St Vincent Street
Separated Bicycle Facility

Post Construction Stage Safety Audit

Report prepared for

Nelson City Council
te kaunihera ō whakatū

ViaStrada Ltd

Final August 2014

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Appendices

1 Background

1.1 The safety audit team

The Saint Vincent Street Separated Bicycle Facility (SBF) post construction safety audit was carried out by:

- Warren Lloyd, Safety Audit team leader, ViaStrada Ltd
- Tim Hughes, Safety Audit team, NZ Transport Agency

1.2 Safety team meetings

On Thursday the 31st August 2014, the project initiation meeting was held at the Nelson City Council office at 10:15 AM, to confirm the project objectives, the project and safety audit scope plus any other audit matters. Warren Lloyd of ViaStrada, Tim Hughes of the NZ Transport Agency and Phil Hamblin & Rhys Palmer (NCC) were in attendance with Ari Fon (Project Designer for Aurecon).

This was followed up with a client debriefing meeting on Friday 1st August at 8:30 a.m. where the safety audit team (SAT) presented their initial thoughts from the site visit and advised the client the expected content of the post construction safety audit. In attendance were Warren Lloyd, Tim Hughes, Phil Hamblin, Rhys Palmer Kayleen Goldthorpe and Marg Parfitt (NCC)

1.3 Site Visits

On Thursday 31 July 2014, the SAT completed the daytime safety audit between 11:00 a.m. and 5:30 p.m.

On the same day, the night time safety inspection was carried out between 11:00 p.m. and 12:00 a.m.

1.4 The safety project team

The safety issues raised in this audit will require responses from the designer and the project safety engineer. The client decision and action taken against the safety issues will also be recorded. The following people are responsible for these actions:

Table 1: Safety project team roles

Name	From	Role
Ari Fon	Aecom	Designer response
Kayleen Goldthorpe	Nelson City Council	~~Safety Engineer~~ **NCC Project Manager**
Rhys Palmer	Nelson City Council	Client Decision
Rhys Palmer	Nelson City Council	Action Taken

1.5 Report format

The report format is based on the NZ Transport Agency Road Safety Audit Procedures: 2013. This audit goes further in that it includes a non-motorised user review as these will be the predominant users of the SBF.

1.6 Reference documents

The report refers to two audit and review documents

1.6.1 Road Safety Audit Procedures

The document used is the TFM9 Guidelines INTERIM RELEASE MAY 2013.

The expected crash frequency is qualitatively assessed on the basis of expected exposure (how many road users will be exposed to a safety issue) and the likelihood of a crash resulting from the presence of the issue. The severity of a crash outcome is qualitatively assessed on the basis of factors such as expected speeds, type of collision, and type of vehicle/object involved.

The frequency and severity ratings are used together to develop a combined qualitative risk ranking for each safety issue using the Concern Assessment Rating Matrix in Table 2 below. The qualitative assessment requires professional judgement and experience from a wide range of projects of varying sizes and locations. Note that the following information given in Table 2 and Table 3 is used to inform severity, frequency of crash events and the risks with suggested actions[1].

The SAT considers that death or serious injury can be recorded as 'very likely' for a crash between a motorised vehicle and a cyclist when the impact speed is above 30 km/h or if heavy vehicles are involved. For cyclists, serious injuries can occur when they are travelling at speed and collide head on with another cyclist or obstacle and are thrown from the bike. This is because cyclists are vulnerable to injury when involved in a collision with a motorised vehicle and vulnerable to head injuries when thrown from their bike. It is acknowledged that helmets are useful but only provide limited protection at lower impact velocities.

The ranking of the frequency of crashes is difficult in the absence of reliable estimates of usage, so has primarily been based on personal risk to each user. We have not made assumptions on the amount of future use.

Table 2 Severity rating matrix

[1] Taken from the NZ Transport Agency 'Road Safety Audit Procedures tfm9 Guidelines INTERIM RELEASE MAY 2013

	Frequency (probability of a crash)			
Likelihood of death or serious injury	**Frequent**	**Common**	**Occasional**	**Infrequent**
Very likely	Serious	Serious	Significant	Moderate
Likely	Serious	Significant	Moderate	Moderate
Unlikely	Significant	Moderate	Minor	Minor
Very unlikely	Moderate	Minor	Minor	Minor

While all safety concerns should be considered for action, the client will make the decision as to what action will be adopted. This report gives safety ranking guidance and it is acknowledged the client must consider factors other than safety alone. The suggested action for each concern category is given in Table 3 below.

Table 3 Concern categories

RISK	SUGGESTED ACTION
Serious	A major safety concern that must be addressed and requires changes to avoid serious safety consequences.
Significant	Significant concern that should be addressed and requires changes to avoid serious safety consequences.
Moderate	Moderate concern that should be addressed to improve safety
Minor	Minor concern that should be addressed where practical to improve safety.

1.6.2 Non-Motorised User (NMU) Review procedures 2006

NMUs have the same basic issues as any transport user and road designs should reflect this. The NMU review process is considered appropriate for this site because the safety audit alone will not address the SBF facility with its unique user environment. The NMU review is used as it provides more detailed consideration of NMU requirements under the headings noted in Table 4.

Table 4: NMU review requirements

Connected	The facility links origins and destinations without detours or delays in a legible, continuous and consistent manner
Attractive	Is the facility attractive in terms of the built and natural environment and its interaction with other facilities and road users
Safe	The facility should not have personal security or road safety concerns

Accessible	The facility design is fit for purpose for all active users, and in particular sensory or mobility impaired users, and people with children and pushchairs.

Therefore this report is a combination of these document formats. However, the NMU issues will be listed as comments with no ranking criteria unless there is a safety concern that can be ranked.

1.7 Scope of audit

This is a post construction stage safety audit of the recently constructed separated bicycle facility on the east side of St Vincent Street between Toi Toi Street and Gloucester Street.

1.8 Plans and documents provided

The SAT has been provided with the following documents for this audit:

- Aurecon document: EC3520 – St Vincent Street Separated Cycle Lane Preliminary Design Summary
- Aurecon Plans: St Vincent Street Separated Cycle Lane Stage 1.
- OPUS detail design stage safety audit of the St Vincent Street Separated Bicycle Facility Stage 1 Toi Toi St to Gloucester St.
- OPUS Post construction stage safety audit of the St Vincent Street Separated Bicycle Facility Stage 1 & 2 Totara St to Gloucester St.

The SAT has been provided with the following plans for this audit, see Table 5.

Table 5 Plans provided for audit

Stage	Plan No	Sheets	Amendment
1	27-0730	5	E
2	270731	1, 2, 4	B
2	270731	3	C

1.9 Project description

The project aim is to provide a 3.0 m wide bi-directional cycle path, separated from the footpath and moving traffic along the east side of St Vincent Street. The project area extends from the Railway Reserve shared path at Totara Street to Gloucester Street.

1.10 Project objectives

Specifically the St Vincent Street SBF project objective is to link the Railway Reserve shared path to the City.

This project also fits under the Nelson City Council Walk/Cycle/School package, with the following objectives

- To increase peak hour walking and cycling throughout the city
- Increasing waking and cycling at all other times

There are also a subset of these objective outcomes including;

- Extend and further develop existing walking and cycling networks

- Target schools to make walking and cycling for school children easier and safer, thereby reducing peak hour vehicle congestion
- Reduction in deaths and serious injuries as a result of road crashes
- More transport choices, particularly for those with limited access to a car
- Reductions in adverse environmental effects from land transport
- Contributions to positive health outcomes

1.11 Terminology

It is important that the reader understands the terms used by the SAT. The table below details the technical terms used throughout this document along with their definitions and descriptions.

Table 6: Terminology

Term	Description
Active user	Facility users who are physically active when using their transport mode. It typically applies to pedestrians and cyclists but may also include mobility impaired, recreational, fitness and other general users, i.e. not just commuters.
Dooring	The term car 'dooring' is a used to describe when a driver opens their door and either the cyclist collides with the door or is knocked or swerves into the live traffic lane. This is the highest risk to cyclists using on-road facilities adjacent to parking and results in the most fatal and serious cycle injury crashes due to fallen cyclists being run over by following vehicles.
Cycle lane	An on-carriageway bicycle facility delineated from moving traffic with a solid painted lane line. Cycle lanes may be adjacent to the kerb ("kerb-side"), adjacent to motor vehicle parking ("car-side"), or between general traffic lanes on the approach to intersections. Cycle lanes provide for cycling in the same direction as traffic, or for contraflow riding on one way streets on the correct side of the road.
Cycle path	A facility physically separated from motor traffic and intended for the use of cyclists If in a road corridor, cycle paths are usually behind the kerb. . Legally a cycle path may also be used by pedestrians.
CPTED	Crime Prevention Through Environmental Design. This design principle considers things that make a path more desirable to use, increasing the perception of safety.
Intervisibility	This is a term used to describe the sight lines in two directions. For example between a pedestrian and a driver and the sight line from that same driver back to the pedestrian.
Separated Bicycle Facility (SBF)	This is a cycle facility that is physically separated from motorised traffic, but on the same level as general traffic on the traffic side of the kerb lines, and me be on the kerb side of parked cars. Separation is typically in the form of sections of concrete kerb or bollards. The facility may provide for bi-directional or uni-directional cycle flow.
'Take the lane'	This is a term used to describe riding in the safest location to negotiate a section of (typically narrow) road. The cyclist rides as if they are a vehicle, i.e. along the centre of the traffic lane. This is sometimes called 'vehicular cycling'.

Term	Description
Types of cyclists[2] or "Target Audience This system classes the general population in four categories with respect to cycling:	
Strong & Fearless	Will ride on a busy road without cycle lanes and represents just under 1% of the general population.
Enthused & Confident	Will ride on a busy road with conventional cycle lanes and represents 7% of the general population.
Interested but Concerned	Prefer quiet streets and paths. For busy streets they require separation from motor traffic and represent around 60% of the population. This is the group to target in any design if a significant increase in user numbers is desired.
No way no how	Are unlikely to cycle and represent 33% of the population.

1.12 Disclaimer

The findings and recommendations in this report are based on an examination of available relevant plans, the specified road and its environs, and the opinions of the SAT. However, it must be recognised that a complete elimination of all safety concerns cannot be guaranteed as no road can be regarded as absolutely safe and this report does not claim to have identified 100% of all possible safety issues. Safety audits do not constitute a design review or an assessment of standards with respect to engineering or planning documents.

Readers are urged to seek specific technical advice on matters raised and not rely solely on this report alone.

While every effort has been made to ensure the accuracy of the report, it is made available on the basis that anyone relying on it does so at their own risk without any liability to the safety audit team or their organisations.

[2] See https://www.portlandoregon.gov/transportation/article/237507

2 Safety audit team feedback

There were many positive aspects of the St Vincent Street SBF observed during the post construction safety audit.

- The SBF surfacing was very smooth and a pleasure to ride on
- The no stopping restrictions on both sides of St Vincent Street at intersections, made crossing here safer for all road users
- The use of 'under kerb' storm water sumps kept the SBF at a constant width and removed the issues associated with uneven or non-trafficable lids causing constrictions along the route
- The use of a buffer was observed to accommodate car doors opening and drivers accessing there vehicles and passengers entering or exiting vehicles without causing a hazard to SBF users
- The use of LED street lighting at the southern end of St Vincent Street meant there was good night time visibility for SBF users and driver visibility of SBF users was also increased.

2.1 Safety audit team response to meeting project objectives

The following table outlines the SAT's assessment of whether or not the project has achieved its stated objectives:

Table 7: Meeting Project objectives

Objective	Achieved or not achieved
Link the Railway Reserve shared path to the City	Partial; this project contributes to achieving this objective. It will be achieved when the stage 2 link is completed along with the path through Anzac Park
To increase peak hour walking and cycling throughout the city	Potential to achieve
Increasing waking and cycling at all other times	Potential to achieve
Extend and further develop existing walking and cycling networks	Achieved
Target schools to make walking and cycling for school children easier and safer, thereby reducing peak hour vehicle congestion	Achieved
Reduction in deaths and serious injuries as a result of road crashes	Unlikely – see below
More transport choices, particularly for those with limited access to a car	Potential to achieve
Reductions in adverse environmental effects from land transport	Potential to achieve

3 Safety Audit Findings

3.1 Crash severity and likelihood assessment

It should be noted that the likelihood rating assigned to 'Death or Serious Injury' is often "likely" or "very likely" because crashes between cyclists and motorised vehicles often results in serious injury or fatality crashes. At intersections where vehicles travel at lower speeds, the severity may be decreased but may also be compounded by visibility issues. Also, when considering the target audience of "interested but concerned" cyclists, it must be remembered that this group includes children of 10 years or older, whose physical size can increase the severity of injury when compared with an adult cyclist experiencing the same conflict.

3.2 Main risks arising from the bi-directional SBF concept.

The provision of separated bicycle facilities is novel for New Zealand but is in widespread use in some European countries and is also being introduced into Australia and North America. Research shows they improve cyclist perceptions of safety and encourage use by "interested but concerned" people who would cycle if facilities felt safer. They fear being struck from behind by traffic and separate facilities are effective at removing this fear. However most of actual risk to cyclists is at intersections and driveways, and the research evidence consistently finds that for one way facilities the risk at intersections and driveways is measurably higher and for two way cycling the risk is substantially higher again. The two way risk is due to motorists failing to notice cyclists from the unexpected 'contraflow' direction. In the case of St Vincent St this is also the downhill direction so cyclist speeds are higher, and could reach speeds sufficient for serious injury and death. The risk of death and serious injury increases rapidly at impacts over 30 km/h.

When taking this into account, extraordinary measures are required to mitigate the inherent risks involved at intersections and driveways for two-way separated facilities on one side of a road.

3.3 SBF Profile

3.3.1 SBF lack of physical separation **Significant**

For two way travel, physical separation is required by current legislation and considered necessary from a safety and user comfort perspective. It is noted that the Aurecon Plans sheet 5 and sheet 9 show that a "Hynds precast concrete wheel stop (or similar approved by engineer) installed on parking side of buffer zone. Units placed with 1.0 m separation. These concrete separation barriers have not been installed.

During the audit a group of riders was observed to exit the SBF and travel contraflow through the Gloucester Street roundabout. This manoeuvre is physically possible at the entry and exit of both roundabouts and somewhat intuitive based on the SBF's bi-directional nature and marking styles. This creates conflict among SBF users and between drivers and cyclists transitioning between the road and SBF. This situation removes protection to SBF users where protection by separation is most warranted.

Just as there is a continuum of risk aversion and rider skills across the 'interested but concerned' group there is a continuum of perception as to what level of separation is desirable. The actual degree of physical separation required could be informed by 'legal opinion' or alternately the Council could determine the appropriate level of physical separation based on the facility's intended target audience. It is acknowledged that physical separation can range from a row of vertical delineator posts, landscape planting in low median islands through to large concrete barrier islands; the following figures illustrate some possibilities along this continuum: (note; the Riley kerbs may not be regarded as sufficient physical separation.)

Riley Kerb - Swanston Street, Geelong

Modular barriers Triangle Rd AK

Concrete SBF barriers - Sydney

Figure 1: various forms of physical separation

Each level of provision has pros and cons, from the separation not having enough profile and drivers don't notice it, some profiles are hazardous if cyclists ride over them and there is concern that a low concrete median island may become a tripping hazard if it is located where pedestrians do not expect it.

Drivers on St Vincent Street may have very little awareness of the SBF as the only demarcation is the 100 mm wide painted white line. This marking has very little presence at night time. The SBF does some protection from cars parked on the east side of St Vincent Street, but they can also obscure path users. The implementation of physical separation will improve the SBF conspicuity to drivers.

Recommendations:

3.3.1.1 Council provides good physical separation for the SBF on the approach

lanes and departure lanes at both roundabouts.

3.3.1.2 Council confirms their target audience for this facility and determines the level of protection this user groups requires to want to use it.

3.3.1.3 Council undertakes to provide safe separation between the SBF and moving traffic, sufficient to meet legal requirements.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Very likely**

Designer Response: *Agree. As allowed for in design, provide physical separation along full length of buffer with solid wheel stop/barrier system in conjunction with increased delineation*

NCC Project Manager: Wheel stops discussed and continually raised as a trip hazard. See email Via Strada and Tim Hughes 11 Sept 2014. Posts should be adequate to meet legal separation, but reinforce with some concrete islands at busy locations eg driveways and intersections.

Client Decision: *Use posts where possible, and concrete islands at busy driveways. Use posts only at intersections pending further works. Gloucester Street roundabout is scheduled with the next stage of this cycle facility project. Toi Toi Street roundabout is scheduled through the minor works programme.*

Action Taken: Concrete islands at busy driveways, Harvey Norman (x2), Fruit and Vege Shop, Daycare Centre, City Fringe, and between driveways at 137/135 St Vincent Street. Posts installed elsewhere.

3.3.2 No stopping at intersections and entrances Moderate

The Aurecon preliminary design summary identified the need for a sight distance of 90 m measured 3.0 m back form the limit lines for intersections. The appropriate length of no stopping was provided to achieve this. The design summary did not identify the lack of sight distance at busier entrances as a risk and yet some entrances are busier than some intersections.

The SAT thought this intersection distance could be reduced slightly which could gain a few car parks at intersections. However, the busy entrances should have similar clear sightline distances.

Figure 2: 90 m sight lines (no parking) at intersections

Recommendations:

3.3.2.1 Council to consider slightly reducing the intersection sight distance requirement (possibly reinstate some on street parking) and applying a similar clear sight line criteria (no parking) at busy entrances.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Infrequent**	*Death or serious injury is* **Likely**

Designer Response: *Agreed. Review no stopping at busy intersections to provide consistency for treatment at intersections.*

NCC Project Manager: Agree

Client Decision: *Agree*

Action Taken: Parks removed each side of driveways listed above for island treatments. One additional car added on approaches to side roads where possible. Additional parking not added to roundabout approaches or departures pending future projects.

3.3.3 Priority to drivers at SBF intersections Moderate

The current priority to drivers at intersections means that cyclists on the SBF are required to look in several directions before crossing the side road: they must look 180 degrees behind them to ensure there are no turning vehicles coming from behind; down each side road for exiting or crossing vehicles; and forward to oncoming (and potentially turning) traffic before they cross every side road. This is a complex task for cyclists. Looking backwards over one's shoulder can be physically difficult as it alters a cyclist's balance; elderly and less mobile riders can find looking at even 90 degrees difficult.

It is difficult to legally provide priority to cyclists on paths crossing side roads and intersections, research is needed to find successful ways of managing the conflict. The greatest risk is for contraflow riding as drivers are not used to looking in that direction.

Figure 3: Cyclist looking over his shoulder to check for turning vehicles at intersection

Recommendations:

3.3.3.1 The decision to make cyclists give way at (busy) intersections is supported by the SAT as there could be more serious injury crashes if cyclists had priority and crossed side roads at speed. Motorists would not necessarily recognise this, look in both directions for cyclists and comply with the rule.

3.3.3.2 Recognising the importance of the safety in numbers effect, council should monitor SBF use to determine when there are sufficient cyclists that drivers will always expect them and look for them. Safe and legal solutions are likely to emerge from trials in the next few years. So in the future, there is potential for the SBF to be safely assigned priority over motorised vehicles at all entrances and intersections.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Likely**

Designer Response: *Agreed. No change required to existing layout. Intersections to be monitored.*

NCC Project manager: ***Agree***

Client Decision: *Agree and add to monitoring schedule for future review*

Action Taken: ***No change. Item added to Minor Works Programme for future review.***

3.3.4 Intervisibility entering driveways — Significant

Intervisibility between vehicles entering driveways, cyclists and pedestrians will be restricted by cars parked on St Vincent Street. This is particularly more risky for contra-flow cyclists and at very busy driveways. Council has determined that all side streets will have 90 m clear visibility from a point 3.0 m back from the limit lines. The SAT considers this principle to be appropriate to some of the busy driveways with access along the SBF; if this is applied, all cyclists on the SBF will benefit by having increased intervisibility when crossing driveways.

An empty grey trailer was also observed parked in the assigned parking bays at the south entrance to Harvey Norman, while difficult to see at night and could be an unmarked, unlit hazard, the trailer's presence did allow entering and exiting drivers improved intervisibility at this location in comparison to if a large SUV or van had been parked there, for example.

Figure 4: Improved intervisibility example

Recommendations:

3.3.4.1 All driveways should have some parking removed from both sides to increase intervisibility between the SBF users and drivers.

3.3.4.2 Council to consider what level of driveway activity warrants parking removal for a set distance from that driveway.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Common**	*Death or serious injury is* **Likely**

Designer Response: *Review of parking provisions can be carried out in conjunction with check on no stopping at intersections in 3.3.2. Some removal of car parks could be achieved in areas where existing demand is not high.*

NCC Project Manager: ***Write to all businesses and landowners inviting comment on driveway visibility would be the best way to gauge what driveways are needing the extra visibility.***

Client Decision: *Carparks removed on the driveways listed above.*

Action Taken: ***Carparks removed and islands installed as listed above.***

3.3.5 Awareness of SBF when exiting driveways Moderate

Drivers exiting property, shops and businesses and on the east side of St Vincent Street, must cross the SBF. Some drivers may not be aware of the presence of the SBF or may forget about it as they leave, again this is greater risk for contra-flow cyclists. There are some permanent warning signs located on some of the exits, but it is not evident where this warning applies, i.e. on the footpath, the SBF or on the road itself?

Figure 5: Cycle logos at driveway (note that the advertising signs are not well-placed)

Recommendations:

3.3.5.1 The SBF should have the bi-directional cycle logos with directional arrows painted at all driveways and entrances.

3.3.5.2 Busier driveways could be supplemented with a "Look for Cyclists" sign with arrows. The sign could be located lower than the standard 2.5 m height, which may communicate that the SBF is closer and the sign is not referring to St Vincent Street itself. This sign could also be a pavement surface sign.

3.3.5.3 The council may also consider using the green coloured surfacing under the markings to highlight this potential conflict location.

3.3.5.4 It may be appropriate to consider vertical speed controls on some busier exits to reduce conflict speed, thus reducing crash injury

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Common**	*Death or serious injury is* **Unlikely**

Designer Response: *Recommend that driveways to be marked with both cycle symbols and arrows highlighting cyclist movement in both directions and in accordance with design.*

NCC Project Manager: ***Drawings prepared to show cycle symbols on all***

driveways for reissue to contractor for installation.

Client Decision: *Agree*

Action Taken: ***All driveways marked with cycle symbols and arrows.***

3.4 Toi Toi Roundabout

3.4.1 Limited visibility for southbound cyclists on SBF Significant

The visibility issue is created by the roundabout design which enables some drivers to travel through the roundabout at higher than desirable speed. Crossing cyclists also have limited decision time for northbound traffic turning right at the roundabout, and for oncoming through traffic from the Toi Toi Street west approach. The safety issue for cyclists is not having enough time to cross the road safely with vehicles able to travel too fast which means any crash could result in serious injury. It is now well recognised that having less visibility (or at least balanced visibility) at roundabouts is safer for all road users, this would mean that visibility sight lines should not be increased but the vehicle speeds should be reduced.

Figure 6: Limited visibility at Toi Toi roundabout

Recommendations:

3.4.1.1 Council to consider providing a raised platform for pedestrians and cyclists crossing the east approach of the Toi Toi Street roundabout. This could be a courtesy crossing as used in the Nelson CBD. The platform should be located so that a vehicle on the approach and departure lane can queue without blocking the roundabout or the raised platform.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Very likely**

Designer Response: *Construction of a raised table to be considered as part of possible future upgrade of intersection.*

NCC Project Manager: ***There are many existing constraints at the Toi Toi Street roundabout which need working through with specific project and works cannot be programmed until land purchase is arranged.***

Client Decision: *Project added to Minor Works Programme for the specific works at Toi Toi Street roundabout to make suitable and safe pedestrian and cyclist facilities. Land purchase negotiations are underway.*

Action Taken: ***Project added to minor works programme. Land purchase negotiations are underway.***

3.4.2 Limited visibility for northbound cyclists on SBF Moderate

Northbound cyclists at the Toi Toi approach to the roundabout waiting area have limited visibility to their right to assess Toi Toi Street westbound vehicles approaching the roundabout when there are larger vehicles parked at the west most parking space in front of the shop. During the site visit the vehicles observed were often associated with servicing the shop and can include large delivery trucks.

Northbound cyclists on the splitter island waiting to cross the Toi Toi Street exit lane have to look 90º to their left, to assess whether northbound vehicles are turning right at the roundabout and whether drivers travelling from Toi Toi west will continue to the Toi Toi Street eastbound exit lane. The cyclists have limited time to make their decision and this is compounded by the speed that some drivers can travel through the roundabout.

Recommendations:

3.4.2.1 Council should discuss the need for the west-most car parking space with the shop owner/tenant to see if this park can be removed to improve intervisibility between northbound cyclists crossing Toi Toi Street and west bound drivers on Toi Toi Street.

3.4.2.2 As per the limited visibility issue for southbound cyclists, the Council should consider providing a raised platform for pedestrians and cyclists crossing the east approach of the Toi Toi Street roundabout.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Likely**

Designer Response: *Recommend that NCC consult on removal of parking space with shop owner/tenant. Construction of raised table to be part of possible future upgrade of intersection.*

NCC Project Manager: ***Unlikely to be allowed to remove carpark as it is directly outside the shop entrance. Hold rails on the island will help raise awareness of motorists for the pedestrian and cyclist activities. Raised table or other solution to be part of future project when land purchase is arranged.***

Client Decision: *Agree, removal of carpark is unlikely to be possible. Project added to Minor Works Programme for future works at the intersection*

Action Taken: ***Hold rail added to pedestrian refuge and project added to minor works programme for future works***

3.4.3 Limited SBF space adjacent to shop car park Moderate

Cyclists passing the shop on the south east corner of the Toi Toi roundabout have a very narrow path available, with a 400 mm vertical drop into the shop car park.

Figure 7: Narrow path on east corner of Toi Toi roundabout

Many cyclists and pedestrians were observed to walk through the car park in preference to using the narrow footpath. This creates a multitude of safety issues for pedestrians and cyclists in this location as there is only room for single file riding and walking. The conflicts on this narrow path include any opposing movements; cyclists passing pedestrians travelling in the same direction; and southbound on-road cyclists verses northbound SBF cyclists. The auditors understand the council is developing options for improving pedestrian and SBF access at this location.

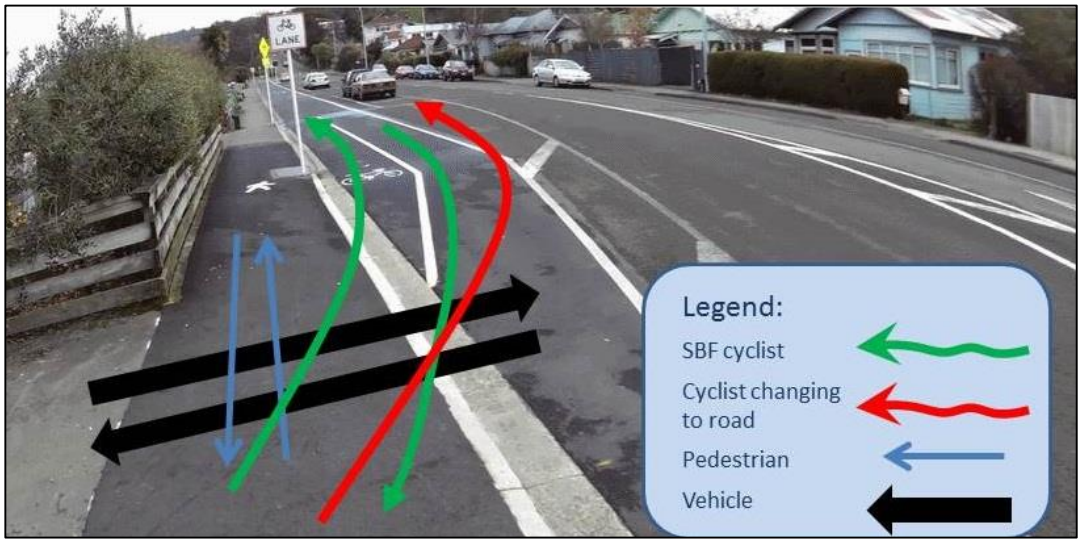


Figure 8: User conflicts on narrow path approaching roundabout

Recommendations:

3.4.3.1 Council continues to progress improving this short section of the SBF and footpath.

3.4.3.2 Any SBF design should also accommodate pedestrian use and provide clear delineation between the on road and off road cyclist use in this location.

Frequency Rating: ***Severity Rating:***

Crashes are likely to be **Common** *Death or serious injury is* **Unlikely**

Designer Response: *Agree that existing layout not ideal but this is governed by privately owner land on SE side of intersection. Recommend that this be addressed once NCC negotiates land entry/transfer.*

NCC Project Manager: ***Land purchase negotiations are underway. Recommend that the path is widened when possible, and kerb extension on St Vincent Street is used to separate the different user paths***

Client Decision: *Land purchase negotiations are underway and project added to Minor Works Programme for future works.*

Action Taken: ***Land purchase needs to be completed first before physical works can be undertaken.***

3.4.4 Limited splitter island capacity Moderate

The splitter island on the east approach of the Toi Toi Street roundabout is very small and has limited capacity for pedestrians and cyclists to wait for their crossing lane to clear.

Figure 9: Narrow splitter island

Recommendations:

3.4.4.1 Council to consider increasing the size of the splitter island

3.4.4.2 Council to consider additional methods to improve the level of comfort and safety for pedestrians and cyclists crossing here, such as installing holding rails and using tactile warning paving.

Frequency Rating: ***Severity Rating:***

Crashes are likely to be **Occassional** *Death or serious injury is* **Likely**

Designer Response: *Existing lane widths provide limitations on provision of increased island width. Provision of holding rails and tactile pavers preferred treatment.*

NCC Project Manager: ***Hold rails can be added to pedestrian refuge. Difficult to add tactile pavers while land purchase negotiations are incomplete and vehicle entrance conflicts with pedestrian waiting area.***

Client Decision: *Agree*

Action Taken: ***Hold rails added, and recommendations are to be included in future project on Minor Works Programme.***

3.5 Gloucester Street roundabout

3.5.1 Northbound cyclist desire line — Significant

Cyclists riding northbound on the SBF are confronted with several route choices across the Gloucester Street east approach to the roundabout. During the site visit, northbound cyclists were observed to:

- ride off the SBF and travel contraflow around the roundabout and turn right into the Gloucester Street eastbound exit lane;
- follow the green coloured surfacing and travel contraflow along the south side on road cycle lane until there was a gap in westbound traffic so they could cross to the correct side of the road. It may be that cyclists feel comfortable doing this after riding contraflow along the St Vincent Street SBF.
- continue along the footpath and cross at the pedestrian crossing location with pedestrians;
- continue along the footpath and ride directly across the Gloucester Street approach lane and take refuge in the narrow painted median markings between the pedestrian crossing and the roundabout splitter island.
- leave the SBF, cross the road prior to the Gloucester St roundabout and continue on in the northbound traffic lane. It was not clear whether these cyclists made this manoeuvre with the aim of avoiding using the SBF on the roundabout, because they knew that the SBF provision currently stops after the roundabout, because they wanted to avoid the entrance way to the supermarket north of the roundabout or for personal route choice reasons. We would not expect interested but concerned riders to perform this manoeuvre.

Recommendations:

3.5.1.1 This crossing will require careful design that needs to address the former contraflow cycle lane that was provided on Gloucester Street east, keeps SBF cyclists off the road and provides a safe crossing facility for the 'interested but concerned' cyclists.

3.5.1.2 The council should consider providing a raised platform for pedestrians and cyclists crossing the east approach of the Gloucester Street roundabout, as discussed previously.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Very likely**

Designer Response: *Agreed. The construction of a raised platform to be considered as part of the proposed upgrade to Gloucester Street roundabout.*

NCC Project Manager: ***The existing refuge is as close to the desire line a conventional refuge can be paced due to vehicle tracking requirements. A raised table could be used to achieve better outcomes on the desire lines***

for pedestrians and cyclists and removal of the refuge would remove a potential traffic obstruction on Gloucester Street.

Client Decision: *Raised table is not appropriate in this situation because of the Principal Road Classification on both Gloucester and St Vincent Streets and the traffic mix involved. There is inadequate pedestrian and cyclist presence at this stage to maintain the required level of attention for the vehicle traffic. Options to be considered once the pedestrian and cyclist numbers are high enough. Solution to be considered against traffic signals for overall intersection management in the 10 year plan.*

Action Taken: ***Design to progress with improvements to the St Vincent Street / Gloucester Street roundabout. Design to be safety audited before construction.***

3.5.2 Southbound SBF route continuity — Moderate

It is not apparent to southbound cyclists approaching the Gloucester Street roundabout, how they should cross the intersection. During the site visit, southbound cyclists were observed to ride directly across the roundabout in the general traffic lane. This was only done by more confident cyclists who were comfortable taking the lane; 'interested but concerned' cyclists are not likely to want to imitate such behaviour. The cycle route sign on the south east corner of the roundabout seems to imply this is the expected manoeuvre. Fortunately, this sign is difficult to see due to another sign directly behind it.

Figure 10: St Vincent southbound exit at Gloucester Street

Recommendations:

3.5.2.1 The SBF needs to be physically separated from the St Vincent Street roundabout approaches and departures to ensure the 'interested but concerned' cyclists stay on the SBF and confident cyclists can ride into the traffic lane at a safer location.

3.5.2.2 The council should consider providing a raised platform for pedestrians and cyclists crossing the east approach of the Gloucester Street roundabout, as discussed for the Toi Toi Street roundabout.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Likely**

Designer Response: *Agreed. Physical separation should be considered as part of proposed upgrade to Gloucester Street Roundabout.*

NCC Project Manager: ***Agreed***

Client Decision: *Agreed*

Action Taken: ***Design to be completed for the St Vincent Street / Gloucester Street roundabout. Design to be safety audited prior to construction.***

3.5.3 Minimal time for assessing eastbound drivers Moderate

Southbound cyclists at the Gloucester Street (east) crossing, essentially have to wait for Gloucester Street west approach through vehicles and St Vincent Street northbound vehicles (some may turn right) to clear the intersection because there is insufficient space and time for cyclists to cross this lane if these vehicles enter the Gloucester Street eastbound exit lane.

Recommendations:

3.5.3.1 Council should consider providing a raised platform for pedestrians and cyclists crossing the east approach of the Gloucester Street roundabout as discussed previously.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Infrequent**	*Death or serious injury is* **Likely**

Designer Response: *Matter to be considered as part of proposed upgrade to Gloucester Street roundabout.*

NCC Project Manager: ***Agreed***

Client Decision: *Agreed*

Action Taken: ***Design to be completed for the St Vincent Street / Gloucester Street roundabout. Design to be safety audited prior to construction.***

3.6 General

3.6.1 Vehicle parking discipline in assigned spaces Minor

It was observed on-site that parking discipline varied along the site with most vehicles parking on the buffer side of the wide parking space provided, and this is expected as it keeps drivers further from moving traffic when they exit their vehicles. There is good evidence now that narrower parking spaces and longer parking periods, results in better parking discipline, i.e. within the allocated space. The greatest risk to on road cyclists on midblock facilities next to parking is being hit by an opening car door as this often results in cyclists being thrown out in front of moving traffic. Parking discipline is thus critical to cyclist safety in this location.

Figure 11: Poor parking discipline and dooring

The severity for this issue has been rated lower because the SBF located on the passenger side of cars greatly reduces the risk of serious injury as cyclists are not 'captured' by the door, or thrown into the live traffic lane. The photo on the right shows vehicle occupants being able to access the car when the parking discipline is good and pedestrians stay within the buffer zone, thus not constricting the SBF.

Recommendations:

3.6.1.1 Council to consider using 2.0 m wide parking spaces and hatching in the "buffer area" to ensure improved parking discipline.

Frequency Rating:		***Severity Rating:***	
Crashes are likely to be	**Occassional**	*Death or serious injury is*	**Unlikely**

Designer Response: *Parking discipline will be improved with installation of solid barriers and delineation through buffer zone.*

NCC Project Manager: ***Agreed, but suitability of material for the physical separation so as not to create a trip or other hazard for other road users.***

Client Decision: *Agreed*

Action Taken: ***Posts installed between vehicle bays and solid islands installed where parks removed at busy driveways.***

3.6.2 Advertising sings in the SBF — Minor

Some businesses were observed to use the SBF as a location for advertising their business or activities on their site on certain days. The signs are a hazard to SBF users and may also be a distraction to drivers entering their site, looking at the sign information and not path users.

Figure 12: Poorly placed advertising signs

Recommendations:

3.6.2.1 Council should require that the SBF is kept clear of any signs & other obstructions and enforce this requirement

3.6.2.2 Council may consider allowing businesses to advertise within the parking space or buffer zone as a benefit of the SBF which could be seen to offset loss of parking at their entrances and improve parking discipline by limiting the ability of vehicles to park in the buffer zone.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Unlikely**

Designer Response: *NCC compliance personnel to follow up on signs placed on bicycle lane. Benefit in allowing these to be placed within the buffer zone provided signs are kept clear of bicycle lane.*

NCC Project Manager: Write to the business owner and advise that signs can be put in the buffer zone, as long as signs don't encroach into the vehicle or cycle lanes.

Client Decision: *Agreed,*

Action Taken: ***Letter to business owner.***

3.6.3 Rubbish and recycling bins in the SBF **Moderate**

Refuse and recycling bins were observed on the footpath for collection. This would result in the collection trucks travelling along the SBF to collect and empty the bins, causing a significant conflict with SBF users.

Figure 13: Rubbish bin on footpath

Recommendations:

3.6.3.1 Council may consider allowing residents and business owners to place their refuse and recycling bins within the parking space or buffer zone as this will keep the bins out of the SBF and improve collection access

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Likely**

Designer Response: *NCC to determine preferred placement of rubbish/recycling bins. Some benefit in allowing these to be placed in the buffer zone provided bins are kept clear of bicycle lane.*

NCC Project Manager: ***Monitor bin placement and discuss with refuge collection agencies to determine best procedure.***

Client Decision: *Agree*

Action Taken: ***Discussion with refuge collection agency, yet to be undertaken.***

3.7 Night time audit

Several of the street lights were not operational during the site visit, as the street light upgrade and installation project was not complete; this has therefore not been identified as an issue. Some other issues were observed:

3.7.1 Route consistency — Minor

There was good lighting consistency along the whole route with only one dark area observed. There were increased light levels at intersections which is good as intersections involve high potential for conflict. The only dark area was the north east quadrant of the Toi Toi roundabout where the extra lighting from the Victory Park paths and the business lighting was shaded by the large trees.

The entrances to businesses were not illuminated, if it can be established that there is no activity here during the hours of darkness this is considered acceptable.

The main inconsistency observed was between the bright white LED lighting south of Toi Toi Street and to the north of Toi Toi Street where the lighting appears quite yellow with a much lower level of illumination. During the night visit the predominant source of lighting on Toi Toi street came from the cyclists' own headlights whereas excellent intervisibility was provided between cyclists and drivers south of Toi Toi Street under the LED street lights. It is understood the contractor ran out of LED light fittings and the older yellow lights will be replaced soon. It was also noted that the yellow street lights made it difficult to see the green surfacing on the black AC footpath at the Gloucester Street roundabout.

Although outside the scope of this project, it was noted that the brighter white LED lights at the Totara Street end of the SBF made the Railway Reserve shared path, with no lighting, appear very dark and uninviting which does not achieve route consistency for active users.

Recommendations:

3.7.1.1 A night time site visit is required to measure actual lighting levels on the northeast quadrant footpath and SBF to determine if additional lighting or tree thinning is required in this location.

3.7.1.2 Council monitor the night time use of business entrances to determine if additional street lighting is required.

3.7.1.3 Council confirms that the LED street lights will be continued along the St Vincent Street route from Totara Street to Anzac Park.

3.7.1.4 Council gives consideration to lighting the Railway Reserve shared path.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occassional**	*Death or serious injury is* **Unlikely**

Designer Response: *Check lighting levels are achieved as per design requirements for both traffic lanes and the bicycle lane.*

NCC Project Manager: ***Lighting levels to be checked***

Client Decision: *Agreed*

Action Taken: ***Lighting levels to be checked on completion of the light installation programme.***

3.7.2 Parking at night — Moderate

Only one car and a light trailer were observed parked in the assigned spaces adjacent to the SBF buffer. These vehicles appeared to be 'in the middle of the road' as there was no kerb or physical separator defining the parking area. The light trailer was grey and was very hard to see against the grey road surface, this would also apply to dark vehicles parked here.

Recommendations:

3.7.2.1 As per the route consistency, council confirms that the LED street lights will be used along the whole route.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Infrequent**	*Death or serious injury is* **Likely**

Designer Response: *Parking would be aided by installation of solid separation in the buffer zone along with improved delineation.*

NCC Project Manager: ***Agreed***

Client Decision: *Agreed*

Action Taken: ***Install posts and islands and RRPM on the road centreline***

3.7.3 40km/h speed sign — Minor

The recently installed 40 km/h speed sign is located in a small raised island in the SBF buffer zone. The sign itself is black as it uses LED technology; the pole is white with the newly installed concrete island also being relatively white. However, there is no delineation or retro reflective warning signs on the pole or island which makes this difficult to see when located some 3.5 m from the kerb. This sign could be struck by an inattentive driver. The school speed zone sign has not been added to this pole yet.

Recommendations:

3.7.3.1 That additional delineation and/or retro reflective warning signs are added to the sign or island for south bound, night time drivers.

3.7.3.2 Council ensures the school speed zone sign is added.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Infrequent**	*Death or serious injury is* **Unlikely**

Designer Response: *Agreed add delineation to existing sign along with school speed zone sign.*

NCC Project Manager: ***Sign had reportedly been stolen, along with another elsewhere. Sign replaced and RRPM to be added to island***

Client Decision: *Agreed*

Action Taken: ***Sign replaced and RRMP added to island***

4 Audit Statement

We certify that we have used the available plans, and have examined the specified roads and their environment, to identify features of the project we have been asked to look at that could be changed, removed or modified in order to improve safety. The problems identified have been noted in this report.

Signed: Date: 08 Aug 2014

Warren Lloyd

Director, ViaStrada Ltd

Signed: Date: 08 Aug 2014

Tim Hughes,

National Traffic and Safety Engineer, NZ Transport Agency

5 Safety Project team statement

Designer: *NameAri Fon*

(See letter 25 August 2014, attached) *Position……..*

Signature…….. *Date…….*

NCC Project Manager: *Name……*

Position……..

Signature…….. *Date…….*

Client: *Name……* *Position……..*

Signature…….. *Date…….*

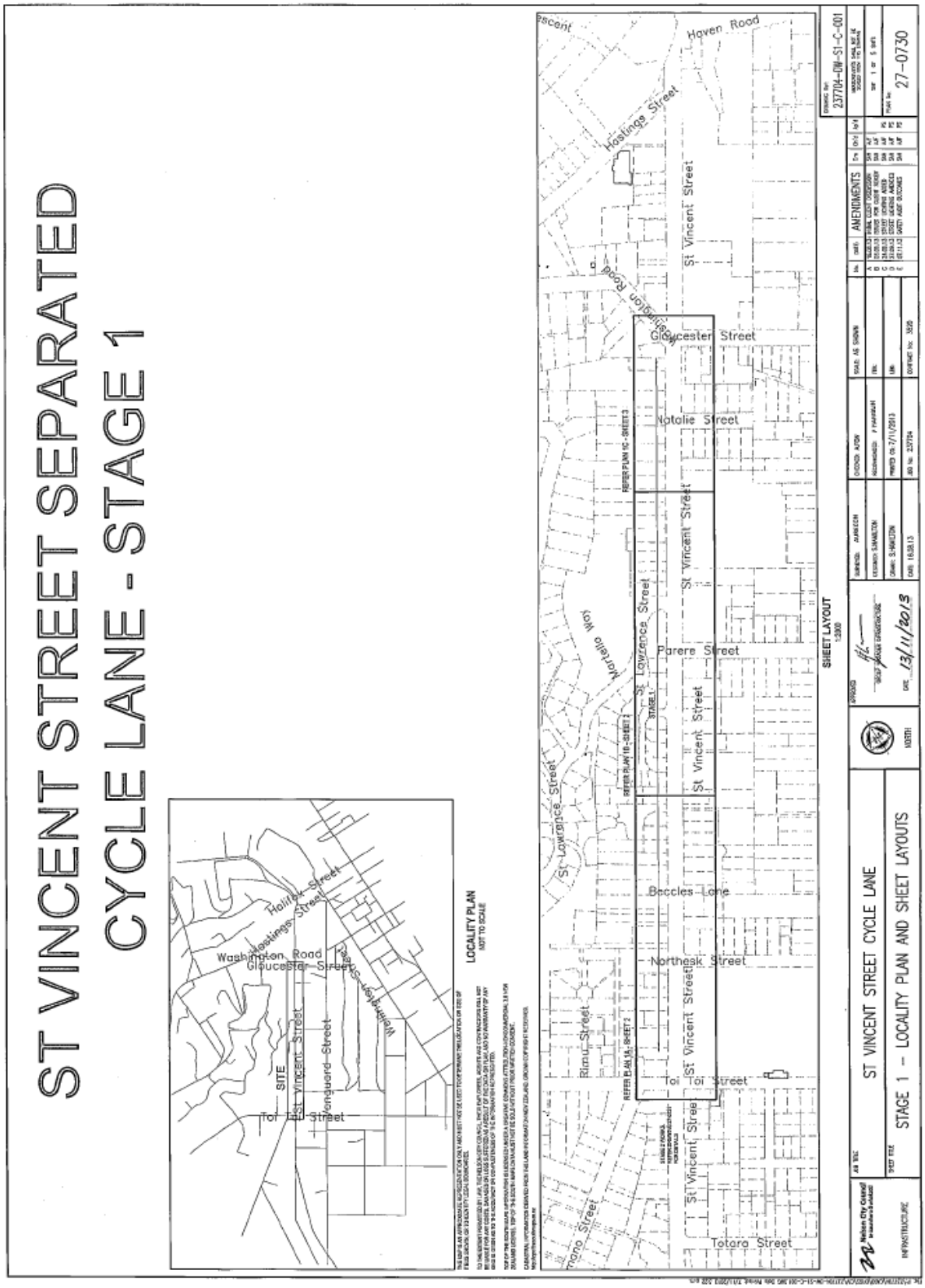
Action Completed: *Name……* *Position……..*

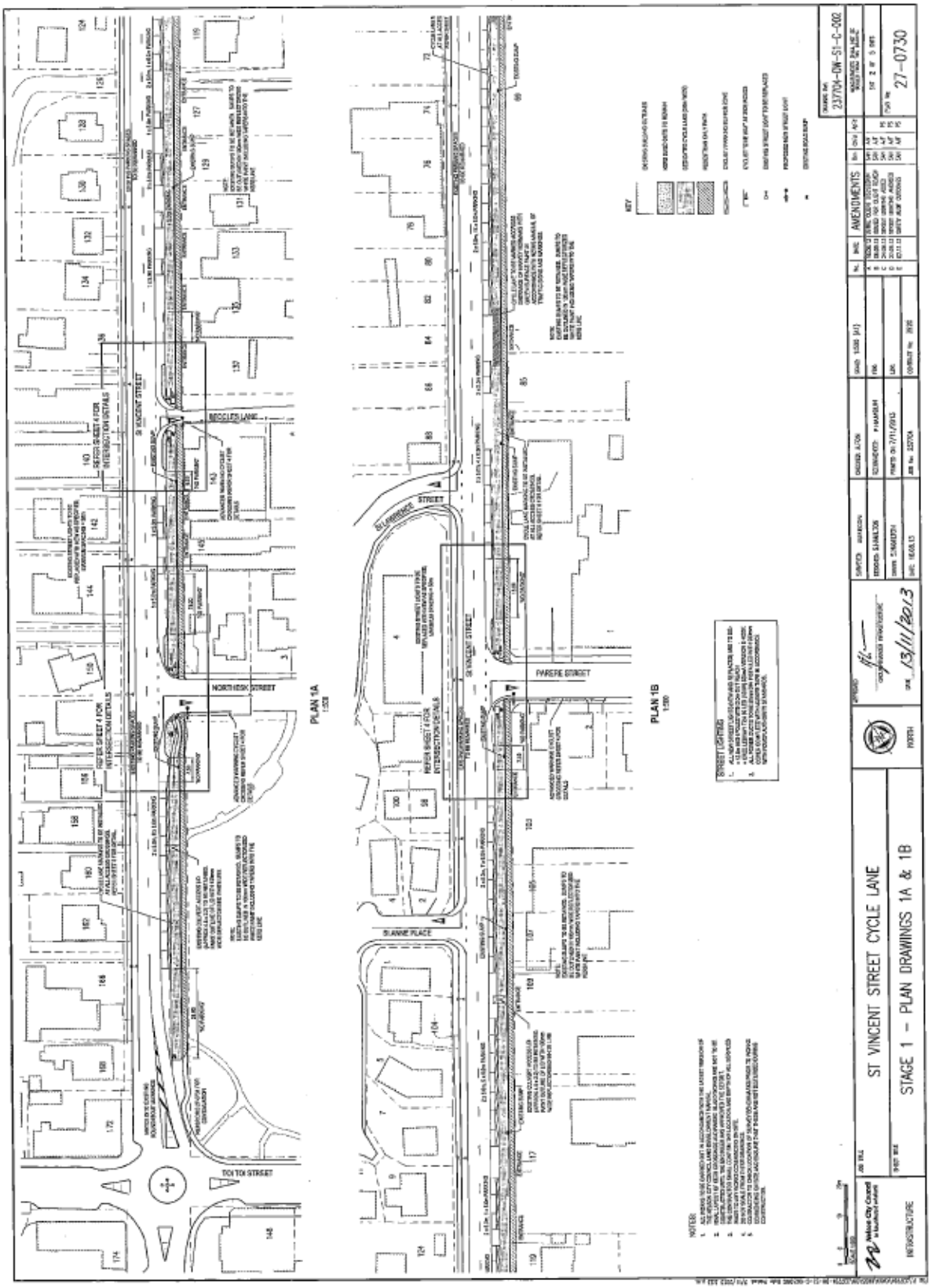
Signature…….. *Date…….*

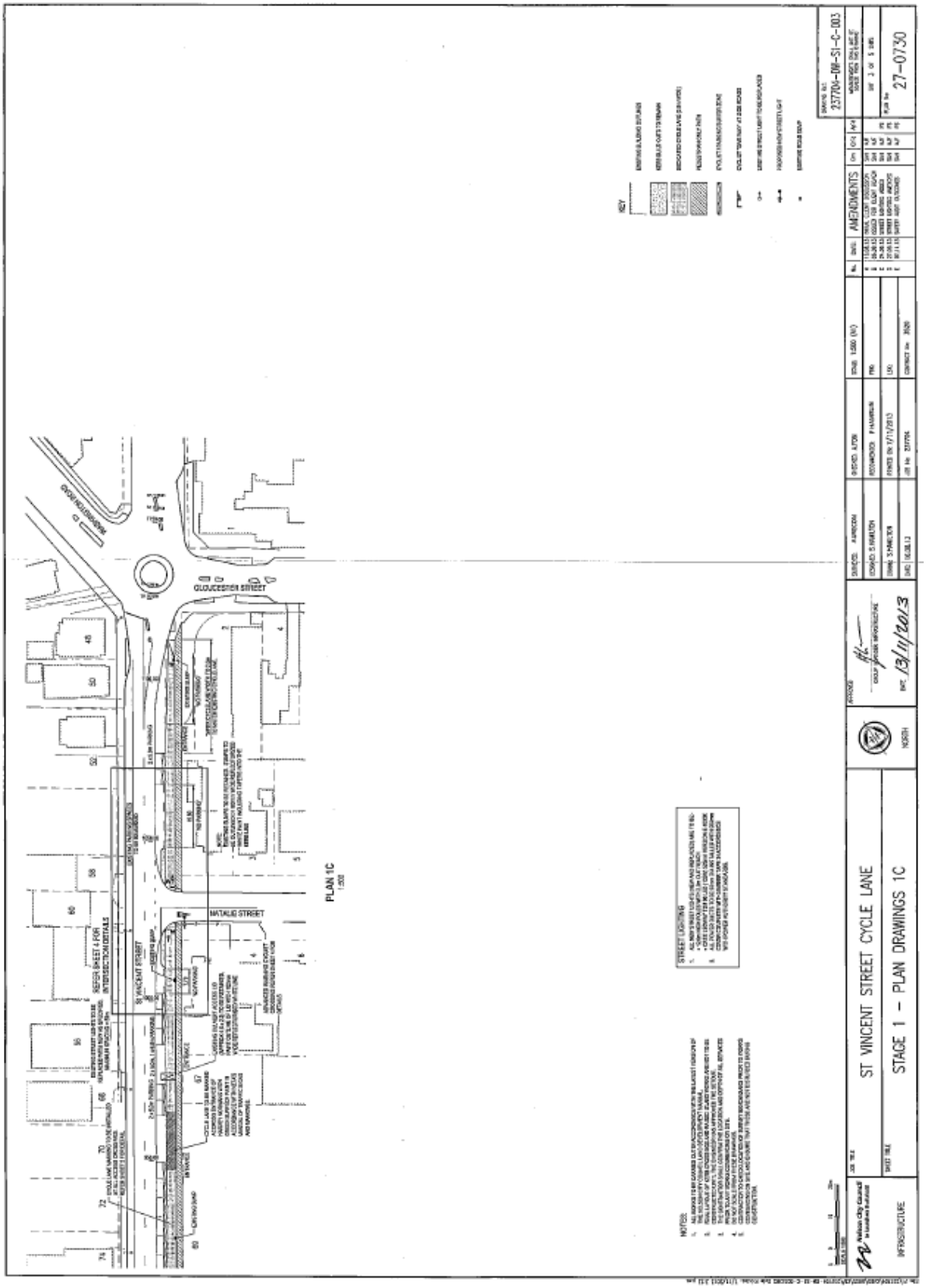
Project Manager to distribute audit report incorporating decision to designer, Safety Audit Team Leader, Safety Engineer and project file.

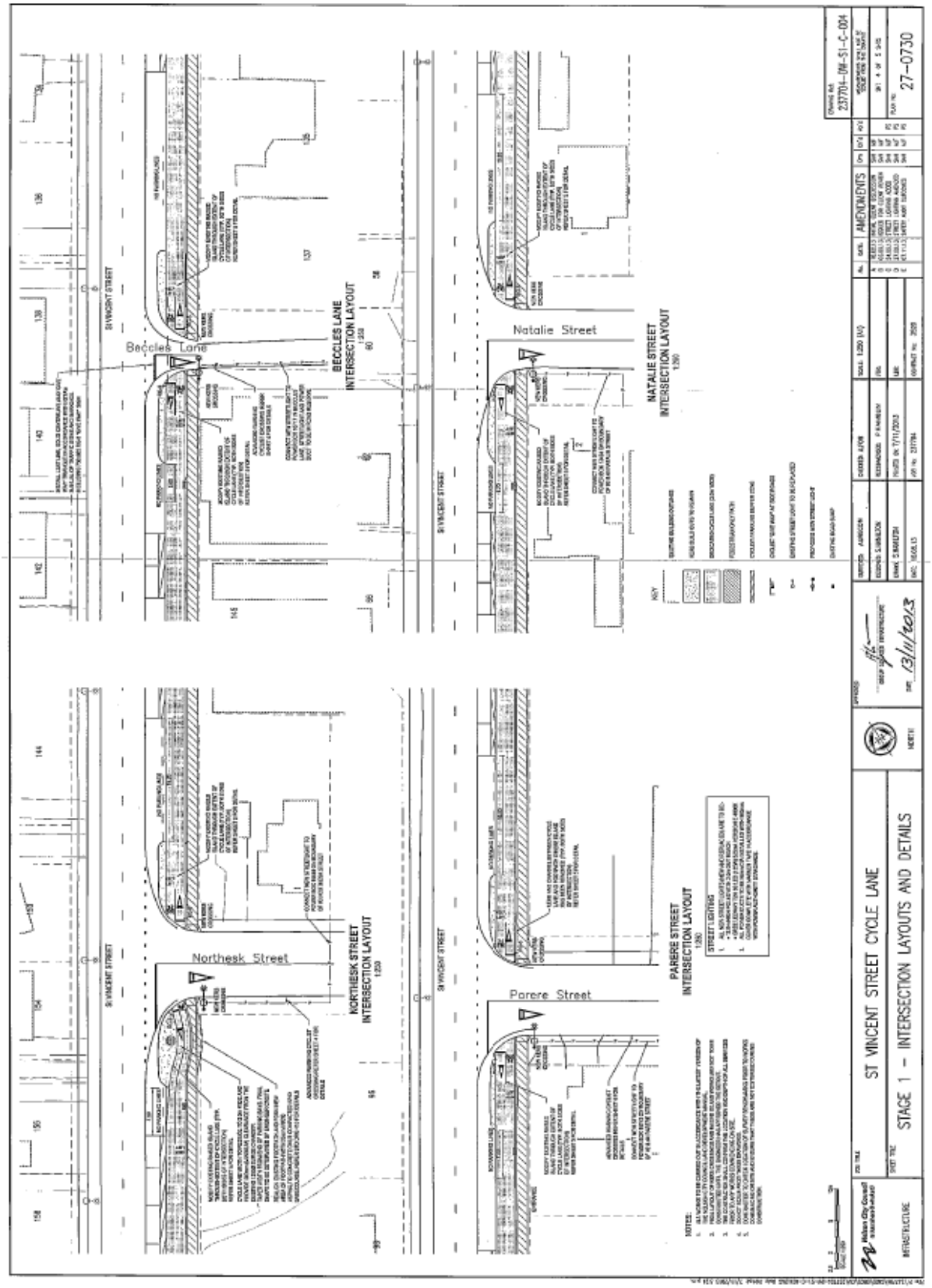
Date: *……..*

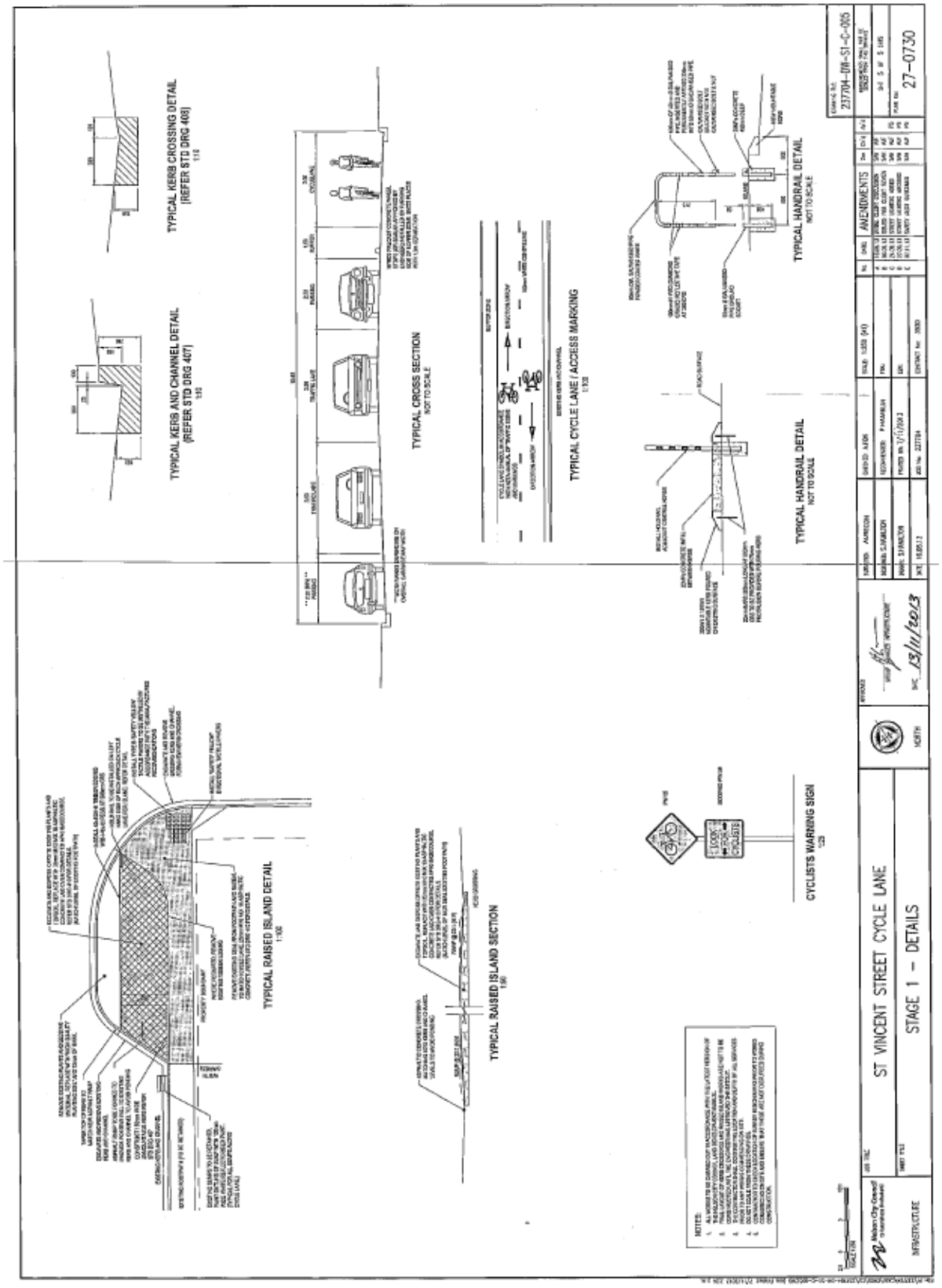
Appendix A Plans

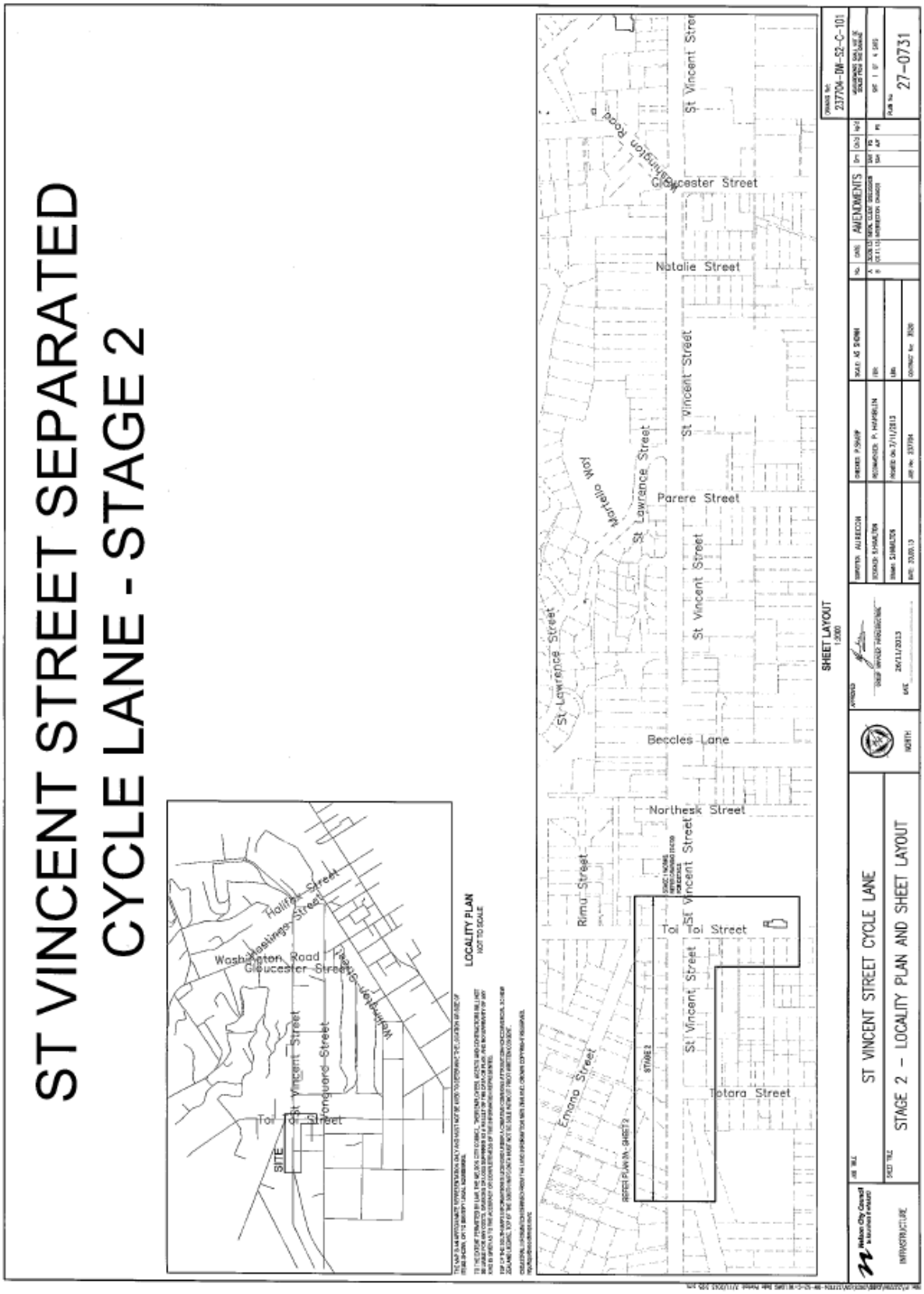


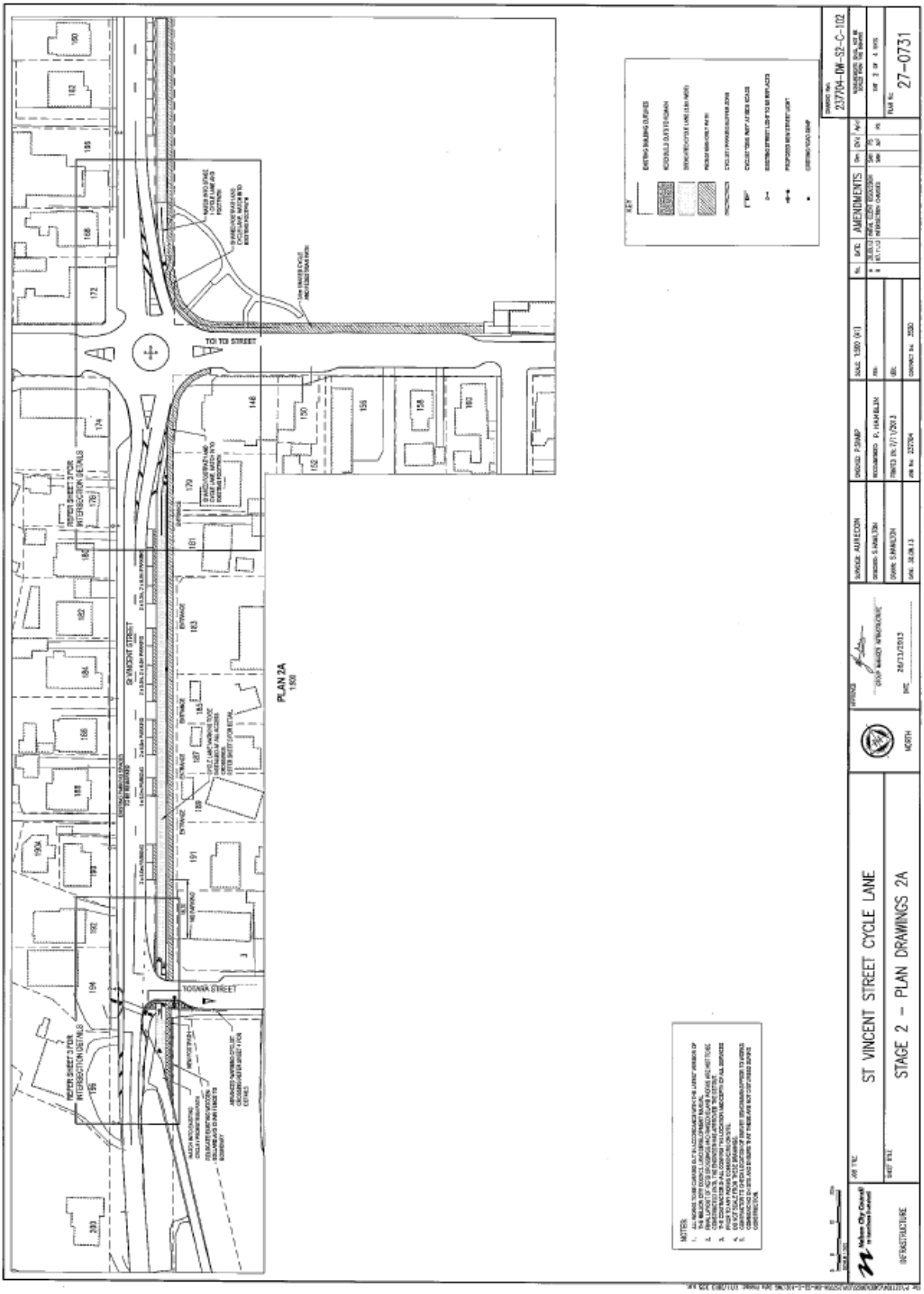

ST VINCENT STREET CYCLE LANE
STAGE 1 – PLAN DRAWINGS 1A & 1B
PLAN 1A
PLAN 1B
NORTH HIGH STREET
TOI TOI STREET
BEDLETS LANE
ST VINCENT STREET
PARERE STREET
SLANNE PLACE
13/11/2013
27-0730

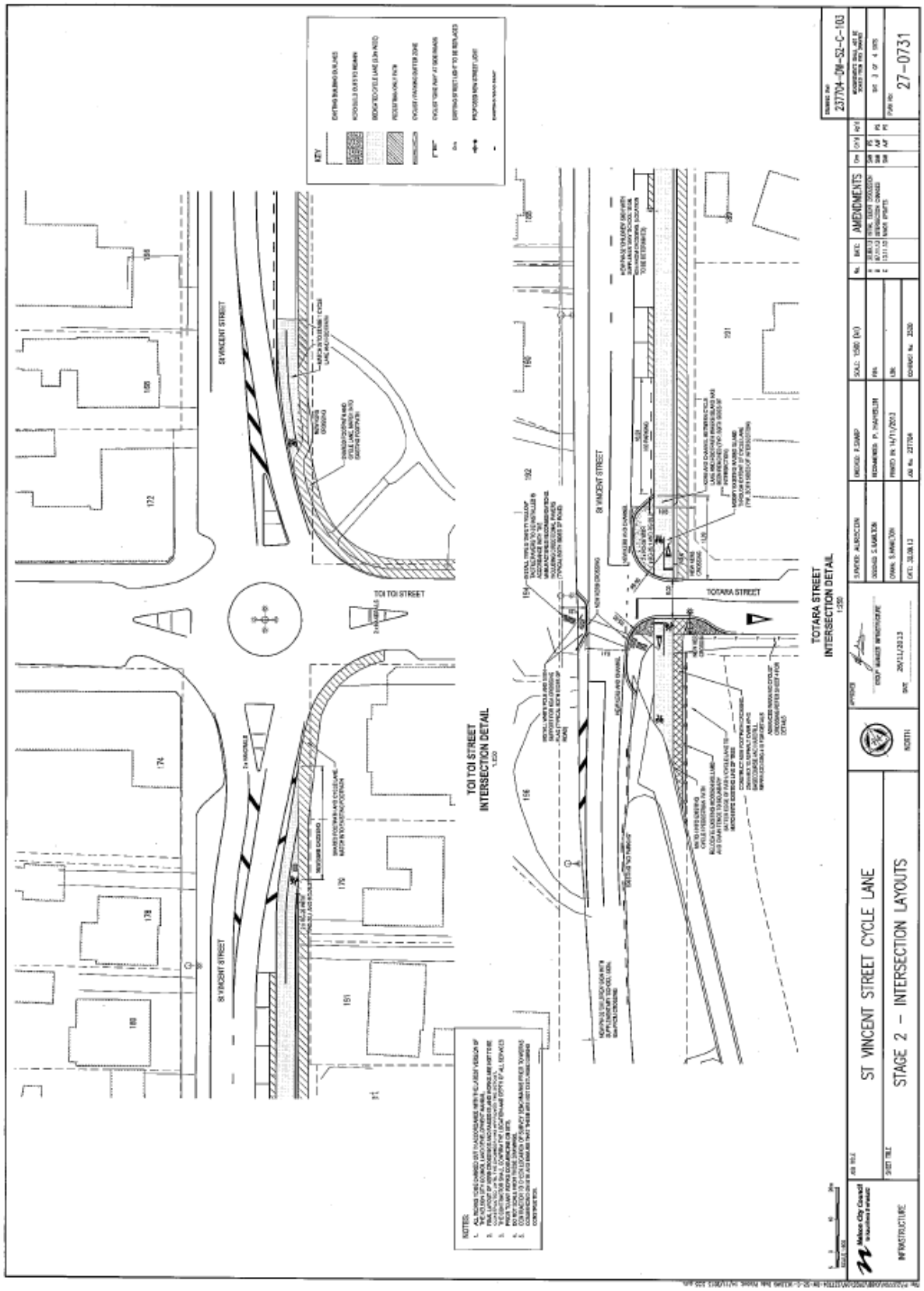

GLOUCESTER STREET
NATALIE STREET
ST VINCENT STREET
PLAN 1C
1:500
ST VINCENT STREET CYCLE LANE
STAGE 1 – PLAN DRAWINGS 1C
INFRASTRUCTURE
27-0730
13/11/2013

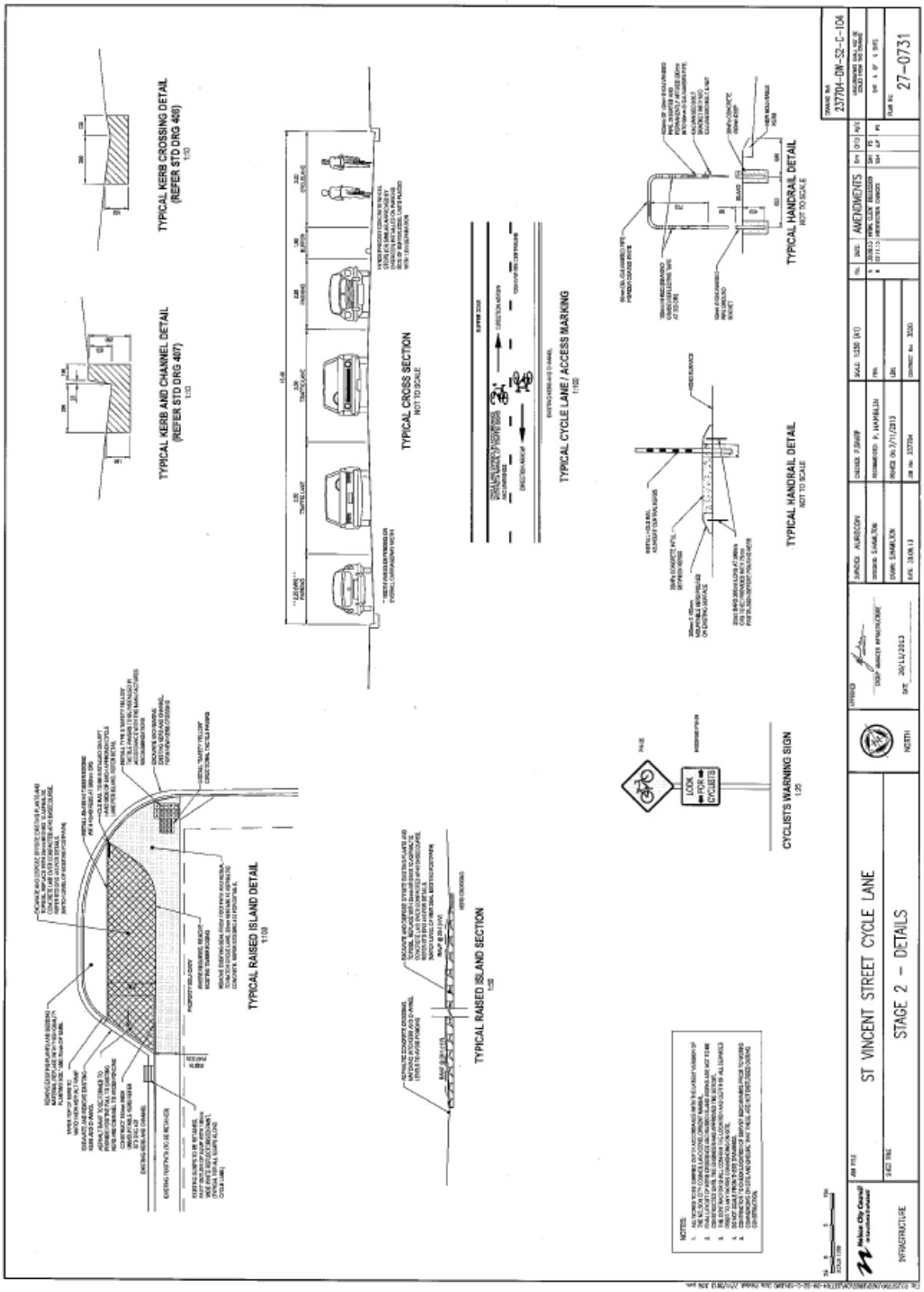

Beccles Lane
BECCLES LANE INTERSECTION LAYOUT
Natalie Street
NATALIE STREET INTERSECTION LAYOUT
Northesk Street
NORTHESK STREET INTERSECTION LAYOUT
Porere Street
PARERE STREET INTERSECTION LAYOUT
ST VINCENT STREET
ST VINCENT STREET CYCLE LANE
STAGE 1 - INTERSECTION LAYOUTS AND DETAILS
AMENDMENTS
27-0730


TYPICAL KERB CROSSING DETAIL
(REFER STD DRG 403)
TYPICAL KERB AND CHANNEL DETAIL
(REFER STD DRG 407)
TYPICAL CROSS SECTION
NOT TO SCALE
TYPICAL CYCLE LANE / ACCESS MARKING
TYPICAL HANDRAIL DETAIL
NOT TO SCALE
TYPICAL HANDRAIL DETAIL
NOT TO SCALE
TYPICAL RAISED ISLAND DETAIL
TYPICAL RAISED ISLAND SECTION
CYCLISTS WARNING SIGN
ST VINCENT STREET CYCLE LANE
STAGE 1 – DETAILS
INFRASTRUCTURE
AMENDMENTS
27-0730


ST VINCENT STREET SEPARATED
CYCLE LANE - STAGE 2
LOCALITY PLAN
NOT TO SCALE
SITE
Toi Street
St Vincent Street
Stonyguard Street
Washington Road
Gloucester Street
Hastings Street
Halifax Street
Parade Esplanade
SHEET LAYOUT
1:2000
Gloucester Street
Washington Road
Natalie Street
St Vincent Street
Parere Street
St Lawrence Street
Beccles Lane
Northesk Street
Rimu Street
Emano Street
Totara Street
Toi Street
STAGE 2
AMENDMENTS
237704-DW-S2-C-101
27-0731
ST VINCENT STREET CYCLE LANE
STAGE 2 – LOCALITY PLAN AND SHEET LAYOUT
INFRASTRUCTURE
NORTH


ST VINCENT STREET CYCLE LANE
STAGE 2 – PLAN DRAWINGS 2A
INFRASTRUCTURE
TOI TOI STREET
TOTARA STREET
ST VINCENT STREET
PLAN 2A
1:500
AMENDMENTS
27-0731


ST VINCENT STREET CYCLE LANE
STAGE 2 – INTERSECTION LAYOUTS
TOI TOI STREET INTERSECTION DETAIL
TOTARA STREET INTERSECTION DETAIL
TOI TOI STREET
TOTARA STREET
ST VINCENT STREET
AMENDMENTS
27-0731


TYPICAL KERB CROSSING DETAIL
(REFER STD DRG 450)
TYPICAL KERB AND CHANNEL DETAIL
(REFER STD DRG 407)
TYPICAL CROSS SECTION
NOT TO SCALE
TYPICAL CYCLE LANE / ACCESS MARKING
TYPICAL HANDRAIL DETAIL
NOT TO SCALE
TYPICAL HANDRAIL DETAIL
NOT TO SCALE
TYPICAL RAISED ISLAND DETAIL
TYPICAL RAISED ISLAND SECTION
CYCLISTS WARNING SIGN
LOOK FOR CYCLISTS
NOTES:
ST VINCENT STREET CYCLE LANE
STAGE 2 – DETAILS
INFRASTRUCTURE
AMENDMENTS
27-0731