International Transport Forum

Light Protection of Cycle Lanes:
Best Practices Discussion Paper

168 Roundtable

Brian Deegan
Urban Movement

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The International Transport Forum

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International Transport Forum
2 rue André Pascal
F-75775 Paris Cedex 16
contact@itf-oecd.org
www.itf-oecd.org

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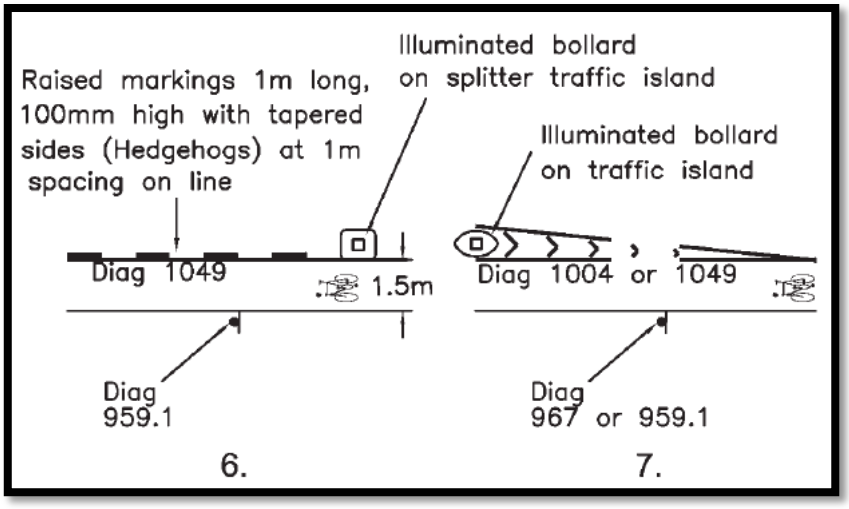
The history of light protection

Light *protection, separation* and *segregation* are terms we use interchangeably in the context of cycle lanes in this paper, with segregation most commonly used in the UK, where this report draws several examples from. A definitive history of the light protection of cycle lanes has yet to be written and so this introduction represents a personal view of the key moments that led to its usage. The true story is that it did not really become a recognised treatment until the issue of the first National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide in 2011. This document showcased the use of posts and planters used in conjunction with bike lanes to offer protection. The idea was that kerb segregated tracks were expensive and took a long time to implement and so objects could be placed on lanes to temporarily protect them. Spain had at this stage been using various products for this end and similar approaches had been used in Italy, New Zealand, Australia, Japan, Canada and England. Figure 1 shows an extract from the 2005 London Cycling Design Standards (LCDS) referencing different approaches to cycle lane protection.

Figure 1. The use of "hedgehogs" to protect a cycle lane



Source: London Cycling Design Standards, 2005

In the UK the official use of light protection had a launch date of September 6th 2013, with the opening of the Royal College Street scheme in the London Borough of Camden. Figure 2 shows the scheme which featured Spanish products used alongside planters, floating parking and flexible posts to create the UK's first lightly protected bike lane (Laker, 2013).

Figure 2. **News article from Cycling Weekly in UK**

Source: Laura Laker, Cycling Weekly, 2013

Similar schemes were subsequently launched in Manchester, Newcastle, Brighton and Bristol. At present there are many kilometres of protected bike lanes across the UK, particularly in London where the approach has underpinned the London Mayor's flagship "Mini-Holland" programme that is adopting Dutch quality infrastructure onto London's streets.

Principles and approaches

What is light segregation?

The London Cycling Design Standards (LCDS) (Transport for London, 2014) defines light segregation as the use of physical objects intermittently placed alongside a cycle lane marking to give additional protection from motorised traffic. Figure 3 shows this approach on a cycle lane.

Figure 3. Light protection separating a cycle lane

Photo: Urban Movement

Transport for London (TfL) undertake an annual Attitudes to Cycling survey which consistently states that people would cycle more if conditions felt less dangerous (Transport for London, 2016). Close passing is cited as one of the main causes of near miss encounters in London (Aldred et al., 2016) and other research suggests that cycle lanes do not encourage safe passing by being too narrow (Parkin and Meyers, 2010). Light segregation offers a way to protect space for cyclists and provide a physical buffer between riders and motor traffic. This has been shown to encourage more people to cycle. A research paper produced in London showed that protected routes had higher proportions of women, older people and children than control sites (Aldred et al., 2017).

What are its benefits?

The three principal benefits of light segregation, when compared to mandatory or advisory cycle lanes and to kerb separation, are the increased levels of service it could offer to cyclists, value for money and adaptability.

The estimated cost of constructing a kerb separated cycle track in central London is approximately GBP 700 000 per km, compared with around GBP 60 000 per km for light segregation. Pre-cast bolt on kerbs can reduce the costs of full segregation dramatically but costs associated with drainage, maintenance and carriageway crossfall reconstruction are still substantial.

Cities constantly change, and light segregation offers materials and layouts that can adapt to these changes. Most products can be bolted into the surface of the carriageway and repositioned inexpensively with minimal disruption. This means that layouts can be altered if developments requiring carriageway space occur, or if temporary road diversions are needed to lessen the network impact of a major scheme. Gaps between objects can also be adjusted to allow for cyclists to enter and leave the lane more easily.

The Royal College Street scheme in Camden was monitored for 15 months after its implementation. During that period, the number of cyclists using the route increased by 70% and collisions reduced from 18 in the 15 months before the scheme to three in the 15 months after (Urban Movement, 2015). Figure 4 shows the protection offered by light segregation objects.

Figure 4. Planter and level segregation on Royal College Street

Photo: Urban Movement

Legality

In the UK, objects used for light segregation are not road signs or markings and are therefore not covered by the Traffic Signs Regulations and General Directions (TSRGD) document.

Light segregation is recognised by the Department for Transport (DfT) in the UK and appears in their guidance on cycle infrastructure design for the strategic road network (Highways England, 2016).

In discussions about light segregation schemes, the DfT has clearly stated that there are no TSRGD-related regulatory issues if objects do not mimic or obstruct any regulatory road marking. However, highway authorities wishing to use light segregation do so at their own risk and should seek internal legal opinion before placing obstructions in the highway.

Research

Several cities that have achieved significant recent increases in the number of people cycling have used light segregation to protect cycle lanes. Transport for London's (TfL's) International Cycling Infrastructure Best Practice Study includes case studies on infrastructure in New York, Washington D.C., Christchurch and Seville, all of which use forms of light segregation (Transport for London, 2013). Use of light segregation helped Seville to deliver a 50-mile long segregated cycle network in four years. Figure 5 shows light segregation in Seville.

Figure 5. Light segregation in Seville

Photo: Urban Movement

The study makes a distinction between types of light segregation that are difficult for motor vehicles to overrun (including flexible posts, concrete blocks and planters) and those that can be crossed easily by vehicles (such as low, pre-formed plastic objects and raised road markings).

It notes that posts and planters offer a higher degree of actual and subjective safety but are costlier and less adaptable. They are more difficult barriers for pedestrians to navigate and they present significant difficulties for good drainage design.

The types that can be overrun are generally regarded by practitioners as very successful. They can be built quickly and cheaply, do not interfere with buried services and drainage, offer maintenance savings (when compared to 'higher' forms of segregation) and can offer an improved sense of subjective safety.

The study makes the following important caveats:

- The lanes themselves must be fit for purpose in terms of widths and hours of operation.
- Enforcement of illegal parking or loading is needed.
- The width of the adjacent general traffic lane should be sufficient to minimise the likelihood of encroachment.

Research has been undertaken on lightly segregated cycle lanes by the National Institute for Transportation and Communities (NITC) in the United States. It concluded that cycling numbers increased within the first year from 21% to 171% in locations where lightly segregated facilities were introduced. Residents, who accounted for 85% of survey respondents, said that they would be more likely to ride a bicycle if they were physically separated by barriers (NITC, 2014).

Research undertaken in Christchurch, New Zealand by Dr Glen Koorey and colleagues looked at two sites where motor vehicles were known to encroach regularly on a cycle lane (Koorey et al., 2013). Motorists' behaviour was monitored before and after implementation of low-level 'Riley' separators and again after the addition of flexible posts. At one location the low-level separators reduced incursion from 65% to 19%. This incursion fell to 0.1% once the flexible posts were added.

Transport for London (TfL) commissioned the Transport Research Laboratory to investigate the impact of light segregation on the behaviour and safety of road users (Transport Research Laboratory, 2013). Two types of light segregation were used: Zicla 'Zebra 9' (armadillos) plastic bolt-on delineators spaced at 2.5m intervals and 1m-high Jislon flexible posts (wands) at 2m intervals. These were compared to 365mm-wide kerb segregation and a mandatory cycle lane marking. The trial measured the distance from each type of separation that cyclists and motorists feel comfortable keeping and explored the participants' general feelings about safety with each type. Figure 6 shows Zicla zebras in Barcelona.

Figure 6. Zebra (armadillos) light segregation objects in Barcelona

Photo: Urban Movement

Cyclists perceived kerb segregation to be safest, followed by the two light segregation types, then by the white line. The order of preference was reversed for motorcyclists. They rated kerb segregation as the least safe because it caused them to change position to be further away from the separation. Pedestrians also rated kerb segregation the least desirable due to the difficulty of crossing it.

Flexible posts were preferred to low separators by all users, and the trial showed that motorists give greater clearance to posts than to the zebras (armadillos). Motorcyclists are willing to ride closer to flexible posts than other road users and regard them as more beneficial to safety than kerbs or zebras (armadillos).

Cyclists generally rode in fairly central positions within the lane regardless of the type of separation, but tended to ride further from the low separators than the flexible posts or the kerb. They were more comfortable riding nearer to moving motor vehicles when higher objects are present.

The research concluded that there was little objective safety difference between any of the methods, but that narrower forms of segregation may have more application on-street where space is a premium. Combinations of the light protection techniques was also suggested as being potentially effective, but on-street trials would have to be conducted to gather more information. Figure 7 shows a product which combines high level visible features with low level features.

Figure 7. Combination product in use in London

Photo: Urban Movement

Transport for London (TfL) has recently researched the effectiveness of several light segregation schemes in London and the yet unpublished results are summarised here with kind permission.

- In general terms, light segregation is proving its worth as a cost-effective means of providing effective protection for cycling, and of increasing subjective safety for people on cycles.

- The use of some light segregation features, especially in ways that are inconsistent with existing guidance, could have adverse effects - real and perceived - on people cycling or other users of the street.
- It is important that light segregation features are clearly visible to all users of the street.
- There is some sensitivity about the effect of light segregation features on the aesthetic qualities of the street, and this matter should be thoughtfully considered in context.
- There is no one-size-fits all approach to light segregation, and the choice of features and layouts should take into account the volumes of people walking and cycling, pedestrian crossing patterns, likely demand for kerbside access, and motor vehicle volumes and speeds.
- Other than when very low-profile features are used, light segregation is generally effective at preventing vehicles entering the cycle lane and enhancing subjective safety for cyclists.
- The choice and placement of light segregation features should be such as to enable the protected cycle lane to be well maintained.
- Light segregation at all study sites was set back only a short distance at junctions and formal pedestrian crossings. This seems effective at achieving slow vehicle turning speeds.
- Road markings and light segregation features should reinforce each other's purpose and visibility.

Issues

Each trial site should be carefully considered before introducing light protection. Safety audit comments should be reviewed and, where appropriate, mitigated on a site-by-site basis in order to minimise the impact on all modes of transport. Highway authorities wishing to use light protection do so at their own risk and should seek relevant professional and technical advice before doing so.

Experience of light protection to date appears to raise no specific or significant issues with increasing risk for other users. However, from the Transport Research Laboratory trial, the perception of risk from motorcyclists is high for low separating objects and kerbs. Heavy Goods Vehicle (HGV) drivers participating in the trial also expressed concerns about striking low separators. Figure 8 shows a planter that has been struck by a passing vehicle.

Figure 8. **Damaged planter**

Photo: Urban Movement

Research and monitoring has not generally focused on this aspect of the use of light separation and so more evidence is required. Listed below are the key issues that should be addressed, with some suggestions around risk mitigation until more information is reported.

When assessing the visibility of objects and the risk of vehicle strikes, the level of risk is likely to be highest for two-wheelers (largely cycles and motorcycles) which could be destabilised by striking part of any object in the carriageway, and for lower types of separation. As research shows, however, users tend to keep their distance from such objects.

Good visibility of objects is essential, at all times of the day. Maximising this may be a matter of improving street lighting levels, ensuring that the objects have the recommended reflectiveness and, if necessary, installing a larger object such as a bollard or flexible post on an island at the beginning of a run of low segregating objects.

Motor vehicles should not generally cross a solid mandatory lane marking and the risk of them doing so is likely to be reduced if the adjacent general traffic lane is greater than 3.0m in width.

Offsetting the lane markings by up to 0.5m or even introducing a hatched area around or next to the objects could also help to minimise the risk of vehicle strikes providing that they do not obscure the objects. Figure 9 shows a response to planter strikes in Camden where more vertical posts were introduced.

Figure 9. **Vertical posts protecting planters in London**

Photo: Urban Movement

The risk of cyclists striking objects may be reduced with wider cycle lanes (at least 2.0m, allowing for overtaking within the lane).

A risk assessment should be undertaken for every site to assess the likelihood of collisions with objects occurring.

To minimise the tripping hazard for pedestrians, areas around controlled and uncontrolled crossings (which feature blister tactile paving) should be kept clear of segregating objects in order to remove the risk that blind and partially sighted people might encounter them.

Analysis of pedestrian desire lines should be undertaken to identify where gaps between segregating objects may need to be provided.

In busier locations where there is likely to be frequent informal crossing between light segregating objects, in may be desirable to encourage cyclists to slow down. It should also be noted that light separation may not be feasible in these locations and that perhaps stepped tracks or motor traffic speed and volume reduction may be preferable. Figure 10 shows a pedestrian crossing a row of light segregation objects.

Figure 10. **Pedestrian crossing light separation**

Photo: Urban Movement

There is also a risk when light separation ends at junctions due to the presence of turning motor vehicles. The key to reducing this risk is maximising the visibility of the cyclist to motorists. Light separation has advantages over kerb separation in that the status of the cycle facility is ambiguous. Cyclists are more clearly 'in the carriageway' and so motorists should be anticipating having to adjust. The London Cycling Design Standards advises ending the segregation five metres from side road junctions, allowing cyclists to move out away from the kerbside as necessary to make themselves more visible to motorists.

Detailed design needs to be informed by a risk assessment of site-specific conditions and typical road user behaviour in that location. A better understanding of the impact on visibility of using different types and spacings of objects would also be beneficial. For example, tightly spaced flexible posts are likely to form an effective 'wall', significantly reducing visibility of the cycle lane for motorists.

Risks may arise from cyclists being unable to move out of protected lanes to turn left (turn right in the UK). If this is the case, then gaps in the segregation can help cyclists to move out into general traffic lanes to turn left or right. To reduce the risk further, methods of enabling cyclists to stay on the nearside and make a turn in two stages are likely to be desirable.

It is important that road sweepers should be able to access all parts of the cycle lane. Access is also needed for gully cleansing and to repair lamp columns. A wide (2.0m+) cycle lane is the best way to secure this access. Intermittent large gaps (10m or more between objects) can also help reduce any problems caused by lack of access for maintenance. Light separation could also be designed to be easily removable, which may be a more practical approach than leaving gaps if the need for access is infrequent.

For objects that need ongoing maintenance, such as planters, a good approach is likely to be to negotiate a short-term fixed fee with street cleansing contractors. Long term visibility and reflectivity of light protection objects is also a key consideration.

Design considerations

Layout

The UK experience has led to the following "rules" being shared and suggested by the engineers engaged in delivery. They are collected here to inform best practice. They are flexible and likely to change.

Light segregation should be used in conjunction with mandatory cycle lane markings. Crossing a mandatory cycle lane is a moving traffic offence unless motor vehicles are accessing nearside unrestricted parking or loading. Motor traffic, if following the law, would therefore not come into contact with light segregation at speed.

Objects used for light segregation should not resemble road markings or be used in a way that might obscure an existing road marking. They should therefore be placed on the nearside (cyclist's side) of the mandatory cycle lane marking.

Reflective and light-coloured elements are needed on all objects to make them visible at night. For example, flexible posts should have at least 60% of their surface covered in retroreflective material

Objects should not be used in a way that compromises accessibility for any person with a mobility impairment: gaps and step-free access must be provided at formal and informal crossings.

Light segregation should not be used where general traffic is expected to straddle it, although it may be suitable to be over-run where there is a need for occasional crossing movements to access the kerbside.

Access to the kerbside must remain, at least in clearly identified locations, for emergency service vehicles, community service vehicles and taxis (where they need to employ ramps).

Consultation with user groups – particularly local businesses, residents, access groups and commercial vehicle operators – is essential, to ensure that user needs are met properly.

Experience suggests that a more vertical and visible object such as a bollard, post or planter should be used at the start of a run of light segregation to increase the visibility of this protection for all road users.

In regards to the spacing of objects, the London Cycling Design Standards (LCDS) established a range of 2.5m to 10m on links, but the impact of different spacings for different objects has not been tested. At bends and at junctions, it may be that spacing needs to be tighter to achieve the same separating effect. In Spain, 2.5m is the maximum spacing between objects so this is open to interpretation. Many objects are themselves continuous and so may lend themselves to larger spacing. If the visual effect is present to deter encroachment by motor vehicles then the spacing can be left to good engineering judgement.

When assessing the appropriate height of taller objects (i.e. flexible posts), consideration needs to be given to the impact of the height on cyclists, in terms of how close to the posts they may be willing to ride. It is likely that typical clearance would be less for posts below the level of most cyclists' handlebars. However, different heights have not been tested in practice. Figure 11 shows flexible posts used on Cycle Superhighway 2 in London.

Figure 11. **Flexible post segregation**

Photo: Urban Movement

When determining the appropriate lane width to match the cycle flow, consideration must be given to whether cyclists may want to overtake within the protection of the light segregation, particularly with higher flows, but if this is not possible, then they may need to move out of the protected area to do so (which would require large gaps between objects).

The presence of powered two-wheelers using the route will impact on the number of strong visual vertical features such as wands or bollards that are used. They will need clear visibility and warning of any obstruction in the highway particularly low-level types.

Highway layout considerations such as the camber, gradient, complexity or alignment will affect placement. Light protection on a bend may need multiple vertical features to raise the conspicuity of the protection so that other vehicles do not try and cut across it without realising it is there. The maintenance of the carriageway and any street lights and drainage should also be a key layout consideration.

Products

The following four categories are suggested as key determinants of the suitability of using light protection in different contexts.

- Protection: how protected cyclists feel and what is the expected level of encroachment.
- Installation cost: how much the treatment costs per km.
- Durability: how well the treatment stands up to general traffic impacts.
- Aesthetics: how the treatment blends with a quality street approach whilst remaining visible.

Bespoke delineators may be produced, and, as long as they do not replicate any existing road marking and are suitably distinct enough to be clearly visible by other road users, then the form is flexible. Table 1 shows an assessment of the main types of light separation on the market. All have their pros and cons. Maximum protection may cause aesthetic issues in certain street contexts and likewise the most appealing may not be the most protective. This assessment is subjectively based on personal experience of using the products.

Table 1. **Product assessment table**

Product	Protection	Cost	Durability	Aesthetics
1. Flexible post	★★★	★★★	★★★	★★
2. Lacasitos	★★★	★★	★★★	★★
3. Armadillos	★★	★★★	★★	★★
4. Orcas	★★	★★★	★★	★★
5. Planters	★★★	★★	★	★★★
6. Wandorca	★★★	★★★	★★★	★★

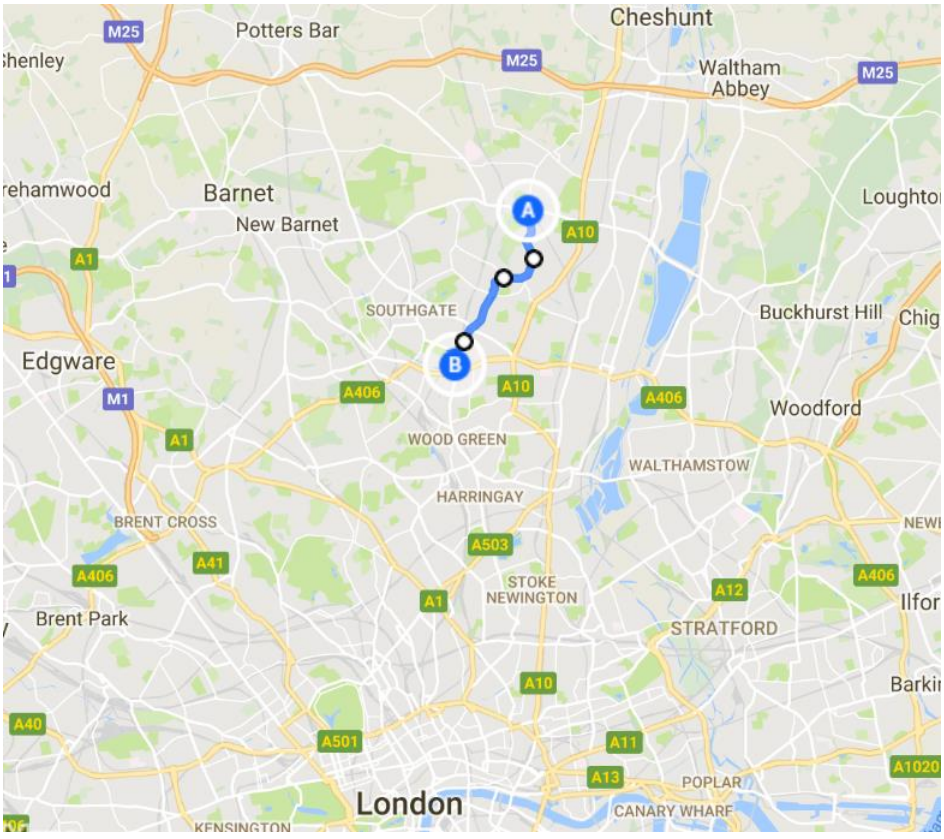
Note: Numbered images below are taken by Urban Movement and correspond to Product in Table 1.

Case study

Location

Figure 12 shows the location of the UK's longest (6km) continuous stretch of light segregation: the A105 (green Lanes) in Enfield. Enfield is an area of approximately 82km² in north London with a population of 330 000. In 2013 Enfield was awarded over GBP 30 million worth of funding from Transport for London to help them become a Mini-Holland. The concept of the Mini-Holland programme was to deliver Dutch style infrastructure in outer London to encourage cycling. The Green Lanes scheme was one of the first projects developed and links the town centre in the north with the London Borough of Haringey in the south.

Figure 12. Green Lanes in Enfield



Source: Google Maps

The context for traffic segregation along the length of Green Lanes varies between a high road layout featuring shops and commercial properties to a connector road featuring residential areas with off street parking and semi-detached properties. Car ownership is high in Enfield compared to the London average and cycling numbers are low. Green Lanes carries over 10 000 motor vehicles a day and so is a busy strategic road.

Approach

Installing light traffic segregation on Green Lanes faced two major challenges. The first was that access to off street parking was required by cars for long stretches of the route. This meant that vehicles would have to cross the cycle lane to access properties. If full protection using a kerb upstand had been used then less than half the route would have been segregated as there would have been so many gaps. The decision was therefore made to use light segregation that could be driven over to access local properties but the hope was that the objects would still deter encroachment from through traffic.

Figure 13 shows how a combination of light segregation objects was used to achieve this end. A vertical and visible post was used at the start of a run, to warn other road users about the obstructions and these were followed by larger low-level units. When driveway access was required a smaller low-level unit was utilised so that vehicles could comfortably pass over them. These smaller units kept up the repetition of the larger objects and effectively deterred incursion from passing motor traffic.

Figure 13. Combination of light protection objects past crossovers

Photo: Urban Movement

The second major challenge came from the fact that the route was also a bus route. This meant that cycle lane segregation would have to yield to allow buses to pull towards the kerb to pick up and drop off passengers. In most of the UK this normally results in the cycle provision stopping and starting again. As efforts were being made to encourage more cyclists in Enfield then the decision was made to try and continue provision without expecting cyclists to merge in with heavy traffic.

In the UK bus stop bypasses have been used in this context as they effectively route cyclists around the nearside of the bus stop effectively creating an island for bus passengers to wait on. On Green Lanes however there was not enough room for a bus stop bypass and so the Danish approach of shared bus boarders was used.

Figure 14. **Shared bus boarder in Enfield**

Photo: Urban Movement

Figure 14 shows a shared bus boarder where the cycle track is raised to footway level so that when passengers step on and off the bus they do so into the cycle track area. This apparent conflict does not seem to materialise in practice as approaching cyclists can see the bus at the stop and so are expecting people to be in the space. They therefore adjust their speed and position to pass safely or wait until the area is clear. Most of the time the area will be clear and so it is obvious when action needs to be taken.

References

Highways England (2016) "Cycle Traffic and the Strategic Road Network",Interim Advice Note 195/16, http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian195.pdf

Koorey, G., Wilke, A., and Aussendorf, J., (2013) Assessment of the effectiveness of narrow separators on cycle lanes, https://rcaforum.org.nz/sites/public_files/images/AMI-IPENZTG13-CycleLaneSeparators-final.pdf

Laker, L. (2013) Segregated cycle lanes using planters and armadillos could spread across Britain September 6, http://www.cyclingweekly.com/news/segregated-cycle-lanes-using-planters-and-armadillos-could-spread-across-britain-25912

National Institute for Transportation and Communities (NITC), (2014), Evaluating protected bike lanes in the US, https://bikeportland.org/wp-content/uploads/2014/06/NITC-RR-583_ProtectedLanes_FinalReportb.pdf

Parkin, J. and C. Meyers (2010), "The effect of cycle lanes on the proximity between motor traffic and cycle traffic" *Science Direct*, Vol. 42/1, pp.159-165, https://doi.org/10.1016/j.aap.2009.07.018.

Rachel Aldred et al. (2016) Cycling Near Misses, http://www.nearmiss.bike/wp-content/uploads/2014/12/Nearmissreport-final-web-2.pdf

Rachel Aldred et al. (2017), "Diversifying and normalising cycling in London, UK, An exploratory study on the influence of infrastructure", Journal of Transport and Health, Volume 4, March 2017, pp. 348-362.

Transport Research Laboratory, (2013), "The impact of light segregation on the behaviour and safety of road users", https://trl.co.uk/media/309316/ppr704_-_alternative_separation_methods_for_cycle_lanes.pdf

Transport for London (TfL) (2013) International Cycling Infrastructure Best Practice Study , http://content.tfl.gov.uk/international-cycling-infrastructure-best-practice-study.pdf

Transport for London (TfL) (2014) London Cycling Design Standards, Chapter 4.3.4 , http://content.tfl.gov.uk/lcds-chapter4-cyclelanesandtracks.pdf

Transport for London (TfL) (2016) Attitudes to Cycling Annual Report, http://content.tfl.gov.uk/attitudes-to-cycling-2016.pdf

Urban Movement (2015), "Royal College Street, Phase 1, Post Implementation Review", http://www.urbanmovement.co.uk/uploads/1/4/1/9/14194615/cycling_in_the_city_v1.0_final.pdf

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This report reviews the effectiveness of light separation as an alternative to more permanent infrastructure to protect cycle lanes. With more cyclists on the roads than ever, it is important to consider infrastructure options that safeguard cyclists and other road users whilst being cost effective and easily adaptable to cities that are constantly changing.

International Transport Forum
2 rue André Pascal
F-75775 Paris Cedex 16
T +33 (0)1 45 24 97 10
F +33 (0)1 45 24 13 22
contact@itf-oecd.org
www.itf-oecd.org

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