Principles of cycle planning

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What is a bicycle?

The bicycle's been a familiar sight for nearly 170 years. But familiarity doesn't always mean we know as much about something as we might and even the best intentions don't necessarily mean we'll get it right.

We may all think we know what's needed to ride a bike. A bit of tarmac, some trouser clips and a Mars bar – that's all there is to it, isn't it? Well yes, and no. It may be part of the answer, but if cycling is to be not only possible, but practical, pleasant and popular, then there are a lot more things that need to be considered, especially by people with responsibility for the environment in which we cycle.

It is a widely held view among cyclists that the outcomes from planning for cyclists in recent years leave a lot to be desired. And very often it's in matters of detail, and apparent unawareness of some fundamental principles, that schemes fail most badly.

This paper will therefore go through some of the basic principles about cycles and cycling that should be known and applied by anyone engaged in cycle planning, or indeed in transport planning more generally.

The bicycle is the most efficient form of transport known to man, and one of the most versatile. But that doesn't mean it's perfect! It's important to understand the strengths and weaknesses of the combination of a bicycle and its rider when planning for cycling.

Conservation of momentum

One of the weaknesses of the bicycle is that the energy for propulsion comes entirely from muscle power, which is limited. If moving the bicycle demands more energy than the body can comfortably provide, cycling becomes hard work, tiring and unpleasant.

It has been shown that every time a cyclist has to stop and then re-start, it uses up as much energy as is required to ride an additional 100 metres. There doesn't have to be much stopping, or slowing to give way, for that to add up to significant extra effort. So back-street routes or cycle paths that repeatedly require cyclists to give way are never going to create popular cycling environments. Similarly, one-way systems that involve detours increase the energy demands and make cycling less attractive.

A good way to minimise energy when cycling is to make the most of the kinetic energy that is built up when a cycle has been pedalled to speed. Conservation of momentum means slowing down or stopping as little as possible. The strong personal desire to minimise effort is a powerful reason why direct, energy-efficient and speedy routes are needed if cycling is to be popular.

Sports cyclist	20 - 30+ mph
Confident commuter	15 - 20 mph
General utility/commuter	10 - 15 mph
Children	10 - 20 mph
Leisure rider	10 - 15 mph

Table 1: Typical cycling speeds (on the level)

Table 1, above, shows some typical cycling speeds. The first thing to note is that very few people cycle at less than 10 mph. Below this speed, quite large movements of the handlebar are needed by most people to keep balance and cycling is uncomfortable. Above this speed, however, a bicycle becomes largely self-steering, requiring only body movement to maintain stability.

People automatically ride in the way that is most energy-efficient for them, and it is not widely appreciated that each cyclist has his or her own optimum rate of pedalling, or cadence. Obliging a person to ride slower than their preferred speed for any significant time can be as uncomfortable as obliging them to ride faster.

Of course, downhill almost any cyclist can exceed 20 mph and teenagers on BMX bikes may double that. Cycle brakes are not very efficient and can be difficult for people with smaller or weaker hands to apply with any great force. Steep hills, up or down, are never a good idea for cycling even if short, and long hills need to be managed properly.

In the great majority of places, the road network accommodates the range of cycling speeds very easily. If separate infrastructure does not do likewise, cycling will be less pleasant and some people, especially younger people, will ride at speeds that are unsafe for the circumstances.

Surface quality

Rough or uneven surfaces destroy momentum, and they also have important consequences for comfort and safety. Indeed, poor surfaces lead to more injuries to cyclists than collisions with other vehicles. Cycle tyres are narrow, pressures may be twice those of cars and bikes have minimal suspension.

Upstands do nothing to encourage cycling. Cycle paths should *not* end with dropped kerbs but should arrive at road level, with a perfectly flush taper back from the junction itself. This is normal practice in road building and was once common for cycle paths too.

Observation and visibility

The ability to see what is going on around you is essential for safe cycling, and in particular to be able to see other road users who might conflict with where you're going. Looking ahead is easy and most of the information that a cyclist needs about traffic conditions can be gained through eye movement alone, which is very quick and has no effect on the stability of the bicycle.

Looking wider than this, however, requires the cyclist to move his or her head, which is slower and affects stability increasingly the more the cyclist turns. It is more difficult to balance and control a bicycle when not looking ahead, and most people when cycling are not good at seeing what is going on behind them. Very few can make the prolonged look back that is needed to be sure of the intentions of a driver behind as you approach a junction.

The skilled cyclist will modify their position on a road to ensure that they are seen and to physically deter unsafe movements from behind. In this way they limit the amount of attention that needs to be given to what is happening behind. Less confident cyclists, on the other hand, are more vulnerable when circumstances require them to move to the right, perhaps simply to go ahead where there is a left-turn lane.

The difficulty of looking behind on a bike has important consequences for road-side paths and explains their poor safety record. Figure 1 shows how much easier it is for the road cyclist to protect his safety than the rider on the path. The path cyclist cannot exert any influence on drivers behind, while looking through the wide arc from 45° or more to the left to nearly 180° to the right is very difficult, even when stopped. Many people simply give a cursory glance and take the chance.

When planning for cycling, don't assume that cyclists have eyes in the back of their heads, or on stalks to see round sharp corners or over vegetation.

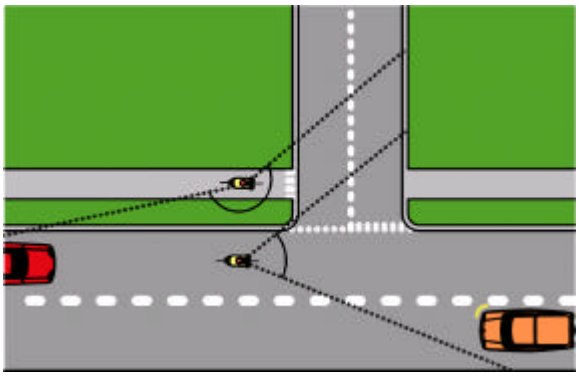


Figure 1

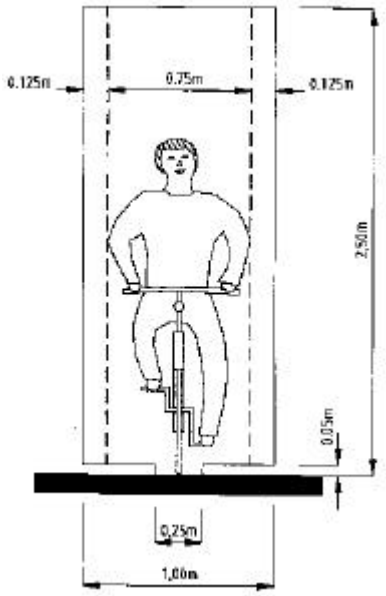


Figure 2

Personal space

The amount of lateral space available to a cyclist is very important for comfort and both actual and perceived safety. For less confident cyclists in particular, traffic passing too close is unpleasant and stressful.

Riding along, a cyclist takes up about 0.75 metre of lateral space at any time. However, bicycles are not single track vehicles but oscillate naturally from side to side in the process of maintaining balance. The overall envelope of space needed by a cyclist under optimum conditions is about 1 metre *(Figure 2)*.

When a cyclist moves off from a standing start, or stops and dismounts, or travels slowly, more room is needed. Cyclists also have to move sideways more significantly in response to surface defects that may not be noticed by other drivers. Weather, particularly a strong wind, can make it difficult for a cyclist to keep to a straight line. Extra space is needed for all these things and to provide a margin for error and natural 'drift'.

On a free-flowing road with traffic but no parking, a confident cyclist will ride at about 0.5 metre from the road edge at elbow height.

It's a pretty good rule of thumb that other drivers give a cyclist as much room as the cyclist gives to the kerb; hence they pass about 0.5 metre from the off-side of the cyclist's personal envelope.

Adding it all up, the cyclist gets about 2 metres of personal space to accommodate the physical requirements of the bicycle and personal comfort. and that meets most people's requirements on a 30 mph road *(Figure 3)*.

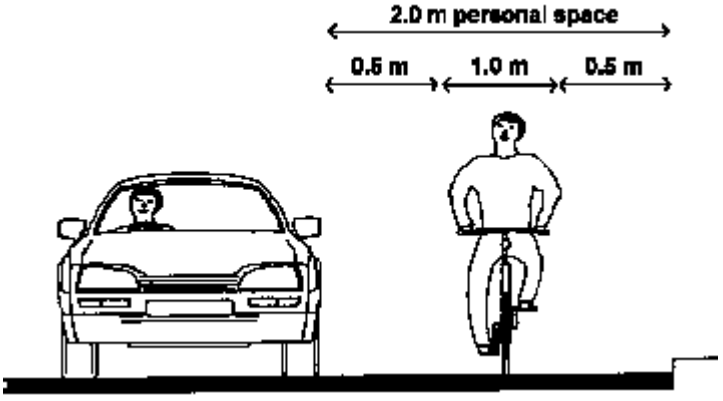


Figure 3

If anything you do when planning for cyclists results in a cyclist getting less space than this, then you will most probably make cycling more difficult, less comfortable and perhaps less safe.

This is one reason why many cyclists do not like cycle lanes, in the presence of which motorists often drive up to the lane line when otherwise they might keep further out. Unless cycle lanes provide within themselves all the personal space that a cyclist needs – that is, they are at least 2 metres wide – cyclists will often be passed more closely than would otherwise be the case and research suggests that motorists often overtake faster too. Just as important, lanes narrower than 2 metres give misleading messages to motorists about the amount of space that a cyclist needs, not only where there are cycle lanes but where there aren't. This is detrimental to the co-operation on the roads that we should be seeking to achieve.

At traffic speeds above 30 mph, or where there are many high-sided vehicles, a cyclist needs additional space to take account of the more pronounced slipstream and suction effects of passing vehicles that otherwise can greatly impair steering. It is often not appreciated that personal space for cycling needs to be related to traffic speed and both traffic and weather conditions. Narrow, inflexible cycle lanes can increase hazards considerably on busy roads or in bad weather.

Road profiles

This leads to consideration of road profiles, which relate the space available along a road to the requirements needed for safe and comfortable overtaking. Profiles are usually classified as spacious, narrow and critical.

A spacious profile *(Figure 4)* is one where there is plenty of room for motor vehicles to pass a cyclist leaving as much personal space for the cyclist as is appropriate for conditions. Spacious profiles can still lead to problems for cyclists who need to manoeuvre across the flow of traffic, such as to turn right, if they encourage high traffic speeds, but on roads with moderate traffic they generally result in a comfortable cycling environment.

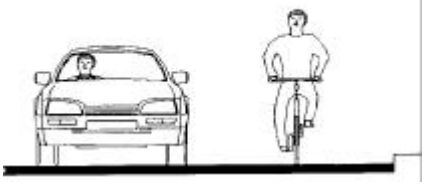


Figure 4

Figure 5

Tight road profiles *(Figure 5)* are where there is insufficient space for a motorist to pass a cyclist to such a degree that this is obvious to everyone. Other traffic is obliged to wait behind the cyclist until more space is available. Tight profiles lead to lower traffic speeds and may be safe, but less confident cyclists can find them intimidating, being under pressure or harassment to move out of the way.

Critical profiles *(Figure 6)*, which lie between spacious and tight, are the most problematic. There is insufficient space for a cyclist to be passed safely, but following drivers do not recognise this. They think they can get past and in doing so may drive uncomfortably close to the cyclist. Sometimes a confident cyclist can use positioning to deter this, but this may result in aggression if the driver perceives the cyclist's behaviour as unreasonable. It is important to avoid critical profiles at all times if cycling is to be pleasant and popular.

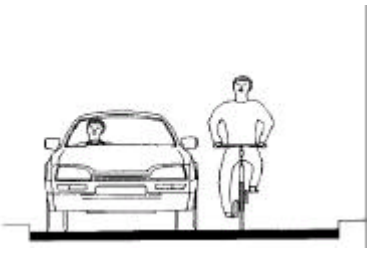


Figure 6

The *Cycle Infrastructure Design* draft suggests minimum safe passing distances of 1 metre at 20 mph and 1.5 metres at 30 mph, which seems appropriate. The total width required for overtaking by cars is 3.8 metres at 20 mph and 4.3 metres at 30 mph, with extra width required where large vehicles operate. These figures indicate that the critical profiles to avoid are between 2.75 metres and 3.75 metres at 20 mph or 2.75 metres to 4.25 metres at 30 mph, which is a wider range than the consultation suggests but consistent with its calculations.

Finally, with regard to space for cycling, it is important to recognise the needs of people who use large cycles: tandems, trikes, recumbents, bikes with child and goods trailers. Each of these has an important role in meeting the needs of people who wish to cycle, especially for families and people with disabilities. The cycling environment should seek to accommodate all types of cycle.

Risk and vulnerability

That brings me to the much misunderstood matter of risk when cycling. An important fact to recognise is that cycling is a very safe mode of transport. The fact that people who cycle regularly live longer and healthier lives than those who don't says it all. Whatever risks there are in cycling, there are clearly more in not doing so.

So please don't get hung up about cycling safety and go for an over-protective approach to cycle planning – try to keep the risk in perspective.

Moreover, the more people who cycle, the lower is the risk per person. When cycle use doubles, risk goes down by a third. The most effective way to improve cycling safety is to get more people cycling. It is by discouraging cycling in any way, that you will increase risk.

Now, of course, many people have come to believe that cycling is anything but safe, and there is undoubtedly a great deal that could and should be done to make cycling safer. It is very important to address perceptions about safety if we are to get more people to cycle, and I will say more about that later, but as professionals it is imperative that, in dealing with the perceptions, you understand the facts and you do not inadvertently make reality worse.

Cyclists are vulnerable road users, but the nature of their vulnerability is often misunderstood. It is not traffic per-se that causes conflicts for cyclists, but crossing, turning and weaving movements in situations where everyone is not exercising the required degree of care. Controlling speed through junctions and ensuring that crossing distances are short are important ways of minimising the vulnerability of cyclists. But so, too, is encouraging co-operation and involving all road users in sharing responsibility. When road users are aware of each other's presence and can predict behaviour, problems seldom arise.

Casualties

The number one cause of cycling casualties is not motor traffic but bad surfaces, probably accounting for at least 80% of injuries. In many towns the best thing that a local authority can do to improve safety is to mend the roads. Of reported casualties, some 70% take place at junctions and more than half of these at side roads. Busy junctions are places where all road users can be tasked to fully comprehend the traffic situation, and anything that adds to the complexity of a junction is unlikely to benefit safety.

Roundabouts sometimes show disproportionate concentrations of cycling casualties and most of these occur where drivers entering the roundabout do not see a cyclist on the circulatory road. The least safe place to be on a roundabout is near the edge (*Figure 7)*.

Figure 7

Another of the most common types of crash involve the opening of a vehicle door into the path of a cyclist. Most people recognise the possibility of an offside door being opened but still people get hurt. Fewer people recognise the hazard from a door opening when moving up the outside of a queue of traffic, but passengers take less care than drivers. Cycle lanes seem to be increasing this risk as cyclists take less care.

Ask people what they fear about cycling in traffic and many will mention the possibility of a vehicle hitting them from behind. In fact, the rear hit is one of the least common types of crash and when it does occur it is sometimes because the cyclist veered injudiciously into traffic. This is another instance where perception and reality are different, and some attempts to address this problem, such as by moving cyclists onto the pavement, merely move risk elsewhere, such as to junctions where the level of risk is inherently higher.

Most cycling casualties, especially those that are not on the carriageway, are not recorded by Stats 19. In my work as an Expert Witness to the courts on cycling, around three-quarters of the cases I have dealt with have involved cycle facilities, a proportion grossly disproportionate to where most cycling takes place even when one takes account of the greater complexity of facility claims and thus the need for expert evidence. The greatest error you can make in planning for cycling is to assume that cycle facilities are inherently safer than cycling on the roads, for while the hazards may sometimes be different, they are often less predictable and can be just as life threatening.

Table 2 shows the top five causes of facility injuries in cases that I have dealt with recently. The percentages are not mutually exclusive but simply relate to the proportion of cases in which these have been factors. If anyone should think these are just bumps and scratches, each of these categories includes a fatality.

- Surface defects (33%)
- Visibility (22%)
- Cycle lanes (22%)
- Collisions with pedestrians (14%)
- Collisions with hardware and other obstructions (11%)

Table 2: Cycle facility crashes

It is for good reason that so many cyclists rebelled at the suggestion in the draft Highway Code that cyclists should use facilities where provided and why they are so often ignored. It is important to respect the judgement of users and to understand the fundamental limitations of planning for cyclists apart from motor traffic.

Cyclists and pedestrians

Cyclists and pedestrians are often considered together. Both are vulnerable road users, but that is as far as the similarity goes.

Table 1 showed typical cycling speeds. Notice how much greater are all these speeds compared with the 3 - 4 mph at which pedestrians walk. The minimum speed for cycling is 2.5 times that of a pedestrian, while faster cyclists travel at 5 times the speed, much closer to the speed of motor traffic.

The energy 'cost' to a cyclist of stopping and re-starting is 80 times that for a pedestrian. The rolling wheel of a cycle is much less tolerant of poor surfaces and cannot simply 'step up' when a change of level is encountered. Cyclists cannot turn on the spot, move sideways or stop suddenly – 3 characteristics on which a lot of pedestrian safety depends.

In fact, cyclists have very little in common with pedestrians and facilities designed for pedestrians are rarely suitable for cycling. It is time to relegate the shared footway to history.

Cycle training

A very positive development in the last few years has been the growth in availability of cycle training in the UK. Modern cycle training is based on the principles of vehicular cycling and teaches cycling technique in a similar way to teaching someone to drive a car: how to integrate with traffic rather than to fear it. It teaches people to respond dynamically to the changing traffic situation around them, rather than to follow a rigid set of rules, for this is the safest and most efficient way to cycle.

An important facet of vehicular cycling is that, with only a few exceptions, it is technique that matters more than fitness or speed. It is possible to cycle vehicularly and safely in most places at modest speed and there are now many people who have passed successfully through training schemes to prove it.

It is very important that cycle planning does not undermine or inhibit safe cycling technique by requiring cyclists to ride in a non-vehicular manner.

The single most important skill taught in modern cycle training is positioning, for it is through this that cyclists can exert the greatest influence on their safety. The aims of positioning are to ride where you can best see and be seen; where you may deter others from putting you at risk; and to ride as directly as possible, to simplify bike control.

In practice, good positioning means riding relative to the moving traffic lane, not relative to the kerb *(Figure 8)*, and to keep away from the places of greatest risk such as by the give-way lines at side roads and roundabouts. This practice has important consequences when planning for cycling, and in particular can conflict with the provision of cycle lanes which may inhibit best practice.

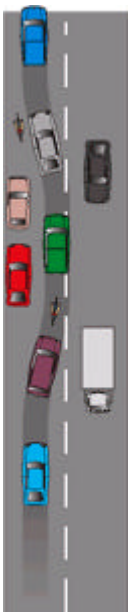


Figure *8*

I clearly have a vested interest, but I would strongly recommend that anyone involved in cycle planning becomes familiar with *Cyclecraft*, which is the course book for the National Cycle Training Standard and explains in detail how you should expect cyclists to ride.

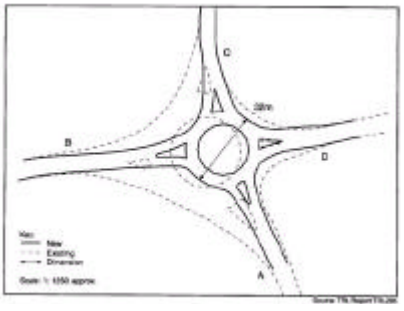
The road network

The overwhelming majority of cycling takes place on the general road network and it is unlikely that any alternative could be provided that would better meet the needs of cyclists in terms of access, ease of use or safety. Planners and engineers have far more potential to encourage – or discourage – cycling when designing ordinary roads than by implementing cycle-specific infrastructure. Moreover, whatever else might be provided, many people will want to continue to cycle on the roads where the need to address problems will not go away.

So what are the main problems?

I've already mentioned that cyclists need sufficient space to operate. One of the greatest space-related hazards today is the centre island which results in a critical profile for cycling. They are a considerable deterrent to cycle use, even where traffic speeds are not high. Yet the benefits of these devices seem to be minimal, for they have little effect on car speeds. If there is no clear pedestrian demand for crossing the road at these places, they should be removed. Where pedestrians need to cross, substitution by a zebra or controlled crossing would better meet the needs of both pedestrians and cyclists.

Lane widths have an important impact on the perception of safety, and width reductions to fit in more lanes are an anti-cycling measure. Sometimes this is done to add a bus lane on one side of the road. This is fine for cyclists when they can use the bus lane, but going in the other direction they may face a critical profile over a considerable distance. Planning for cyclists and public transport should be complementary not in opposition; a better bus service does not justify making conditions more difficult for cycling.



Conversely, widening the nearside lane on multi-lane roads can be a very useful way of giving cyclists extra space without imposing the constraints of a cycle lane or disadvantaging anyone.

Sometimes there is too much space around. Large radii at junctions can encourage higher speeds while making it more difficult for drivers to see cyclists. At the same time there is more 'unprotected space' for cyclists to cross where they may feel vulnerable. Large roundabouts are an example of this problem. The use of tighter, continental geometry can help to reduce risk to cyclists, but in some cases these junctions are not going to be cycle-friendly until a more harmonious method of traffic control is introduced.

Free-flow lanes at junctions, merges, diverges and slip roads are other examples of the kind of design that is incompatible with encouraging cycling.

A general reduction in vehicle speeds would probably be the best incentive for more people to cycle. But it is not just absolute speed that is important but also the way that vehicles are driven. Places where drivers continually brake and accelerate to minimise the effect of traffic calming on their progress are sometimes more intimidating for cycling than free-flowing roads with higher speeds.

I've mention that cyclists need direct routes. In an increasing number of countries, cyclists are being exempt from one-way restrictions. We should follow suit, to improve access by bike. People are pragmatic: if its easier to get somewhere by bike than by car, many will switch mode.

Hierarchy of provision

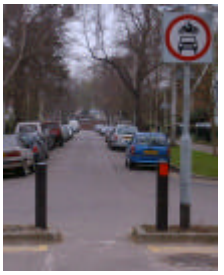
The *Cycle Infrastructure Design* draft repeats, upfront, the Hierarchy of Provision when planning for cyclists. What you should consider first – traffic volume and speed reduction, junction treatment and traffic management measures – have much more potential for wider benefit than options lower down the Hierarchy. However, I retain a major misgiving with the Hierarchy, in that it suggests that if you can't implement, for whatever reason, the preferred options, then you *should* do something lower down. I disagree. In many cases a 'do nothing' option will be better than inappropriate cycle facilities.

Naturally, my preference is for cycling conditions to be improved. But my top priority of all is that they shouldn't be made worse. Alas, we are awash in this country with facilities that have been introduced in a desire to 'do something', but which have made cycling more difficult and led to hostility and aggression towards the many cyclists who are not prepared to use them. If you can't implement a higher option now, keep up the pressure until you can.

Cycle facilities

That brings me to the role of cycle facilities in providing a better environment for cycling.

The most useful facilities are those that enable shorter or quicker journeys, or open up access not available to other traffic. Exemptions from traffic management restrictions, links between estates and, of course, cycle parking are all examples of things that can make cycling easier. Routes away from traffic can sometimes provide useful shortcuts or pleasant places for leisure cycling.



Much more controversial are facilities alongside roads. I explained earlier how much more difficult it is to see turning traffic from a cycle track than from the road. And I have described how cycle lanes often result in cyclists being passed closer and faster than where a lane is not present, as well as compromising the ability to ride vehicularly.

Some people tell me, it's OK for you, but we need these facilities for less experienced people and children. But can less skilled riders be expected to deal competently with hazards that more experienced cyclists find so difficult?

A statement by the Austrian government makes the point: "Most bicycle accident victims are older people and children. They are put at risk by the complexity of cycle paths on the one hand and on the other hand by their over-confidence that their safety on cycle paths is substantially greater than on the road.

At the international Velo City conference in Munich this year, a Swiss delegate described how there has been a major shift in his country from accommodating cyclists separately to mixing cyclists with traffic, with changes to the road environment as necessary. This has led to big increases in cycling. The mayors of Munich, Brussels, Copenhagen and Paris each explicitly stated how they wanted cycling back on their *streets*. And even a speaker from the Netherlands defined 'cycle-friendly cities' as those with as few special facilities for cyclists as possible.

The factors that are driving these trends include recognition that the quality of separate infrastructure is rarely good enough to satisfy a wide range of cyclists; that the capacity of such infrastructure is too limited for potential cycling growth; and intractable problems of safety.

There are probably few aspects of traffic engineering where the detail of schemes is so important as in cycle planning. Quality, particularly in the detail of execution, is all important, for a cycle route is only as good as its weakest link.

Every two-way cycle track should have a centre line as you would expect on a road, for cyclists are notoriously bad at keeping left without one and head-on collisions are often serious. At bends, forward visibility should reflect typical cycling speeds and be no less than a cyclist would expect on a road. Centre and edge lining are important for safety after dark. Vegetation should be kept well back, not only to contain seasonal growth so that it cannot intrude into the path (people have suffered serious eye injury as a result), but so that the path is not dark and threatening at night. Reflective signs should be provided to warn of bends, junctions and all other potential hazards. A cyclist should expect to receive a similar level of service to that on a road.

It is sometimes suggested that the safety of road-side cycle tracks can be improved by ramping them where they cross roads. Recent research suggests otherwise. While motorists travel more slowly, cyclists become over-confident and the net casualty rate for these places remains about the same.

A benefit of cycle lanes can be the bypassing of stationary traffic, but only if they are wide enough for cyclists to ride clear of opening car doors and where they have good sight of pedestrians crossing between vehicles. 2 metres is the minimum width for this. Cycle lanes leading to junctions need special care, for they can encourage cyclists to ride up the inside of left-turning vehicles, one of the principal causes of cycling fatalities. Where left turns are common or junctions are regularly used by long vehicles, it is safer not to use kerbside lanes and perhaps not ASLs either.

Sometimes, it is said that cycle lanes have a role in drawing attention to the presence of cyclists. There are better and safer ways to do this. If you want to highlight the presence of cyclists to drivers emerging from a side road, direct specific warnings at the junction towards them, but don't encourage cyclists to ride where their safety depends critically upon others obeying the rules.

More generally, if you want to make drivers more aware of cyclists, you might try copying the Californian 'share the road' signs *(Figure 9)* which seek the active involvement of motorists in assisting cyclists rather than the perception given by cycle lanes that they are there to get cyclists out of others' way.

Figure 9

Audits

All highway and cycling schemes should be subject to audit.

If you are designing infrastructure for cyclists, imagine yourself driving along it in your car. If there's anything that would cause you concern as a motorist, go back to the drawing board and put it right! The expectations of cyclists are no less important than the expectations of motorists.

I have become very disappointed with the results of safety audits from a cyclist's perspective. All road audits should, in my view, have a mandatory field in which the impact on cyclists should be assessed, and all cycle infrastructure schemes should be subject to the same methodology and standards as road schemes. But either will only be useful if there is a much better understanding of cycling safety issues by auditors. Evaluation of personal space, inter-visibility, relative speed, surface quality and the implications for good cycling practice are all important aspects of conducting a cycle-conscious safety audit.

Key audit criteria

- Personal space
- Road profiles
- Inter-visibility + distractions
- Relative speed
- Surface quality
- Impact on vehicular cycling

More generally there is a need to audit the existing road network to see where changes could benefit cyclists. There is a procedure published by IHT but I am no fan of it. It is more concerned with finding reasons to introduce cycle facilities than improving road conditions, and audits I have conducted with it have given results quite contrary to the perceptions of cyclists. On the other hand, I have carried out audits around measuring personal space and assessing the profile of roads and these have proved much more relevant.

Perception

Finally, I return to the important issue of people's perceptions of risk and how to encourage more people to cycle. I've stressed how important I believe it to be not to make reality worse just to meet inaccurate perceptions. I also believe that the way that cycling has been accommodated in recent years has often fuelled rather than reduced people's fears about cycling.

A recent study from Copenhagen – where they know better than most about cycle facility design – suggests that cycle lanes have very little benefit in terms of encouraging people to cycle while increasing risk. Segregated cycle tracks can lead to more cycling but also lead to more casualties and the space requirements will not be found in many British cities, except on separate alignments such as disused railway lines. Cycle tracks may be a more practical, though expensive, option alongside some inter-urban roads.

Generally, however, meeting people's fears about cycling by providing cycle-specific infrastructure is not likely to be any more successful in the future than it has in the past. Some large infrastructure-based projects have led to fewer people cycling rather than more.

I don't pretend to have a definitive answer to getting more people to cycle, but I am more encouraged by the results of soft measures, such as personalised travel planning, than by cycling infrastructure solutions. Non-cycling measures, such as restrictions on motor vehicle access and parking, have also proved successful in achieving modal shift. While it is important that these options are accompanied by measures to make cycling easier, this should be done in ways that make cycle traffic more dominant on the roads, not removed to the margins of the traffic system.

To directly address people's fears about cycling, modern cycle training is proving very effective. But if this is to achieve its full potential, then planning for cycling needs to be consistent with best cycling practice, not at odds with it.

Don't forget that the UK used to have a lot of cycling with almost no special facilities. Traffic volumes in our larger towns were not much less then than now, but cyclists fitted in better because speeds were lower and the road system was better suited to cycling. It may be unfashionable to talk of turning clocks back, but it would not be a bad thing to reflect on the conditions of 50 years ago if we are to achieve similar levels of cycling.

Planning for cycling is important and should become more so in the years ahead. It needs to be based on a sound understanding of the science of cycling, the strengths and weaknesses of the bicycle and its rider and what works and what doesn't.

I end this paper with two quotations. The first is by the American, John Forester, but it has its roots when John cycled in Bristol as a child and is just as relevant to the UK today:

"Cyclists fare best when they act and are treated as drivers of vehicles
– same roads, same rights, same rules"

The second quotation is from Ernest Marples, a former Minister of Transport who was himself a cyclist:

"If you make conditions right, there's a great future for cycling.
If you make them wrong, there's none."

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