Prevention and Management of Ghost drivers Incidents on Motorways
The French Experience
The contribution of ITS to Immediate Detection and Optimum Management of Ghost drivers Incidents

Pierre VICEDO, Director of Operations of the Autoroute Blanche, Société des Autoroutes et Tunnel du Mont-Blanc
1440, Route de Cluses 74 138 Bonneville Cedex - France
Tél : 00 33 4 50 25 20 01, @mail : pierre.vicedo@atmb.net

Summary

Ghost drivers incidents on motorways is a concern for French motorway companies. The accidents resulting from this type of frontal collision (10 fatalities per year) are spotlighted by the media and are an anxiety-producing phenomenon for the public. The operations that generate ghost drivers incidents are often deliberate violations and performed by elderly drivers who have lost their marks and are not familiar with the motorway infrastructure or its rules of use or result from behavior incompatible with driving (driving under the influence of alcohol, drugs, medication, or psychiatric problems). Motorway operators have undertaken the prevention and management of the ghost drivers hazard (geometry, signage, equipment, confinement, radio and light messages, training). These conventional responses are effective but insufficient. The eradication of the phenomenon can only be considered with the development of embedded systems and ITS applications (European program DG tren "Go Safe" tender, ERTICO European program "CVIS" project).

1. Ghost drivers Traffic on Motorways - The Stakes of Safety

1.1 Problem

Motorway operators have all deplored ghost drivers incidents with accidents, have become aware of their unexpected nature and have all

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<tr>
<td>Accidents</td>
<td>46</td>
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<tr>
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<tr>
<td>LI</td>
<td>15</td>
<td>7</td>
<td>99</td>
<td>0,4%</td>
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Excerpt from the “AFSA Safety File” - processing of ghost drivers accident data on the French motorway network from 1999 to 2003
reacted in their way to prevent and manage such events. From 1999 to 2003, ghost drivers traffic incidents have represented 0.2% of all accidents involving injuries (source ASFA) on the French motorway network, but 4.4% of deaths for the same period. They caused the death of 11 people in 2004.

The scope of the phenomenon is wider however, as the vast majority of ghost drivers incidents do not cause an accident. Little information is available on these ghost drivers incidents that are “resolved” by themselves; the systematic data collected by motorway operators show that on the average, a ghost drivers incident is notified every 10 to 15 days on the network, about 25% of those notified are confirmed and 1 to 3% of the ghost drivers alerts result in an accident.

1.2 Definition of ghost drivers incident

A ghost drivers incident is characterized by the circulation of a vehicle against the normal flow of traffic in the lane. It should be noted that this definition encompasses reverses which generally involve drivers attentive to the maneuver they are undertaking even if it is dangerous for them and for others.

1.3 Overriding factors

In ghost drivers accidents, certain factors are more present than in accidents overall, in particular:
- A higher occurrence of ghost drivers incidents in open toll sections (presence of interchanges with no toll barriers);
- A significant share of ghost drivers incidents occur at night (50 to 60%) probably due to the lesser legibility of interchanges and lighter traffic;
- A higher proportion of drivers with an illegal blood-alcohol level,
- An over-representation of elderly people;
- Drivers with psychological problems or under the influence of medication, drugs, or attempting suicide.

2. The Experience of French Companies in the Prevention of Ghost drivers Incidents

The preventive actions the most routinely implemented at the infrastructure level consist in improving the signage and road markings at the points of choice at the entrance to motorways at interchanges.

The B1 no entry sign and J5 directional marker in the diverging area are positioned side by side and arrows are marked on the road.

They also consist in better separating the traffic lanes on the two-way interchange ramps.

Combination of mini GBA and BOA system (at the structural level)
3. The Experience of French Motorway Companies in Managing Ghost Drivers Incidents

3.1 Stakes

On the average, vehicles are driven at 130 kph on the motorway, that is a little more than 2 kpm. The speed of vehicles being driven the wrong way is not actually known, but it can be surmised that drivers driving the wrong way are driving more slowly, about 1.5 kpm or 90 kph. Even if traffic is light, with a density of 1 vehicle per km for example, each minute, a vehicle driving the wrong way will encounter 3 to 4 vehicles representing as many potentially serious accident possibilities. The speed of detection and reaction (alert and information) is thus essential in limiting the risk of accident.

3.2 Immediate Ghost drivers Detection and Driver Alert Systems

The different ghost drivers driver alert systems, with or without detection, that are not mutually exclusive:

Systems without detection (signaling)
- Conventional signaling
- Reinforced signalling
- Luminous signalling (diode panels)
- Light barriers (light poles)

Systems with detection
- Doppler Radars
- DAI (video) Loops
- Luminous signaling (diode panels or flashing lights)
- Light barriers (light poles)
- Sound alarm

Today, we do not know how to evaluate the impact of these devices on drivers whose attention is deficient. These systems are undoubtedly not 100% efficient in preventing ghost drivers incidents, but they at least allow the immediate detection of the phenomenon with an alert to the Command Post, which is essential in reacting as best possible and ensuring the safety of other drivers.

3.3 Procedures and Measures Set up For Immediate Confinement

For any ghost drivers alert, operators trigger confinement procedures with the closure of toll barriers, tunnels and motorway access (barriers combined with information panels at access points) in the direction of the zone concerned. An emergency stop that maintains all the manual or automatic toll lane barriers closed (credit card, change, remote toll lanes). This system requires a software adaptation; the transaction occurs but the barrier stays down, and the lane assignment lights remain unchanged. This operation also activates a flashing “alert..."
bottleneck light signal upstream from the toll barrier by GSM to slow down drivers nearing the toll barrier. Toll attendants are provided with a brochure to give to drivers indicating the cause of the disruption.

3.4 The limits of the Solutions in Effect

The speed with which information is broadcast, and its accuracy on the presence of a vehicle driving the ghost drivers is essential in managing this type of incident, whether internally, or directed at the highway police or drivers present on the network (message on remote-controlled variable message panels, information relayed on the 107.7FM radio station with a Traffic Announcement safety message).

The operator has implemented confinement but this does not protect vehicles driving inside the confined area. These vehicles only have access to information by radio, VMP that is generally not very accurate as to the positioning of the vehicle driving the wrong way, resulting in a possible uncontrolled reaction to this message.

4. The Contribution of European ITS in Handling this Problem

Several research orientations can be considered:
- vehicle / infrastructure communication with the identification of a ghost drivers incident, alert transmitted to the driver and behavior to adopt following this alert (find a refuge, U-turn, immediate stop, etc.);
- vehicle / vehicle communication coupling the alert with information transmitted directly to other vehicles in addition to the CP (VMP, Radio, GPS, etc.) in particular on the location of the vehicle driving the wrong way.

An invitation to tender on these topics has been launched European-wide: “the safety of ghost drivers drivers, their detection and their management” “GO-SAFE 1” project. Another project has been selected within ERTICO program as CVIS project.

5. Conclusion

The problem of ghost drivers incidents is complex due to the drivers concerned. These drivers are not highly aware of the alerts provided by signaling, even reinforced signaling. An infrastructure and signaling designed with a concern for legibility and simplicity can certainly limit the number of ghost drivers incidents. It is essential to include the “ghost drivers” concern in the design of infrastructures, in particular as regards their geometry.

When ghost drivers incidents cannot be avoided, their rapid detection is essential to prevent potential accidents with the immediate broadcast of information to network users.
Users, whose protection is a primary objective for each motorway operator, also have a role to play in combating ghost drivers incidents. The training of users in motorway driving in order to limit ghost drivers incidents, but also in how to react in each situation, is also an important factor.

After having done their utmost with regard to the infrastructure itself, and having improved the perception, legibility and understanding of signaling and messages by drivers, subsequent developments will concern:

- Improving communication between vehicles and infrastructure and triggering an immediate alert to other vehicles;
- Information and training targeting populations that present a risk and who are often the cause of ghost drivers incidents, actions to deploy by the administrations with the support of motorway operators;
- Training drivers on the behavior to adopt in the presence of a ghost drivers alert.