

# **Box Hill / Burma Road / Station Road / Baroda Street Intersection**

## **Options Evaluation using the Multi-Criteria Analysis (MCA) tool**

### **Design Objectives**

The following design objectives have been used to assess the effectiveness of possible interventions.

- Improve safety for people walking
- Improve convenience for people walking
- Improve safety for people on bikes
- Improve function of the bus stops
- Improve general road safety
- Improve general traffic efficiency

Considerations were given to the relative priorities of the objectives:

- Given the presence of nearby schools/pre-school facilities and the Khandallah train station, pedestrians should be well provided for.
- Given that the predominance of vehicle flows is north-south legs (Box Hill – Burma approaches) we should consider aligning priority controls with the dominant flow.
- Given the vehicle turning conflicts from and into the side roads, we should consider opportunities to allow for safer vehicle manoeuvres.

### **Options Evaluation Summary**

#### **1. Do nothing**

This involves leaving the intersection unchanged. We would continue to periodically monitor the site safety performance and investigate changes if the safety record consistently deteriorates.

This option is not considered appropriate as the community wants safety improvements done at the intersection. This is evidenced by the significant safety concerns raised by respondents to the online survey conducted July 2020. Observations by transport engineers confirm the issue and suggest that safety improvements are justified.

## **2. Minor improvements to pedestrian zebra crossing**

This involves leaving the zebra crossing at the current position but making it more visible by lengthening the white zebra crossing markings, extending the pedestrian pole black & white stripes and adding reflective fluoro-orange discs at a higher level. This also includes relocating the Burma approach pedestrian limit line further back to allow vehicle clearance in and out of Station Road. The former location of the pedestrian limit line will then be yellow cross hatched.

Overall performance is slightly positive. We expect that this minor improvement to the pedestrian crossing would slightly improve pedestrian safety and reduce driver difficulty turning in and out of Station Road.

## **3. Minor road improvement (Dragon's Teeth markings) to the Box Hill – Burma Road approaches**

This involves creating Dragon's Teeth roadmarkings on the Box Hill and Burma Road approaches to the pedestrian zebra crossing. As this is currently being trialled by NZTA at several Local Government Units (LGUs) across the country, permission will be needed to implement this option.

Overall performance is slightly positive. We expect that this minor road improvement would slightly improve pedestrian safety, reduce vehicle speeds and slightly reduce driver difficulty turning in and out of Station Road.

Consideration must be made as a significant amount of road markings to create the narrowing effect might impact on bicycle tires travelling along the road especially on wet days.

## **4. Raise the pedestrian zebra crossing at the current location**

This involves raising the pedestrian zebra crossing to footpath level to ensure slower vehicle speeds. This also includes relocating the Burma approach pedestrian limit line further back to allow vehicle clearance in and out of Station Road. The former location of the pedestrian limit line will then be yellow cross hatched.

Overall performance is positive. A raised pedestrian crossing would achieve lower speed on the approaches to the intersection and may reduce driver difficulty turning in and out of Station Road.

Drainage must be considered to avoid surface flooding to adjacent properties. Further investigation needed to confirm feasibility of the approach ramp to the raised pedestrian crossing as it may affect turning movements from the side roads.

## **5. Relocate the pedestrian zebra crossing to the south**

This involves relocating the pedestrian crossing to the south of Baroda Street on Box Hill. The southern bus stop on Box Hill must be moved further south. The pedestrian crossing streetlight power source must also be relocated to the new location. Creating left and right turn lanes on Station Road can be considered.

As this option is closer to the crest on Box Hill, there will be limited forward visibility for northbound vehicles approaching the pedestrian crossing. Additional measures must be considered such as wigwag lanterns or advance warning signs.

Overall performance is positive. The relocation of the pedestrian crossing to the south will make priorities clearer at the intersection with the possibility of creating turning pockets for both Baroda Street and Station Road. Will see NZTA comment to confirm feasibility of option.

The relocation of the Box Hill bus stop further south will remove several parking spaces.

Further investigation resulted that this option will not meet the visibility sightline requirement at the proposed location. The crossing must be situated much further south of Baroda Street to satisfactorily achieve the design guideline.

## **6. Relocate the pedestrian zebra crossing to the north**

This involves relocating the pedestrian crossing to the north of Station Road on Burma Road. The northern bus stop on Burma Road will be moved either further north on Burma Road or move to south of Baroda Street. The pedestrian crossing streetlight power source must also be relocated to the new location. Creating left and right turn lanes on Station Road can be considered.

As this option is closer to the northern bend on Burma Road, additional measures must be considered such as wigwag lanterns or advance warning signs.

Overall performance is negative. The location of the crossing is not in the pedestrian crossing desire line and will possibly create unsafe pedestrian behaviours due to the proximity of the new crossing.

This is a fatal flaw consideration.

## **7. Additional lane on Station Road (not considered an option on its own)**

This involves removing the pedestrian extension kerb on Station Road and creating left and right turn lanes. This will reduce queue lengths on Station Road during peak hours. This option will make it more difficult for pedestrians to cross Station Road.

After discussion, the project team agreed that this option can only be considered if the pedestrian crossing is relocated or combining it with Options 5, 6, 12 or 13.

For this reason, the team did not assess this option therefore no scoring and ranking was given.

## **8. Prohibit right turn out of Station Road (not considered an option on its own)**

This involves creating a no right turn restriction exiting Station Road either permanently or during peak hours only. This will eliminate right turn conflicts out of Station Road especially during peak hours.

This will require northbound vehicles from Station Road to turn left and utilise the Nicholson-Cockayne roundabout. This may encourage dangerous manoeuvres along Box Hill to avoid driving further south down to the roundabout just to go north. There is no other desired alternative route available. Enforcement is also a concern.

After discussion, the project team agreed that this option cannot be considered on its own but can be incorporated in the detailed design of other options. For this reason, the team did not assess this further therefore no scoring or ranking was given.

## **9. Raised table at intersection**

This involves lifting the road level at the intersection including Baroda Street and Station Road to achieve lower speeds on the approaches to the intersection.

Overall performance is positive. A raised table would achieve lower speeds on the approaches to the intersection making it safer for pedestrians. The reduced speed will assist but the turning conflicts to and from the side roads, especially Station Road remains.

There are drainage considerations with a raised table to ensure not to lead to surface flooding of adjacent properties. With a raised table there are no defined storm water paths via kerb and channel to the collection points (catch pits/sumps). There are concerns related to bus travel across a tabled intersection and possible discomfort to bus patrons. Both matters need to be addressed in the detailed design stage if this option is taken forward.

## **10. Roundabout at Station Road.**

This involves installing a roundabout at the Box-Hill Station Road intersection. Baroda Street approach will remain as a Give Way. This option requires the pedestrian crossing on Box Hill to be relocated south of Baroda Street.

Overall performance is negative. The concept of the roundabout at this intersection is appealing as this provides a clear right of way priority and easier for right turning vehicles from Station Road. But there are several considerations when opting for a roundabout.

A roundabout would slow traffic and provide guidance for vehicles. However, pedestrian and cycle crashes often increase with the introduction of a roundabout. In this case there is no opportunity for pedestrian central refuge islands due to space limitations and providing for larger vehicle (including buses) turning manoeuvres.

The roundabout option requires that vehicle flows on each leg are similar. There is a big disparity on the vehicle volumes between the main road (Box Hill / Burma Road) and the side roads (Station Road/ Baroda Street). The main road averages 13,000ADT while Station Road averages 3200ADT and Baroda Street a mere 420ADT.

Secondly, a roundabout must have a built-in deflection to ensure vehicles slow down on the approach but should still allow large vehicles to manoeuvre safely. The only option to allow for safe turning of large vehicles at this site is to construct a mountable roundabout which reduces the deflection significantly. Due to the limited carriagewidth at this site, it is difficult to install a roundabout that can achieve both the deflection and the safe turning requirements.

Lastly, the installation of the roundabout combined with the close proximity of the Box Hill pedestrian crossing creates a two-stop scenario for the main thoroughfare. This may create safety concerns and efficiency issues for northbound and southbound vehicles especially during peak hours.

This is a fatal flaw consideration.

## **11. Signalised Mid-block crossing at the current location**

This involves installing a signalised pedestrian crossing at the current location of the zebra crossing.

Overall performance is positive. As the signalised crossing will be located on the pedestrian desire line, it is expected this option will achieve compliance and safety for pedestrians. Although there will be slight delays when crossing Box Hill, the signals will provide a safer

crossing opportunity for the pedestrians. Turning conflicts on Station Road and Baroda Street need to be addressed.

#### **12. Signalised Mid-block crossing to the north of current location.**

This involves relocating the pedestrian crossing to the north of Station Road on Burma Road and signalling it. This will require relocating the northern bus stop on Burma Road either further north of Burma Road or move to south of Baroda Street. Creating left and right turn lanes on Station Road can be considered.

As this option is closer to the northern bend on Burma Road, additional measures must be considered such as wigwag lanterns or advance warning signs.

Overall performance is negative. The installation of signals will require pedestrians to wait until the pedestrian phase is activated. More importantly, the location of the crossing is not on the pedestrian crossing desire line and will possibly create unsafe pedestrian crossing behaviours due to the proximity of the new crossing.

#### **13. Signalised Mid-block crossing to the south of current location**

This involves relocating the pedestrian crossing to the south of Baroda Street on Box Hill and signalling it. This will require relocating the southern bus stop on Box Hill further south. Creating left and right turn lanes on Station Road can be considered.

As this option is closer to the crest on Box Hill, there will be limited forward visibility for northbound vehicles approaching the pedestrian crossing. Additional measures must be considered such as wigwag lanterns or advance warning signs.

Overall performance is positive. As the signalised crossing will be located on the pedestrian desire line, it is expected this option will achieve compliance and safety for pedestrians. Although there will be slight delays when crossing Box Hill, the signals will provide a safer crossing opportunity for the pedestrians.

The relocation of the pedestrian crossing to the south will make priorities clearer at the intersection with the possibility of creating turning pockets for both Baroda Street and Station Road.

The relocation of the Box Hill bus stop further south will remove several parking spaces.

#### **14. Signalised intersection except Baroda Street approach**

This involves installing traffic signals to control vehicle and pedestrian movements at the intersection except Baroda Street. Convert Baroda Street approach from Give Way to Stop. Creating left and right turn lanes on Station Road can be considered.

Overall performance is positive. As the signalised crossing will be located on the pedestrian desire line, it is expected this option will achieve compliance and safety for pedestrians. Although there will be slight delays when crossing Box Hill, the signals will provide a safer crossing opportunity for the pedestrians.

The option may consider relocating the pedestrian crossing on Box Hill to the south of Baroda Street. This will make priorities clearer at the intersection with the possibility of creating turning pockets for both Baroda Street and Station Road.

As there is a significant number of pedestrians crossing Baroda Street further safety measures must be implemented along Baroda Street if this option is considered.

#### **15. Signalised intersection all approaches**

This involves installing traffic signals to control all vehicle and pedestrian movements at the intersection. Creating left and right turn lanes on Station Road can be considered.

Overall performance is positive. The option will allow all vehicle and pedestrian movements with allocated phase times. Pedestrians would be given an early start before turning vehicles are allowed to filter through the pedestrian crossings and giving way to people still on the crossings.

As the signalised crossing will be located on the pedestrian desire line, it is expected this option will achieve compliance and safety for pedestrians. This will also remove the confusion and conflict for vehicles turning in and out of the Station Road and Baroda Street.

The option may also consider relocating the pedestrian crossing on Box Hill to the south of Baroda Street. This will make priorities clearer at the intersection with the possibility of creating turning pockets for both Baroda Street and Station Road. This must be evaluated in the detailed design should this option be considered.

#### **16. Convert Station Road to One-Way direction**

This involves converting Station Road to a One-Way road towards Cashmere Avenue. This will eliminate both the left and right turn conflicts exiting Station Road. This will require

northbound vehicles from Station Road find alternative routes such as the Nicholson-Cockayne roundabout or Rangoon Bridge.

Overall performance is moderately negative. The one-way restriction is considered too inconvenient for motorists as there is no good alternative route going north. It was considered an inappropriate intervention as it does not provide enough accessibility in the area and may just shift the problem to other areas.

This is a fatal flaw consideration.

#### **17. Lower speed limit in the area**

This involves lowering the speed limit approaching the intersection to 30km/hr or 40km/hr to reduce vehicle speeds in the whole area.

Overall performance is positive. A lower speed limit makes it safer for pedestrians although the turning conflicts from the side roads, especially Station Road, remain.

This option would not be effective without some form of gateway treatment on all legs to ensure awareness approaching the intersection and promote vehicle compliance to the lower speed limits. This can be explored with other options if considered.



**Below are the results of the evaluation conducted by the project team:**

**Shortlist options (top 5)**

Option 4 Raised pedestrian zebra crossing at the current location

Option 9 Raised table at intersection

Option 11 Signalised mid-block crossing at the current location

Option 13 Signalised southern mid-block crossing

Option 15 Signalised intersection Box Hill/Station Rd/Burma Rd/Baroda St

**Options not considered further:**

Option 1 No change

Option 2 Minor improvements to the pedestrian zebra crossing

Option 3 Minor road improvements to the Box Hill - Burma Rd approaches

Option 5 Relocate pedestrian zebra crossing to the south

Option 6 Relocate pedestrian zebra crossing to the north (fatal flaw)

Option 7 Additional lane on Station Road (not option on its own)

Option 8 Prohibit right turn from Station Road (not option on its own)

Option 10 Roundabout at Station Road (fatal flaw)

Option 12 Signalised northern mid-block crossing

Option 14 Signalised Box Hill/Station Rd/Burma Rd (except Baroda St)

Option 16 Convert Station Road to One-way (fatal flow)

Option 17 Lower speed limit