Highway maintenance

THIS BRIEFING COVERS

The impact of road defects on road safety, types of defects that affect cyclists in particular; improving cycling conditions in planned road maintenance programmes, funding and costs; duties, standards and liability; compensation claims; how defects form; maintenance procedure and practice.

HEADLINE MESSAGES

- For their comfort and safety, cyclists need highway authorities to maintain smooth and defect-free roads.
- Pothole, ruts, loose gravel, ice or diesel/oil spills not only make cycling uncomfortable, but can cause serious, sometimes fatal injuries.
- It is not just the depth of a pothole that matters to cyclists – its location and shape makes a difference too (i.e. defects towards the kerb, longitudinal cracks that can trap wheels etc.)
- Any road maintenance procedure is a cost-effective opportunity to make other changes to improve conditions for cycling at the same time (e.g. through road layout or marking).

KEY FACTS

- From 2007-2018, 'poor or defective road surface' was recorded by the police as a 'contributory factor' in incidents in which 26 cyclists died = an average of two p.a.
- About 12% of the legal claims handled by Cycling UK's Incident Line on behalf of our members are due to poor maintenance.
- Minor roads carry over 82% of cycle mileage, compared to only about 35% of car mileage. Major roads, however, are prioritised for maintenance.
- Local authorities in England and London had higher percentage of roads in poor condition in 2018/19 than in 2017/18 (21% as opposed to 18%/ 26% as opposed to 23%). The percentage had, however, dropped in Wales (from 17% to 12%).
- Altogether, English, London and Welsh authorities reckon that it would take 10 years to restore their roads to a reasonable state (subject to sufficient funding and resources).
- In Scotland (2018), 36.3% of local authority roads had either deteriorated to some extent or were in poor overall condition and in need of planned maintenance soon.
- The RAC's 2019 report on motoring found that condition and maintenance of local roads was a top concern among drivers (at 33%, it came third out of a list of twenty).
- For 2018/19, the one-time 'catch up' cost is £9.79 billion, or an average per local authority of: £69.9m in England; £31.9m in London; £36.3m in Wales
- In Scotland, the estimated maintenance backlog for local roads is £1.8 billion.
- 1.86 million+ potholes were filled altogether in England, Wales & London in 2018/19, a 24% rise on 2017/18 (1.5million). This cost £97.8m.
- It costs from £32 to £42 per 'planned' pothole fix, as opposed to £64 to £70 for a 'reactive' fix.
- Most authorities will prioritise the repair of a pothole if it is 40mm (or less) deep.
- Between them, from 2013/14 to 2017/18 (five years) 156 councils paid out 25 times as much in compensation claims per cyclist than for motorists: the average pay-out per cyclist = £8,825.93; the average pay-out per motorist = £338.88.

Cycling UK VIEW

- All road users suffer from poorly maintained roads, but cyclists are disproportionately affected.
- Local authorities need sufficient funding so that they can maintain roads well.
- The business case for highway maintenance investment should reflect the environmental and health benefits of reduced fuel consumption, and the deterrent effect of poor surfaces on cycling and walking (due to the greater risks and effort involved), as well as the reduced costs of highway repairs, delays, and damages to both people and vehicles.
- National guidance, and the policies and standards adopted by individual highway authorities for inspecting and prioritising repairs should take account of cyclists' comfort and safety. These should then be used to assess whether highways authorities are liable when cyclists suffer injury or other damages due to highway defects.
- For cyclists, the location and shape of a surface defect, not just the depth, are important. All guidance should therefore emphasise that special consideration must be given to defects that:
  - Are at or near junctions;
  - Are on downhill sections of roads;
  - Present a sharp upstand on the far side of the defect;
  - Run along rather than across the path that cyclists will be taking, i.e. those which are more likely to trap a cyclist's wheel.
- Local authorities should devote more of their resources to road surface renewal or resurfacing programmes, rather than short-term, emergency patching.
- Minor roads and off-road cycle facilities, where most cycling occurs, should be given greater priority in highway maintenance policies and procedures (including winter maintenance), while the whole-life upkeep of off-road cycle routes should be planned and costed-in from the outset.
- Highway authorities should be encouraged to use bicycles with sensors to monitor road and cycle track surface quality, and to use specialised narrower vehicles to keep cycle tracks free of debris and vegetation, or from snow and ice.
- Safe and convenient cycle access should be retained at the site of road/streetworks, wherever possible.
- Utility companies must ensure that reinstatements are safe, and remain safe, for cycling; and that cycle signing, coloured surfacing and other features are retained or enhanced. Where utility companies perform to a poor standard, local authorities must oblige them to reinstate to a proper condition.
- Authorities should respond quickly to any reports made by cyclists alerting them to road defects. Online reporting tools (e.g. Cycling UK's Fill that Hole) are an effective channel for this.
- The providers of defect management systems for highway authorities should integrate their products with Fill that Hole and similar public defect-reporting websites, to facilitate two-way communication between site-users and highway authorities.
- When resurfacing, local authorities should take the opportunity to 'cycle proof' the road, i.e. systematically consider improving cycling conditions as part of the project. This approach requires coordination between maintenance planning, highways engineers and those promoting sustainable travel. It also helps maximise the synergies between cycling and maintenance budgets and enhances their value.

BACKGROUND INFORMATION

1. Road defects, streetworks and cycling

a. Casualties

Cycling on poorly maintained roads is uncomfortable and hard work.[1] As one study found, "Comfortable cycling requires smooth rolling at lowest possible energy input."[2] Worse, cyclists can be injured by vibration and crashes, and even die from falls due to a surface defect.

Cyclists, however, are disproportionately disadvantaged because they are not protected in the same way as motor vehicle occupants.

- From 2007-2018 (GB), 'poor or defective road surface' was recorded by police at the scene as a 'contributory factor' (CF) in incidents in which 26 cyclists died, i.e. an annual average of two:[3]

Reported cyclist casualties where poorly maintained roads is reported as a contributory factor, 2007-2018, GB		
Year	**Killed**	**Seriously injured***
2007	2	*15*
2008	0	*18*
2009	1	*29*
2010	6	*25*
2011	3	*42*
2012	3	*41*
2013	1	*38*
2014	1	*55*
2015	1	*45*
2016	4	60
2017	1	40
2018	3	50
Total	**26**	
Average a year	**2**	

* For serious injuries, we cannot compare figures for 2016-2018 with earlier years because the police changed their reporting systems from 2016 onwards, with the result that they started classifying some injuries they used to record as 'slight' as 'serious' instead. This means we can't analyse trends for seriously injured casualties over a long-term period. The changes in the reporting system do not affect fatalities.

- By no means are all non-fatal crashes caused by a road defect reported to the police. In 2018/19, 65% (over 11,000) of admissions among cyclists to English hospitals were the result of non-collisions (i.e. they didn't involve another vehicle, person or object). Although it is not possible to say how many were due to defective road surfaces, it is likely that they accounted for a fair proportion.[4]
- From 2014-2018 (GB), in casualty incidents involving a cyclist where a CF reported, the police put 0.78% of them down to a 'poor or defective road surface'. This is c.3.5 – 4.5 higher than for other types of motor vehicle (except for motorcycles, where the figure is c.4.5 – 6 times higher).[5]
- About 12% of the legal claims handled by Cycling UK's Incident Line on behalf of Cycling UK members are due to poor maintenance.

b. What defects do cyclists need local authorities to prioritise for repair?

Each local authority sets its own criteria for prioritising surface defects for repair, usually specifying a certain depth:

- The annual 2019 ALARM survey reports that around three-quarters of authorities who responded used 40mm (or less) as the guideline depth to define a pothole, although this not always the only consideration. Location and nature of traffic may be factored into the set criteria too.[6]

Certainly, the depth of a defect is by no means the only factor that needs to be assessed when considering the comfort and safety of cyclists. Its shape and/or location may be the main problem, regardless of how deep it is (see box below).

Potentially, any deviation in a road surface can present a hazard and, even if a cyclist is aware of a pothole coming up, motor traffic passing by can force them to alter their path and ride over or into it. Worse, in the dark and/or if filled with rainwater, defects are especially hard to see and avoid in time.

In the Netherlands and other countries, instrumented bicycles are used for assessing the smoothness and comfort of cycling conditions, (i.e. with sensors which can detect unevenness). Cycling UK wants to see these adopted in the UK.[7]

There are, of course, other surface hazards, such as oil spills, ice, snow (see section 8), gravel patches, broken glass, sunken drain covers and slippery ironwork or road markings etc. Authorities need to tackle these too, e.g. through robust winter maintenance and sweeping procedures, and regular inspections.

These are the type of defects that cause particular problems for cyclists, and should be given special consideration in national and local maintenance standards, and all relevant policies and regimes:

- Defects towards the side of the road, where most people ride – i.e. the two metres nearest to the kerb or any regular car parking space. Defects here can force cyclists to swerve out into the carriageway.
- Defects at or near junctions, where cyclists are likely to be looking at other traffic rather than the road surface. Their balance may also be affected when cornering.
- Defects on downhill sections of roads where cyclists will probably be travelling faster, making it more likely that a jolt will cause serious injury or damage.
- Defects which present a sharp upstand on the far side, i.e. where a bike wheel hits a steep or sharp-edged 'wall' as it tries to leave the depression.
- Defects which run along rather than across the path that cyclists will be taking, i.e. those which are more likely to trap a cyclist's wheel, like a tramline. Slots in drainage covers aligned with the direction of the road can do this too, so covers should be installed with the slots at right angles to the kerb.

c. Catering for cyclists: best practice

Give greater priority to minor roads

Minor roads carry only about 35% of car mileage, compared to over 82% of cycle mileage, but major roads are usually deemed the maintenance priority because they carry most motor traffic overall (over 66%).[8]

In contrast, in the Netherlands and Denmark where cycle use is high, cycle paths and roads used for cycling enjoy more attention than the road network. Cycling UK believes that this should become the practice in the UK, with these routes being inspected and swept regularly, and subject to effective winter maintenance.

Budget for whole-life maintenance

When planning an off-road cycling facility, local authorities need to ensure that they budget for ongoing maintenance. Routes that fall into disrepair, remain unswept or are encroached by vegetation that is rarely, if ever, cut back, will naturally fail to attract users and result in yet further neglect.

A range of equipment is available for carrying out cycle path maintenance (e.g. small, narrow sweepers), and it is important to invest in it from the start.

Check lighting, markings and signage

Inspection regimes should include checks on lighting and all signage relevant to cyclists. Ill-lit cycle paths may be hazardous and make users feel personally insecure, putting them off using routes in the dark, especially if the surface is heavily rutted. Worn markings or damaged signage are another problem, because they make it difficult to identify a cycle facility.

Keep a close eye on utility companies

Utility companies have the statutory right to dig up the road surface. Their operations often take place at the side of the road and involve trenches, drainage gullies and ironwork. As this is the part of the carriageway where most cycling occurs, it is particularly important for companies to reinstate the road properly. Local authorities, who have control over the work of utilities, need to insist that this is done and force action if it is not.

In 2019, Cycling UK gave both written and oral evidence to the Parliamentary Transport Select Committee's inquiry into local roads funding and governance. The Committee said:

"This plague of potholes is a major headache for everyone. The consequences of a deteriorating local road network are significant. It undermines local economic performance and results in direct costs to taxpayers—either through rising costs of deferred work or through a mend and make do approach that does not represent good value for money in the long-term. It also affects motorists—damaging vehicles—and causes injuries to passengers, particularly those with existing medical conditions.

"The safety of other road users, especially cyclists, is seriously compromised. Pedestrians, particularly those who are older or vulnerable, can be left feeling anxious and isolated, afraid to leave their own homes."

https://publications.parliament.uk/pa/cm201719/cmselect/cmtrans/1486/full-report.html

d. Cycle access during road/streetworks

Safe and convenient cycle access should be retained at road/streetworks wherever possible. This means that:

- Cyclists should not be unnecessarily diverted, especially not onto busier or narrower carriageways.
- Cyclists should not be endangered by grit, debris, temporary metal plates or any slip hazard. The area round construction sites needs to be kept clean.
- Temporary, one-way shuttle-working traffic lights to control narrowed sections of road should give cyclists enough time to pass through safely before traffic starts coming towards them.
- Speeds should be reduced and/or warning signs installed to advise drivers not to overtake cyclists. These are far preferable to 'Cyclists dismount' signs (unless the entire carriageway is closed to all traffic and cyclists have to be diverted onto the footway).
- Two-way cycling should be arranged wherever possible even when one-way diversions are in place for motor traffic.

Code of practice

The DfT publishes a code of practice for anyone responsible for street and road works on all highways and roads (except motorways and dual carriageways with a speed limit of 50mph+.[9]

This has a section on catering for cyclists, advising practitioners that they "must ensure suitable provisions are made for the safety of cyclists passing or crossing the works."

It stresses many of the practices recommended by Cycling UK, e.g.:

- the need for particular care where cycle lanes or cycle tracks are affected
- to "consider whether access on the carriageway can be preserved for cyclists, even if it needs to be closed to motor vehicles"
- preventing unsafe conditions for cyclists during shuttle working with traffic control; and
- bearing in mind that cyclists need more time than motorists to clear a section controlled by portable traffic signals.

e. Improving cycling conditions in planned road maintenance programmes

Not only are most roads many decades old, but also designed according to guidance that's been superseded.

The last few years, however, have seen a number of positive infrastructure innovations for cycling, along with superior design guidance (e.g. from London and Wales[10]). We are awaiting updated guidance from the DfT too.

Planned maintenance programmes for established roads, streets or junctions, are cost-effective opportunities to implement new approaches and layouts to benefit existing cycle users and encourage others to take up cycling.

It is thus important not to isolate highway maintenance from other processes, especially traffic management and 'placemaking' (looking at the role of the street as a place, not simply as a route for through-traffic).

Road surfaces have a 10-20-year lifespan, and local authorities typically schedule streets for total reconstruction and renewal several years in advance. This gives them an ideal opportunity to plan improvements for cycling well ahead, and coordinate their cycling and planned road maintenance programmes to maximise the synergies between budgets. The best way of facilitating this is through partnership working between highways engineers, sustainable travel officers and other stakeholders.

To ensure this happens, all maintenance procedures and their results need to be 'cycle-proofed': "… a process which over time ensures that the built environment generally, and roads specifically, are seen to be safe, convenient and pleasant for cycle use by people of all ages and abilities."

This means seeking contributions from any developers to improve cycling provision, looking at speed limits and traffic calming, investigating the possibility of segregated cycleways, 'light' segregation (e.g. by traffic wands), cycle lanes, cycle-friendly junctions and signals, tightening corner radii etc.

Well managed highway infrastructure, the national code of practice for the UK (see section 5 below) says: "When schemes are planned and programmed there may be an opportunity to incorporate added value to the safety, priority, integrity or quality of footways and crossing facilities (particularly for vulnerable users), cycle routes and crossing facilities [etc]."

For more on cycle proofing, see: www.gov.uk/government/groups/cycle-proofing-working-group

2. Condition of local roads

As mentioned above, over four-fifths of cycle traffic is concentrated on minor roads, which are by and large maintained by local councils. Unfortunately, they are also the most likely to have deteriorated in recent years, creating a significant backlog to clear.

- According to the Asphalt Industry Alliance's 2019 ALARM survey, local authorities in England and London had higher percentage of roads in poor condition in 2018/19 than in 2017/18. The percentage had, however, dropped in Wales:

	Poor condition		Adequate condition		Good condition	
	2017/18	2018/2019	2017/18	2018/2019	2017/18	2018/2019
England	18%	21%	28%	24%	54%	55%
London	23%	26%	26%	29%	51%	45%
Wales	17%	12%	28%	30%	55%	58%
Poor = less than 5 years' life remaining						
Adequate = 5-15 years' life remaining						
Good = 15 years'+ life remaining						

- Altogether, the authorities reckon that it would take 10 years to restore their roads to a reasonable state (subject to adequate funding and resources). [11]
- In England, between 2007/08 and 2018/19, the proportion of roads where maintenance should be considered ('red' category): [12]
  - Fell from 5% to 3% for 'A' roads and motorways
  - Fell from 8% to 6% for 'B' & 'C' roads
  - Rose from 15% to 16% for unclassified roads.
- In Scotland (2018), 36.3% of local authority roads had either deteriorated to some extent ('amber'), or were in poor overall condition and in need of planned maintenance soon ('red').[13]
- Potholes etc. also affect drivers. The RAC's 2019 report on motoring found:[14]
  - The condition and maintenance of local roads was a top concern (at 33%, it came third out of a list of twenty).
  - 49% thought the condition of local roads had worsened since the last year.
  - 77% were in favour of a bigger chunk of the motoring taxes ring-fenced to fund local road maintenance.

3. Funding and costs for maintenance

a. What's the budget for local road maintenance?

Structural road maintenance is funded by both local and central governments and, in London, by Transport for London. In England, central funding is now allocated according to need, but there are other streams available (e.g. the Pothole Action Fund).

- In the March budget 2020, the Chancellor established a new Potholes Fund of £500m a year for the following five years (England) =£2.5bn, said to represent a 50% increase for local road maintenance budgets in 2020-21.[15] The (pre-budget) ALARM survey estimated the 'one-time catch-up' cost for England (outside London) at £7.97bn. [16]

Also according to the ALARM survey:

- For 2018/19, the average budget for highway maintenance per authority – which includes work on bridges, street lighting and cyclical processes like sweeping etc. – stood at:
  - £31.5m in England, excluding London (up from £26.2m in 2017/18)
  - £10.6m in London (up from £9.2m in 2017/18)
  - £7.8m in Wales (down from £8.1m in 2017/18).

b. What's the backlog in ££s?

- The total one-time 'catch-up' cost in England, Wales and London is estimated to be £9.79 billion:[17]
  - England - £7.97bn in total / £69.9m on average per authority
  - London - £1.02bn in total / £31.9m on average per authority
  - Wales - £797.5m in total / £36.3m on average per authority
- In Scotland, the estimated maintenance backlog for local roads is £1.8 billion. [18]

c. What's the funding split between major and minor roads?

Mile-for-mile in England, motorways and A roads (i.e. those managed by Highways England) received more funding than local roads (i.e. those managed by local authorities):[19]

- In 2018/19, c£4.9bn was spent on maintenance altogether (major + minor roads).
- Of this, £960m went on motorways and A roads, and £3.9 billion on local roads.
- This means that a fifth of the funding was invested in only 2.4% of the network, i.e. the 4,400 miles of roads managed by Highways England.
- In 2018/19, just under half of the total maintenance expenditure went on minor roads (B, C and unclassified), although they make up 88% of road length.
- In January 2018, the Local Government Association calculated that between 2015 and 2020, the Government in England planned to spend 52 times more on national roads than on councils' local roads (£1.1m compared to £21k a mile).[20]

d. Costs

- 1.86 million+ potholes were filled altogether in England, Wales & London in 2018/19, a 24% rise on 2017/18 (1.5million). This cost £97.8m.[21]
- It's more expensive to fill potholes reactively than as part of a planned programme:[22]

2018/19	Average number of potholes per authority	Planned cost	Reactive cost
England	15,067	£41	£65
London	2,711	£42	£64
Wales	2,531	£32	£70

- Buckinghamshire sets out how much various treatments costs (see section 7b below)

e. Wider case for highway investment

- Rough surfaces increase costs in terms of fuel, oil, wear and tear, and depreciation.[23]

4. Compensation claims

Poor road conditions also generate road user compensation claims for personal injury or vehicular damage. This is an added outlay.

Freedom of Information requests from Cycling UK, answered by 156 councils in Britain, found that from 2013/14 to 2017/18 (five years) local authorities paid out 25 times as much per cyclist than for motorists:[24]

- Authorities' average compensation pay-out per cyclist = £8,825.93 (this is probably because cyclists are more likely to suffer serious personal injury).
- Authorities' average compensation pay-out per motorist = £338.88
- 537 cyclists and 19,363 motorists made successful claims
- A total of 40,687 claims were paid out (figure includes council responses where no distinction between cyclists and motorists were made)
- Total compensation and legal costs for 156 authorities = £44,856,858.41
- Authorities on average incurred costs of £287,543.96

Clearly, local authorities need more funding to keep their roads in a fit state of repair to help them avoid paying out £millions in compensation.

Compensation claims and Section 58

An authority that fails to discharge its maintenance duties (see section 5 below) puts itself at risk of compensation claims from road users who suffer damage or personal injury as a result of a road, footway or cycleway surface defect.

Such cases, however, are often disputed by a council's legal advisers, and liability may be difficult to substantiate. Moreover, the law provides authorities with a 'statutory defence' against claims if they can prove that they operate a reasonable and adequate system for highway repair and maintenance.

For England & Wales, this defence is set out in Section 58 of the Highways Act 1980 (England & Wales), which states: "it is a defence … to prove that the authority had taken such care as in all the circumstances was reasonably required to secure that the part of the highway to which the action relates was not dangerous for traffic."

This, and following clauses, explains that, to mount such a defence, the authority must maintain those roads according to a hierarchy and which types of traffic are likely to use them. They must also carry out inspections to detect errors when they occur, and, if the road condition is below standard, repair it, or erect notices alerting users to the problem.

Section 1 of the Roads (Scotland) Act 1984 and the Roads (Northern Ireland) Order 1993, Article 8 make similar provisions.

Yet there is no definition of 'reasonable', often making it too hard for injured parties to establish whether the council has failed in its duty, and too easy for councils to defend themselves successfully.

5. Duties, standards and liability

Strategic roads (i.e. most motorways and trunk roads) are maintained by the relevant national authority (e.g. Highways England, Transport Scotland and the Welsh Government. In Northern Ireland, the Department for Infrastructure is the sole roads authority for both national and local roads). Most other roads, which carry most cycle traffic are the responsibility of local highways authorities.

a. Local authorities

LAs have several statutory duties and powers relating to the maintenance (interpreted as 'repairing') of the public highway, principally under the:

- Highways Act 1980 (s41(1)) (HA1980), England and Wales;
- Roads (Scotland) Act 1984 (ss 1&2); and
- Roads (Northern Ireland) Order 1993, Article 8.

The 'highway' includes footways and cycleways.

The Active Travel (Wales) Act 2013 states: "The Welsh Ministers and each local authority must, in the exercise of their functions under Parts 3, 4, 5, 9 and 12 of the Highways Act 1980 (creation, maintenance and improvement of highways, interference with highways and acquisition etc. of land), in so far as it is practicable to do so, take reasonable steps to enhance the provision made for walkers and cyclists." [25]

b. Utility companies

The New Road and Street Works Act 1991 (UK-wide) applies to the conduct of gas, water, electricity and telecommunications companies who have a statutory right dig up the highway if they need to – i.e. Section 81 (England and Wales), for instance, requires such 'statutory undertakers' to satisfy the highway authority that their apparatus doesn't cause danger to road users. The highway authority can also order the utility company to make good any defects associated with their operations.

For more on streetworks, see: www.gov.uk/government/publications/street-works-faq

Forcing a highway authority to repair a road (UK)

1: Raise concerns directly with local authority
2: If no action results, resort to legal action under Section 56 of the *Highways Act 1980*. This involves obtaining an order from the Magistrates' Court, which should force them to fix the defect(s).

Notes:

For the ins and outs of vegetation clearance (e.g. if hedge cuttings are causing a nuisance on the carriageway), see our briefing at: www.cyclinguk.org/campaigning/views-and-briefings/vegetation-and-hedge-trimmings

See section 8 below for a note on snow and ice.

c. The National Code of Practice: *Well-managed Highway Infrastructure*

Local highway authorities must refer to the national code of practice, *Well-managed Highway Infrastructure* which, although not statutory, is backed by central and local government in all the nations of the UK.[26] Most authorities report that they are now compliant with it.[27]

The Code's latest revision in 2016 focusses on 'asset management', an approach Cycling UK supports because it marks a shift from reactive maintenance to more planned maintenance.

Conversely, the Code also focusses on 'risk-based' assessment. This is double-edged because, instead of recommending standards (e.g. the need to fill an 40mm+ deep pothole urgently), it advises authorities to minimise the risks of harm (including disruption as well as injuries). With the freedom to come up with their own criteria on repair, inspection frequency, vegetation clearance and winter maintenance regimes etc, cash-strapped councils may therefore be tempted to revise their standards downwards.

While the Code includes advice on maintaining/managing cycle routes specifically, and on the need to keep them in mind more generally (see extracts below), Cycling UK was dismayed that it failed to mention the defects that put cyclists most at risk (see above).

We therefore believe that the Code should include, or be supplemented by, recommended good practice standards that address this shortcoming. These would also provide a default benchmark for settling liability claims, while still leaving local authorities latitude to adopt reasoned departures, in accordance with local circumstances and priorities.

Extracts from Well-managed Highway Infrastructure

"Network hierarchy should take into account the desirability of continuity and of a consistent approach for walking and cycling.

"… traffic composition might indicate unusually high proportions of particular users, for example motorcyclists or cyclists for whom surface condition is of particular importance.

"Securing continuous improvement in the safety and serviceability of cycle routes, in particular network integrity, will be a necessary component for encouraging cycling as an alternative to the car. It will be important for maintenance strategy positively to address this.

"Network integrity is a particularly important consideration where cycle routes are segregated for part of their length, but intermittently rejoin the carriageway. In these circumstances a reasonably consistent level of maintenance should be provided, and attention paid to carriageway edge condition in the un-segregated sections.

"It would seem logical for cycle routes to be inspected by cycle, although inspection of parts of some shared routes may be possible by walking or by vehicle as appropriate.

"Where footways or cycle routes remote from carriageways form part of an integrated route or network intended to encourage walking and cycle use, or are promoted by the authority, consideration should be given to adopting a consistent safety inspection frequency for the route or network as a whole.

"The [safety inspection] regime should be developed based on a risk assessment and provide a practical and reasonable approach to the risks and potential consequences identified. It should take account of potential risks to all users, and in particular those most vulnerable."

6. Reporting systems

Cycling UK's Fill That Hole site, set up in 2007, allows any road user to report road defects online. This automatically relays the information to the relevant highways authority so that they can fix the problem. Most local authorities offer their own online reporting facilities too.

Fill That Hole and systems like it (e.g. Fix My Street) are a valuable complement to routine inspections because they help alert the authority to a problem that they may not otherwise find out about until the next inspection, which might be months away.

To optimise their benefits (and the statistics they collect), all reporting systems need to facilitate efficient two-way communication between site-users and councils. For example, councils need to acknowledge receipt of a report and feedback on whether the defect has been repaired. This is something that *Well-managed Highway Infrastructure* advises.

In 2019, almost 10,000 road defects were logged on Cycling UK's Fill that Hole site.
www.fillthathole.org.uk

7. The physical side

a. How do road defects form and how do you stop them?

How road defects form

Road surfaces tend to deteriorate gradually as a result of natural weathering and ageing.

Asphalt, the most common material used to bind aggregate into a road surface, normally lasts for only 15-20 years before it becomes oxidized by sunlight and heat. This makes it increasingly brittle and susceptible to cracking, while the constant passage of vehicles exacerbates the damage.

Cracks allow water to infiltrate the surface and, as they expand and let in more water during repeated freezes and thaws, bigger holes form. Motor vehicle tyres widen and deepen the defects and can push loose foundation material out of them.

How to prevent them

- **Inspect surfaces regularly** - a good programme of inspection, backed by reporting tools for the public (e.g. Cycling UK's fillthathole.org.uk) can help councils identify their priorities for repair.
- **Keep roads well-drained** - ditches, culverts and drains need to be cleared regularly and roads engineered so that they don't collect standing water.
- **Ensure surfaces are watertight** - if done properly, surface dressing (a thin layer of asphalt and chippings) can help make the surface watertight, but care is needed to avoid leaving loose chippings and other hazards behind.
- **Minimise utility works and check quality of repair** - opening the road surface for streetworks (i.e. work carried out by utility companies) weakens the structure and contractors may not reinstate the carriageway properly afterwards.
- **Cut back overhanging vegetation regularly** - overhanging vegetation (mainly trees) can prevent or reduce the amount of direct sunlight falling on the road surface and drip rainwater onto it. This means that the carriageway underneath takes longer to dry out and more susceptible to water penetration and the freeze-thaw effect.
- **Regularly resurface** - all roads eventually fail. There comes a point when it is more cost-effective to resurface a road completely, than to keep patching it.
- **Reduce traffic** - as large vehicles cause most damage, restricting their access to certain roads can help prolong the life-span of the surface.

Which vehicles do the most damage?

Road damage caused by vehicles passing over the surface is roughly proportional to the weight over the axle to the power of four.

Thus, a car with 500kg weight over each axle does over 15,000 times the damage of a 90kg rider + bike, while a lorry axle with the maximum 10.5 tonnes does almost 200,000 the damage of a car, and almost 2.5 billion times the damage of a person on a bike.

Lorries, therefore, are responsible for by far and away the greatest proportion of damage to the road network, despite making up just 5% of road traffic.

http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol7/section2/hd2406.pdf

b. Reactive maintenance, surface dressing or full-depth resurfacing?

Surface defects are often patched up reactively on a short-term, individual basis, and millions are fixed each year. As mentioned above (section 3d), it is more expensive to fill a pothole reactively than as part of a planned maintenance programme.

Many of these defects, however, result from an underlying structural problem, or because the road has been allowed to reach the end of its usable life. This situation may well lead to mounting costs for emergency repairs and compensation claims.

A superior option is either to seal the surface before the road reaches the end of its lifespan, or to reconstruct it completely to its full depth. Disruption will be inevitable, especially on a busy road, but the treatment will prevent potholes from forming so frequently, and ample evidence suggests that this is better value for money.[28]

The problems of surface dressing

Surface dressing is commonly used on minor roads as a cheap alternative to full resurfacing. It is designed to seal the surface and prevent moisture penetration. If well-laid in good conditions and on smooth roads, this treatment can preserve a deteriorating surface for longer, extending the road's life and preventing potholes.

On the other hand, if applied to an already deformed or damaged surface, surface dressing merely blankets it. The surface remains bumpy and difficult to negotiate on a cycle.

Also, although the standard approach is to make at least two sweeps afterwards, this may be done inefficiently or not at all. As a result, the road may be covered for some time by loose chippings, a hazard that can make cyclists skid.

Poor workmanship or bad weather, moreover, can lead to premature failure, especially if the dressing has been laid under trees where conditions are cooler and damper. Irregular adhesion creates an extremely rough surface and undermines the treatment's purpose.

Where resources and conditions permit, resurfacing will give a far better, long-lasting surface comfortable for cyclists and other road users.

c. Costs and benefits of different treatments

Method	Cost (m2)	Longevity	Benefits	Drawbacks
Surface dressing: asphalt layer with chipped stone rolled in. Loose stones swept up twice.	£6-£12	7 years	Seals surface to prevent water ingress; restores skid resistance; very cheap; quick to lay.	Very poor riding surface, especially when first laid; fails to deal with surface irregularities; short term gravel deposits; fails if laid in or just before poor weather; unpopular with cyclists.
Micro-surfacing: thin layer of asphalt mixed with small aggregate.	£10-£16	7 years	Fixes slight surface irregularities; restores skid resistance; cheap; surface ready to use hours later.	May miss larger defects; surface may lift or fail if laid poorly or in bad conditions.
Plane & patch: inlay surfacing for small or large areas rather than repairing potholes.	£30-£40	?	Replaces the surface, restores texture and grip, extends road life, relatively fast process.	Does not fix deep problems with the foundations; can be expensive if several layers need replacing & on a busy road needing thicker treatment.
Resurfacing: damaged sections planed out & relaid with fresh material	£29-£59	10 years +	Fully repaired surface makes excellent riding surface; fully impermeable to water.	Expensive; disruption; often needs several days/ nights with road closed.
Full reconstruction: removal of base course & rebuild, to prevent recurrent failure due to underlying weakness	c£100 +(May cost less on quiet roads)	18 years	Replaces the surface; restores texture and grip; extends road life; creates or restores the structural layers of the road.	Very expensive; considerable disruption.

This table is based on online information from Buckinghamshire & Hertfordshire Council Councils.[29]

8. Snow and ice

Section 41 of HA1980 (as modified by section 111 of the Railways and Transport Safety Act 2003), imposed a duty on highway authorities to "ensure, so as is reasonably practicable, that safe passage along a highway is not endangered by snow and ice".

Section 34 of the Roads Scotland Act says: "A roads authority shall take such steps as they consider reasonable to prevent snow and ice endangering the safe passage of pedestrians and vehicles over public roads."

The duty under Section 41 HA1980 does not extend to gravel or oil on the surface of the road, a common source of danger to cyclists. However, this does not remove the possibility of a highway authority being found negligent if it fails to remove gravel, oil or other debris which subsequently results in injury/damage to a road user.[30]

- *Well-managed Highway Infrastructure* says: [31]

> "Issues for consideration in developing [a winter service] policy should include [...] treatment of facilities for walking and cycling; [...] extent of priority for vulnerable users."
>
> "It is also important to consider equipment requirements for dealing with footways and cycle routes. Specialist equipment, such as footway ploughs and footway salt spreaders, may be necessary for this purpose."

See Sustrans blog on cyclists' casualties associated with falling on ice: https://www.sustrans.org.uk/our-blog/opinion/2018/november/ice-major-cause-of-cycling-accidentsand-what-can-be-done-about-it/

FOOTNOTES AND REFERENCES:

[1] Taylor, Mark (et al). *Cyclist exposure to hand-arm vibration and pavement surface improvement in the City of Edinburgh*. Scottish Transport Applications Research (STAR 2017). www.starconference.org.uk/star/2017/Taylor.pdf.
[2] Holzel, C. (et al). *Cycling comfort on different road surfaces*. 2012. https://www.sciencedirect.com/science/article/pii/S1877705812016955
[3] Figures from Parliamentary Question 27 Feb 2018 https://www.theyworkforyou.com/wrans/?id=2018-02-22.129317.h & Freedom of Information request by Cycling UK, answered 29 Jan 2020. https://www.whatdotheyknow.com/request/cyclist_collisions_with_potholes?nocache=incoming-1526502#incoming-1526502
[4] Hospital Episode Statistics (Hospital Admitted Patient Care, External cause). https://digital.nhs.uk/data-and-information/publications/statistical/hospital-admitted-patient-care-activity
[5] DfT. *Reported Road Casualties Great Britain* 2018. September 2019. Table RAS 50005. www.gov.uk/government/collections/road-accidents-and-safety-statistics
[6] Asphalt Industry Alliance. *ALARM: Annual Local Authority Maintenance Survey*. March 2019. https://www.asphaltuk.org/wp-content/uploads/alarm-survey-2019-digital.pdf.
[7] Bíl, Michal (et al). *How comfortable are your cycling tracks? A new method for objective bicycle vibration measurement*. 2015. www.researchgate.net/publication/276939322_How_comfortable_are_your_cycling_tracks_A_new_method_for_objective_bicycle_vibration_measurement.
[8] DfT. *Road Traffic Estimates in Great Britain 2018*. July 2019. Tables TRA 0204 & 0402. www.gov.uk/government/collections/road-traffic-statistics
[9] DfT. *Safety and Road and Street Works: A Code of Practice.* Oct 2013. www.gov.uk/government/uploads/system/uploads/attachment_data/file/321056/safety-at-streetworks.pdf

[10] TfL. *London Cycling Design Standards*. 2014. https://tfl.gov.uk/corporate/publications-and-reports/cycling; Welsh Government. *Design Guidance: Active Travel (Wales) Act 2013*. 2014. http://gov.wales/docs/det/publications/141209-active-travel-design-guidance-en.pdf
[11] Asphalt Industry Alliance. *ALARM: Annual Local Authority Maintenance Survey*. March 2019. https://www.asphaltuk.org/wp-content/uploads/alarm-survey-2019-digital.pdf
[12] DfT. *Road Conditions in England 2018*. Jan 2019. Tables RDC 0121 & 0131. www.gov.uk/government/collections/road-network-size-and-condition
[13] https://statistics.gov.scot/resource?uri=http%3A%2F%2Fstatistics.gov.scot%2Fdata%2Froad-network-traffic / see also Audit Scotland. *Maintaining Scotland's Roads. A follow-up report: impact report*. June 2018. www.audit-scotland.gov.uk/uploads/docs/report/2018/ir_180626_maintaining_roads.pdf
[14] RAC. *Report on Motoring 2019*. https://www.rac.co.uk/drive/features/report-on-motoring-2019/ . Note that, in 2019, motorists weren't as concerned about local road maintenance as they were in 2018.
[15] https://www.gov.uk/government/publications/budget-2020-documents/budget-2020
[16] Asphalt Industry Alliance. *ALARM: Annual Local Authority Maintenance Survey*. March 2019. (Link above)
[17] Asphalt Industry Alliance. *ALARM: Annual Local Authority Maintenance Survey*. March 2019. (Link above)
[18] Letter from the Rural Economy and Connectivity Committee to Michael Matheson MSP. 21 November 2019. https://www.parliament.scot/S5_Rural/RECC_20191121_EM_to_Cab_Sec_TIC_-_pre_budget_financial_scrutiny_on_roads_maintenance_issues.pdf
[19] DfT. *Road network size and condition statistics*. Tables RDC0310 & RDL0101. https://www.gov.uk/government/collections/road-network-size-and-condition
[20] LGA. *Government's national roads receiving 52 times more funding than councils' local roads.* Press release 25 Jan 2018. www.localgov.co.uk/Councils-hit-out-over-disparity-in-road-funding/44608
[21] Asphalt Industry Alliance. *ALARM: Annual Local Authority Maintenance Survey*. March 2019. (P13). (Link above).
[22] Asphalt Industry Alliance. *ALARM: Annual Local Authority Maintenance Survey*. March 2019. (Link above)
[23] Robbins, M (et al). *Literature review: The effect of pavement roughness on vehicle operating costs*. NCAT. May 2015. http://www.eng.auburn.edu/research/centers/ncat/files/technical-reports/rep15-02.pdf
[24] These figures come from Freedom of Information requests made to all UK highways authorities by Cycling UK in February 2018 (not all replied). https://docs.google.com/spreadsheets/d/1chQX0HsYHmsnjUSe8qLgYW7I8ferxV5w6z8-VaeeedU/edit#gid=0
[25] www.legislation.gov.uk/anaw/2013/7/pdfs/anaw_20130007_en.pdf
[26] UK Roads Board. *Well-managed Highway Infrastructure: a code of practice.* October 2016. In theory, its guidance took effect in October 2018. http://www.ukroadsliaisongroup.org/en/codes/index.cfm
[27] Asphalt Industry Alliance. *ALARM: Annual Local Authority Maintenance Survey*. March 2019. (Link above).
[28] DfT/Highways Agency. *Maintaining strategic infrastructure: roads*. June 2014. www.nao.org.uk/wp-content/uploads/2015/06/Maintaining-Strategic-Infrastructure-Roads.pdf.
[29]www.buckscc.gov.uk/services/transport-and-roads/road-maintenance-and-repairs/road-treatment-programme/choosing-the-right-road-surface/
https://www.hertfordshire.gov.uk/statweb/meetingsnov04toapr13/Highways%20Maintenance%20Topic%20Group/20110624/Appendix%20G.pdf
[30] Grierson I and Huxford R, *Highway Risk and Liability Claims*. UK Roads Board/ICE. 2009.
[31] UK Roads Board. *Well-managed Highway Infrastructure: a code of practice.* October 2016. (Link above).