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General information concerning at-grade junctions

The purpose of this information sheet is to present the essential links between the geometry of the various types of junction and their safety.

It also provides some basic principles for designing at-grade junctions without traffic lights. Traffic-light controlled junctions, which are covered in a specific sheet, are only referred to in the «General» section of this document.

General

DEFINITION

The junction is a meeting place where the users of the public space come together. It is a complex space, due to the diversity of the often contradictory, antagonistic and conflicting uses that must be catered for. It is an arrangement that varies over time and in space. It is also a reference point in the town and, sometimes, a means of architectural or emblematic expression of the place.

DESIGN ISSUES

For a long time, the only consideration was the performance of the junction in terms of its traffic

capacity. In fact, it is often a place where conflicts are poorly managed.

As a result, road safety and the comfort of use deteriorate.

In some cases, it is not unusual to find that **more than half of accidents**, in built-up areas, occur at junctions.

THE JUNCTION IN THE ROAD NETWORK

Establishing a hierarchical classification of roads is a good approach that must also incorporate junction design.

Users must find on their route the type of junction they expect to find. This expectation is directly related to the function of the road and its treatment.

The correspondence between the road category and the type of junction can be summarised as follows:

	VRU.A or VRU.U expressways	Arterial roads	Neighbourhood or local roads
VRU.A or VRU.U Urban expressways	⇒ Interchange ⇒ Roundabout	⇒ Interchange ⇒ Roundabout ⇒ Traffic lights	
Arterial roads ⇒ Arteries (boulevards, avenues) ⇒ Urban boulevards		⇒ Traffic lights ⇒ Roundabout ⇒ Grade-separation	⇒ Give-way ⇒ Stop ⇒ Roundabout ⇒ Traffic lights
Neighbourhood or local roads			⇒ Priority to the right** ⇒ Give-way ⇒ Stop ⇒ Roundabout ⇒ Traffic lights

* In urban areas, grade separated intersections, while possible, should remain the exception.

** Type of junction strongly recommended in 30 kph zones

INFORMATION NEEDED FOR JUNCTION DESIGN?

The design of a junction first requires an analysis of the basic data:

- the existing or anticipated types of user or vehicle: light vehicles, pedestrians (adults, Persons with Reduced Mobility, young people, etc.), bicycles, motorcycles, motorbikes, heavy vehicles, exceptional loads, public transport, etc. and the associated accident research;
- traffic flows by movements and periods;
- the approach speeds (V85, speed below which 85% of users travel).

These will be completed with observations of the environment and behaviour:

- local life;
- local daily routines, parking, shops, activities, etc.;
- road management, type and use of road reservation;
- the operation and configuration of the preceding and following junctions ...

THE ESSENTIAL JUNCTION DESIGN RULES

1. The junction must be legible upon approach and give a true image of itself to users.
2. It must be as compact as possible in order to limit points of conflict.
3. It must ensure the satisfactory mutual visibility of all users liable to come into conflict.
4. It must be simple and reduce driving tasks.
5. It must be legible from within and not cause hesitation in the choice of manoeuvre.
6. It must reduce the speed of all users.
7. It must take account of all users (use of pedestrian crossings, pavement built-outs, traffic islands, advanced cycle boxes, etc.).
8. It must above all, promote the essential criterion of safety, even more than fluidity.



Could things not be simpler?

JUNCTION FITTINGS

- Police road signs control prohibitions and levels of priority; they must systematically be accompanied by the corresponding road markings.
 - Direction signing must be provided wherever the user needs information to enter or leave the intersection.
 - The lighting must be adapted to the environment and not create an obstacle
 - The urban amenities and street furniture must not constitute obstacles too close to the traffic: poles, pylons, various supports (non breakable under impact), brickwork and street furniture, containers, etc. The word «obstacles» is also taken to include anything that blocks the path of pedestrians and cyclists.
 - The safety and continuity of pedestrian crossings must be ensured.
Crossings will preferably be no more than 8 m long (12 m at traffic-light controlled junctions) or will be treated, for example, as two or more crossings, with sufficiently large intermediate islands (min. 1.5 m recommended).
 - Pedestrian crossings must include a lowered section of pavement (footpath) in contact with the road and be provided with podotactile strips (dropped kerbs are covered by a standard).
- More generally, the planning rules for optimising the travelling conditions for disabled persons and persons with reduced mobility must be complied with.

CAR PARKING

Car parking can only be permitted if the conditions of mutual visibility are respected for all users.

Illegal parking must be stopped as it is generally a source of insecurity (visibility and manoeuvring).

Public transport stops will generally be situated after the junction.

The geometry of normal at-grade junctions

The layout must ensure the safety of the most vulnerable modes of transport, namely pedestrians and cyclists.

The design must enable authorised movements without encouraging excessive speeds.

The width of traffic lanes must be reduced to meet minimum requirements (a width of 3 m is sufficient for a standard lane, and can be even less according to the situation) and particularly where there is more than one lane in any given direction. Junction design will take the needs of cyclists into account. The connecting radii between the different roads contributes to the legibility of the hierarchy of the roads and to controlling speeds.

The roads must connect as orthogonally as possible.

For secondary roads losing priority (priority from the right, give-way and stop), the stacking of vehicles two-abreast should be avoided to prevent them obstructing one another's view of the conflict (excluding roundabouts).

In the presence of heavy traffic (heavy vehicles, buses and exceptional transports), roundabouts must ensure the integrity of traffic, in particular of pedestrians and cyclists, without necessarily resulting in excessively wide lanes, which encourage speeding.

Contra flow sections, that are sometimes permitted for buses and bicycles, create particular situations that must be properly considered.

The distance between junctions dictates the flow and speed of traffic; in town, the urban grid should give a distance between junctions of the order of 80 to 100 m for main junctions.

Access roads linking to major generators of traffic (car parks, shopping centres, industrial, commercial or service establishments, etc.) must be considered and treated as junctions.

The geometry of roundabouts

The above principles also apply to roundabouts. The specific characteristics and the effect of the «fashion» for roundabouts warrant the particular principles applying to this type of junction to be further developed.

Roundabouts have a good safety record, as they only generate tangential conflicts. The efficiency, safety and comfort of pedestrians and cyclists must be relativised for this type of junction, even if there is a real increase in safety (in particular when the

geometric configuration of the roundabout causes the speed of vehicles to be greatly reduced).

The perception on approach is mainly obtained from the treatment of the central island. The height of the central island and its treatment will create a background and a shape that the user will associate with the type of junction.

The entry must not be too tangential to avoid excess speeds.

The notion of obstacles on the central island must assume that approach speeds are actually limited to 50 kph.

The visibility of vehicles entering the left-hand quarter of the roundabout (measured at 10 m from the entry to the roundabout) must be ensured, but not to an extent that this will encourage anticipative behaviour. Similarly, visibility shall be ensured around the edge of the central island by maintaining a strip of approximately 2 m wide free of high obstacles.

An outside radius of the order of 15 m is sufficient for buses and heavy vehicles to turn around the roundabout (even 12 m for semi-transversible roundabouts).

A larger radius, not greater than 25 m, may be justified, e.g. for a roundabout with more than four legs.

In order to maintain its speed control function, a roundabout must allow the inscription of a trajectory deflection radius smaller or equal to 100 metres (the trajectory deflection is the circular arc radius passing 1.5 m from the kerb of the central island and 2 m from the right-hand kerbs of the entry road and opposite exit road) equal to or smaller than 100.

Care will also be taken not to oversize the facility (width of the roundabout carriageway, entry and exit lane widths, radii, etc.).

Vigilance is also required regarding the cross-falls that are used (longitudinal approach gradients, cross falls on the ring of the roundabout).

In view of the risks, the choice of 2 lanes at the roundabout entry will require justification. If the operation of the roundabout requires double-lane entries, the layout and the sizing of the roundabout must always reduce any negative effects (speed, traffic weaving, poor awareness of the presence of pedestrians and cyclists, etc.).

Traffic islands on the legs of the roundabout also provide a refuge for pedestrians crossing in two stages. A minimum width of 2 m is desirable.

MINI-ROUNDBOUTS

Their design must adapt to the environment in which they are located (see «Controlling speed through design»).

Associated subjects

- Traffic-light controlled junctions
- Safety and hierarchy of urban roads
- 30 kph zones.
- Heavy vehicles
- Priority systems
- Visibility
- Legibility and perception
- Persons of Reduced Mobility
- Cyclists
- Pedestrians at the heart of urban public space planning
- Controlling speed through design

Bibliographic references

- Guide carrefours urbains (Urban crossroads guide), Lyon Certu, January 1999.
- Sections 70 en agglomération guide de conception et de recommandations (70 kph zones in metropolitan areas, design guide and recommendations), Lyon Certu, June 1996.

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These sheets can be downloaded from the following websites:

- Certu (<http://www.certu.fr>)
- DSCR road safety «job portal» (<http://securite-routiere.metier.i2>)
- Sétra (Intranet: <http://catalogue.setra.i2> and Internet: <http://catalogue.setra.equipement.gouv.fr>).

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