

The road improvement presented here is an adaptation of the existing technical recommendations. It has been undertaken in an experimental framework and has been submitted to evaluation.



Site before the roadworks



Site after the roadworks

2+1 roads An example in the Manche Department

Location and characteristics of the site

In November 2003, the CETE Normandie-Centre (Technical Research Centre for Normandy and the Centre region of France, reporting to the French ministry of Transport) undertook a safety assessment of the Departmental Road RD901, between Querqueville and Beaumont-la-Hague, in the Manche Department.

In the wake of this study, the Council of the Manche Department decided to improve two different 3-lane sections. The geometry of these two segments, where posted speed limit is 90 km/h, is characterised by a sloping section of bends (2 km) then a relatively flat straight section (4 km).

This road carries 10,000 vehicles per day, including 3% trucks. This is mostly a commuter traffic linked to the nearby nuclear power plant in La Hague.



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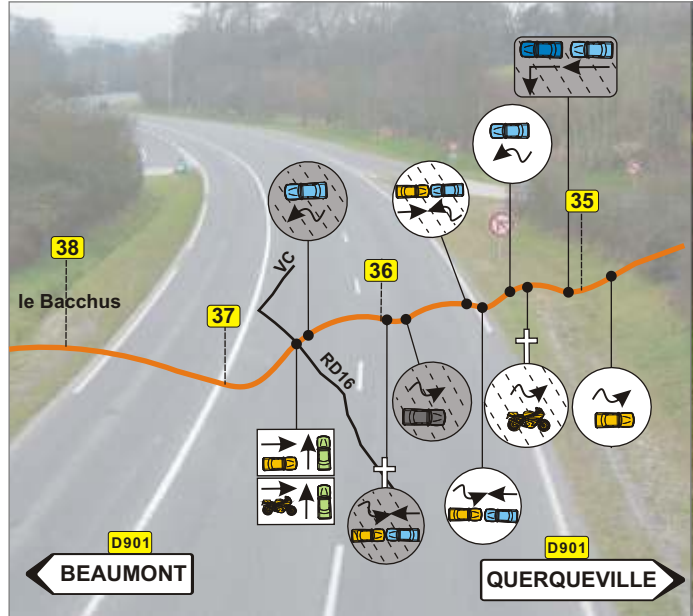
RACA Roads otherwise to induce calm driving
 Understanding the behaviour of drivers to design roads differently

▲ Accident rate before the redesign of the junction

18 injury accidents were reported between 1998 and 2006: 8 serious accidents (in which 5 were fatal)

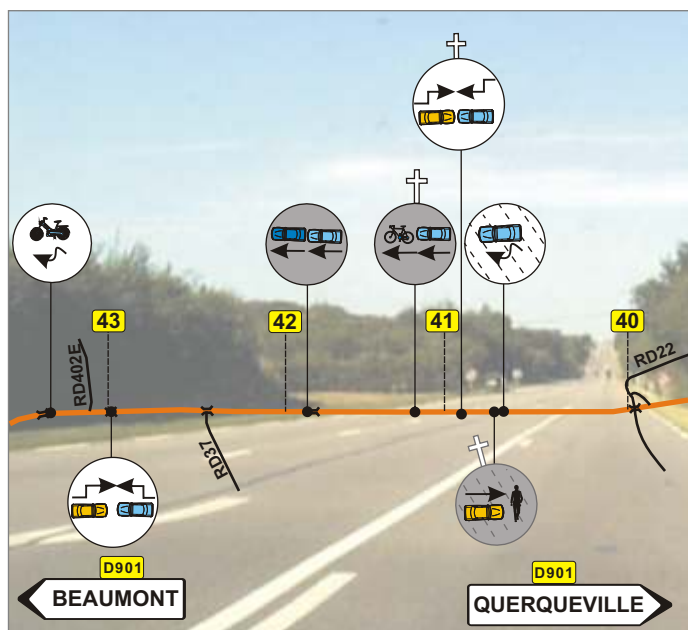
In the bendy zone, 11 injury accidents were recorded: 3 serious accidents (in which 2 were fatal).

- 8 losses of control (3 serious accidents; 2 were fatal) on five different bends, often on wet road surfaces:
 - 5 vehicles out of 8 crossed the opposite lane: 3 were involved in head-on collisions with oncoming vehicles (2 serious accidents; 1 fatal),
 - 3 vehicles left the road on the right-hand of the carriageway.
- 2 right-angle collisions at junctions.
- 1 rear-end collision at a private access.



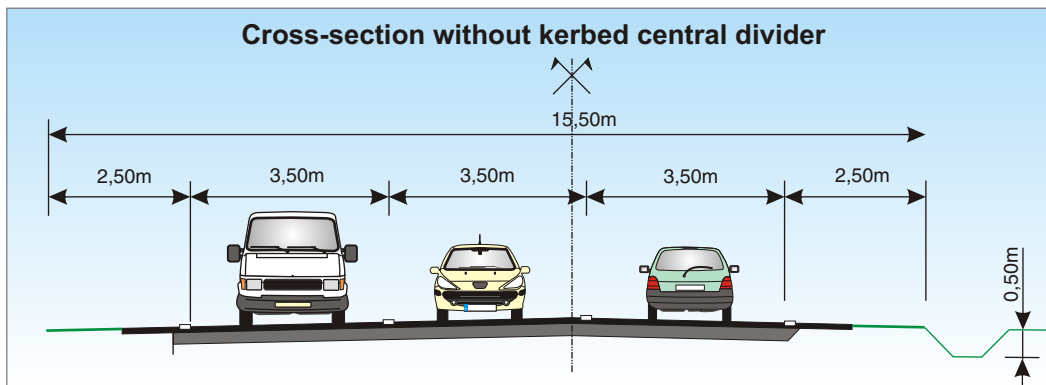
On the straight section 7 injury accidents were reported: 5 serious accidents (in which 3 were fatal).

- 2 head-on collisions caused by a driver overtaking on a three-lane single carriageway where overtaking is possible in both directions (of these 1 was a fatal accident).
- 2 vehicles left the road on the right-hand of the carriageway.
- 2 fatal collisions implying a pedal-cyclist or a pedestrian at night.
- 1 moped user fell on the roadway (1 serious accident).



▲ Problems posed by the site

Description of the RD901 before the works



Section with bends: 3 lanes on which overtaking is prohibited in one direction



Straight section: 3 lanes where all users can overtake in both directions

This 6 km-long section is prone to accidents

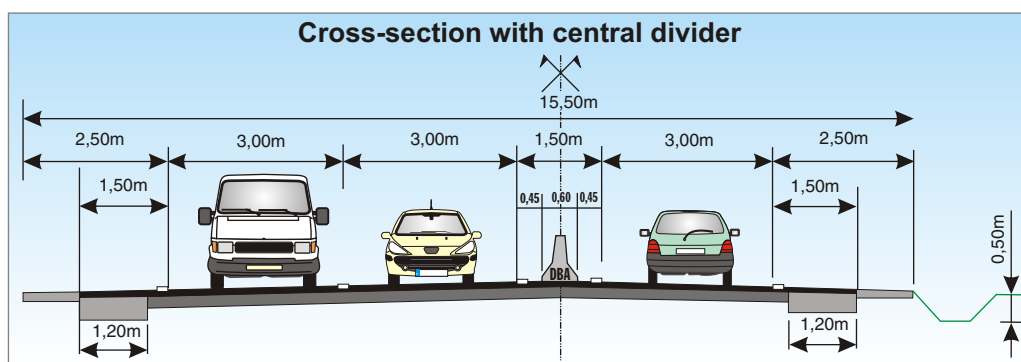
- An ambiguous and heterogeneous cross-section:
 - alternation of 3 lane, 2 lane and 2x2 lane sections, all coupled with a posted 90 km/h speed limit,
 - 3.5 m-wide lanes, whether overtaking is permitted or not.
- A poor night time perception of the bends, with different radii of curvature.
- A mix of at-grade and grade-separated intersections.
- Worn and grassy road verges.
- No particular facilities in favour of bikes.

▲ The 2+1 roads concept

The objectives

- To reduce the severity of accidents by avoiding head-on collisions.
- To facilitate avoidance or recovery manoeuvres.
- To enable vulnerable road users to travel off the carriageway.
- To remain within the existing right-of-way.

The principles of the new design



Section with bends after the works



Straight section after the works

Nature and cost of the works

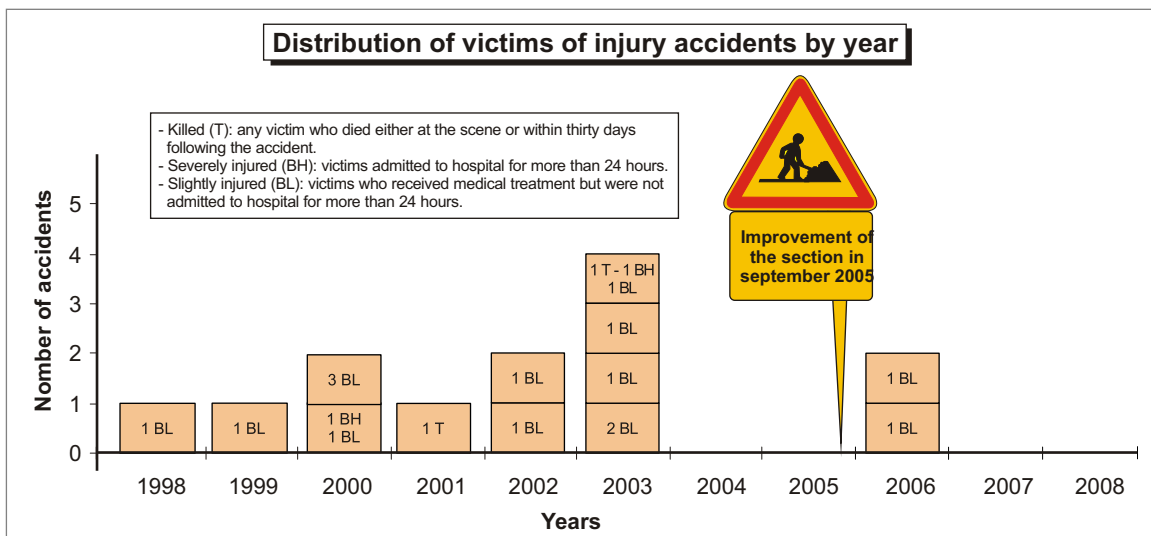
- Reduction of lane width from 3.5 to 3m.
- Physical separation of the traffic lanes with concrete barriers central divider.
- Provision of a 1.5m-wide multi-purpose hard shoulder on both sides.
- Resurfacing of the road on the whole section and high-grip surfacing in bends.
- Installation of audible road marking, visible at night and in rainy weather, in the middle of the road and on roadsides.
- Operation cost: 3.5 million euros.

▲ The after works situation

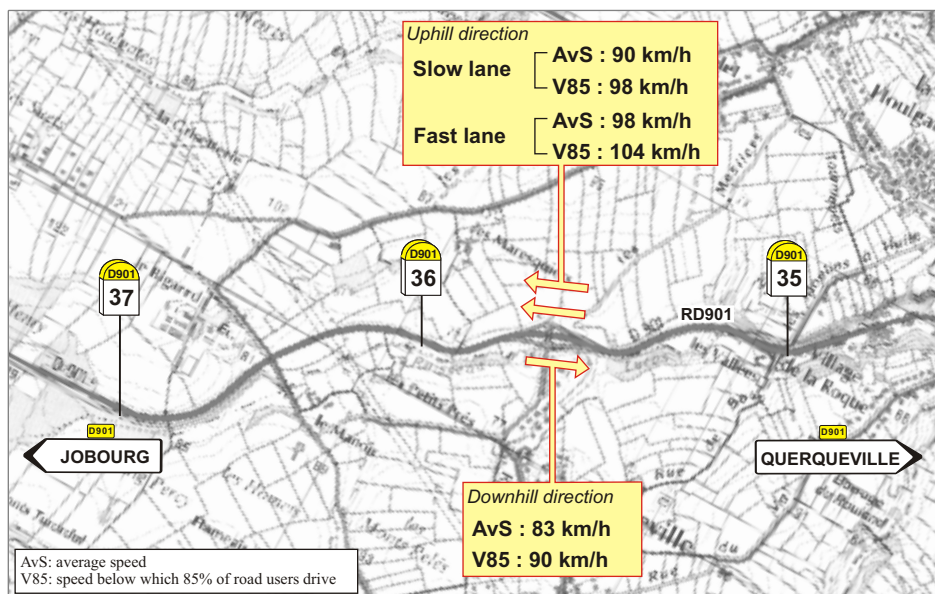
Section with bends

Traffic accident analysis

- In the three years following the opening of this section to traffic (September 2005), 2 accidents with minor injuries caused by loss of control of a single vehicle were reported. In one case the median divider blocked the vehicle's trajectory, preventing it from leaving the road.
- There were also 3 damage-only accidents caused by losses of control on a bend.
- There is evidence of impacts on the central divider: the concrete barrier in the central reserve has successfully stopped an errant vehicle.



Speed measurements

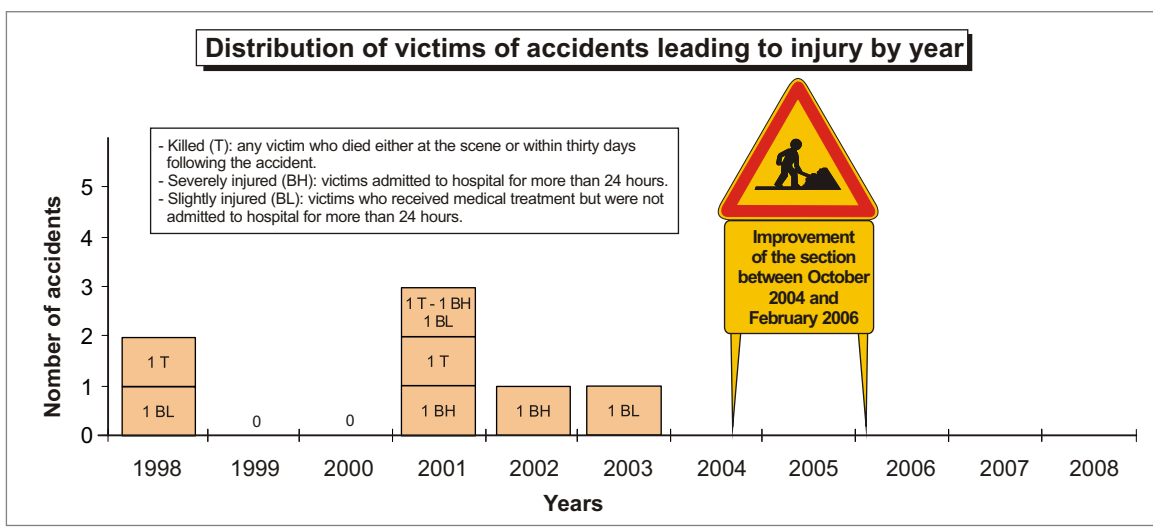


- Recorded speeds are higher (around 8 km/h) in the uphill direction (2 lanes) than in the downhill direction (1 lane).
- In the uphill direction speeds remain high with regards to the site (bends and slope).

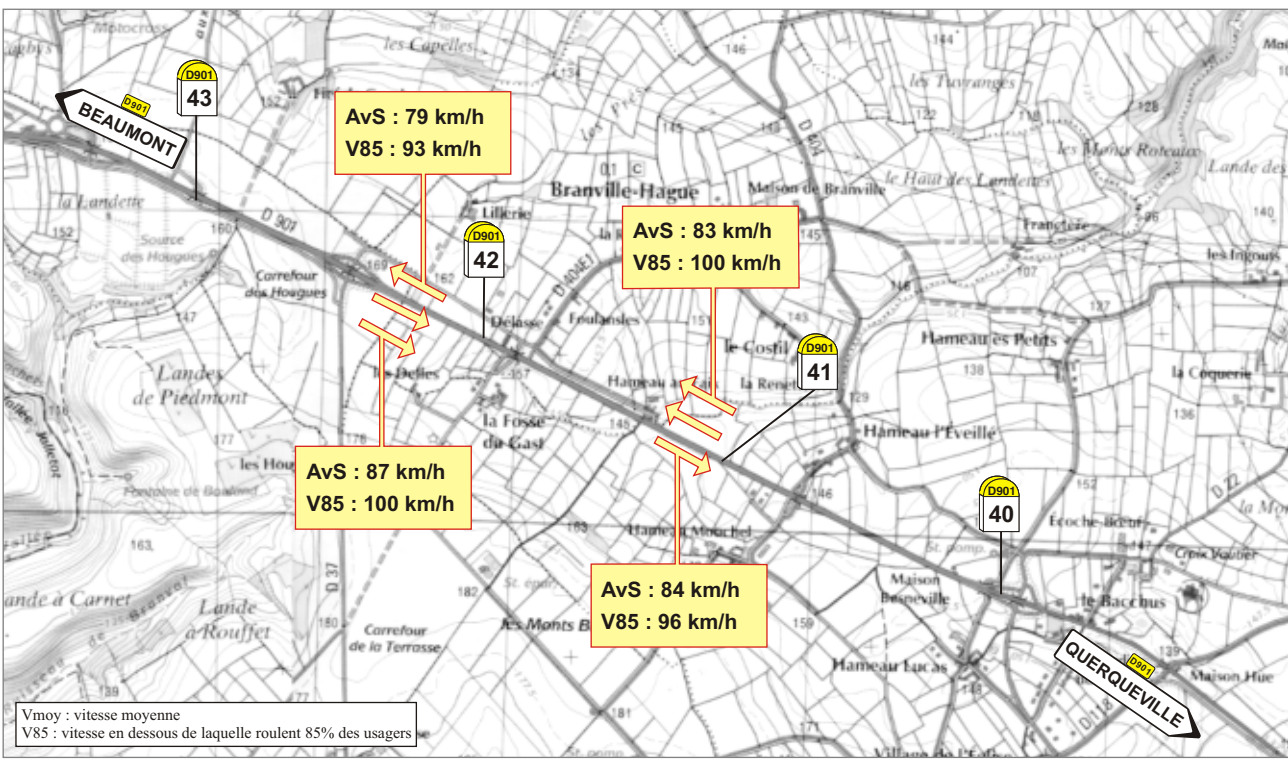
Straight section

Traffic accident analysis

- In the two-and-a-half years following the opening of this section to traffic (February 2006) no injury accidents were recorded.
- A damage-only accident occurred, however, at the barrier termination of the central divider. The driver said he was caught by surprise.
- There is evidence of impacts on the median divider indicating that the installation is effectively performing its role in the event of loss of control.



Speed measurements



- It is also noted that speeds on the 2-lane sections (V85 = 100 km/h) are higher than on the single lane sections (V85 = 95 km/h).

Observations

The 2+1 road is a new approach that is part of a transport policy called “Roads otherwise to induce calm driving”

- It represents an adaptation of existing technical recommendations.
- The divider in the central reserve separates the lanes.
- The driving lane width is reduced with further provision of hard shoulders.

Thanks to this road improvement, the Manche Department has met its targets

- To remain in the existing right-of-way.
- To reduce the severity of impacts by preventing head-on collisions.
- To facilitate recovery manoeuvres in the event of vehicles slightly leaving the roadway.
- To facilitate the circulation of vulnerable road users off the carriageway.

Two-and-a-half years after the opening to traffic, the results are satisfactory

- Reduction in the number and the severity of accidents.
- Satisfaction of road users, road managers, the police and the elected representatives.
- Feeling of inconvenience caused by the central barrier but also feeling of improved safety.
- Speeds remain high on the two-lane sections (but no possible comparison with the previous measures).

Specific issues to keep in mind in the future

- Regular clearance of the water gullies in the double concrete barrier central divider.
- Proper treatment to the terminations of the central divider and installation of appropriate signage.
- Establishment of a diversion route (for maintenance operations and emergency interventions).
- Reflexion on the potential presence of wild animals on the carriageway.



This report is part of a collection entitled "Roads otherwise" available on Sétra websites: intranet: <http://intra.setra.i2> et internet: <http://www.setra.developpement-durable.gouv.fr>

The aim of this series is to gather on-site experiences.
The author and the Administration's liability does not apply on this document.

Project group "Roads otherwise to induce calm driving"

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Réseau
Scientifique
et Technique du
MEEDDM

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