

# SPEED BEHAVIOUR IN FRANCE : DISTRIBUTION STRUCTURES AND CHANGES OVER THE PERIOD 1986-1998

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## ABSTRACT

The fact that speeds over the last decade have failed to improve raises doubts about the nature and effectiveness of prevention policy in this area in France. and in view to reforming preventive measures, it is necessary to analyse the effective status of speed in the traffic system. Driving speeds are governed by laws and are to an extent determined by the legal norm, but they also depend on the general social context. The aim of our research is to investigate the way speeds changed in France between 1986 and 1998 using observations from the annual speed surveys conducted in a scientific way by the National Observatory. We have attempted to identify the relative roles of the dimension of conformity with ambient practices and the dimension of compliance with the law on the different types of roads that make up the French network. For this we have used a "conformity scale" defining groups of relative speeds.

The analysis has been restricted to light vehicles during the daytime. Results support the hypothesis that speed behaviours are determined by three major dimensions: acceptance of legal provisions, willingness to diverge from the legal limit while still conforming with average speeds and a belief in the right "to choose" one's own speed by driving faster or slower than other drivers. The relative importance of these dimensions depends on the type of road and the speed limit in force. Three typical distribution structures have been identified which are each well represented by the profiles observed on interurban motorways, county roads and trunk roads in built-up areas where respectively 40%,47% and 81% are exceeding the legal limit.

Concerning the changes, on roads where speeds are limited to 130 km/h or 110 km/h, the status of the speed limit as a limit that must not be exceeded has been impaired. The lowering of the speed limit from 60 km/h to 50 km/h has reduced speeds in built-up areas although positioning with respect to the legal norm indicates a reluctance to comply with the new 50 km/h limit : the majority of drivers (70%) exceed the speed limit on built-up roads. On the other types of roads the speeds of all groups of drivers are remarkably stable

By comparing these findings with other sources of information about speeds and their determinants it would be possible to clarify the concept of "norm of practice" which would probably help us to understand the inflexibility of speed behaviour.

## INTRODUCTION

Driving speeds are governed by laws and are to an extent determined by the legal limit, but they also depend on the general social context and the context within which driving is learnt, context where behaviours conform to a greater or lesser extent to the legal limit. From research conducted into "Basic driver behaviour" (Moget & Biecheler (1985)) it emerges that faced with legal requirements, the driver must make the fundamental 'choice' to obey these or to exercise the 'right' to decide on the most appropriate practices to ensure travel safety, corresponding with objectives in terms of economic expectations and driving pleasure. Norms of practice may thus diverge from the legal norm.

Over the last decade, although the introduction of the penalty points licence in 1992 should have helped to educate drivers, no improvement in speeding behaviour is apparent, except perhaps in urban areas, (ONISR (1998); Biecheler & Cauzard (1999)). The fact that speeds have failed to improve, and have even deteriorated on some types of road, raises doubts about the nature and effectiveness of prevention policy in this area. Regulatory action is intended to keep speeds below certain limits in order to reduce accident risk and if we want to do more than just measure its effects, in terms of average speeds or the percentage of vehicles exceeding the speed limit, it is necessary to analyse the effective status of speed in the traffic system. This may highlight the way of reforming preventive measures.

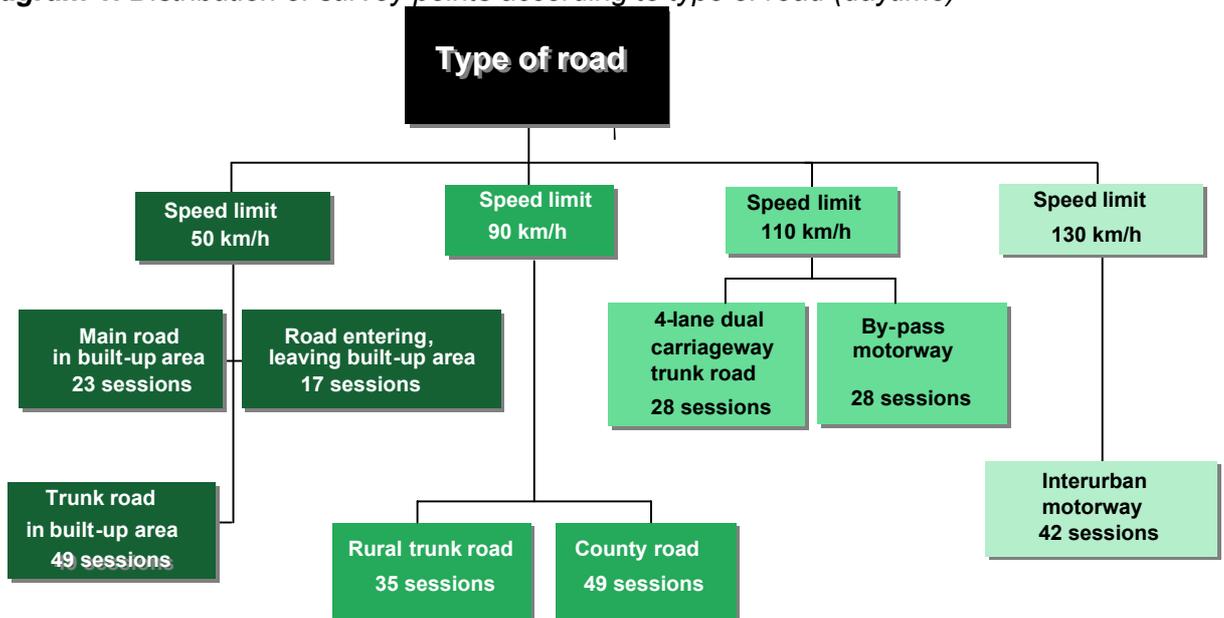
The aim of this paper is to investigate the way speeds changed in France between 1986 and 1998 using observations from the annual speed surveys conducted by the National Interministerial Road Safety Observatory (ONISR). We have attempted to identify the relative roles of the dimension of conformity with ambient practices and the dimension of compliance with the law on the different types of roads that make up the French network. The analysis method was based on this fundamental distinction between "conformity" and "legality". The analysis has been restricted to light vehicles during the daytime.

## DATA AND METHODS

Since 1973, the time when speed limits were being introduced on French roads, the ONISR set up a survey system able to measure and analyse driving speeds, on an annual basis. Investigation of changes in speed between 1988 and 1998, and more generally during the period 1986-1998, uses the speed data collected by the ONISR survey system, whose structure we shall briefly describe below.

### The ONISR speed data collection system

The aim of the ONISR speed measurement surveys is to establish the average speed of vehicles and monitor how this changes. Each year a sample of the road network is selected for speed observations.

**Diagram 1.** Distribution of survey points according to type of road (daytime)

Source : ONISR speed measurement surveys

Speeds are measured with speed measurement devices located on a number of panels of observation points distributed over the four principal types of roads : motorways, trunk roads, high traffic county roads and urban roads.

Diagram 1 above shows the distribution of survey points according to road category and the normal speed limit on these roads.

The basic speed measurement sequence is called "session". The durations of the sessions ranged from 20 minutes to 60 minutes depending on the number of lanes and the category of road. The data were collected by staff employed by a private survey company.

Data processing was predefined in the specifications drawn up by the ONISR, so as to be representative of the hours of the day and of the type of day (weekday-weekend); measures occur three times a year on each point of the panel.

### Defining groups of relative speeds (conformity scale)

Variations in speed are partially related to factors on the site, for example the traffic flow and its composition (percentage of lorries), the practices of surrounding drivers (percentage of drivers committing speed violations) or a police presence. Variations are also the result of factors which are specific to individual drivers. It is possible to measure this individual speed tendency using the difference between the driver's speed and the average speed on the site during the session. This difference indicates the driver's position on the conformity scale and expresses his or her propensity to drive slower, faster or at the same speed as the other vehicles at the site.

A conformity scale has been specified which consists of three conformity levels ranging from the slowest vehicles to the fastest vehicles : slow = (-6 km/h and less), conforming= (-5 km/h, +5 km/h),fast= (+6 km/h and more). The small differences of less than 5 km/h define then vehicles complying with the mean speed. On this basis it is possible to describe the distribution of drivers by distinguishing between the *dimension of legality* (or their tendency to comply with the speed limit) and the *dimension of conformity* (or their tendency to comply with the average speed).

It is important to make one fundamental comment about this concept of conformity with the average speed: when the distribution of speeds at a certain point is closely grouped around the mean (in which case most driving speeds are near the average) conforming to the mean involves conforming to a "social norm". When, however, the distribution of speeds is widely spread or has two modes, the average does not have the same significance. The social norm is in reality a system of different social norms which correspond to different types of users with different norms of practice.

The proposed method differentiates between drivers on the basis of a dual reference, what is legally permitted and what they decide they have the right to do. Dividing drivers into six groups, combining three levels of conformity and two legality levels, provides a means of exploring more effectively the manner in which drivers reach a compromise with the legal system. The levels which define the six groups have been established on the basis of the position of the driver's speed ( $V_i$ ) in relation to the average speed at the location ( $\bar{V}$ ) and the speed limit (Lim) : *slow and legal* ( $V_i < \bar{V}$  and  $V_i < \text{Lim}$ ), *slow and illegal* ( $V_i < \bar{V}$  and  $V_i > \text{Lim}$ ), *conforming and legal* ( $V_i$  close to  $\bar{V}$  and  $V_i < \text{Lim}$ ), *conforming and illegal* ( $V_i$  close to  $\bar{V}$  and  $V_i > \text{Lim}$ ), *fast and legal* ( $V_i > \bar{V}$  and  $V_i < \text{Lim}$ ), *fast and illegal* ( $V_i > \bar{V}$  and  $V_i > \text{Lim}$ )

In this paper we have applied this breakdown into six groups according to relative speeds to the national road network and conducted analysis for the period 1986-1998. The results describe the frequencies of drivers in each group and their speeds and relate to the *daytime speeds of light vehicles on the eight types of road* covered by the ONISR/ISL survey: interurban motorways, by-pass motorways, 4-lane dual carriageway trunk road, 2- or 3-lane trunk road, county roads, trunk road in a built-up area (small sized towns), main roads in urban areas (centre of middle sized towns), road entering or leaving built-up area (middle sized towns).

### The components of average speed

The average driving speed on a given type of road results from the mean speeds of each of the six groups of drivers. It is calculated using the weighted average of the mean speed of each group.

$$v = \sum_i p_i \times v_i, \text{ where :}$$

$v$  is the average speed on the type of road in question,

$i$  is an index which takes on values from 1 to 6, 1 = slow-legal, 2 = slow-illegal, 3 = compliant-legal, 4 = compliant-illegal, 5 = fast-legal and 6 = fast-illegal),

$p_i$  is the proportion of drivers who are in group  $i$   $\sum_i p_i = 1$

## RESULTS

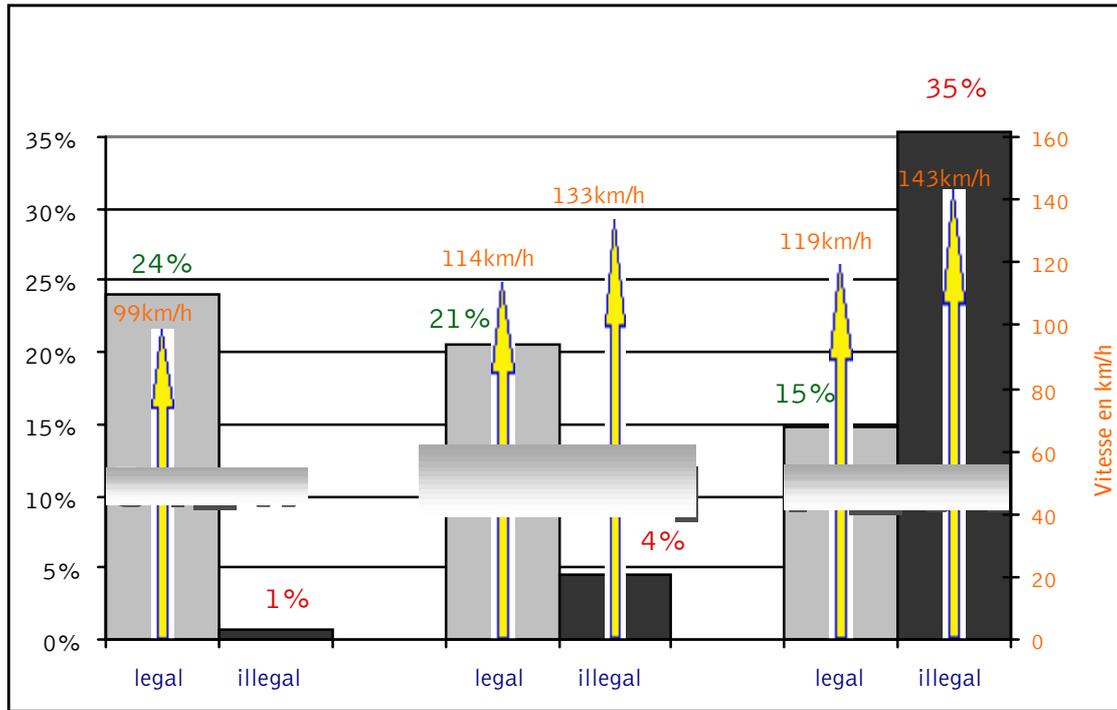
Behaviours are structured in some cases with reference to the legal norm, in others with reference to the type of road and the capabilities of the vehicle driven or the driver: we can postulate that different groups of drivers have different norms depending on sociological, economic and ethical values.

The results presented are divided in two parts, the first one concern the distribution structures of observed speeds the second one is exploring the changes and the evolution during the period 1986-1998.

### The distribution structures of observed speeds

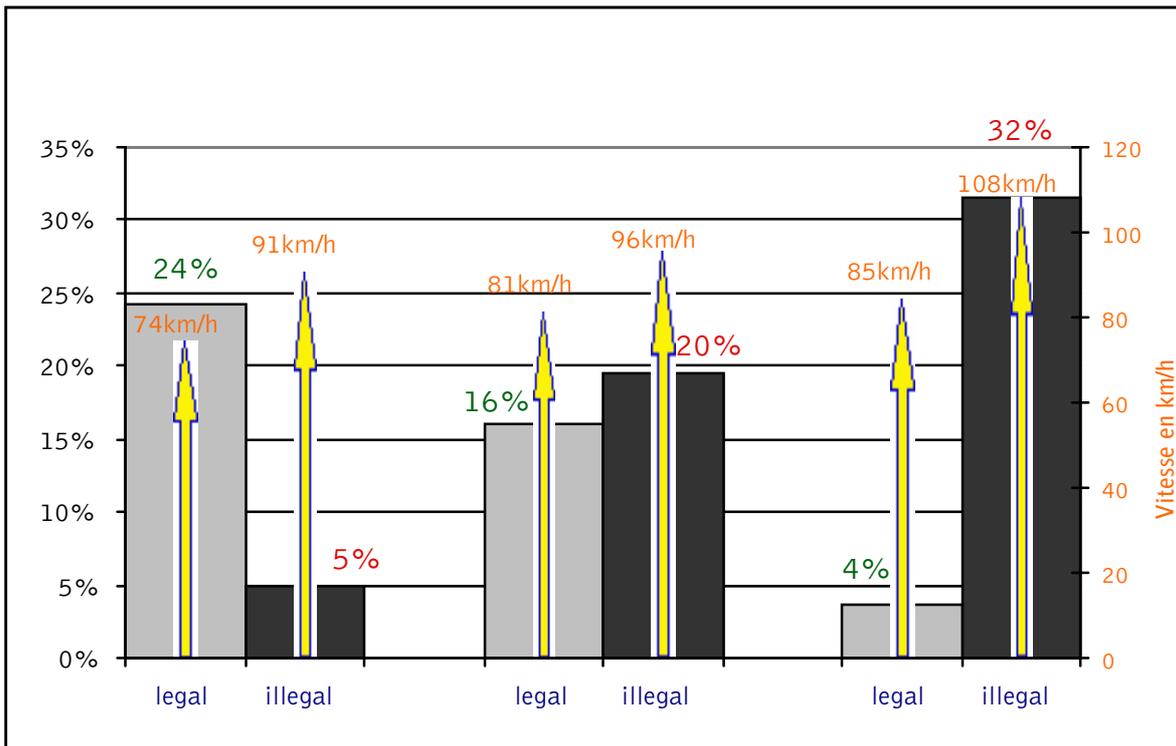
We have analyzed the speed structures observed on the different types of roads in 1998. Three typical distribution structures have been identified which are respectively well represented by the profiles observed on interurban motorways, county roads and trunk roads in built-up areas.

**Figure 1.** Speed distribution on interurban motorway with a speed limit of 130 km/h . The typical case of type 1.



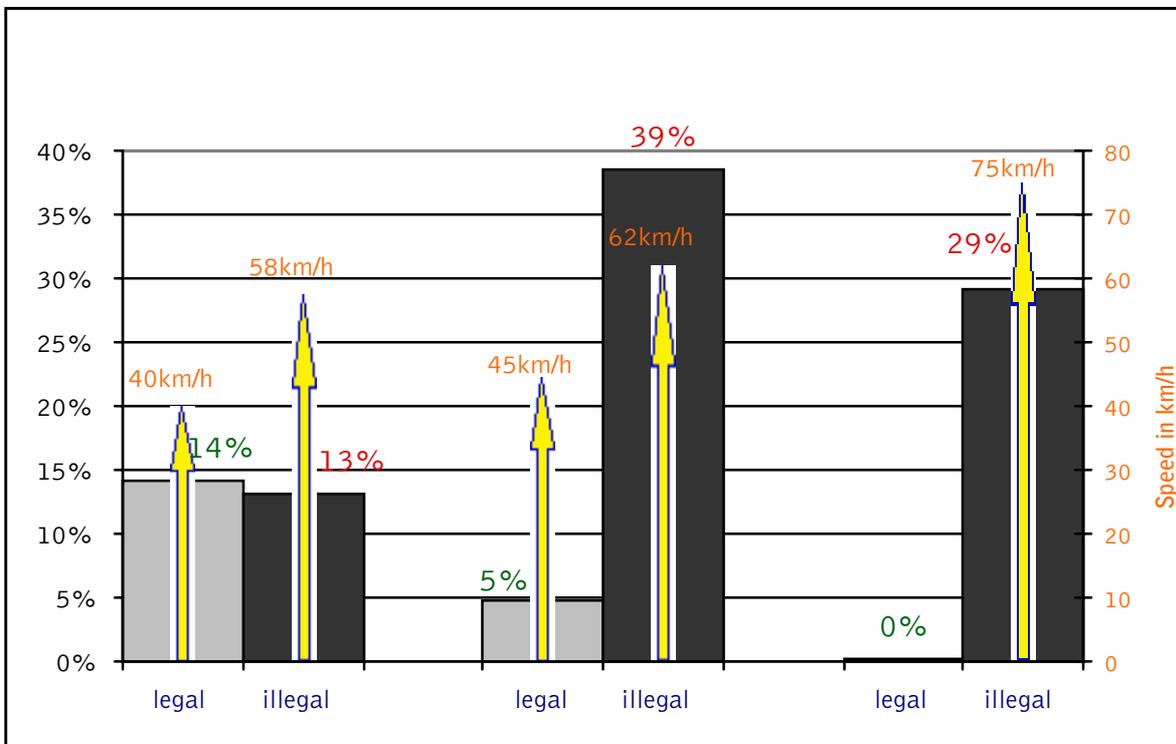
Type 1 includes interurban motorways, by-pass motorways and 4-lane dual carriageway trunk roads

**Figure 2.** Speed distribution of county road. The typical case of type 2.



Type 2 includes county roads, rural trunk roads and main roads in built-up areas

**Figure 3.** Speed distribution of trunk road in a built-up area. The typical case of type 3.



Type 3 includes trunk roads in built-up areas and road entering or leaving built-up zones.

These structures essentially relate to the frequency of drivers who comply with the average and the distribution of these drivers between legal and illegal speeds.

Table 1 summarise the results provided on the eight types of roads.

### **The type 1 distribution structure**

The type 1 distribution features the following main determinants of speed: the right to drive fast (35% to 40% of drivers) and the decision to obey the law (40 to 45% of drivers). Two tendencies are apparent within the latter group, slow drivers (around 25%) and drivers with moderate speeds (15% to 20%), which correspond to two distinct norms of practice. Interurban motorways, by-pass motorways and 4-lane dual carriageway trunk roads can be assigned to this distribution profile.

### **The type 2 distribution structure**

The type 2 distribution features several equally important determinants of behaviour : compliance with the legal norm (40 to 47% of drivers) which can be subdivided into two additional tendencies, slow (21 to 25%) and moderate (16 to 26%); willingness to drive faster than the speed limit without diverging excessively from the average speed (18% to 23% of drivers) and claiming the right to drive at high speeds (24% to 32% of drivers). County roads, rural trunk roads and main roads in built-up areas can be assigned to this distribution profile.

### **The type 3 distribution structure**

The type 3 distribution displays a clear tendency for the majority of drivers (more than two out of three) to exceed the speed limit. This tendency is subdivided into a tendency not to diverge from the average speed (around 40%) and the tendency to diverge from both average behaviour and the speed limit (around 30%). Trunk roads in built-up areas and road entering or leaving built-up zones can be assigned to this distribution profile.

**Table 1 : Distribution of the principal tendencies according to type of road**

	Legal speed			Illegal speed		
	Slower than the average	Conforming with the average	Faster than the average	Slower than the average	Conforming with the average	Faster than the average
Interurban motorway	24% 99 km/h	21% 114 km/h	15% 119 km/h	1% 121 km/h	4% 133 km/h	35% 143 km/h
By-pass motorway	27% 88 km/h	15% 101 km/h	5% 100 km/h	2% 106 km/h	10% 116 km/h	40% 127 km/h
4-lane dual carriageway trunk road	25% 91 km/h	16% 99 km/h	6% 103 km/h	3% 114 km/h	14% 118 km/h	36% 128 km/h
County road	24% 74 km/h	16% 81 km/h	4% 85 km/h	5% 91 km/h	20% 96 km/h	32% 108 km/h
Rural trunk road	25% 74 km/h	20% 80 km/h	5% 81 km/h	4% 91 km/h	18% 96 km/h	28% 107 km/h
Main road in built-up area	21% 37 km/h	26% 42 km/h	3% 42 km/h	4% 54 km/h	23% 58 km/h	24% 65 km/h
Trunk road in built-up area	14% 40 km/h	5% 44 km/h	0% 33 km/h	13% 58 km/h	39% 62 km/h	29% 75 km/h
Roads entering or leaving built-up areas	13% 44 km/h	2% 48 km/h	0% -	13% 57 km/h	42% 62 km/h	29% 74 km/h

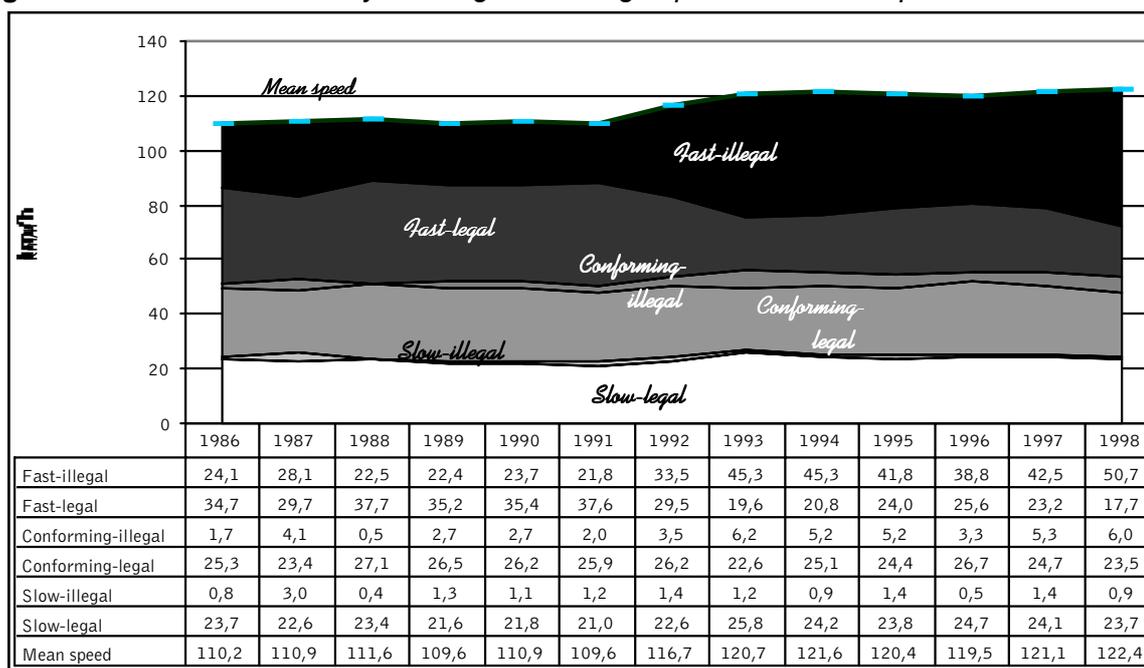
Source : ONISR/INRETS (1998)

### Change in average speed and its components (1986-1998)

We have calculated the components of average speed on each road category and for each year of the period 1986-1998. For example, on interurban motorways in 1998 the average speed can be broken down as follows :  $122.4 \text{ km/h} = 24.0 \% \times 98.6 \text{ km/h} + 0.7\% \times 120.8 \text{ km/h} + 20.6\% \times 114.1 \text{ km/h} + 4.5\% \times 133.4 \text{ km/h} + 14.9\% \times 119.1 \text{ km/h} + 35.3\% \times 143.4 \text{ km/h}$ . The average speed therefore results from six components each representing the contribution of one of the six groups :  $122.4 = 23.7 + 0.9 + 23.5 + 6.0 + 17.7 + 50.7$ . (Figure 4, last column)

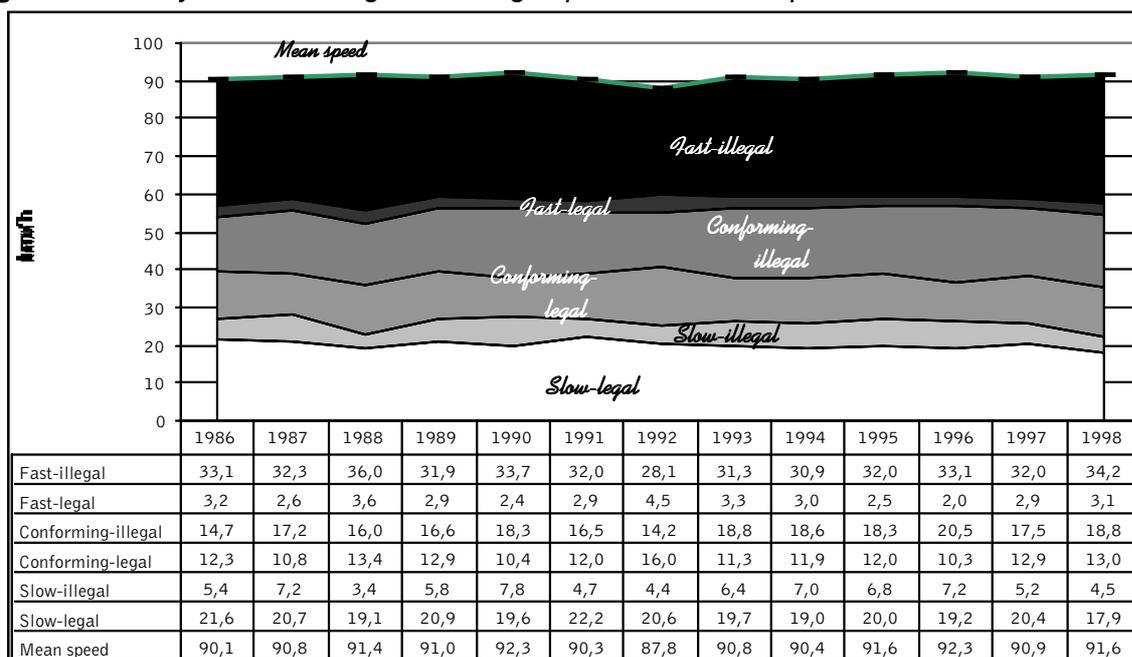
Figures 4,5 and 6 show how the contribution of each group to mean speed has changed for each of the three typical structures, taking as examples interurban motorways, county roads and trunk roads in built-up areas.

Figure 4. Interurban motorways: change in average speed and its components 1986-1998



On interurban motorways on the average speed has increased from 110,2 km/h to 122,4 km/h. The increasing contribution made to this average speed by fast drivers who are over the speed limit is remarkable (Figure 4). This contribution has risen from 24,1 in 1986 to 50,7 in 1998. This results from two factors : an increase of the percentage of fast-illegal drivers, and parallelly an increase of the mean speed of these drivers . In 1998 the proportion of the fast-illegal group is 35% and its average speed is 143 km/h. In addition the contribution of drivers who are faster than the others while obeying the speed limit (fast-legal group) has fallen from 34,7 to 17,7, due to the decrease of the proportion of the. fast-legal group and not to a change of the speed. The contributions of the others groups have remained more or less stable.

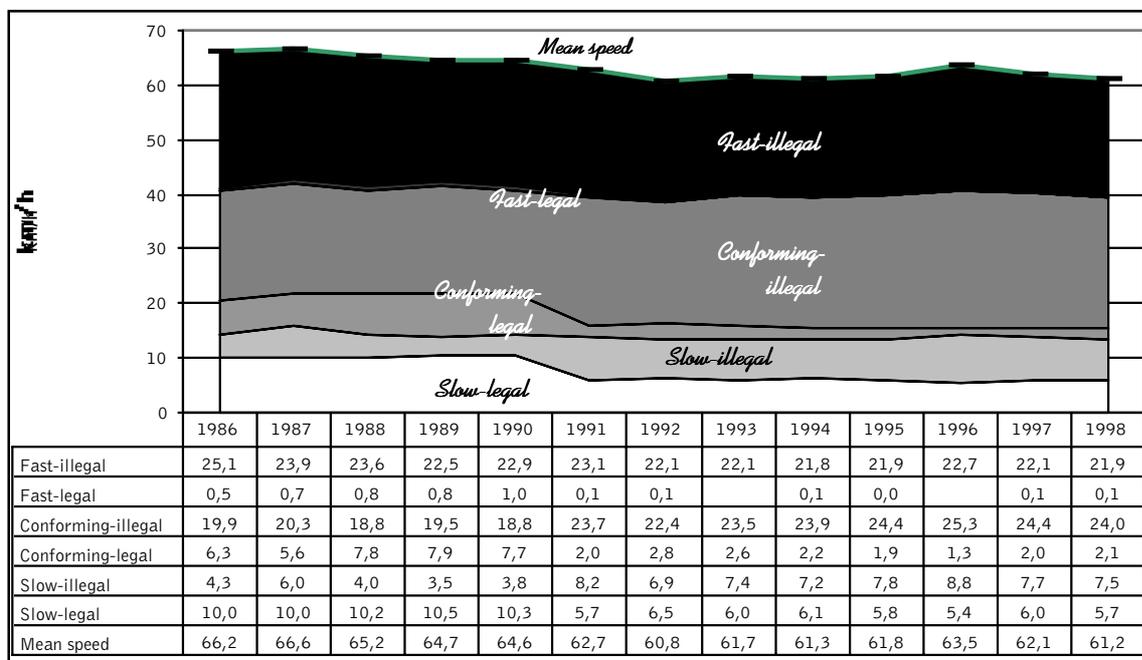
Figure 5. County roads : change in average speed and its components 1986-1998



On county roads (Figure 5), the high weight of the fast-illegal group has remained practically stable over the period (approximately 33). In 1998 the proportion of the fast-illegal group is 32% and its average speed is 108 km/h.

No significant difference in the speed practices appear on the period 1986-1998.

Figure 6. Trunk road in built-up area: change in average speed and its components 1986-1998



On trunk roads in built-up areas, we observe over the period 1986-1998 a slow and progressive decline of the average speed since 1987 to 1992. From 1992 the average speed is remained stable (around 61- 62 km/h) apart a perturbation in 1996. The reduction over the period 1986-1998 is of 5 km/h.

A change of the relation of the drivers to the legal threshold has occurred since 1991, which is therefore associated with the lowering of the speed limit in built-up areas to 50 km/h. (December 1990, 1st).

On Figure 6 we observe a remarkable change of the components of the average speed from 1991. The values of the components stable until 1990 are modified after this year and remained stable since then. This transformation affects only the contributions of the conforming and the slow groups. The fast-illegal group accounts for a constant weight of 22-23 over the period.

The contribution of the conforming-illegal group has risen to 18,8 to 23,7. Simultaneously the contribution of the conforming-legal has fallen from 7,7 to 2,0. The contribution of the slow-illegal group has risen to 3,8 to 8,2. Simultaneously the contribution of the slow-legal has fallen from 10,3 to 5,7.

The modification of speed practices described by this transformation gives to the conforming-illegal group the major weight in the average speed since 1992.

In 1998 the proportion of the conforming-illegal group is 39% and its average speed is 62,1 km/h. In comparison, in 1986 the proportion of the conforming-illegal group was 29% and its average speed is 69,1 km/h. While the speed has been lowering of 7 km/h the proportion of conforming-illegal has been growing up, and from in 1998 90% of the conforming group (versus 70% in 1986). Driving close to the average speed means in 90% cases be a speed limit violator.

In other terms, the change from a 60 km/h to a 50 k/h limit in built-up areas did encourage a change in driving speeds and led to a lowering of speeds, but positioning with regard to the legal norm indicates a reluctance to comply with the new 50 km/h limit.

## CONCLUSIONS AND OUTLOOK

Analysis has shown the prevalence of speed behaviours which are determined by three major dimensions: acceptance of legal provisions, willingness to diverge from the legal limit while still conforming with average speeds and a belief in the right "to choose" one's own speed by driving faster or slower than other drivers. The relative importance of these dimensions depends on the type of road and the speed limit in force. Three typical distribution structures have been identified.

In order to conduct more precise qualitative analysis of the determinants of these behaviours it would be necessary to investigate sub-populations which are differentiated on the basis of the tendencies they exhibit, as has been done in the Pas de Calais area (Peytavin & Biecheler (1997)). Exploitation of this survey aimed to identify the influence of dissuasive measures on behaviours. A different approach to exploitation could be used to identify the determinants of norms of practice.

### Speed distribution structures

This research has explored simultaneously the relationship between drivers and the legal norm and the social tolerance of illegality. The speed distributions established in 1998 reveal a differentiation among drivers on the basis of the "choice" of speed:

- on interurban and by-pass motorways and on four-lane dual carriageway trunk roads, between 35 and 40% of drivers choose to drive fast with no regard to the speed limit while between 41 and 45% of drivers comply with the limit.
- outside built-up areas, on high-traffic county roads or trunk roads, the different tendencies are fairly evenly represented among drivers: slow or moderate speeds below the speed

limit, and, with respect to illegal speeds, conforming to the average speed or deliberate choice of a higher speed,

- the same even distribution is found on main roads in built-up areas,
- in built-up areas, both on trunk roads entering and leaving urban areas, almost 70% of drivers exceed the speed limit, with 40% remaining close to the average speed and 30% driving much faster.

### The observed changes

Over the last ten years the following major changes in speeds are apparent:

- a considerable increase on interurban motorways (+12,2 km/h) and by-pass motorways (+ 9 km/h). All groups are involved in this trend, but the contribution of the fast-illegal group is particularly large and increasing,
- a slightly smaller increase (+2,8 km/h) on the 4-lane dual carriageway trunk network, for which the conforming-illegal group is mainly responsible,
- a general reduction in speeds (-5 km/h) on trunk roads in urban areas resulting from a uniform reduction among the three groups (slower, conforming to the average and faster),
- remarkable stability in the speeds of all groups of drivers from the slowest to the fastest on all the other types of road - county roads, trunk roads outside urban areas, roads entering and leaving urban areas and main roads in medium-sized towns (only monitored since 1991).

Thus, on those roads where speeds are limited to 130 km/h or 110 km/h, the status of the speed limit as a limit that must not be exceeded has been impaired. The lowering of the speed limit from 60 km/h to 50 km/h has reduced speeds in built-up areas although positioning with respect to the legal norm indicates a reluctance to comply with the new 50 km/h limit. Lastly, it is apparent that the majority of drivers exceed the speed limit on built-up roads.

### Outlook

It would be possible to supplement these results by applying the same descriptive procedure to an analysis of night-time speeds, lorry speeds and differentiating between weekdays and weekends.

From a methodological point of view, it is possible to examine the results using a variant of the conformity scale based on the *ratio* between the driver's speed and the local average speed (Lynam et al, 1999) rather than the *difference* between the driver's speed and the average speed.

In order to conduct more accurate qualitative analysis of the determinants of these behaviours it would be necessary to investigate sub-populations, which are differentiated on the basis of their tendencies. The approach to identify the determinants of norms of practice will use variables describing social context, mobility habits and the drivers relationship with his vehicle.

## BIBLIOGRAPHY

- Biecheler M. B.(1973). Contenu et coût d'un tableau de bord de sécurité. Conclusions de l'enquête sur route après un an d'activité. Objectif n° 1, 3ème phase, Juin 1973.
- Biecheler M. B.(1974). Méthodologie de la comparaison des coûts d'enquête pour atteindre une précision donnée, en fonction du mode de recueil des données.Objectif n° 1, 8ème phase, Janvier 1974.
- Biecheler M. B.(1976). Tableau de bord de sécurité routière. Propositions de solutions opératoires. Objectif n° 17, 5ème phase, Décembre 1976.
- Biecheler M. B., M.A. Cambois (1977). Rédaction du cahier des charges du recueil des données. Objectif n° A1, 1ère phase, Février 1977.
- Biecheler M. B., Crespin F.(1978). Rédaction du cahier des charges du traitement et de l'exploitation des données. Objectif n° A1, 4ème phase, Janvier 1978.
- Biecheler M.B. Peytavin J.F. (1997). Réglementation, environnement et choix de la vitesse. Convention DSCR/INRETS.Rapport DERA n° 96-70013, décembre 1997 (72p).
- Cauzard J.P.(1999). Etude de l'évolution des vitesses en France entre 1991 et 1996: Pratiques sur route et Attitudes sociales. Rapport DERA-LPC 9907. Rapport de convention DSCR-INRETS n°98 70 001, octobre 1999 (49p).
- Koscielniak B. (1998). Réglementation, environnement et choix de la vitesse. Mémoire de DESS, Juin 1998 (132 pages). Stage USTL/INRETS, Sous la responsabilité à l' INRETS de M. B. Biecheler, avec le conseil scientifique de S. Camiz et l'encadrement informatique de J.F. Peytavin.
- Lynam D.A, Baruya A, Taylor M.C.and Finch D.J. (1999). Managing speeds to reduce accidents in UK. Transport Research Laboratory, Crowthorne.
- Moget M. et Biecheler M.B (1985). Le comportement de base du conducteur. Cahier d'Etudes ONSER n°64. Avril 1985.
- ONISR Bilan : Statistiques et commentaires
- ONISR. Observations par sondages de paramètres de la circulation routière (non daté)
- Peytavin J.F., Biecheler M. B.(1997). Driver's speeding behaviour and attitudes to law enforcement in different traffic situations. A multisite road survey in France. In *Traffic Safety on two Continents, Conference* Lisbonne 22-24 september 1997.
- Peytavin J.F., Biecheler M. B.(1999). Vitesse réglementaire, comportements et attitudes des conducteurs : une méthode d'analyse multi-site. In *Méthodes d'Evaluation des Mesures de sécurité Routière*, PIARC, October 1999, Ed. Peeters and D. Heuchenne, group C13/2, p32-41.