, this visibility requirement cannot be fulfilled with vehicles in the right turn lane from New North Road turning right to Carrington Road, a common situation.
- The visibility line shown in blue provides a visibility of approximately 83m and assumes that a vehicle has to turn across both lanes of traffic. This equates to a minimum Gap acceptance of 5 seconds. As can be seen, this visibility requirement cannot be fulfilled with vehicles in the right turn lane from New North Road.
- The visibility line shown in green is the maximum achievable visibility when the visibility is blocked by traffic waiting to turn into Carrington Road, being 58m.

Further changes to visibility in practice may occur due to topography (the southbound approach is located in a dip north of the high point of the intersection), due to vehicle types queued (larger vehicles such as trucks and buses restricting sightlines more than cars) and depending on how far into the driver waiting to filter advances into the intersection. However, these variations are overall more likely to further restrict sightlines compared to the already assessed shortcomings discussed above.

While not directly related to the above calculations, we also note that a turning driver would have to cross three lanes, being the two general lanes discussed above and a third independent cycle lane. Cyclists would be at particular risk to be missed or ignored by drivers trying to find a gap. This adds to the safety risks of filtering at this location.

In summary, we do not consider that filtering is an appropriate response here, as competing capacity and safety aspects are likely to lead to unsatisfying compromises.

1.3 Task 3 (High Level Signage Discussion)

1.3.1 Requirements

This design assistance considered the potential design and locations for advance directional signage that would direct “regional trip” drivers around the town centre that currently turn right from NNR into Mt Albert Road). Any such redirection would have beneficial effects on the performance of the intersection (this is discussed in Test 2 in the traffic modelling). It is noted that any such redirection signage is not intended to direct drivers down local roads, only along arterials / connector roads.

Another key criterion would be whether the signage is be able to function in multiple scenarios – i.e. ideally during all the following scenarios:

- Construction phase
- Operations (right turn into Mt Albert allowed)
- Operations (right turn into Mt Albert banned)*

*Note: This would also acknowledge the currently proposed modus operandi of initially allowing the right turn, but having the fall back option of banning it. Ideally, any signage implemented could be easily modified later to suit a turn ban.

Other factors to be considered include location of the signage, conspicuity (to be more effective) as well as cost and difficulty of implementation.

It is reiterated in this context that the large majority of regular users are likely to be aware of the turn constraints / bans and as such may detour even without signage.

1.3.2 Location

The biggest element of drivers amenable to be redirected are considered to be those from the south(west) along New North Road at the New North Road / Richardson Road intersection. Drivers arriving here from the northwest (Woodward Road) are unlikely to turn left to then turn right again at the town centre, especially if they are "regional" trips. These drivers would likely stay on the Carrington Road -> Mt Albert Road route.

Similarly, few regional drivers are expected to drive in a u-turn fashion, i.e. arrive via Richardson Road westbound turning right onto NNR and then turning right again to travel back east via Mt Albert Road – unless they have a stop-over in the town centre (a group of drivers discussed separately below).

- As such, the first directional signage (or set of signage) should be located on the southwestern New North Road approach to Richardson Road intersection.
  - The appropriate location (assuming a single, large sign) would be sufficiently far away from the intersection to allow easy transition to the right turn lane. MOTSAM recommends 80-120m distance.
  - If a second, repeater sign is chosen to be added, then it might be considered to have the first sign be somewhat closer to the intersection, say at 75m, and the second at 150m.
- At least one further sign on the detour route itself would be recommended, likely about 80m ahead of the Richardson Road / Owairaka Avenue intersection, to provide guidance to drivers detoured in this direction. A third sign could possibly be added at Owairaka Avenue / Mt Albert Road to conclude the detour.

A second larger group of drivers that would ideally be re-routed are those who start out in the town centre block (south of the main intersection), or had a stop-over in this area, before then wanting to continue on a "regional trip" towards the east. This group is harder to re-route with signage as it is both more complex to convey once a driver is within the New North Road block between Richardson Road and Mt Albert Road.

On the positive side, people stopping at the town centre are significantly more likely to be locals or regular visitors, and thus would be much more likely to already be aware of constraints (or a potential ban) on right turning at the intersection. Thus, arguably, this group has less need for signage.

However, there are some key locations where signage could be useful:

- Facing at right angles to the road, opposite the major off-street car park driveways (with the more important ones listed first):
  - Opposite (west side) of the off-street car park at the tennis courts
  - Opposite (east side) of the off-street car park at the train station
  - Opposite (east side) of the Ballast Lane vehicle crossing

These signs will also be able to provide information to people not specifically using these three off-street car park areas, as people walk or drive to the town centre, particularly if they are regulars, alerting them to the recommended redirection route.

1.3.3 Type of Sign

For the town centre-internal signs, standard static signs appear as the only logical choice, as the other options would be deemed too expensive. For the main road redirection sign(s) on New North Road, the three options would be:

- Static sign
- Illuminated static sign
- Variable message sign – of modern manufacture, i.e. able to convey colours and shapes (such as other standard road signs) as well as text

The key benefits of an illuminated sign over a static sign would be the greater conspicuity at night. However this is likely also the time period when the sign would be least needed (for a voluntary redirection). Therefore, it may only be worth using such signs if a permanent ban is implemented.

They key benefits of a variable message sign would be greater conspicuity and the ability to change the message – making it uniquely suited to being used for all three stages of construction, voluntary redirection and (if implemented) full ban. For voluntary redirection, it could also be programmed to only be active at key hours of the day. The two other sign types do not provide such abilities, though the sign post infrastructure for static signs itself can at least be re-used easily if the sign has to be changed after initial implementation. The key downside of a variable message sign would be the added cost.

1.3.4 Imagery and Text

The likely colour used would be green, in accordance with normal directional signage. However, during the construction period, it could instead also use the standard orange construction signage palette.

Text and imagery would depend on whether a voluntary redirection or a ban is in place at the New North Road / Mt Albert Rd intersection. Possible images / text are described below and attached as sketch graphics, to provide a starting point for further discussion:

- Voluntary (sketch **Figure 3**): Dashed line option for existing route and white route line for recommended route - text “Optional route East”
- Prohibited (sketch **Figure 4**): Dashed line option for existing route, with “no right turn” sign at town centre, and white route line for recommended route – text “No right turn at Mt Albert”

2. Traffic Modelling

2.1 Introduction

The assumptions for traffic modelling are as per the Offer of Service of 22 February 2017. The scenarios modelled are set out in the offer of service letter, and discussed further in the results section below.

2.2 Model results

Below **Table 1** shows the simplified results (overall intersection delays) of the various modelling tests undertaken for this scope, compared against models already run previously. For context, intersection flows are also provided.

	Base layout, AM	Option 1, AM (RT to Mt Albert Rd permitted, split phasing)	Option 3, AM (RT to Mt Albert Rd banned)		Base layout, PM	Option 1, PM (RT to Mt Albert Rd permitted, split phasing)	Option 3, PM (RT to Mt Albert Rd banned)
Volumes AM							
Base (existing) flows	2,980	2,980	N.A.		3,093	3,093	N.A.
Test 1 (design change - Mt Albert RT lane 50m=>80m)	N.A.	2,980	N.A.		N.A.	3,093	N.A.
Test 2 (40% RT flow removed & 60% retained (Option 1)/changed to through (Option 3))	N.A.	2,951	2,951		N.A.	3,058	3,058
Test 2 and 3 (further 15% reduction of all flows as travel behaviour change reaction)	N.A.	2,508	N.A.		N.A.	2,598	N.A
Test 1 and 2 (for Option 3 only, as Option 3 always has Test 2 effect applied)	N.A.	N.A.	2,951		N.A.	N.A.	3,058
Delay AM (s)							
Base (existing) flows	106.8	148.5	N.A.		81.4	284.7	N.A.
Test 1 (design change - Mt Albert RT lane 50m=>80m)	N.A.	125.2	N.A.		N.A.	279.6	N.A.
Test 2 (40% RT flow removed & 60% retained (Option 1)/changed to through (Option 3))	N.A.	139.9	91.8		N.A.	271.5	48.3
Test 2 and 3 (further 15% reduction of all flows as travel behaviour change reaction)	N.A.	62.7	N.A.		N.A.	89.3	N.A.
Test 1 and 2 (for Option 3 only, as Option 3 always has Test 2 effect applied)	N.A.	N.A.	80.2		N.A.	N.A.	48.1

Table 1 – Flows and model results of test scope, with models previously run in light grey shading

We note some minor differences in the results of models that had already been reported on previously – such as the right turn banned PM peak scenario now having 48.3 seconds delay instead of 49.3 seconds delay as previously reported. These are due to factors such as changing one of the pedestrian phases as discussed in Section 3 of the Flow Transportation Specialists letter of 17 November 2016.

This pedestrian phase change (but not the other possible changes discussed in Section 3 of that report) was included as instructed by Auckland Council / Auckland Transport, while otherwise the model settings remain the same as for previous reporting. Exceptions are where they are intentionally changed by the testing scenarios in this scope, respectively with one exception discussed further in the results assessment.

More detailed results are contained in the full movement summary sheets provided separately. An initial analysis of the model result implications is provided below.

2.2.1 Test 1 (Longer Mt Albert Road Right Turn Lane)

The extended right turn lane length from Mt Albert Road into New North Road creates significant improvements during the AM peak – in Option 1 (split phase, right turn retained), the average intersection delay for the future layout is reduced by 23 seconds compared to the layout without the extended lane. Reviewing the more in-depth movement summaries, the Mt Albert Road approach itself benefits particularly strongly, seeing approximately 40 seconds improvement.

In Option 3 (right turn banned), significant improvements also occur, with 11 seconds improvement of the overall intersection delays, and 15 seconds for the Mt Albert Road approach itself. The impact is not as large as with Option 1 as there is less initial delay.

The benefits are more limited during the PM peak, with Option 1 improving only some 5 seconds over the whole intersection, in part because the right turn from Mt Albert Rd into New North Road is a smaller share of the overall flow than in the morning. The individual Mt Albert Rd approach performance in the PM model scenario actually increases in delays. However, this is considered to be due to automatic SIDRA re-optimisation of the intersection which creates an overall (slightly) better outcome after the lane length is increased. In practice, there is no expectation that simply lengthening the lane would result in longer delays on Mt Albert Rd in the PM peak – but it further indicates that there is little to no beneficial effect during the PM peak in Option 1.

For Option 3 in the PM peak, there are essentially no improvements, with changes of approximately a second in the results for both overall delays and Mt Albert Road delays.

In summary, there are significant benefits to increasing the lane length on the approach, but these seem limited to the AM peak. Due to the car parking impacts as described in the design assistance section of this memorandum, and to keep individual effects separate, this Test 1 was not cumulatively applied to the other tests described below.

2.3 Test 2 (Voluntary Redirection Flow Reduction)

Using an assumed voluntary redirection happening south of the intersection via Richardson Road, 40% of the right turn flow from New North Road into Mt Albert Road were removed from the Option 1 models. It is noted that in the Option 3 models, this test had effectively already been included previously in earlier reporting, as 40% of the right turn flow had been removed, assuming redirection ahead of the intersection and with the remaining 60% re-allocated to travel straight through instead.

With this test flow change, in the AM peak of Option 1, there are benefits in the AM peak, but these are limited to some 9 seconds compared to the base flow scenario. While not trivial, this does not suffice to bring the projected future delays down to existing levels.

In the PM peak for Option 1, the impact is similar, with some 13 seconds improvement. While this is slightly larger, it is also a reduction from a much larger average delay, and thus is almost irrelevant considering the extensive delay increase compared to the existing situation.

In the context of the PM peak, we note that automatically optimised SIDRA results initially showed a much more significant of approximately 104 seconds instead of 13 seconds. This level of improvement was considered unrealistic for a mere 35 cars less on the turn flow (1% of the overall intersection flow). As such, the SIDRA phasing was manually forced to have the same phase time split as the comparison scenario without the 40% right turn redirection (i.e. had the same time allocated to each phase, and the same phase sequence), resulting in this more conservative result.

In summary, the voluntary redirection of some drivers south of the intersection does not appear to create a very significant benefit. This is due to the fact that the reduced flows are very small compared to the overall intersection flows, and because the partial redirection does not permit the much more beneficial signal phasing changes that a full redirection / right turn prohibition allows.

2.4 Test 3 (Travel Behaviour Change Flow Reduction)

As traffic flows are dynamic, the congestion increase that is projected to be created by an Option 1 layout (right turn retained, split phase arrangement, existing flows), is likely to cause some drivers to switch to other modes, routes, times, or to choose not drive.

In short, the actual congestion increase over the current level is in practice likely to be less substantial than that created by simply applying the current base flows to the new Option 1 layout. To test the potential impact of travel behaviour change created by the reduced capacity (and the period of construction which precedes it), the Test 3 scenario tested flow reductions of 15% on all approaches and turns (on top of the Test 2 changes in flows). It is noted as a caveat that the actual flow reductions will of course be influenced by various other factors, such as conditions elsewhere in the network.

As can be seen, during the AM peak in Option 1, this would drop the projected average congestion some 46 seconds below the existing delays. This, especially considering the reduced capacity of Option 1 compared to the base layout, is obviously unrealistic. Practical delays after converting to Option 1 and adding travel behaviour change are likely to be around current congestion levels, or slightly above.

As such, it is considered likely that morning peak travel behaviour change reductions are likely to be much lower than 15%.

During the PM peak in Option 1, the 15% flow reduction of the scenario creates extremely substantial benefits. These bring an over-capacity intersection back into “current congestion levels” range, with projected average delays only some 8 seconds higher than modelled for existing flows and existing layout, and an improvement on average delays compared to with the base flow of almost 200 seconds.

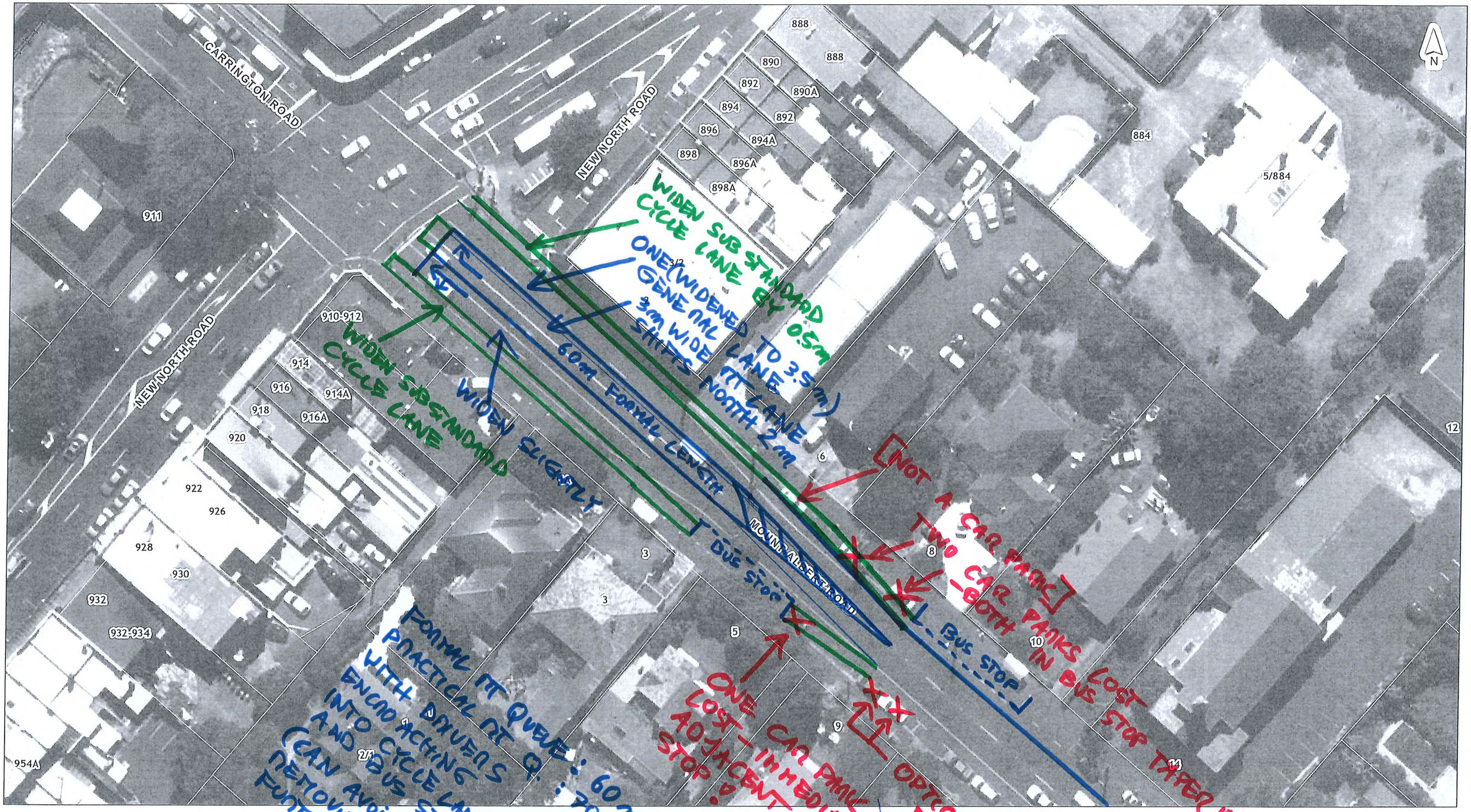
It is considered likely that practical reductions will be less than 15% (and thus the practical increases in delays higher than 8 seconds), though not as different from the Test 3 scenario as during the AM peak.

Layout Option 3 (right turn banned) was not assessed in this scenario, as the more efficient phasing already increases capacity / improves performance, and thus, it is unrealistic to expect any flow reductions at an intersection that flows more freely.

In summary, this test provides a window into the ability of the intersection congestion to return to more manageable levels with only some level of travel change behaviour / flow reduction. This can be seen in comparison to the projected but in practice theoretical extreme congestion levels resulting from the combination of existing flows and future layout, which theoretically would more than triple delays in the PM peak.

This indicates that there is a reasonable chance that a split phase Option 1 could work with more acceptable delay increases, especially if backed with the opportunity to switch to an Option 3 layout should practical results differ (generally speaking, there is a higher range of variability about Option 1 practical impacts than Option 3 impacts).

TDG



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Height datum: Auckland 1946.

0 5 10 15
Meters

Scale @ A3
= 1:500

Date Printed:
22/02/2017

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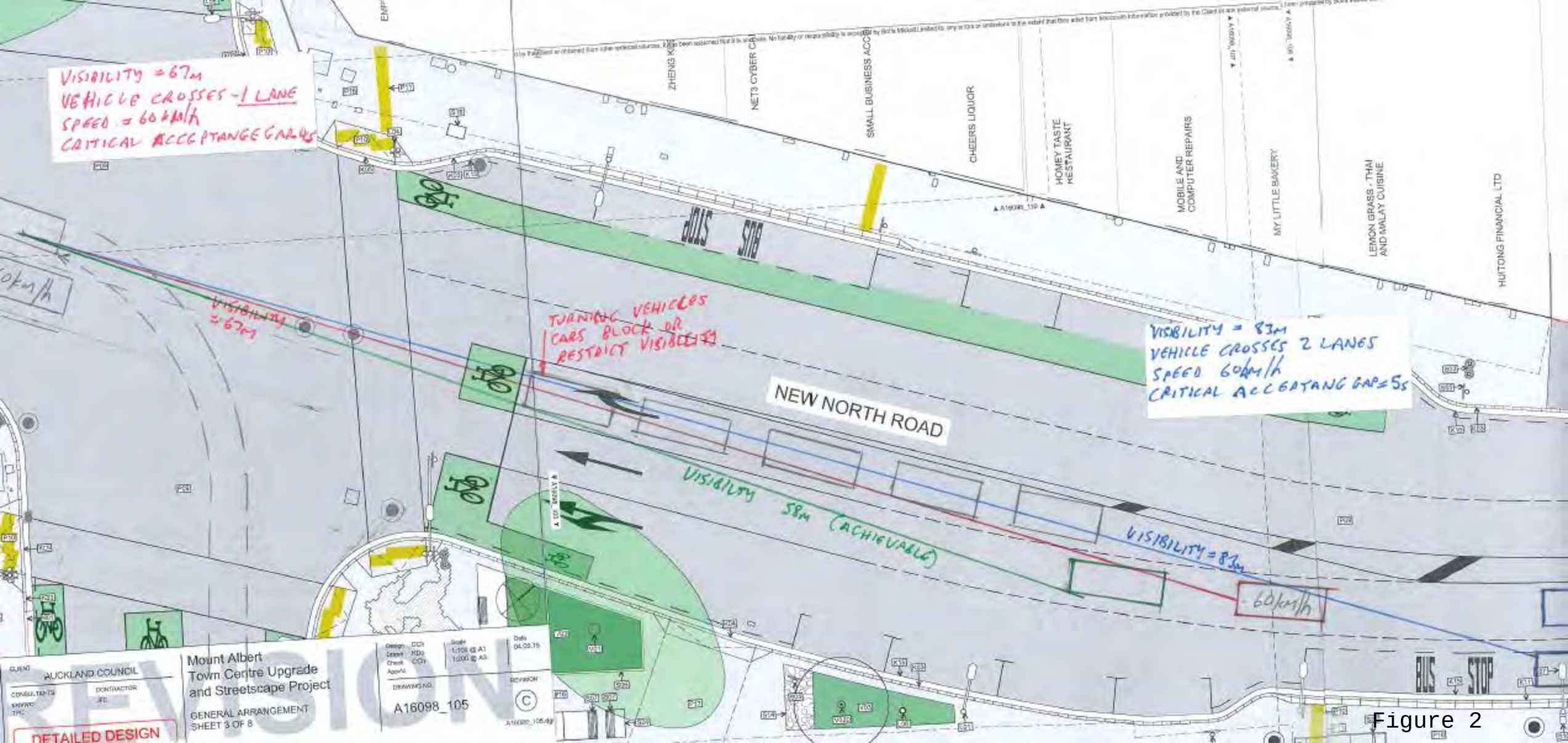
Figure 1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NET3 CYBER C
SMALL BUSINESS ACC
CHEERS LIQUOR
HOMEY TASTE RESTAURANT
MOBILE AND COMPUTER REPAIRS
MY LITTLE BAKERY
LEMON GRASS - THAI AND MALAY CUISINE
HUITONG FINANCIAL LTD
BUS STOP
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BUS STOP
AUCKLAND COUNCIL
Mount Albert Town Centre Upgrade and Streetscape Project
GENERAL ARRANGEMENT SHEET 3 OF 8
A16098_105
DETAILED DESIGN
REVISION

Figure 2

Optional Route East

Figure 3

No right turn at Mt Albert

Figure 4