

## RESOLUTION NO. 94/1 ON DRIVING IN WEATHER CONDITIONS OF POOR VISIBILITY

[CEMT/CM(94)4]

The Council of Ministers of the ECMT, meeting in Annecy on 26 and 27 May 1994,

**NOTING** that visibility distance is of the utmost importance for safe driving;

**HAVING REGARD TO** the report on driving in weather conditions offering poor visibility;

**NOTING** that the visibility distance is strongly influenced by bad weather conditions;

**CONSIDERING** that accidents which occur in bad weather, particularly in fog, often involve a large number of vehicles and that these accidents are even more severe when lorries are involved;

**TAKING ACCOUNT OF** the fact that accidents occurring in these circumstances are often attributable to inappropriate behaviour by drivers;

**NOTING** that technical facilities can offset the poor visibility to some extent;

**CONSIDERING** that harmonisation of driving rules in adverse weather would make it easier for drivers to get to know them and, accordingly, comply with them;

**RECOMMENDS** that the ECMT Member countries:

- Take measures to ensure that drivers behave appropriately in adverse weather conditions; such measures might include, for example:
  - The introduction of speed limits which are set in relation to the visibility distance.
  - The prohibition of overtaking by certain categories of vehicle.
- Ensure that the behaviour adopted in these particular circumstances is taught not only in the initial training but also in professional training or refresher courses for drivers.
- Provide for visual means enabling drivers to estimate visibility distances, such as beacons, road-studs and road marking.
- Provide warning signs, or if necessary equipment, for areas where reduced visibility is particularly frequent and serious owing to adverse weather conditions.

- Ensure that indications given to road users by means of road signs and signals, especially regarding directions, are as efficient as possible.
- Provide appropriate information for road users regarding traffic conditions and safety rules to be observed by developing real-time means of information, among other types, through variable-message signs and radio frequencies.
- Encourage the general fitting of rear fog lights on vehicles, while at the same time ensuring that these cannot be confused with brake lights and laying down specific conditions for use, thus referring to the competent bodies, in particular ECE-UN.
- Promote the fitting of in-vehicle equipment ensuring optimum and effective visibility conditions (demisting and defrosting of windows, high-performance windscreen wipers, etc.).
- Step up information campaigns on safety rules which all road users must observe, especially with regard to the most vulnerable road users.
- Continue research and develop international co-operation, especially as regards:
  - The problem of reduced visibility.
  - Pervious surfacing.
  - Aids to drivers by means of new technologies.
  - The transmission of driver information to vehicles.
  - Fog detectors and warning systems.
- Develop monitoring devices for the purpose of detecting offences in all circumstances.
- Try to ensure that, when general measures are adopted, they are harmonised throughout Europe.

**INSTRUCTS THE COMMITTEE OF DEPUTIES** to ensure that the report and recommendations adopted are transmitted to all the government departments and organisations concerned and to monitor all further developments in this connection in the various Member countries of the Conference.

## REPORT ON DRIVING IN WEATHER CONDITIONS OF POOR VISIBILITY

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### BACKGROUND

At the Spring 1992 sessions of each of the Groups (Road Traffic, Signs and Signals, and Road Safety), it was decided that the topic “driving in fog” should be included in the work programmes of both Groups.

A joint report by the German Delegation (to the CCSR) and the French Delegation (to the CSR), based on the findings of the survey of all of the ECMT Member countries, showed that the importance of the fog problem varies across countries depending on their geographical location and the resulting weather conditions. In some countries it is even non-existent or is so unusual that permanent measures are not required.

However, other more common types of bad weather, such as rain or snow, have an impact on road traffic conditions and safety which is comparable to that of fog or which presents certain similarities. It seemed therefore desirable to extend the discussions to all weather conditions even though fog remained the main focus of the study.

Since ECMT was established, no specific studies have been devoted to the impact of weather conditions on road traffic and especially on road safety, although in a number of reports this problem was raised and taken into account, particularly in 1979 in the resolution on road traffic at night, which is a very similar issue in a number of respects.

On an international level, few studies have examined the influence of weather conditions on the flow of road traffic and on accidents. The literature on this subject is limited. Other than the OECD report published in 1976 on “Adverse weather, reduced visibility and road safety”, there is no comprehensive study that treats the problem as a whole and which could provide guidelines for setting priorities in this field.

Although there are few in-depth studies which make it possible to measure accurately the impact of bad weather on traffic conditions and on road accidents – either as the primary cause or as an aggravating factor – a number of incidents have shown how highly vulnerable the road network and road users are to particularly severe weather conditions. Mention may be made, for example, of the accident which occurred during foggy weather, on 27 February 1990 at Ressons on Motorway A1 in France and was one of the most serious accidents on a French motorway with 4 mortalities, 12 serious injuries and 22 minor injuries in 4 multiple-vehicle collisions. There have also been accidents of this kind in Germany under similar circumstances.

Although exceptional situations make an impression on the public, it must be remembered that this is a daily problem and that “normal” bad weather conditions have a much greater overall impact.

A distinction has to be made between bad weather conditions which can be considered as normal - for instance snowfall in mountainous regions or in the countries of Northern Europe in winter, to which drivers are accustomed and for which they are likely to be equipped, or fog at certain times in particularly vulnerable areas which are well-known and generally indicated as such – and weather conditions which are exceptional due to their suddenness, rarity or unusual violence, and for which road users are less well prepared.

Bad weather conditions consisting of snow, rain, and fog affect traffic conditions and road safety primarily in two ways:

- By reducing visibility.
- By making the road more slippery.
- And, to a lesser extent, by bringing forces to bear which change a vehicle’s path as a result of the strength of the wind which often accompanies rain and snow.

This report and the recommendations which accompany it will primarily focus on the aspect of reduced visibility and its consequences. The condition of the road is also an essential parameter of safety which has to be borne in mind, since it cannot be completely dissociated from visibility in many cases owing to the water and mud thrown up by passing vehicles. It is only in this respect that the condition of the road will be taken into consideration in this report.

## **1. THE PROBLEM**

### ***1.1 Impact of bad weather on visibility and definition of terms***

The first difficulty of discussing bad weather conditions is defining the meaning of the terms used.

What exactly is meant by rain, snow or fog? What is their impact on traffic conditions and at what point do problems begin to appear?

Meteorologists themselves have different approaches depending on whether they are describing physical phenomena, their causes or their effects. The criteria that they use and the thresholds that they choose as meaningful are not the ones which are most relevant to road traffic.

Thus the definition of dense fog chosen in the United States, setting maximum visibility at 800 metres, meets the needs of aviation but is unsuitable for automobiles, for which less than 200 metres visibility is considered to be inadequate.

Bad weather conditions – rain, snow and especially fog – reduce drivers’ visibility very significantly. This is extremely hazardous, for the driver has less time and less distance to react to a cyclist, a pedestrian or an obstacle.

The usual visual indicators whereby distances can be assessed safely in dry weather are considerably modified. In normal conditions a driver can see an obstacle (an accident, a vehicle which has broken down, congested traffic) at a distance of at least 300 metres. When visibility is reduced, in

dense fog for example, this distance can be less than 50 metres, which represents 6 times less visibility, while at the same time the braking distance increases when the road surface is wet.

Rain also affects the driver's visibility because of the presence of drops of water, but also because of the disturbance caused by water splashed by other vehicles, particularly during overtaking, which obscures the view through windows and increases the risk of excessive glare, but can also deposit dirt on vehicles' lights, thus reducing their effectiveness. Similar problems can be experienced in snowy weather.

In conclusion, visibility distance is the most relevant criterion for identifying hazards and should be used in deciding which traffic regulation is appropriate to adopt.

It is on the basis of this concept of visibility distance that road users should adjust their speed as laid down by the main rule of driving in Article 13 of the Vienna Convention<sup>1</sup>.

## **1.2 The scope of the problem**

### **1.2.1 Frequency of bad weather**

The frequency of bad weather – rain, snow, and fog – varies according to the country, region and time of year.

Fog, while tending to occur more habitually in particular geographical areas in its light or dense forms, can occur anywhere for short or extended periods of time.

Similarly, snow is more common in mountainous areas or in the countries of the more extreme North or South, while it is more occasional in plains areas.

The specific hazards created by the occurrence and the very nature of such weather are made worse by the exceptional or unexpected character of some situations. The fact that drivers are surprised and unaccustomed to certain kinds of bad weather, but also the lack of technical or regulatory measures for specific areas or periods when the weather strikes, complicate the situation still further.

### **1.2.2 Statistics on accidents**

Although few studies are available for calculating the direct impact of weather on traffic conditions and safety, the effects can be estimated by means of a few figures.

For example, in 1992, in France, one out of five accidents on motorways and in the United Kingdom, one out of six accidents on the whole network, occurred in bad weather.

Studies have shown that accidents are twice as numerous in rainy weather and four times more severe in foggy weather, and that 10% of fatalities were the direct result of inadequate assessment of weather conditions, primarily owing to excessive speed or failure to maintain a safe distance between vehicles.

More specifically, rain is the most frequent bad weather phenomenon. Although the accident and fatality rates both double in rainy weather, on the other hand there is a drop in the number of accidents involving pedestrians or two-wheel vehicles, probably because this kind of road use is less frequent in the rain. It would also appear that speeds both on motorways and roads decrease slightly in rainy

weather. This shows that drivers do modify their behaviour by driving with greater caution, although the speeds at which they drive are still as a rule too high.

Snow has a very specific impact on road traffic. It slows down the flow of traffic and reduces visibility while making roads more slippery which both have a direct negative effect on safety.

According to the above-mentioned OECD report, the statistics available in many countries, especially in the Nordic countries, do offer the means of accurately determining the number of accidents in snowy weather, since accidents occurring in rain, snow and fog are classified under a single heading. It seems however that accidents in snow are less serious than accidents in dry or foggy weather, although there is a higher rate of accidents involving only material damage.

A Finnish study shows that during the winter, 15% of accidents occur when there is snow.

As regards fog, the information and figures provided by the ECMT Member countries – and set out in the table below – lead to the following conclusions:

- The number of casualties – especially fatalities – account for only a small proportion of the overall figures each year for the entire road and motorway network.
- However, the accidents are more severe.
- The accidents are relatively more frequent and on a larger scale on motorways than on other roads or in built-up areas.

Year 1991	Number of accidents in fog		Accidents in fog as a percentage of all accidents		Number of fatalities caused by accidents in fog		Fatalities caused by accidents in fog as a percentage of all accidents	
	A	B	A	B	A	B	A	B
Portugal	401	–	0.8	–	47	–	1.8	–
United Kingdom	2 858	184	1.2	2.9	64	8	1.4	3.41
Netherlands	563	64	1.4	3.1	39	6	3.0	4.1
Belgium	662	84	1.14	2.75	26	6	1.58	3.2
Denmark	222	5	2.53	3.14	14	–	2.31	–
Finland (78-86)	–	23	6	2.4	–	2	–	13.3
Switzerland*	1 648	243	1.98	3.04	28	3	3.36	3.10
France	1 760	141	1.20	2.45	186	20	2.4	3.5

A = on the road and motorway network as a whole.

B = only on motorways.

\* 1992

- It is difficult to identify a common characteristic of this kind of accident which is valid for Europe as a whole. There is a great difference between the Northern and Southern European countries owing to climate and latitude, but also owing to geographical factors which are responsible for fog formation.

- A higher number of accidents occurs in countries experiencing the greatest number of foggy days.
- On the other hand, in countries where fog occurs only occasionally or even exceptionally, more accidents occur in relative terms and they are more severe.

To analyse this pattern rigorously would require not only that we know the number of foggy days in the year, which is the trend indicator, but also exactly how long the fog lasted and its density as well as the precise area affected. Without this data, we will inevitably observe divergences in the correlations between the number of foggy days and the number and severity of accidents which will make it impossible to establish a general pattern.

### *1.2.3 Circumstances and causes of these accidents*

Accidents in fog, and especially on motorways, frequently involve a number of vehicles and often lorries. They are pile-ups which occur on entering a fog patch due to braking or a manoeuvre by the first driver surprised by the loss of visibility. Although we should not overlook the large percentage of accidents which occur on the ordinary highway network, the media's attention is clearly attracted by what is often the sensational aspect of these pile-ups which involve a large number of vehicles and restrict or even stop the flow of traffic.

The analysis of such accidents shows that they are caused primarily by the inadequate behaviour of drivers. The most common causes of accidents – aside from excessive speed and insufficient spacing between vehicles – relate to wide disparities in the speeds of vehicles, deficiencies as regards vehicle lights and signing, and increasing eye fatigue.

Some of the authorities responsible for roads and especially for motorways feel that, all other things being equal, it is the rise in the daily mean volume of traffic on motorways that is one of the reasons for the increased accidents in foggy weather and that this trend will become more marked in the future.

## **2. MEASURES IN FORCE OR UNDER CONSIDERATION**

Given the seriousness of this situation, a variety of regulatory or technical measures have been implemented in some ECMT Member countries and others are under consideration.

The first goal is to prevent accidents and reduce their severity, either by compensating for the loss of visibility through better guidance and greater visibility of the vehicles themselves, by regulating traffic conditions, and also by providing drivers with faster and more accurate information.

### **2.1 Regulations**

#### *2.1.1 General driving rule*

In all of the countries of Europe, the general rule set out in the highway code or its equivalent, whereby drivers are required to have control of their vehicles in all circumstances and to adjust their driving accordingly, applies automatically in the event of bad weather.

The UN-ECE Vienna Convention on Road Traffic of 1968 sets out provisions relating to driving when visibility is inadequate, in particular the use of lamps and requirements for front and rear fog lamps.

### 2.1.2 *Special rules of behaviour*

Nevertheless, a few countries have introduced special rules which are more specific about the general rule's applicability in specific hazardous situations. These rules concern:

a) *Speed limits*

In France, in rainy weather (defined as the moment when it becomes necessary to use windscreen wipers) the general speed limit is reduced:

- On motorways from 130 to 110 km/h.
- On roads with divided carriageways from 110 to 100 km/h.
- On ordinary roads from 90 to 80 km/h.

During the winter, some Northern European countries lower the speed limit. For example, in Finland from 1 November to 28 February it is lowered from 100 to 80 km/h on roads and from 120 to 100 km/h on motorways;

Only two countries – France and Germany – have introduced specific regulations based on visibility distance. The German regulation specifies that when visibility is less than 50 metres in fog, snow and rain, the maximum legal speed shall be 50 km/h unless there is some other special provision. The French regulation, based on the same principle, states that in the event of visibility of less than 50 metres owing to fog, snow or heavy rain, the maximum speeds shall be reduced to 50 km/h on all road and motorway networks.

- b) Together with this reduction of authorised speed limits, Germany has also prohibited overtaking for lorries with a permitted gross laden weight exceeding 7.5t as soon as visibility is less than 50 metres.
- c) Except for the general rule requiring all drivers to maintain an adequate stopping distance from the vehicle in front, there is no specific rule which sets a minimum distance between vehicles on the basis of visibility (except for lorries in several countries).

### 2.1.3 *Regulations applying to vehicles*

- a) Aside from such countries as Denmark, Finland, Norway and Sweden which require the use of dipped headlights continuously during the day, their use is also called for when visibility distance is less than 200 metres in Belgium, 100 metres in Portugal and the United Kingdom, or whenever visibility is significantly reduced, without specifying the distance, in Germany, Switzerland and the Netherlands.
- b) There is a general requirement that lorries be equipped with rear fog lights. As is mentioned in the report on lorries and road accidents<sup>2</sup> the standards set for the quality and power of lights, the illumination of rear licence plates, the use of retro-reflectors, reversing lights, rear and side reflectors and rear fog lights are not only intended to improve the lorry drivers' visibility and to make lorries easier to see, but also to indicate more clearly their clearance and size, especially when visibility is reduced.



Rear fog lights remain optional for small vehicles in most countries, and they may only be used when the visibility distance is less than 50 metres in Switzerland, Germany, France, Portugal and the Netherlands. In the United Kingdom and Belgium this distance is extended to 100 metres.

In addition to standards concerning windscreen wipers and demisting systems, some countries have introduced special standards to reduce the effects of the spray of mud or rain, such as headlight wiper systems (Sweden, Finland) or mud-flaps on the wheels of lorries (including EC Member countries implementing a Directive).

#### 2.1.4 *Traffic regulations*

Certain vehicles are banned on some highways, notably vehicles transporting hazardous substances in the Netherlands and Germany.

However, the highway authorities in many countries, more particularly, Belgium, France, Germany, Spain and Switzerland, are able to close certain highways or sections of roads which are made particularly hazardous by bad weather or which have become inaccessible. Such is the case for some mountain passes blocked by snow in winter, but also for certain roads from which snow is being cleared or where there is a danger of avalanches.

## 2.2 *Road Infrastructure*

Various systems have been set up or are being tested in some countries to give advance warning of fog, to indicate traffic rules to be observed, or to provide markings which give drivers guidance or allow them to judge distances.

To improve the guidance of vehicles and to allow drivers to estimate the distance from the car in front or to judge visibility, various systems of guidance posting have been developed by some countries:

- In Belgium, where lighting is provided on the main road and motorway network, a driver can use the lighting poles to estimate distances.
- On mountain roads, marker posts placed along the side of roads make it possible to identify the edge of the road when the shoulders are covered with snow or snowdrifts and also provide a system of guidance.
- On motorways, in many countries the broken side markings can be used as guidance marks whose alternating pattern can help drivers judge distances. The use of reflecting road-studs known as “cats eyes” can serve a similar purpose.

Currently in France the marking separating the carriageway from the emergency stopping lane is 26 metres long (20 metres are painted, 6 metres are unpainted). The tests made on the motorway between Montluçon and Clermont-Ferrand on a 20 km segment consisted of doubling this distance to 52 metres to provide drivers with a visual means of measuring the 50-metre distance.

This marking provides a means of estimating distances and therefore helps the driver to maintain a safe distance from the vehicle ahead and avoid exceeding the speed limits set on the basis of the visibility distance.

In addition, tests on raised side markings are being carried out. This system, which consists of a painted line which is raised at regular 50-metre intervals, provides guidance in rainy or foggy weather by means of:

- A visual effect, because the raised portion of the painted line remains above the water when it is raining.
- A sound effect, when the vehicle crosses the line.

These raised side markings tested on 400 linear kilometres of motorway in France in 1992 are being installed on the right side of roads over a distance of 4 300 km, with priority given to areas subject to frequent rain or fog.

- Although it is valid and useful in all weather, the use of painted chevrons on the road surface at regular intervals is especially effective when visibility is reduced. The system is currently used in France and is being tested in the Netherlands and the United Kingdom.
- In general, over the entire ordinary road network, the placing of marker posts along the roadside at regular intervals in particularly hazardous areas also provides guidance when visibility is reduced.

Other systems which make it possible to guide road-users, to provide them with distance markers and to inform them of fog are currently being developed in a number of countries, examples being:

- The installation of flashing lights on emergency telephone stands every 2 km on motorways in France, which when they are in service simultaneously warn of fog ahead, improve the guidance of vehicles and make these telephone stands more conspicuous in an emergency.
- The use of variable message panels to warn road-users of bad weather, to inform them of traffic conditions and related special traffic rules and to advise caution, which have been installed in Switzerland, France, the Netherlands, the United Kingdom, Portugal and Germany.

In certain countries special systems have been installed in areas where fog is frequent.

In Germany, eight sets of panels known as ‘fog warnings’ have been tested on German motorways according to the following process:

- **Phase 1**

When visibility is between 120 and 80 metres, the authorised speed is reduced to 80 km/h, lorries are not allowed to overtake and the panel announces a warning of ‘fog’.

- **Phase 2**

When visibility is between 80 and 60 metres, the maximum speed is reduced to 60 km/h.

- **Phase 3**

When visibility is between 60 and 40 metres, speed is reduced to 40 km/h and a flashing light goes on.

- **Phase 4**

When visibility is below 40 metres, the overtaking lane is closed by means of a series of signals instructing drivers that they must clear the lane, that the lane has been closed and that overtaking is prohibited.

Drivers now expect to receive full and relevant information (not only advance warning on fog but also on traffic congestion). The installation of road hazard signals of this type certainly serves this function. These systems with variable message panels inform drivers of weather conditions (fog, for instance) and provide instructions on speed, overtaking and the use of lanes. They are triggered automatically by weather conditions, road conditions or traffic density. Furthermore they make it possible to point out locations or arteries which are potentially hazardous not only because of fog but also for other reasons, and by regulating the flow of traffic they help reduce congestion and increase the capacity of highways.

At present, 150 km of the German road network have been equipped in this way. The motorway equipment programme plans to install these panels along some 500 km of the network by 1995.

Another example of how a hazardous location can be dealt with is the equipping of the 550 metres long Beez viaduct over the Meuse river in Belgium. It is a model of how various systems can be combined in an area which is particularly hazardous because of frequent very thick fog. The system set up consists of:

- Four fog detectors placed at well chosen sites.
- The installation of luminous beacons set at a low level and facing traffic.
- The installation of 32 visibility panels which come on only in foggy weather and which display either road hazards, speed limits or instructions regarding lane closures.
- The installation of 6 television cameras which enable the police to monitor traffic.

In this context, there is also a system of road lighting whose height varies depending on the visibility distance.

For the record, it may also be noted that there are also new kinds of treatment of the road surface, pervious road surfacing, used to prevent splashing and surface water layers, which also help improve visibility in rainy weather.

### **2.3 Research**

A great deal of research is currently being conducted along a number of different lines and with a variety of goals. The research is primarily on understanding visibility problems better and the phenomenon of fog itself with a view to:

- Improving the guidance of road users and their awareness of other vehicles as well as of other road users, pedestrians, cyclists and obstacles.
- Increasing the perception distance of road signs by improving the photometric qualities of their coating or by lighting them, for example.

There is also research on aids to drivers and new techniques of providing road users with information either on board vehicles, through appropriate road signs and signals or by fitting vehicles with collision avoidance radar or other devices, such as those being studied under the PROMETHEUS programme.

Research is also being done on fog detectors which make it possible to measure fog density and to provide accurate real-time information to both road authorities and drivers by means of existing information technology or techniques as yet to be developed.

### **3. ENFORCEMENT OF REGULATIONS**

The enforcement of the special regulations which are in force during bad weather is just as important as enforcing general driving regulations and raising or at least maintaining the level of safety.

The legal and technical conditions in which this enforcement is carried out are especially important in these situations for it is often difficult to intercept offenders for safety reasons.

The fog itself can create technical difficulties with respect to the identification of specific vehicles or drivers.

Although enforcement in these conditions is problematic, it is not however impossible, and modern or future technology should improve its feasibility and quality.

### **4. TRAINING, INFORMATION, COMMUNICATION**

Road safety education and initial driver training are among the most effective means of thoroughly instilling in road users an awareness of the attitudes and behaviour adapted to prevailing traffic conditions and giving due consideration to the presence of other road users.

The education and training programmes existing in most ECMT Member countries, like the examinations by which the knowledge acquired is tested, are increasingly introducing these concepts of behaviour in addition to the essential knowledge of regulations, especially where weather conditions are concerned.

It has now become essential in the interests of road safety to inform road users of traffic conditions – and therefore of the weather conditions – that they will encounter on their route so that they can modify their behaviour, and even postpone their departure or take a different route.

In addition to the information which is now supplied by variable message panels and the progress that can be expected with new information technologies, particularly those on-board vehicles, much has been done as regards the provision of driver information over the past few years.

This information is transmitted in different ways:

- Through the national or local highway information centres, by telephone or Minitel in France (36 15 ROUTE).
- Through the media, especially through specialised radios which provide real-time information on traffic conditions along the route being taken, particularly on motorways, and which give safety warnings or remind drivers of driving rules to be observed in specific circumstances.

- By information panels at the entrance to certain routes: access to mountain passes, toll booths on motorways, etc.

In certain countries, information campaigns have been organised either regularly (Belgium, Portugal) or occasionally (Netherlands, United Kingdom, France, Switzerland) on a national, regional (Netherlands) or even local basis (a motorway concession in France). These campaigns generally remind drivers of the safety rules they should observe, especially with regard to the more vulnerable road users such as pedestrians and cyclists.

On the other hand, information campaigns in enterprises, and particularly haulage enterprises, still remain rudimentary.

## CONCLUSION

The spectacular nature and severity of accidents which occur in bad weather means that they are a major problem even though they account for only a small percentage of the fatalities caused by traffic accidents.

A number of different measures have been introduced in many countries, particularly those in which the problem is especially serious owing to their climate.

First, this concern – particularly the need for the driver to adjust his behaviour to the prevailing conditions – is increasingly being incorporated in training programmes.

Moreover, some countries have laid down specific regulations requiring road users to adapt their behaviour.

Improvements can be expected from the development of systems which enable drivers to see other vehicles and obstacles more readily. The use of high-performance headlights and a greater uniformity in the brightness of vehicles' tail lights, including fog lights, would be a considerable improvement.

Vehicle guidance can be improved by increasing the visibility and perception distances for the systems used, such as markings, road-studs, and delineators. However, account must be taken of the risk that, by permitting higher speeds, such measures could lead to more pile-ups.

An improvement in the conspicuousness of road signs – to prevent hesitancy among drivers and to make it easier to select from among options – can be achieved by lighting road signs or using luminous variable message panels.

In the future, major improvements are to be expected from the development of new technologies - which will make it possible to convey reliable and accurate real-time information on traffic conditions - and from the development of aids to drivers such as on-board collision avoidance radar systems, so research should be continued in these fields. However, today's technical systems already make it possible to increase the visibility distance, and regulatory measures such as speed limits should make it possible to modify drivers' behaviour.

### Notes

1. Every driver of a vehicle shall in all circumstances have his vehicle under control so as to be able to exercise due and proper care and to be at all times in a position to perform all manoeuvres required of him. He shall, when adjusting the speed of his vehicle, pay constant regard to the circumstances, in particular the lie of the land, the state of the road, the condition and load of his vehicle, the weather conditions and the density of traffic, so as to be able to stop his vehicle within his range of forward vision and short of any foreseeable obstruction.
2. Document CEMT/CS(93)18.