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English version

The cross-section, a sharing tool for urban roads

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Resources, regions and habitats
Energy and climate
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Present for the future

The cross-section,
a sharing tool for urban roads

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et les constructions publiques
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Foreword for publications translated into foreign languages

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Thanks

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Introduction

Urban roads are characterised by the multiple functions they fulfil: they carry vehicular traffic, provide car parking, accommodate pedestrian traffic, and enable us to access shops, amenities and housing. And yet the car has progressively taken over more and more of the available road space, at the expense of other road users. Today, in response to social and environmental demands, public policy seeks to give priority to other forms of travel, such as cycling, walking and public transport, by controlling car use more effectively.

How should streets be organised in order to accommodate all these uses? How can different transport modes and the various needs of residents and other users be reconciled? How should the available space be shared out? Of course, there is no single answer to these questions: each individual street must be considered on its merits and according to the importance of its different functions.

With this in mind, this work provides road designers with techniques and tools to help them successfully ration urban road space while maintaining a "unifying" approach. In this guide, the reader will find all the recommendations necessary to create variable cross-sections and their constituent elements: footpaths, carriageways, dedicated spaces for cyclists and public transport, separators, and vegetation.

Preliminary comment

This document is an abstract of the french guide "*Le profil en travers, outil du partage des voiries urbaines*"

The original french version includes five key chapters and two appendix:

- Chapter 1 – Sharing the public space
- Chapter 2 – Which sharing for which urban roads?
- Chapter 3 – The preliminary studies before the design
- Chapter 4 – Building the cross-section
- Chapter 5 – Sizing the constituent elements of the cross-section
- Appendix 1 – The regulatory framework
- Appendix 2 – Lateral margin dimensions between users

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1. Sharing the public space

1.1 The notion of sharing

1.1.1 Definition and transcription to the public space

The term *sharing* induces two apparently contradictory notions:

Sharing = **pooling** together

Sharing = dividing into **several parts**

In both cases, the definition refers to "beneficiary" players who are, in the case in hand, users of the public space.

We should not be limited to the notion of travel mode but rather talk about shared **uses** of public space, as these are not solely restricted to the circulatory function. These uses not only include circulation and parking but also:

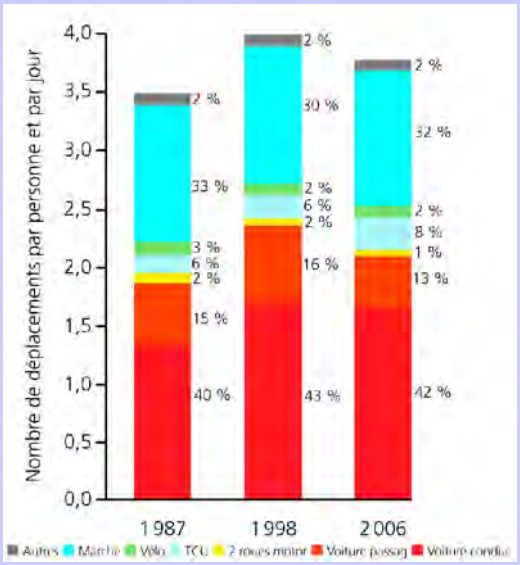
- local life in various forms (walking, temporary occupation for professional or recreational purposes, interface with neighbourhood activities),
- the installation of urban furniture and planting,
- functional utilities (sanitation, utility networks, etc.).

Did you know?

A survey on the mobility of people living in the Lille district shows an example of the breakdown of travel per mode in a large conurbation.

The car is the leading means of transport, but it fell between 1998 and 2006.

With 1/3 of transport modes, walking is the second most popular mode.



Source: Cete Nord-Picardie, on the basis of surveys of household travel 1987, 1998, 2006, métropole lilloise.

Sharing = pooling together

In this sense of the term, sharing relates to **joint** a**ppropriation of a single element** by the different beneficiaries.

For the public space, this corresponds to the idea of a **diversity** of uses, their mix at the same time and in the same place. This can concern a varying number of uses, depending on whether diversity is partial or total.

For example, there is partial combination of carriageways which, by default, welcome all motorised or non-motorised vehicles, combined bike/public transport lanes, on-road parking without marking whereas pedestrian priority zones [1] correspond more to total diversity.

Pedestrian priority zones correspond to places where diversity can be total (photo: Cete Méditerranée).

1 The definition of pedestrian priority zones is on page 16.

Sharing = dividing into several parts

In this sense of the word, sharing refers to the **breakdown** of the element in question **into several portions**, and their **distribution** to beneficiaries.

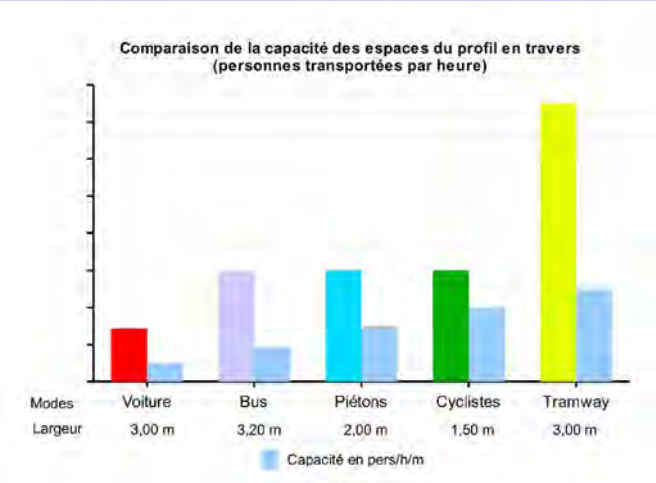
In the case in hand, this corresponds to the idea of breaking down the total land requirement and allocating thus determined elementary spaces to different uses and/or users.

Sharing then leads to a **separation** of these uses, in particular the separation of travel modes.

This separation is usually **spatial** and permanent through permanent allocation of places designated for given uses.

> *This leads, for example, to identifying elements such as the carriageway or the footway.*

Some figures...



The theoretical capacity of people transported in a tramway site is double that of a bus lane (on the basis of 250 people per tramway and 100 people per bus with a frequency of 2 minutes).

For equivalent width (3 m), a traffic lane processes 5 times fewer people (with traffic of 1,200 vehicles per hour and 1.15 persons per car).

With smaller measurements (2 m and 1.50 m), footways and cycling facilities have a capacity equal to a bus lane.

But the separation can also be **temporal**, as a space can be allocated to certain uses at certain times of the day.

This may be valid for:

- road networks designed to allow diversity;
  a good example of this is access allowed to delivery vehicles in pedestrian areas at certain times,

- or spaces allocated to certain uses;
  for example, reservation of parking spaces for deliveries and variable allocation of lanes depending on the direction or category of vehicle.

A lane for public transport only is used in the morning in one direction and in the evening in the other direction, in line with commuter traffic.

The two types of separation are of course not exclusive of each other, as spatial separation can only concern part of the total land requirement.

As far as the public space is concerned, this dual notion of sharing applies both to linear spaces like streets and public squares.

In the first case, the only point of interest to us here, the dominance of longitudinal traffic functions, leads us to analyse separation and diversity in priority in the transversal dimension, the transcription of which is expressed in ***cross-sections***. This is the main purpose of this document.

1.1.2 The cross-section, the result of a choice

The determination of the cross-section is mainly founded on the development objectives of the street in question; it should be consistent with the functions assigned to that street and with its position in the prioritisation of the road network and the urban context.

To achieve these objectives, the choice between separation and diversity of uses can be made by taking into consideration the advantages and disadvantages of each configuration with respect to compatibility of these uses and by taking them all into account in the cross-section design process.

- In the case of separation, this is expressed by precautions to be taken in terms of juxtaposition and leads to the notion of "**separator"**.
- In the case of diversity, questions should be raised about the possible **cohabitation** of uses.

This partly depends on the regulatory field, as certain traffic conditions and use of space are governed by regulations (see below), but also, and above all, by best practices and experience feedback.

Moreover, the two senses of the word "sharing" are not mutually exclusive; *cross-sections* defined on this basis even usually combine spaces allocated to separate uses and places of diversity.

Examples:

Part of the total land requirement can be reserved for a given mode of transport (photo: Certu).

A carriageway allocated to "general traffic" by definition combines several transport modes (photo: Cete Nord-Picardie).

A lateral space in the total land requirement is often dedicated to several uses (photo: Cete Nord-Picardie).

1.2 The regulatory framework

The design, management and operation of lanes open to public traffic are governed by rules set out in:

- Code de la route,
- Code de la voirie routière,
- Code de l'urbanisme,
- Code de la construction et de l'habitation,
- Code de l'environnement,
- various texts relating to accessibility, in particular Act 2005-102 dated 11th February 2005 for equal opportunities, participation and citizenship of disabled persons.

It is worth recalling a few essential rules here relating to terms of use of the public space which authorise the presence of users or not in specific road spaces.

Certain diversities of use are thus instituted by regulations that set a definition for certain elements:

- the **pedestrian area** allows diversity between pedestrians and bicycles (article R. 110-2, Code de la Route);
- the **pedestrian priority zone**, on the carriageway, allows diversity between all users. Pedestrians are priority users (article R. 110-2, Code de la Route);
- the **carriageway** is the part of the street where all motorised and non-motorised vehicles should normally circulate (article R. 110-2, Code de la Route). Cohabitation with pedestrians is possible if there are no footways or suitable verges for their use (pedestrians therefore need to walk on the side of the carriageway, according to R. 412-35, Code de la Route).

Certain types of diversity are allowed by law if the traffic policing authority issues a decree:

- in pedestrian areas, only access of motorised vehicles needed to deliver to the zone is allowed (article R. 110-2, Code de la Route);
- cycling tracks and lanes can be open to motorcycles (article R. 431-9, Code de la Route);
- dedicated lanes can be open to several categories of user if the mayor's decree establishing them allows it (article R. 412-7, Code de la Route).

Other types of diversity are clearly excluded:

- footways are only allocated to pedestrians, children under 8 may however sometimes cycle on them (article R. 412-34 of the Code de la Route);
- ways reserved to one or several categories of users are, by definition, forbidden to other categories (article R. 412-7 of the Code de la Route).

Mode	Piétons	Vélos	Cyclomoteurs	Motos	Véhicules légers et poids lourds	Autobus	Tramways
Trottoir		Sauf enfant (art. R. 412-35)					
Aire piétonne			limitée à la desserte (art. R. 411-3)				
Zone de rencontre							
Voie verte							
Bande cyclable	si trottoir absent ou non accessible (art. 412-35)		Par arrêté (art. R.431-9)				
Piste cyclable			Par arrêté (art. R. 431-9)				
Chaussée		(*)					
Site TC		Par arrêté			Par arrêté		

Présence autorisée par les textes réglementaires
Présence autorisée moyennant conditions particulières ou arrêté du gestionnaire de la voirie
Présence interdite
(*) La loi LAURE impose, en amont, leur prise en compte

Terms of use of public space imposed by regulations .

1.3 Compatible uses

Over and above the regulatory aspects, diversity between the different uses of the public space can only be envisaged if they are compatible in terms of safety and functionality for the users present.

It is obvious that static uses (parking or urban furniture) should not be mixed with medium or high speed travel speeds for safety reasons and even comfort. Remember that parking is authorised in specifically defined spaces, or failing that on the carriageway unless it hinders traffic. The installation of urban furniture should be designed to be compatible with paths and circulations.

As far as compatibility with travel modes is concerned, two essential criteria are to be taken into account to appreciate it: speed differentials and flow volumes between the relevant user categories which interact with each other.

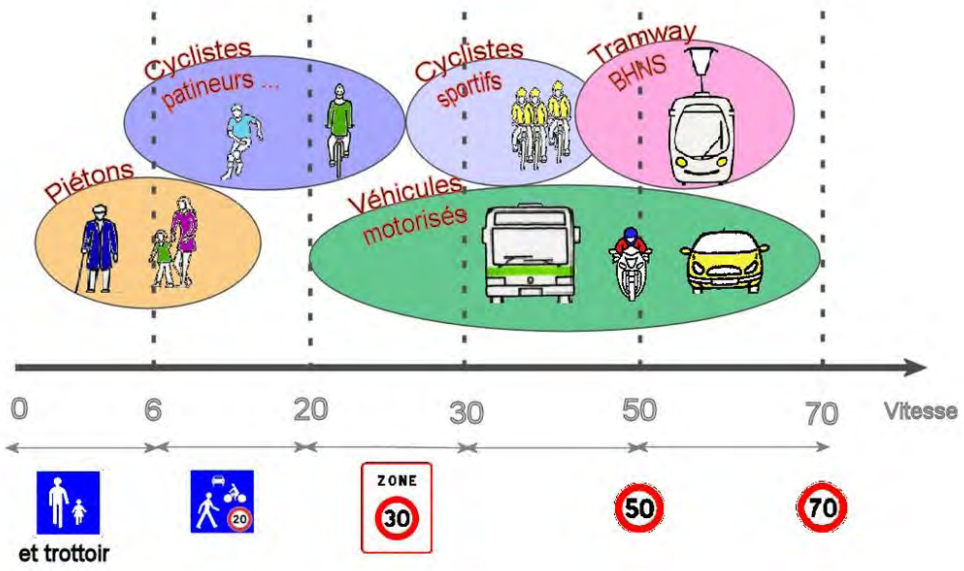
Speed differential is a fundamental criterion which could make separation between modes desirable and even necessary when too high.

For example, the AICPR document on non-motorised transport[2] identified five speed segments where cohabitation did not raise a problem:

- 0 – 6 km per hour speeds practised by pedestrians and other footway users;
- 6 – 15 km per hour speeds practised by the majority of cyclists, skaters, electronically powered bicycles;
- 15 – 30 km per hour speeds practised by athletic cyclists, most motorised vehicles in neighbourhood or city centre streets;
- 30 – 50 km per hour speeds practised by motorised vehicles on main roads;

2 By J.-C. Poutchy-Tixier: “Taking into account Non-Motorised Transport in road network planning”, International seminar on sustainable development in road transport, New Delhi, November 2001 and “Transport Non Motorisé”, January 2002.

- 50 – 70 km per hour speeds practised by motorised vehicles in structuring roads in periurban environments, motorcyclists, priority vehicles.



Speed practised by users in the city: an essential criterion for diversity.

When use of the bicycle becomes an urban transport mode, separation between cyclists and pedestrians proves necessary for everyone's safety (photo: Cete de l'Est).

On a "voie verte" or greenway, where space is mainly dedicated to walking, cyclists and pedestrians can cohabit (photo: Cete de Lyon).

Even though it is difficult to define general quantitative rules, the necessity of guaranteeing certain fluidity of different traffic leads to the introduction, among choice criteria, of **frequency of use** of the space in question and the **importance of flows**, both in absolute and relative terms. A small number of users present in the same space makes diversity possible. Likewise, it can be envisaged in the case of a strong imbalance in favour of the most vulnerable users.

For example: *streets of a housing estate without space allocated to pedestrians,*
infrequently used bus lanes open to cyclists,
pedestrian zones where pedestrians dominate and motorised users are infrequent.

Infrequently used bus lane open to cyclists (photo: Cete de l'Est).

Where is it possible to mix transport modes?...

The following table presents a summary of **diversities allowed by regulations** which may be **reasonably envisaged** in terms of safety and functionality of the relevant road networks.

This table is only indicative. Each case of diversity should be examined in detail, in particular according to frequency of use criteria. The different terms used to designate types of roads or lanes mentioned in the table below correspond to definitions given in the glossary in the appendix.

<table>
<tr><th>Mode</th><th>Vélos</th><th>Cyclomoteurs</th><th>Motos</th><th>Véhicules motorisés (avec peu de PL)</th><th>Véhicules motorisés (avec beaucoup de PL)</th><th>Autobus</th><th>Tramways</th></tr>
<tr><td>Piétons</td><td>aire piétonne
voie verte</td><td>aire piétonne
zone de rencontre
rue sans trottoir (*)</td><td>aire piétonne
zone de rencontre
rue sans trottoir (*)</td><td>aire piétonne
zone de rencontre
rue sans trottoir (*)</td><td></td><td>aire piétonne</td><td>aire piétonne</td></tr>
<tr><td>Vélos</td><td></td><td>piste et bande (avec arrêté)
zone de rencontre
zone 30</td><td>zone de rencontre
zone 30</td><td>zone de rencontre
zone 30</td><td></td><td>couloir mixte</td><td rowspan="5">site banal</td></tr>
<tr><td>Cyclomoteurs</td><td></td><td></td><td rowspan="4">chaussée des zones de rencontre, zones 30, rues à 50, sections 70</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>Motos</td><td></td><td></td></tr>
<tr><td>Véhicules motorisés (avec peu de PL)</td><td></td><td></td></tr>
<tr><td>Véhicules motorisés (avec beaucoup de PL)</td><td></td><td></td><td></td></tr>
<tr><td>Autobus</td><td></td><td></td><td></td><td></td><td></td><td></td><td>site réservé TC</td></tr>
</table>

Mixité possible sans précaution particulière (par rapport au site considéré)
Mixité envisageable moyennant conditions particulières
Mixité non envisageable

(*) The “street without footway” configuration corresponds to several streets in small towns and villages, old urban centres but may also apply to housing estates. These roads could be considered to be either pedestrian priority zones or 30 zones. They are usually limited to reduced total land requirements with very low traffic where pedestrians can walk without danger and the visually-impaired can find their way with respect to the closeness of buildings.

“Pedestrian priority zone”: a space with pedestrian priority where all users are accepted.

To make this cohabitation work, vehicle speed is limited to 20 km per hour.

The “pedestrian priority zone” concept can be applied to a street, cover a square or set of streets. It is not very extensive in order to make it possible to reduce vehicle speed drastically.

This is expressed by features designed for pedestrians to encourage or even force vehicles to drive slowly. The space should be convivial with a carriageway that is not sharply defined while maintaining an imprint. Blind and visually-impaired persons but also elderly people or other pedestrians requiring it should be able to identify lateral spaces on which they can walk comfortably and safely without mixing with vehicles.

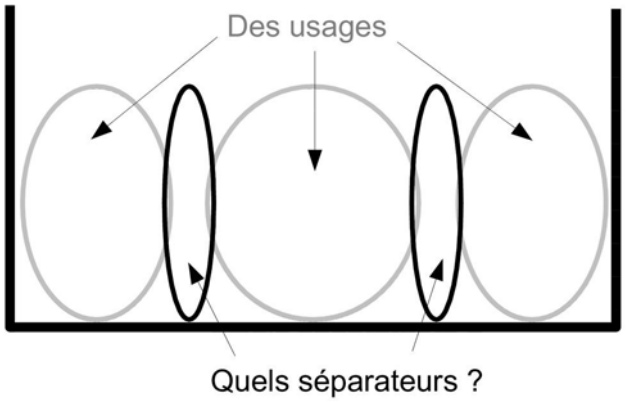
This new concept to France already exists with a few variants in Belgium and Switzerland but a few French streets have also been developed in this spirit.

1.4 Separation of uses

Although it is possible to separate all uses of public space, it should not be the basic rule in the urban environment; the street should maintain a user friendly character where exchange should be encouraged.

This separation is often impossible owing to limited available total land requirement.

If required to separate users, by allocating a defined part of the total land requirement to them, the dual question of their **juxtaposition** and **materialisation** of the separation needs to be addressed. It is then necessary to determine the type, nature and dimensions of the separator.



1.4.1 Juxtaposition and positioning of uses

The context and objectives condition the positioning of users in cross-sections. Their degree of compatibility and their relative positioning has a direct impact on the type and dimensions of separator and calibration of road network spaces.

In absolute terms, although it is possible to put all modes into direct contact, it is not reasonable in many cases, especially when contiguous spaces have been very tightly calibrated and when the speed differential is too high.

In regulatory terms, there are few restrictions in this area. The Code de la Route however, in principle, enforces the positioning of antagonistic traffic lanes by stipulating driving on the right. Likewise, a cycle lane is necessarily positioned to the right of the carriageway.

As with diversity, the speed differential and flow volumes involved are essential criteria to determine if two modes can be juxtaposed. This produces the frequent recommendation to "place the most rapid modes in the centre and leave pedestrians in contact with neighbourhood spaces".

These elements are also essential for the choice of the type of separator to be implemented. This is for example what makes the levelling of pedestrian areas acceptable with respect to carriageways inside 30 zones.

As with diversity, the relevance of the juxtaposition of uses can be assessed in terms of advantages and disadvantages and with reference to their mutual compatibility.

The juxtaposition of narrow footways and motorised circulation induces a sense of insecurity for pedestrians (photo: Certu).

Pedestrians are more comfortable on this narrow footway: vehicles leave room thanks to the cycling lane (photo: Cete Méditerranée).

1.4.2 The notion of separator

As mentioned above, the choice of separating certain uses immediately raises the question of the separating object, linked with ideas on juxtaposition.

The separator can thus be defined as a means of materialising the cross-section, **which has no other purpose** than to separate both sections of a road, with respect to the uses allocated to them.

The separation of both uses suggests their juxtaposition and in fact covers two functions:

- The demarcation of the allocated spaces,
- The protection of spaces (with respect to other uses).

This definition leads to the exclusion of central reservations when they are wide enough to allow another circulatory function and when they have been laid out in consequence (e.g.: pedestrian paths, parking). In this case, it will however be necessary to consider the separator used in order to materialise the limit between this space and the surrounding carriageway(s).

It is accepted however that the installation of road facilities (public lighting, signage, etc.) or planting (alignment plantation, borders, lawn, etc.) on a space primarily designed to separate lanes or parking should not prevent us from considering this space as a separator.

According to this logic, simple level change or regulatory marking are separating systems as they materialise the limit between spaces allocated to different uses.

A curb between a footway and carriageway, a "bump" between the general road and public transport dedicated lane, longitudinal marking between specialised or dedicated lanes are examples of this type of separator which provide little or no protection at all from a user intruding a neighbouring space.

Restraining systems (crash barriers, etc.), walls and fences are also elements that can be considered to be separators. Their user protection function, contrary to the previous case, corresponds to the maximum level of separation as they cannot be crossed. However, it should be noted that they are not urban development tools adapted to the subject of this guide.

What the Code de la Route says...

A solid line is a separator that may not be crossed

Art. 412-19 "*When axial or traffic lane longitudinal lines are placed on the carriageway, they forbid drivers from crossing them".*

Likewise, markings of a cycle or bus lane cannot be crossed by general traffic lane users. The latter cannot overlap, even occasionally, into these dedicated spaces except to leave or approach the carriageway.

Art. 412-23 "*When the carriageway has broken longitudinal lines defining the traffic lanes: [...]*

2° If it is a lane reserved for certain categories of users, the other users can only cross into it to leave or approach the carriageway".

The notion of separator can therefore not be dissociated from the degree of its **permeability**, which is only meaningful if one reasons in terms of

"**surmountable feature"** ***by whom?***

and ***in which conditions?***

This amounts to defining the degree of protection of spaces allocated against deliberate intrusion or not by other users.

Although the main function of the separator is to materialise allocation of spaces in order to favour legibility and give a concrete aspect to regulations, it is just as important to choose a system that guarantees satisfactory compliance with objectives and operating and safety issues.

The limits of the efficiency of a solid white line between two traffic lanes or of a footway curb with respect to parking are good illustrations of this issue.

Photo: Cete de l'Est

The degree to which a separator may be crossed mainly depends on three factors making it more or less dissuasive to the various users:

- its nature,
- its form,
- its dimensions.

For example, a row of bollards can be crossed by non-motorised users, but not by cars. This type of separation should however be used in roads where vehicle speed is low as they can become dangerous obstacles for motorcycles.

Photo: Cete de l'Est

The choice will therefore depend in the first place on the type of users that need to be separated. But it is not enough to take its nature only into account. It is also necessary to take into account the conditions of these uses in the space allocated to them, in particular the width of these spaces and the general organisation of the street.

- The separation should be naturally be clearer and should be insurmountable when two users with a large speed differential cross each other. Example: narrow footways and traffic at 50 km per hour.

Insurmountable separation justified by a major speed differentiation between tramway and cyclists (Photo: Certu).

- Insurmountable separators produce greater flexibility of use if the speed differential is not too high; it is then possible to reduce the width of the spaces or authorise occasional crossing over which would not disturb general operation and not jeopardise safety.

A surmountable separator is used to reduce traffic to one lane in an automobile carriageway next to a tramway platform while maintaining the possibility of exceptionally overtaking a stationary vehicle (breakdown). (Photo: Certu)

The choice of the type of separator and its sizing are covered later in this guide (part three).

1.5 Advantages and disadvantages of spatial diversity and separation

Of all the key criteria used to appreciate the advantages and disadvantages of the two sharing options, the following should be recalled:

- space consumption, insofar as the total land requirement is necessarily limited;
- visibility of the development which has an impact on safety and appeal;
- functionality for the different uses considered individually, in terms of proximity and exchanges;
- management and maintenance requirements;
- the urban landscape[3] which contributes to the perception of the place.

1.5.1 Diversity of uses

As already mentioned above, diversity is not possible in all cases. Certain uses are obviously incompatible. It can only exist in certain conditions.

Space consumption

Diversity allows optimisation of **the consumption of space** by the presence of several users in the same surface area and by the economy linked to the absence of a separator. This should be put into perspective in certain cases where diversity requires an extension of the space. This is for example the case of bus lanes open to cyclists.

Photo: Certu

Advantages

• Consumption of a reduced space

Disadvantages

• In some cases, involves the extension of spaces

3 The notion of "landscape" should not be restricted to plants but also cover notions of configuration and the atmosphere of a locality.

Legibility

For users in traffic, the space is less **legible** than in the case of spatial separation; the landscape and processing of mixed locations require more care to make them understandable to users "in transit in the site" (example of the pedestrian area) and can raise identification problems. Understanding is however more simple transversally, except for blind and visually-impaired persons.

Photo: Cete de l'Est

Advantages

- General understanding of space is more simple transversally

Disadvantages

- In principle not so good for longitudinal uses
- Difficult for blind and visually-impaired persons to find their way

Longitudinal functionality

In principle, diversity has a generally positive impact on safety as it usually slows downs the speed of the fastest users owing to the enforced cohabitation with other, slower users; this is however the result of a balance of power that implies that the latter are present in sufficient number. To the contrary, it can become a disadvantage in terms of efficiency for public transport for example.

Photo: Cete de l'Est

Advantages

- Reduced speed and better awareness of other users

Disadvantages

- Penalises the most rapid modes

Transversal functionality

It makes transversal uses easier and improves **accessibility** for a large proportion of users with better permeability of lanes (absence of separators). But it also involves mixing potential conflicts in the same location.

Advantages

- Permeability of spaces

Disadvantages

- Multiple conflicts in the same location

Photo: Certu

Operation and maintenance

Operation is usually made easy and simple in terms of access and width of spaces to be processed, but the increase in the number of uses makes it more difficult to neutralise space for intervention on a temporary basis.

Advantages

- In principle simplified by the uniqueness of the space, easier access

Disadvantages

- Space more difficult to neutralise, travel more generally hindered

Urban landscape[4], atmosphere of locations

If the necessary care is not taken with design, a mixed space could offer a sensation of uniformity.

Advantages

- Weaker road connotation

Disadvantages

- Risk of uniformity

Photo: Cete de l'Est

4 The notion of "landscape" covers notions of configuration and the atmosphere of the locality.

1.5.2 Spatial separation of uses

We have already seen that, in absolute terms, separation can be set up between all uses.

Space consumption

In terms of **space consumption**, the juxtaposition of elements dedicated to one single mode can lead to large total land requirements, even though some spaces are not often used. This is accentuated by the necessity of inserting separators between these elements in certain cases. But in view of necessarily smaller total land requirements, the will to separate often leads to minimal widths for each use which is a disadvantage on the functional level.

Photo: Certu

Advantages

- Better control of flows and spaces

Disadvantages

- More important owing to the allocation of dedicated spaces
- Risk of insufficiently sizing space

Legibility

Better **legibility** of locations generally results from the allocation of spaces reserved for each use, in particular for longitudinal traffic, except if this leads to excessively complex organisation. This is not necessarily obvious for transversal uses, depending on the width available and nature of features.

Photo: Certu

Advantages

- Better longitudinal legibility owing to the allocation of separators

Disadvantages

- Enhanced complexity of junctions
- To be put into perspective for transversal uses

Longitudinal functionality

Photo: Certu

On the **functional level**, longitudinal uses, in particular circulatory, are facilitated by the reservation of spaces that reduce cohabitation conflicts, but perverse effects can arise (in particular, increased speeds of motorised modes). The low use of certain dedicated spaces can also lead to deviated uses (e.g.: dedicated lanes used by other modes). In addition, gains in the main section are often cancelled out at junctions in terms of capacity and fluidity of traffic.

Advantages

- Dedicated spaces: improved safety and efficiency
(this needs to be put into perspective by the impact of junctions)
- Improved continuity of itineraries for a given mode

Disadvantages

- Perverse effects (speed, non-compliance with dedicated sites)
- Often leads to minimal widths per use

Transversal functionality

Photo: Certu

Transversal exchanges can be made more difficult by separators, despite the possibility of creating “refuges”. Simplification of conflicts is counterbalanced by an increase in their number. Respect for accessibility constraints incurs specific features.

Advantages

- Simpler conflicts: separators can offer “refuge” possibilities

Disadvantages

- Penalised by separators and the succession of conflicts
- Lengthening of crossings
- Increase in the number of intersections, causes of reduced safety

Operation and maintenance

Operating restrictions are linked to the multiplication of reduced width spaces and the presence of separators that complicate cleaning and repair tasks and maintenance operations (on networks, facilities). This can lead to neglected maintenance of certain sections.

Advantages

- Possibility of maintaining certain uses in the case of heavy intervention

Disadvantages

- More complex and expensive maintenance (specific equipment needed)

Urban landscape, atmosphere of localities

In terms of **landscape**, the advantages and disadvantages are more difficult to outline: separation, which involves differentiation of spaces is, in principle, a favourable factor to combat uniformity. However it offers the disadvantage of breaking up the public space.

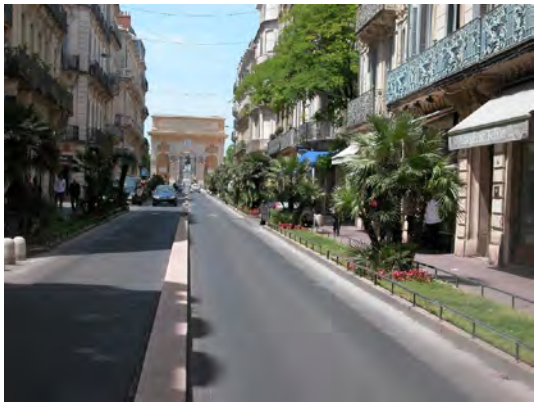


Photo: Certu

Advantages

- Diversity, a varied range of tools made up by separators
- Organisation of the space
- Perspective effects

Disadvantages

- Breaking up of the space, road widths, multiplicity of elements
- More striking functional aspect

2. Building the cross-section

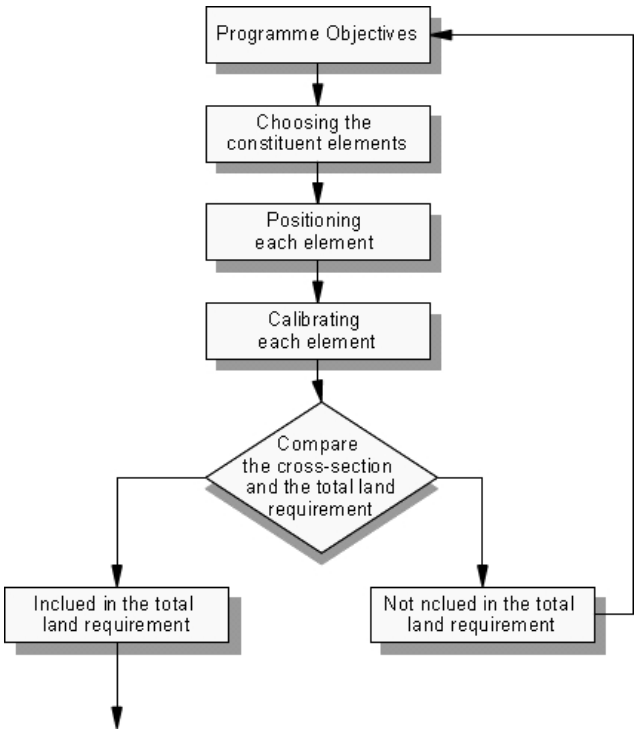
The planning programme consists of the diagnostic of objectives and sequences set out in the previous chapter. On that basis, it is possible to make technical proposals for cross-sections. The approach guiding these proposals is described below.

Even though it is not recalled in this chapter, the developer should bear in mind the type of street, its urban context and the programme's objectives. To guarantee the quality of the development, this system should be applied to all detailed proposals to be made.

In practical terms, this firstly consists in organising circulations for the different users in space or time then sizing each chosen element in the section's composition.

This construction is iterative as it is rare for functional requirements to correspond precisely with available total land requirement. It will firstly be done for the main road section. Secondly, it will be necessary to check that the cross-section works in view of a large number of factors and restrictions that could call its use into question: junctions, networks, accessibility for private users or require its adaptation to specific points: junction, reduced total land requirement, infrastructure…

For a given sequence, this study phase can result in the construction of several sections meeting the programme's objectives.



Iterative approach to the construction of the cross-section

2.1 Organising circulations

The urban road network needs to receive various circulations which, as seen in part one, are not always compatible and each have their own requirements. Good organisation of circulations and uses is therefore necessary to avoid conflicts, offer maximum security for all and create spaces consistent with needs expressed in the programme.

2.1.1 Choosing the constituent elements of the cross-section

The functions allocated to the road and the sharing principle[5] will allow a choice of all or part of spaces. It is obviously not necessary to create a specific space for each transport mode but, owing to the multiplicity of uses and transversal exchanges and rarity of spaces, it is often necessary to organise certain cohabitations.

On the basis of the chosen organisation, the designer will specify the spaces making up the section:

- Footways are necessary in all cases except in certain cases (pedestrian area, shared space, housing estate road, etc). They will be studied in such a way as to:
  - ensure access that is at least compliant with regulations on road accessibility for disabled persons;
  - welcome other uses other than access: installation of urban furniture, presence of stalls, markets, footway cafés, refuse management, etc.
- Likewise, cyclists should be taken into account, by defining the type of development most adapted to the context. This is an obligation set out in article 20 of the LAURE Act;
- Then the prioritised objectives of the programme will set:
  - the number of lanes in the carriageway depending on the type of traffic and level of service targeted;
  - the existence of automobile, cycle, motorcycle and delivery parking needed, depending on the neighbourhood's requirements, road's functions;
  - the existence of lanes reserved for public transport depending on the level of service required;
- Finally, the respective position of each space and allocation conditions determine the presence of separators and their degree of "surmountability".

At this stage in the design, no use or transport mode should be discarded in principle. The aim is to favour access to the largest number by:

- finding a balance to avoid dominant functions;
- not excessively specialising the spaces in order to allow their use by different functions and differently in time in order to optimise space consumption;
- set up circulation spaces according to homogenous speeds for better user safety;
- avoiding definitive definitions of possible uses of a location, as experience shows that real uses are often different from scheduled ones;
- avoiding that the road causes a break but, to the contrary, takes into account transversal exchanges;
- no longer sizing lanes for the rush hour only.

All these recommendations will help to find a cross-section where no element will be oversized to the detriment of others.

In the case of a small total land requirement, it is only necessary to keep what cannot be done elsewhere and, if necessary, ensure accessibility to services[6].

The different programmes proposed for road networks with equivalent functions will produce different organisations of cross-section spaces.

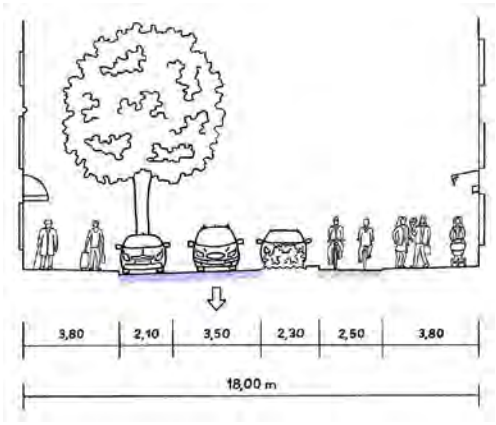
5 See part 1 which presents the sharing principles and questions to be raised in order to choose.

6 See paragraph 2.4.

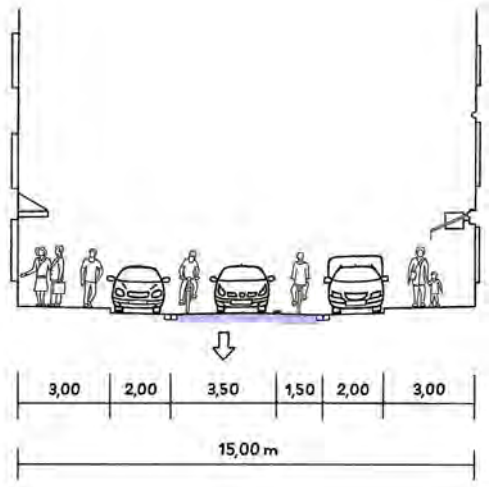
Examples:

Two layout examples for cyclists

For the same functions – presence of pedestrians, one-way street, parking needs, necessity of ensuring cycling continuity in both directions – with a similar total land requirement, there are two possible layout solutions.



Consistent with Grand Lyon's policy to develop cycling in the city, the idea behind the developed section of the rue de la Part Dieu was to separate cyclists from general traffic by creating a track. It is a structuring development for the city's cycling network with strong legibility (photo: Certu).

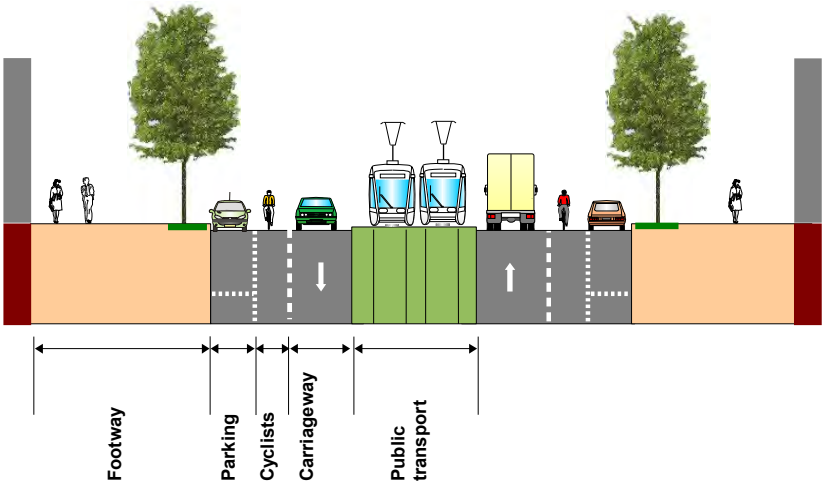


Layout of the rue d'Esquerchin in Douai where well-established local practices involving the presence of cyclists led developers to focus on diversity in one direction with the creation of two-way cycling facilities (photo: Cete Nord-Picardie).

2.1.2 Positioning each element

Secondly, the elements should be positioned in the cross-section according to the principles set out below.

Generally speaking, the fastest vehicles (or the ones required to be rapid) are those most distant from buildings. In this way, starting from building frontages and moving to the middle of the road, there are: pedestrians, bicycles, motorised vehicles[7] (light vehicles, light utility vehicles and motorcycles), public transport on dedicated lanes.



Basic principle, the most rapid vehicles are set at a distance from building frontages.

Certain requirements are imposed:

- Pedestrian areas are placed alongside neighbourhood activities;
- Parking zones are linked to a pedestrian space: a footway, a path laid out alongside a public transport dedicated lane, a central footway, etc.

7 Motorised vehicles include passenger vehicles, light utility vehicles, LGVs, motorcycles and public transport when not in a dedicated lane.

Spaces organised according to the general rule – Cours Charlemagne (Lyon)

Context

"*Re-establishing the city on the basis of water, producing an urban imagination on the confluent, thinking about space in terms of duration, intimately blending the city and the park, combining continuity of spaces and diversity of uses"* are just some of the objectives set out by the project to renovate the Lyon Confluence district. The Cours Charlemagne is its main street and was planned with all this in mind.

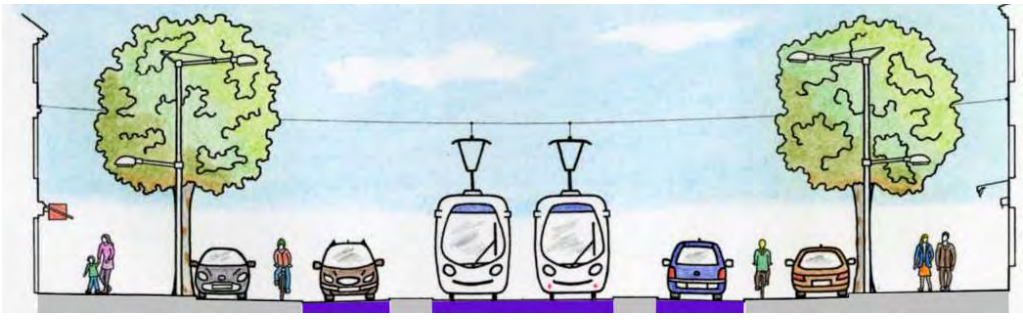
New uses, new sharing

The Cours Charlemagne should offer residents south of the Lyon peninsula with a link with the rest of the conurbation, provide links to existing and future facilities and therefore open up and help to develop the peninsula. Furthermore, it is one of seven main routes in the non-motorised traffic network identified by Grand Lyon in the conurbation's sustainable urban transport plan.

The extension of the T1 tram line providing efficient public transport with this district induced new sharing of the road network with a role given to each transport mode.

Initially mainly occupied by motorised vehicles with a carriageway 12m wide for a total land requirement of about 33 m, this avenue now offers spaces for pedestrians, cycles, public transport and motorised vehicles. Well organised, these spaces combine the efficiency of public transport, reduction of vehicle speed, legibility of cycling facilities and neighbourhood life. This redistribution of space is conditioned by the strong requirement to maintain the perspective given by two rows of plane trees. The lamp-posts and posts supporting the tramway lines are positioned in the tree alignment.

The tramway platform, carriageways and cycle lanes are separated by small level differences (around 5 cm) resulting in a certain permeability favourable to transversal uses. The Cours Charlemagne offers a new face where all users find their own place.

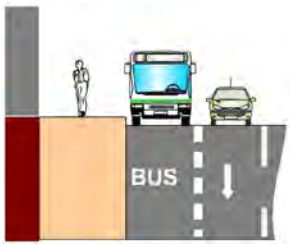


Separation and organisation of spaces following the general principle, with, in the centre, the fastest users, and pedestrians in contact with neighbourhood life (photo: Certu).

Other organisations of space are possible, some of which differ from the basic principle. It is then necessary to study the positioning of each element in detail as the juxtaposition induces conditions on development and on operation. These points are accompanied by brief comments, details of space design are featured in part five.

Spaces destined for public transport

Positioning public transport laterally can reduce its speed:



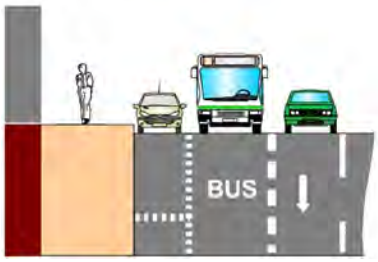
- one-way public transport lane alongside footways:

☺ stops take up less space in the section;

☺ favourable to bus/bicycle cohabitation;

☹ need for wide footways or adapted public transport speed;

☹ delivery and collection of household refuse made difficult .



- **one-way** public transport lane alongside parking:

☺ distances public transport from pedestrians;

☺ favourable to bus/bicycle cohabitation;

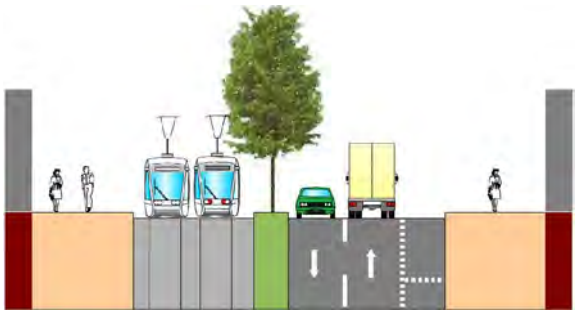
☹ could disturb parked vehicles;

☹ delivery areas to be developed closer to demand;

☹ collection of household refuse made difficult;

😐 laid out “advanced” stop;

😐 vehicles must be able to cross separators .



- **two-way** public transport lane (on a two-way traffic lane):

☹ residential access difficult;

☹ delivery and collection of household refuse made difficult;

☹ poor legibility in intersections;

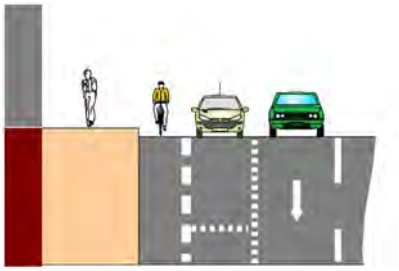
☹ in the presence of parking alongside the dedicated lane, the insertion of separators accessible to pedestrians could induce their longitudinal movement;

😐 pedestrian crossing requiring refuges.

Caption: ☺ favourable aspect, ☹ unfavourable aspect, 😐 recommendation.

Spaces for cyclists

The cycle lane is a lane on the carriageway, it is always positioned to the right of traffic. Cycle tracks are separate lanes, they can be positioned between parking areas and the footway:



- a **one-way** lane placed between footway and parking area:

😐 a broadened lane to take into account parking and the curb of the footway;

😐 well defined separation between footway and path;

☺ good safety in the main section with respect to passenger vehicles;

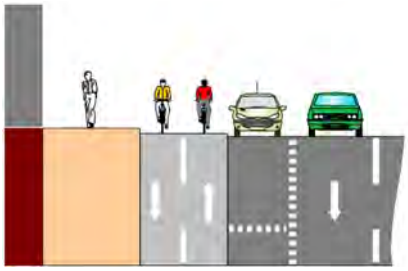
☺ recommended for lanes with little lateral activity and strong circulatory function;

☹ possible conflicts with pedestrians accessing parked vehicles;

☹ in-depth study of intersections for good visibility;

☹ separation between cycle path and parking designed not to hinder pedestrians accessing their vehicle;

☹ difficult insertion in general traffic.



- **two-way** path placed between footway and parking:

😐 located independently to the right or left;

😐 well defined separation between footway and the cycle path;

☺ good safety in the main section with respect to passenger vehicles;

☹ possible conflicts with parked passenger vehicles (to be modulated depending on the width of the cycle path);

☹ precise study needed at intersections to ensure good visibility;

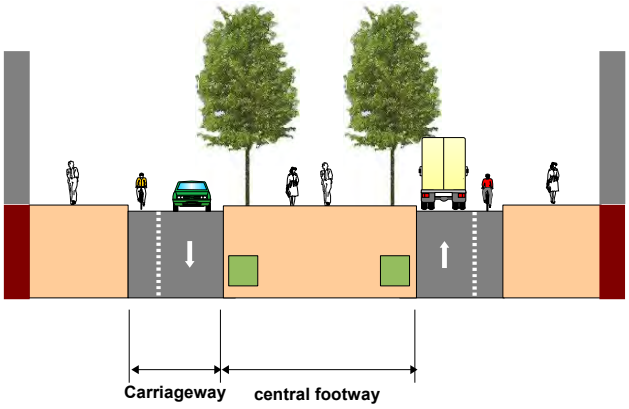
☹ difficult insertion in general traffic.

Caption: ☺ favourable aspect, ☹ unfavourable aspect, 😐 recommendation.

Case of central footways

In wide avenues, a central footway is possible if its geometric features allow pedestrians to walk on it:

- for pedestrians on the central footway:



😐 the recommended width is over 10 m;

☹ in the axis, pedestrian crossings at junctions are in conflict with vehicles turning left. This layout is unusual, making conflicts less obvious.

- for cyclists on the central footway:

☺ good safety in the main section;

☹ as for pedestrians, conflicts at intersections are not obvious;

☹ access to the cycle path forces cyclists to cross the carriageway.

Caption: ☺ favourable aspect, ☹ unfavourable aspect, 😐 recommendation.

Case of one-way roads

The position of spaces in one-way roads follow the same rules as those presented for two-way roads (see paragraph 2.1.2).

Cyclists should be allowed to take the contraflow by setting out a "double cycling way" or opening of a public transport lane (see part 5 for sizing conditions).

Two-way cycle paths on **two-way** public transport dedicated lanes are placed independently:

•to the **right** of the traffic direction, the general traffic direction is juxtaposed to the opposite direction of the dedicated lane:

- ☹ there is a risk of full-frontal impact and therefore of more serious accidents;
- ☺ but mutual visibility is good;
- ☹ legibility of the development is lower for transversal uses in particular for pedestrians, refuges are necessary;
- 😐 it is necessary to insert an insurmountable separator.

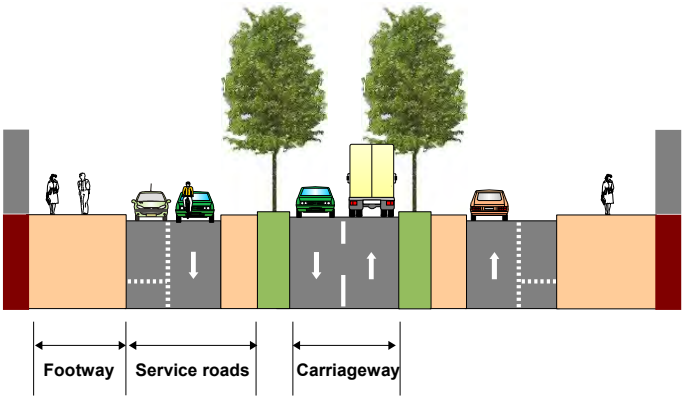
•to the **left** with respect to the traffic direction, the general traffic direction is juxtaposed against the same direction of the dedicated lane;

- ☹ mutual visibility is less good than in the previous case with more frequent impact risks;
- ☺ but less serious;
- ☺ legibility of the development is better for transversal uses;
- 😐 the separation should be more or less surmountable.

Case of service roads

The basis principle to place the fastest users in the centre is respected. The neighbourhood access functions of others are isolated.

The service road is designed like access lanes, opting for a diversity of traffic and speed reduction:



- 😐 developed in the spirit of a 30 zone;
- 😐 without specific developments for cyclists as they ride along the service road;
- 😐 longitudinal or angle parking;
- 😐 narrow lanes which are nevertheless accessible to emergency services and deliveries.

Caption: ☺ favourable aspect, ☹ unfavourable aspect, 😐 recommendation.

2.1.3 Studying the limits between road spaces

When each space making up the cross-section has been positioned, it is necessary to look at the limits. The designer has various possibilities to create this separation; as mentioned in part one, marking on the carriageway, a simple difference in surfacing and materials, level difference between spaces, insertion of linear emerging systems (solid or not), narrow reservations and installation of urban furniture are all possible solutions.

The decision to separate spaces physically or not and the choice of separator should take into account the advantages and disadvantages presented by each system, according to the criteria mentioned in part one.

Uses involved are of course decisive, with respect to the level of service expected generally and individually (in terms of safety, comfort and fluidity):

- The type of uses that need to be separated should be taken into account mainly by differential crossing of user speed and category;
- The conditions of use of the space in question can lead to seeking a greater or lesser degree of permeability of spaces, therefore a varying degree of surmountability in separators (examples: protection of the allocated space, access to lateral parking);
- The nature and importance of transversal uses (pedestrian crossing, neighbourhood access, parking, spacing between junctions) should also be integrated for the same reasons;
- The relative positioning of spaces between them also influences on the degree of surmountability of separators.

Access to lateral parking implies a surmountable separator at low speed (photo: communauté urbaine de Marseille Provence métropole).

A configuration inducing a juxtaposition of traffic directions contrary those imposed by the Code de la route requires separator to be more difficult to cross(photo: Certu).

Right-of-way constraints have a necessary impact on choice, which interacts with the width of relevant spaces and users' perception:

- it is usually preferable to **leave room for users rather than separators,** in particular to non-motorised modes, but taking care with any perverse effects (speed, undesired uses);
- to the contrary, relatively wide or surmountable separators can help to reduce the width of separated spaces when uses allow it;
- the impact on users' perception of space allocated to them (wall effect, guidance, etc.) is linked to the form, nature of the separator (emergence, visual contrast, etc.).

This paved gutter visually reduces a 6.15 m wide carriageway (photo: Cete de l'Est).

A 0.50 m wide curb can separate the cyclist from parked vehicles by minimising hindrance for passengers and cyclists (photo: Certu).

In a wide and relatively illegible space, the separator can facilitate guidance (photo: Certu).

The management and operation of spaces induce constraints which need to be integrated when choosing the separator:

- the presence of physical separators can prove incompatible with certain maintenance tasks (sweeping, snow clearance, access to networks, refuse collection, etc.);
- collection of surface water should be taken into account for installation (run-off and collection of water);
- exceptional situations induce constraints on the form of the separator (risk of congestion due to a broken down vehicle, accessibility of emergency services, passage of exceptional transport, etc).

Integration in the general **architectural part** of the street guides the choice of materials, form, possible use of plants and/or urban furniture.

A simple difference of materials constitutes a purely indicative separation that could prove to be enough when the relevant spaces can remain permeable to other uses without damaging the general operation. It can be reinforced by urban furniture or marking in the case of carriageways.

Marking has a regulatory character, defined by law (IISR). Part one (Généralités) of this instruction defines it as a road *sign category*, whereas part seven (Marques sur chaussée) specifies the conditions of use. It is reserved for carriageways and is used to materialise traffic lanes and parking. Its road connation does not recommend it for the urban environment except in the specific case of dedicated lanes for which it is better adapted.

Other options, which can be grouped under the term of *physical separators*, can be used to separate all spaces in the cross-section: public transport dedicated lane, carriageway, cycle path, footway, etc. Indications are given in part five of this guide on their creation and sizing.

2.2 Sizing appropriate to the total land requirement

Constituent elements of the section are calibrated on the basis of standard widths or widths generally accepted in the same context but juxtaposed to form one or several outline cross-sections.

Their precise adjustment will be done in a second phase after having checked that they can be inserted into the total land requirement and that they work.

2.2.1 Calibrating each element of the section

Each criterion of the programme has an impact on one or several constitutive elements of the road network. The problem lies in interrelations between criteria and the cumulative needs each element has to satisfy:

- Pedestrian circulation conditions the footway, parking;
- neighbourhood activities determine parking, the footway. The latter acts as an interface between private and public areas;
- the importance given to cyclist circulation, according to general traffic conditions, justifies the choice of the type of cycling facility and parking volume;
- the presence of public transport has an impact on the carriageway, the footway and justifies the existence or not of dedicated lanes;
- general traffic objectives define the carriageway and how parking is processed;
- landscaping objectives and urban furniture influence the footway, the central reservation and proportions between spaces.

It is noted that the footway is the element most often used and too often not considered to be a priority. **It is therefore the footway that should be calibrated first**.

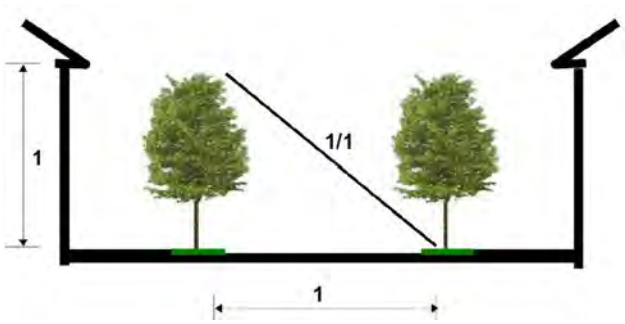
The presence of several spaces and their relative positioning lead to the insertion of separators. Some have no impact on the transversal dimension such as curbs or marking - the latter is often included in the calibration of traffic lanes -others occupy a place in the section that should not be underestimated (see paragraph 3.7).

Complementary to a functional approach to the development of the cross-section, reflection on **its form** leads to sizing spaces differently. A few ideas are proposed below.

Proportion between buildings and road spaces

The height/width ratio offers a perception of the place where the building asserts its presence to varying degrees. When designing the cross-section, it is necessary to take this ratio into consideration so that the street may be read in line with required user behaviour.

For a new road, it is possible to work on these dimensions, in particular in urban planning documents, by defining the public right-of-way, distance of the building and its height.



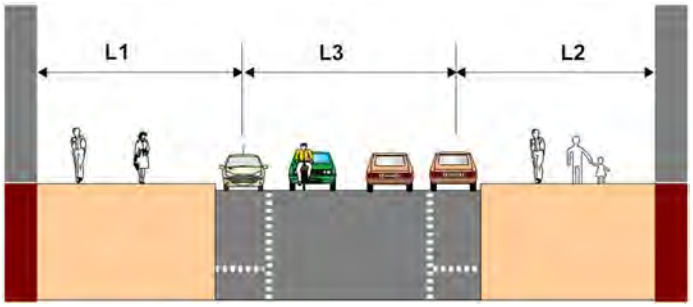
Tree alignments create a closed space for the carriageway (W/H = 1) instead of an open space with a ratio over 2.

Rehabilitation of an existing road network does not allow fundamental modification of this ratio. However, other elements in the section can be adjusted to offer a different perception of the place: creation of tree alignments, presence of urban furniture, modification in the footway-carriageway ratio, etc.

Proportion between constituent elements of the cross-section

The carriageway has a breaking effect in the public space. Inappropriate heavy traffic and road width are some of the factors that accentuate this rupture and reinforce the feeling of insecurity and discomfort for pedestrians. Even if it does not always help to solve the problem, when designing the cross-section, it is important to respect satisfactory proportions between footway and carriageway.

There are no rules but proposals have been imagined to balance the dimensions of road spaces which are more favourable and more harmonious to neighbourhood details:



- in Paris, as of 1832, the engineer, Partiot had established the proportion of 3/5 for the carriageway and 2/5 for footways, it was applied until 1930;
- "safer city, no-accident neighbourhood" experiments focused on the proportions of the rue de Mützig (67) with a footway-carriageway ratio of (L1+L2)/L3 = ½;
- broad avenues are designed with a 3/3 breakdown, this is the case of the rue Faidherbe in Lille (see paragraph 5.1 of part five) or the example of Troyes below.

Troyes

BEFORE – Narrow footways and dominance of the carriageway produce the image of a distribution road (photo: ville de Troyes, D. Le Nevé).

AFTER – Carriageway reduced to the strict minimum, wide and comfortable footways and 3/3 breakdown offer an image where the carriageway gives way to lateral spaces (photo: ville de Troyes, D. Le Nevé).

An effort will also be made not to unbalance the section by favouring a footway at the expense of another unless in very narrow streets or if one side of the street has a special interest (shop fronts, sea front, etc.). In the latter case, to the contrary, it is recommended to set out a dissymmetrical section.

For example, at Cagnes-sur-Mer, the footway on the sea front is very wide thus encouraging pedestrians to walk along it, the one on the building side is smaller in size (photo: Certu).

2.2.2 Sufficient total land requirement

If the projected section fits within the total land requirement, more room could be given in priority to:

- pedestrians;
- bicycles, giving them separate lanes if this is not already the case;
- public transport, in particular on the station level;
- occupation of the public domain (pavement cafés, kiosks, urban furniture, etc.);
- parking (if there is demand and if this creation is compatible with general policy).

The choice to focus on a specific mode will depend on the existing or desired nature of the road and objectives of the programme.

Aix-en-Provence (13)

BEFORE – The cours Mirabeau before its redevelopment included 4 traffic lanes with longitudinal parking on one side, i.e. a width of 14 m between its curbs. Illegal parking was frequent on the side not developed for that purpose as well as in bus lanes.

AFTER – In the early nineties, the town council decided to renovate the Cours, one of its aims being to recreate a real walking place pedestrians. For that, it was necessary to control motorised traffic, reconquer the space and enlarge footways. The Cours was developed into a 30 zone and radically transformed with a carriageway reduced to 6 metres (two-way traffic), considerably enlarged lateral spaces and parking removed throughout its length.

Photo: Cete Méditerranée

2.2.3 Restricted total land requirement

If the planned section is not immediately included in the available total land requirement, it is considered to restrict it.

The designer should in this case approach this difficulty by reconsidering the project in view of the development programme. Sometimes this results in reconsidering one or several of its objectives.

A few questions may be raised:

•Is it possible to reduce the width of certain spaces? Reducing dimensions could prove possible but experience shows however that often this burdens the operation of the space; it will then be necessary to review the objectives of the programme. It is thus possible to:

- optimise the width of a single element of the section without excessively modifying the general operation;
- reduce the speed of vehicles or flows by reducing the width of the carriageway;
- opt for separators that are less space consuming.

☹ *All road network spaces have here been reduced to reveal conflicts: space available to pedestrians occupied by stalls (1), parking that overlaps onto the carriageway (2) hence wing mirrors that exceed the gauge without obstacle*[8] *(3) (photo: Certu).*

8 Here marked by white posts.

•Is it possible to opt for a diversity of uses? We have seen that diversity presents the advantage of being less space consuming:

- •putting bicycles back into general circulation, by developing the road network in the 30 zone. If there are public transport lanes and it is not reasonable to put bicycles with cars (very high car flows, several car lanes), it may be possible to put bicycles with buses;
- •developing space in the 30 zone, in the shared space or pedestrian area;

By treating this lane as a 30 zone, cyclists are mixed with motorists without having to create cycle lanes (photo: Cete Nord-Picardie).

- •putting public transport in a pedestrian priority zone, with or without specific management giving priority to public transport in a short length or even in a single lane.

Temporal dedicated lane with tramway and general traffic (photo: Certu).

•Is it possible to **remove an element** from the section? This is only possible for elements that are not indispensable to the operation of the road network and do not jeopardise user safety:

- partial or total removal of parking. It can for example be placed off the road;
- removal of one or several traffic lanes, moving from 2 to 1 lanes per direction in the main section is often possible without reducing the itinerary's capacity;
- deviating part of traffic to another itinerary by ensuring that difficulties are not transferred elsewhere, modifying the traffic plan to make the road one-way;
- creating an alternative over short distances;
- the construction of one single, properly sized footway on the side where activity is stronger, or even no footway on light traffic roads while of course reducing motorised vehicle speed (for example by setting up a shared space).

It is preferable to offer one single footway that is comfortable for pedestrians than two excessively narrow ones (photo: Certu).

Redevelopment of a structuring axis in restricted total land requirement - Schiltigheim

The urban context

The northern sector of the Strasbourg conurbation is structured by three north-south radial axes. One of them consists of the route de Bischwiller in the municipalities of Schiltigheim and Bischheim and the rue de la République in the municipality of Hoenheim.

The Bischwiller-République axis drives the north sector's urban recomposition. Total land requirement before development consisted of a 10 m carriageway lined with two parking lanes with footways 1.50 m or sometimes 0.50m wide on the most restricted sections.

This axis, which is 7 km long, mainly acts as a municipal access and transit road with traffic flows between 10,000 and 15,000 vehicles per day. The section covered by this operation measures 3.2 km. It is covered by two urban bus lines.

Objectives

The redevelopment objectives of the Bischwiller-République axis target the redevelopment of the axis with three issues: securing economic and commercial functions along the axis, reinforcing east-west relations between the Bischwiller-République axis and other north-south radials and, finally, assert municipal centrality. The development of the axis should allow:

- better incorporation of non-motorised modes (pedestrians and bicycles) to guarantee enhanced safety by redistributing a larger share of public space to them;
- improvement of bus circulation within this axis by setting aside bus lanes and accounting for them more effectively at junctions.

Description of the development

The major factors taken into account to establish the cross-sections are:

- 1.40 to 1.80 m footways,
- a 6.50 m carriageway (imposed by the public transport operator),
- a parking strip between 1.80 and 2 m.

The total land requirement is between 10 and 16 m. After several variants, it appears that it was impossible to create cycle lanes so it was decided to reduce vehicle speed to 30 km per hour to take into account the presence of cyclists in general traffic. Although not classified as a 30 zone, the processing of the carriageway is similar: an alternating parking zone forming chicanes, central traffic island, reduction of the traffic lane.

Before

After

•Is it possible to **find a different design for the separation** between the section's spaces?

•removing or modifying separators that occupy the territory in the section;

•making separators exceptionally easy to cross in order to allow greater permeability so that a user can exceptionally cross into the lateral space to which he or she is not allocated. It is thus possible to calibrate spaces to the minimum: cycle lane or bus lane and traffic lane, low footway curbs and narrow carriageway, etc.

Low footway edges can exceptionally allow two LGVs to cross (photo: Cete de l'Est).

•Is it possible to **obtain more total land requirement**?

The aim is to investigate property acquisition possibilities to increase the total land requirement on a section or hot spot.

This is an iterative approach which needs to involve all intervening parties.

Narrow total land requirements

When the total land requirement is narrow (less than 8 or 10 m), the design needs to answer the same questions as above. It is however necessary to take care not to aggravate the initial situation and not trap users (a person with reduced mobility forced to use the carriageway without being able to use the footway, a cyclist on the carriageway without an escape, a narrow carriage way without an occasional refuge for vehicles, etc.).

Thinking about the transversal dimension to deal with these narrow rights of way is not the only solution; it is thus necessary to review punctual features linked to the specificity of the urban context.

Questions often find their answers by investigating the following possibilities in-depth:

• grouping together functions in the same space (therefore more diversity) while taking care to set up measures in favour of vulnerable users (creation of 30 zones, mixed area or pedestrian priority zone, etc.);

• only keeping indispensable spaces (usually one carriageway an at least one footway);

• reducing the carriageway to the minimum (for example, without lateral parking, 4 m allows two passenger vehicles to cross and 5.50 m allows two LGVs to cross very slowly with wing mirrors folded down if necessary);

• making a street one-way by modifying the traffic plan;

• making separators surmountable (it is possible to choose narrow carriageways of 4 to 4.50 m which allow two passenger vehicles to cross and have low footway curbs so that two LGVs may, exceptionally, cross);

• remember to create punctual facilities (refuges, locks, alternating traffic, etc.) which offer a good alternative between safety and circulation.

Punctual narrowing to moderate speed and facilitate neighbourhood access - Oissel

Context

Neighbours of this urban road which attracts traffic that is already quite heavy (14,000 vehicles per day in both directions) with the presence of LGVs and buses, have filed complaints, in neighbourhood meetings, on the excessive speeds and dangers incurred when they leave their homes. The town of Oissel (pop.: 11,000), one of the 37 municipalities of the conurbation of Rouen (pop.: 420,000), therefore decided to find a solution despite very small room for manoeuvre given the very small available total land requirement.

Objectives

- Obtaining a significant slowdown in traffic
- Improving safety of neighbourhood access (improving mutual visibility)

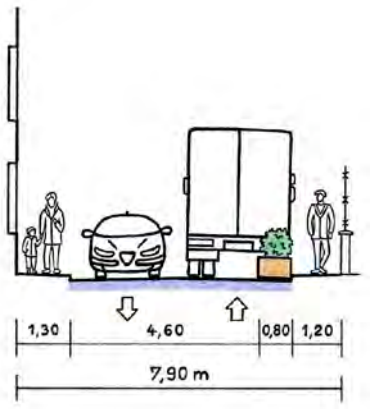
Main features

The development consisted, on the section in question measuring 400 m (7.90 m total land requirement including 5.40 m of carriageway) in setting up speed ramps and protectors, i.e.:

- One-shot speed ramps alongside a certain number of neighbourhood accesses improving visibility and providing a slowdown factor when two passenger vehicles cross each other and alternating traffic when a passenger vehicle crosses an LGV or bus;
- in the middle of the section in question, the traffic light junction (existing) has been adapted into a platform with the aim of slowing down speeds;
- 30 km per hour speed limit throughout the narrow section, i.e. 400 m.

Comments

The total land requirement did not allow for regulatory sized footways. They were not in fact modified. To increase efficiency with respect to the objectives (stronger wall effect), the features set up are “tougher” than those initially scheduled by the engineering office.



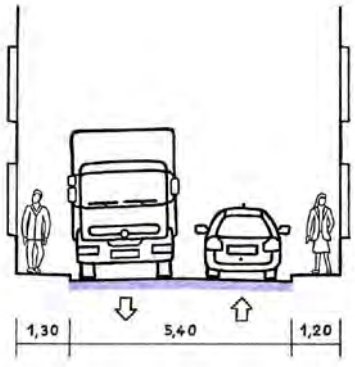


Photo: Cete Normandie-Centre

2.3 Adapting cross-sections to specific points

In the urban environment, the main section of a given sequence will be frequently disturbed by specific points: reduced total land requirement, junctions, engineering structures. The section, planned in these specific points, must adapt to the different sections considered for which the initial constraints evolve. The aim however is not to design the section solely according to these points which have a short length that not make up a sequence.

2.3.1 Occasional reduction of the total land requirement

When the total land requirement is reduced in a specific point and it is not possible to maintain the chosen section, it is necessary to look at which functions can be downsized or deleted over a short linear section (parking, general traffic, etc.). If this is impossible, reducing the speed limit from 50 to 30 km per hour is a way of reducing specialised spaces. It is also possible to set up alternating traffic controlled by traffic lights or not. The road network is thereby developed to ensure safety and accessibility of all users.

Occasional reduction of total land requirement solved by alternating traffic while keeping both footways (photo: Cete de l'Est).

The section obtained should always satisfy the verification requirements set out above, in particular accessibility of the road to persons with reduced mobility and emergency vehicles.

2.3.2 Zones with bends

In sections with bends, the width of the carriageway, as well as the installation of urban furniture are determined with the turning diagram of long vehicles which defines wheel trajectory and chassis overhang. The use of IT tools, like the Giration software, can be used to check this.

Photo: Cete de l'Est

2.3.3 Junctions and approaches

Improvement in visibility conditions at junctions and pedestrian crossings, junction management (addition of dedicated lanes or not), creation of refuges for pedestrians or bicycles, can modify the section at the approach and at the junction.

The most frequently encountered cases are:

- the creation of left-turn and right-turn lanes,
- the insertion of cycle tracks upstream of junctions,
- the creation of pedestrian refuges (minimal width: 2 m),
- interruption of parking,
- the stopping of a tree or plant alignment.

The reader should refer to the *Carrefours urbains* guide for detailed design of intersections.

2.3.4 Public transport stations

The installation of stops for public transport requires particular attention. A stationary vehicle can have consequences on the circulation of other motorised modes and the station itself requires designing the pedestrian area in order to reduce journeys, make them safe and leave room for passers-by. Developments for bicycles at stations should allow continuity and safety of the journey by limiting conflicts.

2.3.5 On or under engineering structures

Engineering structures are permanent spots in the development. Their calibration is subjected to strong constraints: financial, geometrical, technical or operational.

In existing structures, it is not possible to reproduce upstream or downstream sections. It is necessary to adapt them to height and width gauges as well as load conditions. The type of structure (tunnel, reduced gauge, subway, bridge, etc.) and its length could justify it being treated as a specific sequence or a transitional zone between two sequences. On this section, functions can be selected or downgraded depending on total land requirement reductions.

Punctual interruption of a bus lane at this lower passage (photo: Cete Méditerranée).

For new structures, it is possible to maintain the section on either side by ensuring itinerary continuity. It can be useful to add an additional space dedicated to a use (cyclists, pedestrians, etc.) if it represents marginal extra cost with respect to the whole structure. The cross-section of crossing structures integrates separators and restraint systems needed for user safety.

For underground structures, the section is determined according to the height gauge of vehicles. For their calibration, it is recommended to refer to the specialised guides published by the Setra[9] and the CETU[10].

Certain users (cyclists and pedestrians) are usually forbidden to cross tunnels. It is then necessary to provide continuity in their surface itinerary or in a dedicated structure.

9 Service d'études techniques des routes et autoroutes.

10 Centre d'Études des tunnels.

2.4 Consistency checks with the whole project

The cross-section is just one part of the project evaluation and checks set out below should not be done afterwards; they are an integral part of the design. The process is to start by establishing one (or several) outline sections that meet the objectives of the main section then assess, adapt and even question them with respect to other design issues:

- Awareness of transversal users, in particular at junctions;
- accessibility to certain vehicle categories;
- emergency vehicles,
- service vehicles,
- exceptional transport,
- the constraint imposed by the networks.

These elements are highlighted here as they do not always formally appear in the programme. Finally, as in all projects, a general assessment of objectives is indispensable.

2.4.1 Transversal uses

After having designed the road in its main section, it is necessary to check that all the factors considered together guarantee the right movement conditions in the transversal direction (pedestrians, residents, etc.).

2.4.1.1 In the main section

The following should be ensured:

- Mutual visibility, particularly at junctions, pedestrian crossings, neighbouring entries, public transport stops;
- That the presence of insurmountable separators does not incur malfunctions for transversal uses: neighbouring exits, left-hand turns, pedestrian crossings (in particular check that the width of the carriageway is compatible with the crossing according to the same recommendations as junctions).

2.4.1.2 At junctions

The reader should refer to recommendations for the design of urban junctions featured in the 1999 *Carrefours urbains* Certu guide. Here we cover the specific factors involved in designing junctions liable to impact the design of the main section. The approach will be dimensional but also functional.

The spaces making up the cross-section are calibrated to allow:

- Turning of vehicles as they come to intersections. The dimensions of footway curb curve angles, the width of the carriageways and location of urban furniture will be studied in detail to ensure good vehicle turning.

Photo: Cete de l'Est

- The length of pedestrian crossings and therefore the width of carriageways should not exceed 12 m with lights and 8 m without lights. Above that, an intermediate refuge island measuring at least 2 m wide is required.
- The layout of specific left-hand turn lanes and/or right-hand turn lanes requires additional right-of-way on the approach to the junction. Often the removal of parking upstream of the junction allows insertion of these specific lanes which are narrower than conventional lanes. When junctions are too close up, these specific lanes occupy the whole lane linear between intersections.

Choosing to organise spaces, and therefore circulations, in a cross-section leads, in certain cases, to configurations which can lead to major malfunctions capable of calling into question the very design of the cross-section.

- The layout of lateral two-way sites reserved for public transport or cyclists leads to conflicts with vehicles' turning movements from the main road which are difficult to manage. These malfunctions appear in two-way or one-way roads.
- In the presence of close junctions, one-way cycle lanes or paths contiguous to the carriageway are preferable to separate ones.
- The flow at junctions is clearly lower than in the main section. When junctions are very close, they determine the number of lanes in order to guarantee sufficient instant flow and storage.

Valence (26)

The grands boulevards surrounding the old town of Valence had become a major transit axis with a 2x3 network occupying the whole right-of-way. Overflow of half transit traffic by the new orbital to the south, led the council to rehabilitate the boulevards to share the space in a more balanced way.

The road, reduced to 3 lanes, was placed outside a pedestrian platform on which a dedicated lane was placed for buses, which was also open to cyclists.

The carriageway, 9 m wide, includes a traffic lane in each direction and a central space. The latter, alternately, allows several functions:

- facilitating and securing pedestrian crossings by the creation of refuges;
- ensuring automobile traffic flow at intersections by allocating this space to left-hand turn movements.

Photo: Certu

2.4.2 Accessibility to emergency vehicles

Road networks should allow access to buildings by emergency vehicles and, in general, parking of ladder vehicles. This accessibility is imposed by the Code de la Construction.

2.4.2.1 Accounting for the emergency services principle

When the main section of the road is modified, it is necessary to make sure that the emergency accessibility function is still possible. Two notions have to be taken into account:

The first consists in positioning the road concerned by the new development. If it is a structuring axis of the city, the designer should lay out the road to give maximum accessibility to emergency services. For example, it is important to avoid creating insurmountable separations that confine emergency vehicles in a space that could be blocked by general traffic without any possible means of escape. The aim is to allow emergency vehicles to reach their place of intervention faster. This function becomes essential when the road leads to certain risk buildings.

Central lane reserved for emergency services (and buses) justified by necessary accessibility to risk facilities (photo: Certu).

The second consists in ensuring that all roads allow emergency vehicles, depending on the nature of buildings, to circulate and park next to buildings. The approach slightly depending on whether it is to rehabilitate or create a road.

For **existing roads**, their dimension conditions the construction of the type of building for the granting of planning permission. To be clear, an existing street with a carriageway width in excess of 3 m allows housing to be considered accessible by ladder vehicles. The houses were built in consequence. When modifications intervene on the site, it is necessary to ensure that road developments once more respect the same building fire prevention rules as before: width of the carriageway, accessibility to hydrants, turning of emergency vehicles, etc.

New roads will be sized according to the type of buildings serviced. For example, it will not be necessary to calibrate the roads of a housing estate for emergency vehicles if the houses have their last floor less than 8 m up and a fire hydrant is located less than 200 m way.

It is essential to consult emergency services when formulating the project's objectives and constraints.

2.4.2.2 Road dimensions

The Code de la Construction introduces two types of emergency roads:

- "the ladder lane", road that may be used to set up ladders,
- "the emergency vehicle lane", road that may be used by emergency service vehicles. They lead to the ladder lane from the public road.

Their features differ slightly depending on which regulations are applied: regulation on housing buildings, on establishments receiving the public or tall buildings. The main dimensions are specified in the following tables:

➢ For the ladder lane

Dimensional constraints of the ladder lane	Type of building		
	housing	**Public building**	**Tall building**
Length (m)	10 m	10 m	-
Width of road, excluding parking lane* (m)	4 m	4 m	4,50 m
Maximum slope (%)	10 %	10 %	10 %
Minimum distance of the frontage from the closest edge (m)	1 m		-
Maximum distance of the frontage from the closest edge (m)	8 m		-
For a 30 m ladder	6 m		-
For a 24 m ladder	3 m		-
For a 18 m ladder			

** If there is no parking, the footway can be included in the ladder lane if there is enough bearing capacity.*

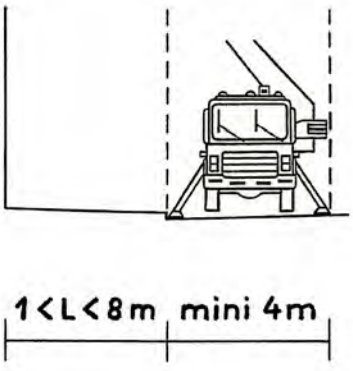
➢ For the emergency vehicle lane

Dimensional constraints of the emergency vehicle lane	Type of building		
	housing	**Public building**	**Tall building**
Minimum width of the road		8 m	
Carriageway width, excluding parking lane (m)	3 m	3 or 6 m*	3,50 m
Minimum interior radius (m)	11 m	11 m	11 m
Extra width in bend (m)	15/R	15/R	15/R
Maximum slope (%)	15 %	15 %	10 %
Free height (m)	3,50 m	3,50 m	3,50 m

** Defined according to the width of the total land requirement (see decree dated 25th June 1980 modified).*

In towns, in most cases, streets act as "emergency vehicle lanes" and "ladder lanes".

Although for new roads, there is an obligation to respect these values, for existing roads it is necessary to check with emergency services that prior accessibility conditions are maintained. In all cases, the cross-section should have at least those features imposed for accessibility to housing:



Dimension and position of the emergency vehicle parking zone.

- carriageway width (excluding parking lane): 3 m;
- carriageway width for parking of emergency vehicles: 4 m;
- extra width in bend: 15/bend radius;
- free height: 3.50 m;
- distance between the frontage and carriage way or ladder lane: between 1 m and 8 m.

When the carriageway is at least 8 m from the building, the footway cleared of all obstacles should allow parking of ladder vehicles (photo: Certu).

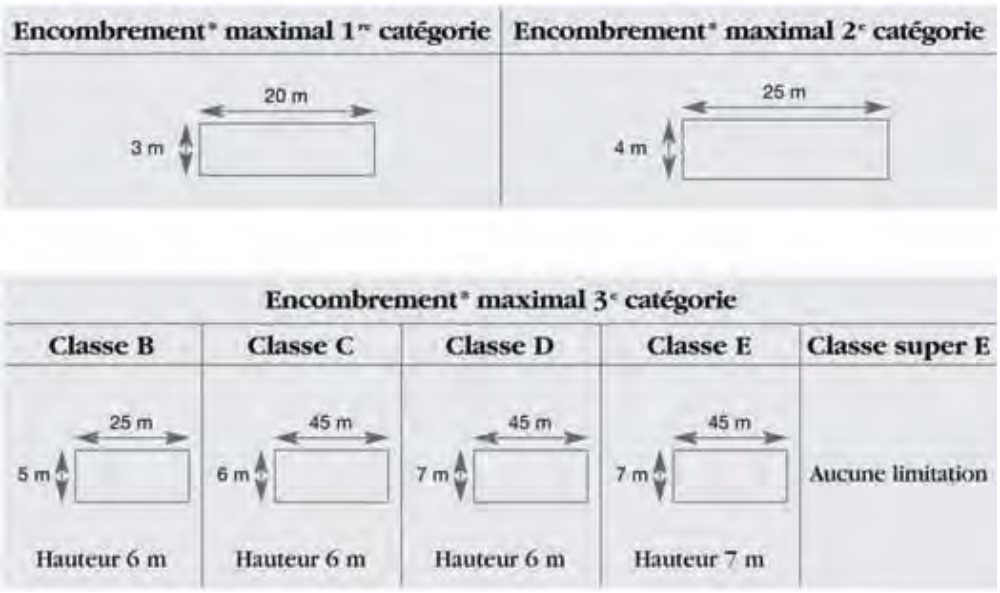
2.4.3 Accessibility to urban service vehicles

It is necessary to check that the planned section satisfies requirements for the passage of service vehicles or offers alternative solutions. The main services to be taken into account are:

- collection of household refuse for which a minimal carriageway width of 3.50 m is recommended (circular n° 77-125 dated 15th August 1977 of the French Ministry of Infrastructure recommends this value for private lanes, it does not impose it on public roads);
- deliveries and removals by LGVs with maximum headroom of 2.60 m;
- cleaning of roads by variable sized vehicles from 1.70 m to 2.55 m;
- snow clearance; the decree issued by the Ministry of Infrastructure on 18th November 1996 does not fix a minimum value for winter service vehicles but maximum widths depending on the vehicle type (see appendix 1). In the urban environment, councils in charge of this service tend to prefer small sized vehicles which navigate more easily in streets and thus solve the problems of obstacles, including parking. When looking at the crossing of conurbations via national or departmental roads, the designer should take into account the operator's opinion.

2.4.4 Transit of exceptional transport

So-called exceptional transport is one with dimensions or weight not compliant with the general stipulations of the Code de la Route. In the decree dated 26th November 2003 (NOR: EQUS0301916A), exceptional convoys are classified into three categories according to their weight, width or height). Their geometric features are summarised in the table below:



In the case of the development of an urban road included in an exceptional convoy itinerary, they should whenever possible be taken into account[11]. Rather than sizing the cross-section according to the gauge of these specific users, the aim is rather to check that they can transit in certain conditions.

If the choice of part of the development or other restrictive factors do not allow it, the exceptional convoy, subject to specific time (or day) restrictions and a police escort, can take the whole right-of-way, overlapping onto the opposite direction lane or taking a way in the complete wrong direction.

The straight line movement of a convoy requires freeing variable space according to its category (see table). However, the width to be cleared on the ground rarely corresponds to the width of the convoy, the width of the axles often being less than that of the load transported. The width to be cleared is not on the ground level but rather 50 cm above ground. The estimation of the space to be cleared when turning or at intersections is more difficult and means analysing the turning diagram.

Stopping traffic allows this convoy to transit through a street which is not calibrated for its gauge (photo: Cete Normandie-Centre).

11 The *Transports exceptionnels et aménagements de voirie en milieu urbain* document published by the Certu in 2001 explains in detail how to plan the road network to allow their transit.

2.4.5 Suspended or buried networks

The aim is to check that all suspended or buried network elements have been positioned and that their supports or protuberances are compatible with the planned sections.

To develop an existing network, they are a constraint. Their presence could be incompatible with certain elements of the section, for example:

- with cycle traffic (cycling lanes and paths);
- with separators (curbs, bumps);
- buried networks are incompatible with tree alignments when located in the space necessary to develop their roots. The NF P 98-332 norm dated February 2005 defines the distance rules between buried networks and neighbouring rules between networks and plants;
- next to parking zones for operating reasons and accessibility to networks (unless to neutralise these spaces).

Photo: Cete Nord-Picardie

Photo: C. Chain, Certu

☹ *Access to networks can be difficult owing to surface development.*

For new roads, the location of networks should be in line with the section's development. Checking the section consists in ensuring that the spaces are sized to receive networks and in particular protuberances which take up more space than the networks themselves and questioning their positioning relating to operating constraints in the event of an intervention on these networks (the constraint is often suffered by pedestrians whereas a free space of 1.40 m minimum should be kept around any obstacle!).

2.4.6 Assessing the project

Assessing the cross-section profile consists in checking to which degree it allows the project to achieve the objectives set. If several sections are studied, the choice should be done after assessment of each one. Assessment should answer the following questions:

- What is improved? (safety, accessibility, local life, etc.)
- What is the level of satisfaction obtained with respect to initial objectives?
- What are the risks of malfunction or deviated uses?
- Is the section part of a sustainable development approach ensuring evolution and durability possibilities?

The development will be assessed at all design study phases and in particular when all the developments and related operations will be determined. It can be presented in several forms: "theoretical" through check-lists, analysis charts or value estimation methods but also *in situ* with the implementation and assessment of a temporary development.

An assessment grid can be simply done in the form of a table with in columns the pre-selected sections and a line for each objective. The latter can be assessed on the basis of indicators that can be pre-established in the programme. An "initial section" column will be used to match up to the original.

It is also possible to use other methods based on **quality approaches** like safety checks for road projects for the road safety aspect of all users or the RST02 grid finalised by the *Réseau scientifique et technique de questionnement et d'analyse des critères de développement durabl*e. Both are part of a general approach.

Assessments conducted throughout the project help to minimise anomalies that can appear during the safety inspection before commissioning. Likewise, it is always recommended to conduct a simulation on site before definitive construction. Remember that the correction of anomalies after construction is costly and sometimes impossible.

3. Sizing the constituent elements of the cross-section

The sizing of each element of the cross-section is based on the principle that each user needs sufficient space to move in conditions that guarantee a level of safety and service compliant with the requirements set out in the programme.

For that, it is necessary to consider that each user moving in the public space – pedestrian, cyclist, automobile, bus, tramway – occupies a volume defined by a **gauge.** This gauge varies according to the user in question (a car is wider than a cycle), depending on the vehicle type (a city car is narrower than a saloon), it varies in time (vehicles are now wider than those built in the eighties) and also according to the use and place (for example, next to a station, pedestrians will be carrying luggage and thus take up more space; a parking car will need additional lateral space to open doors, wider for a disabled person than an able-bodied person).

There is a difference between static gauge which represents the contour of a stationary vehicle and the **dynamic gauge** when it is in movement. The latter intervenes in the calculation of widths as it integrates trajectory variations linked to the user's behaviour, at different accessory movements or excess curve widths.

Example: The dynamic gauge of a cyclist will not be that of the bicycle+ cyclist when stopped as the action of pedalling induces lateral movements that need to be taken into account.

Furthermore, pedestrians, like cyclists or motorists, do not move just a few millimetres from the edge of the space in which they travel. They need additional space on each side of the gauge to give users "air space" allowing them to move safely without coming into conflict with other users or elements in the section.

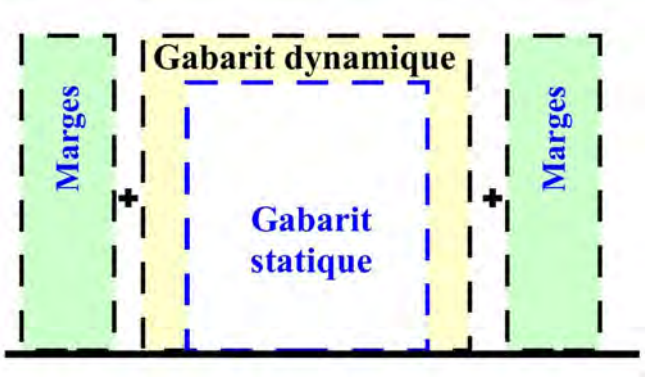
Examples: Two vehicles crossing each other naturally move away at a distance that mainly depends on their speed. Likewise, a margin should be left between pedestrians and a bus to take into account the speed differential between them The wall effect produced by parked vehicles means that vehicles travelling on the carriageway instinctively move away.

The importance of these **margins** should not be minimised in the design of the section. Excessively narrow sizing can lead to malfunctions and risks for users. Juxtaposing two spaces calibrated to a minimum, without considering what happens between them, inevitably leads to malfunctions even with separators.

Examples: Footways too narrowly calibrated along a narrow street will induce a strong feeling of insecurity for pedestrians. A narrow carriageway with an excessively narrow parking zone will produce risks of collisions with wing mirrors (vehicles more or less well parked) or parking across the footway and carriageway. Along narrow roads, it is preferable to set out comfortable parking zones over 2 m.

In contrast, excessive sizing could give too much comfort and lead to undesired uses of the space: excessively wide cycling lanes encourage motorists to park or even travel in them just as wide carriageways encourage speeding.

Finally, all these factors put together produce a “comfortable” space for users in a given context.



When reading the following paragraphs, it is indispensable to know this design principle. The reader, for each space making up the profile will find: its calibration on the basis of the gauge of the user in question, an estimation of additional margins induced by lateral occupation and the impact of the presence of several users in the same space.

The widths given below should be considered as basic design tools. Rarely taken from regulations, we recommend adapting them (more or less) according to the location and uses as presented in parts two and three.

3.1 Spaces aimed at pedestrians

Generally speaking, pedestrian traffic is located:

- on footways which are higher than the carriageway;
- in spaces at the same level as the carriageway; the limit between the pedestrian area and the carriageway can be materialised by a gutter, bollards, posts, a specific material, marking, etc.;
- in pedestrian areas;
- greenways or non-motorised ways which are covered in paragraph 5.2 "spaces aimed at cyclists".

Footways and spaces at the same level as the carriageway can be lateral (most frequent) or central (between two carriageways). In the latter case, the separation width between the two carriageways should be enough to allow pedestrians to walk safely and comfortably.

This chapter specifically covers lateral spaces like footways and spaces at the same level as the carriageway.

The role of the footway is not only limited to the sole function of pedestrian movement. It also hosts several uses including the installation of urban furniture which needs to be taken into account in sizing; in some cases, when the width of the footway allows it, the road operator can authorise the installation of temporary activities such as pavement cafés, stalls, markets, etc.

The footway does not have a sole function which is used by pedestrians (photo: Cete de l'Est).

3.1.1 Sizing for all able-bodied or disabled pedestrians

The "pedestrian" generic covers several categories of users ranging from alert persons who move rapidly and reduced mobility persons (elderly people, children, disabled persons) who, every day, have to deal with many obstacles that hinder their movements.

Reduced mobility persons (Certu).

The basic principle behind the design of a footway will therefore be to size it for reduced mobility persons firstly. Remember that the law imposes rules that take into account the difficulties these persons, depending on their disability, have to face to guarantee accessibility to road networks for all.

It is therefore easy to understand that a wide footway, without obstacles, for pedestrians only and separated from other traffic, is the best solution for their requirements. Furthermore, it is obvious that the wider and more comfortable it is, the more automobile traffic is attenuated and the more pedestrians assert their presence.

If the footway's sole function is for pedestrians and if there are not too many of them, a width of **2.50 m** is recommended. This width ensures:

- maximum clearance allowing two pedestrians to cross each other comfortably (1.80 m),
- possible "sterilisation" of part of the footway to install everyday urban furniture (0.70 m).

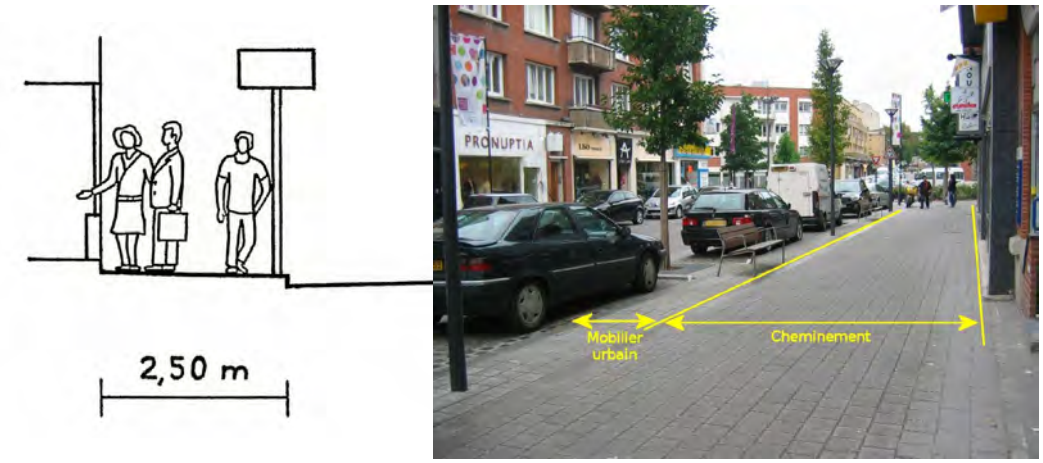


Photo: Cete Nord-Picardie

A 2.50 m footway is recommended to allow pedestrian circulation and the installation of urban furniture.

In certain cases, a heavy flow of pedestrians (shopping street for example) can require pedestrian walking space width calculated according to the flow. Generally speaking, it is accepted that the flow corresponding to a 2 m **pedestrian walking space** width is about:

- 2,000 pedestrians/hour along buildings with shops (reasons for moving: shopping, walking, strolling, etc.)
- 3,000 pedestrians/hour in other cases (reasons for moving: home-work travel, etc.).

It is obviously necessary to increase the footway width to accommodate high flows. The Highway Capacity Manual[12] (version 2000) proposes a formula to calculate flow (D) per metre of pedestrian footway in pedestrian/minute taking into account the speed of walking (V) in metres/minute and density (d) in pedestrians/m²:

$$D = V \times d.$$

12 English reference document covering road capacity.

What the regulations impose...

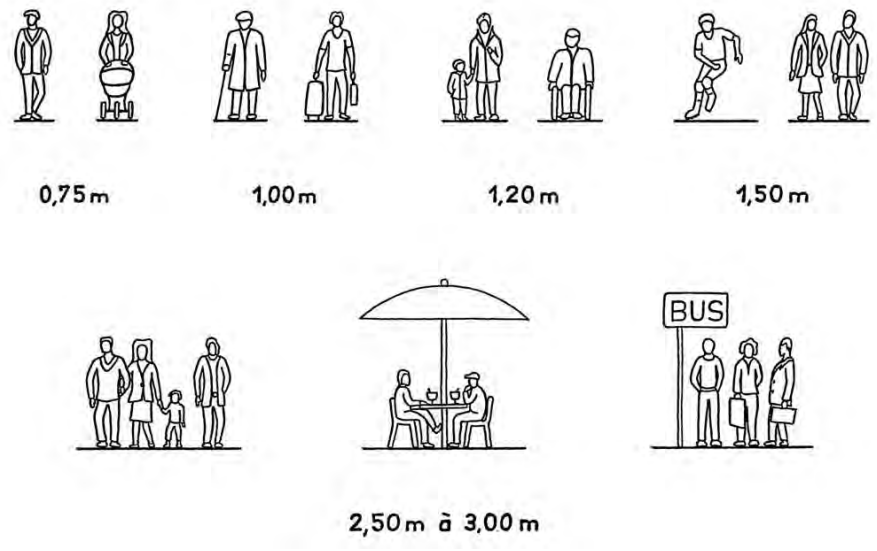
In any case, footways should be calibrated according to regulatory recommendations resulting from the Act dated 11th February 2005 including decrees n° 2006-1657 and 2006-1658 dated 21st December 2006 and its application decree dated 15th January 2007 which impose a "minimal footway width of 1.40 cleared of furniture or any other obstacle" or any occupation of the public space (pavement café, etc.) with a slope lower than or equal to 2%. This width can sometimes be reduced to 1.20 m in the absence of a wall or obstacle on either side of the footway.

3.1.2 A footway should take into account neighbourhood activities

Yet the footway, for all that, is not solely limited to longitudinal circulation of persons. Its "social dimension" needs to be taken into account when defining a cross-section with the many uses encountered:

- strolling or shopping in streets with heavy commercial activity;
- waiting in front of a school;
- waiting at public transport stops;
- temporary occupations such as stalls, pavement cafés;
- urban furniture, bins, refuse sorting containers, plants;
- use by roller skaters, considering that the Code de la Route assimilates them to pedestrians even though they are not always well accepted.

These occupations also determine the width of footways and should not be implemented to the detriment of accessibility.



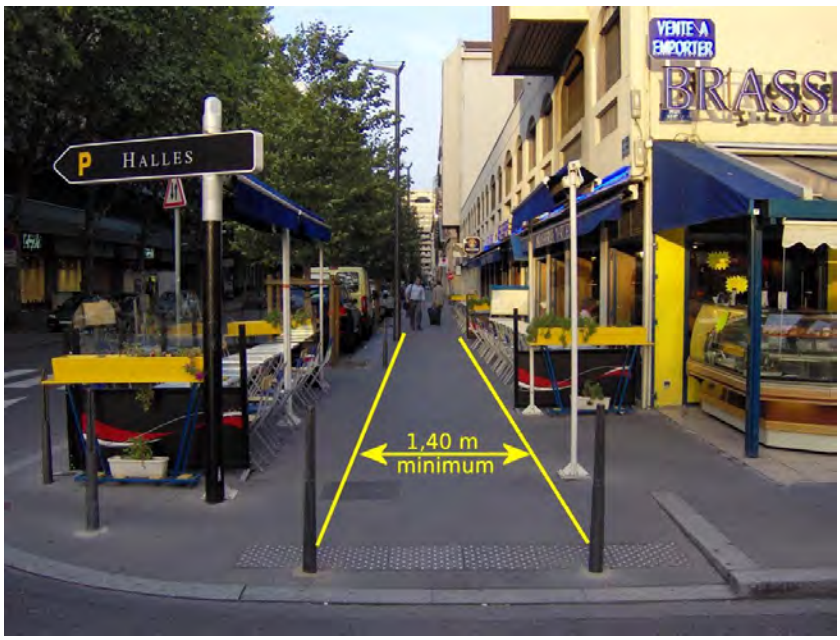
Width needed for certain everyday uses of pedestrian spaces.

With this in mind, when a very wide footway is available, it is not enough to leave the minimum 1.40 m imposed by regulations for pedestrian use and allocate the rest for other uses.

For example, the City of Paris accessibility chart imposes the following values:

- the occupation of the footway by other activities is only acceptable when it is wider than 3 m;
- over and above 3 m, pavement cafés should not occupy more than one third of the width of the footway ("one third rule").

Here, the pavement café occupies all the footway space, incompatible with pedestrian traffic (photo: Cete de l'Est).



On a wide footway, various uses are possible by leaving enough space for pedestrians (photo: Certu).

Finally, good safety is primarily achieved by maintaining clear mutual visibility between the different users of the road network, whether motorists, pedestrians or cyclists.

The major safety conditions to be sought for "modest" accesses (e.g. access to private housing) are therefore:

- guaranteed **visibility**: enough visibility distance between a vehicle leaving access and a pedestrian walking on the footway;
- respecting (if it is possible to intervene sufficiently upstream in the design of access) a certain distance between the traffic lane and the gate of a house/block of flats in such a way as to allow off-road parking of a passenger vehicle when entering and exiting.

The design of the space dedicated to pedestrians will have a direct impact on visibility conditions: an increase in its width contributes to improved mutual visibility.

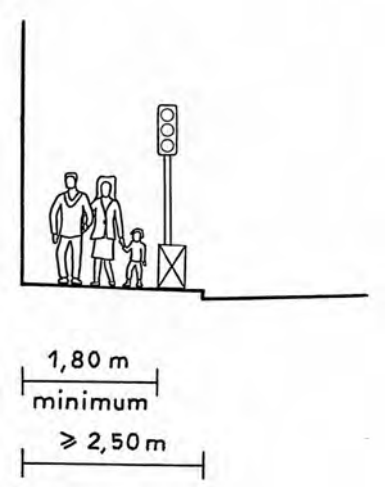
3.1.3 Installing urban furniture on the footway

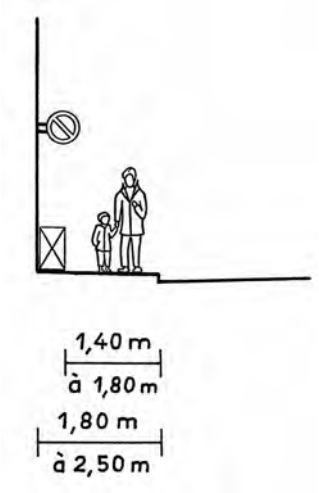
Generally speaking, the footway should also receive urban furniture. Its location determines its dimensions. The width of the footway and installation of urban furniture should be studied together following the rules set out below.

3.1.3.1 Guaranteeing pedestrian walking space

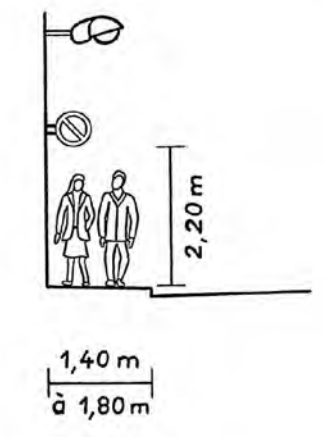
Respect for the minimum walking space mentioned in paragraph 1.2 leads us to identify two cases.

The case of fairly wide footways (in excess of 2.50 m), where the installation of most urban furniture is possible by respecting comfortable pedestrian walking space of 1.80 m, a width that allows two wheelchairs to cross each other. The furniture will then be aligned together with respect to a footway strip set aside for that purpose.





The case of narrower footways, where the furniture tends to be located along building frontages. In very restricted spaces, certain installations can be placed near to frontages. However, owners of the relevant buildings need to give their permission.



Cantilevered elements will be placed at least 2.20 m high[13].

Positioning of urban furniture on pedestrian walking space should be avoided (photo: Cete de l'Est).

The pedestrian area is a place mainly dedicated to pedestrians but it is however necessary to take into account exceptionally accepted users: emergency vehicles, delivery vehicles, etc. That is why urban furniture needs to allow clearance for their access. Furthermore, it should not obstruct visibility of shop windows and shops and leave enough space for pedestrians to walk along frontages.

It should be designed in compliance with the recommendations of the decree dated 15th January 2007 on the accessibility of road networks and public spaces and in particular low obstacle detection.

13 Cantilevered urban furniture less than 2.20 m high should be brought into line by a low element installed no more than 0.40 m from the ground or by a raised element at least 3 cm (extract of the decree dated 15th January 2007).

3.1.3.2 Saving space consumed by urban furniture

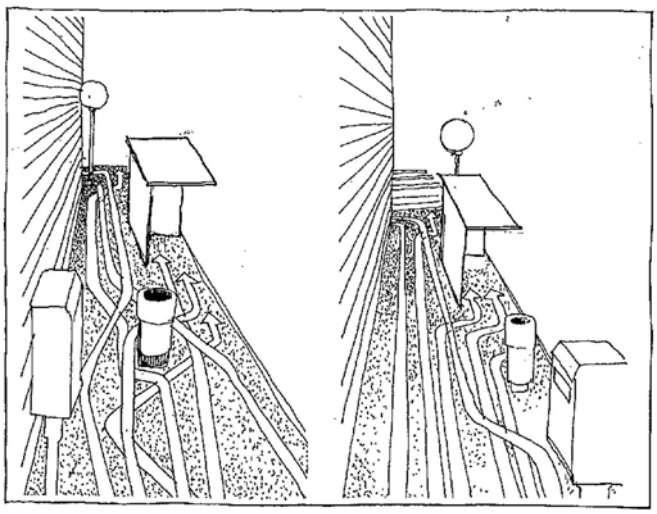
The growth of cities and the development of individual and collective transport lead to crowding of our footways. It is possible, through appropriate design and installations, to limit the proliferation of urban furniture allowing space saving and better legibility.

To avoid excess furniture, it is necessary to focus on furniture that is essential to the city's operation – traffic signs, lighting, network emergences, shelters for public transport users, bins, etc. – reducing others which are not always indispensable (bollards, barriers, advertising boards) and even ban private-interest features that have nothing to do on the footway.

It is also possible to group together several functions either in furniture design (phone booths built into bus shelters, benches with built-in flower boxes) or in its installation (baskets or boards fixed onto lighting masts). Sometimes these features fall under the responsibility of different people who need to be involved in the project.

Aligning furniture also helps to improve pedestrian walking space. In the presence of trees, urban furniture will be better laid out in their alignment.

Sometimes, there are additional spaces, with occasional enlargements which, for example, could be used to install furniture.



Finally, during road rehabilitation work, certain technical adjustments could be made at an acceptable cost in the project's economy like burying suspended cables and network emergences.

3.1.3.3 Distancing urban furniture from the side of the carriageway

If located on the footway curb side, a distance between the edge of the carriageway and the furniture should be maintained to ensure user safety, protection of facilities and accessibility. In the urban environment, there are no formal rules on this positioning. The designer should be able to calculate it according to lateral occupation (parking, circulation, etc.) and the type of furniture (board, bus shelter, low furniture, lighting mast, etc.).

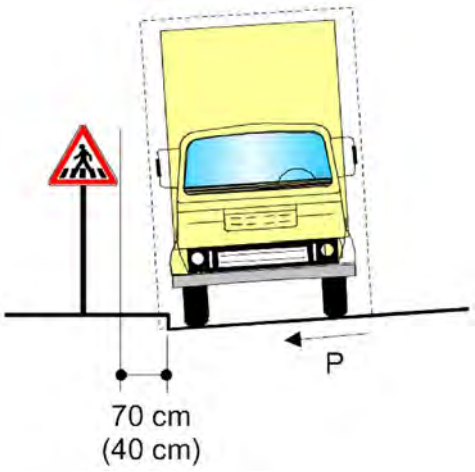
Road user safety

Urban furniture can create an obstacle. Distancing it from the edge of the carriageway is favourable for safety. Remember that accidents against obstacles make up 34% of fatal injuries in the urban environment. These are increasing in number and are more serious when crossing small conurbations and in main streets where the speed limit is 50 to 70 km/h.

In the urban environment, no rules set out a protective distance. The Certu's document, *Accidents contre obstacles en milieu urbain, comment limiter leur nombre et leur gravité,* presents useful ideas on their installation. It highlights specific risks linked to certain obstacles.

Protection of installations

To give enough space to the gauge of vehicles located on a carriageway, a distance between the edge of the carriageway and the outer edge of furniture is necessary. It is determined according to the transversal slope of the carriageway, the presence of wing mirrors and the height of the furniture.

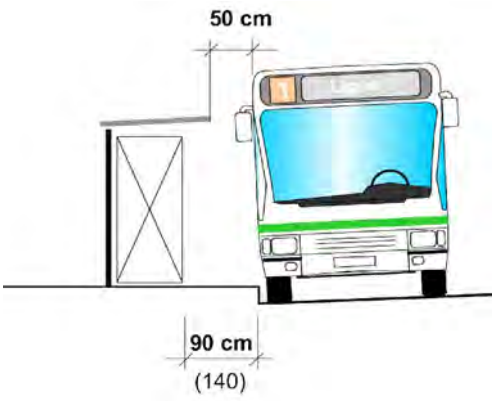


Article 8 g) of the ministerial instruction on road signage specifies that "the distance between the plumb of the extremity of a road sign located on the side of the carriage way and neighbouring bank of this extremity should not be less than **70 cm**" and in a conurbation, it is possible to "accept a shorter distance". In constrictive sites or in a dense urban environment, it is also possible to reduce sign size.

In towns, a distance between **40 cm** and **50 cm** provides enough protection in most cases.

Alongside longitudinal parking, a distance of **50 cm** between the urban furniture and the vehicle is necessary to open doors. This distance is increased to **70 cm** in angled parking zones in order to take into account cantilevering of vehicles that overlap onto the footway. This is necessary to size the footway.

When bus shelters are placed on the edge of the carriageway, they should be placed **50 cm** from the edge for cantilevered elements such as the roof. A minimum width of **90 cm** should also be allowed between the bus shelter and the edge of the footway to let people in wheelchairs through. This is increased to 1.40 m if the pedestrian space is not accessible from the side of the built frame.



Rue Faidherbe: “gargantuan” footways - Lille

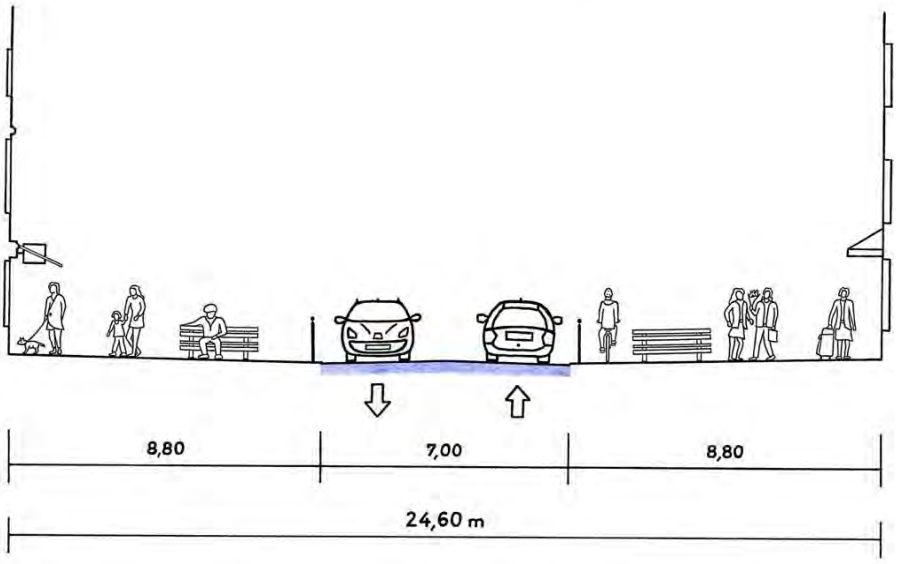
Context

Photo: C. Chain (Certu)

In 2004, Lille was designated European city of culture. To round off the festivities, the media showcased this magical place which hosted all sorts of artistic events: the Mézières arches, the Bambuco bamboos, the Shanghai rambla.

The development of the rue Faidherbe reflects a determination to create homogenous contemporary spaces on the city’s scale. The development part satisfies the principle of legibility aimed at favouring a perspective of the city from the station and helping to enhance the urban landscape through new proportions.

Another public space dimension



For its section consisting of a carriageway and two footways and owing to its gauge, the design of the street by architect-town planner Pierre Gangnet offers a simple and effective vocabulary. This is implemented through an identical paving layout on both sides of the street.

Its specificity lies in these "gargantuan" 8.8 m footways designed to receive large flows of pedestrians comfortably. Each one has carefully aligned urban furniture. The space between small posts and benches forms a rectilinear corridor 1.5 m wide materialising a non-allocated place used as an escape by bicycles during peak hours. Likewise, all users can move comfortably on this level paving, which has no superfluous curbs. The fire service and cash escort companies can easily access their parking areas thanks to movable posts. All this is done in an easy relationship with other users thanks to a fairly broad carriageway.

The many parking possibilities offered nearby (Lille station, place du général de Gaulle or perpendicular streets) allowed parking to be deleted.

Photo: Cete Nord-Picardie

A reference 30 zone

The rue Faidherbe symbolises a city centre public area shared by all transport modes that can live together safely. In a traffic flow control situation, the contractors rebalanced the position of cars while allowing each resident to choose, in all circumstances, the most convenient transport mode: foot, bicycle, car, bus or metro. These developments accompany a new living environment. The rue Faidherbe, after this makeover, has become a favourite walking place.

The city is shared better. The rue Faidherbe in Lille is compelling proof. It shows the city council's determination to reduce the position of cars while leaving flexible use.

Photo: Cete Nord-Picardie

3.2 Spaces aimed at cyclists

The Code de l'Environnement in its article L. 228-2 introduces, among other things, **the obligation** to design the urban road network by favouring cycle traffic.

A cycling itinerary can consist of several developments that are not limited to tracks or lanes. A 30 zone, a pedestrian area or a pedestrian priority zone with consistent installations in themselves guarantee cyclist traffic. Finally, other possibilities include opening collective transport sites to cycle traffic or creating a specially dedicated direction.

The factors determining the choice of a type of development result from the study of the urban context and objectives of the programme, in particular:

- political orientations in terms of transport (sustainable urban transport plan, local urban development plan, spatial planning and sustainable development proposal, etc.),
- the hierarchic level of the road in the network (see part 4),
- the speed limit for motorised users,
- present flows (cyclists and other users),
- the typology of users.

This chapter only covers the main section. For more complete design, it is necessary to refer to the *Recommandations pour les aménagements cyclables* guide published by the Certu in 2008.

The presence of cyclists in general traffic or in spaces dedicated for public transport and the design of parking zones are covered in paragraphs 3.3 to 3.5.

What the regulations impose...

Article L. 228-2 of the Code de l'environnement sets out the road operator's obligations with respect to the development of cycling itineraries: "*When constructing or renovating urban roads, with the exception of motorways and urban rapid roads, cycle itineraries should be included in the form of tracks, ground markings or independent lanes, depending on traffic needs and constraints. The development of these cycle itineraries should take into account the orientations of the urban transport plan, if one exists*".

Non-compliance with the provisions of the law can result in the cancellation of deliberations approving the project and call into question budgetary feasibility. It could, in the case of an accident involving a cyclist after its completion, trigger off legal personal penal liability action against the mayor (article 2133-34 of the Code général des collectivités territoriales).

3.2.1 Sizing according to use

This paragraph is used to specify a few elements of basic practices concerning cyclists without which specific layouts would not be satisfactory.

Several factors need to be taken into consideration to define the width of a cycling development:

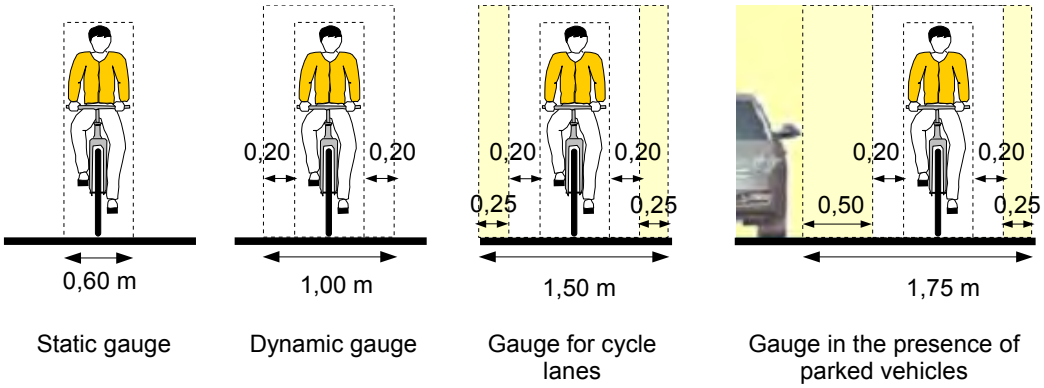
- type and rate of occupation envisaged: adults, schoolchildren, families out for a outing? Is the structure used by other users (roller bladers, pedestrians, mopeds, etc.)? Is it one-way or two-way, in a town centre or in a periurban environment? Can two cyclists overtake each other in complete safety, etc?

- immediate vicinity of the development: presence or not of lateral parking, non-usable width (gutter, positioning of water collection grids), risks of side-swiping by trucks that speed past, uphill or downhill sections,
- the cyclist's dynamic gauge.

Dynamic gauge is obtained from the 60 cm wide static gauge of a bicycle to which is added an extra width of 20 cm on each side for balance. The **dynamic gauge** of a cyclist is therefore **1 m.**

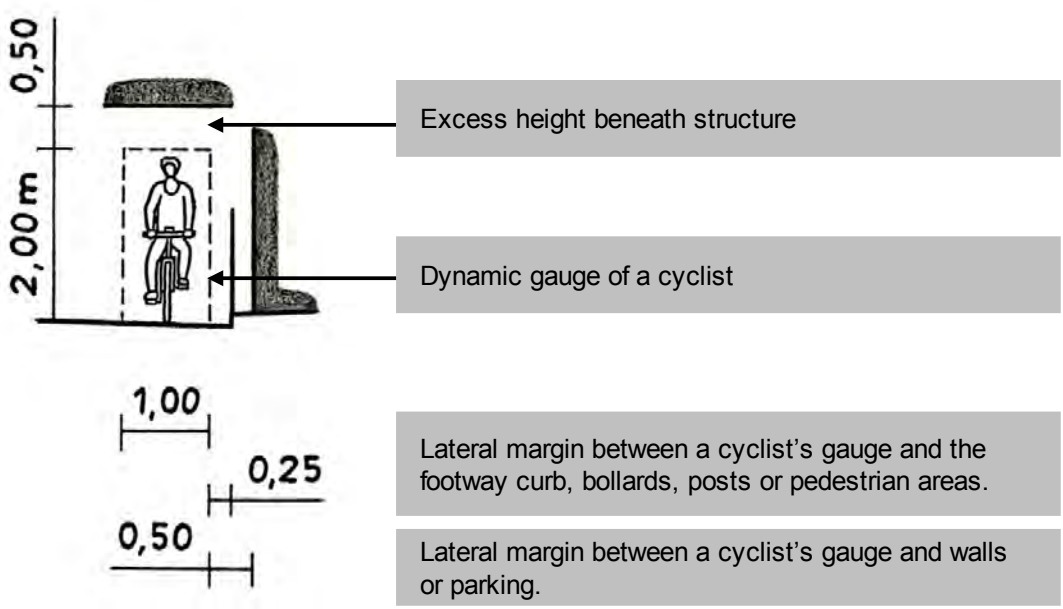
Adult bicycles measure **1.80 m** long and **2 m** should be considered for the bicycle + cyclist height.

In the event of a wall effect, along a wall, parking spaces or in a tunnel, for example, the cyclist instinctively moves over around 0.50 m and 0.25 m from the edge of the footway. This should be integrated when sizing a development.



The cyclist, with a static gauge of 0.60 m needs space of 1.50 m to travel normally or even 1.75 m in the presence of parked vehicles.

The space needed for a cyclist to travel can therefore be summarised as follows:

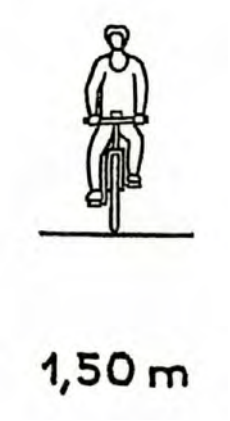


3.2.2 Cycle lanes

Photo: Certu

A cycle lane designates a lane on the carriageway dedicated to cyclists. It is delimited by T3 type marking (see paragraph 5.7). It is one-way and is located to the right of traffic. In the urban environment, it is often the best solution to use a bicycle. Opening of parked vehicle doors and illegal parking on the lane are the major disadvantages of this system.

The recommended width is **1.50 m excluding marking for a cycle lane** in a main section. Experience in French cities confirms that this dimension is a good compromise. It is sometimes possible to reduce this width to 1.25 m when there is low motorised traffic or when right-of-way is restricted. For the passage of specific points, it is absolutely necessary to reduce to less than 1 metres excluding marking.



3.2.3 Cycle tracks

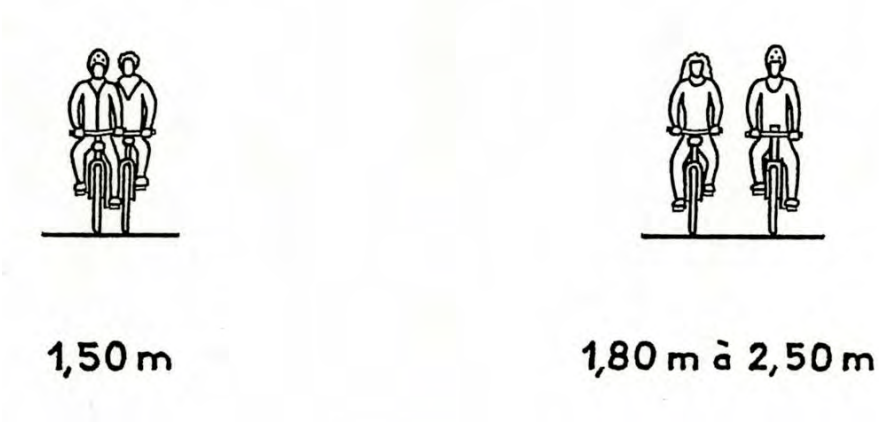
Photo: Certu

The cycle track is a carriageway exclusively allocated to cycle traffic. It is therefore separated from other carriageways by a physical separator: level difference, curb, reservation, etc. In the main section, the cycle track offers good safety conditions, the level of safety is less good in intersections (difficult insertion into the carriageway, reduced visibility). That is why it is well adapted to periurban networks where there are few intersections. The position of the tracks in the cross-section will depend, among other things, on the management of junction conflicts.

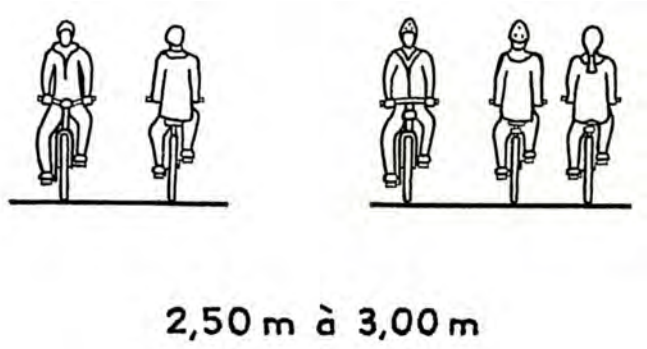
A one-way track will be located as far away as possible from frontages to avoid conflicts with neighbourhood accesses. As it is separated from other road areas, a width of 2 to 2.50 m is recommended to let through machines needed for maintenance. The narrowest of these are 1.70 m wide.

It can be reduced to 1.80 m if located at the intermediate level between footway and carriageway (without lateral parking) or between the footway and parking (with simple marking or separating island). It needs to be at least 1.80 cm wide to allow two cyclists to cross over.

The minimum width of 1.50 m is only possible when the track is located at the same level as another space without insurmountable separation for bicycles which is the case of tracks on the footway level.



Two-way tracks are difficult to insert into a highly urbanised context, especially as far as junction and neighbourhood access conflict management is concerned. One-way cycle tracks should be preferred (one for each direction). It should be noted that a two-way track should be **2.50 to 3 m wide**.



3.2.4 Two-way cycle traffic

As far as sizing lanes for which one direction is dedicated for cycles (two-way for cyclists) is concerned, there is no minimum width below which this type of system is not recommended: it works in extremely narrow streets where traffic and vehicle speeds remain very low. However, visibility should be clear at each intersection. Carriageways of around 3.50 m without longitudinal parking only allow cyclists and cars to cross at walking pace; at less than 3 metres, it is physically impossible to cross over.

In pedestrian priority zones and 30 zones, two-way cycle traffic exists automatically unless the police authority stipulates the contrary.

For your information, a survey by the Club des villes cyclables is useful to establish if it is necessary or not to mark the direction set out for cyclists:

Motorised traffic Width	< 1,000 veh. / day	1,000 to 5,000 veh. / day	5,000 to 8,000 veh. / day	> 8,000 veh. / day
< 3.50 m	No marking	No marking	X	X
3.50 m < L < 4.50 m	No marking	Marking	X	X
L > 4.50 m	Marking	Marking	Marking or separation	Separation

X: Cases not very realistic or not recommended.

It is possible to establish parking along the direction dedicated to cyclists if, in compliance with the Code de la Route, the police authority formally authorises it by decree.

Photo: Cete Nord-Picardie

When cyclists are placed between the footway and parking, the space will be calibrated like a cycle track (see paragraph 5.2.3).

Photo: Certu

3.2.5 Greenways

Greenways are specific itineraries dedicated to non-motorised users: pedestrians, joggers, cyclists, roller skaters and even horse riders. It can take over existing rights-of-way – former railway tracks, forest paths, urban park crossings or be created specifically. By definition, they are two-way and their width can vary greatly. Next to towns, the presence of pedestrians is stronger so a width between 3 m and 5 m can be necessary. It may be difficult to allow all users to cohabit in the same space and separate tracks and different coverings could be used.

A greenway in the Marais poitevin where all non-motorised users cohabit (photo: Cete Normandie-Centre).

An entrance developed as a 30 zone - Douai

The urban context

Douai, population: 42,000, has developed over the centuries. The capital of the Northern French and Pas-de-Calais coalmining area during the twentieth century, it is now an industrial, legal and university centre.

For several years, the council has endeavoured to restructure its urban spaces, thus transforming the image of the locality. In 2006, construction of the n° 1 tram line started.

Rue d'Esquerchin: town entrance

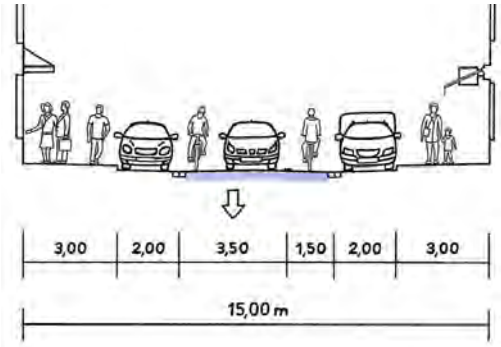
This 30 zone lane inaugurates a certain reconquest of the town by the development of calmed traffic streets. Wide footways, continuous cycle itineraries, reduction of the speed of motorised vehicles and multiple uses of the carriageway facilitate traffic.

Photo: Cete Nord-Picardie

On a 450 m long section, two road network sections have been implemented. They correspond to two separate rights-of-way and work differently.

The first is two-way (approximately 300 m) and allows distribution towards the city centre via three access lanes. It includes two comfortable footways, bilateral parking and a 6 m carriageway where cyclists and motorists cohabit. The presence of cyclists on the carriageway is recalled, on the sides of the road, by cycle pictograms.

The second is one-way (approximately 150 m) and consists of a 3.50 carriageway and one-way cycling lane. Next to the town centre, this section moderates motorist speed and minimises cyclist journey times.



For the whole zone, footways are coloured in red bitumen to set them apart from spaces dedicated to other modes. Raised platforms placed at junctions punctuate the space by a visual level difference expressed by a covering consisting of beige gravel on resin. They effectively reduce motorist speed.

Photo: Cete Nord-Picardie

3.3 Spaces dedicated to general traffic

In the following section, we cover the carriageway space allocated to general traffic excluding parking and dedicated lanes. In the urban environment, this space, by default, receives all types of motorised or non-motorised vehicles. Its calibration will depend on the objectives targeted for the types of uses, function of the road, level of service for general traffic and more or less assertive presence of other users.

For neighbourhood access lanes, traffic is rarely a sizing factor. The carriageway is calibrated as precisely as possible to users in a context of reduced speeds while allowing the passage of utility vehicles such as emergency services, deliveries, etc.

For roads where the circulatory function dominates, the focus goes to the level of service and safety that users require and to determining the number of traffic lanes and their calibration. The questions to be asked are: is it necessary to size for peak hours? Is it acceptable to have congestion at certain times of the day or not? It is impossible to avoid these questions if you do not want to waste space and have uncontrolled behaviour at off-peak times.

But in this precise case, reflection on the cross-section should optimise spaces, in particular the carriageway in order to give maximum room to other users and induce behaviour compatible with the urban environment crossed, by the width of the carriageway, the presence of parking, etc. It plays a flow regulating role (speed and traffic).

3.3.1 Sizing for motorised vehicles

3.3.1.1 Capacity and number of lanes

To characterise road capacity, the most frequently used variable is maximum debit, usually expressed in vehicles per hour. This is the hourly traffic threshold over which the slightest incident could cause congestion.

Remember the principles to bear in mind to evaluate the capacity of a road network in the urban environment:

- Junctions determine the flow capacity and not the main section. Consistency between the cross-section and junctions' flow capacity should therefore be checked.
- Contrary to certain preconceptions, the flow is not proportional to speed. Even on roads with few junctions, it is known that maximum traffic flow capacity does not correspond to very high speeds. On an urban rapid road section, the maximum flow is obtained at speeds of around 50 km per hour. On urban roads not isolated from their environment, speeds of around 30 to 50 km per hour usually allow heavier flows (between 1,500 and 2,000 vehicles per hour) than at higher speeds.
- A large number of other factors can hinder flow: lateral occupations (parking, neighbourhood activity, etc.), the presence of other slower users (cyclists), pedestrian crossings, etc.

The table below gives, for each type of road, maximum flow numbers. The values are expressed per direction and for one lane.

Type of urban road	Features	Maximum flow (*)
Road with dominant circulatory function	Isolated from its environment (no lateral parking, absence of neighbourhood life, absence of direct neighbourhood accesses, etc.).	1,500 to 1,800 vehicles per hour
	Lined with footways, little neighbourhood life, absence of parking, road width at least 3 metres.	1,000 to 1,500 vehicles per hour
Interdistrict road	Lined with footways, neighbourhood life, lateral parking, road width less than or equal to 3 m.	600 to 1,000 vehicles per hour
District road	Lined with footways, neighbourhood life, lateral parking, narrow road width.	400 to 600 vehicles per hour

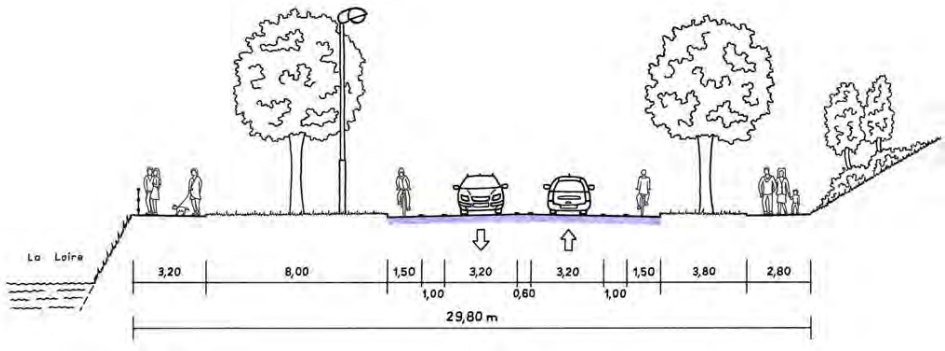
(*) We should note that the rush hour represents between 8 and 12% of average daily traffic.

Nantes (44)

A specific example that shows that without contact with urbanisation and few junctions, the main section of a single carriageway can have a flow of around 40,000 vehicles per day

The boulevard de Sarrebrück in Nantes is an urban road isolated from neighbourhood life: on the south side it is bordered by the Loire river and on the north access to various districts is done via the back on the Boulevard de l'Europe. This situation does not seem to stick to urban planning, without parking on the road and with few crossroads to hinder traffic, showing that it is possible to have strong traffic flow with a single carriageway.

The move to a dual carriageway aims to reduce speed and create cycle lanes. Since, the traffic has not fallen; 42,000 vehicles per day were recorded in 2006 whereas speeds have effectively fallen. Counting shows that, in this situation, a road in its main section can allow a capacity of more than 1,800 vehicles per hour.



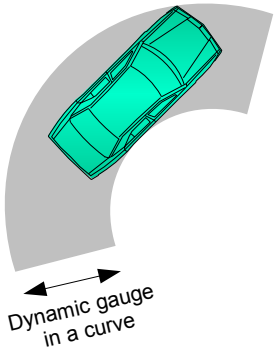
Section in a main section without collisions between users, with wide lanes, no parking and no neighbourhood life. (Photo: Cete de l'Ouest)

3.3.1.2 Calculation according to vehicle gauge

There is a wide variety of motorised vehicles in towns: passenger vehicles, motorcycles, buses, utility vehicles, LGVs. Depending on the speed, uses and function of the road, they will not be taken into account in the same way. The development programme will determine how they should be taken into account, the type of users present on the carriageway and the level of service required (speed, traffic, journey times, etc.).

Calculation of the width of roads takes into account the dynamic gauge of vehicles. For motorised vehicles, it is difficult to evaluate. It depends on several factors linked to the characteristics of the vehicle, the state of the road, the transversal slope, the driver's behaviour, etc. To calculate the width of lanes, it is considered that, in a straight line, it is assimilated to a vehicle's static gauge to which variable margins are added according to speed. In a curve, the dynamic gauge should take into account excess widths linked to the gyration of the vehicle.

In a straight line



In a curve

Passenger vehicles

These make up the majority of vehicles on the road but they do not present any specific sizing problems.

The static gauge of a passenger vehicle varies from 1.60 m to 2 m excluding wing mirrors, considering that it is necessary to add approximately 0.25 m to include both wing mirrors. An average width of 1.80 m excluding wing mirrors and 2 metres with wing mirrors should be taken into account.

Did you know?

Cars have got wider: width of a Renault 5 (1972) = 1.52 m
width of a Renault Clio 1 (1990) = 1.63 m
width of a Renault Clio 3 (2005) = 1.71 m

The smallest city cars like the Peugeot 107 measure 1.86 m wide, including wing mirrors (1.63 m without wing mirrors).

The width of a saloon (Renault Laguna) is 2.06 m with wing mirrors (1.81 m without wing mirrors).

Two-wheeled motorised vehicles

Two-wheeled motorised vehicles cover two vehicle categories: mopeds and motorcycles. Their features vary but their geometry is quite similar with:

- a length between 2 m and 2.30 m;
- a width (excluding wing mirrors) of around 0.70 m for mopeds and between 0.75 m for "light" motorcycles and 1 metre for "roadsters" fitted with side bags. With wing mirrors, the width is at least 0.80 m.

As for cyclists, it is important to add extra width to this static gauge, in order to take into account the movements of two-wheeled motorised vehicles.

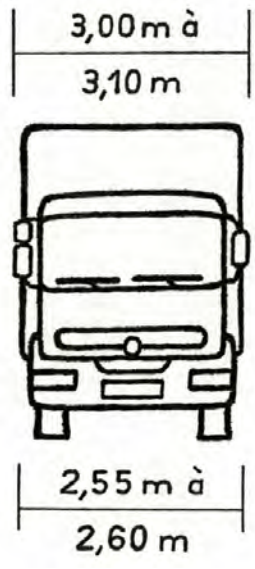
Owing to their dynamic features, they ride exclusively on the carriageway with other motorised vehicles and are, in this guide, assimilated to light vehicles. We should note that light two-wheeled motorised vehicles are better suited to the urban environment and make up the majority.

Buses and coaches

Public transport services are run on identified itineraries. The lanes should therefore be sized to guarantee their circulation in comfortable conditions compliant with their requirements. Their features are described in paragraph 3.4, "Spaces dedicated to public transport".

Large Goods Vehicles (LGVs)

In towns, certain LGVs are indispensable for urban operation: deliveries, collection of household refuse, emergency vehicles. Their passage must be guaranteed. However, it is not necessary to offer them a high level of service. The aim is to decide how they need to be taken into account to define the width of roads; for example, can they cross each other or take advantage of occasional road widening in the case of the narrowest carriageways.



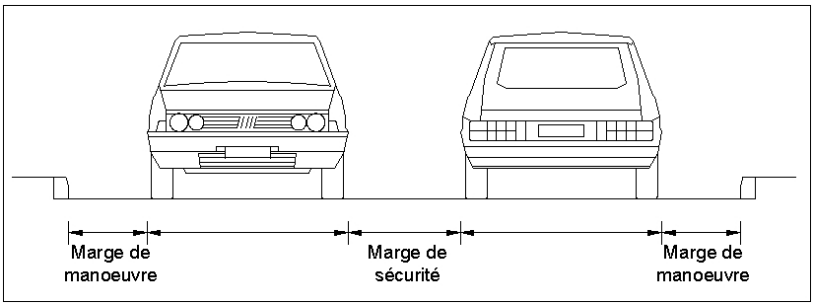
Although their length can vary, their width is usually around 2.50 m for the chassis, axle and cabin combined. It is between 3 m and 3.10 m between wing mirrors. These are dimensions encountered in most makes.

Load elements can vary from 2.55 to 2.60 m in compliance with the Code de la route.

In height, the gauge to be applied is defined in the Code de la voirie routière i.e. 4.30 m.

Lateral margins

To cross, two vehicles need both room for manoeuvre and a safety margin. The first applies to fixed elements: verges, parked vehicles, obstacles; it induces the wall effect notion. The second applies to the presence of other users: spaces between vehicles when crossing or overtaking. In the urban environment, these margins increase appreciably with speed.



According to the street configuration, taking average gauges of 1.80 m for a light vehicle and 2.55 m for a large goods vehicle, it is possible to approach the various carriageway widths according to the hierarchy of lanes and type of traffic with the aim of reducing "drivable" space and therefore a lower flow speed without compromising capacity (see the paragraph below which presents a few standard widths).

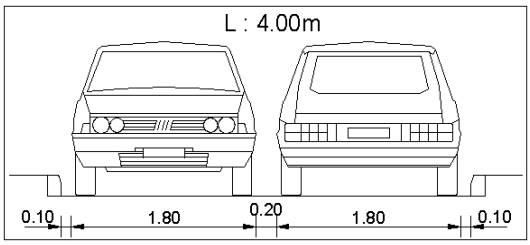
3.3.2 Examples of frequent carriageway widths

In the configurations presented below, the carriageway widths are measured between verges and the crossover speeds of vehicles are indicated for free flow without taking into account any events that could hinder fluidity or safety (lateral parking, heavy presence of pedestrians on footways, etc.). They apply to a straight line plan. They need to be increased in the curves in order to take into account lateral overlapping of vehicle bodywork.

3.3.2.1 Two-way two-lane road

Carriageways measuring 4 m to 4.80 m:

- crossing over of two passenger vehicles is done at low speed;
- in the main section, a passenger vehicle cannot cross an LGV (except by driving onto the footway, where there is no parking or at intersections).



Metz (57)

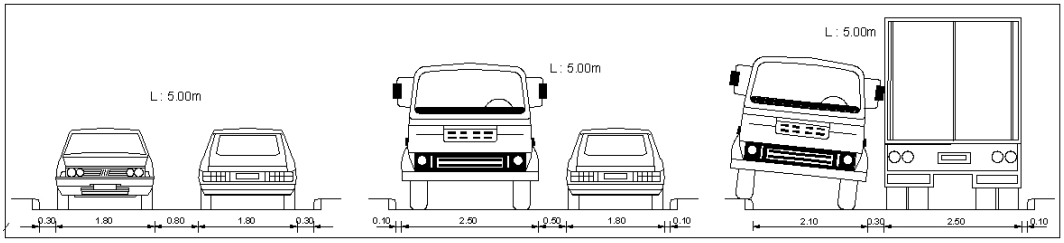
Small street in a residential district

Photo: Cete de l'Est

This street in Metz leads to residential districts and traffic is limited to neighbourhood movements.In this context, a 4 m wide carriageway lined with parking spaces is enough to fulfil this function. The crossing over of two passenger vehicles is possible at walking speed, in the presence of wider vehicles, crossing is possible where there is no parking and at intersections.

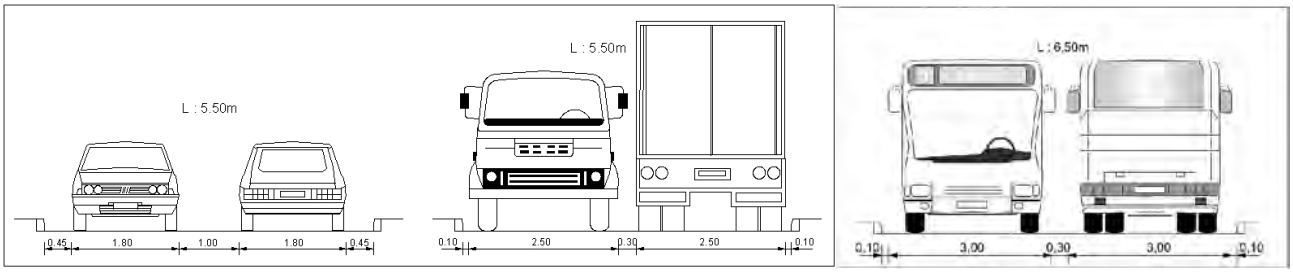
Carriageways measuring 4.80 to 5.50 m:

- two passenger vehicles can cross in satisfactory conditions at 30 to 50 km per hour;
- a passenger vehicle and LGV can cross at low speed;
- in the main section, it is not possible for two LGVs to cross (except by driving on the footway or where there is no parking, at intersections).



Carriageways measuring more than 5.50 m:

- two passenger vehicles can easily cross in free flow at speeds of 50 km per hour or more. Carriageways of more than 6.50 m are therefore avoided which induces high speeds for passenger vehicles;
- two LGVs can cross; for a carriageway measuring less than 6 m, it is done at low speed, in the presence of a regular bus line, the width is at least 6 m (width to be modulated depending on the frequency see paragraph 3.3.3).



La Fare-les-Oliviers (13)

Narrow street crossing the conurbation

The RD 10 crosses the town of La Fare-les-Oliviers in a very restricted right of way context (distance between frontages around 8 m)

Photo: Cete Méditerranée

It has not yet been requalified and should not be taken as a model but this example shows that a 6m wide carriageway (5.80 m in some parts) allows two LGVs to cross without difficulty at low speed. However, this old design does not offer pedestrians sufficient footway width to guarantee minimum safety and comfort.

3.3.2.2 One-way one lane road

The tables below indicate recommended lane widths according to the speed limit required.

Maximum speed (km per hour)	Presence of buses or LGVs	No buses or LGVs
30	3 m	2.50 m ≤ l < 3 m
50	3.20 m	3 m
70	3.50 m	(*)

(*) *Configuration not very relevant with respect to the type of traffic.*

Accessibility for emergency vehicles should be checked as well as for services (delivery, collection of household refuse, removals, snow clearance, etc.)

Saint-Étienne-du-Rouvray (76)

In this one-way street where the width between frontages varies between 8.30 m and 9.30 m, the carriageway has been calibrated at 3.25 m, alternating lateral parking at a minimum of 2 m, the footways vary between 1.50 m and 2 m. This sizing allows easy circulation of a regular bus line and delivery trucks.

Photo: Cete Normandie-Centre

3.3.2.3 Road with more than one lane per direction or for one direction

When the carriageway includes several lanes in one direction, the calibration of lanes should not be done systematically on the basis of two LGVs that cross each other but should consider that they drive normally in the right-hand lane.

Exceptionally, if a vehicle is stationary, it is simply necessary to check that it is possible to overtake at low speed. That is why, in this table, the right-hand lane is wider than the left-hand lane.

Maximum speed (km per hour)	Right-hand lane	Other lanes
30*	2.80 m	2.20 m
50	3 m	2.50 m **
70	3 m	2.75 m **

** This configuration with more than one lane per direction is not recommended for a 30 zone considering the high speed risks at off-peak times .*

*** Value to be increased according to the presence of LGV traffic or buses on these lanes.*

Lyon (69)

Originally the carriageway of this one-way street consisted of two parking lanes, three general traffic lanes and a bus lane. The automobile traffic was heavy. The insertion of a tramway platform while maintaining the structuring character of this road required optimisation of space dimensions. The original functions were maintained by reducing parking and the number of lanes.

Photo: Certu

The carriageway, placed between parking and the tramway platform separator, is 5.60 m wide for 2 traffic lanes. This dimension allows easy parallel circulation of LGVs and passenger vehicles.

3.3.3 Impact of the presence of other users

The Code de la Route indicates that the carriageway welcomes, by default, all motorised or non-motorised types of vehicle. It is therefore necessary to avoid sizing it for automobile traffic only.

When conditions are favourable (30 zone, shared space or very light traffic), **cyclists** can be placed in general traffic. It is not then necessary to increase the lane width to allow vehicles to overtake cyclists but rather lay out lanes that are consistent with calm traffic.

Furthermore, the carriageway should also allow circulation of users: emergency vehicles, deliveries, urban services, exceptional transport. Their impact on sizing is covered in paragraphs 2.4.3 to 2.4.5.

If **lateral parking** is correctly sized (see paragraph 3.5), it should not influence the calibration of traffic lanes.

In the presence of a **bus** lane, the carriageway is calibrated in accordance with the line's level of service (speed, frequency) bearing in mind the probability of a bus crossing an LGV or another bus. For example, for a very busy 2x1 carriageway, a width of 6.50 m is recommended. This width offers drivers good driving conditions.

Schiltigheim (67)

Within the framework of the development of the Bischwiller-République road, the cross-section choice was guided by the presence of two strong urban transport lines.

The operator gave instructions to its organising authority to set out a width of 6.50 m on a 2x1 lane carriageway ensuring that bus drivers have good driving conditions to keep to the displayed commercial speed.

Photo: Cete de l'Est

Whatever the case before final development, it is recommended to do a real-life simulation on-site, in particular to check the possibility for two LGVs to cross according to the planned width of the carriageway and the desired speed limit.

Crossing of a town centre developed as a 30 zone - Sélestat

The urban context

Sélestat is a town with a population of 17,000, located in the Bas-Rhin between Strasbourg and Colmar at the junction of two trunk roads. The development of this road links the "water tower" – a marker at the entrance of the town hall – to the bridge over the Ill. This road, used by traffic varying from 7,500 to 10,000 vehicles, depending on sections, with a low percentage of LGVs (2 to 3 %) is a place where sharing of public space is not easy in view of safety and parking problems.

It is a major road which offers access to the town centre. It also connects up the various districts of the town. It is both a boulevard surrounding the town centre and a penetrating avenue.

Objectives

The town council set itself a strong objective, general redevelopment with the following key points:

- high quality treatment of space: nobility of the major artery of the town;
- calmed traffic throughout the axis;
- maintained parking capacity ;
- shared spaces with more space given to pedestrians while maintaining continuity of traffic, comfort and safety of cyclists;
- a friendly atmosphere with space given to plants and water;
- reinforced neighbourhood activities (mainly shops) by setting out spaces for pavement cafés and parking.

Description of the development

The carriageway is 6 m wide, bordered on both sides by a short-term parking lane (managed with meters). A paved strip reduces the width of the road. Raised areas are inserted in the main section for pedestrian crossings and to reduce speed.

Three sequences and two entry junctions make up the development of the road.

The entry junctions make a strong imprint by considerably narrowing the road. These gates are managed by traffic lights which take into account cyclists.

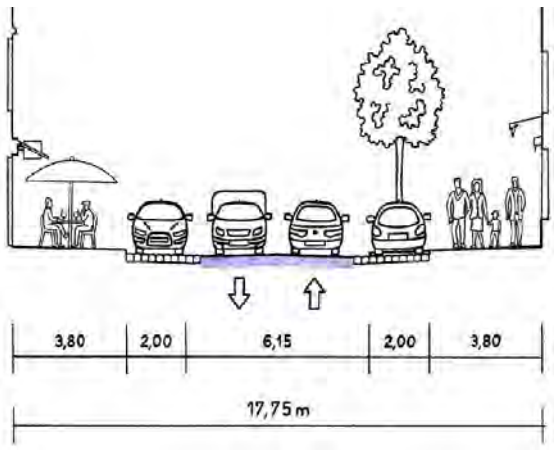


Diagram and photos: Cete de l'Est

3.4 Spaces dedicated to public transport

Spaces dedicated to public transport vehicles whether guided or not, group together:

- **lanes dedicated** to buses or bus lanes,
- **carriageways dedicated** to public transport.

They can be either exclusively dedicated – called dedicated lanes – or open to other users – called shared sites.

Several types of dedicated lanes are possible: one-way or two-way, axial or lateral, with general two-way or one-way traffic, not excluding "combined" solutions with, for example, one single direction as a dedicated lane, the other as an open lane, or when both directions are found on close but separate roads.

For a detailed design of these dedicated lanes, the reader should refer to the *Guide d'aménagement de voirie pour les transports collectifs* published in 2000 by the Certu.

Here we look at a few design principles applicable to sizing of the cross-section; positioning of the site and sizing of spaces. Separators are covered later in paragraph 3.7.

3.4.1 Positioning in the cross-section

The choice of the type of dedicated lane and its positioning in the profile depend on observations and ideas resulting from diagnostics studies, in particular, in terms of lane typology, building structure, access of all vehicles or public transport, presence of other users, disruptions and available total land requirement.

Reflection on the choice of positioning should therefore mainly emerge from iterative discussion between on-site realities and the search for maximum efficacy for public transport. In this reflection, the most important issues in terms of level of service and safety primarily focus on stations and intersections, the design of the main section often being less difficult.

Axial site

Most frequently, the axial site[14] offers maximum level of service for public transport. It is based on the principle, mentioned in part 1, of distancing the most rapid users from buildings. In this way:

- an axial site largely facilitates access to neighbourhood buildings, as general traffic is then found directly in contact with lateral activities[15]:
- neighbourhood accesses are not penalised by the crossing (or borrowing) of the dedicated lane; they neither affect progress or safety of public transport;
- the functions of daily management (cleaning, collection of household refuse, etc) as well as access for emergency services are also more easily catered for;
- deliveries are done in the best possible conditions;
- finally, the positioning of parking, in contact with lateral activities, is optimal as pedestrians leaving or accessing their cars no longer need to cross the dedicated lane.

However, this configuration is not appropriate when the site is shared with other users (cyclists, taxis) in particular at junctions. Stations take up more space than for a lateral site for which at least one platform is built on the footway.

14 The site is axial with respect to general traffic.

15 However, this positioning can sometimes create problems of access to stations for public transport users, especially if automobile traffic is heavy and fast.

Lateral site

The positioning of lateral sites can be done, while taking the following into account:

- strong commercial activities or a dense habitat on one side, little or no local life on the other (presence of a blind wall, river, railway track, etc.) can encourage unilateral positioning of activities and housing, with inclusion of a station in order to guarantee good access;
- to the contrary, if there are several accesses on one side (private garages, courtyards or residential car parks, service stations, etc.) requiring people to cross the dedicated lane frequently, a unilateral location will be more satisfactory on the other side; it is however possible, in certain cases, to use or create a service road to group together accesses;
- likewise, in particular if there is no station, the option could be taken to position the dedicated lane opposite housing in order to reduce phonic interference and vibrations;
- if there is a good balance between activities on both sides of the road, or dominant visual symmetries (continuous buildings, tree alignments, etc.), the principle of axial positioning will be imposed, more rarely the bilateral principle.

The two-way lateral site, a source of conflict at intersections and barely visible for other users, should be avoided.

3.4.2 Sizing of dedicated lanes

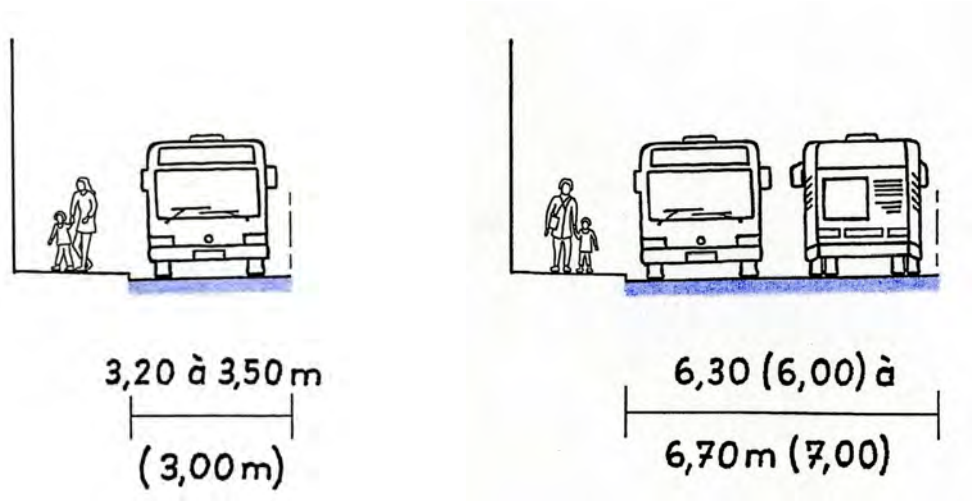
Lanes dedicated to public transport should be sized on the basis of static and dynamic gauges to which margins, varying according to expected level of service for this transport mode and lateral occupations, are calculated. The values below are valid in a straight line, extra width should be provided for curves according to the vehicle.

3.4.2.1 Dedicated bus lanes and sites

To determine the width of bus lanes or dedicated sites, proceed as indicated in paragraph 3 while adding the gauge of a bus and lateral margins needed between the vehicle and other users or elements of cross-section. They vary according to the speed of vehicles. It should be noted that the circulation of buses in the immediate vicinity of parking reduces bus speed. The same can apply to proximity of a footway without specific arrangements.

Gauge of a bus

There are several sizing possibilities but for the most frequently encountered developments, the width of dedicated bus lanes are included in the values set out below:



One-way bus lane *Two-way bus lane*

Width excluding marking (values to be used only exceptionally are featured in brackets).

3.4.2.2 Spaces dedicated to tramways

The width of tramway platforms or other guided transport modes[16] is determined using the same logic as for bus lanes. The widths can however be defined more precisely owing to the presence of guiding systems and an apparently better controlled trajectory.

The **static gauge** of guided transport varies according to material requirements. In France it is between 2.30 m and 2.65 m (2.13 m in Saint-Étienne).

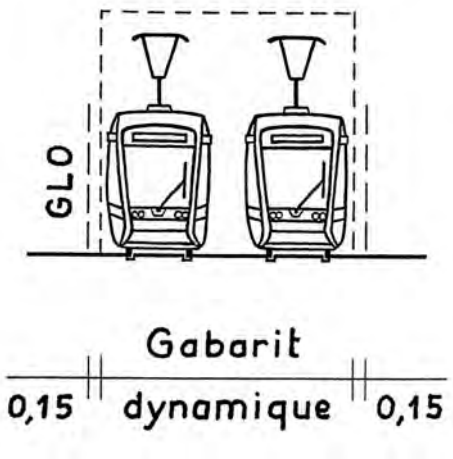
The **dynamic gauge** will be defined by the following factors:

In a straight line, taking into account the different accessory movements as well as other auxiliary factors and parasitic movements.

In bends, excess widths should be added owing to slopes and length of coaches. It is necessary to add width to the interior and exterior of the bend.

Finally, excess heights (suspended lines, upper passages, underground zones) should be included, depending on the slope and connections of the **long section** (hollows and bumps).

The **obstacle limit gauge** is obtained by adding air space (of around 0.15 m) to the dynamic gauge.



16 Guided transport: the decree n° 2003-425 dated 9th May 2003, or STPG, defined a public transport system for which the vehicles are required to follow all or part of their journey on a defined trajectory. Guiding may be automatic, slow-speed or not, material or immaterial.

TEOR public transport system – Conurbation of Rouen

TEOR (Transport est-ouest rouennais) is a BHNS (bus à haut niveau de service – high service level bus) system designed to reinforce the Métrobus public transport structure set up in 1994 (tramway with an underground section in the city centre) mainly north-south in direction.

The infrastructure

It consists of three lines measuring a total 39.4 km with a 3.9 km joint section in the central part of the city. On it, TEOR vehicles travel on dedicated lanes (photos 1 and 2). At intersections with general traffic, they benefit from a detection system upstream of junctions giving them priority at traffic lights by integrating specific retractable TEOR phases in the cycle.

This infrastructure is used to achieve good commercial speeds, regularity, passenger comfort equal to or better than those on a tramway. For example there is a maximum frequency of 1 per direction every 2 minutes during the rush hour.

Photo 1 – dedicated lane

Photo 2 – dedicated lane

Rolling stock

TEORs are articulated Agora or Citelis vehicles (photo 3) In 2008, their total number was 66. During the rush hour, a total 31 TEOR vehicles circulate on the three lines.

They are fitted with an optical guiding system consisting of a camera that reads the imposed trajectory on the carriageway, materialised by double broken lines painted on the ground (photo 3) and a computer that analyses the position of the vehicle with respect to the theoretical trajectory and transmits necessary corrections to the steering column to ensure precise and regular arrival in stations. The driver can at any time take over and drive the TEOR manually.

Photo 3 - Citelis

Operating assistance and passenger information system (SAEIV)

It is used to monitor and regulate all vehicles of the Métrobus network and inform passengers (times and miscellaneous messages).

Performance of the TEOR system in terms of journeys

The number of journeys made is 40,000 per day which represents 10 million journeys per year.

Photos: Cete Normandie-Centre

3.4.3 Sharing with other users

Besides accessibility needed for emergency vehicles, dedicated lanes can be shared with other users. This sharing has an impact on the sizing of spaces.

3.4.3.1 Lanes dedicated to buses

The opening of bus lanes to other categories of users (emergency vehicles, of course, but also taxis, tourist coaches, cyclists, etc) may be envisaged in the following 3 conditions:

- the layout should take this into consideration (width, road signs, etc.);
- the use rate (public transport vehicles and other uses) allow good cohabitation;
- the impact of the decision at junctions has been carefully examined.

For sections where a high level of service is required, it will be necessary to be more restrictive and avoid cohabitation.

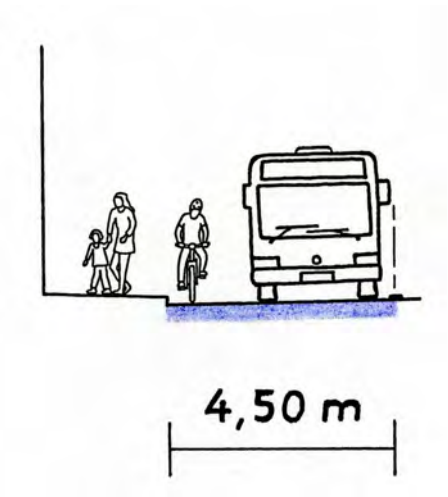
Bus lanes open to cyclists

Besides the use rate of bus lanes, it is necessary to look into relative speeds between cyclists and buses. The focus will naturally go to the level of service of the public transport line:

- for high levels of service, cohabitation is often to be avoided;
- for a conventional line, this cohabitation is possible. It can, in certain cases, lead to the widening of the bus lane (see below). Over short distances, when bus and cyclist speeds are similar, low use rates or short distances between stations, broadening is not necessarily necessary.

Cyclists, owing to their relatively slow speed and vulnerability, should be placed on the extreme right-hand side of the carriageway.

Photo: Cete de l'Ouest

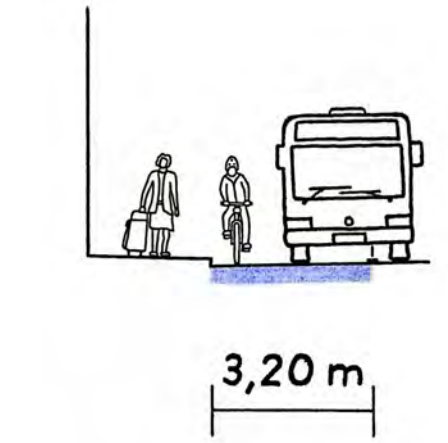


With a width at least equal to 4.50 m ("widened lane"), buses can normally overtake cyclists without leaving their dedicated lane while leaving a distance of 1 m between the bus and the cyclist. It is then possible to either mark a cycle lane or not.

If there is enough space, this solution can be applied to:

- heavy bus traffic;
- high bus speed – however larger extra width should be provided in the case of strong inclines (4% and more).

The "widened lane" may also be chosen when a bus lane goes against the usual traffic direction.

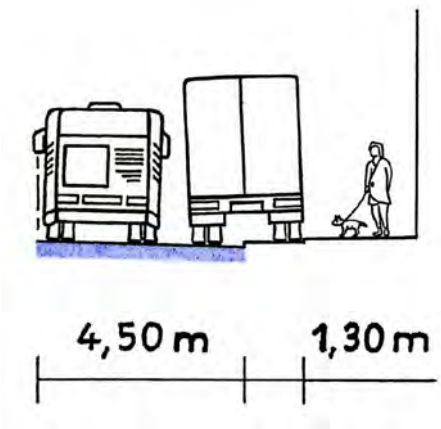


If the width of the bus line is less than 4 m, overtaking of cyclists by buses is only possible if they partially leave the lane. This is the case of an **"open lane".** This configuration is impossible for contraflow bus lanes.

This solution works, even if general traffic is heavy, in certain conditions:

- bus traffic remains relatively limited (fewer than 15 vehicles per hour per direction, therefore an average use rate of a bus around every 4 minutes per minute in the rush hour);
- bus and cyclist speeds are very similar; from this viewpoint, one-way downward or flat lanes are favourable;
- when sections between intersections or stops are short.

Two-way dedicated lanes give more flexibility on this level and do not usually require extra width if open to cyclists.



Bus lanes open to deliveries

Practices vary from one town to another. Some towns forbid access of bus lanes to deliveries, others authorise it occasionally. For the latter cases, the design of bus lanes and delivery areas should allow buses to overtake stationary delivery vehicles.

Delivery areas in a 2.50m insert have no impact on the width of the bus lane. In the presence of a 1.30m semi-insert, it is possible to either keep the width of the lane if this is "open" or broaden it to 4.50 m especially if the bus has no possibility of overlapping into the general traffic lanes.

3.4.3.2 Lanes dedicated to tramways

The opening of tramway lanes to other categories of users, even urban buses, is, besides a few exceptions, to be avoided:

- the space taken up (length) and kinetic features (braking, acceleration, trajectory) of the tramway are very different from other vehicles, of all kinds, including buses;
- owing to this, regulatory provisions and therefore signs governing the tramway and road vehicles differ;
- finally, longitudinal circulation of cyclists can raise safety problems due to the presence of rail grooves and sometimes cyclists' unpredictable behaviour which could affect passenger safety.

3.4.4 Relations with lateral spaces

The design of dedicated bus lanes needs to take into account the nature of uses in lateral spaces. They have an impact on their sizing and on the operation of public transport.

3.4.4.1 Parking

Its presence along public transport dedicated lanes can only hinder the level of service and its safety. This can require an additional space due to the wall effect and opening of doors.

In the presence of parking, an axial site therefore seems most suitable.

Placing parking between the public transport site and general traffic requires inserting a pedestrian path of at least 1.50 m.

Parking along contraflow bus lanes (to the right of the bus) should be avoided insofar as it considerably disturbs buses. Furthermore, regulations on road signs require placing a solid line which forbids vehicles to cross the bus lane to park.

3.4.4.2 General traffic

Passenger vehicle speeds and traffic influence the choice of public transport developments. In the case of strong pressure from automobile traffic, a lightly used dedicated lane is either invaded by traffic or parking, in which case the installation of separators is indispensable.

3.4.4.3 The footway or pedestrian walking spaces

Placing a dedicated lane alongside a narrow pedestrian path incurs:

- disturbance for public transport which can be expressed by a reduction of their maximum speed (approximately 30 km per hour),
- disturbance to passengers due to a strong speed differential and risk of collision with bus wing mirrors.

The juxtaposition of these two entities usually requires installing separators (high curbs, etc) while reserving an additional "buffer" zone if possible.

3.4.4.4 Cycling facilities

Juxtaposing a lane (or track) and public transport dedicated lane leads to:

- placing the cycling facility to the right of the dedicated lane;
- for tramways, keeping a certain distance between the gauge without obstacle and the track. Failing this an insurmountable separator is necessary.

Variable allocation of a public transport dedicated lane - Lyon

The context

La Montée des Soldats is a "départemental" (county) road north of the city of Lyon which links the residential districts of Caluire and Rillieux-la-Pape to the city centre. 900 m long, this very busy road receives 19,000 vehicles per day per direction with peaks in the morning in the downward direction (towards Lyon city centre) and in the evening in the upward direction.

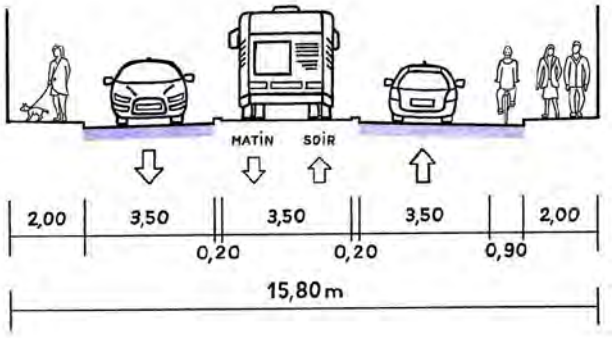
Initially developed as a dual carriageway, several accidents would occur at night at excessive speeds. To reduce the danger, the Rhône general council experimented reducing the cross-section to one lane per direction. The results were decisive in terms of user safety and traffic flow.

On the basis of experiments conducted, the Syndicat des transports pour le Rhône et l'agglomération lyonnaise (SYTRAL) decided to use spaces freed by the removal of the two traffic lanes to set up a dedicated bus lane.

Optimised sharing in space and time

As the total land requirement did not allow construction of an axial two-way site, the SYTRAL opted for a reversible one-way bus site: it is used from 5 a.m. to 1 p.m. in the downward direction and from 2 p.m. to midnight in the upward direction. In this way, the journey time during the rush hour is reduced in both directions.

In the end, this new development satisfies road users and public transport users. Variable time use of a road results in optimised sharing of space occupation.



Main section (Photos: Certu)

Access regulated by traffic lights and barriers

"Montée des Soldats" station

3.5 Spaces destined for parking

This chapter exclusively looks at on-road parking. Recommendations relating to car parks are not covered.

On-road parking is possible either directly on the road next to the footway or in differentiated spaces organised in the form of a lane along the footway or inserts in the footway. In the second case, it can be marked out by a low footway curb or, better still, by a double slope gutter, rows of paving, etc. Parking on the footway level should be limited to specific cases as it generates conflicts with pedestrians.

3.5.1 Parking for cars

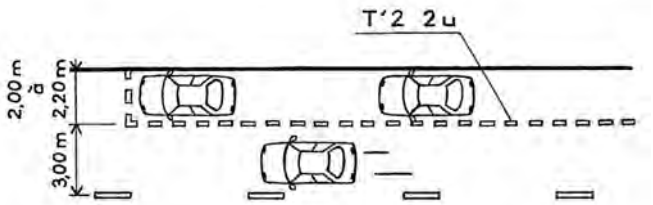
There are two types of parking in towns:

3.5.1.1 Longitudinal

In this arrangement, vehicle parking only hinders general traffic on one lane. It is therefore adapted to most urban road networks.

It is recommended to lay out longitudinal parking by inserting a few spaces (6 spaces maximum), alternating with advanced sections of footway to help pedestrians to cross, installation of urban furniture or plants as well as positioning of household refuse containers.

The recommended dimensions are summarised in the following diagram:

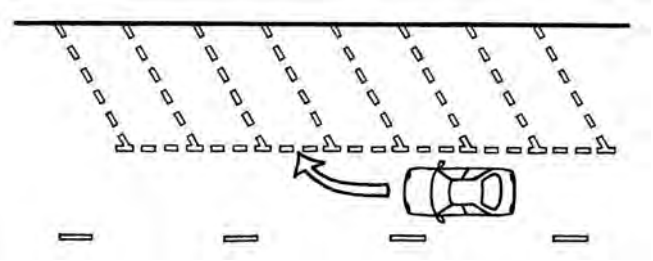


3.5.1.2 Perpendicular or angled

In this case, manoeuvring often hinders general traffic in both directions. It is thus recommended to avoid this type of parking on very busy roads or with public transport sites. In contrast, it is well adapted to residential district. This organisation can reduce pedestrian spaces by the overlapping of vehicle cantilevering onto the footway. It is thus necessary to lay out parking or the footway to maintain a width of 1.40 m free of all obstacles (see paragraph 5.1.3).

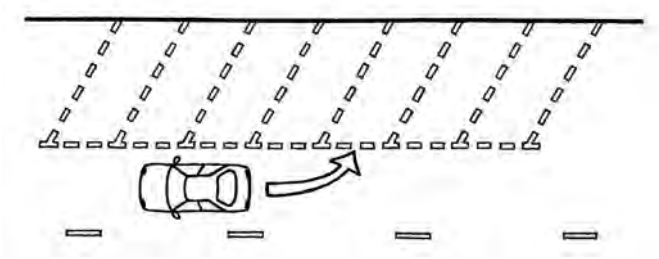
The question of forward or reverse entry can be raised with this type of parking:

- **Forward entry**: the vehicle exits in reverse with poor visibility, in particular, of cyclists on the road. However, the motorist does not hinder traffic when entering.



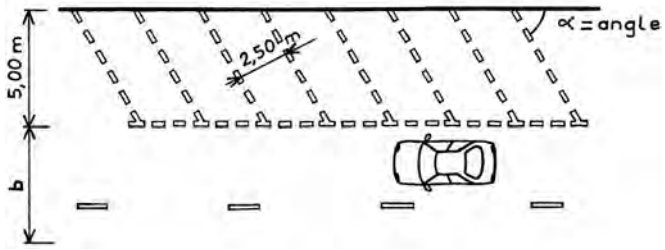
- **Reverse entry**: it creates a certain disturbance to traffic on the adjacent lane. The parking vehicle reverses towards the footway, therefore the driver and passengers, and therefore children) can get in and out more safely (the open door blocks access towards the road). However, emission of exhaust fumes when starting is done on the pedestrian side. Exiting is much safer than the previous method: better visibility, less manoeuvring. In addition, as it disturbs traffic less, it is particularly recommended when vehicles exit during the rush hour.

  In the case of a two-way road, this arrangement could encourage certain motorists driving in the opposite direction to park directly in forward mode. This is against the Code de la Route.



Parking space dimensions are as follows:

Angled parking

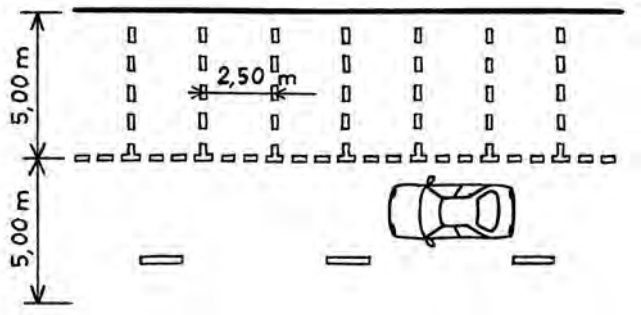


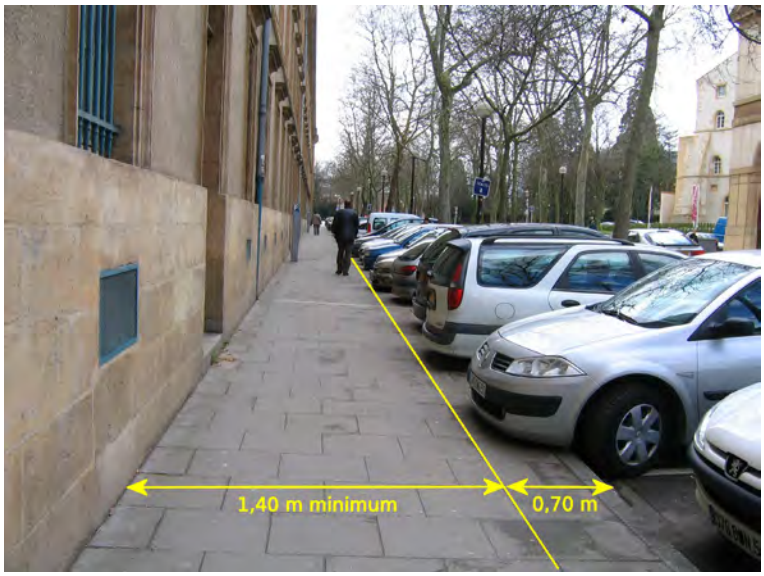
b = space for exiting manoeuvring

For an angle of 45°: b = 3 m

For an angle of 60°: b = 4 m

Perpendicular parking





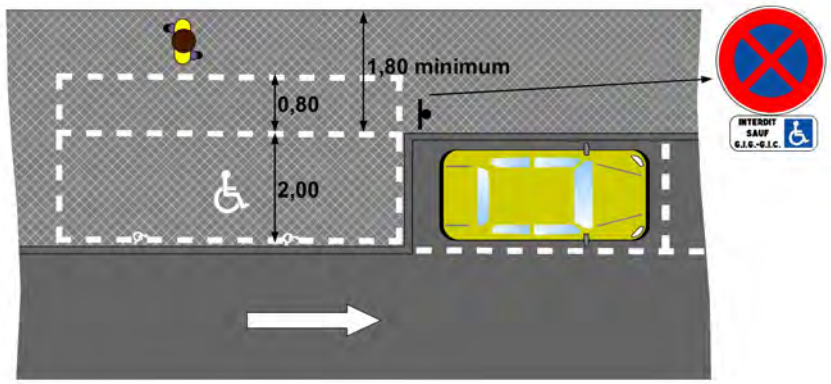
Layout of broad footways along perpendicular or angled parking to take into account the vehicle overlap which can reach 70 cm (photo: Cete de l'Est).

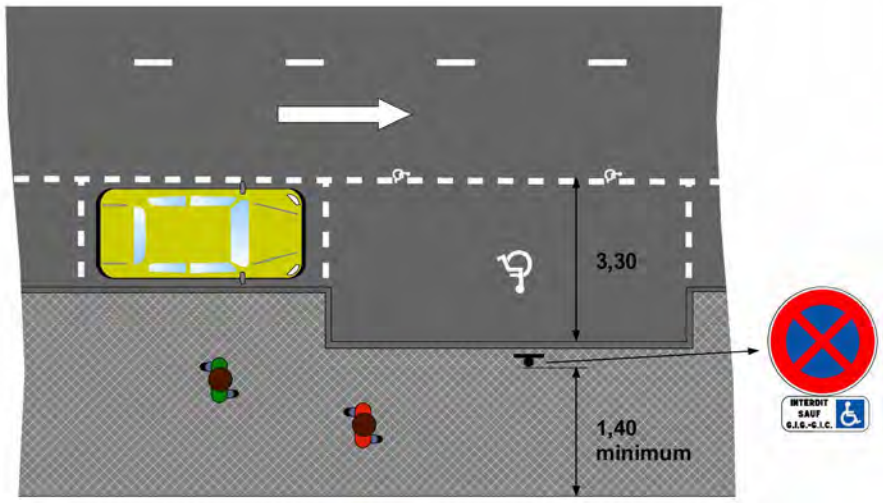
3.5.2 Parking for the disabled

For each parking zone, it is recommended to set aside 2% of spaces accessible and adapted to persons in a wheelchair (decree n° 2006-1658 dated 21st December 2006). In principle, the spaces should also be equally distributed on the road.

The decree dated 15th January 2007 specifies that a "dedicated parking space cannot be less than 3.30 wide" and should have a "transversal slope of less than 2%". In addition, the accessible parking space should be linked to the footway by an accessible path without using the road, which should be at least equal to 0.80 m. If this path comprises changes of direction, it is necessary to include minimal enlargements to allow movement of the wheelchair. If the path is not level with the footway, it should have a lowered access at least 0.80 m wide.

In the case of an access control system, it is recommended to set up minimum headroom of 2.15 m to facilitate access of vehicles adapted to persons using a wheelchair.





The insertion of a parking space for the disabled imposes a footway+parking width of at least 4.70 m if it is on the right and 3.80 m if it is on the left (diagrams: Cete de l'Est).

3.5.3 Bicycle parking

There are several possibilities for bicycle parking in public spaces:

On-road parking: it does not reduce pedestrian areas and allows several units in the same street, depending on demand. It consists of installing stands on the road at regular intervals which replace a car parking space (6 to 12 bicycles per space). Replacing the last car parking space before a pedestrian area by a bicycle parking zone offers the advantage of improving the visibility of pedestrians as they approach to cross and makes them more easily identifiable to motorists driving on the road.

Parking on the advanced section of footway: the same principle applies as on-road parking with the creation of an advanced footway on which bicycle parking facilities are installed. The advantages are the same. The advanced pavement is delimited by curbs, so the installation of a wheel stop is not particularly necessary.

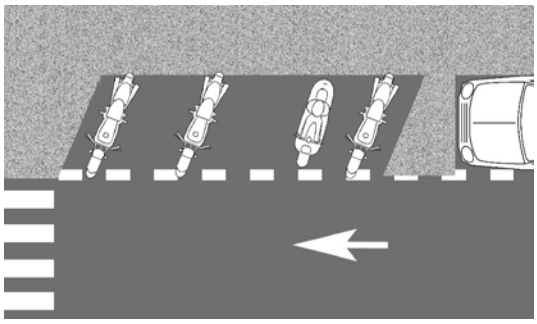
Parking on a wide footway: when the width of the footway allows it, bicycle parking facilities may be installed, including in small disseminated units (for 4 to 6 cycles). Of course, the space dedicated to pedestrians should allow their safe and comfortable circulation. To avoid circulation of cyclists on the footway, it is necessary to design a direct access between the parking zone and the area dedicated to cyclists. Combining or grouping together with other features such as bus shelters or phone booths is recommended to avoid multiplying urban furniture on the footway.

3.5.4 Motorcycle parking

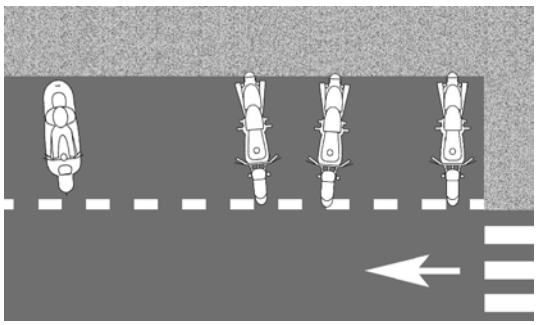
Despite the very varied features of motorised two-wheel vehicles, their dimensions are quite similar: width of around 0.70 m and length varying from 1.80 m for a moped to 2.30 m for a motorcycle. 2.30 m long by 1.20 m wide are therefore the most appropriate dimensions needed for parking spaces.

On the road, three types of parking are possible:

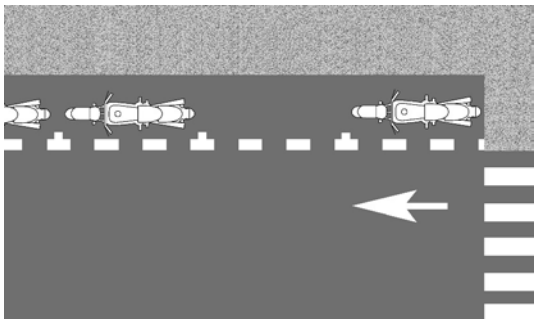
angled



perpendicular



longitudinal



Diagrams: Cete Normandie-Centre

It is noticeable that angled parking allows integration in longitudinal parking designed for cars as it represents the same depth. Depending on the angle, the number of spaces will be 5 or 6 motorcycles for 2 car spaces. In both cases the angle will be designed for reverse entry of the motorcycle.

Angled parking in a one-way street. The driver has good visibility to enter traffic. The bollard protects motorcyclists from parking cars (photo: ville de Paris).

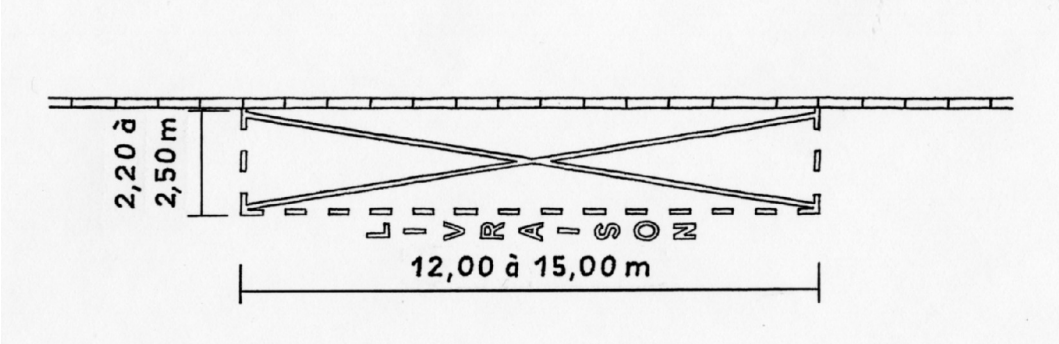
When the footways are wide enough (around 7 m), it is possible to transform part of the pedestrian area into a parking zone for two-wheeled motorised vehicles which enter via the lowered footway of a neighbouring access so that motorcycles can directly access the parking zone.

For more precise design of parking of two-wheeled motorised vehicles, readers should refer to the Certu guide, *Le stationnement des cyclomoteurs et des motocyclettes en agglomération*, 2007.

3.5.5 Delivery areas

The delivery area should be able to receive a 2.60 m wide LGV (refrigerated truck). Materialisation on the ground may however be smaller than this. A dimension between 2.20 m and 2.50 m wide by 12 to 15 m long (at least 8 m depending on the type of vehicle) is recommended. A handling area should be set out at the rear of the vehicle.

As its dimension is larger than longitudinal parking, it is necessary to check that the widths of carriageways and footways next to delivery areas allow the presence of other users: pedestrians (including persons with reduced mobility, motorists, cyclists.



Marking of delivery areas.

There are 3 types of delivery areas:

On-road, the delivery area is integrated into longitudinal parking. It usually overlaps by 0.50m onto the road side. It is therefore necessary to ensure that vehicles driving on the road can pass, at least at reduced speed.

Semi-insertion on footway, it is only possible if the carriageway and footway are wide enough to let pedestrians and vehicles pass. It offers 1.30 m width which implies that the vehicle overlaps onto the road by 1.30 m.

Full insertion on footway, the delivery area will include a vehicle parking zone at the rear and a bevel to exit the vehicle.

3.5.6 Cash escort companies

Legislation requires banks to offer secured delivery areas. The Act dated 10th July 2000 allows mayors to reserve parking spaces on the public road for cash escort vehicles. In application of this Act, decree 2000-1234 dated 18th December 2000 stipulates, in article 5, that a parking space should be dedicated for cash escort companies to access premises. The principle of their location consists in shortening the journeys of cash escorts. The decree gives no dimensions to be applied. The law states that this type of development should be paid by the beneficiary organisation targeted by the decree.

3.6 Planted areas

In towns, planted areas are a major element of the urban landscape. For their aesthetic appeal, their silhouette and their colour, plants contrast with geometrical urban forms and the hardness of mineral materials. Plants offer infinite possibilities to enhance non-built areas, accompany roads, create reference points, enhance perspectives, etc.

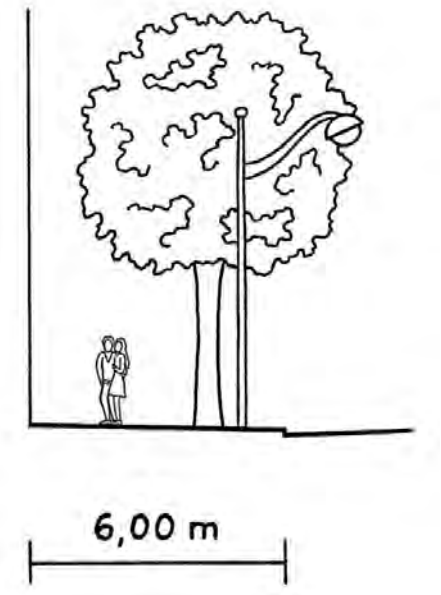
Many areas can receive them: central reservation, footway, pedestrian street, etc. Their presence in the road network has a major impact on the composition of the cross-section in terms of proportions, volumes to be dedicated, impact on networks, etc. In small total land requirements, plants will be limited or absent but the wider the total land requirement, the more share green spaces can take up. The choice of trees is conditioned by available air and soil space allowing planting.

3.6.1 Inserting plants in the cross-section

The plant is a living "material" which is characterised by its own dynamics, i.e. strength of birth, growth, survival and adaptation to the environment. This notion of "life" should be the dominant concern in all developments.

In the urban environment, plants are placed in difficult conditions. All precautions should be taken to define their installation and facilitate implementation and subsequent maintenance.

The choice of trees should also take into account the dimensions reached in adulthood.



Placing a tree on the footway implies a width of at least 6 m.

These plane trees are too cramped in this street.

3.6.1.1 Choice of species

There are a large number of plant species. They are characterised by their size, shape, stem, foliage, flowers. To develop plants, and trees in particular, need favourable growing conditions: space, sunlight, soil, etc.

When constructing the cross-section, species will be mainly chosen according to natural shapes of the air or underground parts. Maintenance conditions, type of foliage (deciduous or evergreen) and natural conditions – climate, exposure, soil, presence of water – are other factors to be taken into account to choose the trees.

Upper part of trees

The height of trees is between 5 and 30 m depending on the species. It is smaller in towns than in the natural environment.

The shape of their upper also influences the volume taken up by plants. The trees can be spread, oval-shaped, cone-shaped, slender, fastigiated, weeping, etc. Advantage should be taken not only in aesthetic terms but also in order not to have to correct undesirable effects that the choice of a more adapted species could have avoided. Fastigiated trees for example are well adapted to urban sites as the branches avoid building frontages and do not overhang the carriageway.

It is difficult to plant high developing trees in a space less than 16 m. They should in this case only be planted on one side or fastigiated and medium-sized trees used.

Fastigiated tree: a tree with branches that tend to grow upwards rather than spread. This feature can be more or less important depending on the species (photo: Certu).

Underground part of trees

Underground, the development of the root system is proportional to the air volume. There are species with a powerful and pivoting root system such as oaks or superficial and lined out systems such as Robinia and poplars. Some can damage networks and foundations of nearby buildings, others the coverings of urban footways. These factors should be borne in mind when planting.

3.6.1.2 Planting conditions in the cross-section

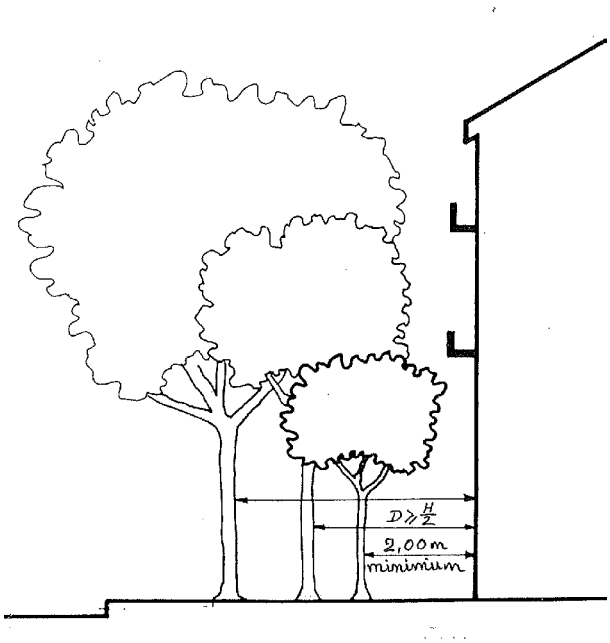
Besides the composition principles set out above, the designer should follow a few planting principles mainly linked to the space taken up and development.

- Distance from buildings

Distance from buildings mainly affects trees. It is necessary to give them sufficient volume for their development without them excessively disturbing residents by blocking the light.

This distance therefore depends on the species planted. The 2002 Certu *Les plantations d'arbres en ville* guide recommends planting them at a distance at least equal to half of the full adult height of the tree. Depending on the choice of species and pruning, this distance can be modulated. Article 671 of the Code Civil however fixes a minimum distance of 2 m from the limits of a neighbouring property for trees measuring over 2 m tall and 50 cm for shrubs.

Species that develop considerably, like plane trees, need at least a 10 m radius around the trunk. Very regular pruning allows to contain them to a lesser radius. But as of 5 m, the choice of small developing trees is strongly recommended. In narrow streets, it is best to plant fastigiated, small developing trees.



- Distance from the road

As with urban furniture, plants, and trees in particular, need to be set at a distance from the carriageway.

The installation of plants should allow vehicles to circulate without collision, with a gauge of 4.30m above the side of the carriageway.

Landscaped developments should be designed while respecting safety conditions for pedestrians and motorists. Trees that create obstacles for motorised users should be distanced or isolated from traffic. In towns, there are no distancing rules and it is not recommended to isolate them by safety features. Rather than set rules, it is recommended to integrate plants in a general development concept contributing to road safety.

It is also important to guarantee mutual visibility between users, especially at intersections and neighbourhood exits, by limiting the height of shrubs to 60 cm and excluding planting of trees in visibility cones; a tree alignment can create a "wall" effect in perspective.

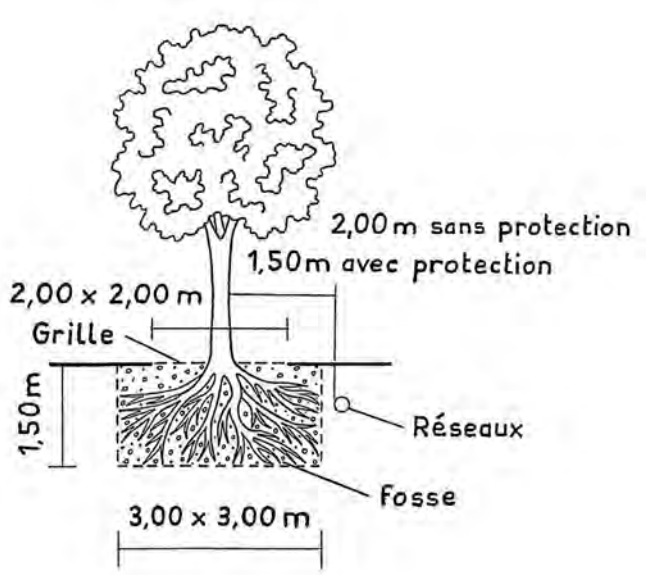
- Distance from parked vehicles

In the presence of parking perpendicular to the carriageway, trees should be planted in a line at more than 1.10m from the side of the carriageway.

- Underground space needed for plant growth

When planting, plants should have enough soil volume in which to take the elements needed for their growth. This volume should reach at least 10 m^3 for a large developing tree. For example, the following figures can be used:

- 0.50 x 0.50 x 0.50 m for shrubs,
- 1 x 1 x 1 m stem shrubs and conifers,
- 3 x 3 x 1.50 m for large developing trees.



Furthermore, the final development should leave enough space around the plants to let them develop and avoid cramping of the root system. This space should be designed to reduce aggressive factors such as compacting of soil, pollution provided by streaming, vehicle collision. Hedges should be planted in rows at least 1m wide. The frame around trees should be sized according to the species and type of protection chosen: grid, paving, filtering coating. A 2x2m frame is needed when planting a large developing tree.

- Planting with respect to networks

Planting has a consequence on utility networks. Roots can grow and damage buried networks, in particular, water pipes. The development of the crown of the tree can, in time, become incompatible with suspended networks.

Constraints due to the presence of networks should not however prevent planting. It is possible to protect them by setting out an acceptable distance or by implementing protective systems.

The NF P 98-332 norm dated February 2005 on distancing rules between buried utility networks and neighbourhood rules between networks and plants defines the following distancing rules:

- Without protection, networks should be at least 2 metres from trees and 1 metre from shrubs in borders or hedges;
- With a protective system or deviation of roots, networks can be placed at 1.50 m from trees;
- The distance between suspended line posts and trees varies between 2 m and 6 m depending on the nature of the cable;
- The distance between suspended lines and the branches of a tree varies between 1 and 5 m, depending on the nature of the cable. Shrubs and coppices should be kept at a distance of 2m for low voltage and 3 m for high voltage.

The installation of lampposts should be done according to the development of trees at adulthood.

3.6.2 Using plants to clarify the image and spatial organisation of locations

3.6.2.1 Contribution to the image of locations

Plants should give identity and character to the different urban roads (depending on their hierarchy in the network). An avenue will have 2, 4 or even 6 rows of trees which give a majestic dimension and highlight perspectives. Plants are thus capable of creating a perspective background or reinforcing and enhancing a specific place (square, junction). In contrast, the volume they take up can reduce perspectives.

The vegetal mass should be adapted to the setting and different elements of the section. Landscaped developments of a neighbourhood street will be limited and proportioned to space and life of the district.

3.6.2.2 Contribution to the operation and organisation of spaces

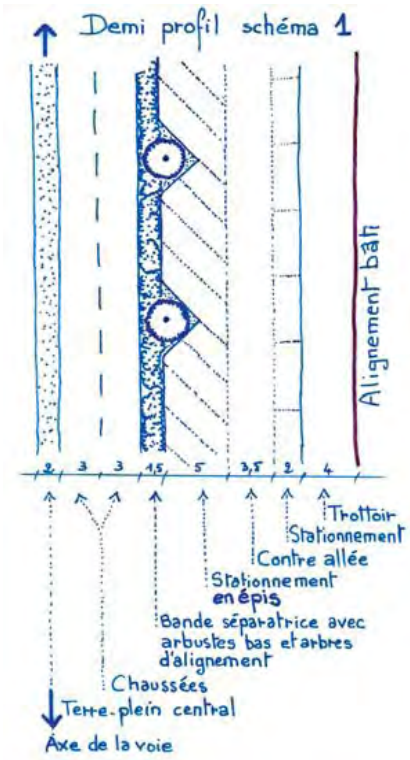
Landscaped developments improve functions linked to movements.

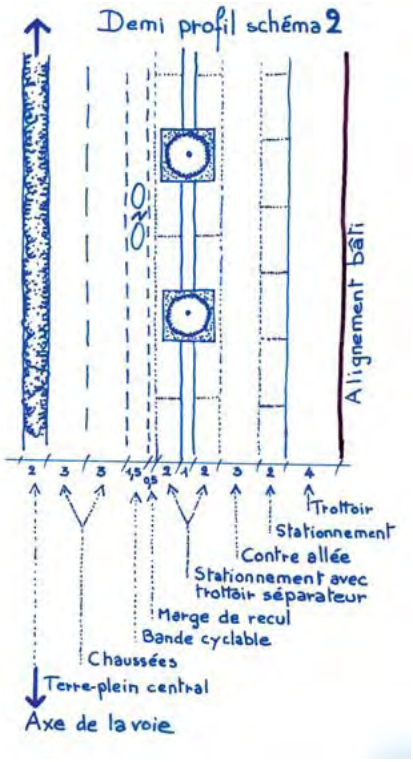
They can act as separators and contribute to the identity of locations. In very busy roads, landscaped developments isolate spaces dedicated to non-motorised traffic (pedestrians, cyclists). In streets where traffic is lighter, they are study to give a visual permeability of neighbourhood and physical activities for transversal exchanges.

They can also contribute to road safety by asserting the urban image of the place and its multifunctionality. The planting of borders of shrubs along roads is an effective way of reducing speed by creating a wall effect.

Two examples of spatial organisation for which plants are voluntarily used to contribute to their presentation

These two semi-sections cover an urban dual carriageway separated by a central reservation and lined by service roads. Plants here contribute to the image and organisation of the street.





The first is based on the determination to separate uses. Released from urban constraints and marked out by separators, the motorist may be encouraged to drive faster.

The second offers another, more calming way to share space with a transition between urban life and circulation. The planted border is moved to the central reservation, creating a separator forcing pedestrians to use the crossings set out for them.

A calmed avenue - Longueau

Context

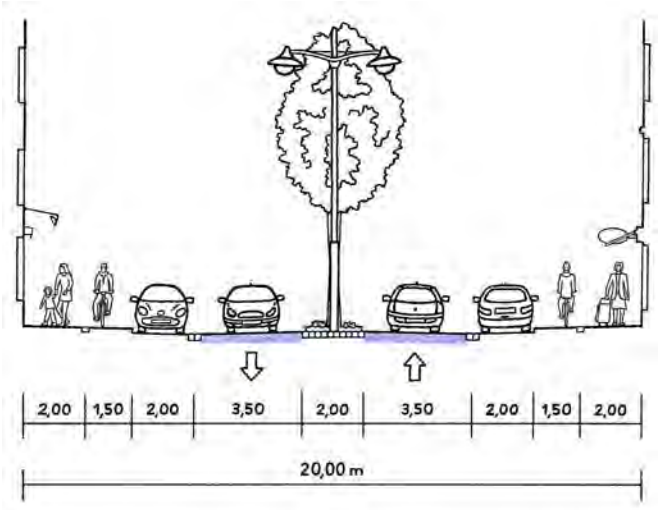
East of the district of Amiens, Longueau, with a population of 5,300, is a municipality that plays a transitional role between access to road infrastructure (motorways, ring road) and dense urban network. The town is bordered to the east by several shopping zones and to the south by a railway station of national importance which is constantly expanding. As a major axis through the municipality, the avenue Henri Barbusse had to receive heavy traffic of around 25,000 vehicles per day in both directions. In this urban environment, between 1991 and 1995, some thirty or so accidents were identified.

Reasserted urbanity

When developing the eastern ring road in Amiens, the town of Longueau grasped the opportunity of the declassification of the RD 934 to review redevelopment of this major, "penetrating" road.

The council wanted to maintain its identity and offer the population a high quality living environment. This urban renewal aims to dissuade transit traffic while offering reorganised and high quality urban development.

The project consisted in narrowing the drivable width (a 3.50m lane per direction) and central landscape development planted with trees integrating street lighting. On each side of the avenue, a cycle track was laid out on the footway level, inserted parking organised along the carriageway. In the lower section of the avenue, as available frontage space is reduced, cyclists have to share the footway with pedestrians. Bus stops on the carriageway are left to give priority to local life rather than circulation of motorised vehicles. The central landscaped reservation is only interrupted for left-hand turns. It should be noted that road signs send transit traffic to other itineraries.



The length of this peaceful avenue is now a 30 zone.

Re-appropriated space

The district council of Amiens was given the competence to develop this space when it was declassified. Amiens métropole spent €2.2 million on work from April 2002 to May 2003.

Photo: Cete Nord-Picardie

Adjustments were made very shortly after its commissioning for better organisation of parking or manoeuvring space when exiting garages. However, users and the council remain satisfied with what was achieved.

This space, fairly reallocated between all uses, is now a road that is less constrained by motorised users. Transit traffic has considerably decreased to leave room for non-motorised modes which had been neglected owing to heavy traffic. The drivable space remains integrated but has a restricted configuration.

Appropriation of the avenue Henri Barbusse is now effective for the whole population.

3.7 Separations between spaces in the section

Part one, on sharing road networks, introduces the notion of separation of uses, which implies looking at limits between each space. From simple marking on the road to restraint systems, including simple differentiation of materials or coatings, lines of paving, gutters, curbs, bumps and other emerging systems, central reservations or urban furniture, there are many possibilities of creating this separation as indicated in part 2.

3.7.1 Physical separators

Of these different tools, here we will only cover the most frequently encountered physical separators in the urban environment.

It is indeed considered that:

- restraint systems are mainly road safety tools. They are in fact covered by detailed recommendations, norms and rules (see circular n° 88-49 dated 9th May 1988 relating to the layout and conditions of use of vehicle restraint systems against accidental exiting from the carriageway);
- a simple difference of materials or coverings can offer a virtual separation rather than a genuine element constituting the cross-section. It involves no particular design problems as long as its choice has been judged possible (see paragraph 2.1.3);
- for the use of urban furniture, it is necessary to refer to 3.1.3 of this section.

Physical separators targeted here therefore are all emerging systems which, over and above delimiting spaces, are designed to offer varying degrees of protection.

This protective function is closely linked to the notion of **surmountability of the separator**, which can be adapted to the different categories of users (pedestrians, bicycles, mopeds, motorcycles, cars) and delimits more or less independent spaces: carriageways, cycle tracks, footways, "protected" public transport dedicated site.

As far as carriageways are concerned, in order to be consistent with the Code de la Route, it is considered that:

- for lanes of the same level:
  4. normally surmountable separators correspond to a delimitation of lanes on the same carriageway (bumps),
  5. exceptionally or totally insurmountable separators lead to considering several carriageways for the same road (central reservations and other narrow emerging systems);
- spaces of different levels, even if the difference is small (2 cm), are considered to be separated carriageways.

3.7.1.1 Bumps

They are solid emerging systems, in surfacing or concrete of low or average height with a rounded shape, with or without straight vertical walls. A width of 30 cm and height between 8 and 10 cm maximum are usual dimensions, which allow road vehicles to cross them at reduced speed but not two-wheeled vehicles whose drivers need to put their foot on the ground.

Placed between traffic lanes, they should not be obstacles that could surprise or lead to trajectory deviations, particularly for two-wheeled vehicles, which leads to reducing their height and requires particular attention paid to their visibility by all users and particular motorcyclists, cyclists and pedestrians.

3.7.1.2 Central reservations and other narrow emerging systems

In road vocabulary, the central reservation is defined as a strip of land separating carriageways. This type of separator can however be used to delimit other spaces such as footways, public transport lane, etc., which would mean broadening the definition.

It is recalled in fact that when its width allows use corresponding to a function other than that of separating, it should not be considered as a separator and be developed in consequence. For example, over and above 1.20 m wide, it can allow pedestrian access and be considered as such if not developed to dissuade pedestrians (see paragraph 3.1).

Although a central reservation can be covered in a mineral material or plants, delimited by curbs or not, it is not defined by a minimum width. That is why here we group into the same family all solid emerging systems other than bumps defined above. This ranges from emerging, simple or adjacent curbs, genuine central reservations and other elements with sharp edges, prefabricated or cast on-site.

The choice of its width and covering should be consistent to avoid any ambiguity:

- it is preferable to give more comfort to non-motorised modes rather than oversize separating systems;
- it is important for it to be perceptible by all users, both longitudinally and transversally.

3.7.1.3 Difference of levels between two spaces

Two spaces can be separated by a difference in height. This is the principle usually used by footways; parking spaces, cycle tracks, public transport sites are also treated as such. It is the shape and height of curbs that determine the degree of surmountability by users.

The heights most frequently used for straight curbs are:

- ≤ 2 cm: the difference in level is surmountable by all users, including people in wheelchairs but not well perceived by people with impaired sight;
- 4-5 cm: this height may be easily crossed by road vehicles, it is therefore used for off-road parking and access to carriage entrances. Detected by persons with impaired sight, it cannot be crossed by persons in a wheelchair and can cause problems for cyclists;
- 6 to 8 cm: as the difference in level is difficult to cross for vehicles, even at moderate speed, it is adapted for cycle tracks located at an intermediate level between the carriageway and the footway;
- 12 to 15 cm: the difference in level is not easy to cross for vehicles and corresponds to the conventional footway configuration;
- 15 cm and over: the difference in level is very difficult for vehicles to cross owing to their road clearance[17] (except for SUVs).

17 Road clearance: height of the lowest point of the vehicle located between the front end and rear end.

Bevelled curbs are the easiest to cross with larger heights, for example:

- for a height of 4 cm with a bevel of 1 for 3, a larger height is possible without compromising accessibility for disabled persons if the slope remains less than 5%;
- a bevel of 3 to 4 for A type curbs of 7 cm makes the space accessible to vehicles, this is too high however to be crossed by cyclists without having to put their foot on the ground.

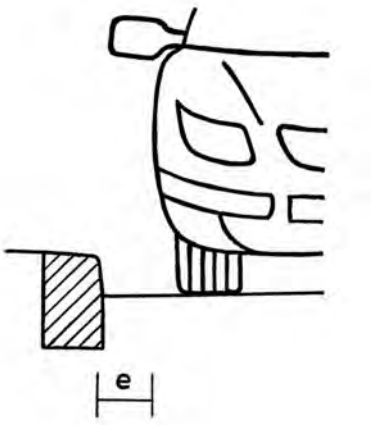
The above values correspond to type T, A or I normalised curbs which are the most adapted to main road sections (see norm NF P 98-340).

If the difference in level takes no room in the total land requirement, it is necessary however to ensure that the wall effect induced by the height of the curbs does not require having to widen spaces. It in fact has a strong impact on the level of the cross-section and the flow of rainwater.

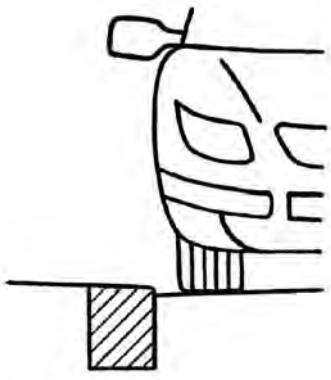
3.7.1.4 Impact on sizing

Physical separators have an impact on sizing of the cross-section which can be strong for the following reasons:

- by nature, they consume space in the section to be built, corresponding (at least) to their width;
- by their presence, they induce a wall effect for moving users which could require having to widen the spaces they border (see figure below);
- if they are insurmountable, they no longer offer flexible use, in particular for transversal uses, emergency interventions and various services (deliveries, collection of household refuse, etc.), which could lead to increasing the width of the spaces they border and even a review of the whole cross-section.



High curbs: broadening of spaces linked to the wall effect (see appendix 2).



Low curbs: no broadening of spaces.

3.7.2 Longitudinal marking of the carriageway

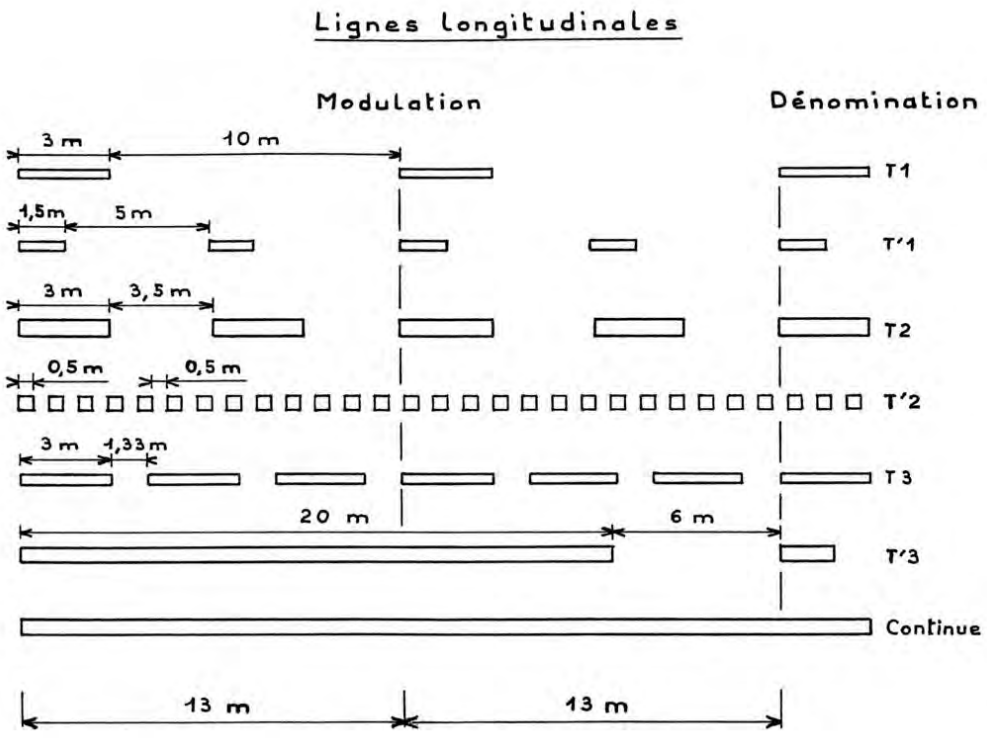
Even though covered by precise regulations, it is nevertheless of use to recall here a few essential notions concerning marking on the carriageway (for more details, readers are invited to refer to the Certu *Guide sur le marquage de la chaussée en agglomération*).

Remember that in the urban environment, marking in the main road section is not the basic rule, in particular owing to its road connotation. It is however justified when specific road operation rules are to be highlighted, for example the organisation of parking on a carriageway or the creation of dedicated lanes (cycle lane, bus lane). It should comply with the inter-ministerial instruction on road signs (book I, section 7).

With respect to cross-section issues, only longitudinal lines are covered here:

- road edge markings (not recommended in a conurbation),
- lines separating lanes of a carriageway,
- lines marking out parking spaces.

Lines are characterised by their modulation and their width. The latter is defined according to the type of road, the type of line and spaces to be separated. It should be homogenous over the same road section. The following diagram presents the types of line encountered in the urban environment:



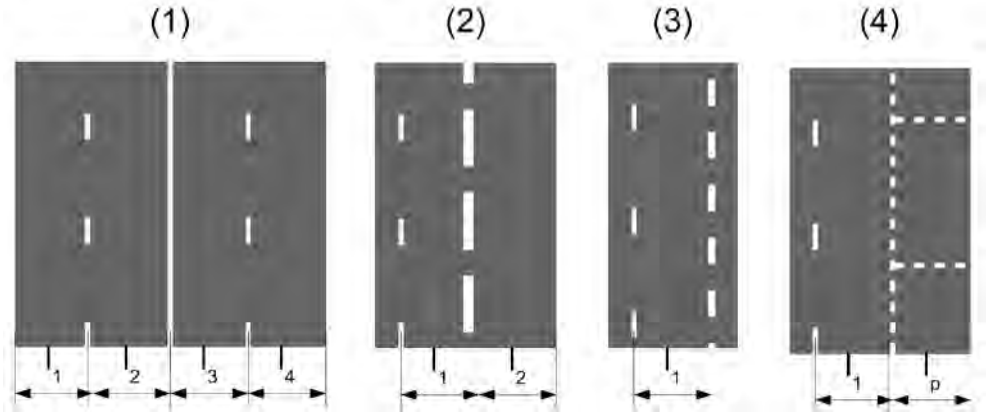
The width of lines is defined with respect to a unit width, “u”. It is:

- 5 cm for distribution or access roads,
- 6 cm for arterial roads (excluding urban expressways),
- 3 cm for cycle tracks.

The table below is a recap of the main values to be taken into account:

Marking name	Type of line	Width
Road edge marking		
Line marking the side of the road	T2	3u
Traffic lane separation line		
Solid line		
• separating lanes	solid	2u
• delimiting a central reservation	solid	3u, 2 x 3u or 5u
Broken line		
• separating traffic directions, traffic lanes	T1, T'1 or T3	2u*
• dissuasion lane to replace a solid line	T3	2u
• broken line in the case of punctual interruption of a solid line	T'2	2u, 3u or 5u
Separation line for dedicated lanes		
• buses: closed lane	solid	5u
• buses: open lane	T3	5u
• cyclists (cycle lane)	T3	5u
Separation of traffic directions of cycle tracks	T'1	2u
Other separation lines		
Parking separation (from other lanes)	T'2	2u

** This width is increased to 3u on the approach to traffic islands.*



Marking takes up no room in the cross-section. It is positioned as follows:

•(1) general traffic lane separation lines (solid or broken line) are placed in the separation axis (l_1);

•(2) lines separating specialised lanes (bus lane or cycle lane) are included in the adjacent general traffic lane;

•(3) road edge marking (exceptionally used in the urban environment) is counted outside the carriageway;

•(4) parking separation lines are included in the parking zone (l_p).

3.8 Run-off of rainwater

Even though not really constituent elements of the cross-section rainwater collection and evacuation systems must be taken into account in the development's design process.

3.8.1 Collection systems

Like suspended or buried networks, these elements are a constraint for the determination of the section, as their positioning needs to be compatible with the proposed solution while guaranteeing their correct operation and maintenance.

However, the type and dimensions of rainwater evacuation systems are directly linked to the width of the different parts of the total land requirement (carriageways, verges), and, to a lesser degree, the nature of their surfacing. They should be sized according to these factors and the section along the road, while taking into account their integration into a general rainwater treatment network to which they are connected by drains.

In practice, this leads to iterative reasoning, as a choice of the type and a sizing principle of the system are necessary to insert the section which will then be used to check functionality and compatibility. Besides the system itself in the main section, the positioning and type of drains should, if necessary, also receive particular attention in view of the traffic they need to support (case of grids, with respect to pedestrians, two-wheel vehicles or LGVs for example).

In contrast with buried networks, rainwater evacuation systems usually consume the total land requirement as they are located on the surface and are difficult to integrate into elements making up the section. Owing to this, they are usually inserted between two elements of the section (carriageway and footway most frequently) and can, in certain cases, act as separators.

This could have a positive impact in terms of consumption of the total land requirement when the system can effectively replace a specific separator. Positioning of a flat drain (CC type) in the access of a two-lane carriageway to replace marking is an appropriate example in low-traffic roads.

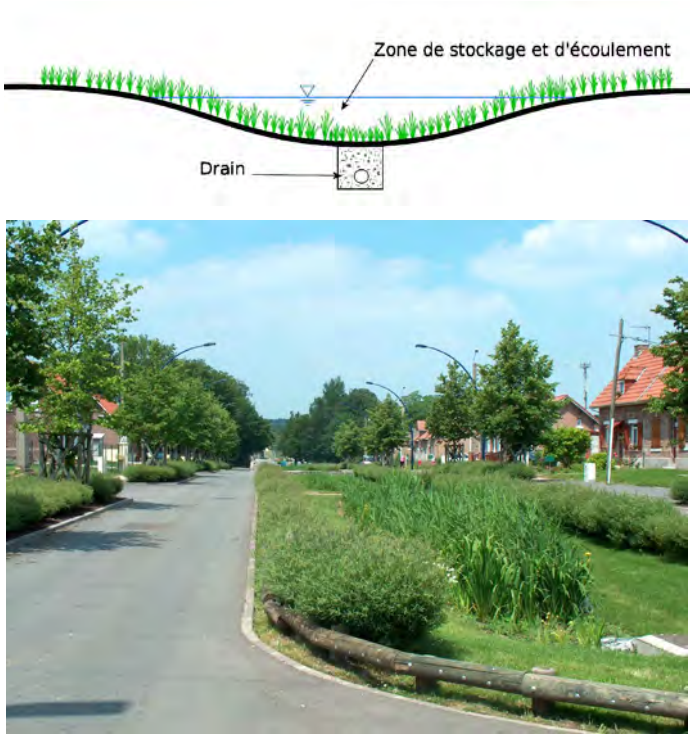
Photo: Cete de l'Est

However, the problem of rain water evacuation can, in certain cases, be made more complex by the presence of certain types of solid separators and it is thus important to take it into consideration when choosing the type of separator.

3.8.2 Alternative solutions

It is possible, when designing certain road networks, to include alternative rainwater collection, storage and treatment methods. These techniques replace conventional collector techniques. They play an essential role in rainwater management. Some have no impact in the design of the cross-section (reservoir carriageway, wells, etc.) others consume space like landscape valleys and trenches.

Valleys are wide and shallow trenches with gently sloping sides. They are used to stock, flow off and sometimes evacuate all or part of rainwater by infiltration or evaporation. Valleys are triangular, trapezoid or free shaped. In the case of a strong longitudinal slope, partitions are included. For gentle slopes (< 2 or 3°‰) a concrete curved channel will be placed at the bottom to evacuate water which should not stagnate.



Landscaped valley in an estate to store and treat rainwater. (Photo: Cete Nord-Picardie)

Trenches are narrow and deep excavations used to retain rainwater. They can be placed along roads, under footways or on parking limits. On the surface, they can be covered with draining materials (surfacing, pebbles).

These systems tend to be found in housing estates, industrial zones or in certain periurban road networks where the total land requirement allows landscaped integration and treatment of rainwater. These systems should be studied in detail as they are not always compatible with certain constraints of the urban environment like the existence of networks and the presence of pollution risks.

They should be sized in compliance with technical instruction dated 22nd June relating to conurbation water treatment networks.

Draining trench between the carriageway and footway (photo: Cete du Sud-Ouest).

3.8.3 Transversal slopes

Good run-off of water induces implementation of a transversal slope oriented towards collection systems.

The footway transversal slope is between 0.5% and 2%. The upper limit is imposed by disabled persons' accessibility rules.

The carriageway section is usually roof-shaped for finish purposes with a 2% slope. Parisian carriageways had a section calculated on the basis of a parabola which cannot be mechanically implemented.

A pleasant-to-live new housing estate – Hénin-Beaumont

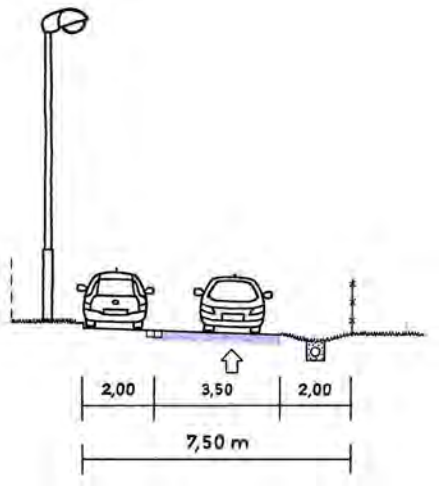
The urban context

Located south of Lille, Hénin-Beaumont, population: 26,000 (2002), is a town in the Nord - Pas-de-Calais mining area. To guarantee accessible housing to the largest number, the town planned the construction of housing estates. Following flooding and to meet the demands of the district community which wants to control its water treatment networks (rejection less than 10 l/s/ha) , the council built reduced road networks to optimise waterproofed surfaces.

Optimised road network due to a landscaped valley

Accessible via a U-shaped single lane road, this housing estate of around 30 semi-detached houses built in 2004, has an optimised road on both sides with cross-section made up of a traffic lane accompanied by level lateral parking. On the opposite side, the verge consists of a 2m wide landscaped valley in the lower part with respect to the road network. Its purpose is to receive all rainwater from the carriageway and even from house roofs.

The carriageway has a number of uses, yet a traffic lane and spaces dedicated for entry to houses and parking (mainly for visitors) are visible. All these spaces are on the same level so they are differentiated by varied materials: bitumen concrete for the traffic lane and parking, brushed hydraulic concrete for entrances, paved line marking the limit between parked and circulating cars. These differences in materials and the narrowness of the carriageway help to guide visually-impaired people. The road has been reduced but is wide enough to allow trucks through (household refuse, deliveries, removals).



A user-friendly public area

There is no clear limit between public and private land. All visual separations have been removed and roads and footways are on the same level for total cohabitation of uses.

Benefiting from well designed features both in terms of the neighbourhood space available and the urban landscape, this type of housing estate modifies the sharing of road space while significantly reducing waterproofed surfaces.

Residents and users are perfectly satisfied. The development produces a pleasant living environment which makes this operation a success. Thus is born a new generation of integrated housing estates.

Photo : Cete Nord-Picardie

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Glossary or terminology

Nowadays, the multidisciplinary approach taken in road planning projects sometimes induces difficulties in understanding the terms used. Words do not always have the same meaning. Moreover, when elaborating this guide, we were led to specify the concept covered by terms rarely encountered in literature and which have a definition that was not self-evident for all.

The definitions below aim to specify the meaning of words frequently used in cross-sections. They come from either regulations (Code de la route, circular n°64 issued by the French Public Works Ministry and dated 4th April 1957 on road nomenclature) or technical literature. When they are taken from regulations, definitions are put in quotation marks.

General

Conurbation (or urban area)

As stated in the Code de la route, this is a "space in which buildings are closely grouped together with its entrance and exit notified by signs placed for this purpose along the road that crosses it or lines it".

Legibility

The capability of a road and its environment to give every user, by all their constituent elements, a precise, easily and quickly understandable image of the road and its environment as well as probable or possible movements of other users and expected behaviour.

Non-motorised modes

Mainly pedestrians and cyclists.

Parking permit

Authorisation to occupy the public road space for a defined period. Characterised by the absence of right-of-way on the occupied area. The competent authority is the one holding all public order policing powers. It receives the opinion of the road operator.

Road occupation permit

Temporary permission to occupy the public road space characterised by an occupied right-of-way which includes modifications of its integrity. It is granted by the authority in charge of maintaining the public space.

Road

Land acquired for public purposes for all paths or streets open to public traffic; a road can comprise several carriageways and one or several reserved or dedicated lanes separated from each other, in particular by one or several central reservations or one or several differences of level that correspond to separators. A general regulatory term, including streets, a more appropriate term for the urban environment as well as avenues, boulevards, "cours", etc.

Street

The dictionary states that it is a "roadway lined with houses; a road within a conurbation". The word does not precisely designate a legal way category. In general,

vehicle speed is limited to 50 km per hour, in which case the term, **street at 50 km per hour** is used.

TCSP (transport collectif en site propre) literally *Public transport dedicated lane*
Public transport system using a maximum number of dedicated or reserved lanes on its itinerary.

Vehicle
The Code de la route considers vehicles to be all motorised or non-motorised mobile machines, requiring a driver, from bicycles to agricultural machines, including all heavy goods vehicles (LGVs) and public transport vehicles. It is necessary to distinguish road vehicles, also called automobile vehicles or, in shorthand, vehicles, from rail vehicles.

Visibility (distance from) / stopping distance
In road language, and through inaccurate use of language, the visibility distance (with respect to an obstacle located on the road) corresponds *at least* to the stopping distance, consisting of:

- the distance travelled at the reference speed during the driver's perception and reaction time as well as the vehicle's braking time;

- the distance travelled during braking, until the vehicle stops completely.

The perception and reaction time is usually considered to be equal to 2 seconds.

Types of way

Pedestrian area
According to the Code de la Route, this is a "street section or set of street sections in a conurbation, excluding heavy traffic roads, comprising an area exclusively allocated to pedestrians in a temporary or permanent way". It is a legal way category, which has to be signalled and covered by a decree.

Street without pavement (footway)
This is a street that has no pavement (footway). This possibility is set out by the Code de la Route that specifies: "in the absence of pavement or verge set out for pedestrians, the pedestrian may walk on the road". It is not a priority street for other users. The word does not designate a legal way category.

70 section
Section of a road in a conurbation with a speed limit "increased to 70 km per hour where there are few residents and pedestrians and where they are protected by appropriate systems" (cf. article 413-3 of the Code de la Route). This measure does not concern LGVs which should not exceed 50 km per hour.

Voie verte (non-motorised way) greenway
Road set aside for non-motorised vehicles, pedestrians and horse-riders only.

VRU (urban rapid road)
These are roads where the circulatory function dominates. The term "VRU" does not have a legal status. This notion is used in contrast with traditional urban roads supposed to be used at moderate speed (50 km/h). There are VRUs with motorway features (VRU A) and others (VRU U).

30 zone
The Code de la Route defines this as a "section or street sections corresponding to a zone allocated to the circulation of all users. In this zone, vehicle speed is limited to

30 km per hour. All the roads are two-way for cyclists, unless it is stipulated by the policing authority". This is a legal way category which should be signalled on entry and exit and be covered by a decree. It should be developed to be consistent with the 30 km/h speed limit and includes, in principle, a road and a pavement.

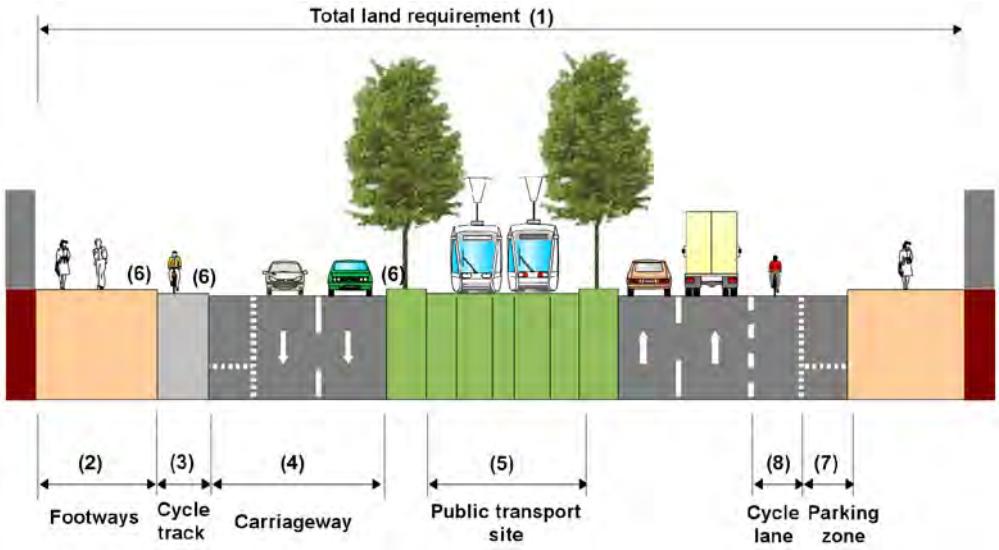
Pedestrian priority zone

The Code de la Route specifies "section or set of street sections in a conurbation corresponding to a zone allocated to the circulation of all users. In this zone, pedestrians are authorised to walk on the carriageway without parking there and have priority over vehicles. Vehicle speed is limited to 20 km per hour. All roads are two-way for cyclists, unless it is stipulated by the policing authority". This is a new legal way category in France. It should be planned in line with the 20 km per hour speed limit 20 and signalled at the entrance and exit.

Cross-section

Cross-section

The cross section is defined as a "section perpendicular to the road axis of all points defining its surface". With the longitudinal section and the horizontal alignment, it is one of the elements used to characterise the geometry of a road network.



Cycle lane (8)

As set out in the Code la Route, this is a "lane exclusively reserved for bicycles or tricycles on a road (4) with several lanes".

Carriageway (4)

As set out in the Code de la Route, "part(s) of the road normally used for vehicle traffic". A carriageway can include one or several traffic lanes; it may include extra widths for cycling lanes, reserved lanes or parking lanes (7),...

Total land requirement (1)

Land surface belonging to the public authority and allocated to the road and its appendages; the right-of-way corresponds precisely to land belonging to the owner of the road (see cross-section below).

Cycle track (3)

As set out in the Code de la Route, "carriageway exclusively reserved for bicycles or tricycles"

Platform (of the road)

Road surface which includes the carriageway(s), verges (in urban areas, footways) and central reservation(s), as well as dedicated lanes and tracks, if they are contiguous to or close to the main carriageway(s) and, in particular, are not on a different level to it (or them).

The platform is included in the construction limits, itself included in the right-of-way; in highly urbanised environments. These three notions are often confused; a cross-section in a countryside context is more explicit to explain these terms.

Separator (6)

A physical feature on the ground, aimed at delineating various parts of the platform allocated to various uses: general traffic, public transport, etc. It can be surmountable: a simple bump or slight level difference (accessible protected site), may be crossed by pedestrians but not motor vehicles: it can be a reservation of varying size, it may be planted or decorated with urban furniture (inaccessible protected site) or provide a total obstacle: barrier, fence (integral reserved site). Road marking is also a separator whereas a difference in colour or surfacing is not in itself a separator .

Public transport site (5)

Surface, place, space, set of traffic lanes on which public transport circulates. There are several types of Public Transport sites:

Mixed flow lane: accessible to all vehicles;

Shared lane: site only accessible to public transport vehicles and certain well identified categories of vehicles, emergency vehicles or bicycles for example;

Dedicated lane: site for exclusive use of public transport vehicles (unless special dispensation granted by the owner). The reserved site is interrupted, by regulations, when public transport loses its priority:

- when it crosses a junction,
- when it crosses pedestrian crossings, in the sole case of them being equipped with signal light.

NB: a shared or reserved lane can be protected or not by a separator (6), designed to be more or less easy to cross by users, motorists, cyclists and pedestrians.

Full dedicated lane: the integral reserved site is made physically inaccessible, including to pedestrians and cyclists. Other traffic lanes can only be crossed by an integral reserved site using a level crossing or grade separated crossing.

Central reservation (6)

Strip of land or physical feature on the ground, of a certain width, designed to separate several parts of the platform allocated to different uses: general traffic, public transport, etc.

Footways (1)

Verges specially developed for pedestrians. They are usually higher than the road surface.

(Traffic) lane

Subdivision (materialised or not) of the carriageway (4) with sufficient width to allow the circulation of one line of vehicles.

Parking zone (7)

Zone specially developed to allow parking of all types of vehicle. It can be longitudinal, perpendicular to the carriageway or angled, depending on the position of parked vehicles. It is called a car park when located outside the platform.

Miscellaneous

Channel

Ridge formed by the raised edge and the carriageway when there are no gutters.

Gauge

Space occupied by a user in height and width (pedestrian, cyclist, vehicle).

GLO (gauge without obstacle)

Used to describe a guided mode on rails or not: maximum clearance volume for a vehicle while considering the various possible dynamic overhangs. This volume should remain free of obstacles, either fixed obstacles (suspended line post, traffic signing, urban furniture, etc) or mobile ones (other vehicles, pedestrians, etc.) when public transport vehicles pass.

Traffic island

System on the ground designed to signal, over short distances, the trajectory of vehicles to allow the installation of traffic signing, and/or provide refuges for pedestrians. The island can be "hard" (raised with respect to the road surface) and may be surmountable or not (by vehicles) or simply painted.

Refuge

Zone specially developed between two traffic lanes to allow pedestrians to cross a road safely, in two or more phases.

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La sección transversal, herramienta de la repartición de las vías urbanas

La red vial urbana se caracteriza por la multiplicidad de sus funciones. Por ella se circula, se estaciona, se pasea, se accede a los comercios, actividades y viviendas. Ahora bien, el coche no ha cesado de ocupar cada vez más sitio en detrimento de los demás usos. Actualmente, la acción pública, como respuesta a una demanda social y a los desafíos medioambientales, intenta favorecer otros modos de desplazamiento como la bicicleta, la marcha o los transportes públicos, controlando mejor la utilización del automóvil.

¿Entonces cómo compartir la calle para todos estos usos? ¿Cómo pueden cohabitar los diferentes modos de desplazamiento, las necesidades de los habitantes y las de los transeúntes, de los vecinos...? ¿Qué espacio dar a cada uno? Para estas preguntas no hay una respuesta única, cada calle, según la importancia de sus funciones, es un caso particular.

Por ello, esta obra propone a los diseñadores una acción y herramientas para conseguir la repartición del espacio de la red vial en un espíritu «agrupador». El lector encontrará el conjunto de las recomendaciones que permiten elaborar una sección transversal y todos los elementos que la componen: aceras, calzadas, espacios reservados a los ciclistas o a los transportes públicos, separadores, vegetales.

Le profil en travers, outil du partage des voiries urbaines

La voirie urbaine se caractérise par la multiplicité de ses fonctions. On y circule, on y stationne, on s'y promène, on y accède aux commerces, activités et habitations. Or la voiture n'a cessé de prendre de plus en plus de place au détriment des autres usages. Aujourd'hui, l'action publique, en réponse à une demande sociale et aux enjeux environnementaux, cherche à favoriser d'autres modes de déplacement comme le vélo, la marche ou les transports en commun en maîtrisant mieux l'utilisation de l'automobile.

Comment alors partager la rue pour tous ces usages ? Comment peuvent cohabiter les différents modes de déplacement, les besoins des habitants et ceux des passants, des riverains... ? Quel espace donner à chacun? À ces questions, il n'y a pas de réponse unique, chaque rue, selon l'importance de ses fonctions, est un cas particulier.

C'est pourquoi cet ouvrage propose aux concepteurs une démarche et des outils pour réussir le partage de l'espace de la voirie dans un esprit « rassembleur ». Le lecteur y trouvera l'ensemble des recommandations qui permettent d'élaborer un profil en travers et tous les éléments qui le composent : trottoirs, chaussées, espaces réservés aux cyclistes ou aux transports collectifs, séparateurs, végétaux.

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The cross-section, a sharing toll for urban roads

Urban roads are characterised by the multiple functions they fulfil: they carry vehicular traffic, provide car parking, accommodate pedestrian traffic, and enable us to access shops, amenities and housing. And yet the car has progressively taken over more and more of the available road space, at the expense of other road users. Today, in response to social and environmental demands, public policy seeks to give priority to other forms of travel, such as cycling, walking and public transport, by controlling car use more effectively.
How should streets be organised in order to accommodate all these uses? How can different transport modes and the various needs of residents and other users be reconciled? How should the available space be shared out? Of course, there is no single answer to these questions: each individual street must be considered on its merits and according to the importance of its different functions.
With this in mind, this work provides road designers with techniques and tools to help them successfully ration urban road space while maintaining a "unifying" approach. In this guide, the reader will find all the recommendations necessary to create variable cross-sections and their constituent elements: footpaths, carriageways, dedicated spaces for cyclists and public transport, separators, and vegetation.

Résumé français en fin d'ouvrage
Ver la síntesis en español al fina del libro

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