3.3.4 Wayfinding

Wayfinding, or legibility, relates to how people can find their way around an area. For pedestrians and cyclists this is of particular importance as they are more likely to move through an area if the route is clear. There are many tools that designers can use to provide a series of design cues by which people can orientate themselves. For example, changes in building height and form, materials and finishes and landscape features. From a broader perspective designers should ensure that journeys through the network are relatively straightforward. In general:

- The more the orthogonal street layout the more legible it will be (as well as being the most connected).
- The network should be structured to draw people towards *Focal Points* such as *Landmarks*, *Gateways* and other civic buildings and spaces.

Figures 3.14 and 3.15 illustrate how legibility can be achieved with street networks by drawing people toward key destinations or *Focal Points*.

Figure 3.14: Poundbury, Dorchester, UK. The network of interconnecting streets directs people toward a central location, whilst also allowing for route choice (base map source: Google Earth).

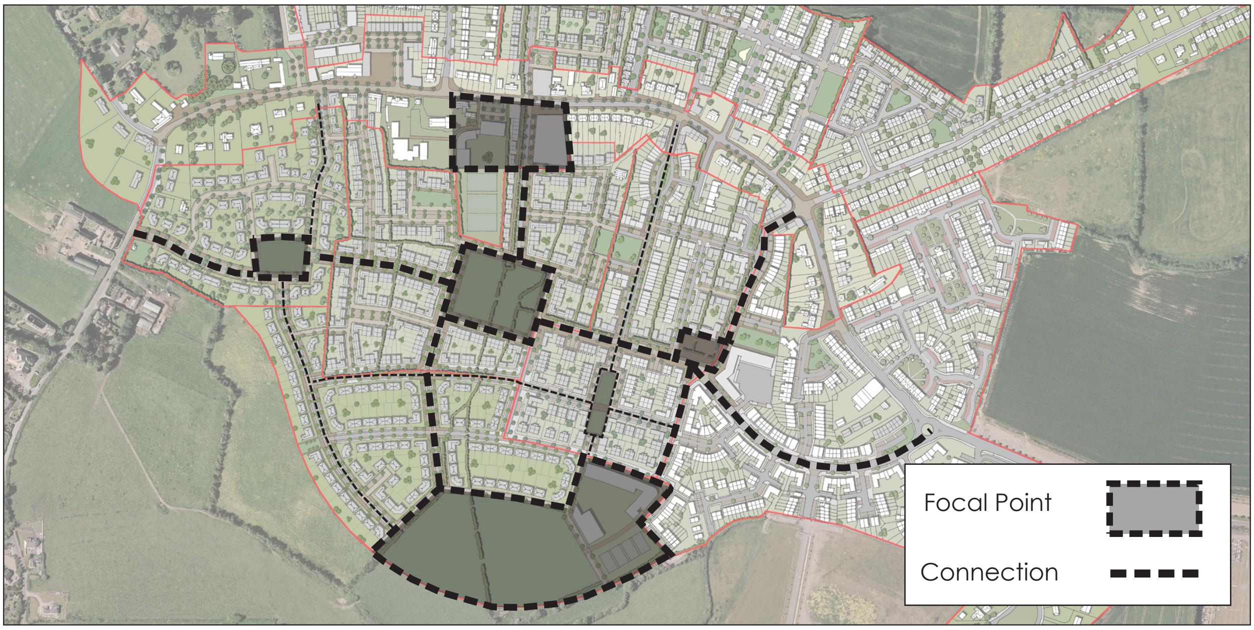


Figure 3.15: The Newcastle LAP (South Dublin County Council) illustrates how movement within the village is structured by connecting major Focal Points, which are also used to slow/discourage through traffic.

To Increase effectiveness the streets around *Focal Points* require a more individualised design response that highlights their high place value. These are further discussed below in relation to their implications for street design.

Landmarks and civic buildings and spaces

Landmarks are features that stand out from their surrounds and are valued by the broader community for their aesthetic and/or historic qualities. Examples include a tall or historic building, archaeological site or landscape feature. Civic buildings and spaces generally include local facilities such as areas of open space and buildings of civic importance. Areas of open space include parks, squares or plazas. Buildings of civic importance include a wide range of places such as schools, churches, hospitals and other institutions.

Designers should highlight these *Focal Points* by (see Figure 3.16):

- Ensuring that pedestrian facilities are adequate to cater for large number of visitors.

- Traffic is calmed using surface treatments and other elements that further highlight the importance of the place.

Gateways

Gateways are used to demarcate a point of arrival from one place to another. They are important placemaking tools as they form the 'first impression' of a place. *Gateways* are also an important traffic-calming tool as they can be used to inform drivers of a change in driving conditions ahead. Common forms of gateways in Ireland occur at the entrances to residential estates and on National Roads at approaches to villages.

To create an effective gateway that adds value to place designers should:

- Use elements of place such as landscape and built form to create a strong sense of enclosure (see Figure 3.17).

- Use material changes and street furniture as supplementary measures (see Figure 3.18).

Figure 3.16: Illustration of surface treatments in Dundalk, Co. Louth. These treatments enhance the sense of place by expanding the square into the adjacent streets and are an effective way of improving pedestrian mobility and calming traffic.

Figure 3.17: Example of a Gateway from Adamstown, Co. Dublin, where changes to the built form and landscaping treatments add to the sense of enclosure and create a formal entry point.

Transition Zones

A *Transition Zone* refers to an area that may be needed for slowing vehicles when entering an urban area from a faster moving road, such as from a rural road into a city, town or village or from a motorway into an integrated street network (see Figure 3.19). Designers should emphasise *Transitions Zones* by:

- Introducing measures that provide enclosure, such as large trees.
- Applying transitional geometric measures, such as the narrowing of carriageways.
- Applying changes to carriageway surfacing materials.

The length of a *Transition Zone* will largely be influenced by the required reduction in speed. Designers should also take into account how visible/prominent any subsequent *Gateway* is. If a *Gateway* is highly visible from a distance, a *Transition Zone* may not be necessary as drivers will instinctively be inclined to slow.

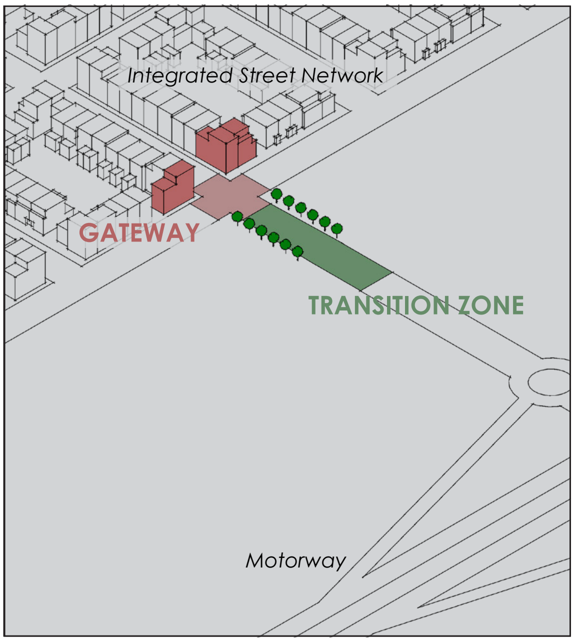


Figure 3.19: Illustration of a Gateway and Transition Zone that reinforces a large speed reduction when entering an integrated street network.

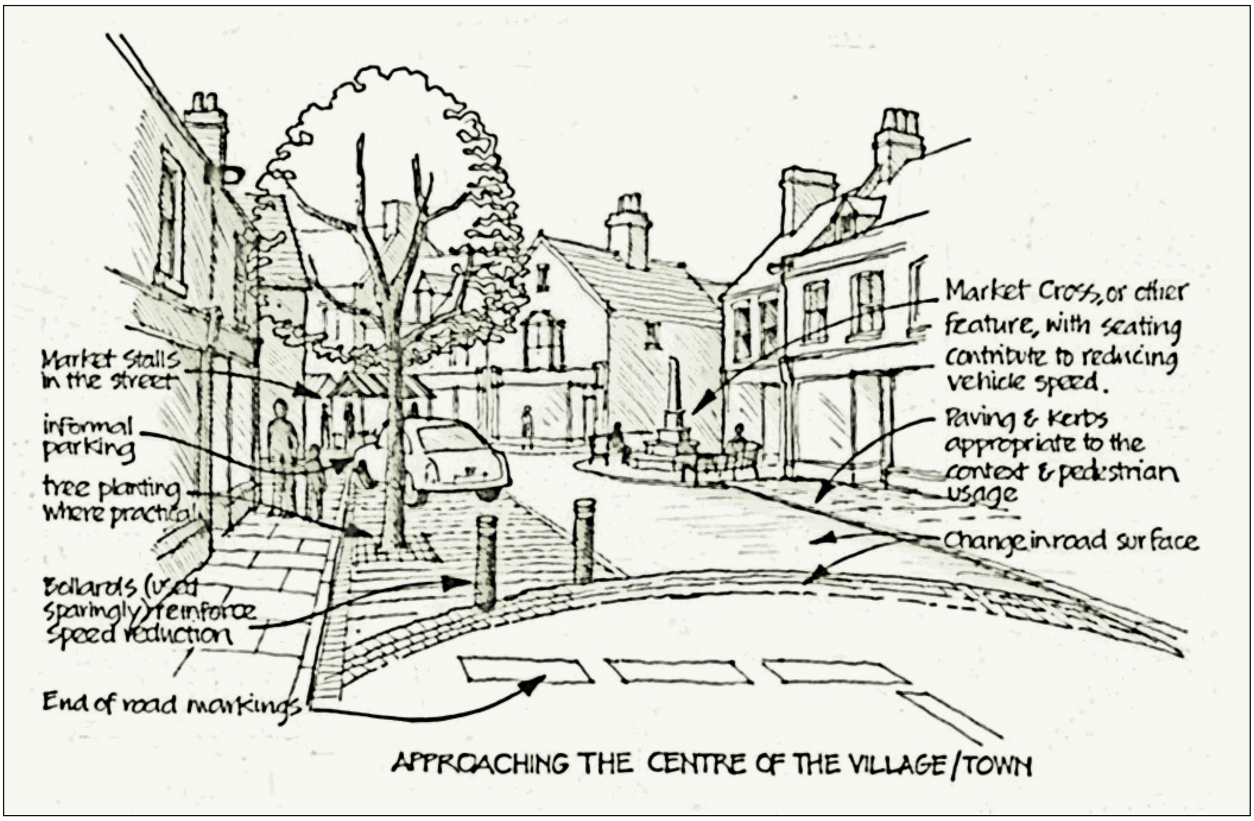


Figure 3.18: Image from Traffic in Villages (2011) showing a various number of gateway treatments designed to enhance the character of the village and calm traffic.

3.4 Management

3.4.1 Vehicle Permeability

Integrated networks do not require the same degree of restrictions to be placed on the movement of vehicles as is applied to more conventional/segregated networks. A network of integrated/self-regulating streets provides the framework for higher levels of accessibility for slow modes (including motor vehicles at slow speed) and strategic continuity for cross-network modes at more moderate speeds (such as public transport) as (see Figure 3.20):

- The slower nature of *Local* streets (i.e. 10-30 km/h) will result in them being less attractive to through traffic. Although trips through *Local* streets may be more direct (and therefore legible), the traffic-calmed nature of these streets may not necessarily result in significant advantages in overall journey times.

- Through traffic will be attracted to *Arterial/Link* streets where trips are more direct and are designed to cater for more moderate speeds (i.e. up to 50km/h).

- Public transport along *Arterial/Link* streets can be prioritised by measures such as *Quality Bus Corridors* and *Bus Lanes* (see Section 3.4.3 Bus Services).

There are a number of advantages to more permeable networks in regard to the management of traffic and vehicle speeds such as:

- Drivers are more likely to maintain lower speeds over shorter distances than over longer ones. As drivers are able to access individual properties more directly from *Access/Link* streets (where speeds are more moderate) they are more likely to comply with lower speed limits on *Local* streets (see Figure 3.21).

- Permeable layouts provide more frequent junctions which have a traffic-calming effect as drivers slow and show greater levels of caution.[7]

Figure 3.20: Examples from Adamstown, Co. Dublin. Through routes (top) are designed to cater for more moderate speeds and to prioritise public transport movement. Local streets (bottom) are slower moving, thus discouraging use by through traffic.

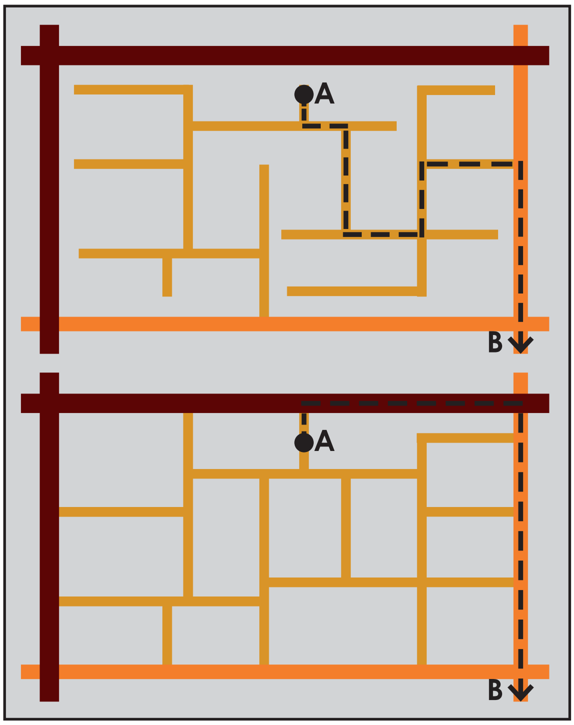


Figure 3.21: Drivers are more likely to comply with posted speed limits where less time is spent on streets with a low design speed (as per the bottom example)

7 Refer to *Whose Street is it Anyway? Redefining Residential Street Design* (2006).

- Increasing access to neighbourhood cells can result in the more equitable distribution of traffic and the impacts of congestion as it is no longer concentrated on a few select junctions or local access streets (see Section 3.4.2 Traffic Congestion) and noise and air pollution (see Section 3.4.5 Noise and Air Pollution).

- The value of place can also be improved as slower moving traffic has less impact on the surrounding environment (see Section 3.4.5 Noise and Air Pollution).

- Frequent entrances to a neighbourhood cell can reduce the size of individual junctions and streets. This will reduce the potential for severance between communities and increase pedestrian/ cyclist mobility as streets/junctions are more compact and easier to navigate.

Designers may be concerned that more permeable street layouts will result in a higher rate of collisions. However, research has shown that there is no significant difference in the collision risk attributable to more permeable street layouts in urban areas and that more frequent and less busy junctions need not lead to higher numbers of accidents.[8]

The degree to which permeability is provided for different transport modes can be categorised into four types (see Figure 3.22):

- *Dendritic Networks* which place significant restrictions on movement for all users.

- *Open Networks* which allow full permeability for all users.

- *3 way Off-Set Networks* which contain a large proportion of 3 way junctions.

- *Filtered Permeability* networks which allow full permeability to some users whilst placing greater restrictions on others.

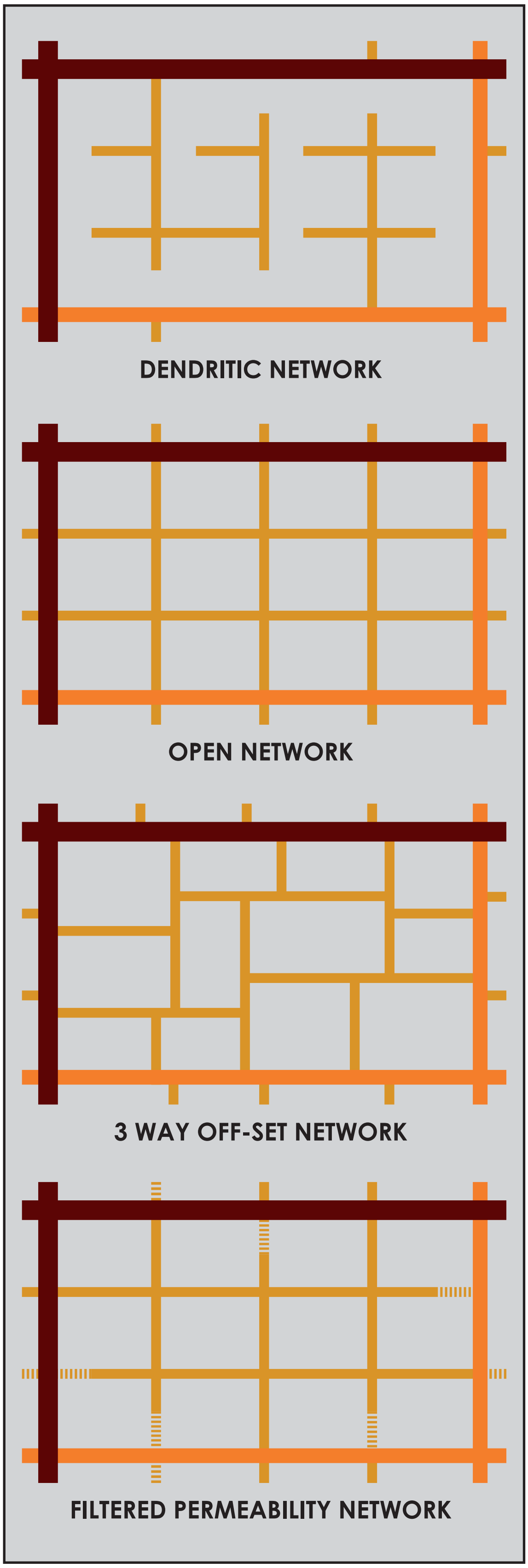


Figure 3.22: Types of Street Network identified within Road Safety Planning: New tools for Sustainable Road Safety and Community Development (2007).

8 Refer to *Whose Street is it Anyway? Redefining Residential Street Design* (2006) and 'Safenet' analysis *Manual for Streets: Evidence and research* (2007).

Designers should avoid the creation of *Dendritic* networks which place heavy restrictions on movement. The use of cul-de-sacs that do not allow through access for users should be restricted throughout any network (see Section 3.3.2 Block Sizes).

Open Networks place few restrictions on the permeability of users. They are best suited to contexts where maximum accessibility is desirable for all users such as within *Centres*. *Open Networks* may also be desirable in *Business Parks/Industrial Areas* to allow more efficient access for commercial vehicles.

3 Way Off-Set Networks allow through movement for all modes, however, they discourage faster modes by requiring vehicles to slow, stop and/or change direction repeatedly when travelling along *Local* streets. Such networks are suitable to all contexts, but there are limitations to their overall effectiveness. The use of multiple junctions off-sets can reduce legibility. This can discourage walking/cycling as the network is difficult to navigate and the route unclear (as well as increasing journey times). It can also result in driver frustration, as noted above.

Filtered Permeability Networks, which restrict universal permeability, may be applied where designers are seeking to prioritise the movement of more sustainable modes (i.e. pedestrians, cyclists and public transport) over private vehicles. For example bus gates and other measures, may also be used to prioritise bus movements, particularly in *Centres* (see Section 3.4.3 Bus Services). The limited use of vehicular cul-de-sacs may be considered in *Neighbourhoods* and *Suburbs* where there is a particular concern regarding through traffic.

The use of vehicular cul-de-sacs to enforce *Filtered Permeability* networks should be approached with caution. Their overuse can result in many of the negatives associated with Dendritic networks being replicated. Additional design measures should be applied to ensure that pedestrian and cycle links are not perceived as 'anti social spaces'. Links should maintain clear sight lines and be overlooked by development (see Figure 3.23).

Figure 3.23: Examples of vehicular cul-de-sacs in Adamstown, Co. Dublin, which allows for through pedestrian and cyclist access only and has incorporated design measures to ensure that it is safe (i.e. clear sightlines and passive surveillance).

Within existing networks, pressure is often applied from local communities to create vehicular cul-de-sacs. Designers should approach such requests with caution, as street closures will often simply shift the problem elsewhere.

One-way streets have also been widely implemented, retrospectively, in order to filter vehicle permeability and relieve traffic congestion. The use of one-way systems for traffic management should also be approached with caution by designers as they:

- Promote faster speeds as drivers are likely to drive faster when no risk is perceived from oncoming traffic.
- Will result in longer vehicular journeys, including those for cyclists and public transport.
- Can be confusing for users when they deflect people away from destinations.
- Require additional signage.

Conversion to one-way systems may be beneficial on narrow carriageways where the street reserve is limited in order to provide additional space for pedestrians, cyclists and other public realm improvements. Counter flow cycle lanes should also be considered in order to maintain permeability for cyclists Examples include Centres where the implementation of a one-way system has direct placemaking benefits as it allows for additional footpath width and/or on-street parking (see Figure 3.24).

The key to network design is balance. An optimal approach to network design is to start from the position of an *Open Network*. This will provide for the development of a robust network that can evolve over time to meet the changing needs of a place. Parts of the network may then be refined by incorporating elements of *Filtered Permeability Networks* and *3 Way-Off Set Networks* according to local conditions and where there are clear benefits in terms of prioritising more sustainable modes of transport, improving safety and reducing energy consumption.

Figure 3.24: Example from Drogheda, Co. Louth, of narrow street that was converted from a two-way system to a one way system to facilitate a series of improvements within the town centre that calm traffic, expand the pedestrian domain and strengthen the sense of place.

3.4.2 Traffic Congestion

A primary function of all transport policies has been to reduce the waste of resources caused by congestion. National and regional transport policies and plans have recognised that it is not feasible or sustainable to accommodate continued demand for car use. In contrast, sustainable modes (walking, cycling and public transport) can cater for very high volumes of movement in a far more efficient manner (see Figure 3.25). Policies and plans, therefore, promote sustainable modes of travel and acknowledge that, in the absence of demand management, a certain level of car congestion is inevitable.

One of the outcomes of a more connected, traffic-calmed network will be reduced car dependency and increased use of more sustainable modes of transport. This is the most balanced way of addressing traffic congestion. Higher levels of connectivity for all users will also enable greater vehicular permeability, albeit at slower speeds. The benefits of this approach include:

- Slower vehicle speeds are often perceived to be a cause of congestion but can lead to increased traffic capacity (see Figure 3.26).
- More frequent minor junctions with fewer vehicle movements calm traffic and are easier for pedestrians and cyclists to navigate.

Within urban networks, delay and congestion overwhelmingly occur at junctions. Segregated networks channel traffic towards fewer junctions and this can locally concentrate the negative impacts of traffic, resulting in large junctions where bottlenecks occur (see Figure 3.27). The design of junctions has traditionally prioritised the minimisation of vehicular queuing and delay. As a result pedestrians can face significant delays. This is also evident in the various computer programs used to analyse junction design, which have the calculation and minimisation of vehicular queuing and delay as their primary outputs. Designers will often seek to provide junctions that operate below 90% capacity as measured by the ratio of flow to capacity (RFC).

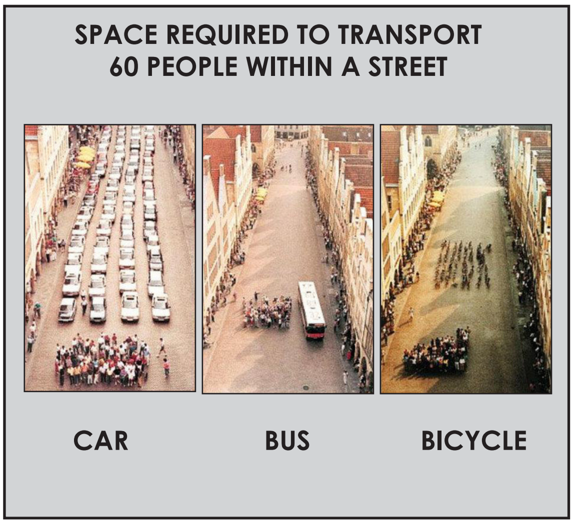


Figure 3.25: Illustration of the amount of space required to transport the same number of people via different modes of transport (image source: Munster Planning Office, Germany)

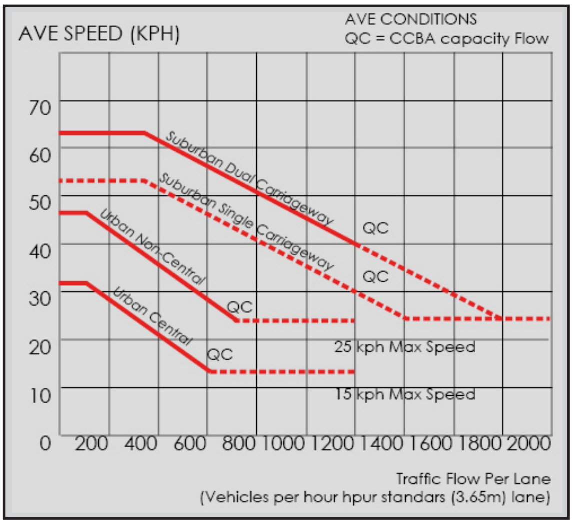


Figure 3.26: Extract from the Traffic Management Guidelines (2003) showing Traffic flow capacity increasing as speed reduces.

Smarter Travel (2009) requires greater priority to be given to the movement of pedestrians in order to facilitate more sustainable travel patterns. This includes the reprioritisation of traffic signal timings (both new and existing) to favour pedestrians and cyclist instead of vehicles and to reduce pedestrian crossing distances[9] (see Section 4.3.2 Pedestrian Crossings and 4.4.3 Junction Design).

The creation of more compact junctions that minimise pedestrian and cyclist waiting times, will place additional pressures on junction performance. In areas where pedestrian activity is high (such as in *Neighbourhoods* and *Centres*) junctions may have to operate at saturation levels for short periods (i.e. above 93% during peak periods). Where junctions operate at or near saturation levels and they are frequented by bus services, priority measures should ensure services are not unduly delayed (see Section 3.4.3 Bus Services). Where longer periods of saturation occur, pedestrian cycle times may be extended. This should be done in preference to the implementation of staged/staggered crossings (see Section 4.3.2 Pedestrian Crossings).

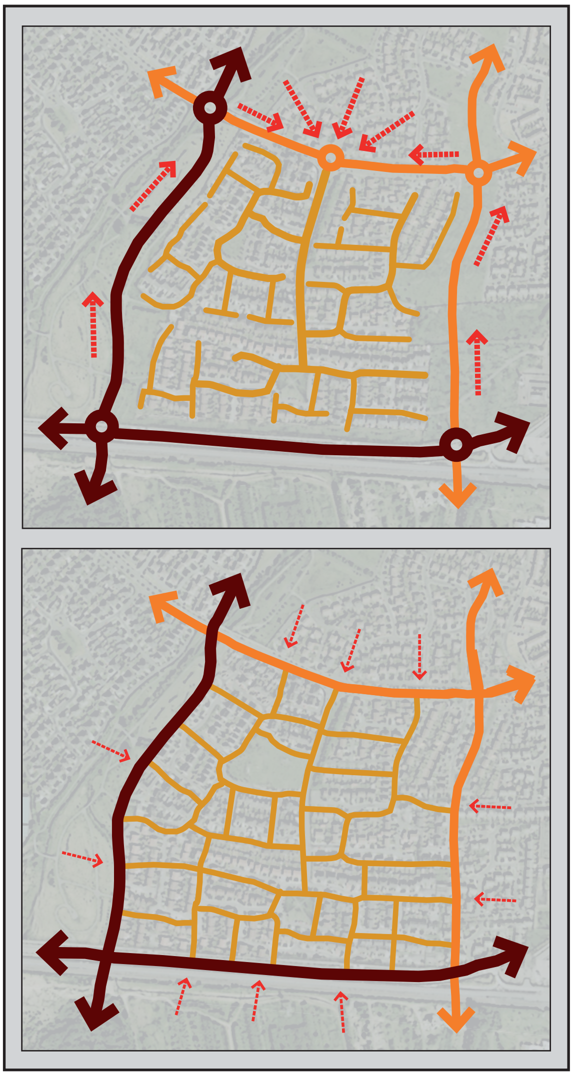


Figure 3.27: Highly segregated 'cell and distributor' networks channel faster moving traffic to large junctions where bottlenecks may occur (left). More permeable networks result in more frequent minor junctions with fewer vehicle movements (right) which calm traffic and are easier for pedestrians and cyclists to navigate.

9 *Refer to Action 16 of Smarter Travel (2009).*

3.4.3 Bus Services

Street networks underpin the efficiency and sustainability of public-transport and, consequently, the ability to facilitate higher development densities along public transport corridors in accordance with the objectives of *Smarter Travel* (2009). This includes an objective that all houses within urban areas are located within 800m of a bus route/ stop.[10] Permeable networks which maximise connectivity will assist in achieving this objective. *Smarter Travel* (2009) also requires the implementation of bus priority measures,[11] such as *Quality Bus Corridors* and *Bus Lanes*. These ensure that buses can move through congested networks with minimal delays.

Designers must have regard to the location of bus services as a strategic network issue. In general:

- Bus services should primarily be directed along *Arterial* and *Link* streets as these will be the most direct routes with between destinations with the greatest number of connections.
- QBCs or *Green Routes* should be provided on streets which cater for higher frequency services[12] over longer distances (see Figure 3.28).
- On lower frequency routes, or in less congested networks, bus lanes that allow buses to move towards the front of queuing traffic at junctions may suffice. This approach may also be preferred on existing streets where the street reserve is constrained.

Designers should consult with bus operators regarding the need for dedicated lanes. Under-used or unnecessary lanes can serve only to increase the width of carriageways (encouraging greater vehicle speeds) and consume space that could otherwise be dedicated to placemaking/traffic-calming measures such as planted verges, wider footpaths, cycle tracks or lanes and on-street parking.

Designers should also consider the use of bus gates (see Figure 3.29) and selective bus detection technology that prioritise buses to improve journey times by restricting other motorised vehicles. These should be strategically placed throughout a network, and in particular within *Centres*, to filter permeability and ensure more rapid movement for buses.

10 Refer also to Action 13 of *Smarter Travel* (2009).
11 Refer to Action 12 of *Smarter Travel* (2009).
12 Refer to *Bus Connects* (NTA) for further information on service frequency.

Figure 3.28: QBCs and Bus lanes should be considered on all Strategic Routes where the high frequency services occur or where their future need has been established.

Figure 3.29: Example of a 'bus gate' in Tallaght, Co. Dublin, which filters permeability to allow for the free passage of buses whilst excluding other vehicles.

3.4.4 Relief Roads

The focus of this Manual is the creation of place-based/sustainable street networks, which balance pedestrian and vehicle movement. However, it is recognised that there are some roads which are required to cater for the efficient movement of larger volumes of motorised traffic at faster speeds over longer distances. These are generally referred as *Inner Relief Roads* and *Urban Relief Roads*.[13]

Inner Relief Roads are generally used to divert traffic within an urban area, away from a *Centre* or *Node*. The design of these routes needs careful consideration. Chapter 2 highlights the issues associated with the provision of higher speed/highly segregated routes though cities, towns and villages. Authorities in many urban areas have attempted to overcome issues of severance by vertically separating these routes into a series of tunnels, cuttings or elevated carriageways. Such solutions, however, tend to be reserved for major national projects and can have significant negative impacts on place (see Figure 3.30).

It is more likely that *Inner Relief Roads* through urban areas will need to occur at moderate speeds (50 km/h). The route should be integrated within the urban fabric so that a sense of place is maintained and to prevent severance between adjoining areas. There are many examples in Ireland of streets that carry significant volumes of through traffic at moderate speeds and retain a high place value/levels of connectivity (see Figure 3.31). Successful solutions tend to be designed as boulevards with well planted medians and verges that provide a buffer between the heavily-trafficked carriageway and the surrounding pedestrian environment. Boulevards may also be designed as a 'multiway' boulevard with a central carriageway for through traffic and access carriageways at the side (see Section 3.4.5 Noise and Air Pollution).

Figure 3.30: Examples of major urban roads that move large volumes of traffic via vertical segregation. These require significant investment in infrastructure. As illustrated in the middle and bottom examples they can have negative impacts in terms of place and/or connectivity (image sources: Google Street View).

Figure 3.31: Dorset Street, Dublin, an example of a street that carries large volumes of traffic and where recent improvements have ensured it maintains an important place function.

13 See DN-GEO-03031 Rural Road Link Design (2017).

Urban Relief Roads are generally routed around urban areas and are commonly referred to as *By-Passes* or *Outer Ring Roads*. Designers may use these routes to direct longer distance traffic, and in particular Heavy Goods Vehicles (HGVs), away from cities, towns and villages provided they are clearly separated from the urban fabric (see Figure 3.32). Urban development should not extend to the edge of these routes without full integration into the surrounding street network. This is a strategic issue that should be resolved via a County Development Plan/ Local Area Plan (see Figure 3.33) and may also require close consultation with TII, where the road is part of the national road network.[14] In the case of a motorway or national grade separated dual carriageway the future integration of the road would not be an option.

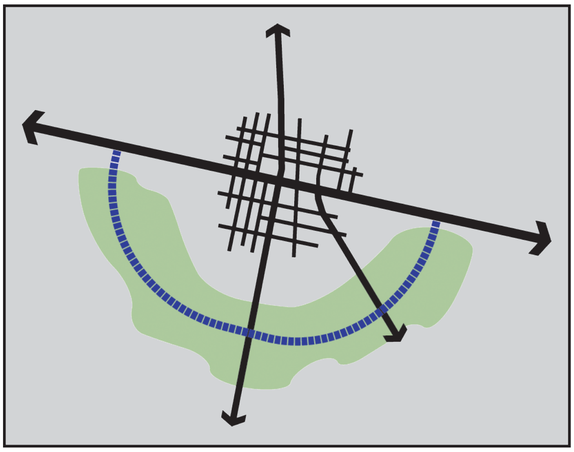


Figure 3.32 Outer Relief Roads can be used to direct long distance traffic away from cities, towns and villages

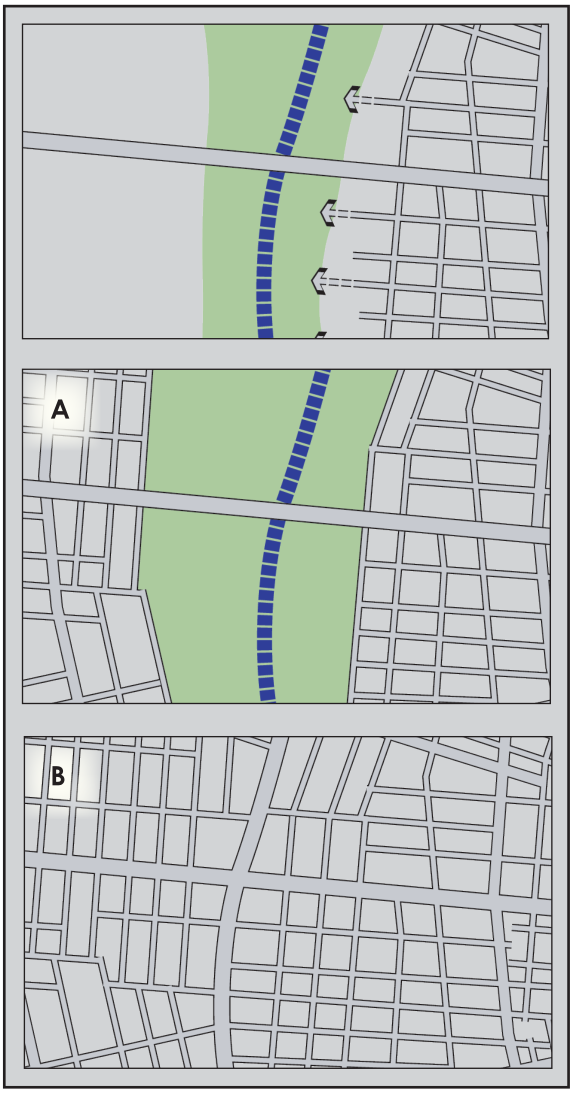


Figure 3.33: As urban expands toward an *Urban Relief Road (top) a strategic decision will need to be made as to either maintain segregation and 'leapfrog' leaving a green belt (middle), or moderate speed, retrofit and integrate route (bottom).*

14 Refer to *Spatial Planning and National Roads: Guidelines for Planning Authorities* (2012).

3.4.5 Noise and Air Pollution

The primary source of widespread environmental noise in Ireland is road traffic. Traffic is also the main source of air pollutants in cities, towns and villages. Whilst air pollutants generally have declined in recent years, those pollutants associated with traffic have not, principally because of an increase in traffic volumes and congestion.[15] Busy or congested roads can create pollution 'hot-spots' and can have a significant negative impact on adjacent street activities. Pollution can also seriously affect the attractiveness of walking and cycling along affected routes.

The main factors which determine the level of road noise and air pollution are traffic volume, speed, levels of congestion and the proportion of HGVs. Many of these issues may be substantially addressed by directing large volumes of traffic (and in particular HGVs) away from cities, towns and villages via *Urban Relief Routes* (see Section 3.4.4 Relief Roads) and by reducing speeds (see Table 3.2). The creation of a permeable street network which promotes walking, cycling and public transport will also lead to reductions in vehicular traffic and less concentration of traffic and consequently of noise and air pollution.

It is inevitable that some heavily-trafficked routes (such as *Arterial* streets) will pass through urban areas. Whilst traffic volume and noise have a significant impact on the value of place, there are many examples in Ireland of streets that carry significant volumes of through traffic at moderate speeds which retain a high place value (as per Figure 3.31 - Dorset Street). Whilst some mitigation measures can be provided through construction materials used on carriageway surfaces and within adjoining buildings, most integrated or place-based solutions should involve (see Figure 3.34):

- Apply boulevard typologies with well planted medians and verges that reduce pollution[16] and provide a buffer between the heavily-trafficked carriageway and the surrounding pedestrian environment.
- Consider the use of multiple carriageways that separate through traffic from access traffic and parking.

15 Refer to *Air Quality In Ireland* (2009).

16 Refer also to *Effectiveness of Green Infrastructure for Improvement of Air Quality in Urban Street Canyons* (2012).

SPEED AND NOISE REDUCTION

Speed Reduction	dB (A) Reduction
from 70-60 km/h	1.8
from 60-50km/h	2.1
from 50-40km/h	1.4

TRAFFIC AND NOISE REDUCTION

Traffic Volume Reduction	dB (A) Reduction
30%	1.6
40%	2.2
50%	3.0
75%	6.0

Table 3.2: Noise reduction effects of lowering traffic speeds and volumes

At a broader level, land uses should be distributed in a manner that takes into account sensitivity to traffic noise:

- Commercial or retail uses should be used to shield more sensitive receptors (i.e. residential uses). Such an approach complements the principle of integrated street design as it focuses commercial/ retail uses on *Arterial* and *Link* streets where public transport services are likely to be located.
- Where residential uses are provided on the upper floors of buildings, aspects of the upper floors may be orientated so that they are perpendicular (i.e. at right angles) to the roadway. This will ensure a degree of overlooking, whilst deflecting the impacts of pollution (see Figure 3.35).

Figure 3.35: Example of a development adjacent to a busy Arterial Street where residential development is provided over a commercial podium at street level.

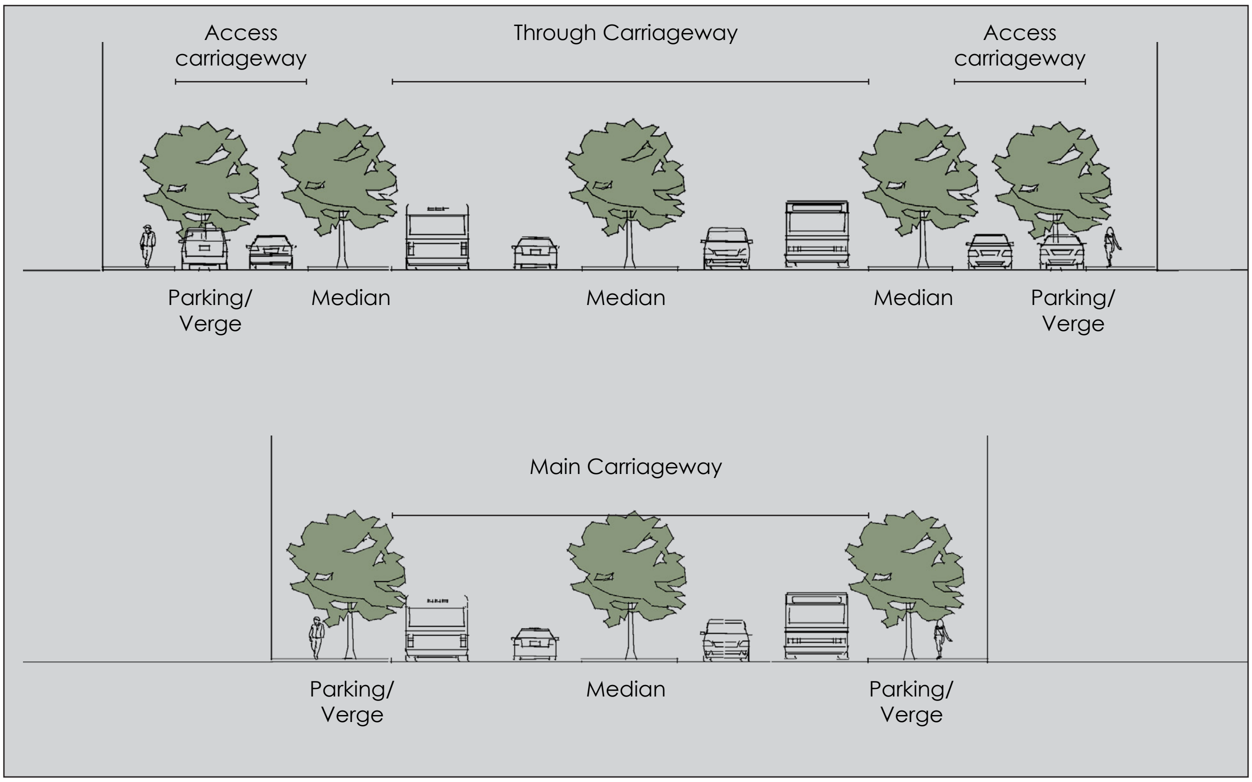
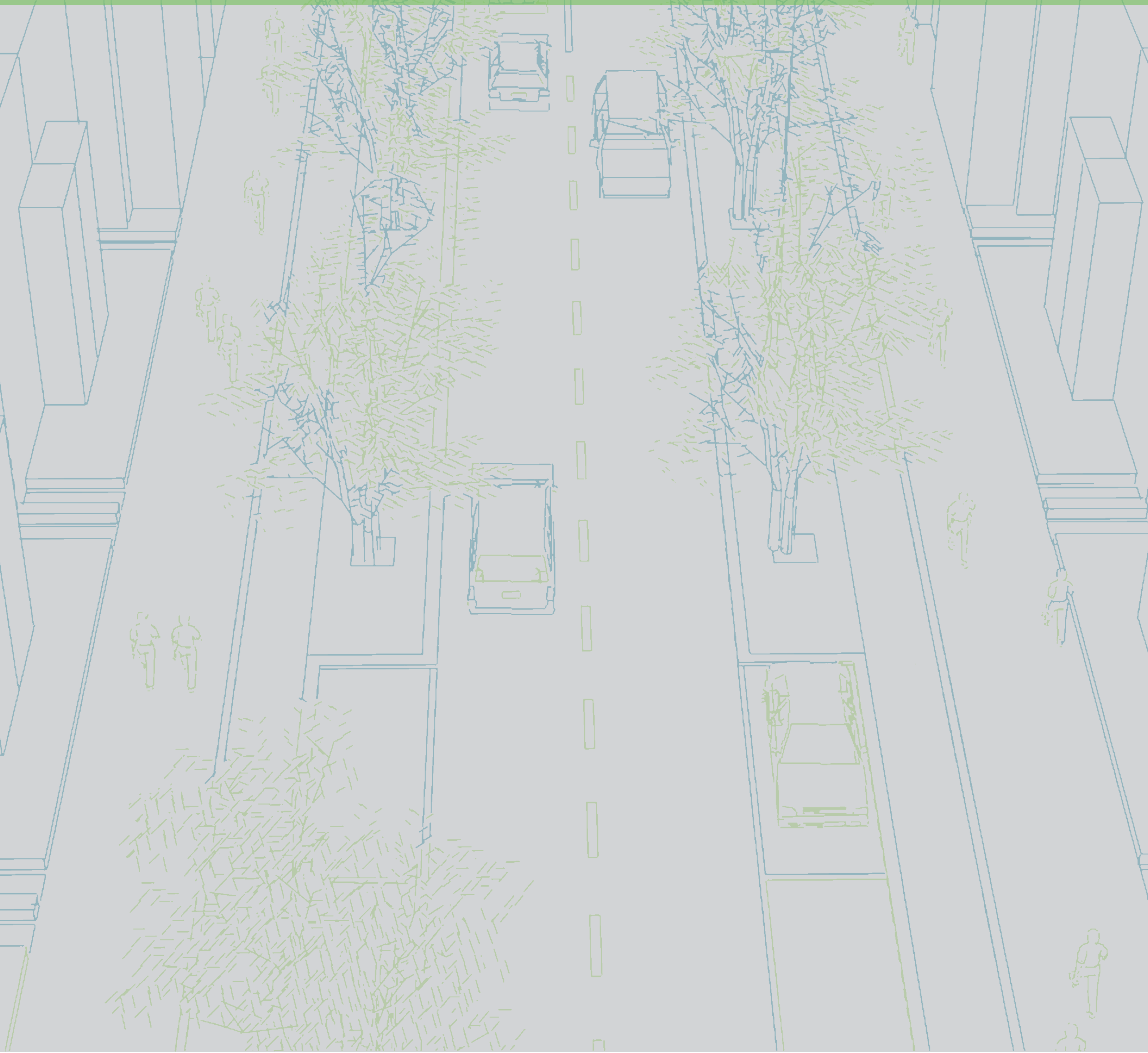


Figure 3.34: Examples of Urban Boulevard street typologies which mitigate the impacts of noise through place based design solutions.

CHAPTER 4 - STREET DESIGN

A more integrated approach to street design can create a 'win-win' scenario, where designers can enhance the value of place whilst calming traffic and improving pedestrian and cyclist comfort. To achieve this outcome, designers need to consider the multi-functional role of the street and apply a package of 'self-regulating' design measures.



4.0 Street Design

4.1 Movement, Place and Speed

4.1.1 A Balanced Approach to Speed

Balancing the priorities *Context* and *Function* creates a shifting dynamic in street design. The UK *Manual for Streets* (2007) illustrates this relationship as a simple graph depicting some well known scenarios (see Figure 4.1). Key to the successful implementation of responsive design solutions is the issue of speed, particularly so with regard to pedestrian and cyclist safety, comfort and convenience (see Figure 4.2). Expectations of appropriate speed will vary greatly from person to person and there is little relevant research on this subject. Intuitively one would expect motorists' tolerance of low-speed journeys to increase in intensively developed areas (i.e. from the *Centres*, to *Neighbourhoods* to *Suburbs*) and according to journey type (i.e. from *Local* to *Link* and to *Arterial* Streets.

Designer must balance speed management, the values of place and reasonable expectations of appropriate speed according to *Context* and *Function.*[1] In this regard:

- Within cites, towns and villages in Ireland a default speed limit of 50km/h is applied.
- Speed limits in excess of 50km/h should not be applied on streets where pedestrians are active due to their impact on place and pedestrian safety.
- Lower speed limits of 30km/h are a requirement of *Smarter Travel* (2009) within the central urban areas, where appropriate.[2]
- Where pedestrians and cyclists are present in larger numbers, such as in *Centres*, lower speed limits should be applied (30-40km/h).
- Where vehicle movement priorities are low, such as on *Local* streets, lower speed limits should be applied (30km/h).

Figure 4.1: Illustration from the Manual for Streets 2 (2010) depicting the relationship between place and movement in regard to some well know scenarios.

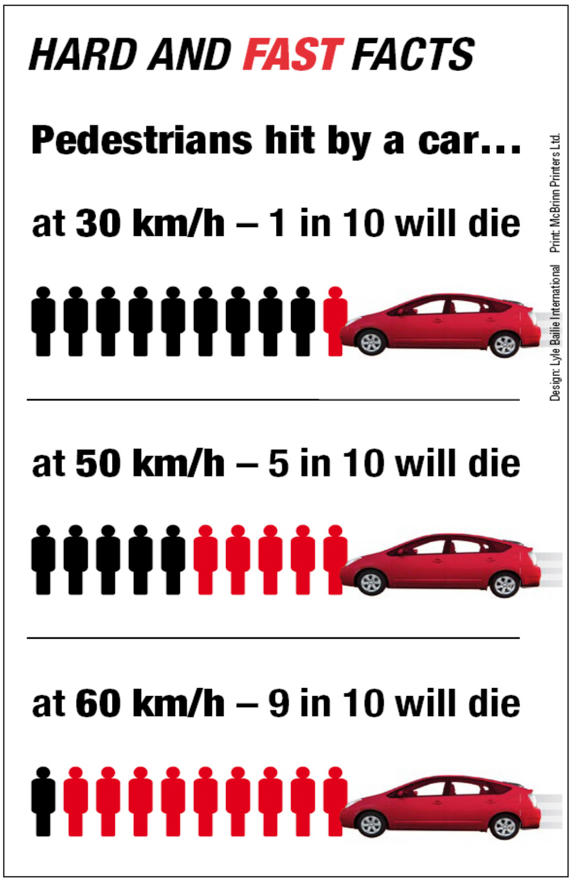


Figure 4.2: Illustration from the Road Safety Authority showing the impact of vehicle speeds on pedestrian fatalities. This is of primary consideration when considering appropriate speeds and levels of pedestrian activity.

1 Further guidance in regard to special speed limits is available from Section 9 of the *Road Traffic Act - Guidelines for the Application of Special Speed Limits (2011).*
2 Refer to Action 16 of *Smarter Travel (2009).*

- Local Authorities may introduce advisory speed limits of 10-20km/where it is proposed that vehicles, pedestrians and cyclists share the main carriageway.

Design speed is the maximum speed at which it is envisaged/intended that the majority of vehicles will travel under normal conditions. In this regard:

- In most cases the posted or intended speed limit should be aligned with the design speed.

- In some circumstances, such as where advisory speeds limits are posted, the design speed may be lower than the legal speed limit.

- The design speed of a road or street must not be 'updesigned' so that it is higher than the posted speed limit.

Table 4.1 illustrates the broader application of design speeds according to *Context* and *Function*. Designers should refer to this table when setting speed limits and designing urban streets and urban roads to align speed limits and design speeds.

When applying these limits designers must also consider how effectively they can be implemented, as the introduction of more moderate and/or lower speed limits out of context and/or without associated speed reduction measures may not succeed.

PEDESTRIAN PRIORITY — VEHICLE PRIORITY

FUNCTION					
ARTERIAL	30-40 KM/H	40-50 KM/H	40-50 KM/H	50-60 KM/H	60-80 KM/H
LINK	30 KM/H	30-50 KM/H	30-50 KM/H	50-60 KM/H	60-80 KM/H
LOCAL	10-30 KM/H	10-30 KM/H	10-30 KM/H	30-50 KM/H	60 KM/H
	CENTRE	**N'HOOD**	**SUBURBAN**	**BUSINESS/ INDUSTRIAL**	**RURAL FRINGE**

CONTEXT

Table 4.1: Design speed selection matrix indicating the links between place, movement and speed that need to be taken into account in order to achieve effective and balanced design solutions.

4.1.2 Self-Regulating Streets

An appropriate design response can successfully balance the functional needs of different users, enhance the sense of place and manage speed in a manner that does not rely on extensive regulatory controls and physically intrusive measures for enforcement. In short, place can be used to manage movement. Such environments are referred to as being self-regulating. Within this self-regulating street environment the design response is closely aligned with the design speed (see Figure 4.3).

Within Ireland, the *Dublin Traffic Initiative: Environmental Traffic Planning* (1995) was, perhaps, the first strategic document in Ireland to recognise the link between the street environment and driver behaviour. It cited the use of narrow streets and on-street parking as traffic-calming tools. The *Adamstown Street Design Guide* (2010) draws upon research undertaken in regard to the UK *Manual for Streets* (2007) to advance this approach. It cited a combination of place-based psychological measures and integrated them with more traditional physical measures in order to create a self-regulating street environment (see Figure 4.4).[3]

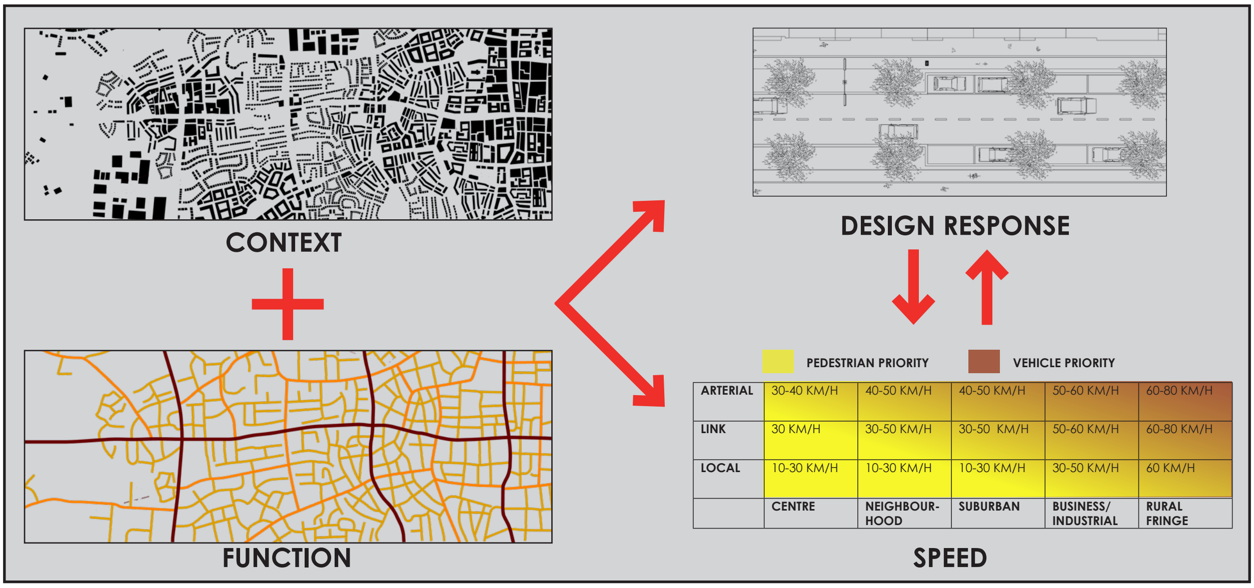
There is no set formula of how a package of psychological and physical measures should be applied. The design team must take into account that:

- Physical and psychological measures are most effective when used in combination.[4]
- The more frequently and intensely physical and psychological measures are applied, the lower the operating speed.

Analysis of the Road Safety Authority *Free Speed Survey* 2008, 2009 and 2011, inclusive showed that where there are few psychological and physical measures, average drivers regularly exceeded the posted speed limit. Conversely where these measures are more frequently and/or more intensely applied, driver speeds were lower and compliance with the posted speed limit was greater (see Figure 4.5).

3 Refer also to Section 2.2 'Safe Streets' of the *Adamstown Street Design Guide* (2010).

4 Refer to *Psychological Traffic Calming* (2005).



Figures 4.3: Illustration of the links between place, movement and speed that need to be taken into account in order to achieve effective self-regulating street environments.

Figure 4.4: Extract from the Adamstown Street Design Guide.
Illustration of the psychological and physical, or 'hard' and 'soft', measures that influence driver speeds and may be used to enhance place and manage movement.

Close Proximity of Buildings (left)

Continuous Street Wall (right)

Active Ground Floor Uses (left)

Pedestrian Activity (right)

Frequent Crossing Points and Junctions (left)

Horizontal and Vertical Deflections (right)

Narrow Carriageways (left)

Minimising signage and road markings (right)

Reduced Visibility Splays (left)

On-Street Parking (right)

Tighter Corner Radii (left)

Shared Surfaces (right)

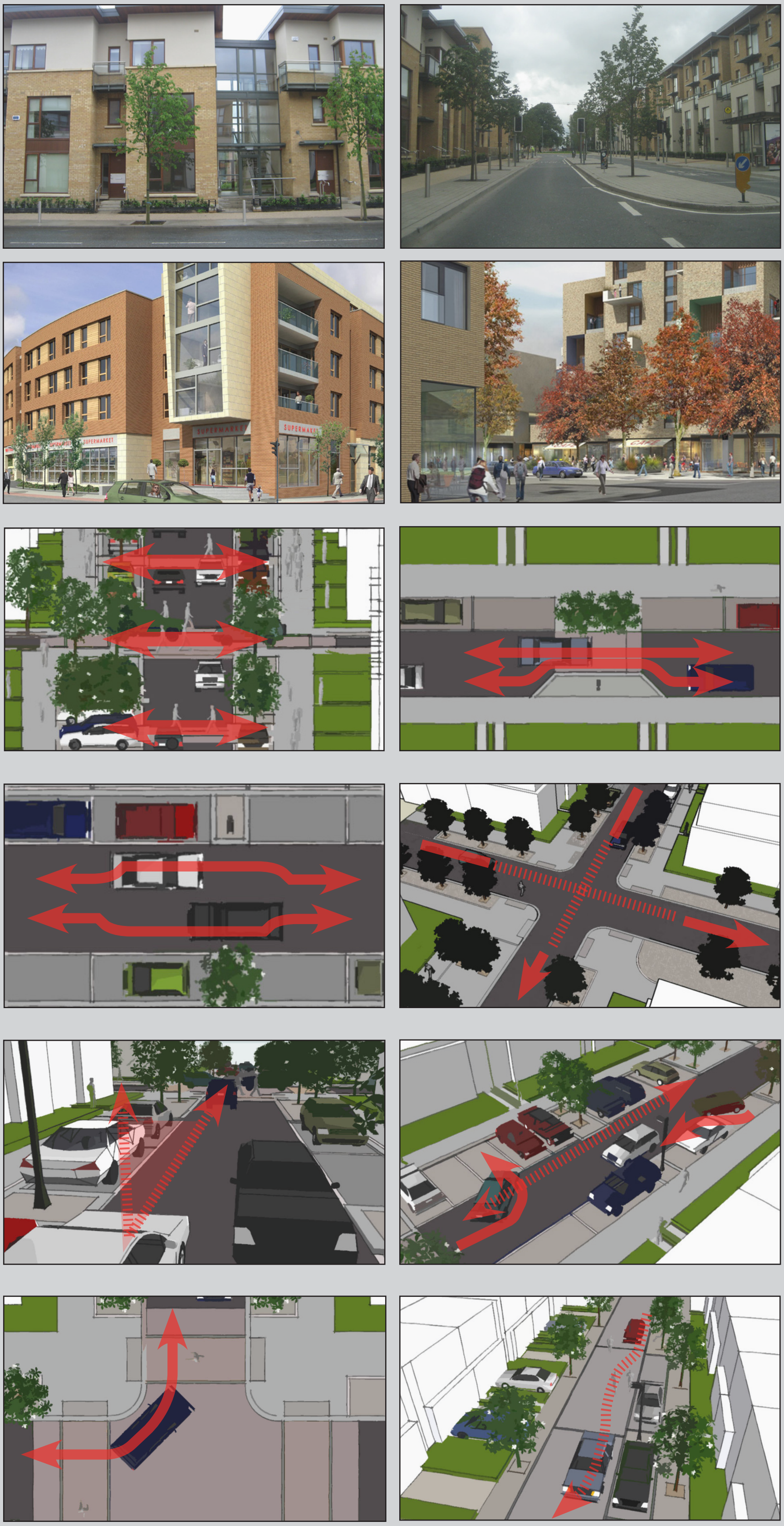


Figure 4.5: Road Safety Authority Free Speed Survey and Street Characteristics

The Road Safety Authority periodically undertakes free speed surveys throughout urban and rural Ireland. In 2008, 2009 and 2011 the speeds of some 9,500 vehicles along 23 streets within metropolitan Dublin were recorded.

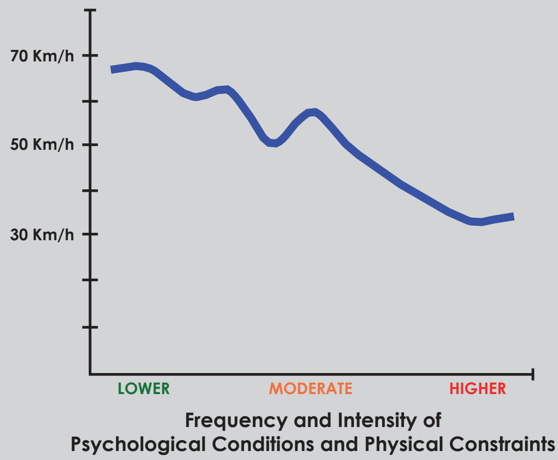
An analysis of the characteristics of the street environment at each of the 23 locations was carried out for the preparation of this Manual. This survey recorded the frequency and intensity of psychological and physical design measures that influence driver behaviour, such as those illustrated in Figure 4.4.

The survey results demonstrated that the individual effectiveness of these measures varied. For example, as would be generally expected, the presence of deflections (such as ramps) had a strong influence on reducing speed. Results also showed that other 'softer' measures, such as a sense of enclosure, surveillance and activity created by a continuous line of development fronting directly onto the street, have a strong influence on lowering speed.

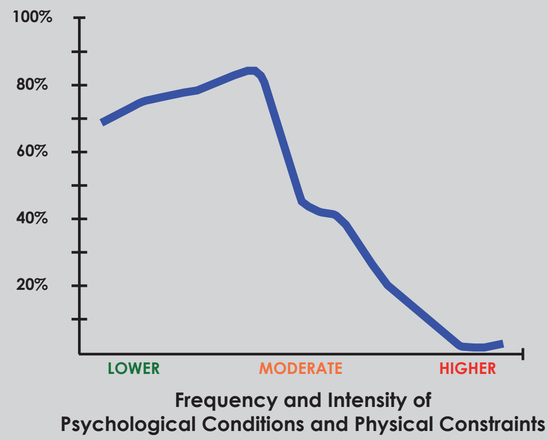
Overall, the results demonstrated a strong trend whereby as the frequency and strength of the psychological and physical design measures increased, the lower the operating speed and the greater the level of compliance with the posted speed limit (see graphs A and B). This trend was generally consistent for all road types including those which did not have ramps.

Figure 4.2 illustrates that an increase in vehicle speeds from 50 km/h to 60 km/h nearly doubles the chance of a pedestrian fatality, should they be struck by a vehicle. Graph C is particularly significant in this regard as it illustrates that where there are limited psychological and physical design measures on streets with a speed limit of 50 km/h most drivers will exceed the speed limit by 10 km/h or more. Conversely where the frequency and strength of these measures are high full, or near full, compliance with the speed limit occurred. In many cases the average operating speed dropped below 40 km/h.

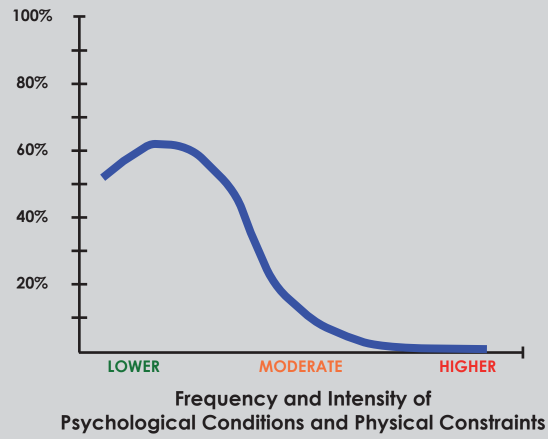
A. AVERAGE OPERATING SPEED



B. % OF DRIVERS EXCEEDING SPEED LIMIT



C. % OF DRIVERS EXCEEDING SPEED LIMIT BY 10 KM/H OR MORE (50 km/h streets only)



In retrofit scenarios, designers must carefully consider the characteristics of the existing street environment prior to implementing self-regulating measures as:

- The measures contained within this Manual should not be implemented in isolation as they may not fully address issues related to inappropriate driver behaviour on existing streets.

- Designers should carry out a detailed analysis to establish the levels of intervention and design measures required in any given scenario (see Figure 4.6).

For example, in many older *Centres* and *Neighbourhoods,* measures such as connectivity, enclosure, active street edges and pedestrian activity are generally strong. In these circumstances the design measures contained within this Manual may be readily applicable. The application of a holistic solution may be more challenging within a more conventional or highly segregated road environments. Under such circumstances a wider package of measures may need to be implemented.

This Manual cannot account for every scenario that a designer will encounter. In addition to those examples contained in the ensuing sections, to assist designers in the process of retrofitting it is intended that a series of 'best practice' case studies will be made available as downloadable content.

Figure 4.6: Examples from Youghal, Co. Cork (left), and Dorset Street, Dublin City (right), of retrofitted design responses that are appropriate according to Context and Function. The narrow, enclosed and lightly trafficked nature of the street within Youghal is highly suited to a shared carriageway. The heavily trafficked nature of Dorset Street makes it highly suited to a Boulevard type configuration.

4.2 Streetscape

4.2.1 Building Height and Street Width

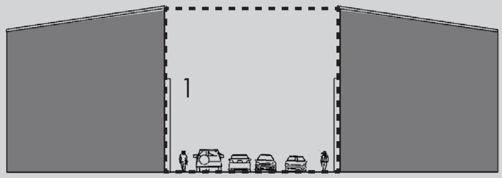
Sense of enclosure is generally measured as a ratio where the height of a building (measured from front building line to front building line) is measured against the width of a street. Consideration needs to be given as to how consistently this ratio applies along the length of the street through the creation of a street wall. The street wall refers to how continuous the sense of enclosure is along the street.

Enclosing streets with buildings helps to define them as urban places, creates a greater sense of intimacy[5] and promotes them as pedestrian friendly spaces that are overlooked. This sense of intimacy has been found to have a traffic-calming effect as drivers become more aware of their surroundings.

Designers should seek to promote/maintain a sense of enclosure on all streets within cities, towns and villages (see Figure 4.7). In this regard.

- A strong sense of enclosure should be promoted in large *Centres*. The most effective way of achieving this is with a building height to street width ratio greater than 1:2 and street wall that is predominantly solid (allowing for intermittent gaps only).
- A good sense of enclosure can also be achieved with a building height to street width ratio of 1:3 and a street wall that is 75% solid, provided a continuous line of street trees are planted along the street. This approach may be more desirable in smaller *Centres* or *Neighbourhoods* where maintaining a more human scale is desirable.
- A strong sense of enclosure may be difficult to achieve where the total street width exceeds 30m wide, such as on *Boulevards*. In such circumstances design teams should emphasise the sense of enclosure with the planting of continuous rows of large closely planted street trees.

BUILDING HEIGHT TO STREET WIDTH RATIO

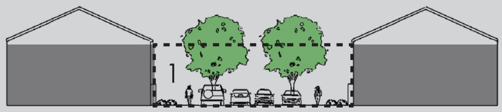


1

Ratio of 1:1 - Very strong sense of enclosure (street trees optional)

2

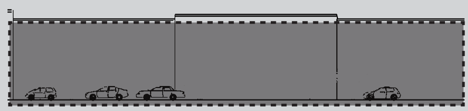
Ratio of 1:2 - Strong sense of enclosure (supplementary street trees desirable)



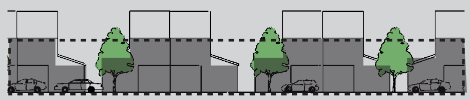
3

Ratio of 1:3 - Moderate sense of enclosure (supplementary street trees required)

CONTINUITY OF THE STREET WALL



75%+ solid - strong sense of enclosure (street trees optional)



75% solid - moderate sense of enclosure (supplementary street trees required)

Figure 4.7: Measurements that indicate the sense of enclosure by way of building height to street width ratio and the percentage of the street wall that is solid.

5 Refer to Section 07 of the *Urban Design Manual* (2010).

- Within established areas creating a strong sense of enclosure may result in building heights that would conflict with those of the surrounding area. In such circumstances designers may emphasise enclosure though other design measures, such as the planting of street trees.
- The planting of street trees should also be considered as a retrospective traffic calming measure in existing contexts where levels of enclosure are traditionally weaker, such as in *Suburban* areas.
- The planting of street trees may also be desirable within *Transition Zones* (see Sections 3.4.1 Wayfinding and 3.4.4 Relief Roads), in advance of *Gateways* and within *Rural Fringe* areas as an advance warning to drivers of changing conditions ahead.

The measures illustrated in Figure 4.7 should not be strictly viewed as quantifiable. For example a moderate building height to street width ratio, in addition to a moderate continuity of street wall, does not equate to a strong sense of enclosure. Rather they should be viewed as complementary, i.e. a strong sense of enclosure is created where both elements are strong.

The relationship between building height and street width is also key to creating a strong urban structure, by increasing building heights in proportion to street widths. This will also promote greater levels of sustainability and legibility by placing more intensive development along wider/busier streets, such as *Arterial and Links* streets, to support public transport routes and highlight their importance as connecting routes, respectively (see Figure 4.8).

Additional building height may also be used at junctions to create a 'book end' effect (see Figure 4.9). This approach will assist in slowing vehicles as they approach junctions and will improve legibility by highlighting connecting routes throughout the network.

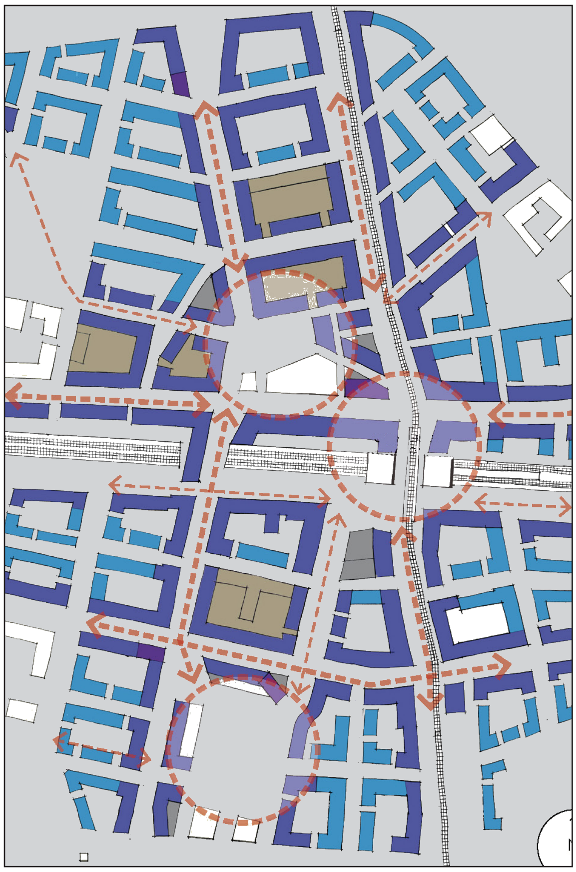


Figure 4.8: Plan illustrating how taller buildings (purple) are placed along busier routes (and around major spaces) to enclose streets and reinforce the structure of the area.

Figure 4.9: Reinforcing junctions with additional building height will assist in slowing vehicles as they approach junctions and will improve legibility by highlighting connecting routes throughout the network.

4.2.2 Street Trees

Street trees are an integral part of street design as they contribute to the sense of enclosure, act as a buffer to traffic noise/ pollution and enhance place. A traffic-calming effect can also be achieved, where trees are planted in continuous rows and their canopies overhang, at least in part, the vehicular carriageway. Street trees can also be used to enhance legibility by highlighting the importance of connecting routes and distinguishing one area from another through variations in size and species selection.

The planting of trees should be considered as an integral part of street design. In general, the size of the species selected should be proportionate to the width of the street reserve. For example (see Figure 4.10):

- Larger species, with a canopy spread greater than 6m will be best suited to wider streets, such as *Arterial* and *Link* streets.
- Smaller species with a canopy spread of 2-6m will be best suited to narrower streets such as *Local* streets.

Designers may seek to vary this approach in keeping with the characteristics of a place. For example:

- Sparse planting may be more appropriate in a *Centre*, enhancing its urban qualities.
- Smaller species may be more appropriate where buildings are located in close proximity to the street edge carriageway (i.e. to take account of overshadowing, growth restrictions).
- Larger species may be desirable within *Suburbs*, to enhance the greener character associated with these places.

To be effective, trees should be planted at intervals of 14-20m. This may be extended periodically to facilitate the installation of other street facilities, such as lighting. Designers should also consider the impact of root growth. Tree roots may need to be contained within individual tree pits, continuous soil planting strips or using other methods to restrict growth under pavements/toward services.

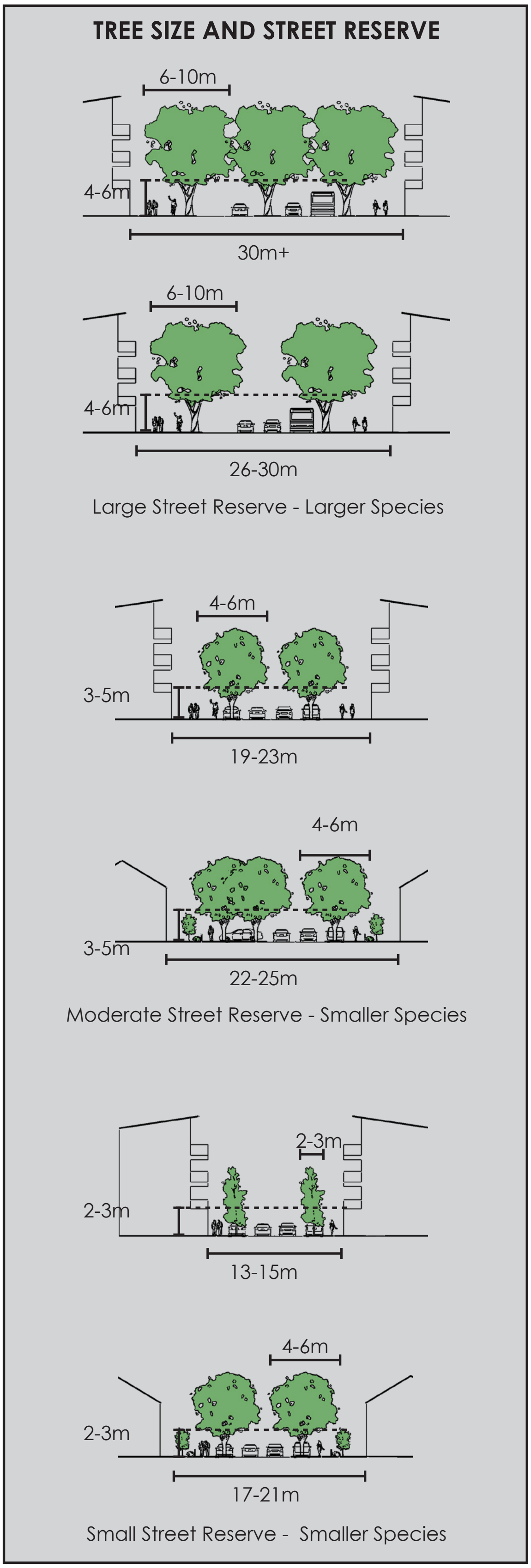


Figure 4.10: General guide to the canopy width and clearance height for street trees.

4.2.3 Active Street Edges

Active street edges provide passive surveillance of the street environment and promote pedestrian activity. This should be a principle aim of the design team. Increased pedestrian activity also has a traffic-calming effect as it causes people to drive more cautiously.[6]

Designers should seek to promote active street edges on all streets within cities, towns and villages. The most effective way to promote pedestrian activity is to place buildings in close proximity of the street (see Section 4.2.1 Building Height and Street Width) with a high frequency of entrances and other openings. In this regard (see Figure 4.11):

- To maximise activity in *Centres* the street edge should be lined with development that promotes a high level of activity and animation such as retail, commercial or other appropriate uses. To maximise the effectiveness of these uses, setbacks should be minimised (for example 0-3m) and a high frequency of entrances provided (for example every 5-10 metres).
- Where larger retail/commercial floor plates are proposed at ground floor level an active street edge may be achieved by creating multiple entrances and/or wrapping them with smaller perimeter units that front on to the street (see Figure 4.12).
- *Arterial* and *Link* streets through intensively developed *Neighbourhoods* may also sustain retail/commercial activity, particularly on corner locations.
- Higher levels of privacy are desirable where residential dwellings interface with streets. This may be provided via a small setback (for example 1-3 metres) which incorporates planted strip that defines public and private space (see Figure 4.13).
- Residential development will also promote on-street activity where individual dwellings (including ground floor apartments) are 'own door' accessed (see Figure 4.14).

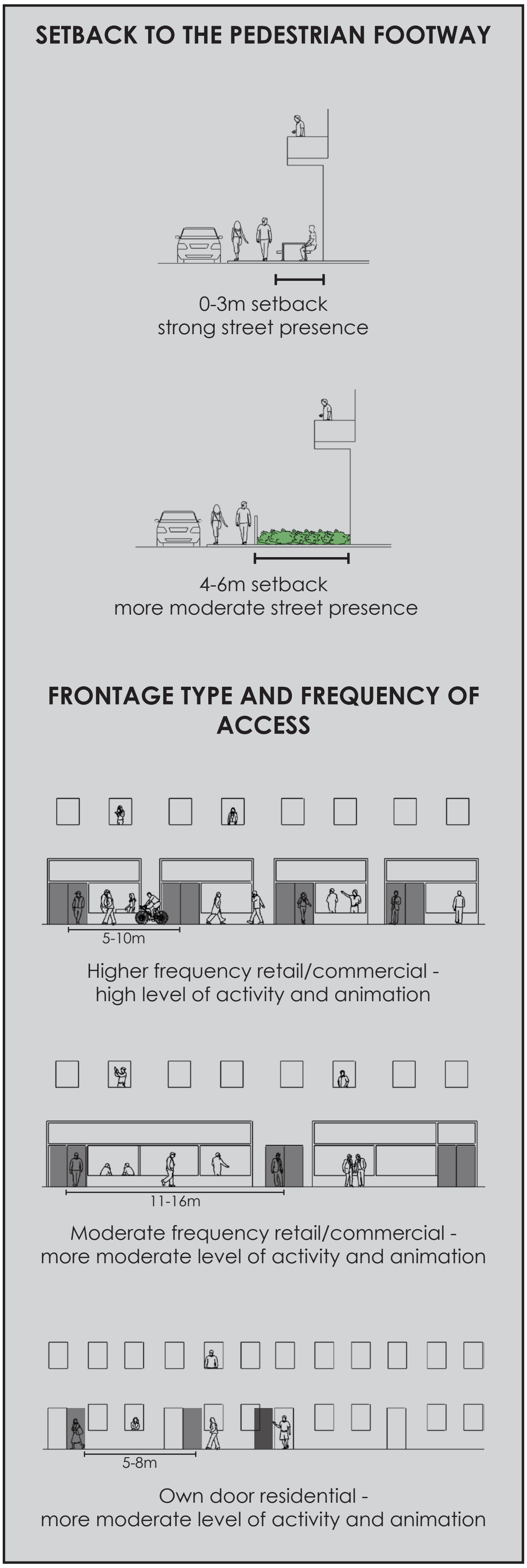


Figure 4.11: Measures that indicate active and animated street interfaces.

6 Refer to Section 2.2.5 of the UK *Manual for Streets* (2007).

- Greater flexibility in regard to setbacks may be needed in existing areas where they are defined by an existing pattern of building lines

- The inclusion of in-curtilage parking within front gardens (i.e. to the front of the building line) may result in large building setbacks that substantially reduce the sense of enclosure. In addition to the above, designers should avoid a scenario where parking dominates the interface between the building and the footway (see Section 4.4.9 On-Street Parking and Loading).

In addition to the above, further advice with regard to the creation of active street edges may also be taken from the *Urban Design Compendium*.[7]

7 Refer to Section 5.1.2 Building Lines and Setbacks and Section 5.2 Animating the Edge, UK *Urban Design Compendium* (2000).

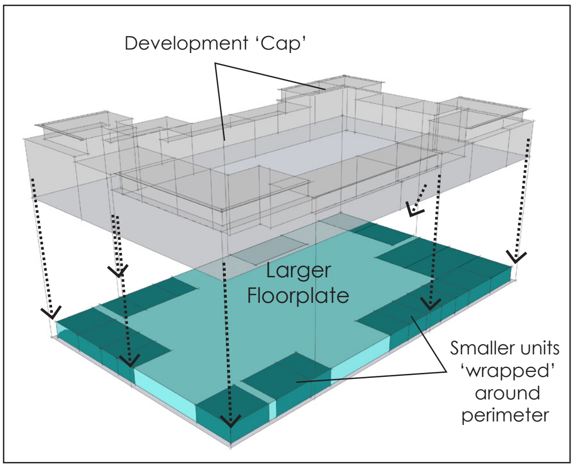


Figure 4.12: Illustration of how a larger retail/ commercial unit can be accommodated within a block whilst promoting an active street edge that is also overlooked from the upper levels.

Figure 4.13: Privacy strip to the front of residential development. The strip provides a buffer and clearly define the private domain from the public.

Figure 4.14: A fine grain residential environment where all ground floor dwellings are directly accessible from the street via 'own door' entrances. Note, in this instance access to upper floors is provided via internal lobby areas.

4.2.4 Signage and Line Marking

The principal source for guidance on signage and line marking is the Department of Transport *Traffic Signs Manual* (TSM) (2010), which categorises signage and road marking into four main categories:

- TSM Chapters 2 and 4: *Information Signs* that give directions and distances to destinations or which provide other information that may be relevant to road users;
- TSM Chapter Section 5: *Regulatory Signs* that give instructions, prohibitions or restrictions which road users must obey and indicate the existence of a Road Traffic Regulation or implement such a Regulation, or both.
- TSM Chapter Section 6: *Warning Signs* are used to alert the driver to a danger or potential danger on the road ahead.
- TSM Chapter Section 7: *Road Markings* are defined as markings on the surface of the road for the control, warning, guidance or information of road users and may either be used on their own or to supplement associated upright signage.

Regulatory Signs can be further divided into three main groups:

- *Mandatory Signs* are used to indicate that a road user must take a certain action. For Example 'Stop', 'Yield' or 'Keep Left'.
- *Restrictive Signs* to indicate a limit must not be exceeded. For Example '50 km/h Speed Limit' or 'Weight Limit 3 tonne'.
- *Prohibitory Signs* to indicate something which must not be done. For Example 'No Right Turn' or 'No Parking'.

The implementation of a self-regulating street environment means that the reliance on signage or line marking to direct or instruct people is significantly reduced. As noted in the *Manual for Streets* (2007)[8], there may also be traffic-calming benefits of a 'less is more' approach to reinforce lower design speeds. For example, the removal of centre line markings has been found to reduce vehicle speeds and the number of accidents.[9] With reduced signage drivers must navigate the street environment with full regard to their own behaviour and the behaviour of others around them. An emphasis on the values of place also requires the visual impact of signage to be considered in order to reduce visual clutter.

The TSM warns against over providing signage and line marking. Section 1.1.10 of the TSM states in relation to signage in general, 'signs should only be erected where there is a demonstrable need, because unnecessary, incorrect or inconsistent signs detract from the effectiveness of those that are required and tends to lead to disrespect for all signs'. There is also a limit to how many signs/line markings drivers can absorb in a short period.

To define where designers are allowed to employ discretion, Section 1.1.12 of the TSM states that:

- 'Shall' or 'must' indicates that a particular requirement is mandatory;
- 'Should' indicates a recommendation; and
- 'May' indicates a permissible option.

8 Refer to Section 9.1.7 of the *Manual for Streets* (2007). Designers should also note that the *Manual for Streets* recommended monitoring streets where little or no signage is used to confirm its effectiveness.

9 Refer to Improving *Traffic Behaviour and Safety Through Urban Design, Civil Engineering* (2005).

Designers should use this discretion with regard to the self-regulating characteristics of streets and the impact of signs/line marking on the value of place when applying the TSM. In this regard:

- Minimal signage is required on *Local* streets due to their low speed nature and low movement function. The generally lightly trafficked nature of these streets means that the use of signage can be minimised, and in some cases eliminated altogether.
- The requirements for signage on *Arterial* and *Link* streets will be higher than on *Local* streets. The use of signage should be kept to the minimum requirements of the TSM, particularly where place values are very high, such as in the *Centre* context.

Designers may have concerns about minimising signage on streets that carry higher volumes of traffic, but there are many successful examples where the amount of signage provided has been significantly reduced (see Figures 4.15 and 4.16).

Figure 4.15: Walworth Road, Central London, UK, before (top) and after (bottom). The street carries over 20,000 vehicles per day and as part of major upgrade signage and line marking were minimised (image source: Southwark Council).

Figure 4.16. Kensington High Street, London, UK, where as part of upgrade works, a major decluttering exercise took place which included removing all guardrails, minimising signage and line marking. It is notable that upon completion of the works, vehicle speeds decreased and the incidence of accidents decreased by 43% (2003-2005). Left image source: Kensington and Chelsea Borough Council.

With regard to signs and line marking more generally (see Figure 4.17):

- Signage structures should be rationalised. Individual sign poles may be better utilised and signs should be clustered together on a single pole.[10]

- Non-regulatory, and in particular *Information Signs*, signage may be embedded within street surfaces or incorporated into other items of street furniture.

- Local authorities should undertake periodic decluttering exercises to remove unnecessary repetitive and redundant signage.[11]

- The size of individual signs should generally be to the minimum specification stated in the TSM for the particular speed limit.

- The use of *Warning* signs should be limited as they are generally not required in built-up areas where potential hazards are clearly legible and vehicles travel at lower to moderate speeds. Warning signs should be installed only if an engineering assessment indicates a specific need for improving road safety for users and it is clear that the sign will be effective.[12]

10 Refer to Action 16 of *Smarter Travel* (2009) which requires the rationalisation of signage poles

11 Refer to UK Department for Transport *Local Transport Note 1/08*. Examples of guidelines are available from www.english-heritage.org.uk

12 Refer to Sections 6.1.17 and 6.1.19 of the *Traffic Signs Manual* (2010).

- Designers should minimise the duplication of signage and/or road marking. Where signage and road markings provide the same function, preference should be given to the provision of road markings only, unless specifically required by the TSM. In general, road markings are more legible for drivers and have less of a visual impact on the streetscape.

- The use of signage and/or road marking that duplicate existing regulations should be avoided and may lead to confusion. For example the use of double yellow lines around corners to reinforce the standard prohibition on stopping within 5m of a road junction may lead to misinterpretation that loading is generally permitted.[13]

Designers should also note that a *Regulatory* sign may not be required as a 'regulation' or a 'mandatory requirement'. Designers may conclude that a *Regulatory* sign may not be needed due to the self-regulating nature of the street and/or in order to reduce the overall amount of signage used.

13 Refer to Section 7.6.5 of the *Traffic Signs Manual* (2010).

Figure 4.17: Example of the improvements to a streetscape that can be achieved where signage and line marking are substantially reduced. Note all changes have been made within the scope of the TSM.

4.2.5 Street Furniture

Street furniture serves many purposes that relate to both place and function and includes a variety of commonly found items within a street such as public art, lighting, bollards, guardrails, seating and cycle parking. Whilst items such as public art may be of place value only, many other items, if well designed, provide a place and function value (see Figure 4.18).

In general, the provision of street furniture must be considered as part of the overall design of street. In this regard:

- The placement of street furniture should be considered as part of a wider strategy, such as part of an integrated landscape plan or series of street typologies.
- Street furniture should be placed within a designated zone, such as a verge (see Section 4.3.1 Footways, Verges and Strips)
- The items used should be chosen from a limited palette that promotes visual cohesion (see Section 5.2.1 Policy and Plans), while contrasting with the background to assist the visually impaired.
- The number of items used should be balanced with other facilities (including signage and line marking) to reduce clutter.
- Existing items of historic value which promote local character should be clearly identified (see Section 4.2.8 Historic Contexts).

Guardrails

An integrated approach to street design will substantially reduce the need for obtrusive physical barriers such as guardrails. For example, the alignment of crossing points with desire lines will eliminate the need for guardrails to redirect pedestrians (see Section 4.3.2 Pedestrian Crossings)

In this regard:

- Guardrails should not be used as a tool for directing and/or shepherding pedestrians.

Figure 4.18: An example from Drogheda, Co. Louth, where well placed street furniture has a functional role that also provides a major contribution to the streetscape and value of place.

- Guardrails should only by installed where there is a proven or demonstratable safety benefit, for example where people may inadvertently step onto the carriageway (e.g. at a school entrance).[14]

Where the potential need for guardrails is identified (such as via a Road Safety Audit), designers should review their design as this need may highlight inadequacies in the design (such as the failure to take proper account of pedestrian desire lines). Designers should also consider the use of street furniture that may guide pedestrian movement and also contributes to the sense of place and provide amenities (see Figure 4.19).

Authorities should remove unnecessary guardrails on existing streets. The removal of individual sections of guardrails should be the subject of a rigorous and well documented assessment process. Further guidance in regard to the removal of guardrails may be obtained from, UK *Guidance on the Assessment of Pedestrian Guardrail* (2012 update) and UK Department for Transport *Local Transport Note 2/09* (see Figure 4.20). The *National Cycle Manual* (2011) also recommends the removal of guardrail as it poses a safety risk to cyclists.[15] Once guardrails have been removed monitoring should be undertaken to ensure the works have had the desired effect.

Designers may have some concerns in regard to the removal of guardrails on busy streets due to their perception as effective 'crash' barriers. However, guardrails are only effective at stopping vehicles at very low speeds and therefore may provide a false sense of security resulting in pedestrians and vehicles both paying less attention.[16]

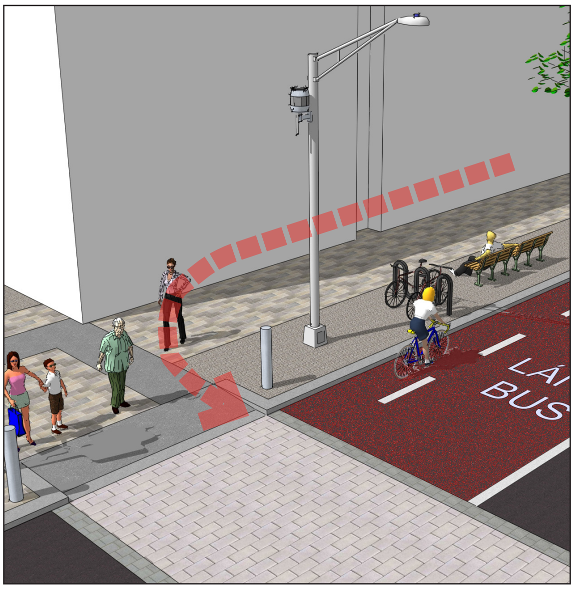


Figure 4.19: Items such a bicycle racks, seating and/or bollards are less intrusive elements that can be used to guide pedestrians toward crossing points and reduce illegal kerb mounting.

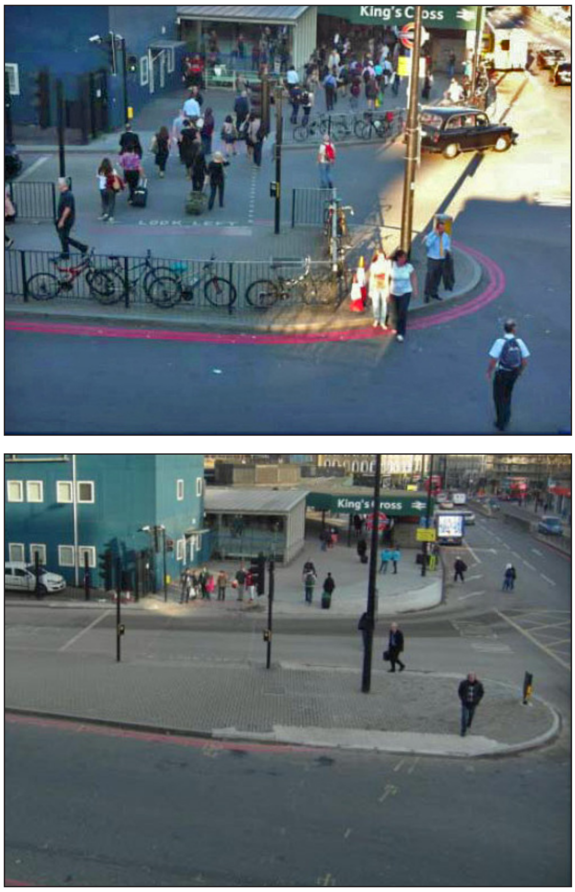


Figure 4.20: Before and after images near Kings Cross station, London, extracted from the TfL document Assessment of Pedestrian Guardrails. TfL have undertaken a wide program of guardrail removal throughout the streets of London.

14 Refer to UK Department for Transport *Local Transport Note 2/09: Pedestrian Guardrailing,* for further guidance.
15 Refer to Sections 1.1.4, 4.4.1.2-4.4.1.4 and 4.4.4 of the *National Cycle Manual* (2011).
16 Refer to UK *Guidance on the Assessment of Pedestrian Guardrail* (2012).

Lighting

Good quality lighting promotes a safer environment by ensuring inter-visibility between users. Poorly illuminated carriageways and cycle lanes can also make it difficult for users to identify potential hazards. The quality of lighting will also have a major impact on perceptions of security. If lighting levels are not sufficient, a place may not be perceived as safe, particularly for pedestrians and cyclists. This may discourage people from walking and cycling, particularly in the winter months when days are shorter, and undermine the viability of public transport.

The standards used for lighting within Ireland are generally taken from *British Standard Code of Practice for the Design of Road Lighting* (BS 5489). Whilst these documents should be referred to in regard to technical details, there are broader design considerations in regard to type of lighting used and the position and design of lighting columns.

Lighting should be designed to ensure that both the vehicular carriageway and pedestrian/cycle path are sufficiently illuminated. On roads and streets within urban areas white light sources should be used, such as metal halide, white SON, Cosmopolis and LEDs. Where orange (SOX) or softer honey (SON) coloured lights are currently used, they should be replaced with white light as part of any upgrade (see Figure 4.21).

With regard to the height of lighting columns:

- Heights should be sensitive to the scale of the adjacent built environment.
- In city, town and village streets, a lantern mounting height in excess of 8 metres is unlikely to be required.
- On *Local* streets, and in areas of heritage significance, mounting heights should be no greater than 6 metres.
- Where higher numbers of pedestrians are active, such as in *Centres*, consideration should be given to supplementing the traffic route lighting installation with a lower intensity pedestrian lighting lanterns mounted at a lower height on the same columns (see Figure 4.22).

Figure 4.21: Examples of differing types of lighting and their effectiveness in terms of safety and placemaking.

Lighting installations should be generally located within a verge (see Section 4.3.1 Footways, Verges and Strips) and/or within build-outs that separate bays of on-street parking (see Section 4.4.9 On-street Parking and Loading). Where no verge is available, lighting should be located at the back of footways, to minimise any disruption to pedestrian movement provided:

- They are positioned, where possible to coincide with property party lines to avoid obstructing entrances or windows.
- They are not located in close proximity to properties where they may compromise security.

On narrow streets or streets with narrow footways, consideration should be given to using wall-mounted lanterns

Lanterns should be selected and positioned so as to avoid creating obtrusive light spill on windows, particularly in the case of upstairs residential properties. Internal or external baffle plates can be fitted to lanterns to minimise nuisance light spill. Lights should also be positioned away from trees, which in time may grow to envelop the lanterns or cast shadows which will render the lighting less effective.

To reduce street clutter designers should consider combining lighting with other installations (see Section 4.2.4 Signage and Line Marking and as per Figure 4.22). Traffic signal heads, small signs, bus stop signs etc. can be mounted on lighting columns with a degree of co-operation and co-ordination between the relevant authorities and service providers. CCTV columns, which need to be more rigid than lighting columns, can also accommodate lighting and other functions. Ancillary lighting equipment, such as electrical supply pillars, should also be located with a view to minimising their impact on the streetscape, while not creating an obstruction or hazard to pedestrians. Metering cabinets in particular, which may be up to 1.5 metres high, should be located against walls, as unobtrusively as possible, while bearing in mind that they must be accessible for maintenance and meter reading.

Figure 4.22: Example of a light installation that is designed with both the pedestrian and the vehicle in mind and also incorporates signals for a pedestrian crossing (image source: Camden Streetscape Manual).

4.2.6 Materials and Finishes

The use of materials and finishes is one of the most defining elements of a street, particularly where it is used to define the levels of segregation and integration within a street. The material palette can define space, calm traffic and improve legibility, reducing the need for barriers, signage and line marking in favour of texture and colour. Materials can be used to enhance the value of place and produce more attractive and cost-effective streets.

When choosing surface materials, designers should:

- Use robust surfaces (such as natural stone, concrete block paving or imprinted asphalt) extensively throughout *Centres* and around *Focal Points* to highlight the importance of place, calm traffic and alert drivers of higher levels of pedestrian activity (see Figure 4.23).

- Use robust surfaces and/or changes in colour around *Gateways* and *Transitional Zones* to alert drivers of changing driving conditions (see Section 3.3.4 Wayfinding).

- Choose items from a limited palette to promote visual cohesion (see Section 5.2.1 Policy and Plans).

- Apply a hierarchical approach to the application of materials. Altering the palette according to the street hierarchy and/or importance of place will assist in way finding.

- Use of contrasting materials and textures to inform pedestrians of changes to the function of space (i.e. to demarcate verges, footway, strips, cycle paths and driveways) and in particular to guide the visually impaired (see Section 4.3.4 Pedestrianised and Shared Surfaces).

The layout and colour of tactile paving used to assist the visually impaired in navigating the pedestrian environment should ensure that a consistent logic is applied. This includes the cumulative impact of tactiles with other material choices. For example, the use of strong red or yellow tactile paving may not be appropriate to avoid visual clutter associated with too many surface types or colours. In such instances an approach which balances the need for visual contrast (to aid the visually impaired) whilst promoting visual cohesion is preferable (see Figure 4.24). Further guidance on the use of tactile paving may also be taken from Section 13.3 of the *Traffic Management Guidelines* (2003) and the UK *Guidance on the use of Tactile Paving Surfaces* (2005).

Figure 4.23: O'Connell Street, Dublin. The high place status, intensity of activity and low design speed (30 Km/h) is highlighted by high quality and robust materials, such as granite paving.

Designers may have concerns in regard to the initial costs associated with using higher specification materials and their ongoing maintenance. The use of higher quality materials has wide economic benefits. For example, in relation to shopping streets, research in the UK has shown that streets finished with better quality materials result in better market prices, better rents and better retail sales.[17] Capital costs should also be measured against savings that result from a reduction in the need for barriers, signage, line marking and longer term costs related to durability and maintenance. Further guidance may be obtained from *Advice Note 2 - Materials and Specifications* and the *Natural Stone Surfacing - Good Practice Guide (SCOTS Guide) (2004)* .

The quality of materials may also be selected to ensure that more robust and higher quality materials are used where they are most needed and appreciated. Figure 4.25 from the *Adamstown Street Design Guide* (2010) provides an overview of how the standard of materials may be applied with regard to amenity, density and activity. When applied systematically it directs the designers to use the highest specifications of materials in the *Centres* and along streets which are the most active, such as *Arterial* and *Link* streets. It will also direct the use of higher specification materials to the vicinity of *Focal Points*. Good results may also be achieved on lower budgets, provided material selection has the desired effect of supporting other measures aimed at calming traffic and defining place (see Figure 4.26).

Figure 4.24: Example form Drogheda, Co. Louth, of red tactile paving at a zebra crossing which has been toned down to balance the degree of contrast with higher specification materials.

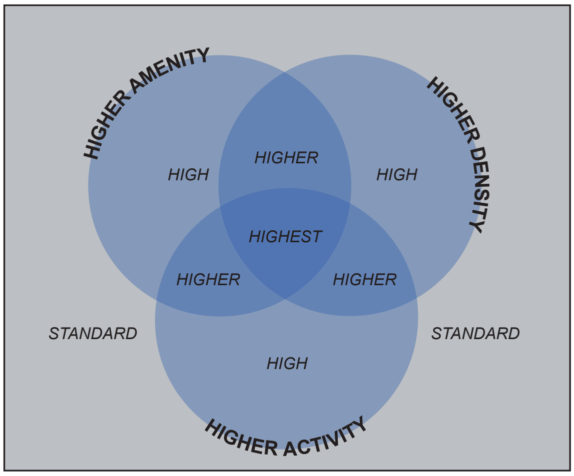


Figure 4.25: Diagram illustrating a hierarchical and cost-effective approach to the specification of materials on streets.

Figure 4.26: Fade Street, Dublin City Centre. To reduce the overall cost of work in remodelling the street, lower budget materials such as HRA with coloured aggregate chips and epoxy resin bound surfaces were used on the carriageway and footpath, respectively.

17 Refer to *Paved with Gold* (2007).

4.2.7 Planting

Planting is generally located in areas such as medians, verges, build-outs and privacy strips. Landscaping is traditionally used to add value to places though visual enhancement. There are many approaches that can be taken with regard to planting, for example:

- Within *Centres* a greater emphasis may be placed on using 'harder' landscape elements that define them as urban, allow greater freedom of movement and are able to withstand higher level of pedestrian traffic (see Figure 4.27).
- In *Neighbourhoods* and *Suburbs* a greater emphasis may be placed on the use of planted materials to promote 'softer' landscape elements and a greener 'living' character (see Figure 4.28).

Other key considerations include the ongoing maintenance and size of street trees/planting at maturity. Quality and maintenance should be viewed in a similar regard to the application of materials and finishes (as per Figure 4.27) with a hierarchical approach that promotes the use of higher quality planting within *Centres* and along streets which are the most active, such as *Arterial* and *Link* Streets, and around *Focal Points*.

Figure 4.27: Example from Dundalk of an area with higher activity, the use of planted materials will be more sparsely and selectively applied in favour of more robust and durable materials.

Figure 4.28: Example of a residential character, a rich palette of planted materials will enhance green qualities.

Designers should also consider the size of trees, shrubs and other landscape elements at full maturity. In general designers should avoid planting that will grow to obstruct movement and surveillance. There are exceptions to this, for example overgrown medians can help reinforce narrower carriageways and tall shrubs may deflect sightlines reducing forward visibility.

Streets also support an important drainage function within built-up areas. The shift toward sustainable forms of development has seen the emergence of Sustainable Urban Drainage (SUDs) systems. SUDs consist of a range of measures that emulate a natural drainage process to reduce the concentration of pollutants and reduce the rate and volume of urban run-off into natural water systems (and thus the pollutants it carries). The incorporation of SUDs elements into the fabric of the street itself can also serve to increase legibility and add value to place (see Figure 4.29). Further advise with regard to the use of SUDs may be found in the *Greater Dublin Strategic Drainage Study* (2005).

Figure 4.29: Examples of Sustainable Urban Drainage incorporated into a street in the form of a small 'swale' (top) and larger linear basin (bottom). These treatments not only assist in containing urban surface water run-off but also contribute to the sense of place by adding a unique feature.

4.2.8 Historic Contexts

Additional design considerations must be taken into account in areas of historic significance that are highly sensitive to interventions. Historic features help reinforce an areas character/place value and may also play a role in managing speeds (see Figure 4.30). The most appropriate course of action should be to minimise any level of intervention to existing historical features.

Elements of street furniture associated with the historic use of the street should be identified and protected, where appropriate (see Figure 4.31). Significant historic features may also include the street surface itself (as per Figure 4.30)[18] and any features set into it such as coalhole covers, weighbridges, pavement lights, cellar doors etc.

An 'assessment of significance' should be prepared when dealing with interventions within historic core areas. This is seen as addressing/acknowledging essential elements of the historic urban environment which may have architectural, historical and technical significance. For example when dealing with an established street layout and associated materials a distinction is drawn between three levels of significance:

1. Undisturbed areas of existing historic streets, which have the highest value and bear witness to the skill of historic craftsman;

2. Areas where streets have been altered or reconfigured using the original design/material;

3. Reinstated street areas re-using salvaged material from other places.

The mechanism for the protection of historic areas is based on statutory protection. If an area lies within an Architectural Conservation Area (ACA) or forms part of the setting of a protected structure (or a number of protected structures), development policies will be set out in the relevant County/City Development Plan, as well as active planning control.[19]

Figure 4.30: The stone sett paved carriageways of Temple Bar, Dublin, are of historical significance, enhance the areas value as a cultural corner and calm traffic by creating a sense of shared space.

Figure 4.31: An example of a historic water fountain in Newcastle, Co. Dublin. Such features are integral of local identity and should be retained.

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18 *Refer to Paving: the Conservation of Historic Ground Surfaces.* Forthcoming in 2013. Department of Arts, Heritage and the Gaeltacht.'

19 Refer also to the *Architectural Heritage Protection Guidelines for Planning Authorities* (2011).

4.3 Pedestrian and Cyclist Environment

4.3.1 Footways, Verges and Strips

A strong sense of enclosure and active street edges contribute to a pedestrians/cyclists sense of security and comfort by creating streets that are overlooked, animated and sheltered from inclement weather conditions. Studies have found that providing wider and better quality walking facilities can lead to an increase in walking.[20] Well designed footpaths are free of obstacles and wide enough to allow pedestrians to pass each other in comfort. For this purpose the footpath is divided into three areas (see Figure 4.32):

- Footway: this is the main area along which people walk.
- Verges: These provide a buffer between pedestrians and the vehicle carriageway and provide space for street furniture and street trees as well as overflow space for pedestrian movement (see Figure 4.33).
- Strips: These spaces, provided directly to the front of a building, may be occupied by activities generally associated with retail/commercial uses such as stalls or outdoor seating. Strips may be incorporated into the private space of a dwelling (as per Figure 4.13).

Footways

Minimum footway widths are based on the space needed for two wheelchairs to pass each other (1.8m). In densely populated areas and along busier streets, additional width must be provided to allow people to pass each other in larger groups. In this regard:

- The width of footways should increase from *Suburbs* (lower activity), to *Neighbourhood* (moderate activity) and to *Centres* (higher activity) and as development densities increase.
- The width of footways should increase according to function from *Local* (lower activity), *Link* (moderate activity), to *Arterial* streets (moderate to higher activity) as connectivity levels increase.
- The footway should be maintained at a consistent width between junctions and should not be narrowed to accommodate turning vehicles.

Figure 4.34 illustrates the space needed for pedestrians to comfortably pass each other with reference to the anticipated levels of activity within a street. These standards should be used to formulate the minimum footway widths.

20 Refer to Section 5.1 of the UK *Manual for Streets 2* (2010).

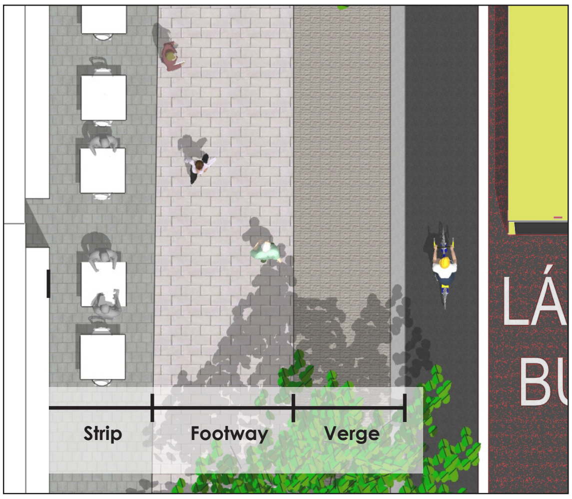

Figure 4.32: Illustration of the area generally thought of as the footpath. This area should be viewed and designed as three areas of activity.

Figure 4.33: Example from Castlebar, Co. Mayo, where the verge acts a designated space for street furniture, lighting facilities and planting of trees, keeping the footway clear of obstacles.

In areas of particularly high pedestrian activity, such as shopping streets or close to major nodes (such as a train station) more complex modelling may be needed to determine footway widths. In such cases designers may refer to the UK *Pedestrian Comfort Guidance for London* (2010) for further guidance in regard to footpath widths based on the volume of pedestrians per hour (provided these do not fall below the thresholds in Figure 4.34). This guidance may also be of particular assistance in assessing pedestrian comfort levels on existing footways.

In a retrofit situation increasing footpath widths should be a priority for designers and where appropriate, accommodated by narrowing vehicular carriageways (see Section 4.4.1 Carriageway Widths). Increases in width should also be considered as part of a package of facilities, including the provision of cycle lane/tracks, on-street parking and other street facilities (including street trees).

Designers should also ensure that the design of vehicle crossovers clearly indicate that pedestrians and cyclists have priority over vehicles. There should be no change in level to the pedestrian footway and no use of asphalt (which would incorrectly indicate vehicular priority across a footpath). Large or busy driveways (i.e. access to large car parks) may, however, be demarcated by a change in surface materials, such as contrasting paving and/or coloured concrete (see Figure 4.35). Designers should also refer to Section 5.4 - Entrances and Driveways of the *National Cycle Manual* (2011) for further design guidance where cycle tracks are present.

Verges

The need and size of the verge will largely be dependent on the function of the street and the presence of on-street parking. In general:

- On *Arterial* and *Link* streets with no on-street parking a verge of 1.5-2m should be provided as a buffer and to facilitate the planting of large street trees and items of street furniture.

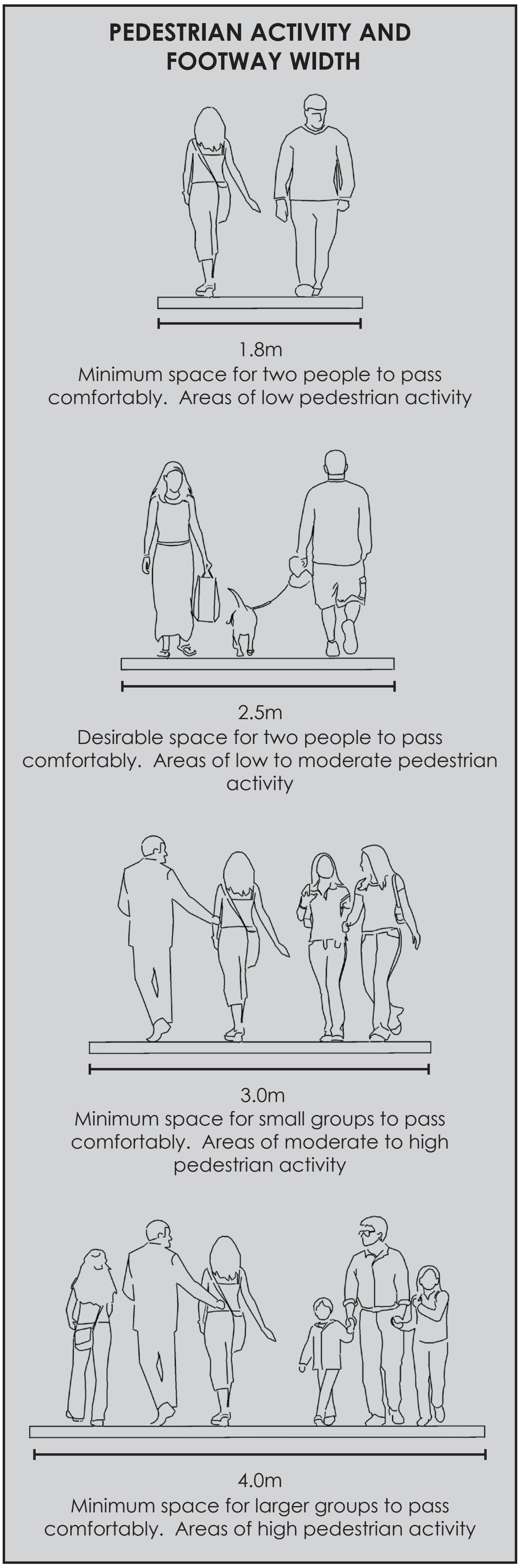

Figure 4.34: Diagram showing the amount of space needed for pedestrians to pass each other with regard to pedestrian activity levels.

- There is no minimum requirement for verges on *Local* Streets, but designers may need to provide space to prevent any encroachment of street furniture into the footway.

- Where on-street parking is provided, a verge (and change in kerb line) may be needed on approaches to junctions to enforce the visibility splays (see Section 4.4.5 Visibility Splays). In such cases the width of the verge will generally correspond to the width of car parking spaces.

- A verge should be provided where cycle tracks are located adjacent to parking spaces (see Section 4.3.5 Cycle Facilities)

- A verge (minimum of 0.3m) should be provided in areas of perpendicular parking where vehicles may overhang the footway (see Figure 4.36)

Strips

Strips may be provided as a designated zone that further animates the street and, in the case of a residential property, provide a buffer between the footway and the private residence.

With regard to areas of commercial activity:

- Where outdoor seating is provided the minimum width of a strip should be 1.2m.

- Outdoor seating may also be provided within a verge area, where the footway runs between the shop front and seating area.

- There is no recommended maximum size of a strip, but the design team should consider the impact of larger setbacks on the sense of enclosure of the street if a large area is proposed.

- A designated strip may also be considered within *Centres* on shopping streets to provide additional space for window shopping.

For residential areas designers should refer to Section 4.2.3 Active Street Edges, with regard to the width of privacy strips.

Figure 4.35: Example from Dublin where pedestrian priority across driveways is indicated by maintaining footway levels and surface treatments.

Figure 4.36: An example where a narrow verge is provided to ensure that vehicle overhangs do not intrude on the footway.