# 2 Design Principles

### The Functional Network

Cycle journeys commonly follow transport corridors that are also used by buses, cars and pedestrians. The primary function of these routes may differ for different user groups, for example a main road, a district centre high street, a residential street, a parkland path or canal towpath may all form components of a strategic cycle route, but each serves a different function for other users.

It is important to plan and design routes in terms of their function within the cycle route network, as well as responding to the differing requirements of other users. In general, the strategic cycle route network benefits from a greater degree of separation from other modes in order to offer the highest level of service to cyclists.

### The Importance of Context

Roads and streets are generally dominated by the requirements of motor traffic, which demands a certain amount of space in which to operate safely, for parking, and to minimise delays. These aspects are generally associated with a 'movement' function.

Pedestrians and cyclists also have requirements for safe movement, places to sit and parking for bicycles. The needs of non-motorised users are predominantly about the 'place' function of roads and streets, although on busier roads and junctions cyclists also need to be able to travel at speed and in safety in a similar manner to motor traffic.

If the basic requirements for non-motorised traffic are not met, the transport system as a whole suffers. Footways that are narrow and congested, cluttered with signs and other street furniture, streets that are too busy and dangerous for residents to enjoy spending time in will all generate more motor traffic simply because travelling on foot or bicycle is unpleasant or hazardous.

If we neglect the 'place' function of residential streets and local centres, strategic transport corridors become congested with car traffic doing very local short trips. The most successful places offer safe access from the surrounding area and space for people to spend time outside in comfort and safety doing a variety of activities, therefore spending more time and money locally.

The context is very important when selecting the type of cycle infrastructure. The appropriate infrastructure will depend on the wider context of a particular location to reflect the dominant function of the street as a whole. For example Victoria Square lies at the very heart of the city centre where lots of cycle and pedestrian routes cross, but its primary function is as a 'place':

- City centre shopping streets where the primary users are pedestrians. Other vehicles, including cycles, should operate as close to walking pace as possible and be prepared to give way when they enter vehicle restricted areas. Being able to use the whole width between buildings can help reduce potential for conflict. Traffic within the area bounded by the Queensway is primarily entering for access to parking and deliveries so there is no requirement for speeds above 20mph, reducing the need to provide physically separated infrastructure for different modes.

- Local centres that sit on main roads such as Kings Heath, Handsworth or Acocks Green need a good balance between 'place' and 'movement' functions. The optimum design treatment may be to reduce traffic speeds to enable cycling on the carriageway and to provide opportunities for pedestrians and cyclists to cross main roads safely to reach local attractors. Wider footways offer better opportunities for people to spend time, on public benches or street cafes, and this activity helps to modify user behaviour, reinforcing lower speeds. This may require moving parking to side streets or formalising it into bays. Restricting turning, parking and loading activities can help to improve local safety by reducing the number of conflicting vehicle movements, making it easier for drivers, cyclists and pedestrians to take in the range of activities.
- The multiple requirements of bus stops, loading bays, parking bays, crossings and frequent side roads that are typical in local centres do not offer good conditions in which to provide continuous fully segregated cycle tracks, but cyclists may need specific assistance at places within the street such as early start signals or a bus stop bypass.
- In residential areas, the principle of 'filtered permeability' can be used to offer short cuts and through routes for cyclists on tracks that are unavailable to motor traffic, although the streets themselves should also have low speed limits to protect residents, especially children.
- In industrial areas there is a high percentage of HGV traffic and the geometry (wide roads and sweeping corners) required to accommodate this enables higher speeds by other vehicles. The combination of high speeds and HGV traffic suggests greater segregation is required for cyclists even though the flows of traffic may be low. This situation also occurs in some local centres that are close to industrial areas or motorway junctions.
- Off-road and leisure routes typically use surfaces that cyclists share with pedestrians, with the expectation that most cyclists will modify their behaviour when pedestrians are present.
- Off road tracks within the highway are required where there are high speeds or flows of motor traffic and should generally be fully separate from pedestrians unless pedestrian use is very low. On busy corridors with few frontages and infrequent side roads, motor traffic speeds will naturally be faster and cyclists and pedestrians will require greater separation from motor traffic. On roads such as Nechells Parkway with few frontages, the number of cyclists is always likely to exceed the occasional pedestrian traffic and there is no need for separation of pedestrians and cyclists on the track itself.

The overall width available, the intensity of use and the relative speeds of the different types of user are critical factors where cyclists share a surface with other modes.

The aim should be to reduce the speed differential as far as possible, and to eliminate or control conflicting movements at busy junctions and crossings.

If this cannot be achieved, there is an increased necessity to provide fully separate facilities for each mode.

| | MORE SEPARATION | → | MORE INTEGRATION |
|---|---|---|---|
| **ON-CARRIAGEWAY** |  |  |  |
| **OFF-CARRIAGEWAY / ON-HIGHWAY** |  |  |  |
| **OFF-HIGHWAY** |  |  |  |

*Different options for cycle route provision (Transport for London)*

### The Importance of Adaptability

Facilities that are adequate for a small number of cyclists may need to be adapted as demand increases. There is an ambition for more 'Dutch style' facilities, but successful operation of this type of infrastructure relies to some extent on public acceptance of priority for cyclists at side roads and compliance with car parking regulations. This may be problematic in parts of the city where there is high demand for road space, habitual parking on footways and other vacant spaces regardless of posted restrictions, and where pedestrians and motorists significantly outnumber cyclists.

As the number of cyclists increases, there is greater justification for providing more road space and giving additional time at traffic signals and crossings. Experience in cities such as London, Berlin and New York suggests that the rate of increase quickly gathers pace as cyclists start to form a significant part of the traffic. Birmingham is currently somewhat behind these cities, but the growth in cycling over the last five years suggests significant latent demand.

The **Strategic Network** is for moving people through the area efficiently, serving the main transport nodes around the city and nearby regional destinations. It comprises of main road routes and parallel routes that form other corridors near to main roads. Strategic radial routes will typically converge on the city centre but may be up to 1km apart at the edge of the city, so some connecting routes are required to ensure efficient movement. Multiple centres of activity such as local district centres, suburban business, industrial and retail parks need to be connected into this strategic network. The strategic network is important because it enables more people to travel to key destinations, boosting the economic vitality of the city. The strategic network should also provide opportunities to combine cycling with other modes of transport for longer trips.

The **Local Network** is a finer mesh of routes, typically 250m to 400m apart, offering coherent ways to navigate to local destinations using quieter roads and off road links, with safe ways to cross the busiest roads. These routes serve local schools, shops, housing estates, suburban stations and other destinations. The emphasis on these routes is to address issues that compromise safety or make cycling unattractive, such as busy road crossings or extensive diversions due to one way systems or physical barriers such as canal, rail and river crossings. The local network is important because it helps to address traffic growth and road safety across residential areas by providing an alternative to numerous short local car journeys that have a big impact on minor neighbourhood roads.

The **Green Route Network** is made up of off road trails and quiet roads that provide an attractive environment for cycling. While such trails may be used for all types of trips to key destinations, the design objective may also be entirely to stimulate new trips by providing a largely traffic-free route in attractive surroundings. For many users, the act of cycling will be the sole function of the route. The leisure network is important as a venue for low-cost exercise, local tourism and healthy living. The 'Changing Gear' report particularly emphasises the potential of the extensive canal towpaths and green spaces in Birmingham as a leisure and tourism asset.

**Interchanges**. The bicycle is not suitable for every journey, but it can easily be combined with car, bus, rail and tram providing there are suitable facilities for 'park and ride', including options for cycle hire. This gives people much greater flexibility in using the whole transport network, leading to overall efficiencies.

In practice these functional distinctions are not so clear cut, but offer a conceptual framework that can be used to think about which of the core principles of design are most important on a given route.

### Five Core Principles

The five widely accepted core principles for all cycle routes taken from the original Dutc guidance are:

- **Safety**. Routes should be safe to use and should feel safe for all users. ‘Feeling safe’ is sometimes referred to as subjective safety, and includes feelings of vulnerability to crime as well as fear of traffic danger (regardless of whether there is an actual record of crime or injury accidents). Cycling is generally a safe activity and there are few accident clusters within the city, however fear of traffic danger is the major deterrent to more people cycling[1]. Routes along busy and/or high speed roads should therefore offer separation from motor traffic where possible. Routes away from roads, in open spaces and in subways should have good visibility and lighting. The fear of crime affecting personal security is the major deterrent to walking, less so for cycling[1] compared to traffic danger. Subways that are now generally regarded as poor provision for pedestrians (due to fear of crime) may therefore still be valued by cyclists if they are well designed and offer a traffic free non-stop route through a complex junction.

- **Directness**. Routes should connect origin and destination using the least distance and least delay as possible, by minimising the requirement to stop at junctions and crossings. The alignment should generally cover the minimum distance between two points, however it is sometimes advantageous to avoid steep gradients or major junctions by using an alternative route that is slightly longer but more convenient and easy to use. For example, crossing the ring road is a barrier to cycling in Birmingham due to the large and complex junctions, but cyclists and pedestrians may have options to cross on link sections away from high capacity multi-lane roundabouts.

- **Coherence**. A network may comprise of many different elements but there should always be continuous provision, with no ‘gaps’ at difficult locations. This is one of the most important issues to address, because routes that are discontinued due to a major barrier such as a main road crossing or width constraint are of limited value. Clear signing is particularly important where cycle routes use minor roads and tracks that are not signed for other traffic. Coherence involves the whole journey, including easy access to secure cycle parking at home and at the destination. Highway improvement works are often focussed on a particular location, but there should be an underlying plan for phased implementation to build up a coherent route over time.

- **Attractiveness**. Infrastructure should be attractive to the intended users, for example wide enough to cycle side by side, with no sharp corners or restricted sightlines and easy to follow. Routes should generally aim to cater for a wide range of cycling abilities, safe enough for slower cyclists but still convenient for experienced and faster cyclists.

- **Comfort.** Routes should be physically comfortable, with a good quality surface. Riding in traffic can be stressful, especially if the intended manoeuvre is unclear, has many obstacles or is poorly signed. Designs should therefore be mentally comfortable with clarity at junctions, protection from opposing traffic

[1] Understanding Walking and Cycling, Pooley et al, Lancaster University, 2011

movements, separation from pedestrians and be clear of street furniture. Routes designed for leisure cycling should be able to accommodate cycling two abreast, while on-carriageway commuter facilities should ideally provide sufficient width for a cyclist to overtake another cyclist without having to move into an adjacent motor traffic lane.

The experience in London, New York and Copenhagen, all of which have seen a rapid increase in cycling, suggest that a sixth criteria of '**Adaptability**' should be added to enable cycle provision to be revised on a regular basis to cater for increased demand and the changing function of roads and streets over time. In each city, facilities that were adequate for a small amount of cycling have become overwhelmed as numbers increased, and roads that were once dominated by moving car traffic have become more important as 'places'. This type of evolution is necessary, for example dismantling the Queensway inner ring road at the Bullring would have been unthinkable in the 1980s but became inevitable for the expansion of the city centre when the road and its traffic became a barrier to growth rather than an asset.

### Width of a cyclist

A moving cyclist travelling in a straight line has an effective width (sometimes referred to as the dynamic envelope) of 1.0m, which is the shoulder width of the cyclist plus a small (0.2m) allowance for deviations from a straight path in order to maintain balance (See Figure 2). At very low speeds of under 5mph on uphill gradients and near junctions, the 'wobble' required to maintain balance is exaggerated (up to 0.8m) and additional width is recommended. Where there are metal drain gulleys at the edge of the carriageway, cyclists need sufficient space to avoid them.

Child trailers, tricycles, three wheeled recumbent cycles and hand-cycles for people with disabilities generally have an axle width of around 0.9m. The additional width and length of non-standard cycles should be considered to ensure infrastructure is accessible to a wide range of users.

Allowing for the wobble-factor and a 0.5m separation between cyclists, Figure 2 illustrates a 2.5m dynamic envelope for two side-by-side cyclists.

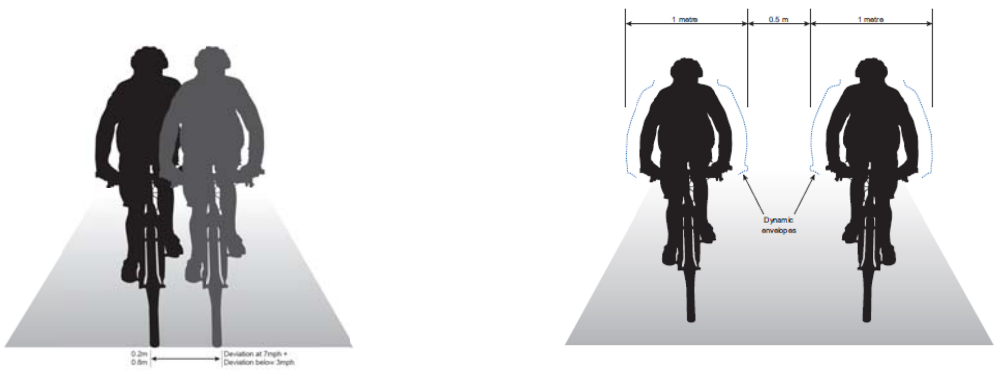



**Figure 2: Dynamic envelope of cyclists[2].**

[2] Local Transport Note 2-08, Cycle Infrastructure Design

### Distance to fixed objects

Where a cycle track or lane is bounded by a solid vertical feature such as a wall, fence or hedge, cyclists will require 1.0m clearance (from their centre line (tyre)) to avoid hitting it. This clearance is reduced to about 0.25m for a smaller upstand such as a low kerb (Table 1).

As with motor vehicles, cyclists require some additional width at bends and corners to enable them to lean into a corner and to maintain momentum. Superelevation is not required on corners but adverse camber should be avoided.

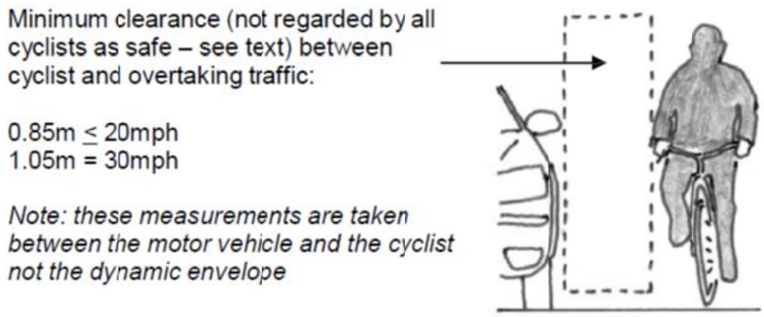
| Minimum design distances to fixed objects | |
|---|---|
| Distance from wheel (centre of cyclist) | Object |
| 0.25m | Kerb <50mm |
| 0.50m | Kerb >50mm |
| 0.75m | Street furniture: sign pole, lamp column etc |
| 1.0m | Wall, railing, bridge parapet, parked vehicle |

**Table 1: Separation from fixed objects.**

### Distance to other traffic

TRL research has shown that, under test conditions, nearly half the cyclists studied felt unsafe when cars travelling at 20mph passed them with a clearance of 0.95m. However, Dutch research has established that motorists driving at this speed are willing to overtake cyclists leaving a clearance of only 0.85m. This distance increases to 1.05m when passing at 30mph. Suggested minimum separation from overtaking traffic[3] is shown below in Figure 3.

**Figure 3: Separation from passing vehicles**




| **Design minimum safe passing distance** (measured from *outside* of cyclist's dynamic envelope) | |
|---|---|
| 20mph | 1.0m |
| 30mph | 1.5m |

[3] Cycling England Design Portfolio

These distances are widely adopted throughout Europe, for example it is written into French law that drivers overtaking cyclists should give clearances of at least 1.0m and 1.5m at 30kmh (19mph) and 50kmh (31mph) respectively.

### General Traffic Lane Widths

A common issue when retrofitting cycle facilities in the UK is that a localised narrowing such as a pedestrian refuge, and also general lane widths typically between 3.2m and 3.9m are wide enough for a motorist to overtake a cyclist without crossing the centre line, but without the 1.0m to 1.5m clearance that makes it feel safe and comfortable. This lane width is also hazardous when HGV traffic attempts to overtake without crossing the centre line. TRL studies have shown that drivers generally use the centre line as their primary reference point for adopting road position.

For this reason, cycling within a shared carriageway (i.e. no cycle lanes) should generally be accommodated by either 3.0m lanes (or less) that require drivers to consciously overtake by moving into an opposing lane or centre hatching, or lanes of 4.0m width (or more) so that drivers can overtake within the lane and leave adequate clearance. These widths also enable cyclists to safely adopt the ‘primary’ and ‘secondary’ riding positions that are taught in Bikeability training (Figure 4).

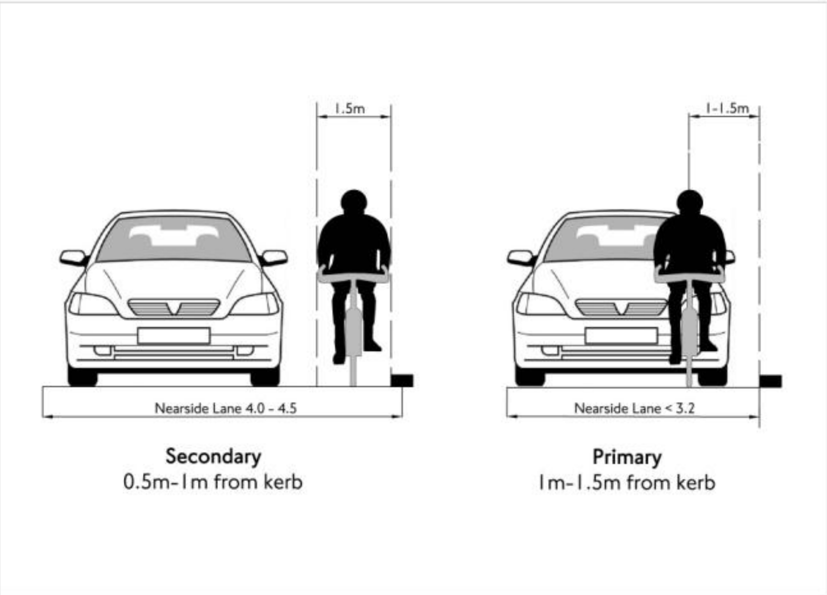



**Figure 4: Primary and Secondary positions**

In predominantly residential areas that also carry significant volumes of traffic at peak times it may be helpful to include ‘throttle’ features that prohibit access to wider vehicles and provide a ‘gateway’ to remind drivers that they are entering an area where lower speeds and more pedestrian and cycle activity are expected.

Figure 5 provides an indication of what overall carriageway widths can accommodate and Figure 6 illustrates the size of vehicles that individual traffic lane widths can accommodate. Widths pertaining to trunk roads are given in TD27, although it should be noted that TD50 permits lane widths as narrow as 2.25m in certain circumstances on the approaches to traffic signal stop lines. Further guidance on traffic lane widths is given in Manual for Streets 2.

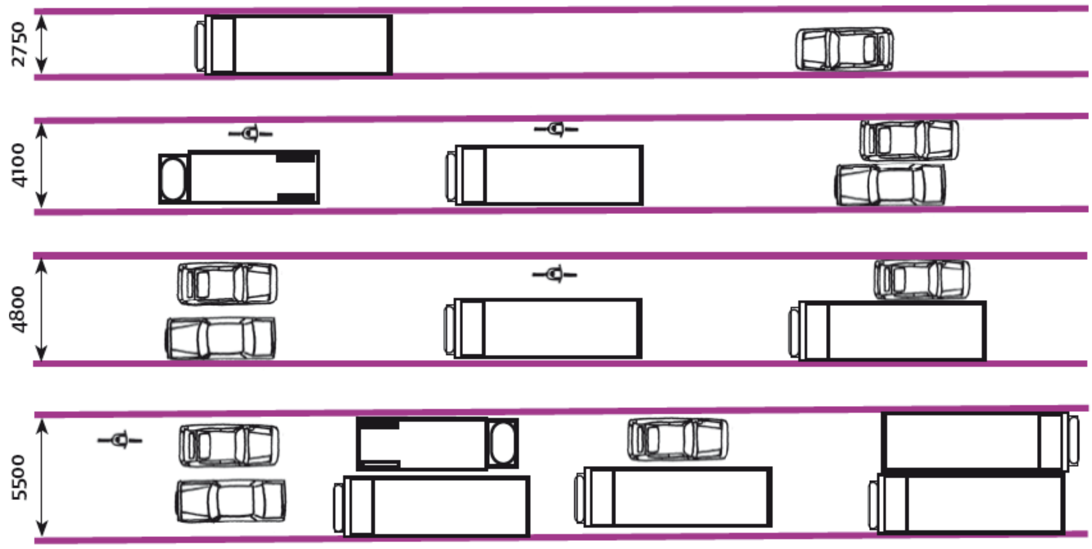



**Figure 5 - Illustration of what various carriageway widths can accommodate[4]**

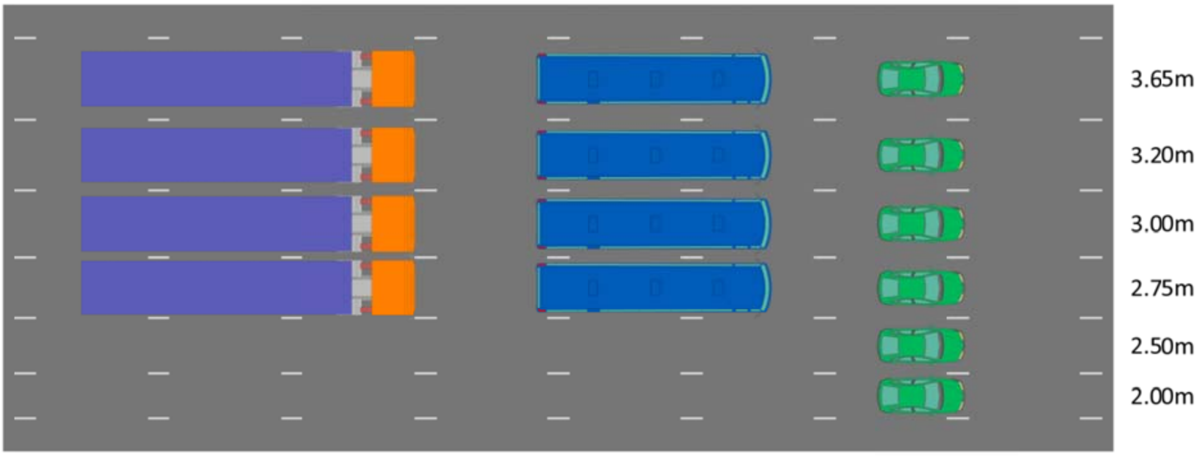



**Figure 6 - Vehicles and Lane Widths[5]**

Whilst traffic lane widths of 3.65m (metrication of 12 feet) have often been provided as standard in the United Kingdom, lane widths of 3.0 metres have been used in many parts of the country on urban roads for some time, and can successfully accommodate most typical vehicles (including HGVs) at speeds up to 40mph.[6]

Where flows of large vehicles are low, and speeds are modest (less than 35mph), lane widths as narrow as 2.75m can accommodate car traffic comfortably. Larger vehicles can pass one another at this width at lower speed with care, although some drivers may choose to encroach slightly outside of lanes to pass (i.e. into an advisory cycle lane).

Where general lane widths exceed these values, designers should take the opportunity to reallocate space to walking and/or cycling. Where lane widths are in the critical range of

[4] Manual for Streets

[5] Cardiff Cycle Design Guide

[6] Transport and the Urban Environment, IHT, 1997

3.2m to 3.9m, conditions will be unsuitable for cycling on the carriageway unless traffic speeds and volumes are sufficiently low for drivers to cross into the opposing lane to pass a cyclist comfortably.

New developments should either provide sufficient carriageway width for safe on-carriageway cycling within lanes, or off-carriageway cycle tracks (with appropriate provision for crossing the carriageway where necessary and without frequent delays).

*Physical width restrictions (in association with a TRO restriction) can be used to exclude larger vehicles from using residential areas with narrow roads as through routes. Access for emergency vehicles (such as the gate in this photograph) must be retained.*

*Road closures (which may be for traffic/speed management or crime prevention, or to prevent traffic from using residential service roads) often make roads more attractive to cyclists due to the consequent reduction in traffic. Cycle 'gaps' at road closures offer 'filtered permeability' for cyclists where motorised through traffic is being restricted and should be incorporated into the design of all closures unless there is a safety issue.*

### Width requirements of infrastructure types

The following section explores the width of different infrastructure, taking into account the conditions that are typical in Birmingham.

Table 2 provides a summary of the widths required by the elements that typically make up a cycle route. Because of the need for greater separation as traffic speeds and volumes increase, the table includes options for higher speed roads, and also for roads with high frequency of buses or HGV traffic. The widths for off-carriageway surfaces refer to usable width bearing in mind additional clearance required for vertical features such as walls and traffic sign poles. The widths for on carriageway refer to distances to middle of the white lines.

**Table 2: Widths of Infrastructure**

| Design feature | Desired width | Minimum acceptable width* | Notes |
|---|---|---|---|
| **Cycle Tracks and Footways** | | | |
| Green Route or canal towpath (two-way shared with pedestrians) | 2.5m unsegregated<br>3.0m segregated | 2.0m | Width of 2.5m used in some public open space to help reduce cycle speeds and visual impact. Canal towpaths around Birmingham are typically constrained by adjacent structures so ideal width seldom possible. |
| Footway (pedestrian only space or pedestrian side of segregated facility) | >2.0 | 1.8m | Footways in busy areas require additional width where possible to offer a good level of service. |
| Unsegregated footway/cycle track (2-way) within highway with full kerb height to carriageway | 3.0m | 2.0m | 2.0m only acceptable in lightly used areas with little pedestrian activity or at a pinch point. Buffer zone of 0.5m required adjacent to car parking. |
| Cycle only track (or cycle side of segregated facility) | 2.0m | 1.5m | It is important that there is sufficient width to overtake/ride two abreast especially where it is impossible to leave the facility due to level difference or kerbed barrier. |
| Hybrid (terraced) 1 way track adjacent to carriageway and footway | 2.5m | 1.5m | It is important that there is sufficient width to overtake/ride two abreast especially where it is impossible to leave the facility due to level difference or kerbed barrier. |

| **Design feature** | **Desired width** | **Minimum acceptable width*** | **Notes** |
|---|---|---|---|
| **Cycle Lanes** | | | |
| Advisory cycle lane with flow | 1.8m | 1.25m | 1.3m lane can typically be used on one side of a standard 7.3m carriageway where speed limit is 30 mph. 1.5m lane usually adequate within 30mph roads.<br><br>1.25 acceptable for nearside advisory lead in lane to advanced stop line if available width is restricted. |
| Mandatory cycle lane with flow | 2.0m | 1.25m | 2.0m lane allows sufficient space for overtaking or riding two abreast within the lane on roads with higher traffic speeds/flows. |
| Contraflow cycle lanes (advisory or mandatory) | 2.5m | 1.5m* | *flows <1500 vehicles per day, average speed <25mph |
| Protected mandatory cycle lane (Light segregation) | 2.3m | 1.8m | Includes 0.3m to accommodate separation feature. |
| **All Purpose Traffic Lanes** | | | |
| Traffic lane (cars only, speed limit 20/30mph) | 3.0m | 2.75m | 2.5m only at offside queuing lanes where there is an adjacent flared lane |
| Traffic lane (bus route or >8% HGVs, or speed limit 40mph) | 3.25m | 3.0m | 3.65m width on routes not used by cyclists such as flyovers and underpasses. |
| 2-way traffic lane (no centre line) between advisory cycle lanes | 5.5m | 4.0m | Only where 12 hour flow <4000 vehicles and/or peak hour <500 vehicles with minimal HGV/Bus traffic. |

| **Design feature** | **Desired width** | **Minimum acceptable width*** | **Notes** |
|---|---|---|---|
| **Other Features** | | | |
| Bus Lane shared with cyclists | 4.5m | 3.0m | |
| Buffer Zones and Verges (kerb segregation feature, hatched area where cycle facility adjacent to parking bays, verge between cycle track and carriageway with 40mph+ speed limit) | >0.5m | 0.5m | Increased separation required where traffic speeds and volumes are greatest. |
| Central reserve at uncontrolled crossing | >2.5m | 2.0m | Typical bicycle length is 1.8m |
| Car parking bay | 2.0m | 2.0m | |
| Disabled parking bay | 2.7m | 2.0m | |
| Loading bay | 2.7m | 2.7m | Minimal width must be achieved for bay to be enforceable. |
| Street furniture (sign poles, lamp columns etc) distance from kerb | Locate off the cycle track or footway | 0.5m | Street furniture should not be placed within cycle tracks and footways if possible. |

**The minimum widths should not be used on steep gradients where slow moving uphill cyclists require additional width for balance and control and fast moving downhill cyclists require additional clearance from objects and other users.*

## Improving conditions on existing highways

The design sections of this document set out some of the ideal solutions for new build schemes and for redesigning whole streets.

Site-specific and budget constraints generally make it difficult to achieve the ideal cycling facility on existing roads. The designer may need to look at identifying parallel routes on quieter roads, opportunities to exclude HGV traffic or to reduce the volume of traffic. Such interventions could include (but are not limited to):

- Reduce vehicle capacity by removing vehicular lanes in order to increase available highway width for cyclists.
- Limit use by large vehicles in order to achieve narrow lane running for general traffic
- Inset, remove or relocate parking and loading bays
- Inset bus stops
- Make links one-way (but retain 2 way cycling)
- Alter or narrow footway configurations as appropriate
- Introduce shuttle working
- Reduce vehicle speed limits or install traffic calming such that links require less segregated cycling infrastructure
- Reduce vehicle volumes through point closures and 'filtered permeability' such that links require reduced specific cycling infrastructure
- Mixed provision along a given link such that it transitions between different cycle link types as appropriate.

Table 3 below sets out the options for allocating carriageway space over the range of highway widths and conditions typically encountered within Birmingham.

**Table 3: Cycle Facilities within Carriageways (see also Appendix A for larger version)**

| | | Below 5.5m | 5.5-6.0m | 6.0-6.5m | 6.5-7.0m | 7.0-7.5m | 7.5-8.0m | 8.0-8.5m | 8.5-9.0m | 9.0-9.5m | 9.5-10.0m | 10.0-10.5m | 10.5-11.0m | 11.0-11.5m | 11.5-12.0m | 12.0m and above |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GENERAL (INC LOCAL CENTRES) | BUSY | Unlikely scenario | Centre marking only | | Centre marking only, consider narrow hatching at widths approaching 7.0m | Centre hatching and 3.0m lanes | Centre hatching and 3.0m lanes OR 2.0m ghost island and 2.75m lanes if heavy right turns | 2.0-2.5m ghost island and 3.0-3.25m lanes | | 2.5m ghost island and 3.25m lanes | Consider other options to avoid overly-wide traffic lanes - eg parking lay-bys, cycle lanes, central medians, wider footways | | | | | |
| | QUIET | Omit centre marking | Centre marking only | Centre marking only, consider narrow hatching at widths approaching 6.5m | Centre hatching and 2.75m lanes | Centre hatching and 2.75m or 3.0m lanes | Centre hatching and 3.0m lanes OR 2.0m ghost island and 2.75m lanes | 2.0-2.5m ghost island and 3.0-3.25m lanes | | Consider other options to avoid overly-wide traffic lanes - eg parking lay-bys, cycle lanes, central medians, wider footways | | | | | | |
| CYCLE LANES | BUSY | No cycle lanes | No cycle lanes | No cycle lanes | Consider centre hatching options to create 'virtual' cycle lanes | Consider centre hatching options to create 'virtual' cycle lanes, possible narrow cycle lead-in to ASL in one direction only | Consider centre hatching options to create 'virtual' cycle lanes, or 1.5m cycle lane in one direction | Consider centre hatching options to create 'virtual' cycle lanes, or 1.8m cycle lane in one direction | 1.3m advisory lanes in both directions or wider lane in one direction only | 1.5m cycle lane and 3.0m traffic lane both ways | 1.8m cycle lane and 3.0m traffic lane both ways | 1.8m cycle lane and 3.25m traffic lane both ways | 1.8m cycle lane and 3.0m traffic lane both ways with centre hatching | 1.8m cycle lane and 3.0m traffic lane both ways, with centre hatching, or narrower lanes with 2.0m ghost island | 1.8-2.0m cycle lane and 3.0-3.25m traffic lane both ways, with 2.0-2.5m ghost island | |
| | QUIET | No cycle lanes | No cycle lanes | Consider centre hatching options to create 'virtual' cycle lanes | Consider centre hatching options to create 'virtual' cycle lanes, possible narrow cycle lead-in to ASL in one direction only | Consider centre hatching options to create 'virtual' cycle lanes, or 1.5m cycle lane in one direction | Consider centre hatching options to create 'virtual' cycle lanes, or 1.8m cycle lane in one direction | 1.3m advisory lanes in both directions or wider lane in one direction only | 1.5m cycle lane and 2.75m traffic lane both ways | 1.8m cycle lane and 2.75m traffic lane both ways | 1.8m cycle lane and 3.0m traffic lane both ways | 1.8m cycle lane and 2.75m traffic lane both ways with centre hatching | 1.8m cycle lane and 2.75-3.0m traffic lane both ways with centre hatching, or narrower lanes with 2.0m ghost island | 1.8-2.0m cycle lane and 2.75-3.0m traffic lane both ways with 2.0-2.5m ghost island | | |
| BUS LANES | BUSY | No bus lanes | No bus lanes | No bus lanes | No bus lanes | No bus lanes | No bus lanes | No bus lanes | No bus lanes | 3.0m bus lane if cyclists in opposite direction can be accommodated off-c/way** | 3.0m bus lane, ideally cyclists in opposite direction should be accommodated off-c/way** | 3.0m bus lane, cyclists in opposite direction accommodated off-c/way OR with wide lane containing cycle symbols** | 3.0m bus lane with 1.5m cycle lane in opposite direction** | 3.25m bus lane with 1.5-1.8m cycle lane in opposite direction** | 3.5m bus lane, 3.0-3.25m traffic lanes, 1.8m cycle lane** | Wide bus lane in one direction OR 3.0m bus lane in one direction with centre hatching OR 3.0m bus lanes both ways** |
| | QUIET | Bus lanes unlikely to be justified on quieter roads | | | | | | | | | | | | | | |
| | | | | | | | | | | ** Note - Traffic lane adjacent to a bus lane can be reduced to 2.75m if there is not a significant proportion of HGVs. | | | | | | |
| DUAL C/WAY | BUSY (above 1200-1400veh/hr) | Unlikely scenario | Unlikely scenario | Two lanes with centre line marking only | Wide inside lane with cycle symbols along channel | Wide inside lane with cycle symbols along channel, consider narrow cycle lanes esp at lead-in to ASLs | 1.5m cycle lane with two 3.0m traffic lanes | 1.5-1.8m cycle lane with two 3.0-3.25m traffic lanes, consider buffer or light segregation | 1.8-2.0m cycle lane with two 3.0-3.25m traffic lanes, with buffer or light segregation | | Consider other options to avoid overly-wide traffic lanes - eg parking lay-bys, bus lanes, or wider footways / central reserves | | | | | |
| | BUSY (below 1200-1400veh/hr) | Unlikely scenario | Unlikely scenario | Convert inside lane to bus lane (3.25m preferred if off-peak parking), with one 3.0-3.25m traffic lane | Convert inside lane to bus lane 3.25-3.5m, with one 3.0-3.25m traffic lane | Convert inside lane to bus lane up to 4.5m wide with traffic lane up to 3.5m wide, consider advisory cycle lane within bus lane | | Convert inside lane to bus lane 3.0-3.5m, with 3.0-3.25m traffic lane and separate cycle track on inside, consider buffer or light segregation | | Bus lane 3.0-3.5m, with two 3.0-3.25m lanes, OR 3.5m bus lane and one traffic lane and separate cycle track on inside with buffer or light segregation | | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario |
| | QUIET | Unlikely scenario | Convert inside lane to cycle lane with buffer OR 2.0m parking bay with wide single lane inc cycle symbols | | Convert inside lane to 2.0m parking bay and 1.5-1.8m cycle lane, with one 3.0m traffic lane | Convert inside lane to 2.0m parking bay and 1.5-1.8m cycle lane with buffer or light segregation, and one 3.0m traffic lane | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario | Unlikely scenario |

*Notes:*

*'Busy' refers to A Roads, or to B (and occasionally Unclassified) Roads with significant number of buses or HGVs.*

*'Quiet' refers to most Unclassified Roads, or to 'B' Roads with few buses or HGVs.*

*If parking is retained then deduct 2.0m from overall c/way width (or 4.0m for parking both sides), plus width of buffer zone 0.5-1.0m if desired.*

*Information shown is for guidance only and designers should still consider local conditions and carry out stakeholder and public consultations on any proposals.*

*Any lane widths less than those shown in the table would require agreement with the Traffic Manager.*

## Facility selection in relation to traffic speeds and volumes

A choice of design options is available on any particular connection notwithstanding physical constraints, budget and operational requirements of the wider network. The designer may choose to integrate cyclists with motor traffic on the carriageway, or look to separate them from other users by providing cycle tracks within the highway or by creating a completely separate route away from the highway.

**Table 4: Flow / Speed Table:**

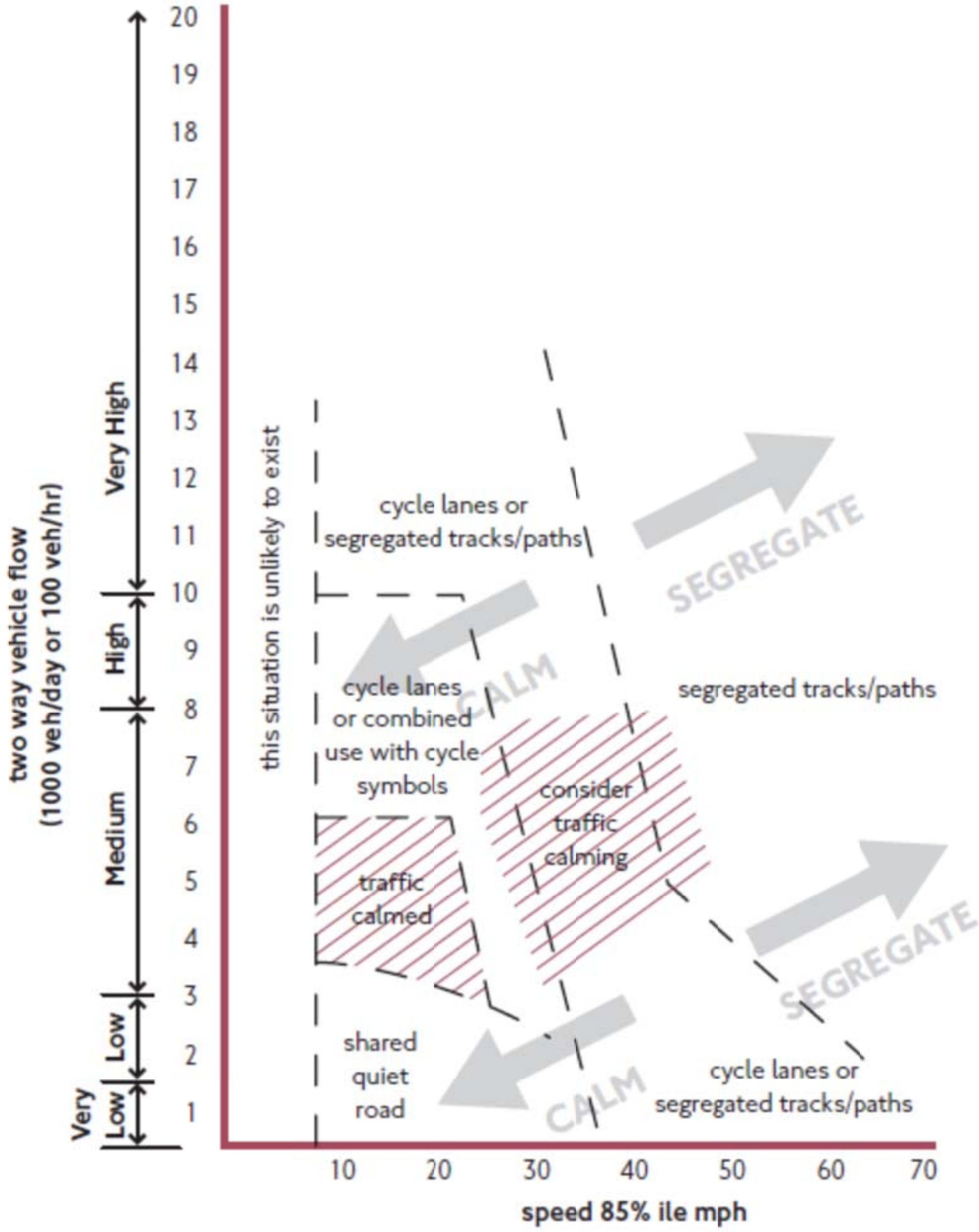
| Flow | 85th percentile speed | | | |
|---|---|---|---|---|
| | **<20 mph**<br>**Very Low** | **20 to 30 mph**<br>**Low** | **30 to 40 mph**<br>**Medium** | **>40 mph**<br>**High** |
| **Very Low**<br>**Less than 1,500 vpd,**<br>**or 150 vph** | Quiet Street | Quiet Street | Cycle lanes | Cycle lanes or tracks |
| **Low**<br>**1,500-3,000 vpd,**<br>**or 150-300 vph** | Quiet Street | Quiet Street or Shared Use | Cycle tracks or lanes | Cycle lane or tracks |
| **Medium**<br>**3,000-8,000 vpd,**<br>**or 300-800 vph** | Cycle tracks or lanes | Cycle tracks or lanes | Cycle tracks or lanes | Cycle tracks |
| **High**<br>**8,000-10,000 vpd,**<br>**or 800-1,000 vph** | Cycle tracks or lanes | Cycle tracks or lanes | Cycle tracks or lanes | Cycle tracks |
| **Very High**<br>**Greater than**<br>**10,000 vpd** | Cycle tracks or lanes | Cycle tracks or lanes | Cycle tracks or lanes | Cycle tracks |

Source: *Adapted from London Cycle Design Standards (TfL, 2005)*

*Notes:*

1. *vpd = number of motor vehicles in a 24 hour weekday.*
2. *vph = typical number of motor vehicles in a typical morning peak hour.*
3. *Where traffic speed/flow is low, the designer should aim to avoid the use of signs or markings specifically for cyclists.*
4. *Cycle lanes used in the higher speed/flow situations should provide good separation between cyclists and motorists. Wide cycle lanes or hatching can help here.*
5. *In congested areas, cycle lanes can be useful even when traffic speed is low.*

In general, where there is a high volume of traffic or fast moving traffic, it is advantageous to separate cyclists from motor traffic or undertake traffic management measures to reduce the volume and speed of traffic (see Figure 5).




**Notes:**
1. Each route will need to be judged in the light of its specific situation
2. Cycle lanes or tracks will not normally be required in traffic calmed areas
3. Congested traffic conditions may benefit from cycle lanes or tracks
4. Designs should tend to either calm traffic or segregate cyclists

**Figure 5: Facility Selection (London Cycling Design Standards 2005)**

### Facility selection in relation to location

There are places on relatively high flow roads within city and district centres that also have a lot of pedestrian activity e.g. Broad St, Harborne and Kings Heath high streets.  The aim in these areas is to reduce traffic speeds as far as possible to enhance safety for pedestrians and cyclists. These areas usually include frequent crossings, side roads, on-street loading, busy bus stops, and in some cases kerbside car parking, all of which can make it difficult to provide any form of continuous cycle track or lane that gives any advantage to cyclists. They are sometimes called ‘mixed priority’ roads and streets.

Separate cycle facilities do not always work particularly well in such locations. Cycle lanes and tracks may be interrupted by bus stops, loading bays and parking. If kerbed facilities are installed to deter unlawful parking on a cycle track, this may act as a barrier or trip hazard for pedestrians.

An alternative way to better accommodate pedestrians and cyclists in district centres is through a combination of ‘de-cluttering’ to remove obstacles such as signs and other street furniture from footways, removing on street parking to widen the footway or formalising on-street parking into bays, reducing the carriageway width to single lane for through traffic and reducing speeds to 20mph. Local Transport Note 3-08, Mixed Priority: Practitioners Guide gives further advice on designs.

A ‘shared space’ approach using traffic calming measures and urban design helps to change the appearance and user behaviour, as in this example from Poynton, Cheshire where there are over 27,000 vehicles per day including 6% HGVs. The ultra-low-speed environment has helped to smooth the flow of traffic through the town so that the overall vehicle journey times have not increased. Because of the low speeds, motorists are more willing to stop to permit pedestrian crossing movements, even away from designated crossing points.

*Poynton: Removal of street clutter, use of textured central margin and side bars to visually narrow carriageway while still providing adequate width for HGVs. Cyclists use the all-purpose carriageway but can enter the footway at-grade to stop at shops etc.*

Birmingham City Council has identified the potential for extensive 20mph speed limits (see Figure 6), that would enable safer on-road cycling on residential roads and district shopping areas within the city. This is an important element of the cycling strategy because the way in which people use the streets changes significantly when traffic speeds are reduced. For cycling, 20mph roads may offer greater opportunities for quiet routes, exemptions from turning bans and unsegregated contraflow cycling, reducing the requirement for segregated cycling infrastructure.

*The Chamberlain Clock at the centre of the Jewellery Quarter is dominated by motor traffic in contrast to Seven Dials in London where traffic management and lower speed limits have helped to increase the number of pedestrians and cyclists and returned it to being a local focal point.*

In common with the core retail area in the city centre and local district centres, residential streets are also places where fully segregated facilities are of limited benefit. In new developments, there is some advantage in having separate cycle facilities that connect up culs de sac, making walking and cycling more attractive through the principle of 'filtered permeability'. This may also be desirable in older streets where through-traffic is a problem, by closing off an existing road but retaining a 'gap' for cyclists. Making areas less conveniently accessible to car traffic is an important part of encouraging more journeys on foot and by bicycle because this helps to ensure that there is a time advantage for cycling, as well as improving the safety and ambience of streets.

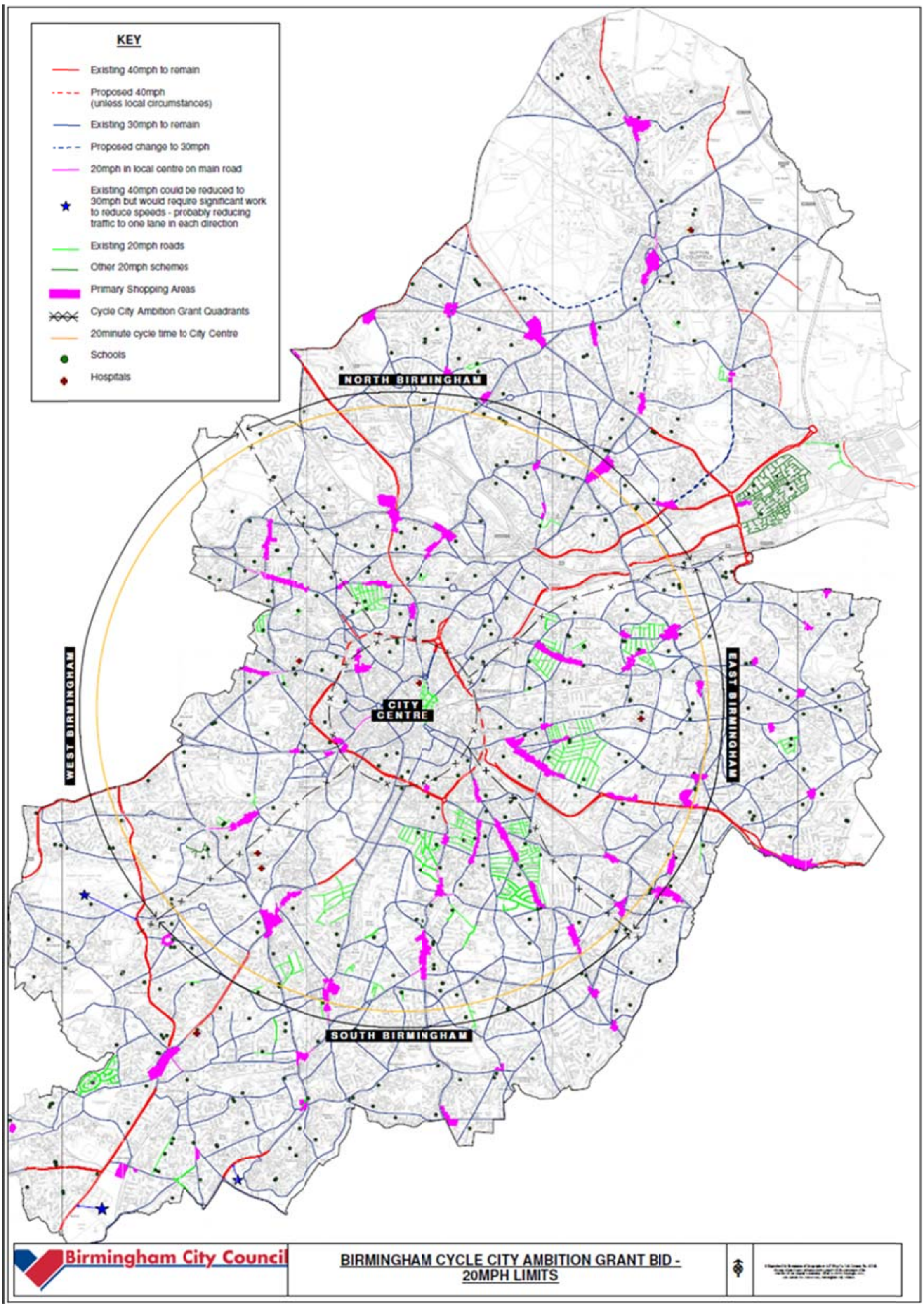



**Figure 6: Proposed 20mph areas**

The initial approach should always be to look at what measures can be introduced to address traffic speeds and flows on roads where this as part of the overall traffic management strategy for the city or locality, and then at what is the appropriate infrastructure for cycling. Failure to address strategic traffic management issues can result in expensive over-engineered cycle infrastructure that is unused because it is impossible to develop continuous safe facilities within existing traffic conditions.

Where the number of cyclists using a street exceeds the number of vehicles (e.g. Cheddar Rd on the Rea Valley route), it may be possible to introduce a 'cycle street' (similar in concept to a Home Zone), where the design of the street implies priority to pedestrians and cyclists.

*Textured paving, narrow carriageway, greenery and limited forward visibility used to create low speed areas with priority for non-motorised users while retaining capacity of on-street residential parking.* (DfT)

At the other extreme, roads and streets with few 'active frontages' (i.e. blank building walls or wide verges) tend to have higher speeds (regardless of the speed limit), relatively low pedestrian flows and few side roads and crossings. These areas are typically local distributor roads, parts of the ring road or sections of arterial roads running between local centres where 'movement' is the primary function. It is along these roads that segregation in the form of wide cycle lanes or cycle tracks is the most desirable form of provision for cyclists, including adequate separation at the busiest and most complex junctions.