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## **SAFETY AT LEVEL CROSSINGS**

### **Example of a level crossing located near a roundabout**

### **Presentation of the technical guide**

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### **Summary presentation of the roundabout and level-crossing guide**

Faced with a large number of road accidents at intersections, the French planning authorities have decided to opt for roundabouts at new intersections and to replace certain existing accident-prone intersections with roundabouts.

As the number of roundabouts grows, the planning authorities and road-management entities are, increasingly, confronted with the problem of tailbacks near level crossings. In view of the right-of-way for vehicles already in roundabouts, and given driver behaviour, these tailbacks can lead to blockages at level crossings. Conversely, roundabouts may become blocked when level crossings are closed.

The guide produced in 2006 by Sétra (*Service d'études techniques des routes et autoroutes* – Technical Department for Transport, Roads and Bridges Engineering and Road Safety) is designed to provide planning authorities and management entities with recommendations and technical solutions.

The proposed approach is based on risk analysis and evaluation so that planning authorities and management entities can find appropriate responses in a variety of situations. It is essential that there be consultation and cooperation with all of the partners concerned from the preliminary stages of the project.

Proposed solutions can be either preventive (enhancement of static signage, addition of dynamic signage or installation of traffic lights at the level crossing) or remedial (creation of a clearance area, direct right-turn lane or installation of traffic lights at one or two of the roundabout entries).

## **1. CONCERNS AND CONTEXT**

In France, a large number of road accidents occur at intersections.

Accidents at intersections in France account for 25% to 30% of all road accidents, for 15% of road-accident deaths and for 20% of serious road-accident injuries.

In this context, the creation of roundabouts at new intersections and the replacement of certain existing accident-prone intersections with roundabouts can often result in a reduction in the number and gravity of intersection accidents.

However, as growing numbers of roundabouts are built near level crossings, the planning authorities are, increasingly, confronted with the problem of tailbacks on one of the approach lanes. These tailbacks can lead to safety concerns, since the level crossings or the intersections may become blocked.

This issue, therefore, is rail-related as much as road-related.

Each year, there are some 170 collisions between trains and road users, resulting in around 50 deaths and causing severe injury to some 20 people.

While these deaths represent only around 1% of annual French road deaths, they account for a very high proportion of those killed on the rail network. In this context, the central road-safety authority has, in cooperation with the two rail players SNCF and RFF, set up a central body dedicated to drawing up and supervising an action plan designed to enhance safety at level crossings. Actions include the elimination of the most dangerous level crossings, the automation of certain others and the upgrading of signage.

The creation of this guide for planners and project owners is one of the actions decided on by this central body.

It goes without saying that, while the creation of a roundabout at a new or existing intersection is intended to result in greatly enhanced road safety, safety levels at the level crossing must also be maintained or improved.

## **2. CHALLENGE**

The main challenge attaching to the creation of a roundabout at a new or existing intersection near a level crossing is the danger of tailbacks blocking the railway line or the roundabout during rush hour or at any other time when traffic is heavy.

The main danger is that of the level crossing becoming blocked by a tailback from the roundabout due to the absence of right-of-way for vehicles entering the roundabout and to a tendency on the part of drivers to enter the level-crossing area even when there are stationary vehicles just ahead (fig. 2).

Conversely, a roundabout can become blocked when the level crossing is closed. The safety ramifications of this scenario are, however, less worrying (fig. 1).

It should, in any event, be noted that roundabouts force drivers to slow down as they approach nearby level crossings, thereby reducing the risk of collision with a train or with infrastructure components such as barriers.

In the light of these facts and of the various possible scenarios, it is important that the characteristics of the development choice be examined closely, notably as regards the following parameters:

- desirability of the roundabout option
- action relating to the distance between the level crossing and the roundabout (new or extensively-modified intersection)
- action relating to the project layout

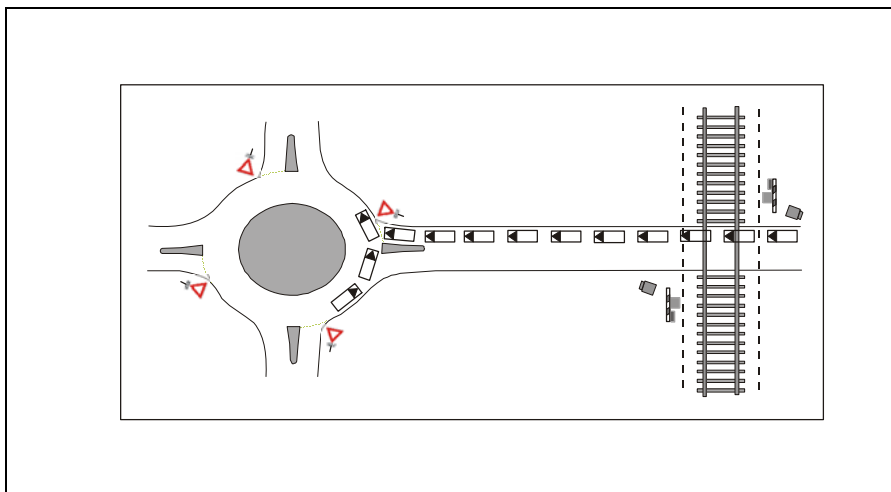
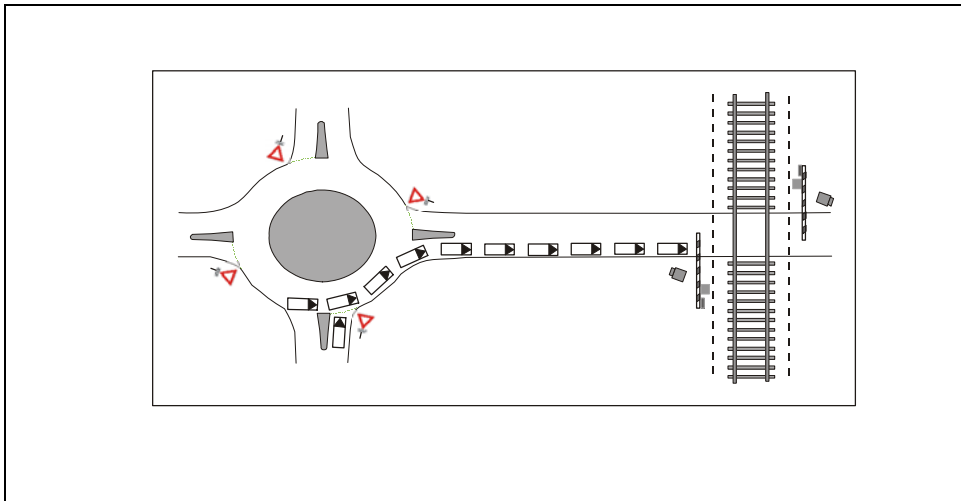


Fig. 2



**Fig. 1**

### 3. APPROACH

Since many different scenarios are possible, it is important that an analysis be initiated during the preliminary study phase in order to determine the desirability of the roundabout option and the possible attendant risks for the level crossing.

The approach proposed by the guide is based on the analysis and evaluation of the potential risk and the implementation of appropriate measures to address that level of risk.

In all events, it is important to organise consultation involving all of the partners from the preliminary phase in order to ensure that full account is taken of all of the objective technical parameters as well as of the interests of all of the parties concerned by the creation of a roundabout near a level crossing.

### 4. RISK ANALYSIS

Risks are of two types:

- tailbacks from the roundabout to the level crossing
- adverse affect of level crossing closure on roundabout operation

In safety terms, these two types of risk have different ramifications and require different solutions.



**Tailback from a roundabout to a level crossing**



**An intersection blocked while a level crossing is closed**

Based on the distance between the roundabout and the level crossing, the guide explains in which cases a risk evaluation should be performed.

The risk-evaluation procedure consists in calculating the maximum length of the tailback at the entry to the roundabout and comparing that length to the distance between the roundabout and the level crossing.

Over and above parameters relating to layout and accident figures (for existing sites), data collection must be accompanied by detailed analysis aimed at evaluating, on one hand, the probability of a tailback reaching the level crossing during the rush quarter-hour, and, on the other hand, the probability of level-crossing closure leading to the blockage of the roundabout and, thereby, to a tailback on an approach lane stretching as far as a poor-visibility zone.

## 5. PROPOSED SOLUTIONS

Solutions depend on the risk evaluation and, therefore, on the level of risk. Based on the risk level, preventive and/or remedial solutions should be implemented with a view to ensuring that the level crossing is kept clear. The technical feasibility in road and rail terms must also be evaluated (notably as regards the detection devices required for the operation of road-traffic control systems).

These solutions may be static, involving the use of signage or clearance lanes. They may also be dynamic, using variable signage (light signalling) controlled on the basis of tailback detection and train-arrival detection.

No given solution will be appropriate for all site layouts, roundabout sizes and traffic flows, or for all distances between a roundabout and a level crossing. Certain solutions may be usefully combined.

The technical guide entitled “*Sécurité aux passages à niveau*” (safety at level crossings) covers the various solutions for cases where a roundabout is located near the level crossing. The topics covered include:

- types of layout to be avoided,
- risk gradation for use in choosing solutions that are pertinent in terms of efficiency and, therefore, in terms of cost limitation,
- types of solution to implement: preventive measures (enhancement of static signage, addition of variable signage or installation of traffic lights at the level crossing) and remedial measures (use of clearance lanes or installation of traffic lights at one or more of the roundabout entries or on the roundabout proper, in order to keep the railway tracks free),
- scope and limits of use for the various solutions,

- appendices concerning the detection systems required and special cases (roundabout very close, mini-roundabout and level crossing located inside a roundabout)
- a table summarising the proposed solutions and their probable advantages and disadvantages.

## **6. CONCLUSION**

In addition to the technical parameters, a number of key safety points also need to be taken before into account when building a roundabout at a new or existing intersection near a level crossing:

- the safety of level crossings is of paramount importance, and any development work performed near level crossings must maintain or enhance that safety,
- consultation and cooperation starting at the preliminary stage will enable each partner's safety objectives to be reached; this point is all the more important when complex technical studies concern railway installations,
- the choice of safety measures is determined by the specific natures of individual situations, and is not automatic; consultation and cooperation are required, and evaluation should be conducted when the new infrastructure is opened to the public and in the medium term.

The technical guide may be obtained in English or French from the Sétra sales office at:

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