

University of New South Wales

Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit



Project Ref: TS-13-RSA-0625B

Prepared for: University of New South Wales

Date: 5th December 2013

2013

Table of Contents

1. Introduction	3
2. Road safety audit process	3
3. Responding to this audit	3
4. Site details	4
5. Proposed works and scope of the audit	7
6. Crash statistics.....	8
7. Documents used to facilitate audit.....	8
8. Audit findings.....	8
9. Audit conclusion	22
10. Appendix A1: Transport for NSW option.....	23
11. Appendix A2: Option 3 – Modified Transport for NSW proposal	24
12. Appendix A3: Option 7 – Centre platform.....	25

Document control

Project Ref	Date	Revision	Author	Reviewer
TS-13-RSA-0625B.docx	5 December 2013	B	Darren Vella	Simon Penca

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1. Introduction

Transafe has been engaged by the University of New South Wales to undertake a feasibility design stage road safety audit of the proposed light rail platform stops on Wansey Road, at the University of New South Wales in Kensington.

This audit was conducted by:

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RMS Accredited (Level 3) Senior Road Safety Auditor (Auditor ID: RSA-03-0530)

and;

Simon Penca [BEng Civil (Hons), Director]

RMS Accredited (Level 3) Senior Road Safety Auditor (Auditor ID: RSA-03-0531)

The auditors have had no involvement in the design or development of the subject site being audited.

2. Road safety audit process

A road safety audit is a formal examination of an existing or future road or traffic project in which an independent, qualified team reports on the projects crash potential and safety performance (Austroads 2009). This road safety audit has been carried out in accordance with the Austroads Guide to Road Safety Part 6: Road Safety Audit (2009) with reference to relevant standards and guides, and draws on industry practice and experience to identify potential road safety audit findings. However, no guarantee is made that every deficiency has been identified.

3. Responding to this audit

As set out in the road safety audit guidelines, responsibility for the road safety audit always rests with the project team and not the auditor. The project team is under no obligation to accept or agree with all of the audit findings. Also, it is not the role of the auditor to agree to or approve the project teams response to the audit. This audit report should be responded to in writing including reasons for rejection of an audit finding. Acceptance of all findings of this report would not guarantee that every potential road safety issue has been addressed, rather adoption of the audit findings should improve the level of safety of the subject site.

4. Site details

Wansey Road is classified as a local road and is generally aligned north-south with one lane in each direction. Located on the eastern boundary of the Randwick Racecourse, it provides access to the northern end of the University of New South Wales via the intersection with High Street.

High Street in the vicinity of Wansey Road is a collector road and is generally aligned east-west with one lane in each direction. Buses operate along High Street to cater for the large patronage to the adjacent university. A zebra crossing exists on High Street (to the east of Wansey Road) to facilitate north-south pedestrian movements (across High Street). Bus stops are located on the southern side of High Street, east of the zebra crossing and Wansey Road.

Figure F1: Location plan



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Photo P1 – High Street/Wansey Road intersection, view north from east side of intersection



Photo P2 – High Street/Wansey Road intersection, view north from west side of intersection



Photo P3 – High Street/Wansey Road intersection, view east from south side of intersection



Photo P4 – High Street/Wansey Road intersection, view west from south side of intersection

5. Proposed works and scope of the audit

As part of new Sydney Light Rail network, light rail tram platforms are proposed on Wansey Road, immediately north of the intersection with High Street, adjacent to the University of New South Wales. At the completion of the project and allowing for a steady growth in population and shift to public transport, on a typical semesters day the Wansey Road light rail platforms are expected to cater for approximately 10,000 arrivals and 7,000 departures, with arrival peaks in the order of 1,100-1200 (15mins) and departure peaks in the order of 600-700 (15mins). To cater for such demand, three proposed light rail platform options are being considered as follows:

- Transport for NSW option: Involves the central light rail tracks along High Street deviating to the western side of Wansey Road through the intersection of Wansey Road / High Street. Side platforms are proposed to west of Wansey Road - a two-way, two-lane roadway, with proposed signals at the intersection of Wansey Road / High Street), and a zebra crossing across Wansey Road. Refer to Appendix A1.
- Option 3 – Modified Transport for NSW proposal: This option is similar to the previous option, with the exception that on-street parking will be provided on the eastern side of Wansey Road (indented), platforms will be wider, and a dedicated bicycle path provided on the far western side of Wansey Road (west of the light rail platforms and pedestrian area). There is also provision in this option for Gate 9 to be relocated to the intersection of Wansey Road / High Street to form a fourth leg. Refer to Appendix A2.
- Option 7 – Centre Platform: This option is essentially the same as option 3 (in terms of the overall positioning of the tracks and arrangement of the traffic and parking lanes on Wansey Road), with the exception that a central light rail platform stop is proposed for both directions of travel. There is also provision in this option for a scramble pedestrian crossing to be incorporated into the intersection signals (at the Wansey Road / High Street intersection). Refer to Appendix A3.

The scope of this road safety audit is to review the proposed options and identify potential safety deficiencies relating to the infrastructure changes with respect to all road users including vehicles, buses, light rail, pedestrians and cyclists, with a recommendation on the preferred option from a safety perspective to be provided.

This audit does not include an assessment of the existing conditions at the subject site. It also does not include an assessment of the proposed light rail arrangement along High Street, outside of the intersection with Wansey Road, nor does it include an assessment of the intersection with Arthur Street and Botany Street. Although this audit may cover lighting pole locations, this is not a formal lighting luminance assessment. Similarly, this audit may cover pedestrian accessibility, however this is not a formal DDA assessment.

6. Crash statistics

Limited details of known crashes are available at the subject site. Nonetheless, the crash history at the subject site is not expected to influence the findings of this audit at this early feasibility design stage assessment.

7. Documents used to facilitate audit

The following information / drawings were used to facilitate the audit:

- UNSW High Street Stop Proposed by TfNSW, Drawing No: PV-01 Sheet 1 of 13 Version 6.2 and PV-07 Sheet 7 of 13 Version 6.3, Created: N. Bettini;
- UNSW High Street Stop Option 3, Drawing No: PV-02 Sheet 2 of 13 Version 6.3 and PV-08 Sheet 8 of 13 Version 6.3, Created: N. Bettini;
- UNSW High Street Stop Option 7, Drawing No: PV-05 Sheet 5 of 13 Version 6.3 and PV-11 Sheet 11 of 13 Version 6.3, Created: N. Bettini;
- Site photos (taken 1/10/13) and background information including nature of the road environment, abutting development, pedestrian behaviour, and available transport links: Provided by Anthony Coyle – Senior Associate at TraffixGroup;
- UNSW Future Circulation Structure, Drawing No: -- Sheet 1 of 3, Created: N. Bettini;
- UNSW Significant Trees, Drawing No: -- Sheet 2 of 3, Created: N. Bettini;
- UNSW Potential Future Development, Drawing No: -- Sheet 3 of 3, Created: N. Bettini;
- UNSW Daily Student and Staff Movements: Departures 2013 (Monday-Thursday);
- UNSW Daily Student and Staff Movements: Arrivals 2013 (Monday-Thursday); and,
- Fig 1a, Ridership Projections 2020, Revision 2, 14 November 2013.

8. Audit findings

The findings of the road safety audit are detailed on the following pages. A response from the project team should be inserted into the relevant columns. Responses to audit findings are generally not required by the auditors; rather a record should be kept for reasons of adoption or rejection of the findings for future reference by the project team.

Audit findings table

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
General		
8.1	Specific design parameters such as horizontal geometry, signs and line marking, etc are unknown at this early design stage and therefore have not been audited as part of this assessment. It is assumed that such design parameters will be accommodated in accordance with Austroads and RMS standards.	
8.2	Ideally, poles and other objects should be set back from the road. Each of the proposed options require realignment of adjacent traffic lanes along High Street and Wansey Road, which could result in traffic being deviated and ultimately located closer to existing fixed hazards such as power poles and trees. It is acknowledged that there is an existing risk associated with collisions into parked vehicles in the kerbside lane, and the severity of a crash into the new hazards rather than the existing parked cars is difficult to quantify, however, while the change in alignment and narrowing of lanes would typically be expected to increase the likelihood of crashes overall, the proposed change in the immediate road environment (overall) is expected to result in lower operating speeds and a lower likelihood of crashes. Ideally no pole (or any other roadside hazard) should be placed within the clear zone. In practice, this is difficult to achieve, particularly in urban areas. A clear zone of 3.0m is applicable for a posted speed limit of 60km/h, less for speeds less than 60km/h (i.e. 2m clear zone would be applicable at 40km/h).	
8.3	The inherent nature of the raised tram platforms presents possible roadside hazards. Ideally, the approach end of raised tram platforms should be shielded and the longitudinal side of a tram platform should also be considered for shielding (depending on the stop use, patronage, type, location, clear zone offset etc). High profile barrier kerbs/omni stop bollards can be considered for this purpose in low speed environments (i.e. less than 60km/h), instead of crash cushions and safety barriers.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
8.4	Catenary poles will be required to provide power to trams. Where possible, the location of these poles should be provided in between the opposing tram tracks to reduce the number of poles required (i.e. try and avoid the use of a line of poles on each side of the road, effectively doubling the required number of poles), and maximise the offset of these poles to adjacent traffic (i.e. the tram reserve effectively provides a 'buffer'). Ideally, all new catenary poles should be positioned outside the clear zone as they are considered significant roadside hazards.	
8.5	Further to item 8.4, catenary poles are likely to be located close to adjacent traffic at the intersection of Wansey Road and High Street in order to support overhead wires that span the relatively large area of the intersection. Areas of particular concern at this intersection include the northeast and southwest corners of the intersection where eastbound and westbound vehicles will be required to deviate through the intersection. Poles at these corners would be undesirable as they will be located within the expected errant vehicle departure paths should a motorists fail to negotiate the deviation. Suitable protection of these poles is likely to be difficult, which could result in significant unshielded roadside hazards.	
8.6	The use of fencing at each of the proposed new stops options to encourage particular pedestrian routes is supported in principle. Fencing should also be considered to act as a physical obstruction should a tram driver open the incorrect side tram doors (and physically restrain tram patrons and prevent them stepping out into traffic or the other tram track). Any fencing located within the clear zone should be crashworthy (i.e. no horizontal members). Typical roadside fencing such as weldmesh is considered appropriate.	
8.7	Given the nature of the abutting development and very high volumes of pedestrians expected to be in the vicinity of Wansey Road and High Street traffic, consideration should be given to implementing a fulltime 40km/h speed limit along the subject lengths of Wansey Road and High Street to lessen the severity of possible conflict between vehicles/trams and pedestrians and cyclists. 40km/h is considered a minimum for the works proposed given the resulting road environment. Much lower speeds (e.g. 10km/h) would be adopted in a shared zone.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
8.8	The longitudinal step-up/down from the platforms to the tram tracks is a potential pedestrian hazard. Pedestrians can reasonably be expected to take shortcuts directly from the platforms to their desired destination and between platforms. This hazard cannot be effectively addressed given the need to maintain access between the platforms and trams, however its presence can be highlighted using adequate delineation. Appropriate devices such as signage, line marking, pavement marking, and fencing should be considered to highlight the ramps and step-down (in addition to tactile ground surface indicators for DDA compliance).	
8.9	Specific details of proposed bus infrastructure along High Street in close proximity to Wansey Road is unclear. It is understood that some buses will continue to operate along High Street (with trams expected to replace the majority of buses). Where bus patrons are expected to use the proposed trams as a connecting form of transport, ensure proposed bus stops are appropriately positioned (i.e. in close proximity to facilities, connecting tram platforms, pathways for passengers between connecting facilities and trams, etc). It is also important that bus stops are appropriately positioned to provide bus drivers appropriate sight lines when entering back into the traffic stream.	
8.10	It is understood that the right-turn vehicle movement from High Street into Wansey Road will be prohibited for each of the proposed options. This measure is supported, as it will help simplify the intersection, reduce the number of likely tram/vehicle/pedestrian conflicts and reduce likely delays at the intersection.	
8.11	It is understood that the signals at the intersection of Wansey Road and High Street for option 7 are likely to include a scramble type crossing where each leg of the intersection is required to yield to all crossing pedestrians. Crossing pedestrians are permitted to cross perpendicular or diagonal. The provision of a scramble type crossing is strongly supported and should ideally be incorporated into either option at this location given the expected number of pedestrians and nature of the intersection. A standard signalised crossing arrangement at this location is likely to operate as a de facto scramble crossing with the risk of conflict to those pedestrians not specifically permitted to cross during a particular phase. Furthermore, any proposed scramble type crossing would need to give due consideration to disabled and vision impaired users. Vision impaired and physically impaired pedestrians would cross perpendicular to the crossing as directed by tactile ground surface indicators. TGSIs would need to be designed and positioned to direct such pedestrians across the crossings via the shortest distance (across the roadway), but not necessarily the shortest overall route. Able-body pedestrians would be free to cross anywhere within the scramble crossing (i.e. the shortest route, but not necessarily the shortest distance across the roadway).	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
8.12	Planting areas are proposed for each option. Ensure only low, non-hazardous vegetation is provided. Vegetation should not obstruct motorist and pedestrian sight lines around the corners at the intersection.	
8.13	It appears likely that larger eastbound vehicles that turn left into Wansey Road will encroach upon the opposing traffic lane. Expected vehicle turning movements should be checked to ensure this does not occur. It is also important that the left rear of the turning vehicle cannot mount the pedestrian crossing located on the north western corner of the intersection (at the southern end of the tram platforms), where pedestrians may be waiting to cross.	
8.14	Special attention is required when developing either option to ensure the widths of the pedestrian crossings and signalised crossing times are adequate to accommodate the peak pedestrian platoons (e.g. morning and afternoon weekdays). Narrow crossings (with fencing that creates a bottleneck) can result in 'bunching', and short crossing phases can result in pedestrians being stranded on the roadway and /or tram reserve during high pedestrian demand times. Option 7 provides shorter pedestrian crossings at the Wansey Road / High Street intersection, and a greater island storage area between the tram tracks (north side of the intersection). Such features are important to reduce the likelihood of pedestrian conflict.	
8.15	It is understood that Wansey Road may ultimately become a shared zone for pedestrians, trams and vehicles. Careful consideration needs to be given to how the interim arrangement could be adapted to a shared zone in the future. Specific considerations such as providing a sense of equality for all users by removing kerb and other level differences is one important consideration for effective shared zones, however this may be difficult to achieve with the provision of trams and need to provide at-grade access to the trams.	
8.16	Several vehicle movements through the intersection of Wansey Road and High Street require vehicles to cross the tram tracks. Also, east-west movements require a deviation through the intersection (an existing condition). This required deviation would be difficult to delineate across the tram tracks, with the tram tracks and likely surrounding concrete apron providing a misleading visual cue for eastbound motorists. Some vehicles may inadvertently drive along the tram reserve. Also, the presence of tram tracks within the intersection can result in loss of skid resistance, particularly when the pavement is wet. This will be exacerbated by the need for braking, which is increased at an intersection. Appropriate delineation devices such as signage, line marking and pavement marking, raised reflective pavement markers and flexible paddles/bollards should be considered to highlight the necessary traffic paths.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
8.17	Further to the previous item, bicyclists and motorcyclists are particularly vulnerable when crossing tram tracks as their wheels can be caught or redirected by the tracks. This should be avoided as much as possible and crossing points should desirably be closer to perpendicular.	
8.18	It is understood that a bicycle lane may be provided on the west side of Wansey Road for each option to cater for north-south bicycle movements. While this is supported in principle, it is also understood that as part of the overall long-term arrangement, cyclists will be encouraged to use Botany Street as the north-south route. This provision of a suitable alternative away from the tram platforms and potential conflict with trams and pedestrians is supported and preferred.	
8.19	It is understood that a 'G' turn is proposed to accommodate eastbound motorists that wish to turn right from High Street into Botany Street. This is planned by requiring such motorists to turn left into Wansey Road, then right into Arthur Street and then right into Botany Street to travel south. A number of potential issues associated with this proposal require further consideration: • This may exacerbate the issue raised in item 8.13. • This movement will be very difficult to sign / advise eastbound motorists wishing to travel south at Botany Street. Its likely that such motorists will not realise that the right turn is not permitted until they reach the Botany Street / High Street intersection. • The overall 'G' turn movement will direct additional traffic along Wansey Road, which is undesirable and increases overall potential for conflict with pedestrians and tram patrons at the adjacent tram platforms. • Further to the previous item, the 'G' turn would require two additional right-turns (compared to the one at Botany Street). This increases overall risk of motorist conflict (motorist versus motorist) and pedestrian conflict (motorist versus pedestrians).	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
Option proposed by Transport for New South Wales & Option 3 – Modified Transport for New South Wales proposal		
8.20	<i>The option proposed by Transport for New South Wales and Option 3 (modified Transport for New South Wales proposal) are essentially the same. Option 3 provides more detail and has an improved crossing arrangement (i.e. use of kerb outstands), provision for a bicycle path, and wider platforms for pedestrian manoeuvrability / storage. The following comments made for this proposed arrangement apply to both the original option and option 3.</i>	
8.21	The longitudinal edge and face of the island platform will be located immediately adjacent to southbound traffic, and therefore within the clear zone. The immediate preceding northbound traffic lanes are essentially aligned straight and operating speeds at this location are expected to be very low. Nonetheless, there is still a risk of an errant vehicle encroaching the platform due to no offset / buffer being provided. This arrangement would require a longitudinal and approach protection of the tram platform to adequately shield traffic from the platform hazard and also protect pedestrians from errant vehicles. The use of high-profile barrier kerb and omni-stop bollards could be explored instead of crash cushions and safety barrier given the low operating speeds expected at this location.	
8.22	Potential pedestrian/tram patron 'lean-back' will need to be allowed for with this option given the close proximity of the eastern side of the platform to the northbound traffic lane. A buffer and physical separation (e.g. offset fencing) should be provided to ensure pedestrians/tram patrons leaning back on platform railing cannot be struck by passing vehicles, including larger vehicles with protruding side mirrors.	
8.23	A tram driver may inadvertently open the doors on the incorrect side especially if abutting tram stops are central island type stops.	
8.24	The east-west crossing of Wansey Road at the northern end of the platforms is to consist of a zebra crossing across the traffic lanes and a signalised crossing over the tram tracks, while the southern end will consist of a fully controlled signalised crossing. The following potential safety issues associated with these crossings should be considered: The zebra crossing is proposed further north of the signalised crossing over the tram tracks. This will result in a 'reverse-maze' arrangement where pedestrians crossing from east to west between the zebra crossing and tram tracks will be diverted south and have their back to trams approaching from the north (the most immediate potential conflict). A similar issue results for pedestrians travelling north to the tram crossing at the northern end of the platform. All such maze type crossings should be aligned so that crossing pedestrians face the immediate adjacent potential conflict / approaching trams / traffic. It appears possible in this case to shift the zebra crossing further south of the signalised crossing of the tram tracks.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
	- The inconsistent crossing types in close proximity are undesirable. Pedestrians crossing the tram tracks on a green man may unwittingly assume they have complete right-of-way across the zebra crossing, however zebra crossings require pedestrians to be alert and not assume all vehicles will see them / give-way. - While fully controlled signalised crossings of tram tracks are supported in principle, ideally they should always display the green crossing man phase and only change to the red man when a tram is approaching (applicable to the northern end crossing only). Having the crossing operate like a typical pedestrian crossing (i.e. red man displayed until activated by a pedestrian) is likely to result in non-compliance. - Northbound trams approaching the signalised crossing should be given the green tram phase when departing the tram stop and not be required to stop at the crossing and partially at the tram platform (similar principle should be applied to southbound trams approaching the Wansey Road / High Street intersection signals). - The central island located at the southern end of the southbound tram platform is relatively narrow and may be used as a refuge for pedestrians crossing from the east to the west (and vice versa) against a red man. This increases the potential for pedestrian and tram conflict, as well as pedestrians potentially being stranded on the roadway during a green vehicle phase. When the signals at the southern end of platforms (at the intersection) display a red man for the east-west crossing phase, some pedestrians may choose to continue north along Wansey Road and cross Wansey Road mid-block between parked vehicles. This increases the risk of conflict between crossing pedestrians and vehicles on Wansey Road	
8.25	A dedicated off-road north-south bicycle path is proposed on the western side of Wansey Road / the proposed tram platforms. The provision of such an asset is supported in principle however the following potential issues associated with this proposed arrangement should be considered: - It may be difficult to segregate pedestrians and bicyclists along the bike path and immediately adjacent to it. Pavement marking and signage are often ineffective. This could result in pedestrians encroaching the bicycle path and result in conflict between pedestrians and cyclists. - Providing a suitable intersection at the southern end of the bicycle path and the perpendicular pedestrian footpath will be difficult. Potential conflict is likely at this intersection (of the bicycle path and pedestrian path). Either the pedestrians or the cyclists will be required to give-way and this will be difficult to make obvious, mark, and sign. Furthermore, compliance to such give-way requirements is likely to be poor.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
	- There is no continuity of the bicycle path at the southern end and details of a suitable north south crossing to cater for cyclists have not been provided. Ideally a separate pedestrian / cyclist crossing should be provided, however as previously mentioned, it would be difficult to restrict the crossing to cyclists and not pedestrians. - Sight lines between southbound cyclists and pedestrians using the east-east footpath immediately at the southern end of the bicycle path are likely to be restricted by the adjacent Randwick Racecourse property (even with the small splay provided as shown).	
8.26	Gate 9 is proposed to be relocated to the signalised intersection of Wansey Road and High Street to create a fourth leg, and permit all movements into and out of Gate 9. While it is appreciated that this access road is expected to only cater for low volumes (i.e. deliveries etc), it is preferred that this access remain in its current location away from the signals. Allowing a fourth leg and all turn movements (from the fourth leg) will increase potential for conflict at the intersection where pedestrians will be crossing. Furthermore, it is preferred that the intersection be kept as simple as possible (i.e. by avoiding another leg if possible). The left-in, left-out arrangement further east for Gate 9 as per option 7 is preferred.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
Option 7 – Centre platform		
8.27	This option involves the unusual arrangement of southbound trams travelling towards and to the left of northbound traffic without a buffer between the approaching trams and northbound traffic. This arrangement is expected to be disconcerting for some motorists and is likely to lead to ‘spooking’ creating a shy-line effect and possible encroachment of the opposing lane. This effect could be minimised by providing a fence between northbound traffic and southbound trams.	
8.28	The longitudinal edge and face of the central island platform will be located approximately 3.5m from adjacent traffic, and therefore will be outside the clear zone and the risk of vehicle encroachment upon the platform is considered very low (also due to the likely low operating speeds at this location).	
8.29	The east-west crossing of Wansey Road at the northern end of the platform is to consist of a zebra crossing across both the traffic lanes and the tram tracks, while the southern end will consist of a fully controlled signalised crossing. The following potential safety issues associated with these crossings should be considered: • The adjoining zebra crossings across the southbound tram tracks and Wansey Road is of particular concern as follows: ◦ Pedestrians crossing from the east may have right-of-way over vehicles on Wansey Road and lower their level of awareness when continuing over the tram tracks. With no separation between the tracks and roadway, there is little margin for error. This would be exacerbated by the inability for trams to stop all of a sudden. ◦ Further to the previous point, southbound tram drivers approaching the zebra crossing may have difficulty seeing pedestrians crossing from the east due to sight line obstructions created by queued southbound vehicles waiting at the zebra crossing. ◦ Northbound motorists may have a momentary sight line obstruction to pedestrians crossing from the central platform to the east soon after a southbound tram has passed. Pedestrians may choose to cross immediately after a tram has passed, seemingly ‘appearing’ at the zebra crossing. ◦ Similar to the previous point, southbound cyclists may have a momentary sight line obstruction to pedestrians crossing from the central platform to the west soon after a northbound tram has passed. Pedestrians may choose to cross immediately after a tram has passed, seemingly ‘appearing’ at the zebra crossing.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
	- Both directions of approaching trams will not have right-of-way at the northern zebra crossing. The free-flowing and sometimes unpredictable nature of a zebra crossing is likely to lead to tram and pedestrian conflict at this location, exacerbated by the close proximity of the crossing to the tram stop (i.e. trams may depart the stop but have to give-way to crossing pedestrians soon after), and the inability for trams to stop all of a sudden. - Notwithstanding the previous point, northbound trams required to give-way to pedestrians at the northern zebra crossing will be required to stop while still partially at the platform, which is undesirable. - Southbound trams approaching the signalised crossing at the intersection of Wansey Road / High Street should be given the green tram phase when departing the tram stop and not be required to stop at the crossing and partially at the tram platform.	
8.30	It appears that a dedicated off-road north-south bicycle path is also proposed as part of this option, on the western side of Wansey Road / the proposed tram platforms. The provision of such an asset is supported in principle however the following potential issues associated with this proposed arrangement should be considered: - It will be difficult to segregate pedestrians and bicyclists along the bike path and immediately adjacent to it. Pavement marking and signage are often ineffective. This could result in pedestrians encroaching into the bicycle path and result in conflict between pedestrians and cyclists. - Providing a suitable intersection at the southern end of the bicycle path and the perpendicular pedestrian footpath will be difficult. Either the pedestrians or the bicyclists will be required to give-way and this will be difficult to make obvious, mark, and sign. Furthermore, compliance to such give-way requirements is likely to be poor. Potential conflict is likely at this intersection (of the bicycle path and pedestrian path). As per the previous item, this is also likely to be an issue at the northern end zebra crossing. - Ensure that the drop-off between the bicycle path and the tram tracks is protected. It is likely that a fence would be required to prevent cyclists falling onto the tram tracks if they lose balance, or need to avoid a hazard.	
8.31	Many of the potential issues associated with the previous two items 8.28 and 8.29 could possibly be avoided or minimised by simply omitting the pedestrian crossing of Wansey Road and the tram tracks at the northern end of the platform for this option. Pedestrians wishing to travel north from the central island platform can do so by walking between the two tram tracks to the Arthur Street intersection where crossing movements can be facilitated via the intersection signals.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
	Pedestrians coming from the north wishing to access the tram platform can do so from the Arthur Street signals, and pedestrians coming from the north to access the university can do so by either walking along the platform / area between the tram tracks, or using the eastern side Wansey Road footpath. Furthermore, the requirement for the far western side pedestrian footpath (west of the bicycle path) is all but redundant in this option given the other available north-south routes. This would eliminate the potential conflict at the zebra crossing and bicycle lane intersection and enable the provision of an exclusive bicycle path free of pedestrians (provided pedestrians comply with signs and markings at each end of the bicycle path advising that pedestrian access is prohibited).	
8.32	Gate 9 is to remain in its current location and allow only left-in and left-out movements. This arrangement is supported.	

University of New South Wales – Proposed Light Rail Platform Stops on Wansey Road		
Feasibility Design Stage Road Safety Audit		
Item	Findings	Project team response
Preferred option from a road safety perspective		
8.33	The key considerations in providing safe light rail platforms at the subject site includes avoiding/limiting potential conflict for all road users, and where this cannot be avoided, ensuring that consequences of potential conflict are minimised. Other important considerations include providing a road environment that: • Is simple, obvious, expected and predictable; • Is free of physical obstructions and is forgiving; • Provides logical connectivity; • Provides direct pedestrian access; and, • Caters for all expected user groups including cyclists and vulnerable/disabled pedestrians. There is not a great difference between the proposed options. Although option 7 - Centre Platform is expected to have less potential conflict points compared with option 3 (<i>assuming the northern crossing in option 7 is either removed as detailed in item 8.30, which is preferred, or alternatively is fully controlled with signals. The removal of the subject crossing would have the added benefit of reducing delays to tram services and improving overall level of service</i>). The design of option 7 is simple and consistent with the likely arrangement of much of the abutting tram network (running within the median). It also: • Provides an offset buffer (i.e. the width of the southbound tram reserve) between the tram platform and adjacent traffic, providing improved level of safety for both motorists and pedestrians / tram patrons. • The separation of the two opposing tram tracks requires less space for the provision of the 90degree curve through the intersection. Compared to option 3, this enables a larger central refuge island at the southern end of the platform, and reduces the required north-south crossing distance. • It enables complete segregation between the tram reserve and Wansey Road. The use of fencing along the tram reserve will physically corral pedestrians to designated crossing points (not mid-block between parked cars or between platforms), of which the southern end is fully controlled (and will avoid ambiguous right-of-way confusion between trams and pedestrians often associated with uncontrolled crossings and sometimes zebra crossings – this is particularly worth noting if the northern end crossings are removed as per item 8.30). • It allows for the provision of a scramble crossing at the intersection of Wansey Road and High Street. While such a crossing can be adopted in option 3, the shorter crossing distances in option 7 makes it better suited to a scramble crossing (i.e. less crossing time required and therefore reduced overall delay at the intersection). • Centre island platforms are particularly suited to locations where patronage tends to peak in one direction (such as at this stop / the university).	

Project team response undertaken by:

Name.....Signed.....Date.....

9. Audit conclusion

This road safety audit has attempted to balance the safety needs of all road users within the site/design constraints. It is the intention that all audit recommendations are realistic and feasible and commensurate with the actual risk posed.

A handwritten signature in blue ink, appearing to read 'D Vella'.

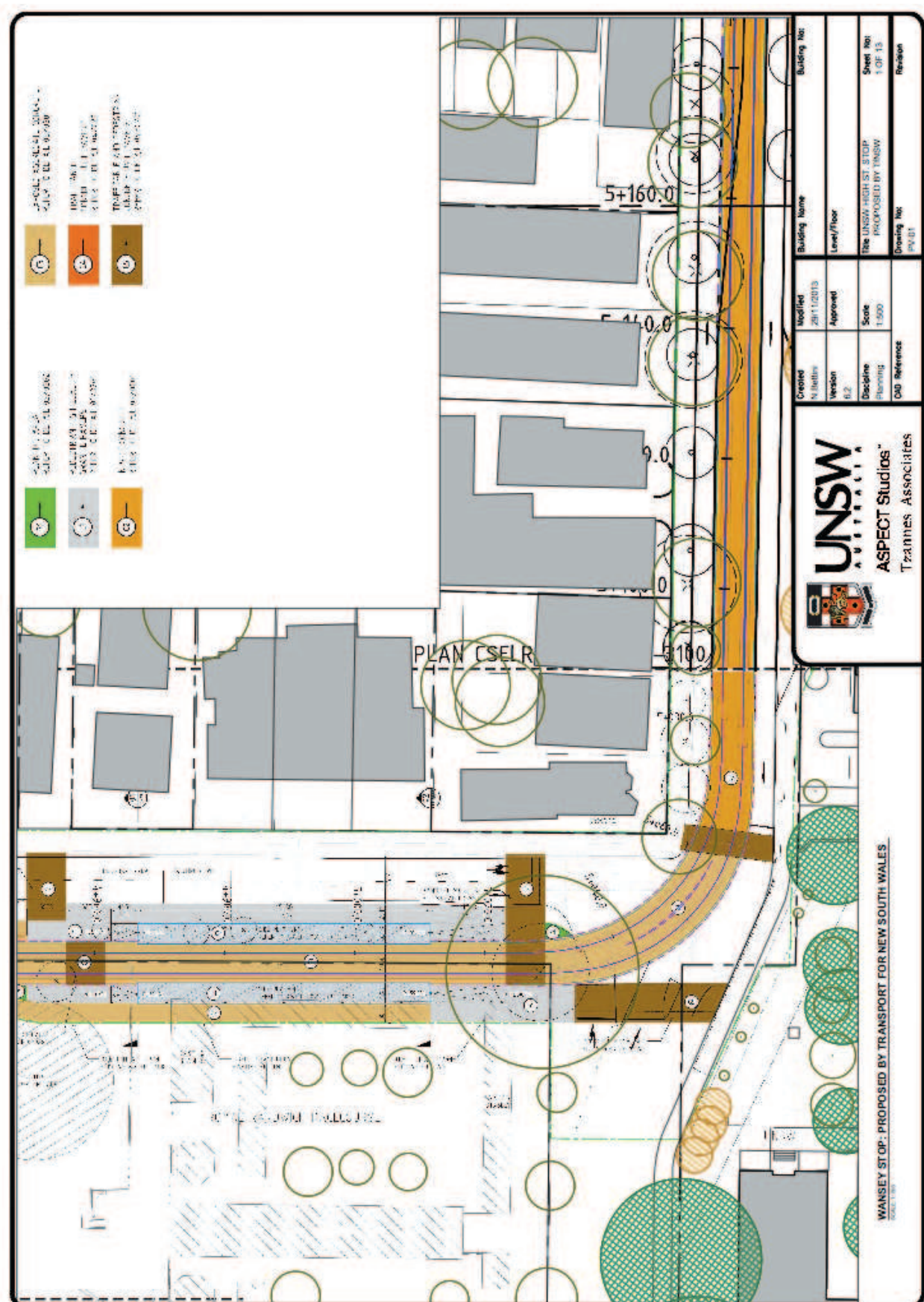
Darren Vella [BEng Civil (Hons), Director]
Accredited Senior Road Safety Auditor

and;

A handwritten signature in black ink, appearing to read 'Simon Penca'.

Simon Penca [BEng Civil (Hons), Director]
Accredited Senior Road Safety Auditor

10. Appendix A1: Transport for NSW option





12. Appendix A3: Option 7 – Centre platform

