Phil Jones Associates

Transport Planning Consultants

Sustrans

The Merits of Segregated and Non-Segregated Traffic-Free Paths

A Literature-Based Review

Updated Report, August 2011

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1 EXECUTIVE SUMMARY

Introduction

1.1 Phil Jones Associates was commissioned by Sustrans in 2008 to carry out a literature-based research study into segregated and non-segregated traffic-free paths. This was needed to provide an evidence base in connection with Sustrans' proposal to the Welsh Assembly, which would place a duty on Highway Authorities to develop and maintain a network of traffic free paths for walkers, cyclists and disabled people across Wales.

1.2 PJA was instructed in May 2011 to produce this updated version of the report, reflecting new documentation and research that has been published in the intervening period. Paragraphs that have been added or altered in this second version of the report are indicated by a **bold paragraph number.**

1.3 Guide Dogs for the Blind Association (GDBA) has objected to the Sustrans initiative, as they wish to see separate paths for pedestrians and cyclists on any future traffic-free routes, something that Sustrans has difficulty in assenting to.

1.4 GDBA/JCMBPS have also suggested that funding could be made available to create wholly separate networks of pedestrian and cycle routes. This concept has not been considered in this report, on the basis that it is likely to be impractical in most situations. Cyclists and pedestrians will generally wish to reach the same destinations, and given the limited opportunities to provide routes away from traffic it is highly unlikely that two separate corridors will be available.

1.5 This report sets out to make an objective and evidence-based assessment of the following:

- Current state of policy and design guidance
- Actual and perceived risks to path users.
- User behaviour on segregated and non-segregated paths
- The advantages and disadvantages of segregated and non-segregated paths
- The implications of alternative design choices

1.6 We stress that this report has been prepared independently of both Sustrans and Guide Dogs for the Blind Association and represents our professional assessment of the key issues.

1.7 The various documents reviewed for this study are scheduled in Appendix B. The list includes:

- Policy statements and produced by Sustrans, Guide Dogs for the Blind Association and the Joint Committee for Blind and Partially-Sighted People
- Guidance and standards from the UK
- Guidance and standards from overseas
- Primary research, case studies and academic papers from various sources

1.8 The benefits of traffic-free paths are set out in many reports and policy statements including the Welsh Assembly's *Walking and Cycling Strategy for Wales* and the *Walking and Cycling Action Plan for Wales*; and reports produced by Sustrans, and these benefits are not disputed by GDBA. GDBA maintain that these benefits can also accrue from segregated or wholly separate paths, however.

The Benefits of Traffic-Free Paths

1.9 Encouraging more people to walk and cycle creates three principal types of benefit;

- Health benefits, through increased exercise and by reducing traffic injuries
- Environmental benefits, principally through reduced CO_2 and other emissions
- Economic benefits, by reducing congestion and. through tourism spending

1.10 Traffic-free paths are particularly important in encouraging new and returning cyclists to gain more confidence, whilst also providing an important resource for pedestrians.

1.11 Guide Dogs for the Blind Association, in its submission to the Welsh Assembly made the point that that these benefits can accrue if the path is segregated or separate paths are provided, so that vulnerable users feel safer. The issue of perceived risk is considered in more detail later in this report, but it needs to be recognised that segregated paths are generally more costly than non-segregated paths and require greater land.

1.12 It is self-evident to us that the benefits of traffic-free routes are directly related to the overall extent of the network provided, and that for any given expenditure, the lower the cost of the routes, the greater distance that can be built and maintained.

1.13 There must also be a presumption that a path of some form, whether segregated or non-segregated, needs to be provided to enable people to reach their desired destination. A failure to complete a key connection – due to insufficient funding or land constraints for example - will devalue the remainder of the link and the network as a whole.

1.14 A visit to the Taff Trail in Cardiff to see the operation of a disabled cycle centre confirmed the value that disabled cyclists gain from being able to use a single level surface that can accommodate special cycles or where a carer can walk or cycle alongside them.

Disabled cycling, Bushy Park (Companion Cycling)

Policy Positions

1.15 The policy positions of Sustrans and Guide Dogs for the Blind Association /Joint Committee on Mobility for Blind and Partially-Sighted People (JCMBPS) were reviewed.

1.16 GDBA are concerned that the sharing of paths with cyclists presents a very real hazard to pedestrians, particularly those with mobility and sensory impairments and other vulnerable groups. GDBA state that they have amassed considerable evidence that collisions between cyclists and disabled persons occur regularly. JCMBPS state that the increase in the number of paths shared by cyclists and pedestrians is causing widespread concern to people with a sensory impairment and pedestrians generally.

1.17 JCMBPS therefore sets out a hierarchy of provision whereby parallel routes for pedestrians and cyclists, separated by a verge, would be the most favoured solution. Shared use (ie a non-segregated path) would only be acceptable on the most quiet and rural routes.

Visually impaired walker with guide dog & cyclist on segregated traffic free path,
Castle Park, Bristol, National Route 4 (Julia Bayne/Sustrans)

1.18 Sustrans accept that disabled people do express concerns of being hit, or being passed too closely, by a speeding cyclist and that while the risk of being hurt is low, there is perceived danger that affects users' behaviour, possibly to the extent that they will not use the route. However, Sustrans also note that their routes (most of which are non-segregated) are well used by people with visual impairment, because they are well surfaced, continuous, free of traffic and convenient.

1.19 Unfortunately while Sustrans carry out monitoring on path use, and ask whether users have a disability, they do not currently record the nature of that disability and therefore cannot provide firm data on the number of blind and partially sighted users of their network. It is recommended that such data is collected in future.

1.20 Sustrans recognise that some form of segregation can help blind people use the path more safely and confidently and that in urban areas, where use is high, segregation by forming a separate track or by a level difference may be appropriate.

1.21 In rural areas however, Sustrans state that non-segregated paths will be the norm, for several reasons:

- Many paths attract family groups including both walkers and young children on bicycles
- Shared (non-segregated) use of space provides a greater width for everyone including wheelchair users who appreciate a wider space to manoeuvre in.
- Physical separation on canal paths would separate one group of the enjoyment of being by the water
- Complete physical segregation would be impossible on many stretches of path and elsewhere it would be costly to install and maintain

1.22 It is considered that there is actually some common ground between Sustrans and GDBA/JCMBPS. Sustrans do accept that segregation is appropriate in some circumstances, particularly in high use urban locations; and GDBA/JCMBPS accept that non-segregated paths may also be possible, albeit only on very lightly used rural routes. The issue can therefore be seen not in terms of absolutes – whether either segregated or non-segregated paths are generally better – but in trying to define the circumstances when one is to be preferred over the other.

Literature Review – Guidance, Case Studies, Research and Academic Papers

1.23 The documents reviewed for the study are listed in Appendix B. In addition a snapshot of the attitudes of keen cyclists was obtained from a posting on the forum of the Cyclists' Touring Club website.

1.24 Notwithstanding the general preference for segregation expressed in some technical guidance documents, there are several factors to be taken into account when deciding between non-segregated and segregated paths. These include:

- Pedestrian and cycle flow
- Cycle speed
- Cycle journey purpose
- Visibility along the path
- Presence of vulnerable users – elderly, disabled, children
- Available width/presence of pinch points eg bridges
- 'Exchange' activity – shopping, playing etc.

1.25 Unfortunately the guidance documents rarely give any numerical guidance on these factors, generally stating that designs need to be produced on a site-specific basis, taking local factors into account.

1.26 Significantly, the most recent Department for Transport (DfT) guidance document, the draft Local Transport Note on Shared Use facilities (published in May 2011) moves away from a presumption in favour of segregation and states that the decision whether or not to do so should be based on local circumstances. It is based on research carried out by Intelligent Space Atkins (discussed below), carried out in collaboration with MVA and PJA.

1.27 The risk of actual conflict on traffic-free paths is generally low, although poor standards of maintenance and design can produce paths with a poor accident record for cyclists. Perception does not match reality however; in Milton Keynes, cyclists thought the traffic-free Redways were safer than they actually are; and on the Queen Charlotte Trail, a rural multi-day trail in northern in New Zealand, walkers who did not meet cyclists had more negative views of sharing the route than walkers who did meet cyclists.

1.28 Good information alerting people to the legitimate presence of cyclists on paths can help to reduce perceived conflict. In Kensington Gardens adverse views of cycling went down after cycling was legitimised, despite an increase in cycling. One challenge is how to communicate cyclists' presence to blind and partially-sighted people, but Codes of Conduct, such as those promoted by Sustrans or the Royal Parks, and well-designed tactile surfacing which indicates when pedestrians are entering a path shared with cyclists can help.

1.29 Detailed studies of pedestrian and cyclists on shared use paths in the UK carried out for the Countryside Agency have shown that their behaviour is more complex than may be thought – both cyclists and pedestrians typically use the whole of the path, and cyclists have commented in

several studies of the problem of pedestrians not keeping to the part of path designated for their use on segregated facilities.

Group of pedestrians using the whole of a segregated path, Lancaster (Sustrans)

1.30 The Countryside Agency studies also showed that (on paths carrying up to around 100 users per hour) conflict on non-segregated paths is an extremely infrequent occurrence. However, when people talk about conflict, its assumed incidence increases and appears to be more serious. The discussion and focussing of attention on conflict serves to escalate its perceived existence.

1.31 Some studies have shown that it is the proximity of cyclists to pedestrians that creates most conflict, rather than their speed – and several studies have shown that most cyclists do slow down when they meet pedestrians.

1.32 The recent research studies carried out by Atkins for DfT and Transport for London (TfL) found that 'interactions' – defined as incidents where a pedestrian and cyclist interact in a way that causes minor discomfort or conflict – were rare occurrences and there was no significant difference in conflict levels between the two types of path. The Atkins studies have also found that the cycle speeds tend to increase with segregation, so that actual conflict can be higher on segregated paths.

1.33 It was also found that a white line is not an effective means of segregating a pedestrian/cycle path. Overall, it was found that the level of non-compliance amongst all users was around 1 in 7, and the level of non-compliance for pedestrians is around double that for cyclists.

1.34 Some research on the possible methods of segregation has shown that using a level difference or a barrier between paths can create a hazard for cyclists. However, the new draft LTN advises that it is the preferred means of segregation.

1.35 Considerable research has been done overseas on the development of more objective methodologies to assess 'level of service' (LOS) on non-segregated paths. The original thinking on this related level of service, for both pedestrians and cyclists, to the frequency with which path users pass or meet one another. More recently researchers in the US have refined this approach, recording the responses of cyclists to videos of varying conditions on real paths, and relating their perceptions of path quality to measurable parameters – principally user flow, modal split and path width.

1.36 This approach is considered to have merit in that it provides a logical and auditable methodology for predicting users' opinions of conditions on a particular path.

1.37 Some applications of LOS concepts have already been made to assess the suitability of routes through London greenspaces for shared use, but these have generally focussed on pedestrian LOS, on the basis that they make up the vast majority of users. Recent research carried out for TfL has proposed how this methodology could be extended to shared use paths, however.

1.38 It is important to note we have not been able to find any research that objectively assesses the degree of perceived risk that is felt by blind and partially-sighted people when actually using a path that is shared with cyclists. Previous studies have generally used focus groups to assess the problem rather than seeking, say, to interview actual path users to ascertain how their perceptions vary with path conditions, including segregation.

1.39 It may be that such an approach (which could be based on the 'perceived LOS' philosophy used in the TRB work) could be used in future research.

1.40 The literature review does provide a series of possible guidance levels for path user flow that may justify segregation, as set out in Table 2 of this report, however the most recent guidance produced by TfL indicates that unsegregated paths can cater for high flows of pedestrians and cyclists, if they are wide enough. That guidance also recommends that segregated paths are not used where cycle flows are low, as pedestrians tend not to comply with segregation in such circumstances.

1.41 The research has pointed to a list of possible advantages and disadvantages of segregated and non-segregated traffic-free routes, which are given in Table 3 of the report. Disadvantages of segregation include the increased overall width required is greater. As noted at the outset, it is taken as a given that a path should be provided – the key question is what type of path is appropriate for a given situation.

1.42 These advantages and disadvantages show that the choice between segregation and non-segregation is highly dependent on local circumstances, as set out in Table 4 of the report. This finding is consistent with the new draft Local Transport Note published by DfT and with draft TfL design guidance.

1.43 In any particular situation the choice between segregation and non-segregation is likely to depend on the balance between several of these factors, and the table illustrates why it is not appropriate to set a firm presumption in favour of any particular solution.

Conclusions

1.44 The study has confirmed that traffic-free routes are vitally important if cycling and walking are to be encouraged and that there should be a presumption in favour of completing the network. It has also demonstrated that it is not generally feasible to provide wholly separate pedestrian and cycle routes; most routes will have to cater for both types of user, as well as other groups such as equestrians.

1.45 Both segregated and non-segregated paths have their advantages and disadvantages. There is no ideal form of segregation, for example; all have their pros and cons.

1.46 Our review has identified a number of indicators that point towards segregation or non-segregation being the most appropriate response in a particular situation. The choice will depend on the balance between these factors. Local circumstances will therefore inevitably influence the best design for a particular section of path.

1.47 Although considerable research has been carried out which shows that actual levels of conflict on shared paths are low, and that perceptions of conflict are often lower than focus groups may suggest, little objective research has been done into the behaviour and perceptions of blind and partially-sighted people when sharing routes with cyclists.

1.48 Further research is therefore advisable into the response of vulnerable groups to different conditions, both in terms of path design and use. Extending Sustrans' surveys to identify the nature of any disability, so that variations in the numbers of blind and partially-sighted users could be investigated, would be a starting point in this process.

1.49 Further technical guidance would hopefully enable the best path design to be produced for any particular location, on a case by case basis, helping to overcome the differences between Sustrans and GDBA and to build upon the substantial degree of agreement that does exist.

1.50 It is hoped that this report has helped to provide a balanced overview of the benefits of providing more extensive networks of traffic-free routes throughout Wales; and has provided a way forward that will assist all groups in coming to a common view on how best to decide on the type of path to be provided in any given situation.

2 INTRODUCTION

2.1 In 2008, Sustrans commissioned Phil Jones Associates (PJA) to carry out a literature-based research study into segregated and non-segregated traffic-free paths, and the subsequent report was issued in December of that year.

2.2 PJA was instructed in May 2011 to produce this updated version of the report, reflecting new documentation and research that has been published in the intervening period. Paragraphs that have been added or altered in this second version of the report are indicated by a **bold paragraph number.**

2.3 During the period since the publication of the initial version of the report, PJA has worked with MVA and Intelligent Space Atkins on research for the Department for Transport, leading to a new Local Transport Note on the design of shared use pedestrian and cycle paths. At the time of writing (August 2011) the LTN has been published as a draft for peer review.

2.4 The original PJA report was required in order to provide an evidence base in connection with Sustrans' proposal to the Welsh Assembly, which would place a duty on Highway Authorities to develop and maintain a network of traffic free paths for walkers, cyclists and disabled people across Wales. The then-proposed Legislative Competence Order (LCO) is contained in Appendix A.

2.5 Following the 'Yes' vote in the March 2011 referendum on law-making powers, the proposed LCO fell, but the Welsh Government now intends to place a such a duty on Local Authorities through the Highways and Transport (Wales) Bill, which is planned to be brought forward within the next two years.

Visually impaired walker with guide dog & cyclist on segregated traffic free path,
Castle Park, Bristol, National Route 4 (Julia Bayne/Sustrans)

2.6 In 2008 Guide Dogs for the Blind Association (GDBA) objected to the Sustrans initiative, as they wish to see separate paths for pedestrians and cyclists on any future traffic-free routes, something that Sustrans has difficulty in assenting to. Most of Sustrans' paths provided to date as part of the National Cycle Network have been traffic-free paths without segregation, although some sections are segregated, most commonly in urban areas.

2.7 This report therefore sets out to make an objective and evidence-based assessment of the following:

- Current state of policy and design guidance
- Actual and perceived risks to path users.
- User behaviour on segregated and non-segregated paths
- The advantages and disadvantages of segregated and non-segregated paths
- The implications of alternative design choices

2.8 The study was carried out over a relatively short period of time and was therefore largely based on a literature review, including:

- Policy statements
- Technical guidance
- Research and other reports

- Conference papers
- Published data

2.9 A joint meeting was held in 2008 with Sustrans Wales and representatives of GDBA and Disability Wales to gain a better understanding of the views of the key organisations. On the same day a visit was made to a section of the Taff Trail, a long distance non-segregated traffic-free path, between Cardiff city centre and Bute Park, to see the operation of part of the trail and to visit Pedal Power, a cycle hire centre specialising in meeting the needs of disabled cyclists.

Part of the Taff Trail through Bute Park (Microsoft Live Local)

2.10 A presentation of the draft conclusions of the 2008 research was made to a meeting of the Joint Committee on Mobility for Blind and Partially-Sighted People, which helped to clarify the views of that organisation and GDBA.

2.11 In addition, views were obtained from other organisations promoting the use of traffic-free routes by disabled people; a snapshot of the attitudes of keen cyclists was obtained from a posting on the forum of the Cyclists' Touring Club website; and telephone discussions were held with a representative of The Royal Parks, an organisation that has recent experience of introducing cycling to pedestrian routes in Kensington Gardens and The Regent's Park, and with Intelligent Space Atkins, consultants working on similar projects in London green spaces and for Transport for London.

2.12 We stress that this report has been prepared independently of both Sustrans and Guide Dogs for the Blind and represents our professional assessment of the key issues.

3 LITERATURE REVIEW AND OTHER RESEARCH – INTRODUCTION

3.1 The various documents reviewed for this study are scheduled in Appendix B. The list includes:

- Policy statements and produced by Sustrans, Guide Dogs for the Blind Association and the Joint Committee for Blind and Partially-Sighted People
- Guidance and standards from the UK
- Guidance and standards from overseas
- Primary research, case studies and academic papers from various sources

3.2 At the outset, however, it is useful to define what is meant by traffic-free paths, both segregated and non-segregated. 'Traffic-free paths' is a term used by Sustrans to mean a path that can be used without restriction, except that motorised vehicles (including motorcycles) are not permitted [1] and on some paths horses are not allowed.

3.3 The term 'Greenways' is also used by Sustrans (and Transport for London) to describe quiet, appealing traffic-free routes to, between and within green spaces[2]. Clearly not all of the traffic-free routes that would be provided as a result of the Sustrans proposal in Wales could be classed as Greenways, but it is expected that a significant proportion would be.

3.4 These traffic-free paths may be divided in some way – for example by a change of level, surfacing material or by a white line (possibly raised) - to indicate which part of the path is meant to be used only by pedestrians, and which part is meant to be used by cyclists[3], in which case they are referred to in this report as 'segregated'. Alternatively there may be no such division in which case they are referred to here as 'non-segregated'.

3.5 The term 'shared use' can be used in two ways - to indicate that all people may use the path, or that there is no segregation between users, and so for that reason the term is not used in this report.

3.6 The Department for Transport's draft Local Transport Note 1/04 (soon to be withdrawn) uses the latter definition of shared use, and uses the term 'adjacent use' to mean paths where

[1] Other than motorised disability scooters travelling up to 15mph, which are generally permitted to use the paths.

[2] Sustrans also use the term 'Greenways to include quiet streets that are conducive to walking and cycling.

there is a cycle track in close proximity to a footway or footpath but is segregated from it in some way. Such a path would be called 'segregated' in this report.

3.7 The DfT's new draft LTN on shared use facilities uses the same definitions as this report, however, which will hopefully help understanding.

3.8 GDBA/JCMBPS have also suggested that funding could be made available to create wholly separate networks of pedestrian and cycle routes. This concept has not been considered in this report, on the basis that it is likely to be impractical in most situations. Cyclists and pedestrians will generally wish to reach the same destinations – whether making leisure trips or travelling for day-to-day needs – and given the limited opportunities to provide routes away from traffic it is highly unlikely that two separate corridors will be available.

3.9 The Department of Transport's draft LTN 2/04 notes that providing cycle-only routes is difficult as pedestrians generally wish to use the paths. Clearly there would also be significant cost implications if two networks were to be required. The DfT's new draft LTN also notes that if it is proposed to create a cycle track on a new alignment, it is likely that pedestrians will wish to use it.

3.10 Furthermore, it should be recognised that in many cases, sections of the network are formed from bridleways, which cyclists, pedestrians and equestrians are already entitled to use. Resurfacing of these routes enables a greater range of users to gain access, including cyclists on road bikes and wheelchair users.

[3] Although pedestrians still have the legal right to use the cyclists' part – see LTN 2/04, para 10.1.2

4 THE BENEFICIAL OUTCOMES OF TRAFFIC-FREE PATHS

4.1 The benefits of traffic-free paths (whether segregated or non-segregated) are set out in many reports and policy statements including the Welsh Assembly's *Walking and Cycling Strategy for Wales* (2003) and those produced by Sustrans, and these benefits are not disputed by GDBA. GDBA maintain that these benefits can also accrue from segregated or wholly separate paths, however.

4.2 Encouraging more people to walk and cycle creates three principal types of benefit;

- Health benefits, through increased exercise and by reducing traffic injuries
- Environmental benefits, principally through reduced CO_2 and other emissions
- Economic benefits, by reducing congestion and. through tourism spending

4.3 The Walking and Cycling Strategy for Wales notes in the Foreword that *"How we choose to travel is important for our health, our environment and the economy. Walking and cycling can bring about tremendous health benefits to individuals through increasing the amount of physical activity we undertake. Walking to the bus stop helps us use other environmentally friendly forms of transport. Altogether they will help to improve local air quality and reduce emissions that have a global impact. They form a vital part of tourism encouraging visitors to Wales In terms of Welsh society, opening up walking and cycling facilities for everyone is an important element in creating equal opportunities, for example to meet the needs of disabled people and deprived communities."*

4.4 The Welsh Strategy document also sets out in para 2.7.6 the key role that traffic-free paths play in encouraging more people to cycle: "*Use of off-road and traffic-free cycling facilities during holidays or short leisure breaks allows people to develop confidence to cycle elsewhere e.g. in urban areas for journeys to work, school and shopping*."

4.5 In 2009, the Welsh Assembly Government published the Walking and Cycling Action Plan for Wales, which set targets and actions for increasing walking and cycling. The Ministerial Foreword to the Action Plan noted that: *"The benefits of walking and cycling more often, whether for routine trips to the shops, to work or for simply for recreation, are clear. By walking and cycling more, people's health can be improved and by relying on our cars less, traffic congestion is reduced and the greenhouse gas emissions causing climate change can be cut. In addition, by encouraging sustainable access to the natural environment our rural economies are supported."*

4.6 The Action Plan set a number of actions for various agencies, including the increased provision of safe traffic free walking and cycling routes and the continued development of the National and Local Cycle Networks; and targets, including a tripling of the percentage children cycling to school and adults cycling to work.

4.7 Sustrans' annual monitoring reports confirm that traffic-free paths are vital to encouraging new and returning cyclists to gain more confidence, whilst also providing an important resource for pedestrians.

4.8 The *2007 Annual Monitoring Report on the National Cycle Network* states that:

- Use of the NCN increased by 4.7% on the previous year, to 354m trips
- 50% of trips on the NCN are walking, 50% cycling
- The traffic-free sections of the NCN carry 82% of its trips
- 9% of cyclists on the NCN are new or returning to cycling
- 13% of women cyclists describe themselves as novices (women cyclists generally being in the minority)
- 14% of the users of the NCN are over 60
- 3% of trips on the NCN are made by people with a disability, rising to 5% in those over 60.

4.9 The 2008 Sustrans monitoring report found that these trends were continuing, with use of the NCN increasing by a further 9%, and with a like-for-like increase of 3%. Again trips on the network were split roughly half and half between pedestrians and cyclists. Although the NCN is often seen mainly as a leisure route, the biggest increase in usage was in weekday journeys, suggesting that utility cyclists are also benefiting from the NCN. Some 23% of the journeys on the NCN were for commuting, more than double the number of trips for this purpose made in 2007.

4.10 Sustrans carried out monitoring of the London Greenways network in 2009 and found that of the users:

- 18% were over 55 (compared to 8-12% of London cyclists in total)
- 42% were women (compared to around 33% of London cyclists in total)
- 19% were below 16 years old.
- 7% had a long term illness or disability
- 19% could have used car or motorcycle
- 44% of trips were for commuting, shopping or other personal business

4.11 In Wales, the Taff and Celtic trails are particularly important and carry some 2.1m trips per annum. A study carried out for Sustrans, reviewed further below, estimated that the trails bring a total benefit of some £75m per annum to the economies of South Wales, generating an overall 1400 jobs.

4.12 Guide Dogs for the Blind Association, in its submission to the Welsh Assembly on the proposed Legislative Competence Order (LCO), make the point that that these benefits can accrue if the path is segregated or separate paths are provided, so that vulnerable users feel safer. The issue of perceived risk is considered in more detail later in this report, but it needs to be recognised at the outset that segregated paths are generally more costly than non-segregated paths and require greater land. This point is acknowledged in the new draft LTN.

4.13 It is self-evident to us that the benefits of traffic-free routes are directly related to the overall extent of the network provided, and that for any given expenditure, the lower the cost of the routes, the greater distance that can be built and maintained. Resources are limited and need to be spent wisely. as noted in para 3.2.5 of the Walking and Strategy for Wales.

4.14 The Welsh strategy also notes, in para 2.7.5 that it is important that the network is continuous, if it is to meet peoples' need to travel. There must therefore be a presumption that a path of some form, whether segregated or non-segregated, needs to be provided to enable people to reach their desired destination. A failure to complete a key connection – due to insufficient funding, land constraints for example - will devalue the remainder of the link and the network as a whole.

5 POLICY POSITIONS

5.1 The issue at the heart of this report is to assess the difficulties that particular user groups have in sharing multi-use paths with other user groups; and how these difficulties can and should be addressed, taking into account all of the other advantages and disadvantages of segregated and non-segregated paths. It is therefore important that the fundamental concerns of those representing blind and other vulnerable users are set out clearly, together with Sustrans as the proponents of the LCO.

5.2 GDBA summarise their concerns in the statement to the Welsh Assembly on the proposed LCO, stating that "*The sharing of paths with cyclists can present a very real hazard for pedestrians in general but even more so for those with mobility and sensory impairments, people with learning difficulties, older people, and carers",* and that "*We have amassed considerable anecdotal evidence that collisions and near-misses between cyclists and disabled pedestrians are a regular occurrence, and, as importantly, the negative impact on the independence of disabled people who are no longer able to use routes that are used by cyclists. These incidents relate not only to existing pedestrian paths used by cyclists, legally or illegally, but also to those paths specifically designed and developed for shared use."*

5.3 These concerns are expressed in more detail in the Joint Committee on Mobility of Blind and Partially Sighted People (JCMBPS) Policy on Adjacent Facilities Pedestrians and Cyclists (2004) which states that: "*The increase in footways and footpaths shared by cyclists and pedestrians is causing widespread concern not only to people with a sensory impairment but also to other pedestrians and facility planners."*

5.4 Notwithstanding these concerns JCMBPS state that '*The provision of safe, well designed and convenient cycle routes is important'.*

5.5 The JCMBPS Policy goes on to set out a hierarchy of provision for traffic-free routes:

- Parallel routes for pedestrians and cyclists, separated by a verge, desirably 1m wide and minimum 0.5m wide
- Parallel routes separated by a change in level (50mm to 100mm). Desirably 3-3.5m wide for cyclists, 2m for pedestrians
- Parallel routes separated by a barrier (hedge or railing, 1m high). Desirably 3.9m wide for cyclists where bounded both sides.

- Segregation by a raised white line, plus 'ladder' tactile surfacing to denote pedestrian and cyclist parts, different colour surfacing etc.
- Segregation by a flat white line is never acceptable
- If the above solutions are not possible, shared use is not acceptable, except on rural routes in sparsely populated areas where routes are used by few people infrequently (eg forest paths).

5.6 Sustrans has also produced a statement, dating from 1998 that deals, *inter alia,* with these issues, *"Disabled People and the National Cycle Network".* Sustrans note that the NCN does benefit many disabled people, including disabled cyclists on tandems or specialist cycles. The visit made to Pedal Power in Cardiff (see below) demonstrated the value of providing for disabled cyclists.

5.7 Sustrans in their policy note agree that disabled people do express concerns of being hit, or being passed too closely, by a speeding cyclist and that while the risk of being hurt is low, there is perceived danger that affects users' behaviour, possibly to the extent that they will not use the route.

5.8 Sustrans' note states that their routes (most of which are non-segregated) are well used by people with visual impairment, because they are well surfaced, continuous, free of traffic and convenient. Unfortunately Sustrans do not currently record the nature of the disability in their user surveys and therefore cannot provide firm data on the number of blind and partially sighted users of their network.

5.9 It is therefore recommended that Sustrans' survey form is amended to collect data on the nature of any disability. This would enable Sustrans to begin to assess the relationship between various path characteristics (including segregation) and the level of usage by blind and partially sighted people, and other vulnerable groups.

Pedal Power is a charitable organisation dedicated to making cycling accessible to all, operating from centre on the Taff Trail that hires specialist cycles to disabled people and their carers. Many of these cycles are larger than normal – up to around 1.2m in width – and often people need to walk alongside cyclists to accompany them. Similar facilities exist elsewhere – for example in Bushy Park, London.

Pedal Power – 'side by side' tricycle (Phil Jones)

Disabled cycling, Bushy Park (Companion Cycling)

Discussions with the manager of the Pedal Power centre found that whilst there are concerns over some cyclists travelling too fast on the shared use Taff Trail, on balance she preferred the whole of the path to be available for disabled walkers and cyclists so that they had maximum flexibility in its use.

5.10 Sustrans state that limited research on the problems of pedestrians and cyclists sharing paths has been done, but in their experience the problem can be minimised through consultation, good design standards and publicity and education. They recognise that some form of segregation can help blind people use the path more safely and confidently and that in urban areas, where use is high, segregation by forming a separate track or by a level difference should be the aim.

5.11 In rural areas however, Sustrans state that non-segregated paths will be the norm, for several reasons:

- Many paths attract family groups including both walkers and young children on bicycles
- Shared (non-segregated) use of space provides a greater width for everyone including wheelchair users who appreciate a wider space to manoeuvre in
- Physical separation on canal paths would separate one group of the enjoyment of being by the water

- Complete physical segregation would be impossible on many stretches of path and elsewhere it would be costly to install and maintain.

Non-segregated rural route, National Route 45, Swindon, Coate Water (J Bewley/Sustrans)

5.12 Sustrans' policy says that each situation must be considered on its merits, and that where non-segregated paths are proposed, the need for publicity and education material – eg a Good Cycling Code and signs indicating a shared facility, encouraging cyclists to travel slowly and courteously past pedestrians - should be considered.

5.13 Sustrans produced a similar and more general note on shared use (segregated and non-segregated) paths, *'Shared Use Paths'* (2000) which again acknowledged the concerns of vulnerable users and stated that if people perceive the conditions to be unsafe they will not use the route. The note also states that in urban areas where use is high, segregation should be the aim, and that adequate sight lines are important.

5.14 In summary, this review of the policy statements of Sustrans and groups representing the blind and partially sighted reveals that there is actually some common ground. Sustrans do accept that segregation is appropriate in some circumstances, particularly in high use urban locations; and GDBA/JCMBPS accept that non-segregated paths may also be possible, albeit only on very lightly used rural routes.

5.15 The issue can therefore be seen not in terms of absolutes – whether either segregated or non-segregated paths are generally better – but in trying to define the circumstances when one is to be preferred over the other.

5.16 A review of current technical guidance was made in an attempt to answer this question, and the findings are summarised in Table 4 near the end of this report, which sets out the numerous factors we have identified that point towards segregation or non-segregation.

6 GUIDANCE DOCUMENTS AND STANDARDS

6.1 The Walking and Strategy for Wales, published in 2003, acknowledged the concerns expressed by GDBA/JCMBPS, stating that *"It can be frightening for walkers and cyclists alike when other users of paths behave in an inconsiderate way and especially so for those with disabilities, or older people".* It goes on to say that it believes that shared use paths "*must be managed in various ways, just as space is arranged on the highway and delineated by markings, islands etc***".**

6.2 Having said that, the 2003 Strategy also noted that "*There is little research on the experiences of people who use shared-use paths, but research has shown that most conflict between pedestrians was perceived, not actual".* The research referred to in the Strategy is that carried out for the Countryside Agency by Surrey University, which is discussed further below.

6.3 The Department for Transport's draft Local Transport Note (LTN) 1/04 *Policy, Planning and Design for Walking and Cycling* states that there are some circumstances where either segregated or non-segregated may be appropriate, but also – particularly on routes that are used for utillty cycling – makes a presumption in favour of physical segregation unless conditions dictate otherwise. Factors affecting the decision not to segregate pedestrians from cyclists are the volume of flow in each group and the total width available, but these issues are not quantified. The note advises that in some circumstances segregation by direction of flow may be appropriate. Draft LTN 1/04 also notes that accidents between pedestrians and cyclists in pedestrianised areas are very rare.

6.4 Draft LTN 1/04 introduces what may be called the 'no-loss principle', ie that any new measures should represent a real improvement over the existing situation for all user groups. A similar principle is set out in the new draft Local Transport Note (see below). This suggests that a more stringent test for non-segregation should apply when cyclists are being allowed to use a route that is currently only used by pedestrians**.**

6.5 The draft LTN 2/04 *Adjacent and Shared Use Facilities for Cyclists and Walkers* deals with the issue of segregation in more detail, giving minimum widths for segregated and non-segregated routes, but it should be noted that this document principally applies to routes in built up areas, where the predominant function of the route is for 'utility transport' and where use by pedestrians

and cyclists is likely to be high. Guidance produced by the Countryside Agency and Sustrans (discussed below) is cited in draft LTN 2/04 as the source of guidance in rural areas[4].

6.6 Draft LTN 2/04 notes that any new facilities should be planned to cater for both pedestrians and cyclists, on the grounds that it is likely that pedestrians will want to use the route from time to time (other than when a new cycle track will run parallel to an adjacent good quality pedestrian route) and the choice will normally be between segregated and non-segregated use.

6.7 The Note again advises that there should be a presumption in favour of segregation, with a level difference (eg kerb) being the preferred method, and that the factors tending towards segregation are high flows of pedestrians and cyclists; frequent use by disabled people or other vulnerable users; and there being sufficient width available. Draft LTN 2/04 notes however that *"As there will always be site-specific factors to take into account, each case must be decided on its merits.'* The note recommends a documented site assessment process that considers local circumstances, providing an audit trail of the decision. (Note – the latest draft LTN has removed this presumption, however).

6.8 Draft LTN 2/04 sets out the requirements for segregation to be indicated at the start of paths, using tactile paving (ladder/tramline pattern) and signing, as well as at junctions with other paths. Such junctions are difficult in practice, however; inevitably there will be an area that is effectively unsegregated, where cyclists and pedestrians have to cross one another's space. It is also not possible to maintain level differences between cycle and pedestrian areas where segregated paths cross.

6.9 Draft LTN 1/04 and 2/04 will shortly be overtaken by a new Local Transport Note on Shared Use facilities, an initial draft of which has recently (May 2011) been issued by the Department for Transport for peer review. The consultant team working on this project is being carried out by MVA, in conjunction with PJA and Intelligent Space Atkins.The LTN is based in part on unpublished research carried out by Intelligent Space Atkins, and which is discussed further in Para 7.107 below.

6.10 The new draft LTN proposes a significant change in that there is no longer to be a presumption in favour of segregation. This is because the research '*suggests that the potential for conflict is not as great as it is sometimes perceived to be'.* Instead designers are encouraged to

[4] Although Sustrans provide many urban paths – see discussion of Greenways guide below.

'take decisions appropriate to the scheme context rather than adopting certain features as a starting point in the design development process'.

6.11 The new draft LTN states that issues associated with segregation include:

- Splitting the route reduces the width available to both user groups;
- Physical segregation features reduce effective widths;
- White line segregation is often ignored;
- Implementation costs may be significantly higher; and
- May make maintenance more difficult.

6.12 Circumstances given where segregation may be useful are where:

- the route is intended to accommodate significant flows of cyclists, especially high speed flows;
- large flows of pedestrians and cyclists are expected at the same time;
- the number of cyclists relative to pedestrians is expected to be high;
- predominant user movements are along rather than across the facility;
- heavy cycle flows pass numerous frontagers; and
- a significant proportion of vulnerable users is likely to use the facility.

6.13 Where segregation is deemed appropriate, the draft LTN concludes that segregation by level difference offers the best performance, and is also preferred by blind and partially sighted people.

6.14 In terms of width, the draft LTN advises that separate facilities should generally provide 2m minimum for pedestrians and 2.5m for cyclists, allowing room for each to pass within the designated part of the path. However, an unsegregated path of 3m to 4m total width may comfortably accommodate the combined flows of pedestrians and cyclists in many circumstances. The draft LTN relies on *Cycle Infrastructure Design* (see below) for guidance on cycle width requirements.

6.15 The draft LTN does not offer any guidance on the capacity of segregated or unsegregated routes, but advises that capacity will not normally be an issue. It advises designers to observe existing flows to ascertain how much capacity may be available. The draft LTN continues to cite Sustrans as a source of technical advice for Greenways in rural areas.

6.16 The most recent Department for Transport guidance document on planning for cycling, LTN 2/08, *Cycle Infrastructure Design* does not give a strong presumption in favour of segregation. It states that "*the potential for conflict between pedestrians and cyclists should be minimised"* but notes that segregation, while being an option, may not make best use of land; and that while pedestrians and cyclists often claim a preference for marked routes through pedestrianised areas, in practice this can lead to higher cycle speeds and greater potential for conflict.

6.17 LTN 2/08 advises that the ability of a cyclist to interact safely with pedestrians depends on the sightlines available – to maintain momentum, anticipate the actions of others and if necessary to stop in time. It notes that cycling speeds should not cause inconvenience to pedestrians and that generous sightlines can help pedestrians and cyclists to avoid one another, but that at some conflict points measures (eg chicanes) may be required to reduce cycling speeds. Design speeds are higher on routes used for commuting.

6.18 The width requirements for various types of route are similar to those given in draft LTN 2/04 and the new draft LTN on Shared Use.

6.19 LTN 2/08 also makes the general point however that "*Detailed route design entails development of a series of site-specific solutions. It can be difficult to apply a standard solution to the kind of issues that arise when designing for pedestrians and cyclists".* It goes on to say that infrastructure can be designed by from a behavioural approach, "*observing how users interact and then formulating a solution that accommodates the main movements of each mode while minimising the potential for conflict."* and that '*Such an approach may require a move away from the idea of fully segregated areas for pedestrians, cyclists and motorists'.* This approach is clearly in tension with the approach of the GDBA towards such 'shared space' ideas, but is notable none the less.

6.20 Updated detailed guidance on designing traffic-free routes has been produced by Sustrans, in its *Connect2 and Greenways Design Guide (2007).* This document is being applied by Sustrans to the design of new traffic-free and other routes across the UK, including those being funded through the Connect2 grant award of 2007. As noted earlier, the new draft LTN on Shared Use facilities cites Sustrans a creditable source of advice on traffic-free routes in rural areas, although the Greenways document does cover both urban and rural routes.

6.21 The Connect2/Greenways Guide notes that Greenways will often be provided along paths that already legal for cyclists to use, such as bridleways, and that their resurfacing will make it

possible for a greater range of people to use them – including disabled people, young people and the elderly. The Guide recognises that many groups may raise issues with a scheme, including groups representing the disabled as well as bodies such as the Ramblers' Association, and that all of these concerns must be addressed through the design. The visual impact of schemes can raise objections, particularly in rural areas.

6.22 The Guide advises that most Greenways will involve a shared surface and that its width must accommodate the number and range of users that will be attracted to use it. This will generally range from a minimum of 2m in rural areas to 3m or wider in urban areas, plus verges on either side. There will be exceptions to this, however, say where routes have to pass through pinch points (eg an existing bridge) where it may be necessary to go below normal standards. Clearly new bridges are another location where costs are high and the guide advises that it may be possible to go below the general path width, especially if the restriction is only short and has good visibility.

Segregated route (with substandard widths) on Cutterslowe Bridge, National Cycle Route 51, Oxford (J Bewley/Sustrans)

6.23 The Greenways guide includes indicative costs for new paths. These do vary widely, depending on particular factors such as the number of bridges and junctions and the organisation that builds the scheme (whether in-house resources or a contractor). The document advises that a shared path with will typically cost between £35,000/km and £151,500/km (average £93,500/km) and that a segregated path will be significantly more expensive at between some £116,500/km and 466,500/km (average £291,500/km). The guide notes that kerbing, which could be used to create a level difference to segregate users, adds considerably to path costs.

6.24 Further advice on typical path costs was sought from Sustrans' staff who confirmed that a 5m segregated path would typically cost between two and three times that of a 3m non-segregated path. The ratio of the average figures in the Greenways document is a little over three.

6.25 The Countryside Agency (now subsumed into Natural England) also produced a Greenways design guide, published in 2003. It does not appear that this guide will be updated. The CA design guide places greater emphasis on segregating routes as a starting point than the Sustrans guide, but again acknowledges that there are local factors to be taken into account when making a decision whether to segregate.

6.26 These include the volume of users (200 users per hour is suggested as an upper limit for non-segregated routes) and the nature of the route (leisure or utility). The document does state that non-segregated paths "*do not cater for blind or partially-sighted people"* but this statement is not expanded upon.

6.27 The report also notes that focus groups can overstate the effect of shared use in deterring use, referring to the research carried out for CA by University of Surrey (see below), and advises that there may be more problems in creating shared cycle/pedestrian paths from existing pedestrian-only routes – thus restating the 'no-loss' principle noted earlier.

6.28 The report also advises that a route that *"does not meet the needs of all users"* should not be built if insufficient funds are available to build a more suitable path; but this does not in our view reflect the importance of providing a connected network. Strict adherence to this guidance could result in a key link in a path remaining incomplete, thus reducing the attractiveness of the remaining parts of the network and undermining the investment made elsewhere.

6.29 Guidance documents on cycling provision generally and traffic-free routes in particular from other parts of the UK and other countries have also been reviewed and there is a similar pattern to the advice.

6.30 Transport for London published comprehensive design standards for cycle facilities in 2005 which include some guidance on shared traffic-free paths. The TfL standards point to the importance of pleasant traffic-free routes, such as those through parks, for people taking up cycling. Later in this report there is reference to recent schemes where cycling has been permitted in Kensington Gardens and The Regent's Park. Again the no-loss principle is included – the document advises that provision for cyclists should not create new hazards for pedestrians. When

shared use routes are created then a clear and transparent process, including consultation with disability groups, should be carried out.

6.31 The TfL strategy for promoting cycling includes Green Cycle Corridor Routes (Greenways), which are traffic-free routes through parks and other similar areas. The document observes that cyclists do vary from the hardened commuter to children, novice and elderly cyclists who may be apprehensive about cycling generally, and who benefit from such routes.

6.32 The TfL standards have a section devoted to non-segregated paths (referred to as shared use paths) which state that the cyclist design speed should be 10mph, reduced from the 15mph used on other paths. The document does not advise when segregation is needed (referring to draft LTN 2/04 on this issue) but does refer to the need to reduce cyclists' speed if they are too high or visibility is limited.

6.33 In 2007 TfL commissioned an Equality Impact Assessment of its policy and procedures for providing Greenways. This report, prepared by independent consultants, was a 'limited and qualitative' EqIA focussing on the Greenways Implementation Plan. The report concluded that *"The positive benefits of Greenways outweigh the negative impacts, and that TfL has complied with its public duty to promote disability equality. But it is important to recognise that shared use Greenways represent a negative impact for some disabled people. Further work in interpreting the law, particularly in relation to proportionality, is recommended."*

6.34 This important research was subsequently commissioned by TfL and is discussed below.

6.35 The EqIA noted that there is very little research available on the views of particular groups on using Greenways, and how the perception of risk could be mitigated. As a result it was difficult to assess a proportionate response to the problem. Criteria for assessing proportionality could be:

- The number of people affected
- The nature of the general impact on people
- The scale and cost (of dealing with the issue)

6.36 Little information was available to the consultants preparing the EqIA because they were not able to assess:

- The proportion of Greenways that will involve shared or segregated use;
- The proportion of Greenways that will be used by speedy commuting cyclists and/or by vulnerable groups of pedestrians;
- The proportion of Greenways that are at all accessible to wheelchair users

6.37 The report therefore concluded that these issues will be dealt with at local level – ie on a case by case basis. This is done by TfL using its Green Cycle Route Implementation Plan (GreenCRISP) and the EqIA report recommended enhancements to this process to ensure that the needs of disabled people are taken into account. The report notes that there is benefit in having a well documented design, consultation and review process that will form an audit trail for the authority and demonstrate compliance with Disability Discrimination legislation.

6.38 The EqIA report does include a preference for segregation in the majority of cases, but does acknowledge that the actual risks to pedestrians are small and that there are also risks of segregating paths – namely that neither party is then encouraged to consider the other's needs.

6.39 There are also limitations on how segregation can be achieved on Greenways. A classification of routes is suggested where 'A' routes are high speed, high capacity segregated routes cater for all users; 'B' routes are medium speed/capacity routes for leisure users where cyclists may be impeded, and 'C' routes are low speed/capacity routes where cyclists may need to dismount and which cater for less than 100 users per hour.

6.40 Transport for London has recently produced new draft design guidance on Greenways, which will be published as an Annex to the updated version of the London Cycling Design Standards. This guidance is based on further (unpublished) research on Greenways carried out by Atkins, which is summarised in para 7.112 below.

6.41 The TfL Greenways guidance also has no presumption for either segregated or unsegregated paths, but includes a table setting out the pros and cons of each type of facility, which include the following key guidance:

Unsegregated paths:

- Older users tend to be less satisfied with unsegregated paths
- May encourage more considerate behaviour amongst all users

- Cycle speeds may be lower at all times
- There may be a greater number of interactions between users, but lower potential for actual conflict and severe collisions
- May enable a narrower path width, with lower construction and maintenance costs
- May enable a more sympathetic design

Segregated paths

- Public perceptions may favour segregated paths
- Cyclists tend to observe segregation, unless there are pedestrians using the cycle track
- Pedestrians may walk in the cycle track, particularly when cycling flows are low
- Non-compliance with segregation can increase the potential for severe collisions
- May require a wider path, with higher construction and maintenance costs
- Segregated routes require more signs

6.42 A key finding of the Atkins research (see para 7.112 below) which underpins the guidance is that typically:

- 20% of pedestrians walk in the cycle track when cycle flows are less than 150 per hour
- 5% of pedestrians walk in the cycle track when cycle flows are less than 300 per hour

6.43 The TfL guidance provides recommended widths for segregated and unsegregated routes based on bands of pedestrian and cycle flows, as follows:

Level of Flow	Pedestrians per hour	Cyclists per hour
Very low	0-120	0-10
Low	120-200	10-50
Medium	200-450	50-150
High	450-900	150-450
Very high	>900	>450

6.44 Based on these flow bands, recommended design criteria for paths are:

Level of Flow	Minimum Width Criteria for Unsegregated Paths	Minimum Width Criteria for Segregated Paths
Very low/Low	Space for one cyclist to pass one pedestrian comfortably	Space for two-way cycle flow and two pedestrians to pass on respective sides of the path.
Medium	Space for one cyclist and two pedestrians to pass comfortably at the same time	Space for two-way cycle flow and two pedestrians to pass comfortably on respective sides of the path
High	Space for one cyclist and four pedestrians to pass comfortably at the same time. Also allows cyclists to ride three abreast comfortably.	Space for two-way cycle flow and at least four pedestrians to pass comfortably on respective sides of the path.

6.45 And the resulting recommended path widths (not allowing for additional space required where the path is bounded by walls/edges) are:

Level of Flow	Overall Minimum Width Unsegregated Paths	Overall Minimum Width Segregated Paths
Very low/Low	2m	3m.
Medium	3m	4m
High	4.5m	5.4m

6.46 The Netherlands has very high levels of cycling and the most recent advice published by the Information and Technology Platform for Transport, Infrastructure and Public Space (CROW) – the *Design Manual for Bicycle Traffic* – was reviewed. The Netherlands generally has excellent infrastructure for cyclists, much of which is segregated from both traffic and pedestrians.

6.47 Notwithstanding this, the CROW manual does recommend allowing cyclists to enter into pedestrianised streets that carry pedestrian flows of up to 200 per hour per metre width, with the degree of segregation depending on pedestrian flows,;

- non-segregated when pedestrian flows are less than 100 people per hour per m width
- segregated by a white line at flows of 100-160 /hour/m width
- segregated by a kerb at flows of 160-200 /hour/m width

6.48 In terms of non-segregated paths away from town centres, the CROW guide notes that these are suitable for flows of up to 25 peds/hour/m width and cycle flows are 'not high'. Other factors pointing towards segregation include high numbers of elderly people, who can feel endangered, and what might be termed 'exchange' activities along the path that would interfere with cyclists – shopping, playing etc. The manual notes that a height difference between segregated portions of a track can be a source of cycle accidents, however.

6.49 New Zealand's *Cycle Network and Route Planning Guide* also covers cyclist infrastructure generally, and uses the concept, applied in many countries, of 'Level of Service' (LOS) to assess the quality of provision.

6.50 The NZ guide states that cyclists' needs vary and that off-road paths are important in encouraging new cyclists. They also benefit walkers, joggers, parents with prams etc. The guide advises that paths that are planned to be used exclusively by cyclists do provide a high LOS, but are often used by pedestrians, echoing the advice in draft LTN 2/04.

6.51 Non-segregated paths maximise the benefit to a community and provide well for vulnerable cyclists; but the LOS for cyclists can be poor and conflict can arise where there are significant flows. They are therefore said to be appropriate where flows are 'modest'. Segregated paths are more appropriate for higher flows and help to reduce conflict; but pedestrians do sometimes stray into the space defined for cyclists. They also cost more than non-segregated paths.

6.52 A more rigorous assessment of the issue and a more evidence-based approach to defining Level of Service for cyclists on a six-point scale (A to F) is contained in the Australian publication *Minimising Pedestrian-Cyclist Conflict on Paths*. LOS values of D and below are generally regarded as unsatisfactory.

6.53 The Australian guide provides detailed advice on path design, with the familiar statements that segregation is required at higher flow levels and that limited width and visibility increase conflict. Pros and cons for non-segregated and segregated paths are given, including cost, land-take, conflict and cycle speed.

6.54 The Australian advice on calculating LOS for cyclists refers to two methods – the first is the 2000 US *Highway Capacity Manual* method, which assesses LOS from the number of 'events' (interactions between path users) per hour and path widths of either 2.4m or 3.6m. The second and more rigorous method is as defined in the research carried out by Hummer et al (reviewed in the Research section of this report), and which forms the basis of current US Transportation Research Board advice.

6.55 In summary, a presumption in favour of segregated solutions for traffic-free paths is included in a number of policy and guidance documents, although it is significant that the most recent document issued by the Department for Transport and the emerging guidance published by TfL removes this presumption.

6.56 The documents also often set a higher requirement for the justification of non-segregation where cyclists are introduced to routes that were formerly for pedestrians only, what may be termed the 'no-loss principle'. This implies that a different approach may be required when a new path is provided, or a bridleway is resurfaced, compared to the situation when cyclists are introduced to an existing footpath.

6.57 The guidance documents generally point to the need for segregation being dependent on a number of factors which include:

- Pedestrian and cycle flow
- Cycle speed
- Cycle journey purpose
- Visibility
- Presence of vulnerable users – elderly, disabled, children
- Available width/presence of pinch points eg bridges
- 'Exchange' activity – shopping, playing etc.

6.58 The guidance also makes it clear, however, that segregation leads to increased costs and width requirements. It is therefore essential that affordability and practicability considerations are also taken into account.

6.59 Most of the documents do not define critical flow values for pedestrians and cyclists, or other objective tests to indicate where segregation or non-segregation is to be preferred. Exceptions include the fairly recent Australian document, which refers in turn to US research; and the emerging TfL guidance on Greenways. The research underpinning both of these documents is considered in more detail in the next section of this report, along with other research on the risks (actual and perceived) encountered by people on traffic-free shared paths; and how they behave.

7 RESEARCH EVIDENCE AND CASE STUDIES

Actual Risk

7.1 The guidance documents reviewed above indicate that the actual level of conflict between pedestrians and cyclists on traffic-free paths is small, although it is acknowledged that there is under-reporting of pedestrian and cycle injuries generally.

7.2 This is supported by the research report published by the Department for Transport's *'Road accident casualties: a comparison of STATS19 data with Hospital Episode Statistics' (2006),* which concludes that 2% of pedestrians admitted to hospital have been injured by cyclists. The report does note that this is some 3 to 4 times the number of casualties that are recorded on STATS19[5] forms, however.

7.3 Obviously some of these pedestrian/cycle accidents would have happened on the carriageway, and the US Federal Highway Administration report *FHWA-RD-99-078 – Injuries to Pedestrians and Bicylists: An analysis Based on Hospital Emergency Department Data* disaggregates the data by location, showing that some 60% of pedestrian-cycle conflicts take place on footways. It is not possible to ascertain how many of these accidents took place on routes where cycling is permitted, however.

7.4 Vandebona and Kiyota, in the paper *Safety Perception Issues Related to Pedestrians and Cyclists*. note that only 0.5% of road casualties in Japan in 1998 resulted from cycle/pedestrian accidents, although this is increasing and there may well be some under-reporting of the problem.

7.5 Evidence of the poor accident record of a particular set of non-segregated traffic-free routes is given in the report by John Franklin, *Two decades of the Redway cycle paths in Milton Keynes (1999).* The Redway network is one of the largest urban path networks of its kind in the UK, and intended to encourage local trips by walking and cycling. The routes are generally 3m in width, with narrower leisure routes in places.

[5] STATS19 is the standard form used by the Police to record the circumstances of road accidents.

7.6 Despite the availability of the network, only 3% of journeys to work are made by cycle in Milton Keynes and the results of accident studies at local hospitals indicates that the likelihood of a cyclist being injured on a Redway (per km cycled) is significantly greater than on the road network. There are no definitive figures available on which to assess the level of pedestrian/cycle conflict, although a sizable minority of cyclists - 1 in 3 - perceive pedestrians as unpredictable and a danger. Not all injuries to cyclists involve pedestrians - recorded accidents include cycle-cycle collisions, collisions with dogs and eye injuries from protruding vegetation.

7.7 Franklin attributes this poor accident record to the following factors:

- Poor visibility
- Sharp bends
- Steep gradients
- Bollards
- Slippery bridges
- Loose gravel
- Mud
- Poor maintenance of vegetation and surfaces
- Poor lane discipline

7.8 Notwithstanding this record, attitudinal surveys show that cyclists perceive the Redways as more safe than cycling on roads, something of a paradox; and some 69% of cyclists said that the network encouraged them to cycle more, albeit that these journeys appear to be occasional short-distance trips rather than more regular utility trips.

7.9 Clearly any traffic-free routes must be well designed and maintained, whether segregated or non-segregated, in order to avoid such an outcome.

Perceived Risk vs Actual Risk

7.10 A further example of how perceptions may have less to do with reality than may be imagined is the New Zealand Department of Conservation study *Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track*, which sought the views of walkers on a multi-day natural track in a rural part of the country where cycling had been allowed on a trial basis (cycling has since been allowed permanently). This report found that walkers were generally

positive towards cyclists, and that walkers who encountered cyclists were overall no less satisfied with their visit than those who did not.

7.11 However, when asked whether seeing cyclists had (or would have) affected their enjoyment of the track, a notable minority (21%) said that it would. And most interestingly, the proportion of people who had negative perceptions of cyclists came from walkers who had not encountered any (32%) and that the negative effect was strongest amongst older walkers (58%). Attitudes to specific issues were asked, which surprisingly found that walker opinions about the hazard of cyclists travelling too fast were less negative amongst those that had actually met them.

7.12 The research paper concludes that many of the social conflict issues are based on perceptions of meeting cyclists, which appear to be different to the reality of meeting them, and that older walkers were more inclined to hold these negative views.

7.13 Work carried out by Kiyota et al, *Pedestrian Traffic Conflicts on Shared Pavements* looked at shared use routes in Japan, where they became commonplace after cyclists were allowed to use them in 1978. Video observations of a short length of non-segregated traffic-free path (effective width 3.5m) were made to assess cycle speed and the distance between pedestrians and cyclists. A total of 800 passings were observed. The study found that average cycle speed became significantly lower as pedestrian flows increased, and that although there was a range of cycle speeds, the maximum speeds observed also fell.

7.14 The research also investigated the attitudes of three groups of pedestrians – schoolchildren (9 to 10 years old), university students and elderly people (typically over 65 years old) – to 38 video recordings of a shared use path with varying degrees of cycle and pedestrian use. Somewhat surprisingly the perception of risk increased in the situations where cycle speed was low, since these situations were where the path was most crowded.

7.15 The researchers concluded that the distance between users was the most important factor in determining perceived risk, and that this perception falls very quickly when distance (skull to skull) increases from less than 75cm to over 150cm. Furthermore, the risk perceived by children and elderly people was generally higher than that of the university students. This study suggests that increasing path width may be a useful way of reducing perceived conflict.

7.16 Two related studies for the Countryside Agency by a team of researchers led by Uzzell of the University of Surrey examined in some detail the actual and perceived risk on traffic-free routes

in the UK. The first study *User Interaction on Unsegregated Non-Motorised Shared Use Routes* (2000) (the Phase 1 report) was summarised in the CA's *Research Note CRN32*. In that study five 50m sections of non-segregated traffic-free paths were studied, all 2m to 3m in width with verges on either side, straight and with level gradient.

7.17 In the introduction to the Phase 1 report it is noted that whilst segregation is often suggested as a solution to the conflicts between different user groups - including pedestrians and cyclists but also other groups such as horseriders – this is impractical because of space demands, and alternatives to segregation need to be found.

7.18 A series of video surveys were carried out, together with user interviews both on site and later at home. The study sought to define conflict in more detail, using scales related to 4 pairs of opposing descriptors of a situation (Peaceful/Hostile, Unintrusive/Intrusive, Co-operative/Competitive, Agreeable/Disagreeable), combining these to produce a single conflict score.

7.19 Observations were made on weekdays and weekends, with flows being generally higher at weekends. User numbers on the paths varied by location and by day but were generally between around 10 and 70 per hour. The proportion of pedestrians varied from 9% to 81%. On average pedestrians and cyclists were split 32%/64%, with other users (joggers, wheelchair users, horseriders) making up 4% of users. Most journeys were recreational in nature but 18% were journeys to work, shopping and to school. Average cycle speeds were measured at 14km/h, with 10% travelling at over 20km/h

7.20 Position on the path was measured and it was found that neither walkers nor pedestrians travel in a straight line. Cyclists travel in an elongated s-curve, slowly moving to the left and right and subsequently correcting their course. Walkers adopt a complex course in an erratic and less predictable trajectory. This makes it difficult for any user to anticipate where they might encounter another user. This clearly has important implications for visibility requirements and offers one explanation why it is often reported that walkers do not tend to respect path segregation.

Group of pedestrians using the whole of a segregated path, Lancaster (Sustrans)

7.21 The behaviour of cyclists and pedestrians, when they encounter one another, was analysed. It was found, as in other research, that cyclists reduce their speeds substantially when they encounter pedestrians, but the same effect was found when cyclists met other cyclists. Interestingly, pedestrians tended to increase their speed when they met other users. Cyclists tended to keep to their left when meeting others coming towards them but would pass others either on the right or left. Pedestrians show no preference for passing on the left or right. This is perhaps unsurprising as pedestrians are generally not required to follow markings when using footways and footpaths.

7.22 Over the period filmed (45 hours) more than 1500 people were observed, only about 12% of whom met other users in the 50m section recorded and only two recorded incidents involved actual conflict[6] - a cyclist swerved to avoid another cyclist and a cyclist came within the collision zone of a dog walker.

7.23 At the level of flows studied it was calculated that people meet other path users about every 6 – 7 minutes. Interestingly when people were asked on site whether they had met other path users in the 50m zone, they recalled more interactions (20%) than had taken place; and when they were asked again two weeks later via a home questionnaire, the proportion reporting an encounter rose to 40%. This suggests that passing other users is a memorable event, and that path users remember the path as being busier than it actually was, a finding that may have implications for group expressions of perceived conflict.

7.24 When asked on site about conflict, using the four bi-polar measures, path users gave low scores – the overall result was 1.57 out of a maximum score of 5. No respondents reported hostility and few reported intrusion, competition or disagreeableness. Where conflict did register with users, it was associated with intrusion, caused by the unpredictable movement of other users, journey purpose, speed and inadequacies in the signing and maintenance of routes. The rating of visibility on the path is the most important environmental characteristic in explaining increases in perceived intrusion.

7.25 In the follow up questionnaires people were presented with scenarios describing interactions between path users and were asked to assess the conflict felt by different user groups. Scenario 1, for example, described cyclists passing a family who were walking.

7.26 Significantly, respondents' perceptions of conflict in these imagined scenarios were greater than the conflict reported during the actual use of the routes. When asked to imagine themselves as horse riders or joggers in other scenarios, respondents perceived that the levels of conflict were higher again. Considerate behaviour, path width and speed of travel were found to be extremely important in determining perceived level of conflict in all of the imagined scenarios.

7.27 Focus groups were also held to discuss conflict which found that the principal consequence of perceived conflict was anxiety and fear about personal safety. This feeling was intensified by a number of factors, including crowding, cyclists travelling at speed, meeting groups (especially young people) and reduced visibility. In the extreme, it was reported that these perceptions can lead to people avoiding shared-use routes. In one case, the Thames Path, some users suggested that commuter cyclists can present a particular hazard due to their speed and journey purpose.

7.28 Following this initial study, a Phase II research exercise was carried out by the same team to assess actual and perceived conflict on busier sections of non-segregated shared use path. This report, *User Interactions In Non-Motorised Shared Use Environments: Phase II* was summarised in the Countryside Agency's report CRN69.

7.29 The sections studied for this research were selected as they were reported to be locations where conflict was high – the route selection process was termed 'looking for trouble'. The six sites selected were the Egerton Road to Southway path, Guildford; the Tamsin Trail, Richmond Park; the

[6] But no collision occurred. Conflict was defined as *'A physical interruption or interference with a person's actions or intended actions by other users or by characteristics of the environment, which either blocks a person's behaviour or violates their collision zone'*

Camel Trail, Cornwall; the Regents Canal Towpath, Islington; the Cuckoo Trail, East Sussex; and the Grantchester Path, Cambridge. Average hourly flows varied from 17 people (Cuckoo Trail on a weekday) to 107 (Camel Trail at weekends).

7.30 At 5 of the 6 sites studied there were local physical features which were reported to cause conflict. These were a sharp bend (Guildford) narrow bridge (Tamsin Trail), segregated bridge leading to non-segregated path (Camel Trail), narrow path (Regents Canal Towpath) and chicane (Cuckoo Trail).

7.31 Only 5% of the 157 interactions analysed provided examples of actual conflict, and in no case was any contact recorded. In the case of the Granchester Path, its width (less than 1m) seems to have been the most influential factor, suggesting that actual conflict is mostly caused by the restricted space forcing route users into each others' collision zones, rather than by the density of users.

7.32 During filming, 956 route users were interviewed. Visibility was again a significant predictor in terms of how acceptable it was for both cyclists and walkers to share routes with each other. The level of perceived conflict measured at each site was recorded at 1.65 out of 5, only slightly higher than was found in the Phase I study.

7.33 The follow up questionnaire surveys at home again found low conflict levels but at a higher level (1.99) than when on site, suggesting that negative events give rise to more significant memories. Imaginary scenarios presented in the questionnaire indicated that respondents are generally concerned not about conflict between users but about routes with blind corners and concealed places.

7.34 Notwithstanding these findings of low conflict, users expressed a preference for two separate paths, one for walkers and one for cyclists. A less favoured alternative was for segregation by a white line.

7.35 A further questionnaire was carried out on people living up to three miles from the routes to assess barriers to their use. Few respondents had any personal experience of conflict – 4% had experienced collisions whist a further 7% knew of people who had done so, but only 3% of these related to shared use, the others being events such as 'fell off cycle, caused by black ice'.

7.36 Factors cited as deterring people from using the routes were mainly related to the usefulness of the route (15% of respondents) and how far the route is from their home (10%). Only 3% of respondents gave the fact that the route is used for cycling as a reason for not using it.

7.37 Focus groups were again convened and the research found that discussing conflict escalates users' perceptions of it. Most of the focus groups suggested user Codes of Conduct as a means of addressing conflict, together with good maintenance to make the full width of the path available.

7.38 These two important studies found that conflict on non-segregated paths is an extremely infrequent occurrence, at the levels of usage studied (up to 107 path users per hour). However, when people talk about conflict, its assumed incidence increases and appears to be more serious. The discussion and focussing of attention on conflict serves to escalate its perceived existence.

7.39 It is notable that there is no mention of blind people in these research reports. It is not known whether any blind people were observed using the paths.

7.40 The Cyclists' Touring Club typically represents experienced cyclists, many of whom are comfortable with cycling on roads and who therefore may have less interest in using traffic-free paths than novice cyclists.

7.41 The CTC commissioned consultants to produce the report *Cyclists and Pedestrians – Attitudes to Shared-Use Facilities* (2000) which included a literature review; questionnaire surveys of traffic-free facilities in 5 city centre and suburban locations; and discussions groups to explore users' views in detail. The focus groups included elderly people, wheelchair users, sight and hearing impaired users and people with learning difficulties.

7.42 One site was a non-segregated pedestrianised area and four were routes adjacent to roads. Two of these are said to be segregated/partially segregated; and there are two sites where it is not clear from the report whether the routes are segregated or not. It may be inferred from the report that the sites were converted to shared use rather than being created new, and therefore may not meet the 'no-loss' test. No data is presented on the level of use of the 5 sites.

7.43 The literature review suggested that shared use could be made tolerable when best practice design was used to minimise conflict, but that the most vulnerable groups (eg the elderly and mobility impaired) are likely to have lower levels of tolerance. The surveys found that a

significant minority of users of the 5 sites claimed that crashes were a problem, and that around half of users had a slight or big fear of crashes. More than half of users felt that they had not received sufficient guidance on how to share the routes. Nevertheless, more than half of cyclists and 17% of pedestrians said they cycled/walked more because of the schemes.

7.44 The discussion groups involved people who had experience of using shared use facilities. It is important to note that the groups were mostly focussed on urban transport issues and did not consider the rights of way network or the needs of recreational users.

7.45 In general the study found that the routes are disliked but are tolerated because of the cycling safety and mode-shift benefits. Independent wheelchair users found the smooth surface and dropped kerbs helpful but other mobility impaired people felt unsafe. Some users suggested that shared use deters the use of the paths by some groups (blind people, children and the elderly) but the report notes that in fact use of the paths by pedestrians had in some places increased.

7.46 The strongest view expressed by users was that shared use facilities in urban areas should be a last resort; the first choice should be to provide on-carriageway facilities for cyclists.

7.47 In reviewing the results of these focus groups the potential for concerns to be exacerbated through discussion, as revealed by the work carried out for the Countryside Agency, needs to be considered.

7.48 A further snapshot of the views of CTC members was obtained for this report through a posting on the CTC web-forum, http://forum.ctc.org.uk, which asked for members' experiences of using traffic-free paths.

7.49 Not surprisingly, many of the comments expressed views on the relative merits of on-road and off-road cycle facilities, but it was possible to derive the Table 1 (overleaf) which summarises the stated advantages and disadvantages of segregated and non-segregated paths, which also notes how many times each comment was made.

Advantages of non-segregation/Disadvantages of segregation	
Comment	No times made
Pedestrians do not always respect segregation - eg white line, planting	15
Inadequate width left for 2-way cycling/overtaking	6
Tramline paving dangerous	4
Shared paths encourages better cooperation between users, less anger etc	4
More expensive, needs to be wider	2
Cyclists go faster when segregated creating greater risk when pedestrians encountered	2
Wider path than with segregation - easier to pass cyclists	1
Cyclists do not respect segregation - eg white line	1
Dangerous/difficult for inline skaters - effect of raised line	1
Rain water retained by white line	1
Segregation not needed on low volume routes	1
Upstand kerbs used for segregation create risk	1
Fences used for segregation create risk (collision with handlebars)	1
Segregation reduces ability of cyclists to move out of the way of pedestrians	1
Segregation introduces street clutter	1
Shared use allows for groups of users - more sociable	1
Prefer shared path but with centre line (directional) marking	1
Disadvantages of non-segregation/Advantages of segregation	
Comment	No times made
Segregation allows cyclists to go faster	2
Unpleasant to use for both peds and cyclists	1
Pedestrians do tend to move out of the way onto their side	1
Pedestrians made more aware of cyclists by markings	1
White line does give guidance to users where to be	1
Segregation by strip of grass works better	1
Segregation needed on approach to road junctions	1

Table 1 – Responses to posting on CTC web forum

7.50 While this data was from a limited sample of committed cyclists and therefore may not be representative, it does suggest that segregation does not remove all sources of conflict from shared use paths. The frequency with which the comment was made that pedestrians do not always respect segregation is particularly striking.

Pedestrians straying into cycle track, National Route 93, Portrush (Robert Ashby/Sustrans)

7.51 The TRL report 583 *Cycling in Vehicle Restricted Areas* (2003) undertook video monitoring, speed surveys of cyclists and interviews with pedestrians and cyclists in pedestrianised streets in Cambridge, Hull and Salisbury. Average hourly pedestrian flows were between 877 and 2093 per hour (with peak flows of 1644 to 4920 per hour), average cycle flows were much lower at 14 to 116 per hour. In some of the locations cycling was banned for part of the day.

7.52 Although the situation is somewhat different to a traffic-free path, the research again showed that average cycle speeds reduced from an average of around 20km/h when pedestrian flows were light, to less than 10km/h when they were highest. 85th percentile speeds were around 26km/h (low ped flow) and 12 km/h (high ped flow), and young (15-24) cyclists travelled on average somewhat faster (around 4km/h on average) than middle-aged cyclists. This research again confirmed that cyclists typically moderate their behaviour when encountering pedestrians.

7.53 In the attitudinal surveys, when asked an open question about the pedestrianised streets, most pedestrians did not mention cyclists as a problem. When asked specifically about cyclists in the pedestrian area, most pedestrians were 'not at all' or 'not very much' concerned, and people were not so much concerned about themselves as about possible injuries to children and elderly people. Between 5% and 16% of pedestrians said that they had at sometime seen or been involved in an incident involving a cyclists and a pedestrian, but many of these appeared to involve pedestrians walking out of shops, something that would not generally occur on a traffic-free path.

7.54 Cyclists were mainly concerned about the unpredictable nature of pedestrians and about 12% said they had been involved in an accident with a pedestrian but that a third of these were

arguments about whether cycling should be permitted. (It should be also noted that the large disparity between pedestrian and cycle flows means that the proportionate risk to pedestrians would be much lower than this.)

7.55 Both pedestrians and cyclists supported segregation using white lines or similar, but the report notes that none of the sites actually were so designed, and so opinions may have been based on a supposition that segregation would be effective.

7.56 TRL Research Report 287, *Delineation for cyclists and visually impaired pedestrians on segregated, shared routes*, considered alternative markings and textured surfaces that could be used to segregate shared use paths, including the current recommended marking, a 20mm high trapezoidal thermoplastic line[7]. Tests were carried out where visually-impaired people attempted to detect and to follow the delineators, including using a long cane, and cyclists rode over the delineators at an angle.

7.57 The research found advantages and disadvantages with all of the alternative delineators, including the current recommended marking. 20% of visually-impaired people failed to detect the recommended line and less than 60% of the testers were able to follow it without losing contact. Some 31% said that they found it difficult to follow. There are also reported problems with the thermoplastic material slumping over time, becoming less detectable.

7.58 Some views of segregated paths were also sought from the groups of visually impaired people and cyclists. 54% of the visually impaired people had never used shared segregated paths, either because they did not need to or because none were available locally. One person did say that he had experienced problems staying on the pedestrian side and had been knocked over and injured by a cyclist as a result.

7.59 81% of the cyclists used segregated shared routes. 32% of those cyclists said they find difficulties with pedestrians walking on the cyclists side of the path, the most common difficulty reported.

7.60 The report concluded that, despite its problems, the 20mm high trapezoidal line remained the best compromise of all of the delineators tested.

[7] Traffic Signs Regulations and General Directions marking ref 1049.1

Cyclist Level of Service

7.61 A number of reports were reviewed that provided a methodology for assessing the Level of Service on shared use paths.

7.62 The basic approach was originally devised by Botma in the paper *Method to Determine Level of Service for Bicycle Paths and Pedestrian-Bicycle Paths* (1995). This uses the frequency of interactions between path users ('events') as the primary determinant of Level of Service, on the basis that meetings (when path users travelling in opposite directions) and passings (when one path user overtakes another) bring the potential, however remote, for discomfort, inconvenience and danger for those involved.

7.63 In calculating the number of events, Botma doubles the number of passings, on the assumption that this type of interaction is more stressful since only one path user can anticipate the event. Clearly this would also be true of meetings when one of the users is a blind person. Level of Service F (the lowest level) is defined as one event every 20 seconds. LOS A is defined as one event every 95 seconds. The overall LOS is calculated by averaging the frequency of events for both pedestrians and cyclists, to give a single score.

7.64 The paper stresses that the approach is theoretical and should be compared to users' perceptions of level of service in real situations, using field trials. Such field trials (using video techniques) have been carried out in the US research discussed below, and could be repeated in the UK to assess user perceptions here. It may be possible to extend the methodology to particular groups, including blind and partially-sighted people.

7.65 The Botma paper ignores pedestrian-pedestrian interactions and uses only pedestrian-cycle and cycle-cycle interactions in its theoretical approach. It also only considers 2 lane paths – that is paths of around 2m width where passing events can only take place by a user crossing into the opposing stream to pass a slower user. As cyclists are the faster path users (they are assumed to travel at 4 times the speed of pedestrians), the theoretical Level of Service of both pedestrians and cyclists is actually dependent only on cycle flow.

7.66 The model used here, where both pedestrians and cyclists use the same 'lane' (even where there is no centreline marking), moving into the opposing lane to pass slower users, is fundamentally different to the model used by Peter Brett Associates and Intelligent Space Atkins on the LOS calculations in London parks, reviewed below. That methodology assumes that cyclists

inhabit a separate pair of lanes, even on unsegregated paths. In our view the model used by Botma accords more closely with reality.

7.67 The approach pioneered by Botma has been reviewed and updated, based on the actual attitudes of path users in the United States, in the research report *User Perceptions of the Quality of Service on Shared Paths* by Hummer et al (2005). The previous recommended methodology, based on Botma's methodology, was considered unsatisfactory on several grounds, including that it only allowed for 2.4m and 3m wide paths and had not been calibrated for conditions and perceptions in the US.

7.68 The introduction to the Hummer paper notes that shared-use paths are becoming increasingly busy across the US and that path designers need guidance on how wide to make new or rebuilt paths and on whether to separate the different types of users – questions that go to the heart of this research review.

7.69 The study was not based on theoretical limits of interactions, but on user perceptions. The researchers showed 36 sixty-second video clips of 10 shared use paths to 105 path users, and asked them to record their assessment of the quality of the experience from a cyclist's point of view, against 3 specific criteria and giving an 'overall' rating, using a 5 point scale (bad to excellent).

7.70 The widths of the paths varied from 2.4m to 6m; none were segregated although 6 of the 10 had a centreline to separate users travelling in each direction. The flows in the video clips varied from 44 to 2320 users per hour, and the number of meetings and passings[8] on which the research was based, varied from 1 to 89 per minute. The percentage split of cyclists[9] and pedestrians[10] varied from 81%/19% to 15%/85%. The average path was 3.3m wide, had a centreline, had a one-way volume of 105 users per hour and was 60% cyclists/40% pedestrians.

7.71 Analysis of the user's overall rating scores was assessed against meetings, passings and path geometry and the following mathematical model (the SUPLOS[11]) was developed:

[8] Defined as 'active passings' when the rider in the video travelled past another user; and 'passive passings' when someone else passed the rider.

[9] Adult and child cyclists

[10] Including walkers, runners and skaters

[11] Shared-Use Path Level of Service

Rating = 5.446 – (0.00809*wevents) – (15.86*rwidth) – (0.287*clin)

Where:

wevents = number of meetings per minute + (10*number of active passings per minute)

rwidth = 1/path width (in feet); and

clin = presence of centreline (0 if no, 1 if yes)

7.72 The rating therefore reduces with the number of interactions on the path, with a strong weighting (10) to the number of times that the rider passes another path user (rather than the doubling factor used by Botma); increases with path width and (somewhat surprisingly) reduces if there is a centreline. It is interesting to note the large weight given to passings, in the context of the fact that a sighted pedestrian is in a no-worse situation than a blind person when being passed by a cyclist travelling in the same direction.

7.73 The researchers note that a centreline tends to increase cyclists' feeling of restriction, something that can be understood in the light of the work carried out by University of Surrey for the Countryside Agency, which found that cyclists prefer to travel on a sinuous route from one side of the path to the other.

7.74 The researchers note that it would be helpful to produce a similar rating methodology for other types of path user, but no such research has been identified in this study. Clearly were this approach to be used to assess the perceptions of blind and partially-signted users it would be necessary to obtain their perceptions of actually using paths of different widths, flows and degrees of segregation, as the video technique would not be suitable.

7.75 This research has formed the basis of an advice note to the designers of shared use paths published by the US Department of Transportation, the *Shared-Use Path Level of Service Calculator – A User's Guide* (2006). A downloadable spreadsheet has also been produced, which enables the mathematical model derived in the research[12] to be used to calculate LOS, based on the following input data:

- Path width
- Centreline (yes/no)
- Total one-way user volume per hour (the model assumes 50/50 directional split)

[12] With the addition of a term based on the number of notional lanes on the path (the 'delayed pass factor')

- Mode split (Adult cyclists, walkers, runners, in-line skaters, child cyclists)

7.76 The advice note includes a table that gives the results of the model for typical path widths of 2.4m to 6m, and for one-way flows of between 25 and 1000 users per hour, assuming a general mode split of 55% adult cyclists, 20% pedestrians, 10% runners, 10% in-line skaters and 5% child cyclists.

7.77 LOS values of C and above are generally considered acceptable, and using this limit the model shows that the maximum desirable two way (assuming 50/50 directional split) flow on various path widths is as follows:

- 2.4m path – 50 users per hour
- 3m path - 150 users per hour
- 3.6m path - 300 users per hour
- 4.9m path - 500 users per hour
- 6m path - 600 users per hour

7.78 Caution should be used in applying these results in the UK however; they have not been calibrated for UK conditions and are sensitive to mode split, given that the model assesses LOS from the number of passings and meetings, which in turn depends on the number of users travelling at different speeds. The model also only assesses LOS from the cyclist's point of view.

Shared Use Paths in Parks

7.79 Research and case studies carried out for The Royal Parks in London shed further light on the actual and perceived levels of conflict between users. A telephone conversation with an officer of The Royal Parks provided further background information. Most cycle/pedestrian routes in the Royal Parks are non-segregated, except where cycle flows are particularly high (eg Rotten Row in Hyde Park). Problems with segregation on routes with lower numbers of cyclists include pedestrians straying into cyclists' space[13]; the visual impact of signs and lines; and the practical difficulties where paths cross.

[13] Pedestrians outnumber cyclists by a significant margin on most routes in the Royal Parks

7.80 It is understood from Sustrans in London that the Royal Parks are developing pedestrian priority signage to indicate to cyclists that the paths are places where they should give way to pedestrians.

7.81 In the *Final Report of the Kensington Gardens Shared Use Trial* (2002) Atkins describe surveys carried out on two non-segregated paths – the 19m wide Broad Walk and the 4.3m wide Palace Walk – on three occasions; when cycling was banned, shortly after it was permitted and one year later.

Shared Use on Palace Walk, Kensington Gardens (Atkins)

7.82 Flows on Broad Walk were typically up to 600 per hour, (32/hour/metre width) with 8% cyclists. Palace Walk saw flows increase from 70 to 200 per hour during the study (up to 47/hour/metre width) with cyclists making up 29% of users. These flows are similar to the maximum of 36 users per metre width on the paths studied in the Countryside Agency research reported above (assuming a 3m path width at the Camel Trail).

7.83 Questionnaire surveys were carried out which were almost exclusively completed by pedestrians. A very interesting finding of the research was that pedestrians' negative perceptions of cyclists were significantly lower after cycling was permitted, even though the number of cyclists had increased. 26% of people thought that collisions with cyclists were a problem before implementation of the cycling scheme, which fell to only 2% a year after. People also thought that the proportion of cyclists that behaved well rose from 40% beforehand to around 80% a year afterwards.

7.84 Video surveys examined some 4500 user movements on the paths and found no collisions, 6 near misses and 1 display of aggression. The number of evasive manoeuvres fell from 18 (before) to an average of 6 (after), despite the large increase in cycling.

7.85 In summary there was a small and decreasing incidence of danger, with no actual accidents between park users. A small minority of people wanted to see segregation between pedestrians and cyclists, but this fell from 18% before cycling was permitted to 9% a year afterwards.

7.86 Cyclists were observed travelling at varying speeds and gave pedestrians a wide berth, but the study did note that faster cyclists can intimidate pedestrians. The wide downhill section of Broad Walk was a location where high cycle speeds were noted.

7.87 Despite these apparent localised problems however, the report generally concluded that the implantation of the shared use cycling scheme had produced clear improvements in pedestrians' opinions of cycle/pedestrian interaction and courtesy. Clearly if pedestrians expect to meet cyclists they are less likely to be concerned when they do so. No mention is made in the report of the concerns of blind and partially sighted people, however.

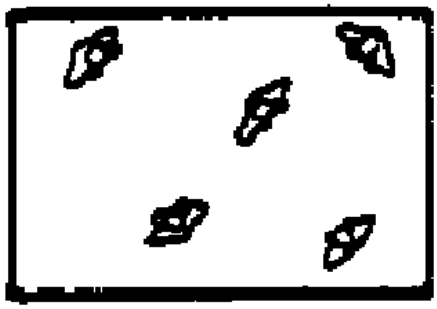
7.88 Atkins carried out further monitoring of the unsegregated shared use operation of Broad Walk through Regents Park during 2010, and found that it was working well. The path carries around 400 users per hour in the weekday peak and some 1000 users per hour in the weekend peak. Most of the users are pedestrians, but the number of cyclists has grown significantly since 2008.

7.89 The study found that 97% of users said that the overall quality of the park was good or excellent. On the route itself, video surveys found that over 99% of cycle journeys involved no conflict with pedestrians, and that 82% of pedestrians, and 74% of people with a disability were comfortable with the shared use trial. All cyclists declared themselves satisfied with the scheme. Cyclist speeds were around 13 miles per hour on average.

7.90 A further study for The Royal Parks, prepared by Peter Brett Associates *Cycle Review at The Regents Park* investigated the behaviour and attitude of users of the Broad Walk. Cycling was permitted on a temporary basis from July to September 2007 and the report also considered three options (non-segregated, segregated by white line and separate paths) for permanently accommodating cyclists along the route.

7.91 Video surveys to indicate usage and questionnaire surveys were carried out before and after cycling was permitted along the route. The respondents to the questionnaire were 1/3 cyclists, 2/3 pedestrians. Most people who were asked their opinion of the cycle route had no comment to make; of those who responded roughly a third were negative and a little under a half were positive.

7.92 One feature of the review was that Level of Service (LOS) calculations were carried out, based on pedestrian measures of LOS set out in the US Highway Capacity Manual, rather than the cycle-based methodology described earlier. Six levels of service are defined in the Manual, ranging from A (pedestrians are able to move in their desired paths without altering their movements in response to other pedestrians) to F (walk speeds are severely restricted and forward progress is made by shuffling). A LOS of C and above is regarded as desirable.



Pedestrian LOS A

Pedestrian LOS F

7.93 The peak 15 minute flow of pedestrians (526) was used to assess LOS, and assuming an effective width of 7.6m to account for street furniture less a width of 2.5m to allow for two cyclists passing one another, leaving 5.1m for pedestrians. The Highway Capacity Manual method relates Level of Service to the flow of pedestrians/minute/metre and takes account of the fact that many pedestrians on the path will be in groups (the 'platooning effect'). The peak measured flow of 7 pedestrians/min/m width gives an LOS of B, which is only one level below the highest possible.

7.94 Consequently the report concludes that permitting cyclists to use the Broad Walk still provides sufficient area for pedestrians to move freely, even at peak times. Even if the pedestrian flow was twice as heavy, LOS for pedestrians would still be C, above the level that is regarded as unsatisfactory.

7.95 This assessment has been made from a pedestrian point of view and can be criticised for making the assumption that cyclists will remain in a defined 2.5m track, whereas in reality they will be travelling within the pedestrian streams. No comment on this fact is made in the PBA report. Again, no assessment of the particular concerns blind and partially-sighted users is made in the report.

7.96 In order to assess LOS from a cyclist's point of view, and whilst acknowledging the caveats given above, we have run the US SUPLOS model for the Broad Walk, based on the following input data taken from the PBA report together with some assumptions:

- One way total flow = 880 users per hour
- Path width = 7.6m (25.3 feet)
- Mode split = 3% adult cyclist, 90% walkers, 5% runners, 1.5% skaters, 0.5% child cyclist

7.97 Interestingly, this gives a very low LOS of F for cyclists. Total flows would need to be reduced to 230 users per hour to give an overall LOS of C, although user perceptions (not counting the 'delayed pass factor) would still be at Grade C with a total flow of 760 users per hour.

7.98 This analysis demonstrates the need to consider Level of Service from both the pedestrian's and cyclist's point of view, when shared use paths are being considered, since they can give quite different results.

7.99 Further application of these techniques was carried out by Intelligent Space Atkins in their *Pedestrian and cycle observation study, Hampstead Heath* (2007). This report carried out manual counts of pedestrians and cyclists flows on weekdays and weekends (pedestrian flows also being obtained using automatic loggers over more extended periods) during the summer of 2007. Questionnaire surveys of path users were also undertaken. The surveys were carried out on routes that are currently shared use and those that are designated for pedestrian use only.

7.100 The study found that the routes through across the Heath are mainly used by pedestrians. The paths are used by some mobility and visually-impaired pedestrians, although no numbers are given.

7.101 The maximum proportion of cycle use recorded was 17% of flows, which occurred on a path designated for shared use. The busiest routes carried average flows of up to 77 cyclists per hour, while maximum average pedestrian flows were up to 1080 per hour. The paths across the

Heath are generally non-segregated and have widths of generally 2m to 6m, with some steep gradients.

7.102 Level of Service calculations were carried out for the paths using a similar methodology to that used by Peter Brett Associates for Regents Park – ie to discount the width required for two-way cycling and to assess pedestrian density (taking platooning into account) across the remaining width. The width assumed for two-way cycling was 1.8m rather than the 2.5m used by PBA, however, which does seem somewhat narrow.

7.103 Using this approach, Atkins recommended that some paths be opened up to cycling, but that other paths should remain only for pedestrians, for reasons such as high usage levels, congestion, path gradient and poor visibility. Some of the latter routes were identified as requiring targeted enforcement to prevent cycling, as they are considered unsuitable but are currently well used by cyclists. The report also recommended that education and information needs to be reviewed to ensure that users understand on which routes cycling is, and is not, permitted.

7.104 The attitudinal surveys of path users found that while 7% were actually cycling at the time, a further 12% sometimes cycle, showing that pedestrians and cyclists are not mutually exclusive groups. Of the people who cycled some or all of the time, 63% said that they cycle on paths were cycling is not allowed. It is perhaps questionable whether it is feasible, in the light of this finding, to ensure that any paths that are designated as pedestrian only remain so without considerable enforcement being required, again pointing to the impracticability of providing wholly-separate pedestrian and cycle networks.

7.105 Whilst 71% of cyclists gave their reason for cycling as 'leisure', 18% said that they were doing so to avoid local roads, while 11% were travelling to work or school. Utility journeys therefore make up a significant minority of journeys. When asked whether there should be more, fewer or the same number of paths for cyclists, only 13% of respondents said that there should be fewer. This result does not suggest that there is a significant level of conflict between path users, although the introduction to the report does note that groups representing cyclists and pedestrians are at odds over the issue of allowing more cycling on the Heath.

7.106 As noted earlier, the pedestrian-based LOS calculation, deducting a fixed width for two way cycling does over-simplify the complex behaviours of path users, as revealed by the detailed video analysis undertaken by the University of Surrey in the Countryside Agency research. This approach

is justified by its proponents on the basis that pedestrians make up by far the largest majority of path users, however.

7.107 Further (unpublished) studies of user behaviour on paths was carried out for DfT by Intelligent Space Atkins in support of the new draft Local Transport Note on Shared Use Facilities. This study monitored the operation of a number of segregated (by raised or flat white line) and unsegregated routes. The study found that 'interactions' – defined as incidents where a pedestrian and cyclist interact in a way that causes minor discomfort or conflict – were rare occurrences and there was no significant difference in conflict levels between the two types of path.

7.108 It was found that a white line is not an effective means of segregating a pedestrian/cycle path. Overall, the level of non-compliance amongst all users was around 1 in 7, and that the level of non-compliance for pedestrians is around double that for cyclists.

7.109 The research also noted that there was a difference in path user behaviour between weekdays and weekends. During weekdays, path users tend to be making journeys independently and individually, whereas at weekends more users are travelling in groups of two or more people. Pedestrians walking side-by-side in groups take up more width on a path and this can lead to a significant proportion walking in the cycle lane – up to a third of pedestrians were found to be non-compliant at one site at a weekend.

7.110 Although segregated facilities should provide a better level of service for cyclists through higher speeds, the study found that average speeds were not significantly greater on the segregated routes. This likely to be due to a combination of reasons, including cyclists slowing as pedestrians choose to walk in the cycle lane. As with other studies, it was found that cycle speed decreases as pedestrian flow increases, as cyclists moderate their speed.

7.111 Interviews with path users were carried out, and both user groups perceived that path use was generally considerate. Agreement was strongest on unsegregated routes, suggesting that behaviour is more considerate where there is a requirement for all users to interact.

7.112 In 2009/10 Intelligent Space Atkins were commissioned to carry out a similar research exercise by Transport for London, which has led to the draft Greenways design guidance referred to in para 6.40 above. This research was carried out over two phases and involved a total of 16 shared use paths through London green spaces, both segregated and unsegregated. Sites in the Phase 2 research included constrained locations such as gates and bridges.

7.113 The data collected at the various sites comprised pedestrian and cycle flows and speeds; video studies of interaction and passing distances at key locations; questionnaire surveys of users; and records of key design characteristics including width, gradient, crossfall, bounding details, surface type, alignment and sightlines.

7.114 The research confirmed that there are significant differences between weekday and weekend uses; pedestrians tend to peak at the weekend, between lunchtime and late afternoon, when some 75% were using the paths for leisure activities. Cycle flows tended to be highest on weekdays, with the highest levels taking place during the 8am to 9am commuter peak.

7.115 The research examined the effect of segregation and gradient on cycle speeds and found that although there was a significant range of individual cycle speeds across all locations, speeds were lower on unsegregated paths where the gradient exceeds 1% (although the difference is relatively small) and to a greater degree where the gradient exceeds 7%. This suggests that cyclists moderate their speeds on gradients in unsegregated conditions.

7.116 Segregation was found to lead to a higher rate of unexpected interactions and near misses between users, most of which were minor in nature, compared to unsegregated paths. The number of such interactions was low in both types of environment, however.

7.117 The perceptions of pedestrians using the paths was at odds with these objective assessments, however. Pedestrians felt that segregated routes are safer and more comfortable, and were more concerned about cycle speeds, compared to unsegregated routes. These concerns were more likely to be held by vulnerable pedestrians.

7.118 The perceptions of cyclists using the paths were that unsegregated routes cause them to moderate their speeds, which was borne out by the data collected. Cyclists were also more likely to consider segregated routes 'uncomfortable', compared to unsegregated routes.

7.119 Discussion group consultations were carried out with pedestrian and cycle users to gain a more detailed understanding of their views and attitudes. The pedestrian group had representatives with a range of ages, disability and gender. Generally the pedestrian group preferred segregation while the cycling group preferred unsegregated paths. Interestingly while pedestrians felt that walking on the cycle side of a route for a short period of time was not a problem, they would be angry if cyclists used the pedestrian side of the path. Cyclists did say that

they sometimes used the pedestrian side if they had to avoid obstructions, including pedestrians, on their side.

7.120 The Atkins Phase 1 research for TfL proposed a methodology for defining a Level of Service for assessing the usability of unsegregated paths, based on the number of users/metre width/minute. On the basis that cyclists travel some 3.5 times (weekends) and 5 times (weekdays) faster than pedestrians, the number of cyclists was multiplied by these factors to obtain the overall number of 'pedestrian equivalent' users.

7.121 A summary of the proposed LOS factors is given below (based on openspace/parkland criteria):

Pedestrian equivalent users/metre width/minute (min-max)	**Level of Service Classification**	**Description**
0 to 3	A	OPEN: There is sufficient space for pedestrians and cyclists to select their own walking speeds and overtake other users.
4 to 6 7 to 9 10 to 12	B+ B B-	IMPEDED: There is space for users to select a normal movement speed and to by-pass other users in primarily one-directional flows. In areas where there are two-directional flows, there may be the chance for unexpected interactions to occur.
13 to 15 16 to 18 19 to 21	C+ C C-	CONSTRAINED: In this situation, the freedom to select individual movement speeds and bypass slower moving users is restricted. In areas with high levels of two-way movement there is a strong possibility for unexpected interactions between users.
22 to 24 25 to 27 28 to 30	D+ D D-	CONGESTED: At this Level of Service the majority of users will have their normal movement speeds restricted and reduced due to difficulties in by-passing slower moving users. There is a possibility of intermittently reaching critical density at times.

Pedestrian equivalent users/metre width/minute (min-max)	Level of Service Classification	Description
31 to 33 34 to 36 37 to 39	E+ E E-	CROWDED: At this Level of Service, all users will have their movement speeds restricted, requiring frequent changes in direction. Extreme difficulties would be experienced by pedestrians attempting to reverse or cross directional movement.
40 to 42 43 to 45 46 to 48	F+ F F-	JAMMED: At this Level of Service, all users will have their movement speeds restricted, requiring frequent changes in direction. Extreme difficulties would be experienced by pedestrians attempting to reverse or cross directional movement.

7.122 Although these LOS levels represent a possible rationale for assessing the width requirements of unsegregated paths, they were not tested during the research and do not feature in the draft TfL guidance summarised in para 6.40 above.

7.123 The Atkins Phase 2 study for TfL, as well as looking at additional sites, went on to propose suitable path widths for various levels of flow, depending on whether the path was segregated or unsegregated, based on typical width requirements (eg space needed for a cyclist to pass two pedestrians), and with only minor differences these recommendations were carried through to the final guidance, as set out in Para 6.43 above.

7.124 The Atkins research considered in detail the factors that affected the degree of compliance of path segregation by pedestrians and cyclists. Key findings were that:

- For any given location at any time, cyclists are more compliant with segregation than pedestrians.
- Levels of compliance with segregation improve as the relative proportion of cycle activity increases and worsen as the relative proportion of pedestrian activity increases.
- As cycle flows increase, pedestrian compliance significantly improves, suggesting compliance of both user groups is dependent on a critical flow of cyclists.

- Cycle flows of less than around 150 per hour are insufficient to maintain appropriate levels of compliance. One in five pedestrians walk in the cycle lane when there are fewer than 2.5 cyclists per minute.
- Cycle flows of over around 300 per hour achieve 95% compliance by pedestrians
- Compliance is likely to be influenced by other site specific factors such as pedestrian capacity, the presence of cross routes, path width and group size.

7.125 The research therefore recommended that where cycle activity is low during peak weekday or weekend periods, segregating a shared use path may lead to unexpected user interactions and potential conflict as a result of non-compliance by pedestrians. This was observed widely on Greenways in London.

7.126 This advice has now been incorporated into the draft London Cycling Design Standards, as noted in Para 6.40 above.

8 KEY FINDINGS OF THE LITERATURE REVIEW

8.1 The starting point for the study literature review was the policies of Sustrans and groups representing blind and visually impaired people – the former being that traffic-free paths should generally be non-segregated unless it was necessary to segregate users; and the latter taking the opposite view, that there should be a presumption in favour of segregation.

8.2 Despite these differences, the review has shown that both groups support good facilities for pedestrians and cyclists, including disabled people of all kinds; and that both accept that segregation and non-segregation can be acceptable in some situations. Sustrans accept that segregation is more appropriate in busy urban areas and GDBA accept that non-segregation can be appropriate on very quiet rural routes. Essentially the difference is over the middle ground.

8.3 Numerous policy and guidance documents, including the Welsh Assembly's *Walking and Strategy for Wales*, highlight the difficulties that vulnerable users have in sharing paths and indicate a presumption in favour of segregation. Notably the new draft Local Transport Note from the Department for Transport removes the presumption in favour of segregation. Moreover, the latest published DfT guidance document on cycle facilities LTN 2/08 does not include a strong commitment to segregation, suggesting that wider paths and better visibility may be better solutions. The Welsh Strategy also states that there is little research on the experiences of path users, and that previous research has shown that most conflict is perceived rather than actual.

8.4 The benefits that traffic-free paths bring are not in doubt – there are significant health, environmental and economic benefits, but their extent will obviously be dependent on the amount of new paths that are built and the provision of a well-connected and continuous network. The Welsh Assembly's Policy notes that resources are limited and must be used wisely, and it is important to recognise that segregated paths are up to three times more expensive than segregated ones.

8.5 Clearly, therefore, while segregation is supported by some groups representing vulnerable users, it is not a panacea and there are advantages and disadvantages of both types of path in particular circumstances. The next section of this report provides a summary of the findings of the study in this area.

8.6 Notwithstanding the general preference for segregation expressed in some technical guidance documents, there are several factors to be taken into account when deciding between non-segregated and segregated paths. These include:

- Pedestrian and cycle flow
- Cycle speed
- Cycle journey purpose
- Visibility
- Presence of vulnerable users – elderly, disabled, children
- Available width/presence of pinch points eg bridges
- 'Exchange' activity – shopping, playing etc.

8.7 Few of the guidance documents give any numerical guidance on these factors although the research carried out by Intelligent Space Atkins which underpins the new draft London Cycling Design Standards does provide some guidance on flow levels, including minimum cycle flows to achieve pedestrian compliance with segregation. The new draft LTN specifically states that setting appropriate flow levels is difficult and should be based on local observations. The guidance documents also generally state that designs need to be produced on a site-specific basis, taking local factors into account.

8.8 Our review of the research available has confirmed that the risk of actual conflict on traffic-free paths is generally low, although one notable example was found – the Redways in Milton Keynes – where poor standards of maintenance and design have led to a poor accident record for cyclists. Not all of these accidents relate to conflict with pedestrians, however.

8.9 Perception does not match reality however; in Milton Keynes, cyclists thought the Redways were safer than they actually are; on the Queen Charlotte Trail in New Zealand walkers who did not meet cyclists had a worse opinion of them than walkers who did.

8.10 Good information alerting people to the legitimate presence of cyclists on paths can help to reduce perceived conflict. In Kensington Gardens adverse views of cycling went down after cycling was legitimised, despite an increase in cycling. One challenge is how to communicate cyclists' presence to blind and partially-sighted people, but Codes of Conduct, such as those promoted by Sustrans or the Royal Parks, and well-designed tactile surfacing which indicates when pedestrians are entering a path shared with cyclists can help. At the moment there is no specific paving providing warning on the entry to an unsegregated shared use path, however.

8.11 Detailed studies of pedestrian and cyclists on shared use paths in the UK carried out for the Countryside Agency and most recently from the Department for Transport and Transport for London have shown that their behaviour is more complex than may be thought – both cyclists and pedestrians typically use the whole of the path, and cyclists have commented in several studies of the problem of pedestrians not keeping to the part of path designated for their use on segregated facilities. Non-compliance by pedestrians is higher at weekends when people are more likely to be travelling in groups and when cycle flows are light.

8.12 The studies for the Countryside Agency also showed that on paths carrying up to around 100 users per hour, found that conflict on non-segregated paths is an extremely infrequent occurrence. However, when people talk about conflict, its assumed incidence increases and appears to be more serious. The discussion and focussing of attention on conflict serves to escalate its perceived existence.

8.13 Some studies have shown that it is the proximity of cyclists to pedestrians that creates most conflict, rather than their speed – and several studies have shown that most cyclists do slow down when they meet pedestrians and that speeds are lower on unsegregated routes.

8.14 Research on the possible methods of segregation show that the recommended white line still has some drawbacks and is a compromise; and that using a level difference or a barrier between paths can create a hazard for cyclists. The latest draft DfT guidance advises that a level difference is the best option if segregation is to be used, but that it can increase costs considerably.

8.15 Considerable research has been done overseas on the development of more objective methodologies to assess 'level of service' (LOS) on non-segregated paths. The original thinking on this related LOS for both pedestrians and cyclists on the frequency with which path users pass or meet one another. More recently researchers in the US have refined this approach using the responses of people to videos of varying conditions on real paths and using regression analysis to relate their scores to measurable parameters – principally user flow, modal split and path width.

8.16 This approach is considered to have merit in that it provides a logical and auditable methodology for predicting users' opinions of conditions on a particular path.

8.17 Some applications of LOS concepts have already been made to assess the suitability of routes through London greenspaces for shared use, but these have generally focussed on pedestrian LOS on the basis that they make up the vast majority of users. This methodology has

some drawbacks, and is not really suitable where the cyclists make up a higher proportion of path users. A possible approach to assessing overall level of service for both pedestrians and cyclists has been proposed by Atkins in their latest research for TfL, but this has not been tested in practice.

8.18 It is important to note we have not been able to find any research that objectively assesses the degree of perceived risk that is felt by blind and partially-sighted people when actually using a path that is shared with cyclists. Previous studies have generally used focus groups to assess the problem rather than seeking, say, to interview actual path users to ascertain how their perceptions vary with path conditions, including segregation.

Indicative Flow Levels

8.19 The literature review does provide a series of possible guidance levels for path user flow that may justify segregation, as set out in Table 2 overleaf. It is notable that the different documents give fairly similar orders of user flow.

8.20 The Department for Transport has chosen not to include indicative flow levels in its draft LTN on Shared Use, however.

Source Document	Recommended Flow Limit for Non-Segregated Path	Comments
Countryside Agency – Greenways Handbook	200 users per hour along path	Wording suggests that this is an indicative figure (eg 200). No distinction between pedestrian and cycle users.
CROW – Design Manual for Bicycle Traffic	100 pedestrians per hour per metre width on pedestrianised streets.	Would imply 300 peds per hour on a 3m wide path, but this advice is given in the context of pedestrianised streets. No value for cycle flow given
	25 pedestrians per hour per metre path width on traffic-free paths away from town centres.	Would imply 75 peds per hour on a 3m wide path. No value for cycle flow given.
University of Surrey for Countryside Agency – Phase I and II research	At least 100 users per hour on 3m path	Actual and perceived conflict found to be low at these flow levels.
TRB	150 users per hour on 3m path	Level of Service C, taken from look up table, assuming average modal split.

Table 2 – Possible traffic flow limits of non-segregated traffic-free paths

8.21 More recent guidance by TfL, based on research by Atkins indicates that non-segregated paths can cater for high levels of flow if wider paths are used. A 4.5m wide path is indicated as catering for up to 900 pedestrians and 450 cyclists per hour. TfL also advise that pedestrians are unlikely to conform paths with cycle flows of less than 150 cyclist per hour, and that this can lead to unexpected conflicts.

Advantages and Disadvantages of Segregated and Non-Segregated Paths

8.22 Finally, the research has pointed to the following list of possible advantages and disadvantages of segregated and non-segregated traffic-free routes – see Table 3 below. As noted at the outset, it is taken as a given that a path should be provided – the key question is what type of path is appropriate for a given situation.

Advantages of non-segregation/Disadvantages of segregation	
Effect	Comment
Non-segregated paths are narrower and require less land.	Segregated paths need to provide space for pedestrians to pass pedestrians and for cyclists to pass cyclists. On non-segregated paths all users can use the same space to pass one another. Land availability is a constraint that can be difficult to overcome. Strict requirement for segregation could therefore make it impossible to complete the network.
Non-segregated paths are less costly.	Up to around 3 times less if segregation by kerb is used.
Non-segregated paths are more flexible, catering for varying proportions of pedestrians and cyclists.	Both user groups can use the whole path. Research at Hampstead Heath shows that pedestrian and cycle use can peak at different times.
Pedestrians do not always respect segregation and often stray into the area designated for cyclists. This is more likely when cycle flows are less than 150 per hour **(August 2011)**	Supported by video research and by opinion surveys.
Cyclists go faster on segregated routes.	Likely to create a greater risk of injury if a collision with a pedestrian does take place.
Cyclists may also not respect segregation if only a white line is used.	Latest draft DfT Local Transport Note advises that segregation with a white line is not recommended. **(August 2011)**

All methods of segregation have their drawbacks.	Raised white lines may not be detected by all users; tramline paving, kerbs and fences create a hazard for cyclists and visually impaired people; intermediate verges increase width, land take and construction and maintenance costs. Rainwater can be retained by raised white lines and upstands
Segregation introduces street clutter and detracts from the amenity of the path.	Particularly important in rural areas where there can be objections to path creation from rural interest groups.
Non-segregated paths cater for a greater range of users	Eg disabled cyclists, cyclists on special vehicles, those accompanied by walkers, family groups, skaters, equestrians. Wheel chair users prefer a level surface.
Non-segregated paths can improve civility between path users	By definition it is not possible for a user to be in the 'wrong' place if the path is not segregated, removing one potential source of conflict.
Disadvantages of non-segregation/Advantages of segregation	
Effect	Comment
Segregation reduces perceptions of conflict by pedestrians, particularly vulnerable groups.	Segregation may therefore reduce the propensity of vulnerable groups to avoid using the path.
Segregation can reduce actual conflict when cycle flows are high. **(August 2011)**	On the basis that path users remain on their designated side of the path
Segregation gives a better level of service to cyclists, allowing them to go faster.	Level of Service may be particularly important for utility cyclists who may otherwise find it more convenient to use the road. Increased cycle speed is only achieved if path users remain on their designated side of the path. **(August 2011).**
Segregation makes pedestrians more aware of the possible presence of cyclists, through white lines, kerbs, tramline markings etc.	
Segregation helps cyclists to pass pedestrians engaged on 'exchange' activities – eg playing, shopping,	

Table 3 – Advantages and Disadvantages of Segregated and Non-Segregated Paths

8.23 These advantages and disadvantages show that the choice between segregation and non-segregation is highly dependent on local circumstances, as indicated in Table 4 below, which gives a series of 'indicators' that can be used to help decide which type of path is appropriate. The new draft LTN published by DfT includes a list of factors to be taken into account which can be read as a summary of this table, and the draft TfL Greenways guidance also includes a similar table.

Characteristic	Indicators for		Comment
	Non-Segregation	Segregation	
Path Type			
Existing footpath?	No	Yes	'No loss' principle – pedestrian concerns likely to be higher where cyclists being allowed onto paths that are presently pedestrian only.
Urban/Rural	Rural	Urban	Rural paths more sensitive to sign clutter and flows likely to be lower
Views/interest to one side	Yes	No	Eg waterfronts – all path users will want to be able to enjoy one side of the path.
Location with high visual quality	Yes	No	Segregation has a visual impact which may be less appropriate in sensitive locations, both urban and rural.
Location with high ecological value	Yes	No	Increased path width has the potential to create increased impact – disturbance to habitat, run off etc.
Path Users			
Cycle Flow	Low	High	**(August 2011)**
Numbers of Vulnerable pedestrians	Low	High	Further research needed to quantify response of vulnerable pedestrians to real-life situations
Variability of modal split	High	Low	High peak demand by particular user group can be better accommodated if all the path is available.

Characteristic	Indicators for		Comment
	Non-Segregation	Segregation	
Numbers of groups	High	Low	Groups (eg families, parents teaching children to cycle) appreciate being able to use the whole path.
Numbers of disabled cyclists	High	Low	Disabled cyclists require greater widths for themselves and for assistants.
Path Users (cont'd)			
Proportion of Utility cyclists	Low	High	Utility cyclists travel faster and require higher level of service
Cycle speeds	Low	High	Cycle speeds can be reduced through well designed barriers.
Number of non-travelling path users	Low	High	Playing, shopping, fishing etc.
Flows across path	High	Low	Crossing movements of pedestrians and cyclists are more difficult to handle with segregated paths, particularly if change of level or fencing used.
Path Geometry			
Land availability	Narrow	Wide	Segregation requires greater land width and may not be achievable through pinch points.
Costs/m width	High	Low	High costs would apply for example on bridges and other structures
Visibility[14]	Good	Poor	Adequate visibility is significant factor in reducing perceived conflict.
Gradient	Flat	Steep	Steeper gradients increase cycle speeds

[14] Guidance on visibility requirements for cyclists is given in LTN 2/08 and TA90/05

Characteristic	Indicators for		Comment
	Non-Segregation	Segregation	
Number of junctions	High	Low	Junctions between paths are more difficult to handle with segregated paths, particularly if change of level or fencing used.

Table 4 – Indicators for Segregated and Non-Segregated Paths

8.24 In any particular situation the choice between segregation and non-segregation is likely to depend on the balance between several of these factors, and the table illustrates why it is not appropriate to set a firm presumption in favour of any particular solution.

9 CONCLUSIONS

9.1 This report has sought to investigate, primarily through a review of available literature, the complex issue of when it may be appropriate to segregate traffic-free routes between cyclists and pedestrians, with particular reference to the problems experienced by blind and partially-sighted people.

9.2 The study has confirmed that traffic-free routes are vitally important if cycling and walking are to be encouraged and that there should be a presumption in favour of completing the network. It has also demonstrated that it is not generally feasible to provide wholly separate pedestrian and cycle routes; most routes will have to cater for both types of user, as well as other groups such as equestrians.

9.3 These paths may be segregated into pedestrian and cycle areas, or may be non-segregated; the case for segregation being the default response has been made by groups representing blind and visually impaired and other vulnerable uses; Sustrans would normally prefer the starting point to be an unsegregated path, although there are limited circumstances when both groups would agree on the type of path that would be appropriate.

9.4 Both types of path have their advantages and disadvantages, as set out in Table 3 of this report. There is no ideal form of segregation; all have their pros and cons.

9.5 Our review has identified a number of indicators, as set out in Table 4, that point towards segregation or non-segregation being the most appropriate response in a particular situation. The choice will depend on the balance between these factors. Local circumstances will therefore inevitably influence the best design for a particular section of path.

9.6 Further research is recommended into the response of vulnerable groups to different conditions, both in terms of path design and use. Extending Sustrans' surveys to identify the nature of any disability, so that variations in the numbers of blind and partially-sighted users could be investigated, would be a starting point in this process.

9.7 Various Level of Service models have been identified through the literature report and these may well provide a useful and objective tool to inform path design, Some use of LOS techniques has already been made for paths through green spaces in London, although these do not explicitly consider vulnerable groups.

9.8 Updated technical guidance based on this literature review and further research will hopefully enable the best path design to be produced for any particular location, on a case by case basis, helping to overcome the differences between Sustrans and GDBA and to build upon the substantial degree of agreement that does exist.

9.9 It is hoped that this report has helped to provide a balanced overview of the benefits of providing more extensive networks of traffic-free routes throughout Wales; and has provided a way forward that will assist all groups in coming to a common view on how best to decide on the type of path to be provided in any given situation.

Phil Jones Associates Ltd

Appendix A –
Previously Proposed Legislative Competence Order

Consultation draft of an Order to be laid before the National Assembly for Wales and Parliament under section 95(5) of the Government of Wales Act 2006, for approval by resolution of the Assembly and of each House of Parliament.

DRAFT STATUTORY INSTRUMENTS

2009 No.

CONSTITUTIONAL LAW,

DEVOLUTION, WALES

The National Assembly for Wales (Legislative Competence) (Traffic Free Routes) Order 2009

*Made - - - - ****

Coming into force in accordance with Article 1

At the Court at Buckingham Palace, the *** day *** of *** 2009

Present

The Queen's Most Excellent Majesty in Council

In accordance with section 95(5) of the Government of Wales Act 2006[(a)] a draft of this order has been laid before, and approved by resolution of, the National Assembly for Wales and each House of Parliament.

Accordingly, Her Majesty, in pursuance of section 95(1) of the Government of Wales Act 2006, is pleased, by and with the advice of Her Privy Council, to order as follows:-

Citation and commencement

1. This Order may be cited as the National Assembly for Wales (Legislative Competence)(Traffic Free Routes) Order 2009 and it comes into force on the day after the day on which it is made.

Amendments to Schedule 5 to the Government of Wales Act 2006

2.—(1) Part 1 of Schedule 5 to the Government of Wales Act 2006 is amended in accordance with this article.

[(a)] 2006 c.32.[15]

(2) In field 10 (highways and transport), after matter 10.x insert—

Matter 10.y

The development and maintenance of traffic free routes across Wales that take into account the needs of all users."

Clerk to the Privy Council

EXPLANATORY NOTE

(This note is not part of the Order)

This Order amends Schedule 5 to the Government of Wales Act 2006 ("the 2006 Act"). The effect of the Order is to extend the legislative competence of the National Assembly of Wales to make new laws for Wales by Measure under section 93 of the 2006 Act.

The amendment relate to field 10 (highways and transport) in Part 1 of Schedule 5. Article 2(2) inserts matter 10.y [number to be inserted at a later stage] which extends the legislative competence of the National Assembly for Wales to include the development and maintenance of traffic free routes. The wording of the matter is taken from the Sustrans proposal to the National Assembly's Enterprise and Learning Committee and accepted by the Committee as a basis for consultation.

This extended legislative competence of the National Assembly for Wales is subject to the general limitations that apply to the exercise of such competence by virtue of Part 3 of the Government of Wales Act 2006.

Appendix B – Schedule of Documents Reviewed

Sustrans Shared Use Path Research – Literature Review Summary

[Note – Titles of documents added in August 2011 report are underlined]

Document Title	Type	Author	Date Pub.	Key Points	Comments
Guidance and Standards from the UK					
Walking and Cycling Strategy for Wales	Policy and Guidance	Welsh Assembly	2003	• Three key benefits of more walking and cycling – health (physical and mental), environment and economy (through tourism) • Significant opportunity to increase walking and cycling • Use of traffic free routes during holidays allows people to develop confidence to cycle elsewhere on utility trips. • Important that network is continuous • Needs of disabled people must be considered along needs of able-bodied. • User hierarchy – Disabled, peds, cyclists, public transport, freight, other motorised traffic • Equal weight given to JCMBPS policy statement on principles of sharing space. • Space is limited therefore sharing space take place – including by segregation of routes. • (3.2.5) – Many miles of NCN already which are shared. Spaces can be defined by demarcation or physically segregated into two paths where space allows. Not easy and resources	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				limited however. Inconsiderate usage can cause fear especially disabled and elderly people. • (3.2.6) Realistic approach to shared space is to be promoted, managed in various ways. • (3.2.7) Little research done on shared use paths, but research shows that most conflict is perceived, not actual. Considerate behaviour is the most important factor. • Code of Conduct to be developed and publicised. • Can off carriageway routes be practicably separated? • If shared paths, these must be segregated and managed. • NCN has played invaluable role in encouraging people to walk and cycle more.	Refers to Countryside Agency (by University of Surrey) research, summarised in CRN32
A Walking and Cycling Action Plan for Wales	Action Plan	Welsh Assembly	2009	• Four themes, including encouraging sustainable travel through better walking and cycling infrastructure. • Benefits of encouraging active travel – reduced car dependence, health, emissions. • Targets for increasing travel to school, non-recreational adult trips, recreational trips. • Series of key partners identified to deliver outcomes, including Sustrans and Local Authorities.	

Document Title	Type	Author	Date Pub.	Key Points	Comments

				• Actions include
				  ○ – Develop cycling infrastructure benchmarking programme in Wales.
				  ○ Increase provision of safe traffic-free walking and cycling routes to workplaces and key destinations
				  ○ Continue development of National and Local Cycle Networks.	

Draft LTN 1/04 – Policy, Planning and Design for Walking and Cycling	Design Guidance		2004	• Accidents between peds and cyclists in pedestrianised areas are rare. Cyclists tend to slow down. • 'No loss' principle should apply – any new measures should represent a real improvement over existing • Adjacent or shared use are both possible solutions for traffic-free routes. • Presumption in favour of segregated use, particularly for utility routes. • Decision will depend on volume of peds and cyclists and width. • Segregation by direction also may be appropriate, eg where visibility is restricted.	
Draft LTN 2/04 Adjacent and Shared Use Facilities for Cyclists and Walkers	Design Guidance	DfT	2004	• Redefines shared use to mean no segregation • Principally applies to urban areas – see CA and Sustrans guidance for rural areas.	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• Presumption to adjacent paths especially where use high • Typical widths given – 5m for segregated path, 3m for unsegregated path. • Level difference preferred for segregation • Segregation by kerb, railing or upstands etc make movement across the facility difficult. • Risk of collision with handlebars or pedals if railings or walls used. • Grass verge has maintenance implications • Risk for cyclists of raised white line noted and can trap debris. • Segregated facility – 180 users per hour can be accommodated. • Downhill gradient increases cycle speed, increases conflict • Relates deterrence to amount of use. • Refers to CA research phases 1 and 2	No guidance on numbers except that segregated paths can cater for 180 users per hour.
Draft LTN on Shared Use Facilities (May 2011)	Design Guidance	DfT	2011	• Based on Atkins research (see below) • Removes presumption in favour of segregation. • Shared use should only be provided where high standards can be achieved. • Any new cycle track should be designed to accommodate shared use • Refers to Sustrans for guidance on	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				rural paths. • Notes that segregation increases costs. • Segregation by white line is ineffective • Segregation by level difference is preferred. • Unsegregated paths are more efficient in terms of width. • No guidance given on when to segregate in terms of user flows.	
LTN 2/08 – Cycle Infrastructure Design	Design Guidance		2008	• Benefits of more cycling given – health etc. • Betterment principle restated – measures for peds and cyclists should offer positive provision. • Needs of disabled people should be taken into account in consultation and design. • Designs should be safe and perceived to be safe. • Potential for conflict between pedestrians and cyclists should be minimised. • Problems of hearing and sight-impaired pedestrians noted. But cyclists can mix with peds in vehicle restricted areas. • Conflict increases with restricted width, heavy flows, high speeds and where routes cross • Detailed designs need to be site-specific – difficult to apply standard solutions.	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• Marking cycle routes through pedestrianised areas can lead to higher speeds. • Refers to LTN 2/86 on shared use. • Converting existing footways is loss of provision for pedestrians • Notes that segregation is an option but if room is limited does not make best use of land • Considerable variation on off-road routes – design depends on use of route (commuting/leisure) – higher design speed for commuting (20mph) than leisure use. • Ability of pedestrians to interact safely depends on speeds and sightlines available – generous sightlines help pedestrians and cyclists avoid each other. • At conflict points cycle speed may need to be reduced using tight radii, but better to widen the route and address visibility issues. • Recommended widths same as draft LTN 2/04 • Coloured surfaces expensive to lay	Suggests that better to provide wider unsegregated route. Refers to Countryside Agency (Uzzell) research
Connect2 and Greenways Design Guide	Design Guidance	Sustrans	2007	• Emphasises benefits to peds and cyclists. Overall aim is to reduce car use and increase active travel. • Mainly rural but important urban links • 15% of users are new or resumed	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				cyclists • Often upgrading of paths that are already legal for cycles to use – eg bridleways. • Resurfacing makes it possible for disabled/elderly/young children to access the countryside. All need traffic free level access. • Visual impact of routes – key issue in rural areas. • Can't leave unsurfaced footpath alongside as walkers will transfer to cycleway – not wide enough. • Width 2m rural to 3m+ urban depending on usage – even 3m can be inadequate • Notes on divided path (Lancaster) that white line largely ignored. • Split level paths expensive to build and maintain • Raised concrete delineator can be a hazard in wet weather • May have to have narrow sections to overcome obstacles • Chicanes can be used to slow cyclists at problem sites.	Would be worsened by segregation measures
Greenways Handbook	Design Guidance	Countryside Agency	2003	• Focus groups note shared use as one factor deterring use but notes that this can be overstated by interviewees • Use (leisure or utility) and flows will inform design – width and segregation • Must consult with representatives of blind and partially	Cites findings of CRN32 – Uzzell research.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• Supports segregation as starting point but points to some advantages of shared use. Need to weigh benefits and disbenefits. • States that unsegregated paths 'do not cater for blind and partially-sighted people' • Flows of over 200 best served by segregation. • Segregation/non-segregation may vary along length of route. • Shared use more acceptable on new facilities. • States that paths should not be built that do not meet the needs of all users simply because insufficient budget is available. • Lengthy code of conduct suggested.	
London Cycling Design Standards	Design Guidance	TfL	2005	• Doesn't fully address shared use/segregated use, referring to draft LTN 2/04 • Blind issues only dealt with under tactile • 10mph design speed on shared routes, 15mph otherwise • Points to possibility of cycle traffic calming but doesn't say how to do it.	
Cycling on Greenways – Equality Impact Assessment	Policy review	TfL	2007	• Review of Cycling on Greenways Implementation Plan • Prepared with close involvement of disabled people – reference group. • Endorses 'shared use as last resort'	Presumption in favour of segregation but acknowledges that more information needed.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				approach • But acknowledges that risks are small • Proposes (crude) A/B/C classification • Support for code of conduct • Encourages more inclusive (Green CRISP) design process • Acknowledges that more information needed to advise proportionality • Give advantages and disadvantages of shared use.	
Green CRISP version 2	Procedure	TfL	2005 ?	• Highlights involvement of Disabled groups, Equality considerations • Refers to Inclusive Mobility	Greenways EIA has recommended some changes to Green CRISP which will continue to evolve. Needs more definitive guidance on numbers etc.
Draft Appendix D to London Cycling Design Standards (currently unpublished)	Design Guidance	TfL	2010	• Greenways – routes away from main trafficked roads, for use by people of all abilities. • Include segregated and unsegregated shared use paths • Indicative design flows levels defined. • Minimum path widths given for seg and unseg routes to cater for all levels of flow. • Notes that cycle speeds lower on unseg paths • Notes advs/disadvs of both types of path • Non-compliance by pedestrians a	Based on unpublished (August 2011) research by Atkins, summarised below.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				problem at low cycle flows (<150 per hour)	
TA90/05 – Geometric Design of Ped, Cycle and Equestrian Routes	Trunk Road Standards	HA	2005	• Use 30kph/10kph (short distance) design speeds • Base shared use on Cycle speeds • SSD 30m/10m • Des Widths ped only 2.6, cycle only 3m • Shared use for low flows. • Unseg have worked at 2m for 200 users per hour • Preferred min 3m • High flows, segregation – preferred through 1m verge, 0.5m min. • Seg by fencing but guardrail problem of collision with handlebars and pedals	Importance guidance on sightlines.
TA 91/05 – Provision for Non-Motorised Users	Trunk Road Standards	HA	2005	• Different requirements between and within user types – eg novice cyclists • May be some value in segregating but in isolated areas adjacent or shared use gives greater sense of security • But disabled people cautious • Need segregation at more than 200 per hour (draft LTN 2/04)	
Guidance and Standards from Overseas					
Design manual for bicycle traffic (CROW)	Standards/ Guidance	CROW	2006	• Cyclists entering pedestrianised streets depends on ped flow o <100/hr/m – shared use o 100-160 – sep. by line	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				○ 160-200 – sep. By kerb ○ >200 no cycling. • Advantages of shared use – maximum freedom for peds and cyclists • Advantage of segregation – less nuisance, safer. • But height difference between tracks is source of cycle accidents. • But nuisance and danger not great – German research shows ped/cycle accidents seldom and hardly ever serious. • Shared use paths – up to 25 peds/hr/m and cycle flows not high. • Factors against shared use – lack of space, 'exchange' activities (shopping, playing), many old people (who can feel endangered)	
New Zealand Cycle Network and Route Planning Guide	Guidance	Land Transport Safety Authority	2004	• Cyclists' needs vary – child/novice, basic competence, experienced • Child/novice benefit particularly from traffic free provision • Urban off-road paths encourage new trips, partic recreational and neighbourhood cyclists. Also benefit walkers, joggers, parents with prams etc. • Can be less safe than roads if not well designed. • Exclusive cycle path – high LOS but used sometimes by walkers • Shared paths maximise community	Does not explicitly address blind and partially-sighted users.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				benefit, good for vulnerable cyclists • LOS for cyclists can be poor, conflict where significant volumes. Appropriate where numbers are modest. • Separated paths help avoid conflict but peds can stray into cycling space. Appropriate for large numbers of peds and cyclists. Cost more.	
New Zealand Pedestrian Planning Guide	Guidance	Land Transport New Zealand	2005	• Need adequate width, signing and visibility on shared use paths. • If segregated, do so with kerb, line, median strip, landscape barrier or raising ped route. • Shared Use paths desirably 3.5m • Segregated paths desirably 4.5m • Some pedestrians perceive danger, especially elderly.	
Minimising Pedestrian-Cyclist Conflict on Paths	Guidance	Austroads	2006	• Traffic-free routes popular for encouraging formerly inactive people to take up walking and cycling. • Shared paths suitable for most kinds of users but problems likely to arise at high levels of usage. • Consultation essential. • Path conflict most often causes inconvenience and anxiety rather than crashes or injury. Real level of conflict may be different from users' perceptions. • Gives pros and cons for shared (non-segregated) and separated paths	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				including cost, land take, usage, conflict elimination, bicycle speed. • Giving more certainty can increase speeds. • Width, visibility and edge clearances have significant impact on level of convenience and conflict. • LOS defined as per US Highway Capacity Manual (2000) A-F and from Hummer research • LOS assessed from number of 'events' per hour or 'wevents' – interactions between cyclists and pedestrians • Need to assess likely flow – latent demand. • Segregation by kerb, fence or verge (1-2m wide); Physical barriers create potential hazard. • Emphasis on keep left, despite the fact that the law doesn't require peds to do it. All shared paths should have centreline marking. • Signs necessary to encourage good user behaviour.	
Shared Use Path Level of Service Calculator – A User's Guide	Guidance	US Department of Transportation	2006	• Provides evidence for cycle LOS based on width and mode split – partic % pedestrians • Solutions to low LOS are widening and striping • Provides mathematical tool to assist	Key document that provides quantitative assessment of (cyclist) LOS on non-segregated paths.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				path designers – downloadable spreadsheet	
Policy Statements and Reports by UK organisations					
Paper to Enterprise Committee	Report	Sustrans	2008	• 14% of trips on NCN were new/returning cyclists • 3% of trips by disabled users. • 10% by over 60s • EqIA requirement to be embedded	
Shared Use Routes	Info Sheet	Sustrans	1999	• Uses “shared use” to mean either segregated or unsegregated paths. • Points to cost efficiency of shared use. • 2-3m wide • Parents on foot can accompany children learning to ride – advantage of shared use. • Proportion of converted footways very small. • Acknowledges deterrence potential • Uses ‘high’ to justify segregation but without numbers.	Potential confusion over terminology.
Disabled Persons and the NCN	Info Sheet	Sustrans	1998	• Benefits of NCN to disabled people including disabled cyclists • Potential problems can be overcome through consultation, good design and education (Good Cycling Code, signage)	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• Shared use paths are well used by visually impaired pedestrians • Segregation justified in high use urban areas. In rural areas unsegregated will be the norm. • Advantages given. •	No factual evidence quoted
The Economic Impact of Cycling and Walking on the Celtic and Taff Trails	Report	Institute of Transport and Tourism for Sustrans	2008	• Celtic and Taff Trails carry 1.5m and 0.6m users pa respectively • Total economic benefit £75m pa, generating 1399 jobs. • Traffic free sections (68% of total km) generate more trips than shared highway sections. • 34% pedestrians, 56% cyclists, 0.6% disabled. • (At Nantgarw) – 14% novice cyclists, 8% over 60, 91% of cyclists say the route has enabled them to increase activity.	
The National Cycle Network Route User Monitoring Report 2007	Report	Sustrans	2007	• 50% pedestrians, 50% cyclists • 82% of users on traffic free sections (33% of network) • 9% new or returning cyclists • 15% under 16 • 14% over 60. 25% of these trips on rural traffic free sections. • 3% of trips by disabled people. 5% in those over 60.	
The National Cycle Network Route User Monitoring	Report	Sustrans	2009	• Use of the NCN increasing by a further 9%, like-for-like increase of	

Document Title	Type	Author	Date Pub.	Key Points	Comments
Report to end of 2008.				3%. • 50% pedestrians, 50% cyclists. • Biggest increase in usage was in weekday journeys. • 23% of the journeys on the NCN were for commuting, more than double the number of such trips made in 2007.	
London Greenways Monitoring Report 2009	Report	Sustrans and TfL	2010	• 18% of users over 55 (compared to 8-12% of London cyclists in total) • 42% women (compared to around 33% of London cyclists in total) • 19% below 16 years old. • 7% had a long term illness or disability • 19% could have used car or motorcycle • 44% of trips were for commuting, shopping or other personal business	
Adjacent Facilities for Peds and Cyclists – Policy Statement	Policy Statement	JCMBPS	2004	• Cycling is one of range of problems – others include path surfaces etc • 96% think no shared pavements • Should only provide segregated facilities, ideally with 1m verge, then kerb, then barrier, then raised line • Otherwise make separate provision for cyclists. • Except in quiet rural areas – eg forest path.	These would be improved by Greenways. Unlikely to see any improvements therefore.
Shared Spaces Policy Statement	Policy Statement	JCMBPS	2005	• Mainly concerned with shared space concept • Also summarises cycle/ped conflict	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				concerns	
Primary Research, Case Studies and Academic Papers					
How People React on Off Road Routes Phase I	Research	University of Surrey for The Countryside Agency	2000	• Unsegregated paths carrying fairly low flows (up to 70 per hour) were studied using video and user surveys, both on site and later at home. • Cyclists weave across the whole path, walkers use the whole path randomly. • Cyclists reduce speed when they meet walkers, walker increase their speed. • The frequency of meeting other path users is fairly low (at these flow levels) • Actual conflict is low but perceived conflict can be higher. • Physical factors eg visibility affect conflict.	No assessment of use by blind people.
How People React on Off Road Routes Phase II	Research	University of Surrey for The Countryside Agency	2002	• Follow up survey focussing on 'hotspots'. • Similar methodology – slightly higher flows (max 107 per hour) – and similar conclusions. • Surveys also of people living in the vicinity of the paths. Most reasons for not using are related to lack of usefulness, presence of cyclists was cited by few.	No assessment of use by blind people.

Document Title	Type	Author	Date Pub.	Key Points	Comments

Kensington Gardens Shared Use Trial – Final Report	Research	Atkins		• Video survey of speeds and interactions, plus questionnaires, on two locations in the park at weekends and weekdays on three occasions;
				  ○ Before cycling permitted
				  ○ Immediately after cyc. permitted
				  ○ One year later
				• Lower levels of conflict at later surveys even though cyclist numbers increased.	

Cycle Review at Regent's Park	Research	Peter Brett Associates	2008	• Considers three options for introducing cycling on Broad Walk, Regents Park • Carries out LOS analysis for peds based on HCM which shows that non-segregated is within acceptable limits • Refers to possible widening of 4m paths being justified. • Includes analysis of segregated vs non-segregated paths.	Uses LOS from pedestrian's point of view.
The Regent's Park The Broad Walk Shared Use Monitoring	Research	Atkins	2011	• Path carries around 400 users per hour in the weekday peak and some 1000 users per hour in the weekend peak. • Most are pedestrians, but number of cyclists has grown significantly since 2008. • 97% of users said that the overall quality of the park was good or excellent. • Over 99% of cycle journeys involved no conflict with pedestrians	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• 82% of pedestrians, and 74% of people with a disability were comfortable with the shared use trial. • All cyclists were satisfied with the scheme. • Cyclist speeds were around 13 miles per hour on average.	
Shared Use Operational Review (Unpublished, completed 2010)	Research	Atkins	NA	• Research underpins the draft DfT Local Transport Note published in May 2011. • 'Interactions' between pedestrians and cyclists are rare occurrences. • There was no significant difference in conflict levels between segregated and unsegregated pathes. • A white line is not an effective means of segregating a pedestrian/cycle path. • Overall, the level of non-compliance amongst all users was around 1 in 7 • The level of non-compliance for pedestrians is around double that for cyclists. • Non-compliance by pedestrians is higher at weekends due to greater numbers of people walking in groups.	
Off Highway Design Guidance – Phase 1 and 2 Research Reports	Research	Atkins	2009 / 2010	• Detailed research of behaviour of pedestrians and cyclists on segregated and unsegregated paths • Total of 16 sites studied • Focus group research on pedestrian	

Document Title	Type	Author	Date Pub.	Key Points	Comments
				and cyclists' views. • Conflicts are low but unexpected conflicts are more common on segregated paths • Pedestrians less likely to observe segregation than cyclists, particularly when cycle flows are low (150 per hour identified as threshold value) • Cycle speeds slightly lower on unsegregated routes • Pedestrians, particularly vulnerable people, feel more comfortable on segregated routes. • Level of Service assessment for pedestrians and cyclists proposed. • Recommended path widths based on flow levels and passing criteria. • Research underpins emerging TfL design guidance.	
TRL 583 Cycling in Vehicle Restricted Areas	Research	TRL	2003	• Majority of cyclists slow as pedestrian flows increase • Minority (young males) don't slow down. • Cycling not generally cited as a problem unprompted. • Young males travel faster – but not that much (1-2kmh) • 5% to 16% of pedestrians say they know of an incident involving cyclists but many involve leaving shops. • 12% of cyclists involved in incidents with pedestrians but one-third were arguments.	Not directly relevant to traffic-free paths but indicator of cyclist behaviour.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• Suggestion that cyclists required to give way to peds. • And segregation – marked line. • Questionnaires pointed to possible accident problem – but severity?	
TRL Report 287 'Delineation for cyclists and visually impaired pedestrians on segregated, shared routes' TA Savill, C Gallon, G McHardy	Research	TRL	1997	• Standard 20mm trapezoidal marking is a compromise • Some VI people have difficulty in keeping on one side of the line – • one person in test said had strayed onto cyclist side and had been injured by cyclist • Slumping • 20% of 100% blind people failed to detect it • Less than 60% were able to follow it without losing contact. • 31% found it difficult to follow • 26% of cyclists find difficulty with pedestrians walking on cyclists side of path. • 1/3 of blind people use this path and most have had difficulties – staying on the ped side and with cyclists on the ped side.	White line is not without its problems Higher cycle speeds with segrgation combined with failure to detect line by blind person could lead to more severe injury.
Pedestrian-Cyclist Conflict Minimisation on Shared Paths and Footpaths	Research	Austroads	2006	• Full review of the issues and published research. • Level of Service procedure as per Hummer reviewed but with local (remove negative term for centre line	Refers to DfT research from 1993 that ped/cycle accidents low.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				marking) removed. • Emphasis on keep left generally	
User Perceptions of the Quality of Service on Shared Paths	Research	Hummer et al	2005	• Video based survey to assess (5 point scale) cyclist's view of quality of route. • Mathematical model derived that relates LOS to path width, number of weighted events and presence of centreline	Only assesses cyclists' perceptions of comfort and freedom to manoeuvre. But could still be held to be of importance to peds, on the assumption that cycle/ped conflict increases with cyclist frustration. Doesn't consider segregated paths. Doesn't consider commuter/recreational use. Considers flows of 44 to 2320 per hour. 14% to 81% cyclists
"Slow Traffic Using Shared Facilities", 80th Annual Meeting of the Transportation Research Board, Washington.	Research Paper	Botma, H., Kiyota, M. and Vandebona, U.	2001	• Theoretical analysis of shared use (non-segregated paths) to establish approach to determining Level of Service • Proposes that conflict is related to frequency of meetings (travelling towards each other) and passings (travelling in same direction) • Assumes factor of 10 for passings on the basis that slower user is not aware of faster user when travelling	Primary research that establishes "LOS based on event frequency" approach

Document Title	Type	Author	Date Pub.	Key Points	Comments
				in same direction.	
Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand	Research Paper	Gordon Cessford Science and Research Unit, Department of Conservation, New Zealand	2002	• Off road leisure track in northern South Island, NZ • Lit review – actual risks are low but perception of risk can be higher amongst peds • Increased familiarity may change hazard perceptions of walkers • Survey of 370 walkers. • More negative reponses towards cyclist from those who hadn't seen one; and from older walkers. Amongst those who had seen a bike, higher concern from those who had not expected to see one.	• Perception of problem greater than reality. • Managing expectations is key to reducing concerns.
Safety Perception Issues Related to Pedestrians	Research Paper	Vandebona	2001	• Space separation is a key factor in determining pedestrian and cyclist (from cars) stress levels • Conflict related to density of usage. • Ped/cycle collisions are small proportion of all casualties (0.5%) in Japan - but growing . • Cyclists go slower in pedestrian environments so greater safety at high densities (?) • But large variation in cycle speeds on shared paths – children at risk. • Video survey – asked peds for view of danger – varied by separation and by age of user. • Used heartbeat monitoring for car interactions – speed and separation factors	

Document Title	Type	Author	Date Pub.	Key Points	Comments
Bicycle and Pedestrian Traffic Conflicts on Shared Pavements	Kiyota et al		2000	• Shared use is common in Japan. • Conflict is infrequent at low densities. • Cyclists travel more slowly at high densities – graph for this – both average and highest speed declines. • Pedestrian stress depends more on density than speed.	Can't get hard guidance from this but confirms key principles principles.
The 'On-again/Off-again" Debate about Cycle Facilities	Conference paper	Glen Koorey, University of Canterbury	2005	• Both on and off road cycle facilities have potential safety issues • Problems come through poor design and maintenance • Pathways important to young children/cycle learners. • Potential for conflict with peds • Code of conduct good idea, reinforced through signs and markings.	Useful overview paper.
Cyclists and Pedestrians - Attitudes to Shared Use Facilities	Research	Consultants for CTC	2001	• Surveys of users and focus groups • Mainly on urban commuting routes • Routes disliked but tolerated • Significant minority thought crashes a problem • Insufficient guidance on use • education and publicity can help and inclusive design process. • Had been successful in increasing cycling and walking. • New routes more acceptable than putting cyclists onto ped-only routes.	Summary report only.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• Wheelchair users liked routes • Anecdote of withdrawal from blind people	
Road accident casualties: a comparison of STATS19 data with Hospital Episode Statistics	Research	Department for Transport	2006	• Based on hospital admissions, collisions with cyclists make up 2% of serious pedestrian injuries (159 in 2002/3)	
Impacts on Safety and Feeling of Safety of Cycling Infrastructure in Copenhagen	Conference Paper	Rasmussen	2007	• 36% mode share to cycle • 340km network • Cycle tracks have made cyclists feel safer • Generally one-way 2.2m to 2.5m along street, seg by kerbs from traffic and peds. • Very few cycle lanes • Fewer injuries on links more on intersections. • Overall more injuries on junctions and links – cycle cycle injuries, with turning cars and with peds. • Banning on street parking makes it worse! More turning traffic. • Overall reduction in KSI cycle accidents and per km cycled • Cyclists feel safer • But health benefits of encouraging cycling more than offsets accident increase.	Not directly relevant but shows that car conflict is key issue for road safety – particularly at junctions. Also that health benefits shouldn't be ignored.
FHWA-RD-99-078 – Injuries to Pedestrians and Bicylists: An analysis Based on Hospital Emergency Department Data	Research	Stutts and Hunter	1999	• Study of pedestrian and cyclist admissions to hospital. • Very few ped/cycle collisions – 0.8% according to Austroads report.	Data on ped/cycle crashes. Referenced in Austroads document.

Document Title	Type	Author	Date Pub.	Key Points	Comments
				• 60% of ped/cycle conflicts occurred on the footway • But ped and cycle injuries on sidewalks are not rare in themselves – slips etc.	
Two decades of the Redway cycle paths in Milton Keynes	Research	John Franklin	1999	• Red routes have poor accident record • No. accidents involving pedestrians not clear • Do not encourage utility cycling • Perceived as safe however	Strong indication that standards of visibility and maintenance affect actual safety. Koorey notes that the Red Routes have poor standards, little directness or coherence.