

Shared Use

Operational Review

2012

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1. Executive Summary

1.1 Introduction

- 1.1.1 Atkins was commissioned as part of a multidisciplinary project team which includes MVA Consultancy, Phil Jones Associates and TRL to carry out evidence based research into the factors which influence the design and operation of segregated and unsegregated pedestrian and cyclist shared use facilities. The research project helped inform the preparation of a new Local Transport Note on shared use routes for pedestrians and cyclists.
- 1.1.2 At the core of this research are user behavioural studies to support an understanding of how pedestrians and cyclists interact on unsegregated and segregated shared use facilities.
- 1.1.3 This technical note presents the findings of research into the factors which affect the operation and quality of shared use facilities adjacent-to-road. An evidence based approach was used to undertake comprehensive case studies in Norwich and Cambridge, supported by additional evidence from Bristol, York, Peterborough and Newcastle.

1.2 Activity and speed

- 1.2.1 During weekday peak periods, pedestrian and cyclist activity profiles on the segregated and unsegregated shared use facilities studied showed activity typical of utility cycling and functional walking, with movement strongly directional to/from urban centres in the morning and evening peak periods respectively. At such times, the vast majority of users are travelling as individuals.
- 1.2.2 At the weekend, there are less well defined peak periods for cyclist and pedestrian activity, and the profiles of both user groups tend to follow similar patterns. More users travel in groups of two or more people than during weekday peak periods. When pedestrians travel in groups, compliance with segregation (where present) is lower than when they travel as individuals, irrespective of activity levels.
- 1.2.3 Pedestrians walking in larger groups tend to lead to a significant proportion of their number walking in the cycle track (on a segregated shared use facility in York, one third of pedestrians walk in the cycle track at the weekend).
- 1.2.4 Segregation by white line was found to be ineffective at supporting full compliance with segregation by pedestrians and cyclists. Based on the data collected in this study, there appears to be a weak inverse relationship between compliance and user flows, in that compliance tends to deteriorate with increasing flows. This relationship appears to be intuitively correct - as flows of pedestrians or cyclists increase, and especially as group sizes increase, people can be expected to use more of the width available. This is likely to be at the expense of compliance with the segregating feature.
- 1.2.5 Findings indicate that average cycle speeds are not significantly faster on segregated routes compared with unsegregated ones. Cycle speeds on segregated routes are likely to be influenced by a combination of factors, including pedestrians walking in the cycle track.

- 1.2.6 Observations indicate that maximum cycle speed decreases as pedestrian flow increases on unsegregated shared use routes. This suggests that cyclists moderate their behaviour in the presence of pedestrians. Maximum cycle speeds were also seen to decrease on segregated routes when pedestrians were present, although to a lesser extent than on unsegregated routes.
- 1.2.7 At some of the locations studied, there were clear differences in cycle speeds between weekday commuting periods and out-of-commuting periods at the weekend, when cyclists tended to travel slower. In general, cycle speed is likely to be influenced by other factors, such as user density on the route and the nature of the route as a corridor for movement or a destination.
- 1.2.8 Some cyclists were observed to cycle on-road rather than use adjacent-to-road (on-highway) shared use routes in Norwich and Cambridge. The decision to cycle on-road is likely to be dependent on many factors which could include journey preferences (such as the importance of journey time or journey ambience), confidence levels and perceived safety. This suggests that adjacent-to-road shared use facilities do not operate as effectively as the equivalent on-road route for some cyclists.

1.3 Route width and capacity

- 1.3.1 On shared use routes, segregating cyclists and pedestrians reduces the width available to each user group. This reduction could have implications for the level of comfort for all users.
- 1.3.2 Level of Service techniques have been developed elsewhere for standardising and measuring pedestrian capacity and level of comfort. In this context, and taking into account the presence of cyclists, the methodology included an assessment of the peaks of pedestrian activity and the amount of usable space available. Platoon Level of Service for pedestrians on each route is categorised on a scale from A (open movement) to F (jammed). To date, this technique has only been developed and standardised for pedestrian movement.
- 1.3.3 In Cambridge the Level of Service for pedestrians on the unsegregated route during the weekday morning peak and weekend peak is B, indicating that it has sufficient capacity for pedestrians but comfort may be affected at busy times or when more than one cyclist is passing.
- 1.3.4 In Norwich the Level of Service for pedestrians on the unsegregated route during the weekday morning peak and weekend peak is A, indicating that it has sufficient capacity at current levels of pedestrian activity.
- 1.3.5 On the segregated routes in Cambridge and Norwich, the Level of Service for pedestrians during the weekday morning and weekend peaks is A, indicating there is sufficient capacity on the footway side of these routes for current activity.
- 1.3.6 Equivalent techniques to measure the Level of Service of cyclists have not been developed for the UK. Cyclist Level of Service is likely to be influenced by range of factors that could include journey time.

1.4 Observed interaction and perceived behaviour

- 1.4.1 This assessment considered shared use environments only, and did not take into account interaction between pedestrians or cyclists and other vehicles. It should be noted that adjacent-to-carriageway facilities can introduce new “junctions” and crossing

points (e.g. across side roads) for cyclists, which can lead to increased interaction and potential for conflict with motor vehicles, but this was outside the scope of the research.

- 1.4.2 Using categories of user interaction based on empirical analysis in the Norwich and Cambridge case studies, the difference in the potential for conflict on segregated and unsegregated routes was found to be minimal.
- 1.4.3 The project involved on-site interviews with pedestrians and cyclists in Norwich and Cambridge. Both groups were generally comfortable using the segregated and unsegregated routes studied.
- 1.4.4 Behaviour by both pedestrians and cyclists on segregated and unsegregated routes was judged to be considerate by both user groups. Agreement was strongest on unsegregated routes, suggesting that behaviour is more considerate on these routes, where the requirement to interact with other types of user is clearer.
- 1.4.5 Despite perceived non-compliance with segregation by both pedestrians and cyclists on weekdays and weekends, both groups were comfortable on the segregated route in Cambridge. In Norwich, perceived user comfort on the segregated shared use facility was lower than on the unsegregated facility.
- 1.4.6 Of the people interviewed, cyclists generally used the shared use routes more regularly than pedestrians. In Cambridge low lighting levels affected use by both pedestrians and cyclists at certain times of the day. In Norwich the impact of low levels of lighting affected pedestrians more than cyclists.
- 1.4.7 No collisions, and no conflict of any significance took place during the video surveys. Most of the interaction recorded was relatively inconsequential, where one or more users adjusted their speed/position. The most severe category of interaction observed was that of marginal conflict, where cyclists or pedestrians slowed down or changed direction but movement was calm and controlled.
- 1.4.8 Only 5 instances of marginal conflict were recorded and they took place on the two unsegregated routes. However, both these of routes were relatively narrow at 2.2m (the two segregated routes were 3m and 4m wide). Limited width increases the need for users to make allowances for other users, and it would be reasonable to expect that the level of interaction would reduce with increasing width. Regardless of this, the incidents recorded were relatively benign in nature.
- 1.4.9 In Cambridge, two people (4% of sample) said they had experienced a collision on the segregated route, and two people using the unsegregated route (3% of sample) said likewise. In Norwich, three people (3%) said they had experienced a collision on the segregated route - there were no reports of collisions on the unsegregated route. The findings suggest that there is no material difference in levels of collisions regardless of segregation.

1.5 Summary

- 1.5.1 No collisions, and no conflict of any significance were observed during the study period. The vast majority of cases of interaction observed were relatively inconsequential and only 5 cases of marginal conflict were recorded, with these exclusively being instances of users adjusting to one-another's presence.
- 1.5.2 The findings of this project suggest that collisions are no more likely on unsegregated routes than segregated ones, while the need to interact with other users is likely to

increase. However, the data also suggest that where there is sufficient route capacity to provide a good level of service, conflict is less likely to be an issue, regardless of whether the route is segregated (by white line) or not.

- 1.5.3 As such, it is reasonable to conclude that where capacity is adequate, the difference in the potential for conflict on segregated and unsegregated routes is likely to be minimal.

2. Introduction

- 2.1.1 Atkins was commissioned as part of a multidisciplinary project team which includes MVA Consultancy, Phil Jones Associates and TRL to carry out evidence based research into the factors which influence the design and operation of segregated and unsegregated pedestrian and cyclist shared use facilities. The research project helped inform the preparation of a new Local Transport Note on shared use routes for pedestrians and cyclists.
- 2.1.2 At the core of this research are user behavioural studies to support an understanding of how pedestrians and cyclists interact on unsegregated and segregated shared use facilities.
- 2.1.3 This technical note presents the findings of research into the factors which affect the operation and quality of shared use facilities adjacent-to-road. An evidence based approach was used to undertake comprehensive case studies in Norwich and Cambridge, supported by additional evidence from Bristol, York, Peterborough and Newcastle.
- 2.1.4 The technical note is structured as follows:
- Chapter 3: Our Approach
 - Chapter 4: Case Study: Cambridge
 - Chapter 5: Case Study: Norwich
 - Chapter 6: Support Site: Bristol
 - Chapter 7: Support Site: Newcastle
 - Chapter 8: Support Site: Peterborough
 - Chapter 9: Support Site: York
 - Chapter 10: Summary of key findings
 - Appendix A: Questionnaire
 - Appendix B: Interaction study descriptions: Norwich
 - Appendix C: Interaction study descriptions: Cambridge
 - Appendix D: Pedestrian Level of Service

3. Our Approach

3.1.1 Data collection, analysis and interpretation for this project were undertaken for four shared use case study sites, all of which were adjacent-to-road. Data has been undertaken at:

- Two sites in Cambridge, one of which was segregated
- Two sites in Norwich, one of which was segregated

3.1.2 Additional data was collected at segregated shared use facilities in Bristol, York, Newcastle and Peterborough to provide support evidence for comprehensive analysis in Cambridge and Norwich.

3.2 Case Study Methodology (Cambridge and Norwich)

3.2.1 **Design Characteristics** were recorded on-site at each facility according to a number of criteria, including:

- Width
- Gradient
- Crossfall
- Bounding
- Surface
- Alignment, sightlines and visibility

3.2.2 **Pedestrian and cycle activity** was assessed using video recordings made at each survey location. Flow data was captured for the peak three-hour weekday morning period and peak weekend period. Data collected included:

- Pedestrian and cyclist directional time profiles
- Pedestrian and cyclists compliance with segregation (if present)
- Cyclist activity on the shared use facility relative to cyclist activity on-road (if applicable)

3.2.3 **An assessment of cycle speeds** was undertaken by capturing a sample of cyclists on video. Speeds were calculated by recording the time taken to pass through sections of known length. By recording the number of users within the same study area on the route, cycle speeds were compared with user density.

3.2.4 **An interaction study of pedestrian and cyclist behaviour** was undertaken using videos recorded during peak periods, and following an evidence-based, empirical approach. The types of interaction between cyclists and pedestrians were categorised according to their effect. This methodology has been used in previous interaction studies on shared use routes. In this method, the interaction assessment technique is based on that used in a TRL conflict study with a few alterations. The TRL study “Behaviour at Cycle Advance Stop Lines” (carried out in 2002) used five categories to classify interactions:

- Precautionary braking/lane change,

- Controlled braking/lane change,
 - Rapid deceleration/lane change resulting in a near miss,
 - Emergency braking/violent swerve resulting in a near miss,
 - Emergency action followed by collision.
- 3.2.5 Some of the categories were considered to overlap for the purposes of this research and the least severe category, "Precautionary braking/lane change" did not capture lesser interactions. Given this, and the difficulty in consistently determining the degree of interaction by video analysis, four broad categories were established:
- Minor interaction; arising when one or more users adjust their speed/position to allow others to pass,
 - Marginal conflict; unplanned interaction where cyclist/pedestrian slow down or change direction to allow for other users, but movement is calm and controlled,
 - Conflict; arising from unexpected interaction (e.g. cyclist/pedestrian has to take emergency action to avoid contact),
 - Collision.
- 3.2.6 Interaction events were categorised subjectively. It was considered preferable to assess observed behaviour and judge user interactions in this way rather than define them using only an external quantitative measure, in order to capture the wider context and specific details of each interaction.
- 3.2.7 On unsegregated shared use routes, cyclists tended to weave around pedestrians, making frequent adjustments to their speed and direction as they went. This general interaction between cyclists and pedestrians is generally not identified as hazardous.
- 3.2.8 **A user perception study** was undertaken by carrying out on-site questionnaire surveys at the same locations as video data collection, with an option for respondents to provide a postal response in order to improve the response rate. Key questions were based on:
- Perceived quality of the pedestrian/cyclist environment
 - Perceived comfort
- 3.2.9 The results of this survey provide a qualitative assessment of the perceptions of users on existing shared use facilities.

3.3 Support Evidence Methodology

- 3.3.1 On-site data collection and interpretation were undertaken at an additional four segregated shared use facilities across the UK (Bristol, Newcastle, Peterborough and York) to provide support evidence for trends emerging from the comprehensive assessments of the Norwich and Cambridge case studies.
- 3.3.2 Pedestrian and cyclist activity (including compliance) was recorded over the same time periods as used in Norwich and Cambridge.. The level of cycling on the road was also recorded.
- 3.3.3 A representative sample of cycle speeds on the shared use facility was recorded.

4. Case Study: Cambridge

4.1 Locations

- 4.1.1 Two locations in Cambridge were assessed, both located less than a mile to the south west of the city.
- 4.1.2 The following images show the camera views for the locations used to record activity at each site:



Figure 1 – Unsegregated route alongside the Fen Causeway (Left: link section and Right: junction with route through park)



Figure 2 – Segregated route on Barton Road (Left: link section and Right: junction on Barton Road)

4.2 Survey Details

4.2.1 The following table outlines details for all surveys undertaken at the Cambridge Sites:

	Weekday Survey	Weekend Survey
Date	Friday 20/11/2009	Saturday 21/11/2009
Times	07:00-10:00; 16:00-19:00	11:00-18:00
Locations	One Segregated route One Unsegregated route	
Weather	Overcast	Overcast
Flow Survey Frequency	Every half an hour	
Flow Survey Duration	15 minute sample for full profile, full hour at peak times	
Flow Survey Method	Video recording	
Total Questionnaires Received	101	43
Questionnaires Completed on site	62	41
Postal Questionnaires handed out	217	103
Received by Post	39	2
Postal Response Rate	18%	2%

Figure 3 – Survey details

4.2.2 The low number of responses received by post (particularly at the weekend) is such that response bias cannot be ruled out

4.3 Design Characteristics

4.3.1 Barton Road (Segregated Route)

Category	Description
Route context	Barton Road, link section preceding intersection with Newnham Road. A main road in a suburb of Cambridge.
Shared Use type	Segregated shared use, with two way cycle track segregated from the footway by white line.
Approximate width	Footway 1.5m, cycle track 1.5m
Crossfall on a typical section	Negligible.
Bounding	Roadside bounded with kerblin. Inner edge bounded by mature beech hedge approximately 2m high. Hedge suitably maintained at time of assessment, but could affect the operation of the route if not consistently properly maintained
Surface	Tarmac in good condition.
Gradient	Level along length of route.
Sightlines	Very clear, linear route with no obstructions to visibility.
Maintenance	Well maintained clear route with no debris present.
Key Land uses	Cambridge University halls of residence and college buildings located within walking/cycling distance to route.
Comments	None

Figure 4 – Design Characteristic Assessment



Figure 5 – (Left) Cyclist in segregated cycle track, and (Right) detail of segregation on Barton Road.

4.3.2 The Fen Causeway (Unsegregated Route)

Category	Description
Route context	The Fen Causeway, link section. A heavily trafficked A road, leading into Cambridge town centre.
Shared Use type	Unsegregated.
Approximate width	Total width 2.2m. This is narrow, though should potentially allow one pedestrian and one cyclist to pass comfortably.
Crossfall on a typical section	0.45%
Bounding	Roadside bounded with kerbline. Inner edge bounded by mature beech hedge approximately 2m high.
Surface	Tarmac in good condition.
Gradient	Level along length of route.
Sightlines	Very clear, linear route with no obstructions to visibility.
Maintenance	Well maintained clear route with no debris present.
Key Land uses	Cambridge University halls of residence and college buildings located within walking/cycling distance to route.
Comments	None

Figure 6 – Design Characteristic Assessment



Figure 7 – (Left) Detail of route bounding, and (Right) shared use designation on The Fen Causeway.

4.4 Pedestrian and Cyclist Activity

4.4.1 Weekday Activity: Unsegregated Route

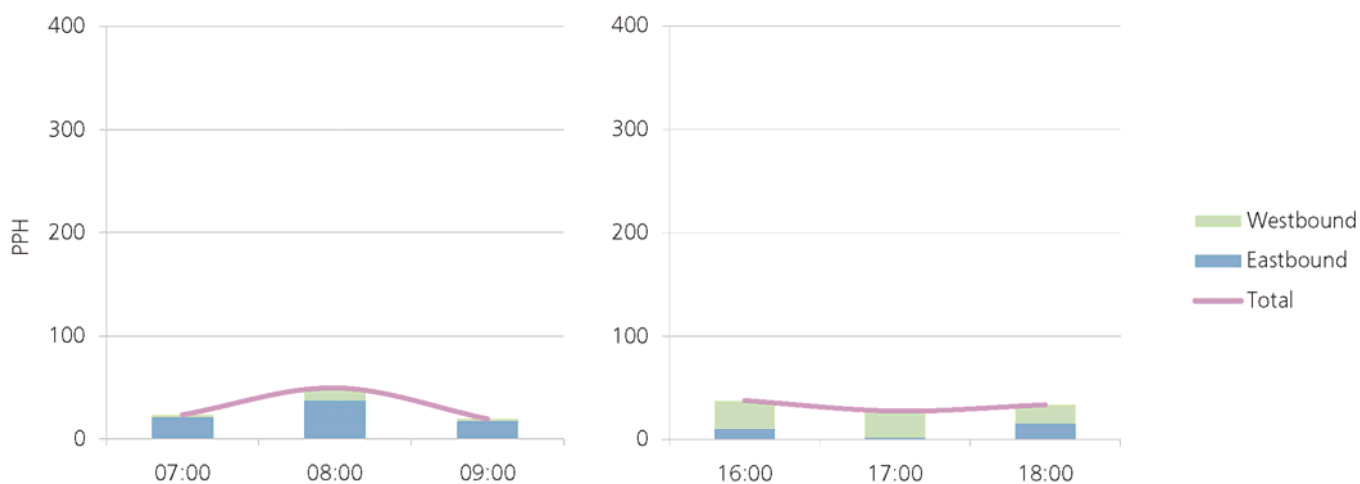


Figure 10 - Pedestrian Activity (Weekday)

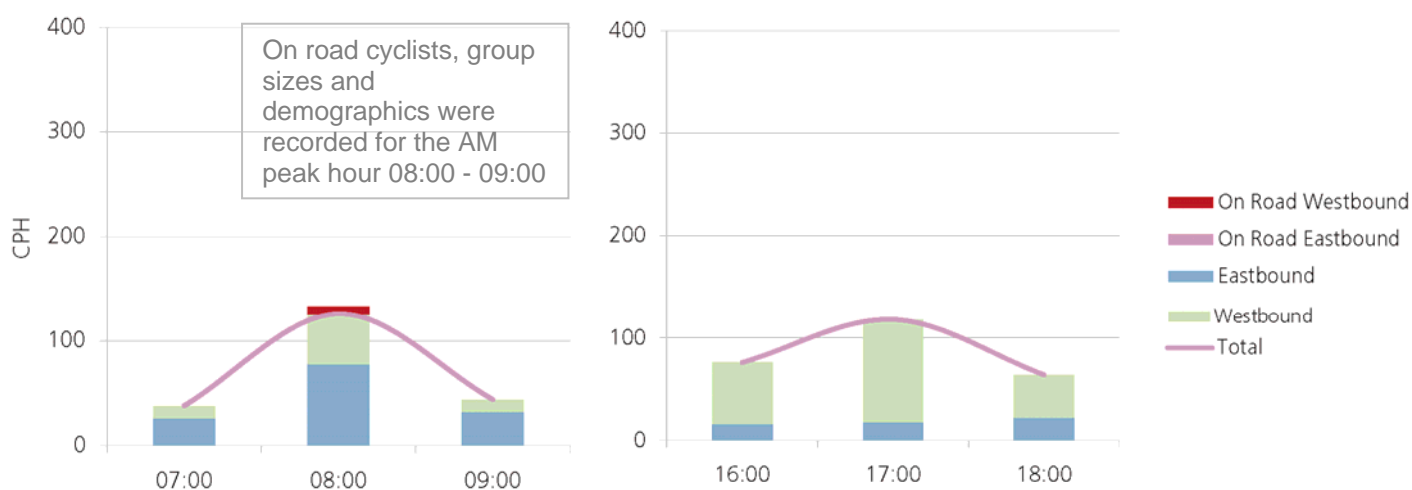


Figure 10 - Cyclist Activity (Weekday)

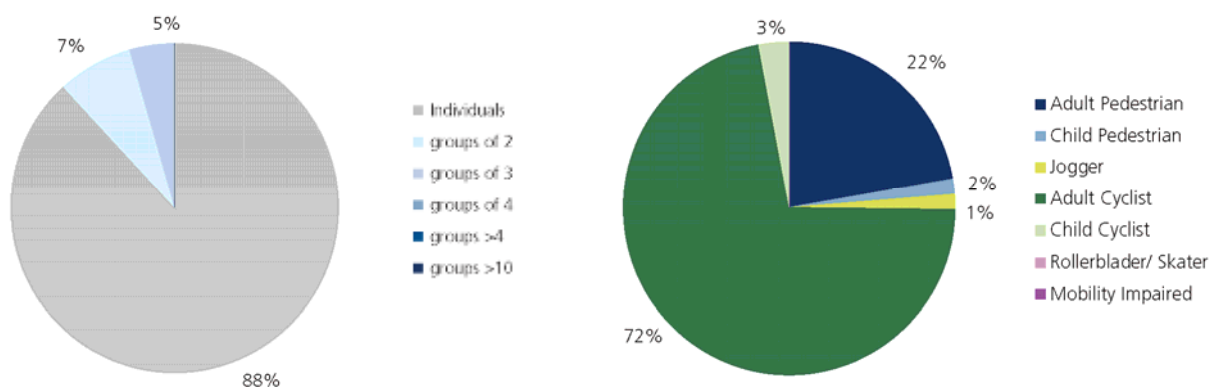


Figure 10 - Group Size and Demographics Activity (Weekday 08:00 - 09:00)

4.4.2 Weekend Activity: Unsegregated Route

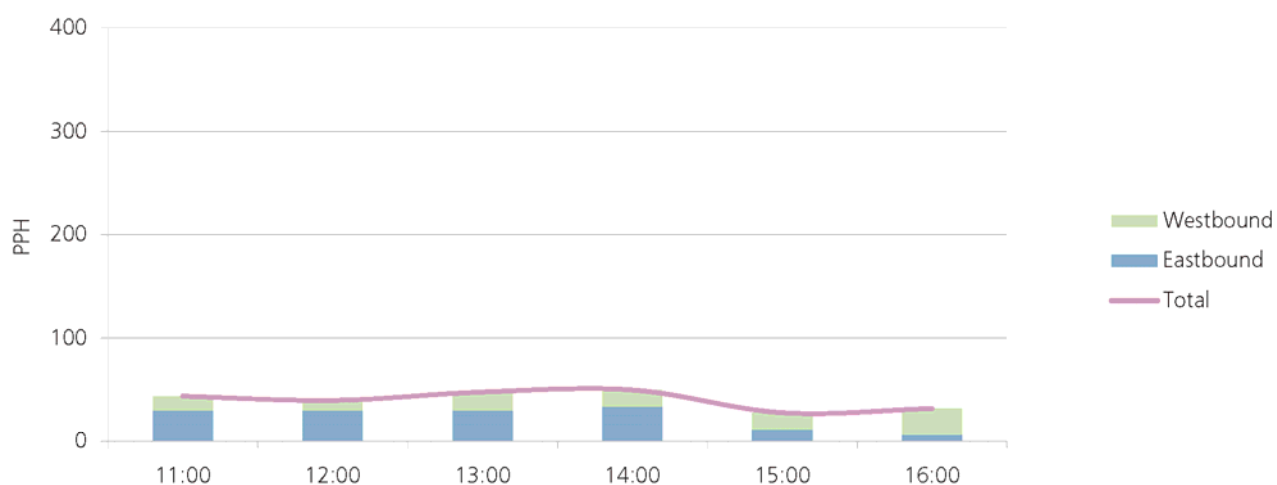


Figure 13 - Pedestrian Activity (Weekend)

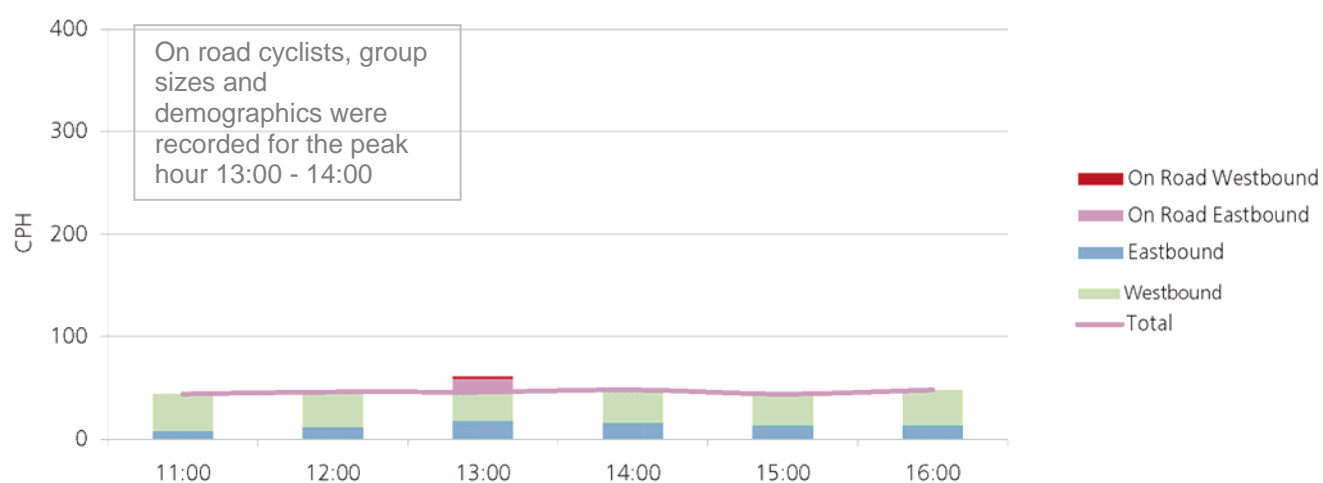


Figure 13 - Cyclist Activity (Weekend)

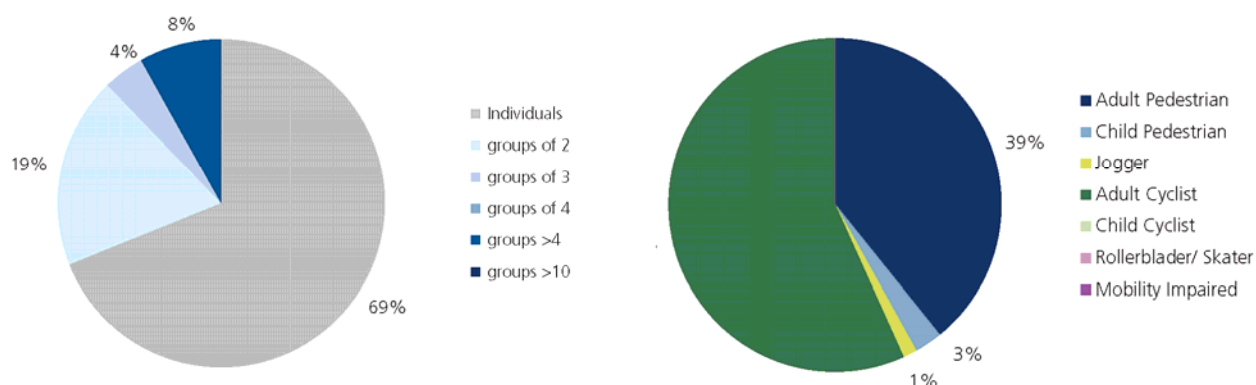
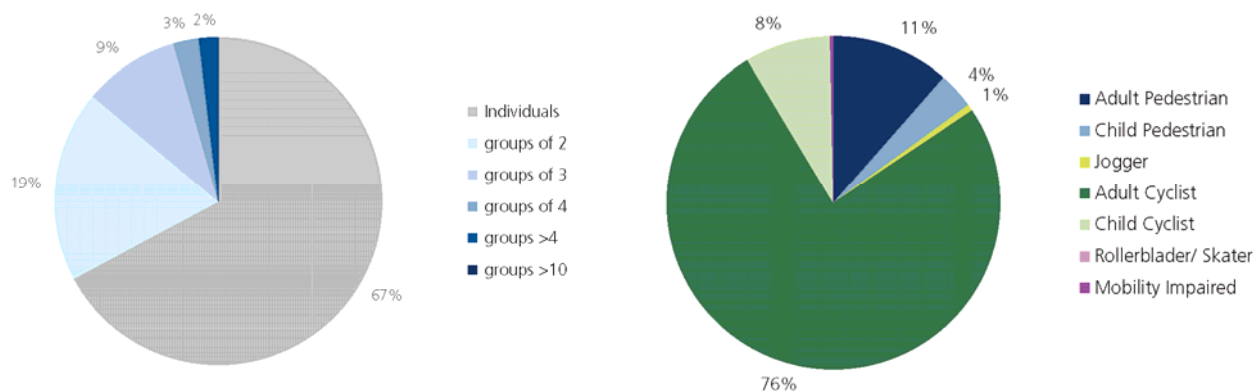
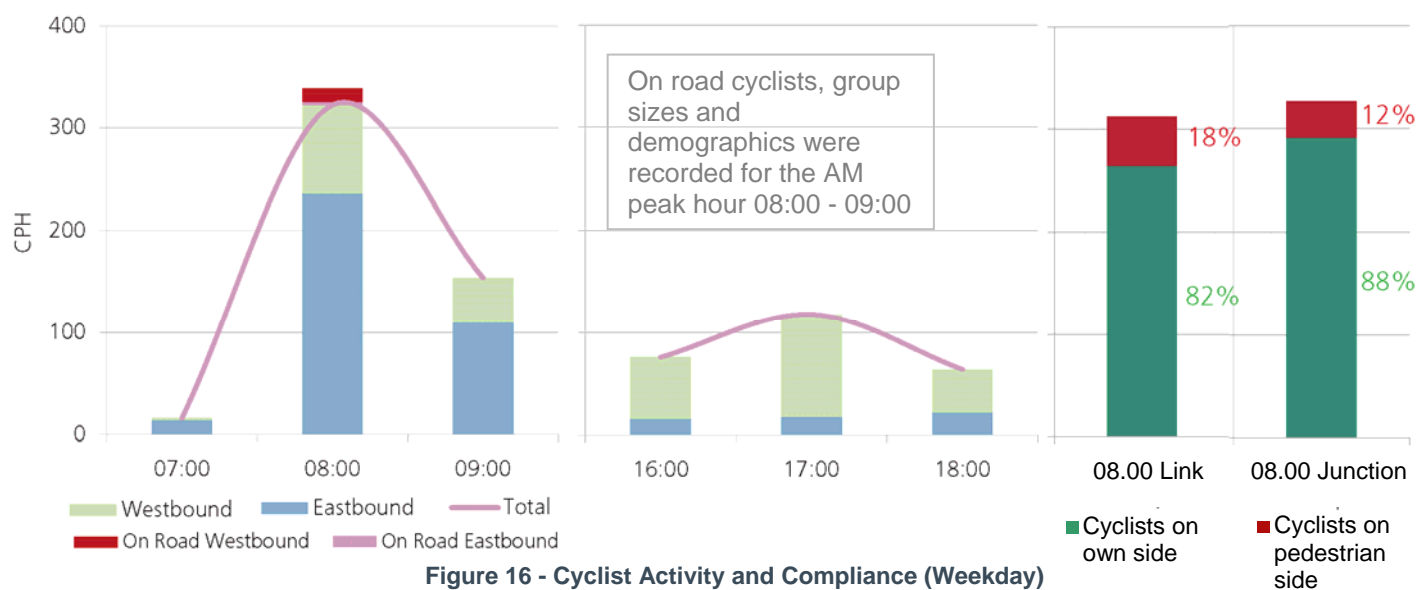
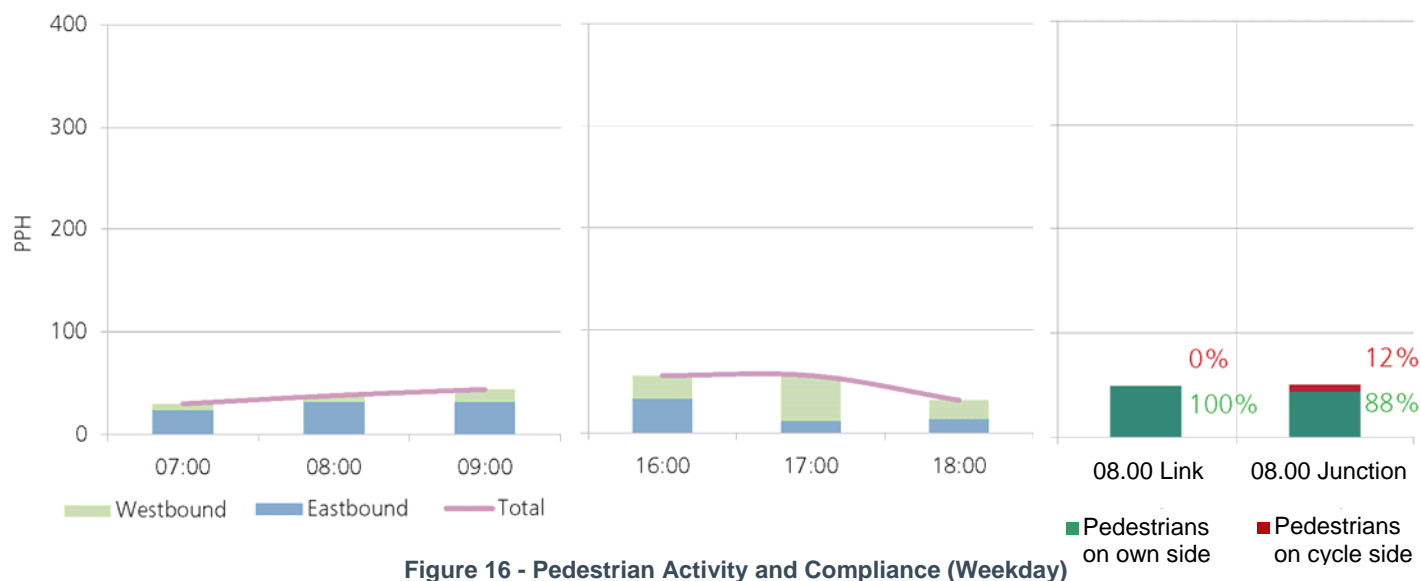


Figure 13 - Group Size and Demographics Activity (Weekend 13:00 - 14:00)

4.4.3 Weekday Activity: Segregated Route



4.4.4 Weekend Activity: Segregated Route

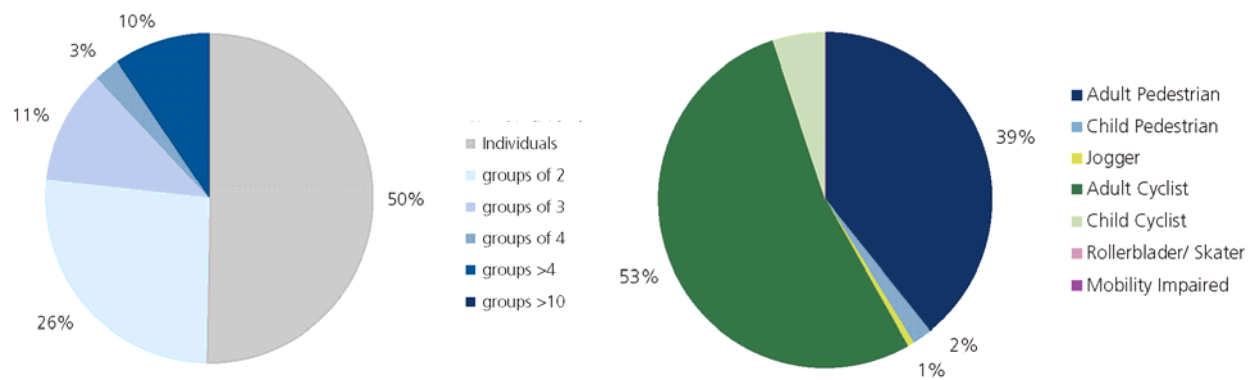
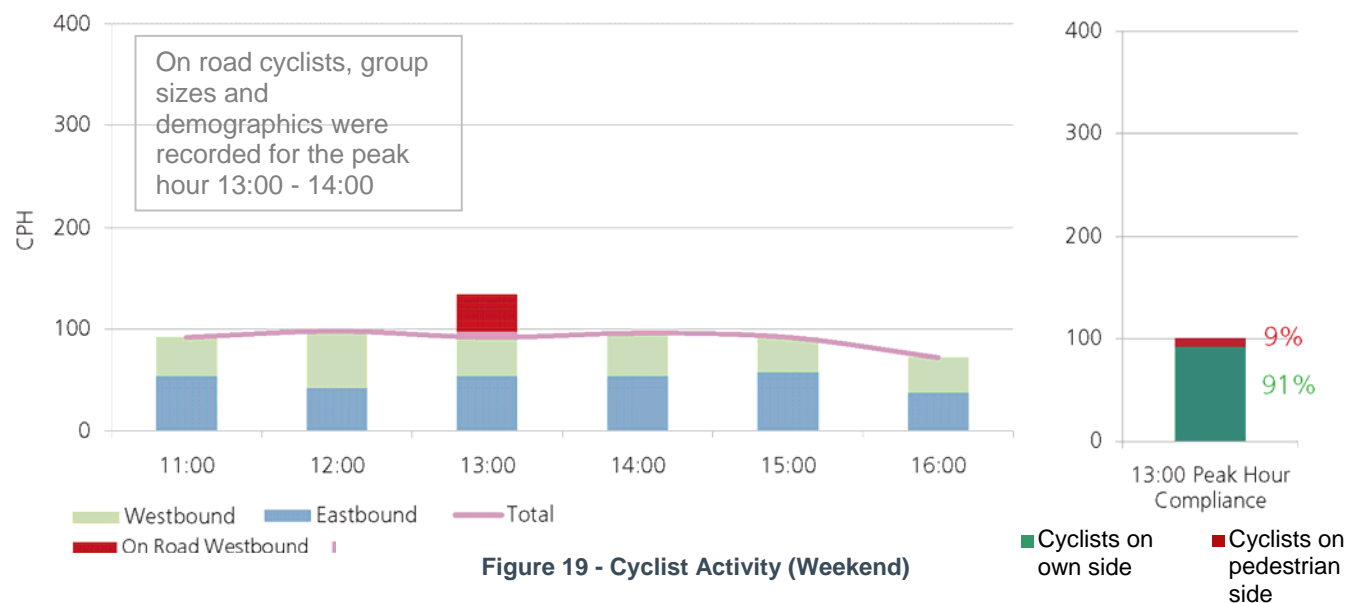
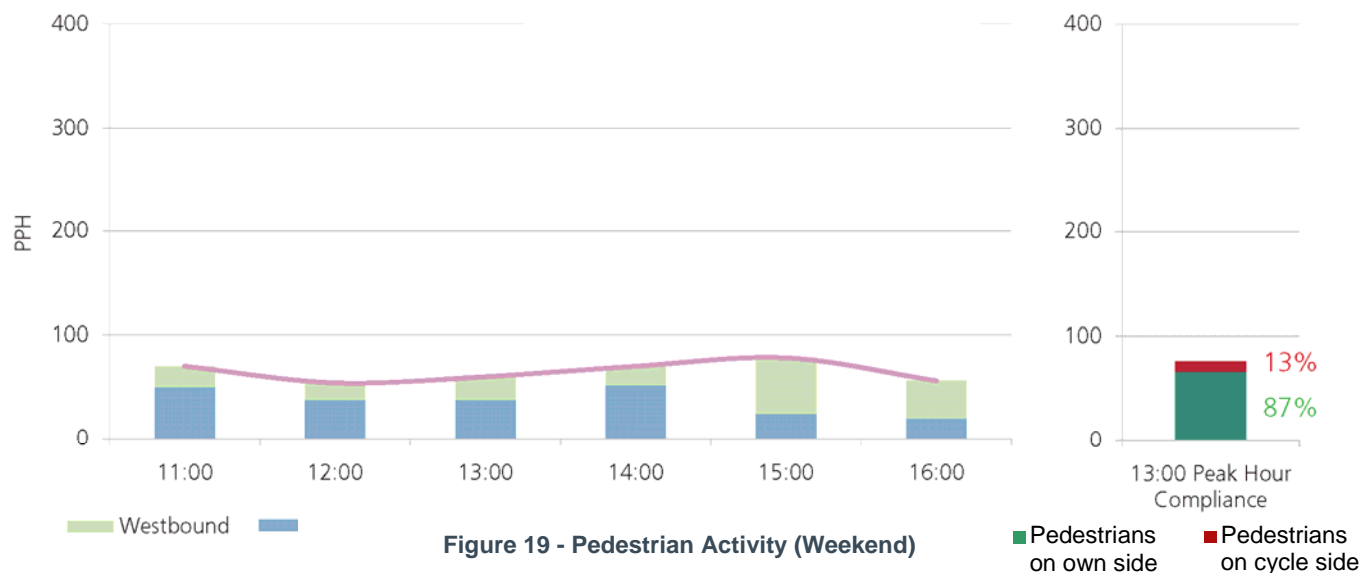
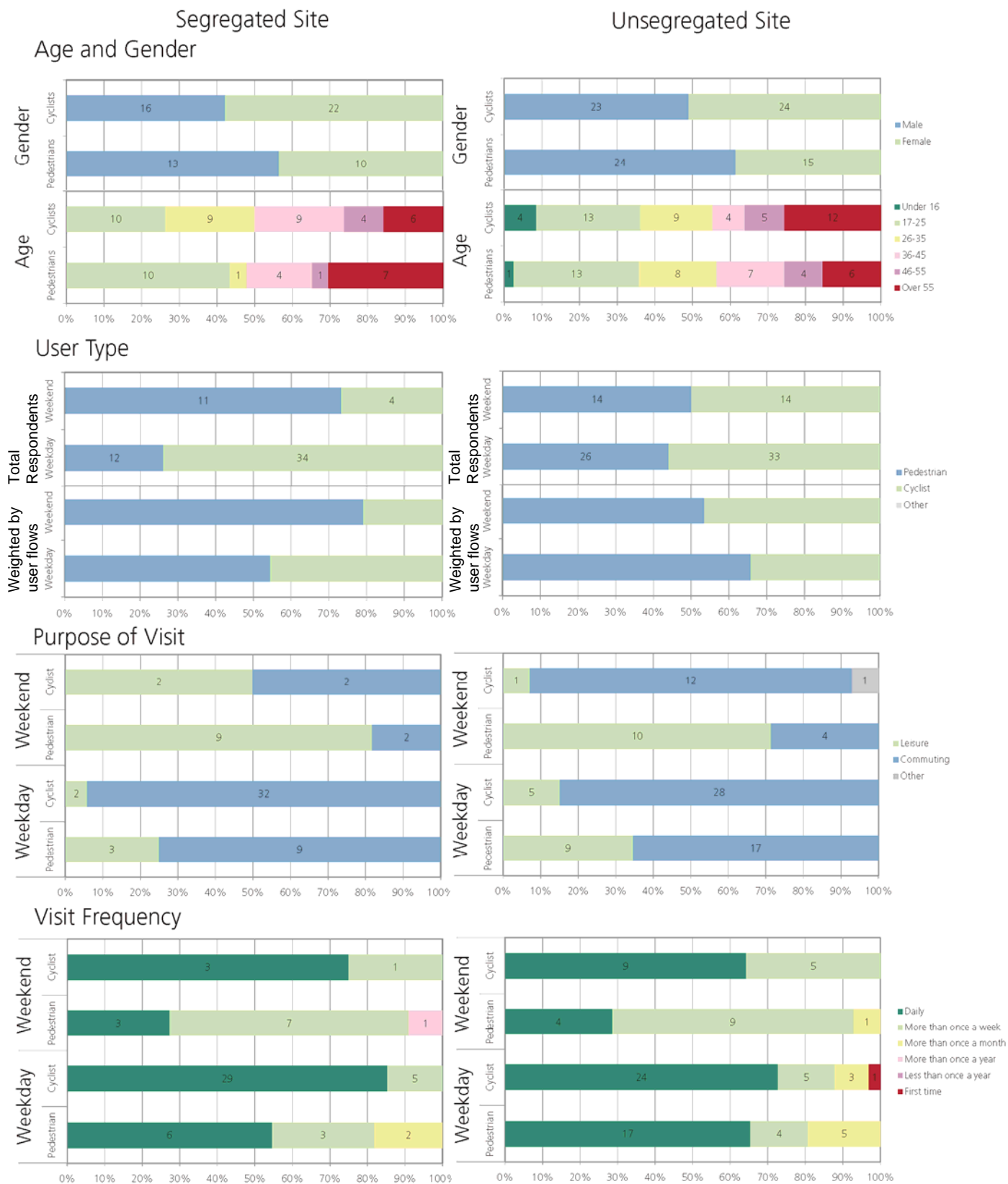


Figure 19 – Group Size and Demographics Activity (Weekend 13:00 – 14:00)

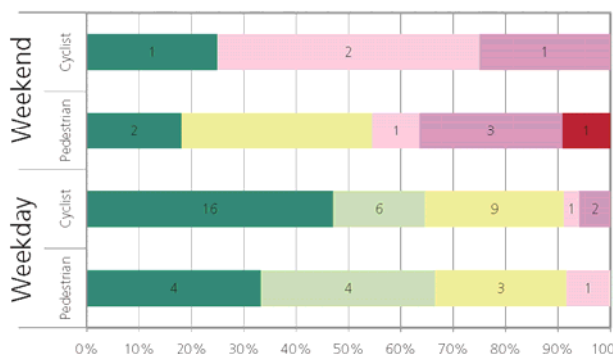
4.5 User Perceptions

4.5.1 Cambridge Questionnaire Results: User Demographics

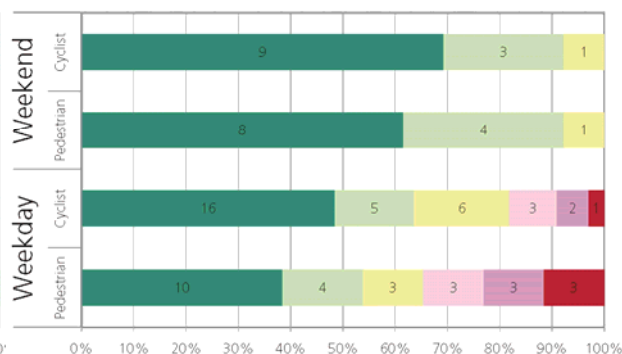


4.5.2 Cambridge Questionnaire Results: User Demographics

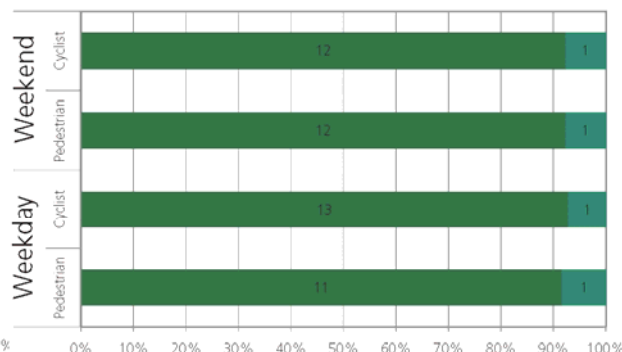
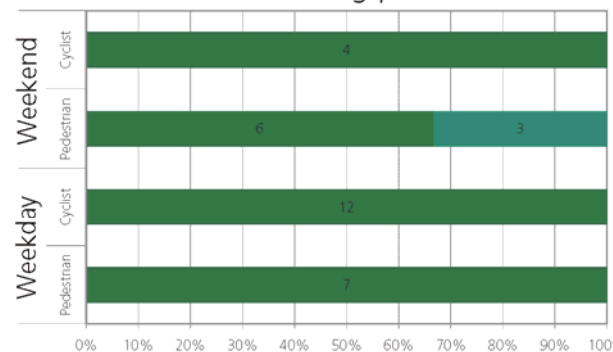
Segregated Site
Journey time to reach path



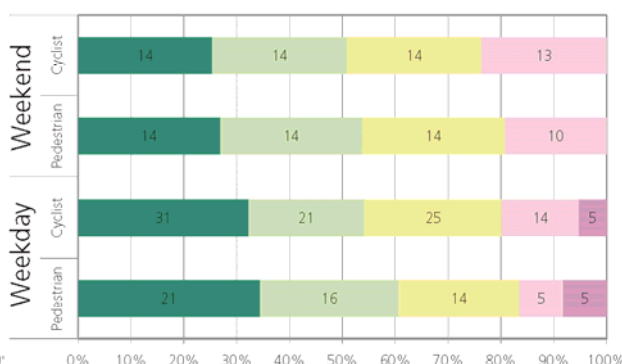
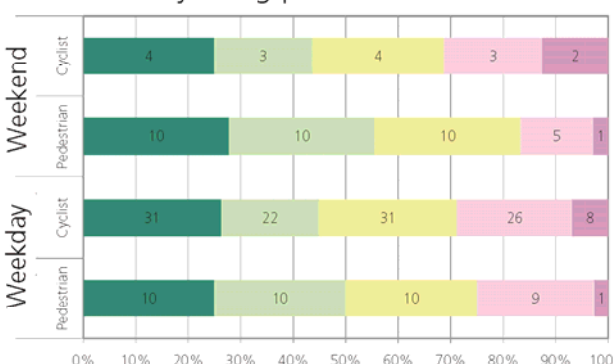
Unsegregated Site



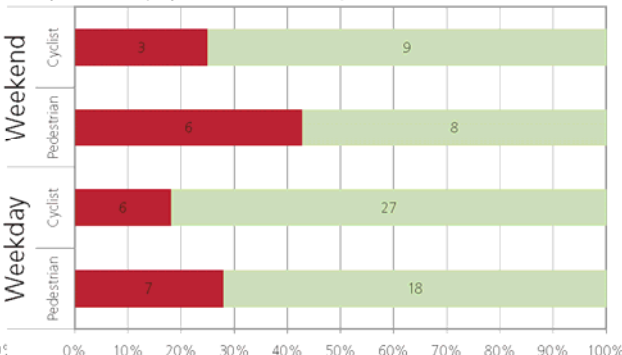
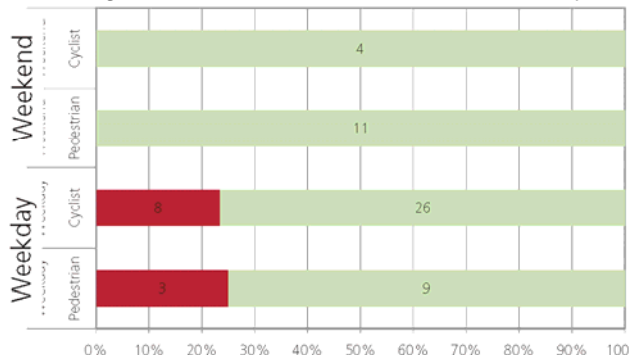
Intended travel time along path



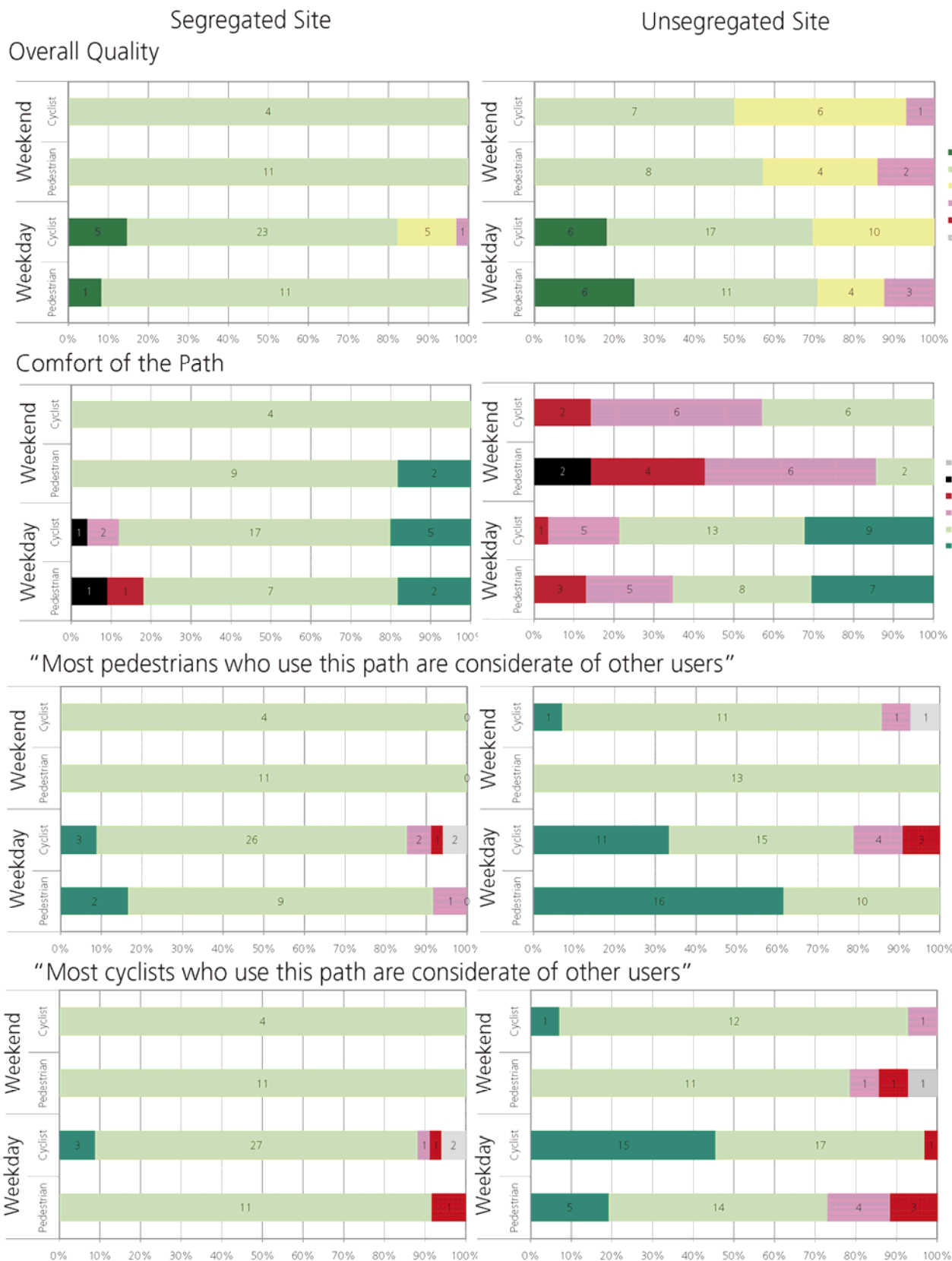
Times of day using path



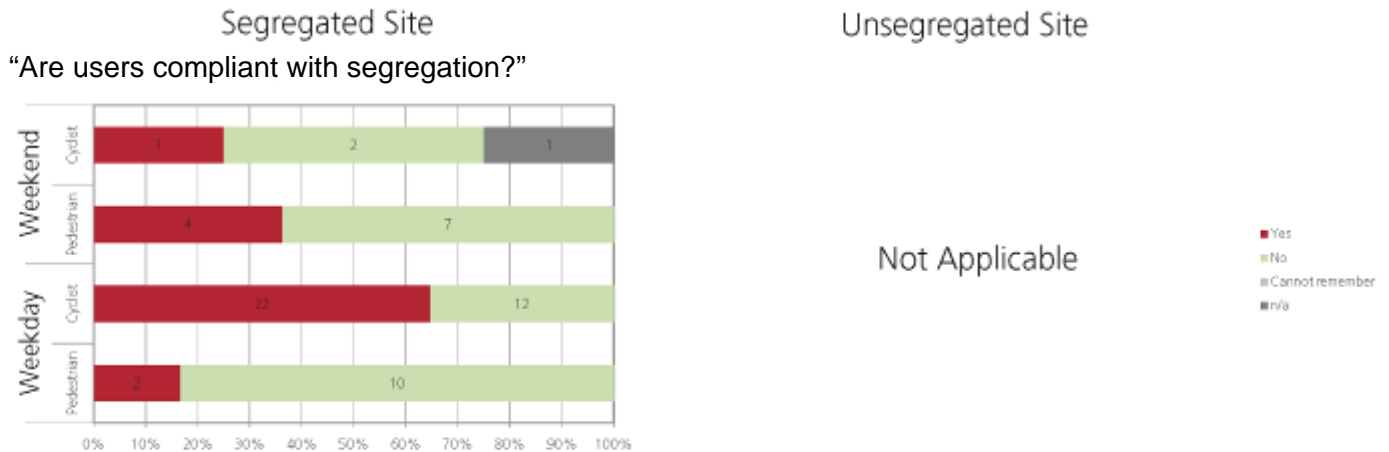
Do light levels at different times of the day affect your enjoyment of the path?



4.5.3 Cambridge Questionnaire Results: Quality and Comfort of the Route



4.5.4 Cambridge Questionnaire Results: Compliance



- 4.5.5 There was strong agreement by both pedestrians and cyclists that people are more considerate of others on the unsegregated route than on the segregated facility. This contrasts with lower levels of perceived comfort for the unsegregated route, suggesting that other factors influence user comfort.
- 4.5.6 There was a strong perception that many users do not comply with segregation, although this did not noticeably affect the perception of user comfort on the segregated facility.
- 4.5.7 One respondent to the Cambridge surveys noted that they have a mobility impairment. The respondent was using the segregated route and stated that they were comfortable with the shared use design and made no further comments.

4.6 Cyclist Speeds

- 4.6.1 The figure below shows an assessment of cycle speeds at the two locations in Cambridge. The results show that higher cycle speeds were observed on the unsegregated facility, where speeds were recorded along a straight section. Cycle speeds on the segregated facility were recorded nearer a junction and this may have had an effect on cycle speeds, which are likely to be lower due to the proximity to the junction. In this respect, it is worth comparing these results with those recorded in the Norwich case studies (see para 5.6.1).

	Weekday		Weekend	
	Segregated	Unsegregated	Segregated	Unsegregated
Maximum Speed (mph)	15.6	17.0	15.3	18.5
Minimum Speed (mph)	4.8	8.3	8.9	8.6
Average (mean) Speed (mph)	9.7	11.6	11.7	14.5
Median Speed (mph)	8.8	11.3	11.5	14.5
Standard Deviation +	12.5	14.0	13.4	17.2
Standard Deviation -	6.9	9.2	10.0	11.8

Figure 20 – Cycle speed summary

- 4.6.2 Figures 21 and 22 show how user density on the segregated and unsegregated facilities affected cycle speed. The findings suggest that cycle speeds on the segregated shared use facility are not significantly affected by user density. On the unsegregated facility, maximum cycle speeds decreased with small increases in user density, though there was insufficient activity on the route to assess how this trend is affected by a larger range of user densities.

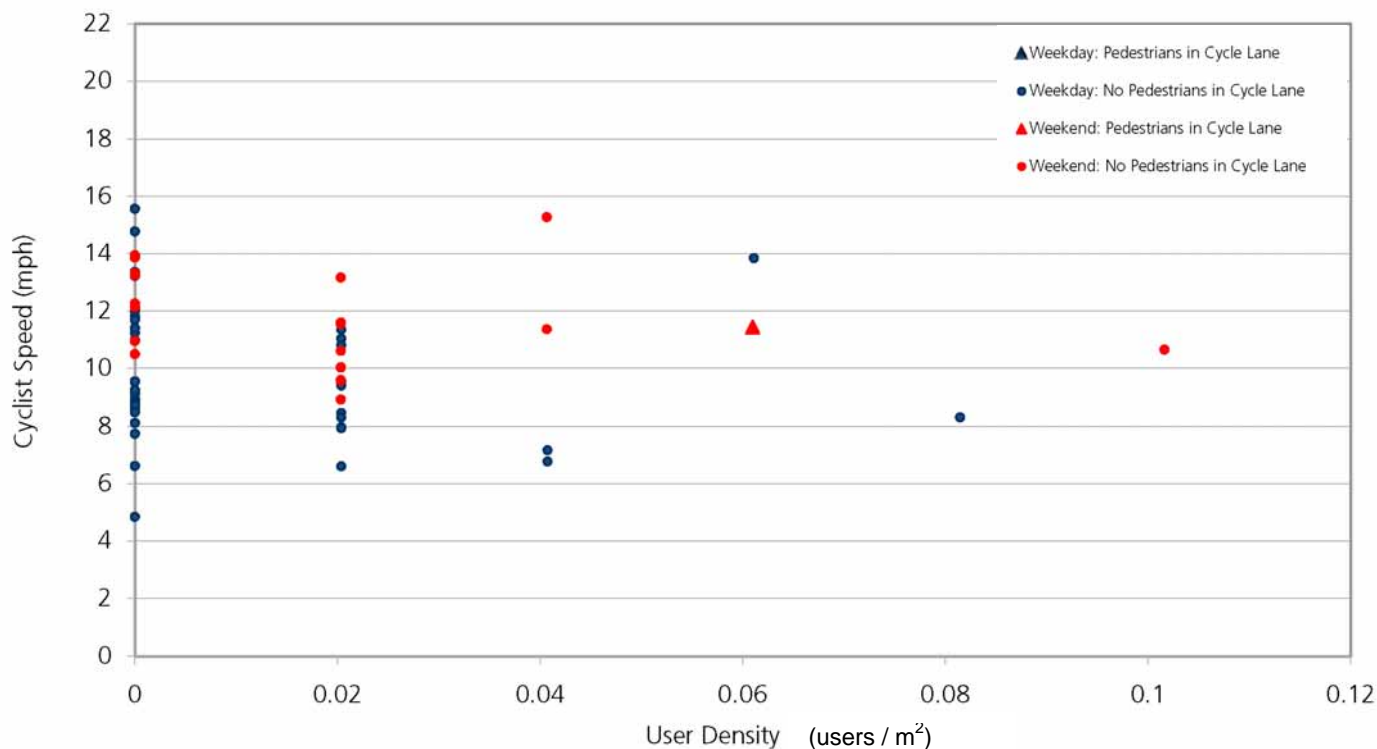


Figure 21 – Cyclist speed and user density chart (segregated site)

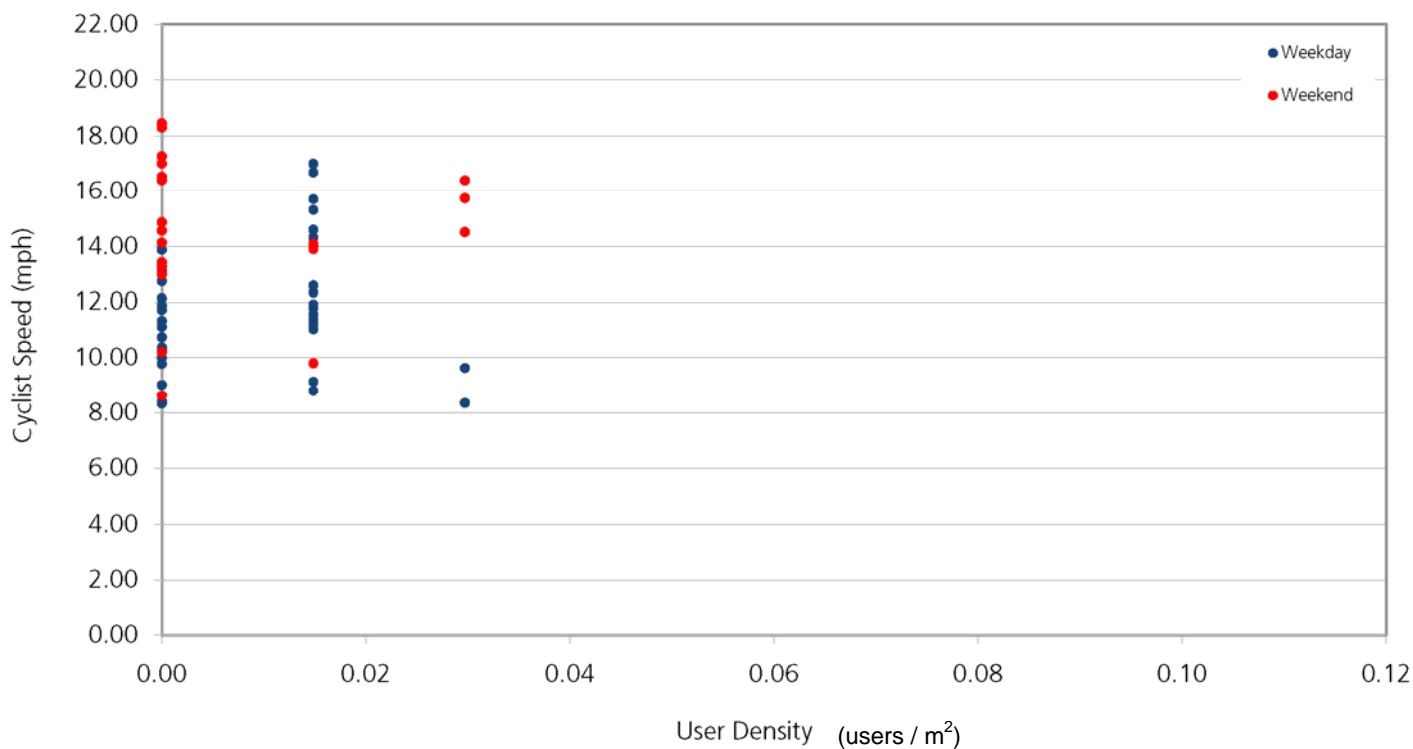


Figure 22 – Cyclist speed and user density chart (unsegregated site)

4.7 Interactions

- 4.7.1 Figure 23 shows a summary of the types of interaction observed in Cambridge.
- 4.7.2 No collisions, and no conflict of any significance was observed on either facility. Many instances of minor interaction recorded on the unsegregated facility were primarily due to the limited width (2.2m), which is unlikely to allow two pedestrians and one cyclist to pass comfortably. The segregated route by comparison is significantly wider (3.0m), and many instances of minor interaction were primarily due to pedestrians walking in the cycle track.
- 4.7.3 A full list of the observations is shown in the appendices.

Figure 23 – Interaction summary

Cambridge sites		Fen Causeway Unsegregated		Barton Road Segregated
		Link	Junction	Link
Weekday 8.00 - 9.00	Pedestrians per hour	50	50	38
	Cyclists per hour	126	126	322
	Minor interaction	1	2	0
	Marginal conflict	1	1	0
	Conflict	0	0	0
	Collision	0	0	0
Weekend 13.00 - 14.00	Pedestrians per hour	48	48	60
	Cyclists per hour	46	46	92
	Minor interaction	3	2	4
	Marginal conflict	1	0	0
	Conflict	0	0	0
	Collision	0	0	0

5. Case Study: Norwich Shared Use Routes

5.1 Location

- 5.1.1 The two routes assessed in Norwich are near the University of East Anglia and located about 2 miles west of the city centre.
- 5.1.2 The following images show the camera views for the locations used to record activity at each site:



Figure 24 – Unsegregated route alongside Bluebell Road (Left: Link and Right: Junction)



Figure 25 – Segregated route alongside The Avenue

5.2 Survey Details

5.2.1 The following table outlines details for all surveys undertaken at the Norwich Sites:

	Weekday Survey	Weekend Survey
Date	Friday 20/11/2009	Saturday 21/11/2009
Times	07:00-10:00; 16:00-19:00	11:00-18:00
Locations	One Segregated route One Unsegregated route	
Weather	Overcast	Overcast
Flow Survey Frequency	Every half an hour	
Flow Survey Duration	15 minute sample for full profile, full hour at peak times	
Flow Survey Method	Video recording	
Total Questionnaires Received	88	61
Questionnaires Completed on site	81	56
Postal Questionnaires handed out	176	105
Received by Post	7	5
Postal Response Rate	4%	5%

Figure 26 – Survey details

5.2.2 The low number of responses received by post is such that response bias cannot be ruled out

5.3 Design Characteristics

5.3.1 The Avenues (Segregated Route)

Category	Description
Route context	The Avenues (section between George Borrow Road and Bluebell Road) is a wide road approximately 500m long in a residential suburb of Norwich.
Shared Use type	Segregated shared use on the northern side only, with two way cycle track segregated from pedestrian-only side by white line.
Approximate width	Total width of 4m of which approximately 1.8m is designated as cycle track. Approximately 4m wide grass verge between cycle track and road, Usable pedestrian space of around 1.6m due to overhanging planting.
Crossfall on a typical section	Negligible.
Bounding	Grass verge with mature trees roadside. Inner side bounded by residential fences and gardens with established planting.
Surface	Pedestrian side surfaced with concrete paviours in satisfactory condition. Cycle track is Tarmac in satisfactory condition.
Gradient	Overall significant gradient. Some local undulation in surface also.
Sightlines	Clear, linear route with no obstructions to visibility.
Maintenance	Some leaf-fall from adjacent trees remaining on route.
Key Land uses	University of East Anglia campus and halls of residence located within walking/cycling distance to route.
Comments	Cyclists also make use of the road.

Figure 27 – Design Characteristic Assessment



Figure 28 – (Left) Cyclists appearing to be passing at less clearance than they would like in the cycle track; leaf debris reducing usable width on The Avenues. (Right) Modal separation.

5.3.2 Bluebell Road (Unsegregated Route)

Category	Description
Route context	Bluebell Road, opposite intersection with Salter Avenue. A main road in a residential suburb of Norwich.
Shared Use type	Unsegregated shared use on eastern side.
Approximate width	Total width 2.2m. This is narrow, though should potentially allow one pedestrian and one cyclist to pass comfortably.
Crossfall on a typical section	Negligible.
Bounding	Roadside grass verge of 1.6m with raised wooden barrier in places. Inner edge bounded by grass verge of approximately 1.6m with school playing fields adjacent, separated by a metal fence. Mature trees present on both verges.
Surface	Tarmac in good condition.
Gradient	Level along length of route.
Sightlines	Very clear, linear route with no obstructions to visibility.
Maintenance	Some leaf-fall from adjacent trees remaining on route.
Key Land uses	University of East Anglia campus and halls of residence located within walking/cycling distance to route.
Comments	Cyclists also make use of the road.

Figure 29 – Design Characteristic Assessment Table - Norwich



Figure 30 – (Left and Right) Shared use on Bluebell Road is not correctly signed.

5.4 Pedestrian and Cyclist Activity

5.4.1 Weekday Activity: Unsegregated Route

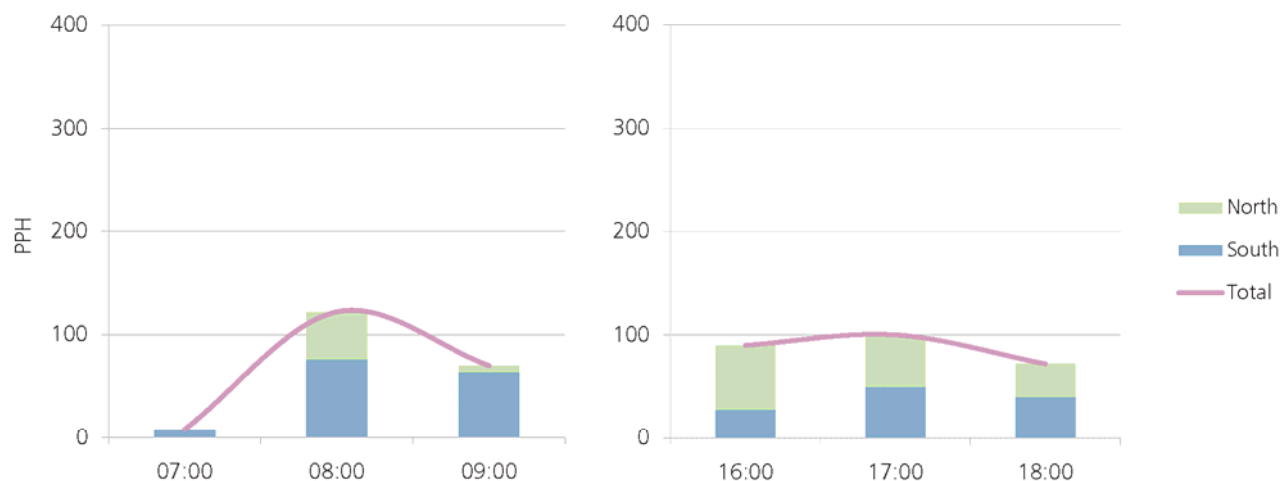


Figure 31 - Pedestrian Activity (Weekday)

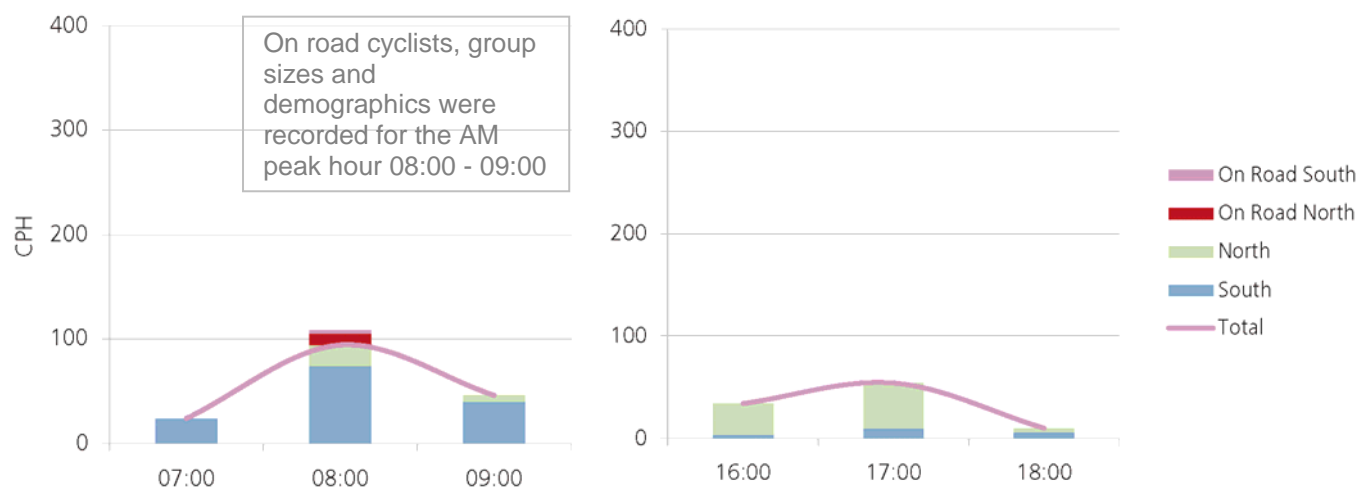


Figure 32 - Cyclist Activity (Weekday)

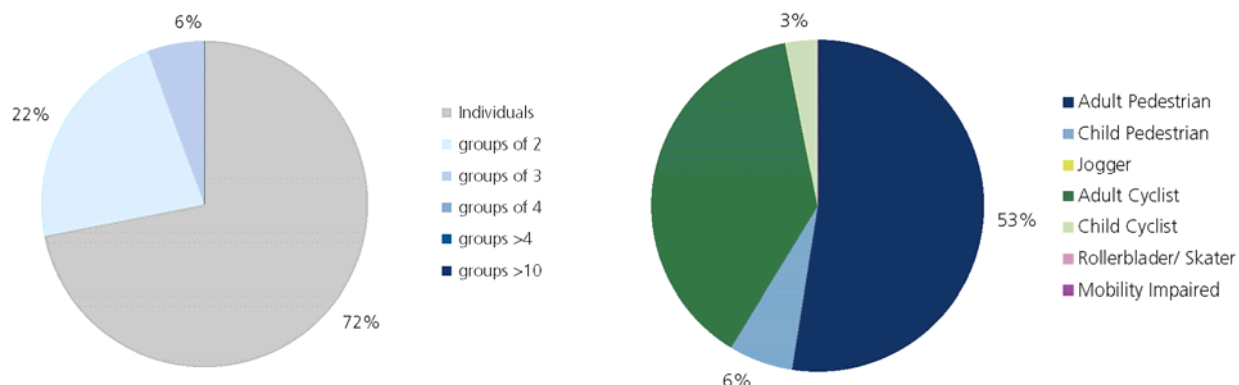


Figure 33 - Group Size and Demographics Activity (Weekday 08:00 - 09:00)

5.4.2 Weekend Activity: Unsegregated Route

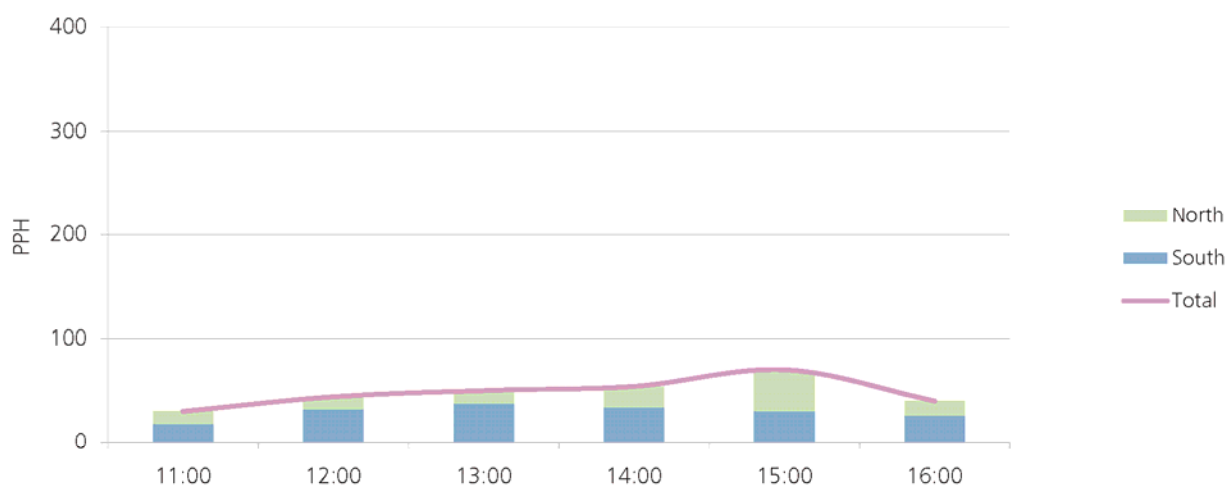


Figure 34 - Pedestrian Activity (Weekend)

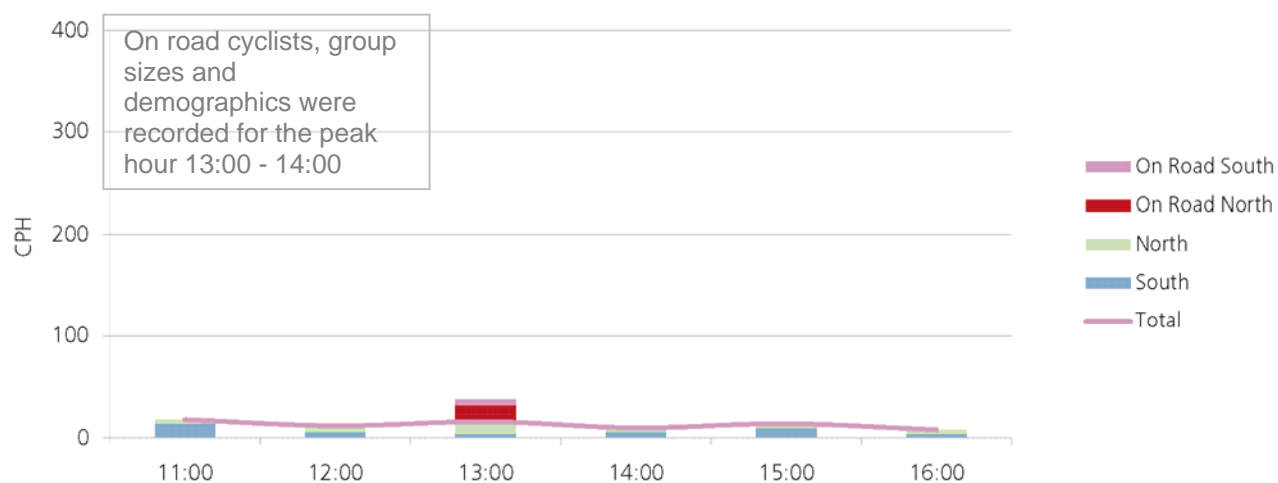


Figure 35 - Cyclist Activity (Weekend)

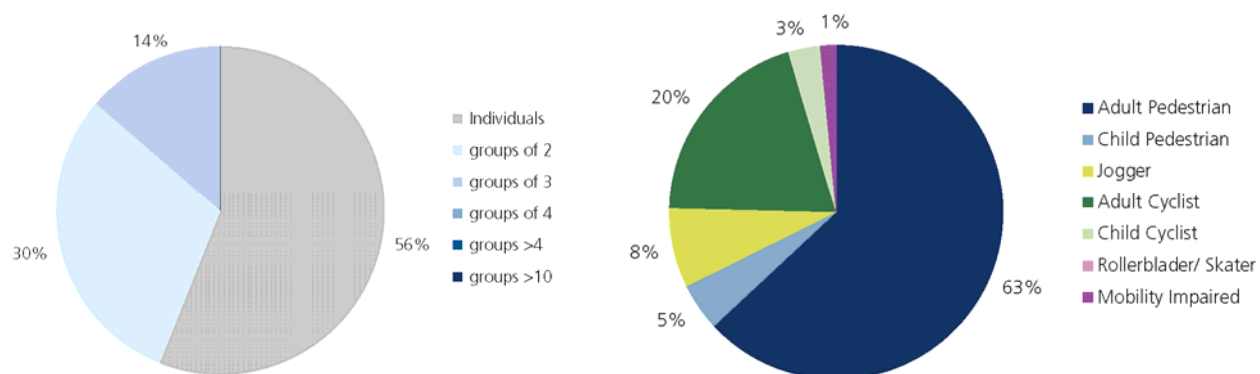


Figure 36 - Group Size and Demographics Activity (Weekend 13:00 - 14:00)

5.4.3 Weekday Activity: Segregated Route

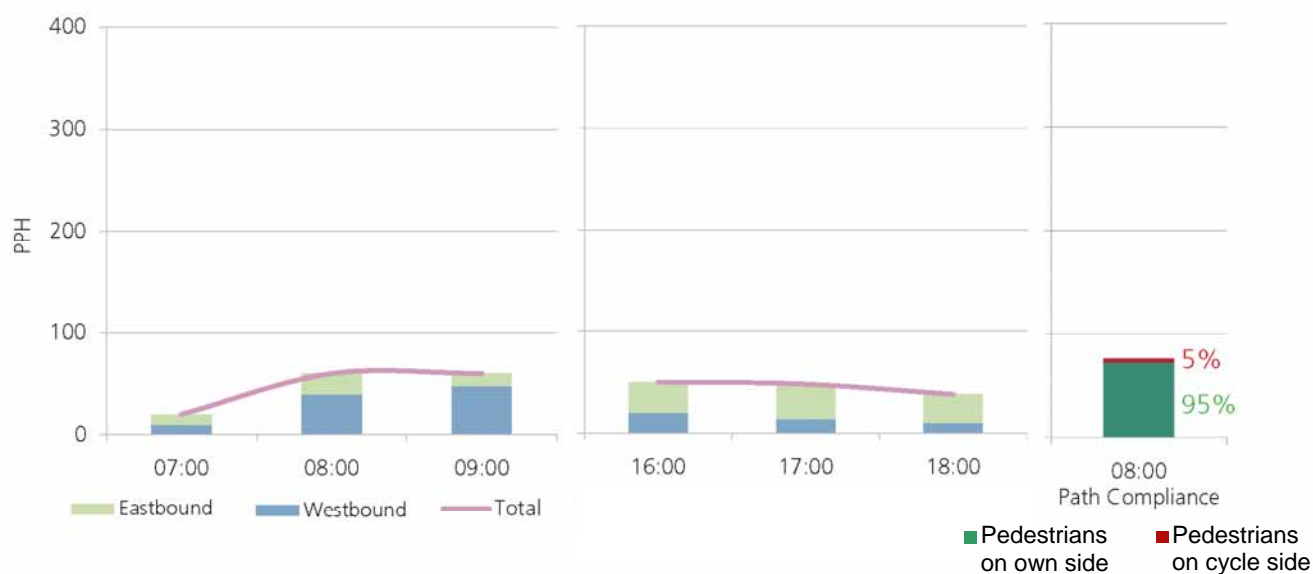


Figure 37 - Pedestrian Activity (Weekday)



Figure 38 - Cyclist Activity (Weekday)

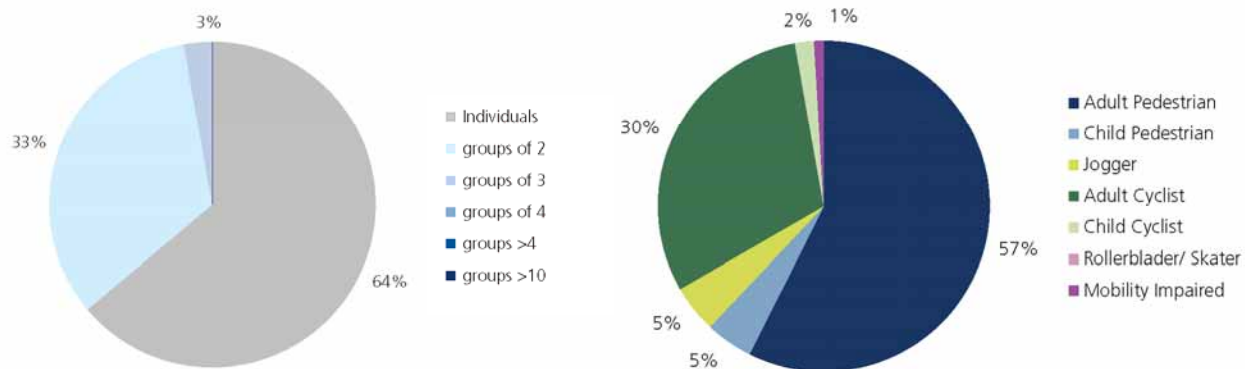


Figure 39 - Group Size and Demographics Activity (Weekday 08:00 - 09:00)

5.4.4 Weekend Activity: Segregated Route

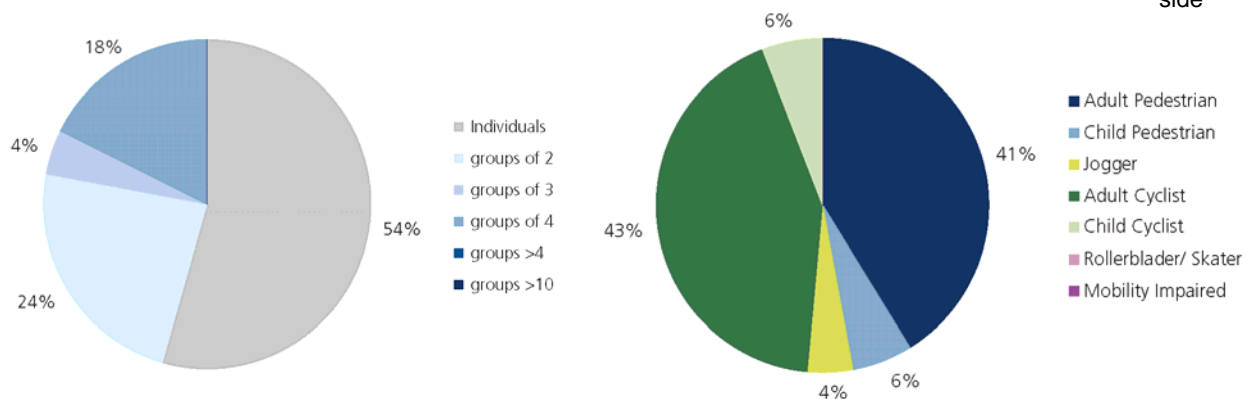
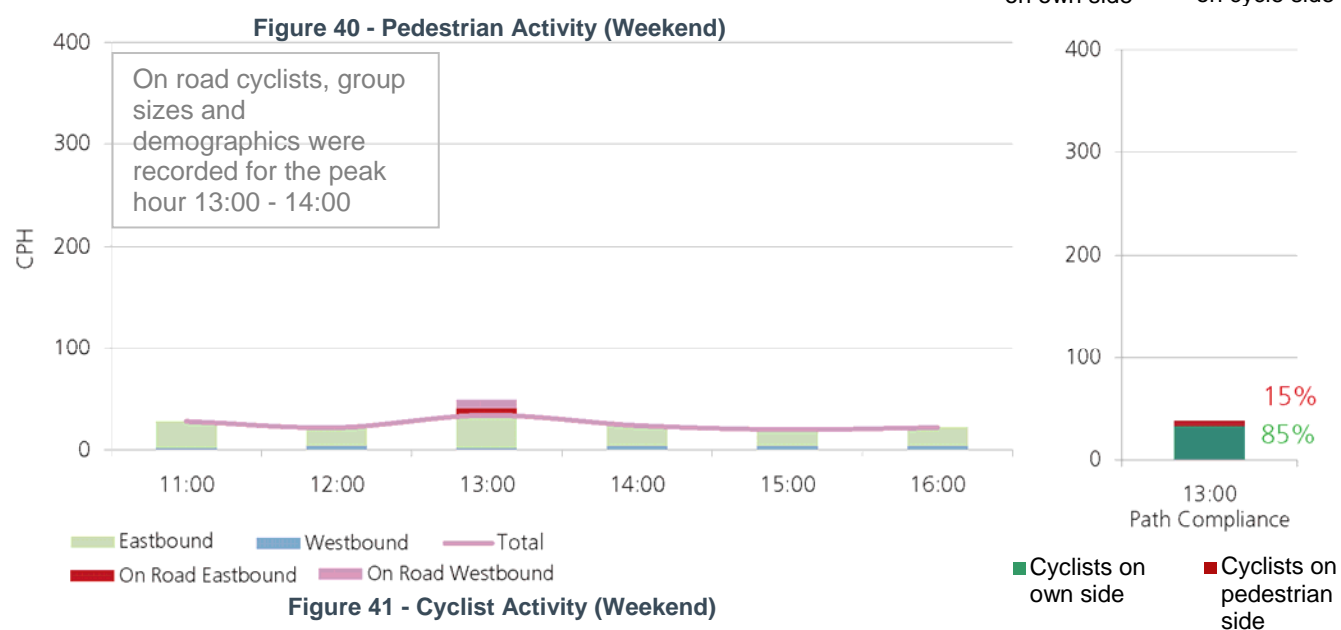
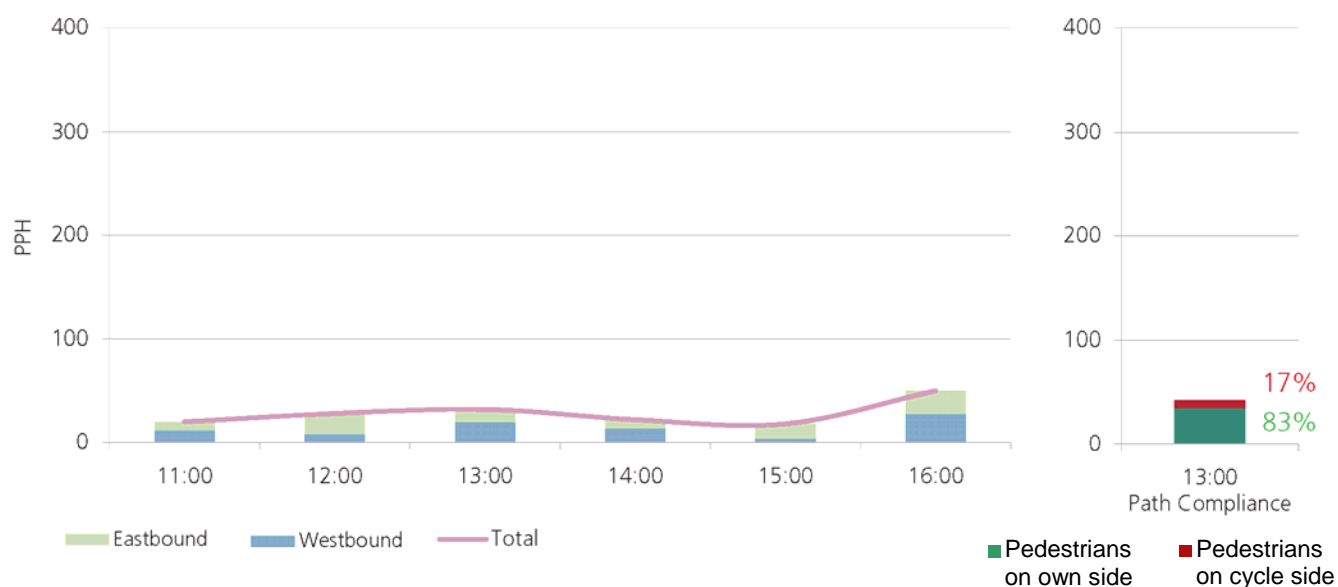


Figure 42 – Group Size and Demographics Activity (Weekend 13:00 – 14:00)

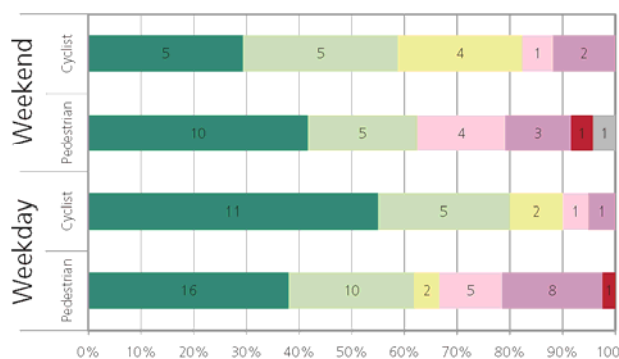
5.5 User Perceptions

5.5.1 Norwich Questionnaire Results: User Demographics

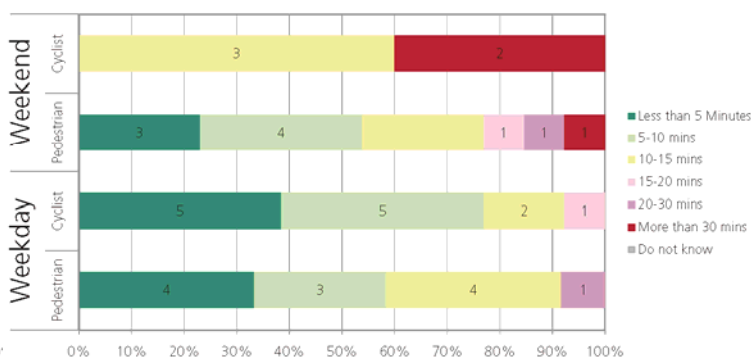


Norwich Questionnaire Results: Journey Details and Impact of time of day/lighting

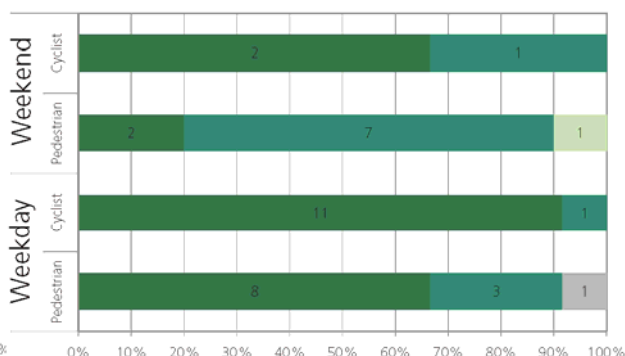
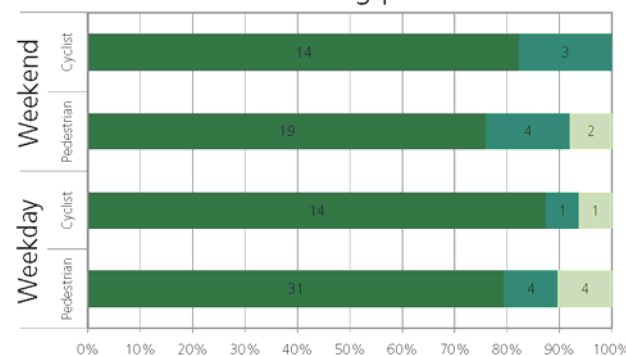
Segregated Site Journey time to reach path



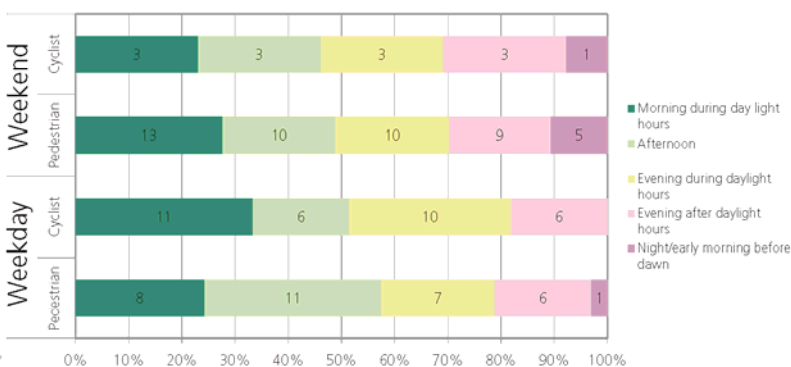
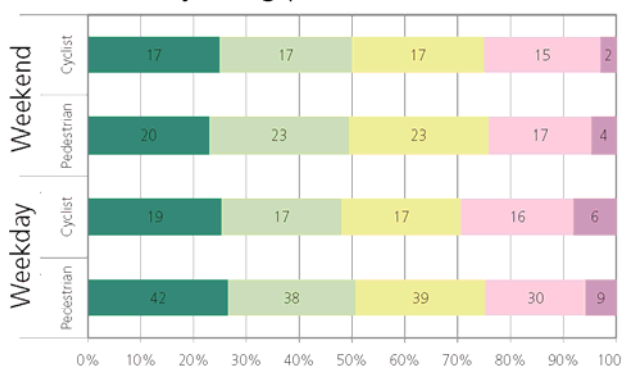
Unsegregated Site



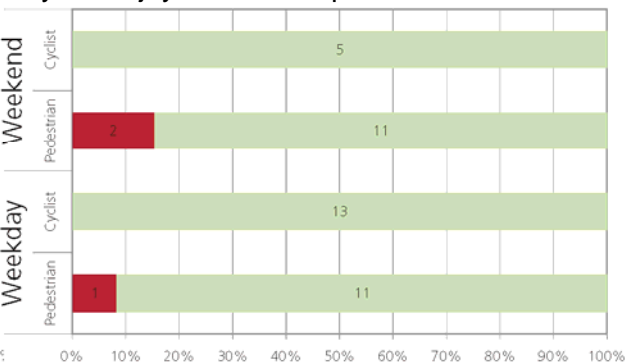
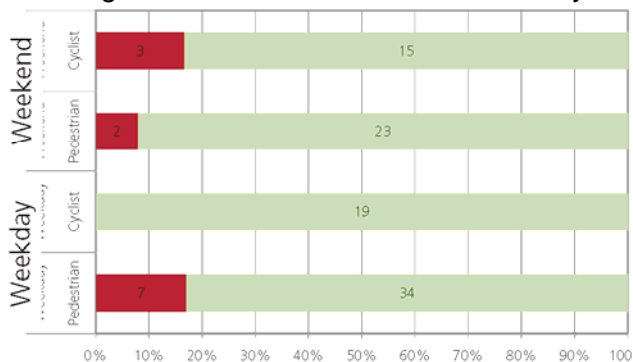
Intended travel time along path



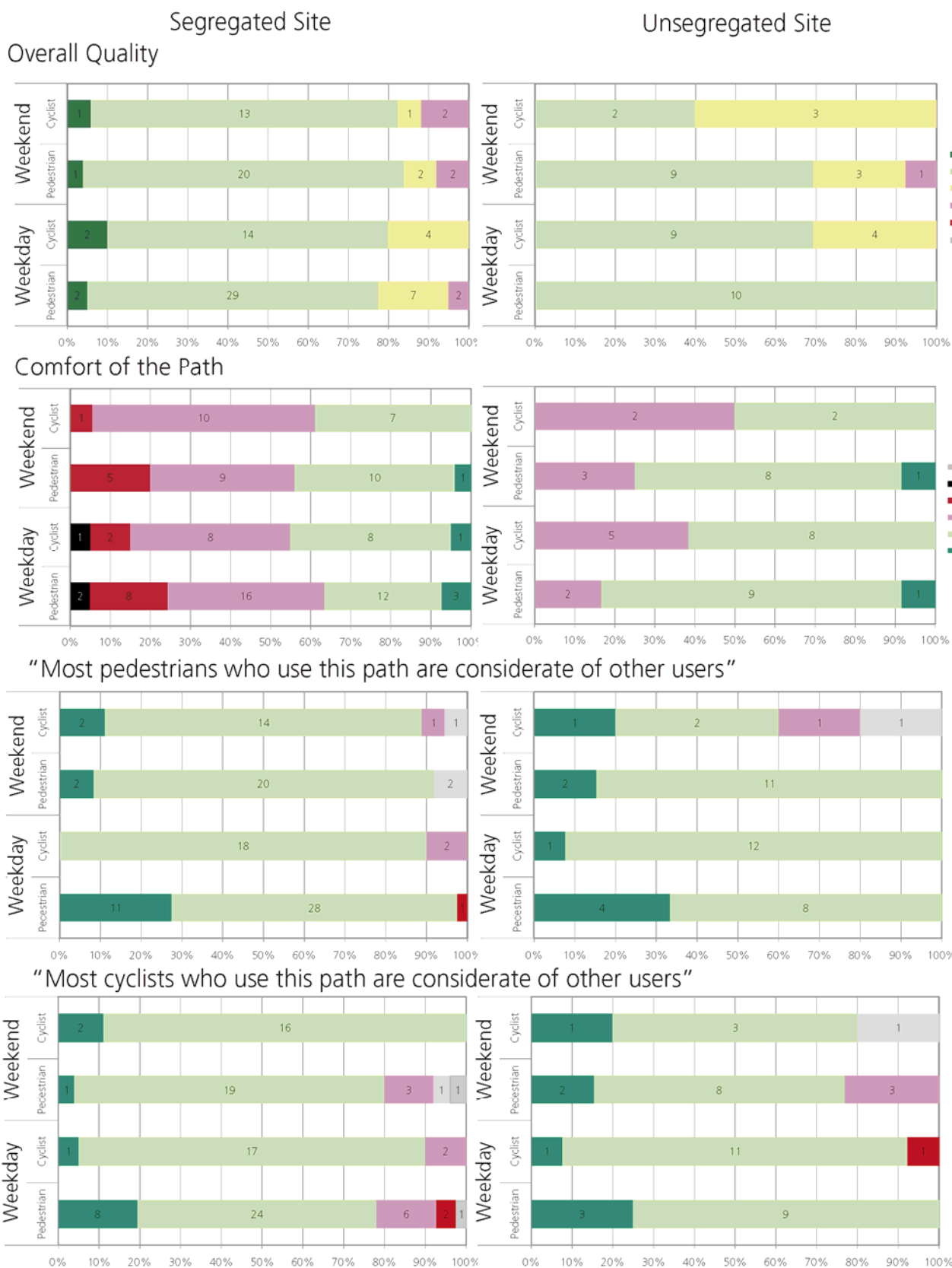
Times of day using path



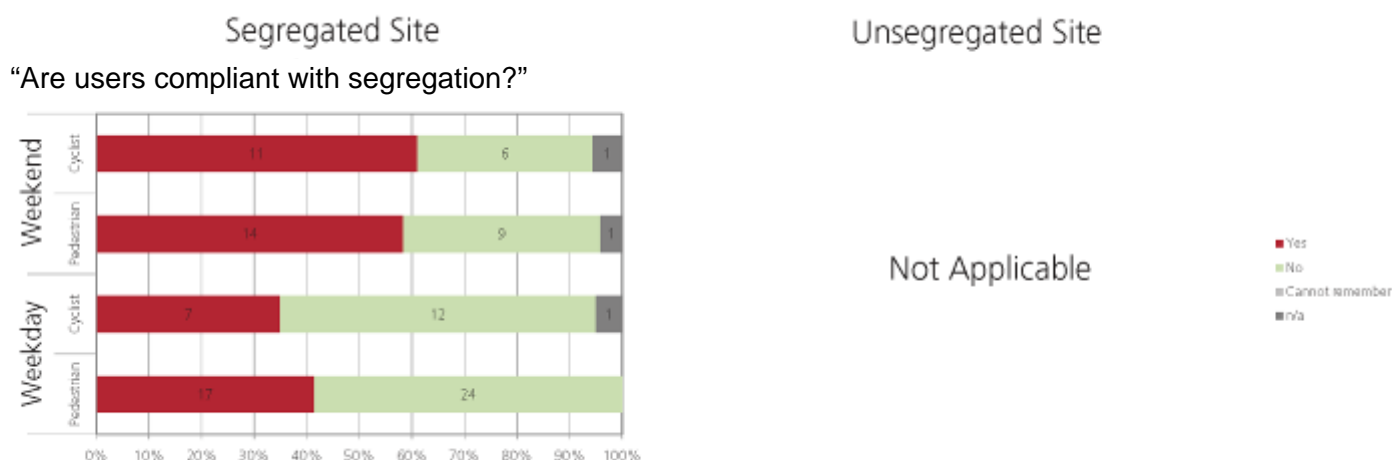
Do light levels at different times of the day affect your enjoyment of the path?



5.5.2 Norwich Questionnaire Results: Route Quality and Comfort



5.5.3 Norwich Questionnaire Results: Segregated Route Compliance



5.5.4 In summary, there was a great perception by both user groups on the unsegregated shared use route that pedestrians and cyclists are more considerate of others compared with responses from users of the segregated facility.

5.5.5 There is strong perception that many users do not comply with segregation, and this is supported by low levels of perceived comfort on the segregated facility by both pedestrians and cyclists.

5.5.6 One respondent to the Norwich surveys noted that they have a mobility impairment. The respondent was using the segregated route, and stated that they felt very uncomfortable using the route.

5.6 Cyclist Speeds

- 5.6.1 The figure below shows an assessment of cycle speeds at the two locations in Norwich. The results show that higher maximum cycle speeds were observed on the segregated facility. During weekday peak periods, average speeds are lower on the unsegregated facility compared with the segregated facility, and at the weekend this trend is reversed.

	Weekday		Weekend	
	Segregated	Unsegregated	Segregated	Unsegregated
Maximum Speed (mph)	16.4	14.5	21.9	19.5
Minimum Speed (mph)	6.0	5.2	4.2	7.7
Average (mean) Speed (mph)	10.4	9.2	8.9	13.6
Median Speed (mph)	10.5	8.9	8.3	13.5
Standard Deviation +	13.1	11.6	12.0	16.5
Standard Deviation -	7.6	6.8	5.9	10.8

Figure 43 – Cycle speed summary

- 5.6.2 The figures overleaf show how user density on the segregated and unsegregated facilities affects cycle speed. The findings suggest that cycle speeds on the segregated shared use facility are not significantly affected by user density. On the unsegregated facility, there is a clear trend showing cycle speeds markedly decreasing as user density increases.

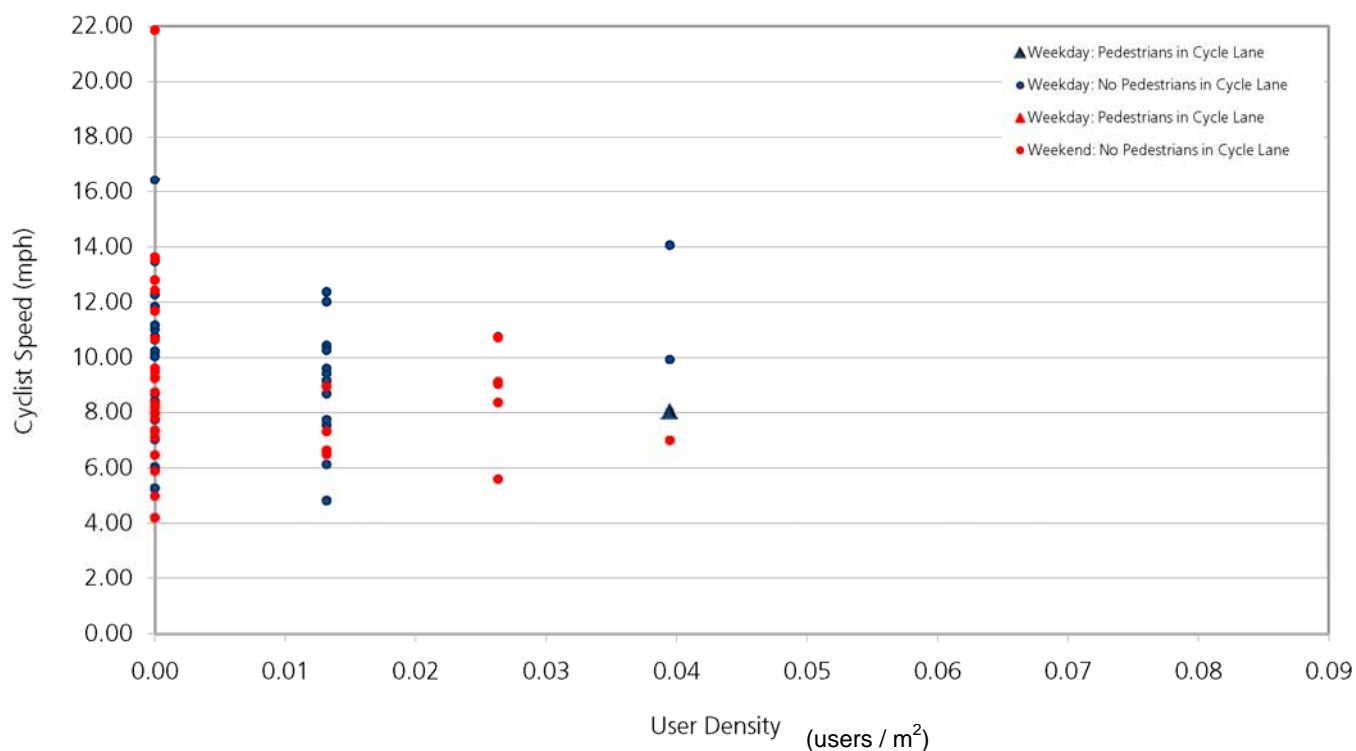


Figure 44 – Cyclist speed and user density chart (Segregated site)

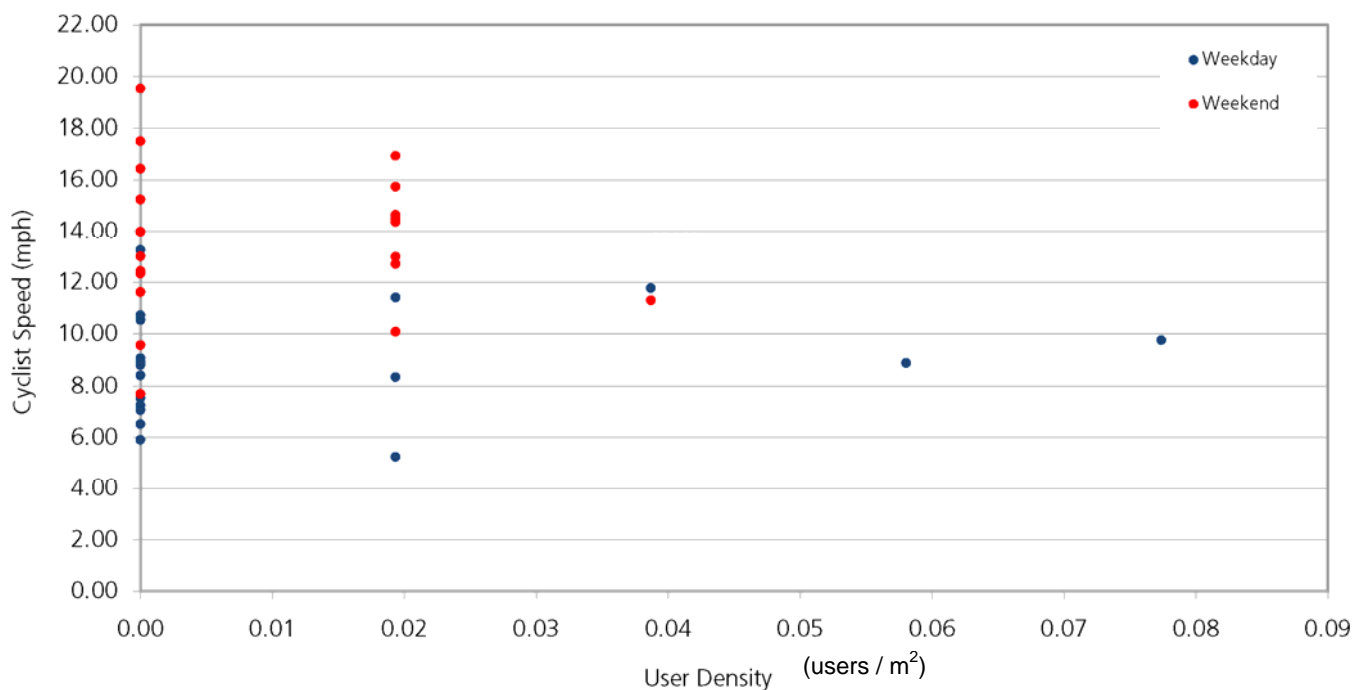


Figure 45 – Cyclist speed and user density chart (Unsegregated site)

5.7 Interactions

5.7.1 The figure below shows a summary of the observations in Norwich.

5.7.2 No collisions, and no conflict of any significance was observed on either facility. Many instances of minor interaction recorded on the unsegregated facility were primarily due to the limited width (2.2m), which is unlikely to allow two pedestrians and one cyclist to pass comfortably. The segregated route by comparison is significantly wider (4.0m), and many instances of minor interaction were primarily due to pedestrians walking in the cycle track.

5.7.3 A full list of these observations is shown in the appendices.

Norwich sites		The Avenues Segregated	Bluebell Road Unsegregated	
		Link	Link	Junction
Weekday 8.00 - 9.00	Pedestrians per hour	60	122	122
	Cyclists per hour	24	94	94
	Minor interaction	4	5	16
	Marginal conflict	0	2	0
	Conflict	0	0	0
	Collision	0	0	0
Weekend 13.00 - 1400	Pedestrians per hour	32	50	50
	Cyclists per hour	34	16	16
	Minor interaction	2	1	1
	Marginal conflict	0	0	0
	Conflict	0	0	0
	Collision	0	0	0

Figure 46 – Interaction Summary

6. Support Site – Bristol

6.1 Location

- 6.1.1 Cattle Market Road, link section, north-east of Bath Bridge Roundabout. The eastern side is segregated shared use. No footway on southern side.

6.2 Survey Details

- 6.2.1 The following table outlines details for all surveys undertaken at the following site.

	Weekday Survey	Weekend Survey
Date	Thursday 19/11/2009	Saturday 21/11/2009
Times	07:30-10:00; 16:00-19:00	12:00- 18:00
Total Locations	1 Site: Segregated	
Weather	Overcast	Overcast
Flow Survey Frequency	Continuous Count	
Flow Survey Method	Onsite	

6.3 Design Characteristics

Category	Description
Route context	Cattle Market Road, link section, north-east of Bath Bridge Roundabout.
Cycle track type	Single cycle track segregated from pedestrian space by raised white line. Cycle track is immediately adjacent to road.
Approximate width	Footway <1.5m and cycle track <1.5m
Crossfall on a typical section	Negligible.
Bounding	Roadside bounded by kerb. Building side bounded by continuous wall of building edge.
Surface	Tarmac in average condition.
Gradient	Slight.
Sightlines	Clear sightlines with no obstructions
Maintenance	Route shows signs of degradation.
Key Land uses	Urban town centre land use
Comments	None

Figure 47 – Design Characteristic Assessment Table - Bristol



Figure 48 – (Left) Shared use designation, and (Right) building edge on route at Cattle Market Road.

6.4 Pedestrian and Cyclist Activity

6.4.1 Weekday Activity

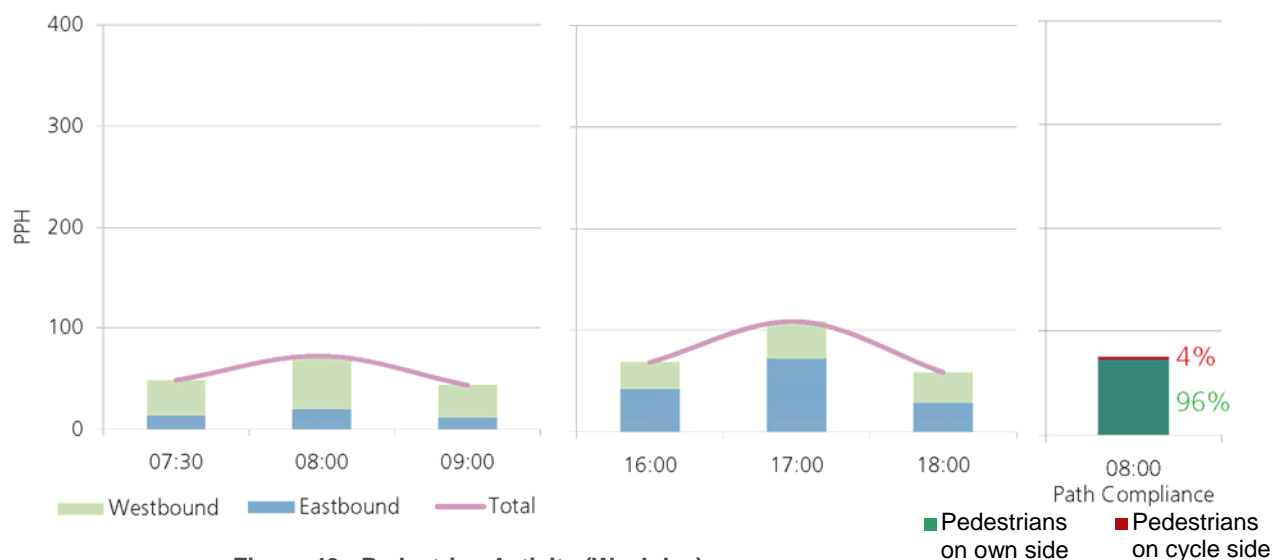


Figure 49 - Pedestrian Activity (Weekday)

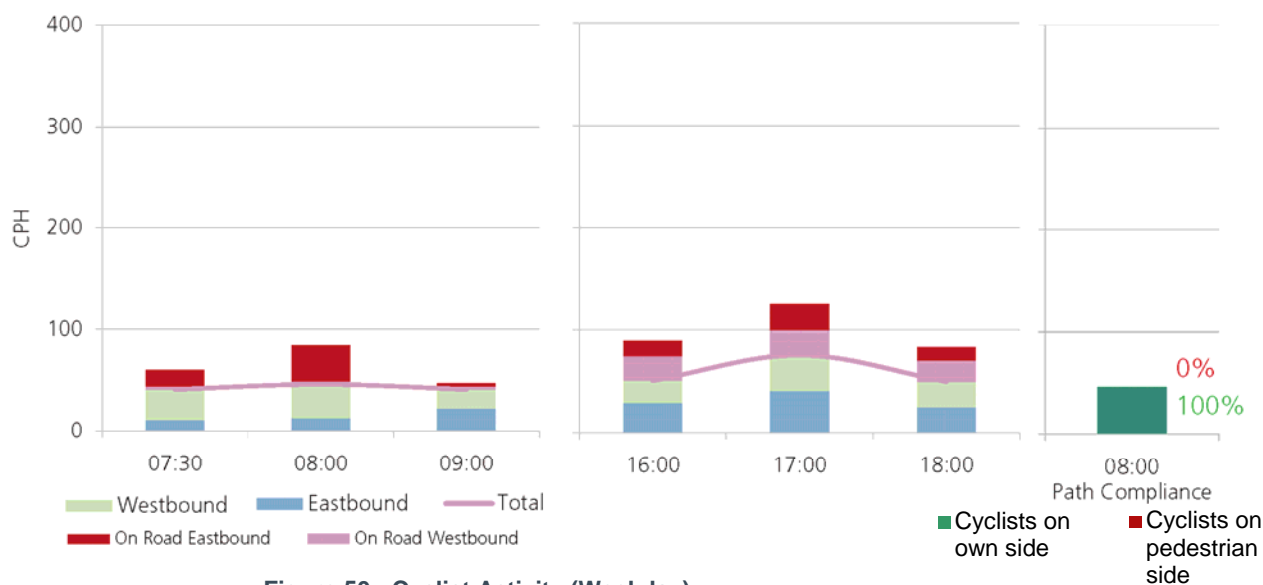


Figure 50 - Cyclist Activity (Weekday)

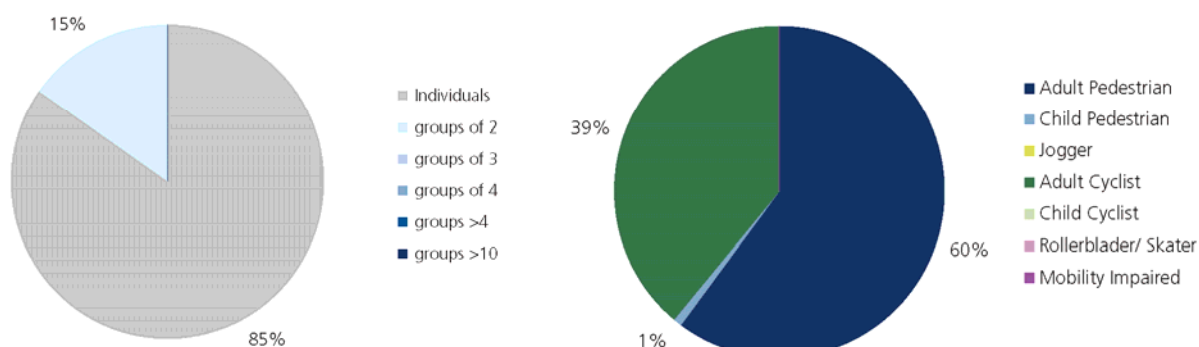


Figure 51 - Group Size and Demographics Activity (Weekday)

6.4.2 Weekend Activity

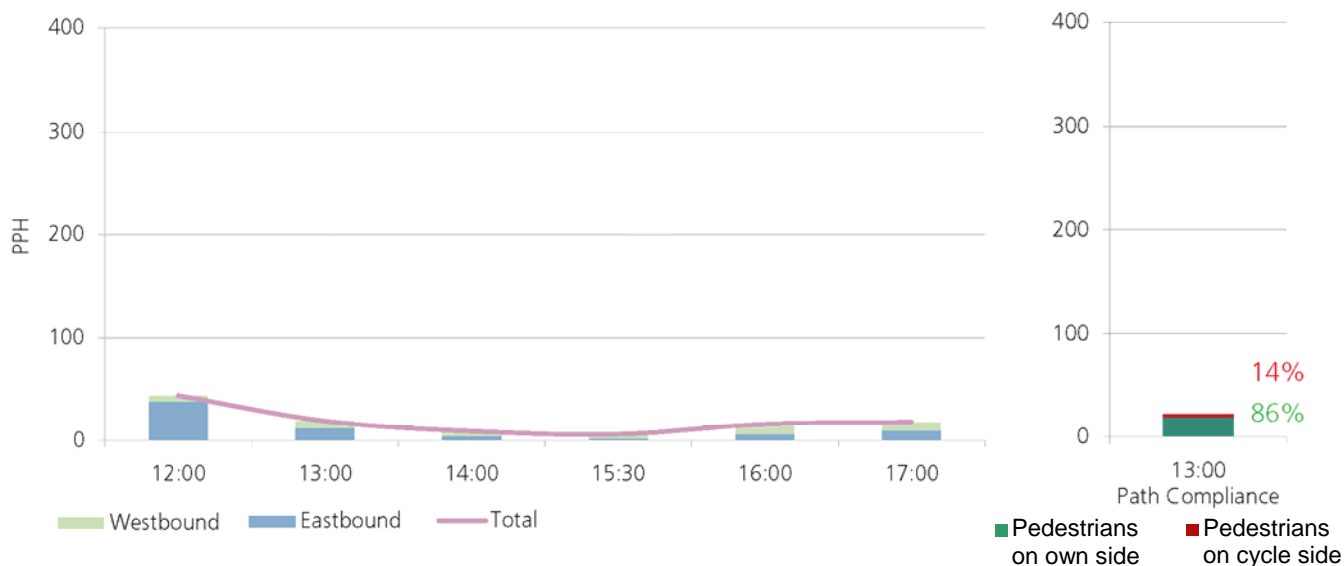


Figure 52 - Pedestrian Activity (Weekend)

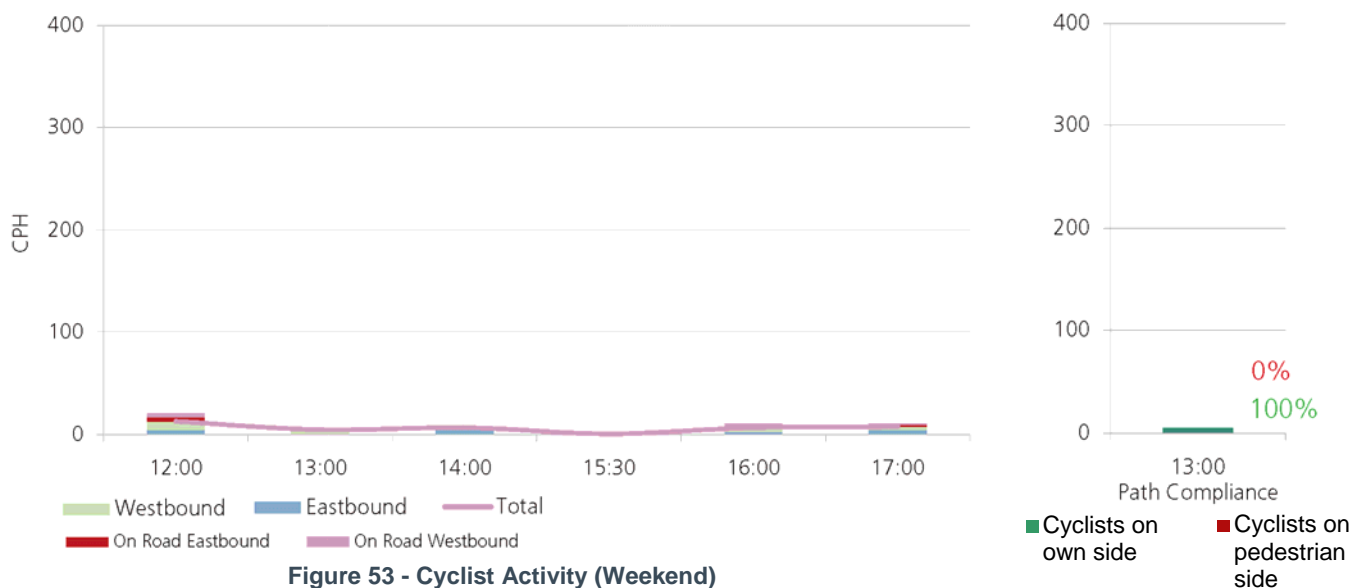


Figure 53 - Cyclist Activity (Weekend)

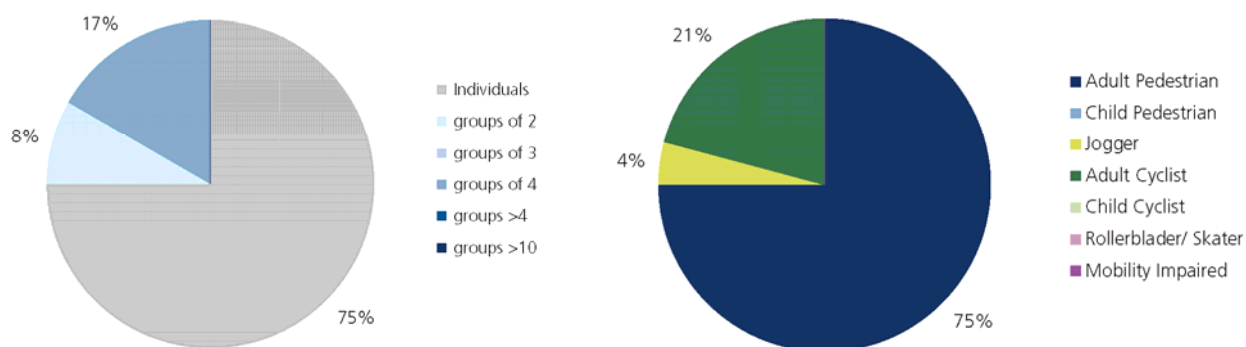


Figure 54 - Group Size and Demographics Activity (Weekend)

6.5 Cyclist Speeds

	Weekday	Weekend
	Segregated	Segregated
Maximum Speed (mph)	19.5	22.2
Minimum Speed (mph)	9.0	6.0
Average (mean) Speed (mph)	14.1	13.6
Median Speed (mph)	13.3	12.7
Standard Deviation +	17.5	17.8
Standard Deviation -	10.8	9.4

Figure 55 – Cyclist speed summary

6.6 Key Findings

- 6.6.1 There is a relatively high level of compliance with segregation by both pedestrians and cyclists during weekday peak period, though typically, the level of compliance decreases at the weekend.
- 6.6.2 There is a high level of on-road cycling adjacent to the shared use facility during commuting periods, supporting the view that the road network is the preferred choice for many commuter cyclists.

7. Support Site – Newcastle

7.1 Location

- 7.1.1 Scotswood Road, link section, west of junction with Whitehall Road. Footway is segregated shared use.

7.2 Survey Details

- 7.2.1 The following table outlines details for all surveys undertaken at the following site.

	Weekday Survey	Weekend Survey
Date	Thursday 19/11/2009	Saturday 21/11/2009
Times	08:00-10:00; 16:00-19:00	11:00-14:00
Locations	1 Site: Segregated	
Weather	Overcast	Overcast/Rain
Flow Survey Frequency	Continuous Count	
Flow Survey Method	Onsite	

7.3 Design Characteristics

Category	Description
Route context	Scotswood Road, link section, west of junction with Whitehall Road.
Cycle track type	Single cycle track segregated from pedestrian space by raised white line. Cycle track is immediately adjacent to road. An on-carriageway cycle lane runs adjacent to the footway.
Approximate width	Footway 1.9m and cycle track 2.35m
Crossfall on a typical section	Negligible.
Bounding	Roadside bounded by kerb. Inner side bounded by continuous banked planting/grass verge.
Surface	Tarmac in good condition.
Gradient	Level.
Sightlines	Very clear sightlines with no obstructions
Maintenance	Route is well maintained although there is some minor overgrowth encroaching onto footway.
Key Land uses	Light industrial/business in surrounding area.
Comments	None

Figure 56 – Design Characteristic Assessment Table - Newcastle



Figure 57 – (Left) Shared use designation, and (Right) clear lines of sight on Scotswood Road route.

7.4 Pedestrian and Cyclist Activity

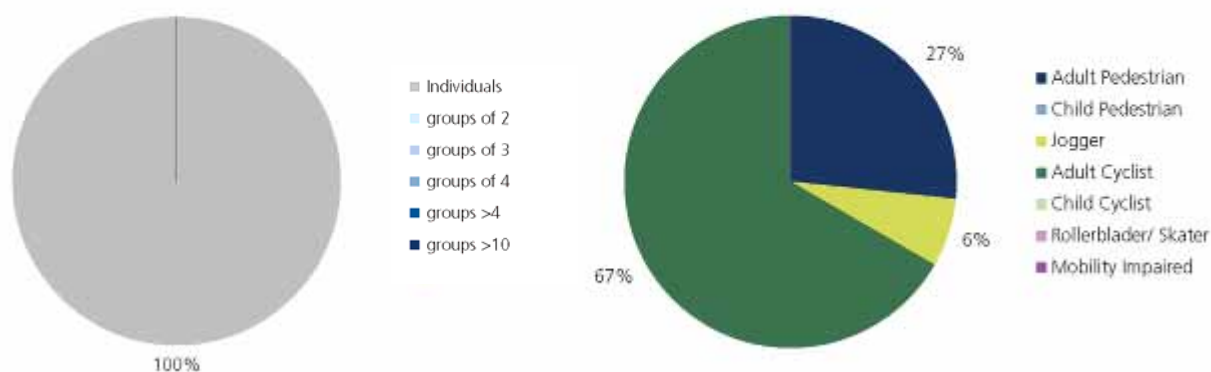
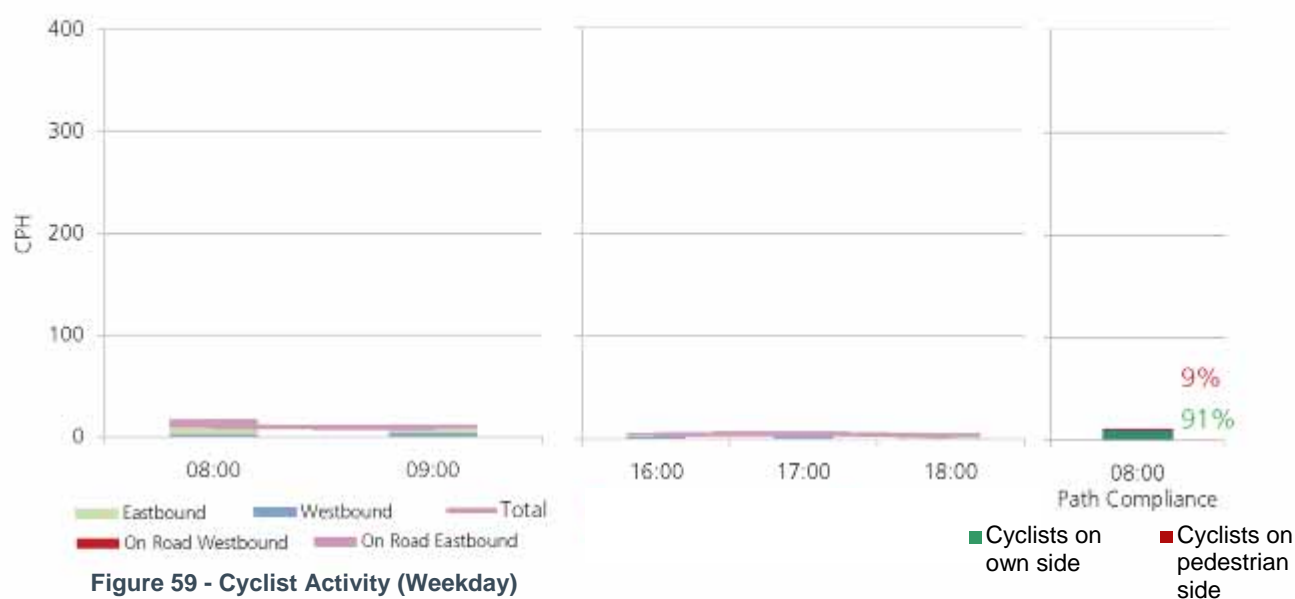
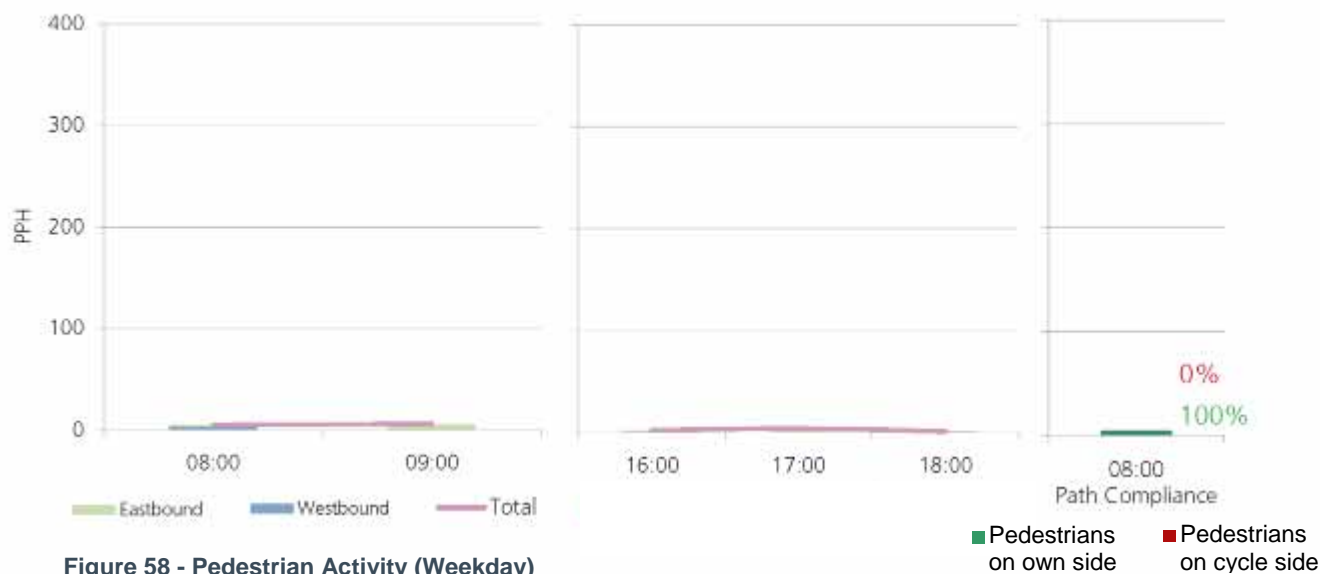


Figure 60 – Group Size and Demographics Activity (Weekday)

7.4.1 Weekend Activity:

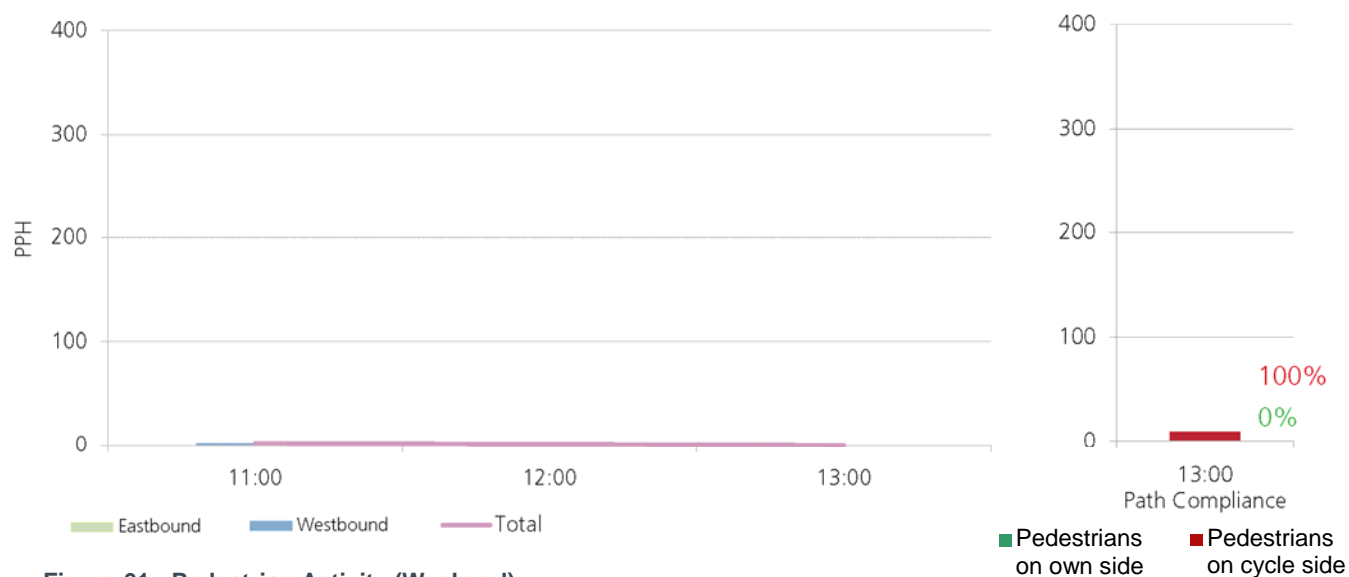


Figure 61 - Pedestrian Activity (Weekend)

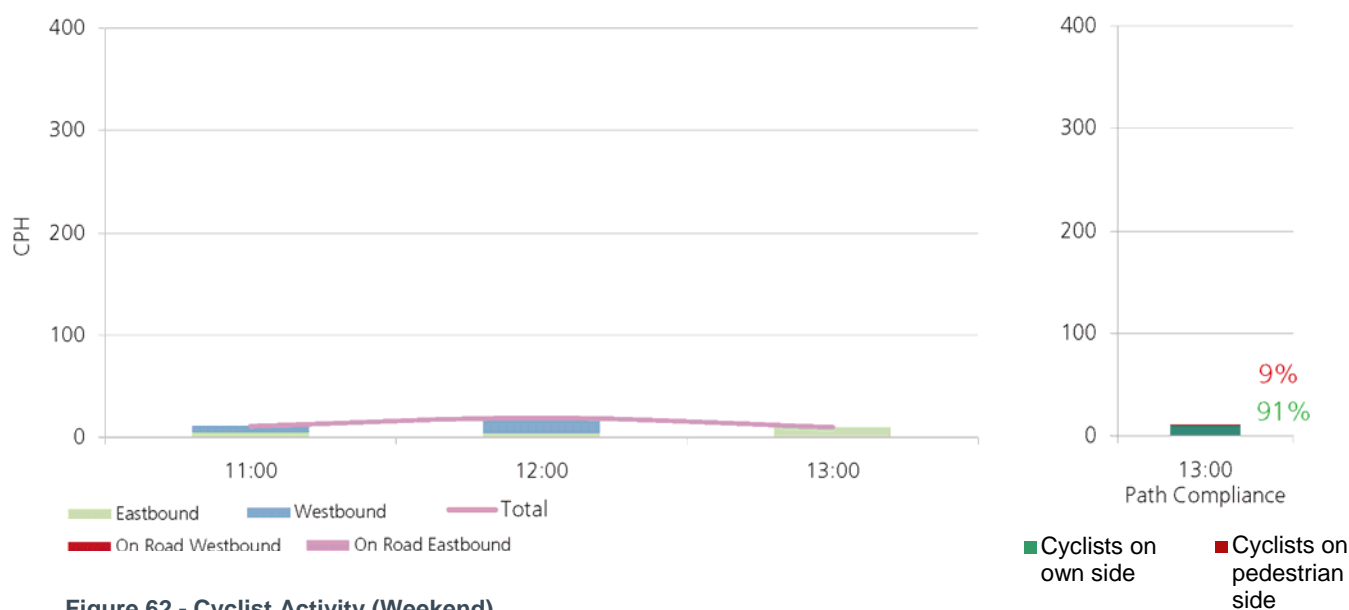


Figure 62 - Cyclist Activity (Weekend)

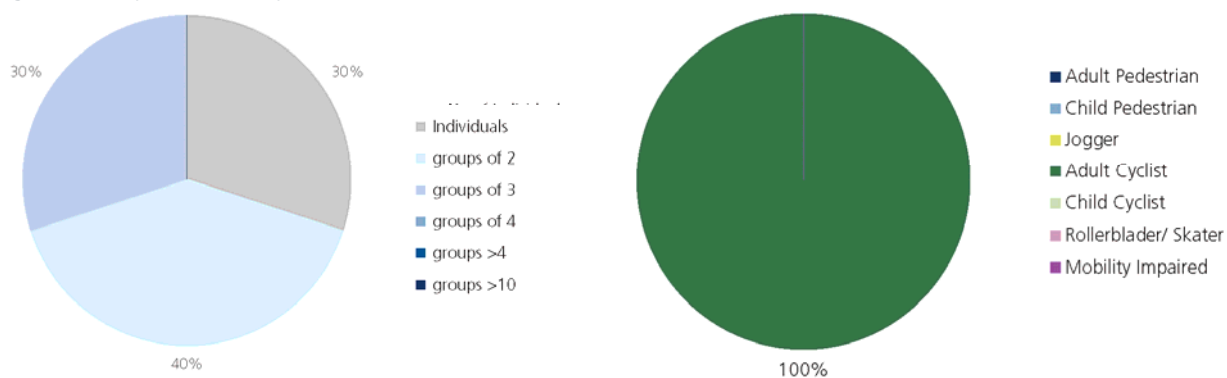


Figure 63 - Group Size and Demographics Activity (Weekend)

7.5 Cyclist Speeds

	Weekday	Weekend
	Segregated	Segregated
Maximum Speed (mph)	17.7	16.6
Minimum Speed (mph)	6.4	6.7
Average (mean) Speed (mph)	12.0	10.9
Median Speed (mph)	12.2	10.3
Standard Deviation +	15.1	15.0
Standard Deviation -	9.1	6.8

Figure 64 cycle speed summary

7.6 Key Findings

- 7.6.1 There is low activity of both pedestrian and cyclist user groups on this facility.
- 7.6.2 Maximum and average cycle speeds are marginally higher during peak weekday periods, supporting the importance of lower journey time during commuting periods.

8. Support Site – Peterborough

8.1 Location

- 8.1.1 London Road, link section between intersection with East Station Road and Oundle Road. Main A road heavily trafficked. The western side is segregated shared use.

8.2 Survey Details

- 8.2.1 The following table outlines details for all surveys undertaken at the following site.

	Weekday Survey	Weekend Survey
Date	Thursday 12/11/2009	Saturday 14/11/2009
Times	07:00-10:00; 16:00-19:00	11:00-18:00
Total Locations	1 Site: Segregated	
Weather	Fine/Overcast	Overcast/Light Rain
Flow Survey Frequency	Continuous Count	
Flow Survey Duration	6 Hours (Weekday) 7 Hours (Weekend)	
Flow Survey Method	Onsite	

8.3 Design Characteristics

Category	Description
Route context	London Road, link between intersections with East Station Road and Oundle Road. Main A road heavily trafficked. The western side is segregated shared use.
Cycle track type	Two way cycle track segregated from pedestrian space by raised white line.
Approximate width	Footway 1.2m, cycle track 1.5m
Crossfall on a typical section	Negligible.
Bounding	Outer edge bounded by concrete wall approximately 1.5m high. Inner edge bounded by metal bridge railings.
Surface	Tarmac in good condition.
Gradient	Raised towards middle of bridge with medium gradient either side.
Sightlines	Poor. Route enclosed by concrete wall which obstructs visibility. Route curves laterally breaking lines of sight from either end of the bridge.
Maintenance	Well maintained clear route with no debris present.
Key Land uses	Route leads to town centre.
Comments	None

Figure 65 – Design Characteristic Assessment - Peterborough



Figure 66 – (Left) Raised gradient evident on route, and (Right) cycle track bounded by roadside concrete wall adjacent to London Road.

8.4 Pedestrian and Cyclist Activity

8.4.1 Weekday Activity:

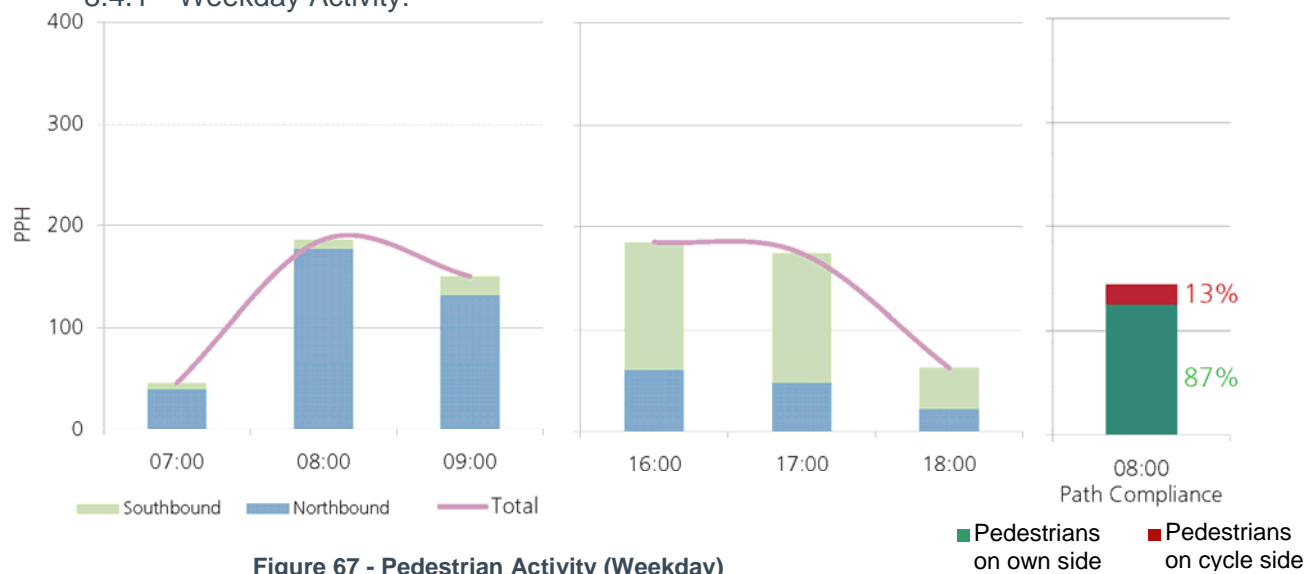


Figure 67 - Pedestrian Activity (Weekday)

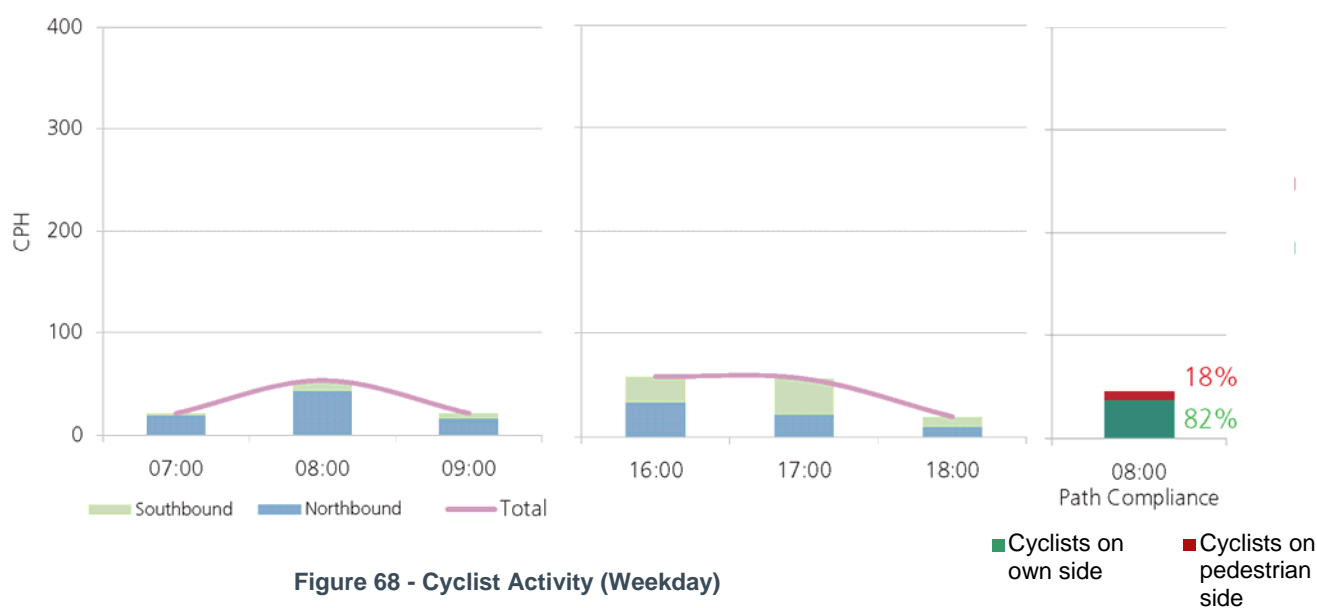


Figure 68 - Cyclist Activity (Weekday)

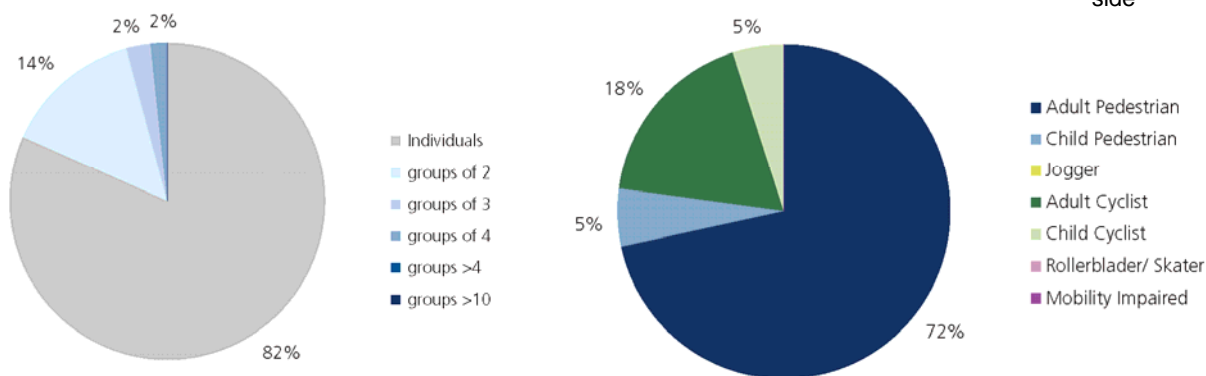


Figure 69 - Group Size and Demographics Activity (Weekday)

8.4.2 Weekend Activity

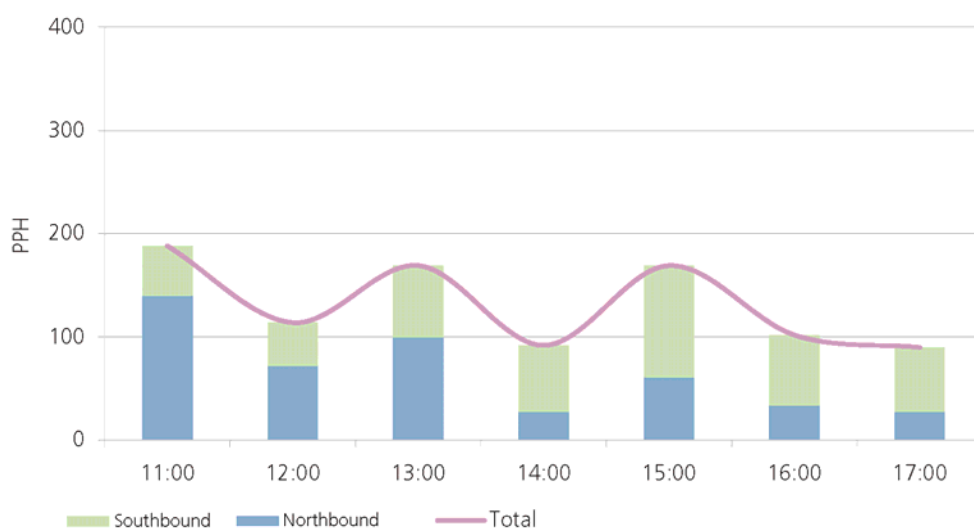
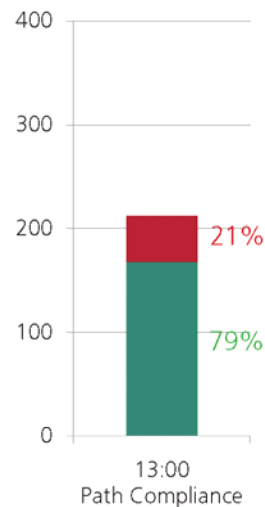


Figure 70 - Pedestrian Activity (Weekend)



■ Pedestrians on own side ■ Pedestrians on cycle side

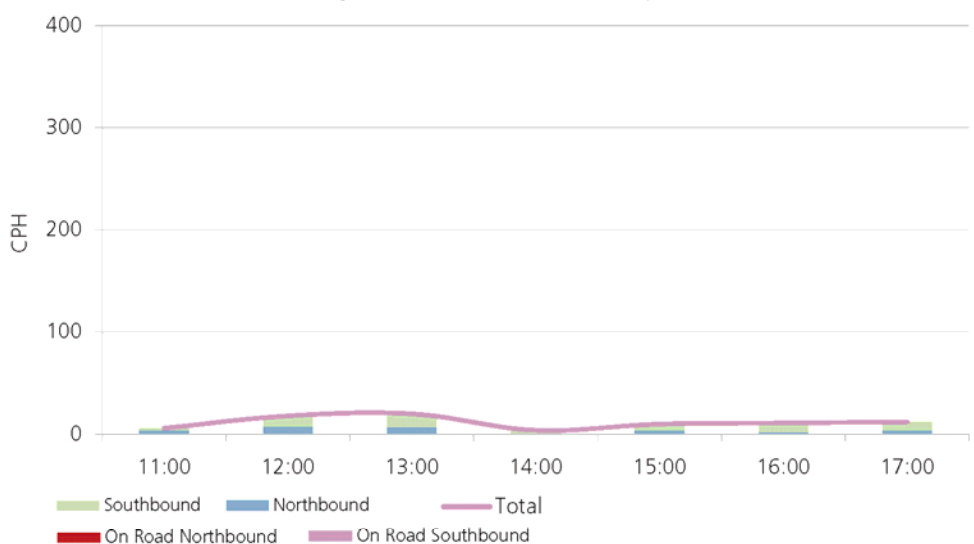
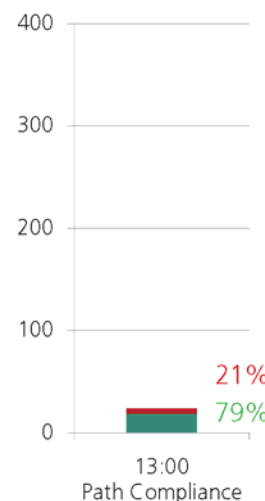


Figure 71 - Cyclist Activity (Weekend)



■ Cyclists on own side ■ Cyclists on pedestrian side

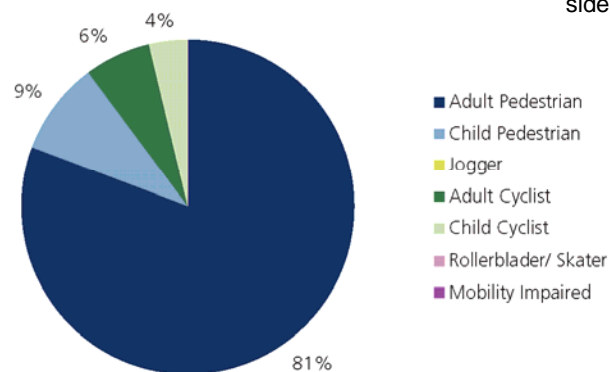
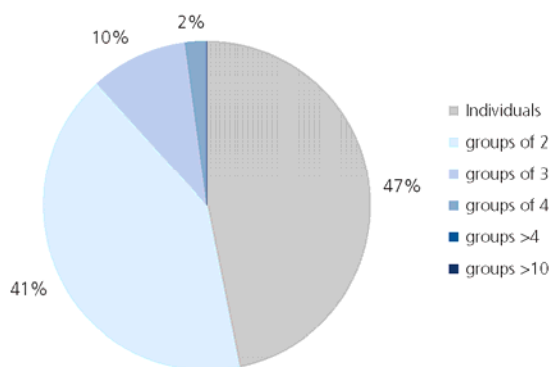


Figure 72 - Group Size and Demographics Activity (Weekend)

8.5 Cyclist Speeds

	Weekday	Weekend
	Segregated	Segregated
Maximum Speed	14.1	11.7
Minimum Speed	6.7	4.3
Average (mean) Speed	9.6	8.3
Median Speed	8.8	8.4
Standard Deviation +	11.8	9.8
Standard Deviation -	7.4	6.8

Figure 73 – Cyclist speed summary table

8.6 Key Findings

- 8.6.1 During the peak weekday commuting periods, only 18% of users are in groups of two or more compared with 53% of users who are travelling in groups of two or more at the weekend.
- 8.6.2 Compliance with segregation decreases at the weekend, supporting the view that compliance can be affected by the number of users (particularly pedestrians) in groups of two or more.
- 8.6.3 Maximum and average cycle speeds are higher during peak weekday periods, supporting the importance of lower journey time during commuting periods.

9. Support Site – York

9.1 Location

- 9.1.1 Hull Road, linear section between intersection with Tang Hall Lane and Carlton Avenue. Main A road heavily trafficked. The northern side is segregated shared use.

9.2 Survey Details

- 9.2.1 The following table outlines details for all surveys undertaken at the following site.

	Weekday Survey	Weekend Survey
Date	Friday 13/11/2009	Sunday 15/11/2009
Times	09:00-11:00; 16:00-18:00	11:00-18:00
Total Locations	1 Site: Segregated	
Weather	Fine/Overcast	Fine/Overcast
Flow Survey Frequency	Continuous Count	
Flow Survey Duration	4 Hours (Weekday) 7 Hours (Weekend)	
Flow Survey Method	Onsite	

9.3 Design Characteristics

Category	Description
Route context	Hull Road, link between intersection with Tang Hall Lane and Carlton Avenue. Heavily trafficked A road.
Cycle track type	Two way cycle track on northern side segregated from footway by raised white line.
Approximate width	Footway 2m, cycle track 1.9m
Crossfall on a typical section	0.45-0.9%
Bounding	Roadside kerblines. Inner side bounded by residential fences and garden edges with established planting and small grass verge.
Surface	Tarmac in good condition.
Gradient	Level along length of route.
Sightlines	Very clear, linear route with no obstructions to visibility.
Maintenance	Well maintained clear route with no debris present.
Key Land uses	School/college opposite. Suburban area, predominately residential land use
Comments	None

Figure 74 – Design Characteristic Assessment Table - York



Figure 75 – (Left) Shared use designation and (Right) wider context of route adjacent to Hull Road. Note roadside position of footway.

9.4 Pedestrian and Cyclist Activity

9.4.1 Weekday Activity:

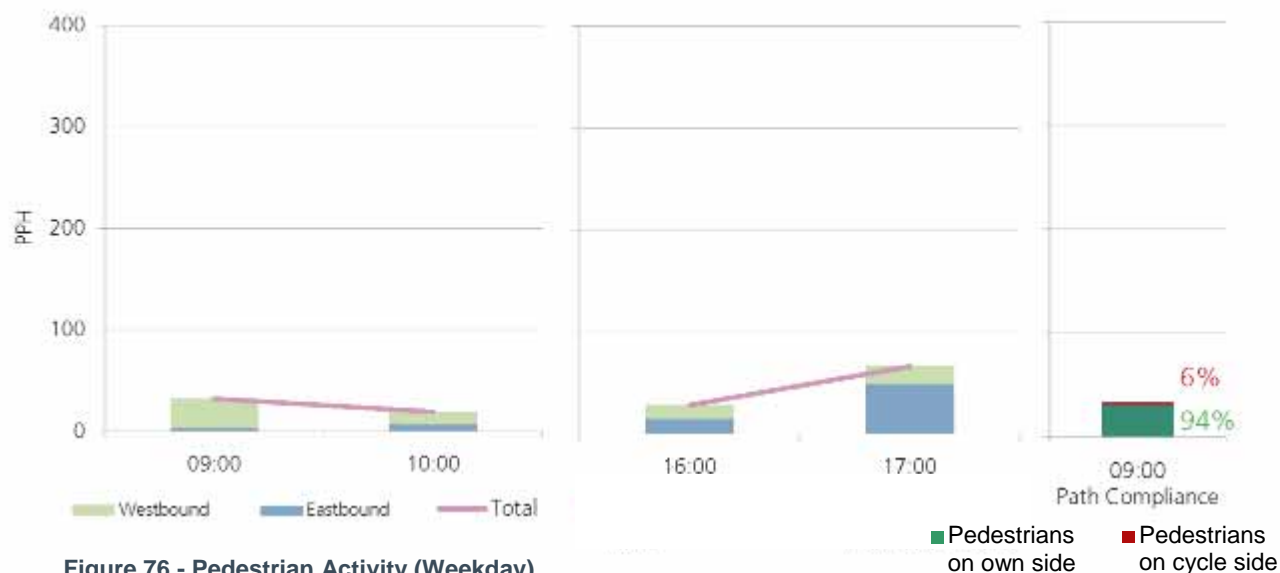


Figure 76 - Pedestrian Activity (Weekday)

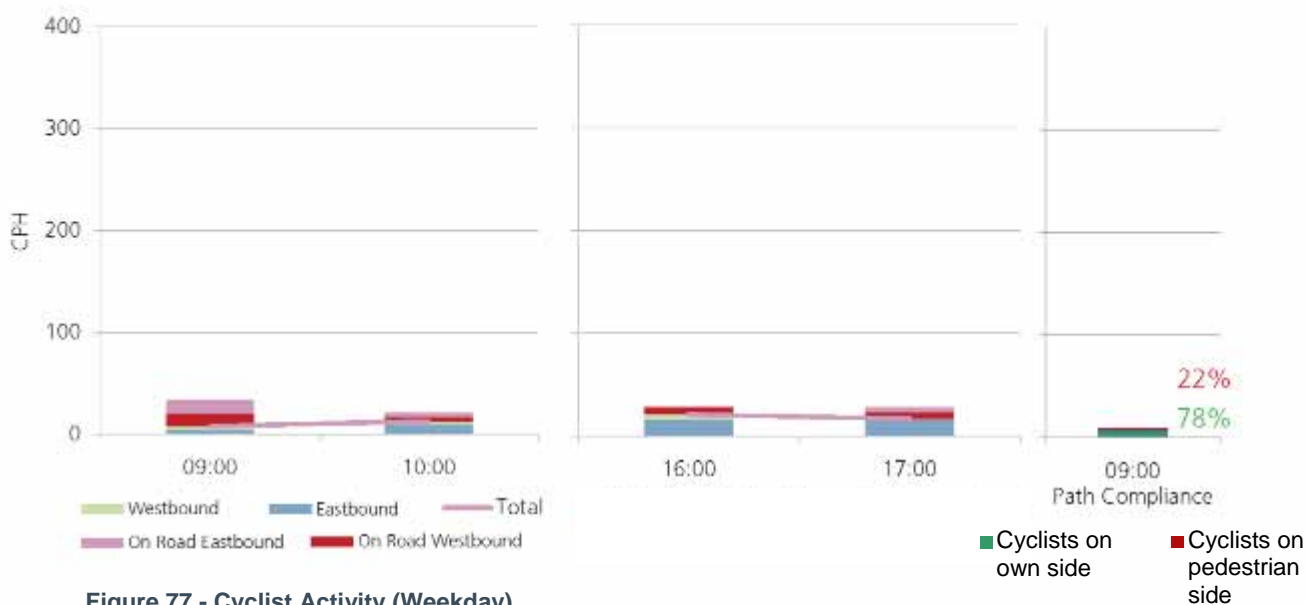


Figure 77 - Cyclist Activity (Weekday)

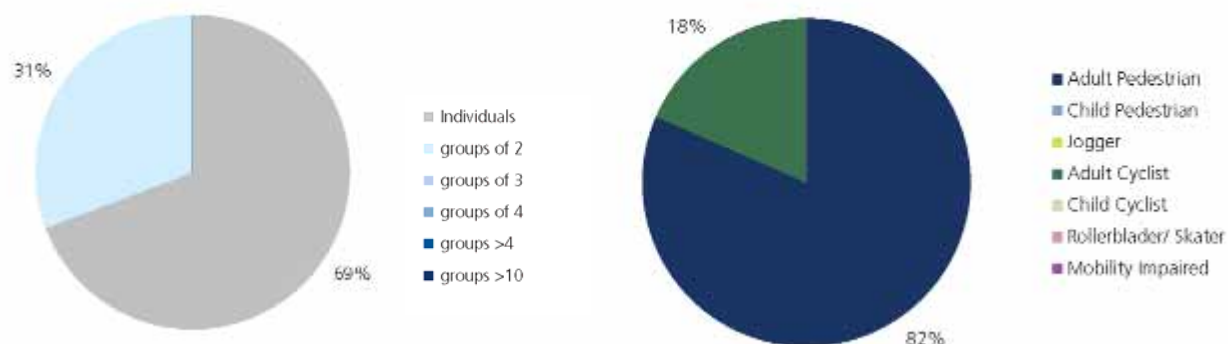


Figure 78 – Group Size and Demographics Activity (Weekday)

9.4.2 Weekend Activity:

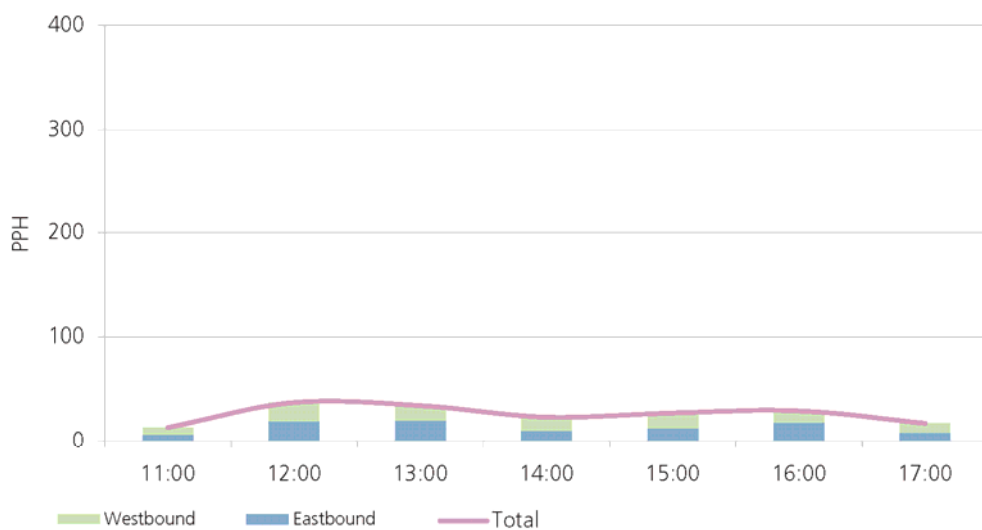


Figure 79 - Pedestrian Activity (Weekend)

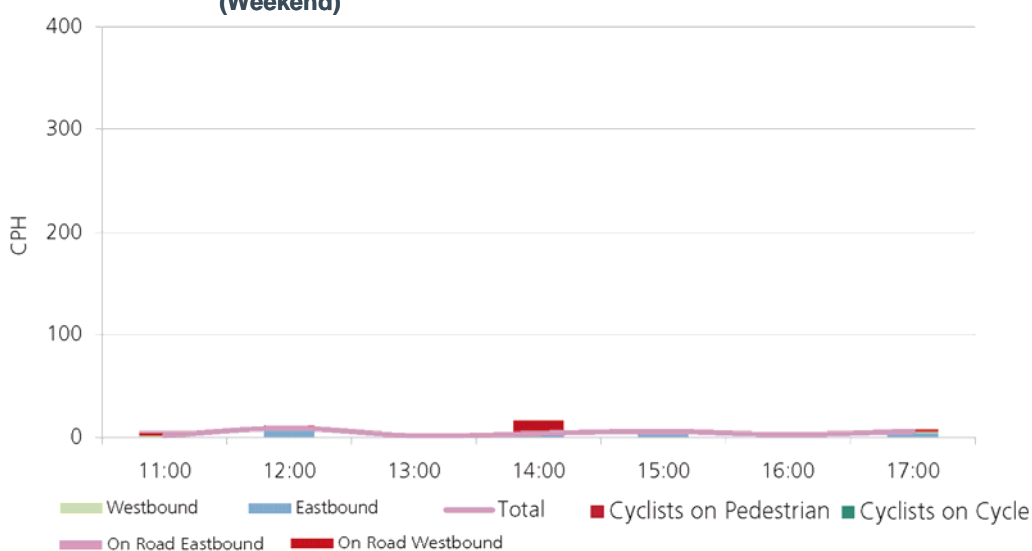
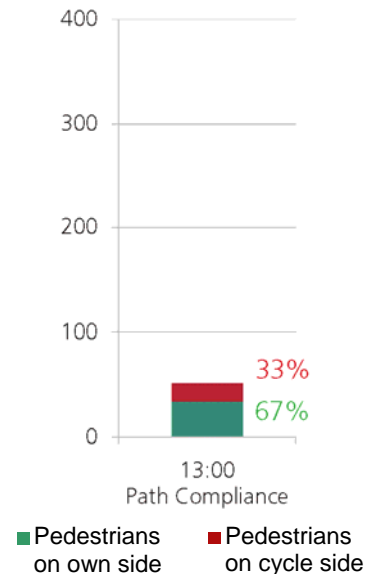


Figure 80 - Cyclist Activity (Weekend)

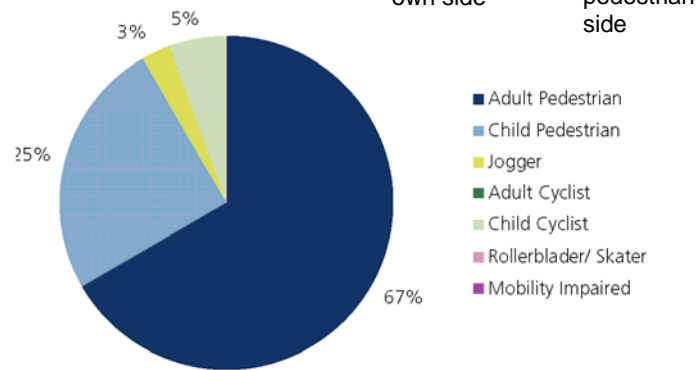
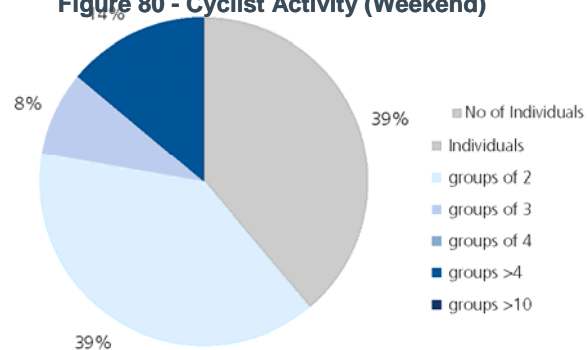
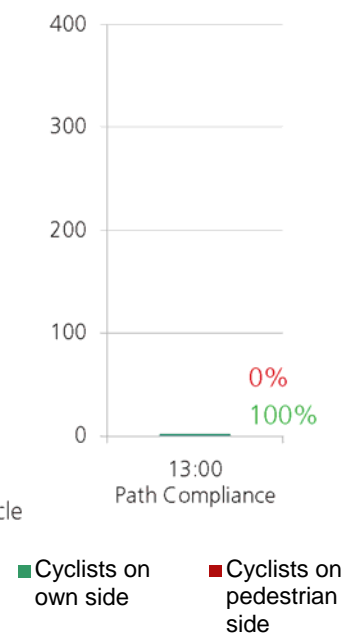


Figure 81 – Group Size and Demographics Activity (Weekend)

9.5 Cyclist Speeds

	Weekday	Weekend
	Segregated	Segregated
Maximum Speed	10.5	12.4
Minimum Speed	7.3	7.4
Average (mean) Speed	9.2	10.0
Median Speed	8.9	10.2
Standard Deviation +	10.2	11.3
Standard Deviation -	8.2	8.7

Figure 82 – Cyclist speed summary

9.6 Key Findings

- 9.6.1 There is a relatively low level of compliance with segregation by cyclists during weekday peak period, though cycle activity on the shared use facility is very low.
- 9.6.2 There is a high level of on-road cycling adjacent to the shared use facility during commuting periods, supporting the view that the road network is the preferred choice for many commuter cyclists.
- 9.6.3 At the weekend, the level of compliance of pedestrians decreases, when approximately one third of all pedestrians walk in the cycle track. At such times, cycle activity is very low.

10. Summary of Key Findings

10.1 Activity and speed

- 10.1.1 During weekday peak periods, pedestrian and cyclist activity profiles on the segregated and unsegregated shared use facilities studied showed activity typical of utility cycling and functional walking, with movement strongly directional to/from urban centres in the morning and evening peak periods respectively. At such times, the vast majority of users are travelling as individuals.
- 10.1.2 At the weekend, there are less well defined peak periods for cyclist and pedestrian activity, and the profiles of both user groups tend to follow similar patterns. More users travel in groups of two or more people than during weekday peak periods. When pedestrians travel in groups, compliance with segregation (where present) is lower than when they travel as individuals, irrespective of activity levels.
- 10.1.3 Pedestrians walking in larger groups tend to lead to a significant proportion of their number walking in the cycle track (on a segregated shared use facility in York, one third of pedestrians walk in the cycle track at the weekend).
- 10.1.4 Segregation by white line was found to be ineffective at supporting full compliance with segregation by pedestrians and cyclists. Based on the data collected in this study, there appears to be a weak inverse relationship between compliance and user flows, in that compliance tends to deteriorate with increasing flows. This relationship appears to be intuitively correct - as flows of pedestrians or cyclists increase, and especially as group sizes increase, people can be expected to use more of the width available. This is likely to be at the expense of compliance with the segregating feature.
- 10.1.5 Findings indicate that average cycle speeds are not significantly faster on segregated routes compared with unsegregated ones. Cycle speeds on segregated routes are likely to be influenced by a combination of factors, including pedestrians walking in the cycle track.
- 10.1.6 Observations indicate that maximum cycle speed decreases as pedestrian flow increases on unsegregated shared use routes. This suggests that cyclists moderate their behaviour in the presence of pedestrians. Maximum cycle speeds were also seen to decrease on segregated routes when pedestrians were present, although to a lesser extent than on unsegregated routes.
- 10.1.7 At some of the locations studied, there were clear differences in cycle speeds between weekday commuting periods and out-of-commuting periods at the weekend, when cyclists tended to travel slower. In general, cycle speed is likely to be influenced by other factors, such as user density on the route and the nature of the route as a corridor for movement or a destination.
- 10.1.8 Some cyclists were observed to cycle on-road rather than use adjacent-to-road (on-highway) shared use routes in Norwich and Cambridge. The decision to cycle on-road is likely to be dependent on many factors which could include journey preferences (such as the importance of journey time or journey ambience), confidence levels and perceived safety. This suggests that adjacent-to-road shared use facilities do not operate as effectively as the equivalent on-road route for some cyclists.

10.2 Route width and capacity

- 10.2.1 On shared use routes, segregating cyclists and pedestrians reduces the width available to each user group. This reduction could have implications for the level of comfort for all users.
- 10.2.2 Level of Service techniques have been developed elsewhere for standardising and measuring pedestrian capacity and level of comfort. In this context, and taking into account the presence of cyclists, the methodology included an assessment of the peaks of pedestrian activity and the amount of usable space available. Platoon Level of Service for pedestrians on each route is categorised on a scale from A (open movement) to F (jammed). To date, this technique has only been developed and standardised for pedestrian movement.
- 10.2.3 In Cambridge the Level of Service for pedestrians on the unsegregated route during the weekday morning peak and weekend peak is B, indicating that it has sufficient capacity for pedestrians but comfort may be affected at busy times or when more than one cyclist is passing.
- 10.2.4 In Norwich the Level of Service for pedestrians on the unsegregated route during the weekday morning peak and weekend peak is A, indicating that it has sufficient capacity at current levels of pedestrian activity.
- 10.2.5 On the segregated routes in Cambridge and Norwich, the Level of Service for pedestrians during the weekday morning and weekend peaks is A, indicating there is sufficient capacity on the footway side of these routes for current activity.
- 10.2.6 Equivalent techniques to measure the Level of Service of cyclists have not been developed for the UK. Cyclist Level of Service is likely to be influenced by range of factors that could include journey time.

10.3 Observed interaction and perceived behaviour

- 10.3.1 This assessment considered shared use environments only, and did not take into account interaction between pedestrians or cyclists and other vehicles. It should be noted that adjacent-to-carriageway facilities can introduce new “junctions” and crossing points (e.g. across side roads) for cyclists, which can lead to increased interaction and potential for conflict with motor vehicles, but this was outside the scope of the research.
- 10.3.2 Using categories of user interaction based on empirical analysis in the Norwich and Cambridge case studies, the difference in the potential for conflict on segregated and unsegregated routes was found to be minimal.
- 10.3.3 The project involved on-site interviews with pedestrians and cyclists in Norwich and Cambridge. Both groups were generally comfortable using the segregated and unsegregated routes studied.
- 10.3.4 Behaviour by both pedestrians and cyclists on segregated and unsegregated routes was judged to be considerate by both user groups. Agreement was strongest on unsegregated routes, suggesting that behaviour is more considerate on these routes, where the requirement to interact with other types of user is clearer.

- 10.3.5 Despite perceived non-compliance with segregation by both pedestrians and cyclists on weekdays and weekends, both groups were comfortable on the segregated route in Cambridge. In Norwich, perceived user comfort on the segregated shared use facility was lower than on the unsegregated facility.
- 10.3.6 Of the people interviewed, cyclists generally used the shared use routes more regularly than pedestrians. In Cambridge low lighting levels affected use by both pedestrians and cyclists at certain times of the day. In Norwich the impact of low levels of lighting affected pedestrians more than cyclists.
- 10.3.7 No collisions, and no conflict of any significance took place during the video surveys. Most of the interaction recorded was relatively inconsequential, where one or more users adjusted their speed/position. The most severe category of interaction observed was that of marginal conflict, where cyclists or pedestrians slowed down or changed direction but movement was calm and controlled.
- 10.3.8 Only 5 instances of marginal conflict were recorded and they took place on the two unsegregated routes. However, both these of routes were relatively narrow at 2.2m (the two segregated routes were 3m and 4m wide). Limited width increases the need for users to make allowances for other users, and it would be reasonable to expect that the level of interaction would reduce with increasing width. Regardless of this, the incidents recorded were relatively benign in nature.
- 10.3.9 In Cambridge, two people (4% of sample) said they had experienced a collision on the segregated route, and two people using the unsegregated route (3% of sample) said likewise. In Norwich, three people (3%) said they had experienced a collision on the segregated route - there were no reports of collisions on the unsegregated route. The findings suggest that there is no material difference in levels of collisions regardless of segregation.

10.4 Summary

	Cambridge		Norwich	
	Segregated	Unsegregated	Segregated	Unsegregated
Does the route operate effectively for pedestrians?	The level of service is A at all peak times, compliance with segregation is high, and there is adequate space available for the level of use User perceptions are generally good. No collisions, and no conflict of any significance recorded.	The Level of service is B at peak times. User perceptions are generally good. No collisions, and no conflict of any significance recorded.	The level of service is A at all peak times, compliance with segregation is lowest at the weekend when there are larger pedestrian groups using the route User perceptions are generally ok. No collisions, and no conflict of any significance recorded..	The Level of service is A at peak times. User perceptions are generally good. No collisions, and no conflict of any significance recorded.
Does the route operate effectively for cyclists?	Cycle compliance is relatively low at peak weekday times, due to	The route operates effectively in spite of limited width User perceptions	Cycle compliance is acceptable. User perceptions	The route operates effectively in spite of limited width User perceptions

	Cambridge		Norwich	
	capacity of the cycle track. The risk is mitigated by considerate behaviour. User perceptions are generally good. No collisions, and no conflict of any significance recorded.	are generally good. No collisions, and no conflict of any significance recorded.	are generally good. No collisions, and no conflict of any significance recorded.	are generally good. No collisions, and no conflict of any significance recorded.

10.4.1 No collisions, and no conflict of any significance were observed during the study period. The vast majority of cases of interaction observed were relatively inconsequential and only 5 cases of marginal conflict were recorded, with these exclusively being instances of users adjusting to one-another's presence.

10.4.2 The findings of this project suggest that collisions are no more likely on unsegregated routes than segregated ones, while the need to interact with other users is likely to increase. However, the data also suggest that where there is sufficient route capacity to provide a good level of service, conflict is less likely to be an issue, regardless of whether the route is segregated (by white line) or not.

10.4.3 As such, it is reasonable to conclude that where capacity is adequate, the difference in the potential for conflict on segregated and unsegregated routes is likely to be minimal.

11. Appendix A: Questionnaire



Intelligent Space
ATKINS
 Euston Tower
 286 Euston Road
 London
 NW1 3AT

intelligentspace@atkinsglobal.com
 www.atkinsglobal.com | www.intelligentspace.com

Shared Pedestrian and Cycle Routes Questionnaire

Thank you for taking a questionnaire. It should take no longer than five minutes to complete. This survey is being carried out by Atkins Intelligent Space on behalf of the Department for Transport as part of a research led study of walking and cycling.

This survey aims to gather information about, and investigate attitudes to, the issue of shared pedestrian and cyclist routes. The research forms part of an ongoing assessment that will be used to help balance the needs of pedestrians, cyclists and other users when designing and implementing shared use routes.

We would be grateful if you could fill in the attached questionnaire as accurately as possible with regards to your use of the pedestrian and cycle route at the location where you were given this questionnaire. Please return the completed questionnaire to Atkins Intelligent Space within one week using the postage-paid addressed envelope provided.

If you have any specific queries about this questionnaire, or would prefer a copy in large print, please contact our team on 0207 121 2550 or email us at intelligentspace@atkinsglobal.com

Figure 83 – Questionnaire covering letter

8a "Most pedestrians who use this path are considerate of other users".
Please indicate your opinion on the above statement:

<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Disagree
<input type="checkbox"/> Agree	<input type="checkbox"/> Strongly disagree
<input type="checkbox"/> No opinion	

8b Please write below any other comments about pedestrians using the path.

8c "Most cyclists who use this path are considerate of other users".
Please indicate your opinion on the above statement:

<input type="checkbox"/> Strongly agree	<input type="checkbox"/> Disagree
<input type="checkbox"/> Agree	<input type="checkbox"/> Strongly disagree
<input type="checkbox"/> No opinion	

8d Please write below any other comments about cyclists using the path.

9 If you were walking on this path:

Do you ever walk on the side of the path designated for cycling?

<input type="checkbox"/> Yes	<input type="checkbox"/> Do not know/ cannot remember
<input type="checkbox"/> No	<input type="checkbox"/> N/A (handed survey on an unsegregated shared use path)

10 If you were cycling on this path:

Do you ever cycle on the side of the path designated for walking?

<input type="checkbox"/> Yes	<input type="checkbox"/> Do not know/ cannot remember
<input type="checkbox"/> No	<input type="checkbox"/> N/A (handed survey on an unsegregated shared use path)

11 If you were walking a dog on this path:

a How many dogs did you walk? number

b How often do you walk your dog(s) on the path?

<input type="checkbox"/> Daily	<input type="checkbox"/> More than once a year
<input type="checkbox"/> More than once a week	<input type="checkbox"/> Less than once a year
<input type="checkbox"/> More than once a month	<input type="checkbox"/> First time

12 If you were using this path with young children:

a How many children did you have with you? number

b How often do you bring your children to the path?

<input type="checkbox"/> Daily	<input type="checkbox"/> More than once a year
<input type="checkbox"/> More than once a week	<input type="checkbox"/> Less than once a year
<input type="checkbox"/> More than once a month	<input type="checkbox"/> First time

c Do you ever use a push chair or pram on the path? ☐ Yes ☐ No

d Do your children bring bicycles/ scooters? ☐ Yes ☐ No

13 It would be helpful if you could provide the following information. You are under no obligation to give it.

a Do you consider yourself to have a disability that affects your use of shared use paths?

<input type="checkbox"/> Visual or hearing impaired	
<input type="checkbox"/> Mobility impaired	
<input type="checkbox"/> Other	<u>please specify</u>

b What gender are you? ☐ Male ☐ Female

b What is your age?

<input type="checkbox"/> under 16	<input type="checkbox"/> 17-25	<input type="checkbox"/> 26-35
<input type="checkbox"/> 36-45	<input type="checkbox"/> 46-55	<input type="checkbox"/> over 55

14 What is the first part of your postcode? E.g. NW1

15 Do you belong to any organisation which has a particular interest in walking or cycling in this area? If so, please give details

Thank you for taking the time to complete this questionnaire. Your help is much appreciated.

Figure 85 – Questionnaire page 2

12. Appendix B: Interaction Descriptions (Norwich)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
08:15	Minor interaction	Cyclist riding southbound	2 pedestrians walking abreast southbound	Cyclist rides around pedestrians	1-2m
08:18	Minor interaction	Cyclist riding southbound	Pedestrian walking southbound	Cyclist rides around pedestrian	1-2m
08:44	Minor interaction	Cyclist riding southbound	2 pedestrians walking abreast southbound	Cyclist rides by pedestrians passing closely	<1m
08:45	Marginal conflict	Cyclist riding northbound	2 pedestrians walking abreast southbound	Pedestrian required to step aside to allow cyclist to pass	<1m
08:46	Minor interaction	Cyclist riding southbound	Pedestrian walking northbound	Pedestrian required to step aside to allow cyclist to pass	<1m
08:46	Minor interaction	Cyclist riding southbound	Pedestrian walking northbound	Pedestrian required to step aside to allow cyclist to pass	<1m
08:54	Marginal conflict	Cyclist riding southbound	Group of two pedestrians walking abreast southbound	Pedestrian required to step aside to allow cyclist to pass	<1m

Figure 86 Bluebell Rd Norwich, unsegregated, link section (Friday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
13:34	Minor interaction	Cyclist riding northbound	2 pedestrians walking abreast northbound	Pedestrian required to step aside to allow cyclist to pass	<1m

Figure 87 Bluebell Rd Norwich, unsegregated, link section (Saturday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
08:14	Minor interaction	Eastbound cyclist travelling fairly quickly in cycle track	2 westbound pedestrians in footway	Pedestrian nearest cyclist moves to one side slightly	1-2m
08:32	Minor interaction	Two cyclists (one in track, one in footway) approach oncoming cyclist in track	N/a	Cycling pair move to single file to allow approaching cyclist to pass	1-2m
08:37	Minor interaction	Cyclist in track and child cyclist in footway approach oncoming cyclist in track	N/a	Cyclists in track pass each other without deviating significantly	<1m
08:53	Minor interaction	Westbound cyclist	N/a	Overtaken by another cyclist	1-2m

Figure 88 The Avenues, Norwich, segregated, link section (Friday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
13:29	Minor interaction	Eastbound cyclist	Eastbound pedestrians walking in cycle track	Pedestrians overtaken by cyclist - they look over shoulder	1-2m
13:31	Minor interaction	2 westbound child cyclists (1 in footway, 1 in track) approach oncoming adult cyclist in track	N/a	Child cyclist in track moves out of the way of oncoming adult cyclist	<1m

Figure 89 The Avenues, Norwich, segregated, link section (Saturday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
08:08	Minor interaction	Cyclist slowly approaches driveway	Passengers exit car stopped in middle of driveway	Cyclist rides past passengers exiting car	1-2m
08:08	Minor interaction	Northbound child cyclist	Group of school children ahead of cyclist walking in same direction	Cyclist swerves to overtake school children	<1m
08:21	Minor interaction	Southbound cyclist	Two pedestrians passing each other	Cyclists passes northbound pedestrian	<1m
08:22	Minor interaction	Slow moving northbound cyclist attempts to pass pedestrian group on their right then their left side	Two adults with a child. One of the adults is walking a dog.	Both adults step out of the way for cyclist to pass	<1m
08:22	Minor interaction	Two slow moving southbound cyclists	Two adults with a child. One of the adults is walking a dog.	Cyclists pass group. No change in behaviour	<1m
08:26	Minor interaction	Two cyclists approach each other	Refuse collection worker between cyclists	One cyclist overtakes refuse collection worker then deviates slightly to allow the other cyclist to pass	1-2m
08:36	Minor interaction	Southbound cyclist	Southbound pedestrian	Pedestrian overtaken by cyclist in close proximity. No change in behaviour	<1m
08:43	Minor interaction	Southbound cyclist	Two pedestrians walking abreast southbound	Pedestrians overtaken by cyclist in close proximity. No change in behaviour	<1m
08:45	Minor interaction	Fairly quickly moving northbound cyclist	Southbound pedestrian	Pedestrian moves out of the way of cyclist who continues on intended line	1-2m
08:45	Minor interaction	Fairly quickly moving northbound cyclist	Southbound pedestrian	Pedestrian moves slightly out of the way of cyclist who continues on intended line	1-2m

Figure 90 Bluebell Rd Norwich, unsegregated, junction (Friday), part 1

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
08:48	Minor interaction	Southbound cyclist	Two southbound pedestrians	Cyclist passes between them very closely and continues on intended line	<1m
08:52	Minor interaction	Southbound cyclist	Southbound pedestrian	Cyclist passes pedestrian closely then continues on intended path	<1m
08:52	Minor interaction	Northbound cyclist	Northbound pedestrians	Cyclist 'tailgates' pedestrians for a few seconds then overtakes them	<1m
08:55	Minor interaction	Southbound cyclist	Two adults walking with a child southbound	Cyclist moves around pedestrians to overtake them	<1m
08:55	Minor interaction	Fairly quickly moving southbound cyclist	Two adults walking with a child southbound	Cyclist swerves to pass pedestrians who move across to walk on grass alongside route	<1m
08:55	Minor interaction	Slowly moving southbound cyclist	Two adults walking with a child southbound	Cyclist waits and then swerves to pass pedestrians who move across to walk on grass alongside route	<1m

Figure 90 Bluebell Rd Norwich, unsegregated, junction (Friday), part 2

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
13:34	Minor interaction	Northbound cyclist	Two northbound pedestrians walking side-by-side	Cyclist overtakes pedestrians, pedestrian nearest cyclist moves to one side	1-2m

Figure 91 Bluebell Rd Norwich, unsegregated, junction (Saturday)

13. Appendix C: Interaction Descriptions (Cambridge)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
08:03	Minor interaction	Westbound cyclist	Pedestrian ahead of cyclist travelling in same direction	Cyclist passes near the lamp post where space is limited. Pedestrian slightly surprised	<1m
08:03	Marginal conflict	Eastbound cyclist	Two pedestrians walking in the opposite direction with child on a scooter	Cyclist tries to pass in the middle of group. One pedestrian pulls the child out of the way. They also step into the road	<1m

Figure 92 Fen Causeway, Cambridge, unsegregated, link section (Friday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
13:03	Minor interaction	Three westbound cyclists	Eastbound pedestrian	Cyclists swerve around pedestrian to pass	N/a
13:18	Minor interaction	Eastbound cyclist	Two westbound pedestrians walking abreast at pinch point created by lamppost	Pedestrian steps to one side to allow cyclist to pass	N/a
13:36	Minor interaction	Westbound cyclist	Mother and child running eastbound	Mother steps aside to allow cyclist to pass	N/a
13:59	Marginal conflict	Eastbound cyclist travelling slowly	Two eastbound pedestrians ahead of cyclist	Pedestrians separate to allow cyclist to pass. One of them steps into the road	N/a

Figure 93 Fen Causeway, Cambridge, unsegregated, link section (Saturday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
13:43	Minor interaction	Group of five eastbound cyclists	Eastbound pedestrian ahead of cyclists	Cyclists overtake pedestrian, passing closely. Pedestrian may be uncomfortable with passing distance and number of cyclists	<1m
13:49	Minor interaction	Eastbound cyclist travelling slowly	Group of five westbound pedestrians occupying footway and cycle track	Pedestrians and cyclist make way for each other. Cyclist passes in between pedestrians	<1m
13:49	Minor interaction	Eastbound cyclist travelling slowly	Group of five westbound pedestrians occupying footway and cycle track	Pedestrians and cyclist make way for each other. Cyclist passes in between pedestrians	<1m
13:50	Minor interaction	Westbound cyclist travelling slowly	Two eastbound pedestrians occupying footway and cycle track	Pedestrians step aside for cyclist who passes between them	1-2m

Figure 94 Barton Road, Cambridge, segregated, link section (Saturday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
08:06	Minor interaction	Two cyclists follow two pedestrians in joining the shared use route	Pedestrians stop/change direction	Pedestrians are surprised by cyclists	N/a
08:09	Marginal conflict	A large group of cyclists are waiting to cross the road	A few pedestrians are also waiting to cross	Another cyclist tries to pass them all. Presumably asks one of the group to move to get through	<1m
08:39	Minor interaction	A cyclist is about to cross the road	A pedestrian is also waiting to cross	Cyclist crosses the pedestrians path when they move off. Pedestrian stops for cyclist	<1m

Figure 95 Fen Causeway, Cambridge, unsegregated, junction (Friday)

Time	Category	Initial state - cyclists	Initial state - pedestrians	Outcome	Approx passing distance
13:29	Minor interaction	Cyclist heading westbound	Group of pedestrians waiting to cross road	Cyclist slows down and passes pedestrians closely. Pedestrians step out of the way	<1m
13:58	Minor interaction	Two eastbound cyclists at crossing facility	Eastbound pedestrian walks alongside them when they cross	A westbound cyclist passes pedestrian who may feel uncomfortable with the proximity of the cyclists	<1m

Figure 96 Fen Causeway, Cambridge, unsegregated, junction (Saturday)

14. Appendix D: Pedestrian Level of Service

14.1.1 Level of Service is a standard measurement of pedestrian capacity and level of comfort. In this context, the methodology assesses the peak volume of pedestrian flow activity and the amount of available, usable space for users.

14.1.2 Platoon Level of Service is measured on a sliding scale to benchmark the level of comfort of routes from A, with plenty of available space to walk freely, through F, where the crowd and space available minimises the freedom of movement. This is shown in the figure below

Platoon LOS	Description
A	Open
B	Impeded
C	Constrained
D	Congested
E	Crowded
F	Jammed

Figure 86 – Questionnaire page 2

14.1.3 The Platoon Level of Service standard takes into account grouping of pedestrians, whether voluntarily or involuntarily, which tends to reduce the level of comfort for each user.

14.1.4 Widths were obtained from on-site surveys by Atkins.

14.1.5 Peak hour pedestrian flows (scaled to an equivalent flow per unit time per unit width) have been used in all calculations. Flows were measured during the peak pedestrian hour on a typical Saturday in November 2009 as presented in the flow assessment.