ROBERT KELLY TRANSPORT CONSULTANT LTD
CHARTERED ENGINEER / TOWN PLANNER
robertwkelly@eircom.net
00353 858711584

GRAND CANAL TWO-WAY CYCLE TRACK REVIEW

RATHMINES ROAD (PORTOBELLO) TO GRAND CANAL STREET LOWER

1st July 2013

CONTENTS:

1. Introduction

2. Background

3. Site inspection

4. Cycle track function and user behavior

5. Conflict and Risks

6. Findings and Recommendations

1.0 INTRODUCTION

RWKelly and Associates LTD were approached by the National Transport Authority and requested to undertake a user audit inspection of the new two-way cycle track constructed along the Grand Canal from Lower Grand Canal Street to Rathmines Road (Portobello).

The key objective of this report is to assess the behavior and risks associated with this two-way cycle track crossing the main radial roads of the Grand Canal Bridges between Rathmines Road and Lower Grand Canal Street.

Specifically the following issues are addressed:

- Identification of non-typical, uncontrolled or unplanned traffic movements (all modes, but especially cyclists and pedestrians) at or approaching two-way cycle track junctions along the above route
- Assessment of the risk / risk factors associated with these movements
- Proposed solutions to address the movements and associated risk.

2.0 BACKGROUND

Dublin's Lord Mayor officially opened the Canal Way Cycle Route on 22nd March 2012. The 3.6km off-road cycle route runs from Portobello to Sheriff St along the Grand Canal. It passes Leeson St Bridge, Dublin's Docklands and over Samuel Beckett Bridge. It is the first part of a planned cross-city, off-road cycle route. See map below.

The Mayor said:

"The numbers of people cycling in the city have increased by over 70% since 2004. Dublin City Council is responding to that demand and facilities like the Canal Way and dublinbikes create a more cycle-friendly city. As the Canal Way Cycle Route is off-road it's ideal for families, young people and also visitors. Cycling is a healthy, cost effective and easy way to get around Dublin"

To date the development of the section of the Canal Way under consideration has been designed and developed by Dublin City Council. So while the NTA was not the original

funding authority for the Grand Canal Cycle Scheme the NTA is in discussion with sponsoring agencies around the extension of existing two-way cycle facilities, and options to deliver new two-way routes.

The NTA therefore wish to identify any design or user issues with the existing facility before they embark on a funding process for the remaining sections of the route. See figure 1 below of the planned development of the full Canal Way, Royal Canal and Tolka Valley Schemes.

It is clear from my inspections of the new Cycle Track along the sections described (see Fig 2 below) that while it is a very high quality facility the development of a two way orbital cycle route intersecting key radial commuter routes to/from the City has resulted in introducing new vehicle/cycle and cycle /pedestrian conflicts that heretofore didn't exist. Furthermore the National Cycle Manual guidance on two-way cycle tracks does not include for junction design issues, with the exception of one example crossing a minor side road. The NTA would like to understand the additional complexity that is related specifically to two-way cycle tracks at signalised junctions.

The intention of this short report is to identify these conflicts, observe user behavior and propose high-level interventions that may reduce the associated risks that are identified. There is also clearly a need for detailed design guidance to be included in the National Cycle Manual for two-way cycle facilities crossing or intersecting with major roads both signalized and un-signalised.

It should be noted that this report is based on site observation only and has not included an analysis of existing or past accident records or pre/post construction accident records. There is a need for all new facilities such as this one for pre and post implementation monitoring to be undertaken over a period of time in order to confirm or rebut observational findings.



Fig 1: Canal Way, Royal Canal and Tolka Valley Cycle Route Scheme

Canal Way - Phase 1 (Open)
The route starts from Portobello (Rathmines Road) in Dublin 4 and finishes at Sheriff Street, Dublin 7. It is mostly segregated.

Canal Way - Phase 1 (Open)
The route starts from Portobello (Rathmines Road) in Dublin 4 and finishes at Sheriff Street, Dublin 7. It is mostly segregated.



3.0 SITE INSPECTIONS

Site inspections were undertaken on the 11th/12th June 2013. The purpose of the inspections was to cycle the whole route a number of times observing cycle, and pedestrian behavior as well as to experience the quality of the cycle facility and the operation of the cycle lights/separate pedestrian lights at the canal bridge junctions. Each of the Canal Bridge junctions was monitored during morning/evening peaks and off peak periods during this time.

The section of the route inspected and the Bridge junctions monitored are shown in Fig 2 below, i.e. all junctions between Portobello Bridge and Lower Grand Canal Street Bridge.

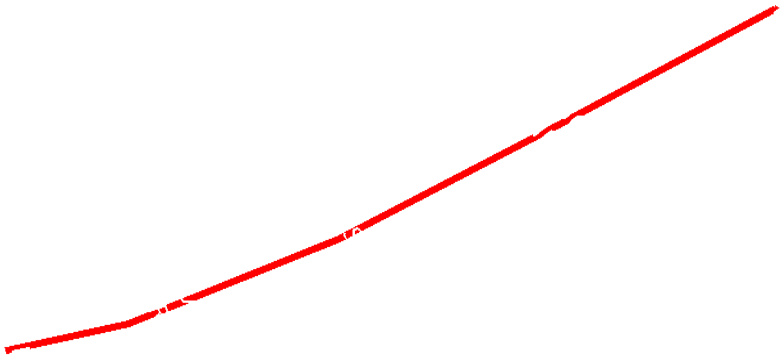


Fig 2 - Section of route inspected and key bridge junctions

As mentioned above the objective of the site inspection was to understand the actual cycle user behavior on the two way cycle track and at junctions as well as to observe the actual functioning of the facility i.e. was it in accordance with the design function planned or was it functioning in a different manner. Another objective was then to observe potential cycle/pedestrian and cycle/motorized conflicts.

It should be borne in mind that all the bridge junctions observed are different. They have different carriageway layouts, lane demarcations and allowed/banned turning movements. The cycle track designers have also treated them differently in planning the layout of the cycle signals and crossings. Up to date surveyed layouts should be requested from DCC as recent overlays and signing/lining contracts have altered the cycle facilities from the original layouts.

I have taken the Portobello or Rathmines Road Bridge as an example to look at cycle user/motorized vehicle conflicts and cycle user/pedestrian conflicts. The other junctions have similar but not identical conflict movements.

I am also proposing some generic type solutions or remedial options, which would need to be customized to the individual circumstances on site, but which identify an alternative approach to dealing with some of the conflicts identified.

4.0 CYCLE TRACK FUNCTION AND USER BEHAVIOUR

I am not quite sure what the intended function of this two way cycle track was i.e. was it intended as stated in the Lord Mayors opening address as a facility for families, visitors and children? i.e. a recreational facility. If that is the case it may not have been envisaged that it would be predominantly used as a commute to work facility, which is the way I observed it functioning. (during mid-week working days)

The Track was very busy during peak periods and quiet during off peak periods. (sometimes empty for a few minutes). The Track is predominantly being used as an orbital connection between key radial routes by commuter cyclists. (Cyclists are using it to connect between Rathmines Road and Leeson or Baggot Street for example). This is resulting in a significant number of turning movements from the radial roads to the cycle track and vice versa.

However it is also being used as a safer and quieter off road facility by tourists and recreational cyclists (often women) or children this was particularly obvious off peak but in low numbers. (I didn't get a chance to observe the route over a weekend, which would no doubt show, a larger number of recreational users). The track was empty for substantial periods of time during mid morning and mid afternoon periods, see Fig 3 below>



Fig 3 - quiet section of Canal Cycle Track mid morning...also notice track narrowing due to trees and preservation of parking on adjoining service road.

In regard to user behavior there were a number of obvious areas where users do not behave in the manner planned as follows:

1. Cyclists do not stop at or behind the holding lines for the red cycle signal light on the Track, and many commence crossing on the pedestrian "Green Man" before the Bicycle Green. Most cyclists advance to the point where the Track adjoins the Road. (see Fig 4 below)

2. The relatively high volumes Cyclists executing right turns into the cycle track from the radial road over the Canal Bridges are weaving across the traffic lanes or making a box turn. However there is no refuge for either of these movements. See Fig 5/6 below. It is not clear what the planned design was for this movement., as some bridges have ASL's some don't but none have "box turn" storage areas.

3. Motorists queuing are blocking the pedestrian and cycle crossing points when the Green Bicycle or Green Man is up. See Fig 7.

4. Cyclists exiting from the cycle track are crossing through a pedestrian "Green Man" (on main road) to execute right/left turn movements from the cycle track. While this is not considered a high risk conflict it is intimidating for pedestrians and frustrating for cyclists. Again this is as a result of introducing the cycle track at this location but also the lack of space at these locations and the large numbers of pedestrians and cyclists during peak hours.

I will deal more specifically with these situations in the next sections under conflicts and findings/recommendations.



Fig 4 – Most (almost all) cyclists do not stop behind signal holding lines, they move forward to the junction as shown above



Fig 5 – Right turn to cycle track from the middle of the road, also note vehicles blocking crossing.



Fig 6 - Weaving and right turn to cycle track from the middle of the road



Fig 7 – Motorists blocking crossing

5.0 CONFLICT AND RISKS

In this section three potential cycle/vehicle and cycle /pedestrian conflicts (arising as a result of the two way cycle track crossing the main radial roads) at the Canal bridges are identified. Any potential accident that occurs has its own discrete characteristics and chain of events. Also each of the above junctions has its own characteristics.

For the above reasons each of the observed conflicts are dealt with in a generalised manner as are proposals to address the conflicts.

Figure 8 below identifies the potential conflicts observed. One is as a result of a cycle weaving maneuver to turn right into the cycle track, the other is a direct cut across the traffic lanes by a cyclist to access the cycle track from the footpath and the third is a pedestrian /cycle conflict at the signalized pedestrian/cycle crossings with pedestrian movements across the road and cyclists turning left and right to/from the cycle track.



Fig 9 – pedestrian waiting to cross - cyclists turn through crossing pedestrians

In assessing the level of risk associated with the above conflicts one will need to analyze data from similar conflict movements in other areas (as this scheme is newly built) and monitor this scheme over the next few years. In Ireland we do not as yet have sufficient data for two-way cycle tracks crossing busy signalized intersections.

If one looks at the likelihood of occurrence of a conflict and its severity we can surmise that the highest risk and most severe conflict is probably cyclists on the main radial roads cutting across or weaving across traffic lanes and holding (in the middle of the bridge) to turn right into the two way cycle track, when there is very limited space on the bridge for the exposed cyclist to hold and wait for a gap in the opposing traffic. The other conflict identified i.e. cyclists turning through the pedestrian crossing would not be considered to be high risks as speeds are low and visibility between the cyclist and pedestrian is good.

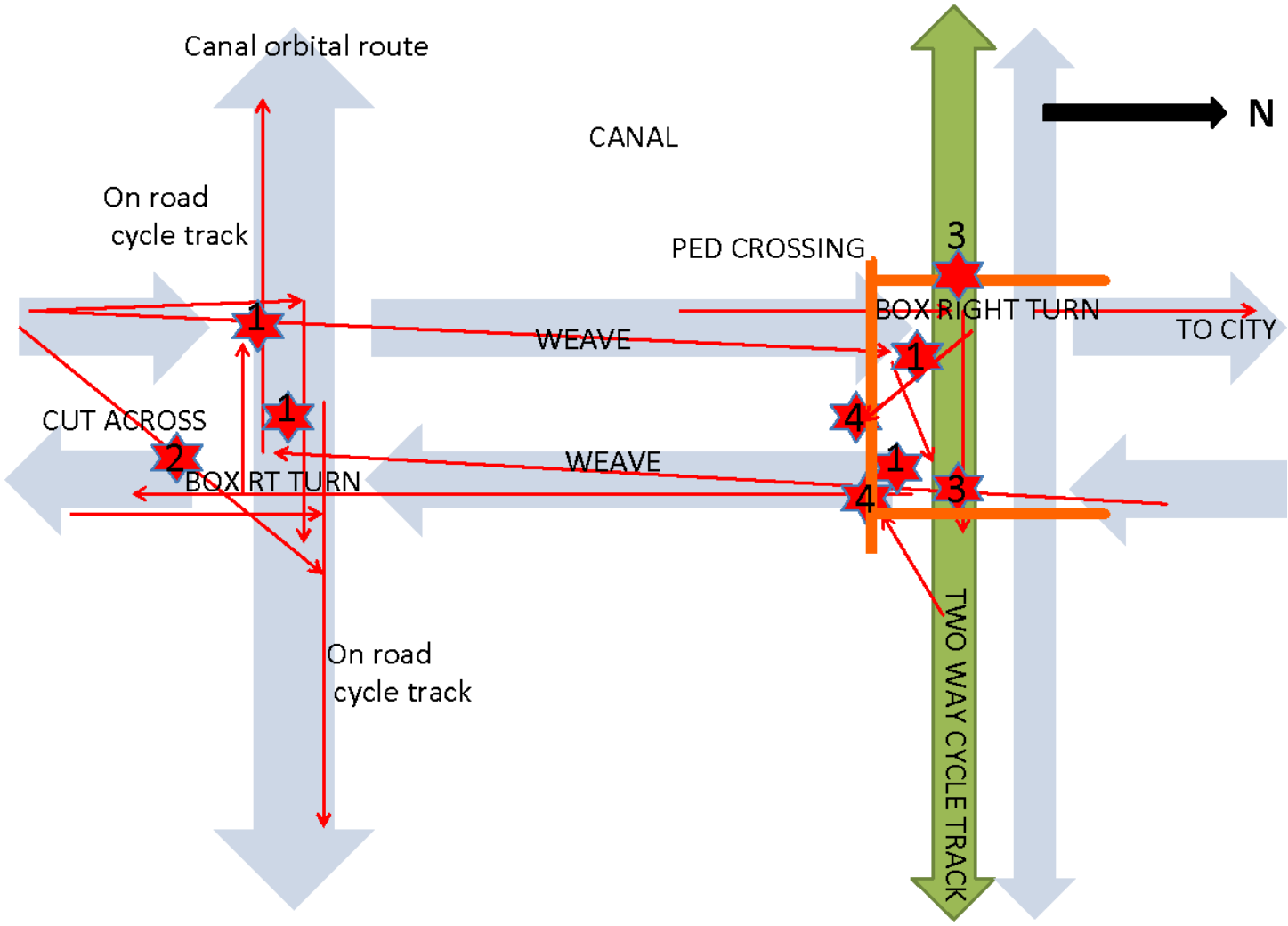


Fig 8 – Conflict Diagram

Essentially there is a problem of space on the Canal Bridges to segregate all movements. Some movements must therefore mix and conflict. All the movements are under the control of signals and one cannot design for illegal movements, which are also occurring, ie breaking of the red cycle and pedestrian lights.

This does not mean that this situation should be accepted as good practice and design because there are options to reduce risk and conflict in these circumstances. These are discussed in the next section.

Below is a summary table which summarises the 4 principal conflicts identified in the Fig 8 above.

Conflict Type (ref diagram 5.0)	**Frequency (observed – to be validated)**	**Potential Outcome (e.g. v. serious, serious, minor..)**	**Risk**	**Design Solution / Mitigation**
Veh/Cycle Conflict TYPE 1 :TURNING RIGHT FROM MAIN ROAD TO TWO WAY CYCLE TRACK Cyclist weaving from extreme left to two-way facility on far right (fig 6) or taking stationary position mid bridge between two opposing traffic streams (fig 5)	**Very frequent**	**Serious**	**High**	**Encourage "left to go right: by creating Box Turn space**

Veh/Cycle Conflict Type 2 – ESSENTIALLY SAME AS 1 ABOVE BUT USUALLY BY RISK AVERSE CYCLIST cyclists cutting across into opposing traffic prior to bridge to access on road cycle track	**Infrequent**	**Serious**	**High**	**Encourage "left to go right" by creating Box Turn space**
Cycle/Cycle Conflict Type 3: CYCLISTS BLOCKING ENTRANCE TO CYCLE TRACK- Cyclists stacking in both lanes of cycle facility, precluding cyclists from entering ..	**Frequent**	**Minor – due to low speeds**	**Low**	**Cyclists are not stacking correctly behind holding lines for signals or on the correct side. Holding lines should be moved forward and more stacking space created.**
Ped/Cycle Conflict Type 4: PEDESTRIANS CROSSING BRIDGE ON "GREEN MAN" – Cyclists turn through crossing pedestrians (fig 9)	**Very frequent**	**Minor due to low speeds**	**Low**	**Not much can be done but the flashing amber lights help. Recommend changing to Toucan crossings for consistency**

Table 1 Conflict table – refers to conflict diagram fig 8

6.0 FINDINGS AND RECOMMENDATIONS

In assessing the severity of the potential cyclist/vehicle and pedestrian/cyclist conflicts one must consider each case and site individually as discussed earlier. However in general terms I would comment as follows:

- The overall speed environment during peak hours when the conflicts are most regular is quite low i.e. 20-40kph. This would not be the case off peak or during night time hours.

- The highest risk, most significant and most frequent conflict observed is the inbound cyclist cutting across or weaving to turn right into the Cycle Track. The cyclist is exposed in the middle of the inbound carriageway with a very small gap to outbound traffic or vice versa in the outbound direction.

- The second conflict of significance is the cyclist cutting across the road to the footpath in order to access the on road cycle track (although this is infrequent).

- A further conflict observed is a cycle pedestrian conflict as a result of turning movements across the pedestrian crossing by cyclists moving on the pedestrian "Green Man" rather than the cyclist green light.

SEE TABLE AND CONFLICT DIAGRAM ABOVE

The findings and recommendations are split into three sections:

1. Pedestrian Crossings
2. Cyclist Crossings
3. Bridge traffic lane configuration

Pedestrian Crossings:

1. Set back the bridge abutments to create more space for pedestrian and cyclists to negotiate the crossing and access/egress from the Cycle Track. See Fig 11.
2. Consider the conversion of all pedestrian / Cycle crossings to Toucan crossings, this will significantly shorten the green time required and reduce traffic delays on the radial roads over the bridges. Notwithstanding the fact that the existing arrangement is working, but is not being observed by most cyclists
3. Remove the pedestrian movement from the Canal Bridge by constructing an off set pedestrian bridge crossing just adjacent to the bridge parapets. See Fig 10 below. Use the extra space provided by the footpath on the bridge to facilitate cyclists and Box Turn movements. This is obviously an expensive solution but one that can be considered for the future.
4. Create more space on the Canal bridges for vulnerable users by reducing the general traffic capacity on the bridges to reflect the exit and approach lane capacity.



Fig 10 Extend pedestrian crossing directly across canal via a separate pedestrian bridge



Fig 11 - Extend pedestrian crossing directly across canal via a separate pedestrian bridge



Fig 12 – Toucan Crossing Lower Grand Canal Street

Cyclist Crossings:

1. Create a "Box Turn" storage area for cyclists turning right into the Cycle Track. See Fig 13
2. Remove Advance Stop lines where Box turning is provided for, see Fig 14
3. Consider replacing the dedicated Cycle crossing signals with standard "Toucan" crossings for pedestrians and cyclists as is on the Lower Grand Canal Bridge junction. See Fig 12

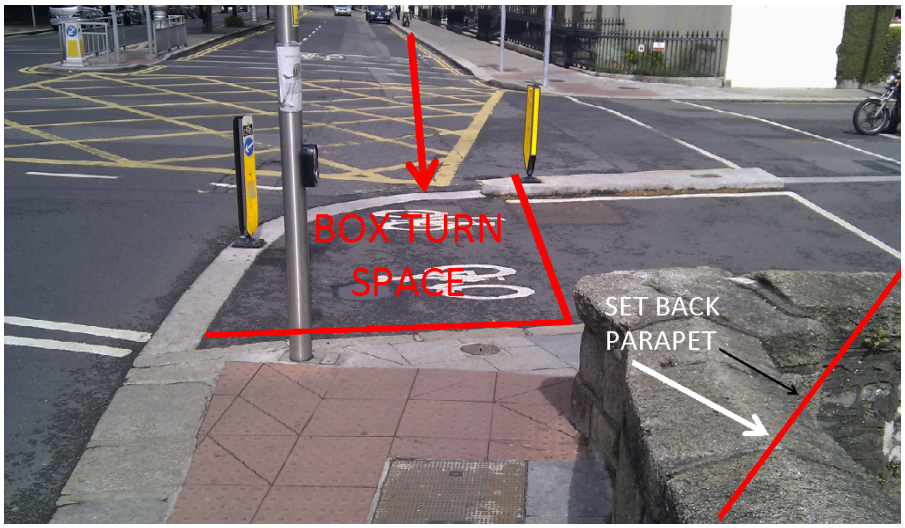


Fig 13 – Create Space for Box Turn movements



Fig 14 Box Turn space , lane for passing cyclist, and remove ASL
Bridge traffic lane configuration

1. Using the bridge as a storage area for vehicles in advance of the traffic signals is taking space from other more vulnerable users such as cyclists and pedestrians and providing negligible extra storage capacity for vehicles. In terms of road safety this is creating risks and conflicts for vulnerable users that could be minimized and reduced. In some situations i.e. Portobello Bridge cycle facilities that were previously on the bridge have been removed. See Fig 15
2. Where there are single general traffic lane approaches and exits from the bridges these should be maintained over the bridge and the extra space re –allocated to cyclists and bus lanes. See Fig 16/17/18/19



Fig 15 - Cycle lanes on Portobello bridge deck and approaches prior to upgrade



Fig 16 - Cyclists being "squeezed on the approaches to Portobello Bridge. The left turn lane carries low volumes of general traffic



Fig 17 - Two outbound lanes on Baggot St Bridge and no cycle lane



Fig 18 Single lane entry and exit outbound with two lanes on Ranaleigh Bridge – convert to Bus lane and Cycle lane



Fig 19 - Outbound lane at Northumberland Road, note there is plenty of space for cycle track and cyclist Box Turn area

Recommendations:

1. **The construction of the Grand Canal Two Way Cycle Track has resulted in the introduction of new vehicle/cycle and pedestrian /cycle conflicts particularly at the intersections with the radial road junctions at the Canal Bridges. These conflicts should be minimized and facilities put in place to provide extra space for cycle right turn movements and pedestrian movements.**

2. **The design treatments (i.e. pedestrian/cycle crossings, traffic lane markings, advance stop lines) are not consistent along the route. This should be rectified.**

3. **The Canal Bridges are a pinch point for vehicular/cycle/pedestrian traffic. Too much space is allocated to vehicular traffic creating a safety risk for vulnerable users. This situation should be reviewed through the provision of new pedestrian (adjacent) facilities or the re allocation of roadspace to cyclists and pedestrians. In my opinion the bridges should facilitate one traffic lane, one bus lane and cycle track both in bound and outbound, but each bridge must be considered separately as they are of different widths and carrying different volumes of vehicles and pedestrians/cyclists.**

4. **All future extensions of the two-way cycle facility should consider the above recommendations. A monitoring program should be put in place to annually report on accidents and cycle/pedestrian volumes.**

5. **Up to date surveyed layouts OF ALL THE RADIAL ROAD JUNCTIONS intersecting the cycle track should be requested from DCC as recent overlays and signing/lining contracts have altered the cycle facilities from the original layouts.**

6. **Implement the specific findings outlined in section 6 above**

CONCLUSION:

The development of the two-way cycle facility along the Canals is an excellent initiative and has drawn considerable numbers of commuter and recreational cyclists to use it. It is of note that there is a parallel cycle facility on the road along the Canal Orbital route which is also well used.

The younger and more risk averse cyclists tend to stay with the on road facility but many newer, older and less risk averse tend towards using the off road facility. Both facilities are complimentary as the new facility has taken some pressure from the on road cycle lanes are they had reached capacity during peak periods.

The new two way cycle track has however resulted in the introduction of cycle/vehicle and cycle/pedestrian conflicts as outlined in this report. The lack of design detail to facilitate the right turning cyclists from the main radial roads to the new facility is apparent and resulting in a variety of risky conflicts that could be remediated through the introduction of measures as described in this report.

Each site location is different and these proposed measures need to be designed and detailed prior to confirming the most appropriate solution for each junction.

This report also raises the fact that there are no design solutions proposed in the current NTA Cycle Design Guidelines Manual for Two-Way cycle tracks at junctions. It also raises a question in regard to the appropriateness of the use of ASL (Advance Stop Line) at very confined locations which encourage right turn cyclists to the middle of the road in moving traffic where there is no space for storage. In these cases the report proposes the development of storage space for “left to turn right”movements .

NOTE:

THE ABOVE REPORT WAS BASED ON OBSERVATION DURING A NUMBER OF SITE VISITS AND CYCLE JOURNEYS ALONG THE CORRIDOR OVER A NUMBER OF

DIFFERENT DAYS. IT IS THEREFORE NOT DEFINITIVE OF ALL CONFLICTS BUT ONLY THOSE OBSERVED IE OTHER BEHAVIOURAL EVENTS SUCH AS MOTORCYCLISTS/SCOOTERS/JOGGERS/ROLLER BLADES ETC USING THE CYCLE TRACK MAY CAUSE CONFLICTS BUT WERE NOT OBSERVED.