

HEAVY GOODS VEHICLE OVERTAKING BANS SOME INFORMATION TO ASSIST DECISION-MAKING

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Abstract

An HGV overtaking ban over distances of several kilometres is one of the road operation and traffic control measures that have been proposed in France to improve the coexistence of heavy and light vehicles on highly trafficked roads on the national network, in particular interurban 2x2 lane roads.

Based on experiments in France and other European countries, this paper gives a brief account of knowledge in this area in order to provide infrastructure managers who are considering introducing a measure of this type with information on which to base their decision. It summarizes the available information and performs some initial evaluation and analysis of effectiveness while warning against some undesirable effects of the measure.

Keywords: Heavy goods vehicles, Overtaking ban, Traffic, Road safety, Traffic flow, Freight transport, Social acceptance.

Résumé

L'interdiction aux poids lourds de dépasser mise en oeuvre sur des distances de plusieurs kilomètres fait partie des mesures d'exploitation et de régulation du trafic existant proposées en France pour améliorer la cohabitation des poids lourds et des véhicules légers sur les axes à fort trafic du réseau routier national, en particulier les 2x2 voies en zones interurbaines.

Se référant aux expériences françaises, et à celles des autres pays européens, ce document présente brièvement les connaissances sur ce sujet afin de fournir aux gestionnaires d'infrastructures qui envisageraient d'instaurer une telle mesure des éléments de support à la décision. Il fait la synthèse des informations disponibles et en extrait les premiers éléments d'appréciation et de pertinence tout en mettant en garde contre d'éventuels effets non souhaités de la mesure.

Mots-clés: Poids lourds, interdiction de dépasser, trafic, sécurité routière, débits, transport routier de marchandises, acceptabilité sociale.

1. The Different Types of HGV Overtaking Ban

An overtaking ban may take several forms depending on its context and objectives. In its static form, the ban may be either permanent or intermittent. **Permanent overtaking bans** were the first to be introduced and are the most frequent. These are shown by a fixed sign. The application of the overtaking ban can be restricted to vehicles whose weight exceeds the limit stated on the panel. Modulation of the ban according to the time of day transforms the ban into an **intermittent overtaking ban**. Last, users are informed about **dynamic overtaking bans** for Heavy Goods Vehicles (HGVs) by means of variable message signs (VMS). Such systems use devices, which collect and analyse data on traffic conditions and apply predetermined activation thresholds (for example, with regard to total traffic flow or the proportion of HGVs). The overtaking ban may be applied in real time or during forecast periods of heavy traffic.

2. French Experience

To our knowledge, trials in France that have been followed by an evaluation have been performed at four sites: the A4 motorway, the RN83 National road, the Poitiers/Bayonne route and the A16 motorway near Dunkirk. With the exception of the A16, these trials, their conditions of application and the main conclusions are described below and summarized in part 4 of this paper. These experiments all involve sections of 2x2 lane road.

2.1 On the A4 Between Brumath and Reichstett

A trial was conducted on a section of the A4 motorway. The trial started in July 1997. The evaluation of the trial was entrusted to the CETE de l'Est (De Gonneville, 2001). This experiment showed that the effects of the HGV overtaking ban on speeds and lane use are linked to the general traffic conditions, in particular the level of traffic and the proportion of HGVs in the traffic mix on the section. Figure 1 shows that the largest gains are observed in free-flow traffic. When traffic becomes denser and the proportion of HGVs increases, Figure 2 shows that compliance with the ban falls.

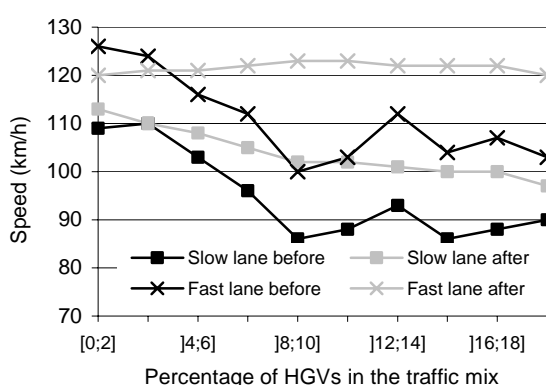


Figure 1 – Before and after comparison on the A4 of the average speed on each lane (1500 to 2000 v/h for the 2 lanes).

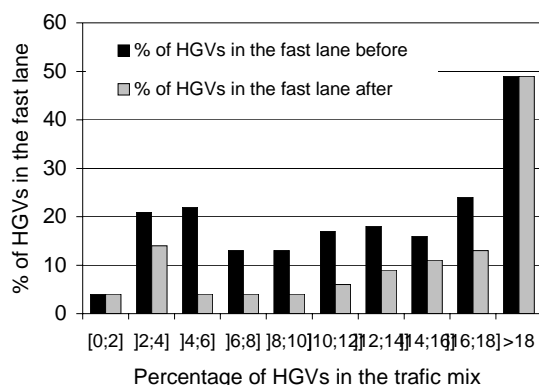


Figure 2 – Before and after comparison on the A4 of the percentage of HGVs travelling in the fast lane (2000 to 2500 v/h for the 2 lanes).

2.2 On the RN83 between Colmar and Sélestat

The HGV overtaking ban has been trialled on a 2x2 lane section of the RN83 National Road and assessed by DDE du Haut-Rhin (Dupont-Roc, 2002). The measure has been in force since

September 2001 in response to a high traffic level. The opinions collected from those involved in road safety, the road managers and the police indicate that the measure is considered to have positive impacts. The principal impression is that traffic flow has improved, even if this is accompanied by an impression of excessive speed on the left-hand lane and danger caused by the creation of an “impenetrable wall of HGVs”.

2.3 On the Route Between Poitiers and the Spanish Frontier

The route between Poitiers and the Spanish frontier via Bordeaux has experienced a continual rise in HGV traffic for more than 10 years. A first set of experiments was launched in 2003 with the implementation of HGV overtaking bans on several sections. The HGV overtaking bans have been gradually extended to cover a major part of the route between Poitiers and the Spanish border (cf. Sétra, 2006).

From the measurements of the impact of the ban on traffic (Barthe, 2005), it appears that the percentage of HGVs traveling in the left-hand lane(s):

remained stable at the measurement points on sections without an overtaking ban ;

fell by more than 4 percentage points (7 → 2.5%) between 2003 and 2005 on the sections with an overtaking ban.

The experiment confirmed the existence of “walls of HGVs” (at least 4 HGVs traveling one after the other), but it has not been possible to establish a direct correlation with the introduction of the overtaking ban.

The HGV drivers survey shows that most of them are “in favor” of the measure. But they accept it more easily when they consider that it is justified. They recognize that it improves light vehicle traffic flow and overall safety. It should be noted that the transport of hazardous materials (THM), to which a lower speed limit applies, is considered to be a source of disturbance by the other drivers on sections where the overtaking ban applies.

3. European Experience

For reasons that probably relate to the nature of the different road networks and the level of congestion on them, experiments of overtaking bans were found only in some European countries by the literature review (CETE de Lyon, 2007). The countries where bans have been applied and for which documentation is readily available are mainly in Northern Europe. The following paragraphs describe four documented studies. As these experiments have influenced one another, the methodologies have some common features. As for the French experience, their conditions of application and the main results are summarized in part 4 of this paper.

3.1 Dutch Experience

All Types of HGV Overtaking Ban

The Netherlands was among the “pioneers” as regards introducing HGV overtaking bans. This may be explained by the large amount of through traffic passing through the country. Thus, overtaking bans were first trialled in the Netherlands in 1997 on 185 km of 2x2 lane motorways. The ban at the time consisted of an intermittent ban operating at peak periods. In October 1999, the measure was extended to 750 km of additional 2x2 lane motorways (cf. Helleman, 2007). Then, in February 2002 and June 2003, the ban was further extended to 400

additional kilometres of motorway. Finally, since January 2005, a dynamic overtaking ban has been trialled in the Netherlands on two sections of the A2 motorway.

The Dynamic Overtaking Ban

In spite of improvements, the ban could be in force during periods of low traffic in which overtaking HGVs posed no safety or congestion problem. This observation gave birth to the idea of a dynamic ban which would only be activated during periods of heavy traffic. Two dynamic HGV overtaking ban trials thus started in January 2005 on the A2 motorway. The overtaking ban is enforced during periods, when specific traffic conditions, described below, are satisfied (Tool, 2005).

Table 1 – Activation and deactivation thresholds for the dynamic HGV overtaking ban.

Cross Section		2x2 lanes (Limburg)	2x3 lanes (Utrecht)
Reference Capacity (in v/h in each direction)		4600	6700
Activation	Total flow (in v/h in both directions)	2600	4500
	HGV flow (in HGV/h in both directions and % of total flow)	250 (9.6%)	150 (3.3%)
Deactivation	Total flow (in v/h in both directions)	2300	4200
	HGV flow (in HGV/h in both directions and % of total flow)	230 (10.0%)	130 (3.1%)

Experience in the Netherlands tends to confirm that dynamic overtaking bans provide greater benefit than static bans. The acceptability of this measure among all types of motorists is considerably increased by the fact that it is activated during the most appropriate periods, without it being any less effective.

3.2 German Experience

In the context of a constant increase in traffic on German motorways and in order to overcome congestion problems, it appeared essential to introduce appropriate traffic management measures. The trial consisted of a permanent overtaking ban on approximately 75 km of 2x2 lane motorway, distributed over 12 sections in the West and South of the country.

Economic Appraisal of the Measure

An economic appraisal of the measure was conducted in the framework of this trial (Drews, 1999). The generalized costs were calculated for each category of user. The results presented in Figure 3 relate only to “level” sections. On sections with descending gradients (slopes), the evaluation conducted on the experimentation demonstrates that the measure has no social benefit. In contrast, on ascending gradients, the measure always seems justified by a “positive” social benefit. With regard to the gradient of the boundary line on Figure 4, economic analysis confirms that one-way vehicle flows over 2000 v/h for a 2x2 lane section seem to represent the most appropriate domain of application for the HGV overtaking ban.

Results from the Accident Analysis

In general, the changes observed subsequent to the introduction of the ban seem to be moderate. The accident analysis conducted on the sections upstream and downstream of the ban revealed no marked impact. This trial has shown that the most beneficial effects of the ban are on sections where HGV traffic poses accident problems, in particular in the vicinity of lane reductions, after carriageways have been reduced from 3 to 2 lanes or near interchanges

and on 2x2 lane road sections with directional vehicle flows in excess of 2000 v/h. However, these results must be qualified with reference to the local context and the objectives pursued.

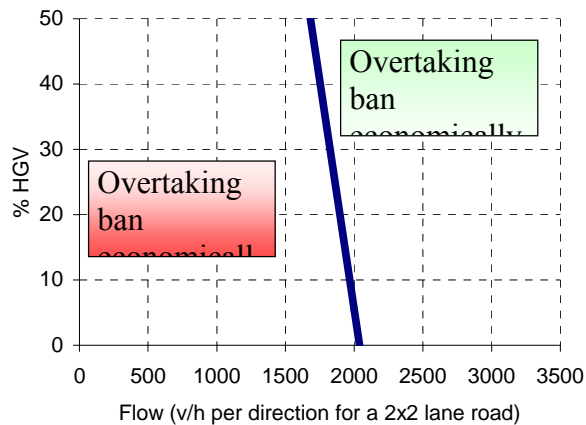


Figure 3 – "Social benefit" associated with the HGV overtaking ban as a function of traffic conditions, on a "level" section (Drews, 1999).

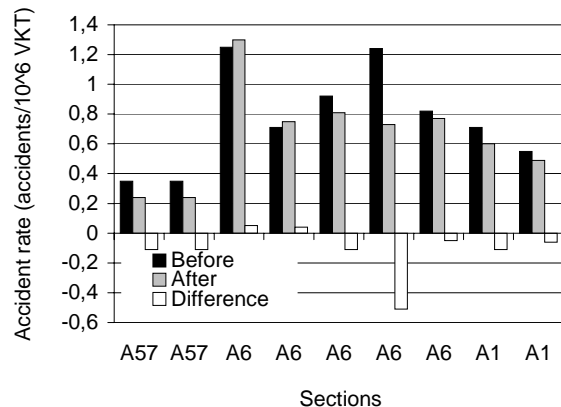


Figure 4 – Change in the number of accidents on the test sections on the German network (Drews, 1999).

Generalization of the Overtaking Ban in Germany ?

After several phases of trials during the 1990s, Germany has extended the overtaking ban to a major part of its network, and applied it in all its different forms, permanent, intermittent and dynamic. At present, the HGV overtaking ban applies to approximately 750 km of motorways in Bavaria and a similar length on the Baden-Wurtemberg network.

As for the Federal Ministry, it tends to favour HGV overtaking bans in peak periods. The Bundesanstalt für Stassenwesen (BAST), has conducted research on the thresholds for implementing a dynamic overtaking ban. These thresholds are shown in Table 2 below. These values are default settings. Observations of traffic should enable them to be optimised and modulated on the basis of local traffic conditions. The Federal Ministry of Transport has not yet performed an appraisal of the dynamic HGV overtaking ban.

Table 2 – Activation and deactivation thresholds for the dynamic HGV overtaking ban.

Cross Section		2x2 lanes	2x3 lanes	2x4 lanes
Activation	Flow in v/h (per direction)	3200	4000	4400
	% HGVs	25	20	20
Deactivation	Flow in v/h (per direction)	2900	3600	3900
	% HGVs	15	10	10

3.3 Danish Experience

An overtaking ban was trialed in Denmark between 2001 and 2003 on a major part of the 2x2 lane motorway network (Ágústsson, 2004).

Based on the German experience, the sections of motorway for the trial were selected according to the following criteria:

- a maximum length of 10 km for each section.
- one-way AADT of over 20,000 vehicles, with more than 10% of HGVs.
- a minimum distance of 10 km between two sections with the ban.

No significant change in the average speed of vehicles was observed after the overtaking ban was introduced. However, it was observed that speeds in the fast lane became more homogeneous.

Observations on the experimental sections have shown good compliance with the ban. The situation seems to deteriorate at the end of these sections as a marked immediate increase in the number of HGVs overtaking each other has been observed downstream of the experimental sections, a phenomenon which has been described as an “Elephant race”. However, traffic returns to its “normal” state less than 3 km after the end of the overtaking ban.

3.4 British Experience

The Highways Agency has trialled an HGV overtaking ban on a three mile section of motorway near Birmingham. The Northern section of the M42 motorway between junctions 10 and 11 is a 2x2 lane road with hard shoulders. The road carries relatively heavy traffic. Observations before the trial showed that HGVs frequently overtook each other on this section of motorway, which had adverse impacts on all categories of road user. Overall, the results one year after the implementation of the overtaking ban, presented in Figure 5 and Figure 6, show a very slight reduction in average journey times for passenger cars and HGVs (Highways Agency, 2007).

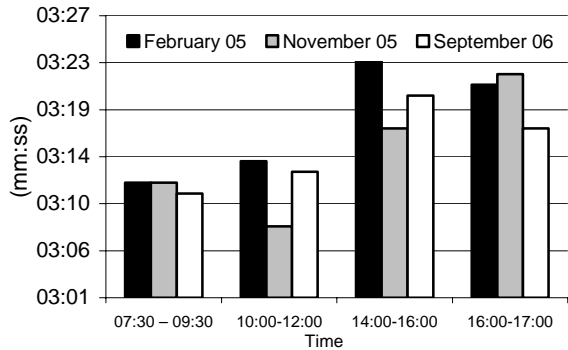


Figure 5 – Average journey times for passenger cars on the experimental section of the M42

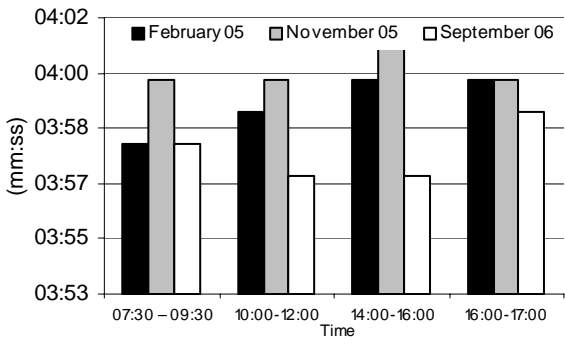


Figure 6 – Average journey times for HGVs on the experimental section of the M42

The data for February 2005 show that almost 12% of the HGVs were observed in the fast lane at the end of the experimental section before the implementation of the ban. As soon as the overtaking ban was introduced, this rate fell to 4%, and remained at this level during the following months.

Although not enough time has elapsed to permit a rigorous accident study, the data collected so far tends to show that the HGV overtaking ban has had a positive impact on accidents. Besides, the doubts of the freight transport profession have not been confirmed by the traffic data, which shows that after a period of adaptation there is a reduction in average journey time for vehicles of all categories. In spite of the fact that the number of HGVs in the fast lane has been reduced by a factor of three, 4% of them still use the fast lane.

4. Summary of French and Foreign Experience

Table 3 – Summary of French and Foreign Experience.

		France			Europe			
		A4	RN83	Poitiers/ Spanish border	NL	DE	Denmark	United Kingdom (M42)
Type of ban	Permanent		•	•	•	• (*)		
	Intermittent	• (7am- 7pm)		• (6am- 10pm)	•		• (6am- 6pm)	• (7am- 7pm)
	Dynamic				• (*)	•		
Weight threshold		>3.5 t	> 19 t	> 12 t	X	X	>3.5 t	> 7.5 T
Cumulative length		7 km	20 km	150 km	90 km	75 km	100 km	5 km
Traffic data (per direction, 2x2 lanes)		AADT=25 000 vehicles and HGV=13% of traffic	AADT=22 000 vehicles and PL=14% of traffic	AADT=12 500 vehicles and HGVs=32% of traffic (on RN10)	Activated at 2600 v/h and HGVs =10% of traffic	Activated at 3200 v/h and HGVs =25% of traffic	AADT ≥ 20 000 vehicles and HGVs≥10 % of traffic	AADT=29 000 vehicles and HGVs=23 % of traffic
Impact on traffic		//	+	+	+	+	+	+
Speeds	HGV	//	//	-	-	-	+	+
	PC	//	//	+	+	+	+	+
% of HGVs on fast lane & compliance with ban		//	+	+	+	+	+	+
Headways		//	-	-	-	+	X	X
User satisfaction	HGV	+	+	X	+	+	+	X
	PC	+	-	-	+	+	+	-
Safety		X	//	-	//	+	-	+

Colour code:

+ = favourable opinion

- = unfavourable opinion

// = neutral or divided

opinion

(*) means that the cumulative length relates to this type of overtaking ban only.

X indicates missing data.

HGV = Heavy Good Vehicle and PC = Passenger Car.

5. Benefits and Disbenefits

Table 4 below summarizes the positive and negative effects that have been observed during the trials described above.

Among the positive effects we should include the calming of traffic and the “psychological” comfort provided to PC drivers who no longer have to wait for HGVs to overtake each other.

For passenger car drivers, the overtaking ban seems to be equivalent to the removal of a constraint imposed by HGV traffic.

The negative effects relate mainly to one point : heavy vehicles align their speed on that of the slowest vehicle, which has direct economic consequences on road freight transport, and induces the creation of “walls” of HGVs. This phenomenon has frequently been observed but the conditions, which give rise to it, are not easy to model. It may have many consequences, such as creating difficulties in entering or leaving the road or masking signing for vehicles in the fast lane.

Table 4 - Summary of Positive and Negative Effects in the Experiences.

		Positive Effects	Negative Effects
Impacts on traffic		Improved flow	
Speeds	General observations	Homogenization of speeds on both lanes	The speeds of all the HGVs conform with that of the slowest vehicle (for example THD)
	Free-flow traffic (flow < 2000 v/h per direction for both lanes)	Increase in average speeds on both lanes	
	Dense traffic (flow > 2000 v/h per direction for both lanes)	↗ in PC speeds	↘ in HGV speeds
% of HGVs in the fast lane		↘ to approximately 2%	↘ (smaller) in the case of dense traffic
Compliance with the ban		Compliance generally good	Margin of improvement (2% of HGVs in the fast lane despite the ban) Compliance less good when the % of HGVs in the traffic rises
Headways			Tendency to fall for HGVs
Appreciated by road users		Measure considered beneficial by PC drivers	Measure sometimes considered to be damaging by HGV drivers
Safety	Improvement in safety in sections with accident problems due to HGV traffic		Creation of “walls” of HGVs on the right-hand lane which interfere with merge and demerge movements on
	Calming of traffic on the controlled sections		"Elephant race": an immediate return to overtaking by HGVs at the end of the controlled sections.

6. The Appropriateness of the Measure: some First Conclusions

This initial survey of French and foreign trials has identified the foreseeable effects of the various types of HGV overtaking ban on traffic and their acceptance by road users. A major issue when evaluating the implementation of an overtaking ban is the sensitivity of the results to the initial traffic conditions. A summary of this information is essential in order to attempt to define, in the context of “traffic-centred” approach, the conditions under which it would be appropriate to introduce an overtaking ban covering significant lengths of road.

From the point of view of traffic flow, two parameters play a major role: the percentage of HGVs in the traffic mix and total vehicle flow. They provide a basis for deciding whether the implementation of an overtaking ban is appropriate on a section of road.

Broadly, when the percentage of HGVs is too low, HGVs overtaking each other are responsible for few problems and they can coexist with passenger cars without any problems. A ban therefore penalizes them with no good reason. In contrast, when the percentage of HGVs is high, the probability of encountering HGVs which are overtaking each other is far from negligible and the measure is very effective. It is however under these circumstances that compliance with the ban seems to be the smallest. The ban must therefore be accompanied by monitoring measures (to monitor compliance, speeds, and headways) and information that is appropriate and that can be understood by all drivers (in particular foreigners). This monitoring should involve interception and must therefore be organized (monitoring plans, vehicle checking areas). In a similar way, when total vehicle flow is low, the benefits of the ban are limited. And when total vehicle flow becomes very high, the fundamental diagram (traffic flow can be modelled using relationships which link flow to the mean speed or occupancy rate. The graphic representation of these mathematical relationships is known as the “fundamental diagram”) shows that the speed of passenger cars falls. The gain provided by restricting HGVs to the right-hand lane disappears under these conditions.

Some first factors that determine the domain of validity of the application of the HGV overtaking ban in the current state of knowledge are summarized below:

- sections of 2x2 lane road which are level or with an ascending gradient;
- sections that are several kilometres long (between 5 and 20 km);
- directional flows on the 2x2 lane roads higher than 2000 v/h and whose AADT is above 20,000 vehicles per day;
- a percentage of HGVs above 10% with an intensification of monitoring when traffic level rises;
- permanent bans preferred on sections with HGV accident problems;
- intermittent or dynamic bans favoured on sections with congestion and traffic problems due to HGVs.

Last, the impact of a measure of this type on the transfer of HGV traffic to other roads should be investigated and anticipated. Prior thought should be given to the situation as regards **alternative routes** before any decision is taken in order to encourage the transfer of heavy through traffic onto the most appropriate road sections.

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