Two Networks Are Better Than One

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Summary

In Oxford we are implementing two cycle networks rather than just one. One network provides fast routes on existing roads. The other network provides safe routes on back streets and cycle tracks, with crossings of main roads.

Designing the networks for two different markets allows us to adapt the existing road network, rather than creating cycle routes from scratch. This is cheaper than the old approach, allowing us to make progress faster, and to achieve end-goals faster.

Most of our streets are too narrow to fully meet the requirements of all users. Space therefore has to be reallocated in favour of the cyclist. Using existing road space also restricts car traffic, making cycling safer, and even more attractive.

This addresses one of the key problems we face - how to restrict the car without attracting political opposition.

By integrating with bus and pedestrian priority measures, this Twin Network Approach goes a long way towards defining a complete sustainable transport strategy for the urban road network.

The Twin Network Approach was initially designed for a medium-sized city with few new roads. However, the concept can be adapted for smaller towns, cities with some new roads, and potentially for larger cities.

1. Introduction

For years, Oxford had been developing its network scheme-by-scheme, as opportunities arose. There was no overall strategy for the network, and there were endless arguments about which types of cycle facilities were preferable. The strategically-minded among us found this a boring waste of time. Also, without a strategy, the political purpose of the network was always up for debate. As environmentalists, we wanted traffic restraint built into the strategy, rather than always having to argue for it.

It is well known that the only effective way of reducing car use is to make it impossible. In Oxford, we have a long tradition of raising car-parking charges, and leaving motorists to sit in traffic queues. Bus and cycle lanes have been provided wherever there is room, to give the alternative modes every advantage. But still they drive! Just recently, we have closed a main road. It took years to negotiate that, and it will take years to close the next one. Are there additional ways in which we can restrain motorists, without causing a revolt? Can the cycle facilities that we provide help to restrain motorists?

At the same time, there is widespread support for cycling, both nationally and locally. There is considerable suppressed demand for cycling, both among children and adults. But all our efforts to date have generated little additional cycling. We need to go a step further, if we are to have an effect. We must make a significant qualitative improvement in our cycle network. Besides anything else, unless the new facilities attract more cyclists, the motorists will reasonably be able to claim that they are being restrained for no purpose. The network must be seen to work.

2. An ideal cycle network

Cyclists have lots of competing demands for cycle facilities. They variously want them to be fast, direct, safe, pleasant and personally secure. They also need them to link together to make complete routes (this has been one our principal failures, so far).

Adult commuter cyclists will not use routes that are slow or circuitous. There is some debate whether potential new adult cyclists are looking for speed or safety in the first instance. However, it is clear that when he or she has achieved a degree of confidence on a bike, and if there are no major hazards, the route of choice will be determined by speed. Since our road system was originally designed around the economic activities of adults, the route of choice will generally be the main traffic streets.

Some adults are not quite so in a hurry. They will seek out routes through pleasant surroundings, preferably away from cars. Children will often be obliged to use routes away from the traffic by their parents. The absence of a route that is perceived as safe will often be suppressing a significant demand among children to be allowed to cycle to school.

At night, attitudes change. Few women are happy using back streets, let alone cycle tracks through parks. There need to be routes available that are busy enough to avoid the fear of being attacked.

3. Rethinking the ideal

It is impossible to provide cycle facilities that work for all cyclists at reasonable cost (and probably not even then). The approach we have developed in Oxford is to provide two separate cycle networks, one aimed at adult commuters, the other aimed at schoolchildren. This is called the Twin Network Approach.

Adult commuters are primarily interested in the time it takes them to get to work. We can therefore reduce the emphasis placed on absolute safety, and provide simple facilities, such as cycle lanes, on the main roads. A small number of other road junctions will need treatment, where there are traffic lights or roundabouts. This is especially likely to be required around large traffic generators, such as hospitals and campus universities.

Schoolchildren need complete routes at a reasonably safe standard. Directness is not quite so important. We can therefore pick out a network of back streets and cycle tracks that can be made to link up. In Oxford we sought routes every half-mile (800m) or so. Our efforts are then concentrated on creating main road crossings.

Both networks are supported by other back streets. These form the conventional access routes to the main roads for adults, but also access to the designated back street network for schoolchildren.

Some of these other back streets will require traffic calming, but few will need any cycle facilities as such.

The following sections outline the facilities required in more detail, drawing on best practice from Oxford and elsewhere.

4. The main road network

4.1 Cycle Lanes

The basic requirement is for on-carriageway cycle lanes on all urban main roads. These need to be as continuous as possible. They need to be marked across side road junctions, and alongside pedestrian crossing markings (zig-zags).

The minimum dimensions we regard as acceptable are 1.0m for the cycle lane and 2.5m for the general traffic lane. General traffic lanes of this width need to be separated by a median strip of some kind. We have main roads laid out with these dimensions that appear to operate quite satisfactorily, though a little uncomfortably. The minimum width required for this median strip is still being debated locally, but is probably at least 0.3m.

4.2 Median Strips and Refuges

A wide median strip between the general traffic lanes provides a continuous informal crossing opportunity for pedestrians. This can take the form of a long traffic island, or more simply (and cheaply) parallel painted dashed lines. This can be enhanced by the use of pedestrian refuges (small traffic islands with illuminated bollards) at key crossing points on street corners. These refuges also create a protected central area at junctions, which can considerably assist cyclists turning right across the traffic coming in the opposite direction.

4.3 Parking

Where parking is required, it needs to be provided for in bays, with the cycle lane and general traffic lane marked around it. Residential parking bays can be a minimum of 1.7m wide. Short-stay parking bays should be 2.0m wide, to provide some protection against car doors opening.

4.4 Bus Stops and Bus Lanes

Cycle lanes are not compatible with bus stop markings, so bus stop markings need to be removed. If there is a problem with illegal parking, narrowing the carriageway is more effective than markings. Except perhaps at major stops, overtaking should be discouraged, in that it disadvantages bus users, and is dangerous for cyclists.

Bus lanes (minimum 3.0m) can safely be shared with cyclists, if the bus drivers can be persuaded to drive non-agressively. Stopping buses travel at about the same net speed as cyclists, so overtaking is usually unnecessary. Where there are express buses operating, the bus lane should ideally be 4.0m wide, and have a 1.0m cycle lane marked within it. Bus lanes should operate at all times, not just in the peak.

4.5 Junctions

Traffic-light controlled junctions should feature advanced stop lines for cyclists. If at all possible, the use of multiple queuing lanes should be avoided. Especially where there are separate filters for the lanes, this creates a very dangerous situation for cyclists turning right. Cyclists have to be able to pull across flowing traffic without fear of being cut up. This can only happen safely if the traffic

is proceeding slowly. Widening at junctions can literally be fatal. The extra lane at traffic lights often adds only marginally to the capacity of the junction, and should be dispensed with unless the congestion this would cause is genuinely intolerable.

The radii of the junctions should be kept to the bare minimum. The reduces the distance across the junction for cyclists, and makes it more reasonable for them to stay in front of the traffic until after the junction is passed. Overtaking cyclists at junctions is dangerous, and should be discouraged by engineering measures as much as possible.

4.6 Roundabouts

Preventing overtaking on roundabouts requires them to be designed to operate at about 20mph (30kph) maximum. This is in sharp contrast to conventional British designs! Best practice is to narrow the entry to the roundabount, and tighten the entry angle.

5. The back street network

The bulk of this network can be formed of existing back streets. These need linking together with cycle tracks and crossings of main roads. We sought routes between each of the main radial roads, and crossings of the main roads roughly every half a mile (800m). Wherever possible, we tried to run close to schools and other major traffic generators (colleges, hospitals, shopping centres). A key design tool was choosing names for the routes; if there wasn't a sensible name, the route probably didn't go anywhere useful.

5.1 Traffic Calming

Some back streets will need traffic calming, especially if they are parallel to main roads and are likely to be heavily used by schoolchildren. The preferred forms of traffic calming are shallow humps, pedestrian refuges (effectively parallel narrowings), and junction-tightening (usually in association with parking bays).

5.2 Cycle Tracks

Where tracks are viable (usually across green land of some kind), they should be designed to be shared with pedestrians. This means they should be at least 2.0m wide, depending on the volume of pedestrians. Since pedestrians will use them, they should not be thought of as fast cycle routes. Tracks should not be segregated; cyclists should expect pedestrians to get in their way, and behave accordingly. Some form of cycle-calming may be required to enforce this. These could be: access barriers that allow the passage of cycles but not motor cycles; cattle-grids or rumble strips; swing gates that push open from both directions. Signs indicating that priority ought to be given to pedestrians may also be appropriate.

5.3 Main Road Crossings

The simplest crossing of a main road is a large pedestrian refuge. This ought to be 2.0m wide, so that a cycle can comfortably fit inside. This type of crossing will genarally be sufficient where a cycle track crosses a main road.

An adaptation of this is where a back street crosses a main road from one side road to another. In this instance a refuge before and after the junction provides a protected central area, so the cyclist can cross each direction of traffic separately. The presence of the refuge also means that the traffic lanes will have been narrowed, which improves the safety of the crossing by slowing the traffic down.

Where a cycle track crosses a particularly busy main road, or where there isn't enough room to provide a refuge, a Toucan crossing (a light controlled crossing for cyclists and pedestrians) can be used. However, these cost the equivalent of at least ten refuges, so will need to be used only when necessary.

Toucan crossings can be provided for crossing between side roads. However, the only arrangement that is deemed safe is if left turns out of the side roads through the crossing are banned. This may not always be possible. Simply closing the side roads, or installing full traffic lights at the junction might prove easier.

5.4 Links Along Main Roads

When there is no other route available, it will be necessary to have short sections of the back street network follow a main road. Rather than use the pavement, this can be done by building a cycle track using the edge of the carriageway. This might consist of a two-way track on one side of the road, or two one-way tracks either side. Which depends on the feasibility of crossings at either end, and on whether cycle traffic is predominantly on one side of the road or the other. These edge-of-carriageway cycle tracks usually have to incorporate one or both of the cycle lanes as well.

This type of cycle track has all the usual problems that face routes on pavements. There are complicated interactions at bus stops, pedestrian crossings and side roads. However, they don't take space away from pedestrians, which gets past one major problem. Having the cycle track as part of the road also clarifies the approach at bus stops, pedestrian crossings and side roads. In general, however, it is better to only use such cycle tracks where there is no back street alternative, and for as short a distance as possible. In this way, most of the problem situations can be avoided.

5.5 Pavements

The pavements of main roads should not be used unless there is absolutely no back street alternative, and there is insufficient room to build a cycle track in the carriageway. In the whole of Oxford, there were only two situations where the pavements of main roads had to be used. In both situations the pavement is over 4.0m wide, so we are able to mark out a cycle track without having to narrow the pavement unreasonably.

6. Other back streets

Little treatment is generally needed for roads that don't form part of either network. The main exception is traffic-light controlled junctions and roundabouts, which are occasionally used on minor roads. These need approach cycle lanes, advanced stop lines and calming, as appropriate. The aim should be for all these roads to operate at around 20mph (30kph).

Other minor facilities will be useful for local access. These include exemptions to road closures and turning bans, use of one-way streets in both directions, and short cycle tracks. However, these facilities are unlikely to link together to form a coherent network, and shouldn't be signposted in the same way as the main back street network.

7. Sustainable transport strategy

The treatment of main roads indicated above goes a long way to defining the road layout appropriate to a sustainable transport system. The additional crossing facilities, especially the extended use of median strips, will do much to make life easier for the pedestrian. New links for cyclists will be used just as much by pedestrians. In a few places, cycling facilities will take land that might be devoted to improving the pedestrian environment. But in general, there will be far more opportunities for this than the places where it is critical to provide cycle facilities.

Some additional bus facilities will be required, to ensure that there is public transport access on principal corridors without undue delay caused by traffic congestion. Where roads are narrow, there may be difficult choices to be made between providing for buses or for bicycles. Each situation needs to be considered on its own merits. In general, however, the loss of continuity for cyclists will have more influence on travel patterns than the loss of priority for buses. There may well also be other means of giving buses priority, for instance by holding back the traffic before the bottleneck. Two such bus gates are in use in Oxford, with a fair degree of success.

8. Other cities

In Oxford, we have a major advantage over many other cities: we have not spent the last thirty years building roads. The level of traffic we have now in the city is little changed from the situation then. The current Transport Strategy goes one further, by removing virtually all the remaining sections of dual carriageway in the city centre (generally so that one carriageway can be used exclusively for buses).

So how does the Twin Network Approach work in other cities? Ideally, you should dispense with your dual carriageways and multi-lane roads. They are basically hostile environments, attuned to the needs of the car, and have no real place in a sustainable transport system.

Short of that, the answer lies in the nature of the road. If the road concerned is an old road that has been widened, it will be valuable to cyclists. The best treatment is to provide a cycle lane (preferably quite wide), and advanced stop lines at traffic lit junctions. On particularly busy roads, cyclists will need the option of turning left (right in Britain) in two stages (the first to just beyond the junction, the second with the cross-flowing traffic).

If the road forms part of a gyratory, the important thing is to ensure that each junction has lights, giving the cyclist the opportunity to turn right. In some situations, a cycle lane on the inside of the gyratory may be useful. However, in general gyratory systems are dangerous for cyclists, and abandoning them in favour of the conventional use of two-way streets is much to be preferred.

New roads have usually been built on top of the original street network. They usually have little frontage, and generally don't need to be used by cyclists. However, they may have severed the old street network, breaking a link that cyclists would otherwise use. Restoring that link will usually be the best way of providing for cyclists, and undoing the damage caused by the building of the road.

9. Conclusion

In this paper I have explained the cycle strategy that has developed over the years in Oxford. The Twin Network Approach has enabled us to concentrate resources separately on the problems of providing for cycling that is both fast and safe.

Such a cycling strategy has also proved to be an excellent basis for a sustainable transport strategy, combining as it does incentives to use alternatives to the car (carrots) with restrictions on the use of the car (sticks). This allows us to restrain traffic without causing unreasonable pain to motorists. The main addition needed to the basic cycling strategy is a parallel development of facilities for buses.

The strategy as described, while most readily applicable in a city such as Oxford, can be extended to cities which have more history of road building. The strategy shows that by planning for cycling, we can envisage how the road network must change to allow the sustainable modes to flourish. This requires a fundamental reallocation of road space on our main roads.

In terms of cost-effectiveness, sustainability and practicality, we have found that two networks really are better than one.