Leith Walk cycling infrastructure analysis

Summary of key findings

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Introduction

AECOM were commissioned by the City of Edinburgh Council to record observations and analyse video monitoring data for new cycling infrastructure on Leith Walk. Videos were recorded and analysed to assess the operation and safety of three elements of new infrastructure:

- Bus stop bypasses on Leith Walk (northbound and southbound), north of McDonald Road;
- A cycle priority crossing across Albert Street; and
- A continuous footway across Middlefield.

The location of this infrastructure is shown in Figure 1.

While this infrastructure is not yet common in Edinburgh and across Scotland, it follows the approach set out in national and local policy to prioritise people and place over motor traffic in street design and operation. This report summarises the findings on how they currently operate and analysis of this data, as well as observations that were recorded during analysis and whilst on site.

The data sets analysed were from shortly after installation (November 2017), 6 months post-installation (May 2018) and 12 months post-installation (November 2018). A total of 6 days were surveyed in each data set (4 weekdays, 1 Saturday and 1 Sunday), with the time period analysed being from 07:30 to 09:30 and 16:30 to 18:30 each day.

The Transport Research Institute (TRI) at Napier University were sub-consulted via AECOM. The university has undertaken a more detailed behaviour study on the northbound bus stop bypass on Leith Walk.

The results from the analysis of the bus stop bypasses, cycle priority crossing and continuous footway, including the results from the behaviour study, are presented in the following sections.

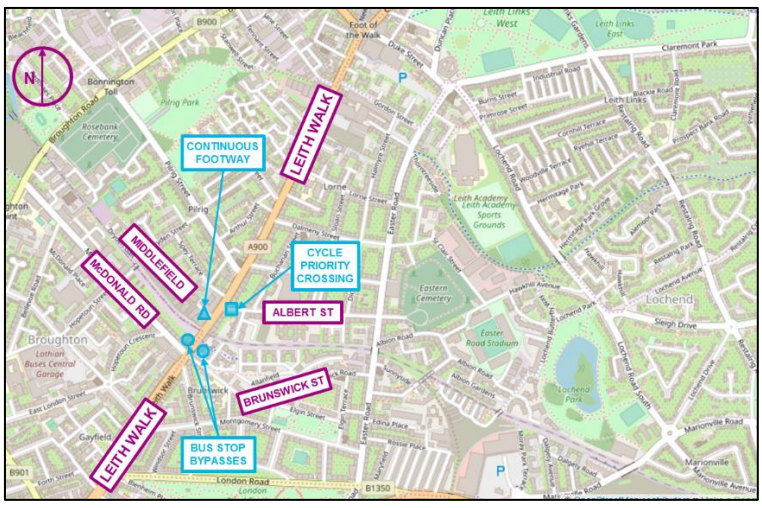


Figure 1 – Location of infrastructure on Leith Walk

Other studies

Other studies that have been undertaken in the United Kingdom are summarised below:

Cambridge (2015) – Bus stop bypasses

In 2015, Sustrans produced a report which focused on a series of bus stop bypasses in Cambridge, which were being implemented by Cambridgeshire County Council (CCC) within the area. The study monitored two bus stop bypasses, at Huntingdon and Hills Road, and concluded that interactions between cyclists and pedestrians at the bus stops were relatively infrequent and of low severity at both sites. The majority of interactions were safe and normal behaviour, while it appeared that pedestrians made more adjustments at these sites than cyclists.

Source: Sustrans, 2015. Cambridgeshire 'Floating Bus Stops' Interaction Analysis.

London (2018) – Bus stop bypasses

TRL undertook video analysis of the behaviour of cyclists and pedestrians at six sites across London on behalf of Transport for London. The sites were analysed twice: once where the site had an uncontrolled pedestrian crossing; and a second time with a Zebra crossing being provided.

The total number of interactions over a 7 day period, and a total of 14 hours per day, was between 255 and 293, depending on the pedestrian crossing layout.

The study found that the vast large majority of cyclists (over 90%) passed through the bus stop bypasses without an interaction with a pedestrian.

Interactions were measured using a 1 to 5 scale (from 1, 'precaution', to 5, 'collision') and between 92 and 97% of the interactions scored 1 or 2 on the scale.

Individual video examinations were undertaken of the small number of more serious interactions between cyclists and pedestrians. Factors judged to be important in these interactions were as follows:

- pedestrian inattentiveness;
- local features that constrained pedestrian movements or reduced intervisibility;
- crowding; and
- lack of space for manoeuvring.

Source: TRL, 2018. Bus Stop Bypasses - Analysis Of Pedestrian And Cyclist Behaviour Via Video.

Manchester (2016) – Bus stop bypasses

In 2015, as part of the Oxford Road Bus Priority Scheme, Transport for Greater Manchester (TfGM) committed to constructing a trial bus stop featuring a bus stop bypass. The trail layout was monitored for 24 hours and for seven consecutive days, while 19 hours of video footage from different days and time periods was analysed to determine the number of interactions that occurred.

There were 35 minor conflicts (defined as cyclist or pedestrian had to make minor adjustments to their speed or direction to avoid a possible collision), 18 major conflicts (defined as cyclist had to brake heavily or pedestrian has had to move out of the way rapidly to avoid a possible collision) and no actual contacts observed over the 19 hour time period (defined as there has been a collision of some sort between cyclist / pedestrian / vehicle).

As there were no contacts even at the busiest times, the study concluded that, in general terms, there was sufficient time and space for bus users, pedestrians and cyclists to interact with each other safely.

Source: Transport for Greater Manchester, 2016. Oxford Road Bus Stop Evaluation Report.

Brighton (2016) – Bus stop bypasses

The Lewes Road scheme in Brighton included bus stop bypasses, intended to make cyclists feel safer and encourage greater travel on bicycle by those who may be less experienced or confident travelling this way.

In order to assess satisfaction, user surveys were undertaken by independent surveyors of bus users, pedestrians and cyclists. The vast majority of pedestrians, cyclists and bus users found the bus stops both easy and safe to use. For all road user categories at least 85% said that the bus stops were 'very easy' or 'easy' to use and at least 84% said that they were 'very safe' or 'safe'.

Source: Brighton & Hove City Council, 2016. Lewes Road Interim Post-Construction Monitoring Report.

London (2018) – Continuous footways

Transport for London (TfL) commissioned Steer Davies Gleave to undertake a research to determine how continuous footways influence driver behaviour and the consequent level of risk for pedestrians and cyclists. The study focused on seven sites where continuous footways had been introduced and studied these over a 3 day period.

The key findings of the study were as follows:

- Drivers were more likely to give way to pedestrians who were on or very near the continuous footway. 78% of drivers gave way to pedestrians who were crossing the continuous footway, but this dropped to 17% for pedestrians not yet at the continuous footway.
- The majority of drivers (97%) gave way to cyclists who were level with their vehicle or ahead of them;
- Drivers were more likely to give way to pedestrians when pedestrian flows were higher.
- Drivers were more likely to give way to pedestrians when turning out a side road junction, compared to turning into the side road.

Source: Steer Davies Gleave, 2018. Driver Behaviour At Continuous Footways Research.

Definitions

Bus stop bypasses, cycle priority crossings and continuous footways are defined in the following paragraphs. Images of the infrastructure are shown in figures 2 to 4.

Bus stop bypass

A bus stop bypass, also known as a ‘floating bus stop’, is an arrangement that involves a cycle track running behind the passenger boarding area at a bus stop, between an island and the pavement. At the bus stop bypasses on Leith Walk the cycle tracks are at the same level as the pavement and are segregated by a single row of corduroy paving on either side of the cycle track. Uncontrolled crossings are provided to assist pedestrians crossing the cycle track between the pavement and island, with two rows of tactile paving and informal Zebra crossing markings being provided.

Figure 2 - Bus stop bypass (Leith Walk Southbound)

Cycle priority crossing

Where a cycle track crosses a relatively lightly trafficked side road junction, the cycle track can be continued across and given priority over the side road. The crossing is generally sited on a flat-topped road hump to ensure low vehicle speeds and provides pedestrians with a crossing point. Road markings are used to instruct vehicles to give way to the cycle track and pavement on approach.

Figure 3 - Cycle priority crossing across Albert Street

Continuous footway

A continuous footway is an uninterrupted pavement that extends across a side road junction. They are most suitable at junctions with low levels of vehicular traffic turning in and out of them. Continuous footways should not contain any change in design and materials or breaks that might give the visual impression of priority to motor traffic. The drivers / riders of motor vehicles should treat this area as part of the pavement that they have to cross.

The section of pavement crossing the side road should also be at the same level as the rest of the pavement, meaning drivers / riders have to ramp up and over it, helping to keep vehicle speeds low.

Figure 4 – Continuous footway across Middlefield

Interaction

An interaction has been defined as two road users affecting one another. This analysis in this study considered interactions between pedestrians and cyclists next to the bus stop bypasses, and between non-motorised users (pedestrians and cyclists) and motor vehicles at the cycle priority crossing and continuous footway.

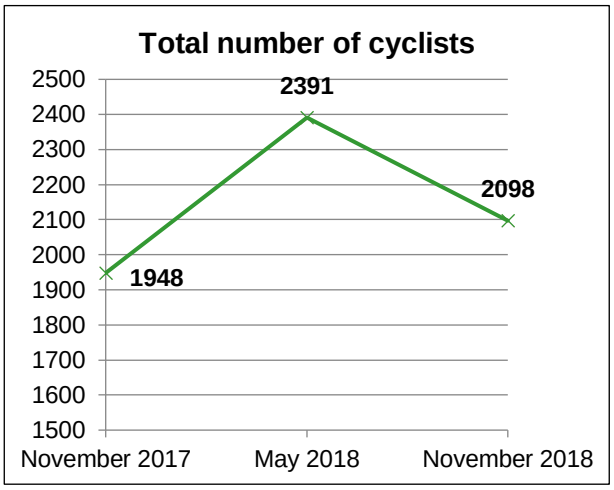
Interactions were classified by which type of road user gave way to the other.

Conflicts between road users, ranging from no interaction to a collision, were considered separately by TRI, and this was focused on the northbound bus stop bypass on Leith Walk.

Key findings – bus stop bypasses

The key findings from the analysis of the bus stop bypasses on Leith Walk, north of McDonald Road, are presented in the following paragraphs.

Total number of cyclists



It was found that the number of cyclists was highest in May 2018, and that the number of cyclists was greater in November 2018 than in November 2017.

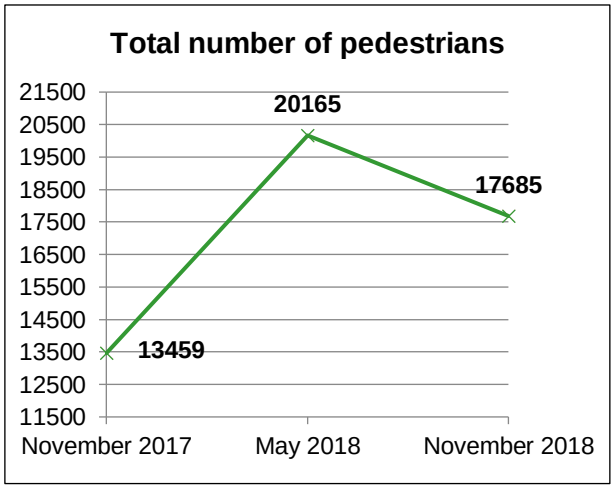
The total number of cyclists in May 2018 was 14% greater than in November 2018 and 23% greater than in November 2017

The increase in May 2018 is likely due to the temperature and weather conditions making cycling more appealing to inexperienced or novice cyclists.

The average number of cyclists on Leith Walk on a weekday in May 2018 was found to be 505, compared to 463 in November 2018 and 422 in November 2017.

The total number of cyclists was 7% greater in November 2018 compared to in November 2017

Total number of pedestrians



The largest number of pedestrians was recorded in May 2018, with 20,165 pedestrians (on east and west pavements) counted across the surveyed period.

The total number of pedestrians in May 2018 was 14% greater than in November 2018 and 50% greater than in November 2017

Again, the increase in May 2018 is likely due to the temperature and weather conditions making walking more appealing than other modes of travel.

The total number of pedestrians was 31% greater in November 2018 compared to November 2017 (17,685 in November 2018 versus 13,459 in November 2017)

The total number of pedestrians was found to be higher in the PM peak period across all of the data sets. This was particularly true in the 2018 data sets (May and November) where the number of pedestrians was found to be 124% and 135% higher in the PM peak period.

The western pavement was generally observed to have a higher average footfall than the eastern pavement in all of the data sets. On the average weekday the count on the western pavement was found to be between 4% and 28% greater in the AM peak across all of the data sets and between 22% and 41% greater in the PM peak in the November 2017 and November 2018 data sets. In May 2018 the average weekday count was slightly greater on the eastern pavement (1,287 versus 1,269).

Use of cycle infrastructure by direction

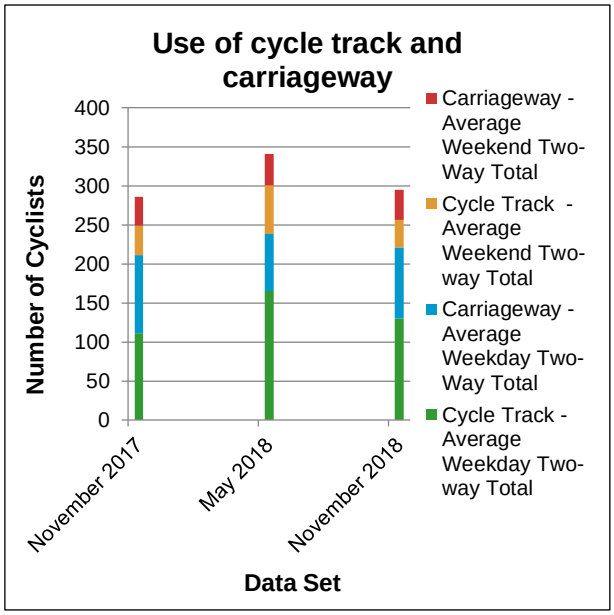
Between 67% and 80% of cyclists use the southbound (uphill) cycle track on the average weekday.

This is likely due to the gradient of the route. Cyclists travelling southbound have to cycle uphill and there is therefore likely to be a greater speed differential between cyclists and vehicles, meaning it is likely more comfortable for cyclists to cycle in the cycle track.

During the peak periods on the average weekday, between 46% and 69% of cyclists cycle northbound (downhill) on the carriageway. This is likely because cyclists travelling northbound are travelling downhill and there is thus likely to be a lower difference in speed between cyclists and vehicles. Furthermore, cyclists travelling northbound on the cycle track would likely have to regulate their speed to avoid conflicts with pedestrians and to stay in the cycle track, while cyclists on the carriageway would likely be able to maintain a more constant speed.

There was found to be greater use of the cycle tracks in May 2018 compared to use of the carriageway

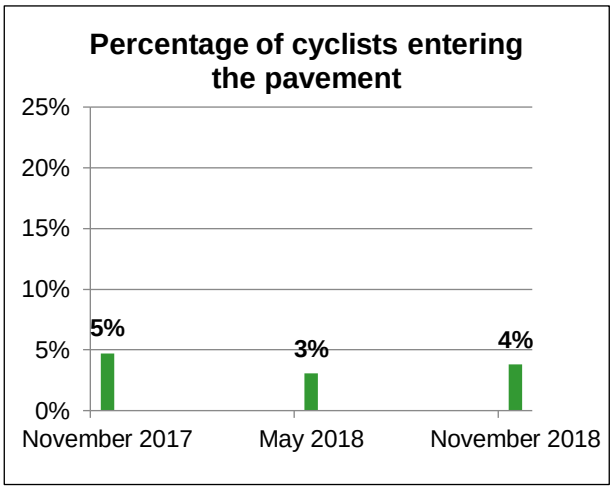
This appears to be due to greater use of the infrastructure by inexperienced or less confident cyclists at during the summer months, while the cyclists using the infrastructure during the working week in November are more likely to be confident cyclists travelling for a utility purpose.



Proportion of cyclists entering the pavement

The proportion of cyclists leaving the cycle track and entering the pavement was found to be between 3% and 5% of the total number of cyclists recorded using the cycle tracks.

The percentage of cyclists entering the pavement was lowest in May 2018 (3%), and was lower in November 2018 (4%) compared to in November 2017 (5%).



Observations made during the analysis suggest that cyclists enter the pavement to avoid pedestrians and to give them more room, particularly when pedestrians are transitioning to and from the island at the bus stop bypasses. Additionally, it was observed that if the bus stop is overcrowded, pedestrians waiting for the bus spill out of the bus stop island onto the cycle track, which blocks the cycle track for cyclists.

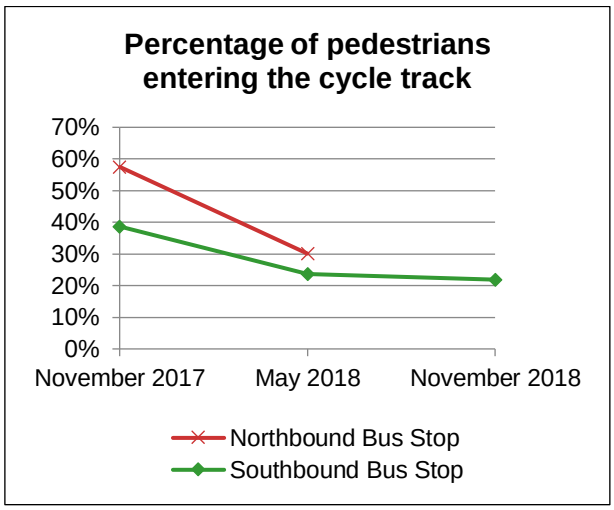
Number of pedestrians entering the cycle track

The total number of pedestrians entering the cycle track at the southbound bus stop decreased between November 2017 and November 2018, with 2,301, 2,298 and 1,831 entering the southbound cycle track in November 2017, May 2018 and November 2018 respectively. The overall pedestrian volumes on the eastern pavement were 5,949, 9,733 and 8,365 in November 2017, May 2018 and November 2018 respectively.

The total number of pedestrians entering the cycle track at the northbound bus stop in November 2018 was affected by the pavement on the west side of Leith Walk being temporarily narrowed due to road works, which meant that the number of pedestrians entering the cycle track rose to 11,788 from 4,320 and 3,142 in November 2017 and May 2018 respectively.

Figure 5 - Narrowing of western pavement on Leith Walk

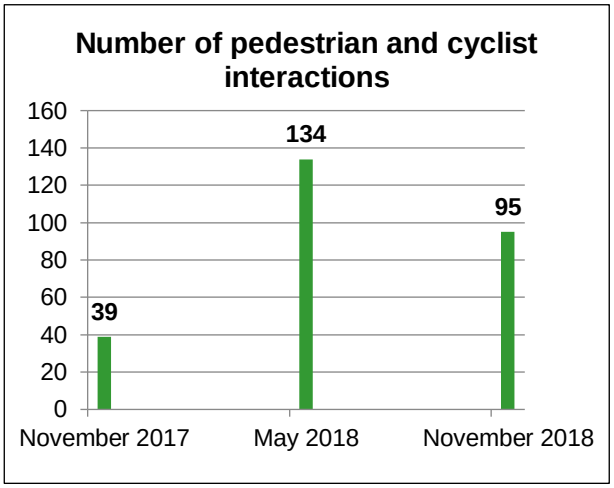
Discounting the data from the November 2018 data set that was affected by the temporary pavement narrowing, the data indicates that the number of pedestrians entering the cycle track at the bus stop bypasses has been trending downwards, while the number of pedestrians increased between November 2017 and November 2018.



The percentage of pedestrians entering the cycle tracks generally decreased over time, except for at the northbound bus stop in November 2018 when the pavement was temporarily narrowed due to road works

Total number of interactions

There were relatively low numbers of interactions between cyclists and pedestrians across the days and periods that were surveyed, but there were generally more interactions in May 2018 than in November 2017 and November 2018. The total number of interactions in November 2017, May 2018 and November 2018 was 39, 134 and 95 respectively. This can be explained by the fact that there were generally more cyclists using the cycle tracks in May 2018 with respect to the other periods surveyed.

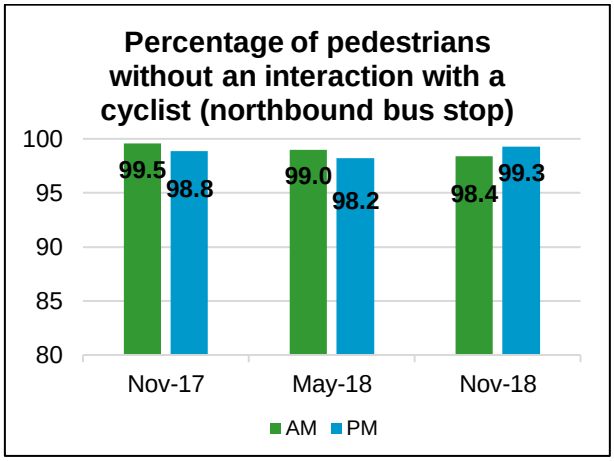


There were more interactions in November 2018 compared to in November 2017, however the number of interactions in November 2018 is likely influenced by the fact that the pavement was temporarily narrowed on the west (northbound) side of the road, and as a result there were more pedestrians entering the cycle track.

In the interactions that did occur, cyclists gave way 69% of the time in November 2017, while the equivalent figures in May 2018 and November 2018 were 48% and 31%. This illustrates an increasing trend of pedestrians giving way to cyclists.

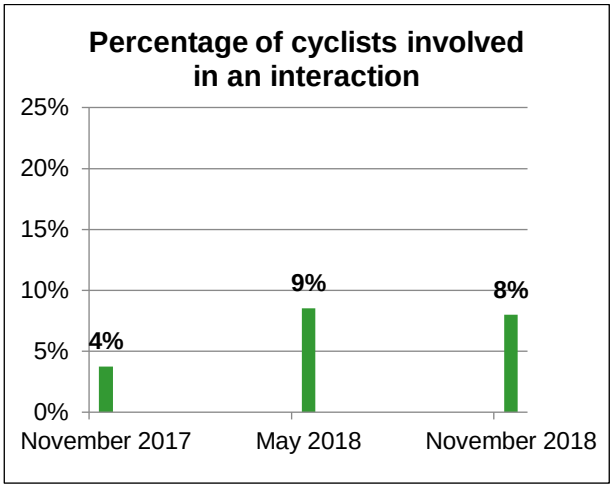
There were a greater number of interactions in May 2018, when the pedestrian and cycle flows are highest, and these were more likely to be of an increased severity

The percentage of pedestrians who were not involved in a conflict at the northbound bus stop was found to be greater than 98% in the AM and PM peak periods across each of the data sets.

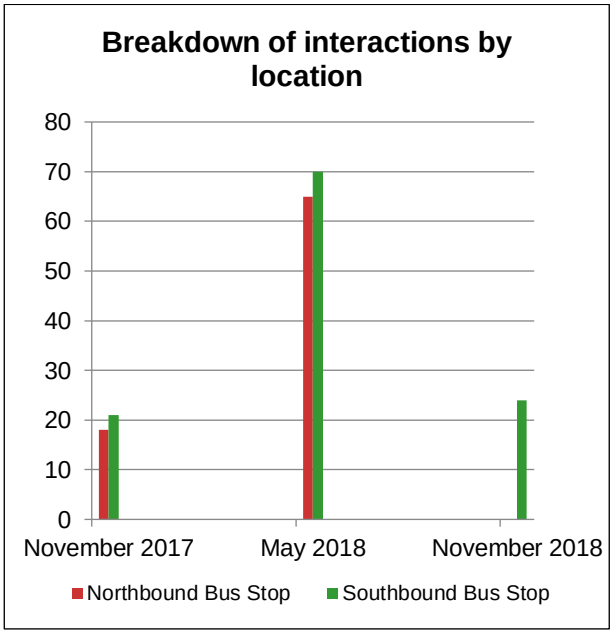


Whilst the percentage decreased between November 2017 and November 2018 in the AM peak period, it increased in the PM peak period in the same time period.

The percentage of cyclists cycling in the cycle track that were involved in an interaction with a pedestrian was 4%, 9% and 8% in November 2017, May 2018 and November 2018 respectively



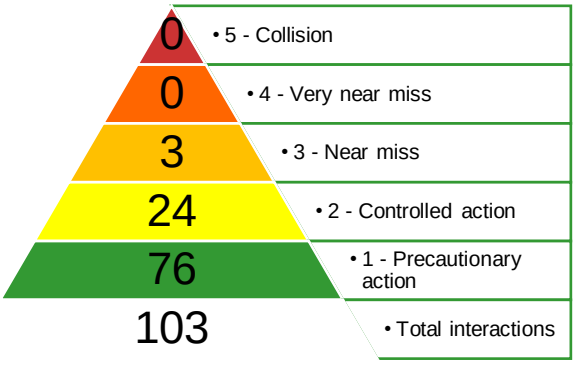
Analysis of the number of interactions by location indicates that the number of interactions that occurred at the southbound bus stop in November 2018 almost reduced back to the number that occurred in November 2017 after peaking in May 2018. The number of interactions that occurred at the northbound bus stop rose between May 2018 and November 2018, but this can be explained by the temporary constructions works that narrowed the pavement during the November 2018 monitoring. The number of interactions in November 2018 may have reduced to closer to the number recorded in November 2017 were these works not taking place during the November 2018 survey.



It should be noted that the proportion of interactions at the northbound and southbound bus stops in November 2017 was factored based on the May 2018 data, as the number of interactions was not recorded by side of the road.

Nature and cause of interactions (northbound bus stop, November 2017)

Interactions that occurred at the northbound bus stop in November 2017 were studied in more detail. The interactions that occurred were classified on a scale of 0 to 5, with 0 being no interaction and 5 being a collision. A breakdown of the interactions that occurred at the northbound bus stop in November 2017 is provided below:



As shown in the figure above, of the interactions that did occur, the vast majority involved either a precautionary action or a controlled action. There were no collisions or very near misses.

The relative direction of travel between the pedestrians and cyclists was found to have an impact on the frequency and severity of interactions.

The results suggest that there are more interactions when cyclists and pedestrians are travelling in the same direction, i.e. not facing each other. The interactions in this case tended to be of a higher severity: 20% of the interactions scored higher than 1 (precautionary action) when pedestrians were not facing the cyclist. When the pedestrian and cyclists were facing each other, i.e. opposing flows, only 5% of interactions scored higher than 1.

Two of the main causes of interactions between non-motorised users were found to be pedestrians walking on the cycle track and overcrowding of the pavement

Overcrowding of pedestrians in the cycle track was observed predominantly in the late afternoon and early evening hours. The overcrowding was sometimes associated with large groups of pedestrians alighting from the bus stop. It was noted that when there are groups of pedestrians, some of them may be unaware that they are walking on a cycle track.

When pedestrians are not facing the cyclist, i.e. travelling in the same direction, cyclists were observed taking zig-zag manoeuvres between the pedestrians, rather than a stop and wait action, when the cycle track became busy with pedestrians.

Approximately 40% of the interactions observed were due to some activity related to the bus stop, i.e. waiting for the bus and queuing or standing on the cycle track, alighting from the bus or walking towards the bus.

Design / Operational observations

It was observed that pedestrians use the cycle track to overtake slow walkers, especially at narrow parts of the pavement, and that pedestrians alighting buses use the cycle track to cross over to the pavement.

The observed behaviour of the pedestrians suggests that they may be using the cycle track as an extension of the pavement where they have a tendency to stand and walk on the cycle track. This could be improved with an increase in the pedestrian's awareness of the design of bus stop bypasses or other visual aids to differentiate the different functions of the space. This could be achieved through a local information campaign or wider media information dissemination about the use of these facilities, or information at the bus stop.

In addition, physical measures could help better define and highlight the cycle track area to pedestrians to improve their compliance. Such measures could include:

- information signage;
- road markings,
- colour contrasts; and
- level changes

Further research into people's behaviour and decision making would provide a better understanding to the reasons for non-compliance and perceptions of safety and operation.

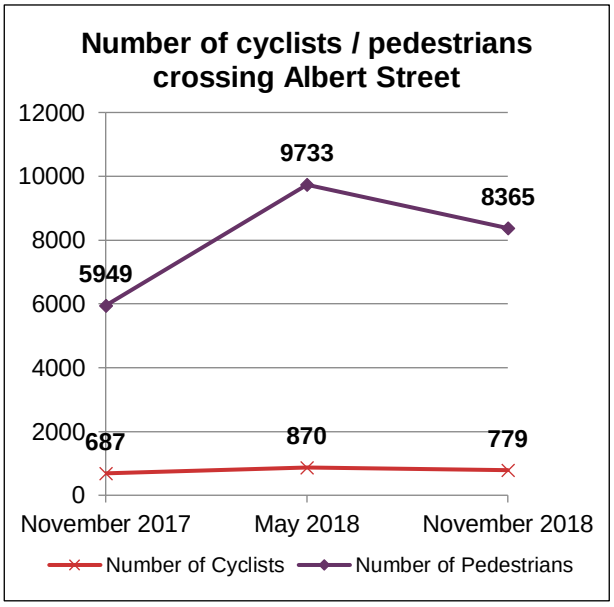
It should be noted that changes are going to be made to the cycle tracks on Leith Walk, associated with the Edinburgh Tram extension to Newhaven. These changes include providing a level difference between the pavement and cycle track and improvements to better highlight the crossing points.

Key findings – cycle priority crossing

The key findings from the analysis of the cycle priority crossing across Albert Street are detailed in the following paragraphs.

Number of non-motorised users using crossing

The number of non-motorised users crossing Albert Street was found to be highest in May 2018 (10,603 compared to 6,636 in November 2017 and 9,144 in November 2018). This is likely due to the temperature and weather conditions being more suited to walking and cycling in May in comparison to November.



The number of non-motorised users crossing Albert Street in November 2018 (9,144) was found to be 38% greater than the number crossing in November 2017 (6,636)

Generally, there were higher numbers of pedestrians crossing compared to cyclists, especially pedestrians crossing southbound in the AM period and northbound in the PM period.

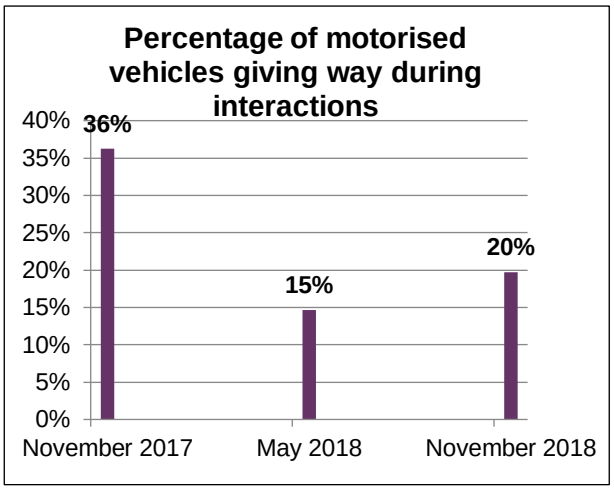
Percentage of vehicles giving way to non-motorised users at cycle priority crossing

The results for both the AM and PM periods show that there were higher numbers of non-motorised users giving way than motorised vehicles on most of the surveyed days.

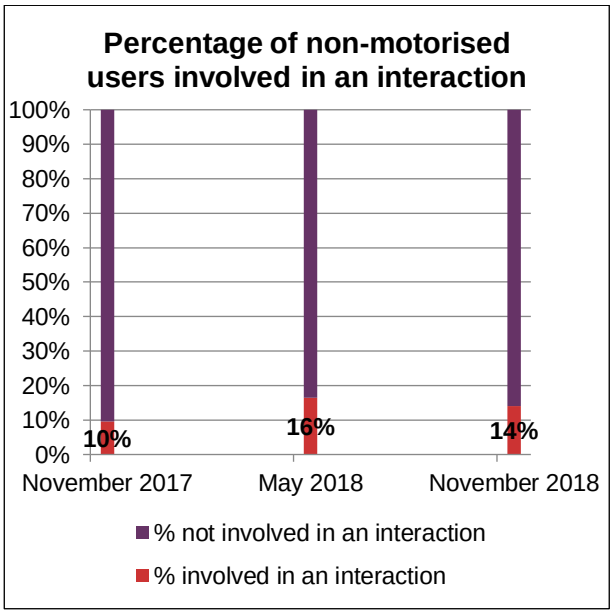
On average non-motorised users gave way to motorised vehicles 64%, 85% and 80% of the time in November 2017, May 2018 and November 2018 respectively

This downward trend of compliance by motor vehicles could indicate that the drivers / riders of motorised vehicles have become familiar with the arrangement in the period since it was introduced

and are using it similarly to how they would with a typical junction with a side street.

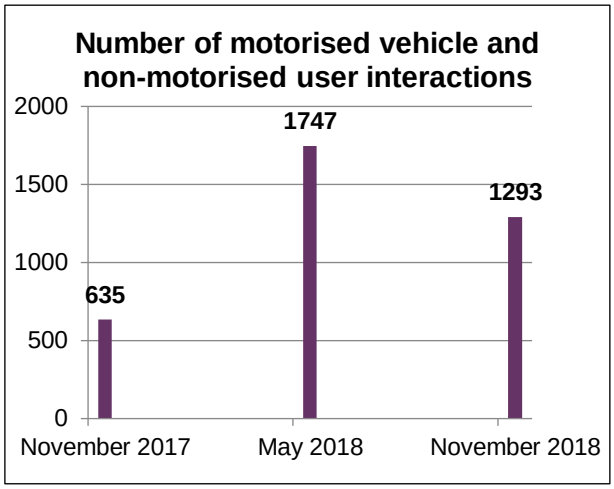


On average, 10% of non-motorised users were involved in an interaction with a motorised vehicle in November 2017, with the equivalent figures in May 2018 and November 2018 being 16% and 14% respectively. This indicates that non-motorised users were more likely to be involved in an interaction with a motorised vehicle in May 2018 and November 2018 with respect to November 2017.



The total number of interactions between non-motorised users and motorised vehicles was highest in May 2018 (1,747), followed by November 2018 (1,293) and November 2017 (635).

The total number of interactions in November 2018 was found to be 104% greater than in November 2017 (1,293 compared to 635)



The number of vehicles entering and exiting Albert Street, and the number of non-motorised users crossing Albert Street, were found to be greatest in May 2018 and least in November 2017. This helps explain the trend in the total number of interactions.

Design / Operational observations

The key findings that have been detailed indicate that the aims of the design may not be being met. Whilst the number of non-motorised users using the crossing has increased, the percentage of motorised vehicles giving way to non-motorised users has decreased.

During the site investigations it was noted that there are some elements of the design that could be compromising the scheme, including:

- The give way markings on the cycle track could lead cyclists to believe that they have to give way to motorised vehicles; and
- The road markings and lining are very faint, and the continuation of the cycle track is not conspicuous.

It should be noted that the condition of the road markings and lining have likely deteriorated over time since the scheme was constructed, meaning that any influence these had on the behaviour of

road users is likely greater in November 2018 with respect to November 2017.

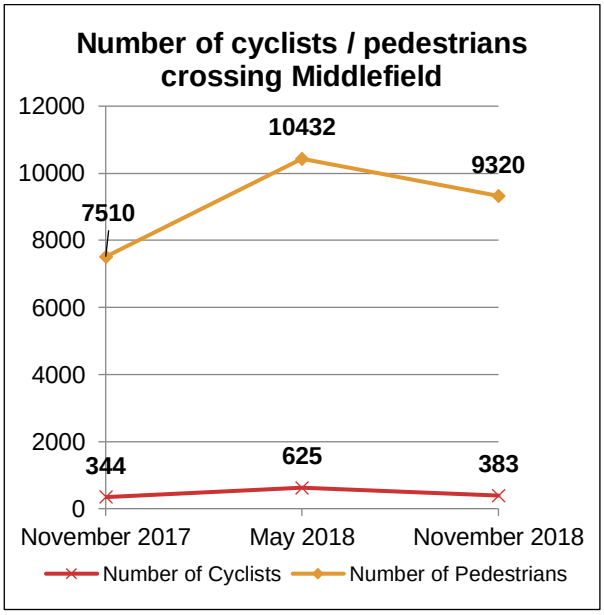
Further research into people's behaviour and decision making would provide a better understanding to the reasons for non-compliance and perceptions of safety and operation.

Key findings – continuous footway

The key findings from the continuous footway across Middlefield are presented in the following paragraphs.

Number of non-motorised users using crossing

The average number of non-motorised users crossing Middlefield was found to be highest in May 2018 (11,057 compared to 7,854 in November 2017 and 9,703 in November 2018). This is likely due to the temperature and weather conditions being more suited to walking and cycling in May in comparison to November.



The average number of non-motorised users crossing Middlefield in November 2018 (9,703) was found to be 24% greater than the average number crossing in November 2017 (7,854), showing an upward trend

In the AM period there were more pedestrians crossing southbound than northbound, while in the PM period the results show that there were generally more pedestrian movements northbound than southbound.

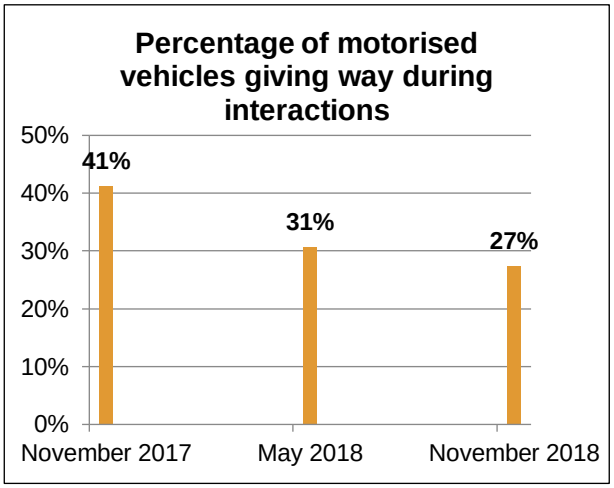
The number of cyclists crossing Middlefield was found to be greater in the PM period across the days that were studied in comparison to the AM period. This is consistent with the findings from the number of cyclists using the cycle tracks adjacent to the bus stop bypasses.

Percentage of motorised vehicles giving way to non-motorised users at continuous footway

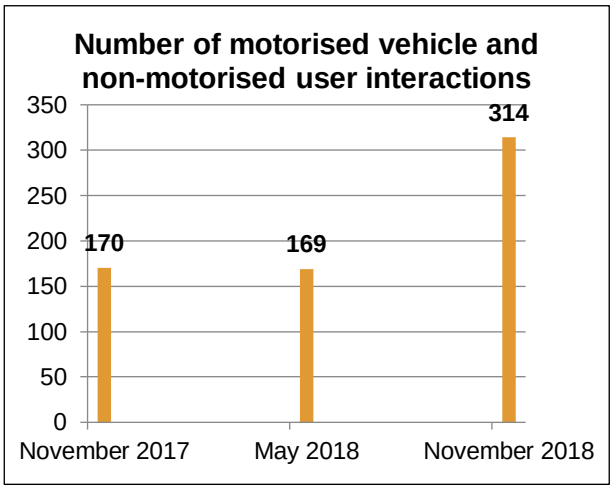
The results show that overall there were slightly more non-motorised users giving way than motorised vehicles across the surveyed days.

On average, non-motorised users gave way to motorised vehicles 59% of the time in November 2017, 69% of the time in May 2018 and 73% of the time in November 2018

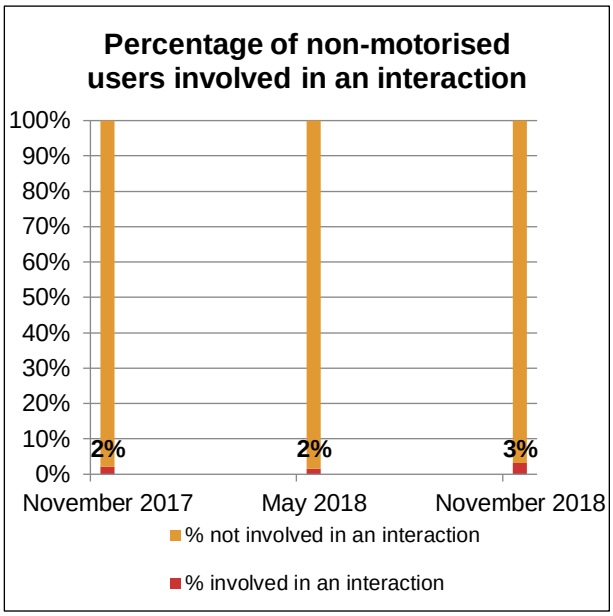
This downward trend of compliance by motor vehicles could indicate that the drivers / riders of vehicles have become familiar with the arrangement in the period since it was introduced and are using it similarly to how they would with a typical junction with a side street.



The total number of interactions between non-motorised users and motorised vehicles was highest in November 2018 (314), with the total number of interactions in November 2017 in May 2018 being broadly similar (170 and 169 respectively).



The average percentage of non-motorised users being involved in an interaction with a motorised vehicle in November 2017 and May 2018 was found to be 2%, while it was 3% in November 2018.



The number of interactions and the percentage of non-motorised users involved in an interaction increased from November 2017 and May 2018 to November 2018

The number of interactions in November 2018 was found to be around 85% greater than in November 2017 and May 2018. This appears to be due to the fact that the number of vehicles entering and exiting Middlefield is highest in November 2018, both on weekdays and at the weekend, and the number of non-motorised users crossing the continuous footway being observed to be high in November 2018. The the total number of non-motorised users crossing was highest in May 2018, followed by November 2018 (November 2018 – 9,320; May 2018 – 10,432; November 2017 – 7,510).

During the analysis it was observed that non-motorised users would be hesitant to cross if a motorised vehicle was turning to enter Middlefield, and occasionally non-motorised users would be waved across by the drivers / riders of motorised vehicles to let them cross.

Design / Operational observations

The key findings that have been detailed indicate that the aims of the design may not be being met. Whilst the number of non-motorised users using the crossing increased between November 2017 and November 2018, the percentage of motorised vehicles giving way to non-motorised users has decreased.

During the site investigations it was noted that the road markings on Middlefield, whilst not continued across the pavement and cycle track, could lead the drivers / riders of motorised vehicles to regard this as a normal road and being unaware that they should give way to non-motorised users.

Further research into people's behaviour and decision making would provide a better understanding to the reasons for non-compliance and perceptions of safety and operation.

It should be noted that changes are currently being made to the road markings on Middlefield and road user behaviour at the continuous footway will be continued to be monitored moving forward.